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ENHANCED MONITORING PROGRAM: 2024 REPORT

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SUMMARY

The Enhanced Monitoring Program (EMP) began sampling trips of prioritized Class-6 purse-seine vessels, in both, Manta and Posorja, Ecuador in March 2023, with 2024 marking the second year of the program. During 2024 the EMP sampled 607 wells from 80 trips of 32 vessels from the fleets of Ecuador, El Salvador, Nicaragua, Panama, Spain, and the United States. Estimates of bigeye tuna (BET) catch per trip for the sampled trips ranged from 1 to 484 metric tons (t), and the coefficients of variation (CVs) ranged from 0.004 to 0.87, with median of 0.27. The higher CVs on lower estimated BET catches are the result of greater variability in the proportion of BET among the sampled wells of individual trips.

Port-sampling data collected by the EMP have significantly contributed to scientific studies in support of management. For example, a model for the well-level relationship between the EMP estimates of the proportion of BET in the well and those from the observer for the same wells, has been developed (SAC-16 INF-I), and can be used to predict well-level BET catch from observer data for unsampled wells and trips of vessels sampled by the EMP. Similar models can be developed for skipjack and yellowfin tuna, the other two main tropical tuna species, using EMP data. These types of models, fitted to port-sampling data to be collected by the proposed IATTC Port-Sampling Program (PSP; see below), have potential use for both fleet-level and trip-level species catch estimation, for all three purse-seine set types and all three tropical tuna species.

Additionally, development and implementation of the EMP identified several potential areas of improvement for the Traditional Port-Sampling (TPS) protocol for fleet-level species catch estimation. These areas of improvenment (minimization of the opportunistic aspects of the TPS protocol; increase in the flexibility in trip and well selection; and, increase in within-well coverage for floating-object set wells) were addressed with the development of a probability sampling protocol for the PSP (SAC-16-05), and

performance of the proposed PSP protocol was evaluated with a simulation study (SAC-16 INF-J).

The result of these studies are presented as part of the response of the scientific staff to the request made by the Commission on paragraph 8 of Resolution C-24-01, related to improvement of the TPS and its integration with the EMP, through the proposed PSP.

In 2025, the EMP is being implemented with a reduction in sampling coverage, in comparison to 2024, due to the loss of the sampling team based in Posorja, Ecuador; i.e. in 2025, sampling technicians will only be based in Manta. The approved budget does, however, include travel expenses for sampling technicians to carry out occasional sampling in Posorja. Furthermore, as a result of a voluntary contribution made by the United States, in 2025 the EMP has been able to expand its data collection responsibilities to the collection of morphometric data of tropical tunas and prioritized bycatch species during the unloading of Class-6 purse seine vessels in Manta, and in Mazatlan, Mexico. As of March 15, the length and weight of 5,367 individuals have been measured (2,011 yellowfin tuna, 500 bigeye tunas, 2,725 skipjack tunas and 131 from bycatch species). The sampling will continue through at least the end of 2025 and data collected will be analyzed to update and strengthen the morphometric relationships for both tropical tunas and prioritized bycatch species, while also providing robust insight into temporal and spatial variability in those relationships.

1. BACKGROUND

Resolution C-24-01 includes a management measure, directed at decreasing the fishing mortality on bigeye tuna (BET) by encouraging vessels to avoid sets where large amounts of BET are present, which is based on individual-vessel catch thresholds (IVTs). This measure established the Enhanced Monitoring Program (EMP) as a science-based support tool, responsible for the implementation of data collection during catch unloading in port. The port-sampling data collected by the EMP are used to estimate the BET catch, by trip, for trips of vessels sampled by the EMP, as well as a measure of precision on those estimates. The EMP began sampling of trips of prioritized Class-6 purse-seine vessels, in both Manta and Posorja, Ecuador in March 2023, and 2024 marks the second year of the program.

