Public Certification Report

for

Australian Northern Prawn Fishery

Brown tiger prawn (*Penaeus esculentus*)
Grooved tiger prawn (*P. semisulcatus*)
Blue endeavour prawn (*Metapenaeus endeavouri*)
Red endeavour prawn (*M. ensis*)
White banana prawn (*Fenneropenaeus merguiensis*);
Red-legged banana prawn (*Fenneropenaeus indicus*)

Twin, triple and quad otter trawl

MRAG Americas, Inc.

6 November 2012

CLIENT DETAILS:
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MSC reference standards:
MSC Accreditation Manual Version 5
MSC Fisheries Certification Methodology (FCM) Version 6
Fishery Assessment Methodology Version (FAM) Version 2
MSC Chain of Custody Certification Methodology (CoC CM) Version 7
MSC TAB Directives (All)
MSC Policy Advisories (All)

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List of Acronyms

AAT	Administrative Appeals Tribunal
ABARES	Australian Bureau of Agriculture and Resource Economics and Sciences
ABC	Acceptable Biological Catch
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AMCS	Australian Marine Conservation Society
ANAO	Australian National Audit Office
BBL	Biologically Based Limits
B	Biomass
B_{MSY}	Biomass at Maximum Sustainable Yield
BRS	Bureau of Rural Sciences
BRD	Bycatch Reduction Device
CRD	Catch Receiver Document
CFRAB	Commonwealth Fisheries Research Advisory Body
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CITES	Convention on International Trade in Endangered Species
CLCIPA	Carpentaria Land Council Indigenous Protected Area
CMO	Crew Member Observer Program
CMS	Convention on Migratory Species
CRIS	Cost Recovery Impact Statement
CoC	Chain of Custody certification
CPUE	Department of Agriculture, Fisheries & Forestry
DAFF	Department of Agriculture, Fisheries & Forestry
DSEWPac	Department of Sustainability, Environment, Water, Population and Communities
DIEWR	Department of Environment and Water Resources
EAFM	Ecosystem Approach to Fisheries Management
EPDC Act	Environment Protection and Biodiversity Conservation Act 1999
ERA	Environmental Risk Assessment
ERM	Environmental Risk Management
ESDP	Ecologically Sustainable Development Policy
EEZ	Exclusive Economic Zone
ETP	Endangered, Threatened or Protected (species)
FMA	Fisheries Management Act, 1991
F	Fishing mortality rate
F_{MSY}	Fishing mortality rate at Maximum Sustainable Yield
FRDC	Fisheries Research and Development Corporation
FAO	Food and Agriculture Organisation of the United Nations
FAM	Fisheries Assessment Methodology (MSC)
FCM	Fisheries Certification Methodology (MSC)
FMP	Fisheries Management Plan
HCR	Harvest Control Rule
HS	Harvest Strategy
HSP	(Commonwealth) Harvest Strategy Policy
HMS	Highly Migratory Species
IMO	International Maritime Organization
IT	Incidental Take
IUCN	International Union for the Conservation of Nature
IUU	Illegal, Unregulated and Unreported
JBG	Joseph Bonaparte Gulf
LRP	Limit Reference Point

MAC	Management Advisory Committee
MLS	Minimum Landing Size
MSE	Management Strategy Evaluation
MSC	Marine Stewardship Council
MEY	Maximum Economic Yield
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
NPOA	National Plan of Action
NGO	Non Governmental Organisation
NPF	Northern Prawn Fishery
NPFREC	NPF Research & Advisory Committee
NORMAC	Northern Prawn Management Advisory Committee
NPRAG	The Northern Prawn Resource Assessment Group
OVI	Objective Verifiable Indicators
PI	Performance Indicator (MSC)
PSA	Productivity Susceptibility Analysis
QDPI	Queensland Department of Primary Industries
RAG	Regional Advisory Group
REC	Research & Environment Committee
RBF	Risk Based Framework (MSC)
SICA	Scale Intensity Consequence Analysis
SAG	Scientific Advisory Group
SC	Scientific Committee
SG	Scoring Guidepost
SSB	Spawning Stock Biomass
SSF	Spawning Stock Fecundity
SSN	Spawning Stock Number
SFR	Statutory Fishing Right
SPM	Surplus Production Model
SAFE	Sustainability Assessments for Fishing Effects
TRP	Target Reference Point
TAP	Threat Abatement Plan
TVH	Transferable Vessel Holders
TAC	Total Allowable Catch
TED	Turtle Exclusion Device
UN	United Nations
UNEP	United Nations Environment Programme
UoC	Unit of Certification (MSC)
VMP	Vessel Monitoring Plan
VMS	Vessel Monitoring System
VPA	Virtual Population Analysis
WGSA	Working Group on Stock Assessment
WTO	Wildlife Trade Operation
WWF	World Wide Fund for Nature

1 Introduction

This report sets out the draft results of the assessment of the Australian Northern Prawn Fishery (NPF) carried out by MRAG Americas, Inc. against the Marine Stewardship Council (MSC) Principles and Criteria for Sustainable Fishing. The purpose of this report is to provide background information, evaluation of the fishery, and justification for scoring the performance indicators provided by the MSC in the generic assessment tree of the Fishery Assessment Methodology, as defined in the Guidance to MSC FAM Version V2.1. MRAG conducted no primary research as part of this assessment, and relied on existing information to conduct the analysis. The report intends to clearly set out key issues for consideration during annual surveillance audits and for subsequent recertification.

The record of document amendments is provided in **Table 1**.

Table 1 Document Amendment Record

Version	Start	End	Description
Client Draft	22/09/2011	27/03/2012	Inserted comments from WWF and NPF Industry Pty Ltd. Awaited clarification on JBG harvest strategy development which was in process at the time of the assessment.
Peer review draft	28/03/2012	19/06/2012	Peer review comments were made available on 20/04/2012, but the assessors reverted back to Peer Reviewers, pre PCDR for comments on changes to Red Legged banana prawns (on receipt of advice from MSC) and the Client Action Plan. Final comments were made available on 29 June, 2012.
Public Comment draft	12/07/2012	13/08/2012	PCDR incorporates client comments and peer review comments.
Final Report and Determination	13/08/2012	29/08/2012	Final Report and Determination incorporates public comments
Certification Report	27/09/2012	6/11/2012	Public Certification Report – post objection period

The MSC Guidelines to Certifiers specify that the unit of certification is "The fishery or fish stock (=biologically distinct unit) combined with the fishing method/gear and practice (=vessel(s) pursuing the fish of that stock) and management framework."

Unit of Certification

The fishery assessed for MSC certification is defined as:

Australian Northern Prawn Fishery

There are four species covered in the tiger prawn sub-fishery, each representing a separate unit of certification.

- Brown tiger prawn (*Penaeus esculentus*)
- Grooved tiger prawn (*P. semisulcatus*)
- Blue endeavour prawn (*Metapenaeus endeavouri*)
- Red endeavour prawn (*M. ensis*)

There is one species in the banana prawn sub-fishery, this representing a separate unit of certification:

- White banana prawns (*Fenneropenaeus merguiensis*);

There is one species in the Joseph Bonaparte Gulf (JBG) sub-fishery, this representing a separate unit of certification:

- Red-legged banana prawns (*Fenneropenaeus indicus*)

Geographical Area: The Northern Prawn Fishery (NPF) occupies an area of 771,000 km2 off Australia's northern coast. The Fishery extends from the low water mark to the outer edge of the Australian fishing zone (AFZ) along approximately 6,000 km of coastline between Cape York in Queensland 142° 09' 00" E and Cape Londonderry in Western Australia 126° 58' 00" E.

Method of Capture: Twin, quad or triple rig otter trawl

Stock: North Australian brown tiger prawn, grooved tiger prawn, blue endeavour prawn, red endeavour prawn, white banana and red-legged banana prawn stocks:

Management System: The fishery is managed through a combination of input controls (limited entry, seasonal closures, gear restrictions and operational controls), implemented under the *Northern Prawn Fishery Management Plan1995*. Management arrangements for the fishery remained unchanged for 2009–10.

Client Group: NPF Industry Pty Ltd and World Wildlife Fund

Table 2: Northern Prawn Fishery, Client Group Vessels:

Vessel Name	Client Name	Symbol
SHOMAC	ADVANCE PTY. LTD.	FWSZ
BRAMPTON	AUSTFISH PTY LTD	P010
TERRITORY FORCE	AUSTFISH PTY LTD	F864
VOLTAIRE	AUSTFISH PTY LTD	F747
TERRITORY SPIRIT	AUSTFISH PTY LTD	F579
NEWFISH II	AUSTRAL FISHERIES PTY LTD	P216
OCEAN THIEF	AUSTRAL FISHERIES PTY LTD	B169
KFV SHEARWATER	AUSTRAL FISHERIES PTY LTD	F555
KODIAK T	AUSTRAL FISHERIES PTY LTD	F635
KFV HERON	AUSTRAL FISHERIES PTY LTD	F701
COMAC ENDEAVOUR	AUSTRAL FISHERIES PTY LTD	F639
NEWFISH I	AUSTRAL FISHERIES PTY LTD	F015
COMAC ENTERPRISE	AUSTRAL FISHERIES PTY LTD	F871
SEA THIEF	AUSTRAL FISHERIES PTY LTD	B7
GNARALOO	AUSTRAL FISHERIES PTY LTD	FPKN
XANADU 1	BINDING NOMINEES PTY LTD	F630
VULCAN	BRAMPTON FISHING CO. PTY LTD	F843
OCEAN MISS	DUJOUR PTY LTD	HSJ
KFV SANDPIPER	FRENCHMAN NOMINEES PTY LIMITED	BR001
BRAHMAN	HENCHMAN FISHING COMPANY PTY LTD	B285
BEACHLANDS	JOHN E THOMAS	B53
JALAURA	JOHN J JARRETT (JNR)	FVKB
SAMANTHA J	K J LOCK INVESTMENTS PTY LTD	FZAB
CINDY ANN	M & G HOSCHKE PTY LTD	B264
SOUTH PASSAGE	M & G HOSCHKE PTY LTD	J001
FV CAPE YORK	MADANG CONTRACTORS (QLD.) PTY. LTD.	K6D
EMSERVE	MADANG CONTRACTORS (QLD.) PTY. LTD.	FVEY
ROSEN-C	NORMAN A & COLIN M JAMES	FWUE
WARLOCK	NORMAN A & COLIN M JAMES	O519
ADELAIDE PEARL	RAPTIS FISHING LICENCES PTY LTD	O572
DOLPHIN PEARL	RAPTIS FISHING LICENCES PTY LTD	O573
AUSTRALIAN PEARL	RAPTIS FISHING LICENCES PTY LTD	O576
KARUMBA PEARL	RAPTIS FISHING LICENCES PTY LTD	O579
ARNHEM PEARL	RAPTIS FISHING LICENCES PTY LTD	O581
FLINDERS PEARL	RAPTIS FISHING LICENCES PTY LTD	O580
RAPTIS PEARL	RAPTIS FISHING LICENCES PTY LTD	O575
EYLANDT PEARL	RAPTIS FISHING LICENCES PTY LTD	O585
BRISBANE PEARL	RAPTIS FISHING LICENCES PTY LTD	O520
NORTHERN PEARL	RAPTIS FISHING LICENCES PTY LTD	O574
MUNDORA	ROBERT J ROSE	FXJR
CENATOR	RONALD S & RACHELLE L EARLE	B103
GULF BOUNTY	RONALD S & RACHELLE L EARLE	FVNV
PROTEUS	RONALD S & RACHELLE L EARLE	FVMJ
OCEAN WILD	RONBRIDGE PTY. LTD.	B229
BOUNTIFUL LADY	RUBY MARINE ENGINEERING PTY. LTD.	B26
RUBY ENTERPRISE	RUBY MARINE ENGINEERING PTY. LTD.	B146
PERPETUA	THE DECKSTORE PTY LTD	FMGT

SENHORA DE FATIMA	W.A. SEAFOOD EXPORTERS PTY LTD	F258
LADY SERENE	W.A. SEAFOOD EXPORTERS PTY LTD	F443
OCEAN EXPORTER	W.A. SEAFOOD EXPORTERS PTY LTD	P246
OCEAN PRODUCER	W.A. SEAFOOD EXPORTERS PTY LTD	P245
AUSTRAL	ZILZIE NOMINEES PTY LTD & HORIZON BAY HOLDINGS PTY LTD	F622

http://www.afma.gov.au/wp-content/uploads/2010/06/Northern-Prawn-Fishery-13-October-2011.xls,.

2 Summary

This report provides details of the MSC assessment process for the Australian Northern Prawn Fishery. The assessment process began in May, 2011 and has reached certification as of 6 November, 2012. The fishery occurs off Australia's northern coast. The Fishery extends from the low water mark to the outer edge of the Australian fishing zone (AFZ) along approximately 6,000 km of coastline between Cape York in Queensland 142° 09' 00" E and Cape Londonderry in Western Australia 126° 58' 00" E. The assessment covers six species: Brown tiger prawn (*Penaeus esculentus*); Grooved tiger prawn (*P. semisulcatus*); Blue endeavour prawn (*Metapenaeus endeavouri*); Red endeavour prawn (*M. ensis*); White banana prawns (*Fenneropenaeus merguiensis*); and Red-legged banana prawns (*Fenneropenaeus indicus*); as well as and three distinct trawl operations. These are:

1. The Banana prawn sub-fishery (usually from the 1st of April and up to mid-June, but may be shortened using applied input control rules), targeting white banana prawns in less than 20 metres depth);

2. The Tiger prawn sub-fishery (usually from 1 August and to end30th November, but may be shortened using applied input control rules) generally comprising mixed catches of adult brown tiger prawns (but not exclusively) between 10m to 20 m, grooved tiger prawn (over fine mud and often in deeper water) and endeavour prawns (usually between 30-45 m); and

3. The Joseph Bonaparte Gulf (JBG) sub-fishery targeting red-legged banana prawns, which historically has operated in both seasons, but has been closed in the banana prawn season from 2007-2010 inclusive as a trial to improve the economic return from the fishery.. Fishing takes place in deeper water in depths of 45 to 85 metres.

A rigorous assessment of the wide-ranging MSC Principles and Criteria was undertaken by the assessment team and detailed and fully referenced scoring rationale is provided in the assessment tree provided in Section 5.1.4 of this report. Peer reviews of the assessment are presented in Annexes 1 and 2.

On completion of the assessment and scoring process, the assessment team concluded that the:

Tiger prawn sub-fishery, with Unit of Certification species, Brown tiger prawn (*Penaeus esculentus*), Grooved tiger prawn (*P. semisulcatus*), Blue endeavour prawn (*Metapenaeus endeavouri*) and Red endeavour prawn (*M. ensis*), **could be certified** according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

Banana prawn sub-fishery, with Unit of Certification species, White banana prawns (*Fenneropenaeus merguiensis*) **could be certified** according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

JBG sub-fishery, with Unit of Certification species, Red-legged banana prawns (*Fenneropenaeus indicus*)) **could be certified** according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

2.1 Summary of the evaluation results

Principle 1 examines the status of the target stock and whether the management system maintains the reproductive capacity within safe and rational limits. Exploited populations should be maintained at levels of abundance sufficient to maintain their productivity and reproductive capacities for yields over the long term, provide margins of safety for error and uncertainty, and restore and rebuild stocks that have become depleted.

SUMMARY

Overall scores for Principle 1 species were as follows:

Brown tiger prawn (*Penaeus esculentus*)	100
Grooved tiger prawn (*P. semisulcatus*)	100
Blue endeavour prawn (*Metapenaeus endeavouri*)	96.3
Red endeavour prawn (*M. ensis*)	80.6
White banana prawns (*Fenneropenaeus merguiensis*);	81.9
Red-legged banana prawns (*Fenneropenaeus indicus*)	85

Principle 2 examines five components which are considered to cover the range of potential ecosystem elements that may be impacted by a fishery, taking into account the status, management strategies and information relevant to each of these components.

SUMMARY

Overall scores for Principle 2 were as follows:

Brown tiger prawn (*Penaeus esculentus*)	89
Grooved tiger prawn (*P. semisulcatus*)	89
Blue endeavour prawn (*Metapenaeus endeavouri*)	89
Red endeavour prawn (*M. ensis*)	89
White banana prawns (*Fenneropenaeus merguiensis*);	88.3
Red-legged banana prawns (*Fenneropenaeus indicus*)	82

Principle 3 examines the structure and performance of the management system.

SUMMARY

Overall scores for Principle 3:

Brown tiger prawn (*Penaeus esculentus*)	97
Grooved tiger prawn (*P. semisulcatus*)	97
Blue endeavour prawn (*Metapenaeus endeavouri*)	97
Red endeavour prawn (*M. ensis*)	97
White banana prawns (*Fenneropenaeus merguiensis*);	97
Red-legged banana prawns (*Fenneropenaeus indicus*)	97

2.2 Harmonization with other MSC assessments

The targeted stocks have not been the subject of another MSC assessment. The outcome of the NPF assessment is therefore not harmonised with any other fishery.

3 Background to the Report

3.1 Authors/Reviewers

Team members are **Richard Banks (LA/P3), Dr Shelley Clarke (P2), Dr Derek Staples (P1) and Duncan Souter**. Lead assessor is **Richard Banks,** MRAG Americas.

Mr Richard Banks (Team Leader and P3 assessor)

Mr Banks is Lead Assessor for the certification and had primary responsibility for Principle 3. Richard has undertaken 30 fishery assessments in Australia. Richard has also worked on series of prawn fisheries including Northern Prawn, Torres Strait Prawn, Indonesian Arafura Sea, Vietnamese and Malaysian Multi taxa and Indian prawn fisheries. The NPF full assessment will be Richard's third, and second prawn trawl assessment. Richard is a fisheries management specialist and policy programming specialist having worked on similar issues for international agencies, Commonwealth and State Fisheries. Richard holds a Bachelor's degree in Fisheries Economics and a Masters in Agricultural Economics from the University of Portsmouth, and Imperial College, London respectively. Richard has been trained in and has applied the Risk-based Framework methodology for previous MSC assessments.

Dr Shelley Clarke (P 2 assessor)

Dr Clarke is a fisheries scientist with extensive experience with marine ecosystem impact assessment and bycatch issues. She has a master's degree in fisheries ecology from the University of Washington and a doctorate in quantitative fisheries science from Imperial College London. As a consultant to the Hong Kong government for 6 years, Dr Clarke designed and executed numerous seabed ecology and trawl fishery studies in sub-tropical waters. More recently her work has focused on bycatch species, particularly sharks and other species which are often under-reported in routine catch monitoring databases. Having served on the MSC Stakeholder Council from 2003-2006 and the MSC Technical Advisory Board from 2006-2009 she has a detailed understanding of both the intent and practical application of the MSC principles and criteria.

Dr Derek Staples (P1 assessor)

Dr Staples is former Senior Fisheries Officer of the United Nations Food and Agriculture Organisation (FAO) Regional Office for Asia and the Pacific, and is also the past-Secretary of the Asia Pacific Fisheries Commission. He has a PhD in fisheries ecology from the University of Canterbury, New Zealand and a post-doctoral diploma in aquaculture from the Tokyo University of Fisheries, Japan. In his last position, Dr. Staples was responsible for providing technical advice on coastal and offshore fisheries for all of FAO Asian-Pacific Member countries and has been actively involved in a number of FAO projects in Asia.

In Australia, he was Deputy Executive Director of the Bureau of Resource Sciences (BRS), and was a senior science advisor to Ministers and policy decision makers in the Department of Agriculture, Fisheries and Forestry, in Australia (DAFF). Prior to this he was a scientist for many years with the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO), working in the NPF, and a participant in the MSC pre assessment for Northern Prawn, Dr Staples has experience in the Risk Based Framework.

Mr Duncan Souter

Mr Souter is the CEO of MRAG Asia Pacific, based in Brisbane. Prior to joining MRAG, Mr Souter was the Fisheries Advisor to two Australian government ministers for fisheries, and before that the CEO of the Queensland Seafood Industry Association. Mr Souter has a detailed understanding of Australian fisheries governance arrangements and management frameworks. Mr Souter contributed to the Principle 3 assessment.

3.2 Previous Assessments

This fishery has not been assessed for MSC before the current assessment.

3.3 Consultations and Field Inspections

Inspections of the fishery and consultations with the client and various stakeholders were conducted to obtain information on the nature of the fishing, and the nature and relationship of management entities.

The list of individuals who attended meetings during consultations or the site visit is provided below.

Table 3 Participants at meetings during the field inspections.

	Name	Affiliation	Date	Issues	Location
1	Pieter Wildekamp	AFMA	2 Sept	Compliance	Darwin
2	Peter Parker	Raptis (Trawl company)	5 Sept 2011	Background to fishing operations and CoC	Darwin
3	Louise Deacon-Casey	Independent NPF trawler owner	5 Sept 2011		Darwin
4	Rik Buckworth	CSIRO	15 Sept 2011	Stock assessment (All species overview)	Brisbane
5	Trevor Hutton			Tiger and Endeavour Prawns	
6	Rob Kenyon			Sea surveys	
7	Roy Dong			Modeler	
8	Bill Venables			White Banana prawns	
9	Eva Plaganyi-Lloyd			Red-legged Banana prawns	
10	David Brewer	CSIRO	19 Sept 2011	Bycatch	Brisbane
10	David Milton				
11	Cathy Dichmont	CSIRO	20 Sept 2011	Research	Brisbane
12	Shane Griffiths			ERA assessments	
13	Peter Trott	WWF	20 Sept 2011	Bycatch interactions	Brisbane
14	Stephanie Bradley				
15	Eddie Hegerl	NORMAC Environmental NGO member	20 Sept 2011	Bycatch interactions	Brisbane
16	Melissa Brown	AFMA	21 Sept 2011	Fishery and bycatch management	Brisbane
17	Fiona Hill				
18	Ian Knuckey	NPRAG	21 Sept 2011	Research	Brisbane
19	Tooni Mahto	AMCS	21 Sept 2011	Bycatch management	Brisbane
20	Ron Earle	Trophic Ocean Prawns	21 Sept 2011	Fisheries and fisheries management and NPF Workshop	Brisbane
21	Annie Jarrett	NPF Industry Pty Ltd	21 Sept 2011		
22	Matt Barwick				
23	David Carter	Austral Fisheries			
24	Andrew Prendergast				
25	Neal Harris	Jowter Seafoods			
26	Ian Boot	Austfish PL			

27	Norm Peovitis	WA Seafood Exporters			
28	Arthur Raptis	A Raptis & Sons PL			
29	Ayesha Plant				
30	Phil Robson				
31	Greg Albert	NQTA			
32	Peter Schultz				
33	Max O'Halloran	QLD Trawl Ass			
34	Stuart Richey	NORMAC			
35	Pat Caleo	MSC			
36	Di Tarte	MEPA PL	22 Sept 2011	NPF Workshop	Brisbane
37	Cathy Dichmont	CSIRO			
38	Rick Buckworth				
39	Mel Brown	AFMA			
40	Fiona Hill				
41	Brodie Macdonald				
42	Tooni Mahto	AMCS			
43	Peter Trott	WWF, Australia			
44	Sian Breen				
45	Stephanie Bradley	WWF, USA			
46	Eddie Hegerl	NORMAC			
47	Rodrigo Bustamante	CSIRO	22 Sept 2011	Ecosystem and habitats	Brisbane
48	Annie Jarrett and Matt Barwick	NPF Industry Ltd	26 Sept 2011	Harvest strategy, Observer coverage and data	Brisbane

3.4 Consultation

MRAG contacted the following stakeholders by email or post concerning the assessment of the Northern Prawn Fishery. The schedule of contacts is provided in **Table 4**.

Stakeholder	Name	e-mail contact
NPF Industry Pty Ltd	Annie Jarrett Matt Barwick	annie.jarrett@bigpond.com m.barwick@npfindustry.com.au
Fishing Companies		
1. Austral	David Carter Austral CEO/ NPFI Director Andy Prendergast (fleet master	dcarter@australfisheries.com.au aprendergast@australfisheries.com.au
2.	Ron Earle Chairman NPFI; Earlando	ronearle@skymesh.com.au
3.	George Raptis NPFI Director; A Raptis & Sons Mike O'Brien Fleetmaster	'graptis@raptis.com.au' mobrien@bigpond.com.au
4.	Norm Peovitis, NPF Director; WA Seafoods	npeovitis@waseafoods.com.au

5.	Greg Albert NPFI Director; Madang Contractors	madang@ledanet.com.au
AFMA	Melissa Brown Josh Fielding Peter Venslovas Pieter Wildekamp	Melissa.brown@afma.gov.au joshua.fielding@afma.gov.au Peter.Venslovas@afma.gov.au Pieter.Wildekamp@afma.gov.au
MAC Chairman	Stuart Richey	s.richey@bigpond.net.au
RAG	Ian Knuckey	Ian@fishwell.com.au
CSIRO	Cathy Dichmont Rik Buckworth Dr Eva Plaganyi Garry Fry Mark Tonks David Brewer David Milton Rodrigo Bustamante Bill Venables	Cathy.Dichmont@csiro.au Rick Bukworth@csiro.au Eva.Plaganyi@csiro.au Gary.fry@csiro.au Mark.tonks@csiro.au David Brewer@csiro.au Eva Plaganayi@csiro.au Bill Venables@csiro.au
Australian Marine Conservation Society/NORMAC conservation member	Eddie Hegerl	ehegerl@ozemail.com.au
Australian Marine Conservation Society	Tooni Mahto	toonimahto@amcs.org.au
WWF	Peter Trott Alison Cross Stephanie Bradley	PTrott@wwf.org.au alison.cross@wwfus.org Stephanie.Bradley@wwfus.org
Australian Conservation Foundation	Chris Smyth Marine Campaign Coordinator	c.smyth@acfonline.org.au
Human Society International	Alexia Wellbelove	Alexia@hsi.org.au
Pew Conservation Trust	Imogen Zethoven	izethoven@pewtrusts.org.
Greenpeace	Cat Dorey	cdorey@greenpeace.org

Table 4 Schedule of contacts

Date	Purpose
26 May 2011	Stakeholder notification of full assessment
26 May 2011	Assessment timeline
26 May 2011	Notification of Assessment Team nominees
28 June 2011	Confirmation of Assessment Team nominees
28 June 2011	Notification of intent to use default assessment with Risk Based Framework (RBF)
28 June 2011	Notification of assessment visit and call for meeting requests
22 August 2011	Detailed invitation to stakeholders and description of RBF
22 August 2011	Logistic information for public meeting

Date	Purpose
22 August 2011	Clarification of scale of the fishery
5 September 2011	Commencement of public consultation
30 September 2011	Confirmation of Peer Reviewers
12 July 2012	Notice of PCDR availability
6 September 2012	Notice of Final Report and determination

3.5 The Fishery under Assessment

3.5.1 Description of the fisheries

The NPF comprises three distinct sub-fisheries: Tiger prawn multispecies sub-fishery (Brown tiger prawn (*Penaeus esculentus*), Grooved tiger prawn (*P. semisulcatus*), and Blue endeavour prawn (*Metapenaeus endeavouri*); Red endeavour prawn (*M. ensis*); the Banana prawn (*Fenneropenaeus merguiensis*) trawl sub-fishery; and the JBG Red-legged banana prawn (*Fenneropenaeus indicus*) sub-fishery. All sub-fisheries target prawns using twin, triple and quad otter trawls.

Prawn trawling is an active fishing method which involves towing a conical-shaped net spread open by two or four steel or timber otter boards over the seabed, commonly called otter trawling. Ground chains are also used on the nets to stimulate prawns into the trawl mouth. Vessels in the NPF may tow a range of nets in a variety of configurations. These are regulated by the *Northern Prawn Fishery Management Plan 1995* (the Management Plan) and relevant Determinations. In addition to the main nets, a small "try-net" is also used to test the potential catches for a given area. All trawl nets (other than try-nets) in the NPF are required to be fitted with approved Turtle Excluder Devices (TEDs) and Bycatch Reduction Devices (BRDs).

Most of the vessels in the NPF are purpose built steel boats and range in length from 17 m to 28 m. All NPF boats have modern, sophisticated catch handling, packing and freezing capabilities as well as wet (brine) holding facilities. All vessels use electronic aids such as colour echo sounders and Global Positioning Systems (GPS) and plotters. Satellite phones and fax equipment is used by most vessels and many have introduced on-board computing facilities, as well as electronic log books. All vessels are required by legislation to have an operational Vessel Monitoring System (VMS).

Prawns account for >95% of the landed catch in the three fisheries combined. Landings of banana prawn (white *Fenneropenaeus merguiensis and red-legged F. indicus*), averaged around 5,800 tonnes in the period 2009 and 2010, the two tiger prawns (brown (*Penaeus esculentus*) and grooved (*P. semisulcatus*)) averaged 1,440 tonnes, and endeavour prawns (blue (*Metapenaeus endeavouri*) and red (*M.ensis*)) averaged 390 tonnes. The catch of red-legged banana prawn from the JBG over the same period averaged 352 tonnes (6% of the total banana prawn catch).

Retained prawn species catches in 2010 amounted to 10 t of king prawns. In 2010, the fishery also landed 19 t of scampi, 3.6 t of shovel nose and slipper lobsters, 16.6 t of Moreton Bay Bugs, 1.2 t of squid, 3.36 t of cuttlefish, 946 kg of scallops, and smaller quantities of other retained species.

Specific sub-fishery definitions are identified as follows:

- Banana prawn sub-fishery in less than 20 metres, running from 1 April until end of June;
- Tiger sub-prawn fishery comprising mixed catches of adult brown tiger prawns, (caught between between10-20 m), grooved tiger prawn (over fine mud and often in deeper water) and endeavour prawns (usually between 30-45 m). The season for this fishery runs from 1st August until the end of November;.
- JBG sub-fishery occurs in 45-85 metres, with one season coinciding with the banana prawn season, and the second coinciding with the tiger prawn season.

White banana prawns are caught mainly during the day in the Gulf of Carpentaria east of Arnhem Land and on isolated grounds along the Arnhem Land coast in < 20 m depth, whereas red-legged banana prawns are caught in the Joseph Bonaparte Gulf (Figure 1) in 45-85m. The white banana prawns form dense aggregations ('boils') that may be located by spotters in planes, who direct the trawlers to them. The highest catches are taken in areas offshore from the nursery areas based around the mangrove forests. Trawl times are considerably shorter than in the tiger prawn, lastingfrom 20 to 30 minutes.

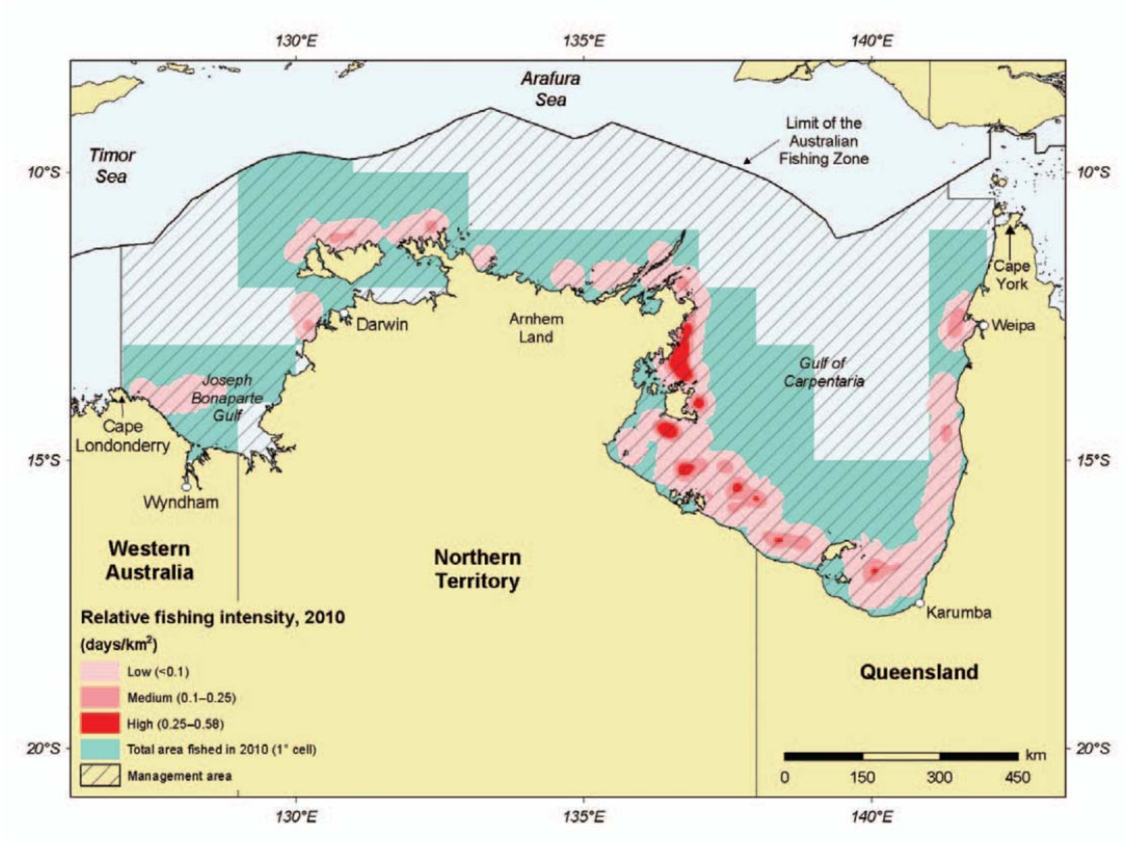
Tiger prawns are taken mainly at night in the southern and western Gulf of Carpentaria and along the Arnhem Land coast. The tiger prawn fishing grounds are often close to those of banana prawns, but the highest catches are in areas near the nursery coastal seagrass beds—the habitats. Red endeavour and king prawns are caught as retained species of the tiger prawn sub-fishery. A daylight trawl ban is in place during the second (tiger prawn) season. The length of prawn trawls in the tiger prawn fishery may be for up to 3 hours.

Red-legged banana prawns are caught in deeper waters of the JBG. The sub-fishery takes place during neap tides with fishing only occurring for up to 14 days a month (on average). The sub-fishery was closed during the first fishing season (the white banana prawn season) from 2007 to 2010 inclusive. Catches are usually higher from August to November

There are two closed seasons each year at which time there is no fishing throughout the area. These are: 1st December to 1st April, and 15th June to 1st August.

A maximum of 52 vessels fished during 2010. There has been an average annual 3,113 vessel days of effort attributed to the banana prawn season in the last 5 years, and 5,231 vessel days of effort attributed to the tiger prawn season. All NPF-licenses vessels are entitled to fish in the JBG sub-fishery; only 5 vessels have operated in the JBG sub-fishery in recent years with approximately 280 vessel days.

Figure 1: Relative fishing intensity in the Northern Prawn Fishery, 2010



Source: Woodhams *et al* (2011)[1]

[1] Woodhams, J, Stobutzki, I, Viera, S, Curlotti, R and Begg G.A (eds) Fishery status reports 2010: status of fish stocks and fisheries managed by the Australian Government. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra, Australia

3.5.2 History of the Fishery

Year	Description
1966	Two vessels operating
1970	200 vessels operating
1971	Seasonal closure for banana prawns introduced
1974	Banana prawn catch peaked at 12,712 t. Total prawn catch 13,815 t
1977	First management plan in place with limited entry licensing at 302 vessels
1977 and 1980	Controls on vessel replacement
1983	Tiger prawn catch peaked at 5751 t
1984	Unitisation introduced in response to fishing overcapacity and overcapitalization. Adoption of A-units as a measure of vessel size and power. B-units introduced and served as a right to fish. NORMAC formed.
Mid-1980s	Mid-1980s buy back scheme aimed at reducing A-units to 70,000 by 1990. Voluntary buyback extended to B-units.
1987	Mid-season closure (15th June to 1st August) introduced to reduce effort on tiger prawns before they spawn, in response to a decline in tiger prawn recruitment. Daylight trawling during the tiger prawn season ban introduced. Vessels restricted to towing two nets.
1988	Fishery became solely managed by the Commonwealth under the Offshore Constitutional Settlements arrangements.
1990	Buyback scheme refinanced, with amended target of 53,844 A-units by early 1993.
1993	Licence numbers reduced from 216 to 132 from 1990 to 1993 through voluntary sales to the buy back and compulsory surrender of 30.33%. The target was met in April 1993.
1995	A new Management plan and SFRs introduced under the Australian Fisheries Management Act 1992, based on existing effort units in the fishery, to replace class A and B units. A & B Class units rolled into A & B Statutory Fishing Rights (SFRs)
1998	Northern Prawn Resource Assessment Group advise that effective effort directed at tiger prawns was well above MSY and should be reduced by 25-30%. Bycatch Action Plan developed and implemented.
2000	Fishery moved to gear based management units using headrope length. Gear SFRs replaced A SFRs. B (boat) SFRs remain in place.
2001	AFMA commissioned an international expert review, which confirmed that tiger prawns were overfished and levels of fishing effort were too high to promote recovery. NORMAC established a target SMSY (spawner biomass that produced MSY) by 2006, with 70% uncertainty.
2002	40% effort reduction target met through 25% reduction in total allowable headrope length and shortening of season (to 134 total days in 2002, 2003 and 2004).
2004	NORMAC established MEY as the overall management objective of the fishery. Smsy redefined as limit reference point. NORMAC recommended 25% reduction in the operational value of gear SFRs.
2005	25% reduction in total allowable headrope length. Second tiger prawn season lengthened, with additional measures to minimize tiger prawn catch in the first banana prawn season.
2006	NPF management Plan 1995, amended to allow for the use of different gear types (including quad gear) and provide for the collection of prawn broodstock.
2006	Structural adjustment package removed 43 class B SFRs and 18365 gear SFRs (45% and 34% reductions, respectively).
2007	NPF Harvest Strategy Under Input Controls introduced, which aims to pursue MEY and maximize profit by changing effort levels using the results of a bioeconomic assessment of the tiger prawn fishery. Harvest Strategy includes catch trigger limits and decision rules for banana and tiger prawn fisheries.
2008	Agreement to allow a 33% increase in total gear in the fishery, resulting in an increase in the operational value of each gear SFR from 0.5625 cm to 0.7481 cm.
2008	Research undertaken to assess the advantages and disadvantages of effort control and catch control management options for the NPF.
2009	In 2009 the available tiger prawn season was increased by four weeks based on the outputs of the 2008 tiger prawn stock assessment, resulting in a season commencing 25 July and closing 19 December. The application of catch trigger limits and decision rules resulted in an early

	closure of the fishery on 4th December.
2010	In 2010 the banana season commenced 31 March at 2200 UTC, and concluded on 10 June at 0200 UTC, extending for 10 weeks. The tiger season commenced on 1 August at 0830 UTC and concluded 29 November at 2230 UTC, extending for 17 weeks.
2011	Harvest strategy and controls rules drafted for red-legged banana prawns, waiting for final approval by the AFMA Commission for implementation in 2012.

3.6 Target stock status and harvest controls (P1)

3.6.1 Stock biology and structure

The commercial penaeid prawns of northern Australia have been surveyed by electrophoretic techniques to determine the extent of geographic differentiation throughout their ranges in Australian waters. Genetic differences were detected among widely separated populations of *Penaeus latisulcatus* and *Metapenaeus endeavouri*, but *P. esculentus*, *M. ensis*, *P. semisulcatus* and *Fenneropenaeus merguiensis* showed no evidence of genetic differentiation. In both *P. latisulcatus* and *M.endeavouri* the most marked differences were detected between the samples from the Gulf of Carpentaria and Western Australia[2].

Die et al (2001)[3] suggested that there are several distinct stocks of tiger prawns in the NPF and suggested that assessments should be applied at a finer scale than that of a single stock. They based this conclusion on a simulation model of the currents in the Gulf of Carpentaria and the behaviour of larval prawns that was used to predict the offshore spawning regions from which tiger prawn larvae could be expected to reach the seagrass nursery areas along the coast. The model shows that there are large gaps between these effective spawning areas and this suggests limited mixing of tiger prawn larvae within the Gulf of Carpentaria. However, both larvae (Rothlisberg et al, 1983)[4] and adult prawns (Somers & Kirkwood, 1984)[5] can migrate relatively long distances within the GOC and it appears that considerable mixing might also occur.

As part of the Management Strategy Evaluation (MSE), Dichmont (2006)[6] and Dichmont *et al* (2006)[7] developed a multi-stock tiger/endeavour prawn assessment and compared that with a single stock assessment and concluded that the single stock assessment was more robust and produced the most reliable result. They also tested the most conservative case, which is that each stock in the operating model of the MSE was totally independent of each other and the intermediate case that there were correlations between stocks. In both cases, the single stock assessment was more robust and would lead to better management of the prawns in the NPF.

2 Mulley JC and Latter BDH (1981)Geographic differentiation of tropical Australian penaeid prawn populations. *Australian Journal of Marine and Freshwater Research* 32 (6) 897 - 906

3 Die, D., Loneragan, N., Haywood, M., Vance, D., Manson, F., Taylor, B., et al. (2001). Indices of recruitment and effective spawning for tiger prawn stocks in the Nothern Prawn Fishery. Canberra, Australia: FRDC Final Report 1995/014.

4 Rothlisberg, P. C., Church, J. A., & Forbes, M. G. (1983). Modelling the advection of vertically migrating shrimp larvae. Journal of Marine Research, 41 , 511-538.

5 Somers, I. F., & Kirkwood, G. P. (1984). Movements of tagged tiger prawns, Penaeus spp, in the western Gulf of Carpentaria. Journal of marine and Freshwater reserach 35 (6) , 713-723.

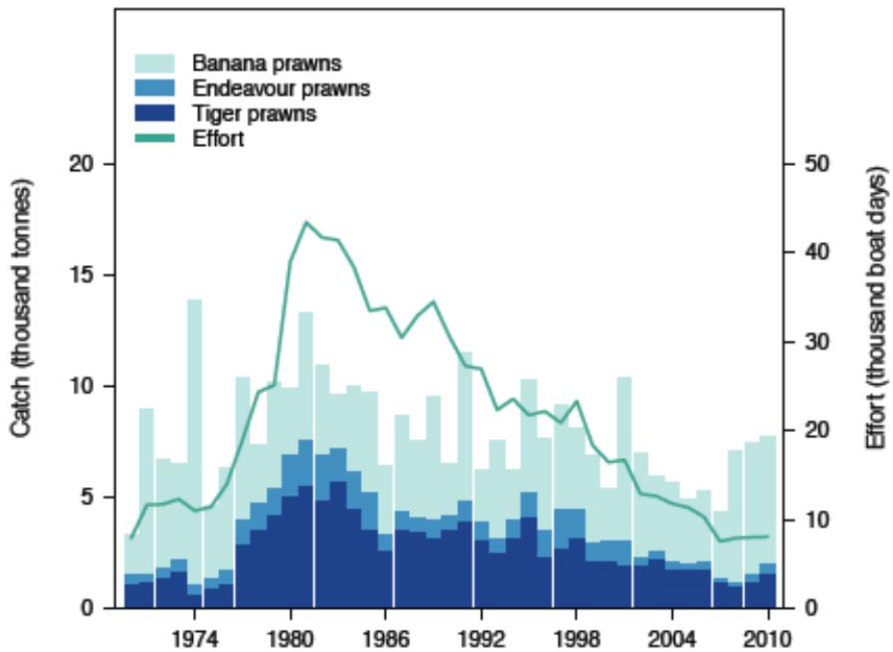
6 Dichmont C. M. (2006) Mangement strategies for an input contro;ed fishery based on the capture of short-leved tropical species: the example of Australia's Northern Prawn Fishery. Ph.D thesis, University of Tasmania, Australia.

7 Dichmont, C. M., Deng, A., Punt, A., Venables, W., & Hadon, M. (2006a). Management strategies for short-lived species: the case study of Australia's Northern Prawn Fishery. 1. Accounting for multiple species, spatial structure and implementation uncertainty when evlauating risk. *Fisheries Research 82* , 204-220.

3.6.2 Stock status and reference points

The total fishing effort in the NPF has declined significantly as a result of management (Fig 2). At its peak in 1981, there were 286 vessels fishing with a total of 43,419 vessel days. In 2010, 52 vessels fished the NPF for 8,044 days; 3,149 vessel days fished during the banana prawn season and 4,898 vessel days during the tiger prawn season.

Figure 2: Prawn catch and effort in the NPF. Source: Woodhams, et al (2011)[8]



In many management systems, the standard or default target reference point (TRP) is based on the biomass that provides for maximum sustainable yield (B_{MSY}), and the MSC uses B_{MSY} as a default target reference point (TRP). The management system may choose to increase the biomass TRP for biological or economic reasons. Recognition of uncertainty, biological features, and/or ecological role (e.g. forage species) are biological justifications for TRP higher than B_{MSY}. On the other hand, an increase in economic benefits, such as managing for maximum economic yield (B_{MEY}), is a non-biological reason for TRP higher than B_{MSY}.

Because the maximum economic yield occurs at a fishing mortality less than the fishing mortality of maximum sustainable yield, the $B_{MEY} > B_{MSY}$. Compared to $B_{MSY,}$ attaining B_{MEY} adds a layer of precaution because the risk of reducing the biomass to a level below the actual B_{MSY} is reduced. This reduces the risk of recruitment impairment but the use of B_{MEY} is primarily an economic decision.

When scoring a fishery for Outcome, use of B_{MEY} could lead to a 100 score for scoring issue 2 of PI 1.1.2 (reference points) as the TRP is such "that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, <u>or a higher level</u>, …." However, when scoring 1.1.1, a fishery could score < 80, if the biomass were below B_{MEY}, (i.e. not "fluctuating around its target reference point") even though it might be fluctuating around the B_{MSY} level, which is the default MSC TRP. Therefore by setting a TRP that is more conservative than the default MSC TRP, a fishery might set itself up to fail the

[8] Woodhams *et al Ibid*,

MSC standard (as written) even though in reality it might be performing better than a fishery that uses a less conservative TRP such as B_{MSY}.

The instruction and guidance in FAM 6.2.4 to 6.2.36 focuses on biological sustainability, given the prominent role of MSY and B_{MSY} in the Guidance. The MSC gives examples of biologically-justified TRP>B_{MSY} (e.g., low trophic level species), but none of economically-justified TRP>B_{MSY}. The use of MEY is intended to increase economic yield (as the name suggests) and the MSC does not reference economic goals as an evaluation consideration for 1.1. A fishery at B_{MSY} would suffer in the MSC system if the management system changed the TRP from B_{MSY} to B_{MEY}, as it would take time for the biomass to grow, and the fishery would change from $\geq$80 to <80 with no change in the biological status of the fishery. Fisheries that find themselves at levels $\geq$80 using B_{MSY} but <80 using B_{MEY} would unlikely chose to enter MSC assessment and put themselves in a rebuilding situation that may call for impracticable conditions. Requiring rebuilding for a fishery with a biomass at or above a biologically-justified sustainable level seems inconsistent with intent of the MSC standard.

The Australian northern prawn fishery (NPF) has a TRP designated as B_{MEY}. B_{MEY} is defined as 1.2* B_{MSY}. Several of the NPF stocks are at or above B_{MSY} but below B_{MEY}. As the fishery has B_{MSY} calculated, the stock assessment demonstrates that the stocks are at or fluctuating around a biologically-justified TRP. We conclude that the economically-based B_{MEY} should not be the TRP used to evaluate PI 1.1.1 in a case like this (particularly when the status of the fishery relative to B_{MSY} is known and documented), and have used B_{MSY} or proxy for evaluating 1.1.1.

3.6.2.1 Brown Tiger prawn (Penaeus esculentus)

Stock status

The most recent assessment of the status of brown tiger prawn (AFMA, 2011[9]) estimates a number of parameters in relation to the agreed reference points (see below for definition of reference points). The stock status of *P. esculentus*, is based on a size-structured population model that uses size data obtained from real-time surveys in the GOC (Punt et. al., 2010)[3] . The method is described in detail at 3.6.6. It should be noted that the latest assessment is a "routine" assessments that is fed directly into the harvest strategy as a basis for determining appropriate effort levels for the sub-fishery using real-time data obtained in the "recruitment surveys" conducted before the prawn fishing season. Because of the short time available to provide the advice, only the median value of the spawing biomass (S_y) as a proportion of S_{msy} and S_{mey} based on the reference stock assessment case are reported. Parameter estimation, sensitivities and confidence limits are given for 2007 in Punt, et al., (2010)[10]. These details are inclued below.

Current assessment based on most recent "routine" assessment

Table 5: Current status of *Penaeus esculentus* against reference points

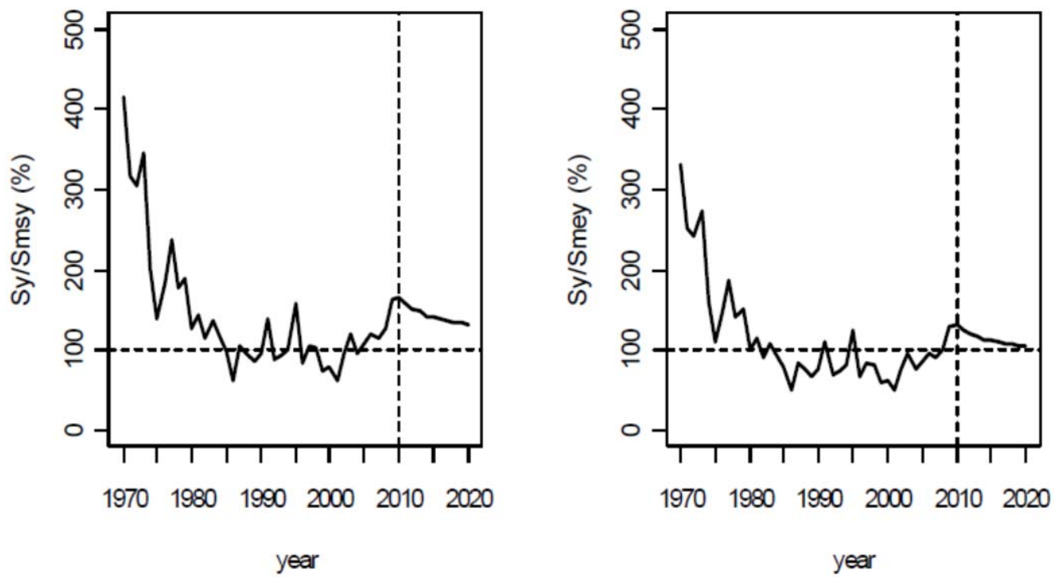
Name	Reference	Current value (2010)
S_{2010}/S_{MEY}	Target Reference Point	131%
5-year mav ($S_{2006-2010}/S_{MSY}$)	Limit Reference point = 50%	138%
E2010/EMEY	Target effort	32.8%
5-year mav ($S_{2006-2010}/S_{MSY}$)	Limit effort = 50%	25.1%

[9] AFMA (2011a) NPF RAG Assessment 2010/11. Tiger Prawns Milestone: Delivery of stock assessment and economic outputs

[10] Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessment and bio-economic management advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.

Following a period of overfishing in the late 1990s to the whole tiger prawn sub-fishery and a rebuilding strategy from 2002 to 2006, the stock is now above the MCS target biomass target reference point (TRP) of Bmsy (as well as above the NPF TRP of Smey) and well above the biomass limit reference point (LRP). Effort levels are also well below both the TRP and LRP, indicating overfishing is not occurring (Fig. 3 and Table 5).

Figure 3: Ratio of spawning biomass of *Penaeus esculentus* to S_{MSY} (left) and Ratio of spawning biomass to S_{MEY} (right)



Source: AFMA, NPF RAG Assessment 2010/11[11].

Status as determined from detailed stock assessment in 2009

(Punt et. al., 2010)[3] published results that showed the time trajectory of the spawning biomass with 90% confidence intervals. They also tested the sensitivity of in the estimates of the different parameters using (i) a reference base case based on the size structured model, (ii) a variant of this model where size data are not used, and (iii) a delay-difference model that was used in previous estimates. Figure 4 shows that the time trajectories for each model are similar but the absolute estimate of the spawning biomass is sensitive to the model used. All models show relatively small 90% confidence intervals.

[11] AFMA, 2011a, *Ibid*

Figure 4: Index of the spawning biomass of *Penaeus esculentus* from 1970 to 2007 (a= reference case; b= without survey data; c = delay difference model). Dotted lines show 90% confidence intervals.

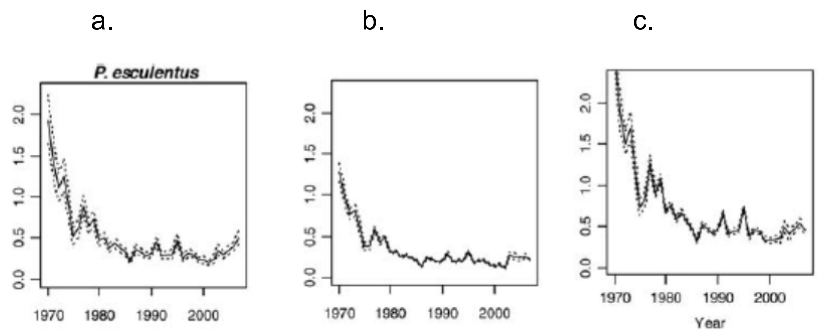


Table 6: Summary statistics (with 90% confidence intervals in brackets) for the reference base case for P. esculentus

C_{2008} (t)	C_{MEY} (t)	S_{MEY}/S_{MSY}	S_{2007}/S_{MSY}	S_{2007}/S_{MEY}
852 (783-927)	1232 (1148-1303)	1.164(1.134-1.203)	1.250 (1.166-1.362)	1.073 (1.002-1.161)

As shown in Table 6, the estimates of the ratio S_{MEY}/S_{MSY} were 1.164 for the reference case (and the lower 90% confidence interval was greater than 1 at 1.134). This confirms the expectation that maximization of the profit leads to higher target stock sizes and lower target levels of catch and effort. The level of spawning biomass in 2007 was 1.250 higher than the S_{MSY} (and the lower 90% confidence interval was also greater than 1 at 1.166). The level of spawning biomass in 2007 was 1.073 higher than the S_{MEY} (and the lower 90% confidence interval was also greater than 1 at 1.002). The current catch (C_{2008}) is well below the catch at MEY.

Conclusion
The stock status is assessed based on very sophisticated modelling techniques and excellent data inputs (see 3.6.5 and 3.6.6). It can be stated with confidence that the stock is at a level which maintains high productivity and has a low probability of recruitment overfishing.

Reference points
Biomass reference points
The choice of reference points to meet the Commonwealth of Australia's Legislative requirements and is aimed at realizing the objectives of the NPF Management Plan 1995 that includes "Ensure the utilization of the fishery resources is consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle." More details concerning the reference points can be found at 3.6.3.

Target: S_{MEY} (Spawning biomass at maximum economic yield)
Limit: Moving average of S_Y/S_{MSY} over 5 most recent years = 0.5

S_{MEY} is a conservative target reference point that aims for economic efficiency while still maintaining the stock above S_{MSY}. Similarly, S_y/S_{MSY} is a conservative limit reference point that takes 50% of S_{MSY} as a state that is undesirable. A moving average used to account for year-to-year variability in abundance that could cause rapid changes in management responses.

Effort reference points
Target: E_{MEY} (Effort at maximum economic yield) 1.e. E_y/E_{MEY} = 1.
Limit: Moving average of E_Y/E_{MSY} over 5 years = 0.5

P. esculentus is a scavenger that feeds on a wide variety of detritus, small animals and plants (e.g., forams). It comprises only a very small proportion of many species of penaeid, carid and sergistid shrimps that occupy similar feeding niches in the food web of the NPF, and it is not considered a low trophic level (LTL) species.

Conclusion: Limit and target reference points are appropriate for the stock.

3.6.2.2 Grooved tiger prawn (Penaeus semisulcatus)

Stock Status

The most recent assessment of the status of grooved tiger prawn (AFMA, 2011[12]) estimates a number of parameters in relation to the agreed reference points (see below for definition of reference points). The stock status of *P. semisulcatus*, is based on a size-structured population model that uses size data obtained from real-time surveys in the GOC (Punt et. al., 2010)[3] . The method is described in detail at 3.6.6. It should be noted that the latest assessment is a "routine" assessments that is fed directly into the harvest strategy as a basis for determining appropriate effort levels for the sub-fishery using real-time data obtained in the "recruitment surveys" conducted before the prawn fishing season. Because of the short time available to provide the advice, only the median value of the spawing biomass (S_y) as a proportion of S_{msy} and S_{mey} based on the reference stock assessment case are reported. Parameter estimation, sensitivities and confidence limits are given for 2007 in Punt, et al., (2010)[13]. These details are inclued below.

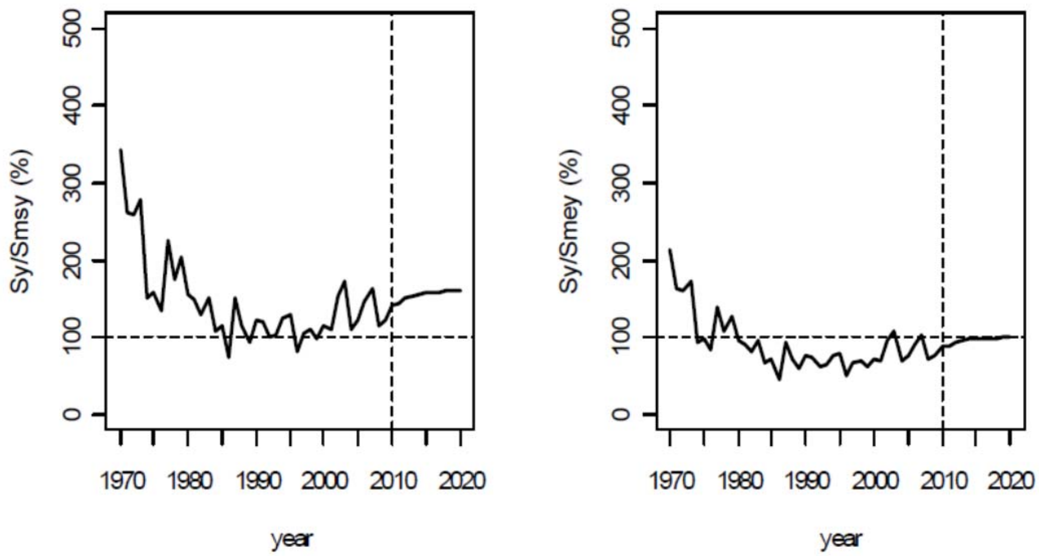
Table 7: Current status of *Penaeus semisulcatus* against reference points

Name	Reference	Current value (2010)
S_{2010}/S_{MEY}	Target Reference Point	88.6%
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit Reference point = 50%	138%
E_{2010}/EMEY	Target effort	117%
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit effort = 50%	32.8%

Following a period of overfishing in the late 1990s to the whole tiger prawn sub-fishery and a rebuilding strategy from 2002 to 2006, the stock is now above the MSC default biomass target reference point (TRP) of Bmsy and well above the biomass limit reference point (LRP). However, the biomass is below the NPF TRP; projections indicate that biomass will reach the TRP in approximately 2014. Effort levels are also well below LRP, but above the TRP, indicating that biological overfishing is not occurring. (Figure 6 and Table 7).

[12] AFMA (2011a) NPF RAG Assessment 2010/11. Tiger Prawns Milestone: Delivery of stock assessment and economic outputs
[13] Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessment and bio-economic management advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.

Figure 5: Ratio of spawning biomass of *Penaeus semisulcatus* to S_{MSY} (left) and ratio of spawning biomass to S_{MEY} (right).

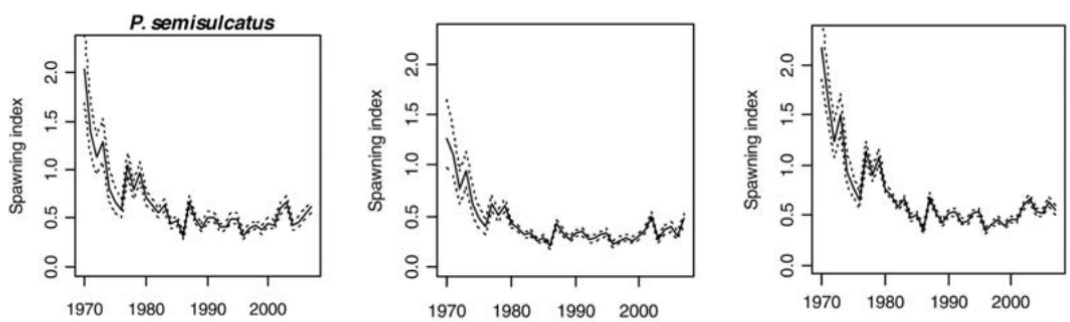


Source: AFMA, NPF RAG Assessment 2010/11.

Status as determined from detailed stock assessment in 2009

Figure 6: Index of the spawning biomass of *Penaeus semisulcatus* from 1970 to 2007 (a= reference case; b= without survey data; c = delay difference model). Dotted lines show 90% confidence intervals.

a. b. c.



Punt et. al., 2010)[3] published results that showed the time trajectory of the spawning biomass with 90% confidence intervals. They also tested the sensitivity of in the estimates of the different parameters using (i) a reference base case based on the size structured model, (ii) a variant of this model where size data are not used, and (iii) a delay-difference model that was used in previous estimates. Figure 6 shows that the time trajectories for each model are similar but the absolute estimate of the spawning biomass is sensitive to the model used. All models show relatively small 90% confidence intervals.

Table 8: Summary statistics (with 90% confidence intervals in brackets) for the reference base case for *P. semisulcatus*

C_{2008} (t)	C_{MEY} (t)	S_{MEY}/S_{MSY}	S_{2007}/S_{MSY}	S_{2007}/S_{MEY}
1039 (839-1253)	1447 (1386-1536)	1.331(1.309-1.356)	1.414 (1.339-1.449)	1.063 (1.008-1.118)

As shown in Table 8, the estimates of the ratio S_{MEY}/S_{MSY} were 1.331 for the reference case (and the lower 90% confidence interval was greater than 1 at 1.309). This confirms the expectation that maximization of the profit leads to higher target stock sizes and lower target levels of catch and effort. The level of spawning biomass in 2007 was 1.414 higher than the S_{MSY} (and the lower 90% confidence interval was also greater than 1 at 1.39). The level of spawning biomass in 2007 was 1.063 higher than the S_{MEY} (and the lower 90% confidence interval was also greater than 1 at 1.008). The current catch (C_{2008}) is well below the catch at MEY.

Conclusion
The stock status is assessed based on very sophisticated modelling techniques and excellent data inputs (see 3.6.5 and 3.6.6). It can be stated with confidence that the stock is at a level which maintains high productivity and has a low probability of recruitment overfishing. While the biomass is above B_{MSY}, it is below the TRP of B_{MEY}.

Reference points
Biomass reference points
The choice of reference points to meet the Commonwealth of Australia's Legislative requirements and is aimed at realizing the objectives of the NPF Management Plan 1995 that includes "Ensure the utilization of the fishery resources is consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle." More details concerning the reference points can be found at 3.6.3.

Target: S_{MEY} (Spawning biomass at maximum economic yield)
Limit: Moving average of S_Y/S_{MSY} over 5 most recent years = 0.5

S_{MEY} is a conservative target reference point that aims for economic efficiency while still maintaining the stock above S_{MSY}. S_y/S_{MSY} is a conservative limit reference point that takes 50% of S_{MSY} as a state that is undesirable. A moving average used to account for year-to-year variability in abundance that could cause rapid changes in management responses.

Effort reference points
Target: E_{MEY} (Effort at maximum economic yield) 1.e. E_y/E_{MEY} = 1.
Limit: Moving average of E_Y/E_{MSY} over 5 years = 0.5

P. semisulcatus is a scavenger that feeds on a wide variety of detritus, small animals and plants (e.g. forams). It comprises only a very small proportion of many species of penaeid, carid and sergistid shrimps that occupy similar feeding niches in the food web of the NPF, and it is not considered a low trophic level (LTL) species.

Conclusion: Limit and target reference points are appropriate for the stock.

3.6.2.3 Blue endeavour prawn (Metapenaeus endeavouri)

Stock Status
The most recent assessment of the status of the blue endeavour prawn (AFMA, 2011[14]) estimates a number of parameters in relation to the agreed reference points (see below for definition of reference points). The stock status of *M. endeavouri*, is based on a size-structured population model that uses size data obtained from real-time surveys in the GOC (Punt et. al., 2010)[3]. The method is described in detail at 3.6.6. It should be noted that the latest assessment is a "routine" assessments that is fed directly into the harvest strategy as

[14] AFMA (2011a) NPF RAG Assessment 2010/11. Tiger Prawns Milestone: Delivery of stock assessment and economic outputs

a basis for determining appropriate effort levels for the sub-fishery using real-time data obtained in the "recruitment surveys" conducted before the prawn fishing season. Because of the short time available to provide the advice, only the median value of the spawing biomass (S_y) as a proportion of S_{msy} and S_{mey} based on the reference stock assessment case are reported. Parameter estimation, sensitivities and confidence limits are given for 2007 in Punt, et al., (2010)[15]. These details are inclued below.

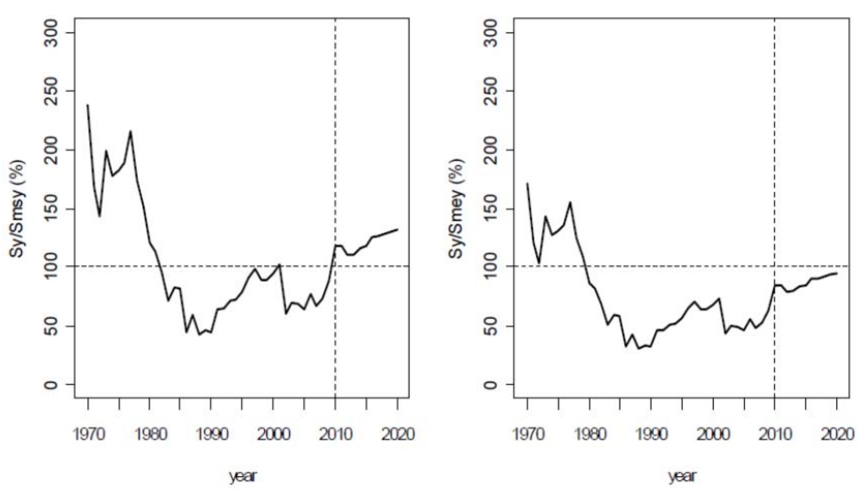
Current assessment based on most recent "routine" assessment

Table 9: Curent status of *Metapenaeus endeavouri* against reference points

Name	Reference	Current value (2010)
S_{2010}/S_{MEY}	Target Reference Point	84.8%
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit Reference point = 50%	85.0%
E2010/EMEY	Target effort	N/A
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit effort = 50%	N/A

Following a period of overfishing in the late 1990s to the whole tiger prawn sub-fishery and a rebuilding strategy from 2002 to 2006, the stock is now above the MCS target biomass target reference point (TRP) of Bmsy (but below the NPF TRP of Smey) and well above the biomass limit reference point (LRP) (Table 9 and Fig. 7)

Figure 7: Ratio of spawning stock size of *Metapenaeus endeavouri* to S_{MSY} (left) and ratio of spawning stock size to S_{MEY} (right).



Source: AFMA, NPF RAG Assessment 2010/11[16].

Status as determined from detailed stock assessment in 2009

(Punt et. al., 2010)[3] published results that showed the time trajectory of the spawning biomass with 90% confidence intervals. They also tested the sensitivity of in the estimates of the different parameters using (i) a reference base case based on the size structured model, (ii) a variant of this model where size data are not used, and (iii) a delay-difference model that was used in previous estimates. Figure 8 shows that the time trajectories for each model

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15 Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessment and bio-economic management advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.

16 AFMA,2011a*, Ibid*

are similar but the absolute estimate of the spawning biomass is sensitive to the model used. All models show relatively small 90% confidence intervals.

Figure 8: Index of the spawning biomass of *M. endeavouri* from 1970 to 2007 (a= reference case; b= without survey data; c = delay difference model). Dotted lines show 90% confidence intervals.

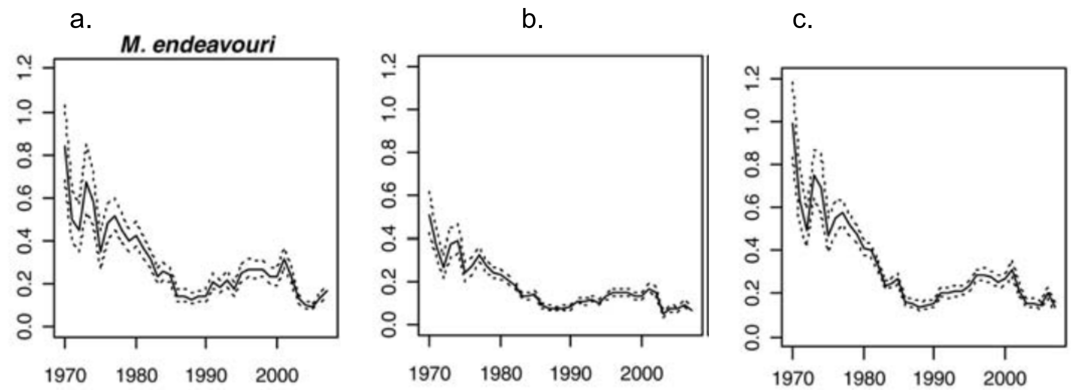


Table 10: Summary statistics (with 90% confidence intervals in brackets) for the reference base case for *M.endeavouri*

C_{2008} (t)	C_{MEY} (t)	S_{MEY}/S_{MSY}	S_{2007}/S_{MSY}	S_{2007}/S_{MEY}
325 (278-372)	646 (593-699)	1.218(1.191-1.259)	0.796 (0.724-0.888)	0.653 (0.587-0.727)

As shown in Table 10, the estimates of the ratio S_{MEY}/S_{MSY} were 1.218 for the reference case (and the lower 90% confidence interval was greater than 1 at 1.191). This confirms the expectation that maximization of the profit leads to higher target stock sizes and lower target levels of catch and effort. The level of spawning biomass in 2007 was 0.796 of the S_{MSY} (and the lower 90% confidence interval was 0.724). The level of spawning biomass in 2007 was 0.653 of the S_{MEY} (and the lower 90% confidence interval was 0.587). However, the current catch (C_{2008}) is well below the catch at MEY.

Reference points

Biomass reference points

Target: S_{MEY} (Spawning biomass at maximum economic yield)

Limit: Moving average of S_Y/S_{MSY} over 5 most recent years = 0.5

S_{MEY} is a conservative target reference point that aims for economic efficiency while still maintaining the stock above S_{MSY}. S_y/S_{MSY} is a conservative limit reference point that takes 50% of S_{MSY} as a state that is undesirable. A moving average used to account for year-to-year variability in abundance that could cause rapid changes in management responses.

M.endeavouri is a scavenger that feeds on a wide variety of detritus, small animals and plants (e.g., forams). It comprises only a very small proportion of many species of penaeid, carid and sergistid shrimps that occupy similar feeding niches in the food web of the NPF, and it is not considered a low trophic level (LTL) species.

Conclusion: Limit and target reference points are appropriate for the stock.

3.6.2.4 Red endeavour prawn (Metapenaeus ensis)

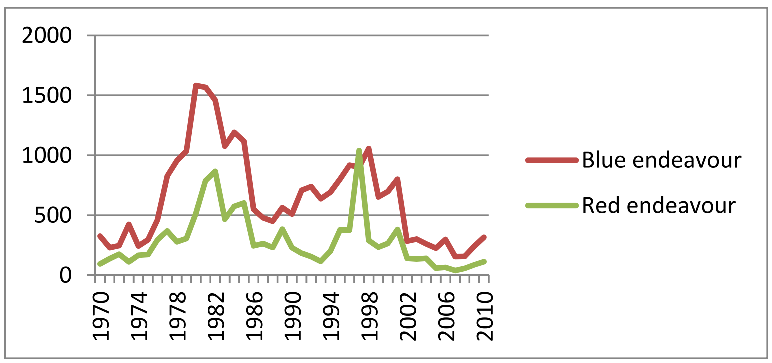
Stock Status

Because the catches of red endeavour prawns are small and variable, red endeavour prawns are not included in the regular stock assessments carried out by the CSIRO for the two species of tiger prawns and the blue endeavour prawn.

Except for 1997, red endeavour prawn catches have always been lower than blue endeavour prawn catches (Fig. 9). Since the fishery restructuring and the large reduction in fishing effort, red endeavour prawn catches have averaged 72 tonnes (2006-2010)[17]. Over the same period, blue endeavour catches averaged 234 tonnes.

Catches have shown similar trends to that of the blue tiger prawn with high catches in the 1980s but with recent declines reflecting the management interventions imposed on the fishery (Fig. 9) that has reduced the number of fishing vessels and the fishing effort over the last two decades.

Figure 9: Estimated catch of red and blue endeavour prawns for the NPF, 1970 to 2010



Source: CSIRO (pers comm, email 9 December, 2011)

It is important to note that the status of this stock is assessed based on logic that applies for stocks that are well managed but do not have a formal stock assessment or biomass based reference points. In this case “likely”, “highly likely” and “high degree of certainty” are interpreted both qualitatively (through analogy with similar stocks, plausible argument and qualitative risk assessments (Productivity Susceptibility Analysis) (in 6.2.31 (MSC FAM V.2.1)), example of surrogate measures where yield is calculated based on a proportion of the observed biomass and the harvested fraction determined on empirical evidence from harvested catches and their consequences.

Further, an empirically based Level 2 analysis (PSA – Productivity Susceptibility Analysis) rated red endeavour prawns as low risk (Griffiths, S. *et al* (2007)[18]). The attribute values for many of the units (e.g., age at maturity, depth range, mean trophic level, etc.) were obtained from published literature and other resources (e.g., scientific experts), and stakeholder input was provided at several points in the assessment through the NPF Resource Assessment Group (NPF RAG) (fishers, managers and scientists). Note the blue endeavour prawn was

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[17] CSIRO (pers comm.) Estimated endeavour prawn catches since 1970 (email of 9th December, 2012.

[18] Griffiths, S., Kenyon, R., Bulman, C., Dowdney, J., Williams, A., Sporic, M., et al. (2007). *Ecological risk assessmant for the effects of fishing: Report for the Northern Prawn Fishery.* Canberra: Australian Fisheries Manageamant Authority.

rated as “medium risk”, although subsequent stock assessments have found that stocks are not overfished.

Both species of endeavour prawns (red and blue endeavour prawns) are included as economic bycatch in the in the bio-economic model (AFMA, 2011a[19]) for the tiger sub-fishery and are thus included in the harvest strategy (see below).

In conclusion, as for the other stocks in the tiger prawn sub-fishery, it can be inferred that the stock of red endeavour prawns is at a level that maintains high productivity and has a low probability of recruitment overfishing.

Reference points

Biomass reference points

There are no formal reference points for red endeavour prawns, but they are considered in the harvest strategy (HS) for the tiger prawn sub-fishery. The HS target reference point for the sub-fishery is the Maximum Economic Yield (MEY) and covers the two species of tiger prawns, two species of endeavour prawns and two species of king prawns. This recognizes that maximizing the net benefits for the sub-fishery as a whole may lead to some stocks (species) being over-harvested, while others may be under-harvested, an outcome that is considered acceptable as long as no stock (species) is driven to low levels as indicated by their status with respect to the limit reference point.

In the case of red endeavour prawns, the reference points are the same as those for the other species and the species is also included in the trigger catch rate of 350kg/day that forms part of the control rules to stop fishing[20].

Conclusion:

Given that it is not possible to carry out formal stock assessments on such a low-catch species, the reference points are appropriate for the stock.

3.6.2.5 White banana prawn (Fenneropenaeus merguiensis)

Stock Status

Because the annual recruitment of the white banana prawns is driven by environmental conditions (rainfall and catchment basin runoff) (Vance *et al*, 1998[21]), it is difficult to conduct stock assessments based on simple stock recruitment assumptions. However, annual catches have been correlated with rainfall, and prediction of catches made on the basis of the rainfall preceeding the banana prawn fishing season (Venables, *et al*., in press[22]). Since 1970, catches, especially in the southeastern Gulf of Carpentaria, have responded more or less as expected to changes in rainfall, indicating that the stocks of banana prawns have remained at levels above those at which recruitment has been impaired. Catches have also bounced back in areas of the Gulf where there were some concerns that overfishing may have occurred. Historical records, therefore, indicate that the banana prawn sub-fishery is

[19] AFMA, 2011a,. *Ibid*

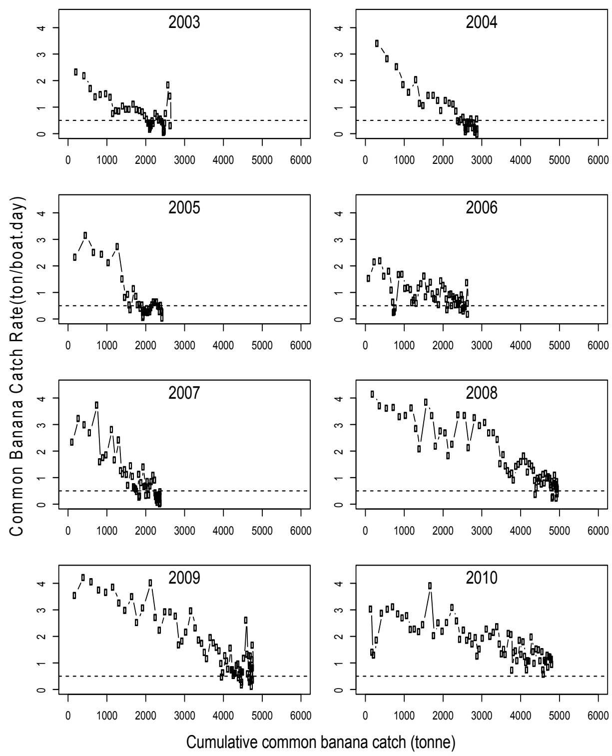
[20] This control rule is not in the current harvest strategy but is contained in the AFMA Northern Prawn Fishery Second Season information 21 July 2010

[21] Vance, D. J., Haywood, M. D. E., Heales, D. S., Kenyon, R. A., and Loneragan, N. R. 1998. Seasonal and annual variation in abundance of postlarval and juvenile banana prawns, *Penaeus merguiensis*, and environmental variation in two estuaries in tropical northeastern Australia: a six-year study. *Marine Ecology Progress Series.* 163: 21-36.

[22] Venables, B., Hutton, T., Lawrence, E., Rothlisberg, P., Buckworth, R., Hartcher, M., *Kenyon, R.* (in press). *Predictions of common banana Prawn potential catch in Australia's Northern Prawn Fishery.* Canberra, Australia: Australian Fisheries Management Authority.

sustainable with the current short fishing season. The season can be shortened in lower catch years, based on catch rates (see account of the HS below).

Figure 10: Annual changes in the escapement of *Fenneropenaeus merguiensis* at the end of the fishing season shown by a plot of the catch rate vs the accumulative catch rate.

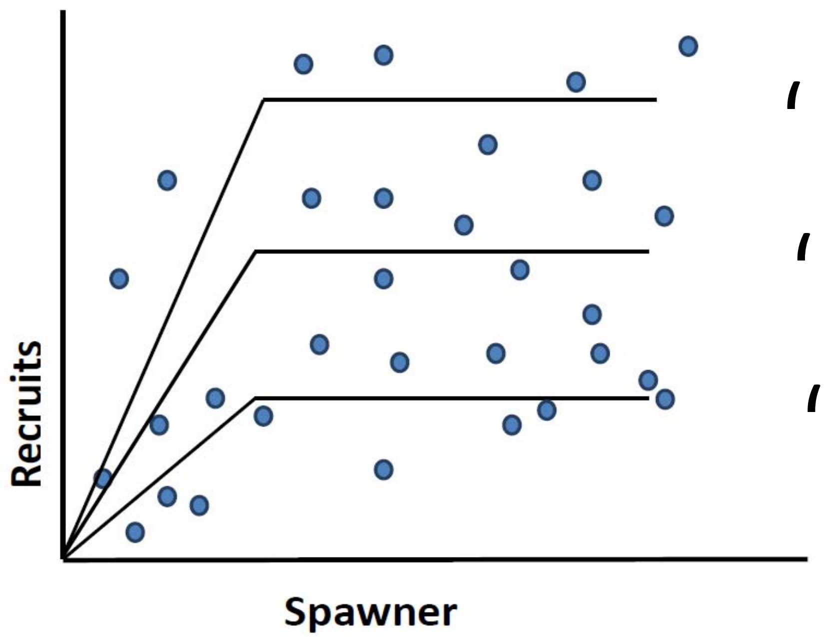


Source: Dichmont, C., CSIRO, Interview No 3.

The catch rate at the end of the season is now higher than in earlier years, providing evidence that the escapement (biomass and number of prawns remaining at the end of the banana prawn fishing season (in April/May)) has increased in recent years (Fig. 10).

A conceptual model can be used to describe the dynamics of the white banana prawn population (Fig. 11). The spawning stock:recruit relationship can be shown as a series of “lines” that reflect the intensity of rainfall. “Line” (a) is high rainfall, (b) is medium rainfall and (c) is low rainfall. Each “line” shows a threshold above which there is no relationship between the spawners and subsequent recruits. Below this threshold, recruits are influenced by the size of the spawning stock and at the extreme, zero spawners results in zero recruits. The fact that residual catch, after taking into account rainfall, has not declined indicates that the stock has not dropped below the threshold, and is in fact fluctuating around an average B_{MSY}. Each year the catch is a function of the number of recruits and in some areas of the GOC, the fishing effort, which is managed through the input controls, including the length of the fishing season based on catch rates.

Figure 11: Conceptual model of white banana prawn dynamics (Buckworth interview[23]). (a) = high rainfall; (b) = medium rainfall; and (c) = low rainfall



Further, an empirically based Level 2 analysis (PSA – Productivity Susceptibility Analysis) rated white banana prawns as low risk (Griffiths, S. *et al* (2007)[24]). The attribute values for many of the units (e.g., age at maturity, depth range, mean trophic level, etc.) were obtained from published literature and other resources (e.g., scientific experts), and stakeholder input was provided at several points in the assessment through the NPF Resource Assessment Group (NPF RAG) (fishers, managers and scientists).

Based on the evidence provided it would appear that the stock has been maintained or has exceeded the biomass that produces MSY, and the stock is at a level which maintains high productivity and has a low probability of recruitment overfishing.

Reference points

Biomass reference points

Because of the environmentally driven inter-annual variability there are no formal biomass reference points. Concepts such as a static MSY and 0.5MSY are not appropriate for this species and MSY needs to be interpreted in a more dynamic sense as the maximum average yield (MAY) or maximum economic return (MEY surrogate). The surrogate measures are that there will be a sufficient escapement from the sub-fishery to not

[23] Buckworth, R (pers comm): Email of 21/9/11 [Interview record #2]

[24]Griffiths, S., Kenyon, R., Bulman, C., Dowdney, J., Williams, A., Sporic, M., et al. (2007). *Ecological risk assessmant for the effects of fishing: Report for the Northern Prawn Fishery.* Canberra: Australian Fisheries Manageamant Authority.

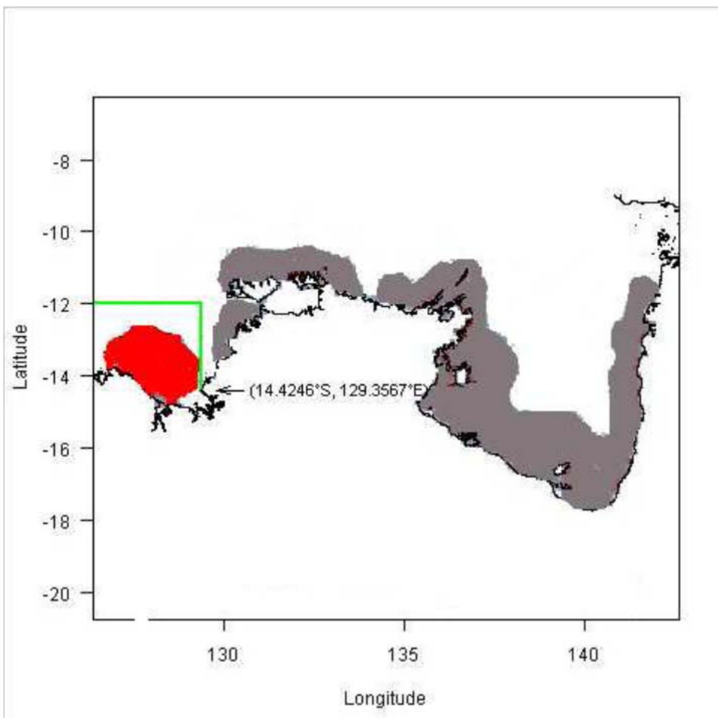
jeopardize subsequent recruitment and to maximize the economic return from the fishery within the constraint of the limit. The surrogate limit reference point is a catch rate of 500kg/day that is used to shorten the season length if catch triggers are not reached. The trigger catch is based on an average of the catches of the fourth fishing week in the most productive banana prawn seasons over a ten year period and divided by the number of boats. Both the past history of catches and analyses of residuals (see 3.6.3) have shown that the control rules based on this LRP have been effective[3]. Even in the years where there have been very poor catches in some areas, the rebound in the catch would indicate that the banana prawn fishery is resilient.

3.6.2.6 Red-legged banana prawn (Fenneropenaeus indicus)

Stock Status

Red-legged banana prawns comprise a relatively small percentage of the total prawn catch and have had less stock assessment attention than the tiger prawns. The bulk of their catches within their NPF range come from the Joseph Bonaparte Gulf (JBG) (Fig. 1). A red-legged banana prawn area has been defined and is shown in Fig. 12. It comprises the main fishing grounds where red-legged banana prawns are caught in the JBG.

Figure 12: The area defined as the Joseph Bonaparte Gulf (JBG) sub-fishery for red-legged banana prawns.



Source: AFMA (2011b)

An assessment model is available for red-legged banana prawns. It is a quarterly age-based biological model with no economic component internal to the model (in contrast to that for the Tiger Prawn fishery) (for more detail of the method see 3.6.6. For the stock assessment (but not the current HS), the limit reference point proxy (as per the Harvest Strategy Policy Guidelines) of $0.5B_{MSY}$ is used. The overfishing reference points are the corresponding fishing mortality levels that correspond to the above over the long-term. The assessment model was used to interpret the limit reference point as kilos of catch. The assessment model computed that the limit reference point of 0.5Bmsy was equal to 390 kg/day.

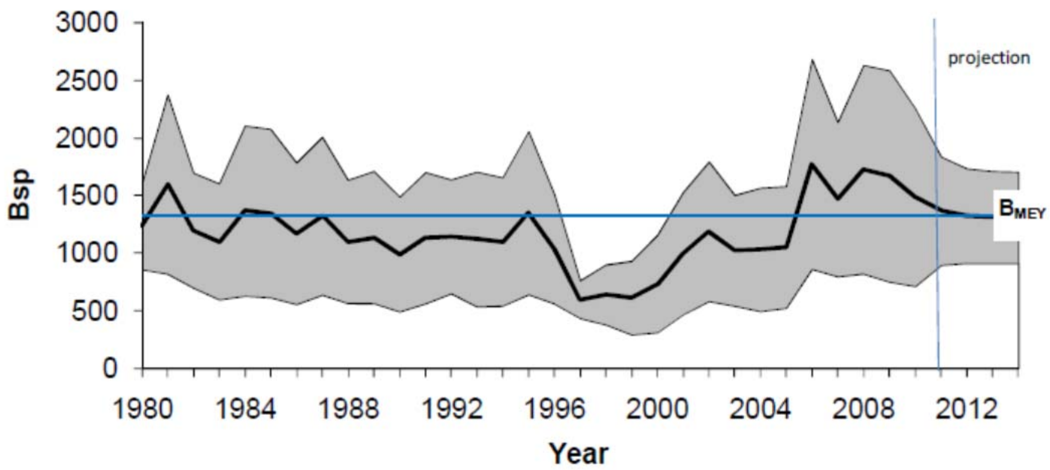
The most recent assessment of the status of red-legged banana prawn (AFMA, 2011[25]) estimates the following parameters against the reference points (see below for definition of reference points).

Table 11: Curent status of *Fenneropenaeus indicus* against reference points

Name	Reference	Current value (2011)
S_{2011}/S_{MEY}	Target Reference Point	119-126%
S_{2011}/S_{MSY}	MSC default TRP	134-152%
$S_{2010}/0.5S_{MSY}$	Limit Reference point	268-303%
R_{2007}/av R	Current recruitment	147%

Recent changes in the seasonality of fishing makes it difficult to estimate MSY and MEY and the associated biomass and fishing levels. Two estimates of the spawning biomass at MSY and MEY (S_{MSY} and S_{MEY}) have been calculated, one based on the period 1989-2007 and the second based on 2007 (Table 11). The S_{MSY} values were 1,106 and 979 tonnes, respectively, and the S_{MEY} values were calculated as 1.2 times the S_{MSY} – 1,327 and 1,175 tonnes, respectively. The current spawning biomass S_{2010} was estimated at 1,485.3 tonnes (STD =470), which is above both estimates of S_{MSY} (119% and 126%, respectively) and the NPF TRP of S_{MEY} (119% and 126%, respectively). It is also well above the LRP $0.5S_{MSY}$ (268-303%, respectvely). The recruitment in 2007 was also above the average recruitment for the period 1987-2006.

Figure 13: Spawning biomass of *Fenneropenaeus indicus* from 1980 to 2010, projected out to 2014. Shaded areas are associated Hessian-based 90% confidence intervals.



Source: AFMA (2011b), NPF RAG Assessment 2010/11 Red-legged banana prawns.

Spawning biomass declined in 1996 and was low until 2006 (Fig. 13). During this period, management measures aimed at reducing fishing effort for the NPF were put in place and red-legged banana prawn stocks also responded. Thus, since 1997 the effort on the red-

[25] AFMA 2011b. *NPF RAG Assessment 2010/11 Red-legged banana prawns.* Canberra, Australia: Australian Fisheries Management Authority.

legged banana prawns has declined significantly along with the catch. The CPUE has also increased over this period.

The red-legged banana prawn assessment is much less certain than the tiger and endeavour assessments, as shown by the wider 90% confidence intervals. Because there is no pre-season survey, the assessment relies on CPUE data only and the standardisation of these data may be less reliable than that applied to the other species which have been subject to longer and more in-depth analyses. As a result, the LRP does not align with the tiger and endeavour prawn LRP of the five-year average of the most recent consecutive year and is more conservative, namely that the LRP is implemented as soon as the stock falls below 0.5 B_{MSY} for two years in a row. Since the model relies on fisheries dependent data, some provision for collecting catch rate data may be required. For the same reason, the fishery would be re-opened after a single year's closure in order to maintain reliable data for the stock assessment. Historically, the stock has only dropped below this level once, during the years 1997-1999.

