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Hydroacoustic assessment of Chilean Jack Mackerel (*Trachurus murphyi*) in the northern zone of Chile (2026)

Chile

Hydroacoustic assessment of Chilean Jack Mackerel (*Trachurus murphyi*) in the northern zone of Chile (2026)

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Abstract

Hydroacoustic survey data were collected aboard the R/V “Abate Molina” across 33 transects and 35 midwater fishing hauls off Northern Chile. Chilean jack mackerel (*Trachurus murphyi*) biomass was estimated using a Simrad EK–80 scientific echosounder operating at 38 kHz, sampling the water column from the surface to a depth of 500 m. Acoustic backscatter was interpreted through echogram analysis and validated using species identification from fishing hauls.

Survey results yielded a total estimated abundance of 3.262 billion specimens and a total biomass of 642,244.1 t. Fork length (FL) ranged from 11 to 54 cm, with the 51 and 53 cm size classes absent. The overall length structure was multimodal, featuring a primary mode at 23 cm FL and secondary modes at 15 and 33 cm. Jack mackerel were distributed between Arica (18º25'S) and Valparaíso (33º00'S), with the vast majority of biomass concentrated within the first few nautical miles from the coast.

RESULTS

A hydroacoustic assessment of *T. murphyi* was conducted aboard the R/V "Abate Molina" between March 18 and April 29, 2026, spanning the northern and central Chilean coast from Arica (18°25'S) to Valparaíso (33°00'S). The sampling design consisted of 33 transects oriented perpendicular to the coast, spaced at 25 nm intervals and extending up to 100 nm offshore (Figure 1). One transect was extended to 105 nm offshore due to the presence of jack mackerel aggregations near the outer boundary of the survey grid. In addition, 35 midwater fishing hauls were executed for species identification and biological sampling. The primary commercial species detected during the acoustic survey were jack mackerel (*Trachurus murphyi*) and anchovy (*Engraulis ringens*).

