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Chile Annual Report 2020 Jumbo squid

Chile

PO Box 3797, Wellington 6140, New Zealand
P: +64 4 499 9889 – F: +64 4 473 9579 – E: secretariat@sprfmo.int
www.sprfmo.int

CHILE ANNUAL REPORT

SPRFMO-SCIENTIFIC COMMITTEE

Jumbo squid (*Dosidicus gigas*)

September, 2020.

Undersecretariat for Fisheries and Aquaculture
Chilean Government

1 DESCRIPTION OF THE FISHERY

1.1 Composition of the Fleet.

In Chile, the jumbo squid fishery has both an artisanal[1] and an industrial fleet[2]. Annually, a catch quota of 200,000 tons is established, which is divided into 80% for the artisanal fleet and 20% for the industrial fleet.

Artisanal fleet

In 2019 the artisanal fleet landed 17,376 tons of jumbo squid, equivalent to 29.86% of the national total. This activity had the participation of 1,066 vessels of dimensions equal to or less than 18 meters in length (Table 1). The largest fishing operation was carried out by vessels 12 meters or less in length, with a participation of 94.75%, equivalent to 1,010 vessels. This group of vessels landed a total of 14,478.46 tons, which corresponds to 83.32% of the total landings made by the artisan fleet.

The fishing gears used during 2019 by the artisanal fleet include purse seine, gillnet, longline, and jigging, among others. However, the target fishing for this resource is carried out only with jigging equipment by this fleet. 990 vessels, equivalent to 90.4% of the total operating in this fleet, landed 80.9% (14,057.4 t) of this resource during 2019. On the other hand, fishing carried out with purse seine corresponded to 3,248.6 tons, equivalent to 18.7% of the total landed by this fleet in 2019. In this regard, only 39 vessels used it and corresponded to 3.6% of the total operating in this fleet during 2019. Therefore, the other fishing gears represented 0.4% of the total landing for this year and only mobilized 6% of the total operating this year.

When observing the period 2006-2019 it is identified that as of year 2011 the number of boats operating on jumbo squid has surpassed the 1,000, being the year 2012 the one that register the greater number. However, the increase in the participation of boats has not meant an increase in landings (Table 1).

Table 1: Artisanal fleet composed of vessels equal to or less than 18 meters in length, which operated in Chile to capture *Dosidicus gigas* in the period 2006-2019

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
N° Boats ≤18m)	788	688	708	613	706	1880	2180	1540	1747	1419	1657	2102	2056	1066
Langing (t)	243307	83299	135444	51140	66049	138708	114955	97224	125396	104242	141576	115351	110576	17376

Fuente: SERNAPESCA

[1] Vessels less than 18 meters in length, that operates mainly with hand line jigging.
[2] Vessels over 18 meters in length, that operates mainly with mid-water trawl.

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Industrial Fleet

The industrial fleet landed 40,666,479 tons, equivalent to 70.14% of the national total, during 2019.

The industrial landings of jumbo squid involved 35 vessels, of which 15 landed more than 3 tons per fishing trip (Table 2). Of the latter, 10 were the vessels that used mid-water trawling as a capture method for the target fishing of this resource, landing 39,688,967 tons, equivalent to 97.60% of the total landed by this fleet during 2019.

The industrial operation also used for the capture of jumbo squid the purse seine and bottom trawling gears, which represented 1.75% and 0.65%, respectively, of the total landings made during 2019 by this fleet.

During the period 2006-2019 a decrease in the number of industrial vessels that have operated annually and landed more than 3 tons of *Dosidicus gigas* is observed. However, this has not meant a considerable decrease in the fishing power of this fleet. The years 2010 and 2014 stand out as those in which more tons were landed.

Table 2: Industrial fleet with landings greater than 3 tons per trip, which operated in Chile to capture Dosidicus gigas in the period 2006-2019.

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019*
N° Ships	59	60	73	41	83	86	57	32	35	32	18	19	12	15
Total Landing (t)	7332	40427	8557	3405	134379	24787	30010	9047	51206	39446	39338	39130	35351	40666

Source: SERNAPESCA * The landing includes the total reported by the industrial fleet

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

1.2.1 Catches

Since 2012 there has been a catch quota for jumbo squid in Chile, which by 2019 corresponded to 200,000 tons.