This document presents results of the EMP for 2024 and provides updates on the implementation of the program in 2025. Section 2 outlines the data collection and BET catch estimation processes conducted by the EMP, in support of Resolution C-24-01. Section 3 presents a summary of scientific research carried out by the scientific staff to date that uses data collected by the EMP, as well as the results of analyses of EMP data that have been previously published. That research is presented in detail in documents SAC-16 INF-I and SAC-16 INF-J. Section 4 provides information about the status of activities in 2025, including data collection for the improvement of length-weight relationships for morphometric studies of the three main tropical tuna species (bigeye, yellowfin and skipjack). Finally, section 5 addresses the requests made by the Commission to the scientific staff listed on paragraph 8 of Resolution C-24-01.

2. RESULTS OF THE ENHANCED MONITORING PROGRAM

2.1. Data collection

Between January and December 2024, the EMP sampled 80 fishing trips of 32 purse-seine vessels from the fleets of Ecuador, El Salvador, Nicaragua, Panama, Spain and the United States. For 18 of these vessels, at least two trips were sampled (Figure 1). The number of trips sampled for each vessel varied, based on several factors, such as the frequency with which the vessel unloaded in ports where the EMP operates; the availability of sampling technicians at the time of unloading; and, in the latter months of the year, the

prioritization for sampling of vessels whose BET catch was approaching the thresholds of Resolution C-21-04[1].

The selection of trips for sampling was based on the extent to which fishing activity during a trip involved set types and areas that were considered a priority for data collection (SAC-14-10), where wells with catch from floating-object (OBJ) sets made in the western area of the EPO (west of 95°W; OBJ OFF and OBJ IN-west strata) (Figure 2) were top priority. In total, the EMP sampled 607 wells in 2024.

2.2. Estimates of BET catch per trip and their coefficients of variation

The BET catch estimates for trips sampled by the EMP were obtained using the methodology described in document SAC-14-10. For each trip this involved obtaining an estimate of the BET catch for each stratum of the trip, and summing those estimates to obtain the trip-level estimate. For strata of the trip that were not sampled by the EMP, estimates from the observer Set Summary data, also known as Resumen De Lances (RDL) in Spanish, were used. For 72% of the sampled trips for which a trip-level coefficient of variation could be computed (56 out of 78[2]), the trip-level BET estimate was based entirely (36 trips), or almost entirely (20 trips[3]), on the species composition obtained from EMP data (Figure 3). For the remaining 28%, the RDL species composition data had to be used more extensively due to a higher number of strata per trip that could not be sampled by the EMP (Figure 3).

BET catch estimates per trip for the 80 trips sampled in 2024 ranged from 1 to 484 t. Comparing the 2024 estimates with those obtained for the period covered in 2023 (March – December), there was a tendency for BET catches in 2024 to be lower during March – May, as compared to the same months in 2023 (Figure 4). However, the decreasing temporal trend in BET catches that occurred in the latter part of 2023 can also be observed in the latter part of 2024, although the catches at the end of 2024 are lower than those at the end of 2023 (Figure 4).

The coefficients of variation (CV[4]) obtained for the 2024 trip-level BET catch estimates ranged from 0.004 to 0.87, with median of 0.27. When analyzing the CVs of the estimates since the beginning of the program in March 2023, the overall median is 0.23. Similar to 2023, the 2024 CVs showed an increase in the latter part of the year (Figure 5). This increase coincides with considerably lower BET catches during that time period (Figure 4). The higher CVs on lower estimated BET catches are the result of greater variability in the proportion of BET among the sampled wells for individual trips (examples of this for 2023 were presented in SAC-15 INF-H). Overall, the CVs obtained in 2024 are consistent with what was anticipated based on results of simulations ran last year by the scientific staff (SAC-15 INF-H).

