Final Report • July 2015

Marine Mammals Bycatch Assessment Chile

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Final Report	***Access:*** Private
Title: **Marine Mammal Bycatch Assessment-Chile**	***Date:*** July 2015
	N° of Pages: *113*
Authors: Javier Unibazo, Joaquín Aurtenechea, Mary Ann Hausdorf, Jennifer Brewer	***Project N° AVS Chile:*** 16001
Client: The New England Aquarium	***Contact:*** Tim Werner
Key Words: *Marine mammal, bycatch, whale, dolphin, sea lion.*	

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1. Information about Chile

1.1. Geography

Chile is a long and narrow coastal Southern Cone country on the west side of the Andes Mountains. It stretches over 4.300 km (2.670 mi) north to south, but only 350 km (217 mi) at its widest point east to west. This range encompasses a significant variety of climates and landscapes. It contains 756.950 km^2 (292.260 sq mi) of land area, 120.857 km^2 of territorial sea (up to 12 miles) and an Exclusive Economic Zone (from 12 miles to 200 miles) of 3.150.739 km^2. Including the area around its oceanic islands, its area totals 3.271.596 km^2 of sea. Including its offshore islands, but excluding its Antarctic claim, Chile lies between latitudes 17° and 56°S, and longitudes 66° and 81°W. The parallel 18°21´03´´ demarcates the northern sea border with Peru whereas the southern maritime border is in the Drake Passage. On land, the length of Chile's border with Peru to the north is approximately 180 km, and with a shared 850 km border with Bolivia to the east, from the parallel 17°29´54´´S to the parallel 22°48´51´´ S. From there, it continues to the intersection with the meridian 66°25´O, in the centre of the Beagle Channel, in a 5.500 km border line with Argentina. Chile also claims 1.250.000 km^2 (480.000 sq mi) of Antarctica as part of its territory, the Chilean Antarctic Territory. In the insular territory, Chile controls Easter Island and Sala y Gómez Island, the easternmost islands of Polynesia, and Robinson Crusoe Island, more than 600 km (370 mi) from the mainland, in the Juan Fernández Islands. Also controlled but only temporarily inhabited (by some local fishermen) are the small islands of San Ambrosio and San Felix (ProChile, 2003).

1.2. Political Administration

The territorial organization of Chile corresponds to the division of the Chilean territory for political and administrative purposes, as defined by the Constitution of 1980. This legal document stipulates that the country is a unified state, whose administration is functional and territorially decentralized. For the government and the interior administration of the State, the territory of the Republic of Chile is currently divided into fifteen regions (Figure 1) which, in turn, are subdivided into provinces. For the purposes of local administration the provinces are divided into municipalities.

According to the report from the 2012 census, carried out by the National Institute of Statistics, Chile has a population of 16,634,603 inhabitants, of whom 8,101,890 are men and 8,532,713 are women. The population growth rate for the period 2002-2012 was 0.99% per year (INE, 2012).

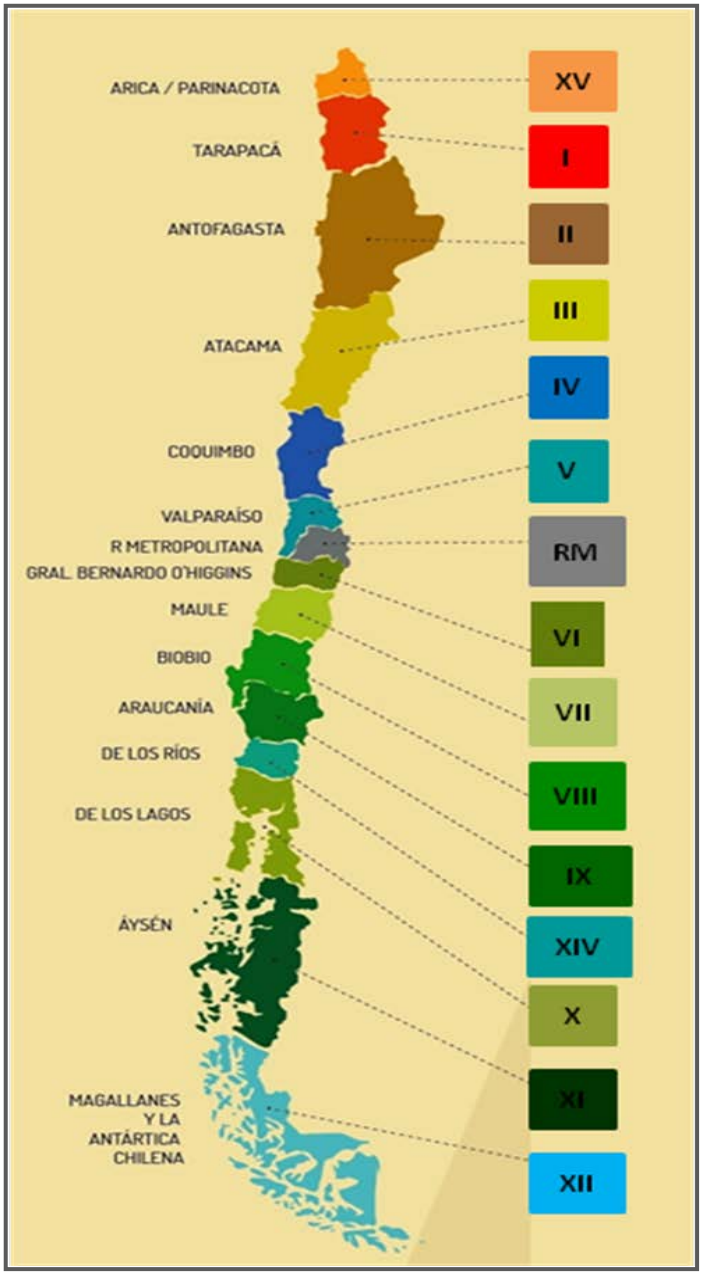

Figure 1. Political Map of Chile showing its Regions.
©J. Aurtenechea

1.3. Economy

Chile has a market-oriented economy characterized by a high level of foreign trade and a reputation for strong financial institutions and sound policy that have given it the strongest sovereign bond rating in South America. Chilean GDP in 2014 was 258.160 million US dollars. Exports of goods and services account for approximately one-third of GDP, with commodities making up some three-quarters of total exports. Copper alone provides 19% of government revenue. From 2003 through 2013, real growth averaged almost 5% per year, despite the slight contraction in 2009 that resulted from the global financial crisis. Growth slowed to 4.2% in 2014. In May 2010, Chile signed the OECD Convention, becoming the first South American country to join the OECD. The three most important export goods are: copper, fruit, and fish products (CIA, 2013).

1.4. Climate

The climate of Chile is diverse and ranges from the world's driest desert in the north, the Atacama Desert, through a Mediterranean climate in the center, humid subtropical in Easter Island, to an oceanic climate, including alpine tundra and glaciers in the east and south. According to the Köppen climate classification system, Chile hosts at least seven major climatic subtypes within its borders. There are four seasons in most of the country: summer (December to February), autumn (March to May), winter (June to August), and spring (September to November) (gob.cl, 2015).

2. Fisheries in Chile

According to FAO, Chile is among the 10 most important fishing countries in the world. The fishing/aquaculture sector is one of the pillars of the Chilean economy, with a total landing of 3.276.225 tonnes in 2014 and exports of 1.340.768 tonnes, representing 6.164.835 million dollars in export of fish and fish products during that year (Table 1) (SUBPESCA, 2015). This value represents 8.1% of the total national exports in 2014 and accounts for 1.05% the Chilean GDP (Banco Central de Chile, 2015). The sector contributes to job creation and employed

directly approximately 90.000 people in the extractive sector and 11.304 in the aquaculture sector (SUBPESCA, 2014).

Table 1. Landing & Export Volumes and Value. Sources: Customs, IFOP.

	Landing accumulated to December	Exports accumulated to December	
Year	(t)	(t)	(M US$)
2009	4.579.831	1.436.146	3.799.209
2010	3.924.401	989.012	3.578.310
2011	4.431.998	1.176.534	4.697.234
2012	3.683.355	1.259.631	4.563.558
2013	2.851.670	1.248.720	5.241.529
2014	3.276.225	1.340.768	6.164.835
Average 09-14	3.791.247	1.241.802	4.674.113

In the Chilean wild capture fisheries, the most abundant species are the pelagic species jack mackerel (jurel), sardine, anchovy and "caballa" mackerel (Figure 2). Chile's aquaculture industry is dominated by salmon and trout (primarily Atlantic salmon), although mollusc production (mussels and scallops) is strong as well.

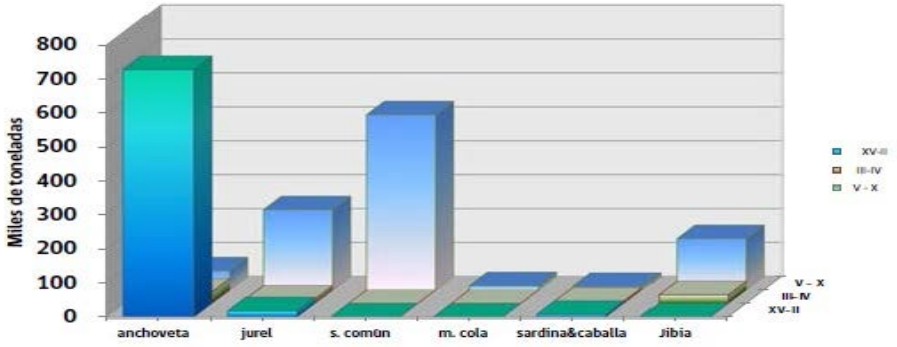

Figure 2. Landings of main pelagic species per region, 2014.
Source: Sernapesca.

The main destination countries of Chilean fishery and aquaculture products in terms of value in 2014 were the United States (26%), Japan (20.4%), Brazil (9.5%), Russia (6.7%) and China (6.4%) ()

Table 2). Fish products exported by Chile are from industrial and artisanal-scale[1] fisheries, and intensive and small scale aquaculture operations. Participation in relation to the volume of exports by products is led by the frozen products, which represent 51.3% of the total, followed in a smaller proportion by fishmeal (19.2%), refrigerated products (15.1%) and oil (6.5%) (Figure 3.)

Table 2. Main Destination Countries for Seafood Exports 2013-2014. Sources: Customs-IFOP

Country / Item	Value (thousands US$)		Participation (%)		Variation (%)
	2013	2014	2013	2014	
United States	1.336.443	1.602.010	25,5%	26,0%	19,9
Japan	1.037.513	1.255.963	19,8%	20,4%	21,1
Brazil	518.782	585.379	9,9%	9,5%	12,8
Russia	311.106	412.066	5,9%	6,7%	32,5
China	399.036	393.870	7,6%	6,4%	-1,3
Spain	174.879	180.872	3,3%	2,9%	3,4
South Korea	105.220	149.323	2,0%	2,4%	41,9
Germany	94.786	117.403	1,8%	1,9%	23,9
France	106.546	114.366	2,0%	1,9%	7,3
Others	1.157.219	1.353.584	22,1%	22,0%	17
Total	5.241.529	6.164.835	100,0%	100,0%	17,6

[1] Use of the terms artisanal, commercial, semi-industrial, and industrial can be deceptive in fisheries, with definitions varying from one national policy context to the next. The term artisanal normally refers to boats in the smallest length class. Contrary to standard English usage in other contexts, artisanal boats often have engines or mechanized gear, though other aspects of the fishery may be quite traditional. Similarly, the term commercial can be a vessel size class, larger than artisanal but smaller than industrial. It does not necessarily distinguish commercial operations from subsistence or recreational ones. Industrial vessels are generally the largest size class, with semi-industrial vessels being large but not as large as industrial vessels.

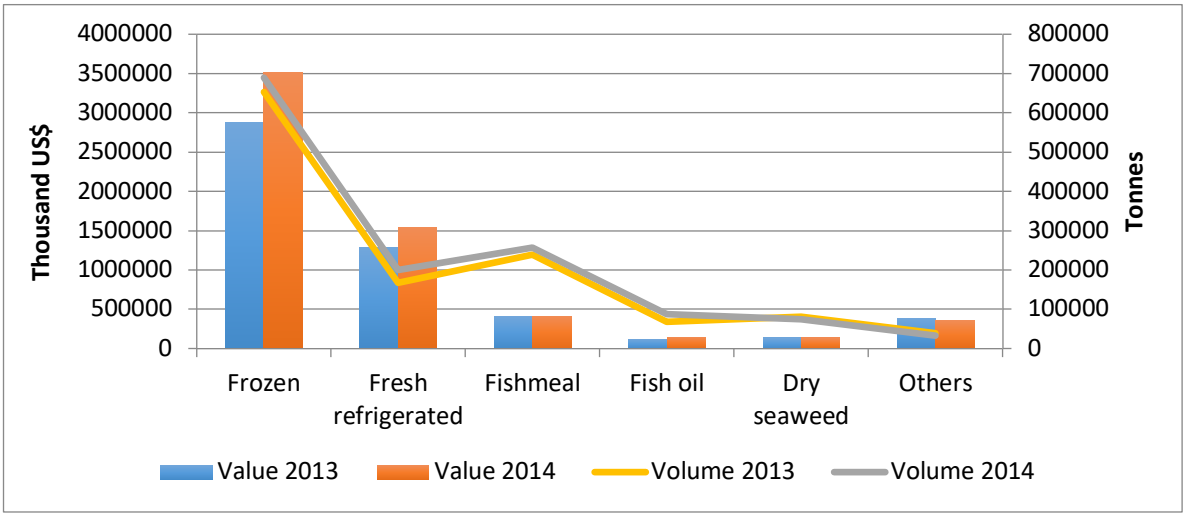

Figure 3. Export participation by product line. Source: Sernapesca

Of the 93 different types of products exported in 2014, the first eight represent 85.5% of total exports in terms of value. Within this subset, Atlantic salmon is the main resource with a value close to US $ 2.812 million, representing 50% of the total value of fish and aquaculture exports. Rainbow trout is located in second place, with 10.8% of the total value, followed by Pacific salmon, in third place, and below that by the group "pelagic fish" (Table 3).

Table 3. Seafood exports by type of product, 2013-2014. Sources: Customs- IFOP

Type	Value (thousands US$)		Variation (%)
	2013	2014	
Atlantic salmon	2.291.603	3.013.287	31,5
Rainbow trout	760.227	700.782	-7,8
Pacific salmon	459.380	648.723	41,2
Pelagic fish	289.999	346.421	19,5
Mussel	184.589	188.849	2,3
Mackerel	170.386	158.389	-7
Salmonids*	168.012	145.001	-13,7
Giant squid	75.800	115.224	52
Others	897.209	892.728	-0,5
Total	5.241.529	6.164.835	17,6

*King salmon, brown trout, non-specified salmon

Chile's fisheries sector consists of three broad groups: the industrial sector; small-scale or artisanal fishers, including small-scale farmers; and aquaculture (Figure 4). The small-scale or artisanal fishers group includes fishermen owning either small boats (or *lanchas*), with or without engines (Figure 9), or larger boats, with a length of more than 15 m to 18 m and 80 m^3 of capacity (Figure 11). Small-scale farmers are artisanal fishermen mainly engaged in seaweed and mollusc collection.

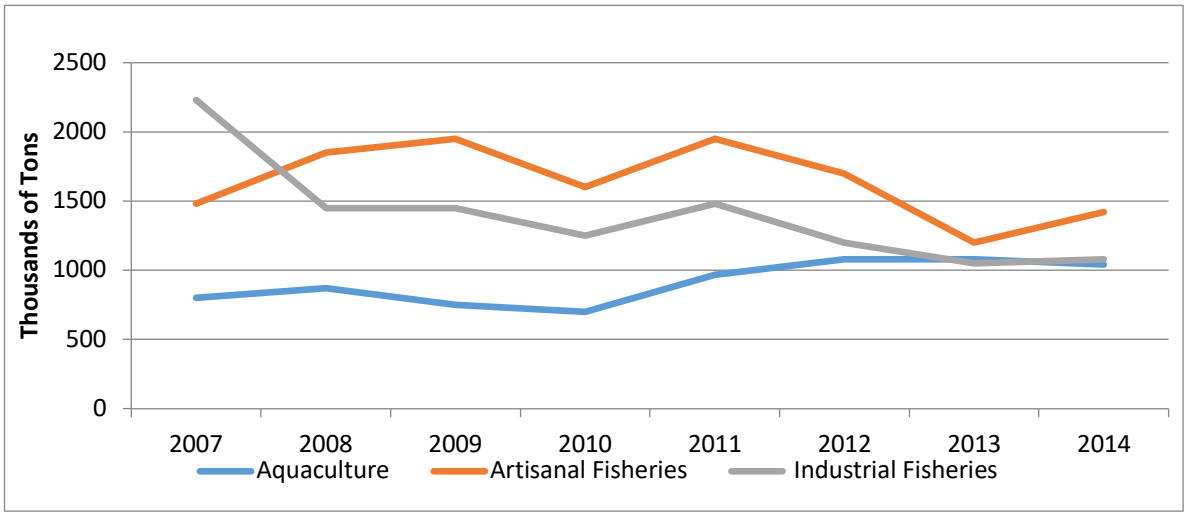

Figure 4. Contribution by sector. Source: Sernapesca

In Chilean terms, artisanal activities are those carried out directly and on a habitual manner by artisanal fishermen duly registered in the National Service of Fisheries and Aquaculture--SERNAPESCA's Registry for Artisanal Fishermen (RPA-*Registro Pesquero Artesanal*). They also include fishing by fishers' organizations composed only of artisanal fishermen, whether they are small-scale fishers or small-scale farmers. In addition, artisanal activities refer to landings from vessels under 18 meters, with a hold capacity not over 80 m^3 and with a gross registry tonnage not exceeding 50 GRT. Industrial fishing activities are those also carried out by individuals or legal persons registered in the Registry for Industrial Fisheries (RPI-*Registro Pesquero Industrial*), normally owning bigger fishing vessels and generally associated with processing facilities on land. This category includes factory vessels, for which specific regulations apply. They might either work in the Chilean EEZ or in international waters.

2.1. Industrial Fisheries

Industrial fishing refers to the activity performed by vessels of overall length exceeding 18 meters, with technologized fishing systems, such as trawls, longlines and purse seines that allow for mass capture of a wide variety of fishery resources (Figure 5 and Figure 6). This activity takes place in territorial waters outside the exclusive area reserved for artisanal fishing (corresponding to the first five nautical miles measured from the shoreline or the inland waters of the national maritime territory). Until 2012, industrial fisheries were regulated by Law N° 19.713 of Maximum Catch Limit per Shipowner (LMCA) and its amendments. This allocation mechanism distributed the annual total allowable catch established for the industrial sector in each fisheries unit subject to a management system, among the shipowners registered in the respective fishery. The current General Law of Fisheries and Aquaculture (LGPA) replaced the LMCA, allowing shipowners the option to change their fishing authorizations to A-class Tradable Fishing Licenses (LTP). With the new legislation for fisheries and aquaculture, tendering procedures for industrial fisheries for a 20-year period were established. These procedures are renewable and legal rules that apply to their expiration, divisiblity, and transferrance.

Figure 5. A Chilean Industrial Trawler. ©J. Unibazo

Figure 6. A Chilean Industrial Purse Seiner. ©J. Unibazo

The main pelagic resources extracted by this sector in the country are the anchovy, sardine and mackerel, which are mostly processed for fishmeal production. In addition, demersal resources are targeted by industrial fisheries such as hake, southern hake and three fins hake; deepwater resources such as Chilean seabass (Patagonian toothfish or *bacalao de profundidad*) and hoki; and crustaceans such as yellow and red shrimp. In addition to the extractive sector, industrial activity also includes processing plants, which uses the resources extracted by the various fishing fleets as raw material.

The industrial landings in 2014 reached a total figure of around 1082 tonnes, representing a slight decline from 2013. Pelagic fish (89%), demersal fish (6%) and pelagic molluscs (5%) compose this landing (Figure 7) (SERNAPESCA, 2015).

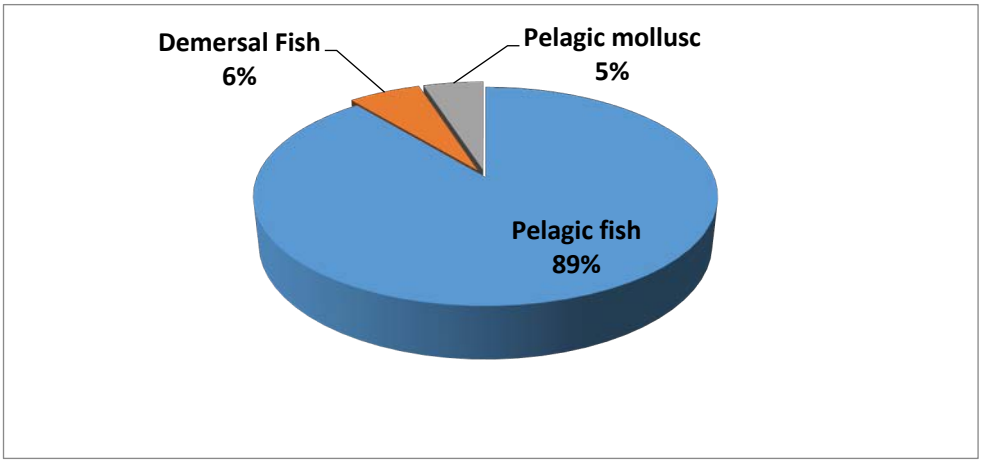

Figure 7. Industrial Landings Composition 2014. Source: Sernapesca.

2.1.1. Private Organizations

The main industrial fisheries associations in Chile are:

- **The South Austral Fisheries Federation (FIPES).** Established in 1992 to promote the rational use of existing aquatic resources in the fishing macrozone of the X, XI and XII Regions. Three fishing companies are part of this federation.

- **The Fishing Industry Association (ASIPES).** Established in 1950 with the main objectives of promoting the development of industrial fisheries, ensuring the preservation of species and enforcing, through their actions, the views of the fishing industry to the authorities, public agencies and government bodies. Nine fishing companies are part of this association (*see* http://www.asipes.cl/conocenos/).

- **The National Fisheries Society (SONAPESCA).** Established in 1947, its aim is to promote the development of policies that encourage and develop fisheries, seeking appropriate solutions to fishing problems through dialogue and collaboration with the authorities. This society comprises eight partners (*see* https://www.sonapesca.cl/gremios-socios/).

2.1.2. Industrial Fleet

In terms of volume, the Chilean industrial fishing mainly targets pelagic resources both in the North and in Central parts of the country. In the Northern part, anchovy is the main species captured, followed by jack mackerel and "caballa" mackerel. However, the largest quantities of mackerel and sardine are caught in Central and Southern Chile. Jack mackerel and 'caballa' mackerel are also caught in increasing volumes outside the Chilean EEZ, a relatively recent development that has required big boats with adequate autonomy and refrigeration capacities. The rest of the industrial fishing fleet is composed of the operation of several factory vessels, which are allowed to fish only in the extreme south of Chile and in international waters. They are mainly responsible for the landing of several types of southern hakes, conger eels and a part of the very valuable Patagonian toothfish or Chilean seabass ('*bacalao de profundidad'*). These fisheries, combined with the production of common hake in Central Chile, and limited amounts of shrimp and prawn, constitute the core of what is called 'industrial activities'.

The structure of the industrial fishing fleet in operation during 2014 is presented in Table 4. Vertically integrated firms normally own industrial vessels, and therefore, most of these boats supply a variety of processing lines owned by the firm, even though occasionally they might supply other processing plants and traders.

Table 4. Industrial Fleet as for 2014. Sources: Sernapesca, RPI.

Type of owner	Operating vessels	Minimum length (m)	Maximum length (m)	Average length (m)	Average capacity (m^3)
Natural person	15	16	35	22,8	105
Limited liability company	13	17	28	19	69
Public limited company	202	21	66	43,6	732

The composition of the industrial fleet in 2014 by fishing gear is shown in Figure 8.

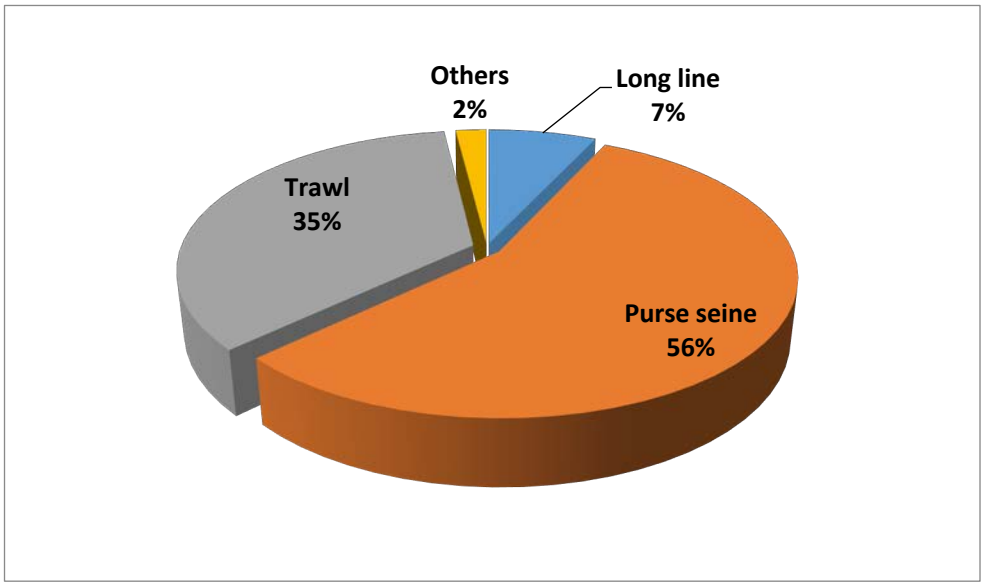

Figure 8. Composition of the Industrial Fleet in 2014. Source: Sernapesca.

2.2. Artisanal or Small-Scale Fisheries

In Chile, small-scale fishing corresponds to an extractive fishing activity carried out by natural or legal persons fishing on a personal, direct and regular basis. This activity can be conducted by vessels up to 18 meters in length and 50 tons of Gross Register Tonnage (GRT) (Figure 9, Figure 10, Figure 11 and Figure 12). A small-scale fisherman is defined as a fisher that operates as shipowner or crew member in a small-scale vessel. A small-scale shipowner has one or two vessels; a diver or shellfish collector conducts extraction activities of shellfish; and an algae collector gathers and dries algae.

Fishermen and their vessels must be included in the Small-Scale Fisheries Registry (RPA) managed by SERNAPESCA with the mandate to exploit a particular species, under one or more categories and in a particular region.

The first five miles from the Chilean coast are reserved for small-scale fisheries. This area is called Reserve Area for Small-Scale Fisheries. Meanwhile, the first mile is for exclusive use by

vessels less than 12 m in length, from the northern limit of the country up to the southern limit of Chiloe Island.

Figure 9. Chilean Artisanal Fleet. ©J. Unibazo

Figure 10. Chilean Artisanal Fleet in *Caleta* Tumbes. ©J. Unibazo

Figure 11. Chilean Artisanal Purse Seiner. ©J. Unibazo

Figure 12. Artisanal purse seiner (left) and artisanal longliner (right). ©J. Unibazo

In the last 20 years, small-scale fisheries have moved from being a traditional and low-technology actors with low contribution to the national economy to being a sector of territorial, regional and national importance, even participating in international markets. Management of its fishing resources has also shown a significant increase (OCDE, 2009).

During 2014, the artisanal sector reported landings for an amount close to 1093 tons, excluding the extraction of seaweed, a 20% increase compared with last year. The artisanal landings consisted of pelagic fish, accounting for 66% of the total, molluscs, representing 22%, crustaceans (3.9%), demersal fish (3.2%) and other species (5.5%) (Figure 13).

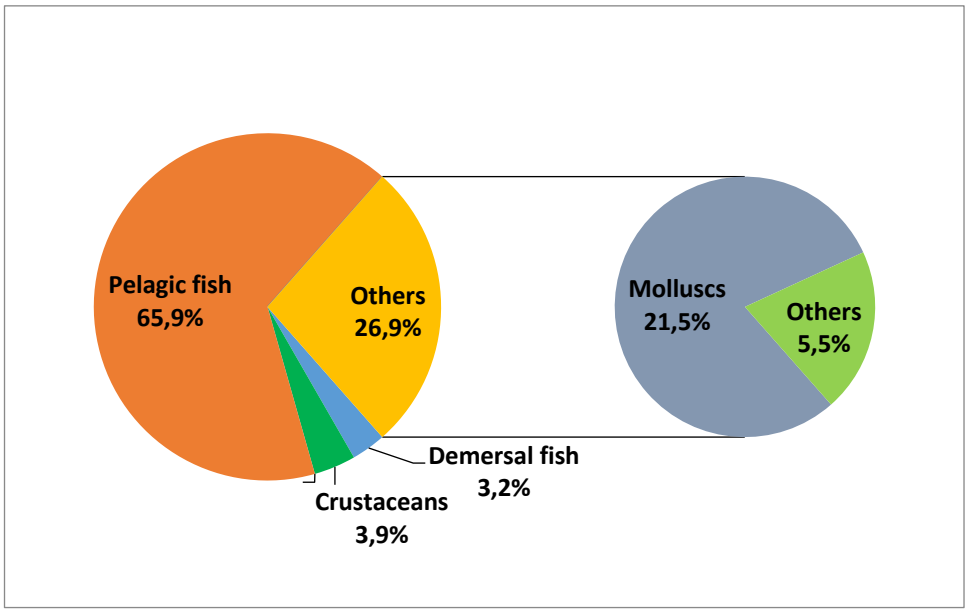

Figure 13. Artisanal Landings Composition 2014. Source Sernapesca.

2.2.1. Artisanal Fishers Associations and Artisanal Landing Ports

Small-scale operators are organized in cooperatives, syndicates and other cooperative structures. At the end of 2014, there were 1131 organizations of this type, 51% of which are found in the Southern part of the country,

Table 5. Artisanal Organizations to December 31, 2014. Source: Sernapesca

Region	N° of Organizations	N° of Members
XV	9	742
I	13	504
II	40	1503
III	48	1876
IV	77	4334
V	64	3620
VI	25	685
VII	42	1598
VIII	252	14258
IX	20	669
XIV	62	2120
X	354	11817
XI	114	2504
XII	11	291
Totals	1131	46521

In Chile, the coastal areas permanently used by artisanal fishermen in the course of their activities are called artisanal landing ports or "*caletas*". According to the Decree-Law N° 240, which establish the official list of registered *caletas* for artisanal fishermen, there are 464 *caletas* along the Chilean coast (Table 6).

Table 6. Caletas along the Chilean coast. Source: Sernapesca

Region	Province	N° of *Caletas*
I	Iquique	10
II	Antofagasta	11
	Tocopilla	7
III	Chañaral	3
	Copiapó	9
	Huasco	9
IV	Elqui	17
	Limarí	6
	Choapa	10
V	Valparaíso	17
	San Antonio	7
	Petorca	5
	Isla de Pascua	5
VI	Cardenal Caro	5
VII	Curicó	4
	Talca	5
	Cauquenes	4
VIII	Ñuble	3
	Concepción	41
	Arauco	31
IX	Cautín	9
X	Llanquihue	49
	Palena	38
	Chiloé	93
	Puerto Montt	1
XI	Aysén	18
	Capitán Prat	1
XII	Tierra del Fuego	1
	Ultima Esperanza	2
	Magallanes	6
	Antártica Chilena	2
XIV	Valdivia	25
	Osorno	8
XV	Arica	2
Total		**464**

GIS information about *caletas* can be found at:

https://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=startdown&id=5654

2.2.2. Artisanal Fleet

At the end of 2014, the RPA had over 12.000 boats registered (Table 7). The South Region (from VIII to XII Regions) is the area where the bulk of the fleet capacity exists, reflecting the availability of coastal fishery resources. Small scale fishers tend to operate with relatively simple craft (81% of the artisanal fleet), with bigger units less abundant. In terms of number of fishermen, approximately 150,000 fishermen are registered at the RPA. Table 8 provides a breakdown of artisanal fishers by occupation.

Table 7. Artisanal fleet to December 31, 2014. Source: Sernapesca.

Region	E1	E2	E3	E4	**Totals**
XV	113	61	17	23	214
I	223	70	10	11	314
II	383	94	6	7	490
III	281	103	33	17	434
IV	748	389	16	19	1172
V	499	400	31	34	964
VI	31	38	0	0	69
VII	140	292	10	17	459
VIII	1398	930	144	381	2853
IX	60	65	17	0	142
XIV	288	101	28	39	456
X	1550	1334	175	74	3133
XI	395	169	11	11	586
XII	138	585	76	20	819
Totals	6247	4631	574	653	12105

E1: boat with a length of up to 8 m and 5 m^3 capacity
E2: boat with a length of more than 8 m to 12 m and 15 m^3 capacity
E3: boat with a length of more than 12 m to 15 m and 45 m^3 of capacity
E4: boat with a length of more than 15 m to 18 m and 80 m^3 capacity

Table 8. Artisanal fishermen as of December 31, 2014. Source: Sernapesca.

Region	Seaweed Collector	Boat Owner	Diver	Fisherman	**Totals**
XV	728	174	107	1129	2138
I	1974	281	328	848	3431
II	2975	431	627	1206	5239
III	3886	383	493	1639	6401
IV	4272	1025	1121	3172	9590
V	3350	804	405	3958	8517
VI	1166	61	64	281	1572
VII	1824	387	140	1942	4293
VIII	17552	2405	2024	14699	36680
IX	1862	123	39	595	2619
XIV	3831	417	661	2045	6954
X	25152	2909	4461	11202	43724
XI	2981	537	694	2411	6623
XII	5284	644	928	4367	11223
Totals	76837	10581	12092	49494	149004

Small-scale production is very asymmetric with regard to fisheries, type of boat and levels of activity and income. Bigger fishing units, although less common in this sector, are landing most of the fish captured, while receiving very high incomes, particularly in the pelagic fisheries with Chilean seabass. In contrast, individual fishers collecting molluscs or algae, or working in small fishing craft, are generally less efficient, can earn substantially less, and may even be unable to support themselves or their families in a sustainable manner in many coastal fisheries. Such fishing activities are often complemented by other work, aimed at improving the income of the fishing household (OCDE, 2009).

Fishing gear used by the artisanal fleet includes five major types: 1) gillnets, surface and bottom; 2) longlines, surface and bottom; 3) hand line; 4) purse seine net, operated from an open boat and 5) traps. It is not possible to individually characterize artisanal fleets by fishing gear, as fishermen can use seasonally different gear depending on the target species. Sometimes artisanal fishermen use more than one gear at a time. Although there is a general pattern in

relation to the use of gear, many fishermen are opportunistic and may work on different boats with different gears, in different seasons and from different ports.

2.3. Aquaculture

Chile is in the top 10 producer countries of farmed seafood in the world (FAO, 2014.). Chile's aquaculture industry is dominated by salmon and trout (primarily Atlantic salmon), although mollusc production (mussels and scallops) has been increasing rapidly in recent years. From the early 1990s, Chile also started farming abalones and turbot, becoming the first nation to do so in Latin America and one of the few that commercially farms marine species in-land in this part of the world. The aquaculture industry now produces over 16 different species (Table 9).

Table 9. Aquaculture production by species to December 2014. Source: Sernapesca.

Type	2013 (t)	2014 (t)	Variation
Atlantic salmon	492.622	610.075	23,8%
Mussel	256.134	236.498	-7,7%
Rainbow trout	144.321	124.468	-13,8%
Pacific salmon	143.540	107.544	-25,1%
Seaweed	12.032	12.369	2,8%
Scallop	4.559	3.883	14,8%
Others	3.612	3.791	5,0%
Pacific oyster	58	89	53,5%
King salmon	986		-100,0%
Total	1.059.877	1.100.731	

In Chile, there are currently 3,300 aquaculture concessions. Species mainly include salmonids, mussels, scallops, abalones and more recently algae, among others (*see* http://www.subpesca.cl/portal/619/w3-article-92935.html).

Marine sites for salmon farming are concentrated in the X and XI Regions of Chile (Figure 14). However, increasing amounts of farmed fish are being produced further south, in the XII Region. Marine salmon farms were initially established in protected bays and areas, 20-45 meters deep.

As the level of production per site grew and annual harvest surpassed the 1000-3000 tonnes, farmers started moving to deeper, more exposed and more distant sites, including a number of areas that were originally neglected because of poor infrastructure.

Figure 14. Salmon farm site located in the inland sea of Chiloé.
©Luis Outeiro

Average farming capacities per site and total production per firm have grown throughout the years, and today overall output is concentrated in a smaller number of enterprises. Farming on marine sites in Chile can only take place in authorized areas which are included in zones previously approved by and locally named, Aquaculture Authorized Areas (AAA). Approved areas for the X and XI Regions, where most farming activities take place, amount to 860.500 hectares, 10.200 out of which are occupied by salmon farms (1.2% of totals: 2.8% and 0.6% of available space in the X and XI Regions, respectively). Chile is the second largest salmon producer in the world after Norway with a production in 2014 of 610.000 tons of Atlantic salmon, 124.500 ton of trout and 107.500 tons of Pacific salmon (See http://www.sernapesca.cl/informes/estadisticas).

