Fisheries Department
6 Redheughs Rigg
South Gyle
Edinburgh, EH12 9DQ

T: 0131 335 6662
E: fisheries@acoura.com

MSC SUSTAINABLE FISHERIES CERTIFICATION

Chile squat lobsters and nylon shrimp modified trawl fishery


Public Certification Report

September 2016

Prepared For: **La Asociación de Armadores e Industriales Pesqueros de la IV Región (AIP)**

Prepared By: **Acoura Marine Ltd.**

Authors: **Julian Addison & Sara Adlerstein-Gonzalez**

Public Certification Report

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Certification Body:

Acoura Marine

Address:

6 Redheughs Rigg
Edinburgh
EH12 9DQ
Scotland, UK

Name: Fisheries Department
Tel: +44(0) 131 335 6601
Email: fisheries@Acoura.com
Web: www.Acoura.com

Client:

La Asociación de Armadores e Industriales Pesqueros de la IV Región (AIP)

Address:

7 Av. Costanera 900
Coquimbo
Chile

Name: Leandro Sturla
Tel: +34626124139
Email: leandro_sturla@yahoo.es

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Glossary

AESS	Equatorial Subsurface Water
AIA	Antarctic Intermediate Water
Bpa	Precautionary reference point for spawning stock biomass
Blim	Limit biomass reference point, below which recruitment is expected to be impaired.
Bmsy	Biomass corresponding to the maximum sustainable yield
B_0	Equilibrium biomass when there is no fishing
CBA	Acceptable Biological Quotas
CCT	Scientific and Technical Committee
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CM	Management Council
CNP	National Fishery Council
CPUE	Catch per Unit Effort
CZP	Regional Fishery Councils
DZP	Direcciones Zonales de Pesca
ETP	Endangered, threatened and protected species
F	Fishing Mortality
Fmsy	Fishing mortality giving maximum sustainable yield
FAM	MSC's Fisheries Assessment Methodology
FAO	Food and Agriculture Organisation of the United Nations
FAP	Fishery Administration Fund
FIP	Fisheries Research Fund
FIPA	Fisheries and Aquaculture Research Fund
HCR	Harvest Control Rule
IFOP	Institute for Fisheries Research
ITQ	Individual Transferable Quota
MCS	Monitoring, Control and Surveillance
LGPA	General Law on Fisheries and Aquaculture
LMCA	Maximum Catch Limit by Owner
LTP	Tradable Fishing Licenses
MINECON	Ministry of Economy, Public Works, and Tourism
MPA	Marine Protected Areas
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
NGO	Non-Governmental Organisation
P1	MSC Principle 1
P2	MSC Principle 2
P3	MSC Principle 3
PEP	Extraordinary Fishing Permits
PI	MSC Performance Indicator
PSA	Productivity Susceptibility Analysis
RAE	Artisanal Harvest Regime
RBF	Risk Based Framework
SG	Scoring Guidepost (MSC)
SI	Scoring Issue (MSC)
SICA	Scale Intensity Consequence Analysis
SSB	Spawning Stock Biomass
TAC	Total Allowable Catch
UoC	Unit of Certification
VME	Vulnerable Marine Ecosystem
VMS	Vessel Monitoring System

1. Executive Summary

- Acoura Marine Ltd. confirms that this fishery is within the scope of the MSC standard.
- This report provides details of the MSC assessment process for the Chile squat lobsters and nylon shrimp modified trawl fishery for La Asociación de Armadores e Industriales Pesqueros de la IV Región (AIP). The assessment process began on 23rd January 2014 and was concluded on the 13th of September 2016.
- A comprehensive programme of stakeholder consultations 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** (TED) for this assessment is the date of certification.

The assessment team for this fishery assessment comprised of Julian Addison who acted as team leader and primary Principle 1 specialist; Sara Adlerstein-Gonzalez who was primarily responsible for evaluation of Principles 2 & 3. Paul MacIntyre was the traceability expert advisor.

Client strengths

- The fishery benefits from comprehensive data collection, stock assessment and management systems.
- The nylon shrimp and yellow squat lobster fisheries are being exploited at a level consistent with MSY

Client weaknesses

- Stock biomass estimates for red squat lobster in the southern region have shown recent signs of decline and are currently significantly below B_{msy}
- There are gaps in information in relation to the level of discarding of both target and non-target species.

Determination

- On completion of the assessment and scoring process, the assessment team concluded that the Chile squat lobsters and nylon shrimp modified trawl fishery achieved the required standard and should be certified as a, “Well Managed and Sustainable Fishery”, in accordance with MSC Principles and Criteria for sustainable fishing.

Rationale

- There are a number of areas which reflect positively on the fishery:
    - There are well-defined limit and target reference points
    - There is a robust harvest strategy in place including explicit harvest control rules
    - The stock assessment methodology has been externally peer-reviewed
    - The effects of the fisheries are highly likely to be within limits of national and international requirements for protection of ETP species
    - The fisheries operate within a comprehensive legal and customary framework in which long term objectives are clearly defined

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:

- Recovery of the red squat lobster stock in the southern fishing zone to its target reference point
- The level of discarding of the target species should be quantified
- Sufficient data should continue to be collected to detect any increase in risk level to main retained and bycatch species
- Sufficient data should be collected to measure trends and support a full strategy to manage impacts on ETP species in particular corals
- Sufficient data should be collected to allow the nature of the impacts of the fishery on habitat types to be identified
- Short and long term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, should be explicit within the fishery's management system.
- Decision-making processes in the demersal crustacean fisheries should respond to serious and other important issues
- A monitoring, control and surveillance system should be implemented in the demersal crustacean fisheries on board of industrial and artisanal vessels
- A research plan should be developed for the artisanal fisheries

» 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 6.3.1** of this report.

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.

2. Authorship and Peer Reviewers

2.1 Assessment Team

All team members listed below have completed all requisite training and signed conflict of interest documents necessary for assessment team membership on this fishery.

Assessment team leader: Julian Addison

Primarily responsible for assessment under Principle 1

Dr Julian Addison is an independent fisheries consultant with 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 experienced shellfish management approaches in North America as a visiting scientist at DFO in Halifax, Nova Scotia and at NMFS in Woods Hole, Massachusetts. 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 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 recently completed or is currently undertaking MSC full assessments for the Newfoundland and Labrador snow crab fishery, the Ireland and Northern Ireland bottom grown mussel fisheries, both the Estonia and Faroe Islands Barents Sea cold water prawn fisheries, the Nephrops fishery in the Skagerrak and Kattegat, separate assessments for the Swedish, Danish and Norwegian shrimp fisheries in the Skagerrak and Norwegian Deep, the Eastern Canada offshore lobster fishery, the Limfjord mussel and cockle fishery, the Normandy and Jersey lobster fisheries and the North Sea brown shrimp fisheries. He has also undertaken various MSC pre-assessments and surveillance audits and has carried out peer reviews of MSC assessments in both Europe and North America of lobster, cold water prawn, razorfish, cockle and scallop 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.

(Please note that the original nominated Principle 1 expert, Patricio Arana, had to withdraw from the certification assessment team for personal reasons and he was replaced on the team by Julian Addison)

Expert team member: Sara Adlerstein-Gonzalez

Primarily responsible for assessment under Principle 2 & 3

Dr. Adlerstein's research program is in the area of applied aquatic ecology, with emphasis on population assessments and ecosystem dynamics. Her current research focuses on the Great Lakes ecosystems. The goals of her work are to improve monitoring and increase the value of available information, understand processes that determine the distribution and abundance of aquatic organisms, and quantify responses of aquatic communities to stressors and management. To attain these goals, Dr. Adlerstein uses state-of-the-art statistical analyses to for example: (1) estimate reliable indices for abundance trends of fish and of organisms at lower food web levels (all Great Lakes); (2) investigate relationships between population trends and management or environmental stresses; (3) quantify relationships between population distribution and habitat; (4) describe fish movements; and (5) evaluate consequences of environmental stressors for ecosystem and fisheries using food-web models. The major contributions of her research are in applications for management, including diagnostics of environmental quality and advances in concepts related to fish movement and distribution. Her research has provided guidance for several resource management agencies, including the Great Lakes Fishery Commission, Michigan Department of Natural Resources and U.S. Geological Surveys' Great Lakes Science Center. Dr. Adlerstein has participated as consultant in groups of expert evaluators for the MSC process - Chilean hake, Banco Chinchorro and Sian Ka'an Caribbean spiny lobster fisheries. She has also peer reviewed MSC assessments.

(Please note that the original nominated Principle 3 expert and team leader, Ian Scott, had to withdraw from the certification assessment team for personal reasons and he was replaced as the Principle 3 expert by Sara Adlerstein-Gonzalez and as team leader by Julian Addison).

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 me 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 Rob Blyth-Skyrme and John Tremblay. A summary CV for each is available in the **Assessment downloads** section of the fishery's entry on the MSC website and further information can be obtained by contacting Acoura.

Rob Blyth-Skyrme has broad fisheries and environmental science, management and policy knowledge, having gained over nearly 20 years of postgraduate work in the marine field. Rob previously led the marine fisheries and aquaculture work of Natural England, the UK Government's statutory advisor on nature conservation in England. Rob has also worked as Deputy Chief Fishery Officer for the Eastern Sea Fisheries Joint Committee, co-managing the activities of a staff of 16 Fishery Enforcement, Research and Environment Officers. He has been involved in assessing numerous MSC fisheries, including assessments of shrimp and lobster fisheries.

Dr. Tremblay has over 35 years of experience in marine fisheries ecology and biology. He has a Ph.D. in Marine Biology from Dalhousie University (1991), and M.Sc. (1982) and B.Sc. Degrees (1979) from the University of Guelph. From 1983 to 2015 he was with the Science Branch of Fisheries and Oceans Canada (DFO). His areas of expertise include the population ecology of invertebrates, stock assessment of decapod crustacea, and communication of fisheries science with stakeholders and peers. He has participated extensively in peer review processes as a team leader and as a reviewer. As head of the Maritimes Region Lobster Unit at the Bedford Institute of Oceanography (BIO) for 10 years, he was responsible for regular assessments of the most valuable commercial species in Canada. John has 32 publications in peer-reviewed journals covering topics such as the early life history of scallops and lobsters, trends in populations of invertebrates and fish in relation to the environment, catchability in traps, and lobster growth and movement. The topics of over 50 technical publications which he co-authored include assessments of lobsters, crabs and scallops, and methods for estimating abundance of decapod crustacea. He retired from DFO in 2015 and is currently a Scientist Emeritus at BIO.

2.1.2 RBF Training

Julian Addison has been fully trained in the use of the MSC's Risk Based Framework (RBF).

3. Description of the Fishery

3.1 Unit(s) of Certification and scope of certification sought

Acoura Marine Ltd confirms that the fishery is within scope of the MSC certification sought for the assessment as defined.

Prior to providing a description of the fishery it is important to be clear about the precise extent of potential certification. The MSC Guidelines to Certifiers specify that the Unit of Certification (UoC) is **"The fishery or fish stock (biologically distinct unit) combined with the fishing method / gear and practice (= vessel(s) and / or individuals pursuing the fish of that stock)"**.

This clear definition is useful for both clients and assessors to categorically state what was included in the assessment, and what was not. This is also crucial for any repeat assessment visits, or if any additional vessels join the certificate at a later date. The UoCs for the fishery under consideration are as set out below.

The fishery being assessed for MSC certification is defined as 8 UoCs as follows:

UoC 1:

Species:	Nylon shrimp (*Heterocarpus reedi*)
Fishing Method:	Industrial Modified Trawl
Geographical Area:	Northern & Southern Zones (Regions II, III, IV, V, VI, VII, VIII)
Management System:	SUBPESCA
Client Group:	La Asociación de Armadores e Industriales Pesqueros de la IV Región
Eligible Fishers:	Vessels belonging to the client group or approved by the client group.

UoC 2

Species:	Nylon shrimp (*Heterocarpus reedi*)
Fishing Method:	Artisanal Modified Trawl
Geographical Area:	Northern Zone (Regions IV)
Management System:	SUBPESCA
Client Group:	La Asociación de Armadores e Industriales Pesqueros de la IV Región
Eligible Fishers:	Vessels belonging to the client group or approved by the client group.

UoC 3

Species:	Yellow Squat Lobster (*Cervimunida johni*)
Fishing Method:	Industrial Modified Trawl
Geographical Area:	Northern Zone (Regions III, IV)
Management System:	SUBPESCA
Client Group:	La Asociación de Armadores e Industriales Pesqueros de la IV Región
Eligible Fishers:	Vessels belonging to the client group or approved by the client group.

UoC 4

Species:	Yellow Squat Lobster (*Cervimunida johni*)
Fishing Method:	Artisanal Modified Trawl
Geographical Area:	Northern Zone (Regions IV)
Management System:	SUBPESCA
Client Group:	La Asociación de Armadores e Industriales Pesqueros de la IV Región
Eligible Fishers:	Vessels belonging to the client group or approved by the client group.

UoC 5

Species:	Yellow Squat Lobster (*Cervimunida johni*)
Fishing Method:	Industrial Modified Trawl
Geographical Area:	Southern Zone (Regions V, VI, VII, VIII)
Management System:	SUBPESCA
Client Group:	La Asociación de Armadores e Industriales Pesqueros de la IV Región
Eligible Fishers:	Vessels belonging to the client group or approved by the client group.

UoC 6

Species:	Red Squat Lobster (*Pleuroncodes monodon*)
Fishing Method:	Industrial Modified Trawl
Geographical Area:	Northern Zone (Regions II, III, IV)
Management System:	SUBPESCA
Client Group:	La Asociación de Armadores e Industriales Pesqueros de la IV Región
Eligible Fishers:	Vessels belonging to the client group or approved by the client group.

UoC 7

Species:	Red Squat Lobster (*Pleuroncodes monodon*)
Fishing Method:	Artisanal Modified Trawl
Geographical Area:	Northern Zone (Region IV)
Management System:	SUBPESCA
Client Group:	La Asociación de Armadores e Industriales Pesqueros de la IV Región
Eligible Fishers:	Vessels belonging to the client group or approved by the client group.

UoC 8

Species:	Red Squat Lobster (*Pleuroncodes monodon*)
Fishing Method:	Industrial Modified Trawl
Geographical Area:	Southern Zone (Regions V, VI, VII, VIII)
Management System:	SUBPESCA
Client Group:	La Asociación de Armadores e Industriales Pesqueros de la IV Región
Eligible Fishers:	Vessels belonging to the client group or approved by the client group.

These UoCs were used as they are compliant with client wishes for assessment coverage and in full conformity with MSC criteria for setting the UoC. The client has agreed to share the certificate on a fair and equitable basis.

3.1.1 Statement that the fishery is within the MSC scope

The assessment team confirms that the fishery under assessment meets the scope requirements, which are defined in MSC Certification Requirements Version 1.3, 14 January, 2013 (CR 27.4).

Principle 3, Criterion A1: The fishery is not conducted under a controversial unilateral exemption to an international agreement. Principle 3, Criterion B14: The fishery does not use destructive fishing practices such as poisons or dynamite.

3.1.2 Scope of Assessment in Relation to Enhanced Fisheries

The fisheries for *Heterocarpus reedi, Cervimunida johni* and *Pleuroncodes monodon* are not enhanced fisheries.

3.1.3 Scope of Assessment in Relation to Introduced Species Based Fisheries (ISBF)

Heterocarpus reedi, Cervimunida johni and *Pleuroncodes monodon* are native to the waters being assessed and as such do not constitute ISBF fisheries.

3.2 Overview of the fishery

3.2.1 La Asociación de Armadores e Industriales Pesqueros de la IV Región (AIP)

The Client for this fishery is La Asociación de Armadores e Industriales Pesqueros de la IV Región (AIP):

7 Av. Costanera 900, Coquimbo, Chile
Contact: Leandro Sturla (Executive Director)
Email: leandro_sturla@yahoo.es

The Association was founded 25 years ago. It has a membership of 13 companies, of which 11 are based in Region IV. Most members have vertically integrated operations with fishing vessels, and processing plants, with the marketing of product to national and international markets. Apart from the crustaceans, the swordfish fishery is important with activities in national and international waters.

Among the main objectives of the AIP are: the promotion and maintenance of regional fishing activity; the dissemination of best fishing practices to its members; ensuring that the fishing operations of its members comply with the regulations; support biological studies and develop appropriate standards; and present the vision of its members to government, politicians, NGOs and others. In Coquimbo, AIP has a fishing pier that supports the activities of its members.

The client confirms that the following seven companies that are members of AIP form the client group for the fishery currently in the process of MSC certification:

Antarctic Seafood S.A.
Address: Geronimo Méndez 1610, Coquimbo
Telephone: (56-51) 223 0671
Contact: Mario Venegas, mvenegas@antarticseafood.cl

Pesquera Quintero S.A.
Address: Avenida Veintiuno De Mayo 1057, Quintero
Telephone: (56-32) 232 4700
Web: http://www.pesqueraquintero.com
Contact: Stefan Koper, stefan.koper@pesqueraquintero.com

Bracpesca S.A.
Address: Avenida Ahumada 230 Of., Coquimbo
Telephone: (56-51) 232 7771
Contact: Claudio Velasquez, cvelasquez@comercialhym.cl

Soc Pesquera Isladamas Sa
Address: Camino Libertad 19, Coquimbo
Telephone: (56-51) 232 4395 (56-51) 232 1079
Contact: Guillermo Donoso, empresasdonoso@gmail.com

Pesquera Sunrise S.A.
Address: Camino Libertad 19, Coquimbo
Telephone: (56-51) 232 4395 (56-51) 232 1079
Contact: Guillermo Donoso, empresasdonoso@gmail.com

Sociedad Pesquera Costa Brava Ltda
Address: Camino Libertad 19, Coquimbo
Telephone: (56-51) 232 4395 (56-51) 232 1079
Contact: Guillermo Donoso, empresasdonoso@gmail.com

Exportadores De Mariscos Rymar
Address: Calle Gerónimo Méndez 1851 Galpón 37, Coquimbo
Telephone (56-51) 223 2788
Contact: Williams Mauad wmauad@rymar.cl

3.2.2 Description of the Fishery and Area Under Evaluation

As defined in OECD (2010), "*Chile's territories are located in continental South America, on the Antarctic, in Oceania, and in the Pacific Ocean. Its continental coastline stretches 4 337 km (measured on a straight line), while its Exclusive Economic Zone (EEZ) totals almost 2.8 million km^2*". The most abundant marine species are jack mackerel, sardine, anchovy and horse mackerel. The fishing and management areas off the coast of Chile are based on the 15 administrative regions of the country (Figure 1). Nylon shrimp, yellow squat lobster and red squat lobster are exploited by trawl fisheries along a large part of the Chilean coast (between 26º and 38º S).

Off northern Chile including Regions III & IV the continental shelf is narrow, with a steep drop off to the deeper ocean; to the south the platform is wider providing the industrial trawl fleet with the opportunity to fish further off-shore. The three species are found at different depths; as shown in Figure 2. These two facts indicate why there are different mixes in the catch of non-target species.

Figure 1. Administrative regions of Chile

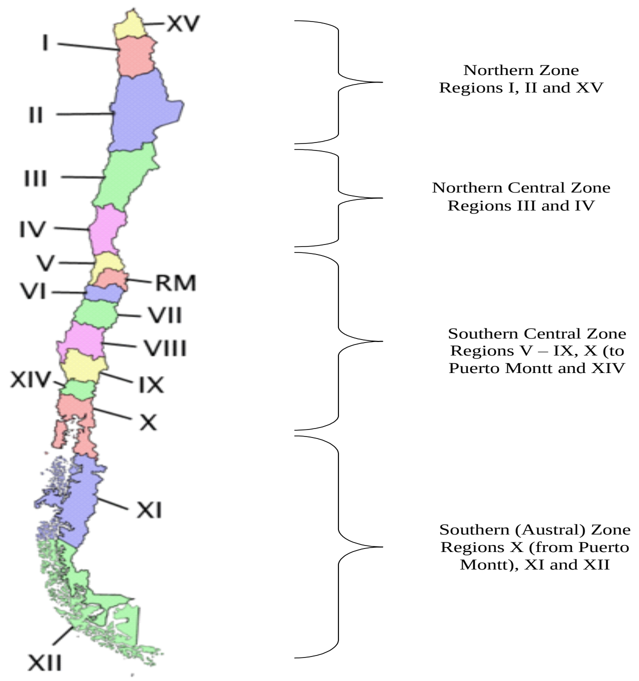
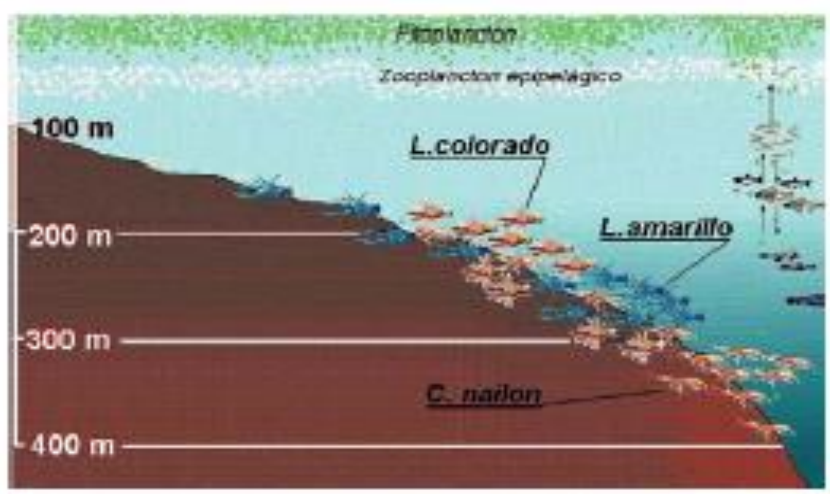


Figure 2: The Depth of the Habitat of the Three Species



Source: SUBPESCA

Nylon shrimp, and yellow and red squat lobsters are exploited by industrial and artisanal trawl fisheries along a large part of the Chilean coast (26º to 38ºS); South East Pacific FAO statistical area 87, within Chilean Administrative Regions XV to VIII.

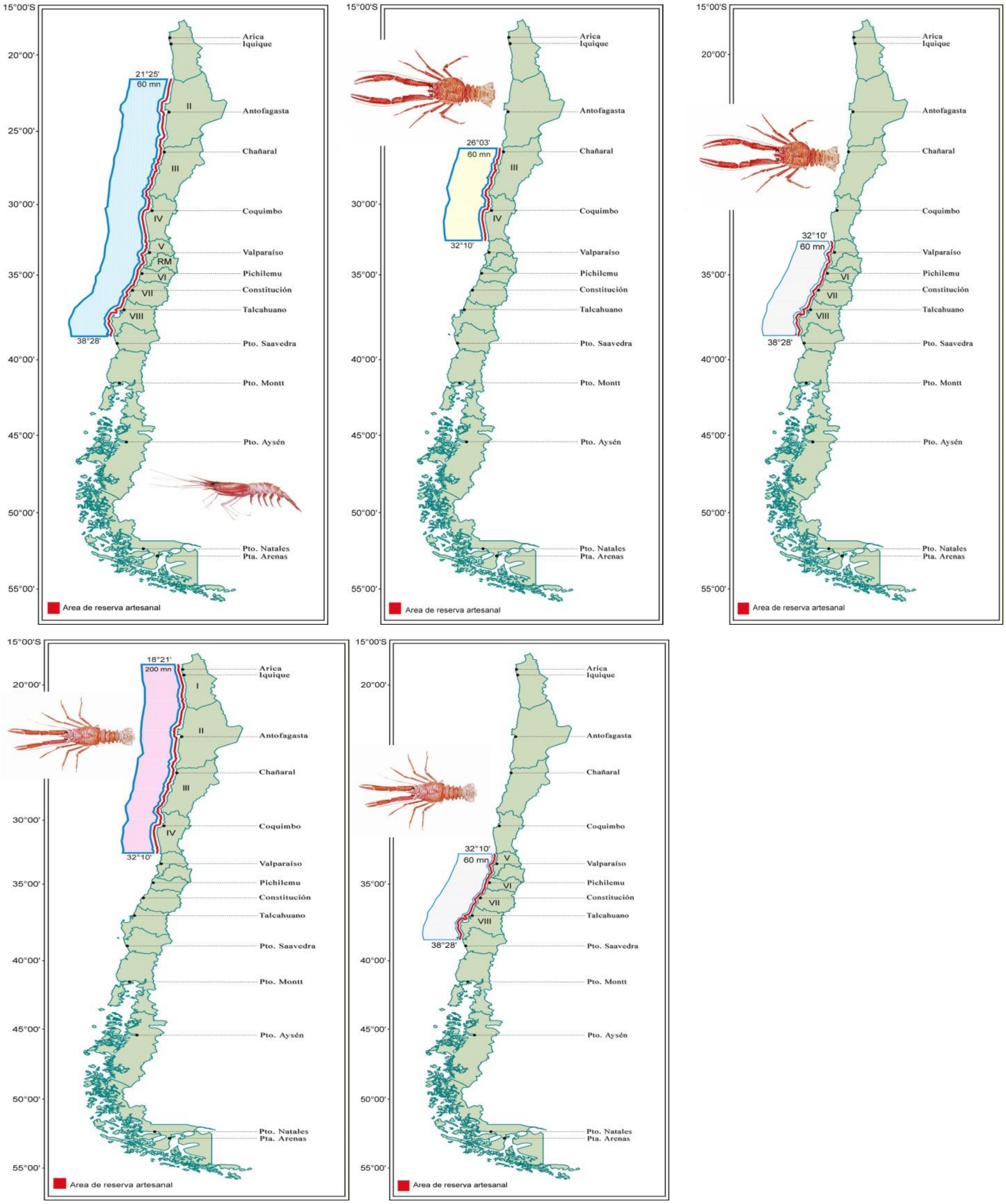
The Chilean General Law on Fisheries and Aquaculture (Ley General de Pesca y Acuicultura LGPA) defines fishery units under its jurisdiction within imaginary lines from 5 nm from the coastal baseline up to 60 nm. Fishery units are defined as fishing activities conducted by the industrial fishery with respect to a resource in a specific geographical location (Art. 2 45). The law indicates that fishing is not allowed within the first 1 nm and defines an area exclusively for artisanal fisheries within 1 nm and 5 nm out from the coastal baseline where trawling is not allowed (LGPA Art 49). However, in the north, artisanal and industrial fishing for demersal crustacean fisheries (nylon shrimp, red squat lobsters and prawn) is allowed from 1 nm to 5 nm off Regions III and IV (MINECON D.S. Nº200/2003), where the continental shelf is narrowest and most of the vulnerable biomass is found. Further south, in regions V-VIII, nylon shrimp is always found outside the 5 nm and larger concentrations of squat lobsters are also found outside the 5 nm.

For **nylon shrimp** there is only one fishery unit defined between the northern boundary of Region II and the southern limit of Region VIII (21º26' to 38º28', Figure 3). In this assessment, the unit of certification for the nylon shrimp industrial fishery includes the whole extent of the fishery unit area, although the fishery takes place mostly from Region IV to VIII. The unit of certification of the artisanal fishery includes only Region IV.

For **yellow squat lobster** there are two fishery units: i) the Northern Unit extends within the northern limit of Region III and the southern limit of Region IV, and ii) the Southern Unit extends within limits of Regions V and VIII (Figure 3). Units of certification for yellow squat lobster for the industrial fishery include the extent of each of the northern and the southern fishery units. The artisanal unit of certification includes only Region IV.

For **red squat lobster** there are also two fishery units: i) the Northern Unit extends from the northern limit of Region XV (boundary with Peru) to the southern limit of Region IV, and ii) the Southern Unit extends within the limits of Regions V and VIII (Figure 3). Units of certification for red squat lobster for the industrial fishery include Regions II to IV in the north (although fishing in the last six years has been conducted only in Region IV) and the whole extent of the southern fishery unit. The artisanal unit of certification includes only Region IV.

Figure 3. Areas defined for demersal crustacean fisheries. Top: Nylon shrimp fishery area; Middle: Yellow squat lobster northern and southern fishery units; and bottom: Red squat lobster northern and southern fishery units. Red line is the imaginary line 5 nm artisanal from the coastline.



Source. Arana

3.2.3 History of the Fisheries

Nylon shrimp

The nylon shrimp fishery developed in the 1950s between Regions II and VIII. In 1995, the nylon shrimp fishery was declared to be in full exploitation and is subject to annual catch quotas. In 2001, as a management measure to support recovery of the stock there was a two-year temporary closure of the fishery in the sea area off Region V to X. The closure was lifted for regions V and VI in 2003, but in 2004 and 2005 the fishery remained closed for Regions VII and VIII. Since 2006, the whole fishery has been open. Since 1998, there has been an annual seasonal closure in July and August each year, set due to the period of highest spawning period. The setting of annual TACs regulates fishing mortality. IFOP has monitored the fishery since the 1970's with more detailed research since 1994. Annual landings of nylon shrimp peaked at around 10,000 tonnes in 1994-1996, but in recent years have been around 4000 tonnes (Figure 4), with the majority of landings coming from the southern fishing zone (Figures 5 & 6). Landings do not necessarily reflect stock abundance as they are regulated by annual quotas. In recent years the nylon shrimp landings have not exceeded quotas (Figures 4-6).

Figure 4. Annual landings and quotas (t) of nylon shrimp for total area of fishery (Source: SERNAPESCA-SUBPESCA)

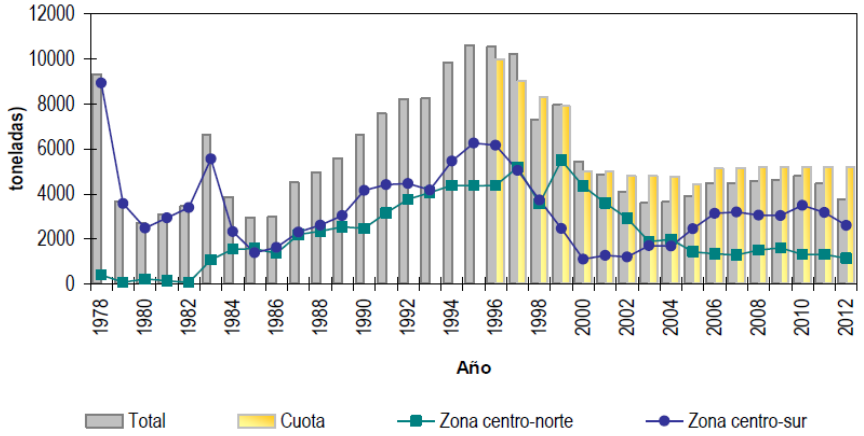


Figure 5. Annual landings (bars) and quotas of nylon shrimp (t) for northern zone of fishery (Source: IFOP-SUBPESCA)

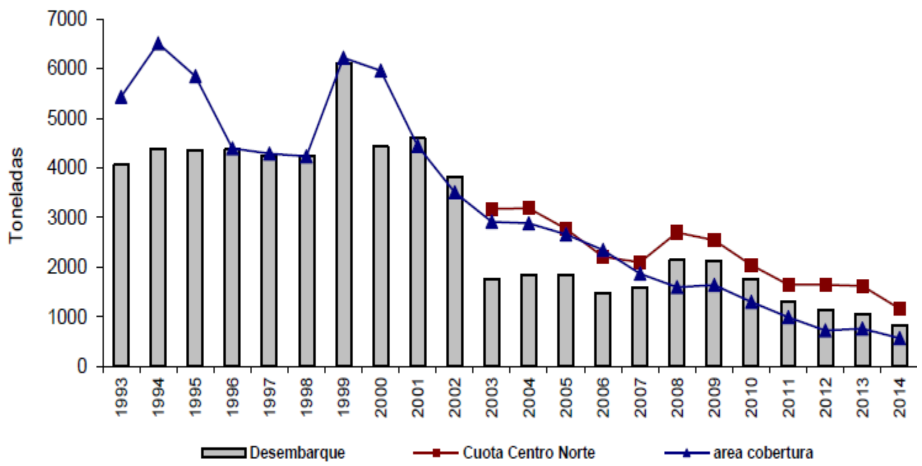
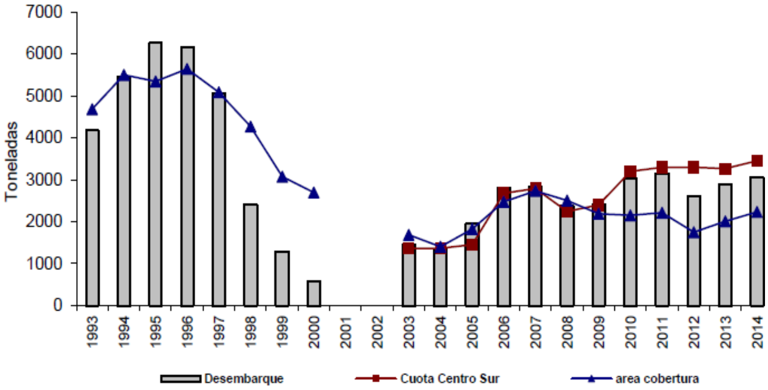


Figure 6. Annual landings (bars) and quotas (t) of nylon shrimp for southern zone of fishery (Source: IFOP-SUBPESCA)



<u>Yellow squat lobster</u>

The Yellow squat lobster fishery started in the 1950s with Coquimbo, Valparaíso and San Antonio being the most important ports. In 1995, management of the species was separated into two units of fishery; the first covering regions III and IV (north), and the second covering regions V to VIII (south). The northern unit is classified under the full exploitation regime, while the second is currently considered as a Fishery under Recovery. Under both regimes, the fishery has been subject to conservation measures, such as biological and seasonal closures and catch quotas. There is an annual closed season between the beginning of January through March for both units. The southern fishery was closed between 2001 and 2007. In the northern region annual landings were around 6,000 tonnes in 1996 and 1997, declined considerably at the beginning of the millennium but in recent years have recovered (Figure 7). In the southern region landings were around 4,000 tonnes in 1997-1998, but declined significantly prior to the closure of the fishery in 2001. Landings recovered to around 2,500 tonnes in 2008 to 2011, but have since declined to 1000 to 1500 tonnes (Figure 8). Landings do not necessarily reflect stock abundance as they are regulated by annual quotas. For both the northern and southern fishing zones, the landings in recent years have not exceeded the quotas (Figures 7 and 8), and the most recent figures for 2015 show that landings are below quotas (Figure 9).

Figure 7. Annual landings (bars) and quotas of yellow squat lobster for northern zone of fishery (partial data for 2015) (source: IFOP – SERNAPESCA)

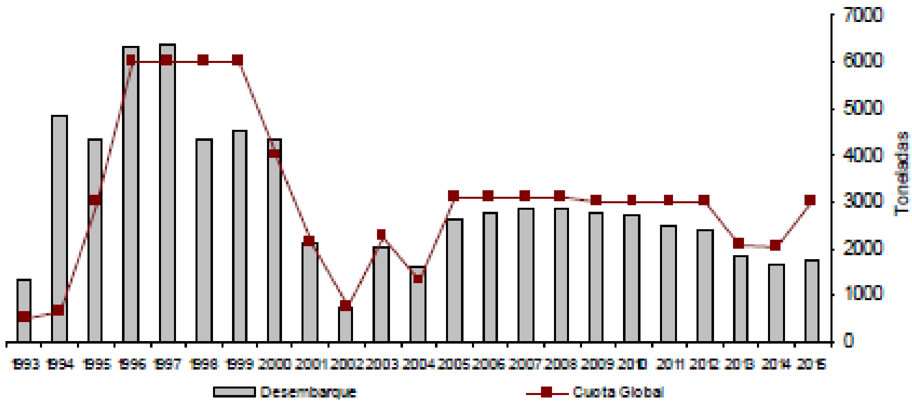


Figure 8. Annual landings (bars) and quotas of yellow squat lobster for southern zone of fishery (partial data for 2015) (source: IFOP – SERNAPESCA)

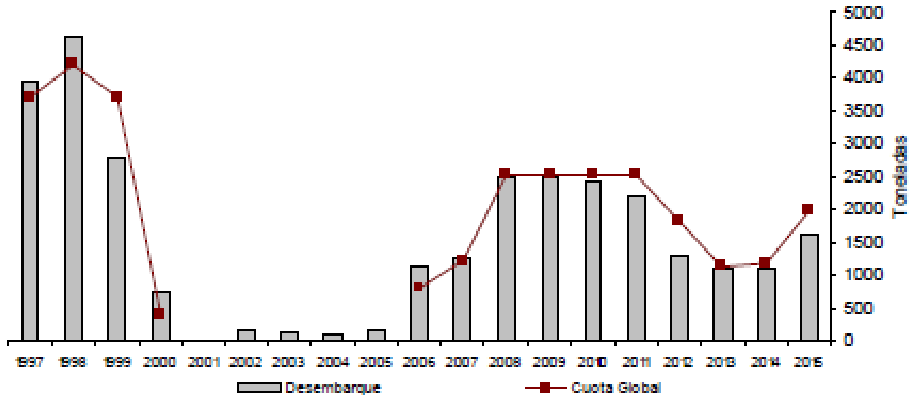
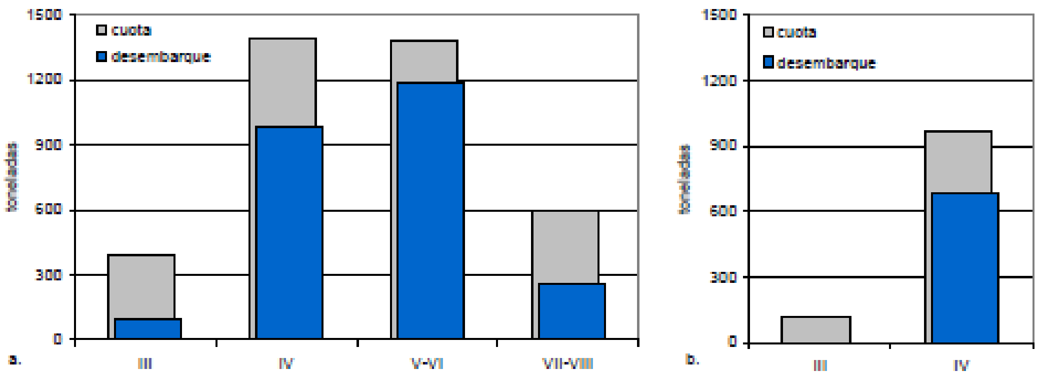


Figure 9 Landings (blue) and regional quotas (grey) for yellow squat lobster from March to August 2015 for industrial (left) and artisanal fleets (right). (source SUBPESCA and SERNAPESCA)



Red squat lobster

Red squat lobster is distributed between Isla Lobos de Afuera, Peru to Region VIII of Chile. Two fishing units are distinguished: northern (Regions XV to IV) and southern (Regions V to VIII) and they are evaluated separately. The fishery uses the same vessels that target the two other species. While the fishery has been active since the mid-1950s, official landing figures distinguishing landings of red squat lobster from the yellow have only been available since 1978. Initially, the fishery was between Regions V and VIII, with activity in the north (Regions III and IV) from 1998 only. The fishery in the north is considered to be fully exploited, with an annual global quota together with a closed season between January 1 and March 31. In the northern fishery, landngs were 2000 to 2500 tonnes in 2000-2002 but have declined significantly in recent years (Figure 10). The fishery in the south is considered to be under recovery. The fishery was closed in 2001. From 2005 there was a quota for research purposes and from 2009 a higher quota was set to reach, in 2011, 3,600 mt. Whilst historically, the highest landings in the south were in 1979 with 30,000 tonnes, more recently landings peaked at 12,000 tonnes in 1998-99, but were just over 6,000 tonnes in 2013-14 (Figure 11). Landings do not necessarily reflect stock abundance as they are regulated by annual quotas. For both the northern and southern fishing zones, the landings in recent years have not exceeded the quotas (Figures10 and 11), and the most recent figures for 2015 show that landings are below quotas (Figure 12).

Figure 10. Annual landings (bars) and quotas of red squat lobster for northern zone of fishery (partial data for 2015) (source: IFOP – SERNAPESCA)

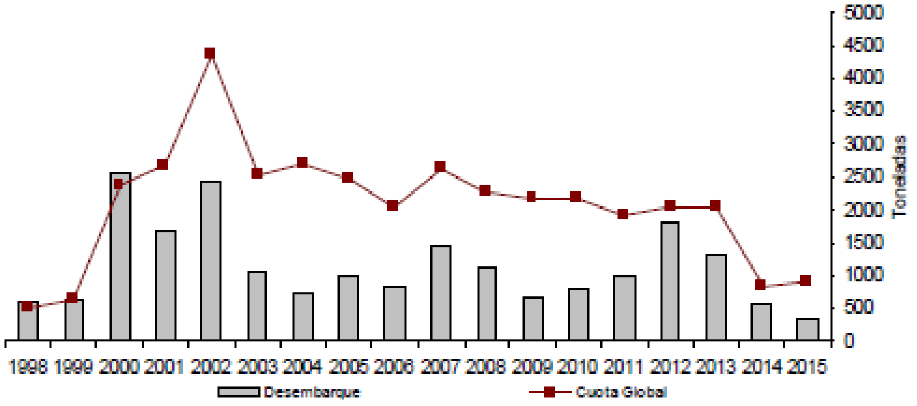


Figure 11. Annual landings (bars) and quotas of red squat lobster for southern zone of fishery (partial data for 2015) (source: IFOP – SERNAPESCA)

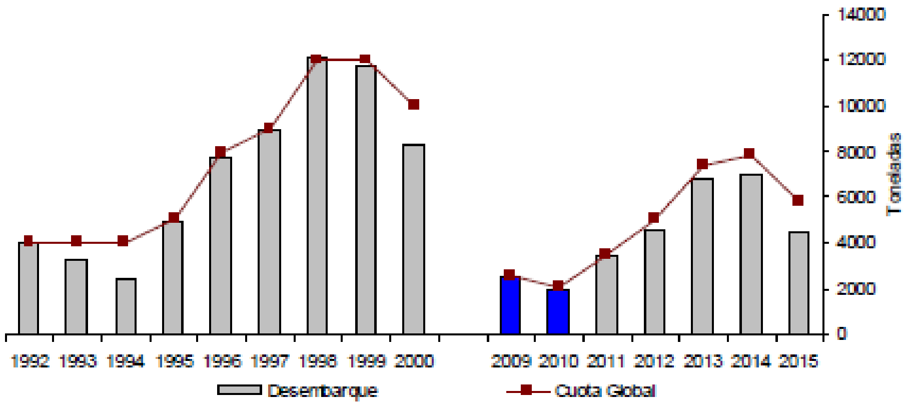
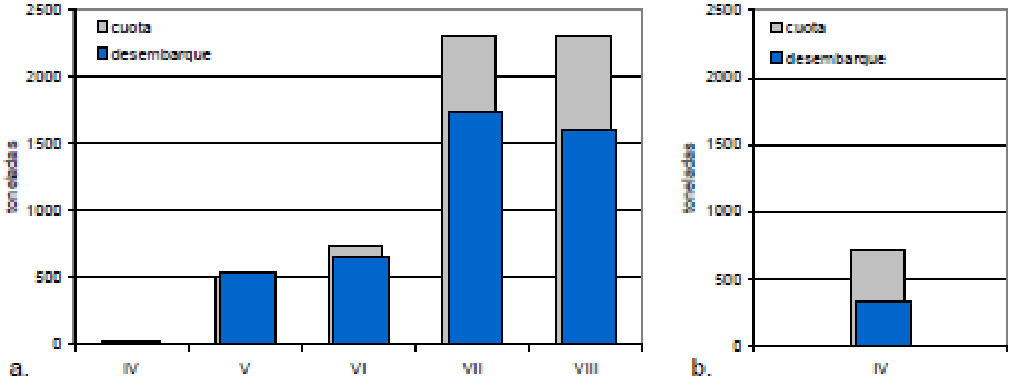


Figure 12 Landings (blue) and regional quotas (grey) for red squat lobster from March to August 2015 for industrial (left) and artisanal fleets (right). (source SUBPESCA and SERNAPESCA)



3.2.4 Fishing Practices

The demersal crustacean trawl fisheries are conducted by industrial and artisanal vessels. Most of the vessels are involved in all three crustacean fisheries. For Fisheries under Recovery Regime, i.e., for yellow and red squat lobsters in the southern units, there is no distinction between administration of the artisanal and industrial fisheries. For Fully Exploited Fisheries, i.e., fisheries for nylon shrimp and yellow and red squat lobster in northern units, industrial and artisanal fisheries have different administration rights and obligations. Overall, the number of vessels in the demersal crustacean fisheries operating in the industrial fisheries during the last 10 years has decreased from 26 to 19 and has fluctuated in the artisanal fisheries between 9 and 5 vessels (Table 1).

Table 1 Number of Vessels in the Demersal Crustaceans Fisheries

Total Demersal Crustacean Fisheries

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Industrial	26	24	24	23	21	20	20	20	20	19	19
Artesanal	9	7	7	6	5	8	7	8	8	7	7

Nylon Shrimp

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Industrial	20	22	24	23	21	20	20	20	16	11	9
Artesanal	6	5	6	5	5	8	7	7	7	6	7

Yellow Squat Lobster

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Industrial	13	15	20	18	20	19	19	19	16	16	15
Artesanal	3	3	4	5	5	6	6	7	6	6	6

Red Squat lobster

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Industrial	8	9	9	9	9	6	13	11	12	15	13
Artesanal	3	3	3	4	3	5	5	4	5	3	6

Source: Zilleruelo 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015a, 2015b.

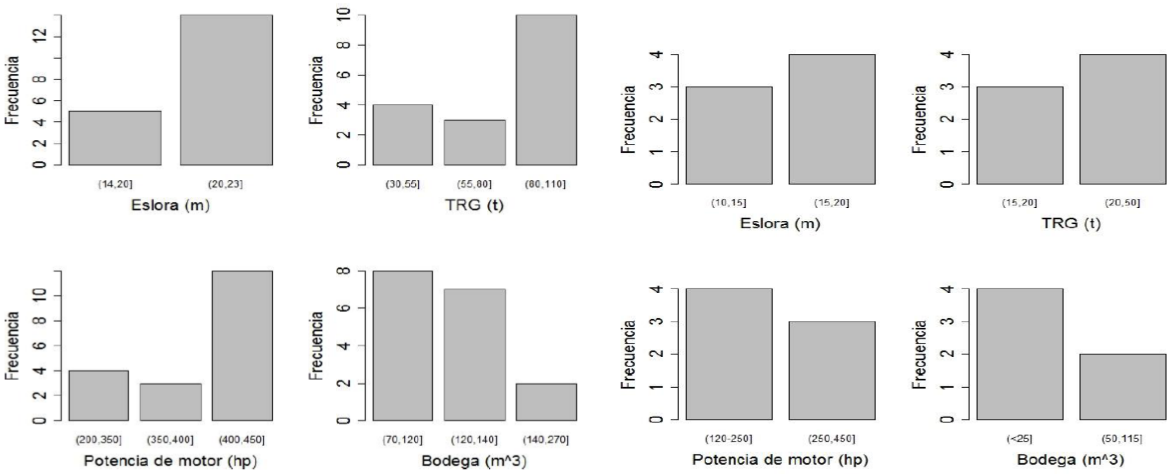
Vessels in the crustacean fisheries operate at depths of between 150 m and 750 m, with fishing trips of between 1 and 4 days (although shorter trips are more common in the north). The catch per trip varies between 0.5 t and 20 t, depending on zone, targeted species, and the month.

Artisanal and industrial vessels are very similar (Figure 13) and there are limited technical differences between the characteristics of the two types of vessels. The law defines artisanal vessels of the type that participate in these fisheries as those up to 18 m in length and 80 m^3 of storage capacity (LGPA Art. 2 14). On average artisanal vessels are smaller, with lower HP and storage capacity than industrial vessels (Table 2, Figure 14). Industrial vessels have instrumental navigation, and echo sounders. In addition, they are required to have equipment for satellite positioning, which allows continuous monitoring of location. Artisanal vessels are also required to use satellite positioning.

Figure 13. Example of industrial and artisanal vessels operating in the demersal crustacean fisheries

Source: Zilleruello 2015

Figure 14. Characteristics of: left) industrial vessels operating between Region II and VIII, right) artisanal vessels operating Regions II and V.



Source: Zilleruello et al 2015

<u>Table 2: Characteristics of the Artisanal and Industrial Fleets targeting demersal crustaceans 2014. Length (eslora), tonnage (TRG) and storage capacity (bodega).</u>

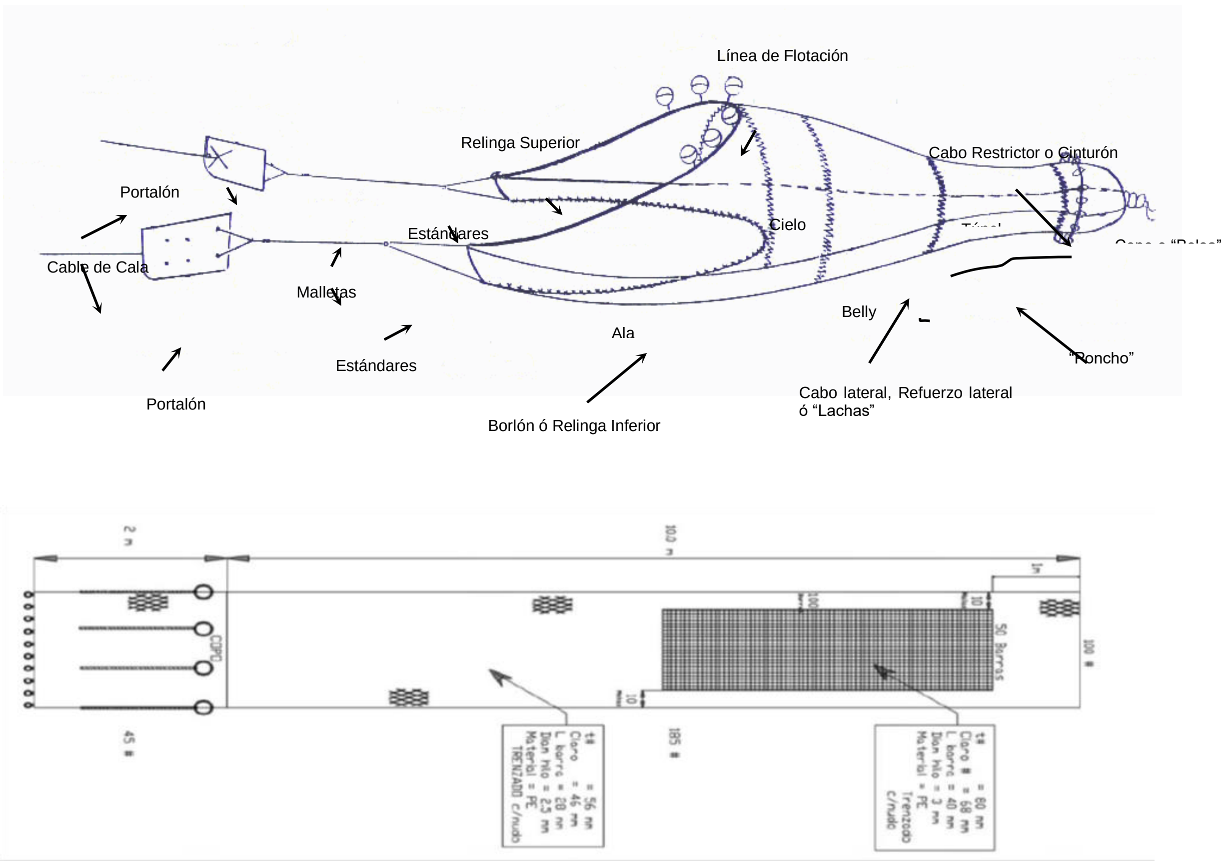
Flota		Eslora (m)	TRG (t)	Bodega (m^3)	HP (potencia)
Artesanal	Mínimo	12,0	15,0	21,3	90
	Máximo	17,9	49,9	110	450
	Promedio	16,8	41,5	50	318
Industrial	Mínimo	15,0	32	48	198
	Máximo	22,9	106,5	272	525
	Promedio	21,1	84,4	123,2	402

Source: Zilleruello et al 2015

Traditionally the trawl gear models used by demersal crustacean fisheries were the "modified German trawl" and the "modified semiballon", the second used mainly in the south. Mesh sizes were of 1 ½ " (38-40 mm) usually in the tunnel and cod end, and to 2"(50 mm), in the wings. The opening of the net varied between 2.5 and 3.5 m. To avoid friction with the seabed and consequent wear, protectors were used covering parts of the net. The nets were mainly of polyamide and reused from discarded nets from purse seiners. These trawl gears were replaced by a new design because of concerns of catching small and immature individuals of the target species, bycatch mortality imposed on non-target species, and damage caused by interaction with the seafloor.

The new gear design was the product of several years of efforts (FIP 2008-20, FIP- 2008-26) conducted by researchers at the Pontificia Universidad Catolica de Chile (Queirolo *et al*. 2012). The new trawl was made mandatory starting November 2014. The gear consists of a net with two panels of 28.8 m headrope and 32 m footrope with sweeps and bridles of 1 and 5 m, respectively (Figure 15, 16). Characteristics of the new bottom trawl gear in the demersal crustacean fisheries were established in Res. Ex. 762/2013 and modified in Res. Ex. 145/2015. These include overall dimensions, net material and mesh sizes in different parts of the nets, structures to protect against wear, and escape devices. The nets should use a square mesh panel constituted by a mesh with minimum opening of 70 mm or 35 mm of internal dimension. The panel should have a minimum length equivalent to 25% of the tunnel and cod end and width should cover the superior panel of the net section. Minimum mesh size for the tunnel and cod end for nylon shrimp nets is 50 mm and for yellow and red squat lobster is 60 mm. It was mentioned during the site visit that some fishers use the 60 mm mesh size for targeting nylon shrimp which results in loss of small individuals when the tow is taken on deck resulting in some unaccounted fishing mortality. Also during the site visit information was provided on experiments with net designs within the regulations that had been made to improve net selectivity and allow hake to exit the gear unharmed and minimize bycatch.

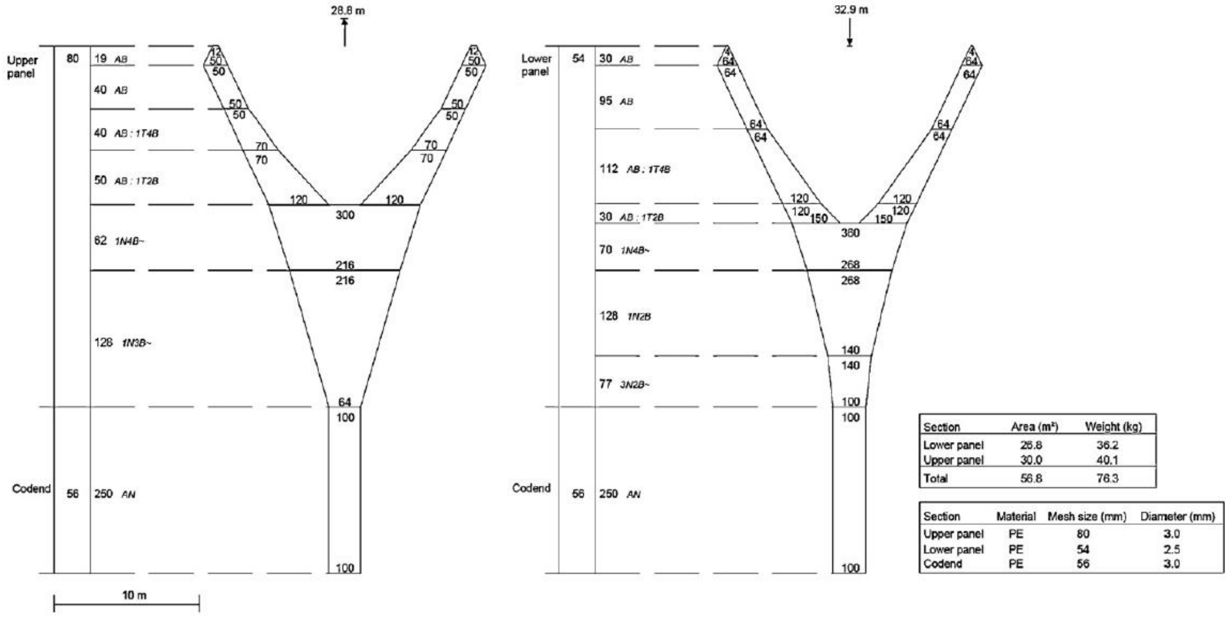
Figure 15. Configuration of the Modified Demersal Crustacean Trawl and Design of the Square Mesh to Allow for Escape of Fish Bycatch.



Source: Informes Técnico (R. Pesq.) No 017/2013 and Queirolo 2010 FIP 2008-26 Report.

FIP 2008-26 "Evaluación del Desempeño Operativo de la Nueva Red de Arrastre en Pesquerías de Crustáceos Demersales"

Figure 16. Design of the new crustacean trawl used during experimental fishing for evaluation



Source: Queirolo et al 2011.

The list of vessels that are currently fishing within the UoCs is given in Table 3. However, it should be noted that the quota is owned by the company who may then fish for that quota with a designated vessel.

Table 3: List of member vessels

VESSEL (LOA)	REGISTRATION NO. PORT	OWNERS / ADMINISTRATORS
ISLA PICTON (21)	2239 - VALPARAISO	ANTARTIC SEAFOODS
GRINGO (22)	1778 - VALPARAISO	ANTARTIC SEAFOODS
ISABEL S (17,5)	1429 - COQUIMBO	ANTARTIC SEAFOODS
ORIENTE (17,9)	1234 - QUINTERO	PESQUERA QUINTERO
DON STEFAN (21.0)	2945 – VALPARAISO	PESQUERA QUINTERO
ELBE (17,9)	2891 – VALPARAISO	PESQUERA QUINTERO
ELDOM (22,2)	2070 – VALPARAISO	PESQUERA QUINTERO
RAUTEN (18,3)	VALPARAISO	PESQUERA QUINTERO
ULYSES (21,4)	VALPARAISO	PESQUERA QUINTERO
CUCAÑA (22,6)	VALPARAISO	PESQUERA QUINTERO
DON MARIO (21,4)	VALPARAISO	PESQUERA QUINTERO

VESSEL (LOA)	REGISTRATION NO. PORT	OWNERS / ADMINISTRATORS
CACHAGUA I (22)	1855 – VALPARAISO	BRACPESCA
NISSIN MARU III (20,5)	2192 – VALPARAISO	BRACPESCA
LINDA KAY (21)	1860 - VALPARAISO.	BRACPESCA
AMANCAY (15,7)	63 - CALDERA	RYMAR
CHAFFIC I (11,9)	2570 – COQUIMBO	RYMAR
PUNTA DE TALCA (19,9)	2234 - COQUIMBO	RYMAR
FOCHE (22)	2111 – VALPARAISO	ISLA DAMAS
COCHA (22)	1826 – VALPARAISO	ISLA DAMAS
ISLA ORCAS (22)	1868 – VALPARAISO	SUNRISE
LONQUIMAY (22)	1840 – VALPARAISO	ISLA DAMAS
POLUX (22)	2234 -	GUILLERMO DONOSO

Source: client

An up to date vessel list can be obtained by contacting Acoura Marine Ltd. using the following details:

MSC Fisheries Department

Contact Email: Fisheries@Acoura.com

Contact Tel: +44(0)131 335 6600 (Acoura main number)

3.2.5 Administrative Framework

Artisanal fishers have an exclusive five-mile reserve and shares of global quotas. With the new law the global quota in some fisheries is partitioned between the industrial and artisanal sector. This was established in 2013 for 12 fisheries and for a 20-year period. Through this procedure the small-scale sector was supposed to access 55% of the total landings and the industrial to reduce its participation to 45%. Quota transfer from the industrial sector to the small-scale fishers equals $51 million a year, and included shrimp and Patagonian toothfish (SUBPESCA website). There are categories of vessels based on several characteristics, with the largest category with loading capacity not exceeding 80 t by fishing trip. Artisanal fishers are represented at the various councils.

For the demersal crustacean fisheries there is an Artisanal Harvest Regimen (Regimen Artesanal de Extraccion RAE). An artisanal vessel is defined as one exploited by an artisanal fishing right owner (armador), registered in the Artisanal Fishery Registry, and under 18 m in length and 80 m^3 of storage capacity (LGPA Title I Art. 2 14).

The law incorporates new definitions to assess and measure availability of fishery resources as under-exploited (subexplotada), fully-exploited (en plena explotación), overexploited (sobreexplotada), and collapsed (agotada o collapsada). Administration measures are contingent to these definitions of stock condition (LGPA Art. 2º 59). In this respect, the new law incorporates new international sustainability standards such as Biological Reference Points (BRP) and the Maximum Sustainable Yield (MSY) (Rendimiento Maximo Sostenible RMS), which set the maximum catch that a resource can be subject to without affecting its medium and long-term sustainability. As a result, different management measures have been established, such as restricted access, annual catch quotas with spatial and temporal distributions, transferable fishing licenses, extraordinary fishing permits, and spatial and temporal closures for each species. Determination of these BRP points must be made by decree of the Ministry of Economy, Public Work and Tourism (Ministerio de Economia, Fomento y Turismo MINECON), and according to the determination made by the relevant Technical Scientific Committee (Comité Científico Técnico CCT). There are eleven technical committees CCT (eight for fisheries and three for aquaculture), which should decide on the availability of fishery resources, BRP and catch quotas.

The three demersal crustacean fisheries in this assessment are under closed access and are regulated by annual global catch quotas, among other measures. Open access is not granted for fisheries that are fully exploited or have been overexploited and then declared in recovery (LGPA Art.19) which is the case for the demersal crustacean fisheries.

The **nylon shrimp fishery** II - VIII Region is under a Full Exploitation regime (D.S. MINECON Nº611/1995. The 2016 global quota established for the fishery was 5,904 t (D.E. Nº945/2015). 2016 allocation among research allowance and industrial and artisanal fisheries by region and fishing periods is as follows:

CAMARÓN NAILON II-VIII REGIONES			**Toneladas**
CUOTA GLOBAL			**5.904**
Reserva de investigación			110
Cuota Remanente			5.804
FRACCIÓN INDUSTRIAL			**4.635**
Descuento Art. 16º Transitorio			230
FRACCIÓN INDUSTRIAL, con descuento Art. 16º Transitorio			**4.405**
	Cuota objetivo II-III Región		**55**
		Enero-Julio	49
		Octubre-Diciembre	6
	Cuota objetivo IV Región		**730**
	Descuento Art. 16º Transitorio		230
	Cuota objetivo IV Región, con descuento Art. 16º Transitorio		**500**
		Enero-Julio	450
		Octubre-Diciembre	50
	Cuota objetivo V Región		**730**
		Enero-Julio	657
		Octubre-Diciembre	73
	Cuota objetivo VI Región		**1.040**
		Enero-Julio	936
		Octubre-Diciembre	104
	Cuota objetivo VII Región		**1.040**
		Enero-Julio	936
		Octubre-Diciembre	104
	Cuota objetivo VIII Región		**1.040**
		Enero-Julio	936
		Octubre-Diciembre	104
FRACCIÓN ARTESANAL			**1.159**
Incremento Art. 16º Transitorio			230
FRACCIÓN ARTESANAL, con incremento Art. 16º Transitorio			**1.389**
	Fauna Acompañante		25
	Cuota Objetivo Artesanal		1.134

The **yellow squat lobster** Northern Unit fishery III-IV Region is also under Full Exploitation regime D.S. MINECON Nº377/1995). The 2016 quota was 2,500 t (D.E. Nº945/2015) allocated as:

LANGOSTINO AMARILLO III-IV REGIONES			Toneladas
CUOTA GLOBAL			**2.500**
Reserva de investigación			50
Cuota Remanente			2.450
FRACCIÓN INDUSTRIAL			**1.642**
Descuento Art. 16º Transitorio			160
FRACCIÓN INDUSTRIAL, con descuento Art. 16º Transitorio			**1.582**
	Cuota objetivo III Región		**164**
		Marzo-Agosto	148
		Octubre-Diciembre	16
	Cuota objetivo IV Región		**1.478**
	Descuento Art. 16º Transitorio		160
	Cuota objetivo IV Región, con descuento Art. 16º Transitorio		**1.318**
		Marzo-Agosto	1.187
		Octubre-Diciembre	131
FRACCIÓN ARTESANAL			**808**
Incremento Art. 16º Transitorio			160
FRACCIÓN ARTESANAL, con incremento Art. 16º Transitorio			**968**
	Fauna Acompañante		18
	Cuota Objetivo Artesanal		790

The yellow squat lobster Southern Unit fishery V-VIII Region is under a Fishery under Recovery regime (D.S. MINECON Nº787/1996). The allocated 2016 quota was 1,830 t; there is also a bycatch quota of 13 t (D.E. Nº944/2015). 2016 allocation by region and time period was as follows:

Región	Total	Marzo-Agosto	Octubre-Diciembre
V-VI	**1190**	1071	119
VII-VIII	**640**	576	64
Total	**1.830**	1.647	183

The red squat lobster XV-IV Northern Unit fishery is under Full Exploitation regime (D.S.MINECON Nº245/2000). The 2016 quota was 970 t (D.E. Nº945/2015) allocated as:

LANGOSTINO COLORADO XV-IV REGIONES			Toneladas
CUOTA GLOBAL			**970**
Reserva de investigación			19
Cuota Remanente			951
FRACCIÓN INDUSTRIAL			**251**
Descuento Art. 16º Transitorio			160
FRACCIÓN INDUSTRIAL, con descuento Art. 16º Transitorio			**91**
	Cuota objetivo II-III Región		**405**
		Marzo-Agosto	36
		Octubre-Diciembre	04
	Cuota objetivo IV Región		**211**
	Descuento Art. 16º Transitorio		160
	Cuota objetivo IV Región, Descuento Art. 16º Transitorio		**51**
		Marzo-Agosto	46
		Octubre-Diciembre	05
FRACCIÓN ARTESANAL			**700**
Incremento Art. 16º Transitorio			160
FRACCIÓN ARTESANAL, con incremento Art. 16º Transitorio			**860**
	Fauna Acompañante		15
	Cuota Objetivo Artesanal		685

The red squat lobster V-VIII Region Southern Unit fishery is under a Fishery under Recovery regime (D.S. MINECON Nº430/1991). The 2016 quota was 3,231 t (D.E Nº 944/2015) with a quota of 64 t for research and 37 t for bycatch. 2016 allocation was as follows:

Región	Total	Marzo-Agosto	Octubre-Diciembre
V	**390**	350	40
VI	**390**	350	40
VII	**1175**	1060	115
VIII	**1175**	1060	115
Total	**3130**	2820	310

Fisheries that are declared fully exploited are subjected to a Full Exploitation Regime ("Regimen de Plena Explotación"). Conditions and regulations under this regime are contained in LGPA Paragraph 2ºArt. 21-38. Fisheries under this regime and for which there is a global quota, have a sectorial and regional split of the quota as shown above. The artisanal sector is under the Artisanal Harvest Regime administration system for closed access by fleet and individually (Regimen Artesanal de Extracción por flota e individualmente RAE) (LGPA Art. 55) described below. The industrial sector is administered through Tradable Fishing Licenses (Licencias Transables de Pesca LTP). There are two types of Licenses: Class A LTP which are renewable and class B LTP which are not. The industrial fishery until 2012 was regulated by Maximum Limit by Vessel Owner (Límite Máximo de Captura por Armador LMCA) (Art.2 of Law 19.713), a mechanism that assigned the global quota among registered fishing owners based on historical catch. The new LGPA substituted the LMCA by LTP allowing LMCA industrial fishing owners to change their rights to Class A LTP access. All holders in the demersal crustacean fisheries transferred their LMCA rights into LTP. These LTP shares are equivalent to the sum of participation shares relative to historical catch of the authorized vessels in the previous system. They are assigned for 20 years and can be renewed if there are no disqualifying infractions due to non-compliance. The LTPs are transferable and can also be divided. The Class B licenses (Class B LTP) were created to allow for those who want to join the fisheries and are acquired through a public auction mechanism. These Class B LTPs become available when a fishery reaches 90%, 95% and 100% of the MSY (RMS). They are allocated for up to 15% of the industrial quota and are also assigned for 20 years but are not renewable. They are subjected to auction when expired. Artisanal owners that are assimilated to this regime should follow the law in the same terms as the industrial sector.

For the demersal crustacean fishery units in this assessment that are under the full exploitation regime, nylon shrimp between II-VIII Region, yellow squat lobster III-IV Region, and red squat lobster III-IV Region, the regulation approved the public auction of 15% of the industrial fraction of the global quota for LTP Class B which took place in 2015 (D.S Nº 103/2015, R.E. Nº2886/2015). Thus, the next auction will take place in 20 years (2036), and the industrial quota for these fisheries is 85% Class A and 15% Class B. There are no artisanal nylon shrimp fisheries south of Region IV and the artisanal demersal crustacean fisheries that operate in Regions III- IV using trawl are under an RAE administration system.

Description of the RAE is contained in LGPA Title IV. In Region IV there are four fishing right owners targeting the three demersal crustacean species in this assessment. The criteria to allocate the artisanal fraction of the global quota for 2014-2028 as shown above are based on landings (January 2010 to June 2013, 98% weight) and time since registration in the fishery of all vessels registered (2%). Individual allocations were made by reported landings by vessel (January 2010 to December 2012, 45% weight), time since registration (30%), vessel length (20%) and vessel TRB (5%) (R.Ex. Nº67/2014). The RAE allocation represents 97% of the artisanal quota while the rest (quota bolsón) is for trap and small vessels. The artisanal fishing right holders can give the rights to LTP holders for the total or part of their annual allocation (LGPA Art. 55 N). LTP holders can harvest that amount but in compliance with LTP regulations. Annual quotas of 708.10 t, 799.00 t, and 763.62 t were allocated for 2016 among the four fishing right owners (Table 4).

There are also annual quotas for the species and areas outside of the fishery units and percentages of landings and as bycatch (fauna acompañante) which are determined for a period of up to three years (LGPA Art.3 c, f). These were established for 2015 to 2017 (D.E. Nº 117/ 2015) as follows:

Nylon shrimp 5 t as bycatch in the prawn (*Haliporoides diomedeae*) fishery in Regions XV, I, IX, XVI and X, and 3 t in trawl fisheries targeting fish, and 2 t in other fisheries; **Yellow squat lobster** 7 t as target in Regions XV, I, II, IX, XIV and X, 3 t as bycatch in the nylon shrimp fishery in Region II, 3 t as bycatch of the red squat lobster fishery in Regions XV, I and II, 3 t as bycatch of the prawn fishery in

Regions XV, I, II, IX, XIV and X, 4 t as bycatch of other resources; **Red squat lobster** 5 t as target in Regions IX, XIV and X, 2 t in the prawn fishery in Regions IX, XIV and X, and 5 t as bycatch in other fisheries in Regions IX, XIV and X.

Table 4. Distribution of the demersal crustacean quotas 2016 in Region IV: A) temporal distribution of quota and residual quota by species, B) temporal distribution of individual quota by species and vessel.

	Recurso/Distribución temporal	Enero - Julio	Octubre - Diciembre	Total (t)
Cuota Flota (t)	Camarón nailon	637,29	70,81	708,10
		Marzo - Agosto	Octubre - Diciembre	Total (t)
	Langostino amarillo	719,10	79,90	799,00
		Marzo - Agosto	Octubre - Diciembre	Total (t)
	Langostino colorado	687,258	76,362	763,62

	Recurso/Distribución temporal	Enero - Julio	Octubre - Diciembre	Total (t)
Cuota Residual (t)	Camarón nailon	19,71	2,19	21,90
		Marzo - Agosto	Octubre - Diciembre	Total (t)
	Langostino amarillo	45,9	5,1	51,00
		Marzo - Agosto	Octubre - Diciembre	Total (t)
	Langostino colorado	14,742	1,638	16,38

B) Distribución temporal de la cuota individual por nave y recurso:

Camarón nailon IV región, en toneladas.

	Armador	Embarcación	Enero - Julio	Octubre - Diciembre	Total
Camarón nailon	PATRICIO GENARO VIAL CHABRILLARD	PUNTA TALCA	169,36	42,34	211,70
	ERIC ALEXIS ARAVENA ARAVENA	TRAUWÜN I	158,848	39,712	198,56
	NICANOR DEL ROSARIO GONZALEZ VEGA	CHAFIC I	122,64	30,66	153,30
	GONZALO ANDRES ZUÑIGA ROMERO	BONI MAURI	115,632	28,908	144,54

Langostino amarillo IV región, en toneladas.

	Armador	Embarcación	Enero - Julio	Octubre - Diciembre	Total
Langostino amarillo	PATRICIO GENARO VIAL CHABRILLARD	PUNTA TALCA	215,73	23,97	239,70
	ERIC ALEXIS ARAVENA ARAVENA	TRAUWÜN I	201,195	22,355	223,55
	NICANOR DEL ROSARIO GONZALEZ VEGA	CHAFIC I	155,295	17,255	172,55
	GONZALO ANDRES ZUÑIGA ROMERO	BONI MAURI	146,88	16,32	163,20

Langostino colorado IV región, en toneladas.

	Armador	Embarcación	Enero - Julio	Octubre - Diciembre	Total
Langostino Colorado	PATRICIO GENARO VIAL CHABRILLARD	PUNTA TALCA	205,686	22,854	228,54
	ERIC ALEXIS ARAVENA ARAVENA	TRAUWÜN I	192,348	21,372	213,72
	NICANOR DEL ROSARIO GONZALEZ VEGA	CHAFIC I	148,824	16,536	165,36
	GONZALO ANDRES ZUÑIGA ROMERO	BONI MAURI	140,4	15,6	156

Fisheries that have been declared as over-exploited, under a total closure for at least three years, and found to be recovering such that it is possible to set a global catch quota, are subjected to a Fisheries under Recovery Regime ("Regimen de Pesquerias en Recuperacion" LGPA Art. 39). When a fishery is declared in this regime all fishing authorizations for the fishery unit expire. Conditions and regulations under this regimen are described in LGPA Paragraph 3º Art. 39-40. Fishing rights are given as Extraordinary Fishing Permits (Permiso Extraordinario de Pesca PEP) with annual rights for up to an assigned proportion of the global quota. Under this regime, fishing rights are awarded every year by SUBPESCA at a public auction. Thus, participation in these fisheries is through these public auctions for quota shares or also by transfer of PEPs. The auction is to distribute the annual global quota within a fishery unit among vessel owners that have vessels with appropriate fishing rights. Shares allocated through these auctions are for the equivalent of 10% in tons of the annual global quota in the fishery unit. There are two types of shares: variable and fixed. The first year the fishery is auctioned, the whole quota is allocated into 10 variable shares, each 10% of the quota. Every year the share is decreased by 10% until it is depleted. Starting during the second year that the fishery is auctioned, and as these variable shares decrease, there are newly available portions of the quota that are auctioned to fixed shares. These fixed shares are for 10% of the quota and are valid for 10 years. After these 10 years the share is again available for auction. The quota is distributed regionally, given the status of the resource in the area, and where fishing right owners can fish their percentage allocations of the total quota. Conditions for these procedures were established in 1996 (MINECON D.S. 97/1996) and modified in subsequent decrees (Nº 173, 2003; Nº162, 2013). There is no distinction between industrial and artisanal shares under this regime. Although this system was intended to distribute the quota over a greater number of participants, in practice the fixed shares are purchased by the same fishing companies with variable shares.

Other administration rules that apply to the demersal crustacean fisheries are seasonal closures to protect spawning and recruitment. These are effective for yellow squat lobster between January 1st and March 31st in Regions III to VIII (DS No324 1996), and for red squat lobster between January 1st and March 31st in Regions XV to IV (DS Nº1.242 2005) and V to VIII (DS Nº323 1996). For nylon shrimp there is a fishing closure from July 1st to August 31st from Regions II to VIII (DEx Nº92 1998).

There is also an extraordinary closure to protect egg bearing of all demersal crustaceans in Regions V-VII between September 1st and 30th (DS Nº471 2014). There are also regulations related to the trawl gear described above within the fleet description section.

The number of vessels operating in the fisheries (other than those in RAE) is variable as the fishery is administered with individual quotas with rights belonging to the companies, in the northern units through LTPs and in the south through PEPs. In both regimes, the owner of the license decides which and how many vessels participate in a given year. Then these vessels are registered with SERNAPESCA and there is a registration fee.

The current (2016) allocation of the quotas between companies is given in Table 5.

Table 5 Allocation of quotas (% of total) for nylon shrimp, yellow squat lobster and red squat lobster across the fishing companies (source: SUBPESCA)

Nylon shrimp

EMPRESAS	2016
ANTARTIC SEAFOOD	19.57
BAYCIC BAYCIC MARIA	<0.01
BLUMAR S.A.	1.81
BRACPESCA	16.17
CAMANCHACA PESCA SUR S.A.	0.52
COSTA BRAVA LTDA PESQ.	2.07
GRIMAR S.A. PESQ.	0.28
ISLADAMAS S.A.	21.00
LANDES S.A. SOC. PESQ.	0.15
MOROZIN BAYCIC MARIA ANA	<0.01
MOROZIN YURECIC MARIO	<0.01
QUINTERO LTDA. SOC. PESQ.	<0.01
QUINTERO S.A. PESQ.	34.06
RUBIO Y MAUAD LTDA.	0.34
SUNRISE S.A. PESQ.	3.69
ANTONIO CRUZ CORDOVA NAKOUZI E.I.R. L	0.29

EMPRESAS	2016
BIO BIO S.A. PESQ.	<0.01
ENFEMAR LTDA. SOC. PESQ.	0.03
ALIMENTOS ALSAN LTDA	0.01
TOTAL	**100.00**

Yellow squat lobster – northern region

EMPRESAS	2016
ANTARTIC SEAFOOD	36.83
BAYCIC BAYCIC MARIA	<0.01
BRACPESCA	38.29
GRIMAR S.A. PESQ.	0.02
ISLADAMAS S.A.	11.01
MOROZIN BAYCIC MARIA ANA	0.01
MOROZIN YURECIC MARIO	<0.01
QUINTERO S.A. PESQ.	6.66
RUBIO Y MAUAD LTDA.	4.92
SUNRISE S.A. PESQ.	2.17
ENFEMAR LTDA. SOC. PESQ.	0.08
ALIMENTOS ALSAN LTDA	<0.01
TOTAL	**100.00**

Yellow squat lobster – southern region

EMPRESAS	2015	2016
CAMANCHACA PESCA SUR	39.01	33.59
BLUMAR S.A.	17.65	18.40
QUINTERO	0.54	0.54
SUNRISE	1.16	0.50
BRACPESCA	20.78	22.07
ISLADAMAS	10.51	9.51
ANTARTIC SEAFOOD	6.80	8.13
GRIMAR S.A.	1.00	1.00
RUBIO Y MAUAD LTDA.	2.24	2.23
BIO BIO S.A.	0.01	0.01
PESQ. ANTONIO CRUZ CORDOVA		0.01
SOC. PESQ. ENFEMAR LTDA.		0.01
TOTAL	**100.00**	**96.00**

Red squat lobster – northern region

EMPRESAS	2016
ANTARTIC SEAFOOD	14.23
BRACPESCA	28.54
ISLADAMAS S.A.	9.85
RUBIO Y MAUAD LTDA.	1.20
QUINTERO S.A. PESQ.	0.13
SUNRISE S.A. PESQ.	45.95

EMPRESAS	2016
ALIMENTOS ALSAN LTDA	<0.01
TOTAL	**100.00**

Red squat lobster – southern region

EMPRESAS	2015	2016
CAMANCHACA PESCA SUR	67.81	59.06
BLUMAR S.A.	15.12	17.87
BRACPESCA	6.12	7.11
EMPACADORA DEL PACIFICO	1.50	1.50
ALIMAR	0.50	0.50
SUNRISE S.A.	0.50	0.50
ARTIC S.A. ELAB	0.50	0.50
ISLADAMAS S.A.	2.81	2.81
BIO BIO S.A.	0.00	0.00
ANTARTIC SEAFOOD S.A.	3.94	3.94
DISTRIMAR LTDA.	0.00	0.00
RUBIO Y MAUAD LTDA.	0.69	0.68
PESQ. QUINTERO S.A.		0.01
SOC. PESQ. ENFEMAR LTDA.		0.01
PESQ. ANTONIO CRUZ CORDOVA		0.01
TOTAL	**99.50**	**94.50**

3.3 Principle One: Target Species Background

Principle 1 of the Marine Stewardship Council standard states that:

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

Principle 1 covers all fishing activity on the entire nylon shrimp, yellow squat lobster and red squat lobster stocks - not just the fisheries undergoing certification. However, the fisheries under certification would be expected to meet all management requirements, such as providing appropriate data and complying with controls, therefore demonstrably not adding to problems even if the problems will not cause the certification to fail.

In the following section the key factors which are relevant to Principle 1 are outlined.

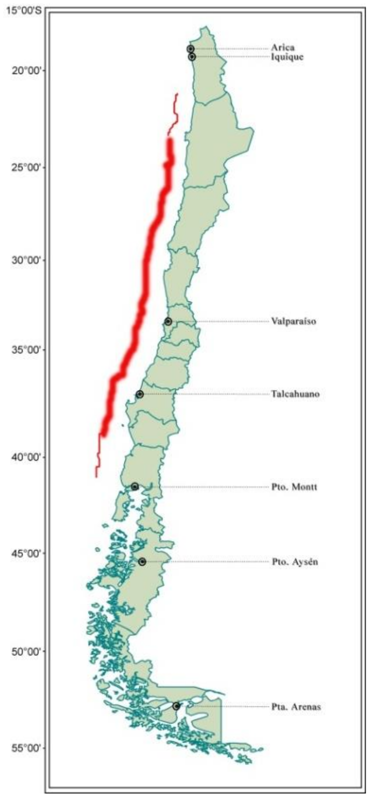
3.3.1 Nylon shrimp fishery resources and life history

Taxonomy and distribution

The nylon shrimp, *Heterocarpus reedi* (Bahamonde, 1955), known in Chile as 'camarón nailon', is a decapod crustacean of the family Pandalidae. Its distribution is off the north-central and south-central Chilean coast, between 23°48'S (south of Antofagasta) and 39º00'S (Puerto Saavedra) (Figure 17). The distribution is essentially continuous within Antofagasta and Coquimbo Regions (III and IV), but further south their presence is becoming sporadic, found in small pockets in the north and south of the Maipo River Canyon in Region VI, and off Point Nugurne in Region VII. In addition, this species is also present off the coast of Peru. The nylon shrimp inhabits the continental shelf and upper slope at depths ranging between 150 and 800 m, although the fishery is carried out primarily between 150 and 500 m, with a more or less continuous distribution, parallel to the Chilean coast within this depth range. The nylon shrimp inhabits the mixing zone of the masses of Equatorial Subsurface Water (AESS) and Antarctic Intermediate Water (AIA), which is characterized by being cold (10-12 ° C) and saline (34.5 to

34.9 ppt) (Bahamonde & Henriquez, 1970). Nylon shrimp is found primarily in clay, sedimentary rock, sand, muddy sand and sandstone.

Figure 17. Geographical distribution of nylon shrimp (*Heterocarpus reedi*) in Chile.



Migration and stock structure

Whilst local movements in both latitude and depth have been observed (Mistakidis & Henriquez, 1966), there have been few studies of movements of the nylon shrimp. Within a local region, Arana & Nakanishi (1971) identified seasonal movements in which the highest densities were located north of Valparaiso Bay (32°10'S) in deeper waters during summer and autumn, while between winter and spring highest densities were south of this bay in shallower waters, resulting in a migration pattern in an oblique direction to the coast. This migration is assumed to be related to biotic and abiotic factors, possibly to promote reproductive and larval development aspects, and may be linked with the presence in the same location of a centre of upwelling, contributing to the rise of the larvae to a plankton-rich ocean area, thus favouring its initial development. Studies of population structure of nylon shrimp (Mistakidis & Henríquez, 1966; Bahamonde & Henríquez 1970; Arana *et al*., 1975) and results from recent stock surveys show that the average carapace length (CL) of males is lower than that of females, and that for both sexes larger individuals of the population are generally located to the south of latitude 32°S.

Growth

Growth of crustaceans occurs through the shedding of the exoskeleton (ecdysis). As with all crustacean species, estimation of growth parameters is difficult because there are no hard structures in which records of annual cycles allow the determination of age (in comparison with otoliths in fish), and because growth rate depends on both moult increase and moult frequency. Arana *et al*. (1976) observed that moulting may occur in three periods of the year (April, August and October-December), which is consistent with the periods in which there are noticeable changes in moisture content and ash in nylon shrimp. Estimates of growth parameters from various studies are given in Table 6.

Table 6. Growth parameters estimated for *Heterocarpus reedi* by various authors.

Área	Método	Sexo	L_∞ (mm)	k	t_o (años)	phi	Período	Referencia
Papudo a Punta Tres Cruces	Separación estados de muda	Machos Hembras	37,67 43,87	0,343 0,305	-0,117 0,170	2,688 2,769	1969 – 1980 1984 - 1985	Ziller, 1993
V Región	MIX (Tallas modales) Ajuste no lineal	Machos Hembras	40,68 48,34	0,199 0,174	-0,809 -0,510	2,518 2,608	1968-1973, 1981 y 1992-1994	Roa & Ernst, 1996
II - VIII Región	MIX (Tallas modales)	Machos Hembras	52,14 52,86	0,105 0,149	0,508 0,614	2,455 2,620	May-Ago 1996	Pavez *et al.*, 1996
II - VIII Región	MIX (Tallas modales)	Ambos	46,33	0,138	0,374	2,471	Base de datos 1980	Canales *et al.*, 1999

phi= log k + 2*log L_∞ Longitud infinita (L_∞) expresada como longitud cefalotorácica

Reproduction

Heterocarpus reedi are sexually dimorphic, with females being larger than males. Nylon shrimps mate in the autumn, followed by extrusion of eggs which are carried by the female for 4-6 months followed by release of larvae in early spring. The number of eggs has been observed to vary between 1,000 and 27,000 with fecundity dependent on size of female shrimp as follows:

Number of eggs = 0,010 * $CL^{3,903}$
(Arana *et al*., 1976)

The length at first maturity was estimated by different authors (Table 7), demonstrating that this species reaches maturity in the range of 24.5-28.8 mm CL, with the most probable size of 25 mm CL and an age of about 2.5 years (Arana *et al*, 1976; Canales et al, 1999.). Maximum age of nylon shrimp is thought to be between 7 and 9 years.

Table 7. Estimates of length at first sexual maturity in *Heterocarpus reedi* from various sources.

Método	Período analizado	$LC_{50\%}$ (mm)	Rango (mm)	Edad (años)	Referencia
Ajuste logístico		25,5		3,02	Arana & Tiffou, 1970
Ajuste logístico		25,1		2,5	Arana *et al.*, 1976
Ajuste logístico, ajuste no lineal	May-Ago 1996	24,5	23,8-24,9		Monardes & Olate, 1996
Ajuste no lineal, Máxima verosimilitud		28,8	28,2 - 29,6		Acuña *et al.*, 1997
Máxima verosimilitud	Jul-Ago 1997		18,0 - 37,3	6	Canales *et al.*, 1999

LC = longitud cefalotorácica

Prey and predators

Nylon shrimp are active predators, with some feeding specificity, and omnivorous detritivore feeders (Andrade and Baez, 1980). The main predators for nylon shrimp are the bigeye flounder (*Hippoglossina macrops*), Patagonian toothfish (*Dissostichus eleginoides*), kingclip (*Genypterus blacodes*) and Chilean hake (*Merluccius gayi gayi*). Nylon shrimp is not considered to be a key low trophic level (LTL) species.

Natural mortality

Natural mortality has been estimated using different methodologies by various authors (Table 8).

Table 8. *Heterocarpus reedi* natural mortality estimated by different methodologies and authors.

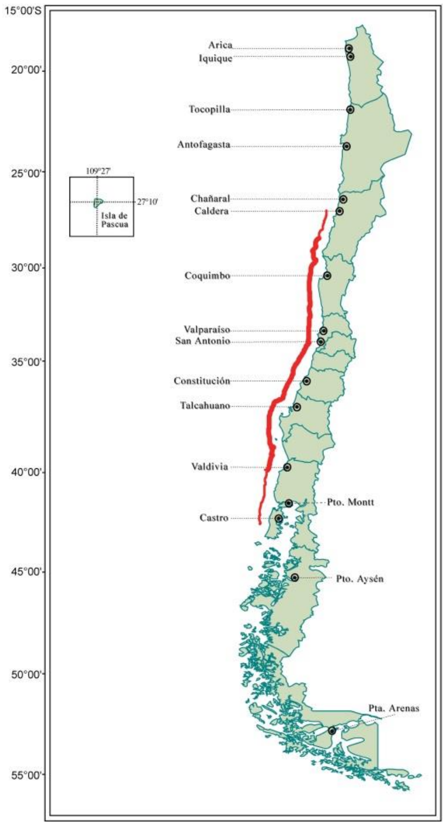
Metodología	Machos	Hembras	Ambos	M/K machos	M/K hembras	Referencia
Pauly (1980)	0,590	0,526				Ziller, 1993
Pauly (1980)	0,649	0,580				
Pauly (1980)	0,704	0,629				
Rikhter & Efanov (1976)	-	0,533				
Roff (1988)	-	0,604				
Roff (1988)	-	0,479				
Pauly (1980)	0,203	0,253				Pavez *et al*., 1996
Van Sickle (1974) Caddy (1984)	0,85	0,74				Acuña *et al*., 1997
Rikhter & Efanov (1976)		0,46	0,28		2,64	Canales *et al*., 1999
Alagaraja (1984)	0,33	0,27	0,21	1,66	1,55	
Alverson & Carney (1975)	0,59	0,48	0,36	2,96	2,76	
Roff (1988)		0,28	0,12		1,61	
Taylor (1958)	0,21	0,18	0,14	1,06	1,03	
Promedio ponderado			0,28			

3.3.2 Yellow squat lobster fishery resources and life history

Taxonomy and distribution

The yellow squat lobster, *Cervimunida johni* (Porter, 1903), known in Chile as 'langostino amarillo' is a decapod crustacean of the family Galatheidae. Its distribution is generally considered to be from Punta Lobos (28 º 18'S, Region III) in the north to the southern boundary of the island of Chiloé (43 º 10'S, Region X) (Figure 18). However, research vessel surveys have confirmed the presence of *C. johni* further to the north off Punta Foxes (26 º 10'S). The squat lobster is distributed in depths ranging from 150 to 500 m, in a thin strip of seabed on the upper continental slope and sporadically over the continental shelf. The highest concentrations are found off the coasts of the Regions of Coquimbo, Valparaiso and O'Higgins (Regions IV to VI). There is some overlap in the geographical distribution of the yellow squat lobster with other commercially-exploited crustaceans, the red squat lobster (*Pleuroncodes monodon*) and the nylon shrimp (*Heterocarpus reedi*), but the three species tend to be found at different depths. Areas of abundance of *C. johni* are influenced by the Equatorial Subsurface Water (AESS), which are characterized by relatively high salinities, usually greater than 36.6 ppt, with temperatures ranging between 10 and 11ºC and very low concentrations of dissolved oxygen, usually less than 1.0 mL L^{-1}. Especially in the south of the yellow squat lobster's distribution area, upwelling is observed during periods of prevailing winds, which contributes to fertilization of the surface water and the growth of phytoplankton.

Figure 18. Distribution of yellow squat lobster, *Cervimunida johni*, off the Chilean coast.



Migration and stock structure

Yellow squat lobster distribution is characterized by large scale clusters of individuals in certain areas of the continental slope. Local movements are observed, but this species does not exhibit large scale migrations on the continental shelf as exhibited by the red squat lobster. In the Northern Fisheries Unit (Regions III and IV), observations of population structure of yellow squat lobsters in 2008 showed that the length frequency distribution was unimodal (Acuña *et al*. 2010). Males ranged in size between 10.1 and 53.9 mm carapace length (CL) with a mode at 37 mm CL, whereas females ranged in size from 11.2 to 46.7 mm CL with a mode of 28 mm CL. In subsequent research cruises in 2009 and 2010, length distributions of lobsters exhibited more than one mode showing peaks of recruitment to the stock, although this was more evident in males than in females. In the Southern Fisheries Unit (Regions V and VI), monitoring conducted in 2007 determined that males have larger average lengths in all areas compared to females. Average lengths of males and females ranged between 32.2 and 41.8 mm CL and 31.2 and 34.8 mm CL respectively (Arana *et al.,* 2008). Males predominate in the total catches and there is a progressive dominance of males above 35 mm CL, reaching nearly 100% at lengths > 38 mm CL (Arana *et al*., 2008).

Growth

Growth of crustaceans occurs through the shedding of the exoskeleton (ecdysis). The main moulting period after which the squat lobster has a soft shell for a short period of time is from late November to late summer (February-March). For this reason, SUBPESCA maintains a biological ban from 1 January until 31 March each year, seeking to protect individuals during the main moulting period. As with all crustacean species, estimation of growth parameters is difficult because there are no hard structures in which records of annual cycles allow the determination of age (in comparison with otoliths in fish), and because growth rate depends on both moult increase and moult frequency. In addition, in the yellow squat lobster it is common for individuals to protect themselves, burying or hiding in cavities or inaccessible areas of the seafloor after moulting, thus reducing the chances of being caught by fishing gear (Arana, 1990). There have been various estimates of growth parameters with varying results (Table 9). According to these estimates, most individuals in the catch would be 5-8 years, sexual maturity would be reached at 3-4 years of age, and the maximum age that could be reached would be close to 10-12 years.

Table 9. Growth parameters estimated for *Cervimunida johni* by various authors

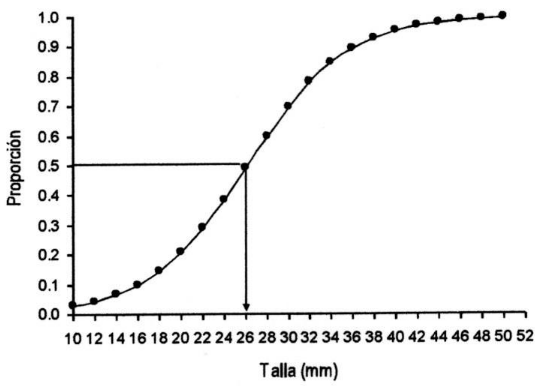
Sexo	L_∞	k	t_0	Referencia
Hembras Machos	54.60 60.70	0.177 0.265		Alegría *et al.* (1993)
Ambos	46.00	0.315		Wolff & Aroca (1995)
Hembras Machos	51.80 58.00	0.194 0.165	-0.44 -0.58	Pavéz *et al*. (1994)
Hembras Machos	53.90 57.40	0.196 0.221		Pavéz & Falcón (1995)
Hembras Machos	54.60 62.10	0.177 0.165	-1.87 -1.62	Pool *et al*. (1996)
Hembras Machos	49.00 59.30	0.154 0.118		Acuña *et al*. (1996)
Hembras Machos	57.55 59.36	0.101 0,174	0.04 0.79	Arana *et al*. (2000)
Hembras Machos	45.60 52.80	0.174 0.151		Arancibia *et al*. (2005)

Reproduction

Information on the reproductive behaviour of yellow squat lobster is based mainly on the analysis of the proportion of egg-carrying females and the stages of embryo development (Henriquez, 1979; Palma & Arana, 1997; Acuña *et al*, 2005.). Monitoring surveys indicate the presence of egg-carrying females during winter and spring, and based on the high percentage of carrying females in catches (> 80% of all females), it has been suggested that each female produces one clutch of eggs per year (Palma & Arana, 1997 Acuña et *al.*, 2005). However, in the period from June to October females with early stage embryos have been found, suggesting that not all females are mated at the same time. The size range of egg-carrying females is very broad, ranging from 11.5 mm to 43.5 mm CL (Palma & Arana, 1997, Acuña et al., 2005).

Size at sexual maturity has been investigated in both the northern and southern fisheries. In the northern region, Espejo *et al*. (2001) estimated the size at which 50% of individuals are sexually mature ($LM_{50\%}$) to be 26.1 mm CL (Figure 19), and in a separate study in Region IV Acuna *et al*. (2008) estimated the length at first maturity to be 24.9 mm CL. In the southern area, Zilleruelo & Montenegro (2007) estimated the size at 50% maturity to be 32.7 mm CL, although this may represent an overestimate of size at maturity in this area (P. Arana, pers.comm.).

Figure 19. Logistic curve describing *Cervimunida johni* sexual maturity, in the northern area (Espejo et al., 2001).



It has been suggested that in *C. johni* it is not necessary for females to have moulted for mating to take place. The presence of eggs under the abdomen of the female of this species is recorded from May to November in the north and between May and December in the south, with maximum numbers of egg-carrying females between July and October in the north and between July and November in the south (Figures 20 & 21).

Figure 20. Proportion of egg-carrying females of yellow squat lobster in region III, period 2007 - 2008 (black bars) and 1998-2001 (white bars).

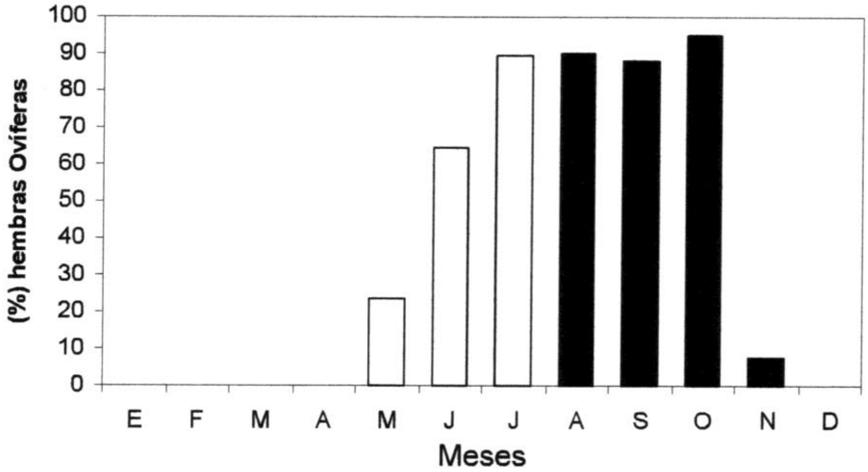
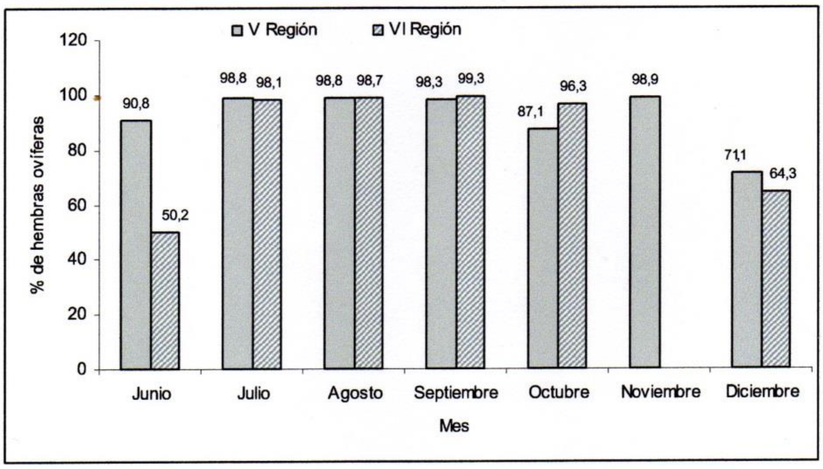


Figure 21. Percentage of egg-carrying females in yellow squat lobster, by month and region (V and VI) in the southern fishery



Fecundity has been determined in the northern regions with the number of eggs between 500 and 13,500 eggs (Figure 22). The relationship between carapace length and number of eggs is:

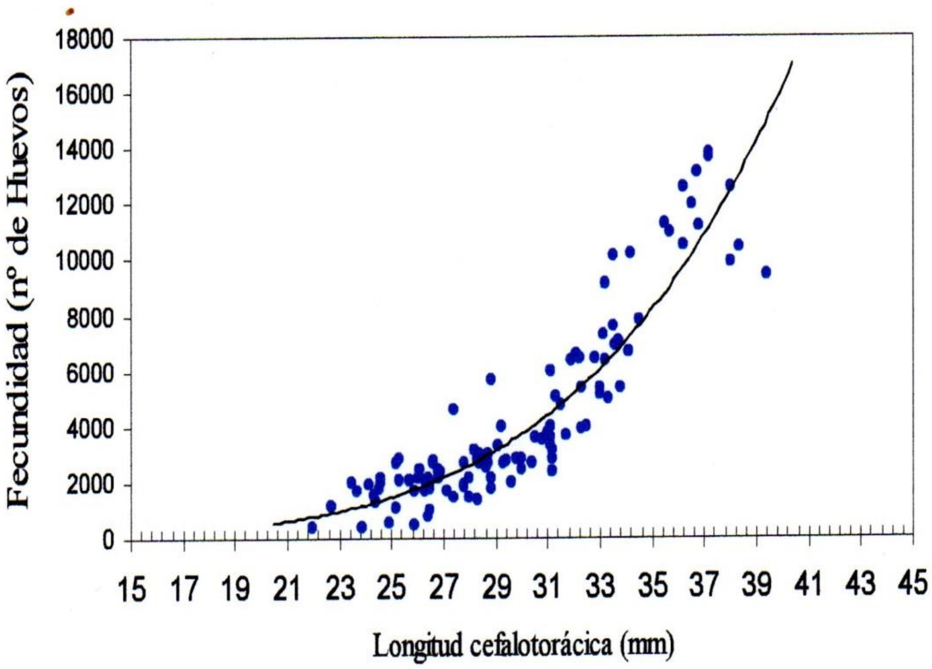
$$NTH = 0{,}00011 \cdot LC^{5{,}1006}$$

(Acuña *et al.,* 2008)

where,

NTH: total number of eggs. LC: female carapace length (mm).

Figure 22. Ratio adjustment carapace length-average number of eggs by female yellow squat lobster caught in Region IV.



Larvae stage

Monitoring the embryonic development of *C. johni* under laboratory conditions (11-13°C in seawater), revealed that for these conditions, this phase lasts between 28-40 days. There has been no study of the development of the larvae stage in *C. johni*.

Predators and prey

Acuña *et al.* (2007) identified the bigeye flounder (*Hippoglossina. macrops*) as an important predator of yellow shrimp, recording the presence of *C. johni* juveniles (8.0 to 8.7 mm CL) in flounder stomachs mainly in June. Larger bigeye flounder is known to prey upon nylon shrimp and yellow squat lobster (Villarroel & Acuña, 1999). Yellow squat lobster is not considered to be a key low trophic level (LTL) species.

Natural mortality

Estimates of the natural mortality rate (M) are of great importance in the analysis of population dynamics, and biological reference points may be more sensitive to changes in natural mortality than variations in growth (Collie & Gislason, 2001). A number of studies have estimated natural mortality rate (M) in the yellow squat lobster, resulting in a range of estimates (Table 10).

Table 10. Natural mortality rate of *Cervimunida johni* estimated by various authors

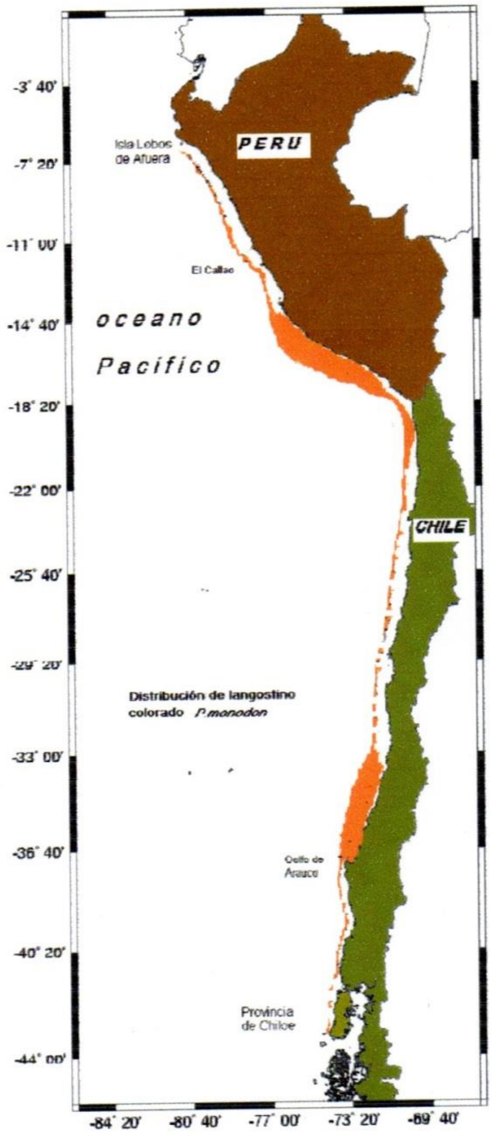
Sexo	M (1/año)	Método	Referencia
Machos Hembras	0.317 0.352		Pavéz *et al*. (1994)
Machos Hembras	0.66-0.77 0.77-0.92	Algaraja, 1994	Wolff & Aroca (1995)
Machos Hembras	 0.88-0.99	Rikhter & Efanov, 1976	Wolff & Aroca (1995)
Machos Hembras	0.250 0.300	Pauly, 1980	Acuña *et al*. (1996)
Machos Hembras	0.263 0.165	Algaraja, 1994	Escuela de Cs. Del Mar (2000)

3.3.3 Red squat lobster fishery resources and life history

Taxonomy and distribution

The red squat lobster, *Pleuroncodes monodon* (H. Milne Edwards, 1837), known in Chile as 'langostino colorado' is a decapod crustacean of the family Galatheidae. The species is characteristic of the south eastern Pacific Ocean, and is distributed from Lobos de Afuera in Peru, to the island of Chiloe in Chile (Haig, 1955) (Figure 23). Abundance of *P. monodon* is influenced by the Equatorial Subsurface Water (AESS), which are characterized by relatively high salinities, usually greater than 36.6 ppt, with temperatures ranging between 10 and 11ºC and very low concentrations of dissolved oxygen, usually less than 1.0 mL L^{-1}. Especially in the south of the red squat lobster's distribution area, upwelling is observed during periods of prevailing winds, which contributes to fertilization of the surface water and the growth of phytoplankton. Sediment and nutrients that outflow from various rivers in this region are also important in determining distribution and abundance of *P. monodon*. The red squat lobster inhabits muddy sand, rich in organic matter that serves as a food source (Gallardo *et al*. 1980).

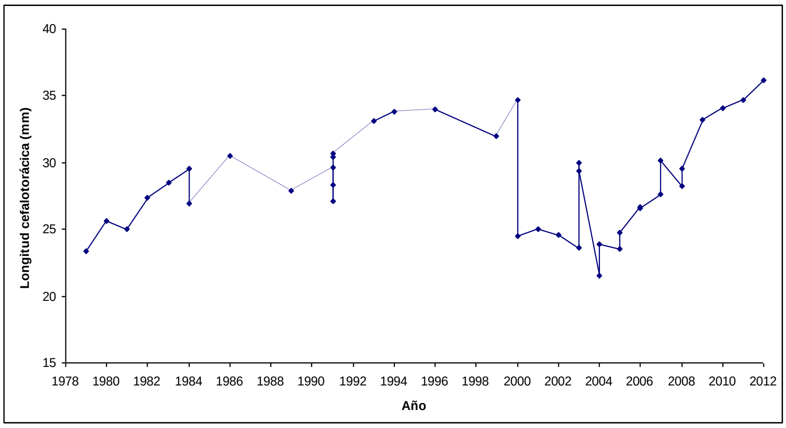
Figure 23. Distribution of *Pleuroncodes monodon* in the Southeast Pacific Ocean.



Migration and stock structure

Red squat lobsters are found in high concentrations on parts of the continental shelf, in shallow water in the spring when the females are carrying eggs and in deeper water during the summer. It is hypothesized that these shifts must be associated with changes in environmental conditions or biological requirements of the females, which require higher temperature during the embryonic development. Direct assessments of red squat lobster during the period 1979-2012 showed variations in the overall sex ratio, but there were always more males than females. From 2005 a gradual increase has been seen in the average size of individuals captured in the direct assessments in the southern area, increasing from 23.5 mm in 2005 to 36.2 mm CL in 2012 (Acuña *et al*., 2013) (Figure 24). Monitoring also suggests that the average size of red squat lobster declines during the fishing season.

Figure 24. Overall Average length determined in direct assessments of red squat lobster between 1979 and 2012 in the Southern Fishery Unit. (source: Acuna et al., 2013)



Growth

The main moulting period for the red squat lobsters after which lobsters have a soft shell for a short period of time is from late November to late summer (February-March). For this reason, SUBPESCA maintains a biological ban from 1 January until 31 March each year, seeking to protect individuals during the main moulting period. As with the yellow squat lobster, estimation of growth parameters is difficult because of the lack of hard structures in which records of annual cycles allow the determination of age and because squat lobsters bury or hide in cavities or inaccessible areas of the seafloor to protect themselves after moulting, thus reducing the chances of being caught by fishing gear (Arana, 1990). There have been various estimates of growth parameters with varying results (Table 11). According to these estimates, most individuals in the catch would be 3-5 years old, and the maximum age that could be reached would be close to 8 years.

