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South Pacific Regional Fisheries Management Organisation

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SC9-Doc24

Chile Annual Report – Jack Mackerel

Chile

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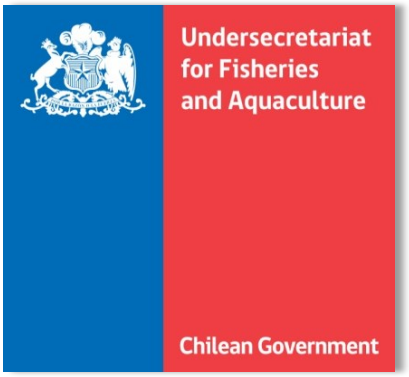

CHILE ANNUAL REPORT

SPRFMO-SCIENTIFIC COMMITTEE

Jack mackerel (*Trachurus murphyi*)

August, 2021.

Undersecretariat for Fisheries and Aquaculture
Chilean Government

1. DESCRIPTION OF THE FISHERY

1.1 Composition of the Fleet.

The industrial purse seine fleet operating in the jack mackerel fishery in both, the SPFRMO area and in the Chilean EEZ, between January and June 2021 consisted of 54 fishing vessels, which represents a reduction of around 31% when compared to the period between 2018 and 2020 (Table I), and this is explained by a lower participation of vessels below a hold capacity of 600m^3 from 2018 onwards. On the other hand, the number of vessels from the center-south area larger than 900m^3 has been stable during the last five years.

Taking into account the total number of industrial fishing vessels operating within the SPRFMO area during the 2016-2020 period, regardless of their hold capacities, this number has showed a sustained downward trend, from 6% in 2016 to 0% in 2020-2021. Consequently, jack mackerel operations have been concentrated within of the Chilean EEZ (Table I, Table II).

Table I. Number of industrial purse seine vessels catching jack mackerel in the Chilean EEZ and the SPRFMO (combined) area between 2016 and June 2021. Information is provided by year and hold capacity (2021* preliminary data).

Hold capacity (m^3)	2016	2017	2018	2019	2020	2021*
0 ≤ 300	3	0	0	0	0	0
300 ≤ 600	57	57	46	42	42	26
600 ≤ 900	7	5	5	7	6	5
900 ≤ 1,200	1	2	1	1	1	1
1,200 ≤ 1,500	6	8	7	8	8	8
1,500 ≤ 1,800	9	9	9	10	10	10
1,800 ≤ 2,100	4	4	4	4	4	4
TOTAL	**87**	**85**	**72**	**72**	**71**	**54**

Table II. Number of industrial purse seine vessels catching jack mackerel in the SPRFMO area between 2016 and June 2021. Information is provided by year and hold capacity. (2021* are preliminary data).

Hold capacity (m^3)	2016	2017	2018	2019	2020	2021*
0 ≤ 300	0	0	0	0	0	0
300 ≤ 600	0	0	0	0	0	0
600 ≤ 900	1	0	0	0	0	0
900 ≤ 1,200	0	1	0	0	0	0
1,200 ≤ 1,500	0	0	1	0	0	0
1,500 ≤ 1,800	2	2	0	2	0	0
1,800 ≤ 2,100	2	0	1	0	0	0
TOTAL	**5**	**3**	**2**	**2**	**0**	**0**

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1.2 Catches, Seasonality of Catches, Fishing Grounds and By-catch

a) Catches

An increase in jack mackerel catches has been observed, with a maximum in 2020 throughout the period 2013 - 2021. This increase is explained by the full consumption of the quota allocated to Chile plus transfers of jack mackerel quota from other SPRFMO members. The main volumes of catches have been concentrated during the first half of each year (80% in average of the annual quota).

However, during the same period, it has been observed a decreasing trend in the catches of jack mackerel within the SPRFMO area, with the exception of 2015 when catches within the SPRFMO area accounted for 20% of the total catch (Figure 1 and Table III).

During the first half of 2021, 527,370 metric tons of jack mackerel have been caught in the Chilean EEZ. This value exceeds the national TAC and is explained by transfers from other fishing nations.

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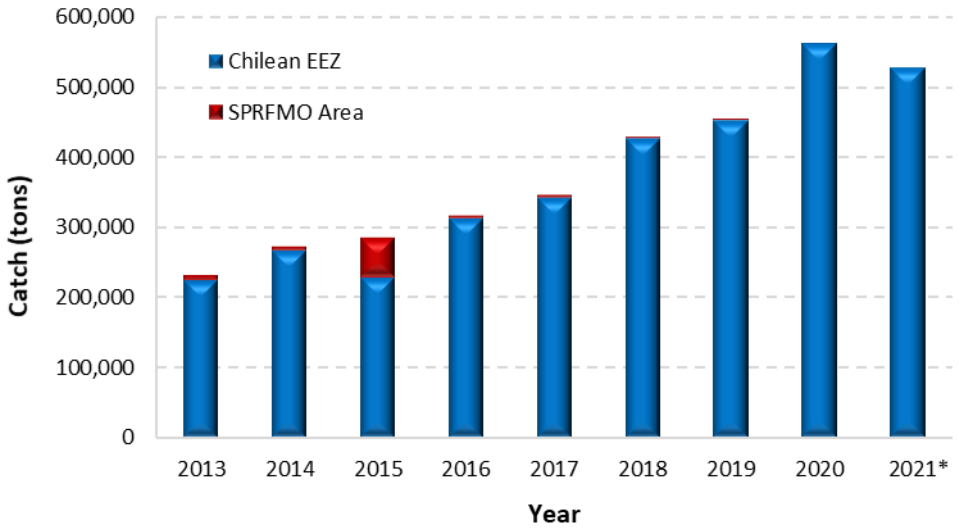
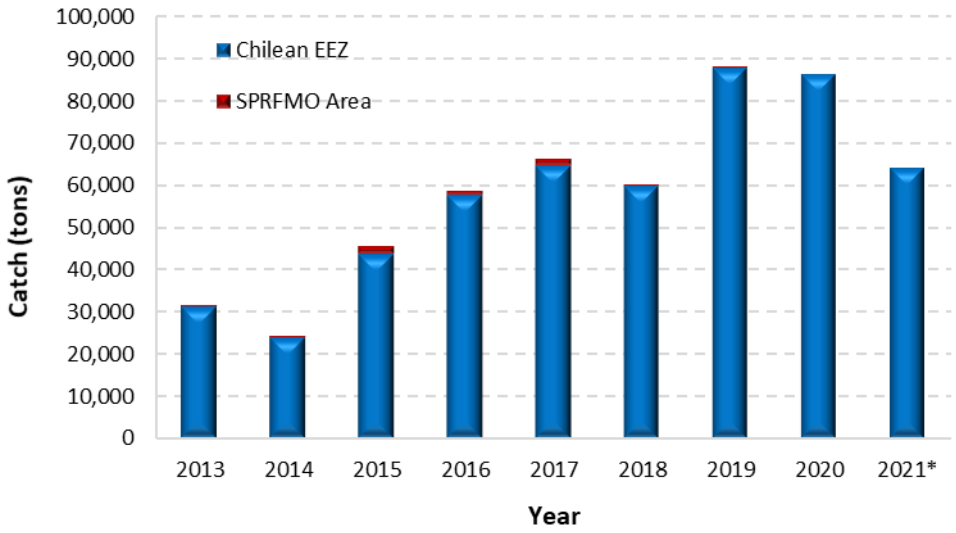