Reference points

Biomass reference points

Prior to the 2012 season, the red-legged banana prawn was managed as part of the total banana prawn sub-fishery that includes both the white banana prawn as well as the red-legged banana prawn. As with white banana prawns, there are no formal biomass reference points. The surrogate measure is that there will be a sufficient escapement from the sub-fishery to not jeopardize subsequent recruitment. Escapement is theoretically controlled through changing the length of the fishing season. The surrogate limit reference point is a catch rate of 500kg/day that is used to trigger the fishing season shortening.

However, between 2007 and 2010 inclusive, the red-legged sub-fishery of the JBP was not fished during the white banana prawn season and fishing occurred only during the tiger prawn season from August to November. During this period, the catch trigger of 350 kg/day applied and, if necessary, closed the sub-fishery. The tiger prawn catch trigger limits closed the entire fishery, including the JBG sub-fishery in 2009 and 2011 when the catch triggers were not met.

More recent stock assessments, have considered some more appropriate reference points. These are proxy points (in the sense that these are defaults in the Commonwealth Harvest Strategy) of $0.5B_{MSY}$ (LRP) and $1.2B_{MSY}$ (TRP).

Target: S_{MEY} (Spawning biomass at maximum economic yield) defined as $1.2B_{MSY}$
Limit: S_Y/S_{MSY} over 2 most recent years = 0.5

S_{MEY} is a conservative target reference point that aims for economic efficiency while still maintaining the stock above S_{MSY}. S_y/S_{MSY} is a conservative limit reference point that takes 50% of S_{MSY} as a state that is undesirable.

However, at the time of assessment, these reference points had not been incorporated into the HS and control rules.

F. indicus is a scavenger that feeds on a wide variety of detritus, small animals and plants (e.g., forams). It comprises only a very small proportion of many species of penaeid, carid and sergistid shrimps that occupy similar feeding niches in the food web of the NPF, and it is not considered a low trophic level (LTL) species.

Conclusion: Limit and target reference points are not included in the current HS under input controls but appropriate TRP and LRP are available in the stock assessment.

3.6.3 Harvest Strategy

In September 2007 the Australian Government released the Commonwealth Fisheries Harvest Strategy Policy and Guidelines for Implementation of the Strategy. The Minister subsequently required the Australian Fisheries Management Authority (AFMA) to implement harvest strategies in all relevant Commonwealth fisheries by January 2009 (DAFF, 2007[26]). The Harvest Strategy Policy and associated implementation Guidelines aim to ensure that key commercial fish species are managed for long-term biological sustainability and economic profitability. It also seeks to provide the fishing industry with a more certain operating environment. The Harvest Strategy Policy provides a framework that allows a strategic, science-based approach to setting total allowable catch levels in all Commonwealth fisheries on a fishery by fishery basis. The implementation guidelines provide practical advice on how to interpret and apply the Harvest Strategy Policy to Australia's fisheries and contain details of the science behind the fisheries management decisions.

The policy is due for review with a report to be provided to the Australian Government Ministers for Fisheries and Environment within five years of its commencement. Opportunities will be provided for stakeholder engagement during this review.

Commonwealth harvest strategies seek to do the following:

- *In all Commonwealth fisheries the exploitation rate of target stocks in any fishing year will not exceed that giving the Maximum Sustainable Yield. The catch of target stocks in all Commonwealth fisheries will not exceed the Maximum Sustainable Yield in any fishing year unless otherwise consistent with a scientifically robust harvest strategy designed to achieve a sustainable target level and that does not result in overfishing or overfished stock;*

- *For the initial and default harvest strategy, reductions in exploitation rate and catch are to be implemented immediately when breeding stocks are assessed to have been reduced below 40% of pre-fished levels, and targeted fishing to cease when breeding stocks are assessed to have been reduced below 20% of pre-fished levels (known as a '20/40' harvest strategy). Alternative harvest strategies may be developed in specific cases where they meet the sustainability objectives and do not result in overfishing or overfished stocks;*

- *The harvest strategy must achieve the objective of avoiding overfishing and avoiding overfished stocks with at least 80% probability (where lack of knowledge about a fish stock precludes decision making with this level of certainty, decisions on catch/units should reflect the application of the precautionary principle).*

The NPF HS (AFMA, 2010[27]) includes distinct strategies for the tiger prawn and banana prawn fisheries and is designed to operate within the current management system of output controls.

The tiger prawn sub fishery strategy has been tested in a simulation environment to assess its performance against the *Commonwealth Fisheries Harvest Strategy Policy* (HSP) (Dichmont et al, 2008[28]). This evaluation showed that the harvest strategy performed well in terms of meeting the HS objectives under a number of different scenarios that included different sources of uncertainty.

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[26] DAFF (2007), Commonwealth Fishery Harvest Strategy, Policy and Guidelines. http://www.daff.gov.au/__data/assets/pdf_file/0004/397264/HSP-and-Guidelines.pdf

[27] AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

[28] Dichmont, C. M., Deng, A., Punt, A. E., Ellis, N., Venables, W. N., Kompas, T (2008). Beyond biological reference performation measures in management strategy evaluation: Bringing in economics and the efects of trawling on the benthos. *Fisheries Research 94* , 238-250.

In the banana prawn sub fishery, recruitment patterns of the white banana prawn has been assessed and been linked to annual rainfall patterns[29]. The HS objective is to allow sufficient escapement from this fishery to ensure an adequate spawning biomass of banana prawns (based on historical data), and to maximize the economic return from the fishery within the above parameter. An analysis of the residual catch (catch with the effect of rainfall removed) shows no trends across the NPF, indicating that fishing has not impacted on recruitment and that the HS is effective. The reduction in fleet size has also reduced the ability of the fleet to search for and catch white banana prawns to the same extent they have done in the past.

3.6.4 Harvest control rules and tools

The NPF is currently managed through a combination of input controls (limited entry, seasonal closures, permanent area closures, gear restrictions and operational controls), which are implemented under the Management Plan.

The table in 3.5.1 describes the evolution fleet management and harvest tools using both successive buy-back schemes (mid-1980s, 1990 and 2006) and tradable gear Statutory Fishing Rights (SFRs), as established in 1995. The number of vessels has been reduced to the level estimated by the Australian Bureau of Agricultural and Resource Economics and Science (ABARES) needed to reach the Maximum Economic Yield (MEY) in the NPF.

The Management Plan provides for the granting of fully transferable SFRs that determine the number of trawlers that may operate (Class B SFRs) and the amount of gear (Gear SFRs) used in the Fishery. In 2001, the Management Plan was amended to allow the total gear pool to be set by a Determination. The gear SFR is set as an amount of headrope length (and corresponding footrope controls), which can be varied depending on the stock status and economic grounds.

In 2002, measures to reduce effort by 40% on tiger prawn stocks were introduced. This was achieved by shortening the seasons and a further 25% reduction in the value of a gear SFR from 24 August 2002. Internal trading amongst the fleet following this measure resulted in a reduction in Class B SFRs from 119 to 102.

In 2006 the Commonwealth Government Structural Adjustment Package removed 42 Class B SFRs and approximately 30% of the effective effort from the NPF.

In 2008, following a recommendation from the Northern Prawn Fishery Management Advisory Committee (NORMAC) there was an 8% increase in effort in the 2008 tiger prawn season. This translated into NPF gear SFRs increasing in operational value from 5.625cm to 7.481cm and Concessions Holders were permitted to use quad gear (with a 10% penalty applied).

The harvest strategies operate as follows (Box 1).

Box 1: A summary of harvest strategies in the NPF (as of September 2011)

BANANA PRAWNS
Species: White banana prawn and red-legged banana prawn.
Target: No current specific target.
Limit: Surrogate limit of a catch rate of 500kg/per boat/per fishing day

The operational objective of the banana prawn sub-fishery (both white and red-legged species) is “to allow sufficient escapement from the sub-fishery to ensure an adequate spawning biomass of banana prawns (based on historical data) and, within this parameter, maximize the economic return from the

[29] Venables, B., Hutton, T., Lawrence, E., Rothlisberg, P., Buckworth, R., Hartcher, M., et al. (in press). *Predictions of common banana Prawn potential catch in Australia's Northern Prawn Fishery.* Canberra, Australia: Australian Fisheries Management Authority.

sub-fishery and also to minimize the catch of tiger prawns in the banana prawn season."

Control rules:

- The season opens for a maximum of 12 weeks (first banana prawn season) but can be shortened by increments of 2 weeks if the average daily catch is less than 500 kg/vessel (fishing) per day. The season is closed after 6 weeks if the pro-rata total tiger prawn catch is more than 33 tones (6.6 tonnes/week*5). The rules are read in conjunction with other management measures, including gear controls and spatial closures.
- Spatial closures apply in a number of locations. The rational for these are explained below.
- The rules are based on an analysis of historical fishery records, which indicated that the approach was likely to result in a sustainable fishery.

The limit of 500kg/per boat/ per fishing day is set to allow sufficient escapement from the sub-fishery to protect the spawning stock.

The season trigger is predominantly intended to improve economic performance of the sub-fishery by extending fishing only when it is profitable.

This strategy has collectively covered the white and red-legged banana fishing season in the period from April to mid-June, and the tiger prawn HS covers red-legged bananas (with a trigger limit of 350 kg per boat/per fishing day) during the tiger prawn season.

An amendment of the control rule has been drafted that sets an explicit trigger for red-legged bananas in both fishing seasons and is awaiting final approval the AFMA Commission for implementation in 2012. These are presented in a subsequent box.

TIGER PRAWNS
Species: Grooved tiger prawn, brown tiger prawn and blue endeavour prawn.

Target: Long-term maximum economic yield (MEY) from a suite of tiger and endeavour prawns (with recognition that some species, when considered in isolation, may be below or above BMEY, but still subject to a limit reference point).
Limit: Half of the spawning stock needed to achieve maximum sustainable yield (0.5SMSY), calculated as the moving average over five years (this limit is currently assessed only for tiger prawns).

The operational objective of the HS is to attain long-term maximum economic yield (MEY) from the tiger prawn species. MEY is calculated as the effort level in each year over a 7 year projection period that creates the biggest difference between the total revenue generated from tiger and endeavour prawns and the total costs of fishing for the tiger prawn sub-fishery as a whole

Control rules: Control rules set for tiger prawns but covers blue endeavours based on the fact that blue endeavours are taken as incidental catches and that control of tiger prawn fishing will also protect this species. The trigger point of 350kg/day refers to all species, including red-legged bananas and results in a total closure of the NPF.

The season may last for up to 4 months, commencing 1st August, with the possibility of early closure in the event that the average catch per boat falls below 350 kg/vessel per day by weeks 12/13. If the averages are not met, then the sub-fishery will close by week 16[30].[31] Subject to stock assessments, targeted tiger prawn fishing can also occur after 1 May during the banana prawn season. The appropriate level of effort will be based on a bio-economic assessment undertaken every alternate year, optimizing the effort over a seven year moving window to maximize profits. Fishing effort is controlled by modification of area, season and gear (headrope length).

- If the limit reference point is triggered, there will be no target fishing on the species concerned. Spatial and temporal measures will be used to prevent fishing on the species.
- Standardised fishing effort for the fleet in any one year cannot be less than half of the standardised effort targeted at brown tiger prawns in 2006.

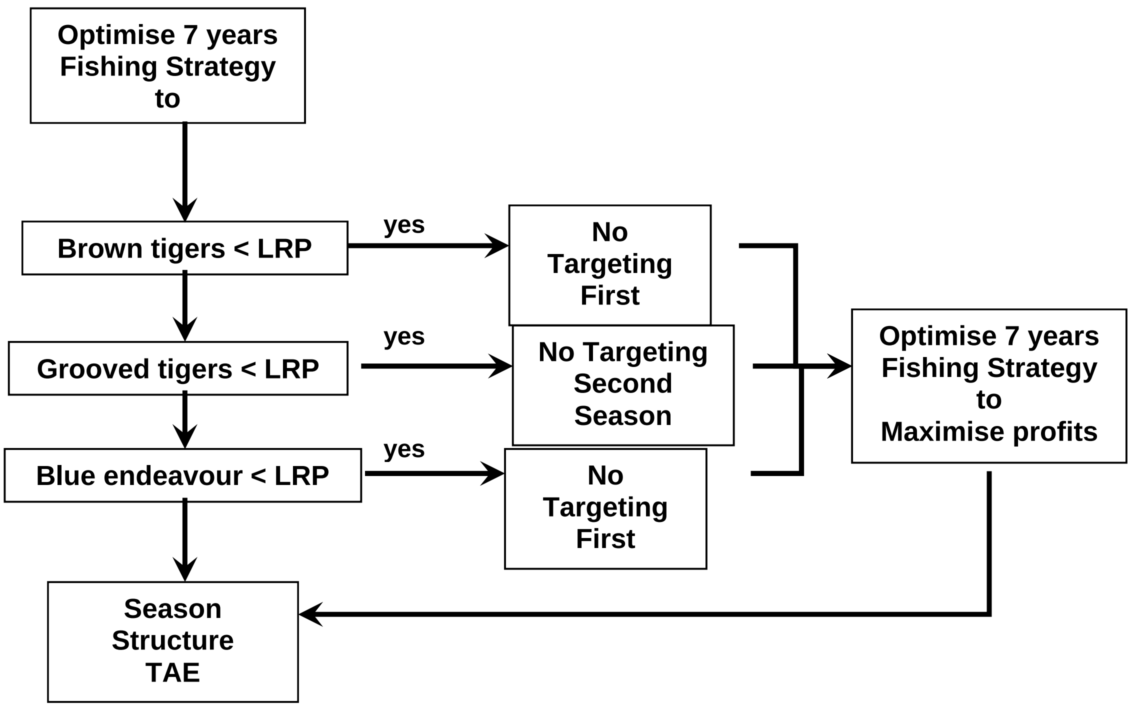
[30] AFMA (ed & rev) 2011, *Northern Prawn Fishery Operational Information* http://www.afma.gov.au/wp-content/uploads/2010/06/NPF-Info-book-2011-FINAL-280311.pdf.
[31] This control rule is not in the current harvest strategy but is contained in the AFMA Northern Prawn Fishery Second Season information 21 July 2010

The season catch trigger is predominantly intended to improve economic performance of the sub-fishery by allowing fishing only when it is profitable.

Source: NPF Harvest strategy, 2011

The basis of the tiger prawn decision rules is that, because blue endeavour prawns are a bycatch of the tiger prawn fishery, controlling the season length and TAE of tiger prawns will equally maintain the stock size of blue endeavour prawns. This has been tested in MSE's (Dichmont *et al*. 2008 and Dichmont *et al.*, in prep). There is, however, a specific blue endeavour prawn rule when this species falls below the LRP. The flow chart for the LRPs is given in Figure 14.

Figure 14: Flow chart of Limit Reference Point decision rules.



The sequence in decision rules is as follows:

1. A bio-economic assessment will be undertaken every alternate year, optimising the effort over a seven year moving window to maximise profits.
2. If the LRP is triggered, there will be no target fishing on the target species concerned. Spatial and/or temporal measures will be used to prevent target fishing on species below the limit reference point.
3. Providing the limit reference point is not exceeded, nominal effort for the fleet in any one year cannot be less than 1.08 times the nominal effort targeted at brown tiger prawns in 2007.
4. The effort in nominal days for each fleet (brown and grooved) for the first two years from the bio-economic assessment will be applied. This will be calculated as a percentage change from the previous year's actual nominal effort.
5. Effort controls will be applied through the use of spatial and temporal closures, and gear; or any combination of these inputs.

6. If effort changes are to be implemented through gear, the change in effort versus the change in gear will be calculated empirically and calculated based on the percentage gear change from the previous year's gear amount.

During the assessment, but after the first consultation period, a number of additional variations were made to the sub fishery harvest strategies. The assessment scoring takes account of the management strategy and rules and tools applied for the assessment period (September 2011), when the Red legged sub fishery had a strategy in place but this was not specific to sub fishery reference points, but implicit linkages could be determined from the Tiger prawn sub fishery RPs. The harvest strategy and harvest tools were revised prior to the Peer Review incorporating new fishery specific RPs and catch triggers and the assessors consider that these meet the intent of the requirements. Other changes include changes to the white banana and tiger prawn management rules (Box 2); Changes to the red legged banan prawn strategy and tools are highlighted in (Box 3).

Box 2 illustrates some changes to the banana prawn season rules which will be implemented to close the fishery to daylight trawling to prevent targeting of banana prawns if the catch triggers are not met. This approach will allow targeted tiger prawn fishing to continue at night east of 138 degrees only.

Box 2: Reported variations to the white banana prawn harvest strategy, rules and tools during the course of the assessment.

Adjustments made to the tiger and banana prawn management rules

Since 2010, operators have been allowed to target tiger prawns in response to positive outputs of the assessment model. At recent NPRAG meetings, there was discussion around the fact that additional effort could be placed on tiger prawn stocks. Based on these discussions, NPFI and NPRAG recommended changes to the current arrangements that will allow continued fishing for tiger prawns if banana prawn catch trigger limits are not met, including through a daylight trawl ban. As follows:

Boats cannot target tiger prawns until 1st May as per the current decision rules

- The tiger prawn trigger limits (6t per week) will remain in place for the first four weeks of the season The same catch reporting periods for white banana prawn catches will be required i.e. weeks 4 & 5; weeks 6 & 7; weeks 8 & 9
- A boat will be considered to be a tiger prawn boat if 75% of the catch is tiger prawns (including ends/kings). Catches from tiger prawn boats (75% or > tiger/end/king catch) will **not** be taken into account in the calculations for white banana prawn catch triggers
- A boat will be considered to be a white banana boat if 75% of the catch is banana prawns. Catch from all banana prawn boats (75% or > white banana catch) **will** be included in the calculation using the current rules (average catch of 500 kg per boat per fishing day)
- Catches from boats with less than 75% white banana or tiger boats will be allocated as 50/50 to the banana and tiger prawn fisheries. White banana prawn catches from those boats will be deemed to represent **a half day** of banana prawn fishing (i.e. the catch from 2 half days will equal one full day of banana prawn fishing) and **will** be included in the calculation
- If the white banana prawn catch limits are not met at any time during the reporting periods, the fishery will be closed **West of 138 degrees** and closed to **daylight trawling East of 138 degrees** between **8am and 6pm** to allow access to the tiger prawn fishery**.**
- The entire fishery will close on **15th June**, regardless of whether boats are banana or tiger prawn fishing.

Source: NORMAC, approved by the NPRAG and referred to the AFMA Commission for out of session approval.

Box 3 provides the description for the harvest strategy introduced from 2012 onwards.

Box 3: New control rules for red-legged banana prawns.

The confidence limits for the estimates of stock size for red-legged banana prawns are broad, such that if the stock was estimated as falling below the LRP in a single year, there would be cause for concern as there is a possibility that the stock was well below the LRP, and hence it would be appropriate to set the total allowable effort (TAE) at zero. As a result, the LRP does not align with the Tiger and Endeavour prawn LRP of the five-year average of the most recent consecutive year and is more conservative, namely that the LRP is triggered as soon as the stock falls below 0.5 $B_{MSY\ for}$ two years in a row. Since the model relies on fisheries dependent data, some provision for collecting catch rate data may be required. For the same reason, the fishery would be re-opened after a year's closure in order to maintain reliable data for the stock assessment. Historically, the stock has only dropped below this level once, during the years 1997-1999.

The following decision rules will be used in the management of the red-legged banana prawns to pursue the fishery TRP (B_{MEY}):

The following decision rules will be used in the management of the red-legged banana prawns:

1. A Limit Reference Point (LRP) of 390 kg CPUE

2. Undertake the annual stock assessment using the natural mortality rate of 0.05 per week (based on tagging data from Die *et al*. 2002) with a co-management and NPRAG-agreed season pattern and using standardised CPUE data,

3. Catch data from the JBG fishery will be analysed for the period from August, September & October inclusive at the end of each calendar year

4. If a minimum of 100 fishing days has been achieved *and* the red-legged banana prawn stock size falls below the LRP for the two most recent consecutive years, then the TAE is zero for a year (no fishing in the following year).

5. After one year, the TAE for the subsequent year would be set at a precautionary level based on the stock assessment model-predicted TAE. The option to use research effort to maintain catch rate data for the assessment could be considered.

6. Else if the LRP is *not* triggered, then

7. Fishing **WILL** be allowed for the full two seasons in the following year provided:

- ➢ that data has been provided for a minimum of 100 fishing days over the full fishing year *AND* that the average catch per boat per fishing day in August, September & October is 390 kg or more

8. Fishing **WILL** be allowed for the full two season in the following year:

- ➢ if data has been provided for less than 100 days of fishing during the full fishing year *AND*
- ➢ whether or not the LRP of 390 kgs per boat per fishing day in August, September & October has been triggered

9. Fishing will **NOT** be allowed in the first (banana prawn) season of the following year:

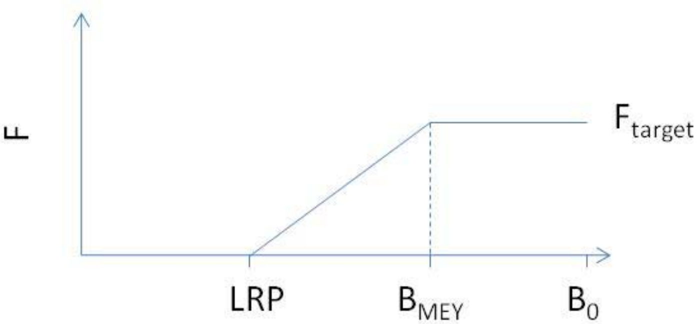
- ➢ If data has been provided for a minimum of 100 fishing days over the full fishing year *AND*
- ➢ that the average catch per boat per fishing day in August, September & October is less than 390 kg,

however the fishery will be re-opened to fishing in the second (tiger prawn) season of the same year

10. The fishery (when fishing is allowed) will open at the same time as the rest of the NPF however the fishery will close if the catch trigger limits/decisions rules in place for the common banana prawn and tiger prawn fisheries close the rest of the NPF in any given season.

Source: NORMAC endorsed by NPFRAG in March 2012 and currently being assessed by the AFMA Commission

Figure 15: **Stylised diagram showing the "hockey stick" rule as described in numbers 2 and 3 above. LRP is limit reference point, F fishing mortality and F_{target} here is F_{MEY} the fishing mortality at Maximum Economic Yield (MEY). B_{MEY} is the biomass at MEY and B_0 is the unfished or virgin stock size.**



Source: NPF harvest strategy, 2012, Dichmont, 2011

The management system is also supported by a variety of closures which have been implemented in the NPF since the fishery's development in the early 1970's. A total of 2.1% of the total managed zone of the fishery is subject to permanent closures, while 8.3% is subject to seasonal closures. (This does not include the fact the entire area of the NPF is shut for approximately 5 and a half months each year, which provides total protection to the entire area of the fishery, all bycatch and all prawns).

The Closures include protected area, spatial, seasonal and daylight (seasonal) closures. Some of these closures and assigned periods have changed through the years. The primary aim of all current closures is to enhance the productivity of the NPF, usually through protecting an early stage of the life history of prawns or through reducing effort on spawners or stocks, and to protect the environmental biodiversity through defined biodiversity hot-spots, marine protected areas and conservation zones. The measures also took account of socio cultural issues including the protection of indigenous interests and reduced interactions with other fisheries (Kenyon, S., *et al*, 2005[32]).

The primary aim of the establishment of most protected area closures is to protect nursery habitats of the prawn species (including seagrass and mangroves).

The closures were almost all established in the 1980s, following scientific research on two complementary topics. Firstly, the basic biology and life cycle of the species was now understood, including the habitats required by the juveniles; and secondly, scientific surveys identified the locations of the crucial inshore nursery habitats (including seagrass and mangroves). The known seagrass locations became the basis of many of the protected area closures.

[32] Kenyon R.A., Jarrett A.E., Bishop J.F.B., Taranto T.J., Dichmont C.M., Zhou S. (2005). Documenting the history of and providing protocols and criteria for changing existing and establishing new closures in the NPF: Final Report to AFMA (AFMA Project R02/0881).

The most common aim for the seasonal area closures is to protect sub-adults. Some bio-economic studies have been undertaken, which confirm the obvious economic value of protecting small prawns. Often though, few or no scientific data were available to support or verify these closures. Many of the closures have been implemented at the request of industry, based on anecdotal advice about small prawn captures. Significantly, major issues when setting and evaluating these sorts of closures remain. For example, uncertainties exist, firstly, as a result of the high annual variability in the timing and location of the peak abundance of small prawns, and secondly, as a result of the occurrence of large and small prawns (usually of different species) together on the same grounds.

The NPF Industry Pty Ltd has implemented a process whereby if/when quantities of small prawn captures are reported, voluntary ‘move-on’ provisions (which require skippers to leave the area where there are large captures of small prawns) are implemented (NPF Industry Pty Ltd, 2012[33]).

An AFMA sponsored Closures Review (Kenyon, *et al*) was undertaken in 2007. The review set out criteria and protocols for the classification and review of current closures and the establishment of new closures (including an Industry workshop that reviewed proposed criteria and protocols and incorporated Industry views into the final protocols). Indigenous interests are also consulted as and when the case for closures are analysed and recommended.

3.6.5 Information

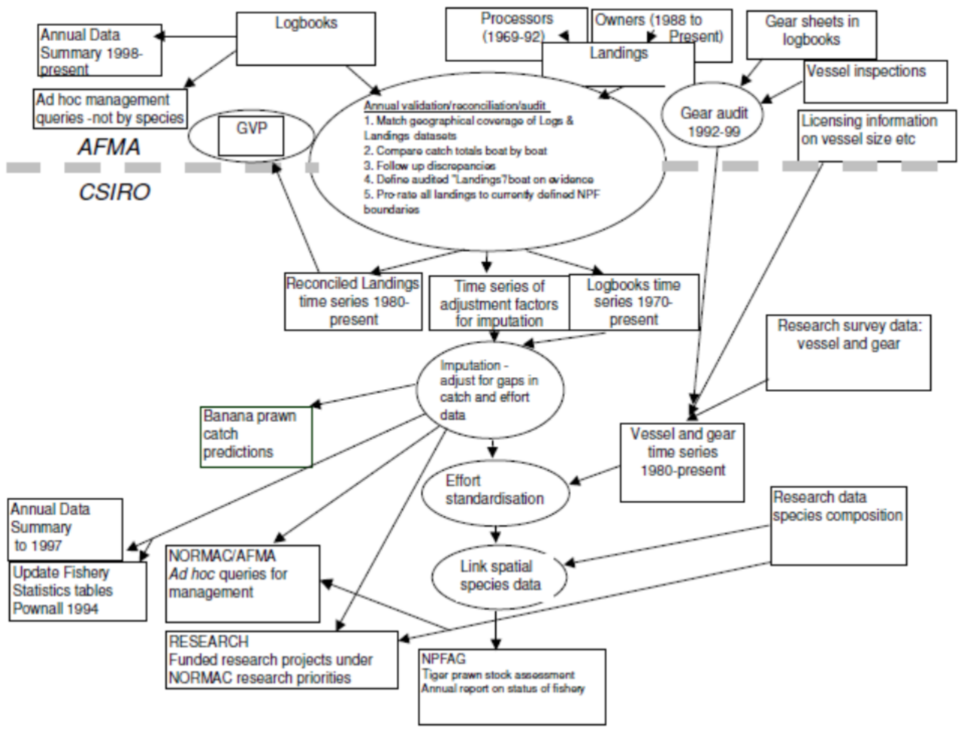
3.6.5.1 Data collection

A comprehensive data collection program has been established for the NPF to ensure reliable information is available on which to base management decisions. Information is maintained on all target prawn species taken in the NPF. The comprehensiveness of the program is a product of the high value of the fishery, the management needs of the fishery and the importance of stock assessment to determine the status of the target species.

The data collection program is based on logbooks that provide for catch and effort data to be recorded daily in logsheets. Processor records are obtained for landings data which are used to verify the logbook catch. Vessel gear details are also collected which track changes in gear and technology in the fishery. This information assists in stock assessments and research being undertaken on effort creep and fishing power studies. This data forms the basis of the NPF’s fishery dependent research program. Targeted fishery independent research, including annual fishery independent surveys for target species and bycatch is undertaken in the NPF. Each year, a recruitment survey is undertaken on the key fishing grounds of the Gulf of Carpentaria. A spawner survey is undertaken during the mid-season break in winter on the western grounds of the Gulf. These surveys started in 2003.

[33] NPF Industry Pty Ltd, (2012), NPF in-season management rules - small tiger prawns and small banana prawns.

Figure 16: Diagrammatic representation of the data and information flow for the NPF assessments and input into the HS



Economic data is collected by ABARES on a regular basis to provide inputs to the NPF's bio-economic model. Figure 16 shows the flow of information and its link to stock assessments and the control rules of the HS.

Environmental information includes general climatic observations through the Australian meteorological network, oceanographic observations during past research cruises and the annual "recruitment" and "spawning" survey cruises.

3.6.5.2 Data Reliability

Bishop *et al*, 2001[34], conclude that annual landings in the NPF have been estimated reasonably accurately since 1980 by combining information from logbooks to supplement landed weights from prawn processing companies and trawler owners. There were periods during the early history of the fishery when not all operators provided logbook information but a detailed augmentation process has been used to estimate missing logbook information so that the total logbook catch corresponds to the landings. This information is needed for species specific stock assessments. The NPF has a long time series of data available for scientific analysis. CSIRO holds a copy of logbook data and annual reconciled landings since 1970. AFMA has had primary responsibility for collecting, collating and verifying the logbook and vessel register data and providing this data to CSIRO.

Economic data from the NPF has been collected by the Commonwealth government's economic research agency, the Australian Bureau of Agriculture and Resource Economics

[34] Bishop, J and Die, D (2001) *Final report: accuracy of catch and effort data for the northern prawn fishery.* CSIRO Marine Research

(ABARES) since the 1980's[35]. Bi-annual economic surveys are carried out by ABARES, aimed at capturing financial information from approximately 40% of the fleet. The financial information is provided by NPF operators with small, medium and large trawlers on a voluntary basis. The information collected in the surveys is used by ABARES to calculate the economic performance of the fishery. ABARES survey information is also used by the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) to assess the performance of AFMA in managing fisheries. Economic data is also collected from SFR holders by the NPF Industry Pty Ltd annually to supplement the collection of economic information by ABAREs.

3.6.5.3 Fishery Monitoring

The fishery has a number of monitoring processes in place that will continue under this harvest strategy. These are:

(a) An annual Gulf of Carpentaria-wide independent data collection program (at sea survey) which was first undertaken in the fishery in August 2002. The survey has two modules:

- a January/February survey that provides data for a fishery independent recruitment index for banana, tiger and endeavour prawns; and
- a June/July survey that provides information to examine the spatial distribution in the fishery and attempts to quantify changes in fishing power, one of the key areas of contention with the current model.

Scientific data is collected through these surveys for all target species and a range of bycatch species.

(b) Scientific and crew member observer programs on commercial trawlers to collect data and to monitor bycatch.

(c) A fishery-wide daily catch & effort logbook program for all target and byproduct species and to record interactions with protected species. Under this program, operators are required to record the location of fishing operations (latitude/longitude) for every day they fish and/or search, regardless of whether any catch is taken; the total number of shots for each fishing day; the species/product retained and size grade information.

(d) Seasonal Landings Returns used to reconcile log book data (target and byproduct species) against commercial landings.

(e) A gear monitoring program to monitor vessel fishing power and TED/BRD configurations. Mandatory data collected through the program includes vessel length; beam; depth; engine make and model; engine power; max. trawl RPM; operating RPM; gear box reduction ratio; kort nozzle; propeller diameter and pitch; plotter make and model; sonar; max. speed; trawl speed (banana and tiger prawn fisheries); TED and BRD configurations.

(f) Annual comprehensive gear surveys to contribute to fishing power analyses and identification of new gear technologies.

(g) VMS data to monitor position of vessels especially with respect to spatial and temporal closures.

(h) Random enhanced VMS polling over a short period to monitor vessel speed.

[35] ABARES (2009), Australian fisheries surveys report 2009, Survey results for selected fisheries, 2006-07 and 2007-08, Preliminary estimates for 2008-09. Available at http://adl.brs.gov.au/data/warehouse/pe_abarebrs99001665/afsr09.pdf

(i) ABARES surveys to collect economic data.
(ii) NPFI surveys to collect economic data

3.6.6 Stock Assessment

3.6.6.1 Tiger and endeavour prawns

Several different assessment techniques for the Tiger Prawn sub-fishery have been developed over time – a delay difference model (Dichmont *et al.* 2003[36]), Bayesian hierarchical biomass dynamic model (Zhou *et al*., 2009[37]), and a newly developed size-based model (Punt *et al*. 2010[38]). Currently, three species (brown and grooved tiger prawns and the blue endeavour prawn) are assessed using a size-structured population dynamics model which operates on a weekly time-step. The parameters of this multi-species population dynamics model, which include annual recruitment, fishery and survey selection patterns, parameters which define the size-transition matrix, and recruitment patterns, are estimated using data on catches, catch-rates, length-frequency data from surveys and the fishery, survey indices and tag release-recapture data. The model allows for the technical interaction among the three species a result of bycatch when targeting one or the other species. The results from the multi-species stock assessment form part of the basis for evaluating the time-series of catches (by species) and levels of fishing effort (by fishing strategy) which maximize net present value. The bio-economic model takes into account costs which are proportional to catches, and those which are proportional to fishing effort, as well as fixed costs. The sensitivity of the results is examined by changing the assumptions regarding the values for the economic parameters of the bio-economic model as well as those on which the assessments are based.

The advantages of the size-structured model include the greater inclusion of available data (specifically catch and survey length-frequency data as well as tagging data), and therefore less use of pre-specified parameters (for example selectivity is estimated, not knife-edge); whereas in the delay difference model this was originally not the case.
The size-structured population dynamics model also allows grade-specific prices to be considered unlike the delay-difference model which is forced to assume that price is independent of size. This has implications in terms of both optimal level of catch as well as optimal timing of catch. The model has greater flexibility in terms of fitting potential alternative effort regimes for different assumptions regarding season length. Importantly, since it still uses weekly time intervals, this model provides a useful tool for evaluation of the trade-off between TAC and season duration/timing (as recognised by the NPF RAG) (by estimating the optimal fishing pattern while estimating the profit into the future.

Model fits to the data are shown in Fig. 17 (the observed length-frequencies and model predictions from size-structured population dynamics model) and Figure 18 (observed survey indices and model-predictions from the size-structured population dynamics model for the “recruitment” and “spawning” surveys). The fits to the length-frequency data (aggregated over year; Figure 17 indicates that the model is capable of capturing the broad features of the catch and survey length-frequency data adequately. The model is also able to follow the survey indices fairly well (Figure 18), although the extent of additional variation (i.e. variation

[36] Dichmont, C. M., Punt, A. E., Deng, A., Dell, Q., & Venables, W. (2003). Application of a weekly delay difference model to commercial catcah and effort data for tiger prawns in Australia's Northern Prawn Fishery. *Fisheries Research. 65* , 335-350.
[37] Zhou, S., Punt, A. E., Deng, A., Dichmont, C. M., Ye, Y., Venables, W. N., *et al*. (2009). Modified Baysesian biomass dynamics model for assessmant of short-lived invertebrates: a comparison for tropical tiger prawns. *Marine and Freshwater Research 60* , 1298-1308.
[38] Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., *et al.* (2010). Integrating size-structured assessmant and bio-economic managemant advice in Australia's Northern Prawn Fishery. ICES Journal of marine Sciences 76 , 1985-1801.

beyond that expected given sampling errors), is relatively high (an additional CV ranging from 0.11 to 0.40, with these CVs being largest for M. endeavouri).

Figure 17: Observed length-frequencies (bars) and model-predictions from the base-case size structured population dynamics model (line). The values shown are averages over the years for which data are available (with weights proportional to effective sample sizes).

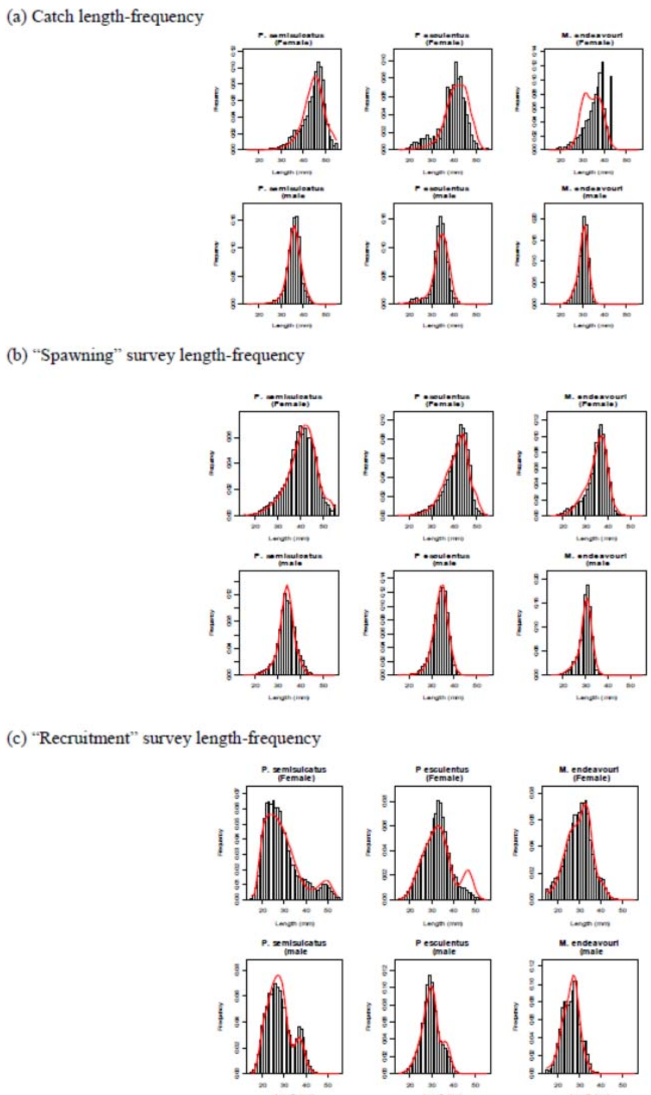
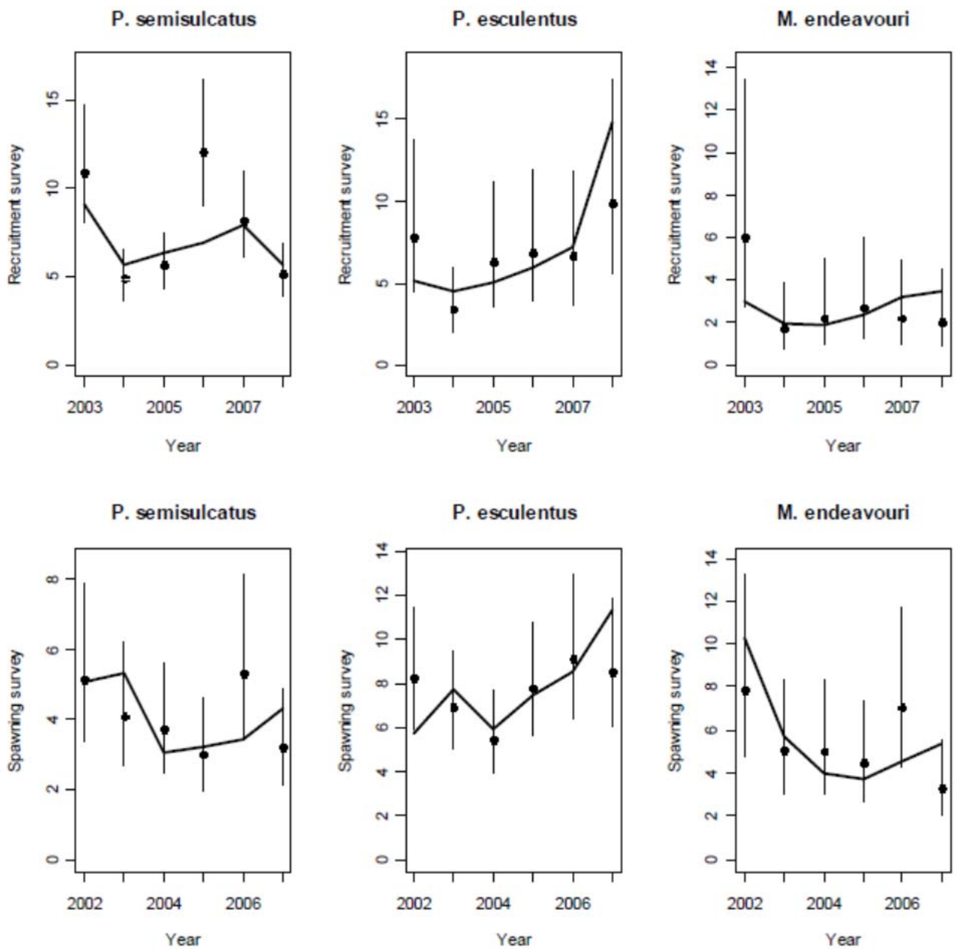


Figure 18: Observed survey indices (dots) and model-predictions from the base-case size structured population dynamics model (lines) for the "recruitment" and "spawning" surveys (upper and lower panels respectively). The vertical lines are 95% confidence intervals based on the sampling error and the maximum likelihood

estimate for the extent of additional variation.



The results of the stock assessment are reviewed by the Northern Prawn Research Advisory Group (NPRAG; comprised of scientists, economist, fishery managers, fishing representatives, and environmentalists) and in 20011 the agreed base case assessment was a size-based model for both species of Tiger Prawns and the biomass dynamic model for blue endeavour prawns.

An evaluation of stock assessment methods and management strategies for the Northern Prawn Fishery was carried out by Dichmont et. al., (2006a); Dichmont et. al., (2006b); Dichmont et. al., (2006s); and Dichmont et. al., (2008) using the management strategy evaluation (MSE), The MSE approach distinguishes between the true state of the resource (as represented by the 'operating model') and that perceived though data collection strategies and stock assessments (a component of the 'management strategy'). The management strategy also includes decision rules that use information on the perception of the status of the system to determine management advice. The management advice determines the management actions and hence any impacts these actions have on the resource and the associated fishery. The MSE approach requires an (operating) model of the resource to act as the 'truth' for the analyses and the five-stock, two tiger prawn species operating model with a weekly time-step is used and conditioned using more than 30 years of logbook catch and effort data as well as the results of fishery-independent surveys. This model allows for the impact of changes over time in efficiency, a key uncertainty in the assessment of these species, and the impact of management implementation error, which has historically been substantial.

Dichmont *et al,* (2006a)[39] showed that the stock assessment model is fairly general and can capture the dynamics of multiple stocks of several species. In Dichmont *et al,* (2006b)[40] three "assessment procedures" are considered (a linear regression of the log-catch rate on time, a biomass dynamic model and a delay-difference model. These assessment procedures capture a range from very simple (a linear regression of log-catch-rate on time) to fairly complicated (an age- and stock-based assessment model), and two forms of the decision rule. The performance of the management strategies is evaluated in terms of whether stocks are left at (or above) the spawning stock size at which Maximum Sustainable Yield is achieved (SMSY), the long-term discounted total catch and the extent of inter-annual variation in catches. The best management strategy in terms of leaving both species close to S_{MSY} is found to be one that changes the timing of the fishing season so that effort is shifted from *P. esculentus* to *P. semisulcatus* and sets more precautionary effort targets for *P. esculentus*. Dichmont *et al*. (2006c)[41] management strategies are evaluated in terms of conservation- and economic-related performance measures. The factors found to have the greatest impact on the performance measures are: (a) how fishing efficiency has changed over time and whether or not the assessment is based on the correct trend in fishing efficiency, (b) the catchability coefficient used to convert from fishing effort to fishing mortality, (c) the difference between the intended fishing effort and the actual fishing effort expended (implementation error), and (d) whether recruitment is spatially correlated among stocks or not. Because the management strategies based on the delay-difference model tend to leave the spawning stock size of *P. esculentus* below the target level of SMSY in median terms, a more conservative management strategies is appropriate, at least until a management strategy is identified that performs better for *P. esculentus*.

Dichmont *et al.* (2008)[42] used an operating model similar to that in Dichmont *et.al*. (2006a), but account was taken of two species of endeavour prawns (*M. endeavouri* and *M. ensis*) as well as the two species of tiger prawns and also included an effort allocation model and a benthic impacts model. Two classes of management strategy were evaluated; one class seeks to move stocks towards the target spawning stock size which is a pre-specified fraction of the spawning stock size at which Maximum Sustainable Yield ($S_{MSY)}$ is achieved using a threshold control rule, while the other class selects time-trajectories of future effort to maximize discounted profit. Management strategies that control effort levels to maximize the total profit over the long-term outperform those which aim to move the spawning stock size toward S_{MSY} in terms of most performance measures. For example, even when the target stock size for the MSY-based management strategy is selected to be the same as that which maximizes profits, selecting effort to maximize profits leads to lower variability in catches and profits. This study also illustrated how broader ecosystem considerations can be included in MSE analyses without the need for the development and implementation of full ecosystem

[39] Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006a). Management strategoes for short-lived species: The case of the Northern Prawn Fishery 1. Accounting for multiples species, spatial structure and implementation uncertainty when evaluating risk. *Fisheries Research 82*, 204-230.

[40] Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006b). Management strategies for short-lived species: The case of Australia's Northern Prawn Fishery 2. Choosing appropriate management strategies using input controls. *Fisheries Research 82* , 221-234.

[41] Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006c). Management strategies for short-lived species: The case of Australia's Northern Prawn Fishery 3. Factors affecting management and estimation performance. *Fisheries Research 82* , 235-245.

[42] Dichmont et.al. 2008 *ibid*

models and hence provides a "middle road" between single-species MSEs and full ecosystem MSEs.

The modelling is carried out by the CSIRO under contract from the AFMA. It is conducted by a team of data, information and stock assessment specialists including part-time input from a world-renown expert from the University of Washington. Modelling results are then reviewed by the NPFRAG. Peer-group review of the actual assessments is provided by two independent stock assessment experts. The methods and results of the assessments are also published in peer-reviewed scientific journals. The assessment was externally peer-reviewed in 2002 by an independent stock assessment expert (Deriso, 2001[43]) who concluded that the assessment was world-class but also recommended the inclusion of fishery dependent data; a recommendation that has been followed.

Red endeavour prawns are considered as part of the economic bycatch of the bio-economic model (Punt *et al*., 2010, Kompas *et al*., 2010).

3.6.6.2 White banana prawns

The stock assessment process for white banana prawns does not follow the traditional pattern for a prawn stock (e.g., for the tiger prawn species). Because of the inter-annual variability driven mainly by the environment, regular stock assessments have not been carried out, but the status of the stock is assessed through historic catch data and with reference to a proxy limit point. There has been extensive research on the causes of stock fluctuations, the most recent being that of Venables *et al* (in press)[44] who modelled the effect of fishing effort and rainfall on the annual season catches in different areas of the NPF.

In a detailed study into the causes of the decline in catches in the Weipa area in the period following 2000, a stock assessment method was trialed[45]. Estimates of daily catch per unit of effort (CPUE) for the banana prawn stock at Weipa were calculated from logbook data. The daily catch data for each year were subjected to virtual population analysis (VPA), and a tuned VPA, with both catchability and terminal biomass being estimated as parameters of the model. The resulting estimates of recruitment and spawning biomass were used, in combination with time series of rainfall, temperature and wind data, to explore whether recruitment was affected by spawning biomass and the effects of the environmental variables. In addition, a depletion analysis based on similar assumptions to the tuned VPA was fitted simultaneously to the daily CPUE data for all years. However, there was insufficient information in the data to demonstrate a relationship between recruitment and spawning biomass and/or the environmental variables. It was concluded that imprecision of the CPUE data for banana prawns is likely to mask any signal of such relationships in the data.

Red-legged banana prawns

Red-legged banana prawns are assessed using a quarterly "age-based" biological model with no economic content internal to the model. Weekly catch and effort data are available from 1970, but given the almost negligible catches during the 1970s, the assessment starts in 1980. These data were analysed per week, per month, per quarter and per year and it was considered that the most sensible aggregation would be by quarter, with four quarters defined as corresponding to the four quarters of a calendar year respectively, i.e. Quarter 1 = January – March; 2 = April – June; 3 = July – September and 4 = October – December. A historic catch series per quarter was constructed using all

43 Deriso, R., A review of the 2001 assessment of tiger prawns in the Northern Prawn Fishery, *Report to AFMA*, October 2001.
[44] Venables, B et al (2011), *Ibid*.
[45] Rothlisberg and Okey (2006), *Ibid*

available catch information. A fairly simple discrete population model was constructed for red-legged banana prawns in the JBG as follows. The number of prawns in year y and quarter
is given by:

$$N_{y,s+1} = N_{y,s}\, e^{-M_s} - C_{y,s} + R_{y,s+1} \qquad \text{for } s = 1 \text{ to } 3 \qquad (1)$$

and

$$N_{y+1,1} = N_{y,4}\, e^{-M_4} - C_{y,4} + R_{y+1,1} \qquad \text{for } s = 4 \qquad (2)$$

where

$N_{y,s}$ is the number of recruited prawns (those corresponding to a size large enough to be fished) at the start of quarter s in year y (which refers to a calendar year),

$R_{y,s}$ is the number of recruits (number of 6-month old prawns) which are added to the population at the end of each quarter s in year y,

M_s denotes the natural mortality rate during quarter s (assumed in the Reference case to be constant throughout the year), and computed by multiplying the weekly natural mortality estimate by 13 (weeks) to reflect a quarterly mortality rate; and

$C_{y,s}$ is the predicted number of prawns caught during quarter s in year y, with catches arbitrarily assumed taken as a pulse at the end of each quarter.

The model, therefore, is sensitive to CPUE interpretations, made more difficult by recent changes in fishing in the Joseph Bonaparte Gulf, where most of the fishing occurs. Consequently, the assessment is much less certain than that of the tiger prawn species (AFMA 2011[46]).

The modelling is carried out by the CSIRO under contract from the Australian Fisheries Management Authority. It is conducted by a team of data, information and stock assessment specialists including part-time input from a world-renown expert from the University of Washington. Modelling results are then reviewed by the NPFRAG. Peer-group review of the actual assessments is provided by two independent stock assessment experts. The methods and results of the assessments are also published in peer-reviewed scientific journals.

Sensitivity tests have been carried out that indicate relative robustness to assumptions and different types of assessment techniques. These are taken into account in assessing stock status

3.7 Environmental Elements (P2)

3.7.1 Context

Environmental concerns associated with trawl fisheries are often centred on physical disturbance to benthic habitat and ecological impacts to the associated benthic or demersal communities[47]. It is therefore important to consider the degree to which the three sub-fisheries comprising the NPF (i.e., the tiger prawn sub-fishery, the white banana prawn sub-fishery and the red-legged prawn sub-fishery (see Section 3.5)) may impact the seabed. Although each of these fisheries uses gear that can be broadly classified as demersal otter trawls, the method of gear deployment varies. In the tiger prawn sub-fishery the trawl is generally lowered over suitable prawn habitat to fish as close as possible to the seabed, and is towed for three to four hours. The red-legged prawn sub-fishery trawls are towed near the

[46] AFMA 2011b. Ibid
[47] Løkkeborg, S. 2005. Impacts of trawling and scallop dredging on benthic habitats and communities. FAO Fisheries Technical Paper. No. 472. Rome, FAO. 58p. Accessed online at http://www.fao.org/docrep/008/y7135e/y7135e00.htm#Contents

seabed but are thought to have a lighter touch on the benthos than the tiger prawn sub-fishery[48]. In contrast, in the white banana prawn sub-fishery the trawl gear is deployed for less than an hour on a prawn aggregation (or "boil") in the water column identified using an echo sounder[49]. Throughout the NPF fishing effort is highly aggregated such that the actual fished region (i.e., areas fished more than 5 boat days per year) is only about 3% of the entire NPF-managed region. There may therefore be large spatial refuges within the NPF that are largely unaffected by fishing[50,51].

Aside from seabed impacts, trawl gear is often characterized as indiscriminate in its catches. In the NPF the amount of bycatch varies considerably by sub-fishery. Estimates of the ratio of bycatch:target catch for the tiger prawn sub-fishery have ranged from 8:1 to 21:1 and a ratio of 13:1 was recently estimated for the red-legged sub-fishery[52]. In contrast, the ratio was found to be only 0.8:1 for the white banana prawn sub-fishery[53]. High rates of bycatch in some sub-fisheries have led to a wide variety of technological innovations for bycatch reduction[54]. As early as the mid-1990s the NPF initiated research and testing of numerous types of bycatch reduction devices (BRDs)[55] leading to compulsory use of a specific suite of turtle excluder devices (TEDs) and BRDs in 2001[56]. Since implementation of these requirements, several millions of dollars have been invested in bycatch reduction and have resulted in the development of new devices which the NPF industry has refined and improved over time[57]. At present, TEDs must have rigid or semi-rigid bars, a maximum bar spacing of 120mm, and an escape opening of at least 700 mm, except if fishing at depths exceeding 200m. BRDs must be either the square-mesh codend BRD, the square-mesh panel BRD, the fisheye BRD, the Yarrow fisheye BRD, a radial escape section (RES) BRD, the Popeye Fishbox BRD or a modified TED which can be used instead of a TED and BRD combination[58]. Field evaluations of the implementation of NPF-approved TEDs and BRDs have documented catch reductions for turtles of 99%, seasnakes of 5%, sharks of 17.7%, rays of 36.3%, large sponges of 85.3%, and small bycatch of 8%[59]. Overall, the fishery

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[48] Personal communication, D. Brewer and D. Milton, 19 September 2011 (see Section 9).

[49] Griffiths, S., Kenyon, R., Bulman, C., Dowdney, J., Williams, A., Sporcic, M. and Fuller, M. 2007. Ecological Risk Assessment for Effects of Fishing: Report for the Northern Prawn Fishery. Report for the Australian Fisheries Management Authority, Canberra, 319pp. (p. 13)

[50] Brewer, D.T., Griffiths, S., Heales, D.S,, Zhou, S., Tonks, M., Dell, Q., Taylor, B.T., Miller, M., Kuhnert, P., Keys, S., Whitelaw, W., Burke, A., and Raudzens, E. 2007. Design, trial and implementation of an integrated, long-term bycatch monitoring program, road tested in the Northern Prawn Fishery. Final Report on FRDC Project 2002/035. CSIRO, 393 pp. (p. 188).

[51] Kenyon R.A., Jarrett A.E., Bishop J.F.B., Taranto T.J., Dichmont C.M., Zhou S. 2005. Documenting the history of and providing protocols and criteria for changing existing and establishing new closures in the NPF: Final Report to AFMA (AFMA Project R02/0881). AFMA Final Research Report. Australian Fisheries Management Authority. PO Box 7051, Canberra Business Centre, ACT, 2610. pp.157.

[52] Tonks, M.L., Griffiths, S.P., Heales, D.S., Brewer, D.T. and Dell, Q. 2008. Species composition and temporal variation of prawn trawl bycatch in the Joseph Bonaparte Gulf, northwestern Australia. Fisheries Research 89: 276–293.

[53] Dell, Q., Brewer, D.T., Griffiths, S.P., Heales, D.S. and Tonks, M.L. 2009. Bycatch in a tropical schooling – penaeid fishery and comparisons with a related, specialised trawl regime. Fisheries Management and Ecology 16: 191–201.

[54] Eayrs, S. 2007. A Guide to Bycatch Reduction in Tropical Shrimp-Trawl Fisheries. Revised edition. Rome, FAO. 108 p. Accessed online at ftp://ftp.fao.org/FI/DOCUMENT/rebyc/a1008e.pdf

[55] Brewer, D., Rawlinson, N., Eayrs, S. and Burridge, C, 1998. An assessment of bycatch reduction devices in a tropical Australian prawn trawl fishery, Fisheries Research 36: 195-215. Accessed online at http://www.sciencedirect.com/science/article/pii/S0165783698000964

[56] Brewer, D., Heales, D., Milton, D., Dell, Q., Fry, G., Venables, W. and Jones, P. 2006. The impact of turtle excluder devices and bycatch reduction devices on diverse tropical marine communities in Australia's Northern Prawn Trawl Fishery. Fisheries Research 81: 176-188.

[57] AFMA. 2009a. Northern Prawn Fishery: Bycatch and Discarding Workplan 1 July 2009 to 30 June 2011. Accessed online at: http:// http://www.afma.gov.au/wp-content/uploads/2010/06/npf_bdw_2009_10.pdf

[58] AFMA. 2011. Northern Prawn Fishery Operational Information 2011. Australian Fisheries Management Authority. Canberra, Australia. 123pp. Accessed online at http://www.afma.gov.au/wp-content/uploads/2010/06/NPF-Info-book-2011-FINAL-280311.pdf

[59] Brewer et al. (2006). Op cit.

reports achieving a 50% reduction in bycatch since the implementation of its first Bycatch Action Plan (BAP) in 1998 and is pursuing additional research to achieve further bycatch reductions[60].

AFMA implements an ecological risk management framework for all Australian Commonwealth managed fisheries. These ecological risk assessment methods were developed in Australia, in many cases in the NPF itself, and have formed the basis for the risk-based framework now used by the MSC[61]. The Australian approach involves a hierarchical assessment of potential impacts from fishing comprising five components: target species; byproduct and discard species; threatened, endangered and protected (TEP) species; habitats; and communities. The hierarchy begins with a qualitative Scale, Intensity, Consequence Analysis (SICA) as Level 1. Those species which are flagged as having higher than acceptable risks pass on to semi-quantitative Productivity-Susceptibility Analysis (PSA) as Level 2, and those which are classified as being at high risk in Level 2 may be subject to a Level 2 Residual Risk Assessment. Assessment beyond Level 2 consists of a quantitative Sustainability Assessment of Fishing Effects (SAFE); this may be implemented as a Level 2.5 assessment (an earlier version of the SAFE) or a Level 3 assessment (the current SAFE). The SAFE methodology estimates fishing impact and compares the impact to sustainability reference points based on basic life-history parameters[62,63]. The NPF was one of the earliest fisheries in Australia to be assessed under these methods and to incorporate the risk assessment results into management strategies such as its Bycatch and Discarding Workplan, and its implementation of various plans of action and recovery plans for TEP species[64]. For the purposes of risk assessment AFMA has stated that the red-legged prawn sub-fishery is considered to have the same characteristics as the tiger prawn sub-fishery and thus the risk assessment results for the tiger prawn sub-fishery apply equally to the red-legged prawn sub-fishery[65]. It is also noted that under the latest assessment of the NPF under the Environment Protection and Biodiversity Conservation Act export assessment it was recommended that “the ERA and the effectiveness of management responses should be reviewed as appropriate, but at least within three years of completion of the level 2.5 SAFE analysis”[66]. A summary of research findings and specific issues arising from the risk assessments of the NPF are discussed below.

3.7.2 Bycatch and retained catch

This section describes all species that interact with the NPF except the target species (Brown tiger prawn (*Penaeus esculentus*), Grooved tiger prawn (*P. semisulcatus*), Blue endeavour prawn (*Metapenaeus endeavouri*), Red endeavour prawn (*M. ensis*), White banana prawns (*Fenneropenaeus merguiensis*), and Red-legged banana prawns (*Fenneropenaeus indicus*)), which are described in Section 3.6. Endangered, Threatened and Protected Species, which are a special subset of bycatch, are introduced here and described in detail in Section 3.7.3. For consistency, this assessment adopts the same non-target species classifications as the

[60] AFMA. 2009a. Op cit.
[61] CSIRO. 2011. Ecological Risk Assessment: a Method for Ensuring the Health of Marine Fisheries. Accessed online at http://www.csiro.au/en/Organisation-Structure/Divisions/Marine--Atmospheric-Research/fisheries-ecological-risk-assessment.aspx
[62] Zhou, S. and Griffiths, S.P. 2008. Sustainability Assessment for Fishing Effects (SAFE): A new quantitative ecological risk assessment method and its application to elasmobranch bycatch in an Australian trawl fishery. Fisheries Research 91: 56–68
[63] Zhou, S., Griffiths, S.P. and Miller, M. 2009. Sustainability assessment for fishing effects (SAFE) on highly diverse and data-limited fish bycatch in a tropical prawn trawl fishery. Marine and Freshwater Research 60: 563–570.
[64] AFMA. 2009b. Ecological Risk Management: Report for the Northern Prawn Fishery – Tiger and Banana Prawn Sub-fisheries
[65] AFMA, personal communication, 24 November 2011.
[66] Department of Environment, Water, Heritage and the Arts (DEWHA). 2008. Letter from Claire Howlett to AFMA Chairman Tony Rundle, 22 December 2008. Accessed online at http://www.environment.gov.au/coasts/fisheries/commonwealth/northern-prawn/pubs/letter-tony-rundle.pdf

NPF's Level 2 (Productivity-Susceptibility Analysis (PSA)) Ecological Risk Assessment[67]: there are thus 135 retained species (referred to in the ERA as "byproduct"), 516 bycatch species and 128 endangered, threatened and protected species (referred to in the ERA as "threatened endangered and protected" (TEP)).

3.7.2.1 Catch Information

There are two sources of information on retained and bycatch species composition in trawls from the NPF: information collected from the fishery itself, and fishery-independent information from research surveys. The greatest amount of fishery-dependent data is available from logsheets, which other than Threatened, Endangered and Protected (TEP) species, only record retained species, often in non-species specific categories such as "bugs" or "squid"[68]. Observer data from crew member observers (CMOs) and scientific observers (SOs) provided by AFMA supplement the logbook data. Some of these fishery-dependent datasets, especially the CMO and logbook data, may lack taxonomic detail particularly for non-valued species. Fishery independent datasets may not duplicate commercial trawl operations and have considerably smaller spatial and temporal coverage. Despite these limitations, research surveys identify all sampled individuals to species (as much as possible) and thus provide the best available information on the actual taxonomic composition of the catch.

Data on the retained and TEP species catch composition are derived from daily logbook records by skippers and from seasonal landing returns submitted by statutory fishing rights holders. These data are submitted to AFMA but then rectified and presented by the NPF under a co-management arrangement[69]. In the Gulf of Carpentaria, data are partitioned between tiger prawn and white banana prawn sub-fisheries based on whether tiger prawns or white banana prawns formed the majority of the catch[70]. All catches reported from the Joseph Bonaparte Gulf are assigned to the red-legged banana prawn sub-fishery. Logsheets have been required since 1977 and data on retained, non-target catch (byproduct) in each sub-fishery since 2004 was provided by AFMA for this assessment (see Section 3.7.2.3).

As logbooks only record retained and TEP species, data on the bycatch (discard and non TEP) component of the NPF is available only from observer programmes and research projects. The NPF's Crew Member Observer (CMO) programme began in 2003 and over time has expanded to collect data on TEP and "at risk" species including turtles, seasnakes, sawfishes and other large elasmobranchs, seahorses and pipefishes, and other at risk teleosts[71]. In 2010, five CMOs (all in the tiger prawn sub-fishery) recorded 394 fishing days and two scientific observers provided by AFMA recorded 143 days, as compared to 8,044 days recorded in logbooks[72,73,74]. Plans are underway to increase coverage in the CMO programme to at least 10% through training and financial incentives[75]. The scientific

[67] Griffiths, S., Kenyon, R., Bulman, C., Dowdney, J., Williams, A., Sporcic, M. and Fuller, M. 2007. Ecological Risk Assessment for Effects of Fishing: Report for the Northern Prawn Fishery. Report for the Australian Fisheries Management Authority, Canberra, 319pp.
[68] Commonwealth of Australia Gazette. 2011. Northern and Torres Strait Prawn Fisheries Daily Fishing Log NP16, GN23, 15 June 2011, pp. 1312-1327. Accessed online at http://www.ag.gov.au/portal/govgazonline.nsf/EE773B2DF581BA65CA2578B00000D9BC/$file/GN%2023%20-%20Vol%201.pdf
[69] AFMA. 2011. Op cit. (p. 40)
[70] Barwick, M. 2010. Northern Prawn Fisheries Data Summary 2010.
[71] Fry, G., Brewer, D., Dell, Q., Tonks, M., Lawrence, E., Venables, W., Darnell, R. 2009. Assessing the sustainability of the Northern Prawn Fishery bycatch from annual monitoring data. AFMA Project 2008/826, CSIRO Marine and Atmospheric Research.
[72] Barwick (2010). Op cit.
[73] AFMA (2009a). Op cit.
[74] Fry et al. (2009). Op cit.
[75] AFMA (2009a). Op cit.

observer programme's current coverage is 2.5%. The observer bycatch data are supplemented by a large number of surveys which were used as input for the NPF ecological risk assessment,[76] as well as major subsequent government-sponsored, NPF-specific surveys and studies[77][78][79].

3.7.2.2 Catch composition of fishery under certification

For the ecological risk assessment CSIRO conducted a scoping exercise involving review of literature, logbooks and observer reports, and discussions with stakeholders to identify all species potentially impacted by the NPF. The resulting list contained 788 species: 9 target, 135 retained, 516 bycatch, and 128 TEP[80]. This risk assessment noted that the NPF estimates total annual biomass of bycatch at approximately 30,000 t as compared to 5,686 t of target species catch and 74 t of byproduct (2004 values)[81,82]. Aside from those individuals excluded by the TEDs and BRDs, most bycatch is usually returned to the water severely damaged or dead[83]. The ecological impacts arising from the high diversity and large amount of bycatch relative to the target and retained catch have been addressed by the NPF through the ecological risk assessment process which is described below for retained, bycatch and TEP species.

No trends in catch composition of the NPF have been identified. A recent study examined species-specific catch rates over time using observer data and fishery-independent NPF monitoring survey data from 2003-2009. Trends in catch rates for three species (the seasnakes *Hydrophis elegans* and *Lapemis hardwickii*, and the sawfish *Anoxypristis cuspidata*) were not statistically significant. However, strengthening of the observer and monitoring programmes for these species, which could serve as surrogates for similar species, was recommended. Many other rare and inconspicuous bycatch species could not be assessed due to lack of data. Since the number of samples required to assess these species was estimated to be well beyond practical limits of the observer and monitoring programmes, alternative assessment strategies were recommended[84].

Interactions with TEP species and species that have otherwise been identified as "at risk" through the ERA process are recorded in the logbooks, by crew member observers and by scientific observers. The reported catch rates for these species are generally much lower in the first two datasets than in the third[85]. Since 2005, among the most commonly reported TEP species (turtles, elasmobranchs (including sawfishes), syngnathids (seahorses and pipefishes), and seasnakes), reported interactions with seasnakes are generally an order of magnitude higher than the others (e.g., 4.1 seasnake interactions per day versus 0.6 sawfish

[76] Griffiths et al. (2007). Op cit.
[77] Brewer et al. (2007). Op cit.
[78] Fry et al. (2009) Op cit.
[79] Bustamante, R.H., C.M. Dichmont, N. Ellis, S. Griffiths, W.A. Rochester, M.A. Burford, P.C. Rothlisberg, Q. Dell, M. Tonks., H. Lozano-Montes, R. Deng, T. Wassenberg, T.A. Okey, A. Revill, T. van der Velde, C. Moeseneder, S. Cheers, A. Donovan, T. Taranto, G. Salini, G. Fry, S. Tickell, R. Pascual, F. Smith, and E. Morello. 2010. Effects of trawling on the benthos and biodiversity: Development and delivery of a Spatially-explicit Management Framework for the Northern Prawn Fishery. Final report to the project FRDC 2005/050. CSIRO Marine and Atmospheric Research.
[80] Griffiths et al. (2007). Op cit.
[81] Ibid. p. 11
[82] AFMA. 2008a. Status Report for Re-assessment for Export Approval Under the EPBC Act-Northern Prawn Fishery. Accessed online at http://www.environment.gov.au/coasts/fisheries/commonwealth/northern-prawn/pubs/reassessment-report-08.pdf
[83] Griffiths et al. (2007). Op cit. p. 14
[84] Fry et al. (2009). Op cit.
[85] See Barwick (2011), Table 8.

interactions per day as reported by scientific observers for the tiger prawn sub-fishery in 2010)[868788].

3.7.2.3 Retained species

The NPF Ecological Risk Management document identifies the retained species in the fishery as bugs, scampi, squid, mud crabs, ornate tropical rock lobster, northern saucer scallop, emperors, breams, trouts, cods, groupers, longtail tuna, snapper and mackerel[89]. A study of byproduct species by CSIRO cited approximately 30 different categories of retained species recorded in NPF logbooks in 1998-2007 with total annual catches varying from 40-470 t. Squid (Loliginidae) represented between 50 and 80% of the byproduct recorded with the remainder comprising bugs (*Thenus* spp.), cuttlefish (Sepiidae), scallops and mixed fish. The study notes that total byproduct catches have decreased over time in parallel with the trawl effort in the NPF but reporting rates are not necessarily reliable due to the influences of fishery operational costs, prawn and byproduct prices, prawn and byproduct catch rates and vessel crew behaviour. For example, it was suggested that a relative increase in the catch of squid may be due to the higher abundances and less restrictive catch limits for squid relative to bugs[90].

Retained catch data provided by AFMA since 2004 illustrate some of these trends. According to the quantities of retained species reported in logbooks, total annual catches of cuttlefishes, squids, scampi and bugs have ranged from 35 to 195 t from 2004-2010 (Table 12)[91]. The highest retained species catches within this period were reported in 2007 reflecting a particularly high catch of squids, but in most other years bugs comprised the largest portion of the retained (non-target) catch.

Table 12: NPF catches (tonnes) of retained species as reported in logbooks 2004-2007[92] and 2008-2010[93].

	2004	2005	2006	2007	2008	2009	2010
Cuttlefish	5	9	4	3	3	4	3
Squid	23	20	15	175	3	8	1
Scampi	22	15	18	5	19	8	18
Bugs	24	34	18	12	23	15	20
TOTAL	74	78	55	195	48	35	42

In addition to these four major groups of retained species, a number of other retained species or groups appear in the logbook data for 2004-2010[94]. Due to a lack of taxonomic detail it is not possible to provide an exact number of species retained in each of the NPF sub-fisheries but logbook records show 18, 39 and 68 retained species categories in the red-legged banana, the white banana and the tiger sub-fisheries, respectively (Table 13). Endeavour prawns dominate the overall retained species composition in the tiger prawn and red-legged sub-fisheries, whereas squids are the most commonly retained species in the white banana sub-fishery.

[86] Barwick (2011), Op cit.
[87] AFMA (2009c). Northern Prawn Fishery Annual Status Report. Accessed online at http://www.afma.gov.au/managing-our-fisheries/fisheries-a-to-z-index/northern-prawn-fishery/publications/
[88] AFMA (2008a). Op cit.
[89] AFMA (2009b). Op cit.
[90] Milton, D.A., Fry, G. C., Tonks, M., Zhou, S., Kuhnert, P., and Zhu, M. 2010. Assessing data poor resources: developing a management strategy for byproduct species in the Northern Prawn. FRDC Project 2006/008 Final Report.
[91] AFMA (2008a). Op cit.
[92] AFMA (2008a). Op cit.
[93] Unpublished data provided by AFMA November 2011.
[94] Unpublished data provided by AFMA, November 2011.

Table 13: Catches (in kg) of major retained species recorded in NPF logbooks (2004-2010)[95]. All species in the tiger prawn sub-fishery for which annual catches exceeded 1,000 kgs and the top ten species in the red-legged and white banana prawn sub-fisheries are shown.

Species	2004	2005	2006	2007	2008	2009	2010	Grand Total
TIGER PRAWN SUB-FISHERY								
Endeavour Prawns	358530	263107	360843	193101	210361	307839	413000	2106781
Bugs - Shovel nosed and slipper lobsters	20010	28303	11997	9388	4500	3951	3354	81503
Squids	21664	19571	13675	6310	3025	7361	1151	72757
King Prawns	1608	18748	28328	17863	639	390	1134	68710
Moreton Bay Bugs			2628	2235	15337	10221	16580	47001
Cuttlefish (mixed)	5375	9246	4317	3408	2664	4263	3346	32619
Siboga Scampi	3454	10589	7916					21959
King Prawns (Eastern & Western)			282	1940	5927	4304	7667	20120
Scampi (mixed)	1819		426	5445	11358			19048
Whitings	5718	2511	2240	841	4989	262	46	16607
Scallops	2783	5952	2265	2442	486	1686	946	16560
Australian Scampi						7510	6365	13875
Blue endeavour prawn			4187	450		3331	2966	10934
Coral prawns	4596	2882	119	60		399		8056
Australian pilchard	5831	1964	2					7797
Saucer scallops	12			6252				6264
Pomfret	3661	246	127			76	524	4634
Goatfishes	959	63	488	2170				3680
Spiny Lobsters	106	312	428	1434				2280
Black Pomfret	208	1027	636	72	59	81		2083
Fish (mixed)	1491	148	137	41		122		1939
Redspot King Prawns			10			451	1384	1845
Molluscs	1310							1310
Champagne lobster - Spear lobster					105	1185		1290
Other byproduct species	2197	1063	2189	2022	642	655	740	9508
Subtotal	441332	365732	443240	255474	260092	354087	459203	2579160
RED-LEGGED BANANA SUB-FISHERY								
Endeavour Prawns	37737	4664	906	3754	3103	17702		67866
Coral prawns	3460	3256	46	25				6787
Bugs - Shovel nosed and slipper lobsters	976	817	10			27		1830
Black Tiger Prawn - Leader Prawn	402	115	45			14		576
Squids	522	12				5		539
Tropical rocklobsters	52	206						258
Red endeavour prawn			252					252
Pomfret	75	152						227
Prawns (mixed)		133						133
Spiny Lobsters	124							124
Other Byproduct Species	155	164	90	57	0	0	0	466
Subtotal	43503	9519	1349	3836	3103	17748		79058
WHITE BANANA PRAWN SUB-FISHERY								
Squids	512	698	1043	168700	433	145	51	171582
Endeavour Prawns	4759	16996	13677	655	1275	4882	3074	45318
Scampi (mixed)	9950	2213	1610		10191			23964
Bugs - Shovel nosed and slipper lobsters	3080	5255	3699	809	3237	355	290	16725
Australian Scampi						381	11990	12371
Siboga Scampi	6843	3408	965					11216
Black Tiger Prawn - Leader Prawn	455	197	1305	265	545	817	360	3944
Spiny Lobsters	613	80	320	5	733			1751
Boschma's Scampi	1389							1389
Prawns (mixed)		24	133		368	768		1293
Other Byproduct Species	1037	802	740	290	583	1129	157	4738

[95] Unpublished data provided by AFMA, November 2011.

Species	2004	2005	2006	2007	2008	2009	2010	Grand Total
Subtotal	28638	29673	23492	170725	17365	8477	15922	294292
TOTAL	513473	404924	468081	430035	280560	380312	475125	2952510

The Level 2 ERA assessed 135 retained species through PSA and found that 16 species were at high risk in the tiger sub-fishery and 15 in the white banana sub-fishery. Fifteen high risk species were common to both sub-fisheries: *Dictyosquilla tuberculata* (mantis shrimp), *Harpiosquilla stephensoni* (mantis shrimp), *Sepia whitleyana* (cuttlefish), *Sepia smithi* (cuttlefish), *Metasepia pfefferi* (cuttlefish), *Solenocera australiana* (coral prawn), *Euprymna hoylei* (cuttlefish), *Zebrias craticulus* (wicker-work sole), *Zebrias cancellatus* (harrowed sole), *Brachirus muelleri* (tufted sole), *Pardachirus pavoninus* (peacock sole), *Aesopia* sp. (sole), *Aseraggodes* sp. (sole), *Zebrias quagga* (zebra sole), and *Upeneus* sp.1 (mullet). *Photololigo* sp. 4 (inshore squid) was found to be at high risk in the tiger prawn sub-fishery only. The assessment noted that it did not necessarily take full account of management actions already in place in the fishery that may mitigate for high risk species. In addition to this, it was also noted that since the PSA defaults to a high risk level in the absence of information, the methodology is more likely to generate false positives for high risk than false negatives. These caveats are particularly important given that the four cuttlefishes and two mantis shrimps considered to be at high risk were so classified due to missing data, and the remaining species were all classified as high risk due to spatial uncertainty[96].

In the Level 2 Residual Risk Assessment two of the cuttlefish species (*Sepia smithi* and *Sepia whitleyana*) were re-classified from high to medium risk as result of justifiable borrowing of missing attribute scores from a closely related species[97]. This reduced the number of high risk species to 14 in the tiger sub-fishery and 13 in the white banana sub-fishery.

Two remaining cuttlefish (*Euprymna hoylei* and *Metasepia pfefferi*) were removed from the list of high risk species on the basis of consultation and expert overrides which are provided for under the ERA methodology[98][99]. The squid *Photololigo* sp. 4 is also shown to have been removed from the list of high risk species on the basis of consultation and expert overrides[100][101]. The basis for the override is, however, unclear as it appears to involve the renaming of the species in question to *Uroteuthis* sp[102]. 4 but this is not explained in the override documentation. All of the retained demersal fish species (eight species) identified as being at high risk in the Level 2 assessment were re-assessed under a quantitative risk methodology (SAFE, Level 2.5) and none was found to be clearly at risk of unsustainable impacts. This was attributed to many species being widely distributed in large, unfished refuge areas[103].

As a result of hierarchical ERA methods, three retained species, the coral prawn (*Solenocera australiana)*, and mantis shrimps (*Dictyosquilla tuberculata* and *Harpiosquilla stephensoni)* were ultimately classified as high risk and have been included on the NPF priority species list[104]. All three species are required to be recorded by CMO and scientific observers but a recent assessment of observer data found that the mantis shrimps had never been found by CMOs, possibly because of their small size and resemblance to other stomatopod species. In contrast, recent research has documented that the coral prawn has a widespread

[96] Griffiths et al. (2007). Op cit. pp. 175-182.
[97] AFMA. 2008b. Residual Risk Assessment of the Level 2 Ecological Risk Assessment species results: Report for the Northern Prawn Fishery, December 2008.
[98] Griffiths et al. (2007). Op cit.
[99] AFMA (2009b). Op cit.
[100] Griffiths et al. (2007). Op cit.
[101] AFMA (2009b). Op cit.
[102] Rik Bukworth, CSIRO, pers comm, January 2012
[103] Brewer et al. (2007). Op cit.
[104] AFMA (2009b). Op cit.

distribution across northern Australia, including offshore areas where no NPF trawling is likely to occur. Therefore, although coral prawn is consistently caught in the NPF[105], it was concluded that this species is not adversely susceptible to impacts from NPF trawling and should be removed from the priority species list[106].

In addition to having assessed the ecological risks posed by the NPF to retained species, another recent study developed ‘acceptable biological catch’ (ABC) levels for bugs, scallops, cuttlefishes and squids. Recent catches of the first three groups were only a small proportion of the estimated ABCs suggesting that the catches of these groups do not need close monitoring by managers unless fishing practices change dramatically. However, the estimated ABC for squids (200 t) was similar to catch levels in some recent years. The study thus recommended that squid catches should continue to be monitored. It also suggested that further studies may be required to resolve whether the estimated biomass value for squids, which was low relative to historical catch levels, may be an underestimate[107].

The NPF Harvest Strategy contains catch or size limits for six types of retained (byproduct) species (Table 14). Comparison between Tables 13 and 14 indicates that current levels of retained catches are within the harvest strategy catch limits. The 500 t trigger limit for squid was set in 2006 as an interim measure and applies to the entire NPF[108]. If the trigger limit is reached during a given calendar year, management arrangements for squid catches will be reviewed but there is no requirement to cease squid catches[109]. A minimum carapace width of 75 mm has been set for bugs in the NPF. This limit is designed to allow bugs to reach sexual maturity before being retained. A recent study examined this and other limits on the take of bugs and found no evidence of overfishing. On the basis that the bugs resource appears to be under-exploited, the study suggested that consideration could be given to reducing the minimum size to 65 mm[110]. A Non-key Commercial Species (Byproduct) Policy is under development by AFMA[111]; once implemented, the three retained species identified as being at high risk by the ecological risk assessment, as well as some cuttlefish and squid species, will be managed under this policy[112].

Table 14 : Byproduct Limits and measures implemented by the NPF under its Harvest Strategy[113].

Species	Possession Limit
Shark, Skates & Rays -(all species)	NIL No part of these species to be retained, including: fins, teeth, skin and saw shark beaks

105 Fry et al (2009). Op cit.
106 Fry et al (2009). Op cit.
107 Milton et al. (2010). Op cit.
108 AFMA (2008a). Op cit.
109 AFMA, personal communication, October 2011.
110 Milton et al. (2010). Op cit.
111 AFMA (2008a). Op cit.
112 AFMA (2009b). Op cit.
113 AFMA (2011), Northern Prawn Fishery: Operational handbook (http://www.afma.gov.au/wp-content/uploads/2010/06/NPF-Info-book-2011-FINAL-280311.pdf)

Saddle Tailed snapper (*Lutjanus malabaricus*) Red Snapper (*Lutjanus erythropterus*) Red Emperor (*Lutjanus sebae*)	(a) a total of 550 kg whole weight, 211 kg fillet weight, 500 kg gilled & gutted weight or 393 kg headed & gutted weight during the period beginning on 1 March in any year and ending on 30 June the same year (b) a total of 55 kg whole weight, 22 kg fillet weight, 50 kg gilled & gutted weight or 40 kg headed & gutted weight during the period beginning on 1 July in any year and ending on 28 February in the same year. Conversion Ratio's W = GG x 1.1 W = F x 2.6 W = HG x 1.4
Mud Crab (*Scylla* sp.)	10 per trip
Broad Barred Spanish Mackerel (*Scomberomorus semifasciatus*), Narrow barred Spanish Mackerel (*Scomberomorous commerson*), Longtail Tuna (*Thunnus tonggol*), Gold Band Snapper (*Pristipomoides multidens*), Coral Trouts, Rock Cods, Sea Breams etc (Serranidae family) and Sweet Lips (Lethrinidae family)	10 whole fish per trip
Rock Lobster (*Panulirus ornatus*), also known as painted crayfish	6 lobsters or lobster tails per trip in total
Barramundi (*Lates calcarifer*), Threadfin Salmon (*Polydactylus sheridani*), Blue Salmon (*Eleutheronema tetradactylum*), Black Jewfish (*Protonidea diacanthus*), Jewelfish or Yellow Jew (*Nibea squammosa*), Spotted Grunter-bream (*Pomadasys kaakan*), Queenfish (*Scomberoides lysan*) (S. commersonianus), Pearl Shell (*Pinctada* spp.), Trochus (Class Trochidae), Trepang (Class Holothuroidae), Coral	NIL catch

In addition to the catch and size limits shown in Table 14 there are also effort-based limits on scampi. Under the current harvest strategy the number of fishing days is limited to 120 per year and if that limit is reached a review by AFMA, NORMAC and NPRAG will be triggered[114]. AFMA reports that a new NPF harvest strategy is being developed and it will contain a more detailed rule for the scampi fishery (i.e., if in any year the total catch is >30 t or the number of vessels involved is ≥8, a catch limit of 30 t for the following year will be imposed and review of the size structure of the catch will be triggered).

3.7.2.4 Bycatch species

Tropical prawn trawl bycatch is highly diverse and varies based on the gear deployed, the fishing grounds and the time of day[115]. In the NPF, bycatch composition can be broadly grouped into northern and southern regions separated at 14ºS (near Groote Eylandt)[116]. A study focused on bycatch in the tiger prawn sub-fishery (which included both the NPF and the Torres Strait prawn fisheries) found 359 species from 100 families. Bathysauridae (deepwater lizardfishes), Leiognathidae (ponyfishes) and Nemipteridae (threadfin breams), which together represent at least 27 species, contributed over 35% of the weight of the

[114] AFMA. 2007. Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls – August 2007.
[115] Dell et al. (2009). Op cit.
[116] Stobutzki, I., Blaber, S., Brewer, D., Fry, G., Heales, D., Miller, M., Milton, D., Salini, J., Van der Velde, T., Wassenberg, T. 2001. Ecological sustainability of bycatch and biodiversity in prawn trawl fisheries. FRDC Project 96/257.

bycatch[117]. A subsequent study of bycatch in the white banana prawn sub-fishery identified 218 taxa from 80 families and six higher level taxonomic classifications. Three species – *Polydactylus multiradiatus* (Australian threadfin), *Caranx bucculentus* (bluespotted trevally) and *Rhizoprionodon acutus* (milk shark) – accounted for just over half (51.4%) of the total bycatch weight[118]. A third study characterized the bycatch of the red-legged banana prawn sub-fishery in the Joseph Bonaparte Gulf as comprised of 195 taxa from 85 families, noting that its species composition is distinctly different from the neighbouring Gulf of Carpentaria. The three most dominant species were *Harpadon translucens* (glassy Bombay duck), *Rhinoprenes pentanemus* (threadfin scat) and *Trichiurus lepturus* (largehead hairtail) which together accounted for 46% of the total biomass[119].

The Level 2 ERA assessed 516 species of discarded bycatch species, 51 of which were elasmobranchs and 465 of which were teleosts[120]. Although Level 2 PSA results were not published for discarded bycatch species[121], these species were assessed using the quantitative SAFE (Level 2.5) approach.

In the elasmobranch SAFE, of the 51 species assessed, five species had an estimated fishing induced mortality rate (u) greater than the minimum unsustainable fishing mortality (u_{crash}): *Carcharhinus albimarginatus* (silvertip shark), *Orectolobus ornatus* (ornate wobbegong), *Squatina* sp. A (eastern angel shark), *Taeniura meyeni* (blotched fantail ray), and *Urogymnus asperrimus* (porcupine ray)[122]. In addition, for five other species, the 95% confidence interval for the estimate of u exceeded the estimated u_{crash} value: *Carcharhinus brevipinna* (spinner shark), *Carcharhinus leucas* (bull shark), *Pristis microdon* (freshwater sawfish), *Pristis zijsron* (green sawfish), and *Sphyrna mokarran* (great hammerhead)[123]. Expert consultation suggested that most of these species were unlikely to be realistically threatened by the fishery because their main distribution extends into deep water (>70 m) or over reefs which are largely unaffected by the NPF[124]. Specifically, for the five species where u exceeded u_{crash}, the risks to *C. albimarginatus*, *O. ornatus* and *Squatina* sp. were downgraded by expert override. The two remaining species (blotched fantail ray and porcupine ray) were added to the NPF's priority species list[125].

Risks to elasmobranchs posed by the NPF tiger prawn sub-fishery were later re-evaluated for the period 2007-2009 and five species were found with estimates of fishing mortality (F) higher than the maximum sustainable fishing mortality (F_{msm}) and the upper 90% confidence interval for fishing mortality (F) higher than the unsustainable fishing mortality (F_{crash}). These species were *C. albimarginatus*, *C. leucas*, *Galeocerdo cuvier* (tiger shark), *O. ornatus* and *S. mokarran*). However, none were considered to be at risk due to widespread distributions and/or low overlaps with the fishery. Furthermore, the blotched fantail ray was re-assessed as having a low risk and the porcupine ray was only considered at risk because its upper 90% confidence interval exceeded F_{msm}.[126]

[117] Stobutzki, I.C., Miller, M.J., Jones, P. and Salini. J.P. 2001. Bycatch diversity and variation in a tropical Australian penaeid fishery; the implications for monitoring. Fisheries Research 53: 283-301.
[118] Dell et al. (2009). Op cit.
[119] Tonks et al. 2008. Op cit.
[120] Griffiths et al. (2007). Op cit.
[121] CSIRO, personal communication, September 2011.
[122] Griffiths et al. (2007). Op cit. p. 258.
[123] Zhou, S. and Griffiths, S.P. 2008. Sustainability Assessment for Fishing Effects (SAFE): A new quantitative ecological risk assessment method and its application to elasmobranch bycatch in an Australian trawl fishery. Fisheries Research 91: 56–68.
[124] Griffiths et al. (2007). Op cit.
[125] AFMA (2009b). Op cit.
[126] Zhou, S. 2011. Sustainability assessment of fish species potentially impacted in the Northern Prawn Fishery: 2007-2009. Report to the Australia Fisheries Management Authority, Canberra, Australia. February 2011.

The discarded teleost bycatch SAFE (Level 2.5 ERA) assessed 456 species and found that five were at risk due to the current fishing mortality exceeding the u_{msy} reference point[127][128]. Nine other species with lower assessed risk levels, were added to the list of species of concern resulting from the SAFE as a result of a Bycatch Subcommittee meeting in January 2009[129]: *Dendrochirus brachypterus* (dwarf lionfish), *Scorpaenopsis venosa* (raggy scorpionfish), *Parascolopsis tosensis* (Tosa dwarf monocle bream), *Hemiramphus robustus* (three-by-two garfish), *Lutjanus rufolineatus* (yellow-lined snapper), *Onigocia spinosa* (midget flathead), *Benthosema pterotum* (skinnycheek lanternfish), *Scomberoides commersonnianus* (Talang queenfish) and *Sphyraena jello* (giant seapike)[130][131]. However, the assessed risks to seven of these species were downgraded through expert overrides and only two species (dwarf lionfish and raggy scorpionfish) were maintained on the NPF list of priority species[132][133]. An update to the SAFE for 2007-2009 found that neither of these species had estimated fishing mortality greater than F_{msm}, even when uncertainty was considered, and no other teleost species were found to be of concern[134].

A summary of the logbook and observer data on discarded bycatch species collected since the four species of concern were identified in 2007, found that neither of the teleosts (dwarf lionfish or raggy scorpionfish) had been found by any of the monitoring programs. That study suggested that these species are reef or hard bottom associated species which are unlikely to be effectively sampled by the CMO programme and they should be removed from the list of species being monitored. Similarly, there were no observer records of the two "at risk" elasmobranch species (blotched fantail ray and porcupine ray). The study concluded that these species would likely be excluded by TEDs and are reef or hard bottom associated species. It was also recommended that these species be removed from the NPF priority species list[135]. The latest version of the NPF priority species list still contains the dwarf lionfish, the raggy scorpionfish, blotched fantail ray and the porcupine ray (October 2011 draft)[136].

As the survey of bycatch in the Joseph Bonaparte Gulf[137] was conducted contemporaneously with the Level 2 ERA, it is important to consider whether the survey discovered any new species which were not covered in the ERA. The species identified as unique to the JBG included *Polydactylus nigripinnis* (threadfin salmon), *Setipinna paxtoni* (anchovy), *Larimichthys pamoides* (jewfish), *Benthosema pterotum* (lanternfish), and *Johnius laevis* (round-nose croaker) which were considered in the Level 2 ERA[138], and *Johnius* cf trawavase (croaker), *Lophichthys boschmai* (anglerfish) and *Abralia amarta* (cephalopod) which were not. In two of the latter three cases, closely related species were assessed (e.g. other *Johnius* spp., anglerfishes of the family Antennariidae) but the cephalopod *A. amarta* may not have sufficient biological and ecological similarity to the other squids from the family Loliginidae which were assessed.