Table 11. Growth parameters estimated for *Pleuroncodes monodon by* various authors

Sexo	L_∞	k	t_0	Zona	Referencia
Machos	60.00	0.196	1660,00	Centro-sur	Miranda (1965)
Ambos	47.81	0.109		Centro-sur	Bustos *et al.* (1982)
Ambos	52.60	0.220	-1.425		Rodríguez *et al*. (1987)
Hembras Machos Ambos	59.92 59.95 59.95	0.244 0.245 0.245	-0.066 -0.056 -0.056	Centro-sur	Arana *et al*. (1990)
Hembras Machos	55.00 59.00	0.260 0.230	-0.056 -0.056	Centro-sur	Peñailillo & Henríquez (1990)
Hembras Machos	44.55 50.45	0.179 0.197	-0.510 -0.510	Centro-sur	Roa (1993)
Hembras Machos	38.36 40.78	0.375 0.371	-0.328 -0.240	Cañón del Bíobío	Roa & Tapia (1998)
Hembras Machos	41.30 50.04	0.199 0.200	-0.510 -0.510	Pichilemu-Achira	Roa & Tapia (1998)
Hembras Machos	47.10 47.53	0.157 0.164		III Región	Quiroz *et al*., 2006
Hembras Machos	50.34 46.40	0.121 0.167		IV Región	Quiroz *et al*., 2006

Reproduction

P. monodon exhibits marked sexual dimorphism. Females carry eggs on their pleopods for about six months between April and December of each year, and females ranging in size from 12.0 to 43.9 mm CL have been observed carrying eggs. Various studies have shown that size at 50% maturity may vary with geographical area from 22.8 to 32.0 mm CL (Palma & Arana, 1997, Roa 1993, Arana *et al*., 2007, 2010).

Fecundity of the red squat lobster ranges from 1,000 to 50,000 eggs dependent on size of female and three studies have estimated the relationship between number of eggs and female carapace length:

$Fecundity = 0{,}010 \cdot CL^{4{,}02}$ (Bustos & Retamal, 1985)

$Fecundity = 0{,}015 \cdot CL^{3{,}844}$ (Palma & Arana, 1997)

$Fecundity = 0{,}002 \cdot CL^{4{,}45}$ (Roa *et al.,* 1997)

Prey and predators

Red squat lobster is an active predator, with some food specificity. In its larval stage, it feeds by filtering algae and other planktonic organisms, whereas in the benthic phase it feeds by filtering suspended particles near the seafloor. It also tends to consume waste arising from the decomposition of plants and animals (detritus), as well as polychaetes and amphipods (Roa & Tapia, 1998). Likewise, a key part of their diet consists of the prokaryotic bacteria Thioploca, so juveniles of this species are usually located in anoxic areas, where the bacteria is found in abundance (Roa *et al*., 1995b). The main predators of squat lobsters are the black eel (*Genypterus maculatus*), bigeye flounder (*Hippoglossina macrops*), Chilean hake (*Merluccius gayi gayi*), pejerrata (*Coelorhynchus aconcagua*) and occasionally elasmobranchs such as skate (*Raja chilensis*) (Bahamonde *et al*., 1984; Retamal, 1977 Arancibia & Meléndez (1984, 1987). Red squat lobster is not considered to be a key low trophic level (LTL) species.

Natural mortality

Estimates of M have been made in both the northern and southern fishery areas, resulting in a range of estimates of natural mortality rate (Tables 12 and 13).

Table 12. Estimation of natural mortality *Pleuroncodes monodon* in Region IV (Coquimbo) (Canales *et al*., 1998).

	MACHOS					
EEPE+EEPM	**Media ponderada (M)**		**0.36**			
Estimación	**Mediana (M)**	**Perc. 2.5% (M)**	**Perc. 97.5% (M)**	**CV (M)**	**Media (M)**	**Var (M)**
Pauly (1980)	0.31	0.15	0.65	40%	0.34	0.018
Rikhter & Efanov (1976)	0.41	0.26	0.59	21%	0.42	0.007
Alverson & Carney (1975)	0.27	0.15	0.47	30%	0.28	0.007
Hoening (1983)	0.22	0.11	0.43	36%	0.23	0.007
Jensen (1996)	0.42	0.33	0.52	12%	0.42	0.002
EEPE	**Media ponderada (M)**		**0.33**			
Estimación	**Mediana (M)**	**Perc. 2.5% (M)**	**Perc. 97.5% (M)**	**CV (M)**	**Media (M)**	**Var (M)**
Pauly (1980)	0.31	0.26	0.37	9%	0.31	0.0009
Rikhter & Efanov (1976)	0.41	0.36	0.46	6%	0.41	0.0006
Alverson & Carney (1975)	0.27	0.21	0.33	11%	0.27	0.0009
Hoening (1983)	0.22	0.17	0.27	11%	0.22	0.0006
Jensen (1996)	0.42	0.37	0.47	6%	0.42	0.0007

	HEMBRAS					
EEPE+EEPM	**Media ponderada (M)**		**0.27**			
Estimación	**Mediana (M)**	**Perc. 2.5% (M)**	**Perc. 97.5% (M)**	**CV (M)**	**Media (M)**	**Var (M)**
Pauly (1980)	0.26	0.12	0.57	40%	0.28	0.013
Rikhter & Efanov (1976)	0.30	0.17	0.47	25%	0.31	0.006
Alverson & Carney (1975)	0.21	0.11	0.35	28%	0.21	0.004
Hoening (1983)	0.17	0.08	0.34	37%	0.18	0.004
Jensen (1996)	0.31	0.25	0.38	11%	0.31	0.001
EEPE	**Media ponderada (M)**		**0.25**			
Estimación	**Mediana (M)**	**Perc. 2.5% (M)**	**Perc. 97.5% (M)**	**CV (M)**	**Media (M)**	**Var (M)**
Pauly (1980)	0.26	0.22	0.31	8%	0.26	0.0004
Rikhter & Efanov (1976)	0.31	0.27	0.34	6%	0.30	0.0003
Alverson & Carney (1975)	0.21	0.17	0.24	9%	0.21	0.0003
Hoening (1983)	0.17	0.14	0.20	9%	0.17	0.0002
Jensen (1996)	0.31	0.28	0.34	5%	0.31	0.0003

Table 13. Estimation of natural mortality *Pleuroncodes monodon* in the central-south (Quiroz *et al*., 2006).

Método	M			M/K		
	Machos	Hembras	Ambos	Machos	Hembras	Ambos
Rikther & Efanov (1976)		0,65			2,5	
Alagaraja (1984)	0,35	0,42	0,38	1,52	1,62	1,55
Alverson & Carney (1975)	0,62	0,75	0,68	2,7	2,88	2,78
Roff (1988)		0,21			0,81	
Taylor (1958)	0,23	0,26	0,25	1	1	1,02

3.3.4 Harvest strategy for the demersal crustacean fisheries

The overarching legislation which determines the harvest strategies for the three demersal crustacean fisheries in Chile is the new General Law on Fisheries and Aquaculture (LGPA in Spanish). The harvest strategy is also governed by the distinction between industrial vessels, which fish under Tradeable Fishing Licences (LTPs in Spanish) or Extraordinary Fishing Permits (PEPs in Spanish), and artisanal fishing vessels which fish under the Artisanal Harvest Regime (RAE in Spanish).

The objective of the new General Law on Fisheries and Aquaculture (LGPA) in Chile as defined in Title I, Section 1 B is "…the conservation and sustainable use of aquatic resources through the application of the precautionary approach, the ecosystem approach in fisheries regulation and the safeguarding of the marine ecosystems in which these resources exist." Furthermore, Article 1 subsection C g) states as its objective "to seek to avoid or eliminate overfishing and excess fishing capacity." These elements of the LGPA provide therefore the framework within which the status of their resources and the fisheries are assessed.

Biological reference points (PBRs in Spanish) are defined in the context of the LGPA. A precautionary biological point is a value estimated by a process of scientific agreement, which corresponds to the state of the resource and of the fishery, and which can be used as a guide for fisheries management. Two types of precautionary reference points should be used: landmark or boundary conservation reference points (limit reference points) and management benchmarks or goals (target reference points). The limit reference points are intended to restrict fishing to safe biological limits within which the stocks can produce maximum sustainable yield (MSY). The target reference points are aimed to achieve management objectives. The reference points should be stock-specific to account for, inter alia, the reproductive capacity, the resilience of each stock and the characteristics of the fishery exploiting the stock, as well as other sources of mortality and major sources of uncertainty. When information for determining reference points for a fishery is poor or absent, a provisional reference point must be established. Provisional reference points may be established by analogy with similar and better-known stocks. In such situations, the fishery should be directed to improve monitoring and the availability and quality of information and to review the provisional reference points accordingly.

By definition in the LGPA, Biological Reference Points correspond to a standardized value or level that has as an objective to evaluate the performance of a resource from the perspective of conservation biology of a stock, and may refer to: a) biomass, b) fishing mortality and c) exploitation rate.

Maximum Sustainable Yield (*Rendimiento Máximo Sostenido*)

The LGPA establishes, in paragraph C of Article 3, the Maximum Sustainable Yield (MSY) (or RMS in Spanish) as a biological target reference point used for determining the overall catch quota, understanding the statement "Keep or carry on the fishery towards maximum sustainable yield considering the biological characteristics of exploited resources". Under the Chilean LGPA, MSY is considered as a management objective and not as a limitation.

The fishing mortality rate which generates maximum sustainable yield should be regarded as a minimum standard for an upper limit reference point. For stocks that are not overfished, management strategies should ensure that fishing mortality does not exceed that which corresponds to maximum sustainable yield, and that the biomass does not fall below a pre-defined threshold. For overfished stocks, the biomass that produces maximum sustainable yield can serve as a rebuilding target. The precautionary approach enshrined within the new Chilean LGPA requires that the management and conservation of aquatic resources and the protection of ecosystems should:

i) be more cautious in the management and conservation of resources when scientific information is uncertain, unreliable or incomplete; and,

ii) not use the absence of adequate scientific information or unreliable or incomplete information, as a reason for postponing or failing to take conservation and management action.

Management actions seek to maintain or restore populations of exploited stocks and, where necessary, associated or dependent species, at levels consistent with the precautionary reference points previously agreed. Such benchmarks should be used to trigger management actions and conservation. Management strategies should include measures that can be implemented when the system is approaching a point of reference. Also, fishery management strategies should ensure that the risk of exceeding limit reference points is low. If a stock falls below the limit reference point or is at risk of falling below such a reference point, conservation and management actions would be implemented to facilitate stock recovery. Management strategies should ensure that, on average, target reference points are not exceeded.

The LGPA identifies four stages of a resource: underexploited, fully exploited, over-exploited and depleted/collapsed, and its scope is detailed in paragraphs 58), 59) and 60). The determination of these points must be made by decree of the Ministry, according to the determination made by the Technical and Scientific Committee. Definitions corresponding to each stage are:

<u>Underexploited fishery:</u> one in which the current biological point is greater when considering the criterion of biomass, or lower in the case of considering the criteria of exploitation rate or fishing mortality, than

the expected value of the maximum sustainable performance and for which can potentially obtain a higher performance.

Fully-exploited fishery: one whose biological point is at or near MSY.

Overexploited fishery: one in which the current biological point is lower than the MSY reference point in terms of biomass, or higher than the MSY reference point in terms of fishing mortality, and which is not sustainable in the long term without the potential for increased performance and with risk of exhaustion or collapse.

Depleted or collapsed fishery: one in which the standing stock biomass is below the point corresponding to the biological limit that has been defined for the fishery, has no ability to be sustainable and whose catches are well below historical levels, regardless of fishing effort being exerted.

In addition, fisheries may be designated as Fishery under Recovery if the fishery has previously been over-exploited but is now in a state of full exploitation.

Elements of the harvest strategy

The LGPA mandates that management plans should be established for each fishery resource, to provide a package of measures to support the work of Scientific Committees. A draft management plan for the three demersal crustacean fisheries was completed in 2015. It is currently under discussion and has yet to be agreed. The management plan will cover all aspects of the harvest strategy. (For more details of the draft Management Plan, see section 3.5.3) The various elements of the harvest strategy that are common to all three demersal crustacean fisheries are outlined below.

Regulations

(i) Limited entry. All fishing vessels must have a licence issued by the Chilean government, and so fishing effort is limited. Under the LGPA, open access is not granted for fisheries that are fully exploited or have been overexploited and then declared in recovery which is the case for the three demersal crustacean fisheries. Licences are transferable and are granted to vessels either for industrial or artisanal fishing (see section 3.2.5 for further details). In practice, the quotas are owned by the fishing companies who may determine which vessels fish for their quota each year.

(ii) Quotas. Catches are regulated by global annual quotas for the fisheries. These quotas may be allocated by region, and split between industrial and artisanal fishing vessels, and small allocations will be made for bycatch in other fisheries and for research purposes (for example to cover catches made during the fishery-independent stock surveys). Individual transferable quotas (ITQs) are allocated within the overall industrial and artisanal quotas. The way in which quotas are allocated across the industrial and artisanal components of the fleet depends upon whether the fishery is defined as under-exploited, fully-exploited, over-exploited or depleted (see section 3.2.5 for further details).

(iii) Technical conservation measures. Fishing is not permitted by any vessels within 1nm of the coast, and the 1nm to 5nm region is reserved for artisanal fishing vessels except in Regions III and IV. There are closed seasons for each species linked to moult and reproductive stages. The yellow and red squat lobster fisheries are closed from 1 January to 31 March each year which coincides with the main moult period when mating occurs. This closure therefore protects against both the capture of soft-shelled lobsters and provides protection for mating individuals. Similarly, the nylon shrimp fishery is closed from 1 July to 31 August. In addition, all demersal crustacean fisheries in Regions V-VII are closed during September which is the time of peak abundance of egg-bearing females. There is no prohibition on the landing of egg-bearing females in any of the fisheries, as the closed seasons are considered sufficient to protect egg production. There is no minimum landing size in the demersal crustacean fisheries.

(iv) Gear restrictions. A new modified trawl became mandatory in November 2014. The new regulation prescribes overall dimensions, net material and mesh sizes in different parts of the nets, structures to protect against wear, and escape devices. The minimum mesh size for the tunnel and cod end for the nylon shrimp fishery is 50 mm and for yellow and red squat lobster fisheries is 60 mm. Full details of the new modified trawl are given in section 3.2.4.

Monitoring

A key element of the harvest strategy is that the above regulations are underpinned by a comprehensive monitoring programme as outlined below:

- All industrial vessels must record fishing position through a mandatory Vessel Monitoring System (VMS)
- Catches must be recorded for each tow of the gear on electronic log books
- An observer programme covering approximately 25% of all fishing trips records species composition including bycatch, total catch composition, length frequency, sex and reproductive status of females for the target species and collects biological samples
- Fishery-independent stock surveys are conducted annually
- 100% dockside monitoring of landings
- Processors must keep mandatory data records on amounts of each species processed

Monitoring and enforcement activities are primarily the responsibility of SERNAPESCA, which monitors landings and quotas, collects statistics and plays an enforcement role. Log book records, dockside landings, transport documentation and processors' records are all cross-checked by SERNAPESCA to monitor compliance with the regulations. Currently there is no on-board enforcement system, as scientific observers do not have an enforcement role. There are plans to implement on-board camera systems in future on all vessels to provide further monitoring of compliance.

Reference points, harvest control rules and associated objectives

For each of the demersal crustacean fisheries there is a management objective and a strategy designed to achieve that objective.

The nylon shrimp fishery has been designated as "fully-exploited" and the management objective should be to ensure that the stock biomass does not fall below 30,000 t and at least to maintain 2012 yields from the fishery. To achieve this objective, the strategy is to have conservative fishing mortality rates in each of the fishery zones in order to protect biomass and to distribute fishing effort to avoid overfishing at a regional level.

The yellow squat lobster fishery has been designated as fully-exploited in the northern area (Region III & IV) and as a Fishery under Recovery in the southern area (Regions V to VIII). The management objectives are to avoid deterioration of stock biomass and stock structure, and to avoid local overfishing. To achieve these objectives, the strategy is to have conservative fishing mortality rates and to ensure that the risk of not meeting these objectives is less than 10%, and to distribute fishing effort to avoid overfishing in the different regions.

The red squat lobster fishery has been designated as fully exploited in the northern area (Region III & IV) and as a Fishery under Recovery in the southern area (Regions V to VIII). The management objectives are to recover biomass at least to the value of the last decade and prevent a decline, or at least maintain current yields and size structure in Regions III and IV. To achieve these objectives, the strategy is to have conservative harvest rates to reduce the risk of not meeting the objectives, and to distribute fishing pressure so as to prevent regional stock reductions.

The harvest strategy for all three demersal crustacean fisheries requires the definition of biological reference points within an MSY framework. As outlined in the section on stock assessment below, target reference points for stock biomass (B_{msy}) and fishing mortality (F_{msy}) and a biomass limit reference point (B_{lim}) have been defined for each fishery. The key harvest control rule is to adjust the annual quota in line with fishing at Fmsy, which in the long term should implicitly maintain the biomass at B_{msy}.

Review of harvest strategies

Harvest strategies are regularly reviewed within both the Scientific Committee and the Management Committee in consultation with stakeholders through the National Fishery Council (CNP in Spanish) and the Regional Fisheries Councils (CZP).

3.3.5 Data / information

An annual monitoring programme for the three demersal crustacean fisheries is set out in the Programa de Seguimiento de las Pesquerías de Crustáceos Demersales, this programme collects information on the following aspects of the fishery:

1. Fleet operations - distribution of catch quotas and landings, number of vessels operating, number of trips, catch per trip, average length of haul, fishing regions and depth, spatial coverage.
2. Fishery indicators - fishing effort (hours trawling), catch (tonnes) and fisheries yield (kilos / hour trawling).
3. Stock composition - length compositions, sex ratio.
4. Information associated with the reproductive process - proportion of females that are ovigerous, size at maturity, and proportion of individuals with soft shell.
5. Other biological information – e.g. length-weight relationship.

This fishery-dependent information is collected through electronic log books completed by the skippers after each tow of the trawl, satellite monitoring of fishing activity through VMS records, observer sampling on around 25% of all trips of total catch composition, size and sex composition, biological sampling of catches, 100% dockside monitoring of landings, and records of landings processed by the factories and transportation records.

In addition to the collection of fisheries-dependent data, the main indicator of stock biomass of the three demersal crustacean species comes from annual fisheries-independent stock surveys. The Fisheries Research Fund (FIP) has funded annual surveys since 1996 to undertake direct biomass assessments of yellow and red squat lobsters (except in 1998 and 2010) and nylon shrimp (except 1997, 2007 and 2010) between Regions II and VIII. The surveys are contracted out by IFOP to various institutions such as the Catholic University of Valparaiso (PUCV), the Catholic University of the North (UCN), the Fisheries Research Institute (INPESCA), the Fisheries Development Institute (FIFG) and the University of Concepción (UdeC). Although the surveys have not been undertaken by the same contractor each year, the surveys use commercial fishing vessels for the surveys under standard sampling regimes. The surveys take place in spring to coincide with peak of egg-carrying in the females. The survey uses a stratified random sampling design with the duration of the trawl tows standardized to 30 minutes, running on average for 1.6 km. The surveys use a swept area method for estimating total biomass: biomass indices per unit area are calculated from the catch taken over a known swept area, based on the time per tow and the width of the opening of the fishing gear, and then extrapolated to the total area of the distribution of the species. During the site visit, stakeholders expressed two concerns about the stocks surveys. Firstly, the surveys may not be covering the full geographical distribution of the stocks because they are conducted using industrial vessels, which can operate within the 5nm zone only in the northern regions, and so in the southern regions the surveys therefore do not cover the 1 to 5nm zone, and for the squat lobster species, there may be some areas in the southern region which are not covered by the surveys. Secondly, there was some concern expressed that the bureaucratic process of tendering for and awarding of contracts is too slow and results in the surveys being carried out too late in the season when most of the fisheries have taken place and thus underestimating biomass.

In addition to the IFOP-contracted surveys, direct assessments and/or monitoring in the southern area of yellow and red squat lobsters have been carried out through funding by the fishing companies exploiting these species, but it is not clear whether these surveys are incorporated within the assessments.

3.3.6 Stock assessment – methods, process and subsequent management advice

Methodology

The data described above form the basis of the stock assessments carried out annually for the three demersal crustacean fisheries. IFOP carries out stock assessments for each species fitting age-structured stock assessment models to fisheries data and fisheries-independent survey indices. IFOP assesses the status of the stocks in relation to pre-defined reference points which are formulated within an MSY framework. The approach to defining appropriate reference points within the MSY framework was developed by IFOP and a team of invited international experts following a series of workshops in 2013 and 2014 (IFOP, 2013; 2014a; 2014b). The workshop developed a tier system to categorise stocks according to what type of assessment could be performed and what type of reference points could be estimated (F_{msy} and B_{msy} or proxies), set out a number of methods by which reference points could be computed, and recommended methods of computing reference points for each of 24 stocks, including the three demersal crustacean species. Dependent upon the status of the stocks in relation to the biological reference points, the fisheries are then characterised as under-exploited, fully exploited or over-exploited. If previously over-exploited, the stock may be designated as "in recovery".

Stock assessment of nylon shrimp

Extensive data are available for the nylon shrimp from both fisheries-dependent and fisheries-independent sources. A long times series of data from 1978 is available on landings, nominal fishing effort, and standardised catch per unit effort (CPUE) along with length composition data, sex ratio and weight at-size. A fisheries-independent estimate of stock biomass from a trawl survey has been undertaken annually since 1996. There is also good information on growth, size-at-maturity and geographical distribution of the stock.

The stock assessment model for the nylon shrimp is an age-structured model used within a Bayesian framework. The model is fitted to length compositions using multinomial residual errors and to landings, CPUE and fisheries-independent survey indices using log-normal residual errors. The length at age data are assumed to be distributed normally around the von Bertalanffy curve with a constant coefficient of variation as mean length increases. The assessment includes a Beverton and Holt stock-recruitment curve with the steepness parameter (h) set at 0.7. There are some uncertainties in the assessment relating to catches in the early years of the fishery and to the transformation of length distributions into age distributions. There are also structural uncertainties relating to the presence of two stocks and changes in the distribution of the species over years.

Based on the above information, MSY proxy reference points for the nylon shrimp fishery have been set according to the methodology set out in Comité Científico Técnico Crustáceos Demersales (2015a) as follows:

B_{msy} = 40% B_0, where B_0 is the equilibrium biomass under no fishing
B_{lim} = 20% B_0
F_{msy} = $F_{45\%SPR|F=0}$
(i.e. the F when biomass per recruit is 45% of biomass per recruit when F=0)

From experience in other fisheries worldwide and based on a sensitivity analysis (IFOP, 2014a, 2014b), $F_{45\%SPR|F=0}$ is considered a suitable proxy for target fishing mortality that would drive a stock towards B40% (40% of B_0) under a wide range of steepness values in a Beverton and Holt stock recruitment curve, without the need to specify a specific steepness value.

Additionally, the target range of biomass levels is defined between 20% under and 50% over Bmsy and F between 25% under and over Fmsy.

The target range described above takes into account the inherent uncertainty in stock assessments. It is recognised that a management strategy that gradually reduces fishing mortality as stock biomass declines should be more robust to uncertainty than one that makes precipitous changes as estimated biomass crosses some specified reference level. Whilst it is understood that re-building plans are required for over-exploited stocks, a gradual decrease in F as spawning stock biomass decreases may serve as a management plan for fully exploited and under-exploited stocks as well as a rebuilding plan for over-exploited or collapsed stocks. In addition, consideration should be given to the range of natural fluctuations in biomass that might occur when fishing at F_{msy}.

Stock assessment of yellow squat lobster

Extensive data are available for the yellow squat lobster from both fisheries-dependent and fisheries-independent sources. A long times series of data is available on landings and standardised catch per unit effort (CPUE) along with length composition data, sex ratio and weight at-size. A fisheries-independent estimate of stock biomass from a trawl survey has been undertaken regularly since 1982 in the south and 1997 in the north. There is also good information on growth, size-at-maturity and geographical distribution of the stock.

The stock assessment model for the yellow squat lobster is an age-structured model incorporating sex-based growth in 11 age classes used within a Bayesian framework. The model is fitted to length compositions using multinomial residual errors and to landings, CPUE and fisheries-independent survey indices using log-normal residual errors. There is no observed stock-recruitment relationship for this species, but average recruitment with deviations away from that average is used in the stock assessment. There are some uncertainties in the catches prior to 1995, and in relation to the conversion of length distributions to age distributions. There are also uncertainties relating to stock boundaries.

Based on the above information, MSY proxy reference points for the yellow squat lobster fishery have been set according to the methodology set out in Comité Científico Técnico Crustáceos Demersales (2015a) as follows:

B_{msy} = 40% B_0, where B_0 is the equilibrium biomass under no fishing
B_{lim} = 20% B_0
$F_{msy} = F_{45\%SPR|F=0}$
(i.e. the F when biomass per recruit is 45% of biomass per recruit when F=0)

As for the nylon shrimp fishery, the target range of biomass levels is defined between 20% under and 50% over B_{msy} and F between 25% under and over F_{msy}.

Stock assessment of red squat lobster

Extensive data are available for the red squat lobster from both fisheries-dependent and fisheries-independent sources. A time series of data is available on landings and standardised catch per unit effort (CPUE) along with length composition data, sex ratio and weight at-size. A fisheries-independent estimate of stock biomass from a trawl survey has been undertaken regularly since 1979 in the south and 1999 in the north. There is also good information on growth, size-at-maturity and geographical distribution of the stock.

The stock assessment model for the red squat lobster is similar to that used for the yellow squat lobster. It is an age-structured model used within a Bayesian framework. The model is fitted to length compositions using multinomial residual errors and to landings, CPUE and fisheries-independent survey indices using log-normal residual errors. There is no observed stock-recruitment relationship for this species, but average recruitment with deviations away from that average is used in the stock assessment. There are some uncertainties in the catches prior to 1995 when quotas were introduced, and in relation to the conversion of length distributions to age distributions. There are also uncertainties relating to stock boundaries.

Based on the above information, MSY proxy reference points for the red squat lobster fishery have been set according to the methodology set out in Comité Científico Técnico Crustáceos Demersales (2015a) as follows:

B_{msy} = 40% B_0, where B_0 is the equilibrium biomass under no fishing
B_{lim} = 20% B_0
$F_{msy} = F_{45\%SPR|F=0}$
(i.e. the F when biomass per recruit is 45% of biomass per recruit when F=0)

Additionally, the target range of biomass levels is defined between 20% under and 50% over B_{msy} and F between 25% under and over F_{msy}.

Uncertainties underlying the stock assessments

For all three demersal crustacean species, there are some uncertainties underlying the outcome of the stock assessments. Firstly, the distribution of the fishery has been observed to change over time, and therefore there may be uncertainty about whether fisheries-dependent data are representative of the whole stock. Secondly over the last few years there has been a change in the trawl used in all three fisheries. The new modified trawl has been introduced slowly over the last three years and became mandatory in November 2014. The new gear has different selectivity properties in comparison with the traditional trawl, but to date the catchability of the new gear has not been incorporated into the current stock assessments. Thirdly there appear to be some significant non-reporting of discarded small individuals in all three fisheries. In addition to the total catch composition which is monitored by observers, there are reports of some tows of the trawl being returned to the sea without being brought on to the deck of the vessel. These tows known as “failed tows” will represent unknown removals from the stock. In addition, the new minimum mesh sizes have resulted in the increase in average size of individuals in the catch, but also some smaller individuals may drop through the net on hauling the trawl on to the deck. This is a particular problem in the nylon shrimp fishery where a mesh size of 60 mm is often used (to avoid the need to change trawl when later targeting squat lobsters) instead of the minimum mesh size of 50 mm which is required within the regulations. In summary there may be an underestimate of the removals from the fishery resulting in uncertainty around the status of the stock. Finally, predation is not included in the assessment model. At present there is a very low abundance of predators and only small predators (e.g. small hake) are present, so currently there is low predation on the demersal crustacean species, and predation is not thought to influence target species dynamics. So whilst at present, there is no need to include predation in the model, it would be more appropriate to model natural mortality as a function of predator (e.g. hake) density rather than assume that natural mortality is constant.

Stock assessment and management advice process

IFOP undertakes stock assessment for all three demersal crustacean species on an annual basis and produces a technical report providing detailed outputs from the assessment. The report is then passed on to the Scientific and Technical Committee (CCT in Spanish) for demersal crustaceans (hereinafter called the Scientific Committee). The Scientific Committee is responsible for considering analyses prepared to address issues defined by SUBPESCA and recommendations to the in support of its decision–making. They are responsible for determining status of the fisheries, biological reference points, and the range within which the management authority can establish quotas. For implementing their reports, the scientific committee should consider information provide by both IFOP and other sources. The committee that is reviewing stock assessments for the three fisheries under consideration in this assessment is the CCT for Demersal Crustaceans with two members from SUBPESCA, two from IFOP and four members nominated by public competition, usually scientists from Universities in Chile who have worked on the demersal crustacean fisheries. The names of the members of the Scientific Committees are published on the SUBPESCA website.

The key role of the Scientific Committee is to provide management advice on the setting of annual quotas termed Acceptable Biological Quotas (Cuota Biológicamente Aceptable (CBA)) for the following year. The Scientific Committee will consider the assessment of the status of the stock in relation to the biological reference points determined within an MSY framework, and will provide advice to the Ministry of Economy, Public Work and Tourism (MINECON in Spanish) on a range for the quotas for the upcoming year based on projections of various scenarios of fishing mortality (F). The advice given by the scientific committee to the Ministry is published on the SUBPESCA website. The Ministry then makes a formal announcement of quotas (CBAs in Spanish).

In addition to the Scientific Committees, there are also Management Committees (CM in Spanish) which have been designated under the new Chilean law to “elaborate, propose, implement, evaluate and modify management plans”. The Management Committee is made up of one representative of SUBPESCA, two to seven representatives of artisanal fishers registered in the respective fishery, three representatives of the industrial sector, one representative of the processing plants and one representative of SERNAPESCA. The Management Committee for demersal crustacean fisheries has elaborated a fishery management plan which has not yet been released but is under final revision.

The stock assessment and management approach used in the demersal crustacean fisheries therefore undergoes detailed peer review through the Scientific Committee and Management Committee. This peer review can be considered to be both internal and external as members of the committees may be outside the assessment process. In addition, both IFOP and SUBPESCA have commissioned external peer reviews, for example, the series of three workshops convened in 2013 to 2014 with invited international experts to evaluate the setting of biological reference points within the MSY framework (IFOP, 2013; 2014a; 2014b). In addition, the stock assessment for nylon shrimp underwent an expert review by Dr Catherine Dichmont (Australia) and Dr Tom Polacheck (US) in November 2014.

3.3.7 Results of latest stock assessments and management advice

Nylon shrimp - northern and southern stocks

Landings of nylon shrimp in the northern fishery have been just over 1000 tonnes in recent years having declined from a peak of around 6000 tonnes in 1999, and in the southern fishery landings have steadily increased since 2000 and have fluctuated between 3000 and 4000 tonnes in recent years (Figure 25). Landings are driven primarily by annual quotas, and so do not necessarily reflect stock status. Catch per unit effort (CPUE) has increased in recent years in both the northern and southern zones (Figure 26).

Figure 25. Landings of nylon shrimp from 1978 to 2013 for northern zone (blue) and southern zone (pink). (Source: SERNEPESCA / SUBPESCA)

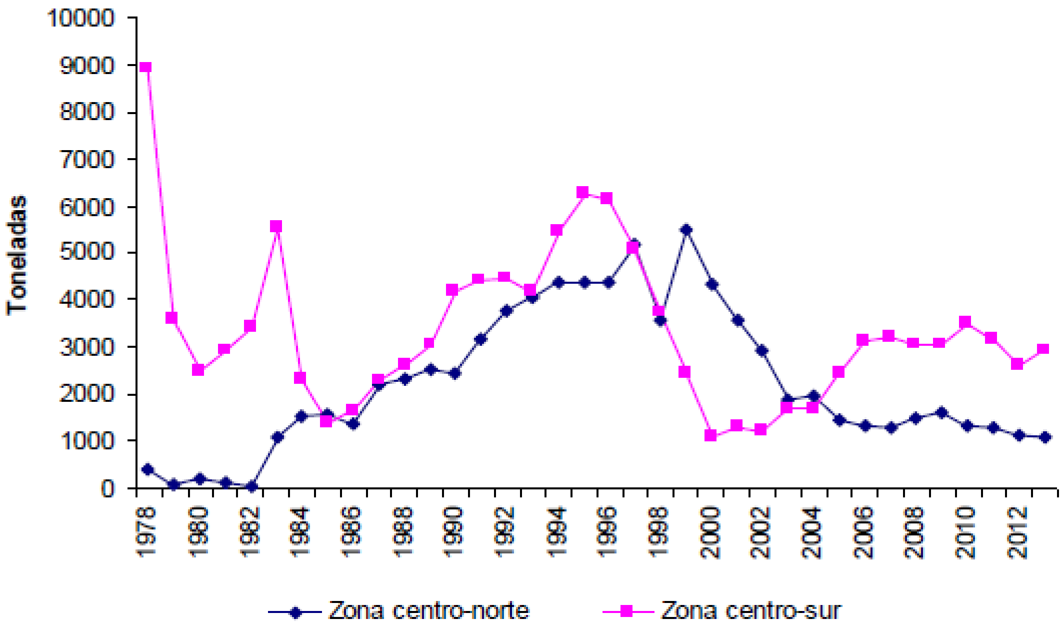
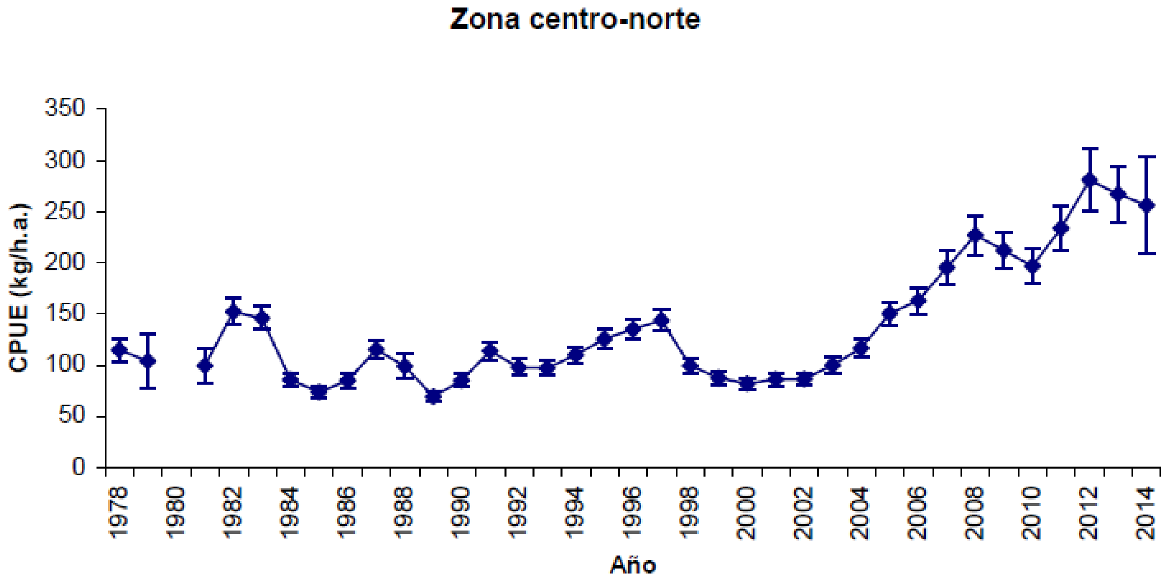
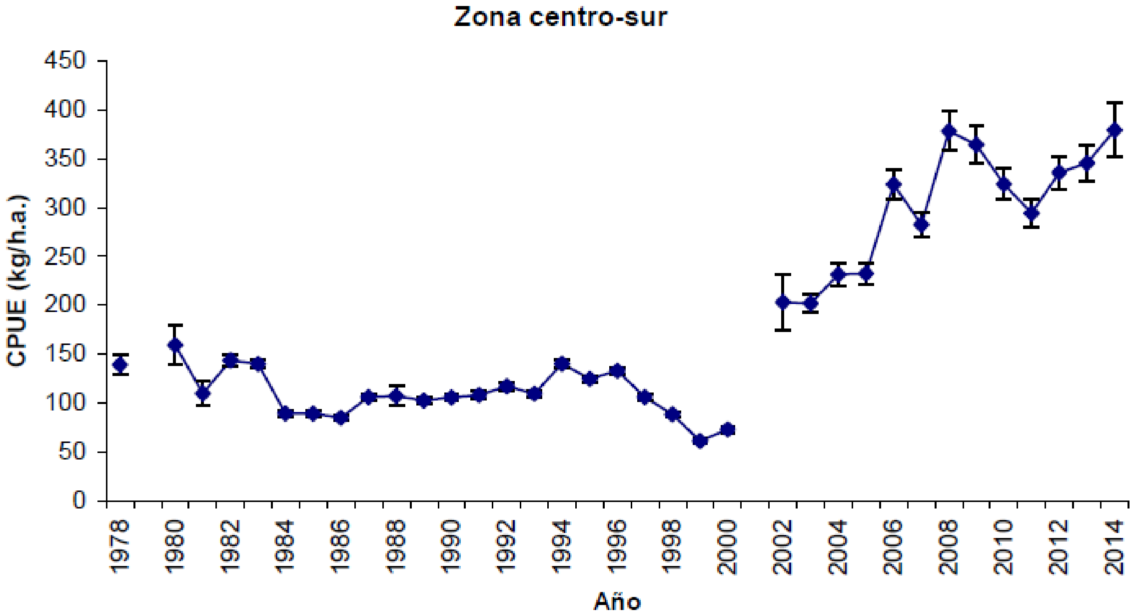


Figure 26. Catch per unit effort (CPUE) for the nylon shrimp fishery – northern zone (top) and southern zone (bottom). (Source: Montenegro et al, 2015)





Length composition sampling of the catches has been carried out in both the northern and southern regions of the fishery with up to 100,000 individuals per year measured in recent years. The mean size of male shrimps is smaller than that for females in both fishing areas, and shrimps of both sexes are larger in the southern region that the northern region (Figures 27 and 28). Catches of shrimps in both fishing regions are predominantly female (Figure 29).

Figure 27. Size distribution of nylon shrimps captured in the northern fishing area from 1984 to 2014. Male, left column and females, right column. (source: Montenegro et al., 2015)

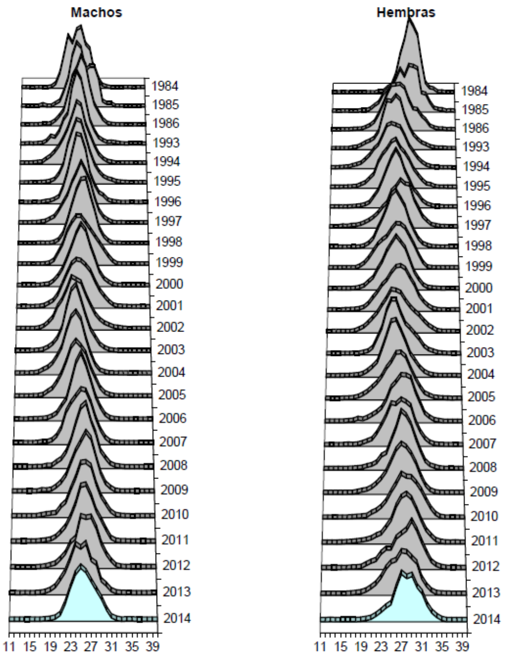


Figure 28. Size distribution of nylon shrimps captured in the southern fishing area from 1984 to 2014. Males, left column and females, right column. (source: Montenegro et al., 2015)

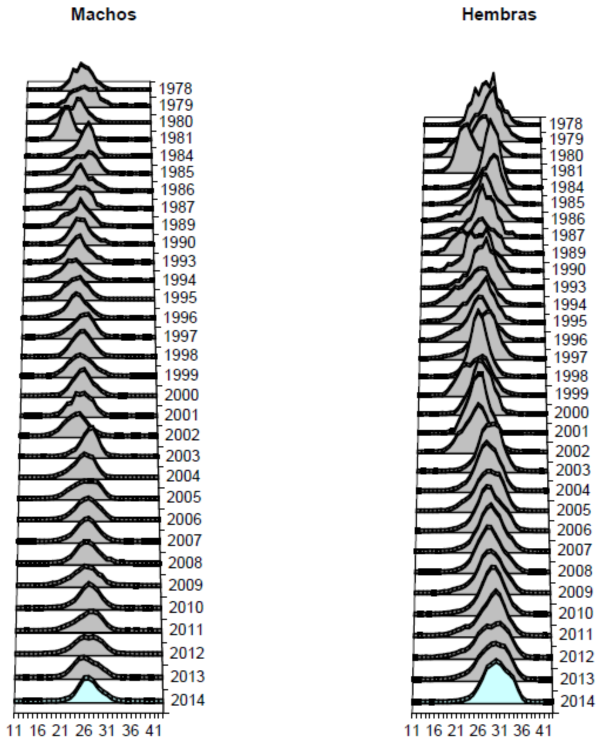
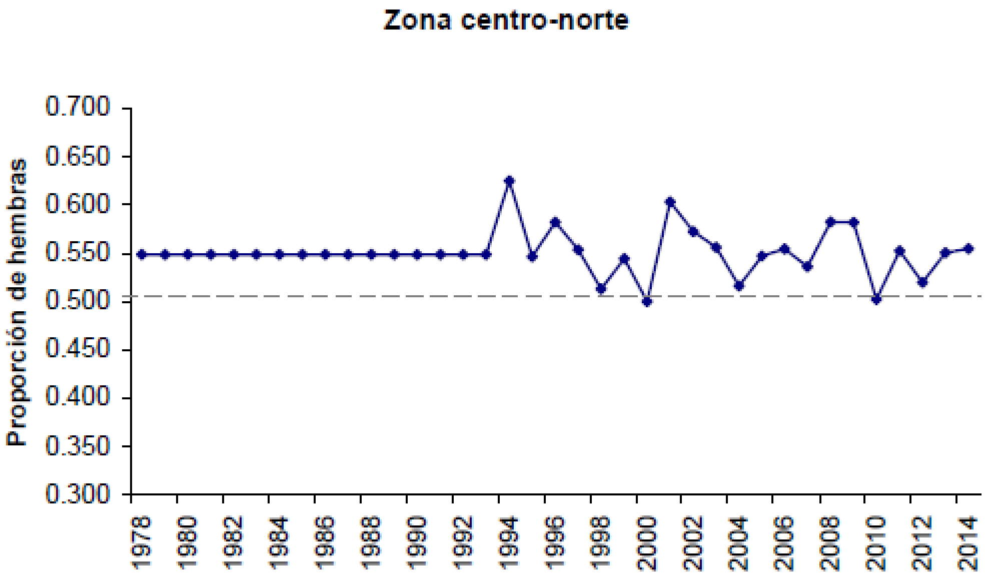
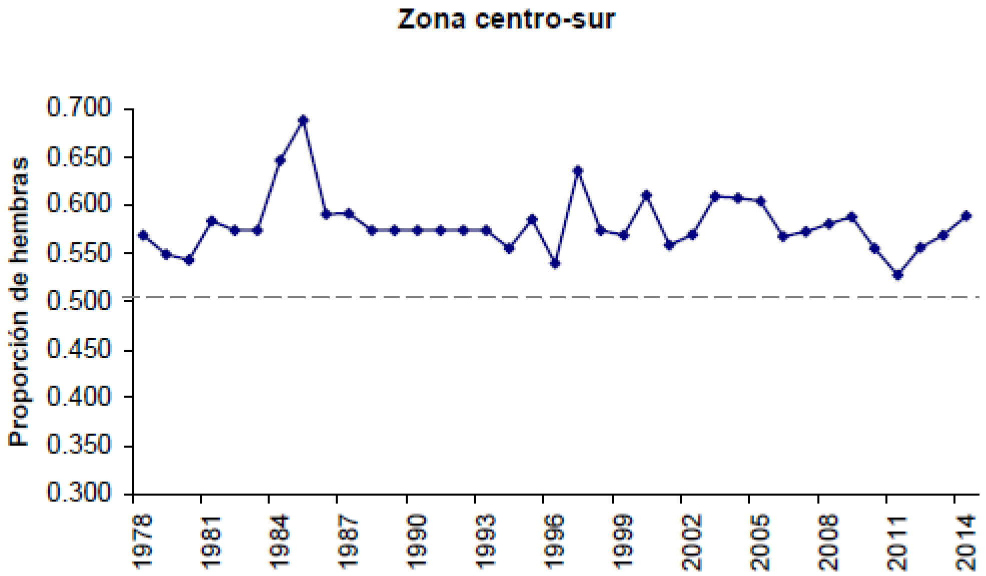


Figure 29. Proportion of females in catches of nylon shrimps from 1978 to 2014. (source: Montenegro et al., 2015)





Biomass estimates using the swept area method from the annual stock surveys show that in the northern region the stock size has been relatively stable in recent years although not as high as at the end of the 1990s (Figure 30) whereas the stock size in the southern region is relatively high in comparison with the stock size from 1998 to 2004 (Figure 31). Size distributions recorded on the surveys show that shrimps are larger in the southern fishing zone than in the northern fishing zone.

Figure 30. Biomass of nylon shrimp in the northern fishing zone (Regions II to IV) as estimated from the fishery-independent stock surveys. (source: Montenegro et al., 2015)

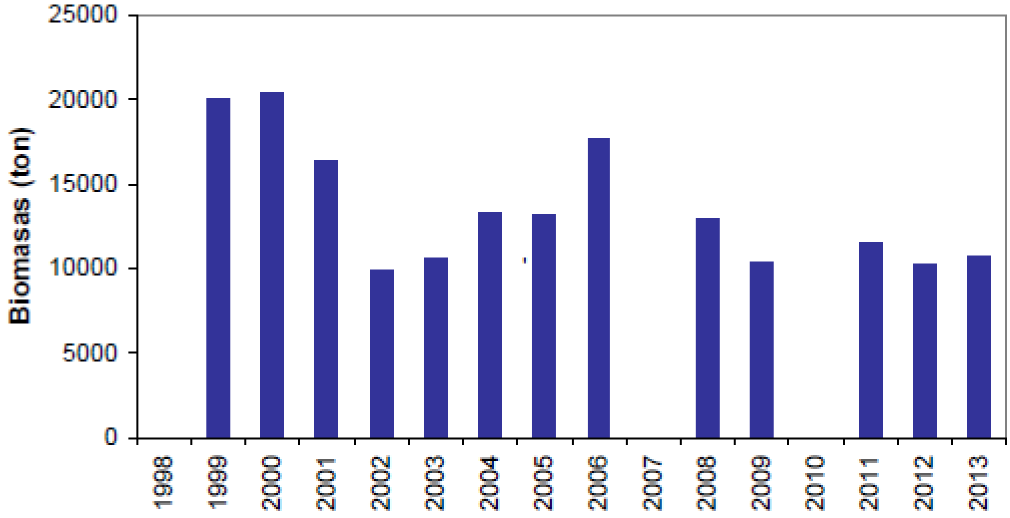
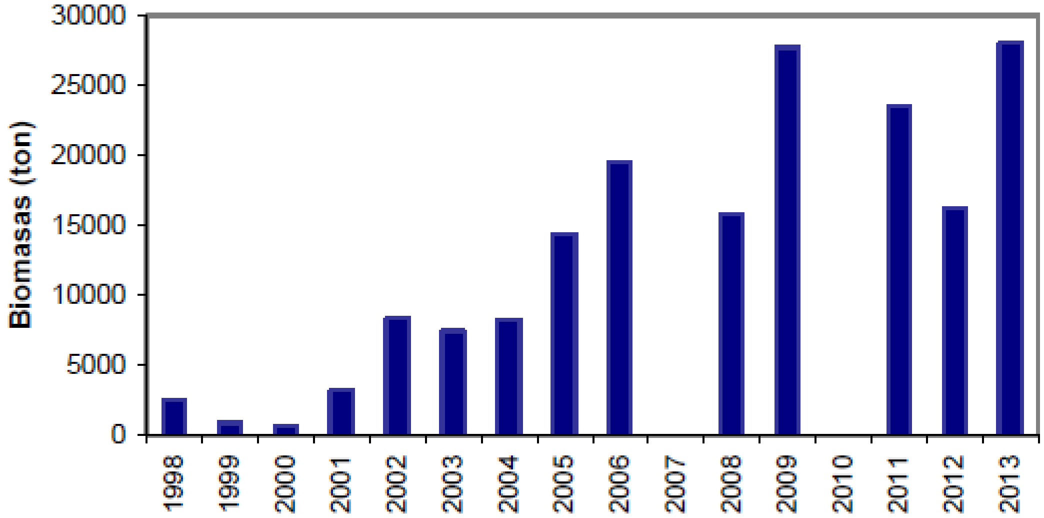


Figure 31. Biomass of nylon shrimp in the southern fishing zone (Regions V to VIII) as estimated from the fishery-independent stock surveys. (source: Montenegro et al., 2015)

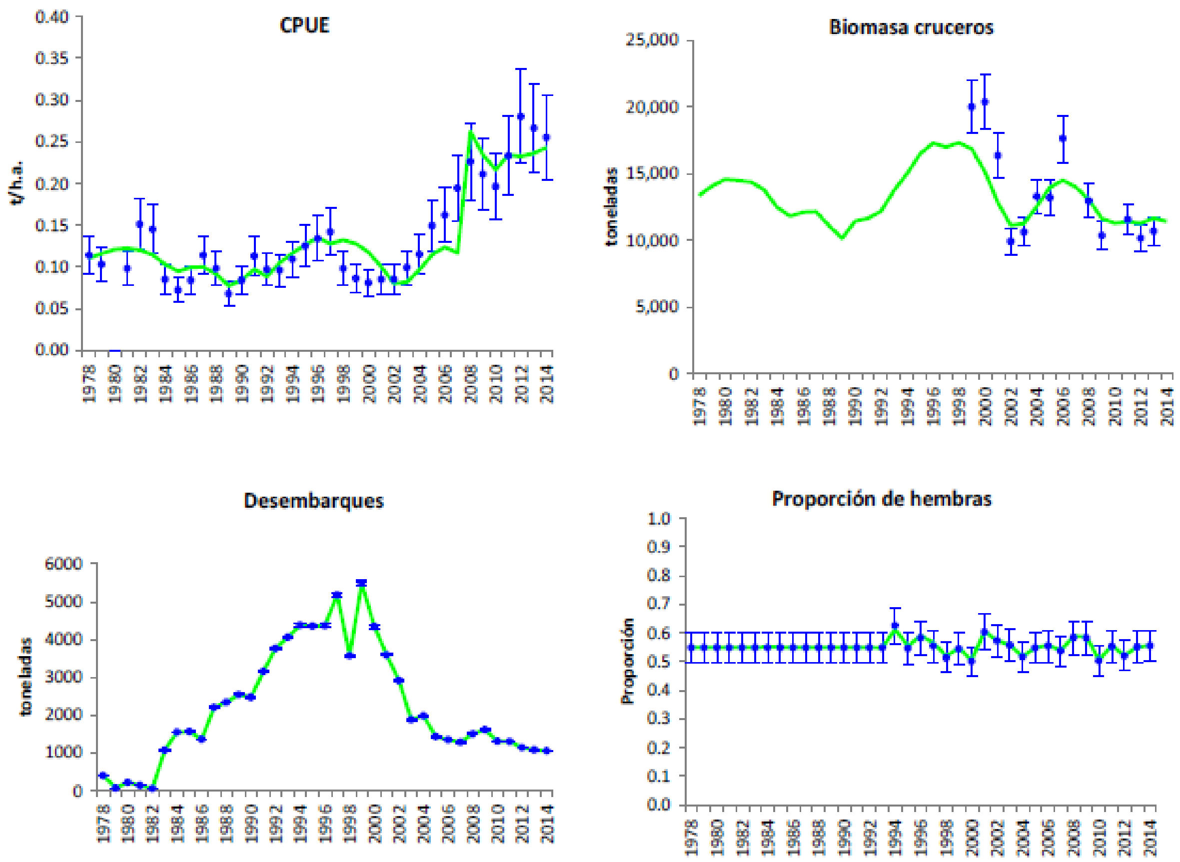


These data are used in an age-structured population model in conjunction with biological parameters describing growth, natural mortality, the relationship between length and weight, maturity and fecundity at size. Sources of uncertainty are taken into account in the model through both process and observation error.

Model fits for the northern zone fishery

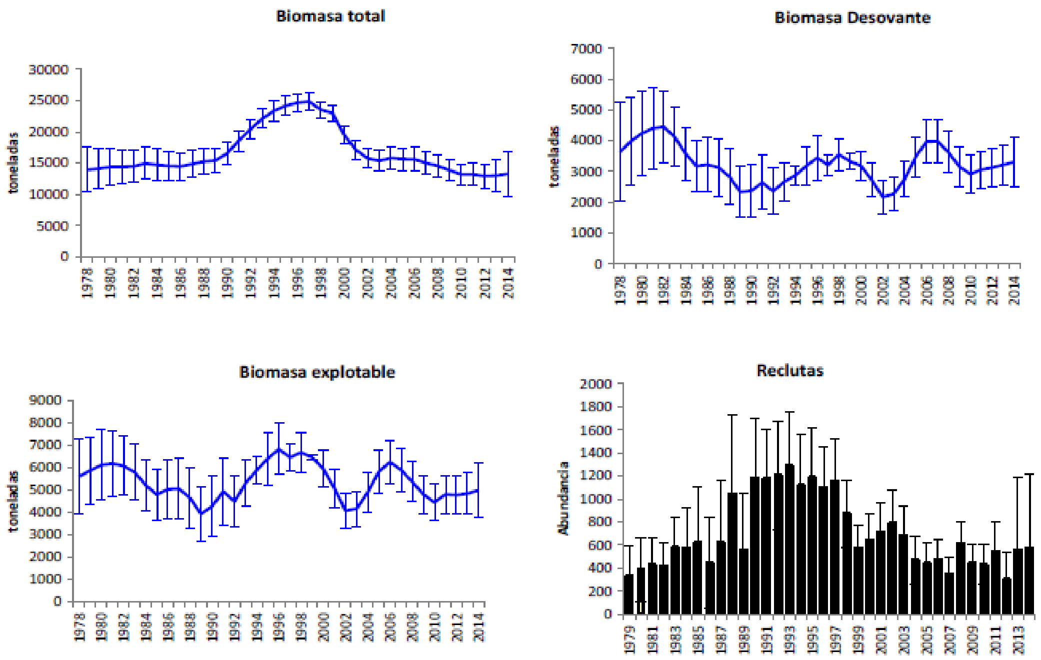
The model provided a good fit to the data in the northern region on CPUE, biomass estimates from the survey, landings and proportion of females in the population (Figure 32).

Figure 32. Model fits to observed data on CPUE, stock survey biomass estimates, landings and proportion of females in the population for the northern fishing zone. (source: Montenegro *et al*., 2015)



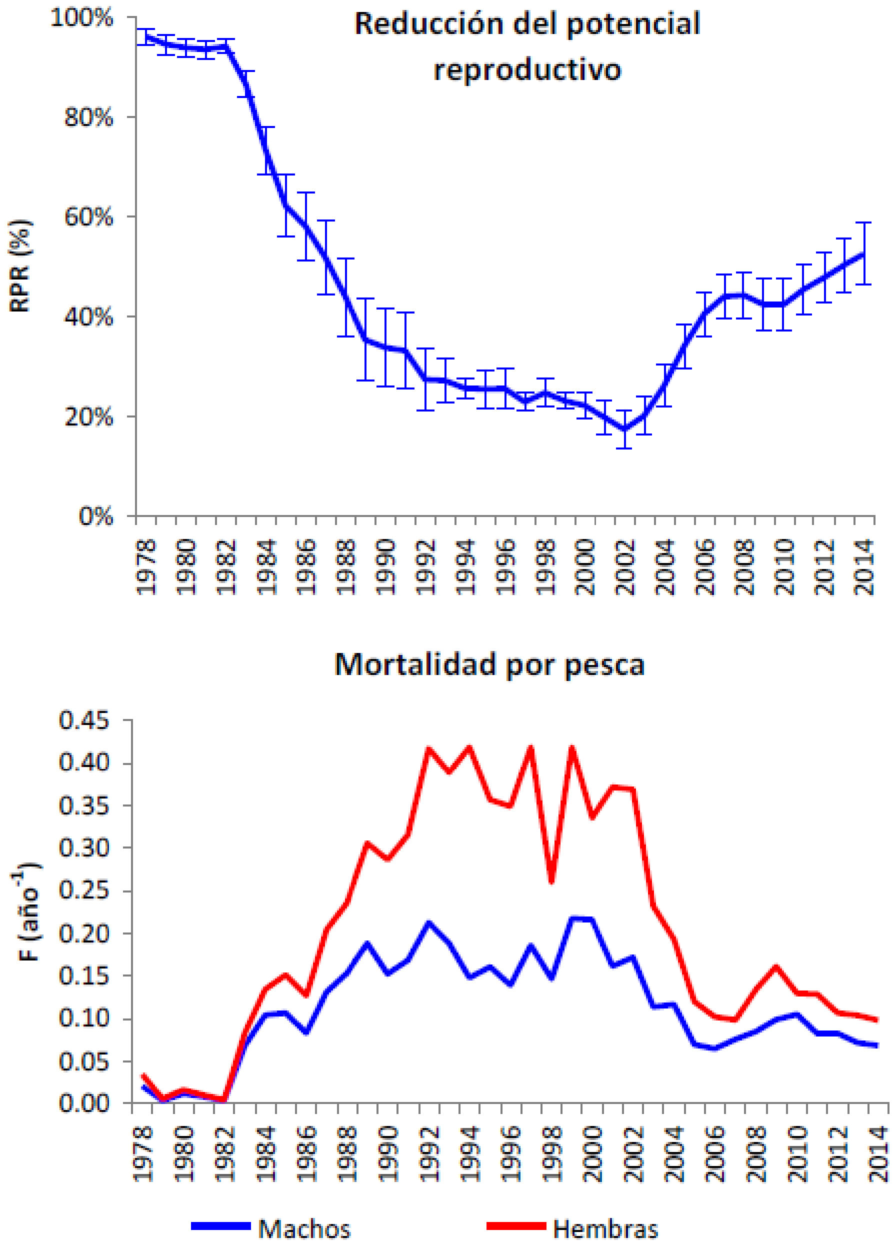
Model outputs show that total biomass has been relatively stable in the northern fishing zone in recent years following a peak in the late 1990s, and that spawning and exploitable biomass have been fluctuating for the last few years. Recruitment is stable but at lower levels than that observed in the 1990s (Figure 33).

Figure 33. Total, spawning and exploitable biomass and recruitment as estimated by the stock assessment model for the northern fishing zone for nylon shrimp from 1978 to 2014. (source: Montenegro et al., 2015)



The model also provides an estimate of the reduction in reproductive potential of the current stock size, which can be compared with the Bmsy proxy of 40% of B_0, and an estimate of the current fishing mortality which can be compared with an estimate of the F_{msy} proxy of F45%SPR (Figure 34). The current biomass is estimated to be significantly above the biomass reference point, and fishing mortality has declined significantly in recent years and that current fishing mortality is well below the F_{msy} proxy.

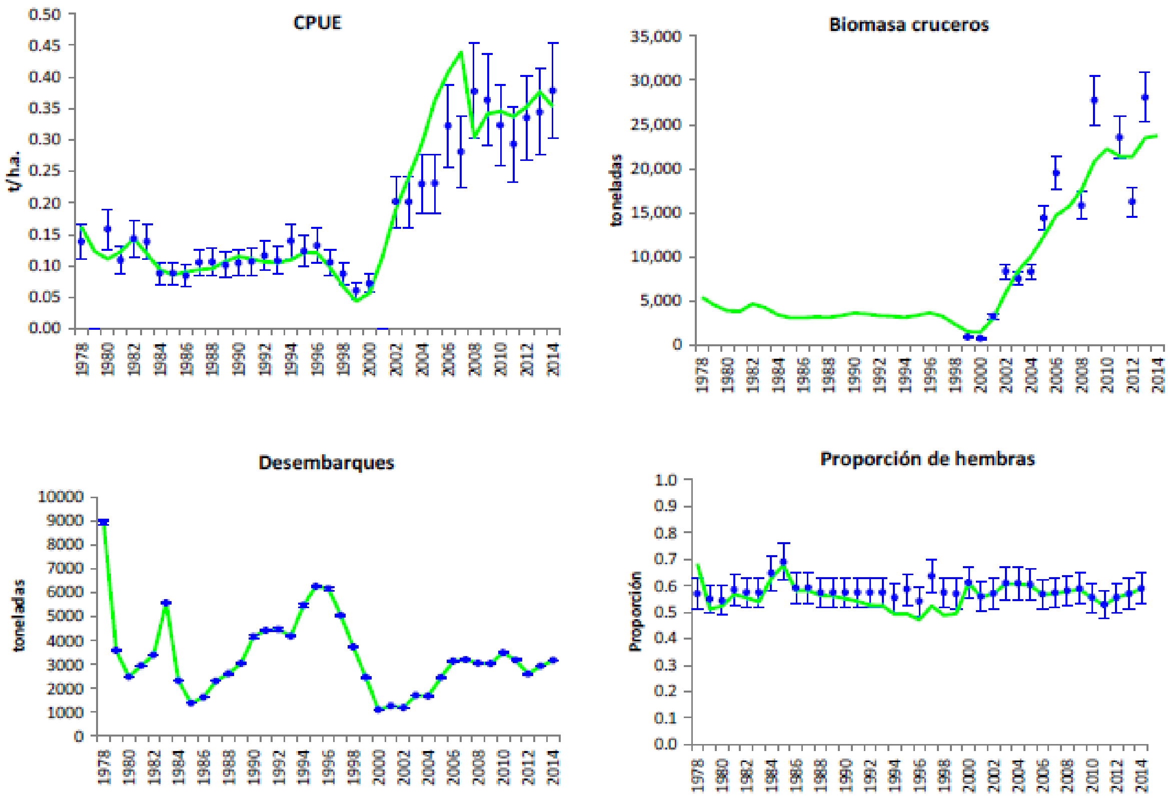
Figure 34. Model estimates of the reduction in reproductive potential of the current biomass (top) and the current fishing mortality (bottom, males in blue, females in red) in the northern fishing zone. (source: Montenegro *et al*., 2015)



Model fits for the southern zone fishery

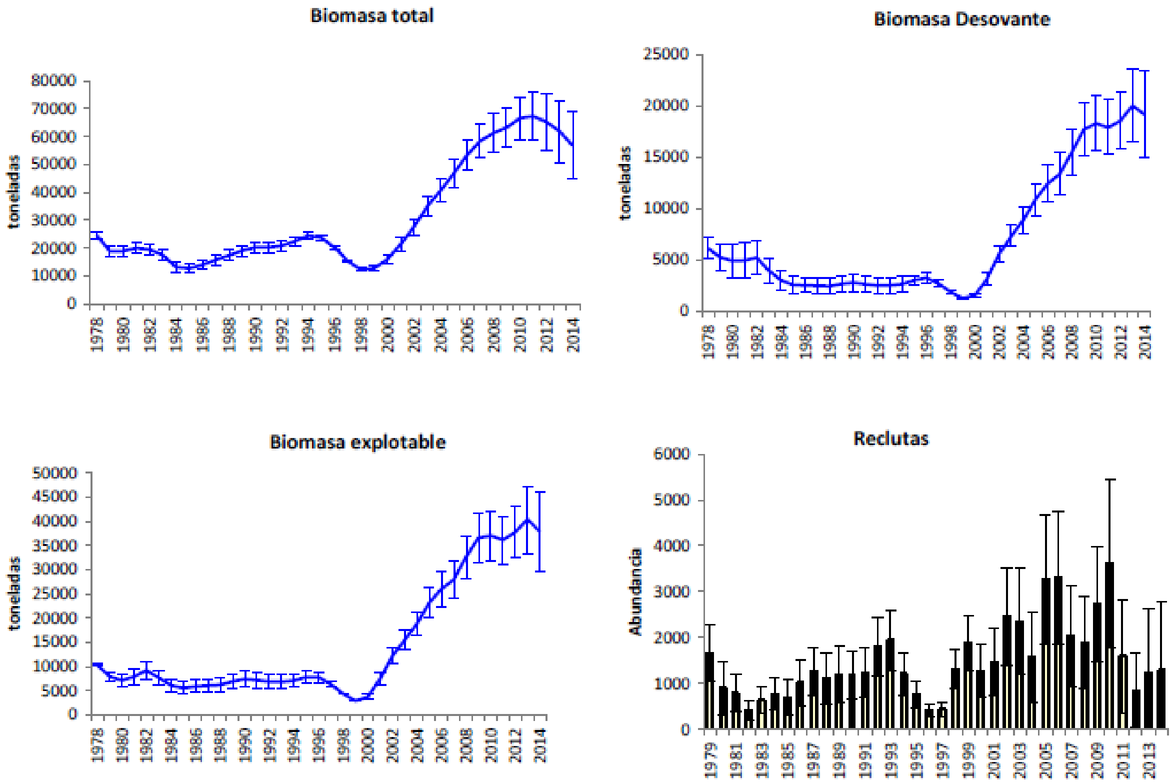
The model provided a reasonable fit to the data in the southern region on CPUE, biomass estimates from the survey, landings and proportion of females in the population (Figure 35).

Figure 35. Model fits to observed data on CPUE, stock survey biomass estimates, landings and proportion of females in the population for the southern fishing zone. (source: Montenegro et al., 2015)



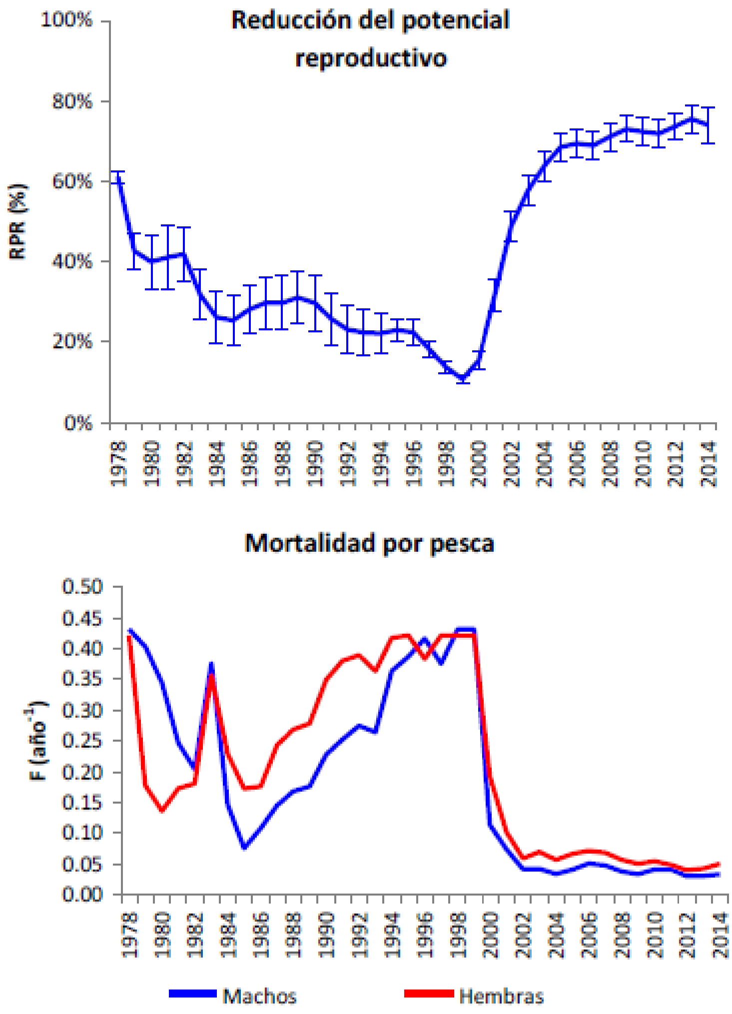
Model outputs show that total, spawning and exploitable biomass have increased significantly in the southern fishing zone in recent years. Recruitment has been at average levels in the last few years, following a period of high recruitment levels from 2001 to 2010 (Figure 36).

Figure 36. Total, spawning and exploitable biomass and recruitment as estimated by the stock assessment model for the southern fishing zone for nylon shrimp from 1978 to 2014. (source: Montenegro *et al*., 2015)



The current biomass is estimated to have been significantly above the biomass reference point for many years, and fishing mortality has declined significantly in recent years and current fishing mortality is well below the F_{msy} proxy (Figure 37).

Figure 37. Model estimates of the reduction in reproductive potential of the current biomass (top) and the current fishing mortality (bottom, males in blue, females in red) in the southern fishing zone. (source: Montenegro *et al*., 2015)



The results of the stock assessments undertaken by IFOP are submitted to the Scientific Committee. The most recent evaluation by the Scientific Committee took place in November 2015 (Comité Científico Técnico Crustáceos Demersales. 2015b). For the northern fishing zone, the stock assessment determined that the ratio of the current biomass to the Bmsy proxy of 40% B_0 is 1.237, and that the ratio of the current fishing mortality to the F_{msy} proxy of F 45%SPR is 0.45, indicating that the northern stock is fully-exploited as defined within the MSY framework (Figure 38). For the southern fishing zone, the stock assessment determined that the ratio of the current biomass to the Bmsy proxy of 40% B_0 is 1.442, and that the ratio of the current fishing mortality to the F_{msy} proxy of F 45%SPR is 0.48, indicating that the southern stock is fully-exploited as defined within the MSY framework (Figure 39).

Figure 38. Phase diagram for the nylon shrimp fishery in the northern zone. (source: Comité Científico Técnico Crustáceos Demersales. 2015b)

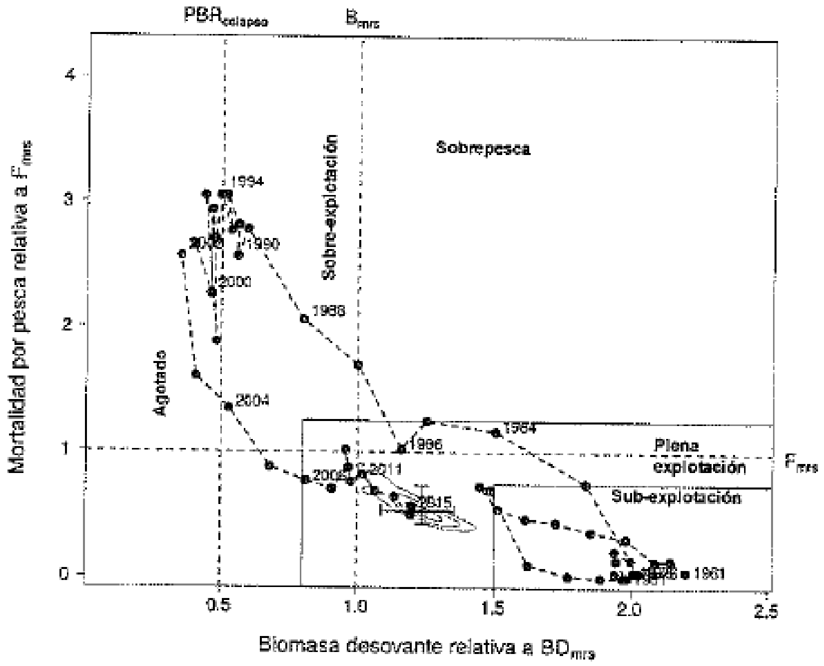
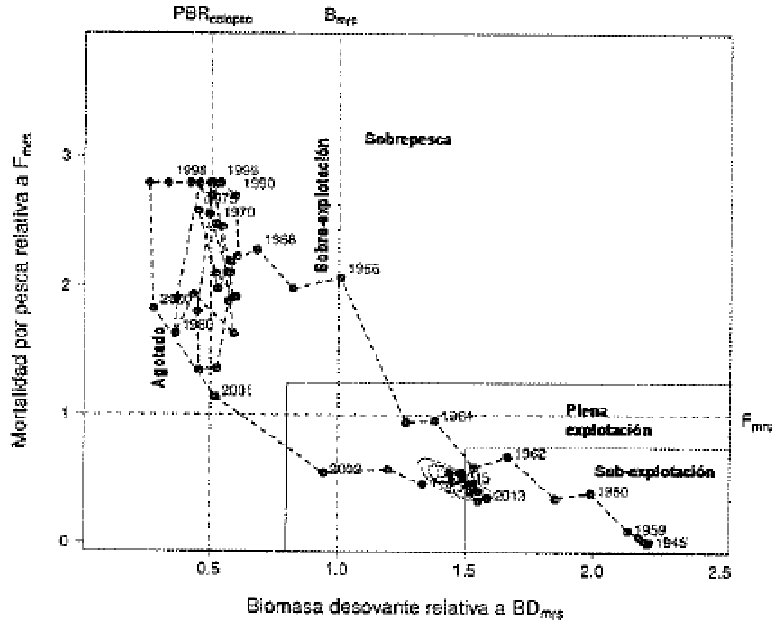


Figure 39. Phase diagram for the nylon shrimp fishery in the southern zone. (source: Comité Científico Técnico Crustáceos Demersales. 2015b)



Based on the assessment of stock status in relation to Bmsy and Fmsy proxies in the two fishing zones, the Scientific Committee evaluated projections of biomass and catches based on five exploitation patterns – no fishing, $F_{40\%}$, $F_{45\%}$ (F_{msy} proxy) $F_{48\%}$ and Fsq (current fishing mortality). Adopting a strategy that the level of risk of exceeding the Fmsy proxy should be no more than 10%, the Scientific Committee advised that the quota (CBA) should not exceed 1,238 tonnes in the northern fishery and 4,666 tonnes in the southern fishery, providing a maximum global quota of 5,904 tonnes in 2016 (Comité Científico Técnico Crustáceos Demersales. 2015b).

Yellow squat lobster – northern and southern stocks

Total landings of yellow squat lobster are significantly lower than in previous years, having declined in the last few years to around 3,000 tonnes from around 5,000 tonnes in 2008-09, and historically landings had in some years been around 10,000 tonnes. The recent decline has occurred in both the northern and southern fishing zones (Figure 40). Landings are driven primarily by annual quotas, and so do not necessarily reflect stock status. Catch per unit effort (CPUE) standardised for year, month, fishing area and vessel using the method of Maunder and Punt (2004) has increased in recent years in the northern region in comparison with historical levels (Figure 41) and has fluctuated over the last 20 years in the southern zone, but is currently declining having reached a peak in 2008 (Figure 42).

Figure 40. Landings of yellow squat lobster from 1979 to 2013 for northern zone (pink) and southern zone (blue). (Source: SERNEPESCA / SUBPESCA)

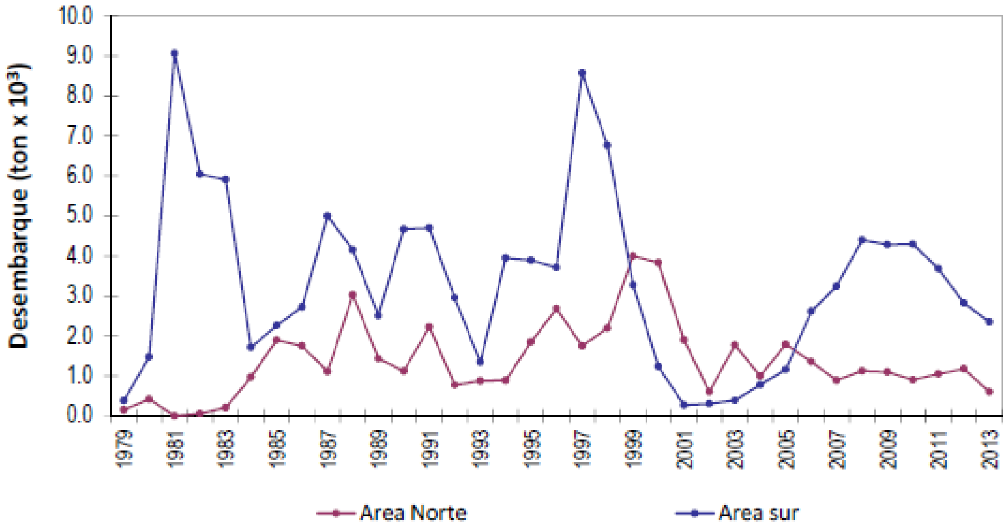


Figure 41. CPUE (nominal and standardised) for yellow squat lobster in the northern fishing zone. (source: Bucarey et al., 2015a)

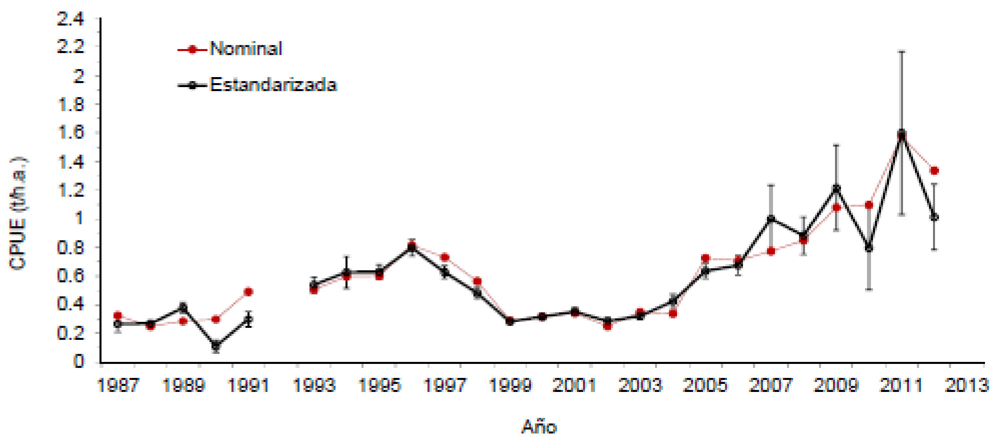
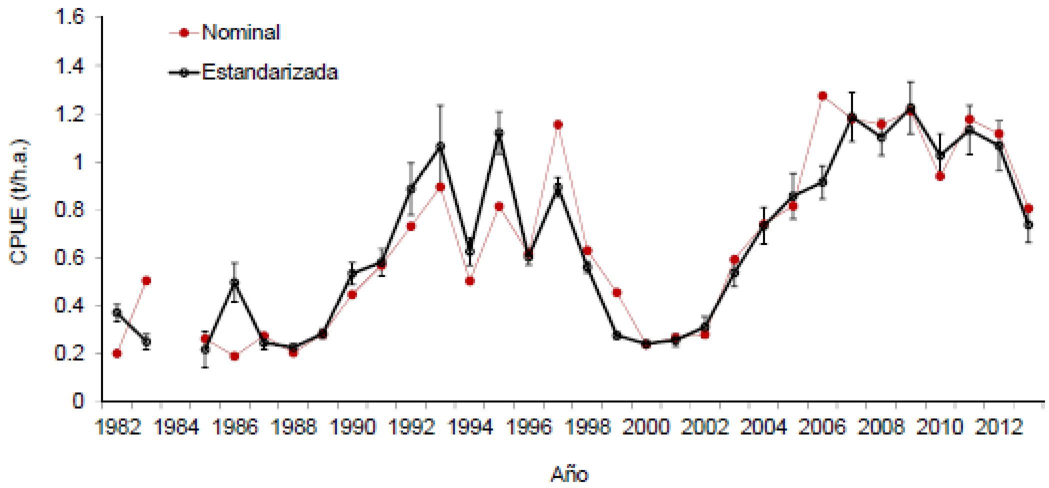


Figure 42. CPUE (nominal and standardised) for yellow squat lobster in the southern fishing zone. (source: Bucarey *et al*., 2015a)



Length composition sampling of the catches has been carried out in both the northern and southern regions of the fishery. In the southern region sampling levels ranged from 15,000 to 35,000 individuals, but sampling levels were much lower in the northern region because observers sample only on industrial vessels and opportunities to sample may therefore be very limited in some years. The mean size of male squat lobsters is larger than that for females in both fishing areas, and squat lobsters of both sexes are larger in the southern region that the northern region (Figures 43 and 44). The sex ratios of catches of yellow squat lobsters in both fishing regions are variable but in most years the catches are predominantly male (Figure 45).

Figure 43. Size distribution of catches of yellow squat lobster in the northern region – females (hembras) and males (machos). (source: Bucarey *et al*., 2015a)

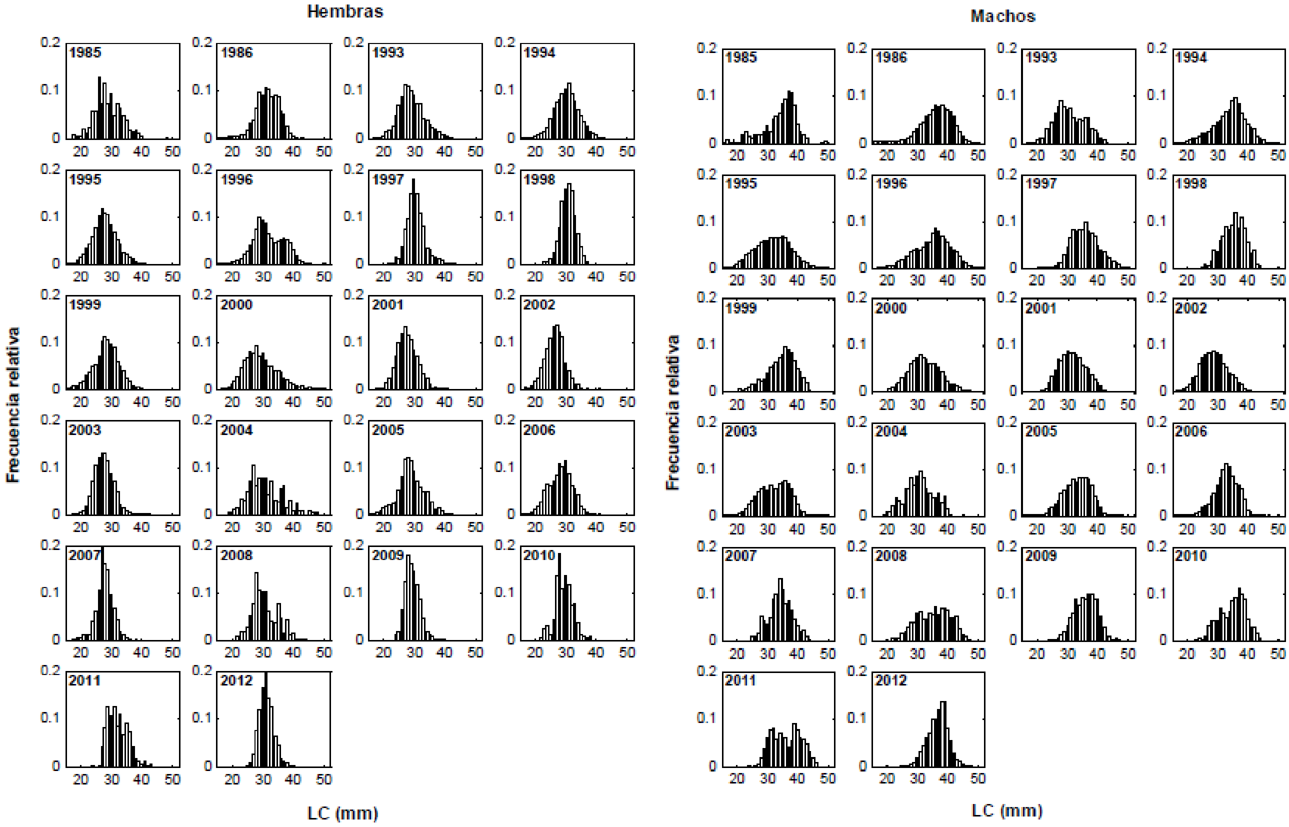


Figure 44. Size distribution of catches of yellow squat lobster in the southern region – females (left) and males (right). (source: Bucarey *et al*., 2015a)

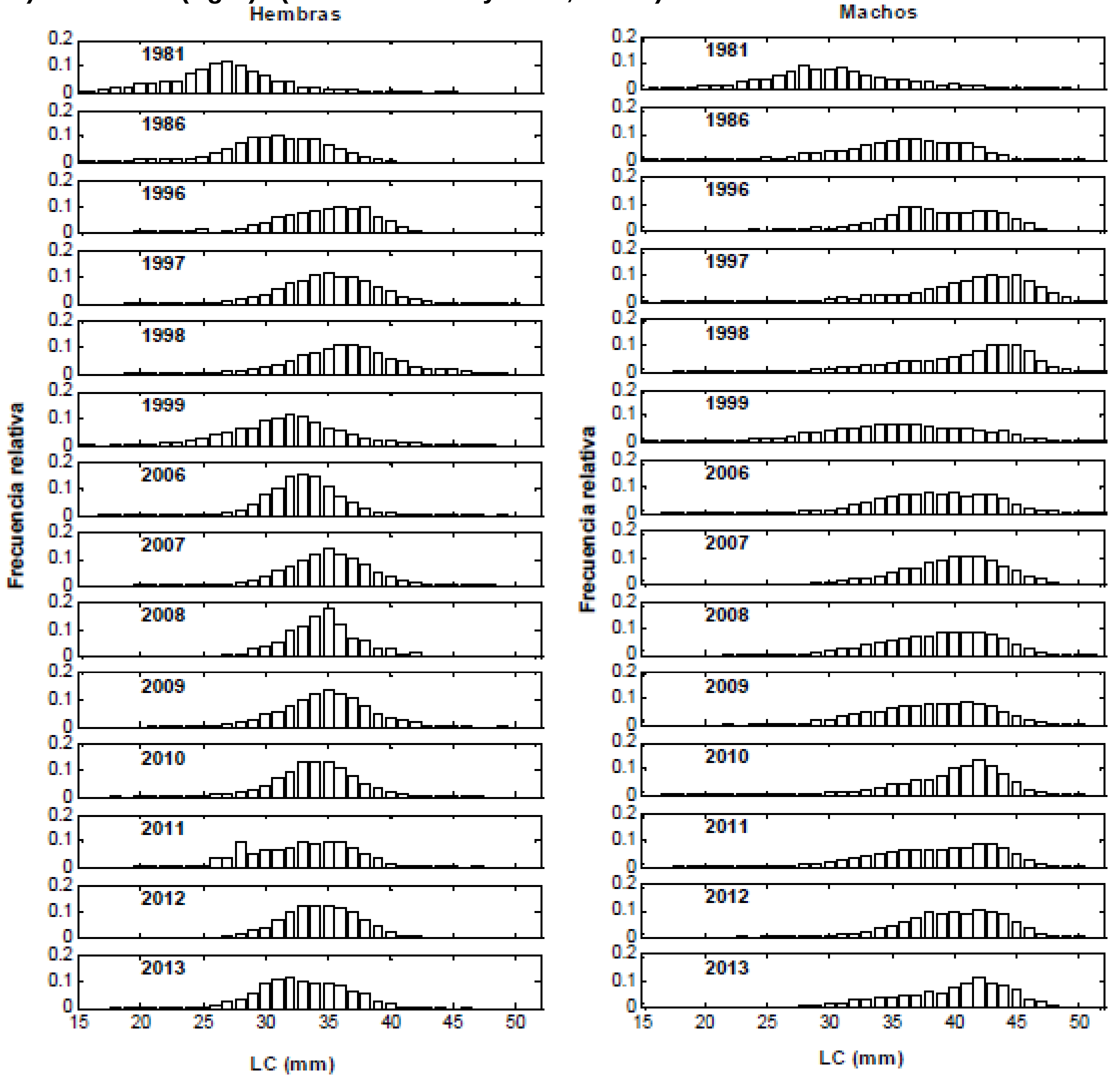
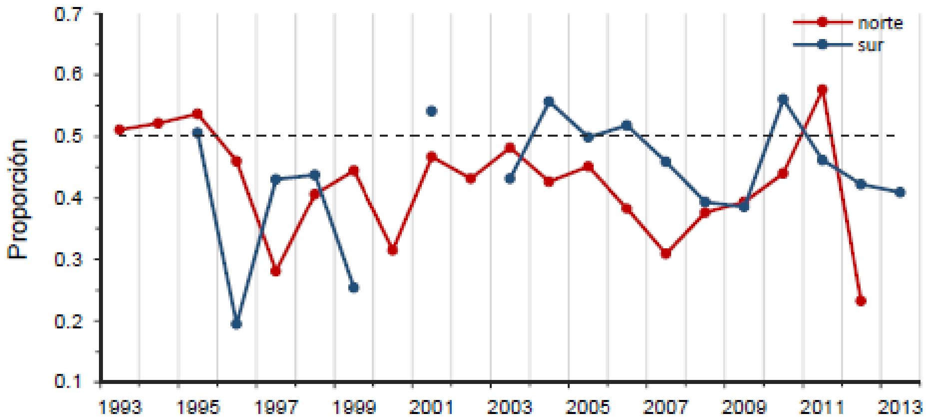
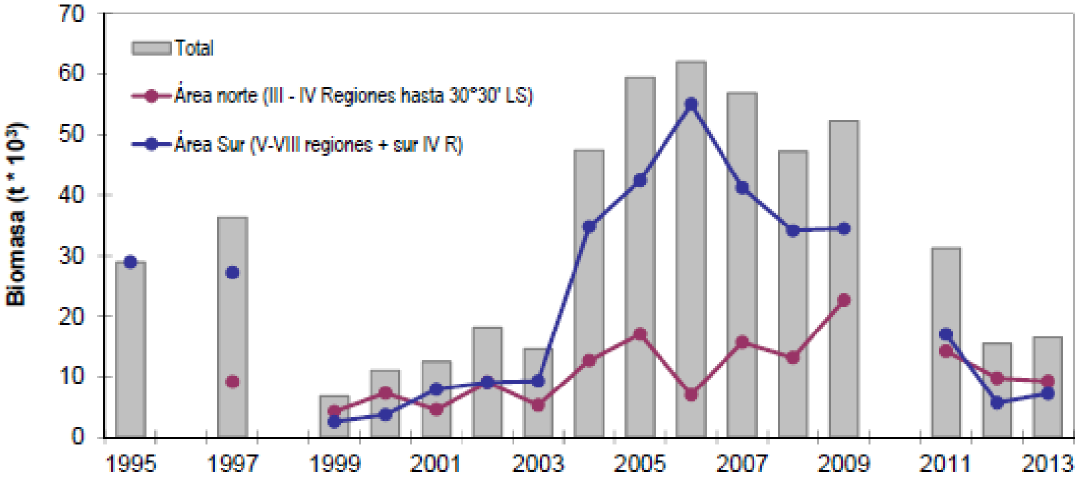


Figure 45. Proportion of females in the yellow squat lobster fisheries in the northern (red) and southern (blue) fishing zones. (source: Bucarey *et al*., 2015a)



Biomass estimates using the swept area method from the annual stock surveys show that in both the northern and southern regions the stock size has declined considerably since a peak biomass in 2006 (Figure 46).

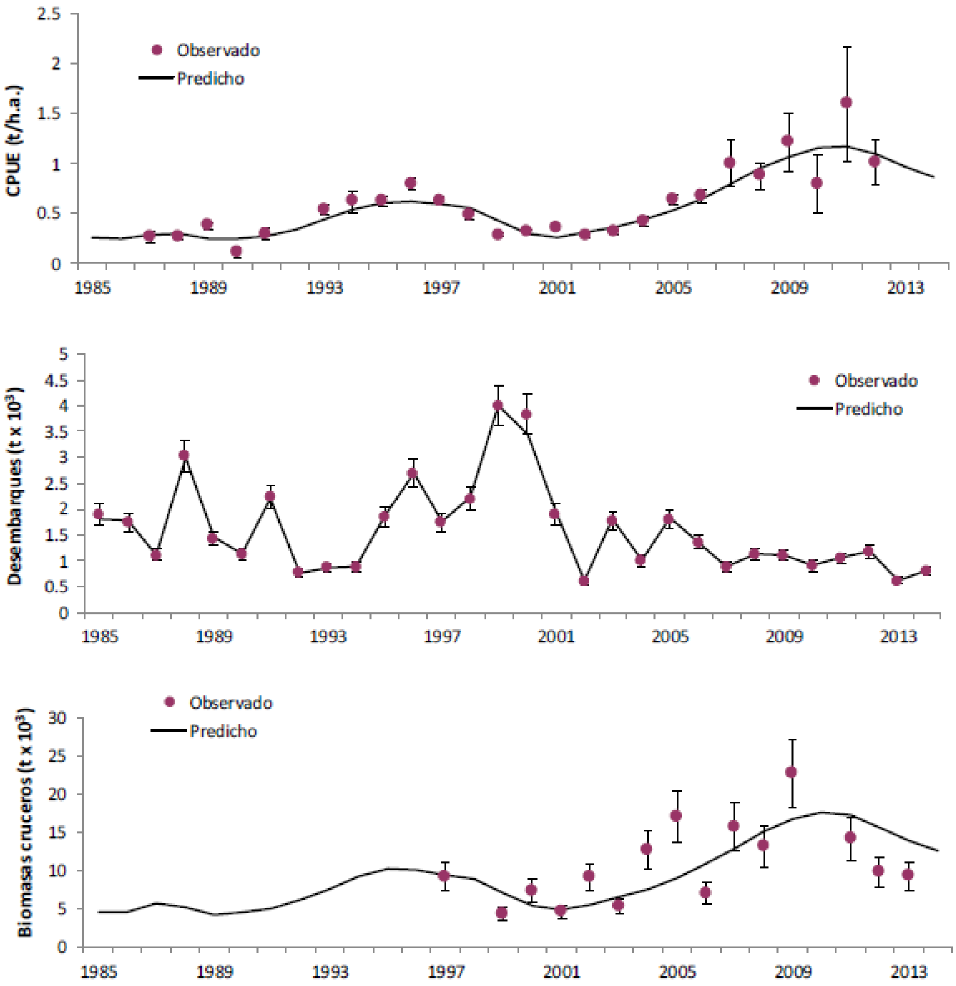
Figure 46. Biomass estimates of yellow squat lobster from fishery-independent stock surveys for the northern (purple) and southern (blue) fishing zones. (source: Bucarey *et al*., 2015a)



Model fits for the northern zone fishery

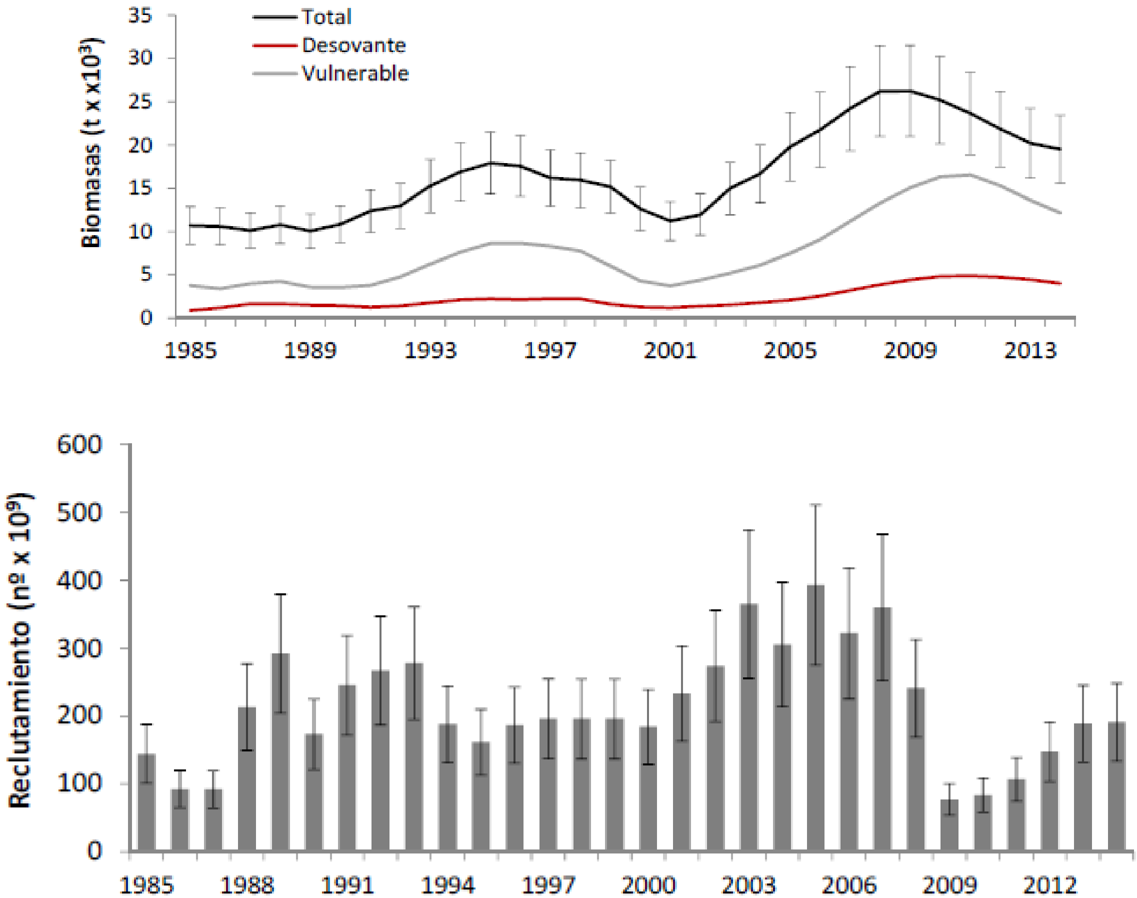
The model provided a good fit to the data in the northern region on CPUE and landings, but provided a poorer fit to the biomass estimates from the survey (Figure 47).

Figure 47. Model fits to observed data on CPUE (top), landings (middle) and stock survey biomass estimates (bottom) for yellow squat lobster in the northern fishing zone. (source: Bucarey *et al*., 2015a)



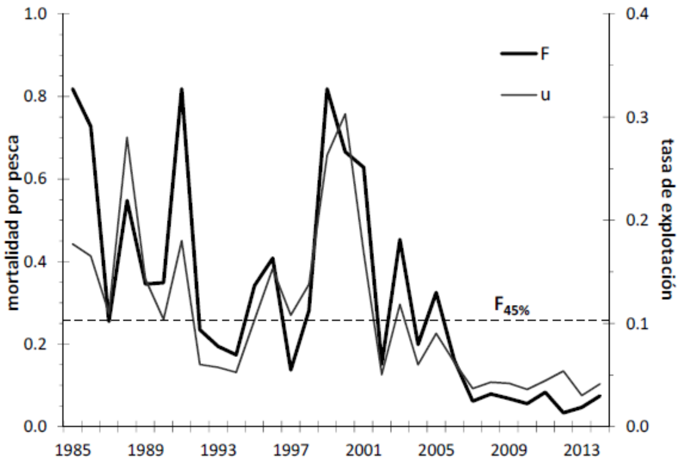
Model outputs show that total, spawning and exploitable biomass have declined in the last few years in the northern fishing zone but are still high in comparison with historical levels. Recruitment has been increasing in the last few years but is still low in comparison with recruitment levels in the early 2000s (Figure 48).

Figure 48. Total, spawning and exploitable biomass (top) and recruitment (bottom) as estimated by the stock assessment model for the northern fishing zone for yellow squat lobster from 1985 to 2014. (source: Bucarey et al., 2015a)



Estimates of fishing mortality show that current F is well below the estimated value of the Fmsy proxy, $F_{45\%SPR}$, of 0.26 (Figure 49). The estimate of current biomass is well above the Bmsy proxy of 40% of B_0.

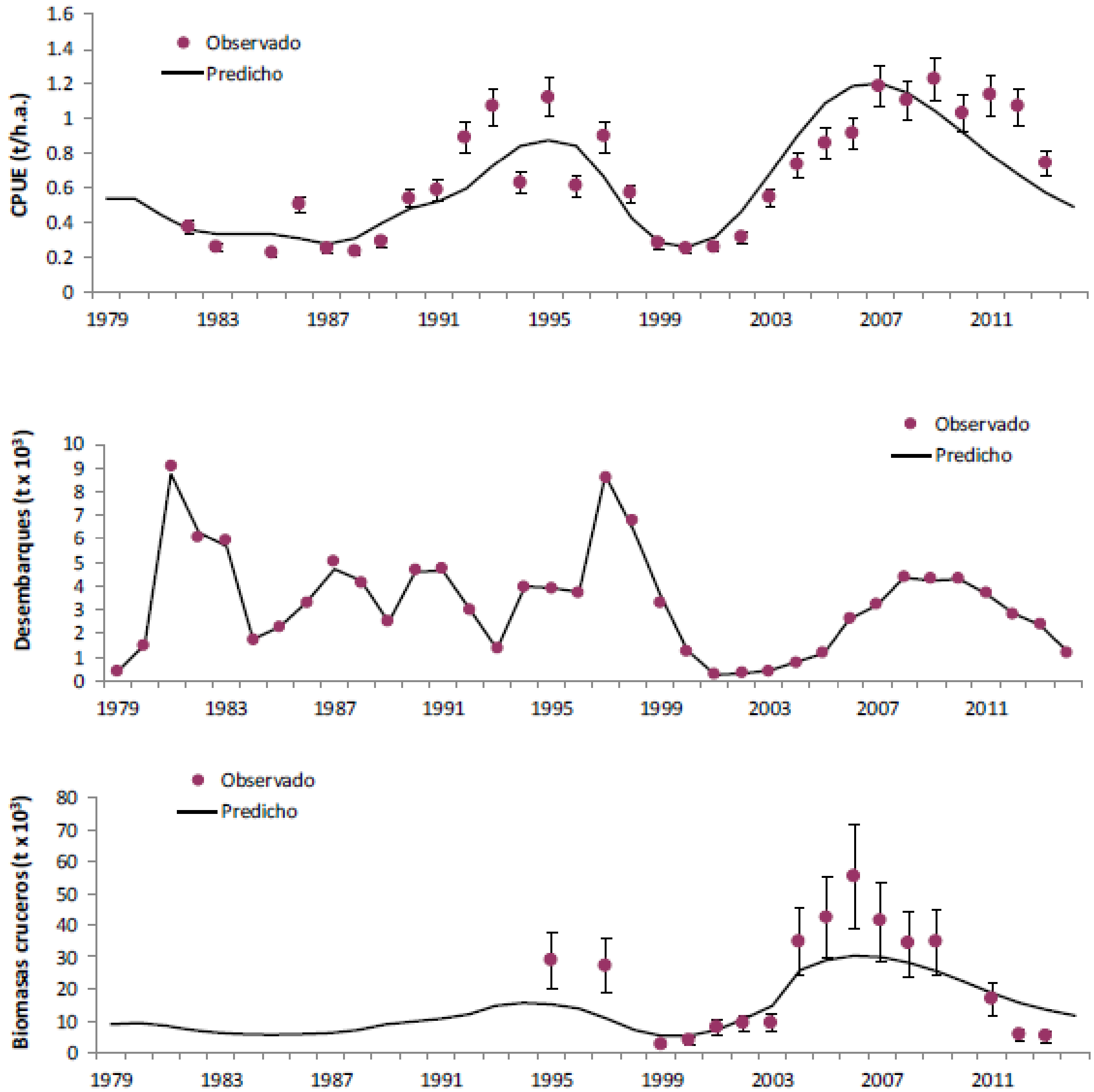
Figure 49. Model estimate of fishing mortality and exploitation rate for the northern fishing zone for yellow squat lobster. Horizontal line is the Fmsy proxy, $F_{45\%SPR}$. (source: Bucarey et al., 2015a)



Model fits for the southern zone fishery

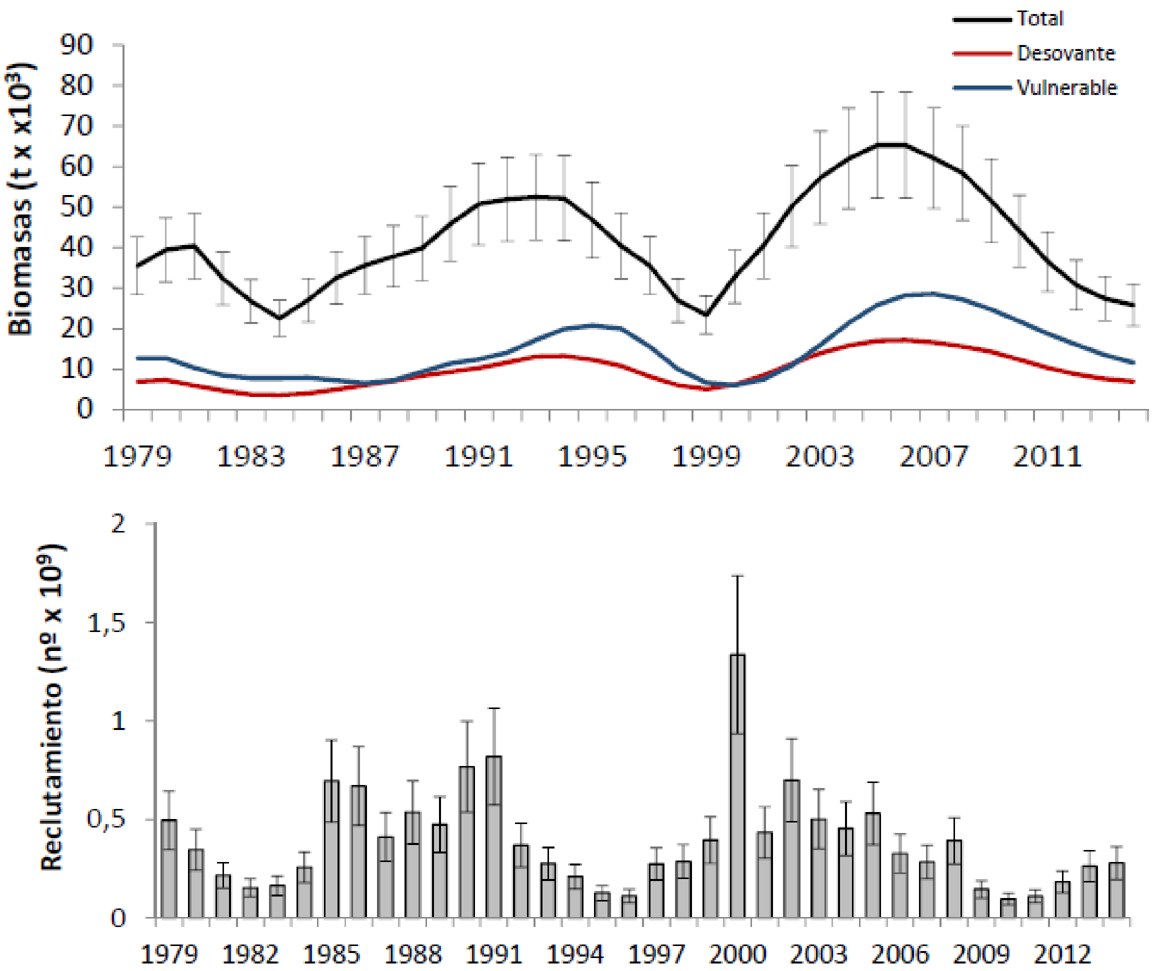
The model provided a reasonable fit to the data in the southern region on CPUE and landings, but provided a poorer fit to the biomass estimates from the survey (Figure 50).

Figure 50. Model fits to observed data on CPUE (top), landings (middle) and stock survey biomass estimates (bottom) for yellow squat lobster in the southern fishing zone. (source: Bucarey *et al*., 2015a)



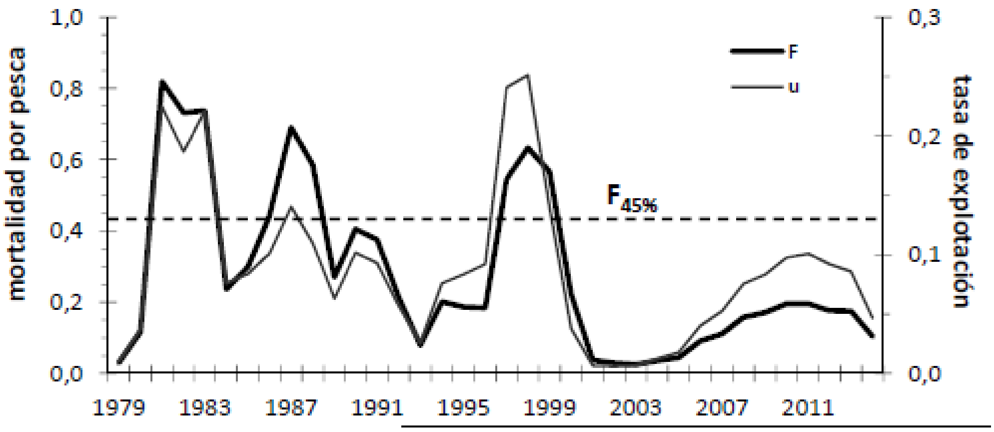
Model outputs show that total, spawning and exploitable biomass have declined in the last few years in the southern fishing zone from a peak in 2005-2006. Recruitment has been increasing in the last few years but is still low in comparison with recruitment levels in the early 2000s (Figure 51).

Figure 51. Total, spawning and exploitable biomass (top) and recruitment (bottom) as estimated by the stock assessment model for the southern fishing zone for yellow squat lobster from 1985 to 2014. (source: Bucarey *et al*., 2015a)



Estimates of fishing mortality show that current F is well below the estimated value of the Fmsy proxy, F45%SPR, of 0.43 (Figure 52). The estimate of current biomass is well above the B_{msy} proxy of 40% of B0.

Figure 52. Model estimate of fishing mortality and exploitation rate for the southern fishing zone for yellow squat lobster. Horizontal line is the F_{msy} proxy, F45%SPR. (source: Bucarey et al., 2015a)



The results of the stock assessments undertaken by IFOP (Bucarey et al., 2015) are submitted to the Scientific Committee. The most recent evaluation by the Scientific Committee of the status of the yellow squat lobster took place in December 2015 (Comité Científico Técnico Crustáceos Demersales. 2015c). For the northern fishing zone, the stock assessment determined that the ratio of the current biomass to the Bmsy proxy of 40% B_0 is 1.88, and that the ratio of the current fishing mortality to the Fmsy proxy of $F_{45\%SPR}$ is 0.44, and that the probability of current F being greater than $F_{45\%SPR}$ is zero, indicating that the northern stock is currently under-exploited as defined within the MSY framework (Figure 53). For the southern fishing zone, the stock assessment determined that the ratio of the current biomass to the Bmsy proxy of 40% B_0 is 1.13, and that the ratio of the current fishing mortality to the Fmsy proxy of $F_{45\%SPR}$ is 0.59, and that the probability of current F being greater than $F_{45\%SPR}$ is < 0.05, indicating that the southern stock is fully-exploited as defined within the MSY framework (Figure 54).

