

14th MEETING OF THE SCIENTIFIC COMMITTEE

7 to 12 September 2026, Tórshavn, Faroe Islands

SC14 - JM 16

**Spatiotemporal Dynamics of the Chilean Jack Mackerel Fishery off
Central-Southern Chile During 2020–2026**

Chile

Spatiotemporal Dynamics of the Chilean Jack Mackerel Fishery off Central-Southern Chile During 2020–2026

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Abstract

The industrial Chilean jack mackerel (*Trachurus murphyi*) fishery off central-southern Chile underwent substantial changes in its spatial distribution, size structure, and fishing performance during the 2020–2026 period.

For most of the study period, fishing activity displayed a remarkably coastal and relatively stable distribution, concentrated primarily between Valparaíso and Mocha Island and within 60 nautical miles (nm) from the coast. This pattern contrasts with that observed during previous decades. The size composition of the catches was dominated by adult fish, particularly individuals measuring 30–39 cm fork length (FL), which represented the principal component of the catches during summer and autumn. However, beginning in 2022, the seasonal decline of this size group occurred progressively earlier each year, suggesting changes in resource availability and a gradual northward displacement of fishing operations.

During 2024, and especially in 2025, the fishery expanded both latitudinally and offshore, extending into waters off the Coquimbo and Atacama regions and reaching approximately 150 nm from the coast. This expansion coincided with a marked reduction in the availability of commercially exploitable schools within the traditional fishing grounds of central-southern Chile and with a progressive decline in catch rates.

The first four months of 2026 represented a particularly critical period for the fishery, characterised by a sharp decrease in landings and catch rates, together with an increased occurrence of juvenile fish (<26 cm FL), a condition not recorded since 2015. Although mitigation measures—including move-on strategies and extensive coastal and offshore exploratory surveys—allowed the fleet to maintain fishing operations, catches remained well below those recorded in previous years.

Overall, the results indicate a recent shift in the spatiotemporal dynamics of *Trachurus murphyi* off central-southern Chile, possibly associated with changes in stock availability and/or environmental variability. Whether the conditions observed during 2026 represent an intensification of the progressively earlier departure of adult schools from the fishing grounds or a response of the stock to recent environmental anomalies remains unresolved. Regardless of the underlying mechanism, these changes have important implications for fishery management, operational planning, and the sustainable exploitation of this resource.

Biological and Fishery Background of the *Trachurus murphyi* Fishery (2020–2026)

Landings and Fishing Yield

At the monthly scale, industrial landings of *Trachurus murphyi* between 2020 and 2026 (through July) exhibited a marked seasonal pattern, characterized by minimum values during spring. These low landings were associated with a reduced presence of schools within the fishing grounds because of spawning migration.

By late spring (December), *T. murphyi* schools consistently returned from the spawning grounds to the fishing area, marking the beginning of a new fishing season. Notably, during 2024 and 2025 this return occurred earlier than usual, beginning in October.

Between January and April of the 2023–2025 period, monthly industrial landings exceeded 80,000 tonnes (Figure 1). Thereafter, landings gradually declined, with a more pronounced decrease during winter, reaching values close to zero by early spring.

In particular, 2025 recorded the highest landings of the entire 2020–2026 time series during January and March. The reduction observed in February resulted from fleet management measures rather than from a decrease in fishing performance. From January through July 2025, the seasonal pattern remained consistent with that observed since 2020 (Figure 1).

During the first half of 2026, industrial landings showed a substantial deficit compared with the same period of previous years (Figure 2), reaching reductions of up to 95% in May. It should be noted, however, that a decline in landings had already been observed in April 2025, intensifying during May and occurring approximately one month earlier than in 2024. Under these circumstances, fishing operations shifted their search strategy toward more northern areas of south-central Chile (Figure 5), allowing a partial recovery of landings during June. In contrast, a similar recovery did not occur in 2026. Instead, fishing activity experienced a significant rebound only after 20 June, resulting in the highest monthly landings of the year during July, which exceeded those recorded in July 2025 by approximately 115%.

Monthly fishing yield, expressed as the ratio between catch and searching effort (Figure 3), closely followed the trend observed for landings. Fishing performance declined markedly between March and May 2026 compared with previous years but recovered substantially during July, reaching values comparable to those observed in July 2021.

Between February and June 2026, at least eight fishing ground search strategies were implemented by the purse-seine fleet operating from the Biobío Region. These exploratory operations, conducted in both coastal and offshore waters, were designed jointly by the skippers and fleet managers, with technical support provided by INPESCA (Figure 4). Although these efforts enabled the fleet to maintain fishing operations during certain periods, they were insufficient to restore the fishing conditions observed in previous years. Only after 20 June did fishing activity recover significantly, leading to a marked increase in *T. murphyi* landings.