Mussel (*Mtyilus chilensis*) farming has grown dramatically since 1998-1999, following the arrival of Spanish enterprises that introduced new technologies and opened the gateway to exports. Nowadays, mussels are the second major aquaculture product in Chile, the 3rd biggest

producer in the world after China and Spain (OCDE, 2009). Mussel farming is currently performed in the south of Chile and handled by small, medium-sized and large producers, most of whom sell directly from farm to big processing plants that have a significant surplus capacity. Processing lines are the property of big companies, most of which have only recently started to farm their own mussels. They are likely to continue buying from small and medium-size producers in the short and medium term. The total Chilean production of farmed mussels in 2014 was 244.200 tons.

Other mollusc species produced in Chile, mainly in the north, is the scallop, and its total production in 2014 was 3.900 tons.

To date, commercial macro algae production is almost exclusively restricted to *Gracilaria* algae, largely in the hands of small-scale farmers, primarily located in southern Chile. This crop has shown many ups and downs throughout the years, and its future is still uncertain due to the high level of market volatility. The technology for this crop is well known and not considered a limiting factor, as is the context around natural environmental conditions and the availability of sites. The total production of algae in 2014 was 12.400 tons.

Figure 15 shows the aquaculture production by type of resources.

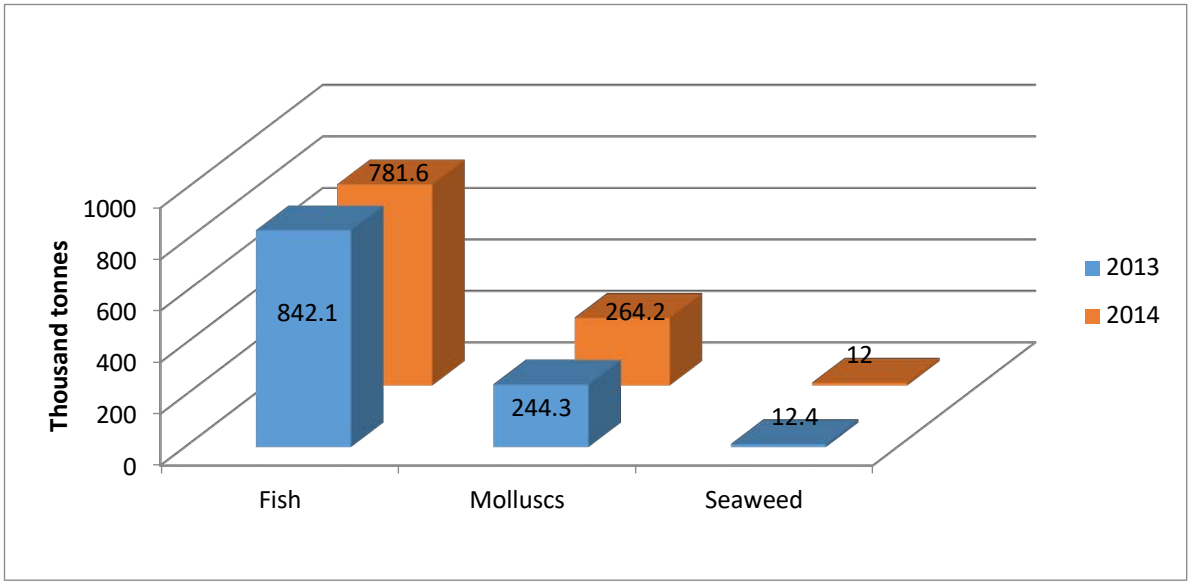

Figure 15. Aquaculture production by type of resources. Source: Sernapesca.

3. Legal Framework of Fisheries

Chile has a well-established governance system in place for fisheries and aquaculture activities, both in the public and private sectors. In broad terms, the State, which represents the public interests and views, sets the basic rules for these activities as they are undertaken either in public waters or refer to common property renewable resources. In turn, the private industrial sector has well organized institutions representing their own interests, while artisanal fishermen also have strong representative associations that operate on their behalf. These parties, working separately and together, focus on local and international issues, and are responsible for the sustainability of the available natural resources and the environment, social development and maximization of wealth accrued by all parties directly involved (OCDE, 2009).

Chilean fisheries and aquaculture are primarily governed by the General Law of Fisheries and Aquaculture (LGPA) - Law 18.892 of 1989 and its amendments, and several other legal bodies and administrative procedures.

3.1. Fishing Governance and Institutions

Chilean fishing and aquaculture activities are governed by the Ministry of Economy, Development and Tourism, through its executive policy-making body, the Undersecretariat for Fisheries and Aquaculture (SUBPESCA), which has a control and enforcement body, the National Fisheries and Aquaculture Service (SERNAPESCA). It is assisted by the Fisheries Research Institute (IFOP), which supplies the basic information and analysis required to develop management proposals and recommendations.

Structure of the Ministry of Economy, Development and Tourism.

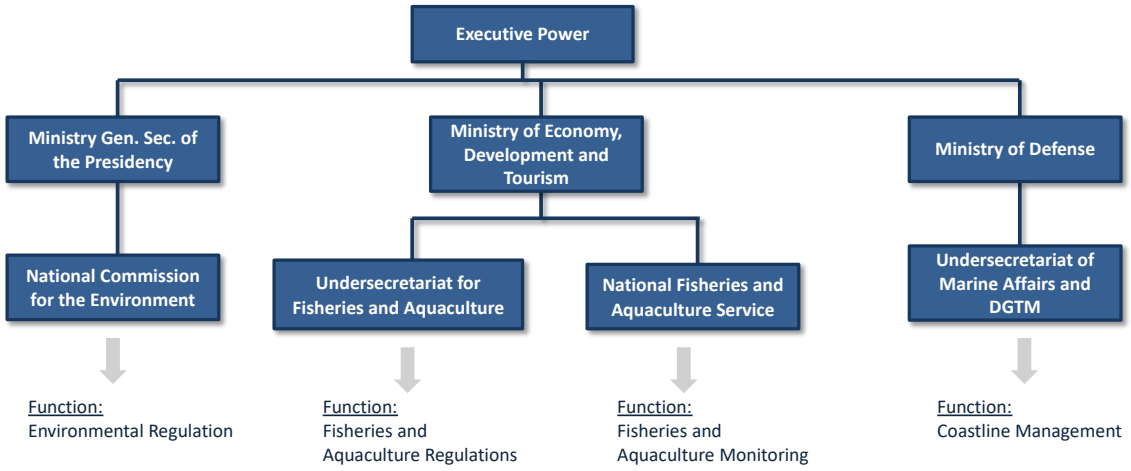

Figure 16 shows the organizational structure of the Ministry of Economy, Development and Tourism.

Structure of the Ministry of Economy, Development and Tourism.

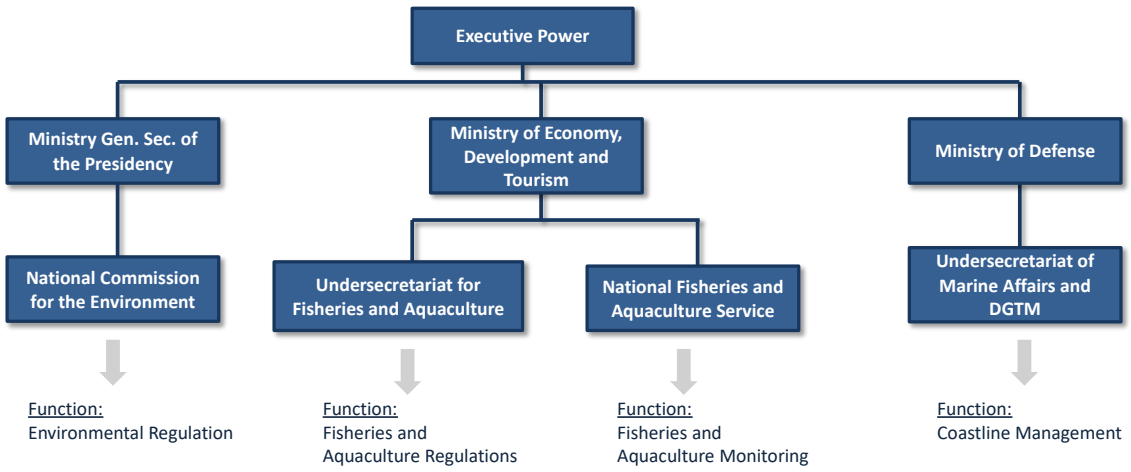

Figure 16. Structure of the Ministry of Economy, Development and Tourism.

3.1.1. Undersecretariat for Fisheries and Aquaculture (SUBPESCA)

The Undersecretariat for Fisheries and Aquaculture (*Subsecretaría de Pesca y Acuicultura* or SUBPESCA) is the principal executive authority responsible for fisheries and aquaculture. It is one of the two Sub-Secretariats of the Ministry of Economy, Development and Tourism, and was formally created in 1976 (Decree-Law 1.626). It is headed by the Undersecretary, who reports directly to the Minister of Economy, and is named by the President (

Undersecretariat for Fisheries and Aquaculture.

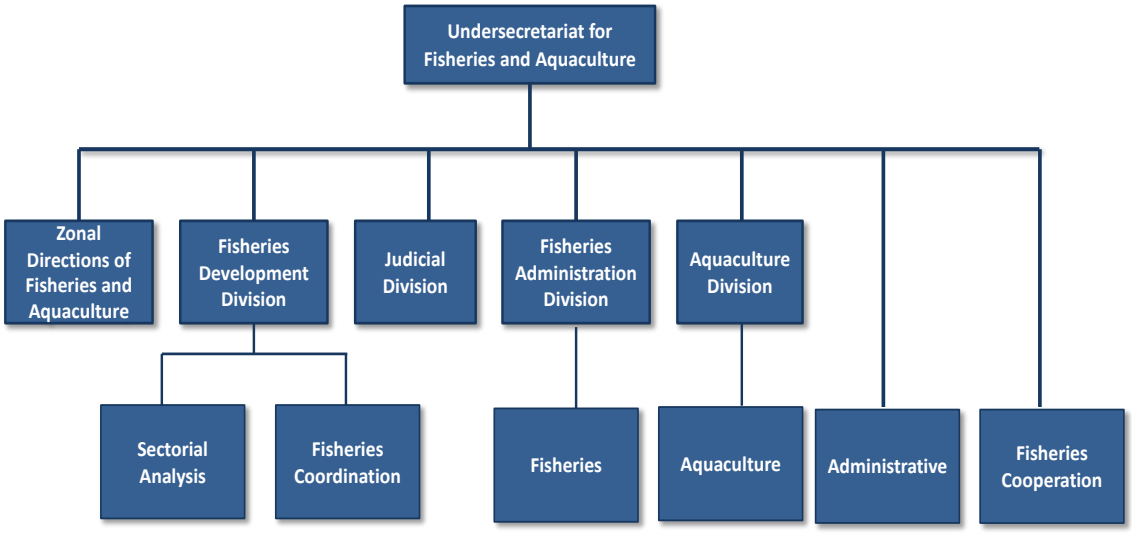

Figure 17SUBPESCA's functions and budget were defined and regulated under Decree-Law 2.442 in 1978. Prior to the formation of SUBPESCA, fishing activities were regulated by the Ministry of Agriculture. SUBPESCA's mission is to regulate and manage fisheries and aquaculture activities through management policies, regulations and measures supported by technical reports based on scientific research and social and economic variables. This mission has a participatory and territorial approach aimed at the sustainable development of national fisheries and aquaculture. In order to fulfill its regulatory role, the Undersecretariat for Fisheries and Aquaculture is composed of 150 officials with its headquarters located in Valparaíso, as well as an office in Santiago for inter-institutional coordination. It also has eight Regional Directorates located throughout the country.

Undersecretariat for Fisheries and Aquaculture.

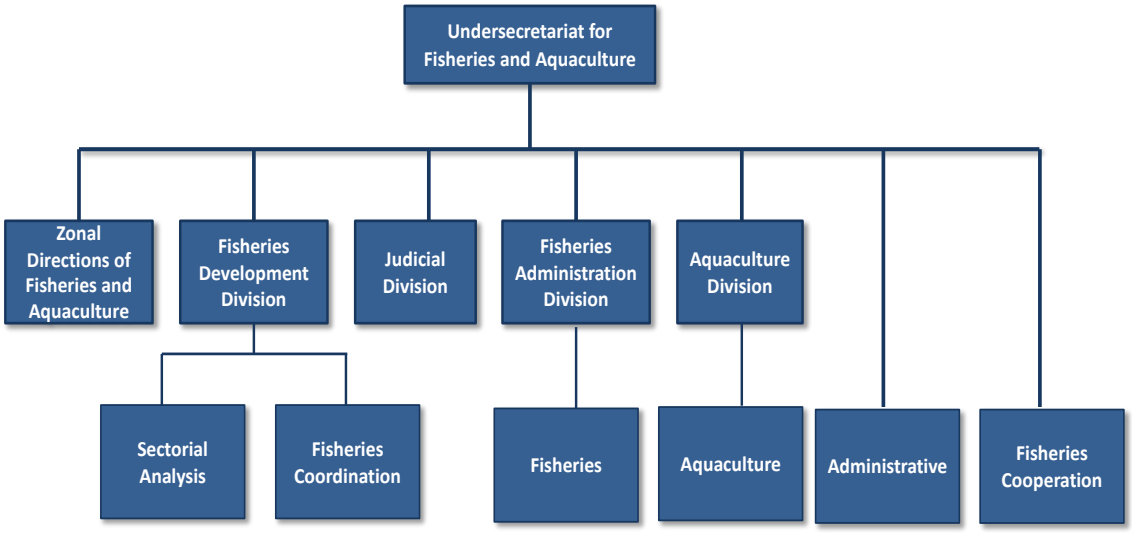

Figure 17. Organizational structure of the Undersecretariat for Fisheries and Aquaculture.

3.1.2. The National Fisheries and Aquaculture Service (SERNAPESCA)

Created by Decree-Law 2.442 of 1978, and with its structure modified by Decree Law (DFL) 1 of 1992, the National Fisheries and Aquaculture Service (or SERNAPESCA) is headed by a National Director and falls under the direction of the Minister of Economy; it is therefore detached from SUBPESCA's direct supervision (Figure 18).

Unlike SUBPESCA, this is a regionalized service, with direct representatives, personnel and offices in all Chilean Regions. Its head office is in Valparaíso and it has 45 offices spread along

the coastline of Chile including two island offices (Easter Island and Juan Fernandez) and a Coordination Office located in Santiago. In 2014, it had a staff of 753 individuals. Its mission is to monitor the compliance with fisheries and aquaculture regulations, provide the services to facilitate their proper implementation and conduct effective sanitary management in order to contribute to the sustainability of the sector and the protection of the aquatic resources and their environment. The dual institutional structure of SUBPESCA and SERNAPESCA requires strong coordination between the two bodies.

National Fisheries and Aquaculture Service

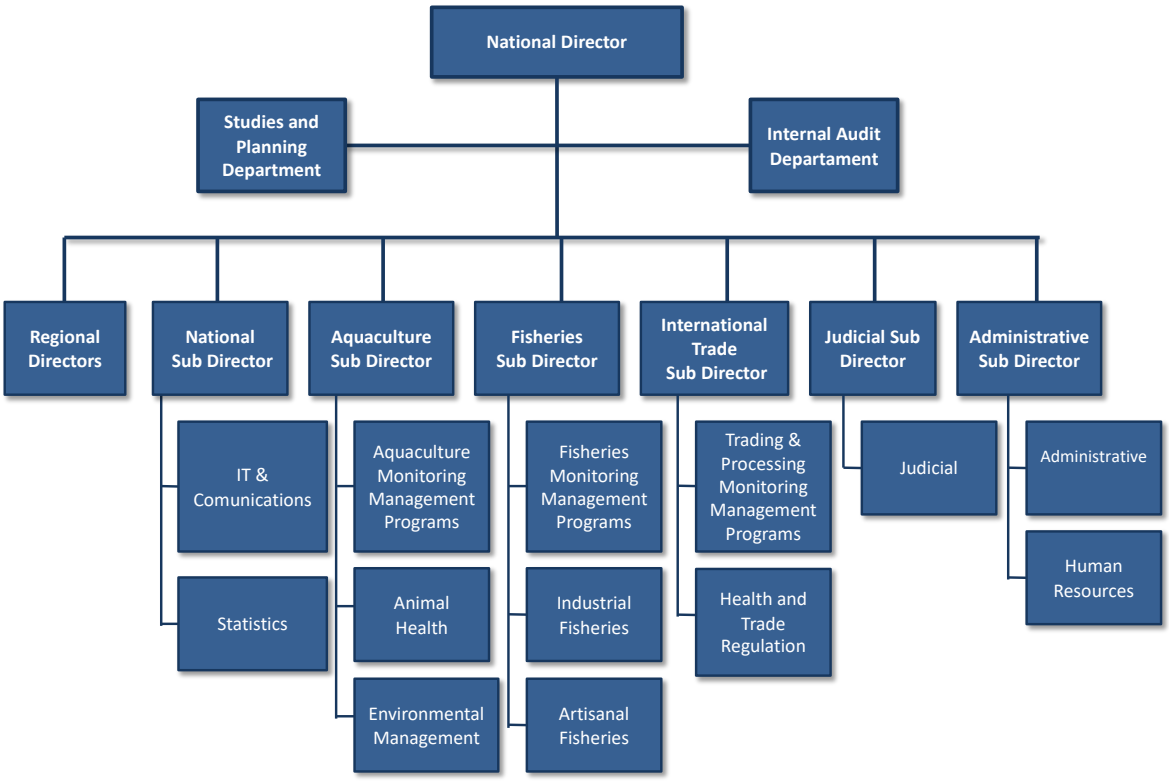

Figure 18. Organizational structure of the National Fisheries and Aquaculture Service.

3.1.3. Fisheries Research Institute (IFOP)

The Fisheries Research Institute (IFOP) is a non-profit corporation created in 1964 by CORFO (Corporation for the Promotion of Production from the Ministry of Economy) and the National Fisheries Association, SONAPESCA (a corporation representing the private sector's interests in

fisheries and aquaculture) through a technical assistance agreement between the Chilean Government, the FAO and UNDP of the United Nations (Figure 19). Originally aimed at promoting fisheries development, IFOP is now the main government agency in charge of providing background information, analysis, and proposals to support the regulation of fisheries and aquaculture activities, and to undertake research to preserve wild fisheries resources and the environment. Its contributions are essential to SUBPESCA, which relies on IFOP's advice to develop management strategies for local fisheries and aquaculture.

The mission of IFOP is to be the provider of scientific and technical advice for the regulation of fisheries and aquaculture, as well as the conservation of aquatic species and their ecosystems. This is achieved through the following strategic objectives:

- Evaluate, diagnose and recommend sustainable total allowable catches for the main aquatic living resources, subject to industrial and small-scale activities, through monitoring, direct evaluations and the study of the fishing oceanographic conditions.
- Evaluate, diagnose and recommend actions directed to the preservation and sustainability of aquaculture, from the environmental and sanitary points of view, through the monitoring of the activity and oceanographic behavior.
- Promote and develop the scientific and technical excellence needed to provide advice regarding fisheries and aquaculture management, together with the capacity building of the research and technical staff.
- Inform society of the concepts of responsible fishing and aquaculture and the sustainable development of fisheries.

IFOP's headquarters are located in Valparaiso, and it has several regional stations. It is headed by an Executive Director, and employs 451 scientists and administrative personnel, based in 17 regional offices, and stationed in 37 different locations. It is directed by a Directive Council, which is normally led by the Undersecretary of Fisheries.

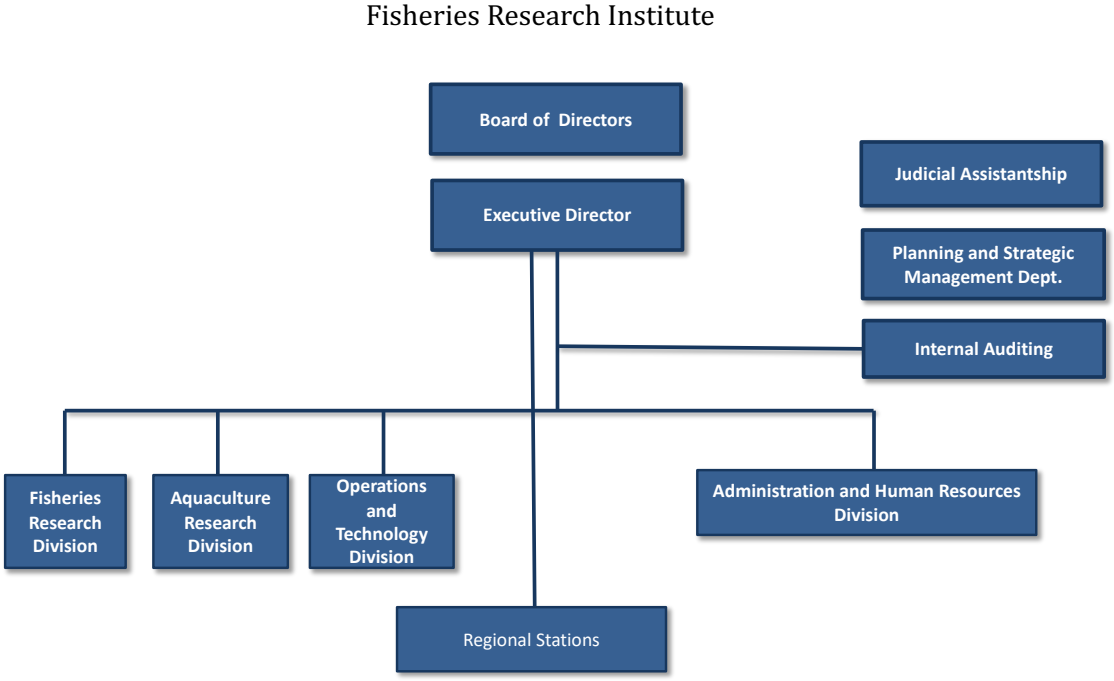

Figure 19. Organizational structure of the Fisheries Research Institute.

3.1.4. Other Institutional Bodies

Other institutional bodies involved in the various aspects of fishing in Chile are:

- Fisheries Management Fund (FAP)

Seeks the promotion and development of fishery activities in a sustainable manner through promoting instruments and social intervention with a territorial approach.

- Fisheries and Aquaculture Research Fund (FIP)

The General Law on Fisheries and Aquaculture established this fund in 1991 aimed at financing studies required to base the adoption of measures for managing fishery and aquaculture

activities. These management measures are aimed at the conservation of aquatic living resources, taking into account biological, fishing, economic, and social aspects.

- Scientific Technical Committees

Advisory/Consultative bodies of SUBPESCA on relevant scientific subjects for fisheries and aquaculture management were created under Law N° 20.657.

- Management Committees

Advisory/Consultative bodies of the fishing authority include the main stakeholders of each fishery as well as officials from SUBPESCA and SERNAPESCA.

- National Aquaculture Commission

The National Aquaculture Commission is a public-private body advising the President of the Republic regarding the development and assessment of the actions, measures and aquaculture programs required.

- National Fisheries Council (CNP)

The National Fisheries Council contributes to the effective participation of fisheries stakeholders at a national level regarding fisheries and aquaculture activities. It is an operative, advisory and consultative body with regard to the subjects established by the law. Its opinions, recommendations, proposals and technical reports are submitted to SUBPESCA on all those subjects stated by the law as well as any other of interest to the sector. The National Fisheries Council has its headquarters in Valparaíso.

- Regional Fisheries Councils

With the enactment of the Law N° 20.256, the Regional Fisheries Directorates became a functional part of SUBPESCA. Currently, there are eight directorates covering stakeholders in these regions. These Directorates are located in Iquique, Coquimbo, Constitución, Concepción, Valdivia, Puerto Montt, Aysén and Punta Arenas.

- Regional Councils for Recreational Fishing

These Regional Councils act as advisory bodies for promoting and developing recreational fishing activities at the regional level.

Aquaculture is regulated entirely by the General Law of Fisheries and Aquaculture (LGPA), which sets out the legal framework for the import of aquatic living resources, access to aquaculture areas, concessions, environmental and health conditions for its implementation, regulations to conduct aquaculture for ornamental or scientific purposes, infractions and sanction system.

Different State institutions play different roles in the aquaculture activity:

- SUBPESCA regulates the activity and establishes the technical conditions under which this activity can be conducted.
- The Undersecretariat of the Armed Forces grants the aquaculture concessions and dictates the appropriate areas for exercise of the activity.
- The Environmental Assessment Service participates in the environmental assessment of the projects.
- SERNAPESCA and the General Directorate of Maritime Territory and Marine Merchant carry out monitoring work.

3.2. Regulations Related to Conservation and Bycatch in Fisheries

Current Chilean regulations related with conservation and bycatch in fisheries are detailed, below.

3.2.1. Mammals, Birds and Marine Reptiles

Chile adopted the protection of marine mammals, penguins and marine reptiles (sea turtles and marine snakes) in 1995 by the Decree-Law N°225 of the Ministry of Economy. The Decree establishes an extractive ban, for a period of 30 years, from November 1995, for 55 species of marine mammals (cetaceans, pinnipeds and mustelids), 10 species of penguins and 5 species of marine reptiles, among these, 4 species of turtles. By this Decree, hunting, capture, possession, transportation, marketing and maintenance in captivity of any cetacean, and the possession, transport, sale or storage of any part of it is prohibited.

3.2.2. Cetaceans

In addition to the Decree-Law N°225, Chile has specific regulations for the protection of cetaceans in national waters.

- **Decree-Law Nº179, June 2, 2008:** Establishes a permanent ban on the capture resulting in death and retention of live specimens of cetacean species present in waters under national jurisdiction. Likewise, it also permanently forbids the marketing, transportation, processing and storage of these species.

- **Decree-Law Nº230, June 20, 2008**: Declares the cetacean species that live within the limits of the national jurisdiction or that cross those limits a "natural monument."

- **Law Nº20.293, October 14, 2008 of the Ministry of Economy**: Declares the maritime areas of sovereignty and national jurisdiction as a whaling-free zone.

3.2.3. Sea Turtles

In 2010, Chile signed the Accession to the Inter-American Convention for the Protection and Conservation of Sea Turtles. The importance of this Convention is the protection bestowed to sea turtles in habitats important for different stages of their lives. Included in the measures mandated by the text of the Convention, the signatory countries have the obligation to comply with the following:

- The capture, retention or incidental capture of sea turtles is forbidden, as well as domestic commerce with their eggs, parts or products.
- The compliance under the CITES Convention in regard to international trade of sea turtles, their eggs, parts or products (such as hawksbill shell).
- The restriction of human activities that may adversely affect sea turtles during their reproduction, incubation and migration stages.

- The protection and conservation of sea turtles, the restoration of their habitat and those sites established and designated as protected areas, as pertinent.
- Support for research directed at experimental reproduction, breeding and re-introduction.
- The promotion of environmental education and the dissemination of information, with the objective to foster the participation of governmental institutions, NGOs and the public at large.
- The reduction to the possible minimum of capturing, wounding or incidental capturing of sea turtles during fishing activities, as well as the development, improvement and utilization of fishing gear, devices and appropriate techniques, including Turtle Excluder Devices (known as TEDs).

3.2.4. Sharks

Chile does not have specific regulations for the protection of sharks but, in 2006, SUBPESCA developed the "National Action Plan for the Conservation of Sharks (Plan Tiburones–Chile)" with the objective to ensure the conservation of the national biodiversity of *Chondrichthyes* (sharks, rays and chimaeras) and the sustainable long-term use of fisheries targeting these species. The plan was designed as a planning and management tool, consisting of thirty objectives that respond to six lines of action or areas considered relevant to national fisheries development: conservation; access and allocation; governance; monitoring, control, surveillance and a system of sanctions; research and supporting institutions. The plan aims to minimize bycatch and discards of species of *Chondrichthyes* in the Chilean fisheries, implementing systems or devices for that purpose.

In 2011, the General Law of Fisheries and Aquaculture (LGPA) was modified for the Law N° 20.525 to integrate the Article 5° *bis*, which establishes the prohibition of finning (mutilation of the fins) on any shark species on board or during transhipment. According to this law, it is mandatory to land any shark species with its fins fully or partially attached to its body.

3.2.5. Sea Lions

Current regulations applicable to common sea lions (*Otaria flavescens*) correspond to a ban on their extraction from 2009 (Decree-Law MINECON / SUBPESCA No.1892-1809, as amended). This ban only allows for an annual catch of 200 live specimens for purposes of public display in zoos in the country or abroad, and only after it has been approved by Sernapesca following the capture protocol detailed in Decree-Law No. 115/12. Every three years the Chilean government evaluates the extractive ban and, so far, its term has always been renewed, although the population of common sea lions is still growing. The law also accepts the maximum annual capture of 60 individuals for customary use, in order to keep the ancestral traditions of the Kawashkar Indigenous Community alive, who inhabit the XII Region.

(*Note*: Currently, the law is not popular due to the sea lion`s interaction with the artisanal fisheries and salmon farms, so there is pressure to allow the hunting of this resource, in order to control their population.)

Table 10 summarizes the relevant laws under national regulations regarding protection of species that may be involved in interactions with fisheries.

Table 10. Relevant regulations regarding the protection of species that may interact with fisheries.

ISSUE	REGULATION
Extractive national ban for a period of 30 years from the date of publication of this decree, on species listed.	Exempt Decree No. 225, 1995
Declared cetacean species in Chile as a natural monument.	Decree-Law No. 230, June 20, 2008
Prohibition of catching cetacean species.	Decree-Law No. 179, June 2, 2008
Prohibition of whaling.	Law No. 20.293, October 14, 2008
Extractive ban for the common sea lion.	Decree-Law No. 1892-1809, as amended
Prohibition of mutilation of the fins of any species of shark.	Law No. 20.525, 2011

3.2.6. Other Laws

- **Law. 20.625, from the Ministry of Economy, Development and Tourism; SUBPESCA, September 2012**

This law establishes a mandate to return marine mammals, reptiles, penguins and other marine birds to the sea, unless they are severely damaged or injured, in which case they shall be retained on board and sent to a rehabilitation center for aquatic species. It also states that vessels having a length equal to or greater than 15 meters shall install on board, and operate throughout the fishing trip, an image-recording device to detect and record any discard action that may occur on board.

This law defines the discard of aquatic species and sets out control measures and sanctions for those who engage in such practices in fishing operations.

The laws introduce definitions for:

- **Discard**: The act of returning marine species caught to the sea.
- **Bycatch**: The catch of species that are not part of the accompanying fauna and consist of marine reptiles, seabirds and marine mammals.
- **Scientific Observer:** Natural person designated by SUBPESCA responsible for monitoring and data collection on board fishing vessels, landing sites and in processing plants, exclusively for conservation and management research purposes of aquatic resources.

SUBPESCA is mandated to approve, through resolution and a technical report, for one or more target species and accompanying fauna, a research program to gather technical information that would enable developing a discard reduction plan of the target species and the accompanying fauna (the bycatch). Such a research program must include, at least, the quantification of discards; identification of causes, including how they occurred and the means for recording this information, and other research information collected by the scientific observers. The program will last no less than two years and shall include a proposal of measures aimed at the reduction of discards of the target species as well as accompanying fauna (bycatch). Within a maximum period of three years of implementation of the research program,

SUBPESCA will establish a plan to reduce discards of the target species as well as accompanying fauna (bycatch) which shall contain, at least, the following elements:

- The management and conservation measures and technological means to reduce discarding of target species as well as accompanying fauna (bycatch)
- A monitoring plan
- An assessment of the measures taken to reduce discarding target species as well as accompanying fauna (bycatch)
- A training program.

The reduction plan should consider a code of good practice in fishing operations as an additional mitigation measure. It may also consider incentives for innovation in systems and gear, aiming to mitigate or reduce discarding of target species as well as accompanying fauna (bycatch).

The law establishes that SUBPESCA will annually generate the list of target species and its accompanying fauna and bycatch that are subject to the research program referred to in this law. The species that are currently under the Scientific Observer research program are:

- Common hake *(Merluccius gayi gayi)*
- Hoki *(Macruronus magellanicus)*
- Southern hake *(Merluccius australis)*
- Three fins hake (*Micromesistius australis*)
- Conger eel (*Genypterus blacodes*)
- Jack mackerel *(Trachurus murphyi)*
- Patagonian toothfish *(Dissostichus eleginoides)*
- Sardine (*Sardinops sagax sagax*)
- Anchovy *(Engraulis ringens)*

The research program was extended to 29th March 2016, after which SUBPESCA will define the reduction plan accordingly.

More info is provided at https://www.youtube.com/watch?v=rTf1EAS3Pcc.

- **Law D.S. N° 136-07 (D.O. 20-02-08)**

This law approves the National Action Plan for Reducing Incidental Catch of Birds in Longline Fisheries; it follows the International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-SEABIRDS), developed by FAO in 1998.

- **Law D.S. N° 38-2011 General Regulation for the Observation of Mammals, Reptiles and Sea Birds, and the Recording of Whale Watching**

This law aims to establish the procedures and general requirements for observation of mammals, reptiles and sea birds as well as documentation of the effects from whale watching.

3.2.7. Marine Parks and Marine Reserves

In 1991, the General Law of Fisheries and Aquaculture (LGPA) conferred to SERNAPESCA the authority to declare areas of conservation and management of aquatic resources. Thus, the latter can declare two types of protected areas established by Supreme Decree of the Ministry of the Environment:

- **Marine reserve.** A safeguarded area of aquatic resources in order to protect, by management, spawning grounds, fishing grounds and areas of repopulation. These areas remain under the custody of SERNAPESCA, and within them fisheries extractive activities can be allowed for transitional periods only by a prior resolution of SUBPESCA (Title I, Article 2, paragraph 42).
- **Marine parks.** Specific and limited areas to preserve ecological units of interest to science intended to safeguard areas for the maintenance and diversity of aquatic species, as well as their habitats. Marine parks remain under the custody of SERNAPESCA, and, in them, no activity can occur except those that are authorized for the purposes of observation, research or study (Title II, Article 3, letter d).

Currently, there are two marine parks and five marine reserves. They are detailed in Table 11.

Table 11. Parks and marine reserves under the custody of Sernapesca. Source: Sernapesca.

Type	Name	Location	Region	Area	Target Resource	Law
Marine Reserve	La Rinconada	Caleta Vieja	Antofagasta	331,61 (Ha)	Scallop	N° 522/1997
Marine Reserve	Isla Chañaral	Isla Chañaral	Atacama	2894 (Ha)	Loco, Limpet, Sea Urchin, Chilean Kelp, Bottle-nosed Dolphin, Marine otter, Humboldt penguin	N° 150/2005
Marine Reserve	Isla Choros y Damas	Isla Choros y Damas	Coquimbo	3863 (Ha)	Loco, Limpet, Sea Urchin, Chilean Kelp, Bottle-nosed Dolphin, Marine otter, Humboldt penguin	N° 151/2005
Marine Reserve	Pullinque	Estero de Quetelmahue	Los Lagos	740 (Ha)	Chilean Oyster	N° 133/2004
Marine Reserve	Putemún	Estero de Castro	Los Lagos	751 (Ha)	Giant mussel	N° 134/2004
Marine Park	Motu Motiro Hiva	Islas Salas y Gómez	Valparaíso	150.000 (Km^2)	Marine Ecosystems, Seamounts, Aquatic Biota	D.S. 235/2010
Marine Park	Francisco Coloane	Isla Carlos III	Magallanes	1506 (Ha)	Humpback whale, Magellanic penguin, Common Sealion	D.S.276/2003

3.3. International Fisheries and Conservation Agreements

The international meetings, conferences, agreements and conventions in which Chile is involved are:

- United Nations
  - Resolution on Sustainable Fisheries
  - Resolution on Oceans and the Law of the Sea
  - Third Review Conference on the 1995 Fish Stocks Agreement or the New York Agreement
  - Regular Process for the Marine Environment Assessment
  - Biological Diversity Beyond Areas of National Jurisdiction
  - United Nations Conference on Environment and Development
  - United Nations Convention on the Law of the Sea (UNCLOS)
- South Pacific Regional Fisheries Marine Organization (SPRFMO)
- The Antarctic Treaty
- Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
- Convention for the Conservation of Antarctic Seals
- Convention for the Protection of Flora, Fauna and Scenic Views of 1967
- Convention on Biological Diversity

- RAMSAR Convention on Wetland
- Convention on the Conservation of Migratory Species of Wild Animals (CMS)
- FAO Committee on Fisheries
- OECD Committee for Fisheries
- Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas
- Convention for the Environmental Protection of Coastal Zones in the Pacific South East
- Discussions on Illegal, Unreported and Unregulated Fishing (IUU)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- International Maritime Organization (IMO)
- Inter-American Convention for the Protection and Conservation of Sea Turtles (CIT)
- Agreement for the Conservation of Albatrosses and Petrels, ACAP
- The International Whaling Commission (IWC)
- Permanent Commission for the South Pacific (CPPS)
- Asia-Pacific Economic Cooperation (APEC)
- World Organization for Animal Health (OIE)
- Meetings with Salmon Producing Countries
- Aquaculture Network for the Americas (RAA)

3.3.1. Review of Some Individual Agreements

- ***The Antarctic Treaty***

Locally enacted in 1961 through Decree 361 (Foreign Affairs), this agreement was originally signed by 13 countries in 1959, including Chile, and aims at ensuring that the continent of the Antarctic be used for peaceful purposes only, favoring international co-operation and scientific research, while preventing actions that may lead to international disputes.

- ***Convention for the protection of flora, fauna and scenic views***

This agreement, enacted through Decree 531 of 1967 (Foreign Affairs) aims at preserving America's flora and fauna from extinction, and asserts that areas of extraordinary scenic beauty, geological, historic or scientific interests neither be threatened nor irrationally intervened.

