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Hydroacoustic assessment of Chilean Jack Mackerel carried out in the north and south-central area of Chile (2023)

Republic of Chile



EXECUTIVE REPORT

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carried out in the north and south-central area of Chile
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**Undersecretary of Economy and Smaller Companies
August 2023**



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REQUIRED

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INTRODUCTION

Hydroacoustic assessment of jack mackerel in the south-central zone of Chile began in 1991, where its fishery is historically concentrated, in autumn when the resource approaches the coast, for pre-spawning feeding purposes in the oceanic sector (Serra, 1991), consolidating from 1997, when the evaluation of the resource includes the results of the project "Hydroacoustic evaluation of the jack mackerel resource in the central-south zone (methodological cruise phase)" (Barbieri *et al.*, 1996), generating a historical series that is interrupted in 2012, due to the distancing of the resource towards the oceanic sector, continuing the research cruises in 2017 and 2020 -2021 (**Table 1**). Additionally, another series of assessments of the resource began in the northern zone of the country in 2010, which have continued until 2021 (**Table 2**).

RESULTS

The hydroacoustic evaluation of the resource during 2023, was carried out under an evolution condition of "ENSO" on the coasts of Chile, recording in the prospecting in the northern zone (March-April), temperature values above the historical average with anomalies $+0.1^{\circ}\text{C}$, intensifying in April with values of $+2^{\circ}\text{C}$ outside 10 nm between $21^{\circ}00'\text{SL}$ and Mejillones. Conditions that were not observed in the south-central zone of the country (June-July), where the anomalies are not expressed as important warm anomalies, recognizing since the beginning of July the daily distribution of values above the historical average, but without reach extreme values, which is consistent with the spatial distribution of SST anomalies in the study area (**Figure 1**).

This year, the Hydroacoustic assessment of jack mackerel between Arica-Parinacota and Valparaíso Regions, 2023, carried out from March 19th to April 29th, covered an exploration area located between the north of Arica ($18^{\circ}25'\text{SL}$) and Valparaíso ($33^{\circ}00'\text{SL}$), unlike in 2021 where it was covered up to the northern limit of Antofagasta ($23^{\circ}25'\text{SL}$), applying as usual a sample design of transects perpendicular to the coast, separated every 25 nm and whose extension reached 100 nm from the coast, obtaining a biomass of 2,508,883 tons of jack mackerel for the prospected area, which represents an increase of 68.8%, 45.1% and 31.7% compared to what was evaluated in 2019, 2020 and 2021, respectively (**Table 1**). Meanwhile, the hydroacoustic assessment of jack mackerel between the regions of Valparaíso and Los Lagos, 2023, developed between June 10th to July 12th in the south-central zone of the country, which covered from the north of Pichidangui ($31^{\circ}55'\text{SL}$) and Corral ($40^{\circ}00'\text{SL}$), the quantified volume of biomass was 837,349 tons, which represented a decrease of 45,9% and 31,0%, compared to what was quantified in the area in 2020 and 2021 ,respectively (Córdova *et.al.*, 2023 a y b) (**Table 2, Figure 3**)

The spatial distribution of jack mackerel in the northern part of the country, this year shows a significant increase in the average density of the resource (137.9 tons/mn^2) compared to what was observed in 2019 (84.9 tons/ mn^2), 2020 (87.8 tons/ mn^2) and 2021 (85.1 tons/ mn^2), which explains the growth of jack mackerel biomass in the surveyed area. This increase is also observed in the south-central zone,



where the average mackerel density of 318 tons/ mn² exceeds the values recorded in 2020 (213.4 tons/ mn² and 2021 (202.9 tons/ mn²), which would be linked to the presence of some aggregations of high acoustic density and a smaller area of distribution of the resource, which support the volume of biomass reached in the study area (**Tables 1 and 2**).