3. SCIENTIFIC RESEARCH BASED ON EMP DATA

The port-sampling data collected by the EMP have significantly expanded research opportunities for the scientific staff to improve science to support management. In addition to the use of EMP data for estimation of BET catch per trip, the EMP data are making possible studies aimed at maximizing the scientific benefits of other existing data sources for estimating fleet-level catch of all three tropical tuna species. Moreover, improvements to data collection for fleet-level catch estimation have been possible thanks to lessons learned during the development of the EMP trip-level sampling protocol. This research

[1] Resolution C-21-04 was replaced in 2024 by Resolution C-24-01 at the 102nd Meeting of the IATTC.

[2] Not included in this calculation are the two trips for which it was not possible to make trip-level CV estimates. In both cases, it was not possible to obtain a representative sample of wells for the trip for logistical reasons. As a result, the EMP data were used to make estimates of BET in the individual wells that were sampled and the observer RDL data were used to make estimates of BET in the other wells of the trip.

[3] For these trips, 90% - 99% of their catch was from EMP-sampled strata.

[4] Methodology used to compute the CVs can be found in Appendix B of SAC-15 INF-H.

is the foundation of the proposal prepared by the scientific staff in response to the request made by the Commission on paragraph 8 of Resolution C-24-01, related to the improvement of the Traditional Port Sampling (TPS) and its integration with the EMP, as part of a proposed IATTC Port-Sampling Program (PSP), which addresses these requests and is presented in document SAC-16-05.

3.1. BET catch estimates per trip from other data sources

In addition to the EMP data, the scientific staff has access to BET catch per trip data from three primary sources: the AIDCP observer program, fishing logbooks, and canneries (processing plants). These data are made available to CPCs through a webpage on the IATTC website, where BET catch estimates per trip from available primary data sources are presented for Class 4 – 6 vessels under their flag. For 2024, 100% of trips from Class-6 vessels had observer data, thanks to the AIDCP on-board observer program. Information from fishing logbooks was available for 62% of all Class 4 – 6 trips. In the case of data from canneries, the IATTC database, as of 15 January 2025, contained information for 22% of the trips made in 2024 (Table 1). The trip-level BET catch estimates from the three primary data sources showed a similar temporal trend in 2024 to that of the EMP estimates (Figure 6). For each of the three primary data sources, there were some trips with estimates very similar to those of the EMP, and others with estimates outside the 95% confidence intervals on the EMP estimates, either above or below the confidence interval bounds.

A positive correlation was found between the EMP estimates and those of the three primary data sources (Figure 7). There was a tendency in 2024 for observer estimates to be greater than the EMP estimates for the same trips, in comparison to the 2023 relationship, consistent with the results of the well-level comparison between EMP and RDL data (SAC-16 INF-I). For cannery estimates, the relationship to the EMP estimates in 2024 tended to be somewhat more centered around the 1-to-1 line (the line that indicates the estimates are exactly the same), compared to the 2023 pattern. To statistically assess the 2024 relationships, simple linear regression models were fitted to the paired trip-level estimates using weighted least squares, with weights equal to the inverse of the variance of the EMP estimates, to mitigate the impact of less precise EMP estimates on the fitted relationship. The estimated slopes for the three linear relationships for 2024—each with a p-value < 0.001—are as follows: 0.63 (s.e. = 0.089) for EMP vs. observer; 1.15 (s.e. = 0.072) for EMP vs. cannery; and 0.53 (s.e. = 0.10) for EMP vs. fishing logbook (Figure 7). Although statistical comparison of the slopes of the three linear relationships is feasible, interpreting the results is complicated by the fact that the scientific staff did not have logbook and cannery estimates for all 78 trips[5] with EMP and RDL estimates. It is not known how the relationships between EMP and cannery estimates, and EMP and logbook estimates, might change had the missing estimates from these two sources been available and included in the regression analyses. The reasons why the information for these trips was not provided are not currently known, and therefore, it is not assumed that the information is missing at random.

