

6th Meeting of the Scientific Committee

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SC6-Doc25

Chile's Annual Report, part I (Jack mackerel)

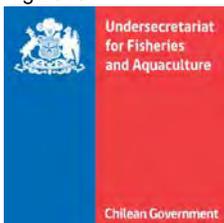


CHILE ANNUAL REPORT

SPRFMO-SCIENTIFIC COMMITTEE

Jack mackerel fishery

August, 2018.



1. DESCRIPTION OF THE FISHERY

1.1 Composition of the Fleet.

The industrial purse seine fleet operating on the jack mackerel fishery in the SPFRMO area and Chilean EEZ between January and July 2018 consisted of 72 fishing vessels. This number is lower than previous years (Table 1) as a result of the low availability of jack mackerel for the northern fleet of the country which represents 64% of vessels operating during 2018 (vessels below 600m³).

Between 2014 and 2018, the number of vessels operating within the SPFRMO area showed a reduction, with the exception of 2015, where almost 30% of the industrial fleet operated in this area. As a result of changes in the resource's distribution, the jack mackerel fleet has operated within the Chilean EEZ during 2016 and 2018. During the first semester of 2018, no fishing operations within the SPFRMO area has been registered (Table II).

Table I. Number of industrial purse seine vessels catching jack mackerel in the Chilean EEZ and the SPFRMO (combined) area between 2014 and Jun 2018. Data were assembled by year and hold capacity. (2018* are preliminary data).

Hold capacity (m ³)	2014	2015	2016	2017	2018 (*)
0-300	0	1	3	0	0
300-600	60	59	57	57	46
600-900	6	6	7	5	5
900-1200	5	3	1	2	1
1200-1500	5	7	6	8	7
1500-1800	8	9	9	9	9
1800-2100	4	4	4	4	4
TOTAL	88	89	87	85	72

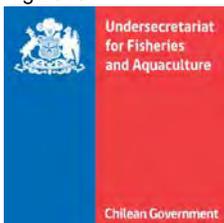


Table II. Number of industrial purse seine vessels catching jack mackerel in the SPRFMO area between 2014 and Jun 2018. Data were assembled by year and hold capacity. (2018* are preliminary data).

Hold capacity (m ³)	2014	2015	2016	2017	2018 (*)
0-300	0	0	0	0	0
300-600	0	0	0	0	0
600-900	0	3	1	0	0
900-1200	3	3	0	1	0
1200-1500	3	9	0	0	0
1500-1800	4	7	2	2	0
1800-2100	1	4	2	0	0
TOTAL	11	26	5	3	0

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

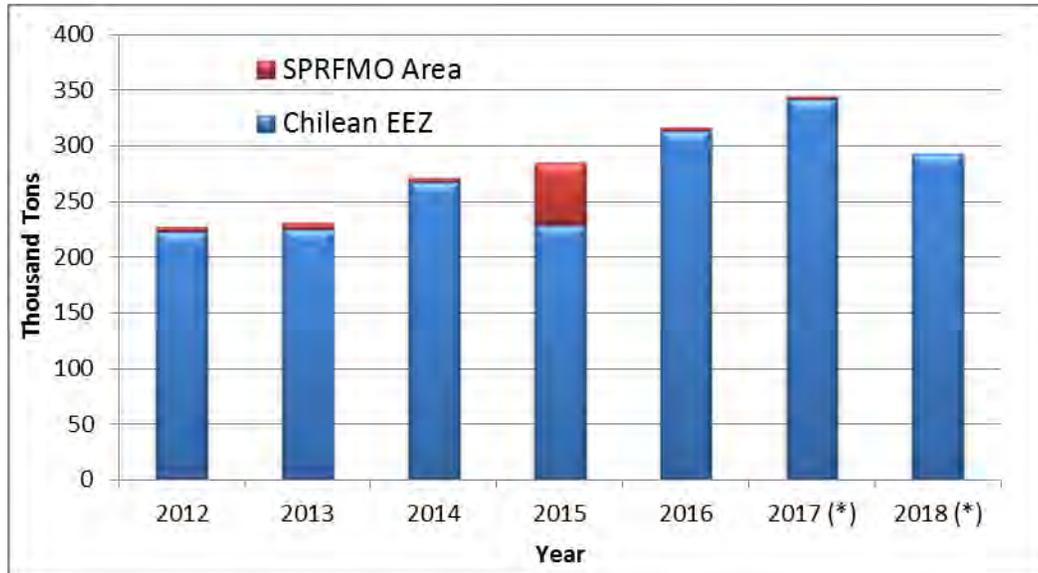
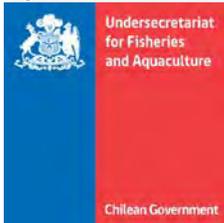
a) Catches

Durante 2012-2018 period, the total catch of jack mackerel by the Chilean fleet has remained stable due to compliance with the catch quotas set by SPRFMO and the quota transfers from other fishing nations, which indicates a constant increase of national catches in the last years.

