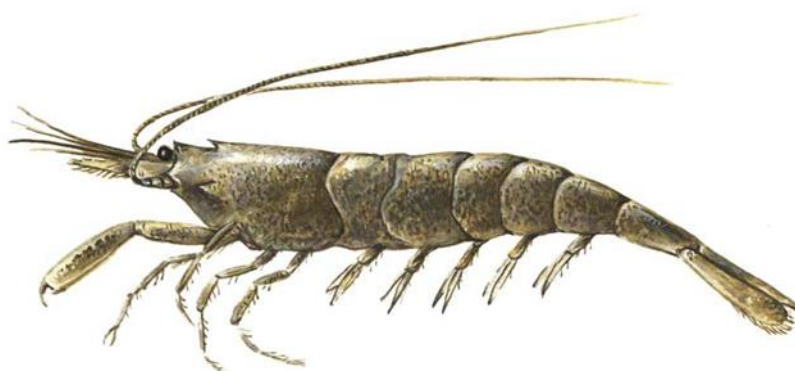


MSC SUSTAINABLE FISHERIES CERTIFICATION

Wash brown shrimp



Public Certification Report

January 2020

Client: Shrimp Producers Organisation Ltd.
Assessment Conducted by: Tristan Southall, Gudrun Gaudian, Julian Addison
On behalf of Lloyd's Register

Assessment Data Sheet

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Contents

Assessment Data Sheet.....	2
1 Executive Summary	8
2 Authorship and Peer Reviewers.....	11
2.1 Assessment Team	11
2.1.1 Peer Reviewers	12
2.2 RBF Training.....	14
3 Description of the Fishery	15
3.1 Unit(s) of Assessment (UoA) and Scope of Certification Sought	15
3.2 Proposed Unit of Certification (UoC)	15
3.3 Final UoC(s).....	16
3.3.1 Total Allowable Catch (TAC) and Catch Data	16
3.4 Overview of the fishery	17
3.4.1 Client Group	17
3.4.2 Fishing Operations & Fleet Characteristics	17
3.4.3 Fishing location.....	19
3.5 Principle One: Target Species Background.....	20
3.5.1 Biology and Life History of Brown Shrimp (<i>Crangon crangon</i>).....	20
3.5.2 History of the fishery and its management	24
3.5.3 Harvest strategy.....	28
3.5.4 Stock assessment.....	32
3.6 Principle Two: Ecosystem Background	38
3.6.1 Ecosystem considerations	38
3.6.2 Habitat	41
3.6.3 Primary and Secondary species.....	61
3.6.4 ETPs.....	72
3.7 Principle Three: Management System Background.....	80
3.7.1 European Union.....	80
3.7.2 United Kingdom / England	81
3.7.3 Inshore Waters	81
4 Evaluation Procedure.....	83
4.1 Harmonised Fishery Assessment.....	83
4.2 Previous assessments	83
4.3 Assessment Methodologies	83
4.4 Evaluation Processes and Techniques	83
4.4.1 Site Visits.....	83
4.4.2 Consultations.....	83
4.4.3 Evaluation Techniques.....	84
5 Traceability	86

5.1	Eligibility Date	86
5.2	Traceability within the Fishery	86
5.3	Eligibility to Enter Further Chains of Custody	87
5.4	Eligibility of IPI stocks to Enter Further Chains of Custody	89
6	Evaluation Results	90
6.1	Principle Level Scores	90
6.2	Summary of PI Level Scores	90
6.3	Summary of Conditions	91
6.4	Recommendations	91
6.5	Determination, Formal Conclusion and Agreement	92
	References	93
	Appendix 1 Scoring and Rationales	102
	Appendix 1.1 Performance Indicator Scores and Rationale	102
	PI 1.1.1 – Stock status	102
	PI 1.1.2 – Stock rebuilding	104
	PI 1.2.1 – Harvest strategy	105
	PI 1.2.2 – Harvest control rules and tools	109
	PI 1.2.3 – Information and monitoring	111
	PI 1.2.4 – Assessment of stock status	113
	PI 2.1.1 Primary species outcome	116
	PI 2.1.2 Primary species management strategy	126
	PI 2.1.3 - Primary species information	130
	PI 2.2.1 - Secondary species outcome	132
	PI 2.2.2 - Secondary species management strategy	135
	PI 2.2.3 - Secondary species information	139
	PI 2.3.1 - ETP species outcome	141
	PI 2.3.2 - ETP species management strategy	143
	PI 2.3.3 - ETP species information	147
	PI 2.4.1 – Habitats outcome	149
	PI 2.4.2 – Habitats management strategy	152
	PI 2.4.3 – Habitats information	155
	PI 2.5.1 – Ecosystem outcome	158
	PI 2.5.2 – Ecosystem management strategy	160
	PI 2.5.3 – Ecosystem information	163
	PI 3.1.1 – Legal and/or customary framework	166
	PI 3.1.2 – Consultation, roles and responsibilities	169
	PI 3.1.3 – Long term objectives	172
	PI 3.2.1 Fishery-specific objectives	174
	PI 3.2.2 – Decision-making processes	176

PI 3.2.3 – Compliance and enforcement	180
PI 3.2.4 – Monitoring and management performance evaluation.....	183
Appendix 1.2 Risk Based Framework (RBF) Outputs	185
Appendix 1.3 Conditions.....	188
Condition 1 Harvest Control Rules.....	188
Condition 2 Assessment of Stock Status	190
Condition 3 ETP Management.....	191
Condition 4 ETP Information.....	193
Condition 5: Habitats Management	195
Condition 6: Consultation, Roles & Responsibility	198
Condition 7: Decision-making Processes	200
Condition 8: Monitoring & Evaluation	202
Appendix 2 Peer Review Reports.....	204
Peer Review A.....	204
Peer Reviewer B	212
Appendix 3 Stakeholder submissions.....	219
Appendix 4 Surveillance Frequency	245
Appendix 5 Objections Process	246

Glossary

ACOM	ICES Advisory Committee
ACFA	ICES Advisory Committee on Fisheries and Aquaculture
BAP	Biodiversity Action Plan
B _{pa}	Precautionary reference point for spawning stock biomass
B _{lim}	Limit biomass reference point, below which recruitment is expected to be impaired.
CFP	EU Common Fisheries Policy
CPUE	Catch Per Unit Effort
CR	Council Regulation
DCF	(EU) Data Collection Framework
DEFRA	Department for Environment, Food & Rural Affairs
EC	European Commission
EEZ	Exclusive Economic Zone
EIFCA	Eastern Inshore Fisheries & Conservation Authority
ETP	Endangered, threatened and protected species
EU	European Union
F	Fishing Mortality
FAO	Food & Agriculture Organisation (UN)
FAR	Fishing Activity Report
F _{lim}	Limit reference point for fishing mortality that is expected to drive the stock to the biomass limit
F _{pa}	Precautionary reference point of fishing mortality expected to maintain the SSB at the precautionary reference point
GES	Good Environmental Status
GRT	Gross Registered Tonnage
HCR	Harvest Control Rule
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries & Conservation Authority
IPi	Inseparable or Practicably Inseparable
IUU	Illegal, unreported and unregulated fishing
LPUE	Landings Per Unit Effort
LTL	Lower Trophic Level
LOA	Length Over All
MACAA	Marine and Coastal Access Act
MCMC	Markov Chain Monte Carlo
MCS	Monitoring, Control and Surveillance
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MOU	Memorandum of Understanding
MSC	Marine Stewardship Council
MSFD	Marine Strategy Framework Directive
MSY	Maximum Sustainable Yield
NGO	Non-Governmental Organisation
OSPAR	Oslo-Paris Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic)
P1	MSC Principle 1
P2	MSC Principle 2
P3	MSC Principle 3
PI	MSC Performance Indicator

PSA	Productivity Susceptibility Analysis
RAC	Regional Advisory Council
RBF	Risk Based Framework
RBS	Registration of Buyers and Sellers
SAC	Special Area of Conservation
SFAWG	Shrimp Fisheries Assessment Working Group
SFC	Sea Fisheries Committee
SI	Scoring Issue (MSC)
SPA	Special Protection Area
SSB	Spawning Stock Biomass
STECF	Scientific, Technical and Economic Committee for Fisheries
TAC	Total Allowable Catch
UoA	Unit of Assessment
UoC	Unit of Certification
UK	United Kingdom
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
VMS	Vessel Monitoring System
VPA	Virtual Population Analysis
WWF	World Wide Fund for Nature
WGCRAN	ICES Working Group on Crangon Fisheries
WGECO	ICES Working Group on the ecosystem effects of Fishing Activities
WGRED	ICES Working Group on Ecosystem Description

1 Executive Summary

- » This report provides details of the MSC assessment process for the Wash Brown Shrimp Fishery for Shrimp Producers Organisation Ltd. The assessment process began on 27th April 2018 and was concluded (to be determined at a later date).
- » A comprehensive programme of stakeholder consultation was carried out as part of this assessment, complemented by a full and thorough review of relevant literature and data sources.
- » A rigorous assessment of the wide ranging MSC Principles and Criteria was undertaken by the assessment team and a detailed and fully referenced scoring rationale is provided in the assessment tree provided in **Appendix 1.1** of this report.
- » The **Target Eligibility Date** for this assessment is the date of certification.

The assessment team for this fishery assessment comprised of Tristan Southall, who acted as team leader and primary Principle 3 specialist; Gudrun Gaudian who was primarily responsible for evaluation of Principle 2 and Julian Addison who was primarily responsible for evaluation of Principle 1. Paul MacIntyre was the traceability expert advisor.

Client strengths

- » The client for this fishery is the Shrimp Producers Organisation Ltd., a company set up by the 2 main buyers of Wash Brown Shrimp, based in Kings Lynn. Shrimp Producers Organisation Ltd initiated a project to improve the information and management within the fishery in order to achieve MSC certification. This project has undertaken considerable industry consultation and has commissioned research and stock assessment and has ultimately implemented the Wash Brown Shrimp Management Plan. This exercise demonstrates considerable commitment on behalf of the client fishery to improve the management for the Wash Brown Shrimp fishery.
- » The 2 King's Lynn shrimp buyers are the only bulk shrimp buyers in the area. As such, the Wash Brown Shrimp Management Plan, which all vessels must be signatory to and compliant with in order to sell their product, is an effective mechanism for managing some aspects of the fishery.

Client weaknesses

- » As noted above the client fishery has made considerable efforts to enhance the information base and implement increased management controls, as evidenced by the Wash Brown Shrimp Management Plan. This industry-led management initiative is non-statutory. By contrast, the Eastern IFCA do have statutory responsibility for the management of the shrimp fishery within 6nm and are themselves in the process of drafting a Shrimp Permit byelaw which would also enable further management controls to be implemented. Whilst it is hard to criticise a fishery for having too much management, it is important that the systems that are in place are complimentary, not contradictory; and do not lead to duplication of effort or confusion.

Determination

Following this assessment team's work, and review by stakeholders and peer-reviewers, the determination will be presented to LR's decision making entity that this fishery has passed its assessment and should be certified.

Following this, and having received no objections, LR confirm that the fishery is certified.

Rationale

- » There are a number of areas which reflect positively on the fishery:
 - › The fishery has been demonstrated to be above a level consistent with MSY

- › There is a clearly-defined harvest strategy embedded within a comprehensive Fishery Management Plan
- › There is detailed information on the habitats in the area, based on recent surveys, including gear impact studies.
- › There is consistent catch composition information, allowing an evaluation of the impact of fishery on bycatch
- › The primary statutory responsibility for management of the Wash brown shrimp fishery (within 6nm) lies with the Eastern Inshore Fisheries and Conservation Authority (EIFCA). There is strong statutory backing (and enforcement) for many of the management measures detailed in the management plan.
- › There are excellent consultation mechanisms in place, with a high level of stakeholder engagement.

Conditions & Recommendations

- » However, a number of criteria which contribute to the overall assessment score scored less than the unconditional pass mark, and therefore trigger a binding condition to be placed on the fishery, which must be addressed in a specified timeframe (within the 5-year lifespan of the certificate). Full explanation of these conditions is provided in **Appendix 1.3** of the report, but in brief, the areas covered by these conditions are:
 - › PI 1.2.2a: Whilst the HCR would be expected to keep the stock fluctuating around a level consistent with or above MSY, the Management Plan does not explicitly state how the annual HCR index will be calculated from the catch and effort data, or whether the trigger reference point will have a fixed value or will be estimated through an annual stock assessment where the population model is fitted to the catch and effort data to evaluate stock status.
 - › PI 1.2.4a: The newly-developed stock assessment methodology including the evaluation of harvest control rules has not yet been peer-reviewed.
 - › PI 2.3.2b: The Brown Shrimp management plan does not contain a list of ETP species likely to be encountered by the fishery, nor is there any on-board identification manual for the fishers to refer to (at the time of the site visit), despite this being explicitly mentioned in the management plan. There are no measures in place to record ETP species encounters specifically. If these measures were in place a strategy to manage ETP species could be said to be in place.
 - › PI2.3.3b: Increase the number of observations and/or not amalgamate observer data over several years in order to pick up trends. Furthermore, in order to improve information on ETP species interactions, the client implements as self – reporting system, recording encounters and interactions with ETPs.
 - › PI 2.4.2b: The current representation of the inshore fleet, which supports a high number of smaller vessels, in fishing intensity data is poor. The lack of VMS data for The Wash fleet, which is primarily composed of boats <12 m, at present means there are significant gaps in data describing the spatial distribution and intensity of fisheries in the area.
 - › PI 3.1.2: The steps that the Shrimp Producers Organisation Ltd have initiated and paid for to develop and implement some vital aspects of management have been vital to enable the fishery to enter the MSC assessment process. However, the IFCA has also been developing fishery-specific management in the shape of a draft shrimp byelaw. These parallel systems have the potential to be complimentary but may also represent the potential for duplication and

contradiction. The formal relationship between these 2 systems and areas of responsibility and future funding should be explicitly defined.

- › PI 3.2.2: Connected to the issues highlighted above in relation to PI 3.1.2 the future fishery-specific decision-making processes should be more clearly established so that the relationship between the IFCA decision-making process and the Shrimp Producers Organisation / SFAWG decision-making process is clarified.
- › PI 3.2.4: The process of fishery specific review is crucial to the on-going improvement in the fishery. This process should be more formally planned for and resourced (including the provision of external review) and it is anticipated that a review will have been undertaken within the lifetime of the certificate.
- » In addition, the assessment team made a number of recommendations. As these are not the result of a failure to meet the unconditional pass mark, they are non-binding; however, in the opinion of the assessment team, they would make a positive contribution to ongoing efforts to ensure the long-term sustainability of the fishery. Details of these recommendations are provided in **Section 6.4** of this report.
 - › PI 1.2.3b: Obtain accurate information on the proportion of non-commercial-sized shrimps that are discarded following riddling of the catch and an estimate of discard mortality that is specific to The Wash fishery.
 - › For PI 2.1.2e: Produce evidence of routine monitoring and review of management measures.
 - › For PI 2.2.2e – Produce evidence of routine monitoring and review of management measures
 - › For PI 2.2.3 to improve information on all Secondary species: It is recommended that a Productivity Susceptibility Analysis (PSA) is conducted on all those species for which no reference points are available. PSA is a semi-quantitative and rapid risk assessment tool that relies on the life history characteristics of a stock (i.e., productivity) and its susceptibility to the fishery in question. This would constitute a risk analysis for each species, calculating an individual score for each species (see also Patrick et al 2009). In the case of this fishery, where so many species are involved, the client should provide such a list of PSA scores for each bycatch species, as part of the regular bycatch analysis.
 - › For PI 2.3.1: Considering that the fishery is operating with The Greater Wash SPA, the client is encouraged to implement greater spatial awareness of fishing vessels regarding areal closures, including voluntary closures and temporary closures due to the seasonal presence of protected seabird species
 - › For PI3.2.2e: When the management plan is revised more explicit consideration should be given to the mechanism from resolution of disputes.
- » For interested readers, the report also provides background to the target species and fishery covered by the assessment, the wider impacts of the fishery and the management regime, supported by full details of the assessment team, a full list of references used and details of the stakeholder consultation process.
- » Lloyd's Register confirm that this fishery is within scope.

2 Authorship and Peer Reviewers

2.1 Assessment Team

All team members listed below have completed all requisite training and signed all relevant forms for assessment team membership on this fishery.

Assessment team leader: Tristan Southall

Primarily responsible for assessment under Principle 3

Tristan Southall is an experienced fisheries assessor who has worked as both principles 2 and 3 expert on a number of previous MSC assessments, including previous assessments of shrimp fisheries. Tristan is based in the UK and has also led a number of assessments of UK fisheries so has expert knowledge of UK fishery management systems. Tristan's MSC related work also includes pioneering the development of multi-fishery MSC project pre-assessments which review the status of all fisheries within a management jurisdiction (i.e. Project Inshore in England and Project Medfish in Spain). More recently, his experience and expertise in the MSC Certification Requirements (and its practical application and associated challenges) has been recognised with a number of assignments contracted directly to MSC. Notably he has been contracted by MSC to develop capacity building tools and deliver capacity building training for prospective fishery clients and stakeholders all around the world.

Other relevant areas of work include the development of fishery management plans (including for UK shellfish fisheries); undertaking fishery impact assessments and managing fisheries liaison and mitigation for off-shore developments (in UK waters). Tristan has considerable professional experience of the EU Common Fisheries Policy and has coordinated EU fisheries training and promotion activities – covering all aspects of sustainable fisheries management and control. As such he is well placed to advise on the considerations following the UK's decision to leave the EU.

When not assessing the sustainability of fisheries Tristan specialises in fishing and marine industry consultancy, combining detailed understanding of marine ecosystems with broad experience of fisheries management policy.

Expert team member: Julian Addison

Primarily responsible for assessment under Principle 1

Julian Addison is an independent fisheries consultant with over 30 years' experience of stock assessment and provision of management advice on shellfish fisheries, and a background of scientific research on shellfish biology and population dynamics and inshore fisheries. Until December 2010 he worked at the Centre for Environment, Fisheries and Aquaculture Science (Cefas) in Lowestoft, England where he was Senior Shellfish Advisor to Government policy makers, which involved working closely with marine managers, legislators and stakeholders, Government Statutory Nature Conservation Organisations and environmental NGOs. He has also worked as a visiting scientist at DFO in Halifax, Nova Scotia and at NMFS in Woods Hole, Massachusetts where he experienced shellfish management approaches in North America. For four years he was a member of the Scientific Committee and the UK delegation to the International Whaling Commission providing scientific advice to the UK Commissioner. He has worked extensively with ICES and most recently was Chair of the Working Group on the Biology and Life History of Crabs, a member of the Working Group on Crangon Fisheries and Life History and a member of the Steering Group on Ecosystems Function. He has extensive experience of the MSC certification process primarily as a P1 team member but also as a P2 team member and team leader. He has undertaken nearly 30 MSC full assessments of crustacean and mollusc fisheries worldwide which use a wide range of stock assessment methodologies and fishing gears. He is a member of the MSC Peer Review College and has carried out peer reviews of MSC assessments worldwide of a wide range of fish and shellfish

fisheries. Other recent work includes a review of the stock assessment model for blue crabs in Chesapeake Bay, USA, and an assessment of three Alaskan crab fisheries under the FAO-based Responsible Fisheries Management scheme.

Expert team member: Gudrun Gaudian

Primarily responsible for assessment under Principle 2

Gudrun Gaudian is an experienced marine ecologist and taxonomist, including coastal and marine surveys, EIA's for coastal infrastructure development and tourism, and research projects in tropical and temperate seas. Work experience also includes coastal and marine management issues, such as identifying sustainable coastal development projects, as well as addressing conservation issues, including selection and planning of marine parks and reserves, sustainable utilisation of natural resources and community-based management programmes. Projects have been undertaken in temperate, polar and tropical marine regions. Since 2010 Dr Gaudian has been working in fisheries certification, applying the Marine Stewardship Council standard for sustainable fisheries, primarily as Principle 2 assessor, both as Team Leader and Team Member. Other relevant work carried out includes pre-assessments, peer reviews and MSC workshops. Furthermore, Dr Gaudian holds an LLM degree in Environmental Law and Management, giving a deeper understanding of law and policy dealing with such relevant issues as the Common Fisheries Policy, water and waste management, and international environmental law including EU environmental policy.

Expert advisor: Paul Macintyre

Paul started working in the Aquaculture sector in 1975, managing salmon farms and processing factories for a large multi-national before transferring in 1990 to aquaculture audit and inspection.

During the last 25 years Paul has carried out over 3,000 audits and inspections of aquaculture and fish processing operations across the UK salmon and trout industry and internationally in the cod, tilapia and shrimp aquaculture sectors. Paul's primary interest is salmonids however his role as Aquaculture Director with Acoura Marine has involved him in the development and trial audit of a number of new aquaculture and agricultural standards.

Paul is a qualified Lead Assessor and approved to audit BRC, MSC / ASC Chain of Custody, GlobalGAP, Organic Aquaculture, Freedom Food, Label Rouge, Best Aquaculture Practices, ASC Salmon and Friend of the Sea. Paul also audits to UK and French retailer standards.

2.1.1 Peer Reviewers

Peer reviewers used for this report were PR1 and PR2. Summary CVs for the short listed peer reviewers from the peer review college are available below and further details are in the [Assessment downloads](#) section of the fishery's entry on the MSC website.

Deirdre Hoare

Deirdre Hoare is an independent fisheries consultant with more than 10 years of experience working in a wide range of projects associated with marine biodiversity and the sustainable use of living aquatic resources. Her principal area of expertise is in relation to stock assessment and ecosystem impacts of both artisanal and commercial fisheries. Her work currently involves evaluation and verification of fisheries management and sustainability against international standards. She also performs fish stock assessments, evaluates data and outlines the limitations.

From 2005 to 2010 she worked as a Fisheries Assessment Analyst and as a Scientific and Technical Officer for the Marine Institute in Ireland. This work involved fisheries research and stock assessment for ICES working groups. The work also involved coordination and management of a Fisher Self sampling program in the Irish Sea, with particular emphasis on spatial and temporal discard measurement tools.

As well as having worked as a researcher, she completed many trips on commercial fishing vessels in the capacity of scientific observer in the NAFO area, North West Atlantic and Irish Coast. She has also experience on finfish and shellfish aquaculture that she gained working in Scotland. She has also worked under contracts for SAI Global on assessments against the FAO Responsible Fisheries Management and Marine Stewardship Council in Iceland, Alaska and Ireland.

Earl Dawe

Mr Earl Dawe retired in 2015 following a 35-year research career with Fisheries and Oceans Canada which focused on the fisheries, biology, population dynamics, and ecology of cephalopods and crustaceans. He has published 170 scientific/technical reports and journal articles (58 in the primary, peer reviewed literature) on various aspects of population biology and ecology as well as fishery resource assessment and management of both short-finned squid and snow crab. Research effort has most recently focused on ecosystem structure and functioning, particularly the relative effects of ocean climate versus predation on finfish and crustacean resources. Earl's career included heavy involvement in the review and formulation of scientific advice for management of shellfish resources in Atlantic Canada as well as the advisory/consultative part of managing the Newfoundland and Labrador (NL) fisheries for short-finned squid and snow crab. He has recently participated as a scientific advisor in the MSC certification of the NL snow crab fishery as well as recently served as peer reviewer in MSC certification of the Western Asturias octopus trap fishery.

Kevin Stokes

Dr Kevin Stokes is a fisheries science, management, and policy consultant with extensive international experience. He has worked at senior management levels in public and private sectors as a scientist, manager, and advisor. Before going to New Zealand, he was responsible for all finfish monitoring, assessment and advice in England and Wales, serving as chair of the EC STECF and as UK representative on the ICES ACFM. He served on multiple UK research councils, led the UK scientific delegation to and served as UK Alternate Commissioner to the IWC. Dr Stokes also worked as Chief Scientist for the New Zealand Seafood Industry Council for 9 years, responsible for science policy and process and advice on all fisheries matters. He has worked on a wide range of fisheries and environmental issues and has provided advice nationally and internationally at senior government and non-government levels. Since 2008, he has worked as a consultant on fisheries, governance and other issues. He has worked across the globe providing technical reviews, programme review and design, certification assessment, governance review and design, Ecological Risk Assessment design, and sustainability advice.

In 2007 Dr Stokes participated in the MSC Quality and Consistency project, reviewing advice on development of the new P1 CR, and as part of the group that led development of the P2 and P3 CR. He has undertaken numerous MSC pre-assessments as well as acting as an assessor, auditor, and peer reviewer for certification assessments ranging from prawns to tunas.

Neil Campbell

Dr Neil Campbell, having worked in the field for twenty years, has considerable experience across a wide range of fisheries science and management areas. He has worked on age- and length-based assessment of shellfish during his time as a population modeller with the Scottish government; assessment of data-poor deep water stocks, and the assessment of widely dispersed, transboundary demersal and pelagic stocks. He is also familiar with the assessment of impacts of fisheries on vulnerable marine ecosystems, through his work with NAFO's ecosystem assessment group, and with the FAO VME database. His work also encompasses the science-compliance boundary, analysing vessel monitoring data to investigate behavioural changes brought about by changes in regulation, developing discard mitigation measures, and the use of CCTV systems as enforcement and research tools.

Dr Campbell's work with the MSC has been similarly diverse, acting as a peer-reviewer for fish and shellfish assessments, as a stakeholder, representing NAFO's scientific council and presenting the most recent advice and stock status to assessors during a field visit, and as a consultant, working on the creation of a global database of stock status.

2.2 RBF Training

Julian Addison has been fully trained in the use of the MSC's Risk Based Framework (RBF), in the latest version of the certification requirements (v2). In addition, both Tristan Southall and Gudrun Gaudian have excellent understanding and experience of the RBF and were fully trained in its use with the previous version of the standard (v1.3). Tristan Southall has been involved in piloting and reviewing some of the RBF tools prior to adoption by the MSC.

3 Description of the Fishery

3.1 Unit(s) of Assessment (UoA) and Scope of Certification Sought

Lloyd's Register have been contracted to undertake an MSC fishery assessment on the fishery defined below (the Unit of Assessment):

Species:	Brown Shrimp (<i>Crangon crangon</i>)
Stock:	UK East coast from and including the Humber to the Thames.
Geographical area:	The Wash, ICES Area IVc, FAO Area 27 - ICES statistical rectangles 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1
Harvest method:	Beam Trawl
Client Group:	Beam trawl vessels operated by Shrimp Producers Organisation Ltd.
Other Eligible Fishers:	Independent shrimp fishers outside the client group would be eligible to join the certificate if signed up to the Wash Brown Shrimp management plan and code of conduct, and through agreement of the SFAWG by majority vote.

This Unit of Assessment was defined in accordance with wishes of the fishery client, following a previous MSC pre-assessment and a fisheries development project.

Lloyd's Register Confirm that the fishery defined in the Unit of Assessment (above) is within scope of the MSC certification requirements¹ and is therefore eligible to be assessed against the MSC fisheries certification standard.

3.2 Proposed Unit of Certification (UoC)

The proposed Unit of Certification for this fishery is as unchanged from that defined at the start of the assessment process and defined above in the UoA. For the avoidance of doubt, details of the technical measures and operational practice:

Species:	Brown Shrimp (<i>Crangon crangon</i>)
Stock:	UK East coast from and including the Humber to the Thames.
Geographical area:	The Wash, ICES Area IVc, FAO Area 27 – ICES statistical rectangles 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1

¹ The fishery is considered to be within scope because:

- it does not operate under a controversial unilateral exemption to an international agreement,
- it does not use destructive fishing practices,
- it does not target amphibians, birds, reptiles or mammals and is not overwhelmed by dispute);

In addition, the fishery:

- has not failed in assessment in the last two years;
- does not catch IPI stocks;
- has not been enhanced (either by restocking or habitat enhancement);
- is not based on an introduced species;
- has not been prosecuted for violations against forced labour laws.

Harvest method:	Beam Trawl – as defined in the Wash Brown Shrimp Management Plan.
Client Group:	Beam trawl vessels operated by Shrimp Producers Organisation Ltd.
Other Eligible Fishers:	Independent shrimp fishers outside the client group would be eligible to join the certificate if signed up to the Wash Brown Shrimp management plan and code of conduct, and through agreement of the SFAWG by majority vote.

3.3 Final UoC(s)

Species:	Brown Shrimp (<i>Crangon crangon</i>)
Stock:	UK East coast from and including the Humber to the Thames.
Geographical area:	The Wash, ICES Area IVc, FAO Area 27 – ICES statistical rectangles 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1
Harvest method:	Beam Trawl – as defined in the Wash Brown Shrimp Management Plan.
Client Group:	Beam trawl vessels operated by Shrimp Producers Organisation Ltd.
Other Eligible Fishers:	Independent shrimp fishers outside the client group would be eligible to join the certificate if signed up to the Wash Brown Shrimp management plan and code of conduct, and through agreement of the SFAWG by majority vote.

3.3.1 Total Allowable Catch (TAC) and Catch Data

Table 1. TAC and Catch Data

TAC	Year	No TAC in the Wash Brown Shrimp Fishery		
UoA share of TAC	Year			
UoC share of total TAC	Year			
Total green weight catch by UoC	Year	2017	Amount	750,197 KG
	Year	2018	Amount	1,102,593 KG

3.4 Overview of the fishery

3.4.1 Client Group

The Client Group for this fishery assessment is Shrimp Producers Organisation Ltd². This is a Private limited Company, incorporated in the UK in 2012 (company number 07945155). This is a company set up by the two King's Lynn shrimp buyers (Lynn Shellfish Ltd. and John Lake Shellfish Ltd.) with a representative of each processor being the sole officers of the company. Both processors also own and operate a number of shrimp vessels. In addition, the client group includes a number of privately-owned vessels which land shrimp to one or other of these processors³. It is a condition of landing to either Lynn Shellfish Ltd. or John Lake Shellfish Ltd. that the vessel is signatory to and compliant with the Wash Shrimp Management Plan (Poseidon (2017)). This is therefore a pre-requisite for market access.

All shrimp is exported to the EU market with Lynn Shellfish Ltd supplying Heiploeg and John Lake Shellfish supplying Klaas Puul Ltd.

3.4.2 Fishing Operations & Fleet Characteristics

The Wash brown shrimp fishery is operated by UK registered vessels using a beam trawl. A number of regulations are in place with additional requirements placed upon the fleet in the Wash Brown Shrimp Fishery Management Plan that all vessels in the client group are signed up to:

	Wash Brown Shrimp Management Plan
Maximum Vessel Size	As per IFCA byelaw: >15.24m in length are prohibited within 3 nautical miles of the coast, with the exception of vessels with dispensation based on historical rights
Maximum Engine Power	221 kw
Maximum aggregate beam length	18m
Minimum cod end mesh size	no less than 22 mm (UK legislation is 16mm)
Use of 70mm mesh veil	Compulsory on vessels over 8m

The majority of the Wash fishing fleet operate from Kings Lynn, although a significant number also operate from Boston. More minor landing may occur in Wells, Lowestoft, Grimsby or Brancaster. All catch is graded at the 2 processing facilities in Kings Lynn. There are no grading facilities in Boston, so landings to Boston are transported by road to Kings Lynn.

Access to the fishing grounds from both ports is significantly constrained by the tide. For many vessels, in particular the smaller vessels with less capacity for keeping catches refrigerated, a single trip will consist of a single tidal cycle (12 hours) but some of the larger vessels have the capacity to undertake fishing trips of several days. Vessels tow for shrimp at relatively slow speeds (2-3 knots) and tows are relatively short (less than an hour per tow). Fishing occurs over sandy ground often close inshore and experienced skippers, with expert knowledge of the shifting sediments and sand banks are able to fish in very shallow waters.

² This is not a Producer Organisation (PO) as defined by EU Common Organisation of the Market Legislation.

³ It is understood that no other significant shrimp buyer with grading facilities exists either in the area or elsewhere in the UK. As a result, all catches of shrimp are likely to pass through these 2 companies (with the exception of cottage-scale processing and sales).

Figure 3.4-1: Typical vessels in the Wash brown shrimp fleet, docked at Kings Lynn. The quayside dries out at low water and the vessels are grounded. Images by T. Southall.



The Wash Fleet comprises of vessels ranging from 8m to 18m and between 50 to 221Kw. Brown shrimps are targeted using bottom trawls. Data from the site visit indicates approximately 30% of the fleet are under 10m, 60% are between 10 and 15m and 10% are over 15m.

The mouth of the net is held open by a beam, with skids at either end. Most vessels are twin rigged, meaning 1 beam will be deployed from either side of the vessel. There is no ground chain or tickler chain on the underside of the net, instead bobbins or rollers are fitted to enable to get to pass over the ground without snagging. Catching small shrimp like *Crangon crangon* necessitates the use of a small mesh net (22 mm). However, all nets are fitted with sieve or veil nets with a 70mm⁴ mesh in order to reduce the capture of larger bycatch fish species. These are cone-shaped nets inserted into the body of the trawl net which direct unwanted by-catch to an escape hole. This is a requirement on vessels with ≥8m aggregate beam width. The shrimp gear configuration does not include chain mats or tickler chains.

Once on board, the shrimp is sorted, cooked and stored. The exact mechanism for this process varies from vessel to vessel. The larger vessels, which contribute the majority of the catch have typically invested in effective on-board sieving mechanisms which are more automated and improve the efficiency with which small bycatch species and non-commercial-sized shrimps are returned overboard. Survival of discarded shrimp is reported to be high (Lancaster & Frid 2002). The catch is then boiled aboard the vessel prior to landing. The larger vessels

Figure 3.4-2: Overview map of key locations of relevance to the fishery.



⁴ There is a derogation allowing vessels below 8m LOA to tow a trawl net without a sieve net fitted.

have invested in more advanced cooking and refrigerated storing facilities on board.

3.4.3 Fishing location

These vessels target brown shrimp in the shallow waters of the Wash and the inshore waters of Eastern England. The highest concentration of activity occurs in the Wash and on the North Norfolk coast. Although most activity takes place within the jurisdiction of the Eastern Inshore Fisheries & Conservation Authority (EIFCA), which extends to 6nm from the UK baseline, some activity does extend beyond, although all activity is within 12nm of the UK baseline. In addition, a small amount of activity may occur in the inshore waters to the North of the Wash which may extend into the jurisdiction of the North Eastern Inshore Fisheries & Conservation Authority (NEIFCA) jurisdiction. The stock⁵ and fishery have therefore been defined in the stock assessment and management plan by the ICES statistical rectangles that catches occur in.

In practice all⁶ catches of brown shrimp within these waters are landed to the 2 processors which make up the client group (with some landings being transported to Kings Lynn by road). As a result, the Shrimp Wash Brown Shrimp Management plan is designed to be a cohesive management arrangement designed to ensure compliance of all vessels within the client group with the management plans conditions whether they are fishing in the EIFCA jurisdiction or beyond.

Figure 3.4-3: Operational images from the shrimp trawl fishery: a) The shrimp trawl about to be deployed; b) the catch in the hopper, prior to sorting; c) the rotary sieve in operation (all images: T. Southall); d) the sieve net configuration(Seafish

<http://www.seafish.org/rass/index.php/profiles/brown-shrimp-in-the-the-wash-eastern-england-light-beam-trawls/?ps=bycatch>)

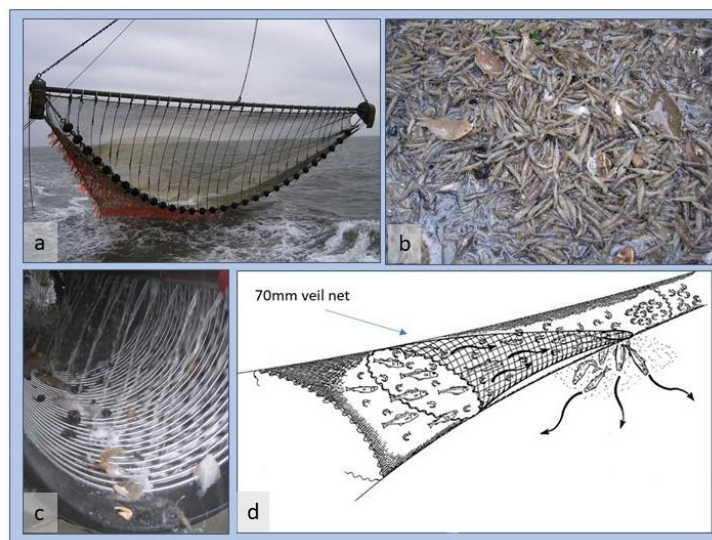
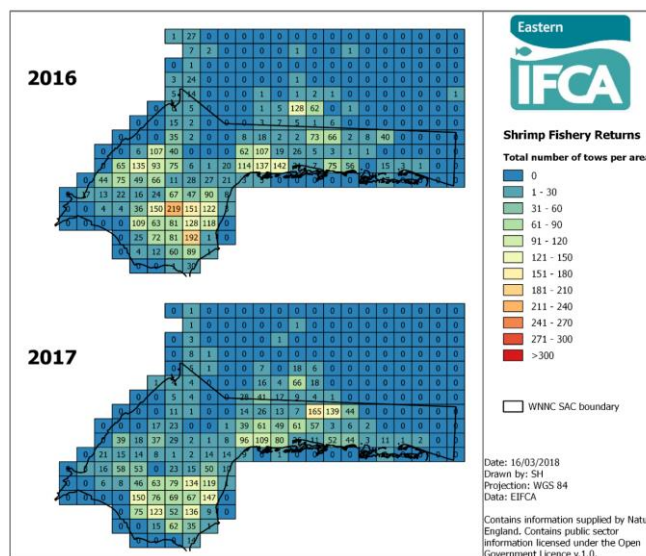


Fig 3.4-4: Total of number of tows of the shrimp beam trawl fishery. Aggregated data from logbook returns. Data is indicative not comprehensive. Source: Quinn (2018).



⁵ See report section 3.5 for discussion about the rationale for the stock definition.

⁶ There is a small catch of brown shrimp which is processed on a local 'cottage' scale locally. The scale of these other catches, and the implications that this has for stock assessment and stock management are discussed later in the report in relation to Principle 1.

3.5 Principle One: Target Species Background

3.5.1 Biology and Life History of Brown Shrimp (*Crangon crangon*)

Taxonomy and distribution

The brown shrimp, *Crangon crangon*, is a decapod crustacean of the family Crangonidae, which is distributed from Iceland in the North Atlantic (Gunnarson *et al.*, 2007) to the North Sea and Baltic Sea (Dornheim, 1969), but is also found in the Black Sea and Mediterranean (Labat, 1977). The primary habitat of *Crangon* is soft bottom substrates but it is also found on sandy shores (Beyst *et al.*, 2001), and although it is generally found close to the coast in shallow waters, *Crangon* may be found throughout the North Sea, although shrimp abundance is very low below 40m water depth (Callaway *et al.*, 2002). *Crangon* exhibits high tolerance and adaptability being found from near-freshwater estuaries to salinities up to 30 psu, and in environments where temperatures may range from 0° to 35° C. Bottom-up factors such as habitat limitation have been cited as the main population driver (e.g. Kuipers and Dapper, 1981) as preliminary analyses suggest only very weak relationships between stock biomass and future recruitment (ICES, 2003).

A series of genetics studies showed that gene flow in *Crangon* is established primarily by oceanographic barriers and that the population is well mixed over large areas and particularly within the North Sea (Bulnheim and Schwenzer, 1993; Weetman *et al.*, 2007; Luttikhuisen *et al.*, 2008). In the most recent study, Luttikhuisen *et al.* (2008) revealed four groups: north-eastern Atlantic including the whole North Sea, western Mediterranean, Adriatic Sea and Black Sea, suggesting a single stock in the area prosecuted by the North Sea brown shrimp fishery. The conclusions from the genetic studies are backed up by the observed extensive migrations and larvae drift of *Crangon* both of which favour genetic exchange between areas. Connectivity studies investigating drift, selective tidal stream transport and migration patterns demonstrate that adult shrimp populations in the North Sea between 5 and 40 m depths provide the larvae recruitment to all areas of the eastern North Sea (Temming *et al.*, 2013). However drift studies suggest that larvae recruiting on the Dutch coast may originate from a different source to that on the German and Danish coast, and therefore in the eastern North Sea there may be some sub-structure within the *Crangon* stock.

In conclusion whilst brown shrimp in both the western North Sea off the UK coast and in the eastern North Sea from Denmark south to France are considered to be a single stock, the geographical separation of the UK fisheries from those on the eastern side of the North Sea, coupled with the low likelihood of adult brown shrimp moving between the eastern and western sides of the North Sea suggests that the UK coastal fisheries should be assessed separately from eastern North Sea fisheries.

Life cycle

Extensive studies of the life history of *Crangon* have been undertaken in the eastern North Sea, and whilst life cycle dynamics may vary geographically over the distributional range of *Crangon* (ICES, 2015), the description provided below matches observations on *Crangon* in The Wash and surrounding areas.

Egg-bearing (berried) female shrimps are present in the population throughout the whole year, but are less common in the autumn than other times of the year (Kuipers and Dapper, 1984). Female length at maturity is reached within one year at around 55 mm length, when 50% of females will carry eggs. Fecundity of the mature females ranges from 2,000 to 10,000 eggs depending on size of female. Egg production can be separated into summer and winter eggs with the size and number of eggs dependent on season. Egg development is temperature dependent with larvae hatching after 18 to 45 days (Redant, 1978). Following hatching, the larvae remain in the pelagic environment for around one month (Criales and Anger, 1986) going through five instars prior to becoming post-larvae, after which the juveniles become the first benthic stage in the life cycle. Juveniles of 7 to 15 mm length originating from winter egg

production (Temming and Damm, 2002) move into the shallow coastal waters in late spring or early summer (Boddeke, 1976). These shallow, high-temperature nursery areas provide abundant food and shelter from predation resulting in high growth rates (Boddeke *et al.*, 1986). As the shrimps grow, they migrate to deeper areas from the tidal flats and juveniles of 20 to 30 mm length are found in sub-littoral areas and tidal gullies (Beukema, 1992). Size of shrimp is therefore correlated with water depth with most adult shrimp found in water between 5 and 30 m (Kuipers and Dapper, 1981). Changes in habitat and water depth with size are described in Figure 3.5-1.

The first large recruitment wave from the winter egg production is followed by a series of smaller recruitment waves, which originate from the spring and summer spawnings, which benefit from shorter egg development times and larger numbers of eggs produced in the warmer temperatures. Growth rates are sex-specific with commercial catches (shrimps > 50mm) dominated by females. The faster growing individuals from the winter egg recruits produce a steep increase in commercial catches in August and September. Shrimp from this cohort do not carry eggs until November, and this egg production is based upon shrimps that survive the autumn fishery or from slower-growing individuals which were not commercial size during the autumn fishery. The surviving larger shrimp will also spawn again in spring and early summer and become the target of the winter and spring fisheries. The maximum observed length of shrimp from scientific surveys is 109 mm, but the average asymptotic length is 79 mm. Brown shrimps are generally short-lived (1.5 – 2.0 years) but within the fishing area, coefficients of total mortality from both predation and fishing is very high, so very few individuals in each cohort survive for longer than a year.

There is no recruitment index for the brown shrimp stock, and preliminary analyses suggest only a very weak relationship between stock biomass and future recruitment (ICES, 2003). The environment in The Wash is highly dynamic and recruitment is much more likely to be driven by environmental factors such as freshwater run-off than by exploitation rates in the fishery. The system's carrying capacity is likely to be the main factor limiting populations evidenced by the observation in the eastern North Sea that the stock recovered from its lowest observed stock level in 1990 in less than two years (Berghahn, 1996).

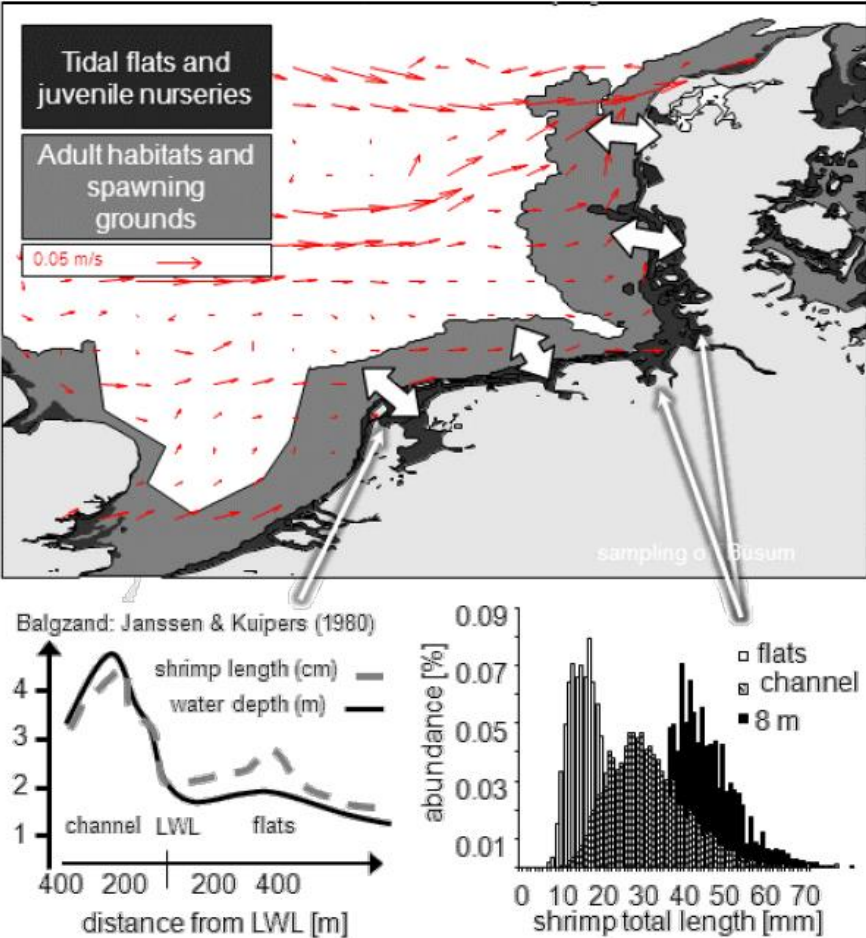


Figure 3.5-1. Diagrammatic representation of change in habitat and depth with size of Crangon. Arrows on upper figure represent average annual currents based on HANSOM oceanographic model. Lower panels represent relationship between shrimp size and depth from Janssen and Kuipers (1980) study in Dutch Balgzand area and sampling on German coast by Hufnagl *et al.*, 2010. (Source: Temming *et al.*, 2013)

Feeding and predators

Crangon crangon feeds on polychaetes, molluscs, small arthropods and fish, and may also consume algae especially *Ulva lactuca* and *U. intestinalis* (Dolmer *et al.*, 2001; Kamermans and Huitema, 1994; Oh *et al.*, 2001). Crangon is an important prey species for a number of predators, including small fish, birds and the shore crab (*Carcinus maenas*). Small fish predators such as goby, (*Pomatichistus microps*), common seasnail (*Liparis liparis*) and the armed or hook-nosed bullhead (*Agonus cataphractus*), feed on smaller rather than larger shrimp with the majority of their prey between 10 and 30 mm in length (Redant, 1978; Jansen, 2002). Other significant larger fish predators include whiting (*Merlangius merlangus*), cod (*Gadus morhua*), dab (*Limanda limanda*) and pouting (*Trisopterus luscus*) of which whiting is the most important predator due to its regular large year-classes. With the exception of those shrimp preyed upon by cod (Daan, 1989; Jansen, 2002) most shrimp consumed are less than 50 mm in length. The fishery generally targets shrimps greater than 50 mm in length, although smaller shrimps may be landed. There is some competition for shrimp therefore between natural predators and the fishery, although mortality from the fishery primarily follows sequentially from predation. The fishery may therefore be less successful in years such as 1990 when there has been an outburst of gadoid species.

Role of *Crangon crangon* within the ecosystem

Brown shrimp is a low trophic level (LTL) species, and so it is necessary to determine whether Crangon is a key LTL as defined by paragraphs SA2.2.8-SA2.2.10 of the MSC Fisheries Certification Requirements v2.0. This question has been considered previously by Temming *et al.* (2013), by the ICES Workshop on the Necessity for Management of Crangon and Cephalopods (WKCCM) and by ICES in response to a special request by Germany and the Netherlands on the potential need for management of brown shrimp in the North Sea (ICES, 2014).

Crangon could be considered as a key LTL stock if it meets two of the following criteria as set out in SA2.2.9ai-iii:

- A large portion of the trophic connections in the ecosystem involves this stock, leading to significant predator dependency;
- A large volume of the energy passing between lower and higher trophic levels passes through this stock;
- There are few other species at this trophic level through which energy can be transmitted from lower to higher trophic levels, such that a high proportion of the total energy passing between lower and higher trophic levels passes through this stock (i.e. the ecosystem is 'wasp-waisted')

To assess whether Crangon meets these criteria, it is important to consider the geographical scale at which the trophic connections of Crangon are evaluated. As noted above, lack of any genetic differentiation between Crangon stocks in the North Sea and studies of larvae drift confirm connectivity between Crangon populations across wide geographical areas, suggesting that the distribution of the Crangon stock should be considered as the whole North Sea. In relation to the above criteria, most predators of Crangon could be considered to be opportunistic feeders, and therefore there are likely to be many trophic connections involving

the Crangon stock, although energy flow across the connections may be low. An Ecopath model of the North Sea (Mackinson and Daskalov, 2007) considered all shrimp species as a functional group, but assuming that Crangon accounts for around one third of that biomass, the model estimated that as food for predators Crangon represents approximately $0.2 \text{ t/km}^2/\text{year}^{-1}$. This is a very small figure in comparison with other consumed food such as polychaetes and small mobile epifauna, and with the channelling of energy from small fish species through to higher trophic levels of $7.8 \text{ t/km}^2/\text{year}^{-1}$, it can be concluded that there is not a major flow of energy from Crangon through to higher trophic levels. On the scale of the North Sea, Crangon cannot be considered to be a key LTL species.

On a more localised geographical scale in, for example, the Wadden Sea or The Wash, the role of Crangon in the ecosystem energy flow is also likely to be very limited. In the eastern North Sea most of the benthic production comes from microbenthic species (Baird *et al.*, 2004). Most predators in the coastal areas also occur in the wider North Sea, but some key smaller predator species such as the goby, (*Pomatoschistus microps*), are found only in the shallow coastal areas and may prey intensively on smaller brown shrimps ($< 50\text{mm}$), and so may be more dependent on Crangon as a prey item. Nevertheless even at a localised level, it is highly unlikely that Crangon in The Wash and surrounding areas is a key LTL species in terms of energy flow through trophic levels.

In addition to the criteria on trophic connections, the stock must meet all of the following criteria set out in SA2.2.9bi:

The species feeds predominantly on plankton; has a trophic level of about 3; is characterised by small body size, early maturity, high fecundity, and short life span (default values: $<30 \text{ cm}$ long as adults, mean age at maturity ≤ 2 , $>10,000$ eggs/spawning, maximum age <10 years respectively); and forms dense schools.

Whilst Crangon meets many of these life history criteria, copepods form only part of its diet, it is only very rarely that individuals grow to a size (i.e. over 80 mm) at which they have $10,000$ eggs per spawning (Temming *et al.*, 2013), and Crangon does not form dense schools. It can be concluded that Crangon does not meet all of these life history criteria.

In summary, in terms of energy flow between trophic levels and life history traits it can be concluded that at the scale of the fishery, Crangon cannot be considered to be a key LTL species, a conclusion drawn also by Temming *et al.* (2013) and ICES (2013, 2014).

3.5.2 History of the fishery and its management

Landings of brown shrimp for consumption (known as consumption shrimp) in the North Sea have been reported since the 1950s, but initially the records were for the German fleet only, with landings from Dutch, Belgian, Danish and UK fleets first recorded in the 1970s, and landings by French vessels included post-2000. The ICES Crangon Working Group (WGCRAN) considers that it is only since 1994 that reported landings are complete and reliable. Since 1994, landings of shrimps have continued to increase, and in most recent years, landings have been above $30,000$ tonnes with the German and Dutch fleets accounting for more than 80% of the overall landings (Figure 3.5-2). Total North Sea landings declined significantly in 2016 to just under $25,000$ tonnes, the lowest level for 20 years, and monitoring of the shrimp fishery and stock in the eastern North Sea confirmed that this decline in landings was due to a weak year class primarily in the German fishery area (ICES, 2017). The time trend of brown shrimp landings is characterised by three very low years in 1977, 1984 and 1990, but on each occasion, landings returned to average levels in the following year, providing evidence that recruitment was not impaired following a poor year. Landings from UK vessels, of which over 90% are landed from The Wash and surrounding areas, have fluctuated significantly over the period 1973 to 2016 (Figure 3.5-3) and continue to represent around 1.5 to 6% of the total North Sea landings (Figures 3.5-2 & 3.5-3). These fluctuations

in UK landings are in contrast to the overall increasing trend in the North Sea, and the decline in landings observed in the eastern North Sea in 2016 was not observed in the UK fishery where landings increased between 2015 and 2016. However the level of fishing activity in The Wash shrimp fishery can be responsive to market prices for shrimp, and therefore declines in landings may simply be due to low market prices.

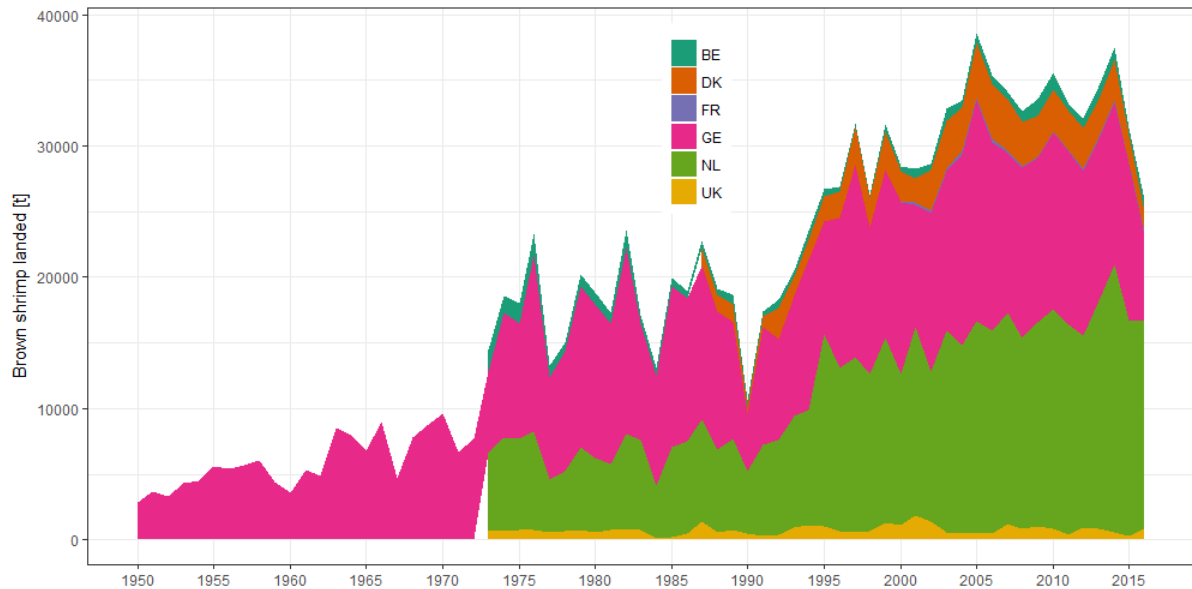


Figure 3.5-2. Total landings (tonnes) of *Crangon crangon* from the North Sea by country from 1950 to 2016. (Source: ICES, 2017).

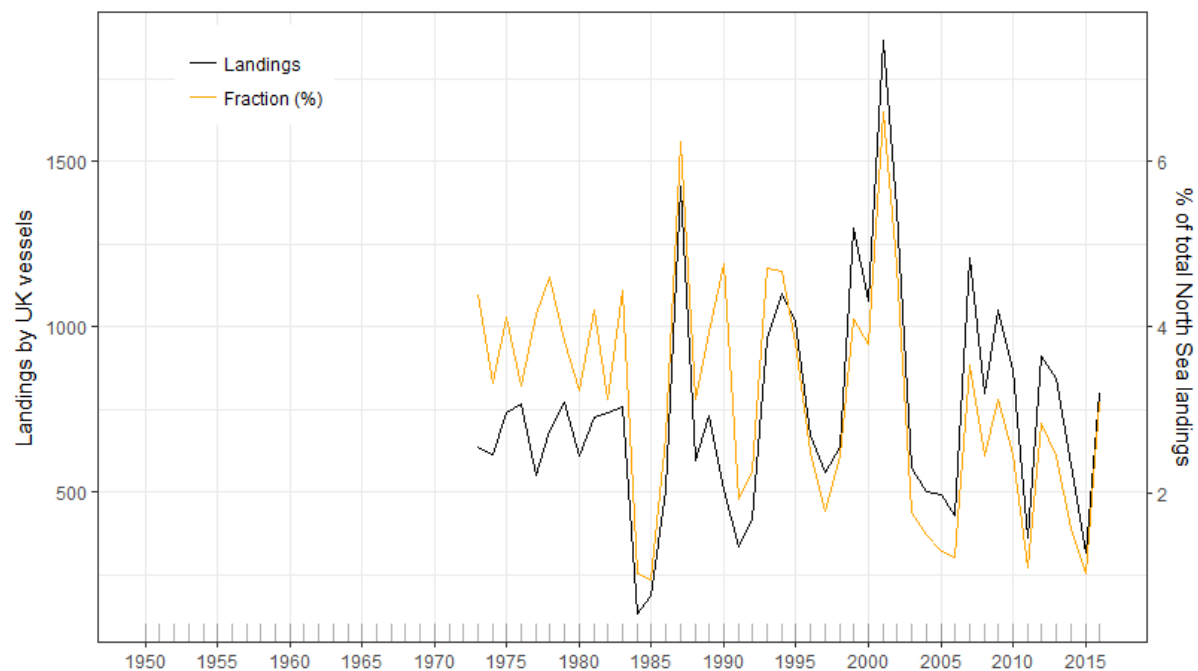


Figure 3.5-3. Landings (tonnes) of consumption shrimps by UK vessels from 1973 to 2016 (black line) and UK landings as a percentage of total North Sea landings by all countries (yellow line). (Source: ICES, 2017).

Scientific advice on management of the Crangon fishery has been provided through ICES since the first meeting of the Working Group on Crangon in 1979 (ICES, 1979). Historically the Crangon fishery was considered to be unmanaged. Restrictions on licences and some technical measures (e.g. minimum mesh size, use of sieve nets to reduce bycatch) had been

implemented but there was no quota on landings or restrictions on overall fishing effort in place. One of the main reasons that Crangon stocks were unregulated was that historically natural mortality of commercial size shrimps (>50mm), primarily through predation, was considered to be significantly higher than fishing mortality and that therefore management of the exploitation rate in the fishery was not considered necessary. In recent years, predator abundance has declined, and new research in the eastern North Sea fisheries suggested that fishing mortality had become the principal component of total mortality in the stock, and estimates of observed fishing mortality were higher than Fmsy proxies calculated from yield-per-recruit models suggesting that the population was growth-overfished.

In the light of new research, ICES convened a workshop to investigate the necessity for management of Crangon stocks (ICES, 2013), in terms of both the impact of the brown shrimp fisheries on the Crangon stock, but also the impact on other commercially-exploited fish stocks in relation to multispecies and mixed fisheries considerations. The ICES Workshop noted that previously it had been considered that the Crangon stock could not be easily overfished because natural mortality was significantly higher than fishing mortality. This conclusion was based on the stock being swiftly re-built after the very low year in 1990, little or no relationship between stock size and recruitment and the analysis by Welleman and Daan (2001) which showed that total landings of shrimps were low in comparison with shrimps consumed by predators. The ICES Workshop concluded that the shrimp population is “bottom-up” controlled by the carrying capacity of the habitat and that there is currently no recruitment overfishing. The analysis of Welleman and Daan (2001) has since been updated by Temming and Hufnagl (2014) who concluded that landings of commercial-sized shrimps now exceed the number eaten by predators, primarily due to the decline in predator abundance.

Whilst there is still no evidence that the shrimp stock is recruitment overfished, there is substantial recent evidence from studies in the eastern North Sea that the stock could be considered to be growth overfished.

- The current estimate of fisheries induced mortality is about 3 to 5 times that of predator induced mortality. In comparison a recent meta-analysis of fisheries data by Zhou *et al.* (2012) estimated that Fmsy was 0.87 times the natural mortality rate across a range of species/fisheries.
- In the 2010-2011 season most of the fleet were “on strike” and stopped fishing in April and May 2011 in response to very low prices. LPUE increased dramatically after the strike, even after correcting for the strong 2010-2011 year class, confirming that a reduction in fishing effort led to an increased LPUE immediately on resumption of fishing and that reduced mortality on undersized shrimps can also lead to increased yields.
- In the eastern North Sea estimates of observed fishing mortality (F) exceeded values of Fmax (the fishing mortality at which the maximum landings can be achieved) derived from a yield-per-recruit model developed specifically for the brown shrimp stock (Temming & Damm, 2002; Hufnagl & Temming, 2011) thereby indicating growth overfishing.
- The demographic structure of the shrimp stock in the eastern North Sea appears to have changed in recent years. The fraction of shrimps larger than 60 mm and larger than 70mm has declined significantly. This is likely to be due to increased mortality, but may also be due to higher productivity in the 1980s when there were high levels of eutrophication. With mean-length-at maturity around 55 mm (Oh *et al.*, 1999) and the number of eggs increasing with increasing size of shrimps, the reduction in fraction of larger shrimp in the population would cause a reduction in egg production.
- Estimates of total annual production in the eastern North Sea using the swept area method suggest that in some years, landings may be equivalent to the total annual production (Tulp *et al.*, 2016).

Following the ICES Workshop (ICES, 2013) and based on the above evidence, ICES advised that management incorporating a reduction in fishing effort would be beneficial because of the currently observed growth overfishing, would lessen the environmental impact of the fishery, and in the long term management would be advisable if main predator stocks such as whiting and cod recover (ICES, 2014). ICES did warn however that for a short-lived species, management would need to be on a short time scale which would inevitably have time and resource implications.

ICES advised that the development of a harvest control rule (HCR) based on a comparison of the most recent commercial landings per unit effort (LPUE) data with pre-defined trigger levels (based on previous LPUE data) was the most appropriate approach for this short-lived species for which a conventional age-based stock assessment is not possible because the vast majority of the annual catch has recruited to the fishery during that year. ICES noted that such an approach follows the general principle of a precautionary approach aimed at guaranteeing an escapement biomass.

In addition to addressing potential management approaches for the Crangon fishery, ICES also advised that Crangon should be taken into account within the framework of ICES advice regarding North Sea mixed fisheries because of the significant bycatch of other species in the small-meshed net Crangon fisheries, and in relation to multispecies interactions because future recovery of gadoid populations could have an impact on shrimp population dynamics.

In response to the ICES advice, a management plan for the brown shrimp fishery in the eastern North Sea was developed by the fishing industry through the Producer Organisations in the Netherlands, Germany and Denmark. The Management Plan sets out details of the harvest strategy including (a) the development of reference points and harvest control rules (HCRs) and proposed increases in the mesh size of the cod-end, (b) an ecosystem approach to management of the fishery through considering alternative methods for reducing unwanted bycatch and the recording of captures of all ETP species and (c) the management structures and processes and the regulations applying to vessels in the Management Plan, links with the North Sea Advisory Council (NSAC), monitoring control and surveillance, and the penalties applied for infringements against any of the rules in the management plan (Brown Shrimp Management Plan, 2016).

Alongside the ICES advice on developing a management plan for Crangon and the management plan drawn up by the fishing industry, in 2015 WWF produced an advisory document to inform a long-term management plan for the brown shrimp stocks in the North Sea. The advice was based on a review of management goals for tropical shrimp trawl fisheries (Macfadyen *et al.*, 2013), but made specific recommendations for the North Sea brown shrimp fishery including the need for increased data and knowledge particularly on the ecosystem effects of shrimp fishing, a reduction in fishing capacity and intensity, increased monitoring and reduction of bycatch and discards, the need for increased spatial closures to address the impacts of shrimp fishing gear on benthic habitats, and increased control and enforcement.

Whilst the scientific evidence on the potential of growth over-fishing presented above relates to the brown shrimp stock in the eastern North Sea, the interpretation of the evidence is highly relevant to the UK fishery in The Wash and the requirement for management of the fishery. The Management Plan put in place for the eastern North Sea fishery has provided a template from which a new management plan has been developed by the shrimp fishing industry in The Wash. The fishing industry's Management Plan for The Wash brown shrimp fishery is described in detail in section 3.7.3.