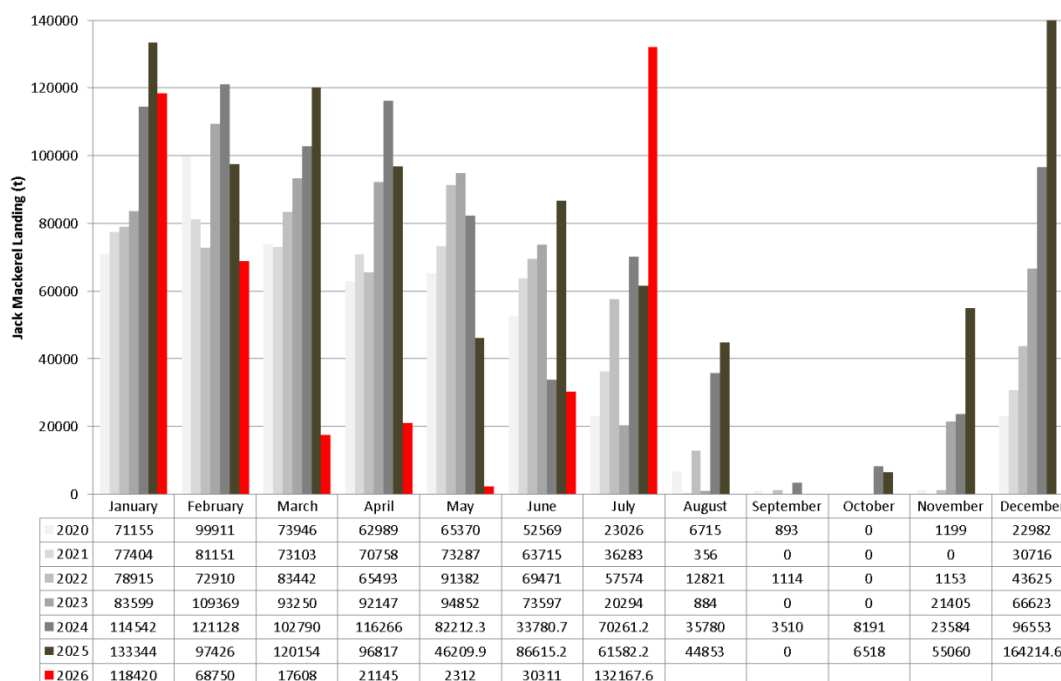


Figure 1. Monthly landings (t) of *Trachurus murphyi* by the industrial purse-seine fleet operating off south-central Chile, 2020–2025 (through April). Source: Chilean National Fisheries and Aquaculture Service (SERNAPESCA).

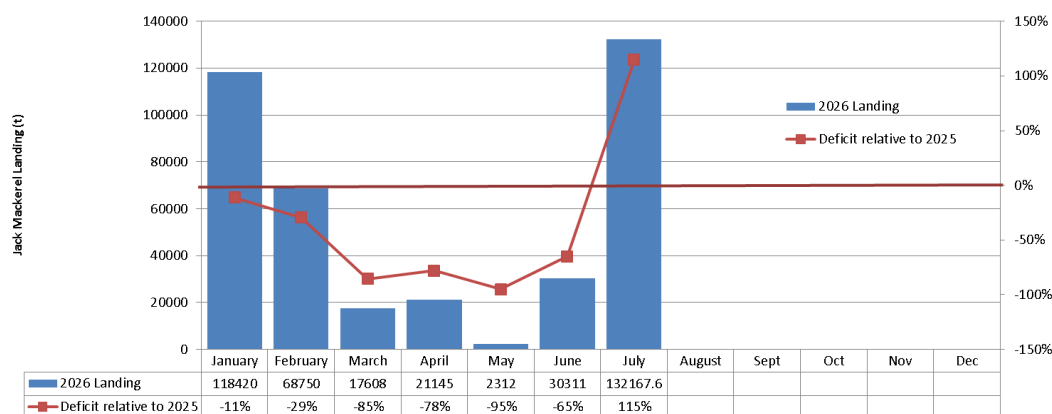


Figure 2. Monthly landings (t) of *Trachurus murphyi* by the industrial purse-seine fleet operating off south-central Chile during 2026 (through July), and percentage deficit relative to the corresponding monthly landings recorded in 2025. Source: SERNAPESCA.

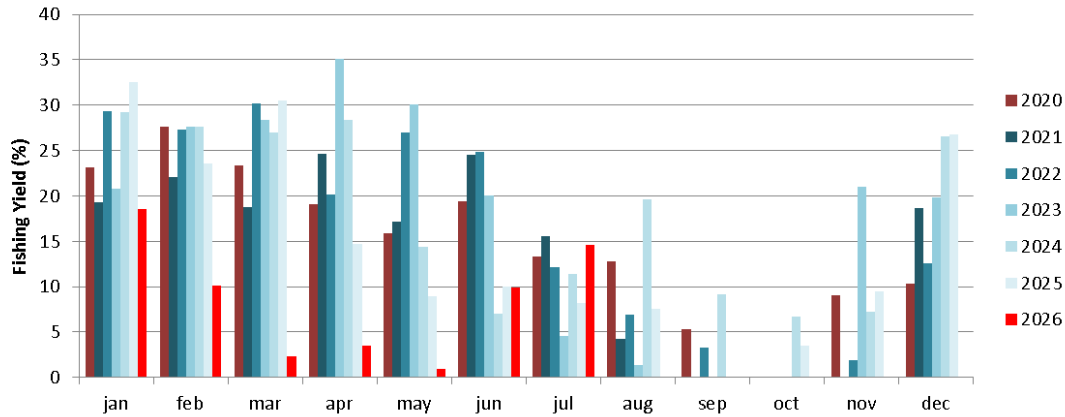


Figure 3. Monthly fishing yield of the industrial purse-seine fleet operating off south-central Chile targeting *Trachurus murphyi* from 2020 to 2026 (through April). Fishing performance was estimated as the ratio between catch divided by hold capacity multiplied by days at sea. Source of monthly catch based on SERNAPESCA data.