Year	Chilean Jack Mackerel (tons)		
	Chilean EEZ	SPRFMO Area	Total
2013	225,443	5,917	231,360
2014	267,615	3,983	271,598
2015	228,409	56,805	285,214
2016	313,403	3,159	316,562
2017	341,572	3,173	344,745
2018	425,426	975	426,401
2019	451,287	2,283	453,570
2020	561,824	0	561,824
2021*	527,370	0	527,370

Figure 1 and **Table III**. Total annual jack mackerel catch within the Chilean EEZ and the SPRFMO area with purse seine nets for the period 2013 – June 2021 (*) preliminary.

In addition to jack mackerel, the national fleet also registered chub mackerel catches which totaled 64,225 metric tons by June 2021. This value is slightly above the average for the period between 2013 and 2020 and that amount has fluctuated in around 57 k tons. However, the capture of this resource within the SPRFMO area (Figure 2 and Table IV) generally fluctuates between 1% of the total, with the exception of 2017, when accounted for 2.2% of the total.



Year	Chub Mackerel (tons)		
	Chilean EEZ	SPRFMO Area	Total
2013	31,226	431	31,657
2014	24,127	31	24,158
2015	43,867	1,820	45,687
2016	57,769	814	58,583
2017	64,915	1,492	66,407
2018	59,774	61	59,835
2019	87,994	249	88,243
2020	86,455	0	86,455
2021*	64,225	0	64,225

Figure 2 and **Table IV**. Total annual chub mackerel catches in the Chilean EEZ and SPRFMO area with purse seine nets for the period 2013 - June 2021 (*) preliminary.

b) Seasonality of Catches

During the first semester of 2021 jack mackerel catches totaled (527,370 tons), which represents the same date of each year, the highest catches registered during of the period between 2016 and 2021.These catches started in December 2019 until June 2020, with a monthly average of around 80,000 tons. Performance that is below 89 thousand tons as a monthly average between January to June 2021.

Absence of juveniles and a distribution of schools of jack mackerel near the coast during the first semester of 2020-2021 resulted in the high catches. This situation occurred in 2019 and 2018 as well.

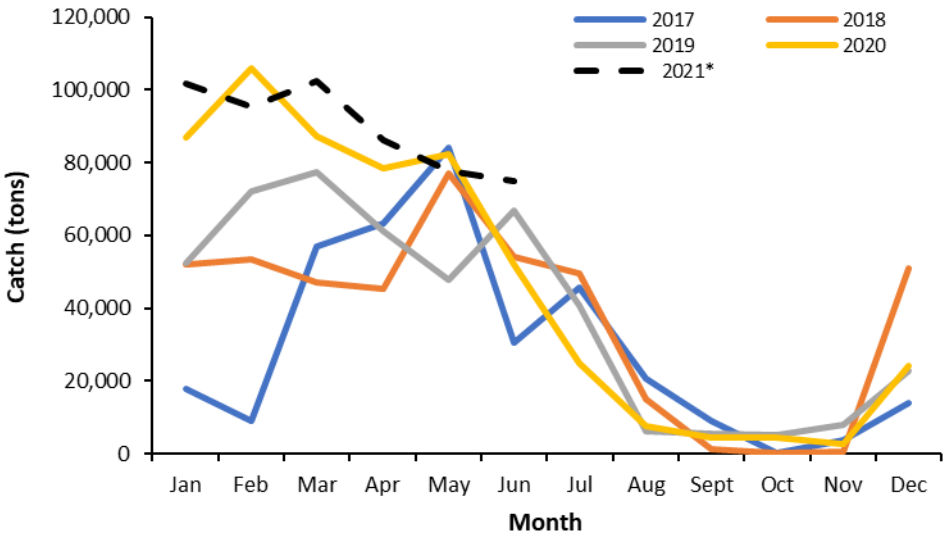


Figure 3: Seasonality of jack mackerel catches by the purse-seine fleet for the period 2017 - June 2021. Source: SERNAPESCA.

c) Spatial Distribution of Catches

During 2018 and 2021, the spatial distribution of jack mackerel catches in the center-south area of Chile was concentrated near the coast, within 100 nm from the coast. On the other hand, in the North area of the country catches were also concentrated near the coast, but within the first 50 nm, and were associated with the operation of fleets aiming at anchovy as target species. However, from the year 2019 and unlike previous years, catches of jack mackerel were mainly made up of the adult fraction, with individuals above the minimum legal size of 26 cm FL (Figure 4 and Figure 7).