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).

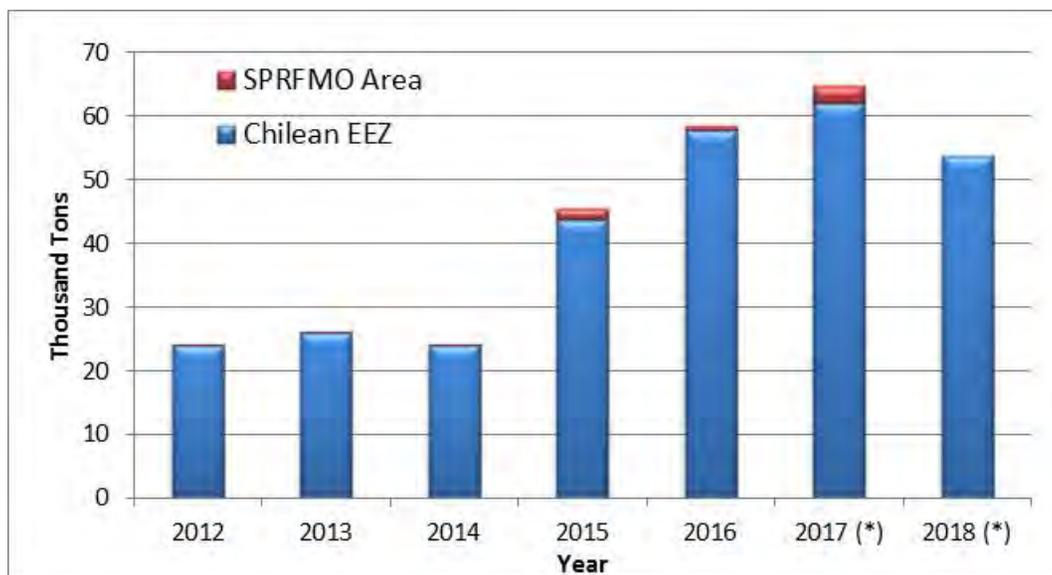
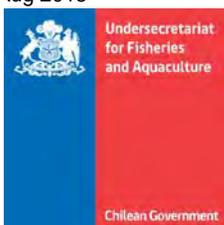
During the first semester of 2018, there are no jack mackerel catches within the SPRFMO area.

Besides jack mackerel, the national fleet also registered chub mackerel catches which totaled 53,772 tons until June 2018. This value has increased in the last years with an increasing trend between 2015 and 2018. However, catches of chub mackerel in the SPRFMO area in the same period will not surpass 1% of this resource's total catch (Figure 2 and Table IV).



Year	Chilean Jack Mackerel (t)		
	Chilean EEZ	SPRFMO Area	Total
2012	223,322	4,138	227,460
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 (*)	341,604	3,155	344,759
2018 (*)	292,597	0,000	292,597

Figure 1 and Table III. Total annual jack mackerel catch in the Chilean EEZ and the SPRFMO area with purse seine nets for the period 2012 – June 2018 (* preliminary).



Years	Chub Mackerel (t)		
	Chilean EEZ	SPRFMO Area	Total
2012	24,120	0,199	24,319
2013	26,086	0,243	26,325
2014	24,135	0,031	24,166
2015	43,863	1,820	45,683
2016	57,770	0,790	58,560
2017 (*)	62,071	2,884	64,955
2018 (*)	53,772	0	53,772

Figure 2 and **Table IV**. Total annual chub mackerel catches in the Chilean EEZ and SPRFMO area with purse seine nets for the period 2012 - June 2018 (* preliminary).

b) Seasonality of Catches

During the first semester of 2018, catches of jack mackerel showed values around 45,000 monthly tons (January-April). This seasonality differs from previous years (2015-2017) where low values of catches were registered during the first months of the year (January-March), mainly due to high abundance of juvenile individuals (Figure 3). Subsequently, during May 2018, catches increase again with values around 70,000 tons, mainly because of the change of the fishing grounds, concentrated in the center-south area of the country.

