



SWG-10-07

JACK MACKEREL FISHERY IN CHILE

ANNUAL NATIONAL REPORT SCIENCE WORKING GROUP 2011



1. DESCRIPTION OF THE FISHERY.

1.1 Composition of the Fleet.

The structure and size of the industrial purse seine fishery operating on jack mackerel in the SPRFMO area and the EEZ has remained stable over the last five years. During this period, between 131 and 112 vessels have operated; this fleet is mainly constituted by vessels of 300-600 m³ of hold capacity (Table I)

The number of vessels operating in the SPRFMO area has decreased over the last three years (2009-2011). As of August 2011, 30 vessels have been recorded. The fleet operating in this area in 2011 is composed by vessels of a hold capacity over 600 m³, most of them (77%) ranging between 1200 and 2100 m³ (Table II)

Table I. Number of vessels operating on jack mackerel in Chilean EEZ and SPRFMO area with purse seine nets, per year and hold stratum, 2006-2010(*) until june.

Hold capacity (m3.)	2007	2008	2009	2010	2011 *
0-300	12	8	8	3	0
300-600	66	65	65	68	63
600-900	10	9	10	7	9
900-1200	19	19	19	17	12
1200-1500	9	10	10	10	10
1500-1800	10	10	11	11	12
1800-2100	5	5	6	6	6
Total	131	126	129	122	112

Table II Number of vessels operating on jack mackerel in the SPRFMO area, per year and hold stratum, 2009-2011 (*) until june.

Hold capacity (m3.)	2009	2010	2011*
0-300	1	0	0
300-600	16	0	0
600-900	5	4	4
900-1200	17	12	3
1200-1500	10	8	7
1500-1800	12	12	10
1800-2100	6	6	6
Total	67	42	30



1.2 Catches, seasonality of catches and fishing grounds.

Catches

The 2011 global quota of jack mackerel catches reaches 284 thousand effective tonnes (Ex. Decree N° 1453/2010); this includes EEZ and high seas catches.

Total catch of Jack mackerel in 2010 continued the decreasing trend of previous years, recording a drop of around 44% with regard to catches harvested in the previous year. The same declining trend is observed in 2011, which is clearly illustrated by the accumulated catch registered until August –around 218 thousand tons, which represent a 15% decrease with regard to the same period of 2010 (Table III)

The part of the catch obtained in the SPRFMO area has as well decreased over the last two years (2010 and 2011), reaching a participation of around 25% with respect to the total catch of jack mackerel.

The reduction of the catch quota for this year limited catches in the northern zone of the country, recording 24 thousand tons to August 2011; this figure represents an 85% decrease in landing registered in the northern zone, compared to the same period of previous year. It is important to note that these catches correspond mainly to jack mackerel caught as bycatch of anchovy.

Besides jack mackerel, chub mackerel catches are recorded. Landings of chub mackerel decreased over the last six years, and this decrease became more evident in 2010 and 2011, not exceeding 26 thousand tons in August (Table IV).

Table III. Jack mackerel catches Chilean EEZ and SPRFMO area with purse seine nets, per year, 2006 - 2011 (*)=until August.

Years	Chilean Jack mackerel (t)		
	Chilean EEZ	SPRFMO area	Total
2006	1.251.499	128.442	1.379.941
2007	1.040.167	262.617	1.302.784
2008	376.370	519.738	896.108
2009	491.792	343.135	834.927
2010	353.453	111.238	464.691
2011*	164.905	53.571	218.477

Table IV. Chub mackerel catches Chilean EEZ and SPRFMO area with purse seine nets, per year, 2006 – 2011 (*)=until August.

Years	Chub mackerel (t)		
	Chilean EEZ	SPRFMO area	Total
2006	345.491	23.295	368.786
2007	233.697	63.492	297.189
2008	87.316	45.702	133.018
2009	136.516	21.936	158.452
2010	94.731	964	95.695
2011*	22.249	2.980	25.229

Seasonality.

As usual, jack mackerel catches concentrated in the first semester of 2010. However, a significant decline is observed since June, situation that was recorded in August in previous years. The highest catches were recorded between March and May, monthly reaching almost 90 thousand tons (Figure 1)

In 2011, as in 2010, decreased catches were observed since June. The highest catches were recorded in February and March, reaching around 40 thousand tons each month.

