SPRFMO
South Pacific Regional Fisheries Management Organisation

14th MEETING OF THE SCIENTIFIC COMMITTEE

7 to 12 September 2026, Tórshavn, Faroe Islands

SC14 - Eco 02

Abundance of Jack Mackerel, Mackerel and Vinciguerria during 2025-26 in the Peruvian sea

Peru

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Lima, July 2026

Contribution to the Scientific Committee of the Regional Fisheries Management Agency for the South Pacific.

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.

South Pacific Regional Fisheries Management Organization
14th Meeting of the Scientific Committee
September 2026

NATIONAL FISHERIES SOCIETY – SCIENTIFIC RESEARCH COMMITTEE
HUMBOLDT INSTITUTE OF MARINE AND AQUACULTURE RESEARCH
PERUVIAN SEA RESEARCH INSTITUTE

Abundance of Jack mackerel, mackerel and Vinciguerria during 2025-26 in the Peruvian sea

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Lima, July 2026

Summary

An update of the analysis on changes in the habitat of Jack mackerel and mackerel has been carried out, with emphasis on what was observed between 2023 and 2026, in addition to aspects of the abundance of *Vinciguerria lucetia*.

Due to El Niño, a negative trend is observed in the biomass of Jack mackerel (*Trachurus murphyi*), that is, there is a decrease in its abundance, which includes mackerel. However, catches in the analyzed period (1983-2026) show, in general, better fishing yields in the years when biomass has been higher. The highest abundance of Jack mackerel, through geostatistical methods since 2024, was estimated during March 2024 with 215 thousand tons.

El Niño events are usually favorable for mackerel (*Scomber japonicus*), unlike what happens with Jack mackerel, but this year mackerel catches, and their abundance, have been minimal. However, catches in the period studied (1983-2026) show, in general, better yields in the years when the biomass has been higher. The highest abundance of mackerel, through geostatistical methods, since 2024, was estimated during March 2024, with 80 thousand tons.

The results obtained from the fish size analysis of 886,287 Jack mackerel individuals sampled between 2011 and 2025 reveal a fishery structured on well-differentiated cohorts, whose modal progression can be followed relatively clearly throughout the study period. This episodic recruitment pattern —in which the same annual class dominates the fishery for several consecutive years before being replaced by a new one— is a recognized feature of Southeast Pacific Jack mackerel biology and has been documented in continuous monitoring by the industrial fleet (SNP, 2013; SNP, 2024).

Since 2021, the expansion of the range of caught sizes reflects the overlap of several cohorts of Jack mackerel, also reviewed at the 12th SNP Workshop (2024). For the years 2024 and 2025 they presented the highest modes of the entire series (48 and 50 cm) and percentages of juveniles below 0.1%, indicating a fishery operating on the 2022 cohort. However, the detection in 2025 of a new cohort with a 38 cm of mode anticipates a transition in the composition of catches in the next two to three years which demands continuous fisheries monitoring.

Annex 1 provisionally shows the catches of Jack mackerel outside 200 miles during June 2026.

1. Introduction

The Scientific Research Committee (CIC) of the National Fisheries Society (SNP), in cooperation with the Humboldt Institute of Marine and Aquaculture Research (IHMA) and the Peruvian Sea Research Institute (IMARPE) organized the **Fourteenth SNPS-IHMA Workshop on the habitat conditions of jack mackerel and other species of the Peru Current in the Humboldt System**, which was held virtually from June 8 to 12, 2026. As usual, there has been the valuable participation and contribution of researchers from the Peruvian Sea Research Institute (IMARPE). This activity is a contribution to the national and international effort to investigate and diagnose the current population situation of Jack mackerel, as well as other important fishing species of the South Pacific, with special emphasis on aspects related to their habitats and abundance, which has been developed since the first workshop in 2011.

2. Description of the abundance of Jack mackerel, mackerel and vinciguerria using acoustic and geostatistical techniques

2.1. Estimating the abundance of Jack mackerel, mackerel and vinciguerria

In the present case, *observed abundance* or *observed biomass* is understood to be the amount of fish (Jack mackerel, mackerel and vinciguerria) measured in mass units (tons) only in the areas of operation of the fishing fleet of the companies affiliated with the National Fisheries Society (SNP). On the other hand, biomass is the total amount of fish in its entire possible distribution area, which is expressed in units of mass (in tons), which cannot be measured only with fishing trips, since the fleet operates in limited areas, it cannot do so within the first 10 miles of coastline and neither in areas with the presence of juveniles or inside marine protected areas.

Apart from the biomass estimates that IMARPE periodically makes of pelagic resources, since the first workshop on Jack mackerel (2011) two methods have been used to estimate the abundance of these species. The first method is acoustic, i.e. a certain number of fishing vessels equipped with digital acoustic detection systems (echo sounders) of 120 kHz frequency, have collected information to be analyzed during the annual workshops.

The second method used is geostatistical, through which all fishing sets carried out between 2021 and 2024, both for Jack mackerel and mackerel, have been regionalized in 8 areas, in order to estimate the centers of gravity and inertia associated with each region. The information was also grouped into fortnights or weeks from January 2025 to January 2026. The average catch per set and zone/fortnight/week was used as an indicator (proxy) of fish density (tonnes/mn2). In this way, the multiplication of the average catch by inertia yields an abundance in tonnes, which is assumed to be proportional to the biomass only in the areas of operation where the fleet has operated. The methodological details used for the analysis of the data are described in SNP (2015).

2.1.1. Jack mackerel biomass estimated by IMARPE using acoustic methods

Information on latitudinal acoustic biomass and annual catches of Jack mackerel along the Peruvian coast has been updated. To this end, information from IMARPE acoustic surveys has been used; the annual landing data have been collected from the website of the Ministry of Production. Figure 2.1.1.1 presents a Hovmoller diagram of changes in latitudinal Jack mackerel biomass between 1983 and the end of 2025.

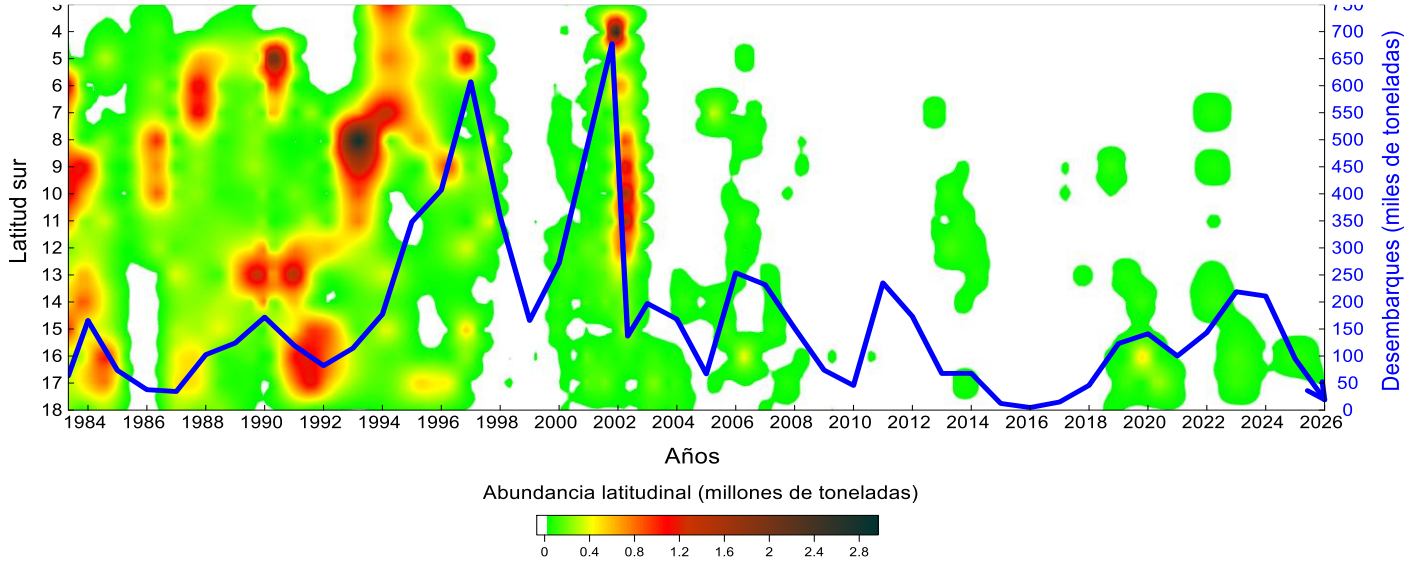


Figure 2.1.1.1. Latitudinal Jack mackerel biomass along the Peruvian coast, represented by the vertical axis on the left between 1983 and 2025 (horizontal axis). The captures are represented by the blue line and the right vertical axis. The colors correspond to biomasses according to the legend of the figure.

In general, two regimes are observed: one between 1983 and 2002, in which biomass fluctuated between medium and high levels; and another regime exists after 2002 with abundances varying between medium and low levels. However, in recent years there has been a positive trend in biomass, that is, an increase towards medium levels of abundance. Catches in the same period (1983-2026) also show, in general, better yields in the years in which the biomass has been bigger, except in the current year when, due to the ongoing El Niño event, jack mackerel catches have been made outside 200 miles in the southern zone (see Annex 1, that data has not been included in the analysis shown in this report).

2.1.2. Abundance of Jack mackerel calculated by geostatistical methods

Figure 2.1.2.1. shows the location and distribution of Jack mackerel fishing sets that have been carried out between the months of January 2025 and January 2026. The sets have been classified by geographical areas and by weeks in order to determine the average catch (tons/mn2), the Center of Gravity (latitude, longitude) and inertia (mn2) in each of them. Jack mackerel fishing sets have been observed only in the southern zone outside the edge of the shelf, from 10 to more than 200 miles from the coast, and between latitudes 17°00'S (Mollendo) and 20°00'S (Pisagua). 734 fishing sets have been made, with catches ranging from 3 to 410 tonnes per set. The average catch was 41.0 tons per set, and 30,429 tons of Jack mackerel have been caught by the industry fleet between January 2005 and January 2026.

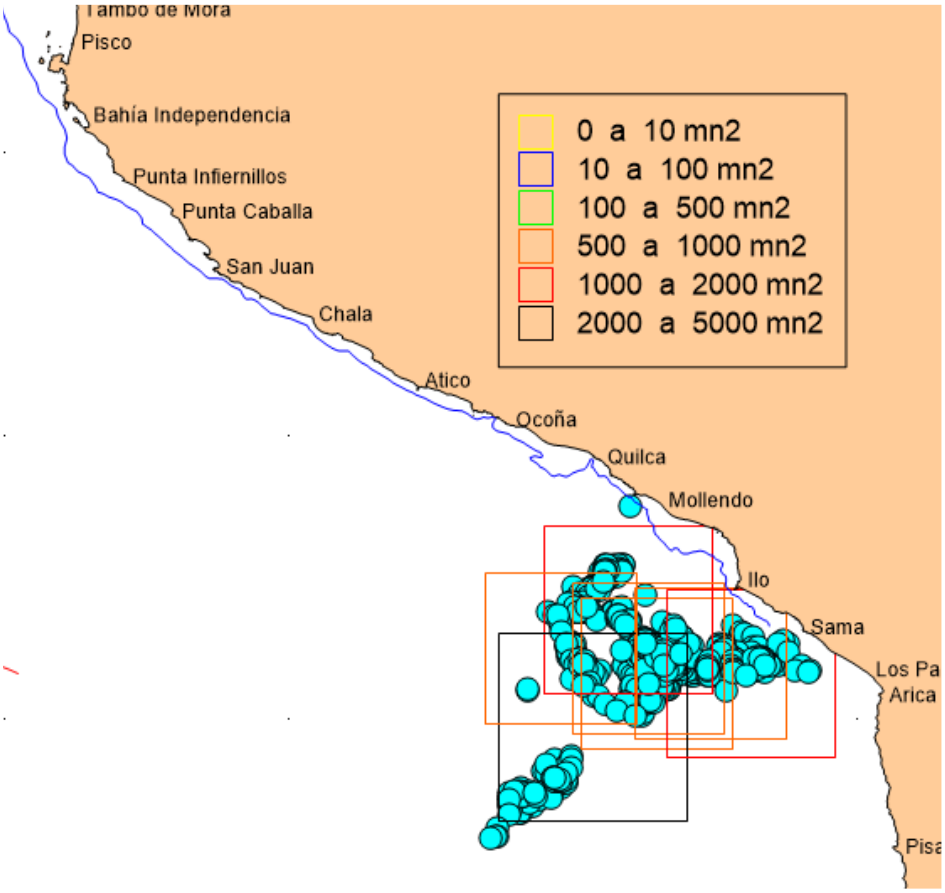


Figure 2.1.2.1. Distribution of Jack mackerel fishing sets and related inertia between 2025 and 2026. The centers of gravity and the magnitude of inertia (indicated by squares according to the legend in the figure) in each area and week have been determined in order to estimate the abundance of Jack mackerel using as an indicator the average catch per set per region and per week.

Figure 2.1.2.2. The estimated abundances and catches (tonnes) for the distribution of Jack mackerel are observed using geostatistical methods between January 2025 and January 2026. It should be noted that the lack of estimates in months without catch is due to the fact that the fishing vessels were participating in the anchovy fishing seasons, or because the corresponding fishing quota had been reached. The highest abundance of Jack mackerel was estimated during mid August 2025 (week 4) with 77.769 ton, followed by the fist week of august 2025 with 62,512 tons.