3.2. Research using detailed EMP and observer data

Data collected by the EMP between March 2023 and December 2024 are being used by the scientific staff as part of research on new methodologies for tropical tuna species catch estimation that take advantage of observer data, given the 100% observer coverage of Class-6 vessel trips. A model for the well-level relationship between the EMP estimates of the proportion of BET in the well and those from the observer (RDL data), for the same wells, has been developed (SAC-16 INF-I). That analysis focused on data for BET from OBJ-set wells and the vessels sampled by the EMP. However, with port-sampling data that would be collected by the proposed IATTC Port Sampling Program (PSP) for the entire Class-6 fleet (SAC-16-05), similar models could be developed by purse-seine set type for each of the three tropical tuna species and

[5] Not included in this calculation are the two trips for which it was not possible to make trip-level CV estimates.

used to predict well-level species catch from observer data for unsampled wells and trips. Such a methodology may prove useful for both fleet-level and trip-level catch estimation. Among the results of the study conducted with EMP data for BET (SAC-16 INF-I), it was found that the overall relationship between the EMP and RDL estimates differed significantly by vessel. In addition, the study found a change in the EMP – RDL relationship from 2023 to 2024. These results highlight the importance of routine collection of port-sampling data that have adequate within-well coverage, so as to obtain predictions for unsampled wells that are as accurate as possible for all vessels and time periods. Similar studies with EMP data will be conducted for YFT and SKJ, which is made possible because the EMP collects data on all three tropical tuna species in each sampled container of a well.

3.3. Research for improvement of fleet-level species catch estimation

Scientific research related to the development of the EMP trip-level sampling protocol for OBJ-set wells identified several potential areas of improvement for the TPS protocol for fleet-level catch estimation, for all three species. These areas of improvement include: minimizing the opportunistic aspects of the TPS protocol, while increasing flexibility in trip and well selection; and, increasing within-well coverage of OBJ-set wells. To address these areas of improvement, a probability sampling protocol for fleet-level species catch estimation was developed and its performance evaluated with a simulation study (SAC-16 INF J). This probability sampling protocol, which would be implemented by the proposed PSP for collection of port-sampling data (SAC-16-05), addresses the areas of improvement listed above while maintaining a similar level of sampling coverage of trips and wells as the TPS protocol.

Additional data on well-level species and length composition were collected from wells with catch from unassociated (NOA) set and dolphin-associated (DEL) set catch, thanks to the Project C.1.b (IATTC-102-02a, funded by a voluntary contribution from the United States. During 2024, a team of two samplers located in Manta, Ecuador, and another team of two samplers located in Mazatlan, Mexico, sampled wells with catch from NOA sets and DEL sets, applying an intensive within-well sampling protocol similar to that used during the EMP pilot study for collection of data from OBJ-set wells. A total of 113 wells were sampled, 73 wells in Mazatlan and 40 wells in Manta (Figure 8). Future work using the Project C.1.b data will evaluate additional within-well sampling options for DEL and NOA-set wells, in terms of the estimation of length composition. The results of that work will be used to refine the within-well sampling component of the proposed PSP protocol (SAC-16 INF-J), if necessary.

4. ACTIVITIES OF THE EMP IN 2025

The approved EMP budget for 2025 (Minutes of the 102nd Meeting of the IATTC) means that the program will be operating with a team of 12 samplers - 6 teams of two people each - based in Manta. Unlike in previous years, the EMP will not have sampling technicians based in Posorja to carry out sampling. During 2023 and 2024, 12 samplers were based in Posorja and carried out sampling of vessels unloading in this port throughout the year. The approved budget for 2025 does, however, include travel expenses for sampling staff based in Manta to travel to Posorja for occasional sampling. During the first quarter of 2025, the EMP sampled 80 wells from 10 trips by Ecuadorian and Panamanian flagged vessels. The lack of personnel based in Posorja, and an increase in the number of vessels unloading in Peru compared to the previous year, led to a reduction in the number of trips sampled when compared to the same period in 2024.

