



Jack Mackerel Benchmark Workshop
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**TECHNICAL REPORT ON THE UPDATED LENGTH-FREQUENCY DATA
FOR THE PERUVIAN JACK MACKEREL STOCK (FAR-NORTH STOCK) IN
PERUVIAN JURISDICTIONAL WATERS**

by

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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.

SUMMARY

We present updated length-composition data for the Peruvian jack mackerel (*Trachurus murphyi*) stock in Peruvian waters for the period 1972–2025, representing a substantial improvement in the availability of information. This information was compiled using an updated jack mackerel length-frequency database developed by the Instituto del Mar del Perú (IMARPE) through the recovery, processing, review, and systematisation of historical biometric sampling data. This work describes the primary data sources used to update the biometric database for the Peruvian jack mackerel stock (the far-north stock), presents the weighting process applied to derive length-composition data, and evaluates the impact of the updated information on stock assessment within Peruvian jurisdictional waters using the JJM model. The main results are presented for discussion within the framework of the Jack Mackerel Working Group (JMWG) and the Jack Mackerel Benchmark Workshop (SCW16).

1. Introduction

In Peru, the Instituto del Mar del Perú (IMARPE) is the institution responsible for monitoring and assessing the status of pelagic fish stocks and associated fisheries within Peruvian waters. For this purpose, it operates a monitoring system that includes several data collection platforms, notably the Pelagic Fisheries Monitoring Programme, which is carried out year-round in major fishing ports along the Peruvian coast. Through the systematic implementation of biometric and biological sampling activities, this program generates relevant data for fisheries and biological research. This information serves as a key input for the assessment of pelagic fish stocks, as well as for the design and implementation of management measures aiming at the sustainable use of Peruvian fisheries resources.

The jack mackerel (*Trachurus murphyi*) is one of the main species monitored through the Pelagic Fisheries Monitoring Programme. Within the framework of IMARPE's institutional objectives, a significant volume of information has historically been compiled from biometric surveys conducted during different fishing seasons. This information is stored in the Scientific and Technological Information System of the IMARPE (IMARSIS). In this context, and as part of efforts to strengthen and update scientific information on this species, IMARPE has developed processes for reviewing, retrieving, integrating, and consolidating historical records from various sources and storage formats. All these efforts have improved the organization and standardization of available biometric sampling data, enhancing its use for scientific purposes.

The main objectives of this report are to: 1) describe the primary data sources used to generate the updated biometric database for the Peruvian jack mackerel stock (the far-north stock); 2) present the weighting process applied to derive jack mackerel length-composition data from the updated information; and to 3) assess the impact of the updated information on stock assessment within Peruvian jurisdictional waters using the JJM model. The main outcomes of this work are submitted for discussion within the framework of the Jack Mackerel Working Group (JMWG) and the Jack Mackerel Benchmark Workshop (SCW16).

2. Methodology

2.1 Data sources

To develop the updated Peruvian jack mackerel length-frequency database, historical data from IMARPE and the IMARSIS system were used, supplemented by additional information obtained through the review, validation, and retrieval of records. This resulted in a dataset covering the period 1972–2025 (see [Figure 1](#)), with records from along the Peruvian coast (see [Figure 2](#)). In addition, the length bins in the length-frequency database were expanded to include a range from 5 cm to 90 cm, noting that biometric measurements were recorded in total length (TL).

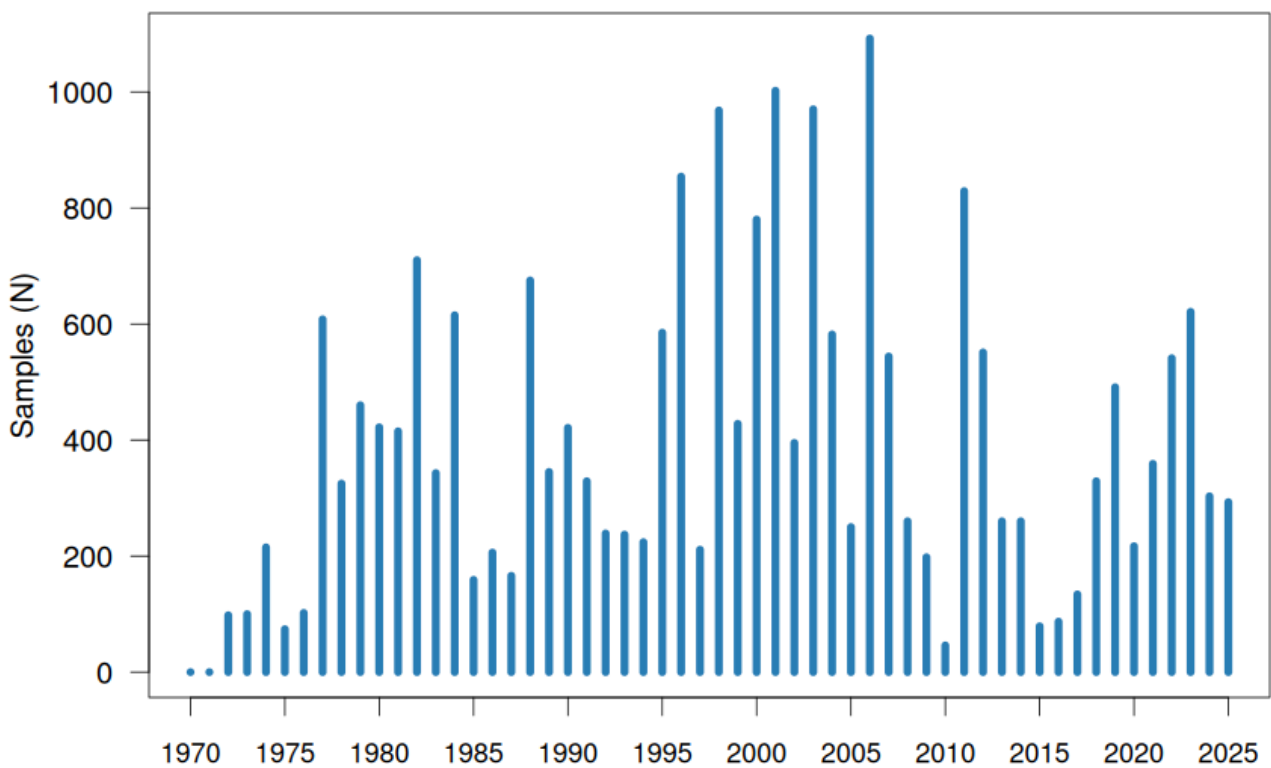


Figure 1. Total number of jack mackerel biometric sampling events during 1972-2025