- ***Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES***

This agreement was approved through Decree Law 873 of 1975, and was enacted as a law by Decree 141 (Foreign Affairs) in the same year. It aims to control international trade in endangered species.

- ***The International Whaling Commission***

The International Whaling Commission (IWC) is an international body set up by the terms of the International Convention for the Regulation of Whaling (ICRW) which was signed by fourteen countries – among them, Chile – in Washington on 2 December 1946 to "provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry". This Convention was only enacted locally in 1979, through Decree 2.700 (Foreign Affairs).

- ***Convention for the Conservation of Antarctic Seals***

Dating from 1978, this complements the Antarctic Treaty. It was officially enacted in Chile by Decree 191 of 1980 (Foreign Affairs), to protect Antarctic seals and balance local ecosystems. Through it, capture areas are designated, and closed seasons established. No related commercial activity has been registered since this agreement was signed.

- ***RAMSAR Convention on Wetlands***

This international agreement, locally enacted in 1981 by Decree 771 (Foreign Affairs), aims at stopping the progressive occupation and disappearance of wetlands, the fragile ecologic systems that are generally home to diverse wildlife. The official document recognizes the importance of wetlands, their ecological functions, and their economic, historic, scientific and recreational values.

- ***Convention on the Conservation of Antarctic Marine Living Resources, CCAMLR***

This agreement was enacted locally in 1982, and was originally signed in Australia in 1980. In Chile it was approved by Decree 662 de 1981 (Foreign Affairs). Conservation measures approved by the Commission in 2007 have been officially adopted by Decree 205 (Foreign Affairs) in that year. This act came into force in 1982 as part of the Antarctic Treaty System in pursuance of the provisions of Article IX of the Treaty. It was established mainly in response to concerns that an increase in krill catches in the Southern Ocean could have a serious effect on

populations of krill and other marine life; particularly on birds, seals and fish, which mainly depend on krill for food. The aim of the Convention is to conserve marine life of the Southern Ocean. However, this does not exclude harvesting carried out in a rational manner. Achievement of this aim is far from simple – it requires the collection of large quantities of information and the development of appropriate scientific and analytical techniques. A 'precautionary' approach has been implemented to minimize risk associated with unsustainable practices in conditions of uncertainty. This approach is complemented by the need to take into account ecological links between species and 'natural' as opposed to 'human-induced' variability – the 'ecosystem approach'.

- ***Convention on the Conservation of Migratory Species of Wild Animals, CMS***

Also known as Bonn Convention, CMS aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, and concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 109 (as of 1 August 2008) parties from Africa, Central and South America, Asia, Europe and Oceania. In Chile it was enacted by Decree 868 of 1981 (Foreign Affairs).

- ***Convention for the Environmental Protection of Coastal Zones in the Pacific South East***

Originally signed in 1981 in Lima, Peru, it was enacted in Chile by Decree 296 (Foreign Affairs) in 1986. Signatory countries include Chile, Peru, Ecuador, Panama and Colombia. It aims to improve regional cooperation to reduce, control and prevent marine pollution in the area through different mechanisms.

- ***Convention on Biological Diversity***

This convention was enacted in Chile through Decree (Foreign Affairs) 1.963 of 1994, and is a treaty that was adopted in Rio de Janeiro in June 1992, with three main goals: i) conservation of biological diversity (or biodiversity); ii) sustainable use of its components; and iii) a fair and equitable sharing of benefits arising from genetic resources. In other words, its objective is to develop national strategies for the conservation and sustainable use of biological diversity. It is often seen as the key document regarding sustainable development. The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993.

- ***United Nations Conference on Environment and Development - alternatively, Rio Summit or Earth Summit- 1992, Agenda 21***

Agenda 21 is a program run by the United Nations related to sustainable development. It is a comprehensive plan of action for application globally, nationally and locally by organizations of the UN, governments, and major groups in every area of human impact on the environment. Chile was among the 188 signatories that subscribed to the document in 1992, aimed at promoting sustainable development. UNCED's proposal to establish National Councils for Sustainable Development motivated Chile to create one of his own, the Chilean Council for Sustainable Development, CCSD, through Decree 90 (Secretariat General for the Presidency) of 1998. This Council aims at implementing all major actions included in Agenda 21, and makes the point of involving all social groups in the decision-making process leading to sustainable development.

- ***United Nations Convention on the Law of the Sea (UNCLOS)***

UNCLOS was enacted in Chile by Decree 1.393 (Foreign Affairs) of 1997. It is an international agreement resulting from the third United Nations Conference on the Law of the Sea (UNCLOS III), between 1973 and 1982. UNCLOS defines the rights and responsibilities of nations in their use of the oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. It was concluded in 1982, replacing four 1958 treaties. UNCLOS came into force in 1994, a year after the 60th state signed the treaty. To date, 156 countries and the European Union have joined in the Convention.

- ***Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas***

Approved through Decree 78 of 2004 (Foreign Affairs), Chile accepted Resolution 15/93 of the 27th Session of the FAO Conference of 24 November 1993. However, regulations to enact this agreement in Chile were only approved through Decree 360 of 2005. These regulations are applicable to all fishing vessels that fish on the high seas, requesting all countries to ensure that their fleets comply with international regulations on conservation.

- ***Action Plan to Prevent, Discourage and Eliminate Illegal, Unregulated and Unreported Fishing, IUU***

By Decree 267 of 2005, Chile adheres to FAO proposals to prevent, discourage and eliminate illegal, unregulated and unreported fishing activities in the high seas and on its EEZ, on its triple condition of coastal nation, flag state and state port authority.

- ***Agreement for the Conservation of Albatrosses and Petrels, ACAP***

After Chile signed this agreement, it was discussed in Parliament in 2004 and enacted in 2005. ACAP is a multilateral agreement which seeks to conserve albatrosses and petrels by coordinating international activity to mitigate known threats to their populations. ACAP came into force in February 2004 and currently has 13 member countries and covers 31 species of albatrosses, petrels and shearwaters.

- ***FAO's Code of Conduct for Responsible Fisheries, CCRF***

The Code of Conduct for Responsible Fisheries was developed by the FAO Committee on Fisheries (COFI) and adopted by the FAO Conference in 1995. The concept of responsible fisheries and the possibility of developing guidelines or a code of practice for responsible fisheries were first brought up at the 1991 Session of the FAO Committee on Fisheries (COFI) within the context of its discussions relating to large-scale pelagic driftnet fishing. This led to the International Conference on Responsible Fishing in Cancún, Mexico in May 1992. The Conference culminated in the adoption of the Declaration of Cancún, which, called upon FAO, in consultation with relevant international organizations, to draft an International Code of Conduct for Responsible Fishing. The purpose of the Code is to encourage the rational and long-term sustainable utilization of fisheries. The Code takes a holistic view of the world's fisheries. In so doing, it prescribes principles and standards for the conservation and management of all fisheries, and addresses the capture, processing and trade in fish and fishery products, fishing operations, aquaculture, fisheries research and the integration of fisheries into coastal area management. The Code is a voluntary instrument, and it is the first international instrument of its type to have been developed for the fisheries sector. As a voluntary instrument the Code does not require formal acceptance by governments. However, there is a moral obligation for governments and other stakeholders to act in a responsible manner and to address urgent management and related sectoral issues.

3.4. Bilateral Agreements

Being a major exporter of fish products, and having a fairly open economy, Chile has bilateral agreements and Free Trade Agreements (FTAs) with different countries:

- Brazil
- Canada
- China
- Costa Rica
- Denmark
- Ecuador
- United Arab Emirates
- Spain
- United States

Between the US and Chile, there is a Memorandum of Understanding among The National Park Service of the Department of the Interior of the USA, The National Ocean Service of the National Oceanic and Atmospheric Administration of the Department of Commerce of the USA, The Ministry of Environment of the Republic of Chile, The National Forest Corporation of the Ministry of Agriculture of the Republic of Chile and the Undersecretariat for Fisheries and Aquaculture of the Ministry of Economy, Development and Tourism of the Republic of Chile on Cooperation in the Conservation and Management of Terrestrial and Marine Protected Areas.

- Russian Federation
- Indonesia
- Iceland
- Japan
- Malaysia
- Morocco
- Mexico
- Mozambique
- Nicaragua
- Norway
- New Zealand
- Uruguay

- Vietnam

4. Current Efforts and Programs to Address Bycatch

4.1. Governmental Institutions

4.1.1. The Rescue and Conservation Unit of Protected Aquatic Species

This Unit of SERNAPESCA is especially focused on strandings and the conservation of protected aquatic species, or those subject to a fishing ban. Its scope of activities is not only to give attention to, but also to make efforts to recover, as far as possible, the stranded specimens and return them to their natural environment. The Rescue and Conservation Unit follows what it is mandated by the LGPA, which states that SERNAPESCA has to oversee the care of some groups of protected species.

The functions of the Unit include the coordination and establishment of procedures and protocols associated with the rescue, stabilization, rehabilitation and reintegration of protected aquatic species nationwide. Also, the Unit establishes cooperation agreements with private medical rescue and rehabilitation centers, public institutions--such as universities, zoos, and other organizations--, and foreign governments. Its other functions are managing the official information from strandings and rescues, establishing management areas in the field of conservation of protected species, and disseminating and communicating the activities of the Unit to the community.

4.2. Non-Governmental Institutions

In Chile, NGOs have concentrated their fisheries-related efforts on discussing bans for whale and marine mammal exploitation; and undertaking environmental issues for matters related to fisheries discards, trawling, etc. They have been particularly active in aquaculture related matters, where they have questioned a number of the industry's environmental practices such as fish escapes, the use of antibiotics, labour practices, salaries, etc.

Among others, the following institutions are known to be developing activities and lobbying on different issues related to fisheries, aquaculture and environmental matters:

4.2.1. Centro Ballena Azul

This group carried out multidisciplinary research seeking to better understand the processes and patterns that determine the functioning of marine ecosystems and identify potential threats affecting the integrity of these ecosystems. The information generated is intended to promote strategies for conservation, management, environmental education and sustainable development, integrating the interests and needs of the stakeholders involved.

4.2.2. Centro de Conservación Cetácea (CCC)

This organization works actively for the conservation of cetacean species and aquatic ecosystems in Chile and the Southern Hemisphere. Its objectives are:

- To promote effective policies for management, conservation and marine protection.
- To develop non-lethal research programs on cetaceans and marine ecosystems, with special emphasis on endangered species.
- To identify and assess human impacts on cetacean populations and propose mitigation measures.
- To promote sustainable development of coastal communities through marine wildlife watching.
- To increase public awareness and to encourage active and informed participation of the public/government in conservation of marine biodiversity and promote the reduction of anthropogenic impacts.
- To strengthen national and international cooperation in marine conservation strategies.

The organization is a member of the Society for Marine Mammalogy and the Antarctic and Southern Ocean Coalition (ASOC).

4.2.3. Ecoceanos Center

The Ecoceanos Center for Conservation and Sustainable Development is an independent civic organization formed in 1998. Its objectives involve the conservation and sustainable management of coastal and ocean resources and ecosystems; and strengthening the informed and proactive participation of civil society and the sustainable development of small-scale fishing communities in coastal and regional economies.

Ecoceanos Center promotes the empowerment and active participation of citizens' organizations, fishers, fishery workers, coastal communities, indigenous peoples, small and medium enterprise fisheries and consumers, to generate policies for access, management and use of areas and marine resources.

Through the development of research projects, training and environmental education, communication and specialized information and citizen environmental advocacy campaigns, Ecoceanos Center seeks to stimulate and promote the interest of the public and the concerns of civil society to the importance and potential problems presented by the oceans and the national coastal areas and the planet.

4.2.4. FIMA

FIMA is a not-for-profit, nongovernmental organization and a public interest, environmental law firm.

Since 1998, FIMA has contributed to the development of environmental laws and legislation, as well as access to environmental justice in Chile. FIMA works in five areas:

- **Environmental Justice:** The objective of this program is to ensure individuals and communities the right of equitable access to a healthy environment.
- **Environmental Democracy:** Seeks to promote the right to access (information, public participation and access to environmental justice) in environmental decisions.
- **Climate Change:** Aims to contribute to the global fight against climate change and to help develop national policies for adaptation and mitigation.

- **Environmental Protection and Sustainability:** The objectives of this program are to reduce and eliminate the degradation of the environment in Chile, and to guarantee the protection of nature.
- **Public Policy:** Contributes to the design and creation of more effective public policies aimed at achieving sustainable development in the country.

4.2.5. Greenpeace

Established in 1994 in Chile, its environmental work is focused on ocean conservation, energy and climate, forest and agriculture.

4.2.6. Oceana

Oceana has a regional office in Chile focusing on the following campaigns: Responsible Fishing, Reducing Bycatch and Protecting Habitat. According to this organization, reducing bycatch is a key component of its efforts to save the oceans and feed the world, along with protecting habitat and reducing overfishing by setting responsible catch limits. Oceana advocates for cleaner fishing gear and campaigns to ban driftnets, and to modify and adapt other fishing gear so they do not catch and kill non-targeted fish and important and protected species like sharks, whales and sea turtles.

4.2.7. Terram Foundation

The Terram Foundation was created in 1997 by a group of professionals from various areas motivated by the need to raise new challenges for the country and to find political, democratic, social and economic answers to public problems which had not been adequately addressed, and respecting also citizens' interests. It considers sustainability as an environmental problem that can only find a solution under a democratic process, expressed in a broad and inclusive debate. Motivated by these ideas, Terram Foundation aims to reflect on appropriate public policies to new challenges, inspired heavily in the affirmation and promotion of democracy and justice, the advancement of the ecological perspective, sustainability and efficiency as the central criterion of economic affairs, and contributing professional and technical expertise in order to build a

new foundation for public policy on the environment. Thematic areas of the foundation are natural resources, environment, salmon aquaculture, economy and globalization. Within the first thematic area, natural resources, its goal is to stimulate debate on the development model based on the exploitation and export of natural resources that exist in Chile, in order to generate analysis and proposals for sustainable management in a number of key sectors: mining, fishing, and forestry.

4.2.8. World Wildlife Fund (WWF)

The mission of the World Wildlife Fund (WWF) is to stop the degradation of the planet's natural environment, and build a future in which humans live in harmony with nature. In order to achieve this mission, WWF focuses its efforts on two broad areas: Biodiversity and Footprint. The first is to ensure that the earth's web of life - biodiversity - stays healthy and vibrant for generations to come. The organization is strategically focusing first on conserving critical places and critical species that are particularly important for the conservation of the earth's rich biodiversity. The second focus is to reduce the negative impacts of human activity - the ecological footprint. The organization is working to ensure that the natural resources required for life--land, water, and air--are managed sustainably and equitably.

WWF has a local office in Chile, WWF Chile, that works to ensure that the unique biodiversity found in southern Chile, both terrestrial and aquatic, is adequately represented in a system of protected areas that are managed effectively, that sustainable use of natural resources is carried out across the landscape, that conservation becomes a commitment of all stakeholders, that rural communities participate in, and benefit from, conservation, and to reduce impacts and improve production practices in forestry, aquaculture and marine areas.

WWF Chile has designated southern Chile, the Chiloense Marine Ecoregion (Figure 20), as one of its 35 priority sites to work on globally, has defined strategies to ensure the protection of their coastal-marine ecosystems, and to reduce the impacts of unsustainable fishing and aquaculture practices through its Strategic Plan for The Chiloense Marine Ecoregion, particularly its Marine Program focused on cetaceans.

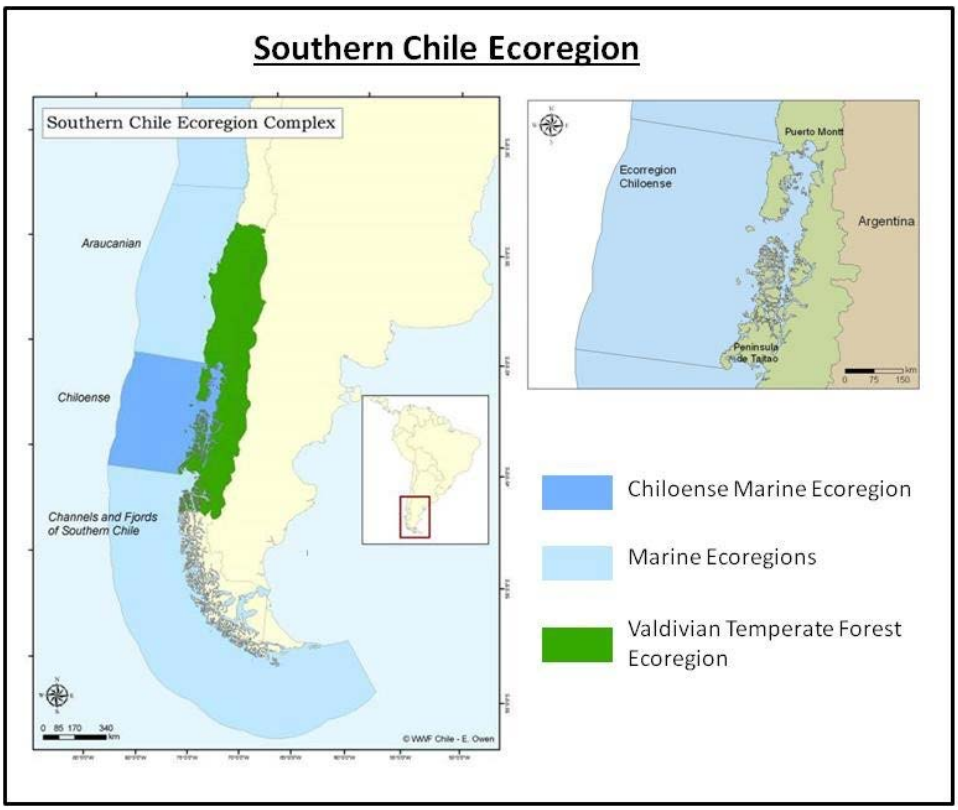

Figure 20. Chiloense Marine Ecoregion. Source: WWF Chile.

5. Marine Mammals in Chile

According to the Ministry of Environment (Ministerio del Medio Ambiente, 2014), in the territorial waters of Chile, 58 species of marine mammals exist, belonging to the groups of Cetaceans, Pinnipeds and Mustelids, which are listed in Table 12.

Table 12. Marine mammals described in territorial waters of Chile. Source: Rodrigo Hucke-Gaete.

Order CETACEA	Species	Common name (SP)	Common name (EN)
Family Balaenopteridae	*Balaenoptera musculus*	Ballena azul	Blue whale
	Balaenoptera physalus	Ballena fin	Fin whale
	Balaenoptera borealis	Ballena sei	Sei whale
	Balaenoptera edeni	Ballena de Bryde	Bryde's whale
	Balaenoptera bonaerensis	Ballena minke Antártica	Antarctic minke whale
	Balaenoptera acutorostrata	Ballena minke	Common minke whale
	Megaptera novaeangliae	Ballena jorobada	Humpback whale
Family Balaenidae	*Eubalaena australis*	Ballena franca	Southern right whale
Family Neobalaenidae	*Caperea marginata*	Ballena franca pigmea	Pygmy right whale
Family Physeteridae	*Physeter macrocephalus*	Cachalote	Sperm whale
Family Kogiidae	*Kogia breviceps*	Cachalote pigmeo	Pygmy sperm whale
	Kogia sima	Cachalote enano	Dwarf sperm whale
Family Ziphiidae	*Berardius arnuxii*	Zifio de Arnoux	Arnoux's beaked whale
	Hyperoodon planifrons	Hiperodonte del Sur	Southern bottlenose whale
	Ziphius cavirostris	Zifio de Cuvier	Cuvier's beaked whale
	Tasmacetus shepherdi	Zifio de Shepherd	Shepherd's beaked whale
	Mesoplodon densirostris	Mesoplodonte de Blainville	Blainville's beaked whale
	Mesoplodon layardii	Mesoplodonte de Layard	Strap-toothed beaked whale
	Mesoplodon grayi	Mesoplodonte de Gray	Gray's beaked whale
	Mesoplodon peruvianus	Mesoplodonte Peruano	Pygmy beaked whale
	Mesoplodon hectori	Mesoplodonte de Hector	Hector's beaked whale
	Mesoplodon traversii	Mesoplodonte de Travers	Spade-toothed beaked whale
Family Delphinidae	*Orcinus orca*	Orca	Killer whale
	Pseudorca crassidens	Orca falsa	False killer whale
	Feresa attenuata	Orca pigmea	Pygmy killer whale
	Globicephala melas	Calderón negro	Long-finned pilot whale
	Globicephala macrorhynchus	Calderón de aletas cortas	Short-finned pilot whale
	Steno bredanensis	Esteno	Rough-toothed dolphin
	Lagenorhynchus obscurus	Delfín oscuro	Dusky dolphin
	Lagenorhynchus cruciger	Delfín cruzado	Hourglass dolphin
	Lagenorhynchus australis	Delfín austral	Peale's dolphin

Table 12 (continued).

	Delphinus delphis	Delfín común de rostro corto	Short-beaked common dolphin
	Delphinus capensis	Delfín común de rostro largo	Long-beaked common dolphin
	Tursiops truncatus	Tursión	Bottlenose dolphin
	Grampus griseus	Delfín de Risso	Risso's dolphin
	Stenella attenuata	Delfín moteado	Pantropical spotted dolphin
	Stenella coeruleoalba	Delfín listado	Striped dolphin
	Stenella longirostris	Delfín rotador	Spinner dolphin
	Lissodelphis peronii	Delfín liso	Southern right whale dolphin
	Cephalorhynchus commersonii	Tonina overa	Commerson's dolphin
	Cephalorhynchus eutropia	Delfín Chileno	Chilean dolphin
Family Phocoenidae	*Phocoena dioptrica*	Marsopa de anteojos	Spectacled porpoise
	Phocoena spinipinnis	Marsopa espinosa	Burmeister's porpoise
Orden CARNIVORA	**Species**	**Common name (SP)**	**Common name (EN)**
Family Otariidae	*Otaria flavescens*	Lobo marino común	South American sea lion
	Arctocephalus philippii	Lobo fino de Juan Fernández	Juan Fernandez fur seal
	Arctocephalus australis	Lobo fino austral	South American fur seal
	Arctocephalus gazella	Lobo fino antártico	Antarctic fur seal
Family Phocidae	*Mirounga leonina*	Elefante marino del Sur	Southern elephant seal
	Leptonychotes weddellii	Foca de Weddell	Weddell seal
	Ommatophoca rossii	Foca de Ross	Ross seal
	Hydrurga leptonyx	Foca leopardo	Leopard seal
	Lobodon carcinophagus	Foca cangrejera	Crabeater seal
Family Mustelidae	*Lontra felina*	Chungungo	Marine otter
	Lontra provocax	Huillín	Southern river otter

6. Project Implementation

6.1. Identification of Fisheries and Products Exported from Chile to USA and Associated Bycatch

6.1.1. Volume of Seafood Exported by Chile

Fisheries and aquaculture exports as of December 2014 had a total value of US $6,164,835 million, representing an increase of 17.6% compared to 2013. This figure also represents an

increase of 41.7% over the average of the five-year period, 2009-2013. Nationally, this sector accounted for 8.1% of the value of total exports in 2014. In terms of volume, exports reached 1.3 million tons, showing an increase of 7.4% over the volume exported in 2013 (Figure 21).

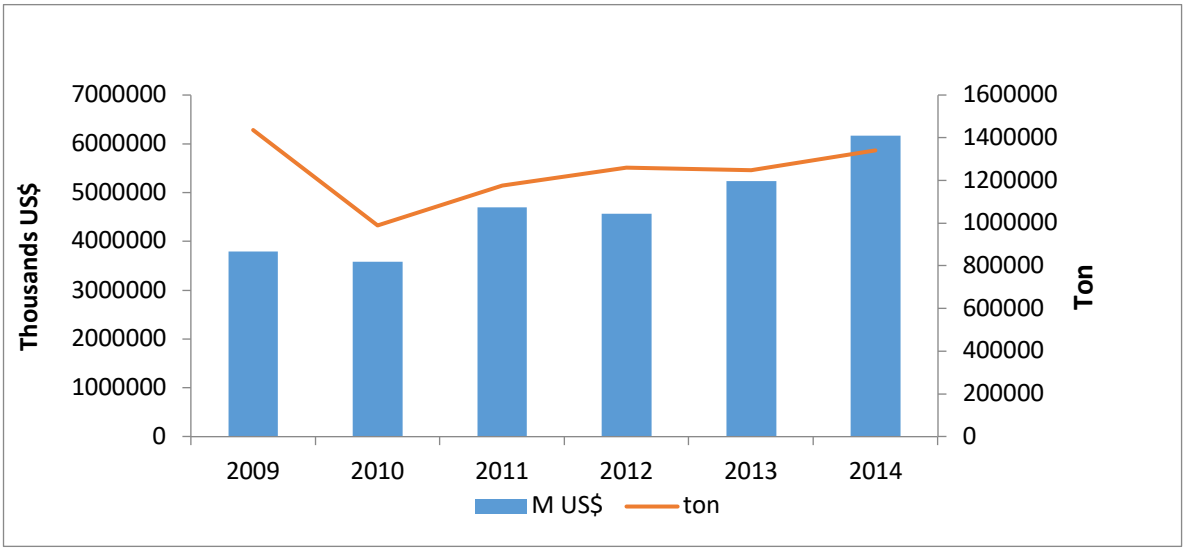

Figure 21. Chilean Fisheries and Aquaculture Exports. Source: Sernapesca.

In terms of processing, frozen products showed a slight increase in volume of 2.2%, with a higher value (21.7%) over last year. In turn, the fresh refrigerated, fishmeal and fish oil are shown to be the main products with the largest increase in volume.

The number of registered seafood export markets at the end of 2014 totalled 110 destination countries. Of these, the nine major ones account for 78% of total export value. The US remains the main trading partner of the sector, representing 26% of the total value, experiencing an increase of 21.7% over 2013, followed by Japan, which accounts for 19.8% , Brazil, Russia and China (Table 13 & Figure 22).

Table 13. Main destination countries of seafood exports to December 2013-2014. Source: IFOP-Customs.

Country	Value (thousands US$)		Participation (%)		Variation (%)
	2013	2014	2013	2014	
United States	1.336.443	1.602.010	25,5%	26,0%	19,9%
Japan	1.037.513	1.255.963	19,8%	20,4%	21,1%
Brazil	518.782	585.379	9,9%	9,5%	12,8%
Russia	311.106	412.066	5,9%	6,7%	32,5%
China	399.036	393.870	7,6%	6,4%	-1,3%
Spain	174.879	180.872	3,3%	2,9%	3,4%
South Korea	105.220	149.323	2,0%	2,4%	41,9%
Germany	94.786	117.403	1,8%	1,9%	23,9%
France	106.546	114.366	2,0%	1,9%	7,3%
Others	1.157.219	1.353.584	22,1%	22,0%	17,0%
Total	5.241.529	6.164.835	100%	100%	17.6

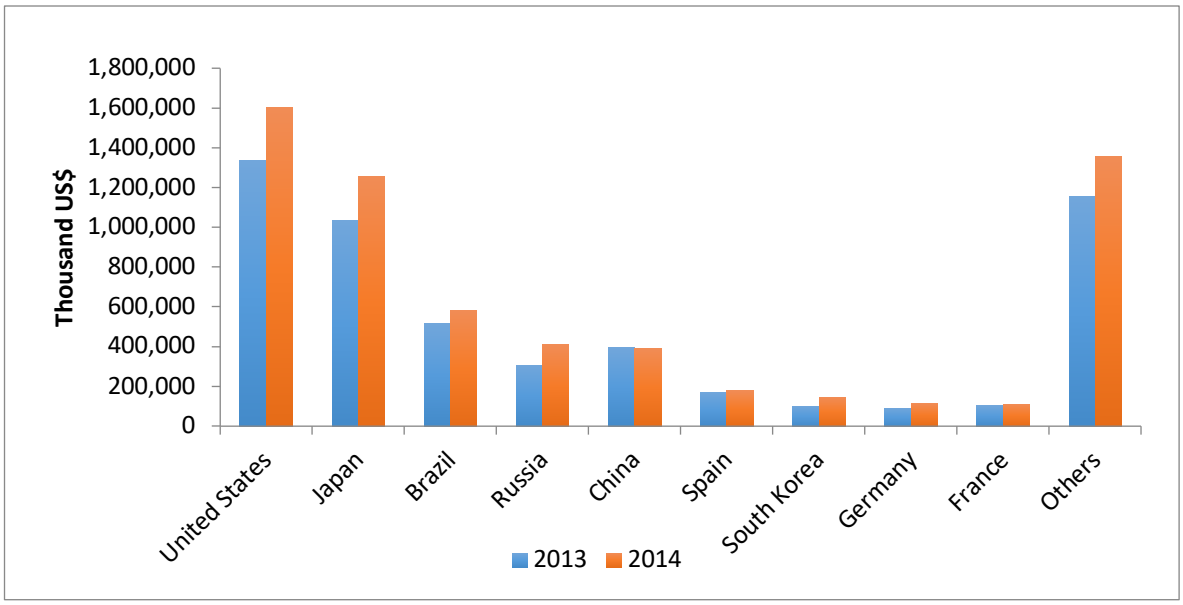

Figure 22. Main destination countries of seafood exports to December 2013-2014. Source: IFOP-Customs.

6.1.1.1. Extractive Subsector

Exports of this subsector, to November 2014, corresponded to a total of US $1.3 billion, a figure that is higher than the previous year in the same month (4%). This value accounted for 22.5% of the total value of fisheries and aquaculture exports. In terms of volume, 557.3 thousand tons were exported, which is 9.4% higher than in November 2013. Frozen products (43.6%), fishmeal (33.7%) and dried seaweed (12.3%) were the top export products in terms of export volume.

Products associated with the extractive subsector were preferably oriented to markets in Asia (48.4% of the total value of the subsector), with China being the main market comprising 35.9% of the export value of this economic group, followed by the European market, with 24.8%, primarily exported to Spain that accounted for 35.1% of its value.

Fishmeal

About 81% of the volume and the export value of fishmeal comes from the extractive subsector. At the end of 2014, this product line ranked second, both in volume and export value of the subsector. Net results show a value of US $346 million, which represented a 4.6% increase compared to last year. The Chinese market represented 33.9% of the total value, followed by the United States, South Korea, Japan, Spain and Italy (Table 14 and Figure 23).

Table 14. Fishmeal exports. Source: IFOP-Customs.

Country	Value (thousands US$)		Volume (tonnes)		Variation (%)	
	2013	2014	2013	2014	Value	Volume
China	181.359	144.679	105.178	91.626	-20,2%	-12,9%
United States	30.491	51.556	17.523	29.580	69,1%	68,8%
South Korea	28.433	42.656	15.298	23.888	50,0%	56,2%
Japan	43.676	39.780	22.938	21.538	-8,9%	-6,1%
Spain	28.664	31.084	17.172	19.416	8,4%	13,1%
Italy	16.818	23.710	8.989	13.826	41,0%	53,8%
Canada	20.777	22.882	12.619	14.507	10,1%	15,0%
Vietnam	3.301	15.243	2.260	9.980	361,8%	341,6%
Taiwan	7.942	13.629	4.968	8.301	71,6%	67,1%
Others	55.346	41.246	32.767	25.012	-25,5%	-23,7%
Total	416.807	426.465	239.712	257.674	2,3	7,5

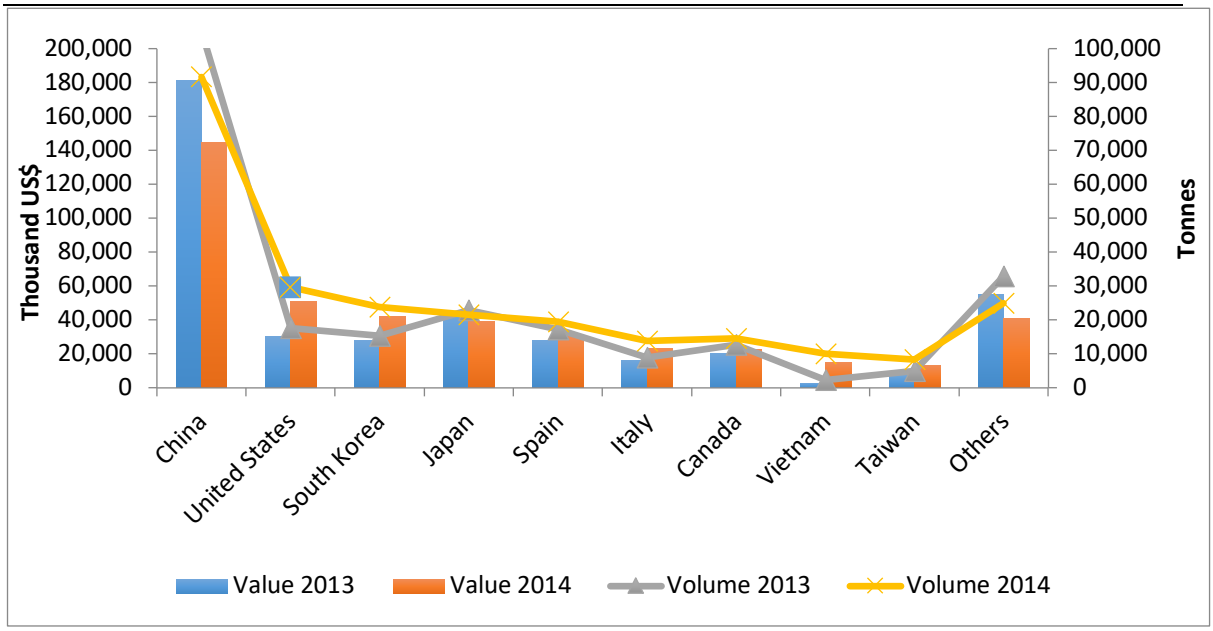

Figure 23. Fishmeal exports. Source: IFOP-Customs.

Frozen Products

Participation in the global extractive subsector of exported frozen products reached 17.5% in value and 38.8% by volume, to November 2014. This product line ranked first in value between the products associated with the extractive subsector. Net results show that this line reached a value of $ 558.3 million, an increase of 3.9% compared to 2013.

The most important destinations of frozen products from the extractive subsector were Japan, Nigeria and the United States, with shares in value of 17.3%; 14.6% and 13.4% respectively (Figure 24). The African market recorded an increase of 1.1% over the same period last year. The United States exports declined in value by 4.5%. Mackerel and giant squid were the largest exports, representing 44.2% and 38.7% of export volume. From these two resources, mackerel shows a decrease in valuation of 6.3% due to declines in the African market and in Peru.

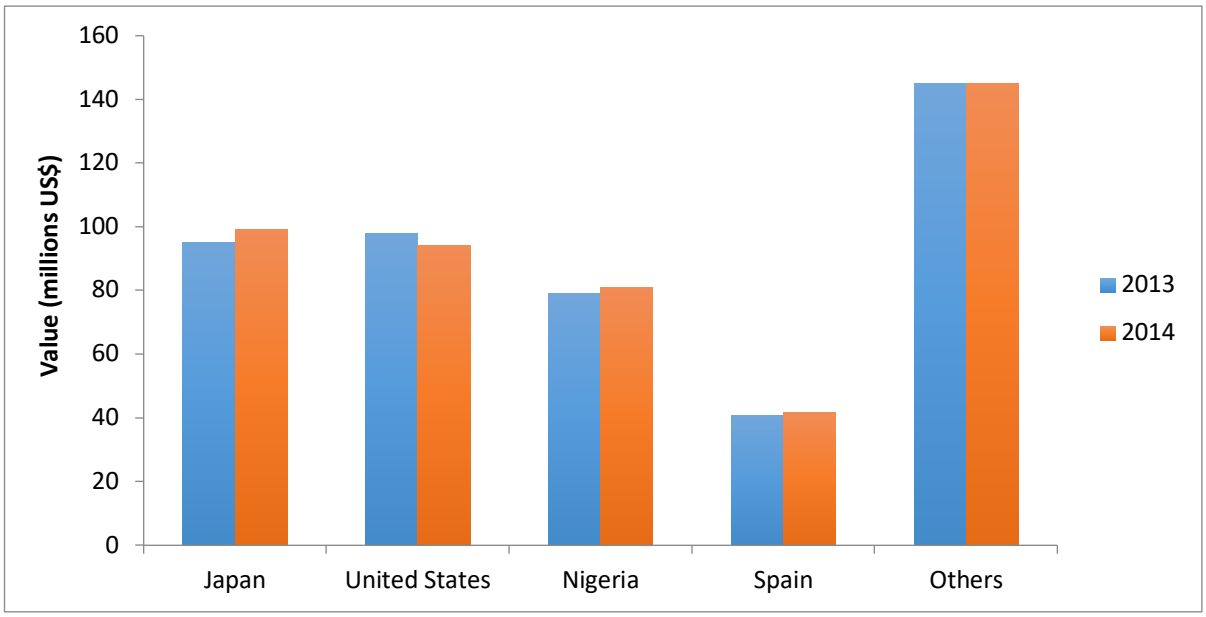

Figure 24. Frozen line exports, extractive subsector. Source: Sernapesca.

6.1.1.2. Aquaculture Subsector

Exports of the aquaculture subsector accounted for 77.4% and 54.7% of the total value and volume exported in 2014, respectively. Its value was US $4.772 million and comprised around 733.5 thousand tons, representing a 21.2% increase compared from 2013. Atlantic salmon was

the main product representing 63.1% of the value, an increase of 31.5% compared to last year. After salmon, rainbow trout and Pacific salmon followed, the first with a decline in value of 7.8% and the second with an increase of 41.2% in value (Table 15 & Figure 25).