[127] Brewer et al. (2007). Op cit.
[128] Zhou, S., Griffiths, S.P. and Miller, M. 2009. Sustainability assessment for fishing effects (SAFE) on highly diverse and data-limited fish bycatch in a tropical prawn trawl fishery. Marine and Freshwater Research 60: 563–570.
[129] Fry et al. (2009). Op cit.
[130] Brewer et al. (2007). Op cit.
[131] Zhou et al. (2009). Op cit.
[132] Fry et al. (2009). Op cit.
[133] AFMA 2009b. Op cit.
[134] Draft NPF Bycatch Work Plan, circa Sept 2011
[135] Fry et al. (2009). Op cit.
[136] AFMA (2011). Op cit.
[137] Tonks et al. 2008. Op cit.
[138] Griffiths et al. (2007). Op cit.

3.7.3 Endangered, Threatened and Protected Species

Under the Environment Protection and Biodiversity Conservation (EPBC) Act of 1999, Australia has designated 444 species as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent[139]. There are also several large groups of species named under Section 248 the EPBC Act as listed marine species. With reference to both of these lists and to the results of the ERA process, the NPF has designated the following as "Listed Marine, Threatened and At Risk Species":

- All species of Syngnathid (pipefishes, seahorses and sea dragons)
- All species of turtle, seasnake and crocodile
- All species of seal and sea lion
- All species of dolphin, whale, porpoise and dugong
- All species of seabird
- Grey nurse shark (*Carcharhinus taurus*)
- Speartooth shark (*Glyphis* sp. A)
- Northern river shark (*Glyphis* sp. C)
- Great white shark (*Carcharodon carcharias*)
- Freshwater sawfish (*Pristis microdon*)
- Narrow sawfish (*Anoxypristis cuspidata*)
- Green sawfish (*Pristis zijsron*)
- Dwarf sawfish (*Pristis clavata*)
- Whale shark (*Rhincodon typus*)

There are national plans of action or recovery for turtles[140], sharks[141] and whale sharks[142]. The only one of these to specify targets or to reference the NPF is the turtle recovery plan which states that a measure of success for the NPF is whether marine turtle capture and mortality decline to levels approaching 5% of 1989-1990 levels and lower levels for loggerhead turtles. As described below, the reduction of turtle bycatch from levels of 5000-6000 individuals in 1989-1990, to <37 individuals per year and no loggerheads (Table 15), exceeds the measure of success by a wide margin (<0.007%).

Interactions with these species, which are collectively referred to as Threatened, Endangered and Protected (TEP) species, are required to be recorded on catch and effort logsheets and by CMO and scientific observers[143][144]. Logsheet-reported interactions with TEP for each sub-fishery in 2004-2010 are shown in Table 15. This section describes the overall assessment and management process of the NPF with regard to TEP species and then summarizes the situation for five distinct groups: mammals, birds, reptiles, elasmobranchs and teleosts.

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[139] EPBC Act List of Threatened Fauna, Department of Sustainability, Environment, Water, Populations and Communities (http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl)
[140] Environmental Australia (2003). Recovery Plan for Marine Turtles in Australia. Accessed online at http://www.environment.gov.au/coasts/publications/turtle-recovery/pubs/marine-turtles.pdf
[141] Australian Government Department of Agriculture, Fisheries and Forestry (2004). National Plan of Action for the Conservation and Management of Sharks. Accessed online at http://www.daff.gov.au/__data/assets/pdf_file/0017/5840/web-shark-plan-full.pdf
[142] Australian Government of Environment and Heritage. Whale Shark (Rhincodon typus) Recovery Plan, 2005-2010. Accessed online at http://www.environment.gov.au/biodiversity/threatened/publications/recovery/r-typus/pubs/rhincodon-typus.pdf
[143] AFMA (2009b). Op cit.
[144] Commonwealth of Australia Gazette (2011). Op cit.

Table 15: Interactions with Threatened, Endangered and Protected Species in the NPF for Tiger Prawn, Red-legged Prawn and White Banana Prawn Sub-fisheries, 2004-2010[145].

Species	2004	2005	2006	2007	2008	2009	2010	Grand Total
TIGER PRAWN SUB-FISHERY								
Seasnakes	10,675	1,837	7,631	6,619	4,434	5,811	5,640	42,647
Seahorses & pipefishes	8	4	38	1,726	36	3	18	1,833
Sawfishes				27	154	58	118	357
Narrow sawfish				57	90	12	27	186
Common Sawshark				6		85		91
Green sawfish				16		40	24	80
Turtles			8	6	8	26	3	51
Flatback turtle	5		10	10	5	2	5	37
Green turtle	4	2	5	2		7	7	27
Pacific (Olive) Ridley turtle	5	1	4	6	3	1	6	26
Hawksbill turtle			4		2	1		7
Unknown or other					7			7
Freshwater sawfish				1			5	6
Gull-billed tern			5					5
Loggerhead turtle	1	1		1	2			5
Dolphins			1	1				2
Dwarf sawfish							2	2
Subtotal	10,698	1,845	7,706	8,478	4,741	6,046	5,855	45,369
RED-LEGGED PRAWN SUB-FISHERY								
Seasnakes	917	617	214	335	86	200	116	2,485
Sawfishes				9	18	1	13	41
Green sawfish				1		19	4	24
Common Sawshark				3		10		13
Narrow sawfish				2			11	13
Seahorses & pipefishes	8	0						8
Green turtle		2						2
Turtles						2		2
Dolphins	1							1
Subtotal	926	619	214	350	104	232	144	2,589
WHITE BANANA PRAWN SUB-FISHERY								
Seasnakes	2,370	1,837	1,752	892	1,450	1,395	1,722	11,418
Sawfishes				109	140	35	131	415
Narrow sawfish				76	44	6	27	153
Common Sawshark						123		123
Green sawfish				4	10	25	18	57
Seahorses & pipefishes	5	4	4	21	2	5		41
Turtles			2	25	4	8	1	40
Green turtle	2	2	5	5			4	18
Flatback turtle	7		2		3		1	13
Hawksbill turtle	2		2					4
Loggerhead turtle		1	2					3
Pacific (Olive) Ridley turtle	1	1	1					3
Dolphins						1		1
Dwarf sawfish				1				1
Freshwater sawfish				1				1
Subtotal	2,387	1,845	1,770	1,134	1,653	1,598	1,904	12,291
GRAND TOTAL	**14,011**	**4,309**	**9,690**	**9,962**	**6,498**	**7,876**	**7,903**	**60,249**

The quantitative Level 2.5 ERA assessed 128 TEP species including marine mammals (whales, dolphins and dugongs), marine birds, marine reptiles (turtles, crocodiles and seasnakes), elasmobranchs (sawfishes and sharks) and teleosts (seahorses and pipefishes). The risk assessment noted a higher likelihood of obtaining a false positive high risk score for TEP species than for other retained and discarded bycatch species because TEP species

[145] Unpublished data provided by AFMA, 25 November 2011.

are included in the analysis if they occur in the area of the fishery, whether or not there has ever been a recorded interaction[146]. Nine TEP species were identified as being at high risk in the tiger prawn sub-fishery including five species of sawfishes and 4 species of seasnakes. In the white banana prawn sub-fishery the same nine species were assessed as being at high risk along with three additional species of seasnakes.

Subsequent to the quantitative Level 2.5 ERA, Level 3 SAFE assessments were carried out for elasmobranch species which included the five species of sawfishes identified as being at high risk in Level 2.5, i.e., *Pristis zijsron* (green sawfish), *Anoxypristis cuspidata* (narrow sawfish), *P. pectinata* (wide sawfish), *P. microdon* (freshwater sawfish) and *P. clavata* (dwarf sawfish). Applying the results of the Level 3 SAFE, and taking into consideration the EPBC Act TEP species, three sawfishes (dwarf, green and narrow) were included in the NPF priority species list for monitoring[147] although they were considered not to be at high risk given the SAFE findings[148][149][150]. Monitoring for some TEP sawfish species is required under the EPBC Act, but it has been recommended that all sawfish species continue to be monitored as they are highly vulnerable to the impacts of fishing[151]. A recent update to the SAFE assessment was undertaken for the period 2007-2009 but the assessed risk levels for sawfishes remained unchanged, i.e. they are not considered to be at high risk[152].

The other group of TEP species requiring further action based on the Level 2.5 ERA was the seasnakes. A study dedicated to this topic was completed in 2008 finding that catch rates for the ten most common species have remained stable since 1976. The study also concluded that trawl mortality was below reference points and no species appear to be at risk based on current levels of fishing effort in the fishery[153]. Since seasnakes are protected species under the EPBC Act[154], interactions with the NPF will continue to be monitored as required through logbook and observer reporting, however, there are currently no seasnakes on the list of NPF priority species as a result of concerns based on risk assessment[155].

3.7.3.1 Marine mammals (whales, dolphins and dugongs)

Marine mammals of 23 species including whales, dolphins and dugongs were assessed in the Level 2.5 ERA and none were considered to be at high risk from the NPF. In the case of dugongs, this was attributed to the fact that most of the seagrass habitat utilized by dugongs is protected from NPF trawl impacts in Protected Area Closures. Marine mammals larger than 5 m were considered to have a low encounterability based on consultation findings that it is not feasible that these animals would be entangled in a 20-24 m sweep trawl net with head rope height less than 5 m. Marine mammals smaller than 5m were expected to escape trawl impacts on the basis of the requirement for TEDs in the fishery since 2001[156]. Logbook TEP data since 2005 indicates there has been one marine mammal interaction per year in the NPF (Table 15).

[146] Griffiths et al (2007). Op cit.
[147] Brewer et al. (2007). Op cit. (p.110, Table 7)
[148] AFMA (2009a). Op cit.
[149] AFMA (2009b). Op cit.
[150] Zhou & Griffiths. (2008). Op cit.
[151] Fry et al. (2009). Op cit.
[152] Zhou (2011). Op cit.
[153] Milton, D.A., Zhou, S., Fry, G.C. Dell, Q. 2008. Risk assessment and mitigation for sea snakes caught in the Northern prawn Fishery. Final report on FRDC Project 2005/051. CSIRO Cleveland, pp. 123.
[154] Milton et al. (2008). Ibid.
[155] AFMA (2009b). Op cit.
[156] Griffiths et al. (2007). Op cit.

3.7.3.2 Marine Birds

Twelve species of marine birds were assessed in the Level 2.5 ERA and none were considered to be at high risk from the NPF. This result was primarily attributed to expert judgement in combination with no history of bird catches by NPF trawl gear at that time. It was acknowledged that discarding may enhance feeding opportunities for bird populations during the fishing season, but the effect on birds of the reduction in food availability during the closed season is unknown[157]. Bird interactions have only been recorded in logbooks or by observers for 2006 (Table 15).

3.7.3.3 Marine Reptiles (Turtles, Crocodiles and Seasnakes)

Six turtle species were assessed in the Level 2.5 ERA and none were found to be at high risk from the NPF. These results were largely due to the successful implementation of TEDs in the NPF in 2001, which reduced the bycatch of turtles from approximately 5,700 to 30 per year[158]. According to data provided by AFMA from logbooks, almost all of the turtles survive their interactions with the fishery (Table 13). CMOs have recorded five species of turtle (hawksbill, olive Ridley, leatherback, green and flatback) from the western and southern portion of the Gulf of Carpentaria. A tendency for CMOs to underreport turtle interactions was noted possibly due to turtles being caught in the throat of the net where they are not seen by the CMOs. Scientific surveys (including observers) have recorded turtles in less than 1% of the trawls, and most commonly encountered flatback and olive Ridley species[159]. The NPF's Industry Code of Conduct for Responsible Fishing states that when turtles are encountered fishers should observe and implement protocols in accordance with the Commonwealth Turtle Recovery Plan[160].

Table 16: Interactions with Threatened, Endangered and Protected Species in the NPF and their Post-Capture Status (data through August 2008)[161].

Life Status	Year	Elasmobranchs	Seasnakes	Syngnathids	Turtles	Total
Alive	2004		9,399	1	24	9,424
	2005		7,111	8	27	7,146
	2006		6,152	17	44	6,213
	2007	207	5,180	8	55	5,450
	2008	139	1,044	5	8	1,196
Alive Total		346	28,886	39	158	29,429
Dead	2004		1628	6	2	1,636
	2005		1252	3	2	1,257
	2006		1112	7	1	1,120
	2007	84	757	1,341		2,182
	2008	54	80		1	135
Dead Total		138	4,829	1,357	6	6,330
Unknown	2004		2,935	14	1	2,950
	2005		1,375	10		1,385
	2006		2,335	18		2,353
	2007	22	1,909	398		2,329
	2008	9	736	1		746
Unknown Total		31	9,290	441	1	9,763
Total		515	43,005	1,837	165	45,522

[157] Griffiths et al. (2007). Op cit.
[158] Griffiths et al. (2007) Op cit.
[159] Fry et al. (2009). Op cit.
[160] NPF Industry Code of Conduct for Responsible Fishing. 2004. Accessed online at http://www.afma.gov.au/wp-content/uploads/2010/06/npf_code.pdf
[161] AFMA. (2008a). Op cit.

Two species of crocodile (freshwater and saltwater) were evaluated under the Level 2.5 ERA and neither was found to be at high risk. Potential impacts to both species are mitigated by the lack of overlap of their habitat with NPF fishing areas and the mandatory use of TEDs in the fishery[162]. No crocodile interactions have been recorded in the fishery.

As described above seasnakes were one of two groups of species which were highlighted as being of concern in the Level 2.5 risk assessment. This risk assessment covered 33 species of seasnakes and kraits and found 7 to be at high risk. Subsequent studies downgraded the risk to these species but all seasnake interactions continue to be monitored in the NPF. BRDs have not proved effective at reducing seasnake catch in the NPF when set at the maximum legal distance from the codend[163]. With the exception of 2008, recent annual interactions (2004-2010) are on the order of 7,000-10,000 per year[164][165][166], and only two-thirds of the seasnakes may survive (Table 16). However, studies indicated that seasnake survival has improved by 13% since the implementation of BRDs as they are now less likely to be crushed by the weight of other bycatch. Since the opportunities for further mitigation through temporal or spatial closures are limited by the wide distribution of seasnakes throughout the NPF fishing grounds, studies suggest the most effective option would be adoption of effective BRD types by the entire NPF fleet. Trials of new BRD types demonstrated that the Fisheye BRD can reduce seasnake catches by at least 43%, with no change in prawn catch, when set 66 meshes from the codend drawstring. Another BRD, the Popeye Fishbox BRD, achieved an 85% reduction in seasnake catch, with no change in prawn catch, when set 70 meshes from the codend[167]. The Popeye Fishbox BRD was approved for use in the NPF in 2007[168].

By mid-2012, the NPF intends to release a study designed to review the implementation, usage and effectiveness of BRDs in the NPF[169]. A preview of a portion of this study was made available in late November 2011 and identified efforts to increase adoption of Witches Hat enhancement devices and Popeye Fishbox BRDs as priorities for 2012[170]. It states that trials of the Witches Hat demonstrated that this device increased the rate of escape of small fish bycatch through a square mesh panel by 34% without changing the prawn catch. It also states that other trials demonstrated that Popeye Fishbox BRDs placed 70 meshes from the codend drawstring reduced small bycatch by 48%, the capture of sharks and rays by 35%, and the number of seasnakes captured by 87%, with no significant prawn loss. The NPF notes that the challenge in increasing implementation rates lies in encouraging fishermen to trial the gear in commercial operations by overcoming concerns regarding prawn loss, gear incapability and crew safety. Information on the existing implementation rates of BRDs and enhancement devices of various forms in the three sub-fisheries is not currently available[171].

3.7.3.4 Elasmobranch Fishes (Sharks and Sawfishes)

As introduced above, like the seasnakes, potential impacts to elasmobranchs, particularly sawfishes, were first highlighted as a concern in the Level 2.5 ERA and subjected to further subsequent studies which resulted in a downgrading of their risk status. Despite the lack of documentation of unacceptable risk, it is recognized that there is a high overlap of the NPF

[162] Griffiths et al. (2007). Op cit.
[163] Milton et al. (2008). Op cit.
[164] AFMA (2008a). Op cit.
[165] AFMA (2009c). Op cit.
[166] Barwick (2010). Op cit.
[167] Milton et al. (2008). Op cit.
[168] AFMA (2009a). Op cit.
[169] Draft NPF Bycatch Work Plan, circa Sept 2011
[170] Burke, A., Barwick, M. and Jarrett, A. 2011. Assessment of approved Bycatch Reduction Devices in the Northern Prawn Fishery. NPF Industry Pty. Ltd. 29 November 2011.
[171] Burke et al. (2011). Op cit.

with the distribution of some sawfish (mainly the narrow sawfish, *Anoxypristis cuspidata*), they have a high degree of endemism, they are slow-moving, and they are high susceptible to capture due to their rostrum teeth entangling in the net mesh. Six of seven sawfish species are listed on CITES Appendix I and the remaining species is listed on CITES Appendix II.

All available data sets for the NPF fishing grounds show that the narrow sawfish comprises the overwhelming majority of sawfish encountered. Catches for this species appear to have been stable between 1990 and 2002 but slightly increasing since 2003 with no statistically significant trend overall. Catch rate trends for dwarf and green sawfish, the only other sawfish with NPF catch records, are difficult to interpret due to low sample sizes.

Studies of NPF logbook, observer and scientific datasets have raised issues concerning under-reporting by CMOs and the practicality of achieving sufficient sampling effort to detect changes in abundance in these rarer species[172][173]. There is varying evidence for the effectiveness of TEDs in mitigating sawfish interactions: some studies have reported that TEDs reduced catches of narrow sawfish by 73%[174], whereas other studies found only a slight effect[175] or maintain there is no effect due to entanglement before the TED is contacted[176]. Sawfishes and other elasmobranchs have been recorded in NPF logbooks since 2007 with 139-417 interactions per year with two-thirds of the sawfishes reported to be alive[177][178][179]. New sawfish research has just been initiated by CSIRO with funding from Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

While the most recent assessments for elasmobranchs besides sawfishes have not raised concern about risk levels[180][181] there are five species that require monitoring under the EPBC Act: grey nurse shark, speartooth shark, northern river shark, great white shark and whale shark. There are no known records of interaction between the NPF and the first four species. The whale shark, while encountered rarely in the NPF, is considered to not be at risk because its exclusion by the trawl mouth opening and/or TED is expected to be 100%[182]. AFMA has produced a guide which can be used to manage interactions with sharks, rays and sawfishes[183].

3.7.3.5 Teleost Fishes (Syngnathids)

Special management attention is required for all syngnathids (seahorses, pipefishes and sea dragons) as they are listed marine species under the EPBC Act. In the Level 2.5 ERA 44 syngnathid species were assessed and all were found to be at low risk, except for the hedgehog seahorse (*Hippocampus spinosissimus*) and the blue-finned ghost pipefish (*Solenostomus cyanopterus*), which were medium risk in the tiger prawn sub-fishery only. These low risk assessments are primarily attributable to a lack of interaction between benthic

[172] Brewer et al. (2007). Op cit.
[173] Fry et al. (2009). Op cit.
[174] Brewer et al. (2006). Op cit.
[175] Griffiths, S.P., Brewer, D.T., Heales, D.S., Milton, D.A. and Stobutzki, I.C. 2006. Validating ecological risk assessments for fisheries: assessing the impacts of turtle excluder devices on elasmobranch bycatch populations in an Australian trawl fishery. Marine and Freshwater Research 57: 395-401.
[176] Patterson, H.M. & Tudman, M.J. 2009. Chondrichthyan guide for fisheries managers: A practical guide to mitigating chondrichthyan bycatch. Bureau of Rural Sciences and Australian Fisheries Management Authority, Canberra.
[177] AFMA (2008a). Op cit.
[178] AFMA (2009c). Op cit.
[179] Barwick (2010). Op cit.
[180] Zhou and Griffiths (2008). Op cit.
[181] Zhou (2011). Op cit.
[182] Brewer et al. (2007). Op cit.
[183] Patterson and Tudman (2009). Op cit.

seagrass and other structured habitats preferred by syngnathids and the NPF's protected area closures[184]. With the exception of 2007, when 1,747 syngnathid interactions were recorded, the number of interactions based on logbook records since 2004 is between 6-42 per year[185][186][187]. In 2010, logbook records indicate 18 interactions, while CMOs recorded 476 and scientific observers recorded 3[188].

3.7.4 Habitat

NPF managed area receiving trawl effort have varied over time due to changes both in the fishery itself and in the assessment methods. Based on an analysis of 1-minute grid cells using data from 1999-2004, Haywood et al (2005)[189] estimated that up to 17% of the NPF managed area receives at least some level of trawl effort in each year. More recently, CSIRO analysis (unpublished) has indicated that roughly 8% of the managed areas grid cells are trawled at least 6 hours each year. Haywood et al. 2005 indicate that the choice of grid size and the threshold set for the minimum duration of trawling time within any one year are important variables in estimating the total proportion of area trawled.

The effects of trawling on benthic and demersal habitats include a combination of mortality, short-term damage and long-term modification impacts. If the trawling intensity is frequent and the productivity/resiliency of the affected habitats is low, recovery times may be extensive and ecosystem functions may suffer long-term disturbance. As introduced in Section 3.7.1, the impacts of trawling in the NPF would most often be associated with the tiger prawn sub-fishery, and to a lesser extent, the red-legged prawn sub-fishery due to deployment of trawls at or near the seabed[190][191]. Habitat impacts from the white banana prawn sub-fishery would primarily be associated with the water column/pelagic environment and are of minimal concern as this habitat is not static. In the NPF, habitat impacts are expected to be mitigated by the fact that fishing effort has declined from 286 vessels in 1981 to 52 vessels in 2009, which are now deployed over only about 3% of the NPF-managed region[192]. Furthermore, the large number of spatial and temporal closures adopted by the NPF serves to protect vulnerable habitats such as seagrass beds and coral and rocky reefs[193].

In the Level 2.5 ERA, photographic data, geomorphic unit mapping, literature, and expert opinion were used to classify 157 habitat types on the basis of substratum, geomorphology, and dominant fauna. Of these, none were found to be at high risk and 65 were assessed to be at medium risk. Of the mmedium risk habitats 48 were inner shelf habitats (0-100 m) dominated by flat to highly irregular unconsolidated sediments of mud to coarse grained biogenic gravels, with large erect sponges, hard and soft corals, complex communities of mixed fauna, and individual animals. The remaining 17 medium risk habitats were coastal margin habitats (0-25 m), which also include several soft sediment seabed types but which were dominated by seagrass communities not identified from the inner shelf. There are hard bottom and fringing habitats scattered throughout both zones.

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[184] Kenyon et al. (2005). Op cit.
[185] AFMA (2008a). Op cit.
[186] AFMA (2009c). Op cit.
[187] Barwick (2010). Op cit.
[188] Barwick (2010). Op cit.
[189] Haywood (2005) Op cit
[190] Griffiths et al. (2007). Op cit.
[191] Personal communication, D. Brewer and D. Milton, 19 September 2011 (see Section 9).
[192] Brewer et al. (2007). Op cit. (p. 188).
[193] Kenyon et al. (2005) Op cit.

Detailed analyses of the impacts of trawling on the benthos in the NPF are provided by a 2005 study conducted near Mornington Island[194] and a more recent study focused on the sedimentary shelves and submerged river beds of the southwestern Gulf of Carpentaria[195]. Based on these studies, there are no known unique, exclusive habitats in either area. The majority of the ecologically important habitats are located in untrawable ground. However there are some areas of high biodiversity, such as marginal reefs and sponge gardens, within trawlable areas and it is not known whether these are permanent structures or whether they form and are dispersed in response to natural environmental disturbance[196]. In the 2005 study, experiments simulating commercial fishing operations through repeated intensive trawling of study sites showed that most benthic assemblages were primarily influenced by seasonal factors rather than trawling. Recovery in a number of sessile or slow moving taxa was found to occur within 6-12 months[197]. As will be discussed further in the following section, recent studies in the Gulf of Carpentaria found that trawling intensity explained only 2% of the biomass density variation in epibenthic invertebrates (including benthic sessile and mobile species), and at most 1% in infaunal invertebrates[198]. While these studies did not examine habitat per se, findings indicating that trawling has little effect on the infaunal community suggest that trawling also has relatively little effect on benthic habitats.

The knowledge accumulated through years of research studies has recently been compiled by CSIRO into a digital spatial library describing the state, composition and spatial variability of the NPF's habitats. This library forms one of the key features of the operational spatial management strategy evaluation framework described in the following section[199].

3.7.5 Ecosystem Structure and Function

In addition to the potential impacts to species and habitats described in the preceding sections, trawl fisheries pose the risk of altering the benthic or demersal communities, or changing prey availability through discards, such that food web dynamics shift. The ecosystem impacts of trawling are well-studied in Australia, including numerous studies in tropical and sub-tropical environments. Previous research has characterized the NPF ecosystem as driven by land-sea interactions, particularly freshwater input which triggers productivity in the form of benthic diatoms and tropical plankton. These studies found no evidence that the fishery affects this ecosystem in a significant way[200].

Previous findings were re-examined in a recent study focused on the tiger prawn sub-fishery (i.e., the sub-fishery with the highest diversity and quantity of bycatch of the three NPF sub-fisheries)[201]. This study confirmed that the effects of trawling at the current scale of the NPF do not affect overall biodiversity and cannot be distinguished from other sources of variation in community structure. In particular, recent analyses showed that the composition and density of demersal fish, epibenthic invertebrates and infauna in the Gulf of Carpentaria were

[194] Haywood M, Hill B, Donovan A, Rochester W, Ellis N, Welna A, Gordon S, Cheers S, Forcey K, Mcleod I, Moeseneder C, Smith G, Manson F, Wassenberg T, Thomas S, Kuhnert P, Laslett G, Burridge C and Thomas S. 2005. Quantifying the effects of trawling on seabed fauna in the Northern Prawn Fishery. Final Report on FRDC Project 2002/102. CSIRO, Cleveland. 462 pp.

[195] Bustamante, R.H., Dichmont, C.M., Ellis, N., Griffiths, S., Rochester, W.A., Burford, M.A., Rothlisberg, P.C., Dell, Q., Tonks, M., Lozano-Montes, H., Deng, R., Wassenberg, T., Okey, T.A., Revill, A., van der Velde, T., Moeseneder, C., Cheers, S., Donovan, A., Taranto, T., Salini, G., Fry, G., Tickell, S., Pascual, R., Smith, F., and Morello, E. 2010. Effects of trawling on the benthos and biodiversity: Development and delivery of a Spatially-explicit Management Framework for the Northern Prawn Fishery. Final report to the project FRDC 2005/050. CSIRO Marine and Atmospheric Research, Cleveland, P382.

[196] CSIRO, personal communication, September 2011.

[197] Haywood et al. (2005). Op cit.

[198] Bustamante (2010). Op cit.

[199] Bustamante et al (2010). Op cit.

[200] CSIRO, personal communication, September 2011.

[201] Bustamante (2010). Op cit.

more strongly related to region, and in some cases time of day, than to the intensity of trawling as mapped by NPF Vessel Monitoring System (VMS) data. Despite the lack of apparent impacts of trawling on the community as whole, impacts in the form of changes in relative abundance between species were observed in some cases. For example, the study found that the mean tropic level at the beginning of the fishery (~1970) was relatively high, then reduced with the increase in fishing effort up to 1980. After that, as fishing effort reduced, the trophic level increased again.

The study also clearly showed using ecosystem modeling that while trawling may negatively affect some functional groups (e.g., sharks, rays, sponges, bryozoans, and gorgonians), and positively affect others (e.g., dollar and pony fishes, some crabs and bivalves), communities can recover rapidly when trawling frequency is reduced. The study thus recommended that management should focus on those taxa that have been assessed to be at risk and/or are designated as TEP species. In addition, the spatial extent, transience and recovery times of high biodiversity areas (e.g., sponge gardens) within the trawlable grounds of the fishery should be the subject of further study.

It is important to consider that although the impacts of trawling on the ecosystem have been relatively well-studied over a number of years, the lack of a clear impact due to trawling activities may be due to either real factors or experimental design artifacts. On one hand, the habitats of the NPF are highly dynamic and regularly encounter high natural variation in the form of storm surges, tides, flooding and cyclones. This situation would suggest that communities may be well-adapted to disturbance. On the other hand, given the long history of continuous trawling in the study area, it proved impossible for the studies to identify any suitable and comparable untrawled areas to serve as a true baseline. This situation might suggest that impacts due to trawling per se could be better identified if proper control sites could be identified.

A recent in-depth research project by CSIRO has successfully integrated bioeconomic stock and ecological risk assessment models with food web, effect of trawling and species distribution models to form an operational spatial management strategy evaluation framework[202]. This tool will facilitate NPF ecosystem-based fisheries management and can complement the design of new Commonwealth marine reserves being undertaken by DSEWPaC as part of Australia's marine bioregional planning programme[203].

3.8 Management System (P3)

3.8.1 Legal and customary framework

The Northern Prawn Fishery is located in the Australian EEZ, but also inside the boundaries of the States of Northern Territory, Queensland and Western Australia. The fishery is managed by the Australian Fisheries Management Authority (AFMA)[204] in accordance with the Fisheries Management Act (FMA) of 1991 and Fisheries Management Regulations 1992, the Fisheries Administration Act 1991 and the Fisheries (Administration) Regulations 1992. Commonwealth-managed fisheries are also subject to aspects of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and the Environment Protection and Biodiversity Conservation Regulations 2000. In particular, fisheries are periodically assessed for compliance with the Guidelines for the Ecologically Sustainable Management of Fisheries.

The FMA is consistent with the United Nations Fish Stocks Agreement and the Food and Agriculture Organisation of the United Nations (FAO) Code of Conduct for Responsible

[202] Bustamante et al. (2010). Op cit.
[203] Lack (2010). Op cit.
[204] http://www.afma.gov.au/

Fisheries. AFMA has also adopted the Ecosystem Approach to Fisheries Management under the national Ecologically Sustainable Development (ESD) Policy and its overarching framework for Commonwealth Fisheries (AFMA, 2005). The ESD includes the principles of ecologically sustainable target and bycatch species, ecological viability of bycatch species, and impact of the broader marine ecosystem

The above laws created a statutory authority model for fisheries management whereby day-to-day management of fisheries are vested with AFMA, with the broader fisheries policy, international negotiations and strategic issues being administered by DAFF.[205]. The Fisheries Administration Act establishes AFMA to manage Commonwealth fisheries. The overall objectives of the FMA 1991 form the basis for the management of all Commonwealth fisheries. The key EPBC Act 1999 requirements that apply relate to the need for a strategic assessment of the fishery management arrangements, and the management of protected areas and species.

Key aspects of the policy framework for Commonwealth fisheries are articulated in:

- Looking to the Future: A review of Commonwealth Fisheries Policy (DAFF, 2003)[206]
- Securing our fishing Future (Commonwealth Minister for Fisheries, 2006)[207];
- Future Operating Environment for Commonwealth Fisheries (AFMA, 2006)[208];
- Commonwealth Fisheries Harvest Strategy Policy and Guidelines (DAFF, 2007)[209].

Sections 161 and 165 of the FMA provide appeal rights for decisions taken by AFMA through administrative means (internal AFMA review, appeal to the Administrative Appeals Tribunal and the Statutory Fishing Rights Allocation Review Panel) and judicial means through appeal to the Federal Court. Australian Fisheries Management Authority decisions to apply the precautionary principle have been upheld in a number of cases, following referral to the Administrative Appeals Tribunal (AATA) (Weire *et al*, 2007[210]). Fishers are advised of their appeal rights and the processes involved. In addition to these processes, the consultation and advisory processes established by AFMA provide mechanisms for the airing and discussion of different perspectives on fisheries management issues by stakeholders. Legal advice on management and appeals is provided by legal expertise within AFMA and by external, independent legal advisers as required.

Legal challenges were made to management plans for the NPF in relation to the compulsory reduction in effort within the 1989 NPF Management Plan. The main arguments were that the amendments to the plan to implement the reduction in effort were ultra vires, and the restructuring program represented an acquisition of rights on unjust terms under the constitution. All of these challenges were unsuccessful[211].

Special provision for ‘traditional fishing’ is made where they might apply in the contexts of both Commonwealth and State Fisheries Law. The Northern Prawn fishery is a specialist offshore commercial fishery. Indigenous rights are however considered in the context of The Aboriginal Land Act 1978 (NT) 12(1)[212] which empowers the Administrator to close the seas adjoining and within 2km of Aboriginal land to others who are not Aborigines entitled by tradition to enter and use the seas in accordance with that tradition. Before doing so he may (and in case of dispute he must) refer a proposed sea closure to the Aboriginal Land

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205 http://www.daff.gov.au/fisheries
206 DAFF (2003). Looking to the Future: A review of Commonwealth Fisheries Policy.
207 AFMA (2007). Future Operating Environment for Commonwealth Fisheries (2006)
208 Commonwealth Minister for Fisheries (2006). Securing our Fishing Future
209 DAFF, 2007, *Ibid*
210 Weire A and Lok P (2007), Precaution and the Precautionary Principle: two Australian case studies, Productivity Commission, Commonwealth of Australia, 2007)
211 Josh Fielding, AFMA, email of 21/12/2011.
212 www.**clc.org.au**/Ourland/**land**_rights_**act**/**Land**_rights_**act**.html

Commissioner. These issues are taken into account through NOPRMAC consultation processes and in the context of closed areas discussions. Once seas are closed it is an offence for a person to enter or remain on these seas without a permit issued by the relevant Land Council.

3.8.2 Consultation, roles and responsibilities

AFMA is a statutory authority with policy input being provided to the Minister via DAFF. All aspects of the fishery management system including the research, surveys, stock assessments, harvest strategies, and management controls are controlled by AFMA.

The Commonwealth model of fisheries management has a number of features that distinguish it from many other countries, the most prominent of which is the partnership approach with industry and other stakeholders. Under this model, the involvement of industry is recognised as being vital to successful fisheries management. For administrative purposes, AFMA has grouped the fishery resources in the Australian Fishing Zone into 21 fisheries that are identified by species, fishing method and/or area.

AFMA’s responsibilities are shared between a Commission and the Chief Executive Officer:

- The Commission is responsible for domestic fisheries management.
- The Chief Executive Officer is responsible for foreign compliance, and for assisting the Commission and giving effect to its decisions.
- The Chief Executive Officer is responsible for the agency that supports these functions.

The CEO is also a Commissioner, and is appointed on a full-time basis. All other Commissioners are appointed on a part-time basis. Appointments are made by the Australian Government Minister responsible for fisheries.

Commissioners are appointed on the basis of their high level of expertise in one or more of the fields of fisheries management, fishing industry operations, science, natural resource management, economics, business or financial management, law, public sector administration or governance. Commissioners cannot hold any executive position in a fishing industry association, nor can they have a controlling interest or executive role in any entity holding a Commonwealth fishing concession.

The current eight Commissioners were appointed on 1 March 2009 for five year terms of office.

The Minister tends to set the policy framework (e.g., see the Ministerial Direction) – the Commissioners oversee the application of the framework in Commonwealth managed fisheries and for ensuring that adequate resources and expertise are available to meet AFMA's legislative obligations. The Commission has three committees to assist in the conduct of its business: the Finance and Audit Committee, the Research Committee and the Environment Committee. The outcomes of Commission meetings are reported to stakeholders as well as to the public through the AFMA website.

As part of AFMA's partnership approach to fisheries management, it has established Management Advisory Committees (MACs) for each major fishery that it manages. MACs are AFMA's main point of contact with client groups in each fishery and play an important role in helping AFMA to fulfil its legislative functions and pursue its objectives. The Committees provide advice to AFMA on a variety of issues, including on-going measures required to manage the fishery, the development of management plans, research priorities and projects for the fishery. The MACs are also charged with ensuring that processes are in place for industry and other interested stakeholders to receive advice from researchers in a form appropriate to the audience.

Roles and responsibilities and advice about operation and participation in MACs and Resource Assessment Groups (RAGs) are provided in:

- Management Paper (FMP) No.1 - Management Advisory Committees (AFMA, 2009a[213])
- Fisheries Administration Paper (FMP) No.7 - Information and Advice for Industry Members on AFMA Committees (AFMA, 2011c[214]).
- Fisheries Administration Paper Series No. 12 Resource Assessment Groups - Roles, Responsibilities and Relationship with Management Advisory Committees (AFMA, 2011d[215])
- Guide to How MACs Work (AFMA, 2003[216])

The MACs are intended to complement the work of fishery managers by providing a broader perspective on management options and a wide range of expertise. MACs therefore provide a forum where issues relating to a fishery are discussed, problems identified and possible solutions developed. The outcomes of these deliberations determine the recommendations that the MAC will make to the AFMA Commission. AFMA's legislation limits the number of members on a MAC to ten, in addition to the Chairperson and an AFMA officer. Increasingly, and where appropriate, AFMA has included a broader range of interest groups in this consultative process. The AFMA Commission decides on a fishery-by-fishery basis whether membership of a MAC should also reflect these wider community interests. As a general rule, revised membership arrangements are considered upon expiry of terms of appointment of existing members.

The MAC that covers the management of the NPF is known as the Northern Prawn Management Advisory Committee (NORMAC). The ten statutory members of NORMAC comprise the Chairman, five from industry, one from the conservation community, a research member (currently the chair of the Northern Prawn Resource Assessment Group), an AFMA Member (currently the Fishery Senior Manager) and a State Government appointee (rotated between Northern Territory and Queensland).

Several other observers and invited guests may also attend from time to time. These include CSIRO scientists, a representative from ABARES and non NORMAC members of the fishing industry, indigenous interests and DSEWPaC. NORMAC provides a public forum, through annual meetings, for discussion on the development of the management regime for the NPF. The first meeting of NORMAC was held in 1984. Minutes of NORMAC meetings are publicly available on the AFMA website[217].

[213] AFMA (2009a) Fisheries Management Paper (FMP) No.1 - Management Advisory Committees. Available at http://www.afma.gov.au/wp-content/uploads/2010/06/fmp01_2009.pdf

[214] AFMA (201c), Fisheries Administration Paper (FMP) No.7 - Information and Advice for Industry Members on AFMA Committees.

[215] AFMA (2011c), Fisheries Administration Paper Series No. 12 Resource Assessment Groups - Roles, Responsibilities and Relationship with Management Advisory Committees. Available at http://www.afma.gov.au/wp-content/uploads/2011/09/Agenda_Item_5.1_Attachment_1_AFMA_CEO_Key_Outcomes_MAC_RAG_Workshop_17_Aug_2011.pdf

[216] AFMA (2003), Guide to How MACs Work. Available at http://www.afma.gov.au/wp-content/uploads/2010/07/macs.pdf

[217] http://www.afma.gov.au/managing-our-fisheries/consultation/management-advisory-committees/normac/

As explained earlier, the NPF stock assessment process is reviewed by the NPRAG[218] which provides advice to NORMAC. RAGs are not a body of the MACs and operate independently from them, although the two groups work closely together. All advice presented by RAGs is given without bias. The MACs consider the advice of RAGs and provide recommendations to the Commission based on how the alternatives will contribute to meeting overall objectives for the particular fishery (risk management) and, ultimately, to the pursuit of AFMA's legislative objectives. Minutes of NPRAG are publicly available of the AFMA website[219].

The main role of RAGs is to provide advice on the status of fish stocks, substocks, species (target and non-target), and on the impact of fishing on the marine environment. This includes providing advice to MAC research sub-committees on the type of information required for stock assessments. RAGs also evaluate alternative harvest options proposed by MACs, including impact over time of different harvest strategies; stock depletion or recovery rates; confidence levels for fishery assessments; and risks to the attainment of approved fishery objectives. RAGs coordinate, evaluate and regularly undertake fishery assessment activity in each fishery. They report their recommendations through the individual fishery MACs to the AFMA Commission on issues such as the setting of total allowable catches (TACs), stock rebuilding targets, biological reference points etc. In effect, the RAGs provide advice taking account of uncertainty and seek to identify the risks associated with the alternatives (risk assessment).

In addition to the opportunities for stakeholder engagement provided by the MACs and RAGs, AFMA:

- provides opportunities for public comment on fisheries management plans;
- holds an annual public meeting;
- requires each MAC to hold an annual public meeting;
- holds around half of AFMA's Commission meetings in regional centres providing opportunities for direct access to AFMA Commissioners by stakeholders and the general public.

A summary of assigned advisory roles and responsibilities is highlighted in the table below.

[218] NPRAG (2011). Minutes. Available at http://www.afma.gov.au/managing-our-fisheries/consultation/resource-assessment-groups/nprag/

[219] http://www.afma.gov.au/wp-content/uploads/2011/09/NPRAG-Minutes-May-2011.pdf

Table 17: Summary of advisory responsibilities between AFMA managers, Source: AFMA (2011), 'Above and Below the line'.

	Item/matter/issue	NORMAC[220]	NPFI/AFMA[221]	NPRAG[222]
1.	Changes to harvest strategies	✓		
2.	Advice on the development and improvement of harvest strategies and ERA			✓
3.	TAC/E setting/decisions (within HSP)		✓ (decision rules)	
4.	TAC/E setting/decisions (outside HSP or decision rules)	✓		
5.	Stock assessment advice and RBC calculations including reference points			✓
6.	Future management decisions • input/output controls • new directions	✓		
7.	Plan amendments	✓		
8.	ERA/ERM	✓		
9.	Review of fishery budget and levies and monitoring of expenditure reports		✓	
10.	Quarterly expenditure reports		✓ (AFMA to provide to NPFI)	
11.	Government Policy (for information to MAC or directly to stakeholders) • Ministerial Direction • NPOAs • OCS • Bycatch	✓		
12.	Review of biological catch & effort and observer data to determine and monitor trends, issues, key target and byproduct / bycatch species monitoring and advice on data generally			✓
13.	Implementing the bycatch and discard program including TEDs and BRDs		✓	
14.	Crew-based observer program		✓	
15.	Routine Management Issues • Directions • Setting season dates • Tiger season – in season management • Banana season – in season management		✓	
16.	Public interest issues (AFMA or NPFI to deal with directly)		✓	
17.	Research (with RAG)			✓
18.	Compliance plan and risk assessment		✓	
19.	Compliance issues		✓	
20.	E-log program		✓	
21.	Strategic research including the Plan	✓		
22.	Strategic assessment review	✓		
23.	MPAs	✓	✓ (operational)	
24.	Auditing of trial program	✓ (reports)	✓	

220 Minutes and action through AFMA Management, Chairs report to the Commission
221 Process to be determined for reporting / recommendations by NPFI to AFMA and elsewhere (e.g. RAG, MAC, wider consultation). Items referred to the Commission by AFMA Management on a case by case basis with feedback to NPFI.
222 The timing of stock assessment and RBC calculations vis-à-vis RAG and MAC meetings is important for process – e.g. if changes to harvest strategy required.

Discussions with various indigenous groups have focused around area closures (including protected area closures), cultural heritage issues including sacred sites, arrangements for NPF skippers and crew to access aboriginal owned land and more recently as part of co-management, exchanges on the NPF management arrangements and cultural heritage training which is being undertaken as part of the NPF pre-season briefings. The NPF Operational Booklet specifically includes information that has been developed in conjunction with indigenous groups on accessing aboriginal owned land and closed seas, and includes a number of closures that have been implemented taking into account indigenous interests (e.g., the protected area closures in Arnhem Bay, Dalumba Bay and Port Essington. There has also been considerable interaction on issues such as the development of proposed Indigenous Protected Areas in the Wellesley Island area. There have been two attendances by indigenous representatives at NORMAC on this issue in the past three years, and NPF Pty Ltd also participates in the Carpentaria Land Council Indigenous Protected Area.(CLC IPA) working group on this issue.

The NPF industry have also been involved in a Fisheries Research and Development Corporation (FRDC) project aimed in improving engagement between the Northern Prawn industry and indigenous groups as part of the NPF co-management approach[223]. The project has been very successful and a key output is that representatives of the Wellesley Island group and the Carpentaria Land Council attend the NPF pre-season briefings which provides an opportunity for the indigenous groups to get a better understanding of the management arrangements in the NPF, and to provide our skippers with cultural heritage training and provide information on issues of cultural importance to them.

3.8.3 Long Term Objectives

The long-term objectives that must be pursued by AFMA in the management of Commonwealth fisheries are prescribed in the Fisheries Management Act 1991. These are:

(a) implementing efficient and cost-effective fisheries management on behalf of the Commonwealth; and

(b) ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development (which include the exercise of the precautionary principle), in particular the need to have regard to the impact of fishing activities on non-target species and the long term sustainability of the marine environment; and

(c) maximising the net economic returns to the Australian community from the management of Australian fisheries; and

(d) ensuring accountability to the fishing industry and to the Australian community in AFMA’s management of fisheries resources; and

(e) achieving government targets in relation to the recovery of the costs of AFMA.

In addition the Act specifies that the Minister, AFMA and Joint Authorities are to have regard to the objectives of:

(a) ensuring, through proper conservation and management measures, that the living resources of the AFZ are not endangered by over-exploitation; and

(b) achieving the optimum utilisation of the living resources of the AFZ; and

(c) ensuring that conservation and management measures in the AFZ and the high seas implement Australia’s obligations under international agreements that deal with fish stocks; and

[223] FRDC (2010/320) Tactical Research Fund: Developing a model for enhanced consultation and collaboration between indigenous communities and the fishing industry: A case study between the NPF Industry and Carpentaria Land Council Aboriginal Corporation and Wellesley Island elders

To assist AFMA in the application of these objectives, the Australian Government has also agreed a *Commonwealth Fisheries Harvest Strategy Policy and Guidelines* ("the Policy").[224] The overarching harvest strategy policy was created by DAFF in close cooperation with AFMA, DSEWPaC (formerly DEWHA), supported by a Steering Committee comprising ABARES, the Commonwealth Fisheries Association (CFA) and independent experts.

The objective of the Policy is:

> *The sustainable and profitable utilization of Australia's Commonwealth Fisheries in perpetuity through the implementation of harvest strategies that maintain key commercial stocks at ecologically sustainable levels and within this context, maximize the economic returns to the Australian community.*

The Policy sets out preferred targets for the management of fish stocks as well as explicit guidance on the level of risk acceptable to the Australian Government. The Policy requires that "harvest strategies for key commercial stocks taken in Australia's Commonwealth fisheries ... be designed to pursue maximum economic yield from the fishery and ensure those stocks remain above levels at which risk to the stock is unacceptably high". More explicitly, the Policy requires that harvest strategies seek to:

- Maintain fish stocks, on average, at a target biomass point (B_{targ}) equal to the stock size required to produce maximum economic yield (B_{MEY});
- Ensure fish stocks will remain above a biomass level where risk to the stock is regarded as too high (B_{lim}) (or proxy); and
- Ensure that the stock stays above the limit biomass level at least 90% of the time.

The Policy also requires that harvest strategies take into account ecosystem interactions. For example, it notes that "one consideration is the relationship the species has with others in the food web or community, particularly if the harvested species is a keystone species. In such circumstances the biomass reference points described above may be increased to take account of a species' importance to the maintenance of the food web or community".

The primary management instrument for most fisheries is a statutory fishery management plan developed under the FMA. Fishery level objectives, as specified in management plans, are the same as the longer term strategic objectives specified in the FMA. While shorter-term fishery specific objectives can be inferred or identified from various management documents, they are not collated in any coherent form. Each Plan incorporates measures that seek to achieve stock sustainability, maximising net economic returns and application of the EAFM.

All Commonwealth fisheries are <u>also</u> required to comply with relevant requirements of the EPBC Act. The objectives of the Act are as follows:

The objectives of the EPBC Act are to:

- provide for the protection of the environment, especially matters of national environmental significance
- conserve Australian biodiversity
- provide a streamlined national environmental assessment and approvals process
- enhance the protection and management of important natural and cultural places
- control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife

[224] DAFF (2007)

- promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources

One of the main provisions of the Act relating to fisheries is the strategic assessment process. Environmental Guidelines for Ecologically Sustainable Management of Fisheries (DEWR, 2007)[225] includes the principles consistent with the FMA Firstly that:

The fishery shall be conducted at catch levels that maintain ecologically stock levels at an agreed point or range with acceptable levels of probability. The objective is subdivided into assessment, management response and information, all of which are entirely consistent with the scoring PIs as set out in MSC principle 1;

Secondly, fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem. The guidelines contain core objectives, accompanied by stipulated measurable indicators, which are consistent with MSC principle 2.

- The fishery is conducted in a manner that does not threaten bycatch species.
- The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities
- The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally.

Each of these objectives contains associated performance indicators on information requirements, assessments and management responses.

3.8.4 Decision-Making Processes

Decisions on the implementation of the policy are taken by the AFMA Commission, following advice from NORMAC, NPRAG, as well as AFMA officers. The AFMA Commission reports on its decisions directly back to the MAC and to stakeholders through media such as the regular AFMA Update[226]*.* AFMA Commission meeting records are not made public. However, NORMAC will always receive a letter from the Commission outlining any decisions made on NORMAC recommendations, including explanations as to acceptance or rejecting of NORMAC recommendations[227]. Parliament could overturn AFMA’s decisions in the event that it disagreed.

3.8.5 Fishery specific management objectives

The fishery conforms to a fisheries specific Fishery Management Plan for the NPF, last amended in 2006[228]. The two core objectives of the plan are:

- that the objectives pursued by the Minister in the administration of the Act, and by AFMA in the performance of its functions, are met in relation to the Northern Prawn Fishery; and
- that the incidental catch of non-target commercial and other species in that Fishery is reduced to a minimum.

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[225] Department of the Environment and Water Resources (2007), Guidelines for the ecologically sustainable management of fisheries, http://www.environment.gov.au/coasts/fisheries/publications/pubs/guidelines.pdf
[226] http://www.afma.gov.au/afma_update/docs/update_0704/update_0704.htm
[227] Fielding, 21 Dec, *op cit*
[228] Australian Government http://www.comlaw.gov.au/Series/F2005B02455

AFMA's objectives are reflected in the Northern Prawn Management Strategy document of 2011[229], where they are expressed as follows:

- Objective 1: Ensure the utilisation of the fishery resources within the Northern Prawn Fishery is consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle.
- Objective 2: Maximise economic efficiency in the utilisation of the fisheries resources within the Northern Prawn Fishery.
- Objective 3: Implement efficient and cost effective management of the Fishery.
- Objective 4: Effectively communicate and consult with AFMA, the fishing industry, other marine resource users and the broader community.
- Objective 5: Ensure that the incidental catch of non-target commercial and other species in the NPF is reduced to a minimum.

The measures by which the objectives of this plan are to be attained include:

- developing and implementing appropriate management measures (including directions referred to in subsection 17 (5A) of the Act) in relation to the Northern Prawn Fishery; and
- implementing an effective program of surveillance for the Northern Prawn Fishery to ensure compliance with this plan; and
- promoting research that is relevant to the Northern Prawn Fishery; and
- preparing an annual budget of costs associated with managing the Northern Prawn Fishery; and
- setting and collecting levies and fees in relation to the Northern Prawn Fishery; and
- collecting data that can be used to assess the status of the Northern Prawn Fishery; and
- monitoring the impact of catching operations in the fishery on ecologically related species and implementing any practical strategies that are necessary to minimise the impact of those operations on those species; and
- developing and implementing a by-catch action plan.

The performance criteria against which the measures taken may be assessed are as follows:

(a) The status of economic efficiency of the Northern Prawn Fishery; and
(b) The status of the biological resources and environmental conditions in the Northern Prawn Fishery area; and
(c) The cost effectiveness of the management arrangements for the Northern Prawn Fishery.

The fishery has a number of monitoring processes in place for each sub fishery. These are referred to in Section 3.6.4 (Information). These actions and outcomes are measurable summarised in the Northern Prawn fishery status report (AFMA, 2010d[230]). Specific reports and reviews are also published across the range of activities undertaken.

The fishery also sets out principles and standards of behaviour for responsible fishing in a Code of Practice[231]. Objectives defined in the Code include:

[229] Dichmont C., Northern Prawn Fishery Harvest Strategy under Input Controls, AFMA, 2011.
[230] AFMA (2010d)
[231] NPF Industry Ltd (2004), Industry Code of Practice for Responsible Fishing (formerly Northern Prawn Fishing Industry Organisation). Available at http://www.afma.gov.au/wp-content/uploads/2010/06/npf_code.pdf

- Set conservation and management measures designed to ensure sustainability of fishery resources at optimal levels
- Cooperate with researchers and managers in the collection of timely and reliable catch statistics and other information needed for the management of the fishery
- Minimise catching of non-target species, the incidental catching of non-utilised species, marine animals and turtles, benthic impacts and the discarding of waste product associated with fishing activities as prescribed in the NPF Bycatch Action Plan.
- Participate in the development and adoption of technology, fishing gear and fishing practices for continued improvements in the sustainability of fishery resources and the marine ecosystem
- Minimise discards of prawns except when the safety of the trawler is threatened
- Ensure that crews observer regulations that prohibit the disposal of waste at sea
- Record and report loss and recovery of fishing gear
- Ensure crews understand shipboard procedures for the disposal of waste engine oil
- Use non ozone depleting refrigerants in trawlers' freezers and alternatives to Halons in fire fighting equipment
- Ensure that fishing operations are conducted with due regard to the USL Code governing the safety of those on board

The fishery also applies a Bycatch Action Plan,[232] which is derived from a series of assessment processes that determine a set of management actions.

The aims of this Bycatch and Discarding Work Plan for the NPF are to develop strategies that will:

- Respond to high ecological risks assessed through AFMA's Ecological Risk Assessment for the Effect of Fishing (ERAEF) and other assessment processes;
- Avoid interactions with species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- Reduce discarding of target species to as close to zero as practically possible; and
- Minimise overall bycatch in the fishery over the long-term.

The key objectives of the NPF Bycatch and Discarding Work Plan for calendar years 2009-11 are to:

- Respond to key high risk species and take steps to increase the knowledge of all high risk species and their interactions with the fishery;
- Develop a longer-term response plan for all remaining high risk species based on scientific advice;
- Develop measures to further reduce TEP interactions;
- Develop and implement cost-effective strategies to pursue continual improvement in bycatch reduction; and
- Assess relative changes in bycatch due to bycatch mitigation and target species management measures.
- Provide six monthly progress reports to the Environment Committee, complete an annual review of the workplan and biannually renew the workplan.

AFMA assesses the sustainability of the NPF bycatch, published in CSIRO reports. Assessments are made against the indicators set in the bycatch management plan[233]. AFMA also submits quarterly TEP monitoring reports to DSEWPaC[234].

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[232] AFMA (2009c) Northern Prawn Fishery, Bycatch and Discarding Workplan, 2009-2011.; Available at http://www.afma.gov.au/wp-content/uploads/2010/06/npf_bdw_2009_10.pdf

[233] AFMA (2009d), Assessing the sustainability of the NPF bycatch from annual monitoring data: 2008.

3.8.6 Incentives for Sustainable Fishing

The explicit management target for the NPF is MEY, which seeks to optimize economic returns (Kompas, 2011[235]; Kompas, 2011[236]). The management system relies heavily on the allocation of secure fishing rights to commercial operators as the basis for achieving a sustainable and economically efficient fishery. The rights of fishers to access the resource are in the form of Statutory Fishing Rights (SFRs) allocated under the relevant fisheries management plan. Transferable SFRs provide commercial fishers with security and flexibility with regard to the access to the stocks. Fishing permits, which are generally also transferable, provide less security being subject to annual renewal, however in practice fishing permits have not been revoked, apart from where they have been replaced by SFRs or removed as part of a structural adjustment process. Conditions can be placed on SFRs and on fishing permits implementing management measures in addition to the primary control on catch or gear Government policy (DAFF, 2003). Where necessary, structural adjustment programs have been undertaken in order to address significant overcapacity issues and to ensure that such overcapacity does not pose a risk to the sustainability of fish stocks. The NPF has seen three successive buy-back schemes implemented (Section 3.5.2).

Management costs are recovered from fishers in line with the Government's cost recovery policy as articulated in the Cost Recovery Impact Statement (CRIS) (AFMA, 2009b[237]). Research (including stock assessments), data collection and AFMA management costs are funded predominantly by industry and government. AFMA is responsible for compliance costs.

Regular stock status and economic assessments (BRS, 2009[238], ABARES, 2009[239]) are undertaken of the indicators including the gross value of production, cost of management, financial performance (indicators including profit at full equity, cash operating surplus and return on investment), determination of major cost increases, regional economic impacts and economic rent. This assessment demonstrates adherence to free market practices.

3.8.7 Compliance and Enforcement

The management system takes a risk-based approach to compliance (AFMA, 2010a)[240]. Compliance risk assessments are undertaken in consultation with the industry[241], and compliance plans are developed for the NPF fishery[242]. Primary compliance tools include vessel monitoring systems on all vessels, prior to landing-reports, catch disposal records and fish receiver records. At-sea and in-port vessel inspection, fish receiver inspections, trip and landing inspections are carried out[243]. There are appropriate provisions for penalties for infringement of fishery management measures in the FMA. There is no evidence of any systematic non-compliance within or across fisheries[244]. AFMA 2010c cites five offences in the 2009 banana prawn fishery, and 6 in the tiger prawn fishery. Alterations to bycatch

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[234] Brown M, AFMA (pers com, September, 2011)
[235] Kompas *et al* (2011), *Ibid*
[236] Kompas T, Dichmont C.E, Punt, A.E, Deng A, Tuong Nhu Che, Bishop, J., Gooday, P., Yemin, Y., Zhou, S., (2010) Maximizing profits and conserving stocks in the Australian Northern Prawn Fishery, Australian Journal of Agricultural Economics, Vol 54, Issue 3.
[237] AFMA (2009b) Cost Recovery Impact Statement, January 2009. Available at: http://www.afma.gov.au/information/publications/corporate/cris/default.htm
[238] BRS, Fishery Status Reports, DAFF, 2009. Available at http://adl.brs.gov.au/data/warehouse/fishrp9abc_011/fishrp9abc_0111011a/FishStatusReport2009.pdf
[239] ABARES (2009), Ibid;
[240] AFMA (2010a), Domestic Compliance and Enforcement Policy. Available at http://www.afma.gov.au/resource-centre/publications-and-forms/afma-update/domestic-compliance-and-enforcement-program/
[241] Venslovas, P., (2011), Domestic Compliance risk assessment 2011-12, letter from The General Manager, Fisheries Operations Branch, AFMA to the NORMAC Chair, 23 March 2011
[242] AFMA (2010b), (Compliance) Risk Assessment, 2010 (Unpublished)
[243] Wildekamp, Interview No 1
[244] AFMA (2010c), Compliance Activities, 2009-2010

devices (2) resulted in prosecutions, whilst other cases were considered as minor, resulting in cautions. There were also 4 cases of interfering with bycatch devices in 2010.

Fishing companies also reportedly implement their own strict codes on non-compliance, with zero tolerance and the threat of instant dismissal in the event of an offence. Historically, industry members provided intelligence for alleged non-compliance offences[245].

AFMA compliance has been subject to both internal[246] and external review[247] and demonstrated to have been effective.

3.8.8 Research Plan

The broad direction of research in Commonwealth fisheries is outlined in AFMA's Strategic Research Plan 2005-2010[248]. This plan describes the way in which AFMA will support the management and development of Commonwealth fisheries resources through research during the five years 2005–2010. The last specific NPF Research Plan was completed in 2001, and has not subsequently been updated.

However research priorities are identified annually by the NPF Research and Environment Committee[249] (NPFREC), approved by NORMAC, and provided to the Commonwealth Fisheries Research Advisory Body (CFRAB) for consideration and assessment of appropriate funding opportunities including Fisheries Research and Development Corporation. Research reports are made publicly available via the AFMA website.

Research activities[250] cover the following areas:

- Effects of trawling
- Monitoring
- Stock assessment
- Fisheries Management

The assessors have identified concerns in this respect in that there has been less research into bycatch, habitat and ecosystem interactions in the JBG (the red-legged prawn sub-fishery) than in the other sub-fisheries in the Gulf of Carpentaria. Although impacts in the JBG may be assessed through reference to the other sub-fisheries, and it is noted that the red-legged prawn sub-fishery consists of only five vessels, further studies of the JBG per se may be warranted. It is evident from interviews that bycatch research has received a much lower priority since the focus on a revised output orientated Harvest Strategy.

3.8.9 Monitoring and management performance evaluation

AFMA's management system is subject to internal and external performance evaluation[251].

Examples of Internal peer reviews include:

- The requirement to report in AFMA's Annual Report on overall performance against the legislative objectives, statutory requirements and financial reporting, the effectiveness of internal controls and adequacy of systems; and the Authority's risk management processes;

[245] Wildekamp, *Ibid*
[246] Venslovas, pers com, September, 2011
[247] Australian National Audit Office (2009), Management of Domestic Fishing Compliance, audit report no. 47 2008-09. Available at http://www.anao.gov.au/~/media/Uploads/Documents/2008%2009_audit_report_47.pdf
[248] AFMA (2005), Researching for Fisheries, Industry and Community: AFMA's Strategic Research Plan, 2005–2010. Available at http://www.afma.gov.au/wp-content/uploads/2010/07/strategic_research_plan.pdf
[249] NORMAC (2011) Northern Prawn Fishery, Research Project Summary, 2000-2011
[250] AFMA,2005
[251] James Findlay, (now) Chief Executive Officer, AFMA, pers com (March, 2010).

- AFMA and the MAC to periodically assess the effectiveness of the management measures taken to achieve the objectives of this Management Plan by reference to the performance criteria specified in the Plan
- An AFMA review of the performance of NORMAC and the RAG
- AFMA also has an internal quality assurance program to determine whether Compliance best practice has been followed. One of a small number of breaches in the NPF was subject to review.

Examples of external reviews include:

- Questioning by the Senate Standing Committee on Rural and Regional Affairs in Senate Estimates hearings (three times/year);
- Strategic assessment of Management Plans and ongoing assessment for export approval under the EPBC Act against the *Guidelines for the Ecologically Sustainable Management of Fisheries*;
- The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) reports on the ecological and economic sustainability of fisheries managed by AFMA; and
- The Australian National Audit Office periodic reviews of aspects of AFMA's performance. This includes a report on its audit into the Management of Domestic Fishing Compliance (audit report no. 47 2008-09).

CSIRO research results are often published in peer reviewed scientific journals.

4 Evaluation Procedure

4.1 Traditional assessment

4.1.1 Principles and Criteria

The *MSC's Principles and Criteria for Sustainable Fishing*, produced through an international consultation process, describe statements against which a fishery may be compared to enable its operators to make a claim that the fish sold on to retailers, processors and consumers comes from ***a well-managed and sustainable source.*** The certification methodology adopted by the MSC involves the application and interpretation of the Principles and Criteria to the specific fishery undergoing assessment. This is considered necessary, as the precise assessment of a fishery will vary with the nature of the species, capture method used, etc. The Principles and Criteria are presented below:

Principle 1. A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.

Intent. The intent of this principle is to ensure that the productive capacities of resources are maintained at high levels and are not sacrificed in favour of short term interests. Thus, exploited populations would be maintained at high levels of abundance designed to retain their productivity, provide margins of safety for error and uncertainty, and restore and retain their capacities for yields over the long term.

Criterion 1. The fishery shall be conducted at catch levels that continually maintain the high productivity of the target population(s) and associated ecological community relative to its potential productivity.

Criterion 2. Where the exploited populations are depleted, the fisheries will be executed such that recovery and rebuilding is allowed to occur to a specified level consistent with the precautionary approach and the ability of the populations to produce long-term potential yields within a specified time frame.

Criterion 3. Fishing is conducted in a manner that does not alter the age or genetic structure or sex composition to a degree that impairs reproductive capacity.

Principle 2. Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.
Intent. The intent of this principle is to encourage the management of fisheries from an ecosystem perspective under a system designed to assess and restrain the impacts of the fishery on the ecosystem.

Criterion 1. The fishery is conducted in a way that maintains natural functional relationships among species and should not lead to trophic cascades or ecosystem state changes.

Criterion 2. The fishery is conducted in a manner that does not threaten biological diversity (at the genetic, species or population levels) and avoids or minimises mortality of, or injuries to, endangered, threatened or protected species.

Criterion 3. Where exploited populations of non-target species are depleted, the fishery will be executed such that recovery and rebuilding is allowed to occur to a specified level within specified time frames, consistent with the precautionary approach and considering the ability of the population to produce long-term potential yields.

Principle 3. The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.
Intent. The intent of this principle is to ensure that there is an institutional and operational framework for implementing Principles 1 and 2, appropriate to the size and scale of the fishery.

Criterion 1. The management system has a clearly defined scope capable of achieving sustainable fisheries in accordance with MSC Principles 1 and 2 and their associated criteria, and includes short and long-term objectives, including those for mitigating ecological impacts of fishing.

Criterion 2. The management system recognizes applicable legislative and institutional responsibilities and coordinates implementation on a regular, integral and explicit basis.

Criterion 3. The management system includes a rational and effective process for acquisition, analysis and incorporation of new scientific, social, cultural, economic and institutional information.

Criterion 4. A comprehensive research program is conducted.

Criterion 5. The management system ensures that there is a high degree of compliance in the fisheries with management measures and directives regarding fishing practices required by the system.

Criterion 6. The performance of the management system is regularly and candidly evaluated in a systematic fashion and the system responds positively to appropriate recommendations for change.

4.1.2 Generic Assessment Tree

The FAM V2 contains a generic assessment tree for use on all future MSC assessments. Each of the MSC's Principles and Criteria for Sustainable Fishing has been integrated into the new structure. Some rearranging of concepts has occurred and some criteria are now considered as issues of scope rather than under specific PIs (i.e., destructive fishing practices and controversial unilateral exemptions from international agreements).

A complete illustration of the new structure is provided in the FAM V2 (Figure 2 on page 11). Among other things, the new tree has eliminated much of the duplication and overlap that previously occurred between Principle 3 and Principles 1 and 2. This has been achieved by addressing the MSC Principles in a more holistic way rather than developing separate performance indicators under each Criterion. For example, many of the operational components formerly under Principle 3 (bycatch and discards, habitat impacts), are now addressed solely under Principle 2.

The new assessment tree organises the performance indicators into components that focus upon the outcomes of the fisheries management process and the management strategies implemented that aim to achieve those outcomes. Therefore the new Assessment Tree structure is divided into three levels for the purposes of scoring:

- Level 1 – is the **MSC Principle** as described in the MSC's Principles and Criteria for Sustainable Fishing (also referred to as the MSC standard).
- Level 2 – is the **Component**, which is a high level sub-division of the Principle.
- Level 3 – is the **Performance Indicator** which is a further sub-division of the Principle and the point at which scoring of the fishery occurs.

Table 18 lists the components and performance indicators under each Principle in the generic assessment tree.

Table 6: MSC Components and Performance Indicators under each Principle

Principle	Component	Performance Indicator
Principle 1.	Outcomes: The current status of the target stock resource	1.1.1 Stock status
		1.1.2 Reference Points
		1.1.3 Stock recovery and rebuilding
	Harvest Strategy (Management): A precautionary and effective harvest strategy	1.2.1 Performance of harvest strategy
		1.2.2 Harvest control rules and tools
		1.2.3 Information / monitoring
		1.2.4 Assessment of stock status
Principle 2.	Retained species	2.1.1 Outcome Status
		2.1.2 Management strategy
		2.1.3 Information / monitoring
	Bycatch species	2.2.1 Outcome Status
		2.2.2 Management strategy
		2.2.3 Information / monitoring
	ETP species	2.3.1 Outcome Status
		2.3.2 Management strategy
		2.3.3 Information / monitoring
	Habitats	2.4.1 Outcome Status
		2.4.2 Management strategy
		2.4.3 Information / monitoring
	Ecosystem	2.5.1 Outcome Status
		2.5.2 Management strategy
		2.5.3 Information / monitoring
Principle 3	Governance and policy	3.1.1 Legal and/or customary framework
		3.2.1 Consultation, roles and responsibilities
		3.1.3 Long term objectives

Principle	Component	Performance Indicator
		3.1.4 Incentives for sustainable fishing
	Fishery- specific management system	3.2.1 Fishery- specific objectives
		3.2.2 Decision-making processes
		3.2.3 Compliance and enforcement
		3.2.4 Research plan
		3.2.5 Monitoring and management performance evaluation

The following definitions apply with respect to the Components under Principle 2:

a) Retained species: Species that are retained by the fishery under assessment (usually because they are commercially valuable or because they are required to be retained by management rules).

b) Bycatch species: Organisms that have been taken incidentally and are not retained (usually because they have no commercial value).

c) ETP species: Endangered, threatened or protected species are those that are recognised by national legislation and/or binding international agreements (e.g. CITES) to which the jurisdictions controlling the fishery under assessment are party.

d) Habitats: The habitats within which the fishery operates.

e) Ecosystem: Broader ecosystem elements such as trophic structure and function, community composition, and biodiversity.

As with previous assessment trees, the generic assessment tree contains scoring guideposts that describe the main thresholds in the scoring system for each performance indicator:

- 100 – defines the upper boundary of the scoring and represents the level of performance on an individual performance indicator that would be expected in a theoretically ‘perfect’ fishery.

- 80 – defines the unconditional pass mark for a performance indicator for that type of fishery. Weighted scores for Criteria under each MSC Principle must average to 80 or higher.

- 60 – defines the minimum, conditional pass mark at the Criterion level for that type of fishery. Any score below 60 represents a performance level that is unsatisfactory.

For each Performance Indicator, the fishery’s characteristics are compared with the requirements of the pre-specified attributes for each of three Scoring Guideposts (60, 80, 100) to establish a score on a scale of 0-100 points. Scoring occurs in increments of 5 points. A performance score of 60-75 is intended to reflect ‘a pass with condition’, a score of 80-95 represents ‘pass without condition’, while a 100 score reflects ‘perfect performance.’ For a fishery to be certified it must accomplish three things:

- Achieve a score of 60 or greater for every performance indicator;
- For each MSC Principle, achieve a weighted average score of at least 80, or pass without conditions.
- A contractual commitment to performance improvement for each indicator that has a score less than 80.

This report covers 6 units of certification. These are divided into the following components:

1. Grooved tiger prawn (*P. semisulcatus*)
2. Brown tiger prawn (*Penaeus esculentus*)
3. Blue endeavour prawn (*Metapenaeus endeavouri*)
4. Red endeavour prawn *(M.ensis)*
5. White banana prawns (*Fenneropenaeus merguiensis*);
6. Red-legged banana prawns (*Fenneropenaeus indicus*)

Table 19: Summary of PIs evaluated by Unit of Certification.

Principle	Component	Performance Indicator
Tiger prawn sub-fishery: Brown tiger prawn (*Penaeus esculentus*)		
Principle 1.	Outcomes: The current status of the target stock resource	1.1.1 Stock status
		1.1.2 Reference Points
		1.1.3 Stock recovery and rebuilding
	Harvest Strategy (Management): A precautionary and effective harvest strategy	1.2.1 Performance of harvest strategy
		1.2.2 Harvest control rules and tools
		1.2.3 Information / monitoring
		1.2.4 Assessment of stock status
Tiger prawn sub-fishery: Grooved tiger prawn (*P. semisulcatus*)		
Principle 1.	Outcomes: The current status of the target stock resource	1.1.1 Stock status
		1.1.2 Reference Points
		1.1.3 Stock recovery and rebuilding
	Harvest Strategy (Management): A precautionary and effective harvest strategy	1.2.1 Performance of harvest strategy
		1.2.2 Harvest control rules and tools
		1.2.3 Information / monitoring
		1.2.4 Assessment of stock status
Tiger prawn sub-fishery: Blue endeavour prawn (*Metapenaeus endeavouri*)		
Principle 1	Outcomes: The current status of the target stock resource	1.1.1 Stock status
		1.1.2 Reference Points
		1.1.3 Stock recovery and rebuilding
	Harvest Strategy (Management): A precautionary and effective harvest strategy	1.2.1 Performance of harvest strategy
		1.2.2 Harvest control rules and tools
		1.2.3 Information / monitoring
		1.2.4 Assessment of stock status
Tiger prawn sub-fishery: Red endeavour prawn *(M.ensis)*		
Principle 1	Outcomes: The current status of the target stock resource	1.1.1 Stock status
		1.1.2 Reference Points
		1.1.3 Stock recovery and rebuilding
	Harvest Strategy (Management): A precautionary and effective harvest strategy	1.2.1 Performance of harvest strategy
		1.2.2 Harvest control rules and tools
		1.2.3 Information / monitoring
		1.2.4 Assessment of stock status
Banana prawn sub-fishery: White Banana prawns (*Fenneropenaeus merguiensis)*		
Principle 1	Outcomes: The current status of the target stock resource	1.2.4 Assessment of stock status
		1.1.2 Reference Points
		1.1.3 Stock recovery and rebuilding
	Harvest Strategy (Management): A precautionary and effective harvest strategy	1.2.1 Performance of harvest strategy
		1.2.2 Harvest control rules and tools
		1.2.3 Information / monitoring
		1.2.4 Assessment of stock status
JBP sub-fishery: Red-legged banana prawns (*Fenneropenaeus indicus*)		
Principle 1	Outcomes: The current status of the target stock resource	1.1.1 Stock status
		1.1.2 Reference Points
		1.1.3 Stock recovery and rebuilding
	Harvest Strategy (Management): A precautionary and effective	1.2.1 Performance of harvest strategy
		1.2.2 Harvest control rules and tools
		1.2.3 Information / monitoring

	harvest strategy	1.2.4 Assessment of stock status
Tiger prawn sub-fishery: **Brown tiger prawn (*Penaeus esculentus*)** **Grooved tiger prawn (*P. semisulcatus*)** **Blue endeavour prawn (*Metapenaeus endeavouri*)** **Red endeavour prawn *(M. ensis)***		
Principle 2.	Retained species	2.1.1 Outcome Status
		2.1.2 Management strategy
		2.1.3 Information / monitoring
	Bycatch species	2.2.1 Outcome Status
		2.2.2 Management strategy
		2.2.3 Information / monitoring
	ETP species	2.3.1 Outcome Status
		2.3.2 Management strategy
		2.3.3 Information / monitoring
	Habitats	2.4.1 Outcome Status
		2.4.2 Management strategy
		2.4.3 Information / monitoring
	Ecosystem	2.5.1 Outcome Status
		2.5.2 Management strategy
		2.5.3 Information / monitoring
Banana prawn sub-fishery: **White Banana prawns (*Fenneropenaeus merguiensis)***		
Principle 2.	Retained species	2.1.1 Outcome Status
		2.1.2 Management strategy
		2.1.3 Information / monitoring
	Bycatch species	2.2.1 Outcome Status
		2.2.2 Management strategy
		2.2.3 Information / monitoring
	ETP species	2.3.1 Outcome Status
		2.3.2 Management strategy
		2.3.3 Information / monitoring
	Habitats	2.4.1 Outcome Status
		2.4.2 Management strategy
		2.4.3 Information / monitoring
	Ecosystem	2.5.1 Outcome Status
		2.5.2 Management strategy
		2.5.3 Information / monitoring
JBP sub-fishery: Red-legged banana prawns (*Fenneropenaeus indicus*)		
Principle 2.	Retained species	2.1.1 Outcome Status
		2.1.2 Management strategy
		2.1.3 Information / monitoring
	Bycatch species	2.2.1 Outcome Status
		2.2.2 Management strategy
		2.2.3 Information / monitoring
	ETP species	2.3.1 Outcome Status
		2.3.2 Management strategy
		2.3.3 Information / monitoring
	Habitats	2.4.1 Outcome Status
		2.4.2 Management strategy
		2.4.3 Information / monitoring
	Ecosystem	2.5.1 Outcome Status
		2.5.2 Management strategy
		2.5.3 Information / monitoring
All fisheries		
Principle 3.1	Governance and policy	3.1.1 Legal and/or customary framework
		3.2.1 Consultation, roles and responsibilities
		3.1.3 Long term objectives

		3.1.4 Incentives for sustainable fishing

Tiger prawn fishery: **Brown tiger prawn (*Penaeus esculentus*)** **Grooved tiger prawn (*P. semisulcatus*)** **Blue endeavour prawn (*Metapenaeus endeavouri*)** **Red endeavour prawn *(M.ensis)***		
Principle 3.2	Fishery- specific management system	3.2.1 Fishery- specific objectives
		3.2.2 Decision-making processes
		3.2.3 Compliance and enforcement
		3.2.4 Research plan
		3.2.5 Monitoring and management performance evaluation
Banana prawn fishery: **White Banana prawns (*Fenneropenaeus merguiensis)***		
Principle 3.2	Fishery- specific management system	3.2.1 Fishery- specific objectives
		3.2.2 Decision-making processes
		3.2.3 Compliance and enforcement
		3.2.4 Research plan
		3.2.5 Monitoring and management performance evaluation
JBP fishery: Red-legged banana prawns (*Fenneropenaeus indicus*)		
Principle 3.2	Fishery- specific management system	3.2.1 Fishery- specific objectives
		3.2.2 Decision-making processes
		3.2.3 Compliance and enforcement
		3.2.4 Research plan
		3.2.5 Monitoring and management performance evaluation

5 Evaluation Results

5.1 Assessment Results

This section presents the scoring guideposts and indicators associated with each criterion and the weights of relative importance assigned to each criterion, and summarises the rationale for each of the performance indicators and scoring guideposts used in the assessment, as well as the weight assigned to each.

5.1.1 Summary of Principle 1

Principle 1 examines the status of the target stock and whether the management system maintains the reproductive capacity within safe and rational limits. Exploited populations should be maintained at levels of abundance sufficient to maintain their productivity and reproductive capacities for yields over the long term, provide margins of safety for error and uncertainty, and restore and rebuild stocks that have become depleted.

5.1.2 Summary of Principle 2

Principle 2 examines five components which are considered to cover the range of potential ecosystem elements that may be impacted by a fishery, taking into account the status, management strategies and information relevant to each of these components.

5.1.3 Summary of Principle 3

Principle 3 examines the structure and performance of the management system.

5.1.4 Scoring Tables

The following tables present the scores, with rationale and information sources, for the performance indicators for each Principle and Criterion. A summary of the final scores for each Performance Indicator is given in Table 19.

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Table 7: Summary table showing final scores for each Performance Indicator

Tiger Prawn Fishery: Brown tiger prawn (*Penaeus esculentus*)

Prin-ciple	Wt (L1)	Component	Wt (L2)	PI No.	Performance Indicator (PI)	Wt (L3)	Weight in	Score	bution to
						Either			Either
One	1	Outcome	0.5	1.1.1	Stock status	0.5	0.25	100	25.00
				1.1.2	Reference points	0.5	0.25	100	25.00
				1.1.3	Stock rebuilding				
		Management	0.5	1.2.1	Harvest strategy	0.25	0.125	100	12.50
				1.2.2	Harvest control rules & tools	0.25	0.125	100	12.50
				1.2.3	Information & monitoring	0.25	0.125	100	12.50
				1.2.4	Assessment of stock status	0.25	0.125	100	12.50
Two	1	Retained species	0.2	2.1.1	Outcome	0.333	0.0667	90	6.00
				2.1.2	Management	0.333	0.0667	80	5.33
				2.1.3	Information	0.333	0.0667	85	5.67
		Bycatch species	0.2	2.2.1	Outcome	0.333	0.0667	80	5.33
				2.2.2	Management	0.333	0.0667	95	6.33
				2.2.3	Information	0.333	0.0667	80	5.33
		ETP species	0.2	2.3.1	Outcome	0.333	0.0667	90	6.00
				2.3.2	Management	0.333	0.0667	95	6.33
				2.3.3	Information	0.333	0.0667	85	5.67
		Habitats	0.2	2.4.1	Outcome	0.333	0.0667	100	6.67
				2.4.2	Management	0.333	0.0667	80	5.33
				2.4.3	Information	0.333	0.0667	95	6.33
		Ecosystem	0.2	2.5.1	Outcome	0.333	0.0667	100	6.67
				2.5.2	Management	0.333	0.0667	90	6.00
				2.5.3	Information	0.333	0.0667	90	6.00
Three	1	Governance and policy	0.5	3.1.1	Legal & customary framework	0.25	0.125	100	12.50
				3.1.2	Consultation, roles &	0.25	0.125	100	12.50
				3.1.3	Long term objectives	0.25	0.125	100	12.50
				3.1.4	Incentives for sustainable fishing	0.25	0.125	100	12.50
		Fishery specific management system	0.5	3.2.1	Fishery specific objectives	0.2	0.1	100	10.00
				3.2.2	Decision making processes	0.2	0.1	100	10.00
				3.2.3	Compliance & enforcement	0.2	0.1	100	10.00
				3.2.4	Research plan	0.2	0.1	70	7.00
				3.2.5	Management performance	0.2	0.1	100	10.00

Overall weighted Principle-level scores		Either
Principle 1 - Target species	Stock rebuilding PI not	100.0
	Stock rebuilding PI scored	
Principle 2 - Ecosystem		89.0
Principle 3 - Management		97.0

Tiger Prawn Fishery Grooved tiger prawn (*P. semisulcatus*)

Prin-ciple	Wt (L1)	Component	Wt (L2)	PI No.	Performance Indicator (PI)	Wt (L3)	Weight in Principle	Score	bution to Principle
						Either			Either
One	1	Outcome	0.5	1.1.1	Stock status	0.5	0.25	100	25.00
				1.1.2	Reference points	0.5	0.25	100	25.00
				1.1.3	Stock rebuilding				
		Management	0.5	1.2.1	Harvest strategy	0.25	0.125	100	12.50
				1.2.2	Harvest control rules & tools	0.25	0.125	100	12.50
				1.2.3	Information & monitoring	0.25	0.125	100	12.50
				1.2.4	Assessment of stock status	0.25	0.125	100	12.50
Two	1	Retained species	0.2	2.1.1	Outcome	0.333	0.0667	90	6.00
				2.1.2	Management	0.333	0.0667	80	5.33
				2.1.3	Information	0.333	0.0667	85	5.67
		Bycatch species	0.2	2.2.1	Outcome	0.333	0.0667	80	5.33
				2.2.2	Management	0.333	0.0667	95	6.33
				2.2.3	Information	0.333	0.0667	80	5.33
		ETP species	0.2	2.3.1	Outcome	0.333	0.0667	90	6.00
				2.3.2	Management	0.333	0.0667	95	6.33
				2.3.3	Information	0.333	0.0667	85	5.67
		Habitats	0.2	2.4.1	Outcome	0.333	0.0667	100	6.67
				2.4.2	Management	0.333	0.0667	80	5.33
				2.4.3	Information	0.333	0.0667	95	6.33
		Ecosystem	0.2	2.5.1	Outcome	0.333	0.0667	100	6.67
				2.5.2	Management	0.333	0.0667	90	6.00
				2.5.3	Information	0.333	0.0667	90	6.00
Three	1	Governance and policy	0.5	3.1.1	Legal & customary framework	0.25	0.125	100	12.50
				3.1.2	Consultation, roles & responsibilities	0.25	0.125	100	12.50
				3.1.3	Long term objectives	0.25	0.125	100	12.50
				3.1.4	Incentives for sustainable fishing	0.25	0.125	100	12.50
		Fishery specific management system	0.5	3.2.1	Fishery specific objectives	0.2	0.1	100	10.00
				3.2.2	Decision making processes	0.2	0.1	100	10.00
				3.2.3	Compliance & enforcement	0.2	0.1	100	10.00
				3.2.4	Research plan	0.2	0.1	70	7.00
				3.2.5	Management performance evaluation	0.2	0.1	100	10.00

Overall weighted Principle-level scores		Either
Principle 1 - Target species	Stock rebuilding PI not	100.0
	Stock rebuilding PI scored	
Principle 2 - Ecosystem		89.0
Principle 3 - Management		97.0

Blue endeavour prawn (*Metapenaeus endeavouri*)

Prin-ciple	Wt (L1)	Component	Wt (L2)	PI No.	Performance Indicator (PI)	Wt (L3)	Weight in Principle	Score	bution to Principle
						Either			Either
One	1	Outcome	0.5	1.1.1	Stock status	0.5	0.25	90	22.50
				1.1.2	Reference points	0.5	0.25	100	25.00
				1.1.3	Stock rebuilding				
		Management	0.5	1.2.1	Harvest strategy	0.25	0.125	100	12.50
				1.2.2	Harvest control rules & tools	0.25	0.125	90	11.25
				1.2.3	Information & monitoring	0.25	0.125	100	12.50
				1.2.4	Assessment of stock status	0.25	0.125	100	12.50
Two	1	Retained species	0.2	2.1.1	Outcome	0.333	0.0667	90	6.00
				2.1.2	Management	0.333	0.0667	80	5.33
				2.1.3	Information	0.333	0.0667	85	5.67
		Bycatch species	0.2	2.2.1	Outcome	0.333	0.0667	80	5.33
				2.2.2	Management	0.333	0.0667	95	6.33
				2.2.3	Information	0.333	0.0667	80	5.33
		ETP species	0.2	2.3.1	Outcome	0.333	0.0667	90	6.00
				2.3.2	Management	0.333	0.0667	95	6.33
				2.3.3	Information	0.333	0.0667	85	5.67
		Habitats	0.2	2.4.1	Outcome	0.333	0.0667	100	6.67
				2.4.2	Management	0.333	0.0667	80	5.33
				2.4.3	Information	0.333	0.0667	95	6.33
		Ecosystem	0.2	2.5.1	Outcome	0.333	0.0667	100	6.67
				2.5.2	Management	0.333	0.0667	90	6.00
				2.5.3	Information	0.333	0.0667	90	6.00
Three	1	Governance and policy	0.5	3.1.1	Legal & customary framework	0.25	0.125	100	12.50
				3.1.2	Consultation, roles & responsibilities	0.25	0.125	100	12.50
				3.1.3	Long term objectives	0.25	0.125	100	12.50
				3.1.4	Incentives for sustainable fishing	0.25	0.125	100	12.50
		Fishery specific management system	0.5	3.2.1	Fishery specific objectives	0.2	0.1	100	10.00
				3.2.2	Decision making processes	0.2	0.1	100	10.00
				3.2.3	Compliance & enforcement	0.2	0.1	100	10.00
				3.2.4	Research plan	0.2	0.1	70	7.00
				3.2.5	Management performance evaluation	0.2	0.1	100	10.00

Overall weighted Principle-level scores		Either
Principle 1 - Target species	Stock rebuilding PI not :	96.3
	Stock rebuilding PI scored	
Principle 2 - Ecosystem		89.0
Principle 3 - Management		97.0

Red endeavour prawn (*Metapenaeus ensis*)

Prin-ciple	Wt (L1)	Component	Wt (L2)	PI No.	Performance Indicator (PI)	Wt (L3)	Weight in Principle	Score	Contribution to Principle Score
						Either			
One	1	Outcome	0.5	1.1.1	Stock status	0.5	0.25	80	20.00
				1.1.2	Reference points	0.5	0.25	80	20.00
				1.1.3	Stock rebuilding				
		Management	0.5	1.2.1	Harvest strategy	0.25	0.125	85	10.63
				1.2.2	Harvest control rules & tools	0.25	0.125	80	10.00
				1.2.3	Information & monitoring	0.25	0.125	80	10.00
				1.2.4	Assessment of stock status	0.25	0.125	80	10.00
Two	1	Retained species	0.2	2.1.1	Outcome	0.333	0.0667	90	6.00
				2.1.2	Management	0.333	0.0667	80	5.33
				2.1.3	Information	0.333	0.0667	85	5.67
		Bycatch species	0.2	2.2.1	Outcome	0.333	0.0667	80	5.33
				2.2.2	Management	0.333	0.0667	95	6.33
				2.2.3	Information	0.333	0.0667	80	5.33
		ETP species	0.2	2.3.1	Outcome	0.333	0.0667	90	6.00
				2.3.2	Management	0.333	0.0667	95	6.33
				2.3.3	Information	0.333	0.0667	85	5.67
		Habitats	0.2	2.4.1	Outcome	0.333	0.0667	100	6.67
				2.4.2	Management	0.333	0.0667	80	5.33
				2.4.3	Information	0.333	0.0667	95	6.33
		Ecosystem	0.2	2.5.1	Outcome	0.333	0.0667	100	6.67
				2.5.2	Management	0.333	0.0667	90	6.00
				2.5.3	Information	0.333	0.0667	90	6.00
Three	1	Governance and policy	0.5	3.1.1	Legal & customary framework	0.25	0.125	100	12.50
				3.1.2	Consultation, roles & responsibilities	0.25	0.125	100	12.50
				3.1.3	Long term objectives	0.25	0.125	100	12.50
				3.1.4	Incentives for sustainable fishing	0.25	0.125	100	12.50
		Fishery specific management system	0.5	3.2.1	Fishery specific objectives	0.2	0.1	100	10.00
				3.2.2	Decision making processes	0.2	0.1	100	10.00
				3.2.3	Compliance & enforcement	0.2	0.1	100	10.00
				3.2.4	Research plan	0.2	0.1	70	7.00
				3.2.5	Management performance evaluation	0.2	0.1	100	10.00

Overall weighted Principle-level scores			Either
Principle 1 - Target	Stock rebuilding PI not sc		80.6
	Stock rebuilding PI scored		
Principle 2 - Ecosystem			89.0
Principle 3 - Management			97.0

White Banana prawns

Prin-ciple	Wt (L1)	Component	Wt (L2)	PI No.	Performance Indicator (PI)	Wt (L3)	Weight in Principle	Score	bution to Principle
						Either			
One	1	Outcome	0.5	1.1.1	Stock status	0.5	0.25	80	20.00
				1.1.2	Reference points	0.5	0.25	80	20.00
				1.1.3	Stock rebuilding				
		Management	0.5	1.2.1	Harvest strategy	0.25	0.125	85	10.63
				1.2.2	Harvest control rules & tools	0.25	0.125	80	10.00
				1.2.3	Information & monitoring	0.25	0.125	90	11.25
				1.2.4	Assessment of stock status	0.25	0.125	80	10.00
Two	1	Retained species	0.2	2.1.1	Outcome	0.333	0.0667	90	6.00
				2.1.2	Management	0.333	0.0667	80	5.33
				2.1.3	Information	0.333	0.0667	80	5.33
		Bycatch species	0.2	2.2.1	Outcome	0.333	0.0667	80	5.33
				2.2.2	Management	0.333	0.0667	95	6.33
				2.2.3	Information	0.333	0.0667	80	5.33
		ETP species	0.2	2.3.1	Outcome	0.333	0.0667	90	6.00
				2.3.2	Management	0.333	0.0667	95	6.33
				2.3.3	Information	0.333	0.0667	80	5.33
		Habitats	0.2	2.4.1	Outcome	0.333	0.0667	100	6.67
				2.4.2	Management	0.333	0.0667	80	5.33
				2.4.3	Information	0.333	0.0667	95	6.33
		Ecosystem	0.2	2.5.1	Outcome	0.333	0.0667	100	6.67
				2.5.2	Management	0.333	0.0667	90	6.00
				2.5.3	Information	0.333	0.0667	90	6.00
Three	1	Governance and policy	0.5	3.1.1	Legal & customary framework	0.25	0.125	100	12.50
				3.1.2	Consultation, roles & responsibilities	0.25	0.125	100	12.50
				3.1.3	Long term objectives	0.25	0.125	100	12.50
				3.1.4	Incentives for sustainable fishing	0.25	0.125	100	12.50
		Fishery specific management system	0.5	3.2.1	Fishery specific objectives	0.2	0.1	100	10.00
				3.2.2	Decision making processes	0.2	0.1	100	10.00
				3.2.3	Compliance & enforcement	0.2	0.1	100	10.00
				3.2.4	Research plan	0.2	0.1	70	7.00
				3.2.5	Management performance evaluation	0.2	0.1	100	10.00

Overall weighted Principle-level scores		Either
Principle 1 - Target species	Stock rebuilding PI not	81.9
	Stock rebuilding PI scored	
Principle 2 - Ecosystem		88.3
Principle 3 - Management		97.0

Red-legged banana prawns

Wt (L1)	Component	Wt (L2)	PI No.	Performance Indicator (PI)	Wt (L3)	Weight in Principle	Score	ution to Principl e Score
					Either			
1	Outcome	0.5	1.1.1	Stock status	0.5	0.25	100	25.00
			1.1.2	Reference points	0.5	0.25	80	20.00
			1.1.3	Stock rebuilding				
	Management	0.5	1.2.1	Harvest strategy	0.25	0.125	80	10.00
			1.2.2	Harvest control rules & tools	0.25	0.125	80	10.00
			1.2.3	Information & monitoring	0.25	0.125	80	10.00
			1.2.4	Assessment of stock status	0.25	0.125	80	10.00
1	Retained species	0.2	2.1.1	Outcome	0.333	0.0667	90	6.00
			2.1.2	Management	0.333	0.0667	80	5.33
			2.1.3	Information	0.333	0.0667	80	5.33
	Bycatch species	0.2	2.2.1	Outcome	0.333	0.0667	80	5.33
			2.2.2	Management	0.333	0.0667	95	6.33
			2.2.3	Information	0.333	0.0667	75	5.00
	ETP species	0.2	2.3.1	Outcome	0.333	0.0667	95	6.33
			2.3.2	Management	0.333	0.0667	95	6.33
			2.3.3	Information	0.333	0.0667	80	5.33
	Habitats	0.2	2.4.1	Outcome	0.333	0.0667	80	5.33
			2.4.2	Management	0.333	0.0667	80	5.33
			2.4.3	Information	0.333	0.0667	65	4.33
	Ecosystem	0.2	2.5.1	Outcome	0.333	0.0667	80	5.33
			2.5.2	Management	0.333	0.0667	90	6.00
			2.5.3	Information	0.333	0.0667	65	4.33
1	Governance and policy	0.5	3.1.1	Legal & customary framework	0.25	0.125	100	12.50
			3.1.2	Consultation, roles & responsibilities	0.25	0.125	100	12.50
			3.1.3	Long term objectives	0.25	0.125	100	12.50
			3.1.4	Incentives for sustainable fishing	0.25	0.125	100	12.50
	Fishery specific management system	0.5	3.2.1	Fishery specific objectives	0.2	0.1	100	10.00
			3.2.2	Decision making processes	0.2	0.1	100	10.00
			3.2.3	Compliance & enforcement	0.2	0.1	100	10.00
			3.2.4	Research plan	0.2	0.1	70	7.00
			3.2.5	Management performance evaluation	0.2	0.1	100	10.00

Overall weighted Principle-level scores		Either
Principle 1 - Target species	Stock rebuilding PI not sc	85.0
	Stock rebuilding PI scored	
Principle 2 - Ecosystem		82.0
Principle 3 - Management		97.0

Principle 1 Performance Indicators and Scoring Guideposts

Brown tiger prawn (*Penaeus esculentus*)

1.1	**Target Species Outcome**			
1.1.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
			The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.
Score: 100				

Justification

Justification: The most recent assessment of the status of brown tiger prawn (AFMA, 2011) shows that stock status is above the default MSC TRP (S_{2010}/S_{MSY}) and also above the NPF TRP of MEY ((S_{2010}/S_{MSY}=131%). 90% lower confidence limit of the parameters and the ratio were published by Punt et. al. (2010) these are also above both TRPs, resulting in a high degree of certainty about the stock status with respect to TRPs. The stock has been above S_{MSY} for several years.