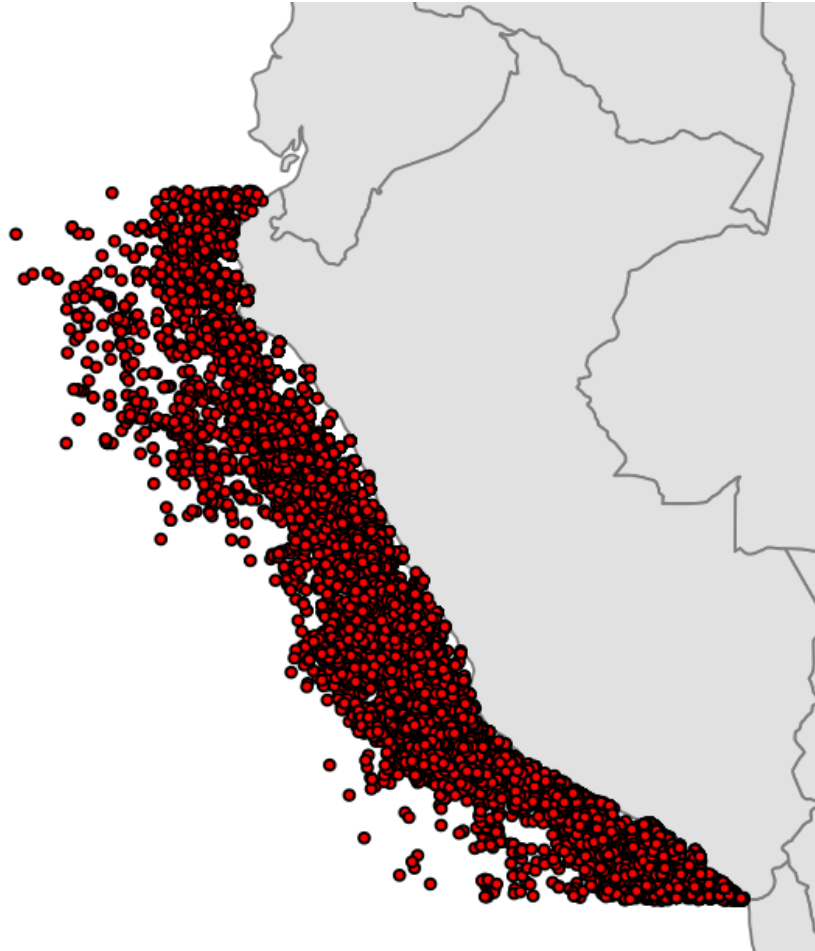


Figure 2. Spatial distribution of Jack mackerel biometric sampling events during 1972-2025

2.2 Data standardization procedure

To derive the length-frequency data for jack mackerel, biometric samples containing individual length measurements and catch information associated with each fishing trip were used. Given that a trawl fleet targeting jack mackerel operated in Peruvian waters during the period 1983–1991 (Ñiquen et al., 2013), samples collected from this fleet were excluded from the analysis. Therefore, only samples obtained from purse seine vessels operating with a 38-mm mesh size were considered. Then, the standardization process applied to the biometric samples was based on a three-level weighting procedure: i) weighting at the fishing trip catch-level, ii) weighting at monthly landings by fleet type, and iii) weighting at annual landings.

For the first weighting level (at the catch of fishing trip), the length-frequency distributions obtained from the biometric samples were used. For this, the theoretical weight-at-length was calculated using the length – weight relationship ($W = aL^b$). We used monthly values for a and b , in most of the calculations, based on the information

reported by [Cahuin et al. \(2026\)](#), also submitted as a technical report to the Benchmark Workshop SCW16). However, when this information was not available, particularly for some observations from the 1970s and 1980s, we used annual values. Based on this, the total theoretical weight of each biometric sampling operation was calculated. Then, a scaling factor was derived as the ratio of the total catch of the trip to the theoretical weight of the sample, which was applied to the observed frequencies to obtain a length distribution representative of the fishing-trip catch.

For the second weighting level, the catch-weighted biometric samples were classified by fleet type. The two main vessel groups participating in the jack mackerel fishery were considered: (i) industrial vessels with a hold capacity greater than 36.2 m³; and (ii) artisanal and small-scale vessels with a hold capacity of up to 32.6 m³. Then, the biometric samples were grouped by month and scaled using monthly jack mackerel landings by fleet type, obtained from the Pelagic Fisheries Monitoring Programme (IMARPE). This dataset is widely used for scientific purposes due to its high temporal resolution and extensive spatial coverage. Weighting was performed using a scaling factor calculated as the ratio of the monthly landing to the observed catch on the biometric samples. This procedure was applied to the length frequencies to obtain distributions representative of the monthly landing by fleet type. Afterwards, the weighted frequencies from both fleets were combined by length class on a monthly scale.

The biometric samples - which had been previously weighted (at the catch of the trip and at monthly landings by fleet type) - were weighted to annual landings. To do this, official landings published in the statistical yearbooks of the Ministry of Production of Peru (Ministerio de la Producción del Perú, PRODUCE) were used. Following the same procedure described above, a scaling factor was calculated as the ratio of the total annual landings and the sum of the monthly landings used in the previous weighting step. This factor was then applied to the size frequencies weighted, yielding annual length-frequency distributions representative of total annual landings. Finally, the length-composition (expressed in proportions) by year was calculated.

2.3 Use of the updated length-frequency data on stock assessment

We evaluate the impact of the updated length-frequency data on the assessment of the Peruvian jack mackerel stock (far-north stock) using the JJM model. For this purpose, we used the configuration of the 2025 assessment (used to establish the jack mackerel

quota for 2026) as the reference model (see [IMARPE 2025](#)). In this model configuration, growth parameters estimated by [Dioses \(2013\)](#) were applied. These growth parameters and the length-frequency data are expressed in total length (TL). The JJM model used catch-at-length data for the period 1980-2025 (also on TL), based on a length-bin matrix ranging from 10 to 70.