Figure 53. Phase diagram for the yellow squat lobster fishery in the northern zone. (source: Comité Científico Técnico Crustáceos Demersales. 2015c)

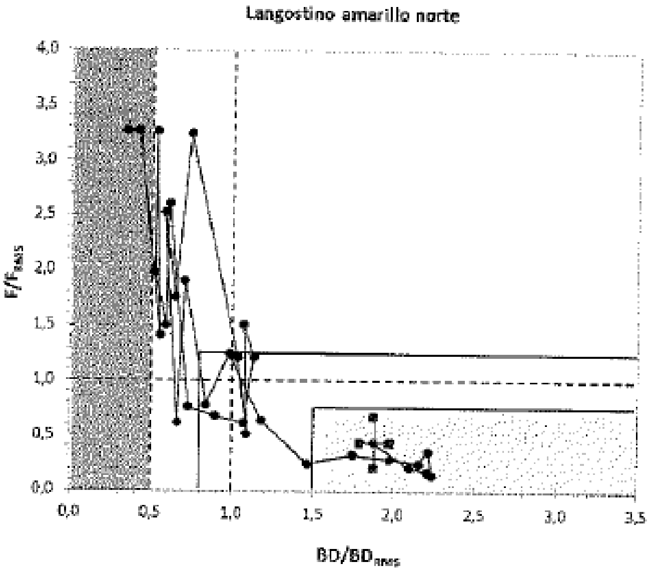
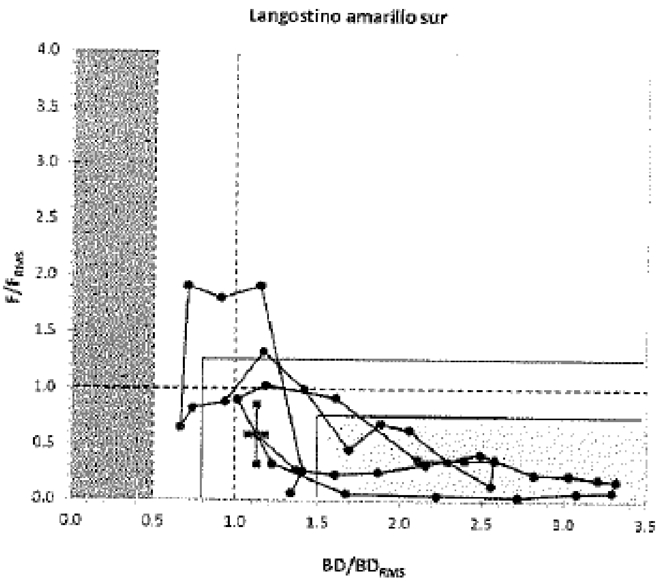


Figure 54. Phase diagram for the yellow squat lobster fishery in the southern zone. (source: Comité Científico Técnico Crustáceos Demersales. 2015c)



Based on the assessment of stock status in relation to Bmsy and Fmsy proxies in the two fishing zones, the Scientific Committee evaluated projections of biomass and catches based on three exploitation patterns – no fishing, F45% (Fmsy proxy) and Fsq (current fishing mortality). Based on these projections, the Scientific Committee advised that the quota (CBA) should be between 2,000 and 2,500 tonnes in the northern fishery and between 1,504 and 1,880 tonnes in the southern fishery in 2016 (Comité Científico Técnico Crustáceos Demersales 2015c).

Red squat lobster – northern and southern stocks

Landings from the red squat lobster fishery in the southern zone have been highly variable. In 1976, recorded landings were 60,000 tonnes, but during the 1980s and 1990s landings rarely exceeded 10,000 tonnes, and by 2001, the fishery was closed. From 2005, there was a small research quota, and commercial quotas were re-introduced in 2009 (Figure 55). The fishery in the northern zone began in 1998, with landings fluctuating around 1,300 tonnes with a peak in 2000 of 2,500 tonnes (Figure 55). Catch per unit effort (CPUE) standardised for year, month, fishing area and vessel using the method of Maunder and Punt (2004) has been stable in recent years in the northern region but higher than levels observed at the start of the fishery (Figure 56). In the southern zone, CPUE declined significantly in the late 1990s prior to closure of the fishery in 2001, and since re-opening in 2009, CPUE is still relatively low in comparison with levels observed in the 1970s and late 1980s (Figure 57).

Figure 55. Landings of red squat lobster from 1968 to 2013 for southern zone (blue) and northern zone (red). (Source: SERNAPESCA / SUBPESCA)

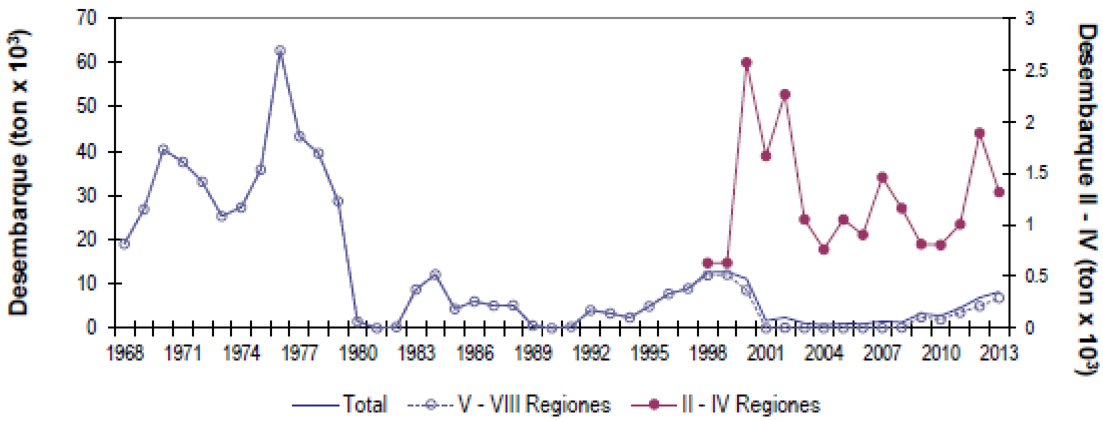


Figure 56. CPUE (nominal and standardised) for red squat lobster in the northern fishing zone. (source: Bucarey et al., 2015b)

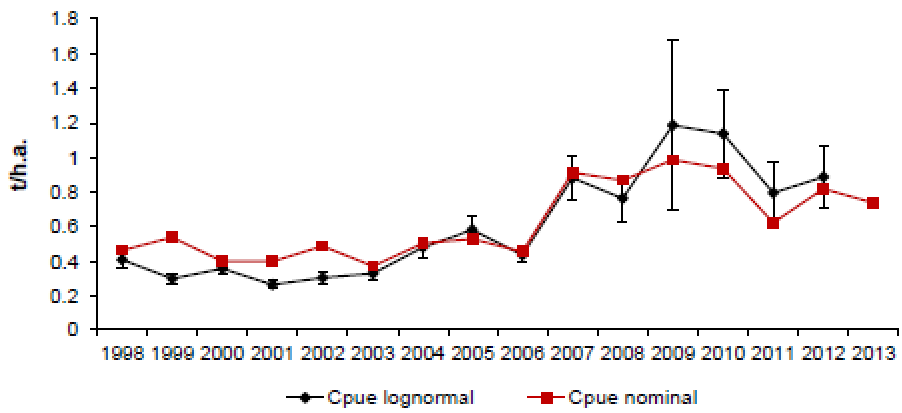
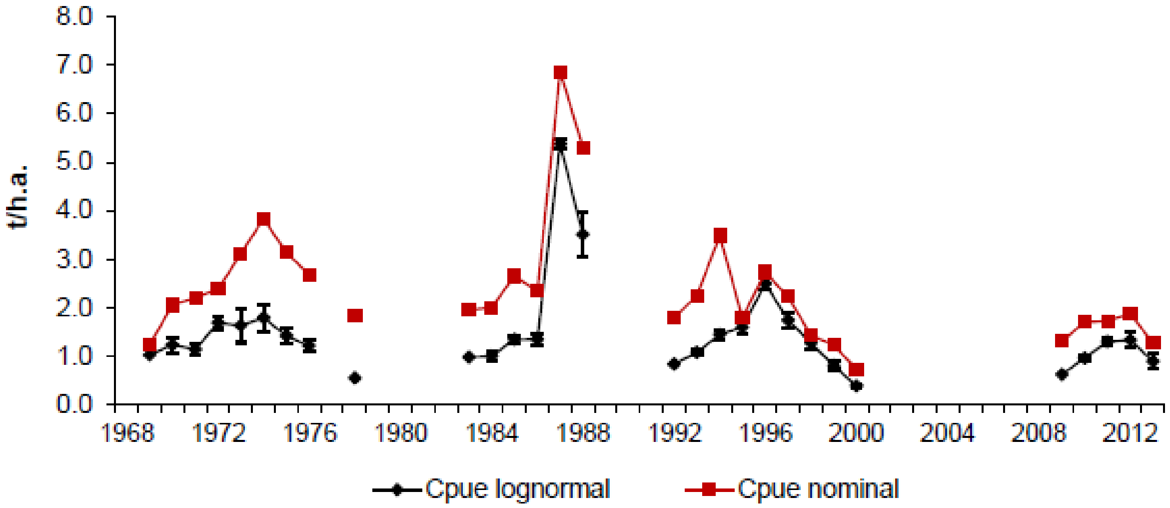


Figure 57. CPUE (nominal and standardised) for red squat lobster in the southern fishing zone. (source: Bucarey et al., 2015b)



Length composition sampling of the catches has been carried out in both the northern and southern regions of the fishery. In the southern region, sampling levels since the fishery re-opened ranged from 15,000 to 30,000 individuals, but sampling levels were much lower in the northern region ranging from 5,000 to 10,000 individuals per year. Opportunities to sample in the northern zone may be very limited in some years because observers sample only on industrial vessels. Size frequency distributions of the catches in the northern and southern zones are shown in Figures 58 and 59 respectively and show that larger red squat lobsters are observed in the catches in the southern region. The proportion of females in catches of red squat lobsters is variable in both fishing regions but clear patterns emerge from the two-time series (Figure 60).

Figure 58. Size distribution of catches of red squat lobster in the northern region. (source: Bucarey et al., 2015b)

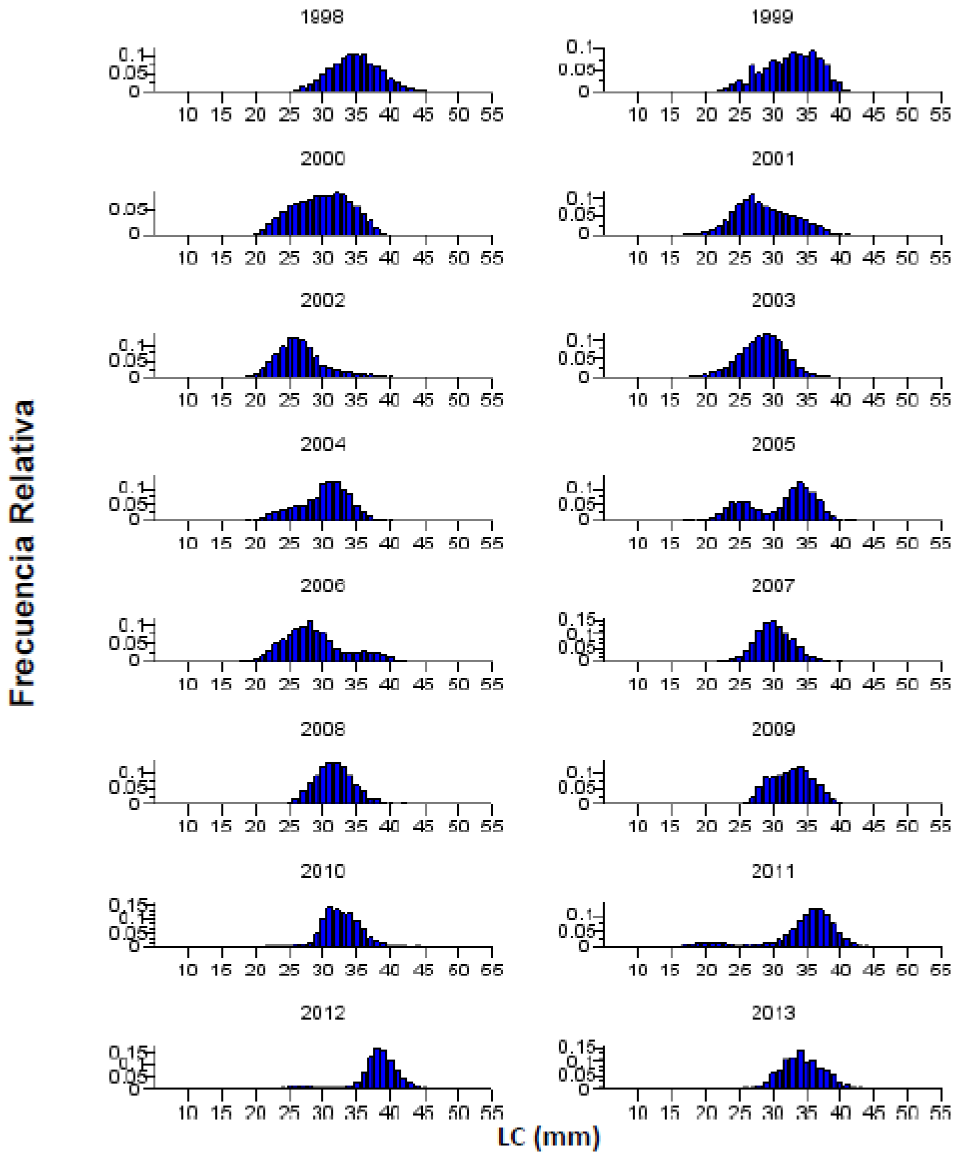


Figure 59. Size distribution of catches of red squat lobster in the southern region. (source: Bucarey et al., 2015b)

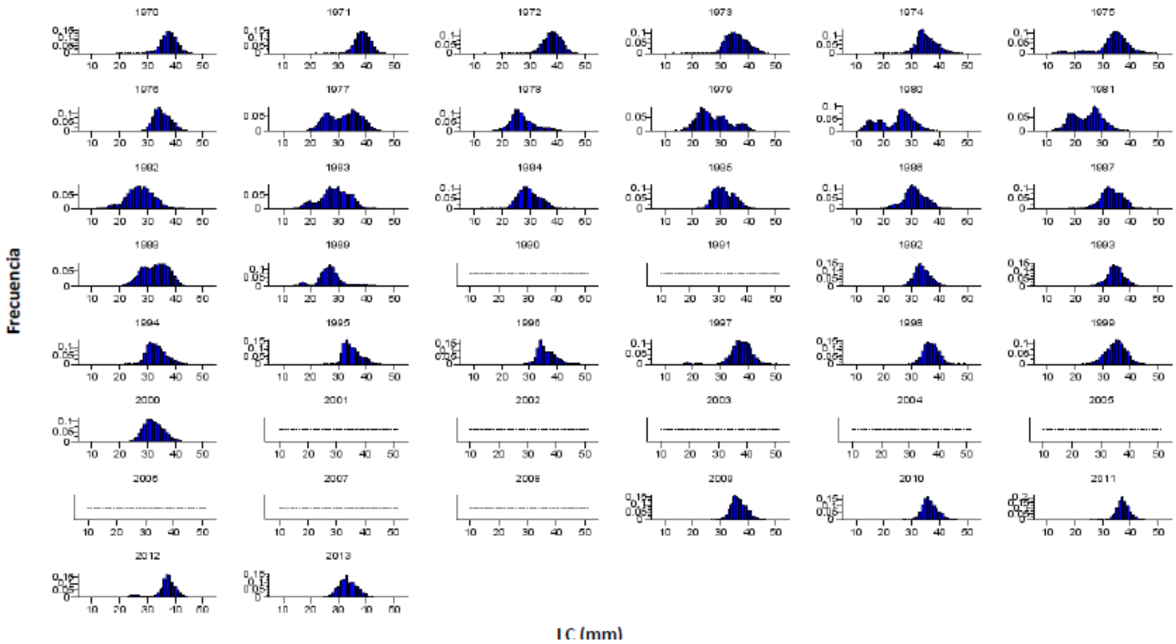
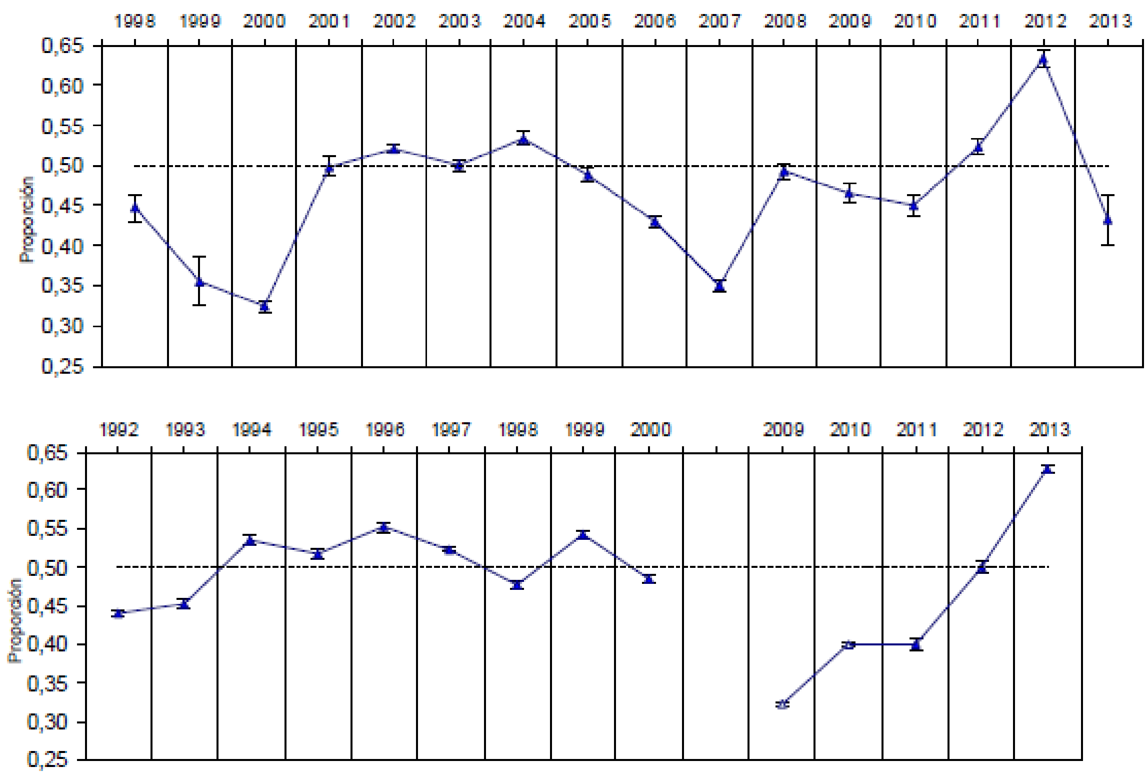


Figure 60. Proportion of females in the red squat lobster fisheries in the northern (top) and southern (bottom) fishing zones. (source: Bucarey et al., 2015b)



Biomass estimates using the swept area method from the annual stock surveys show that in the northern regions the stock size is lower in the last few years than historical levels (Figure 61). Stock size in the southern region estimated from the fishery-independent stock survey has increased significantly recently following very low levels at the beginning of the 2000s (Figure 62)

Figure 61. Biomass estimate of red squat lobster from fishery-independent stock surveys for the northern fishing zone. (source: Bucarey et al., 2015b)

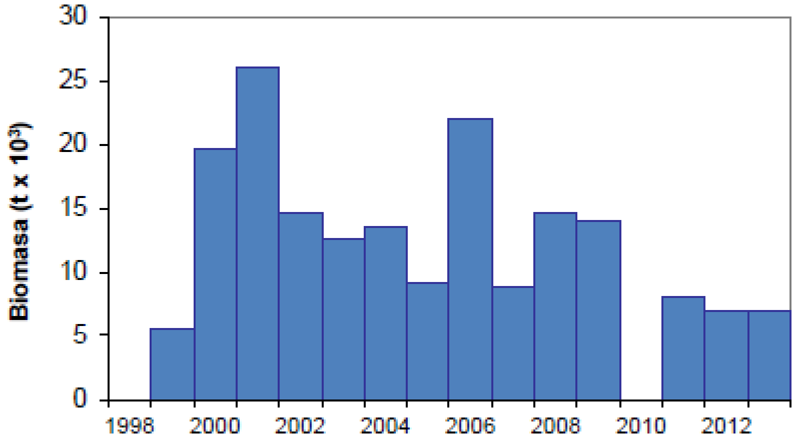
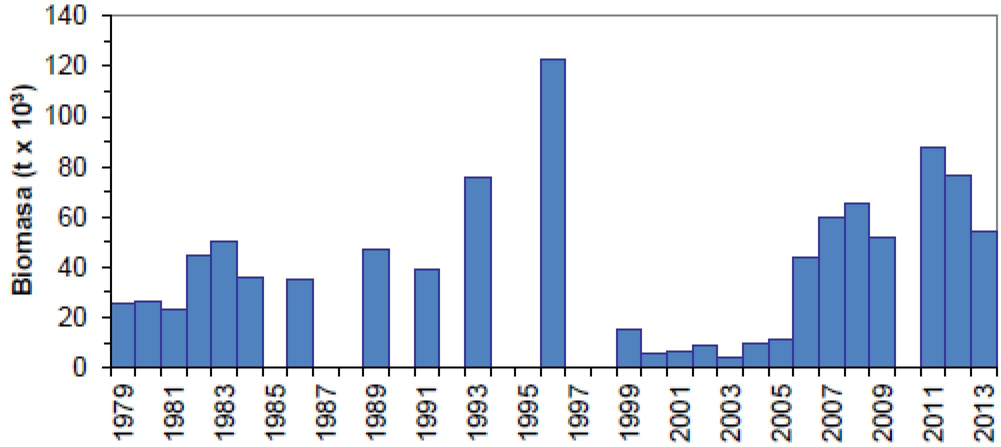


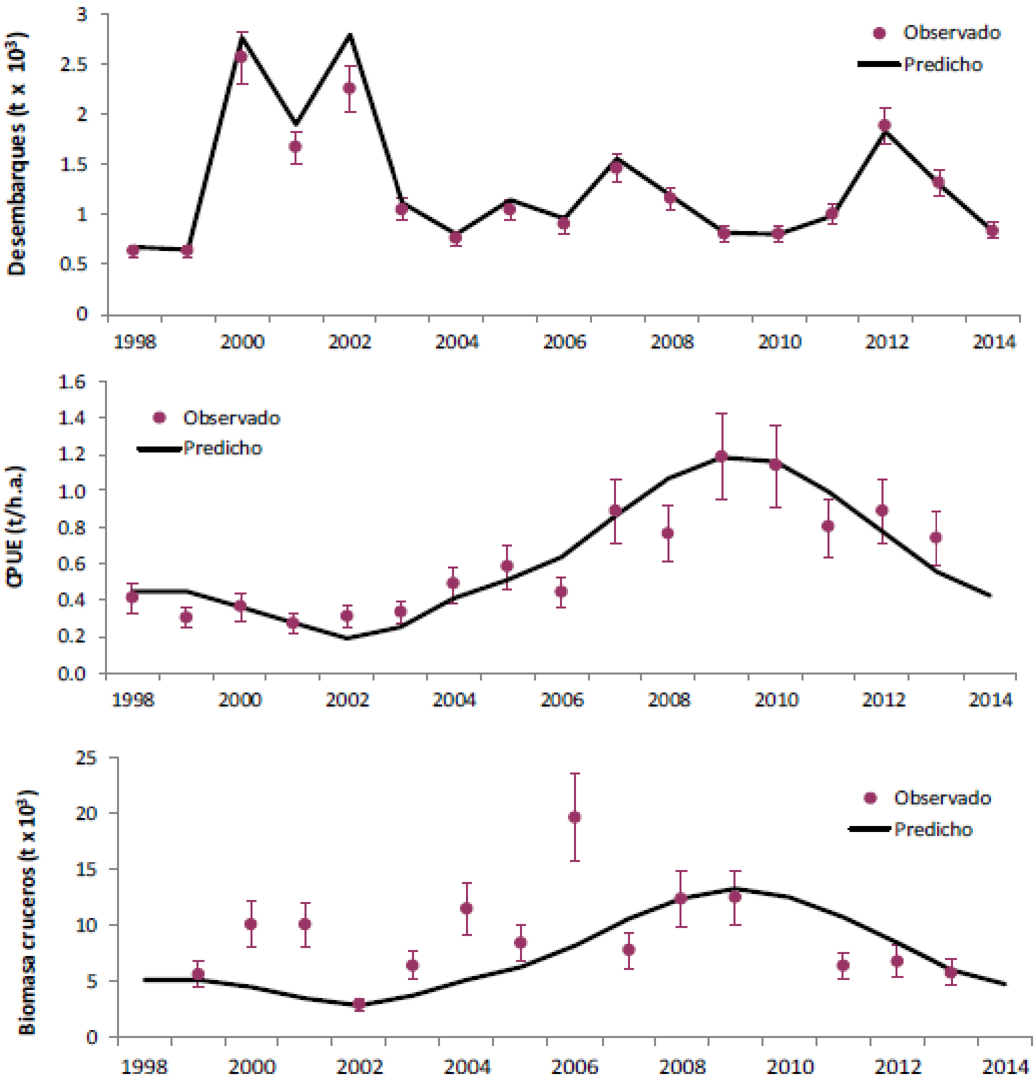
Figure 62. Biomass estimate of red squat lobster from fishery-independent stock surveys for the southern fishing zone. (source: Bucarey et al., 2015b)



Model fits for the northern zone fishery

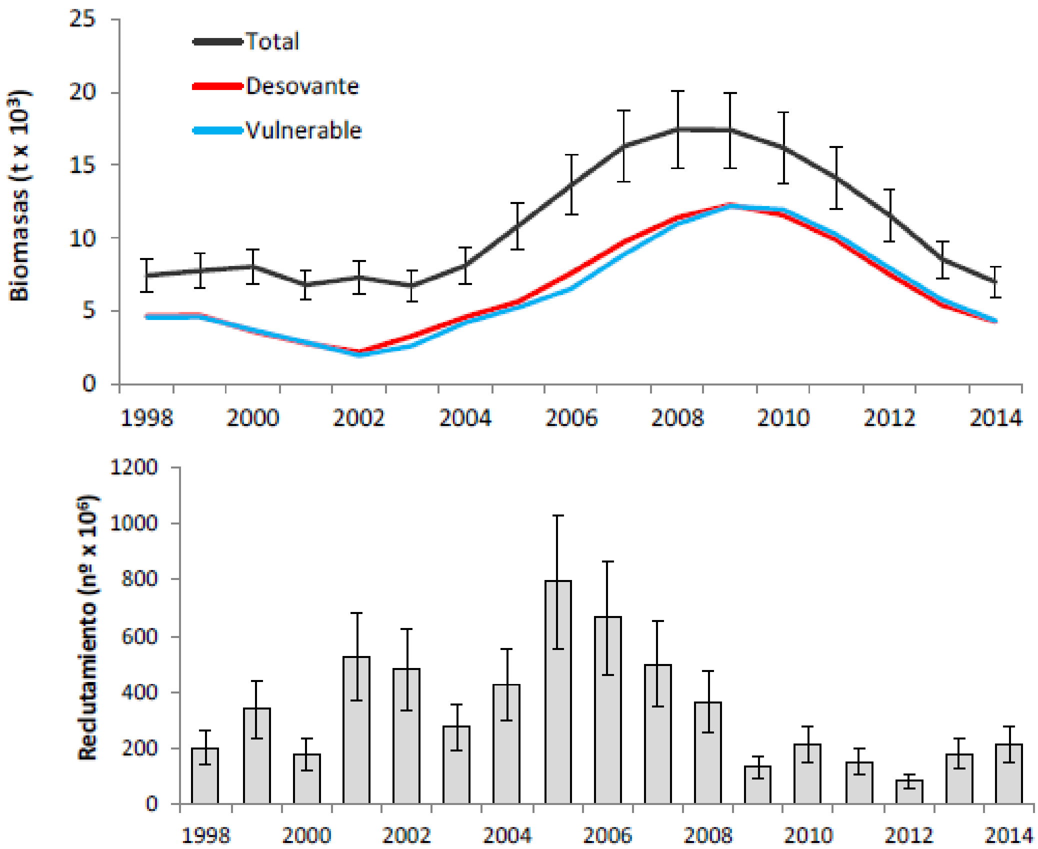
The model provided a reasonable fit to the data in the northern region on CPUE, but provided a poorer fit to the biomass estimates from the survey (Figure 63).

Figure 63. Model fits to observed data on landings (top), CPUE (middle) and stock survey biomass estimates (bottom) for red squat lobster in the northern fishing zone. (source: Bucarey et al., 2015b)



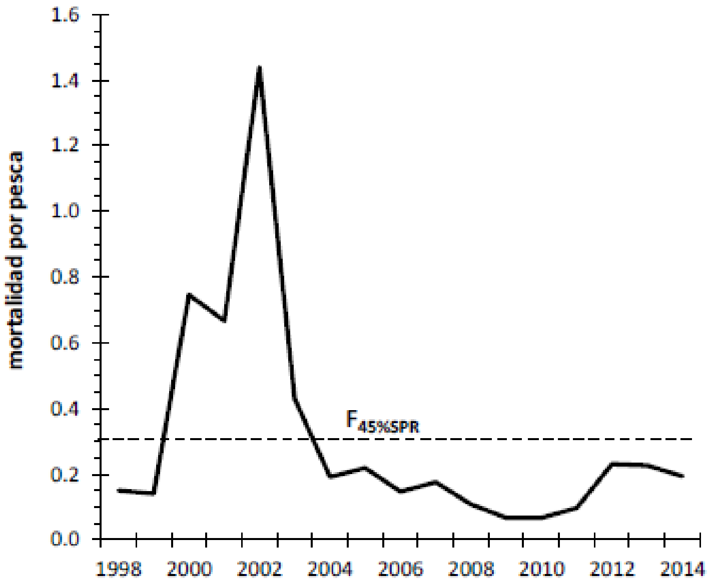
Model outputs show that total, spawning and exploitable biomass have declined in the last few years in the northern fishing zone from a peak in 2008-2009. Recruitment has been at a low level in the last few years in comparison with previous recruitment levels (Figure 64).

Figure 64. Total, spawning and exploitable biomass (top) and recruitment (bottom) as estimated by the stock assessment model for the northern fishing zone for red squat lobster from 1998 to 2014. (source: Bucarey et al., 2015b)



Estimates of fishing mortality show that current F is well below the estimated value of the Fmsy proxy, $F_{45\%SPR}$, of 0.3 (Figure 65). The estimate of current biomass is above the Bmsy proxy of 40% of B_0.

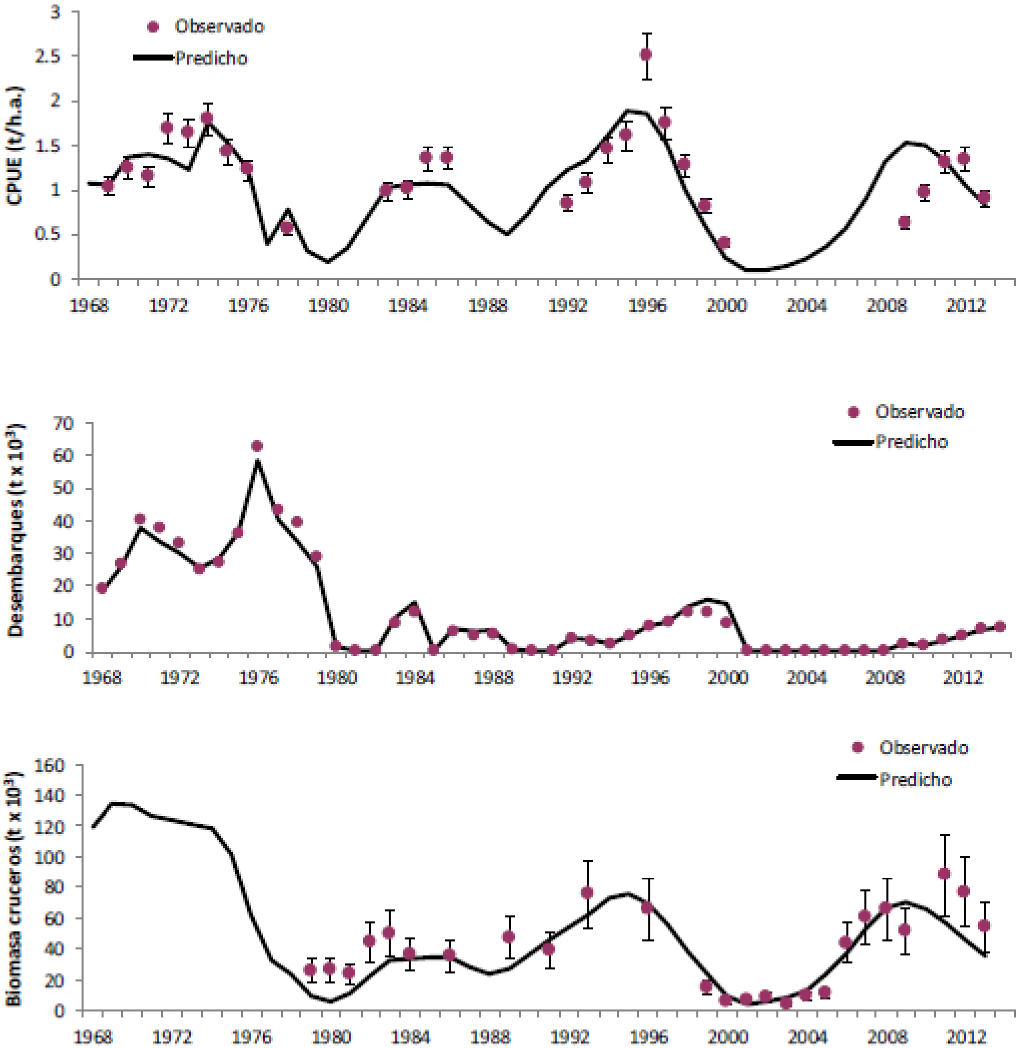
Figure 65. Model estimate of fishing mortality for the northern fishing zone for red squat lobster. Horizontal line is the Fmsy proxy, $F_{45\%SPR}$. (source: Bucarey et al., 2015b).



Model fits for the southern zone fishery

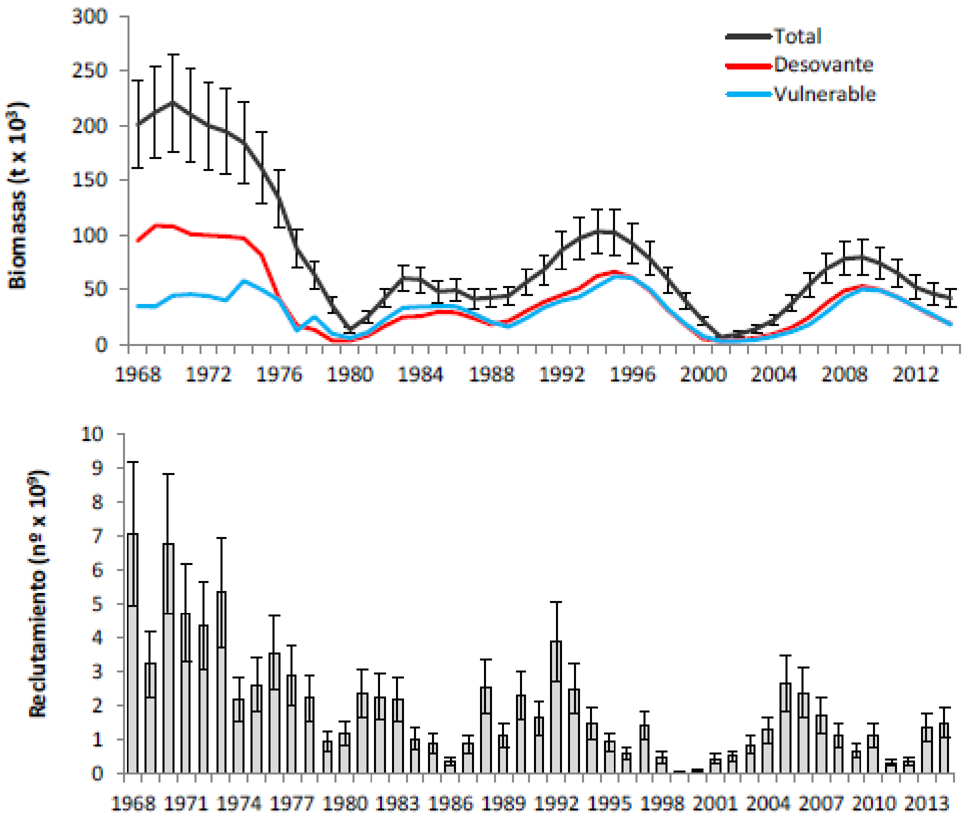
The model provided a good fit to the data in the southern region on CPUE and landings, and provided a reasonable fit to the biomass estimates from the survey (Figure 66).

Figure 66. Model fits to observed data on CPUE (top), landings (middle) and stock survey biomass estimates (bottom) for red squat lobster in the southern fishing zone. (source: Bucarey et al., 2015b)



Model outputs show that total, spawning and exploitable biomass have declined in the last few years in the southern fishing zone from a peak in 2008-2009, and are lower than historical levels. Recruitment has been at a relatively low level in the last few years in comparison with previous recruitment levels (Figure 67).

Figure 67. Total, spawning and exploitable biomass (top) and recruitment (bottom) as estimated by the stock assessment model for the southern fishing zone for red squat lobster from 1998 to 2014. (source: Bucarey et al., 2015b)



Estimates of fishing mortality show that current F has increased significantly since the fishery re-opened in 2009 and is forecast to be 0.4 in 2014 above the Fmsy, $F_{45\%SPR}$ (Figure 68). The estimate of current biomass is well below the Bmsy proxy of 40% of B_0 (Figure 69).

Figure 68. Model estimate of fishing mortality for the southern fishing zone for red squat lobster. Horizontal line is the Fmsy proxy, $F_{45\%SPR}$. (source: Bucarey et al., 2015b).

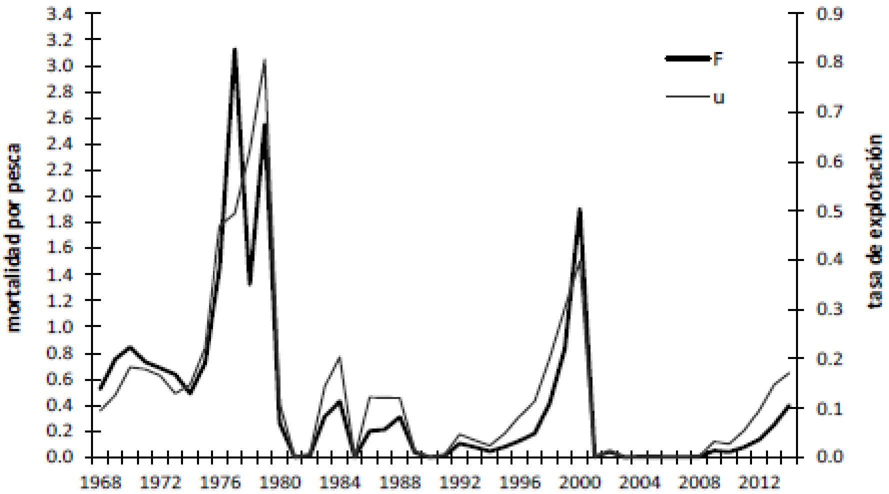
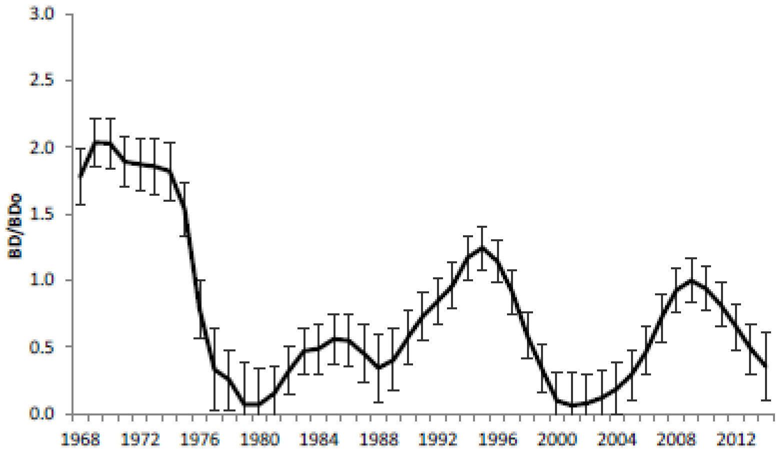


Figure 69. Ratio of estimated biomass to B_0 for southern fishing zone for red squat lobster.



The results of the stock assessments undertaken by IFOP (Bucarey et al., 2015b) are submitted to the Scientific Committee. The most recent full evaluation by the Scientific Committee of the status of the red squat lobster took place in December 2015 (Comité Científico Técnico Crustáceos Demersales. 2015c). For the northern fishing zone, the stock assessment determined that the ratio of the current biomass to the Bmsy proxy of 40% B_0 is 1.53, and that the current fishing mortality is very much lower than the Fmsy proxy of $F_{45\%SPR}$, and that the probability of current F being greater than $F_{45\%SPR}$ is 0.1, indicating that the northern stock is currently under-exploited as defined within the MSY framework (Figure 70).

For the southern fishing zone, the stock assessment determined that the ratio of the current biomass to the Bmsy proxy of 40% B_0 is 0.64, and that the ratio of the current fishing mortality is just below the Fmsy proxy of $F_{45\%SPR}$, and that the probability of current F being greater than $F_{45\%SPR}$ is 0.46, indicating that the southern stock is over-exploited as defined within the MSY framework (Figure 71).

Figure 70. Phase diagram for the red squat lobster fishery in the northern zone. (source: Comité Científico Técnico Crustáceos Demersales. 2015c)

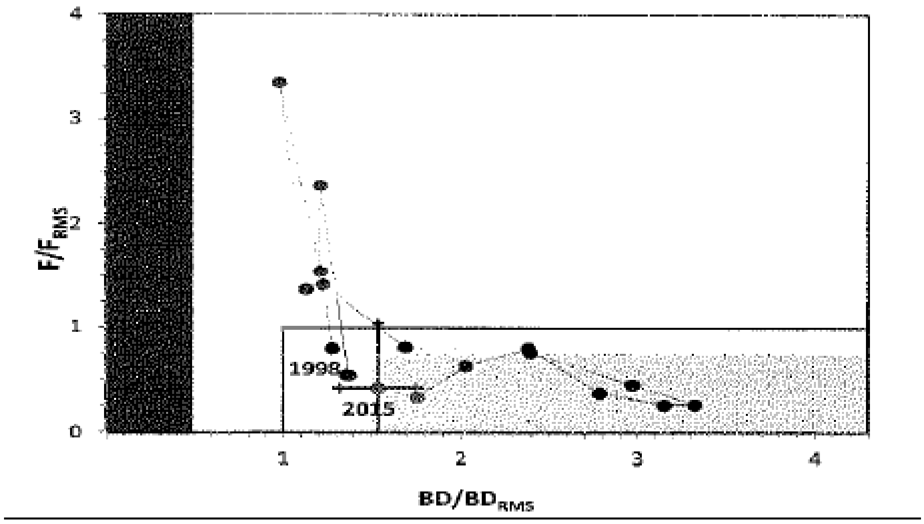
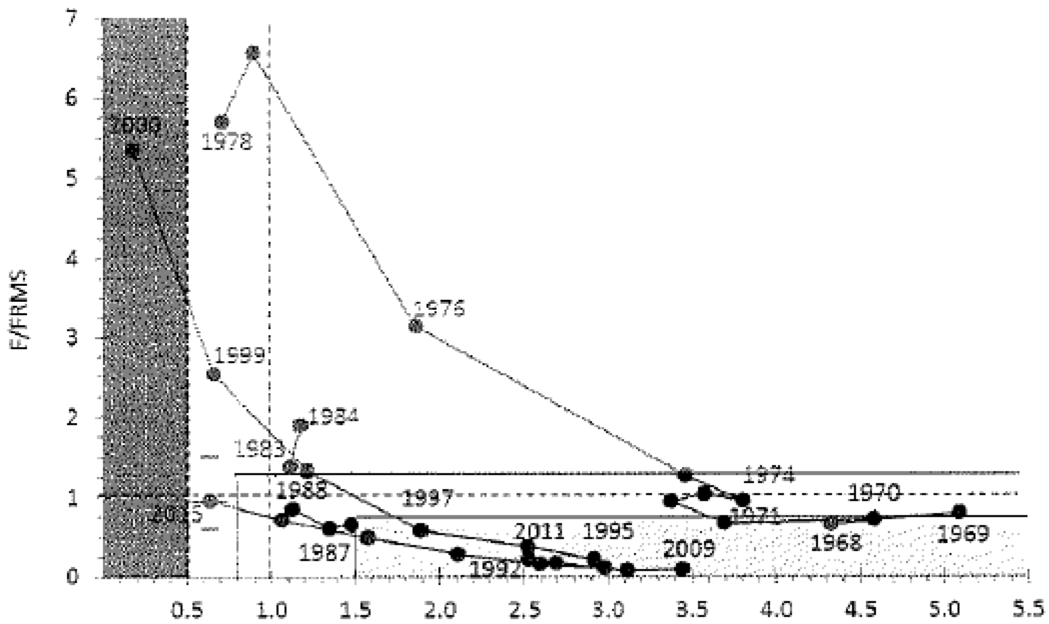


Figure 71. Phase diagram for the red squat lobster fishery in the southern zone. (source: Comité Científico Técnico Crustáceos Demersales. 2015c)



Based on the assessment of stock status in relation to Bmsy and Fmsy proxies in the two fishing zones, the Scientific Committee evaluated projections of biomass and catches based on three exploitation patterns – no fishing, $F_{45\%}$ (Fmsy proxy) and Fsq (current fishing mortality). Based on these projections, the Scientific Committee advised that for the full exploitation regime in the northern fishery, the quota (CBA) should be no higher than 970 tonnes (Comité Científico Técnico Crustáceos Demersales 2015c). For the Fishing under Recovery regime in the southern fishing zone, the quota (CBA) should be no more than 3,231 tonnes (Comité Científico Técnico Crustáceos Demersales 2015c). A further update on quota advice was provided by the Scientific Committee in early 2016 (Comité Científico Técnico Crustáceos Demersales 2016). The ratio of the current biomass to the Bmsy proxy of 40% B_0 in the northern fishery was re-assessed as 1.8, and the fishing mortality estimate for 2015 was adjusted down, giving a new maximum quota for the northern region in 2016 of 1,050 tonnes. For the southern fishery the ratio of the current biomass to the Bmsy proxy of 40% B_0 in the northern fishery was re-assessed as 0.72 with no change to the estimated fishing mortality in 2015, giving a new maximum quota for the southern region in 2016 of 4,750 tonnes.

The latest stock assessment confirms that the red squat lobster fishery in the southern region is over-exploited. The strategy for re-building the stock is to maintain the fishing mortality at or below the Fmsy proxy which should in the short to medium term recover the stock to the Bmsy proxy. In practice, the Scientific Committee has advised that additional precaution should be incorporated in the setting of quotas such that there is a less than 10% risk that fishing mortality will exceed the Fmsy proxy. The most recent assessment and Scientific Committee advice shows that such a strategy should rebuild the stock back to Bmsy by 2021.

3.4 Principle Two: Ecosystem Background

Principle 2 of the MSC standard states that:

Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent ecologically related species) on which the fishery depends.

The following section of the report highlights some of the key characteristics of the fishery under assessment with regard to its wider impact on the ecosystem.

3.4.1 Introduction

Principle 2 comprises five components to consider in relation to the potential interactions of the fishery with the ecosystem. Three components address potential species interaction: retained by-catch, discarded bycatch and endangered, threatened and protected (ETP) species. Two components address the potential impacts of the fishery on the habitat and the ecosystem. Each component is considered against three PIs – status of the relevant element, the management strategy and the availability of information. In scoring the fishery, if more than one element is considered to be impacted by the fishery then each of those elements is scored, with the resulting score being based on the average of the individual scores.

On that basis, analysis in this section covers the aquatic ecosystem, its status and any particularly sensitive areas, habitats or ecosystem features influencing or affected by the fishery; the status and relevant management history of the retained, bycatch and ETP species including specific constraints; and details of any critical environments or sources of concern and actions required to address them.

The Chilean demersal crustacean fisheries are multi-specific as these species overlap in distribution, and take place over a large latitudinal extent between 26º and 38ºS. The fisheries in the last few years used a mixture of traditional bottom trawl gear and a modified trawl design. Traditionally, vessels have used two-panel trawl nets constructed of knotted polyamide from gear previously used in the purse seine fisheries. Factors such as overall size, thick twines, heavy materials and small mesh (50 mm knot-centre to knot-centre), resulted in poor functional and selective performance. Accordingly, there was widespread concern about ecological impacts of the Chilean demersal crustacean trawl fisheries, which led SUBPESCA to request a design and introduction of a new gear to improve selectivity. Related studies were conducted since 2000 and a new design was developed in 2007 (FIP Nº2006-20, FIP Nº2008-26). Queirolo et al (2011) reported on performance of the experimental trawl indicating that it was feasible to significantly reduce non-targeted catch while keeping retention of the target species within acceptable ranges. The new design is of lighter material than the old and mesh size is larger (50 mm for nylon shrimp, 60 mm for yellow squat lobster, and 60 mm for red squat lobster). Characteristics of the new trawl gear were established by law and use was to be mandatory starting December 31, 2013. Unfortunately, difficulties in obtaining construction materials delayed compulsory use (SUBPESCA Nº017/2013, R Ex 762 2013, R Ex 145 2015). The fishery started gradually using the new gear in 2013 and the fleet fully transitioned to the modified trawl when the 762 resolution actually took effect in November 2014. Preliminary data from the 2015 fishery were available for assessment of performance of the new gear.

Vessels operating in demersal crustacean fisheries in the last decade declined from 35 to 26, among those 9 to 6 vessels were artisanal. Industrial vessels operate in the whole latitudinal extent of the fishery units and artisanal vessels in Regions III and IV. Operations are conducted between 106 and 710m. Industrial and artisanal vessels in the fisheries are similar, use the same gear and operate in similar areas. Catch composition from these fishing operations is similar according to information provided by researchers from IFOP during site visit interviews. The main difference between industrial and artisanal fisheries is the administration regime, which imposes fewer requirements on artisanal fisheries. In this assessment, we assumed that there are no differences in catch composition between artisanal and industrial fisheries and used industrial catch to assess artisanal UoCs.

Main indicators provided by data collected by official sources (IFOP, FIP) that relate to P2 are: target and non-target species catch composition in weight, species frequency of occurrence, fishery spatial characterization, interaction with mammals, birds and ETP species, and information on vulnerable ecosystems. Available annual reports of IFOP assessments to characterize fisheries are from industrial catch using the old gear until 2011, a combination from traditional and modified trawl for 2012 to 2014, and from the modified gear for 2015. There are also reports from FIP projects from fishing operations conducted with the modified trawl. In this assessment, relevant information was considered from IFOP and FIP reports.

3.4.2 Retained Species

3.4.2.1 Introduction

Component 2.1 evaluates status, management and information on retained species (i.e. species caught in the fisheries covered under the UoC for a specific assessment). As such this report covers separate assessments for the nylon shrimp, yellow squat lobster and red squat lobster UoCs.

At SG80, main retained species are taken into account while at SG100 all species are considered. Main species are those that: (i) constitute over 5% of the total catch in a specific fishing activity (e.g. the total catch when the bottom trawl is targeting nylon shrimp); (ii) are of high commercial value; or (iii) are vulnerable.

MSC defines retained species (Component 2.1) as that part of the non-targeted catch that is retained by the fishing vessel rather than being discarded (which is termed bycatch) (Component 2.2). MSC requires that the target fishery does not pose a risk of serious or irreversible harm to retained non-target species and does not hinder recovery of the stocks of those species when they are depleted. Proportions of non-targeted catch have implications in this assessment on retained catch (2.1), discarded bycatch (2.2), and the ecosystem (2.5).

3.4.2.2 Retained Species Background

Industrial Sector

Information on retained species in the nylon shrimp, and yellow and red squat lobster fisheries can be inferred from reports on catch composition. Reports do not separate retained catch from bycatch (i.e. discards). There is a study underway to evaluate discards but results will be available after this report is completed. Most studies of catch composition in the demersal crustacean fisheries are based on data available from annual monitoring of the fisheries conducted by IFOP and from FIP special projects. There are also studies of catch composition from direct stock evaluations that provide complementary information. In this section, background information is provided on catch composition that applies to both retained and bycatch species.

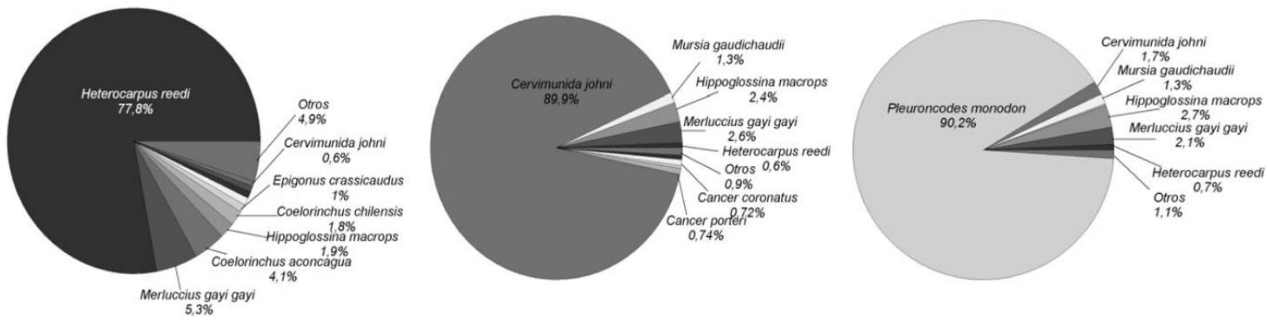
Catch composition of the 1994 to 2004 demersal crustacean fisheries combined analyzed by Acuña et al (2005) identified 149 taxa and two species associations: i) shallow water at 50 - 199 m dominated by yellow squat lobster, red squat lobster, Chilean hake (*Merluccius gayi*), and bigeye flounder (*Hippoglossina macrops*), and ii) deep water between 200 - 499 m characterized by dominance of nylon shrimp, yellow squat lobster, Chilean hake and bigeye flounder. Among these dominant species, Chilean hake is a species of commercial value and retained in the demersal crustacean fisheries while bigeye flounder is discarded. There were several chondrichthyes in the catch among those bigeye chimaera (*Hydrolagus macrophthalmus)* and most prevalent hooktooth dogfish (*Aculeola nigra),* combtooth dogfish (*Centroscylium nigrum),* dusky catshark (*Bythalaelurus canescens or Halaelurus canescens)* and raspthorn sand skate (*Psammobatis scobina).*

Pequeño (1971) reported 11 grenadier species in the yellow squat lobster fishery and described a new species, Aconcagua grenadier (*Coelorinchus aconcagua)* for Chilean waters. Acuña et al (2008) reported eight species of grenadiers in fisheries targeting demersal squat lobsters and nylon shrimp: *C. aconcagua*, *C. chilensis*, *C. fasciatus*, *Coryphaenoides delsolari*, *Lucigadus nigromaculatus*, *Nezumia pulchella*, *Trachyrincus helolepis,* and *Trachyrincus villegai*. Eighteen grenadier species are listed in the most recent IFOP report for crustacean fisheries in northern and central units (21º34–38º29S) and between 70– 617 m depth (Zilleruelo et al 2016). Grenadiers have no commercial value and are discarded.

Buschmann & Astudillo (2004) indicated high proportions of non-target catch in 2004 crustacean fisheries: 81% when targeting nylon shrimp which included 113 taxa, 68.8 % when targeting yellow squat lobster with 84 taxa, and 45.7% when targeting red squat lobster with 80 taxa. These estimates are higher than in other reports. There was no information given on retained and dominant species, data sources and how estimates were generated.

A study by Párraga et al (2012) to define target species or métiers in the demersal crustacean fisheries using IFOP catch composition data from 2007-2009, identified métiers closely aligned with fisheries composition with targets defined by captains. In the **nylon shrimp** métier, target contribution to the catch was 77.8%, Chilean hake 5.3%, Aconcagua grenadier 4.1%, Chilean grenadier (*C. chilensis*) 1.8%, bigeye flounder 1.9%, and cardinal fish (*Epigonus crassicaudus*) 1% (Figure 72). In the **yellow squat lobster** métier, target constituted 89.9% of the catch, Chilean hake 2.6%, bigeye flounder 2.4%, and box armed crab (*Mursia gaudichaudii*) 1.3%. In the **red squat lobster** métier, target constituted 90.2% of the catch, bigeye flounder 2.7 %, Chilean hake 2.1%, yellow squat lobster 1.7% and box armed crab 1.3%. Among these species nylon shrimp, yellow and red squat lobster, Chilean hake and cardinal fish are retained and others discarded.

Figure 72. Composition in Demersal Crustacean Catch 2007-2009 (nylon shrimp, left; yellow squat lobster, middle; red squat lobster, right).



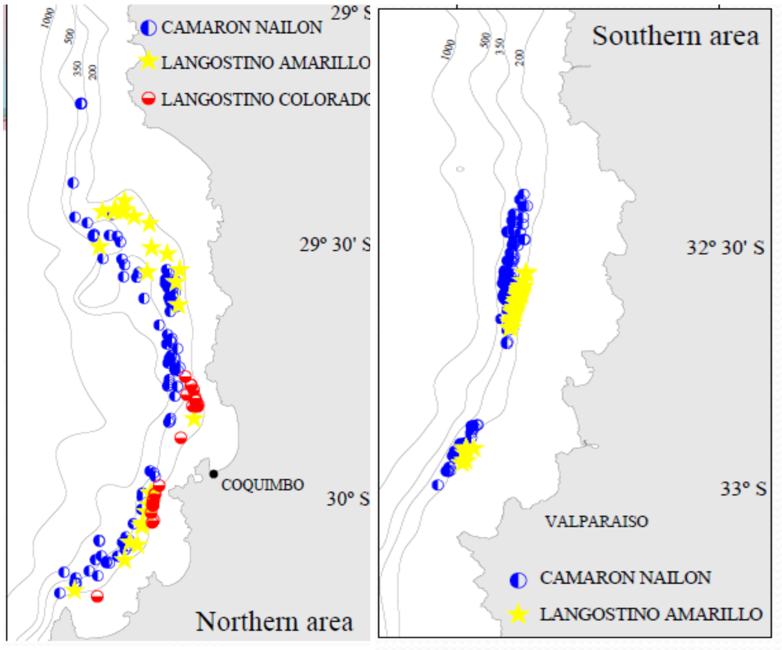
Source Párraga et al 2012.

Catch composition from direct nylon shrimp stock assessments conducted between 2005 and 2009 reported by Arana et al (2013) provides information about demersal communities. Contribution of species other than nylon shrimp to the catch among years ranged from 35.9% to 57.1%. Most significant species included yellow squat lobster 11%, red squat lobster 3.4%, Chilean hake 9.1%, grenadier (*C. fasciatus*) 3.5%, and bigeye flounder 3.2%. Chilean hake is a significant part of the catch when targeting nylon shrimp.

Catch composition of 2007 to 2009 crustacean fisheries using a modified trawl gear rather than the traditional trawl is reported by Queirolo et al (2011). The FIP funded project was to design an improved gear and based on data from 289 hauls made in two traditional fishing areas (Figure 73). Gear consisted of a net with two panels of 28.8 m headrope and 32 m footrope with sweeps and bridles of 1 and 5 m. Nets were of knotted polyethylene (PE); 80 mm mesh size on the upper panel (72 mm inner mesh size), 54 mm in the lower panel (47 mm inner mesh size) and 56 mm at the cod end (47 mm inner mesh size). Six industrial vessels participated in the study, representing 30% of the total catch. Results were used as reference for assessing retained and bycatch species as information for the modified trawl is otherwise scarce.

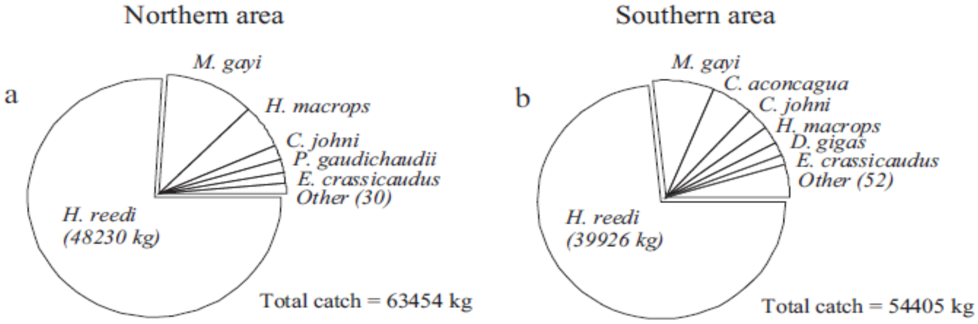
Catch composition of hauls targeting nylon shrimp in the northern area reported by Queirolo et al (2011) included 36 taxa. Nylon shrimp represented 76.1% of the catch (Figure 74). Retained species with highest representation were Chilean hake (11.5%), yellow squat lobster and cardinal fish (about 2%). Chilean hake was present in 100% of the hauls. Composition in the southern area included 59 taxa, almost double the number of taxa in the north. Nylon shrimp represented 73.4% of the total catch and retained species with highest representation were also Chilean hake (7.9%), yellow squat lobster and cardinal fish (about 2%). In hauls targeting yellow squat lobster, there were 24 taxa registered: 20 in the north (8 invertebrates, 7 teleostei, 4 elasmobranchs and 1 myxini) and 15 in the south (7 invertebrates, 6 teleostei and 2 elasmobranchs). Yellow squat lobster represented 85.3% of the total catch by weight in the north and 90.7% in the south (Figure 75). Catch rates varied by area and year. Most important species in the catch were Chilean hake (6.1% north and 5.4% south), and bigeye flounder (4.1% and 5.4%). Other species were nylon shrimp and red squat lobster.

Figure 73. Distribution of Fishing Hauls in the Demersal Crustacean Fisheries using the Experimental Modified Gear from 2007-2009.



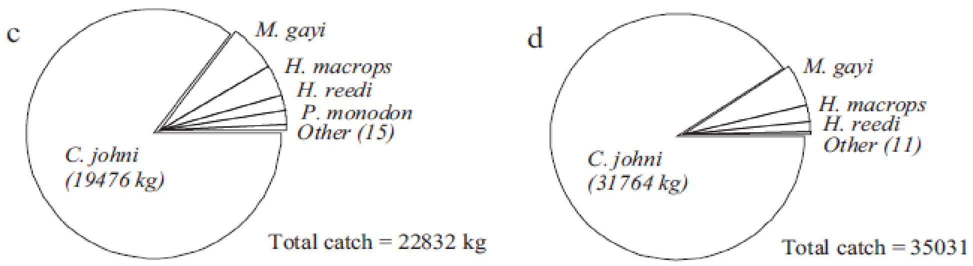
Source: Queirolo site visit presentation, Escuela Ciencias del Mar, Valparaiso.

Figure 74. 2007-2009 Catch Composition of the Nylon Shrimp Fishery Using Modified Trawl.



Source: Queirolo et al 2011.

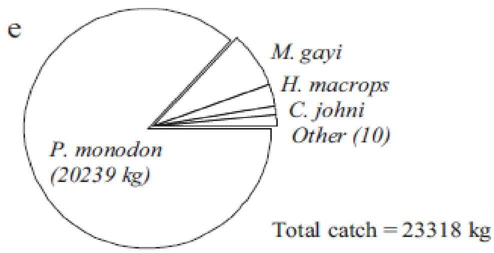
<u>**Figure 75. 2007-2009 Catch composition of the Yellow Squat Lobster Fishery Using Modified Trawl. (left) North Fishery (right) Unit South Unit Fishery.**</u>



Source: Queirolo et al 2011.

In hauls targeting red squat lobster in the northern area, there were 14 taxa recorded (10 invertebrates, 3 teleostei and 1 elasmobranch). The target species represented 86.8 % of the total catch, Chilean hake accounted for 7.6% and bigeye flounder for 2.9% (Figure 76). Yellow squat lobster was also taken. There were no significant differences between years. There was no information for the southern area as the fishery was closed.

Figure 76. 2007-2009 Catch Composition of the Red Squat Lobster North Fishery Unit Using Modified Trawl.



Source: Queirolo et al 2011

Queirolo et al (2011) reported numerous taxa of elasmobranchs in the 2007-2009 catch using a modified gear: five species when targeting nylon shrimp in the northern area (*Halaelurus canescens*, *Aculeola nigra, Centroselachus crepidater, Zearaja chilensis,* and *Torpedo tremens);* 12 taxa when targeting nylon shrimp in the south (*H. canescens*, *Centroscyllium nigrum, A. nigra*, *C. crepidater, Bathyraja sp*, *Psammobatis rudis, Dipturus trachyderma, Gurgesiella furvescens, Z. chilensis,* and *T. tremens* and two unidentified species of sharks and rays*;* two when targeting yellow squat lobster fishery in the southern area (*H. canescens* and *A. nigra)*, and one species when targeting red squat lobster in the north (*H. canescens*). This group is characterized by vulnerable life cycles, low growth rates, late maturity and low fertility rates (Cortés, 2000) and by higher probabilities of being affected by fishing than most teleostei (Stevens et al, 2000; Coelho & Erzini, 2008). Even though contribution of the group was low, presence of *C. crepidater* in 41% of the hauls is noteworthy. Fishing pressure can take elasmobranchs to risk levels or even to population collapse.

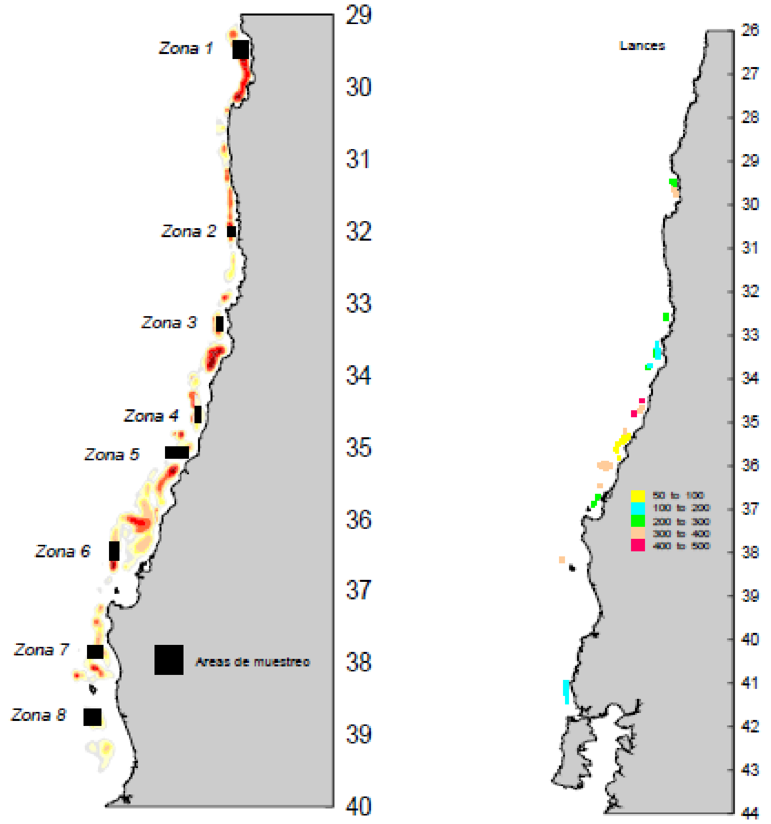
Melo et al (2007) reported on catch composition of nylon shrimp and Chilean hake fisheries as part of the FIP project FIP-2005-61 (Figure 77). The study reported 33 taxa (Table 14). Chilean hake and nylon shrimp were present in 71% and 61% of the hauls; Aconcagua grenadier was as frequently caught as nylon shrimp; several species of crabs were also prevalent and the dusky catshark (*H. canescens)*. Since grenadiers, crabs and sharks have no commercial value they are discarded. Seven other species of elasmobranchs were recorded in over 10% of the hauls.

Melo et al (2007) also identified characteristic species by depth strata in catches. Chilean hake was found over all the study area and its importance decreased with depth. Yellow squat lobster occurred only in the 100 to 300m strata, while nylon shrimp was found deeper to 500m (Table 15). Aconcagua grenadier was found from 200 to 500m. Given community composition, hake and grenadier and other species in Table 14 including chondrichthyes are prevalent when targeting demersal crustaceans.

In Melo et al (2007), chondrichthyes were caught in 75 out of 129 hauls. There were 24 species recorded caught in hauls conducted between 149-492 m (Table 16). The most abundant species was granulatum hooktooth (*Centroscyllum granulatum)* and at 350-450 m depth (Figure 78). In 42% of hauls, there was a shark species in the catch, in 50% a ray species and in 6% a chimaera. Species most frequently caught were dusky catshark, Peruvian skate (*Bathyraja peruana),* granulatum dogfish and hooktooth dogfish. While some species such as dusky catshark and Peruvian skate were found throughout the latitudinal extent of the FIP study, others had reduced distributions (Table 17).

There are no CITES listed species among chondrichthyes species described in demersal crustacean fisheries bycatch. Thus, in this report they are considered bycatch species.

Figure 77. Survey Sites FIP 2005-61 Project on Catch Composition



Source: Melo et al 2007.

Table 14. Species with Highest Frequency of Occurrence (FO) >10% in FIP-2005-61

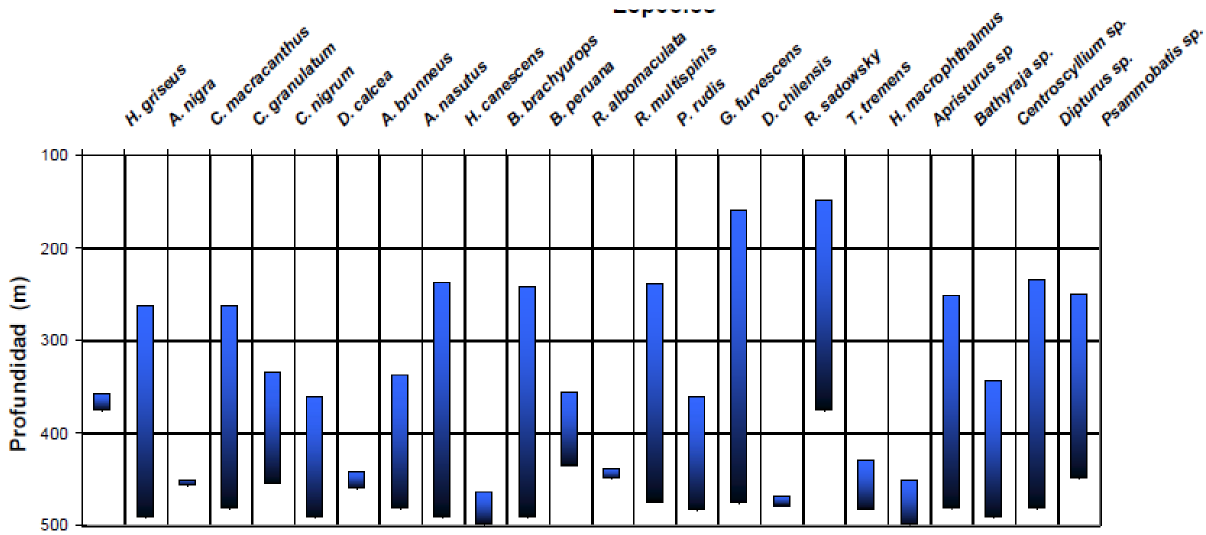
Especie	Nro. Lances	FO (%)
Merluccius gayi	91	71,09
Heterocarpus reedi	79	61,72
Caelorinchus aconcagua	78	60,94
Mursia gaudichaudii	54	42,19
Cervimunida johni	51	39,84
Libidoclaea granaria	51	39,84
Haliporoides diomedae	48	37,50
Halaelurus canescens	46	35,52
Moridae	43	33,59
Hippoglossina sp	37	28,91
Caelorinchus chilensis	36	28,13
Cancer porteri	33	25,78
Dipturus sp	33	25,78
Aeneatorloisae	32	25,00
**Bathyraja peruana*	30	23,44
Epigonus sp	29	22,66
Squilla armata	27	21,09
Actinia indet3	26	20,31
**Centroscyllium granulatum*	24	18,75
Benthoctophus sp	23	17,97
Porianiopsis echinaster	23	17,97
**Psammobatis rudis*	20	15,63
Aeneator fontainei	19	14,84
Notacanthus sexspinis	19	14,84
**Deania calea*	18	14,06
Actinia indet1	18	14,06
Pterygosquilla armata	17	13,28
**Aculeola nigra*	16	12,50
Eptatretus polytrema	16	12,50
**Centroscyllium nigrum*	15	11,72
Doraster qawashqari	15	11,72
Helicolenus lengerichi	15	11,72
Stereomastis sculpta	15	11,72

Table 15. Species Composition of Benthic-Demersal Community by Depth (% biomass >5%): 1=100-200m, 2=200-300m, 3=300-400m, 4=400-500m. FIP-2005-61

Estrato de profundidad	Ensamble de especies	Similaridad promedio
1	*Merluccius gayi* (24,15) *Mursia gaudichaudii* (18,35) *Cervimunida johni* (17,14)	58,18
2	*Merluccius gayi* (16,67) *Cervimunida johni* (12,00) *Heterocarpus reedi* (11,21) *Hippoglossina* sp. (7,99) *Caelorinchus aconcagua* (7,86)	53,21
3	*Heterocarpus reedi* (14,24) *Caelorinchus aconcagua* (12,62) *Merluccius gayi* (9,23) *Mursia gaudichaudii* (9,18) *Libidoclaea granaria* (5,77)	44,42
4	*Haliporoides diomedae* (9,53) *Halaelurus canescens* (7,33) *Heterocarpus reedi* (6,91) *Caelorinchus chilensis* (6,51) *Caelorinchus aconcagua* (6,14) *Merluccius gayi* (6,02) Moridae (5,19)	47,20

Source Melo et al 2007.

Figure 78. Bathymetric Distribution of Chondrichthyes FIP-2005 -61



Source: Melo et al 2007

Table 16. Chondrichthyes Relative Abundance, Frequency of Occurrence and Bathymetric Ranges FIP-2007-32

Orden	Familia / Especie	Abundancia n	Abundancia %	Frecuencia n	Frecuencia %	Rango batimetrico (m)
Hexanchiformes						
	Hexanchidae					
	Hexanchus griseus	5	0.2	2	3	358 - 376
Squaliformes						
	Dalatiidae					
	Aculeola nigra	112	3	16	21	262 - 492
	Centroscymnus macracanthus	1	0.03	1	1	455
	Centroscyllium granulatum	1146	36	24	32	262 - 482
	Centroscyllium nigrum	322	10	16	21	335 - 455
	Centroscyllium sp.	445	13.9	11	15	344 - 492
	Centrophoridae					
	Deania calcea	78	2	18	24	362 - 492
Carchariniformes						
	Scyliorhinidae					
	Apristurus brunneus	6	0.2	3	4	443 - 461
	Apristurus nasutus	101	3	11	15	338 - 482
	Apristurus sp	7	0.2	1	1	476
	Halaelurus canescens	420	13	46	61	237 - 492
	Squalidae					
	*Squalus acanthias**	1	0.03	1	1	*
Rajiformes						
	Arhynchobatidae					
	Bathyraja brachyurops	1	0.03	1	1	482
	Bathyraja peruana	61	2	30	40	243 - 492
	Bathyraja sp.	6	0.2	3	4	252 - 482
	Rhinoraja albomaculata	4	0.1	4	5	356 - 436
	Rhinoraja multispinis	1	0.03	1	1	445
	Psammobatis rudis	62	2	19	25	240 - 475
	Psammobatis sp.	19	0.6	6	8	250 - 450
	*Rhinoraja magellanica**	1	0.03	1	1	*
	Rajidae					
	Gurgesiella furvescens	22	1	7	9	362 - 484
	Dipturus chilensis	191	6	9	12	159 - 476
	Dipturus sp.	165	5.2	32	43	234 - 482
	Rajella sadowsky	3	0.1	1	1	475
	*Dipturus trachyderma**	1	0.03	1	1	*
Torpediniformes						
	Torpedinidae					
	Torpedo tremens	6	0.2	5	7	149 - 376
Myliobatiformes						
	Myliobatidae					
	*Myliobatis chilensis**	1	0.03	1	1	*
Chimaeriformes						
	Callorhinchidae					
	*Callorhinchus callorhynchus**	1	0.03	1	1	*
	Chimaeridae					
	Hydrolagus macrophthalmus	12	0.4	8	11	430 - 483

Source: Melo et al 2007

Table 17. Chondrichthyes Occurrence (% of hauls) in the Bottom Trawl Survey by Sampling Zones in Figure 6.

Species	Zone							
	1	2	3	4	5	6	7	8
H. griseus	—	—	—	—	100	—	—	—
A. nigra	7.2	27.6	20.1	43.2	0.8	1.2	—	—
C. macracanthus	—	—	100	—	—	—	—	—
C. granulatum	—	8.7	1.1	2.9	0.5	49.6	27.2	10
C. nigrum	—	4.6	11.8	6.5	37.7	28.2	10.9	0.1
D. calcea	1.4	10.5	11.5	7.3	5.9	5.9	32.8	25.2
A. brunneus	0.9	—	—	—	—	1.9	57.3	39.9
A. nasutus	—	—	—	35.2	—	64.8	—	—
B. canescens	4	9.1	10.3	13.9	10.4	30.3	14.7	7.2
B. albomaculata	—	—	—	—	—	—	72.6	27.4
B. brachyurops	—	—	—	—	—	—	—	100
B. multispinis	—	—	—	—	—	100	—	—
B. peruana	4.3	10.4	11.5	24.5	3.2	9.6	8.1	28.4
P. rudis	—	5.6	10.6	6.6	24.2	12.5	36.7	3.9
G. furvescens	68.4	31.6	—	—	—	—	—	—
Z. chilensis	—	—	0.6	—	—	1.4	97.5	0.5
D. trachyderma	—	94.5	—	10.4	9.5	26.1	12.6	36.9
R. sadowskii	—	—	100	—	—	—	—	—
T. tremens	—	—	—	18.7	—	—	35.6	17
H. macrophthalmus	6.9	17	7.7	14.8	45.6	—	8	—

Source: Bustamante et al 2014.

Estimates of 2005 to 2015 fisheries from IFOP reports were used in this assessment to evaluate retained and bycatch species. Numerous species (retained and discarded) are recorded in IFOP annual monitoring of demersal crustacean fisheries (Table 18). Information on catch composition by target species and fishery unit from IFOP monitoring is reported annually. Monitoring is conducted between regions III and VIII on industrial fishing operations (Figure 79). Estimates until 2011 are of fisheries using the old traditional trawl, for 2012-2014 using a mixture of traditional and modified trawl, and for 2015 using the new trawl.

Artisanal Sector

Data for the demersal crustacean fisheries are collected exclusively on board of industrial fishery operations. This assessment assumes similar catch composition of industrial and artisanal fisheries. Data collected in Regions III and IV were used to evaluate P2 retained species in artisanal fisheries in Region IV.

Table 18. Species in the Demersal Crustacean Catch Recorded by IFOP Annual Monitoring, Common and Scientific names.

Especies objetivo del proyecto	
Nombre Común	**Nombre Científico**
Camarón nailon	*Heterocarpus reedi*
Gamba	*Haliporoides diomedeae*
Langostino amarillo	*Cervimunida johni*
Langostino colorado	*Pleuroncodes monodon*

Crustaceos	
Nombre Común	**Nombre Científico**
Jaiba araña	*Libidoclaea granaria*
Jaiba mora	*Homolaspis plana*
Langosta enana	*Projasus bahamondei*
Camarón acorazado	*Glyphocrangon alata*
Camarón navaja	*Campylonotus semistriatus*
Homolodromia	*Homolodromia robertsi*
Stereomastis	*Stereomastis shumi*
Paracrangon	*Paracrangon areolata*
Nephropsis	*Nephropsis Occidentalis*
Camarón vidrio	*Pasiphaea acutifrons*
Centolla (juvenil)	*Lithodes turkayi*
Munidopsis	*Munidopsis sp*
Langostino de patas largas	*Uroptychus milneedwarsi*
paguro de profundidad	*pagurus imarpe*
Jaiba reina	*Cancer coronatus*
Jaiba paco	*Mursia gaudichaudii*
Jaiba marmola	*Cancer edwardsi*
Jaiba limón	*Cancer porteri*
Jaiba mochilera	*Lophorochinia parabranchia*
Jaiba no identificada	
Zapateador	*Pterygosquilla armata*
Langostino de profundidad	*Munidopsis barrerai*
Crustaceos sin identificar	

Moluscos	
Nombre Común	**Nombre Científico**
Jibia	*Dosidicus gigas*
Pulpo	*Robsonella fontaniana*
Bathybembix	*Bathybembix humboldti*
Bathybembix	*Bathybembix macdonaldi*
Braquiopodo	*Aerothyris venosa*
Pulpo de brazos largos	*Benthoctopus longibrachus*
Opisthoteuthis	*Opisthoteuthis sp*
Caracol palo-palo	*Argobuccinum pustulosum ranelliforme*
Caracol de profundidad	*Aeneator loisae*

Equinodermos	
Nombre Común	**Nombre Científico**
Estrella de mar	*Asteroidea* spp.
Estrella de profundidad	*Hippasteria hyadesi*
Estrella flaca	*Doraster qawashqari*
Erizo de profundidad	*Sterechinus agassizii*
Erizo boina	*Hygrosoma hoplacantha*

Especies de Pejerrata	
Nombre Común	**Nombre Científico**
Granadero chileno	*Coelorinchus chilensis*
Granadero de ojos grandes	*Macrourus holotrachys*
Granadero aconcagua	*Coelorinchus aconcagua*
Cola de látigo	*Coelorinchus fasciatus*
Cola de látigo notable	*Coelorinchus innotabilis*
Granadero de humboldt	*Coryphaenoides ariommus*
Granadero abisal	*Coryphaenoides armatus*
Granadero escamoso	*Macrourus carinatus*
Granadero atacama	*Nezumia pudens*
Granadero loro	*Nezumia loricata*
Granadero california	*Nezumia stegidolepis*
Granadero negro manchado	*Ventrifossa nigromaculata*
Granadero cabeza de armadura	*Trachyrincus helolepis*
Granadero gris	*Trachyrincus villegai*

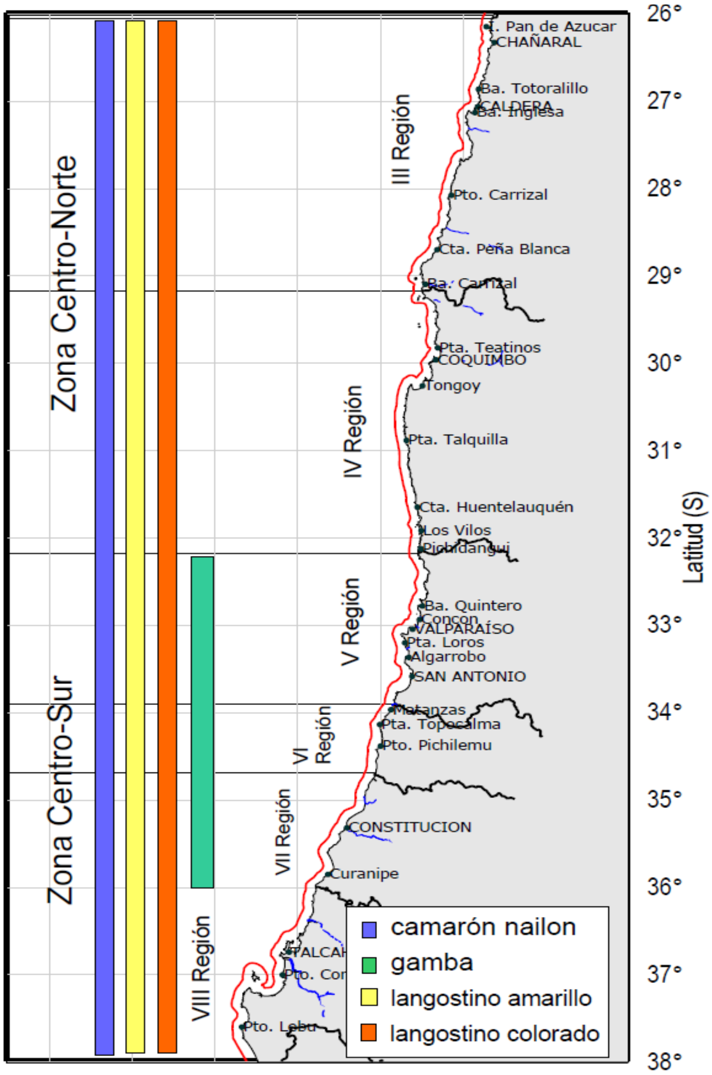
continua… Especies de Pejerrata	
Nombre Común	**Nombre Científico**
Granadero pulgar	*Nezumia pulchella*
Granadero pichirata	*Coryphaenoides delsolari*
Granadero peruviano	*Nezumia convergens*
Granadero sin identificar	

Peces	
Nombre Común	**Nombre Científico**
Merluza comun	*Merluccius gayi gayi*
Merluza de cola	*Macruronus magellanicus*
Congrio dorado	*Genypterus blacodes*
Raya pequén	*Psammobatis* sp.
Pejegallo	*Callorhinchus callorhynchus*
Pintarroja común	*Schroederichthys chilensis*
Tollo fino, tollo común	*Mustelus mento*
Tollo de cachos	*Squalus acanthias*
Alfonsino	*Beryx splendens*
Bacalao	*Dissostichus eleginoides*
Lenguado ojo chico	*Paralichtys microps*
Raya volantin	*Zearaja chilensis*
Blanquillo	*Prolatilus jugularis*
Besugo	*Epigonus crassicaudus*
Tollo lucero	*Etmopterus granulosus*
Pejegato hocicón	*Apristurus nasutus*
Lenguado ojo grande	*Hippoglossina macrops*
Sapata negra,Tiburón narigon	*Centroselachus crepidater*
Torpedo, raya eléctrica	*Torpedo tremens*
Raya Volantin	*Dipturus chilensis*
Tiburon gris, peje humo, tiburón vaca	*Hexanchus griseus*
Raya Volantin Espinuda	*Dipturus trachyderma*
Congrio colorado	*Genypterus chilensis*
Congrio negro	*Genypterus maculatus*
Cabrilla	*Paralabrax humeralis*
Bagre	*Aphos porosus*
Tollo negro peine, tollo de cachos	*Centroscyllium nigrum*
Pejegato café	*Apristurus brunneus*
Congrio de profundidad	*Bassanago nielseni*
Talismán de ojos grandes	*Bajacalifornia megalops*
Anguila espinosa, espinudo, pichón	*Notacanthus sexspinis*
Dragón barbudo, chemo	*Aristostomias lunifer*
Dragón Negro, Colmillo	*Idiacanthus* sp
Willy	*Melanostigma gelatinosum*
Anguila babosa	*Eptatretus polytrema*
Anguila morena	*Ophichthus* sp.
Xenomystax	*Xenomystax atrarius*
Guttigadus	*Guttigadus kongi*
Tollo pajarito	*Deania calcea*
Gata café, tollo gato	*Bythaelurus canescens*
Psychrolutes	*Psychrolutes sio*
Quimera de ojos grandes	*Hydrolagus macrophthalmus*
Raya electrica, Raya tembladera	*Discopyge tschudii*
Antimora	*Antimora rostrata*
Raya Aguila	*Myliobatis chilensis*
Orange roughy	*Hoplostethus atlanticus*
Pez Guadaña	*Hoplostethus mento*
Pintarroja del sur	*Schroederichthys bivius*
Raya aserrada	*Bathyraja multispinis*
Pequen de hocico blanco	*Psammobatis rudis*
Pequen espinoso	*Psammobatis scobina*
Raya costera	*Sympterygia lima*
Raya de manchas blancas	*Bathyraja albomaculata*
Raya gris	*Bathyraja griseocauda*
Raya Mariposa	*Gurgesiella furvescens*
Raya negra	*Ragella nigerima*
Raya peruana	*Bathyraja peruana*
Tollo negro	*Aculeola nigra*
Raya morada	*Ragella sadowski*
Raya (sympterigia)	*Sympterigia sp.*
Raya (bathyraja)	*Bathyraja sp.*
Tollo negro raspa	*Centroscyllium granulatum*
Barbanegra	*Alepocephalus sp*
Caballo de Mar	*Hippocampus* sp.

Otros	
Nombre Común	**Nombre Científico**
Esponja	*Spongia* spp.
Actinia	*Actinia* sp.
Actina de profundidad	*Hormathia pectinata*
Araña de mar	*Colossendeis* sp

Source: Zilleruelo 2016

Figure 79. IFOP Monitoring Areas of Chilean Demersal Crustacean Fisheries. Zona Centro-Norte=North, Zona Centro-Sur=South, camarón nailon= nylon shrimp, langostino amarillo= yellow squat lobster, langostino colorado= red squat lobster.



Source: Zilleruelo et al 2012

3.4.2.3 Retained Species Outcome

To assess retained species, information was considered on the modified trawl reported by Queirolo et al (2011) and estimates from data collected by IFOP observers available from annual reports. IFOP estimates are generated from records of individual weights by species on a subset of tows by fishing trip and species frequencies recorded on all tows. Available information poses limitations to evaluate P2 retained species: i) data are for composition of the catch and do not differentiate between retained and discarded catch, ii) data are recorded on board industrial fishery operations and data for artisanal catch are missing, iii) except for 2015 data are of the fishery using the old trawl and a combination of the old and new trawl.

It is assumed that species identified as species of commercial value are retained and other species of non-commercial value are discarded (Zilleruelo et al 2006). Species of commercial value are nylon shrimp, yellow squat lobster, red squat lobster, Chilean hake, and cardinal fish. These species are also discarded before and after the catch is taken on board but mostly after IFOP observers have evaluated catch composition. Some information on discards is available from 2005 IFOP monitoring (Zilleruelo et al 2006).

Nylon Shrimp

Overall

Outcome status of retained catch is evaluated with data collected in the industrial nylon shrimp fishery unit including Regions III to VIII for the industrial fishery and with data collected mostly in Region IV for the artisanal fishery. Based on data collected by IFOP since 2005 of the fishery targeting nylon shrimp (Zilleruelo et al 2006 to 2015, Queirolo et al 2011) there were two main retained species in each nylon shrimp Unit of Certification (Table 19). Based on data collected from the industrial fishery targeting nylon shrimp in Regions III to VIII there were two main retained species in the industrial fishery. There were two main retained species in the artisanal fishery based on data collected of the industrial fishery since 2010 in Regions III and IV.

Table 19. Nylon Shrimp Trawl Fishery: Summary of Main Retained Species

Industrial	Artisanal
Chilean hake Cardinal fish	Chilean hake Cardinal fish

Nylon Shrimp Industrial Fishery

Catch composition of the nylon shrimp fishery recorded by IFOP indicates that contribution of retained catch was highest in 2005 representing about 20% of the catch; species that contributed over 0.5% were Chilean hake, cardinal fish, and red and yellow squat lobster (Table 20). Chilean hake was the only species that reached > 5% and it was present in over 70% of the hauls across years. Queirolo et al (2011) reported similar retained species in the catch composition: Chilean hake 11.5% of the catch in the north and 7.9% in the south, and yellow squat lobster and cardinal fish about 2% in both areas (Figure 74).

Table 20. Retained Catch Composition (% weight) in Industrial Nylon Shrimp Fishery. Estimates ≥0.7% total. Catch includes bycatch in Table 32.

	2005 N+S	2006 N+S	2007 N+S	2008 N+S	2009 N+S
Nylon shrimp	62	75	75.6	81.5	81.6
Hake	14	8	6.2	3.2	3.5
Cardinal fish			0.7		1
Red &Yellow squat lobster	6	2	1.5		
Landings (t)	**3739**	**4213**	**4341**	**4443**	**4534**

	2010		2011		2012		2013		2014		2015	
	N	S	N	S	N	S	N	S	N	S	N	S
Nylon shrimp	78.9	80.1	72.2	77.0	76.7	72.6	78.3	73.6	79.3	76.0	76.7	77.2
Hake	5.2	3.7	5.4	4.5	5.8	4.1	3.7	6	6.4	7.3	9.6	6.2
Cardinal fish	1	0.7			1.2							

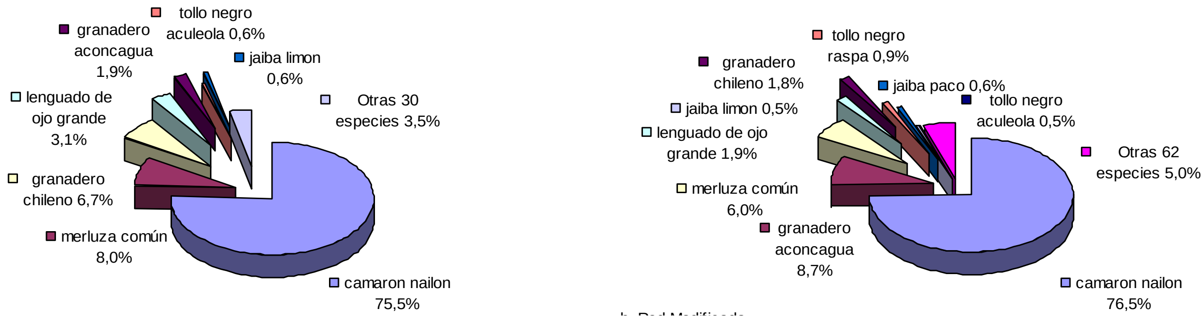
	2010		2011		2012		2013		2014		2015	
	N	S	N	S	N	S	N	S	N	S	N	S
Red squat lobster						3.7						
Yellow squat lobster	3.1	1.3	1					1.1				
Landings (t)	**1759**	**3036**	**1312**	**3141**	**1137**	**2603**	**1069**	**2896**	**821**	**3049**	**602**	**2371**

Sources: Zilleruelo et al 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

*2015 data are preliminary; landings are for January to July (54% of the quota).

IFOP estimates comparing gear performance show decreased Chilean hake contribution in the catch with the modified gear compared to the old of 6% vs. 8% (Figure 80). Nevertheless, estimates by year and area are higher since the new gear is in use (Table 20).

Figure 80. Nylon Shrimp 2013-2015 Fishery: Catch Composition left-old, right-new trawl.



Source: Zilleruelo et al 2016.

*2015 data are preliminary

Chilean hake was the only species of commercial value with >5% contribution to the total catch in the nylon shrimp fishery and is considered a P2 main retained. Cardinal fish catch in the fishery is generally <1% of the catch. There is a 10 t quota as non-target catch in the demersal crustacean fisheries as a whole and based on catch composition information in IFOP reports the 10 t has been exceeded. Cardinal fish constitutes a collapsed stock, the fishery is closed; since the species is vulnerable it is also considered a main retained species.

Nylon Shrimp Artisanal Fishery

Estimates of catch composition of the industrial fishery in the northern area reported by IFOP show that retained species that contributed >0.5% of the catch were Chilean hake, cardinal fish, red and yellow squat lobster (Table 15). Chilean hake in the northern area constituted >5% of the total catch and is considered a P2 main retained species in the artisanal fishery. Cardinal fish catch in the fishery is generally <1%. Queirolo et al (2011) reported that Chilean hake constituted 11.5% of the catch in the northern area and yellow squat lobster and cardinal fish about 2% (Figure 80). Cardinal fish is a collapsed stock, the fishery is closed, and the species is considered vulnerable and so is also considered a main retained species. There is a 2 t quota as non-target catch in the artisanal demersal crustacean fisheries as a whole and based on information in IFOP reports on catch composition, the 2 t would have been exceeded.

Yellow Squat Lobster

Overall

Outcome status of retained species was evaluated with data collected from the industrial fishery in Regions III-IV for the North Fishery Unit and Regions V-VIII for the South Fishery Unit. To evaluate the artisanal fishery, data collected in Regions III-IV were used.

Based on estimates from catch composition data collected by IFOP of the fishery targeting yellow squat lobster and those reported by Queirolo et al (2011) there were two main retained species in the industrial UoC (Table 21). Based on data collected from the fishery targeting yellow squat lobster 2005-2007 and 2010-2015 in Regions III-IV there was one main retained species in the fishery in the North Unit and from data collected 2010-2015 in Regions V-VIII there were two retained species in the South Unit. Based on data collected from 2005-2007 and 2010-2015 of the industrial fishery targeting yellow squat lobster in Regions III-IV there was one main retained species in the artisanal fishery.

Table 21. Yellow Squat Lobster Trawl Fishery: Summary of Main Retained Species

Industrial		**Artisanal**
North Fishery Unit	**South Fishery Unit**	**Region IV**
Chilean hake	Chilean hake Red squat lobster	Chilean hake

Yellow Squat Lobster North Fishery Unit

IFOP reports of catch composition of the yellow squat lobster North Fishery Unit indicate that retained catch was about 16% to 1% of the total (Table 22). Three retained species contributed >0.5 %: red squat lobster, Chilean hake and nylon shrimp. Occasionally red squat lobster and nylon shrimp reached >5% of the catch due to the multi-specific nature of the demersal crustacean fishery. Chilean hake generally constituted around 2% of the catch and was present in over 90% of the hauls. Preliminary catch composition estimates for the 2015 fishery are similar to those in previous years. Queirolo et al (2011) reported that Chilean hake constituted 6.1 % of the catch and nylon shrimp and red squat lobster about 2% (Figure 75).

Table 22. Retained Catch (% weight) in Industrial Yellow Squat Lobster North Fishery Unit. IFOP reports estimates≥ 0.5% of total catch. Catch includes bycatch in Table 39.

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Regions	II-IV	III-IV	III-IV	II-IV V-VI	III-IV V-VI	III IV	IV	III IV	IV	III IV	IV
Yellow squat lobster	82	86	93.5	91.3	93	93.2	90.2	90.7	77.7	81.6	90.5
Red squat lobster	1.5	2					1.3	3.5	9.5		4.3
Chilean hake	7	4	2.5	1.9	2.0	1.0	2.4	2.2	1.2	3.9	1.8
Nylon shrimp	2	0.8							5.7	2.6	0.8

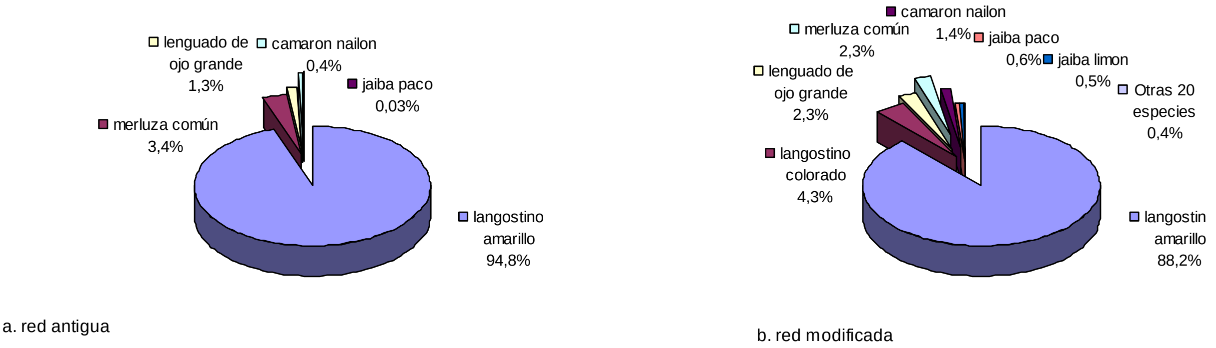
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Landings (t)	2715	2735	2815	2867	2774	2712	2511	2380	1864	1669	1757
				2600	2483						

Sources: Zilleruelo 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

*2015 estimates are preliminary, catch March-August;

IFOP gear performance comparison between the old and the new gear in 2013-2015 fisheries show that Chilean hake fraction of the catch decreased from 3.4% to 2.3% (Figure 81). Nylon shrimp and red squat lobster constituted higher shares of the new gear catch.

Figure 81. Catch Composition 2013-2015 Yellow Squat Lobster Fishery Northern Unit (left) old trawl (right) new trawl.



Source: Zilleruelo et al 2016.

Chilean hake was the only species of commercial value with >5% contribution to the total catch in the nylon shrimp fishery and is considered P2 main retained. Cardinal fish take in the fishery is very low and was not considered a main retained species.

Yellow Squat Lobster South Fishery Unit

IFOP reports on catch composition in the South Unit fishery indicate that retained species catch fluctuated between 4% and 19% (Table 23). Three species made up >0.5% of the catch: red squat lobster up to 17.5%, Chilean hake 2%, and nylon shrimp 1.6%. Chilean hake was present in 90% of the hauls. Queirolo et al (2011) reported that Chilean hake constituted 5.4% of the catch and nylon shrimp 1% (Figure 75).

Table 23. Retained Catch Composition (% weight) in the Yellow Squat Lobster South Unit fishery (closed 2005-2007). Estimates are for species ≥ 0.5% of the total. Percentages do not add to 100% as catch includes bycatch in Table 42.

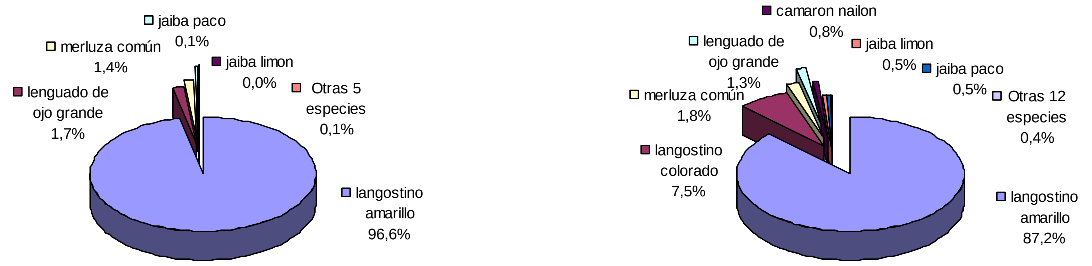
	2008	2009	2010	2011	2012	2013	2014	2015
Regions	II-IV V-VI	III-IV V-VI	V-VIII	V-VIII	V-VI	V VIII	V VIII	V VIII
Yellow squat lobster	91.3	93	91.4	78.1	79.2	95.5	92.9	85.9
Red squat lobster			2.2	14.1	17.5	1.6	2.4	9
Chilean hake	1.9	2.0	1.9	1.8	1.1	0.9	1.4	2.0

	2008	2009	2010	2011	2012	2013	2014	2015
Nylon shrimp				1.5			1.6	1.4
Landings (t)	2867	2774	2400	2230	1302	1093	1103	931
	2600	2483						

Source: Zilleruelo et al 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

IFOP estimates comparing gear performance in the 2013-2015 fisheries show increased contribution of retained species to the catch (Figure 82).

Figure 82. Catch Composition 2013-2015 Yellow Squat Lobster Fishery in southern area (left) old trawl (right) new trawl.



Source: Zilleruelo et al 2016.

Yellow Squat Lobster Artisanal Sector

Retained species in the artisanal yellow squat lobster fishery are assumed to be the same as in the North Unit industrial fishery. Species considered as main retained species is Chilean hake. Although Chilean hake catch is <5 %, it is considered vulnerable given high economic incentives and precarious stock status. Cardinal fish is also vulnerable but catch was minor.

Red Squat Lobster

Overall

Outcome status of retained species is evaluated with data collected from the industrial red squat lobster fishery operating mostly in Region IV for the North Fishery Unit and in Regions V to VIII for the South Unit. To evaluate the artisanal fishery, data from the North Fishery Unit were used.

Based on data collected by IFOP of the industrial fishery targeting red squat lobster and data reported by Queirolo et al (2011) there were two main retained species in the UoC (Table 24). Based on data collected from the fishery targeting red squat lobster in Regions III-IV (2005-2014) there were two main retained species in the industrial fishery North Unit and based on data collected in Regions V-VIII (2011-2015) there was one main retained species in the industrial fishery South Unit. Based on data collected from the industrial fishery targeting red squat lobster in Regions III-IV (2005-2014) there were two main retained species in the artisanal fishery.

Table 24. Red Squat Lobster Trawl Fishery: Summary of Main Retained Species

Industrial		**Artisanal**
North Fishery Unit	**South Fishery Unit**	**Regions III, IV**
Chilean hake Yellow squat lobster	Chilean hake	Chilean hake Yellow squat lobster

Red Squat Lobster Industrial North Fishery Unit

IFOP monitoring reports of industrial vessels 2005-2014 provide information on catch composition of the North Fishery Unit to evaluate P2 species. Retained species made up between about 2 and 45% of the catch (Table 25). IFOP was not able to monitor the fishery in 2015 as most of the quota was allocated to the artisanal sector. There were three retained species with contributions >0.5 % to the catch: yellow squat lobster up to 43.2%, nylon shrimp 6%, and Chilean hake 5.7%. Cardinal fish was among retained species but constituted a low % of the catch. Queirolo et al (2011) reported that Chilean hake constituted 7.6% of the catch and yellow squat lobster about 1% between 2007 and 2009 (Figure 76).

Table 25. Retained Catch Composition (% weight) in the Industrial Red Squat Lobster Fishery North Unit. Estimates for ≥0.5% of the total catch. Includes bycatch in Table 46.

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Red squat lobster	76	71.1	91.3	90.9	94.1	85.9	92.4	91.3	54.4	64.2	No data
Yellow squat lobster	18	18	2.3	1.3		4.5	1.4	2.8	43.2	27.2	
Chilean hake	2	6	1.7	2.0	2.2	5.7	4.0	3.7	1.1	1.5	
Nylon shrimp						0.6				6.0	
Landing (t)	993.4	842.9	1428	1115	684	805	987	1809	1319	585	

Sources: Zilleruelo 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

Species considered as main retained catch in the red squat North Fishery Unit are Chilean hake and yellow squat lobster. Although the proportion of Chilean hake in the catch was often <5%, the species is considered vulnerable given the economic incentive and the compromised status of the stock. Cardinal fish is considered a vulnerable species but catch was minor. Yellow squat lobster is a P1 species and assessed in the P1 species section.

Red Squat Lobster South Fishery Unit

IFOP reports provide information on composition of the catch in the South Unit 2011-2015 in Regions V to VIII to evaluate P2 species. Retained species constituted between about 5 and 10% of the catch. There were three species with shares >0.5%: yellow squat lobster, Chilean hake, and nylon shrimp (Table 26). None of the species reached 5% of the catch. IFOP estimates comparing gear performance in the 2013-2015 fisheries show Chilean hake 4.3% contribution in the modified gear catch vs. 8.3% in the old (Figure 83). Chilean hake was considered P2 main retained species. Although contribution of Chilean hake was <5% of the catch, it is considered vulnerable given economic incentives and compromised status of the stock. Cardinal fish is vulnerable species but catch was minor and was not considered main.

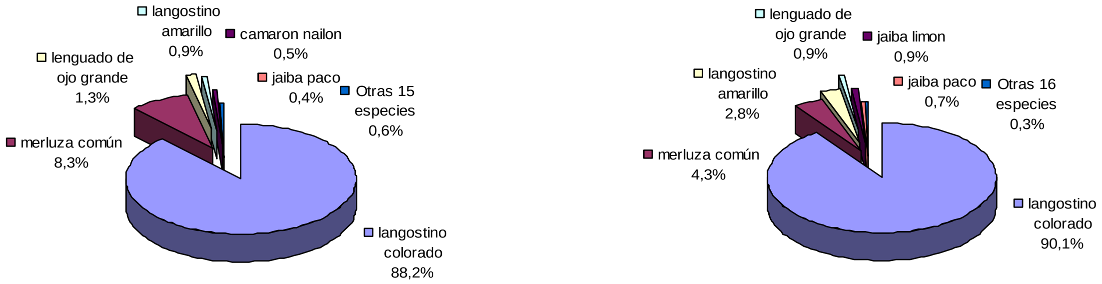
Table 26. Catch Composition (% weight) in the Red Squat Lobster South Unit Fishery. Estimates are for catch ≥0.5% of the total. Catch includes bycatch in Table 47.

	2011	2012	2013	2014	2015
Red squat lobster	94.0	93.7	88.4	91.1	89.5
Yellow squat lobster	0.8	2.7	3.2	2.4	2.5
Chilean Hake	2.7	1.2	4.1	3.8	4.4
Nylon shrimp				2.4	
Landing (t)	3477	4618	6813	6972	4541

Source: Zilleruelo et al 2012, 2013, 2014, 2015, 2016.

* 2015 preliminary data

Figure 83. Catch Composition Red Squat Lobster 2013-2015 Fishery South Unit (left) old, (right) new trawl.



Source: Zilleruelo et al 2016.

<u>Red Squat Lobster Artisanal Fishery</u>

Retained species in the artisanal red squat lobster fishery are as in the industrial fishery in the North Fishery Unit. P2 main retained species are Chilean hake and yellow squat lobster. Although the proportion of Chilean hake in the catch was often <5%, it is considered vulnerable given economic incentives and compromised stock status. Yellow squat lobster is a P1 species and assessed as P1.

Individual Retained Species

Chilean Hake (Merluccius gayi gayi)

Biology. Chilean hake is distributed from 23º 38'S to 47º 08'S (Palma et al 1998) and on the continental shelf to a depth of 500 m (Lillo et al 2005). Distribution is related to the subsurface counter flow of Chile and Peru (subsurface equatorial waters). Information on reproductive biology, spatial distribution of catches, parasitic fauna and mitochondrial DNA suggested at least two stocks: north and south of Talcahuano. For administrative purposes it is considered one stock.