3.5.3 Harvest strategy

EU, national and local legislation and regulations

The overarching legislation under which the harvest strategy for the brown shrimp fishery within UK territorial waters has been developed is the EU's Common Fisheries Policy (CFP) which was revised under EU Regulation No. 1380/2013 and came into effect on 1 January 2014. The CFP places requirements on member states to balance fishing capacity with the available resource and one of the key objectives is that *"the CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield."* Council Regulation (EC) No 1224/2009 establishes a Community control system for ensuring compliance with the rules of the CFP, which sets down vessel licencing requirements, stipulates the requirement for Vessel Monitoring Systems (VMS) to be installed on vessels above 12m in length and requires logbook reporting. In addition, under the European Marine Strategy Framework Directive (MSFD) Member States are required to prepare national strategies to achieve Good Environmental Status (GES) by 2020. Included under Descriptor 3 of GES is the requirement that stocks should be exploited sustainably consistent with high long-term yields, have full reproductive capacity in order to maintain stock biomass, and the proportion of older and larger fish/shellfish should be maintained (or increased) being an indicator of a healthy stock. GES is achieved for a particular stock only if all of the three attributes are fulfilled, implying that all commercially exploited stocks should be in a healthy state and that exploitation should be sustainable, yielding the Maximum Sustainable Yield (MSY). The Crangon fishery is not currently covered by the EU Landings Obligation.

Under EU regulations 850/98 and 227/2013, a series of technical conservation measures are in place for the brown shrimp trawl fishery. The mesh size of the cod end must be 16-31 mm providing a sieve (or veil) net or a separator grid are used. The sieve net is an additional net which allows shrimp to pass into the cod end, but larger fish are directed out of the bottom of the trawl. Similarly, a separator grid allows small shrimp and fish species to pass into the cod end whereas large fish cannot pass through the grid and are directed up and out of the trawl. Sieve nets are found to be much more effective in UK waters and vessels must use a sieve (or veil) net of 70mm mesh, although this regulation applies only to vessels with an aggregate beam width of ≥ 8 m. If any vessels fishing for brown shrimp in UK waters are using a separator grid, there must be a bar spacing of no more than 20 mm. Regulations require the use of riddles on board the vessels to separate out undersized shrimp and bycatch species. Riddling occurs immediately the trawl is brought on to the deck, so minimising mortality of unwanted catch of shrimps and bycatch species.

All brown shrimp fishing activity occurs within the 12 nm limit and is therefore covered by UK national legislation. Fisheries management within England is the responsibility of the Department for Environment, Food and Rural Affairs (Defra), for whom the Marine Management Organisation (MMO) is responsible for the collection of landings data and the enforcement of regulations. The UK Government has recently published a Fisheries White Paper entitled 'Sustainable fisheries for future generations' (Defra, 2018) which states that approaches to fisheries management (effort control and quota management) will be reviewed, that harvest rates will be set in order to restore and maintain fish stocks at least to levels that can produce maximum sustainable yield (MSY), and that an ecosystem approach to fisheries management will be pursued.

The overarching legislation which delegates powers to local management bodies is the Marine and Coastal Access Act 2009 (MACAA) which underpinned the creation of Inshore Fisheries and Conservation Authorities (IFCAs) as replacements for the Sea Fisheries Committees (SFCs). A memorandum of understanding (MOU) exists between MMO and IFCAs to better ensure a co-ordinated approach to management. Through MACAA, IFCAs are given the

power to manage inshore fisheries in their areas out to 6 nm via byelaws and permits. However, IFCA byelaws must be approved by Defra before implementation. Defra have provided guidance on best practice in making byelaws (Defra, 2011c) including regular review and repeal of byelaws. There is also scope for IFCA to make emergency byelaws in circumstances where management action needs to be taken immediately. Shrimp fishing within the 6nm is under the jurisdiction of the Eastern Inshore Fisheries and Conservation Authority (IFCA). The Eastern IFCA has defined its purpose and vision as follows:

“Eastern Inshore Fisheries and Conservation Authority will lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry.”

At the time of the site visit, Eastern IFCA were consulting on draft byelaws for the shrimp fishery which included control of fishing effort in response to changes in stock status identified by scientific monitoring, and on prohibiting use of beam trawls in certain areas to protect sensitive habitats. As of October 2019, these byelaws have been passed by EIFCA, but have not yet been implemented (EIFCA, pers. comm.).

EU, national and local IFCA regulations are subsumed within The Wash Brown Shrimp Management Plan 2017-2020 which has been drawn up by the shrimp fishing industry, and brown shrimp vessels are signatories to The Wash Shrimp Fishery Code of Practice. There were 58 vessels signed up to the Management Plan when it came into force in May 2017, and under the Management Plan vessels must land to the two established processors of shrimps in The Wash and surrounding areas. Whilst the Management Plan is essentially a voluntary agreement within the shrimp fishing industry, the Management Plan covers all commercial fishing vessels because the two processors will not accept shrimps from vessels that are outside the Management Plan.

The Management Plan sets out the overall management structure and responsibilities for The Wash brown shrimp fishery, detailing specific measures for managing the shrimp stock as well as other environmental interactions of the fishery. The long-term objectives are to ensure a long-term, sustainable and stable Wash brown shrimp fishery, to support a highly productive stock of brown shrimp and ensure an ecologically responsible fishery that minimises effects on the marine environment. The Management Plan defines a suite of measures to manage fishing including a harvest control rule, measures to minimise bycatch, habitat and ecosystem interactions and regular monitoring. Shrimp fishing activity within 6 nm is covered by the Eastern IFCA jurisdiction whereas the Management Plan covers ICES rectangles 33F1, 34F0, 34F1, 35F0, 35F1 and 36F0 including any fishing activity outside the 6nm limit, so the Management Plan effectively extends any IFCA regulations to cover the entire brown shrimp fishery.

The harvest strategy for the fishery includes the following elements:

- Vessels must be UK registered fishing vessels licensed to fish in The Wash fishery through national legislation and any local Eastern IFCA byelaw regulations
- Limit on the overall number of vessels in the fishery
- Limit on vessel engine power of 221 kW
- Vessels >15.24m in length are prohibited within 3 nautical miles of the coast, with the exception of vessels with dispensation based on historical rights
- Aggregate beam length restricted to 18 m (9 m each side)
- Minimum cod end mesh size of 22 mm
- Vessels are prohibited to land more than 15% of the total catch of D Grade shrimps (the smallest grade of shrimps that will pass through a 6.5 mm screen)

- Veil net with maximum mesh size of 70mm mandatory on all vessels with aggregate beam length $\geq 8\text{m}$ (currently only 3 such vessels do not use veil nets)
- Catches sorted on board vessels and unwanted catch (shrimp, non-target and bycatch species) returned to the sea immediately following sorting
- Some areas closed to shrimp trawling to protect primarily Sabellaria reefs, but no seasonal limitations on fishing for shrimp
- Regular assessments of the status of the stock
- Fishing effort controlled through harvest control rules (see below)
- A rigorous monitoring and data collection programme
- Vessels must 'hail out' prior to fishing, and 'hail in' prior to landing catch
- A rigorous control and enforcement regime

There is currently no restriction on catches through either an annual Total Allowable Catch (TAC) or individual vessel quotas, and there is no minimum landing size for brown shrimp. At present there is no limit on the number of days that each vessel is permitted to fish. Eastern IFCA have recently been consulting on two byelaws – a Marine Protected Areas Byelaw which would extend the current closed areas within The Wash and surrounding areas, and a Shrimp Permit Byelaw which may incorporate additional technical conservation measures as well as potentially limiting the level of fishing effort through, for example, a limit on the number of tows per vessel in a given time period. Such a measure would be introduced primarily to protect habitat features rather than control fishing effort for stock management reasons. At the time of writing of this report, the byelaws had not yet been implemented.

A key element of the newly-developed Management Plan is the definition of reference points and associated harvest control rules (HCRs).

Firstly, fishing capacity of the shrimp fleet will be maintained at a target level of fishing power calculated as the current sum of each vessel's aggregate beam length (m) multiplied by engine power (kW). In relation to the 58 vessels within the Management Plan at the time of the Plan's implementation, this equates to a total fishing power within the fleet of 100,000 kWm. Entry into the fishery will be strictly controlled to ensure that this fleet capacity is not exceeded, and a fleet inventory will be produced and updated on a regular basis to ensure that this capacity cap is not exceeded through 'technological creep'.

Secondly an HCR annual index would be calculated each year using catch and effort data over approximately 30 days during the peak recruitment period in October/November standardised to a reference vessel. The reference point for the index would be based on an estimate of the expected recruitment distribution, with a reduced effort intervention at 40% of the recruitment mode. In this way a single measure would be taken each year to determine the strength of recruitment with the trigger point being 40% of the catch rate expected at the peak of the season. If the annual index drops below this trigger level, then fishing effort would be reduced by closing the fishery for 7 days in each 14-day period throughout the forthcoming season until the start of the next peak recruitment period in the following October/November.

As described below in section 3.5.4, the stock assessment evaluates stock biomass in relation to 40% of unexploited biomass ($0.4B_0$) which is conventionally used as a target reference point consistent with B_{MSY} , and 20% of unexploited biomass ($0.2B_0$) used conventionally as a limit reference point below which recruitment is likely to be impaired. However it should be noted that these reference points have not been formally adopted in the Management Plan.

The main objective of the harvest strategy is to ensure that each cohort is harvested in such a manner as to minimise the likelihood of both recruitment and growth overfishing. A key element of the harvest strategy designed to avoid recruitment overfishing is one of "constant escapement", i.e. to ensure that sufficient female shrimps in each cohort survive to generate sufficient egg production for future recruitment. The harvest control rule allows this to occur

by reducing the exploitation rate when the main autumn recruiting cohort is small, thereby allowing females to grow larger which coupled with an exponential relationship between egg production and shrimp size ensures that recruitment does not fail. Evidence from both modelling and empirical studies shows that higher catch rates are achieved in the short term following a reduction in fishing effort, so the harvest control rule will also safeguard against growth overfishing. In addition, the Management Plan sets a minimum cod end mesh size of 22 mm, which is well above the requirement of 16 mm within EU and UK legislation, and the cod end mesh size will be reviewed periodically based on the best available scientific data. The mesh size requirements minimise the likelihood of growth overfishing in shrimps and reduces bycatches and discards and are the key element of the Management Plan's objective to minimise and monitor the catching and discarding of smaller brown shrimp, non-target species and by-catch species.

Experimental studies in the eastern North Sea showed that with a 21.7 mm mesh size, the size at which 50% of shrimps are retained is 39 mm (Polet *et al.*, 2000) which means that sub-commercial sized shrimps and immature female shrimps (length at 50% maturity is 55 mm) are caught in The Wash shrimp fishery which uses a minimum cod end mesh size of 22 mm. The catch is then riddled on board the vessel and the smaller non-commercial-sized shrimp and unwanted bycatch of non-target species are discarded rapidly through a discharge chute. The riddles used in The Wash fishery generally allow for the return of shrimps below 46mm for females and 48mm for males. Survival of these discarded non-commercial-sized shrimp was estimated at 91% by Lancaster and Frid (2002).

Research studies continue to evaluate the selectivity properties of shrimp trawls. Significant reductions of discarded brown shrimp have been observed with larger cod end mesh sizes or the use of square mesh cod ends (T45), and research has focussed on veil nets, dimensions and rigging of sorting grids and the use of letter boxes which allows flatfish bycatch to escape through a transverse release hole in the net (e.g. Steenburgen *et al.*, 2011; CRANNET, 2015).

Monitoring and Data Collection

There is a comprehensive monitoring and data collection programme in place for The Wash brown shrimp fishery.

- The key information for the harvest control rules is an index of catch per unit effort (CPUE). All vessels over 10 m in length must complete an EU log book providing information on fishing effort and catches of shrimps and other bycatch species recorded by ICES rectangle. For vessels between 10 and 12m length data are provided in the form of paper records, and vessels over 12m must complete electronic log books. Information from the log book recordings must be provided in a Fishing Activity Report (FAR) every 24 hours. Vessels under 10m do not have to complete an EU log sheet but must complete Eastern IFCA shrimp returns.
- All vessels over 12m in length must be fitted with a Vessel Monitoring System (VMS) which continuously records fishing activity. Whilst this means that information on fishing activity is not comprehensive over the whole fleet, inshore VMS (iVMS) will be introduced to all vessels in 2018, and the Eastern IFCA sightings database should also help to fill any gaps in information on fleet fishing activity.
- Under the Registration of Buyers and Sellers scheme (RBS) the completion of sales notes is mandatory for all shrimp vessels irrespective of size. Processors provide records of landed weights by grade and time fished, which must be within 10% of log book estimates provided on the FAR. There is no sampling of size distributions of shrimps on the quayside (market sampling) for Crangon as the majority of the landings are from a single cohort, and therefore size distribution information would not be informative in relation to year-class strength.

- MMO carry out cross-checking of sales notes from RBS with log book records.
- An observer programme is undertaken by Cefas as part of the EU Data Collection Framework (DCF) programme. Over the period 2015 to 2017, Cefas analysed catch compositions from 13 tows. (There is no fishery-independent survey of abundance of brown shrimps or swept area production estimate.)
- Enforcement by Eastern IFCA and MMO officers occurs through boarding of vessels and quayside monitoring.
- A fleet inventory of all shrimp vessels (including information on vessel length and engine power, beam length, cod end and veil net mesh size and riddle type) will be continually updated.
- Biological information on brown shrimps in The Wash is available, and Management Plan signatories will be required to participate in any biological studies and provide data as required.

Review of Harvest Strategy

Elements of the harvest strategy are regularly reviewed at all levels of the legislative hierarchy. The overarching EU regulations are constantly being reviewed, with a full review of the CFP completed in 2013 and regular review of the technical conservation measures. The UK Government has recently published a White Paper setting out a review of approaches to fisheries management to ensure that fish stocks are restored and maintained at least to levels that can produce MSY, and Eastern IFCA regulations are continuously under review, for example through the current proposed byelaws for the brown shrimp fishery.

The Wash Shrimp Management Plan has been agreed in consultation with the shrimp fishing industry and through the Shrimp Fishery Advisory Working Group (SFAWG) whose members include industry, skippers, Eastern IFCA, MMO, Cefas, Natural England and other interested stakeholders. The SFAWG will review performance of the brown shrimp fishery including non-compliance, management and policy changes and new information that may impact on the fishery in meeting its objectives. There are specific actions stated explicitly within the Management Plan that relate to review of the harvest strategy, e.g. establish a framework for improving fishing practices and activities if and when necessary; the cod end mesh size will be reviewed periodically based on the best available scientific data; and the harvest control rules will be reviewed annually with external scientific support if necessary.

3.5.4 Stock assessment

Historical approaches to stock assessment

Crangon is a short-lived species with the vast majority of the annual catch having recruited to the fishery during that year. Routine age determination of small crustaceans is not possible and so standard age-based analytical stock assessment approaches which estimate MSY and B_{MSY} have not previously been considered to be appropriate for Crangon. The ICES Working Group on Crangon Fisheries and Life History (WGCRAN) concluded that management based on monitoring of LPUE data and subsequent effort reductions if LPUE dropped below reference levels would be the best option for managing this short-lived species.

Until the development of The Wash Shrimp Management Plan, the Crangon fishery in The Wash had not been managed. However, Cefas has provided an annual update of LPUE data to the ICES Working Group based on log book records and recorded landings. As described in Figure 3.5-3, landings of brown shrimp have fluctuated significantly since records began in the early 1970s. It should be emphasised that the level of fishing activity and subsequent landings may in some years be driven more by market considerations than changes in stock. Most of the brown shrimp caught in The Wash is exported to the European continental market

and if prices are low, then fishing activity in The Wash may be significantly reduced or stopped altogether. Despite the potential influence of market prices on annual landings, there is no evidence from Figure 3.5-3 that recruitment has been impaired in years with poor landings as landings in subsequent years appear to recover to previously-observed higher levels.

Landings of brown shrimp follow a seasonal pattern with peak landings occurring in most years from September to December (Figure 3.5-4), with a similar seasonal pattern observed across the North Sea fisheries (ICES, 2017). Landings in all months were lower in 2015 than the 10-year average, but after a poor start to the year in 2016, landings in the peak season were much higher in 2016 than 2015 and above the 10-year average. Landings per unit effort (LPUE) are a better index of stock abundance than landings. Fishing effort was very low in 2015 in comparison with the 10-year average (Figure 3.5-5) such that whilst LPUE was significantly lower in June and July than the 10-year average, in most months LPUE was similar to the long term average (Figure 3.5-6). In 2016, fishing effort was very low in the first 8 months of the year, then rose rapidly to reach a peak in November before declining significantly in December (Figure 3.5-5). LPUE was very low in 2016 irrespective of the low level of fishing activity suggesting that lower stock biomass levels in 2015 persisted into 2016, but there was clearly a strong recruitment pulse observed in the main autumn season in 2016 (Figure 3.5-6). The significant decline in LPUE in November in 2016 may have been as a result of the very high level of fishing effort in the autumn fishery resulting in much of the recruiting cohort being caught early in the autumn season.

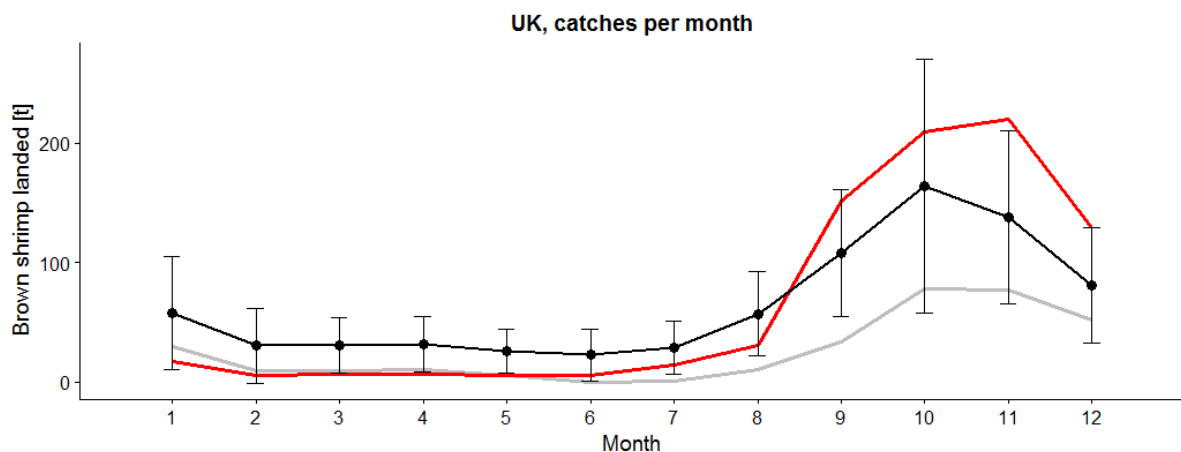


Figure 3.5-4. Landings of brown shrimps in UK by month. Black line: 10 year average and standard deviation (whiskers). Grey line: 2015, red line: 2016. (Source: ICES, 2017)

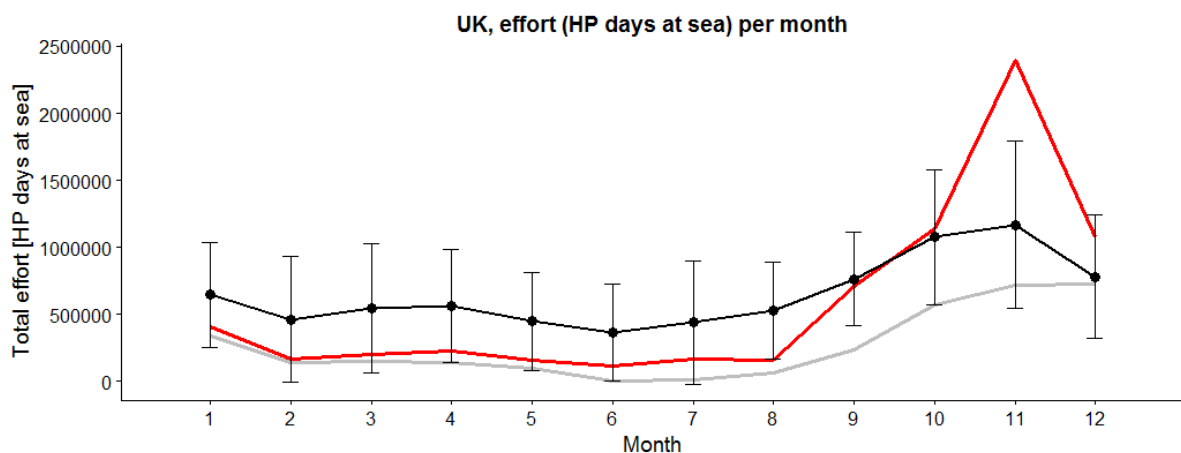


Figure 3.5-5. Monthly effort in UK brown shrimp fishery in horse power days at sea. Black line: 10 year average and standard deviation (whiskers). Grey line: 2015, red line: 2016. (Source: ICES, 2017)

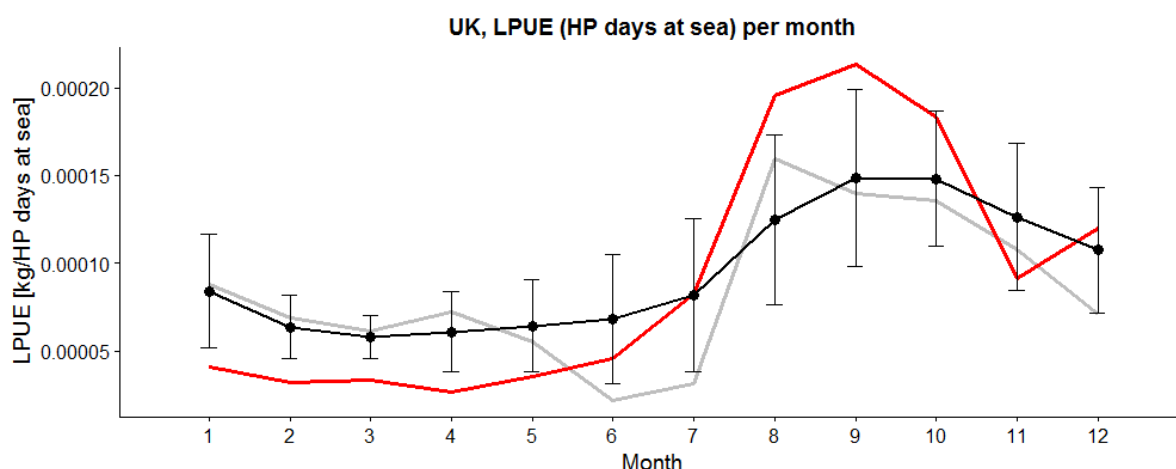


Figure 3.5-6. Monthly landings per unit effort (LPUE) in UK brown shrimp fishery in kgs per horse power days at sea. Black line: 10 year average and standard deviation (whiskers). Grey line: 2015, red line: 2016. (Source: ICES, 2017)

New approaches to stock assessment

As part of the development of a new Management Plan a new approach to stock assessment of brown shrimps has been initiated for The Wash shrimp stock (Medley, 2017).

Medley's approach uses a population model which describes growth in biomass through recruitment and growth in weight of individual shrimps in the population, and reduction in biomass through natural mortality and catches on a half-lunar month (hlm) time step. A half-lunar month is used as the time step because the fishery works around tides as the ports are tidally-restricted and this equates to a time step of approximately two weeks.

$$B_{t+1} = R_{t+1} + B_t e^{-M} - C_t e^{-0.5M}$$

$$R_t = \sum_{y=1}^Y e^{R_{\mu} + R_{\sigma} \varepsilon_y - 0.5 R_{ls} (t - 52(y-1) - R_{lm})^2}$$

where B_t = biomass at hlm t , R_t = "recruitment" as biomass in week t , C_t = observed catch, M = natural mortality, R_{μ} = mean log-recruitment biomass, R_{σ} = log-recruitment standard deviation, ε_y = recruitment yearly standard normal random effect, R_{lm} = the location of the recruitment peak within the year, and R_{ls} = the spread of the recruitment within the year.

The model describes seasonal changes in catch per unit effort (CPUE). The model was fitted to the catch and effort data from 25/07/2012 to 31/12/2016 inclusive using the log-likelihood based on the normal probability and assuming the variance is proportional to the expected catch. The data provide total removals and landings per trip. The model assumes that mortality of discarded shrimps is negligible, so that landings are considered to be equivalent to catch. (The assessment team notes that no information was available on the level of discarding in the shrimp fishery, and whilst survival rate of discarded Crangon has been estimated at 92% (Lancaster & Frid, 2002), the stock assessment model may be underestimating overall fishing mortality.) The model accounts for individual vessel

catchability. Vessel catchability was handled as a random effect, with mean log-catchability dependent on fishing power (based on net beam length and engine power). The model was fitted using a Bayesian approach which uses Markov Chain Monte Carlo (MCMC) simulations.

The model provided a reasonable explanation of the change in catch rates during the year accounting for fishing mortality, with a negative trend in recruitment over the first 4 years, but with an increase in recruitment in 2016 (Figure 3.5-7). Such trends in recruitment are difficult to interpret from such a short time series of data, particularly as recruitment in Crangon is driven more by environmental factors, such as freshwater run-off, than by fishing pressure (Siegel *et al.*, 2004; A. Lawler, Cefas, pers. comm). The model predicts that during the period from 2012 to the end of 2016 stock status has not been depleted to below 40% of its unexploited biomass ($0.4B_0$) which is used conventionally as a target reference point equivalent to B_{msy} . Diagnostics for the fit suggest no major problems for the model fit and indicate that the MCMC had converged and parameter estimates appear valid.

Fortnightly fishing mortalities broadly correspond to the pattern in the catches (Figure 3.5-9). The annual sum of these mortalities is well below the attrition rate estimated in the model (Table 3.5-1). This is a result of the high productivity and resulting estimated stock size.

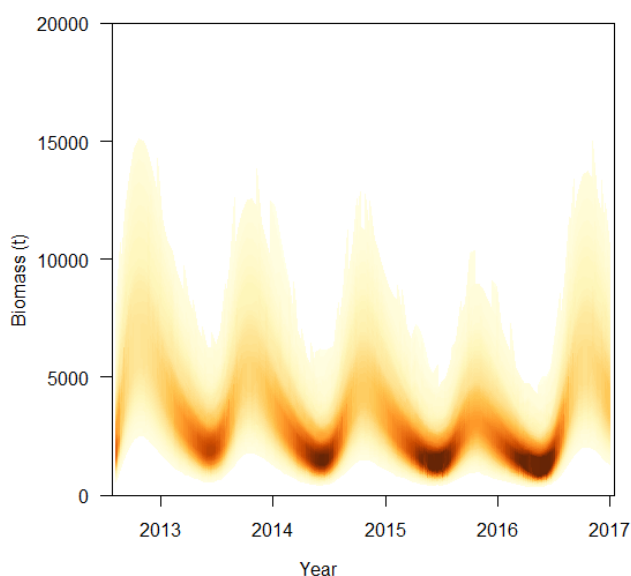


Figure 3.5-7. Biomass for Wash brown shrimp over the available data time series as watercolour plots, where ink density indicates probability density (darker, denser colour indicates higher certainty). (Source: Medley, 2017)

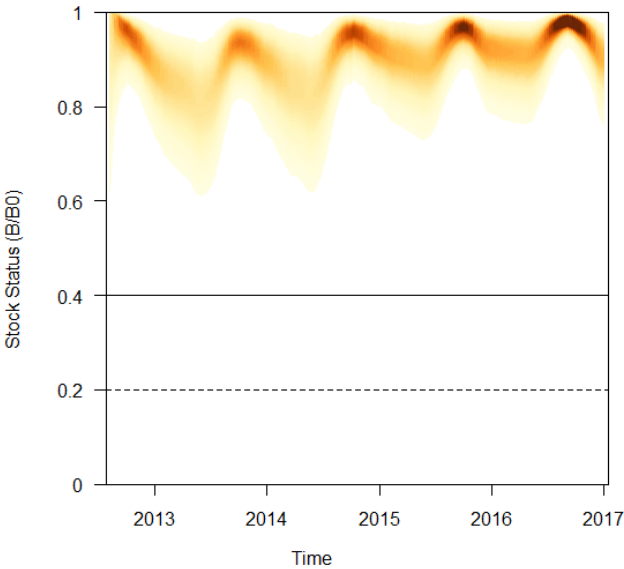


Figure 3.5-8. Stock status for Wash brown shrimp over the available data time series as watercolour plots, where ink density indicates probability density (darker, denser colour indicates higher certainty). Stock status is biomass as a proportion of the unexploited biomass. The horizontal lines for stock status indicate standard target and limit reference points at 40% and 20% respectively of the unexploited biomass. (Source: Medley, 2017)

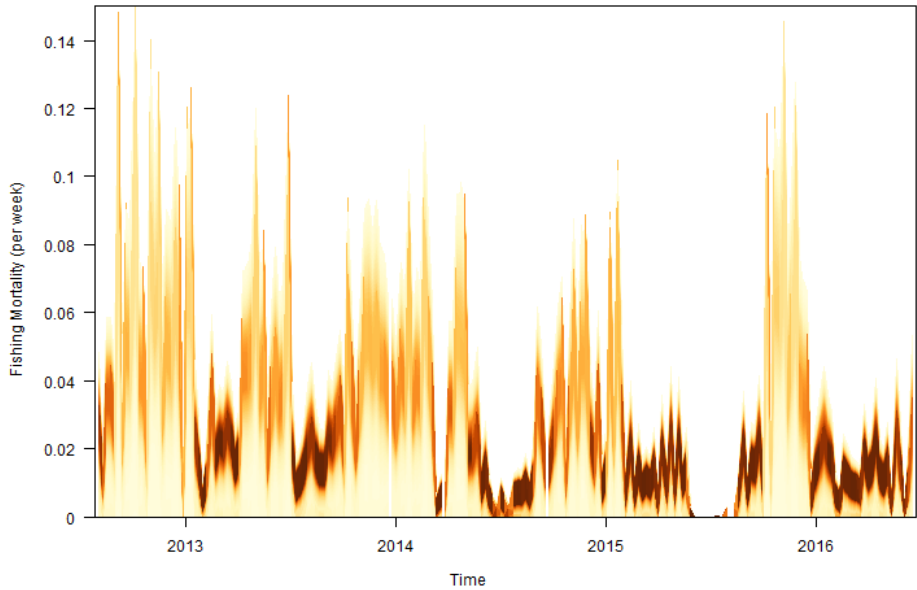


Figure 3.5-9. Probability density of weekly fishing mortalities estimated from the model. (Source: Medley, 2017)

Table 3.5-1 Annual fishing mortality estimated from model (mean attrition rate of 2.13 year⁻¹). (Source: Medley, 2017)

Year	Annual Fishing Mortality
2012/13	0.328
2013/14	0.223
2014/15	0.132
2015/16	0.121
2016/17	0.130

In summary, the population model fits indicated that there are very low risks to the stock of overfishing and that it is highly likely that the stock is above both a target or limit reference point of 40% and 20% respectively of unexploited biomass. Whilst the stock assessment report provided by Medley (2017) provides an evaluation of stock status in relation to these conventional target and limit reference points, it should be noted that these reference points have not been formally adopted in the Management Plan. Finally, it should be stressed that the model has been fitted to only 5 years of data, and a previous model fit to 4 years of data provided a more pessimistic view of stock status. Some precaution should be attached to the current model outputs because the availability of more years' data may result in substantial changes in parameter estimates and perceptions of stock status and productivity.

3.6 Principle Two: Ecosystem Background

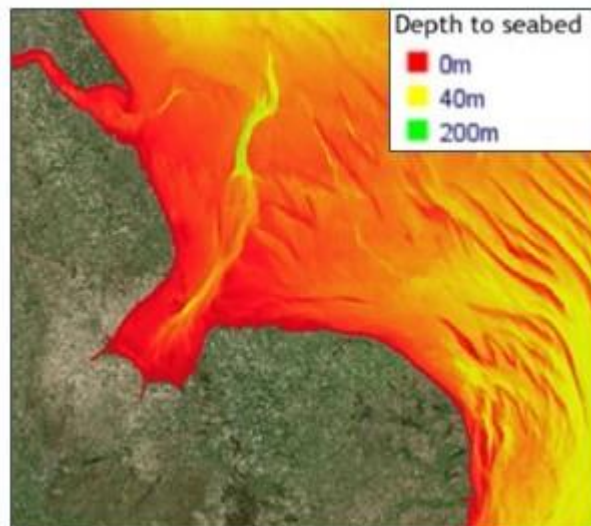
3.6.1 Ecosystem considerations

The relevant descriptors to achieve Good Environmental Status (GES), as defined in the Marine Strategy Framework Directive⁷ (Directive 2008/56/EC), in relation to the Wash and adjoining areas ecosystem health and function, include for example: Elements of food webs ensure long-term abundance and reproduction (Descriptor 4); The sea floor integrity ensures functioning of the ecosystem (Descriptor 6). Other descriptors deal with marine litter and concentration of pollutants, which affect the marine ecosystem health and function. The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. Amongst other issues, the Convention deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of; the most important feature of the Annex (V) is the complete ban imposed on the disposal into the sea of all forms of plastics. Annex IV contains requirements to control pollution of the sea by sewage. The UK is a signatory of and has ratified the MARPOL Convention, and thus relevant legal instruments and logistical structures are in place to enable the implementation of this Convention.

The ecological system in which the fishery operates in influenced by bathymetry (figure 3.6-1) and water currents (figure 3.6-2), as well as benthic habitats as discussed below. The currents along the coast and inlets are strong and tidal, causing sediments to shift in shallower depth.

The eastern coast of England, including the Wash area, is a highly dynamic area, with underlying strong tidal currents, and intense seasonal storms. The Wash is also influenced by inflowing freshwater from the Great Ouse river and significant canals draining the low-lying land. Thus, the inter-dependencies of biotic and abiotic factors driving the ecosystem are not easy to tease apart, and adding shrimp fishing to the mix, adds further complexity. Furthermore, anthropogenic impacts such as construction works (onshore as well as off-shore windfarms and dredging for gravel/ sands) causing significant sediment shifts, pollution, and eutrophication, as well as climate change, add to the complexity of effects on the ecosystem, and thus direct cause and effect is not necessarily obvious, nor is it easy to pin long-term ecological changes to any one cause. For example, effects of climate change are not only related to sea-temperature changes, but also sea-level rise, and thus associated sediment loss and/or redistribution (CPSL 2010).

Figure 3.6-1 Bathymetry in the area of shrimp fishery
(Source: <http://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/>)



⁷ Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive); "The environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive" Article 3

That said, the ecosystem components of this assessment address system-wide issues, primarily impacted indirectly by the fishery, such as ecosystem structure, trophic relationships, and biodiversity. *C. Crangon* is a lower trophic-level species, but the importance of *C. Crangon* as a food source depends on the spatial scale. On a wider scale in the North Sea the importance of *C. Crangon* is expected to be minor, but in the local coastal areas where *C. Crangon* is distributed it is an important food component in the diet of a number of species, even though its role in the energy flow is not dominant. *C. crangon* is also consumed by seabirds especially gulls (*Larus* sp.), terns (*Sterna* sp.) (Walter & Becker, 1997), and waders such as redshank *Tringa tortanus*. Not only is Brown shrimp an important food source for gadoids and pleuronectids, but also for other species such as pogue *Agonus cetaphractus*, gurnards, sea snails *Liparis liparis* (ICES, 1996), gobies *Pomatoschistus microps* and juvenile bass *Dicentrarchus labrax* (Cattrijsse *et al.*, 1997). In turn, Brown shrimp are considered generalist predators, feeding on species such as bivalve spat and polychaetes, such as *L. conchilega* (Reise, 1978), molluscs and small arthropods, as well as algae (*Ulva* spp; Oh *et al.*, 2001). Research carried out by Reise (1978) showed that the presence of a predator such as the brown shrimp can have a greater effect on the abundance of macrofauna than physical disturbance, resulting in changes to sediment composition (Reise 1978). Therefore, the removal of brown shrimp, has the potential to alter the biological community which may in turn change the classification of the given biotope assemblage.

A study by Beukema and Dekker (2005) considered the recruitment success of the spat of the common cockle *Cerastoderma edule*, Baltic tellin *Macoma balthica* and gaper clam *Mya arenaria* in the Wadden Sea in the period 1973–2002. It was found that where there was high biomass of the brown shrimp, there were low numbers of annual recruitment from the three species (Beukema and Dekker 2005). Within the study area, the only area where no decline in recruitment occurred over the study period was in areas which had low brown shrimp biomass (Beukema and Dekker 2005). Therefore, the abundance of brown shrimp has the potential to alter the assemblage of the biotope.

The role of brown shrimp can therefore not be ignored and substantial changes in coastal areas can be expected if the *C. crangon* population is largely reduced, e.g. in the case of recruitment overfishing (ICES 2014). A large variety of species feed on *C. Crangon* in the North Sea. These include a large number of benthic and pelagic fish species, crustaceans, and sea- and shore birds. No fish species relies solely on brown shrimp, and the shrimp diet of fish consists almost exclusively on the juvenile shrimp stages at sizes smaller than 50 mm. Only a small number of fish species consume larger shrimp of marketable size, most

Figure 3.6-2 Kinetic energy at the seabed due to currents
(Source: <http://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/>)



importantly cod and whiting; although they feed mainly on the smaller, juvenile shrimp. These two fish species are widely distributed in the North Sea; brown shrimp is thus only important on a local scale (corresponding to the areas and depths where brown shrimp is distributed) and only for parts of the predator population, mainly the juvenile fish. While brown shrimp is taken in large amounts by these predators and hence represents an important energy source, brown shrimp is neither a preferred nor an optimal prey for the growth of these

species. On the other hand, several of the small predator fish species, which prey intensively on smaller brown shrimps (< 50mm), may be more dependent on this food source, since their populations are mainly distributed in the same depth range as brown shrimp (ICES 2014).

Multispecies considerations (ICES 2014): Gadoids are dominant predators on adult and juvenile *C. crangon* and these fish are currently at low stock sizes in the southern North Sea. There is a possible competition between the shrimp fishery and gadoid predators, i.e. cod and whiting. A massive invasion of whiting in 1990 subsequently led to a very poor *Crangon* fishing season in autumn of 1990 and spring of 1991 (Berghahn, 1996). Currently competition between fisheries and cod and whiting stocks for adult shrimp is unlikely because of the very low abundance of these stocks. If gadoids recover, two effects can be expected: 1) increased competition (fishery versus predators) for adult shrimp and, hence, lower commercial catches, and 2) substantially increased predation of small (< 50mm) brown shrimp, which may decrease the recruitment of brown shrimp to the fished stock component. The predation by other predators is less well investigated; however, most of the adult stages of these fish are small and consume only small (< 50mm) shrimp. Some of these populations may rely to a large extent on the availability of small brown shrimp. The extent to which recovery of the gadoid stocks can affect the stocks of these smaller predators is likewise unknown. Some of these fish, namely gobies, are a preferred food source for both cod and whiting. Both gadoids show a much better growth conversion efficiency if fed with gobies than with brown shrimp (ICES 2014).

The predator–prey interactions have increased in complexity with the three marine mammal populations in the coastal areas inhabited by brown shrimp, namely harbour/common seals *Phoca vitulina* (The Wash and North Norfolk Coast is considered important, being the largest colony of common seals in the UK, with 7% of the UK population), harbour porpoise (*Phocoena phocoena*) and grey seals (*Halichoerus grypus*), among the rarest seals in the world⁸. The combined assembly consumes an estimated total of 145 000t fish annually; many of these will be brown shrimp predators (Temming & Hufnagl 2014).

An information review of the ecosystem impact of the Wash Brown shrimp fishery (Spindrift Marine 2017) concluded that: “the key impacts across each ecosystem component are deemed to be unlikely or highly unlikely”, although a need for time series data was highlighted, particularly with regards to biological effects, impacts on benthic habitats and fauna, and effects on spawning and nursery areas. “There may also be some localised impacts on seabirds, where discards may have a seasonally important effect on food availability and, therefore, on population dynamics. Overall, the likelihood of ecosystem level impacts from *Crangon* fishing is not likely to be high”.

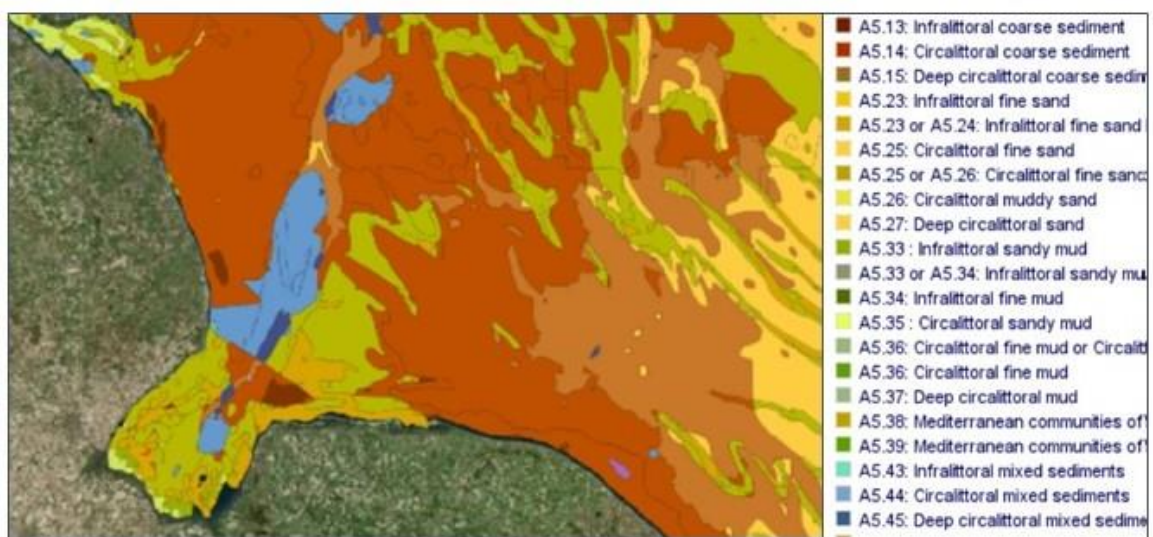
⁸ <http://jncc.defra.gov.uk/ProtectedSites/SACselection/species.asp?FeatureIntCode=s1364>

3.6.2 Habitat

Common Habitat

Crangon crangon is found on sandy and muddy ground, showing a preference for grain sizes between 125 and 710µm (Pinn & Ansell). Brown shrimp can also be found in estuaries and brackish water, it buries itself in the sediment as protection from predators during the day, with only the antenna protruding from the sand. They will emerge when darkness falls to feed. Thus, the fishery for brown shrimp occurs in predominantly sandy/muddy areas. EMODnet provides a broad categorization of the relevant seafloor areas, showing predominantly sandy/muddy sediments of varying composition and configuration depending on the distance from the shore (figure 3.6.-3).

Figure 3.6-3 Sediment characterization of the seafloor in the Wash and adjoining areas – after EMODnet (Source: <http://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/>).



The marine habitats of the Wash and adjoining areas have been and continue to be surveyed as part of ongoing information gathering for protected area designations. For example, the map below (figure 3.6-4) gives detailed benthic habitat distribution over those parts of the shrimp fishery area, which occur within the Wash and North Norfolk SAC.

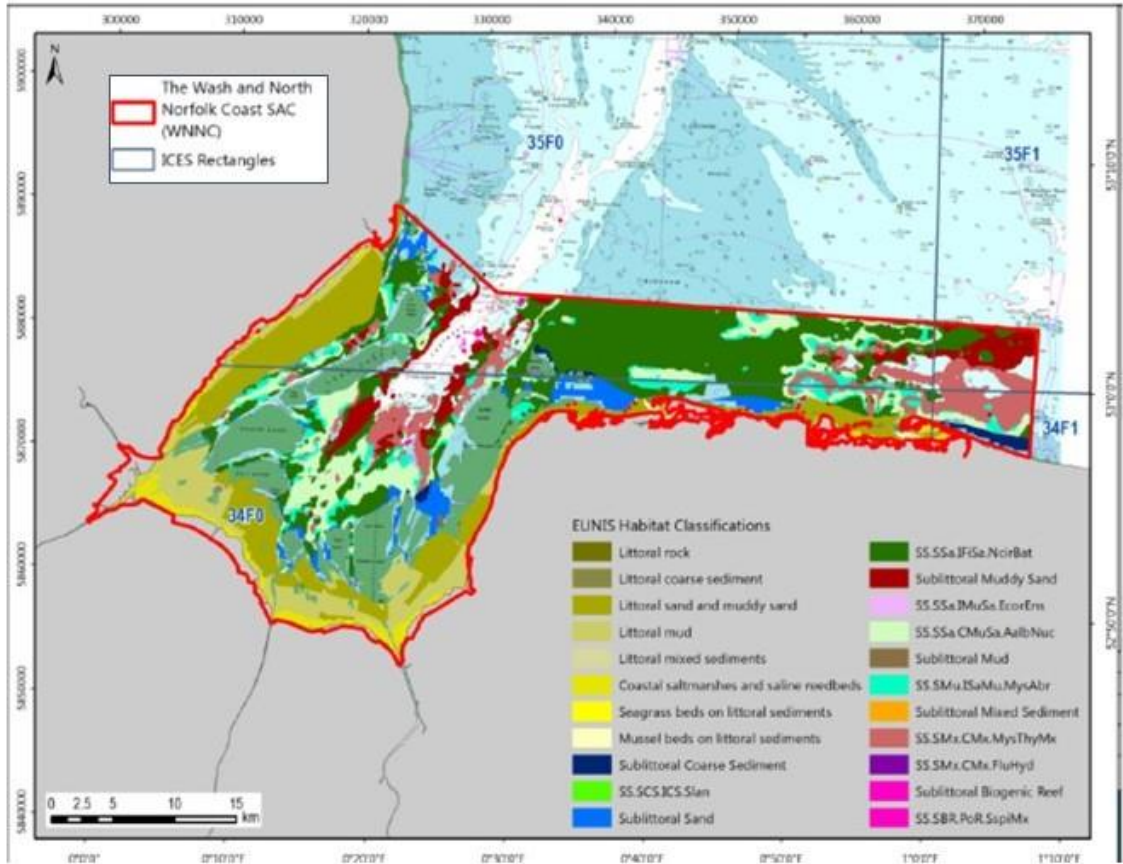


Figure 3.6-4 EUNIS Habitat map of Wash and North Norfolk SAC (Source: in ABPmer & Ichthys Marine (2015))

Protected Areas and VMEs

There are a number of marine protected areas in The Wash and adjoining waters (Figure 3.6-5), indicating the Eastern IFCA 6nm boundary.

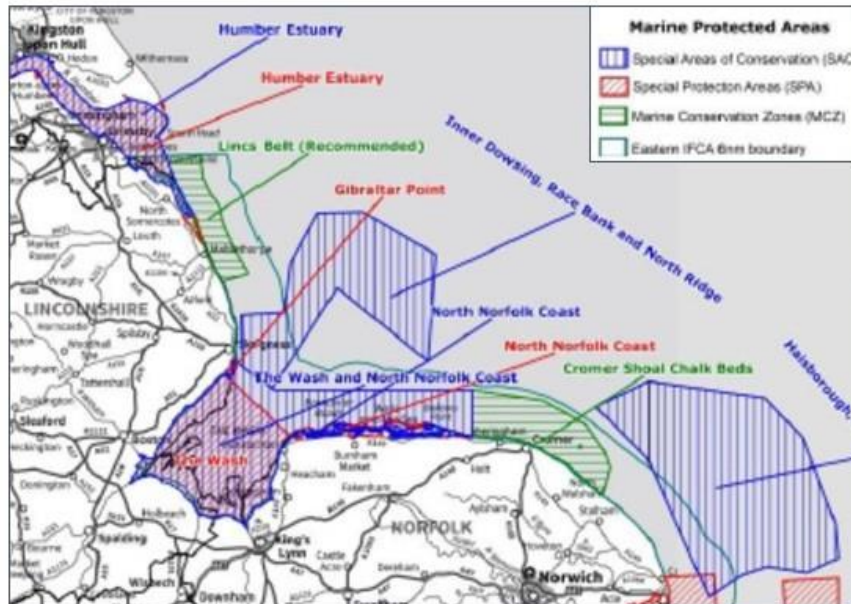


Figure 3.6-5: Marine Protected Areas in and adjoining The Wash, relevant to this fishery (Source: Easter IFCA 2016).

Special Protection Area (SPA)

Since the above map was created (2016) **The Greater Wash SPA** has been classified under Wild Birds Directive 2009/147/EC on 28th March 2018 (Figure 3.6-6). The boundary of the Greater Wash SPA extends beyond 12 nautical miles; hence it is a site for which both Natural England and JNCC have responsibility to provide statutory advice. The SPA lies along the east coast of England in the mid-southern North Sea and extends between the counties of Yorkshire (to the north) and Suffolk (to the south). Legislation behind the classification is the EU Birds Directive 2009/147/EC, as transposed into UK law by the Conservation of Habitats and Species Regulations 2017 within 12 nautical miles, and the Conservation of Offshore Marine Habitats and Species Regulations 2017 between 12 nautical miles and 200nm or the UK Continental Shelf.

The SPA covers an area of 353,578 ha or 3,536 km². The qualifying features for this SPA are several seabird species⁹:

- *Gavia stellata*; Red-throated diver (Non-breeding)
- *Melanitta nigra*; Common scoter (Non-breeding)
- *Hydrocoloeus minutus*; Little gull (Non-breeding)
- *Sterna sandvicensis*; Sandwich tern (Breeding)
- *Sterna hirundo*; Common tern (Breeding)
- *Sternula albifrons*; Little tern (Breeding)

⁹ <http://jncc.defra.gov.uk/page-7585>

In order to achieve the aims of the Wild Birds Directive Accordingly the site has to be managed to ensure the integrity of these seabird populations, by maintaining or restoring: -

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

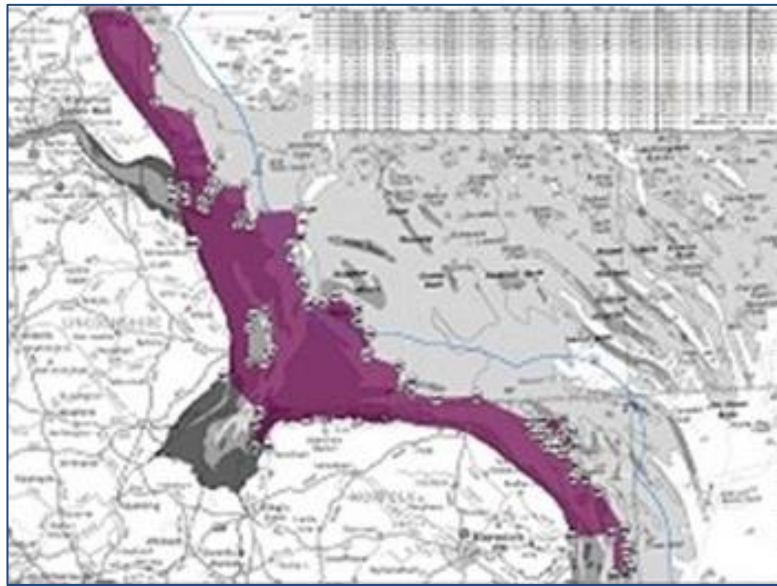


Figure 3.6-6 Greater Wash SPA (Source: <http://jncc.defra.gov.uk>)

The area of the SPA includes a range of marine habitats, including intertidal mudflats and sandflats, subtidal sandbanks and biogenic reefs, including *Sabellaria* reefs and mussel beds. Much of the area is less than 30m water depth, with a deep channel of 90m depth at the Wash approaches.

Several sites that have been notified or designated under British or European conservation legislation overlap or adjoin the Greater Wash SPA boundary; these include Inner Dowsing, Race Bank and North Ridge SAC, The Wash and North Norfolk Coast SAC, and Haisborough, Hammond and Winterton SAC. The boundaries of two Marine Conservation Zones (MCZ); Holderness Inshore MCZ, and Yorkshire coast and Cromer Shoal Chalk Beds MCZ are encompassed with the SPA boundary. This site forms part of the UK's contribution to the OSPAR commission's network of MPAs, Europe's Natura 2000 network and the Emerald network established under the Bern Convention. No detailed information could be found as to how the site is actually managed in practice, in order to ensure that the conservation objectives could be met. As of 25th August 2018, the relevant website said: "Further information on the progress of the Greater Wash SPA around each of the four stages in the MPA management cycle will be provided in due course"¹⁰.

¹⁰ <http://jncc.defra.gov.uk/page-7585#SummaryTab>

Special Area of Conservation – SAC

The Wash and North Norfolk coast SAC¹¹ has an area of 1,078 km² (Figure 3.6-7). It was designated as a Special Area of Conservation (SAC) in 2005. It has extensive areas of predominantly sandy sediments which include intertidal areas. Subtidal areas have communities which include a diverse range of species. These sandy areas result in one of the largest expanses of subtidal sandbanks in the UK (ABPmer & Ichthys Marine (2015)). Fishing vessels bigger than 15.24 meters in length are prohibited from fishing using towed nets to protect features from disturbance from larger vessels (Byelaw 12, EIFCA). The qualifying features for the Wash and North Norfolk Coast SAC are (as published on the Natural England website¹²:

H1110 Sandbanks which are slightly covered by sea water all the time

H1140 Mudflats and sandflats not covered by seawater at low tide

H1150 Coastal lagoons

H1160 Large shallow inlets and bays

H1170 Reefs

H1310 Salicornia and other annuals colonising mud and sand

H1330 Atlantic salt meadows (*Glaucopuccinellietalia maritima*)

H1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)

S1355 Otter, *Lutra lutra*

S1365 Harbour (common) seal, *Phoca vitulina*

¹¹ <http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0017075>

¹²

<https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0017075&SiteName=&countyCode=29&responsiblePerson=&SeaArea=&IFCAArea=>

Only the first three listed features, large shallow inlets and bays, subtidal sandbanks, and intertidal mudflats and sandflats, are of interest as part of this assessment as these are potentially accessed by the shrimp fishery. They are described in greater detail elsewhere in this section of the report, in connection with the impacts of the trawl fishing gears on the underlying habitats.

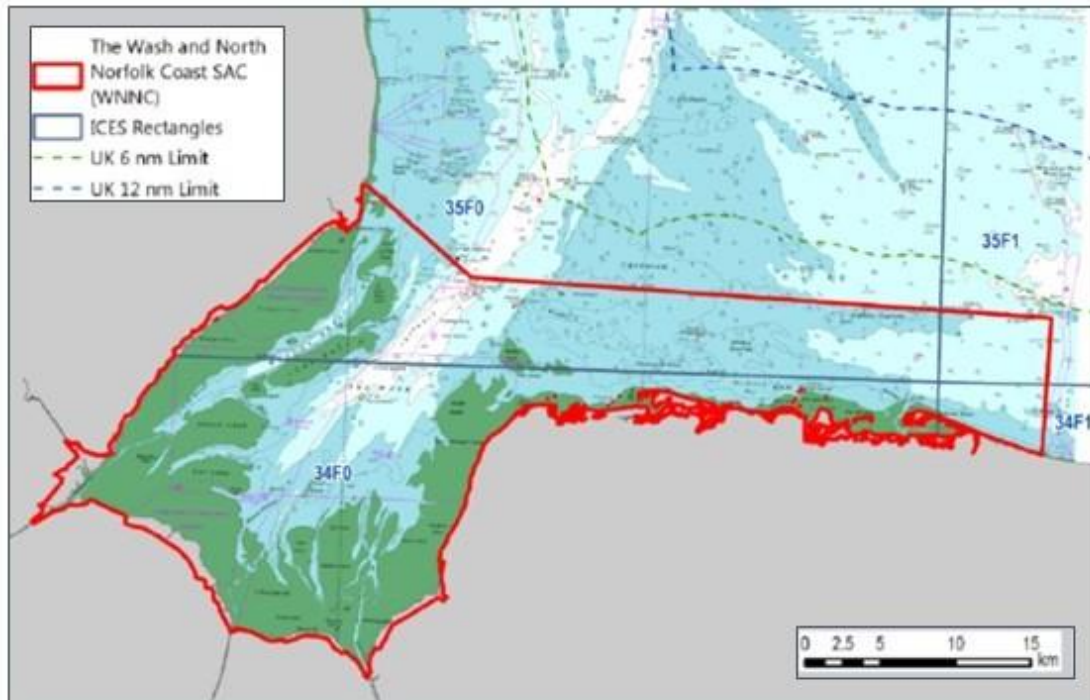


Figure 3.6-7 Location of The Wash and North Norfolk Coast SAC (Source: in ABPmer & Ichthys Marine, 2015)

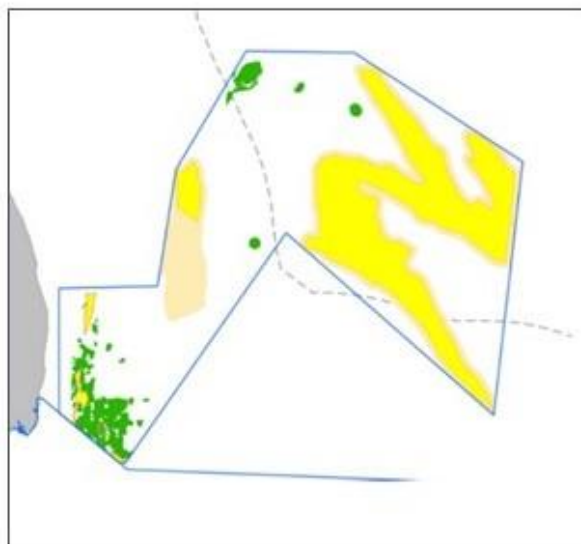


Figure 3.6-8 Boundary of Inner Dowsing, Race Bank and North Ridge SAC. Yellow = sandbanks, light yellow = potential sandbank, green = biogenic reefs (Source: jncc.defra.gov.uk)

The Inner Dowsing, Race Bank and North Ridge SAC¹³ covers an area of 845km², and the protected features include sandbanks slightly covered by seawater all the time (1110), and reefs (1170), both Annex 1 habitats. This site lies across the 12nm limit (Figure 3.6-8).

The main sandbank features of this MPA occur within the Wash Approaches, the Race Bank-North Ridge-Dudgeon Shoal system and at Inner Dowsing. The tops of the sandbanks are characterised by low diversity communities of polychaete worms and amphipod crustaceans. The trough areas between the sandbank features contain a diverse mosaic of biotopes on mixed and gravelly sands. Biogenic reef created by the ross worm *Sabellaria*

¹³ <http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030370>

spinulosa has consistently been recorded within the site. These reefs support a variety of bryzoans, hydroids, sponges and anemones as well as the common lobster *Homarus gammarus* and the commercially exploitable pink shrimp *Pandalus montagui*

The Haisborough, Hammond and Winterton MPA – SAC¹⁴ lies off the north east coast of Norfolk, and contains 'Sandbanks slightly covered by sea water all the time' Annex I Habitat: 1110 (sandbanks lightly covered with water) and 'Reef' (Annex I Habitat: 1170 Reefs). The site lies across the 12nm territorial sea limit therefore advice on this MPA is jointly delivered with Natural England (Figure 3.6-9). It covers an area of 1,467.59 km², and the depth at the site ranges from the top of the bank features that almost breach the sea surface down to 52m below sea level in the sandbank troughs

The site contains a series of sandbanks formed via headland associated geological processes since the 5th Century AD. These sandbanks are curved, run parallel to the coast, composed of sandy sediment and lie in full salinity water with intermediate coastal influence. The site contains a mosaic of different physical habitats corresponding to different biological communities. The fauna of the sandbank crests is predominantly low diversity polychaete (cat worms) and amphipod (shrimp-like crustaceans) communities that are typical of mobile sediment environments. The banks are separated by troughs containing more gravelly sediments and support diverse infaunal and epifaunal communities with occurrences of reefs of the tube-building ross worm *Sabellaria spinulosa*. These *Sabellaria* reefs are also a protected feature of the site and are located at Haisborough Tail, Haisborough Gat and between Winterton Ridge and Hewett Ridge. They arise from the surrounding coarse sandy seabed to heights of between 5cm to 10cm. The reefs are consolidated structures of sand tubes showing seafloor coverage of between 30 to 100 per cent of the sediment¹⁵. Aggregations of *S. spinulosa* provide additional hard substrate for the development of rich epifaunal communities.

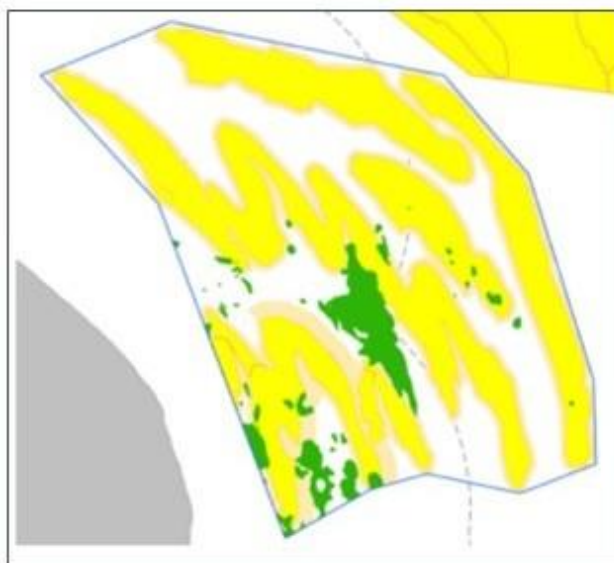


Figure 3.6-9 Haisborough, Hammond and Winterton SAC, yellow = sandbanks, light yellow = potential sandbanks, green = biogenic reefs)

JNCC and Natural England have prepared joint formal conservation advice for Haisborough, Hammond and Winterton SAC. The management measures are that fishing vessels bigger than 15.24 meters in length are prohibited from fishing using towed nets. Protects features from disturbance from larger vessels (Bylaw 12 Inshore trawling restrictions), as well as a raft of other restrictions listed on the website¹⁶.

¹⁴ <http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030369>

¹⁵ <http://archive.jncc.gov.uk/page-6534>

¹⁶

<https://designatedsites.naturalengland.org.uk/SiteMMO.aspx?SiteCode=UK0030369&SiteName=haisborough&SiteNameDisplay=Haisborough,%20Hammond%20and%20Winterton%20SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=>

VME: Biogenic Reefs

Although *Sabellaria spinulosa* reefs have been mentioned as part of the SAC features above, it was thought helpful to provide a more detailed description here, as they are part of the designated features in the SACs and SPA listed above.

The “ross worm”, *Sabellaria spinulosa* Leuckart 1849 is a sedentary, epifaunal polychaete that builds rigid tubes from sand or shell fragments. It is closely related to the more reef-building *S.alveolata*. It is a suspension feeder that is generally found individually or in small aggregations although it can be gregarious in favourable conditions. *S. spinulosa* worms require suspended sediments to build their tubes, and therefore reefs most likely to occur in areas with high turbidity and suspended sediment loads and moderate tidal currents.