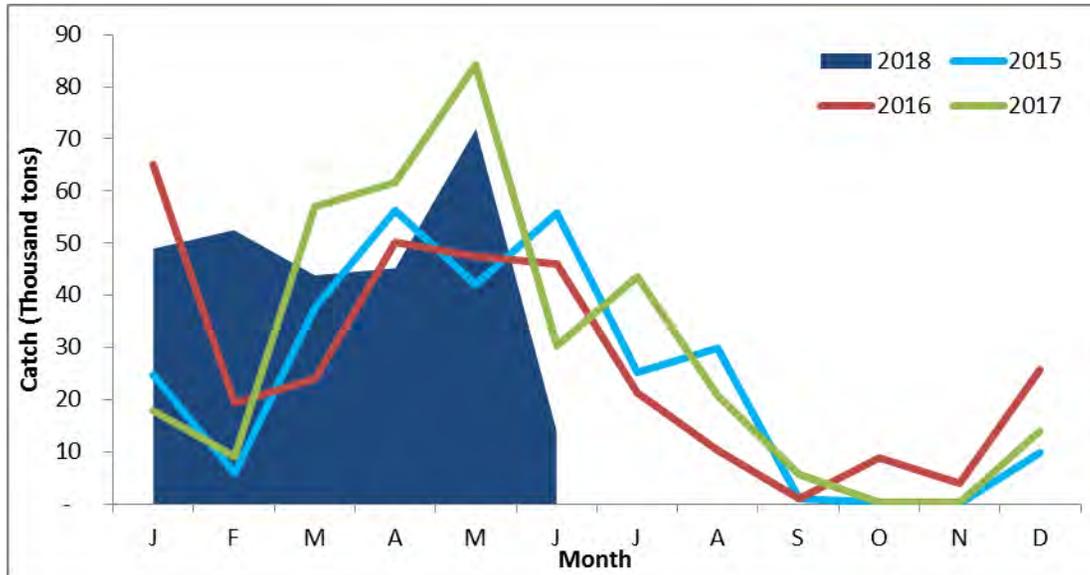
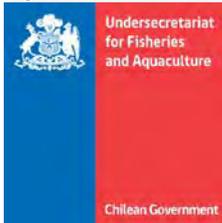


Figure 3: Seasonality of jack mackerel catches by the purse-seine fleet for the period 2015- Jun 2018. Source: SERNAPESCA.

c) Spatial Distribution of Catches

During 2016 and 2017, spatial distribution of jack mackerel catches in the center-south area concentrated in areas near the coast (first 150 nm). North area of the country concentrated catches in areas near the coast (first 50 nm) associated to anchovy as target species. However, unlike previous years, jack mackerel catches concentrated in 22° SL during March 2017 with catches of individuals over the legal minimum size of 26 cm FL.

During 2018, the fleet operating within the center-south area has shown a catch pattern similar to previous years with the particularity of extending its operation area further south than in previous years (38° SL - 43°SL), always within the EEZ. On the other hand, the north area reported catches in areas near the coast (first 30 nm) between March and May mainly (Figure 14).

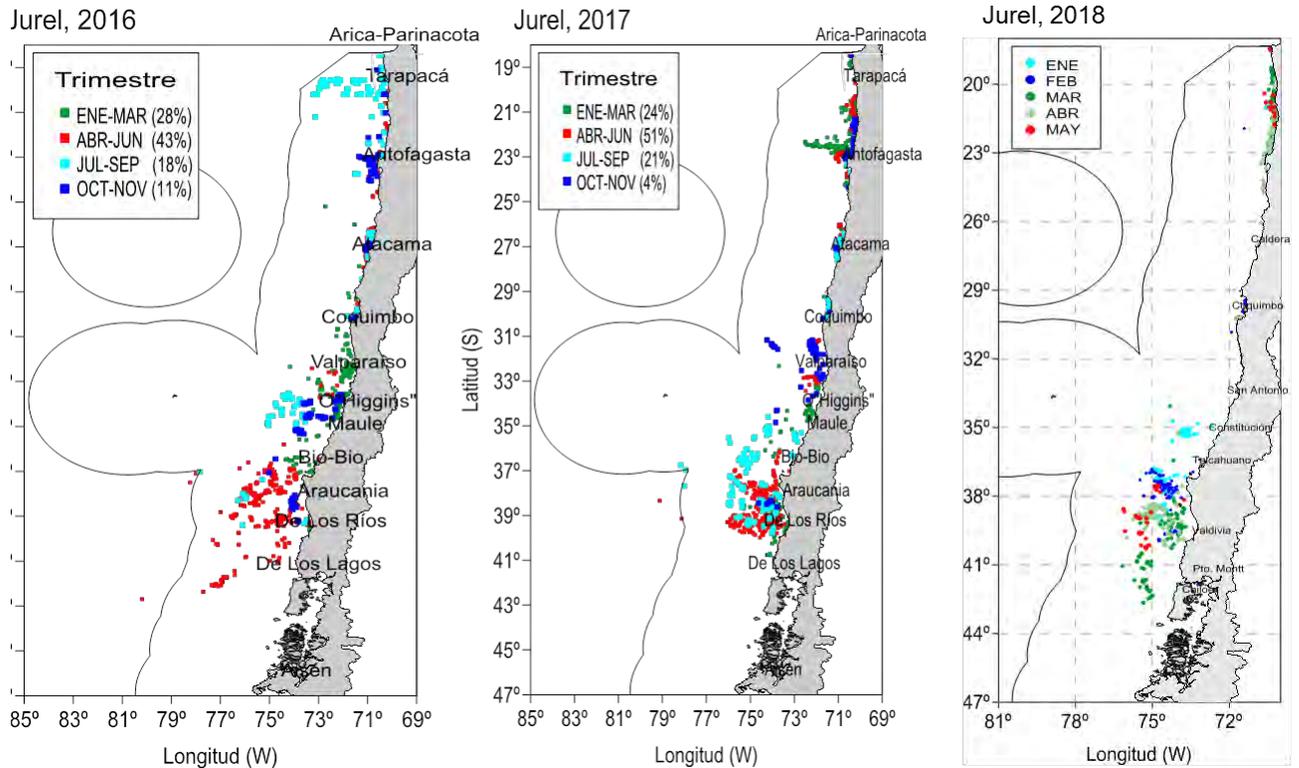
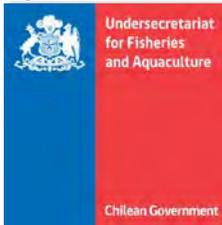
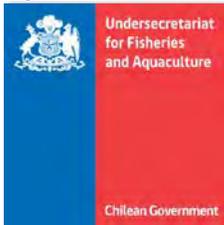