The species undergoes diel migrations. During the day dense schools concentrate near the bottom and disperse at dusk and night hours (Lillo & Rojas 1999). Juveniles tend to be found closer to shore and older individuals most often in deeper waters. During spawning this pattern is modified, as adults approach the coast (Lillo & Rojas, 1999).

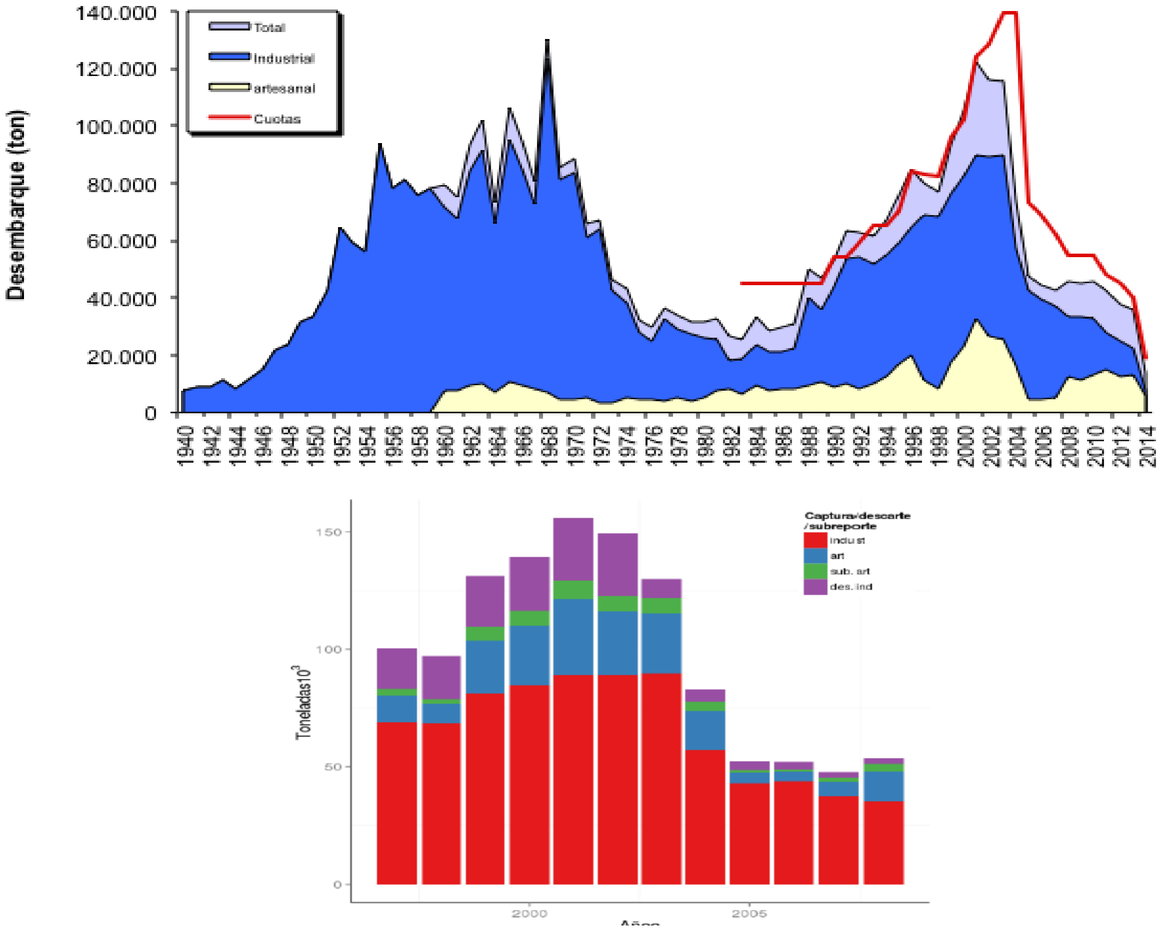
Chilean hake is a serial spawner (Herrera et al 1988) exhibiting a protracted spawning season. Ripe females, eggs, and larvae can be found year around (Bernal et al 1997), but reproductive activity is concentrated from July to November and from January to April (Balbontín & Fischer, 1981; Alarcón & Arancibia, 1993). Eggs and larvae are distributed in stratified waters in and under the thermocline (Braun et al 1999).

Maximum age registered in commercial catches is 11 years for males and 14 for females (Aguayo, 1995). Females grow faster and attain larger size than males. Individuals up to 80cm have been recorded. Asymptotic weight for males and females is 1.2 kg and 3.2 kg respectively (IFOP, 2008). Sexual maturity is attained at around 40 cm for females and 34 cm in males, or about age 3 (IFOP, 2008). Assuming that natural mortality is 0.33, generation time (maturity age + 1/M) is about six years.

Chilean hake consume a variety of crustacean and fish species and are cannibalistic. *Euphausiids,* squat lobsters and nylon shrimp are the most important prey. Anchovy (E*ngraulis ringens*) and sardine (*Strangomera bentincki)* are not as important as they were historically and *Myctophids* has become the main prey fish (Bustos et al 2006). Predators include squids and marine mammals. Jumbo squid has an extensive distributional range in the eastern Pacific and its latest expansion occurred in 2000. Since then, they maintained a presence which resulted in predation and removal of substantial fraction of the hake stock (Tascheri et al 2015). Beginning in 2006, squid biomass declined but hake abundance has not returned to levels observed previous to 2000 (SUBPESCA 2015).

Harvest**.** Chilean hake fishery consists of artisanal (longline and gillnet) and industrial (bottom trawling) sectors. Industrial landings are mainly for export. The fleet is concentrated in Region VIII from where vessels can harvest the south central region. A smaller trawler fleet operates in Region V. The fishery dates back to the 1930s, with catch of small boats mainly consumed in domestic markets. The fishery and stock status have undergone phases of growth and collapse (1946-1973) and recovery (1974-1989). Trends in landings highlight phases experienced in the fishery over the past 70 years (Figure 84). From 1946, landings began to increase as industrial vessels entered into operation and in 1955 exceeded 90,000 t. In the 1960s, landings fluctuated between 73,000 t to 130,000 t, which remains the historical high, influenced by tax incentives and investment in the fishing sector. From mid-1970s, government policy prioritized foreign investment and exports while there was open access to fishery resources resulting in over-investment in the sector and overharvesting. Fishing effort and catches increased, and then over following years landings declined and fluctuated between 25,000 t and 50,000 t. This situation led to restrictions, resource recovery, and later increase in landings peaking in 2002. The first quota was established and the artisanal sector increased its participation. Relatively low catches allowed population age structure and the stock to recover within 15 years. In the following years, several developments such as the General Law for Fisheries and Aquaculture and Maximum Catch Limits were set in place but given the improved stock status incentives and pressure towards the fishing authority the quotas increased by 3,500 t every year reaching 123,000 t in 2003. Starting in 2004 biomass and adult population experienced drastic reduction in part due to squid predation and unaccounted fishing mortality (Figure 84, 85). The stock was dominated by juveniles still abundant throughout the area of distribution but well below the size to contribute to successful reproduction. There has been a reduction of the fleet from around 40 vessels in 2009-2012 to 10 in 2014 with 2 vessels landing 80% of the catch.

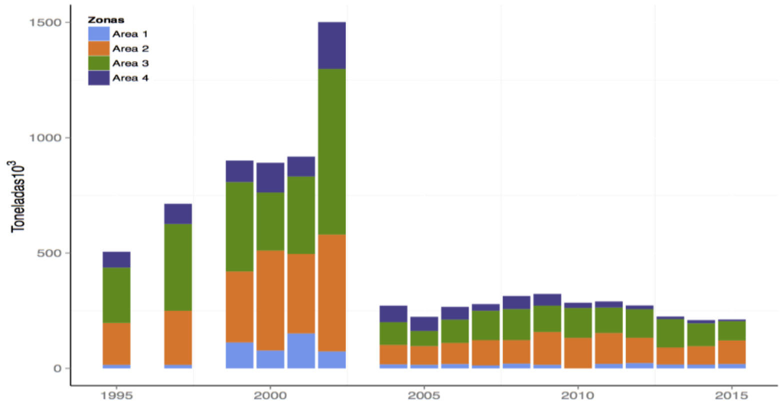
Figure 84. Hake Removals: Industrial and Artisanal Fisheries.



Source: SUBPESCA 2015, Arancibia et al 2010.

*red= industrial, blue=artisanal, Green= under reported artisanal, purple= discards industrial

Figure 85. Hake Biomass Estimates.



Source: Tascheri 2015.

Outcome Status The stock status is “exhausted or collapsed (agotado o colapsado)” and is managed under a full exploitation regime. Stock assessments are annually conducted by IFOP (Figure 86). According to the 2013 stock evaluation the hake resource has a 95% probability of being overexploited and with risk of collapse (SUBPESCA 2014).

Figure 86. Hake Total Biomass (2+) Spawning and Vulnerable Biomass 1968-2013 in Alternative Scenarios Considered in the Stock Assessment Analysis. Includes 95%CI

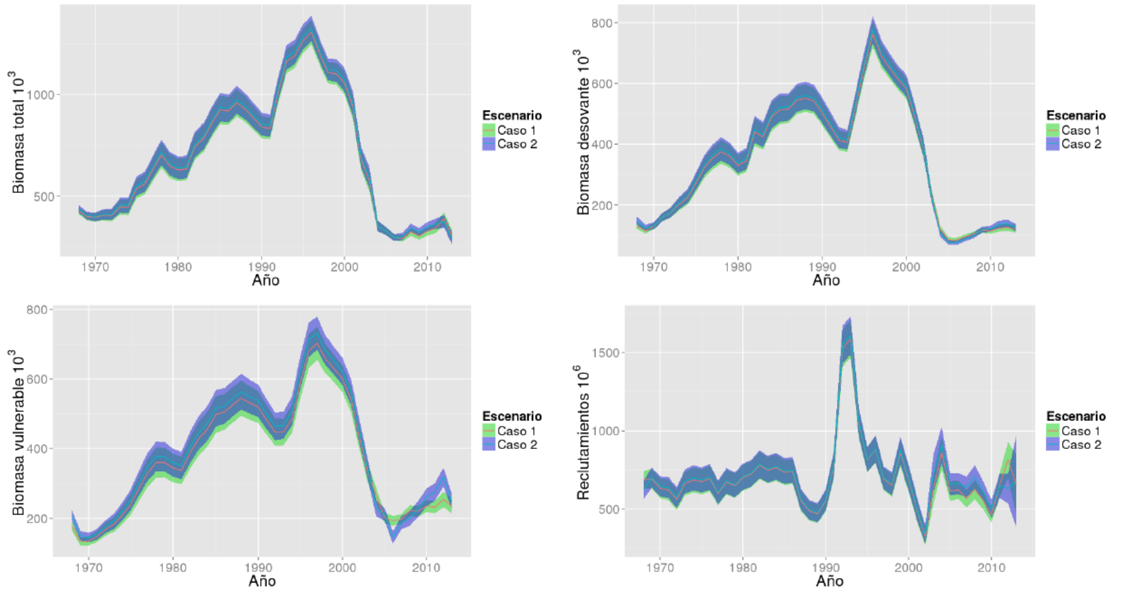


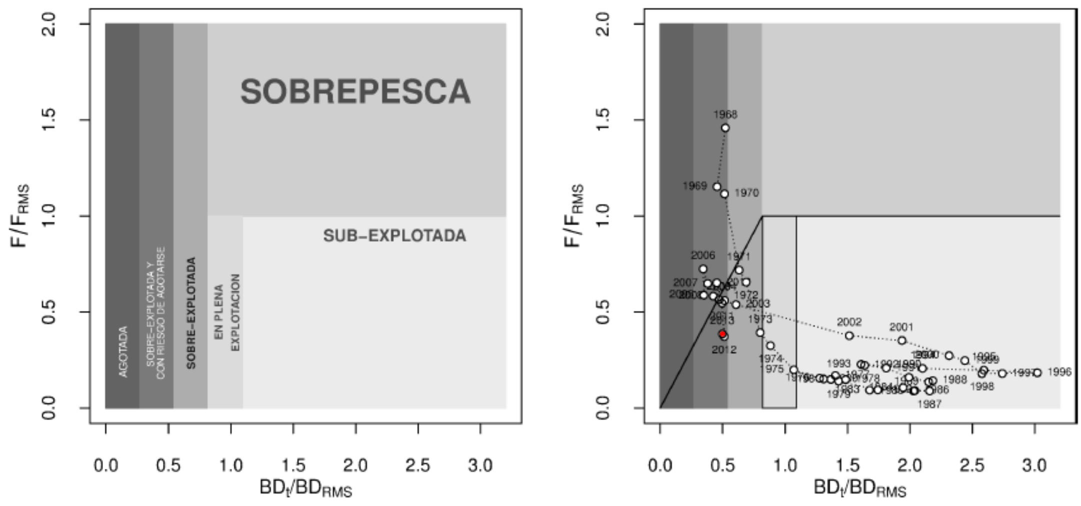
Figura 39. Evolución de la biomasa total (2+), desovante y vulnerable de merluza común entre los años 1968 y 2013 en los dos casos analizados. Se incluye la banda de confianza de 95% en ambos casos.

Source: Tascheri 2015.

Management**.** Minimum mesh size in the cod-end of 100 mm was implemented for all industrial trawl nets in 1983, and use of covered cod-end was prohibited. From 1985 it was prohibited to use hake for reduction into fish meal and oil. Between 1983 and 1989 an annual quota was fixed at 45,000 t and there was an increase in the artisanal sector share participation to 21% between 1974 and 1989. New regulatory instruments were included in the General Law on Fisheries and Aquaculture, and Law on Maximum Catch limits in 1991, and the industrial hake fishery unit was defined between Region IV and 41º 28.6'S and to the west boundary at 60 nm from the baseline. Under the law, the hake fishery was declared “fully exploited”, and fishery access was restricted. Since 1995 between Regions V and IX, the artisanal sector may only use longline and gillnet and the industrial sector longline and bottom trawl. In 1996, this regulation was extended to Regions IV and X. The artisanal fishery was covered by the Artisanal Fisheries Regime with specific quota allocations. In 1994, the global quota was divided between artisanal and industrial fleets at 35:65. From 2001, quantities were allocated for research and bycatch of hake in other fisheries while individual vessel quotas (IVQ) were introduced for the industrial fleet. In 2002 this approach was strengthened by allocating quota between regions and three periods (January - April, May -September 30th and October - November). For the artisanal sector there was a share division by region. In 2005, net characteristics were set. In 2006, a closed season was introduced to protect spawning; currently during September. Given stock status in 2012 a recovery plan was put in place for discussion with relevant stakeholders (SUBPESCA 2012). Currently the fishery is subjected to fully exploitation regime under Transferable Fishery Licenses valid for 20 years and global quotas established annually that can be distributed for two or more time periods. LGPA established a 60% industrial and 40% artisanal fishery share.

The 2014 quota was 19,000 t (D.Ex.Nº1410/2013); 40 t outside the fishery unit. The Scientific Committee (CCT) adopted recommendations: a) SB_{RMS} = 35% SBo; b) SBo limit = 10% Bdo; c) a soft limit was defined as 20% SBo, which defines a level of overharvesting with high risk of collapse; and d) FRMS as limit of overfishing (Figure 87). Range of full exploitation is established between 30% SBo and 40%SBo. Based on assessments carried out by IFOP and INPESCA in 2012, the CCT concurred the resource was overfished and at risk of depletion, with SB of 10% - 15% of SBo. Decline in stock condition was evident from biological indicators such as CPUE and size structure. Also direct monitoring showed decline in biomass of 17% compared to 2012 and low representation of older age classes.

Figure 87. Chilean Hake Reference Points 2013



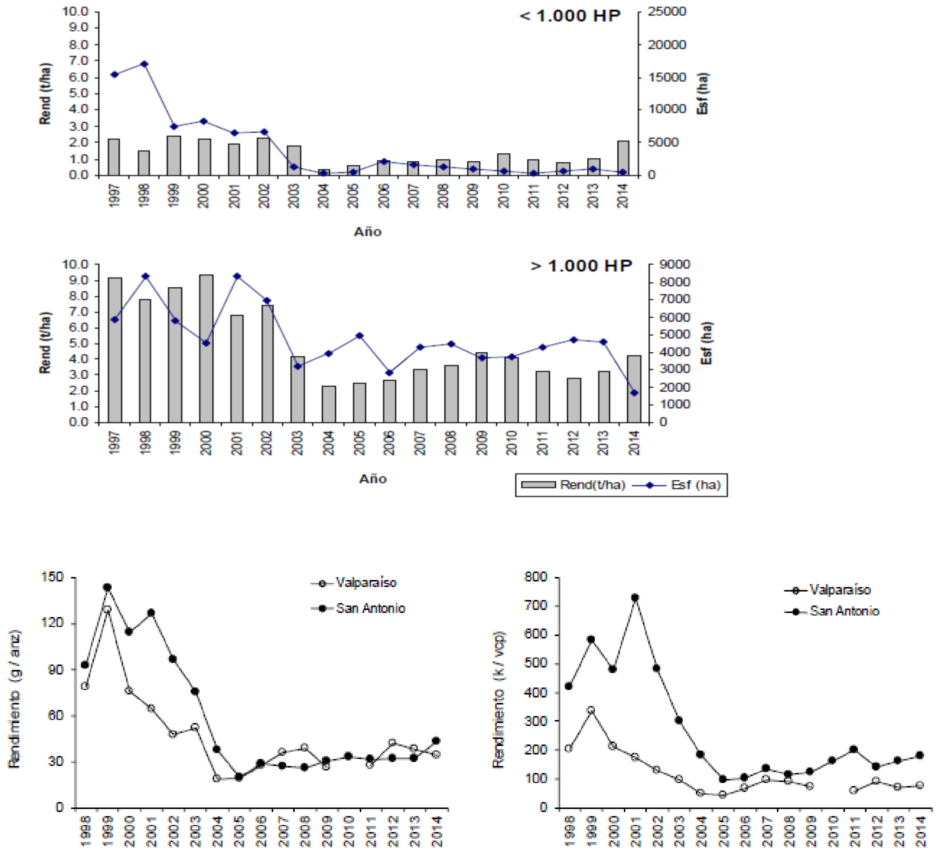
Source IFOP 2013

The quota for 2015 and 2016 was 23,000 t (MINECON D.EX. 1186/2015). The Management Plan for the fishery is in implementation process and considers applying fishing mortalities that will move the stock from current collapsed status ($B<B_{lim}$) in a period of five years. The CCT in consideration of 11 years the stock has been in collapsed status without signs of recovery, and in view of significant illegal fishing taking place, voted in favour of a strategy of applying 60% F_{RMS} and a Biological Acceptable Catch quota between 18,400 and 23,000 t for 2016 (SUBPESCA INFORME TECNICO R. PESQ. Nº 237/2015):

MERLUZA COMUN IV-41°28,6' L.S.	Toneladas
CUOTA GLOBAL	**23.000**
Reserva Investigación	200
Reserva Imprevisto	230
Cuota Remanente	22.570
FRACCION INDUSTRIAL	**13.542**
Enero-Julio	10.156,5
Agosto-Diciembre	3.385,5
FRACCION ARTESANAL	**9.028**
Fauna Acompañante	28
Cuota Objetivo	**9.000**

CPUE in recent years in the industrial and artisanal fisheries has shown a slight increase (Figure 88) suggesting some improvement. The CCT will re-evaluate the strategy; in 2016 the quota will be reduced if signs of improvement do not continue and biomass is increased even if that implies F<60% F_{RMS}. This is in view of uncertainty of the real stock response to 60% F_{RMS} considering significant levels of illegal and unreported catch (SUBPESCA INFORME R. PESQ.Nº 237/2015).

Figure 88. Hake CPUE and Effort in (top) Industrial Trawl and (bottom) Artisanal Fisheries (longline).



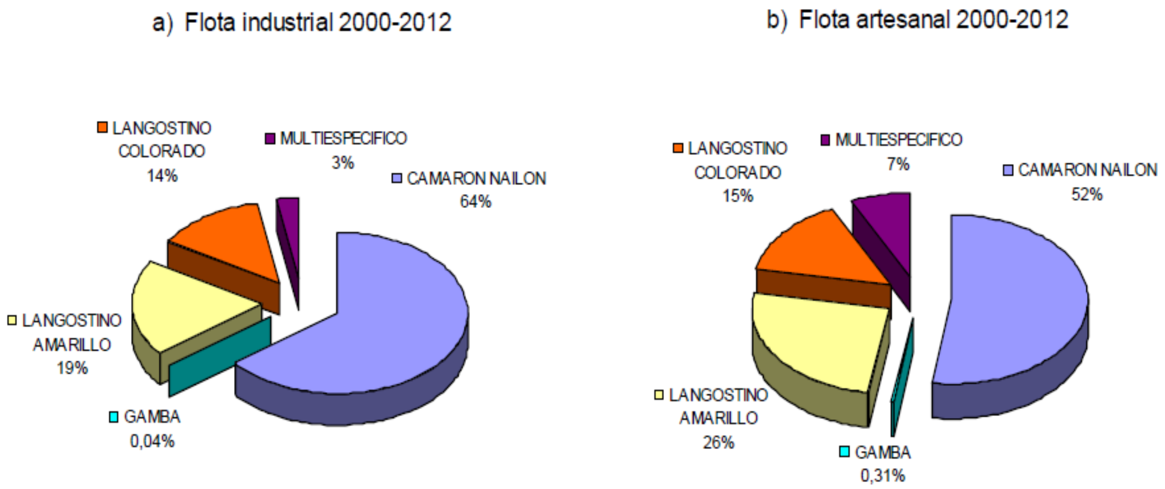
Source: Tascheri 2015

Management as retained catch**.** There were retained non-target quotas: 100 t for nylon shrimp; and 60 t for yellow squat lobster and red squat lobster. Currently, industrial fisheries for other species such as demersal crustaceans need to own part of the quota. For all artisanal fisheries irrespective of gear from Region IV to 41º28'6S there is a 28 t quota (D.EX. Nº39/2015).

Information**.** Landings are monitored by SERNAPESCA through independent dockside monitoring that is paid for by the private sector. IFOP conducts ongoing research to evaluate status of Chilean hake. There are IFOP observers on industrial fishing vessels to record scientific data since the 1960s. Observers do not have a role in compliance. The industry has placed its own observers on board larger vessels since 1995 to ensure compliance with the so called responsible fishing protocol.

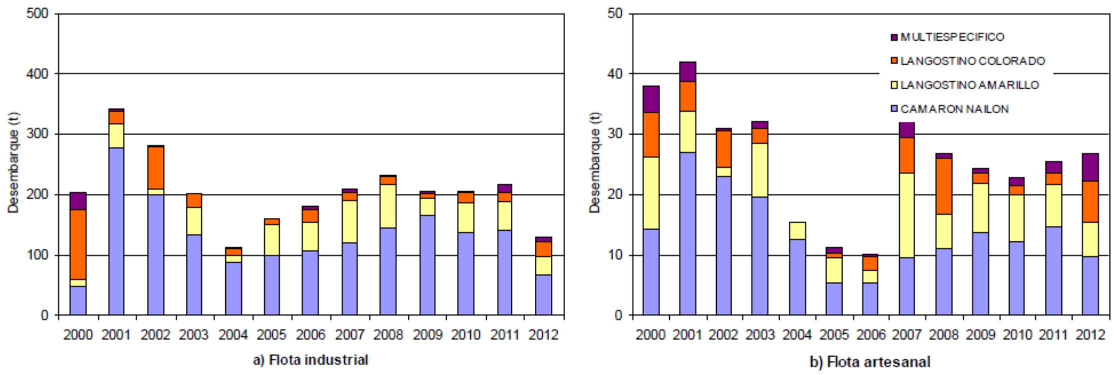
Historically, largest amount of hake in demersal crustacean fisheries, northern and southern areas combined, comes from nylon shrimp fisheries (64% of industrial and 52% of artisanal catch - Figure 89, 90). Highest levels of 342 t and 42 t retained catch in the industrial and artisanal fisheries were in 2001 (Figure 90). While retained catch in the nylon shrimp declined, it increased in the red squat fishery. It is noteworthy that total landings in the industrial crustacean fisheries reported by SERNAPESCA underestimated actual catch. For example, the catch estimated by IFOP for 2012 is 364 t (Table 27) while SERNAPESCA estimate is <150t (Figures 90, 91). This difference is acknowledged in IFOP reports (Zilleruelo et al 2013 among others) noting that this indicates discards and under-reporting of Chilean hake in demersal crustacean fisheries.

Figure 89. Relative Importance of Hake Landings as Retained Catch in Demersal Crustacean Fisheries by Target, Average for 2000-2012.



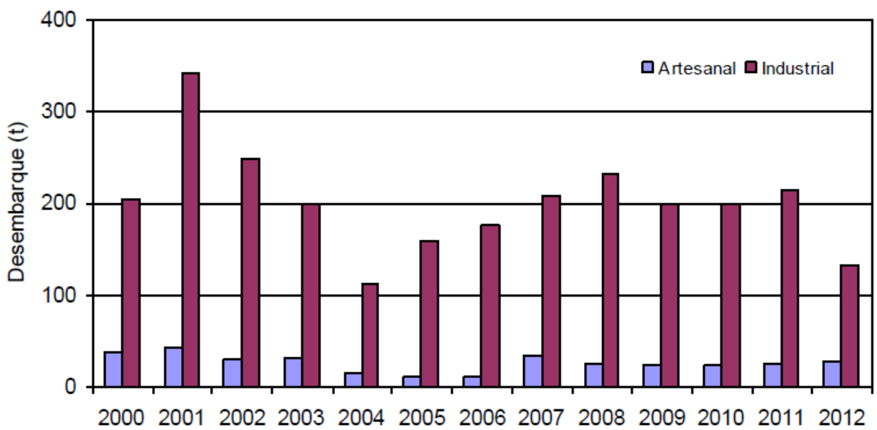
Source Zilleruelo et al 2013. Data from quota control by SERNAPESCA.

Figure 90. Annual Landings of Chilean Hake in Demersal Crustacean Fisheries, industrial fisheries, left; artisanal fisheries, right.



Source Zilleruelo et al 2013. Data from quota control by SERNAPESCA

Figure 91. Annual Landings of Chilean Hake in Demersal Crustacean Fisheries



Source Zilleruelo et al 2013. Data from quota control by SERNAPESCA.

Table 27. Indicators of Hake as Retained Catch in the Industrial Demersal Fishery as a whole by Region, 2012

	Region	III	IV	V	VI	VII	VIII	Z-CN	Z-CS	TOTAL
CAPTURA TOTAL	viajes totales	8	438	273	128	188	156	446	745	1191
	viajes muestreados	1	73	70	39	36	24	74	169	243
	cap_media (t/viaje)	0,35	0,38	0,23	0,38	0,29	0,15	0,38	0,27	0,31
	captura total estimada (t) [CTE]	**3**	**167**	**63**	**48**	**55**	**24**	**170**	**200**	**364**
	Lim_inf CTE	2,8	92,9	48,9	39,3	42,9	19,6	95,4	176,3	296,7
	Lim_sup CTE	2,8	241,8	76,5	57,6	66,9	28,8	244,9	223,4	430,9
	CV	0%	23%	11%	10%	11%	10%	22%	6%	9%
	DESEMBARQUE	**0**	**73**	**26**	**14**	**17**	**1**	**73**	**58**	**131**

Source Zilleruelo et al 2013. Data from IFOP.

The LGPA (law 20.625) contains regulations to start addressing the issue of discards in Chilean fisheries. This should improve accuracy of information to assess effects of retained Chilean hake catch in demersal crustacean fisheries. Regulations require use of video cameras on board of vessels 15 m in length or more, including vessels in the crustacean fisheries, to detect any discards. The regulation was supposed to be implemented within 2 years of the publication of the new law but has been delayed.

There are annual stock evaluations. IFOP conducts research to provide advice for management of the fishery. For stock evaluation fishing mortality is calculated with SERNAPESCA official landings and assuming an error range for discards and underreporting (30 to 7% up to 2008, 2-3% in later years, Figure 84).

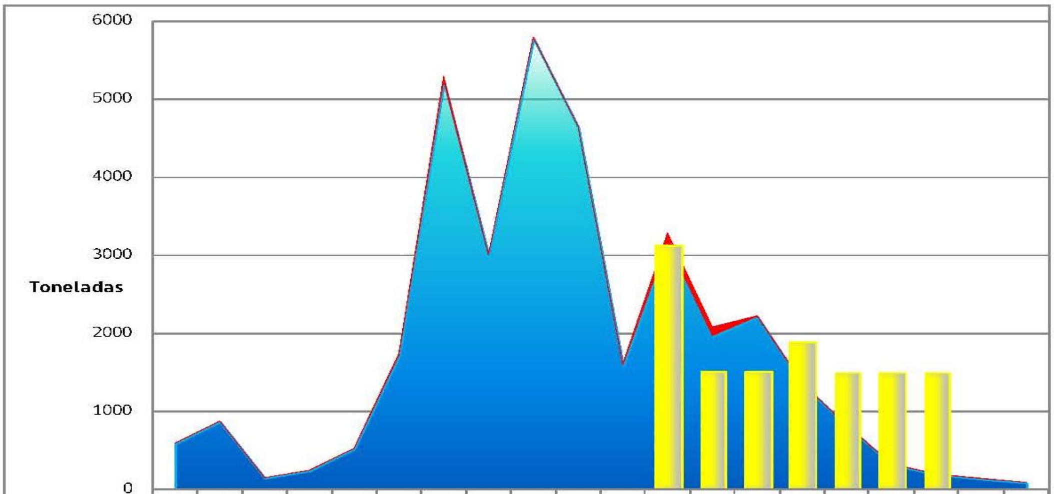
Cardinal fish (Epigonus crassicaudus)

Biology. There is no information available on population structure and spatial dynamics of cardinal fish. Nevertheless, it is assumed that there is a single stock distributed from Regions III to X (SUBPESCA 2011). According to recent research the maximum age is 54 (Ojeda et al 2010); much older than previously thought. Based on this information, estimates of growth and mortality were revised and the species, once classified as of medium productivity, is now considered of low productivity and resilience (SUBPESCA 2011).

Landings. The fishing unit was from Region III to X, but the fishery is closed. Landings increased from 500 t in 1996 to over 5,000 t in 2001 but decreased sharply after 2003 to 185 t in 2009 (Figure 92). The industrial fishery for cardinal fish was as retained catch, mainly from the Chilean hake fishery. Most catches were taken in the northern area from 34º 08'S and 38º 20'S and at depths 300 to 400 m. Fishing areas are distinct (SUBPESCA 2011) and associated with sea mounts over the continental shelf (Galvez et al 2009).

Status. Between 2004 and 2009, the stock was classified in Full Exploitation Status (S.D. N° 644-2004). Exploitation rates greatly exceeded sustainable levels since the beginning of the fishery (Figure 93). Indicators of stock status, such as spawning biomass and total and vulnerable biomass, experienced a steady decline since the 1990s with an average total biomass decline of 12% until 2005 and of 28% between 2006 and 2008. Landings in 2009 represented only 13% of the quota (Figure 92). The stock is currently considered to be 6% of the original biomass compared to 1992 when the fisheries started (Figure 94). The stock has collapsed (SUBPESCA 2014) (Figure 95).

Figure 92: Cardinal Fish Annual Industrial Landings & Catch Quotas

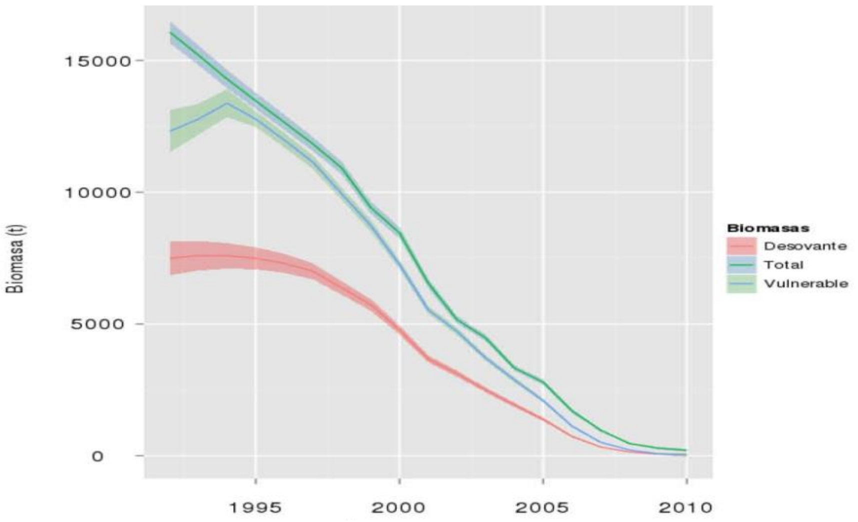


	92	93	94	1995	96	97	98	99	2000	1	2	3	4	2005	6	7	8	9	2010	11
Desemb. Artesanal	0	0	0	1	0	17	49	0	1	0	12	111	109	7	1	1	2	4	4	0
Desemb. Industrial	579	862	137	231	513	1.710	5.235	2.999	5.791	4.648	1.583	3.165	1.961	2.208	1.350	805	312	181	125	77
CUOTA	0	0	0	0	0	0	0	0	0	0	0	3.125	1.510	1.511	1.900	1.500	1.500	1.500	0	0

Note: Landings in the industrial fishery (blue) and artisanal fishery (red). Bars represent annual quotas.

Source: SUBPESCA 2011.

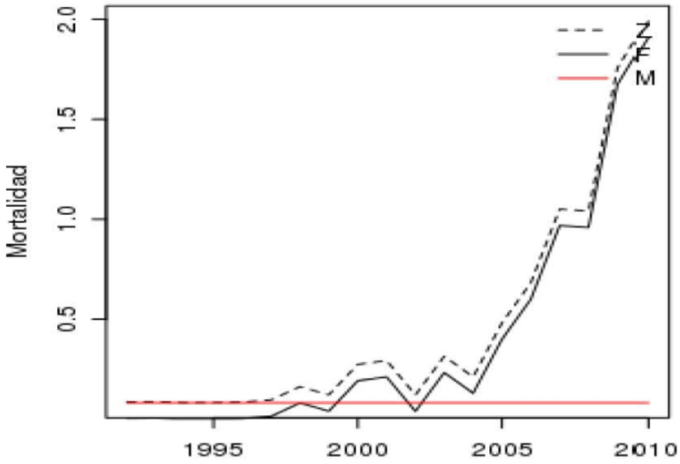
Figure 93: Main Indicators of Status of the Cardinal Fish Stock



Note: Biomasa Desovante = Spawning Biomass.

Source: Tascheri et al 2011.

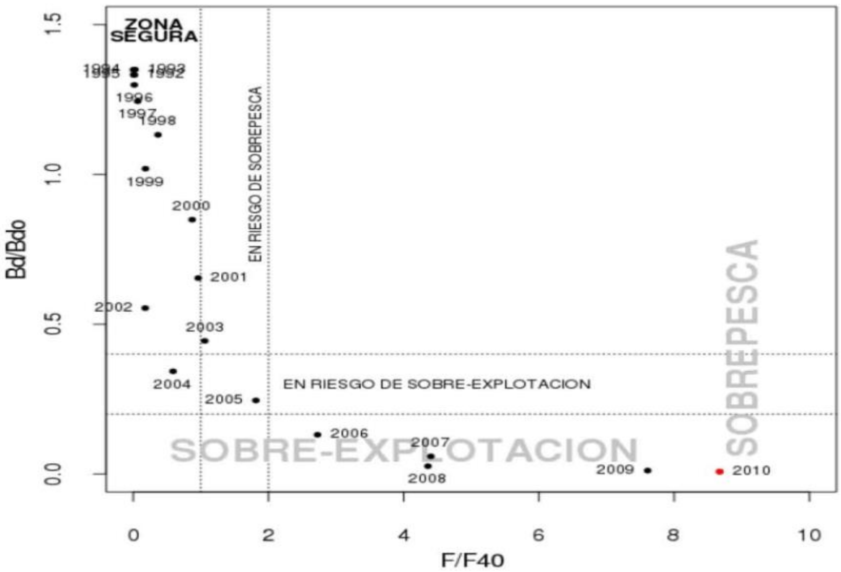
Figure 94: Estimates Cardinal Fish Total (M), Fishing (F) and Natural Mortality Rates



Note: Red line indicates the maximum sustainable fishing mortality.

Source: Tascheri et al 2011.

Figure 95: Cardinal Fish Stock Status

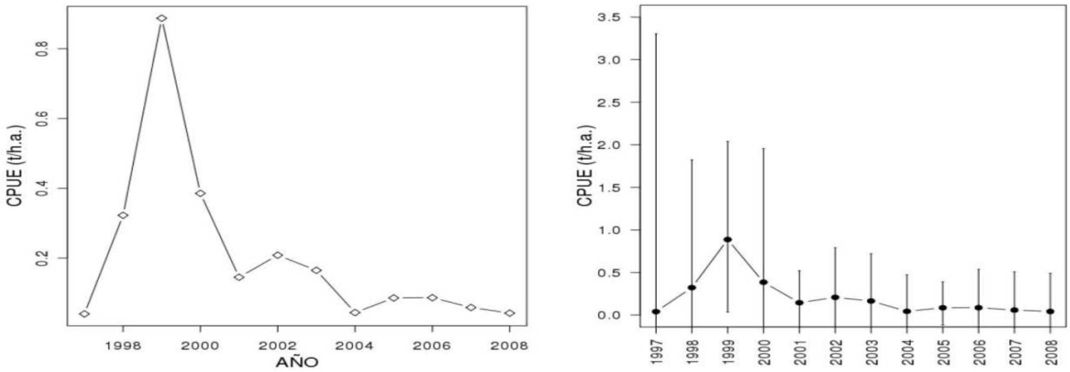


Note: Bdo = Virginal Spawning biomass, En riesgo de sobre explotación = risk of overexploitation, Zona segura = safe zone

Source: Tascheri et al 2011.

Management**.** The commercial fishery is closed since 2010. Stock assessment did rely on analysis of fishing effort and consists of a Tweedie Generalized Mixed Model including year as fixed effect and nested random effects vessel, fishing area, and season (SUBPESCA 2011). The model was implemented with information from fishing tickets (Figure 96). Results showed declining trends from 1999 to 2008. Also landing length composition decreased.

Figure 96: Cardinal Fish CPUE Index and Tweedie Generalized Mixed Linear Model



Note: left figure includes confidence levels

Source: SUBPESCA 2011.

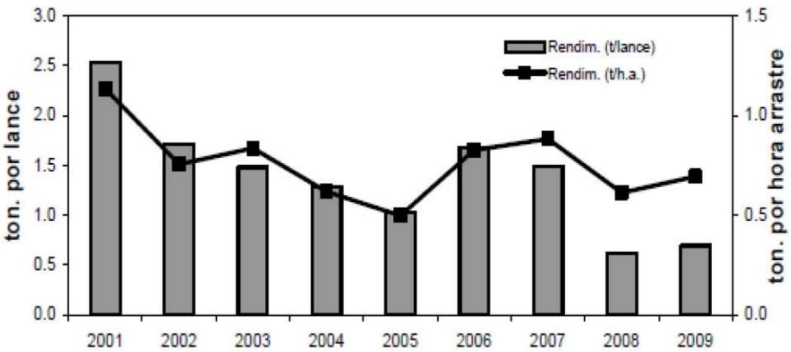
Since 2003 there were quotas by season. During 2004 and 2005 quotas were 1,300 t as target, 134 t as retained and 76 t as research catch; the quota was not taken. The strategy was a constant exploitation at F45% Spawning Biomass and 10% risk. Reference points were based on the assumption that sexual maturity was around age 7 and maximum age 19 years. Research revealed much longer life span of over 50 years. Also, evidence pointed to recruitment overfishing and increase in proportions of juvenile in the catch.

SUBPESCA established a biological closure in 2010 based on "*the decline in the conservation status of the resource.*" The closure is maintained in recognition of the probability that the resource was in worse condition than previously estimated. There is an annual maximum quota as retained non-targeted catch. In 2010 it was 50 t (40 t for industrial and 10 t for artisanal fisheries, D.Ex.Nº1.96/2009, SUBPESCA 2010). The industrial allowable catch was exceeded, and recommendation in 2011 was to reduce retained catch to 12 mt (10 mt for the industrial fishery SUBPESCA 2011). In 2010, 2011 and 2012 the authorized catch was exceeded by 207%, 117% and 227% (SUBPESCA 2014). This figure is for all fisheries combined.

Total retained catch is still 10 t for industrial and 2 t for artisanal fisheries. Among these fisheries are the demersal crustacean fisheries under assessment, which are considered as a whole. The regulation also establishes maximum of 0.5% retained catch in weight of cardinal fish relative to target catch per fishing trip for both industrial and artisanal fisheries.

Information & Monitoring. The stock is assessed within the national monitoring program for demersal fisheries by IFOP (catch, effort, reproduction parameters, and population structure). According to Wiff et al (2008), one of the key issues in assessing the stock is dealing with an abundance index based on catch per unit effort (Figure 97, 98) constructed on a highly multispecies fishery, where target is not easy to determine by data examination. In a same fishing trip, effort can be targeted to cardinal fish and not necessarily reported in fishing tickets. Thus, analysis of CPUE is complex (SUBPESCA 2011).

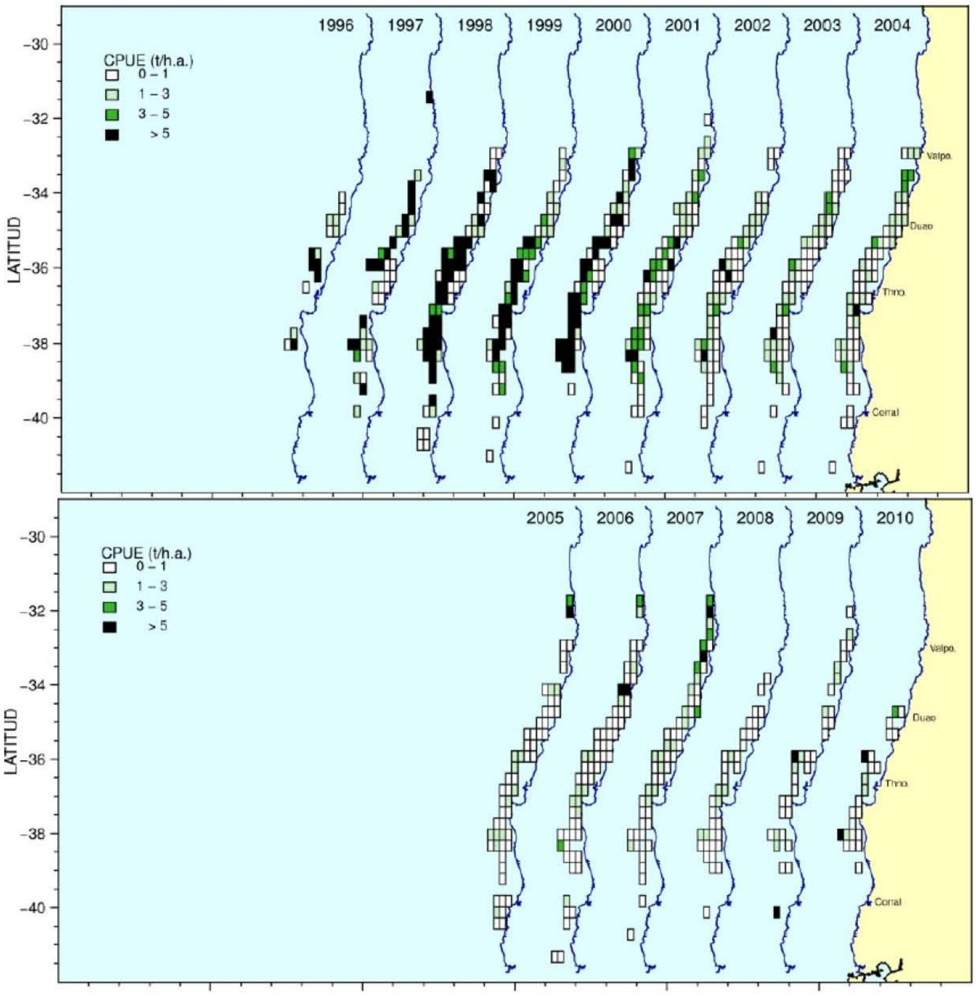
Figure 97: Cardinal Fish Annual CPUEs Used for Assessment



Note: Rendim. = CPUE, mt/lance = mt/tow, t/h.a = mt/ hour

Source: Tascheri et al 2011 and SERNAPESCA and IFOP.

Figure 98: Distribution of Catch per Unit Effort (CPUE) of Cardinal Fish Industrial Fishery



Source: SUBPESCA 2011.

3.4.2.4. Management

Limited entry, gear restrictions, closed seasons and areas, protected species, and quota and quota shares for the non-target species are the main measures to manage retained catch of non-target species in the three demersal crustacean fisheries.

Trawl gear characteristics are regulated by R. Ex. Nº762 2013 and R. Ex. Nº145 2015. The minimum net mesh size of the tunnel and cod end for nylon shrimp between Regions II and VIII is 50 mm, for yellow squat lobster between Regions III and VIII is 60 mm, and for red squat lobster between Regions XV and VIII is 60 mm. The regulation also describes several characteristics for mandatory feature of the net designed to allow non-target fish species (in particular Chilean hake) to escape unharmed (Dispositivo de escape de Fauna Acompañante). SERNAPESCA enforces compliance of these regulations.

Several measures are outlined in the LGPA for management of non-target retained species.

Cardinal fish is a closed fishery and there are quotas for cardinal fish as retained catch in the industrial demersal crustacean fisheries. The quota is 10 t for the industrial fisheries and up to 0.5% of the target by trip; this constitutes a third of the allowed non-target industrial catch and the nylon shrimp fishery takes most of it. The strategy should be effective but removals have been over the quota (around 15 t in 2014 based on IFOP reporting). There is a 2 t quota as non-target species in all artisanal fisheries. These quotas are set without an analysis.

Chilean hake is a closed access fishery subjected to a full exploitation regime with a global quota and Transferable Fishery Licenses. To participate in the nylon shrimp industrial fishery, it is required to be in possession of a share of the Chilean hake quota. There is a 1% maximum landings of the catch as non-target species (MINECON D.EX.39/2015).

There are also measures for retained catch of the demersal crustacean species when they are not the target species in other demersal crustacean fisheries. In order to participate in any of the industrial crustacean fisheries it is necessary to own fishing rights for the other species. The artisanal fisheries have a maximum 10% landings of the catch as non-target species (MINECON D.EX.39/2015).

There will be a plan for reduction of non-target catch when necessary information is collected and analysed as established in the new LGPA Tittle II, Paragraph 1 Bis. The plan will consider a code of good practices to mitigate non-target catch and incentives for improvements in fishing gear.

3.4.2.5. Information

SERNAPESCA maintains information on landings. Since 2002 the law requires that all industrial vessels participating in the fisheries certify the catch at the moment of landing by an auditing company accredited by SERNAPESCA. Landed catch is a measure of retained catch for target species. Landings underestimate retained species catch because there is discarding of these species and because some catch is taken by personal consumption of the crew (“polla”). These issues will be addressed by video cameras on board that will become mandatory.

There are multiple programs monitoring catch composition of the three demersal crustacean fisheries. Scientific observers are required on board of industrial vessels since 2002 (Law 19.173 and new law). Monitoring of catch composition is conducted annually by IFOP observers on vessels identified by SUBPESCA during the last days of every month for the next coming month. Vessels are not authorized to leave port without the observers. Data are collected from catch brought on deck and do not provide information on the proportion of the catch that is retained or discarded. The exception was for the 2005 when data were recorded to estimate retained catch versus discards of Chilean hake, cardinal fish, nylon shrimp, and red and yellow squat lobsters. Data collected during the 2005 survey showed that catch of species of commercial value was also discarded. The effort was discontinued as discards were illegal and the information proved controversial. Thus information from annual IFOP reports on catch composition overestimates retained catch of commercially valued species and landings recorded by SERNAPESCA underestimate catch.

Sampling effort for Regions III and IV is low and influenced by status of the stocks, such that sampling is impractical when quotas are low. This is because quotas are allocated between artisanal and industrial fisheries operating in these areas, and under established thresholds the full quota is allocated to the artisanal sector which does not accommodate observers on board. This happened in the 2015 red squat lobster fishery in the North Unit.

Information available on catch composition from IFOP monitoring of the catch is mostly for the old net. The fishery used the old gear until 2011, a combination of old and new trawls for 2012 to 2014 when the fishery started transitioning to use the new gear and the new gear in 2015. Available 2015 data are still preliminary.

Sampling effort

For the nylon shrimp fishery sampling effort on catch composition is generally around 20% of the trips, which translates on same percentage of the catch, and a minimum coverage of about 10% of trips by region. Higher number of trips is sampled in southern areas. 2012 statistics in Table 28 are representative of recent years.

Table 28. Catch Sampling Coverage (# Trips) 2013 Industrial Nylon Shrimp Fishery.

a. Numero de Viajes		REGION DE CAPTURA						
	PERIODO	III	IV	V	VI	VII	VIII	total
VIAJES IFOP	01/01-31/03		10	9	16	16	2	53
	01/04-31/06			3	5	5		13
	01/09-31/12		5	10	7	8	5	35
	suma	0	15	22	28	29	7	101
VIAJES CONT_CUOTA	01/01-31/03	2	55	45	39	64	9	214
	01/04-31/06		27	22	18	12		79
	01/09-31/12		41	43	30	46	9	169
	suma	2	123	110	87	122	18	462
%	01/01-31/03	0%	18%	20%	41%	25%	22%	25%
	01/04-31/06		0%	14%	28%	42%		16%
	01/09-31/12		12%	23%	23%	17%	56%	21%
COBERTURA	total	0%	12%	20%	32%	24%	39%	22%

Source: Zilleruelo et al 2014.

For the yellow squat lobster fishery sampling effort is at least 20% of the trips by Region which translates on same percentage of the catch. Statistics for 2012 in Table 29 are representative of the recent years.

Table 29. Sampling coverage of the catch (# Trips) 2013 industrial Yellow Squat Lobster Fishery by Region (III-IV= North Unit, V-VI=South Unit)

a. Numero de Viajes		Región de captura				
	PERIODO	III	IV	V	VI	total
VIAJES IFOP	01/04-31/06		22	22		44
	31/06-30/09	1	3	3	1	8
	01/10-31/12		17		5	22
	suma	1	42	25	6	74
VIAJES CONT_CUOTA	01/04-31/06		107	80		187
	31/06-30/09	3	53	15	10	81
	01/10-31/12	2	47	3	6	58
	suma	5	207	98	16	326
% COBERTURA	01/04-31/06		21%	28%		24%
	31/06-30/09	33%	6%	20%	10%	10%
	01/10-31/12	0%	36%	0%	83%	38%
	total	20%	20%	26%	38%	23%

Source: Zilleruelo et al 2014.

For red squat lobster fishery units, sampling effort is about 20% of the trips, which represents about 20% of the catch. Statistics from 2012 in Table 30 are representative of recent years except for 2015 when 90% of the North Unit quota was allocated to the artisanal fishery and Region IV was not surveyed.

Table 30. Sampling Coverage of the Catch (# trips) 2013 Red Squat Lobster Fishery by Region (IV= North Unit, V-VIII=South Unit)

a. Numero de Viajes		Región de captura					
	PERIODO	IV	V	VI	VII	VIII	total
VIAJES IFOP	01/04-31/06	4	15	1	4	7	31
	31/06-30/09	5	9	8	3	10	35
	01/10-31/12	21	6	1	2	5	35
	suma	30	30	10	9	22	101
VIAJES CONT_CUOTA	01/04-31/06	29	44	13	30	48	164
	31/06-30/09	19	28	13	26	62	148
	01/10-31/12	98	6	1	24	40	169
	suma	146	78	27	80	150	481
% COBERTURA	01/04-31/06	14%	34%	8%	13%	15%	19%
	31/06-30/09	26%	32%	62%	12%	16%	24%
	01/10-31/12	21%	100%	100%	8%	13%	21%
	total	21%	38%	37%	11%	15%	21%

Source: Zilleruelo et al 2014.

3.4.3. Bycatch species

3.4.3.1. Introduction

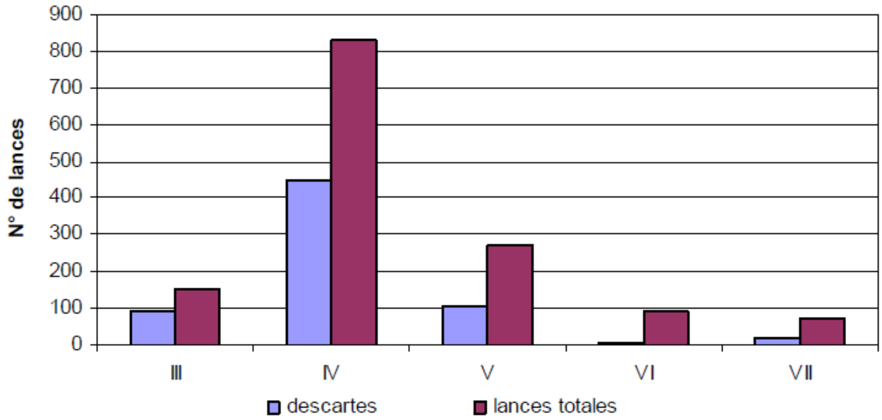
Bycatch consists of those species that are discarded or released, as well as unobserved fishing mortality. Similar to retained species (see above), bycatch may be classified as either minor or main; in most cases species comprising less than 5% of the catch are considered minor; a species that normally comprises 5% or more of the catch would be considered a "main" bycatch species.

Selectivity of trawl gear targeting demersal crustaceans results in discarding of bycatch. Discards of bycatch has been prohibited by Chilean Law (MINECOM Ley 19.173 article 12). Currently, discards are still illegal unless a vessel is participating in the current discard program. Nevertheless, discarding in the demersal crustacean fisheries occurs. Chile has an on board observer program and logistics for estimating discards have been in place, but quantification and monitoring did not take place because discarding was illegal. With the new LGPA there is a research program to estimate bycatch in the three demersal crustacean fisheries that was required to take place starting in April 2013 (R. Ex. Nº 882/2013). Results will be used for a plan to manage bycatch.

3.4.3.2 Background

IFOP collected information on discards from the 2005 industrial fishery targeting demersal crustacean from Regions III to VII (Zilleruelo et al 2006). Data were collected on frequency of discard occurrence, weight of species discarded by target species, and reasons for discarding. Species evaluated were nylon shrimp, yellow and red squat lobsters, Chilean hake and cardinal fish; thus, those species that are mostly retained. The study was to design measures to decrease discards. It identified the following causes for discarding: low size of target species, exceeding non-target species limits, catch of species under closures, catch with excessive amount of mud, catch of target species with soft exoskeleton, exceeding storage capacity, exceeding operation capacity or security reasons, exceeding plant operation capacity, and exceeding target species individual catch quotas. Overall results indicated that discards of commercial valued species occurred on 59.2% of sampled tows. Highest proportion of tows with discards was in Region IV (Figure 99).

Figure 99. Number of Tows in Industrial Demersal Crustacean Fisheries in 2005 and Number in which Chilean Hake was Discarded.



Source: Zilleruelo et al 2006.

A later FIP study (FIP-2007-32) was conducted in recognition of the need to regulate bycatch in the main Chilean fisheries, and to define a basis for a regulatory system. The study reviewed international systems to regulate bycatch and formulated a proposal for a new discard program including a conceptual framework, policy for coordinated efforts, a research project to evaluate causes for discarding, and technological and regulation improvements (Cerda 2009). Although the study did not analyze specific fisheries, it identified Aconcagua grenadier and *Coelorhynchus sp*, among five taxa in the catch of trawl fisheries most susceptible to be discarded, and indicated that their removal can have large effects in ecosystem functioning. There was no follow up of the study in terms of management.

During the site visit, SUBPESCA and IFOP personnel indicated that it is customary that catch of species without commercial value is discarded. Thus, discards of these species can be estimated from catch composition in IFOP reports. Available information indicates that discarding also occurs before catch is brought on deck under a set of circumstances described above. Thus, it can be assumed that all catch of non-commercial valued species is discarded.

3.4.3.3. Bycatch species Outcome

Species information was used on catch composition of the modified trawl reported by Queirolo et al (2011) and estimates available from IFOP annual reports of demersal crustacean fisheries to assess bycatch. IFOP estimates are generated from records of individual weights by species on a subset of tows and species frequencies recorded by trip. Information available poses limitations to evaluate P2 bycatch species similar to evaluate retained species: i) there is discarding before catch is brought on deck, ii) data are for catch composition of retained and discarded catch, ii) data are recorded from IFOP observers on board of industrial fishery operations and data for artisanal catch are missing, and iii) data are mostly of fisheries using the old trawl and a combination of old and new trawl. As noted above, discarding is illegal and not recorded. Discard mortality in demersal trawl fisheries is 100%.

Level of unobserved fishing mortality caused by lost fishing gear is unknown. Nevertheless, during the site visit IFOP personnel, captains and other fishery stakeholders indicated that loss of gear is rare and because nets are expensive every effort is made to recover them.

Nylon shrimp

Overall

Outcome status of bycatch species based on fishery monitoring is evaluated with catch composition data collected in the nylon shrimp fishery unit including Regions III to VIII for the industrial fishery and in Regions III and IV for the artisanal fishery. Information is available by area (northern = Regions III-IV, southern =Regions V-VIII) while industrial fishery UoC covers the extent of both areas.

Up to 73 bycatch species have been reported for the southern area and 44 for the north. Overall, estimates indicate that bycatch was about 10 to 20% of the catch. Two species in the bycatch are classified as main because they represented >5% of the total catch. Although some species of chondrichthyes are vulnerable their current level of removals is low and were not considered as main bycatch.

Based on IFOP reports from data collected since 2005 of the industrial fishery targeting nylon shrimp and also on reporting by Queirolo et al (2011) there were two main bycatch species in each nylon shrimp UoC (Table 31). Based on data collected from the industrial fishery targeting nylon shrimp in Regions III to VIII there were two main bycatch species in the industrial fishery. There were two main bycatch species in the artisanal fishery based on data collected from the industrial fishery targeting nylon shrimp in Regions III and IV.

Table 31. Nylon Shrimp Trawl Fishery: Summary of Main Bycatch Species

Industrial	**Artisanal**
Aconcagua grenadier Chilean grenadier	Aconcagua grenadier Chilean grenadier

Nylon Shrimp Industrial Fishery

IFOP reports of catch composition of the fishery targeting nylon shrimp since 2005 listed high numbers of bycatch species of up to 44 in the north and 73 in the south (Table 32). Bycatch represented around 20% of the catch. There were significant differences between areas. Overall, six species contributed over 0.5% to the catch: Chilean grenadier, Aconcagua grenadier, bigeye flounder, granulatum dogfish, hooktooth dogfish, and yellownose skate. Granulatum dogfish, hooktooth dogfish, and yellownose skate are chondrichthyes and are vulnerable. Representation of hooktooth dogfish in the catch was higher in the northern area and up to 1.7% (Table 32). Granulatum dogfish was recorded in both areas reaching 1.4% in the south. Representation of yellownose skate was higher in the south reaching 1.3%. This species is overharvested; total landings in the northern area were < 1,800t and calculation based on estimates in IFOP reports suggest that its bycatch could have reached 30 t, but since 2013 species contribution to overall catch decreased to < 0.5%. Species that reached > 5% of the catch were Chilean grenadier and Aconcagua grenadier.

Table 32. Bycatch (% weight) in the Nylon shrimp Fishery. Species Represent ≥0.5% of the catch. N= north III-IV Regions, S=V-VIII. Includes retained catch in Table 20.

	2005	2006	2007	2008	2009
Chilean grenadier	1.4	3		1.7	1.9
Aconcagua grenadier	4.7	3		4.7	2.9
Bigeye flounder	4	3.8		1.4	1.7
Yellownose skate				1	0.5
#Others sp	40	39	41	44	54
%	19	6	16	6	6.5
Landings (t)	**3739**	**4213**	**4341**	**4443**	**4534**

	2010		2011		2012		2013		2014		2015	
	N	S	N	S	N	S	N	S	N	S	N	S
Chilean grenadier	2.1	1.9	5.1	2.6	6.8	4.2	6.1	3.1	6.2	4.3	4.7	1.9
Aconcagua grenadier	2.1	4.5	7.7	5.7	2.2	5.2	4.3	5.5	0.8	3.8	2.9	9.0
Bigeye flounder	1.7	1.0	2.3	1.5	1.7		3		1.2	3.3	3.8	1.0
Granulatum dogfish						1.4			0.7		0.8	0.6
Hooktooth dogfish							1.7		0.8		0.7	0.5
Yellownose skate	0.7	1.2		1.3								0.4
#Others sp	40	69	30	66	30	40	12	32	36	49	16	54
%	5.4	6.3	6.3	7.5	5.6	8.7	2.8	7.4	4.6	5.3	1.5	3.1
Landings (t)	1759	3036	1312	3141	1137	2603	1069	2896	821	3049	602	2371

Sources: Zilleruelo 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

*2015 landings are for January to July (54% of the quota).

Queirolo et al (2011) reported 30 species in the 2007 - 2009 nylon shrimp fisheries in the north and 53 in the south using the new trawl (Table 33). Species with highest representation were Aconcagua grenadier with >5% of the catch in the south while bigeye flounder represented >5% in the north.

Species with 2% contribution were armed box crab and giant squid (*Dosidicus gigas*). There were five taxa of chondrichthyes recorded in the north and 12 in the south.

Table 33. Species in 2007-2009 Nylon Shrimp Fishery Using the New Trawl: % hauls.

Group	Species	Northern area			Southern area		
		Hauls (%)	CPUE (kg h^{-1}) ± (S.E.)	CPUE (n h^{-1}) ± (S.E.)	Hauls (%)	CPUE (kg h^{-1}) ± (S.E.)	CPUE (n h^{-1}) ± (S.E.)
Mixini	*Eptatretus polytrema*				24.0	1.16 (0.18)	1.93 (0.3)
Elasmobranchs	*Halaelurus canescens*	39.8	1.90 (0.25)	3.03 (0.38)	34.0	3.51 (0.72)	5.51 (1.17)
	Centroscyllium nigrum				18.0	8.53 (2.37)	9.22 (2.31)
	Aculeola nigra	29.6	1.32 (0.29)	2.74 (0.62)	35.0	1.58 (0.22)	2.83 (0.37)
	Order Squaliformes				3.0	2.63 (1.18)	5.49 (2.47)
	Centroselachus crepidater	3.1	1.84 (0.75)	3.51 (1.57)	41.0	2.63 (0.29)	4.29 (0.48)
	Bathyraja sp.				16.0	1.80 (0.33)	6.28 (0.88)
	Psammobatis rudis				35.0	2.16 (0.29)	5.36 (0.77)
	Dipturus trachyderma				9.0	3.28 (1.28)	2.65 (0.48)
	Family Rajidae				5.0	1.63 (0.62)	7.07 (2.21)
	Gurgesiella furvescens				23.0	1.39 (0.34)	5.11 (0.92)
	Zearaja chilensis	2.0	1.70 (0.25)	0.55 (0.08)	32.0	6.04 (0.93)	2.08 (0.33)
	Torpedo tremens	2.0	5.76 (3.01)	1.12 (0.51)	20.0	5.31 (1.05)	1.39 (0.15)
Teleostei	*Ophichthus remiger*	25.5	1.16 (0.16)	1.72 (0.32)	30.0	1.33 (0.25)	2.53 (0.51)
	Coelorinchus aconcagua	42.9	2.93 (0.61)	121.76 (25.72)	70.0	47.83 (5.64)	1986.24 (234.55)
	Coelorinchus chilensis				15.0	1.67 (0.73)	35.82 (14.79)
	Coelorinchus sp.	5.1	5.60 (5.39)	215.86 (206.28)	27.0	21.29 (3.27)	895.03 (127.6)
	Merluccius gayi	100.0	77.71 (18.25)	296.33 (65.58)	99.0	54.41 (7.23)	235.87 (30.71)
	Brotulotaenia sp.				30.0	3.58 (0.66)	11.95 (2.22)
	Genypterus maculatus				2.0	1.17 (0.74)	4.80 (2.86)
	Epigonus crassicaudus	29.6	19.28 (6.34)	56.15 (18.32)	80.0	15.40 (4.11)	44.52 (12.36)
	Lycenchelys scaurus	6.1	3.16 (0.97)	7.90 (2.43)	2.0	13.21 (12.87)	32.88 (32.33)
	Hippoglossina macrops	85.7	30.38 (3.01)	280.45 (28.49)	85.0	18.83 (2.09)	180.58 (20.16)
Invertebrates	*Dosidicus gigas*	7.1	12.96 (4.93)	0.80 (0.31)	30.0	36.75 (5.73)	2.27 (0.35)
	Platymera gaudichaudii	93.9	7.85 (0.83)	89.05 (9.21)	81.0	1.48 (0.18)	16.05 (1.94)
	Cervimunida johni	38.8	20.87 (6.89)	392.53 (128.97)	86.0	23.23 (5.36)	437.23 (100.24)
	Pleuroncodes monodon	10.2	2.70 (1.4)	75.78 (39.31)			
	*Heterocarpus reedi**	100.0	331.53 (21.63)	44661.00 (2955.79)	100.0	422.93 (23.31)	57512.56 (3195.6)
	Haliporoides diomedeae	8.2	1.55 (1.03)	155.21 (103.02)	25.0	6.30 (1.27)	629.65 (127.94)
	Pterygosquilla armata	35.7	1.06 (0.23)	50.39 (11.26)			

The * denotes the target species.
Only those with a mean CPUE greater than 1 kg h^{-1} and ocurrence greater than 1 are included.

Source: Queirolo et al 2011.

IFOP reports of the 2015 fishery using the new gear include fewer bycatch species than previously. Preliminary data indicated 21 bycatch species in the north and 58 in the south but still bycatch represented about 20% of the catch. Aconcagua grenadier representation in the catch increased and Chilean grenadier decreased. There were five species of chondrichthyes listed for the northern area (Table 34) and 17 taxa for the south (Table 35). Granulatum and hooktooth dogfish catch represented about 0.8% and 0.7% of the total and were present in about 30% to 20% of the hauls while other species were caught less frequently (Figure 100). Yellownose skate bycatch represented 0.38% of the catch in the southern area, thus amounting to about 4 t. This is close to the 6 t quota assigned for the demersal fisheries in Region VIII to 41º 28.6'S (MINECOM D Ex Nº21/2014).

Table 34. Non-target Catch Composition (% weight of the target) 2015 Industrial Nylon Shrimp Fishery in the Northern Area.

	NOMBRE_ESPECIE	n lances	R	Rinf	Rsup	STD_ERR	COEF_VAR
Zona Centro Norte	merluza común		12,5%	0,0%	35,7%	1,18E-01	95%
	granadero chileno		6,1%	0,0%	20,3%	7,23E-02	118%
	lenguado de ojo grande		5,0%	0,0%	17,3%	6,30E-02	127%
	granadero aconcagua		3,7%	0,0%	8,3%	2,32E-02	62%
	tollo negro raspa		1,1%	0,0%	2,9%	9,28E-03	85%
	jaiba limon		1,0%	0,0%	3,5%	1,26E-02	127%
	tollo negro aculeola	4	0,9%	0,0%	2,2%	6,92E-03	80%
	jaiba paco		0,1%	0,0%	0,2%	8,63E-04	115%
	pequen de hocico blanco		0,0%	0,0%	0,1%	4,31E-04	115%
	pequen espinoso		0,0%	0,0%	0,1%	2,16E-04	115%
	raya mariposa		0,0%	0,0%	0,0%	8,63E-05	115%
	pulpo de brazos largos		0,0%	0,0%	0,0%	6,47E-05	115%
	zapateador		0,0%	0,0%	0,0%	2,16E-05	115%

Source: Zilleruelo et al 2016.

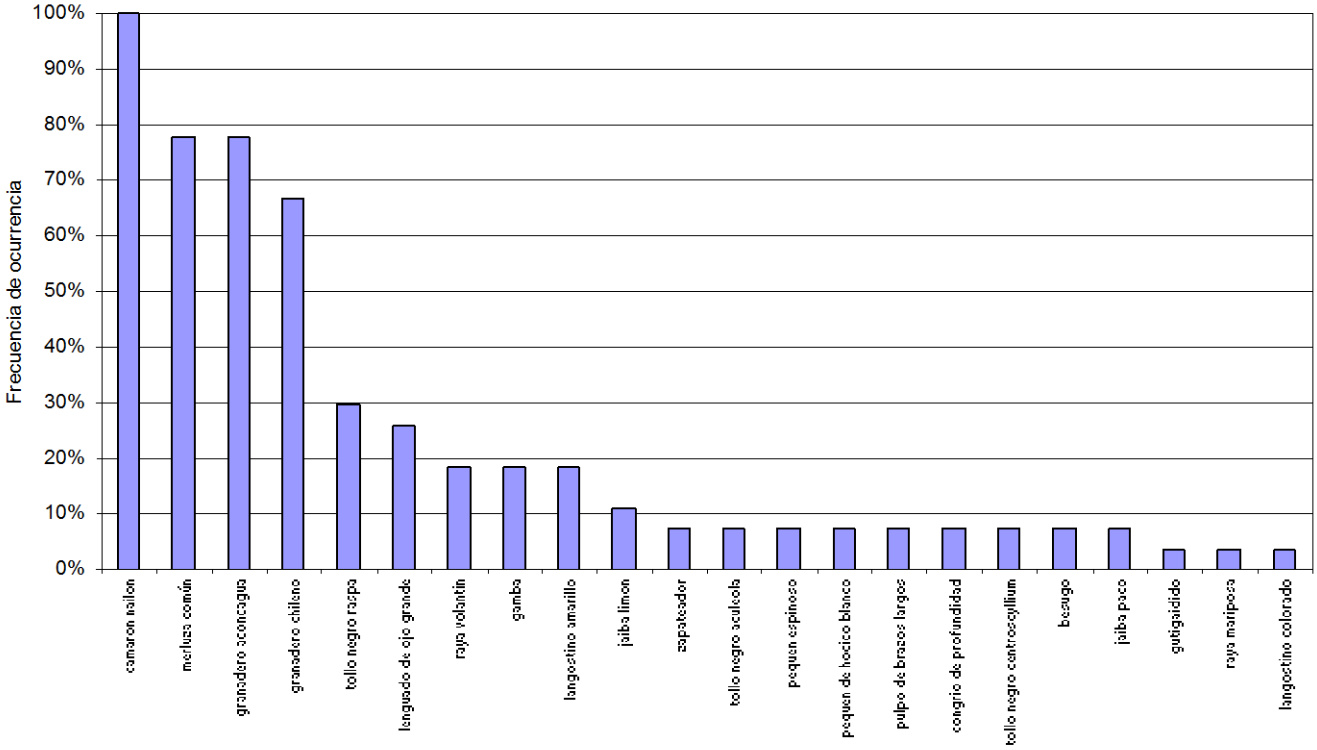
Table 35. Non-target Catch Composition (% weight of the target) 2015 Industrial Nylon Shrimp Fishery in the Southern Area.

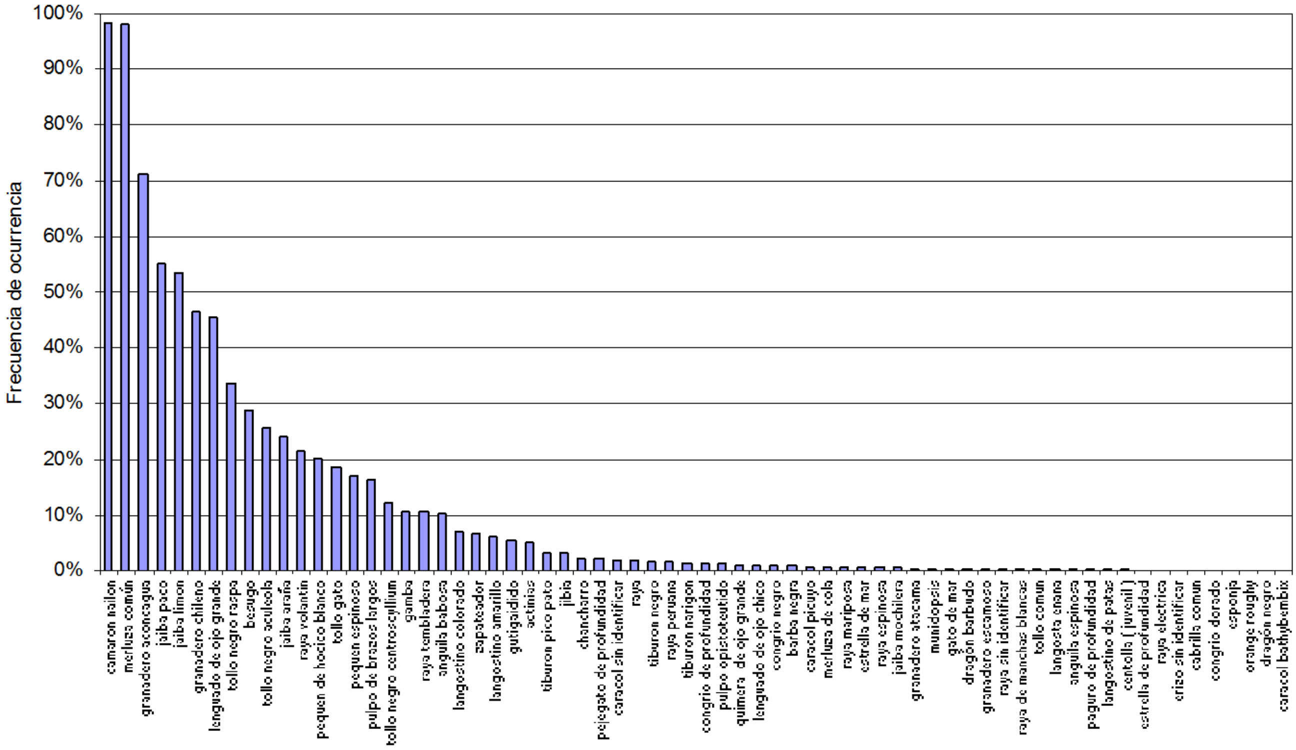
	NOMBRE_ESPECIE	n lances	R	Rinf	Rsup	STD_ERR	COEF_VAR
	granadero aconcagua		11,7%	9,4%	13,9%	1,15E-02	10%
	merluza común		8,0%	6,4%	9,6%	8,14E-03	10%
	granadero chileno		2,5%	1,5%	3,5%	5,02E-03	20%
	lenguado de ojo grande		1,3%	0,9%	1,7%	2,10E-03	17%
	tollo negro raspa		0,8%	0,5%	1,1%	1,34E-03	17%
	jaiba paco		0,6%	0,4%	0,8%	1,02E-03	16%
	tollo negro aculeola		0,6%	0,3%	1,0%	1,66E-03	26%
	jaiba limon		0,6%	0,4%	0,7%	9,27E-04	17%
	jaiba araña		0,5%	0,3%	0,7%	1,18E-03	24%
	raya volantin		0,5%	0,3%	0,7%	1,01E-03	21%
	tollo gato		0,4%	0,3%	0,6%	6,86E-04	16%
	besugo		0,4%	0,2%	0,5%	7,02E-04	19%
	pequen espinoso		0,3%	0,1%	0,4%	7,80E-04	27%
	pequen de hocico blanco		0,2%	0,1%	0,3%	4,03E-04	21%
	tollo negro centroscyllium		0,2%	0,0%	0,3%	7,46E-04	41%
	raya tembladera		0,1%	0,0%	0,2%	4,88E-04	37%
	langostino colorado		0,1%	0,0%	0,2%	5,66E-04	67%
	gamba		0,1%	0,0%	0,1%	3,39E-04	44%
	anguila babosa		0,1%	0,0%	0,1%	1,83E-04	28%
	langostino amarillo		0,1%	0,0%	0,1%	3,74E-04	60%
	gutigaidido		0,1%	0,0%	0,1%	1,27E-04	22%
	congrio negro		0,1%	0,0%	0,2%	4,89E-04	90%
	tiburon pico pato		0,05%	0,01%	0,09%	1,91E-04	37%
	raya peruana		0,05%	0,00%	0,12%	3,62E-04	78%
	jibia		0,04%	0,00%	0,09%	2,87E-04	75%
	raya		0,03%	0,00%	0,10%	3,50E-04	100%
	pulpo de brazos largos		0,03%	0,02%	0,05%	9,06E-05	27%
	raya espinosa		0,03%	0,00%	0,09%	2,97E-04	100%
	tiburon negro		0,02%	0,00%	0,05%	1,30E-04	57%
Zona Centro Sur	merluza de cola	141	0,01%	0,00%	0,04%	1,10E-04	79%
	pulpo opistoteutido		0,01%	0,00%	0,02%	4,28E-05	49%
	langostino de patas largas		0,01%	0,00%	0,02%	7,89E-05	100%
	caracol sin identificar		0,01%	0,00%	0,01%	2,79E-05	42%
	quimera de ojo grande		0,01%	0,00%	0,01%	4,41E-05	72%
	actinias		0,01%	0,00%	0,01%	2,53E-05	42%
	granadero atacama		0,01%	0,00%	0,01%	4,46E-05	85%
	tiburon narigon		0,01%	0,00%	0,01%	2,47E-05	47%
	congrio de profundidad		0,005%	0,000%	0,010%	2,56E-05	54%
	zapateador		0,004%	0,000%	0,008%	2,01E-05	53%
	barba negra		0,003%	0,000%	0,008%	2,09E-05	60%
	chancharro		0,003%	0,000%	0,006%	1,93E-05	74%
	pejegato de profundidad		0,003%	0,000%	0,008%	2,63E-05	100%
	anguila espinosa		0,002%	0,000%	0,005%	1,62E-05	73%
	lenguado de ojo chico		0,002%	0,000%	0,006%	2,19E-05	100%
	raya mariposa		0,002%	0,000%	0,004%	1,22E-05	61%
	erizo sin identificar		0,002%	0,000%	0,005%	1,75E-05	100%
	caracol picuyo		0,001%	0,000%	0,003%	9,73E-06	74%
	estrella de mar		0,001%	0,000%	0,003%	9,15E-06	81%
	centolla (juvenil)		0,001%	0,000%	0,003%	8,76E-06	100%
	raya sin identificar		0,001%	0,000%	0,003%	8,75E-06	100%
	raya de manchas blancas		0,001%	0,000%	0,003%	8,76E-06	100%
	granadero escamoso		0,001%	0,000%	0,003%	8,76E-06	100%
	langosta enana		0,001%	0,000%	0,003%	8,78E-06	101%
	cabrilla comun		0,001%	0,000%	0,002%	7,32E-06	100%
	caracol bathybembix		0,000%	0,000%	0,001%	3,96E-06	101%
	jaiba mochilera		0,000%	0,000%	0,001%	3,33E-06	100%
	dragón negro		0,000%	0,000%	0,001%	2,64E-06	101%
	munidopsis		0,000%	0,000%	0,001%	1,74E-06	100%
	dragón barbudo		0,000%	0,000%	0,000%	8,62E-07	99%

Source: Zilleruelo et al 2016.

We did not consider chondrichthyes species as P2 main bycatch species at the time. However future annual audits should review the situation to ensure that the fishery does not pose a threat to these species and it is recommended that data on bycatch are used to estimate removals by species and is reported routinely. Estimates should be produced for removals of the demersal crustacean fisheries combined as quotas are established for all three fisheries.

Figure 100. Frequency of Occurrence of Species Caught 2015 Nylon Shrimp Fishery using the New Trawl (top) northern area (bottom) southern area.





Source: Zilleruelo et al 2016.

*Data are preliminary

Nylon Shrimp Artisanal Fishery

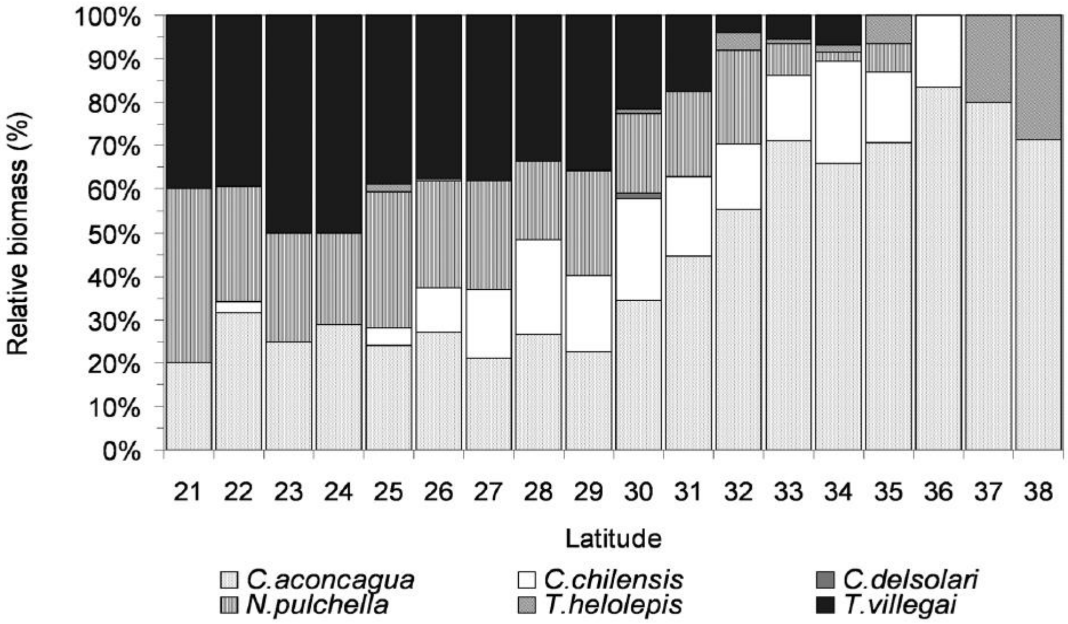
IFOP reports of the fishery targeting yellow squat lobster listed up to 44 bycatch species in the northern area where the artisanal fishery operates. In the 2015 fishery using the new gear, there were 21 species (Figure 100). Over all years, six species have contributed over 0.5% to the catch: Chilean grenadier, Aconcagua grenadier, bigeye flounder, granulatum dogfish, hooktooth dogfish, and yellownose skate (Table 32). Granulatum dogfish, hooktooth dogfish, and yellownose skate are Chondrichthyes species and are considered vulnerable. Nevertheless, harvest in the northern area is <1,800 t and these species generally were <0.5% of the catch. Calculations based on IFOP estimates suggest that largest annual take of one of the species in the last five years was 18t and their contribution to the overall catch has decreased. In the 2015 catch using the new gear, granulatum dogfish and yellownose skate were caught in 30% and 20% of the hauls respectively while other species were caught in <10% of the hauls (Figure 85). We did not consider species of chondrichthyes as main P2 bycatch species at the time. However, future annual audits should review the situation to ensure that bycatch does not pose a threat to these species and it is recommended that data are recorded on bycatch of the artisanal fishery and are used to estimate removals by species and are reported routinely. Species that reached >5% of the catch since 2005 were Chilean grenadier and Aconcagua grenadier. Both are considered P2 main bycatch.

Main Bycatch species

Aconcagua Grenadier- Rattail (Coelorinchus aconcagua)

Acuña et al (2008) analyzed grenadier data from direct stock assessment surveys of the two squat lobsters and nylon shrimp and from commercial fisheries. The study covered an area between 21°34–38°29S and a bathymetric range 70 to 617 m. Data were collected in 2000, 2001, 2002, 2005 and 2006. Aconcagua grenadier was caught throughout the survey area and between 110 and 600 m; the record extends the species distribution previously recorded to between 30° and 41°S. Higher biomass was found towards the south (Figure 101) suggesting that the focus of population distribution is south of the area of operation of the demersal crustacean fisheries.

Figure 101. Relative Biomass Distribution of Macrourids in Demersal Crustacean Fisheries



Source: Acuña et al 2008.

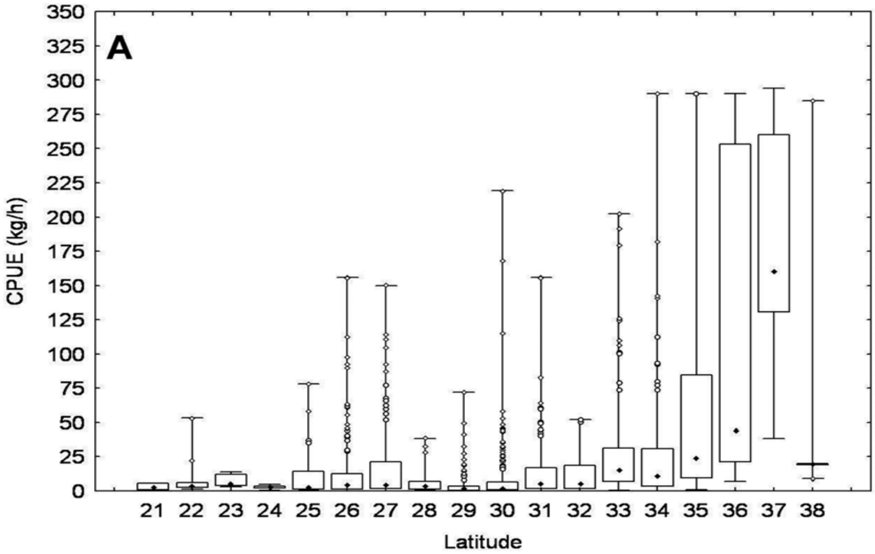
Aconcagua grenadier CPUE ranged between 0.15 - 500 Kg/h; highest > 36^{o} S (Figure 102), further suggesting population distribution towards the south. Individuals were more frequently caught in the deeper water 400 - 500m stratum (Table 36). This suggests population distribution extends towards deeper waters than where the demersal crustacean fisheries operate.

Table 36. Occurrence of Macrourids (%) in Demersal Crustacean Fisheries by Depth.

SPECIES	< 100	100–200	200–300	300–400	400–500
C. aconcagua	-	0.33–9.32	0.40–9.30	5.07–5.63	7.69–15.79
C. chilensis	-	-	1.58	1.45	15.38
N. pulchella	-	0.57	3.16–8.30	22.46–22.67	33.33–38.46
T. villegai	-	-	-	0.72	-

Source: Acuña et al 2008.

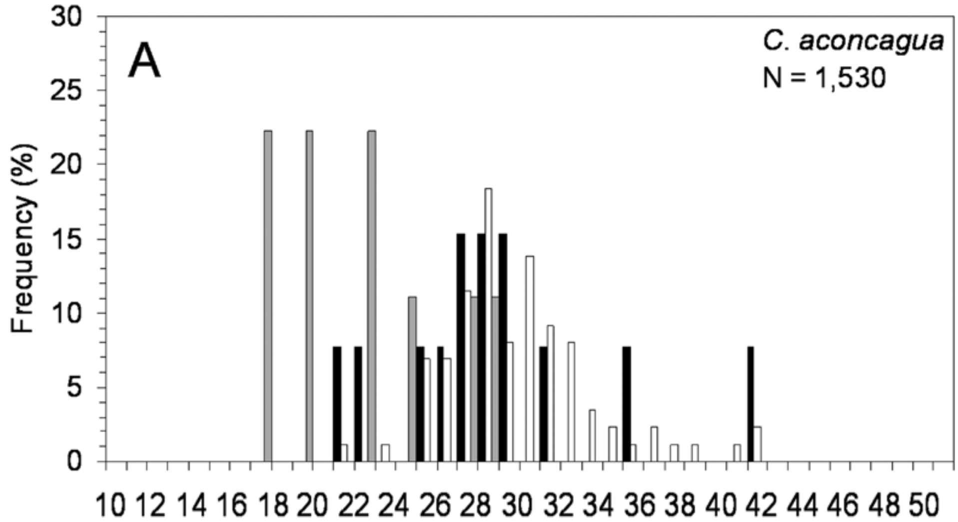
Figure 102. C. aconcagua CPUE (Kg/h) in demersal crustacean fisheries



Source: Acuña et al 2008

Individual length ranged from 12.2–41 cm TL, with a mode at 29 cm (Figure 103). Females were slightly larger and size increased with depth. Males were absent in the first depth stratum and up to 250 m. The reported length-weight relationship for sexes combined is y = 0.0017 x3.1054, *r*2 = 0.9275.

Figure 103. Length frequency distributions (%) of Aconcagua grenadier,



Total length (cm)

■Male □Female ░ Undetermined

Source: Acuña et al 2008.

Biology**.** Little is known of the biology and life history of grenadiers. Eggs are thought to ascend after fertilization and develop in midwater below 200 m. Estimates in Fishbase are: Max length: 41 cm TL. Bayesian length-weight: a= 0.00295 (0.00126 - 0.00693), b= 3.13 (2.93 -3.33), based on LWR estimates for this (Sub)family-body shape. Resilience: Medium, minimum population doubling time 1.4 - 4.4years (Preliminary K or Fecundity). Vulnerability: Moderate vulnerability (43 of 100).

Distribution**.** South-eastern Pacific and Southwest Atlantic: Chile (up to 41°S) and Argentine Patagonia. Benthopelagic; non-migratory; depth range 110 - 600 m.

Ecology**.** The species feeds on copepods, pagurid and brachyurid crabs, and shrimp-like crustaceans. Trophic level estimated from a number of food items using a randomized re-sampling routine. 3.39. Trophic Level: 3.4 ±0.49 se; based on food items.

Macrouronids may be the most important family of deep-sea benthic fishes, both in terms of diversity and biomass. Most grenadiers live on or close to the bottom and are regarded as benthopelagic. Many species have restricted ranges, although deeper-dwelling ones seem to be more widely distributed (Acuña et al. 2008). Although their densities have been estimated only roughly for few areas, their activities must represent a significant contribution to the energy flow in their environment.

Harvest**.** Catch statistics are missing. Pequeño (1971) reported 11 species of grenadiers caught in the trawl fishery for yellow squat lobster. Cerda (2009) in a study of discards presented estimates of annual removals in trawl fisheries from 1999 to 2006 of 4232t, 494t, 1492t, 8077t, 3647t, 5713t, 3137t, 6982t and 13871t. Grenadiers do not constitute commercial fisheries because they do not form large schools or concentrations to be exploited with high commercial benefits. The only grenadier species included in SERNAPESCA listing of fishery resources in Chile is *C. fasciatus.*

Outcome Status. Phylogenetic diversity index: PD_{50} = 0.5000 [Uniqueness, from 0.5 = low to 2.0 = high].

Management**.** There are no current regulations for the species as target or retained species.

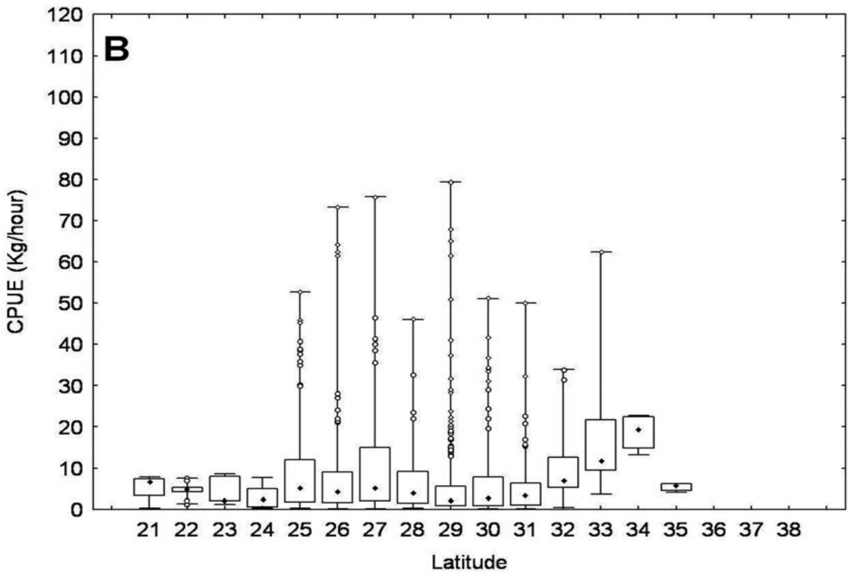
Monitoring & Information. Some biological information is routinely collected in scientific surveys to assess demersal crustacean stocks and from IFOP monitoring of fisheries but it is not routinely reported.

Chilean Grenadier- Rattail (Coelorinchus chilensis)

Acuña et al (2008) analyzed grenadier data from surveys as reported earlier. The authors reported Chilean grenadier caught half as frequently as Aconcagua grenadier and at depth 120 to 580 m. Males were present at depths > 400 m (Table 36). The known bathymetric distribution for the species was extended into shallower depths by the study. Chilean grenadier CPUEs were evenly distributed within a range of 0.008 and 25.9 kg/h. (Figure 104).

Distribution**.** Endemic from South-eastern Pacific Peru to central Chile 4°S - 39°S, 85°W - 70°W. This is a deep-water species; depth range: 120 - 1,480 m. Although its southern distribution is described only up to 39º S it was found in a study from Isla Grande de Chiloé (42° 28' S) to Cabo de Hornos (55° 59'S) at 1,330 m. (Reyes et al 2009).

Figure 104. C. chilensis CPUE (Kg/h) in demersal crustacean fisheries

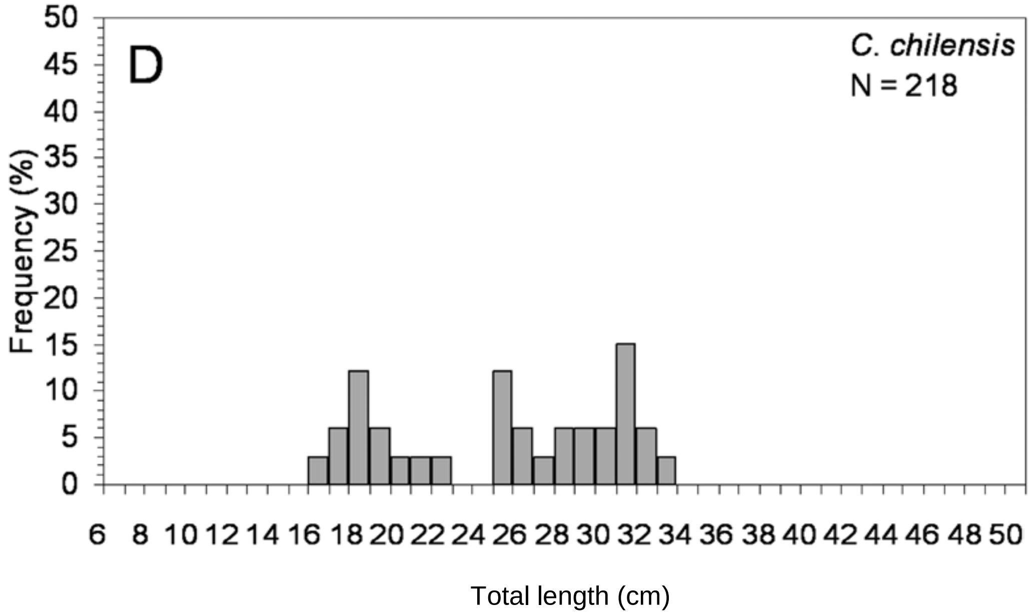


Source: Acuña et al 2008.

Biology**.** In the study by Acuña et al (2008) length of 218 specimens ranged from 16.3 to 33 cm TL (Figure 105). Length frequencies were bimodal, with peaks at 18.25 and 31 cm, most individuals were juveniles. There were few females and males were found > 400 m. It is likely that older individuals and females are found in deeper waters.

Fishbase estimates are: Max length: 48.0 cm TL male/unsexed. Phylogenetic diversity index PD_{50} = 0.5000 [Uniqueness, from 0.5 = low to 2.0 = high]. Bayesian length-weight: a=0.00295 (0.00126 - 0.00693), b=3.13 (2.93 - 3.33), based on LWR estimates for this (Sub)family-body shape. Resilience: Low, minimum population doubling time 4.5 - 14 years (Preliminary K or Fecundity). Vulnerability: Moderate to high vulnerability (53 of 100).

Figure 105. *C. chilensis*, Length Frequency Distributions Sexes Combined.



Source: Acuña et al 2008.

Ecology. Bathydemersal and non-migratory. Trophic Level 3.6 ± 0.5 based on size and trophic levels of closest relatives.

Harvest. Occasionally taken by commercial trawlers off San Antonio but no separate statistics are maintained. This species is nowhere found in great abundance. Grenadiers do not constitute commercial fisheries because there are no large schools or concentrations to be exploited with high commercial benefits.

Management. There are no current regulations for the species as target or retained species.

Monitoring & Information. Some biological information is routinely collected in scientific surveys to assess demersal crustacean stocks and from IFOP monitoring of fisheries but is not routinely reported.

Yellow Squat Lobster

Overall

Outcome status of bycatch species is evaluated with data collected from the industrial yellow squat lobster fishery in Regions III-IV for the North Fishery Unit and in Regions V-VIII for the South Unit. Data from the industrial fishery in Regions III- IV were used to evaluate the artisanal fishery.

Based on estimates from catch composition data collected by IFOP of the industrial fishery targeting yellow squat lobster and those reported by Queirolo et al (2011) there were no main bycatch species in the yellow squat lobster UoCs (Table 37). Based on data collected in Regions III-IV (2005 - 2007 and 2010 - 2015), and from Regions V-VIII (2010 - 2015) there were no main bycatch species in the industrial fishery in the North and South Units. There were no main bycatch species in the artisanal fishery based on data collected in Regions III-IV (2005 - 2007 and 2010 - 2015).

Table 37. Yellow Squat Lobster Trawl Fishery: Summary of Main Bycatch Species

Industrial		**Artisanal**
North Fishery Unit	**South Fishery Unit**	**Regions III, IV**
-	**-**	**-**

Yellow Squat Lobster North Fishery Unit

Queirolo et al (2011) reported 15 bycatch species in the catch composition of the 2007 - 2009 yellow squat lobster fishery in the north unit using the new trawl; none was >5% of the catch. Bigeye flounder was the species with highest representation with 4.1% (Figure 75). Two species of elasmobranchs were reported (Table 38).

Table 38. Species in 2007-2009 Yellow Squat Fishery North Unit using the New Trawl: % hauls.

Mixini	*Eptatretus polytrema*	6.7
Elasmobranchs	*Halaelurus canescens*	6.7
	Aculeola nigra	16.7
Teleostei	*Ophichthus remiger*	40.0
	Lucigadus nigromaculatus	10.0
	Merluccius gayi	93.3
	Brotulotaenia sp.	13.3
	Epigonus crassicaudus	6.7
	Hippoglossina macrops	96.7
Invertebrates	*Dosidicus gigas*	
	Platymera gaudichaudii	76.7
	*Cervimunida johni**	100.0
	Pleuroncodes monodon	30.0
	Heterocarpus reedi	73.3

Source Queirolo et al 2011.

IFOP surveys on catch composition recorded up to 25 bycatch species (Table 39). Bycatch was <7% of the catch. Overall, four species were> 0.5% of the catch: bigeye flounder, armed box crab, lemon crab and Aconcagua grenadier. Same species were most prevalent and generally present in 80% of the hauls. There were four bycatch species of elasmobranchs; most prevalent was yellownose skate. In the 2015 fishery, bycatch was <5% of the catch and there were 15 bycatch species listed (Table 40). There were three species of elasmobranchs recorded: raspthorn sandskate (*Psammobatis scobina*) represented the highest catch with < 0.02% of the total and was present in < 0.5% of the hauls (Figure 106). Although elasmobranchs are vulnerable taxa, these species constituted a small fraction of the catch and total catch in the yellow squat lobster fishery in the North Unit has remained under 3000 t.

None of the bycatch species reached 5% of the catch and there are no P2 main bycatch species in the yellow squat lobster in the North Fishery Unit. Species of chondrichthyes were not considered as P2 main bycatch species. **However future annual audits should review the situation to ensure that bycatch does not pose a threat to these species.**

Table 39. Bycatch Composition (% weight) in Industrial Yellow Squat Lobster Fishery North Unit. Species ≥ 0.5% of the catch. 2008 & 2009 Units Combined. Catch includes retained catch in Table22.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Regions	II-IV	III-IV	III-IV	II-IV V-VI	III-IV V-VI	III IV	IV	III IV	IV	III IV	IV
Bigeye flounder	2.2	2	1.0	2.5	1.7	2.3	2.4	1.1	2.9	3.2	1.9
Armed box crab		0.7	0.7	0.7	1.1	1.9	1.5	0.6	0.7		0.8
Lemon crab				1	0.8	1.3	0.6				0.5

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Aconcagua grenadier	0.7								0.7		
#Other sp	21	17	13	21	20	4	13	3	9	5	13
%	9	4.5	2.0	2.5	1.4		1.7	0.4	1.6	3.3	0.3
Landings (t)	2715	2735	2815	2867	2774	2712	2511	2380	1864	1669	1757
				2600	2483						

Source: Zilleruelo et al 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

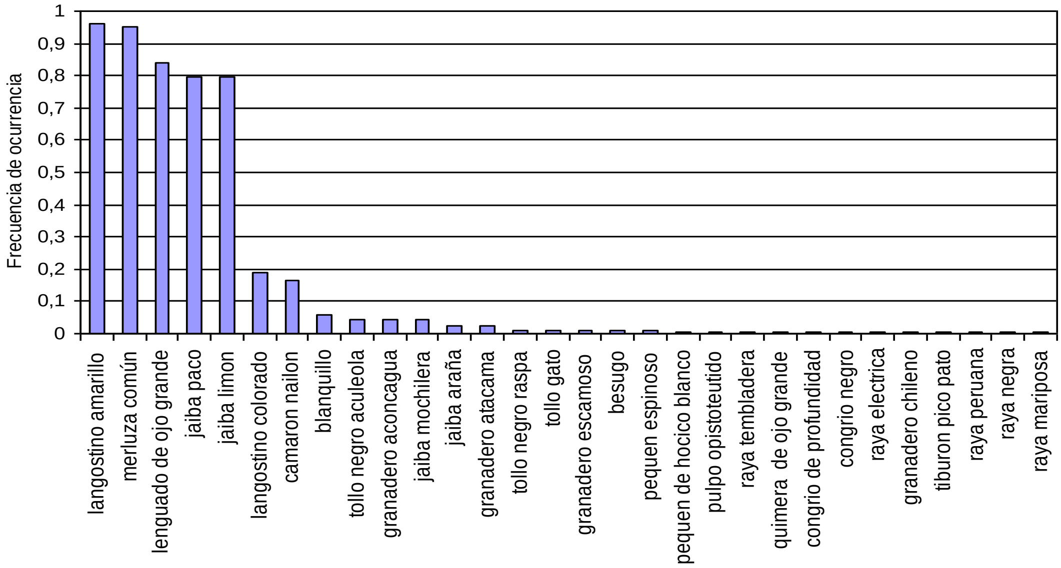
*2015 data are preliminary as landings are for March to August.

Table 40. Non-target Catch Composition (% weight of target) 2015 Industrial Yellow Squat Lobster Fishery in the North Unit.

	NOMBRE_ESPECIE	n lances	R	Rinf	Rsup	STD_ERR	COEF_VAR
Unidad Pesquería Centro Norte	langostino colorado	56	2,3%	0,3%	4,3%	1,03E-02	44%
	lenguado de ojo grande		2,0%	1,3%	2,6%	3,30E-03	17%
	merluza común		1,9%	1,3%	2,5%	3,01E-03	16%
	camaron nailon		0,7%	0,0%	1,5%	3,99E-03	55%
	jaiba paco		0,7%	0,5%	0,9%	9,43E-04	14%
	jaiba limon		0,6%	0,4%	0,7%	7,51E-04	13%
	blanquillo		0,04%	0,0%	0,09%	2,38E-04	62%
	besugo		0,04%	0,0%	0,10%	3,54E-04	101%
	pequen espinoso		0,02%	0,0%	0,06%	2,04E-04	101%
	granadero aconcagua		0,02%	0,0%	0,04%	1,07E-04	61%
	jaiba mochilera		0,02%	0,0%	0,03%	8,97E-05	59%
	tollo negro aculeola		0,013%	0,0%	0,02%	6,20E-05	49%
	raya electrica		0,011%	0,0%	0,03%	1,15E-04	101%
	congrio negro		0,006%	0,0%	0,02%	6,33E-05	100%
	jaiba araña		0,005%	0,0%	0,01%	4,04E-05	80%
	granadero atacama		0,003%	0,00%	0,01%	1,76E-05	70%
	granadero escamoso		0,001%	0,000%	0,004%	1,28E-05	101%
	congrio de profundidad		0,000%	0,000%	0,000%	1,28E-06	101%
	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Source: Zilleruelo et al 2016.

Figure 106. Frequency of Occurrence of Species in the 2015 Yellow Squat Lobster North Fishery Unit.



Source: Zilleruelo et al 2016.

*Preliminary data

Yellow Squat Lobster South Fishery Unit

Queirolo et al (2011) reported four bycatch species in the 2007-2009 yellow squat lobster fishery in the southern area (Table 41). Bigeye flounder represented 5.4% of the catch (Figure 75). Most prevalent species bigeye flounder and armed box crab were present in 100% and 80% of the hauls respectively.

Table 41. Species in Nylon Shrimp Fishery South Unit Using the New Trawl: % hauls.

Mixini	*Eptatretus polytrema*	
Elasmobranchs	*Halaelurus canescens*	
	Aculeola nigra	
Teleostei	*Ophichthus remiger*	14.3
	Lucigadus nigromaculatus	
	Merluccius gayi	100.0
	Brotulotaenia sp.	
	Epigonus crassicaudus	
	Hippoglossina macrops	100.0
Invertebrates	*Dosidicus gigas*	5.7
	Platymera gaudichaudii	80.0
	*Cervimunida johni**	100.0
	Pleuroncodes monodon	
	Heterocarpus reedi	62.9

Source: Queirolo et al 2011.

IFOP surveys on catch composition of the fishery targeting yellow squat lobster in the South Fishery Unit recorded up to 15 bycatch species since 2010 (Table 42). Overall, three species made up >0.5% of the catch: bigeye flounder, armed box crab, and lemon crab. Bigeye flounder was the species with highest contribution of up to 2.7%. In the 2015 fishery, there were 15 bycatch species recorded (Table 43) and although the number of species increased, percentage of hauls where species were caught was lower (Figure 107). There were four species of elasmobranchs: yellownose skate, hocktooth dogfish, raspthorn sand skate and one unidentified skate in the catch. Species were present in <2% of the hauls. Highest catch was of yellownose skate which constituted about 0.006% of the target catch (Table 43), thus 0.005% of total catch. This is an over exploited stock and bycatch in the yellow squat lobster south unit could represent close to half the 12 t quota in the 2015 fishery established as a non-target species for the demersal crustacean fisheries (MINECON D. Ex. No21/2014).

None of the bycatch species reached 5% of the catch and there were no P2 main bycatch species. **We do not consider species of chondrichthyes as main P2 bycatch species at the time. However future annual audits should review the situation to ensure that fishery does not pose a threat to these species and it is recommended that data are recorded on bycatch and are used to estimate removals by species and are reported routinely.**

Table 42. Bycatch Composition (% weight) Industrial Yellow Squat Lobster South Unit fishery. Species listed ≥0.5% of the total. Until 2009 data were reported for units combined. The South Unit was closed 2005-2007. Catch includes retained catch in Table 23.

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Regions	II-IV V-VI	III-IV V-VI	V-VIII	V-VIII	V-VI	V	V VII	
Bigeye flounder	2.5	1.7	2.7	2.5	0.9	1.3	1.4	1.2
Armed box crab	0.7	1.1	0.7	1.0	0.5			0.6
Lemon crab	1	0.8	0.6					0.7
#Other sp	21	20	6	12	5	5	7	12
%	2.5	1.4	0.5	1.0	0.5	0.6	0.3	0.6
Landings (t)	2867	2774	2400	2230	1302	1093	1103	931
	2600	2483						

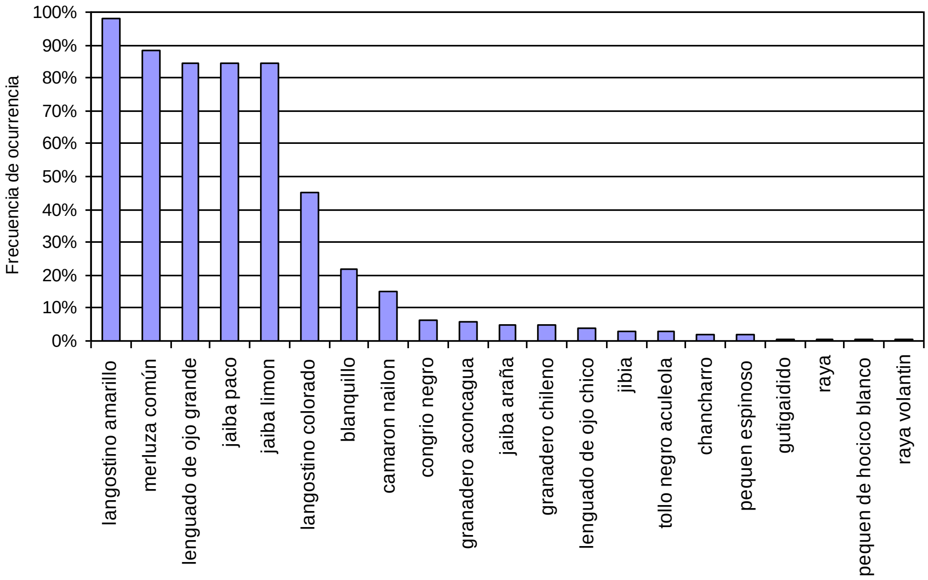
Source: Zilleruelo 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

Table 43. Non-target Catch Composition (% weight of the target) 2015 Industrial Yellow Squat Lobster Fishery in the South Unit.