4.1. Morphometric sampling

The collection of morphometric measurements to refine length-weight, length-length, and weight-weight relationships for the three tropical tuna species and prioritized bycatch species has been implemented in Manta, Ecuador, and Mazatlan, Mexico, with support from an additional voluntary contribution from the United States (SAC-15 INF-E.b). Development of the sampling strategy and protocols began in the fourth

quarter of 2024, with a key focus on ensuring broad spatial and temporal coverage across the active fishery (Figure 9). Initial sampling trials in Manta, Ecuador, during November and December 2024 identified protocol shortcomings, which were subsequently addressed to enhance data collection. Full scale sampling began on schedule on January 9, 2025, and will continue through at least the end of the year.

As of March 15, 2025, samples have been collected from 102 wells across 37 fishing trips of class-6 purse-seine vessels, covering 12 of the 18 spatial areas (Figure 10). These efforts have resulted in the collection of data from 2,011 YFT, 500 BET, and 2,725 SKJ, along with 131 measurements from 6 bycatch species (Table 2). Preliminary plots illustrating the length-weight relationships for YFT, BET, and SKJ are presented in Figures 11 (a–c), while Figures 12 (a–c) depict the relationship between straight fork-length and curved fork-length.[6] Ongoing sampling efforts are expected to further strengthen these relationships for both tropical tunas and prioritized bycatch species, also providing robust insights into temporal and spatial variability.

5. RESPONSE TO RESOLUTION C-24-01

Paragraph 8 of Resolution C-24-01, details requests to the scientific staff for the analysis of different components necessary for the integration of objectives, actions and tasks of the EMP and the TPS, including any suggested improvements to the latter. In response to these requests, the scientific staff has prepared a proposal that can be found in SAC-16-05.

6. ACKNOWLEGMENTS

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[6] Straight fork-length (SFL) is measured from the tip of the snout to the fork in the tail using a rigid measuring stick with calipers. Curved fork-length (CFL) is measured from the tip of the snout following the curve of the body to the fork in the tail using a flexible measuring tape.

TABLE 1. Information available by trip from the main data sources (logbook, cannery and observer) for trips made in 2024 by Class 4-6 vessels (as of January 15, 2025).
TABLA 1. Información disponible por viaje de las fuentes de datos primarias (bitácoras, enlatadoras y observadores) de los viajes realizados en 2024 por buques clases 4-6 (al 15 de enero del 2025).

Vessel class	2024 trips	Logbook		Cannery		Observer	
		Trips	%	Trip	%	Trip	%
4	151	146	97%	22	15%	53	35%
5	153	122	80%	21	14%	110	72%
6	1,122	612	55%	267	24%	1,122	100%
TOTAL	1,426	880	62%	310	22%	1,285	90%

TABLE 2. Numbers of morphometric measurements collected by species, from three eastern Pacific ports (Manta, Mazatlan, and Posorja). Species are identified by three-letter codes: BET (Bigeye Tuna), YFT (Yellowfin Tuna), SKJ (Skipjack Tuna), BKJ (Black Skipjack), FRI (Frigate Tuna), FRZ (Bullet Tuna), DOL (Dolphinfish/Mahi-mahi), WAH (Wahoo), and PLS (Pelagic Stingray).
TABLA 2. Número de medidas morfométricas recolectadas por especie, en tres puertos del Pacífico oriental (Manta, Mazatlán y Posorja). Las especies se identifican por códigos de tres letras: BET (atún patudo), YFT (atún aleta amarilla), SJK (aún barrilete), BKJ (barrilete negro), FRI (Melva), FRZ (Melvera), DOL (Dorado/Mahi-mahi), WAH (Peto), y PLS (Raya látigo violeta).