The current stock is also well above the LRP (moving average of $S_{2006\text{-}2010}/S_{MSY}$ =138%). The probability of being above the LRP is 100% (CSIRO pers comm). Effort levels are also well below both the TRP and LRP, indicating that the overfishing is not occurring (Table 5, Figure 3 of 3.6.2).

The stock is at a level that maintains high productivity and has a low probability of recruitment overfishing.

Conclusion

There is a high degree of certainty that the stock is above the point where recruitment would be impaired (100).

There is a high degree of certainty that the stock has been above BMSY, over recent years (100).

References

AFMA. (2011). NPF RAG Assessment 2010/11. Tiger Prawns. Milestone: Delivery of stock assessment and economic outputs. Canberra, Australia: Australian Fisheries Management Authority.

Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessment and bio-economic management advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.

CSIRO (per comm) Email of 23rd September from C Dichmont, CSIRO

1.1	**Target Species Outcome**			
1.1.2	**Reference Points**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Limit and target reference points are appropriate for the stock	Generic limit and target reference points are based on justifiable and reasonable practice	Reference points are appropriate for the stock and can be estimated.	

1.1	Target Species Outcome			
1.1.2	Reference Points	60 Guideposts	80 Guideposts	100 Guideposts
		appropriate for the species category.		
			The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues.
			The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty
			For low trophic level species, the target reference point takes into account the ecological role of the stock.	
Score: 100				

Justification

The tiger prawn sub-fishery is managed under a Maximum Economic Yield (MEY) strategy that optimises the economic return from the fishery. This is normally achieved at a spawning biomass level (S_{MEY}) that is higher than the biomass that produces the Maximum Sustainable Yield (S_{MSY}), and in this respect is a more precautionary approach than is normally applied in many prawn/shrimp fisheries.

Biomass reference points for the harvest control rules are based on the Commonwealth of Australia legislation (see 3.6.5). They are:
Target: S_{MEY} (Spawning biomass at maximum economic yield).
Limit: Moving average of S_Y/S_{MSY} over 5 most recent years = 0.5

S_{MEY} is a conservative target reference point that aims for economic efficiency while still maintains the stock above $S_{MSY.}$ The limit reference point takes an average of 50% of S_{MSY} as a state that is undesirable. Moving average used to account for year-to-year variability in abundance that could cause rapid changes in management responses.
Effort reference points relating to these biomass reference points are:
Target: E_{MEY} (Effort at maximum economic yield) 1.e. E_y/E_{MEY} = 1.
Limit: Moving average of E_Y/E_{MSY} over 5 years = 0.5

The stock assessment also considers the status of the stock with respect to a TRP of S_{MSY}, the default TRP for MSC assessment of stock status ((MSC FAM V.2.1).

Because this species is a scavenger that feeds on a wide variety of detritus, small animals and plants (e.g., forams), t comprises only a very small proportion of many species of penaeid, carid and sergistid shrimps that occupy similar feeding niches in the food web. SAs such it is not considered to be a species that holds a key role in ensuring diversity and stability in the ecosystem i.e. it is not considered a low trophic level (LTL) species.

1.1	Target Species Outcome			
1.1.2	Reference Points	60 Guideposts	80 Guideposts	100 Guideposts
Conclusion				
The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues (100) The target reference point is such that the stock is maintained at a level consistent with BMSY (and a higher level, at BMEY) and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty (100).				
References				
AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf CSIRO, Interview Nos 2 & 3.				

1.1	Target Species Outcome			
1.1.3	Stock Rebuilding	60 Guideposts	80 Guideposts	100 Guideposts
	Where the stock is depleted, there is evidence of stock rebuilding	Where stocks are depleted rebuilding strategies which have a <u>reasonable expectation</u> of success are in place.	Where stocks are depleted rebuilding strategies are in place.	Where stocks are depleted, strategies are <u>demonstrated</u> to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the <u>shortest practicable</u> timeframe.
		Monitoring is in place to determine whether they are effective in rebuilding the stock within a <u>specified</u> timeframe.	There is <u>evidence</u> that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a <u>specified</u> timeframe.	
Score: N/A				
Justification				
Conclusion				

1.2	Target Species Harvest Strategy (Management)			
1.2.1	Harvest Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There is a robust and precautionary harvest strategy in place.	The harvest strategy is <u>expected</u> to achieve stock management objectives reflected in	The harvest strategy is responsive to the state of the stock and the elements of the harvest	The harvest strategy is responsive to the state of the stock and is <u>designed</u> to achieve stock

1.2	Target Species Harvest Strategy (Management)			
1.2.1	**Harvest Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
		the target and limit reference points.	strategy work together towards achieving management objectives reflected in the target and limit reference points.	management objectives reflected in the target and limit reference points.
		The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but monitoring is in place and evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels
		Monitoring is in place that is expected to determine whether the harvest strategy is working.		The harvest strategy is periodically reviewed and improved as necessary.
Score: 100				

Justification

The present harvest strategy (HS) is based on input controls (AFMA, 2010). The HS is compliant with the Commonwealth of Australia's Legislative requirements and is aimed at realizing the objectives of the NPF Management Plan 1995 that includes "Ensure the utilization of the fishery resources is consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle." The operational objective of the HS is to attain long-term maximum economic yield (MEY) from the tiger prawn species. MEY is calculated as the effort level in each year over a 7 year projection period that creates the biggest difference between the total revenue generated from tiger and endeavour prawns and the total costs of fishing for the tiger prawn fishery as a whole.

The harvest strategy for Brown tiger prawns includes:

1. Indicators (data from the fishery)
2. Monitoring (agreed protocols to get data)
3. Reference points (target and limit)
4. Decision rules (agreed rules for setting input controls)

The harvest strategy has been tested using the NPF Management Strategy Evaluation (Dichmont et al 2006a, Dichmont et al 2066b, Dichmont et al 2006c, and Dichmont et al 2008) (Section 3.6.6). The HS is regularly reviewed and updated as appropriate by the NPF Resource Assessment Group.

There is a robust and precautionary harvest strategy in place.

Conclusions

The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points (100)

The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels (100)

The harvest strategy is periodically reviewed and improved as necessary (100)

References

Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006a). Management strategoes for short-lived species: The case of the Northern Prawn Fishery 1. Accounting for multiples species, spatial structure and implementation uncertainty when evaluating risk. Fisheries Research 82 , 204-230.

1.2	Target Species Harvest Strategy (Management)			
1.2.1	**Harvest Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006b). Management strategies for short-lived species: The case of Australia's Northern Prawn Fishery 2. Choosing appropriate management strategies using input controls. Fisheries Research 82 , 221-234.

Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006c). Management strategies for short-lived species: The case of Australia's Northern Prawn Fishery 3. Factors affecting management and estimation performance. Fisheries Research 82 , 235-245.

AFMA (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

Dichmont, C. M., Deng, A., Punt, A. E., Ellis, N., Venables, W. N., Kompas, T., et al. (2008). Beyond biological reference performance measures in management strategy evaluation:Bringing in economics and the efects of trawling on the benthos. Fisheries Research doi:10.1016/j.fishres.208.05.007

1.2	Target Species Harvest Strategy (Management)			
1.2.2	**Harvest control rules and tools**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There are well defined and effective harvest control rules in place	<u>Generally understood</u> harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	<u>Well defined</u> harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
			The <u>selection</u> of the harvest control rules takes into account the <u>main</u> uncertainties.	The <u>design</u> of the harvest control rules take into account a <u>wide</u> range of uncertainties.
		There is <u>some evidence</u> that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	<u>Available evidence indicates</u> that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	<u>Evidence clearly shows</u> that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
Score: 100				

Justification

There is a comprehensive set of control rules that feed into HS actions, including no target fishing if the LRP is triggered and changes to fishing effort to achieve MEY through the use of spatial and temporal closures and gear modifications. There is also a 350kg/day trigger in place, which if met, results in closure of the fishery. This trigger applies to all species of the tiger prawn sub-fishery and also applies across the whole fishery. The trigger is set at the break-even point, where costs equal revenue.

Following a period of overfishing in the late 1990s, a rebuilding strategy based on the control rules was implemented in 2003 and was successful. The control ensures that the exploitation rate is reduced on the target species. The control rules were part of the MSE reported in 1.2.1 that includes testing of the design of the rules and the sensitivity of management performance to a range of uncertainties.

1.2	Target Species Harvest Strategy (Management)			
1.2.2	**Harvest control rules and tools**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
Conclusions				
Control rules are in place, have been consistently applied and the design of these harvest control rules take into account a wide range of uncertainties (100). Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules. (100).				
References				
AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf Dichmont, C. M., Deng, A., Punt, A. E., Ellis, N., Venables, W. N., Kompas, T., et al. (2008). Beyond biological reference performance measures in management strategy evaluation: Bringing in economics and the efects of trawling on the benthos. Fisheries Research doi:10.1016/j.fishres.208.05.007 .				

1.2	Target Species Harvest Strategy (Management)			
1.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Relevant information is collected to support the harvest strategy	<u>Some</u> relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	<u>Sufficient</u> relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A <u>comprehensive range</u> of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available.
		Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are <u>regularly</u> <u>monitored at a level of accuracy and coverage consistent with the harvest control rule</u>, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	
			There is good information on all other fishery removals from the stock.	<u>All information</u> required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent <u>uncertainties</u> in the information [data] and the robustness of assessment and

1.2	Target Species Harvest Strategy (Management)			
1.2.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
				management to this uncertainty.
Score: 100				
Justification				

A comprehensive data collection program has been established for the NPF to ensure reliable information is available on which to base management decisions. This includes fishery independent surveys (both at the time of prawn recruitment ("recruitment" surveys) and at the time of peak spawning ("spawning" surveys), daily catch and effort logbooks, seasonal landing returns, VMS data and economic surveys. The NPF also has a crew member observer programme and a scientific observer programme. There is a good understanding of uncertainties in the information that has been tested through sensitivity analyses in the stock assessment (see above for MSE references). Environmental information includes general climatic observations through the Australian meteorological network, oceanographic observations during past research cruises and the annual "recruitment" and "spawning" survey cruises.

The information is used in the regular stock assessments, and fed in real time into the HS decision making process that determines the length of closures and the appropriate fishing effort level to achieve the TRP.

Conclusion

A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available (100).

All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty (100).

References

AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

1.2	Target Species Harvest Strategy (Management)			
1.2.4	Assessment of Stock Status	60 Guideposts	80 Guideposts	100 Guideposts
	There is an adequate assessment of the stock status	The assessment estimates stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
		The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
				The assessment has been tested and shown to

1.2	Target Species Harvest Strategy (Management)			
1.2.4	Assessment of Stock Status	60 Guideposts	80 Guideposts	100 Guideposts
				be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
			The assessment of the stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
Score: 100				

Justification

Three species (brown and grooved tiger prawns and the blue endeavour prawn) are assessed using a size-structured population dynamics model which operates on a weekly time-step. The of this multi-species are estimated using data on catches, catch-rates, length-frequency data from surveys and the fishery, survey indices and tag release-recapture data. The estimates include annual recruitment, fishery and survey selection patterns, parameters which define the size-transition matrix, and recruitment patterns, The model allows for the technical interaction among the three species a result of bycatch when targeting one or the other species. The results from the multi-species stock assessment form part of the basis for evaluating the time-series of catches (by species) and levels of fishing effort (by fishing strategy) which maximize net present value. The bio-economic model takes into account costs which are proportional to catches, and those which are proportional to fishing effort, as well as fixed costs. The fit of the model to the data inputs is good, and the sensitivity of the results has been examined by changing the assumptions regarding the values for the economic parameters of the bio-economic model as well as those on which the assessment are based (Punt et. al., 2010)

The stock assessment is carried out by the Commonwealth Scientific Industrial Research Organization (CSIRO) under contract from the Australian Fisheries Management Authority (AFMA). It is conducted by a team of data, information and stock assessment specialists including pat-time input from a world-renown expert from the University of Washington. Modelling results are then reviewed by the Northern Prawn Research Advisory Group (NPFRAG), which is comprised of scientists, economists, fishery managers, fishing representatives, and environmentalists. Peer-group review of the actual assessments is provided by two independent stock assessment experts within the RAG. The methods and results of the assessments are also published in peer-reviewed scientific journals. The assessment was externally peer-reviewed in 2002 by an independent stock assessment expert who concluded that the assessment was world-class but also recommended the inclusion of fishery dependent data; a recommendation that has been followed.

Sensitivity tests in the stock assessment have been carried out that indicate relative robustness to assumptions and different types of assessment techniques. These are taken into account in assessing stock status.

Conclusion:

The assessment is appropriate for the stock and HCRs (100)

The assessment takes into account uncertainty (100)

The assessment has been tested and shown to be robust (100)

The assessment has been internally and externally peer reviewed (100)

AFMA. (2011). NPF RAG Assessment 2010/11. Tiger Prawns. Milestone: Delivery of stock assessment and economic outputs. Canberra, Australia: Australian Fisheries Management Authority.

Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessment and bio-economic management advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.

Grooved tiger prawn (*P. semisulcatus*)

1.1	Target Species Outcome			
1.1.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
			The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.
Score: 100				

Justification

Justification: The most recent assessment of the status of grooved tiger prawn (AFMA, 2011) shows that stock status is above the default MSC TRP (S_{2010}/S_{MSY} = ~120%) but slightly below the NPF TRP of MEY ((S_{2010}/S_{MSY}=88.6%). The stock has been above S_{MSY} for several years and has fluctuated close to the S_{MEY} since 2002 (Section 3.6.2; Fig.5 and Table 7). The 90% lower confidence limit of the parameters and the ratio were published by Punt et. al. (2010) these are also above both TRPs in 2007, resulting in a high degree of certainty about the stock status with respect to TRPs.

The current stock is also well above the LRP (moving average of $S_{2006-2010}/S_{MSY}$ =138%). The probability of being above the LRP is 100% (CSIRO pers comm). Effort levels are also well below both the TRP and LRP, indicating that the overfishing is not occurring.

The stock is at a level that maintains high productivity and has a low probability of recruitment overfishing.

Conclusion

There is a high degree of certainty that the stock is above the point where recruitment would be impaired (100).

There is a high degree of certainty that the stock has been above BMSY, over recent years (100).

References

AFMA. (2011). NPF RAG Assessment 2010/11. Tiger Prawns. Milestone: Delivery of stock assessment and economic outputs. Canberra, Australia: Australian Fisheries Management Authority.

Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessment and bio-economic management advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.

CSIRO (per comm) Email of 23rd September from C Dichmont, CSIRO

1.1	Target Species Outcome			
1.1.2	**Reference Points**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Limit and target reference points are appropriate for the stock	Generic limit and target reference points are based on justifiable and reasonable practice	Reference points are appropriate for the stock and can be estimated.	

1.1	Target Species Outcome			
1.1.2	Reference Points	60 Guideposts	80 Guideposts	100 Guideposts
		appropriate for the species category.		
			The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues.
			The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty
			For low trophic level species, the target reference point takes into account the ecological role of the stock.	
Score: 100				

Justification:

The tiger prawn sub-fishery is managed under a Maximum Economic Yield (MEY) strategy that optimises the economic return from the fishery. This is normally achieved at a spawning biomass level (S_{MEY}) that is higher than the biomass that produces the Maximum Sustainable Yield (S_{MSY}), and in this respect is a more precautionary approach than is normally applied in many prawn/shrimp fisheries.

Biomass reference points for the harvest control rules are based on the Commonwealth of Australia legislation (see 3.6.5). They are:
Target: S_{MEY} (Spawning biomass at maximum economic yield).
Limit: Moving average of S_Y/S_{MSY} over 5 most recent years = 0.5

S_{MEY} is a conservative target reference point that aims for economic efficiency while still maintains the stock above $S_{MSY.}$ The limit reference point takes an average of 50% of S_{MSY} as a state that is undesirable. Moving average used to account for year-to-year variability in abundance that could cause rapid changes in management responses.
Effort reference points relating to these biomass reference points are:
Target: E_{MEY} (Effort at maximum economic yield) 1.e. E_y/E_{MEY} = 1.
Limit: Moving average of E_Y/E_{MSY} over 5 years = 0.5

The stock assessment also considers the status of the stock with respect to a TRP of S_{MSY}, the default TRP for MSC assessment of stock status ((MSC FAM V.2.1).

Because this species is a scavenger that feeds on a wide variety of detritus, small animals and plants (e.g., forams), t comprises only a very small proportion of many species of penaeid, carid and sergistid shrimps that occupy similar feeding niches in the food web. SAs such it is not considered to be a species that holds a key role in ensuring diversity and stability in the ecosystem i.e. it is not considered a low trophic level (LTL) species.

1.1	Target Species Outcome			
1.1.2	Reference Points	60 Guideposts	80 Guideposts	100 Guideposts
Conclusion				
The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues (100) The target reference point is such that the stock is maintained at a level consistent with BMSY (and a higher level, at BMEY) and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty (100).				
References				
AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf CSIRO Interview No 2				

1.1	Target Species Outcome			
1.1.3	Stock Rebuilding	60 Guideposts	80 Guideposts	100 Guideposts
	Where the stock is depleted, there is evidence of stock rebuilding	Where stocks are depleted rebuilding strategies which have a reasonable expectation of success are in place.	Where stocks are depleted rebuilding strategies are in place.	Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the shortest practicable timeframe.
		Monitoring is in place to determine whether they are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
Score: N/A				
Justification				
Conclusion				

1.2	Target Species Harvest Strategy (Management)			
1.2.1	Harvest Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There is a robust and precautionary harvest strategy in place.	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management

1.2	Target Species Harvest Strategy (Management)			
1.2.1	Harvest Strategy	60 Guideposts	80 Guideposts	100 Guideposts
		reference points.	towards achieving management objectives reflected in the target and limit reference points.	objectives reflected in the target and limit reference points.
		The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but monitoring is in place and evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels
		Monitoring is in place that is expected to determine whether the harvest strategy is working.		The harvest strategy is periodically reviewed and improved as necessary.
Score: 100				

Justification

The present harvest strategy (HS) is based on input controls (AFMA, 2010). The HS is compliant with the Commonwealth of Australia's Legislative requirements and is aimed at realizing the objectives of the NPF Management Plan 1995 that includes "Ensure the utilization of the fishery resources is consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle." The operational objective of the HS is to attain long-term maximum economic yield (MEY) from the tiger prawn species. MEY is calculated as the effort level in each year over a 7 year projection period that creates the biggest difference between the total revenue generated from tiger and endeavour prawns and the total costs of fishing for the tiger prawn fishery as a whole.

The harvest strategy for Brown tiger prawns includes:

5. Indicators (data from the fishery)
6. Monitoring (agreed protocols to get data)
7. Reference points (target and limit)
8. Decision rules (agreed rules for setting input controls)

The harvest strategy has been tested using the NPF Management Strategy Evaluation (Dichmont et al 2006a, Dichmont et al 2066b, Dichmont et al 2006c, and Dichmont et al 2008) (Section 3.6.6). The HS is regularly reviewed and updated as appropriate by the NPF Resource Assessment Group.

There is a robust and precautionary harvest strategy in place.

Conclusions

The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points (100)

The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels (100)

The harvest strategy is periodically reviewed and improved as necessary (100)

References

Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006a). Management strategoes for short-lived species: The case of the Northern Prawn Fishery 1. Accounting for multiples species, spatial structure and

1.2	Target Species Harvest Strategy (Management)			
1.2.1	Harvest Strategy	60 Guideposts	80 Guideposts	100 Guideposts

implementation uncertainty when evaluating risk. Fisheries Research 82 , 204-230.

Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006b). Management strategies for short-lived species: The case of Australia's Northern Prawn Fishery 2. Choosing appropriate management strategies using input controls. Fisheries Research 82 , 221-234.

Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006c). Management strategies for short-lived species: The case of Australia's Northern Prawn Fishery 3. Factors affecting management and estimation performance. Fisheries Research 82 , 235-245.

AFMA (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

Dichmont, C. M., Deng, A., Punt, A. E., Ellis, N., Venables, W. N., Kompas, T., et al. (2008). Beyond biological reference performance measures in management strategy evaluation:Bringing in economics and the efects of trawling on the benthos. Fisheries Research doi:10.1016/j.fishres.208.05.007

1.2	Target Species Harvest Strategy (Management)			
1.2.2	Harvest control rules and tools	60 Guideposts	80 Guideposts	100 Guideposts
	There are well defined and effective harvest control rules in place	<u>Generally understood</u> harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	<u>Well defined</u> harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
			The <u>selection</u> of the harvest control rules takes into account the <u>main</u> uncertainties.	The <u>design</u> of the harvest control rules take into account a <u>wide</u> range of uncertainties.
		There is <u>some evidence</u> that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	<u>Available evidence indicates</u> that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	<u>Evidence clearly shows</u> that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
Score: 100				

Justification

There is a comprehensive set of control rules that feed into HS actions, including no target fishing if the LRP is triggered and changes to fishing effort to achieve MEY through the use of spatial and temporal closures and gear modifications. There is also a 350kg/day trigger in place, which if met, results in closure of the fishery. This trigger applies to all species of the tiger prawn sub-fishery and also applies across the whole fishery. The trigger is set at the break-even point, where costs equal revenue.

Following a period of overfishing in the late 1990s, a rebuilding strategy based on the control rules was implemented in 2003 and was successful. The control ensures that the exploitation rate is reduced on the target

1.2	Target Species Harvest Strategy (Management)			
1.2.2	Harvest control rules and tools	60 Guideposts	80 Guideposts	100 Guideposts
species. The control rules were part of the MSE reported in 1.2.1 that includes testing of the design of the rules and the sensitivity of management performance to a range of uncertainties.				
Conclusions				
The design of the harvest control rules takes into account a wide range of uncertainties (100). Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules (100).				
References				
AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf Dichmont, C. M., Deng, A., Punt, A. E., Ellis, N., Venables, W. N., Kompas, T., et al. (2008). Beyond biological reference performance measures in management strategy evaluation: Bringing in economics and the effects of trawling on the benthos. Fisheries Research doi:10.1016/j.fishres.208.05.007 Kenyon R.A., Jarrett A.E., Bishop J.F.B., Taranto T.J., Dichmont C.M., Zhou S. (2005). Documenting the history of and providing protocols and criteria for changing existing and establishing new closures in the NPF: Final Report to AFMA (AFMA Project R02/0881).				

1.2	Target Species Harvest Strategy (Management)			
1.2.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Relevant information is collected to support the harvest strategy	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available.
		Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	
			There is good information on all other fishery removals from the stock.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and

1.2	Target Species Harvest Strategy (Management)			
1.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
				there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.

Score: 100

Justification

A comprehensive data collection program has been established for the NPF to ensure reliable information is available on which to base management decisions. This includes fishery independent surveys (both at the time of prawn recruitment ("recruitment" surveys) and at the time of peak spawning ("spawning" surveys), daily catch and effort logbooks, seasonal landing returns, VMS data and economic surveys. The NPF also has a crew member observer programme and a scientific observer programme. There is a good understanding of uncertainties in the information that has been tested through sensitivity analyses in the stock assessment (see above for MSE references). Environmental information includes general climatic observations through the Australian meteorological network, oceanographic observations during past research cruises and the annual "recruitment" and "spawning" survey cruises.

The information is used in the regular stock assessments, and fed in real time into the HS decision making process that determines the length of closures and the appropriate fishing effort level to achieve the TRP.

Conclusion

A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available (100).

All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty (100).

References

AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

1.2	Target Species Harvest Strategy (Management)			
1.2.4	**Assessment of Stock Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is an adequate assessment of the stock status	The assessment estimates stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
		The assessment identifies major sources	The assessment takes uncertainty into account.	The assessment takes into account uncertainty

1.2	Target Species Harvest Strategy (Management)			
1.2.4	Assessment of Stock Status	60 Guideposts	80 Guideposts	100 Guideposts
		of uncertainty.		and is evaluating stock status relative to reference points in a probabilistic way.
				The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
			The assessment of the stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.

Score: 100

Justification:

Three species (brown and grooved tiger prawns and the blue endeavour prawn) are assessed using a size-structured population dynamics model which operates on a weekly time-step. The parameters of this multi-species are estimated using data on catches, catch-rates, length-frequency data from surveys and the fishery, survey indices and tag release-recapture data. The estimated parameters include annual recruitment, fishery and survey selection patterns, parameters which define the size-transition matrix, and recruitment patterns, The model allows for the technical interaction among the three species a result of bycatch when targeting one or the other species. The results from the multi-species stock assessment form part of the basis for evaluating the time-series of catches (by species) and levels of fishing effort (by fishing strategy) which maximize net present value. The bio-economic model takes into account costs which are proportional to catches, and those which are proportional to fishing effort, as well as fixed costs. The fit of the model to the data inputs is good, and the sensitivity of the results has been examined by changing the assumptions regarding the values for the economic parameters of the bio-economic model as well as those on which the assessment are based (Punt et. al., 2010)

The stock assessment is carried out by the Commonwealth Scientific Industrial Research Organization (CSIRO) under contract from the Australian Fisheries Management Authority (AFMA). It is conducted by a team of data, information and stock assessment specialists including pat-time input from a world-renown expert from the University of Washington. Modelling results are then reviewed by the Northern Prawn Research Advisory Group (NPFRAG), which is comprised of scientists, economists, fishery managers, fishing representatives, and environmentalists. Peer-group review of the actual assessments is provided by two independent stock assessment experts within the RAG. The methods and results of the assessments are also published in peer-reviewed scientific journals. The assessment was externally peer-reviewed in 2002 by an independent stock assessment expert who concluded that the assessment was world-class but also recommended the inclusion of fishery dependent data; a recommendation that has been followed.

Sensitivity tests in the stock assessment have been carried out that indicate relative robustness to assumptions and different types of assessment techniques. These are taken into account in assessing stock status.

Conclusion:

The assessment is appropriate for the stock and HCRs (100)

The assessment takes into account uncertainty (100)

The assessment has been tested and shown to be robust (100)

The assessment has been internally and externally peer reviewed (100)

References

AFMA. (2011). NPF RAG Assessment 2010/11. Tiger Prawns. Milestone: Delivery of stock assessment and

1.2	Target Species Harvest Strategy (Management)			
1.2.4	Assessment of Stock Status	60 Guideposts	80 Guideposts	100 Guideposts

economic outputs. Canberra, Australia: Australian Fisheries Management Authority.
Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessment and bio-economic management advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.

Blue endeavour prawns (*Metapenaeus endeavouri)*

1.1	Target Species Outcome			
1.1.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
			The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.

Score: 90

Justification

Justification: The most recent assessment of the status of the blue endeavour prawn (AFMA, 2011) shows that stock status is above the default MSC TRP (S_{2010}/S_{MSY}=110%) but below the NPF TRP of MEY ((S_{2010}/S_{MSY}=84.8%). 90% lower confidence limit of the parameters and the ratio for 2007 were published by Punt et. al. (2010) these are below both TRPs. The stock is at S_{MSY} for the first time for several years, although it has been building steadily since 2002.

The current stock is also well above the LRP (moving average of $S_{2006-2010}/S_{MSY}$ =138%). The probability of being above the LRP is 100% (CSIRO pers comm). Effort levels are also well below both the TRP and LRP, indicating that the overfishing is not occurring (Table 9, Figure 7 of 3.6.2).

The stock is at a level that maintains high productivity and has a low probability of recruitment overfishing.

Conclusion

There is a high degree of certainty that the stock is above the point where recruitment would be impaired (100).

The stock is at its target reference point of BMSY. (80).

References

AFMA. (2011). NPF RAG Assessment 2010/11. Tiger Prawns. Milestone: Delivery of stock assessment and economic outputs. Canberra, Australia: Australian Fisheries Management Authority.
Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessment and bio-economic management advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.

1.1	Target Species Outcome			
1.1.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
CSIRO (per comm) Email of 23rd September from C Dichmont, CSIRO				

1.1	Target Species Outcome			
1.1.2	Reference Points	60 Guideposts	80 Guideposts	100 Guideposts
	Limit and target reference points are appropriate for the stock	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
			The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues.
			The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty
			For low trophic level species, the target reference point takes into account the ecological role of the stock.	
Score: 100				

Justification

The tiger prawn sub-fishery is managed under a Maximum Economic Yield (MEY) strategy that optimises the economic return from the fishery. This is normally achieved at a spawning biomass level (S_{MEY}) that is higher than the biomass that produces the Maximum Sustainable Yield (S_{MSY}), and in this respect is a more precautionary approach than is normally applied in many prawn/shrimp fisheries.

Biomass reference points for the harvest control rules are based on the Commonwealth of Australia legislation (see 3.6.5). They are:
Target: S_{MEY} (Spawning biomass at maximum economic yield).
Limit: Moving average of S_Y/S_{MSY} over 5 most recent years = 0.5

S_{MEY} is a conservative target reference point that aims for economic efficiency while still maintains the stock above $S_{MSY.}$ The limit reference point takes an average of 50% of S_{MSY} as a state that is undesirable. Moving average used to account for year-to-year variability in abundance that could cause rapid changes in management responses.

1.1	Target Species Outcome			
1.1.2	Reference Points	60 Guideposts	80 Guideposts	100 Guideposts
Effort reference points relating to these biomass reference points are: Target: E_{MEY} (Effort at maximum economic yield) 1.e. E_y/E_{MEY} = 1. Limit: Moving average of E_Y/E_{MSY} over 5 years = 0.5 The stock assessment also considers the status of the stock with respect to a TRP of S_{MSY}, the default TRP for MSC assessment of stock status ((MSC FAM V.2.1). Because this species is a scavenger that feeds on a wide variety of detritus, small animals and plants (e.g., forams), t comprises only a very small proportion of many species of penaeid, carid and sergistid shrimps that occupy similar feeding niches in the food web. SAs such it is not considered to be a species that holds a key role in ensuring diversity and stability in the ecosystem i.e. it is not considered a low trophic level (LTL) species.				
Conclusion				
The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues (100) The target reference point is such that the stock is maintained at a level consistent with BMSY (and a higher level, at BMEY) and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty (100).				
References				
AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf Reference meeting with CSIRO scientists (15 Sept)				

1.1	Target Species Outcome			
1.1.3	Stock Rebuilding	60 Guideposts	80 Guideposts	100 Guideposts
	Where the stock is depleted, there is evidence of stock rebuilding	Where stocks are depleted rebuilding strategies which have a reasonable expectation of success are in place.	Where stocks are depleted rebuilding strategies are in place.	Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the shortest practicable timeframe.
		Monitoring is in place to determine whether they are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
Score: N/A				
Justification				
Conclusion				

1.1	Target Species Outcome			
1.1.3	Stock Rebuilding	60 Guideposts	80 Guideposts	100 Guideposts

1.2	Target Species Harvest Strategy (Management)			
1.2.1	Harvest Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There is a robust and precautionary harvest strategy in place.	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
		The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but monitoring is in place and evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels
		Monitoring is in place that is expected to determine whether the harvest strategy is working.		The harvest strategy is periodically reviewed and improved as necessary.

Score: 100

Justification

The present harvest strategy (HS) is based on input controls (AFMA, 2010). The HS is compliant with the Commonwealth of Australia's Legislative requirements and is aimed at realizing the objectives of the NPF Management Plan 1995 that includes "Ensure the utilization of the fishery resources is consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle." The operational objective of the HS is to attain long-term maximum economic yield (MEY) from the tiger prawn species. MEY is calculated as the effort level in each year over a 7 year projection period that creates the biggest difference between the total revenue generated from tiger and endeavour prawns and the total costs of fishing for the tiger prawn fishery as a whole.

The harvest strategy for Brown tiger prawns includes:

9. Indicators (data from the fishery)
10. Monitoring (agreed protocols to get data)
11. Reference points (target and limit)
12. Decision rules (agreed rules for setting input controls)

The harvest strategy has been tested using the NPF Management Strategy Evaluation (Dichmont et al 2006a, Dichmont et al 2066b, Dichmont et al 2006c, and Dichmont et al 2008) (Section 3.6.6). The HS is regularly reviewed and updated as appropriate by the NPF Resource Assessment Group.

There is a robust and precautionary harvest strategy in place.

Conclusions

The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points (100)

1.2	Target Species Harvest Strategy (Management)			
1.2.1	**Harvest Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels (100)

The harvest strategy is periodically reviewed and improved as necessary (100)

References

Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006a). Management strategoes for short-lived species: The case of the Northern Prawn Fishery 1. Accounting for multiples species, spatial structure and implementation uncertainty when evaluating risk. Fisheries Research 82 , 204-230.

Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006b). Management strategies for short-lived species: The case of Australia's Northern Prawn Fishery 2. Choosing appropriate management strategies using input controls. Fisheries Research 82 , 221-234.

Dichmont, C. M., Deng, A., Punt, A. E., Venables, W., & Haddon, M. (2006c). Management strategies for short-lived species: The case of Australia's Northern Prawn Fishery 3. Factors affecting management and estimation performance. Fisheries Research 82 , 235-245.

AFMA (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

Dichmont, C. M., Deng, A., Punt, A. E., Ellis, N., Venables, W. N., Kompas, T., et al. (2008). Beyond biological reference performance measures in management strategy evaluation:Bringing in economics and the efects of trawling on the benthos. Fisheries Research doi:10.1016/j.fishres.208.05.007

1.2	Target Species Harvest Strategy (Management)			
1.2.2	**Harvest control rules and tools**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There are well defined and effective harvest control rules in place	Generally understood harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
			The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules take into account a wide range of uncertainties.
		There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
Score: 90				
Justification				

1.2	Target Species Harvest Strategy (Management)			
1.2.2	**Harvest control rules and tools**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
There is a comprehensive set of control rules that feed into HS actions, including no target fishing if the LRP is triggered and changes to fishing effort to achieve MEY through the use of spatial and temporal closures and gear modifications. There is also a 350kg/day trigger in place, which if met, results in closure of the fishery. This trigger applies to all species of the tiger prawn sub-fishery and also applies across the whole fishery. The trigger is set at the break-even point, where costs equal revenue. Following a period of overfishing in the late 1990s, a rebuilding strategy based on the control rules was implemented in 2003 and was successful. The control ensures that the exploitation rate is reduced on the target species. The control rules were part of the MSE reported in 1.2.1 that includes testing of the design of the rules and the sensitivity of management performance to a range of uncertainties.				
Conclusions				
The selection of the harvest control rules takes into account the main uncertainties (80). Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules (100).				
References				
Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf Dichmont, C. M., Deng, A., Punt, A. E., Ellis, N., Venables, W. N., Kompas, T., et al. (2008). Beyond biological reference performance measures in management strategy evaluation: Bringing in economics and the effects of trawling on the benthos. Fisheries Research doi:10.1016/j.fishres.208.05.007 . Kenyon R.A., Jarrett A.E., Bishop J.F.B., Taranto T.J., Dichmont C.M., Zhou S. (2005). Documenting the history of and providing protocols and criteria for changing existing and establishing new closures in the NPF: Final Report to AFMA (AFMA Project R02/0881).				

1.2	Target Species Harvest Strategy (Management)			
1.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Relevant information is collected to support the harvest strategy	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available.
		Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with	

1.2	Target Species Harvest Strategy (Management)			
1.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
			sufficient frequency to support the harvest control rule.	
			There is good information on all other fishery removals from the stock.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
Score: 100				

Justification

A comprehensive data collection program has been established for the NPF to ensure reliable information is available on which to base management decisions. This includes fishery independent surveys (both at the time of prawn recruitment ("recruitment" surveys) and at the time of peak spawning ("spawning" surveys), daily catch and effort logbooks, seasonal landing returns, VMS data and economic surveys. The NPF also has a crew member observer programme and a scientific observer programme. There is a good understanding of uncertainties in the information that has been tested through sensitivity analyses in the stock assessment (see above for MSE references). Environmental information includes general climatic observations through the Australian meteorological network, oceanographic observations during past research cruises and the annual "recruitment" and "spawning" survey cruises.

The information is used in the regular stock assessments, and fed in real time into the HS decision making process that determines the length of closures and the appropriate fishing effort level to achieve the TRP.

Conclusion

A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available (100).

All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty (100).

References

AFMA (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

1.2	Target Species Harvest Strategy (Management)			
1.2.4	**Assessment of Stock Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is an adequate assessment of the stock status	The assessment estimates stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule, and is	The assessment is appropriate for the stock and for the harvest control rule and takes into

1.2	Target Species Harvest Strategy (Management)			
1.2.4	Assessment of Stock Status	60 Guideposts	80 Guideposts	100 Guideposts
			evaluating stock status relative to reference points.	account the major features relevant to the biology of the species and the nature of the fishery.
		The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
				The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
			The assessment of the stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
Score: 100				

Justification

Three species (brown and grooved tiger prawns and the blue endeavour prawn) are assessed using a size-structured population dynamics model which operates on a weekly time-step. The parameters of this multi-species are estimated using data on catches, catch-rates, length-frequency data from surveys and the fishery, survey indices and tag release-recapture data. The estimated parameters include annual recruitment, fishery and survey selection patterns, parameters which define the size-transition matrix, and recruitment patterns, The model allows for the technical interaction among the three species a result of bycatch when targeting one or the other species. The results from the multi-species stock assessment form part of the basis for evaluating the time-series of catches (by species) and levels of fishing effort (by fishing strategy) which maximize net present value. The bio-economic model takes into account costs which are proportional to catches, and those which are proportional to fishing effort, as well as fixed costs. The fit of the model to the data inputs is good, and the sensitivity of the results has been examined by changing the assumptions regarding the values for the economic parameters of the bio-economic model as well as those on which the assessment are based (Punt et. al., 2010)

The stock assessment is carried out by the Commonwealth Scientific Industrial Research Organization (CSIRO) under contract from the Australian Fisheries Management Authority (AFMA). It is conducted by a team of data, information and stock assessment specialists including pat-time input from a world-renown expert from the University of Washington. Modelling results are then reviewed by the Northern Prawn Research Advisory Group (NPFRAG), which is comprised of scientists, economists, fishery managers, fishing representatives, and environmentalists. Peer-group review of the actual assessments is provided by two independent stock assessment experts within the RAG. The methods and results of the assessments are also published in peer-reviewed scientific journals. The assessment was externally peer-reviewed in 2002 by an independent stock assessment expert who concluded that the assessment was world-class but also recommended the inclusion of fishery dependent data; a recommendation that has been followed.

Sensitivity tests in the stock assessment have been carried out that indicate relative robustness to assumptions and different types of assessment techniques. These are taken into account in assessing stock status.

Conclusion:

1.2	Target Species Harvest Strategy (Management)			
1.2.4	Assessment of Stock Status	60 Guideposts	80 Guideposts	100 Guideposts
The assessment is appropriate for the stock and HCRs (100) The assessment takes into account uncertainty (100) The assessment has been tested and shown to be robust (100) The assessment has been internally and externally peer reviewed (100)				
References				
AFMA. (2011). NPF RAG Assessment 2010/11. Tiger Prawns. Milestone: Delivery of stock assessment and economic outputs. Canberra, Australia: Australian Fisheries Management Authority. Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessment and bio-economic management advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.				

Red endeavour prawns (*Metapenaeus ensis)*

1.1	Target Species Outcome			
1.1.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	• The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
			The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.
Score: 80				
Justification				

1.1	**Target Species Outcome**			
1.1.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
Because it is not possible to carry out a formal stock assessment for this species (with quantities cauht being extremely low), the following conclusions are based on measures as outlined in 6.2.10, 6.2.18 and 6.2.31 (MSC FAM V.2.1): *example of surrogate measures' where' yield is calculated based on a proportion of the observed biomass and the harvested fraction determined on empirical evidence from harvested catches and their consequences*. The harvest strategy and control rules (severely reduced effort (footrope length reduction), buyback, SFR, limited season, limited area, shorter season, trigger point, low risk designation) have sufficiently reduced the catch relative to previous years that precaution has increased. This precaution essentially prevents the fishery from having the capacity to overharvest. Several generations have passed since the imposition of the HCR, and seems highlylikely that the stock fluctuates around what would be Bmsy if we could measure it. The de facto TRP is whatever the fleet can catch within the precautionary constraints. Therefore, if likely for the stock $\geq$ Bmsy, then high likelihood of being above recruitment impairment. FAM version 6.2.31 allows for measurable proxies that could have some tie to MSY. Catches have shown similar trends to that of the blue tiger prawn with high catches in the 1980s but with recent declines reflecting the management interventions imposed on the fishery that has reduced the number of fishing vessels and the fishing effort over the last decade. Further, as the other species in the tiger prawn sub-fishery have responded with significant rebuilding and are above or at the TRP of B_{MSY}, it can be inferred that this is also the case for red endeavour prawns. To support the conclusion that it is highly likely that the stock is above the point where recruitment would be impaired is the fact that the species has been rated using PSA as "low risk" (Griffith et. al. 2007).				
Conclusion				
It is highly likely that the stock is above the point where recruitment would be impaired (80). The stock is at or fluctuating around its target reference point (80).				
References				
AFMA. (2011). NPF RAG Assessment 2010/11. Tiger Prawns. Milestone: Delivery of stock assessment and economic outputs. Canberra, Australia: Australian Fisheries Management Authority CSIRO (per comm) Email of 23rd September from C Dichmont, CSIRO MSC (2010). Marine Stewardship Council Fisheries Assessment Methodology and Guidance to Certification Bodies including Default Assessment Tree and Risk-based Framework. Ver 2.1, 1 May 2010 Griffiths, S., Kenyon, R., Bulman, C., Dowdney, J., Williams, A., Sporic, M., et al. (2007). *Ecological risk assessment for the effects of fishing: Report for the Northern Prawn Fishery*. Canberra: Australian Fisheries Management Authority.				

1.1	**Target Species Outcome**			
1.1.2	**Reference Points**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Limit and target reference points are appropriate for the stock	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
			The limit reference point is set above the level at which there is an appreciable risk of	The limit reference point is set above the level at which there is an appreciable risk of

1.1	Target Species Outcome			
1.1.2	Reference Points	60 Guideposts	80 Guideposts	100 Guideposts
			impairing reproductive capacity.	impairing reproductive capacity following consideration of relevant precautionary issues.
			The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty
			For low trophic level species, the target reference point takes into account the ecological role of the stock.	
Score: 80				

Justification

Biomass reference points

Red endeavour prawns are considered as part of the target reference point of MEY. As part of the HS, the appropriate level of effort is based on a bio-economic assessment undertaken every alternate year, optimizing the effort over a seven year moving window to maximize profits. Fishing effort is controlled by the modification of area, season and gear (headrope length). As well as the reference points there are trigger catches for both the banana prawn and the tiger prawn sub-fisheries that form part of the control rules to stop fishing for any of the species through appropriate seasonal and spatial closures. Given that the catch data are too small and variable to carry out an independent stock assessment, dealing with this species as part of the suite of species that make up the tiger prawn sub-fishery is appropriate. The total MEY for the fishery, where the MEY for the other main species and the limit reference points can be estimated with a high degree of certainty.

Because this species is a scavenger that feeds on a wide variety of detritus, small animals and plants (e.g., forams). It comprises only a very small proportion of many species of penaeid, carid and sergistid shrimps that occupy similar feeding niches in the food web, and it is not considered a low trophic level (LTL) species.

Conclusion

Reference points are appropriate for the stock and can be estimated (80).

The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity (80).

The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome (80).

References

AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf
Reference meeting with CSIRO scientists (15 Sept)

1.1	Target Species Outcome

1.1.3	Stock Rebuilding	60 Guideposts	80 Guideposts	100 Guideposts
	Where the stock is depleted, there is evidence of stock rebuilding	Where stocks are depleted rebuilding strategies which have a reasonable expectation of success are in place.	Where stocks are depleted rebuilding strategies are in place.	Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the shortest practicable timeframe.
		Monitoring is in place to determine whether they are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
Score: N/A				
Justification				
Conclusion				

1.2	Target Species Harvest Strategy (Management)			
1.2.1	**Harvest Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is a robust and precautionary harvest strategy in place.	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
		The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but monitoring is in place and evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels
		Monitoring is in place that is expected to determine whether the harvest strategy is working.		The harvest strategy is periodically reviewed and improved as necessary.
Score: 85				
Justification				

1.2	Target Species Harvest Strategy (Management)			
1.2.1	**Harvest Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

The HS is compliant with the Commonwealth of Australia's Legislative requirements and is aimed at realizing the objectives of the NPF Management Plan 1995, which is to "ensure the utilization of the fishery resources is consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle."

The operational objective of the HS is to attain long-term maximum economic yield (MEY) from the tiger prawn sub-fishery also includes endeavour prawns, and the MEY is calculated as the effort level in each year over a 7 year projection period that creates the biggest difference between the total revenue generated from tiger and endeavour prawns and the total costs of fishing for the tiger prawn fishery as a whole

Catches of red endeavour prawns are considered along with tiger prawns when assessing MEY in the bio-economic model (red endeavour prawns are treated as part of the revenue).

There is limited spatial separation between tiger and endeavour prawns (with the exception of the 'spikes' in catches of red endeavour prawns which occur very occasionally) and the correlation between tiger and endeavour prawn catches is quite high. As endeavour prawns are generally taken as an incidental part of the tiger prawn catch, catch controls which apply to tiger prawns also apply to endeavour prawns (Pascoe et al. 2010). As a result, the multi-species bio-economic model combined with tiger prawn effort controls is expected to move both endeavour prawns to their TRP of S_{MEY} (Dichmont *et al.* 2008). The HS is based on:

1. Indicators (data from the fishery)
2. Monitoring (agreed protocols to get data)
3. Reference points (target and limit)
4. Decision rules (agreed rules for setting input controls)

Harvest strategy has been tested using the NPF Management Strategy Evaluation.

Conclusions

The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points (80).

The harvest strategy may not have been fully tested but monitoring is in place and evidence exists that it is achieving its objectives (80).

The harvest strategy is periodically reviewed and improved as necessary (100).

References

AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

Dichmont, C. M., Deng, A., Punt, A. E., Ellis, N., Venables, W. N., Kompas, T., et al. (2008). Beyond biological reference performance measures in management strategy evaluation: Bringing in economics and the effects of trawling on the benthos. Fisheries Research doi:10.1016/j.fishres.208.05.007.

1.2	Target Species Harvest Strategy (Management)			
1.2.2	**Harvest control rules and tools**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There are well defined and effective harvest control rules in place	Generally understood harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	

1.2	Target Species Harvest Strategy (Management)			
1.2.2	Harvest control rules and tools	60 Guideposts	80 Guideposts	100 Guideposts
		approached.		
			The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules take into account a wide range of uncertainties.
		There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
Score: 80				

Justification

There is a comprehensive set of control rules including no target fishing if the LRP is triggered and changes to fishing effort to achieve MEY through the use of spatial and temporal closures and gear modifications. Following a period of overfishing in the late 1990s, a rebuilding strategy based on the control rules was implemented and was successful. The main control rule is to adjust the level of fishing effort so that the target of MEY for the tiger prawn sub-fishery is achieved. Of the four main species taken, explicit targets and limits can be calculated for three (two species of tiger prawns and the blue endeavour prawn). In the case of the red endeavour prawns it can be logically argued that the protection and rational utilization (MEY) provided by the control rules for the sub-fishery as a whole will also be effective for red endeavours. Simulation testing has been included as part of the MSE.

The control based on the limit trigger catch rates will ensure that the exploitation rate is reduced if they are exceeded, but the extent to which effort can be redirected away from the different target species through the use of input controls is not known in the case of the red endeavour prawns, but based on historic data and knowledge of the temporal and spatial distribution of the species, it can be achieved.

Conclusions

Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached (80).

The selection of the harvest control rules takes into account the main uncertainties (80).

Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules. (80).

References

Dichmont C.M.,(2011). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

Dichmont, C. M., Deng, A., Punt, A. E., Ellis, N., Venables, W. N., Kompas, T., et al. (2008). Beyond biological reference performance measures in management strategy evaluation: Bringing in economics and the effects of trawling on the benthos. Fisheries Research doi:10.1016/j.fishres.208.05.007.

1.2	Target Species Harvest Strategy (Management)			
1.2.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Relevant information is	Some relevant	Sufficient relevant	A comprehensive range

1.2	Target Species Harvest Strategy (Management)			
1.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	collected to support the harvest strategy	information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available.
		Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	
			There is good information on all other fishery removals from the stock.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
Score: 80				

Justification

A comprehensive data collection program has been established for the NPF to ensure reliable information is available on which to base management decisions. This includes fishery independent surveys, daily catch and effort logbooks, seasonal landing returns, VMS data and economic surveys. The NPF also has a crew member observer programme and a scientific observer programme. There is a good understanding of uncertainties in the information that has been tested through sensitivity analyses in the stock assessment.

Because red endeavour prawn catches are low and variable, there is inadequate information for a stock assessment based on the otherwise existing comprehensive data collection systems. To collect information for a complete stock assessment would require a dedicated research project inconsistent with the scale and intensity of catch of a species that is caught as an incidental to the main species and otherwise well managed.

Conclusion

Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy (80).

1.2	Target Species Harvest Strategy (Management)			
1.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule (80).

There is good information on all other fishery removals from the stock (80).

References

AFMA (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

1.2	Target Species Harvest Strategy (Management)			
1.2.4	**Assessment of Stock Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is an adequate assessment of the stock status	The assessment estimates stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
		The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
				The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
			The assessment of the stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
Score: 80				

Justification

In the case of red endeavour prawns, because no formal stock assessment is possible, a PSA risk assessment has been carried out and the species is also included as an economic by-catch in the bio-economic modelling. These assessments are conducted by a team from CSIRO. The modelling and risk assessment results are reviewed by the Northern Prawn Research Advisory Group (NPFRAG) comprised of scientists, economist, fishery managers, fishing representatives, and environmentalists. Uncertainties have been taken into account in both the bio-economic modelling and in the level 2 PSA risk assessment, and the assessments have been peer reviewed through the NPFRAG.

The current assessment meets the needs of the fishery. The possibility of carrying out a stock assessment for the red endeavour has been investigated by the CSIRO team on several occasions, but because of the very low and variable catches of red endeavour prawns, in their opinion stock assessments based on fisheries data would not yield reliable results.

1.2	Target Species Harvest Strategy (Management)			
1.2.4	**Assessment of Stock Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
Conclusions				
The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points. (80) The assessment takes uncertainty into account. (80) The assessment of the stock status is subject to peer review.(80)				
References				
AFMA. (2011). *NPF RAG Assessment 2010/11 Red-legged banana prawns.* Canberra, Australia: Australian Fisheries Management Authority.				

White banana prawns (*Fenneropenaeus merguiensis*)

1.1	Target Species Outcome			
1.1.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
			The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.
Score: 80				

Justification

Because the recruitment of white banana prawns is driven so strongly by environmental conditions (rainfall and catchment basin runoff) (Vance et al, 1998), stock assessments based on simple stock: recruitment based models are not possible.

Annual catches have been correlated with rainfall and prediction of catches made on the basis of the rainfall preceeding the banana prawn fishing season (Venables, et al., in press). Since 1970, catches, especially in the southeastern Gulf of Carpentaria have responded as expected to changes in rainfall, indicating that the stocks of banana prawns have remained at levels above those at which recruitment has been impaired. Catches have also recovered in areas of the Gulf where there were some concerns that overfishing may have occurred. There is evidence that the escapement (biomass and number of prawns remaining at the end of the banana prawn fishing season (in May/June)) has increased in recent years. In support of the conclusion that it is highly likely that the stock is above the point where recruitment would be impaired is the PSA analysis carried out by Griffith et. al. (2007)

Catches, have fluctuated around a long-term average with no conclusive evidence of long-term positive or negative trends in overall trends in the catch residual (catch with the effects of rainfall and changing effort removed). Based on a consideration of the dynamics of white banana prawns (3.6.2 Fig. 11) it can be inferred that it is highly likely that over the history of the fishery, the stock has fluctuated around a highly productive level consistent with Bmsy or better, but without formal reference points there is an element of uncertainty.

Conclusion

It is highly likely that the stock is above the point where recruitment would be impaired (80).

The stock is at or fluctuating around its TRP (80).

References

Griffiths, S., Kenyon, R., Bulman, C., Dowdney, J., Williams, A., Sporic, M., et al. (2007). Ecological risk assessmant for the effects of fishing: Report for the Northern Prawn Fishery. Canberra: Australian Fisheries Manageamant Authority.

Vance, D. J., Haywood, M. D., Heales, D. S., Kenyon, R. A., & Loneragon, N. R. (1998). Seasonal and annual variation i abundance of postlarval and juvenile banana parwns, Penaeus merguiensis, and environmental variation in two estuaries in tropical Northeatern Australia: a six-year study. Marine ecology Progress Series 163, 21-36.

Venables, B., Hutton, T., Lawrence, E., Rothlisberg, P., Buckworth, R., Hartcher, M., et al. (in press). Predictions of common banana Prawn potential catch in Australia's Northern Prawn Fishery. Canberra, Australia: Australian Fisheries Management Authority.

1.1	Target Species Outcome			
1.1.2	**Reference Points**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Limit and target reference points are appropriate for the stock	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
			The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues.
			The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty
			For low trophic level species, the target reference point takes into account the ecological role of the stock.	
Score: 80				

Justification

The high variability and environmental dependency of this species results in significant variations in catch from year to year. Consistent with the fact that a stock assessment based on simple stock: recruitment based models is not possible, there are no formal biomass reference points, such as MSY. The surrogate LRP and TFP measures are (i) that there will be a sufficient escapement from the sub-fishery to not jeopardize subsequent recruitment and (ii) that the economic yield is maximized each year within this constraint, thus achieving the maximum average return. The surrogate limit reference point is a catch rate of 500kg/day that is used to shorten the season length if catch triggers are not reached. The trigger catch is based on an average of the catches of the fourth fishing week in the most productive banana prawn seasons over a ten year period and divided by the number of boats.

Conclusion

Given the wide variability in annual catches that are environmentally driven, the surrogate reference points are appropriate (80).

Historical catches and analyses of catch residuals have shown that the limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity. (80).

The target reference point is such that the stock is maintained at a level consistent with the $B_{MSY,}$ a surrogate of maximizing the average yield (within the constraint of ensuring adequate recruitment) (80).

Banana prawns are not considered to be a low tropic species (80).

1.1	Target Species Outcome			
1.1.2	Reference Points	60 Guideposts	80 Guideposts	100 Guideposts
References				
AFMA (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf				

1.1	Target Species Outcome			
1.1.3	Stock Rebuilding	60 Guideposts	80 Guideposts	100 Guideposts
	Where the stock is depleted, there is evidence of stock rebuilding	Where stocks are depleted rebuilding strategies which have a <u>reasonable expectation</u> of success are in place.	Where stocks are depleted rebuilding strategies are in place.	Where stocks are depleted, strategies are <u>demonstrated</u> to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the <u>shortest practicable</u> timeframe.
		Monitoring is in place to determine whether they are effective in rebuilding the stock within a <u>specified</u> timeframe.	There is <u>evidence</u> that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a <u>specified</u> timeframe.	
Score: N/A				
Justification				
Conclusion				

1.2	Target Species Harvest Strategy (Management)			
1.2.1	Harvest Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There is a robust and precautionary harvest strategy in place.	The harvest strategy is <u>expected</u> to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy <u>work together</u> towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is <u>designed</u> to achieve stock management objectives reflected in the target and limit reference points.
		The harvest strategy is <u>likely</u> to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but monitoring is in place and <u>evidence</u> exists that it is achieving its objectives.	The performance of the harvest strategy has been <u>fully evaluated</u> and evidence exists to show that it is achieving its objectives including being

1.2	Target Species Harvest Strategy (Management)			
1.2.1	Harvest Strategy	60 Guideposts	80 Guideposts	100 Guideposts
				clearly able to maintain stocks at target levels
		Monitoring is in place that is expected to determine whether the harvest strategy is working.		The harvest strategy is periodically reviewed and improved as necessary.
Score: 85				

Justification

The operational objective is to allow sufficient escapement from the fishery to ensure an adequate spawning biomass of banana prawns (based on historical data) and, within this parameter, maximize the economic return from the fishery and also to minimize the catch of tiger prawns in the first four weeks of the banana prawn season.

The HS is based on:

1. Banana prawn catch and catch per unit effort
2. Reported industry data on catches for weeks 4 & 5; 6 & 7; 8 & 9 of the season
3. Tiger prawn incidental catch trigger of 6.6 tonnes/week *5

The harvest strategy is reviewed regularly by NPF RAG. Venables et al. has evaluated stock recruitment patterns relative to rainfall and this has been reviewed in the context of the Banana prawn harvest strategy. Both the past history of catches and analyses of residuals have shown that the control rules based on this LRP have been effective. Even in the years where there have been very poor catches in some areas, the rebound in the catch would indicate that the banana prawn fishery is resilient. Recent analyses have also shown that the catch rate at the end of the season is now higher than in earlier years, providing evidence that the escapement (biomass and number of prawns remaining at the end of the banana prawn fishing season (in April/May)) has increased in recent years.

Conclusions

The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points. (80).

The harvest strategy cannot formally be tested through a formal management strategy evaluation but monitoring is in place and evidence exists that it is achieving its objectives (80).

The harvest strategy is periodically reviewed and improved as necessary (100).

References

AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

Venables, B., Hutton, T., Lawrence, E., Rothlisberg, P., Buckworth, R., Hartcher, M., et al. (in press). *Predictions of common banana Prawn potential catch in Australia's Northern Prawn Fishery.* Canberra, Australia: Australian Fisheries Management Authority.

1.2	Target Species Harvest Strategy (Management)			
1.2.2	Harvest control rules and tools	60 Guideposts	80 Guideposts	100 Guideposts
	There are well defined and effective harvest control rules in place	Generally understood harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	

1.2	Target Species Harvest Strategy (Management)			
1.2.2	Harvest control rules and tools	60 Guideposts	80 Guideposts	100 Guideposts
		approached.		
			The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules take into account a wide range of uncertainties.
		There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
Score:80				

Justification

The common banana prawn fishery is managed by spatial and temporal closures. The fishing season opens for 12 weeks and can be shortened by increments of 2 weeks (triggered by catches less than 500 kg / day). There is evidence that escapement has increased in recent years under the harvest control rules (see 3.6.2.4) (CSIRO, pers comm.).

Uncertainties are taken account by the application of control rules that ensure that the exploitation rates are reduced as the trigger limits are reached. The trigger limits ensure sufficient escapement as to protect the spawning stock biomass.

The fishery is also supported by protected area closures.

Conclusions

Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as trigger limits are approached (80).

To the extent possible under input controls, the selection of the harvest control rules takes into account the main uncertainties (80).

Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules. (80).

References

AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. . www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

CSIRO (pers comm.) Email of 21st September, 2011

Kenyon R.A., Jarrett A.E., Bishop J.F.B., Taranto T.J., Dichmont C.M., Zhou S. (2005). Documenting the history of and providing protocols and criteria for changing existing and establishing new closures in the NPF: Final Report to AFMA (AFMA Project R02/0881).

1.2	Target Species Harvest Strategy (Management)			
1.2.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Relevant information is collected to support the	Some relevant information related to	Sufficient relevant information related to	A comprehensive range of information (on stock

1.2	Target Species Harvest Strategy (Management)			
1.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	harvest strategy	stock structure, stock productivity and fleet composition is available to support the harvest strategy.	stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available.
		Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	
			There is good information on all other fishery removals from the stock.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
Score: 90				

Justification:

A comprehensive data collection program has been established for the NPF to ensure reliable information is available on which to base management decisions. This includes fishery independent surveys, daily catch and effort logbooks, seasonal landing returns, VMS data and economic surveys. The NPF also has a crew member observer programme and a scientific observer programme.

Real time monitoring is used during the fishing season to feed the observed catch rate data into the closure options under the HS.

Conclusion

A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available (100).

There is good information on all other fishery removals from the stock (80).

References

1.2	Target Species Harvest Strategy (Management)			
1.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf				

1.2	Target Species Harvest Strategy (Management)			
1.2.4	**Assessment of Stock Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is an adequate assessment of the stock status	The assessment estimates stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
		The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
				The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
			The assessment of the stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
Score: 80				
Justification				
There is no formal assessment of the stock status but the harvest strategy (HS) is informed by real-time recording of catch rates at intervals throughout the banana prawn season. The trigger limit of less than 500kg/day has been set on historical data and has not resulted in overexploitation of the stock to date. Modelling has shown that annual recruitment and subsequent catches are driven more by environmental factors (rainfall) than by the size of the spawning stock in the previous year. Also, in some areas of the NPF the annual yield is not greatly influenced by the amount of fishing effort. Given these characteristics, the stock assessment and HS is appropriate for a stock that undergoes large inter-annual variation in abundance and catch as dictated by environmental conditions. The assessment and logic is subjected to peer review through the NPF RAG. Uncertainty is taken into account through the setting of conservative trigger limits, and supported by a number of additional measures including temporal and spatial closed areas.				

1.2	Target Species Harvest Strategy (Management)			
1.2.4	Assessment of Stock Status	60 Guideposts	80 Guideposts	100 Guideposts

Conclusions

The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points (80).

The assessment takes uncertainty into account (80)

The assessment methodology and logic is subject to review (80).

References

AFMA. (2010). *Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls.* Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

Venables, B., Hutton, T., Lawrence, E., Rothlisberg, P., Buckworth, R., Hartcher, M., et al. (in press). *Predictions of common banana Prawn potential catch in Australia's Northern Prawn Fishery.* Canberra, Australia: Australian Fisheries Management Authority.

Red-legged banana prawns (*Penaeus indicus)*

1.1	**Target Species Outcome**			
1.1.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
			The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.
Score: 90				
Justification:				
The most recent assessment of the status of red-legged prawn (AFMA, 2011) shows that stock status is above the TRP (B2010/BMEY = 119-126%) and well above the LRP (B2101/BMSY =134-152%) (section 3.6.2, Figure 12). The stock appears to be at a level which maintains high productivity and has a low probability of recruitment overfishing. However, there is a higher degree of uncertainty in the status of the red-legged banana stock compared with the three main species in the tiger prawn subfishery. There are no fishery independent surveys that can be used to provide indices of recruitment and spawning biomass and the assessment is complicated by the seasonal changes in fishing that have occurred and it was necessary to distinguish the results based on the fishing pattern during 1989-2006 and 2007-2010 when no fishing occurred during the first season in the JBG. Thus the wide 90% confidence intervals highlight the large uncertainty associated with model estimates of spawning biomass and its position relative to the TRP of S_{MEY}.				
Conclusion				
There is a high degree of certainty that the stock is above the point where recruitment would be impaired. (100). The stock is fluctuating around its target reference point (80).				
References				
AFMA. (2011). *NPF RAG Assessment 2010/11 Red-legged banana prawns.* Canberra, Australia: Australian Fisheries Management Authority.				

1.1	**Target Species Outcome**			
1.1.2	**Reference Points**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Limit and target reference points are appropriate for the stock	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
			The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following

1.1	Target Species Outcome			
1.1.2	Reference Points	60 Guideposts	80 Guideposts	100 Guideposts
				consideration of relevant precautionary issues.
			The target reference point is such that the stock is maintained at a level consistent with BMSY or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty
			For low trophic level species, the target reference point takes into account the ecological role of the stock.	
Score: 80				

Justification

Biomass reference points
The red-legged banana prawn is managed as part of both the banana prawn and the tiger prawn fishery. Formal biomass reference points were available at the time of the assessment but not incorporated into management until 2012. Prior to 2012, trigger limits in the banana prawn and tiger prawn fisheries were viewed as implicit LRPs and the implicit TRP which related to the general goal of ensuring that stocks did not fall below BMSY (and BMEY) after the harvest strategy was in place. The LRP for tiger prawns and red legged banana prawn is 0.5*BMSY, and the target reference point for red legged bananas can be interpreted as a the proxy for BMEY = 1.2*BMSY. It is also noted that during the first season, red-legged banana prawns were controlled in the 500kg/day limit, and during the second season by the 350kg/day limit that triggers shortening of the seasons.

The recent stock assessments, however, have considered some more formal reference points based on proxies used in the Commonwealth harvest strategy – LRP= $0.5B_{MSY}$ and TRP = $1.2B_{MSY}$ (MEY). These reference points are consistent with the Commonwealth Harvest Strategy and are similar to those accepted for the two species of tiger prawns and the blue endeavour prawn. Under input controls these equate to 860 fishing days for the TRP and a catch trigger limit of 390kg/day. However, fishing patterns are extremely conservative, and lowering triggers to 390kg/day are perceived as realistic given the search and find functions associated with the fishery.

In the management advice now provided to AFMA, JBG-specific catch recording and catch rate triggers for this species have been introduced in both seasons (first season from 1 April late June, and second season, from 1 August to November). Previous advice has consistently indicated that measures to conserve red-legged prawns were not required, although it was recognized that measures adopted (and reviewed) for the NPF and white banana species in the first season and tiger prawns for the second season, would have collateral benefit for red-legged prawn conservation and management. This has now been addressed with the incorporation of target and limit reference points for in the revised draft NPF HS for the JBG sub-fishery, noting that these are awaiting approval by the Commission for implementation in 2012.

Red-legged banana prawn is not considered a low trophic level species. Precautionary issues such as the ecological role of the stock have been considered but have not been taken into account in setting the TRP.

The new reference points have now been included in a draft amendment to the HS under input controls, and will be implemented in 2012, but at the time of the assessment, they were not applied to management of the fishery, or included in the HS.

Conclusion

1.1	Target Species Outcome			
1.1.2	**Reference Points**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
Reference points are appropriate for the stock and can be estimated (80). The default target reference point is consistent with maintaining the stock at BMSY (80). Red legged banana prawns are not a low trophic species (80).				
References				
AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf Reference meeting with CSIRO scientists (15 Sept) Eagan, M., April, 2012, Amendment to the harvestr control strategy under input controls to include reference points for red legged banana prawns.				

1.1	Target Species Outcome			
1.1.3	**Stock Rebuilding**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Where the stock is depleted, there is evidence of stock rebuilding	Where stocks are depleted rebuilding strategies which have a reasonable expectation of success are in place.	Where stocks are depleted rebuilding strategies are in place.	Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the shortest practicable timeframe.
		Monitoring is in place to determine whether they are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
Score: N/A				
Justification				
Conclusion				

1.2	Target Species Harvest Strategy (Management)			
1.2.1	**Harvest Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is a robust and precautionary harvest strategy in place.	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives

1.2	Target Species Harvest Strategy (Management)			
1.2.1	**Harvest Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
		reference points.	towards achieving management objectives reflected in the target and limit reference points.	reflected in the target and limit reference points.
		The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but monitoring is in place and evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels
		Monitoring is in place that is expected to determine whether the harvest strategy is working.		The harvest strategy is periodically reviewed and improved as necessary.
Score: 80				

Justification:

Prior to the 2012 season, the HS included red-legged banana prawns as part of the banana prawn fishery and the tiger prawn fishery, and was based on general effort restrictions and triggers to reduce the length of the fishing season. Based on the fact that the red-legged banana prawn stock recovered during the late 1990s and early 2000s, the strategy adopted for these – closed seasons, buy back, and catch triggers – was considered by AFMA to have been effective in reducing fishing pressure on red-legged banana prawns. It is noteworthy that there are only approximately 5 boats which fish for up to 14 days per month (on average) when the fishery is open. However, specific reference points were available for the fishery in 2011, and a fishery specific Harvest Strategy has been implemented for 2012. The new HS went into effect for the 2012 season (Eagan, 2012) prior to the peer review. It is too early to say whether the fishery is achieving its objectives linked to the new strategy, but it is evident that objectives were met in response to the old strategy, and through constant monitoring, will continue.

Conclusions

The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points (80).

Evidence suggests that the previous harvest strategy was fully tested and monitoring is in place and evidence exists that it is achieving its objectives. In response to the application of the new strategy, analagies can be drawn from the other two sub fisheries to address the issue of monitoring, testing and simulation (80).

Monitoring is in place that is expected to determine whether the harvest strategy is working (80).

References

AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

Eagan, M., April, 2012, Amendment to the harvest control strategy under input controls to include reference points for red legged banana prawns.

1.2	Target Species Harvest Strategy (Management)			
1.2.2	**Harvest control rules and tools**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There are well defined and	Generally understood	Well defined harvest	

1.2	Target Species Harvest Strategy (Management)			
1.2.2	**Harvest control rules and tools**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	effective harvest control rules in place	harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
			The selection of the harvest control rules takes into account the main uncertainties.	The <u>design</u> of the harvest control rules take into account a <u>wide</u> range of uncertainties.
		There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	<u>Evidence clearly shows</u> that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
Score: 80				

Justification

The control rules in place under input management (AFMA 2010) do not refer specifically to red-legged banana prawns but refer to trigger limits of 500 kg/day during the banana prawn season and 350 kg/day during the tiger prawn season. The red-legged banana prawn fishing was covered by these limits, and if triggered, results in the closure of the whole fishery. To make the control rules more specific to red-legged banana prawns and link to the new TRP and LRP, the HS was amended prior to commencement of the 2012 Red leg banana prawn fishery (Box 3). Limits are now set at 390 kg/day.

The catch triggers set are conservative, reflecting any uncertainties, though there are very limited risks associated with this fishery because of the low levels of effort relative to the other two sub fisheries. Temporal and spatial closed areas, as well as limited access times due to tides also illustrate both conservative management and conservative fishing practices.

Experience from both the tiger prawn and banana prawn fisheries suggest that analogous fisheries clearly demonstrate that the tools are in place for empiracle testing and simulation testing (FAM 6.3.11). The assessors will of course monitor this during surveillance and downgrade if the implementation and evidence does not occur.

Conclusions

Harvest controls have been in place for this sub fushery, but were strengthened in 2012 (80).

Harvest control have been set which are conservative and reflect the main uncertainties (80)

Available evidence indicates that the tools in use have been appropriate and effective in achieving the exploitation levels required under the harvest control rules (80).

Reference:

AFMA. (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

Kenyon R.A., Jarrett A.E., Bishop J.F.B., Taranto T.J., Dichmont C.M., Zhou S. (2005). Documenting the history of and providing protocols and criteria for changing existing and establishing new closures in the NPF: Final Report to AFMA (AFMA Project R02/0881).

1.2	Target Species Harvest Strategy (Management)			
1.2.2	Harvest control rules and tools	60 Guideposts	80 Guideposts	100 Guideposts

Eagan, M., April, 2012, Amendment to the harvest control strategy under input controls to include reference points for red legged banana prawns.

		Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	
			There is good information on all other fishery removals from the stock.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.

Score: 80

Justification

A comprehensive data collection program has been established for the NPF to ensure reliable information is available on which to base management decisions. For red-legged banana prawns, this includes daily catch and effort logbooks, seasonal landing returns, VMS data and economic surveys. The NPF also has a crew member observer programme and a scientific observer programme. There is a good understanding of uncertainties in the information that has been tested through sensitivity analyses in the stock assessment. There are no fishery-independent surveys undertaken in Joseph Bonaparte Gulf.

There are no other fishery removals from the stock.

Conclusion

Level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule. (80)

Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule. (80)

There is good information on all other fishery removals from the stock. (80)

References

AFMA. (2001). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf

1.2	Target Species Harvest Strategy (Management)			
1.2.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Relevant information is collected to support the harvest strategy	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available.
		Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	
			There is good information on all other fishery removals from the stock.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
Score: 100				
Justification				
A comprehensive data collection program has been established for the NPF to ensure reliable information is available on which to base management decisions. This includes fishery independent surveys (both at				

1.2	Target Species Harvest Strategy (Management)			
1.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
the time of prawn recruitment ("recruitment" surveys) and at the time of peak spawning ("spawning" surveys), daily catch and effort logbooks, seasonal landing returns, VMS data and economic surveys. The NPF also has a crew member observer programme and a scientific observer programme. There is a good understanding of uncertainties in the information that has been tested through sensitivity analyses in the stock assessment (see above for MSE references). Environmental information includes general climatic observations through the Australian meteorological network, oceanographic observations during past research cruises and the annual "recruitment" and "spawning" survey cruises. The information is used in the regular stock assessments, and fed in real time into the HS decision making process that determines the length of closures and the appropriate fishing effort level to achieve the TRP.				
Conclusion				
A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available (100). All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty (100).				
References				
AFMA (2010). Northern Prawn Fishery (NPF) Harvest Strategy under Inputs Controls. Canberra, Australia: Australian Fisheries Management Authority. www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf				

1.2	Target Species Harvest Strategy (Management)			
1.2.4	**Assessment of Stock Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is an adequate assessment of the stock status	The assessment estimates stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
		The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
				The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.

1.2	Target Species Harvest Strategy (Management)			
1.2.4	**Assessment of Stock Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
			The assessment of the stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
Score: 80				

Justification

Red-legged banana prawns are assessed using a quarterly "age-based" biological model based on weekly catch and effort data starting in 1980. The assessment takes into account main uncertainties, especially in the interpretation of catch rates.

The modelling is carried out by CSIRO under contract from the Australian Fisheries Management Authority. It is conducted by a team of data, information and stock assessment specialists including part-time input from a world-renown expert from the University of Washington. Modelling results are then reviewed by the Northern Prawn Research Advisory Group (NPFRAG) comprised of scientists, economist, fishery managers, fishing representatives, and environmentalists. Peer-group review of the actual assessments is provided by two independent stock assessment experts in the RAG. Sensitivity tests have been carried out that indicate relative robustness to assumptions and different types of assessment techniques. These are taken into account in assessing stock status.

There is a good assessment of the stock status.

Conclusions

The assessment estimates stock status relative to reference points (reference points stated in the stock assessment. (80).

The assessment takes uncertainty into account (80).

The assessment has been internally peer reviewed (80).

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Principle 2 Performance Indicators and Scoring Guideposts

The Tiger prawn fishery

2.1	Retained Non-target Species			
2.1.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species.	Main retained species are likely to be within biologically based limits or if outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.	Main retained species are highly likely to be within biologically based limits, or if outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.	There is a high degree of certainty that retained species are within biologically based limits.
		If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.		Target reference points are defined and retained species are at or fluctuating around their target reference points.
Score: 90				
Justification				
Retained species comprise less than 1% of the catch composition of the NPF as a whole. By weight, 87% (2004-2010 average) of the NPF retained species derive from the tiger prawn sub-fishery. The most common retained species in the tiger prawn sub-fishery (>20 t total in 2004-2010) are bugs, squids, king prawns, cuttlefishes and scampi. A recent scientific study considered that the main retained species in the NPF as a whole are two species of bugs, two species of scallops, five species of cuttlefishes and six species of squids. However, risks to all 135 retained species were examined in a Level 2 ecological risk assessment (productivity-susceptibility analysis). The Level 2 ERA classified 16 retained species as being at high risk. All but three of these were subsequently reclassified to a lower risk level either in the Level 2 Residual Risk assessment (two cuttlefishes), on the basis of expert judgement (two cuttlefishes and a squid (note documentation issue described in Section 3.7.2.3), or in a Level 2.5 quantitative risk assessment (eight demersal fishes). The three remaining species (*Dictyosquilla tuberculata* (mantis shrimp), *Harpiosquilla stephensoni* (mantis shrimp) and *Solenocera australiana* (coral prawn)) are included on an NPF priority species list and are monitored by crew member observers and scientific observers. Monitoring data show no records of the mantis shrimps but common occurrence of the coral prawn. On the basis of high abundance in the monitoring surveys, the coral prawn was recommended for removal from the list. Acceptable biological catch (ABC) levels (limit reference points) have been developed for four categories, which comprise over 90% of the retained catch in the NPF as a whole (main retained species): bugs (two species), scallops (two species), cuttlefishes (five species) and squids (six species). Catch levels for bugs, scallops and cuttlefishes are well below the ABCs. The squid catch level for the NPF as a whole approached the ABC (~200 t) in 2007 only. In other recent years (2004-2010) squid catches have been an order of magnitude or more lower. Also, there is some uncertainty regarding whether the squid ABC has been under-estimated. Squid catches are being continuously monitored and a catch trigger limit of 500 t for the NPF as a whole has been set under the NPF Harvest Strategy. There are no ABCs for other retained species such as king prawns and scampi, but the catches of these species are low relative to the retained catch as a whole (<4% of the retained catch, which is in turn <1% of the total catch).				
Conclusion				
All retained species have been subject to a quantitative ecological risk assessment as discussed in Section 3.7.2. These assessments, based on a robust methodology, provide a comprehensive evaluation of the retained species. Two mantis shrimps which were considered in theory to be at high risk in the Level 2 ERA, are being continuously monitored by observers but have never been recorded. Biologically-based limits, in the form of Acceptable Biological Catch (ABC) values which are catch limit reference values based on MSY exploitation rates and life history traits, have been estimated for four main groups of retained species (bugs, scallops, cuttlefishes and squids). Catches of the former three groups are well below the ABCs. Therefore, there is a high degree of certainty that these three groups are within				

2.1	Retained Non-target Species			
2.1.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
biologically-based limits. Squid catches in the tiger prawn sub-fishery tally to only ~10% of the ABC for the NPF as a whole. Thus there is a high degree of certainty that squid catches in the tiger prawn sub-fishery are also within biologically-based limits even if for the NPF as a whole squid catches approached the ABC in 2007. All other retained species are considered low risk and/or interact only rarely with the fishery (100). Although the ABCs have been estimated, they are limit rather than target reference points so the second scoring issue of SG100 is not met.				
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Unpublished data on retained species provided by AFMA, November 2011. Griffiths, S., Kenyon, R., Bulman, C., Dowdney, J., Williams, A., Sporcic, M. and Fuller, M. 2007. Ecological Risk Assessment for Effects of Fishing: Report for the Northern Prawn Fishery. Report for the Australian Fisheries Management Authority, Canberra, 319pp. AFMA. 2008b. Residual Risk Assessment of the Level 2 Ecological Risk Assessment species results: Report for the Northern Prawn Fishery, December 2008. AFMA. 2009b. Ecological Risk Management: Report for the Northern Prawn Fishery – Tiger and Banana Prawn Sub-fisheries Brewer, D.T., Griffiths, S., Heales, D.S,, Zhou, S., Tonks, M., Dell, Q., Taylor, B.T., Miller, M., Kuhnert, P., Keys, S., Whitelaw, W., Burke, A., and Raudzens, E. 2007. Design, trial and implementation of an integrated, long-term bycatch monitoring program, road tested in the Northern Prawn Fishery. Final Report on FRDC Project 2002/035. CSIRO, 393 pp. Fry, G., Brewer, D., Dell, Q., Tonks, M., Lawrence, E., Venables, W., Darnell, R. 2009. Assessing the sustainability of the Northern Prawn Fishery bycatch from annual monitoring data. AFMA Project 2008/826, CSIRO Marine and Atmospheric Research. Milton, D.A., Fry, G. C., Tonks, M., Zhou, S., Kuhnert, P., and Zhu, M. 2010. Assessing data poor resources: developing a management strategy for byproduct species in the Northern Prawn. FRDC Project 2006/008 Final Report. AFMA Harvest Strategy AFMA. 2007. Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls – August 2007.				

2.1	Retained Non-target Species			
2.1.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
		The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports high confidence that the strategy will work.
			There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully, and intended changes are

2.1	Retained Non-target Species			
2.1.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
				occurring
				There is some evidence that the strategy is achieving its overall objective.
Score: 80				

Justification

Byproduct management strategies (the Harvest Strategy and the forthcoming Non-key Commercial Species (Byproduct) Policy) are applied across the NPF as a whole and are designed to ensure that regional byproduct resources are sustained.

The NPF's Harvest Strategy contains limits and/or measures for several groups of retained species, including bugs and squid. None of the retained species in the harvest strategy have been assessed as being at high risk in the ecological risk assessment. AFMA is currently developing a Non-key Commercial Species (Byproduct) Policy, which is planned to include the three retained species identified as being at high risk in the ecological risk assessment, as well as some cuttlefish and other squid species.

Based on the results of a recent byproduct research programme, the acceptable biological catch for squid is estimated at 200 t, which suggests that the Harvest Strategy's limit of 500 t may warrant reconsideration. The same study found that the bugs' minimum size limit could be reduced from 75 mm to 65 mm without adverse effects on the sustainability of the resource. Although no other groups of species examined by this study (i.e., cuttlefishes and scallops) are included in the current harvest strategy, catches of these groups are well below the ABC levels.

Conclusion

There are formal measures in place for two of four key byproduct species groups: squid and bugs. Recent scientific evaluation has evaluated current catches and estimated acceptable biological catches for squid, bugs, cuttlefishes and scallops, and no instances of overfishing were identified. A more complete Non-Key Commercial Species (Byproduct) Policy is also being developed. It can therefore be concluded that there is a partial strategy currently in place (80).

The partial strategy is based on the ABCs (limit reference points), life history characteristics of the main retained species, and ongoing monitoring of these species. The results of the monitoring demonstrate that biologically-based limits are not being exceeded for the species covered by the partial strategy, thus there can be some confidence that the partial strategy is working (80) and is being implemented successfully by NORMAC and AFMA (80).

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2.1	Retained Non-target Species			
2.1.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
AFMA Harvest Strategy AFMA. 2007. Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls, August 2007.				

2.1	Retained Non-target Species			
2.1.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species. *(Note: Scoring issues in brackets need not be scored when the RBF is used to score PI 2.1.1.)*	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
		(Information is adequate to qualitatively assess outcome status with respect to biologically based limits.)	(Information is sufficient to estimate outcome status with respect to biologically based limits.)	(Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.)
		Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a comprehensive strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
			Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.
Score: 85				
Justification				

Quantitative data on all retained species is required by the mandatory logbook format of the NPF and the entire catch is represented in the logbook data. However, some similar species are recorded in combined, non-species-specific reporting categories because the species are not common and difficult to separate. This level of detail is deemed adequate by the management system because level 2 risk assessment has been conducted for essentially all of the species nordmally encountered. It is the case that recorded quantities in logbooks may not reflect abundance since retention and reporting rates may vary based on fishery operational costs, prawn and byproduct prices, prawn and byproduct catch rates, and vessel crew behaviour.

Crew member observers and scientific observers also collect information on all retained species encountered. There were 5 crew member observers in the tiger prawn sub-fishery in 2010 with coverage of nearly 5%. The current coverage of the scientific observer programme is 2.5%.

Scientific studies of actual catches versus acceptable biological catches have recently been completed for four main groups of byproduct species: squids, cuttlefishes, bugs and scampi. These concluded that recent annual catches of each byproduct group are a small proportion of the estimated biologically-sustainable total annual catch for those groups, except for squid which was near, but below, the biologically-sustainable level. Squid catches were found to be highly variable between years and the need for further study was noted.

2.1	Retained Non-target Species			
2.1.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Information from the scientific studies has been used to evaluate the partial strategy under the NPF Harvest Strategy for squid and bugs. Information from the ecological risk assessment process has been used to select high risk species for ongoing monitoring.

Ongoing data collection for retained species is required under the mandatory logbook format for the NPF.

Conclusion

In the logbooks, quantitative data are available for the entire catch but some species are reported as a group (non-species specific reporting). However, observer coverage by crew member observers (~5%) and scientific observers (2.5%) supplements this with data for all retained species encountered. Studies have assessed the results of both programmes and made technical recommendations (100).

Quantitative scientific studies have recently been completed and information has been sufficient to estimate outcome status with regard to biological limits. The status of certain species with high annual variability remains somewhat uncertain due to the biology of these species rather than lack of information (80).

Available information is adequate to support a strategy in the form of the existing NPF Harvest Strategy, which incorporates limits and/or measures on squid and bugs. As concluded above (2.1.2) this is a partial strategy which is achieving its objective (80).

Sufficient data are continuously collected through the NPF logbooks and observer programmes and are used to monitor status for some main retained species (e.g., against the squid and bugs catch trigger limits) (80).

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AFMA. 2007. Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls – August 2007.

2.2	Bycatch Species			
2.2.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of	Main bycatch species are likely to be within biologically based limits, or if outside such limits there are mitigation	Main bycatch species are highly likely to be within biologically based limits or if outside such limits there is a partial strategy of	There is a high degree of certainty that bycatch species are within biologically based limits.

2.2	Bycatch Species			
2.2.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	depleted bycatch species or species groups.	measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.	demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.	
		If the status is poorly known there are measures or practices in place that are expected result in the fishery not causing the bycatch species to be outside biologically based limits or hindering recovery.		
Score: 80				
Justification				

A study of bycatch species in the tiger prawn sub-fishery (which included the NPF and the Torres Strait prawn fisheries) found 359 species from 100 families. Bathysauridae (deepwater lizardfishes), Leiognathidae (ponyfishes) and Nemipteridae (threadfin breams), which together comprise at least 27 species, contributed over 35% of the weight of the bycatch. While these species may be considered the main bycatch species in the fishery, all species known to interact with the fishery were assessed under the NPF ecological risk assessment. A quantitative ecological risk assessment (SAFE) was conducted for 51 elasmobranch species and 456 teleost species, some of which are ETP species assessed separately.

Five elasmobranch species had an estimated fishing induced mortality rate (u) greater than the minimum unsustainable fishing mortality (u_{crash}): *Carcharhinus albimarginatus* (silvertip shark), *Orectolobus ornatus* (ornate wobbegong), *Squatina* sp. A (eastern angel shark), *Taeniura meyeni* (blotched fantail ray), and *Urogymnus asperrimus* (porcupine ray). In addition, for five other species, the 95% confidence interval for the estimate of u exceeded the estimated u_{crash} value: *Carcharhinus brevipinna* (spinner shark), *Carcharhinus leucas* (bull shark), *Pristis microdon* (freshwater sawfish), *Pristis zijsron* (green sawfish), and *Sphyrna mokarran* (great hammerhead). Expert consultation suggested that most of these species were unlikely to be realistically threatened by the fishery because their main distribution extends into deep water (>70 m) or over reefs that are largely unaffected by the NPF. Specifically, for the five species where u exceeded u_{crash}, the risks to *C. albimarginatus*, *O. ornatus* and *Squatina* sp. and were downgraded by expert override. The two remaining species (blotched fantail ray and porcupine ray) were added to the NPF's priority species list. A re-evaluation for the period 2007-2009 found five species with estimates of fishing mortality (F) higher than the maximum sustainable fishing mortality (F_{msm}) and the upper 90% confidence interval for fishing mortality (F) higher than the unsustainable fishing mortality (F_{crash}). These species were *C. albimarginatus*, *C. leucas*, *Galeocerdo cuvier* (tiger shark), *O. ornatus* and *S. mokarran*. None were considered to be at risk due to widespread distributions and/or low overlaps with the fishery. Furthermore, the blotched fantail ray was re-assessed as having a low risk, mainly due to its low occurrence in the fished area, and the porcupine ray was only considered at risk because its upper 90% confidence interval exceeded F_{msm}.