This year, the presence of jack mackerel in the coastal sector intensifies in the south-central zone, as most of its aggregations do not exceed 10-15 nm from the coast, compared to a limit of 20 nm observed during 2020-2021, where aggregations of the resource were not registered towards the oceanic sector, which is consistent with what was observed in the spatial distribution of fishing sets, carried out by the purse seine fleet of the Biobío Region, showing the last four years, a concentration of fishing zones within the EEZ but in the vicinity of the coastal sector (**Figures 4 and 5**), product of a stability of the fishing zones of the fleet in the first miles of the coast, which is complemented by the absence of fishing operations by the international fleet, which has unsuccessfully prospected the oceanic sector, operating mainly from southern Peru and northern Chile (Arica - Antofagasta) (**Figure 6**).

The jack mackerel biomass in the south-central zone shows the continuity of the high availability of the resource observed in 2020 and 2021, compared to what was registered in 2008 (520,934 tons) and 2009 (534,538 tons) (**Table 2**), which is comparable with observed in the northern part of the country, where the hydroacoustic assessment carried out have allowed establishing a strong variation in the availability of jack mackerel from 2018 (375,662 tons) to 2023 (2,508,883 tons), which together with the operation of fleet international to the west of the prospected area, suggests a possible redistribution of the resource off the coast of Chile.

Likewise, when considering the strong increase observed in the biomass of the resource and the recurring record in the biomass at the size of smaller specimens (12 to 20 cm) until 2022 and 2023, together with the strengthening this year of larger specimens (28 at 44 cm) observed in 2021 (**Figure 7**), show an improvement in the conditions of the resource, associated with the strengthening of the size structure of the jack mackerel stock off the northern coast of Chile.

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- Córdova, J., B. Leiva y V Catasti 2023a. Evaluación hidroacústica de jurel entre las Regiones de Arica y Parinacota- Valparaíso, 2023. IT/ASIPA/2022. Instituto de Fomento Pesquero. Valparaíso, Chile (40p) +figs., tablas y anexos.



Córdova, J., B. Leiva y V Catasti 2023b. Evaluación hidroacústica de jurel entre las Regiones de Valparaíso - Los Lagos, 2023. IT/ASIPA/2022. Instituto de Fomento Pesquero. Valparaíso, Chile (42p) +figs., tablas y anexos.

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T A B L E S



Table 1
Estimated biomass in the south-central zone of Chile (1997-2023).

Years	1 a 200 nm	200 a 400 nm	400 a 600 nm	Total	Total
	Biomass (tons)	Biomass (tons)	Biomass (tons)	Biomass (tons)	Density (tons/nm ²)
1997	3,753,516			3,753,516	64.7
1998	3,255,838			3,255,838	68.5
1999	4,381,572			4,381,572	71.5
2000	5,889,227			5,889,227	90.3
2001	6,146,418			6,146,418	116.8
2002	2,078,747			2,078,747	38.9
2003	914,653	1,831,599		2,746,252	51.7
2004	529,790	4,022,980		4,552,770	68.3
2005	583,260	3,503,062		4,086,322	74.6
2006	612,457	3,046,805	176,071	3,835,333	63.0
2007	87,753	3,155,924		3,243,676	90.7
2008	1,457	487,507	31,969	520,934	60.5
2009		328,016	206,522	534,538	31.1
2010			89,736	89,736	15.2
2011	7,975		119,545	127,520	131.2
2012			2,547	2,547	69.7
2015				0	0.0
2017	365,986,	65,483		431,469	30.2
2020*	1,548,640			1,548,640	213.4
2021**	1,213,776			1,213,776	202.9
2023**	867,349			867,349	318.0

*Research área 1-150 nm; **Research area1-100 nm.



Table 2
Estimated biomass in the northern zone of Chile (2010-2023).

