

8th MEETING OF THE SCIENTIFIC COMMITTEE

New Zealand, 3 to 8 October 2020

SC8-Doc26

Chile Annual Report 2020 Jack mackerel

Chile

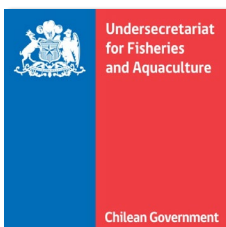


CHILE ANNUAL REPORT

SPRFMO-SCIENTIFIC COMMITTEE

Jack mackerel (*Trachurus murphyi*)

September, 2020



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 SPRFMO area and Chilean EEZ, between January and July 2020 consisted of 70 fishing vessels. This number is similar to the observed during the last two fishing seasons (Table I), and is explained by a lower participation of vessels below a hold capacity of 600m³ compared with 2016 and 2017. On the other hand, the number of vessels from the center-south area larger than 900m³ has been stable during the last five years.

Considering the total number of industrial fishing vessels operating within the SPRFMO area during the period 2016-2020, regardless of their hold capacities, be it has showed a sustained downward trend, from 6% in 2016 to 0% in 2020. 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 Jun 2020. Data were assembled by year and hold capacity (2020* preliminary data).

Hold capacity (m ³)	2016	2017	2018	2019	2020 *
0 - 300	3	0	0	0	0
300 - 600	57	57	46	42	42
600 - 900	7	5	5	7	5
900 - 1.200	1	2	1	1	1
1.200 - 1.500	6	8	7	8	8
1.500 - 1.800	9	9	9	10	10
1.800 - 2.100	4	4	4	4	4
TOTAL	87	85	72	72	70

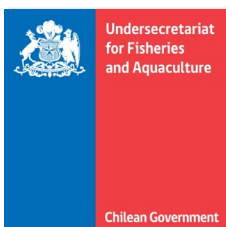


Table II. Number of industrial purse seine vessels catching jack mackerel in the SPRFMO area between 2016 and Jun 2020. Data were assembled by year and hold capacity. (2020* are preliminary data).

Hold capacity (m ³)	2016	2017	2018	2019	2020 *
0 - 300	0	0	0	0	0
300 - 600	0	0	0	0	0
600 - 900	1	0	0	0	0
900 - 1.200	0	1	0	0	0
1.200 - 1.500	0	0	1	0	0
1.500 - 1.800	2	2	0	2	0
1.800 - 2.100	2	0	1	0	0
TOTAL	5	3	2	2	0

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

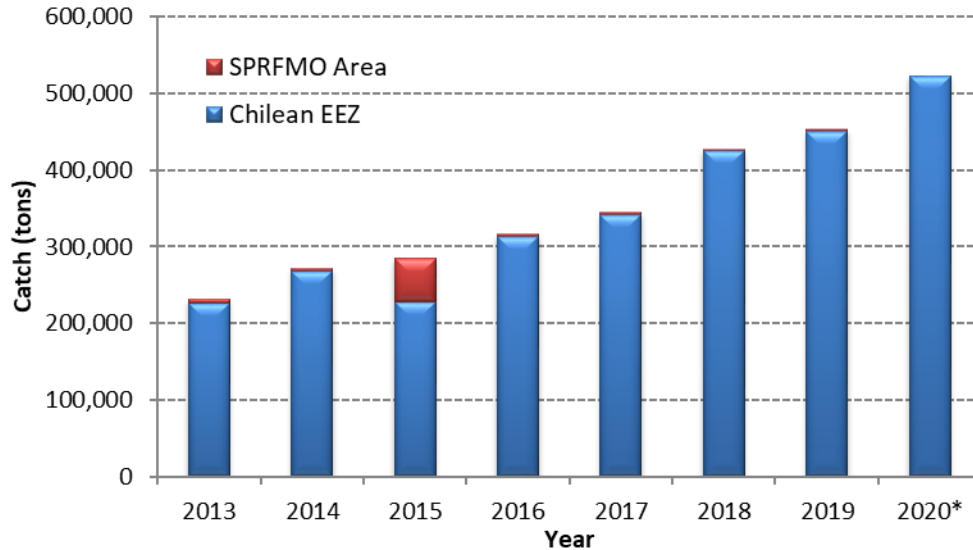
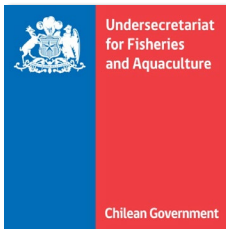
a) Catches

Throughout the period the period 2013 - 2020, an increase in jack mackerel catches has been observed. This increase is explained by the full consumption of the quota allocated to Chile plus transfers of jack mackerel's 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 SPRFMO area accounted for 20% of the total catch (Figure 1 and Table III).

In this same period, there is a decreasing trend in the catches of jack mackerel within the SPRFMO area, with the exception of 2015 where such catches corresponded to 20% of the total captured in such year (Figure 1 and Table III).