Five teleost species were found to be at risk due to the current fishing mortality exceeding the u_{msy} reference. Nine other species with lower assessed risk levels, were added to the list of species of concern resulting from the SAFE as a result of a Bycatch Subcommittee meeting in January 2009: *Dendrochirus brachypterus* (dwarf lionfish), *Scorpaenopsis venosa* (raggy scorpionfish), *Parascolopsis tosensis* (Tosa dwarf monocle bream), *Hemiramphus robustus* (three-by-two garfish), *Lutjanus rufolineatus* (yellow-lined snapper), *Onigocia spinosa* (midget flathead), *Benthosema pterotum* (skinnycheek lanternfish), *Scomberoides commersonnianus* (Talang queenfish) and *Sphyraena jello* (giant seapike). However, the assessed risks to seven of these species were downgraded through expert overrides (due to lack of overlap with the NPF geographically or by habitat or gear selectivity) and only two species (dwarf lionfish and raggy scorpionfish) were maintained on the NPF list of priority species. An update to the SAFE for 2007-2009 found that neither of these species had estimated fishing mortality greater than F_{msm}, even when uncertainty was considered, and no other teleost species were found to be of concern.

Of the four bycatch species placed on the NPF's list of priority species for monitoring, none have been recorded in the observer monitoring programmes. While this could be due to low observer coverage or mis-identification, scientists have suggested that these four species are either hard bottom-associated and/or would be excluded by TED and are therefore unlikely to be encountered.

2.2	Bycatch Species			
2.2.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
Conclusion				
The status of the main bycatch species is considered to be well-known. A comprehensive assessment of bycatch species determined that of 507 species assessed, only four (blotched fantail ray, porcupine ray, dwarf lionfish and raggy scorpionfish) were at risk from the fishery because they exceeded a biologically-based limit. These four species were incorporated into the observer monitoring programme but no interactions with these species have yet been recorded. Scientists suggest that these four species may be hard bottom-associated, and thus outside the trawlable fishing grounds or that interactions are otherwise mitigated through TEDs. The risk assessment gave priority consideration to those species whose median estimates (50^{th} percentile) of fishing mortality exceeded the reference points. It is not clear whether those species whose median estimate did not exceed, but whose 90% confidence interval (i.e. 95^{th} percentile) did exceed, the reference point were consistently carried through to the expert override stage. However, given that none of the species with greater exceedances of the reference points (i.e. exceedance at 50^{th} percentile versus 95^{th} percentile) were ultimately found to be at risk, the probability that these other lower risk species are within biologically based limit is considered to be highly likely (80).				
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2.2	Bycatch Species			
2.2.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations.	There are measures in place, if necessary, which are expected to maintain main bycatch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.	There is a partial strategy in place, if necessary, for managing bycatch that is expected to maintain main bycatch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.	There is a strategy in place for managing and minimising bycatch.
		The measures are considered likely to work, based on plausible	There is some objective basis for confidence that the partial strategy will	The strategy is mainly based on information directly about the fishery

2.2	Bycatch Species			
2.2.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
		argument (e.g. general experience, theory or comparison with similar fisheries/species).	work, based on some information directly about the fishery and/or the species involved.	and/or species involved, and testing supports high confidence that the strategy will work.
			There is some evidence that the partial strategy is being implemented successfully.	There is some evidence that the strategy is achieving its objective.
				There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring.
Score: 95				

Justification

The NPF has a Bycatch Action Plan (BAP) which comprises a strategy for bycatch reduction involving ecological risk assessment of all species (to identify issues), effort reduction, temporal and spatial closures, monitoring and research on use of bycatch reduction devices. The strategy specifies actions directed at those species with identifiable risks. The actions required are commonly used in shrimp/prawn fisheries and have a high level of success. The NPF implemented mandatory use of a specific suite of turtle exclusion devices (TEDs) and bycatch reduction devices (BRDs) in 2001. Field evaluations of the implementation of NPF-approved TEDs and BRDs have documented catch reductions for turtles of 99%, seasnakes of 5%, sharks of 17.7%, rays of 36.3%, large sponges of 85.3%, and small bycatch of 8%. Overall, the fishery reports achieving a 50% reduction in bycatch since the implementation of its first BAP in 1998, and is pursuing additional research to achieve further bycatch reductions.

Four species assessed as being at high risk from the fishery have been placed on a list of priority species for monitoring and are recorded by crew member and scientific observers. No interactions with these species have yet been recorded and while this could be due to low observer coverage or mis-identification, scientists have suggested that these four species are hard bottom-associated and/or excluded by TEDs thus interactions would not be expected. Other bycatch species are only monitored opportunistically by observers whose focus is the list of priority species and ETPs.

Conclusion

The BAP, in conjunction with mandatory use of TEDs/BRDs, use of risk assessments of all species to identify high risks, and the observer monitoring programme for priority species, constitutes a strategy for managing and minimizing bycatch (100). Periodic updates of the Ecological Risk Management document assure that the strategy remains up to date.

The strategy is based directly on the NPF and scientific testing has proven that substantial bycatch reduction will result from proper use of the devices (100). These methods have been used successfully in other similar fisheries.

The NPF claims to have reduced bycatch by 50% but since bycatch quantity and species composition is not routinely monitored, there is only indirect evidence of successful implementation (i.e., reductions in ETP species interactions, which presumably mean TEDs/BRDs are working effectively and thus presumably having an effect on non-ETP species as well). Therefore, there is some evidence that the strategy is achieving its objective (100).

However, some concerns have been expressed about the positioning of BRDs for maximum effectiveness, and lacking further evidence of the successful implementation of bycatch reduction for bycatch species per se, and the lack of any recording of high priority bycatch species by observers, the evidence for the success of the strategy for bycatch species is not entirely clear (80).

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2.2	Bycatch Species			
2.2.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

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2.2	Bycatch Species			
2.2.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Information on the nature and amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch. *(Note: Scoring issues in brackets need not be scored when the RBF is used to score PI 2.1.1.)*	Qualitative information is available on the amount of main bycatch species affected by the fishery.	Qualitative information and some quantitative information are available on the amount of main bycatch species affected by the fishery	Accurate and verifiable information is available on the amount of all bycatch and the consequences for the status of affected populations.
		(Information is adequate to broadly understand outcome status with respect to biologically based limits.)	(Information is sufficient to estimate outcome status with respect to biologically based limits.)	(Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.)
		Information is adequate to support measures to manage bycatch.	Information is adequate to support a partial strategy to manage main bycatch species.	Information is adequate to support a comprehensive strategy to manage bycatch, and evaluate with a high degree of certainty whether a strategy is achieving its objective.
			Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.
Score: 80				

Justification

Several comprehensive scientific surveys have been conducted to assess the bycatch in the tiger prawn sub-fishery. Several quantitative ecological risk assessments have been undertaken using state-of-the-art methods. However, bycatch data collection from the fishery itself is not required by the logbook reporting format. Crew member observers and scientific observers focus their efforts on a list of four priority bycatch species defined through the ecological risk assessment process and ETP species. As a result, there is no ongoing operational data collection on total bycatch quantities or species composition. Research has been conducted to investigate the sample sizes required to detect statistically significant changes in the abundance of rarer (and thus of greater concern) bycatch species, but this research concluded that in most cases the sampling effort is beyond practically achievable levels.

Conclusion

2.2	Bycatch Species			
2.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Qualitative and some quantitative information are available on all bycatch species affected by the fishery through ecological risk assessment, observers and research studies (80).

The observer programme for the tiger prawn sub-fishery is designed to provide sufficient quantitative information to evaluate the outcome status of the four at-risk bycatch species, though to date, no occurrences have been recorded and thus it can be concluded that impacts are somewhat uncertain but likely to be low (80).

Given the comprehensive baseline datasets established and the rigorous ecological risk assessment process, this information is considered adequate to support the strategy to manage bycatch (BAP); however, there may not be a high degree of certainty given the lack of direct evidence pertaining to bycatch species per se (see 2.2.2) (80).

Main bycatch species have been assessed as not being at risk, therefore monitoring focuses on four species that are at risk but rare. Research has suggested that statistically significant change may be difficult to detect due to low occurrence rates, regardless of sample size. Considering these factors, the sampling programme is deemed to be sufficient for the main bycatch species (80).

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery meets	Known effects of the	The effects of the fishery	There is a high degree of

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	national and international requirements for protection of ETP species. The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species.	fishery are <u>likely</u> to be within limits of national and international requirements for protection of ETP species.	are known and are <u>highly likely</u> to be within limits of national and international requirements for protection of ETP species.	<u>certainty</u> that the effects of the fishery are within limits of national and international requirements for protection of ETP species.
		Known direct effects are <u>unlikely</u> to create <u>unacceptable impacts</u> to ETP species.	Direct effects are <u>highly unlikely</u> to create <u>unacceptable impacts</u> to ETP species.	There is a <u>high degree of confidence</u> that there are <u>no significant detrimental effects (direct and indirect)</u> of the fishery on ETP species.
			Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	
Score: 90				
Justification				

In an early ecological risk assessment based on productivity-susceptibility analyses (2007), five species of sawfishes and four species of seasnakes were considered to be at high risk in the tiger prawn sub-fishery. In a subsequent risk assessment based on the SAFE methodology, none of these species were found to be at high risk (2011; see Section 3.7.3 for details). ETP species are constantly monitored by the NPF (logbooks, and both observer programmes), which allows for recognition of potential changes in status and opportunities for plan adjustments. There are national plans of action or recovery for turtles, sharks and whale sharks (specifically). On 22 December 2008, the Australian Minister for the Environmental, Heritage and the Arts certified that an assessment of the NPF under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) found that the fishery was “unlikely to be detrimental to the survival or conservation status of any taxon to which the fishery operation relates, or threaten any relevant ecosystem in the medium to long term”. As a result, export of NPF product has been authorized until 9 January 2014.

Marine mammals (whales, dolphins, dugongs)
Most marine mammals are too large to be entangled in the size of trawl fished in the NPF, or would be excluded by TEDs, which have been mandatory in the fishery since 2001. A single dolphin interaction was recorded for the tiger prawn sub-fishery in 2006 and 2007; no other marine mammal interactions have been recorded since 2004.

Marine birds
In the risk assessment, specialists noted that there have been no historical bird interactions in the NPF. Monitoring data since 2004 indicates 5 gull-billed tern interactions in the tiger prawn sub-fishery in 2006. Indirect effects on foraging ecology have been considered but impacts have not been documented.

Marine reptiles (turtles, crocodiles and seasnakes)
TEDs have reduced the bycatch of turtles in the NPF as whole from approximately 5,700 to 30 per year. Flatback, green, olive ridley, hawksbill and loggerhead turtles have been encountered in the tiger prawn sub-fishery. Overall in the NPF, 96% of turtles were alive at the time of interaction. Interactions with crocodiles are mitigated by the lack of overlap of their habitat with NPF fishing areas, and no interactions have been recorded. An annual average of 6,000 seasnake interactions has been recorded for the tiger prawn sub-fishery between 2004-2010. On average, for the NPF as a whole, only two-thirds of the seasnakes may survive the interaction. Catch rates for the ten most common species of seasnakes have remained stable from 1976-2008. Although there is recognition by the NPF that further reduction in seasnake interaction rates is necessary as they are Australian TEP species. A study of seasnakes completed in 2008 found that they are not at risk and thus population status has not been further assessed (see Section 3.7.3).

Elasmobranch fishes (sharks and sawfishes)
Despite the lack of documentation of unacceptable risk, it is recognized that there is high overlap of the NPF with the distribution of some sawfishes (mainly the narrow sawfish, *Anoxypristis cuspidata*). They have a high degree of endemism, they are slow-moving, and they are highly susceptible to capture due to their rostrum teeth entangling in the net mesh. There are also concerns that cumulative impacts to sawfish from domestic gillnet fisheries and from

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	Status	60 Guideposts	80 Guideposts	100 Guideposts

Indonesian fisheries to the north cannot be or have not been fully accounted for in the ecological risk methodology. Sawfishes reported from the tiger prawn sub-fishery include narrow, green, freshwater, dwarf, common sawshark and unidentified sawfishes. For the NPF as a whole, catches for sawfish (which are most likely the narrow sawfish) appear to have been stable between 1990 and 2002 but slightly increasing since 2003 with no statistically significant trend overall. Catch rate trends for dwarf and green sawfish are difficult to interpret due to low sample sizes. The annual average number of sawfish encounters in the tiger prawn sub-fishery is 180. No interactions with elasmobranch species other than sawfishes have been recorded in logbooks for the tiger prawn sub-fishery. Elasmobranches, reported as a group for the NPF as whole, survive interactions at a rate of 67%.

Teleost fishes (Syngnathids)
There is a low risk of interaction with seahorses, pipefishes and seadragons due to the exclusion of benthic seagrass and other structured habitats preferred by these species from the NPF's fishing grounds due to Protected Area Closures. With the exception of 2007 when 1,726 Syngnathid interactions were recorded, there were no more than 38 interactions per year in the tiger prawn sub-fishery. Due to their delicate nature, the number of Syngnathids surviving interactions is a little as 2% (figures for NPF as a whole).

Conclusion

Direct and indirect fishery effects and their impacts on ETP species have been accounted for in the ecological risk assessments and no species in any of the five groups have been assessed as "at risk". Furthermore, the Australian government's export certification process has declared that the NPF meets the requirements of the EPBC Act. Therefore there is a high degree of certainty that all national and relevant international requirements with regard to ETP are met (100).

Despite the fact that impacts are considered acceptable, there is acknowledgement that some risks still exist. The NPF notes that recent BRD implementation has not proven effective at reducing seasnake catch in the NPF when set at the maximum legal distance from the codend. There are also concerns that cumulative impacts to sawfishes have not been adequately accounted for and that interaction rates have not been adequately reduced by TEDs due to sawfish rostrum entanglement. Therefore, while direct and indirect impacts are considered acceptable, they may still be significant and are the subject of continuing research (80).

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery has in place precautionary management strategies designed to: - meet national and international requirements; - ensure the fishery does not pose a risk of serious or irreversible harm to ETP species; - ensure the fishery does not hinder recovery of ETP species; and - minimise mortality of ETP species.	There are measures in place that minimise mortality, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality that is designed to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality that is designed to achieve above national and international requirements for the protection of ETP species.
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is an objective basis for confidence that the strategy will work, based on some information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work.
			There is evidence that the strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is evidence that the strategy is achieving its objective.

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
Score: 95				

Justification

The NPF has formulated and implemented a Bycatch and Discarding Work Plan (BDWP) and an Ecological Risk Management Strategy, which encapsulate the NPF's strategy for overall minimisation of bycatch through developing management responses to high ecological risks and measures to avoid fishery interactions with species listed under the EPBC Act. This strategy comprises temporal and spatial closures, monitoring programmes, research projects and bycatch reduction activities such as development and testing of new BRDs.

As none of the ETP species have been found to be at high risk from the fishery, the main management achievements for ETP species have been in the form of bycatch reduction, in particular turtle bycatch has been reduced by 99%. However, TEDs and BRDs have had mixed success for other organisms: one study reported that TEDs reduced catches of narrow sawfish by 73% whereas other studies found only a slight effect or no effect due to entanglement before the TED is contacted. Similarly for seasnakes, research results showed that BRDs did not effectively reduce bycatch when placed at the maximum legal distance from the codend, although they did reduce crushing of caught seasnakes and thus improved survival. The need to further reduce seasnake bycatch has been addressed through testing and approval of the Popeye Fishbox BRD which can achieve an 85% reduction in seasnake catch. The NPF intends to release a study by mid-2012 that will review the implementation, usage and effectiveness of BRDs, but at this time no information is available on the implementation rates of various BRDs.

Monitoring programmes, which for TEP species include logbooks, crew member observers and scientific observers, and ad hoc but ongoing research programmes, assess the effects of the fishery on TEP species. There are no defined trigger levels for management action, rather AFMA monitors the currently low levels of interaction and if they begin to rise, management action will be discussed.

Conclusion

There is a strategy in place to manage the fishery's impacts on ETP species. Given that none of these species have been found to be at risk from the fishery, current levels of impacts (interactions) are considered to exceed national and international requirements for these species' protection (100).

The strategy is based on research conducted for this fishery and quantitative analysis provides high confidence and evidence that the strategy does work (100).

There is evidence that the strategy is being implemented successfully given that interactions are monitored, and though variable year-to-year, do not appear to be rising. However, one of the recommendations arising from the 2008 DEWHA export certification was that the NPF should continue to effectively mitigate against and reduce bycatch in the fishery, particularly for sawfish, rays and sea snakes. Based on interaction data from logbooks, supplemented by the findings of research studies, it does not appear that seasnake and sawfish interactions are being continuously reduced under the current management strategy, particularly since the utilization rates for effective BRD types and deployments is not currently monitored. Therefore it cannot be confirmed that the intended changes are occurring (80).

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.3	**Information/ Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Relevant information is collected to support the management of fishery impacts on ETP species, including: - information for the development of the management strategy; - information to assess the effectiveness of the management strategy; and - information to determine the outcome status of ETP species.	Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species, and if so, to measure trends and support a full strategy to manage impacts.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
		Information is adequate to support measures to manage the impacts on ETP species	Sufficient data are available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.
		Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.		Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.

Score: 85

Justification

There are two types of data available to estimate the impacts of the fishery on ETP species: comprehensive, but spatial and temporally limited research studies; and ongoing monitoring of the fishery itself. The former was used as the basis for the quantitative ecological risk assessment, which found that no ETP species are at risk from the fishery. However, it was acknowledged that cumulative impacts may need to be better accounted for in the methodology, particularly for those species that are known to be regionally/globally threatened such as sawfishes (CITES Appendix I listed for all but one species which is CITES Appendix II; IUCN Red List Critically Endangered).

The monitoring data are designed to indicate trends in interactions between ETP species and the fishery. In the tiger prawn sub-fishery, ETP monitoring data are provided by NPF logbooks, the crew member observer programme and the scientific observer programme. The two observer programmes have coverage of 5% and 2.5%, respectively. ETP species interaction rates recorded in logbooks and by crew member observers are generally much lower, and are less likely to be species-specific, than those recorded by scientific observers. For a variety of reasons, species-

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts

specific identifications are not always provided (e.g., in some cases, obtaining a species identification could work against the live release of the organism (sawfishes)). This, in combination with low catch rates, makes it difficult to analyse the data for changes in abundance. A study examining the requisite sample sizes to detect a statistically significant difference found that the number of samples required to assess rare species is well beyond practical limits of the observer and monitoring programmes; therefore, other strategies were recommended.

Conclusion

The combination of quantitative ecological risk assessment and ongoing fishery monitoring is sufficient to determine whether the fishery is a threat to ETP species; to measure trends; and to support the Bycatch and Discarding Work Plan and Ecological Risk Management Strategy (80).

Sufficient data are available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species (i.e., through ecological risk assessment). Fishing related mortality and quantitative estimates of impacts have been undertaken for species of concern through the SAFE-level risk assessments (elasmobranchs, see Section 3.7.1) and statistical analysis of catch rates (seasnakes) (80).

While the monitoring programmes, in particular the scientific observer programme provide accurate and verifiable information (100), the extent of the observer programmes (5% for crew member observers and 2.5% for scientific observers) is considered insufficient to provide enough species-specific data to support a comprehensive strategy or to estimate outcome status with a high degree of certainty (does not meet the first two 100 SGs).

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CSIRO, personal communication, September 2011

2.4	Habitat			
2.4.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function.	The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.

2.4	Habitat			
2.4.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
Score: 100				

Justification

The tiger prawn sub-fishery is believed to have the greatest potential for benthic habitat impacts because it is most closely associated with the seabed of the three NPF sub-fisheries. However, none of the 157 habitat types (benthic and water column) evaluated under the Level 2.5 ecological risk assessment were found to be at high risk. Throughout the NPF fishing effort is concentrated in a 3-month period and occurs over only about 3% of the managed region. One study found that over a 5-year period only 17% of the managed region was trawled at all. The trawled “hotspots” tend to change from year to year such that only a very small proportion of the fished area of the NPF makes up the same hotspot every year.
Recent studies in the Gulf of Carpentaria involving sampling of sites that were subject to high, medium and low intensity trawling in three of the fishing grounds/habitats defined (Groote, Mornington and Vanderlins) found that trawling intensity explained only 2% of the biomass density variation in epibenthic invertebrates (including benthic sessile and mobile species), and at most 1% in infaunal invertebrates. Sessile or slow-moving taxa were found to recover from the effects of intensive trawling within 6-12 months. Findings’ indicating that trawling has little effect on the infaunal community suggest that trawling also has relatively little effect on the majority of benthic habitats within the NPF. The connection between habitat and community is particularly strong in the case of habitat-forming organisms such as gorgonians, soft corals and sponges found in this highly dynamic environment.

These same studies found no unique, exclusive habitats and noted that the majority of the ecologically important habitats are located in untrawlable areas. Some areas of high biodiversity such as marginal reefs and sponge gardens can be found within trawlable areas but these may not be permanent structures given the high natural environmental disturbance regime (e.g., storm surges, tides, flooding and cyclones).

Conclusion

Given the history and depth of research of this topic in the NPF, and the focus of this research on the tiger prawn sub-fishery, there is ample evidence that the fishery does not reduce habitat structure or function to any significant extent, particularly when these impacts are weighed against the impacts of natural disturbance (100).

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CSIRO, personal communication, September 2011.

2.4	Habitat			
2.4.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types.	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of the fishery on habitat types.
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or habitats involved.	The strategy is mainly based on information directly about the fishery and/or habitats involved, and testing supports high confidence that the strategy will work.
			There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is some evidence that the strategy is achieving its objective.
Score: 80				

Justification

Habitat impacts are primarily managed through a system of spatial and temporal closures adopted by the NPF to protect vulnerable habitats such as seagrass beds and coral and rocky reefs, as well as to address economic objectives of the fishery. A total of 2.1% of the managed zone of the fishery is subject to permanent closures while 8.3% is subject to seasonal closures. These areas include all known seagrass beds. Furthermore, the entire fishery is closed for 5.5 months each year. It has been noted that with the decline in fishing effort from 286 vessels in 1981 to 52 vessels in 2009, and the deployment of these vessels of between 8-17% of the NPF-managed region overall and only intensively over about 3% per year (concentrated in a 3-month period), residual habitat impacts from trawls contacting the seabed are expected to be further minimized. Since ecological risk assessments on habitats found little or no detrimental impact on the physical marine environment, AFMA has deferred development of an ecological risk management strategy for NPF habitats until more information is available.

Conclusion

The spatial and temporal closures system represents a partial strategy; a full strategy addressing residual impacts to non-designated but ecologically valuable habitats (e.g., sponge gardens) has yet to be developed (80).

The partial strategy is based on known ecological valuable habitats located within the NPF fishing grounds and there is confidence it will work through VMS monitoring to demonstrate avoidance of closed areas (80).

Some evidence for implementation of the partial strategy is provided in the form of VMS monitoring of vessel movements with regard to the spatial and temporal closure requirements, and by the low number of observed interactions with seagrass bed-associated species such as dugongs and syngnathids (80).

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AFMA. 2009b. Ecological Risk Management: Report for the Northern Prawn Fishery – Tiger and Banana Prawn Sub-fisheries

2.4	Habitat			
2.4.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
AFMA. 2007. Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls, August 2007.				

2.4	Habitat			
2.4.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types.	There is a basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
		Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.	Changes in habitat distributions over time are measured.
			Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	The physical impacts of the gear on the habitat types have been quantified fully

Score: 95

Justification

All habitats in the tiger prawn sub-fishery were mapped for the ecological risk assessment. The impacts of the trawl gear's interaction with these habitat types were evaluated and none of the habitats were found to be at high risk. A number of historical and recent in-depth research projects have, in combination, produced a digital spatial library describing the state, composition and spatial variability of the NPF's habitats. Areas that have been subject to trawling, as well as those that have not, have been identified and the time required for the habitat to recover from trawl-related disturbance has been investigated through quantitative field experiments and simulation modelling. Ongoing information gathering is mainly in the form of VMS monitoring of vessel behaviour with regard to the temporal and spatial closures. While other research studies on habitats may be undertaken in the future, this work is not an ongoing feature of NPF management.

Conclusion

The distribution of habitat types including vulnerable habitat types is well known for the tiger prawn sub-fishery as a result of an in-depth research project focused on this topic, which was completed in 2010 (100).

There is some data (VMS) mapping the interaction of fishing gear with habitats but there is no ongoing mapping of habitat types (80).

Monitoring of fishing effort and total area fished would demonstrate if effort or area increased, which would detect a potential change in risk to the habitat (80).

The physical impact of the gear on habitat types has been extensively studied through field experiments and simulation (100).

References

Griffiths, S., Kenyon, R., Bulman, C., Dowdney, J., Williams, A., Sporcic, M. and Fuller, M. 2007. Ecological Risk Assessment for Effects of Fishing: Report for the Northern Prawn Fishery. Report for the Australian Fisheries Management Authority, Canberra, 319pp.

2.4	Habitat			
2.4.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts

Haywood M, Hill B, Donovan A, Rochester W, Ellis N, Welna A, Gordon S, Cheers S, Forcey K, Mcleod I, Moeseneder C, Smith G, Manson F, Wassenberg T, Thomas S, Kuhnert P, Laslett G, Burridge C and Thomas S. 2005. Quantifying the effects of trawling on seabed fauna in the Northern Prawn Fishery. Final Report on FRDC Project 2002/102. CSIRO, Cleveland. 462 pp.

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2.5	Ecosystem			
2.5.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function.	The fishery is <u>unlikely</u> to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The fishery is <u>highly unlikely</u> to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is <u>evidence</u> that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.

Score: 100

Justification

The ecosystem effects of the NPF's trawl fisheries have been studied in depth, most recently in studies involving both field surveys/experimentation (e.g. sampling of sites that were subject to high, medium and low intensity trawling in a number of fishing grounds) and simulation models. These studies have focused on the tiger prawn sub-fishery (Gulf of Carpentaria), which has the highest diversity of catch. The most recent of these studies, completed in 2010, concluded that the effects of trawling at the current scale of the NPF do not affect overall biodiversity and cannot be distinguished from other sources of variation in community structure. Specifically, trawling intensity explained only 2% of the biomass density variation in epibenthic invertebrates (including benthic sessile and mobile species), and at most 1% in infaunal invertebrates. Community composition and structure were more strongly related to region, and in some cases time of day, than to the intensity of trawling. Nevertheless, mean trophic level was shown to have declined when the fishery was at its peak in the early 1980s and rose again when fishing effort dropped. The study found that communities can recover rapidly when trawling frequency is reduced.

In addition to these studies of the benthic community, a Level 1 risk assessment (based on a Scale Impact Consequence Analysis) concluded that impacts to the ecosystem were of low consequence. The assessed risks, the field studies of impacts, and the monitoring undertaken for the species assessed elsewhere under this principle (P2), further support the lack of disturbance to key components of the ecosystem and thus suggest a lack of disturbance to ecosystem structure and function.

Conclusion

Given the extent of research conducted specifically on ecosystem effects of the tiger prawn sub-fishery, and the lack of findings regarding serious or irreversible harm due to trawling, there is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function (100). However, for this sub-fishery, some uncertainty remains in the form of an absence of suitable control sites for impact assessment, and a continuing lack of understanding of the transience or permanence of high biodiversity areas within trawlable grounds of the fishery.

References

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2.5	Ecosystem			
2.5.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

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2.5	Ecosystem			
2.5.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function.	There are <u>measures</u> in place, if necessary, that take into account potential impacts of the fishery on key elements of the ecosystem.	There is a <u>partial strategy</u> in place, if necessary, that takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a <u>strategy</u> that consists of a <u>plan</u>, containing measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem.
		The measures are considered likely to work, based on <u>plausible argument</u> (e.g. general experience, theory or comparison with similar fisheries/ ecosystems).	The partial strategy is considered likely to work, based on <u>plausible argument</u> (e.g. general experience, theory or comparison with similar fisheries/ ecosystems).	This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.
			There is <u>some evidence</u> that the measures comprising the partial strategy are being implemented successfully.	The measures are considered likely to work based on <u>prior experience</u>, plausible argument or <u>information</u> directly from the fishery/ecosystems involved.
				There is <u>evidence</u> that the measures are being implemented successfully.
Score: 90				

Justification

The Ecological Risk Management (ERM) document for the NPF states that it does not contain specific management strategies for habitats and communities; however, it does contain measures to prevent adverse impacts to species (through quantitative ecological risk assessment, list of priority species for monitoring, and catch monitoring and reporting requirements) and measures to prevent adverse impacts to habitats (through temporal and spatial closures and VMS monitoring of the location and duration of trawling impacts). Therefore, while the ERM document cannot be

2.5	Ecosystem			
2.5.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

considered a full strategy premised on functional relationships between the fishery and the ecosystem, it certainly represents a partial strategy. Evidence that this partial strategy is likely to work and is being implemented is available in the form of species and VMS monitoring data, which are subject to ongoing scrutiny, as well as updates to the ecological risk assessment process and changes to monitoring procedures as necessary. Several research studies have also been conducted to assess the effectiveness of management practices (e.g., TEDs/BRDs) for bycatch and ETP species groups in particular.

Conclusion

The ERM document comprises a partial strategy (rather than a full strategy or plan) (80). This partial strategy is considered likely to work to control impacts (80).

The elements of the ERM document have been tested and proven to work through experience in the fishery involved, as confirmed by comprehensive research studies and reports (100).

Evidence for effective implementation exists in the form of successful lowering of interaction rates with some groups of ETP species, large reductions in the overall amount of bycatch, and VMS monitoring of temporal and spatial closures (100).

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2.5	Ecosystem			
2.5.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	There is adequate knowledge of the impacts of the fishery on the ecosystem.	Information is adequate to identify the key elements of the ecosystem (e.g. trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to broadly understand the key elements of the ecosystem.	
		Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but may not have been investigated in detail.	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated.
			The main functions of the Components (i.e. target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known.	The impacts of the fishery on target, Bycatch, Retained and ETP species and Habitats are identified and the main functions of these Components in the ecosystem are understood
			Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.	Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.
			Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
Score: 90				

Justification

Detailed ecosystem studies have been conducted for the NPF in the Gulf of Carpentaria focused on the tiger prawn sub-fishery. These studies have comprised both field surveys/experiments and simulation models and addressed the issue of the impacts of trawling from many angles. While these research projects have been given generous, multi-year funding, they are not an ongoing component of NPF management. Two issues have been highlighted for further study: the identification of proper control sites for impact assessment, and the effects of trawling on high biodiversity areas (e.g., sponge gardens) within trawlable fishing grounds. A recent study has integrated bioeconomic stock and ecological risk assessment models with food web, effect of trawling and species distribution models to form an operational spatial management strategy evaluation framework. This tool will facilitate NPF ecosystem-based fisheries management.

Conclusion

Information is adequate for a broad understanding of ecosystem elements (80). The main interactions between the fishery and the ecosystem elements have been investigated in detail (100).

The main functions of ecosystem components are known through field investigations and computer simulation; however, the impacts of the fishery on all species and habitats are yet to be fully understood (80).

These research studies have provided sufficient information to understand the main ecosystem consequences for components (e.g., trophic levels), though not necessarily elements (e.g., species) (80). Existing information appears to be sufficient to develop strategies to manage ecosystem impacts; however, it is noted that as serious and/or irreversible

2.5	Ecosystem			
2.5.3	**Information/ Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
ecosystem impacts have not been identified, no such strategies have as yet been developed (100).				
References				

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The White banana prawn fishery

2.1	Retained Non-target Species			
2.1.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species.	Main retained species are likely to be within biologically based limits or if outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.	Main retained species are highly likely to be within biologically based limits, or if outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.	There is a high degree of certainty that retained species are within biologically based limits.
		If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.		Target reference points are defined and retained species are at or fluctuating around their target reference points.
Score: 90				

Justification

Retained species comprise less than 1% of the catch composition of the NPF as a whole. By weight, 10% (2004-2010 average) of the NPF retained species derive from the white banana prawn sub-fishery. The most common retained species in the white banana prawn sub-fishery (>10 T total in 2004-2010) are squids, endeavour prawns, scampi and bugs. Blue endeavour prawns are assessed under P1; red endeavour prawns have not been recorded separately for this sub-fishery. A recent scientific study considered that the main retained species in the NPF as a whole are two species of bugs, two species of scallops, five species of cuttlefishes and six species of squids. However, risks to all 135 retain species were examined in a Level 2 ecological risk assessment (productivity-susceptibility analysis).
The Level 2 ERA classified 15 retained species as being at high risk. All but three of these were subsequently reclassified to a lower risk level either in the Level 2 Residual Risk assessment (two cuttlefishes), on the basis of expert judgement (two cuttlefishes), or in a Level 2.5 quantitative risk assessment (eight demersal fishes). The three remaining species (*Dictyosquilla tuberculata* (mantis shrimp), *Harpiosquilla stephensoni* (mantis shrimp) and *Solenocera australiana* (coral prawn)) are included on an NPF priority species list and are monitored by crew member observers and scientific observers. Monitoring data show no records of the mantis shrimps but common occurrence of the coral prawn. On the basis of high abundance in the monitoring surveys, the coral prawn was recommended for removal from the list.

Acceptable biological catch (ABC) levels (limit reference points) have been developed for four categories, which comprise over 90% of the retained catch in the NPF as a whole (main retained species): bugs (two species), scallops (two species), cuttlefishes (five species) and squids (six species). Catch levels for bugs, scallops and cuttlefishes are well below the ABCs. The squid catch level for the NPF as a whole approached the ABC (~200 t) in 2007 only due to high catches (169 t) in the white banana prawn sub-fishery. In other recent years (2004-2010) squid catches have been near or less than 1 t. Also, there is some uncertainty regarding whether the squid ABC has been under-estimated. Squid catches are being continuously monitored and a catch trigger limit of 500 t for the NPF as a whole has been set under the NPF Harvest Strategy. There are no ABCs for scampi, but the catches of this species are low relative to the retained catch as a whole (<12% of the retained catch which is in turn <1% of the total catch).

Conclusion

All retained species have been subject to a quantitative ecological risk assessment as discussed in Section 3.7.2. These assessments, based on a robust methodology, provide a comprehensive evaluation of the retained species. The fishery meets the first scoring issues of SG60 and SG80. The second issue of SG60 does not apply as the status is not considered poorly known. Two mantis shrimps, which were considered in theory to be at high risk in the Level 2 ERA are being continuously monitored by observers but have never been recorded. Biologically-based limits, in the form of Acceptable Biological Catch (ABC) values which are catch limit reference values based on MSY exploitation rates and life history traits, have been estimated for four main groups of retained species (bugs, scallops, cuttlefishes and squids). Catches of the former three groups are well below the ABCs. Thus there is a high degree of certainty that these three species are within biologically-based limits. In one year (2007) squid catches in the white banana prawn fishery

2.1	Retained Non-target Species			
2.1.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
comprised the majority of catches in the NPF as a whole and in this year squid catches approached the ABC. Although squid catches have not exceeded the ABC in the past seven years, the high inter-annual variability in the resource suggests that exceedance is possible. Thus, while it is highly likely that squid catches in the white banana prawn sub-fishery are within biologically-based limits, further certainty in this conclusion requires gaining a better understanding of natural variations in the population and greater confidence in the ABC estimate. Given that the ABC for squids is currently estimated at 200 t, the NPF catch trigger limit of 500 t may warrant reconsideration. In summary, three of the main species groups are within biologically-based limits with a high degree of certainty and the remaining main species group is highly likely to be within biologically-based limits. All other retained species are considered low risk and/or interact only rarely with the fishery (100). Although the ABCs have been estimated, they are limit rather than target reference points so do not meet the second scoring issue of SG100.				
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2.1	Retained Non-target Species			
2.1.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
		The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports high confidence that the strategy will work.
			There is some evidence that the partial strategy is	There is clear evidence that the strategy is being

2.1	Retained Non-target Species			
2.1.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
			being implemented successfully.	implemented successfully, and intended changes are occurring
				There is some evidence that the strategy is achieving its overall objective.
Score: 80				

Justification

Byproduct management strategies (the Harvest Strategy and the forthcoming Non-key Commercial Species (Byproduct) Policy) are applied across the NPF as a whole and are designed to ensure that regional byproduct resources are sustained.

The NPF's Harvest Strategy contains limits and/or measures for several groups of retained species, including bugs and squid. None of the retained species in the harvest strategy have been assessed as being at high risk in the ecological risk assessment. AFMA is currently developing a Non-key Commercial Species (Byproduct) Policy, which is planned to include the three retained species identified as being at high risk in the ecological risk assessment, as well as some cuttlefish and other squid species.

Based on the results of a recent byproduct research programme, the acceptable biological catch for squid is estimated at 200 t, which suggests that the Harvest Strategy's limit of 500 t may warrant reconsideration. The same study found that the minimum size limit for bugs could be reduced from 75 mm to 65 mm without adverse effects on the sustainability of the resource. Although no other groups of species examined by this study (i.e., cuttlefishes and scallops) are included in the current harvest strategy, catches of these groups are well below the ABC levels.

Conclusion

There are formal measures in place for two of four key byproduct species groups: squid and bugs. Recent scientific evaluation has evaluated current catches and estimated acceptable biological catches for squid, bugs, cuttlefishes and scallops, and no instances of overfishing were identified. A more complete Non-Key Commercial Species (Byproduct) Policy is also being developed. It can therefore be concluded that there is a partial strategy currently in place (80).

The partial strategy is based on the ABCs (limit reference points), life history characteristics of the main retained species, and ongoing monitoring of these species. The results of the monitoring demonstrate that biologically-based limits are not being exceeded for the species covered by the partial strategy, thus there can be some confidence that the partial strategy is working (80) and is being implemented successfully by NORMAC and AFMA (80).

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2.1	Retained Non-target Species			
2.1.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

pp.

Milton, D.A., Fry, G. C., Tonks, M., Zhou, S., Kuhnert, P., and Zhu, M. 2010. Assessing data poor resources: developing a management strategy for byproduct species in the Northern Prawn. FRDC Project 2006/008 Final Report.
AFMA Harvest Strategy

AFMA. 2007. Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls, August 2007.

2.1	Retained Non-target Species			
2.1.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species. *(Note: Scoring issues in brackets need not be scored when the RBF is used to score PI 2.1.1.)*	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
		(Information is adequate to qualitatively assess outcome status with respect to biologically based limits.)	(Information is sufficient to estimate outcome status with respect to biologically based limits.)	(Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.)
		Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a comprehensive strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
			Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.
Score: 80				

Justification

Quantitative data on all retained species is required by the mandatory logbook format of the NPF. However, not all species are necessarily recorded in species-specific reporting categories. Furthermore, it is naturally the case that recorded quantities in logbooks may not reflect abundance since retention and reporting rates may vary based on fishery operational costs, prawn and byproduct prices, prawn and byproduct catch rates, and vessel crew behaviour. Scientific observer coverage in the white banana prawn sub-fishery is similar to that in the tiger prawn sub-fishery (i.e., 2.5%) but the collection of crew member observer data has been limited by operational constraints to a single vessel monitored for half the fishing season during 2011.

Scientific studies of actual catches versus acceptable biological catches have recently been completed for four main groups of byproduct species: squids, cuttlefishes, bugs and scampi. These concluded that recent annual catches of each byproduct group are a small proportion of the estimated biologically-sustainable total annual catch for those groups, except for squid, which was near but below, the biologically-sustainable level. Squid catches were found to be highly variable between years and the need for further study was noted.

2.1	Retained Non-target Species			
2.1.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Information from the scientific studies has been used to evaluate the partial strategy under the NPF Harvest Strategy for squid and bugs. Information from the ecological risk assessment process has been used to select high risk species for ongoing monitoring.

Ongoing data collection for retained species is required under the mandatory logbook format for the NPF.

Conclusion

Quantitative data are available for most but not all species due to non-species specific reporting practices in the logbooks and limited observer coverage (80).

Quantitative scientific studies have recently been completed and information has been sufficient to estimate outcome status with regard to biological limits. The status of certain species with high annual variability remains somewhat uncertain due to the biology of these species rather than lack of information (80).

Available information is adequate to support a strategy in the form of the existing NPF Harvest Strategy, which incorporates limits and/or measures on squid and bugs. As concluded above (2.1.2) this is a partial strategy which is achieving its objective (80).

Sufficient data are continuously collected through the NPF logbooks and used to monitor status for some main retained species (e.g., against the squid and bugs catch trigger limits) (80).

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2.2	Bycatch Species			
2.2.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups.	Main bycatch species are likely to be within biologically based limits, or if outside such limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and	Main bycatch species are highly likely to be within biologically based limits or if outside such limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery	There is a high degree of certainty that bycatch species are within biologically based limits.

2.2	Bycatch Species			
2.2.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
		rebuilding.	and rebuilding.	
		If the status is poorly known there are measures or practices in place that are expected result in the fishery not causing the bycatch species to be outside biologically based limits or hindering recovery.		

Score: 80

Justification

A study of bycatch in the white banana prawn sub-fishery identified 218 taxa from 80 families and six higher level taxonomic classifications. Three species, *Polydactylus multiradiatus* (Australian threadfin), *Caranx bucculentus* (bluespotted trevally) and *Rhizoprionodon acutus* (milk shark), accounted for just over half (51.4%) of the total bycatch weight. While these species may be considered the main bycatch species in the fishery, all species known to interact with the fishery were assessed under the ecological risk assessment. A quantitative ecological risk assessment (SAFE) was conducted for 51 elasmobranch species and 456 teleost species, some of which are ETP species assessed separately.

Five elasmobranch species had an estimated fishing induced mortality rate (u) greater than the minimum unsustainable fishing mortality (u_{crash}): *Carcharhinus albimarginatus* (silvertip shark), *Orectolobus ornatus* (ornate wobbegong), *and Squatina* sp. A (eastern angel shark), *Taeniura meyeni* (blotched fantail ray), and *Urogymnus asperrimus* (porcupine ray). In addition, for five other species, the 95% confidence interval for the estimate of u exceeded the estimated u_{crash} value: *Carcharhinus brevipinna* (spinner shark), *Carcharhinus leucas* (bull shark), *Pristis microdon* (freshwater sawfish), *Pristis zijsron* (green sawfish), and *Sphyrna mokarran* (great hammerhead). Expert consultation suggested that most of these species were unlikely to be realistically threatened by the fishery because their main distribution extends into deep water (>70 m) or over reefs which are largely unaffected by the NPF. Specifically, for the five species where u exceeded u_{crash}, the risks to *C. albimarginatus*, *O. ornatus* and *Squatina* sp. A were downgraded by expert override. The two remaining species (blotched fantail ray and porcupine ray) were added to the NPF's priority species list. A re-evaluation for the period 2007-2009 found five species with estimates of fishing mortality (F) higher than the maximum sustainable fishing mortality (F_{msm}) and the upper 90% confidence interval for fishing mortality (F) higher than the unsustainable fishing mortality (F_{crash}). These species were *C. albimarginatus*, *C. leucas*, *Galeocerdo cuvier* (tiger shark), *O. ornatus* and *S. mokarran*). None were considered to be at risk due to widespread distributions and/or low overlaps with the fishery. Furthermore, the blotched fantail ray was re-assessed as having a low risk, mainly due to its low occurrence in the fished area, and the porcupine ray was only considered at risk because its upper 90% confidence interval exceeded F_{msm}.

Five teleost species were found to be at risk due to the current fishing mortality exceeding the u_{msy} reference. Nine other species with lower assessed risk levels, were added to the list of species of concern resulting from the SAFE as a result of a Bycatch Subcommittee meeting in January 2009: *Dendrochirus brachypterus* (dwarf lionfish), *Scorpaenopsis venosa* (raggy scorpionfish), *Parascolopsis tosensis* (Tosa dwarf monocle bream), *Hemiramphus robustus* (three-by-two garfish), *Lutjanus rufolineatus* (yellow-lined snapper), *Onigocia spinosa* (midget flathead), *Benthosema pterotum* (skinnycheek lanternfish), *Scomberoides commersonnianus* (Talang queenfish) and *Sphyraena jello* (giant seapike). However, the assessed risks to seven of these species were downgraded through expert overrides (due to lack of overlap with the NPF geographically or by habitat or gear selectivity) and only two species (dwarf lionfish and raggy scorpionfish) were maintained on the NPF list of priority species. An update to the SAFE for 2007-2009 found that neither of these species had estimated fishing mortality greater than F_{msm}, even when uncertainty was considered, and no other teleost species were found to be of concern.

Of the four bycatch species placed on the NPF's list of priority species for monitoring, none have been recorded in the observer monitoring programmes. While this could be due to low observer coverage or mis-identification, scientists have suggested that these species are either hard bottom-associated and/or would be excluded by TED and are therefore unlikely to be encountered.

Conclusion

The status of the main bycatch species is considered to be well-known. A comprehensive assessment of bycatch

2.2	Bycatch Species			
2.2.1	Status	60 Guideposts	80 Guideposts	100 Guideposts

species determined that of 507 species assessed, only four (blotched fantail ray, porcupine ray, dwarf lionfish and raggy scorpionfish) were assessed as being at risk from the fishery because they exceeded a biologically-based limit. Observer coverage in the white banana prawn fishery has in recent years been effectively limited to scientific observers with a coverage rate of ~2.5%. Within this sampling effort none of the at-risk bycatch species have been detected. Given that logbooks are not required to record bycatch, and observer coverage is low, there is some uncertainty regarding the effectiveness of the monitoring effort for bycatch species. On the other hand, scientists suggest that these four species may be hard bottom-associated, and thus the potential for interaction with the white banana fishery is very limited given that the trawls are usually shorter. Interactions are otherwise also likely to be mitigated through TEDs.

The risk assessment gave priority consideration to those species whose median estimates (50^{th} percentile) of fishing mortality exceeded the reference points. It is not clear whether those species whose median estimate did not exceed, but whose 90% confidence interval (i.e. 95^{th} percentile) did exceed, the reference point were consistently carried through to the expert override stage. However, given that none of the species with greater exceedances of the reference points (i.e. exceedance at 50^{th} percentile versus 95^{th} percentile) were ultimately found to be at risk, the probability that these other lower risk species are within biologically based limit is considered to be highly likely (80).

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2.2	Bycatch Species			
2.2.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations.	There are measures in place, if necessary, which are expected to maintain main bycatch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.	There is a partial strategy in place, if necessary, for managing bycatch that is expected to maintain main bycatch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.	There is a strategy in place for managing and minimising bycatch.

2.2	Bycatch Species			
2.2.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports high confidence that the strategy will work.
			There is some evidence that the partial strategy is being implemented successfully.	There is some evidence that the strategy is achieving its objective.
				There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring.
Score: 95				

Justification

The NPF has a Bycatch Action Plan (BAP) which comprises a strategy for bycatch reduction involving ecological risk assessment of all species (to identify issues), effort reduction, temporal and spatial closures, monitoring and research on use of bycatch reduction devices. The strategy specifies actions directed at those species with identifiable risks. The actions required are commonly used in shrimp/prawn fisheries and have a high level of success. The NPF implemented mandatory use of a specific suite of turtle exclusion devices (TEDs) and bycatch reduction devices (BRDs) in 2001. Field evaluations of the implementation of NPF-approved TEDs and BRDs have documented catch reductions for turtles of 99%, seasnakes of 5%, sharks of 17.7%, rays of 36.3%, large sponges of 85.3%, and small bycatch of 8%. Overall, the fishery reports achieving a 50% reduction in bycatch since the implementation of its first BAP in 1998 and is pursuing additional research to achieve further bycatch reductions.

Four species assessed as being at high risk from the fishery have been placed on a list of priority species for monitoring and are recorded by NPF crew member and scientific observers. However, in recent years the crew member observer programme in the white banana prawn sub-fishery has been limited by operational constraints to one vessel recording daily bycatch data for half the fishing season in 2011 only.

Conclusion

The BAP, in conjunction with mandatory use of TEDs/BRDs and use of risk assessments of all species to identify high risks, and the observer monitoring programme for priority species, constitutes a strategy for managing and minimizing bycatch. Periodic updates of the Ecological Risk Management document assure that the strategy remains up to date. (100).

Scientific testing for the NPF per se has proven that substantial bycatch reduction will result, thus there is confidence that the strategy will work (100). These methods have been used successfully in other similar fisheries.

The NPF claims to have reduced bycatch by 50% but since bycatch quantity and species composition is not routinely monitored, there is only indirect evidence of successful implementation (i.e., reductions in ETP species interactions which presumably mean TEDs/BRDs are working effectively and are thus presumably having an effect on non-ETP species as well). Therefore, there is some evidence that the strategy is achieving its objective (100), although it is noted that this is primarily based on logbook records as observer coverage in the white banana prawn sub-fishery is largely limited to scientific observers at a coverage rate of 2.5%.

Some concerns have been expressed about the positioning of BRDs for maximum effectiveness and lacking further evidence of the successful implementation of bycatch reduction for bycatch species per se, the evidence for the success of the strategy for bycatch species per se is not entirely clear (80).

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2.2	Bycatch Species			
2.2.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

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2.2	Bycatch Species			
2.2.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Information on the nature and amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch. *(Note: Scoring issues in brackets need not be scored when the RBF is used to score PI 2.1.1.)*	Qualitative information is available on the amount of main bycatch species affected by the fishery.	Qualitative information and some quantitative information are available on the amount of main bycatch species affected by the fishery	Accurate and verifiable information is available on the amount of all bycatch and the consequences for the status of affected populations.
		(Information is adequate to broadly understand outcome status with respect to biologically based limits.)	(Information is sufficient to estimate outcome status with respect to biologically based limits.)	(Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.)
		Information is adequate to support measures to manage bycatch.	Information is adequate to support a partial strategy to manage main bycatch species.	Information is adequate to support a comprehensive strategy to manage bycatch, and evaluate with a high degree of certainty whether a strategy is achieving its objective.
			Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.
Score: 80				

Justification

Comprehensive scientific surveys have been conducted to assess the bycatch in the white banana prawn sub-fishery. Several quantitative ecological risk assessments have been undertaken using state-of-the-art methods. However, bycatch data collection from the fishery itself is not required by the logbook reporting format and with the exception of a small amount of crew member observer data collected in 2011, observer coverage in the white banana prawn sub-fishery is largely limited to scientific observers at a coverage rate of 2.5%. As a result, there is limited ongoing operational data collection on bycatch quantities or species composition. Research has been conducted to investigate the sample sizes required to detect statistically significant changes in the abundance of rarer (and thus of greater concern) bycatch species, but this research concluded that in most cases the sampling effort is beyond practically achievable levels.

2.2	Bycatch Species			
2.2.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts

Conclusion

Qualitative and some quantitative information are available on all bycatch species affected by the fishery through ecological risk assessment and research studies (80).

Observer data for the white banana prawn sub-fishery is primarily composed of scientific observer data. While these data are potentially of higher quality than logbook and crew member observer data, the amount of data in this sub-fishery is low relative to the NPF as a whole. As a result, while the information is considered sufficient there is a higher level of uncertainty when estimating the outcome status of at risk bycatch species due to the reliance on a single data set (80).

Given the comprehensive baseline datasets established and the rigorous ecological risk assessment process, this information is considered adequate to support the strategy to manage bycatch (BAP); however, there may not be a high degree of certainty given the lack of direct evidence pertaining to bycatch species per se (see 2.2.2) (80).

Main bycatch species have been assessed as not being at risk; therefore, monitoring focuses on four species that are at risk but rare. Research has suggested that statistically significant change may be difficult to detect due to low occurrence rates in the samples. Considering these factors, the sampling programme is deemed to be sufficient (80).

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	Status	60 Guideposts	80 Guideposts	100 Guideposts

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery meets national and international requirements for protection of ETP species. The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species.	Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.	The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.	There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.
		Known direct effects are unlikely to create unacceptable impacts to ETP species.	Direct effects are highly unlikely to create unacceptable impacts to ETP species.	There is a high degree of confidence that there are no significant detrimental effects (direct and indirect) of the fishery on ETP species.
			Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	
Score: 90				

Justification

In an early ecological risk assessment based on productivity-susceptibility analyses (2007), five species of sawfishes and seven species of seasnakes were considered to be at high risk in the white banana prawn sub-fishery. In a subsequent risk assessment based on the SAFE methodology, none of these species were found to be at high risk (2011; see Section 3.7.3). ETP species are constantly monitored by the NPF (logbooks, and both observer programmes), which allows for recognition of potential changes in status and opportunities for plan adjustments. There are national plans of action or recovery for turtles, sharks and whale sharks (specifically). On 22 December 2008, the Australian Minister for the Environmental, Heritage and the Arts certified that an assessment of the NPF under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) found that the fishery was "unlikely to be detrimental to the survival or conservation status of any taxon to which the fishery operation relates, or threaten any relevant ecosystem in the medium to long term". As a result, export of NPF product has been authorized until 9 January 2014.

Marine mammals (whales, dolphins, dugongs)
Most marine mammals are too large to be entangled in the size of trawl fished in the NPF, or would be excluded by TEDs which have been mandatory in the fishery since 2001. A single dolphin interaction was recorded for the white banana prawn sub-fishery in 2009; no other marine mammal interactions have been recorded since 2004.

Marine birds
In the risk assessment specialists noted that there have been no historical bird interactions in the NPF. Monitoring data since 2004 indicates no bird interactions in the white banana prawn sub-fishery. Indirect effects on foraging ecology have been considered but impacts have not been documented.

Marine reptiles (turtles, crocodiles and seasnakes)
TEDs have reduced the bycatch of turtles in the NPF from approximately 5,700 to 30 per year. Flatback, green, olive Ridley, hawksbill and loggerhead turtles have been encountered in the white banana prawn sub-fishery. Overall in the NPF, 96% of turtles were alive at the time of interaction. Interactions with crocodiles are mitigated by the lack of overlap of their habitat with NPF fishing areas and no interactions have been recorded. An average of 1,630 annual seasnake interactions has been recorded for the white banana prawn sub-fishery between 2004-2010. On average, for the NPF as a whole, only two-thirds of these seasnakes may survive the interaction. Catch rates for the ten most common species of seasnakes have remained stable from 1976-2008. Although there is recognition by the NPF that further reduction in seasnake interaction rates is necessary as they are Australian TEP species, assessment study of seasnakes completed in 2008 found that they are not at risk and thus population status has not been further assessed (see Section 3.7.3).

Elasmobranch fishes (sharks and sawfishes)
Despite the lack of documentation of unacceptable risk, it is recognized that there is a high overlap of the NPF with some sawfishes distribution (mainly the narrow sawfish, *Anoxypristis cuspidata*), they have a high degree of endemism, they are slow-moving, and they are highly susceptible to capture due to their rostrum teeth entangling in the net mesh. There are also concerns that cumulative impacts to sawfish from domestic gill net fisheries and from

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Indonesian fisheries to the north cannot be or have not been fully accounted for in the ecological risk methodology. Sawfishes reported from the white banana prawn sub-fishery include narrow, green, freshwater, dwarf, common sawshark and unidentified sawfishes. For the NPF as a whole catches for sawfish (which are most likely the narrow sawfish) appear to have been stable between 1990 and 2002 but slightly increasing since 2003 with no statistically significant trend overall. Catch rate trends for dwarf and green sawfish are difficult to interpret due to low sample sizes. The annual average number of sawfish encounters in the white banana prawn sub-fishery is 107. No interactions with elasmobranch species other than sawfishes have been recorded in logbooks for the white banana prawn sub-fishery. Elasmobranches, reported as a group for the NPF as whole, survive interactions at a rate of 67%.

Teleost fishes (Syngnathids)
There is a low risk of interaction with seahorses, pipefishes and seadragons due to the exclusion of benthic seagrass and other structured habitats preferred by these species from the NPF's fishing grounds due to Protected Area Closures. In addition, for the white banana prawn sub-fishery the trawls have minimal contact with the seabed. There were no more than 21 interactions per year with Syngnathids in the white banana prawn sub-fishery. Due to their delicate nature, the number of Syngnathids surviving interactions is as little as 2% (figures for NPF as a whole).

Conclusion

Direct and indirect fishery effects and their impacts on ETP species have been accounted for in the ecological risk assessments and no species in any of the five groups have been assessed as "at risk". Furthermore, the Australian government's export certification process has declared that the NPF meets the requirements of the EPBC Act. Therefore there is a high degree of certainty that all national and relevant international requirements with regard to ETP are met (100).

Despite the fact that impacts are considered acceptable there is acknowledgement that some risks still exist. The NPF notes that recent BRD implementation has not proved effective at reducing seasnake catch in the NPF when set at the maximum legal distance from the codend. There are also concerns that cumulative effects to sawfishes have not been adequately accounted for and that interaction rates have not been adequately reduced by TEDs due to sawfish rostrum entanglement. Therefore, while direct and indirect impacts are considered acceptable, they may still be significant and are the subject of continuing research (80).

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	Status	60 Guideposts	80 Guideposts	100 Guideposts

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery has in place precautionary management strategies designed to: - meet national and international requirements; - ensure the fishery does not pose a risk of serious or irreversible harm to ETP species; - ensure the fishery does not hinder recovery of ETP species; and - minimise mortality of ETP species.	There are measures in place that minimise mortality, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality that is designed to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality that is designed to achieve above national and international requirements for the protection of ETP species.
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is an objective basis for confidence that the strategy will work, based on some information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work.
			There is evidence that the strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is evidence that the strategy is achieving its objective.

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
Score: 95				

Justification

The NPF has formulated and implemented a Bycatch and Discarding Work Plan (BDWP) and an Ecological Risk Management Strategy which encapsulate the NPF's strategy for overall minimisation of bycatch through developing management responses to high ecological risks and measures to avoid fishery interactions with species listed under the EPBC Act. This strategy comprises temporal and spatial closures, monitoring programmes, research projects and bycatch reduction activities such as development and testing of new BRDs.

As none of the ETP species have been found to be at high risk from the fishery, the main management achievements for ETP species have been in the form of bycatch reduction, in particular turtle bycatch has been reduced by 99%. However, TEDs and BRDs have had mixed success for other organisms: one study reported that TEDs reduced catches of narrow sawfish by 73% whereas other studies found only a slight effect or no effect due to entanglement before the TED is contacted. Similarly for seasnakes, research results showed that BRDs did not effectively reduce bycatch when placed at the maximum legal distance from the codend, although they did reduce crushing of caught seasnakes and thus improved survival. The need to further reduce seasnake bycatch has been addressed through testing and approval of the Popeye Fishbox BRD which can achieve an 85% reduction in seasnake catch. The NPF intends to release a study by mid-2012 which will review the implementation, usage and effectiveness of BRDs, but at this time no information is available on the implementation rates of various BRDs.

Monitoring programmes, which for ETP species in this sub-fishery include logbooks, observers (mostly scientific observers) and ad hoc but ongoing research programmes, assess the effects of the fishery on ETP species. There are no defined trigger levels for management action, rather AFMA monitors the currently low levels of interaction and if they begin to rise, management action will be discussed.

Conclusion

There is a strategy in place to manage the fishery's impacts on ETP species. Given that none of these species have been found to be at risk from the fishery, current levels of impacts (interactions) are considered to exceed national and international requirements for these species' protection (100).

The strategy is based on research conducted for this fishery, and quantitative analysis provides high confidence and evidence that the strategy can work (100).

There is evidence that the strategy is being implemented successfully given that interactions are monitored, and though variable year-to-year, do not appear to be rising. However, one of the recommendations arising from the 2008 DEWHA export certification was that the NPF should continue to effectively mitigate against and reduce bycatch in the fishery, particularly for sawfish, rays and sea snakes. Based on interaction data from logbooks, supplemented by the findings of research studies, it does not appear that seasnake and sawfish interactions are being continuously reduced under the current management strategy, particularly since the utilization rates for effective BRD types and deployments is not currently monitored. Therefore it cannot be confirmed that the intended changes are occurring (80).

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

Milton, D.A., Zhou, S., Fry, G.C. Dell, Q. 2008. Risk assessment and mitigation for sea snakes caught in the Northern prawn Fishery. Final report on FRDC Project 2005/051. CSIRO Cleveland, pp. 123.

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Relevant information is collected to support the management of fishery impacts on ETP species, including: - information for the development of the management strategy; - information to assess the effectiveness of the management strategy; and - information to determine the outcome status of ETP species.	Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species, and if so, to measure trends and support a full strategy to manage impacts.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
		Information is adequate to support measures to manage the impacts on ETP species	Sufficient data are available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.
		Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.		Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.

Score: 80

Justification

There are two types of data available to estimate the impacts of the fishery on ETP species: comprehensive, but spatial and temporally limited research studies; and ongoing monitoring of the fishery itself. The former was used as the basis for the quantitative ecological risk assessment which found that no ETP species are at risk from the fishery. However, it was acknowledged that cumulative impacts may need to be better accounted for in the methodology, particularly for those species that are known to be regionally/globally threatened such as sawfishes (CITES Appendix I listed for all but one species which is CITES Appendix II; IUCN Red List Critically Endangered).

The monitoring data are designed to indicate trends in interactions between ETP species and the fishery. In the white banana prawn sub-fishery, ETP monitoring data are provided by NPF logbooks and the scientific observer programme as there is little or no crew member observer coverage. ETP species interaction rates recorded in logbooks is generally much lower than those recorded by scientific observers. For a variety of reasons, species-specific identifications are not always provided (in some cases, obtaining a species identification could work against the live release of the organism, e.g., sawfishes). This, in combination with low catch rates, makes it difficult to analyse the data for changes in abundance. A study examining the requisite sample sizes to detect a statistically

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts

significant difference found that the number of samples required to assess rare species is well beyond practical limits of the observer and monitoring programmes therefore other strategies were recommended.

Conclusion

The combination of quantitative ecological risk assessment and ongoing logbook and scientific observer-based fishery monitoring is sufficient to determine whether the fishery is a threat to ETP species; to measure trends; and to support the Bycatch and Discarding Work Plan and Ecological Risk Management Strategy (80).

Sufficient data are available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species (i.e., through ecological risk assessment). Fishing related mortality and quantitative estimates of impacts have been undertaken for species of concern through the SAFE-level risk assessments (elasmobranchs; see Section 3.7.1) and analysis of catch rates (seasnakes) (80).

It is considered that information sufficient to estimate outcome status with a high degree of certainty would necessarily require a higher level of observer coverage than is currently achieved by the scientific observers in the white banana prawn sub-fishery (2.5%) and there is no crew member observer coverage. While the current information is quantitative, accurate and verifiable, without crew member observers the coverage is low and it may not be representative of all ETP species (does not meet the 100 SG).

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CSIRO, personal communication, September 2011

2.4	Habitat			
2.4.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function.	The fishery is <u>unlikely</u> to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is <u>highly unlikely</u> to reduce habitat structure and function to a point where there would be serious or irreversible harm.	There is <u>evidence</u> that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.
Score: 100				

2.4	Habitat			
2.4.1	Status	60 Guideposts	80 Guideposts	100 Guideposts

Justification

The white banana prawn sub-fishery is not expected to cause substantial benthic habitat impacts because trawls are usually off the bottom. The primary habitat impacts would be in the water column/pelagic environment and are of minimal concern as this habitat is not static. In the ecological risk assessment, tiger and white banana prawn sub-fisheries' habitats were evaluated as one fishery. None of the 157 habitat types (benthic and water column) evaluated under the Level 2.5 ecological risk assessment were found to be at high risk. Therefore even if the white banana prawn sub-fishery does effect benthic habitats on occasion, these effects are considered to be acceptable based on the ecological risk assessment results and that fact that habitat studies have shown that the bottom trawl (i.e. tiger prawn sub-fishery) components of the NPF explained only 2% of the biomass density variation in epibenthic invertebrates and at most 1% in infaunal invertebrates.

Conclusion

Given the history and depth of research of this topic in the NPF, the findings of the ecological risk assessment, and the fact that the white banana prawn sub-fishery is mainly conducted in the water column, there is ample evidence that the fishery does not reduce habitat structure or function to any significant extent (100).

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2.4	Habitat			
2.4.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types.	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of the fishery on habitat types.
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or habitats involved.	The strategy is mainly based on information directly about the fishery and/or habitats involved, and testing supports high confidence that the strategy will work.
			There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is some evidence that the strategy is achieving its objective.
Score: 80				

2.4	Habitat			
2.4.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Justification

Habitat impacts are primarily managed through a system of spatial and temporal closures adopted by the NPF to protect vulnerable habitats such as seagrass beds and coral and rocky reefs, as well as to address economic objectives of the fishery. A total of 2.1% of the managed zone of the fishery is subject to permanent closures while 8.3% is subject to seasonal closures. These areas include all known seagrass beds. Furthermore, the entire fishery is closed for 5.5 months each year. It has been noted that with the decline in fishing effort from 286 vessels in 1981 to 52 vessels in 2009, and the deployment of these vessels over only about 8-17% of the NPF-managed region overall and only intensively over about 3% per year (concentrated in a 6-month fishing season), residual habitat impacts from trawls contacting the seabed are expected to be further minimized. Since ecological risk assessments on habitats found little or no detrimental impact on the physical marine environment, AFMA has deferred development of an ecological risk management strategy for NPF habitats until more information is available.

Conclusion

The spatial and temporal closures system represents a partial strategy; a full strategy addressing residual impacts to non-designated but ecologically valuable habitats is yet to be developed (80).

The partial strategy is based on known ecological valuable habitats located within the NPF fishing grounds and there is confidence it will work through VMS monitoring to demonstrate avoidance of closed areas (80).

Some evidence for implementation of the partial strategy is provided in the form of VMS monitoring of vessel movements with regard to the spatial and temporal closure requirements, and by the low number of observed interactions with seagrass bed-associated species such as dugongs and syngnathids. (80).

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2.4	Habitat			
2.4.3	**Information/ Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types.	There is a basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
		Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location	Changes in habitat distributions over time are measured.

2.4	Habitat			
2.4.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
			of use of the fishing gear.	
			Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	The physical impacts of the gear on the habitat types have been quantified fully
Score: 95				

Justification

All habitats in the white banana prawn sub-fishery were mapped for the ecological risk assessment. The impacts of the trawl gear's interaction with these habitat types were evaluated and none of the habitats were found to be at high risk. Most of the impacts are expected to be associated with trawl contacting the seabed and there considerably less bottom contact in the white banana prawn sub-fishery. A number of historical and recent in-depth research projects have, in combination, produced a digital spatial library describing the state, composition and spatial variability of the NPF's habitats. Areas that have been subject to trawling, as well as those that have not, have been identified and the time required for the habitat to recover from trawl-related disturbance has been investigated through quantitative field experiments and simulation modelling. As these studies related primarily to impacts to the benthos in the tiger prawn fishery they would be expected to overestimate the impacts in the white banana prawn fishery. Ongoing information gathering is mainly in the form of VMS monitoring of vessel behaviour with regard to the temporal and spatial closures. While other research studies on habitats may be undertaken in the future, this work is not an ongoing feature of NPF management.

Conclusion

The distribution of habitat types including vulnerable habitat types is well known for the white banana prawn sub-fishery fishing grounds as a result of an in-depth research project focused on this topic which was completed in 2010 (100).

There is some ongoing data (VMS) mapping the interaction of fishing gear with habitats but there is no ongoing mapping of habitat types (80).

The physical impacts of the gear on benthic habitat types have been extensively studied through field experiments and simulation; habitat impacts from banana prawn trawls are likely to be negligible (100).

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2.5	Ecosystem			
2.5.1	Status	60 Guideposts	80 Guideposts	100 Guideposts

2.5	Ecosystem			
2.5.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function.	The fishery is <u>unlikely</u> to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The fishery is <u>highly unlikely</u> to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is <u>evidence</u> that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
Score: 100				

Justification

The ecosystem effects of the NPF's trawl fisheries have been studied in depth, most recently in studies involving both field surveys/experimentation (e.g. sampling of sites that were subject to high, medium and low intensity trawling in a number of fishing grounds) and simulation models. These studies have focused on the tiger prawn sub-fishery (Gulf of Carpentaria), which has a much higher quantity and diversity of bycatch, as well as benthic disturbance, than the white banana prawn sub-fishery. The most recent of these studies, completed in 2010, concluded that effects of trawling at the current scale of the NPF do not affect overall biodiversity and cannot be distinguished from other sources of variation in community structure. Specifically, trawling intensity explained only 2% of the biomass density variation in epibenthic invertebrates (including benthic sessile and mobile species), and at most 1% in infaunal invertebrates. Community composition and structure were more strongly related to region, and in some cases time of day, than to the intensity of trawling. Nevertheless, mean trophic level was shown to have declined when the fishery was at its peak in the early 1980s and rose again when fishing effort dropped. The study found that communities can recover rapidly when trawling frequency is reduced. The detected impacts found for the tiger prawn sub-fishery are likely to overestimate the ecosystem effects of the white banana prawn sub-fishery.

In addition to these studies of the benthic community, a Level 1 risk assessment (based on a Scale Impact Consequence Analysis) concluded that impacts to the ecosystem were of low consequence. The assessed risks, the field studies of impacts, and the monitoring undertaken for the species assessed elsewhere under this principle (P2), further support the lack of disturbance to key components of the ecosystem and thus suggest a lack of disturbance to ecosystem structure and function.

Conclusion

The white banana sub-fishery in the Gulf of Carpentaria is expected to have much less ecosystem impact than the tiger prawn sub-fishery because of its lower quantity and diversity of bycatch and its lack of seabed contact. Therefore, the extensive research showing no serious or irreversible harm due to trawling in the tiger prawn sub-fishery in the same area (Gulf of Carpentaria) also provides evidence that the white banana prawn sub-fishery is highly unlikely to disrupt the ecosystem (100).

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2.5	Ecosystem			
2.5.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function.	There are measures in place, if necessary, that take into account potential impacts of the fishery on key elements of the ecosystem.	There is a partial strategy in place, if necessary, that takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a strategy that consists of a plan, containing measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem.
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/ ecosystems).	The partial strategy is considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/ ecosystems).	This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.
			There is some evidence that the measures comprising the partial strategy are being implemented successfully.	The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved.
				There is evidence that the measures are being implemented successfully.
Score: 90				

Justification

The Ecological Risk Management (ERM) document for the NPF states that it does not contain specific management strategies for habitats and communities; however, it does contain measures to prevent adverse impacts to species (through quantitative ecological risk assessment, list of priority species for monitoring, and catch monitoring and reporting requirements) and measures to prevent adverse impacts to habitats (through temporal and spatial closures and VMS monitoring of the location and duration of trawling impacts). Therefore, while the ERM document cannot be considered a full strategy premised on functional relationships between the fishery and the ecosystem, it certainly represents a partial strategy. Evidence that this partial strategy is likely to work and is being implemented is available in the form of species and VMS monitoring data, which are subject to ongoing scrutiny, as well as updates to the ecological risk assessment process and changes to monitoring procedures as necessary. Several research studies have also been conducted to assess the effectiveness of management practices (e.g., TEDs/BRDs) for bycatch and ETP species groups in particular.

Conclusion

The ERM document comprises a partial strategy (only) and thus does not meet all of the guideposts for the 100 scoring level (80).

The elements of the ERM document have been tested and proven to work through experience in the fishery involved, as confirmed by comprehensive research studies and reports (100).

Evidence for effective implementation exists in the form of successful lowering of interaction rates with some groups of ETP species, large reductions in the overall amount of bycatch, and VMS monitoring of temporal and spatial closures (100).

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2.5	Ecosystem			
2.5.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

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2.5	Ecosystem			
2.5.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	There is adequate knowledge of the impacts of the fishery on the ecosystem.	Information is adequate to <u>identify</u> the key elements of the ecosystem (e.g. trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to <u>broadly understand the</u> key elements of the ecosystem.	
		Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but <u>have not been investigated in detail</u>.	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but <u>may not have been investigated in detail</u>.	Main <u>interactions</u> between the fishery and these ecosystem elements can be inferred from existing information, and <u>have been investigated</u>.
			The main functions of the Components (i.e. target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are <u>known</u>.	The impacts of the fishery on target, Bycatch, Retained and ETP species and Habitats are identified and the main functions of these Components in the ecosystem are <u>understood</u>
			Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be	Sufficient information is available on the impacts of the fishery on the Components <u>and elements</u> to allow the main consequences for the

2.5	Ecosystem			
2.5.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
			inferred.	ecosystem to be inferred.
			Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
Score: 90				

Justification

Detailed ecosystem studies have been conducted for the NPF in the Gulf of Carpentaria. Although these have focused on the tiger prawn sub-fishery, due to its greater potential for biodiversity and community impacts, the white banana prawn sub-fishery occurs within the same ecosystem (although it has considerably less contact with the seabed). These studies have comprised both field surveys/experiments and simulation models and addressed the issue of the impacts of trawling from many angles. While these research projects have been given generous, multi-year funding, they are not an ongoing component of NPF management. Two issues have been highlighted for further study: the identification of proper control sites for impact assessment, and the effects of trawling on high biodiversity areas (e.g., sponge gardens) within trawlable fishing grounds. A recent study has integrated bioeconomic stock and ecological risk assessment models with food web, effect of trawling and species distribution models to form an operational spatial management strategy evaluation framework. This tool will facilitate NPF ecosystem-based fisheries management.

Conclusion

Information is adequate for a broad understanding of ecosystem elements (80). The main interactions between the fishery and the ecosystem elements have been investigated in detail (100).

The main functions of ecosystem components are known through field investigations and computer simulation; however, the impacts of the fishery on all species and habitats are yet to be fully understood (80).

These research studies have provided sufficient information to understand the main ecosystem consequences for components (e.g. trophic levels) though not necessarily elements (e.g. species) (80).

Existing information appears to be sufficient to develop strategies to manage ecosystem impacts, however, it is noted that as serious and/or irreversible ecosystem impacts have not been identified, no such strategies have as yet been developed (100).

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Red-legged prawn fishery

2.1	Retained Non-target Species			
2.1.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species.	Main retained species are likely to be within biologically based limits or if outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.	Main retained species are highly likely to be within biologically based limits, or if outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.	There is a high degree of certainty that retained species are within biologically based limits.
		If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.		Target reference points are defined and retained species are at or fluctuating around their target reference points.
Score: 90				

Justification

Retained species comprise less than 1% of the catch composition of the NPF as a whole. By weight 3% (2004-2010 average) of the NPF retained species derive from the red-legged prawn sub-fishery. The most common retained species in the red-legged prawn sub-fishery are endeavour prawns (86% of all retained species by weight, 2004-2010 average). Blue endeavour prawns are assessed under P1; red endeavour prawns were recorded separately for this sub-fishery in 2006 only (0.2 t). A recent scientific study considered that the main retained species in the NPF as a whole are two species of bugs, two species of scallops, five species of cuttlefishes and six species of squids. However, risks to all 135 retained species were examined in a Level 2 ecological risk assessment (productivity-susceptibility analysis).

The Level 2 ERA classified 16 retained species as being at high risk in the tiger prawn sub-fishery, which represents the red-legged sub-fishery. All but three of these were subsequently reclassified to a lower risk level either in the Level 2 Residual Risk assessment (two cuttlefishes), on the basis of expert judgement (two cuttlefishes and a squid (note documentation issues described in Section 3.7.2.3), or in a Level 2.5 quantitative risk assessment (eight demersal fishes). The three remaining species (*Dictyosquilla tuberculata* (mantis shrimp), *Harpiosquilla stephensoni* (mantis shrimp) and *Solenocera australiana* (coral prawn) are included on an NPF priority species list and are monitored by crew member observers and scientific observers. Monitoring data show no records of the mantis shrimps but common occurrence of the coral prawn. On the basis of high abundance in the monitoring surveys, the coral prawn was recommended for removal from the list.

Acceptable biological catch (ABC) levels (limit reference points) have been developed for four categories, which comprise over 90% of the retained catch in the NPF as whole (main retained species): bugs (two species), scallops (two species), cuttlefishes (five species) and squids (six species). Catch levels for bugs, scallops and cuttlefishes are well below the ABCs. The squid catch level for the NPF as a whole approached the ABC (~200 t) in 2007 only. In other recent years (2004-2010) squid catches have been lower by an order or magnitude or more. These low levels of retained species catches (in comparison to the estimated ABCs) in combination with the low level of fishing effort in the red-legged fishery (5 vessels) suggests that there is a high degree of certainty that retained species are within biologically-based limits.

Conclusion

All retained species have been subject to a quantitative ecological risk assessment as discussed in Section 3.7.2. These assessments, based on a robust methodology, provide a comprehensive evaluation of the retained species. Two mantis shrimps, which were considered in theory to be at high risk in the Level 2 ERA, are being continuously monitored by observers but have never been recorded. Biologically-based limits, in the form of Acceptable Biological Catch (ABC) values which are catch limit reference values based on MSY exploitation rates and life history traits, have been estimated for four main groups of retained species (bugs, scallops, cuttlefishes and squids). Catches of the former three

2.1	Retained Non-target Species			
2.1.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
groups are well below the ABCs, and thus there is a high degree of certainty that they are within biologically-based limits. Squid catches in the red-legged prawn sub-fishery tally to less than 1 t annually. Thus it is highly likely that squid catches in the red-legged prawn sub-fishery are within biologically-based limits even if for the NPF as a whole catches approached the ABC in 2007. All other retained species are considered low risk and/or interact only rarely with the fishery (100). Although the ABCs have been estimated they are limit rather than target reference points so do not meet the second scoring issue of SG100.				
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2.1	Retained Non-target Species			
2.1.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
		The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports high confidence that the strategy will work.
			There is some evidence that the partial strategy is	There is clear evidence that the strategy is being

2.1	Retained Non-target Species			
2.1.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
			being implemented successfully.	implemented successfully, and intended changes are occurring
				There is some evidence that the strategy is achieving its overall objective.
Score: 80				

Justification

Byproduct management strategies (the Harvest Strategy and the forthcoming Non-key Commercial Species (Byproduct) Policy) are applied across the NPF as a whole and are designed to ensure that regional byproduct resources are sustained.

The NPF's Harvest Strategy contains limits and/or measures for several groups of retained species, including bugs and squid. None of the retained species in the harvest strategy have been assessed as being at high risk in the ecological risk assessment. AFMA is currently developing a Non-key Commercial Species (Byproduct) Policy, which is planned to include the three retained species identified as being at high risk in the ecological risk assessment, as well as some cuttlefish and other squid species.

Based on the results of a recent byproduct research programme, the acceptable biological catch for squid is estimated at 200 t, which suggests that the Harvest Strategy's limit of 500 t may warrant reconsideration. The same study found that the minimum size limit for bugs could be reduced from 75 mm to 65 mm without adverse effects on the sustainability of the resource. Although no other groups of species examined by this study (i.e., cuttlefishes and scallops) are included in the current harvest strategy, catches of these groups are well below the ABC levels.

Conclusion

There are formal measures in place for two of four key byproduct species groups: squid and bugs. Recent scientific evaluation has evaluated current catches and estimated acceptable biological catches for squid, bugs, cuttlefishes and scallops, and no instances of overfishing were identified. A more complete Non-Key Commercial Species (Byproduct) Policy is also being developed. It can therefore be concluded that there is a partial strategy currently in place (80).

The partial strategy is based on the ABCs (limit reference points), life history characteristics of the main retained species, and ongoing monitoring of these species. The results of the monitoring demonstrate that biologically-based limits are not being exceeded for the species covered by the partial strategy, thus there can be some confidence that the partial strategy is working (80) and is being implemented successfully by NORMAC and AFMA (80).

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2.1	Retained Non-target Species			
2.1.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Milton, D.A., Fry, G. C., Tonks, M., Zhou, S., Kuhnert, P., and Zhu, M. 2010. Assessing data poor resources: developing a management strategy for byproduct species in the Northern Prawn. FRDC Project 2006/008 Final Report. AFMA Harvest Strategy.

AFMA. 2007. Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls, August 2007.

2.1	Retained Non-target Species			
2.1.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species. *(Note: Scoring issues in brackets need not be scored when the RBF is used to score PI 2.1.1.)*	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
		(Information is adequate to qualitatively assess outcome status with respect to biologically based limits.)	(Information is sufficient to estimate outcome status with respect to biologically based limits.)	(Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.)
		Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a comprehensive strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
			Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.

Score: 80

Justification

Quantitative data on all retained species is required by the mandatory logbook format of the NPF. However, not all species are necessarily recorded in species-specific reporting categories. Furthermore, it is naturally the case that recorded quantities in logbooks may not reflect abundance since retention and reporting rates may vary based on fishery operational costs, prawn and byproduct prices, prawn and byproduct catch rates and vessel crew behaviour. There is no crew member observer or scientific observer coverage in the red-legged prawn sub-fishery.

Scientific studies of actual catches versus acceptable biological catches have recently been completed for four major groups of byproduct species: squids, cuttlefishes, bugs and scampi. These concluded that recent annual catches of each byproduct group are a small proportion of the estimated biologically-sustainable total annual catch for those groups, except for squid which was near, but below, the biologically-sustainable level. Squid catches were found to be highly variable between years and the need for further study was noted.

Information from the scientific studies has been used to evaluate the partial strategy under the NPF Harvest Strategy for squid and bugs. Information from the ecological risk assessment process has been used to select high risk species for ongoing monitoring.

2.1	Retained Non-target Species			
2.1.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts

Ongoing data collection for retained species is required under the mandatory logbook format for the NPF.

Conclusion

Quantitative data are available for most but not all species due to non-species specific logbook reporting practices and low observer coverage (15 days of scientific observer coverage in 2011 only) (80).

Quantitative scientific studies have recently been completed and information has been sufficient to estimate outcome status with regard to biological limits. The status of certain species with high annual variability remains somewhat uncertain due to the biology of these species rather than lack of information (80).

Available information is adequate to support a strategy in the form of the existing NPF Harvest Strategy which incorporates limits and/or measures on squid and bugs. As concluded above (2.1.2) this is a partial strategy which is achieving its objective (80).

Sufficient data are continuously collected through the NPF logbooks and used to monitor status for some main retained species, e.g. against the squid and bugs catch trigger limits (80).

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2.2	Bycatch Species			
2.2.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups.	Main bycatch species are likely to be within biologically based limits, or if outside such limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.	Main bycatch species are highly likely to be within biologically based limits or if outside such limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.	There is a high degree of certainty that bycatch species are within biologically based limits.
		If the status is poorly known there are measures or practices in		

2.2	Bycatch Species			
2.2.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
		place that are expected result in the fishery not causing the bycatch species to be outside biologically based limits or hindering recovery.		
Score: 80				
Justification				

A study characterizing the bycatch of the red-legged prawn sub-fishery in the Joseph Bonaparte Gulf identified 195 taxa from 85 families and noted that its species composition is distinctly different from the neighbouring Gulf of Carpentaria. The three most dominant species were *Harpadon translucens* (glassy Bombay duck), *Rhinoprenes pentanemus* (threadfin scat) and *Trichiurus lepturus* (largehead hairtail) which together accounted for 46% of the total biomass. While these species may be considered the main bycatch species in the fishery, all species known to interact with the fishery were assessed under the ecological risk assessment. A quantitative ecological risk assessment (SAFE) was conducted for 51 elasmobranch species and 456 teleost species, some of which are ETP species assessed separately.

Five elasmobranch species had an estimated fishing induced mortality rate (u) greater than the minimum unsustainable fishing mortality (u_{crash}): *Carcharhinus albimarginatus* (silvertip shark), *Orectolobus ornatus* (ornate wobbegong), *and Squatina* sp. A (eastern angel shark), *Taeniura meyeni* (blotched fantail ray), and *Urogymnus asperrimus* (porcupine ray). In addition, for five other species, the 95% confidence interval for the estimate of u exceeded the estimated u_{crash} value: *Carcharhinus brevipinna* (spinner shark), *Carcharhinus leucas* (bull shark), *Pristis microdon* (freshwater sawfish), *Pristis zijsron* (green sawfish), and *Sphyrna mokarran* (great hammerhead). Expert consultation suggested that most of these species were unlikely to be realistically threatened by the fishery because their main distribution extends into deep water (>70 m) or over reefs which are largely unaffected by the NPF. Specifically, for the five species where u exceeded u_{crash}, the risks to *C. albimarginatus*, *O. ornatus* and *Squatina* sp. A were downgraded by expert override. The two remaining species (blotched fantail ray and porcupine ray) were added to the NPF's priority species list. A re-evaluation for the period 2007-2009 found five species with estimates of fishing mortality (F) higher than the maximum sustainable fishing mortality (F_{msm}) and the upper 90% confidence interval for fishing mortality (F) higher than the unsustainable fishing mortality (F_{crash}). These species were *C. albimarginatus*, *C. leucas*, *Galeocerdo cuvier* (tiger shark), *O. ornatus* and *S. mokarran*). None were considered to be at risk due to widespread distributions and/or low overlaps with the fishery. Furthermore, the blotched fantail ray was re-assessed as having a low risk, mainly due to its low occurrence in the fished area, and the porcupine ray was only considered at risk because its upper 90% confidence interval exceeded F_{msm}.

Five teleost species were found to be at risk due to the current fishing mortality exceeding the u_{msy} reference. Nine other species with lower assessed risk levels, were added to the list of species of concern resulting from the SAFE as a result of a Bycatch Subcommittee meeting in January 2009: *Dendrochirus brachypterus* (dwarf lionfish), *Scorpaenopsis venosa* (raggy scorpionfish), *Parascolopsis tosensis* (Tosa dwarf monocle bream), *Hemiramphus robustus* (three-by-two garfish), *Lutjanus rufolineatus* (yellow-lined snapper), *Onigocia spinosa* (midget flathead), *Benthosema pterotum* (skinnycheek lanternfish), *Scomberoides commersonnianus* (Talang queenfish) and *Sphyraena jello* (giant seapike). However, the assessed risks to seven of these species were downgraded through expert overrides (due to lack of overlap with the NPF geographically or by habitat or gear selectivity) and only two species (dwarf lionfish and raggy scorpionfish) were maintained on the NPF list of priority species. An update to the SAFE for 2007-2009 found that neither of these species had estimated fishing mortality greater than F_{msm}, even when uncertainty was considered, and no other teleost species were found to be of concern.

Of the four bycatch species placed on the NPF's list of priority species for monitoring, none have been recorded in the observer monitoring programmes. Scientists have suggested that these species are either hard bottom-associated and/or would be excluded by TED and are therefore unlikely to be encountered.

As the survey of bycatch in the Joseph Bonaparte Gulf was conducted contemporaneously with the ecological risk assessment, it is important to consider whether the survey discovered any new species which were not covered in the ERA. The species identified as unique to the JBG included *Polydactylus nigripinnis* (threadfin salmon), *Setipinna paxtoni* (anchovy), *Larimichthys pamoides* (jewfish), *Benthosema pterotum* (lanternfish), and *Johnius laevis* (round-nose croaker) which were considered, and *Johnius* cf trawavase (croaker), *Lophichthys boschmai* (anglerfish) and *Abralia amarta* (cephalopod) which were not. In two of the latter three cases, closely related

2.2	Bycatch Species			
2.2.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
species were assessed (e.g. other *Johnius* spp., anglerfishes of the family Antennariidae) but the cephalopod *A. amarta* may not have sufficient biological and ecological similarity to the other squids from the family Loliginidae which were assessed.				
Conclusion				
A comprehensive assessment of bycatch species determined that of 507 species assessed, only four (blotched fantail ray, porcupine ray, dwarf lionfish and raggy scorpionfish) were assessed as being at risk from the fishery because they exceeded a biologically-based limit. The risk assessment gave priority consideration to those species whose median estimates (50th percentile) of fishing mortality exceeded the reference points. It is not clear whether those species whose median estimate did not exceed, but whose 90% confidence interval (i.e. 95th percentile) did exceed, the reference point were consistently carried through to the expert override stage. However, given that none of the species with greater exceedances of the reference points (i.e. exceedance at 50th percentile versus 95th percentile) were ultimately found to be at risk, the probability that these other lower risk species are within biologically based limit is considered to be highly likely. There are also three species known from surveys in the Joseph Bonaparte Gulf that were not assessed in the ecological risk assessment. Two of these three species are however closely related to species which were assessed and found not to be at high risk from the fishery. It is thus the case that with the exception of three species out of over 500, it is highly likely that the main bycatch species are within biologically based limits (80).				
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2.2	Bycatch Species			
2.2.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations.	There are measures in place, if necessary, which are expected to maintain main bycatch species at levels which are highly likely to be within biologically based limits	There is a partial strategy in place, if necessary, for managing bycatch that is expected to maintain main bycatch species at levels which are highly likely to be within biologically based	There is a strategy in place for managing and minimising bycatch.

2.2	Bycatch Species			
2.2.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
		or to ensure that the fishery does not hinder their recovery.	limits or to ensure that the fishery does not hinder their recovery.	
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports high confidence that the strategy will work.
			There is some evidence that the partial strategy is being implemented successfully.	There is some evidence that the strategy is achieving its objective.
				There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring.
Score: 95				

Justification

The NPF has a Bycatch Action Plan (BAP) which comprises a strategy for bycatch reduction involving ecological risk assessment of all species (to identify issues), effort reduction, temporal and spatial closures, monitoring and research on use of bycatch reduction devices. The strategy specifies actions directed at those species with identifiable risks. The actions required are commonly used in shrimp/prawn fisheries and have a high level of success. The NPF implemented mandatory use of a specific suite of turtle exclusion devices (TEDs) and bycatch reduction devices (BRDs) in 2001. Field evaluations of the implementation of NPF-approved TEDs and BRDs have documented catch reductions for turtles of 99%, seasnakes of 5%, sharks of 17.7%, rays of 36.3%, large sponges of 85.3%, and small bycatch of 8%. Overall, the fishery reports achieving a 50% reduction in bycatch since the implementation of its first BAP in 1998 and is pursuing additional research to achieve further bycatch reductions.

Four species assessed as being at high risk from the fishery have been placed on a list of priority species for monitoring and are recorded by NPF crew member and scientific observers. However, there were only 15 days of scientific observer coverage in the red-legged prawn sub-fishery (in 2011 only).

Conclusion

The BAP, in conjunction with mandatory use of TEDs/BRDs, use of risk assessments of all species to identify high risks, and the observer monitoring programme for priority species, constitutes a strategy for managing and minimizing bycatch. Periodic updates of the Ecological Risk Management document assure that the strategy remains up to date (100).

Scientific testing for the NPF per se has proven that substantial bycatch reduction will result, thus there is confidence that the strategy will work (100). These methods have been used successfully in other similar fisheries.

The NPF claims to have reduced bycatch by 50% but since bycatch quantity and species composition is not routinely monitored, there is only indirect evidence of successful implementation (i.e., reductions in ETP species interactions, which presumably mean TEDs/BRDs are working effectively and are thus presumably having an effect on non-ETP species as well). Therefore, there is some evidence that the strategy is achieving its objective (100), although it is noted that this is based on logbook records only as there has thus far been only 15 days of scientific observer coverage in this sub-fishery. Some concerns have been expressed about the positioning of BRDs for maximum effectiveness and lacking further evidence of the successful implementation of bycatch reduction for bycatch species per se, the evidence for the success of the strategy for bycatch species per se is not entirely clear (this 100 SG not met).