During the period 2012-2019, jumbo squid landings showed a stable trend until 2018, since in 2019 the artisanal fleet was unable to capture this resource due to its low availability in the fishing grounds of this fleet. However, the industrial fleet landed the total quota allocated (Figure 1).

2016 stands out as the year in which the artisanal fleet landed the highest number of tons in this period 2012-2019. On the other hand, the total catches have been made in the Exclusive Economic Zone (EEZ) of the Chilean maritime territory.

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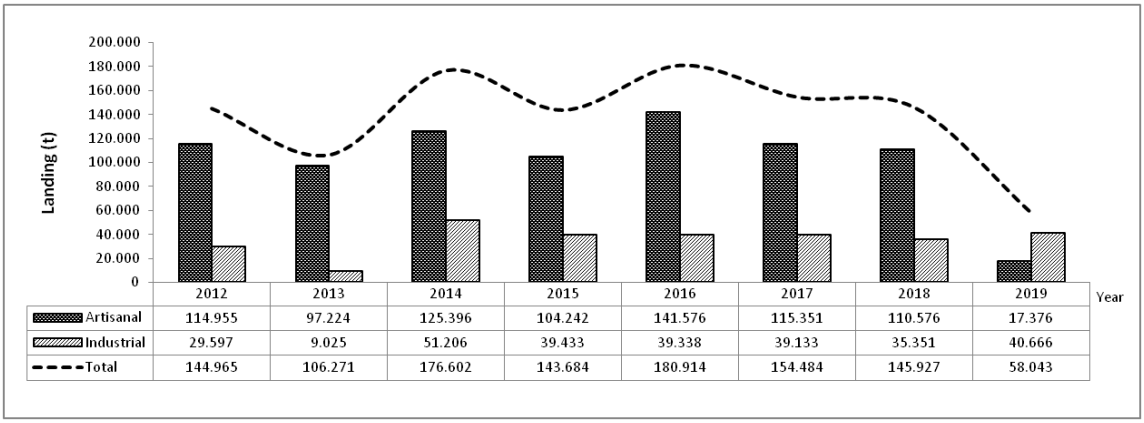

	2012	2013	2014	2015	2016	2017	2018	2019
Artisanal	114.955	97.224	125.396	104.242	141.576	115.351	110.576	17.376
Industrial	29.597	9.025	51.206	39.433	39.338	39.133	35.351	40.666
Total	144.965	106.271	176.602	143.684	180.914	154.484	145.927	58.043

Figure 1. Tons of *D. gigas* landed in the period 2012-2019, by the artisanal and industrial fleet (Source: SERNAPESCA)

1.2.2 Seasonality of catches during 2012-2019

In general, catches are concentrated mainly during the first 8 months of the year, with a decrease in extraction activity from September to October. In this regard, there are monthly seasonal variations that are explained by operational and economic aspects of the fishery (Figure 2). In the particular case of 2019, fishing activity on jumbo squid was mostly concentrated between the months of May and June. Subsequently, the availability of this resource began to decrease from August to landing values far below those observed in previous years.