Table 15. Aquaculture Exports. Source: IFOP-Customs.

Type	Value (Thousands US$)		Volume (tonnes)		Variation (%)	
	2013	2014	2013	2014	Value	Volume
Atlantic Salmon	2.291.603	3.013.287	307.528	383.557	31,5%	24,7%
Rainbow Trout	760.227	700.782	110.485	75.333	-7,8%	-31,8%
Pacific Salmon	459.380	648.723	111.179	107.593	41,2%	-3,2%
Mussel	184.589	188.849	64.995	64.093	2,3%	-1,4%
Salmonids*	168.012	145.001	107.828	99.399	-13,7%	-7,8%
Gracilaria Seaweeds	45.593	49.913	2.459	2.207	9,5%	-10,2%
Abalone (red)	21.326	18.478	583	577	-13,4%	-1,0%
Northern Scallop	5.842		505	526	-5,2%	4,2%
Salmon and FreshwaterTrout	266	928	153	234	248,9%	52,9%
Pacific Oyster	374	463	6	3	23,8%	-50,0%
Japanese Abalone (green)	555	342	13	18	-38,4%	38,5%
Total	3.937.767	4.772.302	705.734	733.540	21,2%	3,9%

*King salmon, brown trout and non-specified salmon.

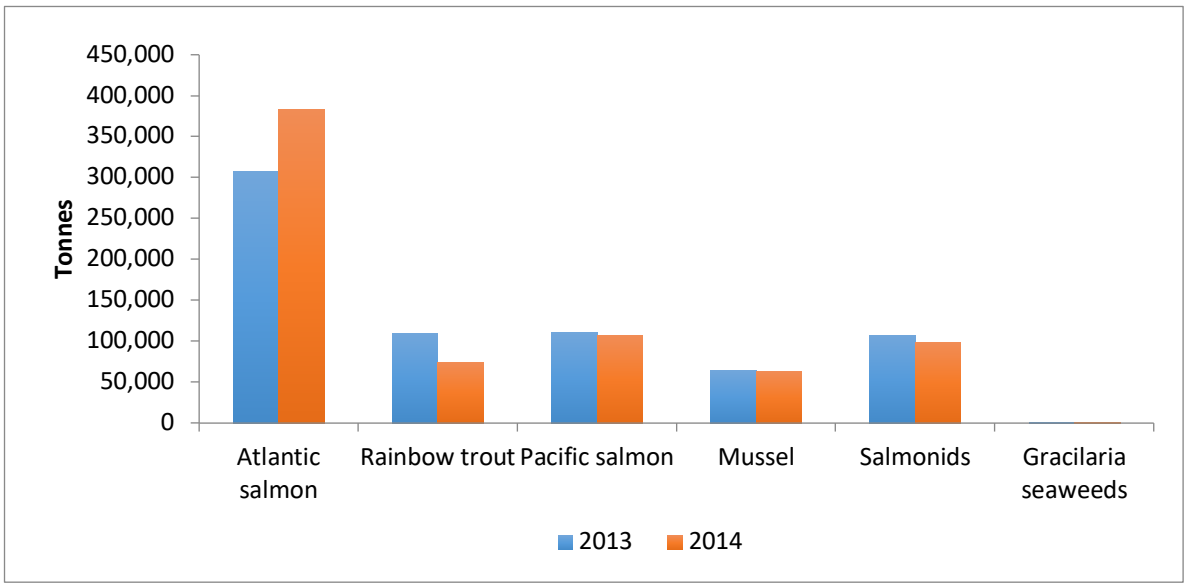

Figure 25. Aquaculture Exports. Source: IFOP-Customs.

Frozen Products

The participation of the aquaculture subsector in the global exports of frozen products corresponded to 82.8% in value and 62.4% in volume in 2014.

This product line ranked first among those associated with the aquaculture subsector, with 61% and 58.7% of the value and volume exported by the subsector, respectively. Net results show that in 2014, the product line reached a value of US $2.626 million, an increase of 26.3% over the previous year. As for the exported volume, these products reached about 430.782 tons, which represented an increase of 2.7% compared to 2013. In terms of FOB prices, a growth of 27.5% was recorded as measured by freight on board compared to the previous year.

Japan was the main market comprising 34.1% of the total value of the product line showing an increase (29.4%) compared to 2013 (Table 16 & Figure 26).

The main resources in this product line were salmonids followed by mussels, abalones and scallops.

Table 16. Exports of aquaculture frozen products accumulated to December 2013-2014. Source: IFOP-Customs.

Country	Value (thousands US$)		Volume (tonnes)		Variation (%)	
	2013	2014	2013	2014	Value	Volume
Japan	769.278	995.462	141.791	137.297	29,4%	-3,2%
United States	309.192	412.117	39.316	43.777	33,3%	11,3%
Russia	302.675	393.601	58.407	66.851	30,0%	14,5%
China	80.333	112.472	16.536	17.808	40,0%	7,7%
Brazil	117.171	102.306	20.435	14.351	-12,7%	-29,8%
Germany	83.686	95.939	11.899	12.412	14,6%	4,3%
France	77.383	85.850	16.926	16.686	10,9%	-1,4%
Thailand	58.368	83.331	11.283	14.491	42,8%	28,4%
Mexico	52.747	75.028	6.566	7.905	42,2%	20,4%
Others	456.912	559.226	96.203	99.202	22,4%	3,1%
Total	2.307.745	2.915.332	419.362	430.780	26,3%	2,7%

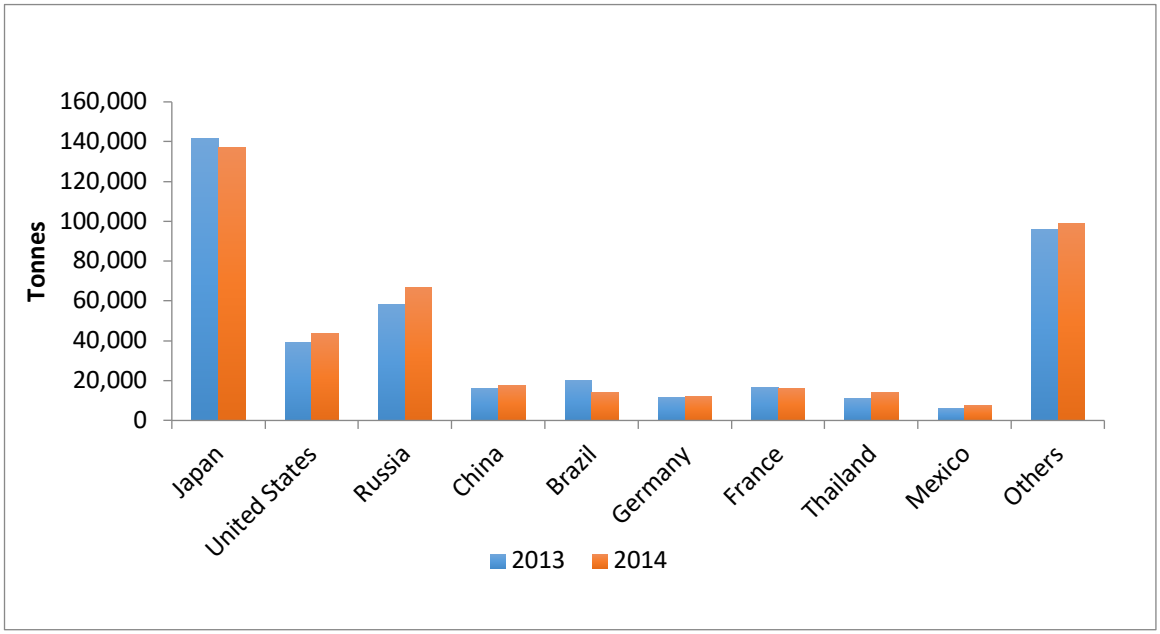

Figure 26. Aquaculture frozen exports. Source: IFOP-Customs.

Fresh Refrigerated

The participation of the aquaculture subsector in the global fresh/refrigerated category reached 97.8% in value and 95.5% in volume in 2014.

This product line was second among those associated with the aquaculture subsector, with 31.8% and 25.9% of the value and volume of exports by the subsector, respectively. Net results show that in 2014, these products reached a value of US $1,520 million, an increase of 21.7% over 2013. As for the volume, it reached 190.337 tons, which also reflects an increase (19.3%) compared to 2013.

The resource-market combination Atlantic salmon-United States accounted for 61.1% of the product line value, showing an increase (21.7%) over 2013. The following combinations were Atlantic salmon-Brazil, which participated with 31.3% of the line value and rainbow trout-United States comprising 5% (Table 17 & Figure 27).

Table 17. Exports aquaculture fresh refrigerated to December 2013-2014. Source: IFOP-Customs.

Country	Value (thousands US$)		Volume (tonnes)		Variation (%)	
	2013	2014	2013	2014	Value	Volume
United States	806.609	957.913	89.795	101.740	18,8%	13,3%
Brazil	370.154	449.991	59.424	73.333	21,6%	23,4%
Argentina	37.658	40.501	5.847	6.053	7,5%	3,5%
China	4.517	20.066	688	3.442	344,2%	400,3%
Canada	323	12.206	44	1.296	3678,9%	2845,5%
Colombia	8.767	11.680	1.072	1.284	33,2%	19,8%
Mexico	8.949	11.404	1.001	1.201	27,4%	20,0%
Uruguay	2.662	3.562	286	354	33,8%	23,8%
Spain	1.999	2.822	248	323	41,2%	30,2%
Others	7.781	9.889	1.080	1.311	27,1%	21,4%
Total	1.249.419	1.520.034	159.485	190.337	21,7%	19,3%

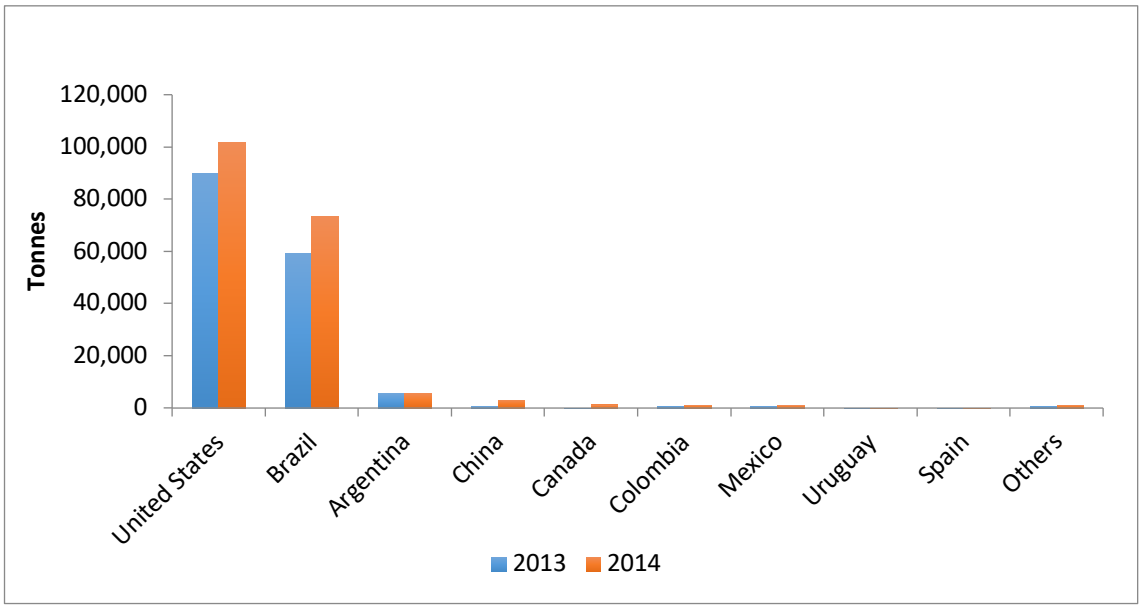

Figure 27. Fresh refrigerated aquaculture exports. Source: IFOP-Customs.

6.1.1.3. Exports to the US

One hundred and forty-one companies exported seafood products to the US between January 2013 and August 2014, comprising 19 fish species, 28 species of shellfish and 4 species of seaweed. In terms of volumes, from January 2012 until August 2014, the most significant fish species from fisheries exported to US were common hake, Patagonian toothfish, hoki, swordfish, anchovy, jack mackerel and southern hake (Table 18 & Figure 28).

Table 18. Main fish species from fisheries exported to US. Source: Sernapesca.

Species	Exports to the US (ton)		
	2012	2013	2014*
Anchovy	559	484	524
Common hake	3126	2890	827
Hoki	1201	818	233
Jack mackerel	161	128	79
Patagonian toothfish	1711	1591	911
Southern hake	52	78	21
Swordfish	961	555	110
Total	7770	6544	2705

* To August 2014.

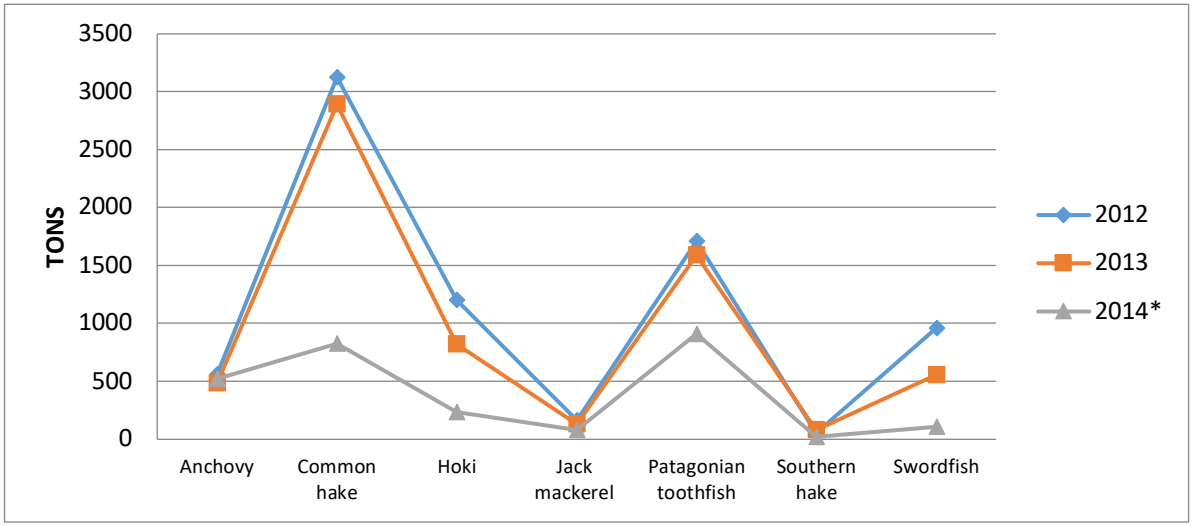

Figure 28. Main wild fish species exported to the US. Source: Sernapesca.

6.2. Origin of Wild Fish Species Exported to the US

The fish species listed in Table 18 were landed in different Regions and extracted by either the industrial or the artisanal fleet. The landings volume of each species by Chilean Region are shown in Figure 29, Figure 30, Figure 31, Figure 32, Figure 33, Figure 34 and Figure 35.

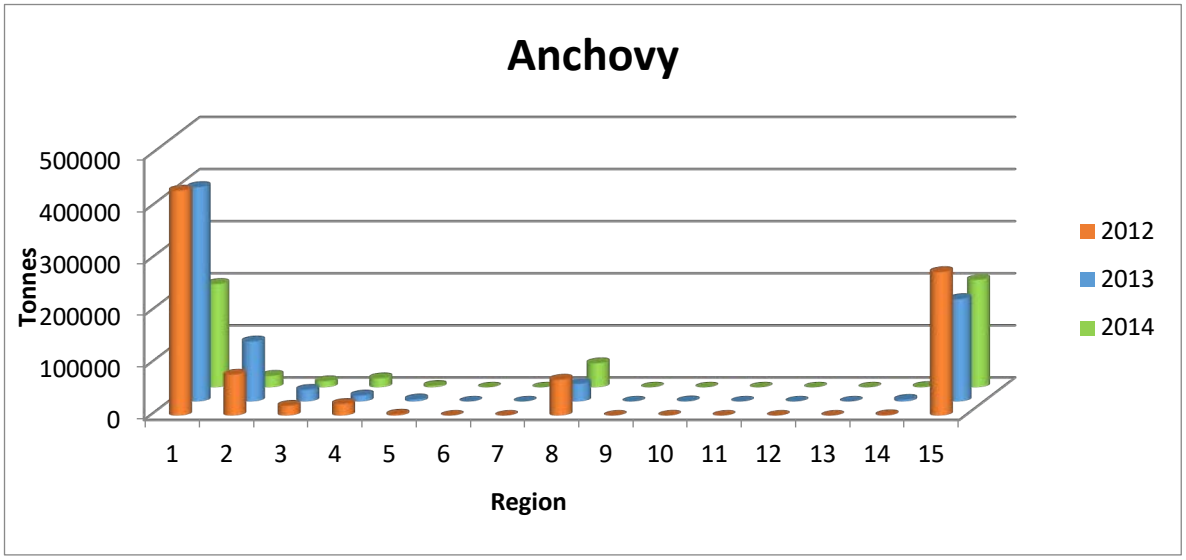

Figure 29. Landings of Anchovy by Chilean Region, 2014 until August. Source: Sernapesca.

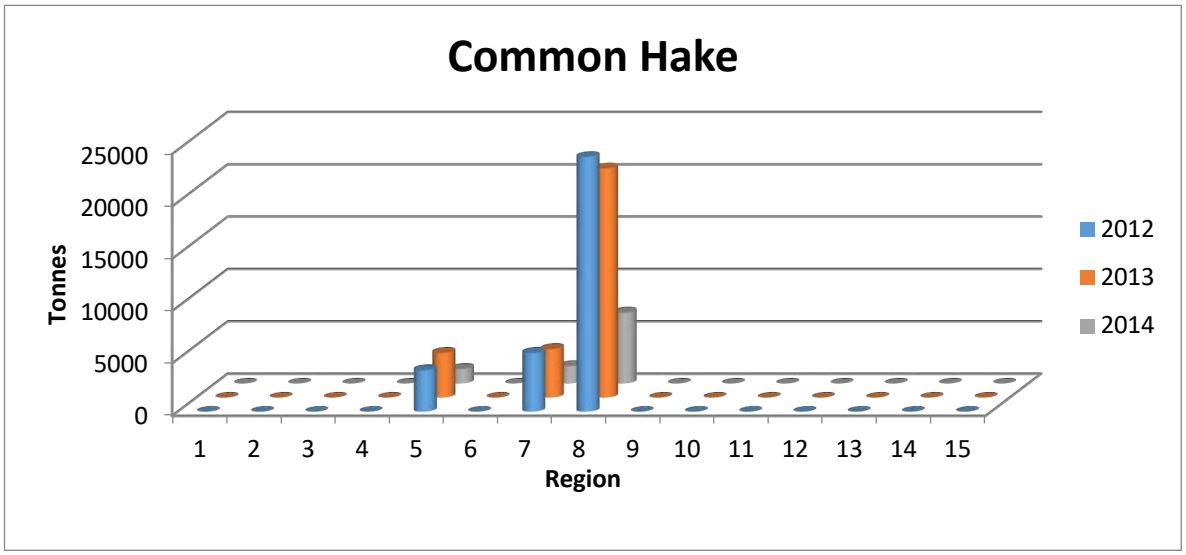

Figure 30. Landings of Common Hake by Chilean Region, 2014 until August. Source: Sernapesca.

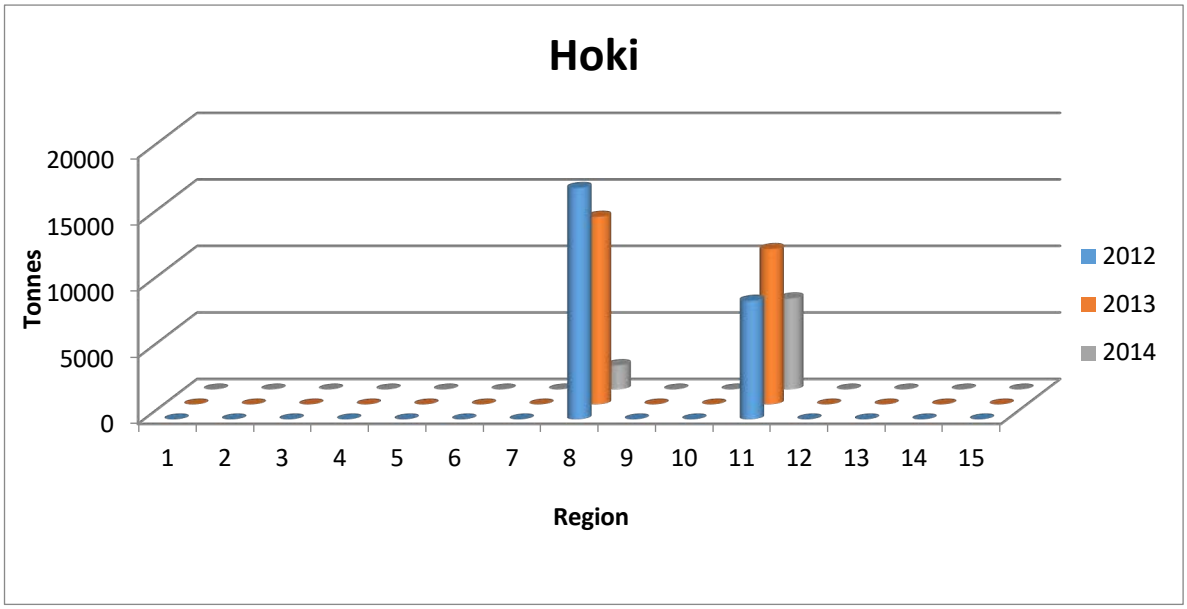

Figure 31. Landings of Hoki by Chilean Region, 2014 until August. Source: Sernapesca.

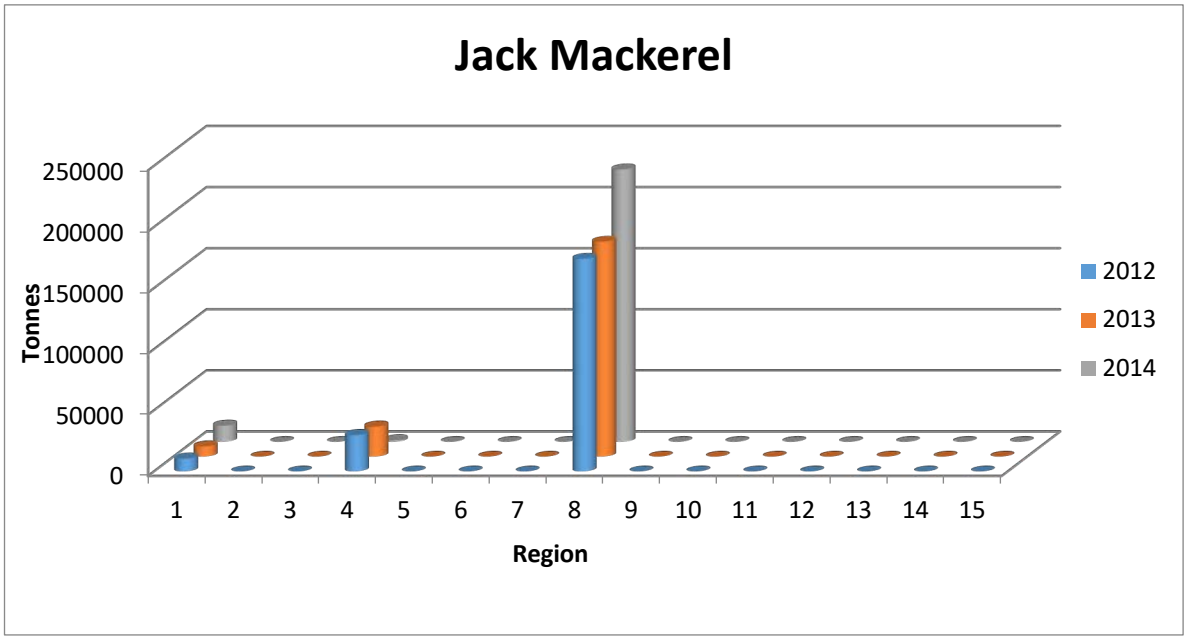

Figure 32. Landings of Jack Mackerel by Chilean Region, 2014 until August. Source: Sernapesca.

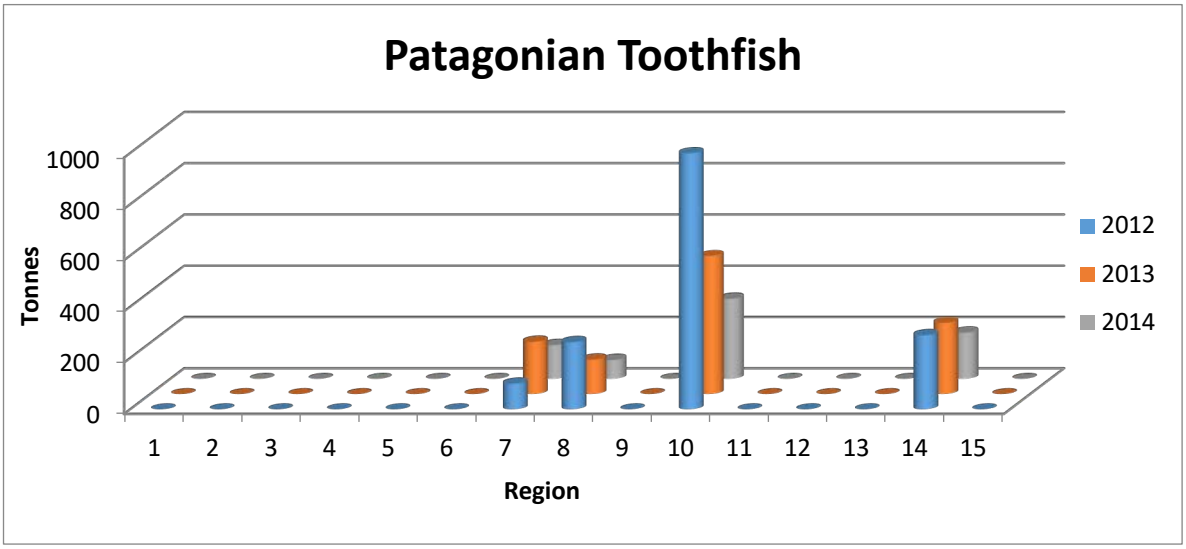

Figure 33. Landings of Patagonian Toothfish by Chilean Region, 2014 until August. Source: Sernapesca.

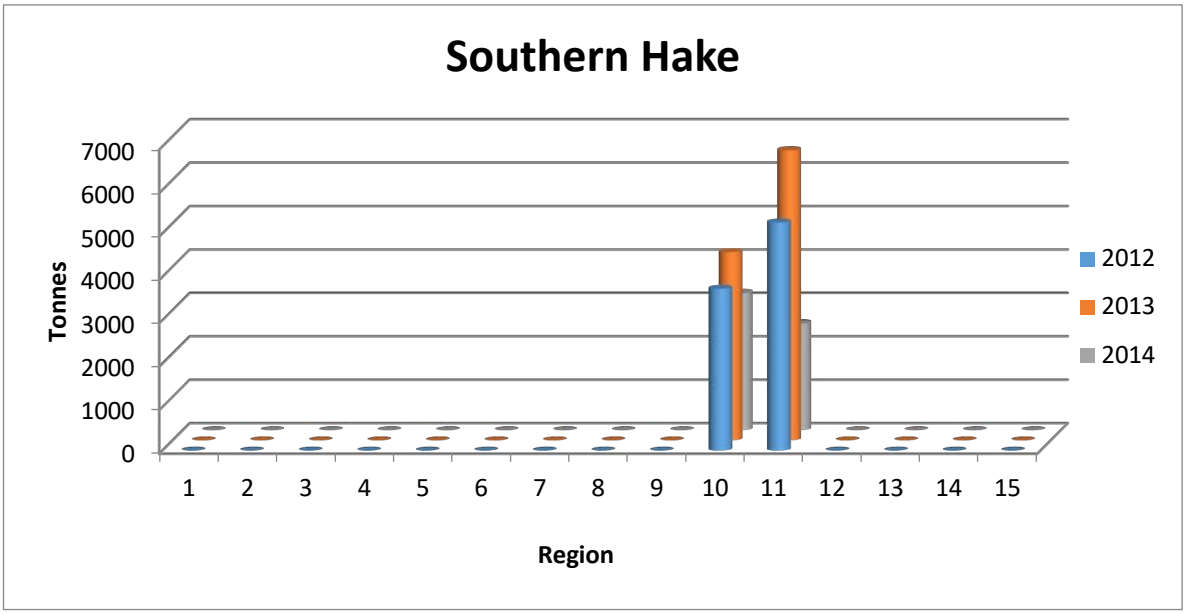

Figure 34. Landings of Southern Hake by Chilean Region, 2014 until August. Source: Sernapesca.

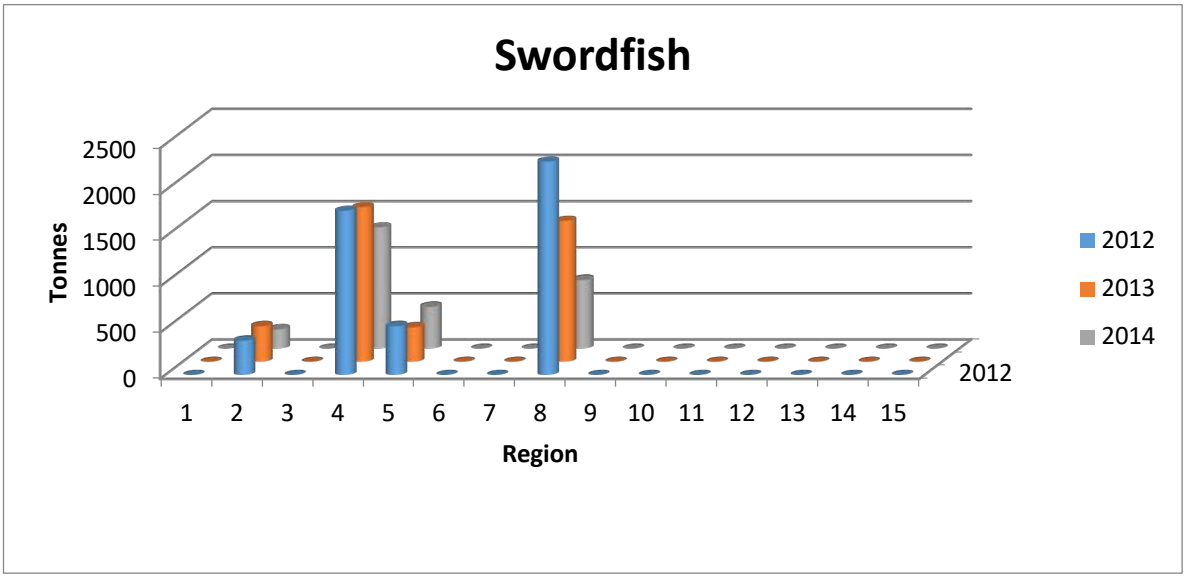

Figure 35. Landings of Swordfish by Chilean Region, 2014 until August. Source: Sernapesca.

6.3. Bycatch Assessment: Deciding Which Species, Gears, and Ports to Assess

Having the knowledge of the most significant fish species exported to the US, in terms of volume, and the landing Regions of those fish species, the most relevant landing ports within each Region were identified for those fish species, together with the fishing fleet type and the gear producing this catch.

Figure 36, Figure 37, Figure 38, Figure 39, Figure 40, Figure 41, and Figure 42 show the landing ports and the volume landed per species.

Information regarding the type of fleet and the gear used to catch the species identified in each of these landing ports are shown in Tables 19-25.

It was decided that the assessment would try to cover the above landing ports for each species but considerations were made in order to prioritize which ones to be effectively covered bearing in mind the following criteria:

- Relative importance of landing volume (tons).

- Fleet type (industrial or artisanal): The distinction was made due to the different factors associated with the type of fishing fleet, mainly the fishing areas where they operate, the gear technology which characterizes each type, etc.
- Gear technology: It is recognized that different gear used can have different potential implications in the species caught as bycatch.
- Previous knowledge about fishery interactions/potential interactions with marine mammals.

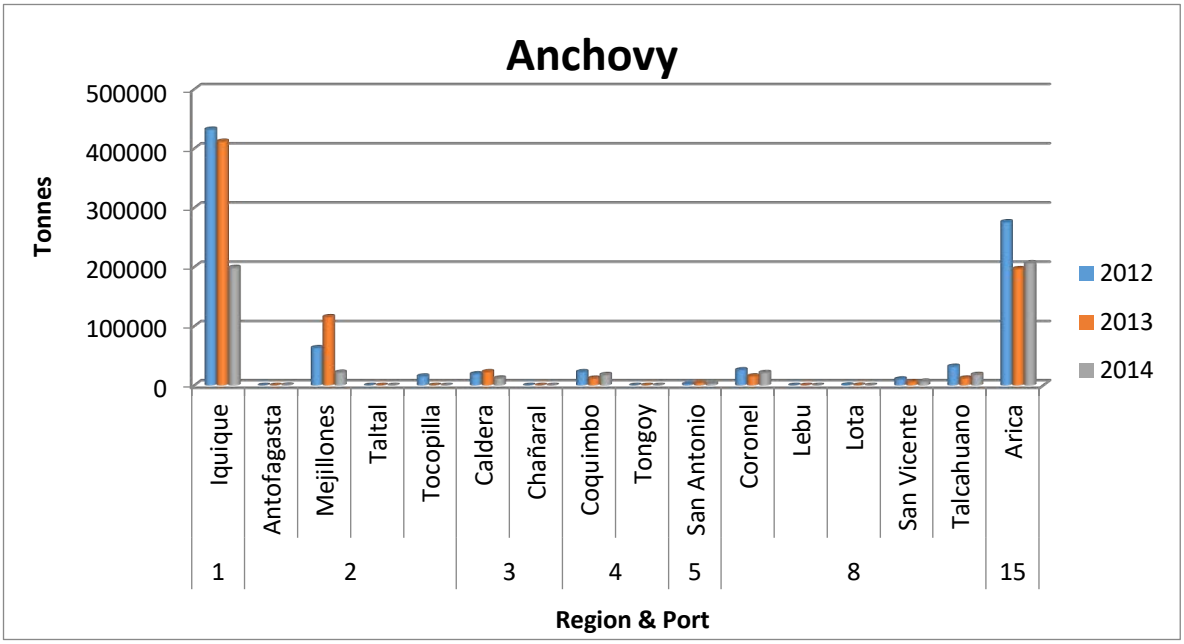

Figure 36. Anchovy landings by port, 2014 until August. Source: Sernapesca.

Table 19. Anchovy landings by port including type of fleet and fishing gear. (2014* until August). Source: Sernapesca.

Region	Port	Type of Fleet	Fishing Gear	Landings (tons)		
				2012	2013	2014*
1	IQUIQUE	Artisanal	Purse Seine	15613	20524	331
1	IQUIQUE	Industrial	Purse Seine	416684	391425	198484
2	ANTOFAGASTA	Industrial	Purse Seine	0	0	659
2	MEJILLONES	Artisanal	Purse Seine	17483	24017	7768
2	TOCOPILLA	Artisanal	Purse Seine	2937	1	0
2	TOCOPILLA	Industrial	Purse Seine	12623	0	0
2	MEJILLONES	Industrial	Purse Seine	45910	91662	14180
3	CALDERA	Artisanal	Purse Seine	19290	22856	12127
4	COQUIMBO	Artisanal	Purse Seine	22794	11917	17961
5	SAN ANTONIO	Artisanal	Purse Seine	2410	4450	3401
8	CORONEL	Artisanal	Purse Seine	16003	12873	18866
8	CORONEL	Industrial	Purse Seine	10028	2775	2628
8	SAN VICENTE	Artisanal	Purse Seine	8255	4287	6601
8	SAN VICENTE	Industrial	Purse Seine	2356	1913	273
8	TALCAHUANO	Artisanal	Purse Seine	31861	12098	18226
8	LOTA	Industrial	Purse Seine	750	495	120
15	ARICA	Artisanal	Purse Seine	120152	93939	83035
15	ARICA	Industrial	Purse Seine	155818	102953	123775

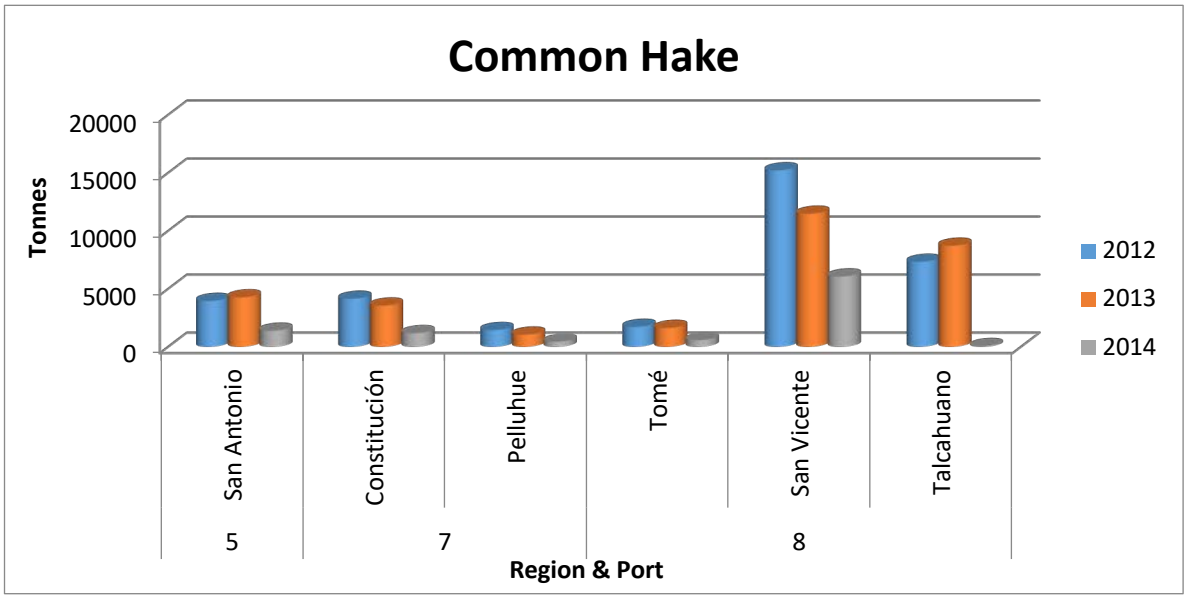

Figure 37. Common hake landings by port, 2014 until August. Source: Sernapesca.