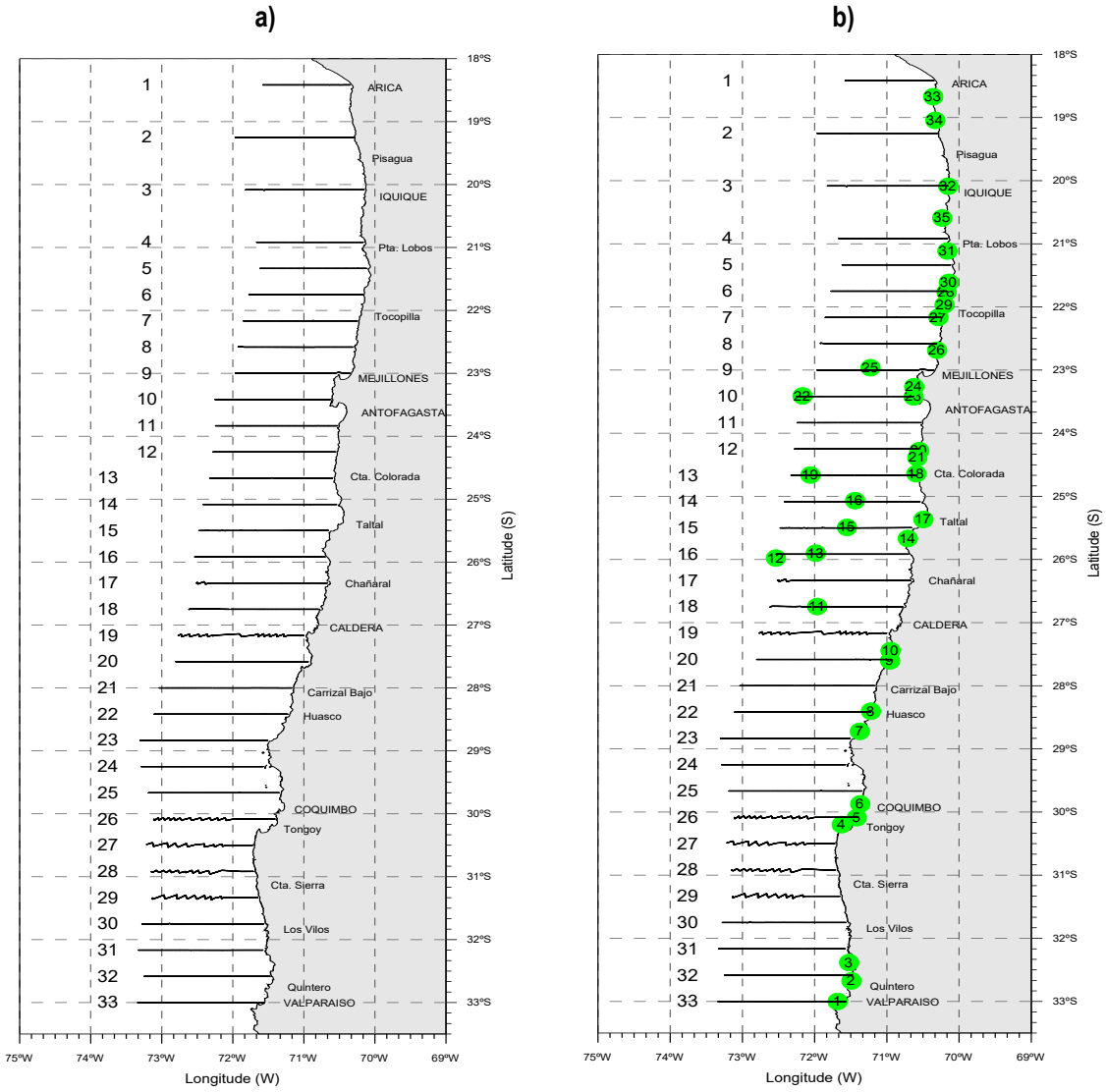

Figure 1. a) Distribution of acoustic transects and b) Fishing hauls.

Total estimated abundance of jack mackerel reached 3.262 billion individuals, with approximately 31% (1.007 billion individuals) located in the offshore oceanic region where small specimens (<26 cm FL) dominated. Total jack mackerel biomass was estimated at 642,244.4 t, representing an 80% decrease compared to the 2025 assessment (Table 1). Importantly, juveniles account for 55% of the total biomass (357,466 t), marking a substantial increase in the juvenile proportion relative to 2025 (14%) (Catasti *et al.*, 2026).

Table 1. Abundance and biomass of jack mackerel. Period 2015-2026.

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
2025	March-April	16,093,054,541	3,074,857
2026	March-April	3,262,079,066	642,244

In 2026, jack mackerel were predominantly concentrated within the first few nautical miles of the coast, exhibiting three distinct spatial sectors:

- Northern coastal sector (SW Iquique), between 1 and 5 nm from the coast, no juvenile individuals were detected in this area and was associated with large specimens ranging from 30 to 52 cm.
- Central offshore sector (SW Antofagasta to Caldera), distributed over a fairly extensive oceanic area over 8,000 nm^2, between 40 and 105 nm from the coast, this area contained juvenile individuals and highly dispersed aggregations.
- Southern coastal sector (Coquimbo to Valparaíso), in the first 4 nm, in a smaller sector, aggregations were highly concentrated (Figure 2).

The bathymetric distribution of the individuals showed that aggregations occurred between depths of 4 and 110 m, with 70% of the biomass concentrated within the top 30 meters of the water column (Figure 3).

Adverse weather conditions, characterized by persistent strong winds, impacted survey operations on several operational days. Between March 22 and April 8, wind speeds well exceeded 10 m/s in the oceanic sector south of 27°S. Although wind speeds moderated between April 9 and 20, localized winds in excess of 6 m/s persisted around the Coquimbo bay system (Figure 4).