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2.2	Bycatch Species			
2.2.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

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2.2	Bycatch Species			
2.2.3	Information / Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Information on the nature and amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch. *(Note: Scoring issues in brackets need not be scored when the RBF is used to score PI 2.1.1.)*	Qualitative information is available on the amount of main bycatch species affected by the fishery.	Qualitative information and some quantitative information are available on the amount of main bycatch species affected by the fishery	Accurate and verifiable information is available on the amount of all bycatch and the consequences for the status of affected populations.
		(Information is adequate to broadly understand outcome status with respect to biologically based limits.)	(Information is sufficient to estimate outcome status with respect to biologically based limits.)	(Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.)
		Information is adequate to support measures to manage bycatch.	Information is adequate to support a partial strategy to manage main bycatch species.	Information is adequate to support a comprehensive strategy to manage bycatch, and evaluate with a high degree of certainty whether a strategy is achieving its objective.
			Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.

Score: 75

Justification

One comprehensive scientific survey has been conducted to assess the bycatch in the red-legged prawn sub-fishery. Several quantitative ecological risk assessments have been undertaken using state-of-the-art methods. However, bycatch data collection from the fishery itself is not required by the logbook reporting format. There is thus only 15 days of observer coverage in the red-legged prawn sub-fishery, there is only a small amount of data available on bycatch quantities or species composition. Research in similar environments in the Gulf of Carpentaria has been conducted to investigate the sample sizes required to detect statistically significant changes in the abundance of rarer (and thus of greater concern) bycatch species, but this research concluded that in most cases the sampling effort is beyond practically achievable levels.

Conclusion

2.2	Bycatch Species			
2.2.3	**Information / Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Qualitative and some quantitative information are available on all bycatch species affected by the fishery through ecological risk assessment and research studies (80).

With the very low amount of observer data available there is only a broad understanding of the outcome status of at-risk bycatch species (60).

Given the comprehensive baseline datasets established and the rigorous ecological risk assessment process, this information is considered adequate to support the strategy to manage bycatch (BAP), however there may not be a high degree of certainty given the lack of direct evidence pertaining to bycatch species per se (see 2.2.2) (80).

Main bycatch species have been assessed as not being at risk, therefore monitoring focuses on four species which are at risk but rare. Research has suggested that statistically significant change may be difficult to detect due to low occurrence rates in the samples. Considering these factors, the sampling programme is deemed to be sufficient (80).

A Condition (1) is raised for this PI (See Section 7.3).

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AFMA. 2009b. Ecological Risk Management: Report for the Northern Prawn Fishery – Tiger and Banana Prawn Sub-fisheries

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	**Status**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery meets national and international requirements for	Known effects of the fishery are likely to be within limits of national	The effects of the fishery are known and are highly likely to be within limits of	There is a high degree of certainty that the effects of the fishery are within limits

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	protection of ETP species. The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species.	and international requirements for protection of ETP species.	national and international requirements for protection of ETP species.	of national and international requirements for protection of ETP species.
		Known direct effects are unlikely to create unacceptable impacts to ETP species.	Direct effects are highly unlikely to create unacceptable impacts to ETP species.	There is a high degree of confidence that there are no significant detrimental effects (direct and indirect) of the fishery on ETP species.
			Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	
Score: 90				
Justification				

In an early ecological risk assessment based on productivity-susceptibility analyses (2007) five species of sawfishes and four species of seasnakes were considered to be at high risk in the tiger prawn sub-fishery, which represents the red-legged fishery. In a subsequent risk assessment based on the SAFE methodology none of these species were found to be at high risk (2011; see Section 3.7.3 for details). ETP species are constantly monitored by the NPF (logbooks, and both observer programmes), which allows for recognition of potential changes in status and opportunities for plan adjustments. There are national plans of action or recovery for turtles, sharks and whale sharks (specifically). On 22 December 2008, the Australian Minister for the Environmental, Heritage and the Arts certified that an assessment of the NPF under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) found that the fishery was “unlikely to be detrimental to the survival or conservation status of any taxon to which the fishery operation relates, or threaten any relevant ecosystem in the medium to long term”. As a result, export of NPF product has been authorized until 9 January 2014.

Marine mammals (whales, dolphins, dugongs)
Most marine mammals are too large to be entangled in the size of trawl fished in the NPF, or would be excluded by TEDs which have been mandatory in the fishery since 2001. A single dolphin interaction was recorded for the red-legged prawn sub-fishery in 2004; no other marine mammal interactions have been recorded since then.

Marine birds
In the risk assessment specialists noted that there have been no historical bird interactions in the NPF. Monitoring data since 2004 indicates no bird interactions in the red-legged prawn sub-fishery since 2004. Indirect effects on foraging ecology have been considered but impacts have not been documented.

Marine reptiles (turtles, crocodiles and seasnakes)
TEDs have reduced the bycatch of turtles in the NPF as whole from approximately 5,700 to 30 per year. Green and unidentified turtles have been encountered in the red-legged prawn sub-fishery, but only four in total since 2004. Overall in the NPF, 96% of turtles were alive at the time of interaction. Interactions with crocodiles are mitigated by the lack of overlap of their habitat with NPF fishing areas and no interactions have been recorded. An annual average of 355 seasnake interactions has been recorded for the red-legged prawn sub-fishery between 2004-2010. On average, for the NPF as a whole, only two-thirds of the seasnakes may survive the interaction. Catch rates for the ten most common species of seasnakes have remained stable from 1976-2008. Although there is recognition by the NPF that further reduction in seasnake interaction rates is necessary as they are Australian TEP species, assessment study of seasnakes in 2008 found that they are not at risk and thus population status has not been further assessed (see Section 3.7.3).

Elasmobranch fishes (sharks and sawfishes)
Despite the lack of documentation of unacceptable risk, it is recognized that there is a high overlap of the NPF with some sawfishes’ distribution (mainly the narrow sawfish, *Anoxypristis cuspidata*), they have a high degree of endemism, they are slow-moving, and they are highly susceptible to capture due to their rostrum teeth entangling in the net mesh. There are also concerns that cumulative impacts to sawfish from domestic gill net fisheries and from Indonesian fisheries to the north cannot be or have not been fully accounted for in the ecological risk methodology. Sawfishes reported from the red-legged prawn sub-fishery include narrow, green, common sawshark and unidentified sawfishes. For the NPF as a whole catches for sawfish (which are most likely the narrow sawfish)

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.1	Status	60 Guideposts	80 Guideposts	100 Guideposts

appear to have been stable between 1990 and 2002 but slightly increasing since 2003 with no statistical significant trend overall. Catch rate trends for green sawfish are difficult to interpret due to low sample sizes. The annual average number of sawfish encounters in the red-legged prawn sub-fishery is 13. No interactions with elasmobranch species other than sawfishes have been recorded in logbooks for the red-legged prawn sub-fishery. Elasmobranches, reported as a group for the NPF as whole, survive interactions at a rate of 67%.

Teleost fishes (Syngnathids)
There is a low risk of interaction with seahorses, pipefishes and seadragons due to the exclusion of benthic seagrass and other structured habitats preferred by these species from the NPF's fishing grounds due to Protected Area Closures. Syngnathids interactions in the red-legged prawn sub-fishery have totalled eight, all recorded from 2004. Due to their delicate nature, the number of Syngnathids surviving interactions is a little as 2% (figures for NPF as a whole).

Conclusion

Direct and indirect fishery effects and their impacts on ETP species have been accounted for in the ecological risk assessments and no species in any of the five groups have been assessed as being "at risk". Furthermore, the Australian government's export certification process has declared that the NPF meets the requirements of the EPBC Act. Therefore there is a high degree of certainty that all national and relevant international requirements with regard to ETP are met (100).

Despite the fact that impacts are considered acceptable there is acknowledgement that some risks still exist. The NPF notes that recent BRD implementation has not proved effective at reducing seasnake catch in the NPF when set at the maximum legal distance from the codend. There are also concerns that cumulative impacts to sawfishes have not been adequately accounted for and that interaction rates have not been adequately reduced by TEDs due to sawfish rostrum entanglement. Therefore, while direct and indirect impacts are considered acceptable, they may still be significant and are the subject of continuing research (80).

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2.3.1	Status	60 Guideposts	80 Guideposts	100 Guideposts

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery has in place precautionary management strategies designed to: - meet national and international requirements; - ensure the fishery does not pose a risk of serious or irreversible harm to ETP species; - ensure the fishery does not hinder recovery of ETP species; and - minimise mortality of ETP species.	There are measures in place that minimise mortality, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality that is designed to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality that is designed to achieve above national and international requirements for the protection of ETP species.
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is an objective basis for confidence that the strategy will work, based on some information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work.
			There is evidence that the strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is evidence that the strategy is achieving its objective.
Score: 95				
Justification				

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

The NPF has formulated and implemented a Bycatch and Discarding Work Plan (BDWP) and an Ecological Risk Management Strategy, which encapsulate the NPF's strategy for overall minimisation of bycatch through developing management responses to high ecological risks and measures to avoid fishery interactions with species listed under the EPBC Act. This strategy comprises temporal and spatial closures, monitoring programmes, research projects and bycatch reduction activities such as development and testing of new BRDs.

As none of the ETP species have been found to be at high risk from the fishery, the main management achievements for ETP species have been in the form of bycatch reduction, in particular turtle bycatch has been reduced by 99%. However, TEDs and BRDs have had mixed success for other organisms: one study reported that TEDs reduced catches of narrow sawfish by 73% whereas other studies found only a slight effect or no effect due to entanglement before the TED is contacted. Similarly for seasnakes, research results showed that BRDs did not effectively reduce bycatch when placed at the maximum legal distance from the codend, although they did reduce crushing of caught seasnakes and thus improved survival. The need to further reduce seasnake bycatch has been addressed through testing and approval of the Popeye Fishbox BRD which can achieve an 85% reduction in seasnake catch. The NPF intends to release a study by mid-2012 which will review the implementation, usage and effectiveness of BRDs, but at this time no information is available on the implementation rates of various BRDs.

Monitoring programmes, which for ETP species in this sub-fishery include logbooks, a small amount of scientific observer coverage in 2011, and ad hoc but ongoing research programmes, assess the effects of the fishery on TEP species. There are no defined trigger levels for management action, rather AFMA monitors the currently low levels of interaction and if they begin to rise, management action will be discussed.

Conclusion

There is a strategy in place to manage the fishery's impacts on ETP species. Given that none of these species have been found to be at risk from the fishery, current levels of impacts (interactions) are considered to exceed national and international requirements for these species' protection (100).

The strategy is based on research conducted for this fishery and quantitative analysis provides high confidence and evidence that the strategy can work (100).

There is evidence that the strategy is being implemented successfully given that interactions are monitored, and though variable year-to-year, do not appear to be rising. However, one of the recommendations arising from the 2008 DEWHA export certification was that the NPF should continue to effectively mitigate against and reduce bycatch in the fishery, particularly for sawfish, rays and sea snakes. Based on interaction data from logbooks, supplemented by the findings of research studies, it does not appear that seasnake and sawfish interactions are being continuously reduced under the current management strategy, particularly since the utilization rates for effective BRD types and deployments is not currently monitored. Therefore it cannot be confirmed that the intended changes are occurring (80).

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

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2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.3	**Information/ Monitoring**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Relevant information is collected to support the management of fishery impacts on ETP species, including: - information for the development of the management strategy; - information to assess the effectiveness of the management strategy; and - information to determine the outcome status of ETP species.	Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species, and if so, to measure trends and support a full strategy to manage impacts.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
		Information is adequate to support measures to manage the impacts on ETP species	Sufficient data are available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.
		Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.		Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.

Score: 80

Justification

There are two types of data available to estimate the impacts of the fishery on ETP species: comprehensive, but spatial and temporally limited research studies; and ongoing monitoring of the fishery itself. The former was used as the basis for the quantitative ecological risk assessment which found that no ETP species are at risk from the fishery. However, it was acknowledged that cumulative impacts may need to be better accounted for in the methodology, particularly for those species which are known to be regionally/globally threatened such as sawfishes (CITES Appendix I listed for all but one species which is CITES Appendix II; IUCN Red List Critically Endangered).

The monitoring data is designed to indicate trends in interactions between ETP species and the fishery. In the red-legged prawn sub-fishery ETP monitoring data is mainly provided by NPF logbooks only; thus far there has only been 15 days of scientific observer coverage for this fishery (for 2011 only). ETP species interaction rates recorded in logbooks is generally much lower than those recorded by scientific observers. For a variety of reasons, species-specific identifications are not always provided (in some cases, obtaining a species identification could work against the live release of the organism, e.g. sawfishes). This, in combination with low catch rates, makes it difficult to analyse the data for changes in abundance. A study examining the requisite sample sizes to detect a statistically significant difference found that the number of samples required to assess rare species is well beyond practical limits of the observer and monitoring programmes therefore other strategies were recommended.

Conclusion

2.3	Endangered, Threatened and Protected (ETP) Species			
2.3.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts

The combination of quantitative ecological risk assessment and ongoing logbook-based fishery monitoring is sufficient to determine whether the fishery is a threat to ETP species; to measure trends; and to support the Bycatch and Discarding Work Plan and Ecological Risk Management Strategy (80).

Sufficient data are available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species, i.e. through ecological risk assessment. Fishing related mortality and quantitative estimates of impacts have been undertaken for species of concern through the SAFE-level risk assessments (elasmobranches; see Section 3.7.1) and analysis of catch rates (seasnakes) (80).

It is considered that information sufficient to support a comprehensive strategy or to estimate outcome status with a high degree of certainty would necessarily require ongoing monitoring data on a species-specific basis. The current very low levels of observer coverage in the red-legged sub-fishery (15 days of scientific observer coverage for 2011 only) cannot be considered to collect accurate and verifiable species-specific information for all ETP species (does not meet the 100 SG).

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CSIRO, personal communication, September 2011

2.4	Habitat			
2.4.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function.	The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.
Score: 80				

Justification

For the ecological risk assessment, the red-legged sub-fishery was considered to be a part of the tiger prawn sub-fishery. However, the red-legged prawn sub-fishery is expected to have benthic habitat impacts similar to, but less

2.4	Habitat			
2.4.1	Status	60 Guideposts	80 Guideposts	100 Guideposts

severe than, the tiger prawn fishery because it is less closely associated with the seabed. None of the 157 habitat types (benthic and water column) evaluated for the ecological risk assessment (which included those in Joseph Bonaparte Gulf) were found to be at high risk. There are no known studies of the effects of trawling on the habitats within the red-legged fishing grounds (Joseph Bonaparte Gulf) but studies of such effects in the Gulf Carpentaria have shown that habitat structure and function is not seriously affected by trawling activities.

Conclusion

The ecological risk assessment for the tiger prawn fishery included an assessment of habitats in the Joseph Bonaparte Gulf and concluded that the habitats are not at high risk. However, confidence is not as high for the red-legged sub-fishery as for the other sub-fisheries for the rapid recovery of communities after trawling as there are no impact studies for the red-legged fishing grounds per se. Therefore, although there is some evidence in the form of the ecological risk assessment results, a finding that serious or irreversible harm is "highly unlikely" is considered most appropriate (80).

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CSIRO, personal communication, September 2011.

AFMA, personal communication, November 2011.

2.4	Habitat			
2.4.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts
	There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types.	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of the fishery on habitat types.
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or habitats involved.	The strategy is mainly based on information directly about the fishery and/or habitats involved, and testing supports high confidence that the strategy will work.
			There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring. There is some evidence that the strategy is achieving its objective.

Score: 80

Justification

2.4	Habitat			
2.4.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

Habitat impacts are primarily managed through a system of spatial and temporal closures adopted by the NPF to protect vulnerable habitats such as seagrass beds and coral and rocky reefs, as well as to address economic objectives of the fishery. A total of 2.1% of the managed zone of the fishery is subject to permanent closures while 8.3% is subject to seasonal closures. These areas include all known seagrass beds. Furthermore, the entire fishery is closed for 5.5 month each year. It has been noted that with the decline in fishing effort from 286 vessels in 1981 to 52 vessels in 2009, and the deployment of these vessels over only about 8-17% of the NPF-managed region overall and only intensively over about 3% per year, residual habitat impacts from trawls contacting the seabed are expected to be further minimized. Since ecological risk assessments on habitats found little or no detrimental impact on the physical marine environment, AFMA has deferred development of an ecological risk management strategy for NPF habitats until more information is available.

Conclusion

The spatial and temporal closures system represents a partial strategy; a full strategy addressing residual impacts to non-designated but ecologically valuable habitats (e.g., sponge gardens) is yet to be developed (80).

The partial strategy is based on known ecological valuable habitats located within the NPF fishing grounds and there is confidence it will work through VMS monitoring to demonstrate avoidance of closed areas (80).

Some evidence for implementation of the partial strategy is provided in the form of VMS monitoring of vessel movements with regard to the spatial and temporal closure requirements, and by the low number of observed interactions with seagrass bed-associated species such as dugongs and syngnathids (80).

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2.4	Habitat			
2.4.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types.	There is a basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
		Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location	Changes in habitat distributions over time are measured.

2.4	Habitat			
2.4.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
			of use of the fishing gear.	
			Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	The physical impacts of the gear on the habitat types have been quantified fully

Score: 65

Justification

All habitats in the red-legged prawn sub-fishery (Joseph Bonaparte Gulf) were mapped for the ecological risk assessment, the impacts of the trawl gear's interaction with these habitat types were evaluated and none of the habitats were found to be at high risk. However, historical and recent in-depth field research projects have focused solely on the Gulf of Carpentaria. Ongoing information gathering for the red-legged fishery is mainly in the form of VMS monitoring of vessel behaviour with regard to the temporal and spatial closures.

Conclusion

A basic understanding of habitat types, the main impacts of the gear on those habitat types, is available through the results of the ecological risk assessment and by inference from extensive research undertaken in the Gulf of Carpentaria (60 and 60).

VMS data shows the interaction of fishing gear from the five vessels in the fishery with Joseph Bonaparte Gulf habitats and is sufficient to detect any increase in risk (80).

A Condition (2) is raised for this PI (See Section 7.3).

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2.5	Ecosystem			
2.5.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function.	The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible

2.5	Ecosystem			
2.5.1	Status	60 Guideposts	80 Guideposts	100 Guideposts
				harm.

Score: 80

Justification

The ecosystem effects of the NPF's trawl fisheries have been studied in depth, most recently in studies involving both field surveys/experimentation (e.g. sampling of sites that were subject to high, medium and low intensity trawling in a number of fishing grounds) and simulation models. The most recent of these studies, completed in 2010, concluded that effects of trawling at the current scale of the NPF do not affect overall biodiversity and cannot be distinguished from other sources of variation in community structure. Specifically, trawling intensity explained only 2% of the biomass density variation in epibenthic invertebrates (including benthic sessile and mobile species), and at most 1% in infaunal invertebrates. Community composition and structure were more strongly related to region, and in some cases time of day, than to the intensity of trawling. Mean trophic level was shown to have declined when the fishery was at its peak in the early 1980s and rose again when fishing effort dropped. The study found that communities can recover rapidly when trawling frequency is reduced.

In addition to these studies of the benthic community, a Level 1 risk assessment (based on a Scale Impact Consequence Analysis) concluded that impacts to the ecosystem were of low consequence. The assessed risks, the field studies of impacts, and the monitoring undertaken for the species assessed elsewhere under this principle (P2), further support the lack of disturbance to key components of the ecosystem and thus suggest a lack of disturbance to ecosystem structure and function.

It should be noted that these studies focused on the tiger prawn sub-fishery in the Gulf of Carpentaria. That sub-fishery has a higher quantity and biodiversity of bycatch, and potentially also a greater degree of benthic impact, than the red-legged prawn sub-fishery. It may therefore be inferred that the ecosystems in the Joseph Bonaparte Gulf may be subject to similar or lesser impacts, assuming that baseline conditions are ecologically similar. When making such an extrapolation, it should also be considered that the red-legged fishery currently comprises only 5 vessels.

Conclusion

While there is some available information on ecosystem impacts available from a similar sub-fishery, differences in baseline ecosystem characteristics between the Gulf of Carpentaria and the Joseph Bonaparte Gulf have not been studied. Nevertheless, the ecological risk assessment covered both areas in terms of species and habitats as one unit (i.e., the tiger prawn sub-fishery) and it is therefore assumed that conditions and impacts are sufficiently similar to conclude that, given the tiger prawn sub-fishery causes no serious or irreversible harm, that the red-legged prawn sub-fishery impacts on its ecosystem are similar or less. In addition, the presence of only five fishing vessels in an expansive fishing ground lends further weight to the conclusion that the fishery is highly unlikely to disrupt the key elements of the ecosystem (80).

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2.5	Ecosystem			
2.5.2	**Management Strategy**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function.	There are measures in place, if necessary, that take into account potential impacts of the fishery on key elements of the ecosystem.	There is a partial strategy in place, if necessary, that takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a strategy that consists of a plan, containing measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem.
		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/ ecosystems).	The partial strategy is considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/ ecosystems).	This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.
			There is some evidence that the measures comprising the partial strategy are being implemented successfully.	The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved.
				There is evidence that the measures are being implemented successfully.
Score: 90				

Justification

The Ecological Risk Management (ERM) document for the NPF states that it does not contain specific management strategies for habitats and communities, however, it does contain measures to prevent adverse impacts to species (through quantitative ecological risk assessment, list of priority species for monitoring, and catch monitoring and reporting requirements) and measures to prevent adverse impacts to habitats (through temporal and spatial closures and VMS monitoring of the location and duration of trawling impacts). Therefore, while the ERM document cannot be considered a full strategy premised on functional relationships between the fishery and the ecosystem, it certainly represents a partial strategy. Evidence that this partial strategy is likely to work and is being implemented is available in the form of species and VMS monitoring data which are subject to ongoing scrutiny, as well as updates to the ecological risk assessment process and changes to monitoring procedures as necessary. Several research studies have also been conducted to assess the effectiveness of management practices (e.g. TEDs/BRDs) for bycatch and ETP species groups in particular.

Conclusion

The ERM document comprises a partial strategy (only) and thus does not meet all of the guideposts for the 100 scoring level (80, 80). The elements of the ERM document have been tested and proven to work through experience in the fishery involved, as confirmed by comprehensive research studies and reports (100).

Evidence for effective implementation exists in the form of successful lowering of interaction rates with some groups of ETP species, large reductions in the overall amount of bycatch, and VMS monitoring of temporal and spatial closures (100).

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2.5	Ecosystem			
2.5.2	Management Strategy	60 Guideposts	80 Guideposts	100 Guideposts

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2.5	Ecosystem			
2.5.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
	There is adequate knowledge of the impacts of the fishery on the ecosystem.	Information is adequate to identify the key elements of the ecosystem (e.g. trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to broadly understand the key elements of the ecosystem.	
		Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but may not have been investigated in detail.	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated.
			The main functions of the Components (i.e. target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known.	The impacts of the fishery on target, Bycatch, Retained and ETP species and Habitats are identified and the main functions of these Components in the ecosystem are understood
			Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.	Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.

2.5	Ecosystem			
2.5.3	Information/ Monitoring	60 Guideposts	80 Guideposts	100 Guideposts
			Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
Score: 70				

Justification

Detailed ecosystem studies have been conducted for the NPF in the Gulf of Carpentaria. Although these have focused on the tiger prawn sub-fishery, which has a similar or slightly greater expected impact on benthic communities than the red-legged sub-fishery (see Sections 3.5 and 3.7.1), differences in the ecosystems of the Gulf of Carpentaria and the red-legged prawn sub-fishery fishing grounds (Joseph Bonaparte Gulf) remain to be studied. The only known field survey for the red-legged fishing grounds found several species unique to that area, although most of these appear closely related to species in the Gulf of Carpentaria. While major ecosystem differences between the two areas would not be expected, this remains unconfirmed. Nevertheless, the impacts of trawling (at a greater intensity in the tiger prawn sub-fishery than the red-legged sub-fishery) can be generally inferred from the detailed studies in the Gulf of Carpentaria to not include serious or irreversible impacts.

Conclusion

Information on the key elements of the ecosystem in the red-legged sub-fishery fishing grounds is available from a bycatch survey and this information in combination with studies of the structure and function of a similar ecosystem in the Gulf of Carpentaria results in an ability to identify the key ecosystem elements. However, as there may be additional ecosystem elements that were not captured in the one-time bycatch survey, or there may be different ecosystem structures (density, composition), interactions or disturbance regimes, ecosystem functions in the red-legged fishing grounds that cannot be said to be broadly understood (therefore 60).

Detailed investigations of the impacts of trawling in a similar ecosystem (i.e., Gulf of Carpentaria) allow the main fishery impacts in the red-legged fishing grounds to be inferred, but one the basis of one survey, these may not have been investigated in the Joseph Bonaparte Gulf per se (80).

Due to only one site-specific survey the main functions of the ecosystem components may not be completely known (therefore not 80). However, given the detail and depth of studies conducted in the Gulf of Carpentaria for a similar fishery, the main impacts of the fishery on the ecosystem can be inferred (80).

Ongoing ecosystem-relevant data is not being collected in the red-legged fishery, perhaps due to its small size (currently five vessels) (therefore not 80).

A Condition (3) is raised for this PI (See Section 7.3).

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Principle 3 Performance Indicators and Scoring Guideposts[252]

3.1	Governance and Policy			
3.1.1	**Legal and/or customary framework**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The management system exists within an appropriate and effective legal and/or customary framework which ensures that it: - Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; - Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and - Incorporates an appropriate dispute resolution framework.	The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2.	The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2.	
		The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective.
		Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with binding judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements binding judicial decisions arising from legal challenges.
		The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.
Score: 100				
Justification				

Overarching Commonwealth legislation relevant to fisheries includes the (1) Fisheries Management Act of 1991 and (2) the Environment Protection and Biodiversity Act 1999. The FMA takes account of the United Nations Fish Stocks Agreement and FAO's Code of Conduct for Responsible Fisheries. AFMA has also adopted the Ecosystem Approach to Fisheries Management through the Ecological Sustainable Development Policy and its overarching

[252] All references for justifications given under P3 are included in the Background section of the report – Section 3.8.

3.1	Governance and Policy			
3.1.1	Legal and/or customary framework	60 Guideposts	80 Guideposts	100 Guideposts

framework for Commonwealth fisheries (AFMA, 2005). The Ecologically Sustainable Development Policy ESD includes the principles of ecologically sustainable target and bycatch species, ecological viability of bycatch species, and impact of the broader marine ecosystem.

Sections 161 and 165 of the FMA provide appeal rights for decisions taken by AFMA through administrative means (internal AFMA review, appeal to the Administrative Appeals Tribunal and the Statutory Fishing Rights Allocation Review Panel) and judicial means through appeal to the Federal Court. These dispute resolution mechanisms have been tested (Weire, 2007) and proven to be effective. Fishers are advised of their appeal rights and the processes involved. In addition to these processes, the consultation and advisory processes established by AFMA provide mechanisms for the airing and discussion of different perspectives on fisheries management and arguably serve to avoid potential legal disputes. Legal advice on management and appeals is provided by legal expertise within AFMA and by external, independent legal advisers as required.

Special provision for ‘traditional fishing’ is made where they might apply in the contexts of both Commonwealth and State Fisheries Law. The Northern Prawn fishery is a specialist offshore commercial fishery. Indigenous rights are however considered in the context of The Aboriginal Land Act 1978 (NT) s 12(1) which empowers the Administrator to close the seas adjoining and within 2km of Aboriginal land, to others who are not Aborigines entitled by tradition to enter and use the seas in accordance with that tradition. Before doing so he may (and in case of dispute he must) refer a proposed sea closure to the Aboriginal Land Commissioner. These issues are taken into account through NOPRMAC consultation processes and in the context of closed areas discussions. Once seas are closed it is an offence for a person to enter or remain on these seas without a permit issued by the relevant Land Council.

Conclusion

The management system is consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2 (100).

The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective (100).

The management system or fishery acts proactively to avoid legal disputes or rapidly implements binding judicial decisions arising from legal challenges (100).

The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2 (100).

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3.1	Governance and Policy			
3.1.2	**Consultation, roles and responsibilities**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The management system has effective consultation processes that are open to interested and affected parties. The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.
		The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.
			The consultation process provides opportunity for all interested and affected parties to be involved.	The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement
Score: 100				

Justification

AFMA undertakes the day to day management of the Commonwealth fisheries under powers outlined in the FMA and Fisheries Administration Act 1991. Overarching policy direction is set by the Australian Government through the relevant Minister responsible for fisheries, acting upon advice from the Australian Government Department of Agriculture, Fisheries and Forestry.

Roles and responsibilities are divided between the respective management organisation (AFMA), the Northern Prawn Industry Pty Ltd, the Northern Prawn Management Advisory Committee (NORMAC) and NPRAG (Table 4)

As part of AFMA's partnership approach to fisheries management, it has established NORMAC, which is AFMA's main point of contact with client groups in the NPF and plays an important role in helping AFMA to fulfil its legislative functions and pursue its objectives. The MACs comprises representatives of the NPF industry, environmental organisations, research interests and fishery managers. Permanent observers are also appointed, which may include DSEWPaC, Australian Bureau of Agriculture and Resource Economics (ABARES), and representatives of CSIRO. The role of the NORMAC is clearly defined (AFMA 2009a, AFMA 2011a, AFMA 2011b). NORMAC provides advice to AFMA on a variety of issues, including the harvest strategy and other on-going measures required to manage the fishery, including the development of management plans, research priorities and projects for the fishery.

In addition to the opportunities for stakeholder engagement provided by the NORMAC, AFMA:

- provides opportunities for public comment on fisheries management plans;
- holds an annual public meeting;

3.1	Governance and Policy			
3.1.2	Consultation, roles and responsibilities	60 Guideposts	80 Guideposts	100 Guideposts

- requires NORMAC to hold an annual public meeting; and
- holds around half of AFMA's Commission meetings in regional centres providing opportunities for direct access to AFMA Commissioners by stakeholders and the general public.

NORMAC considers the wide range of information including local knowledge as part of its advisory processes. The minutes of NORMAC meeting are publically available. These include rationale on how local knowledge has, or has not, been incorporated into management advice to the AFMA Commission. The AFMA Commission (and Parliament), may reject NORMAC advice. In respect to the AFMA Commission, NORMAC will always receive a letter from the Commission outlining any decisions made on NORMAC recommendations, including explanations as to acceptance or rejecting of NORMAC recommendations.

The development of the demarcated closed and protected areas includes direct consultation with indigenous interests and ongoing awareness on traditional rights (FRDC 2010). Representatives of various land councils also attend NORMAC meetings to discuss relevant issues (Jarrett, pers com, January, 2012).

Conclusions

Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and are well understood for all areas of responsibility and interaction (100).

The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used (100).

The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement (100).

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3.1	Governance and Policy			
3.1.3	**Long term objectives**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach.	Long-term objectives to guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are implicit within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy.
Score: 100				

Justification

The long term objectives of the management system are specified in the FMA and the EPBC Act, and further defined in the Commonwealth Fisheries Harvest Strategy Policy and Guidelines. The objectives and policy guidance are consistent with MSC's Principles and Criteria and explicitly require application of the precautionary principle. The fishery is also subject to the Commonwealth EPBC Act which requires periodic assessment against the *Guidelines for the Ecologically Sustainable Management of Fisheries*. These Guidelines are consistent with the MSC Principles and Criteria and encourage practical application of the ecosystem approach to fisheries management.

Conclusion

Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy (100).

References

Australian Government, Australian Fisheries Management Act of 1991. Available at http://www.austlii.edu.au/au/legis/cth/consol_act/fma1991193/

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3.1	Governance and Policy			
3.1.4	**Incentives for sustainable fishing**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers

3.1	Governance and Policy			
3.1.4	Incentives for sustainable fishing	60 Guideposts	80 Guideposts	100 Guideposts
			perverse incentives do not arise.	incentives in a regular review of management policy or procedures to ensure that they do not contribute to unsustainable fishing practices.
Score: 100				

Justification

The fishery has set the achievement of maximum economic yield (MEY) as its management target, consistent with the FMA objective to maximise net economic returns to the Australian community. The allocation of SFRs in the form of individual transferable Gear and B (boat) SFRs is the primary mechanism by which the management system seeks to provide long-term incentives for sustainable fishing in the prawn fishery. Three structural adjustment programs have been undertaken in order to address significant overcapacity issues and to ensure that such overcapacity does not pose a risk to the sustainability of stocks. Management measures (for example seasonal closures and tradable SFRs) also seek to optimize economic benefits. This system is constantly under review as part of the Harvest Strategy.

Implementation of the cost recovery scheme (CRIS, AFMA, 2010), and research funding supports the principle of resource optimization. CRIS was subject to review in 2009.

ABARES has also explicitly evaluated the impact of subsidies (Gooday, 2002). The report concludes that the major subsidy, ‘buy back’ or decommissioning and licence buy back, were seen as positive incentives since they explicitly supported changes to fisheries management, effectively limiting harvest and effort.

Regular economic status assessments are undertaken by ABARES of indicators including the gross value of production, cost of management, financial performance (indicators including profit at full equity, cash operating surplus and return on investment), determination of major cost increases, regional economic impacts and economic rent.

Conclusion

The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure that they do not contribute to unsustainable fishing practices (100).

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Kompas T, Dichmont C.E, Punt, A.E, Deng A, Tuong Nhu Che, Bishop, J., Gooday, P., Yemin, Y., Zhou, S., (2010) Maximizing profits and conserving stocks in the Australian Northern Prawn Fishery, Australian Journal of Agricultural Economics, Vol 54, Issue 3.

DAFF (2003). Looking to the Future: A review of Commonwealth Fisheries Policy.

AFMA (2009b) Cost Recovery Impact Statement, January 2009. Available at: http://www.afma.gov.au/information/publications/corporate/cris/default.htm

Dichmont C, (2011). Northern Prawn Fishery Harvest Strategy under Input Controls, AFMA, 2011.

BRS, Fishery Status Reports, DAFF, 2009. Available at http://adl.brs.gov.au/data/warehouse/fishrp9abc_011/fishrp9abc_0111011a/FishStatusReport2009.pdf

3.1	Governance and Policy			
3.1.4	Incentives for sustainable fishing	60 Guideposts	80 Guideposts	100 Guideposts
ABARES (2009), Australian fisheries surveys report 2009, Survey results for selected fisheries, 2006-07 and 2007-08, Preliminary estimates for 2008-09. Available at http://adl.brs.gov.au/data/warehouse/pe_abarebrs99001665/afsr09.pdf				

3.2	Fishery-Specific Management System			
3.2.1	Fishery- specific objectives	60 Guideposts	80 Guideposts	100 Guideposts
	The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.	The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.	Objectives, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery's management system.	Well defined and measurable short and long term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.
Score: 100				
Justification				
The *Northern Prawn Fishery Management Plan* 1995 reinforces the objectives of the FMA as the objectives of the Plan. Fishery specific objectives can be identified in the Northern Prawn Fishery Harvest Strategy under Input Controls, 2011, and updated annually. The Strategy contains references to use of measurable indicators such as target and limit reference points. Other management documents containing fishery-specific objectives relating to the fishery include the Bycatch Action Plan (BAP), and the NPF Industry Code of Practice. Management outcomes are provided in the BAP and the Strategic Assessment report to DSEWPac (AFMA (2008b).				
Conclusion				
Well defined and measurable short and long term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system (100).				
Reference				
Dichmont C, (2011), Northern Prawn Fishery Harvest Strategy under Input Controls, AFMA, 2011. Australian Government, Northern Prawn Fishery Management Plan, 1995 (as amended). Available at http://www.comlaw.gov.au/Series/F2005B02455 AFMA (2010d) Northern Prawn Fishery Status Report and 2009 Annual Report for the Northern Prawn Fishery. Available at http://www.afma.gov.au/wp-content/uploads/2010/08/npf_annual_status_report.pdf NPF Industry Ltd (2004), Industry Code of Practice for Responsible Fishing (formerly Northern Prawn Fishing Industry Organisation). Available at http://www.afma.gov.au/wp-content/uploads/2010/06/npf_code.pdf AFMA (2009c) Northern Prawn Fishery, Bycatch and Discarding Workplan, 2009-2011.; Available at http://www.afma.gov.au/wp-content/uploads/2010/06/npf_bdw_2009_10.pdf AFMA (2008b), Status Report for Reassessment for Export Approval Under the EBPC Act, Northern Prawn Fishery. Available at http://www.environment.gov.au/coasts/fisheries/commonwealth/northern-prawn/pubs/reassessment-report-08.pdf				

3.2	Fishery-Specific Management System			
3.2.1	**Fishery- specific objectives**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
AFMA (2009d), Assessing the sustainability of the NPF bycatch from annual monitoring data: 2008				

3.2	Fishery-Specific Management System			
3.2.2	**Decision-making processes**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives.	There are informal decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
		Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
			Decision-making processes use the precautionary approach and are based on best available information.	
			Explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
Score: 100				

3.2	Fishery-Specific Management System			
3.2.2	**Decision-making processes**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**

Justification

The decision making processes by AFMA based on advice from NORMAC (working with NPF RAG and the NPF Research and Environment Committee (NPF REC)) are transparent with feedback provided by the Commission directly to NORMAC and to stakeholders through media such as the regular *AFMA Update* and through the Annual public meeting of both the MAC and AFMA.

The decision making process for the NPF is consistent with those for the broader management system and responds to the defined harvest and bycatch management strategies, which respond to research, outcomes evaluations and monitoring programmes. The AFMA website contains an extensive list of evaluations, research reports and assessments, and evidence exists within the NORMAC and the NPFRAG that decisions respond to these findings.

Conclusion

Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions (100).

Formal reporting to all interested stakeholders describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity (100).

References

Australian Government, Australian Fisheries Management Act of 1991. Available at http://www.austlii.edu.au/au/legis/cth/consol_act/fma1991193/

NORMAC (2011a), Agendas, minutes and workshop reports, Northern Prawn Fishery Management Advisory Committee (NORMAC). Available at http://www.afma.gov.au/managing-our-fisheries/consultation/management-advisory-committees/normac/

NPRAG (2011). Minutes. Available at http://www.afma.gov.au/managing-our-fisheries/consultation/resource-assessment-groups/nprag/

3.2	Fishery-Specific Management System			
3.2.3	**Compliance and enforcement**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with.	Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
		Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.
		Fishers are generally thought to comply with the management	Some evidence exists to demonstrate fishers comply with the	There is a high degree of confidence that fishers comply with the

3.2	Fishery-Specific Management System			
3.2.3	Compliance and enforcement	60 Guideposts	80 Guideposts	100 Guideposts
		system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	management system under assessment, including, providing information of importance to the effective management of the fishery.
			There is no evidence of systematic non-compliance.	
Score: 100				

Justification

The management system takes a risk-based approach to compliance. Compliance risk assessments are undertaken in consultation with the industry, and compliance plans are developed for the NPF fishery by AFMA. Primary compliance tools include vessel monitoring systems on all vessels, prior to landing-reports, catch disposal records and fish receiver records. At-sea and in-port vessel inspection, fish receiver inspections, and trip and landing inspections are carried out. There are appropriate provisions for penalties for infringement of fishery management measures in the FMA. There is no evidence of systematic non-compliance in the fishery and there is a high degree of evidence fishers comply with the management system (AFMA 2010c). AFMA acts on intelligence provided and there is a considerable degree of peer pressure applied within the industry to ensure compliance. This is also cemented by the NPF Code of Conduct which ensures the application of best practice such as reporting ETP interactions, and applying appropriate handling practices.

Fishers regularly participate in compliance workshops. Information of importance is shared through this process, and through specific intelligence gathering. NORMAC and NPF industry are consulted on the risk assessment process.

Conclusion

A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules (100).

Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence (100).

There is a high degree of confidence that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery (100).

References

AFMA (2010a), Domestic Compliance and Enforcement Policy. Available at http://www.afma.gov.au/resource-centre/publications-and-forms/afma-update/domestic-compliance-and-enforcement-program/

Venslovas, P., (2011), Domestic Compliance risk assessment 2011-12, letter from
The General Manager, Fisheries Operations Branch, AFMA to the NORMAC Chair, 23 March 2011

AFMA (2010b), (Compliance) Risk Assessment, 2010 (Unpublished)

Wildekamp (Interview No 1),

AFMA (2010c), Compliance Activities, 2009-2010

3.2	Fishery-Specific Management System			
3.2.4	**Research Plan**	**60 Guideposts**	**80 Guideposts**	**100 Guideposts**
	The fishery has a research plan that addresses the information needs of management.	Research is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 2.	A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.	A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.
		Research results are available to interested parties.	Research results are disseminated to all interested parties in a timely fashion	Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available.
Score: See below				

Justification

The broad direction of Research in Commonwealth fisheries is outlined in AFMA's Strategic Research Plan 2005-2010. These plans describe the way in which AFMA will support the management and development of Commonwealth fisheries resources through research during the five years 2005–2010. Each fishery is required to have its fishery-specific plan but the last NPF Research Plan was completed in 2001, and has not subsequently been updated. However research priorities are identified annually by the NPF Research and Environment Committee (NPFREC) and provided to the Commonwealth Fisheries Research Advisory Body (CFRAB) for consideration and assessment of appropriate funding opportunities including Fisheries Research and Development Corporation. Research reports are made publicly available via the AFMA website.

Research activities cover the following areas:

- Effects of trawling
- Monitoring
- Stock assessment
- Fisheries Management controls
- Fishery independent surveys

However, because of the different sub fisheries that exist within the framework of NPF, it is felt that the focus on research tends to prioritize the tiger prawn and white banana prawn subfisheries. For this reason, the separate scores are allocated for each sub fishery (i.e., research focusing on tiger prawns and banana white prawns assessed as comprehensive (SG 100), whilst research in the red leg banana prawn fishery sub-component is deemed not to be sufficient to score (SG 80) because of weaknesses in the availability of bycatch information.

A Condition (4) is raised for this PI.

Conclusion: – Score: 70

Research is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 22 but there has not been a fishery specific written document since 2001 (60).

Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available. (100)

References

AFMA (2005), Researching for Fisheries, Industry and Community: AFMA's Strategic Research Plan, 2005–2010. Available at http://www.afma.gov.au/wp-content/uploads/2010/07/strategic_research_plan.pdf

3.2	Fishery-Specific Management System			
3.2.4	Research Plan	60 Guideposts	80 Guideposts	100 Guideposts
NORMAC (2011b) Northern Prawn Fishery, Research Project Summary, 2000-2011				

3.2	Fishery-Specific Management System			
3.2.5	Monitoring and management performance evaluation	60 Guideposts	80 Guideposts	100 Guideposts
	There is a system for monitoring and evaluating the performance of the fishery-specific management system against its objectives. There is effective and timely review of the fishery-specific management system	The fishery has in place mechanisms to evaluate <u>some</u> parts of the management system and is subject to <u>occasional internal</u> review.	The fishery has in place mechanisms to evaluate <u>key</u> parts of the management system and is subject to <u>regular</u> <u>internal</u> and <u>occasional</u> <u>external</u> review.	The fishery has in place mechanisms to evaluate <u>all</u> parts of the management system and is subject to <u>regular</u> <u>internal</u> and <u>external</u> review.
Score: 100				

Justification

AFMA's management system is subject to internal and external performance evaluation including:

Internal peer reviews, which include:

- The requirement to report in AFMA's Annual Report on overall performance against the legislative objectives, statutory requirements and financial reporting, the effectiveness of internal controls and adequacy of systems; and the Authority's risk management processes;
- AFMA and the MAC to periodically assess the effectiveness of the management measures taken to achieve the objectives of this Management Plan by reference to the performance criteria specified in the Plan
- An AFMA review of the performance of NORMAC and the RAG; and
- AFMA also has an internal quality assurance program to determine whether Compliance best practice has been followed. One of a small number of breaches in the NPF was subject to review.

External reviews, which include:

- Questioning by the Senate Standing Committee on Rural and Regional Affairs in Senate Estimates hearings (three times/year);
- Strategic assessment of Management Plans and ongoing assessment for export approval under the EPBC Act against the *Guidelines for the Ecologically Sustainable Management of Fisheries*;
- The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) reports on the ecological and economic sustainability of fisheries managed by AFMA; and
- The Australian National Audit Office periodic reviews of aspects of AFMA's performance. This includes a report on its audit into the Management of Domestic Fishing Compliance (audit report no. 47 2008-09).

CSIRO research results are often published in peer reviewed scientific journals.

DSEWPac undertake an assessment of the fisheries management activities against the principles outlined in the EPBC Act. There is a regular review of the bycatch programme and a very high level of assessment applied to retained, bycatch, habitat, ecosystem and ETP species. DSEWPaC NPF recommendations can be found on http://www.environment.gov.au/coasts/fisheries/commonwealth/northern-prawn/letter.html

Conclusion

The fishery has in place mechanisms to evaluate <u>all</u> parts of the management system and is subject to <u>regular internal</u> and <u>external</u> review (100).

3.2	Fishery-Specific Management System			
3.2.5	Monitoring and management performance evaluation	60 Guideposts	80 Guideposts	100 Guideposts
References				

Findlay (pers com, 2010),

Venslovas, (pers com, September 2011),

Australian National Audit Office (2009), Management of Domestic Fishing Compliance, audit report no. 47 2008-09. Available at http://www.anao.gov.au/~/media/Uploads/Documents/2008%2009_audit_report_47.pdf

Howlett, C. (2008). Letter to Hon Tony Rundle, AFMA Chairman, containing Recommendations to the Australian Fisheries Management Authority (AFMA) on the ecologically sustainable management of the Northern Prawn Fishery (NPF), DEWHA, December. 2008. Available at http://www.environment.gov.au/coasts/fisheries/commonwealth/northern-prawn/index.html

6 Tracking, Tracing Fish and Fish Products

Traceability of product from the sea to the consumer is vital to ensure that the MSC standard is maintained. There are several aspects to traceability that the MSC require to be evaluated: traceability within the fishery; at-sea processing; at the point of landing; and subsequently the eligibility of product to enter the chain of custody. These requirements are assessed here.

Traceability

Fishing does not occur beyond the NPFI fishing area. VMS records assure that the vessels do not fish out of area. Catch information are recorded on logbooks after each haul, and submitted on landing to NPF Industry Pty Ltd. The information specifically contains reference to species caught (estimated catch (kg), round weight, time and date of haul, and location). As there are six prawn species, the product is graded into species and size, and packed at sea, then frozen and boxed separately and frozen on board in ready-for-distribution packs containing vessel licence number, date, fishing period and vessel name. Product is generally frozen in boxes of 3, 5, 10 and 13 kg. Of the non-prawn retained species, none have characteristics that could be confused with certified products: bugs, scampi, mud crabs, and ornate tropical rock lobster are the only crustacean species retained, and all have distinct characteristics for identification. As only certified product (the six species of prawns) is handled on board and no realistic opportunity for non-certified product to mix with the certified product, the risk to traceability is low onboard the fishing vessels. Therefore, the fishing vessels do not require CoC.

Product moves off the fishing vessels in two ways: 1) off loading to motherships for transhipment to ports in Australia; and 2) direct landings at Australian ports by the individual fishing vessels. Decisions to tranship or to land directly is a function of convenience and cost to the fishing vessel, influenced bysuch factors as catch rates of the fishing vessels and distance from ports. Transhipment vessels serve only as transport and temporary storage, and no change of ownership occurs. The risk of a compromised CoC is low for transhipment vessels: no ownership change occurs during transhipment, the boxes of frozen product are sealed, no transformation of product occurs, product from each fishing vessel is separated during transhipment from other vessels, and the transhipment vessels maintain detailed records of product received from each fishing vessel. Therefore, transhipment vessels would not require CoC.

Owners of the fishing vessels generally retain ownership of product past the initial landings and delivery to cold storage facilities, but some owners that deliver their own catch sell portions of the catch directly to retailers, primarily restaurants and supermarkets. As change of ownership occurs upon sale to retailers, all retailers must have CoC to use the MSC logo. Product, whether from transhipment vessels or from individual fishing vessels, is delivered to cold storage facilities in landing ports on pallets containing product from individual vessels (unless sold directly from the vessel to a retailer). Product is then shipped by truck to other cold storage facilities for consolidation and preparation for export or wider distribution within Australia. Vessel owners retain ownership of the product throughout this process. The risk of a compromised CoC is low for cold storage facilities: no ownership change occurs during transhipment, the boxes of frozen product are sealed, no transformation of product occurs, product from each fishing vessel is separated during storage and further transport, and the cold storage facilities maintain detailed records of product received from each fishing vessel. Therefore, cold storage facilities would not require CoC.

Brokers may work with several independent vessels to arrange sales of project, but normally work on commission rather than purchase and re-sell the product. Brokers that do not purchase product would not require CoC. However, should a broker purchase any product, the change of ownership would require that the broker obtain CoC to allow further use of certification.

Chain of custody for northern prawns would begin at the first point of sale. From the time that the product leaves the vessel until at least the first point of sale, the product is handled on a box in-box out basis. In some cases this would occur when retailers purchase directly from vessels. More frequently, CoC would begin when product arrives at facilities (e.g., cold storage or plants) used by the first purchasers of the product. This first point of sale may occur within Australia, but may also occur in foreign countries to which to product is exported.

All NPF holders with statutory fishing rights (whether or not they are shareholders of NPF Industry Ltd) fishing off Australia's northern coast (the Northern Prawn Fishery) will be eligible to be covered by the MSC fisheries certificate. NFP Industry may elect to charge non-members a fee for maintenance of the certificate. Non-member NPF fishermen wishing to use the certificate would follow the same procedures as NPFI members, including all handling and record keeping requirements. Under these requirements, no additional risk accrues from non-members participating in the certification.

Points of landing
The extent of the fishery certification is to the point of landing of fish at ports where recording, verification and sampling of landings takes place. The ports of landing are restricted to Darwin, Karumba, Weipa, Wyndham, Townsville, and Cairns. Numerous cold storage facilities exist in these ports, and are too numerous and changing to list.

Eligibility to enter chains of custody
The scope of this certification ends at the points of first sale as discussed above. Product may then enter further chains of custody.

Eligibility date
The eligibility date for product from the fishery to bear the MSC label is 1 August 2012. This is the start of the banana prawn season and less than six months after the release of the PCDR.

7 Formal Conclusion and Agreement

7.1 Certification Recommendation

Based on the information in the report and the assessment team recommendations in sections 7.1.1, 7.1.2, 7.1.3, the MRAG Certification Committee agrees the Australia Northern Prawn Fishery should receive certification as a sustainable and well managed fishery.

7.1.1 Tiger prawn fishery

The Performance of the Brown tiger prawn UoC in relation to MSC Principles 1, 2 and 3 is summarized below:

BROWN TIGER PRAWN	
MSC Principle	**Fishery Performance**
Principle 1: Sustainability of Exploited Stock	Overall: 100
Principle 2: Maintenance of Ecosystem	Overall: 89
Principle 3: Effective Management System	Overall: 97

The Unit of Certificate attained a score of 90 or more against each of the MSC Principles. The MRAG Americas Assessment Team, therefore, recommends that the Brown Tiger Prawn Unit of Certification in the Tiger prawn sub-fishery BE certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

There is a general Condition covering Research Plans that is applied to all three fishery sub sectors.

The Performance of the Grooved tiger prawn UoC in relation to MSC Principles 1, 2 and 3 is summarized below:

GROVED TIGER PRAWN	
MSC Principle	**Fishery Performance**
Principle 1: Sustainability of Exploited Stock	Overall: 100
Principle 2: Maintenance of Ecosystem	Overall: 89
Principle 3: Effective Management System	Overall: 97

The fishery attained a score of 90 or more against each of the MSC Principles. The MRAG Americas Assessment Team, therefore, recommends that the Grooved Tiger Prawn Unit of Certification in the Tiger Prawn sub-fishery BE certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

There is a general Condition covering Research Plans that is applied to all three fishery sub sectors.

The Performance of the blue endeavour prawn UoC in relation to MSC Principles 1, 2 and 3 is summarized below:

BLUE ENDEAVOUR PRAWN	
MSC Principle	**Fishery Performance**
Principle 1: Sustainability of Exploited Stock	Overall: 98.8
Principle 2: Maintenance of Ecosystem	Overall: 89
Principle 3: Effective Management System	Overall: 97

The fishery attained a score of 90 or more against each of the MSC Principles. The MRAG Americas Assessment Team, therefore, recommends that the Blue endeavor prawn UoC in the tiger prawn sub-fishery BE certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

There is a general Condition covering Research Plans that is applied to all three fishery sub sectors.

The Performance of the -red endeavour prawn UoC in relation to MSC Principles 1, 2 and 3 is summarized below:

RED ENDEAVOUR PRAWN	
MSC Principle	**Fishery Performance**
Principle 1: Sustainability of Exploited Stock	Overall: 80.6
Principle 2: Maintenance of Ecosystem	Overall: 89
Principle 3: Effective Management System	Overall: 97

The fishery attained a score of 80 or more against each of the MSC Principles. The MRAG Americas Assessment Team, therefore, recommends that the red endeavor prawn UoC in the tiger prawn sub-fishery BE certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

There is a general Condition covering Research Plans that is applied to all three fishery sub sectors.

7.1.2 White banana prawn fishery

The Performance of the White banana prawn fishery in relation to MSC Principles 1, 2 and 3 is summarized below:

WHITE BANANA PRAWN	
MSC Principle	**Fishery Performance**
Principle 1: Sustainability of Exploited Stock	Overall: 81.9
Principle 2: Maintenance of Ecosystem	Overall: 88.3
Principle 3: Effective Management System	Overall: 97

The fishery attained a score of 80 or more against each of the MSC Principles. The MRAG Americas Assessment Team, therefore, recommends that the white banana prawn UoC in the white banana prawn sub-fishery BE certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

There is a general Condition covering Research Plans that is applied to all three fishery sub sectors.

7.1.3 Red legged banana prawn fishery

The Performance of the Red legged banana prawn fishery in relation to MSC Principles 1, 2 and 3 is summarized below:

RED LEGGED BANANA PRAWN	
MSC Principle	**Fishery Performance**
Principle 1: Sustainability of Exploited Stock	Overall: 85.0
Principle 2: Maintenance of Ecosystem	Overall: 82.0

Principle 3: Effective Management System	Overall: 97.0

The fishery attained a score of 80 or more against each of the MSC Principles. The MRAG Americas Assessment Team, therefore, recommends that the red legged banana prawn UoC in the red legged sub-fishery BE certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries.

A number of Conditions have been identified that the fishery must satisfy in order to maintain this Certification. Details are provided in Section 7.3.

7.2 Scope of Certification

The specific scope of this full certification assessment is the harvest of six species of prawns by trawl gear, off Australia's northern coast, within the Australian EEZ, and managed by AFMA through supporting management entities including NORMAC. Eligible fishermen include those holding statutory fishing rights and fishing in the NPF.

7.3 Conditions associated with Certification

All fisheries

There is one condition that applies to all three fisheries that covers Research Plans (3.2.4)

Tiger prawn sub-fishery

There are no fishery specific conditions for this fishery

White banana prawn sub-fishery

There are no fishery specific conditions for this fishery

Red legged banana prawns sub-fishery

There are three fishery specific conditions applying to this fishery including: 2.2.3 (Bycatch information), 2.4.3 (Habitat information), and 2.5.3 (Ecosystem information).

Outcome	**2.2.3 Bycatch species: Information/Monitoring**
PI	Information on the nature and amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch
SG60	• Qualitative information is available on the amount of main bycatch species affected by the fishery. • Information is adequate to broadly understand outcome status with respect to biologically based limits. • Information is adequate to support measures to manage bycatch.
SG80	• Qualitative information and some quantitative information are available on the amount of main bycatch species affected by the fishery • **Information is adequate to support a partial strategy to manage main bycatch species.** • Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).
Scoring	75 Qualitative and some quantitative information are available on all bycatch species

Outcome	2.2.3 Bycatch species: Information/Monitoring
	affected by the fishery through ecological risk assessment and research studies (80). With the very low amount of observer data available there is only a broad understanding of the outcome status of at-risk bycatch species (60). Given the comprehensive baseline datasets established and the rigorous ecological risk assessment process, this information is considered adequate to support the strategy to manage bycatch, however there may not be a high degree of certainty given the lack of direct evidence pertaining to bycatch species per se (see 2.2.2) (80). Main bycatch species have been assessed as not being at risk, therefore monitoring focuses on four species which are at risk but rare. Research has suggested that statistically significant change may be difficult to detect due to low occurrence rates in the samples. Considering these factors, the sampling programme is deemed to be sufficient (80).
Rationale	One comprehensive scientific survey has been conducted to assess the bycatch in the red-legged prawn sub-fishery. Several quantitative ecological risk assessments have been undertaken using state-of-the-art methods. However, bycatch data collection from the fishery itself is not required by the logbook reporting format. There is thus far only 15 days of observer coverage in the red-legged prawn sub-fishery, there is only a small amount of data available on bycatch quantities or species composition. Research in similar environments in the Gulf of Carpentaria has been conducted to investigate the sample sizes required to detect statistically significant changes in the abundance of rarer (and thus of greater concern) bycatch species, but this research concluded that in most cases the sampling effort is beyond practically achievable levels.
Condition	**Condition 1**: Within one year of certification, AFMA and NPFI must be in a position to demonstrate that the second SG of SG 80 requirements are met: • Information is sufficient to estimate outcome status with respect to biologically based limits. Milestones in achieving this end are: By the first surveillance audit, undertake an assessment of the feasibility of a monitoring programme using the results of the existing ERA to extend the observer programme to the JBG fishery; By the second surveillance audit, provide an analysis for the red-legged banana prawn fishery which demonstrates that the available information (logbook and observer) is sufficient to estimate outcome status for at-risk bycatch species with respect to biologically based limits. If the available information is insufficient, implement, by the third surveillance audit, measures to increase bycatch monitoring data gathering.
Client action plan	NPF Industry to liaise with AFMA
Consultation on condition	NPF Industry Pty to ensure adoption by AFMA.

Outcome	2.4.3: Habitat: information/Monitoring
PI	Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types.
SG60	• There is a basic understanding of the types and distribution of main habitats in the area of the fishery. • Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.

Outcome	2.4.3: Habitat: information/Monitoring
SG80	• **The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery.** • **Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.** • Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).
Scoring	65 A basic understanding of habitat types, the main impacts of the gear on those habitat types, is available through the results of the ecological risk assessment and by inference from extensive research undertaken in the Gulf of Carpentaria (60 and 60). VMS data shows the interaction of fishing gear from the five vessels in the fishery with Joseph Bonaparte Gulf habitats (80).
Rationale	All habitats in the red-legged prawn sub-fishery (Joseph Bonaparte Gulf) were mapped for the ecological risk assessment, the impacts of the trawl gear's interaction with these habitat types were evaluated and none of the habitats were found to be at high risk. However, historical and recent in-depth research projects have focused solely on the Gulf of Carpentaria. Ongoing information gathering for the red-legged fishery is mainly in the form of VMS monitoring of vessel behaviour with regard to the temporal and spatial closures.
Condition	**Condition 2**: Within four years of certification, AFMA must be in a position to demonstrate that the SG 80 requirements are met: • The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery; • Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear. Milestones in achieving this end are: By the first surveillance audit, review the creent information available By the second surveillance audit provide a detailed plan to identify the nature, distribution and vulnerability of main habitat types in the JBP fishery, The results on benthic interactions should be available from the second annual review onwards (and used to assist the development of additional management mitigation measures, if deemed appropriate). The adequacy of information will be evaluated by the third surveillance audit, and management actions, if required, implemented by the fourth surveillance audit.
Client action plan	NPF Industry to liaise with AFMA and CSIRO
Consultation on condition	NPF Industry Pty to ensure adoption by AFMA.

Outcome	2.5.3: Ecosystem: Information/monitoring
PI	There is adequate knowledge of the impacts of the fishery on the ecosystem.
SG60	• Information is adequate to identify the key elements of the ecosystem (e.g. trophic structure and function, community composition, productivity pattern and biodiversity). • Main impacts of the fishery on these key ecosystem elements can be inferred

Outcome	2.5.3: Ecosystem: Information/monitoring
	from existing information, but have not been investigated in detail.
SG80	• **Information is adequate to broadly understand the key elements of the ecosystem.** • Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but may not have been investigated in detail. • **The main functions of the Components (i.e. target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known.** • Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred. • **Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).**
Scoring	65 Information on the key elements of the ecosystem in the red-legged sub-fishery fishing grounds is available from a bycatch survey and this information in combination with studies of the structure and function of a similar ecosystem in the Gulf of Carpentaria results in an ability to identify the key ecosystem elements. However, as there may be additional ecosystem elements which were not captured in the one-time bycatch survey, or there may be different ecosystem structures (density, composition), interactions or disturbance regimes, ecosystem functions in the red-legged fishing grounds that cannot be said to be broadly understood (therefore 60 rather than 80). Detailed investigations of the impacts of trawling in a similar ecosystem (i.e. Gulf of Carpentaria) allow the main fishery impacts in the red-legged fishing grounds to be inferred, but these have not been investigated in the Joseph Bonaparte Gulf per se (80). Due to the lack of site-specific studies the main functions of the ecosystem components may not be completely known (does not meet the 80 SG). However, given the detail and depth of studies conducted in the Gulf of Carpentaria for a similar fishery, the main impacts of the fishery on the ecosystem can be inferred (80). Ongoing ecosystem-relevant data is not being collected in the red-legged fishery, perhaps due to its small size (currently five vessels) (does not meet the 80 SG).
Rationale	Detailed ecosystem studies have been conducted for the NPF in the Gulf of Carpentaria. Although these have focused on the tiger prawn sub-fishery, which has a similar or slightly less expected impact on benthic communities than the red-legged sub-fishery, differences in the ecosystems of the Gulf of Carpentaria and the red-legged prawn sub-fishery fishing grounds (Joseph Bonaparte Gulf) remain to be studied. The only known field survey for the red-legged fishing grounds found several species unique to that area, although most of these appear closely related to species in the Gulf of Carpentaria. While major ecosystem differences between the two areas would not be expected, this remains unconfirmed. Nevertheless, the impacts of trawling (at a greater intensity in the tiger prawn sub-fishery than the red-legged sub-fishery) can be generally inferred from the detailed studies in the Gulf of Carpentaria to not include serious or irreversible impacts.
Condition	**Condition 3**: Within four years of certification, AFMA must be in a position to demonstrate that the SG 80 requirements are met: • Information is adequate to broadly understand the key elements of the ecosystem. • The main functions of the components (i.e. target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known. • Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or

Outcome	2.5.3: Ecosystem: Information/monitoring
	the effectiveness of the measures). Milestones in achieving this end are: By the first surveillance audit, confirm that information is adequate to assess species interactions in the JBG sub fishery. By the second surveillance audit, provide details of the main functions of the components, drawing upon other ecosystem research conducted for the NPF as appropriate. If extrapolation from other studies proves infeasible, develop and implement a research plan to address data gaps regarding key ecosystem elements and main functions in the Joseph Bonaparte Gulf. By the third surveillance audit, provide an assessment of how ongoing data collection programmes can provide indicators of adverse ecosystem consequences and assure through monitoring that such consequences will be identified. If ongoing data collection programmes are insufficient, develop and implement a plan to expand monitoring to include ecosystem functions by the time of fourth surveillance audit
Client action plan	NPF Industry to liaise with CSIRO and AFMA
Consultation on condition	NPF Industry Pty to ensure adoption by AFMA.

Outcome	7.3.4 Research Plan
PI	The fishery has a research plan that addresses the information needs of management
SG60	• <u>Research</u> is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 2. • Research results are <u>available</u> to interested parties.
SG80	• **A <u>research plan</u> provides the management system with a strategic approach to research and <u>reliable and timely information</u> sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.** • Research results are <u>disseminated</u> to all interested parties in a <u>timely</u> fashion.
Scoring	70 <u>Research</u> is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 22 (60). Research <u>plan</u> and results are <u>disseminated</u> to all interested parties in a <u>timely</u> fashion and are <u>widely and publicly available</u>. (80) A Condition (6) is raised on Research Plan which addresses the weaknesses in P 2 information
Rationale	NORMAC and the NPFRAG to introduce a research plan that gives equal prominence to target stock status as well as bycatch assessment across all three sub fisheries, as well as mitigation and management.
Condition	Condition 4: Within 2 years, the development of a research plan that provides for a more strategic approach to the NPF issues showing an appropriate balance of activities between stock assessment and ecosystem research across all three sub fisheries. The <u>research plan</u> will provide the management system with a strategic approach to research and <u>reliable and timely information</u> sufficient to achieve the objectives consistent with MSC's Principles 1 and 2. The following milestones are expected: • Research Plan draft by the first surveilance audit • Research Plan finalised by the second annual audit

Outcome	7.3.4 Research Plan
	• Research Plan implemented by the third annual audit.
Client action plan	NORMAC and the NPFRAG
Consultation on condition	NPF Industry Pty to ensure NORMAC and the NPFRAG undertake the assigned output.

7.4 Recommendation associated with Certification

Recommendation 1:

A general recommendation is made relevant to all three sub-fisheries. The expert override component of the ecological risk assessment methodology is an essential step in ensuring that assessment results are appropriately translated into fishery management and monitoring plans. As such, the documentation associated with the expert override process should be more carefully maintained in order to provide a clear and indisputable record of how and why override decisions were taken. Specifically, the names and qualifications of all experts contributing to the override should be documented along with the exact technical basis for the override. Citations should be to reference materials which are in the public domain, and should include the section or page number from which the information is drawn.

8 Client Action Plan

NPF Industry Pty Ltd
Producing the finest quality prawns from a sustainable marine ecosystem

The NPF Industry Pty Ltd is committed to taking these actions to address the four conditions arising from the MSC assessment of the Northern Prawn Fishery (NPF).

Condition 1: Bycatch
By the first surveillance audit, undertake an assessment of the feasibility of a monitoring programme using the results of the existing ERA to extend the observer programme to the JBG fishery;

By the second surveillance audit, provide an analysis for the red-legged banana prawn fishery which demonstrates that the available information (logbook and observer) is sufficient to estimate outcome status for at-risk bycatch species with respect to biologically based limits.
If the available information is insufficient, implement, by the third surveillance audit, measures to increase bycatch monitoring data gathering.

CAP response
Prior to the first surveillance audit, AFMA and NPFI will initiate a desk study to determine at risk species, drawing from the existing ERA, using information that may be relevant to the JBG fishery, and earlier work specific to the JBG.

Following on from this action, by the second surveillance audit, AFMA and NPFI will have determined an appropriate monitoring programme, if at risk species are identified.
By the third surveillance audit, a monitoring system will then be used to provide an analysis for the at risk bycatch in red-legged banana prawn fishery to ensure that the outcome status for at-risk bycatch species is within biologically based limits. If the information is insufficient, further measures will be implemented to increase bycatch monitoring data gathering. This work will completed by end of year 3, with additional actions to be determined for year 4 if required.

Consultation
AFMA was consulted during the development of the CAP for Condition 1, and has agreed to assist NPFI in meeting the milestones; the CAP reflects the partnership role that AFMA will take with NPFI in meeting Condition 1.

Condition 2: Habitats
Within four years of certification, AFMA must be in a position to demonstrate that the SG 80 requirements are met:

- The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery;
- Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.

Milestones in achieving this end are:

By the first surveillance audit, review the creent information available

By the second surveillance audit provide a detailed plan to identify the nature, distribution and vulnerability of main habitat types in the JBP fishery,

The results on benthic interactions should be available from the second annual review onwards (and used to assist the development of additional management mitigation measures, if deemed appropriate).

The adequacy of information will be evaluated by the third surveillance audit, and management actions, if required, implemented by the fourth surveillance audit.

CAP response
By the time of the first surveillance audit, AFMA, NPFI and CSIRO will have reviewed the current available information for JBG to determine existing knowledge of the main habitat types, and to provide the basis for formulating a plan which encompasses the JBG into future habitat assessment work.

By the second surveillance audit, AFMA, NPFI and CSIRO will provide a detailed plan to identify the nature, distribution and vulnerability of all main habitat types in the JBP fishery.

The results on benthic interactions will be available from the second annual review onwards, and used to assist the development of additional management mitigation measures, if deemed appropriate.

AFMA, NPFI and CSIRO, will have determined the adequacy of information by the time of the third surveillance audit and if benthic vulnerabilities are identified, management actions will have been implemented by the fourth surveillance audit.

Consultation
AFMA and CSIRO were consulted during the development of the CAP for Condition 2, and have agreed to assist NPFI in meeting the milestones; the CAP reflects the partnership role that AFMA and CSIRO will take with NPFI in meeting Condition 2.

Condition 3: Ecosystem
Within four years of certification, AFMA must be in a position to demonstrate that the SG 80 requirements are met:

- Information is adequate to broadly understand the key elements of the ecosystem.
- The main functions of the components (i.e. target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known.
- Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).

Milestones in achieving this end are:

By the first surveillance audit, confirm that information is adequate to assess species interactions in the JBG sub fishery.

By the second surveillance audit, provide details of the main functions of the components, drawing upon other ecosystem research conducted for the NPF as appropriate. If extrapolation from other studies proves infeasible, develop and implement a research plan to address data gaps regarding key ecosystem elements, including the main functions in the Joseph Bonaparte Gulf and the risks to ecosystems.

By the third surveillance audit, provide an assessment of how ongoing data collection programmes can provide indicators of adverse ecosystem consequences and assure through monitoring that such consequences will be identified.
If ongoing data collection programmes are insufficient, develop and implement a plan to expand monitoring to include ecosystem functions by the time of fourth surveillance audit

CAP response
By the first surveillance audit, NPFI and AFMA will have initiated a desk top study to evaluate what information is available to support assessment of the JBG ecosystem. This will include drawing from information available on target, retained, bycatch (Condition 1) and Habitat (Condition 2) interactions.

By the second surveillance audit, and as an extension to the earlier desk top study, NPFI, AFMA and CSIRO will evaluate the main functions of the components, drawing upon other ecosystem research conducted for the NPF. If extrapolation from other studies proves infeasible, a research plan will be developed to address data and main functions in the Joseph Bonaparte Gulf.

Based on the results of the desk top studies, by the third surveillance audit, a data collection programmes will be formulated to address fishery specific ecosystem consequences through monitoring that such any adverse consequences will be identified.
If ongoing data collection programmes are insufficient for the JBG sub fishery, NPFI and AFMA will have developd and implemented a plan to expand monitoring to include ecosystem functions by the fourth surveillance audit.

Consultation
AFMA and CSIRO were consulted during the development of the CAP for Condition 3, and have agreed to assist NPFI in meeting the milestones; the CAP reflects the partnership role that AFMA and CSIRO will take with NPFI in meeting Condition 3.

Condition 4: Fishery Research Plan
Within 2 years, the development of a research plan that provides for a more strategic approach to the NPF issues showing an appropriate balance of activities between stock assessment and ecosystem research across all three sub fisheries. The research plan will provide the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC’s Principles 1 and 2.

The following milestones are expected:
- Research Plan draft by the first surveillance audit
- Research Plan finalised by the second annual audit
- Research Plan implemented by the third annual audit.

CAP response
NORMAC and the NPRAG will have formulated a Research Plan draft by year 1, finalised by year 2 with appropriate funding provided, and implemented in year 3.
Consultation
NORMAC and the NPRAG were consulted during the development of the CAP for Condition 4, and have agreed to undertake meeting the milestones; the CAP reflects the partnership role that NORMAC and the NPRAG will take with NPFI in meeting Condition 4.

Australian Government
Australian Fisheries Management Authority

Ref: F2011/0251

25 June 2012

Mr Richard Banks
Lead Assessor
MRAG Americas
13 Ribbon Avenue
PORT DOUGLAS QLD 4877

Dear Mr Banks

Re: Letter of support for Marine Stewardship Council Certification of the Northern Prawn Fishery

I am writing to confirm the support of the Australian Fisheries Management Authority (AFMA) for the Marine Stewardship Council's (MSC) certification process being pursued for the Northern Prawn Fishery (NPF) by the NPF Industry Pty Ltd (NPFI).

In response to the MSC's assessment of the NPF and the conditions which need to be addressed for the NPF to receive and maintain certification, NPFI has developed a Client Action Plan. In developing the Client Action Plan, NPFI has worked closely with AFMA and the Commonwealth Scientific and Industrial Research Organisation to ensure that the actions proposed are achievable, cost effective and deliverable in a timely manner for annual auditing by MSC.

I would like to take this opportunity to congratulate NPFI on its efforts in the assessment process and wish it all the best in attaining MSC accreditation. I have no doubt that AFMA will continue to have a close and effective working relationship with NPFI throughout this process.

Yours sincerely

Dr Nick Rayns
A/Chief Executive Officer

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25 June 2012

Richard Banks
Lead Assessor, MRAG Americas
13 Ribbon Avenue
Port Douglas QLD 4877

Re: Letter of Support for Marine Stewardship Council Certification of the Northern Prawn Fishery.

Dear Richard

I write to confirm the CSIRO's encouragement of the Marine Stewardship Council's certification process being pursued for the Northern Prawn Fishery by the NPF Industry Pty Ltd (NPFI). CSIRO has been involved in the assessment of the NPF for many years and MSC certification would be recognition of these scientific underpinnings, and a valuable step in the management of the fishery.

In response to the MSC's assessment of the NPF and the conditions which need to be addressed for the NPF to receive and maintain its certification, the NPF Industry Pty Ltd has developed a Client Action Plan. In developing the Client Action Plan, the NPF Industry has worked closely with CSIRO (and AFMA) to ensure that the actions proposed are achievable, cost effective and deliverable in a timely manner for annual auditing by MSC.

I would like to take this opportunity to congratulate the NPF Industry Pty Ltd on their efforts in the assessment process and wish them all the best in attaining MSC accreditation. I have no doubt that CSIRO will continue to have a close and effective working relationship with the NPF Industry Pty Ltd throughout this process.

Yours sincerely

RB

Dr Rik Buckworth
Senior Scientist
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10 Interview records

MSC Interview Record
Interview No 1: AFMA Compliance

Stakeholder comments attributable to AFMA Compliance Operations

MRAG Americas Attendees
Team Members: Richard Banks, Lead Assessor
Stakeholders:
Affiliation: Pieter Wildekamp, AFMA Compliance
Location: Telephone interview
Date: 2 September.

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- MRAG Americas as independent CB accredited to carry out MSC assessments
- Purpose of meeting – information collection and identification of issues relevant to fishery assessment
- MSC Principles & Criteria and Assessment Process being followed
- That stakeholder comments may be non-attributable if required

2. Status

What is the nature of the organisation's interest in the fishery (e.g. client / science / management / industry / eNGO etc)
Management

3. MRAG Americas Questions
Assessment team questions for stakeholder response

Question 1: Types of assets available to NPF - VMS, FPVs, inspectors, observers, and a guide on deployment of these assets - e.g. days at sea, number of land and at sea inspections, VMS checking procedures.

In each season (Tiger and Banana), AFMA Compliance Operations conduct a 2 week vessel deployment programme. These are set at random times without pre knowledge by industry. The deployment strategies in the two fisheries are the same.

The vessels have 4 inspectors on board and boarding's may vary from 1-10 /day depending on the density of fishing operations. The tiger season tends to be more concentrated due to prawn aggregations in the same area, allowing for more boarding's. As the season goes on, activities are spread out and the number of daily boarding's can decline.

The banana season is again associated with high concentrations. The White banana activity is in the East, and red legs in Arnhem Land and closer to Darwin.

Port inspections are also undertaken in Darwin and Cairns.

Details of inspections on land and at sea are shown in the Annex (See attached).

The Fishery operates a VMS system to identify potential breaches of closures and the navigation regulation. The monthly analysis is conducted as a preliminary check of vessels entering restricted areas or breaching the navigation regulation conditions. Detected infringements are very rare (See compliance summary 2009-2011).

VMS is not only used as a compliance instrument but also for Industry and Government as a management tool and provides the vessels with safety at sea.

50% of the AFMA compliance costs are met by the industry.

Question 2: A Brief outline of inspector and observer training

AFMA undertakes regular training of its officers. Training includes some of the following activities:

- Illegal foreign compliance,
- Domestic compliance.
- Boarding procedures,
- Evidence collection,
- Search and seizure, Continuity (prove that chain of evidence),
- Scheme examination.

Question 3: Details of industry compliance/educational workshops where AFMA compliance may have orchestrated or participate

The industry operates a high level of voluntary compliance. Indeed, more so than other fisheries. Fishing companies demonstrate a zero tolerance policy such that non compliance detections,

Industry itself is the provider of information. I.e. were specific individuals to commit a systematic offence, industry would inform Compliance, and be prepared to provide evidence to support this.

Prior to each season, industry will attend educational workshops in Darwin, Karumba and Cairns. At this stage, and on other occasions, the industry provides information of use to Compliance.

Question 4: Feedback from the industry at different levels - to port inspectors, to the risk assessment process, thereby demonstrating that they provide information of importance to effective management of the fishery

Compliance does receive satellite calls in the event of systematic non compliance by individuals.

Question 5: Discussions on compliance risks

The main risks tend to be higher in the tiger prawn fishery and comprise:

- Possible fishing during the day – only night time fishing permitted
- Non compliance with closed areas
- Adjustments to BRDs and TEDs

These risks are detected as part of a risk assessment process and are useful in directing compliance activities.

Question 6: Evidence of sanctions applied, and a schedule of penalties

There is no systematic non compliance

There may be occasional infringements, but these are dealt with by an effective sanction system – e.g. for 1 bycatch device infringement, resulted in a penalty of AD 7,000. Fines are also cumulative. However, skippers committing offences are usually dismissed by the companies. An example being of the 4 bycatch stitched devices detected, 3 of the skippers were dismissed.

Summary statement:

In summary, I can confirm, based on my experience to date that:

- The Compliance system demonstrates an ability to enforce relevant management measures, strategies and/or rules.
- Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.
- Evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.
- There is no evidence of systematic non-compliance.

Stakeholder
Email contact: Pieter.wildekamp@afma.gov.au

Assessor: Richard Banks

Annex 1
From: SEDEN Paul [mailto:Paul.Seden@afma.gov.au]
Sent: Wednesday, 14 September 2011 12:07 PM
To: 'richard@consult-poseidon.com'
Cc: LOVELOCK Gavin; WILDEKAMP Pieter
Subject: Re: NPF information [SEC=UNOFFICIAL]

Mr Banks,

Please find the provided information and attachments as requested.

1. List of Land and Sea Inspections for the past 3 yrs.

    2009 May 23 at sea inspection - Oct 43 at sea inspections
    2010 May 9 at sea inspections - Oct 29 at sea inspections
    2011 May 7 at sea inspections

2. Risk assessment doc for compliance of the NPF.

    Attachment 2010 NPF Risk Assessment

3. Table of breaches detected for the last 3 years.

    5 Investigation passed to CDPP in the past 3 years all in 2009.
        4 x BRD's 95(I) (f) FMA all prosecuted and fined
        1 x 105c FMA withdrawn

If you require further information please contact me on the provided numbers.

Cheers'

From: SEDEN Paul [mailto:Paul.Seden@afma.gov.au]
Sent: Thursday, 15 September 2011 11:21 AM
To: 'richard@consult-poseidon.com'
Cc: LOVELOCK Gavin
Subject: FW: NPF information [SEC=UNOFFICIAL]

Hello'

Please inform Richard that I am indeed happy with the transcript of interview.   Please also include comment as to the purpose and use of VMS.

Regards,

Best

From: SEDEN Paul
Date: Wed, 14 Sep 2011 12:23 +0930 Msg: AMOS-349661273
Subject: FW: NPF information [SEC=UNOFFICIAL]
To: 'AFMA_ashmore@customs.amosconnect.com'
Cc: LOVELOCK Gavin

MSC Interview Record
Interview No 2: CSIRO scientists

Stakeholder comments attributable to Stock Assessment scientists

Attendees
Derek Staples (P1) Richard Banks (P3)

Stakeholders: Dr Trevor Hutton, Dr Rik Buckworth, Dr Roy Deng, Mr Rob Kenyon Dr W Venables (afternoon), Dr Eva Plaganyi (afternoon) **Affiliation** **Representatives** CSIRO **Location**: CSIRO, Brisbane **Date**: 15th September 2011

1. Introduction: Richard Banks (P3) introduced the MSC assessment process to the Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team roles and responsibilities
- MRAG as the independent CB accredited to carry out MSC assessments
- Purpose of meeting – The aim of the meeting was to gain a better overview for assessment of PIs under Principle 1 - Sustainable Fish Stocks
- MSC Principles & Criteria and Assessment Process being followed
- Public nature of responses though email etc

It was explained that P1 considered the following:
Stock status (1.1.1)
Reference points (1.1.2)
Stock rebuilding (1.1.3)
Harvest Strategy (1.2.1)
Harvest control rules and tools (1.2.2)
Information and monitoring (1.2.3)
Assessment of stock status (1.2.4)
Rik Buckworth (CSIRO) gave a brief overview of the NPF stock assessment process and CSIRO's role. Stock assessment modelling is carried out by CSIRO under contract from the Australian Fisheries Management Authority. It is conducted by a team of data, information and stock assessment specialists including pat-time input from a world-renown expert from the University of Washington. Modelling results are then reviewed by the Northern Prawn Research Advisory Group (NPFRAG) comprised of scientists, economist, fishery managers, fishing representatives, and environmentalists. Peer-group review of the actual assessments is provided by two independent stock assessment experts. The methods and results of the assessments are also published in peer-reviewed scientific journals. The assessment was externally peer-reviewed in 2002 by an independent stock assessment expert (Rick Deriso) who concluded that the assessment was world-class but also recommended the inclusion of fishery dependent data; a recommendation that has been followed.

2. Status

What is the nature of the organisations interest in the fishery (e.g. client / science / management / industry / eNGO etc

Scientific advice

3. MRAG Americas Questions

Assessment team questions for stakeholder response

4. Stakeholder Key Issues

Question 1: Status and reference points for tiger prawns

A PowerPoint presentation of the current tiger prawn assessment was presented based on the NPF RAG Assessment 2010/11 Tiger prawns (AFMA, 2011). Based on the presentation and subsequent questions the following is a summary of the current assessment and harvest strategy for (i) brown tiger prawns and (ii) grooved tiger prawns.

SPECIES: Penaeus esculentus (brown tiger prawn)

1.1.1: Stock Status
The most recent assessment of the status of brown tiger prawn (AFMA, 2011) estimates the following parameters (see below for definition of reference points).

Name	Reference	Current value (2010)
S_{2010}/S_{MEY}	Target Reference Point	131%
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit Reference point = 50%	138%
E2010/EMEY	Target effort	32.8%
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit effort = 50%	25.1%

Following a period of overfishing in the late 1990s and a rebuilding strategy from 2002 to 2006, the stock is now above the Biomass TRP and well above the Biomass LRP. Effort levels are also well below both the TRP and LRP, indicating that overfishing is not occurring.

SPECIES: Penaeus semisulcatus (grooved tiger prawn)
1.1.1: Stock Status
The most recent assessment of the status of grooved tiger prawn (AFMA, 2011) estimates the following parameters (see below for definition of reference points).

Name	Reference	Current value (2010)
S_{2010}/S_{MEY}	Target Reference Point	88.6%
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit Reference point = 50%	138%
E2010/EMEY	Target effort	117%
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit effort = 50%	32.8%

Following a period of overfishing in the late 1990s and a rebuilding strategy from 2002 to 2006, the stock is now approaching the Biomass TRP and is well above the Biomass LRP. Effort levels are also well below both the LRP and close to the target, indicating that the stock is no longer overfished and overfishing is not occurring.
The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing.
Both tiger prawn species

1.1.2: Reference points
Biomass reference points
Target: S_{MEY} (Spawning biomass at maximum economic yield)
Limit: Moving average of S_Y/S_{MSY} over 5 most recent years = 0.5
S_{MEY} is a conservative target reference point that aims for economic efficiency while still maintain the stock above S_{MSY}
S_y/S_{MSY} is a conservative limit reference point that takes 50% of S_{MSY} as a state that is undesirable. Moving average used to account for year-to-year variability in abundance that could cause rapid changes in management responses.
Effort reference points
Target: E_{MEY} (Effort at maximum economic yield) 1.e. E_y/E_{MEY} = 1.
Limit: Moving average of E_Y/E_{MSY} over 5 years = 0.5

Question 2: Status and reference points for endeavour prawns

Following a PowerPoint presentation from CSIRO and subsequent, the following is a summary of the current status and harvest rule follows for (i) blue endeavour prawns and (ii) red endeavour prawns.

SPECIES: Penaeus endeavouri (blue endeavour prawn)
1.1.1: Stock Status

The most recent assessment of the status of blue endeavour prawn (AFMA, 2011) estimates the following parameters (see below for definition of reference points).

Name	Reference	Current value (2010)
S_{2010}/S_{MEY}	Target Reference Point	84.8%
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit Reference point = 50%	85.0%
E2010/EMEY	Target effort	N/A
5-year mav ($S_{2006\text{-}2010}/S_{MSY}$)	Limit effort = 50%	N/A

Following a period of overfishing for tiger prawns in the late 1990s and a rebuilding strategy from 2002 to 2006, it appears the blue endeavour prawn spawning stock is still below the Biomass TRP but is above the Biomass LRP.

1.1.2: Reference points

Biomass reference points

Target: S_{MEY} (Spawning biomass at maximum economic yield)

Limit: Moving average of S_Y/S_{MSY} over 5 most recent years = 0.5

S_{MEY} is a conservative target reference point that aims for economic efficiency while still maintain the stock above S_{MSY}

S_y/S_{MSY} is a conservative limit reference point that takes 50% of S_{MSY} as a state that is undesirable. Moving average used to account for year-to-year variability in abundance that could cause rapid changes in management responses.

SPECIES: Metapenaeus ensis (red endeavour prawn)

Catches of endeavour prawns have averaged 305 tonnes per year since 2006. CSIRO estimated that red endeavour prawn catches average 30% of the endeavour prawn catch and, therefore, catches on average are approximately 70 tonnes.

1.1.1: Stock Status

There are no stock assessment results for red endeavour prawns and red endeavour prawns are not considered in the bio-economic model as no assessment is available for this species. Their catch is highly variable, unpredictable and usually a small part of the overall prawn catches.

1.1.2: Reference points

No reference points

Question 3: Status and reference points for banana prawns

Two PowerPoint presentations were made by CSIRO, one for the common banana prawn one for red-legged banana prawns. A summary of the current status and harvest strategies for (i) common banana prawns and (ii) red-legged banana prawns follows:

SPECIES: Penaeus merguiensis (common banana prawn)

1.1.1: Stock Status

Because the catch of common banana prawns are driven, to a large extent, on environmental conditions (catchment basin runoff) (Vance et al, 1998), is difficult to conduct stock assessments based on simple stock: recruitment assumptions. However, annual catches have been correlated with rainfall and prediction of catches made on the basis of the rainfall preceeding the banana parawn fishing season (Staples et al, 1984 and (Venables, et al., in press). Since 1970, catches, especially in the southeastern Gulf of Carpentaria have responded as expected to changes in rainfall,indicating that the stocks of banana prawns have remined at levels above those at which recruitment has been impaired. Catches have also bounced back in areas of the Gulf where there were some concerns that overfishing may have occurred. It is claimed, therefore, that “historical records indicate that the banana prawn fishery is sustainable with an annual six week fishing season”. The season can be lengthened in higher catch years, based on catch rates (see HS below)

Catches, therefore, have fluctuated around a long-term average with no conclisive evidence of long-term positive or negative trends in overall trends in the catch resdidual (catch with the effects of rainfall and changing effort removed).

1.1.2: Reference points

Biomass reference points

There are no formal biomass reference points. The surrogate measure is that there will be a sufficient escapement from the fishery to not jeopardize subsequent recruitment.
Escapement is theoretically controlled through changing the length of the fishing season, with a default of 4 weeks
Conclusion: A surrogate limit reference point is set as six weeks fishing season.

SPECIES: Penaeus indicus (red-legged banana prawn)

1.1.1: Stock Status

The most recent assessment of the status of Red-legged banana prawn (AFMA, 2011) estimates the following parameters (see below for definition of reference points).

Name	Reference	Current value (2011)
S_{2011}/S_{MEY}	Target Reference Point	119-126%
S_{2011}	Spawning biomass	1485.3 tonnes
R_{2007}/av R	Current recruitment	147%

Recent changes in the seasonality of fishing makes it difficult to estimate MSY and MEY and the associated biomass and fishing levels. Two estimates of the spawning biomass at MSY and MEY (Bsp_{MSY} and Msp_{MEY}) have been calculated, one based on the period 1989-2007 and the second on 2007. The Bsp_{MSY} values were 1106 and 979 tonnes, respectively and the Bsp_{MEY} values were calculated as 1.2 times the Bsp_{MSY} – 1327 and 1175 tonnes, respectively. The current spawning biomass Bsp_{2011} was estimated at 1485.3 tonnes (STD =470), which is above both estimates of Bsp_{MEY} (119 and 126%, respectively). The recruitment in 2007 was also above the average recruitment for the period 1987-2006.
Note that the Bsp was declined in 1996 and was low until 1998. During this period, restructuring of the fleet occurred and since 1997 the effort on the red-legged banana prawns has declined significantly and the catch has declined and the CPUE increased.
The stock is at a level which maintains high productivity (close to MEY) but no limit reference points have been established (see below for discussion).

1.1.2: Reference points

Biomass reference points

The red-legged banana prawn is managed as part of the banana prawn fishery with the white banana prawn (*Penaeus merguiensis*). As with white banana prawns, there are no formal biomass reference points. The surrogate measure is that there will be a sufficient escapement from the fishery to not jeopardize subsequent recruitment. Escapement is theoretically controlled through changing the length of the fishing season, with a default of 4 weeks. The surrogate limit reference point is a catch rate of 500kg/day that used to trigger the fishing season extensions out to 6 and the 8 weeks.
The changes in the fishing season were highlighted. During 2007-2010, the JBG was not fished during the first seasonal opening (April to June), with fishing occurring during the second seasonal opening
From August to November. As evident from the figure presented, there were thus no recorded
Catches from the JBG during the first season of 2007 through to 2010.

Question 3: Information collected for stock assessment

A comprehensive data collection program has been established for the NPF to ensure reliable information is available on which to base management decisions.

