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Hydroacoustic assessment of Jack Mackerel in the North of Chile in 2024

Chile

Hydroacoustic assessment of Jack Mackerel in the northern area of Chile (202).

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Abstract

This study was carried out with the “Abate Molina” R/V, owned by the Undersecretary of Fisheries and Aquaculture and administered by the Chilean Fisheries Development Institute. During the study, 33 transects were carried out with a western limit of 100 nm, off the coast of northern Chile. The acoustic quantification of jack mackerel biomass was carried out with the Simrad EK–60 scientific echo sounder with a frequency of 38 KHz, collecting information from the surface up to 500 meters deep. The identification of the acoustic data was carried out through the interpretation of the echograms, jointly with the results of the identification fishing.

The main results from the survey indicate a total biomass of 2,781,691 t and an abundance of 13,531.4 million specimens. The structure of fork lengths (FL) was between 9 and 52 cm, with sizes 22 to 24 cm absent, its distribution was multimodal, with main modes at sizes 30, 35, and 36 cm (FL). Finally, the species was distributed between the south of Arica (18º25'S) and Valparaíso (33º00'S), with three main focuses: the first was located in the surroundings of Arica, the second nucleus was located between 45 and 95 nm from the coast SW of Antofagasta (main area) and the third region was located in front of Huasco.

RESULTS

The data were collected on a survey cruise carried out by the R/V “Abate Molina” between March 17 and April 29, 2024. The study area was located between Arica (18°25'S) and Valparaíso (33º00' S). Where 33 hydroacoustic survey transects were carried out perpendicular to the coast and 28 fishing hauls (Figure 1). The main commercial species detected in the acoustic survey were jack mackerel (*Trachurus murphyi*) and chub mackerel (*Scomber japonicus*).