From this, the catch and catch-at-length data were updated through December 2025. We then assessed the impact of using the updated length-frequency data, as described in this report. In addition, we evaluated the effect of changing the metrics in the assessment to fork length (FL, for data and parameters), as used in the SPRFMO assessments. For the change of metrics we used the equation of [Cubillos and Arancibia \(2005\)](#), where $TL_{cm} = 0.514 + 1.091 FL_{cm}$. The model configurations for this work are presented in [Table 1](#).

Table 1. Model configurations to assess the impact of the updated length-frequency data

Model	Description
Data update	
model 0.0	As 2025 assessment (information up to November 2025, catch-at-length data for 1980-2025, length bins 10-70, data and parameters on TL)
model 0.1	As in model 0.0 but with updated catch and catch at length (up to December 2025)
Effect of updated length-frequency	
mod 1.0	As model 0.1
mod 1.1	As model 1.0 but with the updated length composition data (catch-at-length data for 1972-2025, length bins 5-90, data and parameters on TL)
Comparison of metrics	
mod 2.0	As model 1.1
mod 2.1	As model 2.0 but using the metric of FL for configuration and data

3. Results

The data recovery process described in this report has made it possible to retrieve historical information on the size composition of jack mackerel dating back to the early 1970s, as well as to review and update existing records. The updated size-frequency results are presented in [Figure 3](#) and [Figure 4](#). These were generated using the most recent information available provided by IMARPE. This dataset corresponds to institutional information compiled for scientific purposes and, as part of our commitment to SPRFMO, is being made available to support and strengthen jack mackerel stock assessments.

Our results were also compared with the standard length-frequency distribution used in the 2025 assessment of the Peruvian stock of jack mackerel (far-north stock), in order to identify variations, verify consistency, and evaluate potential differences in size composition ([Figure 5](#)). The comparison indicates only minor differences in length frequencies from 2015 onwards. However, more pronounced discrepancies were observed during the 1980s and 1990s, as well as in specific years such as 2006, 2009, and 2013–2014, where the size-frequency distributions differ between databases. These differences may be explained by several factors: i) the incorporation of new information resulting from a data recovery and review process, together with the exclusion of records that did not meet the validation criteria established for this analysis (as described above); ii) the application of a three-level weighting scheme under a standardized processing protocol, in contrast to previous procedures in which only trip catches and annual landings were considered for the weighting, without accounting for fleet type in the weighting process; and iii) the use of monthly-scale estimates for parameters a and b , whereas previous procedures relied exclusively on annual-scale values.

The results of the jack mackerel assessment based on updated data through December 2025 (model 0.0 and model 0.1) are shown in [Figure 6](#). Updating this information maintains the levels and trends in the population indicator estimates, with minor changes in the BRPs (see [Table 2](#) in the Appendix section). [Figure 7](#) shows the effect of updating the length frequency data (model 1.0 and model 1.1). According to this, the effect of updating the length composition by incorporating new information, as well as a longer time series of catch-at-size data (1980-2025 in mod1.0 vs 1972-2025 in mod1.1) and size bins ranging from 5 to 90 in mod1.1 (10-70 in mod1.0), results in notable changes in the population indicators. The main changes occur in relation to total biomass and spawning biomass from the early 1980s to the late 1990s, yielding

lower estimates. Furthermore, even though length-frequency data have not changed significantly in the current period, model 1.1 estimates lower biomass levels for the current period (from around 2017 onwards). The estimated recruitment for the last year is similar between models, although it shows that recruitment peaks during the 1990s and 2000s were at higher levels. In addition, and what remains under analysis and discussion is the overestimation of fishing mortality in mod1.1 (in 1997, reaching values of around 10.9).

As an exercise, we have also assessed the effect of metric selection, as shown in [Figure 8](#). No significant differences were observed in total biomass, spawning biomass or recruitment between the models (new data in TL for model 2.0 versus in FL for model 2.1). However, the estimated F for model 2.1 is much lower than the F of model 2.0, although it remains higher than that estimated by model 1.0. This also requires further discussion and understanding, as we know that the choice of metric should not affect the model results, as long as there is consistency between the metric used in the model configuration (growth parameters) and the data. Despite this, the BRPs for both models (Model 2.1 and Model 2.0) remain quite close.

A summary of the results presented above regarding total biomass and fishing mortalities is also shown in [Figure 9](#). Supplementary material, including the estimated BRPs (biological reference points) ([Table 2](#)) and the negative-log-likelihood components and estimated parameter counts ([Table 3](#)), is presented in the Appendices section.