Figure 4: Spatial-temporal distribution of industrial jack mackerel purse seine fleet 2016, 2017, and May 2018. Source: IFOP.

d) Bycatch

During 2017, catches within the SPRFMO area and EEZ were almost exclusively represented by the target species jack mackerel (*Trachurus murphyi*). Associated catch within the EEZ was mainly composed by chub mackerel (*Scomber japonicas*) that represented 18%. This value was higher than in 2016.

In the northern area of the country, jack mackerel was mostly captured as associated catch of anchovy.



2. EFFORT AND CPUE FOR JACK MACKEREL FISHERY

This information refers to the center-south fleet operating on jack mackerel as target species. Catches, effort and CPUE were calculated for each trip in which jack mackerel represented more than 50% of the total catch.

Until 2010, an increasing trend in the duration of the fishing trips was observed (Figure 6), due to the distance of jack mackerel from its fishing grounds. Subsequently, during 2012 and 2013, catches concentrated within the EEZ, significantly reducing the average length of fishing trips (50%). For the last years of the series (2016-2018), catches concentrated again in areas close to the coast, within the first 150 nm, as shown in the stabilization of the total number and length of fishing trips.

On the other hand, the standardized CPUE, measured as the utilization rate of the fleet's carrying capacity ($\text{catch} / (\text{hold capacity displaced} \times \text{length of fishing trip})$) showed a decreasing trend between 2001 and 2011. Subsequently, in 2012, this indicator changed its trend towards an increase in this line which has stabilized between 2013 and 2018. The change in the trend of the indicator from 2012 is explained by a decrease in the average length of the fishing trips as a result of changes in the distribution of the resource (**Figure 7**).

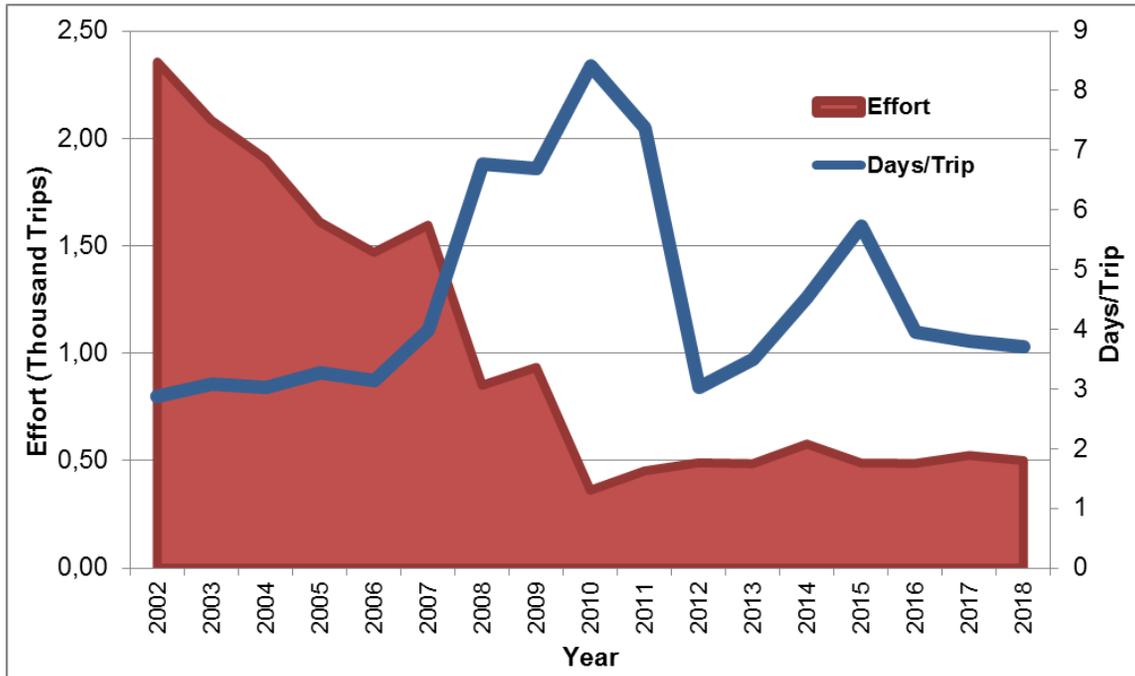
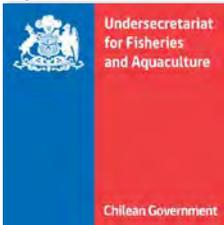