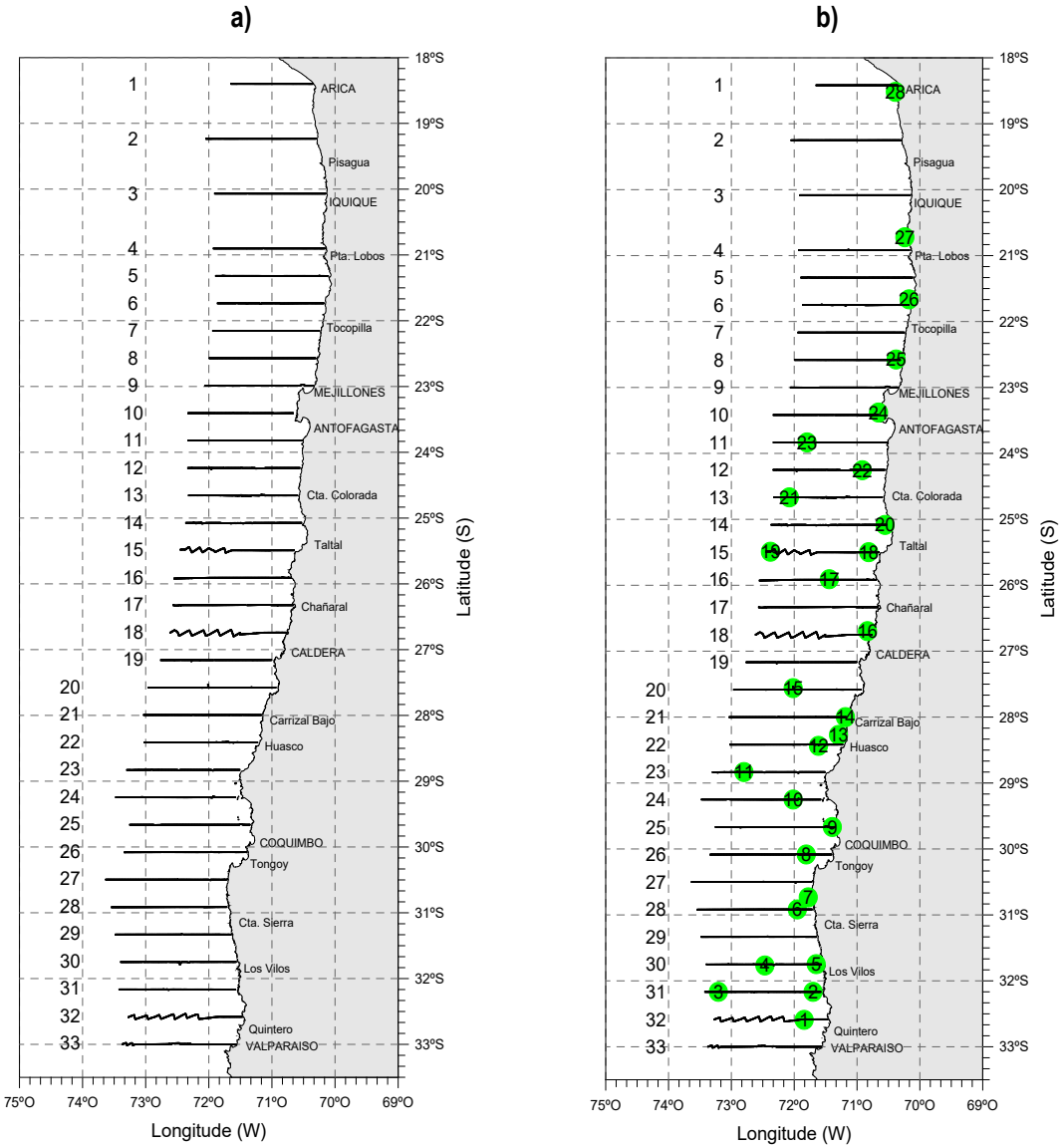

Figure 1. a) Distribution of acoustic transects and b) fishing hauls.

This year, the Hydroacoustic assessment of jack mackerel covered an exploration area located between the north of Arica (18°25'SL) and Valparaíso (33°00'SL). As in 2023, a sampling design of transects perpendicular to the coast was applied, separated every 25 nm, and which extension reached 100 nm from the coast, obtaining a biomass of 2,781,691 tons of jack mackerel for the surveyed area, which represents an increase of 60.9%, 46.0% and 10.9% compared to what was evaluated in 2020, 2021 and 2023, respectively (Table 1) (Córdova *et al*, 2022 and 2024).

The total abundance of jack mackerel was 13,531.4 million specimens, where approximately 66.5% of the abundance (8,995.1 million specimens) corresponds to the juvenile fraction. Additionally, a greater recurrence of high densities of jack mackerel compared to what was recorded in previous years, explain the increase in the level of biomass quantified during this study (Table 1).

Table 1. Abundance and biomass of jack mackerel. Period 2015-2024.

Year	Period	Abundance (n)	Biomass (t)
2015	March-April	5,764,293,123	459,485
2016	March-April	6,716,953,946	577,235
2017	March-April	8,526,700,737	610,544
2018	March-April	10,053,739,366	375,662
2019	March-April	8,541,267,647	1,486,649
2020	March-April	9,013,744,554	1,728,532
2021	March-April	12,261,453,231	1,904,359
2023	March-April	6,693,050,651	2,508,833
2024	March-April	13,531,355,332	2,781,691

Jack mackerel was distributed along the entire coast, between the south of Arica (18º25'S) and Valparaíso (33º00'S) (Figure 2), similarly from what was observed in 2023. Jack mackerel was concentrated in three main areas: the first nucleus was located in the surroundings of Arica, in the first 5 nm off the coast; the second nucleus was located between 45 and 95 nm off the coast to the SW of Antofagasta, and was the area that showed the highest acoustic densities; and the third area was located off Huasco. The bathymetric distribution of the individuals showed that the aggregations ranged between 4 and 130 m deep, highlighting that 80% were located in the first 40 meters (Figure 3).