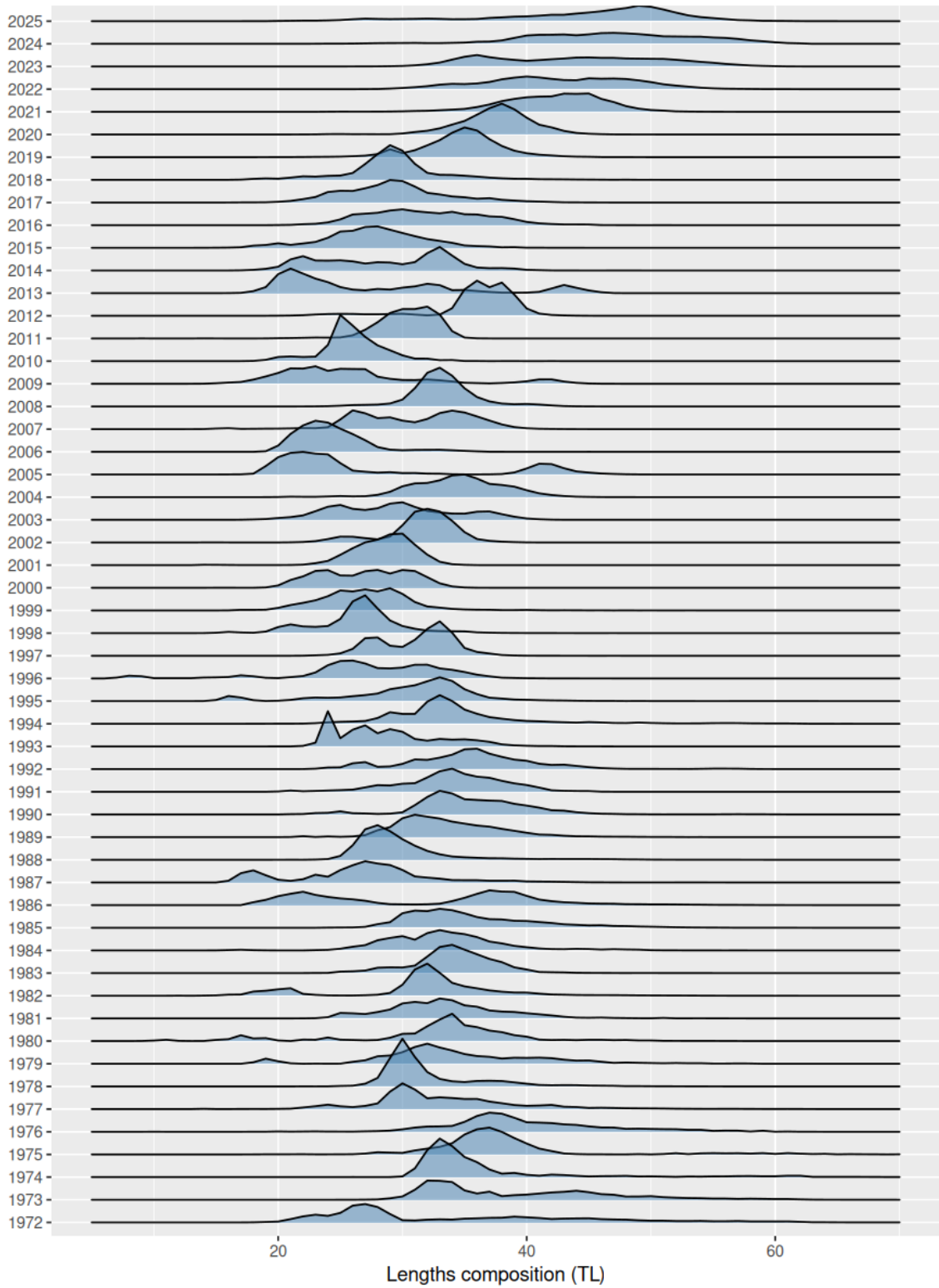


Figure 3. Updated length-frequencies distribution of Peruvian jack mackerel (far-north stock) for the period 1972-2025

Length composition by years

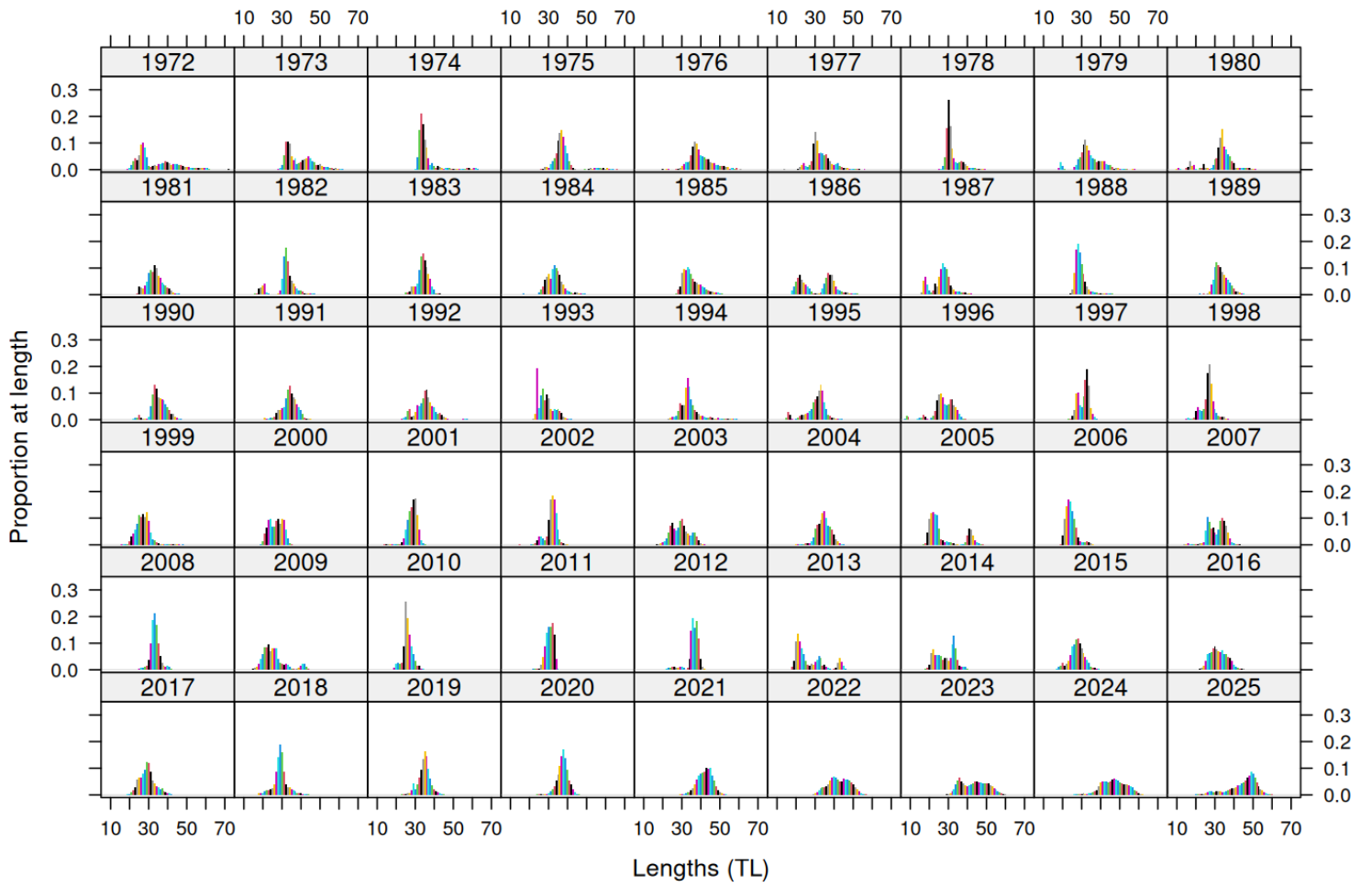


Figure 4. Length composition (by year) of Peruvian jack mackerel (far-north stock) for the period 1972-2025