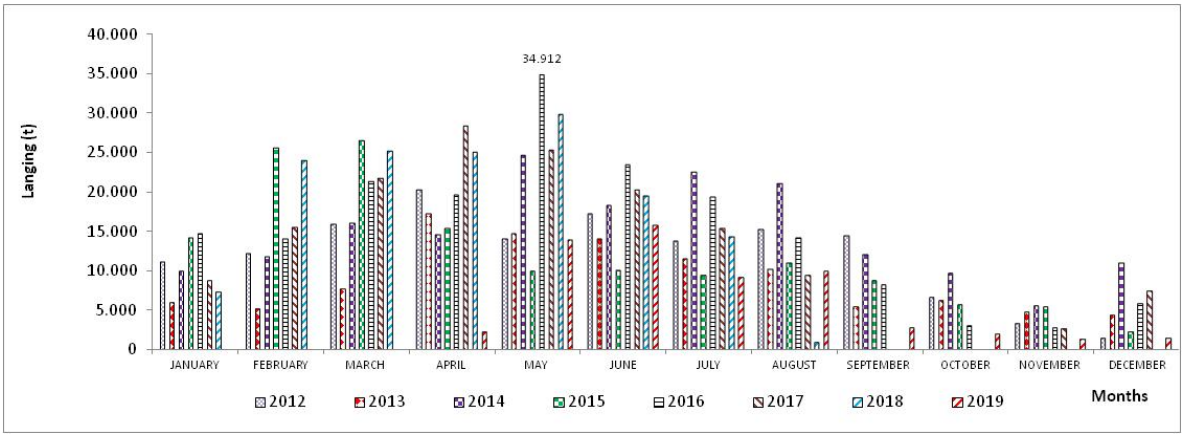

Figure 2. Total tons of *D. gigas* landed in the period 2012-2019, distributed monthly (Source: SERNAPESCA)

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1.2.3 **Spatial Distribution of Catches**

During 2019 the geographical distribution of the sets of the industrial fleet that operated on jumbo squid as a target species and used mid-water trawling as a capture method, were distributed geographically between 33°45'LS and 36°45'LS, as well as between approximately 7.0 and 34.0 nautical miles from the coast (Figure 3). However, the largest landings were recorded in the Biobío Region, around 36°00'LS and 36°45'LS.

Regarding the artisanal fleet, it concentrated its operations mainly between 29°21'LS and 36°30'LS (Figure 4). However, the largest landings were registered between the Coquimbo Region and the Maule Region.

Unlike previous years, bycatch recorded in fishing sets in other fisheries, both for the artisanal and industrial fleet showed a significant decrease in all regions.

Figure 3.- Spatial distribution of fishing sets with catches of *D. gigas* as a target resource during 2019 in the industrial fleet (Source: IFOP).

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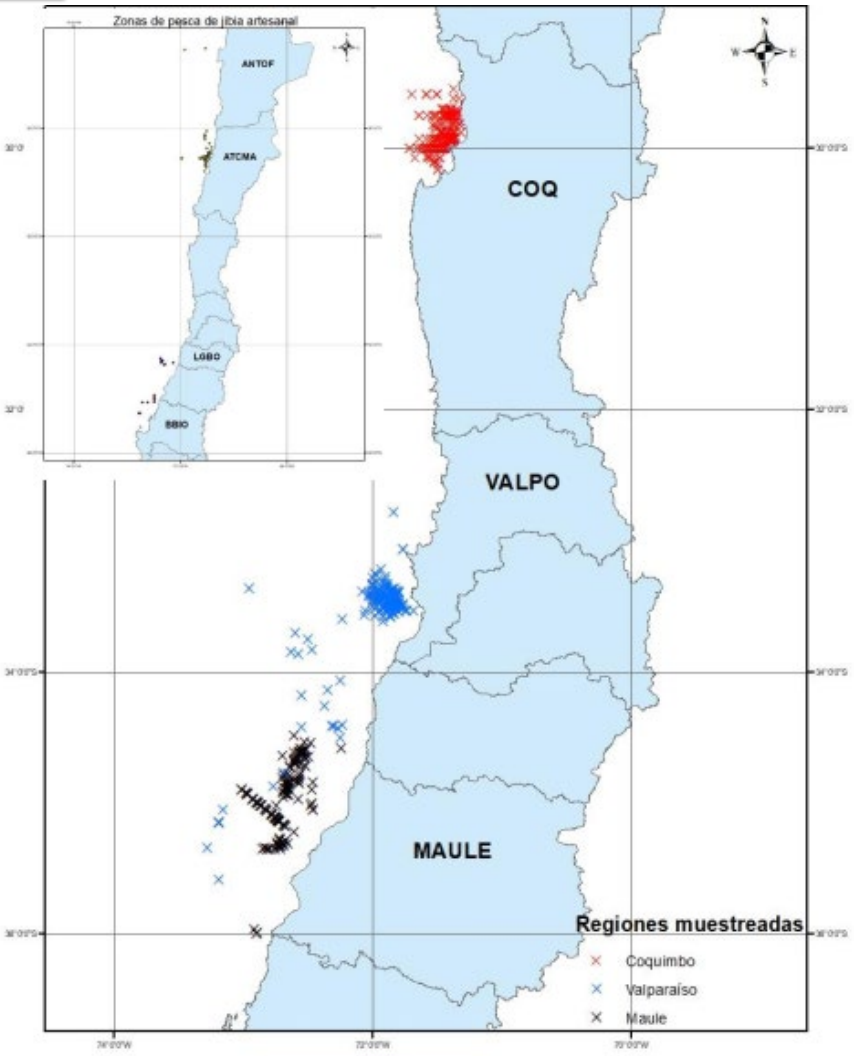

Figure 4.- Spatial distribution of fishing sets with D. gigas catches as a target resource during 2019 in the artisanal fleet (Source: IFOP).