Unidad Pesquería Centro Sur	langostino colorado	49	10,5%	6,1%	14,8%	2,20E-02	21%
	merluza común		2,3%	1,7%	2,9%	3,04E-03	13%
	lenguado de ojo grande		1,4%	1,2%	1,7%	1,35E-03	9%
	jaiba limon		0,8%	0,5%	1,2%	2,00E-03	24%
	jaiba paco		0,7%	0,5%	0,9%	1,10E-03	16%
	jibia		0,2%	0,0%	0,3%	7,22E-04	46%
	blanquillo		0,2%	0,1%	0,3%	5,40E-04	35%
	camaron nailon		0,2%	0,0%	0,4%	1,23E-03	80%
	granadero chileno		0,15%	0,0%	0,4%	1,10E-03	74%
	jaiba araña		0,05%	0,0%	0,1%	3,74E-04	76%
	granadero aconcagua		0,02%	0,0%	0,1%	1,76E-04	81%
	congrio negro		0,012%	0,0%	0,0%	6,05E-05	51%
	lenguado de ojo chico		0,007%	0,001%	0,013%	3,03E-05	44%
	raya volantin		0,006%	0,000%	0,016%	5,54E-05	99%
	tollo negro aculeola		0,003%	0,000%	0,008%	2,40E-05	73%
	pequen espinoso		0,002%	0,000%	0,004%	1,24E-05	71%
	chancharro		0,001%	0,000%	0,001%	3,94E-06	58%
	raya		0,000%	0,000%	0,001%	4,26E-06	101%

Sources: Zilleruelo et al 2016.

Figure 107. Frequency of Occurrence of Non-target Catch 2015 Yellow Squat Lobster Fishery in the South Unit.



Source Zilleruelo et al 2016.

Yellow Squat Lobster Artisanal Sector

Bycatch species in the artisanal yellow squat lobster fishery are assumed to be the same as in the industrial fishery in the North Fishery Unit. None of the bycatch species reached 5% of the catch and there were no P2 main bycatch species. **We do not consider species of chondrichthyes as main P2 bycatch species at the time. However future annual audits should review the situation to ensure that fishery does not pose a threat to these species and it is recommended that data are recorded for the artisanal fishery on bycatch and are used to estimate removals by species and are reported routinely.**

Red Squat Lobster

Overall

Outcome status of bycatch species is evaluated with data collected from the industrial red squat lobster fishery operating mostly in Region IV for the North Fishery Unit and in Regions V -VIII for the South Unit. The artisanal fishery is evaluated with data from the industrial red squat lobster fishery operating mostly in Region IV.

Based on data collected from the industrial fishery targeting red squat lobster in Regions III-IV (2005-2014) and in Regions V-VIII (2011-2015) there were no main bycatch species in the industrial fisheries in the North and South Units (Table 44). Based on data from the industrial fishery in Regions III-IV (2005-2014) there were no main bycatch species in the artisanal fishery.

Table 44. Red Squat Lobster Trawl Fishery: Summary of Main

Industrial		**Artisanal**
North Fishery Unit	**South Fishery Unit**	**Region IV**
-	-	-

Red Squat Lobster North Fishery Unit

Queirolo et al (2011) reported six bycatch species in the catch composition reported in the 2007-2009 red squat lobster in the northern area (Table 45). Species with highest representation was bigeye flounder with 2.9% of the catch (Figure 76). There was one Elasmobranch species.

Table 45. Species in Red Squat Lobster Fishery North Unit using the New Trawl: % hauls present. Includes retained species.

Elasmobranchs	*Halaelurus canescens*	7.7
Teleostei	*Ophichthus remiger*	11.5
	Merluccius gayi	100.0
	Hippoglossina macrops	96.2
Invertebrates	Class Gastropoda	7.7
	Platymera gaudichaudii	73.1
	Cervimunida johni	46.2
	*Pleuroncodes monodon**	100.0
	Order Decapoda	7.7
	Heterocarpus reedi	26.9

Source: Queirolo et al 2011.

IFOP reports of the fishery targeting red squat lobster in the north unit from 2005 to 2014 indicate that there were up to 11 bycatch species (Table 46). Three species contributed ≥0.5 %: of the catch: bigeye flounder, armed box crab and lemon crab. They were present in most of the hauls, 80% in 2014 (Figure 108). Species with highest representation was bigeye flounder reaching 3.8%. There were no estimates for the 2015 fishery using the new gear.

None of the bycatch species reached 5% of the catch and there were no vulnerable species considered main retained species. There were no P2 main bycatch species in the red squat lobster fishery in the North Unit.

Table 46. Bycatch Composition (% weight) in the Industrial Red Squat Lobster Fishery in the North Unit. Species represent at least 0.5% of the total. Catch includes retained catch in Table 25.

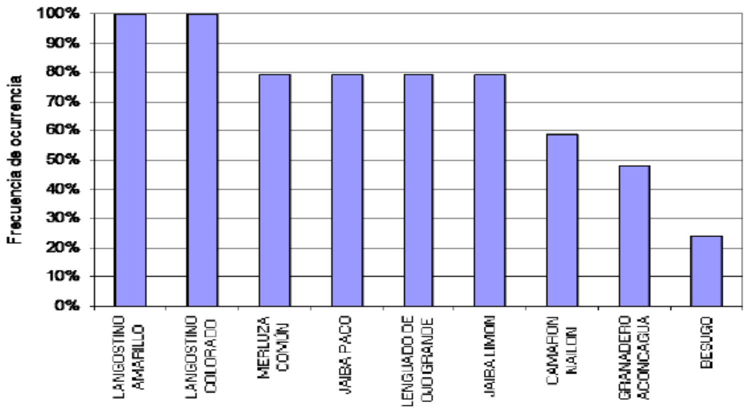
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Bigeye flounder		2.6	1.6	3.8	2.5	2.4	1.0	0.8	0.5	1.0	**No data**
Armed box crab			1.4	1.0	0.7		0.9	0.9	0.5		
Lemon crab								0.5			

#Other sp	**8**	8	7	9	4	4	2	1	-	4	
%	**4**	2.4	1.7	0.9	0.4	0.2	0.1	0.1	-	0.1	

Landing (t)	**993.4**	**842.9**	**1428**	**1115**	**684**	**805**	**987**	**1809**	**1319**	**585**	

Sources: Zilleruelo 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

Figure 108. Species Occurrence in 2014 Red Squat Lobster Fishery in the North Unit.



Source: Zilleruelo et al 2015.

Red Squat Lobster South Unit Fishery

IFOP reports on the industrial catch composition of the red squat lobster fishery in the South Unit since 2011 identified up to 20 bycatch species. Bycatch constituted <5% of the catch (Table 47). Bigeye flounder, armed box crab and lemon crab made up >0.5% of the catch. In the 2015 fishery, these three species were present in 70% of the hauls. There were six species of elasmobranchs; highest catch was of smallthorn sandskate (*Psammobatis rudis*) representing 0.01% of the target catch (Table 48). Yellownose skate constituted about 0.0018% of the catch and was present in < 0.1% of the hauls (Figure 109). This is an overexploited stock and, depending on final estimates for the 2015 fishery, bycatch in the red squat lobster South Unit alone could represent over the 12 t established as non-target quota for demersal crustacean fisheries in Regions IV to 41º28.6'S (MINECOM D Ex Nº21/2014). Composition of the catch in 2015 using the new gear was similar to previous years.

None of the bycatch species reached 5% and there were no main P2 bycatch species. Although elasmobranchs are vulnerable taxa, species constituted a small fraction of the catch and were not considered as P2 main bycatch species. However future annual audits should review the situation, in particular for yellownose skate, to ensure that the fishery does not pose a threat to these species and it is recommended that data are recorded and used to estimate removals by species and are reported routinely.

Table 47. Bycatch Composition (% weight) in Industrial Red Squat Lobster Fishery in the South Unit. Species listed ≤0.5% of the total. Catch includes retained catch in Table 26.

	2011	2012	2013	2014	2015
Bigeye flounder	0.9	1.1	1.7	1.1	0.8
Armed box crab		0.5	1.0		0.8
Lemon crab		0.5	1.0		1.1
#other	10	7	5	14	13
%	1.2	0.3	1	0.9	1
Landing (t)	**3477**	**4618**	**6813**	**6972**	**4541**

Source: Zilleruelo et al 2012, 2013, 2014, 2015, 2016.

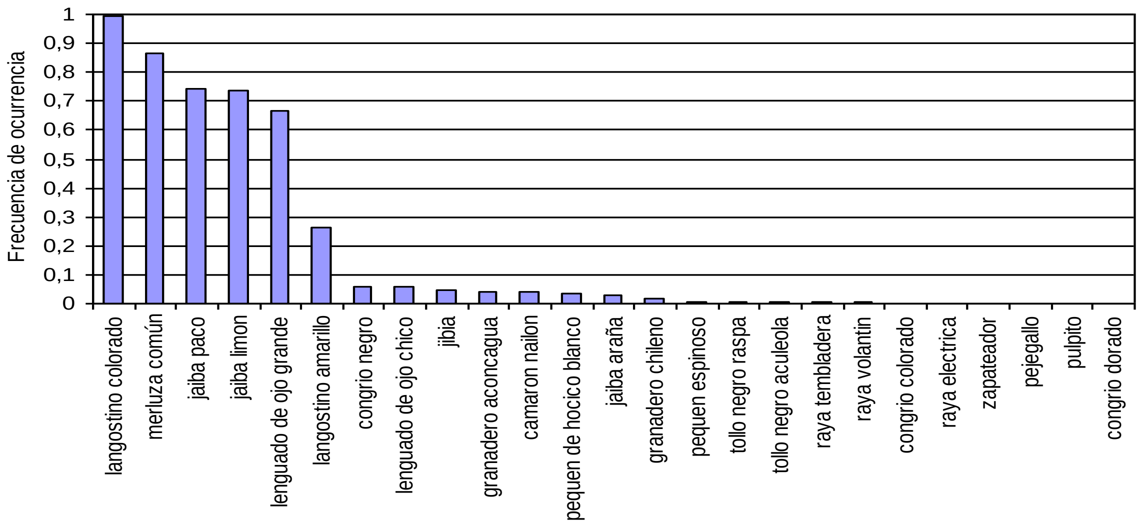
***2015 data are preliminary; landings are for the fishery between March and August.**

Table 48. Non-target Catch Composition (% weight of the target) in 2015 Industrial Red Squat Lobster Fishery in the South Unit.

	NOMBRE_ESPECIE	n lances	R	Rinf	Rsup	STD_ERR	COEF_VAR
Unidad Pesquería Centro Sur	merluza común	140	4,9%	4,2%	5,6%	3,63E-03	7%
	langostino amarillo		2,8%	1,2%	4,4%	8,14E-03	29%
	jaiba limon		1,2%	0,8%	1,6%	2,02E-03	17%
	lenguado de ojo grande		0,85%	0,68%	1,02%	8,84E-04	10%
	jaiba paco		0,84%	0,63%	1,06%	1,10E-03	13%
	lenguado de ojo chico		0,14%	0,07%	0,22%	3,68E-04	26%
	congrio negro		0,06%	0,00%	0,14%	4,21E-04	69%
	jibia		0,04%	0,01%	0,07%	1,66E-04	40%
	camaron nailon		0,02%	0,00%	0,05%	1,51E-04	68%
	pequen de hocico blanco		0,01%	0,00%	0,03%	6,53E-05	46%
	jaiba araña		0,01%	0,00%	0,03%	8,97E-05	65%
	granadero aconcagua		0,011%	0,000%	0,026%	7,65E-05	67%
	raya electrica		0,006%	0,000%	0,017%	5,81E-05	100%
	raya tembladera		0,002%	0,000%	0,007%	2,33E-05	100%
	raya volantin		0,002%	0,000%	0,006%	2,09E-05	100%
	granadero chileno		0,002%	0,000%	0,004%	1,47E-05	90%
	pequen espinoso		0,001%	0,000%	0,001%	4,13E-06	71%
	tollo negro raspa		0,001%	0,000%	0,002%	5,84E-06	101%

Source Zilleruelo et al 2016.

Figure 109. Frequency of Species Occurrence in 2015 Red Squat Lobster Fishery in the South Unit.



Source: Zilleruelo et al 2016.

Red Squat Lobster Artisanal

Bycatch species in the artisanal yellow squat lobster fishery are assumed to be the same as in the industrial fishery in the North Fishery Unit. None of the species reached 5% of the catch and there are no vulnerable species considered main. There were no P2 main bycatch species. Although elasmobranchs are vulnerable taxa, species constituted a small fraction of the catch and were not considered as P2 main bycatch species. However future annual audits should review the situation to ensure that the fishery does not pose a threat to these species and it is recommended that data are recorded in the artisanal fisheries and used to estimate removals by species and are reported routinely.

3.4.3.4 Bycatch species management

There are different management strategies for what the Chilean law defines as discarding and as incidental catch of species such as reptiles, birds, and mammals. In this assessment bycatch species are those discarded while incidental catch of reptiles, birds and mammals are evaluated under ETP species.

Discards are illegal since 2002. The law that will regulate discards was signed on September 26th 2012 (MINECON Nº20.625 2012). LGPA incorporates discards regulations in Title II Paragraph 1º Bis. Before enactment of the law, discards were not monitored. The law calls for a research program to gather information to design a plan to reduce discards of target species (especie objetivo) and non-target species (fauna acompañante) and incidental catch (pesca incidental). The law indicates that the program should consider at least gathering of fishery data collected by scientific observers designated by SUBPESCA.

Article 7ºA gives authority to SUBPESCA to approve research for a plan to reduce bycatch within a period of three years. R.Ex.Nº882/2013 established that program for demersal crustacean fisheries. Accordingly, SUBPESCA charged IFOP to initiate monitoring discards of fishing fleets through observers on board. Research will identify causes of discards and quantify target and non-target species and discards. Using program results SUBPESCA will establish a discard reduction plan including administration measures and technological improvements, a monitoring plan, evaluation of measures and an education program. The plan will also consider a good practice code (Codigo de Buenas Prácticas) and provide incentives to improve fishing gear to minimize bycatch. During the site visit the CAB was made aware of experimentation for such improvements conducted by members of the AIP (Association de Industriales Pesqueros de la IV Region).

Article 7ºB prohibits discards of target and non-target species unless a) sufficient technical information has been recorded according to the project previously described, b) the research project has been conducted, c) global catch quota for target species is established, d) global quota considers discards, and f) discards do not affect species conservation. SUBPESCA will annually establish a list of target and non-target species that should comply with requirements.

Article 63 establishes that fishers will have to report discards. Article 64 E, F establishes mandatory video equipment (cameras or EMS) to monitor fishing operations, and provides sanctions for non-compliance. Cameras will be required for industrial and artisanal vessels > 15m. These would be installed to detect and register onboard discard activities. The law also establishes control measures and sanctions. Regulations and sanctions are not yet in place.

LGPA establishes objectives in relationship with non-target species. One is to apply the ecosystem approach to administer conservation of fishery resources and protect ecosystems, understanding that relationships among predominant species are considered. Other objectives are to consider impact of fisheries on non-target species in the fishery, preservation of aquatic environments, and to minimize discards of target and non-target species and incidental catch.

It can be considered that limited entry, gear restrictions, closed seasons and areas are measures to manage bycatch in demersal crustacean fisheries. Trawl gear characteristics are regulated by R. Ex. Nº762/2013 and R. Ex. Nº145/2015.

A partial strategy to manage bycatch includes the mandatory use of the modified trawl with net features designed to allow non-target fish species to escape unharmed (Dispositivo de escape de Fauna Acompañante) that would reduce bycatch for example of grenadiers and chondrichthyes.

There are no personnel on board fishing vessels to enforce regulations. The law is explicit in that scientific observers will not act as enforcement personnel.

3.4.3.5 Information & Monitoring

Information on bycatch in the three demersal crustacean fisheries in this assessment can be obtained from catch composition monitored by IFOP, similar to information on retained species. There are IFOP annual fishery assessments that cover all demersal crustacean fisheries. Although estimates of discards are missing, in principle catch composition data monitored by IFOP provide information on bycatch as species of non-commercial value are discarded. But information is incomplete because discards also occur before catch is taken on deck. These “failed” tows are recorded but not reported in annual assessments. Thus, it is not possible to fully evaluate significance of bycatch species removals from fisheries.

Information on discards was recorded by IFOP observers for the 2005 industrial fisheries as part of the annual monitoring of demersal crustacean fisheries (Zilleruelo et al 2006). The program was to quantify discards of species of commercial value and does not provide information to assess P2 bycatch species.

Starting in 2013 there is a mandatory research program to quantify bycatch in demersal crustacean fisheries (i.e. discards and incidental catch). R. Ex. Nº882/2013 (Programa de Investigación del Descarte y Pesca Incidental) authorized a research program for industrial fisheries: a) Nylon shrimp Regions II–VIII, b) Yellow squat lobster Regions III-IV, c) Yellow squat lobster Regions V-VIII, d) Red squat lobster Regions XV-IV, and e) Red squat lobster Regions V-VIII. Overall, there are 11 trawl fisheries that are required to participate in the monitoring program with an investment of over $400 million Chilean pesos. Information from the bycatch and discard monitoring program will be officially available in April 2016 according to SUBSPESCA during site visit meetings. Thus, there were no data available on discards for this assessment but analysis is in process

3.4.4. Endangered, Threatened & Protected Species

3.4.4.1. Introduction

Endangered, threatened or protected (ETP) species are those recognized by national legislation or binding international agreements (e.g. Appendix 1 of the Convention on International Trade in Endangered Species CITES), to which the jurisdictions controlling the fishery under assessment are party (MSC, 2013). Species listed under Appendix 1 are included unless it can be shown that the particular stock of the CITES listed species impacted by the fishery under assessment is not endangered. Any other species which have interactions with the fishery are assessed under retained bycatch and discarded bycatch. Impacts may be direct (i.e. through catch) or indirect (e.g. effect of ghost fishing or through collisions with boats and gear).

3.4.4.2. Background

Chile is signatory of CITES, the International Convention for Regulation of Whale Hunting, and the Convention on the Conservation of Migratory Species. An amendment to LGPA (Law Nº20.293) was made in October 2008 to prohibit the killing, hunting, pursuing, possessing, transporting, landing, slaughtering or carrying any species of cetacean within Chilean waters. The amendment and associated regulations appear to be similar to legislation elsewhere in the world to protect marine mammals. As such, trade and impacts of all species under these treaties are regulated by SERNAPESCA, through Decree Nº179. Seabirds are protected by CITES (D.L. N°873, 14/02/1975), the Convention for Protection of Flora, Fauna and Scenic treasures of America (D.S. N°531, 04/10/1967), the Bonn convention of migratory species (D.S. N°868, 12/12/1981), and the National Plan to protect bycatch of marine birds with longline gear (PAN–AM Chile). Law Nº20.293 established regulations for protection, rescue, rehabilitation, reinsertion, observation and monitoring of marine mammals, reptiles and birds. Five MPAs are to protect penguins *(Spheniscus magellanicus, S. humboldti)*, among other species found in coastal areas. Among those, *S. humboldti* is found in the demersal crustacean fishing area but has not been reported as incidental bycatch. There are 98 CITES species currently cited for the Chilean marine territory (Table 49).

Table 49. CITES: Species Listed (Appendices Listing I, II or III) found in Chilean Waters

Family	Scientific Name	Common Name	Listing
Mammals			
Mustelidae	*Lontra felina*	Marine Otter	I
Otariidae	*Arctocephalus australis*	South American Fur Seal	II
Otariidae	*Arctocephalus gazella*	Antarctic Fur Seal	II
Otariidae	*Arctocephalus philippii*	Juan Fernandez Fur Seal	II
Otariidae	*Arctocephalus tropicalis*	Sub-Antarctic Fur Seal	II
Phocidae	*Mirounga leonina*	Southern Elephant Seal	II
Balaenidae	*Eubalaena australis*	Southern Right Whale	I
Balaenopteridae	*Balaenoptera acutorostrata*	Common Mink Whale	I/II
Balaenopteridae	*Balaenoptera bonaerensis*	Southern Mink Whale	I
Balaenopteridae	*Balaenoptera borealis*	Coalfish Whale	I
Balaenopteridae	*Balaenoptera edeni*	Bryde's Whale	I
Balaenopteridae	*Balaenoptera musculus*	Blue Whale	I
Balaenopteridae	*Balaenoptera physalus*	Common Rorqual	I
Balaenopteridae	*Megaptera novaeangliae*	Humpback Whale	I

Family	Scientific Name	Common Name	Listing
Delphinidae	*Cephalorhynchus commersonii*	Commerson's dolphin	II
Delphinidae	*Cephalorhynchus eutropia*	Black dolphin	II
Delphinidae	*Delphinus capensis*	Long-beaked Common Dolphin	II
Delphinidae	*Delphinus delphis*	Pacific Dolphin	II
Delphinidae	*Globicephala macrorhynchus*	Pacific Pilot Whale	II
Delphinidae	*Globicephala melas*	Long-finned Pilot Whale	II
Delphinidae	*Grampus griseus*	Grey Dolphin	II
Delphinidae	*Lagenorhynchus australis*	Blackchin Dolphin	II
Delphinidae	*Lagenorhynchus cruciger*	Hourglass Dolphin	II
Delphinidae	*Lagenorhynchus obscurus*	Dusky Dolphin	II
Delphinidae	*Lissodelphis peronii*	Southern Right Whale	II
Delphinidae	*Orcinus orca*	Killer Whale	II
Delphinidae	*Pseudorca crassidens*	False Killerwhale	II
Delphinidae	*Stenella attenuata*	Bridled Dolphin	II
Delphinidae	*Stenella coeruleoalba*	Stripe Dolphin	II
Delphinidae	*Stenella longirostris*	Lon-beaked Dolphin	II
Delphinidae	*Steno bredanensis*	Rough-toothed Dolphin	II
Delphinidae	*Tursiops truncatus*	Bottlenose Dolphin	II
Neobalaenidae	*Caperea marginata*	Pygmy Sperm Whale	I
Phocoenidae	*Phocoena dioptrica*	Spectacled Porpoise	II
Phocoenidae	*Phocoena spinipinnis*	Black Porpoise	II
Physeteridae	*Kogia breviceps*	Pygmy Sperm Whale	II
Physeteridae	*Kogia sima*	Dwarf Sperm Whale	II
Physeteridae	*Physeter macrocephalus*	Sperm Whale	I
Ziphiidae	*Berardius arnuxii*	Arnoux's Beaked Whale	I
Ziphiidae	*Hyperoodon planifrons*	Southern Bottlenose Whale	I
Ziphiidae	*Mesoplodon densirostris*	Blainville's Beaked Whale	II

Family	Scientific Name	Common Name	Listing
Ziphiidae	*Mesoplodon grayi*	Gray's Beaked Whale	II
Ziphiidae	*Mesoplodon hectori*	Hectors' Beaked Whale	II
Ziphiidae	*Mesoplodon layardii*	Strap-toothed Whale	II
Ziphiidae	*Mesoplodon traversii*	Spade-toothed Whale	II
Ziphiidae	*Tasmacetus shepherdi*	Shepherd's Beaked Whale	II
Ziphiidae	*Ziphius cavirostris*	Goose-beaked Whale	II
Birds			
Spheniscidae	*Spheniscus humboldti*	Humboldt Penguin	I
Reptiles			
Cheloniidae	*Caretta caretta*	Loggerhead Turtle	I
Cheloniidae	*Chelonia mydas*	Green Turtle	I
Cheloniidae	*Lepidochelys olivacea*	Olive Ridley Turtle	I
Dermochelyidae	*Dermochelys coriacea*	Leatherback Turtle	I
Sharks			
Sphyrnidae	*Sphyrna zygaena*	Smooth hammerhead shark	II
Cetorhinidae	*Cetorhinus maximus*	Baskin Shark	II
Lamnidae	*Carcharodon carcharias*	Great White Shark	II
Lamnidae	*Lamna nasus*	Porbeagle Shark	II
Rhincodontidae	*Rhincodon typus*	Whale Shark	II
Fish			
Syngnathidae	*Hippocampus ingens*	Giant Seahorse	II
Cnidaria			
Antipathidae	*Antipathes assimilis*	Black Coral	II
Antipathidae	*Antipathes minor*	Black Coral	II
Antipathidae	*Antipathes speciosa*	Black Coral	II
Myriopathidae	*Plumapathes fernandezii*	Black Coral	II
Schizopathidae	*Bathypathes patula*	Extended Black Coral	II

Family	Scientific Name	Common Name	Listing
Stylopathidae	*Tylopathes contorta*	Black Coral	II
Stylopathidae	*Tylopathes crispa*	Black Coral	II
Agariciidae	*Leptoseris solida*	Stony Coral	II
Caryophylliidae	*Bathycyathus chilensis*	Stony Coral	II
Caryophylliidae	*Caryophyllia diomedeae*	Stony Coral	II
Caryophylliidae	*Caryophyllia huinayensis*	Stony Coral	II
Caryophylliidae	*Caryophyllia smithii*	Devonshire cup Coral	II
Caryophylliidae	*Caryophyllia squiresi*	Devonshire cup Coral	II
Caryophylliidae	*Deltocyathus parvulus*	Devonshire cup Coral	II
Caryophylliidae	*Desmophyllum dianthus*	Cockscomb Cup Coral	II
Caryophylliidae	*Solenosmilia variabilis*	Stony Coral	II
Caryophylliidae	*Tethocyathus endesa*	Stony Coral	II
Dendrophylliidae	*Balanophyllia malouinensis*	Stony Coral	II
Faviidae	*Leptastrea purpurea*	Stony Coral	II
Flabellidae	*Flabellum apertum*	Stony Coral	II
Flabellidae	*Flabellum curvatum*	Stony Coral	II
Flabellidae	*Javania cailleti*	Caillt's Fan Coral	II
Flabellidae	*Truncatoflabellum truncum*	Stony Coral	II
Fungiacyathidae	*Fungiacyathus marenzelleri*	Stony Coral	II
Fungiacyathidae	*Fungiacyathus pliciseptus*	Stony Coral	II
Fungiacyathidae	*Fungiacyathus pseudostephanus*	Stony Coral	II
Fungiidae	*Fungia vaughani*	Stony Coral	II
Micrabaciidae	*Leptopenus hypocoelus*	Stony Coral	II
Oculinidae	*Bathelia candida*	Stony Coral	II
Oculinidae	*Madrepora oculata*	Stony Coral	II
Pocilloporidae	*Pocillopora damicornis*	Cauliflower Coral	II
Pocilloporidae	*Pocillopora danae*	Stony Coral	II

Family	Scientific Name	Common Name	Listing
Pocilloporidae	*Pocillopora verrucosa*	Stony Coral	II
Poritidae	*Porites lobata*	Stony Coral	II
Rhizangiidae	*Culicia stellata*	Stony Coral	II
Turbinoliidae	*Sphenotrochus gardineri*	Organ Pipe Corals	II
Stylasteridae	*Adelopora pseudothyron*	Lace Corals	II
Stylasteridae	*Cheiloporidion pulvinatum*	Lace Corals	II
Stylasteridae	*Errina antarctica*	Lace Corals	II
Stylasteridae	*Stylaster densicaulis*	Lace Corals	II

Source: Downloaded from CITES website 02/10/2016

3.4.4.3. Outcome

Five main taxa are considered in this ETP section: corals, turtles, birds, sharks, and mammals. There is no evidence that demersal crustacean fisheries impact CITES species.

Corals

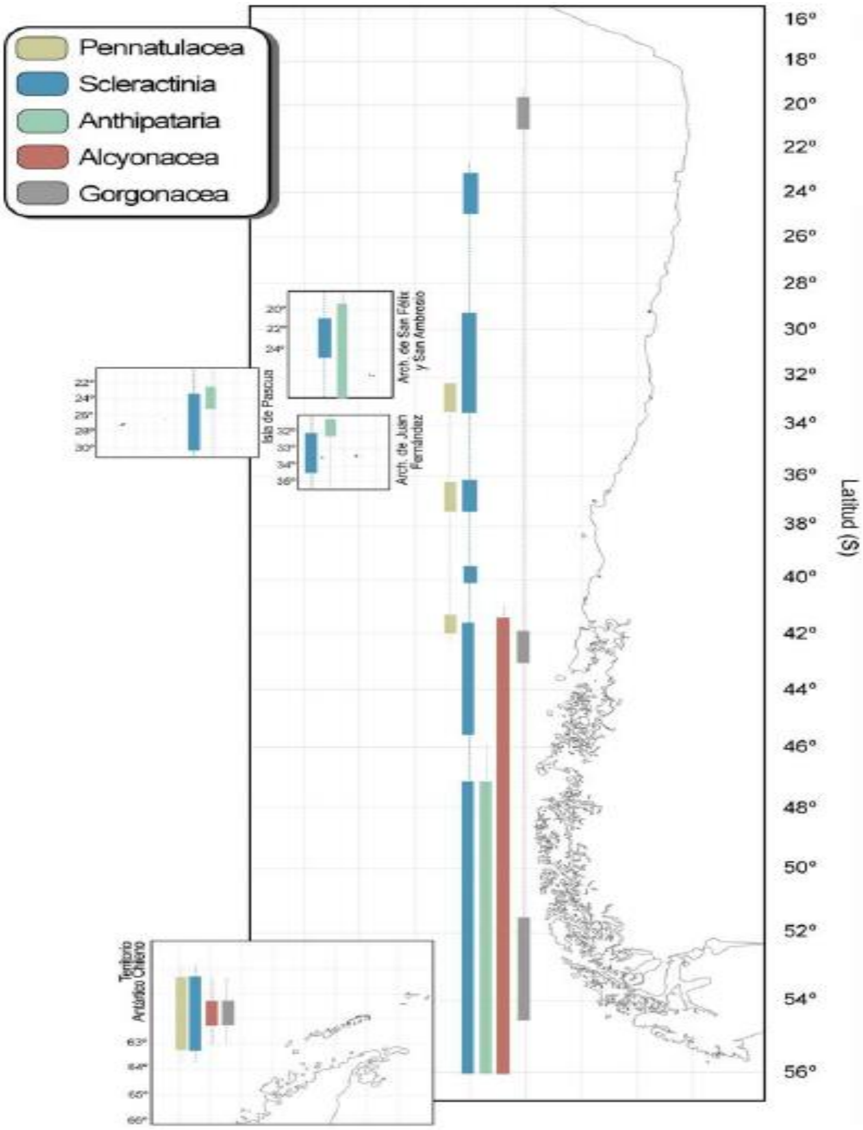
Most recent study on coral distribution in Chile is from a project FIP 2005-61 conducted by Melo et al (2007). A review revealed 110 species reported for Chile. There are no reports of coral reefs in the area of demersal crustacean fisheries. Nevertheless, there are many cold-water coral species along fishery operation areas; several listed as endangered. Most of main coral taxa though are distributed south from the demersal crustacean fishery unit areas (Figure 110). Reports of corals within the latitudinal extent of fisheries are from species mostly distributed deeper than where fisheries are conducted.

The FIP study included a survey during industrial trawling operations targeting demersal crustaceans and Chilean hake between Regions III and X. Corals were identified in 46 samples. Samples were collected with a dredge and also a trap attached to the trawl. Dredge samples are representative of species found in the seafloor top layers, and trap samples are representative of species disturbed by the trawl gear but not always retained. 17 coral species were found: *Antipathes speciosa*, Bathycyathus *chilensis, Thowarella sp, Callogorgia sp,* and *Acanthogorgia sp* collected by trap; *Anthomastus sp, Swiftia sp, Paragorgia sp, Clavularia sp*, *Alcyonium sp, Halipteris sp,* Chrysogorgiidae and Gorgonacea taxa collected with both trap and dredge; and *Renilla chilensis, Balticina sp* collected with dredge only. Bathymetric range varied between 241 and 467 m, but most were found between 401 and 467 m. Most species were found south of demersal crustacean fishery units (Table 50). *B. chilensis* and *A. speciosa* are CITES species (Table 49); the first was found within the area of fishery operations and the second south of it (Table 50).

The FIP study provided photographs representative of communities in the study area showing a variety of organisms including large coral structures, probably Alcyoniidae species; soft corals that form coral fields. High proportion of stations where corals were found (35%) suggests they are ubiquitous within demersal crustacean fishery areas. There were also observations of complex communities and higher incidence of corals (soft, hard, and black corals) in the deeper range of the study area (400 – 500 m), where fishing pressure is lower.

There are 40 CITES coral species listed for Chile (Table 49) including *Tethocyathus endesa* which was reported off Concepción (~37°S) and *B. chilensis* off Papudo (Cairns et al 2005 as reported by Melo et al 2007). Thus, there is potential for unobserved mortality on CITES coral species.

Figure 110: Distribution of Main Coral Taxa Found in Chile



Source: Melo et al 2007.

Interactions. There are no reports of fishery interactions with ETP coral species recorded in IFOP reports of the demersal crustacean fisheries (Table 18). Coral were recorded during the 2007 FIP Melo study and there is potential indirect mortality imposed. Melo et al (2007) noted the importance of identifying where patches of cold-water corals are located and the need to create protected areas.

During the site visit there were statements made by several stakeholders that demersal crustacean trawl fisheries do not cause negative effects on corals, and that even when in the past corals could have been distributed within the path of the fisheries they would have disappeared with years of fishing pressure in same locations. Most recent available information from the 2007 FIP study points out that there are corals in the area of operation of the fisheries and thus there is potential for further negative effects of the fishery on corals.

The information is insufficient to make statements about the magnitude. Nevertheless, effects of the fishery on coral species are highly likely to be within limits of national and international requirements for protection of ETP species given the reduced spatial overlap. This is because corals are generally found in deep waters, suggesting that degree of interaction is limited and potentially higher for the nylon shrimp fishery than for the squat lobster fisheries.

We selected *Tethocyathus endesa* and *Bathycyathus chilensis* as ETP species for this assessment based on the information available, in particular on the work by Melo et al (2007) reporting coral species in the operational area of crustacean fisheries. There is no other evidence that fisheries impact these species since they are not reported within IFOP monitoring of catch composition.

Table 50. Coral Species Distribution IV to IX Regions (Zones 1-2= IV; 3=V; 4=VI; 5=VII; 6-7=VIII; 8=IX). FIP Nº2005-61

Orden	Familia/Especie	Profundidad	Zonas 1	2	3	4	5	6	7	8	Observaciones
Scleractinia											
	Caryophylliidae										
	Bathycyathus chilensis	464								x	Isla Robinson Crusoe, Papudo (Cairns *et al*., 2005)
Alcyonacea											
	Alcyoniidae										
	Anthomastus sp.	241-458			x		x	x	x	x	Coquimbo; Los Vilos, Zapallar (Andrade, 1987)
	Alcyoniidae sp A	250-362	x			x	x				Todos en Magallanes
	Alcyoniidae sp B	356	x								Todos en Magallanes
	Clavulariidae										
	Clavularia sp A	445-467	x	x			x				Magallanes (Ofwegen *et al*., 2006)
	Clavularia sp B	290-460								x	Magallanes (Ofwegen *et al*., 2006)
Gorgonacea											
	Acanthogorgiidae										
	Acanthogorgia sp.	461								x	Baral Monte Submarino (Parin *et al*., 1997)
	Chrysogorgiidae										
	Chrysogorgiidae	464								x	Magallanes (Moyano, 1995)
	Paramuriceidae										
	Swiftia sp.	352-467				x	x	x		x	Coquimbo, Papudo (Andrade, 1987)
	Paragorgiidae										
	Paragorgia sp.	447				x					Provincia Peruviana (Bravo *et al*., 2005)
	Primnoidae										
	Callogorgia sp.	464								x	No hay reportes en la literatura
	Thouarella sp.	461								x	Provincia Peruviana y Magallanica (Cairns, 2006)
	Gorgonacea sp A	262-448				x		x			
	Gorgonacea sp B	445	x	x	x						
Pennatulacea											
	Renillidae										
	Renilla chilensis	464								x	Frente a Valparaiso (Perez & Zamponi, 1999)
	Virgulariidae										
	Halipteris sp.	445	x								Coquimbo, Los Vilos, Papudo (Andrade, 1987)
Ceriantipatharia											
	Antipathidae										
	Antipathes speciosa	464								x	Magallanes (Brook, 1889)

Source: Melo et al 2007.

Management strategy. Coral ETP species are protected by CITES. Other measures that apply to management of corals in the demersal crustacean fisheries are limited entry to the fisheries, gear restrictions, and closed areas. Trawl gear characteristics are regulated by R.Ex. Nº762/2013 and R. Ex. Nº145/2015. The new trawl is lighter than the old trawl to address concerns of effects from gear contact with the seafloor. Further, LGPA Title II Art. 6 A) indicates that the Ministry (MINECOM) should establish geographical areas under a fishery administration regime of Vulnerable Marine Ecosystem (VME) when presence of invertebrates or geological structures is verified that qualifies the area as VME. Under such a regime, trawling and use of gear that can affect the ecosystem is prohibited. Art. 6 B) indicates that

SUBPESCA with information provided by CCTs will establish a list of species for which its fishery can affect VMEs and regulations will apply to those fisheries.

LGPA also establishes objectives to apply an ecosystem approach to administer conservation of fishery resources and protect ecosystems, among which is to consider impact of fisheries on non-target species, preservation of aquatic environments, and minimizing incidental catch, including corals.

Turtles

Four CITES species of turtles are found in the operational area of the fishery: loggerhead turtle (*Caretta caretta*), Olive Ridley turtle (*Lepidochelys olivacea*), green turtle (*Chelonia mydas*) and leatherback turtle (*Dermochelys coriacea*).

Interactions. There are no records of turtles captured in any of the crustacean demersal trawl fisheries and no interactions are expected.

Management strategy. Law Nº 20.293 (2008) establishes regulations for protection, rescue, rehabilitation, reinsertion, observation and monitoring of marine mammals, reptiles and birds. Trade and impacts of all species under this treaty are regulated by SERNAPESCA through Decree Nº179.

Marine mammals

There are 41 CITES species of marine mammals listed for Chilean waters including four species of otaridae (seals). Only one otaridae species, sea lion (*Otaria flavescens)* is known to be present in the area of the demersal crustacean fisheries with potential to interact with the gear. It is not a CITES species. The species is considered of least concern regarding conservation status.

Interactions. IFOP observers have not reported interactions of marine mammals in the demersal crustacean fisheries in annual reports of monitoring of the fisheries.

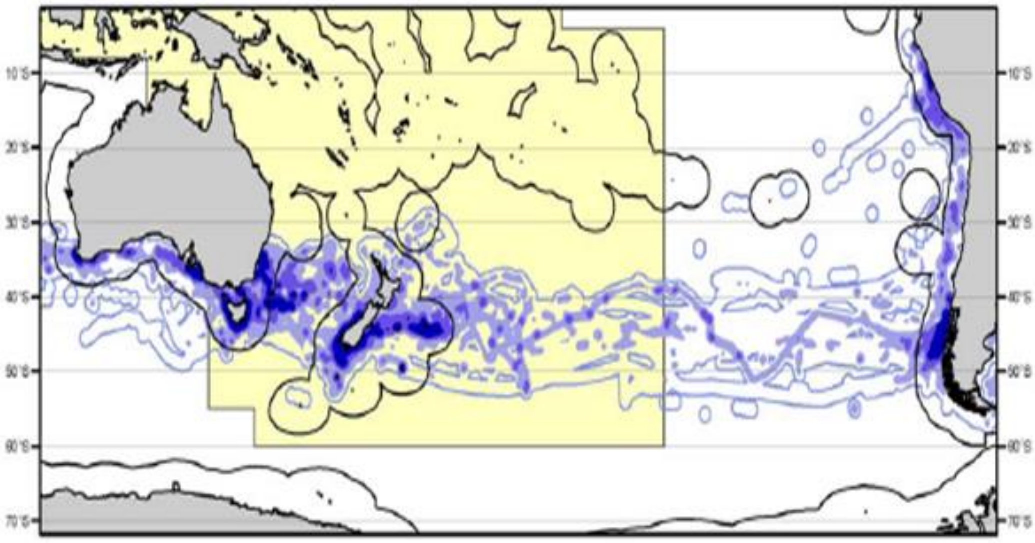
Management strategy. Decrees Nº225 (1995) and Nº135 (2005) established a ban on fishing for marine mammals for 30 years. In 2006, Decrees Nº179 and Nº230 prohibited catch and retention of 43 species of cetaceans. Law Nº 20.293 (2008) declares the maritime spaces of national sovereignty and jurisdiction, as zones free of cetaceans hunting which would take place only for purposes foreseen in the law. It also established regulations for protection, rescue, rehabilitation, reinsertion, observation and monitoring of marine mammals, reptiles and birds. Trade and impacts of all species under this treaty are regulated by SERNAPESCA through Decree Nº179. Law 20.293 (2008) establishes that fishing vessels should have a contingency plan in case of collision, damage or accidental catch of a cetacean.

Seabirds

130 species of birds have been identified as inhabiting marine areas in Chile (Iriarte 1999). There is one CITES species of marine bird listed: the Humboldt penguin (*Spheniscus humboldti)* found in the area of distribution of the crustacean demersal fisheries. The largest colonies occur between 25ºS and 29ºS and two main areas of abundance are between 25ºS and 33ºS (Vianna et al 2014). Individuals are able to move large distances from their colonies and one of the primary threats cited for this species is mortality caused by entanglement in gillnet and purse seine artisanal fisheries within the 5 nm artisanal reserve. There are no reports of species interactions with demersal crustacean fisheries.

There are 16 species of birds classified as Vulnerable, Near Threatened or Endangered (based on IUCN conservation status) that have potential interactions with trawl fisheries (Cabezas and Suazo 2012). None of these is a CITES species although distributions overlap (Figure 111) with demersal crustacean fisheries.

Figure 111: Distribution of Seven Species of Albatross and Petrel during Foraging Period



Source: Cabezas and Suazo 2011.

In 2001, Chile started a process of expert consultation through the Fisheries Research Fund (FIP), which generated participation in the diagnosis of seabird mortality levels and the development of PAN-AM/Chile. In 2011 SUBPESCA created a National Scientific Committee for Biodiversity–Seabirds (Comité Científico Nacional de Biodiversidad–Aves Marinas; CCNB-AM) to support conservation status.

IFOP conducts routine monitoring of bird interactions in several fisheries. Also, information on seabird interactions with fisheries is available from several FIP projects (FIP 2003-21, FIP 2006-30). Information concerns interactions with longline fisheries and industrial demersal trawl fisheries. The Albatross Task Force in Chile is also collaborating with IFOP to facilitate a wider collection of seabird mortality data by observers. A review by Suazo et al (2016) provides summaries of interactions of seabirds with Chilean fisheries: demersal crustacean fisheries are not among those trawl fisheries listed as interacting with birds. This is all the information that is available on potential interactions of Chilean fisheries with seabirds. Absence of any study on the demersal crustacean trawl fisheries does not mean there is no interaction but the assessment team considered that if there was an issue with the crustacean fisheries, then there would be some information published on the subject.

Management strategy***.*** Seabirds are protected by CITES (D.L. N° 873,14/02/1975), the Convention for Protection of Flora, Fauna and Scenic treasures of America (D.S. N° 531, 04/10/1967), the Bonn convention of migratory species (D.S. N° 868, 12/12/1981), and the National Plan to protect bycatch of marine birds with longline gear (PAN–AM Chile). Law Nº 20.293 (2008) established regulations for the protection, rescue, rehabilitation, reinsertion, observation and monitoring of marine mammals, reptiles and birds. Five MPAs are to protect penguins *(S. humboldti, S. magellanicus.)*, among other species found in coastal areas. For the Humboldt Penguin, there is a 30-year moratorium from 1995 on hunting and capture, and the four major colonies (not including intertidal and marine areas) are protected (Vilina et al. 1995, Cheney 1998). The current law requires marine mammals, reptiles, penguins and other marine birds, to be returned to sea unless severely damaged, in which case they will have to be taken to a rehabilitation center.

Sharks

There are five species of sharks in Chilean waters listed in CITES (Table 36). Reports from the 1990s indicate findings of 51 species of sharks and 37 species of rays (Pequeño 1989, Pequeño & Lamilla 1997). Currently, there are 92 Chondrichthyes species described for Chile (Lamilla et al 2005), 54 in territorial waters and 39 that interact with fisheries (Lamilla et al 2008). Between 2004 and 2008 there were 12 species identified as fishery targets. Annual fishery reports record catches of 10 species. Catch statistics on sharks and rays suffer from a lack of clarity of their taxonomy. Pequeño & Lamilla (1997) noted that there are constraints for adequate management of the group because there is no clear taxonomic classification of species in commercial catches, biology of the species is practically unknown, and there is a market driven incentive to increase catch. There are no estimates of shark (and rays) mortality for the demersal crustacean fisheries.

Interactions. Numerous species of chondrichthyes (sharks, rays and chimaera) have been reported in the catch composition of the three demersal crustacean fisheries by the IFOP Observer Program (Zilleruelo et al 2006 to 2015). None of the CITES species has been recorded. Further, CITES species have not been cited in studies of bycatch in the fisheries (Párraga et al 2012 among others) or studies of distribution of cartilaginous fishes in the area of the fishery (Bustamante et al 2014).

Management strategy***.*** The law prohibits finning of chondrichthyes. A guide to identify species in the catch of Chilean fisheries designed for scientific observers, fishers and the general public was recently completed which includes the species in demersal crustacean fisheries. The guide includes facts sheets with information to easily identify species. The guide will help alleviate issues that prevent full evaluation of the species affected by fisheries and serve as an educational tool to raise awareness of conservation status of the species.

Other measures to protect ETPs

Supreme Decree Nº408/1986 and its modifications prohibits fishing within the 1 nm from the coast and an imaginary line situated 1 nm inshore that stretches from the northern maritime border of Chile and parallel 41ºS, including bays and other protected areas. There is also a 5 nm Artisanal Reserve Area where trawling is not allowed (except in Region IV where demersal crustacean fisheries are allowed).

There are five marine protected areas (MPAs) along the Chilean coast but these do not overlap with the operational area of the demersal crustacean fishery. There are marine reserves in Isla Choros-Damas (Region IV) and Putemun and Pullinque (Region X). MPAs are to protect near shore resources such as oyster, scallops and mussels, and vertebrates such as the marine otter, dolphins *(Tursiops truncatus*), penguins *(S. magellanicus, S. humboldti)*, whales (*Megaptera novaeangliae*) and the sea lion.

3.4.5 Habitat

3.4.5.1. Introduction

Under this component the concept of ‘serious or irreversible harm’ refers to change caused by fisheries that fundamentally alters capacity of habitat to maintain its function or to recover from impact (MSC, 2013). The habitat component is assessed in relation to impacts on structure and role of habitats. Usually habitats impacted are bottom habitats rather than pelagic habitats, which would be the case in the nylon shrimp and yellow and red squat lobster fisheries.

3.4.5.2. Overview

Background information presented applies to nylon shrimp, yellow squat lobster, and red squat lobster fisheries as they overlap in distribution and use the same bottom trawl gear.

Impacts of trawling depend on type of substrate trawled and degree of contact with the seafloor. Area impacted by fishing is a function of width of the trawl and distance towed. According to FAO (2007) when bottom trawl gear is used on sandy seabed impacts can be minimal; otter boards scar the seabed and trawl sweeps only smooth the seabed removing small seafloor forms that are regenerated in a relatively short time period. However, when used on hard, gravel, cobble, and boulder substrates, trawls will roll-over larger rocks, and scrape off attached, emergent, epibenthic organisms including sponges and corals. Impacts of bottom trawling depend also on gear design, how the gear is operated, and fishing intensity.

Distributions of the demersal crustacean populations are associated with substrate types and Equatorial Sub-superficial (AESS) and Intermediate Antarctic Water (AIA) (Melo et al 2007). The area where the fisheries operate off Central Chile is influenced by the Humboldt Current and is a typical upwelling ecosystem with high level of primary production. Most of the area is one spatial macro unit (Camus 2001). Sediment composition is characterized by large amounts of organic matter. Studies of seafloor structure on the continental shelf deeper than 150 m are scarce. Sediments, dominated by sand and mud, show latitudinal and longitudinal variation depending on extent of the continental shelf, seafloor morphology (presence of canyons), continental inputs, water column production, and fauna associated with the seafloor (Melo et al 2007). Other characteristics are determined by contribution of rivers, weather and type of material transport. Thus, seafloor characteristics encountered by the fishing gear vary depending on location of fishing grounds.

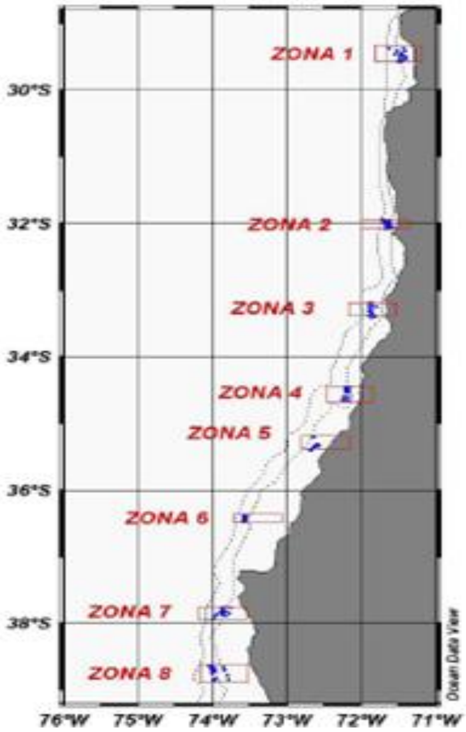
There are diverse habitats between Regions II and VIII in areas where fishing effort takes place. Melo et al (2007) reviewed available information on habitat and communities associated with seafloor, and conducted a survey to investigate habitat and assemblage distributions (Figure 112). Sampling covered depth between 100 and 500 m. Information highlights presence of unique habitat characteristics within demersal crustacean fishery areas. In areas where the platform receives biological material, sediments consist of mud and clay. Sediments in front of Valparaiso and Concepcion consist of fine sand and clay with organism remains and formations of organic and autogenic deposits, such as phosphorite concretions and carbonates. Sediments are rich in organic content except close to rivers where they are also coarser. Roa et al (1995) described benthic habitats which constitute nursery areas for squat lobster in that same general area (35ºS and 37ºS) down to 200 m in depth. Sediments consist of muddy soft bottoms and rocky-muddy hard bottoms. The second type is not accessible to trawling due to abundant interspersed rocks lying in the sediments; other areas consist partially or completely of hard bottoms. The area is characterized by bacterial mats (*Thioploca spp*). There is strong association of these mats and juvenile squat lobster. These extensive microbial communities are local features of the central Chile continental shelf.

Biodiversity

Melo et al (2007) reported 99 macro invertebrate taxa in soft substrates in operational areas of demersal crustacean fisheries. Composition of assemblages varied with latitude and depth and were dominated by polychaetes (60-75%) (Figure 113). Also 157 mega benthos species among mollusk, arthropods and echinoderms were reported. Data were collected (90 sets) with a dredge (Agassiz) and a trap attached to the trawl to retain displaced organisms (129 hauls). Data provide valuable information on benthic communities in the fishery areas, and about organisms that are mechanically disturbed by the trawl path. Communities were dominated by few species and composed by many scarce taxa (Table 51). In both types of samples, numerical representation of cnidarians, which includes corals, was high (13-11%). The trawl gear disturbed 98 species: 59 were captured with the dredge, 37 with the trawl net, and 61 with both (Figure 114). Thus, not all organisms disturbed by the path of the gear were caught by the net, and that explains why cnidarians, echinoderms, mollusks, and some crustaceans are seldom reported in the demersal crustacean catch. Similarity between dredge and trawl samples in Figure 114 suggests the trawl gear interacted strongly with the seafloor. The study was conducted with the old gear and the new gear should have a lesser impact.

Melo et al (2007) reflected on potential impacts of bottom trawl fishing on benthic communities. They noted that samples represent communities that are in areas where trawl fisheries operate, thus some observed patterns can result from fishing. They argued that high diversity of scarce taxa dominated by few species, where disturbances would promote success of few taxa with higher turn around rates, can be one of those patterns. Spatially explicit estimates of potential mortality imposed by bottom trawl gear are needed to evaluate the effect of the trawl gear associated with benthos. These in combination with information on life histories are required to evaluate sustainable fishing effort levels by unit area for the fisheries relative to benthic organisms.

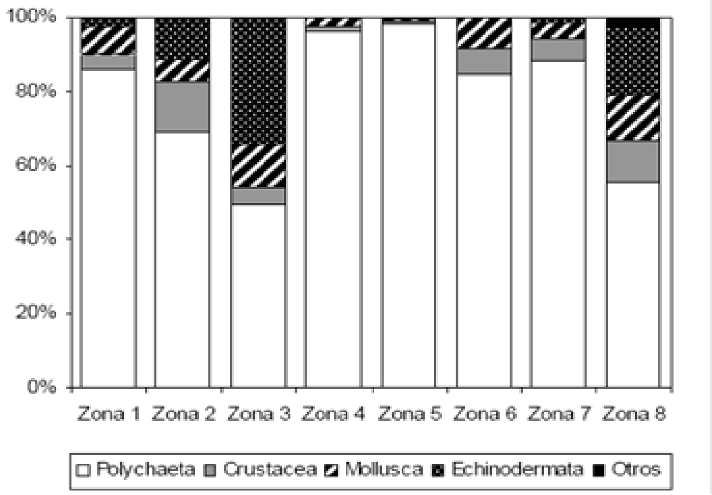
Figure 112: Sampling Stations to Characterize Seafloor & Benthic Communities & Covering the Area where Demersal Crustacean Fisheries Operate.



Note: Broken lines are 100 and 500 m contours

Source: Melo et al 2007.

Figure 113: Relative Abundance of Benthic Macroinvertebrate Groups in Grab Samples



Source: Melo et al 2007.

Figure 114: Number of Phyla in Mega Fauna Samples collected with Dredge and a Trap Attached to Bottom Trawl Gear

Note: Rastra = Dredge; Arrastre = Trawl

Source: Melo et al 2007

Table 51: Most Frequent (top) and Abundant (bottom) Species in 90 Megafauna Samples collected with Agassiz Dredge within the Operational Fishery Areas

Especie	Phylum	Clase	Nro. Lances	% del total
Pterygosquilla armata	Arthropoda	Crustacea	52	58
Heterocarpus reedi	Arthropoda	Crustacea	49	54
Aeneator fontainei	Mollusca	Crustacea	35	39
Pagurus delsolari	Arthropoda	Crustacea	33	37
Cervimunida johni	Arthropoda	Crustacea	28	31
Limopsis marionensis	Mollusca	Bivalvia	22	24
Mursia gaudichaudii	Arthropoda	Crustacea	20	22
Aeneator loisae	Mollusca	Gastropoda	19	21
Cancer porteri	Arthropoda	Crustacea	18	20
Haliporoides diomedae	Arthropoda	Crustacea	18	20
Libidoclaea granaria	Arthropoda	Crustacea	18	20
Miomelon alarconi	Mollusca	Gastropoda	16	18
Ptychosyrinx chilensis	Mollusca	Gastropoda	13	14
Stereomastis sculpta	Arthropoda	Crustacea	13	14
Maldane sarsi	Annelida	Polychaeta	12	13
Pleuroncodes monodon	Arthropoda	Crustacea	11	12
Actinia indet. 1	Cnidaria	Anthozoa	10	11
Actinia indet. 2	Cnidaria	Anthozoa	9	10
Asteroideo indet. 2	Echinodermata	Asteroidea	9	10
Porianiopsis echinaster	Echinodermata	Asteroidea	9	10
Suberites puncturatus	Porifera	Demospongiae	9	10

Especie	Phylum	Clase	Nro. Total indiv.	Frecuencia (%)
Heterocarpus reedi	Arthropoda	Crustacea	7341	49
Pterygosquilla armata	Arthropoda	Crustacea	1775	12
Limopsis marionensis	Mollusca	Bivalvia	1110	7
Pleuroncodes monodon	Arthropoda	Crustacea	1089	7
Cervimunida johni	Arthropoda	Crustacea	669	4
Aeneator fontainei	Mollusca	Mollusca	444	3
Holoturoideo indet.*	Echinodermata	Holothuroidea	386	3
Mursia gaudichaudii	Arthropoda	Crustacea	338	2
Libidoclaea granaria	Arthropoda	Crustacea	283	2
Pagurus delsolari	Arthropoda	Crustacea	200	1
Haliporoides diomedae	Arthropoda	Crustacea	192	1

* 368 especímenes en una sola estación, Zona 7, Est. 8, 344m.

Note: Nro. Lances= #of hauls where taxa were found.

Source: Melo et al 2007.

Vulnerable marine ecosystems (VMEs)

There are no direct reports of VMEs in demersal crustacean fishery unit areas. VMEs include seamounts, hydrothermal vents and cold-water corals and sponge fields. Nevertheless, sampling levels have been low to exclude existence of cold-water corals fields, groups found to be ubiquitous. Also, methane emergence zones, an ecosystem type with unique characteristics within VME ICES (2007) criteria, exist within operational area of the fisheries. Based on ICES (2008), characteristics that should be used as criteria in identification of VMEs are:

- Uniqueness or rarity – area or ecosystem that is unique or that contains rare species whose loss could not be compensated for by other similar areas. These include habitats with endemic species, habitats of rare, threatened, or endangered species that occur only in discrete areas, or nurseries or discrete feeding, breeding, or spawning areas;
- Functional significance of habitat discrete areas, or habitats necessary for survival, function, spawning/reproduction or recovery of fish stocks, particular life-history stages (e.g. nursery grounds or rearing areas), of rare, threatened, or endangered species;
- Fragility – ecosystem that is highly susceptible to degradation by anthropogenic activities. Life-history traits of component species that make recovery difficult, ecosystems that are characterized by populations or assemblages of species with one or more of the following characteristics: slow growth rates; late age of maturity; low or unpredictable recruitment; or long-lived; and
- Structural complexity – ecosystem that is characterized by complex physical structures created by significant concentrations of biotic and abiotic features. In these ecosystems, ecological processes are usually highly dependent on these structured systems. Further, such ecosystems often have high diversity, which is dependent on the structuring organisms.

Seafloor mounts**:** These features are not reported in the operational area of the demersal crustacean fisheries. Fishing takes place primarily over the coastal margin where seafloor mounts do not exist (Melo et al 2007).

Geothermal vents: There are no reports of these types of ecosystems in the operational area of the demersal crustacean fisheries. There is high degree of certainty that they do not exist within the fishery area.

Sponge fields**:** There are no reports of sponge fields. Nevertheless, assemblages of bryozoans, sponges and hydrozoans are reported in the general area of operation of bottom trawl fisheries (Melo et al 2007) and unidentified taxa of sponges are reported among species listed for catch composition the demersal crustacean fisheries by IFOP (Table 18). When soft seafloor is mechanically perturbed these filter feeder species can re-populate where sponge fields previously existed, although this depends on how often they are disturbed and how slowly they grow. According to Melo et al (2007) species composition of these benthic assemblages could indicate that mechanical disturbances of the seafloor occurred and that re-colonization and ecological succession in macro benthic communities took place.

Methane Emergence Areas are not listed among VMEs but they do present characteristics enumerated by ICES (2008) definition above and are reported within the operational area of the fisheries (Melo et al 2007). These are ecosystems of high biodiversity and with particular endemic species. Species depend on autotrophic bacteria and are prey of numerous species, and processes occurring on those areas generate hard bottoms colonized by sessile organisms and utilized as refuge by fish and invertebrate larvae. Normally these areas occur in much deeper waters than where demersal crustacean fisheries operate, but finding by Melo et al (2007) at 349 m in one station located in 33º 23 4’S indicates presence within the fishery area.

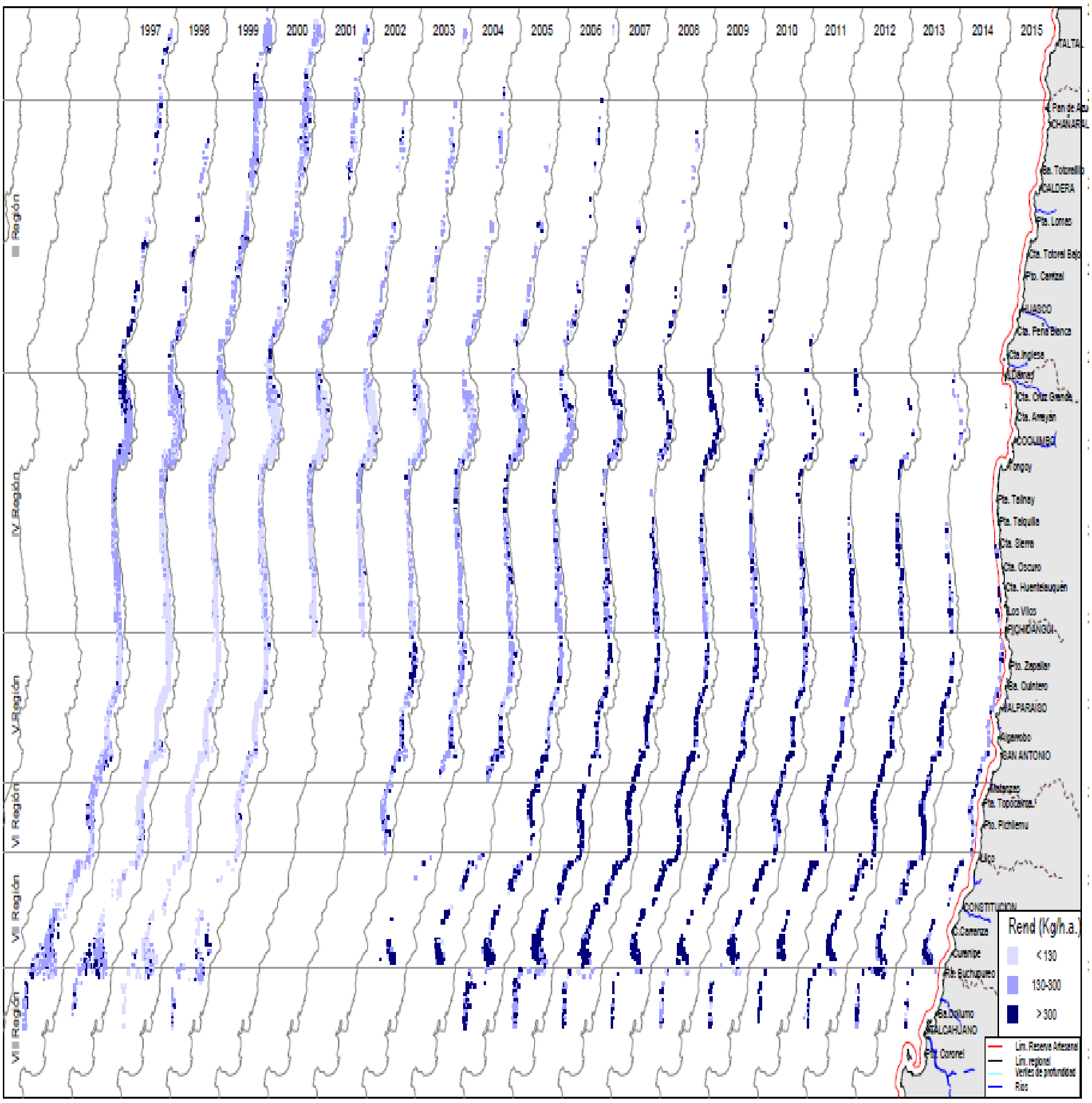
Although the survey conducted by Melo et al (2007) provides valuable information on benthos composition, it used traditional gear and does not represent effects of the modified gear. The modified gear is lighter and has much less contact with the seafloor. Also, there are other trawling fisheries in the area that operate with higher fishing effort, in particular Chilean hake, which could have produced most of the impact measured by the study.

3.4.5.3. Outcome

Nylon Shrimp

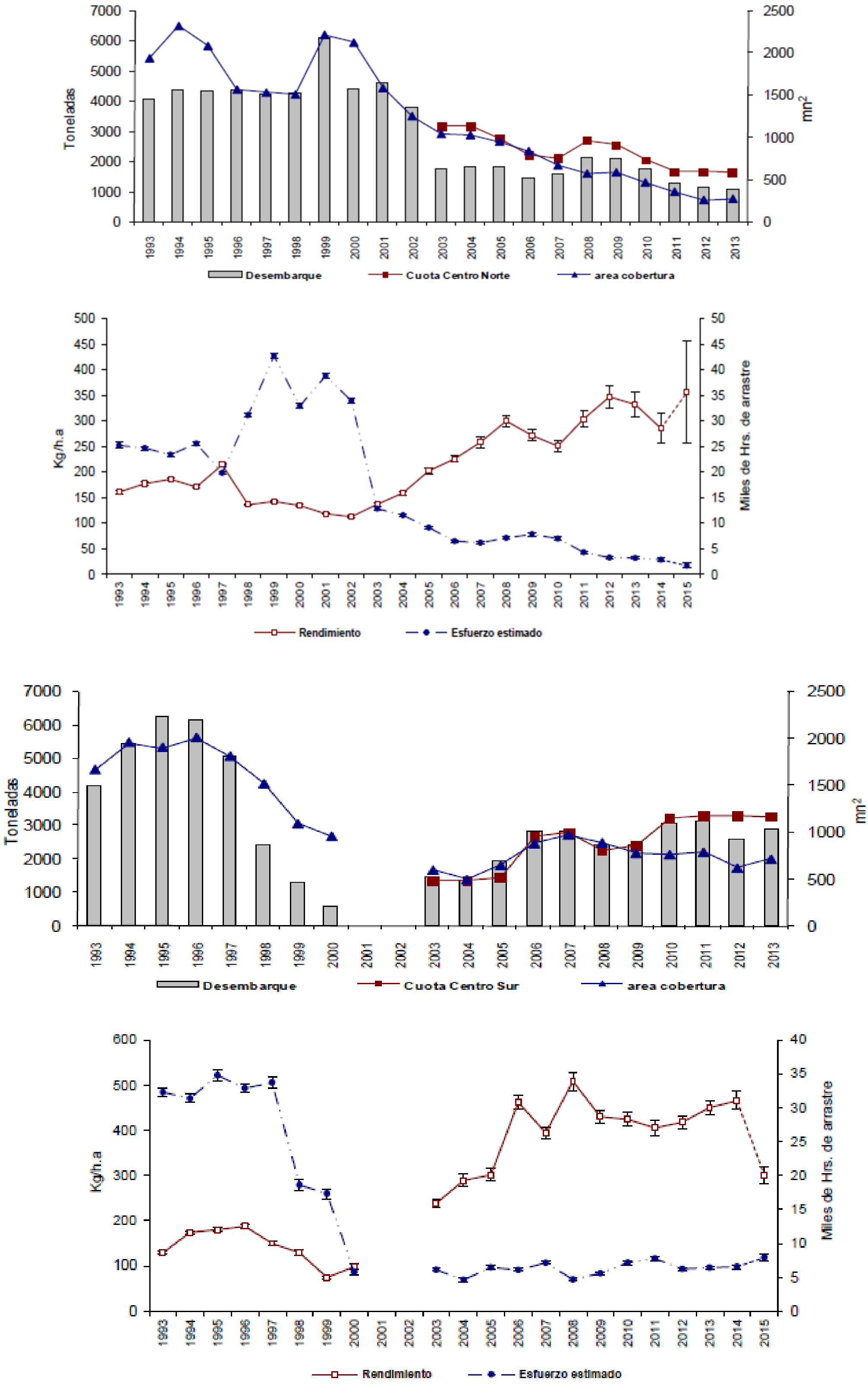
The nylon shrimp industrial fishery takes place between Regions II and VIII (Figure 115). Nylon shrimp populations are distributed between Region II to IX and inhabit the continental shelf and slope at depth between 150-800 m on a variety of substrates (clay, sandstones, silty sand, and mud); the fishery is conducted mostly between 150-500 m (Arana 2012). The fishery operates year round with seasonal closure from July-August. In the northern area, the area covered by fishing steadily decreased from over 2,000 nm^2 in 1999 to 272 nm^2 in 2013 and trawling effort decreased from over 40,000 hr to less than 3,215 hr (Figure 116). Spatial coverage mainly decreased in regions II-III, with fishing restricted to Region IV, mostly around Bahía de Coquimbo (Figure 115). In recent years tow duration is around 2.5 hr and mean depth of operations is 354 m (Table 53). Although fishing grounds have remained the same, operations tended to increase in deeper areas where highest yields were obtained between 400-500 m. In the southern area, the fishing area decreased from over 2,000 nm^2 in the mid-1900s to 718 nm^2 in 2013 and trawling effort decreased from over 40,000 hr to 6,434 hr (Figure 116). In recent years tow duration is 2.4 hours and mean depth of operations is 308 m (Table 40). Fishing operations remained in the areas but concentrated where yields are highest between 200-350m.

Figure 115: Spatial Distribution Nylon Shrimp Fishery (kg/ha) - Region II to VIII.



Source : Zilleruelo et al 2015.

Figure 116. Area Coverage of Fishing Operations Targeting Nylon Shrimp (in blue) & Fishing Effort (1000 hrs. trawling): top =North, bottom= South



Source : Zilleruelo et al 2014, 2016

Table 53. Fishing Operations Targeting Nylon Shrimp 2014: catch (t), effort (ha), CPUE &SD (kg/ha), catch per tow (kg), tow duration (h), mean depth (m) by Region.

Zona	Captura (t)	Horas de arrastre (h.a.)	Número de lances	Rendimiento razón (kg/h.a.)	Error STD razón (kg/h.a.)	Captura media por lance (kg)	Duración media lance (h)	Profundidad media (m)
Centro-norte	319,5	961	381	332	13	839	2,5	354
Centro-sur	1329,8	2954	1257	450	8	1058	2,4	308
Total	1649,3	3916	1638	421	7	1007	2,4	319

Source: Zilleruelo et al 2015

Direct effects on habitat structure

The north area, where the industrial nylon shrimp and artisanal fisheries operate, is characterized by a narrow continental shelf. During winter, the stock is distributed within 200-300 m, thus in the artisanal reserve within 5 nm. The fishery is authorized to operate in the area ("perforations") to have access to the resource. In the northern area, Melo et al (2007) reported fine to coarse sand sediments (mean of 0.137 mm) and mean organic content between 4.39 y 9.51%. Thus, the seafloor within the fishery operations is dominated by soft substrates, less affected by the trawl. In the south, the continental shelf is wider. Nylon shrimp inhabits sand and mud substrates but also rocky habitats (Bahamonde and Henriquez 1970). Thus, targeting the resource in those areas would impact habitat. Study of discards identified "muddy catch" as one cause for releasing the catch, indicating that the old gear interacted strongly with the seafloor (Zilleruelo et al 2006).

Studies of impacts on habitat by bottom trawling in this area are limited (Melo et al 2007). The general opinion of stakeholders from the fishing sector during the auditors' site visit was that the fishery operates over sandy areas, and that contact of the gear with the seafloor does not cause harm to habitat. But design of the modified trawl grew up from concerns over potential negative effects on benthic communities. Effects of the modified trawl gear used in industrial and artisanal demersal crustacean fisheries on the seafloor have not been evaluated. It is expected that the modified trawl will have less impact on the habitat than the old gear. It is lighter and also more susceptible to tear, which has caused the fishery to move away from hard substrate. Despite lack of information on habitat effects of the fishing gear, it is considered unlikely that the fishery is reducing habitat structure and function to a point of serious or irreversible harm. The fishery probably does not operate over seafloor mounts and geothermal vents because it generally takes place at depth <500 m. Methane emergence areas have not been reported in the north.

Indirect effects

There were no reports found of loss of nets in the fishery. During the site visit the question of lost gear was asked and in principle if there is a problem, the gear would be recovered. Therefore, there should not be significant effects of lost nets on habitat structure.

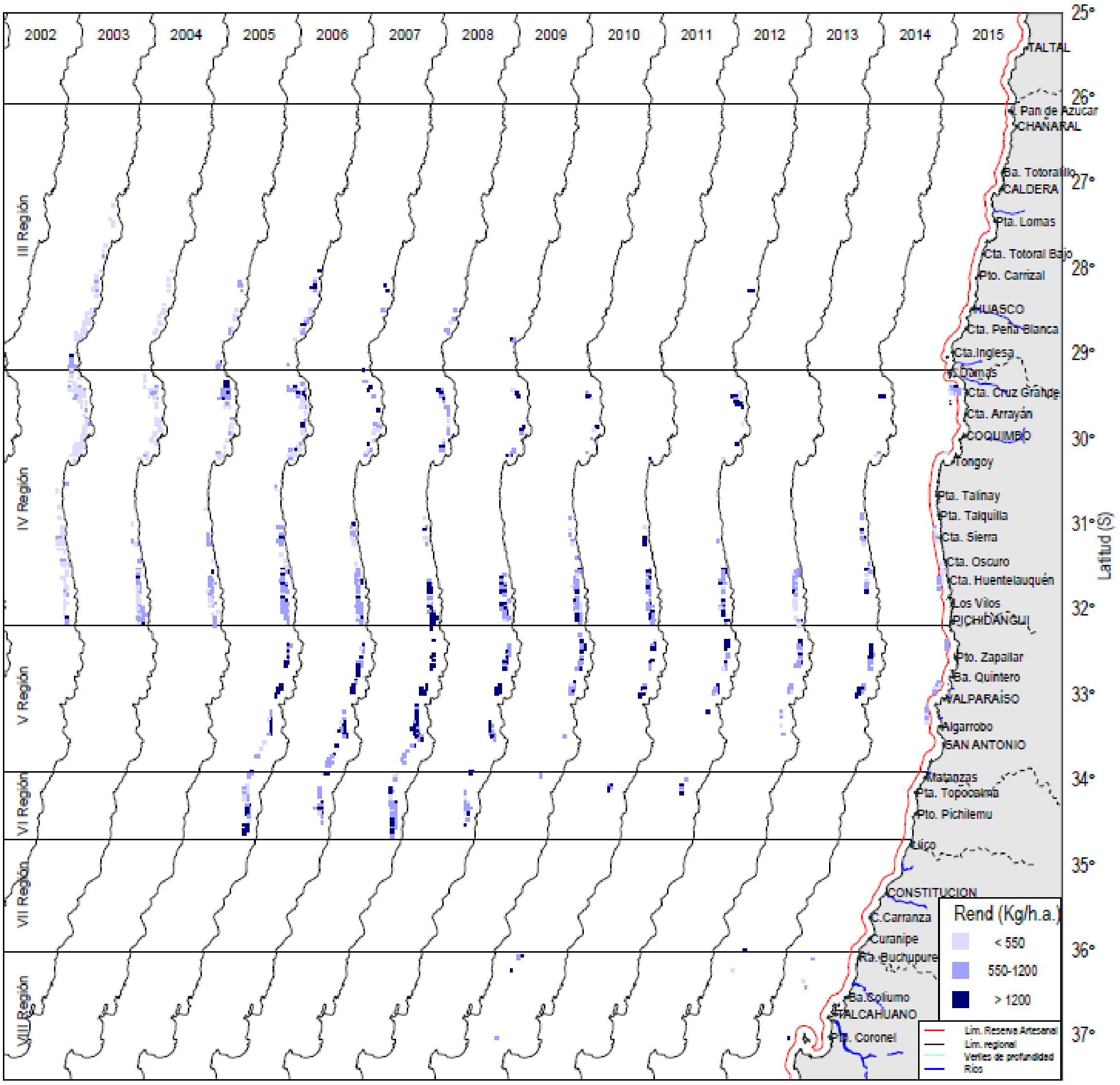
Yellow Squat Lobster

Yellow squat lobster populations are distributed between Regions II and VIII and inhabit the continental shelf and upper slope between 100-500 m on mud, gravel and rocky substrates. The fishery has taken place between Regions III and VIII (Figure 117) and operates year round with a seasonal closure from January – March**.** Yellow squat lobster inhabits muddy and hard substrates. Information presented for nylon shrimp is also applicable to this species in terms of characteristics of the seafloor and potential effects of the old and new gear operation.

Yellow Squat Lobster Northern Area

Fishing operations are mostly in Region IV. The area covered in the north decreased from around 1,000 nm^2 in the late-1900s to 100 nm^2 in 2013 (Figure 118). Also fishing effort varied but has remained stable at around 2,500 hrs of trawling. In recent years trawl duration is 2.1 hrs and mean depth of operations is 207 m (Table 54). Fishing operations have remained in the same areas with higher yields near Coquimbo (Figure 117).

Figure 117: Spatial Distribution of Yellow Squat Lobster Fishery (kg/ha) Region III to VIII.



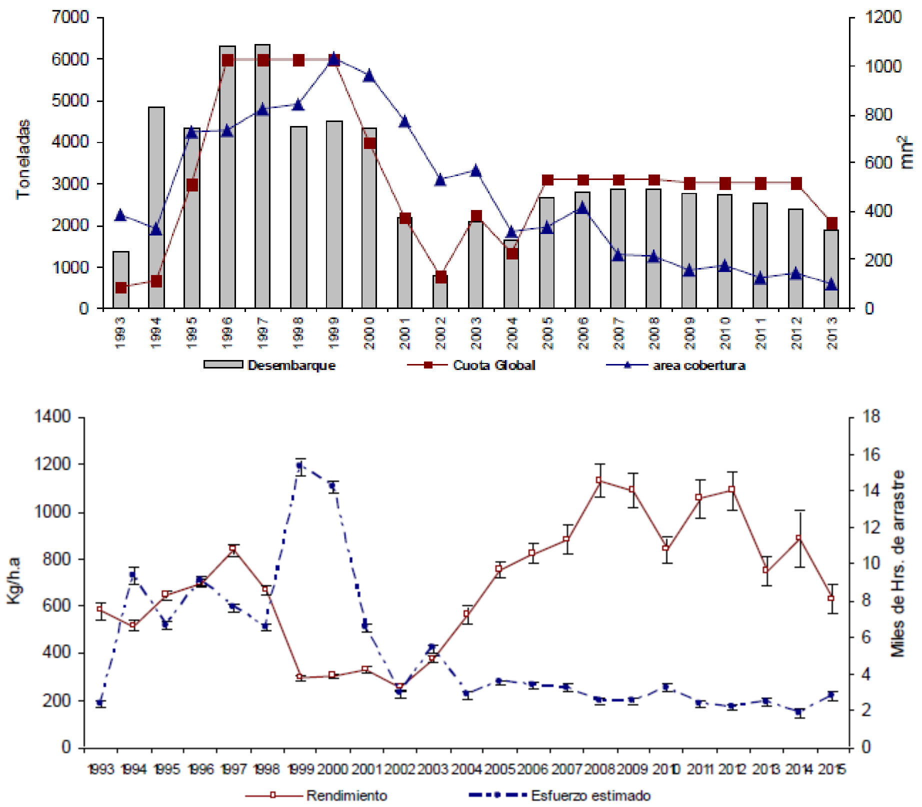
Source Zilleruelo et al 2015.

Table 54. Fishing Operations Targeting Yellow Squat Lobster 2013: catch (t), effort (h.a.), CPUE (kg/ha), catch per tow (kg), tow duration (h), mean depth (m) by Region.

Zona	Captura (t)	Horas de arrastre (h.a.)	Número de lances	Rendimiento razón (kg/h.a.)	Error STD razón (kg/h.a.)	Captura media por lance (kg)	Duración media lance (h)	Profundidad media (m)
UP centro-norte	255,6	341	163	749	31	1568	2,1	207
UP centro-sur	243,6	278	115	876	37	2119	2,4	183
Total	499,2	619	278	806	24	1796	2,2	197

Source: Zilleruelo et al 2015

Figure 118. Yellow Squat Lobster Northern Area (top) Area of Fishing Operations (bottom) Fishing Effort (1000 hrs trawling)

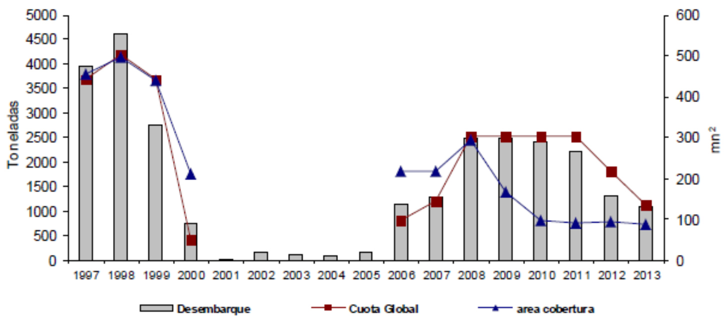


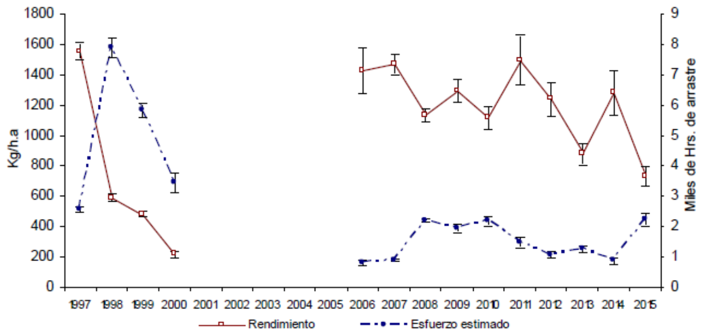
Source Zilleruelo et al 2013, 2015

Yellow Squat Lobster Southern Area

Fishing operations were mostly in Region V and VIII (Figure 117). After the fishing closure was lifted, trawling area reached about 300 nm² but has decreased to about half in the last years (Figure 119). Effort levels have fluctuated between 1,000 and 2,000 hrs of trawling. In recent years tow duration is 2.4 hrs and mean depth of operations is 183 m (Table 54).

Figure 119. (top) Area Coverage of Fishing Operations Targeting Yellow Squat Lobster Southern Area (bottom) Fishing Effort (1000 hrs. trawling)





Source Zilleruelo et al 2013, 2015.

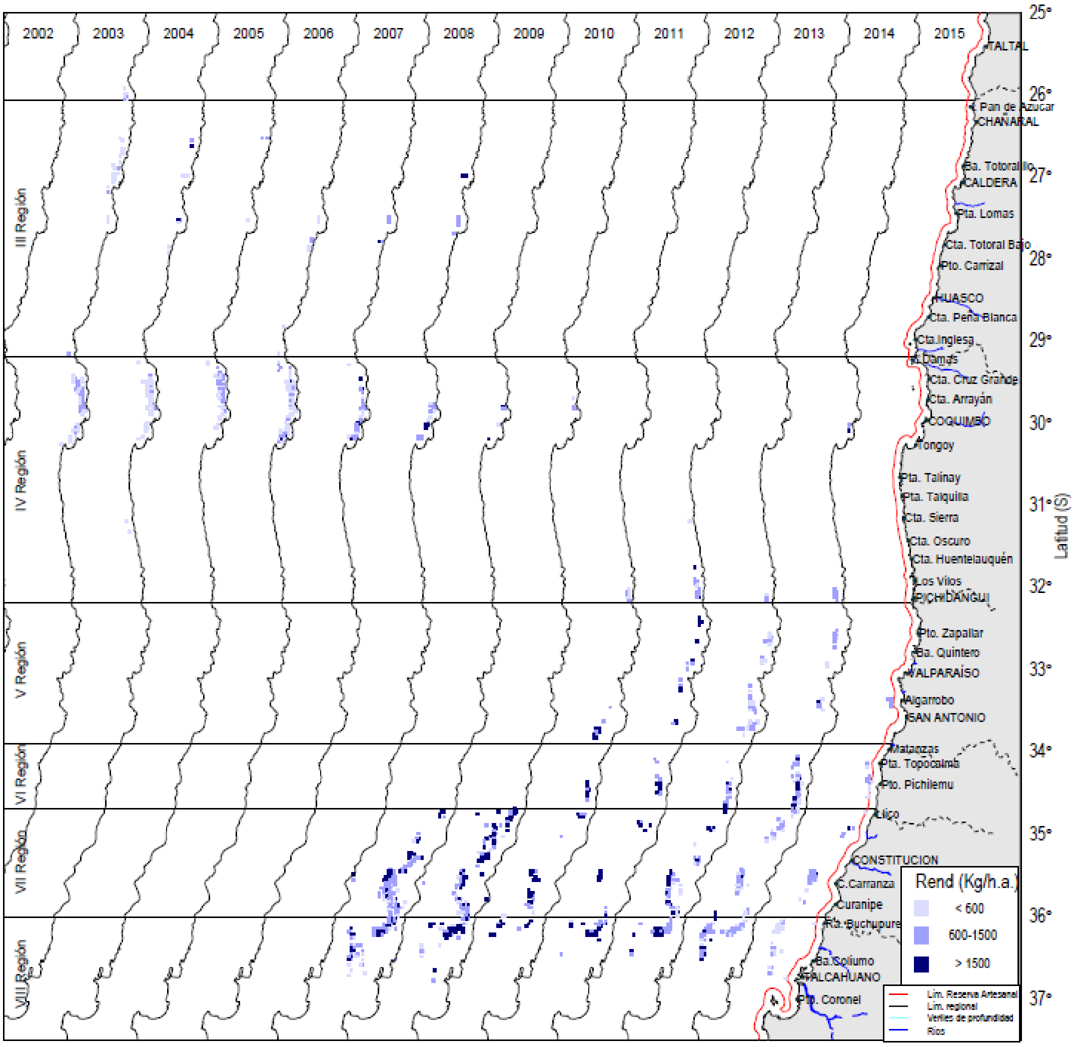
Red Squat Lobster

Red squat lobster populations have a larger latitudinal distribution than the other demersal crustaceans from Region I to X and inhabit the continental shelf and upper slope between 30-400m; off northern Chile 20-40m (Gutierrez & Zuñiga 1977) and is sometimes pelagic. Over 70% of catches are from between 100 and 150 m. Closed season in the north is January - March. The fishery closed in the south between 2001 and 2010, with a research quota since 2005. Because of the closure, fishing was concentrated in the northern area. But in 2011 and 2012 quotas were of 3,600 t and 5,030 t and fishing operations shifted to Regions VII and VIII (Figure 120). The species is found mostly on mud but also hard substrates (Bustos & Retamal 1985). They inhabit muddy and sandy substrates rich in organic matter (Gallardo et al 1993, 1994). Because, a key part of their diet consists of the prokaryotic bacteria *Thioploca*, juveniles of this species are usually located in anoxic substrates, where these bacteria are found in abundance (Roa et al 1995). Although the species is found in soft substrate where effects of trawling can be minor, it is unknown what would be the effect in these *Thioploca* unique areas.

Red Squat Lobster Northern Area

Fishing operations are mostly in Region IV (Figure 120) and trawling area decreased from around 500 nm^2 in the early 2000s to 10 nm^2 in 2013 (Figure 121). Fishing effort varied from over 6,000 hr of trawling to less than 500 hr in 2014. Tow duration in 2014 was 1.5 hrs and mean depth of operations was 225 m (Table 55). The survey did not cover the northern area in 2015.

Figure 120: Spatial Distribution of Red Squat Lobster Fishery (kg/ha) Regions II to VIII.



Source Zilleruelo et al 2015

Table 55. Red Squat Lobster Catch, Effort, CPUE, Mean Tow Duration and Depth in 2014 Fishing Operations by Region.

Zona	Captura (t)	Horas de arrastre (h.a.)	Número de lances	Rendimiento razón (kg/h.a.)	Error STD razón (kg/h.a.)	Captura media por lance (kg)	Duración media lance (h)	Profundidad media (m)
UP centro-norte	48,8	43	29	1135	80	1683	1,5	225
UP centro-sur	1940,5	1872	812	1036	25	2390	2,3	193
Total	1989,3	1915	841	1039	25	2365	2,3	194

Source : Zilleruelo et al 2015

Figure 121. Red Squat Lobster Northern Zone (Top) Area Coverage of Fishing Operations (mn^2) blue line (bottom) Fishing Effort (1000 hrs trawling)

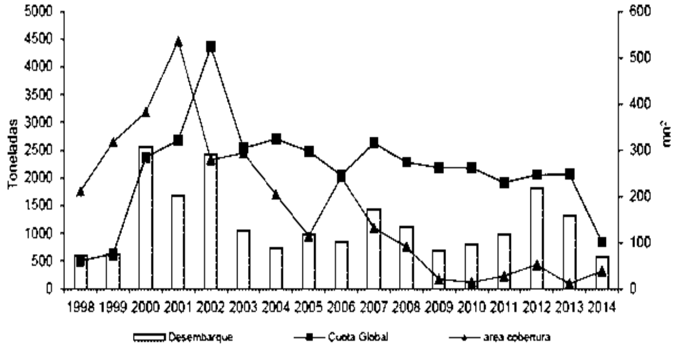
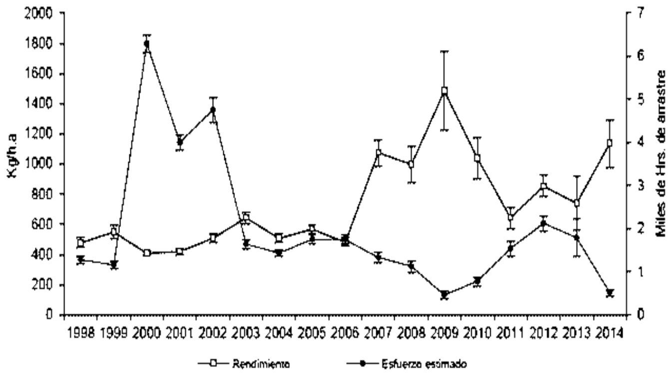


Figura 57. Desembarque (t) y cuota global anual de captura de langostino colorado. Unidad de Pesquería centro-norte. Periodo 1998–2014. Fuente de datos: IFOP- SERNAPESCA.

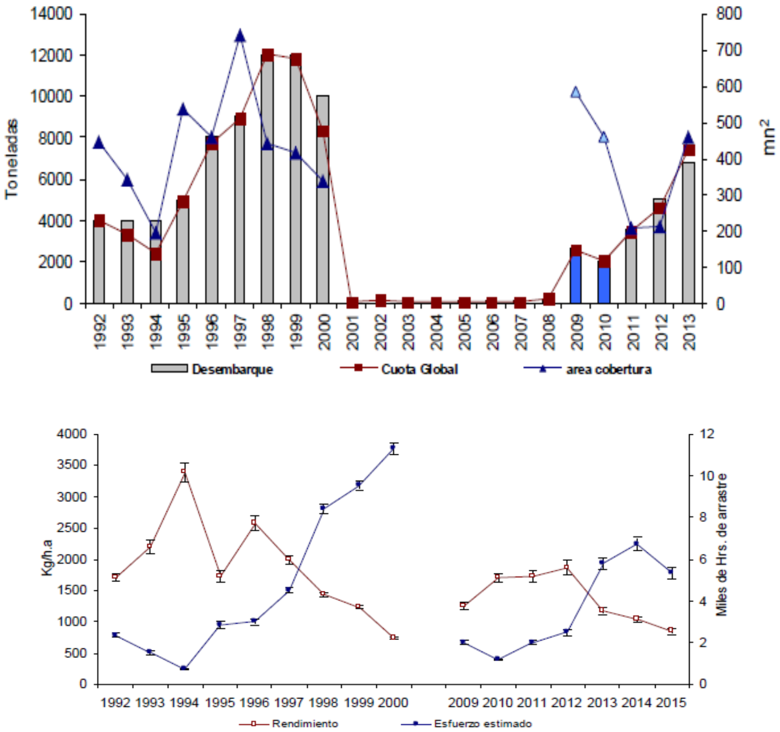


Source: Zilleruelo et al 2015.

Red Squat Lobster Southern Area

Fishing operations are mostly in Regions V and VIII (Figure 120). Area trawled decreased from around 500 nm^2 in late 1990s to 450 nm^2 in 2013 (Figure 122) and fishing effort varied from over 10,000 hr of trawling to around 5,000 hr in 2015. In recent years tow duration is 2.6 hrs and mean depth of operations is 164 m (Table 55).

Figure 122. Red Squat Lobster Fishery Southern Area (top) Coverage of Fishing Operations (mn2) blue line (bottom) Fishing Effort (1000 hrs. trawl)



Source Zilleruelo et al 2014, 2015

3.4.5.4. Management

Introduction

MSC requires that if necessary there is a strategy in place designed to ensure that the fishery does not pose a risk of serious or irreversible harm to habitat types.

Overview

Two management measures are generally designed to limit impact of demersal crustacean fisheries on habitat: **i)** Decree No 408/1986 (modified by Decree 208/2006) prohibits all fishing within the first nautical mile from the coast and an imaginary line situated one mile inshore that stretches from the northern maritime border of Chile and parallel 41ºS, including bays and other protected areas, and **ii)** Law Nº18.892 (1989) and Law Nº19.907 (023) reserves an area for artisanal fishing of five nautical miles, measured from normal baselines, starting at the northern border of Chile up to parallel 41º 28,6'S and around the Oceanic islands, and prohibits trawl fishing activities within this area. Nevertheless, Decree N°200 (2003) establishes that the demersal crustacean fisheries off Regions III & IV are not subject to gear restriction in the 5 nm area of the artisanal reserve. These operations are still subject to the 1nm restriction. The exception was established because evaluations indicated stocks in those regions are mostly within the artisanal reserve area as the continental shelf is narrow.

These measures recognize that the habitat within 5 nm of the coast is important to the ecosystem and thus needs to be protected. These regulations are enforced through the VMS. Law Nº19.521 that amends the General Fisheries and Aquaculture Law established the obligation to install an automatic satellite positioning system on board the industrial fishing fleet in Chile. Therefore, the entire trawling fishing fleet is monitored with the use of satellite positioning systems by the maritime authority (Dirección del Territorio Marítimo y Marina Mercante- DIRECTEMAR) and the Fisheries Enforcement Agency (SERNAPESCA). Operation of the fleet is also monitored by the IFOP observer program.

LGPA Title II, Art. 3ºd) establishes that specific areas can be set up as Marine Parks to preserve ecological units of scientific interest, protect areas that ensure maintaining species and diversity as well as their habitat. Art. 3 e) allows for marine reserves.

LGPA Tittle II Art. 6º a) Indicates that the Ministry through supreme decree and previous technical report of SUBPESCA and communication with the Regional Fishery Council should establish geographical areas under a regime of fishery administration for Vulnerable Marine Ecosystems (VME) when the presence of invertebrates or geological structures is verified that qualifies as VME. Under such regime trawling and use of gear that can affect the ecosystem is prohibited. Art. 6 b) indicates that SUBPESCA with information provided by CCTs will establish a list of species for which bottom fisheries can affect VME. When vessels in those fisheries leave port they should communicate with authorities about intended fishing area and equipment they will use to adhere to a Protocol of Operations in VME. All details of required information are described in the law, as well as steps to follow in such areas if elements are accidentally caught. SUBPESCA is responsible to post reports of these situations.

There is the potential for trawling to be banned in Chile. The new trawl gear was in part designed to address concerns of effects from interaction with the seafloor and have less impact on habitat. The materials are lighter and the contact with the seafloor is decreased.

3.4.5.5. Information

Overview

Information applies to nylon shrimp, yellow squat lobster, and red squat lobster fisheries as there is an overlap in distribution and most studies are not specific for one fishery.

Significant amount of work has been completed on habitat description within the area where the demersal crustacean fisheries operate. Nevertheless, the area is quite extensive. Sediments have been described among others by Hebbeln et al (2001), Gutiérrez et al (2000), Milessi et al (2005), Muñoz et al (2004), and Lamy et al (1999). Topography has been studied by Strub et al (1998), Thornburg & Kulm (1987 a, b), Hagen et al (1996), Pineda (1999), Sobarzo et al (2001), and Laursen & Normark (2002). Studies of benthic biodiversity are mostly in shallow waters 20-150 m. Gallardo (1977) and Fossing et al (1995) reported on bacterial mats. There are studies of demersal fish communities by Sielfeld & Vargas (1996), Menares & Sepúlveda (2005) and Acuña et al (2005). Acuña et al (2005) studied species associated with demersal crustacean fisheries.

As described in the background section, Melo et al. (2007) reviewed information available on biotic and abiotic characteristics of the seafloor off central Chile and conducted a study to further characterize habitat that included surveys on board of commercial operations. The study defined 8 zones extending from Regions IV to IX and between 100 and 500 m, thus covering a significant part of the northern area in this assessment and all of the southern area. Coverage of the sampling was estimated at 1,000 nm^2. Sampling gear included trawl net, dredge and dredger box corer and also included video recording. The study emphasized sampling to detect areas such as hydrothermal vents, seamounts, methane emergences and coral fields. The study also produced bathymetric maps and estimated area swept by the demersal crustacean fisheries.

There is IFOP annual monitoring of demersal fishing operations. Information on trawling effort and location of each demersal crustacean fishery operation is recorded and reported.

In addition to efforts described in the overview section and more recently Ahumada et al (2013) characterized habitat in areas of aggregations of yellow and red squat lobsters in the Coquimbo area at depths between 102 and 215 m using a towed video system. In areas of aggregations of yellow squat lobster at around 178 m, substrate was gravel and mud and some individuals were occasionally in the margins of rocky areas. The fishery operates in similar areas. Observations showed the presence of armed box crab, Chilean hake, bigeye flounder, and unspecified taxa of gastropods and sponges. Areas of aggregations of red squat lobster were mostly on muddy substrate. In areas of aggregations of red squat lobster, species found were similar to those areas of yellow squat lobster except that flounder were absent and species of elasmobranchs were observed. There was overlap in the distribution of the two squat lobster species.

Specific research projects to evaluate potential effects of fisheries on habitat structure or benthic biodiversity are missing. The FONDEF terms of reference note the lack of studies on the design of nets to reduce the impact of trawls on the benthos, but that the new design of net could reduce the area affected by 50%.

3.4.6. Ecosystem

3.4.6.1. Introduction

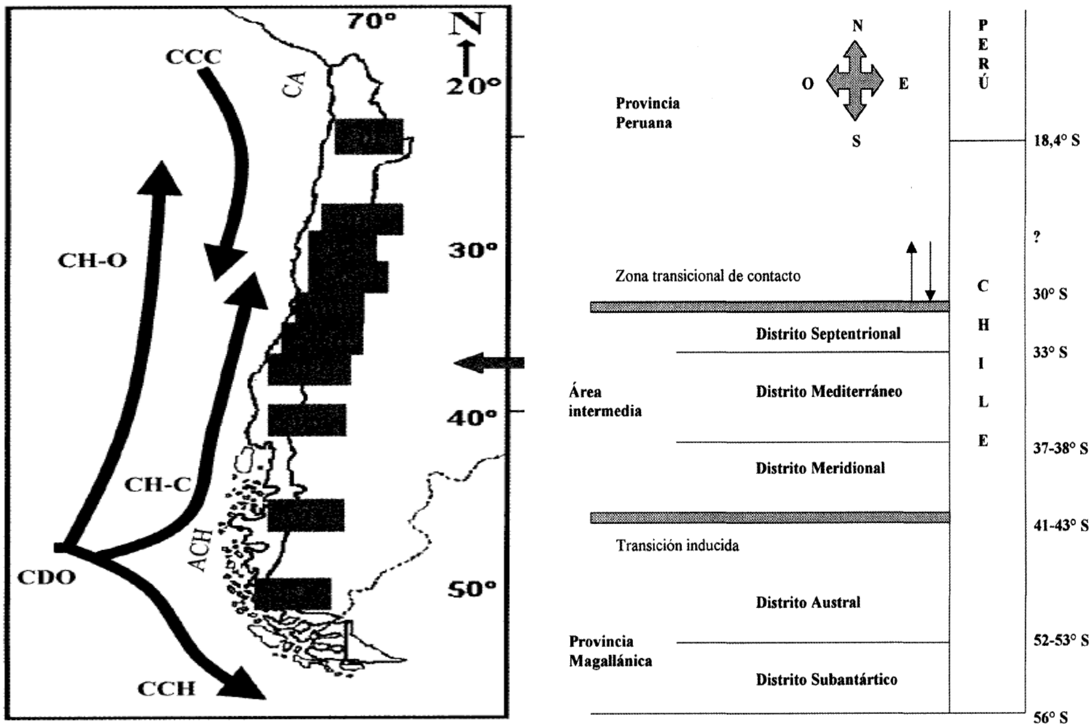
The ecosystem component considers the broad ecological community and ecosystem in which fisheries operate and addresses system-wide issues primarily indirectly impacted, including ecosystem structure, trophic relationships and biodiversity. This component is meant to address cumulative fishery effects on the broader ecological community and ecosystem, in contrast to fishery impacts on species addressed above as retained, bycatch or ETP. Three performance indicators for the ecosystem components verify if: i) the fishery causes irreversible harm to key ecosystem components, ii) confirms that there are measures in place to ensure that the fishery does not pose a risk of serious or irreversible harm, and iii) that there is adequate knowledge of the impacts of the fishery on the ecosystem (MSC 2013).

3.4.6.2. Background

The Humboldt Current ecosystem characteristics where the fisheries operate off the Chilean coast are shaped by a typical upwelling system. Information on ecosystem structure and trophic relationships is available mostly for the southern Humboldt system off central Chile, located from 33°S to 39°S and up to 30 nautical miles offshore the coastline, covering approximately 50,000 km^2. The system comprised areas between Region IV and VIII and the geographical unit corresponds to the “Mediterranean District” of the Humboldt system described by Camus (2001) but is within the “Intermediate Area” which is ecologically independent from the “Peruvian Province” north of 30ºS (Figure 123). Characteristics reported for the southern Humboldt system are applicable to the area of this assessment. Main oceanographic and biogeographic patterns that characterize the system are: rather narrow continental shelf (<30 nm), strong seasonal upwelling period (September to March) and high primary productivity levels (Strub et al 1998, Daneri et al 2000, Escribano et al 2003).

Biodiversity in the marine environment along central Chile is high due to four main water masses: Subtropical Surface (STSW), Subantarctic (SAW), Antarctic Intermediate (AAIW), and Equatorial Subsurface Water (ESSW) (Strub et al 1998). Wind driven coastal upwelling brings ESSW to the surface in the coastal zone, causing persistent and characteristic shallow oxygen minimum zones. Montecinos et al (2003) suggest that coastal SSTs comprise two large-scale climate processes affecting the southern Humboldt: at the inter-annual scale the main source of variability is the ENSO cycle, whereas on a long-term scale, inter-decadal oscillation occurs at a basin-wide, and maybe even global, scale.

Figure 123. Main Circulation Patterns and Biogeographic Zones off Chile. CCC=Contra Corriente Ecuatorial, CDO=Corriente de Deriva del Oriente, CH-O=Chileno Peruana, CH-C=Corriente de los Fiordos, CCH=Corriente Cabo de Hornos



Source: Camus 2001

The southern Humboldt sustains a diverse food web. Large diatoms dominate phytoplankton (Avaria & Muñoz 1982), while zooplankton is dominated by copepods and euphausiids. Jellyfish also constitute an important group in the plankton (Palma & Rosales 1995). Macro crustaceans, such as red and yellow squat lobster and nylon shrimp, are significant benthic components. The fish community is dominated by pelagic species: anchovy (*Engraulis ringens)* and pilchard (*Strangomera bentincki),* which feed on phytoplankton and zooplankton, and are highly abundant and dominate landings. Horse mackerel feeds mainly on euphausiids (Miranda et al 1998). The demersal fish community is dominated by Chilean hake in biomass and landings. Chilean hake inhabits 200–400 m waters and feeds on euphausiids, demersal crustaceans, small pelagic fishes, and is cannibalistic (Meléndez 1984, Arancibia 1989, Cubillos et al 2003). Status and basic ecology of top predators such as marine birds, sea lions, and cetaceans is poorly known.

In Central Chile, fisheries and ENSO induce changes in pelagic and benthic species. The southern Humboldt ecosystem represents an independent management unit, comprising the main fishing ground for the Chilean purse seine and trawling fleets, both industrial and small scale operations, and accounting for approximately 75% of total landings (Neira and Arancibia 2004, Neira et al 2004). Since the 1980’s, development and westward expansion of horse mackerel fishery influenced landings reaching an historical maximum of > 4 million t in 1995, and during 1997–1998 juveniles dominated fishing grounds. A dramatic drop in horse mackerel landings was accompanied by increasing landings of other important resources, Chilean hake, pilchard, and anchovy*.* In its more recent state, individual stocks and the whole food chain are considered significantly altered (Arancibia and Neira 2005), and evidence indicates that most main stocks are overexploited (Neira et al 2014). Ecosystem effects of changes in landings of the most important resources are not well understood.

3.4.6.3. Outcome

Available food web studies have quantified effects of removals of fisheries in the area including the demersal crustacean fisheries under assessment. These models have considered the ecosystem ranging from 33ºS to 39ºS.

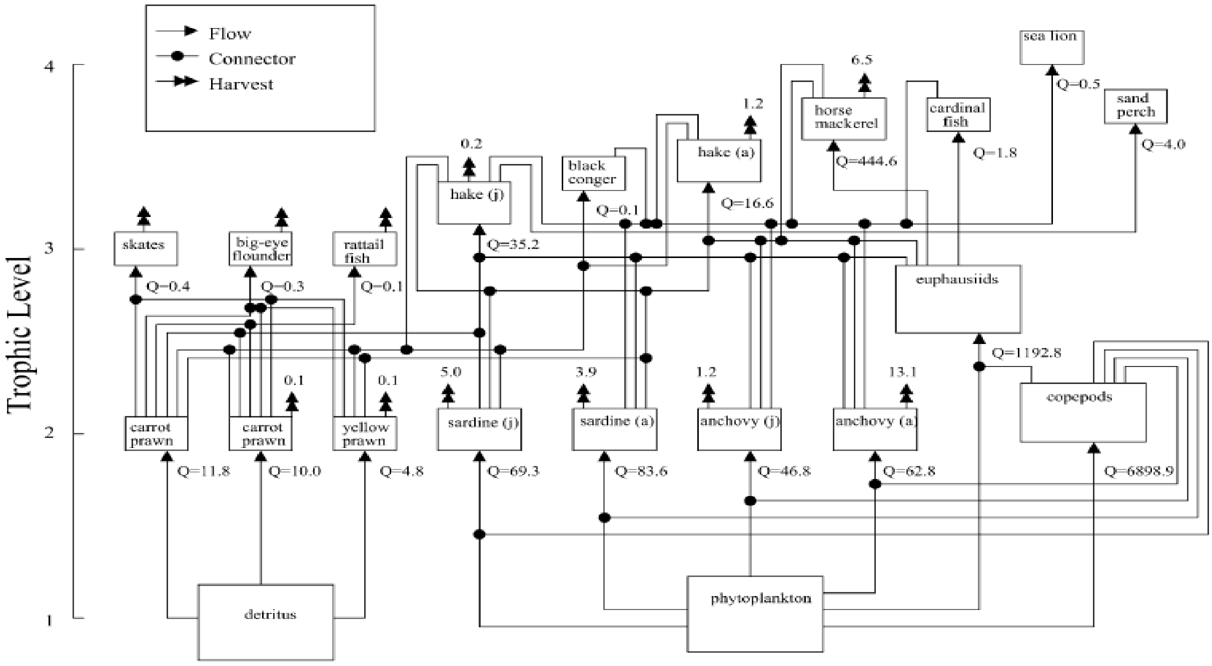
Nylon Shrimp Industrial and Artisanal Fisheries

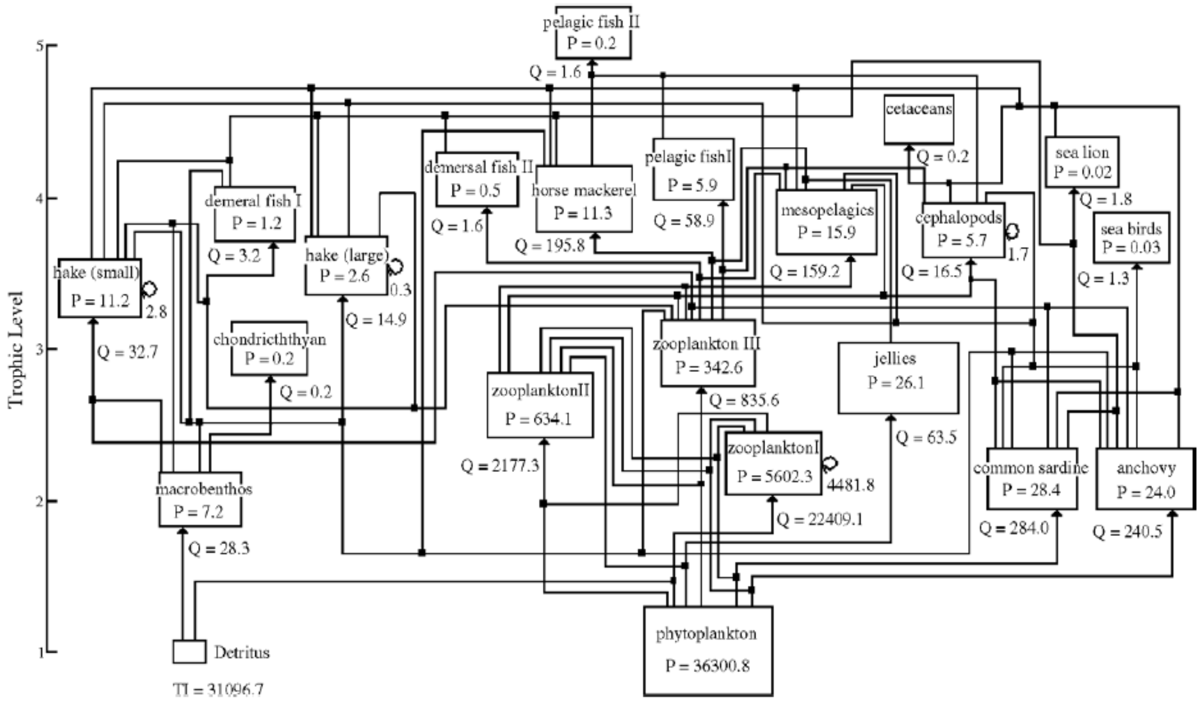
The industrial nylon shrimp fishery is widely distributed covering both most of the latitude and bathymetric distribution of the species (Regions II to VIII and 150-500 m). The upwelling system off Central Chile is an immature system, with short trophic chains and low trophic transfer efficiency (Neira & Arancibia 2004). Predators consume the greater part of juvenile production of most important fishery resources, and fisheries remove a large fraction of adult production. Food web models for such a system which include nylon shrimp in the benthic pathway (Figure 124, Table 56) show that fisheries can have profound effects through food web interactions (Neira et al 2004, 2005, 2014; Arancibia et al 2005). Nylon shrimp feeds exclusively on detritus and is a low trophic level species (2) slightly lower than planktonic forage fish such as sardines considered low trophic level species. The species is a major component of the benthic food web pathway and in recycling organic matter back to the pelagic pathway. Potential ecosystem impacts of the fishery are from removals of this relatively abundant low trophic species which plays a significant role as prey; also from removal of non-target species that are top predators such as Chilean hake.