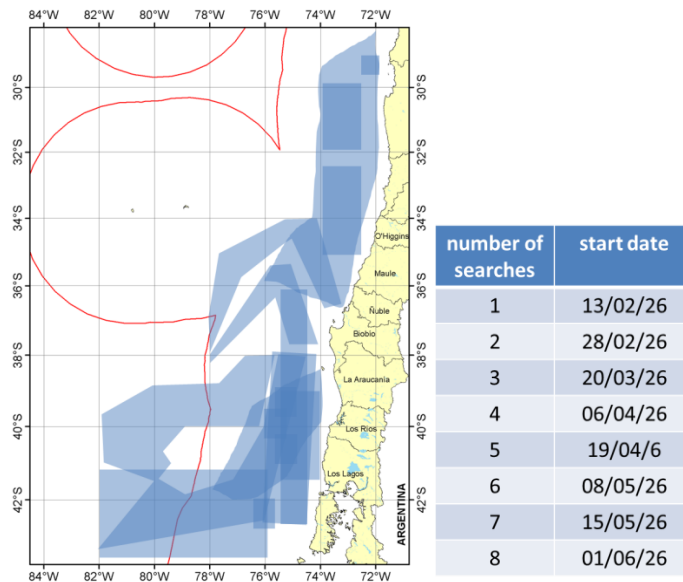


Figure 4. Cumulative spatial distribution of exploratory fishing operations conducted by the Biobío Region industrial purse-seine fleet in the southeastern Pacific during 2026.

Monthly spatial distribution of fishing operations during 2020–2026

Overall, the jack mackerel fishery exhibited marked spatial and seasonal variability throughout the study period (Figure 5). Nevertheless, the principal fishing grounds remained consistently located between the Biobío Region and the northern Los Lagos Region, mainly along the continental shelf edge and within 60 nautical miles (nm) from the coast. An exception to this pattern occurred between May and July 2025, when fishing operations expanded well beyond this limit, reaching distances of up to 150 nm offshore, particularly during June.

During the 2020–2024 period, fishing sets were concentrated primarily between Valparaíso and Mocha Island, maintaining a relatively stable operational core off the Maule, Ñuble, and Biobío regions. The spatial distribution of fishing sets also exhibited a seasonal latitudinal pattern, in which fishing activity shifted between coastal and offshore areas according to the time of year, suggesting that the operational dynamics of the fleet were strongly influenced by the spatial availability of the resource.

Beginning in 2025, a marked shift in this spatial pattern was observed. Fishing activity expanded considerably toward more northern latitudes, particularly north of Valparaíso, incorporating offshore fishing grounds off the Coquimbo and Atacama regions.

Among the most relevant interannual patterns, the spatial distribution of fishing sets remained relatively stable between 2020 and 2023, being concentrated within a continuous corridor extending approximately from 35°S to 40°S. During this period, fishing operations predominated off the Biobío and La Araucanía regions, with occasional northward shifts during specific months.

Subsequently, during 2024 and 2025, the fishery underwent a pronounced northward latitudinal expansion, with recurrent fishing operations off the Coquimbo and Atacama regions, although fishing activity continued within the traditional fishing grounds of south-central Chile.

This fleet behavior was unusual compared with previous years, both in terms of the location of fishing operations and the prolonged duration of their presence in northern Chile. The main reason was the absence of commercially exploitable jack mackerel schools within the historical fishing grounds of south-central Chile. Despite numerous exploratory surveys conducted over different search grids, no positive results were obtained until mid-July 2025, when commercial schools were detected west of La Araucanía Region. This finding allowed the fleet to progressively return to its traditional fishing grounds after experiencing a substantial decline in fishing yields off the Atacama Region.

During 2026, a different pattern of spatial redistribution was observed. Beginning in January, the fleet progressively shifted from the O'Higgins and Maule regions toward the southern Biobío Region, reaching the northern Los Ríos Region by March. This displacement was primarily driven by a fishing strategy aimed at avoiding areas with high concentrations of juvenile *Trachurus murphyi* while targeting adult schools. During April and May, the low availability of commercially exploitable adult jack mackerel substantially reduced fishing activity. However, conditions began to improve in late June, when continuous fishing operations resumed off the Los Ríos and Los Lagos regions. By July, fishing activity had once again expanded over a broad geographic area, extending from the Biobío Region to the southernmost part of the Los Lagos Region (Figure 6).