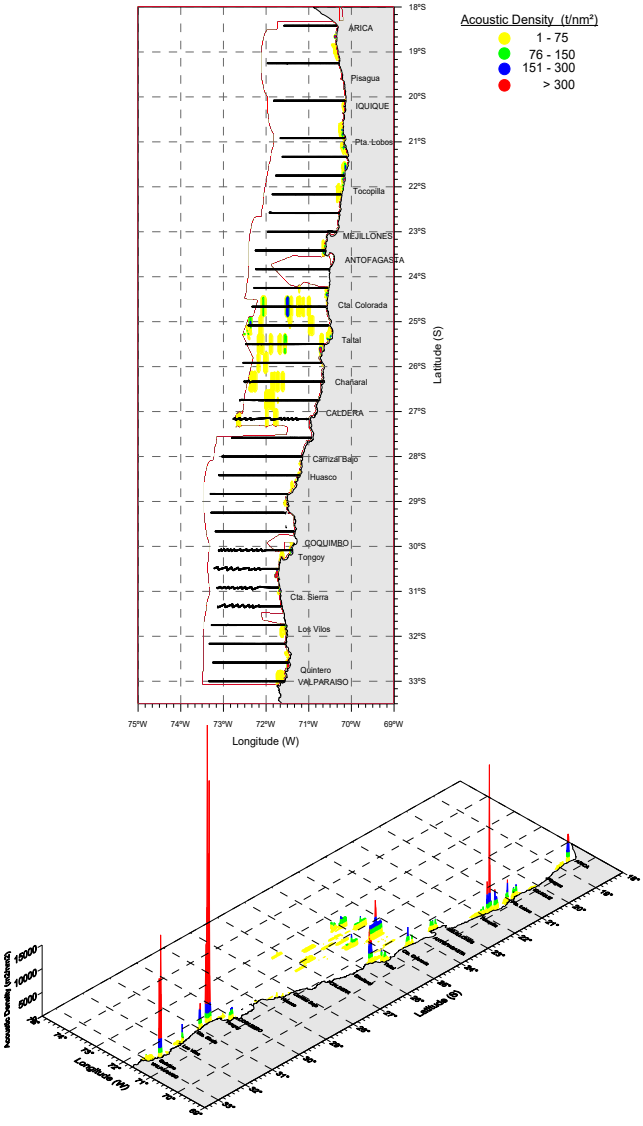

Figure 2. Spatial distribution of jack mackerel in 2026.

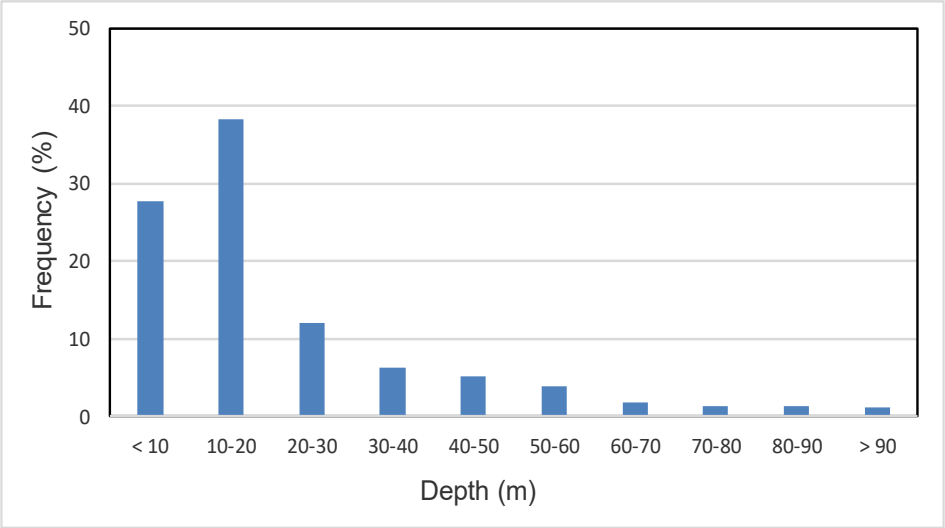

Figure 3. Bathymetric vertical distribution profile of jack mackerel.

