SPRFMO
South Pacific Regional Fisheries Management Organisation

14th MEETING OF THE SCIENTIFIC COMMITTEE

7 to 12 September 2026, Tórshavn, Faroe Islands

SC14 - Doc 28
Annual Report of Peru to the Scientific Committee (ANJ)

Peru

SPRFMO
South Pacific Regional Fisheries Management Organisation

14th MEETING OF THE SCIENTIFIC COMMITTEE
07 - 12 September 2026, Tórshavn, Faroe Islands

Peru National Report No. 2

National report on the situation of the Peruvian stock of jack mackerel (Far-North Stock) and the Peruvian fishery in national jurisdictional waters, period January 2025 – June 2026

Peru

14th MEETING OF THE SCIENTIFIC COMMITTEE

07 - 12 September 2026, Tórshavn, Faroe Islands

Peru National Report No. 2

NATIONAL REPORT ON THE SITUATION OF THE PERUVIAN STOCK OF JACK MACKEREL (FAR-NORTH STOCK) AND THE PERUVIAN FISHERY IN NATIONAL JURISDICTIONAL WATERS, PERIOD JANUARY 2025 – JUNE 2026

by

IMARPE - PRODUCE

This report contains information on the jack mackerel fish stock and fishery in Peruvian jurisdictional waters that, we reiterate, the delegation of Peru, in use of its discretionary powers, voluntarily provides for the purpose of information and support to the scientific research work within the Scientific Committee of the SPRFMO. In doing so, while referring to Article 5 of the Convention on the Conservation and Management of High Seas Fishery Resources in the South Pacific Ocean and reiterating that Peru has not given the express consent contemplated in Article 20 (4) (a) (iii) of the Convention, Peru reaffirms that the decisions and conservation and management measures adopted by the SPRFMO Commission are not applicable within Peruvian jurisdictional waters.

2026

SUMMARY

The Peruvian marine environment is characterized by its high productivity and variability. It is particularly exposed to the effects of the opposed significantly warm (El Niño) and cold (La Niña) climatic patterns in the Pacific Ocean that alternate with relatively short periods of close to neutral conditions. Between 2013 and the first part of 2018, these changing environmental conditions caused a more dispersed distribution, reduced availability, lower abundance indexes, and consequently lower catches of Jack mackerel. This has been followed by an expanded distribution in denser concentrations farther offshore, much higher abundance indexes, increased availability to the industrial and artisanal purse seine fleet, and higher catches of Jack mackerel from the second half of 2018 to 2022. In 2023, a Coastal Niño event was registered along the Peruvian coast, which led to a concentration of Jack mackerel south of the Peruvian coast, making this resource more accessible. In 2024, the catches initially decreased for an initial dispersion of Jack mackerel schools; but when the environmental conditions cooled, Jack mackerel concentrated again south of the coast. During 2025, oceanographic conditions were generally characterized by the seasonal cycle, near-normal sea surface temperature (SST) anomalies, and relatively stable salinity. From February 2026 onward, SST increased progressively, and warmer waters expanded shoreward, generating positive temperature anomalies of up to +2 °C. These anomalies intensified from May onward, primarily within 100 nautical miles (nm) of the coast, accompanied by a marked shoreward displacement of the Subtropical Surface Waters. Between January 2025 and June 2026, the fishery targeted a wide range of sizes, with the highest proportions of juveniles in October 2025 (93%) and November 2025 (87%); during the first half of 2026, the highest proportion of juveniles in the fishery occurred in February (52%) and June (54%). The research surveys in 2025 and 2026 also found younger and smaller juveniles. In late December 2025, IMARPE (Instituto del Mar del Perú) updated the available 2025 Jack mackerel assessment made for the Peruvian (far-north) stock with the JJM model using the configuration agreed during the 13th meeting of the Scientific Committee (SC13). This resulted in a range of options for setting the 2026 TAC that was included in its advice to the Government, recommending three scenarios: (i) the corresponding to approximately 80% of the catch associated with the fishing mortality at maximum sustainable yield (TAC = 175 000 tons, the precautionary scenario), (ii) the corresponding to approximately 90% of the catch associated with the fishing mortality at maximum sustainable yield (TAC = 195 000 tons) and, (iii) the catch corresponding to the catch associated with the fishing mortality at maximum sustainable yield (TAC = 216 000 tons). Based on this advice, in December 2025, PRODUCE established a regulatory measure for the Jack mackerel (*Trachurus murphyi*) to be caught in Peruvian jurisdictional waters. For the large-scale or industrial fleet with a hold capacity greater than 32.6 m^3, the catch limit was set at 88 317 tons. For the artisanal fishing vessels and purse seine vessels with a hold capacity of less than 32.6 m3, the total limit was established at 86 683 tons, of which 34 427 tons were allocated for the January-April 2026 fishing period. Subsequently, the catch limit for the artisanal fleet for the same period was modified at 91 000 tons. For the May–August 2026 fishing period, an additional catch limit of 45 659 tonnes was established, increasing the allocation for artisanal fishing vessels using passive fishing gear (gillnets) and purse seine vessels with a hold capacity of less than 32.6 m^3. An updated assessment with the JJM model has been made by IMARPE based on the most recent information and data available up to June 2026. The recent observations and assessments confirm the increasing trend in the biomass estimates observed from 2016, nevertheless, the model projection for 2026 shows a decrease in its trend. Despite this, the Peruvian Jack mackerel stock is in an overall healthy situation based on the reference points.

TABLE OF CONTENTS

1. INTRODUCTION

This report updates the information provided by the Peruvian delegation during earlier meetings of the SPRFMO Science Working Group and the SPRFMO Scientific Committee (IMARPE-PRODUCE 2012, 2012a, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024 and 2025).

2. THE MARINE ENVIRONMENT

Variability of the Equatorial Pacific conditions over the last 12 months

In the equatorial Pacific (Figure 1), from July 2025 to early January 2026, easterly zonal wind stress anomalies prevailed over the central basin, approximately between 140° E and 140° W. At the same time, weak westerly wind stress anomalies were observed in the western sector, between 120° E and 140° E, and in the central and eastern sector, between 140° W and 90° W. The predominance of easterly anomalies favored the generation and eastward propagation of cold, or upwelling, Kelvin waves. Their signal was reflected in negative subsurface temperature and sea level anomalies, together with associated changes in equatorial geostrophic currents. These waves propagated eastward toward the eastern Pacific and the South American coast.

Between January and February 2026, westerly zonal wind stress anomalies developed over the western and central equatorial Pacific, mainly between 120° E and 170° W. This atmospheric forcing favored the generation of warm, downwelling Kelvin waves. These waves were reinforced by additional warm Kelvin waves generated through the reflection of warm Rossby waves in the western Pacific. However, weak easterly wind stress anomalies were also observed between 160° E and 150° W, although over a smaller area than during the previous period, favoring the generation of new weak cold Kelvin waves. Despite this alternation, the warm signal gradually became dominant, as indicated by increasing positive subsurface temperature and sea level anomalies, together with associated geostrophic current anomalies propagating toward the eastern Pacific and the South American coast.

Finally, between March and July 2026, westerly zonal wind stress anomalies intensified and expanded across the western and central equatorial Pacific, reaching 130° W. This atmospheric pattern favored the generation of stronger warm Kelvin waves than those observed during the previous period. At the same time, warm Kelvin waves associated with the reflection of warm Rossby waves in the western Pacific continued and propagated eastward. The combined effect of these signals led to a further increase in positive subsurface temperature and sea level anomalies, accompanied by strong westerly anomalies in equatorial geostrophic currents. The weaker or even reversed equatorial currents and downwelling Kelvin waves contributed to higher surface and sub-surface temperature anomalies in the central and eastern equatorial Pacific.

Indices of El Niño, sea-level pressure and local sea surface temperatures

The Oceanic Niño Index (ONI), which is based in the Niño 3.4 region sea surface temperature (SST) anomalies, indicated the development of the canonical 2023–2024 El Niño event in the equatorial Pacific from May 2023 to April 2024, after which ENSO-neutral conditions prevailed until early 2026, although ONI values remained predominantly negative. From April to June 2026, ONI values increased rapidly within the El Niño range, rising from approximately +0.5 °C to nearly +1.5 °C (Figure 2a). The Relative Oceanic Niño

Index (RONI; L'Heureux et al., 2024), which filters the influence of the long-term global warming signal on the estimation of SST anomalies in the Niño 3.4 region, adjusted the duration of the 2023-2024 El Niño from July 2023 to March 2024. According to the RONI, this warm event reached a maximum intensity of approximately +1.5 °C in November 2023, considerably lower than the ONI peak of approximately +2.2 °C recorded in December 2023. From July 2024 to March 2026, the RONI indicated La Niña conditions, with the strongest negative anomalies occurring in January and December 2025. Between March and May 2026, the RONI remained within the ENSO-neutral range but displayed a sustained upward trend, approaching the El Niño threshold by May 2026 (Figure 2b).

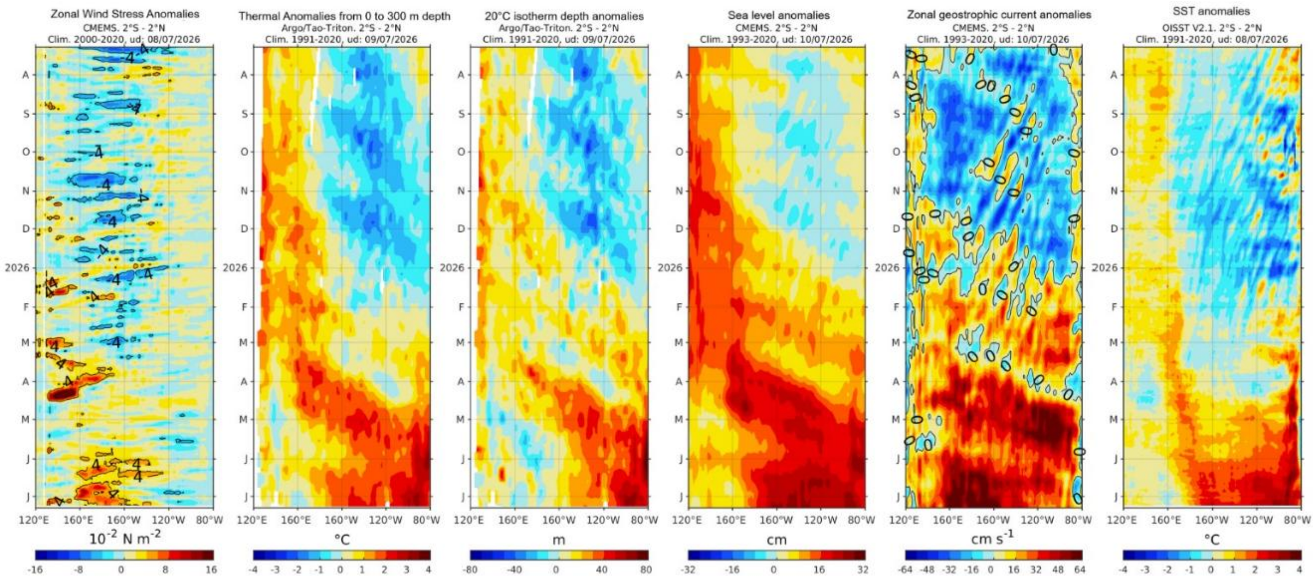


Figure 1. Hovmöller diagrams of: (a) wind stress anomalies; source: CMEMS; (b) mean temperature anomalies in the upper 300 m of the ocean; source: Argo; (c) anomalies of the depth of the 20 °C isotherm; source: Argo; (d) sea level anomalies between 2°N and 2°S (cm); source: CMEMS; (e) geostrophic current anomalies between 2°N and 2°S (cm s^{-1}); source: CMEMS; and (f) sea surface temperature (SST) anomalies; source: OISST v2.1.

In parallel, the Southern Oscillation Index (SOI) exhibited the predominance of neutral values from March 2023 to July 2024, although intermittent negative excursions reached the El Niño range in May, August–September 2023, and February 2024. From mid-2024 to March 2026, neutral conditions generally prevailed, with predominantly positive SOI values. Nevertheless, the index intermittently reached the La Niña range, particularly between October 2025 and March 2026. In April and May 2026, the SOI underwent a rapid transition toward negative values, characteristic of El Niño atmospheric conditions (Figure 2c).

The South Pacific Anticyclone Index (SPAI), which is the three-month running mean of the maximal anomaly of sea-level pressure in the Subtropical Southeastern Pacific region, exhibited a negative trend prior to the onset of the 2023–2024 El Niño event, indicating a weakening of the anticyclone's core; however, a renewed intensification was observed toward the end of 2023. From early 2024 to May 2026, the SPAI remained mostly within the neutral range, with a predominance of slightly positive values, suggesting that the anticyclone was generally somewhat stronger than its climatological mean. Nevertheless, brief weakening episodes were observed during the austral summer of 2024, the austral summer of 2025, and August 2025. By May 2026, the SPAI was close to zero (Figure 2d).