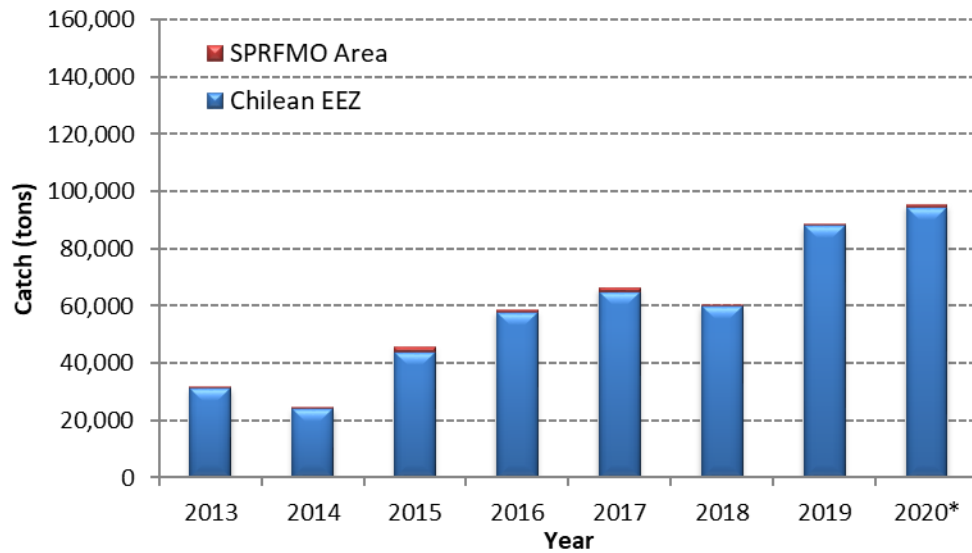
During the first half of 2020, 523,139 metric tons of jack mackerel were caught in the Chilean EEZ. This value exceeds the national TAC and is explained by transfers from other fishing nations.



Year	Chilean Jack Mackerel (t)		
	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*	523,139	0	523,139

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 2020 (*) preliminary.

In addition to jack mackerel, the national fleet also registered chub mackerel catches which totaled 95,377 metric tons by June 2020, a value that represents the highest for this resource in recent years. As of 2016 catches for chub mackerel have fluctuated around to 60,000 tons. However, the capture of this resource within the SPRFMO area (Figure 2 and Table IV) generally fluctuates between 1.46% of the total, with the exception of 2017, when accounted for 2.5% of the total.

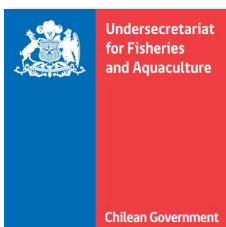


Year	Chub Mackerel (t)		
	Chilean EEZ	SPRFMO Area	Total
2013	31,226	431	31,657
2014	24,127	31	24,158
2015	43,867	1,820	45,687
2016	57,769	814	58,583
2017	64,915	1,492	66,407
2018	59,774	61	59,835
2019	87,994	249	88,243
2020*	94,442	935	95,377

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 2020 (*) preliminary.

b) Seasonality of Catches

During the first semester of 2020 jack mackerel catches totaled (489,693 tons), representing where the highest catches registered during of the period between 2016 -and 2020. These catches started in December 2019 until June 2020, with a monthly average of around 60,000 tons. Performance that exceeds 80 thousand tons as a monthly average for January to May 2020.



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

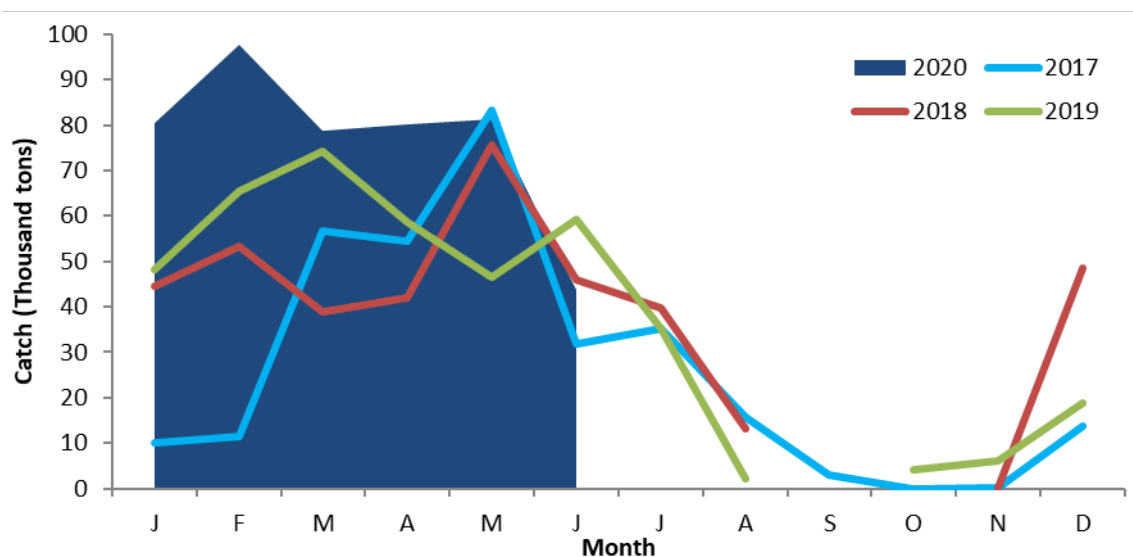
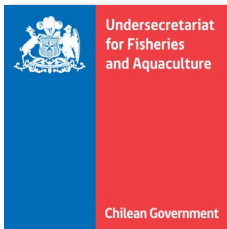