Figure 6: Effort in number of trips with catch (red), and length of fishing trips in days (blue) for the purse seine fleet in the center-southern zone, period 2002-2018 (preliminary). Data SERNAPESCA. Source: IFOP.

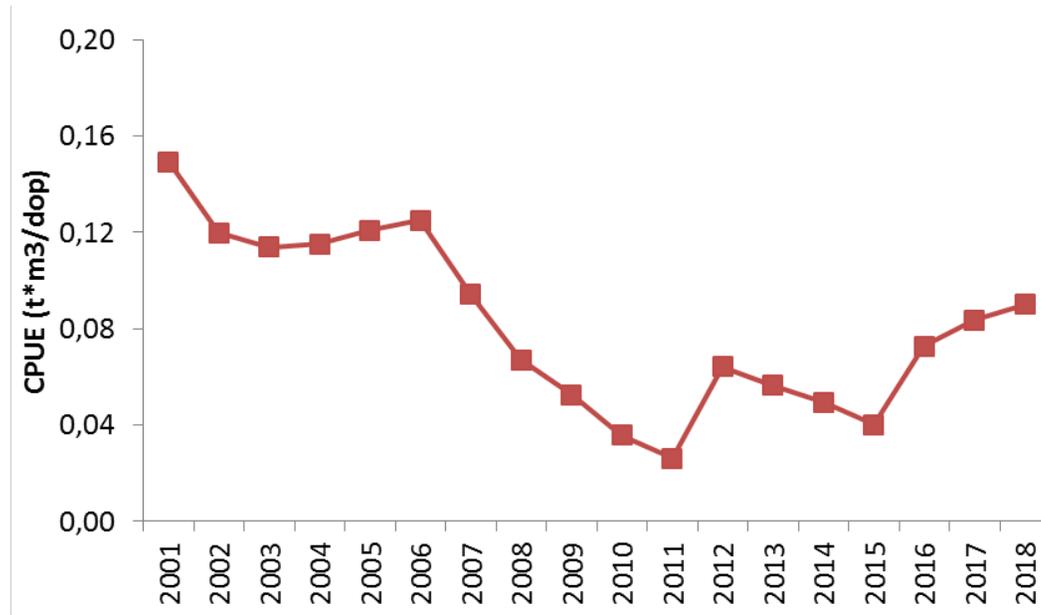
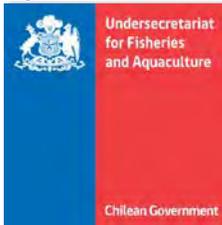


Figure 7: Nominal CPUE for the purse seine fleet in the center-southern zone, period 2001-2018 (preliminary). Source: IFOP-SERNAPESCA.

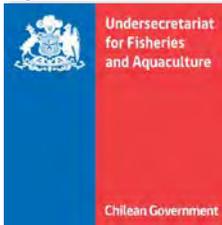
3. RESEARCH PROGRAMS

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

Basic projects performed by IFOP during 2017-2018:

- 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.



- 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 biomass between XV-V Regions, 2018

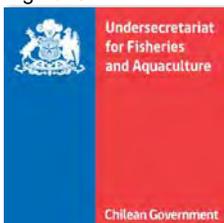
This research cruise took place from March 19 through April 24, 2018, and included an exploration area located between the northern boundary of the country and Valparaíso (33° 00' SL) in perpendicular transects to the coast, reaching up to 100nm off the coast. As a result, the estimated jack mackerel biomass in the prospection area was 375,000 tons.