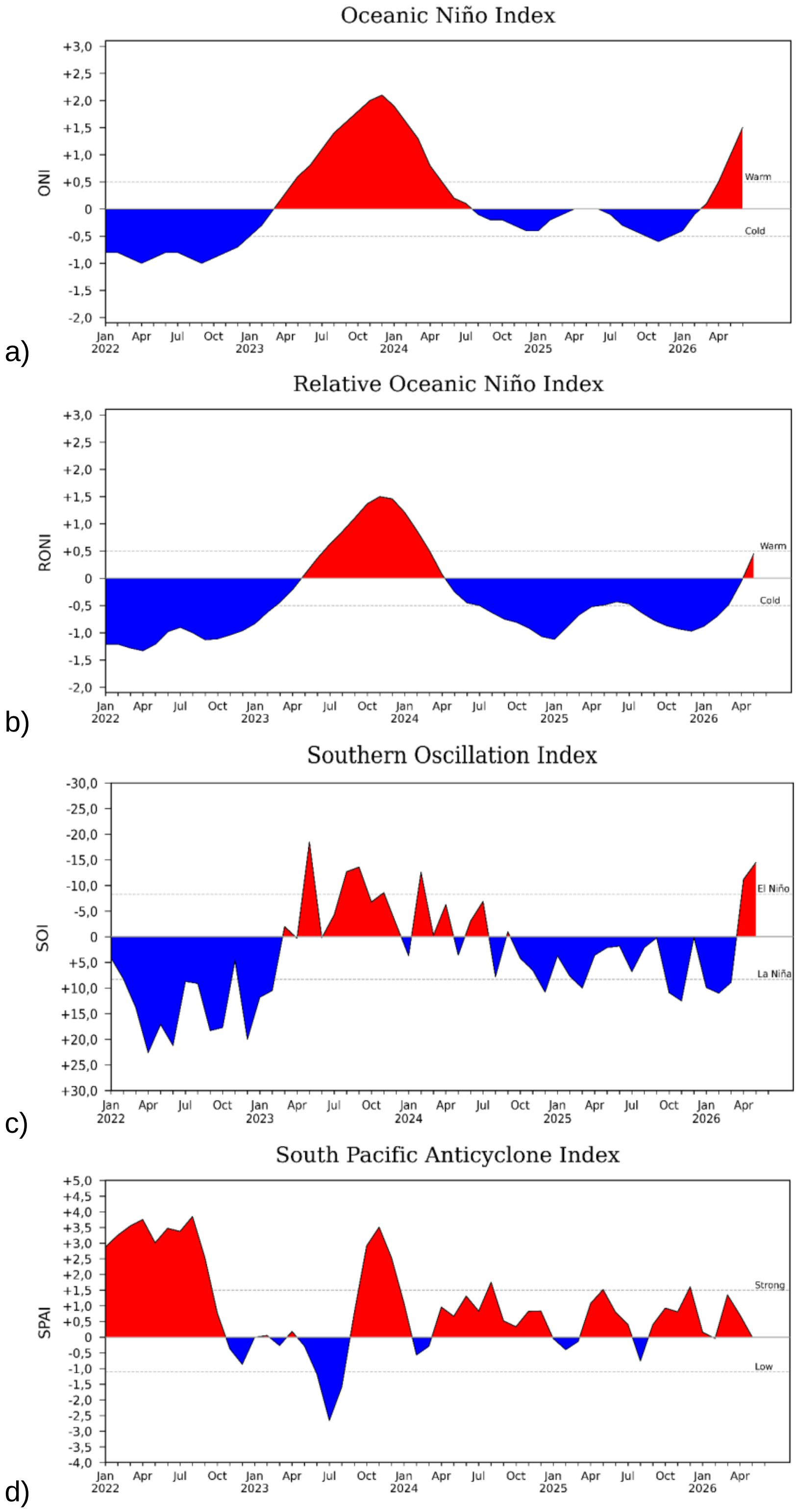
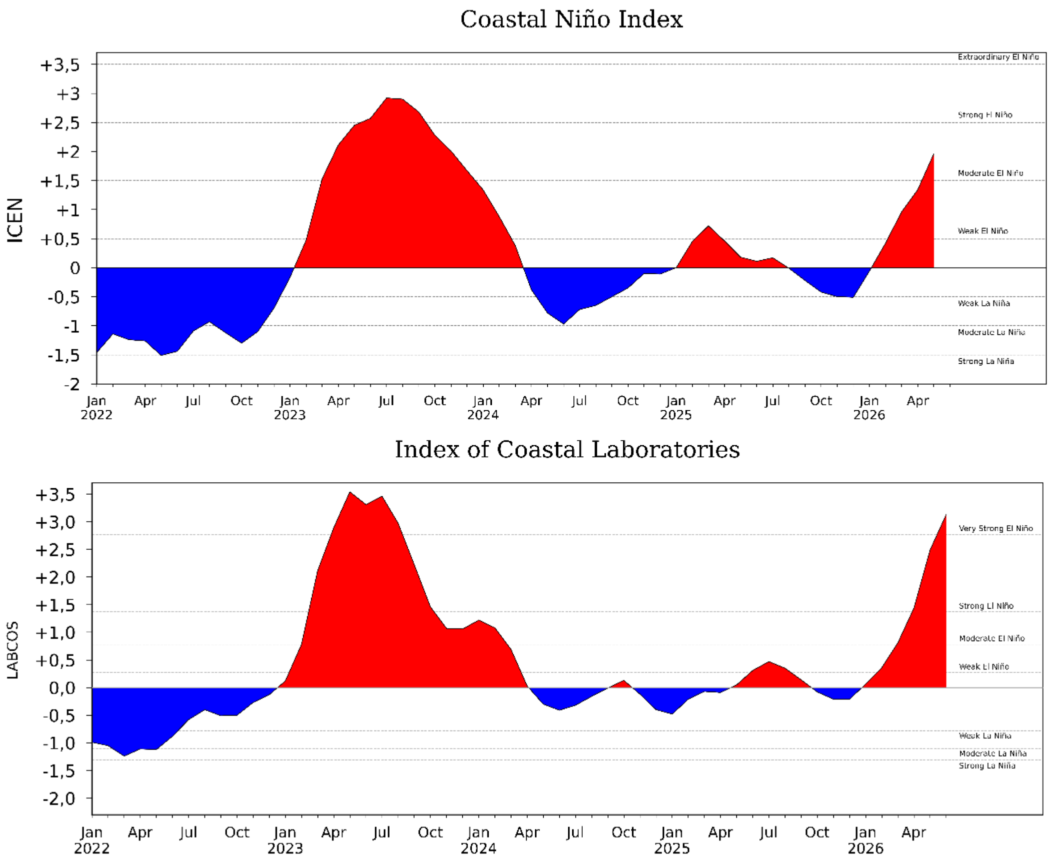


Figure 2. Temporal variability of the (a) Oceanic Niño Index (ONI), (b) the Relative Oceanic Niño Index (RONI), (c) the Southern Oscillation Index (SOI) and (d) the South Pacific Anticyclone Index (SPAI) (d) since January 2022. The SPAI is the three-month running mean of the maximal anomaly of sea-level pressure in the Subtropical Southeastern Pacific region (Chamorro et al., in prep.).

The Coastal El Niño Index (ICEN), derived from sea surface temperature (SST) anomalies in the Niño 1+2 region (ENFEN, 2024), and the LABCOS index, based on monthly SST anomaly records along the Peruvian coast (Quispe & Vásquez, 2015), exhibited a broadly similar temporal evolution. Both indices indicated the onset of anomalous warm conditions in February 2023. The warming event reached the strong 'coastal El Niño' category according to ICEN during the austral winter of 2023 (ENFEN, 2024), whereas the LABCOS index indicated very strong warm conditions during the austral autumn and winter of 2023. According to both indices, this coastal warming event ended toward the end of the austral summer of 2024. Thereafter, predominantly neutral conditions prevailed until early 2026, although both indices displayed marked short-term variability. Negative anomalies predominated during 2024, while positive values were observed during the first half of 2025 in the ICEN and from May to October 2025 in the LABCOS index. Both indices subsequently returned to negative values during the final months of 2025. From January 2026 onward, the ICEN and LABCOS indices exhibited a sustained positive trend, increasing markedly. By May 2026, the ICEN had reached the moderate El Niño category, while the LABCOS index indicated very strong warm conditions by June 2026 (Figure 3).



a)

b)

Figure 3. Temporal variability of the ICEN index (ENFEN, 2012, 2024), which is the three-month running mean of the SST anomalies in the Niño 1+2 region (top panel), and of the LABCOS index, which is the three-month running mean of the SST anomalies recorded in piers along the Peruvian coast (Quispe & Vásquez, 2015; bottom panel), since January 2022.

Coastal-trapped Kelvin waves, local wind velocity and coastal SST anomalies

The variability of filtered sea-level anomalies within 60 nautical miles (nm) of the coast was characterized by the propagation of warm and cold coastal trapped Kelvin waves, with a relatively balanced alternation throughout 2025 and until early May 2026. However, from mid-May 2026 onward, filtered positive anomalies increased, particularly between 5° S and 15° S, indicating the arrival of a packet of strong warm Kelvin waves whose influence persisted until mid-June. By the end of the period, the termination of the warm Kelvin-wave influence and the arrival of a weak cold Kelvin wave contributed to the relative decline of sea level anomalies (Figure 4a).

SST and SST anomalies showed a transition from near-normal conditions during 2025 to pronounced warming during the second quarter of 2026. From March 2026 onward, SST increased progressively along the northern coast and subsequently extended toward the central and southern coasts, reaching as far south as Atico (16° S) and producing anomalies exceeding +6 °C in June. By the end of June, a slight decrease in the intensity of the warming was observed, although anomalies between +3 and +5 °C persisted from Talara (04° 30' S) to San Juan (Figures 4 b-c).

Sea surface salinity (SSS) remained relatively stable along the Peruvian coast during 2025, with values generally consistent with the seasonal cycle, although an unusual intrusion of warm waters of equatorial origin reached the central coast during summer. A broadly similar pattern was observed during the first quarter of 2026. However, during the second quarter, salinity progressively increased along the coast, reaching values above 35.3 off the central coast. This increase was associated with the shoreward displacement of warmer and saltier Subtropical Surface Waters (SSW), which displaced the cold coastal waters southward (17° 30' S) during June (Figure 4d).

Accordingly, the development of the warm conditions associated with the ongoing 2026 El Niño event suggests that the warming was driven primarily by the arrival of warm Kelvin waves. Their influence was reinforced by a weakening of coastal upwelling and by the greater presence of warm and saline oceanic waters within 60 nm of the coast.

The analysis of the temporal evolution of wind velocity anomalies (WVA) as a function of distance from the coast, averaged between 12°S and 20°S, the main area of Jack mackerel catch distribution in recent years, shows marked changes since 2025. In February 2025, coastal winds weakened and, together with the arrival of warm Kelvin waves, favored slight warming. Subsequently, weakly positive WVA prevailed until mid-2025, peaking in June. However, from the second half of 2025 through March 2026, negative WVA predominated, even under La Niña conditions, when stronger trade and coastal winds would normally have been expected. At the beginning of austral summer 2026, a pronounced weakening of the winds was observed. Combined with the arrival of a warm Kelvin wave between January and February, this favored the onset of anomalous warming. In April and May, winds intensified, a behavior characteristic of some warm periods off the Peruvian coast. Nevertheless, positive SST anomalies persisted and even increased due to the arrival of additional warm Kelvin waves and the strengthening of onshore geostrophic flows, which would have slightly offset the cooling associated with wind-driven upwelling. During the first half of June, negative WVA, together with the arrival of a warm Kelvin wave, would have favored significant warming. In the last two weeks of June, winds intensified again and, in combination with the passage of a cold Kelvin wave, would have contributed to slightly attenuating this warming (Figure 5a).