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1.2.4 Fishing Grounds and By-catch

During the 2019 fishing season, no cases of bird bycatch during observed sets were recorded. Mammal bycatch showed the South American sea lion (*Otaria flavescens*) as the only species caught in sets targeting jumbo squid. A total of 31 individuals were captured resulting in death. The greatest capture of South American sea lion was registered during the second quarter, reaching 21 individuals captured. However, the total annual mortality rate of marine mammals expressed in individuals per fishing set was 0.1 ind/set.

2 EFFORT AND CPUE FOR *Dosidicus gigas* FISHERY

Industrial Effort

In terms of monthly effort, it has not been possible to visualize trends across months or periods of the year (Figure 5). However, it was possible to determine an increase in average effort from 2017 to 2019. From 2017 to 2018, the increase in the indicator was greater, with this variation being 27%, but the variation between 2018 and 2019, although positive, was less (6%).

When analyzing the historical series of this fleet's effort, it can be seen that the high periods corresponded to autumn-winter during 2013-2014. During 2015, fishing effort was observed only in the first quarter, as a result of the early exhaustion of the quota. For the particular case of 2019, the highest accumulated effort was recorded during May, which was close to 500 hours. (Figure 5).

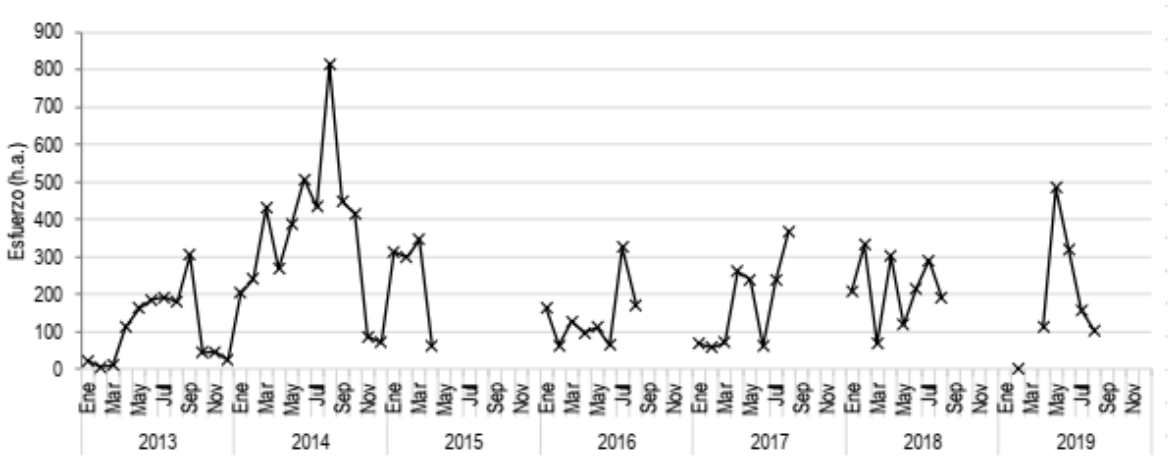

Figure 5.- Monthly effort monitored with jumbo squid catches as target species during the period 2013-2019, measured in hours of trawling (h.a.) (Source: IFOP).

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Artisanal Effort

The monitoring of the artisanal fleet presented two effort indicators: hours out of port and average effective fishing hours, both estimated to the trip by region and year. These indicators showed an upward trend over the years in almost all regions, evidencing that fishing areas are located farther from the coast, as well as jumbo squid groups are more disaggregated, causing an increase in effective fishing time. However, in the case of the average effective fishing hours indicator, this trend is very slight between 2016-2019 (Figure 6).