Table 20. Common hake landings by port including type of fleet and fishing gear. (2014* until August). Source: Sernapesca.

Region	Port	Type of Fleet	Fishing Gear	Landings (tons)		
				2012	2013	2014*
5	SAN ANTONIO	Artisanal	Gillnet	2197	1924	923
5	SAN ANTONIO	Industrial	Trawl	1787	2368	493
7	CONSTITUCION	Artisanal	Gillnet	4167	3583	1204
7	PELLUHUE	Artisanal	Gillnet	1472	1080	474
8	TOME	Artisanal	Gillnet	1746	1657	610
8	SAN VICENTE	Industrial	Trawl	15240	11500	6093
8	TALCAHUANO	Industrial	Trawl	7356	8742	90

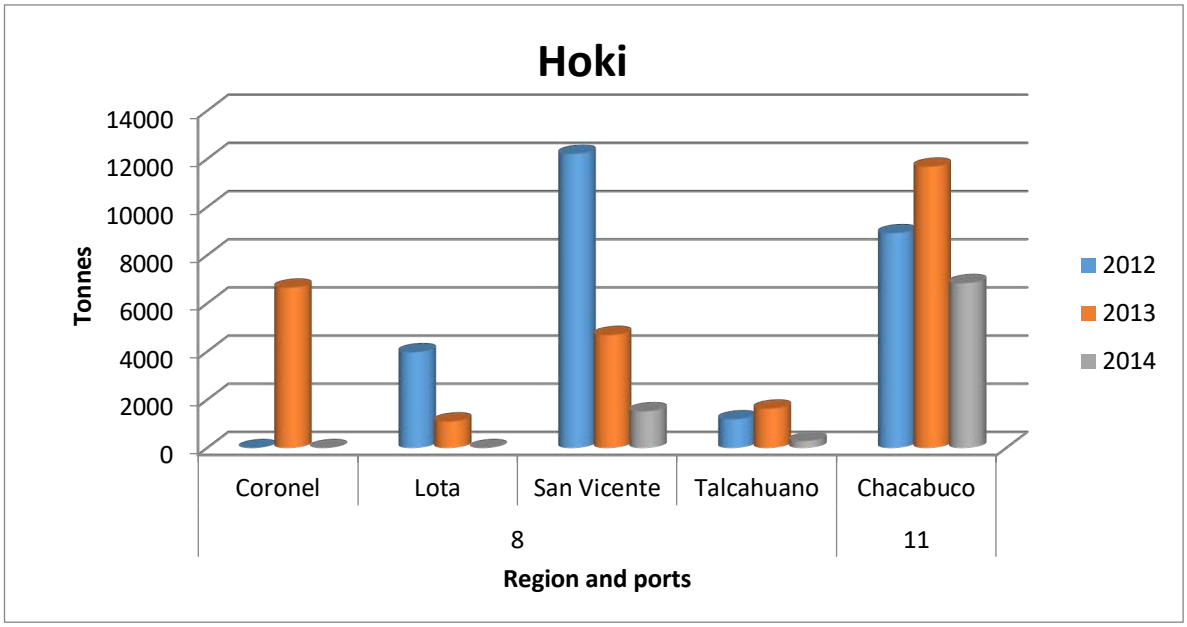

Figure 38. Hoki landings by port, 2014 until August. Source: Sernapesca.

Table 21. Hoki landings by port including type of fleet and fishing gear. (2014* until August). Source: Sernapesca.

Region	Port	Type of Fleet	Fishing Gear	Landings (tons)		
				2012	2013	2014*
8	CORONEL	Industrial	Mid Water Trawl	0	6667	0
8	LOTA	Industrial	Trawl	537	0	0
8	LOTA	Industrial	Mid Water Trawl	3450	1110	0
8	SAN VICENTE	Industrial	Trawl	8460	4406	1533
8	SAN VICENTE	Industrial	Mid Water Trawl	3765	294	0
8	TALCAHUANO	Industrial	Trawl	1198	1542	299
11	CHACABUCO	Industrial	Trawl	7139	80	87
11	CHACABUCO	Industrial	Mid Water Trawl	1788	10384	6766

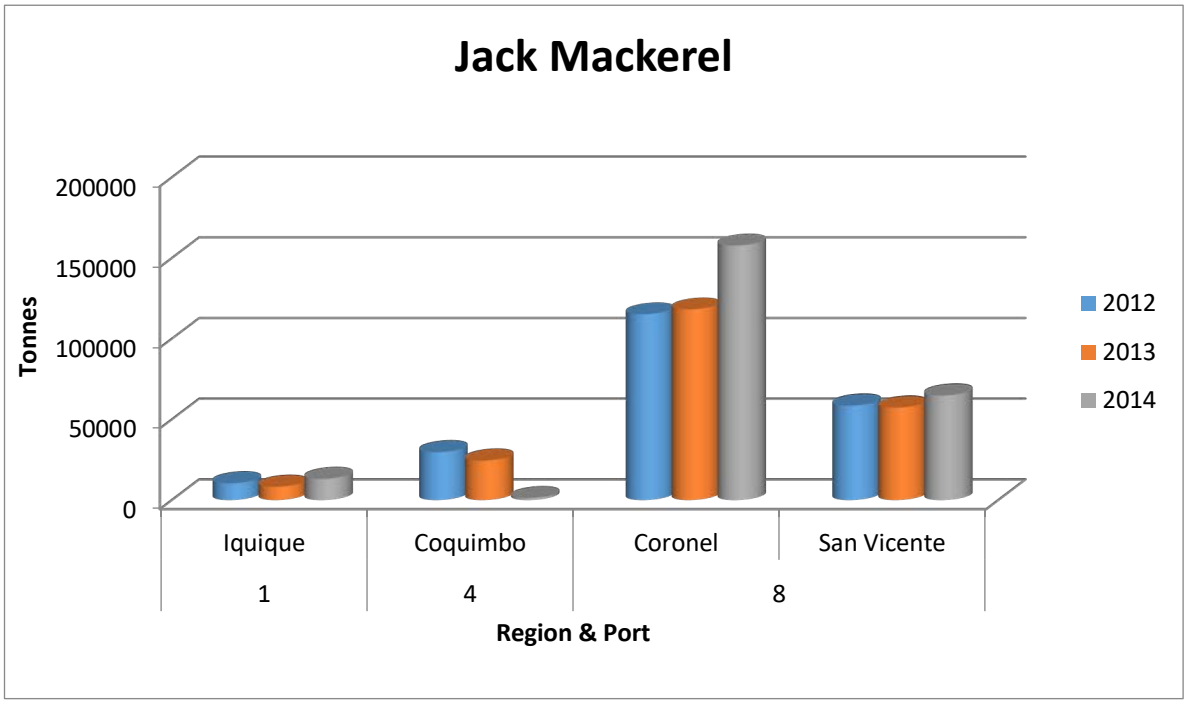

Figure 39. Jack mackerel landings by port, 2014 until August. Source: Sernapesca.

Table 22. Jack mackerel landings by port including type of fleet and fishing gear. (2014* until August). Source: Sernapesca.

Region	Port	Type of Fleet	Fishing Gear	Landings (tons)		
				2012	2013	2014*
1	IQUIQUE	Industrial	Purse Seine	10650	8517	13383
4	COQUIMBO	Industrial	Purse Seine	29946	24741	1453
8	CORONEL	Industrial	Purse Seine	113045	114649	151002
8	CORONEL	Artisanal	Purse Seine	2188	3593	6853
8	SAN VICENTE	Industrial	Purse Seine	58857	57628	65107

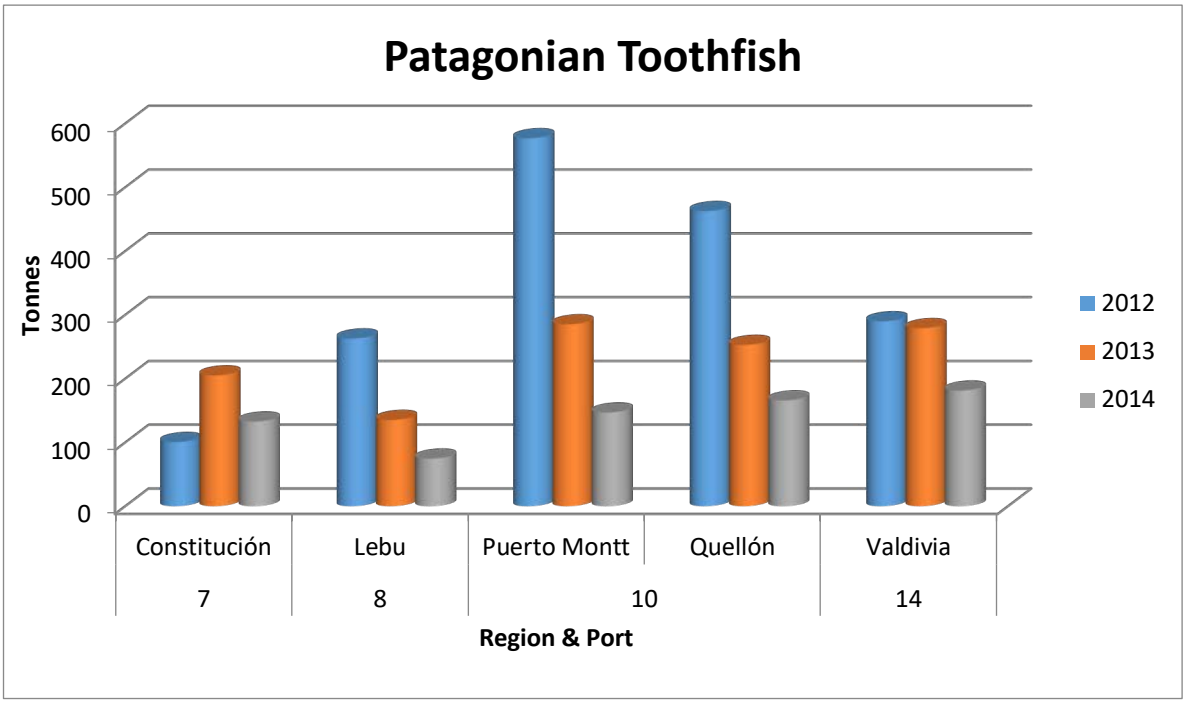

Figure 40. Patagonian toothfish landings by port, 2014 until August. Source: Sernapesca.

Table 23. Patagonian toothfish landings by port including type of fleet and fishing gear. (2014* until August). Source: Sernapesca.

Region	Port	Type of Fleet	Fishing Gear	Landings (tons)		
				2012	2013	2014*
7	CONSTITUCION	Artisanal	Longline	101	206	133
8	LEBU	Artisanal	Longline	263	136	75
10	PUERTO MONTT	Artisanal	Longline	577	286	147
10	QUELLON	Artisanal	Longline	463	253	166
14	VALDIVIA	Artisanal	Longline	290	280	182

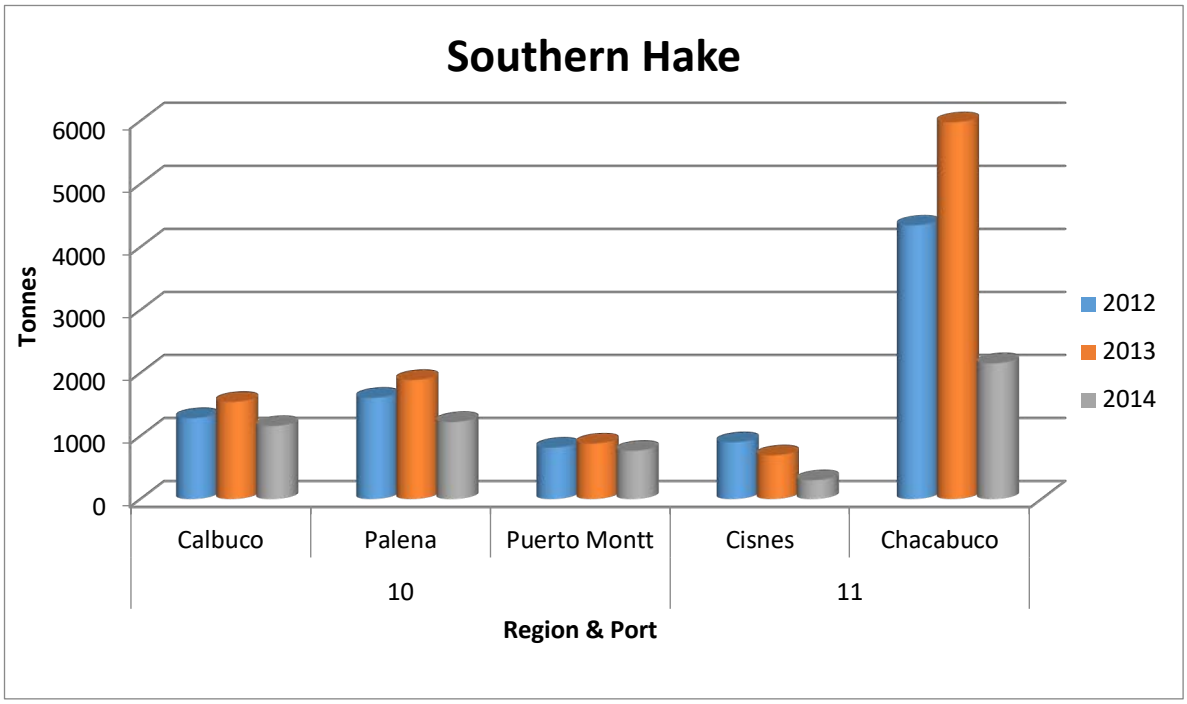

Figure 41. Southern hake landings by port, 2014 until August. Source: Sernapesca.

Table 24. Southern hake landings by port including type of fleet and fishing gear. (2014* until August). Source: Sernapesca.

Region	Port	Type of Fleet	Fishing Gear	Landings (tons)		
				2012	2013	2014*
8	TALCAHUANO	Industrial	Trawl	265	60	116
10	ANCUD	Artisanal	Longline	119	144	141
10	CALBUCO	Artisanal	Longline	1292	1550	1165
10	CASTRO	Artisanal	Longline	172	182	302
10	PALENA	Artisanal	Longline	1614	1897	1230
10	PUERTO MONTT	Artisanal	Longline	822	888	772
11	AYSEN	Artisanal	Longline	179	53	64
11	CISNES	Artisanal	Longline	908	700	305
11	CHACABUCO	Industrial	Trawl	2548	27	33
11	CHACABUCO	Industrial	Mid Water Trawl	1798	5958	2129

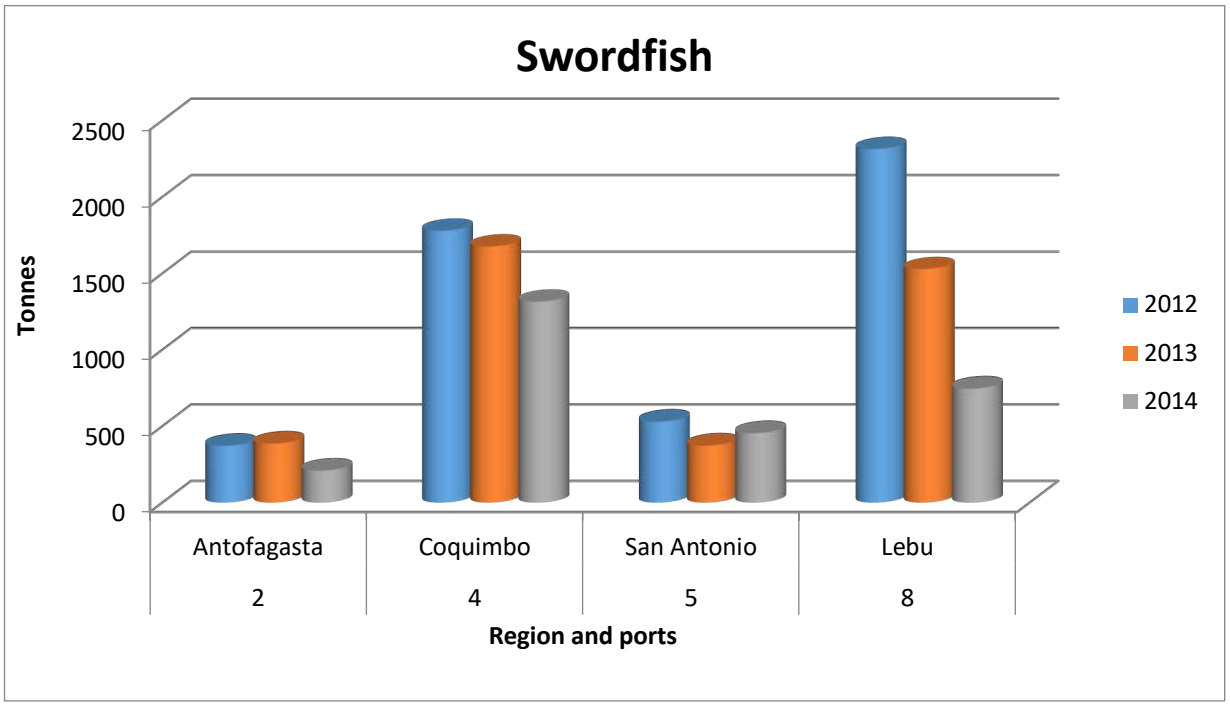

Figure 42. Swordfish landings by port, 2014 until August. Source: Sernapesca.

Table 25. Swordfish landings by port including type of fleet and fishing gear. (2014* until August). Source: Sernapesca.

Region	Port	Type of Fleet	Fishing Gear	Landings (tons)		
				2012	2013	2014*
2	ANTOFAGASTA	Artisanal	Gillnet	374	389	212
2	ANTOFAGASTA	Industrial	Gillnet	43	75	16
4	COQUIMBO	Artisanal	Gillnet	1032	1319	1253
4	COQUIMBO	Artisanal	Longline	350	246	86
4	COQUIMBO	Industrial	Gillnet	61	42	3
4	COQUIMBO	Industrial	Longline	747	357	62
5	SAN ANTONIO	Artisanal	Gillnet	532	376	457
8	LEBU	Artisanal	Gillnet	2314	1528	749

7. Field Data Collection Methods

This section details the methodology used for field data collection, including team selection and training, questionnaire design, sampling frame, and interview summary.

7.1. Team Selection and Training

The Lead Data Collector organized a team of three data collectors, two of them belonging to the Lead´s present work organization, veterinarian Mary Ann Hausdorf and engineer Joaquín Aurtenechea. Both had experience in developing applied research projects in the seafood industry including collecting information by using questionnaires they developed and administered to different stakeholders. The third data collector, Andrea Auger, a marine ecologist, was hired based on her experience in a specific geographic area which would have otherwise been difficult to cover due to travel costs.

Prior to beginning field data collection, social scientist Jennifer Brewer conducted an interactive training workshop. Training materials and group discussion covered information about the background, purpose and scope of the project, ethics, analytical rigor, effective communication, particular interview questions, interviewee recruitment, data documentation, methodological transparency, and planned integration of multiple information sources.

7.2. Questionnaire Design

Under the direction of J. Brewer, two semi-structured questionnaires were designed for interviews, one for fishermen to describe their fishing experiences in relation to marine mammals and one for others with fishing-related experience (e.g., boat owners, port administrator, scientists and authorities) to describe the port more generally in relation to marine mammals. These questionnaires were adapted from those designed for parallel data collection in Ecuador (Brewer *et al*., 2014), with revisions appropriate for the Chilean context. To refine the interview protocol and ensure systematic interview techniques, pilot interviews

were conducted by J. Brewer, J. Unibazo, M.A. Hausdorf, and J. Aurtenechea in three field sites in Region X: Puerto Montt, Chaicas, and Calbuco, as scheduled by the Lead Data Collector.

Questionnaire contents included:

- Contextual information about the interview
- Interviewee experience in fisheries, including ports, vessels, gear, and species
- Personal perceptions about marine mammals
- Interactions with whales, dolphins and sea lions in the last 12 months, including species identifications
- Changes over time in fishing and bycatch
- Prospects for future collaboration
- Uses and markets of marine mammals
- Additional comments
- Interviewer notes on the trustworthiness of the information collected.

The interview forms are included in Appendix 1.

7.3. Sampling Frame

It is important to understand that the completed interviews do not represent a randomized or fully stratified sample of the Chilean fleet as a whole. As described in this section, criteria considered in sampling frame design included: 1) species export status, 2) species landing volume per port, 3) gear technology, 4) prior knowledge of potential interactions with marine mammals, 5) boat size and type, 6) access to prospective interviewees, and 7) travel costs.

Per the port landings analysis above, of 19 species exported to the US, 11 are capture fin fisheries. Of these, fieldwork targeted a geographically distributed sample of ports with the highest landings of seven key finfish species. Three of the 11 export finfish species (sardine, silverside, and southern rays bream) were excluded from the interview sample because export volumes were low or only occurred in one year. Pacific sierra was excluded because it is caught mainly with handlines, with minimal potential for marine mammal interactions. The industrial scale capture fishing fleet operates from private facilities and was not sampled due to difficulty in obtaining access. Shellfish were excluded from the sample because they are harvested by

aquaculture or diving, with minimal marine mammal bycatch. Finfish aquaculture of salmon and trout species were excluded from the questionnaire sample, but they were included in the report based on prior field research. Having substantial past experience working with the aquaculture industry, the data collection team was aware that due to confidentiality concerns, questionnaire interviews would not produce fully reliable information.

The sampling frame was therefore designed to primarily target the seven leading capture fin fisheries with the highest probability of marine mammal interactions species: common hake (merluza comun), jack mackerel (jurel), Patagonian toothfish (bacalao de profundidad), southern hake (merluza austral), swordfish (albacora), anchovy (anchoveta), and hoki (merluza de cola). Because the sampling frame used mainly opportunistic sampling strategies to approach fishermen in the leading ports for these seven species, however, and because many fishing vessels harvest multiple species, the sample also includes information about other species beyond the seven of primary interest.

Species landings data reported above per port was used to select target ports. Among leading export species, common hake is caught mainly in the central area of the country, Regions V-VIII, using artisanal gillnets and industrial trawls. Existing literature and anecdotal evidence suggest that this fishery interacts with marine mammals. Landings of another leading export species, Patagonian toothfish, are mainly located in the central area of Chile, Regions VII and VIII, and southern Regions X and XIV. Evidence exists of fishery interaction with whales, specifically sperm whales. In the case of anchovy, the primary gear used is purse seine, and most landings are in the north of Chile, Regions I-V and XV, with some tonnage landed in the central Region VIII. The fishery is known to interact with marine mammals, mainly sea lion. Hoki is caught by industrial trawlers in the central Region VIII, and, in larger volumes, in the southern Region XI. Evidence of marine mammal interaction in this fishery was unclear from existing literature. Swordfish is landed in the northern Regions of II and IV, and in the central Regions of V and VIII, mainly using gillnets. Existing literature and observations indicate that in this fishery, gillnets in the north interact with marine mammals, mainly dolphins, and with sea turtles. Jack mackerel is caught by purse seiners in the northern Regions I and IV, and in the central Region VIII. Evidence exists of interaction with marine mammals in this fishery. Southern hake is caught in the southern Regions X and XI using artisanal longlines, and, to a lesser extent, industrial trawls. In this fishery, interactions have been documented mainly between the artisanal fleet and sea lions.

Owing to the extensive Chilean coastline and budgetary constraints, the team prioritized sampling in ports with higher landings of each species, excluded those to which travel cost was prohibitive, and selected representative ports in instances where a few ports were located in close proximity to one another. This produced a final sample of 21 ports spread across seven of the country's 14 coastal regions. This included 3 of 7 ports for common hake, 2 of 5 ports for toothfish, 4 of 5 ports for hoki, all 4 swordfish ports, 2 of 3 top ports for anchovy, all 4 jack mackerel ports, and 1 of the top 3 southern hake ports. San Antonio was the port with the highest number of interviews followed by El Manzano, Iquique and Coquimbo.

Interviewers mainly approached prospective interviewees opportunistically along the shore, on readily-accessible beaches and at waterfront facilities, particularly those of fishing industry organizations called *sindicatos*. Some interviews were obtained through referrals, such as to *sindicato* leaders. As noted, above, it was not possible to access the private facilities of the industrial fleet, so that sector is excluded from substantive discussion. Interviews were solicited without explicit consideration of target species caught, gear used, or vessel size, so the resulting sample may or may not be proportional to the export-oriented artisanal fleet as a whole.

7.4. Interviews

Interviews were conducted between August 6 and November 21, 2014. Overall, fishermen were generally willing and open to participate in interviews. In some cases, fishermen referred interviewers to specific persons such as boat owners, captains, or leaders of fishing organizations. During the first few interviews, however, interviewers found that when they asked permission to record the interview using a digital audio recorder, even after explaining confidentiality provisions, several interviewees reversed their decision to participate, became visibly uncomfortable, or suddenly abbreviated their responses. For purposes of obtaining trustworthy data and developing positive relationships with interviewees, audio recording was therefore abandoned after the first few interviews.

The team completed a total of 71 interviews during the study period, 66 with fishermen using fishermen forms and 5 using the port form for fishermen or others providing broader overviews of port activities (

Table *26*). In most of the interviews one respondent was involved but in 21 cases (32%) more than one person participated. The total number of persons with passive or active involvement was therefore 110 or more. Usually when more than one crewmember was onboard, fishermen asked that the interview be directed to the captain or the person in charge. In total, 39 hours of interviews were conducted, with most interviews lasting between 15 minutes to an hour.

Table 26. Number of interviews and type of interviewee per port and month during the study period August-November 2014.

Ports	Region	Fishermen				Others (Port)				Total /Ports
		Aug	Sept	Oct	Nov	Aug	Sept	Oct	Nov	
Anahuac	10	3								3
Antofagasta	2				1					1
Calbuco	10		1							1
Chaicas	10	1								1
Coquimbo	4				4				2	6
Coronel	8				2				1	3
El Manzano	5	1			11					12
Higuerillas	5				4					4
Iquique	1			5	1					6
Lebu	8				2					2
Maicolpué	10		1							1
Mejillones	2				3					3
Papudo	5	1								1
Portales	5			1				1		2
Quintay	5	1								1
Concón, San Pedro	5				5					5
San Antonio, San Pedro	5			13				1		14
San Vicente	8				1					1
Talcahuano	8				2					2
Tumbes	8				1					1
Valdivia	14		1							1
Total / Month		7	3	19	37	0	0	2	3	71

8. Field Data Results

8.1. Fishing Gear

Interviewees were asked about the fishing gear they used during the past 12 months. In 43 cases (65%) fishermen responded that they used only one type of gear, and 2 different gears in 18 cases (27%). In 23 cases more than one type of gear was used (Figure 43).

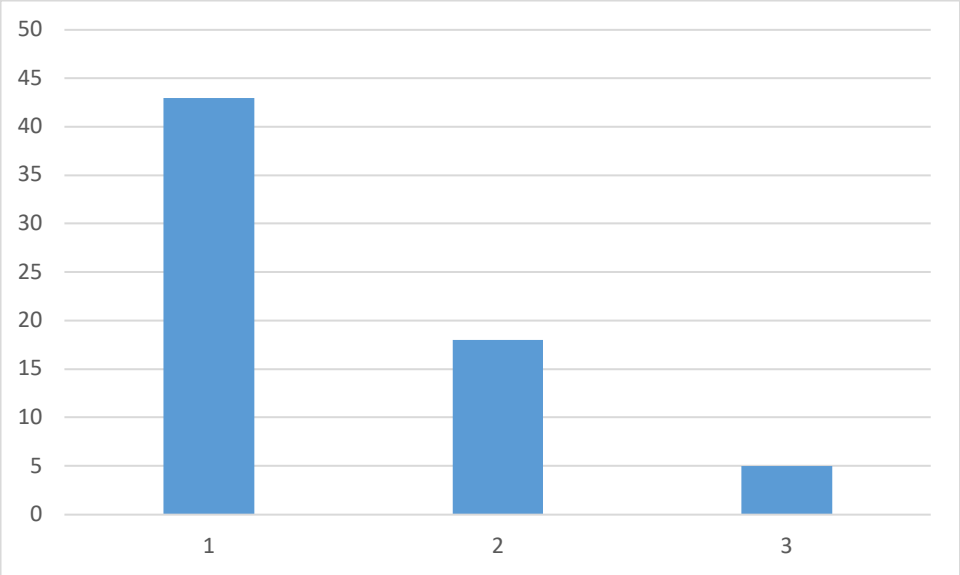

Figure 43. Number of fishing gears used by fishermen in the last 12 months.

The most common fishing gear used by interviewed fishermen was gillnets (surface and bottom) (50%), longlines, tota and purse seine (artisanal and industrial). Other gear less frequently used was hand lines, harpoons and traps (Figure 44).

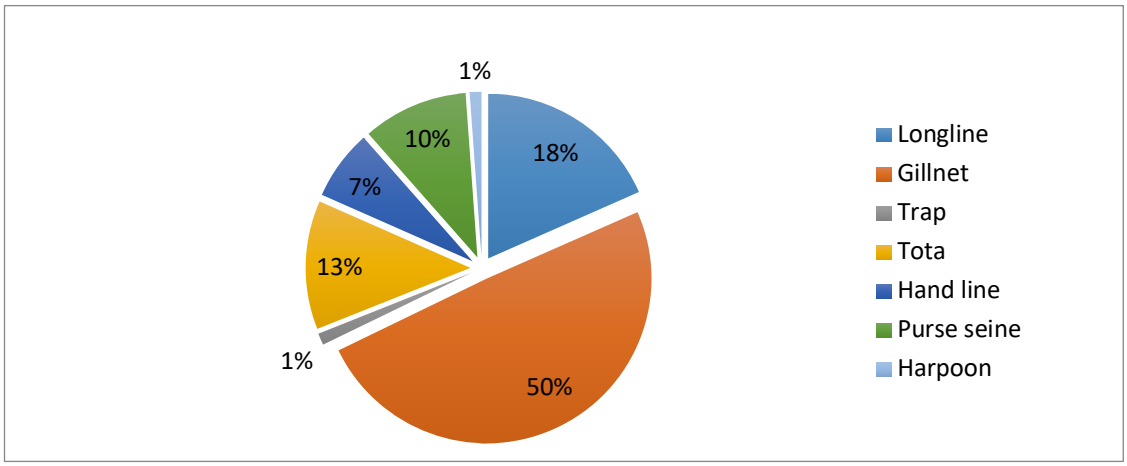

Figure 44. Proportion of each fishing gear used by interviewees (n=66) in the last 12 months.

8.2. Perceptions of Marine Mammals

Fishermen were asked to respond to several questions about their perceptions of marine mammals in relation to fishing and aside from fishing. Three groups of marine mammals were specified: whales, dolphins and sea lions. Fishermen were asked if, from a fishing perspective, they perceive these animals as beneficial, a difficulty, both, or neither, and for what reasons.

In 97% of cases, sea lions were considered a difficulty, followed by whales, in 22% of the cases. Dolphins were seen as a difficulty in only 6% of the cases (Figure 45). The main reason for considering whales and sea lions as a difficulty was because fishermen reported that they eat the caught fish and damage the fishing gear, causing a significant economic loss to fishermen. The difference between these two groups is that whales only affect the Patagonian toothfish fishery while sea lions affect several. According to the interviewees' perceptions, dolphins do not really affect the fishermen nor their activities. More detailed analyses of interview responses follow.

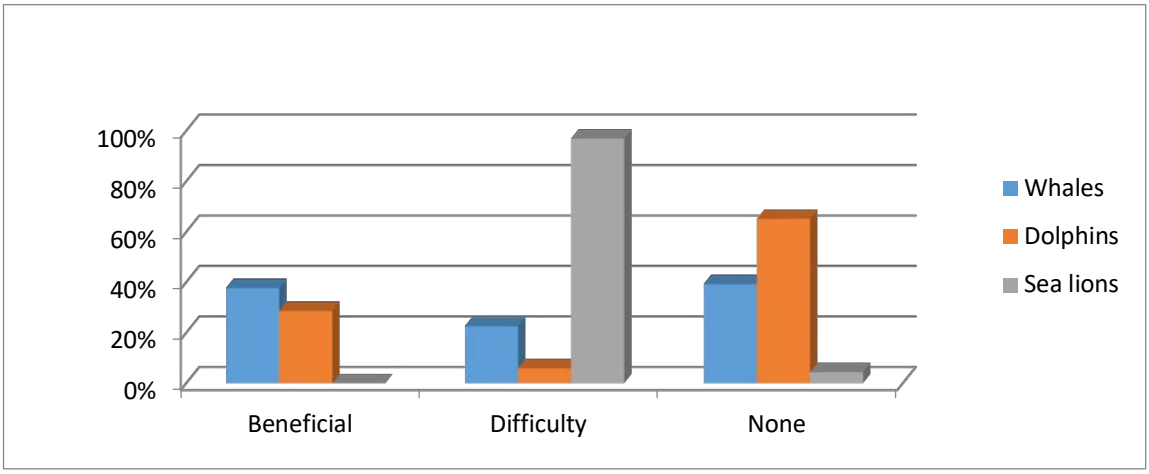

Figure 45. Perception by fishermen regarding marine mammals. Data are shown as proportions.

8.3. Perceptions of Dolphins

When fishermen were asked about their personal perceptions of dolphins from a fishing perspective, among 63 interviews with responses 55% expressed that dolphins don't cause any problems, 35% expressed appreciation for dolphins as being companions, beautiful, spectacular, sacred, or entertaining, 2% (one interview) expressed that dolphins help fishermen by revealing fish, and another 2% expressed that dolphins are a problem because they take fish. Six percent of interviews conveyed entanglements as being problematic for dolphins and/or fishermen. Of these, two interviews (3%) conveyed that dolphins are a problem because they entangle, and another two (3%) conveyed that entanglements are a problem for dolphins but not for fishermen. (See Figure 46).

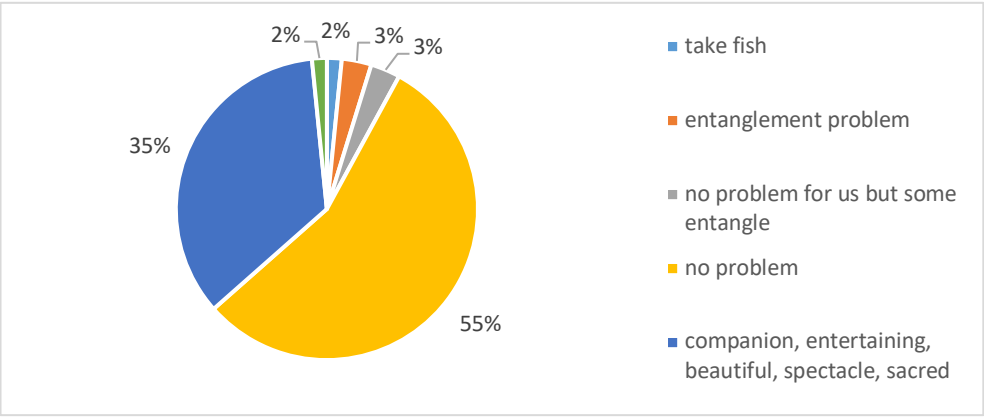

Figure 46. Fishermen perceptions of dolphins, from a fishing perspective.

When fishermen were asked about their perceptions of dolphins from a non-fishing perspective, all responses were either positive or neutral. Eighty percent expressed appreciation for dolphins' beauty, intelligence, entertainment, companionship, or other positive attributes. Five percent expressed that dolphins have value for tourism. Fifteen percent of responses were neutral. (See Figure 47.)

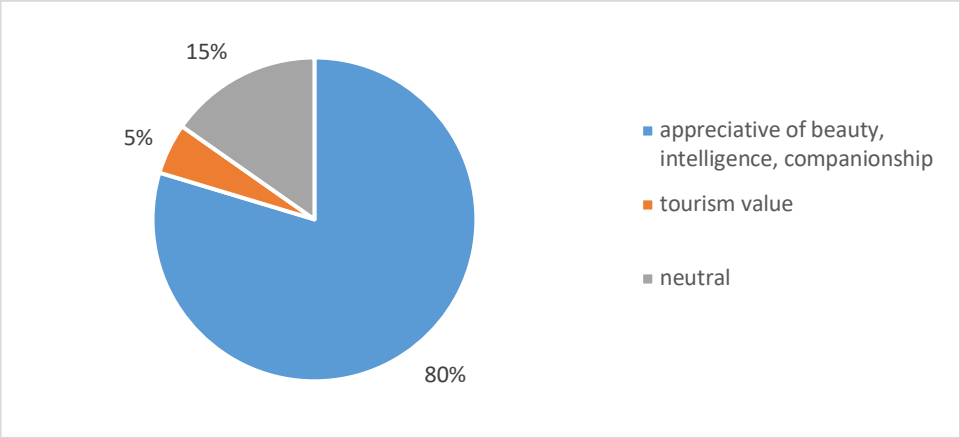

Figure 47. Fishermen's perceptions of dolphins from a non-fishing perspective.