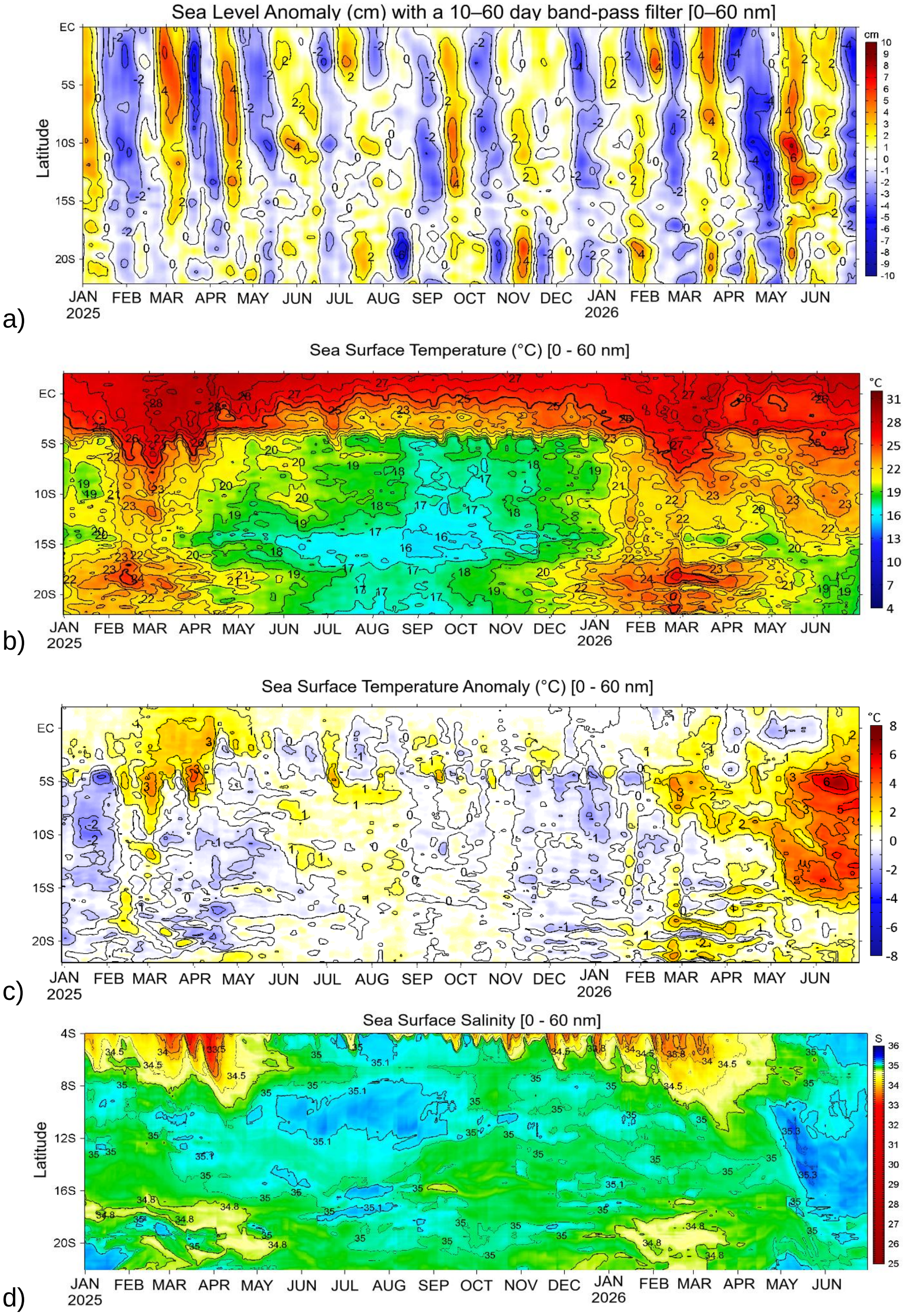
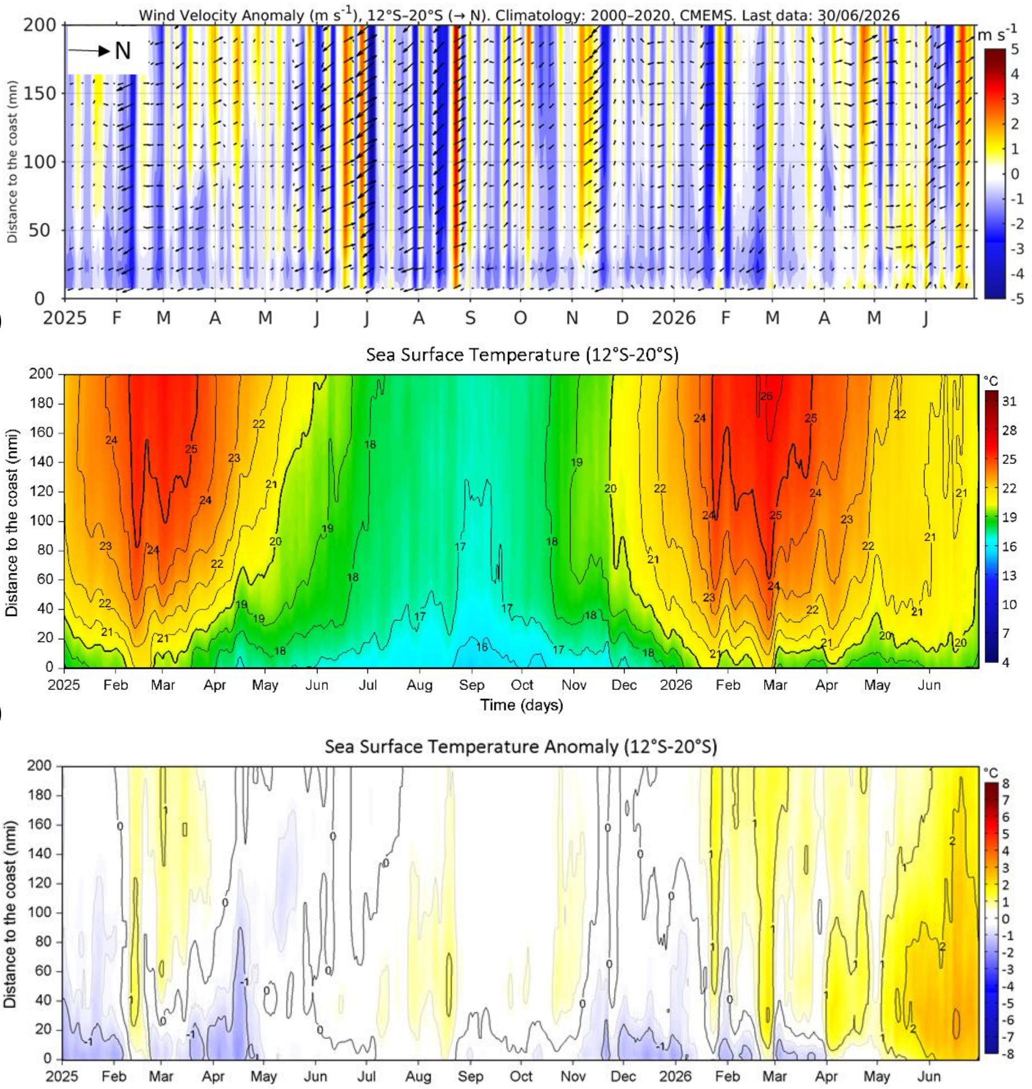


Figure 4. Daily evolution of (a) sea level anomalies (cm) filtered using a 10–60-day band-pass filter, (b) sea surface temperature (°C), (c) sea surface temperature anomalies (°C), and (d) sea surface salinity within the 60 nm and from 0 to ~111 km coastal band adjacent to the Peruvian coast, from 01 January 2025 to 30 June 2026. Data sources: CMEMS (a), OSTIA (b, c), and Mercator (d). Climatological periods: 1993–2020 (a) and 1991–2020 (c).

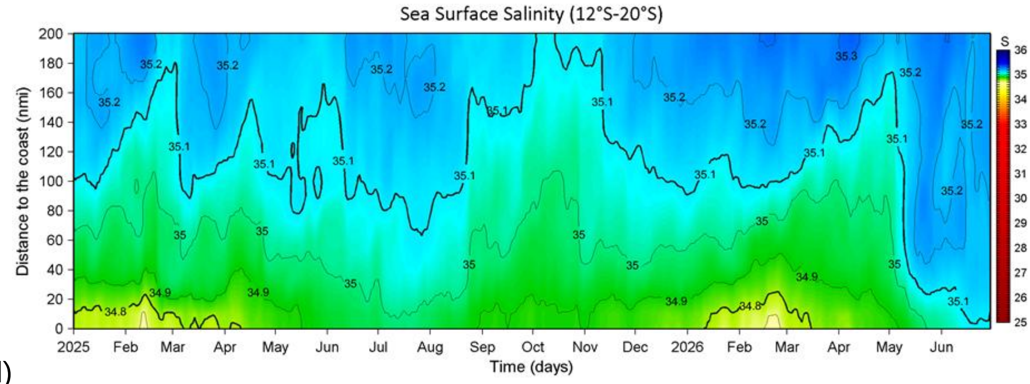
In addition, in the aforementioned region, conditions during 2025 were generally characterized by the seasonal cycle, near-normal SST anomalies, and relatively stable salinity. From February 2026 onward, SST progressively increased and the warmer waters moved closer to the coast, producing positive anomalies of up to +2 °C. These anomalies intensified from May onward, mainly within 100 nm of the coast, together with a pronounced shoreward displacement of SSW. The concurrence of surface warming, persistent positive thermal anomalies, and increasing salinity in the coastal zone indicates a change in the distribution of water masses and a marked weakening of the prevailing coastal upwelling conditions. These changes are consistent with the establishment and strengthening of the ongoing El Niño event, whose influence between 12°S and 20°S became evident from May onward and extended over a broader offshore area during June (Figures 5 b-d).



a)

b)

c)



d)

Figure 5. Mean daily evolution of (a) wind velocity anomalies, (b) sea surface temperature (°C), (c) sea surface temperature anomalies (°C), and (d) sea surface salinity within the region between 12°S and 20°S, extending from the coastal zone to 200 nm offshore, from 01 January 2025 to 30 June 2026. In (a), the colors represent wind velocity anomalies, while the arrows indicate wind direction anomalies. Data sources: CMEMS (a), OSTIA (b, c), and Mercator (d). Climatological periods: 2000–2020 (a) and 1991–2020 (c).

<u>Changes in the surface productivity inferred from satellite Chlorophyll-a</u>

Regarding surface chlorophyll-a concentration (Chl-a), used here as an indicator of primary productivity, intense positive anomalies were observed along the coast during the first half of 2025. These were followed by predominantly neutral conditions from late autumn to early spring 2025. From spring 2025 to April 2026, conditions indicative of high productivity prevailed, with positive anomalies ranging from approximately +2 to +6 µg L^{-1} along much of the coast. From the second half of April to the first week of May 2026, negative chlorophyll-a anomalies of approximately −2 µg L^{-1} were observed between 8°S and 13°S. These anomalies gradually weakened toward near-neutral values, which subsequently extended southward and predominated between 12° S and 20° S through 30 June. North of 12°S, conditions associated with high productivity prevailed from mid-May to late June 2026 (Figure 6).

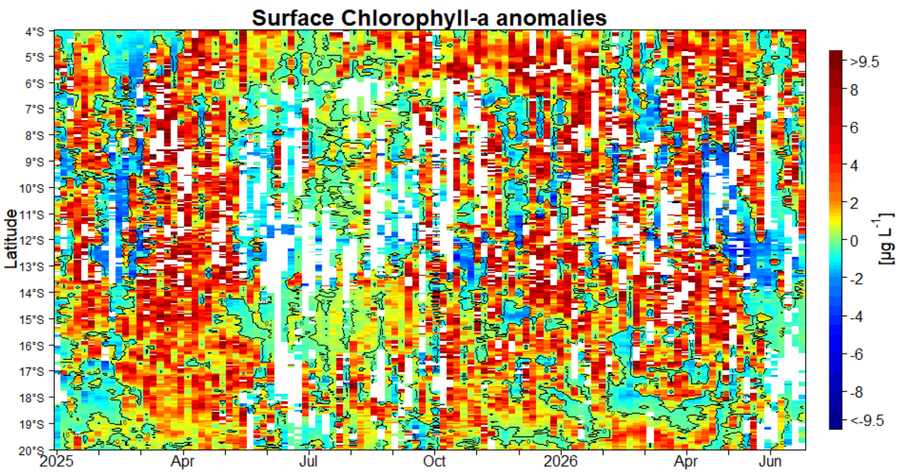


Figure 6. Hovmöller diagram of latitude vs. time of 5-day Chlorophyll-a anomalies (in µg L^{-1}) averaged within 100 km of the coast between 01 July 2025 and 30June 2026. Chlorophyll-a data was obtained from MODIS satellite observations. The anomalies were calculated using a climatology from 2000 to 2020, derived from a merged product of SeaWiFS and MODIS satellite data.

3. CHARACTERIZATION OF THE STOCK

3.1 Spatial distribution

In 2019, denser concentrations of Jack mackerel were observed within 20 to 80 nm from the coast, especially between Chimbote (9°04'S) and Pisco (13°43'S). This pattern continued in the first half of 2020, extending as far north as Paita (5°00'S) closer to the coast for most of the second half of 2020. From late 2020 until May 2022, denser concentrations were observed within 100 nm from the coast, particularly between Supe (10°47'S) and Bahia Independencia (14°14'S). Research survey information indicated low concentrations during the summer of 2023 between Pacasmayo (7°24'S) and Chicama (7°50'S), at 27 mn off Callao (12°03'S), and between Pisco (13°42'S) and Punta San Juan (15°22'S). However, the highest concentration during this period was recorded in the southern part of the Peruvian coast. During the second half of 2023, research surveys recorded Jack mackerel in four areas with sparse characteristics, located between 20 and 50 nm off Talara-Bayovar (north), between 50 and 70 nm off Salaverry (around degree 8ºS, the most important nucleus), and in the south (Atico, and between Quilca and Ilo). Between January and November 2024, the main Jack mackerel fishing areas were located within 90 mn, between Callao (12°03'S) and Morro Sama (17°60'S), with small centers in front of Chimbote. During the summer of 2024 (January and March), the fishing areas were located in the center - south of the coast between Pisco and Morro Sama, concentrating mainly in front of the Attic up to 50 mn from the coast. From April onwards, the fishing areas were concentrated further south between Mollendo (17°00'S) and Morro Sama (17°60'S). In the last months of October to December 2024, the fishing areas of the artisanal fleet were located within 30 minutes from the coast (IMARPE, 2024). During the first quarter of 2025, the industrial fleet of Jack mackerel has carried out its extractive activities between Mollendo (17°00'S) and Morro Sama (17°60'S) within 50 miles of the coast. With regard to artisanal fishing, the fishing areas were located throughout the Peruvian coast, with the highest concentrations of catch mainly in front of Pisco (13°44'S), Ilo (17°38'S), Morro Sama (17°60'S); and, with lower availability in Chimbote (09°05'S) and Paita (05°02'S). By the end of 2025, Jack mackerel were distributed over a limited area in southern Peru, with low-density aggregations located within 60 nm of the coast. In addition, schools were detected above 50 m depth, occurring very close to the surface. During the first half of 2026, Jack mackerel schools were dispersed and could not be effectively monitored during the surveys, preventing an accurate characterization of their distribution and depth.

3.2 Age and growth

The growth parameters used for Jack mackerel are those originally estimated by Dioses (1995) and confirmed by observations and growth estimates by Dioses (2013), Goicochea *et al*. (2013) and Diaz (2013): L_∞= 80.77 cm total length (TL), k = 0.1553 y^{-1} and t_o = -0.3562.

3.3 Reproductive aspects

The monthly variability of the gonodosomatic index (GSI) of Jack mackerel in Peruvian waters (Figure 7) showed a period of higher values in 2012, where GSI values were consistently higher, indicating favorable reproductive conditions for the stock. Between 2013 and 2019, the intensity of the reproductive process was generally low and/or temporally shifted relative to the historical pattern. From 2020 to 2023, GSI values increased, with levels surpassing the historical pattern and maintaining the trend. From 2023 to 2025, GSI values declined and exhibited a temporal shift relative to the historical pattern. In 2026, up to June, GSI values have shown some variability; however, the observed reproductive activity remains within the expected range of the historical seasonal pattern, with the stock currently in its gonadal resting period.