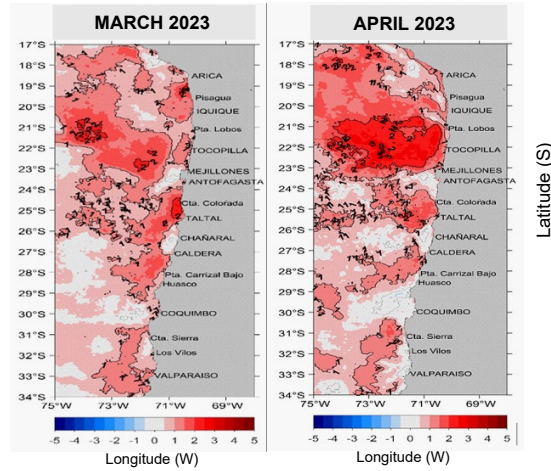
Years	Biomass (tons)	Density (tons/nm ²)
2010	440,358	25.5
2011	432,395	57.2
2012	231,583	28.6
2013	144,139	35.0
2014	87,299	15.1
2015	459,485	57.3
2016	577,235	30.1
2017	610,544	40.9
2018	375,661	14.2
2019	1,486,649	84.9
2020	1,728,531	87.8
2021	1,904,359	85.1
2023	2,508,883	137.9



FIGURES



a)



b)

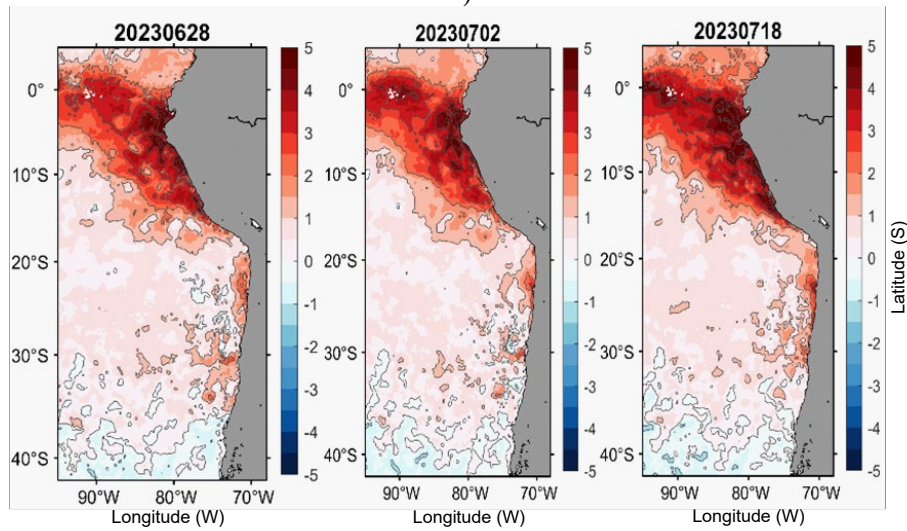


Figure 1.- Cruise period temperature anomalies a) northern zone and b) south central zone.