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 length and biological samples obtained for jack mackerel during 2017 added up 44,061 and 14,826 individuals, 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 Antofagasta and Coquimbo in the northern area, and Valdivia and Talcahuano in the center-south area of the fishery (Table V).



Chub mackerel is the main bycatch in the jack mackerel fishery. It was also sampled during 2017 with a total of 5,246 and 1,417 individuals for length and biological samples, respectively.

Table V. Number of Jack mackerel and Chub mackerel individuals collected in 2017 to gather biological and length samples.

Landing Port	Jack Mackerel		Chub Mackerel	
	Lenght Sampling	Biological Sampling	Lenght Sampling	Biological Sampling
Arica	343	100	65	0
Iquique	1.366	129	2.423	46
Antofagasta	5.884	288	2.181	209
Caldera	3.605	1.822	114	38
Coquimbo	5.633	1.630	360	223
San Antonio	2.685	1.373	97	330
Talcahuano	10.436	4.266	0	297
Valdivia	14.109	5.218	6	274
Chil�e	0	0	0	0
Guaticas	0	0	0	0
TOTAL	44.061	14.826	5.246	1.417

4.2 Length and age composition of catches

a.- Jack Mackerel

Size structure of jack mackerel has shown a constant growth from 2015 to 2018 (Figure 8), with a shift of the mode size from 27 cm FL as mode size in 2015, to 30-31 cm FL in 2018 (first semester). Unlike 2017, sizes between 40-50 cm FL have not been well represented this year in catches, on the other hand, the first semester of 2018 has shown a unimodal size structure between 30 and 31 cm FL.

For this last year, the range of sizes varied between 11 and 64 cm in FL. The main mode was 31 cm in FL, which was provided by the catches of the center-south area of the country. In general, during the first semester of this year, size structure was composed of a lower number of individuals compared to the previous year, mainly because a reduction of catch of individuals between 24 and 28 cm FL.

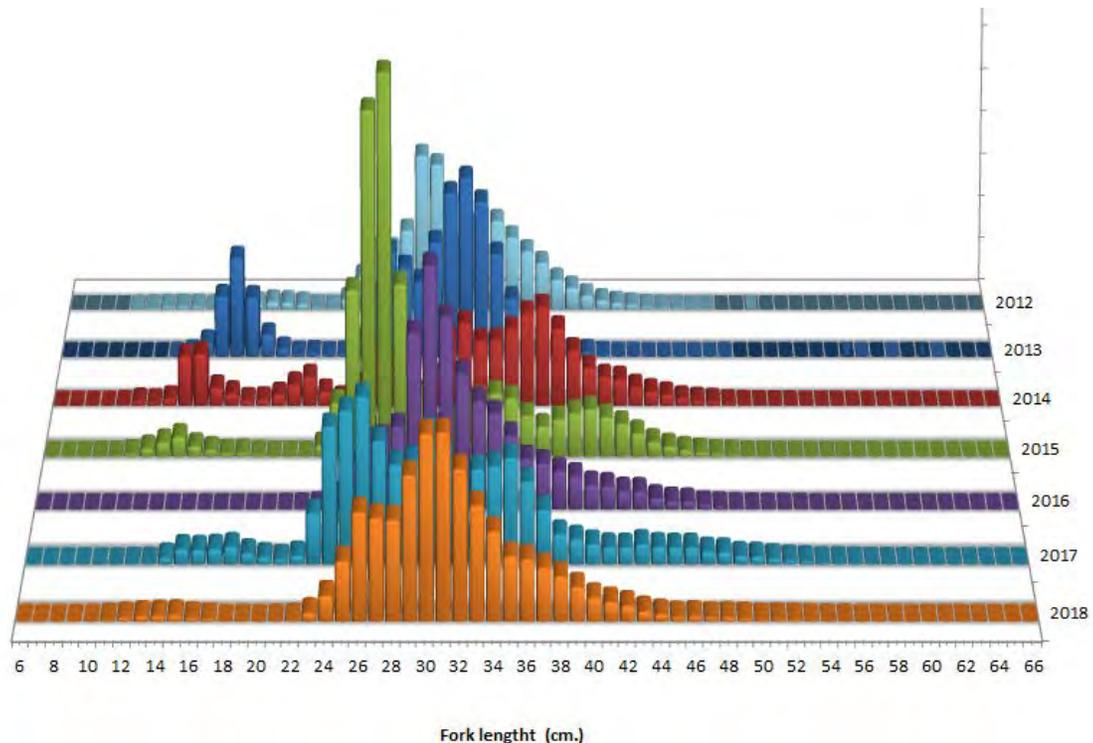
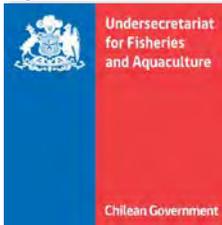


Figure 8. Length structure of jack mackerel, total catch in number 2012 - June 2018. Source: IFOP

Age structure in 2016 was composed of 16 age groups, where ages IV, V, and VI are the main modes, concentrating 66% of catches. These age groups were captured both in the north area and center-south area during 2016 (Figure 9).