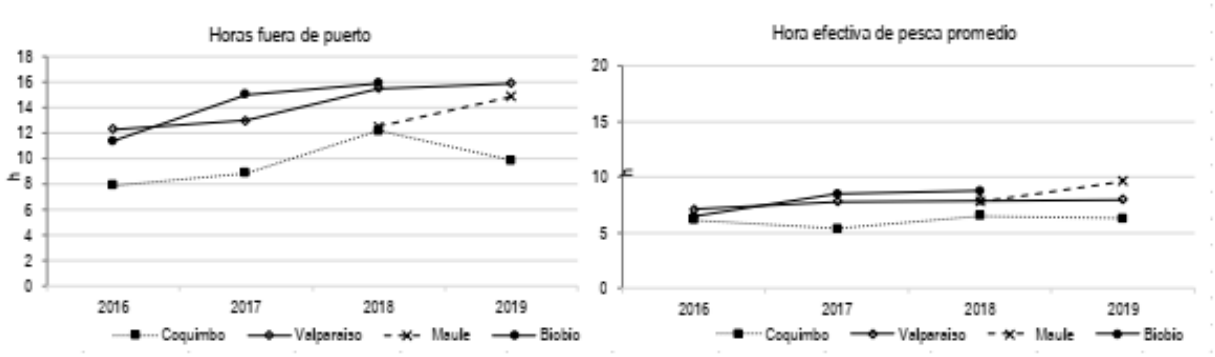

Figure 6.- Average fishing effort per trip, expressed in hours out of port (left) and effective fishing hours (right), by year and region (Source: IFOP)

Industrial Performance

The results of the 2019 performance indicator, were oriented to the fishing activity as a target species and this indicator averaged a value of 14.1 t/h.a.; which indicates an increase of the same with respect to 2018 (9.52 t/h.a.). On the other hand, the month of August registered a value of 25.3 t/h.a., being the highest in 2019. This situation is different and unusual in the historical series, as the highest values are frequently observed during the first half of the year (Figure 7).

Efforts for this fleet are in units of nominal effort and are not standardized, so the fishing yield should not be interpreted as an index of relative abundance. For the latter, a statistical model of the CPUE needs to be fitted. However, for the jumbo squid stock assessment what is of interest is the variation in abundance within a year, since cohorts change by year.

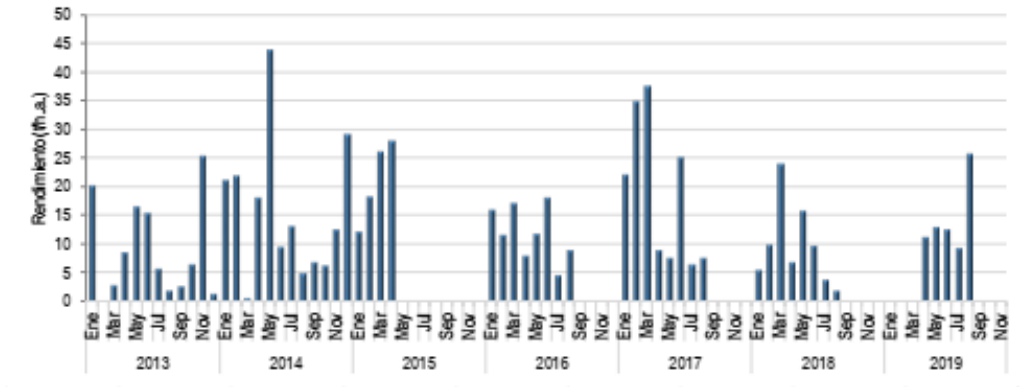

Figure 7: Historical monthly yield (ton/hour trawling) of jumbo squid as a target species of the industrial fleet, period 2013-2019. Source: IFOP

Artisanal Performance

The results of the 2019 performance indicator for the artisanal fleet were obtained from the target fishing operation carried out with the jigging gear. In this regard, this indicator showed a negative trend in the period 2015-2019. The lowest values in each annual series corresponded to the summer season. These lower values could correspond to a lower availability of jumbo squid on the Chilean coast at that time of the year due to the displacement of this resource towards oceanic zones.

It is important to note that from late 2017 to 2019, jumbo squid fishing activity has shown intermittent behavior, with periods of no activity between September and February each year, which ratifies a possible decline in the availability or intentionality of fishing the resource in the spring-summer period.