8.4. Perceptions of Whales

When fishermen were asked about their personal perceptions of whales from a fishing perspective, among 67 interviews with responses the majority, 65%, expressed that there is no problem or they are neutral. Sixteen percent expressed appreciation for whales; of these, a majority appreciated that whales scare or eat sea lions, while others expressed appreciation or admiration for more intrinsic whale attributes such as their beauty, companionship, or size.

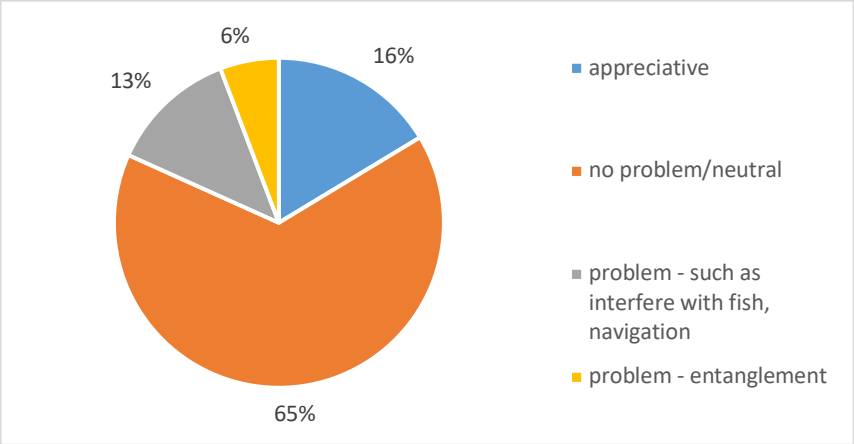

Figure 48. Fishermen's perceptions of whales from a fishing perspective.

When fishermen were asked about their perceptions of whales from a non-fishing perspective, among 63 interviews with responses, 62% expressed appreciation for intrinsic values such as beauty, strength, intelligence, 5% noted tourism value, 30% expressed neutral sentiments or said they are not a problem, and 3% (2 interviews) expressed negative views, some apparently linked to fishing.

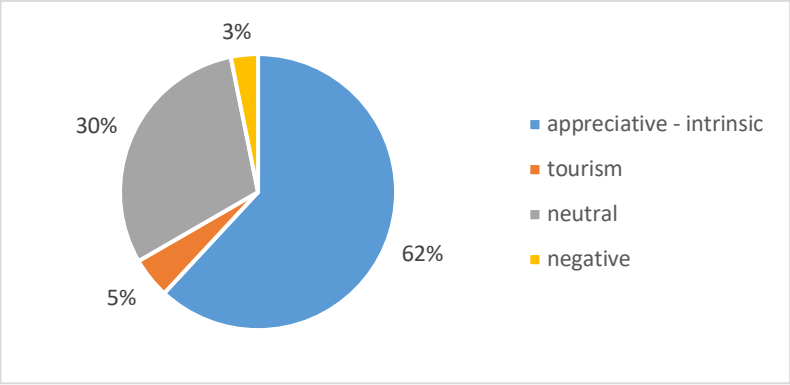

Figure 49. Fishermen's perceptions of whales from non-fishing perspective.

8.5. Perceptions of Sea Lions

When fishermen were asked about their personal perceptions of sea lions from a fishing perspective, among 66 interviews with responses all but three expressed that sea lions are a problem because they interfere with the fish, the gear, and/or the bait. The remaining 5%

reported that sea lions aren't a problem for them personally because of their fishing location or because orcas chase them away.

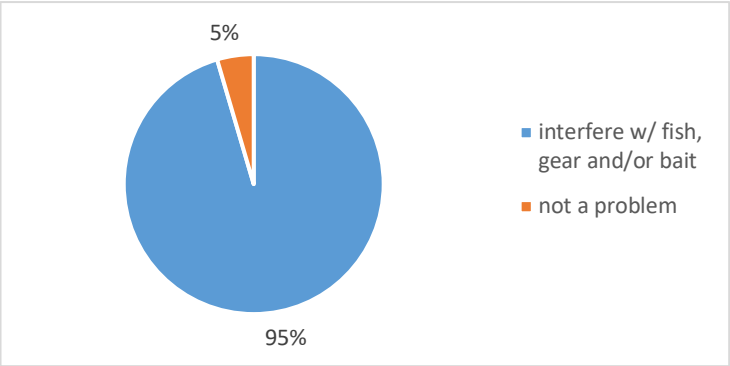

Figure 50. Fishermen's perceptions of sea lions from a fishing perspective.

When fishermen were asked about their personal perceptions of sea lions from a non-fishing perspective, many had difficulty separating their fishing-related sentiments from non-fishing ones. Among 63 responses, 33% expressed clearly negative perceptions but many of these continued to mention fishing-related problems. Another 12% commented mainly on the overabundance of sea lions, with many noting that there are more now than in the past, 28% had neutral or no comments, 25% conveyed appreciation or tolerance for the intrinsic value of sea lions such as their intelligence, adaptiveness, or natural right to exist, and 2% (one interview) noted their tourism value.

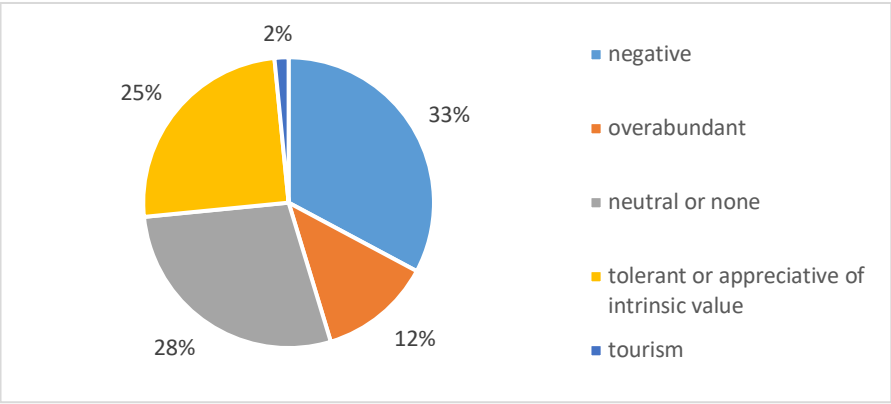

Figure 51. Fishermen's perceptions of sea lions from an ostensibly non-fishing perspective.

8.6. Frequency of Mammal Sightings and Entanglement

Several questions helped to assess the frequency with which fishermen observe evidence of marine mammal entanglements. These included questions about the frequency of whale, dolphin, and sea lion sightings in the last year, frequencies of mammal sightings with evidence of entangled gear in the last year, and estimated frequencies of entanglement.

Among 63 interviewees providing quantifiable or semi-quantifiable responses, 19% said they had seen no whales in the last 12 months, 28% reported seeing one or more but less than 10, and 53% reported seeing a number from 10 to 200 or many or continually.

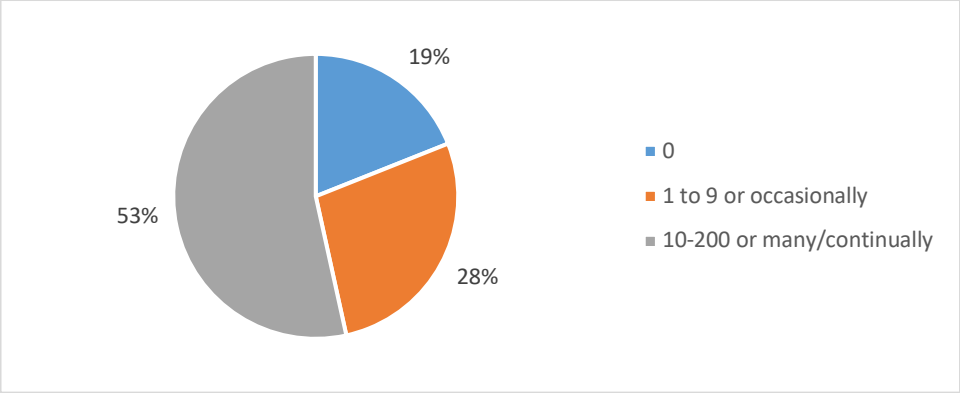

Figure 52. Number of whale sightings in the last 12 months as reported by fishermen.

Among the 63 responses, all but one said they had not seen any evidence of fishing gear interactions with whales, while one said he had seen evidence of trawl gear interactions. Among 64 responses, 53 reported seeing no dead whales in the last 12 months, while 7 reported seeing one dead whale, four reported seeing 2 to 10. Among these, one said it was possible that a dead whale had lines attached, but all others said they saw no evidence of gear entanglement. One interviewee explained that fishermen who find sperm whales to be a nuisance can kill them by shooting them in the head. Although the individual did not admit that he had ever seen this happen, the description was detailed, and was conveyed with some sense of trust, suggesting that it reflected first-hand observation.

When asked about dolphin sightings, among 69 responses, 51% said that in the last year they have seen dolphins always, daily, or many, 17% said they saw dolphins weekly, monthly or seasonally, and 32% said they see dolphins only occasionally, sometimes, few or none.

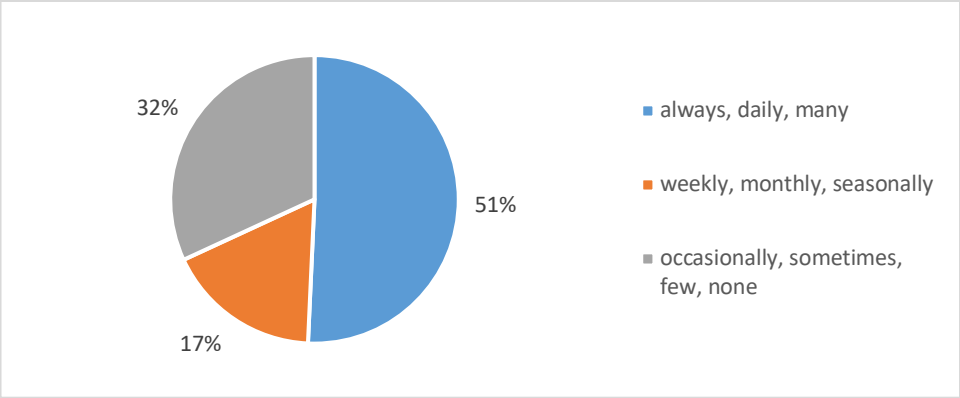

Figure 53. Reports of dolphin sightings by fishermen in the last 12 months.

When asked about having seen dolphins with evidence of entanglement in fishing gear in the last 12 months, among 66 responses, 21% said they had seen none, 11% said they had seen none but that it can happen, and 21% said they had seen at least one occurrence.

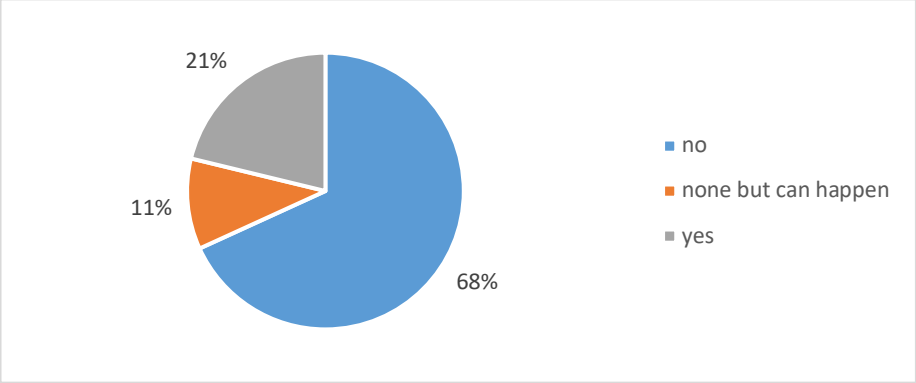

Figure 54. Fishermen reporting sightings of dolphins in the last 12 months with evidence of gear entanglement.

When asked about the frequency of dolphin entanglement in gear from boats such as theirs, among 51 responses, 53% said it doesn't happen, 17% said it happens rarely or few, 14% said

it happens elsewhere or with other gear, 8% said it happens 2-3 times per year, and 8% said it happens approximately on a monthly basis. Of those saying it happens monthly, all four were working on gillnetters in the last year, two each from each of two ports in different regions.

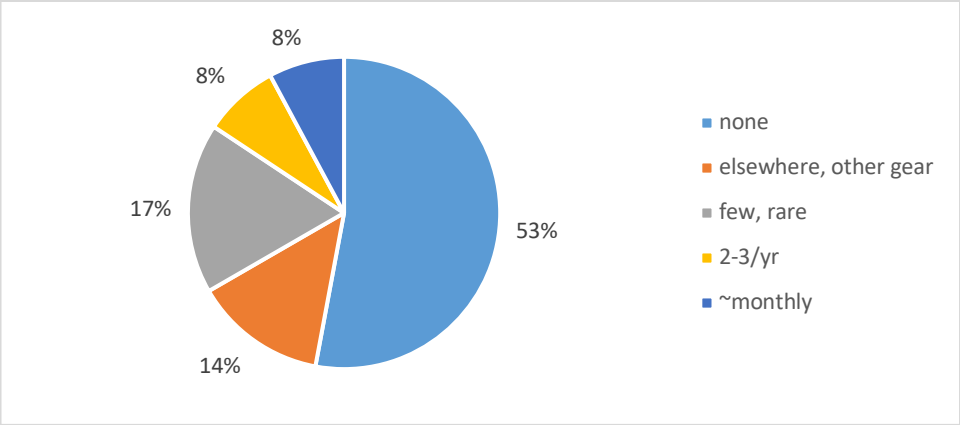

Figure 55. Frequency of dolphin entanglements as reported by fishermen as being typical of boats like theirs.

When asked about frequency of sea lion sightings, among 69 responses 99% reported seeing sea lions on every fishing trip, while just one said recently they were seeing fewer than in the past.

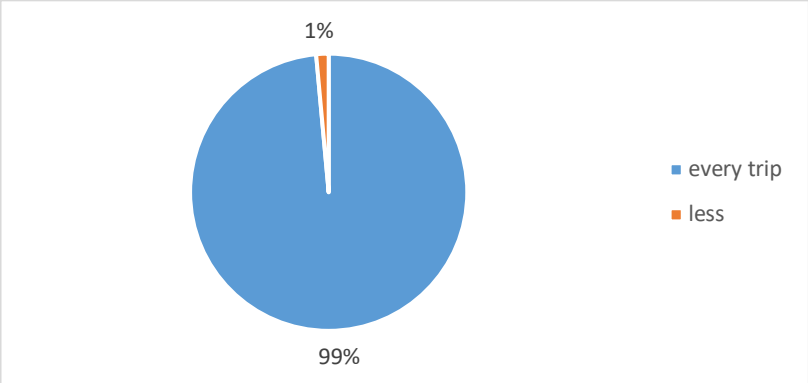

Figure 56. Fishermen reported sea lion sightings in the last 12 months.

When asked about their observations of sea lion entanglements in the last 12 months, among 66 responses 55% said they had seen none, 11% said they only happen with other gear, 18% said yes they had seen some, 15% said yes they had seen 1-2 or a few, and one said he had seen

15. Many noted that although sea lions become entangled, they normally break free, and among those reporting seeing a few entanglements some noted that the entangled sea lions were small.

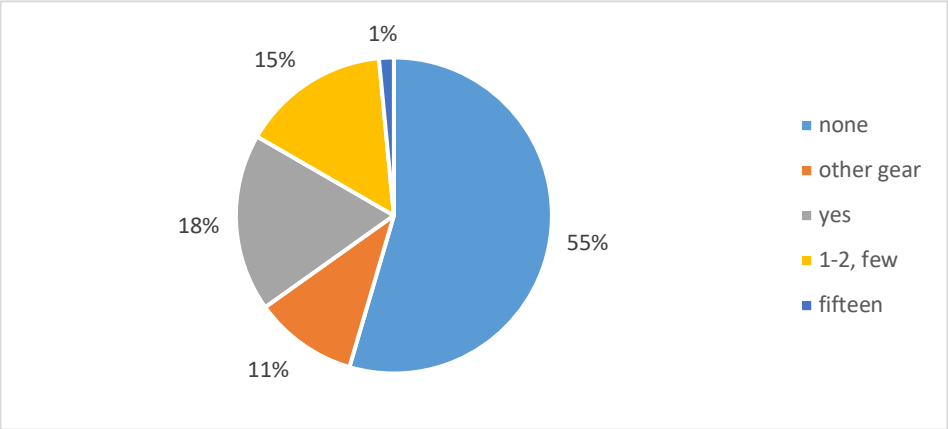

Figure 57. Fishermen reported sea lion entanglements in the last 12 months.

When asked how frequently sea lions become entangled in gear from a boat like theirs, among 47 responses, 40% said it never happens, 47% said it only happens rarely or occasionally, 9% said it happens weekly or monthly, and 4% said it happens always.

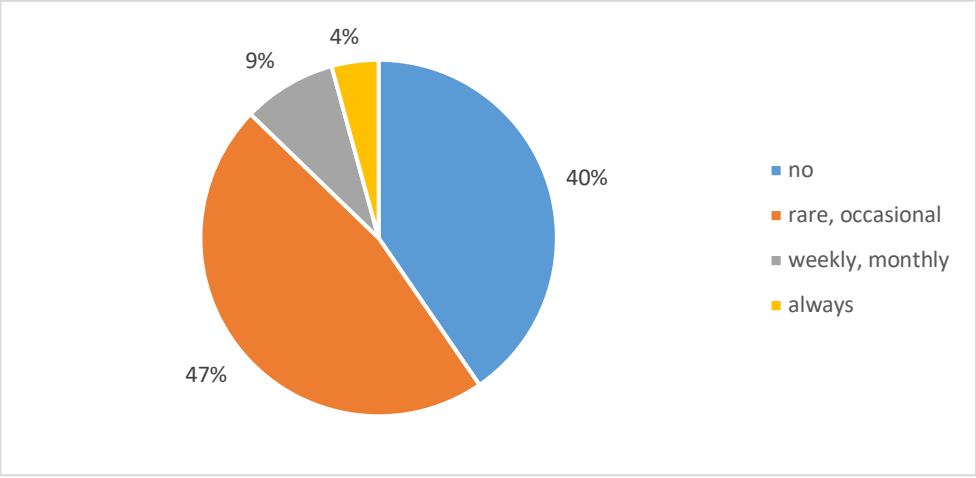

Figure 58. Fishermen reporting frequency of sea lion entanglement in boats like theirs.

8.9. Changes in Bycatch Rate

Fishermen were asked about changes over the last five years in terms of perceived mammal populations and frequencies of entanglement. With respect to whales, among 66 respondents, 65% felt that populations have been stable, 21% felt that populations have increased, and 14% felt that populations have decreased. With respect to dolphins, among 66 respondents 79% felt that populations are stable, 15% felt populations have increased, and 6% felt that populations have decreased. With respect to sea lions, among 66 respondents 98% felt that populations have increased, some noting that the increases are substantial, while only one interviewee felt that the population has been stable.

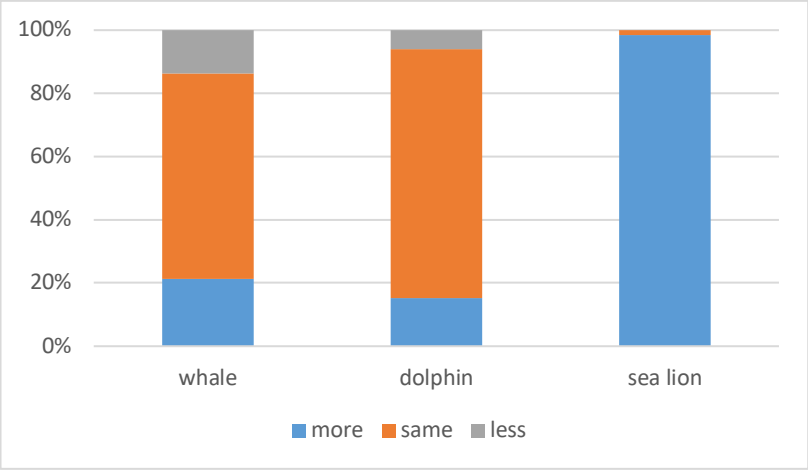

Figure 59. Fishermen perceptions of mammal population trends over last 5 years.

Fishermen were also asked about their perceptions of changes in mammal bycatch rate over the last 5 years. In the case of whales, many interviewees answered that they felt unable to judge since they have no personal familiarity with the problem, but among 45 respondents 89% considered the rate to be stable, 9% considered it to have increased, and 2% considered it to have decreased. In the case of dolphins, among 48 respondents 96% of interviewees indicated that the rate continued to be stable, and 4% indicated that the rate has decreased. In the case of sea lions, among 39 respondents 63% indicated that the bycatch rate has been stable, 28% indicated that it has increased, and 8% indicated that it has decreased. The three interviewees

observing a decline in sea lion entanglements mentioned that sea lions have learned to avoid or escape from gear. Of those observing an increase in entanglements, nine noted that entanglements are up because of the increased sea lion population.

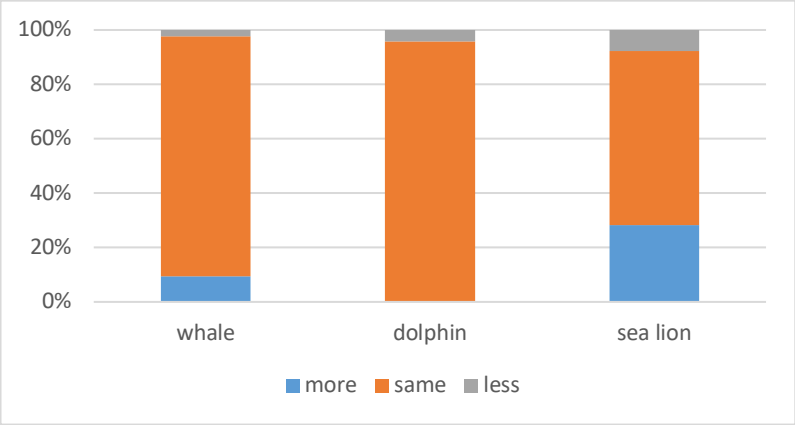

Figure 60. Fishermen perceptions of mammal entanglement trends over the last 5 years.

8.10. Ideas to Reduce Bycatch

When asked, several fishermen shared some ideas to reduce bycatch. The ideas were mostly general and short statements without much elaboration on the details. During the interviews, 30 ideas were received to address interactions with sea lions, 14 with whales and 4 with dolphins. Here is a summary of the most relevant topics mentioned:

Sea lions

- Feed them on the other side, far away from the intended fishing ground
- Create loud sounds to scare them
- Technology to haul the fishing gear faster
- Control the population (e.g., sterilization)
- Use a "tiqui-taca," device of two steel balls that strike together and produce a loud sound
- Ultrasound
- Alarm in the net

- Sea lions learn very fast to avoid any new solutions to scare them, so we need more research to create effective technologies.

Whales

- Use of "cachalotera" device that avoids marine mammal depredation of the fish caught on the line (Figures 76 and 77). It consists of a cone-shaped device used as a protection net to cover the fishing hooks, preventing the marine from accessing the caught fish. In Chile it is used in the Patagonian toothfish fishery to ameliorate interaction with sperm whales.
- Chemical lights
- Sounds to scare the whales, including bombs.

Dolphins

- Change fishing gear
- Use sounds to scare them.

8.11. Interactions with Other Species

Regarding other taxa, fishermen mentioned the existence of other species caught as bycatch but as isolated cases: turtles were mentioned 14 times in that they became entangled with fishing gear but they are normally released alive; sharks were mentioned 4 times and penguins and manta rays only 1 time.

8.12. Future Collaboration

Fishermen were asked about their willingness to collaborate in the future with researchers on fishing techniques to reduce marine mammal bycatch. Most fishermen gave a positive answer (56%) (Figure 61).

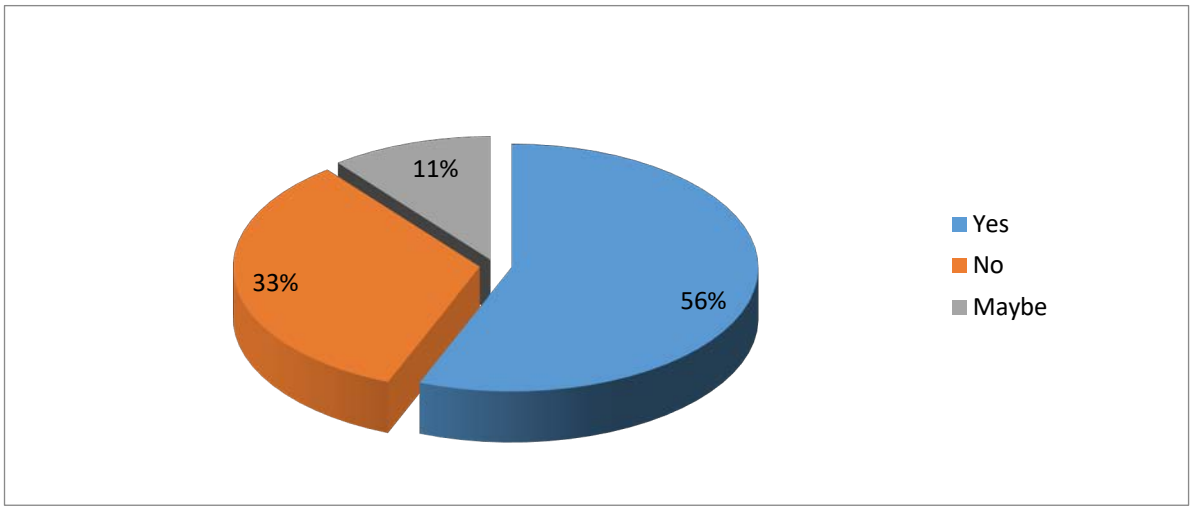

Figure 61. Fishermen willingness to collaborate on future studies to address bycatch in Chile.

9. Discussion

Chile has emerged as one of the major players in the fisheries and aquaculture sector worldwide over the past few decades and the activity is an important component of the national economy. However, this country's development has not been without its difficulties. Resource depletion in the pelagic fisheries that started in the 1990s presented major challenges to companies and communities engaged in marine capture fisheries. As in many other countries, artisanal fisheries remain a difficult problem and current policies have not yet successfully dealt with overexploitation of coastal fisheries resources nor provided stable livelihoods to coastal populations (OCDE, 2009). Most recently, there has been a major disease crisis in the salmon aquaculture industry and there are ongoing conlpcerns related to diversification, zoning and environmental sustainability in the aquaculture industry.

Generally, fish production in Chile has shown a similar situation to other fishing countries, with overfishing resulting in a downward trend in many species, such as anchovy and mackerel (OCDE, 2009).

The policy framework governing the Chilean fisheries and aquaculture sector has evolved considerably over the last few decades. The industrial, artisanal and aquaculture industries have each followed a different path of policy development and their current management reflects the particular challenges and policy pressures confronting the different sectors. General

trends include a lengthy process characterized by overinvestment, severe declines in catch levels, disputes among stakeholders, and fleet downsizing and aquaculture diseases, among other issues.

In the case of industrial fisheries, their management has evolved from open access systems to regimes including global quotas and the allocation of individual tradable quota shares. The introduction of the LTP system has provided a flexible operating environment for the fishing sector, with firms able to self-adapt their capacity and catching patterns to maximize profits. Landings in industrial fisheries have stabilized and the economic performance of the fishing fleet has improved. Fishing seasons have been extended, facilitating a more efficient use of on-shore processing facilities, and employees have more stable and better quality jobs. Moreover, the government, through the Law. 20.625, is exploring the options for shifting to a multi-species and ecosystem approach to fisheries management rather than single species management.

The artisanal fisheries, as in many other countries, present a greater management challenge due to the sheer numbers of fishers involved, the difficulties in enforcing regulations at a local level in a country with a very long coastline and many landing sites, and the high dependence on the artisanal fishing industry by coastal communities with limited alternatives for food and income (OCDE, 2009). Through effective political negotiation, artisanal fishery organisations have obtained exclusive access rights over a five-mile zone adjacent to the Chilean coastline, and have negotiated important shares of different fisheries that straddle this zone.

In terms of fisheries and marine mammal interactions, the policy adopted by Chile has been oriented only to non-lethal use of marine mammals and not for the assessment of the status of interaction, which includes bycatch as a consequence. Furthermore, the government has done more to maintain conservation measures and to preserve marine mammal species present in territorial waters, species mostly included in international agreements signed by the country in order to preserve their populations, as CITES, IWC, CMS, etc.

This policy of non-lethal use of cetaceans has resulted in national regulations aimed at conserving these species without consumptive use. In this regard, the Decree Law (MINECON) No. 225 of 1995 established an extractive ban for a period of 30 years from November 1995, for 55 species of marine mammals (cetaceans, pinnipeds and mustelids), 10 species of penguins and 5 species of marine reptiles, turtles among these. By this decree, the hunting, capture, possession, transportation, marketing and maintenance in captivity of any cetacean, and the possession, transport, sale or storage of any part of it, is prohibited. Along with this, the

Supreme Decree No. 179 of 2008 (MINECON) permanently prohibits the capture of all species of cetaceans present in territorial waters of Chile. This policy was implemented using the authority contained in the General Law of Fisheries and Aquaculture (LGPA) for the aquatic species protected by international treaties. Likewise, Chile enacted in 2009 the Law on Protection of Cetaceans (Law 20,293), declaring the waters under national jurisdiction as a whaling-free zone, and amending the LGPA, giving authority to SERNAPESCA to regulate the observation, rescue, rehabilitation and reintegration of marine mammals, penguins and marine reptiles. This law also establishes penalties for those who shoot, hunt, or capture of any cetacean species, carrying a penalty of imprisonment in its minimum degree and forfeiture, without prejudice to administrative sanctions that apply in accordance with the law.

The promotion of new sustainable practices within an ecosystem approach that Chile is implementing aims to ensure the conservation of marine mammal populations. Examples are the declarations of marine protected areas in the country in order to protect feeding grounds of the humpback whale (*Megaptera novaeangliae*) within the Francisco Coloane Marine Park, or safeguard residence areas of bottlenose dolphins (*Tursiops truncatus*) and the marine otter (*Lontra feline*) within the marine reserves Isla Chañaral and Isla Choros y Damas. Another step towards this goal is the enactment of the law 20.625, which imposes mandatory actions to follow when marine mammal bycatch occurs and, to use observations and science as tools for addressing bycatch.

Over the last few years, in terms of export value, the US has been the main market for Chilean seafood products. This is mainly due to the volume of aquaculture products exported to this destination, largely Atlantic salmon, followed by wild fish species, such as common hake, Patagonian toothfish, hoki, swordfish, anchovy, jack mackerel and southern hake, all from fisheries recognized to have some degree of interaction with marine mammals.

In the case of Atlantic salmon, the interactions are mainly exclusive to common sea lions (*Otaria flavescens*) (Durán *et al.*, 2011). The development of aquaculture in Chile, together with the decrease of fishing, constituted a new feeding niche that was occupied efficiently by this animal (Ace-Hopkins, 2002) (Figure 62). The high density of fish inside fish cages constituted a huge attraction for this predator which can become entangled in the anti-predator nets that salmon farm sites install as a barrier outside the cages which contain the fish, to prevent sea lions to reach, attack and consume the fish growing inside the cage net (Figure 64). These anti-predator nets are widely used and considered the most efficient way of protection against sea lions. Other

methods such as scaring or sonic deterrents have had variable results over time due to habituation of animals to these sounds and the development of avoidance strategies (Quick *et al*., 2004). Predator models have also been used with unsuccessful results.

Figure 62. Sea lion colony near a salmon farm in Hualaihué, X Region.
©J. Unibazo

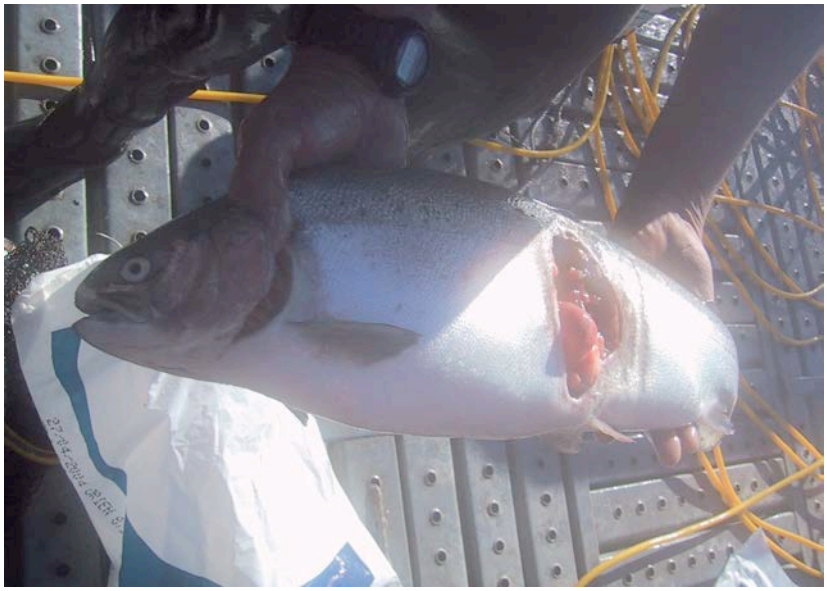

Figure 63. Salmon partially consumed in its ventral part by sea lions.
Source: Durán *et al.*, 2011.

Moreover, the use of firearms seems to have been eradicated from farm sites because there are no current records of sea lion deaths from firearms (Vilata *et al.*, 2010). There has been evidence that such weapons may still be used at farm sites, however, when a resident of Compu, Quellón, was shot by a salmon farming guard after she recorded him shooting some birds that were adjacent to the site (http://www.aqua.cl/2013/12/17/desde-salmonicultora-disparan-mujer-que-registraba-video-de-pesca-ilegal/).

This negative operational interaction with sea lions has not been fully eradicated as demonstrated by the case of an attack that was made by salmon farm workers on an entangled sea lion that occurred while writing the present report (Figure 64). In this case, SERNAPESCA presented a formal complaint with the Public Prosecutor of Aysén for Animal Abuse and Cruelty under the Animal Protection Act, and for capturing and processing a species banned, as laid out in the General Law on Fisheries and Aquaculture. (See http://www.aqua.cl/2015/07/15/sernapesca-presenta-denuncia-por-maltrato-animal-y-matanza-de-especie-protegida/).

Figure 64. Sea lion attacked by salmon farm workers. Source: Sernapesca.

The Environmental Regulation (DS-320 MINECON-2001, as amended) covers the entanglement of marine mammals in any structure belonging to a salmon farm site. Its Article 5 provides that *"every salmon farm site must have an action plan for contingencies, establishing the operating responsibilities actions if circumstances likely to cause negative or adverse environmental effects occur. Contingencies that should be considered are at least: storm, earthquake, the entanglement of marine mammals, the collision of ships with farming structures, the accidental loss of feed, farming structures or other materials, harmful algal blooms or escapes".* Under this regulation, if any entanglement occurs, SERNAPESCA must be informed and an investigation has to follow focused on the actions to minimize any potential recurrence.

During the development of the present project, no official records were obtained showing mortality or incidents of sea lions occurring in the salmon industry. A statement made by the Executive Director of Terram Foundation indicated that, according to a study developed on three farm sites, four to five sea lions die on each site during a six-month period.

However, it is not only sea lions with which the salmon farming industry interacts. An example of the interaction between cetaceans and farm site structures was reported by Hucke-Gaete *et*

al. (2013) with the case of a humpback whale calf that became entangled in a salmon farm's anti-predator nets in the Aysén Region during the austral summer of 2007 (Figure 65).

Figure 67 shows net pens with an anti-sea lion predator net to minimize the risk of sea lions entering the area where the fish cages are located. The same figure shows the interaction between birds and the farm sites, where anti-bird nets are deployed to avoid fish predation by birds.