Figure 3: Seasonality of jack mackerel catches by the purse-seine fleet for the period 2017- June 2020. Source: SERNAPESCA.

c) Spatial Distribution of Catches

During 2018 and 2019, 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 the catches were also concentrated near the coast, but within the first 50 nm, and were associated with the operation of the fleet on anchovy as target species. However, unlike previous years, jack mackerel catches were concentrated between 21° and 22° SL during March 2017 with catches of individuals over the legal minimum size of 26 cm FL.

During 2019, the fleet operating within the center-south area has shown a similar catch pattern, concentrating its operation zone between 37° LS and 41° LS, always within the EEZ. On the other hand, the fleet concentrated its catches a little further north (34° SL- 40° SL) in areas closer to the coast within the first 100 nm (Figure 4). Finally, in the first semester of 2020, unlike previous years, the fleet preferably operated very coastal (first 50mn) with a greater latitudinal coverage.



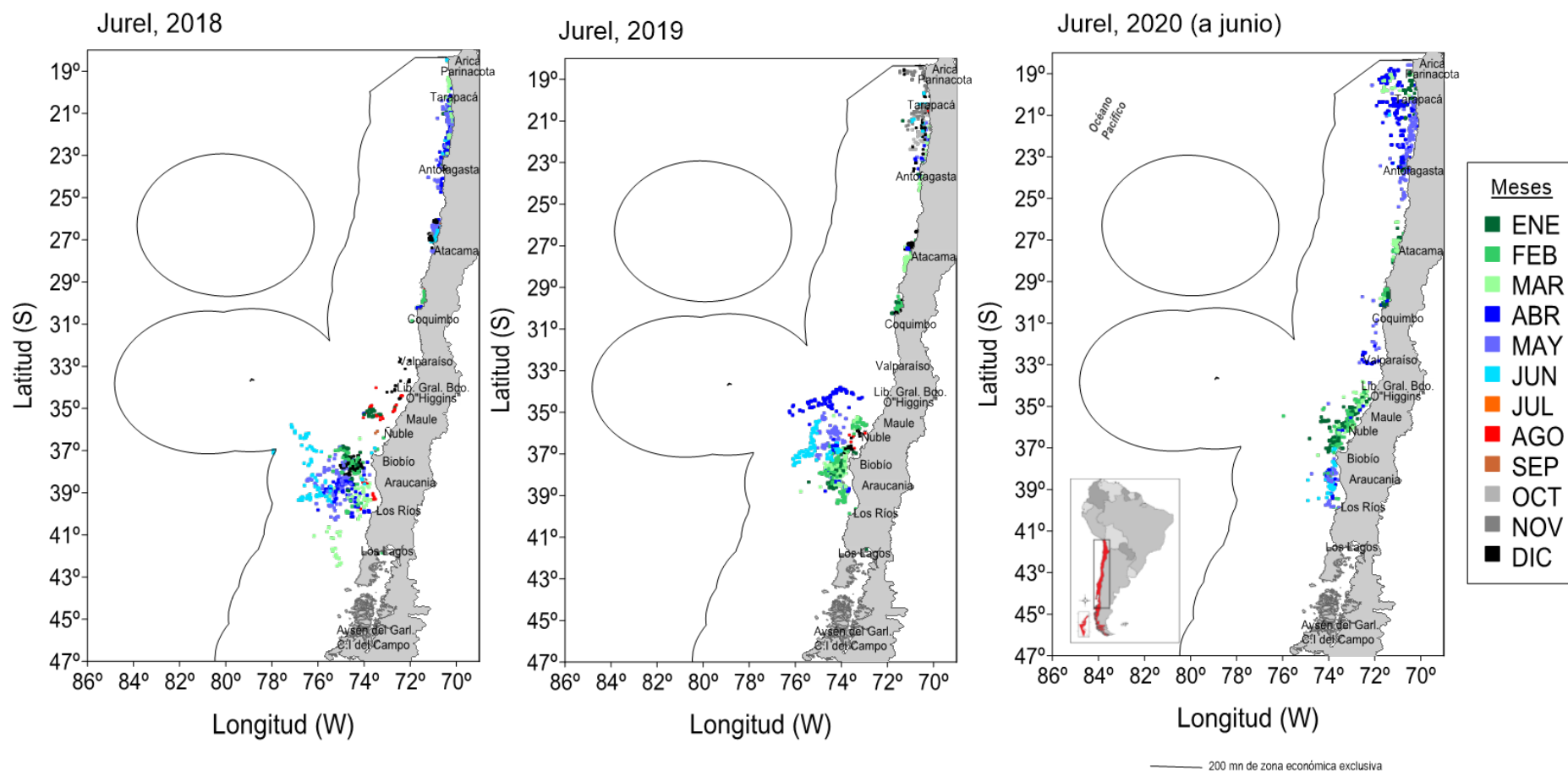


Figure 4: Spatial-temporal distribution of industrial jack mackerel purse seine fleet 2018, 2019, and Jun 2020. Source: IFOP.



d) Bycatch

During the period 2013 - 2019, 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, in the northern area of the country, jack mackerel was mostly caught captured as associated species when the fleet targets catch of 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 (2016-2020), 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 ($\text{catch} / (\text{hold capacity displaced} \times \text{length of fishing trip})$) 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 6).