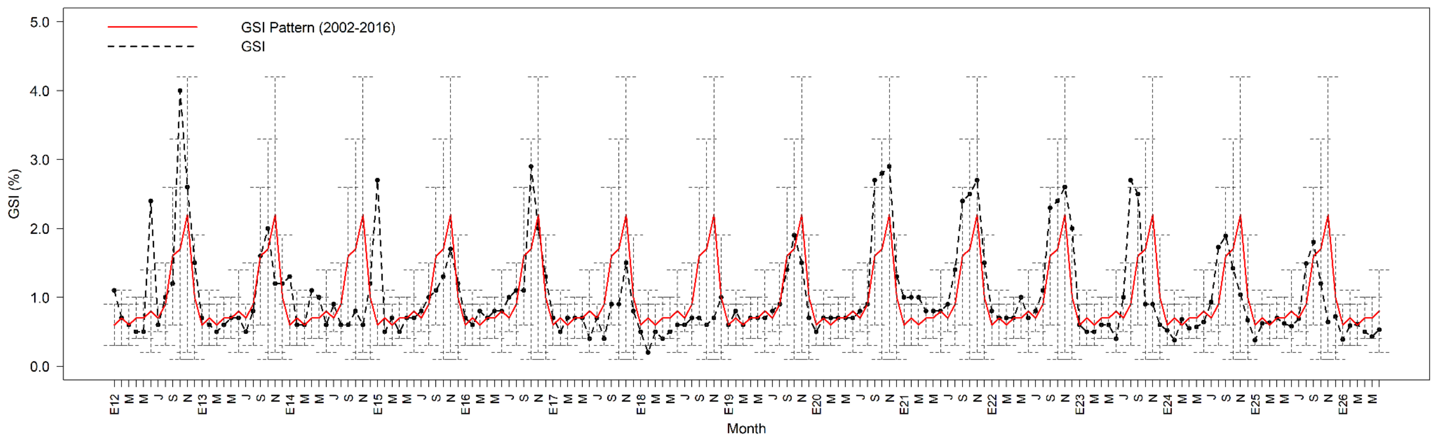


Figure 7. Monthly variability of Gonadosomatic Index (GSI) of Jack mackerel above 26 cm TL caught in Peruvian jurisdictional waters. The solid red lines represent the monthly mean for the period 2002 – 2016 (taken as a standard), and the vertical gray lines represent their standard variations. The black dots and dashed lines are the current monthly values observed from January 2012 to June 2026.

3.4 Trophic relationships

The updated information on preys of Jack mackerel (Figure 8) continues to confirm is an opportunistic forager, with changes in their diet most likely indicating changes in their ecosystem (Konchina 1981; Muck and Sanchez 1987; Alegre et al. 2015) with a clear predominance of euphausiids.

The dominance of euphausiids in the diet of Jack mackerel is more evident during the 1980s and 1990s, corresponding to a slightly warmer multidecadal period, while a more diversified diet is observed during the slightly colder period of 2001 to 2014. During these slightly colder years, euphausiids continued to be an important component of the Jack mackerel diet. However, there was an increased presence of other species, especially zoeas and red squat lobster (Grimothea monodon), with this last prey becoming the dominant component of the Jack mackerel diet during the warmer years of 2015 to 2018, since it has been particularly abundant, probably benefitting from the influence of the strong 2015-2016 El Niño, the moderate 2017 coastal El Niño and the weak 2018-2019 El Niño and the current climate event.

However, since 2019 there has been no clear scenario. Thus, the mesopelagic fish Vinciguerria lucetia, was the prey with the highest contribution to the diet during 2020 (47%) and 2023 (49%), diminishing during 2024 (27%) and 2025 (15%). It was followed by the notable decrease of red squat lobster between 2020 and 2023 (38%-15%), and remarkable increase since 2024 (44%) until now (49%). On the other hand, the contribution of anchoveta was not as high (22% and 12%) in 2021 and 2022, respectively.

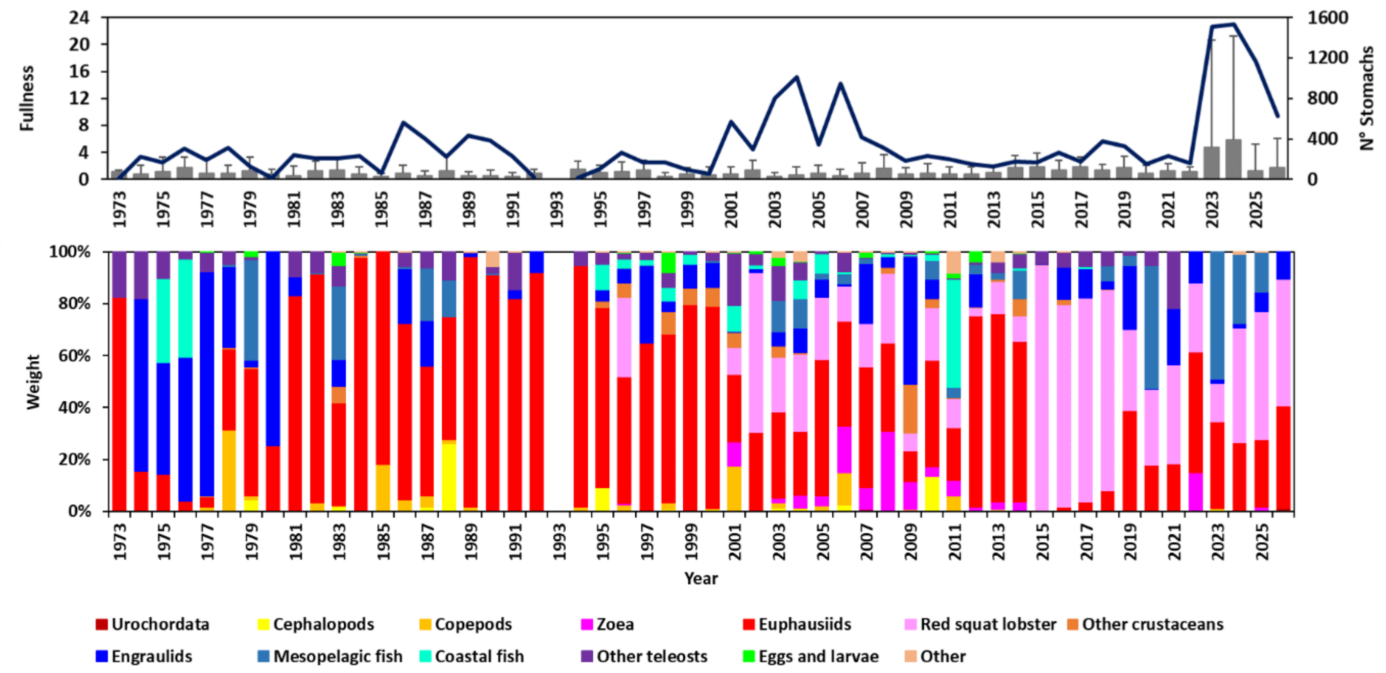


Figure 8. Index of fullness (in %, vertical bars, top panel), sample size (solid lines, top panel) and proportion of preys (vertical bars, lower panel) in stomach content of Jack mackerel *Trachurus murphyi* off Peru from 1973 to June 2025. Updated from Alegre et al. (2013, 2015).

4. DESCRIPTION OF THE FISHERY

In Peruvian national waters, there are two main groups of vessels that fish for Jack mackerel. The first group consists of 104 industrial purse seiners with hold capacities above 36.2 m^3. The second group is made up of artisanal and small-scale fleets, with a maximum holding capacity of 32.6 m^3. The small-scale fleet includes approximately 947 small purse seiners, lightly mechanized withhold capacities ranging from 20 to 32.6 m^3. The artisanal fleet can include up to 23000 small boats using a wide variety of manual fishing gear, with about 704 vessels having hold capacities under 20 m^3 frequently fishing for Jack mackerel, mostly with small purse seines.

The industrial purse seiners participate in two types of pelagic fisheries. One is for Peruvian anchoveta (*Engraulis ringens*), which is mostly used for fishmeal and fish oil. The other one is for Jack mackerel, also targeting chub mackerel (*Scomber japonicus*), bonito (*Sarda chiliensis*), and other mid-sized pelagics such as sardine (*Sardinops sagax*) when available. These fisheries, used exclusively for direct human consumption, take place during different fishing seasons, adopt different searching (and fishing) strategies, use different types of purse seines (with mesh-size of 13 mm for anchovy and 38 mm for mid-size pelagics), as well as different maneuvering and storage holding on board. The fleet cannot fish for both (i.e., anchoveta and mid-size pelagics) during the same trip, and it has been noted that whenever the fishing season is open for the two groups (anchoveta and mid-size pelagics), the industrial purse seine fleet clearly prefers to fish anchoveta. The small-scale and artisanal fleets are more flexible and opportunistic, and target indistinctly a large variety of species depending on their availability and market demand.

4.1. Catch and CPUE trends

The landings of Jack mackerel in Peruvian waters were in continuous decline between 2011 and 2017. During the years 2015 to 2017, annual catches hit their lowest records (Figure 9). The low catches during this period can be attributed to the displacement and dispersion of Jack mackerel concentrations, a direct result of the impacts of the weak 2014 El Niño, the strong 2015-2016 El Niño, the moderate 2017 coastal El Niño, and the weak-to-moderate 2017-2018 La Niña.

Catches during the first part of 2018 were low but increased slightly during the second half of 2018. There was a clear significant increase in catches from 2019 to 2024, likely due to neutral to cold environmental conditions, which may have favored the increased abundance and the availability of Jack mackerel. Additionally, the impact of the 2023-2024 El Niño event was also significant, gradually shifting the concentrations of Jack mackerel to the south of the Peruvian coast, making them more accessible to the industrial, artisanal and smaller scale purse fleet.

In 2025, environmental conditions were predominantly cold. However, the persistent influence of Subtropical Surface Waters (SSW) caused Jack mackerel schools to remain in the southern region, resulting in the highest landings during the summer, followed by a declining trend during the second half of the year. In addition, a series of fisheries management measures have been implemented at the national level to regulate fishing effort and landings, particularly for the small-scale and artisanal fleets. During the first half of 2026 (Figure 9 and Figure 10), Jack mackerel catches declined markedly, mainly due to the displacement and dispersion of schools associated with the continued intrusion of Subtropical Surface Waters (SSW) and the influence of the 2026 El Niño event. These conditions generated changes in the spatial distribution of the resource, favoring the dispersion and displacement of schools toward other areas, which reduced their concentration in the main fishing grounds and limited their availability and accessibility to fishing fleets.

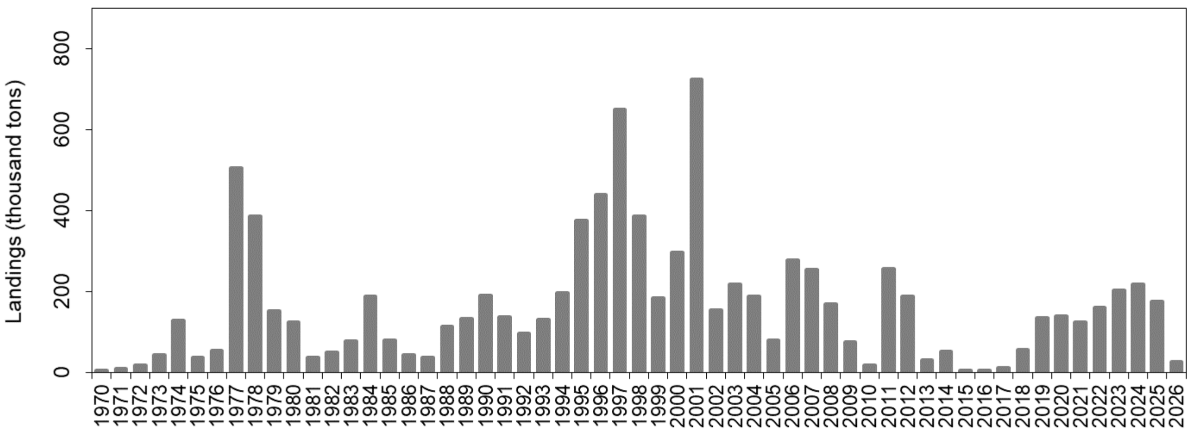


Figure 9. Total annual landings of Jack mackerel (*Trachurus murphyi*) caught in Peruvian waters, years 1970-2026 (up to June 2026).

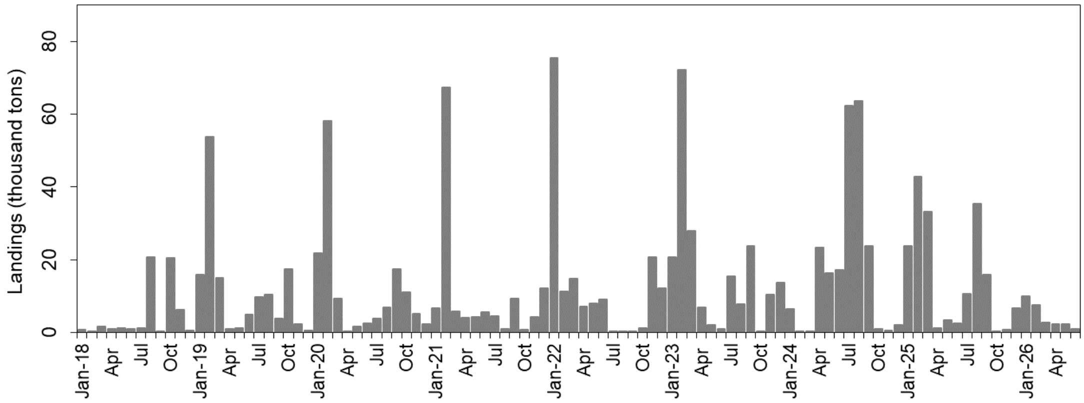


Figure 10. Total monthly landings of Jack mackerel (*Trachurus murphyi*) caught in Peruvian waters, between January 2018 and June 2026.