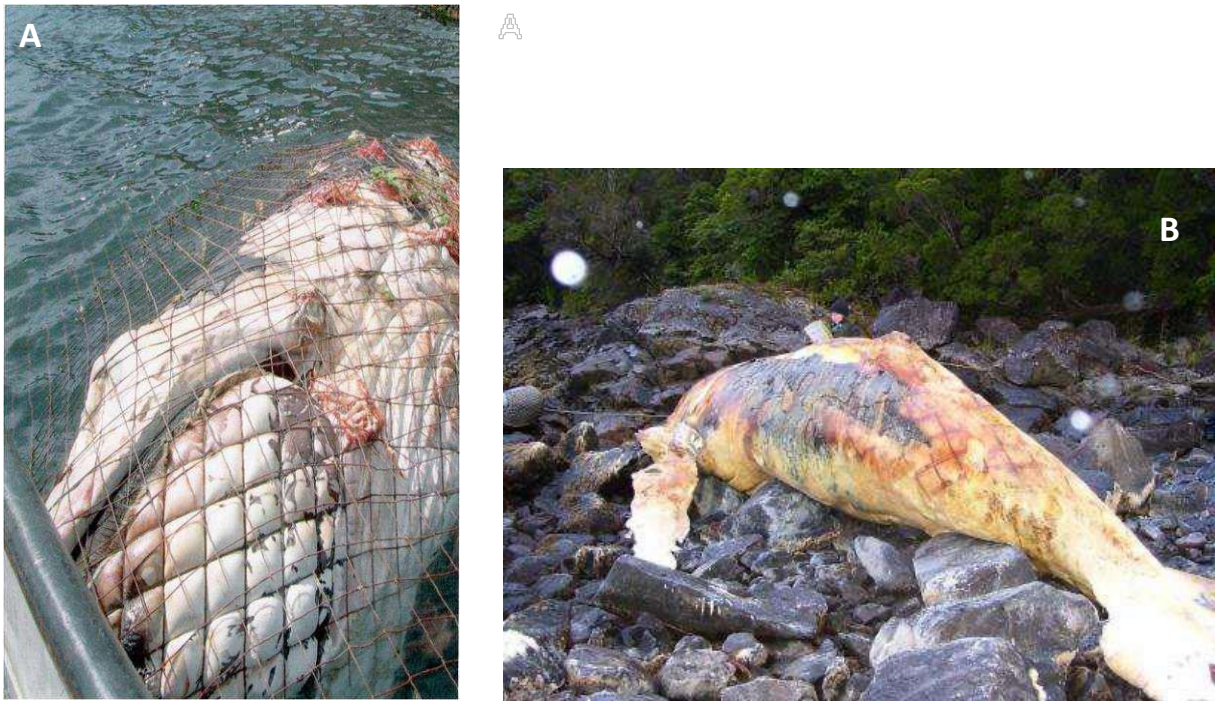

Figure 46. A) Humpback whale calf caught on a salmon farm net in northern Patagonia. B) The same whale beached near the fish farm. ©R. Hucke-Gaete.

Figure 66. Salmon farm cages protected by nets against sea lions and birds to avoid predation. Source: Durán *et al.*, 2011.

Uncertainties exist regarding the level of negative interaction between the salmon farming industry and marine mammals, as there is evidence of a high level of presence of marine mammals in areas where the salmon farms are located. Official records of sightings of cetacean

species in the salmon industry are scarce but there is knowledge in the industry that there are a significant number of sightings around the farm sites. Studies such as "Developing a monitoring tool kit for endemic Chilean dolphins: Identifying critical habitat and anthropogenic impacts" (Coram *et al*., 2013), which had established strategies for the identification of small cetaceans through acoustic monitoring systems (C-PODs), has provided a useful tool for establishing the degree of activity of these cetaceans in certain areas. In this study, five monitoring zones were established in the area of Quellón, X Region (Figure 67), which correspond to an area where the salmon industry is located. Table 27 shows the results obtained in the study where the amount of time dolphins were detected (DPM) on each of the five sites studied was measured in minutes per hour.

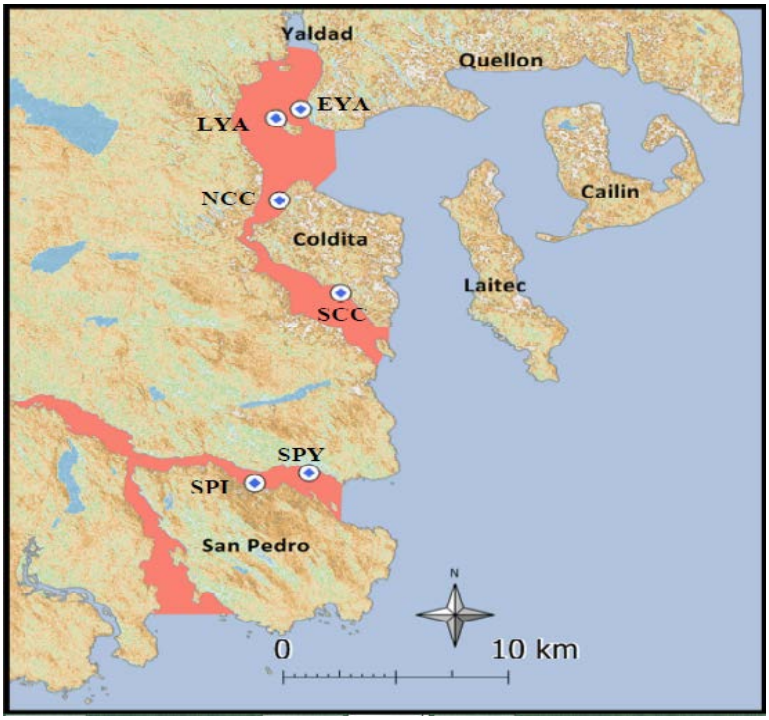

Figure 67. Location of the static PAM sites in core habitat of Chilean dolphins in southern Chiloé. Two C-PODs were placed in Bahía Yaldad (EYA, LYA), two in Canal Coldita (NCC, SCC) and two in Canal San Pedro (SPI, SPY) from April to September 2013. Core habitat of Chilean dolphins is highlighted in orange. Source: Coram *et al.*, 2013.

Table 27. Average detection rates (Dolphins Positive Minutes per hour, DPM/Hour) at each of the five study sites. Source: Coram et al., 2013.

Site	EYA	NCC	SCC	SPI	SPY
Average DPM/Hour	0,94	2,07	2,5	1,7	8,14
+/- 1 SD	2,8	5,4	4,3	3,5	11,8

The results show high activity of Chilean dolphin in the zone of Quellón, especially in the site San Pedro Yatac (SPY), where important aquaculture activities are located, indicating that sightings can be common among salmon farm sites.

An example of whale sightings around a salmon farm in the XI Region was provided by a salmon producer company (Figure 68). Likewise, Hucke-Gaete (*pers. comm.,* 2014) reported a sighting of a blue whale near a fish farm in Contao, Seno de Reloncaví, X Region (Figure 69).

Figure 68. Whale sighting near a fish farm, Aysén, XI Region.
© P. Jorquera

Figure 69. Blue whale sighting near a fish farm in Contao, Seno de Reloncaví, X Region.
© R. Hucke-Gaete (CBA/UACh/WWF)

The potential level of marine mammal interaction with the salmon industry was studied by YaquPacha Chile (Fuentes, 2007) through a study that shows the probability of cetacean sightings in the zone of Dalcahue and Quellón, X Region (Figure 70), which corresponds to areas with a high intensity of aquaculture activities.

Quellón **Dalcahue**

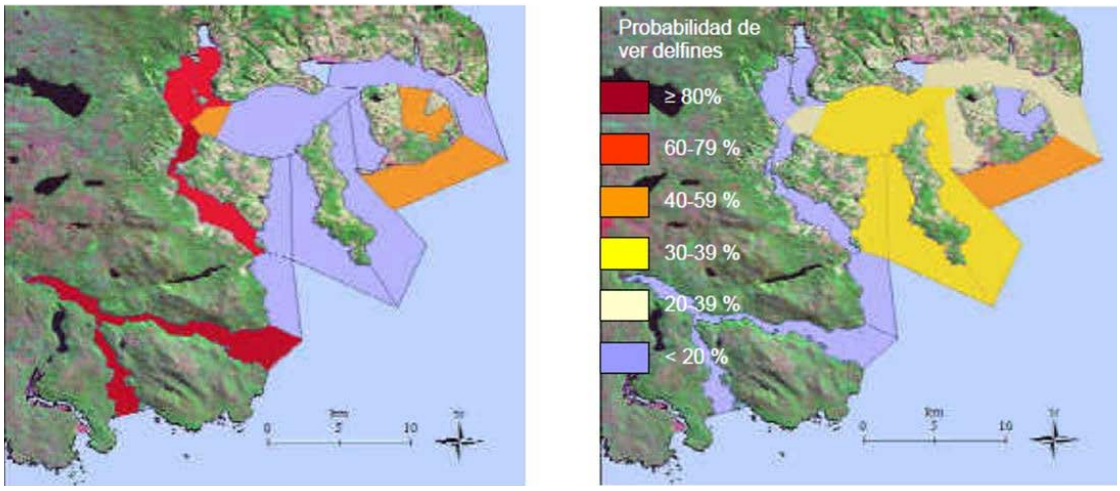

Figure 70. Probability of cetacean sightings for Chilean and Peale's dolphins in different sectors in the south east of Chiloe Island based on predictions from logistic regression models. Source: YaquPacha Chile, 2007.

Moreover, Hucke-Gaete *et al.* (2013) recorded sightings of 107 humpback whale groups (including 222 individuals) between December 2000 and March 2010 from aerial surveys and marine and terrestrial platforms (Figure 72), in the Corcovado Gulf and the Chonos Archipelago (41°- 44°S)--XI and XI--Regions, in an area of salmon farm sites (Figure 71).

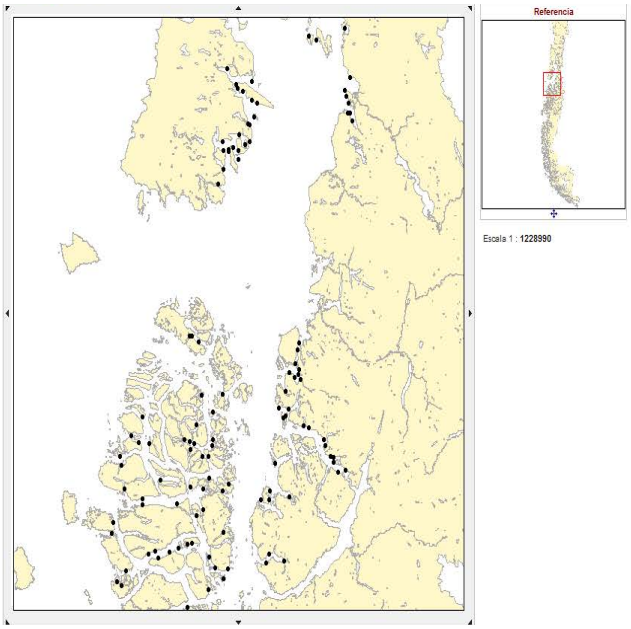

Figure 71. Active farm sites in part of Los Lagos and Aysén Regions.
Source: Intesal.

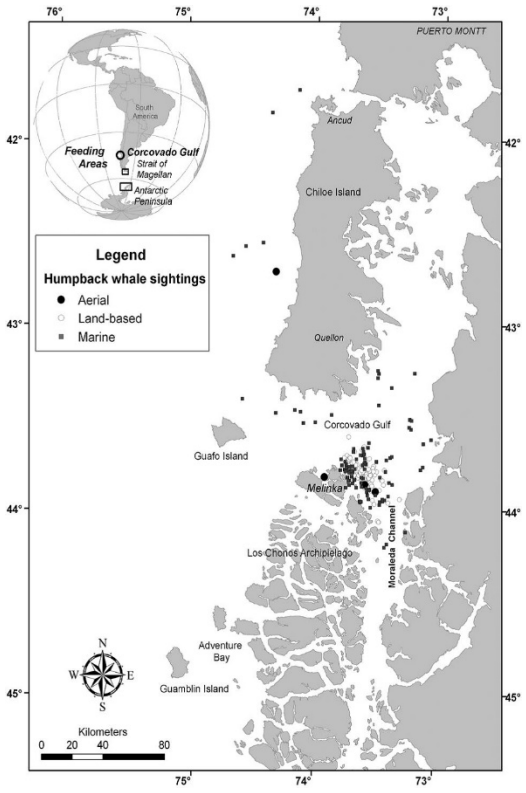

Figure 72. Humpback whale sightings recorded in the Chiloe–Corcovado region, southern Chile, between 2000 and 2010. Source: Hucke-Gaete *et al.*, 2013.

It can be noted from Figure 71 and Figure 72 that whale sightings occur in areas representing a high level of aquaculture activity.

Another study, undertaken between December 2000 and November 2001 (Viddi *et al.*, 2010), based on observations in the channels and fjords of southern Chile (from Puerto Montt to south

of Taitao Peninsula, X and XI Regions), showed 129 cetacean sightings (Figure 73) in areas where aquaculture activities occur.

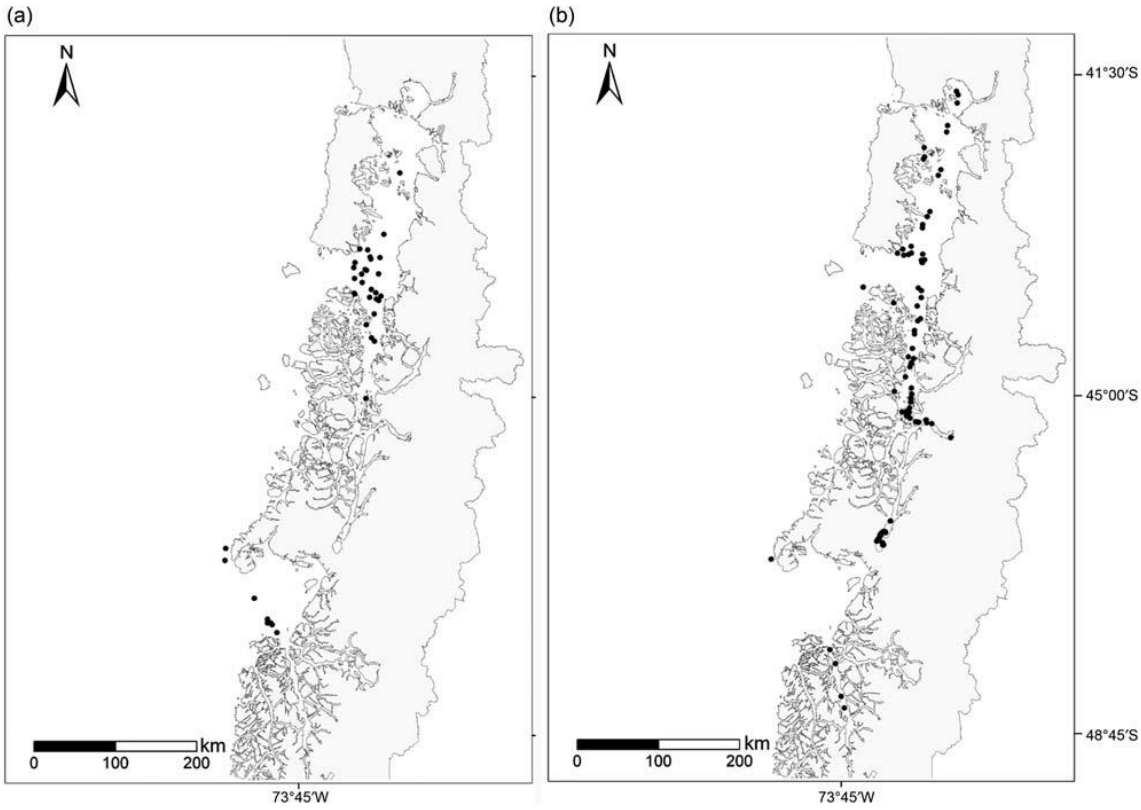

Figure 73. Cetacean distribution in the northern Patagonian fjords, southern Chile.
(a) Mysticetes and (b) Odontocetes. Source: Viddi *et al*., 2010.

In addition to direct interactions with salmon farms, it is also important to consider fishery interactions with salmon farm feed fish. According to Bridson (2014), three species are used in salmon feed in Chile: anchovy *(Engraulis ringens),* sardine (also known as Araucanian herring) *(Strangomera bentincki)*, and jack mackerel *(Trachurus murphyi).* The anchovy is from Peru (82.5%), Chile (17.4%), and Ecuador (0.1%), the sardine/herring is from Chile (100%) and the jack mackerel is from Chile (88.6%) and Peru (11.4%) (Tacon 2009). These are mainly purse seine fisheries. For information on how these fisheries interact with marine mammals, see sections below.

The responses from questionnaires administered by this project revealed high evidence of sea lions interacting with fisheries, including the ones known to produce exports to the US, such as the anchovy, common hake, hoki, jack mackerel and southern hake fisheries. All of the

interviewees recognized a very high sighting frequency, demonstrated by their responses ranging from “constantly” to “always”, or “every day”, and, in 97% of cases, sea lions were considered a difficulty by the interviewees.

The interaction between fisheries and sea lions is related with a longstanding competition for fishery resources. This competition is viewed as a conflict by the fishermen because sea lions prey on fish caught in their fishing gear, often causing damage either to the prey or the fishing gear, but not necessarily resulting in damage to the sea lion nor in bycatch. A study conducted by Sepúlveda *et al*. (2007), aimed to describe the interaction between sea lions and fishermen and to evaluate the effects of operational interference caused by sea lions on their artisanal fishery through interviews and observation trips, showed that 92% (381 of 384) of the fishermen interviewed asserted they had frequent operational interactions with sea lions throughout the year; however, such interactions were observed only in 14.5% of the observer trips on fishing vessels. These results are in line with what was expressed by a SUBPESCA representative who participated in some fishing trips with a fisherman from the V Region who complained about the level of interactions with sea lions while fishing and asked this representative to see the evidence for himself on the fishing grounds. There were no interactions between sea lions and that fishing vessel on those trips. This study reported that the main impacts caused by interactions are damage to the fishing gear and direct removal of fish from the gear. To a lesser extent, the sea lions reduced the catches by chasing fish away from the fishing area. About 56% of the fishermen have observed deaths of sea lions during fishery operations, although they declared that these are generally rare events, occurring by accident when sea lions become entangled in fishing nets. According to Sepúlveda’s results, between 8% and 10% of the interviewed fishermen admitted to intentionally killing sea lions.

Information regarding sea lions that are intentionally killed was also reported by one interviewee within the present project, based on his knowledge of an event occurring in 2013 involving around 80 sea lions found dead on a beach, close to Coquimbo, in the IV Region, and with evidence of the use of explosives. A study conducted by Goetz (Goetz *et al.*, 2008) on the interactions between the South American sea lion (*Otaria flavescens*) and the artisanal fishery off Coquimbo, IV Region, northern Chile, based on 55 interviews with purse seining fishermen and observations aboard fishing vessels, had sea lion interactions observed and reported by 65% of all fishermen interviewed between October 2003 and March 2004.

Another study conducted by Hückstädt *et al.* (2003) on the jack mackerel purse seine fishery showed that this fishery off central Chile competes for the resource with sea lions and that purse-seining makes the fish more accessible to the pinnipeds. Interactions with sea lions were recorded during 31 purse seine sets off central Chile during October 1999. The sea lion behaviour associated with the fishing operations was distinctive. The sea lions approached the purse-seiner as soon as net-setting began. The number of sea lions per set (0–50) was seemingly unaffected by school size of jack mackerel, number of purse-seiners on the fishing ground, whether fishing was occurring during the night or day, the presence of killer whales or the species being targeted. The study also showed other effects of fishing operations on sea lions including incidental mortality and capture. During the study period, two sea lions were killed and 18 captured (identified as juveniles by observers on board). One of the captured animals was seriously injured, with dislocation of the lower jaw and fracture of the left flipper, which likely would have led to its death at a later point in time. The results of this study are aligned with the responses of interviewees within the present project that sea lions entangled in jack mackerel purse seines can usually escape and rarely die.

Interactions with sea lions and the southern hake longline fishery have also been reported by de la Torriente *et al*. (2010), where sea lion predation on southern hake caught on longlines was observed in 58% of the 48 fishing events conducted between October 2005 and September 2006. Most of the sea lion sightings (61.6%) occurred during gear retrieval, when most interactions also occurred. This observation may point to a potential fishing gear improvement for reducing sea lion interactions. In the present project, some longline artisanal fishing boats in Calbuco Port, X Region implemented engines and modified their gear main lines in order to retrieve them faster, minimizing the likely duration of sea lion interactions. One practical challenge however involves the economic implications of this practice, that may provide a disincentive to its application (Soto M., *pers. comm*., 2014). De la Torriente *et al*. (2010) also observed some fishermen attempting to kill or injure sea lions by shooting at them while fishing. However, owing to the mobility of the sea lions, the instability of the boat, and the distance between them, no cases of severe injury or death were recorded.

Operational interactions between *Otaria flavescens* and bottom-trawling fisheries of common hake in south-central Chile have been reported by Reyes *et al.* (2013). That study was based on observations made during September 2004, when incidental sea lion catch in the trawls was 6.3 sea lions/working day (1.2 sea lions/ trawl^{-1}). A total of 82 animals were incidentally caught,

of which 12 were found dead, and the 70 suffered from internal bleeding and/or fractures as a result of their capture (Figure 74).

Figure 74. South American sea lions caught in a single trawl along the continental shelf in south-central Chile during September 2004. Source: Reyes *et al.,* 2013.

In terms of value, the Patagonian toothfish is an important fish species exported to the US. Within the present project, when whales were reported as a difficulty it was because of their operational interaction with the Patagonian toothfish fishery, and interviewees recognized that whales damage the longline gear and the catch causing economic losses to fishermen, mainly artisanal. A study conducted by Hucke-Gaete *et al.* (2004), assessed the interactions of sperm whales (*Physeter macrocephalus*) and killer whales (*Orcinus orca*) with the Patagonian toothfish (*Dissostichus eleginoides*) fishery in southern Chile, conducting surveys with observers on board industrial fishing vessels between April 2002 and March 2003. For the 180 hauls monitored, the evidence of damaged catch when cetaceans were present included toothfish lips (n = 121), heads (n = 16) and trunks (n = 3). During setting operations, 24 groups of sperm

whales were sighted (*n* = 41 individuals) and during hauling operations, 108 groups of sperm whales (*n* = 674, mean group size = 6), 18 groups of killer whales (*n* = 77, mean = 4) and one group of pilot whales (*n* = 15) were recorded. Interactions with fishing operations, however, were only evident when sperm whales and/or killer whales were present. No direct observations were made of cetaceans attacking the line. However, when killer whales were present and damaged fish were being hauled, frenzied activity was observed on several occasions near the line and close to the surface some 50–100 m from the vessel where large numbers of seabirds congregated, possibly to feed on the remains of fish depredated by killer whales. Only one fatal entanglement of a sperm whale with the line was recorded during an exploratory trip undertaken during late 2001, suggesting that this issue does not pose a major threat to cetacean populations. However, the study concluded that this is a problem that needs to be studied in more detail, particularly north of 47°S in Chile where some artisanal fishers use illegal counter measures such as ramming, shooting or even explosives to deter sperm whales or any other marine mammal that may affect the fishery. In October 2014 near the coast of Pichilemu, VI Region a southern right whale *(Eubalaena australis)* entangled in fishing gear was observed. In this case, fishermen alerted the Rescue and Conservation Unit of Protected Aquatic Species of SERNAPESCA, which, after unsuccessfully attempting to release it, chased the animal for several days with no positive results (Figure 75).

Figure 75. A southern right whale entangled in fishing gear near the coast of Pichilemu, VI Region. (Source: Hucke-Gaete *et al*. 2004)

The use of catch-protecting gear has been reported by the Chilean fleet fishing for Patagonian toothfish as a relatively successful deterrent. The system used is named *cachaloteras,* which consist of netting sleeves that cover fishing hooks. The main line has heavy anchor weights at each end, and each branch line containing the hooks and a cachalotera also have weights attached and therefore sink quickly, preventing seabirds from accessing baited hooks during setting. During hauling, the cachalotera (netting) sleeve slides down the branch line to cover the hooks as they are hauled to the surface. This prevents seabirds and marine mammals, including whales, from being able to access the hooks during hauling (Figure 76 and Figure 77).

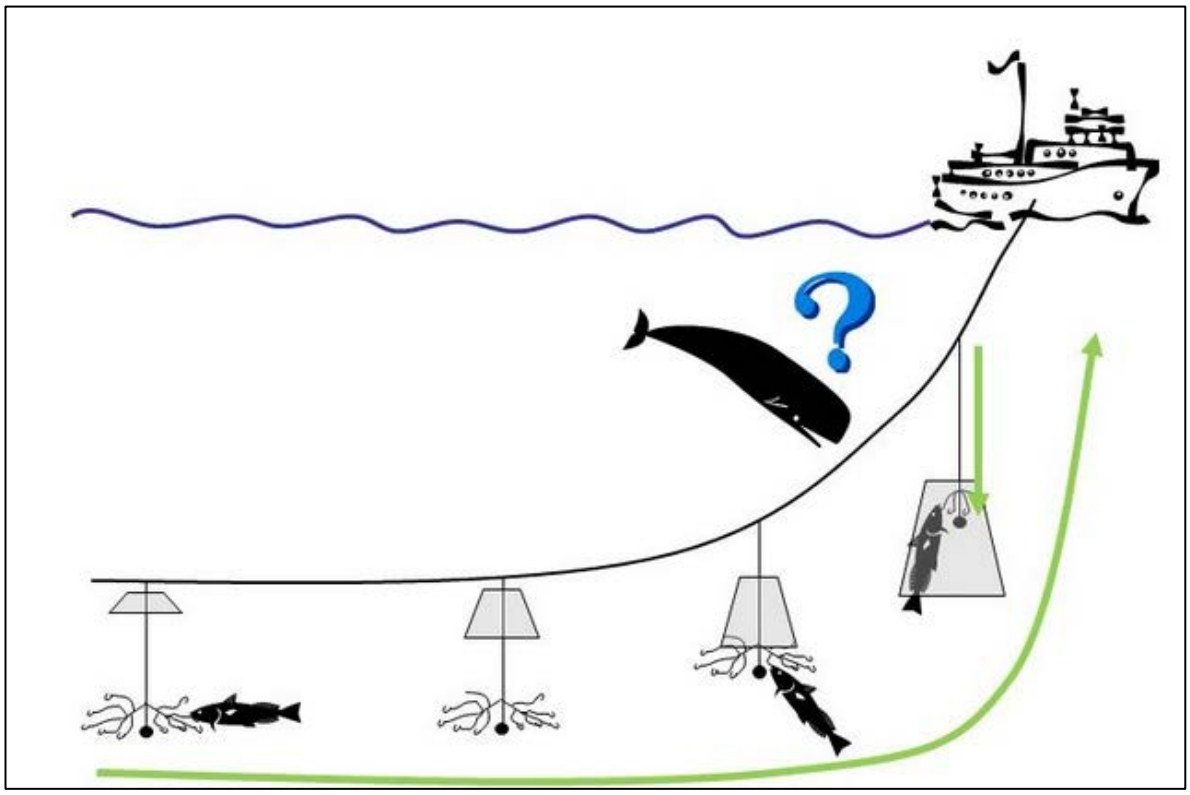

Figure 76. Diagram of a *Cachalotera* system used in the Chilean Patagonian toothfish fishery. Source: Coalition of Legal Toothfish Operators Inc.

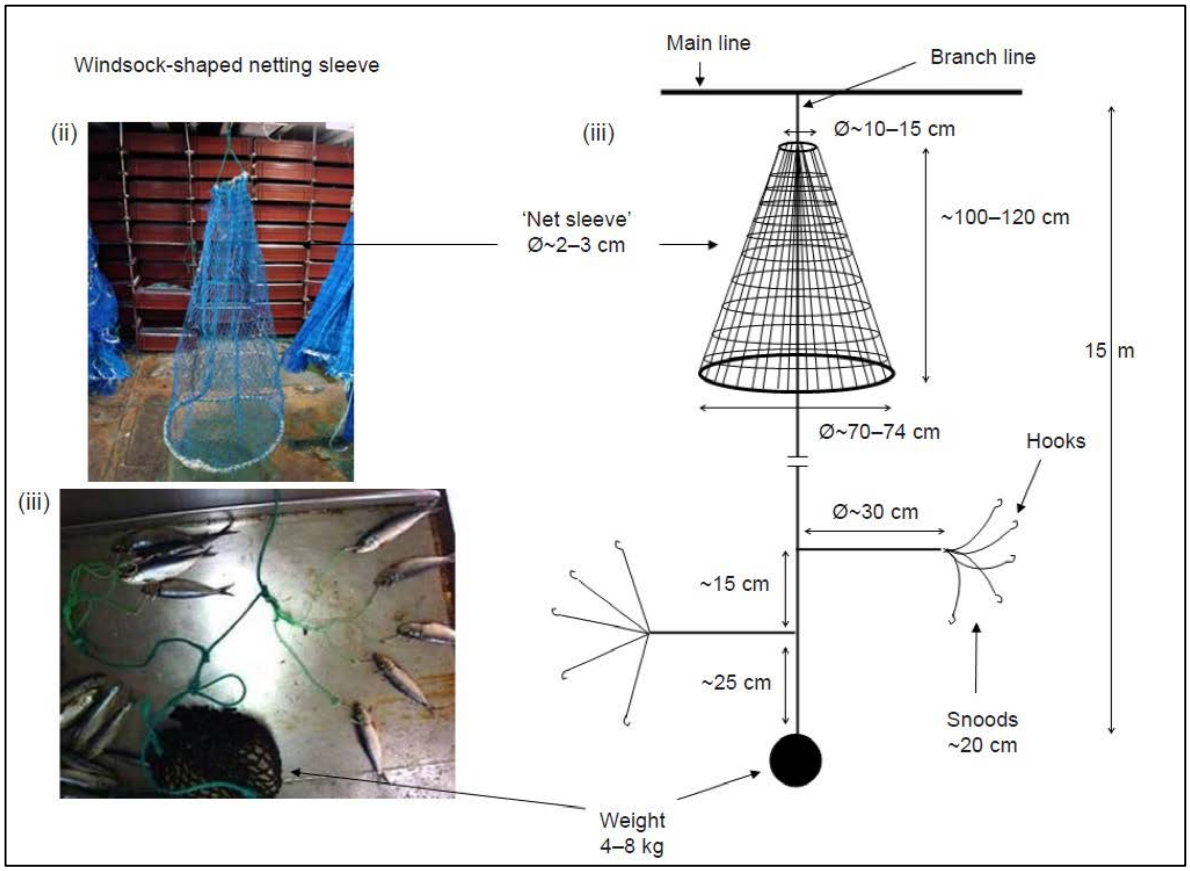

Figure 77. Details of the branch line where (ii) is the net sleeve or 'cachalotera'; (iii) provides details of the measurements of the configuration of the branch line with net sleeve, hooks and weight; and the position of the baited hooks at the end of the hook lines with the position of a weight. Source: Moreno *et al.*, 2008.

The use of *cachaloteras* reduces the risk to marine mammals associated with fishing gear interactions, and has eliminated accidental death of seabirds as a result of fishing with this gear. Research conducted in 2006 found zero seabirds killed when *cachaloteras* were used, compared with 1,542 seabird deaths in the same area in 2002 when *cachaloteras* were not used (Moreno *et al.*, 2008). It is mainly the industrial fleet that uses the system, as the heavy weight of the gear is not compatible with the artisanal fleet, thus negative interactions with whales can still occur in the artisanal Patagonian toothfish fishery.

The swordfish fishery is mainly conducted by the artisanal fleet using gillnets. Interviews conducted within the present project produced reports of interactions with dolphins and sea turtles, which can lead to entanglement and death. These results are in accordance with the

2014 Chilean Annual Report for the Inter-American Convention for the Protection and Conservation of Sea Turtles (CIT), which shows interactions between this fishery and sea turtle species. According to this report, from 2001, 548 turtles have been caught as bycatch, which resulted in the death of only four turtles and the rest released (Table 28).

Table 28. Number of sea turtles caught as bycatch in fisheries for highly migratory species per year of operation, type of fleet and species. *(*Source: IFOP, 2014. Cc= *Caretta caretta*; Dc= *Dermochelys coriácea*; Lo= *Lepidochelys olivacea*; Cm= *Chelonia mydas*; si= unidentified)

Year	Industrial Long Line					Artisanal Gillnet				Artisanal Long Line				Year Total
	Cc	Dc	Lo	si	Cm	Cc	Dc	Lo	Cm	Dc	Cc	Lo	Cm	
2001	26	41		4	2									73
2002	8	102	1	12	1					2	1			127
2003	3	10			1					2				16
2004	2	21			2					4				29
2005	7	29	3		2									41
2006	1	18			1					2				22
2007	2	19	5			1	1			2				30
2008	3	9	8		2				1					23
2009		6												6
2010	1	18				17	1	3	5		24		2	71
2011		11					5	4		1	14	4		39
2012	3	24					2			7	8		12	56
2013											5	2	8	15
Total	56	308	17	16	11	18	9	7	6	20	52	6	22	548
	408					40				100				

The report also establishes that the presence of sea turtles off the Chilean coasts and territorial waters is relatively low and associated with feeding activities. Clusters detected are small and located on the northern mainland coast (Figure). The regular presence of *Chelonia mydas* has been confirmed in four localities: Bahía Chipana (21°18'L.S. 70° 05' L.W), Bahía Mejillones del Sur (23°05' L.S. 70°27' L.W), Caleta Constitución (23°26,21'L.S. 70°36' L.W.) and Bahía Salado (27°41'L.S. 71°00' L.W). The regular presence of *Lepidochelys olivacea* is only registered in playa Chinchorro (18°27,5' L.S. 70°18,2' L.W.) and, finally, the regular presence of *Chelonia mydas* has been identified in the coastal area of Easter Island.

The presence of *Dermochelys coriacea* is associated with national jurisdictions; specimens of this species are occasionally sighted in the coastal zone as *Caretta caretta,* whose presence is mainly associated within the territorial waters in the north of the country.

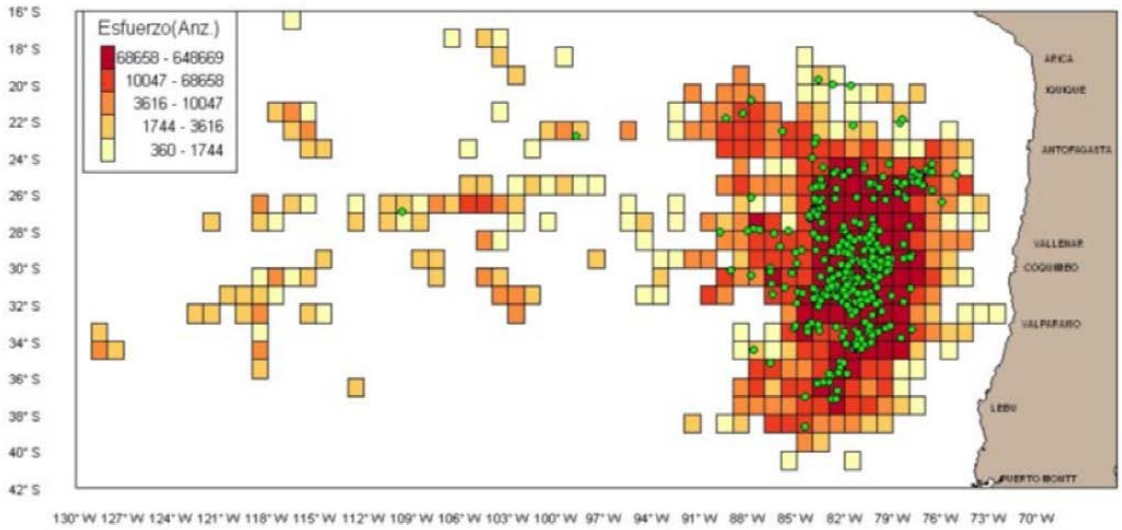

Figure 78. Historical distribution of fishing effort of the industrial longline fleet and records of incidental bycatch of sea turtles in the period 2001-2013. Source: IFOP, 2014.

Regarding dolphin interactions with the gillnet swordfish fishery, it is surprising that even though most of the interviewees were aware of dolphin entanglement, they found this species neither as a difficulty nor as beneficial from their perception as fishermen. This may be because dolphin bycatch in the gillnet swordfish fishery is likely to occur but in a very low order of magnitude.

This report listed the most important exports of wild seafood to the US and the amount exported of each of these items in 2012, 2013, and part of 2014, as reported by Sernapesca. Sernapesca's 2012 export numbers for these items roughly match up with NOAA's 2012 import numbers from the import database, and in some cases (high value species like Patagonian toothfish and swordfish), the numbers matched up reasonably well. In the case of common hake and southern hake, the numbers did not match up. Common hake and southern hake should be included together in "Groundfish, hake" categories in the NOAA database, however, imports in

these categories in 2012 total approximately 220 mt, and exports from Chile to the US of both species that year total 3,178 mt (3,126 mt of common hake and 52 mt of southern hake). However, if you add "Groundfish, hake" and "Groundfish, NSPF" (NSPF stands for "not specifically provided for") NOAA categories together, they total 3,067 mt, which is closer to the Sernapesca export number of 3,178 mt. In other cases (hoki), it may be too difficult to match them up with NOAA imports, as there is no separate code for this species. "FISH, NSPF" and "MARINE FISH, NSPF" are huge categories in the NOAA database, but there is not enough information to tease out how much of that is likely to be certain species or caught with certain gears. The categories used in NOAA's database match the Harmonized Tariff Schedule (HTS) of the United States, which is maintained by the United States International Trade Commission (USITC) (https://hts.usitc.gov/current). The USITC bases categories primarily on tariff rates and the volume of trade in the specific species or product. The import data for the database are compiled by the US Census Bureau and are originally collected from US customs import records. Imports are classified under the HTS as they are imported and if items are categorized in an "NSPF" category, no further information is collected (M. Liddel, *pers. comm*.). Although information on the non-specified (NSPF) categories is generally not available at a finer resolution, original bills of lading should have volume of species imported and can usually be collected and compiled.

10. Conclusion

The results of the present project show that Chilean fisheries exporting to the US occurs have marine mammal bycatch. but it is at a level that seems to be not significant compared to the level of interaction between these mammals and the fishing or the aquaculture operations. The interactions are mainly with sea lions in most of the fisheries assessed. These interactions can negatively impact these populations, as fishermen or salmon workers can deliberately cause the death of these animals. Moreover, fishermen are requesting the State to allow controlled hunting of this species.