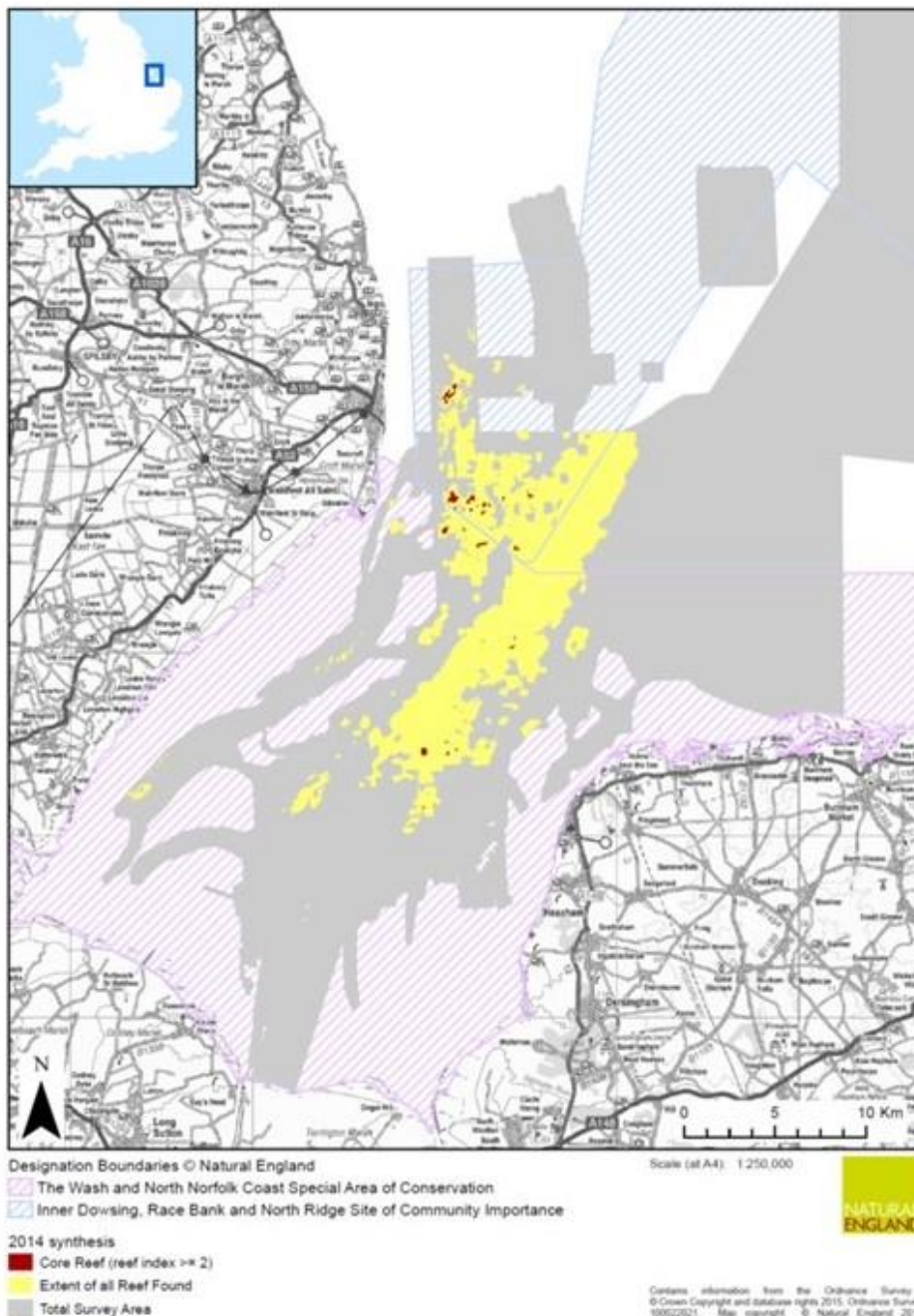


Figure 3.6-10 Distribution of *S.spinulosa* reefs in Wash area (Source: Roberts et al 2016)

Large colonies consisting of fused sand-tubes may form thin crusts or extensive reefs (summary in Last *et al* 2012). The reefs, commonly known as “Ross”, can be many metres across and raised above the sea bed by up to 40 cm (Foster-Smith & White, 2001, Vorberg, 2000), providing a biogenic habitat that allows many other associated species, including epibenthos and crevice fauna, to become established (UK Biodiversity Group, 1999¹⁷). The fauna is distinct from other biotopes and the structure allows species to become established in predominantly sedimentary areas where they would not otherwise be found (Foster-Smith *et al.*, 1997). In this guise therefore, *S. spinulosa* reef has been identified as a priority habitat under the UK Biodiversity Action Plan (BAP). „Reefs” are also listed under Annex I of the EC Habitats Directive (Council Directive EEC/92/43 on the

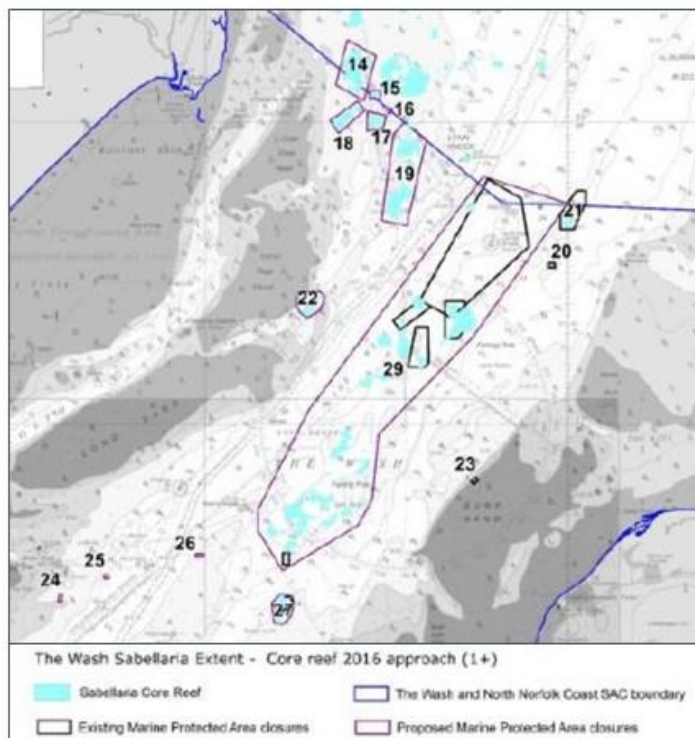


Figure 3.6-11 The Wash *Sabellaria* extent (Source: Eastern IFCA 2018 Marine Protected Area Byelaw proposal; www.eastern-ifca.gov.uk/wp.../2018_07_18_AOB_WFO_Regulations_Update.pdf)

Conservation of Natural Habitats and of Wild Fauna and Flora) as a marine habitat to be protected by the designation of Special Areas of Conservation (SACs). Gubbay (2007) states that for an *S. spinulosa* aggregation to be considered as reef, it must have an elevation of greater than 2cm and cover an area of at least 25m² with no less than 10% coverage.

S. spinulosa reef is a designated feature of the Wash and North Norfolk (WNN) SAC (Figure 3.6-7), the Inner Dowsing Race Bank North Ridge (IDRBNR) SAC, and the Haisborough Hammond and Winterton SAC, as well as the Greater Wash SPA.

A byelaw is currently in place to protect core areas of *S. spinulosa* reef within The Wash and North Norfolk Coast SAC, as identified by Bussell & Saunders (2010), from bottom towed gear. This byelaw closes fisheries activity using bottom towed gear in core reef areas, and it came into force in 2014 (in Roberts *et al* 2016). In 2016 EIFCA started a consultation process to increase the area of protection, based on further *S. spinulosa* surveys, which indicated that this feature was present over a wider area than originally recorded (Figure 3.6-11).

The Authority has completed assessments of commercial fishing activity interactions with the designated features (*S. spinulosa*) of the Wash and North Norfolk Coast Special Area of Conservation (W&NNC SAC) and Inner Dowsing Race Bank and North Ridge SAC. The interactions have been based on site-specific ‘risk’ interactions (as defined and adapted by Defra, 2015¹⁸, a policy to ensure that all existing and potential commercial fishing operations

¹⁷ UK Biodiversity Group (1999). Tranche 2 Action Plans - Volume V: Maritime species and habitats. English Nature

¹⁸ MMO 2014. Guidance: Revised approach to the management of commercial fisheries in European Marine Sites: overarching policy and delivery. <https://www.gov.uk/government/publications/revised-approach-to-the-management-of-commercial-fisheries-in-european-marine-sites-overarching-policy-and-delivery>

are managed in line with Article 6 of the Habitats Directive). As a result of the assessment¹⁹, EIFCA is introducing new towed gear management in the form of further area closures (Eastern IFCA stakeholder engagement plan 2016).

VME: Mussel beds

As a consequence of updated conservation advice published by Natural England in 2017, mussel beds are specified as biogenic reefs and are therefore now recommended for closure from fishing using bottom towed gear (Fig. 3.6.12).

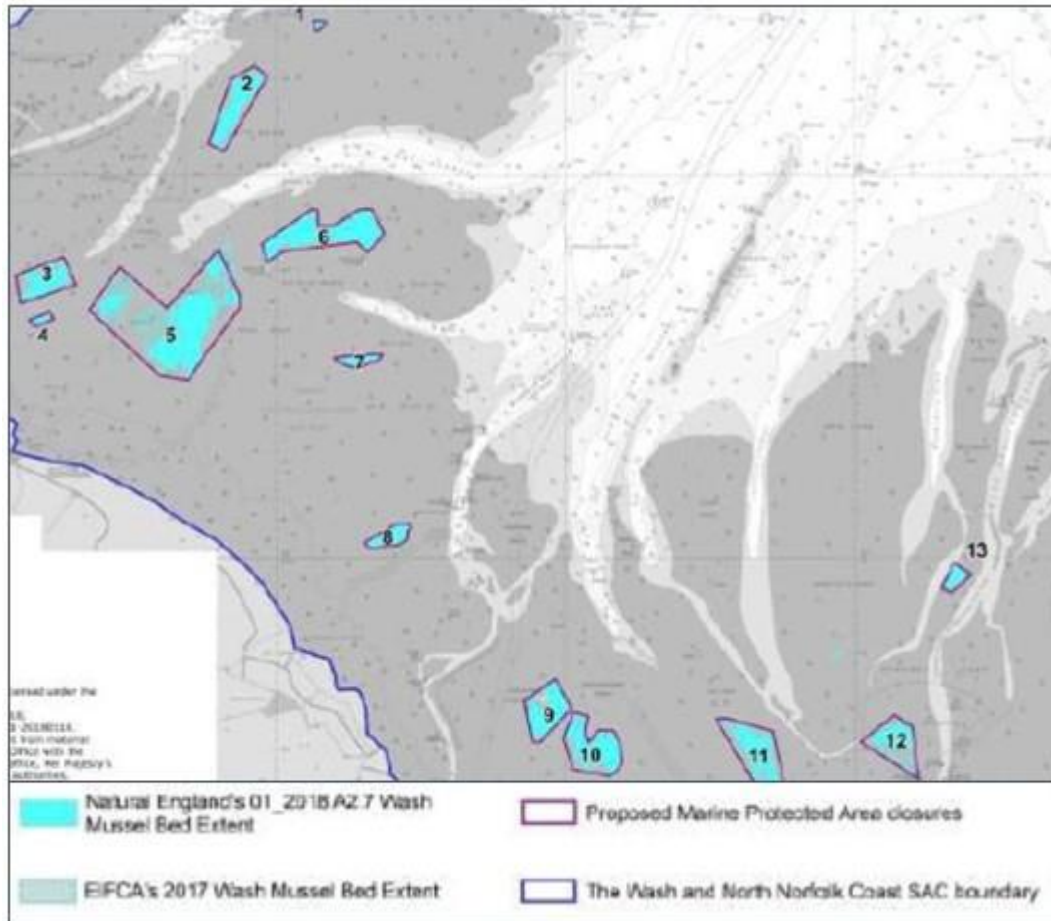


Figure 3.6 12 The Wash mussel beds extent (Source: Eastern IFCA 2018 Marine Protected Area Byelaw proposal; www.eastern-ifca.gov.uk/wp-content/uploads/2018/07/18_AOB_WFO_Regulations_Update.pdf)

Mussel beds are intertidal, and they were not identified as being at risk from shrimp beam trawling, but as biogenic reef they are “red risk” features (in the context of the HAR) and require protection. Shrimp beam trawling does not occur in these areas, their locations are well known by fishers and there is no benefit in trawling over mussel beds, indeed it damages the gear. However, the closures are required under the “Revised Approach” (Defra 2012) and ensure that these important ecological features are protected from trawling damage. It is important to note that this will not preclude future dredge mussel fisheries, which are subject to bespoke Habitats Regulations Assessments and operated within strict conditions of the Wash Fishery Order and existing Eastern IFCA byelaws.

¹⁹ Habitats Regulations Assessment of impacts of shrimp fishery on Wash & North Norfolk Coast Special Area of Conservation <http://www.eastern-ifca.gov.uk/habitats-regulations-assessment-impacts-shrimp-fishery-wash-north-norfolk-coast-special-area-conservation/>

Non-biogenic habitats

Under GSA3.13.3.2 (CR v2.0)²⁰, non-biogenic habitat types need to be considered too. Under the EU Habitats Directive Annex I three habitat types are of relevance in this context in the Wash and North Norfolk MPA, for example, where they have been prime reasons for selection of that site, as well as at the Haisborough, Hammond and Winterton MPA – SAC and Inner Dowsing, Race Bank and North Ridge SAC.

1110 – Sandbanks which are slightly covered by sea water all the time:

On this site sandy sediments occupy most of the subtidal area, resulting in one of the largest expanses of sublittoral sandbanks in the UK. It provides a representative example of this habitat type on the more sheltered east coast of England. The sublittoral sandbanks vary in composition and include coarse sand through to mixed sediment at the mouth of the embayment. Sublittoral communities present include large dense beds of brittlestars *Ophiothrix fragilis*. Species include the sand-mason worm *Lanice conchilega* and the tellin *Angulus tenuis*. Benthic communities on sandflats in the deeper, central part of the Wash are particularly diverse. The sublittoral sandbanks provide important nursery grounds for young commercial fish species, including plaice *Pleuronectes platessa*, cod *Gadus morhua* and sole *Solea*.

1140 Mudflats and sandflats not covered by seawater at low tide:

The Wash, on the east coast of England, is the second largest area of intertidal flats in the UK. The sandflats in the embayment of the Wash include extensive fine sands and drying banks of coarse sand and muddy sand, and this diversity of substrates, coupled with variety in degree of exposure, means that there is a high diversity relative to other east coast sites. Sandy intertidal flats predominate, with some soft mudflats in the areas sheltered by barrier beaches and islands along the north Norfolk coast. The biota includes large numbers of polychaetes, bivalves and crustaceans. Salinity ranges from that of the open coast in most of the area (supporting rich invertebrate communities) to estuarine close to the rivers. Smaller, sheltered and diverse areas of intertidal sediment, with a rich variety of communities, including some eelgrass *Zostera* spp. beds and large shallow pools, are protected by the north Norfolk barrier islands and sand spits

1160 Large shallow inlets and bays

The Wash is the largest embayment in the UK and represents large shallow inlets and bays on the east coast of England. It is connected via sediment transfer systems to the north Norfolk coast. Together, the Wash and North Norfolk Coast form one of the most important marine areas in the UK and European North Sea coast, and include extensive areas of varying, but predominantly sandy, sediments subject to a range of conditions. Communities in the intertidal include those characterised by large numbers of polychaetes, bivalve and crustaceans. Sublittoral communities cover a diverse range from the shallow to the deeper parts of the embayments and include dense brittlestar beds and areas of an abundant reef-building worm ('ross worm') *Sabellaria spinulosa*. The embayment supports a variety of mobile species, including a range of fish and Common seal *Phoca vitulina*.

Subtidal mixed sediments

Grab sample and video survey data gathered by Eastern IFCA in 2016 and 2017 as part of the HAR identified two types of subtidal mixed sediments which occur within Wash and North Norfolk SAC, one being more vulnerable than the other, based on the type of sediment and associated species present. Closures as proposed in the 2018 Marine Protected Area byelaw

²⁰ Uniqueness or rarity – an area or ecosystem that is unique or that contains rare species whose loss could not be compensated for by similar areas or ecosystems

(Figure 3.6-12) focus on the more vulnerable type of subtidal mixed sediment. Vulnerable mixed sediment is defined as angular gravel with sand and mud, supporting various epifauna and occurring in water deeper than 10m below chart datum.

The other common type of mixed sediment within The Wash is mud or sandy mud with gravel rounded by constant movement, sometimes including a layer of broken shell on the surface and supporting very little if any epifauna.

Closures will include a large area of subtidal mixed sediment (with areas of subtidal mud) in deeper water areas (vulnerable habitat) of the central Wash, and an extensive area off the central north Norfolk coast in an area of sea between Wells-next-the-Sea and the eastern boundary of the SAC at Weybourne. The central Wash closure includes areas of mosaic habitat (where there is a reasonable amount of vulnerable mixed sediment) and incorporates some "red risk" features including areas of core *Sabellaria spinulosa* reef and subtidal stony reef. Further, smaller closures will protect core areas of *Sabellaria spinulosa* reef outside of the central closure, in the north-west of The Wash (the Lynn Knock area), off the Inner Dog's Head sandbank and in four small areas of the central Wash.



Figure 3.6-12 Wash and North Norfolk MPA proposed closures by related habitat types (note sediment types), as proposed in Byelaw 2018 (Source: www.eastern-ifca.gov.uk/wp.../2018_07_18_AOB_WFO_Regulations_Update.pdf)

Impact of gear on the substrate and recovery studies

Shrimp beam trawls are designed to skim over the seabed surface so that they catch the brown shrimp on the surface and the water column above. Traditionally, beam trawls with bobbin ropes are used to target brown shrimp. The mouth of the net is held open by a solid metal bar, the beam, usually of 8-9m length (12m is permissible), and a ground rope with bobbins, hard rubber rollers that keep the trawl in contact with the bottom. At the sides, the beam is fixed to two skids or beam shoes, made of steel, which travel along the seabed. The nets are towed from outriggers on both sides of the fishing vessel. As the gear is towed over the seabed, the ground rope stimulates the shrimp to jump into the water column so that they can be scooped up by the net. The bobbins induce rapidly rising water currents which, in combination with vibrations of the sediment, stimulate a startle reaction in buried brown shrimp

which emerge and are scooped into the net (in WWF 2014). The Shrimp beam trawls are much lighter than their flat fish counterparts²¹.

The impact of shrimp trawl fishing gears at the level of the individual gear components and the pressures they cause on the underlying substrate has been considered in several studies (summarised in ABPmer & Ichthys Marine, 2015). Compared to other demersal trawl gears, such as for flatfish, the Brown shrimp fishery has a smaller footprint. The footprint of a gear is defined as the relative contribution from individual larger gear components, such as shoes (in this case), sweeps, and groundgear, to the total area and severity of the gear's impact (Eigaard *et al* 2015). As such, the pressures caused by individual gear components (e.g. depth of penetration into the seabed sediments by the shoes, bobbins, and surface abrasion by the ground gear of a trawl) are considered in relation to the area of impact of those individual gear components (Eigaard *et al* 2015). For Brown shrimp trawl gear the footprint can be separated into two types of paths: (i) from the shoes of the beam, and (ii) from the groundgear (Figure 3.6.13), including bobbins (Figure 3.6-14. The trawl, the shoes and the bobbin ropes together have a total weight of about 550–750 kg (Verschuieren *et al* 2012).

Figure 3.6-13 Conceptual gear footprint of beam trawl TBB (Source Eigaard *et al* 2015)

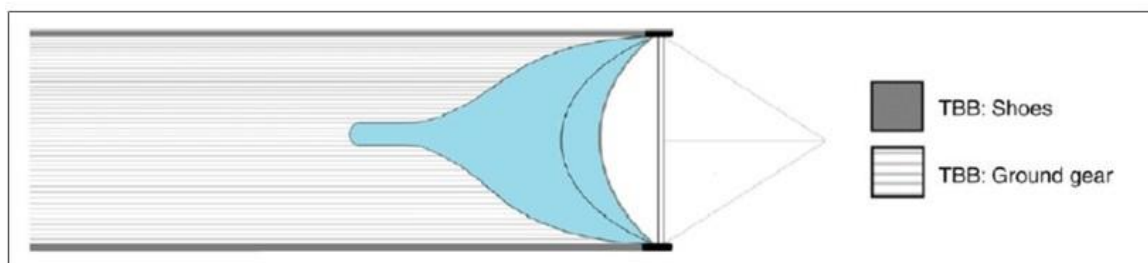
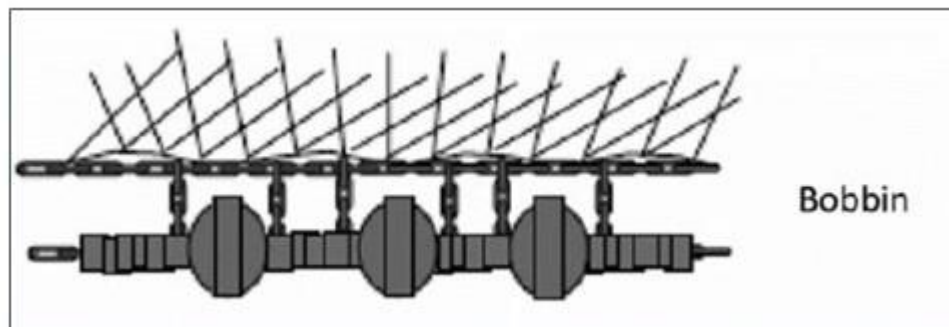


Figure 3.6-14 Bobbin design and configuration in Brown shrimp trawl fishery. The ground rope of a shrimp trawl is typically equipped with 24 to 40 bobbins (Source: Eigaard *et al* 2015)



Brown shrimp trawl beam shoes have been shown to generate shallow furrows (of up to 2cm) in relatively soft sediment the fishery operates in, and furrows appear to be re-absorbed as part of the background movement of sediments in shallower water, caused by tides and currents (Appendix B, ABPmer & Ichthys Marine, 2015). The overall beam trawl (TBB) footprint size of a fishing operation is defined as the width of the beam multiplied with the number of TBBs deployed by the vessel. Noticeably the beam trawl groundgear used for fishing crustaceans (*Crangon crangon*) was found to have less subsurface impact (50%) owing among other to the fact that they do not deploy tickler chains (Verschuieren *et al* 2012) but bobbins.

²¹ <http://www.seafish.org/geardb/gear/beam-trawl-shrimp-beam-trawl/>

The study by ABPmer & Ichthys Marine (2015) also looked at recovery rates of different types of sediments and thus habitat types encountered in the Brown shrimp fishery (see Fig. 3.6-3 for distribution of these sediment types). The findings of the ABPmer & Ichthys Marine study are listed here in brief, highlighting the relevant details for this assessment:

For sublittoral coarse sediments these surface sediments are mobile 10–30% of the time (waves and currents), any furrows made by the gear will be infilled rapidly and therefore recovery was assessed as very high. Based on these assessments it was concluded that sublittoral coarse sediment is not sensitive to surface disturbance and shallow disturbance. Furthermore, the habitat (of sublittoral coarse sediments) is not dependent upon the target or non-target species for its structure and therefore is not considered to be sensitive to the biological effects of their removal.

Tide and wave action -swept infralittoral sand and mixed gravelly sand (SS.SCS.ICS.SLan) has the potential to provide a biotope for dense beds of *L. conchilega*, a polychaete worm that can grow to 30cm in length and makes tubes out of sand grains and shell fragments. Isolated patches of this biotope occur off the north Norfolk coast. Studies show that habitats in high-energy areas have rapid recovery rates and recover faster than low energy environments (Collie et al., 2000; Dignan et al., 2014). As such, recovery is assessed as very high. Based on these assessments it is concluded that infralittoral sand and mixed gravelly sand is not sensitive to surface disturbance. Considering the biology and ecology of *L. conchilega*, which is a robust species living in a high energy area, recovery from disturbance was assessed as high (ABPmer & Ichthys Marine, 2015), and that *L. conchilega* is not sensitive to surface abrasion and has a low sensitivity to shallow disturbance from shrimp trawling. Given its ability to retreat into its tube, and its infaunal position in the sediment, it is not expected to be removed in significant quantities from the site as a result of shrimp beam trawling. The species is considered as having a low sensitivity to biological disturbance, considering the ability of this polychaete to recover quickly following disturbance events (Ager 2008, Rabaut et al 2009)

The sublittoral²² sands (SS.SSa) habitat is made up of clean medium to fine sands or non-cohesive slightly muddy sands which are exposed to wave action. Many species associated with the sand communities are infaunal and so have some protection from shallow disturbance caused by lightweight beam trawlers. Assessments showed (ABPmer & Ichthys Marine, 2015) that sublittoral sand has a high tolerance to surface abrasion and shallow disturbance. Dernie et al. (2003) found that following a physical disturbance event, clean sand habitats had the quickest recovery time (35 days), thus sublittoral sand was concluded to be not sensitive to surface abrasion and shallow disturbance. Furthermore, this habitat is not dependent upon the target or non-target species for its structure and therefore is not considered to be sensitive to the biological effects of their removal (ABPmer & Ichthys Marine, 2015).

The infra-littoral²³ sand habitat with well-sorted medium and fine sands characterised by the polychaete *Nephtys cirrosa* and the gammarid *Bathyporeia* spp. (identified as SS.SSa.IFiSa.NcirBat in Fig. 3.6-3) is typical of an environment regularly disturbed by strong tidal streams or wave action. It was assessed that the infralittoral sand habitat has a high tolerance to surface abrasion and a high tolerance to shallow disturbance. Recovery was assessed as high as any pits or furrows that may form will be readily infilled through natural processes (ABPmer & Ichthys Marine, 2015). Studies by Collie et al. (2000) and Constantino et al. (2008) report that sandy habitats have a rapid recovery, within 100 days following a trawl event. Given the infaunal position of *N. cirrosa* it is assessed as not sensitive to shallow disturbance. A literature review by ABPmer & Ichthys Marine (2015) concluded that *Bathyporeia* spp. have a low sensitivity to shallow disturbance. In terms of biological disturbance, *N. cirrosa* is unlikely to be removed during a trawl event because it is an infaunal

²² Also known as subtidal zone, shallow zone immediately past intertidal zone, permanently covered in water

²³ The infralittoral zone is the algal dominated zone to maybe five metres below the low water mark.

species living at depths within the sediment of between 5 cm and 15 cm, deeper than the expected penetration of shrimp trawl gear into the sediment, and is also capable of burrowing out of the path of a fishing gear. *Bathyporeia* spp are not dependent on any other species to provide or maintain their habitat (ABPmer, 2013). Given the small size and high mobility of the genus it is expected that it will not be removed in significant numbers from shrimp trawling.

Infralittoral muddy sand (SS.SSa.IMuSa / SS.SSa.CMuSa; see also Fig 3.6-3) is a non-cohesive muddy sand (with 5% to 20% silt/clay) in the infralittoral zone, extending from the extreme lower shore down to more stable circalittoral zone at about 15–20 m. The habitat supports a variety of animal-dominated communities, particularly polychaetes (*Magelona mirabilis*, *Spiophanes bombyx* and *Chaetozone setosa*), bivalves (*Fabulina fabula* and *Chamelea gallina*) and the urchin *Echinocardium cordatum*. The cohesion characteristic of the sediment provides some stabilisation to erosion following shallow abrasion which in turn gives any species associated with the biotope protection (ABPmer, 2013). Many of the species associated with muddy sands are infaunal (ABPmer, 2013) and so are not always affected by surface abrasion. Species that are near the surface, as they need the surface for respiration and feeding, such as some bivalves, will also be protected as shrimp trawls are light and designed to have limited contact with the surface, meaning the amount of pressure on the surface is minimal. Assessments show (ABPmer 2015) that the sublittoral muddy sand has a high tolerance to surface abrasion and medium tolerance to shallow disturbance. Recovery was assessed as high as even in sheltered habitats tracks are no longer visible after a few months (Fowler, 1999). It was therefore concluded that sublittoral muddy sands are not sensitive to surface abrasion and have a low sensitivity to shallow disturbance. The habitat is not dependent upon the target or non-target species and for its structure and therefore is not considered to be sensitive to the biological effects of their removal (ABPmer 2015).

Other biotopes situated in The Wash SAC were assessed by the ABPmer & Ichthys 2015 study and include: Tide-swept circalittoral²⁴ mixed sediment with *Flustra foliacea* (bryozoan) and the hydroid *Hydrallmania falcata*. (SS.SMx.CMx.FluHyd in Fig. 3.6-3). Where there is suitably stable hard substrata the anemone *Urticina feline* and the soft coral *Alcyonium digitatum* may also characterise this biotope. Barnacles *Balanus crenatus* and tube worms *Pomatoceros triqueter* may be present and the robust bryozoans *Alcyonidium diaphanum* and *Vesicularia spinosa* appear amongst the hydroids at a few sites. *Sabella pavonina* and *Lanice conchilega* may be occasionally found in the coarse sediment around the stones. The habitat is tide-swept and therefore has high tolerance to surface abrasion. Tolerance to shallow disturbance is assessed as medium as the habitat will still remain and any alterations will be to the superficial layers of the habitat only (ABPmer, 2013). Recovery is expected within 2 years (ABPmer, 2013) and so is assessed as high and sensitivity is assessed as low. Hydroids are more delicate, therefore tolerance to surface abrasion and shallow disturbance is assessed as low. Studies suggest that hydroid species may be able to recover well from temporary short-term trawling activities (in ABPmer & Ichthys 2015), indeed hydroids are also often one of the first colonising species when new bare substrate becomes exposed, for example colonising an artificial reef and becoming abundant within a year (Jensen et al., 1994). Therefore, recovery is assessed as high, within 2 years and sensitivity is assessed as medium. The bryozoan *Flustra foliacea* forms a stiff but flexible bushy clump 6–10 cm high, occasionally up to 20 cm high. Although *Flustra foliacea* is flexible, physical disturbance by a passing shrimp trawl has the potential to cause some damage to the fronds and remove some colonies, as such, tolerance to surface abrasion and shallow disturbance is assessed as low. Recovery will depend on recruitment from other populations and is assessed as high. Silén (1981) found that *Flustra foliacea* could repair physical damage to its fronds within 5–10 days.

²⁴ The circalittoral zone is the region beyond the infralittoral, that is, below the algal zone and dominated by sessile organism, such as oysters, mussels etc

Presumably, as long as the holdfast remains intact, *Flustra foliacea* will survive and grow back (Tyler-Walters & Ballerstedt 2007). Therefore, sensitivity is assessed as medium.

Another circalittoral biotope is muddy mixed sediment of sand and gravels characterised by bivalves, *Mysella bidentata* and *Thyasira spp.*, located either moderately exposed or sheltered (SS.SMx.CMx.MysThyMx). (JNCC, 2015). Tolerance to surface abrasion is high, and to shallow disturbance is medium as the habitat will still remain and any alterations will be to the superficial layers of the habitat only (ABPmer, 2013). Recovery is expected within two years (ABPmer, 2013) and so the habitat is not sensitive to surface abrasion and has low sensitivity to shallow disturbance. The small size of *M. bidentata* protects the species from surface abrasion and shallow disturbance. It is expected that they will be able to pass through meshes or be pushed out of the way of the trawl by the pressure wave as it passes (ABPmer, 2013). Therefore, tolerance is assessed as high and recovery as very high, meaning they are assessed as not sensitive to surface abrasion and shallow disturbance. *Thyasira spp* are found 2–8 cm below the sediment surface therefore the vast majority of the population will not be within the penetration depth of the shoes (2cm). Therefore, tolerance is assessed as high and recovery as very high, meaning they are assessed as not sensitive to surface abrasion and shallow disturbance. The number of studies actually measuring the effect of shrimp trawling on the bottom and benthos is limited, but Doeksen (2006) provides an overview. In essence there is no scientific based agreement on the effect of shrimp trawl on the bottom due to the fact that the few studies that have been carried out in the relevant habitat have looked at different time scales and different (i.e. not fished versus recently fished (Riesen & Reise 1982, Berghahn & Vorberg 1997). It is therefore assessed that the biological community does have a medium tolerance to biological disturbance. Recovery is assessed as high. Therefore, it is concluded that *Thyasira spp* and *M. bidentata* have a low sensitivity to biological disturbance.

Sublittoral biogenic reefs play an important role in the structural composition or the stability of the seabed and provides a habitat for other species. As such, this habitat usually supports a diverse range of fauna and flora (JNCC, 2015). Biogenic reefs are not targeted by shrimp trawls in The Wash. *Sabellaria* reefs are protected – as previously described. Field experiments performed on the reefs of *Sabellaria alveolata* on the French Atlantic coast, and also by empirical calculations of the load of the fishing gear and the compressive strength of the reef, showed that the rollers ran over the reef sections, bouncing off the reef surface and had bottom contact for 39% of the overall trawling time. In this particular study the reef structures were shallow and rose to a height of 30 to 40cm above the seabed. In contrast, however, the trawl shoes had left clear impressions, especially where they had contacted the upper edges of the reef (Vorberg, 2000). Species which are sessile or slow moving and fragile will have a low to medium tolerance to surface abrasion and shallow disturbance. Recovery is dependent upon their biological traits and ability to recolonise and resettle following a disturbance event. In Vorberg's study (2000), all traces caused by the fishing gear had disappeared four to five days later due to the building activities of the worms (Vorberg, 2000). The experimental destruction of *Sabellaria* reefs found the growth during the restoration phase was significantly higher than undisturbed growth. In September/October the average undisturbed growth at the three different measurement points was 0.7 mm a day, while the average daily growth after removing 2cm of surface was 4.4 mm day (Vorberg, 2000). Recovery is assessed as medium to very high. Therefore, sensitivity was assessed as low to medium.

A study by Kaiser *et al* (2018) examined the effectiveness of marine reserves for recovery of temperate reef fauna from towed mobile fishing gear in relation to their life history. The study showed that the recovery rates of biota depend on life-history factors, such as larval longevity and dispersal potential. Recovery for species that had low dispersal potential and specific habitat requirements was slow and could take >20 years. This suggests activities such as bottom trawling or dredging should be avoided where such species occur if their conservation

is an objective. In contrast, species with high dispersal potential and less habitat specific requirements had shorter recovery timescales of c. 2-3 years and would be more amenable to managed trawl frequencies in areas where activities such as fishing occur.

Impact management and community engagement

The protection of MPAs from the detrimental impacts of fishing activity is a fundamental obligation of the Eastern IFCA outlined in the Marine and Coastal Access Act (2009), which is to be achieved above all other main duties and as such, is afforded the highest priority²⁵. The Eastern IFCA is currently finalising a project to assess the impacts of all commercial fisheries in European Marine Sites (a type of MPA) within the district (the final document with proposed mitigation measures is out for consultation until September 2018²⁶).

As already mentioned above, a result of this Habitat Regulation Assessment²⁷, EIFCA is introducing new towed gear management in the form of further area closures (Eastern IFCA Stakeholder Engagement plan 2016). Furthermore, as part of the same evaluation of risk exercise, substrate assessments in the W&NNC SAC have concluded that there is the potential for adverse effects on site integrity resulting from the interaction of shrimp beam trawling, alone and in-combination, with the following subtidal habitats:

- subtidal coarse sediment; subtidal mud; and subtidal mixed sediment.

As a result, Eastern IFCA is developing and implementing management measures, in the form of habitat closures, to protect areas of these 3 subtidal habitats from the impacts of towed fishing gears. As stated in the summary for the Habitats Regulations Assessment²⁸:

Eastern IFCA's Shrimp fishery assessment: key points

Overall, the Wash and North Norfolk Coast is in good condition despite shrimp fishing happening within the site; However, there is not enough evidence to prove "no adverse effect" for some areas; Shrimp fishing could be causing damage to sensitive habitats; therefore, we need to introduce restrictions on shrimp fishing; Mitigation has been proposed in the form of spatial closures, technical (gear) restrictions, and effort limitation. With mitigation in place, we conclude that the shrimp fishery will not have an adverse effect on site integrity. Natural England agree with this conclusion. A formal consultation on the mitigation measures will run from 2nd August to 3rd September 2018.

Common Ground was a project led by the Marine Conservation Society and the Eastern Inshore Fisheries and Conservation Authority (IFCA) with the support of The Wash and North Norfolk Marine Partnership²⁹. It was a collaborative project (Common Ground 2017) and documentary about community views on Marine Protected Areas. The project was designed to record sea users' values, opinions and views on their inshore seas and how they are managed as a way to feed directly into the way the IFCA works. All participants were encouraged to identify what they value about their interaction with the coast and sea, and any

²⁵ Eastern IFCA Strategic Assessment 2018-19.

²⁶ <http://www.eastern-ifca.gov.uk/habitats-regulations-assessment-impacts-shrimp-fishery-wash-north-norfolk-coast-special-area-conservation/>

²⁷ Habitats Regulations Assessment of impacts of shrimp fishery on Wash & North Norfolk Coast Special Area of Conservation <http://www.eastern-ifca.gov.uk/habitats-regulations-assessment-impacts-shrimp-fishery-wash-north-norfolk-coast-special-area-conservation/>

²⁸ <http://www.eastern-ifca.gov.uk/habitats-regulations-assessment-impacts-shrimp-fishery-wash-north-norfolk-coast-special-area-conservation/>

²⁹ <https://wnnmp.co.uk/home/partnerships/common-ground/>

actions the IFCA can take to protect what they care about most, including the ability to make a quality living from fishing. All information from the workshops was fed directly to the IFCA who are using it to inform their working priorities. The Common Ground film identified a range of values that disparate and varied sea users held dear. This common ground helped people from different backgrounds talk about the management of the seas at the workshops, in many cases for the first time, leading to new conversations and relationships between the IFCA and sea users who had not previously participated in their consultations.

An annual assessment of Eastern IFCA fisheries is undertaken each year. The Strategic Assessment is used to identify the highest risk elements of all the fisheries in the district, including fisheries sustainability, viability and environmental impacts³⁰. The work in progress includes sustainable shrimp fisheries management in the Wash and North Norfolk Coast SAC, within the context of managing the relevant MPA's. The management of fisheries in Marine Protected Areas includes the development of Monitoring and Control Plan. The work strategy is also linked to the outcomes of the Community Voice Method (CVM) project (see Common Ground 2017), whereby each species landed (based on MMO landings data) is assessed in relation to a number of criteria, including³¹:

Ecosystem impacts – assessment considers the potential ecosystem level impacts of the main gears associated with each species (e.g. by-catch, habitat damage) and the presence or absence of spawning and nursery areas of each species. This links to issue 5 in CVM: Need to improve understanding of the environment.

Fisheries performance – considers the landed weight and value of catch from within the Eastern IFCA district, any detectable trends in landed catch, landings from within the district as a proportion of the UK total and available ICES advice. This links to issue 3 in CVM: Need to ensure fishing sustainability and viability.

Upcoming legislation

Marine Protected Areas Fisheries Management Measures proposed by Eastern IFCA for the Wash and North Norfolk Coast Special Area of Conservation (SAC) are currently going through the approval process. These management measures are specific for the shrimp beam trawl fishery and the protection of features in the SAC. The new measures are designed to mitigate the impact of shrimp fishing on habitats through:

- Spatial closures – to protect the most sensitive habitats of the site by excluding towed demersal fisheries from the main areas of these habitats;
- Technical (gear) restrictions – to limit the impacts from physical contact between gear and seabed features; and
- Effort limits – to ensure activity in the Wash & North Norfolk Coast SAC outside the proposed closures does not exceed levels identified in the HRA.

The measures are set out in two Byelaws and are required to ensure that the shrimp fishery operates in a way that is compatible with the conservation objectives of this SAC. The protection measures consist of two new byelaws: the Marine Protected Areas Byelaw 2018 (replacing Marine Protected Areas Byelaw 2016), and the Shrimp Permit Byelaw 2018.

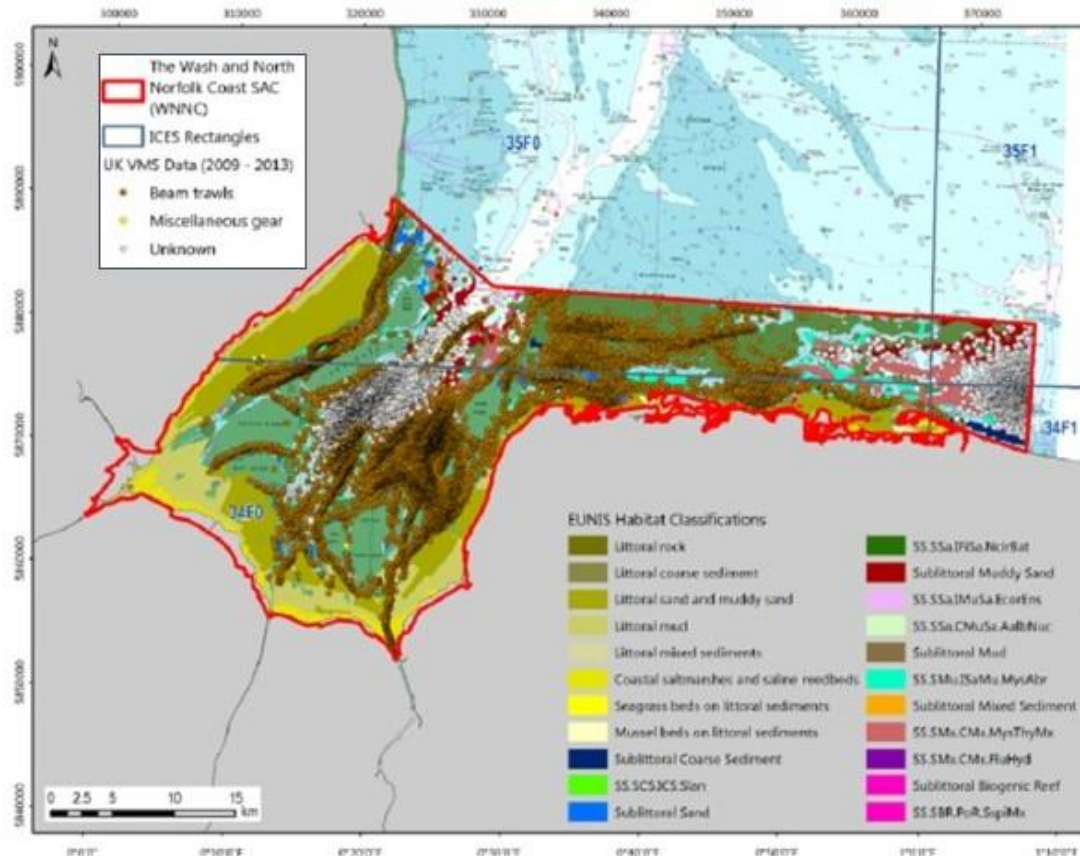
³⁰ Eastern IFCA Strategic Assessment 2018-19

³¹ Taken from EIFCA Strategic Assessment 2018-19

Vessel movement

In order to understand the interaction between the fishery gears and underlying habitat, it is important to see where fishing actually takes place. At present, Vessel Monitoring Systems (VMS) are required in the UK only on vessels $\geq 12\text{m}$ long (EC No. 1224/2009), and from this a location map was generated (Fig 3.6-15)

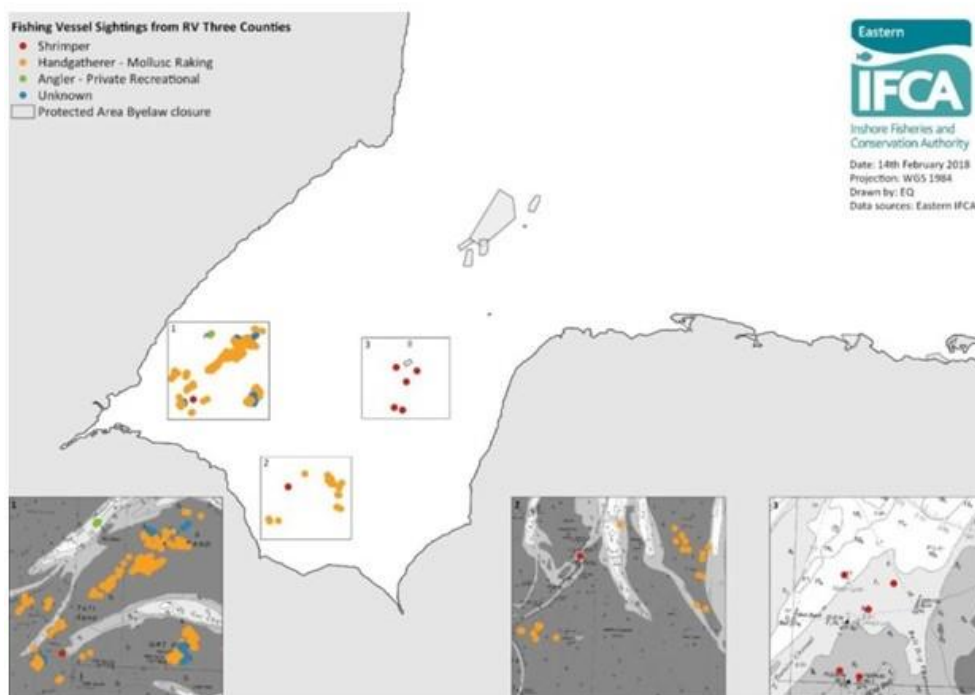
Figure 3.6-15 VMS pings (UK vessels $>15\text{m}$), for beam trawl, miscellaneous, and unknown gears, from 2009-2015 (Source: in ABPmer & Ichthys Marine, 2015)



Current representation of the inshore fleet, which supports a high number of smaller vessels, is poor in fishing intensity data.. The lack of VMS data for The Wash fleet, which is primarily composed of boats $<12\text{m}$, means that currently there are significant gaps in data describing the spatial distribution and intensity of fisheries in the area (Quinn 2018). The representation of the inshore fleet in fishing intensity data is due to change in 2018 upon the arrival of inshore VMS to UK waters, which will be required on all fishing vessels. The I-VMS is designed to be a low-cost reporting system for the management of MPA and inshore fisheries (Williamson 2015), and the requirement for I-VMS is through MMO or IFCA byelaws, not through EU legislation.

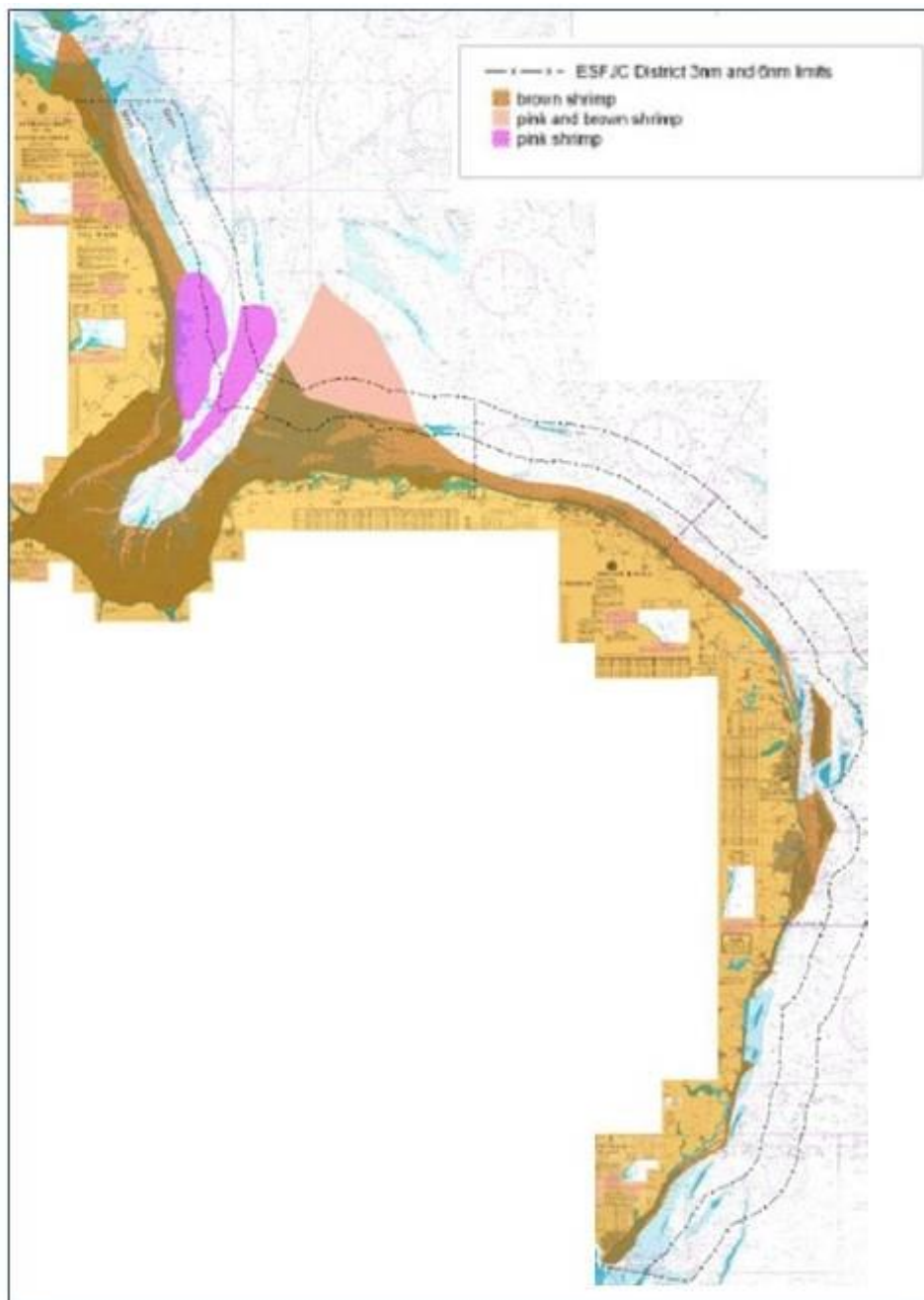
In the meantime, a vessel sightings database was set up in 2010 to record sightings of fishing vessels on an opportunistic basis, when Eastern IFCA officers are at sea for other research and marine protection work. The information gathered from the sightings is collated together with shrimps returns data provided by fishers, and there is correlation where there is area overlap. In 2017, fishing vessels were generally recorded in three distinct areas of The Wash, these have been labelled and reported on as boxes 1 – 3 Fig 3.6-16.

Figure 3.6-16 All fishing vessel sightings recorded in 2017 in The Wash (Source: Quinn 2018)



A project by the Eastern Sea Fisheries Joint Committee also looked at the distribution of shrimp fisheries in the Wash area, and the map shows the distribution in 2010 (Fig. 3.6-17).

Figure 3.6-17 Distribution of shrimp fisheries along the East coast, for 2010 (Source: ESFJC 2010)



3.6.3 Primary and Secondary species

The Brown Shrimp fishery is carried out in coastal zones and estuaries with small meshed nets. The discarding practices associated with it have been regarded as a problem for many

years, indeed since the 1930s, as summarised by Polet (2003) and Neudecker & Damm (2010). The bycatch and discarding of juvenile (flat)fish species, in particular plaice, in the brown shrimp fishery is extensively reported and a well-recognised issue (Revill and Holst, 2004; Catchpole et al, 2008; Neudecker & Damm 2010). There have been a number of relevant studies in the North Sea, in particular the Wadden Sea area (Steenbergen et al 2015; ICES WGCAN 2015; Steenbergen & Rasenberg 2012; Stepputtis et al 2014). In recent years gear design and on-board handling of the catch has made a significant difference as to the amount of bycatch, which will be discussed further below.

Catch composition

Between 2015 to 2017 a catch profile was developed using data collected as part of the Cefas Observer programme on shrimp beam trawls fishing in the Wash. In total, 13 fishing trips were sampled. For each trip, numbers-at-length were raised to the haul, based on an estimated proportion of the total catch volume sampled, then to the trip, based on the proportion of sampled hauls and fished hauls. The length-based data was converted to biomass, using length-weight relationships for each species collected during various scientific trawl surveys (Cefas, *unpubl. Data*; Ana Ribeiro Santos, Cefas, *pers.comm.* April 2018). The catch profile is presented in Table 3.6-1.

Table 3.6-1 Catch composition from observer data for 2015-2017 (Cefas 2018)

Common Name	Scientific Name	Total catch by spp (kg)	Percentage of total catch incl shrimp	Primary (P)/ Secondary (S)
WHITING	<i>Merlangius merlangus</i>	769.92	10.2%	P / main
GOBIES*	<i>Gobiidae</i>	750.65	9.96%	S / main
DAB	<i>Limanda</i>	447.01	5.93%	P / main
EUROPEAN PLAICE	<i>Pleuronectes platessa</i>	201.89	2.68%	P / minor
HERRING	<i>Clupea harengus</i>	177.95	2.36%	P / minor
SPRAT	<i>Sprattus sprattus</i>	75.81	1.01%	P / minor
BASSES	<i>Dicentrarchus spp</i>	74.95	1.00%	S / minor
POGGE (armed bullhead)	<i>Agonus cataphractus</i>	34.06	0.45%	S / minor
BULLROUT ³²	<i>Myxocephalus scorpius</i>	27.19	0.36%	S / minor
COMMON DRAGONET	<i>Callionymus lyra</i>	21.94	0.29%	S / minor
SMELT (SPARLING)***	<i>Osmerus eperlanus</i>	12.48	0.17%	S / minor
HORSE-MACKEREL (SCAD)	<i>Trachurus trachurus</i>	7.11	0.09%	P / minor
SANDEEL	<i>Ammodytes tobianus</i>	6.51	0.09%	P / minor

³² After checking through the species list, it was discovered that 'bullrout' may be a mis-nomer, as this species does not live in the NE Atlantic. It is more likely, from the Latin name, that the observer meant 'Shorthorn sculpin'

SOLE (DOVER SOLE)	<i>Solea solea (=S.vulgaris)</i>	5.48	0.07%	P / minor
SEA SNAILS	<i>Liparis spp</i>	9.21	0.12%	S / minor
LESSER WEEVER FISH	<i>Echiichthys (Trachinus) viper</i>	4.10	0.05%	S / minor
FLOUNDER (EUROPEAN)	<i>Platyichthys flesus</i>	3.98	0.05%	P / minor
PIPER	<i>Trigla lyra</i>	2.62	0.03%	S / minor
COD	<i>Gadus morhua</i>	2.35	0.03%	P / minor
POOR COD	<i>Trisopterus minutus</i>	1.91	0.03%	S / minor
EUROPEAN SEABASS	<i>Dicentrarchus labrax</i>	1.71	0.02%	P / minor
FOUR-BEARDED ROCKLING	<i>Enchelyopus cimbrius</i>	1.61	0.02%	S / minor
NILSSON'S PIPEFISH	<i>Syngnathus rostellatus</i>	1.44	0.02%	S / minor
GREY GURNARD	<i>Eutrigla (Chelidonichthys) gurnadus</i>	1.18	0.02%	S / minor
SOLENETTE	<i>Buglossidium luteum</i>	0.78	0.01%	S / minor
PIPE-FISHES/SEAHORSES	<i>Syngnathidae</i>	0.62	0.01%	S / minor
THICKBACK SOLE	<i>Microchirus variegatus</i>	0.36	0.00%	S / minor
EELPOUT/VIVIPARUS BLENNY	<i>Zoarces viviparus</i>	0.36	0.00%	S / minor
LEMON SOLE	<i>Microstomus kitt</i>	0.32	0.00%	P / minor
BRILL	<i>Scophthalmus rhombus</i>	0.31	0.00%	P / minor
SAND SOLE	<i>Pegusa (Solea) lascaris</i>	0.10	0.00%	S / minor
BALLAN WRASSE	<i>Labrus bergylta</i>	0.07	0.00%	S / minor
WITCH	<i>Glyptocephalus cynoglossus</i>	0.05	0.00%	P / minor
THREE-BEARDED ROCKLING	<i>Gaidropsaus vulgaris</i>	0.04	0.00%	S / minor
THORNBACK RAY ³³ (ROKER)	<i>Raja clavata</i>	0.03	0.00%	S / minor
ESMARK'S EELPOUT	<i>Lycodes esmarkii</i>	0.00	0.00%	S / minor
EUROPEAN EEL **	<i>Anguilla anguilla</i>	0.00	0.00%	S/minor
EEL-POUTS**	<i>Zoarcidae</i>	0.00	0.00%	S / minor

³³ Although classified as NT by IUCN Red Book, it is not an EU protected species, nor is it listed in the 2018 Technical Measures for fishing in EU waters. It is thus a Secondary species.

LUMPSUCKER**	<i>Cyclopterus lumpus</i>	0.00	0.00%	P / minor
SHRIMP	<i>Crangon crangon</i>	4887	64.87%	target
		7533.08	100%	

*Gobies occurred several times in the data set, either as a group or to species level. This is likely due to Observers improving identification skills. It was decided to group all gobies entries together.

**Although the European eel was listed in the data table, it was actually recorded as '0', meaning there was no bycatch of European eel recorded by the observers. The same for Lumpsucker and Eelpouts. European eel is a CITES II listed species and therefore not an ETP. It is listed to be a UK BAP species (2010), as part of river habitat management. It is not listed under Article 13 (Prohibitions) of the Technical Measures EU 2018/120, although it states under (9): As regards European eel (*Anguilla anguilla*) stock, the ICES has advised that all anthropogenic mortalities should be reduced to zero, or kept as close to zero as possible. In the light of that advice, it is appropriate to establish a temporary prohibition to fish for European eel of an overall length of 12 cm or longer in Union waters of ICES area including in the Baltic Sea, to protect spawners during their migration. European eel is not an ETP species.

*** **Smelt (*Osmerus eperlanus*)**, is listed on the UK BAP priority fish species³⁴ as published in 2007 and the Priority Species data collation in 2010 states that this species is in serious decline³⁵ due to river habitat loss. It is stated under NERC 2006 S. 41 to be: "Species "of principal importance for the purpose of conserving biodiversity", together with such species as cod, mackerel and herring, which are found on the same list. The species is listed as LC (least concern) on the IUCN Red Data list and fishbase.org³⁶. It is not listed under relevant marine conservation legislation, such as The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 SI1842³⁷, nor The Conservation of Habitats and Species Regulations 2017 SI1012³⁸)

The catch profile (Table 3.6-1) was used to calculate Primary and Secondary species.

Primary species are those which are managed, i.e. species of commercial value with management tools controlling exploitation. The definition of a primary species (CR v2.0 SA3.1.3.3) is as follows: "A species where management tools and measures are in place, intended to achieve stock management objectives reflected in either limit or target reference points". From this it is clear that only a limit or target reference point needs to be in place. Guidance CR v2 GSA3.1 also gives an example of a primary species as follows: "A species that does not have a full analytical stock assessment, but where established proxies for the PRI are in place and all fisheries impacting that stock are managed to maintain the stock above that proxy reference point." This definition applies to the species identified as Primary in this fishery which do not have full analytical assessments.

Furthermore, Primary species are divided into 'main' and 'minor' groups where 'Main' are those species where the catch of that species comprises 5% or more by weight of the total catch of all species by the UoA; it is also 'Main' if the species is classified as 'less resilient'

³⁴ <http://jncc.defra.gov.uk/page-5164>

³⁵ <http://jncc.defra.gov.uk/speciespages/2477.pdf>

³⁶ <https://www.fishbase.de/Summary/SpeciesSummary.php?ID=1334&AT=smelt>

³⁷ <https://www.legislation.gov.uk/ukxi/2007/1842/schedule/1/made>

³⁸ <https://www.legislation.gov.uk/ukxi/2017/1012/schedule/5/made>

and the catch of that species comprises 2% or more by weight of the total catch of all species. Therefore, it is important that the total catch of all species by the UoA is known. All other primary species not considered 'main' are considered 'minor' species.

Secondary species include fish that are not managed according to reference points, and all species that are 'out of scope' of the standard (birds/ mammals/ reptiles/ amphibians). These 'out of scope' species, if they are not ETPs, are considered 'main' (whereby percentage thresholds apply – see SA3.4.1-5), unless they can be released alive (SA3.4.3). Once that has been established, those Secondary species within scope are assessed as to whether they are 'main' (catch percentage thresholds apply) or 'minor'.

Primary Species

The catch composition Table 3.6-1 was divided into Primary main and minor species, as well as Secondary main and minor species, discussed in the next section.

Species	Assessment Unit ICES Area	B _{lim}	MSY	Advisory Category	Stock status	ICES Advice Year/ section
'Main'						
Whiting <i>Merlangius merlangus</i>	IV	Yes	Yes	Analytical assessment	SSB is now slightly below MSY Btrigger; F is above F _{MSY} ; stock is at full reproductive capacity;	August 2019 ³⁹
Dab <i>Limanda limanda</i>	IV	Yes	Yes	SSB is now estimated with a survey-based assessment model	Stock is above MSY Btrigger (proxy) and above possible reference points	June 2017/ dab.27.3a4/ ICES 2017 ⁴⁰
'Minor'						
European plaice <i>Pleuronectes platessa</i>	IV	Yes	Yes	Analytical assessment	Stock is above MSY Btrigger; and at full reproductive capacity; harvested sustainably	June 2019 ⁴¹
Herring <i>Clupea harengus</i>	IV	Yes	Yes	Analytical assessment	Stock is above MSY Btrigger; and at full reproductive	May 2019 ⁴²

³⁹ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/whg.27.47d.pdf>

⁴⁰ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/dab.27.3a4.pdf>

⁴¹ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/ple.27.420.pdf>

⁴² <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/her.27.3a47d.pdf>

					capacity; harvested sustainably	
Sprat <i>Sprattus sprattus</i>	IV	Yes	Yes	Age based analytical assessment	Stock is above MSY Btrigger; and at full reproductive capacity	June 2019 ⁴³
Horse mackerel <i>Trachurus trachurus</i>	IVb,c	No	No	Survey based assessment, Category 3 stock ⁴⁴	undefined	Sept 2017/ hom.27.3a4b c7d/ ICES 2017 ⁴⁵
Sandeel <i>Ammodytes tobianus</i>	IVb,c 1r	Yes	No	Analytical assessment	SSB below Blim; stock at full reproductive capacity	Feb 2019 ⁴⁶
Sole <i>Solea solea</i>	IV	Yes	Yes	Analytical assessment	SSB above Btrigger; full reproductive capacity	June 2019/ ⁴⁷
Flounder <i>Platychthys flesus</i>	IV, 3a	No	No	Category 3 stock, survey-based assessment	F below MSY; and below possible reference points	June 2017 ⁴⁸ /
Cod <i>Gadus morhua</i>	IV, 7d	Yes	Yes	Analytical assessment	SSB below MSYBtrigger, stock at increased risk/ F above FMSY and above Fpa and Flim	June 2019 ⁴⁹
European seabass <i>Dicentrarchus labrax</i>	IVb,c, 7ad-h	Yes	Yes	Analytical assessment	SSB below MSYBtrigger, reduced reproductive capacity	June 2019 ⁵⁰
Lemon sole <i>Microstomus kitt</i>	IV, 3a, 7d	Yes	Yes/ proxy	Category 3 stock, survey trends-based assessment	SSB above MSYBtrigger (proxy); Stock biomass above possible reference points	June 2019 ⁵¹

⁴³ <http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/spr.27.3a4.pdf>

⁴⁴ http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Introduction_to_advice_2016.pdf

⁴⁵ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/hom.27.3a4bc7d.pdf>

⁴⁶ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/san.sa.1r.pdf>

⁴⁷ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/sol.27.4.pdf>

⁴⁸ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/sol.27.4.pdf>

⁴⁹ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/cod.27.47d20.pdf>

⁵⁰ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/bss.27.4bc7ad-h.pdf>

⁵¹ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/lem.27.3a47d.pdf>

Brill <i>Scophthalmus rhombus</i>	IV, 3a, 7de	Yes	Yes, proxy	Category 3 stock, survey trends based assessment	SSB above proxy MSYBtrigger, Stock biomass above possible reference points	June 2019 ⁵²
Witch <i>Glyptocephalus cynoglossus</i>	IV, 3a, 7d	Yes	Yes,	This is the first time ICES provides advice for witch as a category 1 stock (analytical assessment)	SSB above MSY Btrigger, Bpa, and Blim. The stock is at full reproductive capacity.	June 2019 ⁵³

For dab, flounder, horse mackerel, lemon sole, and brill there is an assessment of stock status in relation to proxy reference points, catch advice is given by ICES and they are managed under the multiannual plan for demersal stocks in the North Sea and the fisheries exploiting those stocks (EU 2018/973). It seems reasonable to conclude that the management plan implicitly (although not necessarily explicitly) aims to maintain these stocks above the proxy reference points. There may not be TACs for some or all of these species, but for dab, for example, the ICES advice describes the justification for why the combined TAC for dab and flounder was removed. Furthermore, as part of the demersal fisheries multi-annual management plan, catch limits can be introduced if stock status declined relative to the proxy reference points, whereby all fisheries impacting that stock are managed to maintain the stock above that proxy reference point. These species listed above are therefore considered managed under the MSC v2.0 definition for Primary species.

Secondary Species

The number of different species in the bycatch is large in this fishery, a reflection of the gear type, seasonality and location, whereby much of the bycatch would be juveniles. It is recommended to conduct a Productivity Susceptibility Analysis (PSA)⁵⁴ on all those species for which no reference points are available, i.e. Secondary. PSA is a semi-quantitative and rapid risk assessment tool that relies on the life history characteristics of a stock (i.e., productivity) and its susceptibility to the fishery in question. This would constitute a risk analysis for each species, calculating an individual score for each species (see also Patrick et al 2009). In the case of this fishery, where so many species are involved, the client should provide such a list of PSA scores for each bycatch species, as part of the regular bycatch analysis.

Twenty-one Secondary species have been recorded in the bycatch. Only one Secondary species can be categorized as 'main' - gobies (9.96%), none of the other Secondary species meet the 5% or 2% threshold.

⁵² <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/bll.27.3a47de.pdf>

⁵³ <http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/wit.27.3a47d.pdf>

⁵⁴ The productivity and susceptibility of a stock is determined by providing a score ranging from 1 (low) to 3 (high) for a standardized set of attributes related to each index. When scoring these attributes, the user has the ability to also assess the data quality associated with each attribute score, and customize the analysis by weighting these attributes according to the fishery. The scores for the productivity and susceptibility indices are then automatically calculated and graphically displayed on an x-y scatter plot. Stocks that receive a low productivity score and high susceptibility score are considered to be at a high risk of becoming depleted, while stocks with a high productivity score and low susceptibility score are considered to be at low risk of becoming depleted; https://www.nefsc.noaa.gov/nft/PSA_pgm.htm

Goby (*Pomatoschistus* spp.)

Species determination of gobies in the field is often impossible thus data availability is limited to the genus *Pomatoschistus* spp. The more abundant goby in the bycatch of the shrimp fishery tends to be the sand goby *Pomatoschistus minutus* (Ellis & Rogers 2015) while other goby species like *P. microps*, *P. lozanoi* or *P. pictus* are less common. Apart from a short pelagic larval stage, sand gobies are benthic species preferring sandy to muddy bottoms in estuarine and inshore waters (Ellis & Rogers 2015). During their movements and migration they do not leave the area. Consequently, there is a high overlap with the brown shrimp fishery area.

Small gobies resemble brown shrimp in shape and length, thereby sorting measures on board are not suitable to separate gobies completely from the edible shrimp fraction and a certain share of the smaller gobies can end up in the cooker. The rest is released and survival rate is estimated to be 50 to 80 %, provided the on-board handling occurs with plenty of water for quick release flushing (*pers.comm.* Vorberg 2017). Sand gobies occur regularly in high densities sometimes in very high densities. Depending on sampling gear and method, an abundance of up to 8000 individuals per hectare could be demonstrated for the Wadden Sea area (Vorberg & Breckling 1999).

As the species is of no commercial interest, little is known of stock size and development. According to the IUCN Red List as stated on fishbase.org sand goby is considered as 'least concern' and the current population trend as 'stable'.