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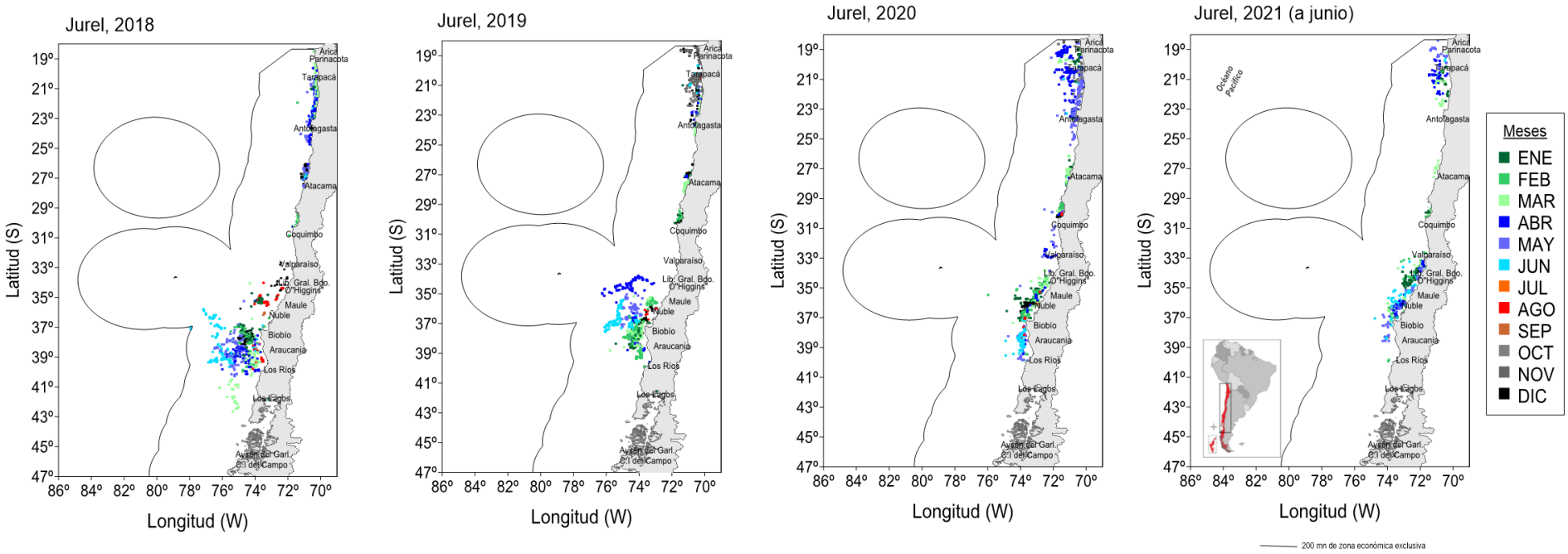

Figure 4: Spatial-temporal distribution of industrial jack mackerel purse seine fleet 2018, 2019, 2020 and Jun 2021. Source: IFOP.

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d) Bycatch

During the period 2013 to June 2021, the operations of the fleet within the SPRFMO area and the center-south area of the Chilean EEZ targeted jack mackerel. For these operations, chub mackerel was caught as the main associated species. Other species caught showed a marginal presence.

On the other hand and as experienced in previous years, in the northern area of the country, jack mackerel was mostly caught as associated species when the fleet targets anchovy.

2. EFFORT AND CPUE FOR JACK MACKEREL FISHERY

The information contained in this chapter is referred to the fleet targeting jack mackerel that operates in the center-south area of the country. Catches, effort and CPUE were calculated for each trip where jack mackerel represented over 50% of the total catch composition.

Until 2010, an increasing trend in the average length of the fishing trips was observed (Figure 5), due to the distances from the coast of fishing grounds for jack mackerel. Later, during 2012 and 2013, catches were concentrated within the EEZ, which considerably reduced (50%) the average length of the fishing trips. In 2015, catches were again performed outside the Chilean EEZ, increasing the average length of the fishing trips to 7 days. For the most recent period (2016-2021), the total number of fishing trips and their average length shows a relative stability due to catches concentrated in areas close to the coast, within the first 150 nm.

On the other hand, regarding the standardized CPUE, measured as the utilization rate of the fleet's carrying capacity (catch / (hold capacity displaced x length of fishing trip)) has shown showed a decreasing trend between 2001 and 2011. Subsequently, in 2012, this indicator changed its trend, increasing towards an increase over time, which is explained by a decrease in the average length of the fishing trips as a result of changes in the spatial distribution of the resource (Figure 6a). The background that is corroborated (Figure 6b), where it is evident towards the most recent years, shows a reduction in the number of vessels operating, which in turn, have obtained an increase both in fishing yields, as well as, in the total catches landed.

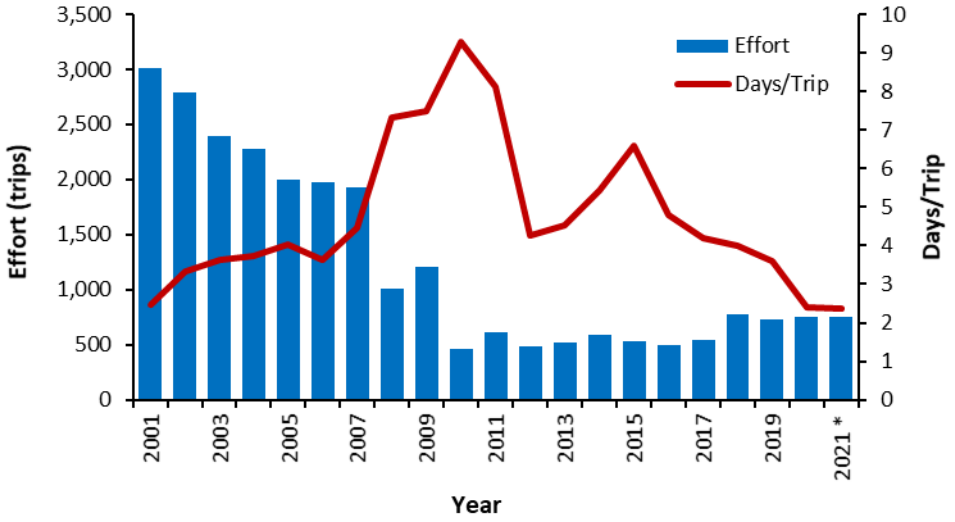

Figure 5: Effort in number of trips with catch (blue), and length of fishing trips in days (red) for the purse seine fleet in the center-southern zone, period 2002-2021 (preliminary). Data SERNAPESCA. Source: IFOP.