Based on interviews collected under this project, T=the sperm whale is the cetacean species with the most interactions in fisheries exporting to the US: primarily the Patagonian toothfish fishery. However, technologies have been developed to minimize this interaction, which have shown satisfactory results with the industrial fleet but limited applicability for the artisanal

fleet due to configuration constraints, mainly the added weight and the needed space for their placement on the boat. Any negative interactions of this species with the fishery are likely to occur due to fishermen trying to cause the death of the animal rather than by direct bycatch due to entanglement or interaction with the fishing gear.

Fishing for swordfish seems to produce the most bycatch, not only marine mammal bycatch (mainly dolphins), but also sea turtles, due to the gear used: gillnets. However, according to fishermen, because of changes in environmental conditions (such as climate change), the level of bycatch has dropped considerably during recent years.

The strong regulations in Chile regarding the protection of marine mammals prevents the existence of a market for species caught as bycatch, so species generally do not reach the port, making the occurrence of bycatch less evident.

New regulations that the government is implementing not only focus on the protection of marine mammals but also address an ecosystem approach to fisheries management, rather than single species management. These will allow a better understanding of, among other issues, the level of bycatch occurring in Chilean fisheries, favouring the implementation of measures to correctly address and reduce it.

11. Acknowledgements

The authors would like to extend their gratitude to all the fishermen and members of the fishing industry for contributing to this report. Support for this study was provided by NOAA's Office of International Affairs under Award Number NA13NMF4690151 to the Consortium for Wildlife Bycatch Reduction at the New England Aquarium, Boston, MA USA.

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APPENDIX 1

© Publications, reports, or presentations using data collected by using this questionnaire or adapting portions thereof should cite the following, in addition to appropriate citations of the resulting reports authored by Werner, et al., Felix et al., Unibazo et al., and Bordino et al.:

Brewer, Jennifer, Tim Werner, Fernando Felix, Javier Unibazo, Rodrigo Hucke-Gaete, Alexandra Apolinario, and Roberto Medina. 2014. Field protocol for international marine mammal bycatch project. Boston, Massachusetts: New England Aquarium.

These materials should only be used or adapted with appropriate training and research design, integrating both social and biological sciences. J. Brewer is generally available to provide additional information and assistance at jennifer.brewer@unh.edu.

Cuestionario – PUERTO - Chile

[Parte I. Información sobre la entrevista]

Fecha, puerto, y sitio (playa, muelle, casa, etc.):
Entrevistador/es:
[Indique nombres de entrevistado/s en lista separada y asignar número/s de código]
Número/s de código entrevistado/s:

Todas las preguntas se refieren a los últimos 12 meses, a menos que se indique lo contrario

[Parte II. Datos personales]

1. [¿Cuántas personas se entrevistan aquí, en esta entrevista?]

2. ¿En el último año, y antes de eso, cuáles son sus trabajos, oficios, o relaciones con la actividad pesquera? [Si es un grupo, enumere por cada categoría, dando cuenta que algunas personas tienen más de un oficio.]

(Año)	(Carrera)	
___	___	Capitán de bote de pesca
___	___	Tripulación de bote de pesca (no capitán)
___	___	Propietario (o co-propietario) de bote de pesca quien también pesca
___	___	Propietario (o co-propietario) de bote de pesca quien no pesca
___	___	Otro empleado de negocio pesquero (quien no pesca y no es propietario – especifique)
___	___	Comprador y vendedor de pescado (podría ser en el puerto, u otros distribuidores)
___	___	Abastecedor de pesquería (botes, desembarcamento, aparatos, etc. - especifique)
___	___	Miembro de una familia de pescadores (quien no pesca)
___	___	Oficial de una organización pesquera (especifique)
___	___	Representante de ONG u organización sin fines lucros (especifique)
___	___	Representante de gobierno (especifique)
___	___	Turismo costero (especifique)

___ ___ Otros (especifique)

[Caracterización general de otras personas presentes pero no entrevistadas y al parecer escuchando, como el número de familiares, compañeros de trabajo, vecinos]:

3. ¿En total, aproximadamente cuántos años de experiencia como pescador tiene Ud.? [Si es grupo, registre todas las respuestas.]

4. ¿Aparte de ser pescador o no, aproximadamente cuántos años de experiencia tiene Ud. con otros trabajos relacionado a la pesca, el mar, u otros recursos naturales (por ejemplo, en la lista arriba)? ¿Puede ofrecer más detalles? [Si es un grupo, registre todas las respuestas.]

[Parte III. Preguntas sobre este puerto & flota]

1. ¿Cuántos botes (de cualquier tamaño) pescan activamente en este puerto el último año?

2. ¿Cuál es la longitud de los botes en este puerto? ¿El más pequeño? ¿El mayor? ¿Hay diferentes grupos por tamaño? ¿Y en este caso, aproximadamente cuántos botes hay en cada grupo?

3. ¿Qué artes de pesca usan estos botes? ¿anzuelos? ¿Redes de enmalle? ¿Redes de cerco móvil? ¿Redes de cerco costeras? ¿Espinel? ¿Otras? ¿Hay diferentes grupos por tipos de arte? ¿Y en este caso, cuántos botes en cada grupo?

¿De estos artes, cuál es el tamaño típico por bote (para entender aproximadamente el esfuerzo pesquero -- por ejemplo, el tamaño de las redes de arrastre y redes de cerco, o los números de anzuelos por línea y líneas por barco, o el tamaño y el número de espineles por bote.)

> ¿Aproximadamente cuántos botes utilizaron cada tipo de arte en el último año (dando cuenta que algunos usan más de un tipo de arte)?

4. ¿Qué especies de peces capturan estos botes?

> ¿Las especies han cambiado en los últimos cinco años?
>
> ¿Si es así, por qué?
>
> ¿En cuales meses del año pescan con cuales artes de pescas?
>
> ¿Los meses de pesca han cambiado en los últimos cinco años?

¿Si es así, por qué?

5. ¿En el último año, cuál es el área donde se pesca desde este puerto? ¿Cuál es la distancia al oeste, sur, norte, y este? [En algunos sitios "este" seria la costa litoral, pero en otros sitios puede ser relevante registrar aguas estuarios, bahías, etc. Si es grupo, registre la pauta agregada.]

6. ¿Ha cambiado esta área, con respecto a años anteriores? ¿Está pescando más lejos de la costa o más cerca? ¿Más al oeste, norte, sur, o este?

¿Si ha cambiado, por qué? [Si es grupo, registre la variedad de respuestas.]

7. ¿En el próximo año o el siguiente, Ud. supone que estas características de la flota en este puerto serán más o menos lo mismo, o hay razones para esperar cambios en el numero o tamaño de los botes o las artes típicas (como por la abundancia de peces, fondos, reglamentos, etc.)?

8. ¿Los botes en el puerto pertenecen a diferentes grupos formales o informales, como cooperativas o sindicatos? ¿En este caso, cuáles diferencias existen entre los grupos? ¿Cómo se llaman? ¿Aproximadamente cuántos pertenecen a cada grupo?

¿Hay botes que no pertenecen a uno de estos grupos, y si es así, cuántos?

¿A cuál grupo pertenece el suyo?

9. ¿Aproximadamente cuántos botes son propiedad de personas o empresas propietaria de un bote con sus artes y motor?

¿Aproximadamente cuántos son propiedad de personas o empresas propietaria de más de un bote?

¿Aproximadamente a cuántos invierten finanzas varias personas (en el bote, el arte y el motor)?

10. ¿En cuáles horas del día se realiza las actividades pesqueras de este puerto?

[Parte IV. Percepciones personales*]

Las siguientes preguntas consideran si - desde la perspectiva de su experiencia en pesquerías - ciertos animales son beneficios, dificultades, o ninguno para pescadores. [Si es grupo, indique el número de entrevistados que seleccionó cada opción, y también registrar toda la gama de respuestas cualitativas.]

1. ¿En su experiencia en pesquería las ballenas, piensa en ellas como: beneficio, dificultad, o ninguno?

¿En qué aspectos o maneras son beneficio o dificultad?
¿Aparte de las consideraciones de pesca, qué piensa Ud. de las ballenas por lo general?

2. ¿En su experiencia pesquería, si piensa en los delfines, piensa en ellos como beneficio, dificultad, o ninguno?

¿En qué aspectos o maneras son beneficio o dificultad?

¿Aparte de las consideraciones de pesca, qué piensa Ud. de los delfines por lo general?

3. ¿En su experiencia pesquería, si piensa en los lobos marinos, piensa en ellos como beneficio, dificultad, o ninguno?

¿En qué aspectos o maneras son beneficio o dificultad?

¿Aparte de las consideraciones de pesca, qué piensa Ud. de los lobos marinos por lo general?

[Parte V. El futuro]

1. ¿En el futuro, le interesa Ud. colaborar con pescadores para discutir e investigar nuevos métodos de pesca más eficientes o para mercados nuevos?

[Para personas interesadas, registre los contactos en otro papel - correo electrónico, teléfono, y dirección]

2. Tiene Ud. ideas sobre innovaciones útiles para reducir interacciones entre artes de pesca y:

¿ballenas? ¿y si es así, los quiere describir?

¿delfines? ¿y si es así, los quiere describir?

¿lobos marinos? ¿y si es así, los quiere describir?

[Parte VI. (Opcional) Usos y mercados*]

1. En este puerto, de los delfines capturados por causalidad o a propósito, qué fracción más o menos Ud. estima (como todos, ningunos, mitad, cuarto, menos) son

¿desechados sin uso personal o el valor comercial?

¿algunas partes son usadas por familiares o vecinos? ¿Qué sectores de la flota serían?

¿se venden algunas partes? ¿Qué sectores de la flota serían? ¿Para qué uso y destino?

2. En este puerto, de los lobos marinos capturados por causalidad o a propósito, qué fracción más o menos Ud. estima (como todos, ningunos, mitad, cuarto, menos) son

¿desechados sin uso personal o el valor comercial?

¿algunas partes son usados por familiares o vecinos? ¿Qué sectores de la flota serían?

¿se venden algunas partes? ¿Qué sectores de la flota serían? ¿Para qué uso y destino?

[VII. Otro]

¿Quiere dar algún comentario adicional, observaciones, opiniones o consejos al equipo de este proyecto?
¿Si no lo ha hecho ya, quiere dar su información de contacto – correo electrónico, teléfono, dirección?

¿Hay otras personas con quienes me recomienda Ud. que yo hable?

¿Y sabe cómo contactarlas? ¿Prefiere que yo mencione su nombre o no?

IX. Notas de entrevistador/a

1. ¿Qué nivel de confianza tienes en las repuestas en esta entrevista?

5 = creo que toda la información es fiable

4 = sospecho que la mayoría de la información central es fiable

3 = neutral, no sé

2 = sospecho que hay errores

1 = creo que hay errores importantes

¿Por qué opinas así?

2. ¿Hay unas frases, palabras, o parrafos illustrativos cuales podemos usar en reportes o publicaciones? ¿Sabes donde estan en la grabacion?

3. ¿Cualquieras observaciones, teorías, o sugerencias o preguntas nuevas tienes?

Cuestionario – PESCADOR - Chile

[Parte I. Información sobre la entrevista]

Fecha, puerto, sitio [playa, muelle, casa, etc.]:
[¿Comó se encontró o seleccionó a esta persona?]
Entrevistador/es, asistente/s:

Número/s de código entrevistado/s:

Todas las preguntas se refieren a los últimos 12 meses, a menos que se indique lo contrario

[Parte II. Experiencia en pesquerías]

1. [¿Cuántas personas se entrevistan aquí en esta entrevista?]

2. ¿En los últimos 12 meses, y antes de eso, cuáles son sus trabajos, oficios, o relaciones con la industria pesquera?

[Si es un grupo, enumere por cada categoría, dando cuenta que algunas personas tienen más de un oficio.]

(Año) (Carrera)

___ ___ Capitán de bote de pesca

___ ___ Tripulación de bote de pesca (no capitán)

___ ___ Propietario (o co-propietario) de bote de pesca quien también pesca

___ ___ Propietario (o co-propietario) de bote de pesca quien no pesca

___ ___ Otro empleado de negocio pesquero (quien no pesca y no es propietario - especifique)

___ ___ Comprador y vendedor de pescado (podría ser en el puerto u otros distribuidores)

___ ___ Abastecedor de pesquería (botes, artes, etc. - especifique)

___ ___ Miembro de una familia de pescadores (quien no pesca)

___ ___ Oficial de una organización pesquera (especifique)

___ ___ Representante de ONG u organización sin fines lucros (especifique)

___ ___ Representante de gobierno (especifique)

___ ___ Turismo costero (especifique)

___ ___ Otros (especifique)

[Caracterización general de otras personas presentes pero no entrevistadas y al parecer escuchando, como el número de familiares, compañeros de trabajo, vecinos]:

3. ¿Cuántos años de experiencia tiene Ud. como pescador?

[Si es grupo, registre todas las respuestas.]

4. ¿Ha pescado Ud siempre desde este puerto, o también de otros? ¿Cuáles?

5. ¿En los últimos 12 meses, aproximadamente de qué tamaños eran los barcos en los cuáles Ud. pescó?

¿Y antes que eso?

6. ¿En los últimos 12 meses, cuáles artes de pesca usó Ud.?

¿Y antes que eso?

7. ¿En los últimos 12 meses, cuáles especies o tipos de pescado capturó Ud.?

¿Y antes que eso?

8. ¿En los últimos 12 meses, cuál es el área donde pesca Ud.? ¿Cuál es la distancia al oeste, sur, norte, y este?

[Parte III. Percepciones personales*]

Las siguientes preguntas consideran si - desde la perspectiva de su experiencia como pescador - ciertos animales son beneficios, dificultades, o ninguno.

[Si es grupo, indique el número de entrevistados que seleccionó cada opción, y también registrar toda la gama de respuestas cualitativas. Si Ud. sabe que alguno de estos animales no existen en esta zona, puede omitirlos.]

1. ¿Desde su perspectiva como pescador, cuando piensa en las ballenas, las ve como beneficio, dificultad, o ninguno?

> ¿En qué aspectos o maneras son beneficio o dificultad?
> ¿Aparte de las consideraciones de pesca, qué piensa Ud. de las ballenas por lo general?

2. ¿Desde su perspectiva como pescador, cuando piensa en los delfines, los ve como beneficio, dificultad, o ninguno?

> ¿En qué aspectos o maneras son beneficio o dificultad?
> ¿Aparte de las consideraciones de pesca, qué piensa Ud. de los delfines por lo general?

3. ¿Desde su perspectiva como pescador, cuando piensa en los lobos marinos, los ve como beneficio, dificultad, o ninguno?

> ¿En qué aspectos o maneras son beneficio o dificultad?
> ¿Aparte de las consideraciones de pesca, qué piensa Ud. de los lobos marinos por lo general?

[Parte IV. Interacciones en los último 12 meses*]

Las preguntas siguientes se refieren a sus observaciones de animales marinos en los últimos 12 meses.

[Si es posible, solicite y registre datos adicionales sobre estas observaciones, especialmente interacciones pesqueras. Si Ud. opina que el año pasado no es un período de tiempo apropiado, puede añadir otro, con una explicación. Si es un grupo, indique aproximadamente cuántos entrevistados están de acuerdo con cada respuesta, incluyendo opiniones de minorías.]

1. Ballenas

¿En los últimos 12 meses, durante sus actividades de pesca, aproximadamente cuántas ballenas vivas vio Ud. en el mar?

> ¿Entre ellas, cuántas no tenían ninguna evidencia aparente de artes de pesca adjuntos o enredados (como redes, cabos)?
>
> ¿Y cuántas tenían evidencia aparente de interacciones con artes de pesca (como redes, cabos)? (incluso arte de su bote mismo, otro bote, o de origen desconocido.)

¿Puede describir más detalles sobre estas observaciones, por ejemplo sitio de pesca?

¿En los último 12 meses, durante sus actividades de pesca, aproximadamente cuántas ballenas muertas vio en el mar?

¿Entre ellas, cuántas no tenían ninguna evidencia aparente de artes de pesca alrededor o estaban enredadas (como redes, cabos)?

¿Y cuántas tenían evidencia aparente de interacciones con artes de pesca (como redes, cabos)? (Incluso arte de su bote mismo, otro bote, o de origen desconocido.)

¿Puede describir más detalles sobre esto, por ejemplo sitio de ocurrencia?

2. Delfines

¿En los últimos 12 meses, durante sus actividades de pesca, con qué frecuencia aproximadamente vio Ud. delfines vivos en el mar? (cada día, cada semana, cada mes, ocasionalmente)

¿En los últimos 12 meses, sabe Ud. que si han quedado enredados delfines en artes de pesca?

¿Con que frecuencia aproximadamente en un bote típico como el suyo?

(cada día, cada semana, cada mes, ocasionalmente)

¿Puede describir más detalles sobre esto, por ejemplo sitio de ocurrencia?

3. Lobos marinos

¿En los últimos 12 meses, durante sus actividades de pesca, con qué frecuencia aproximadamente vio Ud. lobos marinos vivos en el mar? (cada día, cada semana, cada mes, ocasionalmente)

¿En los últimos 12 meses, sabe Ud. si han quedado enredados lobos marinos en artes de pesca?

¿Con que frecuencia aproximadamente en un bote típico como el suyo?

(cada día, cada semana, cada mes, ocasionalmente)

¿Puede describir más detalles sobre esto, por ejemplo sitio de ocurrencia?

[4. Identificaciones]

[Instrucciones: Dependemos en su discernimiento para distinguir entre las dos situaciones, para decidir pedir o no pedir las identificaciones en alguna entrevista, y para explicarnos qué nivel de confianza tienes en las identificaciones. (Este nivel de confianza es APARTE del nivel que se nota al fin de la entrevista.)]

a. Tengo aquí dibujos de especies de ballenas.
¿Tiene algún idea cuales de estos Ud. ha visto enredados, mientras está pescando desde este puerto?

¿Cuáles son las características que Ud. ha visto más claramente para identificar? Por ejemplo: forma del cuerpo, forma de la aleta, forma de la cabeza, color, comportamiento, u otras. ¿Específicamente? ¿O ninguna?

[Comentario del entrevistador sobre su nivel de confianza en las identificaciones de ballenas:

3 = creo que es más o menos fiable

2 = neutral, no sé

1 = creo que no es fiable

¿Por que?]

b. Tengo aquí dibujos de especies de delfines.
¿Tiene algún idea cuales de estos Ud. ha visto enredados, mientras está pescando desde este puerto?

¿Cuáles son las características que Ud. ha visto más claramente para identificar? Por ejemplo: forma del cuerpo, forma de la aleta, forma de la cabeza, color, comportamiento, u otras. ¿Específicamente? ¿O ninguna?

[Comentario del entrevistador sobre su nivel de confianza en las identificaciones de delfines:

3 = creo que es más o menos fiable

2 = neutral, no sé

1 = creo que no es fiable

¿Por que?]

[Parte V. Cambio en el tiempo*]

1. ¿En los últimos cinco años, ha habido algún cambio en la frecuencia de avistamiento de ballenas? ¿Ha aumentado? ¿Ha bajado? ¿Es igual?

2. ¿Y en la frecuencia de avistamiento de delfines?
   ¿Ha aumentado? ¿Ha bajado? ¿Es igual?

3. ¿De lobos marinos?
   ¿Ha aumentado? ¿Ha bajado? ¿Es igual?

4. ¿En los últimos cinco años, hubo algún cambio en la frecuencia de enredamiento de ballenas?
   ¿Ha aumentado? ¿Ha bajado? ¿Es igual?
   ¿En este caso, por qué cree Ud. que ha cambiado? ¿Cambios en las poblaciones de ballenas? ¿Cambios en el comportamiento de las ballenas? ¿Cambios en las especies objetivos de pesca?
   ¿Cambios en las áreas de pesca? ¿Cambios en el uso de artes de pesca? ¿Cambios en la tecnología de botes pesqueros?

5. ¿En los últimos cinco años, hubo algún cambio en la frecuencia de enredamiento de delfines?
   ¿Ha aumentado? ¿Ha bajado? ¿Es igual?
   ¿En este caso, por qué cree Ud. que ha cambiado? ¿Cambios en las poblaciones de delfines? ¿Cambios en el comportamiento de los delfines? ¿Cambios en las especies objetivos de pesca? ¿Cambios en las áreas de pesca? ¿Cambios en el uso de artes de pesca? ¿Cambios en la tecnología de botes pesqueros?

6. ¿En los últimos cinco años, ha habido algún cambio en la frecuencia de enredamiento de lobos marinos? ¿Ha aumentado? ¿Ha bajado? ¿Es igual?
   ¿En este caso, por qué cree Ud. que ha cambiado? ¿Cambios en las poblaciones de lobos marinos? ¿Cambios en el comportamiento de los lobos marinos? ¿Cambios en las especies objetivos de pesca? ¿Cambios en las áreas de pesca? ¿Cambios en el uso de artes de pesca? ¿Cambios en la tecnología de botes pesqueros?

[Parte VI. El futuro]

1. ¿En el futuro, le interesa Ud. colaborar con pescadores para discutir e investigar nuevos métodos de pesca más eficientes o para mercados nuevos?

   [Para personas interesadas, registre los contactos - correo electrónico, teléfono, y dirección]

2. Tiene Ud. ideas sobre innovaciones útiles para reducir interacciones entre artes de pesca y:

¿ballenas? ¿y si es así, los quiere describir?

¿delfines? ¿y si es así, los quiere describir?

¿lobos marinos? ¿y si es así, los quiere describir?

[VII. (Opcional) Usos y mercados*]

1. En este puerto, de los delfines capturados por causalidad o a propósito, qué fracción más o menos Ud. estima (como todos, ningunos, mitad, cuarto, menos) son

¿desechados sin uso personal o el valor comercial?

¿algunas partes son usadas por familiares o vecinos? ¿Qué sectores de la flota serían?

¿se venden algunas partes? ¿Qué sectores de la flota serían? ¿Para qué uso y destino?

2. En este puerto, de los lobos marinos capturados por causalidad o a propósito, qué fracción más o menos Ud. estima (como todos, ningunos, mitad, cuarto, menos) son:

¿desechados sin uso personal o el valor comercial?

¿algunas partes son usados por familiares o vecinos? ¿Qué sectores de la flota serían?

¿se venden algunas partes? ¿Qué sectores de la flota serían? ¿Para qué uso y destino?

[VIII. Opcional]

1. ¿Tiene algún comentario adicional sobre interacciones con aves, tortugas, tiburones? (Estos no son el enfoque primario del proyecto, pero algunos pescadores nos han mencionado.)

[IX. Otro]

¿Quiere dar algún comentario adicional, observaciones, opiniones o consejos al equipo de este proyecto?
¿Si no lo ha hecho ya, quiere dar su información de contacto – correo electrónico, teléfono, dirección?

¿Hay otras personas con quienes me recomienda Ud. que hable?

¿Y sabe cómo contactarlas? ¿Prefiere que yo mencione su nombre o no?

[X. Notas de entrevistador/a

1. ¿Qué nivel de confianza tienes en las repuestas en esta entrevista?
   5 = creo que toda la información es fiable

   4 = sospecho que la mayoría de la información central es fiable

   3 = neutral, no sé

   2 = sospecho que hay errores

   1 = creo que hay errores importantes

   ¿Por qué opinas así?

1. ¿Hay unas frases, palabras, o parrafos illustrativos cuales podemos usar en reportes o publicaciones? ¿Sabes donde estan en la grabación?

2. ¿Cualquieras observaciones, teorías, o sugerencias o preguntas nuevas tienes?]

Questionnaire – PORT –Chile (English translation)

[Part I. Interview information]

Date, port, location (beach, wharf, house, etc.):
Interviewer/s:
[Indicate names of interviewee/s on a separate list and assign code number/s]
Code number of interviewee/s:

All questions refer to the most recent 12 months, unless indicated otherwise

[Part II. Personal information]

1. [How many people in this interview?]

2. In this past year, and before, what were your jobs, positions, or relationships with fishing activities? [If it is a group, note the number per category, realizing some people may hold more tan one position.]

(Year)	(Position)	
___	___	Fishing boat captain
___	___	Fishing boat crew (non captain)
___	___	Owner (or co-owner) of a fishing boat and also personally fishing
___	___	Owner (or co-owner) of a fishing boat but not personally fishing
___	___	Other employee of a fishing-related business (but not fishing and not owner – specify)
___	___	Buyer and seller of fish (could be in the port or elsewhere)
___	___	Fishing supplier (boats, wharfage, gear, etc. - specify)
___	___	Member of a fishing family (but not personally fishing)
___	___	Official of a fishing organization (specify)
___	___	Representative of a NGO or non-profit organization (specify)
___	___	Government representative (specify)
___	___	Coastal tourism (specify)

___ ___ Other (specify)

[General description of other people present but not interviewed but apparently listening, such as numnber of family memners, co-workers, neighbors]:

3. In total, about how many years of fishing experience do you have? [If it is a group, record all answers.]

4. Apart from fishing or not, about how may years of experience do you have with other jobs related to fishing, the ocean, or other natrual resources (for example, in the list above)? Can you offer more details? [If a group, record all answers.]

[Part III. Questions about the port and fleet]

1. ¿How many boats (of what size) have been actively fishing from this port in the past year?

2. What is the length of boats in this port? Smallest? Largest? Are there different size groups? If so, about how many boats in each group?

3. What fishing gear do these boats use? Hooks? Gillnets? Purse seines? Beach seines? Longline? Others? Are there different gear groups? If so, how many boats in each group?

Of these gears, what quantity or size is typical per boat (to understand roughly the fishing effort – for example, the size of trawls and purse seines, or numbers of hooks per line and lines per boat, or the size and number of longlines per boat)?

About how many boats used each gear type in the past year (realizing some more more than one gear)?

4. What species do these boats catch?

Have the species changed in the last five years?

If so, why?

In which months of the year do they fish with which gears?

Have the fishing months changed in the last five years?

If so, why?

5. In the past year, what is the area fished from this port? What is the distance to the west, south, north, east? [In some locales, "east" will be the shoreline, but in other locales it may be estuaries, bays, etc. If this is a group, record the total area.]

6. Have the fishing áreas changed from past years? Is the fishing farther from the coast or closer? More to the west, north, south, east?

If it has changed, why? [If this is a group, record the range of answers.]

7. In the coming two years, do you think these characteristics of the fleet in this port will be more or less the same, or is there reason to expect changes in the number or size of boats, or in typical gear (such as due to fish abundance, finances, regulations, etc.?

8. Do the boats in this port belong to different formal or informal groups, such as cooperatives or unions? If so, what differences exist among the groups? What are they called? About how many in each group?

Are there boats that don't belong to any of these groups, and if so, how many?

What group does your boat belong to?

9. Approximately how many boats are property of individuals or businesses with one boat (with fishing gear and engine)?

Approximately how many are property of individual sor businesses with more tan one boat?

Approximately how many involve financial investments from various people (in the boat, gear, and engine)?

10. In what hours of the day do fishing activities take place from this port?

[Part IV. Personal perceptions]

The following questions consider if, from the perspecive of your experience in fisheries, certain animals are beneficial, difficulties, or neither for fishermen. [If it is a group, record the number of interviewees that select each option, and also record the range of qualitative answers.]

1. In your fishing experience, do you think of whales as: benefit, dificulty, o neither?

In what ways are they benefit or difficulty?

Apart from fishing considerations, what do you think of whales in general?

2. In your fishing experience, do you think of dolphins as benefit, dificulty, or neither?

In what ways are they benefit or difficulty?

Apart from fishing considerations, what do you think of dolphins in general?

3. In your fishing experience, do you think of sea lions as benefit, dificulty, or neither?

In what ways are they benefit or difficulty?

Apart from fishing considerations, what do you think of sea lions in general?

[Part V. Future]

1. In the future, are you interested in collaborating with other fishermen to discuss and investigate new methods of more efficient fishing or new markets?
   [For interested persons, record their contacts on another paper – e-mail, phone, address]

2. Do you have ideas about ways to reduce interactions between fishing gear and whales? If so, please describe them?
   For dolphins? If so, please describe them?

   For sea lions? If so, please describe them?

[Part VI. (Optional) Uses and markets *]

1. In this port, when dolphins are caught by accidento or on purpose, roughly what fraction do you estimate (such as all, none, half, quarter, less) are

   discarded without any personal use or comercial value?

   some parts used by families or neighbors? From what fleet sectores would that be?

   some parts sold? From what fleet sectors would that be? For what use and purpose?

2. In this port, when sea lions are caught by accidento or on purpose, roughly what fraction do you estimate (such as all, none, half, quarter, less) are

   discarded without any personal use or comercial value?

   some parts used by families or neighbors? From what fleet sectores would that be?

   some parts sold? From what fleet sectors would that be? For what use and purpose?

[VII. Other]

Do you want to give any additional comments, observations, opinions or advice to this project team?

If you haven't done it yet, do you want to give your contact information – e-mail, phone, address?

Are there other people you recommend I talk to?

Do you know how to contact them? Do you prefer that I mention your name or not?

IX. Interviewer notes

1. What level of confidence do you have in the answers in this interview?

5 = I believe all the information is reliable

4 = I suspect the majority of the central information is reliable

3 = Neutral, I don't know

2 = I suspect there are errors

1 = I believe there are important errors

Why?

2. Are there descriptive phrases, words, or paragraphs that we could use in reports or publications? Do you know where these are in the audio recording?

3. Do you have any other observations, theories, suggestions, or new questions?

Questionnaire – FISHER – Chile (English translation)

[Part I. Interview information]

Date, port, location (beach, wharf, house, etc.):

[How did you find or choose this interviewee?]
Interviewer/s, assistants:
Code number of interviewee/s:

All questions refer to the most recent 12 months, unless indicated otherwise

[Part II. Fishing experience]

1. [How many people in this interview?]

2. In this past year, and before, what were your jobs, positions, or relationships with fishing activities? [If it is a group, note the number per category, realizing some people may hold more than one position.]

(Year) (Position)

___ ___ Fishing boat captain

___ ___ Fishing boat crew (non captain)

___ ___ Owner (or co-owner) of a fishing boat and also personally fishing

___ ___ Owner (or co-owner) of a fishing boat but not personally fishing

___ ___ Other employee of a fishing-related business (but not fishing and not owner – specify)

___ ___ Buyer and seller of fish (could be in the port or elsewhere)

___ ___ Fishing supplier (boats, wharfage, gear, etc. - specify)

___ ___ Member of a fishing family (but not personally fishing)

___ ___ Official of a fishing organization (specify)

___ ___ Representative of a NGO or non-profit organization (specify)

___ ___ Government representative (specify)

___ ___ Coastal tourism (specify)

___ ___ Other (specify)

[General description of other people present but not interviewed but apparently listening, such as number of family members, co-workers, neighbors]:

3. In total, about how many years of fishing experience do you have? [If a group, record all answers.]

4. Have you always fished from this port, or also from others? Which?

5. In the past 12 months, roughly what size boats have you fished from?

And before?

6. In the past 12 months, what fishing gears have you used?

And before?

7. In the last 12 months, what species or types of fish have you caught?

And before?

8. In the last 12 months, what is the area you have fished? How far to the west, south, north, east?

[Part III. Personal perceptions *]

The following questions consider if, from your perspective as a fisherman, certain animals are benefits, difficulties, or neither.

[If it is a group, record the number of interviewees that select each option, and also record the range of qualitative answers. If you know some of these animals don't exist in this área, you can skip them.]

1. From your perspective as a fisherman, when you think of whales, do you see them as a benefit, difficulty, or neither?

In what ways are they a benefit or difficulty?
Apart from fishing considerations, what do you think of whales in general?

2. From your perspective as a fisherman, when you think of dolphins, do you see them as a benefit, difficulty, or neither?

In what ways are they a benefit or difficulty?
Apart from fishing considerations, what do you think of dolphins in general?

3. From your perspective as a fisherman, when you think of sea lions, do you see them as a benefit, difficulty, or neither?

In what ways are they a benefit or difficulty?
Apart from fishing considerations, what do you think of sea lions in general?

[Part IV. Interactions in the past 12 months*]

The following questions refer to your observations of marine animals in the most recent 12 months.

[If possible, seek and record additional facts about these observations, especially fishery interactions. If you think the past year is not an appropriate time period, you can add another, with explanation. It it is a group, indicate approximately how many interviewees agree with each answer, including minority opinions.]

1. Whales

In the past 12 months, during your fishing activities, approximately how many whales have you seen in the ocean?

Among those, how many did not have any apparent evidence of attached or entangled fishing gear (like net, rope)?

And how many had apparent evidence of interactions with fishing gear (like nets, ropes)? (including gear from your boat, other boats, or of unknown origin.)

Can you describe more details about these observations, for example the fishing location?

In the past 12 months, during your fishing activities, approximately how many dead whales have you seen in the ocean?

Among these, how many did not have any apparent evidence of attached or entangled fishing gear (like net, rope)?

And how many had apparent evidence of fishing gear interactions (like nets, rope)? (including gear from your boat, other boats, or of unknown origin.)

Can you describe more details about these observations, for example the location?

2. Dolphins

In the past 12 months, during your fishing activities, approximately how often did you see live dolphins in the ocean? (each day, week, month, occasionally)

In the past 12 months, do you know if some dolphins have been entangled in fishing gear?

Approximately how often with a typical boat like yours?

(each day, week, month, occasionally)

Can you describe more details about this, for example the location?

3. Sea lions

In the past 12 months, during your fishing activities, approximately how often did you see live sea lions in the ocean? (each day, week, month, ocassionally)

In the past 12 months, do you know if some sea lions have been entangled in fishing gear?

Approximately how often with a typical boat like yours?

(each day, week, month, occasionally)

Can you describe more details about this, for example the location?

[4. Identifications]

[Instructions:

We rely on your discretion to decide if it is appropriate or not to ask for species identifications in each interview, and to explain your level of confidence in the identifications. (This level of confidence is SEPARATE from the level that you note at the end of the interview.)]

a. I have here drawings of whale species.
Do you have an idea which of these you have seen entangled while fishing from this port?

What are the characteristics that you have seen most clearly to make this identification? For example: body shape, fin shape, head shape, color, behavior, or other. Specifically? Or none?

[Interviewer assessment of level of confidence in whale identification:

3 = I think it is more or less reliable

2 = neutral, I don't know

1 = I think it is not reliable

Why?]

b. I have here drawings of dolphin species.
Do you have an idea which of these you have seen entangled while fishing from this port?
What are the characteristics that you have seen most clearly to make this identification? For example: body shape, fin shape, head shape, color, behavior, or other. Specifically? Or none?

[Interviewer assessment of level of confidence in dolphin identification:
3 = I think it is more or less reliable
2 = neutral, I don't know
1 = I think it is not reliable

Why?]

[Part V. Change over time *]

1. In the last five years, has there been a change in the frequency of whale sightings?
   Has it increased? Decreased? Is it the same?

2. And the frequency of dolphin sightings?
   Has it increased? Decreased? Is it the same?

3. And for sea lions?
   Has it increased? Decreased? Is it the same?

4. In the last five years, has there been a change in the frequency of whale entanglements? Has it increased? Decreased? Is it the same?

   In this case, why do you think it has changed? Changes in whale populations? Changes in whale behavior? Changes in fishing target species? Changes in fishing area? Changes in fishing gear use? Changes in fishing boat technology?

5. In the last five years, has there been a change in the frequency of dolphin entanglements? Has it increased? Decreased? Is it the same?

   In this case, why do you think it has changed? Changes in dolphin populations? Changes in dolphin behavior? Changes in fishing target species? Changes in fishing area? Changes in fishing gear use? Changes in fishing boat technology?

6. In the last five years, has there been a change in the frequency of sea lion entanglements? Has it increased? Decreased? Is it the same?
   In this case, why do you think it has changed? Changes in sea lion populations? Changes in sea lion behavior? Changes in fishing target species? Changes in fishing area? Changes in fishing gear use? Changes in fishing boat technology?

[Part VI. Future]

1. In the future, are you interested in collaborating with other fishermen to discuss and investigate new methods of more efficient fishing or new markets?
   [For interested persons, record their contacts on another paper – e-mail, phone, address]

2. Do you have ideas about ways to reduce interactions between fishing gear and whales? If so, please describe them?
   For dolphins? If so, please describe them?

   For sea lions? If so, please describe them?

[Part VII. (Optional) Uses and markets *]

1. In this port, when dolphins are caught by accidento or on purpose, roughly what fraction do you estimate (such as all, none, half, quarter, less) are

   discarded without any personal use or commercial value?

some parts used by families or neighbors? From what fleet sectores would that be?

some parts sold? From what fleet sectors would that be? For what use and purpose?

2. In this port, when sea lions are caught by accidento or on purpose, roughly what fraction do you estimate (such as all, none, half, quarter, less) are

discarded without any personal use or commercial value?

some parts used by families or neighbors? From what fleet sectores would that be?

some parts sold? From what fleet sectors would that be? For what use and purpose?

[VII. Other]

Do you want to give any additional comments, observations, opinions or advice to this project team?
If you haven't done it yet, do you want to give your contact information – e-mail, phone, address?

Are there other people you recommend I talk to?

Do you know how to contact them? Do you prefer that I mention your name or not?

IX. Interviewer notes

1. What level of confidence do you have in the answers in this interview?

5 = I believe all the information is reliable

4 = I suspect the majority of the central information is reliable

3 = Neutral, I don't know

2 = I suspect there are errors

1 = I believe there are important errors

Why?

2. Are there descriptive phrases, words, or paragraphs that we could use in reports or publications? Do you know where these are in the audio recording?

3. Do you have any other observations, theories, suggestions, or new questions?