As gobies are categorised as Secondary main from the catch composition table, an RBF was triggered (MSC CR v2.0 PF4.1.4). Stakeholders were interviewed at the site visit regarding the susceptibility component of the PSA, although they generally felt more comfortable deferring to Cefas, who handles the bycatch during observer trips. The RBF is detailed in Appendix 1.2

Bycatch reduction and gear research

There are statutory bycatch reduction regulations in the shrimp fishery, including:

a) riddles: EU Fisheries regulations (850/98 - Article 25) require the use of onboard riddles to separate shrimp from flatfish. Fisheries use these riddles to separate undersized and return to the sea brown shrimp below 46 mm (female) and 48 mm (male). The survival levels of brown shrimp post return to the sea have been studied, examining effects of riddling and bird predation. It was estimated that between 77 and 80% of all undersized brown shrimp entering a shrimp beam trawl would survive, depending on the level of bird predation (Lancaster and Frid, 2002)

b) The EU technical regulations (EU 227/2013) permitting the use of 16-31 mm cod ends for targeting Brown shrimp, provided a sieve or veil net (Fig 3.6-19) or grid (Fig 3.6-20) is used to reduce bycatch. This measure reduces bycatch by deflecting fish species downwards by the use of a panel of netting or veil through an opening in the lower panel of the net, whilst allowing shrimps to pass through the veil into the cod end. This method is effective in reducing bycatch of fish of larger than 10 cm⁵⁵. Sieve nets are only required by vessels with an aggregate beam width ≥8m (Client information Oct 2019)

⁵⁵ www.seafish.org

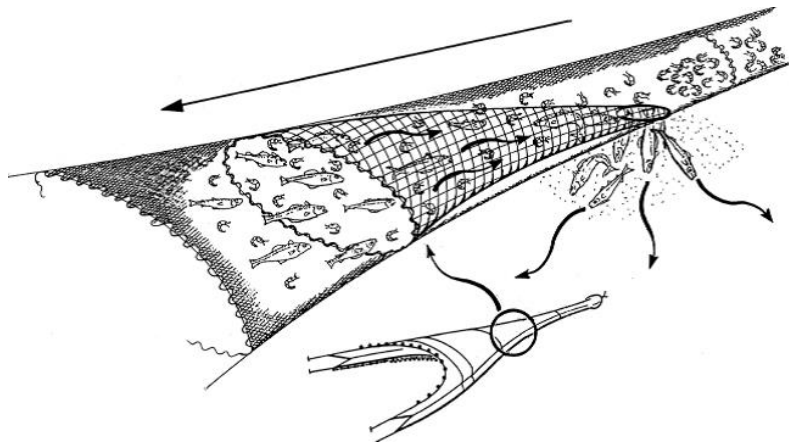


Figure 3.6-19 A sieve or veil net is used in the brown shrimp fishery to reduce bycatch of fish.
(Source: www.seafish.org)

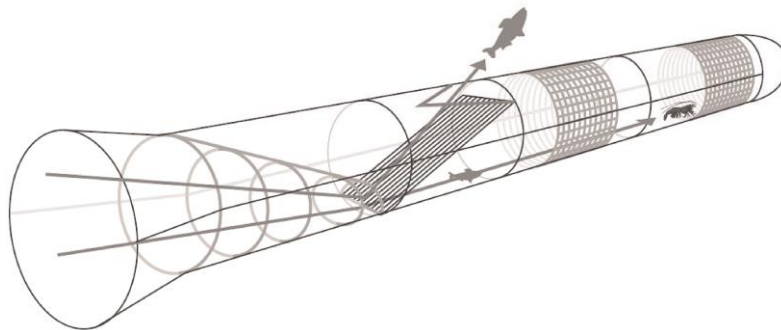


Figure 3.6-20 Schematic illustration of a size and species selective trawl using a 'grid'. Entering fish are led towards the trawl floor and grid via a leading funnel. Larger fish are then led out of the trawl by the grid while smaller fish and shrimp for e.g., pass through the grid and enter the codend (Source: EU Regulation 227/2013)

Mesh sizes of the sieve nets in the client fishery are a maximum of 70mm. As the sieve net sorts out larger animals during the actual fishing process, flatfish such as plaice, starting at sizes of approx. 8 to 12cm, are sieved out and no longer appear in the by-catch (Wienbeck 1993; Neudecker & Damm 2010). All remaining animals and similar sized objects, which are still caught, are emptied into the hopper of the vessel, and are transferred to rotating sieves operated with high amounts of running sea water to increase survival rates (Aviat 2011).

Research into the selectivity of sieve nets (Polet 2003), mounted in front of the cod end has shown that the selectivity of the sieve net for Age 0 fish is very low. Therefore, this device is of rather low value in areas where large amounts of these small fish are caught. The use of the sieve net leads to a significant reduction in unwanted bycatch of invertebrates and non-commercial fish species, which would reduce the impact of the fishery on the marine environment in general. However, the sieve net does lead to losses of commercial shrimp in certain areas and season.

New methods for improving gear efficiency and reducing bycatch continue to be investigated, including the effects of using different mesh types and width in the cod end of conventional gears. Experiments showed that cod ends with T0 or T90 meshes and a mesh size of 26 mm or square mesh cod ends (T45) with a mesh size of 24 mm significantly reduced discards of undersized shrimp. This effect depended on the season, whereby it was more pronounced in summer than in autumn. In summary, it could be shown that increasing the mesh size will decrease the bycatch of undersized shrimps and will - in a situation of a high F/M ratio - lead to increased catch weights and in general larger shrimps in the catch and the population

(CRANNET⁵⁶). Steenbergen *et al* (2011) investigated the use of a 'letterbox' as part of the net configuration, in order to reduce plaice bycatch. The letterbox is a new gear adjustment that consists of a release hole transversely over the net. The idea is that the shrimps go over the hole in the net, while flatfish can escape through the release hole. It was concluded that the letterbox could be a good alternative for the sieve net, especially in spring, when there is a high abundance of juvenile plaice in some shallow water areas. The study noted, however, that the adjustment was not as effective as the sieve net for all species.

The use of optimized cod ends also showed a decrease in the numbers of various by-catch species (Catchpole 2009), although by-catch results were significantly influenced by fishing grounds and season. Furthermore, the type of cod end mesh affected catchability of particular fish species to different extent. Flatfish such as plaice (*Pleuronectes platessa*) experienced better sparing effects when cod ends with T0 mesh compared to cod ends with T45 or T90 mesh were used. In contrast, beneficial sparing effects were found for roundfish species such as goby (*Pomatoschistus* spp.) and hooknose (*Agonus cataphractus*) when square mesh cod ends were used. Square-mesh netting or T90 netting can be used in the construction of the whole codend. These materials provide more consistent selectivity, as the meshes remain uniformly open under tension in the trawl. In traditional diamond-mesh codends there are only certain areas in which the meshes are spread to allow fish to escape. With square-mesh or T90 codends the meshes are more likely to remain open, which creates more opportunities for fish to escape. Square-mesh codends have consistently been shown to be more selective. For example, the use of a square-mesh codend in combination with a selection grid is mandatory in Sweden's Nephrops otter trawl fishery. However, this is not necessarily appropriate for the brown shrimp fishery, where the target species is small.

Vessels fishing for brown shrimp in UK waters must use a grid with a bar spacing of no more than 20mm, fitted so that fish cannot reach the codend without passing through the grid. Research on the use of selective sorting grids in front of the cod-end, to reduce by-catch, has had mixed results, depending on the fishing grounds, as the grid was prone to clogging-up by benthic organisms such as starfish. This made it unacceptable to fishers, despite some clear advantages such as catch reduction of Age 1+ fish, non-commercial fish and invertebrates (Polet 2003).

On-board handling of catch and Survivability studies

The on-board handling of the catch depends to a certain extent on the size of the vessel, as the sorting and processing equipment needs space. Steenbergen *et al* (2015) provided a detailed description of on-board handling of the catch (although for the Dutch fishery, this is applicable here too), the first stage of which is of particular relevance here, as it gives an indication about how speedily the catch is handled. In the process of separating marketable

Figure 3.6-18 Sieving devices on board of shrimp vessels: coaxial sieving drums (left), trembling/shaker sieve (right) (Source: Steenbergen *et al*, 2015).



⁵⁶ <https://www.thuenen.de/en/sf/projects/optimised-brown-shrimp-fishery-crannet/>

shrimp from undersized shrimp and bycatch, the catch is sieved a number of times, on board as well as after landing. The first sieve separates the marketable sized shrimps from small non-marketable sized shrimps, fish, benthic organisms, seaweed and shells. The shrimp sorting devices used in this step are coaxial sieving drums that make a rotating movement (Fig 3.6-18 left side) or trembling/shaking sieves (Fig 3.6-18 right side). The drums separate organisms based on their shape and size. The sorting process and the discharge take place in seawater, and the sorted bycatch is released back into the sea as quickly as possible, preferably via a discharge chute, thus increasing the survivability of the organisms. Because marketable sized shrimps are separated based on their shape and size it is possible that species with similar body shape and size, e.g. goby or hooknose, are retained in this part of the catch.

Marketable sized shrimps are then cooked in the boiling pot, after which another sieve separates the retained small shrimps from the marketable shrimps (Fig 3.6-18 right side). Some fish, like goby, dissolve in the cooking process. Fish or other organisms that do not dissolve in the cooking process are removed by hand, and clean shrimp ready for landing remains. Ashore the landed shrimps are sieved into different size categories, under hygienic conditions, boxed up according to category and frozen.

The vessels in the Wash Brown shrimp fishery use either a rotary system or a shaker type riddle system (Client *pers com.* 28.05.2018, as well as spreadsheet seen of vessels and gears). A consultation, initiated by the client in 2012, tried to find out which sorting device was preferable, rotary vs shaker as a management measure for bycatch (Spindrift-Marine 2012⁵⁷). The investigation concluded that there was little research evidence, comparing these two methods, available at that time. One study that was available concluded that there was no significant difference in survival of bycatch (Berghahn *et al* 1992) between the two methods. Survival depended on different factors, discussed below.

Survival experiments on discards in the shrimp fishery indicate that discard survival is variable, depending on many factors, such as exposure on deck, seasonality, water temperature, air temperature, body size, age of fish, depth caught, catch composition, haul duration, breeding and health status of fish etc. A brief overview was given by Steenbergen *et al* (2015). Boddeke (1989) showed that the main causes of fish mortality were the sorting of the catch on board by means of mechanical sorting sieves and the duration of the catch on board, especially during warm sunny weather. He estimated mortality of juvenile plaice (*Pleuronectes platessa*) to range between 5% and 90%. Berghahn *et.al.* (1992) described a 100% mortality rate for whiting (*Merlangius merlangus*), 10% for bull-rout (*Myoxocephalus scorpius*), hooknose (*Agonus cataphractus*), and viviparous blenny (*Zoarcetes viviparus*). Mortality of flatfish discards depended strongly on the species, the size of the individual fish and catch processing conditions and ranged from 0 to 83%. No differences could be detected in the survival after sorting on different machines. However, due to better sorting efficiency, the rotary sieve may reduce mortality of fish in the by-catch (Berghahn *et. al.* 1992).

Similarly to Berghahn, Lancaster (1999) found that survivability of the bycatch varied with size and species of fish, and with tow duration (as above). In terms of catch composition, where the Berghahn study focused on juvenile plaice, the Lancaster study looked at different gear set-ups all of which used shaking sieve sorters, and noted that plaice and dab were less frequent in the bycatch of the Wash fisheries than those in the Solway Firth. Mortality of shrimp discards in Dutch and German coastal waters is likely to be low. Gamito *et al* (2003) estimated mortality of brown shrimps in the beam trawl fishery in the Tagus estuary. Mortality was estimated to be 0% for water temperatures below 20°C. For temperatures above 20°C mortality increased considerably depending on temperature, fishing and sorting time. Lancaster & Frid (2002) estimated a survival rate of 91% for brown shrimp in UK waters.

⁵⁷ Letter from Spindrift Marine to Client regarding: INVESTIGATION OF THE EVIDENCE TO SUPPORT THE PREFERENTIAL USE OF ROTARY RIDDLE VS. TRADITIONAL SHAKING SIEVE SORTING MACHINES IN THE SHRIMP FISHERY. 6th. Nov. 2012

A summary of recent studies on survivability of discards in the demersal trawl fishery has been published by STECF (2014) based on Revill (2012). In general, the studies showed that elasmobranchs, specifically species of ray, have the highest and most consistent levels of discard survival. Survival rates are typically in excess of 50% across all gears and greater than 80% in many cases. The survival of skates (*Raja*) depended on the condition of the fish once released from the codend, the heavier the codend the worse the outcome. Mortality rates for skates of moderate health and good "health" were 16% and 5%, respectively (Enever *et al* 2009). Studies which have looked at flatfish species including plaice (*Pleuronectes platessa*) and sole (*Solea solea*) and dab (*Limanda limanda*) show variable results between species, with plaice exhibiting higher (~40 – 80%) levels than sole and dab. Survival of plaice has also been shown to be length dependent, with smaller individuals showing lower survival rates than older fish. Survival was also shown to decrease during spawning periods. A study by Ribero Santos *et al* (2016) on mortality of sole in the inshore otter trawl fishery off east England estimated the overall survival to be 51% for those sole under the legal landing size (or Minimum Conservation Reference Size) and 46% for the whole catch.

To quantify survival rates and to understand the factors that may influence survival e.g. physical injury, stress etc., many experiments use captive conditions where animals are monitored in tanks or pens. While this provides a scientific approach, it protects discarded animals from potential predators (sea birds, marine mammals, other fish etc.) that they may otherwise have encountered post discarding. The capture and discarding process is likely to result in a range of injuries and other traumas e.g. oxygen depletion, elevated stress, infection and disease that may severely limit an individual's ability to evade predation in the wild. Therefore, with experimental induced mortality accounted for, the survival estimates from captive observation studies are likely to represent over-estimates of actual survival (STECF 2014).

In the fishery under assessment, the fish caught as bycatch are mainly juveniles. The on-deck sorting procedure aims for rapid sorting and release back into the water, in order to ensure the highest possible survival rate (Site visit pers. com. with fishers). Flatfish species (plaice, sole, dab, flounder) and the resident species typical for The Wash area (rockling, sculpin, sea snail, eelpout, pipefish etc) appear to show a high survival rate (Berghahn *et al.* 1992), depending on trawl duration, temperature and catch composition (*pers.comm.* with fishers at site visit). It appears that gobies are able to survive the catching and sorting procedure fairly well, which may be due to the general ability to live in such a high energy environment as the intertidal and subtidal with strong currents. Roundfish (smelt, herring, whiting, sprat, cod) by comparison appear to be more sensitive to handling, the mortality rate is generally 100% (*pers.comm.* fisher interviews). These observations seem to be backed up by survivability studies outlined above, as well as those compiled by Revill (2012).

3.6.4 ETPs

A number of ETP species could occur in the area of the fishery, these are listed below.

European marine protected species are those listed on Annex IV of the Habitats Directive⁵⁸ whose natural range includes any area in Great Britain. In UK waters, these consist of several species of cetaceans (whales, dolphins and porpoises), turtles and the Atlantic Sturgeon. The Habitats Directive is transposed into UK law under the Habitat Regulations (HR)⁵⁹ for England and Wales (as amended) and the Offshore Marine Conservation (Natural Habitats etc)

⁵⁸ Council Directive 92/43/EEC

⁵⁹ The Conservation of Habitats and Species Regulations 2017, No. 1012
<https://www.legislation.gov.uk/uksi/2017/1012/contents/made>

Regulations 2007 (as amended)⁶⁰, which make it an offence to kill, injure, capture or disturb European marine protected species. Similar legislation exists for Scottish and Irish inshore waters. The Habitats Directive contains measures requiring European Member States to: monitor the conservation status of species listed on the Habitats Directive; ensure measures are in place to prevent capture, killing or disturbance; and to monitor by-catch.

In order to implement these regulations, measures have been introduced, such as a UK cetacean surveillance and monitoring programme⁶¹ and 2007 saw the completion of the first Favourable Conservation Status reports under the Habitats Directive. The programme collates data for all cetacean strandings around the UK coast, determines the cause of death and surveys the incidence of disease. To enable the results of this surveillance to be used in future assessments of the conservation status of cetaceans, a web-based portal for effort-related sightings data – the Joint Cetacean Protocol⁶² – is being developed and implemented by JNCC and partners.

Furthermore, it is an offence to kill, injure, capture or disturb European Protected Species. Good practice guidelines and protocols have been produced for marine industries (pile driving, seismic surveys, use of explosives) on how to assess the likelihood of committing an offence to such species, how to avoid it and whether a licence to carry out activity might be required or not.

Monitoring of by-catch: EU Regulation 812/2004 was implemented in 2005 under the requirements of Article 12 of the Habitats Directive. The regulation requires cetacean observers on-board commercial fishing vessels to minimise cetacean by-catch from fisheries. Sampling should be geared to achieve a bycatch estimate with a coefficient of variation (CV) of less than 0.3. This can only be achieved if there is one or more observed bycatch event. In the absence of any observed bycatch, and assuming continued monitoring is needed, the UK uses the 'pilot study' levels of 10% and 5% for the various fishery segments as the most appropriate approach to setting monitoring requirement levels.

The two main species affected by fishing in UK waters are the harbour porpoise and the short-beaked common dolphin. Since Regulation 812/2004 came into force, for four years running (2005-2008 inclusive) there have been no observations of cetacean bycatch in any of the fleet segments listed for compulsory monitoring. This is not to suggest that UK fisheries do not have a bycatch of any cetaceans, but rather that the segments being statutorily observed under the regulation have very low bycatch rates and are thus unlikely to be at a level that are a conservation threat. This finding has been echoed by other Member States, and lead to a review of the fleets that are currently being sampled, recommending that future coverage should include tangle net, setnet and gillnet fisheries deployed from vessels <15m as well as demersal trawl fisheries. There has not yet been a decision on these recommendations.

⁶⁰ The Conservation of Offshore Marine Habitats and Species Regulations 2017, No.1013; <https://www.legislation.gov.uk/uksi/2017/1013/contents/made>; The Offshore Habitats Regulations fulfil the UK's duty to comply with European law beyond inshore waters and ensure that activities regulated by the UK that have an effect on important species and habitats in the offshore marine environment can be managed.

⁶¹ <http://ukstrandings.org/project-aims/>

⁶² <http://jncc.defra.gov.uk/page-5657>

Harbour porpoise *Phocoena*

The harbour porpoise is a small, highly mobile species of cetacean that is common to all UK waters. It is present off The Wash (see Fig 3.6-19)

Because of pressures such as incidental fisheries by-catch, the species has been assessed as under threat/in decline in the Greater North Sea and Celtic Sea, resulting in its recognition as a species of conservation importance under several directives and conventions. This includes Annexes II and IV of the Habitats Directive, Appendix II of the Bonn Convention and the UK Biodiversity Action Plan. Between the only two wide-scale surveys in the UK and adjacent waters in 1994 and 2005 (in JNCC: Marine Species – harbour porpoise) there was no evidence of change in the overall abundance of harbour porpoise, but there was evidence of a distributional shift. The largest single threat to small cetaceans - fisheries by-catch - was reported to be diminishing in response to a UK – wide Small Cetacean Bycatch Response Strategy, and subsequent long-term monitoring programme. The species is expected to survive and prosper under the current conservation approach (JNCC 2010)⁶³. Conservation efforts that focus on threat/impact reduction, such as fisheries by-catch and underwater noise, coupled with wider surveillance as a mechanism to assess progress and effectiveness, are most likely to achieve effective conservation of harbour porpoise (JNCC 2010).

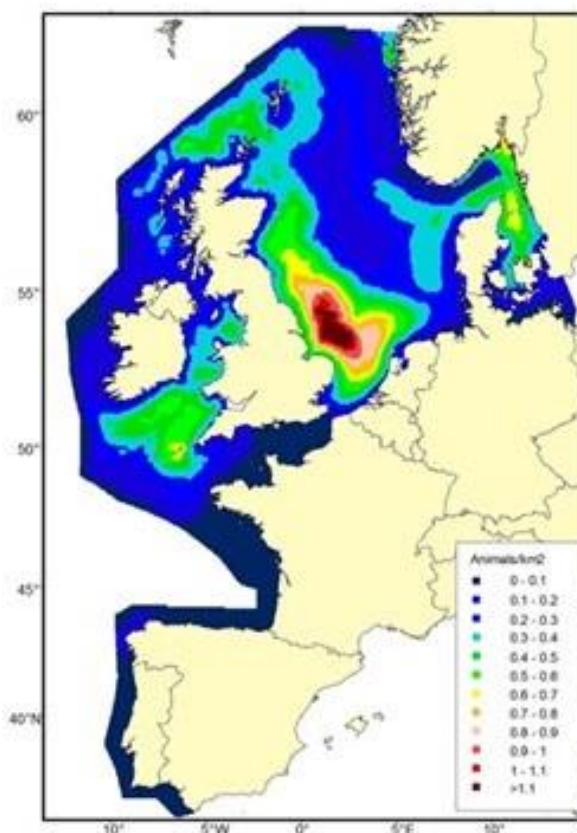
Coastal Bottlenose dolphins *Tursiops truncatus*

Abundance and distribution of bottlenose dolphins (as top predators) is indicative of environmental health. Bottlenose dolphins are vulnerable to the accumulation of pollutants through the food chain and to local disturbance from shipping, tourism, industrial development, and incidental. Underwater noise can have long and short-term effects on cetaceans (such as hearing loss or displacement from an area), but it is unclear to what extent coastal bottlenose dolphins are affected. The conservation status of bottlenose dolphin is assessed under the European Union Habitats Directive (Council Directive 92/43/EEC). Few have been recorded along the English East coast, none off The Wash (see Seawatch Foundation surveys for detailed maps⁶⁴), although sightings have been recorded off the Humber in the summer months.

There is no record from Observer data that cetaceans are accidentally caught in the Brown Shrimp fishery, nor has any anecdotal information been received by the assessment team.

The Harbour seal (*Phoca vitulina*)

Figure 3.6-19 Map of model-based density of harbour porpoise from analyses of pooled SCANS-II, CODA and T-NASS data in summer 2005 and 2007 in the European Atlantic (OSPAR 2018)



⁶³ <http://jncc.defra.gov.uk/page-5474>

⁶⁴ <http://www.seawatchfoundation.org.uk/bottlenose-dolphin-distribution-maps/>

Harbour seal is an Annex II species that is the primary reason for selection of the Wash & North Norfolk Coast SAC to be designated. The Wash is the largest embayment in the UK. The extensive intertidal flats here and on the North Norfolk Coast provide ideal conditions for Harbour seal *Phoca vitulina* breeding and hauling-out. This site is the largest colony of common seals in the UK, with some 7% of the total UK population. A detailed description of harbour seal populations is given in JNCC/Defra species description⁶⁵:

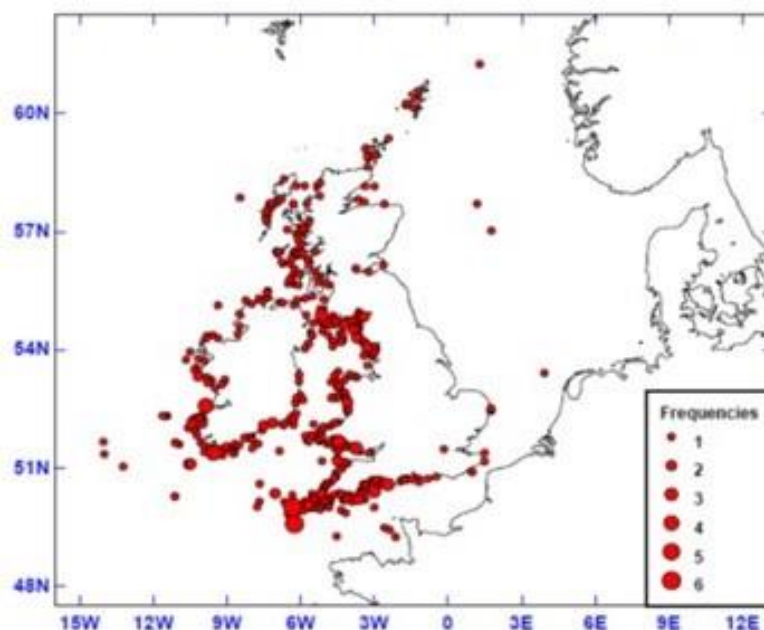
There is no record in the Observer data that harbour seals are accidentally caught in the Brown Shrimp fishery.

Grey seals (*Halichoerus grypus*)

Grey seal are among the rarest seals in the world: the UK population represents about 40% of the world population and 95% of the EU population. The seals spend most of the year at sea, and may range widely in search of prey. They come ashore in autumn to form breeding colonies on rocky shores, beaches, in caves, occasionally on sandbanks, and on small largely uninhabited islands. In such locations they may spread some distance from the shore and ascend to considerable heights. A pupping site is located at Donna Nook Lincolnshire. The Grey Seal is an Appendix II species qualifying feature for The Humber Estuary SAC, but not the Primary reason for site selection.

There is no record from Observer data that seals are accidentally caught in the Brown Shrimp fishery, nor has any anecdotal information been received by the assessment team.

Figure 3.6-20 Distribution of records of all turtle species from 2000-2010 (includes sightings and strandings (live and dead)). Source: Penrose & Gander (2011)



Turtles

All turtle species (*Caretta*; *Chelonia mydas*; *Lepidochelys kempii*; *Eretmochelys imbricate*; *Dermochelys coriacea*) are listed in Schedule 2 of the Habitat Regulations⁶⁶ for England and Wales (as amended). Marine turtles are not indigenous to the United Kingdom, although records have been, and continue to be, made of individuals drifting into the region with warmer water currents (Fig 3.6-20).

Bycatch, strandings and sightings data for turtles are recorded by various organisations throughout the UK and Eire. Of the five species recorded, Leatherback turtles are recorded the most.

⁶⁵ <http://jncc.defra.gov.uk/protectedsites/sacselection/species.asp?FeatureIntCode=S1365>

⁶⁶ The Conservation of Habitats and Species Regulations 2017, No. 1012
<https://www.legislation.gov.uk/ukxi/2017/1012/contents/made>

There are no Observer records to show that turtles have been by-caught in the Brown Shrimp fishery, nor has there been any anecdotal information provided to the assessment team.

Skates, Rays and sharks

For some years, certain TACs for stocks of elasmobranchs (skates, sharks, rays) in EU waters have been set at zero, with a linked provision establishing an obligation to immediately release accidental catches. The reason for that specific treatment is that the conservation status of those stocks is poor and, because of their high survival rates, discards will not raise fishing mortality rates for them, but are deemed as beneficial for the conservation of those species. The latest EU Technical Measures (2018/120)⁶⁷ provide a list of rays and skates that are prohibited to be caught. Relevant for this fishery under assessment are those listed for ICES Area 4b,c (Article 13):

- starry ray (*Amblyraja radiata*)
- white shark (*Carcharodon carcharias*) in all waters
- leafscale gulper shark (*Centrophorus squamosus*) (incl. ICES subarea 4)
- Portuguese dogfish (*Centroscymnus coelolepis*) (incl. ICES subarea 4)
- basking shark (*Cetorhinus maximus*) in all waters;
- kitefin shark (*Dalatias licha*) (incl. ICES subarea 4)
- birdbeak dogfish (*Deania calcea*) (incl. ICES subarea 4)
- common skate (*Dipturus batis*) complex (*Dipturus cf. flossada* and *Dipturus cf. intermedia*) (incl. ICES subarea 4)
- great lanternshark (*Etmopterus princeps*) (incl. ICES subarea 4)
- smooth lanternshark (*Etmopterus pusillus*) (incl. ICES subarea 4)
- porbeagle (*Lamna nasus*) in all waters
- guitarfishes (*Rhinobatidae*) (incl. ICES subarea 4)
- picked dogfish (*Squalus acanthias*) (incl. ICES subarea 4)
- angel shark (*Squatina squatina*) in Union waters

The Technical Measures (2018/120) state that when accidentally caught, species referred to above shall not be harmed and specimens shall be promptly released.

The catch composition information as provided by the Observer programme showed that a juvenile Thornback ray (*Raja clavata*; locally known as 'roker') was caught, the catch weight recorded was 30g. This is not listed as a prohibited species. There are no other Observer records to show that skates/ rays/ sharks have been by-caught in the Brown Shrimp fishery, nor has there been any anecdotal information provided to the assessment team. Larger individuals would have been released via the sieve net.

⁶⁷ COUNCIL REGULATION (EU) 2018/120 of 23 January 2018 fixing for 2018 the fishing opportunities for certain fish stocks and groups of fish stocks, applicable in Union waters and, for Union fishing vessels, in certain non-Union waters, and amending Regulation (EU) 2017/127

Seabirds

The fishery operates within The Greater Wash SPA, the qualifying features for this SPA are several seabird species⁶⁸. These are Annex 1 species of the Birds Directive⁶⁹, and for these species Member States must conserve their most suitable territories in number and size as SPAs. In this context, seabirds can be either evaluated under ETPs or under habitat – the area set aside for their protection.

The following Annex 1 seabird species are found in the Greater Wash area:

- *Gavia stellata*; Red-throated diver (Non-breeding)
- *Melanitta nigra*; Common scoter (Non-breeding)
- *Hydrocoloeus minutus*; Little gull (Non-breeding)
- *Sterna sandvicensis*; Sandwich tern (Breeding)
- *Sterna hirundo*; Common tern (Breeding)
- *Sternula albifrons*; Little tern (Breeding, one of the rarest seabirds breeding in the UK⁷⁰)

In order to achieve the aims of the Wild Birds Directive the site has to be managed in order to ensure the integrity of these seabird populations, by maintaining or restoring: -

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

Gibraltar Point SPA is at the edge of the fishery, according to the heat map of the distribution of the fishery in Fig 3.4-4. The relevant ETP seabird species here are:

breeding little tern (*Sterna albifrons*), overwintering bar-tailed godwit (*Limosa lapponica*), and Oystercatcher (*Haematopus ostralegus*)⁷¹.

The Wash SPA⁷² supports non-breeding: bar-tailed godwit (*Limosa lapponica*); bewick's swan (*Cygnus columbianus bewickii*); black-tailed godwit (*Limosa limosa islandica*); common scoter (*Melanitta nigra*); curlew (*Numenius arquata*); dark-bellied brent goose (*Branta bernicla bernicla*); dunlin (*Calidris alpina alpina*); gadwall (*Anas strepera*); goldeneye (*Bucephala clangula*); grey plover (*Pluvialis squatarola*); knot (*Calidris canutus*), oystercatcher (*Haematopus ostralegus*); pink-footed goose (*Anser brachyrhynchus*); pintail (*Anas acuta*); redshank (*Tringa totanus*); sanderling (*Calidris alba*); shelduck (*Tadorna tadorna*); turnstone (*Arenaria interpres*); waterbird assemblage and wigeon (*Anas penelope*). It also supports

⁶⁸ <http://jncc.defra.gov.uk/page-7585>

⁶⁹ 2009/147/EC Wild Birds Directive,

⁷⁰ <http://jncc.defra.gov.uk/page-6644>

⁷¹

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/844543/Gibraltar_Point_SPA_factsheet.pdf

⁷²

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/844586/The_Wash_SPA_factsheet.pdf

breeding common tern (*Sterna hirundo*) and little tern (*Sterna albifrons*); redshank (*Tringa totanus*);

Of these the following are Annex 1 species , and thus ETPs:

Bewick swan (*Cygnus columbianus bewickii*), bar-tailed godwit (*Limosa lapponica*), common scoter (*Melanitta nigra*), curlew (*Numenius arquata*); gadwall (*Anas strepera*); goldeneye (*Bucephala clangula*); grey plover (*Pluvialis squatarola*); knot (*Calidris canutus*); pink-footed goose (*Anser brachyrhynchus*); pintail (*Anas acuta*); common tern (*Sterna hirundo*); little tern (*Sterna albifrons*)

North Norfolk Coast SPA. This SPA is a part of The Wash and North Norfolk Coast European Marine Site (EMS)⁷³. The qualifying features, seabirds, are :

Botaurus stellaris; Great bittern (Breeding) *
Anser brachyrhynchus; Pink-footed goose (Non-breeding)*
Branta bernicla bernicla; Dark-bellied brent goose (Non-breeding)
Anas penelope; Eurasian wigeon (Non-breeding)
Circus aeruginosus; Eurasian marsh harrier (Breeding) *
Circus pygargus; Montagu's harrier (Breeding) *
Recurvirostra avosetta; Pied avocet (Breeding)
Calidris canutus; Red knot (Non-breeding) *
Sterna sandvicensis; Sandwich tern (Breeding)*
Sterna hirundo; Common tern (Breeding) *
Sterna albifrons; Little tern (Breeding)*

Waterbird assemblage

And those with an Asterix are Annex1 species, thus ETPs

It has to be pointed out that some of these SPAs, in particular Gibraltar Point and North Norfolk Coast may be too shallow for the fishery to operate in. This can also be seen from the heatmap in Fig 3.4-4

Much of this is discussed under the Habitat section of this report. However, seabirds could be impacted by certain activities in the SPA, such as those which alter the habitat on which the seabirds rely. No information could be found in the context of the SPA designation and research which would indicate that studies have been undertaken on the direct impact of the shrimp fishery on seabirds. The Observer reports do not state any direct interaction of the fishery with seabirds (Observer interview site visit June 2018), no seabirds were bycaught.

Indirect effects of fishery on ETPs

Indirect effects of the fishery on ETP species would include the removal of the target species as prey for ETPs. This issue is considered as part of the target species removal and fishing mortality evaluations under Principle 1. The presence of the shipping vessels, including fishery vessels, may constitute an indirect effect in that it would disturb bird populations present in the area of fishing. Considering that the Wash Area is partly managed under the EU Birds Directive (The Great Wash SPA) indirect effects may affect ETP seabird species. Studies by Garthe *et al* (2015)⁷⁴ and Schwemmer *et al* (2011) looked at a possible displacement reaction to ship traffic. 'Loons (*Gavia* spp.) showed clear avoidance of areas with high shipping intensity. Flush distances of four sea duck species differed significantly, with the longest distances recorded for Common Scoters (*Melanitta nigra*) and the shortest for Common Eiders

⁷³ <http://publications.naturalengland.org.uk/publication/4732349359063040>

⁷⁴ http://www.divertracking.com/wp-content/uploads/01_01_Garthe_DIVER_Introduction.pdf

(*Somateria mollissima*). Flush distance was positively related to flock size. Among all the sea duck species studied, the duration of temporary habitat loss was longest for Common Scoters. The study found indications of habituation in sea ducks within areas of channelled traffic'.

Other indirect impact includes removal of shrimp as a food source. This has been accounted for in the natural mortality estimates in the stock assessment of Brown shrimp. In addition, the current biomass target of shrimp is closer to the default precautionary low trophic target than standard MSY even though Brown shrimp is not a key low trophic species. Thus shrimp as a food source for seabirds and marine species is accounted for in the Harvest Controls for this stock.

ETPs in bycatch

There were no ETPs identified from the catch composition data collated by Observers between 2015-2017 (Source Cefas 2018 pers.com).

3.7 Principle Three: Management System Background

Although this fishery is a single jurisdiction fishery there remain a number of relevant tiers of management that have influence to some degree over the operations of the Wash Brown Shrimp Fishery. These are:

- European Union – Common Fisheries Policy applies of all member state fisheries throughout EU waters (and out to 200nm)
- United Kingdom – All UK waters
- Eastern Inshore Fisheries and Conservation Authority – Inshore waters (0-6nm) off the English counties of Lincolnshire, Norfolk and Suffolk
- Wash Shrimp Management Plan – Applying (without statutory backing) to the fleet of vessels which are signatories to the agreement.

Not all management tiers apply in all jurisdictions and some tiers have power over others. For example, a vessel must comply with Eastern IFCA bylaws within 0-6nm but does not have to beyond 6nm. And whilst EU regulations apply everywhere, additional management controls can be applied locally.

In simple terms, the strongest and most encompassing legislative powers which all vessels (and indeed member state authorities) must comply with is at the EU level. Member states may take additional management measures. By contrast the most detailed management arrangements for the shrimp fishery are set out at the local fleet level (i.e. the fleet's own Management Plan) and to a lesser extent by the IFCA bylaws.

3.7.1 European Union

The United Kingdom is a member state of the European Union (see separate box in relation to 'Brexit'). All EU fisheries are governed by the Common Fisheries Policy (CFP). All European laws are signed into law by democratically elected national representatives of The Council of the European Union, after full review and consultation on the proposals with various committees and The European Parliament. However, day to day administration of European fisheries matters, including the drafting of legislative proposals is done by European Commission's Directorate-General for Maritime Affairs and Fisheries (DG Mare) The European Commission is a politically independent civil service.

Even though the day to day management decisions of the Wash shrimp fishery are not taken at an EU level, EU legislation does apply to the fishery. The over-arching fisheries legislation is the Common Fisheries Policy (Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013). This sets out the over-arching objectives for all fisheries and places requirements on member states to balance fishing capacity with the available resource, setting national fleet capacity ceilings (231,106 gt for the UK).

There are a number of pieces of subsidiary European legislation that is also applicable to the shrimp fleet. For example, Council Regulation (EC) No 850/98 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms stipulates the mesh size for shrimp fisheries, the requirement for veil nets and the minimum

Brexit

The following description of the management system for the Wash Shrimp fishery includes clear reference to EU institutions and legislation, which apply at a UK level, including inshore waters. The decision of the UK electorate on June 23, 2016 to leave the European Union (i.e. 'Brexit') looks likely to begin a process in which the UK will repeal key EU legislation - perhaps including the Common Fisheries Policy (CFP), subsidiary laws and marine environmental legislation - although with the potential to absorb parts of EU legislation directly into UK legislation. Scoring in this assessment is based upon the situation at the time of writing (summer 2018) and makes no predictions about how the process will proceed.

target species retention. Other notable legislation of relevance includes Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy, which sets down vessel licencing requirements, stipulates the requirement for Vessel Monitoring Systems (VMS) to be installed on vessels above 12m LOA and requires logbook reporting.

3.7.2 United Kingdom / England

European legislation is enacted by member states through relevant primary and secondary legislation. A Member State may also take non-discriminatory measures that are *more restrictive* than the CFP measures to those fisheries operating within their 0-12 nautical mile zones in respect of national fleets⁷⁵. In practice this also means that member states may take a lead in management measures for fish stocks which have received little attention at an EU level, such as non-quota finfish or shellfish (such as Brown shrimp). The UK Government's Department of Environment, Food and Rural Affairs (DEFRA) is the main fisheries management body in UK and is the representative at fishery negotiations at an EU level.

Following the Marine and Coastal Access Act 2009, the UK government set up The Marine Management Organisation (MMO) as an executive non-departmental public body with responsibility for marine planning, licencing and regulation. From a fisheries perspective, this includes managing UK fishing fleet capacity and UK fisheries quotas as well as collecting fisheries information and ensuring compliance.

3.7.3 Inshore Waters

The MMO shares responsibility for management of English 'inshore' fisheries with Inshore Fisheries and Conservation Authorities (IFCAs) which replaced the Sea Fisheries Committees from April 2011. As well as sharing the management responsibility for inshore fisheries, IFCAs took on new conservation duties as set out in the Marine and Coastal Act (MCA) 2009. Both IFCAs and the MMO have a duty to deliver all EU fisheries regulations under the CFP with the opportunity to apply more restrictive measures. A memorandum of understanding (MOU) exists between the two organisations to better ensure a co-ordinated approach to management.

As finfish are more likely to move between the 'inshore' and 'offshore' zones and many finfish species are under quota, the MMO is generally understood to be the lead management body on finfish. The IFCAs has a greater focus on management of shellfish within its boundary as these are the target for the majority of 'inshore vessels' and most are not subject to quota. However, this distinction between finfish and shellfish is an informal one and both the MMO and IFCAs have a responsibility for managing all sea fisheries occurring within their geographic remits, which overlap in the 0-6 mile zone.

The Eastern IFCA is therefore primarily responsible for the management of the Wash Brown Shrimp fishery and a number of IFCA byelaws already apply management controls to the fishery. The Eastern IFCA are currently in the process of drafting and consulting upon a shrimp bylaw focussed upon this fishery, which includes the option of applying flexible controls in response to changes in status identified by scientific monitoring. However, as this bylaw is not yet implemented, its contents have not been scored as part of this assessment (although the process of bylaw consultation has been used as evidence in support of consultation processes). Instead, it is the existing management structures and byelaws that are scored along with the industry-led Wash Brown Shrimp Management Plan (Poseidon 2017). A copy of the Wash Brown Shrimp Management Plan can be seen on the dedicated website <http://www.washshrimp.co.uk/>

⁷⁵ with certain constraints – i.e. with the approval of the Commission and affected Member States.

The Wash Brown Shrimp Management Plan has been drafted, in consultation with the industry on behalf of the Shrimp Producers Organisation Ltd (the fishery client in this MSC assessment). A key mechanism during this process of consultation and development of management proposals has been the formation of the Shrimp Fishery Advisory Working Group (SFAWG). This group is made up of representatives from:

- Kings Lynn shrimp processors (2 places),
- skippers (2)
- Natural England (1)
- Marine Management Organisation (1)
- Eastern Inshore Fisheries and Conservation Authority (1)
- CEFAS (1)
- Supporting consultancy service: Spindrift Marine / Alert 2020 Services limited

The management plan has been implemented within their organisation and the large majority of shrimp vessels operating in the Wash fishery have signed up to it. These vessels form the Unit of Certification for this assessment. Although the management plan largely contains management controls that are legally binding by virtue of also being IFCA byelaws, it does provide additional functions. Firstly, it introduces a mechanism to constrain catches based on the results of a stock assessment. Whilst this would not be legally binding, the market control that the Shrimp Producers Organisation Ltd have, means that it is likely to be robust. Secondly, it applies to all signatory vessels wherever they catch shrimp. So, whilst IFCA byelaws do not apply beyond 6nm, they are in effect still in force upon the fleet as a result of the Management Plan (although this would not be legally enforceable).

4 Evaluation Procedure

4.1 Harmonised Fishery Assessment

Although there is a fishery using the same gear, targeting the same shrimp species, in the Southern North Sea, off the North coast of the Netherlands, Germany and Denmark, this is not concluded to be overlapping, therefore does not require harmonisation of assessment results.

The stock (or stock management unit) boundary for the Wash Brown Shrimp fishery has been determined as part of the stock assessment exercise to be an English East Coast Inshore stock⁷⁶. The validity of this stock boundary is considered as part of the Principle 1 assessment of this fishery. This fishery is primarily managed by means of the Shrimp Management plan and IFCA byelaws within UK jurisdiction.

The other *Crangon crangon* fishery⁷⁷ in the southern North Sea which has been subject to an MSC assessment has a defined stock management unit of "North Sea Continental Brown Shrimp" along the North Sea coastlines of Denmark, Germany and the Netherlands. It is managed by means of a different management plan within a different jurisdiction.

In spite of concluding that there is no need of formal harmonisation, the assessment team have nonetheless given due regard to the scoring and outcomes of this other North Sea shrimp fishery.

4.2 Previous assessments

There have been no previous MSC assessments undertaken of this fishery.

4.3 Assessment Methodologies

This assessment was carried out according to the scoring guideposts in the MSC Fisheries Certification Requirements v2. This report uses the 'MSC Full Assessment Reporting Template' version 2. The default assessment tree v2.0 was used with no adjustments

4.4 Evaluation Processes and Techniques

4.4.1 Site Visits

A site visit informed this assessment. All three team members - Tristan Southall, Gudrun Gaudian and Julian Addison - attended the site visit in Kings Lynn on 29th – 31st May 2018. The site visit was also attended by Louise Allan of Acoura and Stephanie Good of ASI. Stakeholder meetings were held in the meeting room of the Eastern IFCA. In addition, the grading facilities at Lynn shellfish were visited and a vessel visit was carried out aboard Ana Maria, also at Kings Lynn.

4.4.2 Consultations

A total of 39 stakeholder organisations and individuals with a relevant interest in the fishery were identified and alerted to this assessment audit, by means of e-mail, and given the opportunity to either request a meeting with the assessment team or submit information for their consideration. The interest of others not appearing on this list was solicited through the postings on the MSC website. The use of e-mail and website was deemed to be the most effective means of reaching relevant stakeholders.

⁷⁶ Restricted to ICES statistical rectangles 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1

⁷⁷ <https://fisheries.msc.org/en/fisheries/north-sea-brown-shrimp/>

The assessment team arranged a number of face to face meetings with some additional stakeholder calls carried out remotely where stakeholders were unavailable to meet the assessment team at the time of the site visit. The following individuals and organisations were directly consulted as part of the assessment process. In all meetings a full explanation was provided by way of introduction to the Unit of Assessment, the MSC standard and the assessment process (including the role of the stakeholder in the process). Stakeholders were also given an opportunity to comments on the scoring of the susceptibility attributes used in the Risk Based Framework. In addition, key points discussed are noted below⁷⁸.

Table 2: Summary of stakeholder meetings.

Name	Organisation	Location	Information Discussed / Obtained
Neil Lake Steven Williamson	Client (Shrimp Producers Organisation Ltd)	EIFCA offices	Project background, status of management plan implementation, typical vessel operations.
David Guy	Client Rep		
John Butler Simon Lee Ron Jessop Judith Stout	EIFCA	EIFCA offices	IFCA role in the project / fishery (now and in the future). Status of Habitats assessments, byelaw review, implementation of new spatial and shrimp permit bylaws.
Jake Poll	Crewman / Skipper	FV 'Ana Maria' (LN478)	Typical vessel operations, net and deck sieving configuration, area of operation.
Charlie Abbott	Lynn Shellfish	Lynn Shellfish	Landing controls, e-logs, grading, sales route, waste fraction of catch.
Sam Gregory	MMO	EIFCA Offices	Landing controls, at sea inspections, compliance
Sam Elliott	CEFAS	EIFCA offices	Observer reports, catch profile, species mix, area of operation, habitat impacts.
Tania Davey.	Living Seas / Lincolnshire Wildlife Trust	Conference call	Position of EIFCA in Habitats Regulation Assessment. Some IFCA shrimp and habitat management activity still at consultation stage. Incomplete process.
Charlotte Moffatt Emma Thorpe	Natural England	Conference call	Role of DEFRA / Natural England. Need for additional evidence to demonstrate lack of impact.
Sam Lews	Wash and North Norfolk Coast Marine Partnership	Conference call	
Andy Lawler	CEFAS	Conference call	Stock identity, stock assessment methodology, relationship with ICES Crangon Working Group, role of CEFAS, catch profile data

Following the meetings described above the assessment team concluded that due to evidence provided by the client and information obtained stakeholders, and the large body of published material available to review, no further meetings were required.

4.4.3 Evaluation Techniques

The MSC Principles and Criteria provide the overall requirements necessary for certification of a sustainably managed fishery. To facilitate assessment of any given fishery against this standard, these Criteria are further split into Performance Indicators (PIs) and Scoring Issues (SIs). These represent separate areas of important information and therefore, provide a

⁷⁸ A note was kept of all stakeholder meetings. These are not a formal minute and are not included in this publication, however these provide a record of the meeting for audit purposes and all stakeholders were made aware that such a note was being kept enabling them to request these.

detailed checklist of factors to guide the investigations and consultations of the assessment team members. The evaluation technique used therefore relies upon identifying data, supporting research and focusing consultations on these areas, in order to provide auditable justifications in support of scores given.

Because sufficient auditable evidence was available to the assessors in this fishery the MSC's Risk Based Framework was not been required in most instances. However, the one exception to this was in the scoring of Secondary species outcome (PI 2.2.1). These species are not subject to stock assessment therefore a Productivity Susceptibility Assessment (PSA) was carried out for the main species. The susceptibility attributes were informed by sampling the range of views of stakeholders during the consultation process. This strategy of discussing the PSA exercise and scores during individual stakeholder meetings was deemed to be more effective at achieving maximum participation than requesting all stakeholders return at for a dedicated RBF workshop.

The full MSC scoring exercise was carried out remotely during week commencing 10th September 2018, via conference call with all team members participating. This collective exercise sought to find consensus between team members on scores and resulting conditions and recommendations. Scoring justifications were later written up individually.

In order to make the assessment process as clear and transparent as possible, the Scoring Guideposts are presented in the scoring table and describe the level of performance necessary to achieve 100 (represents the level of performance for a 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), and 60 (defines the minimum, conditional pass mark for each Performance Indicator for that type of fishery).

There are two, coupled, scoring requirements that constitute the Marine Stewardship Council's minimum threshold for a sustainable fishery:

- The fishery must obtain a score of 80 or more for each of the MSC's three Principles, based on the weighted average score for all Criteria and Sub-criteria under each Principle.
- The fishery must obtain a score of 60 or more for each Performance Indicator.

A score below 80 at the Principle level or 60 for any individual Performance Indicator would represent a level of performance that causes the fishery to automatically fail the assessment, whereas a score of 80 or above for all three Principles results in a pass.

5 Traceability

5.1 Eligibility Date

The eligibility date for the Wash Brown Shrimp fishery is the date of certification. The reason for selecting this date is that it is in accordance with both the wishes of the fishery client and the MSC certification requirements.

5.2 Traceability within the Fishery

Traceability up to the point of first landing has been scrutinised as part of this assessment and the positive results reflect that the systems in place are deemed adequate to ensure shrimp is caught in a legal manner and is accurately recorded. The report and assessment trees describe these systems in more detail, but briefly traceability can be verified by:

- no transshipment;
- a geographically restricted fishery enabling concentrated inspection effort;
- accurate reporting – log books and sales notes (regularly inspected and cross-checked);
- verified landings data (including data on other retained species) are used for official monitoring of quota up-take and national statistics;
- a high level and sophisticated system of at-sea monitoring, control and surveillance, including routine boarding and inspection, VMS; and electronic logbooks (for vessels over 12m).
- reporting prior to landing with limited tolerance;
- no other shrimp fisheries in the area, so no likelihood of landings from a non-certified stock.

The above is considered sufficient to ensure shrimp invoiced as such by the fishery originate from within the evaluated fishery and no specific risk factors have been identified.

Table 5 Traceability Factors within the Fishery:

Traceability Factor	Description of risk factor if present. Where applicable, a description of relevant mitigation measures or traceability systems
Potential for non-certified gear/s to be used within the fishery	The UOA includes the gear which is used to catch shrimp. No other methods for catching shrimp are used. There is therefore no potential for non-certified gears to be used. : Eastern IFCA's shrimp permit byelaw includes requirements for all shrimp fishers to use only gear approved by EIFCA. Any gear adaptations which were contrary to the Wash Brown Shrimp Management Plan would be illegal and enforced by the Eastern IFCA (within 6nm). The only potential for non-certified gears to be used would be for catches beyond 6nm, however the risk of this has been considered and concluded to be highly unlikely due to the costs and practical implications of changing gear in order to fish beyond 6nm.
Potential for vessels from the UoC to fish outside the UoC or in different geographical areas (on the same trips or different trips)	There are no adjacent commercially exploited shrimp stocks, so there is no possibility of a UoC fishing shrimp elsewhere. The normal vessel range of the shrimp fishery has been included in the UoC so there is no reason for vessels to fish beyond this.

Potential for vessels outside of the UoC or client group fishing the same stock	There is the small potential for a vessel to not be a signatory to the Wash Brown Shrimp Management Plan and therefore not part of the UoC client group. However, given that the only shrimp buyers in the region will only purchase from vessels which are signatory to the management plan, it is highly unlikely that any such shrimp would enter the MSC chain of custody.
Risks of mixing between certified and non-certified catch during storage, transport, or handling activities (including transport at sea and on land, points of landing, and sales at auction)	No other shrimp stocks are landed to the 2 Kings Lynn buyers. Catches of any vessels landing shrimp who are not part of the client group will not be handled by the 2 Kings Lynn buyers. So, there is negligible risk of non-certified shrimp being mixed with certified shrimp before the point of first sale.
Risks of mixing between certified and non-certified catch during processing activities (at-sea and/or before subsequent Chain of Custody)	<p>Although the shrimp may be cooked and graded at sea, this does not constitute at-sea processing vessels do not cook another vessel's catch. The risks of mixing at the point of on-shore size grading are negligible for the same reasons described in the row above.</p> <p>There is a small risk that shrimp from elsewhere in the UK, notably the North West may arrive legitimately at the Kings Lynn processors by road. The Chain of Custody certificate for the 2 Kings Lynn processors should verify the systems in place for ensuring this non-certified catch does not become mixed with the certified Wash shrimp.</p>
Risks of mixing between certified and non-certified catch during transshipment	There is no transshipment.
Any other risks of substitution between fish from the UoC (certified catch) and fish from outside this unit (non-certified catch) before subsequent Chain of Custody is required	The biggest risk is that small quantities of Wash brown shrimp, landed by small vessels, locally processed (cottage scale) and locally sold, will be labelled as MSC certified. This may not occur and if it does the scale of any such sale would be very small and beyond the control of the Client Group. This would not undermine the sustainability of the fishery or the validity of the management of the UoA.

5.3 Eligibility to Enter Further Chains of Custody

(i) Wash Brown Shrimp; (ii) landed by vessels which are signatory to the Wash Brown Shrimp Management Plan; (iii) to two King's Lynn shrimp buyers (Lynn Shellfish Ltd. and John Lake Shellfish Ltd.) will be eligible to enter further certified chains of custody and is eligible to be sold as MSC certified and carry the MSC ecolabel. This also applies to Wash Brown Shrimp landed to other ports in the Eastern IFCA region and transported by road to the Kings Lynn processors mentioned above.

The product changes ownership at the point of landing for most vessels of the client group. However, it should be noted that both Kings Lynn processors wholly own some of the vessels, therefore the point of the change of ownership will be the point of onward sale from Lynn Shellfish Ltd. and John Lake Shellfish Ltd. Chain of Custody is therefore required for both Lynn Shellfish Ltd. and John Lake Shellfish Ltd.

In November 2019 the vessel list was as follows (please note the most up-to-date version should be found under the Assessment Downloads).

Name	PLN	RSS	Port	Owner
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Portunus	LN 91	A18509	Kings Lynn	Lynn Shellfish
Sea Swallow	LN 20	A18454	Kings Lynn	Lynn Shellfish
Seagull	LN 22	A18456	Kings Lynn	Lynn Shellfish
Lynn princess	LN 175	B10756	Kings Lynn	Lynn shellfish
Boy Neil	LN 126	A18530	Kings Lynn	Lynn shellfish
Abbie Jayne	LN 454	C16055	Kings Lynn	Lynn shellfish
Georgie fisher	LN 474	C18577	Kings Lynn	Lynn shellfish
John Willy	LN 465	C17332	Kings Lynn	Lynn Shellfish
Jaletto	MT 105	C16829	Kings Lynn	Lynn Shellfish
Justine Marie	LN 119	B10773	Kings Lynn	Lynn Shellfish
Matty Jay	LO 541	C16052	Kings Lynn	Lynn Shellfish
Sunny Morn	LN 475		Kings Lynn	Lynn shellfish
Wash Princess	LN 161	B13098	Kings Lynn	Lynn Shellfish
Elizabeth Mary	LN 84	B11268	Kings Lynn	R J Garnett
Sea Rover	LN 464		Kings Lynn	Peter Garnett
Firecrest	LN 479		Kings Lynn	S Garnett
Sarah Louise	MT 115	C18248	Kings Lynn	M Garnett
Boy Tim	LN 271	A18583	Kings Lynn	L & T Allen
Sandra Jaimes	BH 447	A24221	Kings Lynn	F Taylor & A Catton
Little Leer	BN 434	C17735	Boston	Lee Porter
Pamela Mary	LN 471	C17936	Kings Lynn	Jason Leman
Molly P			Kings Lynn	lee porter
New Boat			Kings Lynn	Roman Koziel
Abigail	BN 24	A14963	Boston	Jamie Lee
Vicky Ellen	BN 86	B13034	Boston	Roy Brewster
Tracey Elaine	BN 5	C19048	Boston	W R K Brewster
Patricia B	BN 438	C17932	Boston	Wayne Brewster
Boy Steven	LN 129	A18531	Boston	K & J Smith, A Coy
Maggie S	BN 84	B11948	Boston	M Kettleboro
Our Sarah Jayne	BM 116		Whistable	S Barnes
Jamie Louise	BN 23	B13380	Boston	L Doughty
Ruby Doo	TBA	TBA	Boston	W R K Brewster
Merlin	BN 39	C19272	Boston	P & B Ralph
Seven Sisters	BN 445	C19192	Boston	N E Brewster
Intrepid	BN 67	B10867	Boston	A Bagley
Sovereign	BN 19		Boston	R Bagley
Lili Mae	BN 439	C18174	Boston	Shane Bagley
Cally Seranne	BN 430	C17236	Boston	Richard Bagley
Lucy Marie	BN80		Boston	Ken Bagley
Abbie Lou	LO 574	C18644	Leigh on Sea	W H Osborne Ltd
Catherine Anne	LN 476	C19003	Brancaster	D Loose
Tessa	**	**	Kings Lynn	John Lake Shellfish Ltd
Two Marks	LN 458	C16631	Kings Lynn	John A Lake
Jolene	LN 468	C17628	Kings Lynn	John A Lake

Lucky Luke	LN 6	C17087	Kings Lynn	John A Lake
Charlotte	LN 466	C17386	Kings Lynn	John A Lake
Audrey Patricia	LN 486	C20438	Kings Lynn	John A Lake
Ana Maria	LN 478		Kings Lynn	John A Lake
Audrina	LN 483	C19757	Kings Lynn	Neil A Lake
SeaDog			Kings Lynn	Tim Loose
Reknown	LO 88		Leigh on Sea	Wash Mussels Ltd
Paul Patrick	H 1103	C17518		Sea Breeze Trawlers Ltd John Ashton
Belsterk	LN 95	B11355	Kings Lynn	John Ashton
Five J's	BN 435	C17800	Kings Lynn	S Williamson
Corina II	NN 57	A79893	Kings Lynn	Bubba Shrimp Ltd
Serene Dawn	LT7	A11395	Lowestoft	
Boy Michael	LO92	C18652	Leigh on Sea	
Medway IV	BN109	C16822	Boston	
Kathryn James	BN190	B14590	Boston	
Itsie Bitsie	BN428			
Tricia B	BN429			

5.4 Eligibility of IPI stocks to Enter Further Chains of Custody

N/A

6 Evaluation Results

6.1 Principle Level Scores

Table 6.1: Final Principle Scores

Final Principle Scores	
Principle	Score
Principle 1 – Target Species	82.5
Principle 2 – Ecosystem	83.7
Principle 3 – Management System	84.2

6.2 Summary of PI Level Scores

Principle	Component	Wt	Performance Indicator (PI)	Wt	Score
One	Outcome	0.333	1.1.1 Stock status	1.0	90
	Management	0.667	1.2.1 Harvest strategy	0.25	85
			1.2.2 Harvest control rules & tools	0.25	75
			1.2.3 Information & monitoring	0.25	80
			1.2.4 Assessment of stock status	0.25	75
Two	Primary species	0.2	2.1.1 Outcome	0.333	90
			2.1.2 Management strategy	0.333	95
			2.1.3 Information/Monitoring	0.333	100
	Secondary species	0.2	2.2.1 Outcome	0.333	80
			2.2.2 Management strategy	0.333	90
			2.2.3 Information/Monitoring	0.333	80
	ETP species	0.2	2.3.1 Outcome	0.333	80
			2.3.2 Management strategy	0.333	75
			2.3.3 Information strategy	0.333	70
	Habitats	0.2	2.4.1 Outcome	0.333	90
			2.4.2 Management strategy	0.333	75
			2.4.3 Information	0.333	90
	Ecosystem	0.2	2.5.1 Outcome	0.333	80
			2.5.2 Management	0.333	80

			2.5.3 Information	0.333	80
Three	Governance and policy	0.5	3.1.1 Legal &/or customary framework	0.333	90
			3.1.2 Consultation, roles & responsibilities	0.333	75
			3.1.3 Long term objectives	0.333	100
	Fishery specific management system	0.5	3.2.1 Fishery specific objectives	0.25	90
			3.2.2 Decision making processes	0.25	75
			3.2.3 Compliance & enforcement	0.25	85
			3.2.4 Monitoring & management performance evaluation	0.25	70

6.3 Summary of Conditions

Table 6.2: Summary of Conditions

Condition number	Condition	Performance Indicator
1	Well defined HCRs are in place that ensure that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock fluctuating around a target level consistent with (or above) MSY.	1.2.2a
2	The assessment of stock status is subject to peer review.	1.2.4e
3	There is a strategy in place that is expected to ensure the UoA does not hinder the recovery of ETP species.	2.3.2b
4	Information is adequate to measure trends and support a strategy to manage impacts on ETP species.	2.3.3b
5	There is some objective basis for confidence that the measures/partial strategy will work, based on information directly about the UoA and/or habitats involved.	2.4.2b
6	Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.	3.1.2a
7	There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	3.2.2a
8	The fishery-specific management system is subject to regular internal and occasional external review.	3.2.4b

6.4 Recommendations

For PI 1.2.3b: Obtain accurate information on the proportion of non-commercial-sized shrimps that are discarded following riddling of the catch and an estimate of discard mortality that is specific to The Wash fishery.

For PI 2.1.2e: Produce evidence of routine monitoring and review of management measures.

For PI 2.2.2a – Introduction of veil nets/ sieve nets on all vessels participating in this fishery, including those which have an aggregate beam length of less than 8m

For PI 2.2.2e – Produce evidence of routine monitoring and review of management measures

For PI 2.2.3 to improve information on all Secondary species: It is recommended that a Productivity Susceptibility Analysis (PSA) is conducted on all those species for which no reference points are available. PSA is a semi-quantitative and rapid risk assessment tool that relies on the life history characteristics of a stock (i.e., productivity) and its susceptibility to the fishery in question. This would constitute a risk analysis for each species, calculating an individual score for each species (see also Patrick et al 2009). In the case of this fishery, where so many species are involved, the client should provide such a list of PSA scores for each bycatch species, as part of the regular bycatch analysis.

For PI 2.3.1: Considering that the fishery is operating within The Greater Wash SPA, The Wash SPA and in the vicinity of shallower water SPAs such as Gibraltar Point SPA and North Norfolk Coast SPA, the client is encouraged to implement greater spatial awareness of fishing vessels regarding areal closures, including voluntary closures and temporary closures due to the seasonal presence of protected seabird species.

For PI3.2.2e: When the management plan is revised, more explicit consideration should be given to the mechanism from resolution of disputes.

6.5 Determination, Formal Conclusion and Agreement

Following this assessment team's work, and review by stakeholders and peer-reviewers, the determination will be presented to LR's decision making entity that this fishery has passed its assessment and should be certified.'

Following this review, the decision making entity has approved certification and as no objections this fishery is now certified.