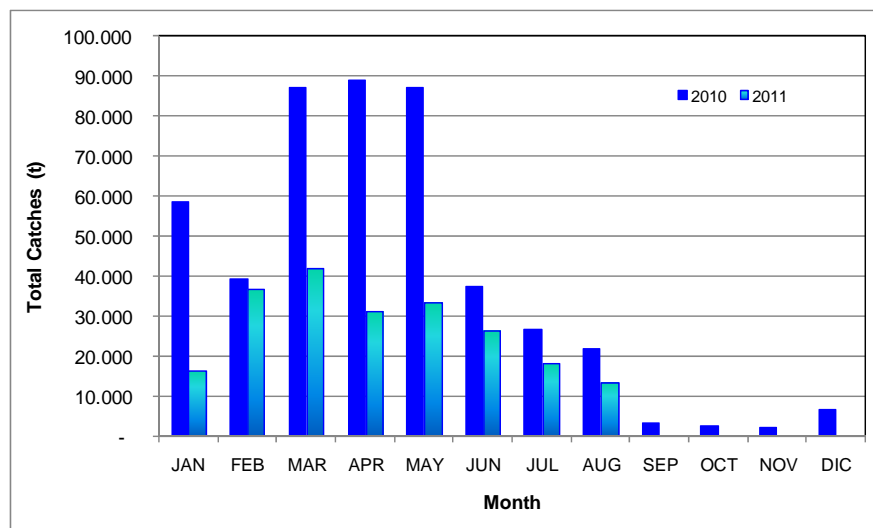


Figure 1: Seasonality of jack mackerel purse-seine fishery, 2010- August 2011. Source: SERNAPESCA.

Spatial distribution of catches.

The spatial distribution of jack mackerel catches in the northern area of the fishery showed in 2010 a pattern similar to that observed in previous years, which is characterized by a catch close to the coast, not exceeding 100 nm.

In the central-southern area, the pattern of catches in the first semester is characterized by catches within the EEZ during January and February, followed by a movement toward southwest in March, staying south of 41°L.S. until June, when it reached a longitudinal extension of 93°L.W (Figure 2). In the second semester of 2010, the usual north-west movement of the fleet is observed, as it follows the migration of the jack mackerel to oceanic zones.

The first semester of this year, a pattern similar to that of the same period of 2010 was observed, but with a longitudinal extension that barely reached 88° L.W. (Figure 3)