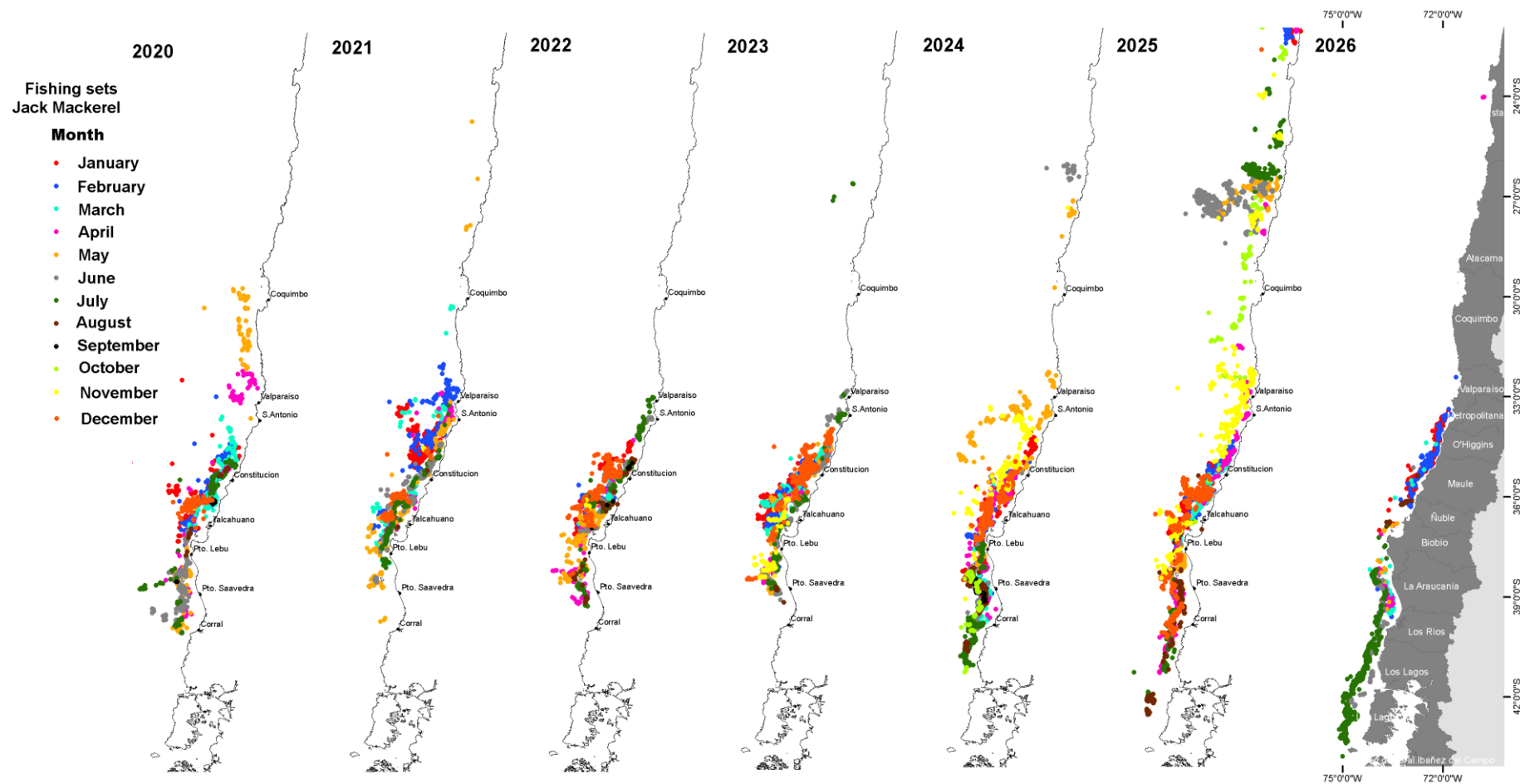


Figure 5. Spatiotemporal distribution of *Trachurus murphyi* fishing sets recorded by the Chilean industrial fleet during 2026 (through July). Source: INPESCA.