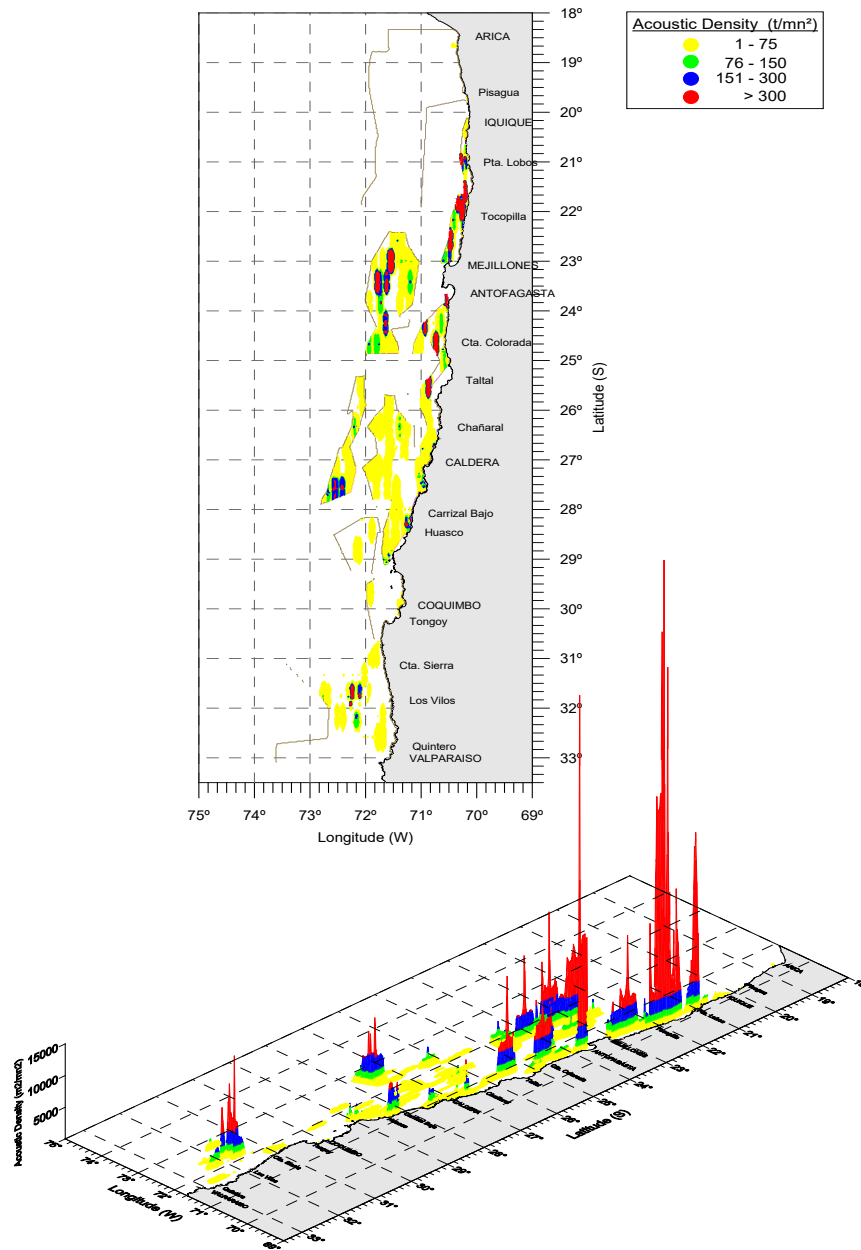


Figure 2.- Spatial distribution of the acoustic density $S_A(m^2/nm^2)$ of northern jack mackerel (2023).