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Appendix 1 Scoring and Rationales

Appendix 1.1 Performance Indicator Scores and Rationale

PI 1.1.1 – Stock status

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
a	Stock status relative to recruitment impairment			
	Guide post	It is likely that the stock is above the point where recruitment would be impaired (PRI).	It is highly likely that the stock is above the PRI.	There is a high degree of certainty that the stock is above the PRI.
	Met?	Y	Y	Y
	Justification	<p>The assessment model estimates that stock biomass over the last few years has been fluctuating between 70% and 90% of unexploited biomass, which is well above the 20% of unexploited biomass level generally used as a limit reference point below which recruitment may be impaired. The assessment model assumes that there is no discard mortality and that landings are equivalent to catch. No information is available on the level of discarding of shrimp, and notwithstanding an estimate of survival rate of 92% for discarded Crangon, the stock assessment model may be underestimating overall fishing mortality. However even taking into account the potential for the assessment model to overestimate stock biomass, the current estimate will still be significantly above PRI.</p> <p>Recruitment of Crangon is driven more by environmental factors and abundance of predators (in years when predator abundance is high) than by the level of stock biomass and the exploitation rate in the fishery. Studies show that it is possible to predict recruitment based on environmental factors such as wind, water temperature, and freshwater run-off. The main fishing season for Crangon in The Wash (and throughout the North Sea) is primarily based on shrimps recruiting into the autumn fishery from larvae hatched in to the plankton in the spring. As the fishery is based predominantly on annual recruits, any decline in recruitment would be reflected in the annual landings. Whilst landings are observed to fluctuate from year to year, low landings are often followed by high landings in the following year, and so there is no evidence that recruitment has been impaired over the history of the fishery. Similar patterns have been observed in the eastern North Sea where the stock recovered within two years following the lowest observed abundance index in 1990.</p> <p>All the evidence demonstrates that there is a high degree of certainty that the stock is above the point of recruitment impairment (PRI). SG60, 80 and 100 are met.</p>		
b	Stock status in relation to achievement of MSY			
	Guide post		The stock is at or fluctuating around a level consistent with MSY.	There is a high degree of certainty that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		Y	N
	Justification	<p>The assessment model estimates that stock biomass over the last few years has been fluctuating between 70% and 90% of unexploited biomass, which is well above the 40% of unexploited biomass level generally used as a target reference point consistent with B_{MSY}. As noted above for SIa, the assumption in the assessment model that landings are equivalent to catch may result in a minor overestimate of</p>		

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
		<p>stock biomass, but it is reasonable to assume that the stock is at or fluctuating around a level consistent with MSY. The SG80 is met.</p> <p>The assessment model has been fitted to only 5 years catch and effort data from July 2012 until the end of 2016, and the previous year's model fit to 4 years of data provided a more pessimistic outlook on stock status with a 20% probability that the stock was below a target reference point of 40% of unexploited biomass. Whilst there appeared to be an increase in recruitment in 2016 following three years of decline, which may account for the improved stock diagnosis in 2017, further work needs to be undertaken to evaluate the robustness of the assessment model. In addition there is potential for the model to overestimate stock biomass because discard mortality is not taken into account, and the assessment team has therefore taken a precautionary view that there is not a high degree of certainty that the stock has been fluctuating around or above MSY in recent years. The SG100 is not met.</p>		
References		Berghahn, 1996; ICES, 2014, 2017; Lancaster & Frid, 2002; Medley, 2017;		
Stock Status relative to Reference Points				
	Type of reference point	Value of reference point	Current stock status relative to reference point	
Reference point used in scoring stock relative to PRI (S1a)	Limit reference point: 20% of unexploited biomass (0.2B ₀)	Specific values of the reference points are not provided in the assessment report. Measures of stock biomass are given as relative (B/B ₀) rather than as absolute values.	The model provides a probability distribution of estimates of B/B ₀ ranging from 0.75 to 0.95 of B ₀ . This estimated range equates to 3.75 to 4.75 x LRP	
Reference point used in scoring stock relative to MSY (S1b)	Target reference point: 40% of unexploited biomass (0.4B ₀) Annual index based on catch and effort during peak recruitment period equivalent to 40% of mode of expected recruitment distribution.	Specific values of the reference points are not provided in the assessment report. Measures of stock biomass are given as relative (B/B ₀) rather than as absolute values. No specific value is given for this reference point.	The model provides a probability distribution of estimates of B/B ₀ ranging from 0.75 to 0.95 of B ₀ . This estimated range equates to 1.88 to 2.38 x TRP Stock is currently above this point, and latest stock assessment concluded that based on the current estimates of the mean and variance of the log-recruitment, the reference point would be exceeded once every 9 years on average.	
OVERALL PERFORMANCE INDICATOR SCORE:				90
CONDITION NUMBER (if relevant):				

PI 1.1.2 – Stock rebuilding

PI 1.1.2		Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	Rebuilding timeframes			
	Guide post	A rebuilding timeframe is specified for the stock that is the shorter of 20 years or 2 times its generation time . For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed one generation time for the stock.
	Met?	N/A		N/A
	Justification	The Crangon stock in The Wash is not considered to be depleted and there is no requirement therefore to score PI 1.1.2.		
b	Rebuilding evaluation			
	Guide post	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, or it is likely based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is strong evidence that the rebuilding strategies are rebuilding stocks, or it is highly likely based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	N/A	N/A	N/A
	Justification			
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				N/A
CONDITION NUMBER (if relevant):				

PI 1.2.1 – Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Harvest strategy design			
	Guide post	The harvest strategy is expected to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Y	Y	Y
	Justification	<p>The harvest strategy for The Wash brown shrimp fishery is underpinned by the EU Common Fisheries Policy for which one of the key objectives is that: “The CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield.” In addition there is a suite of EU Fisheries Control and Technical Conservation measures that apply to the brown shrimp fishery. All brown shrimp fishing activity occurs within the 12 nm limit and is therefore covered by UK national legislation, and fishing within 6 nm of the coast is under the jurisdiction of the Eastern Inshore Fisheries and Conservation Authority (IFCA) to whom powers to manage the fishery through byelaws and permits has been devolved by the Department for Environment, Food and Rural Affairs through the Marine and Coastal Access Act 2009 (MACAA). EU, national and local IFCA regulations are subsumed within The Wash Brown Shrimp Management Plan 2017-2020 which came into force in May 2017 and has been drawn up by the shrimp fishing industry. The long-term objectives are to ensure a long-term, sustainable and stable Wash brown shrimp fishery, to support a highly productive stock of brown shrimp and ensure an ecologically responsible fishery that minimises effects on the marine environment. The Management Plan defines a suite of measures to manage fishing including a harvest control rule, measures to minimise bycatch, habitat and ecosystem interactions and regular monitoring.</p> <p>Key elements of the harvest strategy set out in the Management Plan include limited entry licensing, limits on vessel engine power and beam length, minimum cod end mesh size, compulsory use of a veil (sieve) net for vessels over 8m, mandatory sorting of catches on deck and immediate return of unwanted catch and closed areas. There is currently no restriction on catches through either an annual Total Allowable Catch (TAC) or individual vessel quotas, and there is no minimum landing size for brown shrimp. Regular stock assessments are undertaken and fishing effort is controlled through a harvest control rule.</p> <p>The main objective of the harvest strategy is to ensure that each cohort is harvested in such a manner as to minimise the likelihood of both recruitment and growth overfishing. A key element of the harvest strategy designed to avoid recruitment overfishing is one of “constant escapement”, i.e. to ensure that sufficient female shrimps in each cohort survive to generate sufficient egg production for future recruitment. The harvest control rule allows this to occur by reducing the exploitation rate when the main autumn recruiting cohort is small, thereby allowing females to grow larger which coupled with an exponential relationship between egg production and shrimp size ensures that recruitment does not fail. Evidence from both modelling and empirical studies shows that higher catch rates are achieved in the short term following a reduction in fishing effort, so the harvest control rule will also safeguard against growth overfishing. In addition the harvest strategy seeks to ensure that each cohort of recruiting shrimps is harvested optimally through setting a minimum mesh</p>		

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
		<p>size and requiring that all catches are sorted on board to ensure that survival of discarded smaller shrimps is maximised.</p> <p>There is a comprehensive programme of data and information collection and rigorous monitoring and enforcement of all regulations.</p> <p>In conclusion, the harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in PI 1.1.1 SG60, 80 and 100 are met.</p>		
b	Harvest strategy evaluation			
	Guide post	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but 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.
	Met?	Y	Y	N
	Justification	There is a rigorous monitoring programme in place including monitoring of fishing activity through the VMS system, completion of log books by all larger vessels in the fishery and through Eastern IFCA shrimp returns by smaller vessels. Accurate and detailed recording of landings is achieved by completion of sales notes under the Registration of Buyers and Sellers (RBS) scheme by all vessels in the fishery. Cross-checks by MMO show that these elements of the harvest strategy are working effectively. Monitoring and enforcement activities including vessel inspections through Eastern IFCA and the MMO shows good level of compliance with all management regulations. The harvest strategy embedded within the Management Plan has only just been developed so there has not been an opportunity to fully test it, but the recent stock assessment concluded that stock biomass has been well above conventionally-applied biomass reference points in recent years and therefore the harvest strategy can be considered to be achieving its objectives. SG60 and SG80 are met.		
	The harvest strategy appears to be maintaining stocks above target levels but it has not been fully evaluated through, for example, a management strategy evaluation (MSE) and therefore SG100 is not met.			
c	Harvest strategy monitoring			
	Guide post	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
	Justification	Log books, either paper or electronic, record monthly LPUE, and landings from all vessels are rigorously recorded through the Registration of Buyers and Sellers scheme. A population model is fitted to these catch and effort data to evaluate stock status. VMS is installed on all large vessels, and there are plans to make inshore VMS mandatory on all smaller vessels from 2018. Vessel boardings and quayside inspections are carried out by MMO and Eastern IFCA to check whether gear regulations are being observed. The SG60 is met.		
d	Harvest strategy review			
	Guide post			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			N

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
	Justifi- cation	Elements of the harvest strategy are regularly reviewed at all levels of the legislative hierarchy. The overarching EU regulations are constantly being reviewed, with a full review of the CFP completed in 2013 and regular review of the technical conservation measures. Eastern IFCA are currently consulting with stakeholders over a new shrimp fishing byelaw which, if implemented, will revise certain elements of the harvest strategy. The Wash Shrimp Management Plan has been agreed in consultation with the shrimp fishing industry and through the Shrimp Fishery Advisory Working Group (SFAWG) whose members include industry, skippers, Eastern IFCA, MMO, Cefas, Natural England and other interested stakeholders. The role of the SFAWG is to review performance of the brown shrimp fishery including non-compliance, management and policy changes and new information that may impact on the fishery in meeting its objectives. However the Management Plan is newly-developed and whilst the Management Plan states explicitly that elements of the harvest strategy, e.g. cod end mesh size and harvest control rules, will be reviewed, there has not yet been opportunity for the Management Plan to be fully reviewed and improved as necessary. SG100 is not met.		
e	Shark finning			
	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justifi- cation	Sharks are not a target species and therefore this scoring issue is not scored.		
f	Review of alternative measures			
	Guide post	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as appropriate.	There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as appropriate.
	Met?	Y	Y	N
	Justifi- cation	There is some unwanted catch of brown shrimp in The Wash fishery, although experimental studies suggest that the survival rate of discarded non-commercial-sized shrimps is over 90%. There is a long history of evaluation of measures for reducing the level of unwanted catches through, for example, changes in mesh size, the use of square-meshed cod ends, the use of sorting grids of different dimensions, the mandatory use of a sieve net, the use of letter boxes which allows unwanted catch to escape through a transverse release hole in the net and effectiveness of on-board riddles. Regulations have been introduced in the past and form part of the current Wash Shrimp Management Plan following review by the Shrimp Fishery Advisory Working Group (SFAWG). Eastern IFCA have been consulting with stakeholders on a new shrimp permit byelaw including measures for reducing unwanted catch. There have therefore been regular reviews of alternative measures to minimise mortality of unwanted catch and implement those measures and so the SG60 and SG80 are met. It is not clear that reviews are biennial, and therefore SG100 is not met.		

PI 1.2.1	There is a robust and precautionary harvest strategy in place	
References	The Wash Brown Shrimp Management Plan 2017-2020; CRANNET, 2015; ICES, 2017; Lancaster and Frid, 2002; Polet, 2000; Steenburgen <i>et al.</i> , 2011.	
OVERALL PERFORMANCE INDICATOR SCORE:		85
CONDITION NUMBER (if relevant):		

PI 1.2.2 – Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	Generally understood HCRs are in place or available that are expected to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached.	Well defined HCRs are in place that ensure that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock fluctuating around a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock fluctuating at or above a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, most of the time.
	Met?	Y	N	N
	Justification	<p>The Wash Brown Shrimp Management Plan provides details of two reference points and the associated harvest control rules. Firstly, fishing capacity of the shrimp fleet will be maintained at a target level of fishing power calculated as the current sum of each vessel's aggregate beam length (m) multiplied by engine power (kW). In relation to the 58 vessels within the Management Plan at the time of the Plan's implementation, this equates to a total fishing power within the fleet of 100,000 kWm. Entry into the fishery will be strictly controlled to ensure that this fleet capacity is not exceeded, and a fleet inventory will be produced and updated on a regular basis to ensure that this capacity cap is not exceeded through 'technological creep'.</p> <p>Secondly an HCR annual index would be calculated each year using catch and effort data over approximately 30 days during the peak recruitment period in October/November standardised to a reference vessel. The reference point for the index would be based on an estimate of the expected recruitment distribution, with a reduced effort intervention at 40% of the recruitment mode. In this way a single measure would be taken each year to determine the strength of recruitment with the trigger point being 40% of the catch rate expected at the peak of the season. If the annual index drops below this trigger level, then fishing effort would be reduced by closing the fishery for 7 days in each 14-day period throughout the forthcoming season until the start of the next peak recruitment period in the following October/November.</p> <p>These HCRs are generally understood, are in place, set an upper limit on fishing capacity to control fishing effort and reduce exploitation rate if there is an observed low level of recruitment in any single year. The SG60 is met therefore. However the Management Plan does not explicitly state how the annual HCR index will be calculated and whether the trigger reference point will have a fixed value or will be estimated through an annual stock assessment where the population model is fitted to the catch and effort data to evaluate stock status. It is essential that fishery stakeholders understand fully how the annual index is calculated and the level at which effort reduction would be implemented. In the light of this uncertainty, the assessment team concluded that the HCR is not well-defined in the Management Plan and therefore the SG80 is not met.</p>		
b	HCRs robustness to uncertainty			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a wide range of uncertainties including the ecological role of the stock, and there is evidence that the HCRs

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
				are robust to the main uncertainties.
	Met?		Y	N
	Justification	<p>The key uncertainty surrounding the dynamics of brown shrimp stocks is the variability in annual recruitment. Crangon is a highly productive, short-lived species and the main fishing season in The Wash (and throughout the North Sea) is primarily based on shrimps recruiting into the autumn fishery from larvae hatched in to the plankton in the spring. The HCR is based upon an estimate of the expected recruitment distribution, with a reduced effort intervention at 40% of the recruitment mode. The HCR has been tested using a population model which includes standardisation of fishing effort and accounts for individual vessel catchability.</p> <p>The main uncertainty concerning maintaining a cap on fishing capacity through control on vessels entering the Management Plan is that fishing capacity may increase due to ‘technological creep’ of vessels already in the Management Plan. This uncertainty will be taken into account by maintaining and regularly updating a fleet inventory where any changes in fishing capacity due to engine change or more effective fishing gear can be factored into the estimate of overall fishing capacity.</p> <p>The HCRs are therefore likely to be robust to the main uncertainties. The SG80 is met. The HCRs do not take into account uncertainties relating to the ecological role of the stock, and as the HCRs have only just been developed it is not clear that they are robust to the main uncertainties. The SG100 is not met.</p>		
c	HCRs evaluation			
	Guide post	There is some evidence that tools used or available to implement HCRs 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 HCRs.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Y	Y	N
	Justification	<p>Prior experience in the Crangon fisheries in the North Sea shows that if you close an area or after a significant reduction in fishing effort, then subsequently large numbers of large shrimps are caught, so a reduction in fishing days is a suitable tool for controlling exploitation and subsequently increasing the yield and egg production from an individual cohort of shrimps – SG60 is met. Simulation modelling by Medley (2017) demonstrated that reducing the number of fishing days for the rest of the season following observed low recruitment levels in the main autumn fishery was effective in ensuring that exploitation rate was reduced and future recruitment was safeguarded. The HCR based on an annual index was evaluated in relation to alternative HCRs based on short-term responses to declining catch rates, and was found to be the most appropriate for The Wash fishery. The current levels of exploitation in the fishery estimated by Medley (2017) are low and have ensured that the stock has not dropped below the standard target reference point of 40% of unexploited biomass over the period 2012 to 2017. The SG80 is met. To date there is not sufficient evidence to conclude that the tools in use are effective in achieving the exploitation levels required under the HCRs. For example, it is not clear how fishers’ behaviour may change in relation to significant restrictions in days at sea, how markets will respond to changes in size compositions of landings, and how predation rates may change in response to increased abundance of large shrimps. The SG100 is not met.</p>		
References		The Wash Brown Shrimp Management Plan 2017-2020; Berghahn, 1996; ICES, 2014, 2017; Medley, 2017; Temming et al. 2013; Steenburgen et al. 2015		
OVERALL PERFORMANCE INDICATOR SCORE:				75
CONDITION NUMBER (if relevant):				1

PI 1.2.3 – Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guide post	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, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
	Justification	Licensing of vessels, a fleet inventory (including information on vessel length and engine power, beam length, cod end and veil net mesh size and riddle type) which is an integral part of the Management Plan, VMS and IFCA sightings data, log books recording catch and effort information and obligatory catch returns through sales notes ensure that the fleet composition and fishery removals are well understood. Cross checks by national authorities confirm that fishery removals are recorded accurately. Observer sampling provides information on stock structure, which is also monitored through gradings of landed shrimps, but data on size distribution of landings are not considered essential to the harvest strategy because the majority of the landings are from a single cohort, and therefore size distribution information would not be informative in relation to year-class strength. Biological information on key life history characteristics such as size at maturity is available. Sufficient information is available to support the harvest strategy. SG60 and SG80 are met. Whilst there is a range of information on brown shrimp stocks in The Wash, there is no fishery-independent stock survey which would provide better information on stock structure and productivity and the current monitoring programme does not include any environmental information. The information could not therefore be considered to be comprehensive, and SG100 is not met.		
b	Monitoring			
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA 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.	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 inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N
	Justification	An index of stock abundance is available from records of landings per unit effort recorded from each fishing trip on electronic or paper log books or through Eastern IFCA returns. This information provides the key information for assessing the status of the stock in relation to the reference points and the harvest control rule. The stock		

PI 1.2.3		Relevant information is collected to support the harvest strategy	
		<p>assessment entails fitting a population model to these catch and effort data in order to provide an estimate of biomass in relation to unexploited biomass. Information on fishery removals is available from the Fishing Activity Reports (FAR) produced from log book returns for all vessels of 10m length and above, and sales notes are mandatory for all vessels irrespective of size under the Registration of Buyers and Sellers (RBS) scheme. Cross-checking of sales notes with log book returns by MMO provide evidence that fishery removals and fishing effort are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule. SG60 and SG80 are met. However the assessment team recommends that accurate information is obtained on the proportion of non-commercial-sized shrimps that are discarded following riddling of the catch and that an estimate of discard mortality that is specific to The Wash fishery is obtained.</p> <p>There is no fishery-independent estimate of stock abundance for The Wash fishery (cf. the swept area estimate of biomass for the eastern North Sea Crangon population) and there is not a full understanding of the inherent uncertainties in the data and the robustness of the assessment and management to that uncertainty. SG100 is not met.</p>	
c	Comprehensiveness of information		
	Guide post		There is good information on all other fishery removals from the stock.
	Met?		Y
	Justification	There is minimal bycatch of Crangon in other trawl fisheries because the mesh size in trawls used in other fisheries are much larger than those used in the targeted brown shrimp fishery. There are some smaller vessels which are not part of the Management Plan that will catch brown shrimps for processing for local sales and do not land to the two processors. These smaller vessels are all required to declare their landings through the Registration of Buyers and Sellers scheme (RBS), unless their catch is less than 30kgs and is for personal consumption. There is therefore good information on removals from the stock by vessels outside the Management Plan. SG80 is met.	
References		The Wash Brown Shrimp Management Plan 2017-2020; ICES, 2014, 2017; Medley, 2017.	
OVERALL PERFORMANCE INDICATOR SCORE:			80
CONDITION NUMBER (if relevant):			

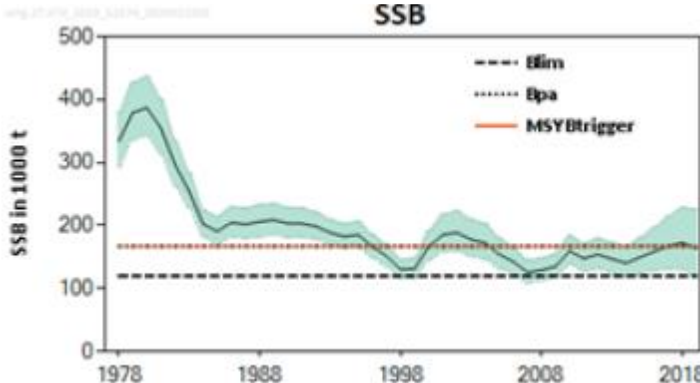
PI 1.2.4 – Assessment of stock status

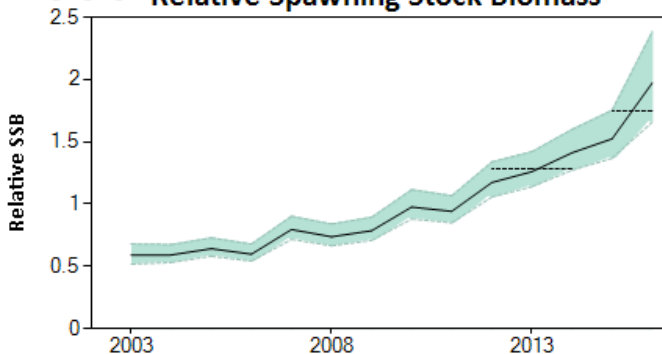
PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Y	N
	Justification	<p>Crangon is a highly productive, short-lived species which cannot be routinely aged, so conventional age-based analytical stock assessments are not possible. In consequence, there are two components to the stock assessment of The Wash brown shrimp fishery.</p> <p>Firstly, a population model has been developed which describes growth in biomass through recruitment and growth in weight of individual shrimps in the population, and reduction in biomass through natural mortality and catches on a half-lunar month time step. This half-lunar month time step is appropriate because the vessels' fishing activity is restricted by tides. The model is fitted to seasonal catch and effort data and provides estimates of fishing mortality and stock biomass in relation to unexploited biomass.</p> <p>Secondly CPUE data are collected from log books and sales notes and trends in monthly CPUE indices are compared with historical trends. (Mortality of discarded non-commercial-sized Crangon is considered to be very low, so that landings are considered to be equivalent to catch.) An HCR annual index calculated using catch and effort data over approximately 30 days during the peak recruitment period in October/November standardised to a reference vessel is compared to a reference index defined at 40% of the mode of the expected recruitment distribution. If the annual index drops below this trigger level, then the harvest control rule is implemented whereby fishing effort would be reduced by closing the fishery for 7 days in each 14-day period throughout the forthcoming season. The in-year evaluation of catch and effort information is an appropriate method of assessment for a short-lived, highly productive species such as Crangon, and is a method used for many other shrimp fisheries worldwide, including many that are MSC certified.</p> <p>The assessment methods can be considered appropriate for the Crangon stock and for the harvest control rule and therefore the SG80 is met. Evidence from Crangon fisheries throughout the North Sea shows that recruitment is driven primarily by environmental factors such as freshwater run-off and predator abundance, and the assessment does not take into account either of these factors. SG100 is not met.</p>		
b	Assessment approach			
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Y	Y	
	Justification	<p>The stock assessment model developed by Medley (2017) evaluates stock biomass as a proportion of unexploited biomass, and compares estimated stock biomass against a target reference point of 40% of unexploited biomass (0.4B₀), conventionally considered to be consistent with MSY, and a limit reference point of 20% of unexploited biomass (0.2B₀) conventionally considered to be a level of biomass below which recruitment is likely to be impaired. It should be noted however that these reference points have not been formally adopted in the Management Plan.</p>		

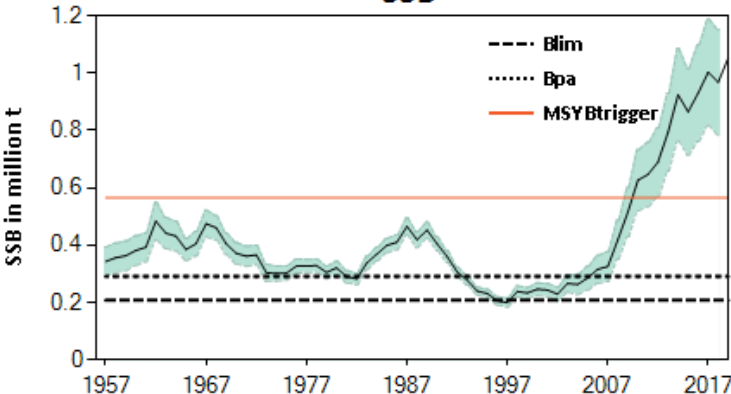
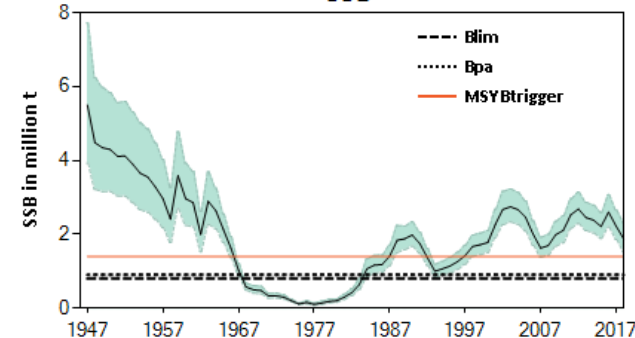
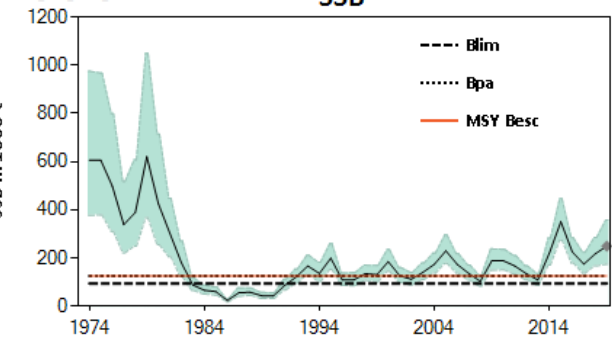
PI 1.2.4		There is an adequate assessment of the stock status		
		<p>In addition, an HCR annual index would be calculated each year using catch and effort data over approximately 30 days during the peak recruitment period in October/November standardised to a reference vessel. The reference point for the index would be based on an estimate of the expected recruitment distribution, with a reduced effort intervention at 40% of the recruitment mode. In this way a single measure would be taken each year to determine the strength of recruitment with the trigger point being 40% of the catch rate expected at the peak of the season. If the annual index drops below this trigger level, then fishing effort would be reduced by closing the fishery for 7 days in each 14-day period throughout the forthcoming season until the start of the next peak recruitment period in the following October/November. There is also a 'softer' target reference point of fishing power calculated as the current sum of each vessel's aggregate beam length (m) multiplied by engine power (kW). The Management Plan aims to keep the overall capacity below 100,000 kWm.</p> <p>The stock assessment therefore estimates stock status on an annual basis relative to reference points which can be estimated. SG60 and SG80 are met.</p>		
c	Uncertainty in the assessment			
	Guide post	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.
	Met?	Y	Y	Y
	Justification	The assessment model accounts for individual vessel catchability. Vessel catchability is handled as a random effect, with mean log-catchability dependent on fishing power (based on net beam length and engine power). Standardisation of fishing effort takes place within the stock assessment model fit. The population model is fitted using a Bayesian approach which uses Markov Chain Monte Carlo (MCMC) simulations, and stock status is estimated relative to the target and limit reference points in a probabilistic way. SG60, 80 and 100 are met		
d	Evaluation of assessment			
	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			N
	Justification	The stock assessment methodology developed by Medley (2017) has not yet been fully tested and shown to be robust primarily because the population model currently uses a very short time series of catch and effort data. Alternative stock assessment approaches have been used for assessment of Crangon stocks in the eastern North Sea. Firstly, total mortality is estimated from length-based methods and then partitioned into fishing and natural mortality. The estimated fishing mortality is then compared with Fmsy proxies estimated from a yield-per-recruit model. Secondly there is an annual estimate of biomass from stock surveys using a swept-area trawl method, which could be used as an indicator of stock biomass or used in conjunction with landings to provide an estimate of fishing mortality. Neither of these alternative approaches has yet been explored for The Wash fishery. SG100 is not met.		
	Peer review of assessment			

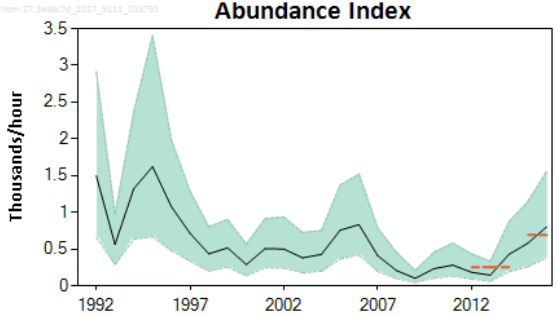
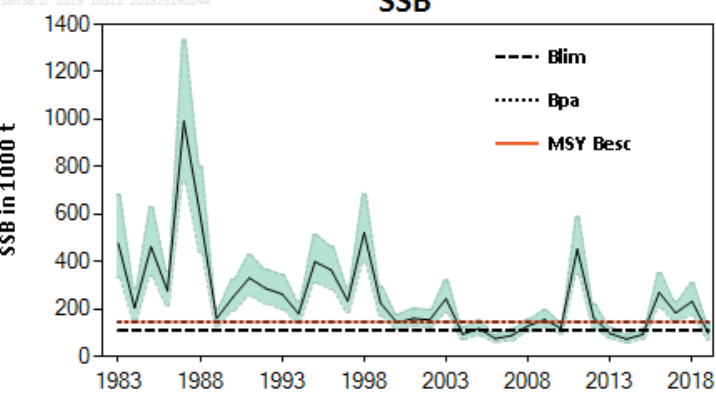
PI 1.2.4		There is an adequate assessment of the stock status		
e	Guide post		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
	Met?		N	N
	Justification	The newly-developed stock assessment methodology including the evaluation of harvest control rules has not yet been presented at the ICES Crangon Working Group, at which alternative stock assessment approaches have been reviewed, and outside the ICES process, the model developed by Medley (2017) has not been formally peer reviewed. The SG80 is not met.		
References		ICES, 2014, 2017; Medley, 2017; Temming and Hufnagl, 2014; Tulp <i>et al.</i> , 2016 The Wash Shrimp Management Plan, 2017.		
OVERALL PERFORMANCE INDICATOR SCORE:				75
CONDITION NUMBER (if relevant):				2

PI 2.1.1 Primary species outcome

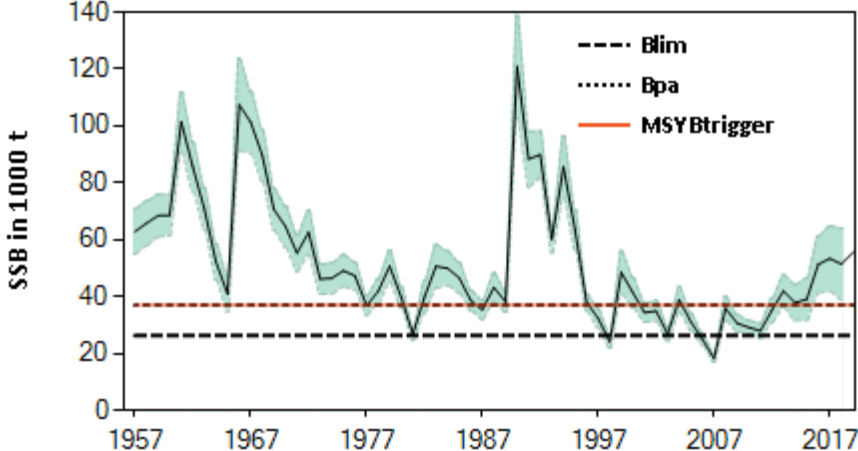
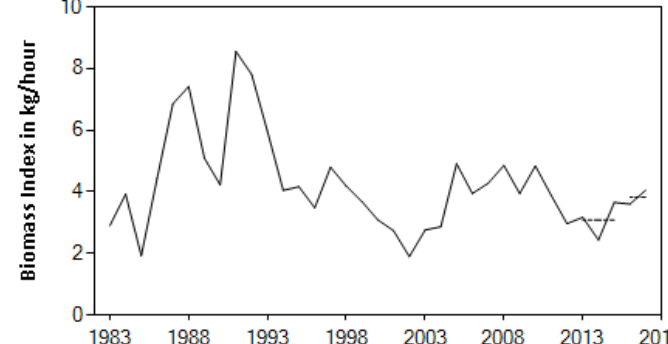
PI 2.1.1		The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.		
Scoring Issue		SG 60	SG 80	SG 100
a	Main primary species stock status			
	Guide post	<p>Main primary species are likely to be above the PRI</p> <p>OR</p> <p>If the species is below the PRI, the UoA has measures in place that are expected to ensure that the UoA does not hinder recovery and rebuilding.</p>	<p>Main primary species are highly likely to be above the PRI</p> <p>OR</p> <p>If the species is below the PRI, there is either evidence of recovery or a demonstrably effective strategy in place between all MSC UoAs which categorise this species as main, to ensure that they collectively do not hinder recovery and rebuilding.</p>	<p>There is a high degree of certainty that main primary species are above the PRI and are fluctuating around a level consistent with MSY.</p>
	Met?	Y	<p>Y</p> <p>Whiting: Y</p> <p>Dab: Y</p>	<p>N</p> <p>Whiting: N</p> <p>Dab: N</p>
	Justification	<p>The two main Primary species identified from the observer report catch composition are Whiting and dab. Each species is treated as an element as part of the scoring.</p> <p><u>Whiting (<i>Merlangius merlangus</i>):</u> Y – SG 60 and SG 80 are met, SG100 is not met</p> <p>Spawning-stock biomass (SSB) has been fluctuating and is now slightly below MSY Btrigger. ICES assesses that fishing pressure on the stock is above FMSY but below Fpa and Flim, and thus harvested sustainably.</p>		
		<p style="text-align: center;">SSB</p>  <p>Source: ICES Advice June 2019</p> <p>At the 2018 benchmark, estimates of stock weights and maturity at age were updated, using the assessment model SAM and Reference points were adapted accordingly.</p> <p>The estimate of SSB is 156,000 tonnes and Blim is 120,000 tonnes, therefore whiting can be considered to be <u>highly likely to be above the PRI</u>. Recruitment was lower than average in 2017 and 2018, but the trend in recruitment over recent years shows</p>		

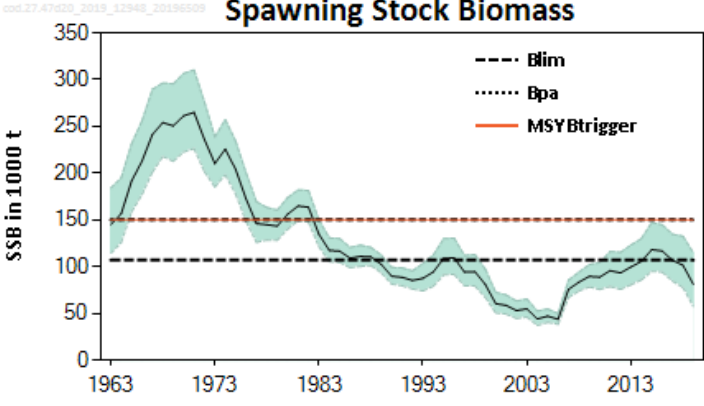
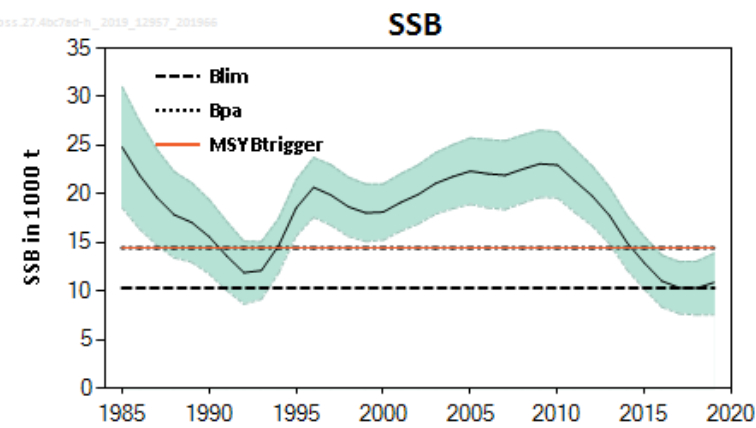
PI 2.1.1		The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.	
		<p>that there was below average in recruitment in 2011 and 2012 when SSB was again below MSYBtrigger, but then there was above average recruitment in 2014 to 2016 when SSB remained low. All of which suggests that currently there is no evidence that recruitment is impaired. Furthermore, MSC Interpretations state that for ICES (target) stocks one can score PI 1.1.1a at 80 if the SSB is above the halfway point between Blim and MSYBtrigger, so using the same rationale for primary species, a score of 80 for whiting is justified here.</p> <p><u>Dab (<i>Limanda limanda</i>):</u> Y – SG60 and SG80 are met; SG100 is not met</p> <p>The assessment of Dab is indicative of trends only, the SSB is survey based (ICES Category 3 stock). Reference points are by proxy, which means that although SSB trends appear to meet the MSYBtrigger, there is not a high degree of certainty.</p> <p>Relative Spawning Stock Biomass</p>  <p>Source: ICES Advice June 2017 (please note, no updated advice at time of checking August 2019)</p> <p>The dashed lines in the graph indicate the average biomass index of the respective year range. Dab is mainly a bycatch species in the demersal fisheries for North Sea plaice and sole and has high discards. There is no catch limit for dab, ICES advises that this currently poses a low risk for the stock</p> <p>As no partial score can be given for this SI, SG80 has been met.</p>	
b	Minor primary species stock status		
	Guide post		<p>Minor primary species are highly likely to be above the PRI</p> <p>OR</p> <p>If below the PRI, there is evidence that the UoA does not hinder the recovery and rebuilding of minor primary species</p>
	Met?		<p>Y</p> <p>All 12 elements meet SG100</p>
	Justification	<p>There are twelve minor Primary species, each an element to score this SI. All elements automatically reach SG80.</p> <p><u>European plaice <i>Pleuronectes platessa</i> SG100 is met</u></p>	

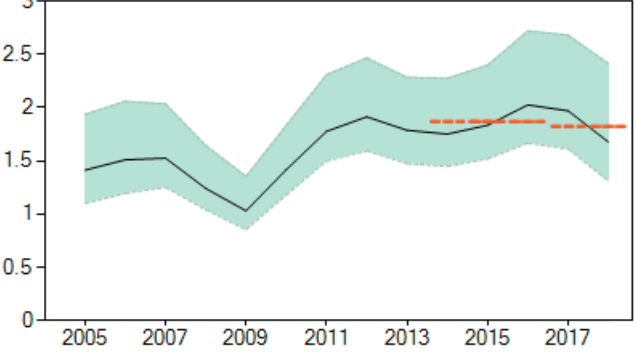
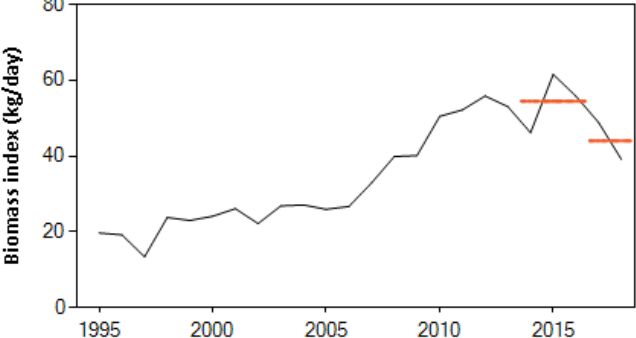
PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
	<p>sgp:27.420_2019_11089_20190610119</p> <p>SSB</p>  <p>Source: ICES Advice June 2019, SG100 met</p> <p>ICES assesses that fishing pressure on the stock is below F_{MSY}, F_{pa}, and F_{lim}; spawning-stock size is above MSY Btrigger, B_{pa}, and B_{lim}. The stock is at full reproductive capacity and harvested sustainably</p> <p><u>Herring <i>Clupea harengus</i>: SG100 is met</u></p> <p>Dec:27.44710_2019_10365_201905102</p> <p>SSB</p>  <p>Source: ICES Advice May 2019</p> <p>The analytical assessment showed that the stock is above MSY Btrigger and at full reproductive capacity, and harvested sustainably, as the fishing pressure on the stock is below F_{MSY}. It is highly likely that the species is above PRI.</p> <p><u>Sprat <i>Sprattus sprattus</i> SG100 is met</u></p> <p>sgp:27.346_2019_10364_20190410341</p> <p>SSB</p>  <p>Source: ICES June 2019</p> <p>The stock was benchmarked in 2018. Recruitments slightly higher than average in recent years have contributed to an increase in SSB well above MSY B_{escapement} in recent years. The F_{cap} of 0.69 is used to ensure that after the fishery has been conducted, escapement biomass is preserved above B_{lim} with high probability. This will result in a median SSB above MSY B_{escapement} in the long term. The spawning-</p>

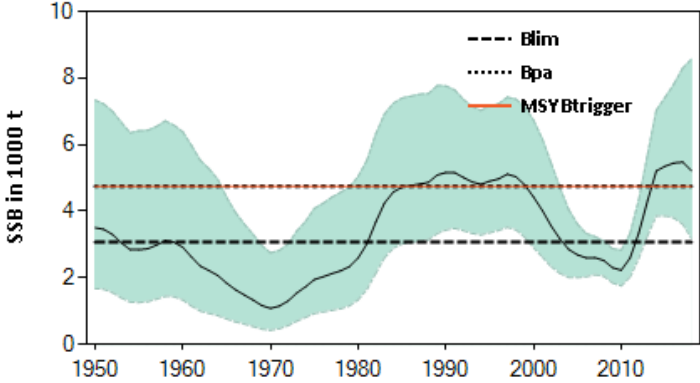
PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
	<p>stock biomass (SSB) at 1 July (2018) has been above MSY $B_{escapement}$ since 2013. Fishing mortality (F) has been higher than average for the last four years. Recruitment (R) at 1 July in 2018 is estimated to have been below the long-term average, but above the average of the last ten years.</p> <p>Given the information available, the species is highly likely above PRI, and there is evidence that the UoA does not hinder rebuilding and recovery as Observer data showed a bycatch of 0.08%.</p> <p><u>Horse mackerel <i>Trachurus trachurus</i> SG100 is met</u></p> <p>Abundance Index</p>  <p>Source: ICES Advice Sept 2017 (latest advice available for the region concerned)</p> <p>The graph includes the index of abundance of fish > 20 cm length in the stock; data obtained from a combination of the IBTS and CGFS surveys in the North Sea (divisions 4.b–c, Q3) and eastern English Channel (Division 7.d, Q4), respectively. Confidence intervals (95%) are included. The survey index indicates that the stock continues to be at a low level, although some signs of recovery are observed. There is evidence that the UoA does not hinder recovery as Observer data showed a bycatch of 0.09% (=7.1kg).</p> <p><u>Sandeel <i>Ammodytes tobianus</i> SG100 is met</u></p> <p>SSB</p>  <p>Source: ICES Advice Feb 2019</p> <p>Area 1r:</p>

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
	<div> </div> <p>ICES assessed that the spawning stock size is below $MSY B_{escapement}$ and below B_{pa} and B_{lim}. No reference points for fishing pressure have been defined for this stock. Fishing mortality (F) has fluctuated, showing a declining trend since the mid-2000s followed by an increase in 2017 and 2018 to approximately the long-term average. The assessment for 2019 is consistent with the assessment from 2018. The large change in the advice from year to year can be explained by the marked interannual variability in biomass and recruitment and the early maturation, both of which are typical for a short-living species. The uncertainty in the estimate of the SSB, F, and recruitment are low, but recruitment and SSB have both been downscaled in the final year of the assessment. The spawning-stock biomass (SSB) has been below the limit biomass level (B_{lim}) since 2004 (except in 2011), increasing in 2018 to above B_{pa}. Recruitment has been low since 2000; however, the 2016 year class is estimated to be one of the largest in the time-series. Stock size at the beginning of 2019 is estimated to be below B_{lim} and this has contributed to the reduction in advised catch for 2019. There is evidence that the UoA does not hinder the recovery and rebuilding of sandeel in region 1r (in addition, there is TAC advice given for this region, whereas other regions – 2r- zero TAC is advised), based on observer bycatch data which showed that 0.08% were bycaught.</p> <p><u>Sole <i>Solea solea</i></u> SG100 is met</p>

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
	<p>No. 27.3a4_2017_0004_201700012304</p> <p>SSB</p>  <p>Source: ICES Advice June 2019</p> <p>The analytical assessment shows that SSB is above Btrigger, and fishing pressure on the stock is above F_{MSY} but below F_{pa} and F_{lim}; and the stock is at full reproductive capacity. It is highly likely the species is above the PRI.</p> <p>Flounder <i>Platychthys flesus</i> SG100 is met</p> <p>No. 27.3a4_2017_0004_201700012304</p> <p>Biomass Index</p>  <p>Source: ICES June 2019</p> <p>The ICES assessment is based on surveys, this is a Category 3 stock. Dashed lines indicate the average biomass index of the respective year range. Flounder is mainly a bycatch species in the coastal fisheries of the North Sea. Large effort reductions of about 60% in the beam and otter trawl fisheries, which take a large proportion of the catch, took place in the period 2003–2015 (STECF, 2016). In 2017, ICES advised that the risk of having no catch limits for the dab and flounder stocks was considered to be low and not inconsistent with the objectives of the Common Fisheries Policy (CFP). Dab and flounder are no longer managed under a TAC. ICES stated that this advice was valid as long as dab and flounder remained largely bycatch species, with the main fleets catching dab and flounder continuing to fish the target species (plaice and sole) sustainably within the FMSY ranges provided by ICES. If this situation changes, or flounder is no longer within safe biological limits, this advice would need to be reconsidered. According to the 2019 Advice information, ICES had not been requested to provide advice on fishing opportunities for this stock. The available survey information indicated no clear trend in stock biomass.</p> <p>The EU multiannual plan (MAP) for stocks in the North Sea (EU, 2018) and adjacent waters applies to by-catches of this stock. The ICES June 2019 Advice states that fishing pressure is below FMSY and meets the precautionary approach (F is below possible reference points). Stock size reference points were undefined.</p>

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
	<p>There is evidence that the UoA does not hinder recovery and rebuilding as Observer data showed a bycatch of 0.05%.</p> <p><u>Cod <i>Gadus morhua</i>: SG100 is met</u></p> <p>Spawning Stock Biomass</p>  <p>Source: ICES Advice June 2019</p> <p>The SSB is below MSYBtrigger and below Blim. and the stock is at increased risk; F is above F_{MSY} and above F_{pa} and F_{lim}, the stock is harvested unsustainably. The latest assessment resulted in a downscaling of SSB, and the stock is now at reduced reproductive capacity... The reason behind the change in advice (June 2019) is a combination of the following: a downward revision of SSB in recent years with the addition of one extra year of data, the recruitment estimate for 2019 being substantially below the value assumed last year, and the need for a large reduction in F to recover the stock to B_{lim} by 2021 because the stock is below B_{lim}. There is evidence that the UoA does not hinder recovery and rebuilding as Observer reports show that bycatch of cod is small (0.03%), SG100 is met.</p> <p><u>European seabass <i>Dicentrarchus labrax</i> SG100 is met</u></p> <p>SSB</p>  <p>Source: ICES June 2019</p> <p>The analytical assessment indicated that SSB is below MSYBtrigger, and there is reduced reproductive capacity. This stock was benchmarked in 2018 (ICES, 2018a); a new tuning series was added, the assumption on natural mortality was revised, the assumption for recreational removals was revised, and discard data were added. Therefore, the present assessment is not fully comparable with the previous year's assessment. Poor catch data quality, owing to limited sampling of the discards and recreational removals, leads to additional uncertainty in the assessment. The discard</p>

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
	<p>values are estimated from sampling programmes where sampling is variable across fleets and years. Anecdotal information suggests that total discards could be considerably underestimated.</p> <p>ICES assessed that fishing pressure on the stock is below FMSY, Flim, and Fpa (ie harvested sustainably); spawning stock size is below MSY Btrigger and between Bpa and Blim (ie the stock is at increased risk)</p> <p>There is evidence that the UoA does not hinder recovery and rebuilding as Observer reports show that bycatch of seabass is small (0.02%), SG100 is met.</p> <p><u>Lemon sole <i>Microstomus kitt</i> SG100 is met</u></p> <p>Item 27.3a47d_2019_12003_20190101</p> <p>Relative SSB</p>  <p>Source: ICES June 2019</p> <p>Lemon sole is mainly a valuable bycatch species in mixed fisheries. The EU multiannual plan (MAP) for stocks in the North Sea (EU, 2018) and adjacent waters applies to by-catches of this stock.</p> <p>This is a Category 3 stock, whereby the survey trends-based assessment showed that SSB is above MSYBtrigger (proxy); and Blim above possible reference points. Length data from commercial fleets have not been consistently provided, and age data are sparse. Improved information on age and length distributions in landings and discards, from most countries participating in the fishery, would be required in order to conduct a fully analytical, catch-based assessment. The figure above shows the relative SSB with 90% confidence intervals, including horizontal lines showing the data limited stocks (DLS) 3.2 decision rule. Whilst there is no sign of overexploitation, the stock size is unknown. There is also no evidence that the stock size is increasing significantly, so the precautionary buffer was applied (ICES June 2019) There is evidence that the UoA does not hinder recovery and rebuilding as Observer data showed a small bycatch of lemon sole of 0.004% (=0.3kg).</p> <p><u>Brill <i>Scophthalmus rhombus</i>; SG 100 is met</u></p> <p>Item 27.3a47m_2019_12003_20190609</p> <p>Biomass index</p> 

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.
	<p>Source: ICES Advice June 2019</p> <p>Brill is mainly a bycatch species in fisheries for plaice and sole. Biomass index is the standardized landings per unit effort (lpue) from the Dutch beam-trawl fleet for vessels > 221 kW. Red lines indicate the average of the abundance index for 2014 to 2016, and for 2017 to 2018. This is a Category 3 stock, ICES assesses that fishing pressure on the stock is below FMSY proxy; and spawning stock size is above MSY Btrigger proxy.</p> <p>The EU multiannual plan (MAP) for stocks in the North Sea (EU, 2018) and adjacent waters applies to by-catches of this stock. Since 1 January 2019, brill in Subarea 4 is under the EU landing obligation, without exemptions</p> <p>There is evidence that the UoA does not hinder recovery and rebuilding as Observer data showed a small bycatch of Brill of 0.004%.</p> <p><u>Witch <i>Glyptocephalus cynoglossus</i> SG100 is met</u></p> <p style="text-align: center;">SSB</p>  <p>Source ICES Advice June 2019</p> <p>In the context of the EU multiannual plan for demersal fisheries in the North Sea, in which this stock is considered bycatch, the EC has requested that ICES provide advice based on the precautionary approach. Fishing mortality (F) has been above FMSY since the beginning of the time-series. Spawning-stock biomass (SSB) that was below Blim around 2010, has increased since then and is now above MSY Btrigger. Recruitment (R) has declined since 2010 and is currently at a low level. ICES assessed that fishing pressure on the stock is above FMSY and between Fpa and Flim, and that spawning stock size is above MSY Btrigger, Bpa, and Blim. The stock is at full reproductive capacity.</p> <p>There is evidence that the UoA does not hinder recovery as Observer data showed a small bycatch of 0.001% (=0.05kg).</p>
References	<p>ICES Advice Whiting 2019; http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/whg.27.47d.pdf</p> <p>ICES Advice dab, June 2017 http://ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/dab.27.3a4.pdf</p> <p>ICES Advice Plaice, June 2019; http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/ple.27.420.pdf</p> <p>ICES Advice Herring, May 2019 http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/her.27.3a47d.pdf</p> <p>ICES Advice sprat June 2019; http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/spr.27.3a4.pdf</p> <p>ICES Advice horse mackerel Sept 2017: http://ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/hom.27.3a4bc7d.pdf</p>

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.	
	<p>ICES Advice sandeel Feb 2019; http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/san.sa.1r.pdf</p> <p>ICES Advice sole, June 2019: http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/sol.27.4.pdf</p> <p>ICES Advice flounder, June 2019 http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/fle.27.3a4.pdf</p> <p>ICES Advice cod, June 2019; http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/cod.27.47d20.pdf</p> <p>ICES Advice seabass June 2019; http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/bss.27.4bc7ad-h.pdf</p> <p>ICES Advice lemon sole, June 2019; http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/lem.27.3a47d.pdf</p> <p>ICES Advice brill, June 2019 ; http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/bl.27.3a47de.pdf</p> <p>ICES Advice witch, June 2019; http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/wit.27.3a47d.pdf</p>	
OVERALL PERFORMANCE INDICATOR SCORE:		90
SI a) = 80 (2 elements); all 12 elements at SIb) score 100.		
CONDITION NUMBER (if relevant):		-

PI 2.1.2 Primary species management strategy

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are measures in place for the UoA, if necessary, that are expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are likely to above the point where recruitment would be impaired.	There is a partial strategy in place for the UoA, if necessary, that is expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are highly likely to be above the point where recruitment would be impaired.	There is a strategy in place for the UoA for managing main and minor primary species.
	Met?	Y	Y	Y
	Justification	<p>By definition of 'primary species', which are species of commercial value with management tools controlling exploitation, all elements listed under PI 2.1.1 meet SG80. These tools, which comprise a strategy as they are regularly reviewed through the ICES process, include: a requirement for accurate information on landings (via log book and sales notes), stock assessments and management rules such as reference points, harvest control rules, quotas and recovery plans where necessary (e.g. cod).</p> <p>This fishery is currently not part of the EU Landings Obligation (EU 2015/812), which was introduced for all EU fishing vessels for certain species and fisheries starting in 2015. <i>Crangon crangon</i> is not a demersal quota species (MMO 2017 statutory guidance). The nature of the fishery is such, that only the target species, Brown Shrimp, is retained. Therefore, a strategy is in place to reduce any bycatch, of both primary and secondary species. All vessels have to use a sieve net (EU 227/2013) and require the use of onboard riddles (EC 850/98). This is also written into the Wash Brown Shrimp Fishery management plan, where the requirement of the sieve net/veil net applies to all vessels with an aggregate beam length of >8m. This complies with the Shrimp fishing nets Order 2002 (which allows vessels of less than 8m aggregated beam length to not have a sieve net). Of the 70 vessels listed as part of the fishery (client information on vessels and gears May 2018), there are 8 vessels with an aggregate beam length of less than 8m, of which three do not use a veil net. The sieve net is designed to separate out larger fish during the actual fishing process. For example, flatfish such as plaice, starting at sizes of approx. 8 to 12 cm, are sieved out and no longer appear in the by-catch (Wienbeck 1993, Neudecker and Damm 2010). All remaining animals and similar sized objects, which are still caught in the cod end with the target species, are emptied into the hopper of the vessel, and are transferred to rotating or shaker sieves operated with high amounts of running sea water to increase survival rates (Aviat 2011). This on-board process is efficient and quick and described in detail in Section 3.6.3 of this report.</p> <p>This strategy applies to all main and minor species elements.</p> <p>SG60, SG80 and SG100 are met.</p>		
b	Management strategy evaluation			

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
	Guide post	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 measures/partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the partial strategy/strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y	Y	Y
	Justification	Testing has shown that a 70 mm sieve net is effective in reducing the bycatch of marketable (and therefore primary) species in the Brown shrimp net. Minimum landing sizes are effective at ensuring that undersized commercial species are not retained. Log books, registered landing ports and effective monitoring, control and surveillance give high confidence that the measures designed to minimise the level of retention on non-target species are effective. Vessels of 10m + length have to complete a log: those between 10-12m complete a paper log, and those of 12+m length complete an e-log in conjunction with VMS. Vessels smaller than 10m do not need to complete a log. For those vessels over 10m the information is accurate (MMO <i>pers comm.</i> at site visit, 30.05.2018), as have sales notes as well to corroborate and which gear is being used. However, all vessels have associated sales notices on landing, and spot checks are carried out by MMO. Design of on-board sorting equipment and methodology is tested for effectiveness and improved designs are encouraged (Cefas <i>pers. comm.</i> 31.05.2018). This is discussed in detail in Section 3.6.3 of the report. Survivability improves with sorting speed and appropriate sorting equipment design (e.g. rotating sieves with plenty of flushing) (Berghahn <i>et al</i> 1998). Research has shown that if fish are released below the water line, mortality due to bird predation is much reduced (<i>pers.comm.</i> with client). SG60, SG80 and SG100 are met.		
c	Management strategy implementation			
	Guide post		There is some evidence that the measures/partial strategy is being implemented successfully .	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its overall objective as set out in scoring issue (a).
	Met?		Y	Y
	Justification	All TAC fisheries, as primary species are by definition, have associated compliance tools in place, and this applies to all Primary species elements. The requirement for all vessels to fish with a 70mm sieve net when targeting shrimp came into force on 1 st January 2003. This is a key element of the strategy to minimise capture (and retention) of market size fish species. This has been implemented successfully and is enforced appropriately. However, the Wash Brown Shrimp Fishery management plan states that the requirement of the sieve net/ veil net applies to all vessels with an aggregate beam length of >8m (in accordance with the Shrimp Fishing Nets Order 2002). Of the 70 vessels listed as part of the fishery (client		

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
		<p>information on vessels and gears May 2018), there are 8 vessels with an aggregate beam length of less than 8m, of which three do not use a veil net. The vessels with an aggregate beam length of less than 8m fish irregularly, and one of these (Sea Rover, as checked on list produced by client Aug 2018) appears not to have signed the Management Plan which is a pre-requisite to be part of this certification.</p> <p>The other key element of the strategy which prevents any fish which are brought on board from being retained is the minimum landing size (MLS) for key commercial species. These have also been implemented for many years as part of EU fisheries management, and has been successful in the prevention of the sale of undersized fish. Technical measures such as sieve net and rotating sorting drum are used throughout the fishery. SG80 is met</p> <p>There is clear evidence, Observer reports and MMO spot-checks, that the strategy is being implemented successfully and is achieving its overall objective of reducing bycatch.</p> <p>SG100 is met.</p>		
d	Shark finning			
	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	Not applicable – none of the primary species are sharks.		
e	Review of alternative measures			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species.	There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species and they are implemented as appropriate.	There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all primary species, and they are implemented, as appropriate.
	Met?	Y	Y	N
	Justification	<p>The sieve net was introduced to the brown shrimp fishery in order to reduce bycatch. Alternative measures have been researched, such as the sorting grid and letter box, as discussed in Section 3.6.3 the report. The letterbox also reduced bycatch of plaice and other flatfish species.</p> <p>The measures that have been adopted in the Wash Brown Shrimp Management Plan are the result of a comprehensive literature search, best practice and practicalities, and intensive discussions weighing up alternatives. For example, minutes of a meeting of the Shrimp Fishery Advisory Working Group (SFAWG) on 9th May 2012 indicate that bycatch reduction measures were discussed and reviewed in detail. As part of the Eastern IFCA shrimp industry workshop (July 2015), bycatch reduction and minimisation of unwanted catches was reviewed. The Eastern IFCA Shrimp industry workshop discussed access limitation as part of management and spatial</p>		

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.
		<p>closure (although this was in relation to habitat management rather than bycatch reduction). The Wash Brown Shrimp Management Plan, which was adopted on 10th Jan, 2017 and came into force on 2nd May 2017 requires that there has to be ‘... timely implementation of management measures, which are routinely monitored and reviewed’. SG80 is met.</p> <p>There does not appear to be a biennial review, SG100 is not met.</p> <p>Recommendation: 2.1.2e – Produce evidence of routine monitoring and review of management measures.</p>
References		<p>Aviat <i>et al</i> 2011; Berghahn & Purps (1998); Neudecker & Damm (2010); Wienbeck H. (1993)</p> <p>COUNCIL REGULATION (EC) No 850/98 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms</p> <p>EU Regulation 227/2013 amending Council Regulation (EC) No 850/98 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms</p> <p>EU Landing Obligation (EU 2015/812)</p> <p>Shrimp Fishing Nets Order 2002 https://www.legislation.gov.uk/ukxi/2002/2870/article/3/made</p> <p>MMO 2017 Statutory guidance; https://www.gov.uk/government/publications/demersal-landing-obligation-2018-guidance/demersal-landing-obligation-2018</p> <p>Eastern IFCA shrimp industry workshop report, 10th July 2015; http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/04/View-the-report-from-the-shrimp-industry-workshop-on-10-July-2015.pdf</p> <p>Eastern IFCA shrimp industry workshop, 29th Sept 2016. http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/09/Shrimp-Workshop-Report.pdf</p> <p>SFWAG 2012 minutes of meeting on 9th May 2012. www.eastern-ifca.gov.uk/.../Shrimp-Fishery-Advisory-Working-Group-9-May-2012</p>
OVERALL PERFORMANCE INDICATOR SCORE:		95
CONDITION NUMBER (if relevant):		-
Recommendation: 2.1.2e – Produce evidence of routine monitoring and review of management measures.		1

PI 2.1.3 - Primary species information

PI 2.1.3		Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impact on main primary species			
	Guide post	Qualitative information is adequate to estimate the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for main primary species.	Some quantitative information is available and is adequate to assess the impact of the UoA on the main primary species with respect to status. OR If RBF is used to score PI 2.1.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for main primary species.	Quantitative information is available and is adequate to assess with a high degree of certainty the impact of the UoA on main primary species with respect to status.
	Met?	Y	Y	Y
	Justification	Quantitative catch composition data is available for all the elements, as investigated and compiled by observers for 13 trips between 2015-17. This information on main primary species elements is adequate to assess with a high degree of certainty the impact of the UoA, in that stock status per species is known (as compiled by ICES), and the amount of bycatch per species is known (in percentage as well as weight). Primary species are, by definition, managed with stock assessments or similar stock status information in place. ICES stock assessments explicitly address accuracy of information and seek out weaknesses of information supplied. SG60, SG80 and SG100 are met		
b	Information adequacy for assessment of impact on minor primary species			
	Guide post			Some quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status.
	Met?			Y
	Justification	Catch composition data on all minor primary species elements is available from detailed observer reports. Primary species are, by definition, managed with stock assessments or similar stock status information in place. The quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status. SG100 is met		
c	Information adequacy for management strategy			

PI 2.1.3		Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species		
	Guide post	Information is adequate to support measures to manage main primary species.	Information is adequate to support a partial strategy to manage main Primary species.	Information is adequate to support a strategy to manage all primary species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Y	Y	Y
	Justification	Stock assessments are done for all Primary species. Observer data and analysis of bycatch (catch composition data), as well as research into survivability of species (Berghahn <i>et al</i> 1998), the statutory use of sieve nets (Wienbeck 1993, Neudecker and Damm 2010, Polet 2003), and research into other types of pre-haul selection (letter box [Steenbergen 2011], sorting grid [Catchpole 2009]), as well as improvement of on-board sorting and sieving of the haul (Aviat <i>et al</i> 2011), together are adequate to support a strategy to manage all primary species elements, and evaluate with a high degree of certainty whether the strategy is achieving its objective (see also Section 3.6.3 in report for details of studies). SG60, SG80 and SG100 are met.		
References		Berghahn <i>et al</i> 1998; Neudecker and Damm 2010; Polet 2003; Steenbergen 2011; Wienbeck 1993		
OVERALL PERFORMANCE INDICATOR SCORE:				100
CONDITION NUMBER (if relevant):				-

PI 2.2.1 - Secondary species outcome

PI 2.2.1		The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.		
Scoring Issue		SG 60	SG 80	SG 100
a	Main secondary species stock status			
	Guide post	<p>Main Secondary species are likely to be within biologically based limits.</p> <p>OR</p> <p>If below biologically based limits, there are measures in place expected to ensure that the UoA does not hinder recovery and rebuilding.</p>	<p>Main secondary species are highly likely to be above biologically based limits</p> <p>OR</p> <p>If below biologically based limits, there is either evidence of recovery or a demonstrably effective partial strategy in place such that the UoA does not hinder recovery and rebuilding.</p> <p>AND</p> <p>Where catches of a main secondary species outside of biological limits are considerable, there is either evidence of recovery or a, demonstrably effective strategy in place between those MSC UoAs that also have considerable catches of the species, to ensure that they collectively do not hinder recovery and rebuilding.</p>	<p>There is a high degree of certainty that main secondary species are within biologically based limits.</p>
	Met?	Y	Y	N
	Justification	<p>There was one Secondary main species as recorded from the Observer catch composition data (see Section 3.6.3). The group thus identified is Gobies – because of the difficulty of identifying these fish to individual species level, all recorded gobies were grouped together and treated as one element ((The observer report recorded 'Gobies/ Gobidae' and 'Sand goby/gobies'). An RBF-PSA was triggered (MSC CR v2.0 PF4.1.4) for this element, consisting of a Productivity Susceptibility Analysis (PSA), as described in detail in Appendix 1.2 of the report. The Appendix provides the scores as derived from using Table PF5 CR 2.0. The MSC worksheet was used to arrive at the scores, which was downloaded from the MSC website for PI 2.2.1</p> <p>Following the PSA, this element – Gobies scored 96.2 (using MSC worksheet). The score was capped at 80.</p> <p>As part of the bycatch reduction strategies on board the vessels, including the quick handling of bycatch and return to sea with plenty of water, it is considered that this strategy does not hinder recovery and rebuilding. SG80 is met.</p> <p>There is no stock assessment of gobies to provide a high degree of certainty that main secondary species are within biologically based limits. SG100 is not met.</p>		

PI 2.2.1	The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.		
b	Minor secondary species stock status		
	Guide post		<p>Minor secondary species are highly likely to be above biologically based limits.</p> <p>OR</p> <p>If below biologically based limits', there is evidence that the UoA does not hinder the recovery and rebuilding of secondary species</p>
	Met?		N
	Justification	<p>The catch composition table in Section 3.6.3 provides a detailed list of the minor Secondary species elements encountered as part of the observer sampling programme. The overall list of minor Secondary species is extensive, there are 20 different species, where each species/ genus is considered an element. Productivity Susceptibility Analyses have not been conducted on the minor Secondary species identified in the Observer catch composition data and the score is therefore capped at SG80 (FCR V2.0 PF5.3.2.2 If the team has opted to use the species grouping option, the final PI score shall not be greater than 80.) There is insufficient information on the populations of all of the Secondary minor elements to determine whether the species are highly likely to be above biologically based limits, therefore, SG 100 is not met for any of the elements.</p> <p>By default, all elements meet the SG80 by virtue of them being a minor species.</p> <p>The assessment team applied a precautionary approach, by using information available from fishbase.com, to check the productivity of those Secondary minor species which were each above 0.1% of the catch as calculated in the catch composition table. The brief overview showed that these five species and/or species groups concerned are fairly resilient and fecund, scoring SG80 by default. All other elements, 16 remaining, which are less than 0.1% of the bycatch score SG80 by default.</p> <p>It is, however, recommended to conduct PSA on all Secondary species encountered in the catch composition data, for future audits as part of the precautionary approach to managing the fishery and its bycatch. This can be done as a one-off exercise for each species, and updated as and when more information becomes available. It would inform the susceptibility of the bycatch concerned. This recommendation is made under the information PI 2.2.3.</p> <p><u>Basses</u> <i>Dicentrarchus</i> spp</p> <p>This group was not identified to species level and constitutes juveniles of bass, whereby larger sized bass would have been separated out via the veil net as well as on board bycatch reduction measures. According to fishbase, <i>Dicentrarchus</i> genus consists of two species native to the Eastern Atlantic: European Seabass and Spotted Seabass, which are difficult to distinguish when juvenile. They are generally found in the littoral zone, juveniles tend to form schools and feed on invertebrates, while the adults are less social and tend to be piscivores. For the Atlantic basses (as compared to Mediterranean) sexual maturity happens between 4-7 years (males) and 5-8 years (females). Fecundity is high (>20,000 eggs). Spawn in batches, spawning takes place in the spring near the British Isles/ northern range. The eggs are pelagic. From the data available it is possible to infer that bass as a genus is resilient and fecund.</p>	