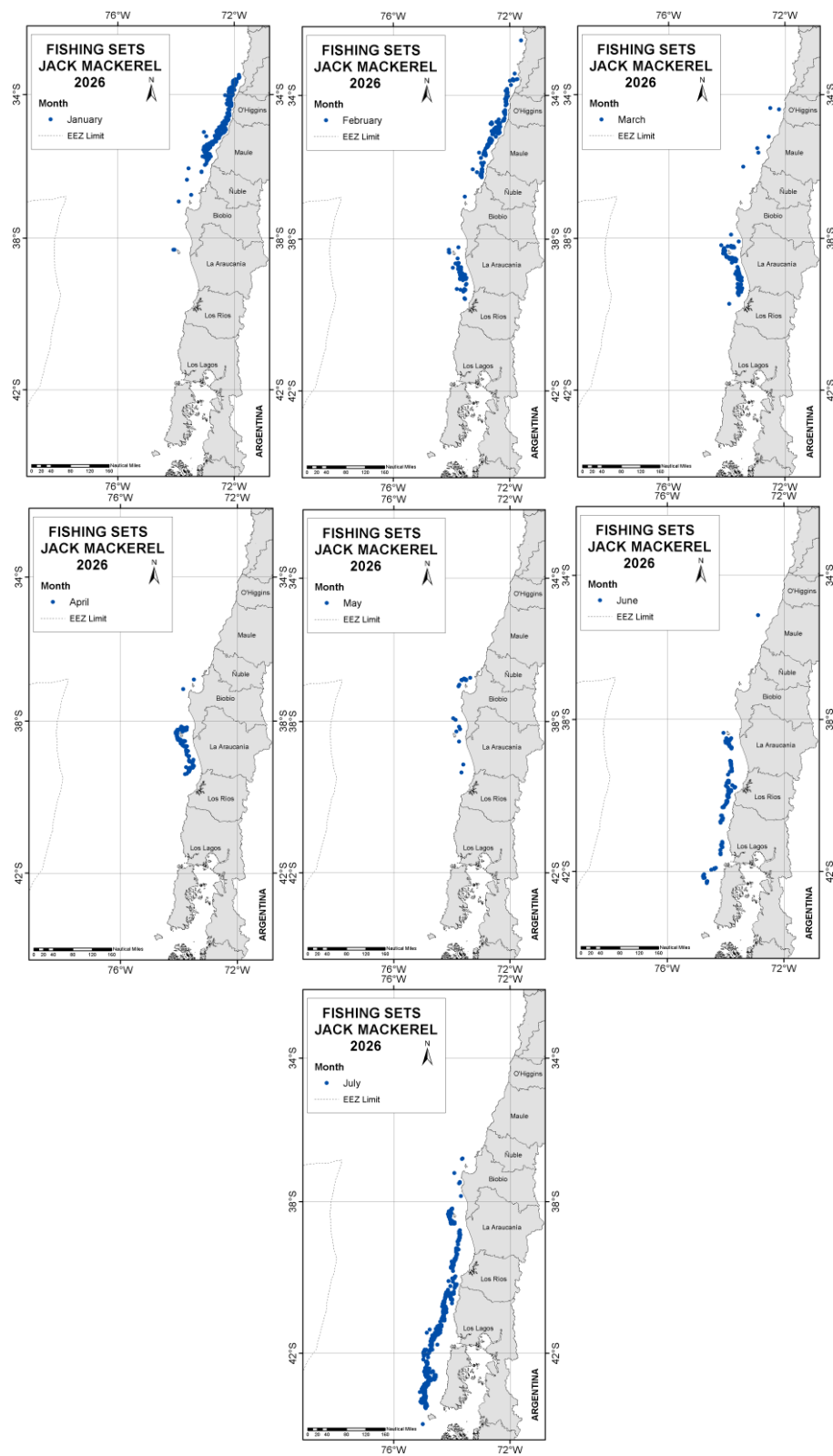


Figure 6. Monthly spatiotemporal distribution of *Trachurus murphyi* fishing sets recorded by the Chilean industrial fleet from January to July 2026 (Source: INPESCA).

Monthly size structure (2020–2026)

The Instituto de Investigación Pesquera (INPESCA) conducts continuous biological monitoring of the industrial *Trachurus murphyi* fishery through both sampling at landing sites and scientific observers deployed aboard purse-seine vessels, who collect biological information directly in the fishing grounds. This long-term monitoring program has generated a comprehensive biological database for analyzing the population size structure of the resource.

For the study period (2020–2026), annual size-frequency distributions of *Trachurus murphyi*, expanded to the total catch, were estimated (Figure 7). Throughout most of the study period, the population was dominated by adult individuals. A substantial contribution of juveniles below the minimum legal size (<26 cm fork length, FL) was only observed during 2026, representing 6.2% of all fish sampled through July.

However, although this value indicates a relatively low proportion of juveniles in the cumulative landings during the first semester of 2026, it does not fully reflect the degree of juvenile dominance experienced by the fishery during that year. This is largely explained by the intensive implementation of the Best Fishing Practices Manual, developed in 2020, which introduced mitigation measures specifically aimed at reducing juvenile catches. These measures included move-on procedures, exploratory surveys in both coastal and offshore fishing grounds, relocation of fishing operations toward areas dominated by adult fish, and temporary reductions in fishing effort through voluntary fleet stoppages lasting from several days to weeks. Consequently, the actual magnitude of juvenile occurrence could not be fully quantified from the observed landings. Nevertheless, beginning in February 2026, individual fishing sets composed entirely of juvenile fish (up to 100%) were recorded, and this situation intensified during March, April, and May (Figure 8).

A clear modal progression in the size structure was observed throughout the study period (Figure 7). In 2020, the dominant modal group was centered at 27 cm FL and progressively increased in size, reaching 36 cm FL by 2023. Subsequently, a new dominant cohort appeared during 2024, with a modal length close to 30 cm FL, and continued growing until early 2026, reaching approximately 35 cm FL. At the same time, a new modal group centered at 24 cm FL emerged during 2026, corresponding to juvenile fish. It is noteworthy that such a significant recruitment of juveniles into the south-central Chile fishery had not been observed since 2015.

The 30–39 cm FL size class represented the principal component of the jack mackerel catches throughout the 2020–2026 period (Figure 9b), generally accounting for more than 50% of the catch during summer and autumn. However, marked interannual differences were observed in the seasonal persistence of this size class. During recent years (2024–2025), it dominated catches during the first semester but declined abruptly during winter.

This pattern appears to be associated with a temporal shift in resource availability linked to changes in the spatial distribution of jack mackerel, which resulted in a progressive northward displacement of fishing operations during 2025–2026 (Figure 5). In this context, the seasonal decline of the 30–39 cm FL size class occurred progressively earlier over time: in June during 2022, in May during both 2023 and 2024, and as early as April in 2025. This

shift forced the fleet to progressively relocate fishing operations north of the O'Higgins Region during the last two years (Figure 5).

Conversely, the seasonal decline of the 30–39 cm FL size class coincided with an increased contribution of the 40–49 cm FL and 50–59 cm FL size classes (Figures 9c and 9d), suggesting either temporal size segregation or a sequential availability of different size groups to the fishery. The size distributions observed during June and July 2026 further support this pattern.

From a spatial perspective (Figure 10), modal groups smaller than 39 cm FL were predominantly distributed north of the Biobío Region, whereas modal groups of 40 cm FL or larger were concentrated from southern Biobío to the southernmost part of the Los Lagos Region.