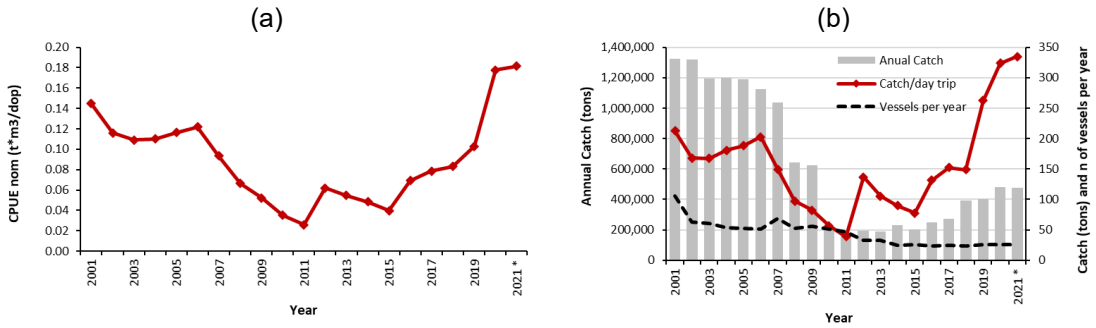

Figure 6: a) Nominal CPUE for the purse seine fleet in the center-southern zone and, b) Total catch per year (grey bar), catch per day of global fishing trips (red line) and number of vessels with catch of jack mackerel for the purse seine fleet in the center-southern zone, period 2001-2021* (preliminary). Source: IFOP-SERNAPESCA.

3. RESEARCH PROGRAMS

Jack mackerel research programs include standard projects carried out annually by IFOP (Fisheries Research Institute) along with complementary projects. Information obtained is used by the Authority to support the decision-making process.

Basic projects performed by IFOP during 2020-2021:

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- Jack mackerel fishery monitoring

This study allowed to obtain real-time information on the evolution of the main biologic and fisheries indicators associated to the jack mackerel fishery and its incidental catch. Monitoring was conducted throughout the maritime space between the northern boundary of Chile and 47°00' SL and included information collected from both small-scale and industrial fleets.

- Bycatch research and Monitoring Program for jack mackerel fishery

Since 2015, This study monitors, with scientific observers onboard, the levels of bycatch and interactions of the fishery with seabirds, marine mammals and turtles, the associated species caught and other ecosystem information used for management. The information collected has been used to establish bycatch mitigation plans and measures as well certify the fishery under MSC.

- Assessment of the total allowable catch

Similarly, as done by the SPRFMO SWG, this study used the Joint Jack Mackerel (JJM) model. This project was aimed at setting up the status of the resource, and also at assessing biologically sustainable exploitation rates. The results were used by the Fishing Authority at improving the stock assessment, simulating different exploitation scenarios and conducting additional analyses.

- Hydroacoustic assessment of jack mackerel between Arica-Parinacota and Valparaiso Regions, 2021.

This survey took place from March 31th through May 1st 2021, and included an exploration area located between the north of Antofagasta (23°25´SL) and Valparaiso (33° 00' SL), unlike previous years where it was covered up to the northern limit of the country, Arica (18 ° 22´SL); due to restrictions arising from the COVID-19 pandemic. As usual, transects were made perpendicular to the coast, reaching up to 100nm off the coast. As a result, the estimated jack mackerel biomass in the prospection area was 1,904,359 tons; which represents an increase of 10.17% compared to the survey of 2020.

- Hydroacoustic assessment of jack mackerel between Valparaíso and Los Lagos Regions, 2020

This survey took place from June 17th through July 16th 2020, and included an exploration area located between the northern of Pichidangui (31° 55' SL) and Corral (40° 00' SL), in perpendicular transects to the coast, reaching up to 150nm off the coast. As a result, the estimated jack mackerel biomass in the prospection area was 1,213,776 tons; which represents a reduction of 21.62% compared to the last survey carried out in 2020.

- Biological condition jack mackerel on the high seas, year 2020

The survey carried out on the high seas during 2020 evidenced a significant reduction in the spawning area, representing 16% with respect to the total study area, together with a change in the distribution and the use of the area by the resource. This situation has been taking place since 2007, considering that the area surveyed in the historical series of this project has not changed significantly within years.

The estimation of daily egg production for 2020 was 2,2 individuals 10 m^{-2}. This figure is similar to the low production levels obtained in 2016 (1,8 individuals 10 m^{-2}) and 2018 (3,6 individuals 10 m^{-2}). It is obtained a low representation of the reproductive condition of the resource and of the parameters that allow estimating its spawning biomass, which lead to an estimate of the spawning biomass of around 61,352 thousand tons, mainly as a consequence of a substantial drop in production of eggs, in a very discreet spawning area.

Within the scenarios that are considered from the different indicators of the biological condition of the resource, it can be concluded that, although the resource was in reproductive activity associated with the maximum spawning period, it was still in the early stages of this process.

4. BIOLOGICAL SAMPLING, AND LENGTH AND AGE COMPOSITION OF THE CATCH

4.1 Biological sampling.

Biological information is obtained on a regular basis from samples collected along the Chilean coast for jack mackerel and its associated species. Sampling is conducted on a daily basis, mainly at landing sites and processing plants, and it is also complemented with information gathered by scientific observers onboard fishing vessels. Information collected includes fork length measurements, otolith collection, total weight, gutted weight, gonad weight, and sex and maturity stages.

The amount of size and biological samples obtained for jack mackerel during 2020 was 47,225 and 13,304 specimens, respectively. For the industrial fleet, samples included at-sea sampling as well as port sampling, covering the whole range of activity reported for this fishery in Chile. The main landing ports were Caldera and Coquimbo in the northern area Talcahuano, Valdivia and San Antonio in the center-south area of the fishery (Table V).

Chub mackerel is the main bycatch in the jack mackerel fishery. During 2020, sampling also included a total of 3,828 and 1,003 specimens of this species for length and biological samples, respectively.

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Table V. Number of jack mackerel and chub mackerel specimens collected in 2020 for biological and length samples.