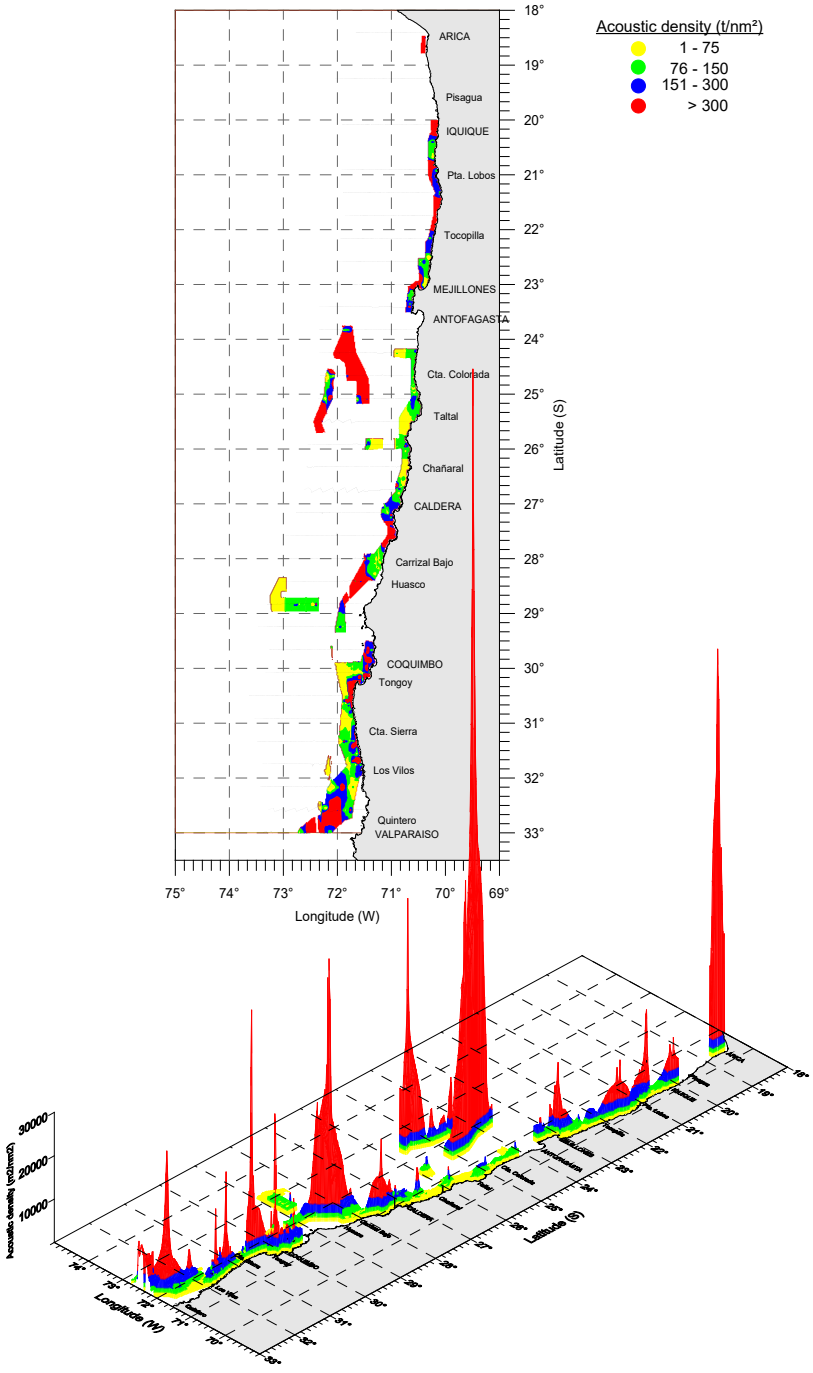

Figure 2. Spatial distribution of jack mackerel.