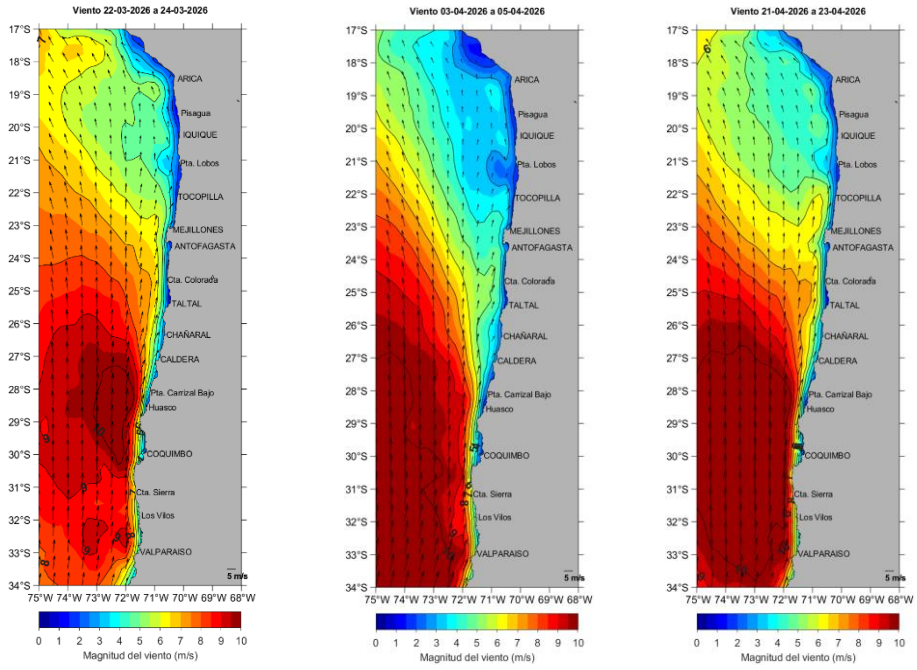

Figure 4. Representative 3-day averaged satellite wind speed fields (m/s) during the survey period.

Catch composition

Species composition and length-weight relationships were derived from 35 midwater target-identification hauls. Catch composition was dominated by *T. murphyi*, appearing in 26 of the 35 fishing hauls (74.3% positive occurrence), directly matching high-density acoustic sign detected during the survey. Total catch across all hauls was 6,221 kg. Jack mackerel accounted for 89.2% of the catch (5,550.7 kg), followed by anchovy (3.3%, 207.8 kg), jumbo squid (*Dosidicus gigas*, 1.6%, 97.6 kg) and chub mackerel (*Scomber japonicus*, 1.0%, 59.2 kg) (Table 2).

Length structure

Fork length ranged from 11 to 54 cm, with no individuals recorded in the 51 or 53 cm sized classes. Length distribution was multimodal, with main mode at 23 cm FL and secondary modes at 15 and 33 cm (Figure 5). Jack mackerel specimens averaged 324.4 g in weight and 28.5 cm in length, while the proportion of individuals below the minimum legal size (< 26.0 cm FL) accounted for 46.9% of total sampled numbers.

Stratification of size structure in fishing hauls

A distinct longitudinal (east-west) size stratification was identified, characterized by a higher frequency of smaller specimens in the offshore spawning grounds (Figure 6). Based on this spatial pattern, the study area was partitioned into four geographic regions:

- Northern coastal sector (zones 2 and 3), coastal area between 1 and 5 nm, from Iquique to SW of Mejillones, was characterized by large specimens ranging from 26 to 52 cm, with a main mode in the 35-37 cm range. Notably, no juvenile individuals (< 26 cm FL) were recorded in this region.
- Central coastal sector (zones 4 and 6), area situated between SW Antofagasta and Huasco, within the first 10 nm, showed a main mode of 33 cm and a secondary mode of 15 cm, with a mean size of 28.9 cm. This area showed 24.7% of specimens smaller than 26 cm.
- Oceanic sector (zone 5), region located beyond 25 nm from the coast, exhibited a unimodal size distribution, characterized by a dominant mode at 22-23 cm and specimens between 20 and 29 cm, where the average size was 23.0 cm. This sector presented 91.8% juvenile specimens.
- Southern coastal sector (zones 7 and 8), this very coastal area, located between Coquimbo and Valparaíso, in the first 4 nm of the coast, characterized by a dominant mode at 23-24 cm and specimens between 21 and 37 cm, where the average size was 23.7 cm. This area contained 90.2% juvenile individuals.

Table 2. Catch composition by weight and geographical position of identification hauls.

				Catches per Haul (kg)					
Haul	Date	Mid Lat	Mid Lon	Jack Mackerel	Anchovy	Jumbo Squid	Chub Mackerel	Other	Total (kg)
1	19/03/2026	33°00,0'S	71°40,9'W	1.0	4.9				5.9
2	20/03/2026	32°40,5'S	71°29,4'W	25.8	25.9			0.1	51.8
3	21/03/2026	32°23,0'S	71°31,3'W	0.3	0.6			0.1	1.1
4	26/03/2026	30°12,0'S	71°37,5'W	469.2					469.2
5	26/03/2026	30°05,4'S	71°25,0'W	397.9				4.7	402.6
6	27/03/2026	29°52,3'S	71°22,1'W	0.1	58.1				58.2
7	29/03/2026	28°43,4'S	71°22,5'W	2.2	4.5	60.0			66.7
8	30/03/2026	28°24,2'S	71°13,3'W	55.1	6.3		2.3	8.9	72.8
9	01/04/2026	27°36,3'S	70°57,3'W		0.2			8.6	8.8
10	02/04/2026	27°26,5'S	70°57,0'W					74.4	74.4
11	04/04/2026	26°44,8'S	71°57,9'W	308.6					308.6
12	06/04/2026	25°58,6'S	72°32,2'W						
13	06/04/2026	25°54,0'S	71°59,8'W	121.7		1.3		42.1	165.1
14	07/04/2026	25°40,1'S	70°42,6'W	116.4			24.3	1.6	142.3
15	08/04/2026	25°29,6'S	71°33,1'W	14.7					14.7
16	09/04/2026	25°04,1'S	71°26,4'W	6.9				2.2	9.1
17	09/04/2026	25°22,0'S	70°29,7'W	48.6				24.4	73.0
18	10/04/2026	24°38,5'S	70°35,5'W						
19	10/04/2026	24°39,5'S	72°03,5'W	14.4		11.5	0.6		26.5
20	11/04/2026	24°16,7'S	70°33,1'W	101.1					101.1
21	12/04/2026	24°23,2'S	70°34,7'W	114.6					114.6
22	13/04/2026	23°24,6'S	72°10,1'W					0.2	0.2
23	13/04/2026	23°25,5'S	70°37,8'W	296.0			6.0		302.0
24	14/04/2026	23°15,8'S	70°37,3'W	41.5					41.5
25	14/04/2026	22°57,8'S	71°13,6'W			1.7		12.4	14.1
26	16/04/2026	22°41,1'S	70°18,2'W		1.1			7.0	8.0
27	16/04/2026	22°10,0'S	70°17,2'W		1.9		8.0	9.6	19.5
28	17//04/2026	21°45,9'S	70°10,4'W	3000.9				18.3	3019.2
29	17/04/2026	21°57,9'S	70°12,1'W	267.4		23.0	16.0	7.0	313.4
30	18/04/2026	21°36,7'S	70°08,5'W	41.7					41.7
31	19/04/2026	21°06,9'S	70°09,7'W	6.4	15.4		1.5	27.5	50.9
32	21/04/2026	20°05,3'S	70°09,0'W	9.8	88.9			2.2	100.9
33	24/04/2026	18°40,2'S	70°21,5'W					18.1	18.1
34	25/04/2026	19°02,7'S	70°19,8'W	0.0			0.4	25.7	26.1
35	25/04/2026	20°35,5'S	70°14,0'W	88.2				10.7	99.0
			Total	5550.7	207.8	97.6	59.2	305.7	6221.0