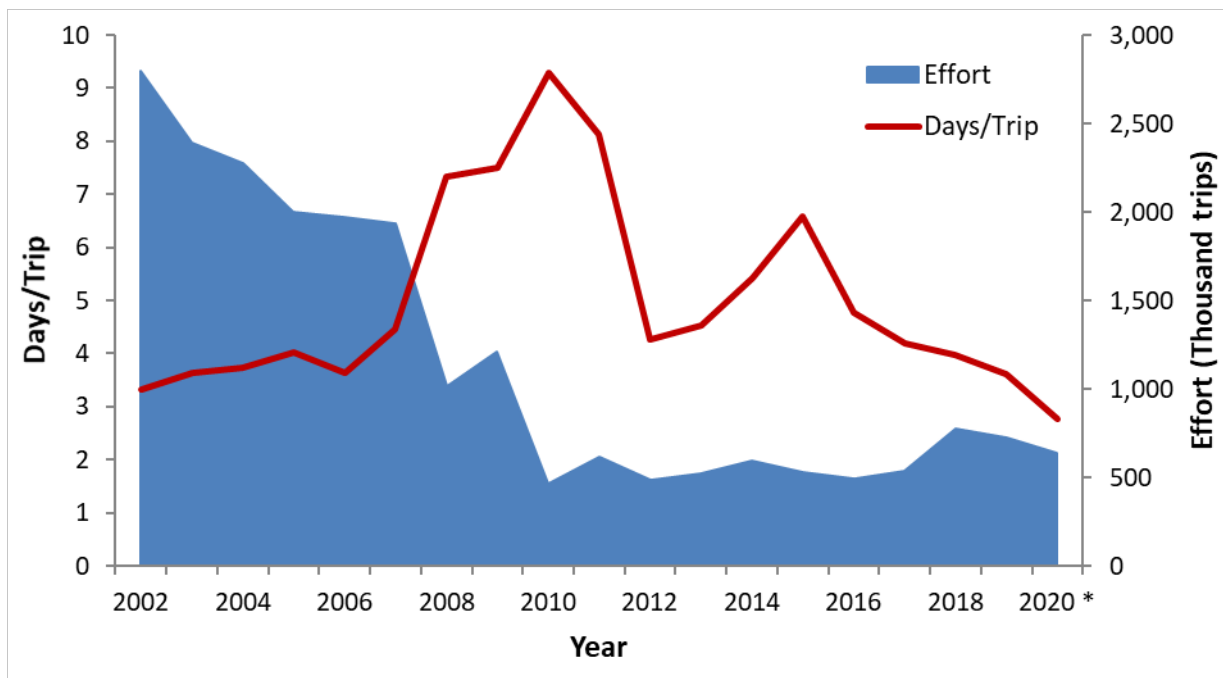
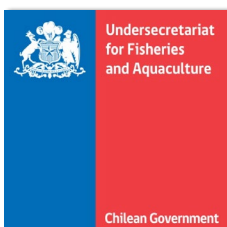


Figure 5: Effort in number of trips with catch (blue), and length of fishing trips in days (red) for the purse seine fleet in the center-southern zone, period 2002-2020 (preliminary). Data SERNAPESCA. Source: IFOP.