Landing Port	Jack Mackerel		Chub Mackerel	
	Lenght Sampling	Biological Sampling	Lenght Sampling	Biological Sampling
Arica	1,288	46	322	0
Iquique	2,924	20	1,186	180
Antofagasta	2,193	251	1,018	184
Caldera	2,309	323	293	13
Coquimbo	7,113	2,851	905	539
San Antonio	3,196	930	8	37
Talcahuano	24,017	7,396	96	50
Valdivia	4,185	1,487	0	0
Chiloé	0	0	0	0
Guaticas	0	0	0	0
TOTAL	47,225	13,304	3,828	1,003

4.2 Length and age composition of catches

Jack Mackerel

Size structure of jack mackerel has shown a constant growth from 2015 to 2019 (Figure 7), with a shift of the mode size from 27 cm FL as mode size in 2015, to 30 cm FL in 2021. During 2018, a bi modal structure was observed with a lower mode with sizes around 15 cm FL, corresponding to the catches of the central-south area. Subsequently, the share of the immature fraction of the stock in the catches being almost nil, in contrast to predicted years.

During the first half of 2021, the sizes from catches ranged between 27 and 50 cm in FL. The main mode was 30 cm in FL and the secondary mode was 39 cm in FL. A reduced contribution from the fleet operating in the northern area is expected, which has been the general pattern observed in recent years.

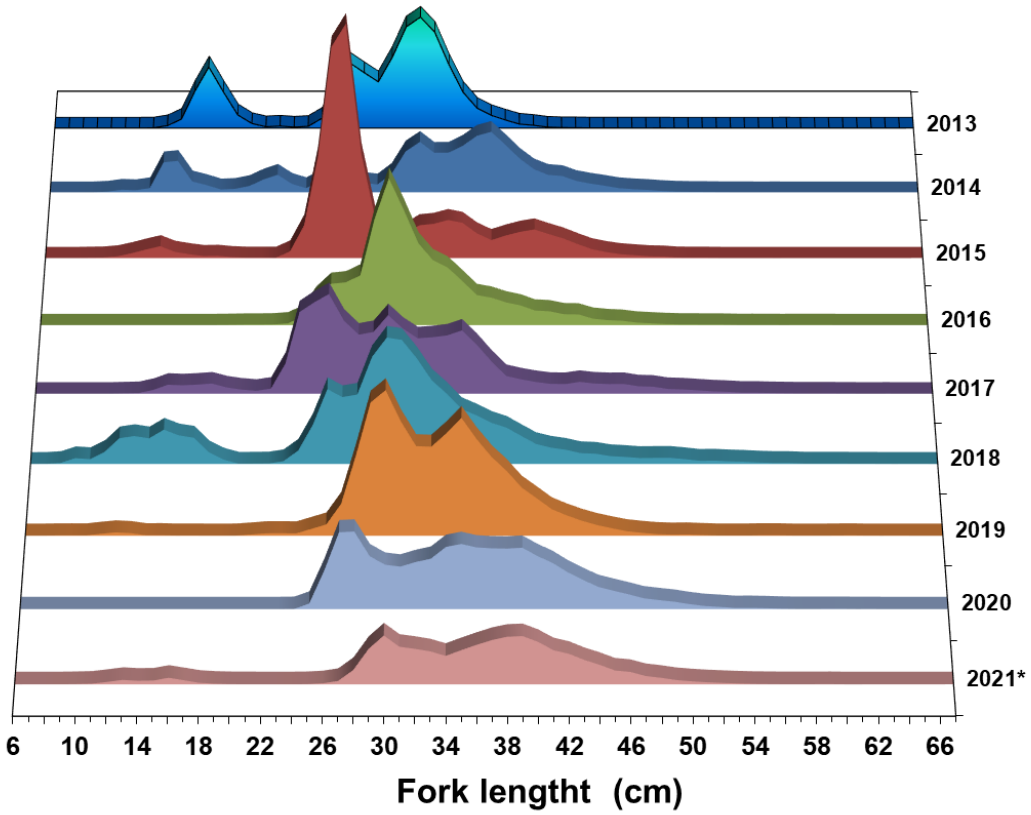

Figure 7. Length structure of jack mackerel, total catch in number for the period 2013 - June 2021. Source: IFOP.

According to the old age group allocation criteria, ages IV, V and VI stand out as the main fashions in the age structure for 2017, concentrating 55% of the catches; those that were captured both in the north, as well as in the south-central zone (Figure 8). For 2018, the size structure showed a structure composed of specimens with a main mode in the age group IV and a strengthening of older ages (modes VII to XI) in comparison with previous years.

During 2019 and 2020, at least 93% of the catch structure was made up of age groups IV to IX.