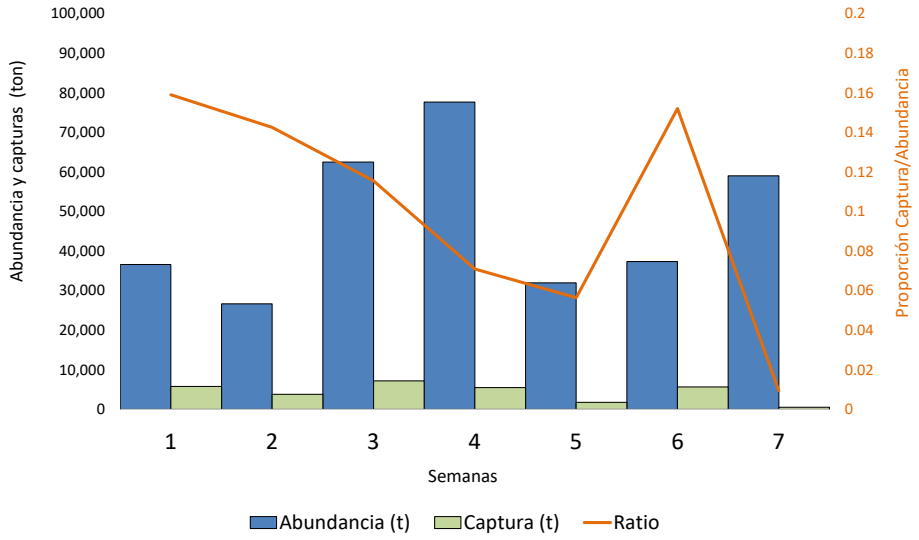


Figure 2.1.2.2. Abundance, catch and relationship between the two for Jack mackerel biomass between August 2005 and January 2026. The estimates shown in blue bars have been made by grouping the catch data by week.

Table 2.1.2.1. Timeline of Fishing Weeks Between 2025 and 2026 (Semana mean Week, and Fecha mean Date)

Semana	Fecha
1	26/07/2025
2	2/08/2025
3	9/08/2025
4	12/08/2025
5	23/08/2025
6	31/08/2025
7	7/01/2026

2.3. **Geographical distribution according to acoustic records obtained for Jack mackerel between 2020 and 2026**

The geographical distribution of Jack mackerel during the period 2020-2026, based on the assessments carried out during IMARPE assessment surveys and on the CHD fishing activities of the industrial fleet, shows that the highest concentration of this species is south of the 12th degree south latitude, with a more continuous record between 13th and 17th degrees south latitude. Isolated areas have also been identified in front of Paita, Punta Falsa, Chicama, Chimbote and Huacho. The distribution of Jack mackerel reaches up to 120 nautical miles, but in general, it is within 50 nautical miles. Figure 2.3.1.

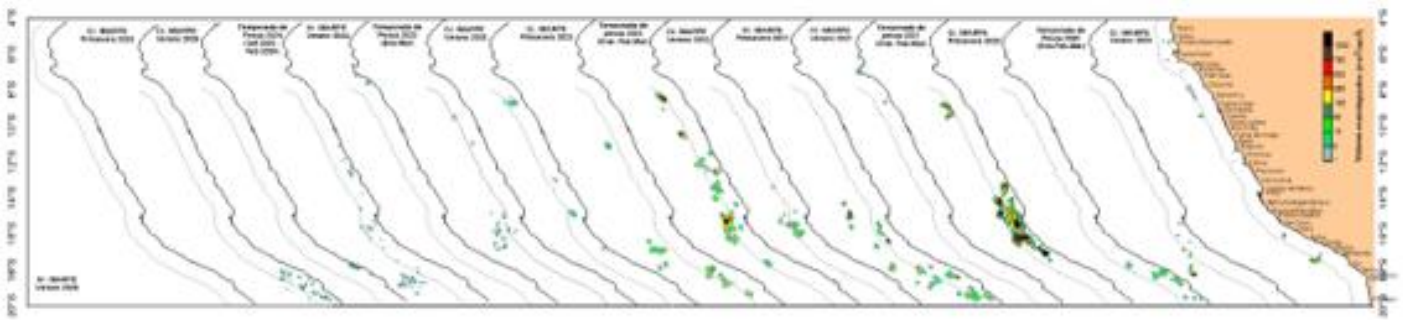


Figure 2.3.1. Geographical distribution of Jack mackerel during IMARPE cruises and SNP Jack mackerel fishing seasons, carried out between the period 2020 and 2025.

2.4 Vertical distribution of Jack mackerel during 2018 to 2026

The vertical distribution of Jack mackerel observed during the period 2018–2026 extended from the surface to approximately 99 m depth, with an average depth of 13.84 m. The shoals were mainly concentrated in the first 20 m of the water column along the entire evaluated area. The shallowest records were observed mainly between 15° and 18° S, while the deeper detections were recorded in isolation in the south-central zone, mainly between 14° and 15° S. Regarding acoustic density, the mean backscatter values were similar between day (-39.16 dB) and night (-40.08 dB), evidencing a comparable vertical distribution during both periods. Figure 2.4.1.

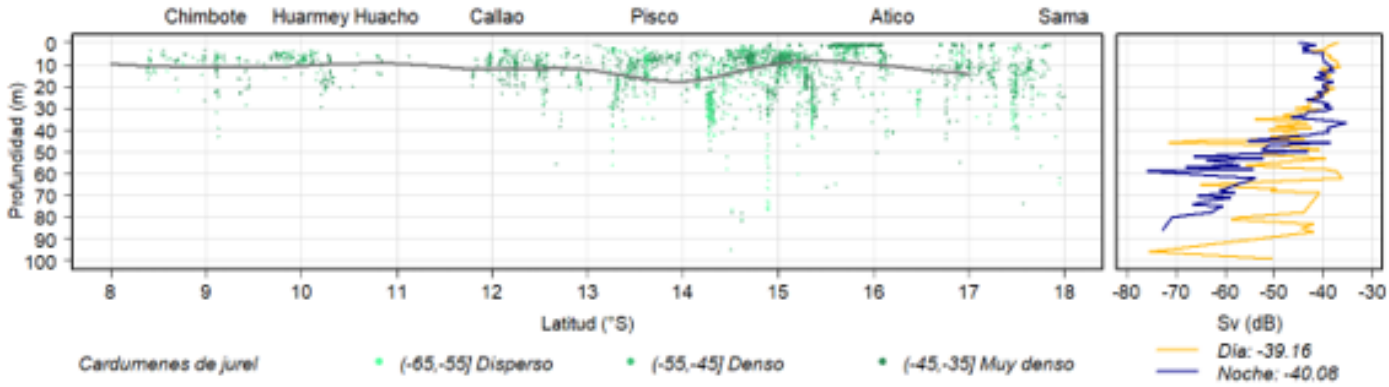


Figure 2.4.1. Latitudinal vertical distribution of Jack mackerel 2018-2025; the right-hand panel shows the backscatter volume (Sv, dB re m2/m3) according to depth.

4.5. Vertical distribution of mackerel during 2018–2026

The vertical distribution of mackerel observed during the period 2018–2026 ranged from 3.8 to 154.9 metres deep, with an average depth of 37.83 metres. The shallowest schools were recorded in the northern area of the evaluated area, between 8° and 13° of south latitude, while the deepest were found in the southern zone, between 15° and 18° of south latitude. On the other hand, the densities were similar both during the day and at night, with mean backscatter values of -38.46 dB and -41.04 dB, respectively. Figure 2.5.1.

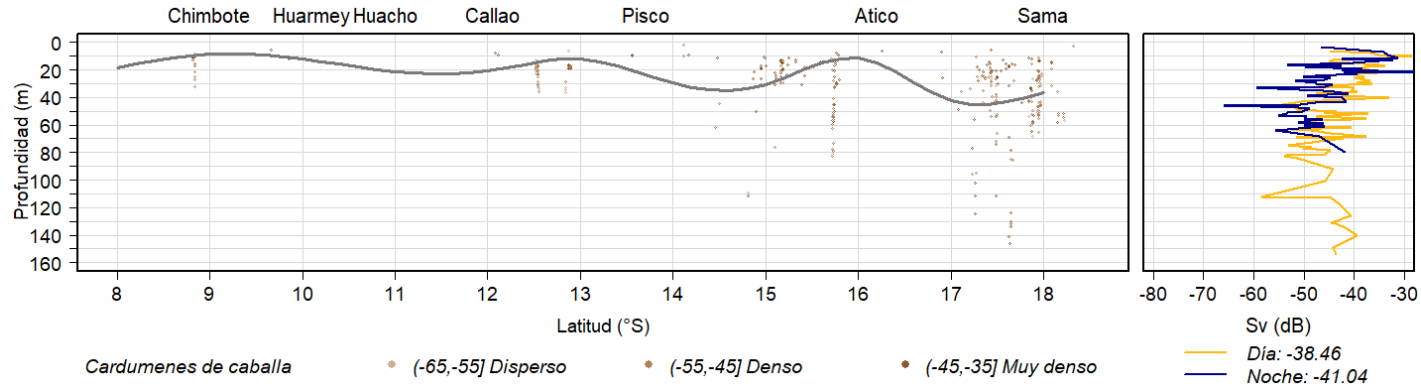


Figure 2.5.1. Latitudinal vertical distribution of Jack mackerel 2018-2025; the right-hand panel shows the backscatter volume (Sv, dB re m2/m3) according to depth.

2.6. Classification of Jack mackerel echoes 2022 -2026

During the activities of the IMARPE surveys and SNP fleet operations in the period 2022 - 2026, a total of 6,270 (340 schools in the 2026 workshop) schools of Jack mackerel were detected. A principal component analysis (PCA) was performed, using *Gaussian Mixing Models (GMM, it* is a statistical clustering technique to identify patterns or groups within a dataset without the need to previously know the number or structure of those groups, organizing the variables

according to energy criteria (NASC, Minimum Sv, Maximum Sv and Average Sv). positional (medium depth) and morphological (length, height, perimeter and area).

The analysis determined three types of clusters 1, 2 and 0; Cluster 1 groups schools with much of acoustic energy and size (possibly dense or large), which would be a priority for industrial fishing operations; followed by cluster 2 (intermediate) and perhaps operable for fishing, but with a higher effort; and cluster 0, with little biomass and high variability, therefore, less attractive for fishing (possibly more dispersed); Table 2.6.1.

Table 2.6.1. Parameters of the detections of schools of Jack mackerel during 2022 – 2026

Variable	Min	Max	Average	Variance	Standard deviation	CV (%)	Cluster
NASC	0.826896	819072.2	77893.44	1.2D+10	109590.4	140.6927	Cluster 1
Sv_max	-61.5498	-5.09617	-24.3935	74.15237	8.611177	-35.3011	Cluster 1
Sv_min	-70	-50.9864	-65.8921	13.89986	3.728251	-5.65812	Cluster 1
Sv_mean	-76.3085	-23.7781	-41.0526	57.1015	7.556554	-18.407	Cluster 1
Profmedia	0.62819	86.64189	16.25375	139.1029	11.79419	72.56291	Cluster 1
Corrected_length	0.566904	706.179	82.21157	6722.798	81.99267	99.73374	Cluster 1
Corrected_thickness	0.77763	67.728	15.57373	83.33921	9.129031	58.61815	Cluster 1
Corrected_perimeter	10.09756	20590.61	1127.931	1745699	1321.249	117.1391	Cluster 1
NASC	14.91716	52834.44	9022.284	1.13E+08	10645.79	117.9944	Cluster 2
Sv_max	-57.6001	-9.67975	-29.0027	52.05901	7.215193	-24.8776	Cluster 2
Sv_min	-70	-50.6379	-65.4256	18.94572	4.352668	-6.65285	Cluster 2
Sv_mean	-67.625	-28.7403	-44.1041	33.28193	5.76905	-13.0805	Cluster 2
Profmedia	0.551332	34.84254	8.447949	28.65669	5.353194	63.36679	Cluster 2
Corrected_length	0.121312	131.2233	28.84453	525.4361	22.92239	79.46876	Cluster 2
Corrected_thickness	0.504	19.5963	6.041877	11.8623	3.444168	57.00494	Cluster 2
Corrected_perimeter	6.853429	1426.232	317.5179	73327.63	270.7907	85.28361	Cluster 2
Corrected_area	0.203592	513.3061	96.09906	9802.75	99.00884	103.0279	Cluster 2
Corrected_area	1.153363	8862.792	714.902	815044.3	902.798	126.2828	Cluster 1
NASC	0.190173	1091.575	152.2359	47456.22	217.8445	143.0967	Cluster 0
Sv_max	-63.6887	-21.5619	-48.1171	76.44493	8.743279	-18.1708	Cluster 0
Sv_min	-70	-46.6083	-64.8374	13.17009	3.629061	-5.59718	Cluster 0
Sv_mean	-80.7925	-40.3234	-56.6104	39.71336	6.301854	-11.132	Cluster 0
Profmedia	0.487316	48.24186	7.314992	33.03719	5.747798	78.5756	Cluster 0
Corrected_length	0.0189	123.8344	18.53689	265.4774	16.29348	87.8976	Cluster 0
Corrected_thickness	0.192327	6.36	1.43472	0.926924	0.962769	67.10501	Cluster 0
Corrected_perimeter	2.812146	557.2548	82.67589	4741.074	68.85546	83.2836	Cluster 0
Corrected_area	0.009694	62.3767	8.580975	72.12462	8.492621	98.97035	Cluster 0

2.7. Mackerel biomass estimated by IMARPE using acoustic methods

Information on latitudinal acoustic biomass and annual catches of mackerel along the Peruvian coast has been updated. To this end, information from IMARPE acoustic surveys has been used; the annual landing data have been collected from the website of the Ministry of Production.

Figure 2.7.1. presents a Hovmoller diagram of changes in mackerel latitudinal biomass between 1983 and the end of 2025. In general, three regimes can be observed: the first occurred between 1983 and 1992, in which the biomass was uniformly distributed along the entire coast, although with medium abundances; the second period occurred between

1992 and 2002, in which biomass fluctuated between medium and high levels; and a third regime exists after 2002 with abundances varying between medium and low levels.

However, in recent years there has been a positive trend in biomass, that is, an increase towards medium levels of abundance. Catches in the same period (1983-2026) show, in general, better yields in years when biomass has been higher.