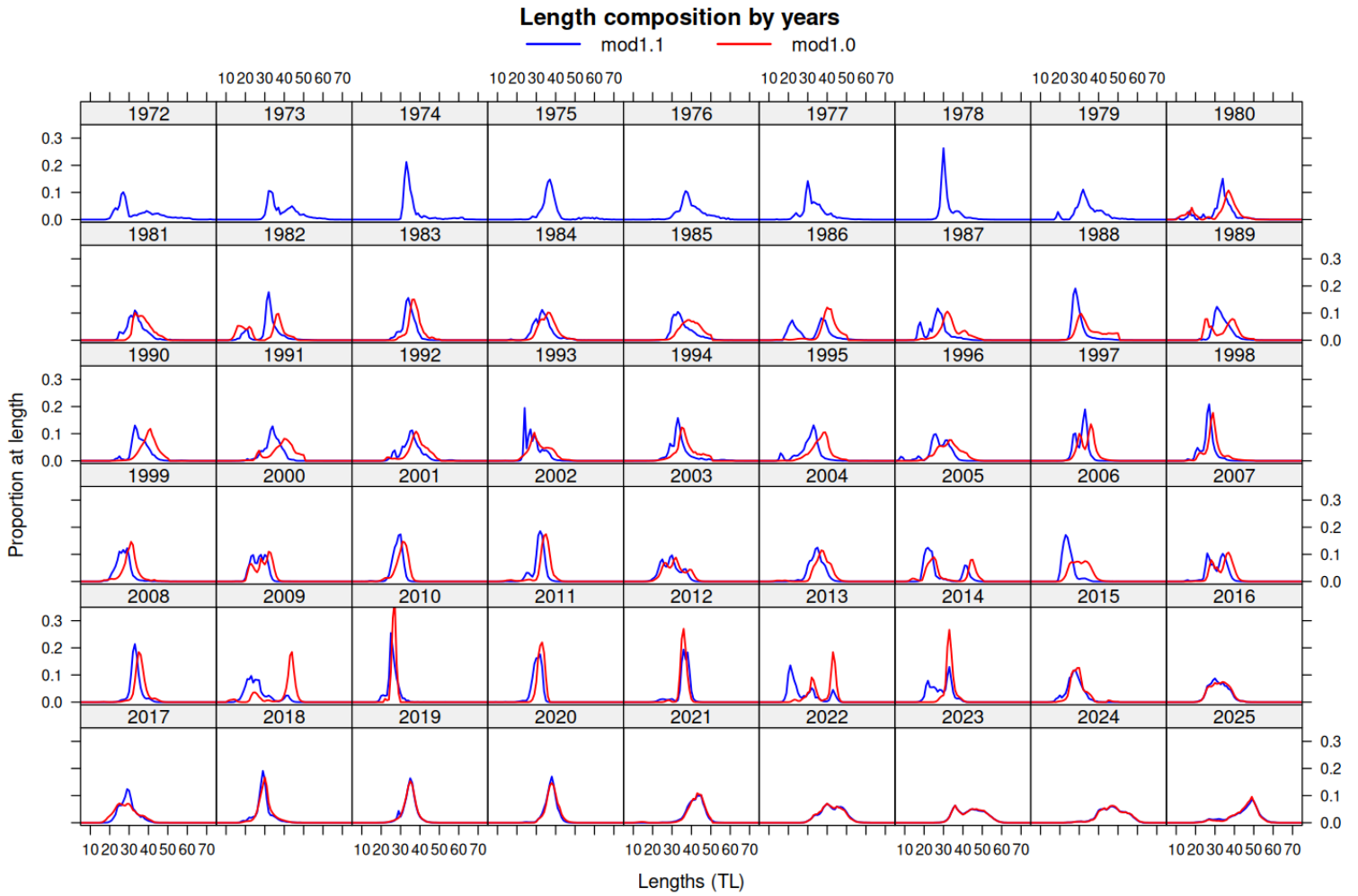


Figure 5. Comparison of length composition using mod1.1 (based on the updated length-frequencies) and mod1.0 (standard length composition used on the 2025 assessment of the Peruvian stock of jack mackerel (far-north stock))