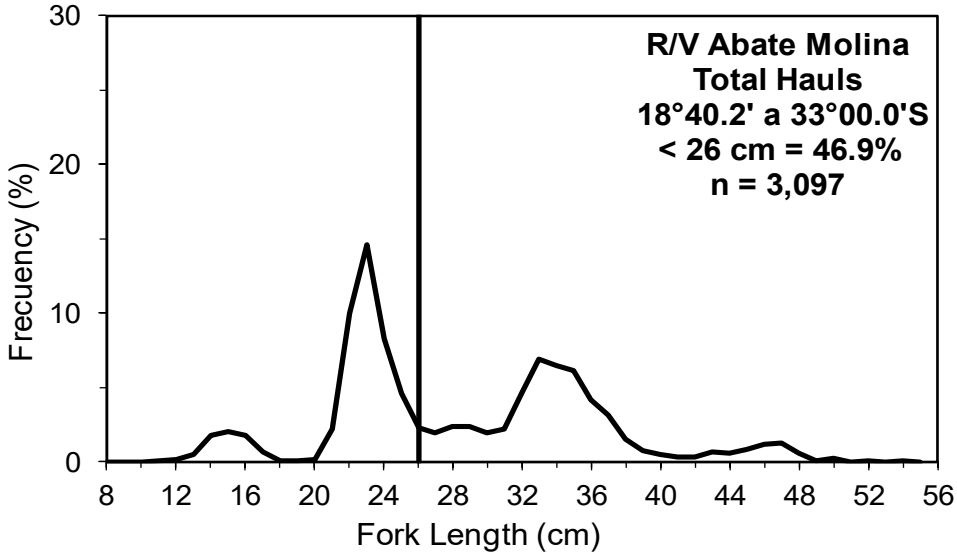

Figure 5. Frequency distribution of fork lengths (cm) of jack mackerel, for prospected area.