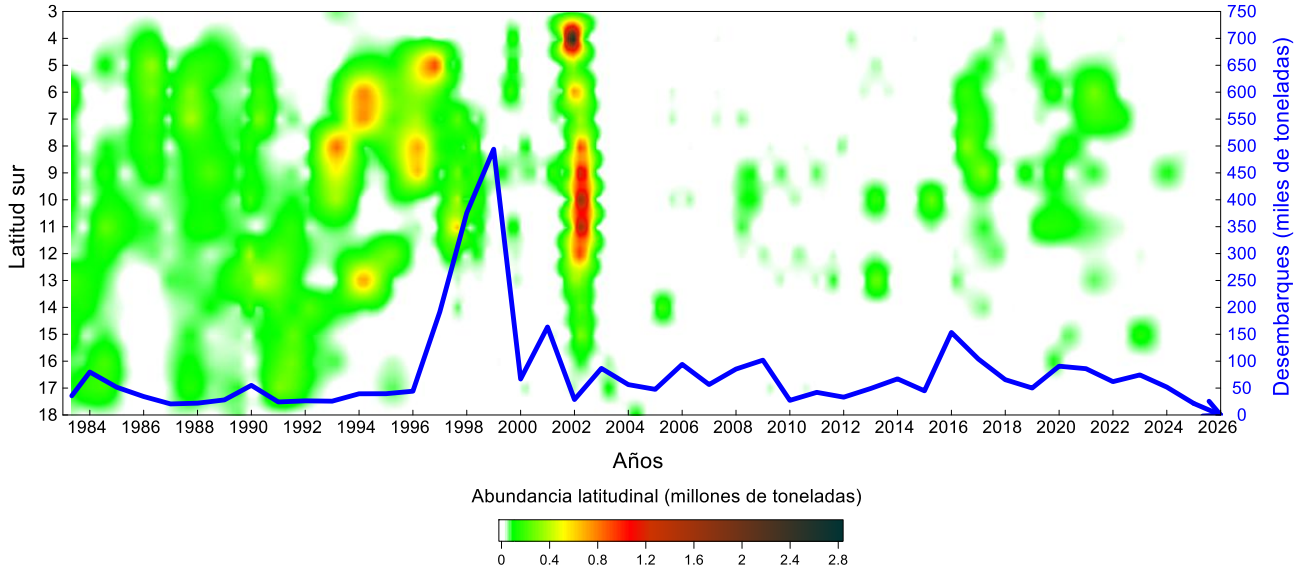


Figure 2.7.1. Latitudinal biomass of mackerel along the Peruvian coast, represented by the vertical axis on the left between 1983 and 2025 (horizontal axis). The captures are represented by the blue line and the right vertical axis. The colors correspond to biomasses according to the legend on the lower side of the figure.

2.7.1. Mackerel abundance calculated by geostatistical methods

Figure 2.7.1.1. shows the location and distribution of mackerel fishing sets that have been carried out between the months of January 2025 and January 2026. The sets have been classified by geographical areas and by weeks in order to determine the average catch (tons/mn2), the Center of Gravity (latitude, longitude) and inertia (mn2) in each of them. Mackerel fishing sets have been observed in the southern zone from 10 to more than 200 miles from the coast, and between latitudes 16°00'S (Lomas) and 21°00'S (Pisagua). 62 sets have been made, with catches ranging from 1 to 210 tonnes per set. The average catch was 38 tonnes per set, and 2,215 tonnes of mackerel have been caught by the industrial fleet between January 2025 and January 2026.

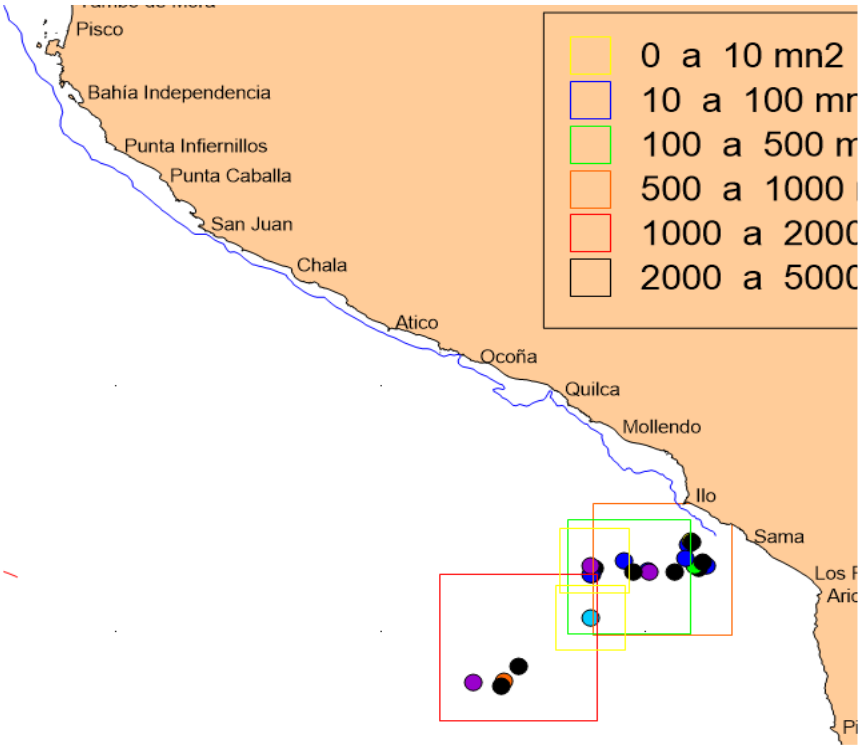


Figure 2.7.1.1. Distribution of mackerel fishing sets and related inertia between August 2025 and January 2026. The colour circles correspond to the southern area. The centres of gravity and the magnitude of inertia (indicated by squares according to the legend in the figure) have been determined in each area and week in order to estimate the abundance of mackerel using as an indicator the average catch per set per region and per week.

Figure 2.7.1.2. The estimated abundances and catches (tonnes) for the distribution of mackerel are observed using geostatistical methods between January 2025 and January 2026. It should be noted that the lack of estimates in months without catch is due to the fact that fishing vessels were participating in anchovy fishing seasons. The highest abundance of mackerel was estimated during mid August (week 4) with 36,369 tonnes, followed by the first week of January 2025 with 25,067 tonnes.

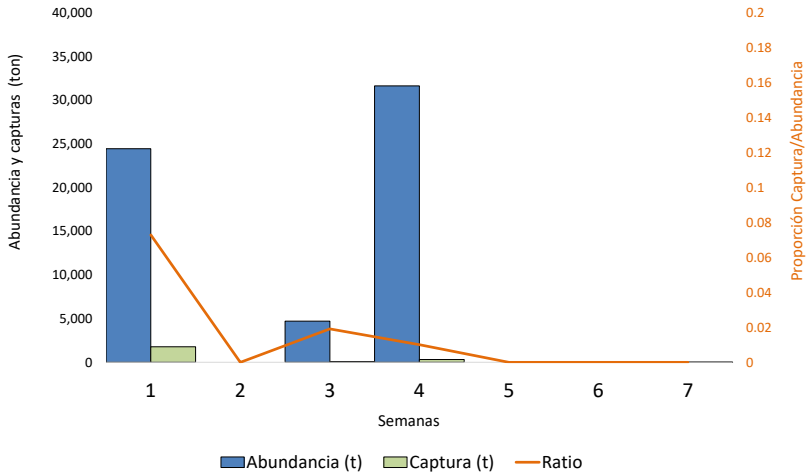


Figure 2.7.1.2. Abundance and catch and relationship between the two for the weeks between January 2025 and January 2026

2.8. Distribution of macrozooplankton during fishing trips between August and September 2025

During the fishing trips, an acoustic detection was made on the macrozooplankton present in the areas covered by some of the fishing vessels that participated in the Jack mackerel and mackerel fishing seson during the year 2025. Figure

2.8.1. It shows the location of the statistical squares with their corresponding average value of the nautical coefficient or acoustic dispersion (NASC, m2/mn2), finding in general that the best values are located south of Pisco.

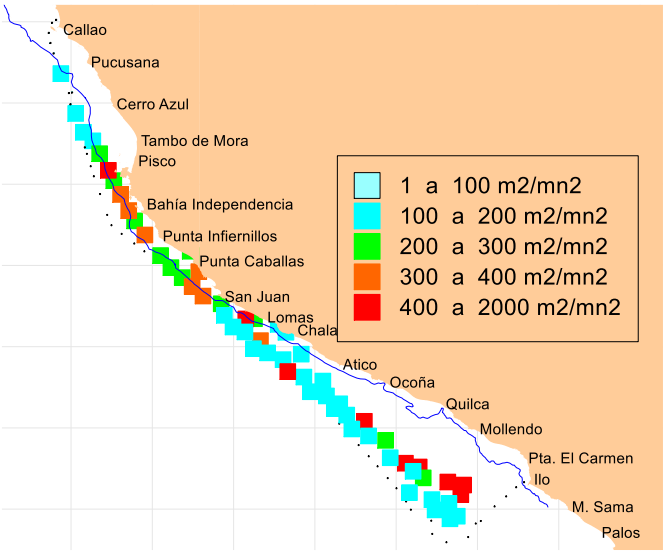


Figure 2.8.1. Distribution of acoustically detected macrozooplanton presented in statistical squares according to the average NASC values (m2/m3) according to depth.

2.9.Estimation of the acoustic abundance of Jack mackerel, mackerel and vinciguerria

In the present case, the data collected by the Sebastián, Tasa 419, Tasa 53 and Matty fishing vessels has been counted for the analysis; 6 weeks of acoustic data collected during the season were analyzed. In all cases, Simrad ES70 model echo sounders operating at the frequency of 120 kHz and Split beam transducers were used. The basic sampling unit (UBM) was 1 nm, with a total of 25,088 nm navigated. Two methods have been applied for the estimation of the acoustic abundance of Jack mackerel, which are presented below.

Since the routes made by the ships were random, and not systematic, a system of stratification of statistical squares in two dimensions or spaces of 15 by 15 nm (225 nm2 in area) was adopted, in which all NASC measurements by UBM were averaged including zeros to avoid overestimation of the results.

In this way, the biomass observed in a certain number of strata or statistical quadrants with the presence of Jack mackerel, mackerel and vinciguerria has been calculated, with which two biomass estimates for the prospected area for each week have been found. Figure 2.9.1. Displays ship routes and calculated acoustic biomasses by weeks in the case of Jack mackerel.

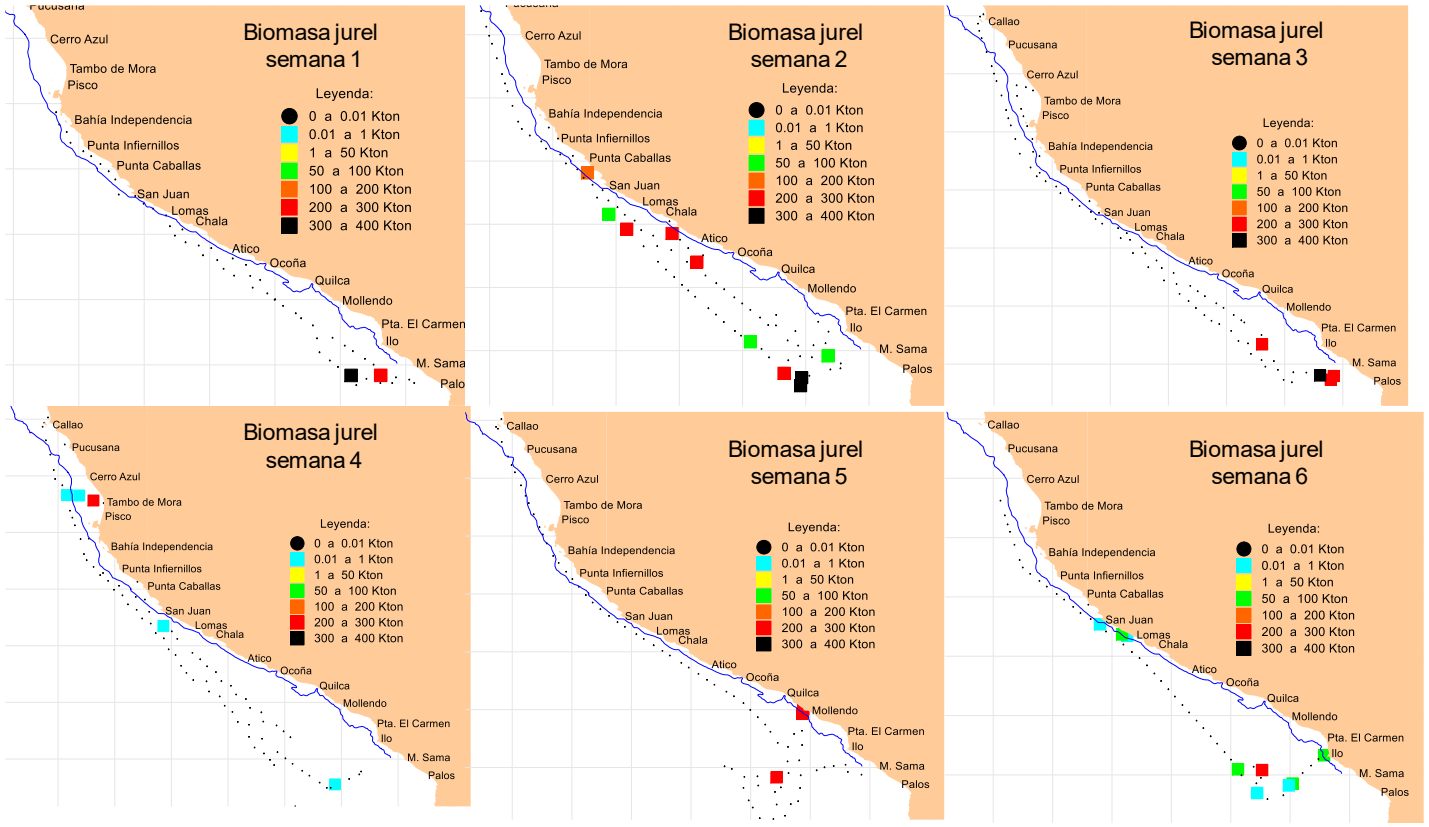


Figure 2.9.1. Mackerel biomass per week by statistical squares of 15 x 15 nm in the area evaluated by the fishing vessels during the fishing weeks in the period August to September 2025

2.10. Synthesis of abundance measurement results for Jack mackerel (*Trachurus murphyi*)

Estimates of mackerel abundance have ranged from 31 to 463 thousand tons in the areas prospected by fishing vessels. Table 2.10.1 presents the main results, including the area covered each week by Jack mackerel; Figure 2.10.1. Shows the size structure of jack mackerel by weeks.

Table 2.10.1. Results of the acoustic biomass estimation and statistical accuracy estimates of the assessment made for Jack mackerel for weeks in 2025.