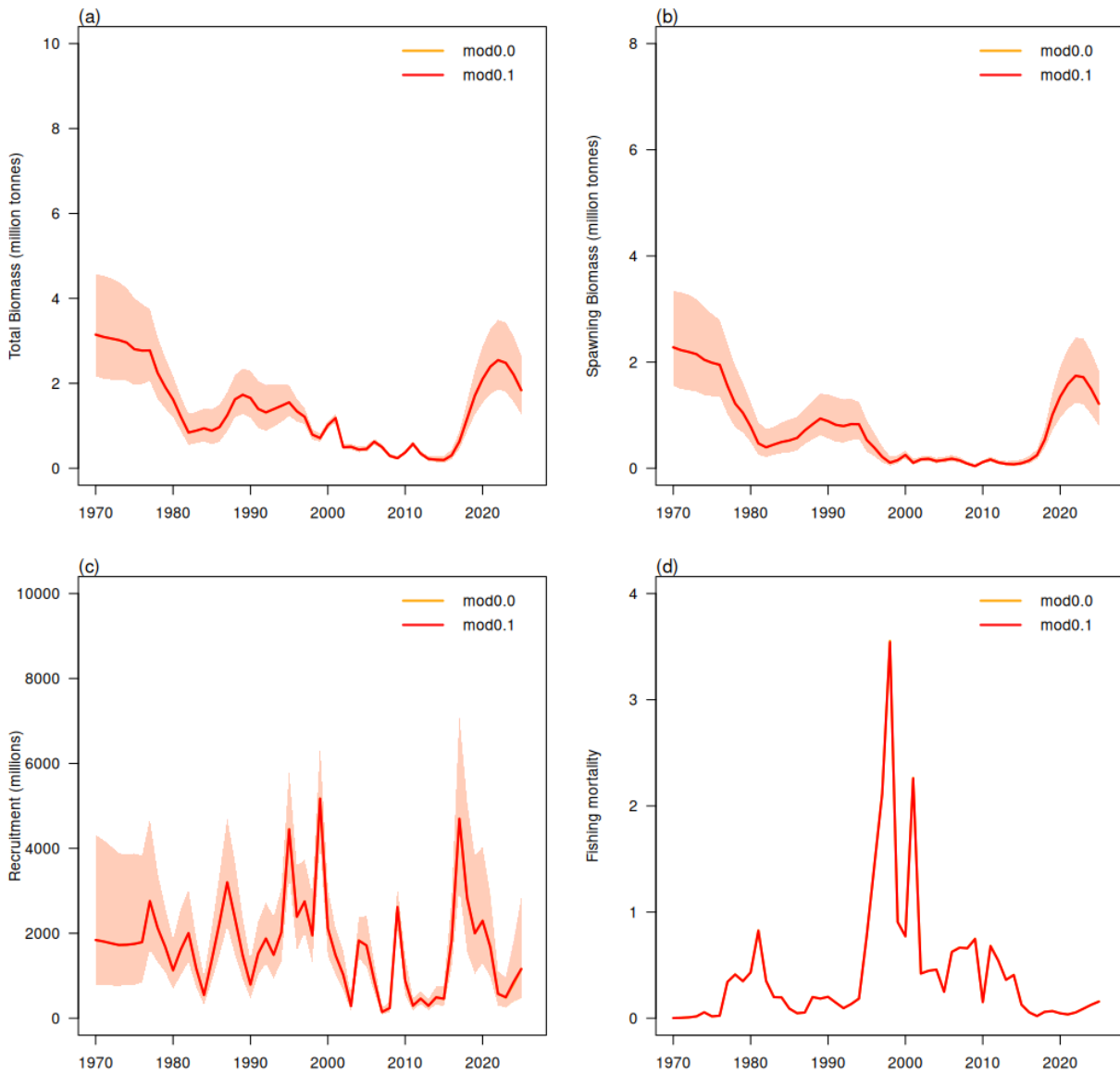


Figure 6. Estimated population indicators for the Peruvian stock of jack mackerel (far-north stock) based on updated data through December 2025 (see [Table 1](#)): (a) total annual biomass; (b) total annual spawning biomass; (c) total annual recruitment; and (d) total annual fishing mortality rate.

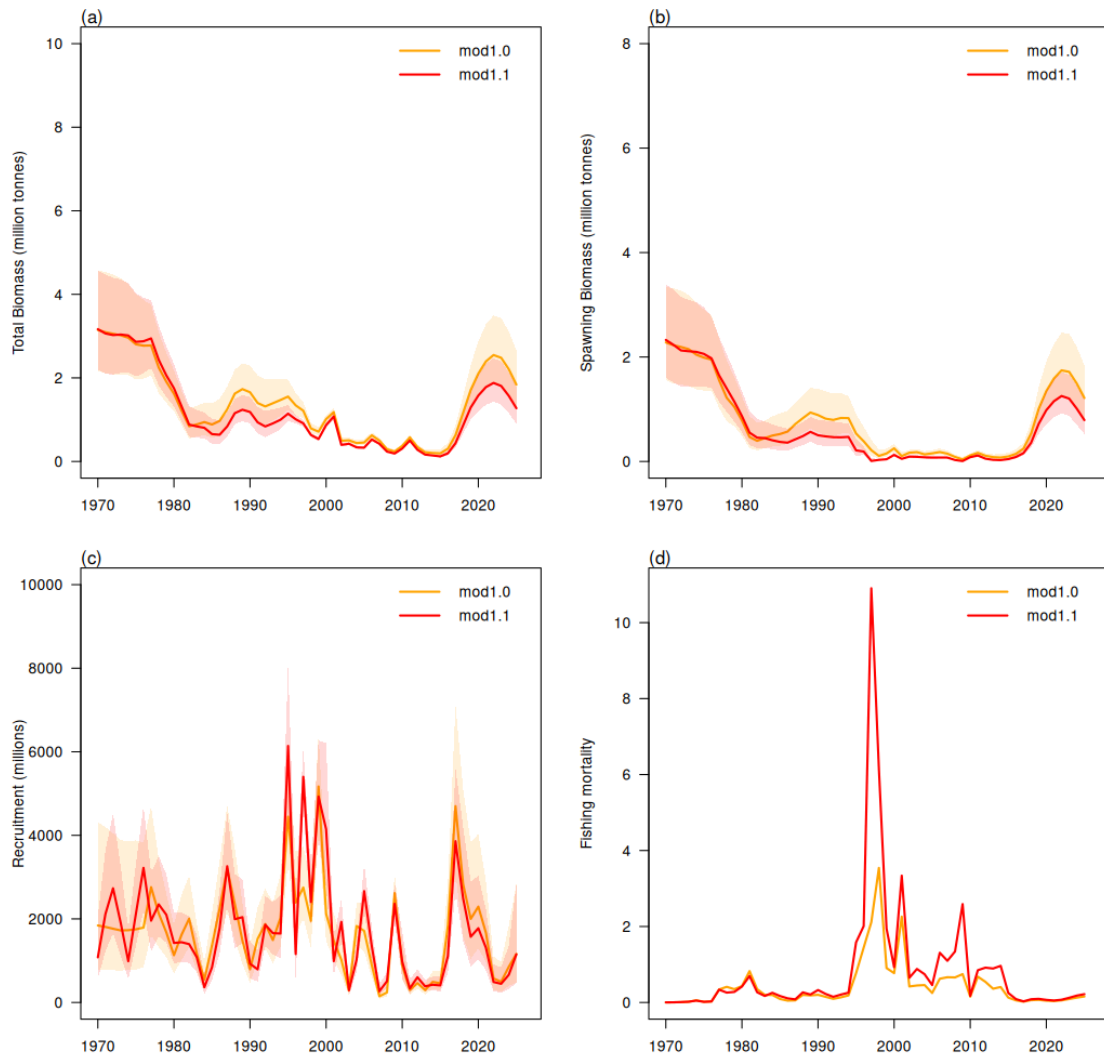


Figure 7. Estimated population indicators for the Peruvian stock of jack mackerel (far-north stock) based on updated length-frequency data (see [Table 1](#)): (a) total annual biomass; (b) total annual spawning biomass; (c) total annual recruitment; and (d) total annual fishing mortality rate.