PI 2.2.1		The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.
		<p><u>Pogge or Hooknose</u> <i>Agonus cataphractus</i></p> <p>These small fish (max length 21cm) can live in inshore waters, preferring sandy bottoms. They have been found to a depth of 270m. They feed on polychaetes and bottom crustaceans. They reproduce after one year, laying up to 3000 eggs. The small size, short life span and growth rate, and high fecundity make it a resilient species.</p> <p><u>Bullrout</u> <i>Myxocephalus scorpius</i></p> <p>It is not clear what species this defers to, as a bullrout is different to <i>Myxocephalus scorpius</i> – which is a sculpin. Assuming that sculpin is meant (as bullrout lives in Australian waters). They are demersal, found on rocky bottoms with sand or mud, or among seaweeds, from 0-451m. They feed on fishes, large crustaceans, occasionally polychaetes and amphipods. During the spawning season, the male's underside becomes deep red with white spots, eggs are deposited in a clutch on the bottom and defended by the male. They lay between 4,000 – 20,000 eggs per year.</p> <p><u>Common Dragonet</u> <i>Callionymus lyra</i></p> <p>Occurs on sand and muddy bottoms from sublittoral to 400 m; feeds on small invertebrates, mainly worms and crustaceans. Common length is 15cm. Complex courtship behaviour with 4 phases: courtship, pairing, ascending, releasing eggs and milt, thus the eggs are scattered. There was no information on fishbase as to the number of eggs per year. This is a fairly short lived small sized species, and one can infer that fecundity is fairly high, given the mode of reproduction.</p> <p><u>Smelt</u> <i>Osmerus eperlanus</i></p> <p>Smelt occupy marine, estuarine and freshwater habitats, often found close to shore in the mid-water. They spend the majority of their life in estuaries, spawning on sand or gravel ideally in fast flowing water of rivers, or in lakes. They release between 8,000 and 50,000 eggs, which spend 3-5 weeks on the riverbed before hatching into larvae that reside in estuaries. Smelt predate on shrimps or other crustaceans, with larger individuals targeting fish. Their common length is 16.5cm, reaching sexual maturity at 15-18cm.</p>
References		<p>https://www.fishbase.de/summary/Myxocephalus-scorpius.html</p> <p>https://www.fishbase.de/summary/Callionymus-lyra.html</p> <p>https://www.fishbase.de/Summary/SpeciesSummary.php?ID=63&AT=Bass</p> <p>https://www.fishbase.de/Summary/SpeciesSummary.php?ID=36&AT=hooknose</p>
OVERALL PERFORMANCE INDICATOR SCORE:		
There are 21 elements: 20 score SG80, 1 scores SG95 (PSA to be capped at 80)		80
CONDITION NUMBER (if relevant):		-

PI 2.2.2 - Secondary species management strategy

PI 2.2.2	There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
Scoring Issue	SG 60	SG 80	SG 100
a	Management strategy in place		
Guide post	There are measures in place, if necessary, which are expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a partial strategy in place, if necessary, for the UoA that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a strategy in place for the UoA for managing main and minor secondary species.
Met?	Y	Y	N
Justification	<p>The nature of the fishery is such, that only the target species, Brown Shrimp, is retained. All vessels have to use a sieve net (EU 227/2013) and require the use of onboard riddles (EC 850/98) in order to reduce bycatch. This is also written into the Wash Brown Shrimp Fishery management plan, where the requirement of the sieve net/ veil net applies to all vessels with an aggregate beam length of >8m. This complies with the Shrimp fishing nets Order 2002 (which allows vessels of less than 8m aggregated beam length to not have a sieve net). Of the 70 vessels listed as part of the fishery (client information on vessels and gears May 2018), there are 8 vessels with an aggregate beam length of less than 8m, of which three do not use a veil net. The sieve net is designed to separate out larger fish during the actual fishing process. For example, flatfish such as plaice, starting at sizes of approx. 8 to 12 cm, are sieved out and no longer appear in the by-catch (Wienbeck 1993, Neudecker and Damm 2010). All remaining animals and similar sized objects, which are still caught in the cod end with the target species, are emptied into the hopper of the vessel, and are transferred to rotating or shaker sieves operated with high amounts of running sea water to increase survival rates (Aviat 2011). This on-board process is efficient and quick and described in detail in Section 3.6.3 of this report.</p> <p>This constitutes a partial strategy that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery, as the PSA for Gobiidae confirms.</p> <p>SG60 and 80 is met for main Secondary species elements</p> <p>However, in order to meet SG100, there has to be population/ stock information on all the Secondary species, or a PSA conducted on all Secondary species elements. SG100 is not met.</p> <p>A Recommendation is added to encourage the implementation of sieve/veil nets on all vessels in this fishery under assessment, including those of a aggregated beam length of <8m (EIFCA meeting 30th Jan 2019, http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/02/35th-EIFCA.pdf)</p>		

PI 2.2.2		There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
b	Management strategy evaluation			
	Guide post	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/species).	There is some objective basis for confidence that the measures/partial strategy will work, based on some information directly about the UoA and/or species involved.	Testing supports high confidence that the partial strategy/strategy will work, based on information directly about the UoA and/or species involved.
	Met?	Y	Y	Y
	Justification	Testing has shown that a 70 mm sieve net is effective in reducing the bycatch of larger Secondary species in the Brown shrimp net. Log books, registered landing ports and effectiveness monitoring, control and surveillance give high confidence that the measures designed to minimise the level of retention of non-target species are effective. Vessels of 10m + length have to complete a log, those between 10-12m complete a paper log, and those of 12+m length complete an e-log in conjunction with VMS. Vessels smaller than 10m do not need to complete a log. For those vessels over 10m the information is accurate (MMO <i>pers comm.</i> at site visit, 30.05.2018), as have sales notes as well to corroborate and which gear is being used. However, all vessels have associated sales notices on landing, and spot checks are carried out by MMO. Design of on-board sorting equipment and methodology is tested for effectiveness and improved designs are encouraged (Cefas <i>pers. comm.</i> 31.05.2018). This is discussed in detail in Section 3.6.3 of the report. Survivability improves with sorting speed and appropriate sorting equipment design (e.g. rotating sieves with plenty of flushing) (Berghahn <i>et al</i> 1998). Research has shown that if fish are released below the water line, mortality due to bird predation is much reduced (<i>pers.comm.</i> with client). SG60, SG80 and SG100 are met.		
c	Management strategy implementation			
	Guide post		There is some evidence that the measures/partial strategy is being implemented successfully .	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Y	Y
	Justification	The requirement for all vessels to fish with a 70mm sieve net when targeting shrimp came into force on 1 st January 2003. The Wash Brown Shrimp Fishery management plan states that the requirement of the sieve net/ veil net applies to all vessels with an aggregate beam length of >8m (in accordance with the Shrimp Fishing Nets Order 2002). This has been implemented successfully and is enforced appropriately. Technical measures such as sieve net and rotating sorting drum are used throughout the fishery, which is checked and verified. SG80 is met There is clear evidence, Observer reports and MMO spot-checks, that the partial strategy is being implemented successfully and is achieving its overall objective of		

PI 2.2.2		There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
		reducing bycatch, and thus maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery.. SG100 is met.		
d	Shark finning			
	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	Not applicable – none of the Secondary species are sharks.		
e	Review of alternative measures to minimise mortality of unwanted catch			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main secondary species.	There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main secondary species and they are implemented as appropriate.	There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all secondary species, and they are implemented, as appropriate.
	Met?	Y	Y	N
	Justification	<p>The sieve net was introduced to the brown shrimp fishery in order to reduce bycatch. Alternative measures have been researched, such as the sorting grid and letter box, as discussed in Section 3.6.3 the report. The letterbox also reduced bycatch of plaice and other flatfish species.</p> <p>The measures that have been adopted in the Wash Brown Shrimp Management Plan are the result of a comprehensive literature search, best practice and practicalities, and intensive discussions weighing up alternatives. For example, minutes of a meeting of the Shrimp Fishery Advisory Working Group (SFAWG) on 9th May 2012 indicate that bycatch reduction measures were discussed and reviewed in detail. As part of the Eastern IFCA shrimp industry workshop (July 2015), bycatch reduction and minimisation of unwanted catches was reviewed. The Eastern IFCA Shrimp industry workshop discussed access limitation as part of management and spatial closure (although this was in relation to habitat management rather than bycatch reduction). The Wash Brown Shrimp Management Plan, which was adopted on 10th Jan, 2017 and came into force on 2nd May 2017 requires that there has to be ‘.... timely implementation of management measures, which are routinely monitored and reviewed’. SG60 and SG80 are met.</p> <p>There does not appear to be a biennial review, SG100 is not met.</p> <p>Recommendation: 2.2.2e – Produce evidence of routine monitoring and review of management measures.</p>		
References		Aviat <i>et al</i> 2011; Berghahn & Purps (1998); Neudecker & Damm (2010); Wienbeck (1993)		

PI 2.2.2	There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.	
	<p>EU DG for Internal Policies, Policy Department B Structural and Cohesion Policies: Fisheries: North Sea Brown Shrimp Fisheries. http://www.europarl.europa.eu/RegData/etudes/etudes/join/2011/460041/IPOL-PECH_ET(2011)460041_EN.pdf</p> <p>COUNCIL REGULATION (EC) No 850/98 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms</p> <p>EU Regulation 227/2013 amending Council Regulation (EC) No 850/98 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms</p> <p>Eastern IFCA shrimp industry workshop report, 10th July 2015; http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/04/View-the-report-from-the-shrimp-industry-workshop-on-10-July-2015.pdf</p> <p>Eastern IFCA shrimp industry workshop, 29th Sept 2016. http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/09/Shrimp-Workshop-Report.pdf</p> <p>SFWAG 2012 minutes of meeting on 9th May 2012. www.eastern-ifca.gov.uk/.../Shrimp-Fishery-Advisory-Working-Group-9-May-2012</p>	
OVERALL PERFORMANCE INDICATOR SCORE:		90
CONDITION NUMBER (if relevant):		-
Recommendation: 2.2.2a – Introduction of veil nets/ sieve nets on all vessels participating in this fishery, including those which have an aggregate beam length of less than 8m		
Recommendation: 2.2.2e – Produce evidence of routine monitoring and review of management measures		

PI 2.2.3 - Secondary species information

PI 2.2.3		Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species.		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impacts on main secondary species			
	Guide post	Qualitative information is adequate to estimate the impact of the UoA on the main secondary species with respect to status. OR If RBF is used to score PI 2.2.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for main secondary species.	Some quantitative information is available and adequate to assess the impact of the UoA on main secondary species with respect to status. OR If RBF is used to score PI 2.2.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for main secondary species.	Quantitative information is available and adequate to assess with a high degree of certainty the impact of the UoA on main secondary species with respect to status.
	Met?	Y	Y	N
	Justification	There was one main Secondary species in the Observer derived bycatch composition, Gobies (see catch composition table in Section 3.6.3 of the main report). There is quantitative information which is adequate to assess productivity and susceptibility attributes for this element. The amount of bycatch of Gobies is known, both in terms of weight and percentage. SG 60 and SG80 are met It is not possible to assess with a high degree of certainty the impact of the UoA on this element, gobies, with respect to status, as there is no stock assessment of gobies. SG100 is not met		
b	Information adequacy for assessment of impacts on minor secondary species			
	Guide post			Some quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status.
	Met?			N
	Justification	Catch composition data on minor secondary species is available from detailed observer reports. Secondary species are, by definition, not managed, there are no stock assessments or similar, therefore the impact of the UoA on minor secondary species with respect to status cannot be given. SG100 is not met. Recommendation: The number of different species in the bycatch is large and a reflection of the gear type and location. It is recommended that a Productivity Susceptibility Analysis (PSA)		

PI 2.2.3		Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species.		
		is conducted on all those species for which no reference points are available. PSA is a semi-quantitative and rapid risk assessment tool that relies on the life history characteristics of a stock (i.e., productivity) and its susceptibility to the fishery in question. This would constitute a risk analysis for each species, calculating an individual score for each species (see also Patrick <i>et al</i> 2009). In the case of this fishery, where so many species are involved, the client should provide such a list of PSA scores for each bycatch species, as part of the regular bycatch analysis.		
c	Information adequacy for management strategy			
	Guide post	Information is adequate to support measures to manage main secondary species.	Information is adequate to support a partial strategy to manage main secondary species.	Information is adequate to support a strategy to manage all secondary species, and evaluate with a high degree of certainty whether the strategy is achieving its objective .
	Met?	Y	Y	N
	Justifi cation	Observer data and analysis of bycatch (catch composition data), as well as research into survivability of species (Berghahn <i>et al</i> 1998), the statutory use of sieve nets (Wienbeck 1993, Neudecker and Damm 2010, Polet 2003), and research into other types of pre-haul selection (letter box [Steenbergen 2011], sorting grid (Catchpole 2009)), as well as improvement of on-board sorting and sieving of the haul (Aviat <i>et al</i> 2011), together are adequate to support a strategy to manage all primary species, and evaluate with a high degree of certainty whether the strategy is achieving its objective (see also Section 3.6.3 in report for details of studies). The information is adequate to support a partial strategy for all main Secondary species elements, which is this case is Gobiidae. SG60 and SG80 are met. PSA would need to be conducted on all Secondary species in order to provide the degree of certainty for SG100 score.		
References		Steenbergen et al 2015; Berghahn et al 1998; Revill 2012; Wienbeck 1993; Neudecker and Damm 2010; Polet 2003; Aviat et al 2011; Steenbergen 2011; Catchpole 2009; Patrick <i>et al</i> 2009.		
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				-
Recommendation: Conduct PSA on all Secondary species in the bycatch to improve information.				3

PI 2.3.1 - ETP species outcome

PI 2.3.1		The UoA meets national and international requirements for the protection of ETP species		
		The UoA does not hinder recovery of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	Effects of the UoA on population/stock within national or international limits, where applicable			
	Guide post	Where national and/or international requirements set limits for ETP species, the effects of the UoA on the population/stock are known and likely to be within these limits.	Where national and/or international requirements set limits for ETP species, the combined effects of the MSC UoAs on the population/stock are known and highly likely to be within these limits.	Where national and/or international requirements set limits for ETP species, there is a high degree of certainty that the combined effects of the MSC UoAs are within these limits.
	Met?	Not relevant	Not relevant	Not relevant
	Justification	No national or international requirements that set limits for relevant ETP species, as identified in Section 3.6.4 of this report, could be identified.		
b	Direct effects			
	Guide post	Known direct effects of the UoA are likely to not hinder recovery of ETP species.	Known direct effects of the UoA are highly likely to not hinder recovery of ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the UoA on ETP species.
	Met?	Y	Y	N
	Justification	<p>The ETPs that may possibly interact with the brown shrimp fishery, have been described in Section 3.6.4 of the main report. Considering that the shrimp fishery predominantly operates in shallower inshore waters, it is unlikely that it encounters some of the larger ETP species highlighted in Section 3.6.4, and thus these are not listed here as elements. No known direct effects of the fishery on these elements have been found recorded in the literature. The direct effect of fishing on ETP species would be from direct capture and subsequent post capture mortality. Based on Observer reports for 2015-17, no direct effect of the fishery on ETP species has been recorded.</p> <p>Any potential larger, adult sized fish species of ETPs would be sorted via the sieve net, and thus escape and are not caught. Smaller sized specimen would end up in the cod-end and hauled on board where the haul is sieved using specially designed equipment to increase the survivability of the bycatch (as described in Section 3.6.3).</p> <p>Any ETP species, as part of the bycatch, would be released back into the water. . Thus, known direct effects of the fishery on ETPs are highly likely to not hinder recovery of ETP species. SG60 and SG80 are met.</p> <p>However, the time series of sampling of bycatch by observers is relatively short, and thus a high degree of confidence is not possible. SG100 is not met.</p> <p>No records or observations could be found which would indicate that the UoA has a direct effect on the population/stock of cetaceans, seals and seabirds as described</p>		

PI 2.3.1		The UoA meets national and international requirements for the protection of ETP species	
		The UoA does not hinder recovery of ETP species	
		in Section 3.6.4 of the main report. Although one juvenile skate (<i>Raja clavata</i>) was found in the bycatch, it is not an ETP.	
c	Indirect effects		
	Guide post	Indirect effects have been considered and are thought to be highly likely to not create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the UoA on ETP species.
	Met?	Y	N
	Justification	Indirect effects, other than direct capture, could be caused by competition for food resources, environmental degradation, ghost fishing or impacts from pollution or litter. These have been considered by the assessment team, by conducting a search of available literature. No relevant studies relating to this fishery in the area have been found and therefore indirect effects are thought to be unlikely to create unacceptable impacts. Potential indirect effects on bird species could include such effects as discarded bycatch being an additional food source, although studies to quantify this are difficult to execute, considering that other factors also impact on seabird populations. Garthe <i>et al</i> (2015) and Schwemmer <i>et al</i> (2011) looked at a possible displacement reaction of seabirds to ship traffic SG80 is met. <u>It cannot be said that</u> there is a high degree of confidence that there are no significant detrimental indirect effects of the UoA on ETP species, as the observer data set to indicate possible ETP bycatch is relatively short. SG100 is not met. <u>Recommendation:</u> The client is encouraged to implement greater spatial awareness of fishing vessels regarding areal closures, including voluntary closures and temporary closures due to the seasonal presence of protected bird species.	
References		http://jncc.defra.gov.uk/page-5164 http://jncc.defra.gov.uk/speciespages/2477.pdf https://www.fishbase.de/Summary/SpeciesSummary.php?ID=1334&AT=smelt Garthe <i>et al</i> (2015); Schwemmer <i>et al</i> (2011)	
OVERALL PERFORMANCE INDICATOR SCORE:			80
CONDITION NUMBER (if relevant):			-
Recommendation: Considering that the fishery is operating within The Great Wash SPA, The Wash SPA and in the vicinity of shallower water SPAs such as Gibraltar Point SPA and North Norfolk Coast SPA ,a recommendation has been raised. The client is encouraged to implement greater spatial awareness of fishing vessels regarding areal closures, including voluntary closures and temporary closures due to the seasonal presence of protected seabird species			4

PI 2.3.2 - ETP species management strategy

PI 2.3.2	<p>The UoA has in place precautionary management strategies designed to:</p> <ul style="list-style-type: none"> • meet national and international requirements; • ensure the UoA does not hinder recovery of ETP species. <p>Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.</p>		
Scoring Issue	SG 60	SG 80	SG 100
a	Management strategy in place (national and international requirements)		
Guide post	There are measures in place that minimise the UoA-related mortality of ETP species, 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 UoA's impact on ETP species, including measures to minimise mortality, which 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 UoA's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species.
Met?	Not relevant	Not relevant	Not relevant
Justification	No national or international requirements that set limits for relevant ETP species, as identified in Section 3.6.4 of this report, could be identified.		
b	Management strategy in place (alternative)		
Guide post	There are measures in place that are expected to ensure the UoA does not hinder the recovery of ETP species.	There is a strategy in place that is expected to ensure the UoA does not hinder the recovery of ETP species.	There is a comprehensive strategy in place for managing ETP species, to ensure the UoA does not hinder the recovery of ETP species
Met?	Y	N	N
Justification	<p>There are several measures to the strategy for minimizing the effect of the fishery on ETP species, these include research into the population levels of ETP species, research into the effect of fisheries on these species, regulatory measures to minimise effects, and fleet specific initiatives.</p> <p>At an overarching level, the EU has a high-level strategy for the protection of endangered species. For example, the EU Birds Directive 2009/147/EC as transposed into UK law by the Conservation of Habitats and Species Regulation 2017 within 12 nautical miles, and the Conservation of Offshore Marine Habitats and Species Regulations 2017 between 12 nautical miles out to 200nm or the UK Continental Shelf require member states to protect certain areas to ensure the favourable status of endangered species. This is being achieved for example by the designation of The Greater Wash SPA, where the overarching conservation</p>		

PI 2.3.2		<p>The UoA has in place precautionary management strategies designed to:</p> <ul style="list-style-type: none">• meet national and international requirements;• ensure the UoA does not hinder recovery of ETP species. <p>Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.</p>		
		<p>objectives for the protected features (certain seabirds) of this site is to ensure they either remain in, or reach favourable condition. The ability of a designated feature to remain in, or reach favourable condition can be affected by its sensitivity to pressures associated with activities taking place within or in close proximity to a protected site.</p> <p>The EU also requires member states to carry out observer work to quantify the impact of fisheries on ETP species. For example, under EU Regulation 812/2004 (laying down measures concerning incidental catches of cetaceans in fisheries) member states are required to report annually with estimates of the overall incidental catches of cetaceans in each of the fisheries concerned. The fact that trawl fisheries (including shrimp fisheries such as the one under assessment) are not specified as requiring a certain level of coverage reflects the fact that the perceived level of risk of incidental capture in these fisheries is considered low.</p> <p>Collection of discard data is enforced through the Data Collection Framework (DCF) of the European Commission (EC). To comply with this ruling, shrimp trawlers have been monitored by on board observer programmes. The annual EU fishing opportunities legislation includes a list of prohibited species, such as skates and rays, which must be promptly released without harm if accidentally caught. For MSC scoring purposes, these are therefore also included in the ETP list.</p> <p>On-board operational practices are further measures to avoid ETP- bycatch, such as the sieve net and rapid on-board processing with plenty of water to improve survivability.</p> <p>SG60 is met</p> <p>The Brown Shrimp management plan does not contain a list of ETP species likely to be encountered by the fishery, nor is there any on-board identification manual for the fishers to refer to (at the time of the site visit, May 2018), despite this being explicitly mentioned in the management plan. There are no measures in place to record ETP species encounters specifically. If these measures were in place a strategy to manage ETP species could be said to be in place. SG80 is not met.</p> <p>In order for a strategy to be comprehensive, quantitative time series data needs to be available which would show this. SG100 is not met.</p>		
c	Management strategy evaluation			
	Guide post	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 measures/strategy will work, based on information directly about the fishery and/or the species involved.	The strategy/ comprehensive 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.
	Met?	Y	Y	N
	Justification	Research has shown that a 70mm sieve net is effective in reducing the bycatch, including ETP species, in the shrimp net. Log books, registered landing ports and effective monitoring, control and surveillance give high confidence that the measures		

PI 2.3.2		The UoA has in place precautionary management strategies designed to: <ul style="list-style-type: none">• meet national and international requirements;• ensure the UoA does not hinder recovery of ETP species. <p>Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.</p>	
		<p>designed to minimise the level of retention on non-target species are effective. Survival experiments on discards in the shrimp fishery indicate that discard survival is variable, and a brief overview was given by Steenbergen <i>et al</i> (2015) and Revill, (2012). This is discussed in detail in section 3.6.3 of the report. Survivability also depends on the speed by which the catch is sorted on board, research has shown that if fish are released below the water line, mortality due to bird predation is much reduced (pers.com with fishers and management).</p> <p>SG80 is met</p> <p>Although observer reports are available, quantitative analysis of bycatch, including ETPs, covers too few hauls to provide high confidence, a longer time series would be needed to give that confidence. SG100 is not met.</p>	
d	Management strategy implementation		
	Guide post	There is some evidence that the measures/strategy is being implemented successfully.	There is clear evidence that the strategy/ comprehensive strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a) or (b).
	Met?	Y	N
	Justification	<p>Technical measures such as the 70mm sieve net and riddles (either rotary or shaker) are used throughout the fishery in order to reduce bycatch when targeting Brown shrimp. This is a regulatory requirement as well as stipulated in the Wash Brown Shrimp management plan. This plan explicitly requires the use of the sieve net at all times on all vessels with a combined beam length of >8m within the UoC. This is a key measure to minimise capture (and retention) of market size fish species, as well as by-catch, and as a consequence adult sized ETP fish species. The statutory requirements for bycatch reduction have been implemented successfully and are enforced appropriately via regular on-board inspections (MMO <i>pers comm.</i> 30.05.2018, at site visit). Collection of discard data is enforced through the Data Collection Framework (DCF) of the European Commission (EC). To comply with this ruling, shrimp trawlers have been monitored by on board observer programmes conducted by Cefas. Data is available to show this (Observer report for 2015-17 Cefas <i>pers.comm.</i> 31.05.2018). Furthermore, non-compliance issues have not been raised (MMO 30.05.2018, site visit)</p> <p>There is no clear evidence that the series of measures are designed into a strategy to address ETP species bycatch, as there is no clear list of possible ETP species in the management plan, nor is there any on board identification and recording of ETP species. SG100 is not met.</p>	
e	Review of alternative measures to minimize mortality of ETP species		
	Guide post	There is a review of the potential effectiveness and practicality of	There is a regular review of the potential effectiveness and

PI 2.3.2		<p>The UoA has in place precautionary management strategies designed to:</p> <ul style="list-style-type: none">• meet national and international requirements;• ensure the UoA does not hinder recovery of ETP species. <p>Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.</p>		
		alternative measures to minimise UoA-related mortality of ETP species.	practicality of alternative measures to minimise UoA-related mortality of ETP species and they are implemented as appropriate.	practicality of alternative measures to minimise UoA-related mortality ETP species, and they are implemented, as appropriate.
	Met?	Y	Y	N
	Justification	<p>The UoA has no recorded impact on and/or interaction with ETPs such as cetaceans, seals and turtles. There has been no recorded direct impact on ETP seabirds. As part of the Greater Wash SPA management closed areas are extended through byelaws in order to help protect the seabirds which are a primary feature of the SPA, and as part of that designation a review of measures has taken place (SG60 met). The sieve net was introduced to the brown shrimp fishery in order to reduce bycatch, including ETP fish species. Alternative measures have been researched, such as the sorting grid and letter box, as discussed in Section 3.6.3 of the report. The effectiveness of on-board measures to quickly sort bycatch with a chance of maximum survivability have been researched and implemented (see Section 3.6.3), Fish ETPs in the bycatch also benefit from these measures. The Wash Brown Shrimp Management Plan, which was adopted on 10th Jan, 2017 and came into force on 2nd May 2017 requires that there has to be ‘.... timely implementation of management measures, which are routinely monitored and reviewed’.</p> <p>SG80 is met</p> <p>No mention of a biennial review process could be found. SG100 is not met</p>		
References		<p>Steenbergen <i>et al</i> (2015); Revill, (2012); Berghahn & Vorberg, 1998;</p> <p>Council Directive 92/43/EEC – Habitats; Birds - Council Directive 79/409/EEC; EU Regulation 812/2004 (laying down measures concerning incidental catches of cetaceans in fisheries); Commission Regulation (EC) 665/2008 establishing the Data Collection Framework; Wash Brown Shrimp management Plan 2.May 2017;</p> <p>For the Wash Shrimp management plan see http://www.washshrimp.co.uk/downloads</p>		
OVERALL PERFORMANCE INDICATOR SCORE:				75
CONDITION NUMBER (if relevant):				3

PI 2.3.3 - ETP species information

PI 2.3.3		Relevant information is collected to support the management of UoA impacts on ETP species, including: <ul style="list-style-type: none">• 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.		
Scoring Issue		SG 60	SG 80	SG 100
a	Information adequacy for assessment of impacts			
	Guide post	Qualitative information is adequate to estimate the UoA related mortality on ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Qualitative information is adequate to estimate productivity and susceptibility attributes for ETP species.	Some quantitative information is adequate to assess the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for ETP species.	Quantitative information is available to assess with a high degree of certainty the magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status of ETP species.
	Met?	Y	Y	N
	Justification	Observer reports covering 13 hauls and on-board observations between 2015-2017 provide some quantitative information which is adequate to assess the UoA's related mortality and impact, and to determine whether the UoA may be a threat to protection and recovery of the ETP species. The information available from these reports indicated that no ETP species were by-caught. SG80 is met Quantitative information was not available to assess with a high degree of certainty the magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status of ETP species. SG100 is not met.		
b	Information adequacy for management strategy			
	Guide post	Information is adequate to support measures to manage the impacts on ETP species.	Information is adequate to measure trends and support a strategy to manage impacts on 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

PI 2.3.3		Relevant information is collected to support the management of UoA impacts on ETP species, including: <ul style="list-style-type: none"> • 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. 		
				whether a strategy is achieving its objectives.
	Met?	Y	N	N
	Justification	The fishery's interaction with ETPs is limited. Although the information provided in the Observer reports is detailed enough, it is amalgamated, and thus it is not possible to see any trends. There is also no on-board recording of ETP species interactions. SG80 is not met.		
References		As in 2.3.1 /2		
OVERALL PERFORMANCE INDICATOR SCORE:				70
CONDITION NUMBER (if relevant):				4

PI 2.4.1 – Habitats outcome

PI 2.4.1		The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.		
Scoring Issue		SG 60	SG 80	SG 100
a	Commonly encountered habitat status			
	Guide post	The UoA is unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	The UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	There is evidence that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.
	Met?	Y	Y	Y
	Justification	<p><i>Crangon crangon</i> is found on sandy and muddy ground, showing a preference for grain sizes between 125 and 710µm (Pinn & Ansell 1993). Thus the fishery for brown shrimp occurs in predominantly sandy/muddy areas.</p> <p>The impact of shrimp trawl fishing gears at the level of the individual gear components and the pressures they cause on the underlying substrate has been considered in several studies (summarised in ABPmer & Ichthys Marine, 2015). Compared to other demersal trawl gears, such as for flatfish, the Brown shrimp fishery has a smaller footprint. The footprint of a gear is defined as the relative contribution from individual larger gear components, such as shoes (in this case), sweeps, and groundgear, to the total area and severity of the gear's impact (Eigaard <i>et al</i> 2015 (see also Section 3.6.2 of main report for more details). As such, the pressures caused by individual gear components (e.g. depth of penetration into the seabed sediments by the shoes, bobbins, and surface abrasion by the ground gear of a trawl) are considered in relation to the area of impact of those individual gear components (Eigaard <i>et al</i>, 2015). For Brown shrimp trawl gear the footprint can be separated into two types of paths: (i) from the shoes of the beam, and (ii) from the groundgear), including bobbins.</p> <p>Brown shrimp trawl beam shoes have been shown to generate shallow furrows (of up to 2cm) in relatively soft sediment the fishery operates in, and furrows appear to be re-absorbed as part of the background movement of sediments in shallower water, caused by tides and currents (ABPmer & Ichthys Marine, 2015).</p> <p>The beam trawl groundgear used for fishing crustaceans (<i>Crangon crangon</i>) was found to have less subsurface impact (50%) owing among other to the fact that they do not deploy tickler chains (Verschueren <i>et al</i> 2012) but bobbins, as compared to fishing for flatfish. The study by ABPmer & Ichthys Marine (2015) looked at recovery rates of different types of sediments and thus habitat types encountered in the Brown shrimp fishery, and found that the commonly encountered habitat types are unlikely to be reduced in structure and function to a point where there would be serious an irreversible harm. SG100 is met.</p>		
b	VME habitat status			
	Guide post	The UoA is unlikely to reduce structure and function of the VME habitats to a point where there would be	The UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would	There is evidence that the UoA is highly unlikely to reduce structure and function of the VME habitats to a

PI 2.4.1		The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.		
		serious or irreversible harm.	be serious or irreversible harm.	point where there would be serious or irreversible harm.
	Met?	Y	Y	N
	Justification	<p>Section 3.6.2 of the report defines VMEs in the context of this fishery and describes in detail the possible VMEs found in the Wash Fishery Area. To inform the issue as to whether the UoA impacts on VME habitats and to what extent, the assessment team have referred to a range of sources, such as habitat maps, published gear impact studies, known locations of vulnerable species, and spatial information on the shrimp fishing vessels. Each VME type is considered an element in the context of the evaluation of this PI.</p> <p><u>Sabellaria spinulosa</u> reefs: these are part of the designated features in the Wash and North Norfolk Coast SAC, the Inner Dowsing Race Bank North Ridge (IDRBNR) SAC, and the Haisborough Hammond and Winterton SAC, and The Greater Wash SPA, areas which are located in the brown shrimp fishing area. As part of the protected area designations, they have been mapped in great detail (see Section 3.6.2 in main report for maps). Closed areas have been implemented, and are currently being extended through further byelaws, to protect these <i>Sabellaria</i> reefs from impacts such as shrimp fishing. Research showed that gear contact with a <i>Sabellaria</i> reef has no long-term detrimental effect, the reef area affected by the shoes regrows within a few days, provided the worms themselves have not been killed (Vorberg 2000). Fishers actively avoid <i>Sabellaria</i> reefs for fear of gear /rope entanglement. Thus, former reports of shrimp fishers destroying such reefs need to be treated with caution (Vorberg 1995), as the vessels do not have the horse power capacity to deal with entanglement, and their gears are lighter than other bottom trawl gear (see Section 3.6.2 in main report). Distribution of shrimp fisheries maps are available, although predominantly for the larger vessels. SG80 is met.</p> <p>Such distribution maps are not yet available for the smaller vessels. These will become available in the future with the introduction of Inshore VMS as part of the management of closed areas. SG100 is not met.</p> <p><u>Mussel beds</u> (<i>Mytilus edulis</i>): The distribution of mussel beds has been mapped as part of the WNNC SAC (see Section 3.6.2 in main report for map). Shrimp fishing does not occur over intertidal nor subtidal mussel beds; subtidal mussel beds are not common, as mussels need a hard and stable substrate to grow on, not prone to sedimentation. As the vessels do not fish over mussel beds, the fishery does not reduce the structure and function to the point where there would be serious or irreversible harm. SG100 is met.</p> <p><u>Non-biogenic habitats</u> as per Habitat Directive (see Section 3.6.2 in main report) have been identified and mapped as part of the WNNC SAC, Inner Dowsing, Race Bank and North Ridge SAC, and Inner Dowsing, Race Bank and North Ridge SAC and parts of which are currently being protected from demersal fishing gears through closed area byelaws, which will be extended under new closed area byelaws currently going through the official signing-off channels. The UoA is highly unlikely to reduce structure and function of the non-biogenic habitats to a point where there would be serious or irreversible harm. SG 80 is met. There is evidence in the form of detailed study (ABPmer & Ichthys Marine 2015) that the UoA is highly unlikely to reduce structure and function of these non-biogenic habitats to a point where there would be serious or irreversible harm. SG100 is met.</p>		
c	Minor habitat status			

PI 2.4.1		The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.		
	Guide post			There is evidence that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm.
	Met?			Y
	Justification	Minor habitats are all those habitats which are neither commonly encountered nor a VME. These habitats have been studied as part of a Risk Based Fisheries Assessment for MPAs study in the Wash and North Norfolk Coast SAC, looking at shrimp trawling in particular (ABPmer & Ichthys Marine, 2015) (see also Section 3.6.2 of this report). This study also looked at recovery rates of different types of sediments and thus habitat types encountered in the Brown shrimp fishery. It was shown, using VMS and boat sightings maps, that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm. Although this study was based on the WNNC SAC area only, it is reasonable to assume that the findings apply to areas outside the SAC where the shrimp fishery operates, as fishing occurs in particular shrimp-friendly habitats only. SG100 is met.		
References		ABPmer & Ichthys Marine, 2015; Eigaard <i>et al</i> , 2015; Pinn & Ansell 1993; Verschueren <i>et al</i> 2012		
OVERALL PERFORMANCE INDICATOR SCORE:				90
CONDITION NUMBER (if relevant):				-

PI 2.4.2 – Habitats management strategy

PI 2.4.2		There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	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 all MSC UoAs/non-MSC fisheries on habitats.
	Met?	Y	Y	N
	Justification	<p>There are measures in place (SG60 is met), amounting to a partial strategy, which include:</p> <p>Fishing behaviour: brown shrimp fishing occurs over sandy/ muddy habitats – the commonly encountered geomorphology, as this is where the shrimp are. It does not occur in shallow intertidal areas where seagrass beds may be found, or over <i>Sabellaria</i> beds, as the lighter fishing gear would snag and could possibly be damaged.⁷⁹</p> <p>Under current byelaws, some areas are closed to shrimp fishers in order to protect certain types of habitats, such as <i>Sabellaria</i> reefs. The extent of habitats has recently been reviewed resulting in an extension of and creation of more closed areas, relevant byelaws are currently going through the process of becoming law.</p> <p>Furthermore, research has shown that the UoA does not cause serious or irreversible harm to existing non-biogenic habitats and <i>Sabellaria</i> reefs (AB ABPmer & Ichthys Marine, 2015). Thus, as the only VMEs under consideration here are <i>Sabellaria</i> reefs and seagrass beds, the UoA does not cause serious or irreversible harm (ABPmer & Ichthys Marine, 2015).</p> <p>Gear configuration: the fishing gear is light with shoes on either end of the beam, and rubber rollers to hold the net down. There is no tickler chain.</p> <p>Location and protected areas: all shrimpers >10m have to complete an on-board log, which is in paper format for those between 10-12m length, and for vessels >12m it is in e-log format. Therefore, for the larger vessels, location is known. In order to obtain information on the location of the smaller vessels, a vessel sightings database is being maintained by EIFCA (Quinn, 2018). The records for the >10m vessels include information on gear configuration as well as catch. This information is not available from the smaller vessels.</p> <p>These measures amount to a partial strategy that is expected to achieve the Habitat Outcome 80 level of performance or above. SG80 is met.</p> <p>SG100 is not met as it has not been possible to obtain and verify observer and compliance data (VMS) on non-MSC fisheries. In addition, the smaller vessels have not yet been fitted with I-VMS (at time of writing this report, Sept 2018), although their movements are partially monitored by sightings- surveys. Furthermore, a strategy requires monitoring of the fishing activity and feedback mechanisms.</p>		
b	Management strategy evaluation			

⁷⁹ In this fishery detailed habitat maps are available, along with closed areas. Vessel movements are monitored. Following the interpretation and decision tree (<https://mscportal.force.com/interpret/s/article/Move-on-rules-at-SG60-for-PI2-4-2a-1527586956234>) applying move on rules does not support SG80 at 2.4.1a so no move on rules are necessary.

PI 2.4.2		There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.		
	Guide post	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/habitats).	There is some objective basis for confidence that the measures/partial strategy will work, based on information directly about the UoA and/or habitats involved.	Testing supports high confidence that the partial strategy/strategy will work, based on information directly about the UoA and/or habitats involved.
	Met?	Y	N	N
	Justification	<p>VMS data for vessels over 12m length show where the fishing vessels are in relation to protected areas (see Figures 3.6-15 to -17 in Section 3.6.2). The fishing gears and vessels are checked regularly by independent inspectors to assess compliance with the rules and regulations governing gear and equipment. These checks are further described in detail under Principle 3 of the report.</p> <p>It is highly unlikely that the vessels would fish over reefs, as it will damage the gear – the gear is relatively light and designed to fish over sandy/muddy bottom. There are areas closed to shrimp fishing in the Wash area (WNNC SAC) and adjoining protected areas (see Section 3.6.2 for maps). This network of marine protected areas has relevant management systems in place which are carried out via government and /or government appointed agencies. The co-ordinates of the closed areas are known to the vessels and can be checked and verified via VMS configuration.</p> <p>SG60 is met.</p> <p>However, current representation of the inshore fleet, which supports a high number of smaller vessels, in fishing intensity data is poor. The lack of VMS data for The Wash fleet, which is primarily composed of boats <12 m, at present means there are significant gaps in data describing the spatial distribution and intensity of fisheries in the area (Quinn 2018). The representation of the inshore fleet in fishing intensity data is due to change in 2018 upon the arrival of inshore VMS to UK waters, which will be required on all fishing vessels. The I-VMS is designed to be a low-cost reporting system for the management of MPA and inshore fisheries (Williamson 2015), and the requirement for I-VMS is through MMO or IFCA byelaws, not through EU legislation. As the system has not yet been implemented on the smaller vessels, and it is important for location verification with respect to habitats,</p> <p>SG80 is not met.</p>		
	c	Management strategy implementation		
	Guide post		There is some quantitative evidence that the measures/partial strategy is being implemented successfully.	There is clear quantitative evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective, as outlined in scoring issue (a).
	Met?		Y	N
	Justification	<p>Regular independent verification of the fishing gear and vessels is conducted on all vessels and reports are available.</p> <p>VMS plots as well as paper logs are available for the larger shrimp vessels (>10m) and are checked (MMO <i>pers. comm.</i> 30.05.2018; Cefas <i>pers comm.</i> 31.05.2018;</p>		

PI 2.4.2		There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.		
		EIFCA pers. com 30.05.2018). There is therefore some quantitative evidence that the partial strategy is being implemented successfully. SG80 is met In order to meet SG100, all vessels which are part of the fishery need to be trackable in relation to habitats and closed areas.		
d	Compliance with management requirements and other MSC UoAs'/non-MSC fisheries' measures to protect VMEs			
	Guide post	There is qualitative evidence that the UoA complies with its management requirements to protect VMEs.	There is some quantitative evidence that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.	There is clear quantitative evidence that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.
	Met?	Y	Y	N
	Justification	<p>Section 3.6.2 of the report defines VMEs in the context of this fishery and describes in detail the possible VMEs and their location found in the Wash and adjoining areas. The UoA is defined as those vessels fishing for brown shrimp primarily inshore, in the Wash and along the coast thereof (see map in Section 3.6.2 by ESFJC 2010 showing the distribution of brown shrimp vessels). The vessels applying for MSC certification include most of the shrimpers operating in the area, in particular the larger vessels, which depend on shrimp catches.</p> <p>The shrimp fishery is governed by standard EU fisheries rules outlined above (i.e. net size, sieve net, riddlers, log-books, VMS etc.), and this applies to all shrimp vessels. The vessels also have to comply with marine protected area legislation and rules, such as not fishing in closed areas (as enshrined in local byelaws). Furthermore, they are not allowed to fish near mussel beds, nor would it be in their interest, as it damages the gear.</p> <p>Observer programmes and inspection programmes, as stipulated by EU fisheries regulations, are used to check the location and behaviour of the shrimp fishery, and applies to all shrimpers, MSC shrimp fisheries and non-MSC fisheries).</p> <p>There are no other MSC certified fisheries in the area; there are two other main fisheries operating in the Wash, both operating on a seasonal basis: Cockles from late spring till late autumn; adult mussels in the first quarter of the year and mussel 'seed' when available and in spring.</p> <p>Considering that all shrimp fishers fishing in the Wash and adjoining areas have to comply with EU fisheries rules as well as national and regional protected area management rules, this is sufficient evidence to meet SG80.</p>		
References		ABPmer & Ichthys Marine, 2015; Quinn 2018; ESFJC 2010		
OVERALL PERFORMANCE INDICATOR SCORE:				75
CONDITION NUMBER (if relevant):				5

PI 2.4.3 – Habitats information

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.		
Scoring Issue		SG 60	SG 80	SG 100
a	Information quality			
	Guide post	The types and distribution of the main habitats are broadly understood . OR If CSA is used to score PI 2.4.1 for the UoA: Qualitative information is adequate to estimate the types and distribution of the main habitats.	The nature, distribution and vulnerability of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA. OR If CSA is used to score PI 2.4.1 for the UoA: Some quantitative information is available and is adequate to estimate the types and distribution of the main habitats.	The distribution of all habitats is known over their range, with particular attention to the occurrence of vulnerable habitats.
	Met?	Y	Y	Y
	Justification	EMODnet provides a broad categorization of the relevant seafloor areas, showing predominantly sandy/ muddy sediments of varying composition and configuration depending on the distance from the shore (see Section 3.6.2 for map). Extensive habitat mapping has been conducted as part of the Habitat Assessment Regulations (HAR), and as a result updated maps on sediment types distribution and <i>Sabellaria</i> reefs, mussel beds and non-biogenic reefs (ABPmer & Ichthys Marine, 2015) are now available for the marine protected areas (Wash and North Norfolk Coast SAC, the Inner Dowsing Race Bank North Ridge (IDRBNR) SAC, and the Haisborough Hammond and Winterton SAC, and The Greater Wash SPA), with extensive detail in particular for The Wash area, where the shrimp fishery predominantly takes place (see distribution maps of vessels Section 3.6.2). SG100 is met.		
b	Information adequacy for assessment of impacts			
	Guide post	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. OR If CSA is used to score PI 2.4.1 for the UoA:	Information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear. OR	The physical impacts of the gear on all habitats have been quantified fully.

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.		
		Qualitative information is adequate to estimate the consequence and spatial attributes of the main habitats.	If CSA is used to score PI 2.4.1 for the UoA: Some quantitative information is available and is adequate to estimate the consequence and spatial attributes of the main habitats.	
	Met?	Y	Y	Y
	Justification	<p>The impact of shrimp trawl fishing gears at the level of the individual gear components and the pressures they cause on the underlying substrate has been considered in several studies (summarised in ABPmer & Ichthys Marine, 2015) – SG60 is met. Compared to other demersal trawl gears, such as for flatfish, the Brown shrimp fishery has a smaller footprint. The footprint of a gear is defined as the relative contribution from individual larger gear components, such as shoes (in this case), sweeps, and groundgear, to the total area and severity of the gear's impact (Eigaard <i>et al</i> 2015). Full details of the UoAs footprint relative to VMEs are available at Figures 3.6-15 to -17 in Section 3.6.2, meeting the requirement for SG80 at SA3.15.6a.</p> <p>ABPmer & Ichthys Marine, 2015, conducted a series of field observations to study the impact of shrimp fishing gear on the habitat types found in the WNNC SAC area. This included sediment types and non-biogenic reefs, as well as biogenic reefs like <i>Sabellaria</i>. The study by ABPmer & Ichthys Marine (2015) also looked at recovery rates of different types of sediments and thus habitat types encountered in the Brown shrimp fishery (see Section 3.6.2 for details). In studies to assess the recovery of <i>Sabellaria</i> reefs following impact, Vorberg (2000) found that the reef could recover in a matter of days depending on whether the worms were still alive and thus could rebuild its casings.</p> <p>In the case of The Wash area, the physical impacts of the gear on all habitats have been quantified fully, and thus extrapolations can be made to adjoining areas. SG100 is met</p>		
c	Monitoring			
	Guide post		Adequate information continues to be collected to detect any increase in risk to the main habitats.	Changes in habitat distributions over time are measured.
	Met?		Y	N
	Justification	<p>The Wash and North Norfolk Coast SAC, The Greater Wash SPA, the Inner Dowsing Race Bank North Ridge (IDRBNR) SAC, and the Haisborough Hammond and Winterton SAC are all part of the Natura 2000 network and subject to the provisions of the Habitats Directive and Birds Directive, which requires monitoring of the Natura 2000 sites (see Article 6 and 11 – Habitats Directive), and to maintain favourable conservation status (as mentioned for example in the Preamble of the Habitats Directive). Continuous monitoring of VMS of the shrimp fishers allows for changes in fishing patterns to be noted, and thus risk evaluations to habitats to be made. At SG80 this is for 'main' habitats, which in this fishery is extensive sandy/muddy substrate areas, the natural habitat of brown shrimp. SG80 is met.</p>		

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.	
		In order to meet SG100 changes in habitat distributions over time need to be measured, and such information is not yet available, as the extensive habitat surveys have only recently been completed for the first time. SG100 is not met.	
References		ABPmer & Ichthys Marine, 2015; Eigaard <i>et al</i> 2015; Vorberg 2000;	
OVERALL PERFORMANCE INDICATOR SCORE:			90
CONDITION NUMBER (if relevant):			-

PI 2.5.1 – Ecosystem outcome

PI 2.5.1		The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function.		
Scoring Issue		SG 60	SG 80	SG 100
a	Ecosystem status			
	Guide post	The UoA 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 UoA 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 UoA 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.
	Met?	Y	Y	N
	Justification	<p>The most obvious ecosystem impact of the shrimp fishery under assessment is likely to be caused by the removal of large quantities of the target species and the impact that this in turn has on food web dynamics. <i>C. crangon</i> is a lower trophic-level species, it is an epibenthic predator, and the importance of <i>C. crangon</i> as a food source depends on the spatial scale (ICES Advice 2014). The shrimp diet of fish consists almost exclusively of the juvenile shrimp stages at sizes smaller than 50mm. Only a small number of fish species consume larger shrimp of marketable size, most importantly cod and whiting; nevertheless, even these species feed mainly on the smaller, juvenile shrimp (ICES 2014). On a wider scale in the North Sea the importance of <i>C. crangon</i> is expected to be minor, but in the local coastal areas where <i>C. crangon</i> is distributed it is an important food component in the diet of a number of species, even though its role in the energy flow is not dominant. Several of the small predator fish species, which prey intensively on smaller brown shrimps (< 50 mm), may be more dependent on this food source, since their populations are mainly distributed in the same depth range as brown shrimp. (ICES 2014) Research has shown, as described in Section 3.6.1, that predators are not reliant on brown shrimp only, and switch to other prey when necessary. Research on the Isle of Man (UK) has shown that larger female <i>Crangon</i> (mainly > 10 mm CL) prey on 0-group fish co-occurring in the study area - plaice (<i>Pleuronectes platessa</i>), dab (<i>Limanda limanda</i>) and sandeel (<i>Ammodytes tobianus</i>). This suggests that predation by adult <i>C. crangon</i> can affect mortality of young fish. The role of brown shrimp can therefore not be ignored and substantial changes in coastal areas can be expected if the <i>C. crangon</i> population is largely reduced, e.g. in the case of recruitment overfishing (ICES 2014).</p> <p>Under Principle 2 it has been shown that the level of bycatch (whether retained or discarded) is kept low by the use of sieve nets and speedy on-board sorting techniques and that any bycatch brought on board is likely to be small (year 0) and with reasonable prospect of post capture survival.</p> <p>The predator-prey interactions have increased in complexity with the gradual build-up of three marine mammal populations in the coastal areas of the North Sea inhabited by brown shrimp, namely harbour seals, harbour porpoise, and grey seals. The combined assembly consumes an estimated total of 145 000t fish annually; many of these will be brown shrimp predators (Temming and Hufnagl, 2014).</p> <p>Other ecosystem impacts have also been considered – these include unintended consequences of operation such as lost gear, fuel and oil pollution, waste and litter. The client has ratified the MARPOL convention and is thus responsible for dealing with any pollution issues. This was discussed in Section 3.6.1.</p>		

PI 2.5.1		The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function.	
		<p>The UoA 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. SG80 is met.</p> <p>Although there is some evidence in the form of individual species and groups studies, such as population trends in seabirds, gadoid/ brown shrimp interactions, the system is physically very dynamic which makes it difficult to tease out the separate ecosystem components quantitatively over a long time series. SG100 is not met.</p>	
References		<p>ICES Advice 2014, Book 6.2.3.4 Request from Germany and the Netherlands on the potential need for a management of brown shrimp (<i>Crangon crangon</i>) in the North Sea;</p> <p>Oh & Hartnoll 2001; Temming & Hufnagl, 2014</p>	
OVERALL PERFORMANCE INDICATOR SCORE:			
80			
CONDITION NUMBER (if relevant):			
-			

PI 2.5.2 – Ecosystem management strategy

PI 2.5.2		There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are measures in place, if necessary which take into account the potential impacts of the fishery on key elements of the ecosystem.	There is a partial strategy in place, if necessary, which takes into account available information and is expected to restrain impacts of the UoA on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a strategy that consists of a plan , in place which contains measures to address all main impacts of the UoA on the ecosystem, and at least some of these measures are in place.
	Met?	Y	Y	N
	Justification	<p>The Common Fisheries Policy of the European Union provides an overarching framework and facilitates an ecosystem-based management of fisheries in European waters. The CFP recognises the need to manage fisheries collectively on a multispecies basis as well as recognising the need to consider ecosystem aspects; this ecosystem approach is increasingly influencing fishery management policy.</p> <p>A further provision of European law designed to protect the marine environment and marine ecosystems is the Marine Strategy Framework Directive 2008/56/EC, which in conjunction with the Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC) (NB: both these Directives have been updated and expanded upon since) is playing an important role in limiting fishery related ecosystem impacts. The overarching goal of the Directive is to achieve 'Good Environmental Status' (GES) by 2020 across Europe's marine environment, including the establishment of a network of Marine Protected Areas by 2020.</p> <p>The relevant descriptors to achieve Good Environmental Status (GES), as defined in the Marine Strategy Framework Directive (Directive 2008/56/EC), in relation to the Wash and adjoining areas ecosystem health and function, include for example: Elements of food webs ensure long-term abundance and reproduction (Descriptor 4); The sea floor integrity ensures functioning of the ecosystem (Descriptor 6). Other descriptors deal with marine litter and concentration of pollutants, which affect the marine ecosystem health and function.</p> <p>In the case of the brown shrimp fishery, the client has initiated the establishment of a brown shrimp management plan for the Wash area, to which all participating fishers have to sign up to. The plan specifically addresses the ecosystem aspect of the fishery – one of the stated objectives is: <i>Ensure an ecologically responsible fishery that minimises effects on the marine environment.</i></p> <p>A range of management measures apply to the shrimp fishery at fleet level (SG60 is met), including areal closures and technical control measures, such as gear design, on board sorting design and gear restrictions (no pulse), which adds to the partial strategy to manage ecosystem impacts of the fishery. In addition, the client promotes research into reducing ecosystem impacts of fishing and has supported research into bycatch reduction devices and survivability studies, in order to reduce ecosystem impacts. SG80 is met.</p> <p>The Wash brown shrimp management plan came into force in May 2017, and the majority of fishers have signed up to it (Client data on vessel signatures, Aug 2018). However, the data time series on some of the measures is not yet available to establish whether all the main impacts of the UoA on the ecosystem are addressed.</p>		

PI 2.5.2		There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.		
		This will be available once feedback is provided into the management plan through ongoing information collection. SG100 is not met.		
b	Management strategy evaluation			
	Guide post	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems).	There is some objective basis for confidence that the measures/partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved	Testing supports high confidence that the partial strategy/strategy will work, based on information directly about the UoA and/or ecosystem involved
	Met?	Y	Y	N
	Justification	Measures are in place to identify and avoid or reduce ecosystem impacts of the fishery where possible (through e-logs, VMS). A full suite of management measures, as listed in the Wash Brown Shrimp management plan, including vessel permits, and permit capping (waiting list) and effort limitation, as well as technical control measures on gears and vessels. SG60 is met. The partial strategy outlined under a) takes account of the benthic ecosystem in terms of trawling per se, including bycatch reduction measures. Experiments have been conducted on the effects of the gear on the benthos, in relation to the high energy environment in which fishing takes place. Experiments have improved gear selectivity to reduce bycatch. In addition, existing fishery management measures (e.g. closed areas and VMS) limit the impact of the fishery on the ecosystem. SG80 is met. As in a) above, the Wash brown shrimp management plan has only come into force relatively recently, to allow testing. SG100 not met.		
c	Management strategy implementation			
	Guide post		There is some evidence that the measures/partial strategy is being implemented successfully .	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Y	N
	Justification	Compliance reports, provided by EIFCA and MMO, show that gear specifications are implemented; e-logs and VMS plots indicate that information collection requirements are being implemented throughout the fleet. VMS plots and vessel sightings indicate where the fishers comply with Natura 2000 requirements (avoiding closed areas). Fishers participate in research to improve gears so as to reduce ecological impacts. SG80 is met. As in b) above, the Wash Brown Shrimp management plan has not yet been implemented fully, there is not yet the time series evidence available. SG100 is not met.		
References		Marine Strategy Framework Directive 2008/56/EC; Habitats Directive 92/43/EEC; Birds Directive 79/409/EC		

PI 2.5.2	There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.	
	NB: the Birds Directive has been updated to EU Birds Directive 2009/147/EC , as transposed into UK law by the Conservation of Habitats and Species Regulations 2017 within 12 nautical miles, and the Conservation of Offshore Marine Habitats and Species Regulations 2017 between 12 nautical miles out to 200nm or the UK Continental Shelf.	
OVERALL PERFORMANCE INDICATOR SCORE:		80
CONDITION NUMBER (if relevant):		-

PI 2.5.3 – Ecosystem information

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem.		
Scoring Issue		SG 60	SG 80	SG 100
a	Information quality			
	Guide post	Information is adequate to identify the key elements of the ecosystem.	Information is adequate to broadly understand the key elements of the ecosystem.	
	Met?	Y	Y	
	Justification	Information is adequate to broadly understand the key elements of the ecosystem. Key elements include the trophic structure of the Wash area ecosystem such as prey, predators and competitors; community composition, productivity patterns and characteristics of biodiversity, as well as interplay with oceanographic features (currents, tides, and season). As part of establishing various marine protected areas in the vicinity of the fisheries area (Wash and North Norfolk Coast SAC, the Inner Dowsing Race Bank North Ridge (IDRBNR) SAC, and the Haisborough Hammond and Winterton SAC, and The Greater Wash SPA), extensive habitat mapping has been conducted as part of the Habitat Assessment Regulations (HAR), as well as extensive species surveys of the primary qualifying species featured in the protected areas (<i>Gavia stellata</i> ; Red-throated diver (Non-breeding), <i>Melanitta nigra</i> ; Common scoter (Non-breeding), <i>Hydrocoloeus minutus</i> ; Little gull (Non-breeding), <i>Sterna sandvicensis</i> ; Sandwich tern (Breeding); <i>Sterna hirundo</i> ; Common tern (Breeding); Harbour seal <i>Phoca vitulina</i> ; <i>Sternula albifrons</i> ; Little tern (Breeding). Their interactions within the ecosystem have been studied as part of the designations. SG80 is met		
b	Investigation of UoA impacts			
	Guide post	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, and some have been investigated in detail.	Main interactions between the UoA and these ecosystem elements can be inferred from existing information, and have been investigated in detail.
	Met?	Y	Y	N
	Justification	The main impacts of this fishery on the ecosystem consist of fishery removal and physical impact on the benthos. Main interactions between the fishery and the ecosystem elements listed under a) can be inferred from existing information, and have been investigated for demersal shrimp trawl (van Denderen <i>et al.</i> , 2015; Vorberg 1997, 2000; Løkkeborg 2005; Rumohr <i>et al.</i> 1994; ABPmer & Ichthys Marine, 2015), as well as the detailed overview given in Section 3.6.1 of this report. SG80 is met Although the main interactions between the UoA and these ecosystem elements can be inferred from existing information, in detail investigations between the different interactions have not yet been possible, as this is a highly dynamic system and such research would need a long timeframe. SG100 is not met.		
c	Understanding of component functions			
	Guide post		The main functions of the components (i.e., P1 target species.	The impacts of the UoA on P1 target species, primary, secondary and

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem.		
			primary, secondary and ETP species and Habitats) in the ecosystem are known .	ETP species and Habitats are identified and the main functions of these components in the ecosystem are understood .
	Met?		Y	N
	Justification	<p>The main functions of the components (i.e. target species, primary, secondary and ETP species and Habitats) in the ecosystem are known. Section 3.6 (and sub-sections) of the main report outline the array of data that are collected in relation to the fishery. The range of data is sufficient to inform about the main functions of the components in the ecosystem. SG80 is met</p> <p>Although observer reports provide detailed quantitative information on bycatch and ETPs, such observations are not frequent enough across the whole fishery, including smaller vessels (which may also pose logistical and safety issues as some vessels are too small to accommodate more than one person). More sampling would allow for a better understanding of the impact of the UoA on secondary and ETP species. There is little information available in the scientific literature to understand the impact of the UoA on benthic non-fish species in the bycatch. SG100 is not met.</p>		
d	Information relevance			
	Guide post		Adequate information is available on the impacts of the UoA on these components to allow some of the main consequences for the ecosystem to be inferred.	Adequate information is available on the impacts of the UoA on the components and elements to allow the main consequences for the ecosystem to be inferred.
	Met?		Y	N
	Justification	<p>There is adequate information available on the impact of shrimp trawl fishery on these components to allow some of the main consequences for the ecosystem to be inferred. This has been discussed in detail in the Principle 2 sections of this report (Section 6.3). SG80 is met</p> <p>As in c) above, Observer reports are not frequent enough across the whole range of vessels to meet this SG. SG100 is not met.</p>		
e	Monitoring			
	Guide post		Adequate data continue to be collected to detect any increase in risk level.	Information is adequate to support the development of strategies to manage ecosystem impacts.
	Met?		Y	N
	Justification	<p>Data is routinely collected on a regular basis to allow for the detection of change or increase in risk level to the main ecosystem components. Relevant data collected include landings data for the target species, discard data from observer trips and reports, and spatial data in relation to habitat and fishing effort (via EU logbooks and VMS). The client is in the process of implementing a self-recording system for ETPs on each vessel (i.e. those vessels that have signed up to the Wash management plan and are part of this certification process. SG80 is met</p>		

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem.	
		As part of the strategic plan development, the Eastern IFCA produces a risk level assessment of the fishery with regards to such ecosystem components as habitat and bycatch, this is ongoing work and feeds into the management of the Wash ecosystem for which the EIFCA is responsible. However, at this stage ETPs are not part of this risk assessment. SG100 is not met.	
References		ABPmer & Ichthys Marine, 2015; van Denderen <i>et al</i> , 2015; Vorberg 1997, 2000; Løkkeborg 2005; Rumohr <i>et al</i> . 1994 http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0017075	
OVERALL PERFORMANCE INDICATOR SCORE:			80
CONDITION NUMBER (if relevant):			-

PI 3.1.1 – Legal and/or customary framework

PI 3.1.1	<p>The management system exists within an appropriate legal and/or customary framework which ensures that it:</p> <ul style="list-style-type: none"> • Is capable of delivering sustainability in the UoA(s); and • 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. 		
Scoring Issue	SG 60	SG 80	SG 100
a	Compatibility of laws or standards with effective management		
Guide post	There is an effective national legal system and a framework for cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and organized and effective cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and binding procedures governing cooperation with other parties which delivers management outcomes consistent with MSC Principles 1 and 2.
Met?	(Y)	(Y)	(Y)
Justification	<p>There is an effective national legal system:</p> <p>National legislation in the UK must be seen within the hierarchy of EU wide fisheries legislation. The principle legislative instrument for fisheries management in the EU is the Common Fisheries Policy (REGULATION (EU) No 1380/2013), which aims at achieving sustainable fisheries management across the EU. This clearly aims to achieve both P1 (stock management) and P2 (wider ecosystem impacts). For example, the regulation states</p> <p>The scope of the CFP extends to conservation, management and exploitation of living aquatic resources bearing in mind UNCLOS. The objective of the CFP should therefore be to provide for sustainable exploitation of living aquatic resources in the context of sustainable development, taking account of the environmental, economic and social aspects in a balanced manner.</p> <p>Underneath the umbrella of the EU CFP, there are many binding regulations covering all aspects of fisheries, which are amended and updated as required. For example, some of the key recent pieces of legislation include the regulations on data collection, IUU and on control & enforcement. The EU CFP allows for additional fisheries management measures to be taken by member states in their inshore waters. The functions of inshore fisheries management in England and Wales, including the establishment of the Inshore Fisheries and Conservation Authorities (IFCA) are clearly set out in the Marine and Coastal Access Act 2009.</p> <p>There are binding procedures governing cooperation with other parties:</p> <p>This PI also seeks to examine cooperation between other parties. The 'stock' boundary for the Wash Shrimp (as defined by the stock assessment and discussed in the scoring of Principle 1) means that it is managed as an inshore stock. This means that it is managed by a single EU member state (UK) with exploitation by vessels of a single EU member state (UK). As such the mechanisms which provide binding procedures governing cooperation with other parties (i.e. other EU member states) are not applied. However, the mechanism for binding cooperation does exist.</p> <p>The precursor for cooperation on stock management at an EU level would be consideration of stock science by ICES. There is an ICES Working Group on <i>Crangon</i> fisheries (WGCRANGON), which discusses stock boundaries and stock assessment approaches in European <i>Crangon</i> fisheries. Although hypothetical, it is worth noting that if this Working Group had concluded that management of <i>Crangon</i> fisheries should be coordinated at an EU level then the mechanism exists to enable that.</p> <p>There is also binding EU coordination in relation to P2 management – such as binding legislation governing all EU member states in relation to habitats, ETP species, gear</p>		

PI 3.1.1		The management system exists within an appropriate legal and/or customary framework which ensures that it: <ul style="list-style-type: none">• Is capable of delivering sustainability in the UoA(s); and• 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.		
		<p>technical regulations, control and enforcement etc. (refer to the relevant PI for details of this EU level legislation).</p> <p>Looking in more detail at management within UK inshore waters the other “other party” with whom organized and effective cooperation may be required is with the neighboring IFCA. Given the location of catches cooperation with the next IFCA south is probably not required, however cooperation with North East IFCA may be required (albeit overlap is likely to be small). Organized and effective cooperation between IFCAs occurs at the level of the Association of IFCAs (http://www.association-ifca.org.uk/). In addition, Section 174 of the Marine and Coastal Access Act 2009 requires IFCAs to cooperate with neighbouring IFCAs and other relevant authorities involved with regulation or enforcement.</p>		
b	Resolution of disputes			
	Guide post	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 UoA.	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 .
	Met?	(Y)	(Y)	(N)
	Justification	<p>The Marine & Coastal Access Act 2009 sets out the rights of appeal for licensing decisions and restrictions on time at sea (under the Sea Fish (Conservation) Act 1967. The Marine & Coastal Access Act 2009 also clearly sets out the powers of the IFCA, so any legal challenge to the power of IFCAs would be based on an interpretation of this legislation.</p> <p>Within the IFCA although there is no formalized dispute resolution process, there is a mechanism to enable disputes to be proactively addressed. Grievances, appeals or disputes can be brought before the IFCA Statutory Meetings. These meetings are public, with minutes available on-line. This is therefore a transparent process and is considered to be effective. Therefore, SG80 is met however, as no example was provided to enable a conclusion that this is tested proven to be effective, SG100 is not met.</p> <p>The Wash Brown Shrimp Management Plan (2017-2020) does not set out a process for the resolution of disputes. However, as this is part of the fishery specific management system this is addressed in PI 3.2.2.</p>		
c	Respect for rights			
	Guide post	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 of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.