2010

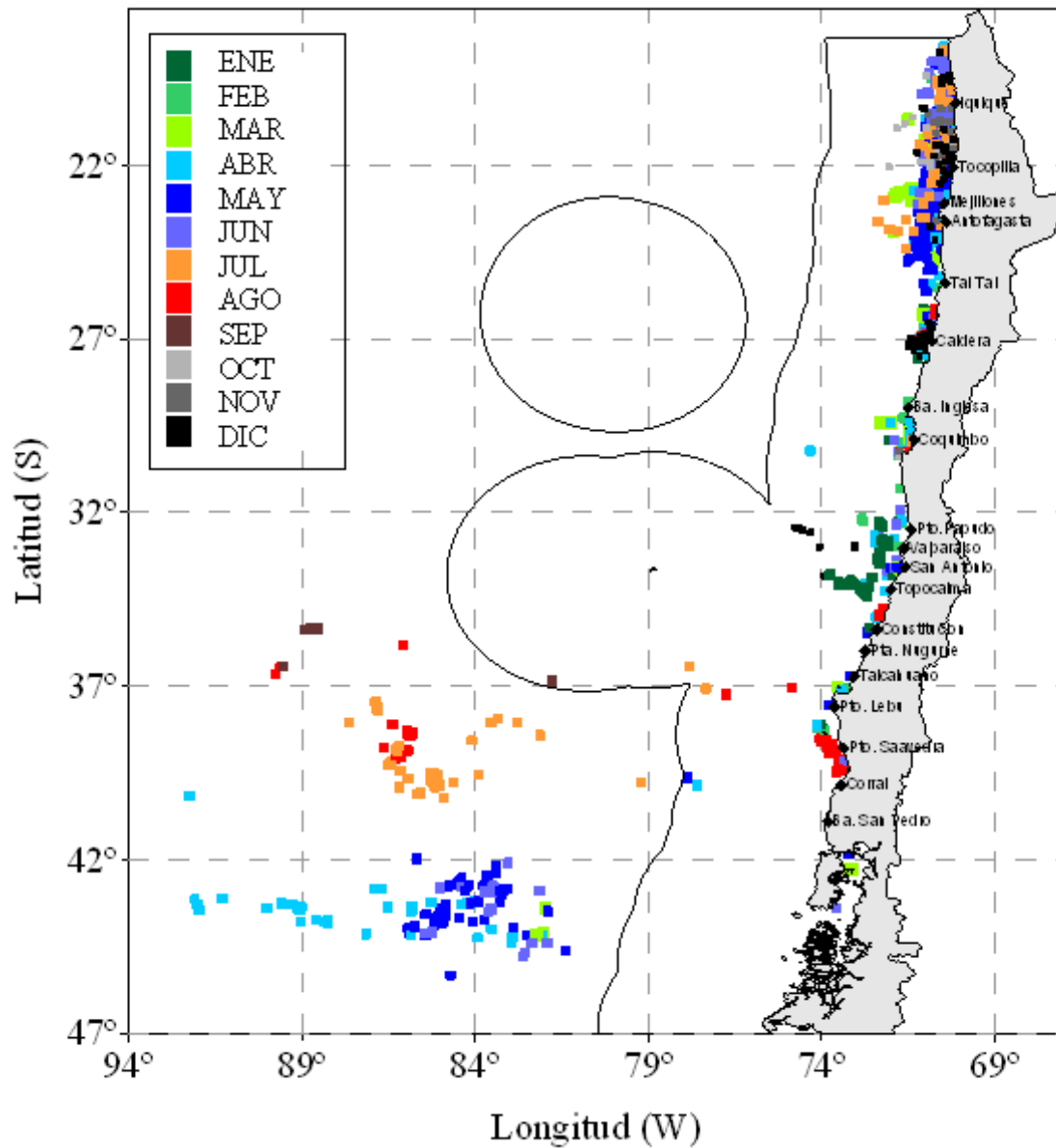


Figure 2: Spatial-temporal distribution of the industrial jack mackerel purse seine fleet 2010. Source: IFOP.