Ecosystem food web models showed that predation mortality constituted the main source of mortality for demersal crustaceans in 1992 and 1998 (Neira et al 2004) accordingly with the important role as prey. Main predators in the study are Chilean hake, a main retained species in the nylon shrimp fishery, and grenadiers, black conger, bigeye flounder, and skates, most of the bycatch species in the fishery. Some of these taxa, such as skates and bigeye flounder, feed almost exclusively on demersal crustaceans. Nylon shrimp biomass is negatively affected by Chilean hake through predation. The study found positive net effects of the Chilean fisheries as a whole on the crustacean species, as direct removal effects were compensated by indirect effects from Chilean hake removals (Figure 125). Hake predation is decreased in a depressed population condition. Studies report strong impact of fishing that causes changes in energy flows, consumption, respiration and production in the ecosystem; but removals are for fisheries combined.

In addition to effects from removals of nylon shrimp by the fishery in the ecosystem, there is a large number of non-targeted species removed in nylon shrimp fishing operations (see sections on retained and bycatch species). Most important species in terms of total biomass removals were Chilean hake, yellow squat lobster, grenadiers, bigeye flounder, armed box and lemon crab. Removal of Chilean hake, a main predator in the ecosystem can have significant effects for ecosystem function. Also removals of grenadiers, a main component of the benthic fish community, and of chondrichthyes can have significant effects for ecosystem function**.** There are no effects from removal of species at risk reported as non-target species. The artisanal fishery with lower landings than the industrial fishery should have relatively less effect on the ecosystem.

Figure 124. Flow (t/km^2 per year) -1992 Food web of the Marine ecosystem off central Chile. (Top) species as separate groups, (bottom) species aggregated into functional groups: yellow and red squat lobster and nylon shrimp are "macrobenthos".





Source: Neira et al 2004, Neira and Arancibia 2004

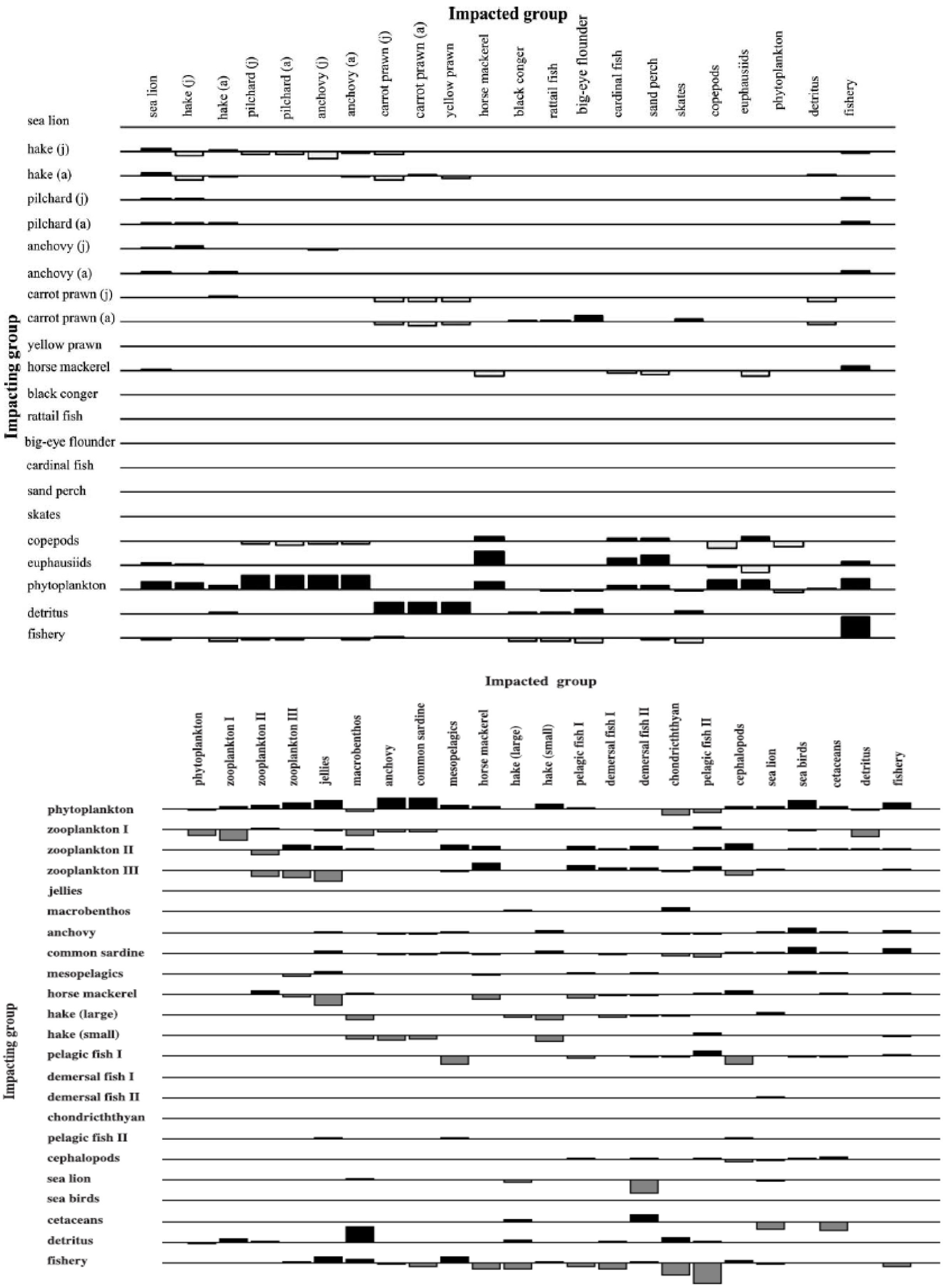
Table 56. Ecopath Input (bold) and output parameters of 1992 central Chile food web in Figure 2. TL-Trophic level, B=Biomass, Y=Fishing yields, F= Fishing mortality, M2= Predation mortality, MO = Other mortality.

Group name/parameter	B_i (t km^{-2})	P_i/B_i (per year)	Q_i/B_i (per year)	Y_i (t km^{-2} per year)	F_i (per year)	M_{0i} (per year)	M_{2i} (per year)	EE$_i$	GE$_i$
1. Sea lion	**0.030**	**1.050**	**15.000**	**0.003**	0.120	0.930	0.000	0.095	0.070
2. Chilean hake (j)	**4.827**	**2.497**	**8.323**	**0.243**	0.050	0.610	1.830	0.755	0.300
3. Chilean hake (a)	**4.487**	**0.541**	**5.159**	**1.188**	0.260	0.130	0.150	0.764	0.105
4. Pilchard (j)	**4.620**	2.537	**15.000**	**5.019**	1.090	0.130	1.320	**0.950**	0.169
5. Pilchard (a)	**6.970**	1.771	**12.000**	**3.933**	0.560	0.090	1.120	**0.950**	0.148
6. Anchovy (j)	**3.120**	3.625	**15.000**	**1.160**	0.370	0.180	3.070	**0.950**	0.242
7. Anchovy (a)	**5.230**	2.171	**12.000**	**4.942**	0.940	0.110	1.120	**0.950**	0.181
8. Carrot prawn (j)	0.665	**5.900**	**18.000**	**0.000**	0.000	0.090	5.810	**0.985**	0.328
9. Carrot prawn (a)	**0.799**	**2.520**	**12.500**	**0.080**	0.100	0.910	1.510	0.638	0.202
10. Yellow prawn	**0.416**	**2.184**	**11.600**	**0.059**	0.140	0.750	1.290	0.657	0.188
11. Horse mackerel	**13.790**	**0.823**	**14.200**	**6.480**	0.470	0.330	0.020	0.598	0.058
12. Black conger	**0.212**	**0.212**	**3.000**	**0.036**	0.170	0.020	0.020	0.913	0.071
13. Rattail fish	**0.256**	0.278	**4.000**	**0.064**	0.250	0.080	0.540	**0.900**	0.069
14. Big-eye flounder	**0.286**	0.304	**3.000**	**0.073**	0.260	0.120	0.000	**0.850**	0.101
15. Cardinal fish	**0.780**	**0.320**	**4.500**	**0.021**	0.030	0.190	0.100	0.198	0.071
16. Pacific sand perch	**0.759**	0.358	**7.000**	**0.231**	0.300	0.220	0.000	**0.850**	0.051
17. Skates	**0.436**	0.362	**3.500**	**0.134**	0.310	0.2200	0.000	**0.850**	0.103
18. Copepods	48.956	**35.000**	**154.519**	–	–	1.750	33.250	**0.950**	0.227
19. Euphausiids	73.627	**2.960**	**16.200**	–	–	0.140	2.820	**0.953**	0.183
20. Phytoplankton	112.107	**120.000**	**0.000**	–	–	82.940	37.060	**0.500**	–
21. Detritus	100.000	–	–	–	–	–	–	–	–

Group name/ parameter	TL$_i$	B_i (t km^{-2})	P_i/B_i (year^{-1})	Q_i/B_i (year^{-1})	Y_i (t km^{-2} year^{-1})	F_i (year^{-1})	M2$_i$ (year^{-1})	M0$_i$ (year^{-1})	EE$_i$	GE$_i$
(1) Phytoplankton	1.00	302.506	**120.000**	–	–	–	36.000	84.000	**0.300**	–
(2) Zooplankton I	2.25	11.623	**482.000**	**1928.000**	–	–	481.518	0.482	**0.999**	0.250
(3) Zooplankton II	2.62	14.091	**45.000**	**154.519**	–	–	44.955	0.045	**0.999**	0.291
(4) Zooplankton III	2.98	26.353	**13.000**	31.707	–	–	12.987	0.013	**0.999**	**0.410**
(5) Jellies	2.81	44.707	**0.584**	1.420	–	–	0.088	0.496	**0.150**	**0.411**
(6) Macrobenthos	2.00	**2.008**	**3.569**	**14.104**	**0.228**	0.114	2.589	0.866	0.757	0.253
(7) Anchovy	2.14	**8.350**	**2.880**	28.800	**6.112**	0.731	1.843	0.306	0.894	**0.100**
(8) Common sardine	2.14	**11.590**	**2.450**	24.500	**8.952**	0.772	1.280	0.397	0.838	**0.100**
(9) Mesopelagic fish	3.84	13.263	**1.200**	**12.000**	–	–	1.199	0.001	**0.999**	0.100
(10) Horse mackerel	3.99	**13.790**	**0.823**	**14.200**	**6.480**	0.470	0.108	0.245	0.702	0.058
(11) Hake (large)	3.55	**4.287**	**0.605**	**5.159**	**1.188**	0.277	0.204	0.124	0.796	0.117
(12) Hake (small)	3.40	**4.487**	**2.500**	**8.323**	**0.243**	0.054	1.616	0.830	0.668	0.300
(13) Pelagic fish I	4.18	**13.380**	0.440	**4.400**	**3.950**	0.295	0.059	0.085	0.806	0.100
(14) Demersal fish I	3.89	**1.683**	0.700	**3.500**	**0.196**	0.116	0.044	0.540	0.229	0.200
(15) Demersal fish II	4.12	**0.780**	0.700	**3.500**	**0.021**	0.027	0.141	0.532	0.240	0.200
(16) Chondricththyans	3.00	**0.436**	0.362	**2.413**	**0.134**	0.307	–	0.055	0.849	0.150
(17) Pelagic fish II	5.08	**0.318**	0.500	**5.000**	**0.106**	0.333	–	0.167	0.667	0.100
(18) Cephalopods	3.78	1.636	**3.500**	**10.606**	**0.001**	0.001	3.496	0.003	**0.999**	**0.330**
(19) Sea lion	4.23	0.090	**0.250**	**20.000**	–	–	0.250	–	**0.999**	0.012
(20) Sea birds	3.74	**0.065**	0.500	**20.000**	–	–	–	0.500	0.000	0.025
(21) Cetaceans	4.51	**0.023**	0.150	**10.000**	–	–	0.01	0.140	0.067	0.015

Source: Neira et al 2004, Neira and Arancibia 2004.

Figure 125. Mixed Trophic Impact from Ecopath Food Web Model for 1992 Central Chile Marine Ecosystem. Yellow and red squat lobsters and nylon shrimp constitute macrobenthos. + and - impacts are shown above and below the baseline



Source: Neira et al 2004, Neira and Arancibia 2004.

Yellow Squat Lobster North Unit Industrial and Artisanal Fisheries

The industrial yellow squat lobster fishery in the northern unit and the artisanal fishery operate mostly in Region IV. Potential ecosystem impacts of the fishery, same as from the nylon shrimp fishery, are from removals of this relatively abundant low trophic species and from removals of nylon shrimp and red squat lobster which play a significant role as prey; also from removal of non-target species that are top predators such as Chilean hake. Yellow squat lobster as the other two non-target crustacean demersal species feed exclusively on detritus and are low trophic level species (2) slightly lower than planktonic forage fish such as sardines. The species are a major component of the benthic food web pathway and in recycling organic matter back to the pelagic pathway.

In additional to effects from removals of yellow squat lobster and the two demersal crustaceans by the fishery, there are other non-targeted species (see sections on retained and bycatch species). Most important species in terms of total biomass removals were Chilean hake, grenadiers, bigeye flounder, armed box and lemon crab. Removal of Chilean hake, a main predator in the ecosystem can have significant effects for ecosystem function. Also removals of grenadiers, main components of the benthic fish community, and of chondrichthyes can have significant effects for ecosystem function. But biomass of non-target catch in the fishery has been generally < 20% of the total catch in the fishery and total catch < 3000 t. There are no known effects from removal of species at risk. The artisanal fishery with lower landings than the industrial fishery should have relatively less effect on the ecosystem. Finally, the fisheries operate within the 5 nm artisanal reserve where biodiversity is highest.

Yellow Squat Lobster South Unit Industrial Fishery

The industrial yellow squat fishery in the southern unit has operated mostly in Regions V and VIII. Potential ecosystem fishery impacts, same as from the nylon shrimp fishery and yellow squat lobster fishery in the northern area, are from removals of this relatively abundant low trophic species and from nylon shrimp and red squat lobster which play a significant role as prey.

In additional to effects from removals of yellow squat lobster and the two demersal crustaceans by the fishery in the ecosystem, there are other non-targeted species (see sections on retained and bycatch species). Most important species in terms of total biomass removals were Chilean hake, bigeye flounder, armed box and lemon crab, but none of the bycatch species constituted main bycatch. Removal of Chilean hake, a main predator in the ecosystem can have significant effects for ecosystem function. But biomass of non-target catch has been generally <20% of the total catch in the fishery and total catch < 2500 t. There are no known effects from removal of species at risk.

Red Squat Lobster North Unit Industrial and Artisanal Fisheries

The industrial red squat fisheries in the northern unit have operated mostly in Region IV. Potential ecosystem impacts of the fishery, same as from the nylon shrimp fishery and yellow squat lobster fisheries, are from removals of this relatively abundant low trophic species and from nylon shrimp and yellow squat lobster which play significant roles as prey.

In additional to effects from removals of red squat lobster and the two demersal crustaceans by the fishery in the ecosystem, there are other non-targeted species (see sections on retained and bycatch species). Most important species in total biomass removals were Chilean hake, bigeye flounder, armed box and lemon crab. Removal of Chilean hake, main predator in the ecosystem can have significant effects for ecosystem function. But biomass of non-target catch has been generally <10% of total catch in the fishery excluding yellow squat lobster and total catch is < 2000t. There are no known effects from removal of species at risk. The artisanal fishery with lower landings than the industrial fishery should have relatively less effect on the ecosystem. Finally, the fisheries operate within the 5 nm artisanal reserve where biodiversity is highest.

Red Squat Lobster South Unit Industrial

Potential ecosystem impacts of the fishery in the southern unit, same as from the other UoCs, are from removals of this relatively abundant low trophic species and from nylon shrimp and yellow squat lobster which play significant roles as prey.

In additional to effects from removals of red squat lobster and the two demersal crustaceans by the fishery, there are other non-targeted species (see sections on retained and bycatch species). Most important species in terms of total biomass removals were Chilean hake, bigeye flounder, armed box and lemon crab. Removal of Chilean hake, main predator in the ecosystem can have significant effects for ecosystem function. But biomass of non-target catch has been generally <10% of total catch; total catch is nevertheless higher than in others UoC reaching close to 7000t. There are no known effects from removal of species at risk.

3.4.6.3. Management Strategy

There are several measures in place within the crustacean fisheries that minimize ecosystem fishery direct impacts from removals of the target species and some non-target species on trophic structure by restricting harvest and fishing areas. Use of quotas for target demersal crustacean species reduces risk of serious or irreversible harm to ecosystem structure and function from fisheries. Use of non-target species quotas for several species also reduces risks. Additionally, apart from off Region IV, there is no trawling activity allowed within 5 nm of the coast to reduce potential interactions with vulnerable ecosystem parts. There is an Action Plan for implementation of the Biodiversity National Strategy including a network of protected areas. Other measures are the result of the Chilean government funded projects for improving gear selectivity and performance to minimize impact of trawl fisheries on ecosystem structure.

LGPA makes specific reference to an ecosystem approach to fisheries management. Many of its provisions have clear orientation towards conservation and protection of marine ecosystems. While much effort in Chile, as elsewhere, has been on studies to better understand ecosystem structure and function, there have been management efforts to protect ecosystem components, with limits on fishing within 5 nm. Within the framework of an Action Plan for implementation of Biodiversity National Strategy, Chile is creating a national network of protected aquatic areas, which includes marine reserves and parks.

There are no specific measures based on ecosystem impact from demersal crustacean removals by fisheries on trophic structure. Food web models are available for the ecosystem off central Chile; fishery management has considered them to inform uncertainties in stock assessment. Materials presented in the ecosystem section reflect that much is known about food webs and impacts of some fisheries on the ecosystem, but the management system has not considered the information for ecosystem based management. From ecosystem studies elsewhere, we can reach similar conclusions. It becomes evident that impediments are system complexity, timely and large data requirements and many uncertainties associated with available information. Nevertheless, there is a need for models incorporating ecosystem interactions to help guide management decisions for demersal crustacean fisheries. They are important prey of Chilean hake, dominant species in the demersal ecosystem and currently depressed so that predation mortality is relatively low. This can partially help explain recovery of some crustacean stocks. So currently, crustacean fisheries are not affecting Chilean hake through feeding interactions, but otherwise fisheries need to account for predator-prey interactions and put measures in place so that fisheries don't pose risk to ecosystem structure and function.

3.4.6.4. Information & monitoring

Significant ecosystem work has been conducted off central Chile which provides adequate understanding of key ecosystem functions, and from which fishery impacts on these functions can be inferred. Main input flows in Central Chile marine ecosystem are between planktonic invertebrates (copepods and euphausiids) and primary producers, as reported for other upwelling ecosystems (Jarre-Teichmann 1998). Other important flows within the pelagic environment are from euphausiids and copepods to horse mackerel, and primary producers and copepods to pilchard and anchovy. Within the demersal environment, main flows are from pilchard and anchovy, and squat lobsters, shrimp and euphausiids, to Chilean hake.

Ongoing research and monitoring of main stocks and fisheries continually contributes to ecosystem understanding, and would likely detect changes in ecosystem functioning over time. A number of studies have investigated the impact of the Chilean fisheries on marine ecosystems (among others Arancibia & Neira 2004, 2005; Neira 2003; Neira et al. 2004, 2014). Arancibia (1989, 1992) and Quiñones et al (1997) analyzed inter-specific relationships between fishery resources and their prey in Central Chile, and concluded that most species that are fishery resources play important ecological roles in the marine system. Trophic relationships between the main components, such as Chilean hake and horse mackerel, have been studied in some detail (Arancibia, 1987, 1991; Miranda et al 1998). Studies use food web ecosystem models to evaluate impacts of Chilean fisheries on food webs at different time periods. Nevertheless, these studies consider effects of demersal crustacean fisheries as a whole. Thus outputs from models do not help understand effects of each fishery on other ecosystem groups. Overall, pelagic species such as horse mackerel, pilchard, and anchovy dominate the system and Chilean hake is the dominant species in the demersal environment.

Chilean hake is the main predator in the system and sea lions play a secondary role. Fisheries today represent the main predator for main target species in the system (Neira et al 2014).

3.5 Principle Three: Management System Background

Principle 3 of the MSC standard states that:

The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

In the following section of the report a brief description is made of the key characteristics of the management system in place to ensure the sustainable exploitation of the fishery under assessment.

3.5.1 Legal and / or Customary Framework

The new General Law for Fishery and Aquaculture (LGPA Ley General de Pesca y Aquicultura), which modified the 1991 law, provides the regulatory framework for sustainable management of hydrobiological resources and their environment in Chile. The old law was scheduled to be re-authorized before the end of 2012. Needs were reviewed and in 2011, a Draft Fisheries Act amending the LGPA entered into Congress. It was reviewed by the Fisheries Committee of the Chamber of Deputies and after over a year of processing, the new law LGPA was officially published in the Diario Official on February 9th 2013. The LGPA modifies the old law in terms of sustainability of aquatic resources, access to industrial and artisanal fishery activities, and regulations for research, management and enforcement. The most significant previous amendment to the LGPA was in 2001 with the establishment of an ITQ system of Maximum Catch Limits by ship-owner, the artisanal extraction regime, management and exploitation areas for benthic resources, a vessel monitoring system and mandatory dockside monitoring of all landings.

Overall, the management system is directly linked to the LGPA, which is amended at intervals to meet emerging issues. The law indicates that effectiveness and implementation of conservation and management measures must be evaluated every five years. One major difference from the previous 1991 law is that there is now explicit consideration of an ecosystem approach with a need for precautionary management, consistent with the FAO code of conduct for responsible fisheries, and lack of information is not acceptable as an excuse for lack of management action. Accordingly, there is a clear orientation towards conservation and protection of aquatic ecosystems. Modifications further ensure that the legal framework is consistent with MSC standards and the delivery of sustainable fisheries.

The explicit objective of the LGPA is the conservation and sustainable use of fishery resources through the application of precautionary and ecosystem approaches. It requires that policy take account of a number of issues: (i) long-term objectives for the conservation and management of fisheries and protection of ecosystems; (ii) application of the precautionary principle with greater caution in management and conservation of resources when scientific information is uncertain, unreliable or incomplete with any lack of scientific information not delaying the introduction of conservation and management measures; (iii) an ecosystem approach to conservation and management of fishery resources and protection of ecosystems; (iv) management of fishery resources in a transparent, accountable and inclusive manner; (v) collection, verification, reporting and sharing of timely and accurate data; (vi) consideration of impacts of fishing on associated or dependent species; (vii) prevention or elimination of overfishing and excess fishing capacity; (viii) effective implementation of conservation and management measures, and (ix) minimization of discards.

Previously, Chile had ratified the conventional nucleus of the precautionary approach (Convention on the Law of the Sea and the Convention on Biological Diversity), the main instruments linked to the application of a precautionary approach (Convention on the Conservation of Antarctic Marine Living Resources on the High Seas of the South Pacific and the Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific), and other instruments that share the basic conceptual framework of the precautionary approach (Rio Declaration on Environment and Development and Agenda 21).

The existing system establishes when and where people can fish, who can fish, how they may fish, how much they can catch, what they can catch, who they talk to about the rules for fishing, how they might gather relevant information and decide what to do with it, how they know that people are abiding by whatever rules are made and how they catch, sanction or penalize wrongdoers. The Law presents a coherent, logical set of procedures within an established structure to deliver sustainable fisheries including quotas, fishing areas, gear characteristics, fishing seasons, regulations and sanctions for non-compliance, roles of stakeholders such as representative councils and scientific committees and requirements for Fishery Management Plans. The law provides the process whereby disputes are resolved and is responsive to changes as they are required.

With respect to ETP species, Chile is a signatory of CITES, the International Convention for the Regulation of Whale Hunting and the Convention on the Conservation of Migratory Species. SERNAPESCA is responsible for regulating the trade of CITES Appendix I and II species. The new LGPA prohibits temporal and permanent catch of species protected by international agreements (Title II, paragraph 1º Art 3 b) and establishes sanctions for non-compliance (Art. 110 j). The law requires the use of tools to minimize catch of non-target species and to avoid and minimize incidental catch, tools to liberate animals caught incidentally, and establishing best practices to avoid, minimize, and mitigate incidental catch of aquatic mammals, birds and reptiles. There is a 2008 law to protect mammal species from harm and the law now includes regulations to limit fishery impacts on marine mammals.

There are also regulations on vulnerable ecosystems. Vulnerable ecosystems are defined in Art.2º.68 and fishing exclusions in Art.4, 6.A and 6.B. These include introduction of a Protocol of Evidence of Vulnerable Marine Ecosystems (Protocolo de Evidencia de Ecosistemas Marinos Vulnerables).

3.5.2 Consultation, Roles & Responsibilities

The Law defines the roles of the main bodies involved in Chilean fisheries including those that undertake research and inform decision making. Each entity has stakeholder representation. According to Chilean regulations, participation of the following entities is required in the administration of national fisheries: Subsecretaria de Pesca y Acuicultura, (SUBPESCA Undersecretary of Fisheries and Aquaculture), Ministerio de Economia, Fomento y Turismo (MINECON Ministry of Economy, Public Works, and Tourism), Servicio Nacional de Pesca y Acuicultura (SERNAPESCA National Fisheries Service), Consejo Nacional de Pesca (CNP National Fishery Council), Consejos Zonales de Pesca (CZP Regional Fishery Councils), Comités Científico Técnico Pesqueros (CCT Scientific Committees), Comités de Manejo (CM Management Committees), Instituto de Fomento Pesquero (IFOP Institute for Fishery Research), Fondo de Investigacion Pesquera y Acuicultura (FIPA Fishery and Aquaculture Research Fund), Fondo de Administracion Pesquera (FAP Fishery Administration Fund), http://www.subpesca.cl/institucional/602/w3-propertyname-539.html. Their roles are as follows:

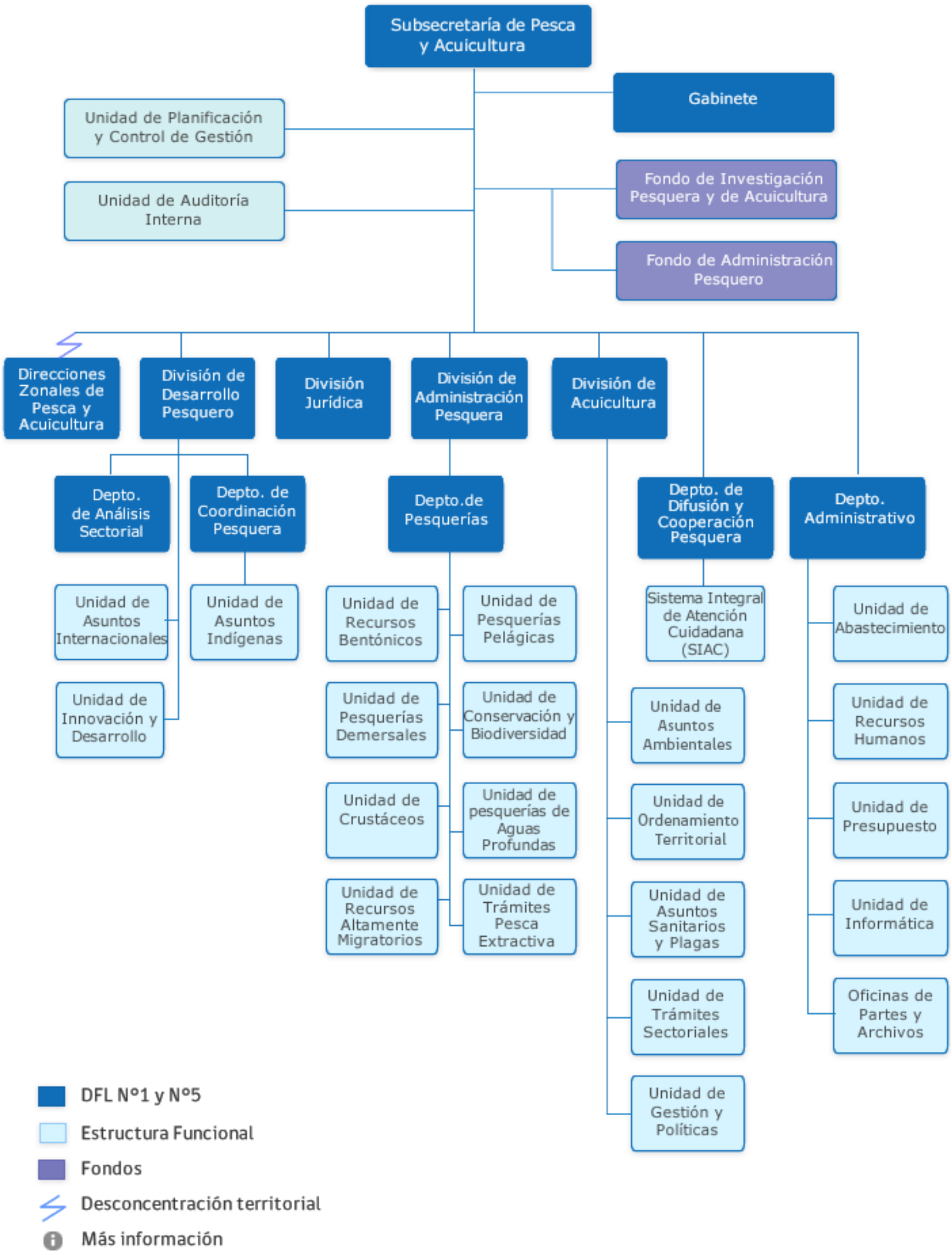
SUBPESCA-MINECON deals with policy, planning and regulation of the fisheries. It was created in 1976 (Decree 1.626) and is the entity that regulates fishery activities and aquaculture according to administration and regulation measures described by the law. The functions of all parts of SUBPESCA are explicitly defined. Regulations are established by Undersecretary of Fishery resolutions or by Minister of Economy decrees. In both cases measures need to be supported by a technical report issued by SUBPESCA and comply with consultations, technical report, previous communication or approvals depending on the law. SUBPESCA is based in Valparaíso. SUBPESCA administration in the regions is carried out by Direcciones Zonales de Pesca (DZPs) (Figure 126), through their Directors who represent the undersecretary in each region. Each DZP maintains working groups with stakeholder participation from the private and public sectors advocated mostly to artisanal activities and to identify and propose measures to solve issues of their interest. SUBPESCA has established a number of consultative groups to inform decision–making, one being the CNP.

SERNAPESCA deals with monitoring, surveillance and control (VMS, landing & quota control, enforcement and statistics). Created by Decree-Law 2.442 of 1978, it is an entity with national presence and with distribution in all regions across the country. Its role is to control regulations of fishery activities in terms of harvest, processing and also aquaculture. The control of landings falls mainly on private enterprise companies contracted according to SERNAPESCA's requirements. In practice, Chile controls landings and not catches.

CNP National Fishery Council is constituted according to article 146 of the LGPA and its membership includes 27 representatives (3 from governmental institutions, 7 nominated by the Chilean president, 7 for the labour sector, 5 for the industrial sector, and 5 for the artisanal sector (http://www.subpesca.cl/institucional/602/w3-propertyvalue-38005.html). CNP's role is to ensure effective involvement of stakeholders in the fisheries sector at the national level on matters related to fishing activity and aquaculture; it has decision-making, consultation, and advising character in areas established by the law. The CNP advises SUBPESCA on policy and regulations governing the fisheries. The CNP submits opinions, recommendations, propositions and technical reports properly documented to SUBPESCA in areas established by the law. The CNP obtains input policies and regulations from regional councils.

CZP Regional Fishery Councils within the LGPA now constitute a functional part of SUBPESCA. There are eight CZFs that represent the regions in the country (XV-I-II; II-IV; V-VI, VII; VIII; IX-XIV; X; XI and XII), and offices are located in Coquimbo, Constitución, Concepción, Valdivia, Puerto Montt, Aysén and Punta Arenas (http://www.subpesca.cl/institucional/602/w3-propertyvalue-38007.html). The CZFs are administration entities with consultation or decision-making roles and its membership includes 18 individuals. They contribute to decentralize administration measures adopted by the authorities and make the participation of representatives of the fishery sector at regional levels.

Figure 126. SUBPESCA Organigram



Source http://www.subpesca.cl/institucional/602/w3-propertyvalue-540.html#

CCT Scientific Committees were established in 2007 (Resolution No. 997) for each of the main species groups to advise SUBPESCA. Currently there are eight CCTs for: 1) Benthic Resources, 2) Small Pelagic Fisheries, 3) Mackerel, 4) Demersal Resources Central area, 5) Demersal Resources Southern area, 6) Demersal Resources Deep Waters, 7) Demersal Crustaceans, and 8) Highly Migratory Species, chondrichthyes and biodiversity **http://www.subpesca.cl/institucional/602/w3-propertyvalue-51147.html**. The CCTs are responsible for considering analyses prepared to address issues defined by SUBPESCA and recommendations to the CNP in support of its decision–making. They are responsible for determining status of the fisheries, biological reference points, and range within which the authority can establish quotas. For implementing their reports CCTs should consider information provided by IFOP as well as from other sources. The committee that is reviewing stock assessments for the three fisheries under consideration in this assessment is the CCT for Demersal Crustaceans with two members from SUBPESCA, two from IFOP and four members nominated by public competition.

The biggest change in the new Law was to provide greater authority to the CCTs while reducing the part played by CNP. Each of the eight established CCTs has associated task groups that undertake detailed analyses. The new law establishes that Management Plans should be established for each fishery resource to provide a package of measures to support the work of CCTs. Agreements are adopted within the CCTs by absolute majority of their active members.

CM Management Committees are entities that advise each fishery to elaborate, propose, implement, evaluate and modify management plans, and created by law 20.657 Art. 8 and 9. The law indicates who integrates the committees and D.S.Nº95/2013 regulates procedures for designation and requirements to be nominated. The make-up of the committees should include one representative of SUBPESCA, two to seven representatives of artisanal fishers registered in the respective fishery, three representatives of the industrial sector, one representative of the processing plants and one representative of SERNAPESCA. The decree also specifies where and when meetings will be carried out, responsibilities of members, and documentation to be produced. The CM for demersal crustacean fisheries has elaborated a fishery management plan which has not yet been released but is under final revisions.

IFOP Institute for Fishery Research as defined by the law is the technical agency within the administration and its main objective is to carry out scientific and technological research related to fisheries and aquaculture. Its mission is to support decision making through implementation of scientific and technical information of public value necessary for the management and conservation of fishery resources and aquaculture and its ecosystems (**http://www.subpesca.cl/institucional/602/w3-propertyvalue-38002.html**). Currently IFOP provides information to SUBPESCA through a contract with MINECON on i) decision making advice (ASIPA) for validated, up to date, quality information for stock assessments, management areas and aquaculture, ii) stock status and sustainable harvest of main fishery resources, and iii) monitoring of toxic algal blooms on fishery areas. Technical reports should be made available to the public as they are submitted to SUBPESCA. IFOP contracts out scientific work (e.g. stock surveys, gear studies) to universities.

Private institutions such as INPESCA S.A. (Fishery Research Institute http://www.inpesca.cl/) can also provide scientific analyses to be considered by the CCTs. They undertake these based upon funding from the industry.

Universities such Pontificia Universidad Católica de Valparaiso, Universidad Católica del Norte, and Universidad de Concepción are contracted to provide assessments of a wide range of stocks.

FIPA funds projects for fishery and aquaculture research necessary for administration measures. Projects are proposed by SUBPESCA but prioritized by a research council (Consejo de Investigación Pesquera y de Acuicultura). FAP depends on MINECON and funds are to promote and enforce regulations of artisanal and recreational fisheries and retrain workers displaced from the fishery sector.

The Navy (Dirección General del Territorio Marítimo y de Marina Mercante (Directemar), besides obligations assigned by the Law of Navigation (Ley de Navegación), has functions related to the enforcement and administration of fishery norms of vessel positioning system (Sistema de Posicionamiento Automático de Naves Pesqueras y de Investigación Pesquera). Also serves in enforcement of regulations on aquatic pollution and marine conservation. The police (Carabineros de Chile) also serve in enforcement roles when appropriate.

The main industrial fishery associations are: Asociación de Industriales Pesqueros del Norte (ASPINOR), Agrupación de Industrias Pesqueras del Sur Austral **(FIPES)**, Asociación de Industriales Pesqueros A.G. **(ASIPES)** and Sociedad Nacional de Pesca **(SONAPESCA)**. The main artisanal fishery associations are: Confederación Nacional de Federaciones de Pescadores Artesanales de Chile

(CONFEPACH), Confederación Nacional de Pescadores Artesanales de Chile (CONAPACH), Asociación de Armadores Pesqueros de Naves Menores (ASOARPES), Federación regional de Pescadores Artesanales de Chile (FEREPA Bio Bio), Federación de Sindicatos de Pescadores Artesanales de la V Region.

The new law mandates that management plans should be established for each fishery resource, to provide a package of measures to support the work of Scientific Committees. Actors in this process are the different industrial and artisanal stakeholders, who will define rebuilding programs and/or protection measures if necessary. And there is a mandate to make an Annual Public Account to provide the country with information on the exploitation status of fishery resources. The management plan for demersal crustaceans, now in draft form and to be made public shortly, will further establish roles and responsibilities within identified activities to accomplish fishery objectives.

The rights of citizens are explicitly defined.[1] They have the right to access non-classified documents (Law 20.285 Access to Information), know the identity of the authorities and officials involved in fisheries administration and management procedures, receive clarification on rules and decisions, request corrective actions if there have been mistakes, make claims; and report any officer who they consider to have been negligent. If stakeholders do not agree with a policy or a sanction, they may appeal to the Minister. SUBPESCA has a website portal for the public to request information which was accessed during this assessment.

The three crustacean demersal fisheries under assessment are taken as bycatch in several fisheries including Chilean hake (*Merluccius gayi*). Regulations on quotas as bycatch were listed above. Chilean hake is also taken as bycatch in the demersal crustacean fisheries. There is a mandatory requirement of hake fishing quotas to conduct fishing operations in all the demersal crustacean fishery units. Thus, owners of LTP fishing licenses for hake constitute stakeholders of the fishery.

3.5.3 Long term objectives

The long term objectives of the fishery are explicitly defined in Articles 1°b and 1°c of the LGPA new Law (see above). Accordingly, the institutional mission of SUBPESCA as currently defined in the SUBPESCA website is to "*Regulate and administrate fishery and aquaculture activities through politics, norms and regulations under a precautionary and ecosystem approach to promote conservation and sustainability of hydrobiological resources for the productive development of the sector*".

Also, Article 8 of the new law establishes a requirement for fishery management plans for all fisheries with closed access, as well as for those classified as fisheries in recovery and incipient fisheries. To accomplish the Management Plan mandate SUBPESCA had to constitute a Committee for each fishery. Representatives of the artisanal, industrial and fishing processing plants were selected by SUBPESCA Res. Ex. N° 2199/2014 and the committee for the demersal crustaceans was established in October 2014. Participation includes one representative of SUBPESCA to preside the Committee, up to seven representatives of the artisanal fishers registered in the fishery, three representatives of the industry with lawful participation in the fishery, and one presentative of SERNAPESCA. The design of the management plan (plan de manejo) of demersal crustaceans was developed within a participatory process. Recommendations by Hindson et al (2005) on fishery management were taken into account (SUBPESCA presentation during site visit). The process has entitled sequential stages including identifying the key issues in the fisheries (through project 2013-141-DAP-46_ID N° 4728-177-LP13 "Apoyo logístico y técnico para el diseño y elaboración del plan de manejo de crustáceos demersales: Camarón Nailon, Langostino Amarillo y Langostino Colorado" conducted by a consulting firm (CESSO).

Several workshops were conducted to identify the main problems in these fisheries including biological, economic, social and environmental dimensions. Biological Reference Points were used as a reference for management as established by the scientific committee and using the best available stock evaluation and in agreement with measures and procedures established in the LGPA.

The Management Plan draft includes a) general background about the fishery such as application area, resources involved, fishing areas and fleets and characterization of the artisanal, industrial and market actors, b) objectives, goals and timing to maintain or move the fishery to MSY for the resources included in the Plan, c) strategies to reach the objectives and goals, which could include conservation and

[1] http://www.subpesca.cl/institucional/602/w3-propertyvalue-543.html

administration measures necessary according to the law, and agreements to resolve the interaction among different fishery sectors involved in the fishery, d) evaluation criteria for compliance of the established objectives and strategies, e) contingency strategies to deal with variables that could affect the fishery, f) research and enforcement requirements, and g) any other aspect that is considered of interest for the implementation of the plan objective. The plan also includes education for crew members in relation to incidental catch and ETP species. The Committee establishes the evaluation period for the Plan, which could not exceed five years after the Plan is formulated.

A draft of the Management Plan for the three crustacean species in this assessment was completed in December 2015 and submitted to the demersal crustaceans CCT. The Management Plan includes the standings, ideas and recommendations put forward and approved by the 29 members of the Management Committee in representation of the sectors involved including the artisanal industrial, processing plants and institutional sectors.

The National Fisheries Policy stipulates that long-term general objectives must be developed on the basis of the following specific aims:

- Sustainability
    - Ensure the effective application of conservation and management measures for appropriate conservation levels of aquatic resources to allow the country to benefit from the greatest benefit possible as a result of its exploitation
    - Guarantee that fisheries activities are engaged in accordance to the long-term productivity of exploited resources and that they are environmentally secure to minimize eventual damage to target species, bycatch and the environment in which they develop;
    - Ensure that fisheries activities are engaged in a responsible manner, in order to secure, among others, the conservation of aquatic resources and their environment, and duly safeguard the rights of present and future generations
- Economic growth
    - Promote economic growth of the sector through the full use of fisheries resources, improvement of the use of the labor force and further market development;
    - Develop a higher level and higher quality of work consistent with the level of investments recommendable in the sector, in order to enhance the livelihood of the sector's players;
    - Boost growth of the fisheries sector encouraging efficient use of productive resources and improvement of processes to reach higher added value of fisheries products, preferably those aimed at human consumption.
- Governance
    - Develop a modern, competent, efficient and reliable public institutional structure with a high degree of coordination and cooperation among the agencies in charge of the administration, enforcement and research in the fisheries sector, to allow mutual benefits and better use of available budgets;
    - Encourage mechanisms that protect the transparency of institutional procedures, decision making and scientific advice processes;
    - Include organized and responsible participation of interest groups in the decision making process for fisheries management, including, among others, territorial, sectorial, ethnic, cultural and gender elements
- Equity
    - Include equity as a relevant element in the adoption of decisions on access, resource allocation and use of the territory;
    - Maintain the balance required to ensure representation of the various groups of interest in the sector, within the decision making process;
    - To assure access to information by the entire sector.

Thus long-term objectives are explicitly stated which appear to be consistent with the MSC principles.

The harvest strategy has a number of features of a precautionary approach. It has established reference points and relatively conservative harvest targets although these are not scored here but under Principle one.

Leal et al, in an analysis of the factors affecting the process of making TAC's decisions each year in various fisheries of Chile, with emphasis on fisheries in Central Chile, concluded that the CNP showed a clear pattern of prioritization of economic and social objectives.

FAO noted that in the past “legislation frequently does not incorporate clear general principles to guide fisheries management, but rather pays unnecessary attention to infractions and procedural aspects, which could be more adequately addressed by regulations”. Another point made is that “the legislation in Chile contemplates fishers’ participation in the management process, which can be broad, restricted or not considered at all, leaving the decisions to the administration. Actions to identify or define measures can be initiated by the administration or by organised groups of stakeholders, as provided in the legislation; administrators only act in response to pressure exerted by fishers”. The new law addresses these issues.

3.5.4 Incentives to sustainable fishing

Key incentives for sustainable fishing include property rights and research funding. The first quota allocation between the artisanal and industrial sectors (Law Nº19.849 1994) was based upon historical performance and later modified in favor of the artisanal fishery on the basis of under reporting or growth of the sector. There were also maximum catch limits for ship owners introduced in 2002 which led to a significant reduction in number of industrial vessels. Entitlements to companies were granted based upon historical catch. With the new law shares are open to public auction. Quota owners can sell, trade, and arrange partnerships with their quota shares under the scheme managed by SUBPESCA. There is a maximum cap of 30% of the global quota per license holder. As elsewhere, this system has likely led to more sustainable fishing practices throughout the industry.

Artisanal Fishery is defined in LGPA Art 2. 28 as fishery harvest activity by individuals in the artisanal fishery registry (Registro Pesquero Artesanal) or registered as artisanal fishers under terms established by the law. There are several categories (property owner or a community of artisanal fishers who are owners of at the most two artisanal vessels, artisanal fisher, diver, collector in the intertidal).

A large part of the required research is financed by the Fisheries and Aquaculture Research Fund (FIPA).

The crustacean sector has been proactive in supporting and funding a number of monitoring and research programs; most notably the introduction of new gear technology.

The Organisation for Economic Co-operation and Development (OECD)[2] considers that “*one of the distinguishing features of Chile’s fisheries and aquaculture policy framework is the lack of extensive government programs providing direct financial payments to the sector. Most of the Chilean government financial transfers to the fisheries and aquaculture sector are in the form of general services. These transfers are for management, research and enforcement services provided primarily by the SUBPESCA, SERNAPESCA and IFOP*”. The OECD goes on to identify that the main sources of finance to the fishery sector are (i) the Banco Integrado de Proyectos which is the State fund coordinated by the Ministry of Planning that in fisheries finances basic studies regarding fish stock evaluation and fisheries management; (ii) FIP (see above)); and (iii) the Fondo de Fomento de la Pesca Artesanal (Fund for the Promotion of Artisanal Fisheries, or FFPA) managed by SERNAPESCA to provide financial assistance to the artisanal sector for infrastructure, organizations, training, restocking, and marketing. Infrastructure projects such as the construction of fishing ports are the responsibility of the Ministry of Public Works. No cost reducing transfers are provided to companies or individual fishers. OECD goes on to highlight that the management regime has evolved from open access systems to policy instruments such as global quotas and the allocation of individual quota shares that allow for a flexible operating environment for the fishing sector, with firms able to self-adapt capacity and catching patterns to maximize profits. This has improved the fleets’ financial performance. Fishing seasons have

[2] OECD 2012 Mejores Políticas para el Desarrollo: Perspectivas OCDE sobre Chile

been extended, facilitating a more efficient use of on-shore processing facilities, and employees have more stable and better quality jobs.

3.5.5 Fishery specific objectives

Objectives for demersal crustacean fisheries are to have a sustainable fishery considering biological and fishery aspects, as well as economic, social and environmental aspects and at the same time to maximize social and economic benefits of the activity and protecting the biological health of the fishery. Specific goals and measures to accomplish the goals such as to maintain fisheries around RMS and a good size structure composition are in the management plan draft that is been reviewed and will be released in the next upcoming months.

Nylon Shrimp

According to LGPA the fishery has been declared “fully exploited” and quotas are allocated for fishery units under LTP (transferable fishery license TAC). Nylon shrimp constitutes one fishery unit and there is one global quota for the fishery unit.

SUBPESCA[3] stated that the management objective for the resource should be to avoid the stock biomass falls below 30,000 t and at least to maintain 2012 yields from the fishery. To achieve this objective, the strategy is to have conservative fishing mortality rates in each of the fishery zones in order to protect biomass and to distribute fishing effort to avoid overfishing at a regional level.

Annual global catch quotas are to maintain or take the fishery to MSY. Based on discussion with the Scientific Committee CCT for demersal crustaceans and IFOP information, SUBPESCA considered appropriate to establish as reference for diagnosis of the stock status MSY (RMF), 40% of the virginal spawning biomass and corresponding fishing mortality.

The scientific committee defines as Biological Reference Points according to LGPA: BMSY (BRMS) = 40%BD0; FMSY (FRMS) = F45%BDPR|F=0; Blim= 20%BD0. Additionally, the range of biomass levels is defined between 20% under and 50% over BRMS and F between 25% under and over FRM.

LGPA states how allocation of the nylon shrimp global catch quota would take place within Region II and VIII between artisanal and industrial fisheries from 2013 to 2032. For a global quota of i) up to 600 t, the total is allocated to the artisanal fishery; ii) between 600 and 4,000 t, artisanal share is increased by 5.88% of the difference between the overall quota and 600 t and the remainder is for the industrial fishery; and iii) over 4,000t, 20% will be for the artisanal fishery and 80% for the industrial fishery.

Of the artisanal share, 75% is to be distributed among regions that comprise the fishery unit, and allocation is based on landings during the preceding two years. There is no equivalent rule for the industrial fishery.

Yellow Squat Lobster

The yellow squat lobster fishery in III - IV Regions is under a full exploitation regimen and in V - VIII Region is under a Fishery under Recovery regimen. SUBPESCA[4] stated that the three short term management objectives are to avoid deterioration of stock biomass and stock structure, and to avoid local overfishing. To achieve these objectives, SUBPESCA has the strategy of establishing conservative harvest rates and to reduce risk of not meeting the objectives to less than 10% and to distribute the fishing pressure to avoid a deterioration of the resource in either of the different regions that comprise the fishery unit. The report goes on to note that due to biomass levels having exhibited a decline, the precautionary approach must be adopted to avoid a further reduction. For 2012, this led to the adoption of IFOP’s scenario that incorporated a low risk of not meeting the objectives (1%) and maintaining the conservative fishery mortality applied from 2010 (0.07).

[3] Informe Técnico (R. PESQ.) N°105 Cuota Global Anual de Captura de Camarón Nailon Langostino Amarillo (*Heterocarpus reedi*), entre la II y la VIII Región, Año 2012

[4] Informe Técnico (R. PESQ.) N°94 Cuota Global Anual de Captura de Langostino Amarillo (*Cervimunida johni*), entre la V y la VIII Región, Año 2012

The scientific committee defines as Biological Reference Points according to LGPA: BMSY (BRMS) = 40%BD0; FMSY (FRMS) = F45%BDPR|F=0; Blim= 20%BD0. Additionally, the range of biomass levels is defined between 20% under and 50% over BRMS and F between 25% under and over FRM.

The LGPA states how allocation of the yellow squat lobster global catch quota would be within Region III and IV between artisanal and industrial fisheries from 2013 to 2032. For a global quota i) up to 350 t, the total is allocated to the artisanal fishery; ii) between 350 and 1,350 t, the artisanal share shall be increased by 10% of the difference between the overall quota and 350 t, the remainder will be for the industrial fishery; and iii) over 4,000 t, 33% will be for the artisanal fisheries sector and 67% for the industrial fishery. In regions V-VIII where the fishery is in recovery, the regime makes no distinction between industrial and artisanal fisheries.

Of the artisanal share, 75% will be distributed among the regions that comprise the fishery unit, and allocation will be based on the landings during the preceding two years.

Licence holders for nylon shrimp, red squat lobster, and Chilean hake fisheries are required to have yellow squat lobster quotas to account for bycatch. Similarly, the yellow squat lobster fishery requires quotas for these species to account for bycatch.

Red Squat Lobster

SUBPESCA[5] stated that in view of the analysis presented in late 2011, objectives set for medium term administration correspond to: recovering biomass in the fishery unit at least to the value of the last decade and preventing a decline, or at least maintaining current yields and size structure in Regions III and IV. Two strategies are identified to achieve defined objectives: application of a conservative exploitation rate thus reducing risk of not meeting the objectives; and distributing fishing pressure so as to prevent regional stock reductions.

The scientific committee defines as Biological Reference Points according to LGPA: BMSY (BRMS) = 40%BD0; FMSY (FRMS) = F45%BDPR|F=0; Blim= 20%BD0. Additionally, the range of biomass levels is defined between 20% under and 50% over BRMS and F between 25% under and over FRM.

LGPA states how allocation of the red squat lobster global catch quota would be within Region I and IV between artisanal and industrial fisheries from 2013 to 2032. For a global quota i) up to 700 t, the total is allocated to the artisanal fishery; ii) between 700 and 2,100 t, the artisanal share shall 700 t, the remainder will be for the industrial fishery; and iii) over 2,100 t, 30% will be for the artisanal fisheries and 70% for the industrial fishery. Of the artisanal share, 75% will be distributed among the regions that comprise the fishery unit, and allocation will be based on the landings during the preceding two years. In regions V-VIII where the fishery is in recovery, the regime makes no distinction between industrial and artisanal fisheries.

3.5.6 Decision making processes in the fishery-specific management system

There are a number of consultative and decision-making bodies involved in Chilean fisheries. According to the LGPA, the fishery authority has to establish consultation, require technical reports and previous communication with entities participating in the administration. These requirements are presented in writing and deadlines on resolutions are established in the law.

There are consultations to establish fishery administration regimes. To establish Full Exploitation regime for a fishery, which is done by decree of the Minister, it is necessary to consult with the CCT, CNP and CZPs of the areas that the fishery concerns. To declare a fishery under Recovery regime or Developing regime (Desarollo incipiente), also done by decree of the Minister, it is required to have the technical report by SUBPESCA, as well as consultation with the CCT and the regional councils.

LGPA Title II Paragraph 1º Art.3 describes the measures for conservation in each fishing area which independently of the administration regime, can be established by MINECON supreme decree with

[5] Informe Técnico (R. PESQ.) N°149 Cuota Global Anual de Captura de Langostino Colorado, entre la XV y la IV Región, Año 2012

technical report SUBPESCA and previous communication with the corresponding CCT. These are biological closures, prohibition for protection for species under international agreements, setting catch (annual or global) and bycatch quotas, and establishing areas as marine reserves and marine parks. Some of these measures are approved by the CNP, such as when there is a need to determine quota shares for extraordinary purposes. For setting global catch quotas, the scientific committees propose a range within which SUBPESCA can choose and after the decision has been made it is communicated back to the committee. LGPA Title II Art.4 establishes that measures that can be established by SUBPESCA in consultation with the respective regional council and previous consultation with the CCT. These are setting minimum legal size by species and tolerance ranges, gear regulations, use of tools to minimize bycatch, use of tools to liberate incidental catch and establishing best practices to minimize incidental catch. There is also a provision to establish temporary closures if oceanographic phenomena cause negative effects to a species in specific areas. The Minister, with a SUBPESCA technical report and previous communication with the regional council, can establish regulations related to vulnerable marine ecosystems (as described in LGPA Art. 6. But the determination of fisheries that can affect vulnerable ecosystems is the responsibility of the relevant scientific committee.

The use of explicit harvest control rules with the incorporation of estimates of risk and uncertainty indicates that a precautionary approach is used based upon the annual assessment process as managed by SUBPESCA. The CCT debates the technical aspects of the assessments and makes recommendations to SUBPESCA.

3.5.7 Compliance and Enforcement

There are several different mechanisms to address monitoring and enforcement of norms established and that are responsibility of SERNAPESCA, and the Chilean army (Armada de Chile) and police (Carabineros de Chile). All regulation of the fishery is land-based.

Current requirements include a satellite positioning system, which has been mandatory since 2000 for industrial vessels. This allows monitoring their positions from when they leave until they return to port which is monitored by the navy and SERNAPESCA. SERNAPESCA considers that the regulation is one of the strongest in the country. Vessels cannot leave port without a functioning system. There are also regulations to govern what happens if a VMS unit breaks down at sea. The VMS is used to enforce the five nautical mile fleet exclusion along the coast. Under a SUBPESCA administrative sanction, a vessel could lose 30% of its annual quota if it violates any time or area closure. The VMS system also regulates where specific company vessels can fish. Not all regulations apply to the artisanal vessels.

Also since 2002, there has been 100% dockside monitoring of landings of the industrial fleet which is undertaken by third party auditing companies accepted by SERNAPESCA. Prior to 2001, regulation of catch against the global annual quota was based upon at-sea logbooks matched with processing plant statistics. Tendering of these services is for a three-year period and based upon both technical and financial criteria. One company (and one backup) is selected from qualifying companies through a rigorous and transparent review process. There are about 250 certified landings inspectors which monitor about 26,000 landings per year. The activities of these companies are audited by SERNAPESCA. The monitoring system for landings of the artisanal sector is similar. In this case, SERNAPESCA staff is employed in the ports to verify landings.

Since 2002 the law established the requirement of accepting scientific observers on board of industrial fishing vessels. Several scientific observer programs provide data on at-sea activities. SUBPESCA makes the designation of which vessels will have observers and these vessels are not authorized to leave port without observers. Artisanal vessels do not make accommodations for scientific observers on board. Scientific observers have taken note of failed tows which are associated with discards which are prohibited, but do not have an enforcement role. Nevertheless, their presence influences the crew behavior during fishing activities (IFOP personnel communication during site visit).

A program of inspectors on board does not exist at the moment and it is recognized that more at-sea enforcement capacity is required. Therefore, on-board camera systems are to be introduced on all industrial vessels at the owner's expense. These will greatly improve the ability of the management system to enforce specific types of regulations (e.g. related to discards and vulnerable species). This should partially resolve this bycatch issue although the absence of inspectors on board remains a problem and IFOP observers mention that not all catch is brought on deck, and thus is not quantified.

Landings are also controlled through paper work necessary for transport (guias de libre tránsito), and also it is mandatory for the processing plants to make all information on raw material and products available. All data must have a legal accreditation (SERNAPESCA Res. Nº1.319 2014).

The LGPA now requires the industrial fisheries to release information on estimated catch after each fishing tow in an electronic logbook. SERNAPESCA should define the criteria to resolve differences between these estimated catches and the information certified by auditing companies at dockside.

SERNAPESCA indicated that quota violations are penalized severely. Bycatch infractions can result in quota reductions, fines and / or skipper suspension.

Gear regulations are currently enforced at dockside. There is no at-sea boarding. It is illegal to use a prohibited mesh and to carry one on board. SERNAPESCA noted that there is no evidence of systematic non-compliance with the regulations.

3.5.8 Research Programme

SUBPESCA, jointly with other fisheries agencies, coordinates the development of fisheries and aquaculture research plans in order to establish the scientific and technical basis to develop administration measures adopted by the authority for the fisheries. The research plan is developed through programs that consist of the execution of assessment procedures for main national fisheries in order to determine status of the aquatic resources and associated fisheries, considering biological, fisheries, economic, social and environmental factors.

Under Law 20.657, SUBPESCA is required to prepare the necessary research program for the regulation of fisheries and gain information on aquatic resources and ecosystems (status, patterns and trends) to support conservation and management measures and the decision making process. The law requires a Research Program at least for a) evaluation of biomass and abundance, b) stock assessment using modelling to determine stock status, and c) ongoing monitoring of the fisheries, population dynamics parameters and oceanographic conditions.

IFOP conducts ongoing monitoring but it can subcontract the research by public competition.

For the demersal crustacean fisheries in this assessment the extent of the area monitored covers the area of the units of certification (Figure 127). Nevertheless, monitoring the fishery has been conducted only on board of industrial vessels because artisanal vessels have not accommodated observers. Thus, specific data for the artisanal fishery, in particular on species composition of the catch are not available. Because in Region IV, artisanal and industrial vessels operate in relatively similar areas, and the vessels are similar and use the same gear, it is assumed that catches are similar to that of the industrial fisheries. Nevertheless, because the industrial quota is relatively low, few tows are sampled and monitoring of the fisheries in the region is affected. Further, the issue is that quota allocation between artisanal and industrial sector depends on stock status and when status is poor all the quota is allocated to the artisanal fishery. In 2015 the red squat lobster quota of 899 t in the northern unit was allocated 90% to the artisanal fishery, and data for the fishery are missing in Region IV. This is of particular relevance for this assessment for P2 in particular because 2015 was the first year the new gear was mandatory and there is no information on catch composition of the new gear for that fishery.

Other research efforts are awarded through the FIPA through public competition. Research includes both on-going monitoring and *ad hoc* projects. Projects may be suggested by the established committees with SUBPESCA prioritizing the work to be completed. Currently, in addition to the Research Program, there are efforts conducted by IFOP to evaluate discards in the demersal crustacean fisheries.

Two main sources finance scientific research; SUBPESCA through direct allocation and funds from the Fisheries Research Fund (FIP) which are subjected to public competition. There are two main sources of financing for scientific research applied to management. The first source is provided by SUBPESCA on the basis of direct allocation. These funds are used to annually fund fisheries monitoring programs and status and exploitation studies (stock assessments). The second source of financing is managed through the Fisheries Research Fund (FIP); its annual research program is open to public competition.

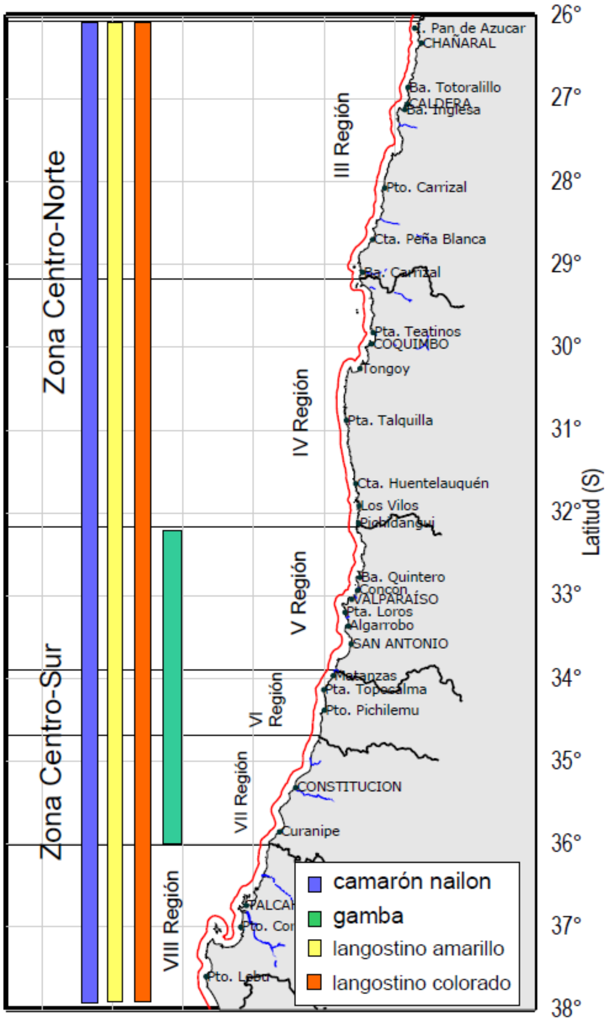
According to the LGPA, SUBPESCA elaborated the Research Program for the Regulation of Fisheries and Aquaculture 2016 (Programa de Investigación para la Regulacion de la Pesca y Acuicultura FIP 2016), which was approved through Resolution Nº3603 2015. There are 60 projects this year that will be evaluated by the Research council (Consejo de Investigacion Pesquera y de Acuicultura).

Entities other than IFOP involved significantly in conducting research related to demersal crustacean fisheries are universities such as the Pontificia Universidad Católica de Valparaiso, Universidad Católica del Norte, and Universidad de Concepción, and INPESCA.

This process provides the management system with reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.

Consequently, a research plan is available that is intended to further the sustainable management of the fisheries. Research results are readily available and disseminated to all interested parties through government documents, scientific literature, and a number of different media. Information on research results on monitoring of Chilean demersal crustaceans stocks and fisheries are electronically available at the IFOP Library- Public Catalogue http://biblioteca.ifop.cl/F/IAAQGLY2FEXC43R1BGBX2HQ98V2GIGGM5AYIVG2L7S1G41RNNY-12386?func=find-c&ccl_term=WSU=crustaceos. FIP reports are available at http://www.fip.cl/Proyectos.aspx.

Figure 127. Latitudinal Extent of IFOP Monitoring Area for Evaluating Demersal Crustacean Fisheries.



3.5.9 Management performance evaluation

During site visit interviews, it was evident that each part of the Chilean demersal crustacean management system (research, monitoring, assessment, harvest control rules, decision making and enforcement) receives some level of scrutiny, primarily through internal and occasionally external review.

Certainly, the CNP and regional councils provide SUBPESCA with feedback on regulations and monitoring, and FIPA undertakes research on the effectiveness of management measures. It is noted that stock assessment external review is primarily engaged by the CCT. This is an efficient use of this expertise and in keeping with practice elsewhere. Management Strategy Evaluation is applied to the fisheries to take account of risk.

The management plan for demersal crustaceans will further establish roles and responsibilities within identified activities to accomplish fishery objectives, including performance evaluations.

4. Evaluation Procedure

4.1 Harmonised Fishery Assessment

At the time of writing, there were no MSC assessments that had already been completed that overlap with this assessment but there is one MSC assessment overlapping this fishery that is currently underway (detailed below).

This other MSC assessment will form an important background resource for the assessment team - collating and reporting on available stock and fishery information, as well as highlighting areas of stakeholder and assessment team concerns.

Completed assessments

None

Assessments in progress

Chile squat lobsters Camanchaca demersal trawl fishery

4.1.1 Harmonisation Details

Harmonisation meeting/s

Initial harmonisation meetings took place between the CABs and it was agreed that the P1 team member would be used for both assessments and that this would aid harmonisation. It was also hoped that both site visits could take place at the same time, however, this was not possible owing to delays in contractual agreements. Further harmonisation discussions took place in June 2016 at the point when the PCDR for this assessment had been published.

Meeting Outcomes

Harmonisation discussions between the assessment teams in June 2016 noted that there was a significant difference in the timeline of the two assessments. This assessment had reached the PCDR stage but the Chile squat lobsters Camanchaca demersal trawl fishery assessment had only just determined initial scores for the fishery. Under such a scenario, MSC Guidance is as follows:

Where an assessment overlaps with a certified fishery or fishery in assessment that a CAB has already scored, the new assessment team shall use as their baseline the rationale and scores detailed for the previously scored fishery.

On that basis, the assessment team for the Chile squat lobsters Camanchaca demersal trawl fishery were able to consider their scores for the fishery in the light of the scores previously agreed for this assessment. In general, there were differences identified in relation to P3 performance indicators only, which allowed the Chile squat lobsters Camanchaca demersal trawl fishery assessment team to review and revise some of their initial scores. It is not possible now (August 2016) to provide a full comparison of scores allocated for the two fisheries by the respective CABs because the scores for the Chile squat lobsters Camanchaca demersal trawl fishery have not yet been finalised and have yet to go through client, peer and stakeholder review. Further harmonisation discussions may therefore be necessary at the first surveillance audit for this fishery when the Chile squat lobsters Camanchaca demersal trawl fishery assessment report should be complete.

4.2 Previous assessments

This is the first MSC assessment for this fishery.

4.3 Assessment Methodologies

This fishery was assessed using version 1.3 of the MSC Certification Requirements and version 1.3 of the MSC Full Assessment Reporting Template.

4.3.1 Assessment Tree

The Default Assessment tree was used for this assessment with no adjustments.

4.4 Evaluation Processes and Techniques

4.4.1 Site Visits

An initial site visit was held during the week commencing 31 March 2014 when the assessment team visited Coquimbo, Valparaiso and Concepción, Chile. This enabled a scheduled programme of consultations to take place with key stakeholders in the fishery – including skippers, scientists, fishery protection officers, NGOs, fishery managers and technical support staff. Prior notification of this site visit was issued on the MSC website in 'The Mercurio' in order that all relevant stakeholders were aware of the opportunity to meet with the assessment team.

Following this initial site visit, the newly modified trawl became mandatory, and the assessment team considered that a second visit became necessary to collect new information concerning the scoring of both Principle 1 and Principle 2 performance indicators. As the new trawl had not become mandatory until November 2014, it was necessary to delay the second site visit to ensure that sufficient information would be available to facilitate scoring of the fishery. During week commencing 14th December 2015, both members of the assessment team undertook a site visit to Coquimbo, Valparaiso and Quinteros, Chile.

(a) Initial site visit

The assessment team for the initial site visit comprised of Ian Scott (P3 and team leader), Patricio Arana (P1) and Sara Adlerstein-Gonzalez (P2).

Table 57 Meeting programme

Monday 31 March 2014

Activity	Name	Position	Organisation
Client meeting, Coquimbo	Leandro Sturla Osciel Velasquez Claudio Velasquez Mario Venegas Willams Mauad Guillermo Donoso Pablo Manriques Antonio Hervas	Managing Director	AIP Client rep. ASI
Stakeholder meeting, Coquimbo	Jaime Molina Pablo Manriques Antonio Hervas	Director General	SERNEPESCA IV Client rep. ASI

Tuesday 1 April 2014

Activity	Name	Position	Organisation
Stakeholder meeting, Coquimbo	Patricio Vial Williams Mahuat Gonzalo Zuñiga Pablo Manriques Antonio Hervas	ASPEARPE ASPEARPE ASPEARPE	Sindicato Independiente de Pescadores Artesanales (SIPART) Client rep. ASI
Stakeholder meeting, Valparaiso	Diana Parroga Jorge Castillo Doris Bucarey Marcelo San Martine Maximiliano Zilleruelo Pablo Manriques Antonio Hervas	Research scientist	IFOP Client's rep. ASI

Wednesday 2 April 2014

Activity	Name	Position	Organisation
Stakeholder meeting, Valparaiso	Antonio Vidal Rodrigo Neira Paula Alarcón Julio Jorquera Francisco Fernandez Pablo Manriques Antonio Hervas	Enforcement and compliance officer	SERNEPESCA Client rep. ASI
Stakeholder meeting, Valparaiso	Manuel Cisternas Rene Puruch T Luis Lablez Gustavo Flores Manuel Perez Pablo Manriques Antonio Hervas	President Membrillo Portales Portales Portales	Pescadores Artesanales Caletas El Membrillo y Portales Client's rep. ASI

Thursday 3 April 2014

Activity	Name	Position	Organisation
Stakeholder meeting, Santiago	Valesca Montes Emma Plotnek Antonio Hervas	Representative Representative	WWF ASI

Friday 4 April 2014

Activity	Name	Position	Organisation
Stakeholder meeting, Concepción	Billy Ernst Luis Cubillos Marco Retamal Antonio Hervas	Research scientist Research scientist Research scientist	University de Concepción ASI
Stakeholder meeting, Talcahuano	Marcelo Moreno Pablo Manriques Antonio Hervas	Enforcement and compliance officer	SERNEPESCA Client rep. ASI
Stakeholder meeting, Talcahuano	Cecilia Palma Nelson Salas Pablo Manriques Antonio Hervas	Research scientist Research scientist	IFOP Sur Client's rep. ASI

(b) 2nd site visit

Owing to the withdrawal of Ian Scott and Patricio Arana from the original team, Julian Addison was appointed as the P1 and team lead and Sara Adlerstein-Gonzalez's role was broadened to include P3.

Table 58 Meeting programme

Wednesday 16 December 2015

Activity	Name	Position	Organisation
Stakeholder meeting	MªAngeles Babilni Alejandro Karstegl Verónica Madrid	Division Chief U. crustaceos	SUBPESCA, Valparaiso
Stakeholder meeting	Maximiliano Zilleruelo	Chief Proyecto Seguimiento Crustaceos	IFOP, Valparaiso
Stakeholder meeting	Patricio Arana Espina	Scientist	Catholic University of Valparaiso, School of Marine Sciences, Valparaiso
Stakeholder meeting	Dante Queirolo	Scientist	Catholic University of Valparaiso, School of Marine Sciences, Valparaiso

Thursday 17 December 2015

Activity	Name	Position	Organisation
Client Meeting	Stefan Koper Andrés Quintanilla Attendee 3	Gerente General Gerente Producción	Pesqueria Quintero Pesqueria Quintero

Friday 18 December 2015

Activity	Name	Position	Organisation
Client Meeting	Leandro Sturla Osciel Velasquez Claudio Velasquez Mario Venegas Willams Mauad Guillermo Donoso	Managing Director	AIP, Coquimbo AIP Bracpesca S.A. Antarctic Seafood Rymar LTDA Isladamas S.A. / Costa Brava
Stakeholder meeting	Enzo Acuña	Scientist	Univ. Catolica del Norte, Coquimbo
Stakeholder meeting	Denise Bore Ricardo Suárez Claudio Astete Pablo Díaz	Scientists	IFOP, Coquimbo
Vessel skipper	Nolberto Caruaja	Skipper	

Source: Acoura Marine assessment team

4.4.2 Consultations

Stakeholder issues

Verbal representations were provided to the assessment team expressing a range of views, opinions and concerns. The team is of the view that matters raised have been adequately debated and addressed as a part of the scoring process for this fishery, and that none of the issues raised, therefore, require separate attention beyond that represented in this report.

Interview Programme

Following the collation of general information on the fishery, a number of meetings with key stakeholders were scheduled by the team to fill in information gaps and to explore and discuss areas of concern. These meetings are summarised in Tables 57 and 58.

Summary of Information Obtained

A substantial amount of information was provided to the assessment team by the client and by stakeholders during the two site visits. Scientists from IFOP and Universities described the stock assessment process in detail along with the nature of the new modified trawl and its selectivity and current programmes assessing the level of discards. Management authorities (SUBPESCA) described the harvest and management strategies in the fishery, and provided a draft copy of the new management plan which has been drawn up for the three demersal crustacean fisheries. SERNEPESCA described the monitoring and enforcement of the fisheries.

4.4.3 Evaluation Techniques

Public Consultation

A total of 41 stakeholder individuals and organisations having relevant interest in the assessment were identified and consulted during this assessment. The interest of others not appearing on this list was solicited through the postings on the MSC website, and by advertising in 'The Mercurio'. These were felt to be the most appropriate media for making these public announcements as 'The Mercurio' has significant readership / uptake in the primary stakeholder locations for this fishery and the processes used on the MSC website for tracking and announcing the various stages of the assessment as it progresses - from Full Announcement through to Certification - form an ideal tool through which to channel stakeholder interest and keep them abreast of the important stages of the assessment as a whole. Initial approaches were made by email and followed up by phone. Issues raised during correspondence were investigated during research and information gathering activities, and during interviews.

Most stakeholders contacted during this exercise either indicated that they had no direct interest in this fishery assessment, or that they had no particular cause for concern with regard to its assessment to the MSC standard.

Process

The MSC is dedicated to promoting "well-managed" and "sustainable" fisheries, and the MSC initiative focuses on identifying such fisheries through means of independent third-party assessments and certification. Once certified, fisheries are awarded the opportunity to utilise an MSC promoted eco-label to gain economic advantages in the marketplace. Through certification and eco-labelling the MSC works to promote and encourage better management of world fisheries, many of which have been suggested to suffer from poor management.

The MSC Principles and Criteria for Sustainable Fisheries form the standard against which the fishery is assessed and are organised in terms of three principles:

» **MSC Principle 1** - Resource Sustainability

» **MSC Principle 2** - Ecosystem Sustainability

» **MSC Principle 3** - Management Systems

A fuller description of the MSC Principles and Criteria and a graphical representation of the assessment tree is presented as **Appendix 1a** to this report.

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 Sub-criteria. Sub-criteria represent separate areas of important information (e.g. Sub-criterion 1.1.1. requires a sufficient level of information on the target species and stock, 1.1.2 requires information on the effects of the fishery on the stock and so on). These Sub-criteria, therefore, provide a detailed checklist of factors necessary to meet the MSC Criteria in the same way as the Criteria provide the factors necessary to meet each Principle.

Below each Sub-criterion, individual 'Performance Indicators' (PIs) are identified. It is at this level that the performance of the fishery is measured. Altogether, assessment of this fishery against the MSC standard is achieved through measurement of 31 Performance Indicators. The Principles and their supporting Criteria, Sub-criteria and Performance Indicators that have been used by the assessment team to assess this fishery are incorporated into the scoring sheets (**Appendix 1.1**).

Scoring of the attributes of this fishery against the MSC Principles and Criteria involves the following process:

» Decision to use the MSC Default Assessment Tree contained within the MSC Certification Requirements (Annex CB)

» Description of the justification as to why a particular score has been given to each sub-criterion

» Allocation of a score (out of 100) to each Performance Indicator

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). The Assessment Tree and Scoring Guideposts for the Fishery Name fishery are shown as **Appendix 1.1** to this report.

Scoring outcomes

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. A score of 80 or above for all three Principles results in a pass.

The set of scoring elements that have been considered in Principle 2 are included in Table 59.

Table 59 Scoring elements

Component	Scoring elements	Main/not main	Data-deficient or not
Retained species			
Nylon Shrimp- Industrial & Artisanal UoCs	Chilean hake Cardinal fish	Main Main	No No
Yellow Squat Lobster North &- Artisanal UoCs	Chilean hake	Main	No
Yellow Squat Lobster- South Industrial UoCs	Chilean hake Red squat lobster	Main Main	No No
Red Squat Lobster- North & Artisanal UoCs	Chilean hake Yellow squat lobster	Main Main	No No
Red Squat Lobster South UoC	Chilean hake	Main	No
Bycatch species			
Nylon Shrimp- Industrial & Artisanal UoC	Aconcagua grenadier Chilean grenadier	Main Main	Data-deficient Data-deficient
ETP species			
All UoCs	*Tethocyathus endesa* *Bathycyathus chilensis*	N/A N/A	Condition on Information
Habitat			
All UoCs	Mud and sand substrates	N/A	Condition on Information

Component	Scoring elements	Main/not main	Data-deficient or not
Ecosystem			
All UoCs	Southern Humboldt demersal food web	N/A	No

4.4.4 RBF Use

Rationale for use of RBF and stakeholder announcements

As noted in sections 4.4.1 and 4.4.2, a second visit was required to assess new information from the fishery following the introduction of a new modified trawl for use in the nylon shrimp and squat lobster fisheries. The new gear has been introduced gradually over a period of two to three years by participating vessels, but its use became mandatory in November 2014. The assessment team considered therefore that there may be a lack of information in relation to the assessment of outcome performance indicators under Principle 2. On that basis, on 17 November 2015 an announcement was made on the MSC website that a second site visit would take place from 16 to 18 December 2015 to gather new information on the fishery and that the assessment team would consider the use of the RBF for Principle 2 outcome performance indicators. In addition to the announcement on the MSC website, all stakeholders were informed of the second site visit, and that the assessment team would be using a stakeholder-driven, qualitative analysis during the site visit to assess any performance indicators that would be scored under the RBF. It was stressed to all stakeholders that the assessment team would rely heavily on participation of a broad range of stakeholders with a balance of knowledge of the fishery in order to achieve a robust outcome from this consultative approach.

RBF Consultation Process Summary

The assessment team spoke to a wide range of stakeholders during the site visit to ascertain what information was now available about the new modified trawl, and to ascertain their views on how the various Principle 2 outcome performance indicators might score if the assessment team concluded that the RBF must be used.

Summary of Information Obtained

Following the stakeholder meetings during the site visit and the review of additional information provided after the site visit from IFOP, SUBPESCA and other stakeholders, the assessment team concluded that the only outcome performance indicator for which there was not sufficient information to score using the default assessment tree was PI 2.2.1 for bycatch species.

Summary of Activities and Components Discussed / Evaluated

The assessment team considered the information available on all main retained and bycatch species. Five main retained species were identified, but for all five species there was a wealth of data and information on stock status, and therefore they could be scored using the default assessment tree. However, for bycatch species, there were two main bycatch species identified for the nylon shrimp fishery (UoCs 1 & 2), Aconcagua grenadier and Chilean grenadier for which there was very little information, and therefore it was necessary to use the RBF to score the bycatch outcome performance indicator, PI 2.2.1. For the yellow and red squat lobster fisheries (UoCs 3 to 8), no main bycatch species were identified and so it was not necessary to use the RBF for these UoCs.

Process of Choosing Most Vulnerable Scoring Element

As noted above, two scoring elements were identified, Aconcagua grenadier and Chilean grenadier. For both species, very little is known about the status of the populations. The nylon shrimp fishery overlaps more with the distribution of Aconcagua grenadier populations than with Chilean grenadier populations, but life history characteristics of the Chilean grenadier suggest that it might be more vulnerable than the Aconcagua grenadier to any impacts of the nylon shrimp fishery. There is justification therefore for potentially choosing either species as the most vulnerable scoring element. Whilst using stakeholder input and all other available information, the assessment team scored both species using the Scale Intensity Consequence Analysis (SICA) approach. Both species score 80 using the SICA, and therefore it was not necessary to undertake a Productivity Susceptibility Analysis (PSA).

As the RBF score for this performance indicator was based on the SICA approach, the assessment team considered that it was more appropriate to consider the Aconcagua grenadier as the most vulnerable scoring element, as the SICA analysis emphasised the interaction of the fishery with the bycatch species in comparison with the PSA which emphasises the life history characteristics of the scoring element.

5. Traceability

5.1 Eligibility Date

The **Target Eligibility Date** (TED) for this fishery will be the date of certification. This means that any fish caught by the certified fleet following that date will be eligible to enter the chain of custody as certified product if and when certification is ultimately granted.

The measures taken by the client to account for risks within the traceability of the fishery – and therefore generating confidence in the use of this date for target eligibility – are detailed in the rest of this section.

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 fish 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 risk of mixing certified and non-certified catch prior to landing

» 100% dockside monitoring of landings

» Segregation of catches from different vessels on the trucks delivering landings to the processing factories

» Strict traceability measures are enforced in the factories to ensure that it is possible to trace a processed product back to the vessel, port of landing and time of capture

5.2.1 Description of Tracking, Tracing and Segregation Systems within the Fishery and Management systems in place relating to Traceability

Catches of certified shrimp and squat lobsters are landed at ports and there is 100% coverage by the dockside monitoring programme. From the port the catches are loaded on to trucks, and catches from each individual vessel are distinguished and kept separate. There is no change of ownership during the transport by trucks from the point of landing to the processing factory. On arrival at the processing factory, catches from each vessel are processed separately, and are labelled with a number, for example, P1. From that point onwards packaged processed product can be traced back to the processing factory, and to the vessel, port of landing and date of capture.

5.2.2 Evaluation of Risk of Vessels Fishing Outside of UoC

The UoCs cover the full range of the distribution of fishing and so there is no risk of vessels fishing outside the UoC.

5.2.3 Risk of Substitution of Mixing Certified / Non-Certified Catch prior to point of landing

Vessels fish with only one gear and all fishing areas are covered by the UoCs, so all catch on a vessel within the UoC will be certified (or non-certified if the vessel is not part of the UoC). There is no risk therefore of mixing certified and non-certified catch prior to landing.

5.2.4 At-Sea Processing

There is no at-sea processing and all processing occurs within the processing factories.

5.2.5 Trans-Shipment

There is no trans-shipment in these fisheries.

5.2.6 Robustness of management systems relating to traceability

All industrial vessels are covered by the UoCs, but there is a possibility that some artisanal vessels will choose not to be included within the certification, which could account for up to 30% of the total landings.

However, all landings are delivered to the processing factories in Coquimbo or Quinteros by truck, during which the catch from individual vessels is separated and labelled accordingly. There is no risk therefore that certified and non-certified catch will be mixed prior to arrival at the processing factories. In the factories all landings from an individual vessel landing on a specific day are identified on the packaging.

5.3 Eligibility to Enter Further Chains of Custody

Only nylon shrimp, yellow squat lobster and red squat lobster caught in the manner defined in the UoC (**Section 3.1**) under restrictions detailed throughout the body of the final Public Certification Report for this fishery shall be eligible to enter the Chain of Custody. Chain of Custody should commence following the first point of landing, at which point the product shall be eligible to carry the MSC logo (under restrictions imposed by the MSC Chain of Custody standard). There are no restrictions on the fully certified product entering further chains of custody. La Asociación de Armadores e Industriales Pesqueros de la IV Región (AIP) does not require its own chain of custody certificate.

5.3.1 Eligible points of landing

Nylon shrimp, yellow squat lobster and red squat lobster may be landed at Coquimbo, Quintero, San Antonio, Tacalhuano and Tomé.

5.3.2 Parties eligible to use the fishery certificate

The client confirms that the following seven companies that are members of AIP form the client group for the fishery currently in the process of MSC certification:

Antarctic Seafood S.A.

Pesquera Quintero S.A.

Bracpesca S.A.

Soc Pesquera Isladamas Sa

Pesquera Sunrise S.A.

Sociedad Pesquera Costa Brava Ltda

Exportadores De Mariscos Rymar

5.4 Eligibility of Inseparable or Practically Inseparable (IPI) stock(s) to Enter Further Chains of Custody

There are no IPI stocks in this fishery.

6. Evaluation Results

6.1 Principle Level Scores

Table 60: Final Principle Scores

Principle	UoC1	UoC2	UoC3	UoC4	UoC5	UoC6	UoC7	UoC8
Principle 1 – Target Species	88.8	88.8	87.5	87.5	87.5	87.5	87.5	80.8
Principle 2 - Ecosystem	81.0	80.3	81.3	81.0	81.7	81.3	81.0	81.7
Principle 3 – Management System	84.0	82.0	84.0	82.0	84.0	84.0	82.0	84.0

Source: Acoura Marine assessment team

6.2 Summary of Scores

Prin-ciple	PI No.	Performance Indicator (PI)	Score							
			UoC1	UoC2	UoC3	UoC4	UoC5	UoC6	UoC7	UoC8
One	1.1.1	Stock status	100	100	100	100	100	100	100	70
	1.1.2	Reference points	80	80	80	80	80	80	80	80
	1.1.3	Stock rebuilding	N/A	N/A	N/A	N/A	N/A	N/A	N/A	80
	1.2.1	Harvest strategy	95	95	95	95	95	95	95	95
	1.2.2	Harvest control rules & tools	90	90	90	90	90	90	90	90
	1.2.3	Information & monitoring	75	75	65	65	65	65	65	65
	1.2.4	Assessment of stock status	90	90	90	90	90	90	90	90
Two	2.1.1	Outcome	90	90	90	90	90	90	90	90
	2.1.2	Management	85	80	85	80	85	85	80	85
	2.1.3	Information	70	65	70	65	75	70	65	75
	2.2.1	Outcome	80	80	80	80	80	80	80	80
	2.2.2	Management	80	80	80	80	80	80	80	80
	2.2.3	Information	75	75	80	80	80	80	80	80
	2.3.1	Outcome	85	85	85	85	85	85	85	85
	2.3.2	Management	85	85	85	85	85	85	85	85
	2.3.3	Information	75	75	75	75	75	75	75	75
	2.4.1	Outcome	80	80	80	80	80	80	80	80
	2.4.2	Management	80	80	80	80	80	80	80	80
	2.4.3	Information	75	75	75	75	75	75	75	75
	2.5.1	Outcome	80	80	80	80	80	80	80	80
	2.5.2	Management	85	85	85	85	85	85	85	85
	2.5.3	Information	90	90	90	90	90	90	90	90
Three	3.1.1	Legal & customary framework	95	95	95	95	95	95	95	95
	3.1.2	Consultation, roles & responsibilities	85	85	85	85	85	85	85	85
	3.1.3	Long term objectives	100	100	100	100	100	100	100	100
	3.1.4	Incentives for sustainable fishing	80	80	80	80	80	80	80	80
	3.2.1	Fishery specific objectives	70	70	70	70	70	70	70	70
	3.2.2	Decision making processes	75	75	75	75	75	75	75	75
	3.2.3	Compliance & enforcement	65	65	65	65	65	65	65	65
	3.2.4	Research plan	90	70	90	70	90	90	70	90
	3.2.5	Management performance evaluation	90	90	90	90	90	90	90	90

Source: Acoura Marine assessment team

6.3 Summary of Conditions

Table 61: Summary of Conditions

Condition number	Condition	Performance Indicator	Related to previously raised condition? (Y/N/ N/A)
1 (UoC 1 only)	The red squat lobster stock in the southern fishing zone should be at or fluctuating around its target reference point	1.1.1	N/A
2 (All UoCs)	The level of discarding in all UoCs should be fully quantified and landings of both squat lobster species should be fully differentiated in landings recorded in the dockside monitoring programme.	1.2.3	N/A
3 (UoCs 1,3 & 6)	Information should be sufficient to estimate outcome status with respect to biologically based limits, and sufficient data should continue to be collected to detect any increase in risk level to main retained species.	2.1.3	N/A
4 (UoCs 5 & 8)	Information should be sufficient to estimate outcome status with respect to biologically based limits	2.1.3	N/A
5 (UoC 2 only)	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	2.1.3	N/A
6 (UoCs 4 & 7)	Information should be sufficient to estimate outcome status with respect to biologically based limits	2.1.3	N/A
7 (UoCs 1, 2 only)	Sufficient data should continue to be collected to detect any increase in risk level to main bycatch species, Aconcagua and Chilean grenadiers	2.2.3	N/A
8 (All UoCs)	Sufficient data should be collected to measure trends and support a full strategy to manage impacts on ETP species in particular corals.	2.3.3	N/A
9 (All UoCs)	Sufficient data should be collected to allow the nature of the impacts of the fishery on habitat types to be identified.	2.4.3	N/A
10 (All UoCs)	Short and long term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, should be explicit within the fishery's management system.	3.2.1	N/A
11 (All UoCs)	Decision-making processes in the demersal crustacean fisheries should respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	3.2.2	N/A
12 (All UoCs)	A monitoring, control and surveillance system should be implemented in the demersal crustacean fisheries on board of industrial and artisanal vessels and the system should demonstrate an ability to enforce relevant management measures in particular in reference to unreported catch and discards.	3.2.3	N/A
13 UoCs (2, 4 & 7)	A research plan for the artisanal fisheries should be implemented.	3.2.4	N/A

Source: Acoura Marine assessment team

6.3.1 Recommendations

There are three recommendations for this fishery. Please see details below:

Recommendation 1 (PI 1.1.3)

The assessment team strongly recommends that the re-building strategy for the red squat lobster fishery in the southern region is re-evaluated if the stock does not show any signs of recovery in the 2017 stock assessment.

Recommendation 2 (PI 1.2.4)

A new modified trawl has become mandatory since November 2014, and this trawl has different selectivity properties to the previously used trawl. To date the change in catchability of the gear has not been incorporated in the stock assessment. The assessment team understands that there are a number of ongoing studies in relation to the catchability of the new gear, and recommends that any change in catchability is taken into account in future stock assessments.

Recommendation 3 (PI 2.2.1)

The assessment team does not consider species of chondrichthyes as P2 main bycatch species at the time. However, it is recommended that future annual audits should review the situation to ensure that the fishery does not pose a threat to these species.

6.4 Determination, Formal Conclusion and Agreement

The fishery attained a score of 80 or more against each of the MSC Principles and did not score less than 60 against any MSC Criteria.

It is therefore determined by the assessment team that the **Chile squat lobsters and nylon shrimp modified trawl fishery should be certified according to the Marine Stewardship Council Principles and Criteria for Sustainable Fisheries**.

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

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Appendix 1. Scoring & Rationale

Appendix 1a – MSC Principles & Criteria

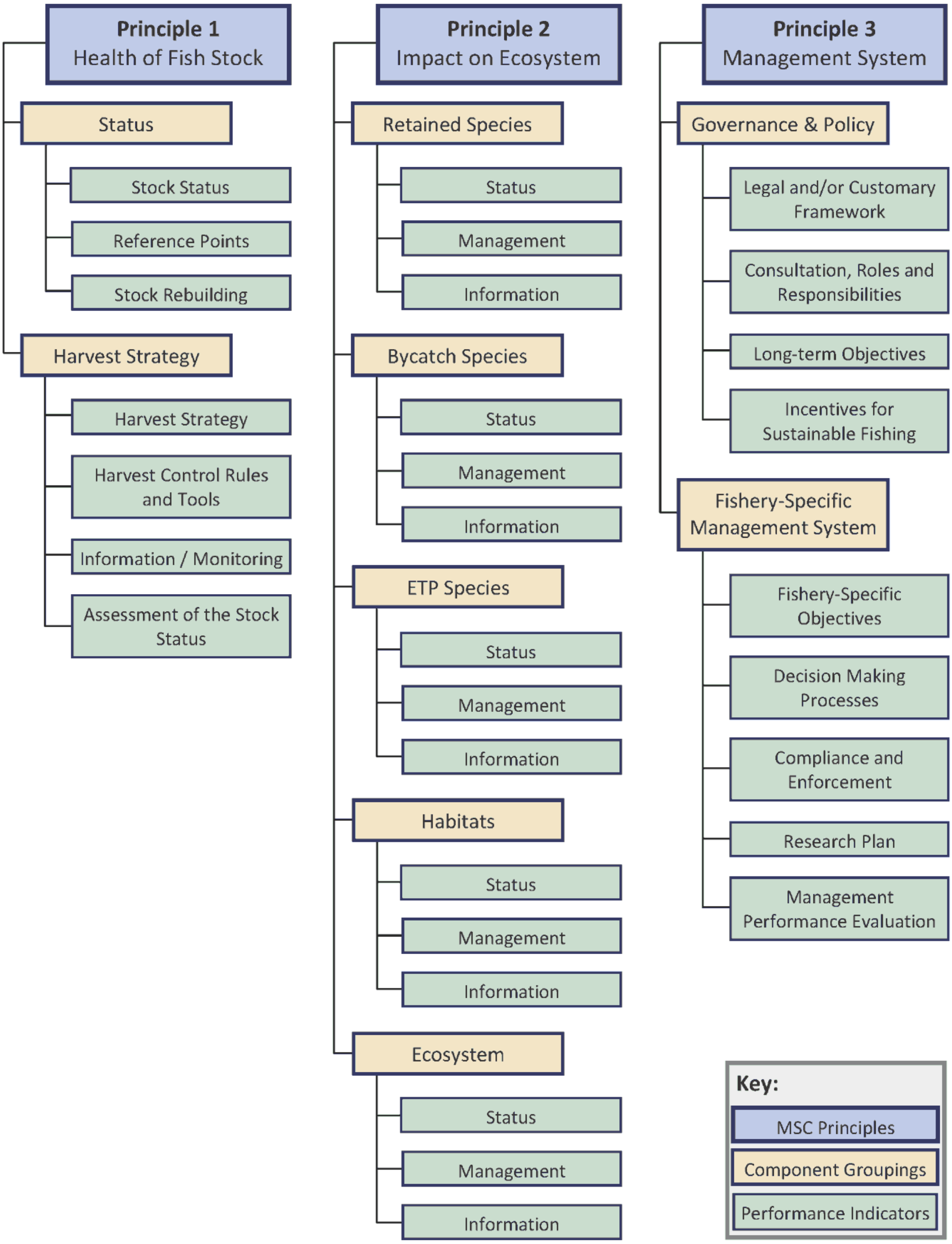

Figure A1 – Graphic of MSC Principles and Criteria

Below is a much-simplified summary of the MSC Principles and Criteria, to be used for over-view purposes only. For a fuller description, including scoring guideposts under each Performance Indicator, reference should be made to the full assessment tree, complete with scores and justification, contained in **Appendix 1.1** of this report. Alternately a fuller description of the MSC Principles and Criteria can be obtained from the MSC website (www.msc.org).

Principle 1

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

Intent:

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

Status

- The stock is at a level that maintains high productivity and has a low probability of recruitment overfishing.
- Limit and target reference points are appropriate for the stock (or some measure or surrogate with similar intent or outcome).
- Where the stock is depleted, there is evidence of stock rebuilding and rebuilding strategies are in place with reasonable expectation that they will succeed.

Harvest strategy / management

- There is a robust and precautionary harvest strategy in place, which is responsive to the state of the stock and is designed to achieve stock management objectives.
- There are well defined and effective harvest control rules in place that endeavour to maintain stocks at target levels.
- Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.
- The stock assessment is appropriate for the stock and for the harvest control rule, takes into account uncertainty, and is evaluating stock status relative to reference points.

Principle 2

Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends

Intent:

The intent of this Principle is to encourage the management of fisheries from an ecosystem perspective under a system designed to assess and restrain the impacts of the fishery on the ecosystem.

Retained species / Bycatch / ETP species

- Main species are highly likely to be within biologically based limits or if outside the limits there is a full strategy of demonstrably effective management measures.
- There is a strategy in place for managing these species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.
- Information is sufficient to quantitatively estimate outcome status and support a full strategy to manage main retained / bycatch and ETP species.

Habitat & Ecosystem

- The fishery does not cause serious or irreversible harm to habitat or ecosystem structure and function, considered on a regional or bioregional basis.
- There is a strategy and measures in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types.
- The nature, distribution and vulnerability of all main habitat types and ecosystem functions in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery and there is reliable information on the spatial extent, timing and location of use of the fishing gear.

Principle 3

The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

Intent:

The intent of this principle is to ensure that there is an institutional and operational framework for implementing Principles 1 and 2, appropriate to the size and scale of the fishery.

Governance and policy

- The management system exists within an appropriate and effective legal and/or customary framework that is capable of delivering sustainable fisheries and observes the legal & customary rights of people and incorporates an appropriate dispute resolution framework.
- Functions, roles and responsibilities of organisations and individuals involved in the management process are explicitly defined and well understood. The management system includes consultation processes.
- The management policy has clear long-term objectives, incorporates the precautionary approach and does not operate with subsidies that contribute to unsustainable fishing.

Fishery specific management system

- Short and long term objectives are explicit within the fishery's management system.
- Decision-making processes respond to relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner.
- A monitoring, control and surveillance system has been implemented. Sanctions to deal with non-compliance exist and there is no evidence of systematic non- compliance.
- A research plan provides the management system with reliable and timely information and results are disseminated to all interested parties in a timely fashion.

Appendix 1.1 Performance Indicator Scores and Rationale

Evaluation Table for PI 1.1.1

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	Guidepost	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
	Met?	Y (all UoCs)	Y (all UoCs)	Y (all UoCs)
	Justification	**All UoCs.** For all UoCs, the estimated biomass is well above the biomass limit reference point of 20% of B_0. Estimates of recruitment from the stock assessment model for the northern and southern fisheries for all three demersal crustacean species show no sign of recruitment impairment. There is a high degree of certainty therefore that the stock is above the point at which recruitment would be impaired.		
b	Guidepost		The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.
	Met?		Y (UoCs 1 to 7) N (UoC 8)	Y (UoCs 1 to 7) N (UoC 8)
	Justification	**UoCs 1 to 7.** Estimates of stock biomass for the nylon shrimp fishery (UoCs 1 & 2), both northern and southern yellow squat lobster fisheries (UoCs 3, 4 & 5), and the northern red squat lobster fishery (UoCs 6 & 7) demonstrate that there is a high degree of certainty that the stock has been fluctuating around its biomass target reference point over recent years. For all these UoCs, fishing mortality in recent years has been estimated to be at or below the Fmsy proxy which should ensure that biomass continues to fluctuate around or be above the target reference point. The SG100 is met therefore for these UoCs. **UoC 8.** For the red squat lobster fishery in the southern region (UoC 8), the most recent stock assessment estimated that the ratio of the current biomass to the Bmsy proxy of 40% of B_0 is 0.72. This estimate falls outside the target range of 20% below and 50% above the biomass target reference point, and therefore the latest assessment confirms that the red squat lobster fishery in the southern region is over-exploited. The stock cannot be considered to be at or fluctuating around its biomass target reference point, and so the SG80 is not met for UoC 8. A condition for UoC 8 is raised therefore and PI 1.1.3 is now scored for UoC 8.		
References		Bucarey, D., C. Montenegro, M. Zilleruelo, D. Párraga and C. Bravo. 2015a. Documento Técnico No. 2. Convenio de Desempeño 2014. Estatus y posibilidades de explotación biológicamente sustenables de los principales recursos pesqueros naciolnales al año 2015. Langostino colorado, 2015. Subsecretaria de Economía y EMT / March 2015. 94pp + Anexos.		

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
	Bucarey, D., C. Canales, C. Montenegro, M. Zilleruelo, D. Párraga. 2015b. Documento Técnico No. 2. Convenio de Desempeño 2014. Estatus y posibilidades de explotación biológicamente sustenables de los principales recursos pesqueros naciolnales al año 2015. Langostino amarillo, 2015. Subsecretaria de Economía y EMT / March 2015. 83pp + Anexos. Comité Científico Técnico Crustáceos Demersales. 2015a. Definicion de puntos biológicos de referencia: camarón nailon (*Heterocarpus reedi*), langostino amarillo (*Cervimunida johni*), langostino colorado (*Pleuroncodes monodon*). Informe técnico 02/2015. Comité Científico Técnico Crustáceos Demersales. 2015b. Determinatión de estado de situación, puntos biológicos de referencia y rango de captura biológicamente aceptable, año, 2016. Camarón nailon (II – VIII Región). Informe técnico 04/2015. Comité Científico Técnico Crustáceos Demersales. 2015c. Determinatión de estado de situación, puntos biológicos y rango de captura biológicamente aceptable, año, 2016. Langostino amarillo (III – VIII Región) y langostino colorado (XV – VIII Región). Informe técnico 03/2015. Comité Científico Técnico Crustáceos Demersales. 2016. Revisión de nuevos antecedentes del Estado de Situación del langostino colorado (XV – VIII Región). Informe técnico 01/2016. Montenegro, C., D. Bucarey, M. Zilleruelo and D. Párraga. 2015. Documento Técnico. Convenio de Desempeño 2014. Estatus y posibilidades de explotación biológicamente sustenables de los principales recursos pesqueros naciolnales, año 2015. Camarón nailon. Subsecretaria de Economía y EMT / March 2015. 101pp + Anexos.		
Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Target reference point	**<u>All UoCs</u>** Bmsy proxy Fmsy proxy	**<u>All UoCs</u>** Bmsy proxy = 40% of B_0 Fmsy proxy = F45%SPR|F=0	**Nylon shrimp (UoCs 1 & 2)** Northern zone: B/Bmsy = 1.24 F/Fmsy = 0.59 Southern zone B/Bmsy =1.44 F/Fmsy = 0.48 **Yellow squat lobster north (UoCs 3 & 4)** B/Bmsy = 1.88 F/Fmsy = 0.44 **Yellow squat lobster south (UoC 5)** B/Bmsy =1.13 F/Fmsy = 0.58 **Red squat lobster north (UoCs 6 & 7)**

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
			B/Bmsy = 1.80 F/Fmsy = 0.28 **Red squat lobster south (UoC 8)** B/Bmsy = 0.72 F/Fmsy = 0.97
Limit reference point	**<u>All UoCs</u>** Blim proxy	Blim proxy = 20% of B_0	**Nylon shrimp (UoCs 1 & 2)** Northern B/Blim = 2.48 Southern B/Blim = 2.88 **Yellow squat lobster north (UoCs 3 & 4)** B/Blim = 3.76 **Yellow squat lobster south (UoC 5)** B/Blim = 2.26 **Red squat lobster north (UoCs 6 & 7)** B/Blim = 3.60 **Red squat lobster south (UoC 8)** B/Blim = 1.44
OVERALL PERFORMANCE INDICATOR SCORE:			**100 (UoC 1 to 7)** **70 (UoC 8)**
CONDITION NUMBER (if relevant):			**1**

Evaluation Table for PI 1.1.2

PI 1.1.2		Limit and target reference points are appropriate for the stock		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
	Met?	Y (All UoCs)	Y (All UoCs)	
	Justification	**All UoCs**. Reference points have been developed for all three demersal crustacean species within a Maximum Sustainable Yield (MSY) framework. Proxies for Bmsy and Fmsy have been used as target reference points and a biomass limit reference point has been defined. The stock assessment for all three species uses an age-structured population model used within a Bayesian framework and the methods used for calculating the reference points are set out in detail by the Scientific Committee (Comité Científico Técnico Crustáceos Demersales, 2015a). The annual stock assessments provide estimates of current biomass and fishing mortality in relation to the limit and target reference points.		
b	**Guidepost**		The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of precautionary issues.
	Met?		Y (all UoCs)	N (all UoCs)
	Justification	**All UoCs**. The annual stock assessment of all three demersal crustacean species evaluates the stock biomass in relation to the limit reference point, Blim, above which there is no appreciable risk of impairing recruitment. For all fisheries Blim is defined as 20% of B_0 (the equilibrium biomass when there is no fishing) which corresponds with the MSC default for Blim. All UoCs therefore meet the SG80. The ecological role of the three demersal crustacean stocks within the Chilean ecosystem has not been taken into account in the setting of the limit reference point. For example, predation is likely to be an important source of mortality for shrimps and squat lobsters, and although predator abundance is low at present, the limit reference point does not take into account the possibility that predator abundance may increase in future years. The SG100 is not met therefore for any of the UoCs.		
c	**Guidepost**		The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
	Met?		Y (all UoCs)	N (all UoCs)

<table>
<tr><th colspan="2">PI 1.1.2</th><th colspan="3">Limit and target reference points are appropriate for the stock</th></tr>
<tr><td></td><td>Justification</td><td colspan="3">All UoCs. The annual assessment of stock status for all three demersal crustacean species in both the northern and southern zones estimates stock status relative to two target reference points, the Bmsy proxy defined as 40% of B_0 (the equilibrium biomass when there is no fishing), and the Fmsy proxy, defined as $F_{45\%SPR|F=0}$ (the F when biomass per recruit is 45% of the biomass per recruit when there is no fishing). Based on a sensitivity analysis (IFOP, 2014a, 2014b), $F_{45\%SPR|F=0}$ is considered a suitable proxy for target fishing mortality that would drive a stock towards a Bmsy proxy of 40% of B_0 under a wide range of steepness values in a Beverton and Holt stock recruitment curve, without the need to specify a specific steepness value. The assessments of the status of the stocks in relation to the target reference points are used to manage the fishery through the setting of appropriate quotas (CBAs) within a MSY framework. All UoCs therefore meet the SG80. The ecological role of the three demersal crustacean stocks within the Chilean ecosystem has not been taken into account in the setting of target reference points. For example, predation is likely to be an important source of mortality for shrimps and squat lobsters, and although predator abundance is low at present, the target reference points do not take into account the possibility that predator abundance may increase in future years. The SG100 is not met therefore for any of the UoCs.</td></tr>
<tr><td rowspan="3">d</td><td>Guidepost</td><td></td><td>For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.</td><td></td></tr>
<tr><td>Met?</td><td></td><td>Not relevant</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Heterocarpus reedi, Cervimunida johni and Pleuroncodes monodon are all considered to be low trophic level species, and existing food web models (e.g. Neira and Arancibia 2004) show that they are all important prey items for a range of predators and are a major component of the benthic food web pathway. Many predator species, particularly hake, are currently at low abundance but these crustacean species could become more important in the food web if predators return to higher abundance. However, considered individually, it cannot be concluded that these three species are key low trophic level species, as they do not meet all the criteria set out in paragraph CB2.3.13 of the MSC Certification Requirements v1.3. In particular, nylon shrimp, yellow squat lobster and red squat lobster do not form dense schools, a large proportion of the total energy in the ecosystem does not pass between each of these species and higher and lower trophic levels in the food chain, there are other species at this trophic level through which energy can be transmitted from lower to higher trophic levels, and these species all have landings which are relatively low (<50,000 t).</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Comité Científico Técnico Crustáceos Demersales. 2015a. Definicion de puntos biológicos de referencia: camarón nailon (Heterocarpus reedi), langostino amarillo (Cervimunida johni), langostino colorado (Pleuroncodes monodon). Informe técnico 02/2015.

IFOP. 2013. Review of biological reference points in domestic fisheries. Report of the 1st International Workshop held in Viña del Mar by IFOP in December 2013. 42pp.

IFOP. 2014a. Review of biological reference points in domestic fisheries. Report of the 2nd International Workshop held in Viña del Mar by IFOP in April 2014. 85pp.</td></tr>
</table>

PI 1.1.2	Limit and target reference points are appropriate for the stock	
	IFOP. 2014b. Review of biological reference points in domestic fisheries. Report of the 3rd International Workshop held in Viña del Mar by IFOP in August 2014. 72pp. Neira, S. & H. Arancibia. 2004. Trophic interactions and community structure in the upwelling system off Central Chile (33 – 390S). J. Expt. Mar. Biol. Ecol. 312: 349 – 366.	
OVERALL PERFORMANCE INDICATOR SCORE:		**80 (All UoCs)**
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 1.1.3 UoC 8 only. Not applicable to UoCs 1 to 7.