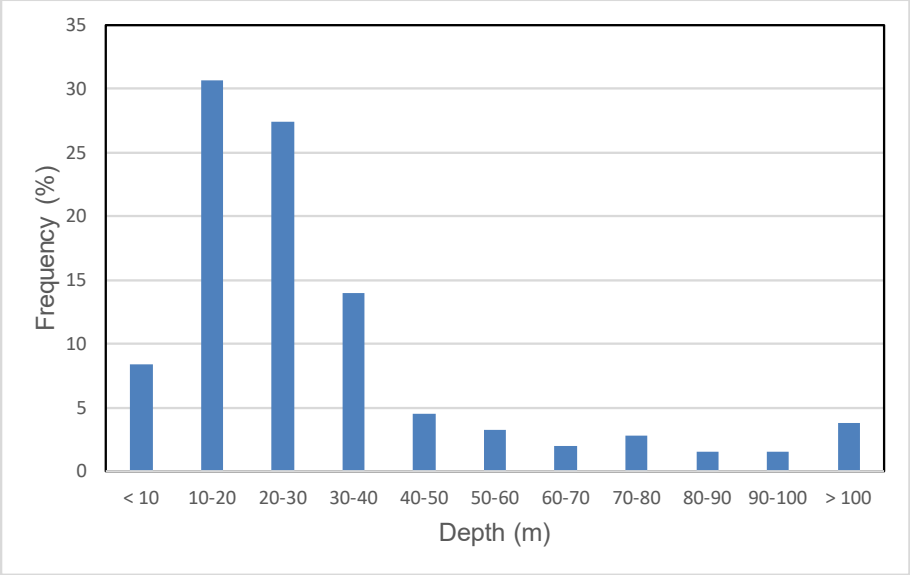

Figure 3. Bathymetric distribution of jack mackerel.

Composition of catches and fishing hauls

The determination of the size structure and weight at the size of the resource was carried out based on the 28 identification fishing hauls. The composition of the haul catches showed a strong presence of *T. murphyi*, appearing in twenty-four of the 28 hauls carried out (85.7% effectiveness), and with the hauls coinciding with important areas of concentration of the resource detected with acoustic equipment. The total catch was 12,214.2 kg, the main commercial species were jack mackerel with 11,906.5 kg (97.5% of the total) and chub mackerel with 236.1 kg (Table 2).

Length structure in fishing hauls.

The sampled specimens presented a structure of fork lengths (FL) between 9 and 52 cm, with sizes 22 to 24 cm absent. Its distribution was multimodal, with main modes at sizes 30, 35 and 36 cm (FL) and secondary at 12 cm. The contribution of individuals below the legal minimum size (< 26 cm FL) is 10.8% for the total data made (Figure 4).

Table 2. Catch by weight (proportion by species in %) and geographical position of identification hauls.

				Catches per haul (kg)				
Hauls	**Date**	**Mid Lat**	**Mid Long**	**Jack Mackerel**	**Chub Mackerel**	**Squid**	**Other**	**Total (kg)**
1	18-03-2024	32°35.5'S	71°50.4'W	111,29	8,56			119,9
2	19-03-2024	32°10.0'S	71°42.0'W	33,42				33,4
3	19-03-2024	32°10.0'S	73°12.4'W			5,11	9,88	15,0
4	20-03-2024	31°45.3'S	72°27.7'W					0,0
5	21-03-2024	31°44.8'S	71°39.0'W	15,90				15,9
6	23-03-2024	30°54.9'S	71°54.5'W	682,62	4,10			686,7
7	23-03-2024	30°43.9'S	71°46.6'W	846,28	14,43			860,7
8	25-03-2024	30°04.6'S	71°48.6'W	65,92				65,9
9	25-03-2024	29°40.0'S	71°23.8'W	106,80				106,8
10	27-03-2024	29°14.9'S	72°00.5'W	0,92				0,9
11	28-03-2024	28°50.0'S	72°47.6'W	69,33				69,3
12	29-03-2024	28°26.2'S	71°36.8'W					0,0
13	29-03-2024	28°16.2'S	71°17.7'W	57,74			18,40	76,1
14	30-03-2024	28°00.0'S	71°11.1'W	336,77				336,8
15	31-03-2024	27°33.6'S	72°00.9'W					0,0
16	02-04-2024	26°41.8'S	70°49.2'W	149,34				149,3
17	06-04-2024	25°54.5'S	71°25.9'W	1,12		1,18	5	7,0
18	06-04-2024	25°29.9'S	70°48.8'W	15,28	3,12			18,4
19	07-04-2024	25°29.5'S	72°22.7'W	266,77	86,10			352,9
20	10-04-2024	25°05.0'S	70°33.3'W	405,92	8,32			414,2
21	10-04-2024	24°40.0'S	72°04.6'W	2,13	1,60	0,13	6,60	10,5
22	11-04-2024	24°15.3'S	70°54.4'W	172,27	57,88			230,2
23	12-04-2024	23°50.0'S	71°47.7'W	43,36	23,54		0,37	67,3
24	14-04-2024	23°22.8'S	70°39.5'W	741,24	0,94			742,2
25	15-04-2024	22°34.5'S	70°22.7'W	635,99	21,81			657,8
26	17-04-2024	21°39.8'S	70°10.4'W	6652,50				6652,5
27	19-04-2024	20°43.3'S	70°14.3'W	55,22	5,70			60,9
28	23-04-2024	18°30.9'S	70°23.4'W	438,38			25,20	463,6
			Total	11906,5	236,1	6,4	65,2	12214,2