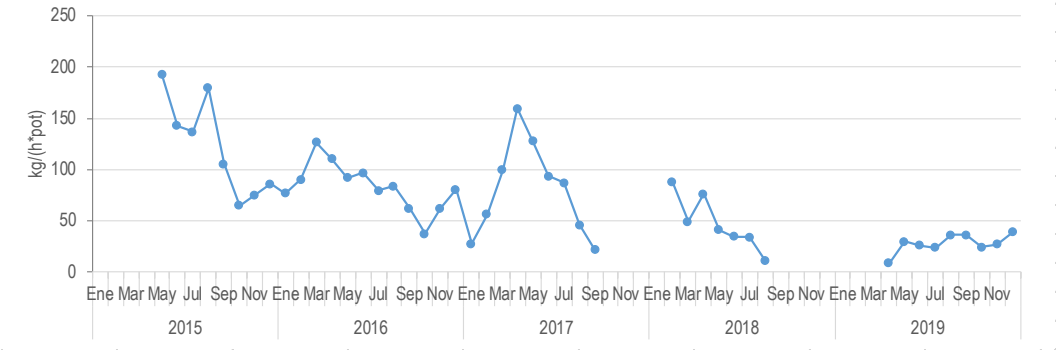

Figure 8.- Historical monthly performance, expressed in kilograms/ (fishing hours*) per month, year, of the artisanal fleet on jumbo squid as a target species, period 2015-2019. Source: IFOP.

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By catch of the industrial fleet

During 2019, a low percentage of associated companion fauna is observed in the target fishing trips on jumbo squid (Table 3). The presence of *Meluccius gayi gayi* stands out, mainly in sets conducted during the months of June and July.

Table 3.- Percentage of accompanying fauna in sets with capture of D. gigas as a target species, year 2019

Vernacular Name Chile	Specie	%
Merluza Común	*Meluccius gayi gayi*	2,18
Jurel	*Trachurus murphyi*	0,001
Reineta	*Brama australis*	0,02

Source: IFOP.

3 RESEARCH PROGRAMS

The research program for the year 2019 is mainly composed of the projects developed by annual agreement with the Institute of Fishing Promotion (IFOP), and complemented by other projects required by the fishing authority, which allow it to support the decision making process.

The projects developed annually by IFOP are:

- **Monitoring of jumbo squid (Dosidicus gigas) fishery**

This study allows the collection of information on the evolution of the main biological and fishing indicators associated with the jumbo squid fishery and its bycatch. The monitoring was concentrated in the main regions of the country where the fishery is developed, which for the particular case of the artisanal fishery is developed mainly in the regions of Coquimbo, Valparaíso and Biobío, being this last one the region where almost the totality of the industrial fishery operates.

- **Evaluation of the status and possibility of exploitation**

This project aims to provide the Scientific and Technical Committee (CCT) with the necessary technical advice, provide the data, background and information needed for the analysis of status and exploitation possibilities, determining the levels of Biologically Acceptable Capture (BAC) for the next annual extractive season in the jumbo squid fishery.

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

4.1 Biological sampling

The collection of all the biological data from the industrial fleet was carried out mainly in the Biobío Region, always by means of on-board sampling by scientific observers.
As for the collection of data from the artisanal fleet, this was done at the time of landing or on board the vessels when it was feasible. Specific biological sampling was done in processing plants or on land at the time of landing as possible, always by scientific observers.

Tables 4 and 5 show the number of specimens sampled (length and biological) for the industrial and artisanal fleet, respectively.

Table 4. Number of trips, fishing sets and samples sampled according to the type of sampling in the jumbo squid industrial fishery 2019 season

Year	Type of sampling					
	Length			Biological		
2019	Trips	Fishing sets	Specimens	Trips	Fishing sets	Specimens
	98	193	7.320	104	129	3.297

Source: IFOP

Table 5.- Number of trips, fishing sets and samples sampled according to the type of sampling in the artisanal fishery of jumbo squid, Season 2019.