PI 3.1.1		The management system exists within an appropriate legal and/or customary framework which ensures that it: <ul style="list-style-type: none"> • Is capable of delivering sustainability in the UoA(s); and • 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. 		
	Met?	N/A	N/A	N/A
	Justification	MSC CR (SA4.3.5) make clear that the focus on this Scoring Issue is aboriginal or indigenous people dependent on fishing for food or livelihood. No such peoples are identified in the context of the fishery under assessment.		
References		The Common Fisheries Policy (REGULATION (EU) No 1380/2013 The Marine & Coastal Access Act 2009 The Sea Fish (Conservation) Act 1967 Habitats Directive 92/43/EEC; Birds Directive 79/409/EC		
OVERALL PERFORMANCE INDICATOR SCORE:				90
CONDITION NUMBER (if relevant):				

PI 3.1.2 – Consultation, roles and responsibilities

PI 3.1.2		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		
Scoring Issue		SG 60	SG 80	SG 100
a	Roles and responsibilities			
	Guide post	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.
	Met?	(Y)	(N)	(N)
	Justification	The functions roles and responsibilities of organizations and individuals involved in the management process are explicitly defined and well understood in <i>many</i> areas, however there are some <i>key</i> areas where these functions roles and responsibility are only 'generally understood'. As a result, SG60 is met but SG80 is not met. The following key functions are explicitly defined and well understood (meeting the requirements for SG60 and SG80): <ul style="list-style-type: none">Fisheries licensing: MMO (roles and responsibilities defined in the Marine & Coastal Access Act (2009))Inshore fisheries enforcement: IFCA (roles and responsibilities defined in the Marine & Coastal Access Act (2009) and MMOEcosystem Science: Eastern IFCA, CEFAS, Natural England Although responsibility for the following functions are generally understood (as evidenced during the site visit by a clear stakeholder understanding of how current processes operate, thus meeting SG 60) these have not been explicitly defined (so SG80 is not met): <ul style="list-style-type: none">Demonstrating MSY for the Wash Shrimp FisheryMonitoring CPUE within the fishery and applying the Harvest Control RuleUndertaking future stock science for the shrimp fisheryAccess to the Wash Shrimp Fishery: there is the potential for confusion between the operation of decision-making processes outlined in the Wash Shrimp Management Plan and those outlined in the Eastern IFCA shrimp Byelaw. In addition, the relationship between the IFCA and the SFAWG has not been explicitly defined.		
b	Consultation processes			
	Guide post	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

PI 3.1.2		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		
				how it is used or not used.
	Met?	(Y)	(Y)	(N)
	Justification	<p>There are a number of effective consultation processes at all relevant tiers of governance.</p> <p>Eastern IFCA publishes and Communications & Engagement Report (most recent available on-line is 2015-16: http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/02/CE-Report-2015-16.pdf). This set out all of the methods that the IFCA use to ensure wider engagement in the activities of the IFCA.</p> <p>A current example of Eastern IFCA Consultation is in relation to the draft shrimp bylaw. This consultation is advertised on-line: http://www.eastern-ifca.gov.uk/eastern-ifca-bylaws-formal-consultation/. Eastern IFCA noted (at the time of the public comment draft report) that "shrimp fishery management measures (are) subject to extensive consultation, including engagement with local fishermen and feedback summaries".</p> <p>Another example of consultation relevant to the IFCA's which is also current at the time of writing is DEFRA consultation on IFCA performance as part of a 4-year review cycle of IFCA Conduct and Operation. https://consult.defra.gov.uk/fisheries/ifcas-conduct-and-operation-report/supporting_documents/ifcaconsultdocument.pdf</p> <p>A similar consultation exercise happened 4 years previously. The resulting document makes clear the nature of the responses received to this consultation (DEFRA 2015). In relation to Eastern IFCA this notes that "Seventeen respondents contributed to the public call for evidence with material specifically about Eastern IFCA"..... "The IFCA's approach and commitment to engagement with stakeholders was acknowledged to be good". "Communication and leadership of the IFCA was acknowledged to be professional, clear and pragmatic".</p> <p>Finally, at the EU level there are regular consultations on key pieces of legislation, such as reform of the CFP (https://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/sec%282010%290428_en.pdf) and even on the annual fisheries opportunities legislation, prior to the setting of quotas: https://ec.europa.eu/info/consultations/fishing-opportunities-2019-under-common-fisheries-policy_en). Various examples of these consultations are available on the EU Maritime and Fisheries Affairs webpages, including submissions to these consultations: https://ec.europa.eu/info/consultations/fishing-opportunities-2017-under-common-fisheries-policy_en</p> <p>Whilst the level of consultation is excellent and consultations typically conclude with a summary of responses it is not always clear how responses have been used or not used, therefore SG80 is clearly met, but SG100 is perhaps not met for all relevant tiers of governance.</p>		
c	Participation			
	Guide post		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.
	Met?		(Y)	(Y)
	Justification	The Better Regulation guidelines (https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-		

PI 3.1.2		<p>The management system has effective consultation processes that are open to interested and affected parties.</p> <p>The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties</p>
		<p>regulation-guidelines-and-toolbox_en) require the European Commission to consult on any policies and regulations and follow effective consultation processes. DEFRA's guidance to IFCA's on Evidence-based marine management also makes clear the critical importance of consultation in the 'Develop and appraisal of options' stage of management, prior to implementation.</p> <p>The Eastern IFCA Communications & Engagement Report set out all of the methods that the IFCA use to ensure wider engagement in the activities of the IFCA. The IFCA have been highly visible since their restructuring from the Sea Fisheries Committee and their engagement with a wide range of stakeholders has been highlighted as being excellent.</p>
References		<p>Eastern IFCA (2016)</p> <p>DEFRA (2015)</p> <p>EC (2017)</p>
OVERALL PERFORMANCE INDICATOR SCORE:		75
CONDITION NUMBER (if relevant):		6

PI 3.1.3 – Long term objectives

PI 3.1.3		The management policy has clear long-term objectives to guide decision-making that are consistent with MSC fisheries standard, and incorporates the precautionary approach.		
Scoring Issue		SG 60	SG 80	SG 100
a	Objectives			
	Guide post	Long-term objectives to guide decision-making, consistent with the MSC fisheries standard and the precautionary approach, are implicit within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC fisheries standard and the precautionary approach are explicit within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC fisheries standard and the precautionary approach, are explicit within and required by management policy.
	Met?	(Y)	(Y)	(Y)
	Justification	<p>At the governance and policy level, clear over-arching long term objectives are set out in the EU common fisheries policy, which guides all European fisheries decision-making. The CFP is periodically reformed and over the years the high-level objectives have become more clearly defined. These now include numerous references to objectives in the pre-amble which are in line with the MSC Principles and Criteria. For example:</p> <p>(4) The CFP should ensure that fishing and aquaculture activities contribute to long-term environmental, economic and social sustainability.</p> <p>(6)obligations to take conservation and management measures designed to maintain or restore marine resources at levels which can produce the maximum sustainable yield.</p> <p>(10) Sustainable exploitation of marine biological resources should be based on the precautionary approach, which derives from the precautionary principle.</p> <p>(13) An ecosystem-based approach to fisheries management needs to be implemented.</p> <p>Article 2 of the CFP gives a full description of these objectives. These are explicit. For example:</p> <p>1.The CFP shall ensure that fishing and aquaculture activities are environmentally sustainable in the long-term.</p> <p>2. The CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield.</p> <p>3. The CFP shall implement the ecosystem-based approach to fisheries management so as to ensure that negative impacts of fishing activities on the marine ecosystem are minimised, and shall endeavour to ensure that aquaculture and fisheries activities avoid the degradation of the marine environment.</p> <p>This therefore meets SG80.</p> <p>At a national level, DEFRA Publishes "Inshore Fisheries and Conservation Authorities: vision, success criteria and high-level objectives". http://www.association-ifca.org.uk/Upload/About/2011-ifca-guide-marine%20management.pdf</p> <p>The Eastern IFCA has defined its purpose and vision as follows: "Eastern Inshore Fisheries and Conservation Authority will lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to</p>		

PI 3.1.3		The management policy has clear long-term objectives to guide decision-making that are consistent with MSC fisheries standard, and incorporates the precautionary approach.
		<p>ensure healthy seas, sustainable fisheries and a viable industry.” At a national level SG80 is also met.</p> <p>In order to meet SG100 it must be demonstrated that these objectives are “required by management policy”. The Treaty on the Functioning of the European Union requires that:</p> <p>“Environmental protection requirements must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to promoting sustainable development”.</p> <p>This may be seen as a high-level requirement to set these objectives, thus meeting SG100.</p>
References		Treaty on European Union and the Treaty on the Functioning of the European Union 2012/C 326/01
OVERALL PERFORMANCE INDICATOR SCORE:		100
CONDITION NUMBER (if relevant):		

PI 3.2.1 Fishery-specific objectives

PI 3.2.1		The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.		
Scoring Issue		SG 60	SG 80	SG 100
a	Objectives			
	Guide post	Objectives , which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery-specific management system.	Short and long-term objectives , which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery-specific 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-specific management system.
	Met?	(Y)	(Y)	(Partial)
	Justification	<p>The objectives contained within the Wash Shrimp Fishery Management Plan are:</p> <ul style="list-style-type: none"> • Ensure a long-term, sustainable and stable Wash brown shrimp fishery; • Support a highly productive stock of the target species, the brown shrimp <i>C. crangon</i>; and • Ensure an ecologically responsible fishery that minimises effects on the marine environment. <p>Specific objectives are to:</p> <ul style="list-style-type: none"> • Ensure a clear framework for communication, collaboration, consultation and inclusion for key stakeholders involved in the management of the fishery; • Ensure clear roles and responsibilities for decision makers involved in the fishery; • Ensure industry complies with laws, rules and regulations set by approved bodies; • Establish a framework for improving fishing practices and activities if and when necessary; • Ensure responsible operations that will maintain the conservation status of the Wash; • Minimise and monitor the: Catching and discarding of smaller brown shrimp; Catching and discarding of non-target species and by-catch species; Interaction with endangered, threatened and protected species; Interaction with sensitive habitats, particularly qualifying features of nature designations. • Ensure timely implementation of management measures, which are routinely monitored and reviewed. <p>These objectives are explicit and cover both principle 1 and 2. Thereby fully meeting SG80. In addition, for Principle 1 the more explicit commitment to measurable target reference points meets that SG100 is partially met.</p> <p>The objectives contained within the Shrimp Byelaw remain in draft form so are not referred to here and have not influenced scoring.</p>		
References		Poseidon (2017)		

PI 3.2.1	The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.	
OVERALL PERFORMANCE INDICATOR SCORE:		90
CONDITION NUMBER (if relevant):		

PI 3.2.2 – Decision-making processes

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.		
Scoring Issue		SG 60	SG 80	SG 100
a	Decision-making processes			
	Guide post	There are some decision-making processes in place 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.	
	Met?	(Y)	(N)	
	Justification	<p>There are established decision-making processes at an EU level. These have resulted in some of the more high-level and generic management measures which apply, such as in relation to data collection, logbooks, VMS, licensing etc. However, the majority of fishery-specific decisions, which are the focus of this performance indicator apply at the national and regional level, most notably within the Eastern IFCA and, more recently, those emanating from the Shrimp Fishery Advisory Working Group (SFAWG) which has been initiated by the Shrimp Producers Organisation Ltd and which has resulted in the Wash Brown Shrimp Management plan.</p> <p>The decision-making processes which the IFCA must follow are set out in various DEFRA guidance documents to IFCAs, such as 'Guidance to IFCAs on evidence-based marine management' and 'Byelaw making powers'. The strategic approach to decision-making used by the Eastern IFCA can be seen in the Eastern IFCA Business Plan (current version 2018-2023). The decision-making processes employed by the IFCA are transparent and engage stakeholders. The IFCA comprises 21 members from a variety of backgrounds, including various fishing interests and fleet sectors) in order to ensure that a wide spectrum of perspectives and expertise are included within the decision making.</p> <p>The Eastern IFCA also hosts and is represented on the SFAWG. As such there has been some IFCA engagement and informal oversight of the decision-making processes that led to the implementation of the Wash Brown Shrimp Management plan. The Wash Brown Shrimp Management Plan details the process of decision-making, including scope of decisions, frequency of decision-making meetings, composition of decision-making body etc. Although this is relatively recently established.</p> <p>However, there is also a parallel fishery-specific decision-making process underway in the IFCA over the introduction of a new Shrimp Byelaw. Because the SFAWG is non-statutory and the Wash Brown Shrimp Management Plan is non-binding, the relationship with the IFCA and the new draft shrimp byelaw should be clarified. The new draft shrimp byelaw includes the potential to adjust exploitation rates based on scientific monitoring of stock status. This is something that is already a key function of the Wash Brown Shrimp Management Plan. Because there appears to be parallel decision-making processes and it is unclear how these will function together in the future SG80 is not met.</p>		
b	Responsiveness of decision-making processes			
	Guide post	Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take	Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.		
		some account of the wider implications of decisions.	adaptive manner and take account of the wider implications of decisions.	account of the wider implications of decisions.
	Met?	(Y)	(Y)	(N)
	Justification	<p>There are numerous examples of the decision-making process responding to serious and other important issues. It can be seen that earlier decisions, predating either the IFCA or the Shrimp Producers Organisation Ltd resulted in appropriate management action either being implemented at an EU level, national level or by the Sea Fisheries Committee (the predecessor to the IFCA). These resulted in limits on catches of small shrimp (Grade D) within the shrimp management plan (in response to concern about catching of undersize shrimp), setting vessel size limits (in response to concern about the impact on inshore stock, livelihood and habitats), requiring veil nets (in response to the issue of bycatch) etc.</p> <p>More recently both the IFCA (with its byelaw review process and the drafting and consultation upon the draft Shrimp byelaw) and the Shrimp Producers Organisation Ltd (with the commissioning of the stock assessment and the drafting and implementation of the Wash Shrimp Management Plan) have demonstrated that fisheries specific decision-making continues to respond in a timely manner to serious and other important issues (such as the need to demonstrate good environmental status of marine environments and the need to develop management capable of ensuring that the shrimp stock remains at or above MSY). The IFCA process is transparent. The degree of transparency is described in more detail in SI 3.2.2d.</p> <p>The SG100 requirement that “all” issues must be responded to is difficult to meet. There are some issues identified in relation to the decision-making process which have resulted in a condition to improve the decision-making processes. Until addressed, it is difficult to conclude that decision-making responds to “all issues” therefore, it is concluded that SG100 is not met.</p>		
c	Use of precautionary approach			
	Guide post		Decision-making processes use the precautionary approach and are based on best available information.	
	Met?		(Y)	
	Justification	<p>The DEFRA Guidance to IFCA's includes guidance on byelaw-making (DEFRA 2011c). The Marine and Coastal Access Act 2009 requires IFCA's to follow this guidance. This guidance explicitly addresses the need for adoption of the precautionary approach and how this should be balanced against the other objective of limiting the amount of unnecessary regulation and bureaucracy (the so-called Hampton Principles). The guidance states that “The precautionary principle is applied in the circumstances where there are reasonable grounds for concern that an activity is harmful but where there is uncertainty about the degree of risk and harm”. This judgement should first and foremost be informed by Risk Assessment.</p> <p>Eastern IFCA undertook a Habitats Regulations Assessment: Commercial beam trawling for shrimp in The Wash and North Norfolk Coast SAC (Eastern IFCA 2018c). This sets out the risk posed by the fishery to sensitive habitats, identifies gaps in data and forms the basis for the draft shrimp fishery byelaw. On the Eastern IFCA website they summarise the outcome of this process: “the assessment used best available evidence, but as there were some gaps in that evidence, we needed to take a precautionary approach in our conclusions about the impacts of the fishery”. This demonstrates a practical interpretation of the precautionary approach in fishery-specific decision-making.</p>		
Accountability and transparency of management system and decision-making process				

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.		
d	Guide post	Some information on the fishery's performance and management action is generally available on request to stakeholders.	Information on the fishery's performance and management action is available on request, and 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 provides comprehensive information on the fishery's performance and management actions and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	(Y)	(Y)	(N)
	Justification	Catch data is readily and publicly available from the MMO website by ICES statistical rectangles, thus enabling some aspects of fishery performance (i.e. catch and catch value) to be readily viewed. The Habitats Regulations Assessment: Commercial beam trawling for shrimp in The Wash and North Norfolk Coast SAC undertaken by Eastern IFCA provides an excellent summary of the fisheries performance and provides insight into the background to management decision-making. Section 8.6 of the Eastern IFCA Constitution and Standing Orders states that "The Clerk will keep (meeting minutes) and make available for public inspection for six years after a meeting of the Authority". http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/03/2018_05_18_EIFCA_Constitution_2018_Final.pdf This includes all relevant information listed in the MSC key guidance for SG60 and SG80, such as subsidies, allocation, compliance and the data and rationales which inform fisheries management decisions. SG80 therefore met, however this stops short of the formal reporting requirement described at SG100.		
e	Approach to disputes			
	Guide post	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 judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.
	Met?	(Y)	(Y)	(Y)
	Justification	The management authority is not subject to continuing court challenges, therefore SG60 is met. No judicial decisions have arisen from legal challenge requiring the management system to comply, therefore SG80 is met. The Shrimp Producers Organisation Ltd can be seen as a proactive step to avoid legal dispute. This brings together the 2 main shrimp buyers (who may traditionally have been seen as rivals) under 1 management system, with defined goals set around ensuring the long-term sustainability of the fishery and environment on which it depends. The SFAWG is also a key body for proactively avoiding dispute by		

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery.
		<p>bringing fishery stakeholders together with scientists, the regulator (i.e. the IFCA) and other interested stakeholders.</p> <p>The structure of the IFCA is also an attempt to proactively avoid legal dispute by ensuring both industry and wider stakeholder involvement at the board level. SG100 is therefore met.</p> <p>Recommendation: When the management plan is revised more explicit consideration should be given to the mechanism from resolution of disputes.</p>
References		DEFRA (2011 b & c)
OVERALL PERFORMANCE INDICATOR SCORE:		75
CONDITION NUMBER (if relevant):		7

PI 3.2.3 – Compliance and enforcement

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.		
Scoring Issue		SG 60	SG 80	SG 100
a	MCS implementation			
	Guide post	Monitoring, control and surveillance mechanisms exist, and are implemented in the fishery and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance system has been implemented in the fishery 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 and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	(Y)	(Y)	(Y)
	Justification	<p>Control and Enforcement is primarily undertaken by the Eastern IFCA. The Eastern IFCA has clear statutory backing for control and enforcement (from the Marine & Coastal Access Act 2009) and are well resourced with 10 uniformed control and enforcement officers and 3 patrol vessels. DEFRA Provide guidance to IFCAs on establishing a common enforcement framework (DEFRA 2011). The IFCA approach to Monitoring, Control and Surveillance is set out in the IFCAs Enforcement Policy, which is published on-line. The IFCAs strategic approach to Control and Enforcement is based on an understanding of risk of non-compliance across fisheries in the region. This considers issues such as the perception of the state of the fishery and changes in regulation. A month by month risk for the shrimp fishery, relative to other fisheries in the region is included in the risk register.</p> <p>Control and Enforcement within the fishery is focused on spatial measures, such as closed areas, and technical measures such as minimum landing sizes, mesh sizes and gear regulation.</p> <p>In addition, the Marine Management Organisation undertake control and enforcement. The control and enforcement focus is on catch quantities and accuracy of log book reporting. Vessels between 10-12m must have a paper log and vessels over 12m must have an e-log. MMO will check catch quantities against these log entries. Similar checks are undertaken on land by MMO to verify the accuracy of sales notes. The MMO are also responsible for monitoring of VMS. Although the IFCA does not have access to the VMS they have a very close relationship with the MMO VMS team, so collaborate to enforce spatial measures.</p> <p>There is clear overlap between the management measures set out in the Wash Shrimp Management Plan and those which are legally enforceable as a result of IFCA bylaws. As a result, the measures in the management plan such as engine power limits, minimum landings sizes, requirements for veil nets are enforced by the IFCA. Although some of the limits within the management plan would not be enforced outside of the IFCA boundary, in practice it is unlikely that vessels would seek to ignore these requirements. Overall the MCS system is concluded to be comprehensive and S100 is met.</p>		
b	Sanctions			
	Guide post	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.
	Met?	(Y)	(Y)	(N)
	Justification	<p>The sanctions that will be applied by the Eastern IFCA are clearly set out in the Enforcement Policy: http://www.eastern-ifca.gov.uk/wp-content/uploads/2016/05/Eastern-IFCA-Enforcement-Policy.pdf This ranges from</p>		

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.		
		Verbal Warning, to Advisory Letter, to Written Letter, to Financial Penalty to Prosecution. These are consistently applied and are thought to provide an effective deterrent IFCA Control & Enforcement Officers <i>pers. comms</i> . Fishers interviewed during the site visit also had a clear understanding of exactly what penalties would apply for infringements and there was clear consensus that these apply equally to all. SG60 and 80 are met. However, without formal evaluation of the performance of the sanctions, the SG100 requirement for 'demonstrably' is not met.		
c	Compliance			
	Guide post	Fishers are generally thought to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	Some 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 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.
	Met?	(Y)	(Y)	(N)
	Justification	Minor issues of historical non-compliance were discussed with the control and enforcement officers of the Eastern IFCA. These included some inaccuracies in landing declarations. This is understood to largely result from difficulties associated with the conversion factor applied to the cooked weight to determine the raw weight. As a result of this the IFCA issued an advisory note. In the past there have been some rumours of vessels removing the veil nets, perhaps because these are clogging up with weed. However, the IFCA report that their enforcement presence is sufficiently high to identify any such non-compliance. http://www.association-ifca.org.uk/Upload/About/2011-ifca-guide-common%20enforcement%20framework.pdf In addition, fishers provide additional information of importance to the effective management of the fishery. For example, in 2015 Eastern IFCA implemented a shrimp returns scheme, whereby fishers operating in this fishery within and adjacent to the Wash & North Norfolk Coast Special Area of Conservation (SAC) are now required to provide weekly data on fishing activity and catch (Eastern IFCA <i>pers. Comms</i>). Therefore, SG80 is met. Because some aspects of the management system are not legally enforceable and are therefore either not enforced by the IFCA or not enforced beyond 6nm SG100 is not met.		
d	Systematic non-compliance			
	Guide post		There is no evidence of systematic non-compliance.	
	Met?		(Y)	
	Justification	There is no evidence of systematic non-compliance. This has been verified by consultations with the Control and Enforcement Officers of the Eastern IFCA. MMO have issued some advisory letters in relation to some vessels failing to meet the 10% tolerance between e-log declarations and final landing declarations. However, understand challenges of estimation (especially given the cooking stage) and do not regard it as systematic non-compliance or an attempt to deliberately mislead (MMO <i>pers. comms.</i>). SG80 is met.		
References		DERFA 2011 Eastern IFCA 2014 Eastern IFCA 2015		

PI 3.2.3	Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.	
OVERALL PERFORMANCE INDICATOR SCORE:		85
CONDITION NUMBER (if relevant):		

PI 3.2.4 – Monitoring and management performance evaluation

PI 3.2.4		There is a system of 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.		
Scoring Issue		SG 60	SG 80	SG 100
a	Evaluation coverage			
	Guide post	There are mechanisms in place to evaluate some parts of the fishery-specific management system.	There are mechanisms in place to evaluate key parts of the fishery-specific management system	There are mechanisms in place to evaluate all parts of the fishery-specific management system.
	Met?	(Y)	(Y)	(N)
	Justification	Key parts of the management system are evaluated (meeting SG60 and 80). Such as: (at an EU Level) <ul style="list-style-type: none">Periodic Reviews (& Reform) of the Common Fisheries Policy, including planned future reviews. For example, The Common Fisheries Policy states that “<i>The Commission shall report to the European Parliament and to the Council on the functioning of the CFP by 31 December 2022</i>”.Evaluations of key Control & Enforcement Legislation (DGMARE 2017)The ICES Working Groups (including WGCranon) also effectively serve as routine evaluations of management performance, by comparing fishery performance to pre-determined targets. (at a National Level) <ul style="list-style-type: none">Evaluation Member States Reports & Data Transmission under the obligations of the Data Collection Framework. (STECF 2015)The UK Department for Environment Food & Rural Affairs (DEFRA) conduct reviews of IFCA Conduct & Operation. Inshore Fisheries and Conservation Authorities Conduct and Operation 2010 - 2014 (Fishery Level) The Wash Shrimp Management Plan 2017-2020 makes reference to the review function that will be provided by the Shrimp Fishery Advisory Working Group (SFAWG), stating that they will review various aspects of management such as the HCR, cod-end, retained catch levels and alternative measures to reduce unwanted catch. It is not clear that these will be formalized reviews or merely part of the scope of oversight of the Working Group. SG100 is not met.		
b	Internal and/or external review			
	Guide post	The fishery-specific management system is subject to occasional internal review.	The fishery-specific management system is subject to regular internal and occasional external review.	The fishery-specific management system is subject to regular internal and external review.
	Met?	(Y)	(N)	(N)
	Justification	The Wash Shrimp Management Plan is newly developed and implemented. The Shrimp Permit Byelaw is currently under development but not fully implemented. Both are the result of internal review processes, therefore SG60 is met. The Wash Shrimp Management Plan is time limited with the current plan running from 2017 until 2020. It is assumed that some form of review will be undertaken as part of the updating process.		

PI 3.2.4		<p>There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives.</p> <p>There is effective and timely review of the fishery-specific management system.</p>
		<p>The draft Shrimp Permit Byelaw does commit to a review:</p> <p>“The byelaw will be reviewed after six years and any permit conditions or eligibility” criteria will be reviewed after 4 years at most”. SG60 is met. There is no formal timetable specified for the review of the Wash Shrimp Management Plan, nor does it state the frequency of external review – SG80 is not met.</p>
References		<p>Blomeyer & Sanz (2017). DGMARE (2017) STECF (2015) DEFRA (2015) Eastern IFCA (2018) Poseidon (2017)</p>
OVERALL PERFORMANCE INDICATOR SCORE:		70
CONDITION NUMBER (if relevant):		8

Appendix 1.2 Risk Based Framework (RBF) Outputs

Table 1.2.2.a. PSA Rationale Table : PI 2.2.1

Productivity		
Scoring element (species)	Gobiidae	
Attribute	Rationale	Score
Average age at maturity.	All Productivity information based on fishbase.org; <5yrs	1
Average maximum age	<10yrs	1
Fecundity	100-20,000 eggs/yr.	2
Average maximum size	<100cm	1
Average size at maturity	<40cm	1
Reproductive strategy	demersal egg layer	2
Trophic level	3.2 (based on diet studies)	2
Density dependence	n/a	
Total Productivity score (MSC spreadsheet): 1.4		
Susceptibility		
	Client fishery only	
Attribute	Rationale	Score
Areal Overlap	<10%, Goby species are widely distributed far beyond the range of the fishery, within the NE Atlantic and North Sea range extends from Norway to Spain. Thus overlap with the fishery with overall distribution is considered low	1
Encounterability	High overlap with fishing gear; gobies are demersal species, living in a similar locale as shrimp, thus encounterability is high	3
Selectivity of gear type	a) Regularly caught, (applying Table PF5 CR2.0)	2
	b) Individuals half the size at maturity can avoid gear or escape because of the net size	2
Post capture mortality	Evidence of some released post-capture and survival as discussed in the main body of the report	2
Catch (weight) only where the scoring element is scored cumulatively	n/a	
Total Susceptibility score (MSC spreadsheet): 1.28		
PSA Score: 1.91		

PSA Spreadsheet:

Only main species scored?			Yes			Productivity Scores [1-3]										Susceptibility Scores [1-3]				Cumulative only															
Scoring element	First of each scoring element	Species Grouping only ID 'At Risk' species by selecting associated species group	Species Grouping only Number of species in species group which this species represents (N/2)	Family name	Scientific name	Common name	Species type	Fishery descriptor	Average age at maturity	Average max age	Fecundity	Average max size	Average size at Maturity	Reproductive strategy	Trophic level	Density Dependence	Total Productivity (average)	Availability	Encounterability	Selectivity	Post-capture mortality	Total (multiplicative)	PSA Score	Catch (tons)	Weighting	Weighted Total	Weighted PSA Score	MSC PSA-derived score	Risk Category Name	MSC scoring guidepost					
1	First	Species Group 1	4	Gobiidae	Pomatoschistus minutus	Sand Goby	Non-invertebrate	Shrimp trawl	1	1	2	1	1	2	2		143	1	3	2	2	1.28	1.31				57	Low	≥80						
1			4	Gobiidae	P. microps	Common goby	Non-invertebrate	Shrimp trawl	1	1	2	1	1	2	2		143																		
1			4	Gobiidae	P. lozanoi	Lozano's goby	Non-invertebrate	Shrimp trawl	1	1	2	1	1	2	2		143																		
1			4	Gobiidae	P. pictus	Painted goby	Non-invertebrate	Shrimp trawl	1	1	2	1	1	2	2		143																		

Appendix 1.3 Conditions

Condition 1 Harvest Control Rules

Performance Indicator	1.2.2a Well defined HCRs are in place that ensure that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock fluctuating around a target level consistent with (or above) MSY.
PI Score	75
Rationale	Whilst the HCR would be expected to keep the stock fluctuating around a level consistent with or above MSY, the Management Plan does not explicitly state how the annual HCR index will be calculated from the catch and effort data, or whether the trigger reference point will have a fixed value or will be estimated through an annual stock assessment where the population model is fitted to the catch and effort data to evaluate stock status. Triggering of the HCR results in a significant reduction in fishing effort, so it is essential that fishery stakeholders are aware of how the annual index is calculated and the level at which effort reduction would be implemented. The HCR is therefore not well-defined and the SG80 is not met.
Condition	Ensure that the harvest control rules are well-defined and clearly understood by all stakeholders.
Milestones	Year 1: Consider revisions to the text of the Management Plan to ensure that the HCRs are clearly understood by all stakeholders, and the trigger point for reducing fishing effort is explicitly defined. (score 75) Year 2: Implement revisions to the text of the Management Plan to ensure that the HCRs are clearly understood by all stakeholders, and the trigger point for reducing fishing effort is explicitly defined. (score at least 80)
Client action plan	At the end of year 2 a well-defined HCR consistent with PI1.2.2 SG80 should be fully embedded and there should be full confidence that HCR will be applied as agreed by stakeholders. Year 1 Actions: <ol style="list-style-type: none"> 1. Establish an action group who will undertake the tasks reporting to the Shrimp Fishery Advisory Working Group (SFAWG). The action group will consist of the fishery management representative(s) and stock assessment scientist. David Guy & Paul Medley 2. The action group will prepare alternative texts for the management plan with supporting materials defining the HCR in clear, easily understood terms. 3. The SFAWG will arrange a meeting with stakeholder representatives to explain the HCR (its purpose and implementation) and consider alternative texts and materials defining its operation within the management plan. The meeting will agree a final form for the HCR. 4. The SFAWG will finalise HCR in the management plan, including the detailed process of its implementation. Responsible David Guy Means of verification (MoV): Stakeholder meeting minutes, revised management plan. Year 2 Actions: <ol style="list-style-type: none"> 5. The SFAWG will arrange the formal distribution of the management plan and supporting materials to stakeholders explaining the HCR and it's implementation. 6. As part of the management plan, stakeholders will monitor the HCR and report to the Shrimp Fishery Advisory Working Group any issues that arise.

	Responsible David Guy MoV: Final fishery management plan, stakeholder distribution list, Shrimp Fishery Advisory Working Group minutes.
Consultation on condition	Consultation is required with the relevant stock assessment scientist(s) and with the Shrimp Fishery Advisory Working Group members.

Condition 2 Assessment of Stock Status

Performance Indicator	1.2.4e The assessment of stock status is subject to peer review.
PI Score	75
Rationale	The newly-developed stock assessment methodology including the evaluation of harvest control rules has not yet been presented at the ICES Crangon Working Group, at which alternative stock assessment approaches have been reviewed, and outside the ICES process, the model developed by Medley (2017) has not been formally peer reviewed. The SG80 is not met.
Condition	Ensure that the assessment of stock status has been peer-reviewed.
Milestones	Yr. 1: Consider options for the peer review of the stock assessment. (score 75) Yr. 2: Complete peer review of the assessment of the stock assessment. (score at least 80)
Client action plan	<p>At the end of year 2, the stock assessment will have undergone external peer review, and the status of the fishery determined by the reviewers. Enquiries have been made to Cefas for pricing</p> <p>The review can be conducted in a number of ways, and the most effective will be determined in Year 1. The review could be conducted remotely, only involving the technical scientists or through a meeting allowing greater interaction. The first actions will identify best procedure for such a review, including whether to present the stock assessment to the ICES Crangon Working Group or conduct a review in the UK with invited experts from CEFAS and/or elsewhere. Stock assessment materials will be produced which can be widely distributed for comment.</p> <p>Year 1 Actions:</p> <ol style="list-style-type: none"> 1. Identify best procedure for review, whether based on a meeting or limited to remote review of materials. 2. Prepare and agree technical peer review ToRs (including relevant issues in the FMP – see Condition 8). 3. Identify potential reviewers with necessary technical expertise. <p>Year 2 Actions:</p> <ol style="list-style-type: none"> 4. Recruit stock assessment scientists to review the stock assessment. 5. Commission stock assessment scientist to prepare written materials for the review and submit to the reviewers. 6. Carry out technical review by 1-2 peer reviewers who submit a joint consensus report of findings, conclusions and recommendations. <p>Responsible David Guy, Paul Medley</p> <p>MoV: Stock assessment materials, Stock Assessment Peer Review Report</p>
Consultation on condition	Consultation is required with appropriate stock assessment scientists and with the Shrimp Fishery Advisory Working Group.

Condition 3 ETP Management

Performance Indicator	2.3.2b There is a strategy in place that is expected to ensure the UoA does not hinder the recovery of ETP species.
PI Score	75
Rationale	The Brown Shrimp management plan does not contain a list of ETP species likely to be encountered by the fishery, nor is there any on-board identification manual for the fishers to refer to (at the time of the site visit, May 2018), despite this being explicitly mentioned in the management plan. There are no measures in place to record ETP species encounters/ interactions specifically.
Condition	Identify the issues and implement a series of measures to provide a strategy that is expected to ensure the UoA does not hinder the recovery of ETP species.
Milestones	<p>Yr. 1: No action: relevant activities undertaken in Condition 4 (score 75)</p> <p>Yr. 2: Begin process of incorporating identified ETPs into management plan based on current information (score 75)</p> <p>Yr. 3: Relevant ETP species should be clearly identified in the management plan and on-board. Appropriate measures should be in place, including to identify and record ETP species encounters/ interactions (score 75).</p> <p>Yr. 4: System should be shown to be functioning as intended (score 80).</p>
Client action plan	<p>By year 4 the monitoring system and management actions, if necessary, will be in place that minimise risks to ETP and show that the fishery is not preventing recovery in populations of ETP species.</p> <p>Year 1 Actions: See Condition 4</p> <p>MoV: Working ETP list is being converted to English then will be agreed by SFAWG/EIFCA before distribution to vessels</p> <p>Year 2 Actions:</p> <ol style="list-style-type: none"> 1. Based on information from Year 1 (see Condition 4), a consultant will be commissioned to develop a management strategy to minimise interactions with ETP by consultations with fishers. The strategy will manage any direct or indirect mortalities caused by the fishery. 2. The management plan will then be updated with the proposed strategy indicating designated ETP species, reporting procedures and any management responses to identified issues. <p>MoV: Wheel house identification sheets, completed ETP recording forms, landings data collection system, proposed updated management plan</p> <p>Year 3 Actions:</p> <ol style="list-style-type: none"> 3. SFAWG will review performance of management measures introduced to reduce interaction risks. 4. Further training of stakeholders will be carried out if necessary to ensure proper implementation of management strategy. 5. ETP interactions reports will be incorporated in regular SFAWG meetings. <p>MoV: Updated FMP, SFAWG minutes, completed ETP forms, compiled data sets</p> <p>Year 4 Actions:</p> <ol style="list-style-type: none"> 6. Fisher self-reporting will gather evidence of management measures in operation, which will be reviewed at SFAWG meeting.

	<p>7. SFAWG will incorporate any further changes to the management plan identified as necessary by the risk assessment (see Condition 4)</p> <p>MoV: Updated management plan, SFAWG minutes, completed ETP forms, compiled data sets</p> <p>Responsible David Guy, EIFCA, SFAWG</p>
Consultation on condition	<p>A Memorandum of Understanding has been formed between EIFCA and the Shrimp Producers Organisation Limited offering support for the actions specified above in the Client Action Plan. LR have received a copy of this as well as email confirmation from EIFCA.</p>

Condition 4 ETP Information

Performance Indicator	2.3.3b Information is adequate to measure trends and support a strategy to manage impacts on ETP species.
PI Score	70
Rationale	Information is not adequate to measure trends and support a strategy to manage impacts on ETP species. The fishery needs to demonstrate how measures work together to manage the level of impact on all potential ETP species, by stating what the ETP species are and what the levels of encounterability risks are.
Condition	The fishery needs to improve on existing ETP species data collection, both observer and self-collected data, to allow for the measuring of trends, and to thus support a strategy to manage impacts on ETP species.
Milestones	<p>Yr. 1: Identify all relevant ETP species, review existing information, identify gaps and plan for further data collection (Score 70)</p> <p>Yr. 2: Begin process of additional data collection (score 70)</p> <p>Yr. 3: Conclude initial round of data collection and begin analysis (score 70)</p> <p>Yr. 4: Present adequate information to assess risks and support a strategy to manage impacts on ETP species (score SG80).</p>
Client action plan	<p>By year 4 there should be an agreed working list of ETP and the SPO will be building a database of interactions with those species. The database will be adequate to measure trends and support the management strategy to minimise risks as required by Condition 3.</p> <p>Year 1 Actions:</p> <ol style="list-style-type: none"> 1. Draw up a working list of relevant ETP for review by EIFCA, English Nature and other appropriate bodies. This would initially be based on relevant protected species. Note that species could be added or removed in future as determined by the SFAWG based on advice from EIFCA or other responsible bodies. 2. The client will employ a consultant will compile status information for each identified ETP species in the Wash area. 3. The consultant will prepare on-board identification sheets, and recording forms for the ETP species. 4. The consultant will incorporate ETP interaction data in the current data collection system (i.e. log books). <p>MoV: Agreed initial ETP list, wheel house identification sheets, data recording forms, landings data collection system</p> <p>Year 2 Actions:</p> <ol style="list-style-type: none"> 5. The SPO will distribute ETP forms and conduct training with stakeholders as necessary for recording any interactions. 6. The SPO will implement data collection system at landings site 7. ETP interactions will be compiled and reported at regular SFAWG meetings. <p>MoV: SFAWG minutes, ETP forms, compiled ETP data.</p> <p>Year 3 Actions:</p> <ol style="list-style-type: none"> 8. The SPO will continue data collection activities, reviewing and adjusting as appropriate.

	<p>9. Using the available information, commission an independent risk assessment for the impact of the fishery on ETP. If the collected data are insufficient, further information may be required for a risk assessment, such as a Scale Intensity Consequence Analysis.</p> <p>MoV: compiled ETP data, risk assessment report</p> <p>Year 4 Actions:</p> <p>10. Based on the risk assessment, a consultant would propose management measures if necessary to reduce risks to ETP from the fishery to acceptable levels (see Condition 3) for review by SFAWG and inclusion in the management plan.</p> <p>MoV: Updated FMP, SFAWG minutes</p> <p>Responsible David Guy, EIFCA, SFAWG</p>
Consultation on condition	<p>A Memorandum of Understanding has been formed between EIFCA and the Shrimp Producers Organisation Limited offering support for the actions specified above in the Client Action Plan. LR have received a copy of this as well as email confirmation from EIFCA.</p>

Condition 5: Habitats Management

Performance Indicator	2.4.2b There is some objective basis for confidence that the measures/partial strategy will work, based on information directly about the UoA and/or habitats involved.
PI Score	75
Rationale	The current composition of the inshore fleet includes a high number of smaller vessels. The fishing intensity data for the smaller vessels is poor. The lack of VMS data for The Wash fleet, which is primarily composed of boats <12 m, means there are significant gaps in data describing the spatial distribution and intensity of fisheries in the area.
Condition	Improve spatial information on the fishery, in particular the smaller vessels to provide some objective basis for confidence that the measures/partial strategy will work.
Milestones	Yr. 1: Review existing spatial data and identify gaps (score 75) Yr. 2: Plan to address identified gaps (Score 75) Yr. 3: Process of addressing identified gaps should be underway (score 75) Yr. 4: Present data directly about the UoA to provide objective basis for confidence that the measures/partial strategy will work (score 80).
Client plan	<p>By the end of year 4, there should be an objective basis of confidence that habitat risks posed by the fishery are low and that the Wash shrimp fishing activities are consistent with the wider plan protecting marine habitats in and around the Wash area.</p> <p>Year 1 Actions:</p> <ol style="list-style-type: none"> 1. EIFCA will review existing spatial data relating to shrimp fishing activity and protected habitat features, and identify gaps in data. 2. EIFCA will identify the appropriate effort threshold to be applied within The Wash & North Norfolk Coast SAC (agreed mitigation against habitats impacts). 3. EIFCA will specify fishing gear that can be used in shrimp fishing within the Eastern IFCA district (agreed mitigation against habitats impacts). <p>MoV: brief report outlining available information and gaps; effort threshold figure; shrimp gear specification</p> <p>Year 2 Actions:</p> <ol style="list-style-type: none"> 4. The SPO / fishers will implement electronic monitoring systems on all vessels operating in the certified shrimp fishery to obtain spatial fishing effort data (at an appropriate ping frequency) to overlay with spatial management areas (restricted areas under EIFCA byelaw) created to minimise habitat impacts. Completion of this action will be subject to roll-out of national iVMS scheme being led by MMO on behalf of Defra 5. The SPO will provide EIFCA with the electronic monitoring system data set. 6. All fishers will provide EIFCA with shrimp returns data (required under EIFCA byelaw) 7. The SPO will provide EIFCA with monthly data on weight and size of shrimps landed, by vessel. <p>MoV: Electronic monitoring system (e.g. VMS) data set for all vessels in Wash shrimp fishery (vessel, date-time, location);</p> <p>Year 3 Actions:</p>

	<p>8. The EIFCA will use relevant data, including electronic monitoring data and shrimp returns (required under EIFCA byelaw), to monitor effort across fished areas and will produce tables of monthly effort.</p> <p>9. EIFCA will implement its effort management system (using the identified effort threshold) to limit impacts on habitats to agreed levels.</p> <p>MoV: Tabled data, draft report for submission to SFAWG; annual “heat map” of effort based on shrimp returns data.</p> <p>Year 4 Actions:</p> <ol style="list-style-type: none"> 1. SFAWG will agree changes, if necessary, to the vessel operations to reduce risks to acceptable levels. 2. SFAWG will update the management plan including, for example, any areas closed to fishing, seasonal closures, move-on rules and changes to fishing operations as appropriate. 3. The EIFCA will continue to collect information to support effective measures achieving habitats outcome. <p>MoV: Report submitted to SFAWG, updated FMP, updated VMS/habitat tables</p> <p>Responsible David Guy, EIFCA</p>
Consultation on condition	<p>Completion of this action will be subject to roll-out of national iVMS scheme being led by MMO on behalf of Defra. The scheme has been delayed but Defra is still aiming to have iVMS units in operation on all commercial fishing vessels within two years. Use of VMS whilst shrimp fishing will be a condition of EIFCA's shrimp permits – which will be required by all vessels when the shrimp permit byelaw (currently in final stages of QA by Defra) is implemented.</p> <p>A Memorandum of Understanding has been formed between EIFCA and the Shrimp Producers Organisation Limited offering support for the actions specified above in the Client Action Plan. LR have received a copy of this as well as email confirmation from EIFCA.</p>

EIFCA comment on PI 2.4.2

PI 2.4.2 – There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.

In 2018 EIFCA completed a thorough assessment of the impact of the shrimp fishery on species and habitats in The Wash & North Norfolk Coast Special Area of Conservation (SAC). This work (“the shrimp Habitats Regulations assessment or HRA”) included consideration of fishing effort over different habitat types. It was informed by “shrimp returns” data (required by EIFCA and which includes location of tows on a grid of boxes c.800m x 1400m) and habitat maps provided by Natural England (and complemented by EIFCA habitat mapping surveys).

The shrimp HRA concluded that we could not rule out “adverse effects” on the integrity of the site (the SAC) from the fishery, and therefore needed to introduce mitigation (management measures for the shrimp fishery). Mitigation has been agreed in the form of (i) Marine Protected Areas Byelaw 2018 and 2019 – areas closed to towed demersal fishing, including shrimp fishing, to protect the most sensitive habitats – and (ii) Shrimp Permit Byelaw with conditions including a requirement for vessels to use a vessel monitoring system within The Wash & North Norfolk Coast SAC and conditions on the overall level of effort and the type of gear that can be used in the remaining open areas. Both of these measures are awaiting final approval by Defra. Natural England has agreed that these measures are sufficient to rule out adverse effects on the integrity of the site. EIFCA considers that the agreed measures provide

an objective basis of confidence that habitat risks posed by the fishery are low and that the Wash shrimp fishing activities are consistent with the wider plan protecting marine habitats in and around the Wash area.

EIFCA will undertake a similar assessment for (HRA) Inner Dowsing, Race Bank and North Ridge Special Area of Conservation during 2019-20, and is likely to recommend additional spatial closures within this site to protect the most sensitive habitats from impacts from towed demersal fishing.

Condition 6: Consultation, Roles & Responsibility

Performance Indicator	3.1.2a 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.
Score	75
Rationale	The Shrimp Producers Organisation Ltd have been instrumental in commissioning a stock assessment and work to consult upon, develop and implement a management plan. This has enabled the fishery to enter the MSC assessment process. Looking ahead it is notable that the Eastern IFCA are also now proposing to introduce additional management controls in the Wash Brown Shrimp Fishery, including mechanisms to control access and constrain catches in response to changes in stock status, in order to demonstrate maximum sustainable yield. There is therefore the potential for confusion, duplication or contradiction in the future about where responsibility lies for (i) controlling access to the fishery, (ii) demonstrating that the fishery is operating at MSY and (iii) implementing the controls to ensure this. Future stock assessments are also likely to be required. At present it is not clear where responsibility for this lies or how this will be paid for. The division of roles and responsibility in these areas between the Eastern IFCA, the SFAWG and the Shrimp Producers Organisation Ltd should therefore be addressed and explicitly defined.
Condition	<p>Functions, roles and responsibilities should be explicitly defined and demonstrated to be well understood for the following key areas of future management responsibility:</p> <ul style="list-style-type: none"> • Demonstrating MSY for the Wash Shrimp Fishery • Monitoring CPUE within the fishery and applying the Harvest Control Rule • Undertaking future stock science for the shrimp fishery • Access to the Wash Shrimp Fishery: there is the potential for confusion between the operation of decision-making processes outlined in the Wash Shrimp Management Plan and those outlined in the Eastern IFCA shrimp Byelaw. In addition, the relationship between the IFCA and the has not been explicitly defined.
Milestones	<p>Yr. 1: Review the relationship between the IFCA shrimp byelaw and the Wash Brown Shrimp Management Plan and the relationship between the Eastern IFCA, the Shrimp Producers Organisation Ltd and the SFAWG. (score 75).</p> <p>Yr. 2: Propose explicit definitions of roles and responsibilities in the key areas noted above. (score 75).</p> <p>Yr. 3: Consult upon the proposed definitions to ensure that these are understood. (score 75).</p> <p>Yr. 4: Implement the definitions. (score 80).</p>
Client action plan	<p>By the end of year 4, the FMP will be updated with a Memorandum of Understanding defining clearly the agreed roles and responsibilities of each organisation.</p> <p>Year 1 Actions:</p> <ol style="list-style-type: none"> 1. A consultant will review current perceived roles and responsibilities between EIFCA, SPO and SFAWG based on meetings with the relevant bodies. <p>MoV: a brief report outlining relationship and any conflicts in responsibility and unclear roles that need to be resolved (including decision making processes)</p> <p>Year 2 Actions:</p>

	<p>2. Draft a Memorandum of Understanding between the SPO, EIFCA and SFAWG defining relevant roles and responsibilities in relation to activities defined in the management plan.</p> <p>3. Submit the Memorandum for discussion and hold a SFAWG meeting to discuss the MoU. The MoU may require further circulation and input from others, such as DEFRA.</p> <p>MoV: Draft MoU, SFAWG minutes.</p> <p>Year 3 Actions:</p> <p>4. Finalise, agree and sign MoU for inclusion in the FMP.</p> <p>MoV: Updated FMP.</p> <p>Year 4 Actions:</p> <p>5. Monitor activities of the management bodies to ensure their roles and responsibilities are not conflicted or inconsistent.</p> <p>MoV: SFAWG minutes.</p> <p>Responsible David Guy, EIFCA, SPO, SFAWG</p>
Consultation on condition	<p>A Memorandum of Understanding has been formed between EIFCA and the Shrimp Producers Organisation Limited offering support for the actions specified above in the Client Action Plan. LR have received a copy of this as well as email confirmation from EIFCA.</p>

Condition 7: Decision-making Processes

Performance Indicator	3.2.2a: There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.
PI Score	75
Rationale	<p>The Shrimp Producers Organisation Ltd have been instrumental in commissioning a stock assessment and work to consult upon, develop and implement a management plan. This has enabled the fishery to enter the MSC assessment process. Looking ahead it is notable that the Eastern IFCA are also now proposing to introduce additional management controls in the Wash Brown Shrimp Fishery, including mechanisms to control access and constrain catches in response to changes in stock status, in order to demonstrate maximum sustainable yield.</p> <p>There are therefore 2 potential decision-making processes which are fundamental to the fishery-specific decisions in this fishery; the IFCA process and the SFAWG process.</p>
Condition	Ensure decision-making processes that result in measures and strategies to achieve the fishery objective are clearly established.
Milestones	<p>Year 1: Review the relationship between the IFCA decision-making process for the shrimp fishery (as illustrated by the Shrimp byelaw drafting process and in particular the future application of the flexible conditions which are contained in the draft byelaw) and SFAWG decision-making process (as illustrated by the conditions contained in the Wash Brown Shrimp Management Plan). (score 75).</p> <p>Year 2: Propose a decision-making process which either establishes a single decision-making process or details how the parallel decision-making process will work together effectively (score 75).</p> <p>Year 3: Consult upon the proposed revised decision-making process and put supporting documentation in place. (score 75).</p> <p>Year 4: Ensure the decision-making process for the Wash Brown Shrimp is fully established. (score 80).</p>
Client action plan	<p>By the end of year 4 the decision making process will be clearly defined in the updated FMP and demonstrably established through SFAWG and EIFCA reports.</p> <p>The decision making process could, along with other areas of responsibility, be addressed in the MoU and if this deemed appropriate, actions in this condition will align with Condition 6.</p> <p>Year 1 Actions:</p> <ol style="list-style-type: none"> 1. A consultant will review regular and irregular decisions that have and will be made, and which bodies are responsible. <p>MoV: Brief report on current decision making practices (including roles and responsibilities).</p> <p>Year 2 Actions:</p> <ol style="list-style-type: none"> 2. SFAWG will discuss with management bodies how different decisions will be made in future and resulting management actions promulgated and agree the decision making process within other roles and responsibilities. <p>MoV: Draft MoU, SFAWG minutes.</p> <p>Year 3 Actions:</p> <ol style="list-style-type: none"> 3. SFAWG will update the FMP with agreed decision making processes, including the processes in the MoU if necessary. <p>MoV: Updated FMP.</p>

	<p>Year 4 Actions:</p> <p>4. SFAWG will establish the decision making process and monitor its effectiveness.</p> <p>MoV: SFAWG minutes.</p> <p>Responsible David Guy, EIFCA, SPO, SFAWG</p>
Consultation on condition	<p>A Memorandum of Understanding has been formed between EIFCA and the Shrimp Producers Organisation Limited offering support for the actions specified above in the Client Action Plan. LR have received a copy of this as well as email confirmation from EIFCA.</p>

Condition 8: Monitoring & Evaluation

Performance Indicator	3.2.4b: The fishery-specific management system is subject to regular internal and occasional external review.
PI Score	70
Rationale	The Wash Brown Shrimp Management Plan is time limited with the current version due to expire in 2020. It is assumed that at the end of this time period a review will be undertaken however it is not specified that this will be the case, or detailed how this will be undertaken. The draft shrimp byelaw does commit to a review (albeit the 6 year timeframe is greater than the MSC definition of 'regular') but does not give consideration to external review. It is expected that a fishery specific review should be undertaken during the timeframe of the certificate and future reviews (including external) should be planned for.
Condition	Ensure the fishery-specific management system is subject to regular internal and occasional external review.
Milestones	<p>Year 1: Plan for a review of the fishery specific management system. This should include consideration of the frequency of external review (score 70).</p> <p>Year 2: Ensure resources in place to enable review and plan for future reviews (score 70)</p> <p>Year 3: Commence the process of review (score 70).</p> <p>Year 4: Complete the process of review of the fishery specific management system. (score 80).</p>
Client action plan	<p>Given the size and scale of the fishery, a regular external review would need to be conducted alongside other activities and would not be commissioned separately.</p> <p>Year 1 Actions:</p> <ol style="list-style-type: none"> 1. SFAWG will develop ToRs for the review based on the FMP, but including other parts of the management system as considered necessary while taking into account the scale of the fishery. 2. SFAWG will add relevant ToRs to stock assessment review based on expertise of those reviewers (see Condition 2). It is expected that stock assessment experts would be able to review the harvest strategy even if not the entire management plan. <p>MoV: Draft ToRs for the review</p> <p>Year 2 Actions:</p> <ol style="list-style-type: none"> 3. Based on the ToRs, SFAWG will decide on alternative review approaches (e.g. commission external reviewers, a fishery advisory body or DEFRA fishery manager) and identify resources available to carry out the review. 4. A consultant will be commissioned to prepare any additional materials (e.g. reports, descriptions of management procedures etc.) if necessary. 5. SFAWG will identify potential reviewers (required skills) for the management plan. <p>MoV: Review plan including ToRs and respective reviewers, approved by SFAWG</p> <p>Year 3 Actions:</p> <ol style="list-style-type: none"> 6. Conduct the review of the current management system including the changes from Conditions 1-7. The review may require a site visit and meetings (such as with the SFAWG) as appropriate. The review report

	<p>will include findings, conclusions and recommendations based on the ToRs.</p> <p>MoV: Management Review Report, Stock Assessment Review Report</p> <p>Year 4 Actions:</p> <ol style="list-style-type: none"> 7. SFAWG and EIFCA will consider the findings, conclusions and recommendations of the external review, and consider future reviews. 8. SFAWG will develop an action plan, if necessary, to respond to the review recommendations, including a recommendation for the next review. <p>MoV: SFAWG minutes.</p> <p>Responsible David Guy, EIFCA, SPO, SFAWG</p>
Consultation on condition	<p>A Memorandum of Understanding has been formed between EIFCA and the Shrimp Producers Organisation Limited offering support for the actions specified above in the Client Action Plan. LR have received a copy of this as well as email confirmation from EIFCA.</p>

Appendix 2 Peer Review Reports

Peer Review A

General Comments:

Question	Yes/No	Peer Reviewer Justification (as given at initial Peer Review stage). Peer Reviewers should provide brief explanations for their 'Yes' or 'No' answers in this table, summarising the detailed comments made in the PI and RBF tables.	CAB Response to Peer Reviewer's comments (as included in the Public Comment Draft Report - PCDR)
Is the scoring of the fishery consistent with the MSC standard, and clearly based on the evidence presented in the assessment report?	Yes	Principle 1. For the assessment and evaluation of the stock status the CB refers to ICES and a key problem is its rapidly changing nature due to the short life span. I agree with the CB arguments for not classifying this Crangon stock as an LTL species. Principle 2 The CB has described all the relevant ecosystem aspects of this fishery. I agree with the CBs assessment of the available data. Principle 3 The EU regulations and the various levels of national regulations with sometimes parallel management efforts contribute to the complexity of the management of this fishery. I agree with the CBs conclusions and their scoring.	No comment required
Are the condition(s) raised appropriately written to achieve the SG80 outcome within the specified timeframe? [Reference: FCP v2.1, 7.18.1 and sub-clauses]	No	The conditions set by the CB are all appropriately written and should be fulfilled without problems, except for 2.3.3 condition 4 where even when it is fulfilled may not improve the data sufficiently to the SG80 mark.	See response to 2.3.3.
Is the client action plan clear and sufficient to close the conditions raised? [Reference FCR v2.0, 7.11.2-7.11.3 and sub-clauses]	Yes	The client action plan indicates a clear understanding of what is required for each condition. Work has already begun on most of the areas, so there should be no major obstacle to closing them in the timeframe.	No comment required

Enhanced fisheries only: Does the report clearly evaluate any additional impacts that might arise from enhancement activities?		NA	
Optional: General Comments on the Peer Review Draft Report (including comments on the adequacy of the background information if necessary)	N/A	pg 1. typo 'foor'. No data has been added to 3.3.1 TAC and Catch Data. Pg 17. typo 'North or the Wash' pg32 typo ' half lunar moth', pg 34 typo' provided a more pessimistic of stock status', pg 35. 'casing sediments', pg 36. 'Marina balthica and marina arenaria' should be; gaper clam Mya arenaria, and Baltic tellin Macoma balthica. pg 42 'Section 0', Reference errors on pages; 46,50,55,57,67,70,71. pg 53 'which run in 2016', pg 75 Brexit box ' which at apply at a UK level', pg 77 'That, that', pg 80 ' to find, to find' .	All comments addressed.

PI Comments:

PI	PI Information	PI Scoring	PI Condition	Peer Reviewer Justification (as given at initial Peer Review stage)	CAB Response to Peer Reviewer's comments (as included in the Public Comment Draft Report - PCDR)	CAB Response Code
1.1.1	Yes	Yes	NA	scoring agreed	No comment required.	
1.1.2	Yes	Yes	NA	scoring agreed	No comment required.	
1.2.1	Yes	Yes	NA	scoring agreed	No comment required.	
1.2.2	Yes	Yes	Yes	scoring agreed	No comment required.	
1.2.3	Yes	Yes	NA	scoring agreed	No comment required.	
1.2.4	Yes	Yes	Yes	scoring agreed	No comment required.	
2.1.1	Yes	Yes	NA	Scoring agreed. However there seems to be an error under European seabass Dicentrarchus labrax SG100 is met, The text states that the 'bycatch of cod is small (0.02%)'.	Thanks, that was a typo	Accepted (no score change)

2.1.2	Yes	Yes	NA	scoring agreed.	No comment required.	
2.1.3	Yes	Yes	NA	scoring agreed	No comment required.	
2.2.1	Yes	Yes	NA	scoring agreed	No comment required.	
2.2.2	Yes	Yes	NA	scoring agreed. typo 'length o not have a sieve net'	Thanks, sorted.	Accepted (no score change)
2.2.3	Yes	Yes	NA	scoring agreed	No comment required.	
2.3.1	Yes	Yes	NA	scoring agreed	No comment required.	
2.3.2	Yes	Yes	Yes	scoring agreed	No comment required.	

2.3.3	Yes	Yes	No	The condition will improve the performance somewhat but the occurrence of several of the ETP species will be so low that the reliability of the subsequent time series as indicators will be uncertain.	Noted. However, it is also possible that the approach proposed in the client action plan may be sufficient to achieve the SG80 within the required timeline. The quality of the data collection activities required under the condition will be reviewed during annual audit and if these are insufficient, this would be clearly identified and would need to be addressed (at the very least) before recertification.	Not accepted (no score change)
2.4.1	Yes	Yes	NA	scoring agreed	No comment required.	
2.4.2	Yes	Yes	Yes	Scoring agreed. Incomplete reference in SI (a) ...non-biogenic habitats and Sabellaria reefs (AB.	Thanks, sorted.	Accepted (no score change)
2.4.3	Yes	Yes	NA	scoring agreed	No comment required.	
2.5.1	Yes	Yes	NA	scoring agreed	No comment required.	
2.5.2	Yes	Yes	NA	scoring agreed	No comment required.	

2.5.3	Yes	No (non-material score reduction expected)	NA	SI (e) Are ETP species considered as part of the bycatch in the Eastern IFCA risk assessment of the fishery, if not then SG 100 not met	Noted and addressed. Thanks.	Accepted (non-material score reduction)
3.1.1	Yes	Yes	NA	Scoring agreed	No comment required.	
3.1.2	Yes	Yes	Yes	Scoring agreed. SI (b) sentence unclear 'Finally, at the EU level there are regular consultations on key pieces of legislation, such as reform of the CFP of even on the annual fisheries opportunities legislation.'	Changed an "of to an "and" so it now reads better. Also added links to the 2 consultations referred to in the sentence.	Accepted (no score change)
3.1.3	Yes	Yes	NA	scoring agreed	No comment required.	
3.2.1	Yes	Yes	NA	scoring agreed	No comment required.	
3.2.2	yes	No (no score change expected)	Yes	SI (b) Justification doesn't clearly state why it doesn't meet 100.	The "all" requirement at SG100 is a high bar. Given the deficiencies identified in the decision-making process it cannot be concluded that the "all" bar is met. A sentence has been added to explain this.	Accepted (no score change)

3.2.3	Yes	No (no score change expected)	NA	SI (b) Is there any evidence to demonstrate that sanctions are consistently applied or provide an effective deterrent with respect to the implementation of the management plan requirements, apart from the pers. Comms. Such as the number of penalties applied in recent years?	A record of penalties in recent years does not provide an evidence of <i>consistency</i> of application. The pers. comms. of key enforcement personnel provide robust audit evidence in relation to compliance and enforcement. A further sentence has been added in relation to the level of understanding of fishers of probable penalties and consistent application.	Accepted (no score change)
3.2.4	Yes	Yes	Yes	Scoring agreed	No comment required.	

RBF Comments

PI	RBF Scoring	RBF Information	Peer Reviewer Justification (as given at initial Peer Review stage)	CAB Response to Peer Reviewer's comments (as included in the Public Comment Draft Report - PCDR)	CAB Response Code
2.2.1 (RBF)	Yes	Yes	scoring agreed	No comment required.	