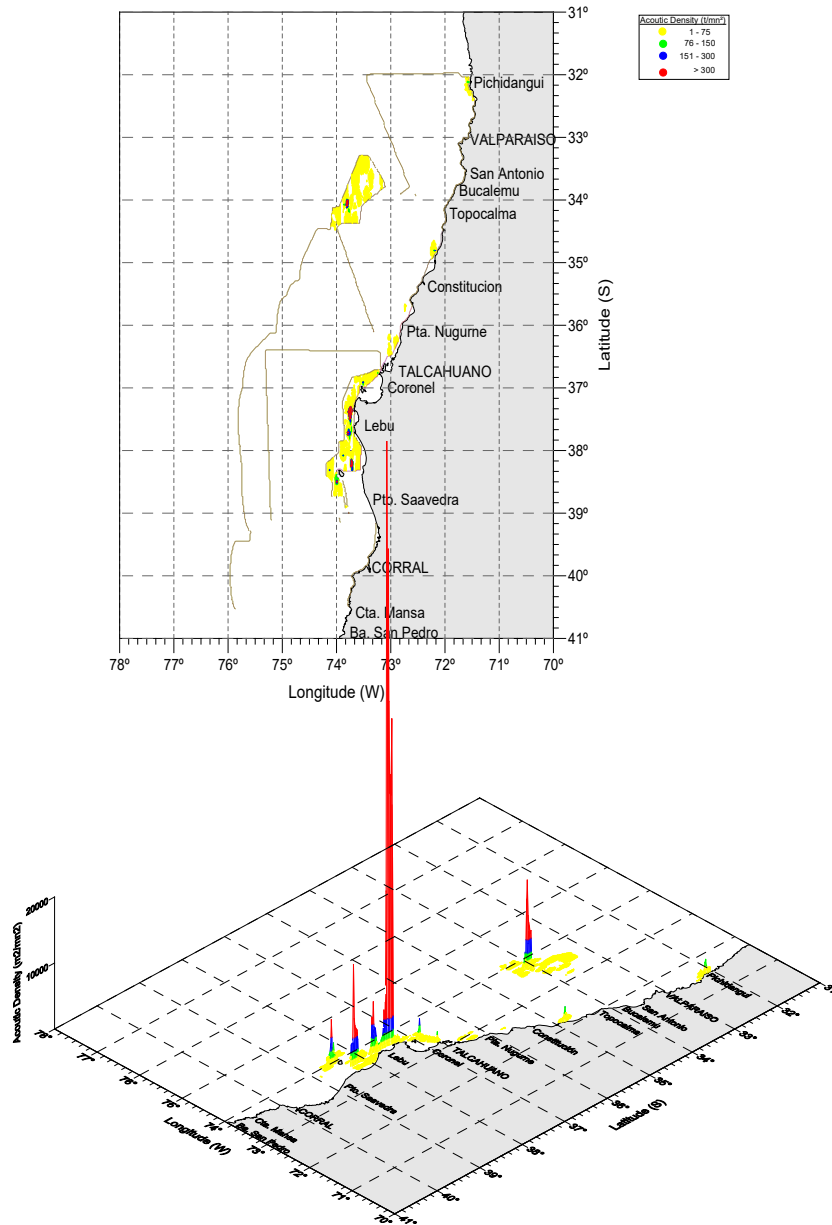


Figure 3.- Spatial distribution of the acoustic density $S_A(m^2/nm^2)$ of jack mackerel in the central-southern zone (2023).