For 2017, size structure at a national level showed a structure composed of individuals with a main mode in the age group IV from the north area of the country and a strengthening of older ages (mode VII to XI) in comparison with the rest of the years, which may be caused by a strengthening of the general structure of the stock due to the management measures implemented by the SPRFMO.

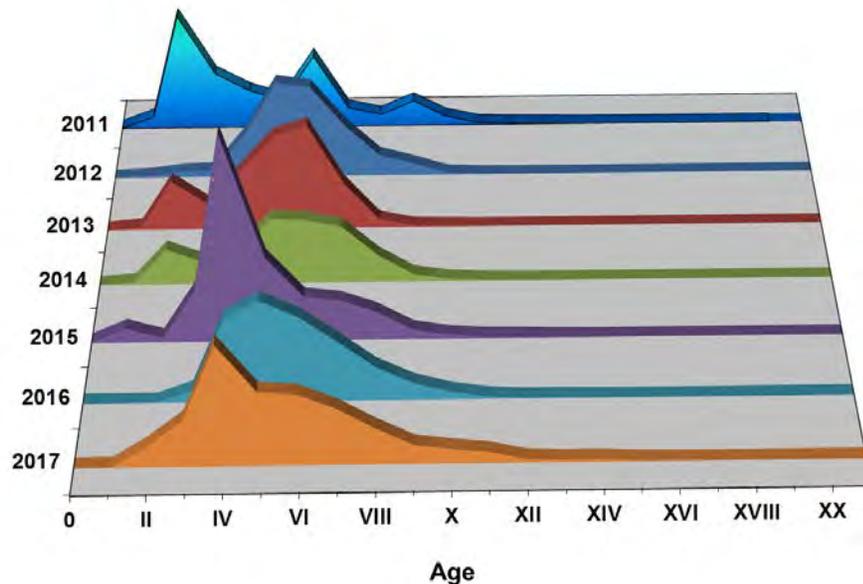
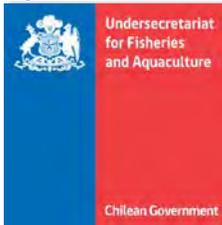
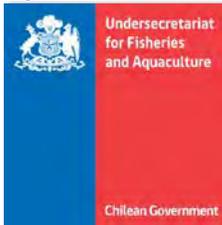


Figure 9: Age structure of jack mackerel, total catch in numbers, 2011 to 2017 (march). Source: IFOP.

Ecosystem Approach considerations

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, resulting in food insecurity and affecting the livelihood of people and countries depending on fish resources. However, there have been observed substantial differences in the use and definition of these terms. In some countries, the term bycatch is used to refer to the catch which is retained and sold but which is not the target species of the fishery. In others, bycatch means species/sizes/sexes of fish which are discarded. The OECD defines bycatch as “Total fishing mortality excluding that accounted directly by the retained catch of target species”. This definition thus includes fish which die as a result of interactions with the fishing gear, even if they do not leave the water and could include fish which die as a result of “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 on Fisheries and Aquaculture in 2012 (through Law N° 20.625, known as “discard law or ban”) incorporating the terms **incidental catch**: marine mammals, seabirds and turtles caught during fishing operations and **discards**: the action of returning to sea hydro biological species caught (target and non-target), as well as sanctions and mechanisms of control for those engaged in these practices. Thus, the Chilean approach to understand, regulate and mitigate bycatch and discard is broad in scope, encompassing the following groups: 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 and identify the causes of discards and bycatch, and to develop and implement Reduction Plans.

Consequently, from 2013 onwards, 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, the specific program for jack mackerel industrial fleet was launched, which will conclude in January 2019 with the enactment, along with the Management Committee of a mandatory Reduction Plan, which should include:

- Management measures and technological means to reduce discards and incidental catch
- A 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.

Chilean observer programs were extended with the Law N° 20.62, 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 Law and reduction plans compliance will be monitored by electronic monitoring systems (EMS) onboard all vessels of the industrial fleet, while artisanal boats larger than 15 m in length will be required to carry EMS 3 years after. The EMS specific regulation has been enacted in 2017.