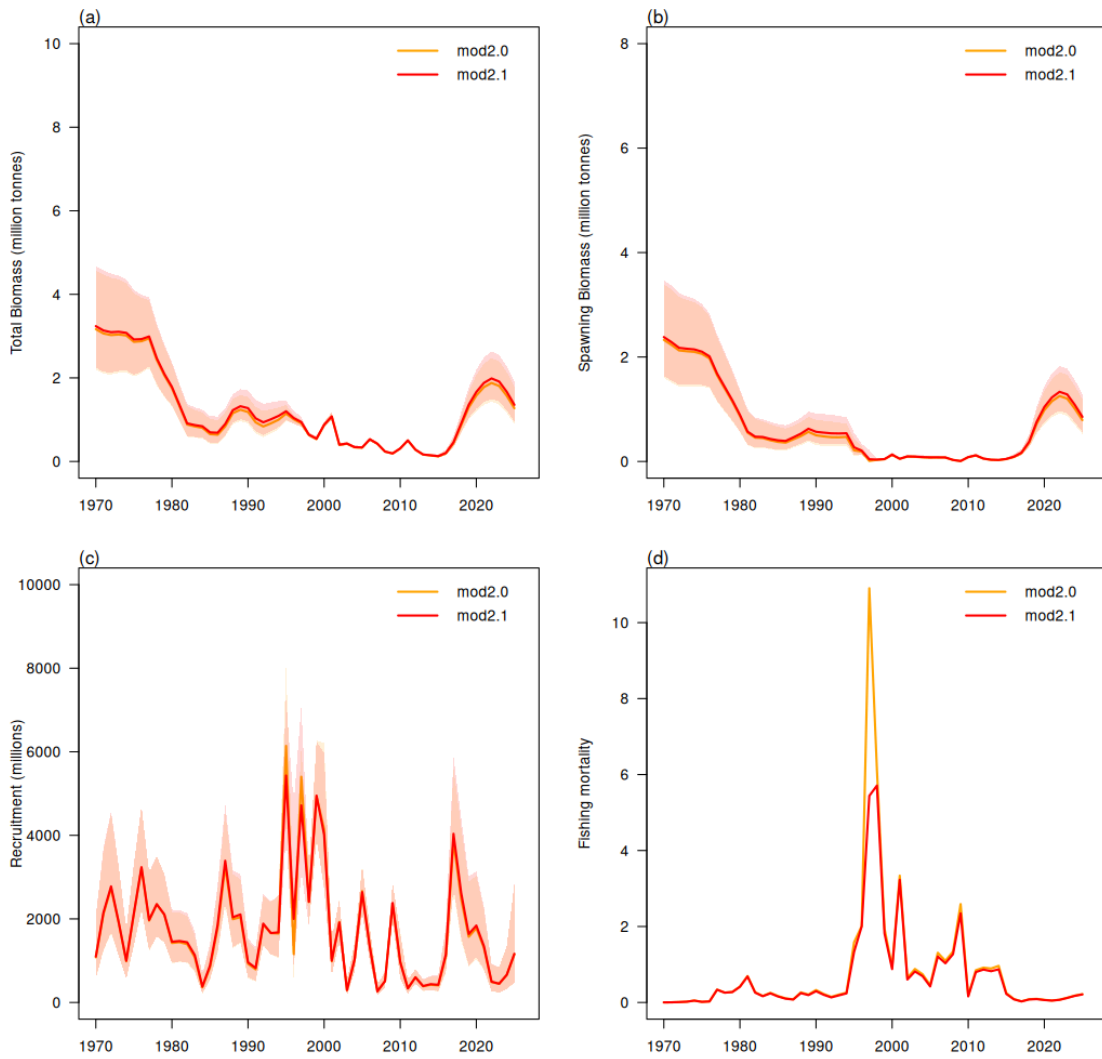


Figure 8. Estimated population indicators for the Peruvian stock of jack mackerel (far-north stock) based on the use of different length metrics (see [Table 1](#)): (a) total annual biomass; (b) total annual spawning biomass; (c) total annual recruitment; and (d) total annual fishing mortality rate.