These are:

1. An annual Gulf of Carpentaria-wide independent data collection program (at sea survey) which was implemented in the fishery in August 2002. The survey has two modules:
    a. a January/February survey which provides data for a fishery independent recruitment index for Banana, Tiger and Endeavour Prawns; and
    b. a June/July spawner survey which also provides information to examine the spatial distribution in the fishery and attempt to quantify changes in fishing power, one of the key areas of contention with the current model.
2. Scientific data is collected through these surveys for all target species and a range of bycatch species.
3. Scientific and crew member observer programs on commercial trawlers to collect data and to monitor bycatch.
4. A fishery-wide Daily Catch and Effort logbook program for all target and byproduct species to record interactions with protected species. Under this program, operators are required to record the location of fishing operations (latitude/longitude) for every day they fish and/or search, regardless of whether any catch is taken; the total number of shots for each fishing day; the species/product retained and size grade information.
5. Seasonal Landings Returns used to reconcile log book data (target and byproduct species) against commercial landings.
6. A gear monitoring program to monitor vessel fishing power and Turtle Excluder Device (TED)/Bycatch Reduction Device (BRD) configurations. Mandatory data collected through the program includes vessel length; beam; depth; engine make and model; engine power; max. Trawl Revolutions per Minute (RPM); Operating RPM; gear box reduction ratio; kort nozzle; propeller diameter and pitch; plotter make and model; sonar; max. Speed; trawl speed (banana and tiger prawn fisheries); TED and BRD configurations.
7. Random comprehensive gear surveys to contribute to fishing power analyses and identification of new gear technologies.
8. Vessel Monitoring Systems (VMS) data to monitor position of vessels especially with respect to spatial and temporal closures.
9. Random enhanced VMS polling over a short period to monitor vessel speed.
10. ABARES surveys to collect economic data (and more recently, economic data collected directly from industry by the NPF Industry Pty Ltd).

Although this comprehensive data collection system is in place for all species, catch levels of blue endeavour prawns and very variable and low, and there is insufficient information content in the catch and catch rate data to conduct a reliable stock assessment. Extending the data collection to a full-scaled at-sea research project is not warranted for such a low value component of the fishery.
Red legged banana prawns in the Joseph Bonaparte Gulf are not included in the spawning and recruitment indices surveys.

6. Other issues

7. Closing

Confirmed

MML Lead Auditor Stakeholders

8. Supplementary e-mail

Annex 2

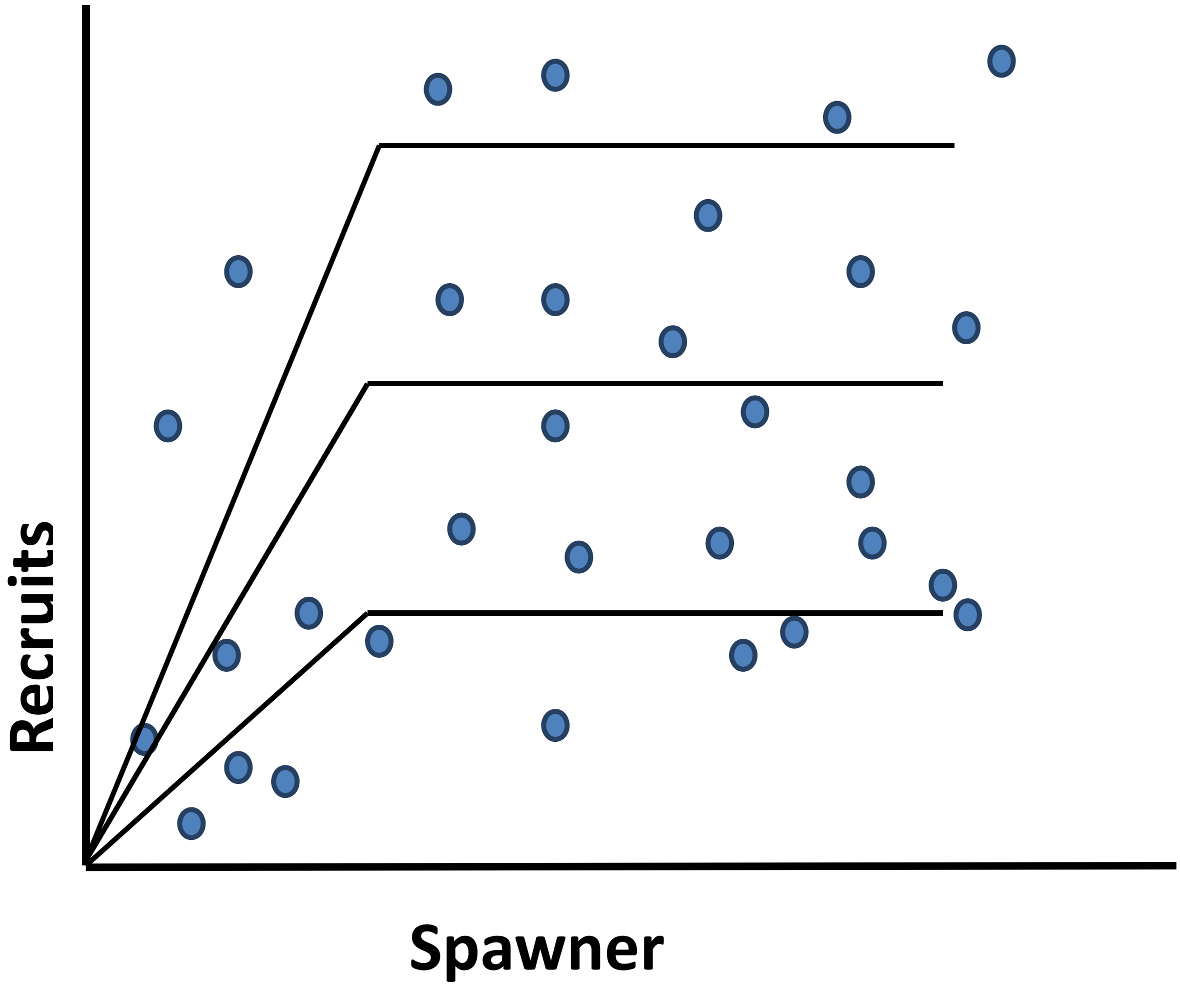
Email: 21st September 2011

hi Derek

as discussed, here is a brief presentation which I plan to preface a more formal presentation

of Bill Venable's banana prawn predictive analysis at tomorrow's NORMAC meeting. Given your long history with research into the species and your obvious continued interest, I would be grateful for any comment that you might have.
cheers
Rik
CSIRO Marine & Atmospheric Research
0457566270
Attachment: PowerPoint Presentation

- We have assumed that there is always sufficient escapement – i.e. spawners left for maximal recruitment (not fished when numbers get low and the prawns are dispersed)
- Before the season triggers were put in place, evidence that escapement of those on the grounds was < 10% - but there were still good catches when there was good rainfall.
- Natural refuge for additional spawners– estuaries and depths < 10m are not fished (and there are prawns there!).
- Management measures have protected sustainability:
  - 1. Seasonal closure has allowed more escapement
  - 2. Current minimum catch trigger of 500 kg/boat/day.
  - 3. Massive reduction in effort
- Although the relationship is unclear, if spawning stock is maintained then in a high rainfall year, catches and recruitment are also high. Last four years have demonstrated this, this year very much so.



Supplementary e-mail
Annex 3
Email: 8th December, 2011

Rik.Buckworth@csiro.au 09/12/2011

to me

Hi Derek

This should do the trick (courtesy Roy Deng). The units are tonnes, of course

Best regs

Rik

From: Deng, Roy (CMAR, Dutton Park)
Sent: Friday, 9 December 2011 9:36 AM
To: Buckworth, Rik (CMAR, Dutton Park); Kenyon, Rob (CMAR, Dutton Park)
Subject: RE: Red endeavour prawn catches

Hi Rik

See attached for the data requested.

Cheers

Roy

YEAR	ENDEAV	Endev (blue)	Ensis (red)
1970	420.057	325.8758	94.1812
1971	366.931	229.5748	137.3562
1972	423.019	246.9486	176.0704
1973	535.72	423.6853	112.0347
1974	409.794	243.2676	166.5264
1975	468.945	296.1445	172.8005
1976	759.999	463.6428	296.3562
1977	1194.984	826.11	368.874
1978	1232.666	954.2289	278.4371
1979	1342.456	1036.451	306.0046
1980	2101.578	1583.206	518.3715
1981	2356.476	1566.913	789.5628
1982	2324.537	1458.475	866.062
1983	1543.756	1076.3	467.4558
1984	1766.597	1191.557	575.0397
1985	1720.286	1117.482	602.8036
1986	793.949	549.5906	244.3584
1987	741.687	478.3444	263.3426
1988	682.531	451.1016	231.4294
1989	947.565	563.4825	384.0825
1990	739.537	509.8215	229.7155
1991	891.23	708.4236	182.8064
1992	894.938	739.6555	155.2825
1993	752.264	637.1503	115.1137
1994	891.766	692.0714	199.6946
1995	1178.123	800.7371	377.3859
1996	1293.074	918.2366	374.8374
1997	1941.414	901.4951	1039.919
1998	1347.013	1056.836	290.1774
1999	885.6255	652.7024	232.9231
2000	963.4055	698.5241	264.8814
2001	1183.056	801.3332	381.7224
2002	424.3436	283.6193	140.7243
2003	436.5638	301.0122	135.5516
2004	401.8375	261.6217	140.2158
2005	284.4085	225.6427	58.76577
2006	363.1625	298.3274	64.83506
2007	194.8432	155.7695	39.07371
2008	215.071	157.3249	57.74613
2009	327.342	241.0473	86.29469

2010	428.088	315.7994	112.2886

MSC Interview Record
Interview No 3: CSIRO Chief Scientist

Stakeholder comments attributable to Senior stock assessment scientist

MRAG Americas Attendees
Team Members: Derek Staples (P1)

Stakeholders:
Affiliation: Cathy Dichmont, CSIRO Marine and Atmospheric Research

Observer:

Location: Brisbane

Date: 20 September, 2011

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- Purpose of meeting – verify findings made with CSIRO scientists on 15th September and clarify
- That stakeholder comments may be non-attributable if required

2. Status

What is the nature of the organisation's interest in the fishery (e.g. client / science / management / industry / eNGO etc)
Senior Stock Assessment Scientist

3. MRAG Americas Questions
Assessment team questions for stakeholder response

Question 1: Probabilities around current assessment estimates

It was noted that the current spawning biomass for the two species of tiger prawns and for the blue endeavour prawns are well above the limit reference points (LRP). MSC scoring guideposts requires justification for the conclusion that "There is a high degree of certainty that the stock is above the point where recruitment would be impaired", where high degree means "greater or equal to the 95th percentile".

Probabilities of being above the LRP will be provided by CSIRO (see attached email).

Question 2: Current status of the harvest strategy (HS)

The HS is a "living document" and updated and modified through the RAG. The latest draft available to CSIRO was dated 2010 and contained annotated amendments made in recent RAG Meetings. This version was provided during the meeting. It was noted that most of the changes were minor and of a technical nature (e.g. reference to nominal effort, not standardized effort in the control rule for tiger prawns).

Question 3: Treating red endeavour prawns as a retained species

Catches of Endeavour prawns (both red and blue endeavour prawns) have averaged 233 tonnes per year since 2006. CSIRO estimated that red endeavour prawn catches average 30% of the endeavour prawn catch and, therefore, catches on average are approximately 70 tonnes.

Catches are so low and catch rates are so variable that it is not possible to conduct an effective stock assessment for red endeavour prawns.

Question 4: Status of white banana prawns.

There is evidence that escapement from the fishery has been increasing in recent years under the harvest strategy. These results will be provided by CSIRO (see attached email).

Stakeholder

Assessor: Derek Staples

Annex 1
Email: 23 September, 2011

Hi Derek

Roy has kindly checked and all 3 spp in the assessment (PS, PE, ME) are 100% above the limit reference point. Hope this helps.

Cheers
Cathy

Dr Cathy Dichmont
Senior Principal Research Scientist | Stream Leader - Resource Use and Conservation
Wealth from Oceans Flagship | CSIRO Marine and Atmospheric Research
Email: 23 September 2011
Annex 2
Hi All

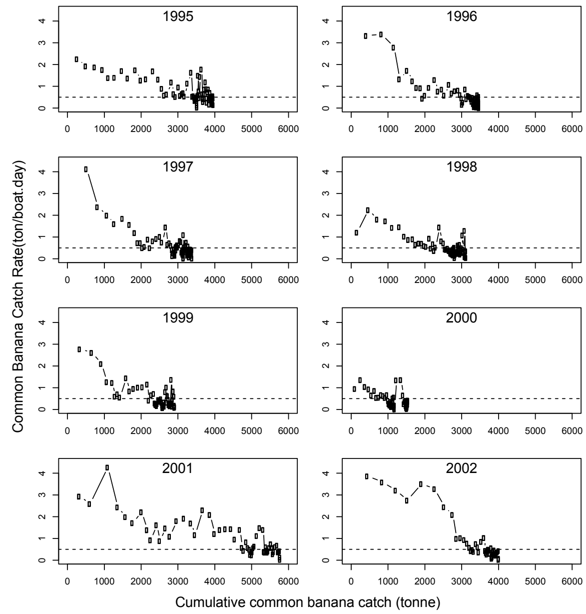
I thought this might put a bit of data behind our assertion that more escapement of common banana prawns are occurring. Roy and I did this yesterday at our NORMAC meeting, but Roy did his magic with getting the numbers (thanks!).

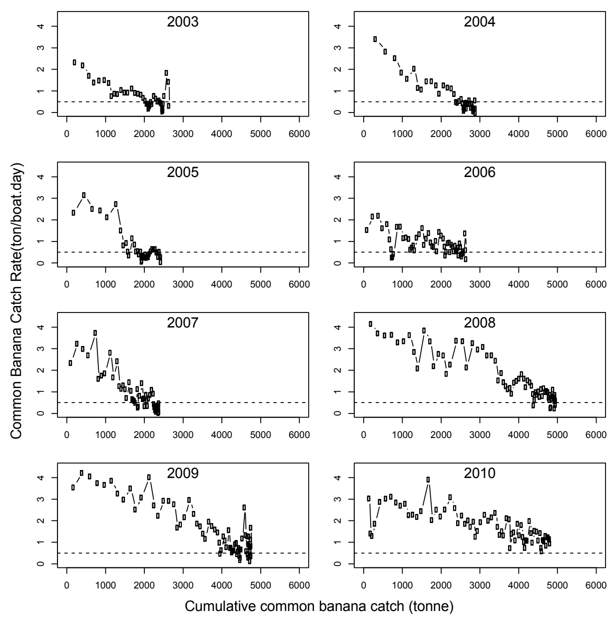
Attached are four figures in a powerpoint presentation (I can send the individual pdf if you need that). The first 3 pages show a classic depletion graph by year, since 1987. We also show the 500 kg/day limit. The last plot is the best. It summarises the number of calendar days that the fleet fished below 500 kg/day. As you can see: In the early days, this fishery would fish for more than a month below 500 kg/day – and then with a much bigger fleet (>120 vessels). Since the early 2000's when management was much more targeted at economics and ensuring escapement, you can see very few days fall in this category. In 2010, there were none. This is despite big flood and large drought years (see Bill's paper) occurring during this period.

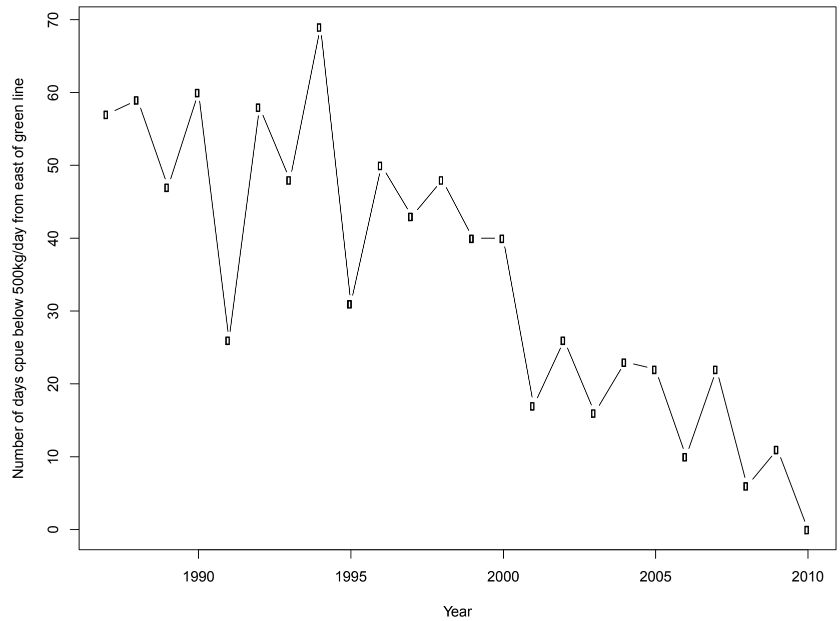
I hope this helps.

Regards
Cathy

Dr Cathy Dichmont
Senior Principal Research Scientist | Stream Leader - Resource Use and Conservation
Wealth from Oceans Flagship | CSIRO Marine and Atmospheric Research


1995
1996
1997
1998
1999
2000
2001
2002
Common Banana Catch Rate(ton/boat.day)
Cumulative common banana catch (tonne)


2003
2004
2005
2006
2007
2008
2009
2010
Common Banana Catch Rate(ton/boat.day)
Cumulative common banana catch (tonne)


Number of days cpue below 500kg/day from east of green line
0
10
20
30
40
50
60
70
1990
1995
2000
2005
2010
Year

MSC Interview Record
Interview No 4: CSIRO scientists

Stakeholder comments attributable to Bycatch related issues

MRAG Americas Attendees
Team Members: Shelley Clarke, Derek Staples

Stakeholders:
Affiliation: CSIRO **Representatives: Cathy Dichmont, Shane Griffiths**

Observer:

Location: CSIRO, Dutton Park (Brisbane)

Date: 20 September 2011

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- MRAG Americas as independent CB accredited to carry out MSC assessments
- Purpose of meeting – information collection and identification of issues relevant to fishery assessment
- MSC Principles & Criteria and Assessment Process being followed
- That stakeholder comments may be non-attributable if required

Stakeholder comments attributable to:
Bycatch-related issues.

2. Status

What is the nature of the organisation's interest in the fishery?
Bycatch monitoring and management

3. MRAG Americas Questions

Assessment team questions for stakeholder response

Question 1: How effective is the bycatch monitoring programme considered to be?

Questions have been asked about the effectiveness of the programme and some studies, i.e. Brewer's study of sampling power, have addressed this. The effect of trawling on benthic habitat has also been studied. All species of concern are on the CMO list of species, but it is not expected that CMOs will be able to identify them (either the species are too rare or too difficult to identify or both). The CMO programme, which is managed by Gary Fry, is considered to be a good programme but enthusiasm of crew and skippers has waned over time despite the fact that the proportion of vessels with CMOs has increased (due to a decrease in fleet size). The data quality also suffers from the difficulties of obtaining representative coverage of the fleet, and the fact that the CMOs are sometimes busy, or concerned for their own safety, or the live release of the animal, and cannot take all desired data such as length and sex. For example, for sawfish they are supposed to record these data but often don't as their priority is to release the sawfish over the side as quickly as possible.

Taking the wider perspective, since the effort in the fishery has decreased, the risk has also decreased. The NPF's approach to risk management for bycatch is similar to other Australian fisheries in the sense that the NPF proactively developed the methods now being applied to all Commonwealth managed fisheries.

With regard to monitoring for *Solenocera australiana*, please refer to prawn specialist Rob Kenyon.

Question 2: Are there trigger levels above which management action would be taken on bycatch interactions?

No, the current situation assumes that low interaction rates (turtles was used as an example) will continue and that if they rise, AFMA will be monitoring this and take action. There is no formal limit at this time and no recognized need to set one.

Question 3: What is the status of further work on sawfishes?

Sawfish will be studied under a new national ecological research program funded by DSEWPaC. This study is about to kick off and will be led by Richard Pillans. It may include cumulative risk considerations.

Question 4: What is the status of risk assessment for the bycatch species, e.g. ponyfish?

NPF bycatch was first assessed by Stobutzki et al. in 2001 using the original version of the PSA. Since then, the PSA model has been modified for the ERA process, but NPF bycatch was not assessed using this Level 2 Risk Assessment approach. This was because the bycatch species were assessed prior to the ERA process using the SAFE methodology, which quantitatively assesses the current fishing mortality against a proxy for Fmsy and Fcrash (a fishery rate which would drive the population to extinction). These (SAFE) results were later provided in a spreadsheet by Shijie Zhou. [This means there are no PSA results for bycatch species which are not retained or TEP.] To some extent the risk assessment in this fishery seems like a patchwork because the methods were, to a large extent, developed here, then formed into a national system, and then re-imposed on the NPF. In the meantime, risk assessment for the NPF had moved on and some decisions were taken regarding the need to revert to older methodologies.

Question 5: What is the background to these concerns raised by WWF: threadfin overfishing, turtle disease, post-release mortality of seasnakes, seahorse/pipefish interactions?

The concerns raised by WWF about Queensland threadfin are based on an estuarine species which would be unlikely to be encountered in the NPF fishing grounds. At present, the NPF does not have much interaction with seagrass and other inshore habitats. This also mitigates interactions with seahorses/pipefishes. The gear used in the NPF is much larger and more offshore than in Queensland which includes, for example, a small beam trawl fishery (and there are many more seahorse/pipefish interactions).

The turtle disease mentioned by WWF was unknown but perhaps Col Limpus would know. Concerns about post-release mortality of seasnakes are lessened by previous studies which showed that most dead seasnakes have drowned in the trawl (and if they haven't drowned they are alive and stay alive). Seasnake handling is addressed by the NPF through a code of conduct. For more information on seasnakes, please refer to David Milton.

Question 6: What is the status of the BRDs and do they need to be improved?

It is true that most of the remaining issues with BRDs are not technical ones, or they involve tinkering with known/proven techniques. BRDs could work more effectively than they currently do if the implementation/usage is improved. The approach to this thus far is to seek voluntary efforts from industry.

4. Stakeholder Key Issues
N/A

Confirmed

Stakeholders

Assessors

Shelley Catherine Clarke

MSC Interview Record
Interview No 5: CSIRO scientists

Stakeholder comments attributable to Bycatch related issues
MRAG Americas Attendees Team Members: Shelley Clarke **Stakeholders:** **Affiliation: CSIRO** **Representatives: David Brewer, David Milton** **Observer:** **Location**: CSIRO, Dutton Park (Brisbane) **Date**: 19 September 2011

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- MRAG Americas as independent CB accredited to carry out MSC assessments
- Purpose of meeting – information collection and identification of issues relevant to fishery assessment
- MSC Principles & Criteria and Assessment Process being followed
- That stakeholder comments may be non-attributable if required

Stakeholder comments attributable to:
Bycatch-related issues.

2. Status

What is the nature of the organisation's interest in the fishery?
Bycatch monitoring and management

3. MRAG Americas Questions

Assessment team questions for stakeholder response

Question 1: What other researchers should be consulted on specific bycatch issues?

The following references to other researchers and their topics of expertise were offered:
- Col Limpus: for turtle species and subspecies definitions and impact assessment
- David Milton: for seasnakes and byproduct studies (subsequently joined the meeting)
- Cathy Dichmont: for target prawn stocks and their assessment
- Richard Pillans: on the issue of cumulative assessments [for sharks]
- Studies by Burke Hill and Ted Wassenberg: on the impacts of discarding
- There are apparently numerous papers in scientific journals resulting from this research—need to search online?

Question 2: Are there particular concerns relating to sawfishes?

With regard to sawfishes, Australia may be the last bastion for these species as they are under serious threat in most other areas of their range. A cumulative assessment was undertaken as part of a previous project of fisheries across northern Australia. Sawfish are caught in the greatest numbers in Australia in the inshore gill net fishery but there may be cumulative impacts under the NPF. Although sawfish can tangle in the gear, their overlap with the fishery is thought to be relatively low (except for Anoxypristis cuspidata) and trawl exclusion devices have been shown to reduce catches by 70% (less of a reduction than for other large elasmobranchs which are reduced by 85-90%).

Question 3: To what extent is research available on invertebrate bycatch or otherwise impacted species?

There are likely to be many invertebrate species in the area potentially impacted by NPF trawling activities that have not been studied (or even identified as present). Many invertebrates have only been subjected to the Level 2 PSA risk assessment because there has been no funding to assess risks under level 2.5 or 3 approaches. All research is funded through proposals and competition is very tight such that if a proposal does not have strong support is it almost not worth putting it in. According to these scientists the research priority should be on studying the effectiveness of the bycatch reduction devices, impacts to seabirds of discarding, and the most effective design for spatial closures [in relation to the plans for new Marine Protected Areas].

Question 4: Which byproduct species are important in this fishery?
With regard to the definition of byproduct species, all prawns are thought to be targeted, with endeavour prawns treated just as tigers when caught. Cuttlefish are a minor part of the byproduct catch and may or may not be retained/handled depending on the vessel, area, etc. Data on scampi may be confidential because there are very few vessels which fish for it; in any case it is considered a separate fishery. The red-legged banana prawn is a different fishery and a different ecosystem. This fishery is relatively low effort compared to the tiger prawn fishery and has less monitoring. Little is known about habitat impacts in the red-legged fishing grounds, however, compared to tiger prawn gear the red-legged gear is "lighter touch", with perhaps less impact to benthic structure. Most fishermen turn their attention to tiger prawn species after the white-legged banana prawn aggregations have dissipated. Across all fisheries, most byproducts would be <5% of the total catch on a species-by-species basis. Previous byproduct studies led to a conclusion that some of these species were under-utilized and could be exploited. However, further studies to identify appropriate size limits, etc. were not undertaken and these fisheries have not developed.

Question 5: Which bycatch/discard species are important in this fishery?
With regard to bycatch (discarded) species, a typical tiger prawn trawl is 50%-90% discards (mainly fish). More bycatch reduction could be achieved through more effective use of bycatch reduction devices, e.g. moving the device closer to the mouth of the cod end, and there have been technical studies which demonstrate this but there is inertia in the fishery since the EPBC Act accreditation has been obtained for the fishery as it currently is. Some "quad gear" has been trialled [which is designed to result in less bottom area swept]. Some of the bycatch species which received expert over-rides and were removed from the monitoring list of species of concern because they were thought to be reef associated (e.g. Lutjanus rufolineatus). *Solenocera australiana* is widespread in its abundance and probably could be removed from the list (but hasn't been). Removal of the mantis shrimps which are on the list with *Solenocera* cannot be similarly justified. The most complete list of species which interact with the fishery is in Stobutzki et al. "Ecological Sustainability of Bycatch and Biodiversity in Prawn Trawl Fisheries". A copy was provided.

Question 6: Are there any issues relating to seabirds or marine mammals?
Issues concerning seabirds are likely to relate to their dependence on feeding on discards. Perhaps some published studies on interactions by the same species in the East Coast (Queensland) Prawn Fisheries may be applicable. Monitoring data regarding impacts to marine mammals (e.g. injury, mortality) should be investigated.

Question 7: Are there any issues relating the monitoring of the fishery?
A recent decision has been taken to pay crew member observers (CMOs) and this is seen as positive. Crew member observers are trained by CSIRO and CSIRO receives their data. However, the data will not be analysed on an ongoing basis unless CSIRO receives funding specifically for that task. Data analysis through 2010 has just recently been funded. Because the CMOs are volunteers, their coverage of the fishery can be sporadic and not representatively allocated. For example, there is very little CMO effort in the white-legged banana prawn fishery as the daily schedule for crew is too intense to allow time for data recording.

4. Stakeholder Key Issues

N/A

Confirmed

Stakeholders

Assessors

MSC Interview Record
Interview No 6: CSIRO scientists

Stakeholder comments attributable to Habitats and ecosystem related issues

MRAG Americas Attendees
Team Members: Shelley Clarke
Stakeholders:
Affiliation: CSIRO **Representatives: Rodrigo Bustamante**
Observer:
Location: CSIRO, Dutton Park (Brisbane)
Date: 21 September 2011

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- MRAG Americas as independent CB accredited to carry out MSC assessments
- Purpose of meeting – information collection and identification of issues relevant to fishery assessment
- MSC Principles & Criteria and Assessment Process being followed
- That stakeholder comments may be non-attributable if required

Stakeholder comments attributable to:
Ecosystem and habitat issues.

2. Status

What is the nature of the organization's interest in the fishery?
Impacts of Fishing on the Ecosystem; Ecosystem Management

3. MRAG Americas Questions

Assessment team questions for stakeholder response

Question 1: Are vulnerable habitats within the fishing grounds known? What is known about them and about the impacts of fishing on them?

There are no known unique, exclusive habitats in the Gulf of Carpenteria (GoC) or the Joseph Bonaparte Gulf (JBG), but this situation might change if more work on taxonomy is done. Most of the ecologically important habitats are located in untrawable ground (e.g. reefs, areas which are too deep or too inshore). There are few areas which are able to be trawled which have not been trawled for the last 40 years, i.e. there are no unimpacted controls in the trawlable area. Within this trawlable area (~25-30% of the area of the GOC) there are some areas of high biodiversity in the form of marginal reefs, sponge gardens, etc. We can say that we know where these areas are/were but it is not clear whether they are permanent or whether they form and are dispersed in response to environmental (non-trawl) disturbance. Previous studies by Mick Haywood et al. (provided on memory stick) conducted in the GOC and JBG examined the impacts of trawling on such habitats. (The recent study (Bustamante et al. (2011)) contains analysis of data from the GOC.) There were data collected in the JBG but they were not analysed and are unlikely to be analysed in the future. It is not known how quickly such high biodiversity communities recover from the effects of trawling but the indications are that in the GOC this recovery is fairly fast.

At a coarse scale, the effects of trawling per se cannot be distinguished from other disturbance, i.e. there is no clear pattern in community structure based on whether the area has low, medium or high levels of trawling (the VMS data upon which these categories were defined are not in the public domain) however figures (graphics) in the Bustamante et al. (2011) report itself may provide a useful indicator of level of trawling activity. Region and night/day are more important factors than the level of trawling or water column and sediment characteristics in determining which community assemblage is found in a given location. Despite the lack of apparent impacts from trawling at a broad scale, if the issue is looked at on a small scale, some impacts can be discerned (e.g. in terms of significant differences in species richness, diversity or evenness, or if stomach content analysis is compared across various trophic groups in heavily fished versus lightly fished areas). Historically, mean tropic level at the beginning of the fishery (~1970) was relatively high, then reduced with the increase in fishing effort up to 1980. After that, as effort reduced, the trophic level increased again. While these changes can be discerned, there were no overall changes in the community. In other words, in order to have a change in the community there would need to be a change in composition and abundance but this example illustrates changes in abundance only.

Question 2: What further research is needed to understand the factors structuring the communities in the GOC and JBG?

It would be useful to have better information on the spatial extent, transience and recovery times of high biodiversity areas within the trawlable grounds of the fishery.

Question 3: What management strategies could be taken based on the research conducted thus far to protect vulnerable habitats within the fishing grounds?

The Bustamante et al. (2011) study has developed a tool for evaluating spatial management options for the NPF. Test runs of the tool have demonstrated that there is no one spatial management plan that will optimize all objectives, e.g. designating Marine Protected Areas results in an increase in predatory species which prey on other trophic/functional groups (such as young dugongs, prawns, etc). The tool was developed to evaluate trade-offs amongst competing objectives; it does not produce a strategy which it recommends should be adopted. CSIRO hopes that the tool will be used to evaluate MPA options, but this has not occurred thus far. Spatial management such as closures or rotations or creating incentives to avoid sensitive areas (e.g. multipliers on quotas for fishing in certain zones or during certain times, as done in the Eastern Tuna and Billfish Fishery) could be evaluated. Marine management in Australia has been primarily based on managing species, not habitats. Habitats (/communities) were addressed in the ecological risk assessment process, and if a need to manage impacts had been identified there would have been actions taken. There is nothing in the Bustamante et al. (2011) study which should trigger a re-assessment of the risk.

Question 4: Is there any further information available with regard to the risk to *Photololigo* spp. (squid) and *Sepia* spp. (cuttlefish)?

The squid are in the water column so they would not be expected to be severely impacted by bottom trawling. On the other hand, cuttlefish are associated with the bottom and in theory would experience a greater impact from trawling. Tony Courtney of Queensland Department of Employment, Economic Development and Innovation can advise on cuttlefish biology and habitat issues. He has also worked on *Thenus* spp. (bugs).

Question 5: Are there ongoing efforts to monitor the effects of fishing on habitats and ecosystems?

No, and no further research is planned at this time. CSIRO's main focus with regard to the Bustamante et al. (2011) study is to encourage uptake of the spatial management evaluation tool by other parties responsible for implementing spatial management plans.

Question 6: What are the drivers of the ecosystem and are these affected by the fishery.

The drivers are land-sea interactions, particularly freshwater input which triggers productivity in the form of benthic diatoms and tropical plankton. There is no evidence that the fishery affects this in a significant way.

4. Stakeholder Key Issues

A. There are only two ways in which biomass is appropriated from the ecosystem: bottom trawl (tiger prawn fishery) and setting on aggregations (white banana prawn fishery). Therefore it would seem that there are only two fisheries under consideration.

B. The GOC is bigger than the North Sea and the fishery has only 52 vessels. The fishery is actually over-managed given its potential impact.

C. Habitats can be defined in terms of the species that live there (*Zostera* spp. as a habitat) or in terms of the activities which occur there (e.g. trawling ground as habitat).

D. Aside from the TEDs, which have successfully mitigated interactions with large animals, the per-vessel impacts of the fishery have remained the same over time (although the number of vessels has decreased over time and thus the overall impact of the fishery has been reduced on this basis).

Confirmed
Stakeholder(s)
Rodrigo Bustamante
Assessor(s)

Shelley Catherine Clarke

Shelley Clarke

MSC Interview Record
MSC Interview Record
Interview No 7: Eddie Hegerl

Stakeholder comments attributable to NORMAC Environmental member

MRAG Americas Attendees
Team Members: Richard Banks, Lead Assessor
Stakeholders:
Affiliation: Eddy Hegerl, NORMAC Environmental Representative
Observer: Peter Trott and Stephanie Bradley, WWF
Location: Brisbane
Date: 20 September.

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- MRAG Americas as independent CB accredited to carry out MSC assessments
- Purpose of meeting – information collection and identification of issues relevant to fishery assessment
- MSC Principles & Criteria and Assessment Process being followed
- That stakeholder comments may be non-attributable if required

2. Status

What is the nature of the organisation's interest in the fishery (e.g. client / science / management / industry / eNGO etc)

Environmental member of NORMAC

3. MRAG Americas Questions

Assessment team questions for stakeholder response

Question 1: Highlight main features and achievements in the NPF bycatch system

- Bycatch mitigation policy historically focused on eliminating turtle discards

  By 1996 the extent and diversity of bycatch was well-known as a result of the CSIRO studies of the fishery undertaken both in independent surveys and on industry boats. The clear priority was to develop effective turtle excluders, which would also have the benefit of excluding large rays and sharks, which also was seen as a conservation priority. Eliminating turtles, sharks and rays provided economic advantage to the industry by preventing prawns from being squashed and damaged. Extensive at-sea testing of various turtle excluder designs was very expensive (over $A2 million) and took two or three years. When NORMAC made TEDs mandatory in the industry in 2000, BRDS were also made mandatory on all nets, but there had been more limited testing and the BRDs were not very effective.

- Invertebrate interactions significantly reduced through spatial closures – down from 1407 to 579 fishing grids

  Although the spatial closure boundaries have been regularly “tweaked” as better data has become available, most of the closures were already in place by 1996. Since 1996, the number of grids fished has diminished because, for economic reasons, the fleet has been reduced from about 187 boats in 1996 to a more viable fleet of 52 boats.

  The swept area within the grids also has reduced as boat skippers became proficient with GPS navigation software, which allows them to mark the localities of consistently good catches and return directly to them in future years, and also to use their GPS units to repeatedly “fish the line”.

- The total volume of bycatch also fallen significantly with the reduction in vessels to 52.

- Bycatch devices have not been greatly effective because of poor visibility. Systems need to generate internal currents. The Witches hat promises to be greatly effective.

  If the bycatch species can’t see where to escape from the net, we may need to design the BRD and its placement in the net so that internal currents within the net push the bycatch to the escapement point, or alternatively create areas of reduced velocity water near the BRD so that bycatch are not swept away from the escapement point.

  One of the researchers involved in flume tank BRD testing for NORMAC had the original idea of sewing a Witches Hat (road safety marking device) into a net. Flume tank tests showed that the Witches Hat created a region of turbulent, reduced velocity water near the escapement point. Field trials last year showed that the Witches Hat, used in conjunction with an existing, NORMAC approved, square mesh panel BRD reduced fish bycatch by 34% without changing the prawn catch. Following a review of recent BRD trials at the NORMAC Bycatch Committee meeting earlier this year, NORMAC accepted the recommendation that an education program be developed for industry in order to enhance the effectiveness of the square mesh panel BRD through the inclusion of Witches Hats.

- Trawl impacts heavily over exaggerated. Boats ‘fish the line’, i.e. tow on the same trawl lines.

  The considerable impacts of NPF trawling on bycatch species and benthos have been well documented in NPF research. What was “heavily over-exaggerated” by some conservation groups was that recovery after trawling would be slow or non-existent.

  Research indicates that both the trawled and un-trawled areas of the NPF experience massive seasonal changes and that recovery of trawled areas is much more rapid than we expected.

  “Fishing the line” i.e. repeatedly trawling the same strip, means that severe trawling impacts are confined to a long thin strip rather than extensive areas of the seabed.

- Sea mammal interactions are unlikely

- Crew observer programme has its limitations (10-12 observers on 52 vessels). CMO changed from voluntary to financial incentive. Training has enhanced their capacity.
  The CMO program is a component of the integrated bycatch monitoring program, which also includes monitoring by an AFMA observer and the CSIRO annual monitoring.

- The effectiveness of the CMO observer scheme is continually under review by NORMAC advised by the long-established Bycatch Committee.

- Scientific observers and bycatch surveys are important but expensive. These ideally should be expanded, but this requires a review of the costs and benefits and depends on how much is successfully gathered each year by the CMO program.

- Bycatch research now living on loose change, with priority switching to harvest strategy because, despite the apparent success of NPF management, the NPF has been required to change by the second season 2012 from an input to an output controlled fishery by AFMA.

- There has been no external review of the observer programme, CMO or scientific to date as this is regarded as “work in progress”. While the Bycatch Committee has always had two or three NPF industry members to advise on practicalities and arrange boats for field testing new gear, the majority of members are experts independent of industry. Nobody is paid for their work on the Bycatch Committee. The Committee is supported by additional bycatch experts from AFMA, CSIRO Marine and the National Centre for Marine Conservation and Resource Sustainability at the University of Tasmania.

Stakeholder – Eddie Hegerl

Assessor: Richard Banks

MSC Interview Record
Interview No 8: AFMA Managers

Stakeholder comments attributable to AFMA fishery manager representative

MRAG Americas Attendees
Team Members: Richard Banks, Lead Assessor, Derek Staples (P1), Shelley Clarke (P2_

Stakeholders:
Affiliation: Mel Brown and Fiona Hill

Observer: Peter Trott and Stephanie Bradley, WWF
Location: Brisbane
Date: 21 September, 2011

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- MRAG Americas as independent CB accredited to carry out MSC assessments
- Purpose of meeting – information collection and identification of issues relevant to fishery assessment
- MSC Principles & Criteria and Assessment Process being followed
- That stakeholder comments may be non-attributable if required

2. Status

What is the nature of the organization's interest in the fishery (e.g. client / science / management / industry / eNGO etc)

Fishery Managers, AFMA

3. MRAG Americas Questions

Assessment team questions for stakeholder response

Question 1: Highlight issues relevant to the NPF harvest strategy

- AFMA are the custodians of the harvest strategy. The RAG reviews the strategy, providing AFMA with advice
- The Harvest strategy is a living document and is regularly updated
- Changes to the document are recommended by NORMAC and submitted to the AFMA Commission for approval.
- There is a separate strategy for each fishery – tiger and white banana, and one in process for red legged banana, to be considered this week. Each strategy is supported by a comprehensive Target Reference Point (Spawning biomass at maximum economic yield)
- In the tiger prawn fishery, each species has its own Limit Reference Point.
- The Strategy is endorsed by the Pre season booklet.

Question 2: Issues relevant to bycatch management

- AFMA applies the ERA process to assess risks to all species. The actions are then transposed to an ERM which identifies the risk mitigation exercise
- There are plans to update the byproduct sustainability measures. However, most catches are well inside the trigger limits. A Minimum Landing Size has just been introduced for bugs.
- AFMA scientific observer scheme coverage is presently 2.5%. There are plans to increase this to 7.5%. These contain bycatch samples
- Skippers produce catch reports which stipulate TEPs and any designated at risk species
- The Crew Member Observer Program (CMO) is being improved through training and financial incentives

- AFMA provides quarterly reports on TEP interactions to SEWPAC. Based on these, SEWPAC has not sought to set any limits
- Biannual reports are submitted to the AFMA Environmental Committee for review
- BRD have been effective. Will provide further evidence of this, but estimate reductions from around 80% to 35%.
- Use of BRDs is statutory. Cairns boats tend to use the Popeye fish box, other boats, and the square mesh panel.
- Witches hat was trialed with the square mesh panel and these has proven to have increased the effectiveness in the BRD
- AFMA have BRD standards which are provided to skippers

Question 3: Issues relevant to management and governance

- Not aware of any challenges to AFMA Commission decisions to date.
- Shared roles and responsibilities are determined
- Industry pays a levy to cover the costs of Stock assessment and bycatch research, Independent Research funded the Commonwealth Fisheries Research Advisory Body, Management and enforcement.
- The NPF management system has not been subject to a performance review but individual elements of this are:
  - Stock assessment and economic research has an internal review process, and scientific papers are externally reviewed
  - The management team is subject to external review
  - The AFMA Commission oversee the harvest strategy

Stakeholder

Assessor: Richard Banks

Follow up questions and responses

From: Richard Banks [mailto:Richard@consult-poseidon.com]
Sent: Monday, 26 September 2011 4:50 PM
To: 'BROWN Melissa'; m.barwick@npfindustry.com.au
Cc: 'Annie Jarrett'; 'Derek Staples'; 'Shelley Clarke'
Subject: Follow up queries

Dear Melissa and Matt

Thank you very much for meeting with us on Wednesday morning. Based on the information provided by you, Fiona and others thus far, the assessment team has started working through the MSC scoring process. Through these discussions we have identified a few key information needs that we believe we requested from you on Wednesday but we would like to reiterate here so that you will have a convenient list to respond to. In addition, there were a few points which arose for the first time this morning. Specifically, we would appreciate further information from you on the following points:
In relation to the query about the risk assessment and how the different levels link together, there is some documentation on this on the AFMA website and I have attached a document which sets this out. Perhaps what is not clear is the process of expert override that occurs. What should also be made clear at this point is that the final outcome of all of these assessments was a priority list of species for which AFMA should implement management arrangements to help minimise interactions with. This message of an output of priority species has often been 'lost in translation' and hence people find it hard to understand why some species appear to drop off the list. Each level of the ERA assessment has its associated issues, which is to be expected with such studies which seek to assess vast amounts of information. At the Level 2 PSA there were some problems in defining life history parameters for species that are not well understood, as well as assessing species that have occurred in research trawls in the area of the NPF but are rarely seen in commercial operations. Both of these factors caused species to return high risk scores when in reality their risk was likely to have been overestimated. A common theme among the species ranked as high priority in the NPF was that they were often on the list due to a lack of information. Hence management responses have included to collect information on the priority species.
A lot of this information is detailed on the AFMA website at http://www.afma.gov.au/managing-our-fisheries/environment-and-sustainability/Ecological-Risk-Management/
Byproduct, Bycatch and Ecosystem related issues

How do you ensure that vulnerable byproduct species are within biological limits and assess that the measures in place will ensure that the fishery does not hinder recovery and rebuilding
See attached report (FRDC 2006/008)

The squid Photololigo spp. 4, and the cuttlefish Sepia smithi, Sepia whitleyana, Metasepia pfefferi and Eupryna hoylei were identified as "high risk" in the report "Ecological Risk Assessment for Effects of Fishing" dated 29 June 2007 (Level 2 risk assessment) and as we understand it has not be re-assessed since. Unlike Dichtyosquilla tuberculata, Harpiosquilla stephensoni and Solenocera australiana, these species have not been carried forward for inclusion in the Ecological Risk Management document (July 2009, or the September 2011 draft). Can you please explain to us the process underlying this outcome, and the justification for not taking these species forward for further action and consideration?
I'm not sure of this. Maybe ask Gary Fry?
In relation to the cuttlefish; as you will have seen there were 4 species of cuttlefish and 1 species of squid assessed as high risk at the level 2 PSA. After the PSA there was what was termed a Level 2 Residual Risk Assessment. This used the attached criteria to potentially reduce the risk level of some species. The Residual Risk Assessment reduced 2 of the 4

cuttlefish species to medium risk by replacing some of their missing attributes with those of a closely related species (see Milton et al 2009). The other 2 cuttlefish and 1 squid species were overridden with expert opinion provided by Malcolm Dunning in May 2009, coupled with the two references below.

It appears that only those species which were classified as "high risk" in one of the ecological risk assessments have been considered for further research, monitoring or management action. Is there an articulated government policy that only "high risk", e.g. as opposed to "medium risk", outcomes will be actioned? If so, can you point us to where we can find documentation of this?

The attached document on further information on the ERM framework outlines that the ERM will only deal with those species defined as a high priority for the fishery at this stage. The AFMA Scientific Observer Program collects information on all bycatch species in the NPF.

1. Can you confirm that the Ecological Risk Management document applies equally to all NPF fisheries, i.e. the tiger prawn fishery, the white banana fishery and the red-legged banana fishery?

Yes. The ERM (and the bycatch and discarding workplan) apply to the NPF, not to a particular component of the NPF.

2. Can you confirm the process for evaluating the effectiveness of the bycatch (byproduct, bycatch and TEP) management strategy for species identified as High Risk, and provide evidence to show that there is a monitoring process in place.

The CMO programme, and Scientific Observer programs provide long term datasets to assess the sustainability of interactions with TEP and high risk species. The Crew-member observer (CMO) program began in 2003 as part of the long-term bycatch monitoring project (FRDC Project No. 2002/035). Each year crew members from a selection of NPF vessels volunteer to participate in the collection of data on interactions with key bycatch species. Crew members attend annual workshops, where they are trained in the collection of reliable and accurate data on Threatened, Endangered and Protected (TEP) species (turtles, sea snakes, syngnathids & sawfish), and other 'at risk' fish, crustaceans and elasmobranchs identified through the Ecological Risk Assessment for Effects of Fishing (ERAEF) and Sustainability Assessment for Fishing Effects (SAFE). This involves collecting and recording vessel and trawl information, species catch statistics and photographing these species for later identification by CSIRO staff. Biological samples are also collected, frozen, and transported back to a laboratory for identification by CSIRO staff. Data from these programs have been analysed and used to evaluate the sustainability of the fishery (see 2008 bycatch sustainability report I sent earlier today)

3. How does AFMA test the effectiveness of the bycatch management strategy

Ongoing review of the ERA process, bycatch and discarding work plans and the continual evaluation of fisheries data enable AFMA to re-evaluate the effectiveness of bycatch management strategies that are in place in the fishery.

4. With reference to the byproduct catch limits in the current version of the harvest strategy, could you confirm what are the units for the snapper and squid limits, e.g. per vessel per year, or within a specific fishery?

A 500t 'trigger limit' for squid is in place. The limit applies for the calendar year and, if reached, initiates a review of current management arrangements for the catch of squid in the NPF. It does not mean the catch of squid must stop once the trigger point is reached.

For saddle tailed snapper, red snapper and red emperor the trip limit is 550kg (whole wt.) per boat in bananas, and 55kg (whole wt.) in tigers.

5. We have asked several potential sources for figures and species list of bycatch in each of the three NPF sub-fisheries (tiger, white banana, red-legged banana) however, we have not yet received this. Can AFMA provide some time series of bycatch (by species, if possible, or if not in aggregate) for the NPF by sub-fishery or if necessary for the NPF as a whole?

See attached spreadsheet in next email. This is only from observed data as comprehensive data on bycatch is not captured in logbooks. There is also likely to be some work on this in the Brewer report which is also attached.

6. Can you provide a list of byproduct (retained) species for the red-legged banana prawn fishery in the Joseph Bonaparte Gulf?

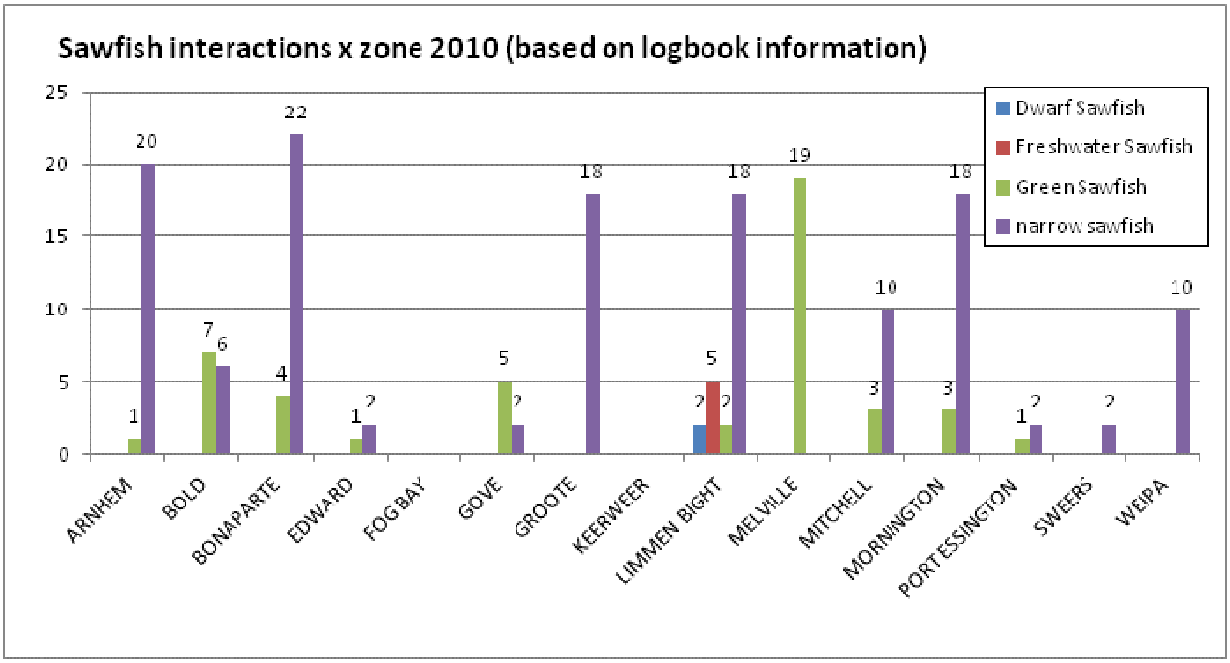
Again see attached spreadsheet in the next email (data for all three fisheries). This data is from logbooks for the last few years. In theory this data should be available since the fishery has been filling in logbooks. Note that for this and question 8 data has been partitioned based on location or date for the three sub-fisheries.

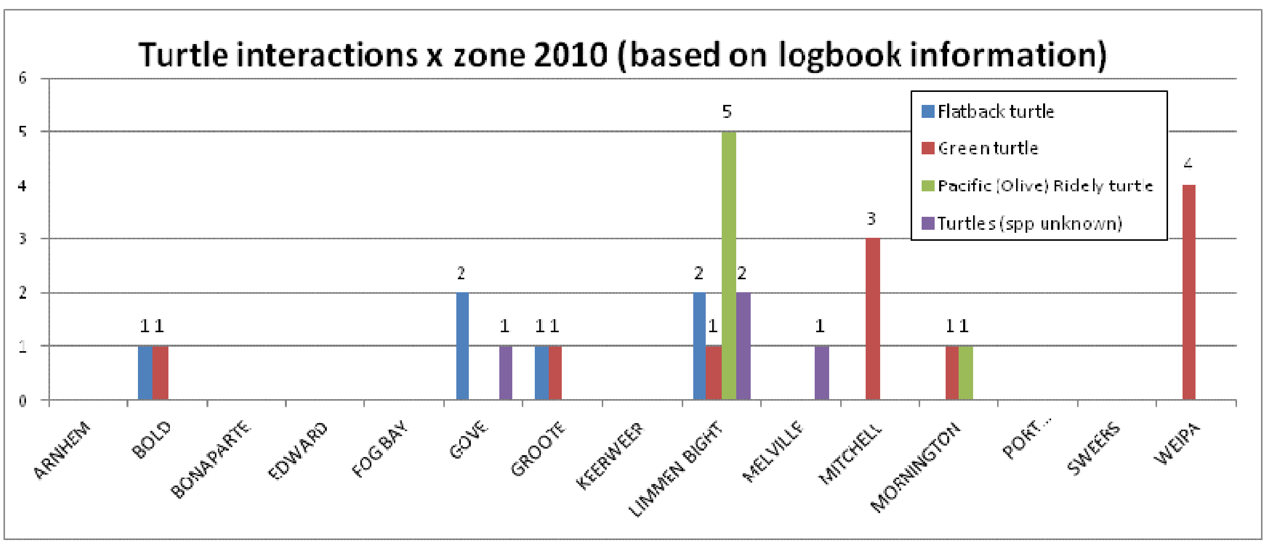
7. Could you confirm the number of years for which byproduct and bycatch data are available for the three sub-fisheries?

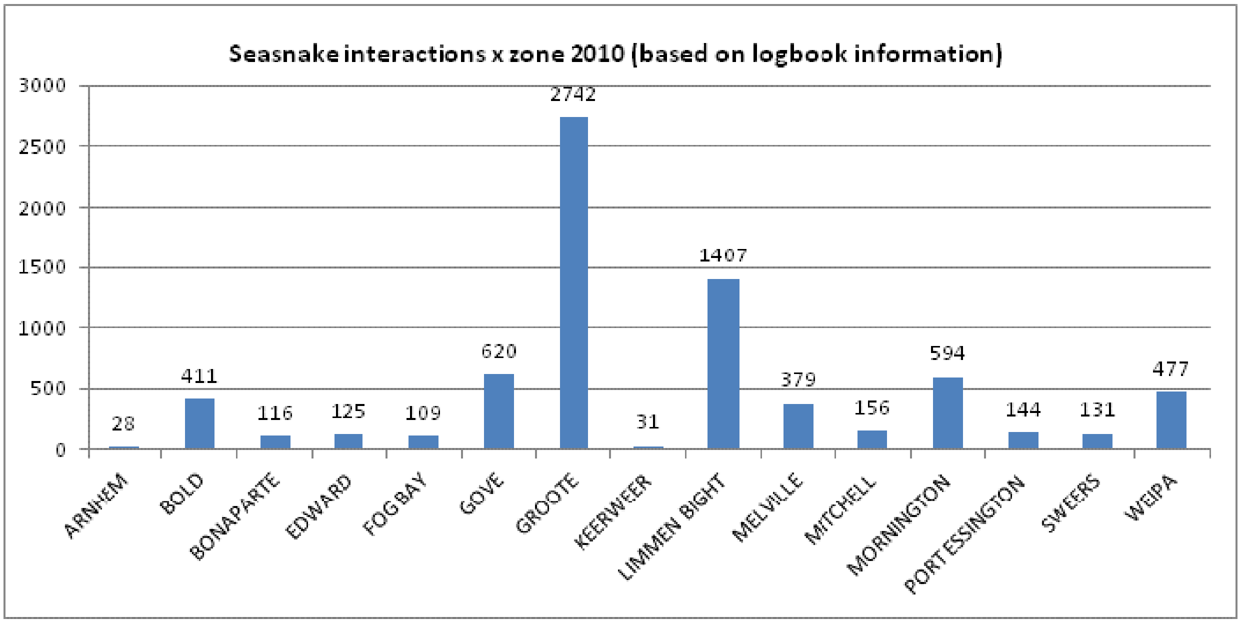
Again byproduct should be available since logbooks have been filled out, bycatch will likely be less based on the number of year's observers and CMO's have been operating in the fishery.

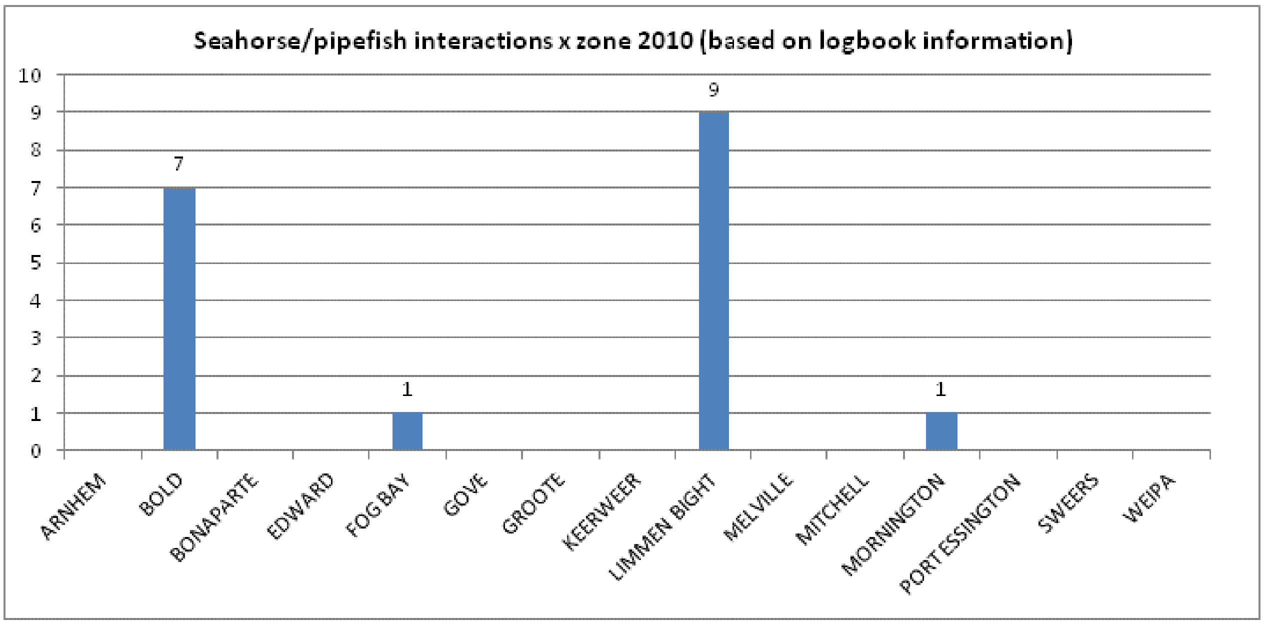
8. Would it be possible to provide us with figures on the number of TEP species interactions by sub-fishery, rather than for the NPF as a whole, or by region as in the NPF Data Summary?

SEE BELOW









9. Can you provide evidence that demonstrates the effectiveness of BRDs, and an estimate as to the extent of bycatch reduction achieved

SEE ATTACHED PAPER

10. You stated that there were BRD standards. Has AFMA ever evaluated the extent to which these are applied?

BRD standards are applied under the bycatch and discarding workplans (previously bycatch action plans) for the fishery. These standards were created by a sub-committee of NORMAC and are applied to the formal testing of BRD's which must occur before a BRD is approved for use in the fishery.
Under the new version of the bycatch and discarding workplan (which is currently being approved for implementation), AFMA and the industry hope to review the standards and those BRD's that are currently in place to ensure the best possible BRD's are being used. This is due to work over recent times which has identified BRDs that are better than some of the earlier BRD models.
The BRD standards are attached for your info.

Harvest strategy

11. Can you confirm the position of the harvest strategy for red legged banana prawns? Are there any minutes that can confirm that the change in strategy was in process at the time of this

assessment, and the proposed changes that are to be implemented in the second season, if any?

It was agreed at the most recent NORMAC to include reference points for Red-Legged Banana Prawns based on the now agreed assessment model. Work is currently progressing to formalize this.

Roles and responsibilities

12. Please provide an outline of the allocated management roles and responsibilities

See attached document titled 'above and below the line table' for a breakdown of management responsibilities.

Thanks in advance for your consideration and assistance. Best wishes,

During the interview with Melissa and Fiona several other questions were raised:

1. SAFE

This was regarding who chooses the probability interval for the SAFE, because if changed it would result in 9 species being assessed as at risk. We are not completely clear on the question, however, I think it relates to the difference between what are termed **Method 1** and **Method 2** in the SAFE report (figures 3 and 4 relate to the elasmobranchs). The choice of which method to use is determined by the author of the report. In this case the two methods differ in how they estimate fishing effort to occur in a given area; method 1 assumes the entire fished area of the NPF is swept once by a prawn trawl, while method 2 uses the actual fishing effort for a given area, in hours of fishing. To this extent the author suggests that method 1 likely overestimates the fishing mortality and as such suggests that the use of method 2 is a more realistic representation of what is occurring in the fishery. If I have got this completely wrong then you are probably best talking to the author of the report.

2. The inclusion of the following prawn in the ERM (*Solenocera Australiana*).

This species of prawn is described as a coral prawn see link for example http://www.publish.csiro.au/?paper=MF9870133

References:

Milton, D.A., Fry, G.C., Kuhnert, P., Tonks, M., Zhou, S. and Zhu, M. 2009. Assessing data poor resources: developing a management strategy for byproduct species in the Northern Prawn Fishery. Final Report. FRDC Project 2006/008. Pp. 214.

Dunning, M C, Yeomans, K, and McKinnon, S G (2000)   Development of a northern Australian squid fishery. Final report on FRDC Project 94/017 to the Fisheries Research and Development Corporation. Department of Primary Industries, Brisbane. 112 pages.

3. A request for information on the Caring for our Country funding and associated targets:

Under the Caring Four Our Country funding arrangements the AFMA Bycatch Program has targets to

a) improve by 250, commercial fishers who have improved practices by 2013 to optimise sustainability
b) increase by 350 fishers by 2013 who have demonstrated an improvement in knowledge and skills in natural resource management.
c)

AFMA have recently formed a contract with NPFI to undertake an assessment of the BRDs currently approved for use in the NPF, the outcomes of which will be used to guide future education of NPF crew, skippers and SFR holders. This will all be undertaken with a view to encourage NPF boats to use the most effective BRDs and will guide an AFMA review of the BRDs permitted for use in NPF.

MSC Interview Record
Interview No 9: Chairman of the NPFRAG

Stakeholder comments attributable to Chair of NPF Resource Assessment Group (NPFRAG)

MRAG Americas Attendees
Team Members: Derek Staples (P1)
Stakeholders:
Affiliation: Ian Knuckey
Observer:
Location: Brisbane
Date: 21 September, 2011

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- Purpose of meeting – information collection and identification of issues relevant to fishery resource assessments
- That stakeholder comments may be non-attributable if required

2. Status

What is the nature of the organisation's interest in the fishery (e.g. client / science / management / industry / eNGO etc)

Chair NPFRAG

3. MRAG Americas Questions

Assessment team questions for stakeholder response

Question 1: Status of white banana prawns

The management objective for white banana prawns is to ensure sufficient escapement from the fishery so that the subsequent recruitment is not impaired. The surrogate reference point, therefore, is 500kg/day that is used to trigger an extension of the season when the abundance is high. The problems of defining a more robust Harvest Strategy under output control.

Question 2: Current status of the harvest strategy (HS)

The HS is a "living document" and updated and modified through the RAG. The latest draft (September 2011) is based on output controls and will be considered in a meeting on 22nd September.

Question 3: Research & Environment Committee (REC)

The REC has not been active over the past few years and at one stage was to be merged with the NPFRAG. As a result, the NPF Research Strategy has not been updated since 2001.

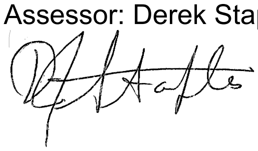
Ian Knuckey has just been appointed as the new Chair of the REC and will address the problem and develop a new Strategic Research Strategy in the near future.
Ian Knuckey has also just been appointed as the Scientific Representative on NORMAC.

Question 4: Funding

Stock assessments are contracted by AFMA using part Industry funding. However, there seemed to be a lack of funding for the development of the HS.

Stakeholder

Assessor: Derek Staples



MSC Interview Record
Interview No 10: Environmental NGO

Stakeholder comments attributable to Australian Marine Conservation Society

MRAG Americas Attendees
Team Members: Shelley Clarke, Richard Banks
Stakeholders:
Affiliation: Australian Marine Conservation Society
Representative: Tooni Mahto
Observer: Peter Trott and Stephanie Bradley(WWF)
Location: Novotel Airport Hotel (Brisbane)
Date: 21 September 2011

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- MRAG Americas as independent CB accredited to carry out MSC assessments
- Purpose of meeting – information collection and identification of issues relevant to fishery assessment
- MSC Principles & Criteria and Assessment Process being followed
- That stakeholder comments may be non-attributable if required

Stakeholder comments attributable to:
Non-governmental conservation organization

2. Status

What is the nature of the organisation’s interest in the fishery?
Bycatch monitoring and management

3. MRAG Americas Questions
Assessment team questions for stakeholder response

Question 1: What are AMCS's primary concerns with regard to bycatch and ecosystem issues for this MCS certification?

AMCS would like to see interaction rates with TEP species continue to move toward zero. In this regard, AMCS does not have a high degree of confidence in the observer data as the coverage is low and it considers the reliability of the crew member observers to be low. Its goal for the NPF observer programme would be to achieve 100% observer coverage. (A variety of other concerns were discussed between the assessors, AMCS and WWF.)

Question 2: Why has AMCS given prawns a negative rating on its seafood card?

First of all it is important to note that Australian prawn fisheries are not considered separately by the AMCS seafood card. Therefore, shortcomings of one fishery may bias the rating for another fishery. The exact reasons for the negative listing for prawns would have to be checked to see whether those issues applied to the NPF.

4. Stakeholder Key Issues
a. Cumulative risks should be addressed through the MSC process
b. When scoring the fishery and uncertainties are encountered a precautionary approach should be adopted.

Confirmed

Stakeholders

(Tooni Mahto)

Assessors

Shelley Catherine Clarke

MSC Interview Record
Interview No 11: NPF Industry Pty Ltd

Stakeholder comments attributable to NPF Industry Pty Ltd

MRAG Americas Attendees
Team Members: Richard Banks
Stakeholders:
Affiliation: NPF Industry Pty Ltd
Representative: Annie Jarrett and Matt Barwick
Location: Coulandra
Date: 26 September

Stakeholder comments attributable to: The Client (NPF Industry Ltd)

2. Status

What is the nature of the organisation's interest in the fishery:

Fishing industry representation, Secretariat of NORMAC, and responsible for some comanagement elements

3. NPF Responsibilities

Assessment team questions for stakeholder response

Question 1: Clarify NPF's Industry's comanagement role

Running the NPF reporting process
Logbook records now collated through NPF
CMO system operating for 9 years and applied throughout the sub fisheries

4. Stakeholder Key Issues

Question 2: Harvest control process and issues

The harvest strategy is based on an input control system that has been demonstrated to be highly effective.
Specific catch rates are set for the two principal target species – tiger, and white banana (including red legged) monitored over a 2 week period. If catch falls below these rates, the fishery is closed.
Other prawn species catches (e.g. endeavours) within each fishery are monitored but are an anticipated interaction, and no specific actions are required, as these are fairly constant and within biological limits.
Tiger prawns caught in the banana prawn fishery are restricted to 6.6 tonnes/week. If this is exceeded, the fishery will be closed. As from 1 May, the 6.6 t limit no longer applies.
The red leg (JBG) fishery is partially protected in the first season by a closure which was introduced to protect pre spawning females. Red legged activity in the first season is also subject to the same 500kg/day limit, as set for banana prawns. As red legged activity has always been at a low level, and stock status identified as stable, no specific harvest strategy was in place for the second season.
A development of a new harvest strategy for red legged banana prawns is in process (and commenced before September, 2011), with supporting LRP and TRPs provided by CSIRO. The proposal is that new and separate catch limits (from the previously used combined banana prawn limits) are being recommended to NORMAC for precautionary reasons. It is expected that fishery specific limits will be endorsed as an input management measure by the AFMA Commission, for introduction into the 2012 fishing year.

Question 3: Bycatch related issues

ERA process undertaken once every 3 years. Assessments undertaken in 2007 and current (2011), which has just been completed.
High risk and data deficient species (including Byproduct, Bycatch and ETPs) are referred to level 2 assessments and are subjected to 'expert override'. Decisions are divided into elimination, usually because of no or minimal encounterability, or referral to higher level assessment (SAFE).
All High level risks are referred for an action decision. Low and medium level risks are eliminated, as AFMA has decided that most effective management actions should deal with species at high risk. Medium level risks may also show undue weighting due to the process used by
Higher level actions may include 'collection of further information', 'initiate impact assessment study', or 'management mitigation'.
The process is also reviewed by DSEWPac, which has endorsed the process and management actions.
Bycatch monitoring surveys are undertaken every three years for each location. These do identify species.
Species interactions for high risk species are also recorded in the Scientific observer programme. The frequency of deploying a larger number of SMOs is being evaluated by NORMAC.
CMOs record some species interactions, most specifically ETP and at risk species, e.g. mantis shrimp, rays, as and when required, but not squid as different species are very difficult to identify. Recording of at risk squid and cuttlefish are recorded by SMOs.
CMOs also check the weight of bycatch relative to target species.
Logbooks record byproduct catches. These are recorded via the NPF Industry Ltd.
Milton, CSIRO, did undertake a review on the Sustainability of byproduct species.
Anecdotal evidence is that because of the way trawling is undertaken in the JBG, by-product is very limited. Apparently, the only real 'retained species' other than bananas and endeavours (in some years) are small amounts of tigers (which are generally caught in the years endeavour prawns are caught), very small amounts of bugs, and mainly saddletail snapper.

Question 4: Governance related issues

Indigenous consultation

Typically discussions with various indigenous groups have focused around area closures (including protected area closures), cultural heritage issues including sacred sites, arrangements for NPF skippers and crew to access aboriginal owned land and more recently as part of co-management, exchanges on the NPF management arrangements and cultural heritage training which is being undertaken as part of the NPF pre-season briefings.

To this end, the NPF Operational Booklet specifically includes information which has been developed in conjunction with indigenous groups on accessing aboriginal owned land and closed seas, and includes a number of closures which have been implemented taking into account indigenous interests e.g. the protected area closures in Arnhem Bay, Dalumba Bay & Port Essington (refer Closure Review book). There has also been considerable interaction on issues such as the development of proposed Indigenous Protected Areas in the Wellesley Island area. There have been two attendances by indigenous representatives at NORMAC on this issue in the past three years, and Matt Barwick also participates in the CLC IPA working group on this issue.

More recently, NPFI have been involved in an FRDC project aimed in improving engagement between the Northern Prawn industry and indigenous groups as part of our co-management approach. The project has been very successful and a key output is that representatives of the Wellesley Island group and the Carpentaria Land Council attend the NPF pre-season briefings which provides an opportunity for the indigenous groups to get a better understanding of the management arrangements in the NPF, and to provide our skippers with cultural heritage training and provide information on issues of cultural importance to them.

MSC Interview Record
Interview No 12: NPF Industry Pty Ltd

Stakeholder comments attributable to CSIRO

MRAG Americas Attendees
Team Members: Derek Staples (P1)

Stakeholders:
Affiliation: Rik Buckworth CSIRO
Cathy Dichmont CSIRO (by phone)

Observer:

Location: Brisbane

Date: 18 May, 2012

1. Introduction. MRAG Americas Lead Auditor to introduce MSC assessment to Stakeholders, including

- Fishery Unit of Certification (and client)
- Assessment Team
- Purpose of meeting – information collection and identification of issues relevant to fishery resource assessments
- That stakeholder comments may be non-attributable if required

2. Status

What is the nature of the organisation's interest in the fishery (e.g. client / science / management / industry / eNGO etc.)
Project Leader Northern Prawns; Senior Scientist

3. MRAG Americas Questions
The interview was held in two parts
Part A: Rik Buckworth
Assessment team questions for stakeholder response

Question 1: Overall comments on peer reviews

Peer reviewer 1 provided a very thorough set of questions and comments. These will be best considered by Cathy Dichmont, who is the stock assessment expert. Peer reviewer 2 focused mainly on the fact that the NPF should be assessed and managed as a series of subsets. In fact, the operational stock assessment model is based on a series of stocks but when used in the management strategy evaluation, it appears that it is more efficient and risk averse to manage the NPF sub-fisheries as one stock. This is only appropriate if sub-stocks can be proved and managed accordingly. The reviewer also uses catch as an indicator of stock status that is not appropriate in the situation where catches are being constrained by management measures.

The control for the fishery is robust and with mid-season adjustments, catch of the two different species of tiger prawns can be controlled. It is important to note that the Maximum Economic Yield (MEY) is a target over 7 years and allows for annual adjustment. It is also important to note that the NPF is a multi-species fishery and managed to achieve the best overall MEY. In such a case it is not possible, or even relevant to manage each species to achieve its own individual target.

Question 2: What is the current status of the harvest strategy (HS)?

The HS is a “living document” and updated and modified through the RAG. The latest draft (September 2011) is based on output controls and will be considered in a meeting on 22nd September.

PART B: Phone interview with Cathy Dichmont

Question 1: What is the scientific basis of the catch triggers in the HS?

These are based on the modelling results and represent the break-even point (i.e. point where the costs equal the benefits) for the different sub-fisheries.

Question 2: Do the stock assessments include results expressed as probabilities?

The stock assessments are carried out yearly and feed directly into the decision making process under the HS. As such, there is insufficient time to calculate probabilities and still provide timely advice. However, all the uncertainties that have been considered and the probabilities are included in the full assessments, as reported in the scientific literature (e.g. (Punt, et al., Integrating size-structured assessmant and bio-economic managemant advice in Australia's Northern Prawn Fishery, 2010).

Punt, A. E., Deng, R. A., Dichmont, C. M., Kompas, T., Venables, W. N., Zhou, S., et al. (2010). Integrating size-structured assessmant and bio-economic managemant advice in Australia's Northern Prawn Fishery. *ICES Journal of marine Sciences 76* , 1985-1801.

11 PEER REVIEW
Annex 1. Peer Reviewer 1

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes/No**	**Certification Body Response**
Justification:		

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	**Yes/No**	**Certification Body Response**
Justification:		

If included:

Do you think the client action plan is sufficient to close the conditions raised?	**NA**	**Certification Body Response**
Justification:		

For reports using the Risk-Based Framework please follow the link.

For reports assessing enhanced fisheries please follow the link.

General Comments on the Assessment Report (optional)

Performance Indicator Review

Performance Indicator Review NPF - Fletcher

Please complete the table below for each Performance Indicator which are listed in the Certification Body's Public Certification Draft Report.

Performance Indicator	**Has all the relevant information available been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response**
Brown Tiger Prawn P. esculentus and Grooved Tiger Prawn P Semisulcatus (essentially the same comments)					
1.1.1	No	No		Significant issues - see attached expansion	See attached response. Revised text will be used to describe stock structure in the report at 3.6.1.and referred to in the text Rothlisberg et al, 1983, Somers & Kirkwood, 1984and Dichmont, 2006.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.1.2		No		As outlined for 1.1.1 - I do not agree that a single reference point for spawning stock adequately reflects the likely spatial structure for this species across the large GoC. It is much more likely that there are a series substocks. A single indicator can hide many local issues. At a minimum there should be specific reference levels for each of the major regions to ensure they are all maintained at adequate levels. This may not deal with potentially even smaller stock level issues. I also have concerns for the single indicator given that the reference point used to determine acceptability appears equivalent to the point circa 1990 in the history of the fishery when catches had already been declining and continued to decline for the next 20 years. This is not consistent with recruitment levels being maintained.	Point 1 addressed in the attachment. Catches declined because of the strict management controls that were introduced that reduced the number of boats from over 300 to 52. Total catch, therefore, is not an indicator of recruitment levels.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.1.3					
1.2.1		No		To receive a score of 100 - the harvest strategy would need to directly include a number of additional elements such as : • ensure an appropriate spatial structure; • include species (not suite) level triggers; • Have predicted catch levels/range for each subregion to determine if the actual fishery catch was actually consistent with expectations an annual basis. • Assess if the catch per region was acceptable or not – if not why not.	• The assessors disagree with substock hypothesis (see attached) • Species cannot be separated at time of capture (i.e. included as "tiger prawns") and although desirable, species level triggers are not feasible • This is the sub-stock argument again This is also the sub-stock argument again

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.2.2		No		The control rules appear to only relate to the average catch of the fleet being above 350kg/day. Some areas of the fishery can therefore potentially be well underneath this and still be able to continue to operate as long as the average is above it. Given the differences in fishing operations varying from twin to quad rigs there should be a standardization process for the calculation of the catch rate threshold for the different types of vessels and gear. Not clear if this is included in the operation of the fishery, nor if there is any calculation of efficiency increases over time. There was no justification provided as to why 350 kg/day is appropriate at the suite level. No comparison of this to SSR curves provided and this catch rate figure was not even mentioned in 1.1.2	Comment is only appropriate if sub-stocks can be proved and managed accordingly. The efficiency increases over time are monitored and included in the stock assessments. The trigger could be changed to reflect changes in efficiency, if the managers think that it is needed. The 350kg/day is the breakeven point where costs = revenue. Added to assessment.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.2.3		n/a		The list of what is actually measured for **this** subfishery is not clear. To achieve the 100 score the data collected must include the issues raised above – which may or may not be collected already – can't really tell from what was presented.	The "issues" raised above are not with adequate foundation, and the score has been left at 100
1.2.4		n/a		The assessment in my opinion HAS NOT taken into account the features relevant to the biology of the species and the nature of the fishery needed for a score of 100 nor does it meet the 80 score post of being appropriate for the stock. See also previous expansion on 1.1.1	This is the sub-stock hypothesis again.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
BLUE and RED ENDEVOUR PRAWNS					
1.1.1		No		Current catch levels, are by eye < 10 - 20 % of maximum levels, this is not consistent with stocks having recovered. Empirically based, fishery independent estimates of recruitment levels being the same as they were in the 80s would be required to meet the 100 score. A model output showing 100 % certainty is not the same as 100% certainty. Moreover even what they indicated were NOT even consistent with the 80 level score as they have not been near or above the target for recent years which is required for the 80 level score.	Catches are now limited by the management measures that have been put in place. Comparisons of catches during the early days of a fishery and after management have been in place for a number of years should not be used to compare recruitment. The default MSC TRP is MSY and this is used in the assessment. The stock is now at BMSY. However, the score has been adjusted downward to 90 to reflect the stock is at its target reference point of BMSY.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.1.2		No		The reference levels used appear to be solely based on model outputs with no direct relation to empirical information. If this is the case, this significantly reduces their real (rather than calculated) robustness as there is nothing to independently verify these levels as being appropriate. If the recent catch history was consistent with these stocks (recruitment) having recovered that would be independent verification – but this does not appear to be the case.	Modelling takes into account all the known empirical information, including real-time indices of recruitment and spawning stock abundance from surveys. Catch levels are not an indicator of recruitment when catches are limited by fishery management interventions.
1.1.3					

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.2.1		No		As these species are apparently only incidental to the tiger prawn HS, it is not appropriate to give their 'HS' a score of 100 as the HS presented is not even specifically directed at this group. This would definitely be required for a score of 100. Stretching the case it may be an 80 – work together but it really is most appropriate at 60 – only likely to work.	There is an assumption here that the tiger prawn HS will cover the other species, because of their close association. If this assumption has not been tested, then a lower score is appropriate.However, clarity is provided on the decision rules (Fig 14) which would suggest a score f 80 or above.
1.2.2		No		Again – there are no specific control rules for these species. Hence this criteria is not met at all – i.e. doesn't get a score of 60. I would suggest these species may best be assessed in P2. They are essentially only retained byproduct species- there is no specifically directed management.	See above

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.2.3		No		There is no mention of any spawning stock or recruitment indices for these species that I could see. It appears that the overall NPF monitoring program was mentioned here rather than list the specific actions that are undertaken and measured for these species. It is unclear what exactly is monitored for these species - both fishery dependent and independent. Cannot really determine a score.	Indices are calculated for blue endeavour prawns but there insufficient catches of red endeavours to carry out quantitative assessments.
1.2.4		No		This assessment may NOT have taken into account the features relevant to the biology of the species and the nature of the fishery needed for a score of 100. (lack of spatial assessments) and therefore I do not think it meets the 80 scorepost as being appropriate.	This is the sub-stock hypothesis again (see attached response)
White Banana Prawns					
1.1.1		Maybe		See expansion	Noted

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.1.2		No		The main question is whether the escapement reference points require a more regional level approach. That the catch in the Weipa area declined and recovered independent of the other areas strongly suggests that regionally based triggers and target points are required. The trigger level may be the same for each area. But if there are less prawns in one area of the fishery - this area should be stopped earlier – no guarantee this will occur if just one trigger. There is also no discussion of where the 500 kg/hr came from. Also no discussion on how changes in fishing practices and efficiencies affect this rate – is there any independent verification that 500kg/day taken by the fleet now leaves the same amount of spawning stock in the water as 5 or 10 years ago?	Other interpretations are possible, e.g. changes in fishing effort in the Weipa area. The 500kg/hour has been derived from historic catch and catch rate analysis.
1.1.3					

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.2.1		No		It doesn't cover the spatial elements of the different stocks. Many of the elements are designed for tiger prawns hence it is only working together. I disagree that the harvest strategy can't be tested – it just needs to show that it is robust to a wide range of starting recruitment levels occurring in each of the regions. This should include the option of not opening the fishery or parts of the fishery if recruitment surveys show that the levels don't exceed the escapement policy level.	See attachment on stock structure. Not sure what this means The comment is not clear
1.2.2		No		Very weak set of justifications. There is no evidence to clearly show the control rules work. The discussion in 1.1.2 about the Weipa decline and recovery did not mention anything specific that directly showed that the control rules affected fishing in this area or to show how the control rules influenced this outcome.	Noted

Performance Indicator	**Has all the relevant information available been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response**
				At best the available evidence indicates the tools are appropriate (80) but it could more easily be argued that there is only some evidence of this (60). If fishing in the Weipa region when it was in a 'depressed' state was not directly affected by the HS then I would say there is NO evidence of the HS working.	
1.2.3		No		Insufficient detail to determine what is available for THIS subfishery.	Data and information is comprehensive across all sub-fisheries
1.2.4		No		The statement about a lack of over exploitation ignores the identified Weipa issue. Again without regional assessments I do not believe that the assessment takes into account all the uncertainties. Finally if the assessment is at 80 why is the recommendation needed??	A very extensive CSIRO study could not find any evidence of over exploitation It is just that – a recommendation, and because the score is below SG 80 is not required as a Condition.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
Red Legged Banana Prawns					
1.1.1		No		No fishery independent surveys to provide indices of recruitment or stock size - this is only consistent with a score at best of 80. Also if the reference points in 1.1.2 were not considered sufficiently confirmed this must affect the certainty of current status.	Stock assessment is not as robust as tigers and has been scored accordingly. However, it is better than that available for many of the world's fisheries.
1.1.2				OK	
1.1.3					
1.2.1		No		The conclusions don't match the recommendation. If a more robust HS is required the current one can't be considered appropriate and working and that there is evidence of it achieving its objectives?	At the time of assessment, the HS was not satisfactory. Since the assessment, a new HS has been developed but the assessors were unable to consider the changes as this post dated the assessment, hence the condition

Performance Indicator	**Has all the relevant information available been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response**
1.2.2		No		Again there is a mismatch in conclusions to the recommendations	This has been rectified
1.2.3		No		Cannot tell precisely what is available for this sub fishery – it says there are independent surveys but in 1.1.1 for this fishery its states there weren't any?	There are no independent surveys. Mistake will be corrected
1.2.4		No		At best it is only 80.	As above
P2 ASSESMENTS					
Tiger Prawn P2					

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.1.1		No		The ABCs are only equivalent to limits not targets therefore the appropriate score is only 80. I have trouble with the accuracy/certainty of the methods used to assess the status of the retained non target species where they generate a high priority species (Mantis shrimp) that is not even recorded in the monitoring data. The assessments for these categories seem to confuse having undertaken a high level of activity with accuracy.	It is true that a target reference point is not defined, however, the biomass is well above the limit reference point and it is not true that the status is poorly known. The lack of a target reference point does not meet the second scoring issue of the SG100.Wik. The ERA methodology accounts for uncertainty by being precautionary. That is why some species were flagged as high risk even though they have been shown not to interact with the fishery. Score has been changed to 90.

Performance Indicator	**Has all the relevant information available been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response**
2.1.2		No		As the partial strategy has not been formally implemented it cannot, by definition, score 100 on implementation	While the fishery has a number of coordinated management measures that could constitute a 'strategy,' these do not apply to all of the retained species assessed as being at high risk (yet). Therefore the fishery has a partial strategy Note that this partial strategy has been implemented

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.1.3		No		Given the low level of scientific monitoring and the lack of studies on the consequences of all the affected populations this fishery is not at the 100 level. Only the 80.	According to MSC Guidance at GCB3.4.2, the highest scoring level for information PIs is as follows: "…relatively complete information on the component, and much of that information should come from systematic monitoring and/or research. This does not mean that information exists on everything, particularly for the Habitats and Ecosystem components, but information is reliable and complete for all the major points of interaction between the fishery and component, to a level of detail appropriate to the scale and intensity of the fishery." We believe the three types of monitoring data, in combination with the numerous scientific/research studies analysing these data is sufficient basis for the score awarded.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.2.1		Yes		OK	NA
2.2.2		No		To score above 80 the management system should include surveys of appropriate areas where there is no prawn fishing to assess the actual consequences on the affected stocks.	The SGs require that there is a strategy (the BAP), that it is based on information from the fishery, has a high confidence associated with it, and is achieving its objectives. All of these requirements are met. Specific components of the monitoring aspects of the strategy are not prescribed.
2.2.3		Yes		OK	NA
2.3.1		Yes		Could state that it meets the EPBC requirements – would have been a clearer justification	The text already states this (first paragraph). This has been added to the Conclusions as well.
2.3.2		Yes		OK	NA

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.3.3		No		Three percent coverage is not usually sufficient for rare encounters. Only 80.	If the information is accurate and verifiable and sufficient to estimate the magnitude of impact a score of 100 in the third SG is warranted. Crew member observer coverage is 5% and scientific observer coverage is 2.5%. Studies by Brewer et al. (2007) and Fry et al. (2009) suggest this is adequate for most ETP, and that impractically large sample sizes would be needed for rare species. Therefore a score of 100 for the third SG only is supported. Some minor clarifying text has been added.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.4.1		No		There is no direct comparison available (or at least presented) of fished and unfished areas hence cannot be 100. It is appropriate for 80.	The text has been modified to better explain the situation. The score of 100 is supported. 1. Only about 8% of the managed area is ever fished. Within this 8% only about 3% is intensively fished and this 3% varies year by year (Haywood et al. 2005). 2. The cited findings were based on a comparison of low/med/high intensity trawling areas within three of the fishing grounds/habitats within the 17% of the area (Bustamante et al. 2010).

Performance Indicator	**Has all the relevant information available been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response**
2.4.2		No		The strategy doesn't actually deal with the habitat impacts on potentially trawlable grounds. It really only deals those habtitats that aren't to be fished (seagrass- corals etc.). There should be some specifics of a strategy to deal with management of the potentially trawlable habitats - how much of these potentially trawlable grounds (i.e. the actual habitat type that will be affected by the fishery – not those that won't) can actually be trawled – annually/ever. I think this is a 60 = a strategy needs to be developed that deals with these gaps.	As is stated in the text, there is partial strategy (temporal and spatial closures) to deal with those habitats in the area which have been classified as ecologically valuable habitats. As other habitats, e.g. sponge gardens which may be transitory features within trawlable ground, are not yet included in the strategy, it is partial strategy (80) rather than a full strategy (100). Note that the text has been clarified as described above for 2.4.1 to better specify the trawlable areas.

Performance Indicator	**Has all the relevant information available been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response**
2.4.3		No		There should be ongoing monitoring of the areas trawled in relation to the specific habitat or habitats that could be affected. Ensure it remains below an acceptable level.	Ongoing monitoring would inform of changes in habitat distribution, but this would affect the second scoring issue of SG 100. As the three scoring issues of SG 80 are met without this monitoring, the scoring is appropriate.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.5.1		No		The assessment presented here misses the point. This criterion is trying to assess the potential impacts on the ecosystem from the fishery. This is much more than just benthic/trawling impacts. It must also explicitly assess the potential impacts on trophic levels and overall community structure in these regions generated from all the removals, damage and discards etc generated by the sub fishery. This assessment could be assisted by having details of the entire community structure for benthic and other associated ecosystem elements in areas fished and not fished by the fishery. Such data probably exist but they were not evidenced here. No score can be given	Impacts to ecosystems were considered in the ERA at Level 1 (SICA; referred to as "communities"). The risk assessment was not conducted for Level 2 (PSA) because the impacts were deemed to be of low consequence (Griffiths et al. 2007, p. 167). New text has been added to address this point. Note that since the primary impacts to the ecosystem are expected to occur through bottom trawling activities, this has been the focus on the assessment studies. The text has been clarified to state that both lightly fished and heavily fished areas were studied.