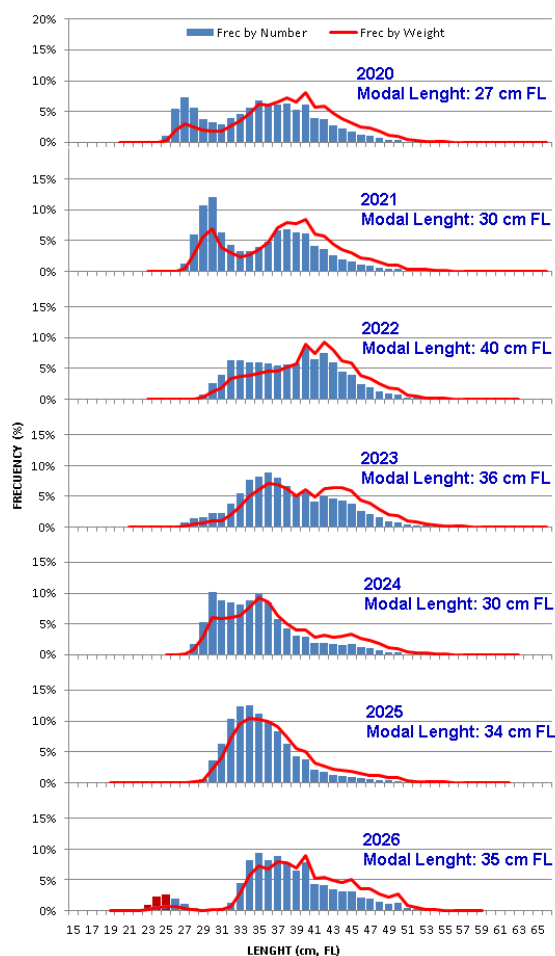


Figure 7. Annual size-frequency distributions of *Trachurus murphyi* in catches of the Chilean industrial fleet during the 2020–2026 period (Source: INPESCA).

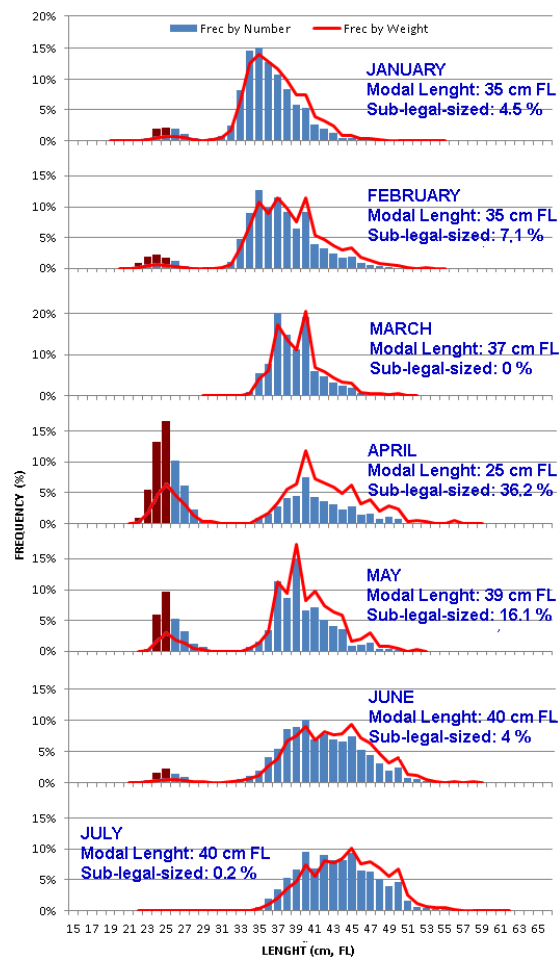


Figure 8. Monthly length-frequency distributions of *Trachurus murphyi* in catches of the Chilean industrial fleet during 2026 (through July) (Source: INPESCA).