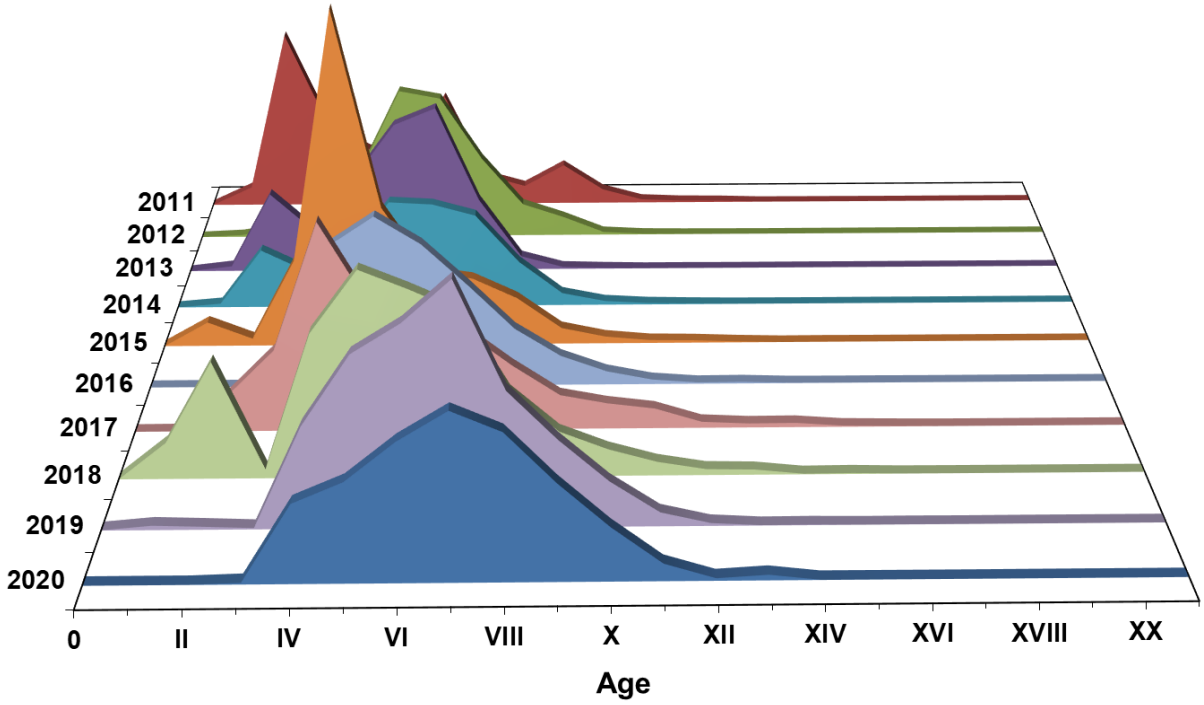

Figure 8: Age structure of jack mackerel, total catch in numbers, 2011 to 2020 period. Source: IFOP.

5. Ecosystem approach considerations in the jack mackerel fishery

There has been a growing concern that the levels of fishing mortality as a result of bycatch and discards, threaten the long-term sustainability of many fisheries worldwide and the maintenance of biodiversity in different areas, compromising the food security and affecting the livelihood of people and countries that depend on fishing resources. However, the use and definition of these terms varies widely. In some countries the term bycatch is referred to the part of the catch that is retained and sold, but is not the target species for the fishery. In others, bycatch consider species/sizes/sexes of fish that are discarded or returned to sea (dead or alive). On the other hand, the OECD defines bycatch as “the total fishing mortality, excluding that accounted directly by the retained catch of target species”. This last definition thus includes fish that dies as a result of the interactions with the fishing gears, even if they do not leave the water, and could include mortalities resulting from “ghost-fishing”. As a reference, FAO defines bycatch as “any catches conducted during the fishing process beyond species and sizes of the marine organisms targeted by the fishery, from sponges, corals, commercial or not commercial fish, seabirds, marine mammals and marine reptiles”. In this regard, Chile has amended its General Law for Fisheries and Aquaculture in 2012 (through Law N° 20.625, known as “discard law”) incorporating the terms **discards** known as “the action of returning to sea hydro biological species caught (target and non-target)” and **incidental catch** as “marine mammals, seabirds and turtles caught during

fishing operations". The new discard law also incorporated penalties and modern tools of control for those engaged in these practices during fishing operations. The Chilean approach to understand, regulate and mitigate discards and incidental catch is broad in scope, encompassing the following groups of species: target and non-target fish, accompanying fauna (bony fishes, chondrichthyes, invertebrates, etc.) and seabirds, marine mammals and sea turtles. The amendment of the Law on Fisheries also introduced fisheries exceptions to the discard ban, conditional on a minimum 2-year monitoring program aimed to quantify discards and incidental catch, to identify their causes, and to develop and implement mandatory fishery-based Reduction Plans for both discards and incidental catch.

Consequently, from 2014 onward, information onboard commercial fleets, for a Nationwide Program on discards and incidental catch in small pelagic purse seine fisheries has been collected, in order to establish reduction plans for these practices, according to the new law (N° 20625) requirements. For these purposes a team of trained observers from the National Observer Program has been used. At the same time, similar programs have also been developed in demersal fisheries.

In January 2015, a specific program for the jack mackerel industrial purse seine fishery was initiated, which was concluded in April 2019 with the enactment of a mandatory reduction plan for the entire fleet, along with the stakeholders at the Management Committee of the fishery. Among other aspects, the reduction plan includes:

- Ban of discard for jack mackerel and its accompanying fauna.
- Mandatory release of all the incidental catch and chondrichthyes caught during fishing operations, using handling protocols (some under current development)
- Management measures and technological means to eliminate discards of accompanying fauna and reduce incidental catch.
- A scientific and compliance monitoring program to evaluate the effectiveness of the measures adopted by the reduction plan.
- A training program for fishermen.
- A code of good fishing practices.
- Incentives for innovation in systems aimed at reducing discards and incidental catch.

It should be noted that the Chilean observer programs were extended with the Law N° 20.625, but with the sole objective of collecting biological and fisheries data to be used in scientific advice for management, without any jurisdiction in compliance. Therefore, the compliance with measures of reduction plan and handling protocols are being monitored remotely by electronic monitoring systems (EMS) onboard all vessels of the industrial fleet, while artisanal boats longer than 15 m (total length) will be required to carry EMS in a later stage (2024). EMS specific regulations have been enacted in 2017 and the system has been fully implemented in the entire industrial fleet as of January 2020. Also as of 2020, industrial vessel owners have the obligation to report, in a set by set basis, all catches, discards and incidental catch through the Electronic Logbook System (SIBE) which has been recently been implemented by the National Fisheries and Aquaculture Service, according to Law. The information content that must be reported in the electronic logbooks includes:

- Geographic Location of the set.
- Time (beginning and end) of the set.
- Amount (weight) or number of specimens by species or species groups.

- Additional information (notes).

It should also be highlighted that at its 8th Annual Meeting, the SPRFMO Commission selected MRAG as the SPRFMO Observer Program Accreditation Evaluator (see Paragraph 59 of the COMM8-Report). In 2020 the Observer Programs of 3 Members; Chile, New Zealand and Australia were evaluated and granted accreditation (CTC8-Doc10_Rev2 SPRFMO Observer Program Implementation Report) in accordance with CMM 16-2021, which recognizes the high standard of work of the Chilean Program.

In order to characterize the incidental catch and mortality of seabirds, marine mammals and sea turtles occurred in the industrial purse-seine fishery for Jack mackerel, a total of 2,167 fishing sets were monitored by scientific observers onboard during 2015-2020. The results are presented for the entire period (combined) with the aim of showing better estimates and trends of both catch and mortality rates, which in this case also correspond to the average incidental catch and the average mortality per set.

As mentioned in previous reports, in the jack mackerel fishery both, the incidental catch and resulting mortality for these groups of species are low, mainly due to the fact that the fishing operations are rather oceanic (compared to artisanal fleets) and also because the crews are making efforts to release specimens alive whenever possible through the use of handling protocols and the compliance with good fishing practices according to the reduction plans previously mentioned.