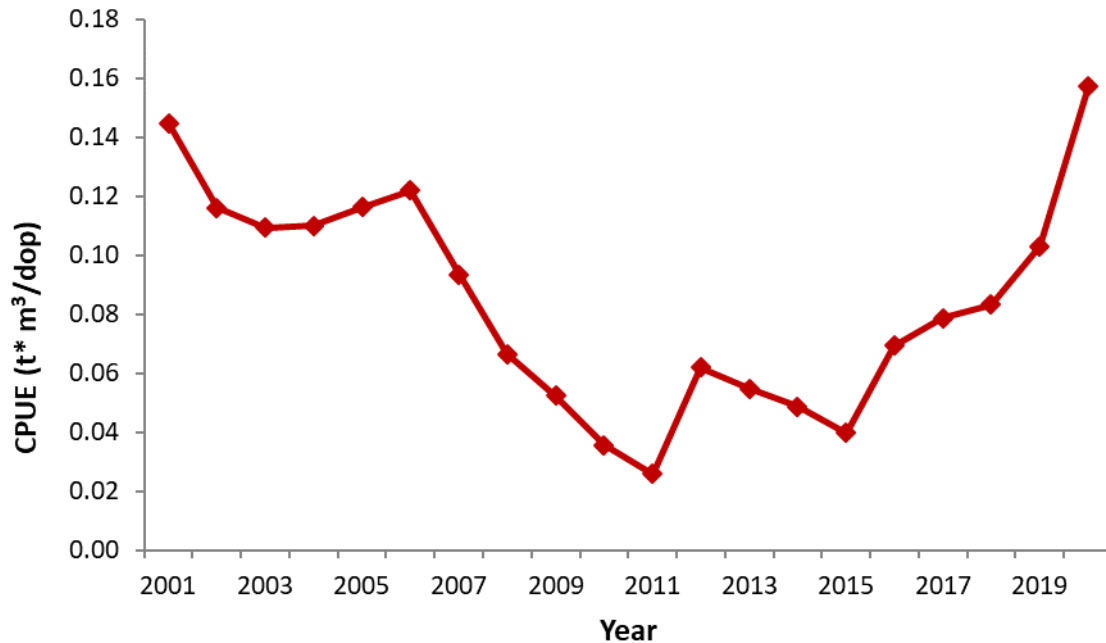


Figure 6: Nominal CPUE for the purse seine fleet in the center-southern zone, period 2001-2020 (preliminary). Source: IFOP-SERNAPESCA.

3. RESEARCH PROGRAMS

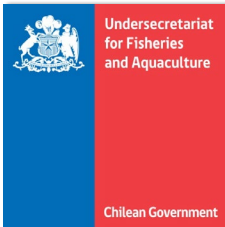
Jack mackerel research programs include standard projects carried out annually by IFOP (Fisheries Research Institute) along with complementary projects. Information obtained is used by the Authority to support the decision-making process.

Basic projects performed by IFOP during 2019-2020:

- 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

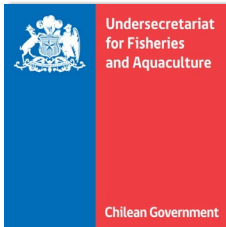
Similarly, as done by the SPRFMO SWG, this study used the Joint Jack Mackerel (JJM) model. This project was aimed at setting up the status of the resource, and also at assessing biologically sustainable exploitation rates. The results were used by the Fishing Authority to improve the stock assessment,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

- Hydroacoustic assessment of jack mackerel between Arica-Parinacota and Valparaíso Regions, 2020.

This research cruise took place from March 17th through April 27th 2020, and included an exploration area located between the northern boundary of the country, Arica (18°22'SL) and Valparaíso (33° 00' SL) in perpendicular transects to the coast, reaching up to 100nm off the coast. As a result, the estimated jack mackerel biomass in the prospection area was 1,728,532 tons; which represents an increase of 16.3% compared to the survey of 2019.

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

This research cruise took place from June 27th through July 19th 2020, and included an exploration area located between the northern boundary of Valparaíso (32° 44' SL) and Corral (40° 00' SL), in perpendicular transects to the coast, reaching up to 330nm off the coast. As a result, the estimated jack mackerel biomass in the prospection area was 1,548,640 tons; which represents an increase of 258.9% compared to the last survey carried out in 2017.



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 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 2019 was 45,295 and 13,943 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 2019, sampling also included a total of 4,617 and 1,772 specimens of this species for length and biological samples, respectively.

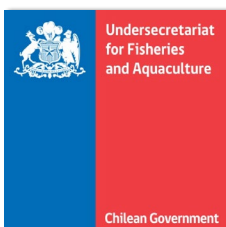


Table V. Number of Jack mackerel and Chub mackerel specimens collected in 2019 for biological and length samples.

Landing Port	Jack Mackerel		Chub Mackerel	
	Lenght Sampling	Biological Sampling	Lenght Sampling	Biological Sampling
Arica	550		28	
Iquique	1,067		48	
Antofagasta	730		141	
Caldera	1,312		747	
Coquimbo	2,795		1,131	
San Antonio	2,740	1,010	0	0
Talcahuano	31,747	11,417	2,345	1,625
Valdivia	4,073	1,487	177	147
Chil�e	281	29	0	0
Guaticas	0	0	0	0
TOTAL	45,295	13,943	4,617	1,772

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 30-31 cm FL in 2019. 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.

During the first half of 2020, the sizes from catches ranged between 25 and 65 cm in FL. The main mode was 27 cm in FL and the secondary mode was 35 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.