The previous increase in monthly Jack mackerel catches during 2018 and 2019, as well as the sustained high catches during 2020 and more recently, in the first part of 2023, can also be attributed to the rising trend in the abundance indexes of CPUE (Capture Per Unit of Effort) from both the industrial fleet and the group of artisanal and small-scale fleets (Figure 11). As can be seen, the monthly CPUE (in tons per trip) of both fleet groups increased during the second half of 2018 and continued to rise, with some fluctuations, during the whole of 2019 and early 2020. Levels remained relatively high, with a generally increasing trend in 2021 till March 2023. Between April 2023 and August 2024, CPUE values remained high and showed some fluctuations, mainly in the summer of 2024, which seems to be associated with the displacement and dispersion of Jack mackerel concentrations due to the impact of El Niño 2023-2024. As of September 2024, CPUE values decreased due to the suspension of extractive activities by industrial and smaller-scale fleets (for compliance with catch limits). During these months, only vessels with lower fishing hold capacity operated.

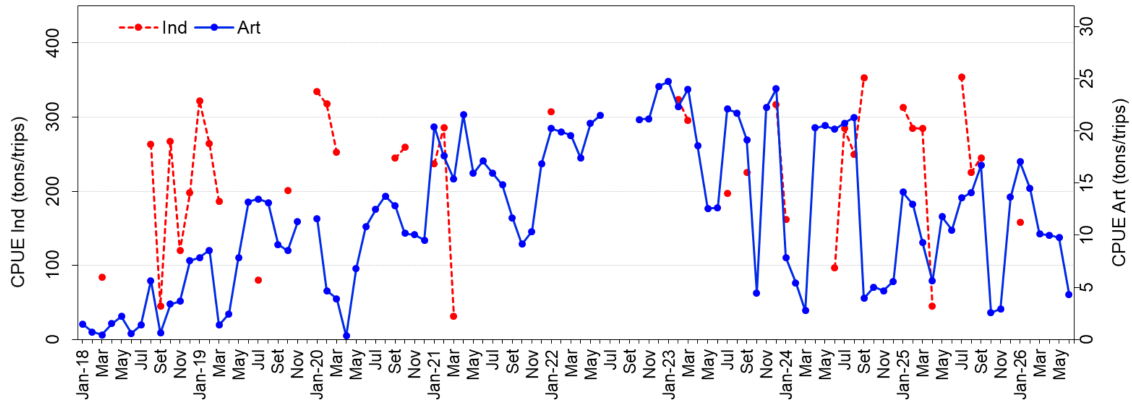


Figure 11. Monthly catch per unit of effort (CPUE, in tons per trip) of Jack mackerel (*Trachurus murphyi*) by the industrial purse seine fleet (red dots and broken lines) and by the artisanal and small-scale purse seine fleets (blue dots and lines) fishing in Peruvian waters between January 2018 and June 2026.

By 2025, CPUE trends exhibited notable differences among fleet types. The industrial fleet recorded high CPUE values during the summer and winter, likely reflecting increased availability and higher concentrations of Jack mackerel in the main fishing grounds. In contrast, the artisanal and small-scale fleets registered lower CPUE values than in previous years. This pattern was associated with the implementation of fisheries management measures (R.M. N° 0508-2024-PRODUCE and R.M. N° 0165-2025-PRODUCE) aimed at regulating fishing effort and landings in these fleets. During 2026, CPUE values for both the artisanal and small-scale fleets showed a declining trend, reflecting reduced Jack mackerel availability in the main fishing areas. This decline was likely associated with the dispersion and displacement of schools driven by the intrusion of Subtropical Surface Waters (SSW) and the influence of the 2026 El Niño event.

The industrial purse seine fleet did not have CPUE data for certain months because the fishery was closed under conservation and management measures implemented by the Peruvian Government. Unlike the industrial purse seine jack mackerel fishery, which may be subject to seasonal closures throughout the year, the artisanal and small-scale fleets are generally allowed to fish for jack mackerel year-round.

4.2. Fishing areas

During 2025 the Jack mackerel fishing areas were located within 150 nm of the coast, mainly between Atico (16°S) and Morro Sama (18°S), with smaller nuclei off Pisco (13°S). The fishing areas of the artisanal and small-scale fleets were generally spread out within 60 nm of the coast. In contrast, the industrial fleet operated primarily during the summer and winter fishing seasons, with fishing grounds concentrated between Mollendo (17°S) and Morro Sma (18°S), within 150 nm of the coast (Figure 12).

In the first half of 2026, the main Jack mackerel fishing areas were mostly located in the south zone of the Peruvian coast within 50 nautical miles (nm) distance, between Atico (16°S) and Morro Sama (18°S). During January and February, the fishing areas mostly concentrated between 10 and 30 nautical miles (nm) distance, located between Mollendo (17°S) and Morro Sama (18°S). In March and June, the fishing areas were located in front of Morro Sama (18°S), with high catches within 20 nm from the coast, associated with the approach to the coast of the Surface Subtropical Waters.

4.3. Size structure

Throughout the period of January 2025 to June 2026, the monthly size frequency distributions of the Jack mackerel observed in Peruvian fisheries, across all fleets, are presented in Figure 13. These distributions indicated that the fishery targets a wide range of Jack mackerel sizes, with either unimodal or multimodal groups. The observed sizes ranged from 16 cm to 65 cm in total length (TL). The highest proportions of juveniles were observed in October, November and December 2025 (93%, 87% and 43%), and in February and June 2026 (52% and 54%).

During 2025 and the first part of 2026, a wide range of size groups was observed in commercial catches. No significant differences were found between the monthly size-frequency distributions of Jack mackerel caught by the artisanal and small-scale fleets and those caught by the industrial fleet, despite slight variations in their main fishing areas. The main fishing areas of the industrial purse seine fleet were located at similar latitudes to those of the artisanal and small-scale fleets, but were further offshore (as shown in Figure 12).

IMARPE research surveys conducted from 2018 to 2025 also found the adult modal groups that were caught by commercial fleets during the same period. The research vessels use different fishing gears with smaller meshes, enabling them to find much younger and smaller juveniles, some measuring as small as 2 cm TL (Figure 14). These small fish are not typically caught in the commercial fishery, which uses more selective nets with a minimum mesh size of 38 mm. The presence of these small fish during research surveys provides valuable evidence of the existence of groups of early juveniles and pre-recruits, not yet available for commercial fishing but soon to be recruited into the exploited population.

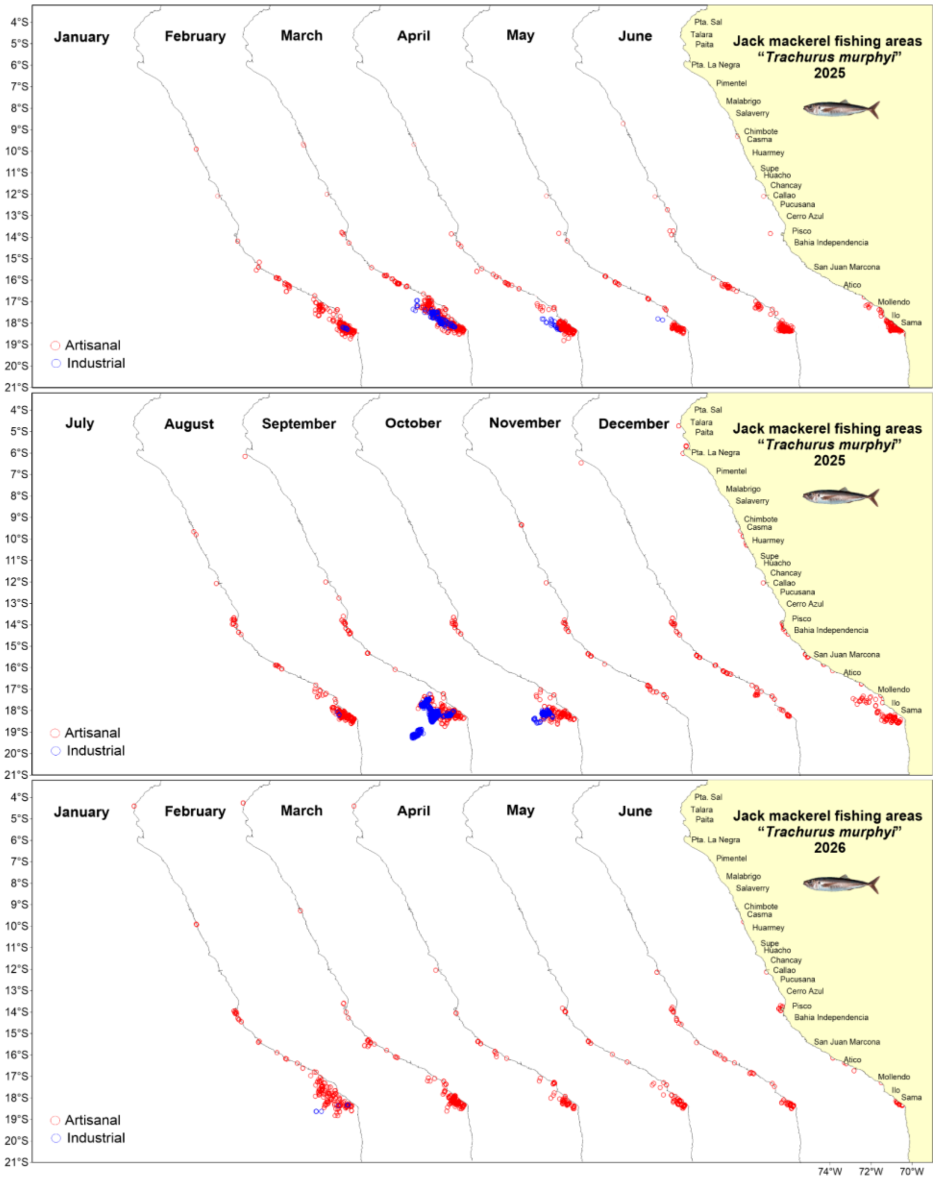


Figure 12. Distribution of the Jack mackerel (*Trachurus murphyi*) fishing areas of the industrial purse seine fleet (blue circles) and by the artisanal and small-scale fleets (red circles) fishing in Peruvian jurisdictional waters, by month, between January 2025 and June 2026.

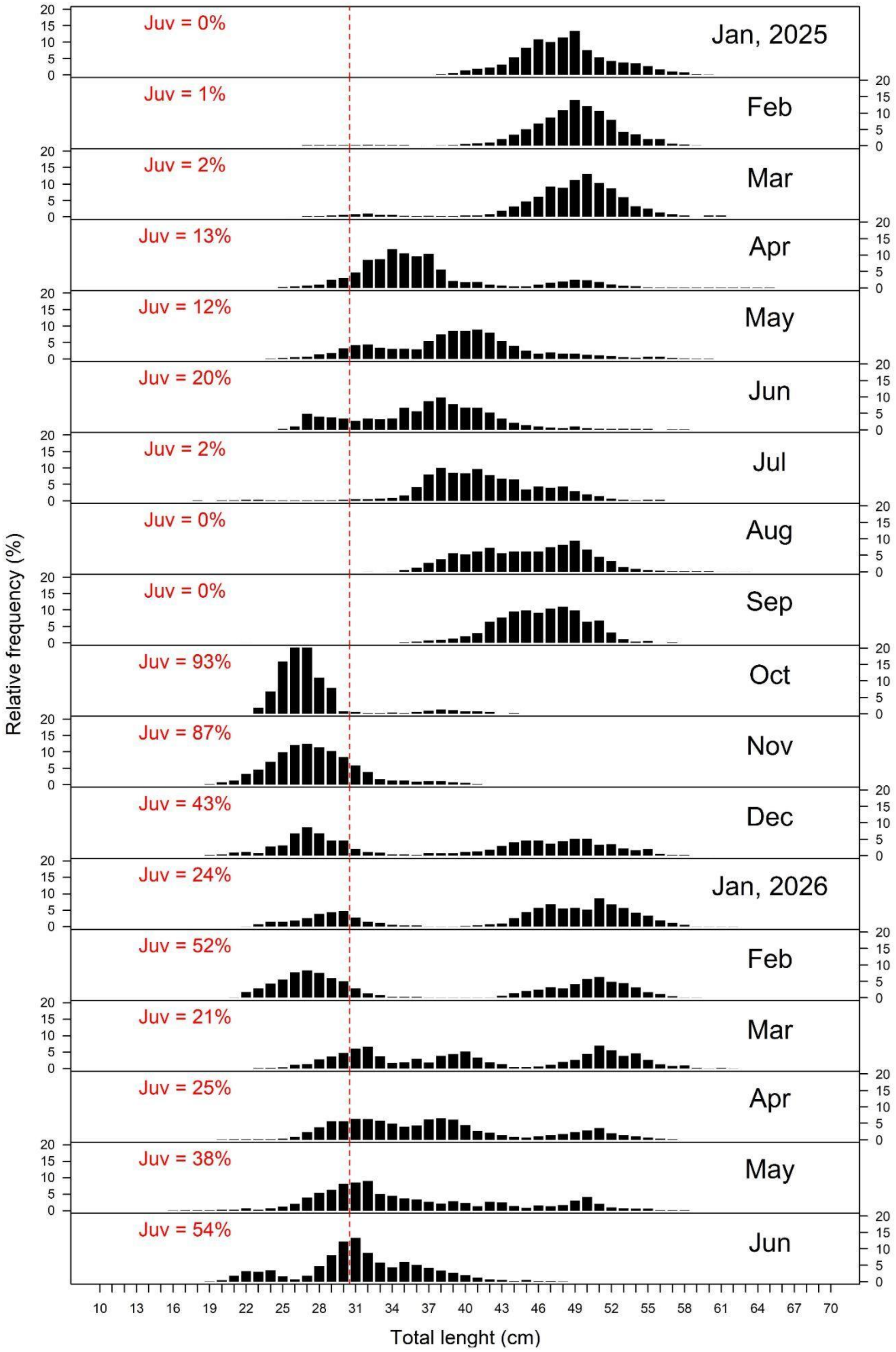


Figure 13. Size frequency distribution of Jack mackerel (*Trachurus murphyi*) caught in Peruvian jurisdictional waters by the Peruvian artisanal, small-scale and industrial fleets, numbers by size in percentage by month, between January 2025 and June 2026.