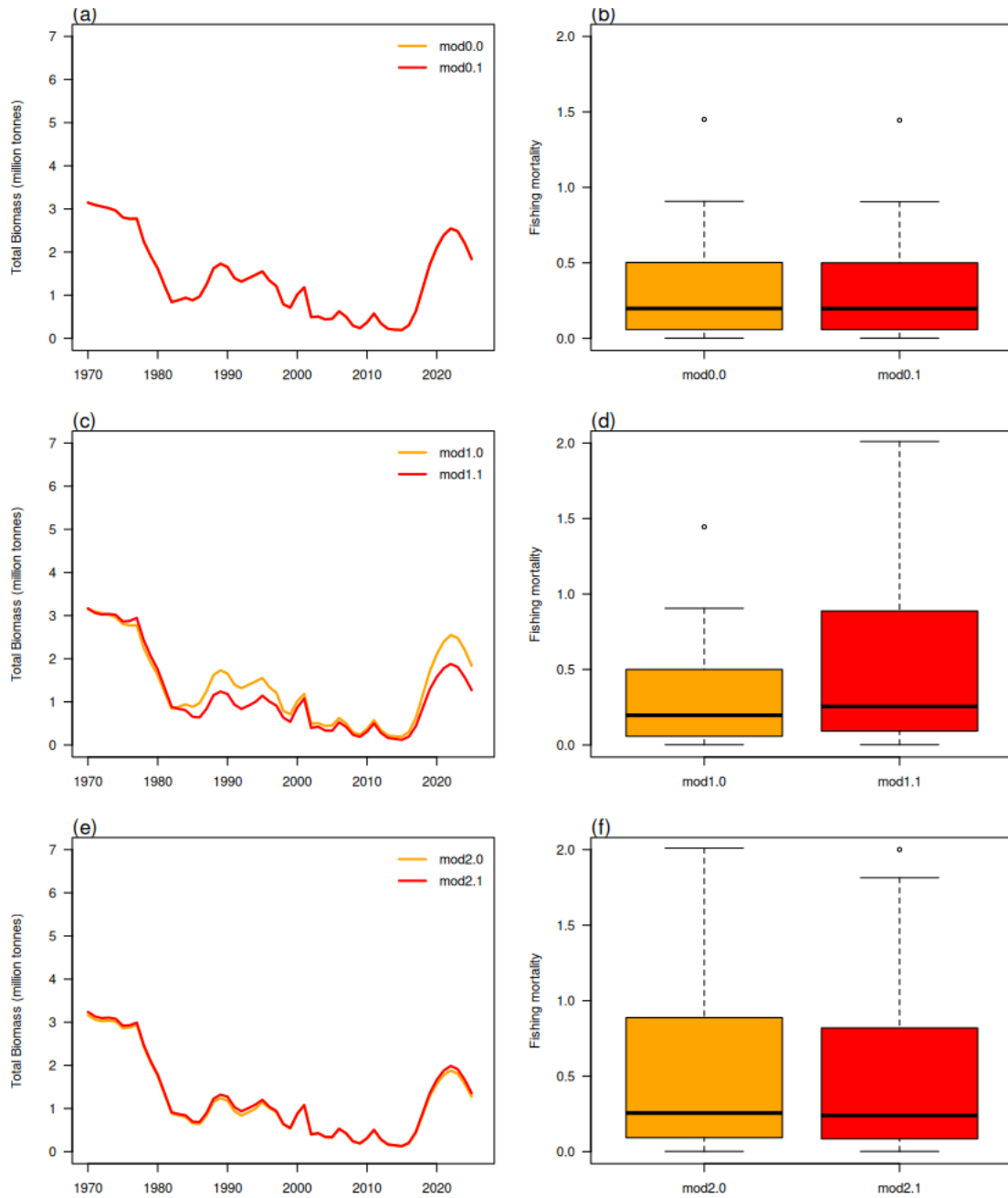


Figure 9. Results of the final JJM model configuration showing the estimated total biomasses of jack mackerel (panels a, c and e) and boxplots of fishing mortality (panels b, d and f) for the three model groups respectively.

4. Concluding remarks

- This work describes the results of a process involving the retrieval and review of data on jack mackerel. Although significant progress has been made, data recovery and validation efforts are still ongoing. This will improve data consistency, enabling the use of the best available data for scientific purposes.
- In terms of data, the new length-frequency database was (i) compiled following a comprehensive review of the available information, (ii) extended the time series, and (iii) was standardized using the same methodological approach. In terms of model estimates, the levels of population indicators were lower (for the 80s and recent period), as well as providing a difference on the BRPs with a reduction of the reference level. However, the apparent overestimation of F when changing the metric from TL to FL — while maintaining consistency between the model configuration and the data — still requires further investigation and understanding.
- We suggest the use of total length (TL) as the official metric for the assessment of jack mackerel in the far-north fleet within the SPRFMO assessments, given that this fleet is currently the only one providing length-based data. The original size data from Peru are measured in TL, and the growth parameter estimates are likewise based on TL. Maintaining a consistent metric throughout the assessment process may help minimize potential biases associated with metric transformations.

5. Acknowledgements

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6. References

1. Cahuín, S., Bouchon, M & Alegre, A. (2026). Length-weight relationship of jack mackerel (*Trachurus murphyi*) in Peru and its implications for biomass estimation. Technical report submitted to the Jack Mackerel Benchmark Workshop (SCW16).
2. Cubillos, L. & Arancibia, H. (1995) Comparative growth performance of horse mackerel of the genus *Trachurus*, with emphasis on *T. symmetricus murphyi*. In: "International symposium on middle-sized pelagic fish", C. Bas, J.J. Castro y J.Ma. Lorenzo (Eds.), Scientia Marina 59(3-4):647-652.
3. Dioses, T. 2013. Age and growth of Jack mackerel *Trachurus murphyi* in Peru. In: J. Csirke, R. Guevara-Carrasco & M. Espino (eds). 2013. Ecology, Fishery and Conservation of Jack mackerel (*Trachurus murphyi*) in Peru. Rev. peru. biol. special issue (published in Spanish with titles, abstracts and captions in English), 20 (1): 045-052.

4. 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

<https://cdn.www.gob.pe/uploads/document/file/9257755/7597179-informe-pesqueria-jurel-durant-e-2025-situacion-y-perspectivas-2026.pdf?v=1767815817>

5. Ñiquen, M., Bouchon, M., Ulloa, D., & Medina, A. (2013). Análisis de la pesquería del jurel *Trachurus murphyi* en el Perú. *Revista peruana de biología*, 20(1), 97-106.

7. Appendix

Table 2. Estimated biological reference points (BRP) for models

	MSY_last	Bmsy_last	Fmsy_last	Capt. Fmsy
model 0.0	103.6826	174.38005	0.30567	216.698
model 0.1	103.69133	174.62351	0.30517	219.342
model 1.0	103.69133	174.62351	0.30517	219.342
model 1.1	117.9494	169.4025	0.34802	188.753
model 2.0	117.9494	169.4025	0.34802	188.753
model 2.1	118291	171.83965	0.34164	191.556

Table 3. Likelihood table

	model 0.0	model 0.1	model 1.0	model 1.1	model 2.0	model 2.1
catch_like	0.93	0.93	0.93	1.99	1.99	2.13
length_like_fsh	452.32	451.74	451.74	514.38	514.38	500.69
sel_like_fsh	11.6	11.6	11.6	17.04	17.04	16.12
ind_like	58.07	58.09	58.09	73.95	73.95	76.38
rec_like	26.75	26.56	26.56	30.33	30.33	28.36
fpen	0.06	0.06	0.06	0.35	0.35	0.17
post_priors_indq	0.04	0.04	0.04	0.06	0.06	0.05
residual	0.17	0.17	0.17	0.13	0.13	0.13
total	549.96	549.2	549.2	638.22	638.22	624.02