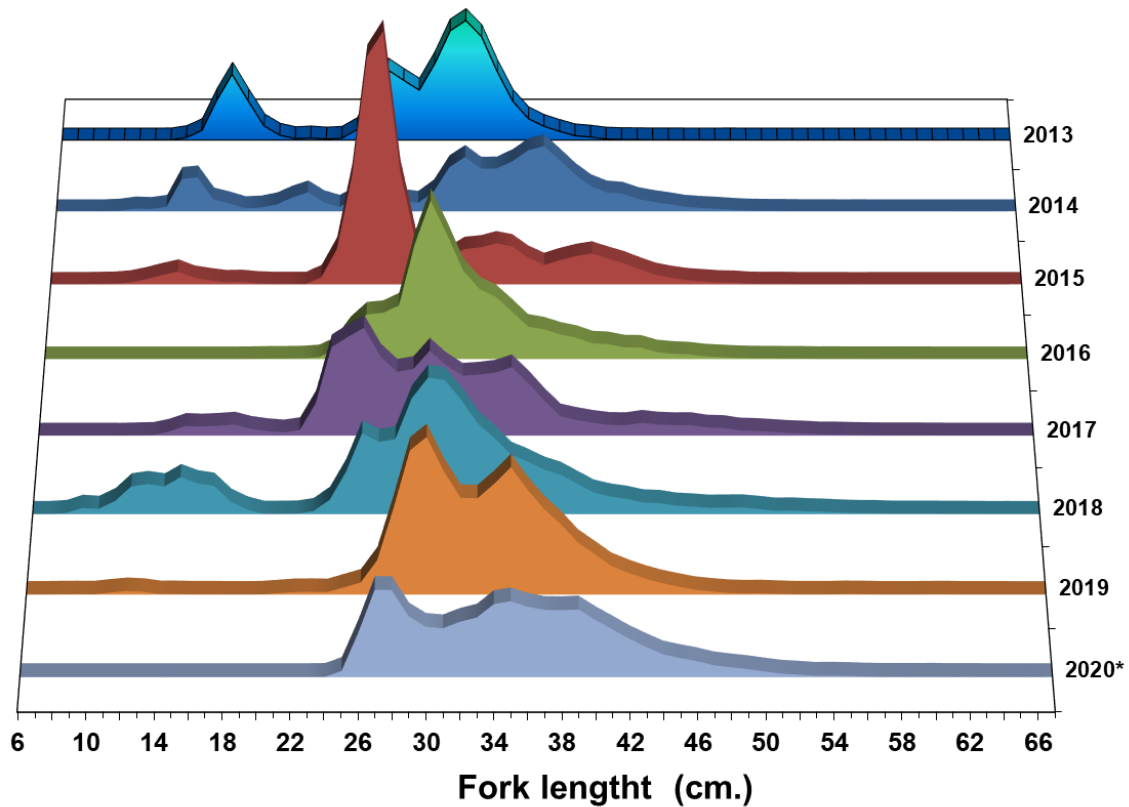


Figure 7. Length structure of jack mackerel, total catch in number for the period 2013 - June 2020. Source: IFOP.

Ages IV, V, and VI stand out as the main modes in age structure for 2017, concentrating 55% of catches. These age groups were caught both in the north area and center-south area during 2017 (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 at least a 93% of the age structure was made up of age groups IV to IX.

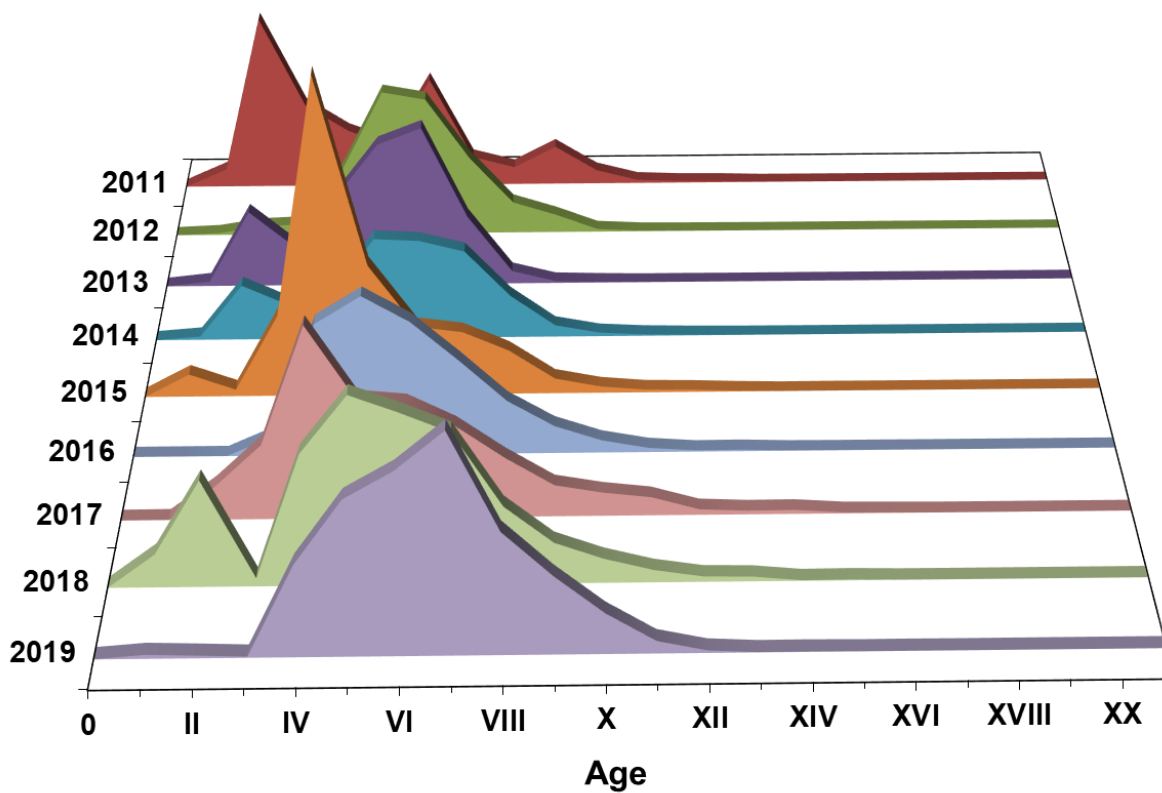
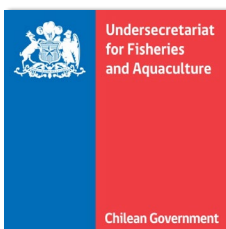