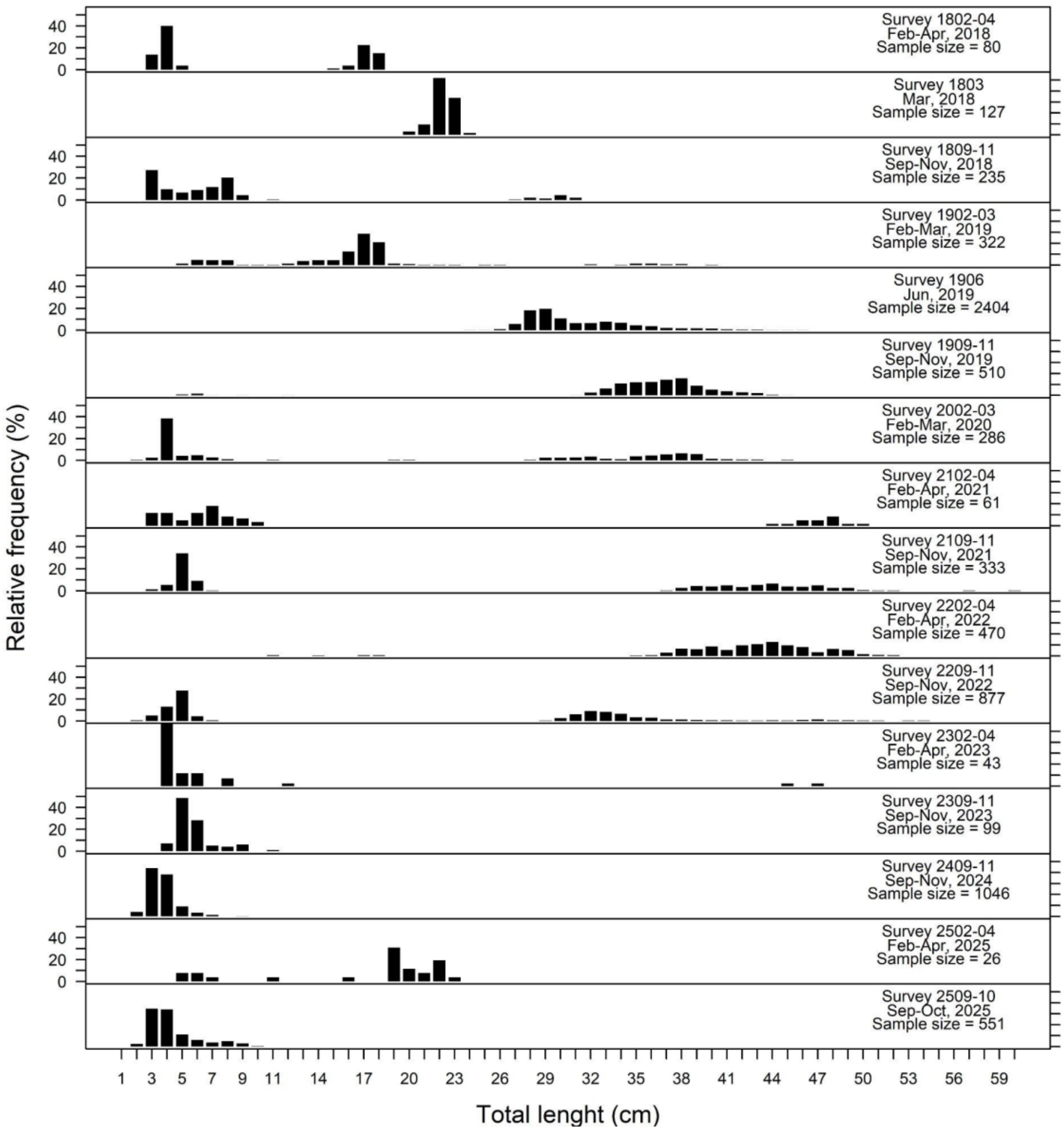


Figure 14. Size-frequency distribution of Jack mackerel (*Trachurus murphyi*) caught in Peruvian jurisdictional waters during research surveys conducted by IMARPE between February 2018 and October 2025.

The above also reinforces the observation made by Csirke & Ñiquen (2017) on the consistent occurrence of all life-history stages of Jack mackerel in Peruvian waters and that the Peruvian Jack mackerel stock reproduces and completes its full life-cycle entirely in Peruvian waters, where it constitutes a unique biological and fishery unit, with most if not all the characteristics of a self-sustained stock unit.

5. STOCK ASSESSMENT

This section presents a summary of the late 2025 assessment of the Peruvian stock of Jack mackerel (far-north stock), which the Peruvian government used to set the total allowable catch (TAC) of Jack mackerel in Peruvian national jurisdictional waters for 2026. This is followed by a review and update of the Joint Jack Mackerel (JJM) model for 2026, conducted by IMARPE using the most recent data and information. This update includes projected catches to the end of 2026.

5.1. 2025 assessment and 2026 TAC

In December 2025, the stock assessment of Jack mackerel was conducted to advise the Vice-Ministry of Fisheries of the Ministry of Production (Ministerio de la Producción del Perú, PRODUCE) on the current stock situation and the possible TAC for 2026 (IMARPE 2025). This assessment was based on the latest version of the JJM model, which was developed during the 13th meeting of the SPRFMO Scientific Committee (SPRFMO 2025). For this, all data and information were updated to the end of December 2025.

In this assessment, the stock size estimated on January 1st 2026 was projected to the end of the year under several exploitation scenarios. The potential impact of each scenario was determined by evaluating the probability that the expected stock spawning biomass (SSB) on January 1st 2027 would fall below the reference level (SSB_{MSY}), as well as the probability that SSB on January 1st 2027 would be lower than the SSB estimated for January 1st 2026, and a TAC that does not exceed the catch corresponding to applying F_{MSY}. Based on the evaluation of these criteria, IMARPE recommended three annual exploitation scenarios to support the determination of the TAC for 2026:

(i) TAC = 175 000 tons (precautionary scenario): scenario corresponding to approximately 80% of the catch associated with the fishing mortality at maximum sustainable yield (C-F_{MSY}).

(ii) TAC = 195 000 tons (intermediate scenario): scenario corresponding to approximately 90% of C-F_{MSY}.

(iii) TAC = 216 000 tons (limit scenario): scenario corresponding to C-F_{MSY}.

Based on this advice, on 31 December 2025, PRODUCE established a catch limit for Jack mackerel in Peruvian jurisdictional waters for 2026. For large-scale or industrial fleets with a hold capacity greater than 32.6 m^3, the limit was set at 88 317 tons for the whole 2026 (R.M. N° 000441-2025-PRODUCE), whereas for the artisanal fishing vessels using passive fishing gear (curtains) and purse-seine vessels with a hold capacity of less than 32.6 m^3, the limit was set at 86 683 tons for the current 2026, with a catch limit of 34 427 tons for the period of January-April 2026 (R.M. Nº 00444-2025-PRODUCE). Then, on 27 February 2026, PRODUCE decided to modify the aforementioned R.M. (R.M. Nº 000444-2025-PRODUCE) by the R.M. Nº 000052-2026-PRODUCE, focused on the artisanal fishing vessels and purse seine vessels with a hold capacity of less than 32.6 m^3, during the same period time (January-April 2026). This modification set a new total limit of 91 000 tons for artisanal vessels.

Then, on 30 April 2026, R.M. Nº 000113-2026-PRODUCE set the total catch limit at 45 659 tonnes for the period May-August 2026. This increased the catch limits for artisanal fishing vessels using passive fishing gear (curtains) and purse-seine vessels with a hold capacity of less than 32.6 m^3.

5.2. 2026 assessment

The main purpose of this latest 2026 assessment is to review and update the JJM model estimates using the most recent information up to June 2026, but with estimated total catch projected to December 2026. For this, the information updating for the 2026 assessment was covered.

5.2.1. Updated information for the 2026 assessment

The information on the catch, catch at length, and weight at the age were updated to June 2026, but with the estimated total catch projected to December 2026 (100 000 tons, as the limit scenario recommended by IMARPE for the 2026 TAC). This information follows the standard procedures used for the 2026 TAC assessment in Peruvian national waters. In addition, relevant information on CPUE, catch-at-length, and weight-at-age was provided during the recent SCW16 Benchmark meeting (May 2026). However, these data will only be incorporated into the stock assessment during the next assessment cycle, following a thorough evaluation, as they were originally generated to support the development of a reference model for the jack mackerel MSE. The echo-abundance*,* selectivity, and the remaining biological data (sexual maturity, age and growth, and natural mortality *M*) remained unchanged concerning the 2014 model since there were no new estimates or data to be added.

The IMARPE's Fisheries Monitoring System routinely collects catch and length composition data. From this, the yearly length-frequency distributions were calculated up to June 2026. The revised CPUE abundance index based on the industrial, artisanal, and small-scale catch and effort data under a Generalized Additive Model (GAM) was updated for the period 2002-2026 (Figure 15). The time series of CPUE from 2002 to 2026 reveals notable temporal variation. Between 2002 and approximately 2016, CPUE values remained relatively stable, fluctuating within a stable range. Beginning in 2018, a clear upward trend was observed, with CPUE increasing substantially year after year. This increase culminated in a pronounced peak during 2022-2024, when the highest CPUE values of the series were recorded.

However, following this peak, based on the updated data for June 2026, a notable decline in CPUE is recorded. Although the 2026 value remains above pre-2017 levels, the magnitude of the decrease is substantial and may indicate a change in stock availability, or signs of a declining abundance (Figure 15). In addition, the implications of recent management measures should be considered, particularly for the artisanal fleets, where the application of regulatory rules such as quarterly fishing periods and specific catch limits may have contributed to the changes in CPUE (see Section 4.1).

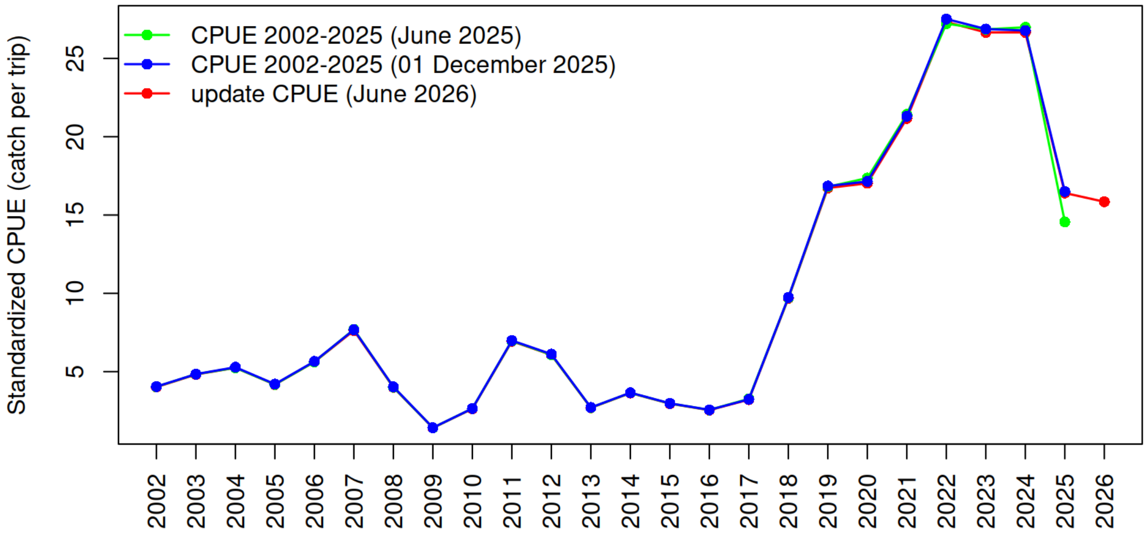


Figure 15. Updated CPUE time series of Jack mackerel (*Trachurus murphyi*) caught in Peruvian jurisdictional waters by the industrial, artisanal, and small-scale fleets between 2002 and 2025 (up to June 2025)

The *echo-abundance* index used in the assessment was estimated as the mean value of all the Nautical Area Backscattering Coefficients (S_A) recorded during the acoustic surveys conducted by IMARPE since 1985. The use of the S_A coefficient is preferred to the acoustic biomass estimates to reduce potential sources of bias that might be introduced by using length frequency data collected during the acoustic surveys to estimate fish density in numbers (abundance) and weight (biomass). The current record of echo-abundance of Jack mackerel only provides estimates up to 2014, this because the environmental conditions linked to strong El Niño and coastal El Niño events from 2015 to 2019. As a result, acoustic surveys, which were focused on assessing the anchovy, were located on nearshore areas (within 60 nautical miles) and missed the best concentrations of Jack mackerel. A 2018 survey that extended further offshore (5 to 100 nautical miles) was impacted by La Niña conditions, causing Jack mackerel to disperse beyond the surveyed areas. Similar conditions during La Niña from 2020 to mid-2022 led to further dispersal of Jack mackerel. Recent surveys have only partially covered their distribution, and the rapid shift to strong El Niño conditions in 2023 and early 2024 forced surveys to focus near the coast. In 2025, predominantly cold conditions and the persistent influence of SSW contributed to a southward displacement of schools, while during the first half of 2026, the continued influence of SSW and the development of El Niño conditions resulted in further displacement and dispersion of schools. Therefore, there is no updating of the echo-abundance index in the current 2026 JJM assessment.