PI 1.1.3		**Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Where stocks are depleted rebuilding strategies, which have a reasonable expectation of success, are in place.		Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the specified timeframe.
	Met?	Y		N
	Justification	**UoC 8 only**. The red squat lobster stock in the south is formally defined as a "Fishery under Recovery", and therefore fishing rights and quotas are distributed on an annual basis to provide strong control over the exploitation rate. Within that regime, the strategy for re-building the stock is to maintain the fishing mortality at the Fmsy proxy which should in the short to medium term recover the stock to the Bmsy proxy. This is achieved by setting annual quotas at precautionary levels such that there is a less than 10% probability that F will exceed Fmsy. The most recent assessment shows that such a strategy should rebuild the stock back to Bmsy by 2021. Experience from all the other demersal crustacean stocks show that such a re-building strategy succeeds, including for some stocks that were previously over-exploited. For example, the nylon shrimp stock was rebuilt in the early 2000s, and the yellow squat lobster fishery was rebuilt in the northern and southern regions in the late 2000s and early 2000s respectively. Maintaining fishing mortality at or below Fmsy has been demonstrated in many other fisheries worldwide as a successful strategy for re-building stocks to Bmsy. The SG60 is met therefore. Although the strategies have been demonstrated to rebuild stocks continuously in the demersal crustacean fisheries, there is currently no evidence that the re-building of the red squat lobster stock in the southern region has started and hence no empirical evidence that re-building will be complete within the specified timeframe (by 2021). The SG100 is not met. The assessment team strongly **recommends** that the re-building strategy is re-evaluated if the stock does not show any signs of recovery in the 2017 stock assessment.		
b	**Guidepost**	A rebuilding timeframe is specified for the depleted stock that is the shorter of 30 years or 3 times its generation time. For cases where 3 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	A rebuilding timeframe is specified for the depleted 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 depleted stock.
	Met?	Y	Y	N

<table>
<tr><td colspan="2">PI 1.1.3</td><td colspan="3">Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">UoC 8 only. The rebuilding strategy defined for the red squat lobster in the southern fishing zone is projected to return the stock to the Bmsy proxy level by 2021, which is less than two generations for the red squat lobster. The SG80 is met therefore. The methods for setting quotas aim to move the stock towards Bmsy and initially to within the target range of 20% below and 50% above the biomass target reference point. As the initial objective is to reach approximately 80% of Bmsy, it cannot be concluded that the shortest practicable rebuilding timeframe is specified and the SG100 is not met.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td>Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within a specified timeframe.</td><td>There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.</td><td></td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">UoC 8 only. Monitoring of stock biomass and fishing mortality on an annual basis allows determination of whether re-building strategies are effective. Although the most recent stock assessment did not provide any evidence of an increase in stock biomass, previous performance in other similar fisheries, and simulation modelling of the strategy of restricting catches so that fishing mortality remains at or below the Fmsy proxy, provides evidence that the stock will be re-built by 2021. In practice, the Scientific Committee has advised that additional precaution should be incorporated in the setting of quotas such that there is a less than 10% risk that fishing mortality will exceed the Fmsy proxy. It is highly likely therefore that the stock will be re-built within the specified timeframe. The SG80 is met therefore.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Comité Científico Técnico Crustáceos Demersales. 2015a. Definicion de puntos biológicos de referencia: camarón nailon (Heterocarpus reedi), langostino amarillo (Cervimunida johni), langostino colorado (Pleuroncodes monodon). Informe técnico 02/2015.

Comité Científico Técnico Crustáceos Demersales. 2015c. Determinatión de estado de situación, puntos biológicos y rango de captura biológicamente aceptable, año, 2016. Langostino amarillo (III – VIII Región) y langostino colorado (XV – VIII Región). Informe técnico 03/2015.

Comité Científico Técnico Crustáceos Demersales. 2016. Revisión de nuevos antecedentes del Estado de Situación del langostino colorado (XV – VIII Región). Informe técnico 01/2016.

IFOP. 2013. Review of biological reference points in domestic fisheries. Report of the 1st International Workshop held in Viña del Mar by IFOP in December 2013. 42pp.</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>80</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 1.2.1

PI 1.2.1		**There is a robust and precautionary harvest strategy in place**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
	Met?	Y (all UoCs)	Y (all UoCs)	Y (all UoCs)

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
	Justification	**All UoCs**. The harvest strategies for the three demersal crustacean fisheries in Chile are underpinned by the new General Law on Fisheries and Aquaculture (LGPA). The objectives of the LGPA are "…the conservation and sustainable use of aquatic resources through the application of the precautionary approach, the ecosystem approach in fisheries regulation and the safeguarding of the marine ecosystems in which these resources exist" and "to seek to avoid or eliminate overfishing and excess fishing capacity." The precautionary approach enshrined within the LGPA requires that the management and conservation of aquatic resources and the protection of ecosystems should be more cautious in the management and conservation of resources when scientific information is uncertain, unreliable or incomplete, and not use the absence of adequate scientific information or unreliable or incomplete information, as a reason for postponing or failing to take conservation and management action. These elements of the LGPA provide therefore the framework within which the status of the demersal crustacean fisheries is assessed. The stock management objective for all the demersal crustacean species is to manage the stocks within a MSY framework and ensure that stock biomass remains within a target range around the Bmsy proxy and that fishing mortality remains within a target range around the Fmsy proxy. The harvest strategy includes limited entry licensing of fishing vessels in which licences are transferable and are granted to vessels either for industrial or artisanal fishing, the setting of annual global quotas for each fishery in line with maintaining the stocks at target reference points, the use of individual transferable quotas, closed areas, seasonal closures during the main moulting and reproductive periods, and strict restrictions on the trawl design including minimum mesh sizes in the cod end to reduce the capture and potential discarding of both non-commercial-sized shrimps and bycatch species, controls on dimensions and material used in the trawl and escape devices. There are also strict monitoring requirements for all vessels in the fisheries including mandatory use of VMS, completion of electronic log books for every tow of the trawl, monitoring of catch compositions and biological sampling through an observer programme covering nearly 25% of fishing trips, direct evaluation of biomass through fishery-independent surveys and 100% dockside monitoring of landings. The assessment of the status of the stock in relation to reference points ensures that the harvest strategy can be responsive to the state of the stock. All elements of the harvest strategy including the harvest control rules work together to ensure that the exploitation rate is consistent with maintaining stock biomass and fishing mortality at levels reflected in the target and limit reference points. The SG80 is met therefore for all UoCs. The comprehensive set of regulations and monitoring requirements for the fishery along with robust harvest control rules, that ensure that the stock management objective of keeping the stock around the target reference points is achieved, have been carefully developed over time. The assessment team considered therefore that the harvest strategy has been designed to achieve stock management objectives reflected in the target and limit reference points and therefore the SG100 is met for all UoCs. A management plan for the three demersal crustacean species, which includes all elements of the harvest strategy, has been drawn up and will be implemented in 2016.		
b	Guidepost	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.

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
	Met?	Y (all UoCs)	Y (all UoCs)	N (all UoCs)
	Justification	**All UoCs**. Annual landings have not exceeded the quotas in any of the fisheries in recent years, so that element of the harvest strategy appears to be working. Cross-checking by SERNAPESCA of landings declarations with log book records and processors' records, and VMS records with fishing positions recorded on electronic log books did not identify any systematic mis-recording of catch or fishing position data. The harvest control rules are designed to maintain stock biomass and fishing mortality at levels reflected in the target and limit reference points, and in general this element of the harvest strategy appears to be working. Overall evidence exists therefore that the harvest strategy is achieving its objectives, so the SG80 is met for all UoCs. The harvest strategy has been fully evaluated during the drafting of the new management plan for the three crustacean species. However under previous harvest strategies some of the demersal crustacean fisheries have been closed in the past following over-exploitation, and currently the red squat lobster fishery in the southern region is currently below Bmsy (for which a condition has been raised against PI 1.1.1). The assessment team considered therefore that it was too early to conclude that the new harvest strategy was achieving its objectives including being clearly able to maintain stocks at target levels. In addition, the assessment team received information during the site visit that discarding of non-commercial-sized shrimp occurred regularly, although such discarding is not permitted under the LGPA, and that the level of this discarding was not quantified. Whilst there is no evidence that the levels of discarding are hindering the achievement of the objectives of the harvest strategy, this provides further justification that the SG100 is not met.		
c	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y (all UoCs)		
	Justification	**All UoCs**. An effective monitoring programme is in place including continual recording of the fishing positions through VMS, recording of catches on electronic log books, recording of landings at the dockside, monitoring of total catch compositions and biological sampling through observer programmes, and fishery-independent estimates of stock biomass. In addition, regulations are enforced by SERNAPESCA, and therefore sufficient monitoring is in place to determine whether the harvest strategy is working.		
d	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Y (all UoCs)

<table>
<tr><th colspan="2">PI 1.2.1</th><th colspan="3">There is a robust and precautionary harvest strategy in place</th></tr>
<tr><td></td><td>Justification</td><td colspan="3">All UoCs. The harvest strategy is under continuous review through regular meetings of the Scientific Committee and the Management Committee and has been previously improved and will be improved when necessary in the future. The Scientific Committee will review the results of the stock assessments undertaken by IFOP and provide advice to the Ministry on quotas on an annual basis, but will also periodically review elements of the harvest strategy (e.g. the determination of reference points) if required to do so by the Management Committee or in consultation with stakeholders through the National Fishery Council (CNP) and the Regional Fisheries Councils (CZP). All elements of the harvest strategy have been rigorously reviewed recently by the Management Committee during the drafting of a Management Plan for all three demersal crustacean fisheries. Elements of the harvest strategy were also reviewed in 2013-14 by a panel of international experts in collaboration with Chilean scientists.</td></tr>
<tr><td rowspan="3">e</td><td>Guidepost</td><td>It is likely that shark finning is not taking place.</td><td>It is highly likely that shark finning is not taking place.</td><td>There is a high degree of certainty that shark finning is not taking place.</td></tr>
<tr><td>Met?</td><td>Not relevant</td><td>Not relevant</td><td>Not relevant</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs. Sharks are not a target species, so this scoring issue is not evaluated.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">General Law for Fishery and Aquaculture (LGPA Ley General de Pesca y Aquicultura)

Comité Científico Técnico Crustáceos Demersales. 2015a. Definicion de puntos biológicos de referencia: camarón nailon (Heterocarpus reedi), langostino amarillo (Cervimunida johni), langostino colorado (Pleuroncodes monodon). Informe técnico 02/2015.

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IFOP. 2014a. Review of biological reference points in domestic fisheries. Report of the 2nd International Workshop held in Viña del Mar by IFOP in April 2014. 85pp.

IFOP. 2014b. Review of biological reference points in domestic fisheries. Report of the 3rd International Workshop held in Viña del Mar by IFOP in August 2014. 72pp.</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>95 (All UoCs)</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

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Evaluation Table for PI 1.2.2

PI 1.2.2		There are well defined and effective harvest control rules in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Generally understood harvest rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
	Met?	Y (All UoCs)	Y (All UoCs)	
	Justification	**All UoCs**. The key harvest control rule in all three demersal crustacean fisheries is the revision of the annual quotas in response to changes in stock status. The objective is to maintain the stock biomass within the target range around the Bmsy proxy and to maintain fishing mortality within the target range around the Fmsy proxy. The stock assessment evaluates projections of biomass and catches based on a range of exploitation patterns – no fishing, F40%, F45% (Fmsy proxy), F48% and Fsq (current fishing mortality) for nylon shrimp, and no fishing, F45% (Fmsy proxy) and Fsq (current fishing mortality) for the yellow and red squat lobsters – to assess the short-term consequences of the different exploitation levels and to understand the implications for the stock in the medium term. The Scientific Committee then advises a maximum quota (CBA) that can be taken in the following year whilst ensuring that the level of risk of exceeding the Fmsy proxy should be no more than a pre-defined level (usually 10%). Methods for determining the quota depend on whether the stocks are considered to be under-exploited, fully-exploited, over-exploited or under recovery, and allocation of quotas between the industrial and artisanal sectors are clearly defined.		
b	**Guidepost**		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules takes into account a wide range of uncertainties.
	Met?		Y (All UoCs)	N (All UoCs)
	Justification	**All UoCs**. The management strategy recognises that there will be natural fluctuations around the equilibrium value of Bmsy, so the harvest control rules are designed to maintain the stock biomass and fishing mortality within a target range around the Bmsy and Fmsy reference points. In addition annual recruitment variation may influence stock biomass in the short term. To take this uncertainty into account, the assessment evaluates projections of stock biomass and catches based on a range of exploitation patterns to assess the short-term consequences of the different exploitation levels and to understand the implications for the stock in the medium term. The harvest control rules can therefore be considered to take into account the main uncertainties and so the SG 80 is met for all UoCs. Natural mortality may vary if there are significant changes in predator abundance and there is uncertainty surrounding the level of discarding in the fisheries for all three species, and these and other uncertainties are not taken into account in the design of the harvest control rules and therefore the SG100 is not met for any of the UoCs.		

PI 1.2.2		There are well defined and effective harvest control rules in place		
c	Guidepost	There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
	Met?	Y (All UoCs)	Y (All UoCs)	Y (All UoCs)
	Justification	**All UoCs**. Limits on the level of fishing effort, the setting of global quotas and technical conservation measures are considered to be appropriate tools to control exploitation rates and to ensure that fishing mortality does not exceed the Fmsy proxy. Annual assessments of the status of the stocks provide evidence that the management tools in place are appropriate to the fisheries for all three species and appear to have been effective in controlling the level of exploitation. The SG100 is met therefore for all UoCs.		
References		Comité Científico Técnico Crustáceos Demersales. 2015b. Determinación de estado de situación, puntos biológicos de referencia y rango de captura biológicamente aceptable, año, 2016. Camarón nailon (II – VIII Región). Informe técnico 04/2015. Comité Científico Técnico Crustáceos Demersales. 2015c. Determinación de estado de situación, puntos biológicos y rango de captura biológicamente aceptable, año, 2016. Langostino amarillo (III – VIII Región) y langostino colorado (XV – VIII Región). Informe técnico 03/2015. Comité Científico Técnico Crustáceos Demersales. 2016. Revisión de nuevos antecedentes del Estado de Situación del langostino colorado (XV – VIII Región). Informe técnico 01/2016.		
OVERALL PERFORMANCE INDICATOR SCORE:				**90 (All UoCs)**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.3

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	**All UoCs**. A wide range of information on the stock structure, stock productivity, stock abundance and fishery removals is collected from both fishery-dependent and fishery-independent sources. Catch and effort data are recorded for each tow of the trawl in electronic log books and catch per unit effort (CPUE) is standardised for year, month, fishing area and vessel. Landings are also monitored rigorously through a100% dockside monitoring programme. An observer programme covering approximately 25% of all fishing trips records species composition including bycatch, total catch composition, length frequency, sex and reproductive status of females for the target species and collects biological samples. In addition to the collection of fisheries-dependent data, the main indicator of stock biomass of the three demersal crustacean species comes from annual fisheries-independent stock surveys, which use a swept area method for estimating total biomass and provide information on stock structure. For all the UoCs, a limited entry licensing scheme which differentiates between industrial and artisanal vessels, rigorous catch reporting procedures and the mandatory use of VMS means that fleet composition and behaviour are well known. Based on the above, the assessment team considered that the SG80 is met. However it is not clear whether any additional non-fishery information, such as environmental information, is collected on a regular basis, and therefore the SG100 is not met.		
b	**Guidepost**	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	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 (All UoCs)	N (All UoCs)	N (All UoCs)

<table>
<tr><th colspan="2">PI 1.2.3</th><th colspan="3">Relevant information is collected to support the harvest strategy</th></tr>
<tr><td></td><td>Justification</td><td colspan="3">All UoCs. Good information about abundance and fishery removals is available for all three demersal crustacean fisheries and is used in the assessment model to evaluate the status of the stock in relation to limit and target reference points, and to evaluate the short and medium term impact of various catch options. Stock abundance is measured through fishery dependent and fishery-independent methods. Recording of catches frorn each individual tow of the trawl is mandatory, and standardised CPUE data are available for all fisheries providing robust indices of stock abundance. In addition the direct assessments from the fishery-independent trawl surveys provide a time series of biomass estimates and stock structure information.

Fishery removals are closely monitored through electronic log book records of catches, observer sampling of total catch compositions, 100% dockside monitoring and processors' landings records. Cross-checking by SERNAPESCA of these various records provides evidence of the accuracy of the data. However, it is clear that there is significant discarding of individuals under the commercial size in all three crustacean species, and that the level of discarding is not full quantified. Observers record total catch composition on board vessels, but because in theory discarding is not permitted, this catch composition is not disaggregated into landings and discards. An IFOP report from 2005 provides estimates of the proportion discarded, but this estimate has not been made in the following years. There are two ongoing projects to monitor the true level of discarding but at the time of the site visit, there were no data available yet from the projects. In addition to the discarding of the non-commercial individuals in the catch brought on the deck of the boat, the assessment team were made aware that some tows of the trawl are not brought on deck and the whole contents of the trawl are released back to the sea (so-called "failed" tows), and that also with the new design of the trawl, some of the smaller individuals of the target species fall through the larger mesh-size net on hauling and are not therefore included in the fishery removals. This is particularly a problem in the nylon shrimp fishery because vessels may not necessarily change their nets when switching from one target species to another, and with a minimum mesh size regulation of 60mm for squat lobsters, but only 50 mm for nylon shrimp, the use of a single gear for all three species results in increased unrecorded losses of small nylon shrimp when hauling the net.

The assessment team concluded that the SG80 is not met therefore for all UoCs and a condition is raised in relation to providing more accurate estimates of the discards of small nylon shrimps and squat lobsters.</td></tr>
<tr><td rowspan="2">c</td><td>Guidepost</td><td></td><td>There is good information on all other fishery removals from the stock.</td><td></td></tr>
<tr><td>Met?</td><td></td><td>Y (UoCs 1 & 2)
N (UoCs 3 to 8)</td><td></td></tr>
</table>

<table>
<tr><th colspan="2">PI 1.2.3</th><th colspan="2">Relevant information is collected to support the harvest strategy</th></tr>
<tr><td></td><td>Justification</td><td colspan="2"> UoCs 1 & 2. Nylon shrimp are caught in other fisheries when they are not the target species. Such landings are recorded and included in the annual global quotas, and so there is good information on other fishery removals from the stock. UoCs 3 to 8. Squat lobsters are also caught in other fisheries when they are not the target species. In the nylon shrimp fishery these landings will be recorded and included in the annual global quota. However small catches of yellow squat lobster occur in the fisheries targeting red squat lobsters and vice versa, and the assessment team were informed that landings recorded on behalf of SERNAPESCA through the dockside monitoring programme do not differentiate between the two species, and so some removals of both squat lobster species are not fully recorded. The SG80 is met therefore for the nylon shrimp fishery (UoCs 1 & 2), but not for the yellow squat lobster (UoCs 3, 4 & 5) and the red squat lobster (UoCs 6, 7 and 8) fisheries. </td></tr>
<tr><td colspan="2">References</td><td colspan="2"> Zilleruelo, M., D. Párraga and C. Bravo. 2015a. Informe de Avance 1. Convenio de Desempeño 2015. Programa de seguimiento de las pesquerias de crustáceos demersales, 2015 (Camarón nailon) Subsecretaría de Economia y EMT / Agosto 2015. 45 pp +Anexos. Zilleruelo, M., D. Párraga and C. Bravo. 2015b. Informe de Avance 2. Convenio de Desempeño 2015. Programa de seguimiento de las pesquerias de crustáceos demersales, 2015 (Langostino amarillo y Langostino colorado) Subsecretaría de Economia y EMT / Octubre 2015. 38 pp +Anexos. </td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE:</td><td> 75 (UoCs 1 & 2) 65 (UoCs 3 to 8) </td></tr>
<tr><td colspan="3">CONDITION NUMBER (if relevant):</td><td>2</td></tr>
</table>

Evaluation Table for PI 1.2.4

PI 1.2.4		**There is an adequate assessment of the stock status**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**		The assessment is appropriate for the stock and for the harvest control rule.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
	Met?		Y (All UoCs)	N (All UoCs)
	Justification	**All UoCs.** Extensive data are available for the three demersal crustacean species from both fisheries-dependent and fisheries-independent sources. A long time series of data is available on landings, nominal fishing effort, and standardised catch per unit effort (CPUE) along with length composition data, sex ratio and weight at-size. In addition a fisheries-independent estimate of stock biomass from a trawl survey has been undertaken annually since 1998 for nylon shrimp, since 1995 for yellow squat lobster and since 1979 and 1999 for the red squat lobster in the southern and northern fishing regions respectively. There is also good information on growth, size-at-maturity and geographical distribution of the stocks for all three species. The stock assessment model used for all three species is an age-structured model used within a Bayesian framework. The model is fitted to length compositions using multinomial residual errors and to landings, CPUE and fisheries-independent survey indices using log-normal residual errors. The assessment provides an estimate of stock biomass and fishing mortality in relation to limit and target reference points, and sets the forthcoming quota at a level that should ensure that fishing mortality does not exceed the Fmsy proxy and that stocks should remain within the target range around the Bmsy proxy. The assessment method is therefore appropriate to the stocks and the harvest control rules, and takes into account the major features relevant to the biology of the species. The assessment is appropriate to the features of the trawl fishery, but a new modified trawl has become mandatory since November 2014, and this trawl has different selectivity properties to the previously used trawl. To date the change in catchability of the gear has not been incorporated in the stock assessment, and so the assessment team concluded that the SG100 was not met. The assessment team understands that there are a number of ongoing studies in relation to the catchability of the new gear, and **recommends** that any change in catchability is taken into account in future stock assessments.		
b	**Guidepost**	The assessment estimates stock status relative to reference points.		
	Met?	Y (All UoCs)		
	Justification	**All UoCs**. For all three demersal crustacean species, the assessment estimates stock biomass and fishing mortality in both the northern and southern regions in relation to the pre-defined limit reference point (Blim = 20% of B_0) and target reference points (Bmsy proxy = 40% of B_0 and Fmsy proxy = $F_{45\%SPR\|F=0}$). The SG60 is therefore met.		

PI 1.2.4		There is an adequate assessment of the stock status		
c	Guidepost	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 (All UoCs)	Y (All UoCs)	Y (All UoCs)
	Justification	**All UoCs**. The assessment model used for all three demersal crustacean fisheries is an age-structured population model used within a Bayesian framework, and the output provides probabilistic estimates of the current state of the stock in relation to the limit reference point, Blim, and the Bmsy and Fmsy proxies used as target reference points. The SG100 is therefore met.		
d	Guidepost			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			N (All UoCs)
	Justification	**All UoCs**. Alternative approaches have been used in the past, and the assessment model has been developed continuously. The methods for estimating the Bmsy and Fmsy proxy reference points have been rigorously explored both within the Chilean scientific community and through a series of workshops that reviewed the use of biological reference points within the Chilean fisheries management system. The current assessment approach is an outcome of that review. However the stock assessment has not yet been modified to include the selectivity properties of the new trawl and does not include quantitative estimates of discard rates, and therefore the assessment team considered that the SG100 is not met.		
e	Guidepost		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
	Met?		Y (All UoCs)	Y (All UoCs)
	Justification	**All UoCs**. The stock assessment and management approach used in the demersal crustacean fisheries undergoes detailed peer review through the Scientific Committee and Management Committee. This peer review can be considered to be both internal and external as members of the committees may be outside the assessment process. In addition, both IFOP and SUBPESCA have commissioned external peer reviews, for example, the series of three workshops convened in 2013 to 2014 with invited international experts to evaluate the setting of biological reference points within the MSY framework (IFOP, 2013; 2014a; 2014b). In addition, the stock assessment for nylon shrimp underwent an expert review by Dr Catherine Dichmont (Australia) and Dr Tom Polacheck (US) in November 2014. The SG100 is therefore met.		
References		Bucarey, D., C. Montenegro, M. Zilleruelo, D. Párraga and C. Bravo. 2015a. Documento Técnico No. 2. Convenio de Desempeño 2014. Estatus y posibilidades de explotación biológicamente sustenables de los principales recursos pesqueros		

PI 1.2.4	There is an adequate assessment of the stock status
	naciolnales al año 2015. Langostino colorado, 2015. Subsecretaria de Economía y EMT / March 2015. 94pp + Anexos. Bucarey, D., C. Canales, C. Montenegro, M. Zilleruelo, D. Párraga. 2015b. Documento Técnico No. 2. Convenio de Desempeño 2014. Estatus y posibilidades de explotación biológicamente sustenables de los principales recursos pesqueros naciolnales al año 2015. Langostino amarillo, 2015. Subsecretaria de Economía y EMT / March 2015. 83pp + Anexos. Comité Científico Técnico Crustáceos Demersales. 2015b. Determinatión de estado de situación, puntos biológicos de referencia y rango de captura biológicamente aceptable, año, 2016. Camarón nailon (II – VIII Región). Informe técnico 04/2015. Comité Científico Técnico Crustáceos Demersales. 2015c. Determinatión de estado de situación, puntos biológicos y rango de captura biológicamente aceptable, año, 2016. Langostino amarillo (III – VIII Región) y langostino colorado (XV – VIII Región). Informe técnico 03/2015. Comité Científico Técnico Crustáceos Demersales. 2016. Revisión de nuevos antecedentes del Estado de Situación del langostino colorado (XV – VIII Región). Informe técnico 01/2016. IFOP. 2013. Review of biological reference points in domestic fisheries. Report of the 1st International Workshop held in Viña del Mar by IFOP in December 2013. 42pp. IFOP. 2014a. Review of biological reference points in domestic fisheries. Report of the 2nd International Workshop held in Viña del Mar by IFOP in April 2014. 85pp. IFOP. 2014b. Review of biological reference points in domestic fisheries. Report of the 3rd International Workshop held in Viña del Mar by IFOP in August 2014. 72pp. Montenegro, C., D. Bucarey, M. Zilleruelo and D. Párraga. 2015. Documento Técnico. Convenio de Desempeño 2014. Estatus y posibilidades de explotación biológicamente sustenables de los principales recursos pesqueros naciolnales, año 2015. Camarón nailon. Subsecretaria de Economía y EMT / March 2015. 101pp + Anexos.
OVERALL PERFORMANCE INDICATOR SCORE:	**90**
CONDITION NUMBER (if relevant):	

PI 2.1.1		The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Main retained species are likely to be within biologically based limits (if not, go to scoring issue c below).	Main retained species are highly likely to be within biologically based limits (if not, go to scoring issue c below).	There is a high degree of certainty that retained species are within biologically based limits and fluctuating around their target reference points.
	Met?	YL / RL / NS — **IN**: SIc / SIc / SIc	YL / RL / NS — **IN**: SIc / SIc / SIc	N (All UoCs)

PI 2.1.1	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species

		Y	SIc				Y	SIc
IS	SIc Y	SIc			**IS**	SIc Y	SIc	
A	SIc	SIc Y	SIc SIc		**A**	SIc	SIc Y	SIc SIc

Key: YL = yellow squat lobster, RL = red squat lobster, NS = nylon shrimp

IN = Industrial North UoCs, IS = Industrial South UoCs, A = Artisanal UoCs

Two scores are given for UoCs where there are two main retained species.

Justification

Information on catch composition recorded on-board industrial vessels by IFOP observers was used to determine retained species as advised by IFOP and SUBPESCA researchers during the site visit. Species of commercial value that are retained are Chilean hake, cardinal fish, and the three target species - nylon shrimp, and red and yellow squat lobster. All other species are discarded.

Researchers also indicated that artisanal catch, although not monitored, should be fairly similar to industrial catch.

UoCs 1 & 2 Nylon Shrimp Industrial & Artisanal

Of the four non-target retained species Chilean hake and cardinal fish are considered main; both are vulnerable and the first has a catch share > 5%.

There are defined biological limits for both species from stock assessments.

Chilean hake stock is collapsed based on assessments carried out by IFOP; the CCT concurred that $SB<SB_{LIMIT}$ and spawning biomass is 11% to 19% of the virginal spawning biomass. Biomass is below the reference point. This main retained species is not within biologically based limits and therefore SG60 and SG80 are scored under SIc.

Cardinal fish stock is also collapsed based on assessments carried out by IFOP. This main retained species is not within biologically based limits and therefore SG60 and SG80 are scored under SIc.

The other two retained species are yellow squat lobster and red squat lobster which are P1 in other UoCs and are within biologically based limits, so SG60a and SG80a are met; but because not all retained species are within biological limits SG100 SIa is not met.

PI 2.1.1		The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species
		UoCs 3 & 4 Yellow Squat Lobster North Industrial - Artisanal Of the retained species Chilean hake is considered main; although catch share is <5% it is a vulnerable species. Cardinal fish is a vulnerable species but catch share was <0.1% and at that low level was not considered main. There are defined biological limits for the main retained species from stock assessments. The stock status of Chilean hake is described above. The main retained species is not within biologically based limits and therefore SG60 and SG80 are scored under SIc. Other retained species are cardinal fish, nylon shrimp and red squat lobster. Not all retained species are within biological limits and SG100 SIa is not met. **UoC 5 Yellow Squat Lobster South.** Of the retained species Chilean hake and red squat lobster are considered main; the first is vulnerable and the other has a catch share >5%. Cardinal fish is vulnerable but catch share was <0.1% and was not considered main. There are defined biological limits for both main retained species from stock assessments. Chilean hake stock status is described above. Main retained species Chilean hake is not within biologically based limit and therefore for this element SG60 and SG80 are scored under SIc. Red squat lobster is a P1 species in other UoCs, and there is a high degree of certainty that it is within biologically based limits (see P1 section). The scoring element meets SG80 SIa. Other retained species are cardinal fish, nylon shrimp and red squat lobster. Not all retained species are within biological limits so the fishery does not meet SG100 SIa.

PI 2.1.1		**The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species**		
		UoCs 6 & 7 Red Squat Lobster North Industrial- Artisanal Main retained species are Chilean hake and yellow squat lobster; the first is vulnerable and the other has a catch share >5%. Cardinal fish is also vulnerable but catch share was <0.01% and was not considered main. There are defined biological limits for both main retained species from stock assessments. Main retained species Chilean hake is not within biologically based limits and therefore for this element SG60 and SG80 are scored under SIc. Yellow squat lobster is a P1 species in other UoCs and is highly likely within biologically based limits (see P1 section). The scoring element meets SG80 SIa. Other retained species are cardinal fish, and nylon shrimp. Not all retained species are within biological limits. The fishery does not meet SG100 SIa. **UoC 8 Red Squat Lobster South.** Of the retained species Chilean hake is considered main; although catch share is <5% it is a vulnerable species. Cardinal fish is also vulnerable but catch share was <0.01% and was not considered main. There are defined biological limits for the main retained species from stock assessments. Chilean hake is not within biologically based limits therefore SG60 and SG80 are scored under SIc. Other retained species are cardinal fish, nylon shrimp and yellow squat lobster. Not all retained species are within biologically based limit and SG100 SIa is not met.		
b	**Guidepost**			Target reference points are defined for retained species.
	Met?			Y (All UoCs)

PI 2.1.1	**The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species**

Justification

Target reference points are defined for all retained species:

Chilean hake: CCT as required by LGPA Art. 153º established biological reference points:

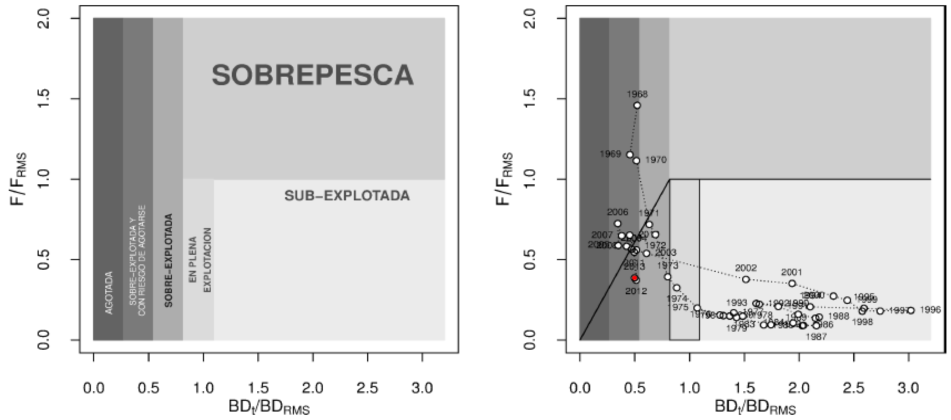
a. BD_{RMS} = 40%BDo
b. BD_{limite} = 20%BDo o 0,5*BD_{RMS}
c. F_{RMS} como límite de sobrepesca o sobre-explotación por mortalidad.

BDo: Virgin Spawning Biomass

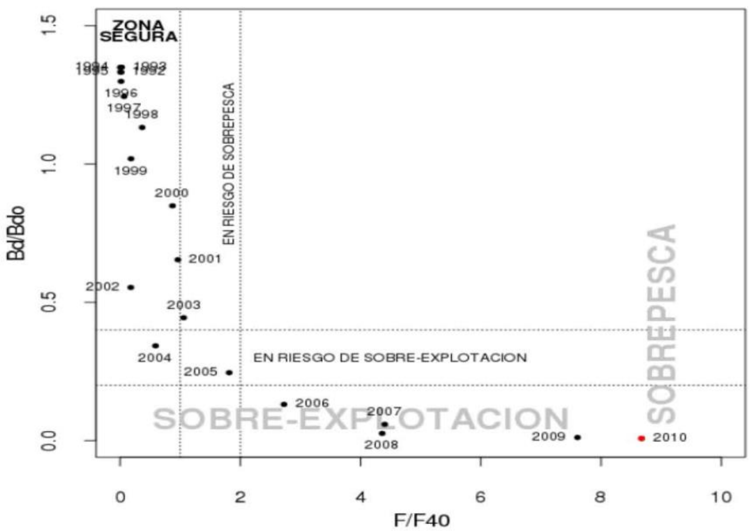
BD_{RMS} = Spawning Biomass at MSY

BD_{LIMIT} = Limit Spawning Biomass

F_{RMS} = Fishing Mortality at MSY level



-Cardinal fish: The Reference point is F45% Spawning Biomass and 10% risk.



Nylon shrimp, yellow squat lobster and red squat lobster are P1 species when they are the target species and reference points are described in the P1 section.

All fisheries meet SG100 SIb.

<table>
<tr><td colspan="2">PI 2.1.1</td><td colspan="3">The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td>If main retained species are outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.</td><td>If main retained species are outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.</td><td></td></tr>
<tr><td>Met?</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td><td></td></tr>
<tr><td>R</td><td colspan="3"> UoC 1 Nylon Shrimp Industrial Main retained species outside limits are Chilean hake and cardinal fish. There are general measures consisting of spatial closures excluding trawl fishing in the first 5 nm from the coastal line and seasonal closures to protect the target species which should also protect these species. There is a global quota for the target species. There is a partial strategy since 2015 of a mandatory modified trawl to allow non-target fish species to escape unharmed which is expected to ensure that the fishery does not impede recovery of Chilean hake and cardinal fish. There are measures specific for each of the main retained species as target and retained species: Chilean hake is a closed access fishery and subjected to a full exploitation regime with global quota and Transferable Fishery Licenses. CCT considering 11 years of collapsed stock without signs of recovery and significant illegal fishing voted in favour of a recovery strategy of applying a 60% $F_{RMS.}$ The fishery Management Plan is in process of implementation and considers fishing mortalities that will in five years move the stock from current collapsed status ($B<B_{lim}$). As retained catch, to participate in the nylon shrimp industrial fishery it is required to be in possession of a share of the Chilean hake quota. The measure should be effective in keeping the marginal contribution of the fishery from impeding rebuilding of the population. The scoring element meets SG60 and SG80 SIc. Cardinal fish fishery is closed. There are quotas only as non-target catch in three trawl fisheries including the demersal crustacean fisheries combined. The quota is 10 t for the industrial demersal crustacean fisheries and up to 0.5% of the target by trip. The scoring element meets SG60 and SG 80 SIc. The fishery meets SG80 SIc. </td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.1.1</td><td colspan="3">The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species</td></tr>
<tr><td></td><td></td><td colspan="3">UoC 2 Nylon Shrimp Artisanal
Retained species and general measures and partial strategy are as for the industrial fishery.
Specific management measures for main retained species are:
For Chilean hake there is a 28 t non-target annual reserve quota for all artisanal fisheries and 1% landing maximum limit by fishing trip.
For cardinal fish there is a 2 t quota as non-target species in all demersal crustacean artisanal fisheries. The fishery meets SG60 and SG80 SIc.
UoCs 3, 4 and 8 Yellow Squat Lobster North Industrial & Artisanal – Red Squat Lobster South
The only main retained species is Chilean hake and is outside limits. General measures and partial strategy for the species are the same as outlined above for the nylon shrimp industrial and artisanal fisheries. The fisheries meet SG60 and SG80 SIc.
UoC 5 Yellow Squat Lobster South
Main retained species are Chilean hake and red squat lobster. Red squat lobster met SG80 SIa. Chilean hake is outside limits. General measures and partial strategy for the species are the same as outlined above for the nylon shrimp industrial and artisanal fisheries. The scoring element meets SG60 and SG80 SIc.
UoC 6 & 7 Red Squat Lobster North Industrial & Artisanal
Main retained species are Chilean hake and yellow squat lobster.
Yellow squat lobster met SG80 SIa.
Chilean hake is outside limits. General measures and partial strategy for the species are the same as outlined above for the nylon shrimp industrial and artisanal fisheries. The scoring element meets SG60 and SG80 SIc.</td></tr>
<tr><td rowspan="3">d</td><td>Guidepost</td><td>If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.</td><td></td><td></td></tr>
<tr><td>Met?</td><td>NA</td><td></td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Nylon shrimp, yellow squat lobster and red squat lobster are P1 species and the status of each is well known.
The status of Chilean hake stock is well known.
The status of cardinal fish is relatively well known.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Queirolo et al (2011), Subsecretaría de Pesca (2015). Zilleruelo et al (2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016). Tascheri (2015). SERNAPESCA Anuarios de pesca.</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>90 (All UoCs)</td></tr>
</table>

PI 2.1.1	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species	
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.1.2

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
	Met?	Y (All UoCs)	Y (All UoCs)	See table below
		Key: YL = yellow squat lobster, RL = red squat lobster, NS = nylon shrimp IN = Industrial North UoCs, IS = Industrial South UoCs, A = Artisanal UoCs **Four scores are given for UoCs where there are four main retained species.**		

SG 100 Met?:

	YL	RL	NS
IN	Y N Y Y	Y N Y Y	Y N Y Y
IS	Y N Y Y	Y N Y Y	
A	N N N N	N N N N	N N N N

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species
	Justification	**UoC 1** Nylon shrimp Industrial Main retained species are Chilean hake and cardinal fish. Several measures relate to all retained species: 1 nm restriction for all fisheries and 5 nm for trawl, seasonal closures for the target. For both species there are measures to ensure that the fishery does not hinder recovery. For Chilean hake, there is limited entry, gear regulations, seasonal closure, and there is a global quota and to target nylon shrimp it is required to own shares of the Chilean hake quota. For cardinal fish, the fishery is closed and there are quotas as non-target catch of other fisheries: the quota for demersal crustacean fisheries as a whole is 10t and up to 0.5% of the target by trip. The fisheries meet SG60 SIa. As a partial strategy, trawl gear characteristics are now regulated and include net features to allow non-target fish species to escape unharmed, in particular Chilean hake. The fishery meets SG80 SIa. Others retained species are yellow squat lobster and red squat lobster. The measures and requirement of quota shares and the gear regulations in place to manage Chilean hake can be considered a strategy and this scoring element meets SG 100. There is no strategy for cardinal fish so SG80 is met. For the other retained species yellow squat lobster and red squat lobster gear restrictions, seasonal closures and global quotas of which retained catch in the nylon shrimp is part of the quota can be considered a strategy. So SG100 is met for these species. Three out of the four retained species meets the SG100, so the UoC scores 95. **UoC 2** Nylon shrimp Artisanal Main retained species are Chilean hake and cardinal fish and general measures are the same as for the industrial fishery. Specific measures for main retained species include for Chilean hake a 28t annual reserve quota for all artisanal fisheries and maximum landings of 1% of the total catch per trip, and for cardinal fish a 2t quota in artisanal demersal crustacean fisheries or 0.5% of target by trip. The fishery meets SG60 SIa. As a partial strategy, trawl gear characteristics are regulated; include net features to allow non-target fish species to escape unharmed, in particular Chilean hake. The fishery meets SG80 SIa. There are measures which constitute a partial strategy for Chilean hake and cardinal fish but the assessment team did not consider that these measures were sufficient to be considered to be a strategy, so for both Chilean hake and cardinal fish the SG80 is met, but not the SG100. Other retained species are the same as the industrial fishery. Measure for yellow squat lobster is a maximum landing of 10% of the total catch and 10 t annual reserve quota (80), and for red squat lobster there is maximum landing of 10% of the total catch and 4t annual reserve quota (80). The UoC does not meet SG100 SIa.

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species
a		**UoC 3** Yellow squat lobster North Industrial Main retained species is Chilean hake; Measures for Chilean hake are outlined above. The fishery meets SG60 SIa. As a partial strategy, trawl gear characteristics are regulated and include net features to allow non-target fish species to escape unharmed, in particular Chilean hake. The fishery meets SG 80 SIa. Other retained species are nylon shrimp, red squat lobster and cardinal fish. There is no strategy in place to manage all retained species. For cardinal fish there is a 10t quota and up to 0.5% of the target by trip for the demersal crustacean fisheries as a whole (80); for Chilean hake (100), nylon shrimp (100) and red squat lobster (100) the measures and the requirement to have quota shares of these species to participate in the yellow squat lobster fishery can be considered a strategy. Three out of the four retained species meets the SG100, so the UoC scores 95. **UoC 4** Yellow squat lobster Artisanal Main retained species is Chilean hake and measures are as outlined above for the nylon shrimp artisanal fishery. The fishery meets SG60 SIa. As a partial strategy, trawl gear characteristics are regulated and include net features to allow non-target fish species to escape unharmed, in particular Chilean hake. The fishery meets SG80 SIa. Others retained species are nylon shrimp, red squat lobster and cardinal fish. There are measures but there is no strategy in place to manage all retained species. For cardinal fish there is a 2t quota in artisanal demersal crustacean fisheries or 0.5% of the target by trip. For nylon shrimp and for red squat lobster as non-target species there is a 10% maximum landing of the total catch and a 5t annual reserve. None of the scoring elements meets 100 and the fishery does not meet SG100 SIa. **UoC 5** Yellow squat lobster South Main retained species are Chilean hake and red squat lobster; others are nylon shrimp, and cardinal fish. Measures were outlined above, to target yellow squat lobster it is required to have quota shares for Chilean hake and of red squat lobster. The fishery meets SG60 SIa. As a partial strategy, trawl gear characteristics are regulated and include net features to allow non-target fish species to escape unharmed, in particular Chilean hake. The fishery meets SG 80 SIa. There is no strategy in place to manage all retained species. For cardinal fish there is a 10t quota and up to 0.5% of the target by trip for the demersal crustacean fisheries as a whole (80); there are strategies for Chilean hake (100), nylon shrimp (100) and red squat lobster (100) which consist of measures and a partial strategy and as non-target species it is required to have quota shares of these species to participate in the yellow squat lobster fishery. Three out of the four retained spceis meets the SG100, so the UoC scores 95.

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species
a		**UoC 6** Red squat lobster North Industrial Main retained species are Chilean hake and yellow squat lobster; others are nylon shrimp and cardinal fish. Measures were outlined above, to target red squat lobster it is required to have quota shares for Chilean hake and of yellow squat lobster. The fishery meets SG60 SIa. As a partial strategy, trawl gear characteristics are regulated and include net features to allow non-target fish species to escape unharmed, in particular Chilean hake. The fishery meets SG 80 SIa. There is no strategy in place to manage all retained species. For cardinal fish there is a 10t quota and up to 0.5% of the target by trip for the demersal crustacean fisheries as a whole (80); for Chilean hake (100), nylon shrimp (100) and yellow squat lobster (100) there is strategy of measures, partial strategy and a global quota for it is required to have quota shares to participate in the red squat lobster fishery. Three out of the four retained species meets the SG100, so the UoC scores 95. **UoC 7** Red squat lobster Artisanal Main retained species are Chilean hake and yellow squat lobster; others are nylon shrimp, and cardinal fish. Specific measures for main retained species include for Chilean hake maximum landings of 1% of the total catch, same as for all other artisanal fisheries; for yellow squat lobster there is a 10% maximum landing of the total catch. The fishery meets SG60 SIa. As a partial strategy, trawl gear characteristics are regulated and include net features to allow non-target fish species to escape unharmed, in particular Chilean hake. The fishery meets SG 80 SIa. There are measures but no strategy in place to manage all retained species. For cardinal fish there is a 2t quota in artisanal demersal crustacean fisheries or 0.5% of the target by trip. For nylon shrimp there is a 10% maximum landing of the total catch. The fishery does not meet SG100 SIa. **UoC 8 Red squat lobster South** Main retained species is Chilean hake; others are nylon shrimp, yellow squat lobster and cardinal fish. Measures were outlined above, to target red squat lobster it is required to have quota shares for Chilean hake. The fishery meets SG60 SIa. As a partial strategy, trawl gear characteristics are regulated and include net features to allow non-target fish species to escape unharmed, in particular Chilean hake. The fishery meets SG 80 SIa. There is no strategy in place to manage all retained species. For cardinal fish there is a 10t quota and up to 0.5% of the target by trip for the demersal crustacean fisheries as a whole (80); for Chilean hake (100), nylon shrimp (100) and yellow squat lobster (100) there is strategy of measures and a global quota for it is required to have quota shares to participate in the red squat lobster fishery. Three out of the four retained species meets the SG100, so the UoC scores 95.

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species		
b	Guidepost	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
b	Justification	**UoC 1 & 2** Nylon Shrimp Industrial & Artisanal Main retained species are Chilean hake and cardinal fish, others are yellow and red squat lobsters. Measures applied to retained species are considered likely to work as area restrictions protect nursery areas for the species and temporal closures protect reproduction and recruitment. Requirement of quota shares for Chilean hake for the industrial fishery and maximum 1% of the catch by trip in the artisanal fishery, and non-target quota for cardinal fish for industrial and artisanal fisheries are likely to keep removals at levels that ensure the fishery does not hinder recovery. The fisheries meet SG60 SIb. The new gear designed to reduce retained fish catch has shown some reduction in retained catch in the 2015 IFOP monitoring of the fishery survey which provides some basis for confidence that the partial strategy will work for Chilean hake and cardinal fish. The fisheries meet SG80 SIb. There has been no testing to support that measures and partial strategy for retained catch of Chilean hake and cardinal fish and for other retained species will work. The new gear designed in part to minimize fish non-target catch is in place for only one year and although surveys compared performance of the two gears there is no information to test it will work for the whole fishery. The fisheries do not meet SG100 SIb. **UoCs 3 & 4** Yellow Squat Lobster North Industrial & Artisanal Main retained species is Chilean hake; others are nylon shrimp, red squat lobster and cardinal fish. General measures are considered likely to work as area restrictions protect nursery areas for the species and temporal closures protect reproduction and recruitment. Requirement of quota shares for Chilean hake in the industrial fishery and maximum landings of 1% of the catch in the artisanal fishery are likely to keep removals at levels that ensure the fishery does not hinder recovery. The fisheries meet SG60 SIb. The new gear designed to reduce retained fish catch has shown some reduction in retained catch in the 2015 IFOP monitoring of the fishery survey which provides some basis for confidence that the partial strategy will work for Chilean hake. The fisheries meet SG80 SIb.		

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species
b		There has been no testing to support that the strategy for main retained species Chilean hake and for other retained species will work. The new gear designed in part to minimize fish non-target catch has been in place for only one year and although surveys compared performance of the two gears there is no information to test it will work for the yellow squat fisheries. The fisheries do not meet SG100 SIb. **UoC 5** Yellow squat lobster South Main retained species are Chilean hake and red squat lobster; others are nylon shrimp, and cardinal fish. Measures applied to retained species are considered likely to work as area restrictions protect nursery areas for the species and temporal closures protect reproduction and recruitment. Requirement of quota shares for Chilean hake and red squat lobster for the industrial fishery, are likely to keep removals at levels that ensure the fishery does not hinder recovery for Chilean hake and keep red squat lobster within biological based limits. The fishery meets SG60 SIb. The new gear designed to reduce retained fish catch has shown some reduction in retained catch in the 2015 IFOP monitoring of the fishery survey which provides some basis for confidence that the partial strategy will work for Chilean hake. The fishery meets SG80 SIb. As above, there is no testing for measures and the new gear has been in place for only one year to test the partial strategy will work. The fishery does not meet SG 100 SIb. **UoC 6 & 7** Red squat lobster North Industrial & Artisanal Main retained species are Chilean hake and yellow squat lobster; others are nylon shrimp and cardinal fish. General measures are likely to work as for the other demersal crustacean fisheries. Requirement of quota shares for Chilean hake in the industrial fishery and maximum Chilean hake landings of 1% of the catch by trip in the artisanal fishery are likely to keep removals at levels that ensure the fishery does not hinder recovery, and for yellow squat lobster quota share requirement and maximum landings of 10% of the total catch by trip are likely to keep removals at levels that ensure the population is within biologically based limits The fisheries meet SG60 SIb. The new gear designed to reduce retained fish catch has shown some reduction in retained catch in the 2015 IFOP monitoring of the fishery survey which provides some basis for confidence that the partial strategy will work for Chilean hake. The fisheries meet SG80 SIb.

<table>
<tr><th colspan="2">PI 2.1.2</th><th colspan="3">There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species</th></tr>
<tr><td>b</td><td></td><td colspan="3">As above, there is no testing for measures and the new gear is in place for only one year to test the partial strategy will work. The fisheries do not meet SG100 SIb.
UoC 8 Red squat lobster South
Main retained species is Chilean hake; others are nylon shrimp, yellow squat lobster and cardinal fish. General measures are likely to work as for the other demersal crustacean fisheries and requirements of quota shares for Chilean hake. The fishery meets SG60 SIb.
The new gear designed to reduce retained fish catch has shown some reduction in retained catch in the 2015 IFOP monitoring of the fishery survey which provides some basis for confidence that the partial strategy will work for Chilean hake. The fishery meets SG80 SIb.
As above, there is no testing for measures and the new gear has being in place for only one year to test the partial strategy will work. The fishery does not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td></td><td>There is some evidence that the partial strategy is being implemented successfully.</td><td>There is clear evidence that the strategy is being implemented successfully.</td></tr>
<tr><td>Met?</td><td></td><td>Y (All UoCs)</td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs
There is some evidence that the fisheries are following the practice to implement measures that constitutes the partial strategy. Evidence of exclusion of trawling in restricted areas is provided by SERNAPESCA. In terms of quotas, landings are certified. The use of the new gear is mandatory starting in November 2014. SERNAPESCA and IFOP provide evidence that all vessels transitioned to the new gear. The fisheries meet SG80 SIc.
For all artisanal fisheries there are no strategies for any of the retained species. The artisanal fisheries do not meet SG100 SIc.
For industrial fisheries there is a strategy for each of the retained species except for cardinal fish. For species with a strategy, which consists of quota shares of annual quotas, plus the above partial strategy, there is no clear evidence it has been successfully implemented, as there are issues with discards in the crustacean fisheries. The industrial fisheries do not meet SG100 SIc.</td></tr>
<tr><td rowspan="2">d</td><td>Guidepost</td><td></td><td></td><td>There is some evidence that the strategy is achieving its overall objective.</td></tr>
<tr><td>Met?</td><td></td><td></td><td>N (All UoCs)</td></tr>
</table>

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species		
	Justification	All UoCs Retained species are Chilean hake, cardinal fish, nylon shrimp, red squat lobster, and yellow squat lobster. There is no strategy for retained species in the artisanal fisheries. There is no strategy for cardinal fish in the industrial fisheries. For Chilean hake, nylon shrimp, red squat lobster, yellow squat lobster there is no evidence the strategy consisting of measures, required quota shares and the improved gear is achieving its objectives in managing the effect of the crustacean fisheries. There will be evaluation of the strategies when a plan for reduction of non-target catch is implemented with necessary information and analysis as established in the new LGPA. The fisheries do not meet SG100 SId.		
e	Guidepost	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?	NA	NA	NA
	Justification	All UoCs Shark finning is prohibited by law and controlled when landing catch. Issue is not scored as there are no retained shark species.		
References		MINECON D.EX. Nº10/2014; SUBPESCA Nº 237/2015, LGPA Art. 5bis. R. Ex. Nº762/ 2013 and R. Ex. Nº145 /2015. CCT RDAP 2015, D. EX. Nº39/2015. LGPA Tittle II, Paragraph 1 Bis.		
OVERALL PERFORMANCE INDICATOR SCORE:				**85 (UoCs 1, 3, 5, 6 & 8)** **80 (UoCs 2, 4 & 7)**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.1.3

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
	Met?	Y (All UoCs)	Y (UoCs 1, 3, 5, 6 & 8) N (UoCs 2, 4 & 7)	N (All UoCs)
	Justification	**UoC 1** Nylon Shrimp Industrial Main retained species are Chilean hake and cardinal fish. There is substantial qualitative and quantitative information collected annually by IFOP on catch composition in the industrial nylon shrimp fishery unit including Regions III to VIII and readily available in annual reports. The amount of Chilean hake taken is reported and data can be used to estimate cardinal fish catch. Overall sample size is about 20% of trips in the fishery. Data from the new gear are available from the 2015 fishery and partially from 2013 and 2014. There are logbooks and SERNAPESCA maintains information on dockside landings. The fishery meets SG60 and SG80 SIa. IFOP data for all retained species are of catch composition but discards are known to occur before (and after) the catch is brought on deck. Thus, IFOP data might underestimate removals by the fishery. IFOP catch estimates are higher than SERNAPESCA landings indicating discards after IFOP observers recorded catch composition. Thus, information is not accurate and verifiable on the amount taken by the fishery. The fishery does not meet SG100 SIa. **UoC 2** Nylon shrimp Artisanal Main retained species are Chilean hake and cardinal fish. IFOP collects catch composition information of the nylon shrimp industrial fishery and it is reasonable to assume that these are qualitatively similar to artisanal catch. SERNAPESCA maintains dockside landing information. The fishery meets SG 60 SIa. Data are not recorded by IFOP from the artisanal fishery. Although it can be assumed that catch is qualitatively similar to the industrial catch, the assumption does not hold for quantitative information. The fishery does not meet SG 80 SIa.		

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
a		**UoC 3** Yellow squat lobster Industrial North Main retained species is Chilean hake. There is substantial qualitative and quantitative information collected annually by IFOP on catch composition in the industrial yellow squat lobster fishery North Unit in Region IV and readily available in annual reports. Overall sample size is about 20% of trips. Data from the new gear are available from the 2015 fishery and partially from 2013 and 2014. SERNAPESCA maintains dockside landing information. The fishery meets SG60 and SG80 SIa. Similar as indicated for the nylon shrimp industrial fishery, the information on retained species is not accurate and verifiable. The fishery does not meet SG100 SIa **UoC 4** Yellow squat lobster Artisanal. Main retained species is Chilean hake. Same argument applies on qualitative information available as for the nylon shrimp artisanal fishery. The fishery meets SG60 SIa. Similar to the artisanal fishery of nylon shrimp there are no data collected for the yellow squat lobster artisanal fishery. The fishery does not meet SG 80 SIa. **UoC 5** Yellow squat lobster South. Main retained species are Chilean hake and red squat lobster. There is substantial qualitative and quantitative information collected annually by IFOP on catch composition in the industrial yellow squat lobster fishery South Unit in Regions V-VIII and readily available in annual reports. Sample size is about 30% of the trips. Data from the new gear are available from the 2015 fishery and partially from 2013 and 2014. There are logbooks and SERNAPESCA maintains dockside landing information. The fishery meets SG60 and SG80 SIa. Similar as indicated for the nylon shrimp industrial fishery, information is not accurate and verifiable. The fishery does not meet SG100 SIa. **UoC 6** Red squat lobster North Industrial. Main retained species are Chilean hake and yellow squat lobster. There is qualitative and quantitative information collected annually by IFOP on catch composition in Region IV and readily available in annual reports. Data from the new gear are available partially from 2013 and 2014 fisheries. IFOP did not collect information from the 2015 fishery because the quota was mostly assigned to the artisanal sector and vessels did not accommodate observers on board. SERNAPESCA maintains dockside information irrespective of quota allocations. The fishery meets SG60 and SG80 SIa. As indicated for the other industrial fishery, information is not accurate and verifiable. The fishery does not meet SG100 SIa.

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species		
a		**UoC 7** Red squat lobster Artisanal. Main retained species are Chilean hake and yellow squat lobster. Same argument applies on qualitative information available as for the nylon shrimp and yellow squat lobster artisanal fisheries. The fishery meets SG60 SIa. Similar to the nylon shrimp and yellow squat lobster artisanal fisheries there are not data collected for the red squat lobster artisanal fishery. The fishery does not meet SG 80 SIa. **UoC 8** Red squat lobster South. Main retained species is Chilean hake. There is substantial qualitative and quantitative information collected annually by IFOP on catch composition in the industrial red squat lobster fishery South Unit in Regions V-VIII and readily available in annual reports. Sample size of about 20% of the trips. Data are available since 2011 as the fishery was closed for some years. Data from the new gear are available from the 2015 fishery and partially from 2013 and 2014. There are logbooks and SERNAPESCA maintains dockside landing information. The fishery meets SG60 and SG80 SIa. As indicated for the other industrial crustacean fisheries, information is not accurate and verifiable. The fishery does not meet SG100 SIa.		
b	**Guidepost**	Information is adequate to qualitatively assess outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
	Met?	Y (All UoCs)	N (All UoCs)	N (All UoCs)

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species		
	Justification	**UoC 1** Nylon Shrimp Industrial Main retained species are Chilean hake and cardinal fish. Data collected on catch composition on board industrial vessels by IFOP observers and dockside monitoring by SERNAPESCA (conducted by an accredited company), together with abundance surveys provide the information for the fishery to meet SG60 SIb. Data used for main retained species stock assessments are those recorded by SERNAPESCA on landings for quota control. Questions are raised about amount of removals as IFOP reports indicate that SERNAPESCA underestimates catch. Additionally, IFOP data do not account for discards before catch is brought on deck. Further, for cardinal fish there is no current monitoring of the population as the collapsed fishery is closed. IFOP monitoring provides data on catch composition which suggests that removals in this fishery are larger than the non-target quota while SERNAPESCA statistics report almost no catch. Thus, data are not considered sufficient to estimate outcome status with respect to biologically based limits. The fishery does not meet SG80 SIb. **UoC 2** Nylon shrimp Artisanal Dockside monitoring by SERNAPESCA and logbooks provide the information for the fishery to meet SG60 SIb. Data on catch composition are not collected on the artisanal fishery. Given the assumption made that catch composition is similar to that of industrial catch, information is adequate but not sufficient to estimate outcome status with respect to their biologically based limits. The fishery does not meet SG80 SIb. **UoCs 3, 5, 6 and 8** Yellow squat lobster North Industrial - Yellow squat lobster South- - Red squat lobster North Industrial - Red squat lobster South Similar to the Nylon Shrimp Industrial fishery, information on main retained species from dockside monitoring by SERNAPESCA and logbooks provide the information for the fishery to meet SG60 SIb but is not adequate to meet SG80 SIb. **UoCs 4 & 7** Yellow squat lobster Artisanal- Red squat lobster Artisanal Similar to the Nylon shrimp Artisanal fishery. The fishery meets SG60 SIb but does not meet SG80 SIb.		
c	Guidepost	Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Y (All UoCs)	Y (All UoCs)	Y (All UoCs)

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species		
c	Justification	**UoC 1** Nylon Shrimp Industrial Data collected on catch composition on board industrial vessels by IFOP observers and dockside monitoring by SERNAPESCA and abundance surveys provide the information for Chilean hake to support measures and partial strategy for the fishery to meet SG60 and SG80 SIc. For cardinal fish evaluations were discontinued in 2010 when the fishery closed. SERNAPESCA underestimate catch and data collected on catch composition on board industrial vessels by IFOP observers provide some information to support a partial strategy but it is not used in stock evaluations. There is evidence that retained species are also partially discarded before and after being brought on deck. The fishery does not meet SG100c. **UoC 2** Nylon shrimp Artisanal Similar to the industrial fishery. The fishery meets SG60 and SG80 SIc but does not meet SG100 SIc. **UoCs 3, 5, 6 & 8** Yellow squat lobster North Industrial - Yellow squat lobster South-Red squat lobster North Industrial - Red squat lobster South Data collected on catch composition on board industrial vessels by IFOP observers and dockside monitoring by SERNAPESCA, and abundance surveys provide the information for main retained species for the fisheries to meet SG60 and SG80 SIc. There is evidence that retained species are also partially discarded before and after being brought on deck. The fisheries do not meet SG100 SIc. **UoCs 4 & 7** Yellow squat lobster Artisanal- Red squat lobster Artisanal Similar to industrial fisheries, IFOP monitoring of the industrial fishery, dockside monitoring by SERNAPESCA and logbooks provide the information for main retained species for the fishery to meet SG60 and SG80SIc. Data are for industrial fisheries and there is evidence that retained species are also partially discarded before and after being brought on deck. The fisheries do not meet SG100c.		
d	Guidepost		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator score or the operation of the fishery or the effectiveness of the strategy)	Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.
	Met?		Y (UoCs 5 & 8) N (UoCs 1, 2, 3, 4, 6 &7)	N (All UoCs)

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
d	Justification	**UoC 1 & 2** Nylon Shrimp Industrial &Artisanal Main retained species are Chilean hake and cardinal fish. Various surveys provide indicators on abundance and status of Chilean hake. There are no surveys for cardinal fish. Reporting from logbooks and SERNAPESCA dockside landing data for quota control provide information on fishery operations. Data are compromised by unreported discards. Routine IFOP catch monitoring provides information on composition. While logbooks and dockside information continue to be collected the sample size of IFOP monitoring of the fishery in the northern area is low and depending on nylon shrimp stock condition. The issue is that artisanal vessels have not accommodated observers onboard and LGPA states for a global quota of up to 600 t the quota is allocated for the artisanal fishery; between 600 t and 4,000 t the artisanal quota is increased by 5.88% of global quota - 600 t and the remainder is for the industrial fishery. If artisanal vessels do not accommodate IFOP observers on board, data collection would be increasingly compromised with decreasing quotas. The fisheries do not meet SG80 SId. **UoCs 6 & 7** Red Squat Lobster North Industrial & Artisanal. Various surveys provide indicators on the abundance of Chilean hake. Reporting from logbooks and SERNAPESCA dockside landing data for quota control provide information on the operation of the fisheries. Data are compromised by unreported discards. Routine IFOP catch monitoring provides information on catch composition. Although logbooks and dockside information continue to be collected, IFOP monitoring of the fishery in the northern area is dependent on red squat stock condition and sample size is low. And it was the case that catch data from the fisheries in 2015 were not collected because stock condition was such that the quota was mostly assigned to the artisanal sector that has not accommodated observers on board. LGPA states that 2013 to 2032 catch allocation between artisanal and industrial fisheries is such that for a global quota of up to 700 t, the total is for the artisanal fishery; and between 700 and 2,100 t, the share is 700 t and the remainder for the industrial fishery. Thus, data do not continue to be collected when the red squat lobster stock condition in the north unit is poor and the fisheries do not meet SG80 SId.

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
d		**UoCs 3 & 4** Yellow Squat Lobster North Industrial & Artisanal Various surveys provide indicators on the abundance of Chilean hake. Reporting from logbooks and SERNAPESCA dockside landing data for quota control provide information on the operation of the fisheries. Data are compromised by unreported discards. Routine IFOP monitoring of the catch provides information on catch composition. Although logbooks and dockside information continue to be collected, IFOP monitoring of the fishery in the northern area is dependent on yellow squat lobster stock condition. The issue is that artisanal vessels have not accommodated observers onboard and LGPA states that 2013 to 2032 catch allocation between artisanal and industrial fisheries is such that for a global quota of up to 350t, the total is for the artisanal fishery; and between 350 and 1,350t, the artisanal share is increased by 10% of the difference between the overall quota and 350t, the remainder is for the industrial fishery. Thus data will not be collected when the yellow squat lobster stock condition in the north unit is poor. The fisheries do not meet SG80 SId. **UoCs 5 & 8** Yellow Squat Lobster South - Red Squat Lobster South. Various surveys provide indicators on the abundance of Chilean hake. Continued IFOP monitoring of the catch, catch reporting from logbooks and SERNAPESCA dockside landing records for quota control provide information on the operation of the fishery. There are no artisanal fisheries that would cause a situation when sufficient data will not be collected from the fisheries. The fisheries meet SG80 SId. Data are compromised by unreported discards precluding assessment of ongoing mortalities to all retained species. The fisheries do not meet SG100 SId.
References		Zilleruelo et al 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016. Queirolo et al. 2011.
OVERALL PERFORMANCE INDICATOR SCORE:		**75 (UoCs 5 & 8)** **70 (UoCs 1, 3 & 6)** **65 (UoCs 2, 4 & 7)**
CONDITION NUMBER (if relevant):		**3, 4, 5 & 6**

Evaluation Table for PI 2.2.1

PI 2.2.1		**The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Main bycatch species are likely to be within biologically based limits (if not, go to scoring issue b below).	Main bycatch species are highly likely to be within biologically based limits (if not, go to scoring issue b below).	There is a high degree of certainty that bycatch species are within biologically based limits.
	Met?	RBF used – UoCs 1&2 Y (UoCs 3 to 8)	RBF used – UoCs 1&2 Y (UoCs 3 to 8)	RBF used – UoCs 1&2 N (UoCs 3 to 8)
a	**Justification**	Catch composition data from IFOP surveys were used in evaluating bycatch species; as indicated by researchers from IFOP and SUBPESCA, species with no commercial value are discarded. Discards are prohibited since 2001, but data recorded by IFOP provide qualitative and quantitative information on discarded bycatch species. **UoCs 1 & 2** Nylon shrimp Industrial & Artisanal Overall, bycatch was about 10 to 20% of the catch with up to 73 species reported for the southern area and 44 for the north. There were five species of chondrichthyes listed for the northern area and 17 taxa for the south. Granulatum and hooktooth dogfish represented about 0.8% and 0.7% of the catch; yellownose skate represented up to 0.38% in the southern area which translates into about 4t and close to the 6t quota assigned for demersal fisheries for Region VIII to 41°28 6'S. The assessment team does not consider species of chondrichthyes as P2 main bycatch species at the time because the representation in the catch as reported by IFOP is low. However it is **recommended** that future annual audits should review the situation when discards are actually evaluated to ensure that the fishery does not pose a threat to these species. There were two main bycatch species for the nylon shrimp fisheries, Aconcagua and Chilean grenadier with catch shares > 5%. Grenadiers do not form schools or aggregations and have no commercial value so they are not targeted. As a result, there is no information on status of these two species and **outcome and SIa for the Nylon shrimp UoCs was assessed using the RBF**. The RBF score for both fisheries meets SG80 SIa. **UoCs 3 & 4** Yellow Squat Lobster North Industrial & Artisanal There were not any main bycatch species identified for these fisheries with catch shares > 5% or which were vulnerable. There were four Chondrichthyes species as bycatch with low representation. The assessment team does not consider species of Chondrichthyes as P2 main bycatch species and it is **recommended** that future annual audits should review the situation to ensure that bycatch does not pose a threat. The fisheries meet SG60 and SG80 SIa. IFOP surveys on catch composition recorded up to 25 bycatch species. There is not a high degree of certainty that all bycatch species are within biologically based limits. The fisheries do not meet SG100 SIa.		

<table>
<tr><th colspan="2">PI 2.2.1</th><th colspan="3">The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups</th></tr>
<tr><td>a</td><td></td><td colspan="3">UoC 5 Yellow Squat Lobster South

There were not any main bycatch species identified for this fishery with catch shares >5% or which were vulnerable. There were four Chondrichthyes species as bycatch with low representation. The assessment team does not consider species of Chondrichthyes as P2 main bycatch species and it is recommended that future annual audits should review the situation to ensure that bycatch does not pose a threat. The fishery meets SG60 and SG80 SIa.

IFOP surveys on catch composition recorded up to 15 bycatch species since 2010. There is not a high degree of certainty that all bycatch species are within biologically based limits and the fishery does not meet SG100 SIa.

UoCs 6 & 7 Red Squat Lobster North Industrial & Artisanal

There were not any main bycatch species identified for these fisheries with catch shares >5 or which were vulnerable. The fisheries meet SG60 and SG80 SIa.

IFOP surveys on catch composition recorded up to 11 bycatch species; up to five since 2010. There is not a high degree of certainty that all bycatch species are within biologically based limits estimates and the fisheries do not meet SG100 SIa.

UoC 8 Red Squat Lobster South

There were not any main bycatch species identified for these fisheries with catch shares >5% or which were vulnerable. Among bycatch species there were four Chondrichthyes including yellownose skate and catch could represent over the 12t established as a non-target quota for the demersal crustacean fisheries for 2015; but data are preliminary. The assessment team does not consider Chondrichthyes as P2 main bycatch species and it is recommended that future annual audits should review the situation to ensure that bycatch does not pose a threat. The fishery meets SG60 and SG80 SIa.

IFOP surveys on catch composition recorded up to 20 bycatch species. There is not a high degree of certainty that all bycatch species are within biologically based limits. The fishery does not meet SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>If main bycatch species are outside biologically based limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.</td><td>If main bycatch species are outside biologically based limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.</td><td></td></tr>
<tr><td>Met?</td><td>NA</td><td>NA</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">UoCs 1 & 2 Nylon shrimp Industrial & Artisanal

Main bycatch species are not outside biologically based limits as indicated by RBF and SG60 and SG80 SIb are not scored.

UoCs 3 to 8

There are no main bycatch species and SG60 and SG80 SIb are not scored.</td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.2.1</td><td colspan="3">The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td>If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the bycatch species to be outside biologically based limits or hindering recovery.</td><td></td><td></td></tr>
<tr><td>Met?</td><td>Y UoCs 1 & 2
N/A (UoCs 3 to 8)</td><td></td><td></td></tr>
<tr><td>Justification</td><td colspan="3">UoC 1 & 2 Nylon shrimp Industrial & Artisanal

Status of main bycatch species Aconcagua and Chilean grenadier is poorly known. Spatial overlap of nylon shrimp fisheries with both grenadier populations is low because their distribution extends to deeper waters and south from where the fisheries operate. Thus, it is unlikely that nylon shrimp fisheries could deplete these populations.

There are several measures in place: 5 nm area closure restrictions for trawl fisheries and seasonal closures, limited entry and target species global quota that works as a choke for bycatch. Trawl gear characteristics are regulated; the net includes features to allow non-target fish species to escape unharmed and significantly reduce non-targeted catch. These measures are expected to result in the fisheries not causing Aconcagua grenadier and Chilean grenadier to be outside biologically based limits. The fisheries meet SG60 SIc.

UoCs 3 to 8.

There are not any main bycatch species in these fisheries.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Queirolo et al (2011), Subsecretaría de Pesca (2015), Zilleruelo et al (2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016). Acuña et al (2008), Reyes et al (2009).</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>80 using RBF (UoCs 1 & 2)
80 (UoCs 3 to 8)</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 2.2.2

PI 2.2.2		**There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There are measures in place, if necessary, that are expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing and minimizing bycatch.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	UoC 1 & 2 Nylon shrimp Industrial & Artisanal Main bycatch species are Aconcagua grenadier and Chilean grenadier and measures are in place to maintain them at levels highly likely to be within biologically based limits. Several measures cover main bycatch species as well as all bycatch species: 5 nm restriction for trawl, seasonal closures, limited entry and global quota. The fisheries meet SG60 SIa. Discards are illegal in Chile unless a vessel is participating in an ongoing research project to evaluate discards. There is a partial strategy of improvements of the design of the trawl gear. Trawl gear characteristics are now regulated and include net features to allow non-target fish species to escape unharmed to significantly reduce non-targeted catch. The fisheries meet SG80 SIa. There is no current strategy to manage bycatch. Discarding is illegal but known to be common practice. The research project currently underway will be the basis for a strategy to evaluate causes and minimize discards. The fisheries do not meet SG100 SIa. UoCs 3 to 8 There are not any main bycatch species and a management strategy would not be required. The fisheries meet SG60 and SG80 SIa. The measures and partial strategy apply to all bycatch species but there is no current strategy in place to manage and minimize bycatch. A research project currently underway will be the basis for a strategy to evaluate causes and minimize discards. The fisheries do not meet SG100 SIa.		
b	**Guidepost**	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)

<table>
<tr><td colspan="2">PI 2.2.2</td><td colspan="3">There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">UoCs 1 & 2 Nylon shrimp Industrial & Artisanal

Main bycatch species are Aconcagua and Chilean grenadier and general measures are 5 nm restrictions for trawling, and nylon shrimp fishery limited entry, seasonal closure, and global quota. While spatial restrictions might not protect grenadier species that are distributed in deeper waters, other measures act as a choke to the amount of bycatch taken in the fisheries. The fisheries meet SG60 SIb.

Trawl gear characteristics including net features to allow non-target fish species to escape unharmed resulted in an overall 2015 decrease in bycatch of Chilean grenadier both in north and south areas. The gear is lighter which might cause fishing higher in the water column; it is also more susceptible to tear which caused changes in fishing areas. The fisheries meet SG80 SIb.

There is no strategy at the moment and the fisheries do not meet SG100 SIb.

UoCs 3 to 8

The lack of main bycatch species and relatively low number of species in the bycatch indicate there is an objective basis for confidence that measures of 5 nm restrictions for trawling, and seasonal closures of the fisheries are working. The modified gear can further reduce bycatch. The fisheries meet SG60 & SG80 SIb.

There is no strategy yet in place to manage and minimize bycatch and discard data are missing to support with high confidence that the strategy is working. The fisheries do not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td></td><td>There is some evidence that the partial strategy is being implemented successfully.</td><td>There is clear evidence that the strategy is being implemented successfully.</td></tr>
<tr><td>Met?</td><td></td><td>Y (All UoCs)</td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs

There is evidence that the 5 nm restrictions for trawling, and seasonal closures, limited entry, global quota and the use of the mandatory gear since November 2014, which constitute the current partial strategy, are being implemented successfully as confirmed by SERNAPESCA and IFOP monitoring of the fisheries. The mandatory use of satellite equipment to control the vessel position ensures that protected areas are effective and the sanctions on non-reporting are of the magnitude to ensure implementation. The fisheries meet SG80 SIc.

There is no strategy in place yet until the results of the mandatory research on minimizing discards are available and recommendations can be implemented. The fisheries do not meet SG100 SIc.</td></tr>
<tr><td rowspan="2">d</td><td>Guidepost</td><td></td><td></td><td>There is some evidence that the strategy is achieving its overall objective.</td></tr>
<tr><td>Met?</td><td></td><td></td><td>N (All UoCs)</td></tr>
</table>

PI 2.2.2		There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations
	Justification	All UoCs Although there is some evidence that the new gear is achieving its overall objective to decrease bycatch of some species, this constitutes only a partial strategy and a management strategy for bycatch is forthcoming. The fisheries do not meet SG100 SId.
References		MINECON Nº20.625 2012, LGPA, R.Ex.Nº882/2013, Acuña et al (2008),
OVERALL PERFORMANCE INDICATOR SCORE:		80 (All UoCs)
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.2.3

<table>
<tr><td colspan="2">PI 2.2.3</td><td colspan="3">Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Qualitative information is available on the amount of main bycatch species taken by the fishery.</td><td>Qualitative information and some quantitative information are available on the amount of main bycatch species taken by the fishery.</td><td>Accurate and verifiable information is available on the catch of all bycatch species and the consequences for the status of affected populations.</td></tr>
<tr><td>Met?</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">UoCs 1 & 2 Nylon shrimp Industrial & Artisanal.

Main bycatch fisheries are Aconcagua and Chilean grenadier. Although discarding is illegal since 2001 and not recorded, catch composition recorded by IFOP annual monitoring of the demersal crustacean fisheries provides qualitative and some quantitative information that in combination with estimates of total landings of the target species recorded by SERNAPESCA allows an estimate of the amount of bycatch. The fisheries meet SG60 SIa and SG80 SIa.

Because discards can occur before the catch is taken on deck, the information provided of all bycatch species from catch composition by IFOP annual monitoring of the fisheries is not accurate and verifiable. The fisheries do not meet SG100 SIa.

UoCs 3 to 8

There were no main bycatch species. Fisheries meet SG60 SIa and SG80 SIa.

Because discards also occur before the catch is taken on deck, the information provided of all bycatch species from catch composition by IFOP annual monitoring of the fisheries is not accurate and verifiable. The fisheries do not meet SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Information is adequate to broadly understand outcome status with respect to biologically based limits</td><td>Information is sufficient to estimate outcome status with respect to biologically based limits.</td><td>Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.</td></tr>
<tr><td>Met?</td><td>Y (UoCs 3 to 8)

Not scored UoCs 1 & 2 due to use of RBF</td><td>Y (UoCs 3 to 8)

Not scored UoCs 1 & 2 due to use of RBF</td><td>N (UoCs 3 to 8)

Not scored UoCs 1 & 2 due to use of RBF</td></tr>
<tr><td>Justification</td><td colspan="3">UoCs 1 & 2 Nylon Shrimp Industrial & Artisanal.

Data-deficient and scored using RBF, so SIb is not scored

UoCs to 3 to 8

Information available indicates that that were are no main bycatch species in these fisheries. The fisheries meet SG60 and SG80 SIb.

Lack of information on bycatch species means that the fisheries do not meet SG100 SIb.</td></tr>
</table>

PI 2.2.3		Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch		
c	Guidepost	Information is adequate to support measures to manage bycatch.	Information is adequate to support a partial strategy to manage main bycatch species.	Information is adequate to support a strategy to manage bycatch, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	UoCs 1 & 2 Nylon shrimp Industrial & Artisanal Information collected by IFOP on catch composition is adequate to support measures and a partial strategy to manage Aconcagua and Chilean grenadier. The fisheries meet SG60 and SG80 SIc. Discards are not monitored because they are illegal and information available is not adequate to evaluate with a high degree of certainty if achieving its objective as there is the possibility of discarding before IFOP observers process the catch. Although monitoring of discards is underway, information is not yet available and the fisheries do not meet SG100 SIc. UoCs 3 to 8 There are no main bycatch species in these fisheries. The fisheries meet SG60 and SG80 SIc. There is uncertainty on the reliability of the data for all bycatch species as there is the possibility of discarding before IFOP observers process the catch. Until discards are monitored it is considered that the information is not adequate to support and evaluate a strategy and the fisheries do not meet SG100 SIc.		
d	Guidepost		Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectively of the strategy).	Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.
	Met?		N (UoCs 1 & 2) Y (UoCs 3 to 8)	N (All UoCs)

<table>
<tr><td>PI 2.2.3</td><td colspan="2">Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch</td></tr>
<tr><td></td><td>Justification</td><td>UoCs 1 & 2 Nylon shrimp Industrial & Artisanal.

Catch composition of the nylon shrimp fisheries is routinely monitored by IFOP annual surveys. Nevertheless it is known that discards occur before catch is taken on deck and information collected by IFOP underestimates bycatch. Thus, these data would not detect any increase in risk to Aconcagua and Chilean grenadiers. The fisheries do not meet SG80 SId.

UoCs 3 to 8

There are no main bycatch species. The fisheries meet SG80 SId.

It is known that discards can occur before catch is taken on deck and that information collected by IFOP underestimates bycatch. Thus there is uncertainty on the reliability of data to assess ongoing mortalities for all bycatch species. The fisheries do not meet SG100 SId.</td></tr>
<tr><td colspan="2">References</td><td>LGPA Tittle II Paragraph Bis, MINECON Nº20.625 2012, LGPA, R.Ex.Nº882/2013, Acuña et al (2008), Zilleruelo et al (2006 -2016)

R. Ex. Nº762/2013 and R. Ex. Nº145/2015.</td></tr>
<tr><td colspan="2">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>75 (UoCs 1 & 2)

80 (UoCs 3 to 8)</td></tr>
<tr><td colspan="2">CONDITION NUMBER (if relevant):</td><td>7</td></tr>
</table>

Evaluation Table for PI 2.3.1

PI 2.3.1		The fishery meets national and international requirements for the protection of ETP species The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.	The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.	There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	**All UoCs**. There are 98 CITES species listed for the Chilean marine territory. There are CITES coral species in the area of the industrial fisheries potentially affected by gear disturbance: *Bathycyathus chilensis* found between 38ºS and 39ºS in a survey on board of bottom trawl industrial fishing operations, and *Tethocyathus endesa* reported off Concepción (~37°S). The potential exists that demersal crustacean fisheries pose unobserved mortality on these species when they were caught in the path of the trawl. Effects of the fishery on these species are highly likely to be within limits of national and international requirements for protection of ETP species given the limited spatial overlap with the fishing areas. There are four CITES species of turtles in the area of the fishery but no records of interaction with demersal crustacean trawl fisheries or reasons to believe they would interact with the gear. There are 41 CITES species of marine mammals listed for Chilean waters including four species of otaridae (seals). Only one otaridae species, sea lion, is known to be present in the operational area of demersal crustacean fisheries but rarely interacts with the gear. It is not a CITES species. There is one CITES species of bird listed for Chile, the Humboldt penguin, and found in the area of the crustacean demersal fisheries. There are no reports of species interactions with demersal crustacean fisheries. There are five species of Chondrichthyes, all sharks, in Chilean waters listed in CITES. There are 39 Chondrichthyes species known to interact with fisheries and numerous species have been reported in the catch composition of the three demersal crustacean fisheries by the IFOP Observer Program. None of these taxa are CITES species and are not considered ETPs. None of the CITES species has been recorded in the fisheries. Further, CITES species have not been cited in studies of Chondrichthyes bycatch of these fisheries or studies of distribution of cartilaginous fishes in the area of the fishery. Thus, effects of the fisheries are highly likely to be within limits of national and international requirements for protection of ETP species and the fisheries meet SG60 and SG80 SIa. Because of studies suggesting potential effects of fishing on ETP corals, there is not a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of all ETP species and the fisheries does not meet SG100 SIa.		

<table>
<tr><td colspan="2">PI 2.3.1</td><td colspan="3">The fishery meets national and international requirements for the protection of ETP species
The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Known direct effects are unlikely to create unacceptable impacts to ETP species.</td><td>Direct effects are highly unlikely to create unacceptable impacts to ETP species.</td><td>There is a high degree of confidence that there are no significant detrimental direct effects of the fishery on ETP species.</td></tr>
<tr><td>Met?</td><td>Y (all UoCs)</td><td>Y (All UoCs)</td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs
There are no recorded interactions by IFOP observers of ETP species of turtles, mammals, birds, and sharks with the demersal crustacean fisheries. For CITES coral species the information available indicates that there was interaction and they can be disturbed by the trawl. Nevertheless, these species are not recorded in the fisheries because they are not retained by the gear. But direct effects are highly unlikely to create unacceptable impacts due to the limited spatial overlap. The CAB has no information to believe that the known direct effects of the fishery create unacceptable impacts to ETP species. The fisheries meet SG60 and SG80 SIb.
Although there is high degree of confidence that the fishery does not impose significantly detrimental direct effects on CITES species turtles, mammals, birds, and sharks this is not the case with CITES species of coral. The fisheries do not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td></td><td>Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.</td><td>There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.</td></tr>
<tr><td>Met?</td><td></td><td>Y (All UoCs)</td><td>Y (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs
There are limited potential indirect effects from loss of gear. During the site visit vessel captains indicated that gear is expensive and when lost it is recovered. Unobserved effects on corals were evaluated under SIb. There are no potential detrimental indirect effects from impacts on food sources for corals that can be cited. Thus, there is high degree of confidence that there are no significant detrimental indirect effects of the fisheries and SG80 and SG100 SIc are met.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Zilleruelo et al 2006 to 2015, Párraga et al 2012, Bustamante et al. 2014. CITES, Melo et al 2007, BirdLife International’s Tracking Ocean Wanderers; Decree Nº 179 and Nº 230, Law Nº 20.293 – 2008, Lamilla et al 2008; Haussermann and Forsterra 2007</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>85 (All UoCs)</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 2.3.2

<table>
<tr><td colspan="2">PI 2.3.2</td><td colspan="3">The fishery has in place precautionary management strategies designed to:
Meet national and international requirements;
Ensure the fishery does not pose a risk of serious harm to ETP species;
Ensure the fishery does not hinder recovery of ETP species; and
Minimise mortality of ETP species.</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>There are measures in place that minimise mortality of ETP species, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.</td><td>There is a strategy in place for managing the fishery’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.</td><td>There is a comprehensive strategy in place for managing the fishery’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.</td></tr>
<tr><td>Met?</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3"> All UoCs Chile is signatory of CITES, the International Convention for the Regulation of Whale Hunting and the Convention on the Conservation of Migratory Species. There are management measures in place to protect marine <u>mammals</u>. National sovereignty and jurisdiction are zones free of cetaceans hunting for purposes foreseen in the law. An amendment to the LGPA (Law Nº20.293) was made in 2008 to prohibit killing, hunting, pursuing, having, possessing, transporting, landing, slaughtering or carrying any species of cetacean within Chilean waters. The amendment and associated regulations appear to be similar to legislation elsewhere in the world to protect marine mammals. Trade and impacts of all species under these treaties are regulated by SERNAPESCA, through Decree Nº179. The law establishes regulations for protection, rescue, rehabilitation, reinsertion, observation and monitoring of marine mammals, <u>reptiles and birds</u>. <u>Seabirds</u> are protected by CITES (D.L.N°873,14/02/1975), the Convention for Protection of Flora, Fauna and Scenic treasures of America (D.S.N° 531, 04/10/1967), the Bonn convention of migratory species (D.S. N° 868, 12/12/1981), and the National Plan to protect bycatch of marine birds with longline gear (PAN–AM Chile). Five MPAs are to protect penguins (Spheniscus magellanicus, S. humboldti), among others species found in coastal areas. S. humboldti is found in the demersal crustacean fishing areas but has not been reported as incidental bycatch. The law prohibits finning of <u>chondrichthyes</u>. A guide to identify species in the catch of Chilean fisheries designed for scientific observers, fishers and the general public was recently completed which will help ETP protection. </td></tr>
</table>

PI 2.3.2		**The fishery has in place precautionary management strategies designed to:** • **Meet national and international requirements;** • **Ensure the fishery does not pose a risk of serious harm to ETP species;** • **Ensure the fishery does not hinder recovery of ETP species; and** • **Minimise mortality of ETP species.**		
		Other measures to protect ETP species include S.D.Nº408/1986 and its modifications that prohibit fishing within 1nm from the coast and an imaginary line situated inshore that stretches from the northern maritime border of Chile and parallel 41ºS, including bays and other protected areas. There is also a 5nm Artisanal Reserve Area where trawling is not allowed (except in Region IV where demersal crustacean fisheries are allowed). Measures that are related to corals in Title II Art. 6 A) indicate that the Ministry should establish geographical areas under Vulnerable Marine Ecosystem (VME) fishery administration regime when presence of invertebrates or geological structures is verified that qualifies the area as VME. Under such regime, trawling is prohibited. Art.6 B) indicates that SUBPESCA with information provided by CCTs will establish a list of species for which its fishery can affect VMEs, and regulations will apply to those fisheries. These measures, partial strategy, and international agreements incorporated into the LGPA can be considered a comprehensive strategy for managing impacts on ETP species to meet conditions for the fishery to meet SG60 SIa, SG80 and SG100 SIa.		
b	**Guidepost**	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is an objective basis for confidence that the strategy will work, based on information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	All UoCs There are no recorded interactions by IFOP observers of ETP species listed in CITES of turtles, mammals, birds, sharks and rays with the crustacean fisheries. Corals were identified in a survey. The lack of reports of interactions of CITES ETP species with the three fisheries provides an objective basis for confidence that measures and strategy is being successful. The fisheries meet SG60 and SG80 SIb. The lack of a quantitative analysis on the potential impacts of the fisheries means that SG100 SIb is not met.		
c	**Guidepost**		There is evidence that the strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Y (All UoCs)	N (All UoCs)

<table>
<tr><td colspan="2">PI 2.3.2</td><td colspan="3">The fishery has in place precautionary management strategies designed to:
Meet national and international requirements;
Ensure the fishery does not pose a risk of serious harm to ETP species;
Ensure the fishery does not hinder recovery of ETP species; and
Minimise mortality of ETP species.</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">All UoCs
There are no recorded interactions by IFOP observers of ETP species listed in CITES of turtles, mammals, birds, sharks and rays or corals with the fishery. The lack of reports of interactions of ETP species listed in CITES with the three fisheries provides an objective basis for confidence that a partial strategy is being implemented successfully. The fisheries meet SG80 SIc.
While ETP interactions are not reported by IFOP observers, there is no clear evidence as there are no inspectors onboard to provide confirmation. The fisheries do not meet SG100 SIc.</td></tr>
<tr><td rowspan="3">d</td><td>Guidepost</td><td></td><td></td><td>There is evidence that the strategy is achieving its objective.</td></tr>
<tr><td>Met?</td><td></td><td></td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs
Although the lack of known interactions of ETP species listed in CITES of turtles, mammals, birds, sharks and rays or corals with the fishery should provide evidence that the strategy is achieving its objective, there is no evaluation of the effect of the fisheries on corals and the fisheries do not meet SG100 SId.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Shotton 1999; Lamilla et al 2005; Dex 225/1995, Dex N°135/2005); D.S. N°179/2008, D.S.N°230/2008, Law Nº20.293 (2008), Melo et al (2007), Cairns et al. 2005, CITES website 02/10/2016, FIP 2003-21, FIP 2006-30, D.L.N°873,14/02/1975, D.S.N°531,04/10/1967, D.S.N°868,12/12/1981 Zilleruelo et al (2006 – 2016).</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>85 (All UoCs)</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 2.3.3

PI 2.3.3		Relevant information is collected to support the management of fishery impacts on ETP species, including: • Information for the development of the management strategy; • Information to assess the effectiveness of the management strategy; and • Information to determine the outcome status of ETP species.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.	Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is sufficient to quantitatively estimate outcome status of ETP species with a high degree of certainty.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	All UoCs IFOP monitoring of the fisheries by IFOP observers and several studies provide information to assess that there are no interactions with ETP species listed in CITES of mammals, turtles, birds, sharks and rays in the operational area of the fishery. Nevertheless a study conducted to characterize the seafloor on board demersal crustacean fishery operations in the general northern and southern areas of the fisheries indicate that there are CITES species of coral in the path of the bottom trawl gear. While there appears to be no direct interaction between the trawl gear and coral species because they are not retained by the net, there may be the case that they are affected. Information on actual impact is sufficient to qualitatively determine that the fishery might impose mortality. The fisheries meet SG60 SIa. Data from IFOP observers on board industrial vessels are from about 20% of the trips in the demersal crustacean fisheries and samples are representative of the catch composition. The fisheries meet SG80 SIa. The use of video cameras that should provide better coverage to estimate outcome status with high certainty is still not mandatory. Further, sufficient information is not available to allow the impact of fishing on coral to be estimated with high certainty. The fisheries do not meet SG100 SIa.		
b	**Guidepost**	Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species.	Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)

<table>
<tr><td colspan="2">PI 2.3.3</td><td colspan="3">Relevant information is collected to support the management of fishery impacts on ETP species, including:
Information for the development of the management strategy;
Information to assess the effectiveness of the management strategy; and
Information to determine the outcome status of ETP species.</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">All UoCs

IFOP monitoring of the fisheries and several studies provide information to assess that there are no interactions with ETP species listed in CITES of mammals, turtles, birds, sharks and rays in the operational area of the fishery and to broadly understand that there could be effects on coral species. The fisheries meet SG60 SIb.

Information on the area fished and the location of corals is sufficient to determine whether the fishery may be a threat to protection for coral ETP species and support a full strategy to manage impacts. Other ETP species are not affected. The fisheries meet SG80 SIb.

Information is not available to evaluate the magnitude of the impacts and consequences on ETP corals species. The fisheries do not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td>Information is adequate to support measures to manage the impacts on ETP species.</td><td>Information is sufficient to measure trends and support a full strategy to manage impacts on ETP species.</td><td>Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.</td></tr>
<tr><td>Met?</td><td>Y (All UoCs)</td><td>N (All UoCs)</td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs

IFOP monitoring of the fisheries and several studies provide information to assess that there are no interactions with ETP species listed in CITES of mammals, turtles, birds, sharks and rays. There is information on the areas fished by each of the UoC at sufficient detail that with information on the general area of the distribution where corals were found is adequate to support measures to manage the impacts on corals. There are no other interactions with ETP species. The fisheries meet SG60 SIc.

The use of the new gear is only in place for one year and there is a need to evaluate performance to measure trends and support a full strategy to manage impacts on ETP species in particular for coral. The use of the new gear is also forcing changes in the areas of operation so information needs to be collected in these areas to support a strategy. The fisheries do not meet SG80 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Melo et al (2007), Vianna et al (2014), Suazo et al (2016), Vilina et al (1995), Cheney (1998), Zilleruelo et al (2006 - 2016), Párraga et al (2012), Bustamante et al (2014)</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>75 (All UoCs)</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td>8</td></tr>
</table>

Evaluation Table for PI 2.4.1

PI 2.4.1		The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
a	**Justification**	**All UoCs** The fisheries use bottom trawl gear and impacts on habitat structure and function are on benthic habitat which depend on substrate and degree of contact with the seafloor. There are no VMEs in the study area but methane emergence areas of high biodiversity have been reported. Diverse habitats between Regions III and VIII are high in organic content and formation of organic deposits with sediments ranging from mud and clay to coarser sand. Nursery areas for squat lobster down to 200 m consist of muddy soft bottoms and also rocky-muddy hard bottoms characterized by extensive bacterial mats (*Thioploca spp)* which are local features of the central Chile continental shelf. Hard bottoms are generally not accessible to trawling due to abundant interspersed rocks. In soft substrates, assemblages are dominated by polychaetes and by few species with high turn around rates and composed by many scarce taxa. Thus, fishing mostly takes place in mud and sand substrate areas where bottom trawl gear disturbs organisms regenerated in relatively short time. Thus, information suggests that fisheries are highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm. The fisheries meet SG60 and SG80 SIa. Specific research projects to evaluate potential effects of the three crustacean fisheries on habitat structure and benthic biodiversity are missing to provide evidence about significance of impact on habitat. The extent of areas affected by crustacean fisheries in the last years are around 1,500 nm^2 for nylon shrimp, 400-100 nm^2 for yellow squat lobster north and south areas, and 100–400 nm^2 red squat lobster north and south areas. It has been shown that the gear interacts and disturbs high number of species. Also there is an argument that observed patterns of high diversity of scarce taxa dominated by few species can be the result from fishing, where disturbances promoted success of taxa with higher turn around rates. Because there are other bottom trawl fisheries in the same area, such as for Chilean hake, in the absence of specific studies it is impractical to evaluate if the fisheries are highly unlikely to cause local extinction of benthic organisms or gross change in species composition that are irreversible. The fisheries do not meet SG100 SIa.		
References		Bustos & Retamal (1985), Roa et al (1995), Melo et al (2007), Zilleruelo et al (2006-2016), Ahumada et al (2013),		

OVERALL PERFORMANCE INDICATOR SCORE:	**80 (All UoCs)**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 2.4.2

PI 2.4.2		There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of the fishery on habitat types.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	All UoCs The measure and partial strategy consists of limiting access into coastal vulnerable areas to trawlers and most recently the new gear. There is also an Action Plan for the implementation of the Biodiversity National Strategy including a network of protected areas. All fishing within the first nautical mile from the coast is prohibited, and the area within 5 nm of the coast is excluded from trawling with the exception of Region IV. Geographical areas under a regime of fishery administration for Vulnerable Marine Ecosystems will be established when presence of invertebrates or geological structures is verified that qualifies the area as a vulnerable marine ecosystem. Under such a regime trawling should be prohibited in such areas. The new trawl gear design for the demersal fisheries was in part designed to address concerns of effects from interaction with the seafloor and have less impact on habitat. The modified trawl with lighter materials should improve gear performance and minimize the impact of bottom trawl fisheries on the seafloor. The fisheries meet SG60, and SG80 SIa. There is no strategy in place for managing the impact of the fisheries on habitat. The fisheries do not meet SG100 SIa.		
b	**Guidepost**	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	All UoCs Excluding trawling from coastal areas and the proper implementation of the measure provides an objective basis for protection of these vulnerable areas. The use of new gear, recently implemented, could theoretically reduce the area affected by the trawl by 50% and by design should reduce the impact on seafloor. This provides some objective confidence that measures and the partial strategy will work. The fisheries meet SG60 and SG80 SIb. The new gear and the new regulation on vulnerable ecosystems have not been tested. The fisheries do not meet SG100 SIb.		

PI 2.4.2		There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types		
c	Guidepost		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Y (All UoCs)	N (All UoCs)
	Justification	All UoCs The use of Vessel Monitoring System and the adoption of the new trawl gear in 2014 by the whole fleet provide evidence that the partial strategy is being implemented successfully. Full compliance with area exclusion and the use of the new gear is confirmed as regulated by SERNAPESCA and recorded by IFOP observers. The fisheries meet SG80 SIc. There is no strategy in place to be implemented for managing the impact of the fishery on habitat types. The fisheries do not meet SG100 SIc.		
d	Guidepost			There is some evidence that the strategy is achieving its objective.
	Met?			N (All UoCs)
	Justification	All UoCs There is no strategy in place to achieve objectives for managing the impact of the fishery on habitat types. The fisheries do not meet SG100 SId.		
References		Law Nº 19.521, Decree No 408/1986 (modified by Decree 208/2006), Law No 18.892 (1989) and Law 19.907 (023), Decree N° 200 (2003), LGPA Tittle II Art. 6. a) Art. 6. b), LGPA Title II, Art. 3º		
OVERALL PERFORMANCE INDICATOR SCORE:				**80 (All UoCs)**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.4.3

PI 2.4.3		**Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	There is basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	-All UoC Significant amount of work has been completed on habitat description within the area where demersal crustacean fisheries operate. There are some studies to characterize the seafloor sediments, topography, benthic biodiversity, and benthic communities associated with demersal crustacean and in the area of the fishing operations that contribute to a basic understanding of the types and distribution of main habitats. Substrates in fishing concentration areas range from hard to soft though dominated by fine to coarse sediments and high organic content. The fishery meets SG60 SIa. A study extending from Regions IV to IX and within 100 and 500 m and total sampling coverage estimated at 1,000 nm^2, covered a significant part of the northern area in this assessment and all of the southern area. The survey included trawl net, dredge and dredger box corer and also video recording; it emphasized detection of areas such as hydrothermal vents, seamounts, methane emergence areas, and coral fields. The study also produced bathymetric maps. There were no reports of vulnerable ecosystems in the area of operation of the fisheries but there are fragile ecosystems in the general area of the fisheries. IFOP annually maps the distribution of fishing effort by the demersal crustacean fisheries. The spatial extent of the fisheries to the studies available suggests that nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the industrial demersal crustacean fisheries. The fisheries meet SG80 SIa. Because the area of operation of the fisheries are quite extensive and information on habitat is restricted in its spatial scale the fisheries do not meet SG100 SIa.		
b	**Guidepost**	Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.	The physical impacts of the gear on the habitat types have been quantified fully.
	Met?	Y (All UoCs)	N (All UoCs)	N (All UoCs)

PI 2.4.3		**Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types**		
	Justification	**All UoCs** There is information on distribution of the main habitats and spatial location of the fisheries, timing and fishing effort which is adequate to broadly understand impacts. The fishery meets SG60 SIb. Information on the spatial extent of interaction and the timing and location of use of the fishing gear is routinely collected by IFOP on industrial fisheries. But there is limited information on habitat structure and how it interacts with or be altered by the gear to identify the nature of the impacts. There is some information pointing out that there are negative effects from bottom trawl fisheries including the demersal crustacean fishery on benthic communities, but insufficient to make statements about the magnitude. Thus it is not considered that sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified. The fisheries do not meet SG80 SIb.		
c	**Guidepost**		Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Changes in habitat distributions over time are measured.
	Met?		Y (All UoCs)	N (All UoCs)
c	**Justification**	All UoCs Information on quotas (which are regionally allocated), number of vessels operating in the fisheries, spatial distribution of fishing operations and estimates of fishing effort and area covered by trawling is monitored annually by IFOP and is considered sufficient to detect any increase in risk to habitat. The fisheries meet SG80 SIc. There are no surveys to monitor habitat distributions over time. The fisheries do not meet SG100SIc.		
References		FIP (2008-36, 2009, 2010); Melo Hebbeln et al 2001, Gutiérrez et al 2000, Milessi et al (2005), Muñoz et al 2004, Lamy et al 1999. et al 2007; INPESCA, Roa et al 1995, Menares and Sepúlveda 2005,		
OVERALL PERFORMANCE INDICATOR SCORE:				**75 (All UoCs)**
CONDITION NUMBER (if relevant):				**9**

Evaluation Table for PI 2.5.1

<table>
<tr><td colspan="2">PI 2.5.1</td><td colspan="3">The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.</td><td>The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.</td><td>There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.</td></tr>
<tr><td>Met?</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs.

The nylon shrimp, yellow and red squat lobster fisheries overlap in distribution and target species play similar ecological roles in the ecosystem and fisheries are evaluated together.

Potential ecosystem impacts of the fisheries are from removals of the assessed relatively abundant low trophic species in their role as prey as target, retained, and bycatch species. Additionally, fisheries remove other species such as Chilean hake, the main predator in the ecosystem, Chondrichthyes and grenadiers and flounders that also play important roles in the demersal food web. Additionally, the gear disturbs benthic communities that are important functional components at the base of the food webs. These actions can have an effect for ecosystem function, nevertheless based on analysis of food web dynamics from models, and considering that removals of target and non-target species in each fishery are modest, that predators are depressed, and that there are no known interactions with ETP species, the fisheries are highly unlikely to disrupt ecosystem key elements to a point of serious harm. The fisheries meet SG60 & SG 80 SIa.

Studies are missing on the current food web and on biomass of bycatch species and other components of the food web to provide evidence that each fishery is unlikely to disrupt ecosystem key elements and the fisheries do not meet SG100 SIa.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Arancibia (1989, 1992), Quiñones et al (1997), Arancibia (1987, 1991), Miranda et al (1998), Arancibia & Neira (2004, 2005), Neira (2003), Neira et al (2004, 2014), Neira and Arancibia (2004).</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>80</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 2.5.2

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	There are measures in place, if necessary.	There is a partial strategy in place, if necessary.	There is a strategy that consists of a plan, in place.
	Met?	Yes (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	All UoCs There are measures that constitute a partial strategy including closed entry, global quotas for the three species and quotas for some non-target species, areas closed to fishing, and gear regulations that ensure that the fisheries do not pose a risk of serious or irreversible harm to ecosystem structure and function. There are area exclusions within 5 nm of the coast (except for Region IV) to protect nursery and recruitment areas and mandatory use of a modified trawl to improve selectivity and minimize interaction with benthic assemblages. There are protections for ETP species and vulnerable ecosystems. The fisheries meet SG60 SIa. The measures in place constitute a partial strategy to ensure the fishery does not cause significant impact on ecosystem structure and function. The fisheries meet SG80 SIa. The lack of a strategy consisting of a plan for any of the demersal crustacean fisheries means the SG100 SIa is not met.		
b	Guidepost	The measures take into account potential impacts of the fishery on key elements of the ecosystem.	The partial strategy takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	The strategy, which consists of a plan, contains measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem. This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function		
	Justification	All UoCs Measures in place make sure that target species which are low trophic species are within biologically based limits and that the fisheries do not constitute a risk for non-target species some of which are vulnerable. The area exclusion measures take into account that trawling has its greatest impact in coastal areas where productivity and biodiversity is highest and which constitute areas of reproduction and recruitment for numerous species, including birds. There is new gear that has less contact with the seafloor, and although fishing is allowed in Region IV, the new design decreases impacts on habitat. An additional positive development about the gear is that it is causing fishing operations to avoid more susceptible hard substrates as the net is prone to tear. Also, the new gear allows non-target fish species to escape unharmed. The fisheries meet SG60 and SG80 SIb. Although the new LGPA explicitly considers an ecosystem management approach, there is no plan yet that considers aspects of functional relationships between the fishery and components and elements of the ecosystem. The fisheries do not meet SG100 SIb.		
c	Guidepost	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).	The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).	The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved.
	Met?	Y (All UoCs)	Y (All UoCs)	Y (All UoCs)
	Justification	All UoCs. Area exclusions effectively spare nursery and recruitment areas from fishing. Removals of the target, retained and bycatch species as result of quotas are kept to levels that should pose no threat to ecosystem structure and function. Maintenance of the status quo would lead to measures and partial strategy to work. And the new gear is likely to have a lesser effect on benthos and reduce bycatch. The fisheries meet SG60 and SG80 SIc. Based on the knowledge of the catch of the target species, and retained, bycatch and ETP species in the context of the work on food webs in Central Chile, the measures are considered likely to work. The fisheries meet SG100 SIc.		
d	Guidepost		There is some evidence that the measures comprising the partial strategy are being implemented successfully.	There is evidence that the measures are being implemented successfully.
	Met?		Y (All UoCs)	N (All UoCs)

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function
	Justification	All UoCs Closed areas are enforced as well as global quotas for the three species and for non-target species by SERNAPESCA. There is compliance with area exclusions within 5 nm of the coast as controlled by VMS. There is 100% enforcement of the mandatory use of the modified trawl. General compliance with measures provides some evidence that they are being implemented successfully. There are no reports of interactions with ETP species and vulnerable ecosystems. The fisheries meet SG80 SId. A longer time series of information in the fisheries would be needed to evidence that the measures are being implemented successfully and to infer the main consequences for the ecosystem. Measures in the new LGPA are still not fully implemented and the new gear has been mandatory for one year. Also, in Central Chile, fisheries and ENSO induce changes in pelagic and benthic species and potential influence of climate change induced oceanographic phenomena that produced for example expansion of the giant squid distribution complicates evaluation of the fisheries' main consequences. The fisheries do not meet SG100 SId.
References		Ley de Pesca. MINECON D.S.Nº139/1998, SERNAPESCA 2014, CCT-CD Reports, SUBPESCA RPESQ 127-2012, Res.Nº762/ 2013, Neira and Arancibia 2004, Neira and Arancibia 2004, Neira et al 2004, 2005, 2014; Arancibia et al 2005
OVERALL PERFORMANCE INDICATOR SCORE:		85 (All UoCs)
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.5.3

PI 2.5.3		There is adequate knowledge of the impacts of the fishery on the ecosystem		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Information is adequate to identify the key elements of the ecosystem (e.g., trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to broadly understand the key elements of the ecosystem.	
	Met?	Y (All UoCs)	Y (All UoCs)	
	Justification	All UoCs Information from numerous studies available on ecosystem productivity and seasonal patterns, abundance of main predators and prey, biodiversity, diets, food web structure, and pelagic and demersal food web components allows the fisheries to meet SG60 SIa. Information from these studies has been used to implement Ecopath food web models which quantify main trophic interactions in the northern and southern areas where the demersal fisheries take place. Information is considered adequate to broadly understand ecosystem key elements. The fisheries meet SG80 SIa.		
b	Guidepost	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, and have not been investigated in detail.	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information and some have been investigated in detail.	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated.
	Met?	Y (All UoCs)	Y (All UoCs)	Y (All UoCs)
	Justification	All UoCs Available data on ecosystem food web components, and studies that used those data to implement ecosystem models, allow quantification of the effects of removals by fisheries in the ecosystem including the demersal crustacean fisheries. Main impacts of the fisheries can be inferred from these studies. The fisheries meet SG60 and SG80 SIb. Available Ecopath models have considered main interactions between fisheries and ecosystem elements. These models were used for example to investigate the importance of giant squid predation on Chilean hake, the main predator of the demersal crustaceans, versus fishery mortality. Thus, current interactions with fisheries can be inferred by models. The fisheries meet SG100 SIb.		
c	Guidepost		The main functions of the Components (i.e., target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known.	The impacts of the fishery on target, Bycatch, Retained and ETP species are identified and the main functions of these Components in the ecosystem are understood.

<table>
<tr><td colspan="2">PI 2.5.3</td><td colspan="3">There is adequate knowledge of the impacts of the fishery on the ecosystem</td></tr>
<tr><td rowspan="2"></td><td>Met?</td><td></td><td>Y (All UoCs)</td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs

Academic research is available on multiple ecosystem components off Chile and the three demersal crustacean species supporting the fisheries under assessment to provide adequate knowledge on their main functions. Nylon shrimp, yellow squat lobster and red squat lobster feed on detritus and have a trophic level species of 2; species are major components of the benthic food web pathway and in recycling organic matter back to the pelagic pathway. Ecosystem food web models showed that predation mortality constituted the main source of mortality for demersal crustaceans in 1992 and 1998. Main retained species is Chilean hake (and cardinal fish but at very low levels) with a level of 3.55 (adults). Chilean hake consume a variety of crustacean and fish species and are cannibalistic. Euphausiids, squat lobsters and nylon shrimp are the most important prey. Some of the bycatch taxa, such as skates and bigeye flounder, feed almost exclusively on demersal crustaceans. Status and basic ecology of top predators such as marine birds, sea lions, and cetaceans is less known. A study on seafloor characteristics has been conducted in the operational area of the fishery and there has been a study to establish the basis of a new system to regulate discards. The main functions of the targets and main retained bycatch species and habitats are known. There are no recorded ETP species impacted by the fishery. On the basis of the foregoing it may be concluded that the fisheries meet SG80 SIc.

The function of target species, retained species and bycatch in the ecosystem are understood but impacts on bycatch and habitat are not identified and the fisheries do not meet SG100 SIc.</td></tr>
<tr><td rowspan="3">d</td><td>Guidepost</td><td></td><td>Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.</td><td>Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.</td></tr>
<tr><td>Met?</td><td></td><td>Yes (All UoCs)</td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs

The qualitative and quantitative information on removals and stock status of target species and knowledge of their main ecosystem function is considered sufficient to infer some of the fisheries’ main consequences. The situation is similar for retained species Chilean hake (although not for cardinal fish) and for bycatch species bigeye flounder and Chilean and Aconcagua grenadiers. The fisheries are thought to have some impact on habitat and do not interact with ETP species. The fisheries meet SG80 SId.