Figure 8: Age structure of jack mackerel, total catch in numbers, for the period 2011 to 2019.
Source: IFOP.



5. Ecosystem approach considerations in the jack mackerel fishery

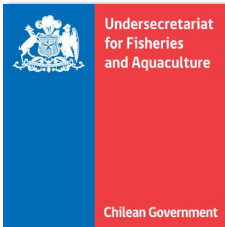
There is a growing concern that the levels of fishing mortality as a result of bycatch and discards, threaten the long-term sustainability of many fisheries worldwide and the maintenance of biodiversity in different areas, compromising the food security and affecting the livelihood of people and countries that depend on fishing resources. However, there have been observed substantial differences in the use and definition of these terms.

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**: the action of returning to sea hydro biological species caught (target and non-target) and **incidental catch**: marine mammals, seabirds and turtles caught during fishing operations and. 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 bycatch and discards 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 Fisheries’ law amendment also introduced fisheries exceptions to the discard ban, conditional on a minimum 2-year monitoring program to quantify discards and bycatch, identify their causes, and to develop and implement mandatory fishery based Reduction Plans for discards and incidental catch.

Consequently, with the law N° 20.625, from 2013 onward, the Scientific Observer Program, using a team of trained observers, has collected information onboard commercial fleets, for a Nationwide Program on bycatch and discards in small pelagic purse seine fisheries, in order to establish a reduction plan for these practices, according



to the law's requirements. In January 2015, a specific program for the jack mackerel industrial fleet was initiated, which was concluded in April 2019 with the enactment of a mandatory reduction plan for the entire fleet, along with the Management Committee of the fishery. The plan includes:

- Ban of discard for jack mackerel.
- 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
- A code of good fishing practices
- Government incentives for innovation in systems aimed to reduce bycatch and discards.

It should be noted that the Chilean observers 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 discard Law's requirements and compliance with reduction plan's measures must be monitored by electronic monitoring systems (EMS) onboard all vessels of the industrial fleet, while artisanal boats longer than 15 m will be required to carry EMS in a later stage (2024). The EMS' specific regulations have been enacted in 2017 and the system has been recently fully implemented in the entire industrial fleet as of January 2020.

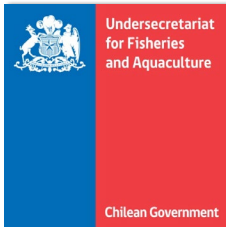
Also as of 2020, industrial vessel owners have the obligation to report, in a set by set basis, all catches, discards and incidental catch through the Electronic Logbook System (SIBE) recently implemented by the National Fisheries and Aquaculture Service, according to Law referred to in Exempt Resolution N° 114 of 2015, of the National Fisheries and Aquaculture Service¹.

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).

In spite of the existence of incidental catch in the jack mackerel fishery, the mortalities are low since most specimens are released alive except for Pink-footed shearwater were

¹ http://www.sernapesca.cl/sites/default/files/res.ex_267-2020_0.pdf



mortalities observed were 100% (15 specimens). The only species of marine mammal affected by this fishery was the southern sea lion, but again, mortalities are low, not exceeding 1% of the specimens caught (**Table VI**).

It should be also noted that as part of an ecosystem approach to the fishery, as of 2014 it has been evaluated the knowledge and application of Annex V of the Marpol International Convention 73/78 onboard the artisanal and industrial fleets, through the information collected for each trip using specific forms.

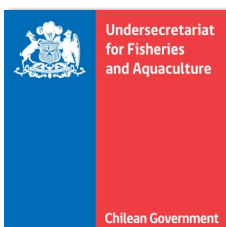
In the case of the vulnerable marine ecosystems indicators (VME), there are no records of interactions with the Jack mackerel purse seine fishery in the EEZ and in the high seas.

According to FAO (Pérez Roda *et al.* 2019), the estimates of annual discards in global marine capture fisheries for the period 2010-2014 was around 9 million metric tons with a wide range of discard rates among fisheries, regions and gear types. As previous assessments (Alverson, 1994 and Kelleher, 2005) the estimate is high and still excludes a number of fisheries and also small-scale fisheries are poorly represented. Unfortunately, no coherent time series of discard rates at the global level can be constructed on the basis of the series of FAO assessments, not being possible to estimate temporal trends in discard levels. However, FAO recognizes that some regions and countries, including Chile, have started to include in their legislations the terms “bycatch” and “discards” as a sign of an emerging political will to mitigate the wasteful practice of discarding.