Performance Indicator	**Has all the relevant information available been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response**
2.5.2		No		No evidence of any specific strategy for managing the 'ecosystem' was presented in the justification. Based on the information provided it maybe meets the 60 point level.	We consider that the information presented supports a finding of a partial strategy, and note that the other peer reviewer agrees.
2.5.3				From what is presented here, the above should be easily fixable.	NA
White Banana Prawn P2					

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.1.1		No		It is concerning that the justification for this subfishery is essentially the same as for tiger prawns despite the fishing method being very different – I would expect mid water trawl catches to take a very different selection of byproduct species to a bottom trawl. This reduces my confidence that what is presented is a specific assessment of this subfishery. This section should focus on assessing the byproduct of this subfishery – not the whole NPF. The same concerns about the outcomes of the assessment methods if a high priority/risk species was identified but this species is not actually recorded in any monitoring. Limits being used as targets. On what was presented only a score of 80 – but this needs clarity for this subfishery	Almost all of the research conducted for the NPF was conducted for the fishery as a whole. Where appropriate and possible this assessment has distinguished where research findings apply to specific sub-fisheries. Where findings are presented for the fishery as a whole, given the conservative nature of the risk assessment process, if the fishery as a whole does not pose unacceptable risks, the sub-fishery would not either. See responses to comments on Tiger Prawn Fishery above.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.1.2				What is the byproduct management strategy - it doesn't say. The statements on the risk for the species are not consistent. The second sentence says none are high risk then the next sentence for non- key commercial species says there are three at high risk? There is a problem through this section of the report of using the term risk in different ways – one of the methods used – PSA - does not actually measure risk - it only measures potential vulnerability (or at best inherent risk). Using the same word to mean different things increases the difficulties in determining if the conclusions presented are appropriate.	This term is shorthand for the Harvest Strategy and the Non-key Commercial Species (Byproduct) Policy. This has been made explicit in the text. The text is not inconsistent. The Harvest Strategy covers species which were NOT considered high risk. The Non-Key Commercial Species (Byproduct) Policy covers OTHER species which ARE considered high risk. CSIRO's ecological risk assessment methodology, which underpins the ecological risk management framework for all Australian Commonwealth fisheries has different levels of analysis. The results of Levels 2 and up are presented in terms of "risk" despite differences in methodology at each Level. Consistent use of the term "risk" in this system is not considered an issue to be resolved in this assessment.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.1.3		No		Status is only known with some certainty for some species – 80 Strategy only covers some species – 80	Agree and have revised based on partial strategy vs strategy noted under Tiger Prawn 2.1.2.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.2.1		No		Same comments on assessment reliability as outlined above. I am not sure why if 'expert override' is used, why the four priority species which were not observed by monitoring would not also have been overridden if they are now considered unlikely to be caught by this method. The conclusions are therefore not consistent - how can the four species be at risk from the fishery if they are not caught? The last paragraph in this section is not clear at all. There is a high level of 'forest for trees' issues with the way these assessments are completed. It is hard to work out what is real (based on actual data) and what are merely artifacts of the decision rules used in the methods.	See response above. ERA methods are precautionary; it should not be surprising that not all high risk species are found in the monitoring data as many are classified as high risk BECAUSE they are rare and data deficient in the ERA. Expert overrides can only occur if there is sufficient information to "override" the precautionary risk rating. Presumably these four species remain on the list due to an absence of information or a higher level of uncertainty. The fact that they are not found in the monitoring data reinforces the fact that they are little known. The four species were identified as being at risk from the precautionary, but theoretical, risk assessments. It is very difficult to summarize an entire risk assessment report in one short paragraph. The point is that exceedance by medians was considered but exceedance by 95% confidence intervals was not. Interested readers should refer to the original report (Zhou 2011). This comment seems to refer to the ERAs not to this MSC assessment. Surely, we cannot dissect all the assumptions of the CSIRO risk assessments here.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.2.2				BRDs won't affect removal of sponges only their retention in nets. This result would most likely be an artifact. The non-trawling or limits on the level of trawling of some areas would be a strategy to limit impact of sponges – which is really a habitat issue. But if this is a mid-water trawl subfishery why are so many sponges affected? The use of whole of NPF data is not useful where the actual fishing methods are very different. Also no mention of effort reductions as part of a strategy??	This sentence is a direct quote from Brewer et al. (2006) (see references) Agree. A sentence has been added describing the contents of the BAP including spatial closures. These issues are also discussed under PI 2.4.1-3. As mentioned above much of the research on the effects of the NPF has been conducted for the fishery as a whole, and not with particular reference to each sub-fishery. It is not clear whether different TED/BRD designs are deployed in different fisheries. Therefore, when describing TED/BRD results we can only refer to the published studies available for the NPF as a whole. This is now mentioned in the added sentence as it is also part of the BAP.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.2.3		No		The conclusions state that this subfishery has much less data and higher uncertainty than the tiger prawn sector – but if the tiger prawn fishery only scored 80 for this criteria – how then does this also get a score of 80?	Please see response to Stokes on White Banana Prawn sub-fishery – 2.2.3.
2.3.1		Yes		The change from five species being high risk to none is mentioned but not explained – what differed??	This was due to moving from a more broadbrush, precautionary method (PSA) to a more detailed and specific methodology (SAFE). This has been clarified in the text.
2.3.2		Yes		OK	NA
2.3.3		Yes		Ok	NA

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.4.1		Yes		OK –if it can be documented/estimated what proportion of the time these mid water trawls do not touch the benthos whilst fishing this would aid this justification.	Benthic interactions are limited to 20-30 minutes per shot. This has been added to the report.
2.4.2		No		If there is no impact on habitat as outlined above do you need a strategy? Is this score too low for this issue?	There is no claim that the white banana sub-fishery NEVER contacts the bottom, but its contact with the bottom is certainly less than the tiger prawn sub-fishery. Therefore, the same partial strategy arguments apply, i.e. seagrass beds are considered but other potentially transient habitats like sponge gardens are not within the strategy.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.4.3		Yes		Part of the justification presented here would be better used in the tiger prawn section.	These two sub-fisheries have been studied together and although the habitat impacts from the white banana sub-fishery would be much less due to less bottom contact, any residual habitat impacts in this sub-fishery would be mitigated by the same strategy that applies to the tiger prawn sub-fishery.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.5.1		No		As outlined above for the tiger prawn ecosystem impacts. The discussion and analysis presented does not address the issues that need to be considered to assess this criteria – this is not a benthic habitat assessment or even a benthic community assessment. As this is a pelagic species taken in mid water trawling - there needs to be at least some assessment on the potential impacts of this fishery on the entire pelagic community and any other potential indirect impacts on associated communities for all removals/discards/damage etc.	See response to comment on Tiger Prawn sub-fishery
2.5.2		No		This is not a strategy to deal with ecosystem level /pelagic community structure impacts.	See response to comment on Tiger Prawn sub-fishery

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.5.3		No		Can't really tell as mainly tiger prawn information is provided.	Ecosystem studies have focused on benthic impacts based on ERA findings that these are the most likely impacts of concern. As stated in previous comments, white banana prawn trawls are expected to have les contact with the benthos, but not zero contact. Therefore, any residual concerns with benthic community impacts from this sub-fishery are addressed to reference to the same studies cited in the tiger prawn sub-fishery assessment.
Red legged Banana Prawn P2					

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.1.1		No		Conclusion states – only highly likely to be based on biological limits – this is a score of 80	See responses to comments on Tiger Prawn Fishery above.
2.1.2		No		No formal byproduct policy implemented currently only scores 80	The comment is not entirely correct. Please response to 2.1.2 for White Banana sub-fishery above. The Harvest Strategy covers several main retained species and IS implemented.
2.1.3		No		The conclusions say that for some species the - Status remains somewhat uncertain – this is not consistent with a score requiring a high degree of certainty - Only fits with 80.	See response to 2.1.3 for White Banana sub-fishery above.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.2.1		No		The justifications are not simple to follow -it is hard to determine for each statement what is actually being assessed – observer data from the fishery – data from a research survey or indirect data on a 'like' species biology and distribution. As outlined above that the analyses result in species not even being caught by the fishery as being priorities does not generate any faith that it is an accurate or robust method.	The only study conducted specifically in the JBG is mentioned in the first and last paragraphs (and referenced as Tonks et al. (2008)). As described above and throughout the document all of the ERA work was conducted for the NPF as a whole. There are, however, no "like" species comparisons, except as discussed in the final paragraph. See responses above.
2.2.2		No		What is mentioned again is at the NPF level - it should state here what is THIS subfishery doing to deal with THIS set of species – not a general statement for the NPF covering ETPS etc – these types of species have their own section 2.3. The conclusions state there is – some evidence that the strategy is achieving its objective – this is only consistent with a score of 80 not 100 as listed	As mentioned above, much of the research supporting this fishery has been conducted for the NPF as a whole, and it is not a simple matter to partition it by sub-fishery. In particular, when we are citing research results for TEDs some of the results on ETPs are relevant to the discussion. Most of the TED research has focused on the ETPs but this does not mean that the results are not also relevant for bycatch in general. No, the third SG for 100 reads: "There is some evidence that the strategy is achieving its objective"

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.2.3		No		2.2.1 Says that the fishery is highly likely to be within limits. This section states that there is only a broad understanding of the risk status of at risk species. – A score of 60. Either this is too low or 2.2.1 is too high. 2.2.1 says none are at risk	The evaluation under 2.2.1 was based on the ERAs which showed that MAIN bycatch species were highly likely to be within biologically acceptable limits. PI2.2.3 considers the overall level of information and monitoring which, for bycatch species overall, meets a lower standard ("information is adequate to broadly understand")
2.3.1		Yes		OK	NA
2.3.2		Yes		Ok	NA
2.3.3		yes		Ok	NA

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.4.1		No		Justification provided only consistent with a score of 60. How much of the specific habitat is trawled each year – 5% - 50% - 100% This would help justify what risk levels are appropriate	It seems reasonable to consider that since the JCB habitats have been thoroughly mapped and a level 2 ERA has been conducted and found no high risks to habitats, that "highly likely" (80%) is the appropriate certainty. It is considered that some field testing would be required for a higher score. What would be the justification for only "likely" (70) for a fishery that has gone through a comprehensive Level 2 ERA without any high risks being flagged? We have not been able to find any information on the area trawled in the JCB. However, the area (30,000 km2) is vast and as stated throughout the document only 5 vessels fish there.

Performance Indicator	**Has all the relevant information available been used to score this Indicator? (Yes/No)**	**Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)**	**Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)**	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response**
2.4.2		No		Cannot determine which elements in the justification relate to JBG versus the whole NPF.	AFMA Ecological Risk Management document, and the NPF's [partial] strategy of spatial and temporal closures are defined and applied across the fishery as a whole (i.e. for all three sub-fisheries).

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.4.3				Given this only scored 60, this seems somewhat inconsistent scoring the 2.4.1 at 80. These data are the basis of the assessment.	There is no inconsistency with 2.4.1 because 2.4.1 is couched in terms of probability, i.e. a threshold of "highly likely" can be met through the theoretical ERA and inference from the GOC. In contrast, here in 2.4.3., to achieve a score higher than 60 in the first two SGs requires "The nature, distribution and vulnerability of all main habitat types in the fishery area are KNOWN…" and "there is reliable information on the spatial extent of interaction, and the timing and location", both of which appear to call for more than inference, i.e. for actual, site-specific data. This is why 2.4.3 scores lower than 2.4.1

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.5.1		No		Same issue as outlined above for the tiger prawn and banana prawn assessments on ecosystem structure. This assessment needs to be done again	See response to comment on Tiger Prawn sub-fishery
2.5.2		No		As above	See response to comment on Tiger Prawn sub-fishery

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.5.3		No		It is completely inconsistent to conclude that an ecosystem status is OK and then say there isn't sufficient data to make such a judgment. Not sure 70 is appropriate.	2.5.1 is scored in terms of probability. For several reasons, including the fact that there are only 5 vessels fishing in about 30,000 km2 of fishing grounds, we believe that a score of 80, corresponding to "highly likely" that serious or irreversible harm will not occur, is warranted. In 2.5.3, the scoring is based on the existence and interpretability of information, not proabability, and the scores fall between 60 and 80. Specifically, there is only one community survey and this may not be sufficient to "broadly understand the key elements of the ecosystem" and to know the main functions of the components. (Note the the 5th SG relates to ongoing information collection which would NOT necessarily relate to the scoring of impact under 2.5.1.) The red-legged sub-fishery had had more than 5 vessels, these information gaps would probably have lowered the impacts score in 2.5.1 below "highly likely" (80). However the very low fishing effort mitigates the risk in 2.5.1.
3.1.1		Yes		Ok	

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
3.1.2		Yes		Ok	
3.1.3		Yes		Ok	
3.1.4		yes		Ok	
3.2.1		yes		Ok	
3.2.2		Yes			
3.2.3		Yes			

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
3.2.4		No		I could find no comprehensive research plan for each sub fishery – an annual set of research priorities is not a plan – which I could not find. The last NPF plan was produced in 2001 -only one that comes up on the website. Therefore I am not sure how they are available publically - could not find them on the AFMA website. Definitely not 100. With what was provided this scores only 60.	The assessors have revised the scoring downwards to reflect that the Research Plan has not been updated, and that there is no present written plan in place. However, the scoring warrants greater than 60 since research results are disseminated (and are publically available)
3.2.5		Yes		Ok	

Any Other Comments

Comments	Certification Body Response
In general I found the scoring to be fairly generous compared to my previous experiences with MSC scoring. There were a number of inconsistencies between what was stated in the conclusions and how this linked to the scoring categories chosen. There was often insufficient separation for the information provided to enable specific examination of the status for each of the subfisheries rather than at	The assessors found the fishery to fulfil a large number of the required SGs, and rigidly interpreted from the scoring guideposts and guidelines. The assessors have provided required levels of detail showing specific catch levels of target, retained, bycatch and ETP species, and the scoring guidelines clearly take account of the intricacies of each fishery. The assessment is also supported by the availability of a very high level

the NPF level. The level of detail in the information provided was often insufficient to enable definitive conclusions to be made. In a number of cases there were inconsistencies in the assessment of data certainty and the certainty of assessments using these data. The major issues I had with the structure of the stock assessment for the tiger prawns were outlined in a separate attachment. Another major issue was the assessment of the ecosystem 2.5. Essentially there wasn't one. This should explicitly examine the potential for each of the sub fisheries to generate overall direct and indirect trophic and community structure impacts, including those generated from the catching of 1000s of tonnes, the discarding of much of this – i.e. very broad direct and indirect impacts on the broader ecosystem). It should not be confused with the benthic impacts of trawling – they are not the same thing –the latter is just a subcomponent of such an analysis. For the bycatch species assessments I found the multiple use of the term 'risk' problematic. Frequently the justification sections included statements along the lines of - xxx were at high risk which was then assessed by another method to only be yyy at high risk but then expert judgement said only zz were really at risk etc. So essentially many of the conclusions were ultimately only based on expert judgement. There was no mention of whether these judgement decisions were made within a formal qualitative criteria/framework to assist with consistency when determining the final outcomes. Of note, there were a number of outcomes produced by these methods whereby 'the species most at risk from the fishery' weren't even being seen in the monitoring program. This raises questions the robustness of the assessment process – it seems very complex but some of the outcomes do not appear to be very accurate.	ERAF process which is rarely seen in other assessments.

Annex 2. Peer reviewer 2

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes/No** **No**	**Conformity Assessment Body Response**
Justification: P1 scoring is complicated, given multiple species with varying information bases, a complex fishery structure and elaborate harvest strategies and supporting science. Much more thorough background information is needed to explain P1-related issues for each stock and to aid scoring justification and logic. Currently, the assumptions and methods used for stock assessment and reference point determination are not well described and it is difficult therefore to understand justification and conclusion statements. In some cases, the material presented does not clearly support the scoring (e.g. on stock status for two or three tiger prawn species). In most cases it is unclear if the scoring is reasonable but the documentation is lacking. I have not attempted to suggest alternative scores because the information to support this is generally insufficient. My strong impression is that P1 scoring overall is too high and that proper attention to supporting material and the FAM guidance would lead to reductions on many PI for most stocks, perhaps leading in some cases to overall P1 scores below 80. I note that references for P1 were fairly limited but it was not possible as a reviewer to source all necessary documents online. It is unclear if all referenced documents are publically available. In any case, as an assessment document, the certification report should contain sufficient information to stand alone in support of scoring. For P1, this is not the case. It would be helpful, as in the P3 scoring tables, to include explicit links to all online material and to note explicitly if references are not publically available. If materials are not easily available, it would be helpful if the CB could supply all referenced materials at least for peer review purposes. (As an aside) It is notable for all species where Sy/Smey and Sy/Smsy plots are shown that there is apparently a simple linear transformation between the two series, implying little elasticity in the economic functions. This may be a major mis-reading but if it is the case, or close, then although it is likely of benefit to use the bio-economic modelling to provide a sound foundation for fishery planning discussions and decision-making, it may be unhelpful in allowing simple understanding of the fishery in relation to MSC scoring requirements. Use of ratio indicators, especially running averages of ratios, does not provide an easy comparison to the default standards in the FAM. It would be helpful for all species where the ratio reference points are used also to see time-series of the absolute estimates of Smsy (in particular). P2 scoring is by each of three fishery types. However, the background information is presented by category combined. This does not aid reading. Within the fishery-specific P2 justification sections, there is a combination of NPF and sub-fishery information. This is unhelpful. If sub-fisheries are to be assessed separately, then the information needs to be		The report content has been expanded to respond to the point of inadequate explanation in some quarters, especially when dealing with stock assessment modelling and the harvest strategy. Explicit P2 assessment against the FAM guidelines was undertaken based on a combination of ERAEF processes to a considerably higher level that the MSC RBF process requires. The P2 scoring also draws heavily from research undertaken by CSIRO, and on occasions supported by FRDC funding. The Tables in the report also provide detailed information on species and animal interactions taking account of logbook records and the observer systems in place. Some of the wording of the Conditions has been amended to reflect all of the scoring elements that have not reached SG 80. The milestones set have been revised in some cases to between 3 and 4 years.

presented by sub-fishery in order to avoid confusion. There is a heavy reliance on Commonwealth ERAEF processes to inform P2 scoring. The ERAEF form a natural starting place for the assessment but there is a sense of over-reliance rather than careful explanation against the FAM scoring guideposts. The ERAEF are founded on extensive information, analyses, and processes and it is natural (and appropriate) to use them. This comment is about the style of the document that results from reliance on ERAEF. It is notable that in Australia the EPBC requirements also provide considerable context. As for ERAEF, however, it is important not just to rely on EPBC existence and findings of lack of detriment – there is a need for explicit assessment against the FAM scoring guideposts. P3 scoring is well documented and supported, with excellent references (and web links) and clear linkage from the background and justification to scoring requirements. The conclusions are clear and the scoring high but robust. It is useful that the assessment team has included some additional thoughts even when the scores given have been high (e.g. at PI3.2.4 and in section 3.8.8). Only one PI (3.2.4) is found to be flawed.	

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	**Yes/No** **No**	**Conformity Assessment Body Response**
Justification: For Red Legged Banana Prawns, at P1, three conditions are set. These seem generally reasonable. (Note there is a very minor problem with the English in the milestone descriptions at PI1.2.1 and 1.2.2. and in the condition statement at PI1.1.2.) For P1 across all species, this peer review suggests a number of scores need to be reappraised following improvements to background documentation and scoring justification and conclusions; this would likely lead to the need for further conditions as the current scoring seems generous. At PI2.2.3, and 2.4.3, conditions are raised for the JBG fishery but they are themselves conditional – if the first condition is met, but it is it is hard to see how in either case, the timescale is reasonable. The timescale is not appropriate if the first condition cannot or is not met as planning will be required only if the first condition is judged not to have been met – something that will take time. At PI2.5.3, the condition raised appears to go further than required already for 80 level scoring on the other fisheries. At P3, a condition is raised at PI3.2.4, but only in respect of the JBG fishery. The scoring logic seems flawed and the condition might need to apply to all fisheries.		

If included:

Do you think the client action plan is sufficient to close the conditions raised?	**Yes/No** **No**	**Conformity Assessment Body Response**
Justification:		

The Client action plans for P1 conditions generally require the client to liaise with AFMA and CSIRO and for AFMA to take actions, often including written commitment. The consultation on the condition in all cases is for the client to “ensure adoption by AFMA”. At P2 and P3, conditions require merely “NPF industry to liaise with CSIRO and to “ensure adoption by AFMA”. Given fishery management responsibilities it is difficult for the client actually to ensure anything and progress on conditions can only be made if appropriate scientific support can be provided and if management consideration and action is made. The client only has a role in these respects insofar as it can ensure appropriate work is carried out through funding, commitments to participation in key processes, etc. There is a requirement for more than just liaison and clearer plans need to be specified so that the client, not science providers or AFMA, can be held to account.	

General Comments on the Assessment Report (optional)

It is unclear why all stocks have been assessed using the default tree. In a number of cases RBF under P1 or consideration as retained species under P2 would have been an option. Background information explaining the reasons for use of the default tree for all stocks would have been useful, perhaps also exposing in advance some of the difficulties that would arise through use of the default tree.

Much of the P2 text across the three defined fisheries is repetitive and relevant to the NPF overall, with little fishery-specific comment. This makes reading difficult and confusion likely. It is not entirely clear that three separate P2 reports are warranted but if they are, and then the materials presented needs to be specific to the fisheries scoring guideline

Performance Indicator Review

1 Brown tiger Prawn (*Penaeus esculentus*)

Please complete the table below for each Performance Indicator which are listed in the Conformity Assessment Body's Public Certification Draft Report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.1	No	No	NA	Table 5 and Figure 3 in section 3.6.2.1 provide simple summaries of stock status from recent stock assessment processes. No probabilistic information is provided, just fixed point estimates with no explanation of the means of calculation. At Figure 3, right hand panel, the value of Sy/Smey in 2010 appears consistent with that given in Table 5 (131%), but it is hard from this limited presentation to agree with the 100 level scoring of scoring guideline 2: no information is provided on the distribution of the target ratio but if the graph shows the median of the distribution of the estimated ratio, it is hard to believe that the FAM 6.2.7(c) criterion for "a high degree of certianty" has been met; it is also apparent that the target reference point (ratio) has only recently been attained and is expected to decline in coming years. A score of 80, not 100, would seem more appropriate for this scoring element. The first scoring guideline appears to have been met at the 100 level – but only given a pers comm reported in the justification, but not based on background material presented. However, it is hard to reconcile the value of 138% in table 5, and the left hand panel of Figure 3 – working through the two, it appears they are correct, but the presentation in the graph is unhelpful due both to misrepresentation of the scale and because it shows ratios by year, rather than 5-year running averages as used for the LRP. More work is needed to present and justify scoring. It appears without additional materials to justify the scores, that the score would overall be 90, not 100. Note, I have read through responses to questions listed in the assessment document but cannot find the pers comm referred to relating to probabilistic statements about status relative to LRPs. It would be usefuul for this to be explicitly linked to the scoring justification (perhaps using a hyperlink).	As expalined above, the inforamtion given in the P1 assessment is derived from the most recent annual stock assessment whch forms the basis of real-time management advice under the HS. The most recent probabilitic information is given in an ICES journal article (reference give above). This will be included in the Assessment Report. In 2007, both the median and the 90% confidence limits for the ratio of S_{2007}/S_{MEY} were above 1.0. The recent movement from an MSY TRP to MEY TRP is reflected in the history of stock status. The fishery adopted the BMEY TRP for the 2007 harvest strategy and thereafter and prior to that was at BMSY. The stock status has not been below SMSY since 2005. The assesors agree with the reviewer that better presentation of the stock assessment would be desirable, but we have to work with what is provided by CSIRO. The pers comm was an email, which is now included in the Interview Record No 2

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1.1.2	No	No	NA	The information provided in section 3.6.2.1 is minimalist and does not actually explain and justify the chosen reference points in detail. It alludes at a high level to conceptual reference points but does not examine the specifics of the reference points used and how they relate to FAM guidance at paragraphs 6.2.17 onwards. Reading 3.6.3 and 3.6.5 does not help to explain the specifics of the reference point calculations and testing (using MSE). In terms of the justification provided in the scoring table, an MEY strategy provides for a higher target spawning biomass htan an MSY strategy, for any given general strategy, but an MEY strategy based on constant catch or effort is not necessarily more precautionary than an MSY strategy based on constant exloitation rate. Similarly, whether an MEY strategy is more conservative than an MSY strategy will depend on adopted assumptions (e.g. concerning recruitment) or risk criteria – only if all these are the same, then the MEY strategy in general would be more "conservative". No details are provided as to the calculated Smey for Brown Tiger Prawn. Figure 3 suggests the ratio of Sy/Smey is calculated annually but it is unclear if Smey is calculated annually. How does Smey vary year-to-year? How does the constant, or average, value of Smey compare to 40%B0 (the MSC default as at FAM 6.2.19(a))? It is clear that Smey and the ratio Sy/Smey are calculated analytically but as the value(s) is (are) not reported, application of FAM guidance at 6.2.19(c) and (d) is unclear. There is nothing in the background documentation that explicitly supports the contention in the justification that 50% Sy/Smsy is conservative (as a moving average) limit reference point. The use of reference points follows extensive MSE testing to ensure that applied control rules are consistent with the Australian Commonwealth Harvest Strategy Policy – the details of the testing, and the performance against the Policy requirements, needs to be explicit to support use of the reference points and FAM scoring. *Note at Figure 3, the left hand panel requires the horizontal dashed line to be drawn at the 50% level., or to halve the values of that axis Note that for consideration of acceptability of the limit reference point, apart from needing*	More details of the MSE is now included. The ratio of S_{MEY}/S_{MSY} has been calculated for the two species of tiger prawns and for the blue endeavour prawn and ranges from 1.164 to 1.414 acroos the species (lower 90% CL of 1.191 to 1.331) (Punt et al 2010). These details will be included in section 3.6.6 Management is based on an MEY target. A constant exploitation of the strategy. The exploitation rate of MEY is more conservative than the exploitation rate of MSY, regardless of whether it is a constant rate of exploitation or not. Management strategy is not based on constant catches and constant effort. The assessors agree that the dotted line is misleading as it does not indicate the LRP. Justification of the moving average will be included. Low Trophic Level (LTL) species are those that occupy positions in an ecosystem that provide the basis of the food web for species at higher levels. Such species can hold a key role in ensuring the diversity and stability of the ecosystem. The first clause about the feed of brown tiger prawn does not imply LTL. BMSY and BMEY are analytically determied.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.3	NA	NA	NA		
1.2.1	Yes	Yes	NA	While the scoring for 1.2.2-4 is lacking in material to support conclusions reached, the scoring for this PI seems sufficient. The justification and conclusions are sound. However, it should be noted that the backgrounnd material presented at 3.6.3 does not capture some of the summary materials referred to in the scorining justification. Note also there is a numbering error in that there are two section 3.6.3s – for harvest strategy and harvest control rules. Note also that there is no clear explanation anywhere for how the flow of inofrmation through assessments and decision-making processes leads to decisions on spatial and temporal management controls, as opposed to effort limitations.	This is adequately covered in 3.6.3 Error in numbering is noted

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1.2.2	No	No	NA	The description of harvest control rules is minimalist. The only (brief) description of the rules is in section 3.6.3, as part of Box 2. The justification notes the controls described at 3.6.3 (without reference ot the section) and lists a key reference (Dichmont et al, 2008). However, no explanation of the rules and their testing is given to support the scoring. While it is undoubtedly the case that the MSE testing considerd uncertainties (scoring guideline 1), no information is provided, even in summary, to support the score given. It is not good enough to rely on the reader to track down and read in detail all references to form his/her own conclusions – the MSC Assessment document itself needs to contain sufficient material to support the scoring. Similalrly at scoring guideline 2, where is the information to support the justification and conclusions? The only information on historic fishery performance is in Figure 3. There, it appears that from about 1980 to 2000, the stock fluctuated around Smsy (left hand panel) – where is the indication of overfishing noted in the justification (and recorded in the table at 3.5.2, and noted under Table 5)? The table referred to in section 3.5.1 is in fact at 3.5.2. it provides a history of management but does not clearly provide evidence of how the control rules now in place, and following the referenced MSE, are effective. More support is needed in the background and in the scoring justification to enable explicit and credible scoring.	Additional description on decisins rules for the tiger prawn fishery are shown in Fig 14. Industry has also adopted an economic trigger limit of 350 kgs / boat / day, which is a more conservative strategy than LRP restriction would apply (NPF Operational Manual) Information on the MSE and testing of uncertainties has been included (Punt et al). The NPF is a multi-species fisheriy and the tiger prawn sub-fishery as a whole was at times overfished in the late 1990s and early 2000s, but a suite of harvest controls linked to stock recovery were implemented at various stages to rebuild stocks above SMSY. Earlier asessments based on different methodology (delay difference) were also more pessimistic at that time (Dichmont, 2011).

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.3	No	No	NA	It is clear that extensive data collection takes place. Much of this is outlined in section 3.6.5 and the reference provided gives additional insight www.afma.gov.au/wp-content/uploads/2010/07/harvest_strategy.pdf (NB The reference could have been used elsewhere to provide support to scoring comments.) The comment in the justification relating to sensitivity testing needs to be referenced. In the conclusions, at the first scoring guideline, it is unclear what is referred to by "environmental information" as none is listed in section 3.6.5. This could compromise the scoring. It is unclear if the second element scoring is reasonable because no details are provided as to data-assessment-HCR linkage and dependency. There is a useful figure in the reference provided that helps in this regard but nothing is included in the main document. From background reading it appears the scoring is reasonable; however, as supported in the MSC Assessment document, defence of the two 100 scores could be difficult.	A more detailed account of the data used in the current stock assessment is now provided in 3.6.5. Environmental information includes general climatic data, detailed oceanographic observations taken during eralier research cruises and durring the two annual surveys (recruitment and spawning indices suurveys). Sensitivity testing is now referenced in the text. The figure is included in the report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.4	No	No	NA	No explicit information on Brown Tiger Prawn is provided in the background section (3.6.5) or in the scoring justification. No explicit linking of the scoring guidelines and guidance is made to support the conclusions and scores. Despite searching online, it has not proved possible to find/download the only reference provided in the scoring table. Online materials at the AFMA website http://www.afma.gov.au/managing-our-fisheries/fisheries-a-to-z-index/northern-prawn-fishery/publications/ do not seem to include up to date stock assessment. The general description in section 3.6.6 (for tiger and endeavour prawns, but not explicitly of Brown Tiger Prawns) describes process more than stock assessment. There is no comment on how the stock assessment links data to control rules, or of assessment sensitivities and robustness. In terms of the scoring, no information is presented to support conclusions on any of the first three scoring guidelines.	More detailed information is included in 3.6.6, including the links between data, assessment and HCR More description is provided on the linkage between stock assessment and the application of control rules.
P2 SCORING FOR TIGER PRAWN FISHERY					

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.1.1	No	No	NA	How is it possible to interpret the first sentence of the justification? What actual basis was used to adopt the species for inclusion in this assessment? How do the criteria relate to the guidance at FAM 7.2.2? At paragraph 2, the 135 species refers to the NPF, not the sub-fishery but the 16 species refers to the sub-fishery (at least this seems to be the caes from section 3.7.2.3) – this is confusing. The second paragraph seems to relate to PI2.1.2 aand PI2.1.3 issues more than to this PI. I do not understand how species can be identified as priority species if they ar enhot ever recorded in the catch – unless the rating is only of potential risk based on productivity and neglects operational issues. How reliable are the methods that have been used extensively to drive the scoring of this assessment? The ABCs constrain catches and could be argued to be surrogate limits (as in the PI2.1.2 justiffication, paragraph 2). It is unclear how the quoted ABCs relate to the expectation of targets as in Scoring guidepost 3. Overall, there is incomplete support for 100 level scoring on both guideposts and score of 80 would seem more reasonable.	The first sentence has been modified for clarity. A sentence has been added to Section 3.7.2 explained that we adopted the same classification of retained, bycatch and ETP as the Level 2 ERA. All 135 retained species from the Level 2 ERA are assessed as being with biologically based limits with a high degree of certainty. The definitions of "main" could be used for scoring guideposts at 60 and 80 but since all species were assessed the 100 SG is relevant. The priority species were based on the Level 2 ERA which was theoretical and precautionary. In some cases, where operational results show the Level 2 ERA was overly precautionary the risk levels have been downgraded through the override process. The text now clarifies that the ABC are limit reference points based on MSY exploitation rates. All species were assessed as being within biological based limits with a high degree of certainty, but no target reference point is defined. Therefore, as the fishery met both issues of SG60, the single issue of SG80, and the first issue of SG100 but not the second, a score of 90 is appropriate.
2.1.2	No	No	NA	NB There seems to be a vestigial piece of text as a brief second paragraph in the cnclusion. Scoring guidepost 1 is atended to and the score of 80 seems reasonable. It is unclear how the final paragraph of the conclusion relates to the second and tird scoring guideposts and the score of 100 seem tenuous. Overall, a score of 80 would seem appropriate.	Orphaned text has been deleted. While the fishery has a number of coordinated management measures that could constitute a 'strategy,' these do not apply to all of the retained species assessed as being at high risk (yet). Therefore the fishery has a partial strategy and we consider a score of 80 more appropriate. The text has been revised accordingly.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.1.3	No	No	NA	Observer rates ar elow and coverage/variability is not described in detail. How do the observer studies verify (or not) regular logbook –collected data? Are the low coverage observer programmes sufficient to provide accurate information on "all" species as required for 100 level scoring on guidepost 1? The scoring on guidepost 3 invokes already used evidence in support of PI2.1.2 scoring. Four sub-scores are recorded but only three are required in the pol – note that the bracketed guidepost applies only for RBF. Overall, the justifications and conclusions seem to support 80 level scoring, not 100, on all guideposts.	There is an ongoing, co-managed (NPF/AFMA), scientific process for comparing logbook, scientific observer and crew member observer records. These records are also used for more in-depth study such as Brewer et al. (2007), Fry et al. (2009) and Milton et al. (2010) which we have cited extensively. It is not surprising that the existence of information (PI2.1.3) and the existence of evidence-based management (PI2.1.2) would describe the same studies. Four sub-scores are necessary UNLESS the RBF is used. The scoring has been modified to reflect the partial strategy vs comprehensive strategy issue described above (see also response to Fletcher).
2.2.1	Yes	Yes	NA	(NB that it is surprising that the informationa nd analysis of the bycatch species seems more rigorous than the retained (byproduct) species.)	The assessment reflects a) a larger number of of bycatch species (516 versus 135) and b) more risk studies (ERA + SAFE + updated SAFE)

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2.2.2	No	No	NA	Whether TED and BRD use constitutes a strategy or just tools to be used withina strategy is debatable. ERxpected bycatch reductions are good, but there is no information on specific species at potential risk and how TED and BRD are expected to mitigate impacts. Use of changes in ETP reductions is indeed "indirect" with respect to other species. Scoring seems generous. Guideposts 1 and 2 scores of 80 would seem justified given the information provided, guidepost 3 (at the 100 level only) is debatable. Guidepost 3 (or 4 at the 100 level) appears aptly scored at 80. Overall, it would appear a score of 80,80,80=8 would be appropriate.	A sentence has been added to explain that there is a strategy document, the BAP (see reference list). There is a strategy so SG1 should be 100. There has been considerable field testing of the devices in the NPF itself and they have been shown to work as documented in peer reviewed papers so SG2 deserves 100. SG3 requires only "some" evidence, so this standard is also met by a demonstrated 50% reduction in bycatch. The issue of high risk bycatch species is addressed through the ERA and monitoring, not through TEDs/BRDs per se.
2.2.3	Yes	Yes	NA	No comment	N/A
2.3.1	Yes	Yes	NA	No comment	NA
2.3.2	Yes	Yes	NA	No comment	NA
2.3.3	Yes	No	NA	There is something flawed in the logic of the three scoring guiddelines. At the third score, while data collected may be accurate and verifiable, the level of coverage, as acknowledged, is low and in some respects insufficient. The first two scores of 80 and 80 seem appropriate, but it is hard to see support for 100 level scoring on the third guidepost.	This comment appears to be directed toward the construction of the SGs rather than the assessment. If the information is accurate and verifiable and sufficient to estimate the magnitude of impact a score of 100 in the third SG is warranted. Crew member observer coverage is 5% and scientific observer coverage is 2.5%. Studies by Brewer et al. (2007) and Fry et al. (2009) suggest this is adequate for most ETP. Therefore a score of 100 for the third SG only is supported. Some minor clarifying text has been added.

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2.4.1	No	No	NA	It appears that trawling has little overall impact but it is unclear as presented if the 3% of areas fished might represent a high proportion of a particular habitat type and whether the studies explaining only 2% of biomass variation, etc, relate to the overall NPF region (including 97% untrawled areas) or just the actual, trawled areas/habitats. The information seems to be available to support a 100 level score but the justification could perhaps be clearer. For example, if the reported studies relate solely to habitat types which are trawled, and the variation explained is derived from comparison of trawled and untrawled areas, an explicit statemet to that end would support the 100 level score.	The text has been modified to better explain the situation. The score of 100 is supported. 3. Only about 8% of the managed area is ever fished. Within this 8% only about 3% is intensively fished and this 3% varies year by year (Haywood et al. 2005). 4. The cited findings were based on a comparison of low/med/high intensity trawling areas within three of the fishing grounds/habitats within the 8% of the area (Bustamante et al. 2010).
2.4.2	No	No	NA	Only 2.1% of the NPF area is permanently closed and 8.1% seasonally. If only 3% is actually fished then there must be circa 87% of the NPF which could yet be fished and which is therefore at potential risk. In the justification it is said that AFMA has deferred development of a rsk management strategy "until more information is available". This is unclear. Even though the ERAEF has not identified high risk areas, the large, potentially fishable area might be expected to be the subject of consideration. To constitute a strategy there need to be objectives, tools and monitoring in place. What are the defined objectives leading to the cxurrent closures, and wwhat are the objectives for the remaining, fishable areas? Guidepost scores of 80 may be justifiable but against the FAM text this is not entirely clear and the scores could need strengthening or possibly lowering to reflect that emasures rather than strategies are in place.	As stated in the previous comment, the text has been clarified to state that only 8% of the managed area is ever fished, and only 3% per year intensively. The statement on development of a risk management strategy is taken from AFMA's Ecological Risk Management document. Our scoring does not claim a strategy, only a partial strategy which is "cohesive arrangement which may comprise one or more measures, an understanding of how it/they work to achieve an outcome and an awareness of the need to change the measures should they cease to be effective. The system of spatial and temporal closures as described in Kenyon et al. (2005) is certainly a partial strategy.
2.4.3	Yes	Yes	NA	No comment	NA

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.5.1	Yes/No	Yes/No	NA	There is considerable use of the same information as used in 2.4, with benthic community variations used to justify both habitat and ecosystem considerations (but not necessarily tryuly representing either). Nevertheless, the work reported is extensive and the conclusions/scoring seems reasonable. More could perhaps be made not just of the specific study but also of evidnce across all species groups (as considered in PI2.1, 2.2 and 2.3). It is also surprising that the ERAEF was not invoked.	Impacts to ecosystems were only considered in the ERA at Level 1 (SICA; referred to as "communities"). The risk assessment was not conducted for Level 2 (PSA) because the impacts were deemed to be of low consequence (Griffiths et al. 2007, p. 167). New text has been added to address this point.
2.5.2	Yes/No	Yes/No	NA	All justification is given in terms of species and habitat management, rather than ecosystem/community management. However, this is a difficult and tenuous area and the use of ERAEF and the residual risk analyses to inform ERM is credible and robust. If the residual risk analyses do not lead to specific ERM measures, then continued monitoring and planned repetition of the ERAEF seems to be a sufficent strategy. Given the lack of currently identified potential risks, those measures, jointly comprising the strategy, should reasonably be expected to be effective at responding toa nd mitigating future risks. The overall sscores are probably justifiable.	NA
2.5.3	Yes	Yes	NA	No comment	NA
P3 scoring for all fisheries					
3.1.1	Yes	Yes	NA	See general comments	
3.1.2	Yes	Yes	NA	See general comments	
3.1.3	Yes	Yes	NA	See general comments	

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
3.1.4	Yes	Yes	NA	See general comments	
3.2.1	Yes	Yes	NA	See general comments	
3.2.2	Yes	Yes	NA	See general comments	
3.2.3	Yes	Yes	NA	See general comments	
3.2.4	No	No	No	The scoring by fishery within the same P3 table is slightly confusing given that separate P1 and P2 tables were produced by stock and fishery. The justification makes clear that there is no research plan as such, and has not been since 2001. The description indicates that there are good processes for ad hoc decision making concerning research priorities – but this is not a plan, and certainly not a comprehensive one. Given the justification as written, it would seem more appropirate to score 60 on scoring guideline 1 (noting that only some of the element 1 conditions are achieved), for all fisheries. For all fisheries, scoring guideline 2 would appear to meet the 100 level scoring guidepost. Overall, therefore, for all fisheries, following FAM 4.2.7ciii, it would appear that the score would be 70, and a general condition required for all fisheries on this PI, not just for the JBG Fishery.	The assessors have revsed the scoring downwards to reflect that the Reseacrh Plan has not been updated, and that there is no present written plan in place. However, the scoring warrants greater than 60 since research results are diseminindated (and are publically available)
3.2.5	Yes	Yes	NA	See general comments	

Any Other Comments

Comments	Conformity Assessment Body Response
Overall, for P1, justification for scoring needs to be strengthened (i.e. documentation needs to be improved) but there are few places where scores are anticipated to drop; the overall score should not therefore fall below 80.	

2 Grooved tiger Prawn (*Penaeus semisculatus*)

Please complete the table below for each Performance Indicator which are listed in the Conformity Assessment Body's Public Certification Draft Report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.1	No	No	NA	Table 6 and Figure 4 in section 3.6.2.2 provide simple summaries of stock status from recent stock assessment processes. No probabilistic information is provided, just fixed point estimates with no explanation of the means of calculation. At Figure 6, right hand panel, the value of Sy/Smey in 2010 appears consistent with that given in Table 5 (86.6%) and the scoring guideline 2 therefore appears to be wrong. The conclusion that there is a high degree of certainty that the stock has been above Bmsy over recent years may be correct (although no probabilistic information on Sy/Smsy is presented), but the target is defined in terms of MEY, not MSY. Figure 6 shows clearly that the stock is <u>below target and has been so for almost two decades</u> (against the current target definition). On this basis, the second scoring guideline does not reach the 100 or the 80 level and an overall score of 100 (or 80) cannot be given. The first scoring guideline appears to have been met at the 100 level – given a pers comm reported in the justification, but not based on background material presented. However, as for Brown Tiger Prawns, it is hard to reconcile the value of 138% in table 5, and the left hand panel of Figure 4 – working through the two, it appears they are correct, but the presentation in the graph is unhelpful due both to misrepresentation of the scale and because it shows ratios by year, rather than 5-year running averages as used for the LRP. More work is needed to present and justify scoring. It appears without additional materials to justify the scores, that the score would overall be 70, not 100, based on meeting the 100 level for scoring guideline 1 but neither the 80 or 100 level at element 2. If the pers comm is ignored, it is unclear whether scoring guideline 1 could be scored at the 60 or 80 level. Note, I have read through responses to questions listed in the assessment document but cannot find the pers comm referred to relating to probabilistic statements about status relative to LRPs. It would be usefuul for this to be explicitly linked to the scoring justification (erhaps using a hyperlink).	The MSC Guidance refers to exploited biomass fluctuates around the BMSY target, or a higher target if this is warranted from a consideration of the trophic inter-dependencies of the target species. This is the TRP used in the scoring, not the more conservative TRP adopted by the NPF management. Stronger justification is provided in the text. The recent change from BMSY target to BMEY target is the basic reason why it has been under the target for two decades. The status has been above BMSY since 2005. More detail is provided in the text

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.2	No	No	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns
1.1.3	No	No	NA	Note comments at PI1.1.1 – the stock is apparently below the TRP and has been for some time. On this basis, scoring of PI1.1.3 should be brought in to play.	This depends on the TRP used to assess the stock status.
1.2.1	Yes	Yes	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns
1.2.2	No	No	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns
1.2.3	No	No	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns
1.2.4	No	No	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns

Any Other Comments

Comments	Conformity Assessment Body Response
The stock status scoring at PI1.1.1 is a concern. The score given, 100, is generous and appears to be wrong. Simple interpretation of the limited information provided suggests the score should be below 80 and a condition applied. This is not because the stock is below the default MSC target level (Smsy or proxy), but because it is estimated to be below the accepted target of Smey. Note that rescoring PI1.1.1 and recognising the stock is below target would result in the need to consider rebuilding plans and scoring of PI1.1.3.	The assessors believe that the scoring is appropriate and can be justified with the addition of more background information, providing the appropriate TRP is the MSY. It does not seem logical to penalize a fishery that aspires to a more conservative TRP than standard.

3 Blue endeavour Prawn (*Metapenaeus endeavouri*)

Please complete the table below for each Performance Indicator which are listed in the Conformity Assessment Body's Public Certification Draft Report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.1	No	No	NA	Table 7 and Figure 5 in section 3.6.2.3 provide simple summaries of stock status from recent stock assessment processes. No probabilistic information is provided, just fixed point estimates with no explanation of the means of calculation. At Figure 7, right hand panel, the value of Sy/Smey in 2010 appears consistent with that given in Table 5 (84.8%) and the scoring olemnt 2 therefore appears to be wrong. The conclusion that there is a high degree of certainty that the stock has been above Bmsy over recent years may be correct (although no probabilistic information on Sy/Smsy is presented), but the target is defined in terns of MEY, not MSY. Figure 7 shows clearly that the stock is <u>below target and has been so for almost two decades</u>. On this basis, the second scoring guideline does not reach the 100 or the 80 level and an overall score of 100 (or 80) cannot be given. The first scoring guideline appears to have been met at the 100 level – given a pers comm reported in the justification, but not based on background material presented. However, as for Brown Tiger and Gr7oved Tiger Prawns, it is hard to reconcile the value of 85% in table 5, and the left hand panel of Figure 5 – working through the two, it appears they are correct, but the presentation in the graph is unhelpful due both to misrepresentation of the scale and because it shows ratios by year, rather than 5-year running averages as used for the LRP. Unlike Brown and Grooved Tiger Prawns, the indicator used suggests the stock is below Smsy, and it is unclear how the statement relatingg to certainty (as a pers comm) is supported. The infoformation in support of a score of 100, or even 80, in insufficient. More work is needed to present and justify scoring. It appears without additional materials to justify the scores, that the score would overall be 70, not 100, based on meeting the 100 level for scoring guideline 1 but neither the 80 or 100 level at element 2. If the pers comm is ignored, it is unclear whether scoring guideline 1 could be scored at the 60 or 80 level. Note, I have read through responses to questions listed in the assessment document but cannot find the pers comm referred to relating to probabilistic statements about status relative to LRPs. It would be usefuul for this to be explicitly linked to the scoring justification (erhaps using a hyperlink).	As for brown tiger prawns. The default MSC TRP is BMSY. More detailed stock assessment results is included in the report. It seems clear that the status of blue endeavours is not as good as that for the two tiger prawn species. However, the 2010 assessment puts it as above Smsy, although it has been below that in the past. The statement that “the stock is at its TRP (again assuming that the default MSC TRP of MSY is appropraite), The score has been changed to 90. The distinction with endeavours is that it is below MEY.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.2	No	No	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns.
1.1.3	No	No	NA	Note comments at PI1.1.1 – the stock is apparently below the TRP and has been for some time. On this basis, scoring of PI1.1.3 should be brought in to play.	The assessors not agree that rebuilding is appropraite for this stock. It is well above the LRP and has met MSY recently, as a result of past interventions. Projections indicate that the stock status will continue to improve.
1.2.1	Yes	Yes	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns.
1.2.2	No	No	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns.
1.2.3	No	No	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns.
1.2.4	No	No	NA	Repeat text for Brown Tiger Prawns at PI 1.1.2.	As for brown tiger prawns.

Any Other Comments

Comments	Conformity Assessment Body Response
The stock status scoring at PI1.1. is a concern. The score given, 100, is generous and appears to be wrong. Simple interpretation of the limited information provided suggests the score should be below 80 and a condition applied. This is not because the stock is below the default MSC target level (Smsy or proxy), but because it is estimated to be below the accepted target of Smey. Note that rescoring PI1.1.1 and recognising the stock is below target would result in the need to consider rebuilding plans and scoring of PI1.1.3.	

4 Red endeavour prawn (*metapenaeus ensis*)

Please complete the table below for each Performance Indicator which are listed in the Conformity Assessment Body's Public Certification Draft Report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.1	No	No	NA	There is no apparent discusion in the assessment document about whether Red Endeavour Prawns might better have been treated under the RBF as a target species, or perhaps as a retained species. Treating the species as a target and using the default assessment tree is not straightforward. It is notable in the background at section 3.6.2.4 that analogy and comparison with the Blue Endeavour Prawns and PSA (as part of ERAEF, not MSC RBF) are used to support scoring at PI1.1.1. Reference to FAM 6.2.31 is appropriate and, in the absence of RBF, is necessary. The final paragraph of the justification, however, is unconvincing, especially in relation to the status of Blue Endeavour Prawns (see comments at PI1.1.1 on that species), the lack of details as to the PSA (it could have been included), and the moot relevance of management interventions with regard to status. With regard to scoring guideline 1, a score of 80 is probably reasonable, though not well argued. For scoring guideline 2, given the status of Blue Endeavour Prawns relative to Smey, and the analogies made, it is difficult to support the 80 level score. If that score is not supportable, then there is a need to consider scoring at PI1.1.3.	The assessors applied 6.2.10, 6.2.18 and 6.2.31 (MSC FAM V.2.1): example of surrogate measures' where' yield is calculated based on a proportion of the observed biomass and the harvested fraction determined on empirical evidence from harvested catches and their consequences. The assessors also consider that the current action of considering red endeavour prawns are as part of the target reference point of MEY as a practical response, given the limited catch for this species, and stated low levels of risk. The alternative would be to embark on a high cost reporting an assessment structure which is not practical in the life of this assessment, nor in the reassessment. Hence, why the assessors also chose not to apply the RBF.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.2	No	No	NA	Section 3.6.2.4 is slightly confusing. It says that the species is included as part of the tiger prawn sub-fishery harvest strategy and overall MEY considerations. Specifically, it is said that there are exlicit trigger catch rates that inform decisions to stop fishing. However, under section 3.6.3, Box 1, the section on Tiger Prawns suggest only that Blue, not Red, endeavour Prawns are included. This is uncear and needs to be tidied up. Under the control rules heading, it is unclear if the trigger catch rate of 350 kg/vessel/day (presumably averaged across vessels, across all areas?) is a combined species catch or a species by species trigger, and whether or nott Red Endeavour Prawns are included. The background documentation needs considerable revision to clarify matters. With regard to scoring guidelines and conclusions, greater support is needed to justify the conclusion at scoring guideline 1; there is no justification provided to support the second element scoring; the third element scoring is more reasonably justifiable by analogy with Blue Endeavour Prawns but Figure 5 does not give confidence that a scoe of 80 is yet supportable. No explicit scoring is done for the fourth scoring guideline (re LTL): coments on other species above are pertinent.	The 350kg trigger limit in place in the secondfishing season is an economic trigger so that operators do not continue fishing when the catches fall below economically viable levels. As such, it applies to all species as a combined trigger. The trigger limit is 350 kgs per boat per fishing day across the whole fishery. The assessors agree that it is difficult to ascertain whether the LRP is set above the level that at which the is an apprecaible risk of impairing reprodcuive capacity. The comparison with the other specie will be strengthened.
1.1.3	No	No	NA	Note comments at PI1.1.1 – the stock is apparently below the TRP and has been for some time. On this basis, scoring of PI1.1.3 should be brought in to play.	The status of blue endeavours has been discussed above, and it is now at or above SMSY.
1.2.1	No	No	NA	Scoring of the first two elements is unclear and requires fuller justification. The harvest strategy for the species is unclear and 100 level scoring on the third element is not well supported.	Noted

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.2	No	No	NA	The second paragraph of the justification is unclear and therefore unconvincing. As noted at 1.1.1, the background sections are not clear as to how Red Endeavour Prawns are included (or not) in the harvest control rules. It is difficult in these circumstances to see support for any of the 80 level scoring in the three scoring conclusions.	Noted and will be amaended
1.2.3	No	No	NA	It appears there is sufficient information available to conduct PSA-type analyses and to argue qualitatively about stock status and fleet structures. There is arguably enough information to support 80 level scoring on scoring guideline 1. Scoring of element 2 would be enhanced if there were data shown on Red Endeavour Prawn catch rates through time, with explicit description of their collection and use – assuming that the species-specific catch rates are indeed used in the harvest control rules (see above). If information were presented,a score of 80 would likely be supportable. Justification of the third 80 level scoring is unclear.	Noted
1.2.4	No	No	NA	Scoring of the first element is unclear and requires fuller justification to reach the 80 level. The peer review scoring appears sound.	Noted

Any Other Comments

Comments	Conformity Assessment Body Response
The stock status scoring at PI1.1.1 is a concern. Simple interpretation of the limited information provided, and recourse to analogy with Blue Endeavour Prawn, suggests the score should be below 80 and a condition applied. This is not because the stock is below the default MSC target level (Smsy or proxy), but because Blue endeavour Prawn is estimated to be below the accepted target of Smey. Note that rescoring PI1.1.1 and recognising the stock is below target would result in the need to consider rebuilding plans and scoring of PI1.1.3. A number of scoring guidelines across a	The assessors do not agree that the fishery should be penalized for aspiring to a more conservative TRP than the default Smsy or proxy). Target reference points are set at a level above BMSY, BMEY is a more precautionary TRP, MSY and MEY are analytically determined. Further, as stated in the MSC Fishery assessment guidance, under RBF, both SICA and PSA are appropriate. Because the level 2 PSA risk assessment is more rigorous and uses more information than the simple SICA, it should stand as a better indicator of stock status.

range of PI appear to have been scored high. Given that most PI scores are 80; this suggests reappraisal could lead to a number of PI scores below 80, and the requirement for a number of conditions. It is unclear why the species was not considered using the RBF option or whether that is now available given the decision to use the default tree.	

5 White banana Prawn (*Fenneropenaeus marguiensis*)

Please complete the table below for each Performance Indicator which are listed in the Conformity Assessment Body's Public Certification Draft Report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.1	No	No	NA	There is no apparent discusion in the assessment document about whether White Banana Prawns might better have been treated under the RBF as a target species. In the first justification paragraph there seems to be something wrong in the clauses following "i.e..". There also appears to be something wrong with the second sentence of the penultimate paragraph. The arguments at PI1.1.2 to justify aTRP are not convincing and the scoring of the second element at 80 is not clearly justified. In the penultimate justification paragraph it is stated that "All indicators suggest…" but no indicators are actually reported in the background section. The evidence presented for an increase in escapement in recent years is weak (at Figure 7) – in that limited evidence, presented only visually and on a small scale, it may be that late season catch rates in very recenet years are higher than previously, but the lack of analysis and statistics is unhelpful. Overall, the background material and justification, and lack of data presentation, do not support the 80 level scoring (thereore likely triggering PI1.1.3).	Justification for scoring is described in the Guidance to the scoring for white banana prawns, demonstrating the high correlation between rainfall and catch. *Catches, have fluctuated around a long-term average with no conclusive evidence of long-term positive or negative trends in overall trends in the catch residual (catch with the effects of rainfall and changing effort removed. It is highly likely that over the history of the fishery, the stock has fluctuated around a highly productive level consistent with Bmsy or better, but without formal reference points there is an element of uncertainty.* Wording will be amended. White banana prawns have been assessed by CSIRO and stakeholders under level2 PSA and are rated as "low risk". This could be included as evidence, as well as our understanding of the dynamics of the fishery.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.2	No	No	NA	The scoring justification is longer than the background material presented. The background section on reference points deals only with a surrogate LRP, a catch rate trigger to reduce season length and ensure sufficent escapement to provide recruitment in subsequent seasons. In the background section on status, Figure 7 (now Figure 10) shows catch rate against cumulative catch – it appears that fishing continues beyond the point when catch rates fall below the 500 kg/day trigger. This is unclear and needs to be explained. Presumably it relates to the 2 week increment condition for season shortening. Nevertheless, the use of a trigger to ensure sufficient escapement is a reasonable surrogate LRP and the 80 level scoring is sound. The background section refers to evidence the stock has been maintained at or above the biomass that would support MSY. The evidence is unclear, as presented. In the scoring justification, it is stated that "A proxy TRP is assumed that the stock is at BMSY appropriate for that year's environmental conditions." This is unclear and needs further explanation. It is not currently sufficient to justify the 80 level scoring for the relevant scoring guideline.	This is a catch trigger not a Limit, which determines season length. Catches have to fall below the trigger, on average (over a two week period), to force the fishery to close for the season. Additionally, where the catch rate does not fall to this point, the fishery is also subject to the mid year seasonal closure. Each year the Bmsy differs according to the level of recruitment, as influenced by the strength of the preceeding wet season rainfall. The fact that catches still meet expectations in terms of the amount of rainfall in the precceding wet season and the residuals have not declined is good evidence of a stock fluctauting around BMSY.
1.1.3	No	No	NA	Note comments at PI1.1.1 – the stock is apparently below the TRP and has been for some time. On this basis, scoring of PI1.1.3 should be brought in to play.	There is no evidence that the stock is below BMSY.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.1	No	No	NA	Because the TRP is unclear some leeway is needed in scoring the first element (all levels). There is no clear definition of the distinction between "work together" and "designed" or of the word "towards" in the 80 level scoring guideline. Without crossing in to the second element, it is hard to score this element at the 100 level, especially as the 2 week increment may allow fishing down below the trigger point – the scheme is pragmatic and the elements (monitoring, no assessment, trigger) work together towards achieving sufficient escapement. But it is hard to move to 100 level scoring. 80 level scoring on element 2 seems fair. The harvest strategy is reviewed as part of normal processes but no specific evidence has been provided to support 100 level scoring.	Scoring has been modified to address this
1.2.2	No	No	NA	It is unclear how "main uncertainties" have been taken in to account. Certainly, no supporting material is provided. At scoring element 3, the 100 level scoring seems high – the only "evidence" presented is in Figure 7. As noted at 1.1.1, this is not clear.	Noted and scoring adjusted, and evidence of uncertainties provided in the guidance.
1.2.3	Yes	Yes	NA		
1.2.4	Yes	Yes	NA		
P2 scoring for White banana Prawn fishery					

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.1.1	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate?	See responses to comments on Tiger Prawn sub-fishery. Almost all of the research conducted for the NPF was conducted for the fishery as a whole. Where appropriate and possible this assessment has distinguished where research findings apply to specific sub-fisheries. Where findings are presented for the fishery as a whole, given the conservative nature of the risk assessment process, if the fishery as a whole does not pose unacceptable risks, the sub-fishery would not either.
2.1.2	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate?	See responses to comments on Tiger Prawn sub-fishery and Comment 2.1.1 above.
2.1.3	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate?	See responses to comments on Tiger Prawn sub-fishery and Comment 2.1.1 above.
2.2.1	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate?	See responses to comments on Tiger Prawn sub-fishery
2.2.2	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate?	See responses to comments on Tiger Prawn sub-fishery

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.2.3	No	No	NA	There are four scores given relative to guideposts, but only three in the FAM (one aplies only with RBF). At the second score it is stated the NPF scientific observer coverage is low relative to overall NPF coverage but at fourth scoring buat hefour most at risk species have emore focus. It is unclear, therefore, just how much sampling of the ky species (or groups) actually takes place. Given theya re rare and interactions hardly see, and the level of overall NPF coverage is very low, what is the ability to detect trends? As written, the justification for 80 level scoring on all guideposts is weak. The scoring for the Tiger Prawn fishery consisted of all 80 scores but the support here is weaker, suggesting an overalls core of less than 80 would be expected.	Four sub-scores are necessary UNLESS the RBF is used. Scoring is NOT relative to tiger prawn scores. Each sub-fishery is scored against the criteria indepedently. SG1: Agree that the information is weaker in this sub-fishery than in tiger prawn but standard of "qualitative and some quantitative information" is still met. SG2: Likewise information is still sufficient to estimate outcome status with some certainty. SG3: Scores 80 because "there is no ongoing operational data collection on total bycatch quantities or species composition" SG4: There has been extensive study devoted to the issue of sample size (e.g. Fry et al. 2009—see references). These studies suggest that the statistical power is adequate to detect a change in risk in the main bycatch species. Recommendations to increase observer coverage are being implemented by AFMA.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.3.1	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate? Note it is difficult to read repetitive txt and make sense of thigs without clear explanation. In the jsutification there is no rationale for the change of risk status from 2007 to 2011 ERAEF. The only explanation is in section 3.7.3 (as referred to) wher ethere is simle citation of SAFE analyses. Most readers won't know about SAFE, so that leads to another level of necessary digging inorder to understand. It would be easier to refer in plain text to a change in risk categorisation due to use of SAFE, rapid quantitative risk assessment methodology for fish species…..(or some such).	See previous responses to this comment. It is not clear whether the comment is asking for less repetition or less cross-referencing (i.e. more duplication of main text and scoring tables). An sentence explaining SAFE has been added to Section 3.7.1 and this is now referenced when SAFE is mentioned in the scoring tables (actually in tables for 2.3.3 not 2.3.1).
2.3.2	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate?	See previous responses to this comment.
2.3.3	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate?	See previous responses to this comment.
2.4.1	No	Maybe	NA	It is stated that this fishery is mid-water but nowhere in the assessment documentation is there a description of the gear or data on bottom contact. It would be helpful tohave something at section 3.5.1 that might be referred to. Assuming there is little or minimal botttom contact, andnoting comments as for Tiger Prawn Fishery re fished as opposed to potentially fished areas, the scoring seems reasonable.	This is clarified in the report Tiger orwns progressive trawling. Banana prawns targeted. Nets are deployed on siting of schools. So benthic impact for 20-30 minutes, as opposed to three hours in the tiger prawns fishery.. Most effort comorises searching as opposed to trawling.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.4.2	No	Maybe	NA	This is repetittive form theTiger Prawn Fishery section but surely if the claim about lack of bottom contact is valid, an explicit strategy would involve assessing risks and realising that any habitat conservation objectives are not compromised, no further measures except mionitoring and reporting are needed, etc…If the Tiger Prawn Fishery can score 100 then so can this, but would it not be better just to get actual strategies sorted, even if they are statement ssof no need for action?	There is no claim that the white banana sub-fishery NEVER contacts the bottom, but its contact with the bottom is certainly less than the tiger prawn sub-fishery. Therefore, the same partial strategy arguments apply, i.e. seagrass beds are considered but other potentially transient habitats like sponge gardens are not within the strategy. Agree that it would be useful to have a full strategy on paper with specific mention of measures, issues, etc. for each sub-fishery.
2.4.3	Yes	Yes	NA	Note that the forst part of the justification starts to sound like the rationale for a simple strategy as noted at PI2.4.2.	Agree that (as above) there is a partial strategy. Note that AFMA states in its Ecological Risk Management document that it does not have a strategy for habitats and ecosystems.
2.5.1	No	No	NA	The justification and conslusions for the Tiger Prawn Fishery are cause for some concern, and comparison with that fishery to justify scoring here is a worry. The comments on the Tiger Prawn scoring are relevant as they highlight the basis of scoring being benthos, something not appropriate here. The need is to consider interactions, direct and indirect, in food chains and community diversity, etc. The White Banana Prawn fishery may be relatively small, but what is the role of the species within local/regional communities/feedwebs?	Impacts to ecosystems were considered in the ERA at Level 1 (SICA; referred to as "communities"). The risk assessment was not conducted for Level 2 (PSA) because the impacts were deemed to be of low consequence (Griffiths et al. 2007, p. 167). New text has been added to address this point. Beyond the risk assessment, ecosystem studies have focused on benthic impacts. As stated in previous comments, white banana prawn trawls are expected to have les contact with the benthos, but not zero contact. Therefore, any residual concerns with benthic community impacts from this sub-fishery are addressed to reference to the same studies cited in the tiger prawn sub-fishery assessment.
2.5.2	No	No	NA	See Tiger Prawn Fishery comments	See response to Tiger Prawn sub-fishery comment

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.5.3	No	No	NA	See Tiger Prawn Fishery comments	See response to Tiger Prawn sub-fishery comment

Any Other Comments

Comments	Conformity Assessment Body Response

6 Red-legged banana Prawn (*Fenneropenaeus indicus*)

Please complete the table below for each Performance Indicator which are listed in the Conformity Assessment Body's Public Certification Draft Report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.1	Yes	No	NA	The first paragraph of section 3.6.2.6 is confusing. The statement that the species is one of the less well assessed in the NPF is at odds with the facts that an assessment at least exists (unlike for some other species) and the use of "although" and the reference to wide geographic range seems irrelevant. The section on stock assessment is not extensive and does not help to understand in any detail what is done. The paragraph following Table 8 is hard to follow, with terminology different to that used in the table. The important features seem to be that the assessment is a quarterly age-based method (though how is ageing done?) reliant primarily on CPUE and with no fishery independent inputs. It is unclear how scaling works in the assessment to provide absolute values of biomass and recruitment by year. The methods of estimatingf Bmsy and Bmey (i.e. Bmsy x 1.2) are unclear and the change in fishing pattern for 2007 is a cause of concern in defining reference points. Taking the assessment at face value, assuming that reference points are reasonnably estimated, and referring figure 9, it appears that the stock is well above a level where recruitment might be impaired and has also shown a steady increase since a decline in the mid 1990s so that it is now at about the estimated Bmey for the period 1989-2007 (and by implication above the Bmsy for that period). There is considerable but unportrayed uncertainty in the Bmsy (and Bmey) estimates as well as in Bsp – nevertheless, it seems reasonable to suggest that the scoring guidelines can be scored at 100 and 80, as given.	This is now clarified in the report.. At the time of assessment reference points were available for red-legged banana prawns, but these were in preparation to support a HS which had not then been applied, although CSIRO and the RAG had not published the material. Reference Points, shown to the assessors, were subsequently used to formulate the harvest strategy for the 2012 year. This is now also refelcted in the scoring, and details provided prior to the peer review (Box 3). The assessment is a production model and not age based. The estimation of MMSY is derived from the assessment and BMEY is estimated by the proxy 1.2XBMSY

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.1.2	No	No	Yes	It is unclear from the background material and justification text what exactly is being scored. It seems that at the time of certification assessment there were no reference points but that during the process advice on reference points has been given and decisions on future reference points are pending. The justification section at paragraph 3 says these new reference points are awaiting approval while in paragraph 5 it is suggested they will be implemented in 2012; this is unclear. The final conclusion in section 3.6.2 is that there are no current reference points but newly devloped ones "are being incorporated." If scoring is against conditions extant at the time of the assessment, it appears there are no explicit reference points. However, trigger limits in the banana prawn and tiger prawn fisheries could be viewed as implicit LRPs and the implicit TRP would relate to the general goal of ensuring stocks did not fall below Bmsy (and Bmey after the HSP was put in place). The background section does not explore whether these impicit reference points were effective. The only information of relevance is the time series of Bsp (relative to Bmsy as calculated for the period 1989-2007) shown in Figure 9. It might be possibe to score PI1.1.1 against these implicit reference points, but the issue is complicated by a change from an imlicit target of Bmsy to Bmey, and changes in fishing practice leading to changes in Bmsy estimation. It is hard to see how reference point sthat might be imlemented from 2012 onwards can be used for certification purposes except as part of future planning. The current scoring invokes the advised new reference points and confuses "have been set" and "are awaiting approval". This seems to be inconsistent with scoring as at the time of certification. Scoiring against existing implicit LRPs following FAM 6.2.21/22 would seem more appropriate, coupled with a likely conditon that could eb atended to by intentions/plans already in place. Through the HSP there is a default TRP; this needs to be explicit in the second scoring conclusion.	Specific reference points for the JBG fishery were available at the time of the assessment. However, trigger limits in the banana prawn and tiger prawn fisheries are viewed as implicit LRPs and the implicit TRP which related to the general goal of ensuring that stocks do not fall below BMSY (and BMEY) after the harvest strategy was in place. The LRP for tiger prawns and red legged banana prawn is 0.5*BMSY, and the target reference point for red legged bananas is the proxy for BMEY = 1.2*BMSY. Therefore the score has been revised SG 80 following the helpful comments from the peer reviewer..
1.1.3	NA	NA	NA		
1.2.1	Yes	Yes	Yes		

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
1.2.2	Yes	Yes	Yes	The current scoring considers the current implicit LRPs (as trigers in two fisheries) and appropriately gives a score of 60. The scoring of element 2 at 80 is more difficult because it involves an interpretation of the available evidence (as in Figure 9); this has not been done explcitly (see e.g. comments at PI1.1.1). The Bsp series suggests a period of decline and then from 1996 a slow increase to a level about the estimate of Bmey – this could be interpreted as evidence ot support the 80 scoring. The justification and conclusion text would need to do this. Given the 60 score and the likley 80 score (if supported), there is a need ot impose a condition – this should not be onerous given that new reference points have been advised.	The status of the HS and the HS reference points is clarified. The scoring has been amended to refelct adjustments from the old (pre 2012) to new triggers (as from April 2012).
1.2.3	No	No	NA	See comments on Brown Tiger Prawns PI 1.2.3. There is not sufficient information to support the scoring as given and the comments in the justification about uncertainty and sensitivity testing appear unfounded. Scoring of element 1 needs to be reappraised. Scoring of element 2 is unclear asit is also unclear what control rules are in place and how monitoring and assessment supports them.	More detail will be added
1.2.4	No	No	NA	The background section at 3.6.6 does not adequately describe the stock assessment. It appears that a quarterly age-based assesmeent is undertaken and that while CPUE are available, there is no fishery independent data available. It is unlcear without source documents, how absolute estimates of Bmsy are derived, or on what basis. It has not been possible to access the referenced source document. The simple statement in the scoring justification that "there is a good assessment of the stock status" cannot be verified, nor the conclusions and scoring. There is no information provided to support the 100 level scoring at scoring guideline 1, and nothing on how uncertainty is taken in to account (element 2).	This is clarified in the report.. At the time of assessment, specific reference points for red-legged banana prawns were available but not included in the HS, Hovever, up to 2011 explicit reference points had been applied based on 0.5 BMSY in the tiger and banana prawn fisheries. The new reference points are fishery specific and available at the time of the assessment.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
P2 scoring for Red Legged Banana Prawn fishery					
2.1.1	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate? If this is a separate fishery, fishery-specific text and scoring rationale is required.	See responses to comments on Tiger Prawn Fishery above. Almost all of the research conducted for the NPF was conducted for the fishery as a whole. Where appropriate and possible this assessment has distinguished where research findings apply to specific sub-fisheries. Where findings are presented for the fishery as a whole, given the conservative nature of the risk assessment process, if the fishery as a whole does not pose unacceptable risks, the sub-fishery would not either.
2.1.2	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate? If this is a separate fishery, fishery-specific text and scoring rationale is required.	See responses to comments on Tiger Prawn sub-fishery and Comment 2.1.1 above.
2.1.3	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate? If this is a separate fishery, fishery-specific text and scoring rationale is required.	See responses to comments on Tiger Prawn sub-fishery and Comment 2.1.1 above.
2.2.1	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate? If this is a separate fishery, fishery-specific text and scoring rationale is required.	See responses to comments on Tiger and White Banana Prawn sub-fisheries above.
2.2.2	No	No	Maybe	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate? If this is a separate fishery, fishery-specific text and scoring rationale is required.	See responses to comments on Tiger and White Banana Prawn sub-fisheries above.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.2.3	No	No	No	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate? If this is a separate fishery, fishery-specific text and scoring rationale is required. There is a problem at the second scoring guidepost in relation to the status outcome scoring at 2.2.2 and FAM definition of "highly likely". There are difficulties with the condition in that the timescales applicable to the conditional requirements may not be feasible.	See responses to comments on Tiger and White Banana Prawn sub-fisheries above. The status outcome was scored in 2.2.1, and was determined from an ERA that concluded the main species were highly likely to be above LRP. However, the lower level of monitoring in this fishery than in other sectors of NPF suggests that increased monitoring would provide a stronger basis for assessing outcome status for the bycatch species. The timescales have been adjusted to take account of both preperation, implementation and nalysis
2.3.1	Yes	Yes	NA	No comment	NA
2.3.2	Yes	Yes	NA	No comment	NA
2.3.3	Yes	No	NA	There is something flawed in the logic of the three scoring guiddelines. At the third score, while data collected may be accurate and verifiable, the level of coverage, as acknowledged, is low and in some respects insufficient. The first two scores of 80 and 80 seem appropriate, but it is hard to see support for 100 level scoring on the third guidepost.	See response to Tiger Prawn sub-fishery 2.3.3.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.4.1	No	No	NA	The first sentence of the justification is not reasonable. Whether a fishery has gear deployed, but also, amongt other things, on the extent of deployment and the types of habitat it contacts. FAM 7.5.6 outlines definitions of likely, highly unlikely, etc. It is not clear from the information and argument provided, how a score of 80 is justified. Given comments at 2.4.3, the score is hard to defend.	The text has been rearranged to make it clear that the ERA considered the red-legged sub-fishery to be part of the tiger sub-fishery. Therefore there are good reasons to consider that the impacts are similar, though perhaps less in the red-legged fishery. It seems reasonable to consider that since the JCB habitats have been thoroughly mapped and a level 2 ERA has been conducted and found no high risks to habitats, that "highly likely" (80%) is the appropriate certainty. It is considered that some field testing would be required for a higher score.
2.4.2	No	No	NA	Comments as for Tiger Prawns – why is almost the same text, and figures, used if the fisheries are separate?	Please see responses above.
2.4.3	No	No	No	The scoring is flawed. The conclsion of the first scoring guideline seemes to be at odds with comments and scoring at 2.4.1. The second scoring guideline seems reasonably scored but here is no text or score for the third scoring guideline. It is therefore unclear how a score of 75 has been derived but it appears the third guideline is intended to be at the 80 level (also borne out by the comment in the condition). There are difficulties with the condition in that the timescales applicable to the conditional requirements may not be feasible.	The scoring was intended to be 60, 60 and 80 (this has been edited). There is no inconsistency with 2.4.1 because 2.4.1 is couched in terms of probability, i.e. a threshold of "highly likely" can be met through the theoretical ERA and inference from the GOC. In contrast, here in 2.4.3, to achieve a score higher than 60 in the first two SGs requires "The nature, distribution and vulnerability of all main habitat types in the fishery area are KNOWN…" and "there is reliable information on the spatial extent of interaction, and the timing and location", both of which appear to call for more than inference, i.e. for actual, site-specific data. This is why 2.4.3 scores lower than 2.4.1. The milestones for Condition implementation is chaged.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
2.5.1	No	No	NA	See Tiger Prawn Fishery comments; note FAM 7.5.6 and definition of highly unlikely – see comments at 2.4.1 above.	See response to comment on Tiger Prawn sub-fishery for 2.5.1 and for this fishery on 2.4.1. In the case of the ERA, only a Level 1 assessment was conducted, but the conclusion was that the impacts were of low consequence. The fishing effort in the red-legged sub-fishery is considerably smaller, and the contact with the benthos (i.e. the major mechanism for ecosystem impacts of concern) is less. Therefore, it is considered that a score of "highly likely" is also warranted for the red-legged fishery.
2.5.2	No	No	NA	See Tiger Prawn Fishery comments	The comment on the Tiger Prawn sub-fishery at 2.5.2 suggests that the scoring is acceptable.
2.5.3	No	No	No	See comments on Tiger Prawn Fishery and on 2.4.3 (habitats). The conditio naims to increse knowledge about the JBG ecosystem beyond that apparently available for scoring at 80 or above on the other two fisheries.	There is no comment on 2.5.3 for the Tiger Prawn sub-fishery. Please see response on this sub-fishery for 2.4.3 above. The timelines for Condition implementation is extended to four years to reflect field survey and analysis.

Any Other Comments

Comments	Conformity Assessment Body Response
The text on Red Legged Banana Prawns is confusing and documentation insufficient to support much of the P1 scoring. It is particularly problematic that old, undefined, and new, yet to be approved, reference points have been described. There is confusion in the text and the scoring in this regard and there is need to clarify what has been assessed and scored (and how). Information on what might be would best be written as a separate section or as part of the client action plan.	

Response to the separate sub-stocks comment (Peer reviewer 1)

The reviewer raises concerns about considering the NPF as a single stock for both stock assessments and management. The reviewer claims “Instead there is much more likely to be a fairly high degree of self-recruitment - which would in turn most likely lead to a series of semi to fully independent substocks being distributed around the GoC. Given the biology of tiger prawns, which have a short larval life with larval behavioral characteristics designed to get them quickly into inshore nursery habitats - not undertake large scale (>100kms) long term movements”.

However, this statement is not supported by the available scientific evidence. Based on a 3-dimensional model of the season currents in the Gulf of Carpentaria and the known diurnal migration of larvae, Rothlisberg, Church, & Forbes, (1983) showed that during the larval life of about 20 days, larvae could be advected up to 150km from their spawning site (average 80km), the direction of advection depending on the time of the year. Diffusion of larvae would add an extra 40km that could be in addition to the advected component. It is not until the early post-larval stage, that the larvae start using the tidal currents to migrate into nursery areas on the flooding tide after they have been advected close to the nursery area. As a result, there could be considerable mixing of the prawns in the Gulf through larval migrations (up to a third of the distance across the Gulf).

Somers & Kirkwood (1984) also showed through extensive tagging experiments that adult prawns are capable of relatively large movements, some up to 80-100 km away from the release point. In general adult prawns tended to move further offhore as they grew and could be located in depths up to 50m (outside the known fishing grounds) some distnce away from their point of release. They found that there is some degree of mixing between the prawn populations inhabiting the fishing grounds to the north and south of Groote Eylandt even within a few months, with the direction of interchange generally being species specific. Both species showed movement offshore, however, the distribution of *P. esculentus* recaptures was generally east of the release area whereas that for *P. semisulcatus* was generally north-east.

The concept of several discrete stocks comes from the work of Die et al (2001) that suggested that there could be several distinct stocks of tiger prawns in the NPF and suggested that assessments should be applied at a finer scale than that of a single stock. They based this conclusion on a simulation model of the currents in the Gulf of Carpentaria and the behaviour of larval prawns that was used to predict the offshore spawning regions from which larvae could be expected to reach the seagrass nursery areas along the coast. The model shows that there are large gaps between these effective spawning areas and this suggested limited mixing of tiger prawn larvae within the Gulf of Carpentaria

It is well known that only a few migrants are sufficient to prevent the development of genetic differentiation between monospecific groups and sub-stocks. Mixing of both adults and larvae on the scale demonstrated by the research would make it more likely that the different prawn species in the GOC are indeed a single stock and can be assessed and managed accordingly (Red-legged banana parwans outside of the GOC are assessed and managed separately). Thus many of the comments based on a perception of the reviewer are not valid.

The studies of Dichmont - (Dichmont, 2006) and (Dichmont, et al, 2006) are prticularly pertinant. Through a Management Strategy Evaluation (MSE), based on a number of performance measures she examined in effects the appropriate spatial and temporal scale of the Management Strategies as well as their mathematical complexity. Options include annual versus weekly time steps, single versus multi-stock assessments and/or decision rules, different assessments, inclusion of age structure. The operating model is based on a 5-stock, two-species, tiger prawn resource and forms the basis for the evaluations. Results showed that spatially-structured assessment would have higher levels of uncertainty attached to the outcomes, because (a) the assessment needs to estimate more parameters from the same amount of data and (b) stock boundaries, if they exist objectively at all, are poorly known with those presently used for only based on opinion. Other concerns associated with moving to a spatially structured stock assessment relate to the true number of stocks and the implications of movement among the stocks. Spatial management is also difficult to implement raising the risk of mis-management.

References

Dichmont, C. M. (2006). *Management Strategies for an input controlled fishery based on the capture of short-lived tropical species: the example of Australia's Northern Prawn Fishery.* University of Tasmania, Australia: Ph.D thesis.

Dichmont, C. M., Deng, A., Punt, A., Venables, W., & Haddon, M. (2006a). Managemant strategies for short-lived species: the case study of Australia's Northern Prawn Fishery. 1. Accounting for multiple species, spatial structure and implementation uncertainty when evlauating risk. *Fisheries Research 82* , 204-220.

Die, D., Loneragan, N., Haywood, M., Vance, D., Manson, F., Taylor, B., et al. (2001). Indices of recruitment and effective spawning for tiger prawn stocks in the Nothern Prawn Fishery. Canberra, Australia: FRDC Final Report 1995/014.

Rothlisberg, P. C., Church, J. A., & Forbes, M. G. (1983). Modelling the advection of vertically migrating shrimp larvae. *Journal of Marine Research, 41* , 511-538.

Somers, I. F., & Kirkwood, G. P. (1984). Movements of tagged tiger prawns, Penaeus spp, in the western Gulf of Carpentaria. *Journal of marine and Freshwater reserach 35 (6)* , 713-723.

Annex 3. Additional comments from Peer Reviewers

Additional comments from the peer Reviewers on the client Action Plan and the changes made to Red legged banana prawn scoring, following receipt of additional information from the fishery and advice from MSC.

NPF – CAP and revised P1 for red legged banana prawns
Reviewer comments – Peer reviewer 1, 29 June 2012

Condition Action Plans

The conditions follow the MSC requirement of specifying *"conditions that closely follow the narrative or metric form of the performance indicators and scoring guideposts used in the assessment tree…. (TAB 33)."* We believe that the milestones and the client action plan collectively will move the fishery to a score of 80 where necessary, or surveillance will pick up any deficiencies.

Condition 1 Bycatch

By the first surveillance audit, undertake an assessment of the feasibility of a monitoring programme using the results of the existing ERA to extend the observer programme to the JBG fishery;
This condition is not well drafted as it is not clear what is to be done? Therefore the CAP response for this is rational.

By the second surveillance audit, provide an analysis for the red-legged banana prawn fishery which demonstrates that the available information (logbook and observer) is sufficient to estimate outcome status for at-risk bycatch species with respect to biologically based limits.
This should really be the first condition not the one above –because if there are no 'at risk' species you don't need a monitoring program. However the condition should be more specific and say that a more detailed analysis is required (as obviously the first one wasn't sufficient) – as the original submission had an analysis purporting to do all this.

I think the actions in the CAP response are broadly appropriate but again they could be more specific
Prior to the first surveillance audit, AFMA and NPFI will initiate a MORE DETAILED desk study to BETTER determine THE RISK STATUS of bycatch species, drawing from the existing ERA, BUT using ADDITIONAL information that may be relevant to the JBG fishery, and earlier work specific to the JBG.

The follow on question therefore is that as the ERAs presented in the original assessment were desktop reviews of available information – what extra will be done?? What additional information is available or what different assessment procedure will be used?
If from these additional studies one or more high risk status species is identified which is scored high due to uncertainties then a specific survey could be undertaken to clarify this. - not necessarily establish an ongoing monitoring program. Such a research survey could provide the information that the "at risk" species are not at risk. If the research survey confirms their at risk status only then is a monitoring program is warranted.

The clients' view is that the AFMA/CSIRO process in place is sufficiently explicit

Condition 2 : Habitats

The timetable in the CAP response seems more reasonable than that outlined in the conditions.

Amended as suggested to having the detailed plan of action by the second surveillance period.

Condition 3 Ecosystems

The CAP response does not outline that it will actually assess the risks to the ecosystem. This may be implied in the text but as the original assessment did not include an assessment of ecosystem risk I think that this needs to be explicit. Such an assessment should be done by the second audit.

This has now been added by the client.

Condition 4 Fishery Research Plan

CAP response is ok – but I would think that a research plan that involves a fishery which uses real time management must be reviewed annually – hence it should be a living document not a set and forget.

Review of P1 for Red Legged Banana Prawns (JBG)

1.1.1

As was the case in the original assessments there is inconsistency between the justification provided and the SGs chosen. The justification says that there is a much higher degree of uncertainty in the status of this species compared with the other stocks – but the scoring level chosen (SG100) would require it has the same high degree of certainty that red legged prawns is above the reference point as the other three species. Either the justification statements are wrong or the score is wrong. At best it would be 80 (highly likely) but if the uncertainty is as high as suggested even this may be too high. We scored the first scoring issue of SG100 because the analyses demonstrate that the stock biomass has a high degree of certainty to exceed the LRP. Given that the biomass relative to MSY is well above the LRP $0.5S_{MSY}$ (268-303%, respectvely), it seems highly certain that that the biomass exceeds ½ Bmsy. We agree that the uncertainty in the assessment would prevent a conclusion that the biomass also met this standard. Therefore, the first scoring issue of SG100 is met and the second scoring issue of SG80 is met, for a score of 90.

1.1.2

My only comment here is that it is not clear that the uncertainty outlined in 1.1.1 has been used to generate these levels.

1.2.1

The new harvest strategy has, in my opinion, a serious flaw. It states that
Fishing WILL be allowed for the full two season in the following year:

- If data have been provided for **LESS THAN 100 days** during the year AND
- **WHETHER OR NOT** the LRP of 390kg/day has been triggered.

This means that the stock can decline to the point that fishing doesn't even occur for 100 days but despite this and low catch rates that would be associated with such a decline it will open the next year. Not fishing for 100 days should be a trigger to review the situation because it is likely to be a good sign that there is a problem.

Therefore the new harvest strategy is not sufficiently robust to deal with major declines in stock levels

Harvest strategies that don't specific acceptable catch and/or effort ranges or tolerances against what is expected are not very robust. There are multiple examples of the TACC following the catch downwards.

The management response has been to set a lower catch trigger for RLBP fishery, because it partially reflects search and find functions which may result in lower catch levels, allied to lower levels of effort overall. The limit is more a reflection of the low levels of effort – i.e., 5 vessels and fishing between 1-15 days each. A range of management actions is laid out in Box 3 by MORMAC which indicates that the management response is well defined and provides for action if the exploitation rate is reduced as limit reference points are approached (SG 80).

1.2.2
The justification here is a bit of old and new –should have been completely re-written. Also given the above problems it cannot be stated that there is evidence that it will work – this should be downgraded to at most 60. The additional information supports our conclusion that the fishery met its objectives for the previous harvest strategy and success of the control rules in other NP fisheries provide evidence that the control rules for red-legged will also be successful; the red-legged fishery is a specialized subset of the NPF, and there is no reason to believe that the control will operated differently. A score of 80 is appropriate.

1.2.3 - The first part of the table was not present in the version sent to me??

Accidently dropped from the review version; added to PCDR.

1.2.4
Not sure how the assessment takes uncertainty into account – No justification for this was provided therefore this only scores a 60. Section 1.1.1 discusses uncertainty identified for the assessment. The conservative TRP (MEY) effectively makes the use of the assessment precautionary; the managers determined that the uncertainty of the assessment did not warrant additional precaution.

Comments on revised PI1 for red-legged banana prawns, and on CAP

Peer Reviewer 2

28 June 2012

PI1 SCORING

Regarding the revised PI1, I have compared the revised scoring with the original and can see differences at 1.1.2, 1.2.1, 1.22, and 1.2.4 (justification and conclusion, in all cases). It would have helped to see a track-changed version of the scoring tables, annotated to explain changes in scoring due either to Peer Review comments or clarification from MSC. In the absence of that, comments here may reflect misunderstanding of the rationale for changes made.
1.1.2: The score for the first SG has been changed to 80 from 60, presumably as a direct result of clarification from the MSC. I have no comment on this. The third SG was previously unscored but has now been scored as 80 using the justification carried over from the original scoring (*Red-legged banana prawn is not considered a low trophic level species. Precautionary issues such as the ecological role of the stock have been considered but have not been taken into account in setting the TRP.*)
The justification is at odds with the SG which requires that TRP "takes into account…". The statement in the conclusion that the red-legged banana prawns are not a low level trophic

species does not attend to whether or not the issue has been taken in to account when setting the TRP.

The ecological role at the 80 level needs consideration only if the stock is considered LTL; we determined that RLBP are not LTL. Therefore, the fourth scoring issue of SG80 doesn't apply and a score of 80 is appropriate.

1.2.1: New text has been added to the justification. There is a problem with the English in the final sentence. Corrected in the revised text. The arguments put forward for the SG scoring are unconvincing. All SG 60 appear to be met. Note that the third SG score given (80) in respect of monitoring is incorrect. The text for the SG quoted is the 60 level text; the score given is 80. We have to demonstrate that we meet all the SG60 scoring issues before we can score an 80. As the scores are cumulative, meeting the 60 is a given upon meeting the 80 in the other scoring issues. We indicated an 80 so that readers would not think we should average this 60 to result in a score <80. There is not yet evidence (as required for 80 level scoring) that monitoring is effective. Given the new HS put in place in 2012, it seems premature to make the claims as in the scoring table. I would expect all three 60 level SG be met but that only the first 80 level SG be met, giving an overall score of 70 and requiring a condition be set. We understand that the HS was put into place in 2012. However, we consider that the fishery met its objectives for the previous HS. We also considered that the fisheries for other NP species met HS objectives. Together, these examples provide evidence that the new red legged HS will also prove successful. Monitoring by the CAB during surveillance will confirm whether this occurs and remedial action will occur if appropriate. Therefore, a score of 80 is appropriate.

1.2.2: There is new text in the justification. There is a "monitor, monitor" and a spelling mistake for empirical. Text corrected. For the third SG scored, there is a change of tense compared with the SG text. The SG says that "tools in use…ARE effective…" while the conclusion/scoring says "…tools in use…HAVE BEEN…" It is very difficult to score at the 80 level when the new HS is only just being implemented. We believe that the success of the control rules in other NP fisheries provide evidence that the control rules for red-legged will also be successful; the red-legged fishery is a specialized subset of the NPF, and there is no reason to believe that the control will operated differently. A score of 80 is appropriate. I would suggest scoring as 80,80,60 with an overall score of 75 and setting a condition.

CAP

The conditions follow the MSC requirement of specifying *"conditions that closely follow the narrative or metric form of the performance indicators and scoring guideposts used in the assessment tree…. (TAB 33)."* We believe that the milestones and the client action plan collectively will move the fishery to a score of 80 where necessary, or surveillance will pick up any deficiencies.

Condition 1: Bycatch appears still to be prescriptive with regard to specific actions and timing. The CAP does not fit well with the prescriptive elements of the Condition but is a measured sequence of logical steps that could render some of the Condition steps redundant. My overall opinion is that the CAP is good but that surveillance rigidly against the condition could be problematic. If it is possible to amend the Condition in line with the CAP, this would be useful (note that the form of Condition 2 seems more appropriate).
The assessors feel that while elements might be deemed prescriptive, the wording in the Condition extracts from the tried and tested already in place in the other sub fisheries. The assessors feel that there is no need to change the wording of the condition.

Condition 2: Habitats is less prescriptive than Condition 1 with the various elements creating a framework for client response rather than setting specific outputs. The CAP seems sensible though it is notable that the timing is not entirely in line with the Condition (e.g. the detailed plan called for in the Condition by the first surveillance audit is provided for in the CAP by the second audit). My overall opinion is that the CAP is reasonable. If it is followed, then surveillance audits will need to distinguish the expected outputs from the CAP from those of the Condition. As for Condition 1, if still possible, amending the Condition to reflect the CAP would perhaps be useful.

Amended as requested.

Condition 3: Ecosystems is again somewhat prescriptive but does build towards fulfilling relevant SG requirements. The CAP is not fully in line with the annual specifications but is a reasonable and well-ordered response to meeting the requirements within the four year period. Overall, where four year periods are specified for meeting SG80 requirements, it would be useful for Conditions to require by the first audit only a detailed plan for work to be undertaken over the four year period. In addition, suggestions, rather than specifications, for annual outputs, would be helpful.

The recommended response suggested would be considered too prescriptive.

Condition 4: Research Plan requires completion within two years but sets milestones extending to the third surveillance audit. I suggest rewriting the Condition to include the explicit SG80 requirements formatted as for Conditions 2 and 3, and reflecting expectations for the first and second audits as outlined in milestones 1 and 2 (though I suggest not using the milestone terminology). The CAP response is appropriate.

The Research Plan would be completed by the second surveillance audit, but the assessors feel that evidence would be needed to illustrate that it is being implemented. This also partially deals with the point raised by Peer Reviewer 1.

The wording in the condition has been amended, and whilst running the risk of being stated as prescriptive, the assessors underline the need for a balanced approach in the research planning to both stock assessment and ecosystem based research.

12 Public Comments

12.1 MSC