Region	Type of sampling			
	Length		Biological	
	Trips	Specimens	Trips	Specimens
Antofagasta			**1**	**10**
Atacama	**6**	**189**	**1**	**78**
Coquimbo	**17**	**488**	**9**	**236**
Valparaíso	**50**	**1.540**	**47**	**1.366**
O'Higgins	**6**	**385**	**1**	**30**
Maule	47	1629		
Biobío			4	120
Total	**126**	**4.231**	**63**	**1.840**

Source: IFOP

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4.2 Length and age composition of catches

Industrial fleet

When observing the size structures of the jumbo squid catches made by the industrial fleet during 2019 for both sexes combined, it stands out that the specimens were distributed between 30.5 and 62.5 cm ML, where 100% of them were below the reference size. The highest frequency of jumbo squid was observed in the size categories between 42.5 to 48.5 cm ML. Therefore, the catches made on this resource show a greater presence of smaller specimens, compared to those made in 2018. Consistent with what was described in the size composition for 2019, the average size observed was considerably lower than that reported in previous years, with a decrease close to 30 cm LOD. It is important to note that in 2018 a change in this indicator had already been observed, particularly in the first half of the year, when it was first recorded below the reference size (Figure 9).

Artisanal fleet

The size structure observed for the artisanal fleet during 2019, corresponds to the data obtained in the Regions of Atacama, Coquimbo, Valparaiso and Maule. From the Biobío Region, a low number of samples was obtained, which prevented a conclusive analysis for this region.

The composition of sizes in all the sampled regions was characterized by the presence of small-sized specimens, where the indicators show that more than 99% of the individuals were under the reference size. In the Atacama Region, the size structure was composed by specimens that varied between the categories 48.5 and 62.5 cm ML, with a unimodal curve in the 54.5 cm ML. Similarly, in the Coquimbo Region, individuals captured by this fleet presented a range that varied between 34.5 and 58.5 cm ML, with a curve with positive asymmetry, with fashions in the 42.5 and 44.5 cm LOD. In the case of the Valparaiso Region, the observed captures were in a larger size range with respect to the other areas sampled with values between 34.5 and 68.5 cm ML. Despite the fact that in the latter region, specimens were observed above the reference sexual maturity size, this proportion only represented 0.08% of the catch analyzed. Finally, the Maule Region showed a size range between 42.5 and 68.5 cm ML. However, and similar to what was observed in the Valparaiso Region, the proportion over reference size was only 0.07% (Figure 10).

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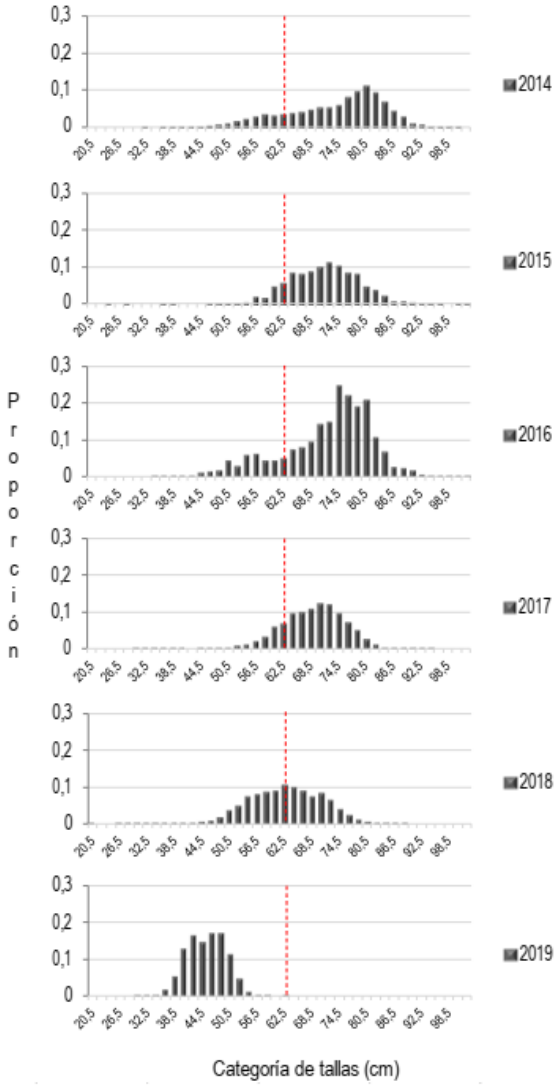

Figure 9- Composition of annual mantle length (cm) in industrial jumbo squid catches (both sexes combined). Vertical red line corresponds to the sexual maturity size of the females estimated by Liu et al. (2010). Seasons 2014-2019. Source: IFOP.