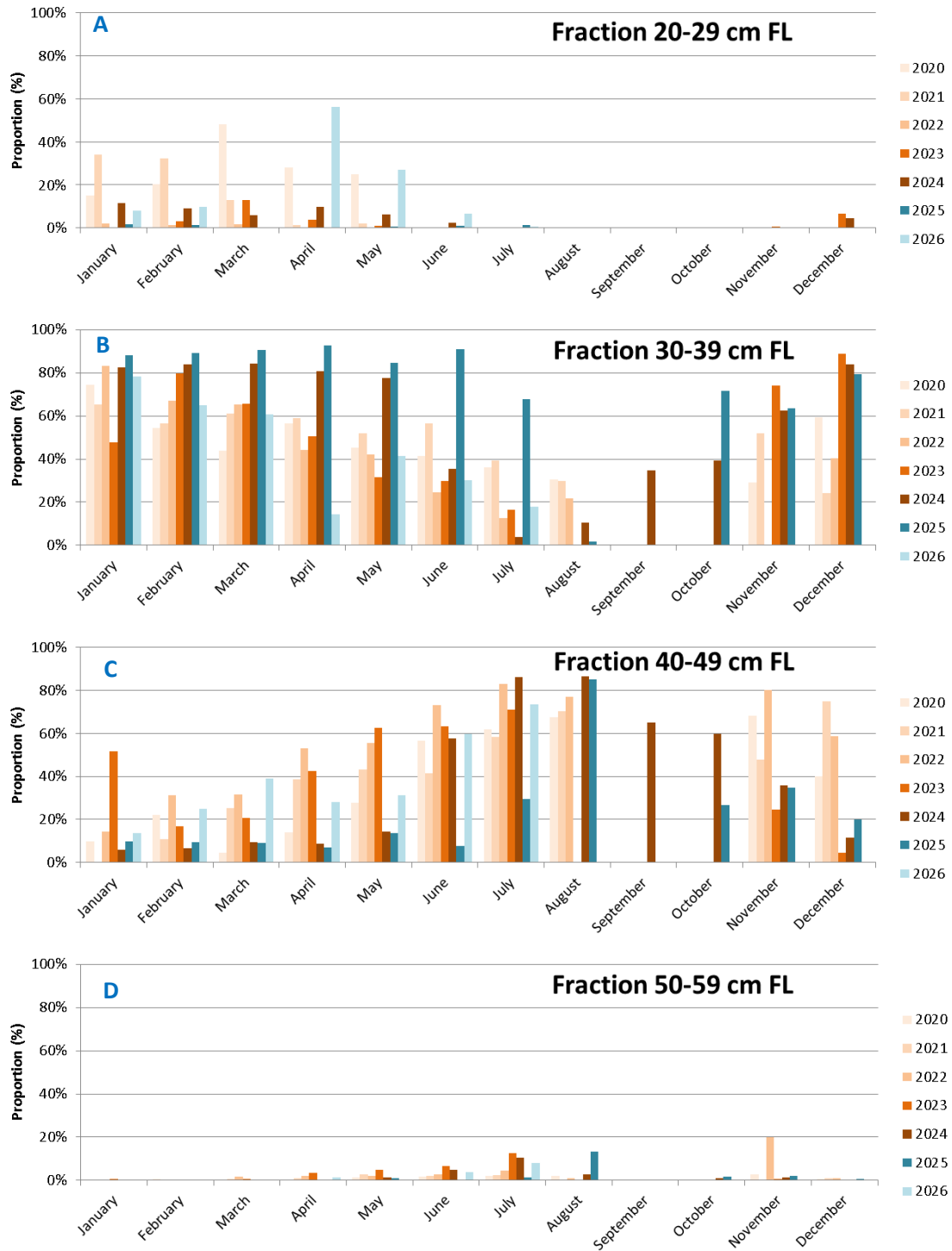


Figure 9. Proportion of size groups present in annual *T. murphyi* catches for the period 2020–2026 (Source: Inpesca)

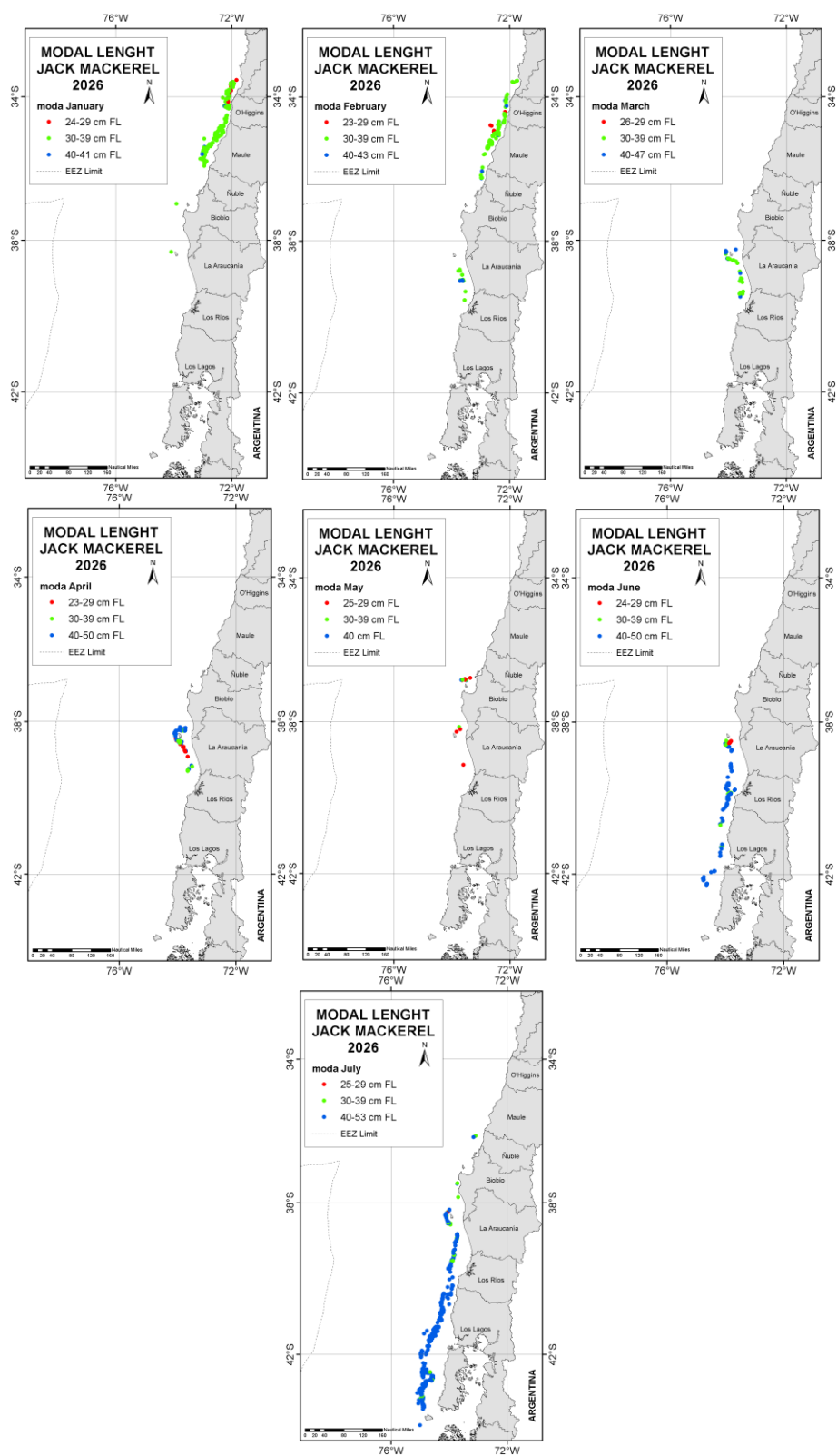


Figure 10. Spatio-temporal distribution of modal groups (cm, FL) recorded in monthly *T. murphyi* fishing hauls by the Chilean fleet during 2026 (January to July) (Source: Inpesca)