2011

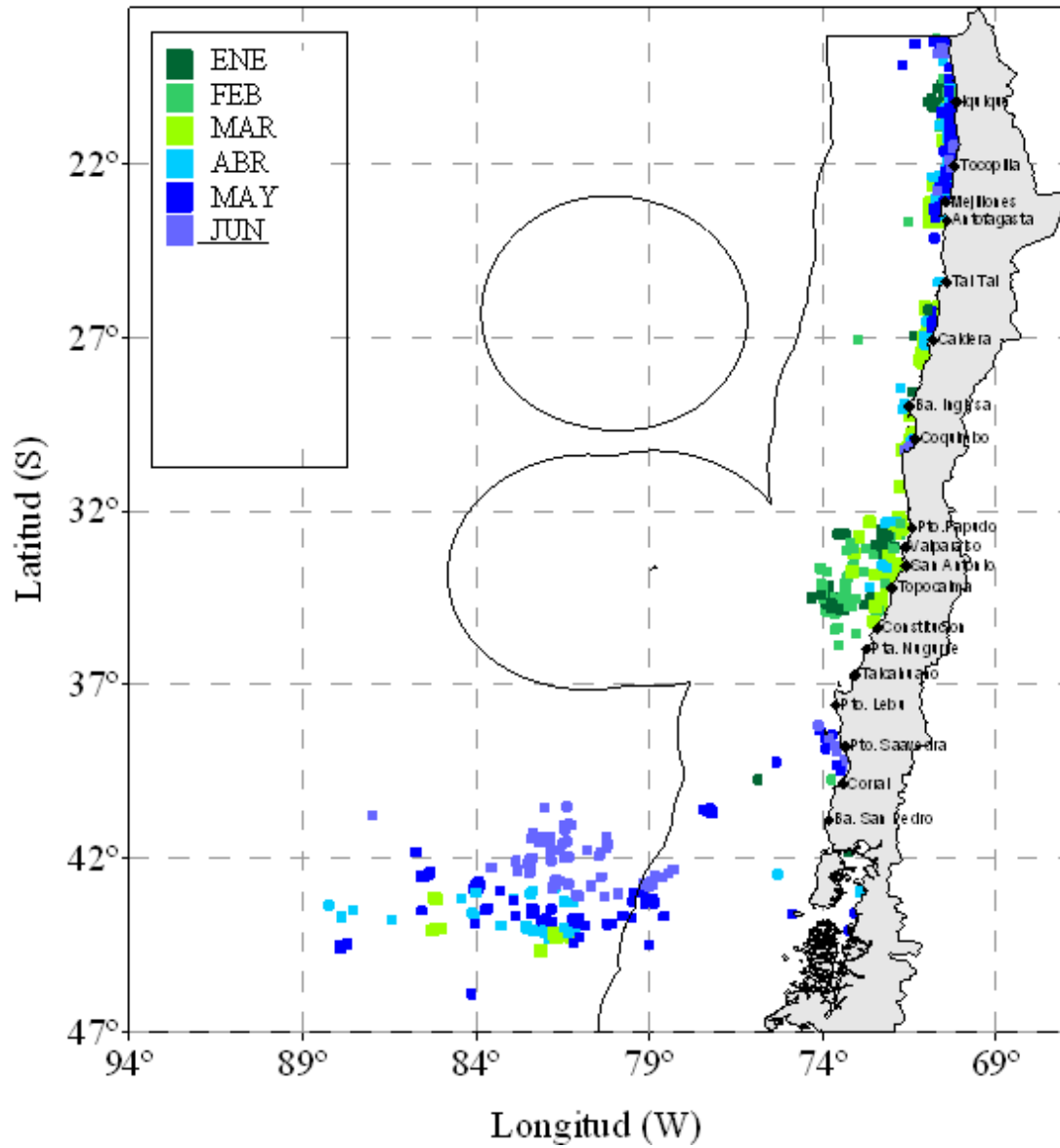


Figure 3: Spatial-temporal distribution of industrial jack mackerel purse seine fleet, until June 2011. Source: IFOP.



Bycatch.

The catch of jack mackerel harvested by the fleet that operated in the area of the SPRFMO shows that Chub mackerel (*Scomber japonicus*) is the main component of bycatch. In coastal areas, bycatch is mainly composed by anchovy (*Engraulis ringens*) and sardine (*Strangomera benthicki*)

For the fleet operating in the northern zone of Chile, Chub mackerel and anchovy are the main components of bycatch.

2. CATCHES, EFFORTS AND CPUE IN THE JACK MACKEREL FISHERY

The information contained in this section concerns the central-southern zone fleet whose target species is jack mackerel. Catch, effort and CPUE are referred to the trips in which the catch of this resource represents more than 50% of the total catch per fishing trip.

Performance of the fleet shows that, in addition to the decrease of catches, the fishing effort –measured in number of trips with catch– continued to decline in 2010, with less than half the number of fishing trips of the previous year. A progressive increase of the duration of the fishing trip is observed as well, reaching an average of 8.4 days for 2010, as a consequence of the fishing grounds moving ever further away from the coast and higher searching times (Figure 4)

Though it is not a good indicator to assess performance of the fishery¹, nominal CPUE of this fleet shows a decline in 2010 with respect to previous year, but it maintains around 400 tons, similarly to levels observed in the period 2001-2004 (Figure 5).

¹As indicated in document # 10 CHJMWS and document Fishing Indicators submitted by Chile in the VIII Science Working Group Meeting, it is not possible to use this index as a relative abundance indicator.