RESULTADOS	Semana 1	Semana 2	Semana 3	Semana 4	Semana 5	Semana 6	unidades
Número de cuadrados positivos:	3.00	10.00	8.00	5.00	3.00	11.00	cuadrados
Area con jurel:	641.22	2,149.90	1,725.92	1,086.79	644.03	2,369.62	n.mi.2
NASC:	2,962.31	2,622.18	5,110.38	186.98	200.28	567.52	m2/n.mi.2
NASC promedio:	987.44	262.22	638.80	37.40	66.76	51.59	m2/n.mi.2
Desviación estándar:	787.95	300.89	462.89	79.17	3.02	148.50	m2/n.mi.2
Número de UBMs con jurel	392.00	368.00	55.00	66.00	122.00	30.00	unidades
NASC promedio ponderado:	23.42	583.10	845.35	80.01	63.61	40.86	m2/n.mi.2
Varianza ponderada:	293,957.79	11,684.01	73,360.48	3,425.81	0.13	1,145.79	unidades
Factor de conversión:	0.74	0.84	0.80	0.72	0.72	0.72	ton/m2
Factor k medio:	9.15	8.66	6.58	4.18	4.37	4.26	t/m2/n.mi.2
Densidad media:	17.40	492.26	677.45	57.30	45.56	29.26	ton/n.mi.2
Varianza de la densidad:	162,260.80	8,327.05	47,113.27	1,757.14	0.07	587.69	unidades
Coeficiente de variación (CV):	2,315.24	18.54	32.04	73.15	0.56	82.85	%
Biomasa metodo 1:	**463,385.55**	**393,534.11**	**801,452.70**	**31,136.77**	**34,226.46**	**94,353.68**	**ton**
Biomasa método 2:	11,156.29	1,058,302.01	1,169,217.79	62,274.72	29,341.41	69,334.80	ton
Diferencia:	97.59	-168.92	-45.89	-100.00	14.27	26.52	%
Límites de confianza:	10.27	49.69	23.81	65.99	2.76	114.39	%
Biomasa adultos	463,385.55	393,534.11	801,452.70	30,047.01	34,226.46	91,148.89	ton
Porcentaje adultos	100.00	100.00	100.00	96.50	100.00	96.60	%
Biomasa juveniles	0.00	0.00	0.00	1,089.76	0.00	3,204.79	ton
Porcentaje juveniles	0.00	0.00	0.00	3.50	0.00	3.40	

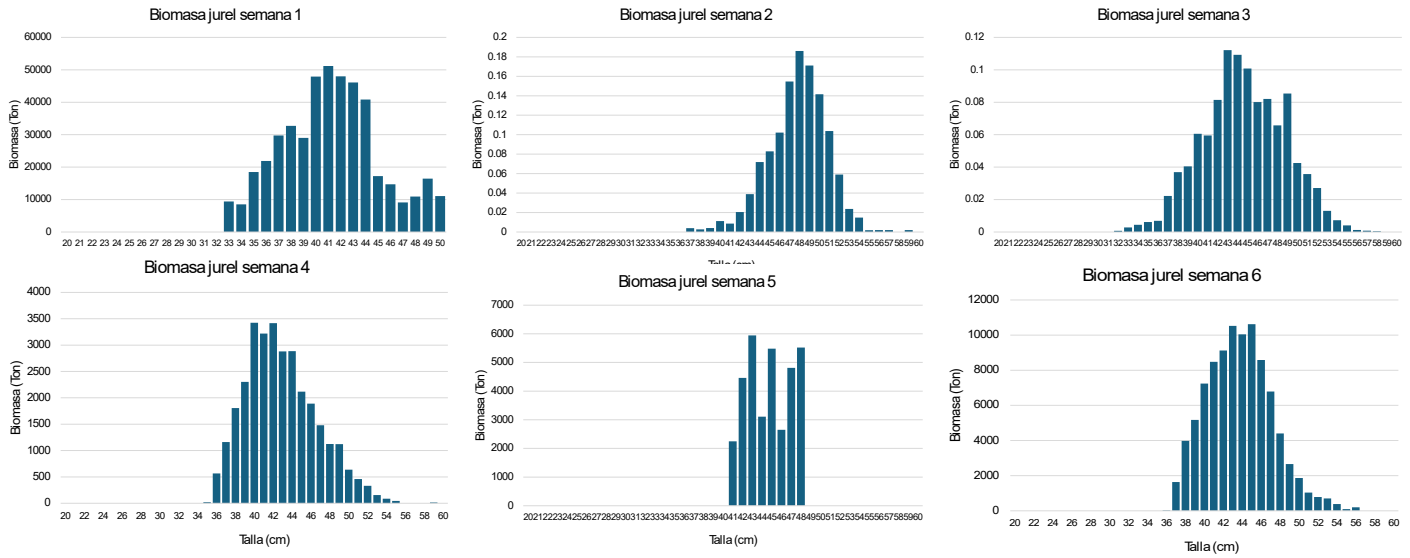


Figure 2.10.1. Biomass structure by Jack mackerel sizes in the areas evaluated between August and September 2025. These estimates apply only to the areas in which the fleet operated. A minimal number of juveniles is observed.

2.11. Synthesis of abundance measurement results for vinciguerria (*Vinciguerria lucetia*)

Estimates of abundance of vinciguerria have ranged from 3 to 937 thousand tons in the areas prospected by fishing vessels. Table 2.11.1. presents the main results, including the area covered each week by the vinciguerria. To estimate the biomass of vinciguerria, an average size of 6 cm has been assumed, since there has been no biological sampling on this species.

Table 2.11.1. Results of the acoustic biomass estimation and statistical accuracy estimates of the assessment made for mesopelagic fishes

RESULTADOS	Semana 1	Semana 2	Semana 3	Semana 4	Semana 5	Semana 6	unidades
Número de cuadrados:	55.00	90.00	15.00	23.00	10.00	1.00	cuadrados
Area:	11,851.26	19,443.02	3,239.80	4,975.87	2,156.33	216.65	n.mi.2
NASC:	1,849.00	381.08	81,310.12	1,320.95	379.81	62.90	m2/n.mi.2
NASC promedio:	33.62	4.23	5,420.67	57.43	37.98	62.90	m2/n.mi.2
Desviación estándar:	29.44	3.86	9,740.45	88.43	45.99	0.00	m2/n.mi.2
Número de UBMs	719.09	379.08	81,310.12	1,320.95	379.81	62.90	unidades
NASC promedio ponderado:	32.63	19.26	200.92	123.32	24.48	62.90	m2/n.mi.2
Varianza ponderada:	134.54	173.37	17,756.46	2,446.50	184.21	0.00	unidades
Factor de conversión:	2.36	2.36	2.36	2.36	2.36	2.36	ton/m2
Densidad media:	76.94	45.40	473.67	290.74	57.71	148.29	ton/n.mi.2
Varianza de la densidad:	747.78	963.57	98,689.65	13,597.53	1,023.80	0.00	unidades
Coeficiente de variación (CV):	35.54	68.38	66.32	40.11	55.45	0.00	%
Biomasa metodo 1:	**937,441.22**	**193,255.08**	**3,879,834.21**	**93,672.61**	**18,035.32**	**3,005.13**	**ton**
Biomasa método 2:	911,809.70	882,631.95	1,534,607.42	1,446,679.07	124,432.23	32,126.46	ton
Diferencia :	2.73	-356.72	60.45	-1,444.40	-589.94	-969.05	%
Límites de confianza:	584.49	39.82	0.02	2.26	97.70	0.00	%

3. Identification of indicators using biological information

3.1. Variations in size structures of Jack mackerel and mackerel

The analysis of jack mackerel and mackerel size structures was carried out based on biometric information per fishing sets recorded in the SNP logbook. These data are obtained from a random sampling, after each fishing set, where ichthyometer measurements are made on the size of the specimens collected of Jack mackerel and mackerel. For data collected during July 2025 and January 2026, the size structure of 230 sets for Jack mackerel and 76 sets for mackerel were analyzed. This information corresponded to records collected between July 26 and September 12, 2025 and January 1 to 17, 2026. The biometric analysis of the structure by size and species (simple frequency of the total length) was calculated after weighting the frequencies of the catch by fishing set and with a temporal and spatial hierarchy. The weighting factor is the result of the relationship between the weight of the sample and the total caught in the set. Since the biometric data does not contain data on weights by height range, the coefficients of the length-to-weight relationship (a and b) were provided by the Peruvian Sea Research Institute (IMARPE):

3.1.1.Size structure of Jack mackerel

In the 2025 season, between July and September, the industrial fleet associated with the SNP registered a range between 29 and 57 cm in total length (LT), with an incidence of juveniles (< 31 cm) of 0.03% in number. The size composition of the Jack mackerel caught by the industrial fleet mainly affected adult individuals, with a main mode of 43 cm.

In the 2026 season, in January, the industrial fleet associated with the SNP registered a range between 41 and 58 cm of total length (LT), with an incidence of juveniles (< 31 cm) of 0% in number. The size composition of the Jack mackerel caught by the industrial fleet mainly affected adult individuals, with a main mode of 46 cm and a secondary mode of 51 cm (Figure 3.1.1.1.).

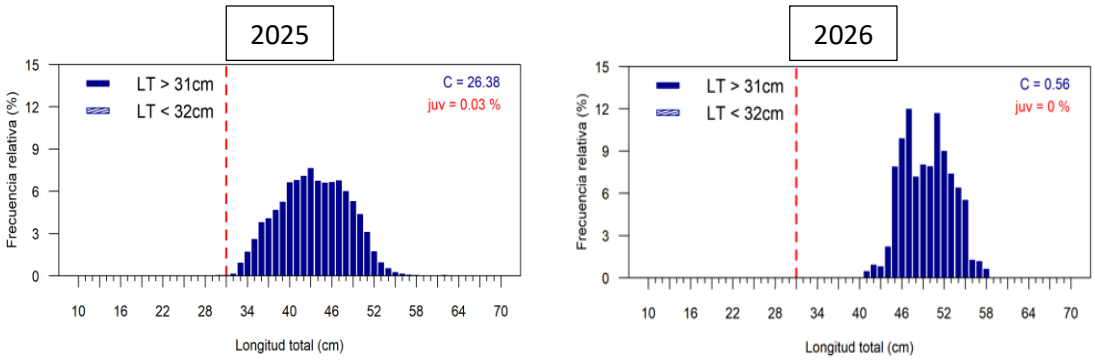


Figure 3.1.1.1. Size composition of jack mackerel catches during 2025 and 2026. The vertical dashed red line corresponds to the minimum catch size (31 cm). Source: SNP biometric log

The size structure observed weekly, between July and September 2025, presented a low incidence of juveniles (<1%), of which the first and second weeks have percentages between 0.11% and 0.08% of juvenile jack mackerel. The main modes per week were in a range between 36 and 48cm, with a mode of 42cm in the last week of September.

The size structure observed weekly, on January 26, showed an incidence of 0% juveniles. The main modes per week were in a range between 47 and 54 cm. (Figure 3.1.1.2.).

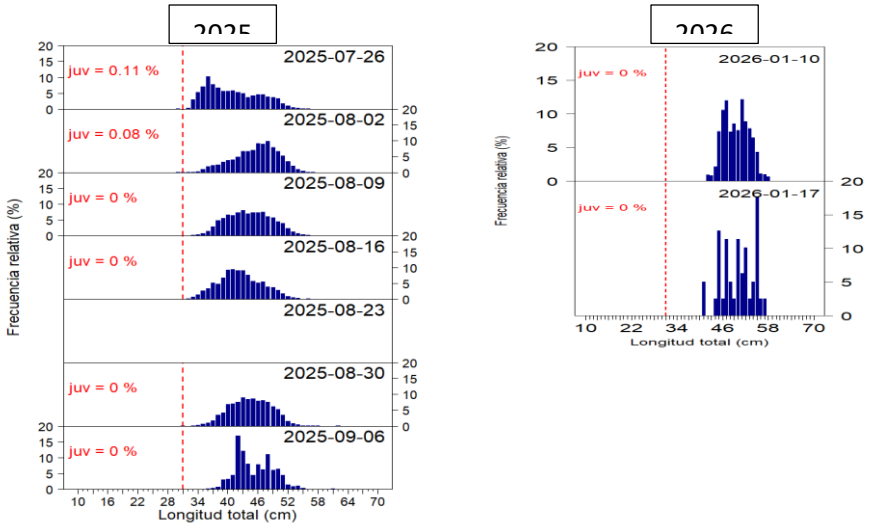


Figure 3.1.1.2. Size composition of weekly catches of Jack mackerel during 2025 and 2026. The vertical dashed red line corresponds to the minimum catch size (31 cm). Source: SNP biometric log

The size structure observed by latitudinal degrees obtained between 2025 and 2026 indicates a wider fleet operating area in 2025 (17° - 19°), compared to 2026 (18°). In addition, a reduced proportion of juveniles is observed in the catches compared to 2025. Latitudinally, during the 2025 season, the composition by size presented higher modes in degrees 17°LS and 18°LS with values of 43 cm; while minor modes in the 19th degree LS with a value of 42 cm. (Figure 3.1.1.1.3.).