Peer Reviewer B

General Comments

Question	Yes/No	Peer Reviewer Justification (as given at initial Peer Review stage). Peer Reviewers should provide brief explanations for their 'Yes' or 'No' answers in this table, summarising the detailed comments made in the PI and RBF tables.	CAB Response to Peer Reviewer's comments (as included in the Public Comment Draft Report - PCDR)
Is the scoring of the fishery consistent with the MSC standard, and clearly based on the evidence presented in the assessment report?	Yes	Scoring appears to be fully in line with MSC standards, and decisions are backed by evidence contained in the body of the report and references contained therein.	No comment required
Are the condition(s) raised appropriately written to achieve the SG80 outcome within the specified timeframe? [Reference: FCP v2.1, 7.18.1 and sub-clauses]	Yes	The conditions are appropriately written to be achievable within the specified time frame. Many of the areas in which the scoring has fallen down seems to be simply a reflection of the fact that the harvest control rule is newly agreed and therefore hasn't had time for implementation and review to occur, or that data sets are currently too short to have a high confidence in their interpretation. I am sure that with the passage of time this issue will resolve itself.	No comment required
Is the client action plan clear and sufficient to close the conditions raised? [Reference FCR v2.0, 7.11.2-7.11.3 and sub-clauses]	Yes	The responses in the client action plan lay out a clear roadmap to deliver actions against each of the conditions, including identifying key steps in the timeline, and assigning responsibility for delivering these to named persons and organisations.	No comment required
Enhanced fisheries only: Does the report clearly evaluate any additional impacts that might arise from enhancement activities?		NA	No comment required

Optional: General Comments on the Peer Review Draft Report (including comments on the adequacy of the background information if necessary)	N/A	The report is well written and clearly understandable. My only general comment is that it has suffered a little from the passage of time since its inception. ICES have produced new advice for many of the primary and secondary bycatch species. The only one which I think might have an impact on scoring is whiting, which has fallen below MSY Btrigger. However, table 3.6.1 could do with checking over and updating of references and links in general. I think the recommendations from the assessment team are a highly valuable additional contribution, and the importance of collecting information on quantities of discarded shrimp, even if just to demonstrate that they are minimal, needs to be emphasised.	References to the most recent ICES stock assessments have been updated, which has resulted in a score change (for whiting), but this has not changed the overall outcome or conditions.
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PI Comments

PI	PI Information	PI Scoring	PI Condition	Peer Reviewer Justification (as given at initial Peer Review stage)	CAB Response to Peer Reviewer's comments (as included in the Public Comment Draft Report - PCDR)	CAB Response Code
1.1.1	Yes	Yes	NA	If I understand figures 3.5.7 and 3.5.8 correctly, the current configuration of the assessment model does indeed show a very high probability that the stock is well clear of the PRI. My only concern with the sentence "Mortality of discarded shrimps was considered to be negligible, so that landings are considered to be equivalent to catch". I can't find any information in the report on the quantities of non-marketable Crangon which are discarded. Lancaster & Frid put survival rates of 91%, so 9% do not survive. Without some information on the quantities of discards, I'm unable to judge whether catch being equal to landings was a reasonable assumption to make in the assessment, and consequently, are the results over-optimistic in the picture they give of stock status. This links to the recommendation made by the assessment team in relation to PI 1.2.3b, regarding data collection	The peer reviewer makes a good point that there is no information on the level of discards, and notwithstanding the high survival rate of discarded Crangon, the assumption in the stock assessment that landings are equivalent to catch may underestimate the overall fishing mortality. On that basis we have re-evaluated the two scoring issues for this PI. The current estimate of stock biomass is approximately 4 x the LRP, and even with some additional uncertainty around that stock estimate, we still consider that there is a high degree of certainty that the stock is above the PRI. For scoring issue b, the potential underestimate of fishing mortality provides additional uncertainty about the status of the stock in relation to MSY. As stock biomass is estimated to be approximately twice the value of the TRP (a proxy for MSY), and even with some additional uncertainty around that stock estimate, it still seems reasonable to conclude that the stock is at or fluctuating around MSY. However the uncertainty around the level of discarding and the discard mortality rate reinforces the assessment team's conclusion that the SG100 is not met. The rationales for this PI have been revised, and some clarifying comments added to section 3.5.4. As noted by the peer reviewer, the assessment team also raised a recommendation under PI 1.2.3 to collect information on discard rates in the fishery.	Accepted (no score change)
1.1.2	Yes	Yes	NA	Scoring agreed.	No comment required	

1.2.1	Yes	Yes	NA	Scoring agreed.	No comment required	
1.2.2	Yes	Yes	Yes	I took several goes to understand PI 1.2.2a, so I can see how it might be difficult for stakeholders. I think the penultimate sentence doesn't quite work as it is currently phrased. The condition looks to be appropriate to the problem though.	The rationale in PI 1.2.2a notes the lack of clarity in the Management Plan about how the annual HCR index will be calculated from the catch and effort data, and whether the trigger reference point will have a fixed value or will be estimated through an annual stock assessment. The rationale has been revised to hopefully clarify why the assessment team concluded that the SG80 was not met.	Accepted (no score change)
1.2.3	Yes	Yes	NA	I strongly concur with the recommendation of the assessment team that collection of information on the proportion of non-commercial sized shrimps that are discarded following riddling of the catch to provide an estimate of discard mortality that is specific to The Wash fishery would make a positive contribution to ongoing efforts to ensure the long-term sustainability of the fishery	No comment required	Accepted (no score change)
1.2.4	Yes	Yes	Yes	Scoring agreed.	No comment required	
2.1.1	No (no score change expected)	No (non-material score reduction expected)	NA	Just to note that since this report was prepared ICES has published new advice on whiting. SSB is now (just) below MSY Btrigger. Table 3.6.1 could be updated to reflect this. http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/whg.27.47d.pdf	Thank you. The text has been edited to include the latest ICES advice. This resulted in whiting scoring SG80 but not SG100, and the overall score for this PI slightly reduced.	Accepted (non-material score reduction)
2.1.2	Yes	Yes	NA	Scoring agreed.	No comment required	
2.1.3	Yes	Yes	NA	Scoring agreed.	No comment required	

2.2.1	Yes	Yes	NA	Scoring agreed.	No comment required	
2.2.2	Yes	Yes	NA	Scoring agreed.	No comment required	
2.2.3	Yes	Yes	NA	Scoring agreed.	No comment required	
2.3.1	Yes	Yes	NA	Scoring agreed.	No comment required	
2.3.2	Yes	Yes	Yes	Scoring agreed. The creation of a database of ETP interactions and linking this to management measures would be an interesting and worthwhile exercise in its own right.	No comment required	
2.3.3	Yes	Yes	Yes	Scoring agreed. See above.	No comment required	
2.4.1	Yes	Yes	NA	Scoring agreed.	No comment required	
2.4.2	No (score increase expected)	No (score increase expected)	Yes	I don't know it is enough to help here, but aggregated VMS data products are available from the ICES website at metier level (i.e.. in this case, TBB_CRU), which could be informative here. Obviously this only includes vessels >12m. It would be useful to see a table, or even just a few sentences in the report breaking the fleet down by length category, to support the assertion that the available data is insufficient. Otherwise, the scoring for this PI is appropriate and the implementation of the measures specified under the condition would be helpful.	Most vessels in this fishery are smaller, hence inshore VMS will be introduced by the EIFCA as part of the habitat management strategy. Some fleet size composition data has been added in Section 3.4.2	Accepted (no score change)
2.4.3	Yes	Yes	NA	Scoring agreed.	No comment required	
2.5.1	Yes	Yes	NA	Scoring agreed.	No comment required	

2.5.2	Yes	Yes	NA	Scoring agreed.	No comment required	
2.5.3	Yes	Yes	NA	Scoring agreed.	No comment required	
3.1.1	Yes	Yes	NA	Scoring agreed.	No comment required	
3.1.2	Yes	Yes	Yes	Scoring agreed.	No comment required	
3.1.3	Yes	Yes	NA	Scoring agreed.	No comment required	
3.2.1	Yes	Yes	NA	Scoring agreed.	No comment required	
3.2.2	Yes	Yes	Yes	Scoring agreed.	No comment required	
3.2.3	Yes	Yes	NA	Scoring agreed.	No comment required	
3.2.4	Yes	Yes	Yes	Scoring agreed.	No comment required	

RBF Comments

PI	RBF Scoring	RBF Information	Peer Reviewer Justification (as given at initial Peer Review stage)	CAB Response to Peer Reviewer's comments (as included in the Public Comment Draft Report - PCDR)	CAB Response Code
2.2.1 (RBF)	Yes	Yes	Scoring agreed.	No comment required	

Appendix 3 Stakeholder submissions

Initial Assessment

No written submissions were made by stakeholder as part of the assessment process. A summary of subjects discussed with stakeholders is summarised in table 2. Where verbal submissions contributed material outcomes of the scoring process these are specifically referred to as *pers. comm.* in the scoring tables in Appendix 1.1.

Following Public Comment Draft Report

MSC Technical Oversight

SubID	Page Ref	Grade	Requirement Version	Oversight Description	PI	CAB Comment
29461	109	Minor	FCR-7.10.6.1 v2.0	PI 1.2.2 SI c. Reference to the current exploitation in the fishery as evidence to support that the tools used or available to implement HCRs are appropriate and effective has not been provided per SA2.5.6 and 2.5.7.	1.2.2,	Reference to the current exploitation rate as estimated for the fishery by Medley has been added to the rationale for scoring issue c.
29474	183	Major	FCR-7.10.6.1 v2.0	PI 2.2.1 PSA Table 1.2.2.a. The rationale for the scoring of areal overlap describes an overlap of >30%, however the rationale goes on to describe the overlap of the fishery with the overall distribution of the species, as low. It is not clear which score should be assigned here and it is also not clear what evidence is being presented to support a score of low risk if that is what is being assigned for this attribute.	2.2.1,	Thank you for noticing, this is a typo, it should have been <10% and has been amended.
29475	183	Minor	FCR-7.10.6.1 v2.0	PI 2.2.1 PSA Table 1.2.2.a. From the rationale provided for the scoring of encounterability, it is not clear what evidence is being used to support the high risk score of 3.	2.2.1,	It is in the nature of the fishery, the gear and location, and natural habitat of gobies, that there is a high risk of encounterability. Extra text added to further clarify.

29476	183	Major	PF 4.4.8.3 v2.0	PI 2.2.1 PSA Table 1.2.2.a. It is not clear from the rationale provided for the scoring of the selectivity attribute that both a. and b. have been scored and what evidence is being used to support the scores awarded.	2.2.1,	b) has been added. The MSC RBF worksheet does not appear to use separate a) and b) in the calculation
29477	183	Major	FCR-7.10.6.1 v2.0	PI 2.2.1 PSA Table 1.2.2.a. From the rationale provided in the RBF scoring table to score post capture mortality, it is not clear what evidence is being used to support the score.	2.2.1,	Thank you - text has been added to clarify.
29478	90, 131, 132	Major	PF 5.3.2.1 v2.0	PI 2.2.1 SI a and b. It is not clear from the rationales provided and missing RBF worksheet whether the assessment team have elected to score 'main' species only using the PSA for PI 2.2.1, and whether scoring should therefore follow the requirement to cap the PI score at 80 as per PF 5.3.2.1.	2.2.1,	Text has been added to further explain what has been scored. Minor species were also scored as required in 2.2.1SIb. According to PF5.3.2.1 we scored main using PSA under SIa) ; SIb deals with minor species only and this has been scored. The final PI score is 80.
29479	131, 182, 183	Minor	FCR-7.10.6.1 v2.0	PI 2.2.1 PSA Gobiidae. As the team have elected to score Gobiidae as a group rather than individual species, it is not clear what approach has been taken to ensure that the assessment of the group of species is aligned with requirements as listed under PF 4.1.5.	2.2.1,	Gobies are extremely difficult to identify to species level, especially juveniles. The Observer report states 4 separate entries under goby: Gobies (twice) Sandy goby, Sandy gobies, thus the same genus is listed 4 times with associated catch record. The team therefore grouped these 4 entries into one Genus and treated this as 'main' (meeting PF 4.1.5a). We completed the productivity part for all species (bi) and as reported in Section 3.6.3 stakeholders were consulted regarding gobies (bii). Spreadsheet has now been included to improve clarity over the approach.
29480	N/A	Guidance	PF 4.1.1.1 v2.0	The RBF worksheet has not been included in the report.	2.2.1,	It has been added into Appendix 1.2.

29485	180	Major	FCR-7.10.6.2 v2.0	PI 3.2.3 SI b. Whilst the rationale makes reference to sanctions being 'consistently applied' and 'thought to provide effective deterrence' consistent with a score of SG80, the rationale states that the SG100 is met however the scoring under the scoring guideposts reflects a score of SG80, therefore it is not clear which score has been awarded.	3.2.3,	Corrected. SG80 met, but not SG100. No score change required.
29486	180	Major	FCR-7.10.6.2 v2.0	PI 3.2.3 SI c. It is not clear from the rationale which score has been awarded for this SI. The rationale states that SG80 is not met and yet the scoring under the scoring guideposts indicates that SG80 is met. The rationale also does not clearly consider whether 'fishers cooperate where necessary, with management authorities in the collection of catch, discard and other information that is of importance to the effective management of the resources and the fishery' as specified under SA4.9.1.	3.2.3,	Typo corrected. Further reference to Eastern IFCA <i>pers comms</i> to fishers cooperation with wider management requirements. No score change required.
29487	176	Minor	FCR-7.10.6.1 v2.0	PI 3.2.2 SI b. Whilst the rationale states that serious and other important issues are addressed by the fishery management system, it is not clear from the rationale to what extent this is done in a 'transparent and timely' manner.	3.2.2,	Reference to 'timely' added. Also now linked to transparency which is scored in SId. No score change.
29488	89	Guidance	FCR_7.12.2.1 v2.0	Please provide the list, or a link to the list, of vessels which are signatories to the Wash Brown Shrimp Management Plan.		Thank you – we have added this into Section 5.3.

Eastern IFCA

General Comments

General comments	Evidence or references	CAB response to stakeholder input	CAB Response Code
Feedback from Eastern IFCA on the PCDR is provided in this document, in conjunction with input to the certification process through ongoing engagement by Eastern IFCA with the Shrimp Fishery Advisory Working Group and the CAB.		Noted	n/a
Eastern IFCA is supportive of the certification of the fishery but highlights below points requiring clarification.		Responses noted below. By way of context the intention of report section 3 is to provide a summary of key aspects of the fishery under certification. As such, the content of section 3 does not explicitly relate to scoring, unless referred to explicitly in the assessment tree. It is not a scientific report and does not report on any primary research or analysis. Instead it presents a summary of the information which was available to the auditors. If some of the responses below to comments in relation to report section 3 are brief, it is in this context.	n/a
Section 3.3 seems to be missing from current version of report. Previous version stated: Section 3.3: The final Unit of Certification for this fishery is as defined below. The only minor additions are to add clarification, for example to limit the ICES statistical rectangles and to clarify that it is the gear, as described in the Wash Brown Shrimp Management Plan (as opposed to any beam trawl). EIFCA comment: This clarification is important because in order to meet requirements of the fishery operating within the Wash & North Norfolk Coast Special Area of Conservation, only the gear described in the Management Plan may be used (in order to align with Eastern IFCA's agreed mitigation following the brown shrimp fishery Habitats Regulations Assessment).	Eastern IFCA shrimp HRA	Section 3.3. is the final UoC which is the result of the certification process and will be added at the time of the Public Certification Report. These clarifications are already stated in the proposed UoC (section 3.2) (the table is split across 2 pages so this may have been missed).	n/a
Section 3.4.2 - Use of 70mm mesh veil - compulsory on vessels over 8m. EIFCA comment: should be "compulsory on vessels with ≥8m aggregate beam width".	EU Council Regulation 850/98 (replaced by new regs?)	Added "compulsory on vessels with ≥8m aggregate beam width".	Accepted (no score change)
Section 3.4.2 - EIFCA comment: must incorporate HRA mitigation conditions, e.g. no tickler chain.	Eastern IFCA shrimp HRA	Have noted, as per the HRA, that the shrimp gear configuration does not include chain mats or tickler chains. The MSC assessment is based on the restrictions on gear configurations which are	Accepted (no score change)

		currently binding in regulation, or included within the shrimp management plan.	
Section 3.4.2 - EIFCA comment: It should be noted that although veil nets are effective at reducing capture of larger bycatch fish species, they are not 100% effective.		The word 'avoid' has been replaced with 'reduce' to convey this point.	Accepted (no score change)
Section 3.4.2 - The larger vessels, which contribute the majority of the catch have typically invested in effective on-board sieving mechanisms which are more automated and effectively return overboard any small bycatch species and non-commercial sized shrimps. EIFCA comment - the sieving mechanisms are not 100% effective: many small fish, especially juvenile flatfish, are still retained.		Reworded to show that these improve the efficiency of the process, rather than making a statement about absolute effectiveness.	Accepted (no score change)
Figure 3.4-4 Total of number of tows of the shrimp beam trawl fishery. Data derived from logbook returns. Source: Quinn (2018). EIFCA comment: these figures were provided by Eastern IFCA and should be accompanied by the caveat that they show aggregated data returned by fishermen but do not include all shrimp fishing activity because of incomplete compliance with requirement to provide data.		Have added: Aggregated data from logbook returns. Data are indicative not comprehensive.	Accepted (no score change)
Section 3.5.1 Bottom-up factors such as habitat limitation have been cited as the main population driver (e.g. Kuipers and Dapper, 1981) as preliminary analyses suggest only very weak relationships between stock biomass and future recruitment. EIFCA comment: evidence or reference for the preliminary analyses referred to here?		The ICES Report of the Workshop on the Necessity for Crangon and Cephalopod Management (2013) discusses the problems with investigating a stock-recruitment relationship for Crangon fisheries primarily because a suitable recruitment index has not been developed. The reference to this document has been added to the text.	Accepted (no score change)
Section 3.5.1 Small fish predators such as goby, (<i>Pomatoschistus microps</i>), common seasnail (<i>Liparis liparis</i>) and the armed or hook-nosed bullhead (<i>Agonus cataphractus</i>), feed exclusively on small shrimp with the majority of their prey between 10 and 30 mm in length (Redant, 1978; Jansen, 2002). EIFCA comment - these fish all feed on a variety of species, not exclusively on shrimp.		The assessment team were trying to emphasise that these predators feed exclusively on smaller rather than larger shrimp, and not that shrimp were the only prey for these predators. The text has been amended for clarification.	Accepted (no score change)
Section 3.5.1 As the fishery targets shrimps greater than 50 mm in length, there is little competition for shrimp between natural predators and the fishery, with mortality from the fishery following sequentially from predation. EIFCA comment: although the fishery targets larger shrimps, small shrimps are caught and landed so there is some competition between natural predators and the fishery.	Processors' records of shrimp size grades	The comment that some shrimps under 50mm are landed is noted and accepted. The text has been revised accordingly in particular from 'little competition' to 'some competition' between natural predators and the fishery.	Accepted (no score change)

Section 3.5.1 - On a more localised geographical scale in, for example, the Wadden Sea or The Wash, the role of Crangon in the ecosystem energy flow is also likely to be very limited. In the eastern North Sea most of the benthic production comes from microbenthic species (Baird et al., 2004). Most predators in the coastal areas also occur in the wider North Sea, but some key smaller predator species such as the goby, (<i>Pomachistus microps</i>), are found only in the shallow coastal areas and may prey intensively on smaller brown shrimps (< 50mm), and so may be more dependent on Crangon as a prey item. Nevertheless even at a localised level, it is highly unlikely that Crangon in The Wash and surrounding areas is a key LTL species in terms of energy flow through trophic levels. EIFCA comment: This seems to be based on assumptions rather than evidence. Although most benthic production comes from microbenthic species, shrimps and gobies bridge the trophic gap between microbenthic and larger fish species. Also, as gobies and similar sized fish will also be bycatch of the shrimp fishery, the impact on the trophic level will not be limited to the removal of shrimp.		Without detailed, quantitative food web studies in The Wash, the evaluation of whether Crangon is a key LTL species in The Wash has to involve some assumptions. Whilst energy does clearly pass through Crangon from lower to higher trophic levels, there are other species such as gobies which also transmit energy through the trophic levels, and the assessment team concluded therefore that the Crangon stock does not meet two of the three criteria set out in SA2.2.9ai-iii. A similar conclusion was reached for the eastern North Sea stock of Crangon for which there have been more detailed studies on Crangon's role within the ecosystem (see ICES, 2013 and Temming <i>et al.</i> , 2013). The evaluation of whether Crangon is a key LTL species is based upon energy flow and life history characteristics and does not consider any potential impacts of the fishery, so the final comment about additional impact of the fishery on the trophic dynamics is not relevant.	Not accepted (no score change)
Section 3.5.1 - Whilst Crangon meets many of these life history criteria, copepods form only part of its diet, it is only very rarely that individuals grow to a size (i.e. over 80 mm) at which they have 10,000 eggs per spawning (Temming et al., 2013), EIFCA comment - is this limit to growth a result of fishing mortality?		Growth to a large size in Crangon is limited by high mortality rates even in the absence of fishing, and this statement from Temming <i>et al.</i> (2013) is based upon growth studies described in Hufnagl <i>et al.</i> (2010) and Hufnagl & Temming (2011).	n/a
Section 3.5.2 - The analysis of Welleman and Daan (2001) has since been updated by Temming and Hufnagl (2014) who concluded that landings of commercial-sized shrimps now exceed the number eaten by predators, primarily due to the decline in predator abundance. EIFCA comment - this only states that the proportion of fished/predated shrimp has changed, and this is a result of the predated figure declining. It does not indicate whether fishing mortality has increased in this time, and if the total mortality is more or less than before.		The critical issue here is that the <u>relative proportion</u> of total mortality explained by natural and fishing mortality has changed since the original analysis by Welleman and Daan (2001), and therefore it may now be necessary to control fishing effort as part of a management strategy.	n/a
Section 3.5.1 cont. - Taken as a whole, this section suggests overfishing is occurring in the Eastern North Sea population. It is a different fishery from The Wash shrimp fishery, but how do intensities compare with the local fishery? Does Medley's model show no over fishing here?		There is evidence from the Eastern North Sea population that <u>growth</u> overfishing may be occurring, and therefore such growth overfishing may be occurring in The Wash fishery. This is referred to in the following text from section 3.5.2 in the report: "Whilst the scientific evidence on the potential of growth over-fishing... relates to the brown shrimp stock in the eastern North Sea, the interpretation of the evidence is highly relevant to the UK fishery in The Wash and the requirement for management of the fishery." Whilst Medley's model describes growth in biomass through recruitment and growth in weight of individual shrimps in the population, and reduction in biomass through natural mortality and	n/a

		catches, it does not explicitly consider growth overfishing. However there is no evidence from the initial fits of Medley's model that recruitment overfishing has occurred.	
Section 3.5.3 - Sieve nets are found to be much more effective in UK waters and vessels must use a sieve (or veil) net of 70mm mesh. EIFCA comment: This only applies to vessels with an aggregate beam width of $\geq 8\text{m}$.		The text has been revised to clarify that this regulation applies only to vessels with an aggregate beam width of $\geq 8\text{m}$.	Accepted (no score change)
Section 3.5.3 - At the time of the site visit, Eastern IFCA were consulting on draft byelaws for the shrimp fishery which included control of fishing effort in response to changes in stock status identified by scientific monitoring , and on prohibiting use of beam trawls in certain areas to protect sensitive habitats. EIFCA comment: EIFCA have passed byelaws for the shrimp fishery which include control of effort (number of shrimp fishing trips over a year) and to prohibit use of beam trawls in certain areas to protect sensitive habitats. These byelaws are at various stages of official scrutiny and will be implemented at point of Defra sign-off.		Noted. The text has been amended to state that as of October 2019, these byelaws have been passed by EIFCA, but have not yet been implemented.	Accepted (no score change)
Section 3.5.3 - Whilst the Management Plan is essentially a voluntary agreement within the shrimp fishing industry, the Management Plan covers all commercial fishing vessels because the two processors will not accept shrimps from vessels that are outside the Management Plan. EIFCA comment - The emergence of a new buyer could affect the accreditation status.		This risk is addressed in the Traceability section. The emergence of a new buyer would indeed be a significant change, the impact of which would be addressed at an annual audit. Or if required, an expedited annual audit.	Accepted (no score change)
Section 3.5.3 - The long-term objectives are to ensure a long-term, sustainable and stable Wash brown shrimp fishery, to support a highly productive stock of brown shrimp and ensure an ecologically responsible fishery that minimises effects on the marine environment. EIFCA comment: measures must also meet the conservation targets of the marine protected area: EIFCA management is designed to do this, so as long as the Management Plan aligns with EIFCA management this is covered.		The comment that 'measures must also meet the conservation targets of the marine protected area' is noted. However our report simply reproduces the long term objectives for the management of the fishery as stated in section 1.3 of The Wash Brown Shrimp Management Plan 2017-2020 (dated 10 January 2017), which does not include any measures in relation to marine protected areas.	Not accepted (no score change)
Section 3.5.3 - Shrimp fishing activity within 6 nm is covered by the Eastern IFCA jurisdiction whereas the Management Plan covers ICES rectangles 33F1, 34F0, 34F1, 35F0, 35F1 and 36F0 including any fishing activity outside the 6nm limit, EIFCA comment - the Management Plan states "The Wash shrimp fishery is within ICES rectangles 33F1, 34F0, 34F1, 35F0, 35F1 and 36F0 inside the six nautical mile limit.		The Client has confirmed that the Management Plan will cover all vessels signed up wherever they fish in the statistical rectangles be that inside or outside the 6 nm limit."	Not accepted (no score change)

Section 3.5.3 - Veil net with maximum mesh size of 70mm mandatory on all vessels over 8m in length (currently only 3 vessels under the 8m length threshold do not use veil nets) EIFCA comment - aggregate beam length $\geq 8m$, not vessel length.		Thank you. Error corrected in text.	Accepted (no score change)
Section 3.5.3 - Harvest strategy - EIFCA comment: We would like clarification on methods suggested to calculate the HCR annual index, what data are being used and how they are collected and analysed to determine the annual index and reference point. How is the expected recruitment distribution calculated - e.g. from models described by Medley? Is the mode the best metric to use? (in single modal populations it tends to sit near the middle, but in bi- or tri-modal populations the mode could sit a good distance from the mean. Would fishing still be allowed - albeit at a reduced intensity - after the trigger level of low shrimp stock had been reached? How is stock biomass to be assessed and what references have been used? Is there a single cohort per year? Does this indicate the adoption of "no fishing" areas as an effective management strategy?		The assessment team agrees that, as currently written, the HCRs require more detail for example in relation to how the annual index is calculated. The assessment team therefore concluded that the HCRs need to be more explicitly defined, which is why we raised the following condition in relation to Performance Indicator 1.2.2: "Ensure that the harvest control rules are well-defined and clearly understood by all stakeholders". The assessment team would recommend that EIFCA engage fully with the Client and the stock assessment expert through the Shrimp Fishery Advisory Working Group Shrimp to ensure that the HCRs are described explicitly and can be clearly understood by all stakeholders.	Accepted (no score change)
Section 3.5.3 cont - The catch is then riddled on board the vessel and the smaller non-commercial-sized shrimp and unwanted bycatch of non-target species are discarded rapidly through a discharge chute. EIFCA comment - this riddling is not 100% effective. Survival of these discarded non-commercial-sized shrimp was estimated at 91% by Lancaster and Frid (2002). What evidence is there for survival of other bycatch species?		Survival of discarded bycatch species is covered in Section 3.6.3 of this report.	n/a
Section 3.5.3 Monitoring and Data Collection - All vessels over 12m in length must be fitted with a Vessel Monitoring System (VMS) which continuously records fishing activity. Whilst this means that information on fishing activity is not comprehensive over the whole fleet, inshore VMS (iVMS) will be introduced to all vessels in 2018, and the Eastern IFCA sightings database should also help to fill any gaps in information on fleet fishing activity. EIFCA comment - inshore VMS is still being developed at time of writing (Oct 2019); it will provide comprehensive information on the location of all commercial fishing vessels.		Noted. As inshore VMS has not yet been implemented, no revision to the current text is required.	Accepted (no score change)
Section 3.5.4 Stock assessment - Evidence/references for statements about recruitment and ICES WGCRAN conclusion?		Section 3.5.4 provides a brief description of the data presented in ICES WGCRAN reports in recent years, and the conclusions drawn by WGCRAN about recruitment patterns in the fishery. As with much of section 3 of this report, the purpose is to provide a general background to the fishery and not to provide a full evaluation of all aspects of the fishery in the form of a scientific paper prepared for publication in a peer-reviewed journal. There will be many instances within section 3 where the text simply provides a	n/a

		description of currently available information and data, and not necessarily a full evaluation of that information or data.	
Figures 3.5-4 and 3.5-6 - request to see data behind these graphs to properly assess. Query whether 3.5-6 is actually calculated as tonnes/HP days at sea rather than kgs/ HP days at sea.		These figures were taken directly from the ICES Crangon Working Group report. The assessment team do not have access to the raw data. Presumably the figures were produced for the ICES WG by Cefas, and therefore the assessment team suggest that EIFCA approach Cefas in relation to obtaining the raw data.	n/a
Section 3.5.4 - New approaches to stock assessment: Recruitment in Crangon is driven more by environmental factors, such as freshwater run-off, than by fishing pressure... EIFCA comment - is there a reference for this?		Siegel <i>et al.</i> (2004) found that shrimp abundance in autumn was correlated with year-to-year changes in physical environmental and biological parameters, winter water temperature, autumn river runoff, the winter NAO index and density of gadoid predators. Unpublished Cefas studies in The Wash determined that environmental factors and gadoid predator abundance had a stronger influence on recruitment in Crangon than the level of exploitation (A. Lawler, Cefas, pers. comm.). Some clarifying text has been added.	Accepted (no score change)
Figure 3.5-7 seems to show that biomass in June is <40% of biomass in November - this contradicts the reported model prediction that during the period from 2012 to the end of 2016 stock status has not been depleted to below 40% of its unexploited biomass (0.4B0) which is used conventionally as a target reference point equivalent to Bmsy		Figure 3.5-7 demonstrates that the model provides a good fit to the seasonal changes in LPUE observed in the fishery and described by Figure 3.5-6. Whilst LPUE is an index of stock biomass, these monthly trends do not take into account growth of individuals within a cohort, and therefore increased total biomass of a cohort, as the season progresses, and may be influenced by catchability of shrimps. In addition, LPUE is not an index of unexploited biomass. Figure 3.5-8 provides output of the model in terms of changes in biomass as a proportion of unexploited biomass, which concludes that stock biomass has not declined below 0.4 of the unexploited biomass from 2012 to 2016. Again, the assessment team recommend that EIFCA liaise with the stock assessment scientist through the Shrimp Fishery Advisory Working Group Shrimp to ensure that the stock assessment model outputs and the HCRs based upon them are described explicitly.	Not accepted (no score change)
Section 3.5.4 - Some precaution should be attached to the current model outputs because the availability of more years data may result in substantial changes in parameter estimates and perceptions of stock status. EIFCA comment: full information is needed in order to draw a conclusion.		Noted. The assessment team are here simply noting that more confidence will be attached to the output of the model when more years of data become available.	Accepted (no score change)

Section 3.6.1 Ecosystem considerations - While brown shrimp is taken in large amounts by these predators and hence represents an important energy source, brown shrimp is neither a preferred nor an optimal prey for the growth of these species. EIFCA comment: reference for this?		ICES 2014	
Section 3.6.2 The sandflats in the embayment of the Wash include extensive fine sands and drying banks of coarse sand, and this diversity of substrates, coupled with variety in degree of exposure, means that there is a high diversity relative to other east coast sites. EIFCA comment - as well as coarse sand there is some muddy sand.		Thank you, edit made.	
Section 4: Traceability: Potential for non-certified gear/s to be used within the fishery. EIFCA comment: Eastern IFCA's shrimp permit byelaw includes requirements for all shrimp fishers to use only gear approved by EIFCA.		Comment added.	
Section 4 - However, given that the only shrimp buyers in the region will only purchase from vessels which are signatory to the management plan, it is highly unlikely that any such shrimp would to enter the MSC chain of custody. EIFCA comment - this is valid so long as there are no other buyers.		Agreed. Any change would be picked up at annual audit.	n/a

PI Specific comments

Performance Indicator (PI)	Input summary	Input detail	Evidence or refs	Suggested score change	CAB response to stakeholder input	CAB response code
1.2.2 - Harvest control rules and tools		There needs to be a clear definition of what "the fishery would close for 7 days in each fortnight period" means in practice.			Agreed. The assessment team concluded that the HCRs need to be more explicitly defined and raised the following condition: "Ensure that the harvest control rules are well-defined and clearly understood by all stakeholders".	Accepted (no score change)

1.2.3 - Information and monitoring	Obtain accurate information on the proportion of non-commercial-sized shrimps that are discarded following riddling of the catch and an estimate of discard mortality that is specific to The Wash fishery	Need to define size of "non-commercial" shrimps - e.g. smaller than "Cs" or smaller than "Ds"			The assessment team recommended that discard rates and mortality of shrimps that pass through the riddle should be estimated. It was assumed that any shrimp that passes through the riddle is below the size that would normally be considered as commercial size. Whether or not non-commercial-sized shrimps are defined as smaller than Grade C or Grade D is not relevant, and any sampling of discarded shrimps would in any case provide information on both quantity and size distribution.	Not accepted (no score change)
2.1.1 - Primary species outcome	Query why bycatch is expressed as a % of catch of shrimps instead of % of population of the bycatch species.	The impact of bycatch of Species X depends on the total population of Species X, which may be completely unrelated to the % of the shrimp catch that Species X makes up. This comment would apply to all parts of the assessment of the impacts of bycatch.			This is a requirement of the MSC standard, e.g. SA 3.4.2.1. Designations of Bycatch species are classified as % of the total catch: >5% = main, <5% = minor.	Not accepted (no score change)
2.1.2 - Primary species management	Sieve nets are only required by vessels with an aggregate beam width ≥8m.	This point applies wherever bycatch is considered in the document.			Thank you for the clarification, we have clarified this in the text.	Accepted (no score change)
2.2.1 - Secondary species outcome		Smelt (<i>Osmerus eperlanus</i>) should be regarded as an ETP species.			Under MSC CR 2.0 smelt does not meet the criteria for ETP. This has been explained in Section 3.6.3 in the Catch Composition section.	Not accepted (no score change)
2.3.2 - ETP species management		Consideration of smelt is required.			Under MSC CR 2.0 smelt does not meet the criteria for ETP. This has been explained in Section 3.6.3 in the Catch Composition section	Not accepted (no score change)
2.4.2 - Habitats management strategy		Furthermore, research has shown that the UoA does not cause serious or			AB ABPmer & Ichthys Marine, 2015 is the in text reference here.	Not accepted

		irreversible harm to existing non-biogenic habitats and Sabellaria reefs EIFCA comment: what reference is used here?				(no score change)
		Inshore VMS is due to be implemented for all commercial fishing vessels as soon as legislation has been agreed (not yet in place at October 2019).			The MSC assessment is based on the status of the fishery at the time of assessment. Future changes such as this would be included as part of the annual audit.	n/a
		Please also see updated text included in Condition 5 in Action plan (note that shrimp returns requirement has had poor compliance but will be enforced with forthcoming new Shrimp Permit byelaw.			This poor compliance was not noted in site visit consultation meetings with either IFCA or MMO. We also note that there were no comments from the IFCA in relation to PI 3.2.3 which relates to compliance and enforcement. MMO specifically stated that there was no systematic non-compliance. There will be a further opportunity to provide evidence of compliance at the annual audit.	N/A
3.1.2 - Consultation, roles and responsibilities		Eastern IFCA shrimp fishery management measures subject to extensive consultation, including engagement with local fishermen and feedback summaries			This comment has been added to the scoring justification.	Accepted (no score change)
3.2.2 - Decision-making processes	There is no formal minimum landing size for shrimp, but a voluntary ban on landing small shrimps ("Ds")				Changed to "limits of the catch of small shrimp, within the shrimp management plan".	Accepted (no score change)

Condition 5	Habitats Management	Lack of VMS data for the Wash fleet: the introduction of inshore VMS is anticipated as soon as legislation has been agreed. Prior to this, the need to gather spatial data on fishing activity will be met through Eastern IFCA's shrimp returns process and co-operation with the Processors.			Thanks for the update, this will also be addressed at future audits, and the score amended according to the milestones where appropriate.	N/A
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Natural England

General Comments

General comments	Evidence or references	CAB response to stakeholder input	CAB Response Code
Description of fishery notes that stock is UK east coast from and including Humber and Thames, but Geographical area only lists some of ICES rectangles within this area- ICES rectangles south of Ipswich are not identified. Due to these discrepancies, it is unclear the exact geographic area the UoA covers.	Section 3.1 of draft report, http://gis.ices.dk/sf/index.html?widget=StatRec	UoA is defined by a) The target stocks b) The fishing method c) The fishing fleets or groups of vessels or individual fishing operators pursuing that stock including entities initially intended to be covered by the certificate. (FCP V2.1 7.5.3) The entire stock of East coast shrimp is considered by the assessment; the geographical area is just used to indicate the specific locations being fished and does not form part of the UoA beyond defining what should be considered (e.g. which habitats the fishery will interact with). The ICES rectangles provide a more precise description of the actual location of the fishery.	Accepted (no score change)
Eastern IFCA have conducted significant and impressive work to develop management measures for the shrimp fishery to ensure it does not have a detrimental effect on the habitats and species of The Wash and approaches. These measures are currently going through the approval process, and so are not yet in place. Natural England is supportive of the MSC accreditation, but recommend that it is contingent on these measures being implemented.		The assessment team thank NE for speaking with us at the site visit in June 2018 and for providing helpful comments at the time. It appeared from the interview that NE is 'comfortable with the fishery' and have an advisory role in the management of the fishery. It was stated that the Wash SAC was of most relevance to the shrimp fishery, and although there are issues regarding the intertidal and subtidal sediments, there is good scope for recovery; The team was told that regarding the Wash SPA NE had no concerns of the shrimp fishery having an effect on the birds themselves. It appears to the assessment team that NE has become even more engaged in the process since that site visit, which is helpful. Annual audits evaluate new information both on stock/s, ecological	Not accepted (no score change)

		components and management changes, and see if these cause a material change. The justification in the report indicates why the fishery as is meets the MSC standard – we have included a number of conditions for the fishery which are binding, and will see the fishery improve over time. Active engagement by stakeholders in the sustainable management is important and this kind of cooperation and feedback has grown in other fisheries, for example the Barents Sea, as part of the MSC certification process and is a very positive long-term outcome.	
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PI Specific Comments

Performance Indicator (PI)	Input summary	Input detail	Evidence or references	CAB response to stakeholder input	CAB response code
2.1.1 - Primary species outcome	Query why bycatch is expressed as a % of catch of shrimps instead of % of population of the bycatch species.			This is a requirement of the MSC standard, eg SA 3.4.2.1	Not accepted (no score change)
			Smelt (<i>Osmerus eperlanus</i>) should be regarded as an ETP species.	A rationale was provided in Section 3.6.3 header: Catch composition as to why smelt is not an ETP species, using MSC criteria.	Not accepted (no score change)
2.2.1 - Secondary species outcome	Available evidence on bycatch studies within the area have not been considered	Draft report only references one unpublished study on bycatch within the fishery. Additional studies on bycatch of North Sea brown shrimp fishery are available. Consideration of a greater number of bycatch studies would make this section more robust, and may alter the Secondary main species that may need to be considered.	e.g. Catchpole, T. L. et al.. 2008. Evaluating the efficacy of technical measures: a case study of selection device legislation in the UK Crangon crangon (brown shrimp) fishery. ICES Journal of Marine Science, 65: 267–275.	This PI deals with Outcome, as reported in the Observer reports, using the actual catch composition. The point raised by NE would then be addressed under management. Thank you for the references. I have added these into the introductory part of Section 3.6.3. And have added Catchpole et al 2008 to the	Accepted (no score change)

			<p>Steenbergen, J. et al. . 2015. Discards Sampling of the Dutch and German Brown Shrimp Fisheries in 2009 – 2012. Stichting DLO Centre for Fisheries Research (CVO). Cvo REPORT 15.003- 40.</p> <p>Alverson, D.L.; Freeberg, M.H.; Pope, J.G.; Murawski, S.A. A global assessment of fisheries bycatch and discards. FAO Fisheries Technical Paper. No. 339. Rome, FAO. 1994. 233p. Additional studies may be available.</p>	<p>bycatch management section in the report. The FAO paper was considered too old to include here, as technical gear changes and practices since 1994 have contributed to changes in bycatch levels</p>	
<p>2.2.2 - Secondary species management</p>	<p>Impact of approximately 20% of vessels exempt from requirement to utilise veil nets is not considered</p>	<p>Bycatch reduction and gear research- The EU technical regulations (EU 227/2013) permitting the use of 16-31 mm cod ends for targeting Brown shrimp, provided a sieve or veil net (Figure 3.6-5) or grid (Figure 3.6-6) is used to reduce bycatch. Eight vessels which are likely to fish within the fishery are not required (under the Shrimp Fishing Net order 2002) to use veil nets but that five of these do still use them (Eastern IFCA, 2019). Eight vessels represents 20.5% of the average number of vessels, or 17% of the maximum number of vessels engaged in the fishery between 2010 and 2015. Potential impacts of 17-21% vessels not utilising veil nets needs to be considered. EIFCA's management measures will require all vessels (regardless of size) to utilise veilnets, but these management measures are not yet implemented. Justification section states. <i>The requirement for all vessels to fish with a 70mm sieve net when targeting shrimp came into force on 1st January 2003.</i> This may alter the score assigned to PI 2.2.2. This PI should therefore be contingent on appropriate management being in place.</p>	<p>Eastern IFCA 2019. 35th EIFCA Statutory Meeting papers. Available at http://www.eastern-ifca.gov.uk/authority-meeting-papers/. Accessed 25th February 2019.</p>	<p>This fishery was assessed and scored in 2018. The ref was not available to the team, as it was published in 2019, so thank you for the link. Sieve nets are currently only required by vessels with an aggregate beam width ≥8m (EIFCA clarification Oct 2019). This aggregated beam length limit is also listed in the WashBS management plan, which all vessels have to sign up to as part of the certification. It is also mentioned in 2.2.2a. Out of the fleet listed, 3 do not use a veil net and they have an aggregated beam length of less than 8m. According to EIFCA (interview June 2018) these small vessels are occasional fishers only, which would suggest that proportional to the rest of the fleet their bycatch impact is comparatively small. This was also confirmed in interviews with Cefas observer. Considering the minutes of the EIFCA 2019 35th meeting on this matter, a recommendation is added to the effect that all vessels fishing for shrimp have a veil net. Recommendations are reviewed annually as part of the regular audit of a certificate.</p>	<p>Accepted (no score change)</p>

	Not all vessels are currently required to utilise veil nets (approx. 20%)- has not been taken into account in assessment	Justification section states <i>The requirement for all vessels to fish with a 70mm sieve net when targeting shrimp came into force on 1st January 2003. See above comment- this may alter the score assigned to PI 2.2.2. This PI should be contingent on appropriate management being in place.</i>		Please see comment above. A Recommendation has been added to PI 2.2.2a	Not accepted (no score change)
2.2.3 - Secondary species information	Not all vessels are currently required to utilise veil nets (approx. 20%)- has not been taken into account in assessment	See above comment		Please see comment above. A Recommendation has been added to PI 2.2.2a	Not accepted (no score change)
2.3.1 - ETP species outcome	Consideration has not been given to all SPAs and SPA features within the UoA	<i>No records or observations could be found which would indicate that the UoA has a direct effect on the population/stock of cetaceans, seals and seabirds as described in Section 3.6.4 of the main report. Only one SPA within the fishery area is described within section 3.6.4 (Greater Wash SPA). Multiple additional SPAs overlap with the UoA (including but not limited to The Wash SPA, North Norfolk Coast SPA, Gibraltar Point SPA)- each designated for different seabird species. The impacts on the qualifying features of all SPAs need to be considered.</i>	Information on features and supporting habitats of the SPAs are available on NE's designated sites view https://designatedsites.naturalengland.org.uk/	This PI evaluates the direct effect of the fishery on identified ETPs. The features supporting habitat MPAs/ SPAs are considered and evaluated under PI2.4, so as not to double count (which is not possible under the MSC certification criteria). A number of ETPs were identified, using the MSC standard (CRv2.0 SA3.1.5). Regarding the Greater Wash SPA, this area was mentioned in the context of seabirds as Annex 1 species, which makes them ETP species. The SPA is also considered under habitat, but only in relation to benthos, not seabirds. The assessment report is not designed to be an exhaustive analysis, it is restricted to those issues which are directly impacted by the fishery. Having said that, the team has added a number of additional SPAs to section 3.6.4 -seabirds listing the Annex 1 species, which are also therefore ETPs. Some of these SPAs may be too shallow for the fishery. From an MSC process point of view, specific features can be scored under one component only, not again under another component. Thus Annex 1 seabirds have been dealt with under ETP.	Accepted (no score change)

				That they happen to live within the Greater Wash SPA is incidental.	
	Consideration has not been given to all SPAs and SPA features within the UoA	<i>Recommendation: Considering that the fishery is operating within The Great Wash SPA, a recommendation has been raised...</i> As noted above and through previous correspondence, there are many additional SPAs within the UoA, which need to be considered.	Information on features and supporting habitats of the SPAs are available on NE's designated sites view https://designatedsites.naturalengland.org.uk/	See above. Text has been added to the Recommendation to reflect that the fishery may be operating in the vicinity of other SPAs	Accepted (no score change)
2.3.2 - ETP species management	Consideration has not been given to bycatch that occurs even when sievenets are used	<i>Research has shown that a 70mm sieve net is effective in reducing the bycatch, including ETP species, in the shrimp net.</i> Studies such as Catchpole et al 2008 show that while sievenets reduce bycatch, there is still a substantial amount of bycatch caught within trawls with sievenets (e.g. average of 492 gobies in every single 1 hour tow)	Catchpole, T. L. et al. 2008. Evaluating the efficacy of technical measures: a case study of selection device legislation in the UK Crangon crangon (brown shrimp) fishery. ICES Journal of Marine Science, 65: 267–275.	This has been given consideration, and it is the information available from observer reports, which is detailed. Bycatch management has been described in detail in Section 3.6.3, in particular under bycatch handling and bycatch reduction. Any ETP species, in the bycatch is handled the same way. Larger species escape through the veil net/ sieve net. Juveniles below a certain size may be caught and this is factored into the scoring.	Not accepted (no score change)
	Statement made to justify meeting of SG60 is incorrect, and so it's unclear if 2.3.2 meets the minimum standard	<i>As part of the Greater Wash SPA management closed areas are extended through byelaws in order to help protect the seabirds which are a primary feature of the SPA, and as part of that designation a review of measures has taken place (SG60 met).</i> This statement is incorrect and should be removed. There are currently no closures to beam trawling in place within the Greater Wash SPA to protect seabirds. There are multiple SPAs within the UoA area, and none of them have areas closed to fishing to protect designated seabirds.	Information on features and supporting habitats of the SPAs are available on NE's designated sites view https://designatedsites.naturalengland.org.uk/	This PI deals with ETPs. The justifications provided for ETP management is sufficient to meet the standard, the PI relates to those ETPs relevant to this fishery. The condition raised for this PI relates to the self-reporting and on-board logging of encounters of ETP species. This self-reporting is alongside the existing Observer programme. Following the Scoring Issues, the fishery meets most of these at 60 and 80.	Not accepted (no score change)
		Smelt should be considered		A rationale was provided in Section 3.6.3 as to why smelt is not an ETP: Smelt (<i>Osmerus eperlanus</i>), is listed on the UK BAP priority fish species as published in 2007. and the Priority Species data collation in 2010 states that this species is	Not accepted (no score change)

				in serious decline due to river habitat loss. It is stated under NERC 2006 S. 41 to be: "Species "of principal importance for the purpose of conserving biodiversity", together with such species as cod, mackerel and herring, which are found on the same list. The species is listed as LC (least concern) on the IUCN Red Data list and fishbase.org. It is not listed in any relevant legislation (eg Wildlife and Countryside Act 2017, Offshore Marine Conservation Regulations 2007). Text has been added to that section to clarify further.	
2.4.1 - Habitats outcome	The section of the report defining VMEs (3.6.2) is incomplete and contains several errors. As this PI has been assessed against incomplete and incorrect evidence, it cannot accurately determine whether the PI has been met.	Section 3.6.2 contains several errors and omissions, including not considering all relevant MPAs within the area (Figure 3.6.5) and considering an incomplete list of features for The Wash and North Norfolk Coast SAC (for example Reef is an Annex I feature not listed). A map of all relevant MPAs can be viewed on MAGIC maps (https://magic.defra.gov.uk/MagicMap.aspx). Advice on MPAs within 12nm including a list of features, a feature map, the sensitivity to activities including trawling, and detailed advice on their conservation objectives can be found on Natural England's Designated Sites System: https://designatedsites.naturalengland.org.uk/ . The GIS files for the maps can be downloaded under the open government license.	https://designatedsites.naturalengland.org.uk/ https://magic.defra.gov.uk/MagicMap.aspx	Thank you for the link to the maps. This PI looks at habitats, both commonly encountered as well as those defined in the MSC CR as VMEs (Habitat characteristics as defined by MSC CR v2.0 GSA3.13.2, GSA6, GSA3.13.3.2) . The distribution of these habitats is evaluated in this PI 2.4.1. The actual management, which covers MPAs, is addressed under PI2.4.2. So it can therefore appear from the distribution maps that some VMEs discovered in surveys, are not located within an MPA. This PI was scored in 2018 using the information and evidence available at the time. Using the links provided by NE, additional text has been added to the various protected areas where appropriate. Those features and issues relevant to scoring the fishery have been addressed. The score for PI2.4.1b has been reduced to reflect the fact that IVMS is not yet available on the smaller vessels to assist with distribution mapping of the vessels.	Accepted (non-material score change)

	Evidence that shrimp beam trawling can cause serious harm to Sabellaria reef has not been considered	<p>2.4.1 does not accurately represent the evidence base when concluding that that beam trawling will have no long term detriment to Sabellaria spinulosa reef. The Vorberg (2000) study used to draw this conclusion relates exclusively to short-term effects following once-only disturbance and conclude that the possibility of impairment by shrimp trawling in the medium to long-term cannot be ruled out in the event of intensive fishing, despite the relatively light weight of the gear used. Other research has shown that gear contact can lead to mortality of S. spinulosa worms and a reduction in complexity of habitat structure. A review of evidence led to the policy decision that bottom towed gears are not compatible with favourable condition of S. spinulosa reefs, based on an evidence summary by the Marine Management Organisation (MMO, 2014 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/310819/sabellaria.pdf). This PI should therefore be contingent on appropriate management being in place to protect S. spinulosa reef.</p>	MMO, 2014 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/310819/sabellaria.pdf	<p>The studies outlined in the report (Section 3.6.2 impact of gear) show in some detail that damage to Sabellaria reefs is reversible within a certain time frame, provided that trawl gear fishing is stopped and the local oceanography allows the settlement of larvae. A study by Kaiser et al (2018) examined the effectiveness of marine reserves for recovery of temperate reef fauna from towed mobile fishing gear in relation to their life history. Based on the information in Section 3.6.2 impact of gear it was concluded that damage to Sabellaria reefs was not irreversible, i.e. they can recover within a relatively short time frame if fishing stops in those areas. It is concluded that the impact of shrimp trawling on Sabellaria has been considered in the report.</p>	Not accepted (no score change)
	Adequate management measures to protect S. spinulosa reef from bottom towed gear is not currently in place in any of the relevant SACs.	<p>The closed areas within The Wash and North Norfolk Coast SAC, Inner Dowsing Race Bank and North Ridge SAC, and Haisborough Hammond and Winterton SAC are not adequate to effectively protect S. spinulosa reef. Larger areas have been proposed in both The Wash and North Norfolk Coast SAC and Haisborough Hammond and Winterton SAC but not yet implemented. Further management measures to those currently proposed will be necessary in Haisborough Hammond and Winterton SAC for beyond 6nm. This PI should therefore be contingent on appropriate management being in place to protect S. spinulosa reef.</p>		<p>If an area is closed in order to protect features within, then the fishery will not fish there, as part of the MSC certification. This already applies in some areas to vessels >than 15m (see Section 3.6.2 on protected areas). If an area is voluntarily closed, then the coordinates should be available to the vessels, and under MSC certification criteria such voluntary measures have to be shown to be adhered to (via VMS heatmaps for example). NE and EIFCA are currently working on the introduction of further closed areas within the footprint of the shrimp fishery, whereby one of the objectives is to protect Sabellaria reefs. The habitat management performance indicator has a condition which allows the</p>	Not accepted (no score change)

				auditing of when/whether such further closed areas are introduced, and how this is monitored - such as the introduction of Inshore VMS. Under the management plan, which participating fishers sign up to, the fishers have to comply with such closed areas/ voluntary closed areas as well.	
	There is evidence that beam trawling does occur on Sabellaria spinulosa reef. Avoidance of S. spinulosa reef by beam trawlers is therefore not a valid reason to conclude that there will be no serious harm to this VME.	Evidence from sightings data (EIFCA) and VMS (MMO) show that beam trawling occurs in areas which are important for S. spinulosa reef. It cannot be concluded that no serious harm will occur due to avoidance. This PI should therefore be contingent on appropriate management measures to protect S. spinulosa reef being implemented.		If an area is closed in order to protect features within, then the fishery will not fish there, as part of the MSC certification. This already applies in some areas to vessels >than 15m (see Section 3.6.2 on protected areas). If an area is voluntarily closed, then the coordinates should be available to the vessels, and under MSC certification criteria such voluntary measures have to be shown to be adhered to (via VMS heatmaps for example). NE and EIFCA are currently working on the introduction of further closed areas within the footprint of the shrimp fishery, whereby one of the objectives is to protect Sabellaria reefs. The habitat management performance indicator has a condition which allows the auditing of when/whether such further closed areas are introduced, and how this is monitored - such as the introduction of Inshore VMS. Under the management plan, which participating fishers sign up to, the fishers have to comply with such closed areas/ voluntary closed areas as well.	Not accepted (no score change)
	The section of the report associated with this contains several errors. As this PI has been assessed against incomplete and incorrect evidence, it cannot accurately	Adequate management is currently not in place in many of the SACs. Sabellaria spinulosa reefs are not a feature of the Greater Wash SPA. Sabellaria spinulosa reefs have not been mapped in great detail in Haisborough Hammond and Winterton SAC or Inner Dowsing Race Bank and North Ridge SAC. These are relatively new sites which do not have full survey coverage. It is therefore	Reise, K., Herre, E., & Sturm, M. 1989. Historical changes in the benthos of the Wadden Sea around the island of Sylt in the North Sea. Helgoländer Meeresuntersuchungen, 43, 417-433. Buhs, F., & Reise, K. 1997. Epibenthic fauna dredged from tidal channels in the Wadden Sea of Schleswig-	Sabellaria are listed under 'other site characteristics' https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020329.pdf ; 'Reefs', have been listed as Annex 1 in SACs described in this report. It does not yet matter how much detail the habitat maps provide, as data and information on mapped features becomes available these will be addressed in future audits of the fishery (which occur annually), and if they	Not accepted (no score change)

	determine whether the PI has been met.	<p>possible there are further reefs which have not previously been surveyed.</p> <p>The summary that gear contact with Sabellaria spinulosa reef has no long term detrimental effect is not consistent with Natural England, JNCC or MMO understanding of the evidence. This interaction is classified as a red risk due to evidence that it undermines the long term viability of this habitat</p> <p>https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/310819/sabellaria.pdf.</p> <p>There are examples of reefs not recovering after they have been removed e.g. within the Wadden Sea (Reise, et al1., 1989; Buhs & Reise, 19972) and approach channels to Morecambe Bay. The assertion that this interaction does not occur is also not consistent with Natural England's understanding. There is evidence of trawl scars on reefs in MPAs demonstrating that this interaction occur and causes lasting damage (Pearce et al 20073), which shows that that the bottom towed fisheries do interact with Sabellaria spp. reef. The ephemeral nature of Sabellaria spp. makes it an incredibly challenging habitat to avoid.</p>	Holstein: spatial patterns and a long-term decline. Helgoländer Meeresuntersuchungen 51: 343-59	are material to the management of the fishery, this will be addressed. It is important to note that those SACs are managed, some of closed areas for vessels of a certain size (>15m), and are currently going through further discussions between NE and EIFCA to introduce more closed areas based on recent habitat mapping results. Shrimp vessels will have to stay out of closed areas, and this is monitored via VMS, and eventually I-VMS for smaller vessels if the closed areas are extended to smaller vessels (see also Section 3.6.2 Upcoming legislation). The long term decline observed in the Wadden See near Schleswig Holstein is increasingly attributed to changing oceanography, lack of viable larvae, and the impact of extensive coastal engineering projects (Vorberg 2016 pers.com)	
	Analysis of potential ecosystem impacts within this section is very limited.	<p>Analysis of potential ecosystem impacts within this section is very limited. NE has concerns on impact of the fishery on various habitat attributes including, but not limited to;</p> <ul style="list-style-type: none"> • Distribution: presence and spatial distribution of biological communities • Structure and function: presence and abundance of key structural and influential species • Structure: species composition of component communities <p>Once appropriate management is in place for each SAC, this will reduce impacts on these features/ subfeatures to an acceptable level where adverse effect on site integrity can be ruled out. Until management is in place, the</p>	https://designatedsites.naturalengland.org.uk/	Ecosystem consideration happens under PI2.5 if the information is publicly available and was made available to the assessment team. Our scoring there presents the evidence of where ecosystem impacts have been considered and the resulting scoring.	Not accepted (no score change)

		fishery is hindering the conservation objectives for the site being met. See above comments related to recent Condition Assessments for SACs See NE Advice on Operations for feature/ subfeature sensitivity to activity.			
2.5.1 - Ecosystem outcome	No consideration is given to impacts of bycatch on seabirds	No consideration is given to impacts of bycatch on seabirds		Seabirds are discussed in Sections 3.6.4 seabirds and indirect effects.	Not accepted (no score change)
	Some habitats within UoA have been determined to be in unfavourable condition due to the fishery- not considered here.	<i>The UoA 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.</i> As part of Defra's revised approach to fisheries (2012) a risk matrix was developed in order to prioritise fisheries management in MPAs. Red risk interactions in the MMO fisheries matrix (https://www.gov.uk/government/publications/fisheries-in-european-marine-sites-matrix) means that the interaction is not compatible with the conservation objectives of the site and that fisheries closures should be brought in to prevent the interaction occurring. Some red risk interactions do not have management in place. The feature is therefore considered to be in unfavourable condition due to ongoing fishing pressures which are preventing the SAC conservation objectives being achieved. More information on site condition is available on NE's Designated Sites View (https://designatedsites.naturalengland.org.uk/). Most of the amber interactions in WNNCSAC have now been assessed by Eastern IFCA, and management has been outlined. This management however is not yet in place. Where management has been determined to be required, but is currently not in place, these features/ sub-features are considered to be in unfavourable condition due to ongoing fishing	https://www.gov.uk/government/publications/fisheries-in-european-marine-sites-matrix , https://designatedsites.naturalengland.org.uk/	Habitat related issues have been evaluated under the habitat component, Pls2.4. The ecosystem component does not address the same issues, habitats cannot be scored twice under different components. The ecosystem component looks at the interplay of the various components, including target species removal. The risk matrix designed by Defra (2012) is an aid for fisheries managers and would be implemented through the relevant offices/ organisations. The fishery will abide by those implemented measures when these are in place. It is up to those who evaluated the risk assessment to translate that into practical measures such as gear restrictions, areal closures etc, and the fishery will have to abide by those measures.	Not accepted (no score change)

		pressures which are preventing the SAC conservation objectives being achieved.			
2.5.2 - Ecosystem management strategy	Adequate management currently not in place within many of the SACs	Without management, an adverse effect on site integrity as a result of the fishery cannot be ruled out. Adequate management is currently not in place in many of the SACs- see above comments. This PI should therefore be contingent on appropriate management being in place. The impacts on the qualifying features of all SPAs need to be considered, including The Wash SPA, North Norfolk Coast SPA, Gibraltar Point SPA and Greater Wash SPA. HRAs for the North Norfolk Coast, Gibraltar Point SPA and The Wash SPA sites have yet to be finalised. HRA for the Greater Wash SPA has not been completed.	Information on features and supporting habitats of the SPAs are available on NE's designated sites view https://designatedsites.naturalengland.org.uk/ , Eastern IFCA shrimp beam trawling within The Wash and North Norfolk Coast SAC HRA, Natural England advice statutory advice letter (provided previously)	The management of SACs is discussed under the habitat component. The implementation and compliance checks of the SAC management measures is responsibility of dedicated agencies (EIFCA, NE). The fishery will have to comply with these measures once in place, and compliance is checked by the relevant agencies. If there is room for voluntary measures until management measures are legalised (eg voluntary areal closures) then this may be a way to bridge the time gap until the necessary byelaws are agreed.	Not accepted (no score change)
2.5.3 - Ecosystem information	Key elements of the ecosystem including all marine protected areas, habitats and species are not outlined within the draft report	Justification: this section only refers to some of the protected species within the fishery area. Key elements of the ecosystem including all marine protected areas, habitats and species are not outlined within the draft report.	Full list of features and subfeatures with site specific Conservation Advice is available on NE's Designated Sites View (https://designatedsites.naturalengland.org.uk/)	Those issues relevant to the fishery have been outlined in the report (i.e. those areas within the footprint of the fishery). To consider all protected areas outside the scope of the Unit of Assessment is out with the remit of this assessment. The habitat and ETP features have been addressed under the relevant components (PIs 2.3 and 2.4).	Not accepted (no score change)
	Disagree full ecosystem has been considered	<i>Information is adequate to broadly understand the key elements of the ecosystem.</i> Disagree that this has been met given not all relevant MPAs, habitats and species and been considered. See various comments above for rationale for this statement.		The information available is adequate to understand broadly the different elements of the ecosystem, such as interplay of oceanography, tides, sediment movement, occurrence of ETPs, food webs and benthic habitats. Obviously as more detailed studies become available, the greater the understanding for those managing the marine area. In the meantime, there is a broad understanding of the key elements.	Not accepted (no score change)

	Section 3.6 includes significant sections that are incorrect/ not up to date e.g. sediment maps, habitat maps, marine protected areas, MPA features etc.	<i>The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the ecosystem are known.</i> Section 3.6 includes significant sections that are incorrect/ not up to date e.g. sediment maps, habitat maps, marine protected areas, MPA features etc.	Up to date feature and subfeature maps, and MPA boundaries are available on MAGIC https://magic.defra.gov.uk/MagicMap.aspx or via NE's data release. Full list of features and subfeatures with site specific Conservation Advice is available on NE's Designated Sites View (https://designatedsites.naturalengland.org.uk/)	The information for this fishery assessment was collated and reviewed from publicly available sources, preferably peer reviewed studies, up to the autumn of 2018. New information kindly provided by stakeholders recently has been added since where relevant. Research and mapping is an ongoing process, and as new publications become available these will be considered in future audits of the fishery where the information makes a material difference to the evaluation of the fishery. This is one of the reasons why a certified fishery is audited annually over a period of 5 years. The publicly available information on the ecological components was deemed sufficient to score the fishery. This followed a pre-assessment of the fishery in 2011.	Not accepted (no score change)
	Many MPAs within UoA have not been considered	Some designated marine protected areas overlapping with the fishery are not considered within the assessment. Map of designated sites is not up to date	https://magic.defra.gov.uk/MagicMap.aspx	This has been addressed under the habitat component above, and the text in the report has been updated.	Accepted (no score change)
	Not all protected habitats/ protected species are considered within the assessment.	Not all protected habitats/ protected species are considered within the assessment. Some features/ subfeatures missing from feature list. Features of only one SPA listed- there are more overlapping SPAs and different designated SPA features within each SPA.	https://designatedsites.naturalengland.org.uk/	This has been addressed under the habitat component above, and the text in the report has been updated.	Accepted (no score change)
	Some habitats known to be adversely affected by the fishery do not yet have management in place	Red risk interactions are not listed here. As part of Defra's revised approach to fisheries (2012) a risk matrix was developed in order to prioritise fisheries management in MPAs. Red risk interactions in the MMO fisheries matrix (https://www.gov.uk/government/publications/fisheries-in-european-marine-sites-matrix) means that the interaction is not compatible with the conservation objectives of the site and that fisheries closures should be brought in to prevent the interaction occurring. Some red	https://designatedsites.naturalengland.org.uk/	This has been addressed under the habitat component above, as well as in the response to the second comment on 2.5.1 above.	Accepted (no score change)

		<p>risk interactions do not have management in place. The feature is therefore considered to be in unfavourable condition due to ongoing fishing pressures which are preventing the SAC conservation objectives being achieved. More information on site condition is available on NE's Designated Sites View. This PI should therefore be contingent on appropriate management measures being implemented.</p>			
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Appendix 4 Surveillance Frequency

Table A4.1: Surveillance level rationale

Year	Surveillance activity	Number of auditors	Rationale
1 & 3	Off-site audit	2 (required as this is initial certification period) as per FCR7.23.4.1	Relatively few of the conditions require and material changes in operation or physical changes which must be verified by site visit. By contrast, documentary evidence of actions undertaken may provide an objective basis to assess progress against milestones. In most cases milestone in year 1 requires review, and milestone in year 3 relates to commencing the process of implementation. No score changes are anticipated in years 1 and 3.
2 & 4	On-site audit	2 2 (required as this is initial certification period) as per FCR7.23.4.1	By year 2 actions to address all conditions should be well underway and initial review and work to address gaps should be largely complete and moving into the implementation phases. An on-site surveillance will be useful at this point to verify progress. Final implementation and completion of all conditions is scheduled for year 4. As a result, score changes are anticipated to occur in year 4. Therefore, an on-site surveillance will be important at this point to verify implementation. This also coincides with meetings to commence recertification (if the client wishes to continue).

Table A4.2: Timing of surveillance audit

Year	Anniversary date of certificate	Proposed date of surveillance audit	Rationale
All years	January 2020	January 2021	No annual scientific advice, so timing of surveillance expected to be in-line with the anniversary of certification.

Table A4.3: Fishery Surveillance Program

Surveillance Level	Year 1	Year 2	Year 3	Year 4
Level 4	Off site surveillance audit	On-site surveillance audit	Off-site surveillance audit	On-site surveillance audit & re-certification site visit

Appendix 5 Objections Process

(REQUIRED FOR THE PCR IN ASSESSMENTS WHERE AN OBJECTION WAS RAISED
AND ACCEPTED BY AN INDEPENDENT ADJUDICATOR)

The report shall include all written decisions arising from an objection.

(Reference: FCR 7.19.1)