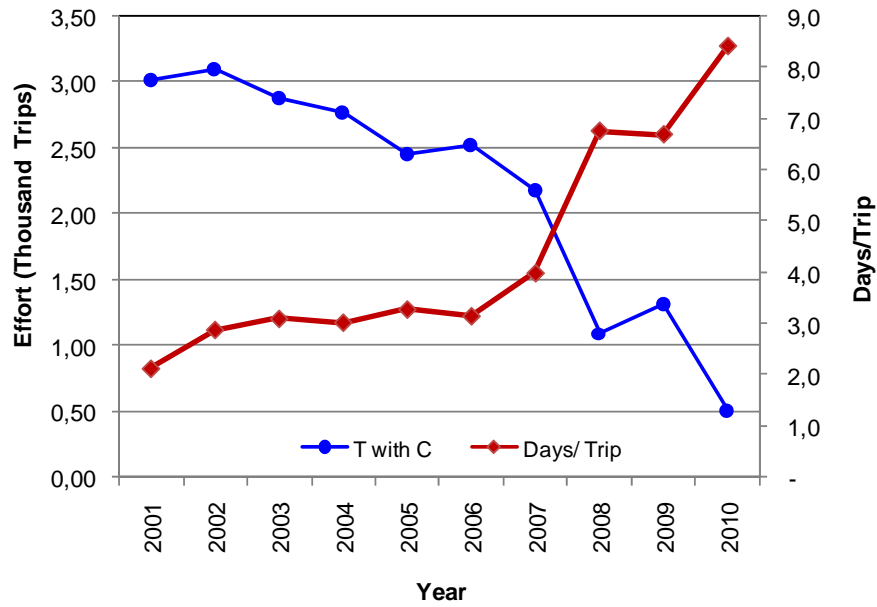


Figure 4: Number of trips with catch (T with C), and duration of trips in days of the purse seine fleet in the central-southern zone 2001-2010. Source: IFOP.

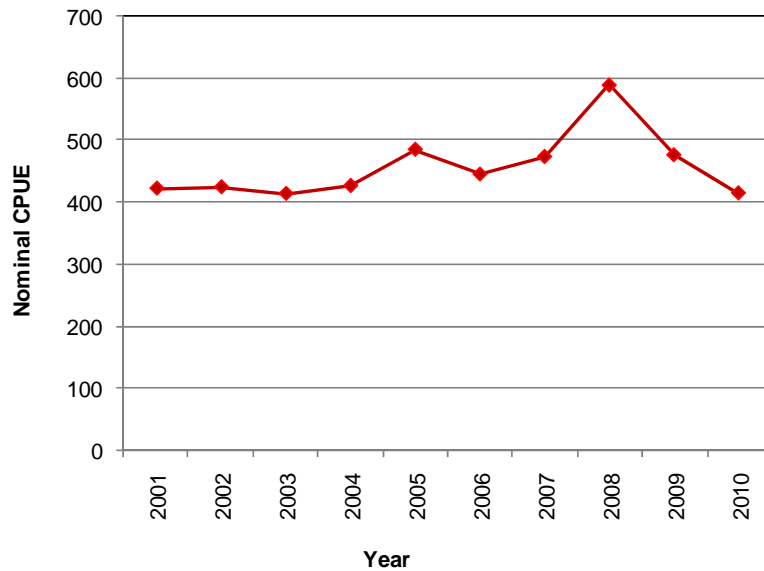


Figure 5: Nominal CPUE of the purse seine fleet in the center-southern zone 2001-2010. Source: IFOP.



3. RESEARCH ACTIVITIES².

The annual jack mackerel research program is constituted by basic projects carried out annually and complementary projects.

Basic projects during 2010 and 2011 were carried out by IFOP, and correspond to:

- *Hydroacoustic assessment of jack mackerel biomass, Regions XV-III.*

Normally, these surveys were carried out in November, covering up to 24°40' L.S. Since 2010, the surveys were redesigned, changing the area covered and the time in which it is carried out.

In 2010, the survey took place between 17 April and 15 May, covering from the north limit of the country until around 27°10' L.S, with 20 transects perpendicular to the coast, which reached 100 nm, and 2 transects that reached 200 nm. In 2011, the survey took place by between the middle of April until the middle of May, covering the area between 18° 25' LS and 27° 10' LS; the same transect design was used.

- *Hydroacoustic assessment of jack mackerel biomass, Regions V-X.*

The survey took place 9-30 June 2010, modifying the traditional prospection area, due to budget and research platform limitations. The new design, however, privileged the prospection in the high seas area, covering from 38° 20' L.S and 41° 15' L.S., with 6 transects from the 200 nm up to the 700 nm. Due to unfavorable environmental conditions that limited the operation of the research vessel "Abate Molina", the survey did not realized the last transect of the northern area of the prospection.