Table VI. Capture and incidental mortality by species in the jack mackerel industrial fleet operating between Valparaíso and Los Lagos Regions and International waters of the SPRFMO. Source: data collected by observers onboard from 1916 fishing sets observed between January 2015 and December 2019. Vega *et al.*, 2020 (Preliminary data, final report is under evaluation).

Common name	Scientific name	N° individuals interacting with fishing gear	N° Killed	Mort (%)	CIP	CV _{CIP}	MIP	CV _{MIP}
Southern sea lion	<i>Otaria flavescens</i>	1.813	14	0,8	0,9	496	0,007	1.395
Dominican gull	<i>Larus dominicanus</i>	244	1	0,4	0,1	1.274	0,0005	4.377
Black-browed albatross	<i>Thalassarche melanophris</i>	215	1	0,5	0,1	1.085	0,0005	4.377
Peruvian pelican	<i>Pelecanus thagus</i>	109	3	2,8	0,06	1.707	0,002	4.377
Unidentified albatross	<i>Thalassarche</i> sp.	61	0	0	0,03	1.831	0	-
Black shearwater	<i>Ardenna grisea</i>	47	2	4,3	0,02	2.262	0,001	3.094
Gray-headed albatross	<i>Thalassarche chrysostoma</i>	36	0	0	0,02	1.881	0	-
Sea swallow	<i>Oceanites oceanicus</i>	18	1	5,6	0,009	1.943	0,0005	4.377
Pink-footed shearwater	<i>Ardenna creatopus</i>	15	15	100	0,008	2.201	0,008	2.201
Humboldt penguin	<i>Spheniscus humboldti</i>	13	1	7,7	0,007	4.054	0,0005	4.377
Cape petrel	<i>Daption capense</i>	8	0	0	0,004	3.190	0	-
Large black shearwater	<i>Procellaria aequinoctialis</i>	8	1	12,5	0,004	3.869	0,0005	4.377
Antarctic giant petrel	<i>Macronectes giganteus</i>	8	0	0	0,004	3.190	0	-
Unidentified swallow	Hydrobatidae	1	1	100	0,0005	4.377	0,0005	4.377
Unidentified penguin	<i>Spheniscus</i> sp.	1	1	100	0,0005	4.377	0,0005	4.377
Wandering albatross	<i>Diomedea exulans</i>	1	0	0	0,0005	4.377	0	-



Leatherback sea turtle	<i>Dermochelys coriacea</i>	1	0	0	0,0005	4.377	0	-
------------------------	-----------------------------	---	---	---	--------	-------	---	---

Mort (%) = Mortality = Number of dead animals / Number of animals captured

Average Incidental Catch (CIP) = Number of animals caught / Number of sets observed

Coefficient of Variation Average Bycatch (CV_{CIP})

Average Incidental Mortality (MIP) = Number of dead animals / Number of sets observed

Average Incidental Mortality Variation Coefficient (CV_{MIP})

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. more than 50% of the total catch per fishing trip). This report also includes fisheries observers onboard and/or at-port sampling coverage.

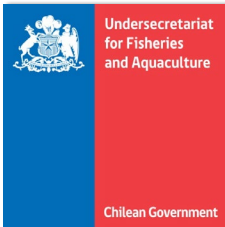
Due to a more coastal pattern of operation of the jack mackerel fishery over the last years and a less frequent and/or unpredictable fishing trips in such area, fleet operations within the SPRFMO Area with observers onboard have been difficult to cover.

Nevertheless, the only two fishing trips targeting jack mackerel within the SPRFMO Area (2019) were covered by scientific observers onboard (100%). When combining SPRFMO coverage with observer coverage within the EEZ the total combined sampling coverage achieves a 26.4% (Table VII).

Within the Chilean EEZ, onboard sampling coverage conducted by observers was 12.0%, and at-port sampling coverage was 14.2%, with a total combined sampling coverage of 26.3%.

Table VII. Sampling coverage by observers at port and observers onboard in the Chilean jack mackerel fishery 2019.

	At-Port	On Board	Total
Chilean EEZ	14.2	12.0	26.3
SPRFMO area	0.0	100.0	100.0
TOTAL	14.2	12.2	26.4



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 2019 was 439,034 tons (Exempt Decree N° 275/2019) and completely extracted in the first half of 2020.

Bycatch Reduction Plan

Mandatory sets of measures to avoid bycatch and discards in the jack mackerel fishery established through Exempt Resolution N° 16:

- http://www.subpesca.cl/portal/615/articles-104138_documento.pdf

Implementation of EMS in the entire industrial fleet

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

- <http://bcn.cl/2k3hn>
- http://www.subpesca.cl/portal/615/articles-106392_documento.pdf

Implementation of Electronic Logbooks in the entire industrial fleet

During 2020 it has been implemented 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 Law's requirements:

- http://www.sernapesca.cl/sites/default/files/res.ex_267-2020_0.pdf