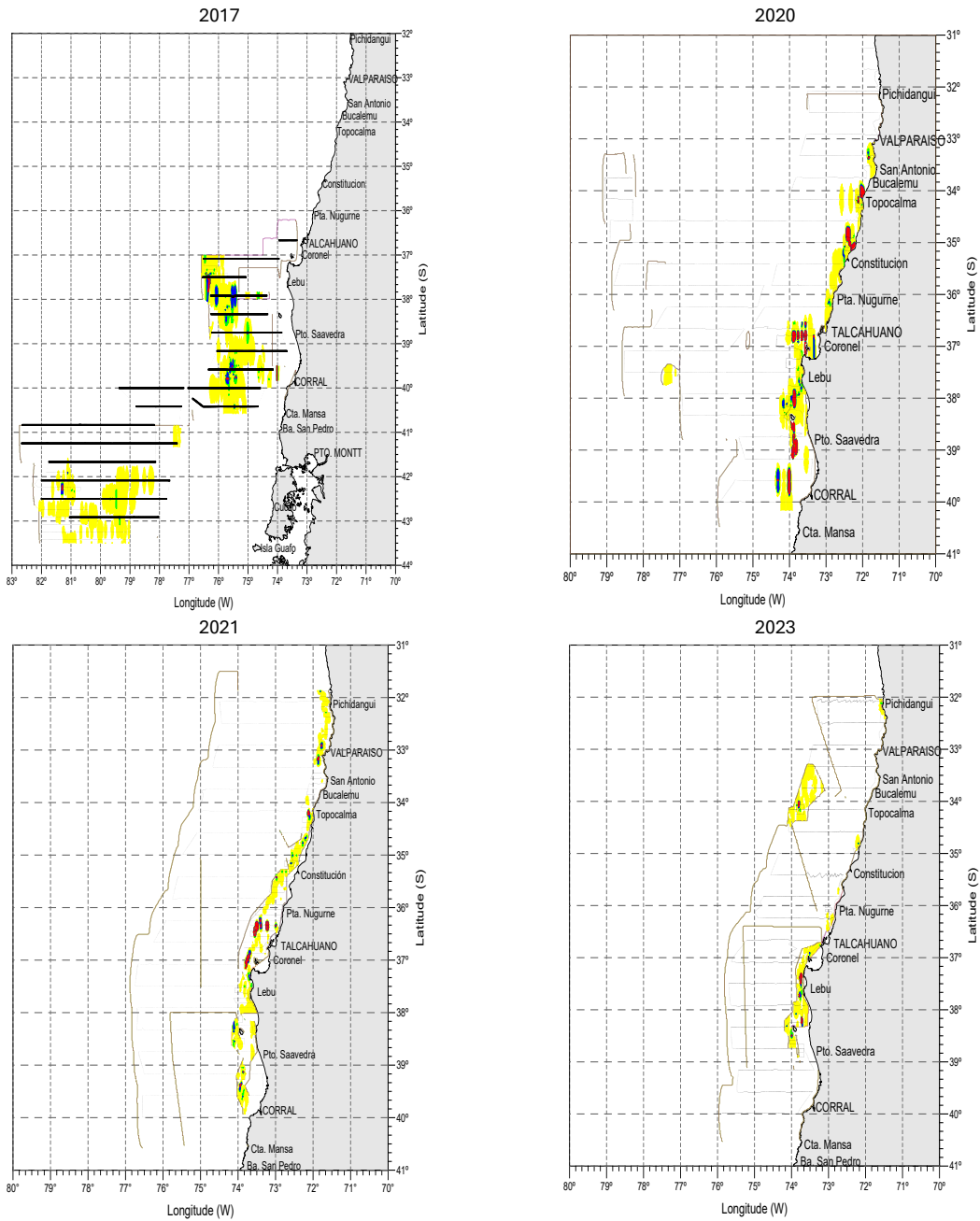
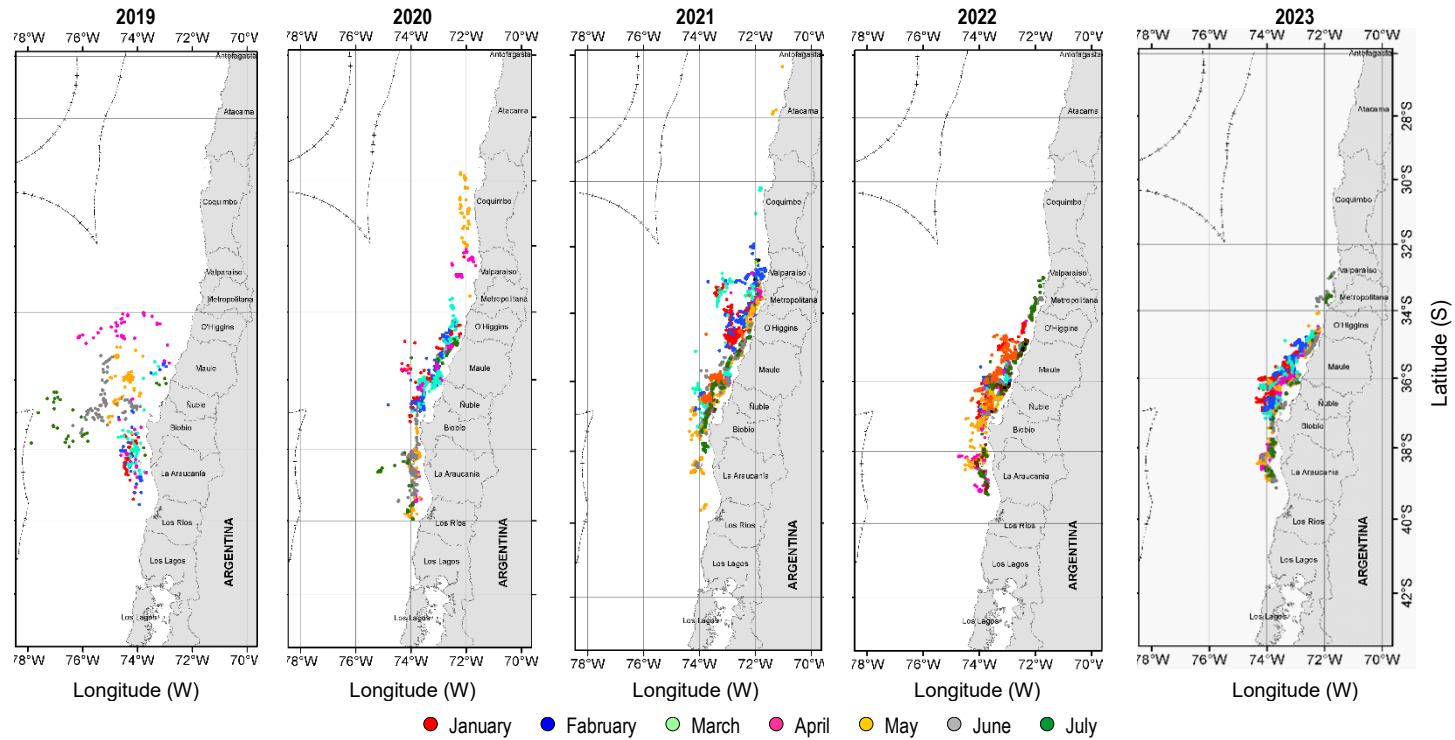