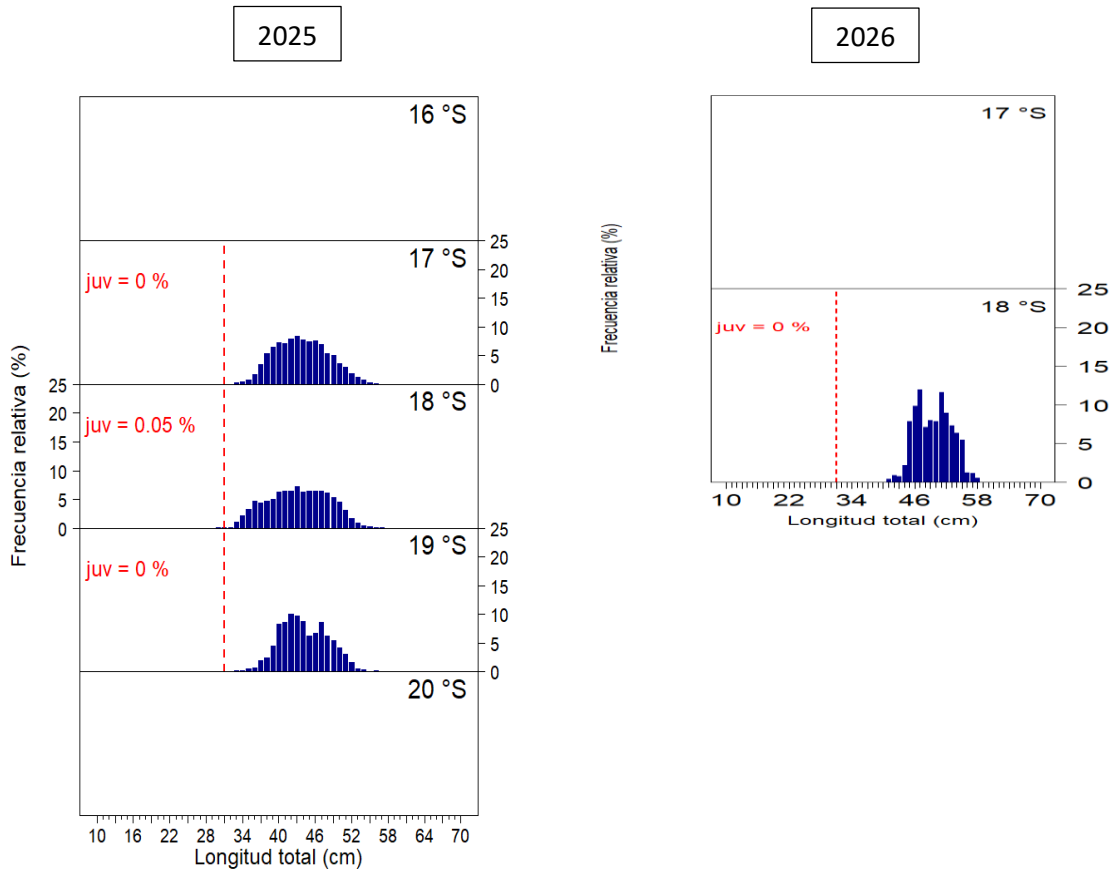


Figure 3.1.1.3. Size composition of jack mackerel catches by latitude, between 2025 and 2026 (left to right). The vertical dashed red line corresponds to the minimum catch size (31 cm LT). Source: SNP biometric logbook

The size structure in 2025 according to distance from the coast presented juvenile Jack mackerel in number (<31 cm), with slightly high values in the 30 nautical miles with a value of 0.36%. However, in 2026 there was no incidence of juvenile Jack mackerel. (Figure 3.1.1.4.).

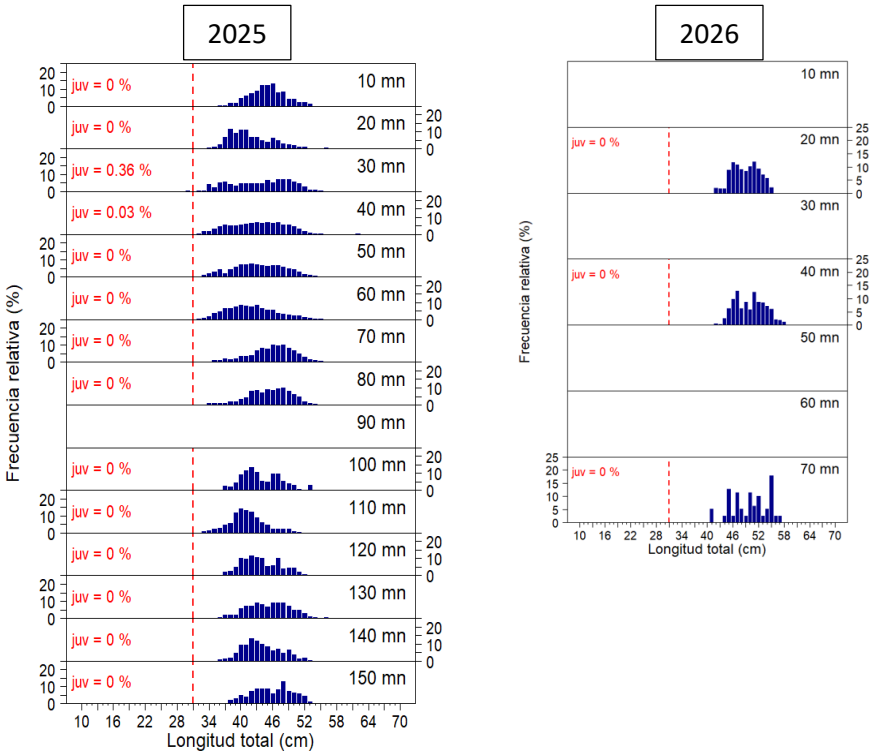


Figure 3.1.1.4. Size composition of jack mackerel catches by distance to shore (nautical miles) between 2023 and 2024 (left to right). The vertical dashed red line corresponds to the minimum catch size (31 cm LT). Source: SNP biometric logbook

3.1.2.Mackerel Size Structure

In the 2025 industrial fishing season carried out from June to December, mackerel was caught with a juvenile percentage of 0.7% in number, made up of individuals whose sizes fluctuated between 23 and 54 cm in total length. The size structure shows a main mode of 35 cm (Figure 3.1.2.1.).

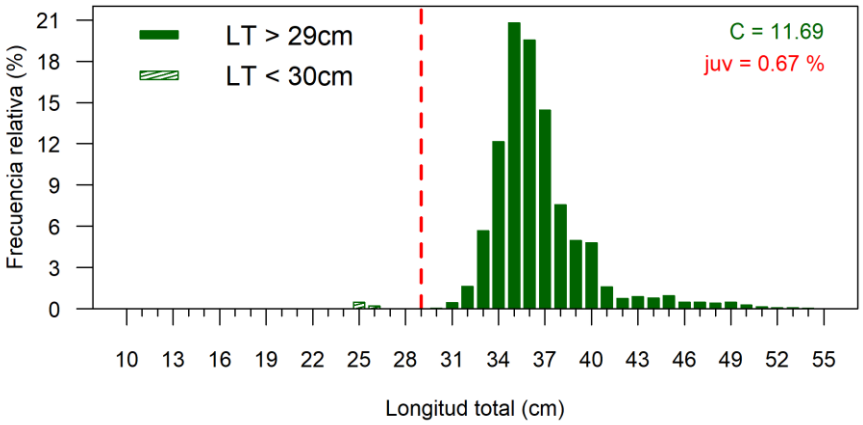


Figure 3.1.2.1. Size composition of mackerel catches during 2025. The vertical dashed red line corresponds to the minimum catch size (29 cm). Source: SNP biometric log

The structure of mackerel sizes observed weekly, between July and August, presented a low incidence of juveniles (<0.1%), of which the fifth and sixth weeks have percentages of 0.03% juvenile mackerel. The main modes per week were located in a range between 35 and 37 cm, with the mode between 35 and 36 cm being the most prevalent (Figure 3.1.2.2.).

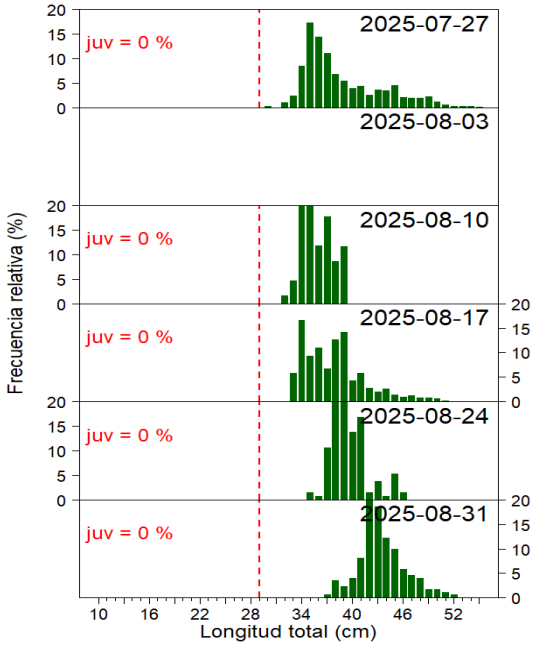


Figure 3.1.2.2. Size composition of weekly mackerel catches during 2025. The vertical dashed red line corresponds to the minimum catch size (29 cm). Source: SNP biometric logbook.

The structure of mackerel sizes observed by latitudinal degrees obtained between the years 2024 and 2025 indicates a wider fleet operating area in 2025 (16° - 19°), compared to the year 2024 (16° - 18°). In addition, a reduced proportion of juveniles is observed in catches in the year 2025. Latitudinally, during the 2025 season, the composition by size presented a larger modes in grades 17°LS to 19°LS, with a range of modes between 35 and 36 cm. (Figure 3.1.2.3.).

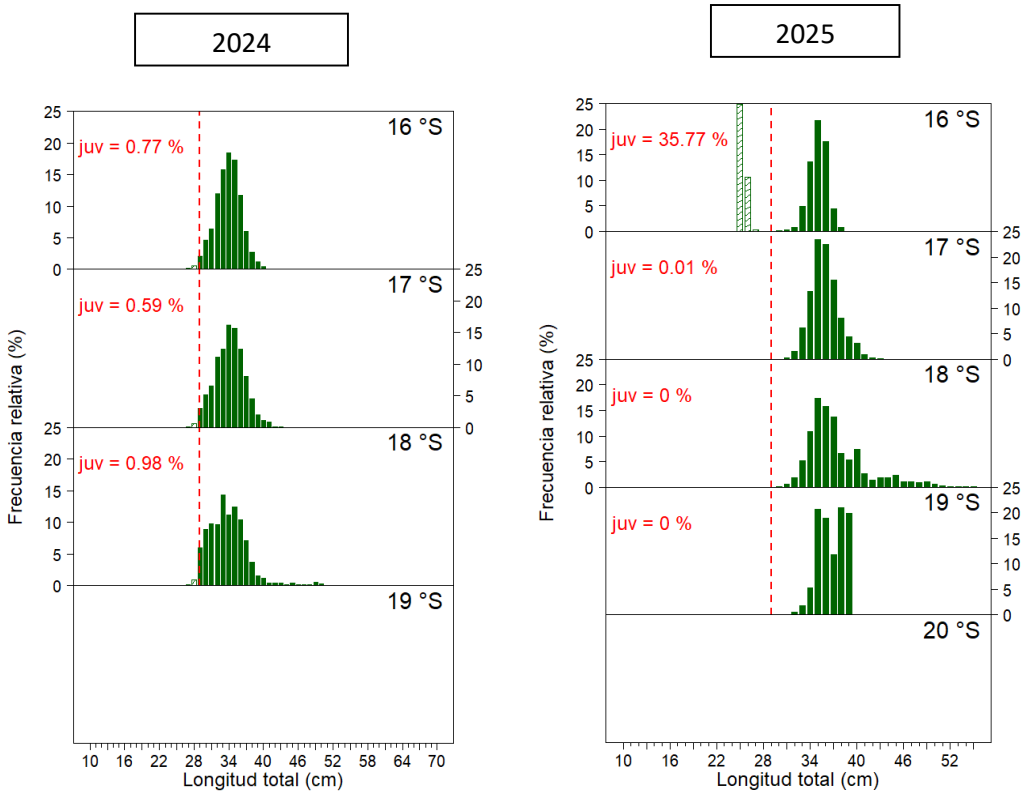


Figure 3.1.2.3. Size composition of mackerel catches by latitude between 2024 and 2025 (left to right). The vertical dashed red line corresponds to the minimum catch size (29 cm). Source: SNP biometric log

The size structure in the second half of 2025 according to distance from the coast presented juvenile mackerel in number (<29 cm), with values of 14% between 60 and 70 nautical miles. In 2024 there were high values of juveniles in the 110 nautical miles (5.3%). (Figure 3.1.2.4.).

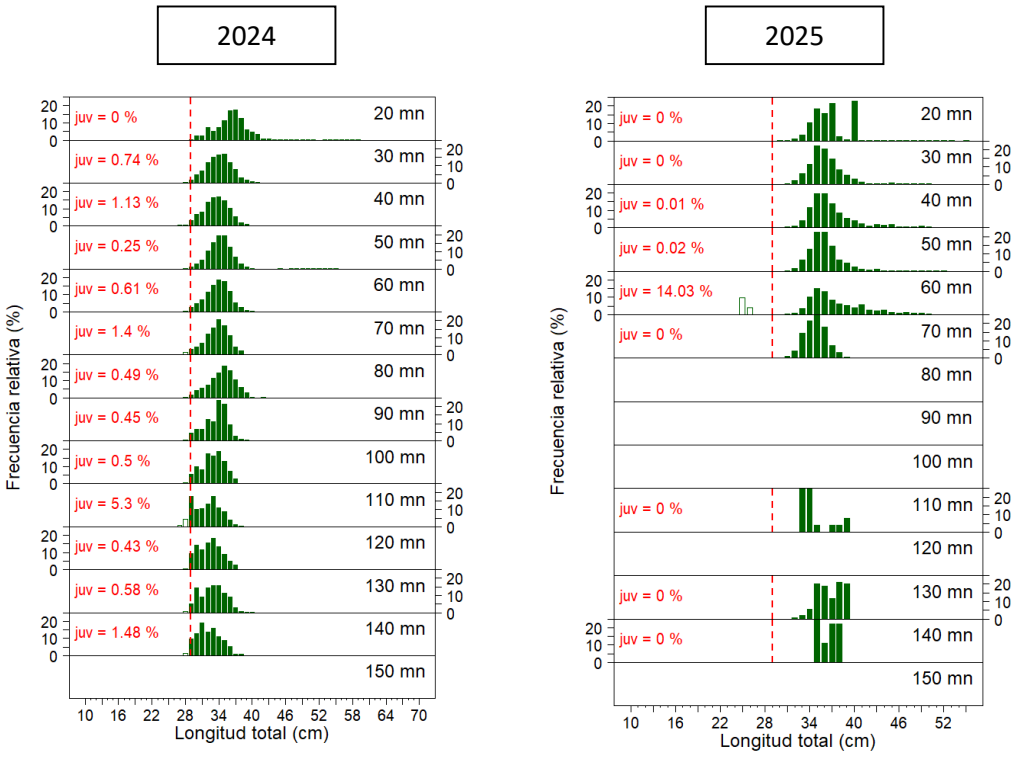


Figure 3.1.2.4. Size composition of mackerel catches by distance to shore (nautical miles) between 2025 and 2026 (left to right). The vertical dashed red line corresponds to the minimum catch size (29 cm TL). Source: SNP biometric log

3.2 Analysis of size distribution of Jack mackerel (*Trachurus murphyi*) by years

During the period 2011 - 2025, 8,036 biometric samples from 92 purse seine vessels were analyzed, registering a total of 886,287 specimens of Jack mackerel (*Trachurus murphyi*). The annual size distribution (Fig. 3.2.1) shows the entry, development, and follow-up of at least four major age groups or cohorts throughout the period evaluated. A progression with several cohorts indicates the existence of a local population, and smaller cohorts are an expression of continuous recruitment.