The species affected by incidental catch (% in relation to the total numbers of specimens caught) are mainly marine mammals (69.8%), followed by Procellariiform seabirds including albatrosses, petrels and shearwaters (16.1%), and coastal seabirds such as seagulls, pelicans and penguins (14.1%). In addition, the capture of one specimen of Leatherback turtle was recorded, which was released alive by the crew. The only species of marine mammal affected is the South American sea lion (*Otaria flavescens*), while the main species of seabirds caught incidentally were the Dominican gull (*Larus dominicanus*) and the Black-browed albatross (*Thalassarche melanophris*), both species altogether represented 58.4% of the total number of seabirds incidentally caught (Table VI). It has to be clarified that with regard to Chilean regulations, the term incidental catch does not necessarily refer to incidental mortality since it relates to specimens caught in the fishing gears that in certain cases can be released alive by the crew. Therefore, observers onboard are required to differentiate and register both, incidental catch and mortality as a result. Consequently, in the Table VI the distinction is clearly made between N° of individuals incidentally caught v/s N° individuals dead as a result of incidental catch, to prevent confusions. In fact, incidental mortality resulting from interactions with this fleet is low, totaling 41 specimens out of 2610 caught for the entire period, where the Pink-footed shearwater (*Ardenna creatopus*) and the South American sea lion represented 39% and 31.7%, respectively in relation to the total number of dead specimens as a result of incidental catch.

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Table VI. Incidental catch and mortality by species in the jack mackerel purse-seine industrial fishery operating between Valparaíso and Los Lagos, (32°10'23'' - 43°44'17'' SL) Chilean administrative regions and international waters of the SPRFMO. Source: data collected by scientific observers onboard from 2,167 fishing sets between January 2015 and December 2020 Source: Vega et al., (2021) Preliminary data, final annual report under evaluation).

Common name	Scientific name	N° of individuals incidentally caught	N° individuals dead as a result of incidental catch	Mort (%)	AIC	CV_{AIC}	AIM	CV_{AIM}
South American sea lion	*Otaria flavescens*	1,823	13	0.7	0.8	526	0.006	1,558
Dominican gull	*Larus dominicanus*	244	1	0.4	0.11	1,356	0.0005	4,655
Black-browed albatross	*Thalassarche melanophris*	215	1	0.5	0.10	1,154	0.0005	4,655
Peruvian pelican	*Pelecanus thagus*	109	3	2.8	0.05	1,816	0.001	4,655
Unidentified albatross	*Thalassarche* spp.	61	0	0	0.03	1,948	0	-
Sooty shearwater	*Ardenna grisea*	47	2	4.3	0.02	2,406	0.0009	3,291
Grey-headed albatross	*Thalassarche chrysostoma*	36	0	0	0.02	2,001	0	-
Wilson's storm petrel	*Oceanites oceanicus*	18	1	5.6	0.008	2,067	0.0005	4,655
Pink-footed shearwater	*Ardenna creatopus*	16	16	100	0.007	2,214	0.007	2,214
Humboldt penguin	*Spheniscus humboldti*	13	1	7.7	0.006	4,312	0.0005	4,655
Cape petrel	*Daption capense*	8	0	0	0.004	3,392	0	-
White-chinned petrel	*Procellaria aequinoctialis*	8	1	12.5	0.004	4,114	0.0005	4,655
Southern giant-petrel	*Macronectes giganteus*	8	0	0	0.004	3,392	0	-
Unidentified storm-petrel	Hydrobatidae	1	1	100	0.0005	4,655	0.0005	4,655
Unidentified penguin	*Spheniscus* sp.	1	1	100	0.0005	4,655	0.0005	4,655
Wandering albatross	*Diomedea exulans*	1	0	0	0.0005	4,655	0	-
Leatherback sea turtle	*Dermochelys coriacea*	1	0	0	0.0005	4,655	0	-

Mort (%) = Mortality: Number of dead animals / Number of animals of the same species captured
AIC = Average Incidental Catch: Number of animals caught / Number of sets observed
CV_{AIC} = AIC Coefficient of variation
AIM = Average Incidental Mortality: Number of dead animals / Number of sets observed
CV_{AIM} = AIM Coefficient of variation

Regarding the spatial and temporal variability of the incidental catch and mortality of both, marine mammals and seabirds, its occurrence is mainly explained by the distance of the fishing operations from the coast in relation to the seasons of the year. During warm seasons (spring-summer) the fleet operates near the coast (39 nm in average), compared with cold seasons

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(autumn-winter) when operations become more oceanic with an average of 92 nm from the coast. It has been seen that this pattern of spatial-temporal operation has a great effect on the intensity of interactions of the fleet, especially with species restricted to terrestrial colonies or those of coastal distribution, such as the South American sea lion and coastal seabirds (Ainley et al., 2009; Baylis et al., 2008; Sabarros et al., 2014). For these last two groups, the average incidental catch during the cold seasons decreased by 133% and 137% respectively, compared to warm seasons. The opposite occurred with albatrosses whose interaction with the fishery increased by 182% during the cold seasons (autumn-winter). Records of incidental catch for albatrosses were mainly obtained at 100 or more nm from the coast (80% of the events), condition which coincides with Spear & Ainley (2008) who reported, for the south-central zone of Chile, that albatrosses are much more abundant in oceanic than neritic waters during winter (Figure 9).