Figure 4.- Spatial distribution of the acoustic density $S_A(m^2/nm^2)$ of jack mackerel (2017, 2020, 2021 and 2023).



Note: Prepared by Fisheries Research Institute (INPESCA).

Figure 5.- Fishing hauls of the purse-seine fleet of the Biobio Region (2019, 2020, 2021, 2022 y 2023).

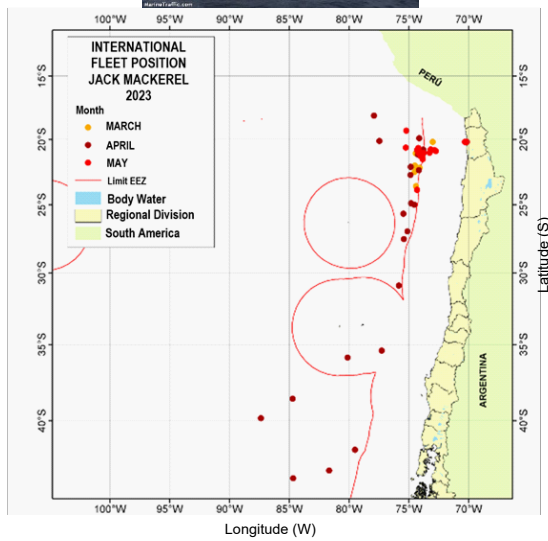
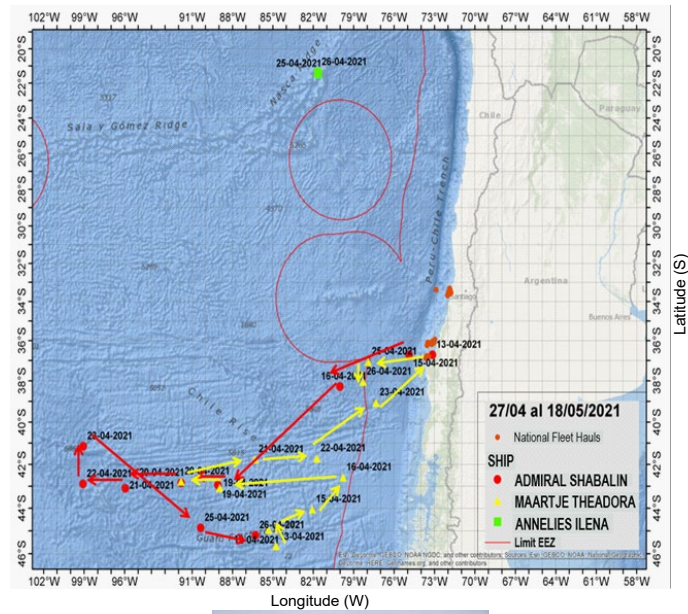


Figure 6.- Admiral Shabalin F/V positions (2021 y 2023).