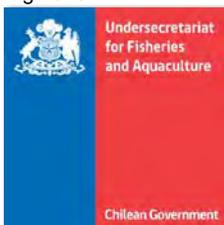


Table VI. Catch and mortality of incidental catch in the jack mackerel industrial fleet. Source: data collected by observers onboard from 863 sets monitored between January 2015- December 2017

Common name	Scientific name	N°Caught	N° Killed	% Mortality	Incidental Capture Rate	Incidental Mortality Rate
Southern sea lion	<i>Otaria flavescens</i>	1484	11	0,7	1,7	0,01
Dominican gull	<i>Larus dominicanus</i>	242	1	0,4	0,3	0,001
Black-browed albatross	<i>Thalassarche melanophris</i>	214	0	0	0,2	0
Peruvian Pelican	<i>Pelecanus thagus</i>	105	3	2,9	0,1	0,003
Unidentified small Albatros	<i>Thalassarche sp.</i>	61	0	0	0,07	0
Black shearwater	<i>Ardenna grisea</i>	46	1	2,2	0,05	0,001
Gray-headed Albatross	<i>Thalassarche chrysostoma</i>	36	0	0	0,04	0
Sea swallow	<i>Oceanites oceanicus</i>	18	1	5,6	0,02	0,001
Pink-footed Shearwater	<i>Ardenna creatopus</i>	14	14	100	0,02	0,02
Pingüino de Humboldt	<i>Spheniscus humboldti</i>	13	1	7,7	0,02	0,001
Spotted Petrel	<i>Daption capense</i>	8	0	0	0,009	0
Large black shearwater	<i>Procellaria aequinoctialis</i>	7	0	0	0,008	0
Leatherback sea turtle	<i>Dermochelys coriacea</i>	1	0	0	0,001	0
Unidentified swallow	<i>Hydrobatidae</i>	1	1	100	0,001	0,001
Wandering albatross	<i>Diomedea exulans</i>	1	0	0	0,001	0

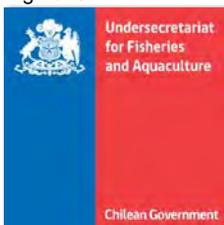
% Mortality: Number of dead animals/Number of caught animals; **Incidental Capture Rate:** Number of dead animals/Number of sets observed; **Incidental Mortality Rate:** Number of dead animals/ Number of sets observed

In the jack mackerel fishery, the incidental catch mainly affected marine mammals (66%) followed by offshore (18%) and coastal seabirds (16%). The only species of marine mammal affected was the southern sea lion, while the main species of seabird caught were the Dominican gull and the black-browed albatross, that together accounted for 59.5% of seabirds accidentally caught. In spite of the numbers encountered, the mortality was significantly low (most specimens are released alive) except for Pink-footed shearwater where mortalities were 100% (**Table VI**).

It should be also noted that as part of an ecosystem approach to the fishery, as of 2014, 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 have been assessed.

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

As of January 2019, this fishery is mandated to implement a Reduction Plan aimed at mitigating discards and catch of seabirds, marine mammals and sea turtles whose compliance will be monitored by EMS.



Observer Implementation Reports

a) AT-SEA AND PORT SAMPLING PROGRAM

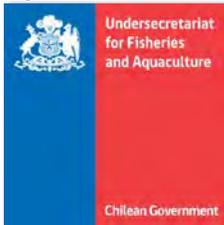
In order to evaluate sampling coverage within the SPRFMO Area, only fishing trips targeting jack mackerel were considered for this report (i.e. more than 50% of the total catch per fishing trip). This also included fisheries observers onboard and/or at-port sampling coverage.

Since the jack mackerel fishery pattern has been nearer to the coast over the last years, fleet operations within the SPRFMO Area with onboard observers due to low frequent and unpredictable fishing trips in such area have been difficult to cover. Those fishing trips are not planned in advance either as to ensure the presence of an observer. In spite of the restrictions, out of the 4 fishing trips operating jack mackerel within the SPRFMO Area (2017), 2 trips were covered by scientific observers onboard, corresponding to a 50% of the total, with a total combined sampling coverage of 28.6%. (**Table VII**).

Within the Chilean EEZ, onboard sampling coverage conducted by observers was 13.1%, and at-port sampling coverage was 15.4%, with a total combined sampling coverage of 28.5%.

Table VII. Sampling coverage by observers at port and observers onboard in the Chilean jack mackerel fishery 2017.

	At-Port	On Board	TOTAL
Chilean EEZ	15,4	13,1	28,5
SPRFMO area	0,0	50,0	50,0
TOTAL	15,3	13,3	28,6



6.- ADMINISTRATIVE MEASURES

a.- Total catch quota.

Each year, by December, 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 2017 was 371,887 tons (Exempt Decree N° 675/2017) that is close to be captured.