In 2011, a new survey was carried out between 22 June and 19 July, in the area between 38°20'LS and 42°05'LS, with 8 transects perpendicular to the coast, which covered from the 200 nm to the 600nm.

- *Monitoring of the jack mackerel fishery.*

² For further details see document CHJMW # 24, "Research and management of Chilean Jack Mackerel (*Trachurus murphyi*) exploited in the South East Pacific Ocean" or SPRFMO-III-SWG-18



The study led to obtaining almost real time information of the evolution of the main biological and fishing indicators associated to the jack mackerel fishery and its bycatch. The monitoring was carried out along the whole maritime space between the north limit of Chile and the 47° 00' L.S., including information of the small-scale and industrial fleet.

- *Jack mackerel stock assessment and estimation of total allowable quota.*

This study used a statistical catch at age model, similar to the one used by the SPRFMO SWG, whose results, along with the results of the SWG, were used to define the status of the resource and estimation of total allowable quotas, under different exploitation scenarios.

On the other hand, complementary projects were prioritized according to the orientations and needs posed in the framework of the SWG. During 2010 and 2011 the following projects have been conducted and/or run:

- *Jack mackerel stock structure, Phase I and Phase II.*

Project *Phase I* aimed at researching into the stock structure of jack mackerel in all the area of distribution and proposing a design for a marking study that allows researching into its migrations. This study was conducted by IFOP between 2007 and 2011.

In order to achieve these goals, the study adopted a multidisciplinary approach, which led to implementing a set of methods, including: genetics (DNA), parasites, morphometry (bodies and otoliths), chemistry of otoliths, and patterns of natural history. The samples were collected in all the area of distribution of the fishery. The *Instituto Nacional de Pesca* of Ecuador, the *Instituto del Mar* of Peru, and the Ministry of Fisheries of New Zealand provided great help in obtaining said samples.

The results of the study advise to carry out a new study, keeping a multi-methodology approach, with a view to evaluating the stability of markers/labels, considering seasonal samplings that allow reducing the uncertainty.

According to this advice, phase II of the study was started in early 2011, and is expected to conclude by the end of 2012.



- *Estimation of the maturity ogive of jack mackerel (2011).*

The project aims at obtaining a maturity ogive that allows estimating mean size and age of sexual maturity. It is implemented by IFOP and lasts 15 months. Results are expected by the end of March 2012. Conducting a workshop is part of the progress made by the project, with a view to standardizing criteria related to the definition of maturity stages. Samples are being collected along the entire range of the fishery in Chile.

- *Background to evaluate a selective improvement of purse seine nets in the jack mackerel fishery, Phase I (2011)*

The project aims at setting the base to evaluate a future improvement of selectivity of the purse seine nets used in the jack mackerel fishery. The study was implemented by the *Pontificia Universidad Católica de Valparaíso*. It considers collecting technical information, analyzing available information of the fishery and consulting national and international experts. This project is expected to conclude by the end of 2011.

4. BIOLOGICAL SAMPLING AND LENGTH AND AGE COMPOSITION OF CATCHES.

4.1 Biological sampling³.

Biological information is regularly obtained from the samplings along the Chilean coast, both for the target species (jack mackerel) and the species associated. Sampling is conducted at a daily level, mainly in landing/discharge sites, complemented by the information recorded by scientific observers on board, including measuring fork length of the fish, extracting otolith, and measuring total weight, gutted weight and gonad weight. In addition, sex and stage of sexual maturation of each specimen are recorded.

Jack mackerel biological and length sampling obtained during 2010 reached 12396 and 75825 samples accordingly, including onboard and at-port samplings, and covered all the area of the fishery off Chile. The main landing ports related to

³ For further details see document SPRFMO-V-D&IWG; "Brief description of the jack mackerel sampling in the Chilean fisheries".



samplings were Iquique in the north, and San Vicente and Coronel in the central-southern zone (Table IV).

Chub mackerel samplings were also carried out for the same year, reaching 5550 samples of length and 1115 biological samples.