Between 2011 and 2013, a cohort with progressive growth was observed, whose modes evolved from 31 cm (2011) to 37 cm (2012) and 43 cm (2013). This period coincided with predominantly cold conditions associated with 2010–2011 and 2011–2012 La Niña events. In 2013, a new cohort was also identified with a mode close to 33 cm, indicating the occurrence of a new recruitment pulse.

During 2014, the size structure presented a main mode of 33 cm, probably corresponding to the cohort detected in 2013, while the proportion of juveniles reached 13.2%. There was an strong El Niño event 2015–2016. However, the small number of individuals recorded during 2015 and 2016 (five specimens in total) prevents of doing credible population inferences for those years.

After several years of low presence of the resource in Peruvian waters, in 2018 there was an important recruitment pulse with mode in 29 cm and a proportion of juveniles of 66.3%, the highest in the period evaluated. This result suggests a strong incorporation of young individuals into the exploitable fraction of the population. Various reports from the fishery

indicate that during those years the re-entry of important age groups of jack mackerel into the Peruvian maritime domain was observed, particularly in the southern zone, possibly associated with changes in the spatial distribution of the stock and an improvement in environmental conditions for recruitment.

Between 2019 and 2021 this cohort showed sustained growth, reaching modes of 35 cm, 38 cm and 44 cm, respectively with a modal progression of close to 4–5 cm per year. During this period, neutral to moderately cold environmental conditions prevailed in the Southeast Pacific, favoring a wide distribution of the resource and a low incidence of juveniles in the catches.

In 2022, a new cohort with a 40 cm main mode was observed, coexisting with remnants of the previous cohort. This bimodal structure reflects the overlap of age groups and suggests a good recruitment process.

During 2023, a new recruitment event was recorded, evidenced by a main mode of 31 cm and a wide distribution of sizes between 20 and 65 cm. The percentage of juveniles reached 9.4% and the highest number of individuals measured in the period was obtained (161,381 specimens). This behavior coincided with the development of the 2023 Coastal El Niño event and later of El Niño in the equatorial Pacific, conditions that modified the spatial distribution of various pelagic species, including Jack mackerel.

Finally, during 2024 and 2025 the cohort detected in 2022 continued its growth, reaching modes of 48 cm and 50 cm, respectively. At the same time, in 2025 a new cohort was identified with a mode of close to 38 cm, suggesting the recent incorporation of a new age group into the population. The proportion of juveniles was minimal in both years (0.1%). The coexistence of this new cohort with larger specimens is a positive sign for the population renewal of the fishery stock over the next few years (2027–2028). Figure 3.2.1. and Table 3.2.1.

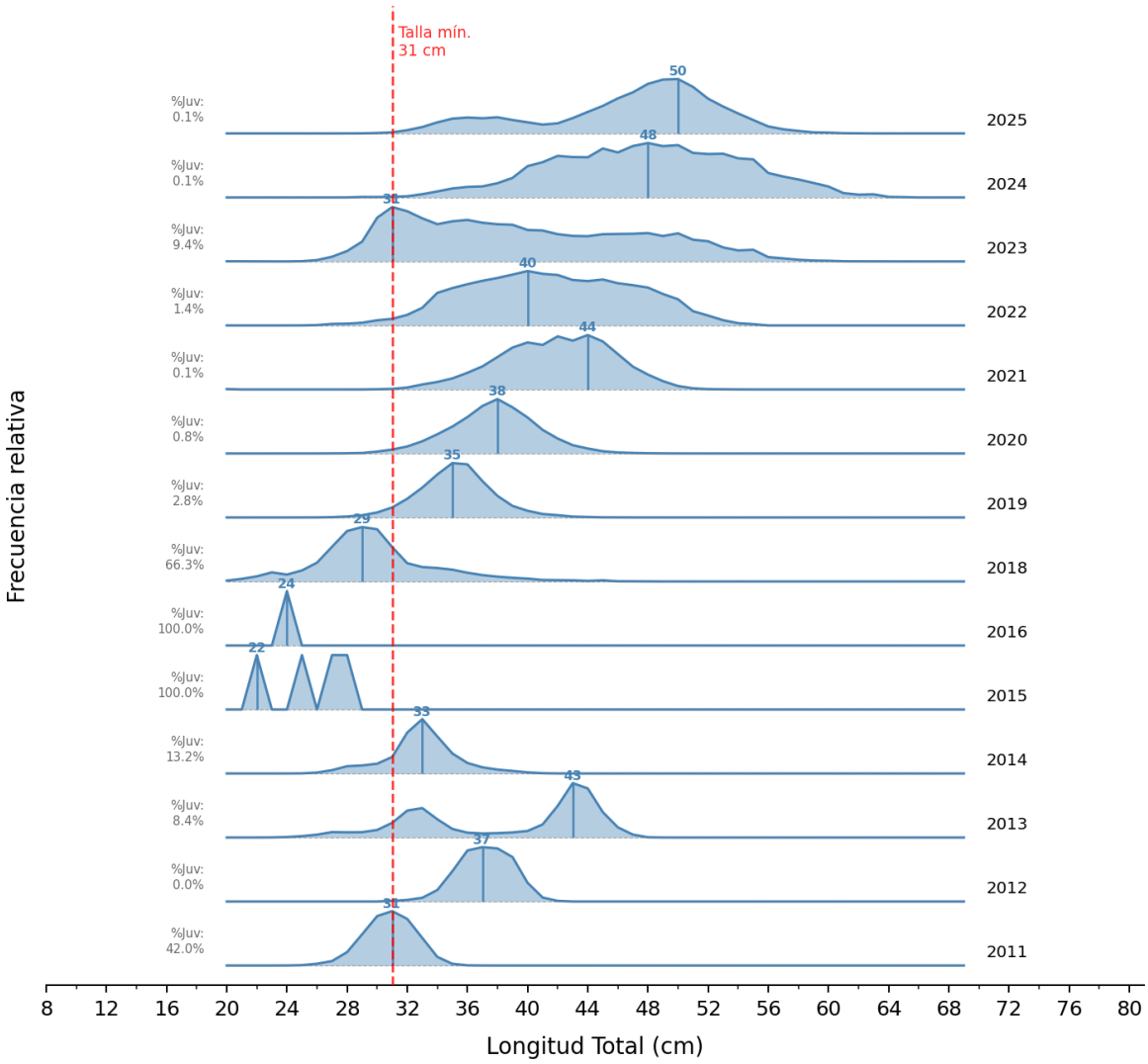


Figure 3.2.1. Distribution of Jack mackerel sizes per year. The dotted red line indicates the minimum legal size (31 cm). The values on each distribution correspond to the main mode.

Table 3.2.1. Mackerel Biometric Records

Año	N° de muestreos	N° de individuos	Talla mínima (cm)	Talla máxima (cm)	Moda (cm)
2025	526	59,219	28	62	50
2024	755	89,331	27	68	48
2023	1,468	161,381	20	65	31
2022	635	70,646	24	55	40
2021	453	59,679	20	54	44
2020	1,003	122,203	24	52	38
2019	853	98,737	20	50	35
2018	375	47,753	20	54	29
2016	1	1	24	24	24
2015	2	4	22	28	22
2014	797	83,179	20	47	33
2013	350	32,076	20	49	43
2012	596	47,757	27	43	37
2011	222	14,321	24	37	31

3.3. Analysis of the distribution of mackerel (*Scomber japonicus*) sizes by years

Unlike other pelagic species such as Jack mackerel, mackerel does not show a clear modal progression from year to year. The size distributions (Fig. 3.3.1.) present a relatively static pattern, with modes ranging from 27 to 36 cm without following a cohort growth sequence identifiable in the annual data. The minimum legal reference size is 29 cm in total length.

Modes of 33 cm (2011) and 36 cm (2012), above the minimum legal size. Low percentage of juveniles (5.7% and 0.1%), indicating captures predominantly on adult individuals. The number of individuals sampled was less than 3,500.

In 2013, mode drops to 30 cm with 13.4% of juveniles. In 2014, the highest sampling effort of the initial period was recorded (80,757 individuals), with a mode of 32 cm and a low % of juveniles (2.4%). In 2015 there was less mackerel fishing (only 1,302 individuals registered), with a mode of 29 cm and 42.5% of juveniles.

In 2016, the highest percentage of juveniles was recorded: 65.9%, with a mode of 28 cm (below the legal minimum). Similar to 2018 with a percentage of juveniles of 52.0% with mode in 27 cm.

In 2017, although the percentage of juveniles was lower (29.3%), the 30 cm mode and the low number of sampled individuals (16,358) suggest the persistence of extractive pressure on these age groups.

From 2019 onwards, a sustained improvement in catch sizes has been observed. Fads stabilize between 30 and 35 cm with consistently low juvenile percentages (< 7%). The year 2020 concentrates the largest sampling effort of the entire period (77,164 individuals and 1,016 biometrics), with mode at 30 cm and 6.8% of juveniles, which suggests a slight entry of smaller sizes in that year.

Finally, for 2021 and 2025 the distributions are concentrated in sizes between 34–35 cm, with percentages of juveniles below 3.5%. The maximum size range is progressively expanded in recent years: 50 cm (2022), 52 cm (2023), 62 cm (2024), 56 cm (2025). Figure 3.3.1. and table 3.3.1.

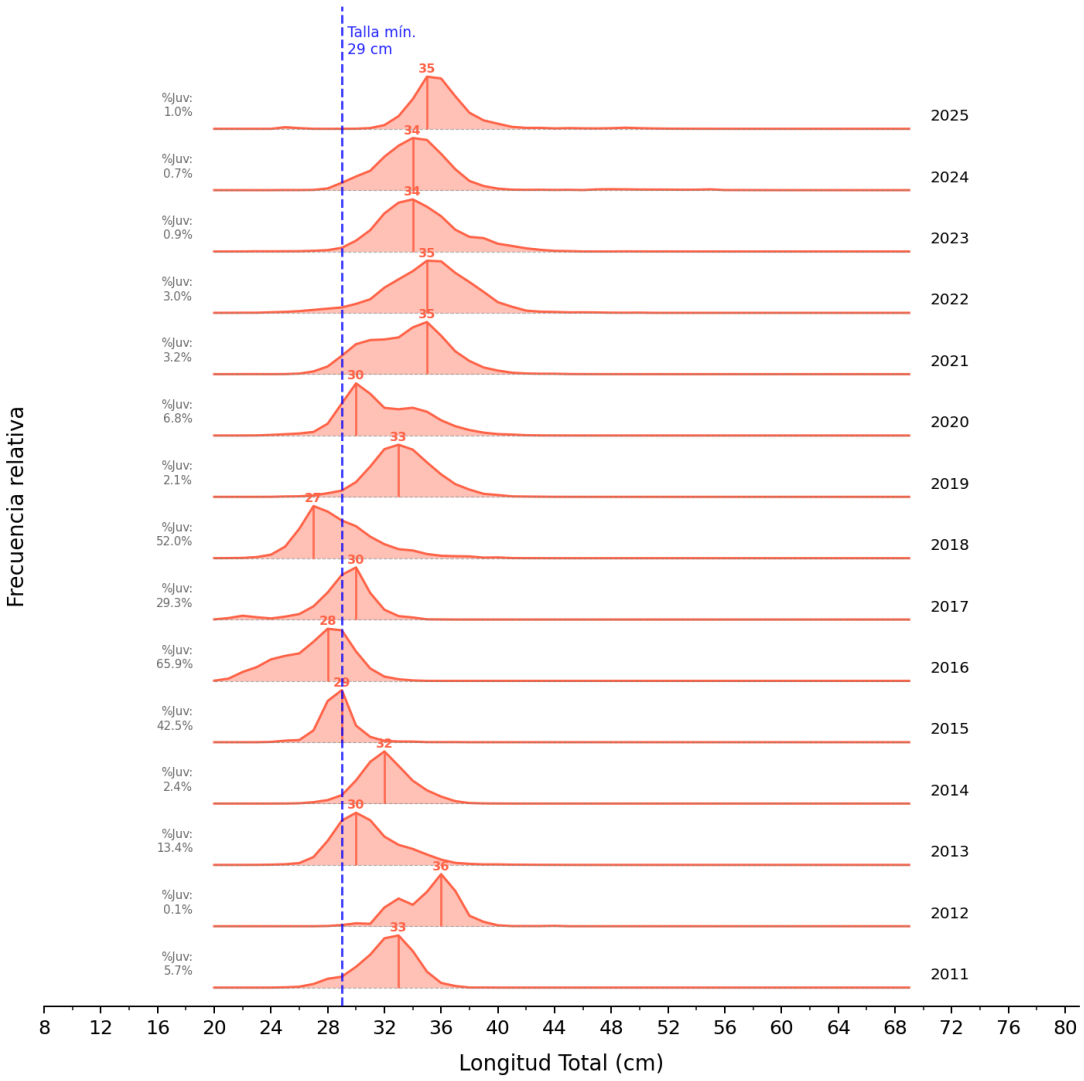


Figure 3.3.1. Distribution of mackerel sizes per year. The dotted blue line indicates the minimum legal size (29 cm). The values on each distribution correspond to the main mode.

Table 3.3.1. Biometric records of mackerel.