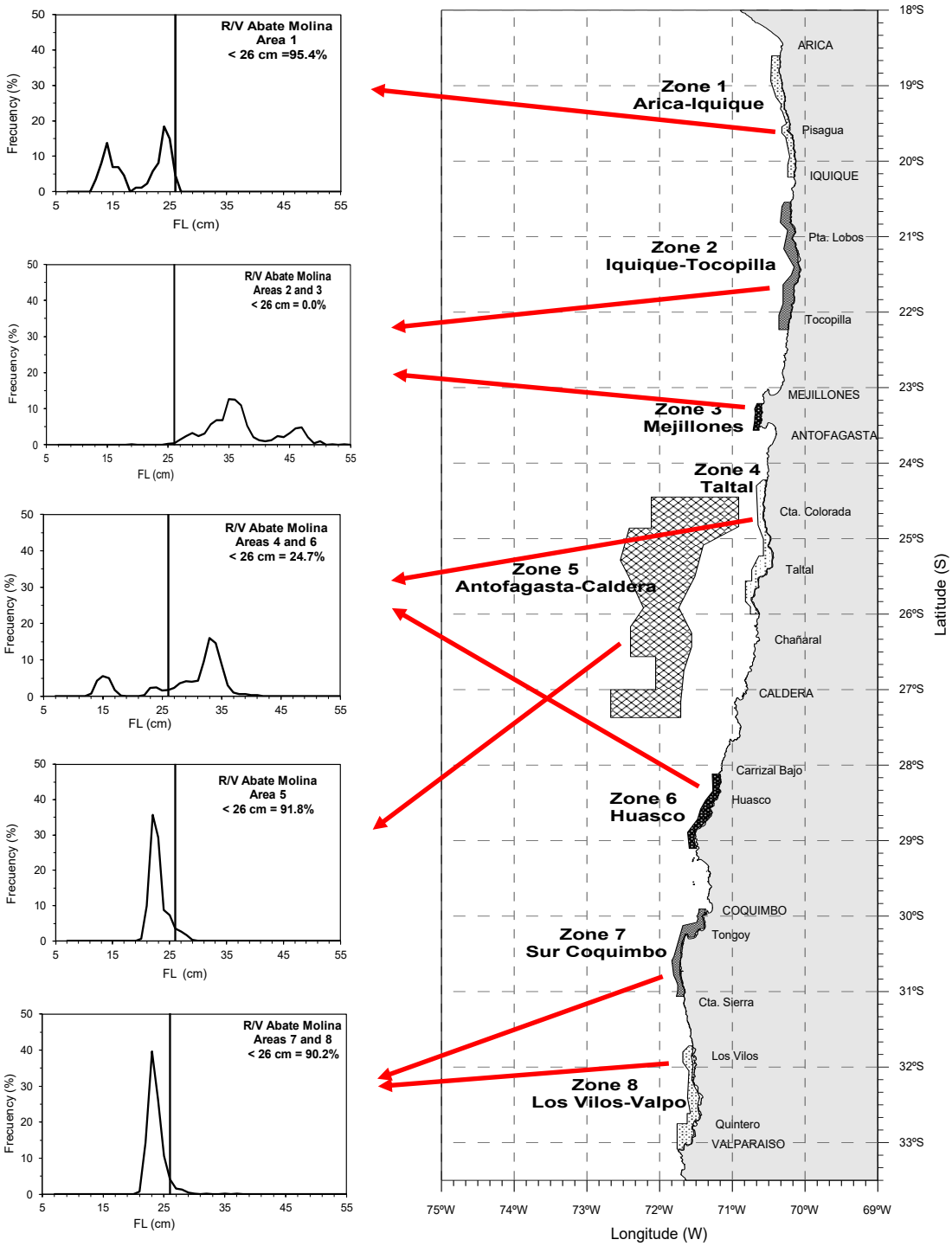

Figure 6. Size structures for jack mackerel for the assessment areas.

DISCUSSION

From 2023 to 2025, *T. murphyi* displayed a clear longitudinal stratification in size structure, with larger specimens being more prevalent in the coastal zone (first 20 nm off the coast), whereas juvenile individuals were concentrated in oceanic waters. This baseline structure reflects the established life-history paradigm for jack mackerel off Chile, where offshore oceanic spawning grounds host young recruits that progressively migrate toward coastal feeding zones as they mature (Córdova *et al*. 2024; Catasti *et al*. 2024) .

However, in 2026 the spatial dynamic of jack mackerel changed significantly due to the large influx of juvenile individuals appearing in coastal areas. Specifically, massive numbers of juvenile individuals (23-24 cm FL) were reported in a very coastal zone located between Coquimbo and Valparaíso (4 nm off the coast), where 90.2% individuals where below minimum legal size (Figure 6). This influx drove a dramatic shift in stock demography, increasing the juvenile proportion of total biomass from 14% (2025) to 55% (2026) (Catasti *et al*., 2026).

This spatial pattern may be associated with the oceanographic conditions observed during the survey period. Nearshore juvenile expansion (or increase juvenile proportion) is a well documented response of pelagic resources to El Niño warming events in the South Eastern Pacific. Following the severe 1997-1998 El Niño, significant changes were recorded in the Chilean jack mackerel fishery, with a widespread displacement of juvenile cohorts into coastal fishing grounds (Arcos *et al*., 2001 and 2004; Córdova *et al*., 2002). Similarly, in 1998, following the El Niño event, Córdova *et al*. (2001) showed that specimens smaller than 26 cm reached 79.5% of total abundance. This pattern was also recorded in the catches of the Soviet fleet off Peru between 1987 and 1988 (El Niño years), when no specimens larger than 29 cm were caught (Córdova *et al*., 2002).

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