The biological data, including sexual maturity at age, was estimated from a length-based ogive using the information from Perea *et al.* (2013) and Dioses (2013a). The weight-at-age matrix was estimated from the mid-length at age, age, and growth parameters, and the length-weight relationship parameters were estimated by year.

A summary of the fishery-dependent, fishery-independent, and biological data used is provided in Table 1. Furthermore, during the 2026 assessment, the impact of gradually adding updated data was measured (models type 1).

Table 1. Data used in the 2026 assessment of the Peruvian (far-north) Jack mackerel stock

Type	Data	Details
From the fishery	Catch	1970–2026
	Catch-at-length	1980–2026
	CPUE	2002–2026
	Selectivity	Dome-shaped
Fishery independent	Echo-abundance	1985–2014
	Selectivity	Logistic
Biological	Growth parameters	k=0.16 y^{-1} Linf=80.77 cm (TL, corresponding to Linf=73.56 cm in FL for the assessment) L0=15.31 cm (TL, corresponding to L0=13.56 cm in FL for the assessment)
	Natural mortality	M=0.33/year
	Maturity at age	First maturity = ~2 years
	Weight at age	From updated W-L parameters

5.2.2. 2026 Joint Jack Mackerel (JJM) model outputs

A set of model configurations was implemented for the 2026 assessment using the JJM model (see Table 2). The objective was to present an updated assessment for the Jack mackerel in the far north. First, we evaluated the effect of updating the JJM model configuration following the work conducted during the recent SCW16 Benchmark meeting (May 2026), using the most recent version of this tool within the SPRFMO framework (models type 0). This step was considered essential to assess the improvements and corrections implemented in the latest version of the JJM model and their implications for the Peruvian national assessment.

The comparison identified substantial changes, mainly related to the modification of the fishing mortality penalty to prevent extreme values greater than 3, improvements to the selectivity calculation, corrections to the treatment of catchability, and updates to the calculation of SPR (Spawning Potential Ratio) reference points, and MSY. Therefore, for the purpose of this assessment update, we decided to retain the same model version used for the 2026 TAC assessment (i.e., the version available as of December 2025).

In addition, a progressive sensitivity analysis of the .tpl (template file; source code) was conducted. This analysis identified the revised fishing mortality penalty as the main driver of the differences observed between mod0.0 and mod0.1 (Figure 16a). These findings supported the decision to retain the model version used for the 2026 TAC assessment until both the data and the software have been fully updated and reviewed for the next TAC assessment in our national waters.

Table 2. Model configurations implemented in the 2026 JJM assessment of the Peruvian (far-north) Jack mackerel stock

Model	Description
Model update	
0.0	- As 2025 configuration and data (Peruvian quota for 2026). - Indices: echo-abundance (cv = 0.2x) and CPUE (cv = 0.2x, 2002-2017; cv = 0.3x, 2018-2025). - JJM model updated to December 2025.
0.1	- As 2025 configuration and data (Peruvian quota for 2026). - Indices: echo-abundance (cv = 0.2x) and CPUE (cv = 0.2x, 2002-2017; cv = 0.3x, 2018-2024). - JJM model updated to June 2026 (changes produced during SCW16 Benchmark meeting).
Data update	
1.0	As 0.0
1.1	As 1.0 but with revised catches through 2025 and projected 2026 catch estimates.
1.2	As in version 1.1, but using FL (fork length) for the length-composition and length frequencies from 10 to 70 cm. This includes revised length composition through 2025 and updated length data for 2026.
1.3	As 1.2 but with updated mean weight at age for 2026.
1.4	As 1.3 but with updated CPUE (cv = 0.2x for 2002-2017; cv = 0.3x for 2018-2026)

We then evaluated the impact of progressively updating the information available for the 2026 assessment (Type 1 models). According to our results, no changes were observed following the model updates (Figure 16c). Furthermore, with respect to the final model configuration (model 1.4), two periods or distinct productivity regimes were identified until the late 2010s, characterized by markedly contrasting levels of productivity. The first period of higher biomass was during the 1980s and 1990s, and the second period with lower biomass was between 2000 and at least 2018. Since 2019, a rapid increase in biomass, to levels similar to those estimated for the high productivity regime, has been observed. These two contrasting regimes described by the JJM model are consistent with the observed decadal regime changes in the marine environment and in the distribution, abundance, population structure, and other biological characteristics of many marine species, including Jack mackerel, in the Peruvian marine ecosystem described by several authors (e.g., Jordan 1983, Chavez et al. 2003, 2008, Csirke 2013, Csirke et al. 2013, 2018, Arguelles et al. 2019). The current biomass estimation of the JJM for this year shows a continuous decrease in its trends since 2023. Notably, the 2026 model outputs confirm this declining trend in biomass dropping to levels comparable to those observed during 2019, and a continued increase in fishing mortality (F), albeit still below F_{MSY}. These results highlight the need for closer monitoring to assess whether the recent decline in CPUE reflects a temporary fluctuation in stock availability, the effects or operational constraints, such as regulatory measures affecting the artisanal fleet.

The fishing mortality (F) estimated for the period 1970–2026 was consistent across the seven model configurations, showing minimal variation in both central tendency and distribution (Figures 16b and 16d). In the most recent period (2019–2026), F initially decreased to historically low levels (e.g., F ≈ 0.04 in 2020–2021); however, this trend has reversed since 2022, with F rising progressively to 0.13 in 2024 and 0.15 in 2025, followed by a decline to 0.12 in 2026. While these values remain below the estimated F_{MSY}, the increasing trajectory warrants attention.

The history and current situation of the unfished biomass, total biomass and annual fishing mortality of the Peruvian (far-north) stock as estimated with the JJM model are presented in the top three panels in Figure 17 and those of the spawning stock biomass and resulting recruitment are presented in the lower panel in the same figure.

As noted early, the stock would have passed through two stages of productivity, or regimes, with high levels of total biomass during the 1990s and low levels since 2000 to at least 2018. These two main stages are represented by two stock-recruitment regimes (Figure 17, lower panel). With one high productivity regime from 1970 to 1996 and a lower productivity regime from 2001 to 2016.

Regarding the two stock, stock-recruitment relationship, it is important to note that the period from 1997 to 2000 was excluded from the curve fitting due to the high variability observed during that period, likely driven by the intense 1997–1998 El Niño event and the potential instability associated with the regime shift itself.

Finally, the results derived from the final configuration of the JJM model, along with the formal projections under different fishing mortality (F) scenarios, suggest that both total biomass and spawning stock biomass remain above the levels required to achieve the MSY under the currently assumed low abundance regime. However, despite the generally positive outlook for stock status, there is a need to be precautionary regarding the recent declines in biomass and monitor the presence of juveniles, both in commercial catches and scientific surveys, as they may indicate a recruitment pulse. Along these lines, the JJM model outputs highlight the significant variability in past recruitment events and emphasize the uncertainty surrounding the current recruitment levels, which are low compared to the strong 2017 - 2018 cohort, as well as future recruitment prospects. This variability aligns with observations discussed in previous sections regarding environmental fluctuations and their influence on the behavior, distribution, abundance, and recruitment of Jack mackerel in Peruvian waters.

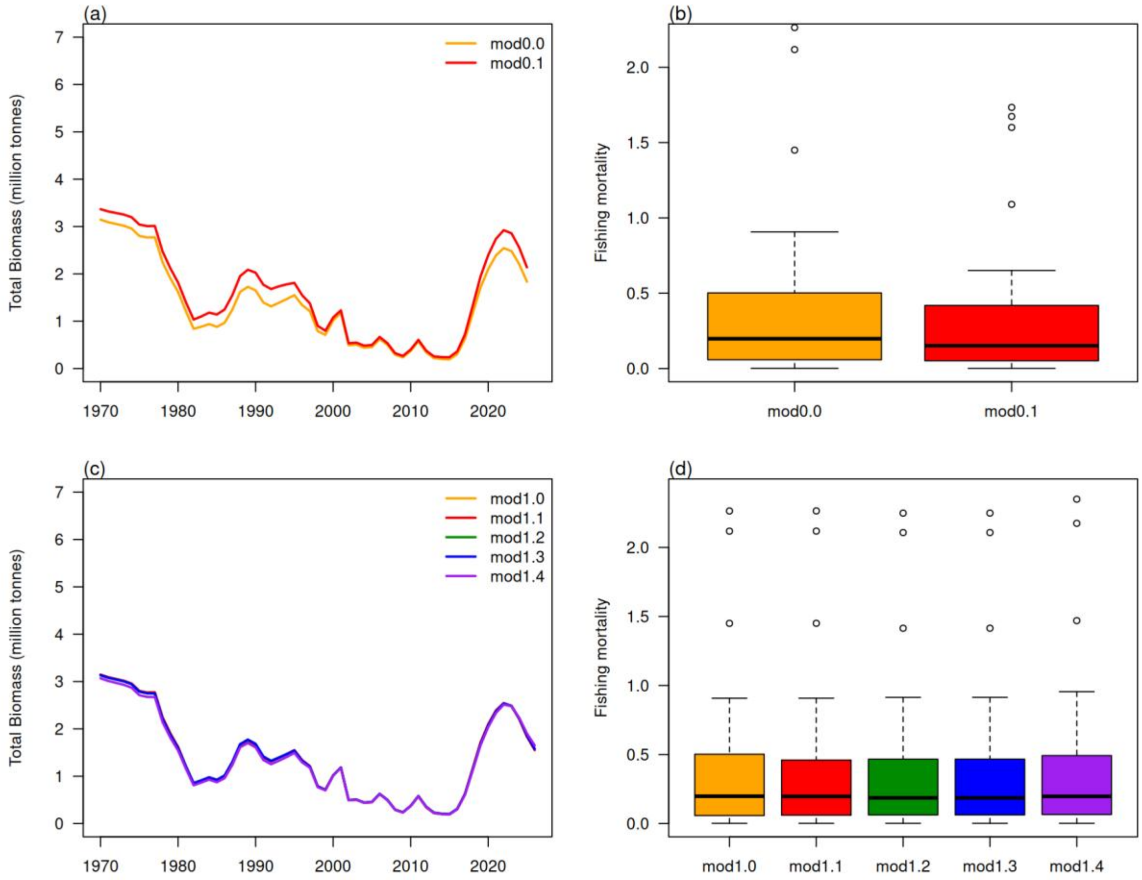


Figure 16. Results of the final JJM model configuration showing the estimated total biomasses of Jack mackerel (Figures a and c) and boxplots of fishing mortality (Figures b and d) for the two model groups respectively.

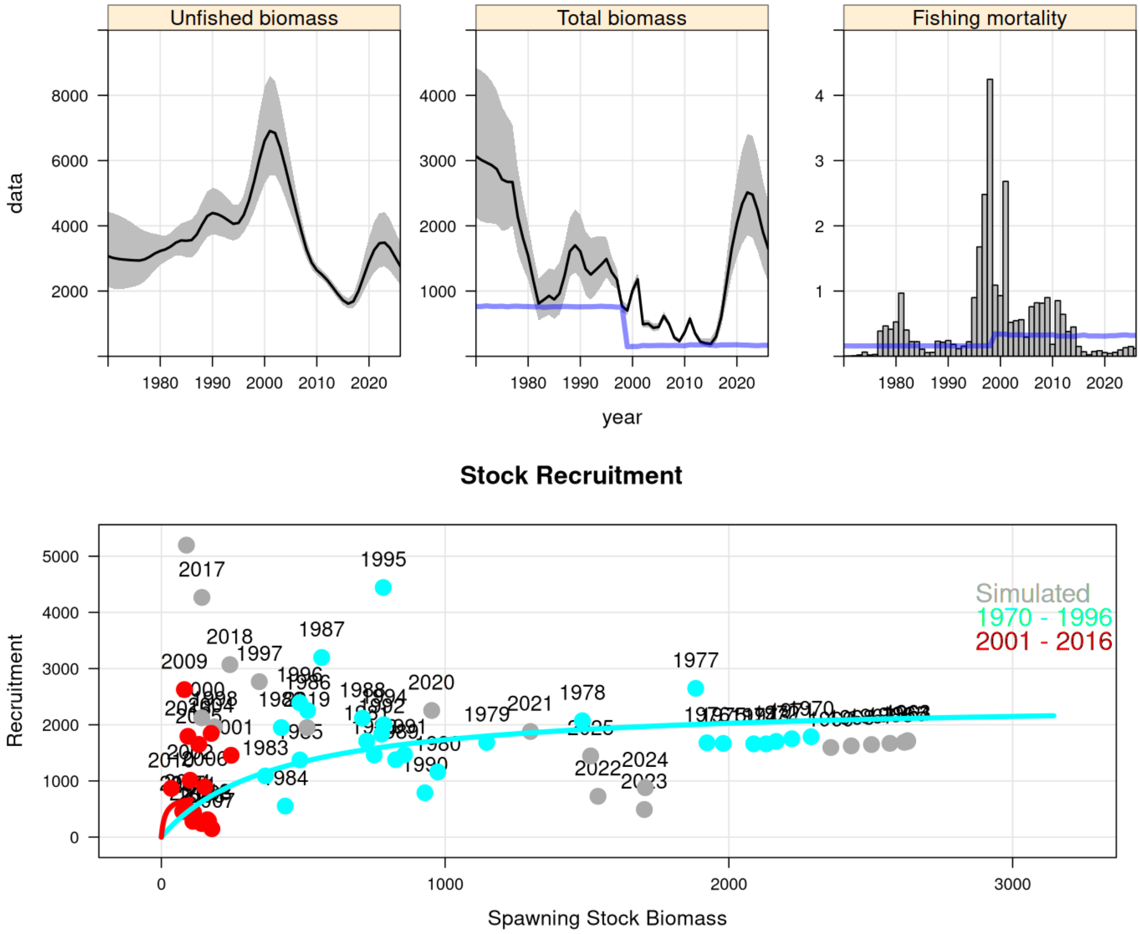


Figure 17. Outputs of the final configuration of the JJM model showing the history and current situation of the Peruvian (far-north) stock of Jack mackerel (*Trachurus murphyi*). Unfished biomass, total biomass (in thousand t) and yearly fishing mortality are presented at the top panels. The stock-recruitment relationship showing two regimes is presented in the lower panel. The horizontal blue lines in the two top-right panels represent the estimated reference levels of mean total biomass (B_{MSY}) and annual fishing mortality (F_{MSY}) corresponding to the Maximum Sustainable Yield (MSY).