Discussion and Conclusions

During the 2020–2025 study period, the *Trachurus murphyi* fishery exhibited an exceptionally coastal spatial distribution compared with that observed over the previous four decades. Fishing operations were conducted predominantly within 60 nautical miles (nm) of the Chilean coast. Likewise, jack mackerel biomass assessments carried out by the Chilean Fisheries Development Institute (IFOP) over part of this period, extending to 200 nm offshore (Córdova *et al.*, 2020; Córdova *et al.*, 2021), indicated a low abundance of the resource beyond the 60-nm limit, supporting the predominance of commercial schools within the coastal zone.

During the same period, the Chilean industrial fleet independently conducted exploratory surveys in offshore waters around 100 nm from the coast; however, these efforts were unsuccessful, and fishing activity remained predominantly coastal. Similarly, the international fleet operating under the South Pacific Regional Fisheries Management Organisation (SPRFMO), outside the Exclusive Economic Zones of Chile and Peru, carried out exploratory fishing operations off central-southern Chile during April 2023 and May and July 2024, reaching approximately 88°W, 44°S in 2023 (Global Fishing Watch, 2023) and 86°W, 46°S in 2024 (SC13 – Doc. 30, 2025). These operations also failed to detect commercially exploitable aggregations of jack mackerel in historical fishing grounds that had been important during the previous decade.

This predominantly coastal distribution pattern changed markedly during 2024 and 2025. In May 2024, and again between May and July 2025, the fleet expanded its fishing operations to approximately 150 nm offshore. This unusual behaviour coincided with a northward displacement of fishing activities and with a marked reduction in the availability of commercial schools south of the O'Higgins Region, suggesting a latitudinal shift in the exploitable fraction of the stock toward northern waters.

Fishing yields also exhibited an earlier-than-usual decline during these years, beginning in May 2024 and even earlier, in April, during 2025. This pattern coincided with the northward displacement of schools dominated by the historically abundant 30–39 cm fork length (FL) size group from the central-southern fishing grounds, followed by a progressive decline in their availability during the subsequent months. An exception occurred in August 2024, when the temporary availability of schools composed primarily of fish measuring 40–49 cm FL off the ports of Coronel and San Vicente resulted in a short-term recovery of landings. Overall, the magnitude of the decline in fishing yields observed during 2024–2025 was substantially greater than that recorded between 2020 and 2023.

The results obtained during the first half of 2026 indicate an especially critical situation for the fishery. Landings and catch rates declined abruptly from February onward, continuing to decrease until May. This situation coincided with a pronounced reduction in the availability of adult schools (≥ 30 cm FL), a pattern that intensified between March and May. Simultaneously, the occurrence of juvenile fish (< 26 cm FL), first detected in January, increased progressively throughout April and May, eventually extending across a large proportion of the historical coastal fishing grounds of central-southern Chile.

To address this situation, the fishing fleet, with technical support from the Fisheries Research Institute (INPESCA) in designing search strategies, conducted eight systematic exploratory surveys, in addition to its routine exploratory fishing operations in both coastal and offshore areas. Despite these efforts, no commercially significant aggregations of jack mackerel were detected. The resource was only found within approximately 5 nm of the coast, in spatially restricted areas such as the vicinity of Mocha Island and the Gulf of Arauco.

In contrast to the low availability observed during the first half of the year, July 2026 was characterised by an exceptionally high availability of *Trachurus murphyi* extending from Mocha Island to southern Chiloé Island. This represented the broadest spatial distribution recorded during the entire 2020–2026 time series and resulted in a substantial recovery of landings, making July the third most productive month of the study period.

Finally, it remains unclear whether the changes observed during the first half of 2026 represent a continuation of the progressive advance in the seasonal departure of the dominant 30–39 cm FL schools from the central-southern fishing grounds, as documented in recent years (González et al., 2025). Unlike previous years, however, there is currently no evidence that these schools shifted northward. Alternatively, these changes may reflect a response of the stock to the environmental variability observed during recent years, including the development of a Coastal El Niño event (ENFEN Report No. 06–2026). Regardless of the underlying mechanism, the recent changes in the spatial and temporal dynamics of the fishery already have important implications for fishing operations and production planning.

Overall, the evidence presented indicates that the spatial and temporal dynamics of the Chilean jack mackerel fishery during 2024–2026 differed substantially from those observed at the beginning of the study period. Determining whether these changes represent a temporary response to environmental variability or the onset of a new distributional pattern of the stock remains one of the major scientific questions for future monitoring. Continued integration of fishery-dependent, biological and oceanographic information will therefore be essential for improving our understanding of the processes regulating the spatial availability of *Trachurus murphyi* to the industrial fishing fleet.

A particularly relevant aspect is that the changes observed during 2024–2026 reflect not only shifts in the resource's spatial distribution but also changes in the size composition available to the fishery. The progressive decline of the historically dominant 30–39 cm LH size class and the relative increase in juvenile specimens in coastal areas may indicate changes in the population structure available to the fleet—a factor that will require careful monitoring during upcoming fishing seasons.

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