Better information on discards and on the status of bycatch species and of habitat impacts would be needed to infer the main consequences for the ecosystem. The changing status of the ecosystem due to climate change induced oceanographic conditions with unprecedented high abundance of giant squid and depressed status of Chilean hake population which is the main predator of the demersal crustaceans under assessment complicates evaluation of the fishery’s main consequences. The fisheries do not meet SG100 SId.</td></tr>
</table>

PI 2.5.3		There is adequate knowledge of the impacts of the fishery on the ecosystem		
e	Guidepost		Sufficient data continue to be collected to detect any increase in risk level (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
	Met?		Y (All UoCs)	Y (All UoCs)
	Justification	All UoCs Information on catch composition data, landings, number of vessels, and area trawled and trawling effort is sufficient to detect any increase in risk to ecosystem impacts. The fisheries meet SG80 SIe. Ecopath ecosystem models are available, if updated with current information they can be used to implement Ecosim models to simulate food web dynamics and responses to fisheries and climate and support development of strategies to manage ecosystem impacts. The fisheries meet SG100 SIe.		
References		Neira and Arancibia (2004), Neira and Arancibia (2004), Neira et al (2004, 2005, 2014); Arancibia et al (2005).		
OVERALL PERFORMANCE INDICATOR SCORE:				**90 (All UoCs)**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.1.1

PI 3.1.1		**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; 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	**Guidepost**	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 organised 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 (All UoCs)	Y (All UoCs)	Y (All UoCs)
	Justification	**All UoCs - Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** The new General Law for Fishery and Aquaculture (LGPA), which modified the 1991 D.S. Nº430 law in February 2013, provides the regulatory framework for sustainable management of aquatic resources and their environment in Chile. The Law defines the roles of main bodies involved in Chilean fisheries including those that undertake research and inform decision making. Each entity has stakeholder representation. As such the fishery operates in the context of a well established legal system that forms the basis for sustainable fisheries in Chile, thus consistent with MSC Principles 1 and 2. As the stocks are not straddling or highly migratory there is no requirement for cooperation with other parties in international terms. The fisheries meet SG60 and SG80 SIa. Given the laws and regulations in force with mandatory procedures which regulate cooperation, it may be considered that required cooperation with other parties is binding. All UoCs meet SG100 SIa.		
b	**Guidepost**	The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery.	The management system incorporates or 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 (All UoCs)	Y (All UoCs)	N (All UoCs)

<table>
<tr><td colspan="2">PI 3.1.1</td><td colspan="3">The management system exists within an appropriate legal and/or customary framework which ensures that it:
• Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; 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.</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster
At the national level, the rights of citizens are explicitly defined. The system of Councils and stakeholder representation on Fishery Management Committees has the aim of making the management process transparent and thus be proactive in avoiding legal disputes. LGPA establishes that all management and regulation decisions adopted by Subpesca, IFOP, Scientific Committees (CCT), and Management Committees (CM) are of public nature and are carried out in a transparent way, which allows all stakeholders to have access to the information and minimizes potential conflicts. The fisheries meet SG60 and SG80 SIb.
Because the new LGPA was introduced in 2013 this means that there has not been enough time for testing and the fisheries do not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">d</td><td>Guidepost</td><td>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.</td><td>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.</td><td>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.</td></tr>
<tr><td>Met?</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster
The Chilean fishery management system has shown a formal commitment to the legal rights of people dependent on fishing for food and livelihood through the creation of a reserve for artisanal fisheries, allocations for artisanal fishers in fishery quotas and the incorporation of representatives of the artisanal fishers in the various levels of Council and other forms of stakeholder consultation. Also Law Nº20.249 created an administrative regime for coastal resources to maintain traditions and use of natural resources by indigenous people (Espacio Costero Marino de Pueblos Originarios). The fisheries meet SG60 and SG80 SIc.
Citizens’ rights are explicitly defined. LGPA establishes in Title III, access regimes to fisheries according to stock conditions and defines conditions for access. The artisanal sector is under the Artisanal Fishery Regime (RAE). The fisheries meet SG100 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">LGPA 20.657 2013.</td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>95 (All UoCs)</td></tr>
</table>

PI 3.1.1	**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; 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.**
CONDITION NUMBER (if relevant):	

Evaluation Table for PI 3.1.2

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	**Guidepost**	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 (All UoCs)	Y (All UoCs)	Y (All UoCs)
	Justification	**All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** A range of bodies are involved in the management process: SUBPESCA and MINECON (policy and its application); SERNAPESCA (compliance); IFOP (research), Universities (research), FIPA (research), CCT, CNP, CM and CZP (management). The roles and functions of these are explicitly defined in the law and are well understood. This covers all areas of responsibility and interaction. Stakeholders are strongly represented in the decision making process. The fisheries meet SG60, SG80 and SG100 SIa.		
b	**Guidepost**	The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)

<table>
<tr><td colspan="2">PI 3.1.2</td><td colspan="3">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</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster
Through IFOP, the CCTs, CM and CNP, SUBPESCA is fully informed of the situation in the various fisheries. Meetings of the various entities (CCT, CM, CNP, and CZP) are open to a wide range of stakeholders including artisanal fishers and the minutes of these meetings explain consideration of the various issues. The fisheries meet SG60 and SG80 SIb.
For fisheries that are fully exploited or are closed to new entrants, Fishery Management Plans must be prepared and the procedures for these are explicitly defined in the Law. This will be considered by the fishers themselves in the Management Committees. Because not all management plans are yet completed, the process in place is such that the fisheries do not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td></td><td>The consultation process provides opportunity for all interested and affected parties to be involved.</td><td>The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.</td></tr>
<tr><td>Met?</td><td></td><td>Y (All UoCs)</td><td>N (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster
The management of Chilean fisheries requires stakeholder input into the various procedures. This is stipulated in the LGPA. Consultation procedures and timing requirements are specified depending on the character of the management action. According to the law, the authority cannot establish management regulations without the compliance to the consultation process. The defined need for stakeholder representation on the various entities provides the opportunity for all interested and affected parties to be represented. For example, the demersal crustacean fishery management committee (Comité de Manejo Crustaceos Demersales) includes 10 members: three artisanal fishers, one nylon shrimp quota share owner (armador), one yellow and red squat lobster quota share owner, one holder of extraordinary fishing permit for squat lobster and one process plant owner; all are selected by the fishing community itself. The committees also include personnel from SUBPESCA and SERNAPESCA and the fisheries meet SG80 SIc.
Among other opportunities, CCTs and CMs include participation of researchers from universities and IFOP. Representatives of NGOs participate in the CZPs. Nevertheless it was noticed that several of the positions in these committees are vacant and during the site visit researchers that have discontinued their roles in these committees expressed difficulties with the personal investment required and lack of incentives to participate in the consultation process. The fisheries do not meet SG100 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3"></td></tr>
<tr><td colspan="4">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>85 (All UoCs)</td></tr>
<tr><td colspan="4">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 3.1.3

<table>
<tr><td>PI 3.1.3</td><td colspan="3">The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach</td></tr>
<tr><td>Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td>a — Guidepost</td><td>Long-term objectives to guide decision-making, consistent with the MSC Principles and Criteria and the precautionary approach, are implicit within management policy</td><td>Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach are explicit within management policy.</td><td>Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy.</td></tr>
<tr><td>Met?</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td></tr>
<tr><td>Justification</td><td colspan="3">All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster

Article 1°b and 1°c of the 2013 Law provide explicit long-term objectives to guide decision making. The explicit objective of the LGPA is the conservation and sustainable use of fishery resources through the application of precautionary and ecosystem approaches. It requires that policy takes account of a number of issues: (i) long-term objectives for conservation and management of fisheries and ecosystem protection; (ii) application of the precautionary principle with greater caution in management and conservation of resources when scientific information is uncertain, unreliable or incomplete; with any lack of scientific information not delaying introduction of conservation and management measures; (iii) an ecosystem approach to conservation and management of fishery resources and protection of ecosystems; (iv) management of fishery resources in a transparent, accountable and inclusive manner; (v) collection, verification, reporting and sharing of timely and accurate data; (vi) consideration of impacts of fishing on associated or dependent species; (vii) prevention or elimination of overfishing and excess fishing capacity; (viii) effective implementation of conservation and management measures, and (ix) minimization of discards. Inclusion in the Law shows that the precautionary approach is not only explicit but required. Fisheries meet the single issue at SG60, SG80 and SG100 SIa.</td></tr>
<tr><td>References</td><td colspan="3">LGPA 20.657 2013</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE:</td><td>100 (All UoCs)</td></tr>
<tr><td colspan="3">CONDITION NUMBER (if relevant):</td><td></td></tr>
</table>

Evaluation Table for PI 3.1.4

PI 3.1.4		The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure they do not contribute to unsustainable fishing practices.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	**All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** Key incentives for sustainable fishing include property rights and research funding. One of the features of Chilean fisheries and aquaculture policy is the lack of extensive government support programmes providing direct financial payment to the sector. The definition of property rights in Chilean fisheries provides incentives for sustainable fishing. Fines for infringements provide an incentive to respect the regulations. The research undertaken reduces information gaps and uncertainty. The approach to definition of management plans and fisher membership in Committees provide for stakeholder participation in the management process which is an incentive. It can be concluded that the management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2. The fisheries meet SG60 and SG80 SIa. Although the auditors did not identify perverse subsidies, incentives that may contribute to unsustainable fishing such as fuel subsidies, the prohibition of discards (together with quotas, sanctions, and lack of enforcement at sea) have resulted in incentives conducive to large unreported catches of target and non-target species in many fisheries. There is a plan underway to address the discard issue but not yet implemented and the fisheries do not meet the single issue at SG100 SIa.		
References		OECD (2010) Law 20.625 Title II, Paragraph 1º BIS		
OVERALL PERFORMANCE INDICATOR SCORE:				**80 (All UoCs)**
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.2.1

PI 3.2.1		The fishery 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	Guidepost	Objectives, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery's management system	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's management system.	Well defined and measurable short and long-term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.
	Met?	Y (All UoCs)	Partial (All UoCs)	N (All UoCs)

<table>
<tr><th colspan="2">PI 3.2.1</th><th>The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC’s Principles 1 and 2</th></tr>
<tr><td></td><td>Justification</td><td>
UoCs 1 & 2 Nylon Shrimp Industrial - Nylon Shrimp Artisanal.
General objectives are the same for all the three demersal crustacean fisheries, which relate to having a sustainable fishery considering biological and fishery aspects (maintain stocks around MSY and an appropriate stock structure and conducting appropriate and timely research), and at the same time to maximize the social and economic benefits of the activity while protecting the biological health of the fishery.
The fishery is under a Full Exploitation regime. SUBPESCA stated that the management objective for the resource should be to avoid that the stock biomass falls below 30,000 t and at least to maintain the 2012 fishery yield. To achieve this objective, the strategy is to have conservative fishing mortality rates in each fishery zone in order to protect the biomass and to distribute fishing effort to avoid overfishing at a regional level. The fisheries meet SG60 SIa.
Specific goals and measures to accomplish them, such as maintaining the fishery around MSY and the size structure composition are broadly consistent with achieving outcomes expressed by MSC Principles 1, but do not consider approaches to limit fishery impacts on other elements of the ecosystem. According to LGPA Art. 8 there should be a Management Plan for demersal crustacean fisheries (each fishery or group of fisheries) containing: objectives, goals and timing as well as strategies to accomplish those goals including necessary agreements among stakeholders, evaluation criteria, research and enforcement requirements, and any other matter that is considered of interest to accomplish the plan.
Currently there is a demersal crustacean Management Plan draft under review and that will be released in the next upcoming months. According to SUBPESCA presentations during the site visit it includes explicit environmental objectives for the fisheries “towards fishery operations with a sustainable strategy that complies with national and international standards.” Action plans include among other aspects related to bycatch, ETP species, gear loss, data share and educational aspects. The management plan is at the draft stage and the fisheries do not meet SG80 SIa.
UoCs 3, 4 & 5 Yellow Squat Lobster North Industrial. Yellow Squat Lobster North Artisanal - Yellow Squat Lobster South.
General objectives are the same for all three demersal crustacean fisheries as described above. The yellow squat lobster fishery in Region III-IV is under Full Exploitation regime and in Region V-VIII under a Recovery regime. SUBPESCA stated that the three short term management objectives are to avoid deterioration of the stock biomass, avoid deterioration of the stock structure, both in the whole stock area, and to avoid local overfishing. The fisheries meet SG60 SIa.
So while some of the objectives which are broadly consistent with achieving the outcomes expressed by MSC Principles 1 are in place, they do not currently include approaches to limit impacts of the fisheries on other elements of the ecosystem. Explicit objectives in the management system addressing these issues should be part of the fishery Management Plan which is under development and will be released within the next months. Since the management plan is not implemented the fisheries do not meet SG80 SIa.
</td></tr>
</table>

PI 3.2.1		The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2
		UoCs 6, 7 & 8 Red Squat Lobster North Industrial, **Red Squat Lobster North Artisanal**, **Red Squat Lobster South**. General objectives are the same for all three demersal crustacean fisheries as described above. The red squat lobster fishery in Region XV–IV is under Full Exploitation regime and in Region V-VIII under a Recovery regime. SUBPESCA stated that in view of the analysis presented in late 2011, objectives set for medium term administration correspond to: recovering biomass in the fishery unit at least up to the value of the last decade and preventing a decline, or at least maintaining current yields and size structure in Regions III and IV. The fisheries meet SG60 SIa. So while some of the objectives which are broadly consistent with achieving the outcomes expressed by MSC Principles 1 are explicit in the system, they do not consider approaches to limit the impact of the fisheries on other elements of the ecosystem. Explicit objectives in the management system addressing these issues should be part of the fishery Management Plan which is under development and not yet implemented. The fisheries do not meet SG80. All UoCs do not fully meet the SG80, but a partial score of 70 is given because within the current fisheries, objectives for P1 are explicit, but P2 objectives are implicit only.
References		D.S. (MINECON) Nº787/1996, D.S. (MINECON) Nº245/2000, MINECON) Nº377/1995, D.S. (MINECON) Nº611/1995, Informe Técnico (R. PESQ.) N°105/2012, Informe Técnico (R. PESQ.) N°094/2011. LGPA 20.657

OVERALL PERFORMANCE INDICATOR SCORE	**70 (All UoCs)**
CONDITION NUMBER (if relevant)	10

Evaluation Table for PI 3.2.2

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 under assessment.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	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 (All UoCs)	Y (All UoCs)	
	Justification	**All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** Procedures for decision making defined in the LGPA apply specifically to the demersal crustacean fisheries. The process includes participation of SUBPESCA as entity in charge of managing the fisheries through administration of policies, norms and regulations; of SERNAPESCA to monitor, provide surveillance and control of measures; and of IFOP to provide information and technical support for decision making and management. The Demersal Crustaceans Scientific Committee is responsible for considering analyses to address issues defined by SUBPESCA for the fisheries and to provide advice to SUBPESCA and recommendations to the CNP. The CZPs contribute to the decentralization of the administration and promote participation of the representatives of the demersal fishery sector at the regional level. The decision making process is explicitly established through the entities involved, and this process results in measures and strategies to achieve demersal crustacean fishery-specific objectives. The process is leading to implementation of fishery management plans for each fishery. The fisheries meet SG60 SIa and SG80 SIa.		
b	**Guidepost**	Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
	Met?	Y (All UoCs)	N (All UoCs)	N (All UoCs)

<table>
<tr><td colspan="2">PI 3.2.2</td><td colspan="3">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 under assessment.</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster

The research program conducted by IFOP and other research institutions is based on explicit consideration of an ecosystem approach with a need for precautionary management, consistent with the FAO code of conduct for responsible fisheries. The three demersal crustacean fisheries under this assessment are regulated among other measures by annual global catch quotas. Quotas are established the previous year and consider information routinely collected and incorporated in stock assessments and in consultation with entities described in the previous SIa. LGPA requires the application of the precautionary principle with greater caution in the management and conservation of resources when scientific information is uncertain, unreliable or incomplete, but explicitly indicates that any lack of scientific information should not delay the introduction of conservation and management measures. The CCT is responsible for considering analyses prepared to address issues defined by SUBPESCA in support of decision–making with respect to the three fisheries. The biggest change in the new law was to provide greater authority to the fishery specific CCTs while reducing the part played by the CNP which is considered an improvement for the decision-making process in these fisheries. Agreements are adopted within the CCTs by absolute majority of their active members. Thus, it is considered that the decision-making processes including the work of the demersal crustacean CCT respond to serious issues identified for the fisheries in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions. The fisheries meet SG60 SIb.

However there are a number of other issues to which the decision-making process has not responded in a timely and adaptive manner such as to the issue of unreported catches, and discards, which in the absence of fishery inspectors on board have consequences for P1 and P2 objectives. Discards have been banned since 2002 and continue to be illegal (except for vessels participating in a current discards evaluation program). A program carried out by IFOP in 2005 provided information on discards in the demersal fisheries but proved controversial and was discontinued. The new law is seeking to correct the issue and established a discard research program to implement a plan to manage discards for the demersal crustacean fisheries (among other fisheries). Research started in 2013 for the crustacean fisheries and is now planned to report in 2017. Also, there are new requirements for electronic logbooks and on-board camera systems for vessels >15 m to monitor discards. This approach to monitoring of fishing activity on board the vessels and enforcement of regulations has been agreed in principle for many years, but has still not yet been implemented. Whilst action has been proposed to tackle these issues which the management authorities have recognised for a long time, the assessment team considered that the response has not been timely and transparent. The fisheries do not therefore meet SG80 SIb.</td></tr>
<tr><td rowspan="2">c</td><td>Guidepost</td><td></td><td>Decision-making processes use the precautionary approach and are based on best available information.</td><td></td></tr>
<tr><td>Met?</td><td></td><td>Y (All UoCs)</td><td></td></tr>
</table>

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 under assessment.		
	Justification	**All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** The scientific technical committee that reviews stock assessments for the three fisheries under consideration is the Demersal Crustaceans CCT currently with two members from SUBPESCA, two from IFOP and four members nominated by public competition. The LGPA Art 1B defines its objective as the conservation and sustainable use of resources through application of a precautionary approach. LGPA requires the application of the precautionary principle with greater caution in the management and conservation of resources when scientific information is uncertain, unreliable or incomplete. These requirements are incorporated in the CCT work. The CCT is responsible for considering analyses prepared to address issues defined by SUBPESCA in support of decision–making with respect to the three fisheries. They are responsible to determine status of the fisheries, biological reference points, range within which the authority can establish the quotas and other management measures. For implementing their reports the CCTs considers the information from the fishery and the populations routinely collected and provided by IFOP and other research institutions. The law also establishes that Management Plans should be established for each fishery resource to provide a package of measures to support the work of CCTs. As example of implementation of the precautionary principle by the CCT is establishment of an extraordinary September closure of the three demersal crustacean fisheries in 2014 for Regions V to VII in response to observed declines of biomass and to protect the period when females are carrying their highest egg numbers. The closure coincides with closure for Chilean hake and will also protect spawning of this non-target species. The action also reflects that best available information from routine monitoring is used to guide the decision making process. The fisheries meet SG80 SIc.		
d	Guidepost	Some information on fishery performance and management action is generally available on request to stakeholders.	Information on fishery 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 fishery 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 (All UoCs)	Y (All UoCs)	N (All UoCs)

<table>
<tr><td colspan="2">PI 3.2.2</td><td colspan="3">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 under assessment.</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster

The law establishes that the public is entitled to request information from SUBPESCA and SERNAPESCA, and there is a mandate to make an Annual Public Account to provide the country with information on the exploitation status of fishery resources. All information relative to demersal fisheries performance and management actions is available to the public through the SUBPESCA and IFOP websites. This includes reports produced by the demersal crustacean CCT, annual reports of the monitoring of the fisheries and direct assessment of the stocks, and from special projects to address particular issues. Landings are available in SERNAPESCA websites. All legal documents are electronically available at the SUBPESCA website The fisheries meet SG60 SId.

Citizens have the right to access non-classified documents (Law 20.285 Access to Information), know the identity of the authorities and officials involved in fisheries administration and management procedures, receive clarification on rules and decisions, request corrective actions if there have been mistakes, make claims; and report any officer who they consider to have been negligent. If stakeholders do not agree with a policy or a sanction, they may appeal to the Minister. The law establishes that SUBPESCA should produce a report every March about the situation of all fisheries with closed access which is the case of the demersal crustacean fisheries. Technical reports of the CCT for demersal crustaceans provide comprehensive information on fishery performance and management actions and describe how the management system responded to findings and relevant recommendations emerging from research and monitoring. Also SUBPESCA Technical Reports for each demersal crustacean fishery provide details of annual quota design and are formal reporting to all interested stakeholders. The fisheries meet SG80 SId.

There is no formal reporting of discards, thus information provided to stakeholders is not comprehensive in terms of fishery performance and lack of verified information on bycatch prevents the fisheries from meeting SG100 SId.</td></tr>
<tr><td rowspan="2">e</td><td>Guidepost</td><td>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.</td><td>The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.</td><td>The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.</td></tr>
<tr><td>Met?</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td><td>Y (All UoCs)</td></tr>
</table>

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 under assessment.
	Justification	**All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** The fishery is operating within the legal framework as there is no evidence that the management authorities have shown any disrespect for the law. The fisheries meet SG60 SIe. During the site visit interviews with stakeholders revealed no record of a fisheries management agency being subjected to court challenges or the existence of violations of a same law or regulation which could compromise the ability of the management system to deliver sustainable demersal crustacean fisheries in accordance to outcomes intended under P1 and P2. The fisheries meet SG80 SIe. The recent biggest change in the law was to provide greater authority to the CCT while reducing the part played by CNP. The broad spectrum of the makeup of the demersal crustacean CCT currently with two members from SUBPESCA, two from IFOP and four members nominated by public competition is evidence of the presence of proactive avoidance of legal disputes. The fisheries meet SG100 SIe.
References		

OVERALL PERFORMANCE INDICATOR SCORE:	**75 (All UoCs)**
CONDITION NUMBER (if relevant):	**11**

Evaluation Table for PI 3.2.3

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	Y (All UoCs)	N (All UoCs)	N (All UoCs)
	Justification	**UoCs 1, 3, 5, 6 & 8 Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster – Industrial**. LGPA establishes the mechanisms to monitor and enforce regulations established for the fisheries. SERNAPESCA controls landings and enforces closures and quota regulations and the use of the gear. Also the Chilean Navy and the police have enforcement roles. There is a requirement for all vessels to carry Vessel Positioning Systems (VMS) which send the signal to SERNAPESCA and the Navy. Landings need to be certified by a company approved by SERNAPESCA. Scientific observers are placed on-board to monitor the demersal crustacean fisheries. These actions provide the authority with information that indicates that fisheries are conducted in authorized areas and periods, that landings are correctly registered and to have information on composition of species in the catch. There is a reasonable expectation that monitoring, control and surveillance are effective in providing information to ensure that fishing operations are conducted in authorized areas and dates, to allow the monitoring of landings for quota control, interaction with ETP species and gear regulations. The fisheries meet SG60 SIa. IFOP conducts annual monitoring of the fisheries with observers on-board industrial operations. But observers have no enforcement authority and there are no inspectors to implement monitoring, control and surveillance of fishing operations at sea. Thus, although landings are strictly monitored, illegal discards and under reporting are not monitored and compliance of management measures cannot be enforced. Otherwise, there are fines and sanctions for non-compliances. There are regulations pending for requiring mandatory surveillance cameras on board and the lack of current surveillance mechanism is such that the fisheries do not meet SG80 SIa. **UoCs 2, 4 & 7 Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster – Artisanal**. Similar to the industrial fishery SERNAPESCA controls landings and gear regulation, which provide a reasonable expectation that they are effective in providing information to monitor and enforce area and time closure regulations, quota control and gear. There have been no IFOP observers on board to monitor artisanal catch. The fisheries meet SG60 SIa and do not meet SG80 SIa.		

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with		
b	Guidepost	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 (All UoCs)	N (All UoCs)	N (All UoCs)
	Justification	**All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** There are well specified sanctions in the law for non-compliance in the demersal crustacean fisheries. There are sanctions for owners of quota shares of extraordinary permits and transferable licenses as well as for vessel captains for actions considered serious with respect to sustainable use of resources. These sanctions are monetary as well as affecting future access to the fisheries. For exceeding quotas for example, the excess amount is taken off the quota for next years. Also access to licenses is taken away for continued offences. Some other sanctions are for catches that are not reported or unreported, for vessels that are not registered, discarding, fishing in non-authorized areas or periods, exceeding non-target species quotas, and fishing without quotas for non-target for certain species. Vessels under 12 m are not controlled. There is some evidence that they are applied and the fisheries meet SG60 SIb. SUBPESCA confirms that sanctions for exceeding quotas have been applied in two cases recently. However in relation to discarding, it has been widely documented that discarding occurs in these fisheries, and because there is no inspection of fishing activity on board the vessels, there is no enforcement of the prohibition on discarding. So whilst in principle sanctions for non-compliance with discarding regulations exist, the lack of on board inspections means that such sanctions are not consistently applied and cannot be considered to provide effective deterrence. The fisheries do not meet SG80 SIb.		
c	Guidepost	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 (All UoCs)	Y (All UoCs)	N (All UoCs)

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with		
	Justification	**UoCs 1, 3, 5, 6 & 8. All industrial UoC Nylon Shrimp – Yellow Squat Lobster Red Squat Lobster**. In general terms fishers are thought to comply with the management system and their participation in the CCT ensures that information of importance to the management of the fishery is provided. The fisheries meet SG60 and SG80 SIc. Nevertheless, there is no high degree of confidence that fishers comply with the management system, as there is the ongoing problem of discards of target and non-target species, which has large implications for management of the demersal crustacean and non-target species populations. One disconnect seems to be between expectations of owners of the fishing rights and fishing captains, such that for example discarding is made necessary by requests on catch characteristics. The issue of compliance was raised during the site visit at the Universidad de Concepcion where researchers expressed concern over the lack of enforcement and the responsibility of the fishery sector. The fisheries do not meet SG100 SIc. **UoCs 2, 4 & 7. All Artisanal UoCs Nylon Shrimp –. Yellow Squat Lobster- Red Squat Lobster** Artisanal fishers have systematically argued that it is not possible to accommodate observers on board. Nevertheless, IFOP researchers have recently communicated to the CAB that there are artisanal vessels participating in this year's monitoring of the catch as well as in the operations to evaluate discards. The fisheries meet SG 60 SIc and SG80 SIc. While we don't have evidence that artisanal fishers comply with the management system as the industrial fishers do, a condition was raised against this issue in PI 2.1.3.		
d	Guidepost		There is no evidence of systematic non-compliance.	
	Met?		N (All UoCs)	
	Justification	**All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** There is evidence of systematic discarding of target and non-target species in the demersal crustacean fisheries, which is illegal under current law. The fisheries do not meet SG 80 SId. Even though there is a temporary exemption to the ban on discarding for those vessels participating in the research program, and indeed in some UoCs, almost all of the vessels are participating in the research program, there was evidence of systematic non-compliance in those UoCs before the research programme commenced. Furthermore, when the research programme terminates, without a change in the legislation, discarding will remain prohibited for all vessels, and it is reasonable to assume that in the absence of any enforcement that discarding will continue to occur on a systematic basis.		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				**65 (All UoCs)**
CONDITION NUMBER (if relevant):				**12**

Evaluation Table for PI 3.2.4

PI 3.2.4		**The fishery has a research plan that addresses the information needs of management**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Research is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 2.	A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.	A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.
	Met?	Y (All UoCs)	Y (UoCs 1, 3, 5, 6 & 8) N (UoCs 2, 4, 7)	N (All UoCs)
	Justification	**UoCs 1, 3, 5, 6 & 8. All industrial UoC Nylon Shrimp – Yellow Squat Lobster Red Squat Lobster**. There are a significant number of institutions and organizations that carry out research on aspects related to P1 and P2 aspects of the demersal crustacean fisheries including IFOP as well as academic institutions. Research program for these fisheries includes analysis of the fishery by IFOP "Programa de Seguimiento de las Pesquerias de Crustáceos Demersales" to collect information necessary to assess stock status (size structure, condition, sex ratios, catch composition, etc.), and direct assessments of the populations contracted by IFOP to different universities. This research is conducted routinely on an annual basis. The surveys have a history of consistency and are conducted under approved standard methodology and research is considered reliable and timely. Other research responds to arising needs. For example, there was ongoing research on gear design to improve selectivity of the net. Currently there is research to evaluate discards in the three fisheries. Research is mandatory, as established in the law, and includes recommendations by the CCT for arising research needs to achieve objectives consistent with P1 and P2 and constitutes a research plan with characteristics for the fisheries to achieve SG60 and SG80 SIa. There have been little efforts to study ecosystem effects of the fisheries and affected trophic levels have not been evaluated. A comprehensive research plan will be carried out when a management plan for the fisheries will be implemented and under current conditions the fisheries do not meet SG100 SIa. **UoCs 2, 4 & 7. All Artisanal UoC Nylon Shrimp –. Yellow Squat Lobster- Red Squat Lobster** Research for stock status is similar as for the industrial fishery. The fisheries achieve SG60 SIa. Monitoring of the fisheries by IFOP, which is considered a critical component of the research plan, has been conducted exclusively on board of industrial vessels, except for this current year when one artisanal vessel is participating. The artisanal fisheries do not meet SG80 SIa.		

PI 3.2.4		The fishery has a research plan that addresses the information needs of management		
b	Guidepost	Research results are available to interested parties.	Research results are disseminated to all interested parties in a timely fashion.	Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available.
	Met?	Y (All UoCs)	Y (All UoCs)	Y (UoCs 1, 3, 5, 6 & 8) N (UoCs 2, 4 & 7)
	Justification	**UoCs 1, 3, 5, 6 & 8. All UoC Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** Results of research carried out by IFOP to monitor the industrial fisheries and to assess the stocks as well as research carried out by other research institutions are published in exhaustive annual reports and are available at the IFOP library and electronically at the IFOP website for interested parties. Reports available on the website on the fisheries and the stocks are currently for the 2014 fisheries which were reported in 2015 and thus results are disseminated in a timely fashion. The fisheries meet SG60 and SG80 SIb. Because the documents are in an open access library, posted in a website and also available to the public in general upon request the industrial fisheries meet SG100 SIb. **UoCs 2, 4 & 7. All Artisanal UoC Nylon Shrimp –. Yellow Squat Lobster- Red Squat Lobster** Results are published as for the industrial fisheries but do not have information from IFOP monitoring of the artisanal fisheries. And the fisheries don't meet SG100 b.		
References		http://www.ifop.cl/?page_id=7, Zilleruelo et al 2006-2016, Montenegro 2008-2015; Queirolo 2015, Bucarey 2013-2014, Canales 2013-2014,		
OVERALL PERFORMANCE INDICATOR SCORE:				**90 (UoCs 1, 3, 5, 6 & 8)** **70 (UoCs 2, 4 & 7)**
CONDITION NUMBER (if relevant):				**13**

Evaluation Table for PI 3.2.5

PI 3.2.5		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	Guidepost	The fishery has in place mechanisms to evaluate some parts of the management system.	The fishery has in place mechanisms to evaluate key parts of the management system	The fishery has in place mechanisms to evaluate all parts of the management system.
	Met?	Y (All UoCs)	Y (All UoCs)	N (All UoCs)
	Justification	**All UoCs Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** SUBPESCA routinely evaluates key parts of the management system in order to establish the need for management measures and this is covered in at least annual reporting and in the decision making process at the demersal crustacean CCT. The law mandates that MINECON is responsible for research quality and as such IFOP stock assessments should be evaluated to assess technical aspects and results as well as methods and procedures for obtaining information. Thus, it can be considered that the fisheries have in place mechanisms to evaluate key parts of the management system and the fisheries meet SG60 and SG80 SIa. The fishery does not have in place mechanisms to evaluate performance of all parts of the management system. Among others, evaluation of compliance and enforcement is missing and also for the ecosystem approach to management and therefore the fisheries do not meet SG 100 SIa.		
b	Guidepost	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 (All UoCs)	Y (All UoCs)	Y (All UoCs)
	Justification	**All UoC Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster** The fishery-specific management system is subject to regular internal review by SUBPESCA and regular external review by the CCT and the CNP. The system is reviewed on a regular annual basis to allow for the definition of management measures such as quotas and allocations for the next year. The fisheries meet SG60 SIb. As the law mandates responsibility by MINECON for research quality it indicates that IFOP reporting should be evaluated by external reviews. Accordingly, IFOP has organized international workshops to review biological reference points in Chilean fisheries in December 2013 with attendance of experts from Chile, the US (Clark, Dorn, Sissenwine), Spain (Fernandez) and Australia (Haddon, Klaer, Zhou). Haddon reviewed stock assessment of the demersal crustacean fisheries. The fisheries meet SG80 SIb. Internal reviews are regular, and the management system for the demersal fisheries can be considered subject to regular external review on the basis that the CCT and the CNP are taken as external because the committees are constituted by a wide range of stakeholders. The fisheries meet SG100 SIb.		

PI 3.2.5	**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**	
References	LGPA, http://www.subpesca.cl/institucional/602/articles-86238_documento.pdf, http://www.ifop.cl/?p=8041, Payá et al 2014.	
OVERALL PERFORMANCE INDICATOR SCORE:		**90**
CONDITION NUMBER (if relevant):		

Appendix 1.2 Risk Based Framework (RBF) Outputs

The Risk Based Framework (RBF) was used for PI 2.2.1 Bycatch species for UoCs 1 and 2 (Nylon Shrimp Industrial and Artisanal Fisheries).

Appendix 1.2.1 Scale Intensity Consequence Analysis (SICA)

Table 1.2.1.c Scoring Template for PI 2.2.1 Bycatch Species *(Reference: CR Table CC5)*

Performance Indicator	Risk-causing activities from fishery under assessment	Spatial scale of activity	Temporal scale of activity	Intensity of activities	Relevant subcomponents	Consequence score	MSC Score
PRINCIPLE TWO: Bycatch Species Outcome **Species:** **Aconcagua grenadier**	• Fishing • Gear loss • Bait collection • Other identified risk-causing activities (please specify)	3	4	2	**Population size**	80	2
					Reproductive capacity		
					Age/size/sex structure		
					Geographic range		
Rationale for selecting worst plausible case scenario:	Catch composition data from IFOP surveys were used in evaluating bycatch species; as indicated by researchers from IFOP and SUBPESCA species with no commercial value are discarded and constitute bycatch in this assessment. Discards are prohibited since 2001, but data recorded by IFOP provide qualitative and quantitative information on discarded bycatch species. Overall, bycatch was about 10 to 20% of the catch with up to 73 species reported for the southern area and 44 for the north. There were five species of chondrichthyes listed for the northern area and 17 taxa for the south. Granulatum and hooktooth dogfish represented about 0.8% and 0.7% of the catch; yellownose skate represented up to 0.38% in the southern area which translates into about 4t						

	and close to the 6t quota assigned for demersal fisheries for Region VIII to 41º28 6'S. We do not consider species of chondrichthyes as P2 main bycatch species at the time. There were two main bycatch species for the nylon shrimp fisheries, Aconcagua and Chilean grenadier with catch shares > 5%. Grenadiers do not form schools or aggregations and have no commercial value so they are not targeted. As a result, there is no information on status of these two species and outcome and SIa was assessed using RBF. As the nylon shrimp fisheries use an unselective bottom trawl gear and there is no target fishery for Aconcagua grenadier, we were able to identify fishing as the activity related to the fishery posing the most risk to the bycatch stock.
Rationale for Spatial scale of activity:	A spatial scale of activity of 3 was given based on survey information suggesting that the species is distributed between 30° and 41°S with higher densities towards the south and beyond the area of operation of the fishery. Further, individuals were more frequently caught in the deeper water 400-500m stratum suggesting that population distribution extends towards deeper waters than where the demersal crustacean fisheries operate. Thus, there is little overlap between the fishery and distribution of the species.
Rationale for Temporal scale of activity:	A temporal scale score of 4 was given assuming that the fishery operates 4 days a week during 36 weeks per year. The nylon shrimp fishery operates year round with closures from July 1 to August 31 and between V and VII during September.
Rationale for Intensity of activity:	An intensity score of 2 was given that the small scale of the fishery for which catch quotas act as a choke for bycatch removals and with landings ranging between around 5,000 to 3,000 t for the target species.
Rationale for choosing most vulnerable sub-component:	Population size was chosen as the most relevant subcomponent as data available on size structure indicate that the fishery is catching individuals in a wide size range and of both sexes and within a large geographical range.
Rationale for Consequence score:	The team and stakeholders contacted agreed that the effect of the nylon shrimp fishery on the Aconcagua grenadier population would have a minimum impact on population size and no impact on dynamics of the population. Further, catch rates in the IFOP surveys taken as an index of abundance have remained stable showing no evidence of depletion.

Appendix 1.3 Conditions

There are 13 conditions for this fishery.

Condition 1 UoC 8 (red squat lobster south) only

Performance Indicator	1.1.1. The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing]
	Scoring issue b SG80 The stock is at or fluctuating around its target reference point.
Score	70
Rationale	For the red squat lobster fishery in the southern region (UoC 8), the most recent stock assessment estimated fishing mortality to be at the Fmsy proxy level, but that the ratio of the current biomass to the Bmsy proxy of 40% of B0 is 0.72. This estimate falls outside the target range of 20% below and 50% above the biomass target reference point, and therefore the latest assessment confirms that the red squat lobster fishery in the southern region is over-exploited. The stock cannot be considered therefore to be at or fluctuating around its biomass target reference point, and so the SG80 is not met for UoC 8.
Condition	By the fourth annual audit, the client should demonstrate that the red squat lobster stock in the southern fishing zone is at or fluctuating around its target reference point.
Milestones	At the first annual audit, the client should provide evidence to the CAB that the re-building strategy for the red squat lobster stock is working. Expected score 70. At the second annual audit, the client should provide evidence to the CAB that the re-building strategy for the red squat lobster stock is continuing to work or that the stock is now at or fluctuating around its target reference point. Expected score 70 or 80. At the third annual audit, the client should provide evidence to the CAB that the re-building strategy for the red squat lobster stock is continuing to work or that the stock is now at or fluctuating around its target reference point. Expected score 70 or 80. At the fourth annual audit, the client should provide evidence to the CAB that that the red squat lobster stock in the southern fishing zone is at or fluctuating around its target reference point. Expected score 80.
Client action plan	The basis of our approach to meeting this condition is to ensure that the rebuilding strategy is successful implemented with the setting of the annual quota based on scientific advice and ensuring that fishing mortality is no higher than the permitted level. Noting the experience in the recovery of the other crustacean stocks we expect the recovery strategy to be successful and this will be demonstrated by the annual stock assessments completed by IFOP. At the same time, we accept the identified weaknesses in the information base and we will work to respond to these issues thus providing greater confidence in the veracity of the scientific results. Also to be taken into consideration, is the possible impact of any potential recovery in fish stocks that could change the level of predation on crustaceans and high natural mortality. On that basis, we acknowledge the need to fully input into the stock assessment process. At the first annual audit we will: (i) provide evidence that AIP has established a permanent working group to monitor activities that may impact the biomass of red lobster; (ii) provide evidence of our contributions to the management process with submissions to the scientific council and fishery management council and any papers that we may prepare to comment on the stock status of red lobster; (iii) provide the most recent status report on red lobster; (iv) provide our comments on the most recent status report on red lobster.

	At the second annual audit we will repeat those same activities. Should it prove to be the case that the red lobster stock has not reached its target reference point, we will provide a prognosis of the situation. At the third annual audit we will repeat those same activities. At the fourth annual audit we will provide the auditors with the evidence that the stock recovery is complete.
Consultation on condition	Our inputs will be based on the on-going activities of the established Committees, IFOP and SUBPESCA. As such we do not need to consult on the implementation of this part of the client action plan, as this is based on internal actions.

Condition 2 All UoCs

Performance Indicator	**1.2.3. Relevant information is collected to support the harvest strategy**
	Scoring issue b (All UoCs) Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule. Scoring issue c (UoCs 3 to 8 only) There is good information on all other fishery removals from the stock.
Score	75 (UoCs 1 & 2) 65 (UoCs 3 to 8)
Rationale	Scoring issue b. it is clear that there is significant discarding of individuals under the commercial size in all three crustacean species, and that the level of discarding is not full quantified. Scoring issue c Squat lobsters are also caught in other fisheries when they are not the target species. In the nylon shrimp fishery these landings will be recorded and included in the annual global quota. However small catches of yellow squat lobster occur in the fisheries targeting red squat lobsters and vice versa, and the assessment team were informed that landings recorded on behalf of SERNAPESCA through the dockside monitoring programme do not differentiate between the two species, and so some removals of both squat lobster species are not fully recorded.
Condition	By the third annual audit, the client should demonstrate that the level of discarding in all UoCs has been fully quantified and that landings of both squat lobster species have been fully differentiated in landings recorded in the dockside monitoring programme.
Milestones	At the first annual audit, the client should provide evidence to the CAB that options for quantifying the level of discarding of target species in all UoCs have been considered, and that a mechanism has been put in place for differentiating between landings of squat lobster species in the dockside monitoring programme. Expected scores 75 (UoCs 1 & 2), 65 (UoCs 3 to 8). At the second annual audit, the client should provide evidence to the CAB that a mechanism has been put in place to quantify the level of discarding of target species in all UoCs, and that landings of squat lobster species are fully differentiated within the dockside monitoring programme. Expected scores 75 (All UoCs).

	At the third annual audit, the client should provide evidence to the CAB that the level of discarding of target species is fully quantified in all UoCs, and that landings of squat lobster species are fully differentiated within the dockside monitoring programme. Expected score 80 (All UoCs).
Client action plan	At the first annual audit we will provide evidence to the auditors that: (i) we have analysed the position from the point of view of the fishing companies and fishing skippers and the actions that would be required on-board the vessels to respond to the need to differentiate between yellow and red squat lobster; (ii) we will provide evidence that trials have commenced to implement the mechanisms to differentiate between the catches of red squat lobster and yellow squat lobster; (iii) n the context of any regulations on discards, we will provide evidence to the auditors that we have designed a programme to quantify discards of all commercial species from the fishing operations for crustaceans. (iv) We will provide evidence that we have met with IFOP to discuss how observers may collect the data required to quantify the level of discards through sampling; (v) we will provide evidence that we have met with SERNAPESCA to determine the mechanisms for differentiating between red and yellow squat lobster on-boar, and on landing and in the processing facility. (vi) We will provide evidence that we have made representations to SUBPESCA to consider these issues in drafting related regulations and the FMP. At the second annual audit, we will provide the auditors with: (i) evidence that the squat lobsters are being classified on-board the vessel and at landing, with audit at the processing plant; (ii) the scheme that has been implemented to quantify catch discards. At the third annual audit we will present the auditors with evidence of the successful implementation of the two schemes.
Consultation on condition	See letters from SUBPESCA, SERNAPESCA and IFOP (Appendix 6).

Condition 3 UoCs 1, 3 and 6 Nylon Shrimp Industrial, Yellow Squat North Unit and Red Squat North Unit Fisheries

Performance Indicator	**2.1.3** Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
	<u>Issues at SG80</u> b. Information is **sufficient** to estimate outcome status with respect to biologically based limits. d. Sufficient data continue to be collected to detect any **increase in risk level** to main retained species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy)
Score	70
Rationale	b.Questions are raised about amount of removals as IFOP reports indicate that SERNAPESCA underestimates catch. Additionally, IFOP data do not account for discards before catch is brought on deck. Further, for cardinal fish there is no current monitoring of the population as the collapsed fishery is closed. IFOP monitoring provides data on catch composition which suggests that removals in this fishery are larger than the non-target quota while SERNAPESCA statistics report almost no catch. Thus, data are not considered sufficient to estimate outcome status with respect to biologically based limits. d. Main retained species are Chilean hake and cardinal fish. Various surveys provide indicators on abundance and status of Chilean hake. There are no

	surveys for cardinal fish. Reporting from logbooks and SERNAPESCA dockside landing data for quota control provide information on fishery operations. Data are compromised by unreported discards. Routine IFOP catch monitoring provides information on composition. While logbooks and dockside information continue to be collected the sample size of IFOP monitoring of the fishery in the northern area is low and depending on nylon shrimp stock condition. The issue is that artisanal vessels have not accommodated observers on board and LGPA states for a global quota of up to 600 t the quota is allocated for the artisanal fishery; between 600 t and 4,000 t the artisanal quota is increased by 5.88% of global quota - 600 t and the remainder is for the industrial fishery. If artisanal vessels do not accommodate IFOP observers on board, data collection would be increasingly compromised with decreasing quotas.
Condition	By the third annual surveillance audit, the following SG80 SIs must be met: - Information should be sufficient to estimate outcome status with respect to biologically based limits of cardinal fish, in particular with respect to discards in the Nylon Shrimp Industrial, Yellow Squat North Unit and Red Squat North Unit Fisheries. -Sufficient data should continue to be collected to detect any increase in risk level to cardinal fish in the Nylon Shrimp Industrial, Yellow Squat North Unit and Red Squat North Unit Fisheries.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options for collecting data to estimate outcome status of cardinal fish, and also to ensure that sufficient data continue to be collected. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism to collect data to estimate outcome status of cardinal fish has been established and there is assurance that sufficient data will continue to be collected. The score will not change on completion of this milestone. At the third annual audit, the client will present the CAB with evidence to show that data to estimate outcome status of cardinal fish has been collected and analysed and also that a mechanism is in place to ensure that sufficient data continue to be collected. The score will not change on completion of this milestone. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the third annual audit the required minimum score is 80.
Client action plan	At the first annual audit we will provide evidence to the auditors that we have we have reviewed with our members, SUBPESCA and IFOP the current approach to data collection and how accurate this is to reflect the quantities of cardinal fish taken in the fishery. On the basis of that review, we will have identified the options for improving data collection of all retained species, including cardinal fish At the second annual audit, we will provide the auditors with evidence that data on the retained catch of cardinal fish are being collected and presented for analysis. At the third annual audit we will present the auditors with evidence that the data have been collected and continues to be collected on cardinal fish, and the data have been taken into account in any new stock assessments of cardinal fish and the setting of the annual allocated catch quota for that species in the crustaceans fishery.
Consultation on condition	See letters from SUBPESCA, SERNAPESCA and IFOP. (Appendix 6)

Condition 4 UoCs 5 & 8 Yellow Squat South Unit and Red Squat South Unit Fisheries

Performance Indicator	**2.1.3.** Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
	Issues at SG80 a. Information is **sufficient** to estimate outcome status with respect to biologically based limits.
Score	75
Rationale	b. Similar to the Nylon Shrimp Industrial fishery, information on main retained species from dockside monitoring by SERNAPESCA and logbooks provide the information for the fishery to meet SG60 SIb but is not adequate to meet SG80 SIb.
Condition	By the third annual surveillance audit, the following SG80 SI must be met: Information should be sufficient to estimate outcome status of Chilean hake with respect to biologically based limits, in particular with respect to discards in the Yellow Squat South Unit and Red Squat South Unit Fisheries.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options for collecting data to estimate outcome status of Chilean hake in the Yellow Squat South Unit and Red Squat South Unit Fisheries. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism to collect data to estimate outcome status of Chilean hake in the Yellow Squat South Unit and Red Squat South Unit Fisheries has been established and there is assurance that sufficient data will continue to be collected. The score will not change on completion of this milestone. At the third annual audit, the client will present the CAB with evidence to show that data to estimate outcome status of Chilean hake has been collected and analysed for the Yellow Squat South Unit and Red Squat South Unit Fisheries. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the third annual audit the required minimum score is 80.
Client action plan	At the first annual audit we will provide evidence to the auditors that we have we have reviewed with our members, SUBPESCA and IFOP the current approach to data collection and how accurate this is to reflect the quantities of Chilean hake taken in the fishery. On the basis of that review, we will have identified the options for improving the data collection. At the second annual audit, we will provide the auditors with evidence that data on the retained catch of Chilean hake are being collected and presented for analysis. At the third annual audit we will present the auditors with evidence that the data have been collected and continues to be collected on Chilean hake, and the data have been taken into account in any new stock assessments of Chilean hake fish and the setting of the annual allocated catch quota for that species in the langostino fishery in the south.
Consultation on condition	See letters from SUBPESCA, SERNAPESCA and IFOP. (Appendix 6)

Condition 5 UoC 2 Nylon Shrimp Artisanal Fishery

Performance Indicator	**2.1.3.** Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
	Issues at SG80 a. Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.
Score	65
Rationale	a. Data are not recorded by IFOP from the artisanal fishery. Although it can be assumed that catch is qualitatively similar to the industrial catch, the assumption does not hold for quantitative information. Other rationale for b and d are as for the industrial fishery.
Condition	By the fourth annual surveillance audit, the following SG80 SIs must be met: - Qualitative information and some quantitative information should be available on the amount of main retained species taken by the artisanal fishery. - Information should be sufficient to estimate outcome status with respect to biologically based limits, in particular with respect to discards. -Sufficient data should continue to be collected to detect any increase in risk level to main retained species.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options for collecting data on the amount of main retained species taken by the Nylon Shrimp Artisanal Fishery. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism to collect data on the amount of main retained species taken by the Nylon Shrimp Artisanal Fishery has been designed. The score will not change on completion of this milestone. At the third annual audit, the client will present the CAB with evidence that a mechanism to collect data on the amount of main retained species taken by the Nylon Shrimp Artisanal Fishery has been implemented. The score will not change on completion of this milestone. At the fourth annual audit, the client will present the CAB with evidence to show that data on main retained species in the Nylon Shrimp Artisanal Fishery has been collected and analysed. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the fourth annual audit the required minimum score is 80.
Client action plan	At the first annual audit we will provide evidence to the auditors that we have reviewed with our members, SUBPESCA and IFOP the issue of data collection for the retained catch in the artisanal nylon shrimp fishery. At the second annual audit, we will provide the auditors with evidence that mechanisms for collecting data on the retained catch in the Chilean artisanal nylon shrimp fishery have been defined. At the third annual audit we will present the auditors with evidence that the data have been collected and continues to be collected for the retained catch in the Chilean artisanal nylon shrimp fishery. At the fourth annual audit we will provide evidence that the collected data has been used in up-dated stock assessments for some fish stocks.
Consultation on condition	See letters from SUBPESCA, SERNAPESCA and IFOP. (Appendix 6)

Condition 6 UoCs 4 & 7 Yellow Squat Lobster and Red Squat Lobster Artisanal Fisheries

Performance Indicator	**2.1.3.** Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species
	Issues at SG80 b. Information is sufficient to estimate outcome status with respect to biologically based limits.
Score	70
Rationale	b. Data are not recorded by IFOP from the artisanal fishery. Although it can be assumed that catch is qualitatively similar to the industrial catch, the assumption does not hold for quantitative information. Other rationale for b and d are as for the industrial fishery in the northern units.
Condition	By the fourth annual surveillance audit, the following SG80 SIs must be met: - Qualitative information and some quantitative information should be available on the amount of main retained species taken by the Yellow Squat Lobster and Red Squat Lobster Artisanal Fisheries. - Information should be sufficient to estimate outcome status with respect to biologically based limits, in particular with respect to discards in the Yellow Squat Lobster and Red Squat Lobster Artisanal Fisheries. -Sufficient data should continue to be collected to detect any increase in risk level to main retained species in the Yellow Squat Lobster and Red Squat Lobster Artisanal Fisheries
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options for col lecting data on the amount of main retained species taken by the langostina Artisanal Fishery. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism to collect data on the amount of main retained species taken by the langostina Artisanal Fishery has been designed. The score will not change on completion of this milestone. At the third annual audit, the client will present the CAB with evidence that a mechanism to collect data on the amount of main retained species taken by the langostina Artisanal Fishery has been implemented. The score will not change on completion of this milestone. At the fourth annual audit, the client will present the CAB with evidence to show that data on main retained species in the langostina Artisanal Fishery has been collected and analysed. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the fourth annual audit the required minimum score is 80.
Client action plan	At the first annual audit we will provide evidence to the auditors that we have reviewed with our members, SUBPESCA and IFOP the issue of data collection for the retained catch in the artisanal squat lobster fishery. At the second annual audit, we will provide the auditors with evidence that mechanisms for collecting data on the retained catch in the Chilean artisanal squat lobster fishery have been defined. At the third annual audit we will present the auditors with evidence that the data have been collected and continues to be collected for the retained catch in the Chilean artisanal squat lobster fishery.

	At the fourth annual audit we will provide evidence that the collected data has been used in up-dated stock assessments for some fish stocks.
Consultation on condition	See letters from SUBPESCA, SERNAPESCA and IFOP. (Appendix 6)

Condition 7 UoCs 1 & 2 Nylon Shrimp Industrial and Artisanal Fisheries

Performance Indicator	**2.2.3.** Information on the nature and amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch
	d. Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).
Score	75
Rationale	d.. Catch composition of the nylon shrimp fisheries is routinely monitored by IFOP annual surveys. Nevertheless it is known that discards occur before catch is taken on deck and information collected by IFOP underestimates bycatch. Thus, these data would not detect any increase in risk to main bycatch species Aconcagua and Chilean grenadiers.
Condition	By the fourth annual surveillance audit, the following SG80 SIs must be met: - Information should be sufficient to estimate outcome status with respect to biologically based limits, in particular with respect to discards in the Nylon Shrimp Industrial and Artisanal Fisheries. -Sufficient data should continue to be collected to detect any increase in risk level to main retained species in the Nylon Shrimp Industrial and Artisanal Fisheries..
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options to ensure that sufficient data continue to be collected to detect any increase in risk to main bycatch species in the Nylon Shrimp Industrial and Artisanal Fisheries. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism to ensure that sufficient data continue to be collected to detect any increase in risk to main bycatch species in the Nylon Shrimp Industrial and Artisanal Fisheries has been designed. The score will not change on completion of this milestone. At the third annual audit, the client will present the CAB with evidence that a mechanism to ensure that sufficient data continue to be collected to detect any increase in risk to main bycatch species in the Nylon Shrimp Industrial and Artisanal Fisheries has been implemented. The score will not change on completion of this milestone. At the fourth annual audit, the client will present the CAB with evidence to show that sufficient data continue to be collected to detect any increase in risk to main bycatch species in the Nylon Shrimp Industrial and Artisanal Fisheries.. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the fourth annual audit the required minimum score is 80.
Client action plan	At the first annual audit we will provide evidence to the auditors that we have reviewed with our members, SUBPESCA and IFOP the issue of data collection for the by catch in the Nylon Shrimp Industrial and Artisanal Fisheries At the second annual audit, we will provide the auditors with evidence that mechanisms for collecting data on the by catch in the Nylon Shrimp Industrial and Artisanal Fisheries have been defined.

	At the third annual audit we will present the auditors with evidence that the data have been collected and continues to be collected for the by catch in the Nylon Shrimp Industrial and Artisanal Fisheries. At the fourth annual audit we will provide evidence that the collected data has been used in up-dated stock assessments for some fish stocks.
Consultation on condition	See letters from SUBPESCA, SERNAPESCA and IFOP. (Appendix 6)

Condition 8 All UoCs

Performance Indicator	**2.3.3.** Relevant information is collected to support the management of fishery impacts on ETP species, including: • Information for the development of the management strategy; • Information to assess the effectiveness of the management strategy; and • Information to determine the outcome status of ETP species.
	c. Information is sufficient to measure trends and support a full **strategy** to manage impacts on ETP species.
Score	75
Rationale	c. The use of the new gear is only in place for one year and there is a need to evaluate performance to measure trends and support a full strategy to manage impacts on ETP species in particular for coral. The use of the new gear is also forcing changes in the areas of operation so information needs to be collected in these areas to support a strategy.
Condition	By the fourth annual surveillance audit, the following SG80 SIs must be met: -Sufficient data should be collected to measure trends and support a full strategy to manage impacts on ETP species in particular corals.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options to collect data to measure trends and support a full strategy to manage impacts on ETP species in particular corals. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism has been designed to collect data to measure trends and support a full strategy to manage impacts on ETP species in particular corals. The score will not change on completion of this milestone. At the third annual audit, the client will present the CAB with evidence to show that a mechanism has been designed to collect data to measure trends and support a full strategy to manage impacts on ETP species in particular corals has been implemented. The score will not change on completion of this milestone. At the fourth annual audit, the client will present the CAB with evidence to show that data to measure trends and support a full strategy to manage impacts on ETP species in particular corals has been collected and analyzed. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the fourth annual audit the required minimum score is 80.
Client action plan	At the first annual audit we will provide evidence to the auditors that we have met with relevant NGOs to gain their views on ETP issues related to the crustaceans fishery and we have held talks with SUBPESCA, IFOP and SERNAPESCA on the potential to develop a full strategy.

	At the second annual audit, we will provide the auditors with evidence that a mechanism to collect data on the interactions of the crustaceans fleet with ETP species has been designed. At the third annual audit we will present the auditors with evidence that a mechanism to collect data on the interactions of the crustaceans fleet with ETP species has been implemented. At the fourth annual audit we will present the auditors with an analysis of the data collected on the interactions of the crustaceans fleet with ETP species.
Consultation on condition	See letters from SUBPESCA, SERNAPESCA and IFOP. (Appendix 6)

Condition 9 All UoCs

Performance Indicator	**2.4.3. Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types**
	b. Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.
Score	75
Rationale	Information on the spatial extent of interaction and the timing and location of use of the fishing gear is routinely collected by IFOP on industrial fisheries. But there is limited information on habitat structure and how it interacts with or be altered by the gear to identify the nature of the impacts. There is some information pointing out that there are negative effects from bottom trawl fisheries including the demersal crustacean fishery on benthic communities, but insufficient to make statements about the magnitude. Thus it is not considered that sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified. The fisheries do not meet SG80 SIb.
Condition	By the fourth annual surveillance audit, the following SG80 SIs must be met: Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options to collect data to allow the nature of the impacts of the fishery on habitat types to be identified. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism has been designed to collect data to allow the nature of the impacts of the fishery on habitat types to be identified. The score will not change on completion of this milestone. At the third annual audit, the client will present the CAB with evidence to show that a mechanism has been designed to collect data to allow the nature of the impacts of the fishery on habitat types to be identified and has been implemented. The score will not change on completion of this milestone. At the fourth annual audit, the client will present the CAB with evidence to show that data to allow the nature of the impacts of the fishery on habitat types to be identified has been collected and analyzed. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the fourth annual audit the required minimum score is 80.

Client action plan	At the first annual audit we will provide evidence to the auditors that we have met with relevant NGOs to gain their views on habitat issues related to the crustaceans fishery and we have held talks with SUBPESCA, IFOP and SERNAPESCA on the potential to develop better information. At the second annual audit, we will provide the auditors with evidence that a mechanism to collect data on the interactions of the crustaceans fleet with habitat has been designed. At the third annual audit we will present the auditors with evidence that a mechanism to collect data on the interactions of the crustaceans fleet with habitat has been implemented. At the fourth annual audit we will present the auditors with an analysis of the data collected on the interactions of the crustaceans fleet on habitat.
Consultation on condition	See letters from SUBPESCA, SERNAPESCA and IFOP. (Appendix 6)

Condition 10 All UoCs

Performance Indicator	**3.2.1.** The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2.
	Issues at SG80 **a. 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's management system.
Score	70
Rationale	a. Specific goals and measures to accomplish them, for all units of certification are broadly consistent with achieving outcomes expressed by MSC Principles 1, but do not consider approaches to limit fishery impacts on other elements of the ecosystem. Currently there is a demersal crustacean Management Plan draft under review but it is at a draft stage. The fisheries do not meet SG80 SIa becauseP2 objectives are implicit within the current fishery's system, but not explicit. Objectives for P1 are explicit and a score of 70 is allocated.
Condition	By the third annual surveillance audit, the following SG80 SIs must be met: - Short and long term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, should be explicit within the fishery's management system.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options to make short and long term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, explicit within the fishery's management system. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism has been designed to make short and long term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, explicit within the fishery's management system. At the third annual audit, the client will present the CAB with evidence to show that 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's management system. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the third annual audit the required minimum score is 80.

Client action plan	We are confident that the fishery management plan that will be prepared for the crustaceans' fishery will fully respond to the MSC requirements. At the first annual audit we will provide evidence to the auditors that we have worked in full cooperation with the Committee and SUBPESCA to present our views on the needs of the FMP. At the second annual audit, we will provide the auditors with a draft of the FMP that indicates how the requirements have been incorporated. At the third annual audit we will present the auditors with the completed FMP.
Consultation on condition	Our inputs will be based on the on-going activities of the established Committees, IFOP and SUBPESCA. As such we do not need to consult on the implementation of this part of the client action plan, as this is based on internal actions.

Condition 11 : All UoCs

Performance Indicator	**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 under assessment.**
	b. Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
Score	75
Rationale	b. There are a number of issues to which the decision-making process has not responded in a timely and adaptive manner such as to the issue of unreported catches, and discards, which in absence of fishery inspectors on board have consequences for P1 and P2 objectives. Discards have been banned since 2002 and continue to be illegal (except for vessels participating in a current discards evaluation program). A program carried out by IFOP in 2005 provided information on discards in the demersal fisheries but proved controversial and was discontinued. The new law is seeking to correct the issue and established a discard research program to implement a plan to manage discards for the demersal crustacean fisheries (among other fisheries).
Condition	By the third annual surveillance audit, the following SG80 SIs must be met: Decision-making processes in the demersal crustacean fisheries should respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options to make the decision-making process responsive to serious and other important issues, in particular to unreported catch and discards, identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism has been designed to make the decision-making process responsive to serious and other important issues, in particular to unreported catch and discards, identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider

	implications of decisions. The score will not change on completion of this milestone. At the third annual audit, the client will present the CAB with evidence to show that the decision-making process is responsive to serious and other important issues, in particular to unreported catch and discards, identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the third annual audit the required minimum score is 80.
Client action plan	We are confident that the design and implementation of the fishery management plan that will be prepared for the crustaceans fishery will fully respond to the required process to consider serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions. At the first annual audit we will provide evidence to the auditors that we have worked in full cooperation with the Committee and SUBPESCA to present our views on the needs of the FMP. At the second annual audit, we will provide the auditors with a draft of the FMP that indicates how the requirements have been incorporated. At the third annual audit we will present the auditors with the completed FMP.
Consultation on condition	Our inputs will be based on the on-going activities of the established Committees, IFOP and SUBPESCA. As such we do not need to consult on the implementation of this part of the client action plan, as this is based on internal actions.

Condition 12 : All UoCs

Performance Indicator	**3.2.3. Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with.**
	Issues at SG80 a. A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules. b. Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence. d. There is no evidence of systematic non-compliance**.**
Score	65
Rationale	a. IFOP conducts annual monitoring of the fisheries with observers on-board industrial operations, but they have no enforcement authority and there are no inspectors to implement monitoring, control and surveillance of fishing operations at sea. Thus, although landings are strictly monitored, illegal discards and under reporting are not monitored and compliance of management measures cannot be enforced. There have been no IFOP observers on board to monitor artisanal catch. b. SUBPESCA confirms that sanctions for exceeding quotas have been applied in two cases recently. However in relation to discarding, it has been widely documented that discarding occurs in these fisheries, and because there is no inspection of fishing activity on board the vessels, there is no enforcement of the prohibition on discarding. So whilst in principle sanctions for non-compliance with discarding regulations exist, the lack of on board inspections means that such

	sanctions are not consistently applied and cannot be considered to provide effective deterrence. d. There is evidence of systematic discarding of target and non-target species in the demersal crustacean fisheries, which is illegal under current law.
Condition	By the fourth annual surveillance audit, the following SG80 SIs must be met: A monitoring, control and surveillance system should be implemented in the demersal crustacean fisheries on board of industrial and artisanal vessels and the system should demonstrate an ability to enforce relevant management measures and apply sanctions in particular in reference to unreported catch and discards.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of options for a monitoring, control and surveillance system to be implemented in the demersal crustacean fisheries on board of industrial and artisanal vessels and for the system to demonstrate an ability to enforce relevant management measures. The score will not change on completion of this milestone. At the second annual audit, the client will present the CAB with evidence that a mechanism has been designed for a monitoring, control and surveillance system to be implemented in the demersal crustacean fisheries on board of industrial and artisanal vessels and for the system to demonstrate an ability to enforce relevant management and apply sanctions. The score will not change on completion of this milestone. At the third annual audit, the client will present the CAB with evidence to show that a mechanism for a monitoring, control and surveillance system in the demersal crustacean fisheries on board of industrial and artisanal vessels has been implemented. The score will not change on completion of this milestone. At the fourth annual audit, the client will present the CAB with evidence to show that a mechanism for a monitoring, control and surveillance system has been implemented in the demersal crustacean fisheries on board of industrial and artisanal vessels and that the system has demonstrated an ability to enforce relevant management measures and apply sanctions if required. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the fourth annual audit the required minimum score is 80.
Client action plan	We are confident that the design and implementation of the fishery management plan that will be prepared for the crustaceans fishery will fully respond to the need for effective MCS. . At the first annual audit we will provide evidence to the auditors that we have worked in full cooperation with the Committee and SUBPESCA to present our views on the needs of the FMP. We will also present the results of an internal review of the requirements for those vessels using the MSC certification. At the second annual audit, we will provide the auditors with a draft of the FMP that indicates how the requirements have been incorporated. We will also provide the auditors with a copy of the internal regulations if these are found be required. At the third annual audit we will present the auditors with the completed FMP and a summary of the preliminary results from the application of the internal regulations. At the fourth annual audit, we will provide evidence to the auditors that the implemented MCS system and internal regulations are functioning correctly and they have demonstrated an ability to enforce relevant management measures and apply sanctions if required.

Consultation on condition	Our inputs will be based on the on-going activities of the established Committees, IFOP and SUBPESCA. As such we do not need to consult on the implementation of this part of the client action plan, as this is based on internal actions.

Condition 13: UoCs 2, 4 & 7 Nylon shrimp, yellow squat lobster and red squat lobster artisanal fisheries

Performance Indicator	3.2.4. The fishery has a research plan that addresses the information needs of management
	a. A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.
Score	70
Rationale	Monitoring of the fisheries by IFOP, which is considered a critical component of the research plan, has been conducted exclusively on board of industrial vessels, except for this current year when one artisanal vessel is participating. The Nylon shrimp, yellow squat lobster and red squat lobster artisanal fisheries do not meet SG80 SIa.
Condition	By the fourth annual surveillance audit, the following SG80 SIs must be met: A research plan provides the management system for the Nylon shrimp, yellow squat lobster and red squat lobster artisanal fisheries with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the development of a research plan for the Nylon shrimp, yellow squat lobster and red squat lobster artisanal fisheries. The score will not change on completion of this milestone. At the second annual audit the client will present the CAB with evidence that a research plan for the Nylon shrimp, yellow squat lobster and red squat lobster artisanal fisheries has been drafted. The score will not change on completion of this milestone. At the third annual audit the client will present the CAB with evidence that a research plan for the Nylon shrimp, yellow squat lobster and red squat lobster artisanal fisheries has been established. The score will not change on completion of this milestone. At the fourth annual audit, the client will present the CAB with evidence that a research plan for the Nylon shrimp, yellow squat lobster and red squat lobster artisanal fisheries has been implemented. These milestones provide incremental steps in achieving the conditions. Only when the final step is complete will the team be able to revise the score. By the fourth annual audit the required minimum score is 80.
Client action plan	At the first annual audit we will provide evidence to the auditors that the requirements for a research plan have been discussed with SUBPESCA and IFOP. At the second annual audit, we will provide the auditors with evidence that the research plan has been confirmed and funding is available for activities to establish it in the next calendar year. At the third annual audit we will present the auditors with evidence that the research plan has been established. At the fourth annual audit we will present the auditors with evidence that the research plan continues to be implemented and that results are available.

Consultation on condition	See letters from SUBPESCA, SERNAPESCA and IFOP.

Appendix 2. Peer Review Reports

Peer Reviewer 1

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes/No** **Yes**	**Certification Body Response**
Justification: The assessment team has provided solid justification for the conclusion that Chile squat lobsters and nylon shrimp modified trawl fishery meet the MSC standard with conditions, and should be certified. Some performance indicators are scored higher than I think justified (see below) but adjusting scores would not change the overall conclusion. I agree with the assessment team's identification of client strengths and weaknesses. The strengths are considerable with healthy stock status in 7 of 8 UoCs, a strong stock assessment and review process, a high level of at sea monitoring (with exception of discards) and the recent implementation of a lighter trawl which should reduce bycatch and habitat effects. Weaknesses are mainly related to lack of data on and control of discards, and insufficient understanding of the effect of the fishery on bottom habitat and associated ETP species.		No response required.

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	**Yes/No** **Yes**	**Certification Body Response**
Justification: The 13 conditions, if met should address the above weaknesses and achieve the SG80 outcome for all PIs by the 4th annual audit. The conditions are comprehensive and complementary in addressing the PIs not met at the SG80 level. .		No response required.

If included:

Do you think the client action plan is sufficient to close the conditions raised?	**Yes/No** **Yes**	**Certification Body Response**
Justification: Yes the action plans as written should close the conditions within the required timeframe.		No response required.

For reports using the Risk-Based Framework please follow the link.

For reports assessing enhanced fisheries please follow the link.

General Comments on the Assessment Report (optional)

Report is comprehensive if not exhaustive, with almost 60 p. for the target species background alone due partly to numerous figures extracted from assessment documents. Certainly helps the reviewers but this may be excessive for most readers.

CAB response: The assessment team understands the peer reviewer's concern that the length of the background information sections may be excessive. However with three different species and 8 UoCs, the report is inevitably more extensive than many other MSC certification reports. For example it was necessary to summarise 6 separate stock assessments in the target species background, hence the large number of figures.

The delineation of 8 units of certification makes the document structure unwieldy but assume options were limited here.

CAB response: The assessment team reviewed whether it was possible to rationalise the number of UoCs, but with three species, northern and southern region fisheries and industrial and artisanal components of the fleet, all with their own characteristics, the assessment team concluded that 8 units of certification were necessary.

Assume there will be a thorough editorial review but changes should not be extensive. The items below should definitely be addressed as they cause confusion or are in error.

- p. 67 Last sentence should refer to southern not northern

CAB response: Noted and error corrected.

- p. 89 last 2 sentences are in reference to southern zone but reference figure (67) is for northern zone

CAB response: Noted and error corrected.

- p. 133 – check Fish base length-wt coeff for C Chilensis.

CAB response: The estimates given are from Fishbase.

- p. 134 – 2nd paragr refers to "no main retained species" should be "no main bycatch species"

CAB response: Noted and error corrected.

- p. 216 – Red squat lobster B/Bmsy and B/Blim – decide whether using what was determined in 1st assessment or in the update on quota advice (p. 92). Some places the figure of 0.72 is used for B/Bmsy, other places 0.64 is used.

CAB response: The assessment team recognises the confusion identified by the peer reviewer. The text has been corrected and the most up-to-date figure of 0.72 is used throughout.

- p. 264 - note that for SI 2.2.3a is there is "Y" under SG100 but text indicates SG100 is not met (agreed).

CAB response: Noted. For SI 2.2.3a, SG100 has been corrected to "N".

- p. 293 - "…as fuel subsidies, the prohibition of discards despite sanctions…" Appears "prohibition" should be replaced with "existence" i.e. discarding is taking place despite the fact that sanctions are in place.

CAB response: It is the prohibition of discards without enforcement that leads to unreported catches. We have modified the text to clarify.

Performance Indicator Review

Please complete the table below for each Performance Indicator which are listed in the Certification Body's Public Certification Draft Report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.1.1	*Yes*	*No*	*Yes condition 1 (UoC 8) should result in SG80 if red squat lobster responds to the reduction in fishing mortality as expected.*	*Agree with the scores based on the model estimates of current biomass in relation to the limit reference point but some of the rationale is misplaced. The certifiers make reference to fishing mortality reference points but MSC Guidance doc (v 1.3, GCB2.2) indicates this PI is expressed in terms of biomass only.* *Agree with scoring of different UoCs based on biomass considerations alone. Condition for UoC 8 is warranted.*	*The assessment team agrees that this PI should be expressed in terms of biomass only and has modified the rationale accordingly.*
1.1.2	*No*	*No*	*NA*	*Agree with scores and rationale for 1.1.2a to c; limit and target reference points are appropriate and meet SG80.* *For SI 1.1.2d (status as key low trophic) rationale should be expanded with additional relevant information. Reference to the current low*	*The assessment team accepts the peer reviewer's comment that there is insufficient rationale presented in relation to SId. Additional information has been provided to justify the conclusion that the three target species are not key low trophic level species.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				abundance of key predators is inadequate as they could return to higher abundance. What about reference to existing food web models? Agree that the target species are unlikely "key low trophic" as defined by MSC, based on (i) lack of school formation (ii) landings are low (<<50,000 t) which is indicative of non key LTL stocks (MSC Guidance v 1.3).	
1.1.3	*Yes*	*No*	*NA*	*Please provide citations for "…previous performance in other similar fisheries "* *For SI 1.1.3b certifiers indicate a timeframe is implicit but none has been set. Both SG60 and SG80 are specific that a rebuilding timeline must be specified. Later in the document (PI 2.1.1c) it is stated that Chilean hake has a time frame in the recovery plan, so setting a timeframe is done within their management framework. I think that 1.1.3b meets SG60 with "implicit timeframe" argument but that overall*	*Examples of previous performance in other fisheries have been added to the rationale.* *The assessment team accepts the peer reviewer's view that the original rationale does not support the SG80 for scoring issue b. Additional information has been presented which demonstrates that there is a re-building strategy in place which is projected to re-build the stock to the target reference point by 2021. The assessment team considers that the additional rationale now supports SG80b.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				score for 1.1.3 is less than 80. A condition would then be set to establish a rebuildiing timeframe. *This condition would to some extent overlap with Condition 1 which incorporates a timeline (3-4 years based on milestones).*	
1.2.1	*Yes*	*No*	*NA*	*Agree with the information and rationale provided and the assigned scores except for 1.2.1d. which is scored at 100. Given that the harvest strategy is not available in one document (e.g. a fisheries management plan), it seems more likley that strategy elements are periodically reviewed, rather that the entire harvest strategy.*	*The assessment team concluded that the harvest strategy as a whole is regularly reviewed by both the Scientific Committee and the Management Committee as part of their statutory role in the management process, and over recent years various elements of the harvest strategy have been modified and improved. The drafting of the management plan for the demersal crustacean fisheries required a full review of the harvest strategy (in addition to the economic, social and environmental targets of the fishery) and it is clear that the entire harvest strategy will continue to be reviewed and improved where necessary through future reviews of the management plan.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
					The assessment team considers therefore that the score of 100 is justified.
1.2.2	*Yes*	*Yes*	*NA*	*Agree that there are well defined and effective harvest control rules and that the justification provided supports the scores of 90.*	*No response required*
1.2.3	*Yes*	*Yes*	*Yes. Condition 2 (all UoCs) should result in SG80 score.*	*Agree that there is a requirement to obtain data on unquantified removals resulting from (i) discarding and (ii) removals by fisheries directed at other species must be addressed.*	*No response required*
1.2.4	*Yes*	*Yes*	*NA*	*Agree that the stock assessment and review process for these species are at a high level and the information and rationale supports the 90 score.* *SI 1.2.4a –agree that the only barrier to meeting SG100 is the potential change in catchability due to the new trawl.*	*No response required*
2.1.1	*Yes*	*Yes*	*NA*	*Assessors have extracted the relevant*	*No response is necessary.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				information on retained species from the catch composition data on a UoC basis and have identified which are the main retained species. They have addressed risks using MSC criteria.	
2.1.2	*Yes*	*Yes*	*NA*	*Scores of 85 (industrial UoCs) and 80 (artisanal UoCs) are supported by the information provided and the rationale. Agree that there are differences among the UoCs with regard to this PI. The artisanal fisheries should score lower given they are not required to have quota shares to retain Chilean hake, nylon shrimp and yellow and red squat lobsters.*	*No response is necessary.*
2.1.3	*Yes*	*Yes*	*Conditions 3 (UoCs 1, 3 and 6), 4 (UoCs 5 & 8), 5 (UoC 2) and 6 (UoCs 4 & 7) will result in SG80 for this PI.*	*Agree that for industrial UoCs, 20% sampling of catch composition by IFOP (30% for Yellow squat lobster South) is substantial. Given that this level of sampling effort is in place, it should be possible to adjust sampling protocols to record discards.*	*No response is necessary.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				It may be reasonable to assume artisanal catch composition is similar but this needs to be evaluated given that in some areas they have exclusive access. Thus conditions 5 and 6 are justified.	
2.2.1	*Yes*	*No*	*NA*	*Agree that the information and rationale provided supports scores of 80 for all UoCs. RBF was used appropriately.* *One concern here is the lack of a clear rationale for not considering chondrichthyes species as main bycatch species given their vulnerability. This rationale should be provided.*	*The reason chondrichthyes were not considered as main bycatch is because, although a vulnerable group, the representation of the reported species in the catch is very low < 1%. None of the species is a CITES species and they were not considered in the ETP section.. Although we did not find an argument to consider these species as main bycatch species, we did place a recommendation to review the situation in annual audits when more data from the new gear are available and to ensure the fishery does not pose a threat.*
2.2.2	*Yes*	*Yes*	*NA*	*Agree that the information and rationale provided supports scores of 80 for all UoCs.*	*No response is necessary.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.2.3	*Yes*	*Yes*	*Condition 7 (UoCs 1 & 2) will result in a score of SG80*	*Given there are no main bycatch species for UoCs 3-8, but there is insufficient monitoring of all bycatch species (SG100 for several Sis), a score of 80 is justified and appropriate.* *A score of 75 is justified for UoCs 1 & 2 given the lack of information on discards including the two grenadier species*	*No response is necessary.*
2.3.1	*No*	*?*	*NA*	*2.3.1a – can degree of overlap between corral and fishery be quantitfed?* *2.3.1b - is it in the IFOP protocol to record corrals? This should be verified by for example reference to a guide to corral species that observers are provided with and trained to use. Please verify. Again quantify "limited spatial overlap"*	*The degree of overlap between coral and the fishery cannot be quantified. As reported the information on interactions comes from one survey of reduced geographical coverage.* *Table 18 presents the list of species recorded by IFOP including sponges and actinians. The trawl gear does not retain coral species so that IFOP monitoring of the catch does not provide data to quantify overlap. As the second peer reviewer noted: Tethocyathus endesa is a small solitary scleractinian (http://epic.awi.de/39507/1/Diercks_et_al_YOUMARES6.pdf), while Bathycyathus chilensis is a small mushroom coral (see http://www.corallosphere.org/taxon/179), also*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
					solitary so it is very unlikely that either would be retained even if impacted. IFOP observers on the crustacean fishery are not trained to identify corals. In other fisheries considered to operate in areas of vulnerable systems the situation is diferent and there is a protocol in place.
2.3.2	*Yes*	*No*		*2.3.2a - Accept that Title II Art. 6A is a strategy but if the information on corrals is not available, don't think it can be said to be comprehensive. SG 100 is too high.*	*We considered the lack on information under 2.3.3 and not under 2.3.2. The strategy is in place but the information is missing to establish VME in areas of the fishery operations. Therefore a score of 100 is appropriate.*
2.3.3	*Yes*	*Yes*	*Condition 8 (all UoCs) is important and mentions corals. When met it should result in a score of 80.*	*2.3.3a – see comment/question on IFOP protocols under 2.3.1b* *2.3.3b – as above*	*No response is necessary.*
2.4.1	*Yes*	*Yes*	*NA*	*Agree that the information and rationale provided supports scores of*	*No response is necessary.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				80 for all UoCs.	
2.4.2	*Yes*	*Yes*	*NA*	*Agree that the information and rationale provided supports scores of 80 for all UoCs. The move to a lighter trawl for all UoCs is an important one and demonstrates these fisheries are taking steps to reduce bottom impacts (and bycatch).*	*No response is necessary.*
2.4.3	*Yes*	*Yes*	*Agree that condition 9 (all UoCs) will bring the score of this PI to 80.*	*Agree that the information and rationale provided supports scores of 75 for all UoCs. There is insufficient information to assess gear impacts on habitat types.*	*No response is necessary.*
2.5.1	*Yes*	*Yes*	*NA*	*Agree that the information and rationale provided supports scores of 80 for all UoCs*	*No response is necessary.*
2.5.2	*Yes*	*Yes*	*NA*	*Agree that the information and rationale provided supports scores of 85 for all UoCs*	*No response is necessary.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.5.3	*Yes*	*Yes*	*NA*	*OK*	*No response is necessary.*
3.1.1	*Yes*	*Yes*	*NA*	*Agree that the information and rationale provided supports score of 100 for all UoCs*	*No response is necessary.*
3.1.2	*Yes*	*Yes*	*NA*	*Agree that the information and rationale provided supports score of 85 for all UoCs*	*No response is necessary.*
3.1.3	*Yes*	*Yes*	*NA*	*Agree that the information and rationale provided supports score of 100 for all UoCs*	*No response is necessary.*
3.1.4	*Yes*	*Yes*	*NA*	*Agree that the information and rationale provided supports score of 80 for all UoCs*	*No response is necessary.*
3.2.1	*Yes*	*Yes*	*Condition 10 (all UoCs) will bring all UoCs to a score of at least 80*	*Agree that the information and rationale provided supports score of 70 for all UoCs.* *Fishery management plan with*	*No response is necessary.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				objecitves is needed	
3.2.2	*Yes*	*Yes*	*Condition 11 (all UoCs) has the potential to result in a score of 80 for this PI. Decision making processes should not only be incorporated in to the fishery management plan but should be followed by decisions to address outstanding issues*	*Agree that the information and rationale provided supports score of 75 for all UoCs.* *In particular, agree that PI 3.2.2b does not meet SG80 based on the inability to take decisions to reduce or elliminate illegal discards*	*No response is necessary.*
3.2.3	*Yes*	*Yes*	*Meeting Condition 12 (all UoCs) will result in*	*Agree that the information and rationale provided supports score of 70 for all UoCs.*	*No response is necessary.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
			a score of 80	*The certifiers have again appropriately identified lack of control on discards as as fundamental issue to be addressed*	
3.2.4	*Yes*	*No*		*Comprehensive research plan does not appear to be available for any UoC and suggest that the condition should apply to all UoCs not just 2, 4 and 7. This should presumably not be diffcult to achieve, and could be part of the process to complete of fisheries management plans (implied by Condition 10)*	*The SG 80 score requires a research plan not a comphrensive research plan. For the industrial fisheries there is a research plan of fishery dependent and fishery independent surveys established by the Technical Committee which ensures monitoring of the fishery as well as the stock.*
3.2.5	*Yes*	*Yes*		*I am not convinced that 3.2.5b is met at 100 given there is no fishery management plan in place, but this is addressed by other conditions. SG80 is clearly met.*	*The assessment team agrees with the peer reviewer that the fishery management plan is not in place, but this is addressed by other conditions, and therefore the assessment team considers that the score of 100 for SIb is justofied.*

Any Other Comments

Comments	Certification Body Response

Performance Indicator	Does the report clearly explain how the process used to determine risk using the RBF led to the stated outcome? Yes/No	Are the RBF risk scores well-referenced? Yes/No	Justification: Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response:
1.1.1	NA			
2.1.1	NA			
2.2.1	Yes	Yes	*RBF was used to score bycatch outcome only for UoCs 1 & 2 as these UoCs were the only ones with main*	No response is necessary.

			bycatch species. Aconcagua grenadier and Chilean grenadier were the 2 species identified. As there is little information on these species, use of SICA is appropriate. *It is clear in report how the RBF was used and how the outcome was arrived at. This is evidenced by the description in section 4.4.4, and in the scoring table for PI 2.2.1 (RBF used only for UoCs 1 & 2).* *Identification of most vulnerable element (Aconcagua grenadier), key risk activity and assignment of scores in SICA scoring template are reasonable.*	
2.4.1	*NA*			
2.5.1	*NA*			

Peer Reviewer 2

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes**	**Certification Body Response**
Justification: Generally yes, subject to the comments below against the different PIs.		No response required

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	**Yes**	**Certification Body Response**
Justification: The conditions and milestones identify the relevant issues and follow the required form – they are written appropriately.		No response required

If included:

Do you think the client action plan is sufficient to close the conditions raised?	**Yes**	**Certification Body Response**
Justification: The CAP seems appropriate – good luck to the client and everyone involved in meeting the conditions.		No response required

For reports using the Risk-Based Framework please follow the link.

For reports assessing enhanced fisheries please follow the link.

General Comments on the Assessment Report (optional)

No comments here, but please see below.

Performance Indicator Review

Please complete the table below for each Performance Indicator which are listed in the Certification Body's Public Certification Draft Report.

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.1.1	*Yes*	*Yes*	*Yes*	*Nothing further.*	*No response required*
1.1.2	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response required*
1.1.3	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response required*
1.2.1	*Yes*	*No (possibly Yes)*	*N/A*	*The score of 100 for SIa is given but the management plan has not yet been implemented. The key question is whether the plan simply packages-up elements that exist separately, or does the plan actually need to be in place for all the elements to be enacted? If the latter, then a score of 100 seems too high.*	*The draft management plan sets out biological, economic, social and environmental targets, as well as formally describing the roles played by all stakeholders. It is therefore a wide-ranging document which describes more than just the harvest strategy. The draft management plan draws together all elements of the harvest strategy that are currently in place and which have been carefully developed over many years, and which will remain in place even if the draft management plan is never formally implemented.* *The assessment team considers therefore that the score of 100 is justified.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
1.2.2	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response required*
1.2.3	*Yes*	*No*	*Yes*	*For UoCs 1 and 2, the SIc text states "Nylon shrimp are caught in other fisheries when they are not the target species. Such landings should be recorded and included in the annual global quotas, and so there is good information on other fishery removals from the stock." The use of the word 'should' doesn't give great confidence that there is good information on all other fishery removals. Essentially, can the team confirm that the catches are recorded?* *For UoCs 3-8, the SIc text indictaes that no disctinction is made in the dockside monitoring data between yellow and red squat lobster in catches from those fisheries, which is something of a concern – are species-specific data recorded anywhere? How can the team be confident that only 'small catches' of each species occur in the fisheries targeting the other species (and given*	*The assessment team accepts the peer reviewer's comment that the rationale as written was not clear. The assessment team confirms that catches in other fisheries are recorded, and the rationale has been modified accordingly.* *Species-specific landings are generally recorded in the fisheries, but the assessment team were informed during the site visit that the dockside monitoring programme did not differentiate between the two squat lobster species when they were a bycatch in the fishery for the other species, on the basis that the mis-reporting by species would 'balance out' across the two fisheries. The proportion of the non-target squat lobster species in the landings was generally no more than 5% with similar "bycatch" levels in each of the two fisheries. Whilst the assessment team felt that this was a deficiency in the monitoring programme, the assessment team recognised that the total landings data for each squat lobster species is unlikely to be signifiantly in error due to this deficiency in the recording practice.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				the scoring text for PI 3.1.4 states "… , the prohibition of discards despite sanctions (together with quotas and lack of enforcement at sea) have resulted in incentives conductive to large unreported catches of target and non-target species in many fisheries")?	
1.2.4	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response reuqired*
2.1.1	*Y*	*N (possibly Y)*	*N/A*	*In several places the report mentions the use of a modified trawl to allow non-target fish species to escape unharmed, and Section 3.2.4 mentions 'escape devices' in the new net design. However, there appears to be nothing in Figures 15 or 16 showing such a device, and I didn't see anything in the introductory text describing what is in place. Nevertheless, the device appears to be an important part of the partial strategy to allow SIc to be scored at 80 (i.e., the text for SIc states "There is a partial strategy since 2015 of a mandatory modified trawl to allow*	*We added a figure howing the escape device to the overall gear design in Figures 15 and 16 and a description of the escape panel. The new design was the product of the research by Queirolo et al in two FIP funded projects from which catch composition results are presented in this assessment. The outcome from the first year of fishery data does suggest the new gear is likely to work, but more years of data are necessary. Since there is a strategy and there is little data to ensure that it is effective we scored PI fisheries Information accordingly to address this issue.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				non-target fish species to escape unharmed"), but without a description, and maybe some evidence that it is likely to be working (even if only from inference with data from other fisheries), it is not clear that the SG80 is met.	
2.1.2	*Yes*	*No (possibly Yes)*	*N/A*	*As for PI 2.1.1, the 80 score for a partial strategy is closely linked to the trawl gears including "net features to allow non-target fish species to escape", but these features don't appear to be described.* *It is noted that, for UoC 2, the text states "There are measures but no strategy for Chilean hake (80) and cardinal fish (80)." If there are only measures, the fishery meets 60 but not 80.* *SIb notes that the new gear 'has shown some reduction in retained catch in a survey'. I may have missed this in the introductory sections, but I didn't see any information or data on this survey,*	*The survey corresponds to the IFOP monitoring of the fishery. We clarified that in the table. The information is shown in several tables related to catch composition within section 3.4.2.3 Retained Species Outcome which shows 2015 catch relative to previous years (Tables 20, 22, 23, 26). Also there are figures comparing catch in 2013-2015 with old and new gear (Figures 80, 81, 82, 83).* *The assessment team considered that there are mesaures in place which constiute a partial strategy for Chilean hake and cardinal fish, and therefore the score of 80 is justified. The rationale has been revised accordingly.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				which is important given its importance for scoring this PI.	
2.1.3	*Yes*	*No*	*Yes*	*A slightly higher score might be supported for this PI for some UoCs through scoring SId up at SG80. The use of VMS aboard all vessels provides a means by which risk may be evaluated. Essentially, if fishing locations are consistent and effort is consistent, then risk might be judged to be equivalent. If effort goes up or fishing locations change then one might expect higher risk.*	*We scored this PI under 80 because data are compromised by discards and there is no information collected from artisanal fisheries. If quotas are low there will be no data collection as allocation would be mostly to the artisanal sector. We find it difficult to evaluate the risk posed by the fishery and the effectiveness of the strategy if the data are unreliable or in the absence of data despite VMS aboard. We do not agree that risk can be evaluated solely on the basis of fishing location and effort.*
2.2.1	*Yes*	*Generally Yes*	*N/A*	*It is noted simply that no score is proided for SIa for UoCs 1 and 2 (just says "RBF used – UoCs 1&2").*	*The RBF score for UoCs and 2 as indicated in the OVERALL PERFORMANCE SCORE is 80. We added the score within the P1 2.2.1 SIa.*
2.2.2	*Yes*	*No (possibly Yes)*		*Same comment as for 2.1.2 – the design of the trawl gear incoporating featurs to allow non-tagrget species to escape is a key characteristic, but it isn't clear what these are or how effective they*	*We have included a figure with details of the escape device of the trawl gear from Queirolo 2010. The specifics of the device are not fully described in the regulation and are subjected to improvements by the fishery as the industry continues experimenting. Estimates are not specifically on the escape device for*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				are.	*the fisheries, only on overall performance of the new gear which includes the escape devices.*
2.2.3	*Yes*	*Yes*	*Yes*	*The practice of illegally discarding catch prior to it coming on deck is something of a concern here, with respect to the reliability of the bycatch data. It might be apporpriate to add in a recommendation that any projects on discarding (e.g., as identified for PI 2.1.3) include consideration of bycatch species as well as retained species.* *A similar comemnt here as made for PI 2.1.3 with respct to scoring 80 for SId with respect to 'risk'.*	*No response is necessary.*
2.3.1	*No*	*No*	*N/A*	*SIc (indirect effects) considers only the effects of lost gear. However, indirect effects also potentially include impacts on habitats that are important for ETP species, or impacts on food sources/prey of ETP species.*	*The only ETP species considered are corals and indirect effects on habitat were evaluated under SIb. We added that there are no potential detrimental indirect effects from impacts on food sources for corals that can be cited.*
2.3.2	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response is necessary*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
2.3.3	*Yes*	*Generally Yes*	*Yes*	*In SIa, the report states: "While there appears to be no direct interaction between the trawl gear and coral species because they are not retained by the net ...." It is noted that Tethocyathus endesa is a small solitary scleractinian (http://epic.awi.de/39507/1/Diercks_et_al_YOUMARES6.pdf), while Bathycyathus chilensis is a small mushroom coral (see http://www.corallosphere.org/taxon/179), so it is very unlikely that either would be retained even if impacted.*	*We agree with the reviewer that it is very unlikely that the coral species would be retained by the fishery even if impacted.*
2.4.1	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response is necessary*
2.4.2	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response is necessary*
2.4.3	*Yes*	*Yes*	*Yes*	*Nothing further*	*No response is necessary*
2.5.1	*Yes*	*Yes*	*N/A*	*Noting that PI 2.5.3 highlights the amount of ecosystem information available, and the existence of ecopath*	*Despite the existence of an Ecopath model, there is no evidence that the fishery is unilkely to disrupt key elements of the ecosystem. In particular when the*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response**
				models, I am surprised at a score of just 80. Focusing specifically on 'key elements', I would have thought a higher score was quite justifiable. If the models are a little old, then a partial score is a possibility, here.	*target species are prey of many other species, the fishery removes also predators, and tbere is uncertainty on total removals. The assessment team consider 80 to be appropiate score. Score of 2.5.3 SIb of 100 reflects the knowledge of main interactions from food web studies.*
2.5.2	*Yes*	*No (possibly Yes)*	*N/A*	*The SIa text states "Since there are not any significant ecosystem impacts, a management strategy is not needed (paragraph 7.1.2.5, MSCFAM v1.3)." I looked for the reference in the CR v1.3 and GCR v1.3 but couldn't find it. However, CRv.1.3 does say (CB 3.3.1) "The team should interpret the term "if necessary" used in the management strategy PIs at SG60 and SG80 for the retained species, bycatch species, habitats and ecosystems components to be applicable to those fisheries that have no impact on the relevant component and where no management strategy is required."* *It is clearly not possible to say that the crustacean fishery has 'no impact' on*	*We interpreted the term "if necessary" as not having significant impact on ecosystem structure and function and therefore that the measures in place were sufficient to achieve an 80 score. We modified the text to reflect the measures in place constitute a partial strategy.*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				the ecosyste, so ecosystem measures at least are needed. Nevertheless, there is evidence presented elsewhere that should allow an 80 score to be achieved.	
2.5.3	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response is necessary*
3.1.1	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response is necessary*
3.1.2	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response is necessary*
3.1.3	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response is necessary*
3.1.4	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response is necessary*
3.2.1	*Yes*	*Yes*	*Yes*	*Nothing further*	*No response is necessary*
3.2.2	*Yes*	*Yes*	*Yes*	*Nothing further*	*No response is necessary*
3.2.3	*Yes*	*Generally Yes*	*Yes*	*The text clearly identifies an issue with complaince in SIa and SId, and the setting of a condition here is*	*The issue here is that there are no inspectors onboard the vessels and so there are no means to apply any sanctions in relation to discards. Nevertheless*

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	**Justification** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Certification Body Response
				appropriate. However it is then not apparent how the fishery meets SG80 for SIb, where the requirement is for sanctions to be "consistently applied and thought to provide effective deterrence." The reports of santions for exceeding quota do not in themselves justify a score of 80 for SIb.	*sanctions for all other regulations for which enforcement is possible are applied.* *Because compliance with discards cannot be monitored, sanctions which are in place cannot be applied. We have reduced the score for 3.2.3 Sib from 80 to 60.*
3.2.4	*Yes*	*Yes*	*Yes*	*Nothing further*	*No response is necessary*
3.2.5	*Yes*	*Yes*	*N/A*	*Nothing further*	*No response is necessary*

Any Other Comments

Comments	Certification Body Response
1) The MSC CR v1.3 details a number of scope requirements including controversial unilateral exemptions (27.4.4.1), controversial disputes (27.4.4.2), destructive fishing practices (27.4.5), etc., but only enhanced fisheries and ISBF issues are considered in Section 3.1.	Additional statements have been added to section 3.1 detailing the scope requirements in relation to controversial unilateral exemptions and destructive fishing practices.
2) Many of the figures, in particular early in the introductory section, are very small, to the extent of being all but impossible to read. For example, Figures 4, 5, 6 and 100. Can these be increased in size, please?	The assessment team has improved the quality of the figures where possible.

3) A number of the figures have also been inserted together with their original captions, which are numbered differently (e.g., Figure 4 is also Figura 7, Figure 5 is Figura 6, Figure 86 is Figura 39, etc.), which a) adds to the size of the space needed for the figure without adding to the size of the figure, and b) is confusing.	The assessment team has revised all figures which contained the original captions including the original figure number.
4) P.42 and 46. It is stated that the target species are "not considered to be a key LTL species". I also very much doubt that the three species here are Key LTL, but it would seem appropriate to relate the statements for each species to the criteria listed in CB2.3.13 (particularly given the statement on Page 171 that "*Nylon shrimp … is a low trophic level species (2) …. The species is a major component of the benthic food web pathway … Potential ecosystem impacts of the fishery are from removals of this relatively abundant low trophic species which plays a significant role as prey*".	The assessment team accepts the peer reviewer's comment that there is insufficient rationale presented in relation to SId. Additional information has been provided to justify the conclusion that the three target species are not key low trophic level species.
5) P.54. The report states "*a mesh size of 60 mm is often used (in the nylon shrimp fishery instead of the 50 mm as required within the regulations*". But, on P.50, it simply states that the minimum mesh size for the nylon shrimp fishery is 50 mm. These statements are somewhat contradictory – is 50 mm a regulation or a minimum?	The regulation for nylon shrimp is a minimum size of 50 mm and for the squat lobsters is 60 mm as stated on page 50: "The minimum mesh size for the tunnel and cod end for the nylon shrimp fishery is 50 mm and for yellow and red squat lobster fisheries is 60 mm."
6) Generally, there is a huge amount of data presented for P1 and P2, and some of it appears to be extraneous to requirements. For example, at the bottom of P. 136 it is noted that Queirolo (2011) reported bigeye flounder made up 5.4% of the catch. But, at the top of P. 137 it is reported that IFOP surveys indicated that bigeye flounder made up only 2.7% of the catch. The statement is then made that "*None of the bycatch species reached 5% of the catch and there are no P2 main bycatch species*." If the Queirolo data are going to be ignored, then they may as well not be presented??	This assessment started when there was only Queirolo's report available for catch using the new gear. The information presented helped the auditors to select species and is presented because there is only one year with information for the new gear. It is the case that the species composition then showed higher contributions of bigeye flounder, and the auditors thought that having the information at hand can be helpful during future surveillance audits.
7) P.196. MSC guidance is a little unclear, but G27.8.8.1 states: "*For Principle 2, scoring elements may be the different species being impacted by the fishery or different habitat types*", the implication being that the list of scoring elements provided in Table 59 should include more than just main retained and main bycatch species (i.e., at least main habitats and key ecosystem elements should be listed). Also, there is no distinction by UoC, but text in the following paragraphs highlights that there are some differences in the scoring elements between UoCs, and if this table was completed then it would definitely help to readers to understand the situation.	Table 59 has been updated accordingly.

8) P. 198. The report states: "*Vessels fish with only one gear and all fishing areas are covered by the UoCs, so all catch on a vessel within the UoC will be certified (or non-certified if the vessel is not part of the UoC). There is no risk therefore of mixing certified and non-certified catch prior to landing*." But, if there are vessels not part of the UoC then there is risk of mixing (e.g., through transshipping, even if illegal?). How many vessels won't be part of the UoC, and which fleets do they come from? What about squat lobsters caught in the hake fleet – how might they be accounted for?	Only catch from vessels in the UoC can be landed as certified nylon shrimp or squat lobsters. The number of vessels which are not part of the UoC will depend on the UoC. In the northern region, most of the vessels in the fishery will be part of the UoC, whereas in the southern region, most vessels will not be part of the UoC. However there is a parallel certification assessment underway in the southern region for squat lobsters which, if successful, will ensure that most vessels in the southern fishery for squat lobsters will also be part of a certified fishery. There is of course still a potential risk of mixing, but the client confirms that there will be rigorous checks and procedures in place to ensure that non-certified catch cannot be mixed with certified catch. These include the prohibition of trans-shipping, 100% dockside monitoring of each vessel, and the segregation of catches from different vessels on the trucks delivering landings to the processing factories, and continued segregation of landings by vessel in the processing factories.

For reports using the Risk-Based Framework:

Performance Indicator	**Does the report clearly explain how the process used to determine risk using the RBF led to the stated outcome? Yes/No**	**Are the RBF risk scores well-referenced? Yes/No**	**Justification:** Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	**Certification Body Response:**
1.1.1	N/A			

2.1.1	N/A			
2.2.1	Yes	Yes	Nothing further.	No response is necessary.
2.4.1	N/A			
2.5.1	N/A			

Appendix 3. Stakeholder submissions

a. Written submissions from stakeholders received during consultation opportunities on the announcement of full assessment, proposed assessment team membership, proposed peer reviewers, proposal on the use or modification of the default assessment tree and use of the RBF.

None

b. All written and a detailed summary of verbal submissions received during site visits pertaining to issues of concern material to the outcome of the assessment[3] regarding the specific assessment.

No written stakeholder submissions were received during the two site visits or prior to the publication of the Public Comment Draft Report. During the site visit in March/April 2014, one stakeholder, WWF, expressed concern that the use of a new modified trawl would become mandatory at the end of 2014, but the assessment of the potential impact of the fishery on retained, bycatch and ETP species and on habitat and the ecosystem would be based solely on data gained from the performance of the old trawl design. The assessment team acknowledged this concern, and a second site visit was arranged in December 2015 primarily to receive new information on the fishery using the newly-modified trawl. Verbal submissions received during the second site visit in December 2015 focussed primarily on the provision of data and information on the performance of the new trawl and no concerns were raised about the fishery under assessment.

c. Explicit responses from the assessment team to submissions described in **a.** and **b.** above.

N/A

MSC Technical Oversight

Fax: +44 (0)20 7246 8901

Date 28/07/2016

SUBJECT: MSC Review and Report on Compliance with the scheme requirements

Dear Julian Addison

Please find below the results of our partial review of compliance with scheme requirements.

CAB	Acoura Marine
Lead Auditor	Julian Addison
Fishery Name	Chile squat lobsters and nylon shrimp modified Trawl fishery
Document Reviewed	Public Comment Draft Report

Ref	Type	Page	Requirement	Reference	Details	PI
20652	Guidance	194-195	CR-27.12.2.1 v.1.3	27.12.2 If the CAB determines the systems are sufficient, fish and fish products from the fishery may enter into further certified chains of custody and be eligible to carry the MSC ecolabel. The CAB shall determine:27.12.2.1 The scope of the fishery certificate, including the parties and categories of parties eligible to use the certificate and the point (s) at which chain of custody is needed. a. Chain of custody certification shall always be required following a change of ownership of the product to any party not covered by the fishery certificate. b. Chain of custody certification may be required at an earlier stage than change of ownership if the team determines that the systems within the fishery are not sufficient to make sure all fish and fish products identified as such by the fishery originate from the certified fishery. c. If the point where chain of custody certification is required is covered by the fishery certificate, the team shall determine the parties or category of parties covered by the fishery certificate that require chain of custody certification.	The report is very clear on the parties eligible to use the certificate and that CoC begins following the first point of landing. However it is not clear when ownership first changes and the point from which CoC is required. For example, will transport by truck as described in section 5.2.1 immediately after landing be covered by the first CoC holder? This a point for guidance only, as this clarification will be required in future assessments as per the FCR v2.0 Reporting Template section 5.3.1.(c) and (e).	

CAB response: The guidance issued in relation to Chain of Custody is noted. Additional text has been added to the report to confirm that ownership does not change when the landings are transported by truck from the point of landing to the processing factory.

Appendix 3.1 Amendments made to the PCDR following stakeholder consultation

With the exception of the MSC Technical Oversight, no responses were received from stakeholders following publication of the PCDR.

Appendix 4. Surveillance Frequency

Table A4: Fishery Surveillance Plan

Score from CR Table C3	Surveillance Category	Year 1	Year 2	Year 3	Year 4
2 or more	Normal Surveillance	On-site surveillance audit	On-site surveillance audit	On-site surveillance audit	On-site surveillance audit & recertification site visit

Source: Acoura Marine Ltd assessment team

Appendix 4.1 Rationale for determining surveillance score

Conditions of certification have been identified. These included Outcome PIs. Some Principle level scores were <85 and, for one PI the RBF was used. As a result, the surveillance level is such that annual, on-site audits should take place.

Appendix 5. Client Agreement

To be inserted at the FDR stage

ASOCIACION DE INDUSTRIALES PESQUEROS DE LA IV REGION

Dear
Billy Hynes
Acoura Marine
6 Redheughs Rigg
Edinburgh EH12 9DQ
Scotland, UK

August 5, 2016

Dear Billy

Chile squat lobsters and nylon shrimp modified trawl fishery: Final Report August 2016

We have reviewed the Final Report and we are happy for this to be published on the MSC web site.

Sincerely

Leandro Sturla
Manager

COSTANERA 900 – COQUIMBO
FONO-FAX: (56) 51-2549005 - MÓVIL: (56) 08 88 807 87
E-MAIL: of.gerenciaaip@tie.cl

Appendix 5.1 Objections Process

N/A

Appendix 6. Support for Client Action Plan

Appendix 6.1 Support from Subpesca

Translation:

In response to the request by letter I inform you that this under secretariat raises no objections to the action plan submitted by your organization for access to the Certification of Sustainability under the MSC Standard of the Nylon Shrimp, Red Squat Lobster and Yellow Squat Lobster fishery."

Subsecretaría de Pesca y Acuicultura
Gobierno de Chile

Carta (D.P.) Nº 1144 /

VALPARAISO, 17 JUN. 2016

Señor
Osciel Velasquez Hernandez
Presidente Asociación de Industriales Pesqueros de Coquimbo
AIP
PRESENTE

Ref.: Carta C.I. Nº 7231 de 2016. Solicitando pronunciamiento respecto a plan de acción.

De mi mayor consideración:

En atención a lo solicitado mediante carta., informo a Ud., que esta Subsecretaría no presenta objeciones al plan de acción presentado por vuestra organización para acceder a la Certificación de Sustentabilidad bajo el estándar MSC de la pesquería de camarón nailon, langostino amarillo y langostino colorado.

Saluda atentamente a Ud.,

RAUL SUNICO GALDAMES
Subsecretario de Pesca y Acuicultura

MAB/AKS/aks

Subsecretaría de Pesca y Acuicultura, Bellavista 168, piso 16, Casilla 100-V, Valparaíso, Chile

Appendix 6.2 Support from Subpesca

Translation: "I'm writing in relation to your earlier correspondence requesting support for the Client Action Plan for the certification program of your demersal crustaceans fishery untaken by your organisation through the MSC. I need to communicate to you that Sernapesca values this initiative of certification of sustainability and, as a result, gives it's support to the development of the certification and client action plan to which the fishery has committed with the result of a sustainable fishery.

In particular, in relation to monitoring and control of the fishery indicated in the Client Action Plan, I need to communicate that Sernapesca is available to work with your organisation in developing more effective, transparent and efficient surveillance procedures."

SERNAPESCA
Ministerio de Economía, Fomento y Turismo
Gobierno de Chile

ORD/DGPFP/Nº: 93166

ANT: Su carta de fecha 3 de junio de 2016

MAT: **Informa apoyo a Plan de Acción pesquería Langostino amarillo, Langostino colorado y Camarón naylon.**

VALPARAÍSO, 15 JUN. 2016

DE : DIRECTOR NACIONAL DE PESCA (S)
SERVICIO NACIONAL DE PESCA Y ACUICULTURA

A : OCIEL VELASQUEZ HERNANDEZ
PRESIDENTE, ASOCIACIÓN DE INDUSTRIALES PESQUEROS DE LA IV REGIÓN

Es grato dirigirme a usted, con relación a la carta citada en antecedentes a través de la cual solicita apoyo al Plan de Acción del Cliente del Programa de Certificación de la Pesquería de crustáceos demersales, que está efectuando vuestra organización a través de Marine Stewardship Council (MSC). Debo manifestar a usted que Sernapesca valora esta iniciativa de certificación de sustentabilidad, y en consecuencia, entrega su apoyo al desarrollo del programa de certificación que se lleva a cabo, y en particular, al Plan de Acción del Cliente que los armadores han comprometido realizar con el fin de contribuir a la sustentabilidad de la pesquería.

Sobre el particular, debo manifestar a usted, que en relación al punto referido al ámbito del seguimiento y control de la pesquería contenido en el Plan de Acción del Cliente, Sernapesca se encuentra disponible para trabajar el tema con vuestra Asociación, de manera de ir desarrollando procedimientos de vigilancia de una mayor eficacia, efectividad y transparencia.

Saluda atentamente a usted,

GERMÁN IGLESIAS VELOSO
DIRECTOR NACIONAL DE PESCA (S)
SERVICIO NACIONAL DE PESCA Y ACUICULTURA

JTD/DMC/gmp
Distribución
- Sr. Osciel Velásquez H.
- Subdirección de Pesquería
-Archivo

Appendix 6.3 Support from IFOP

"In response to your letter requesting the opinion of this research institute about the "action plan for fisheries: yellow squat lobster, red squat lobser and nylon shrimp", I'm pleased to inform you of our agreement with the plan defined for the next four years.

Along with this, we indicate our availability to support this important initiative by your organization, for which we expect an meeting soon with those identified to support you in matters that are our institutional activities."

IFOP

INSTITUTO DE FOMENTO PESQUERO

IFOP/DIR/2016/ N°**502**

Valparaíso, 10 de junio de 2016

Señor
Osciel Velásquez Hernández
Presidente
Asociación de Industriales Pesqueros de la IV Región
Costanera 900
Coquimbo

Ref.: Evaluación del Marine Stewadship Council (MSC).

Estimado señor Velásquez:

En atención a su carta solicitando la opinión de este Instituto de investigación respecto del "Plan de acción para pesquerías: Langostino amarillo, Langostino colorado y Camarón nailon", tengo el agrado de informar a usted nuestro acuerdo con el plan definido para los próximos cuatro años.

Junto con lo anterior, le señalamos nuestra total disposición para apoyar esta importante iniciativa promovida por su organización, para lo cual esperamos una pronta reunión con las personas que sean definidas para apoyarlos en las materias que sean de nuestro quehacer institucional.

Sin otro particular, le saluda atentamente a usted,

INSTITUTO DE FOMENTO PESQUERO IFOP DIRECTOR EJECUTIVO

Claudio Bernal Larrondo
Director Ejecutivo (S)