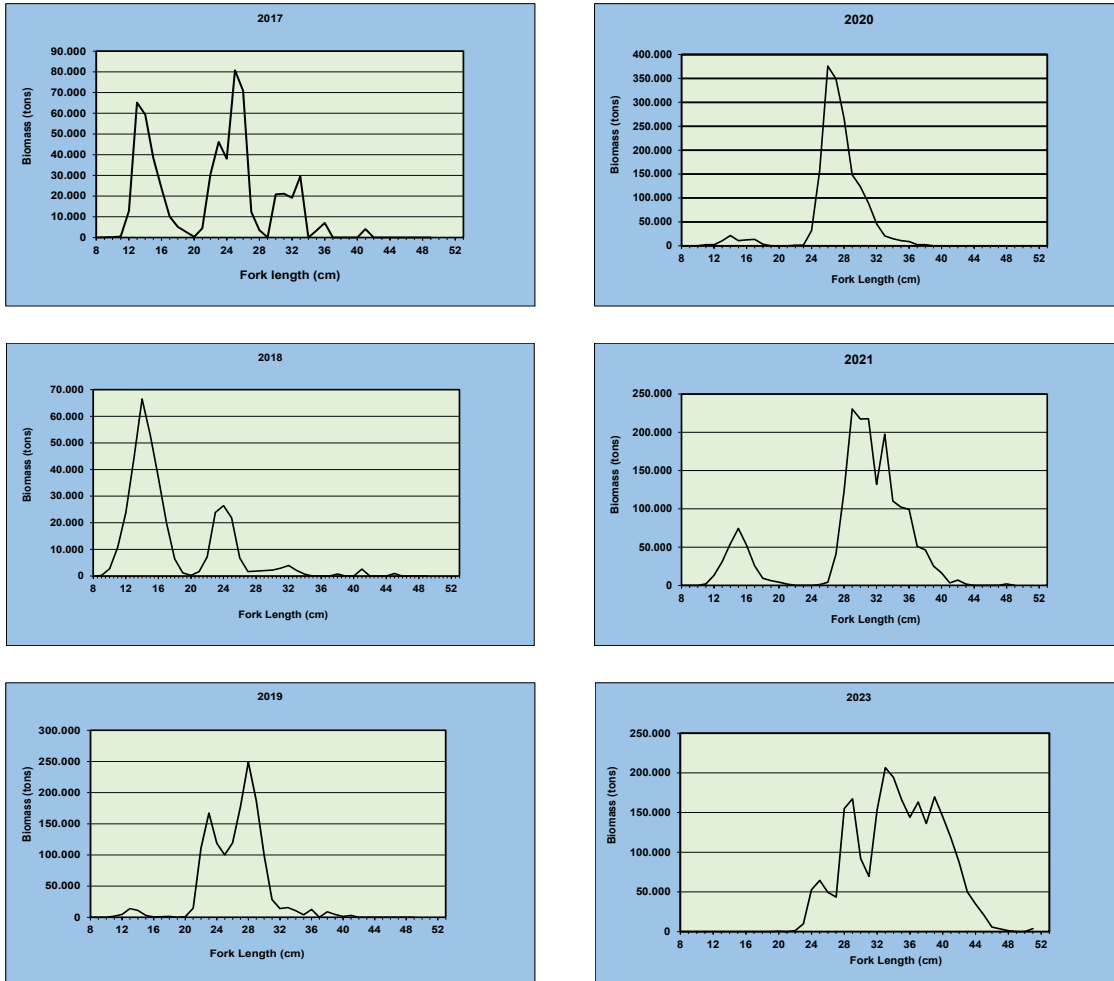


Figure 7.- Biomass at jack mackerel size (2017 -2021, 2023).





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