Table IV. Number of Jack mackerel and Chub mackerel specimens subject to biological and length samplings, conducted in 2010

Port	Jack mackerel (t)		Chub mackerel (t)	
	Lenght Sampling	Biological Sampling	Lenght Sampling	Biological Sampling
ARICA			404	47
IQUIQUE	32.173	849	3.104	183
TOCOPILLA	10.717	518	925	
MEJILLONES	6.760	80	403	41
CALDERA	410	122		1
COQUIMBO	1.669	651	33	20
SAN ANTONIO	163		19	
TALCAHUANO	282	80		
SAN VICENTE	9.259	3.646	548	338
CORONEL	12.682	6.065	110	437
LOTA	1.297	305		48
CORRAL	413	80	4	
TOTAL	75.825	12.396	5.550	1.115

Source: IFOP.

4.2 Length and age composition of catches.

Jack mackerel.

The size structure of jack mackerel in 2010 shows a usual multi-modal distribution, focused on specimens of 16-17 cm FL coming from the northern area of the fishery, followed in importance by modal groups with maximums of around 25 and 27 cm FL, caught in the northern and southern area of the fishery, which would correspond to modal progression of specimens that existed in the stock the previous year (2009)

During the first semester of 2011, the structure was characterized by a low presence of specimens under 26 cm FL, compared to previous years. The mode of 19 cm corresponds to specimens of the northern area, while modes in 30 and 40 cm

correspond to the central-southern area, where the entrance of juveniles is not evidenced (Figure 6).

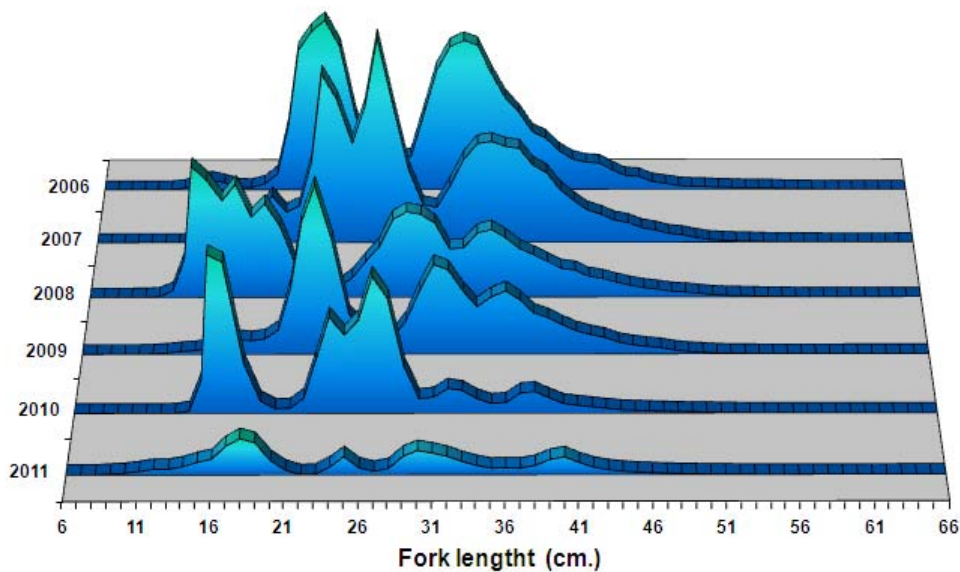


Figure 6 Length structure of jack mackerel, total catch in number 2006- July 2011. Source: IFOP

In 2010, age structure presented a bimodal distribution, focused on specimens in age II and IV. The presence of specimens of age II in the north is evidence of juveniles entering the fishery, similar to what was observed in 2008; however, this time there is low representation of the other age groups. The presence of specimens of age IV was significant both in the northern and central-southern zone (Figure 7).