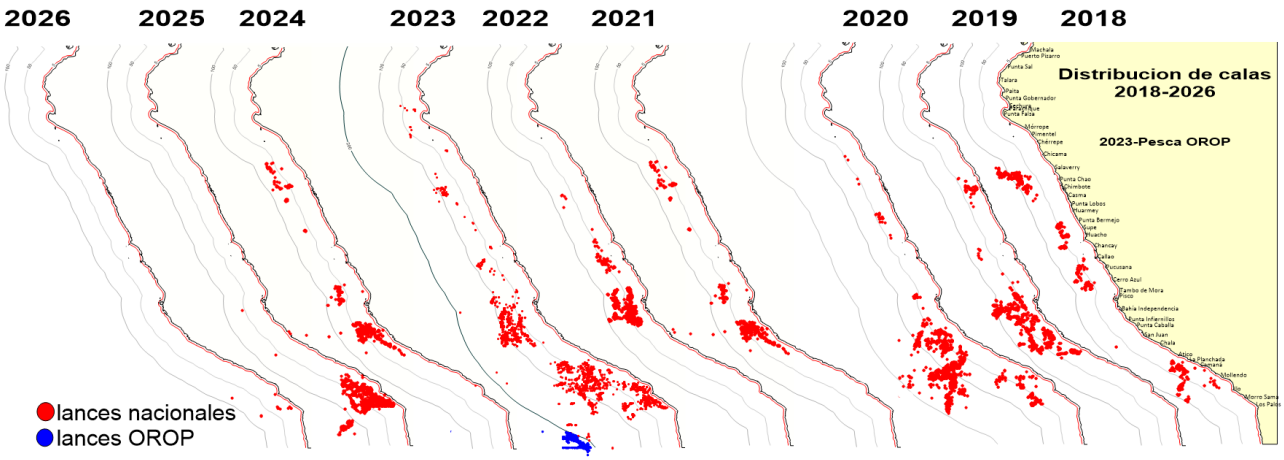
Año	N° de muestreos	N° de individuos	Talla mínima (cm)	Talla máxima (cm)	Moda (cm)
2011	165	3497	25	39	33
2012	108	2,468	28	44	36
2013	524	50,597	22	45	30
2014	906	80,757	20	43	32
2015	9	1,302	24	37	29
2016	350	52,509	20	35	28
2017	130	16,358	20	36	30
2018	468	41,011	20	43	27
2019	571	24,731	24	45	33
2020	1016	77164	20	47	30
2021	472	44478	22	49	35
2022	323	16,943	21	50	35
2023	925	56,882	21	52	34
2024	670	68,830	25	62	34
2025	224	23,601	25	56	35

4. Identification of fishing effort

4.1 SISESAT (vessel monitoring system) information and area of operations.

Information on the spatial dynamics of the fishing fleet with catches of Jack mackerel and Mackerel in the range of the years 2018-2026 (January) was analyzed. During the year 2025, with the SISESAT (Vessel Monitoring System), 619,420 records were obtained from 62 vessels from fishing companies (Tasa, Copeinca, Hayduk, Diamante, Exalmar and Austral), which were collected during fishing operations for CHD (Direct Human Consumption).

It is observed that most of the activity was concentrated from Pucusana to the south end of the coast, with catches obtained outside 200 n.mi. during 2023 (SPRFMO area) and with less effort in the northern and central areas of Peru. In 2024 and 2025, fishing operations were carried out in the southern part of Peru (between 15°LS and 18°LS), reaching the border with Chile (Figure 4.1.1.).



Year	Number of sets with horse mackerel	Number of sets with mackerel
2018	375	468
2019	853	571
2020	1003	1016
2021	453	472
2022	635	342
2023	1947	1106
2024	862	1217
2025	1224	299
2026	10	1

Figure 4.1.1. Annual tours of fishing vessels during Jack mackerel and mackerel fishing. from 2018 to 2026 (January), and the number of sets with catches of Jack mackerel and mackerel per year. The red dots represent the fishing sets made by fishing vessels.

A total of 2369 fishing trips made by the industrial fleet during the period 2018–2026 were analyzed. Figure 4.1.2 shows the percentage distribution of trips according to duration ranges. Between 2018 and 2023, trips with durations between 2 and 4 days predominated. However, from 2024 onwards, there is a progressive increase in the proportion of longer trips (≥ 6 days), which became the predominant category during 2025 and 2026. This behavior would be associated with the displacement of fishing areas to areas further away from the landing ports and a larger dispersion of the shoals, which would have increased the navigation and search times required for fishing operations. It should be noted that the information for 2026 is preliminary.

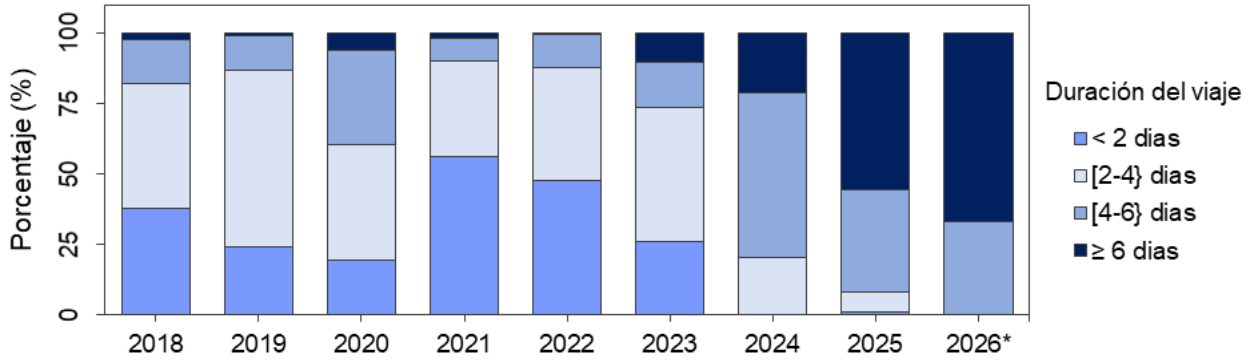


Figure 4.1.2. Percentage distribution of fishing trips by trip duration (days) during the period 2018–2026.

Figure 4.1.3 shows the percentage distribution of fishing sets made by the industrial fleet according to distance from shore during the period 2018–2026. Between 2018 and 2020, the sets were mainly concentrated in the stratum between 50 and 100 nautical miles (mn) from the coast, although with a marked interannual variability. However, from 2021 onwards, there is a trend towards a bigger concentration of activity in the coastal area (stratum from 0 to 50 nm), reaching more than 75% of the casts carried out in 2025 and 2026. It should be noted that the information for 2026 is preliminary. On the other hand, in 2023 a different distribution of fishing sets was recorded, probably related to the oceanographic conditions generated by the El Niño event, which would have modified the distribution and availability of schools of Jack mackerel and mackerel, shifting the fleet's areas of operation to areas further from the coast.

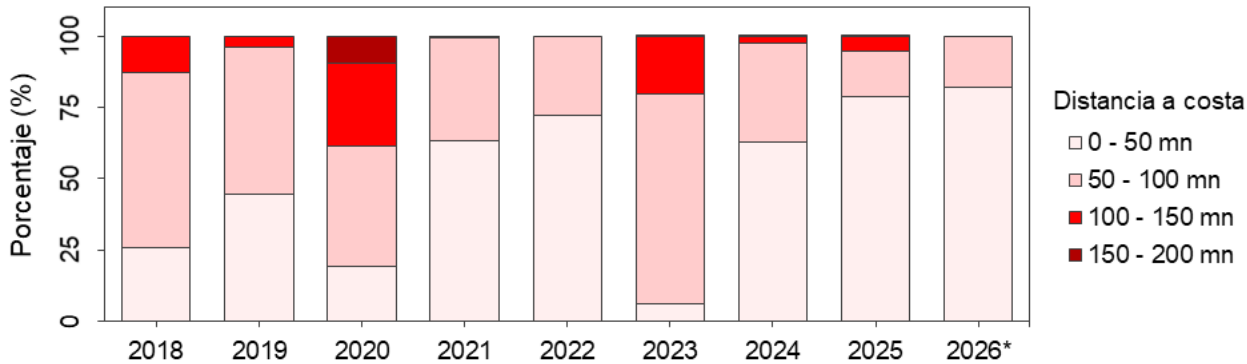


Figure 4.1.3. Percentage distribution of fishing sets according to distance from the coast during the period 2018–2026.

Landings of the industrial fleet showed a marked year-on-year variability during the period 2018–2026. Overall, Jack mackerel was the main species landed, accounting for the largest proportion of catches in most years. Total landings peaked in 2019 (86 thousand tons), followed by 2023 (64 thousand tons) and 2022 (56 thousand tons), while the lowest volumes were recorded in 2021 (30 thousand tons) and 2024 (35 thousand tons). It should be noted that the information for 2026 is preliminary and represents only a fraction of the year.

4.2. Effort and Capture per Unit of Effort (CPUE)

During the period 2018-2026, the fishing effort deployed by the industrial fleet showed variations in its main operational indicators. The number of operational vessels fluctuated between 41 and 61, while the number of fishing trips varied between 189 and 429. In both cases there is no clear trend, with inter-annual fluctuations associated with the dynamics of fishing activity. It should be noted that the values recorded for 2026 are preliminary, so they are not comparable with previous years. Figure 4.2.1.

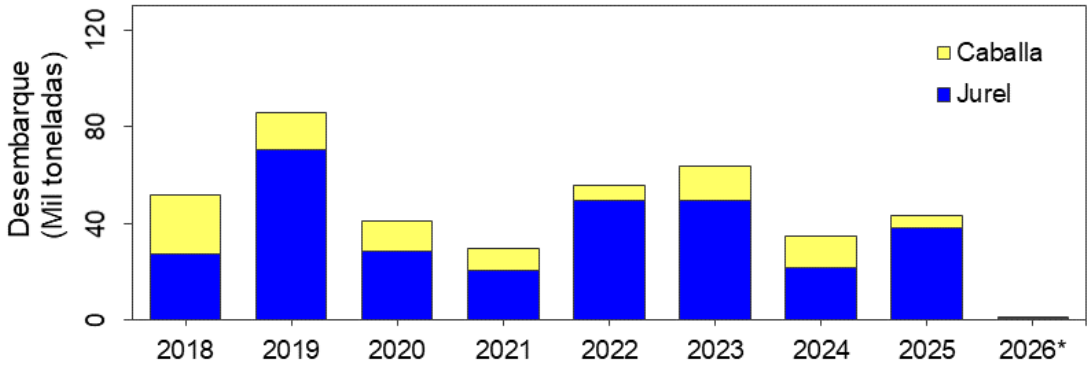


Figure 4.2.1. Annual landing of Jack mackerel and mackerel during the period 2018 to 2026 (blue color correspond to Jack mackerel, yellow color indicate mackerel).

On the other hand, the average duration of trips and the number of fishing sets per trip with catch showed an increasing trend during the last years, reflecting a bigger operational intensity of the fleet (Figure 4.2.2.). This behavior would be associated with the displacement of fishing areas to the south and a larger dispersion of schools, which would have increased the effort necessary for their capture.

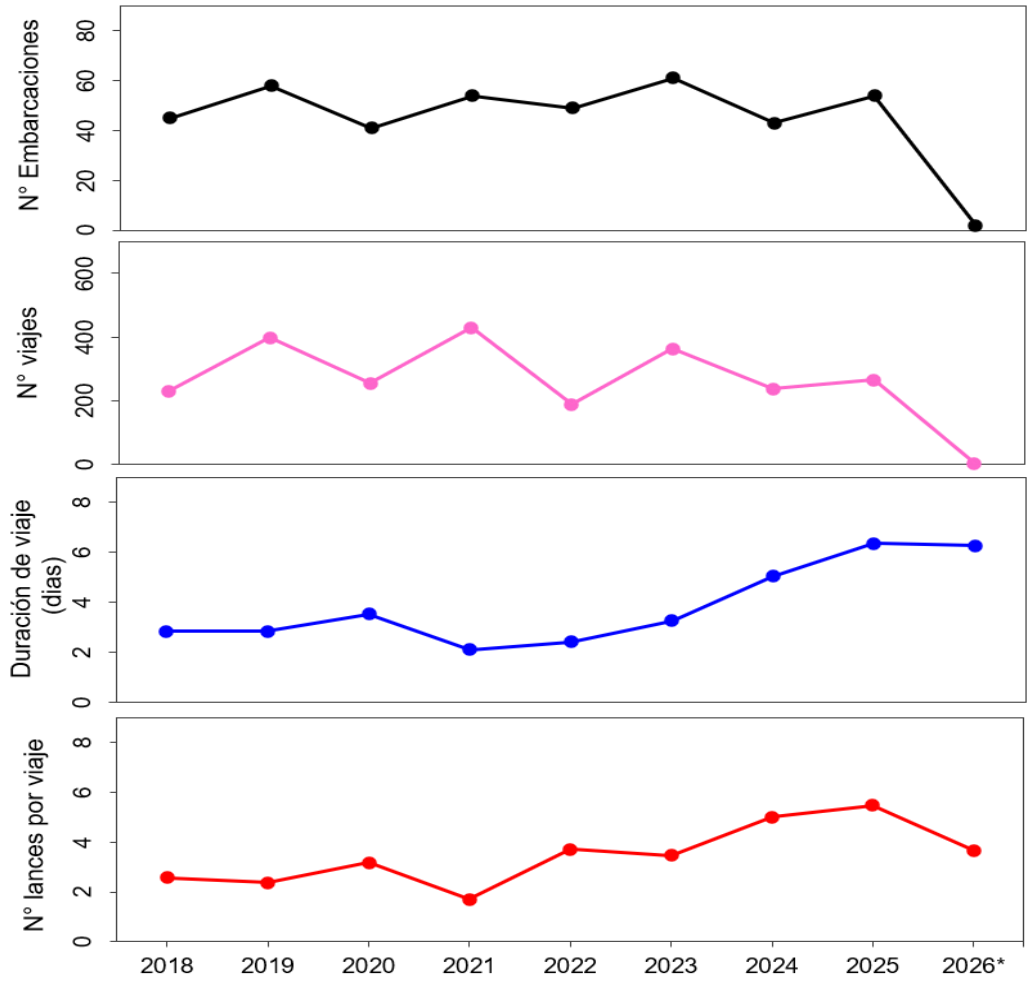


Figure 4.2.2. Annual series of the Indicators of fishing effort during the period 2018 - 2026; expressed in (from top to lower panel): number of vessels, number of fishing trips, average duration of the voyages (days) and average number of sets per voyage with catch.