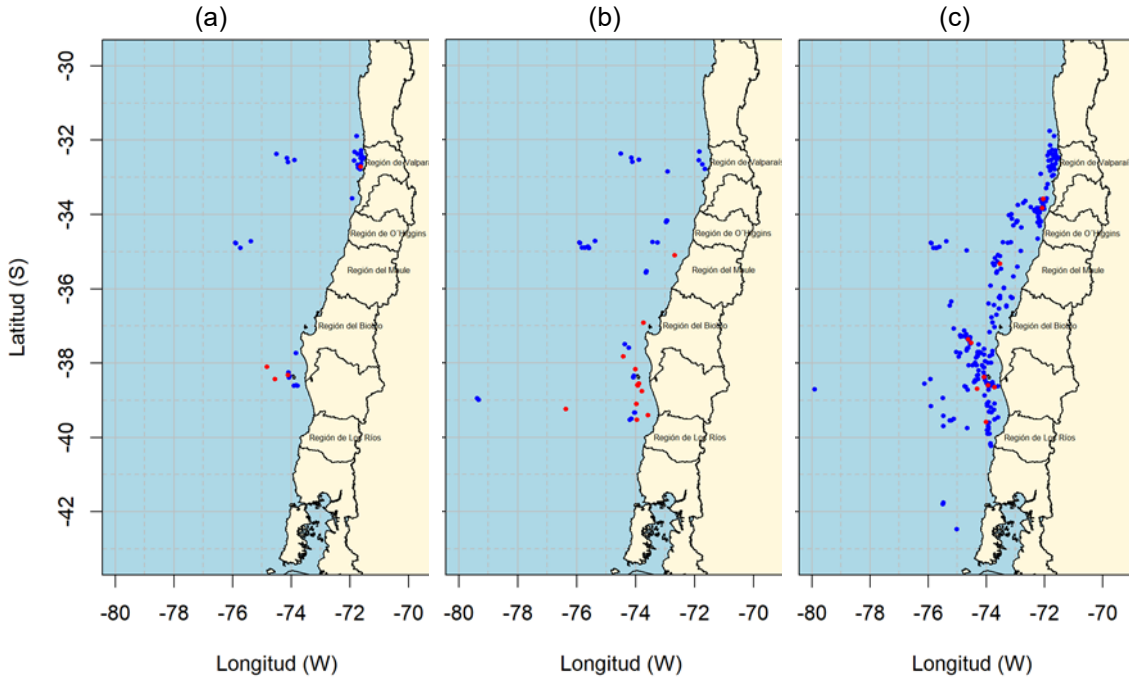

Figure 9. Geographic distribution of sets with incidental catch (blue) and mortality (red) reported in the jack mackerel purse-seine fishery that operated in the south-central zone off Chile during January 2015 - December 2020: a). coastal seabirds; b) Procellariiform seabirds; c) South American sea lion. Source: Vega et al., (2021) Preliminary data, final annual report under evaluation).

Another aspect related to the ecosystem considerations of the jack mackerel fishery is the monitoring of garbage management on the fishing fleet. In this regard, the observer program has been monitoring the handling of garbage generated on board the fishing vessels through the assessment of the level implementation of the Annex V of the International Convention MARPOL, whose main rule prohibits the dumping of plastics into the sea. The program has evaluated the improvement in the degree of knowledge of Annex V and conduct of the crew was, and also the implementation of the regulations in the vessels between 2015 and 2020. Some aspects studied were: 1) the existence of written management plans, 2) the presence of informative material or posters in suitable and visible places on the prohibitions, 3) use of garbage record books and 4) presence of containers. The information was collected by observers using a specific form

designed for such purposes, which was applied at sea during the fishing trip with a fixed frequency of time between trips of three months in order to allow a period of time to observe changes in behavior in the crew regarding the application of the regulations. To improve knowledge of the regulations, observers were tasked by giving talks to the crew on the main rules. A standard guide for observers was developed called "Dissemination of" Annex V-MARPOL 73/78 ": How and what to communicate to the crew on board purse-seine vessels". In addition, flyers, posters, calendars and ecological bags with allusive messages were designed and distributed. Once the results were analyzed, recommendations for prevention or mitigation measures were made to improve the deficiencies observed.

6. Observer Implementation Report

At-Sea and Port Sampling Program

In order to evaluate sampling coverage within the SPRFMO Area, only fishing trips targeting jack mackerel were considered for this report (i.e. trips with more than 50% of the total catch per fishing trip). This report also includes fisheries observers onboard and/or at-port sampling coverage.

During 2020 there was not activity of Chilean vessels in the SPRFMO Area, therefore the sampling activity focused exclusively on the Chilean EEZ. In this sense, within the Chilean EEZ, onboard sampling coverage conducted by scientific observers was 11.1%, and at-port sampling coverage was 9.5%, with a total combined sampling coverage of 20.6% for 2020 (Table VII).

Due to pandemic situation derived from COVID-19, the coverage of fleet operations with observers onboard have been difficult to cover, however, the internal sampling target was met during 2020 with 115 trips monitored with onboard scientific observers and 98 trips sampled at port. Another issue was the more coastal pattern of operation of the jack mackerel fishery over the last years and a less frequent and/or unpredictable fishing trips in such area. However, this situation was solved in a good way for this period and condition, reaching a total coverage, as mentioned, of 20.6% for the period.

Table VII. Sampling coverage by observers at port and observers onboard in the Chilean jack mackerel fishery 2020.

	At-Port	On Board	Total
Chilean EEZ	9.5	11.1	20.6
SPRFMO area*	-	-	-
TOTAL	9.5	11.1	20.6

(*) There was no activity of the Chilean fleet in the SPRFMO area.

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7. ADMINISTRATIVE MEASURES

Total catch quota

In December each year, the Undersecretariat for Fisheries and Aquaculture establishes the catch quotas for each resource in full exploitation regimes to be implemented next year. The jack mackerel quota established by the Undersecretariat for Fisheries and Aquaculture in December 2020 was 504,889 tons (Electronic Exempt Decree, Invoice DEXE202000129) and completely extracted in the first half of 2021.

Bycatch Reduction Plan

Mandatory sets of measures to avoid bycatch and discards in the jack mackerel fishery established through Exempt Resolution N° 16 are found at http://www.subpesca.cl/portal/615/articles-104138_documento.pdf26/2019

Implementation of EMS in the entire industrial fleet

As of January 2020, an Electronic Monitoring System to survey the compliance with Bycatch Reduction Plans and Fishery regulation in general has been implemented.

- http://www.subpesca.cl/portal/615/w3-article-96157.html
- file:///C:/Users/usuario/Downloads/Res%205930-2019.pdf

Implementation of Electronic Logbooks in the entire industrial fleet

During 2020, the mandatory use of Electronic Logbooks in the entire industrial fleet to report in a set by set basis, total catches, bycatch and discards, locations of sets and other fishery information according to the requirements of the Law have been implemented

- http://www.sernapesca.cl/sites/default/files/res.ex_.267-2020_0.pdf

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8. REFERENCES

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