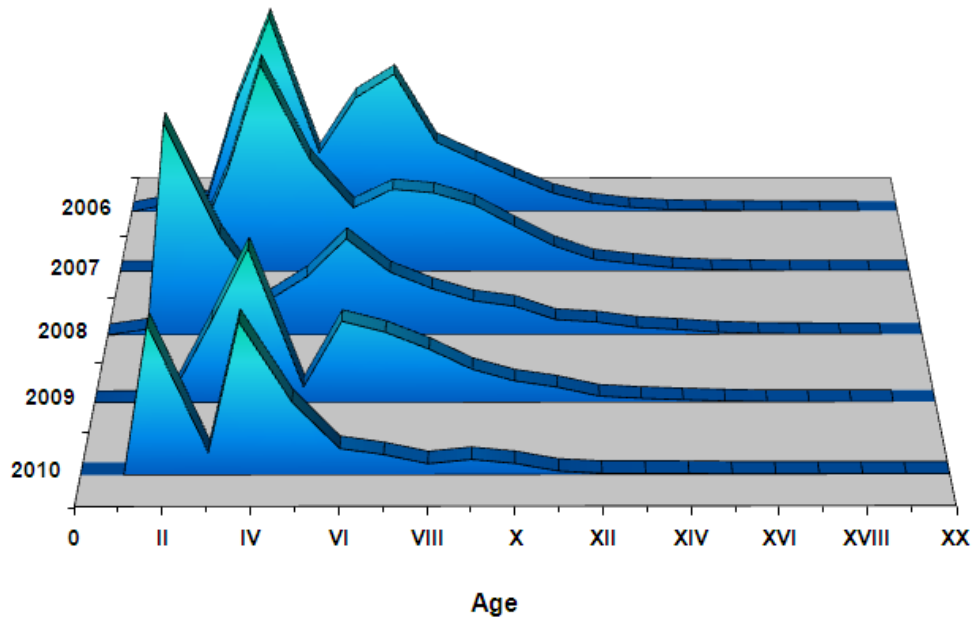


Figure 7: Age structure of jack mackerel, total catch in numbers, 2006-2010. Source: IFOP.

Chub mackerel size composition.

During 2010, a modal size of 33 cm FL was observed; this is the result of the growth of the cohort entering the fishery in 2006 with modal size around 28 cm FL. No signs of new recruitments entering the fishery were observed this year (Figure 8)

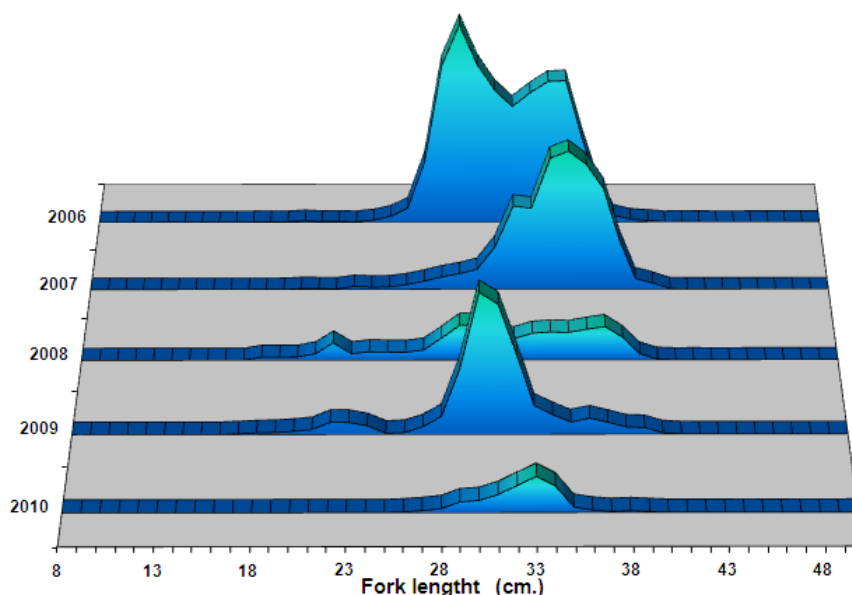


Figure 8: Length structure of chub mackerel, total catch in numbers, 2006-2010. Source: IFOP.

5. OBSERVER AND PORT SAMPLING PROGRAM.

The sampling program implemented by onboard and at-port observers has not been significantly modified, with regard to information provided in previous documents⁴. However, the program considers a continuous improvement of the information and online data collection system, which helps lowering information collection, processing, and response times at a determined quality standard.

To estimate the level of sampling coverage, fishing trips aimed at jack mackerel (i.e. over 50% of the total catch per fishing trip) were analyzed, including onboard and inland samplings. Considering the whole area of the fishery that locates off Chile, sampling coverage reached 7.4% of the target trips; however, analysis per operation area shows coverage of 11.1% in the SPRFMO area and 6.8% in the EEZ of Chile.

⁴ For further details see document SPRFMO-V-D&IWG; "Brief description of the jack mackerel sampling in the Chilean fisheries".