With respect to the efficiency indicators of the industrial fleet during the period 2018-2026, the Catch or Filling Index (CI), the Catch Index by Trip Duration (CI/DV) and the Catch Index by Number of Sets (CI/NL) were analyzed. The Catch or Fill Index (CI) showed an increasing trend between 2018 and 2022, reaching its maximum value in 2022, and then progressively decreasing until 2026. A similar behavior was observed in the CI/DV and CI/NL indicators, which registered their highest values between 2021 and 2023 and subsequently showed a sustained reduction. Taken together, these results suggest a decrease in fishing efficiency in recent years, evidenced by lower levels of catch per trip, per day of operation and per set made. This behavior would be related to a lower aggregation and availability of the resource. Figure 4.2.3.

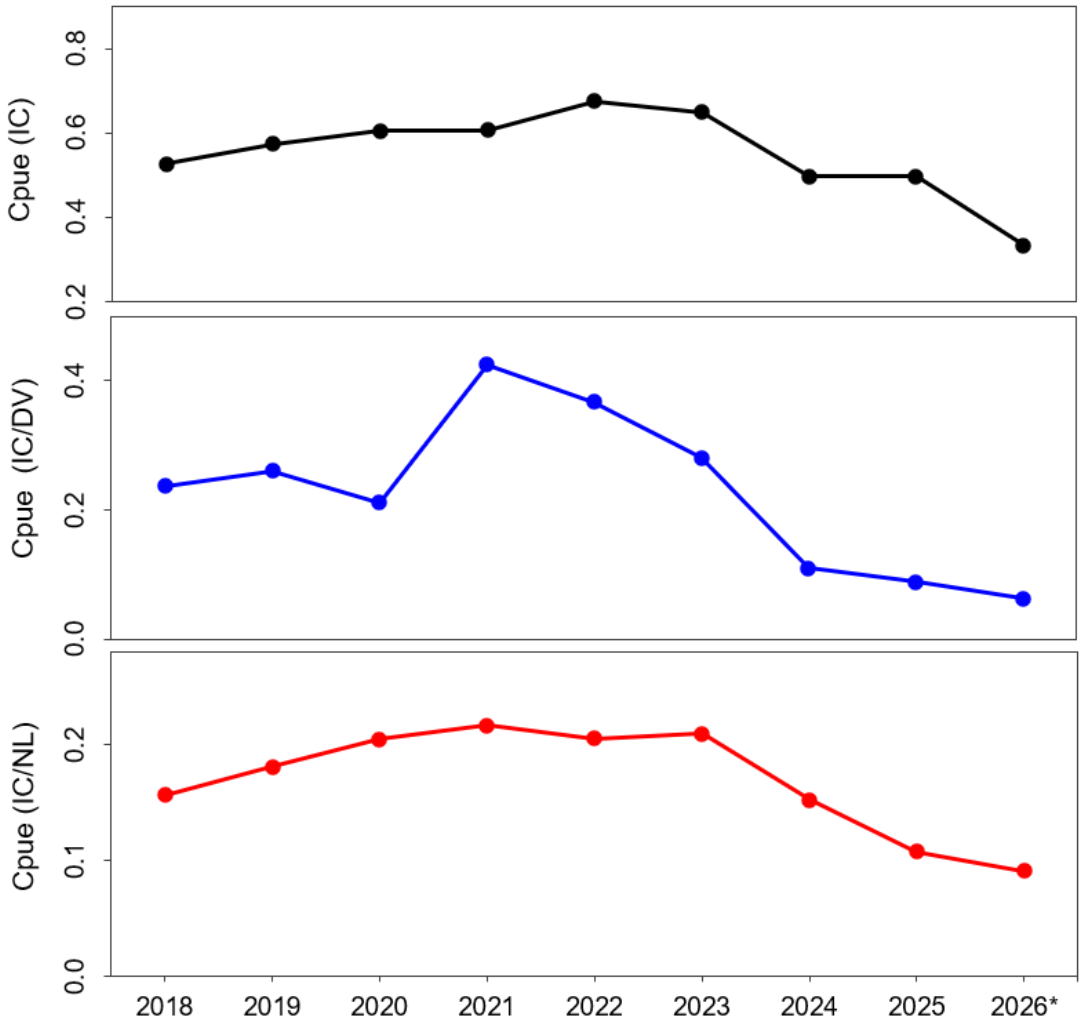


Figure 4.2.3. Annual evolution of the efficiency indicators (CPUE) of the industrial fleet measured in Catch (panels from top to bottom): Fill Index (CI), Catch Index by Trip Duration (CI/DV) and Catch Index by Number of Sets (CI/NL), during the period 2018–2026.

5. Conclusions

5.1. Regarding the abundance of Jack mackerel and mackerel

- For Jack mackerel biomass, two regimes are observed, between 1983 and December 2025: one between 1983 and 2002, in which biomass fluctuated between medium and high levels; and another regime exists after 2002 with abundances varying between medium and low levels.

- For mackerel biomass, three regimes are observed, between 1983 and December 2025: one between 1983 and 1992 in which a uniform distribution was observed along the entire coast, although with medium abundances; the second period occurred between 1992 and 2002, in which the biomass fluctuated between medium and high levels; and a third regime exists after 2002 with abundances varying between medium levels and bass.

- During the activities of the IMARPE surveys and SNP fleet in the period 2022 - 2026, a total of 6,270 (340 schools in the 2026 workshop) schools of Jack mackerel were detected. A principal component analysis (PCA) was performed, using Gaussian Mixture Models. The analysis determined three types of clusters 1, 2 and 0; Cluster 1 groups schools with a lot of acoustic energy and size (possibly dense or large), which would be a priority for industrial fishing

operations; followed by cluster 2 (intermediate) and perhaps operable for fishing, but with a larger effort and cluster 0, with little biomass and high variability, therefore, less attractive for fishing (possibly more dispersed);

5.2. Regarding biological aspects

- The results obtained from the analysis of 886,287 Jack mackerel individuals sampled between 2011 and 2025 reveal a fishery structured on well-differentiated cohorts, whose modal progression can be followed relatively clearly throughout the study period. This episodic recruitment pattern —in which the same annual class dominates the fishery for several consecutive years before being replaced by a new one— is a recognized feature of Southeast Pacific Jack mackerel biology and has been documented in continuous monitoring by the industrial fleet (SNP, 2013; SNP, 2024).

- Since 2021, the expansion of the range of sizes caught reflects the overlap of several cohorts of Jack mackerel, also reviewed at the 12th SNP Workshop (2024). For the years 2024 and 2025 they present the highest modes of the entire series (48 and 50 cm) and percentages of juveniles below 0.1%, indicating a fishery operating on the 2022 cohort. However, the detection in 2025 of a new cohort with a 38 cm mode anticipates a transition in the composition of catches in the next two to three years which demands continuous fisheries monitoring.

- The incidence of juvenile mackerel (< 29 cm TL) was 0.7% in number, with a main mode of 35 cm total length predominating. The highest modal frequencies were recorded in the 19° S degree.

- The percentage of juvenile mackerel recorded in 2025 (0.7%) was higher than that observed in 2024 (0.08%), although lower than the values recorded in 2021 (2.41%) and 2022 (1.5%)

5.3. Identification of fishing effort

- The duration of fishing trips in the period 2018-2026 lasted an average of 4 days.
- The fishing sets carried out during the study period were, in general, within 100 nm of the coast, presenting in 2023 sets outside 200 nm.
- There is a decrease in fishing efficiency in recent years, evidenced by lower levels of catch per trip, per day of operation and per set made. This behavior would be related to a lower aggregation and availability of the resource

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Annex 1: Jack mackerel fishing activities outside the 200 miles during June 2026

In the weeks prior to the development of the fourteenth SNP-IHMA workshop on the habitat conditions of Jack mackerel and other species of the Peru Current in the Humboldt System, fishing operations were carried out targeting Jack mackerel (*Trachurus Murphy*) in international waters outside the 200 nautical miles of the Peruvian maritime domain, in the SPRFMO convention area. These activities are carried out within the framework of the quota assigned to Peru by the South Pacific Regional Fisheries Management Organization (SPRFMO), equivalent to just over 34 thousand tons by 2026. As of June 15, 2026, there were 171 fishing sets carried out by 15 fishing vessels. The catch declared by the national fleet amounted to 4,215 tons, which represents approximately 12.4% of the assigned quota**.**

Fishing activities show a higher concentration in the 20°LS degree and a lower concentration in the 22°LS degree. On the other hand, according to distance from the coast, fishing sets were between 200 and 275 nautical miles (Figure 1).

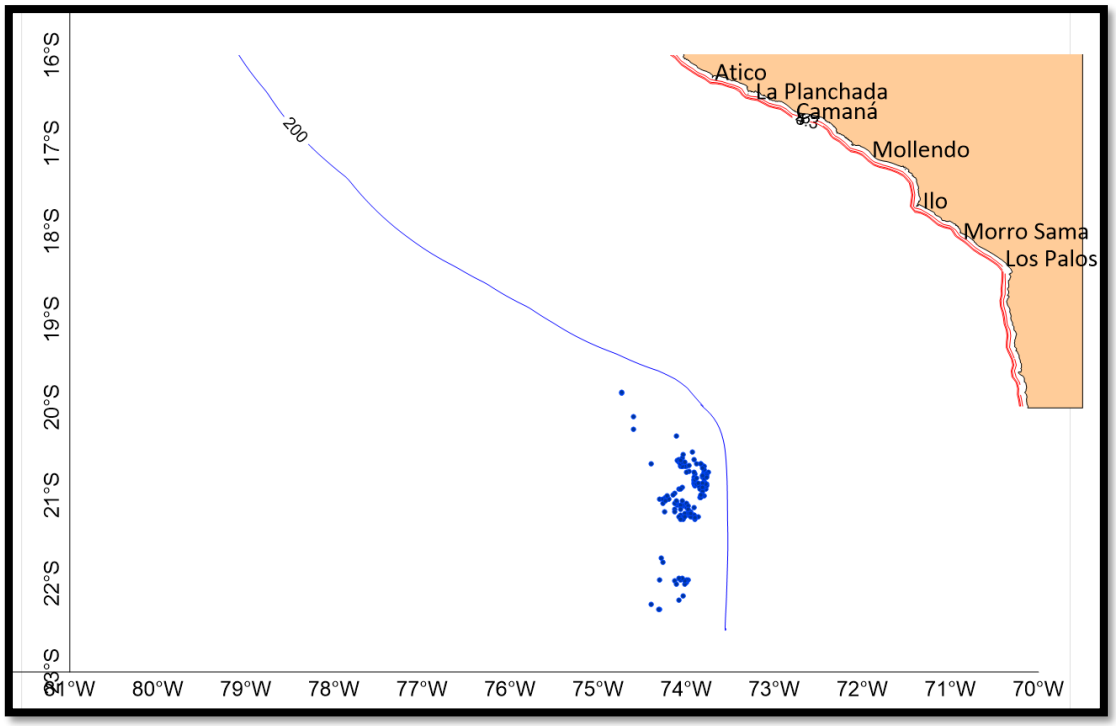

Figure 1. Distribution of fishing sets with Jack mackerel in international waters outside 200 nautical miles in 2026.

The size composition was estimated by weighting the biometric frequencies per catch of each fishing set. For this procedure, the coefficients of the length-weight ratio (a and b) provided by the Peruvian Sea Research Institute (IMARPE) were used.

The results showed specimens with total lengths between 20 and 34 cm. The incidence of juveniles (<31 cm in total length) reached 99.76% in number. Likewise, the distribution presented a main mode of 25 cm (Figure 2).

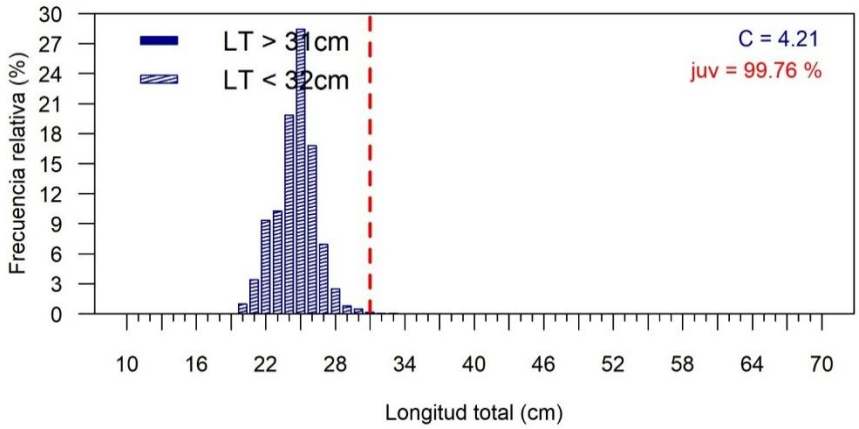

Figure 2. Size composition of Jack mackerel catches during 2026. Source: SNP biometric log

Regarding the distribution of the sets according to distance from the coast, 47% were between 220 and 240 nautical miles, while 37% were registered between 200 and 220 miles. Sets made between 240 and 260 miles accounted for 14%, and those made over 260 miles corresponded to 2% of the total analyzed (Figure 3).

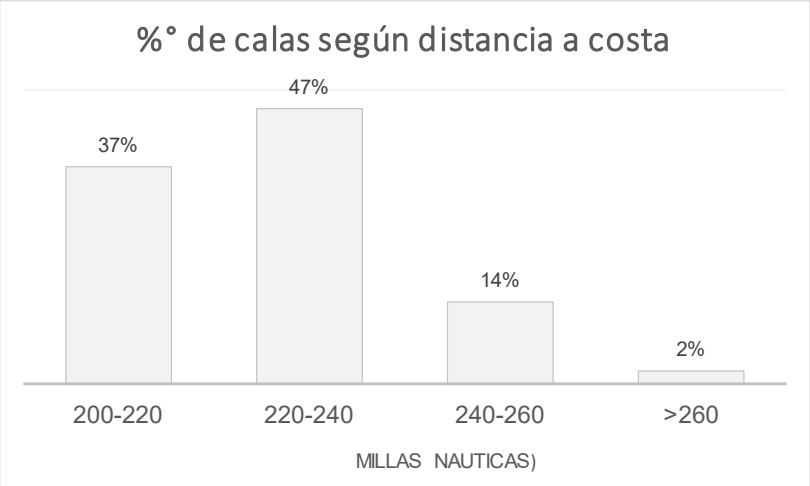

Figure 3. Distribution of coves made according to distance from the coast.