6. REFERENCES

Alegre, A., P. Espinoza & M. Espino. 2013. Trophic ecology of Jack mackerel *Trachurus murphyi* in Peru, 1977 - 2011. *Revista peruana de biología*. Special issue (published in Spanish with titles, abstracts and captions in English), 20(1): 075 - 082.

Alegre, A., A. Bertrand, M. Espino, P. Espinoza, T. Dioses, M. Ñiquen, I. Navarro, M. Simier & F. Ménard. 2015. Diet diversity of jack and chub mackerels and ecosystem changes in the northern Humboldt Current system: A long-term study. *Progress in Oceanography* 137: 299–313.

Arguelles, J., J. Csirke, D. Grados, R. Tafur & J. Mendoza. 2019. Changes in the predominance of phenotypic groups of jumbo flying squid *Dosidicus gigas* and other indicators of a possible regime change in Peruvian waters. Working paper presented to the 7th meeting of the Scientific Committee of the SPRFMO, La Havana, Cuba, 5-12 October 2019. SPRFMO Doc. SC7-SQ03: 19p

Chamorro et al. 2024. Variabilidad del Anticiclón del Pacífico Sur y su influencia sobre el viento en el Sistema de Afloramiento Peruano [In prep.]. Instituto del Mar del Perú.

Csirke, J. 2013. The Jack mackerel in Peru. *Revista peruana de biología*. Special issue (published in Spanish with titles, abstracts and captions in English) 20(1): 5-8.

Csirke, J., R. Guevara-Carrasco & M. Espino (eds). 2013. Ecology, fishery and conservation of Jack mackerel (*Trachurus murphyi*) in Peru. *Revista peruana de biología*. Special issue (published in Spanish with titles, abstracts and captions in English), 20 (1): 001-114.

Csirke, J. & M. Ñiquen. 2017. Evidences of the consistent occurrence of all life-history stages of Jack mackerel (*Trachurus murphyi*) in the northern Humboldt Current System, off Peru and Ecuador. Working paper presented to the 5th meeting of the Scientific Committee of the SPRFMO, Shanghai, China, 23-28 September 2017. SPRFMO Doc. SC6-JM03: 16p

Csirke J, Argüelles J, Alegre A, Ayón P, Bouchon M, Castillo G, Castillo R, Cisneros R, Guevara-Carrasco R, Lau L, Mariátegui L, Salazar C, Tafur R, Torrejón J, Yamashiro C. 2018. Biology, population structure and fishery of jumbo flying squid (*Dosidicus gigas*) in Peru. Bol. Inst. Mar Peru. 33(2): 302-364

Chavez, F., J. Ryan, S.E. Lluch-Cota, M. Ñiquen. 2003. From anchovies to sardines and back: multidecadal change in the Pacific Ocean. Science 299 (5604): 217-221

Chavez, F., A. Bertrand, R. Guevara-Carrasco, P. Soler & J. Csirke. 2008. The northern Humboldt Current System: brief history, present status and a view towards the future. Prog. Oceanogr. 79: 95-105

Diaz, E. 2013. Estimation of growth parameters of Jack mackerel *Trachurus murphyi* caught in Peru, from length frequency analysis. *Revista peruana de biología*. Special issue (published in Spanish with titles, abstracts and captions in English), 20(1), 061-066.

Dioses, T. 1995. Análisis de la distribución y abundancia de los recursos jurel y caballa frente a la costa peruana. Informe Progresivo del Instituto del Mar del Perú (IMARPE), Callao, Perú, No 3: 55 pp

Dioses, T. 2013. Age and growth of Jack mackerel *Trachurus murphyi* in Peru. *Revista peruana de biología*. Special issue (published in Spanish with titles, abstracts and captions in English), 20 (1): 045-052.

Dioses, T. 2013a. Abundance and distribution patterns of Jack mackerel *Trachurus murphyi* in Peru. *Revista peruana de biología*. Special issue (published in Spanish with titles, abstracts and captions in English), 20 (1): 067-074.

ENFEN. 2012. Definición operacional de los eventos El Niño y La Niña y sus magnitudes en la costa del Perú [Nota Técnica, 3p]. Comité Técnico del Estudio Nacional del Fenómeno El Niño. https://enfen.imarpe.gob.pe/download/nota-tecnica-enfen-abril-2012-definicion-operacional-de-los-eventos-el-nino-y-la-nina-y-sus-magnitudes-en-la-costa-del-peru/?wpdmdl=770&refresh=67530eb0e312b1733496496

ENFEN. 2024. Definición Operacional de los Eventos El Niño Costero y La Niña Costera en el Perú. Nota Técnica ENFEN 01 2024. 07 pp. https://enfen.imarpe.gob.pe/download/nota-tecnica-enfen-01-2024-definicion-operacional-de-los-eventos-el-nino-costero-y-la-nina-costera-en-el-peru/

Goicochea, C., Mostacero, J., Moquillaza, P., Dioses, T., Topiño, Y., & Guevara-Carrasco, R. 2013. Validation of the formation rate growth rings in otoliths of Jack mackerel *Tracurus murpphyi* Nichols 1920. *Revista peruana de biología*. Special issue (published in Spanish with titles, abstracts and captions in English),, 20(1), 053-060.

IMARPE-PRODUCE. 2012. National report on the situation of the Peruvian stock of Jack mackerel (northern stock) and the Peruvian fishery in national jurisdictional waters. Peru 2nd National Report 2012. 11th Meeting of the Science Working Group of the SPRFMO, Lima, Peru, 15-19 October 2012. Doc. SPRFMO SWG-11-08a: 65p.

IMARPE-PRODUCE. 2012a. Characteristics of the Peruvian stock (northern stock) of Jack mackerel (*Trachurus murphyi*) in the Southeast Pacific and notes on the scientific basis for its differentiation. 11th Meeting of the Science Working Group of the SPRFMO, Lima, Peru, 15-19 October 2012. Doc. SPRFMO SWG-11-JM-03: 27p

IMARPE-PRODUCE. 2013. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters. Peru National Report No 2. 1st Meeting of the SPRFMO Scientific Committee, La Jolla, Ca., U.S.A., 21-27 October 2013. Doc. SPRFMO SC-01-13: 31p

IMARPE-PRODUCE. 2014. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters. Peru National Report No 2. 2nd Meeting of the SPRFMO Scientific Committee, Honolulu, Hawaii, U.S.A., 01-07 October 2014. Doc. SPRFMO SC-02-17: 40p

IMARPE-PRODUCE. 2015. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters.

Peru National Report No 2. 3rd Meeting of the SPRFMO Scientific Committee, Port Vila, Vanuatu, U.S.A., 28 September - 03 October 2015. Doc. SPRFMO SC-03-19: 21p

IMARPE-PRODUCE. 2016. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters. Peru National Report No 2. 4th Meeting of the SPRFMO Scientific Committee, The Hague, Kingdom of the Netherlands, 10-15 October 2016. Doc. SPRFMO SC-04-09: 23p

IMARPE-PRODUCE. 2017. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters. Peru National Report No 2. 5th Meeting of the SPRFMO Scientific Committee, Shanghai, China, 23-28 September 2017. Doc. SPRFMO SC5-Doc19: 21p

IMARPE-PRODUCE. 2018. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters. Peru National Report No 2. 6th Meeting of the SPRFMO Scientific Committee, Puerto Varas, Chile, 9-14 September 2018. Doc. SPRFMO SC6-Doc20: 31p

IMARPE-PRODUCE. 2019. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters, period January 2018 - June 2019. Peru National Report No 2. 7th Meeting of the SPRFMO Scientific Committee, La Havana, Cuba, 7-12 October 2019. Doc. SPRFMO SC7-Doc34: 27p

IMARPE-PRODUCE. 2020. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters, period January 2019 - June 2020. Peru National Report No 2. 8th Meeting of the SPRFMO Scientific Committee, New Zealand (hosted remotely), 3-8 October 2020. Doc. SPRFMO SC8-Doc24: 32p

IMARPE-PRODUCE. 2021. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters, period January 2020 – June 2021. Peru National Report No 2. 9th Meeting of the SPRFMO Scientific Committee, Held remotely, 27 September - 2 October 2021. Doc. SPRFMO SC9-Doc23: 34p

IMARPE-PRODUCE. 2022. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters, period January 2021 – June 2022. Peru National Report No 2. 10th Meeting of the SPRFMO Scientific Committee, Seoul, Korea, 26-30 September 2022. Doc. SPRFMO SC10-Doc27: 33p

IMARPE-PRODUCE. 2023. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters, period January 2022 – June 2023. Peru National Report No 2. 11th Meeting of the SPRFMO Scientific Committee, Panama City, Panama, 11-16 September 2023. Doc. SPRFMO SC11-Doc28: 40p

IMARPE-PRODUCE. 2024. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters, period January 2023 – June 2024. Peru National Report No 2. 12th Meeting of the

SPRFMO Scientific Committee, Lima, Perú, 30 September - 5 October 2024. Doc. SPRFMO SC12-Doc29: 31p

IMARPE-PRODUCE. 2025. National report on the situation of the Peruvian stock of Jack mackerel (far-north stock) and the Peruvian fishery in national jurisdictional waters, period January 2024 – June 2025. Peru National Report No 2. 13th Meeting of the SPRFMO Scientific Committee, Wellington, New Zealand, 08-13 September 2025. Doc. SPRFMO SC13-Doc29: 32p

IMARPE. 2025. Informe sobre el desarrollo de la pesquería de jurel *Trachurus murphyi* durante el 2025, situación actual y perspectivas de explotación para el 2026. Informe interno IMARPE, Oficio N° 2145-2025-IMARPE/PE, 18 de diciembre de 2025: 27p

Jordan, R. 1983. Variabilidad de los recursos pelágicos en el Pacífico Sudeste: 106-120. Inf. Pesca FAO, 291: 113-130.

Konchina, Y. 1981. The Peruvian Jack mackerel, *Trachurus symmetricus murphyi*, a facultative predator in the coastal upwelling ecosystem. Journal of Ichthyology 21, 46–59.

L’Heureux, M. L., Tippett, M. K., Wheeler, M. C., Nguyen, H., Narsey, S., Johnson, N., ... & Di Liberto, T. (2024). A relative sea surface temperature index for classifying ENSO events in a changing climate. Journal of Climate, 37(4), 1197-1211.

Ministerio de la Producción. 2024. Resolución Ministerial N.º 000508-2024-PRODUCE. Disponible en: https://www.gob.pe/institucion/produce/normas-legales/6333297-508-2024-produce

Ministerio de la Producción. 2025. Resolución Ministerial Nº 000441-2025-PRODUCE. Disponible en: https://cdn.www.gob.pe/uploads/document/file/9239240/7582059-r-m-n-441-2025-produce.pdf

Ministerio de la Producción. 2025. Resolución Ministerial Nº 00444-2025-PRODUCE. Disponible en: https://cdn.www.gob.pe/uploads/document/file/9239516/7582246-r-m-n-444-2025-produce.pdf

Ministerio de la Producción. 2026. Resolución Ministerial Nº 000052-2026-PRODUCE. Disponible en: https://cdn.www.gob.pe/uploads/document/file/9530564/7800784-resolucion-ministerial-n000052-2026-produce.pdf

Ministerio de la Producción. 2025. Resolución Ministerial Nº 000113-2026-PRODUCE. Disponible en: https://cdn.www.gob.pe/uploads/document/file/9893102/8075796-r-m-n-00113-2026-produce.pdf

Ministerio de la Producción. 2025. Resolución Ministerial Nº 0165-2025-PRODUCE. Disponible en: https://www.gob.pe/institucion/produce/normas-legales/6713930-165-2025-produce

Muck, P., Sánchez, G. 1987. The importance of mackerel and horse mackerel predation for the Peruvian anchoveta stock (a population and feeding model). In: Pauly, D. Tsukayama I. (Eds.). The Peruvian Anchoveta and Its Upwelling Ecosystem: Three Decades of Change. ICLARM Studies and Reviews (15), pp. 276-293.

Perea, A., J. Mori, B. Buitron & J. Sánchez. 2013. Reproductive aspects of Jack mackerel *Trachurus murphyi*. *Revista peruana de biología*. Special issue (published in Spanish with titles, abstracts and captions in English),, 20 (1): 020-034.

Quispe, J. & L. Vásquez. 2015. Índice “LABCOS” para la caracterización de eventos El Niño y La Niña frente a la costa del Perú, 1976-2015. Boletín Trimestral Oceanográfico, IMARPE, Callao, Perú. Vol. 1 (1-4): 12-16.

SPRFMO. 2025. 13th Scientific Committee meeting report. Wellington, New Zealand, 8-13 September 2025. SPRFMO SC13 Final report:180 p.