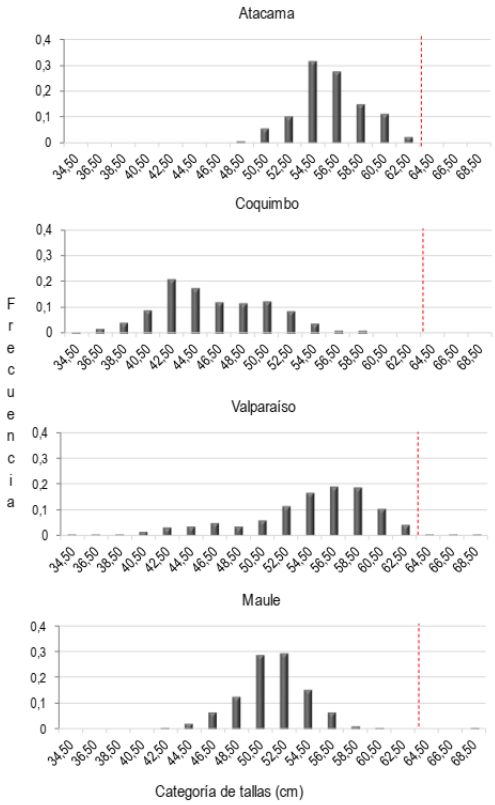

Figure 10.-Composition of mantle length (cm) weighted to the artisanal jumbo squid catches (both sexes combined) by region. Vertical red line corresponds to the size of sexual maturity in females estimated by Liu et al. (2010), year 2019. Source: IFOP

5. AT-SEA AND PORT SAMPLING PROGRAM

The samplings were carried out with the participation of scientific observers on board and in port, covering artisanal and industrial fleets. In total, 100 trips were observed for the industrial fleet, of which 76% were concentrated in the first semester, with 76 fishing trips. This number of shipments, in terms of coverage, corresponded to 29.2% of the total trips directed to jumbo squid during 2019 (342).

For the particular case of the artisanal fleet, it can be seen that during 2019 there was an increase in sampling coverage in all the regions considered, highlighting the Coquimbo Region whose monitoring coverage corresponded to 14.8%, corresponding to 364 monitored trips out of a total of 2,448 trips in the region. On the other hand, the region with the least coverage in this fleet corresponds to the Maule Region with a 6.8% coverage of only 148 trips out of a total of 2,162 trips in the region.

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6. ADMINISTRATIVE MEASURES

Current Administration Measures

The administrative measures applied to the jumbo squid fishery began in 2012, with the objective of maintaining the sustainability of the fishery for this resource. In this context, the Undersecretary of Fisheries and Aquaculture declared this resource in a state of full exploitation, restricting access. On the other hand, in the same year, a global annual catch quota was established and fishing for it was prohibited as a target species for meal production (Table 6).

Table 6.- Main Administration Measure inChile for jumbo squid

Administration Measure	Purpose	Regulation
Regime	Fishing Freedom Regime and General Access Regime, both assimilated to a state of full exploitation from the Arica and Parinacota Region to the Magallanes Region.	Res. Ex. N° 3.974/2019
Access	Suspension of the registration of the resource in the Artisanal Fisheries Registry (RPA), between the Arica and Parinacota regions to Magallanes, for having reached full exploitation status. Effective until Dec. 31, 2024.	Res. Ex. N° 3.974/2019
Annual Global Catch Quota (CGAC)	The jumbo squid CGAC for the year 2019 is 200000 tons: Investigation quota: 1000 ton Bycatch quota: 4000 ton Target quota: 195000ton	D. Ex. N° 25/2020 MINECON
Gear	It states that jumbo squid may only be taken as target fish, using jigging or hand line as fishing gear.	Law N° 21.134/2019
Other measures	*Dosidicus gigas* is eliminated from the payroll of hydrobiological resources to be used as raw material in meal production.	D.S N° 98/2012