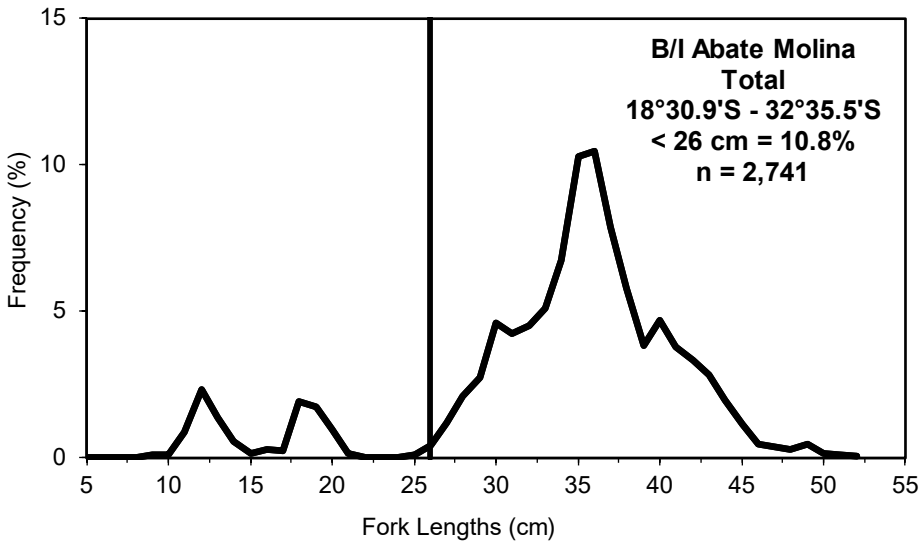

Figure 4. Frequency distribution of fork lengths (cm) of jack mackerel, for surveyed area.

Age structure

The age structure estimated in this survey is consistent with the historical age trend observed in the northern macrozone, where specimens less than two years old have been the most representative between 2013 and 2018. This pattern is consistent with the demographic history of jack mackerel, considering a conceptual model which defines the coast of northern Chile as a breeding area (Arcos *et al*., 2001). However, between 2019-2023 the presence of older age groups has increased, which indicates an improvement in the structure of jack mackerel (Figure 5).

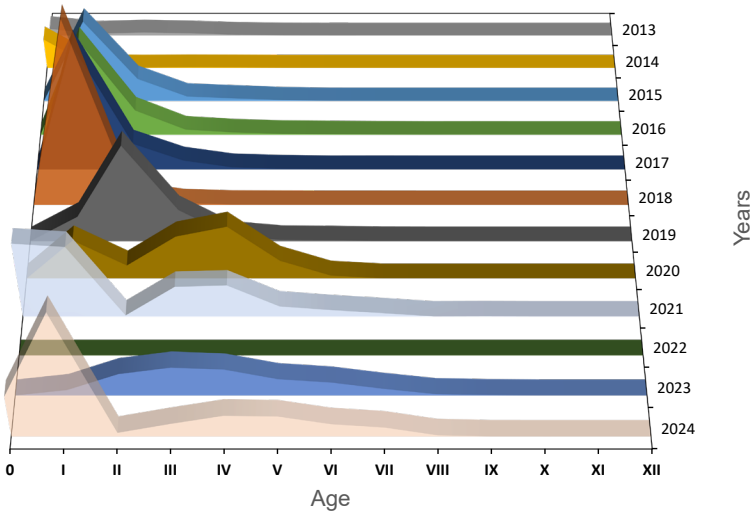

Figure 5. Abundance by age group of jack mackerel (2013-2024).

Finally, when adding the strong increase observed in the biomass of the resource and the recurrent record of smaller specimens (<26 cm), along with the strengthening this year of larger specimens (26 to 52 cm), indicates the improvement of jack mackerel conditions off the northern coast of Chile, which is coincident with Córdova (2023).

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