Species	Manta	Mazatlan	Posorja	Total
BET	500			500
YFT	1,015	996		2,011
SKJ	2,109	616		2,725
BKJ	22			22
FRI	1			1
FRZ		11		11
DOL	38		2	40
WAH	31		4	35
PLS		22		22
TOTAL	3,716	1,645	6	5,367

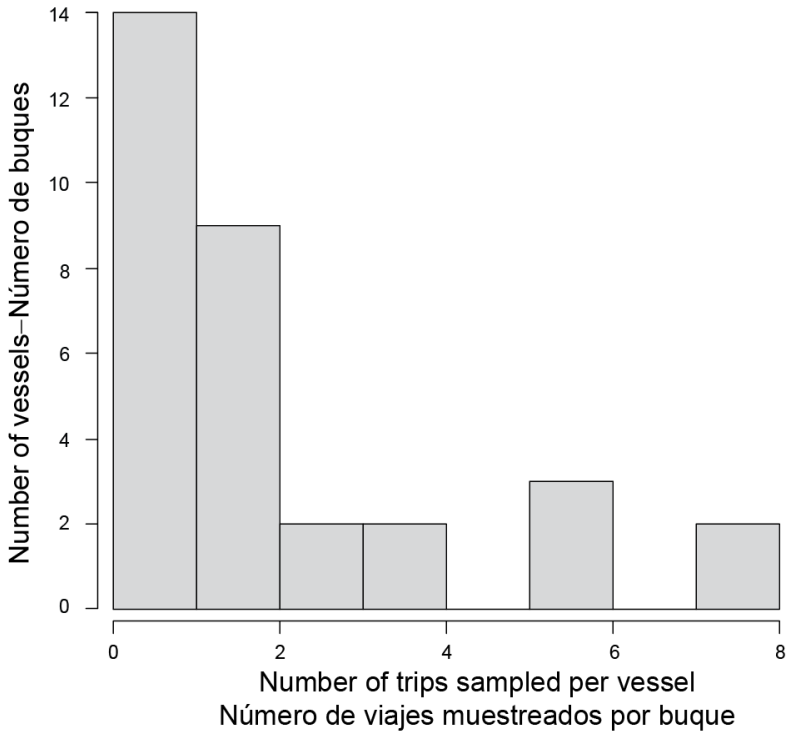

FIGURE 1. Number of trips sampled per vessel for the 80 trips sampled by the EMP in 2024.
FIGURA 1. Número de viajes muestreados por buque para los 80 viajes muestreados por el PRM en 2024.

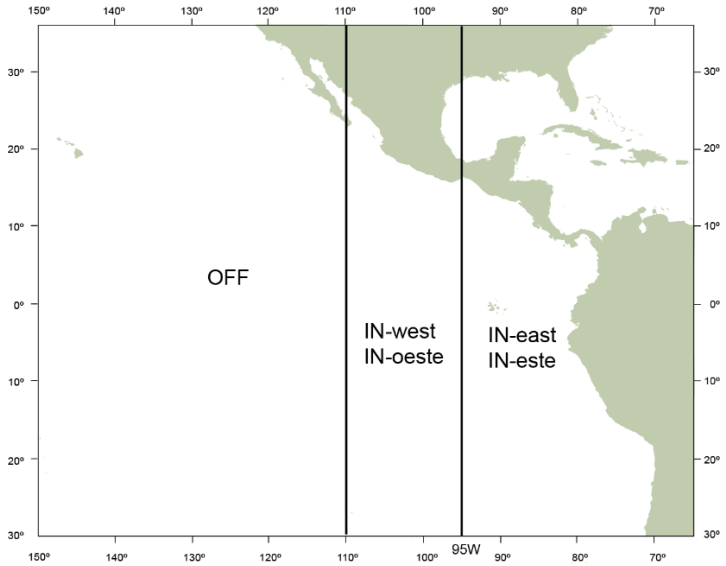

FIGURE 2. Fishing areas established by the EMP for estimates of BET catch per trip. OFF: sets made west of 110°W; OBJ IN-west: sets made between 110°W and 95°W; OBJ IN-east: sets made east of 95°W. The combination of the catch area and the set type used (NOA, OBJ or DEL) defines the strata established by the EMP.
FIGURA 2. Áreas de pesca establecidas por el PRM para las estimaciones de captura de BET por viaje. OFF: lances realizados al oeste de 110°O; OBJ IN-oeste: lances realizados entre 110°O y 95°O; OBJ IN-este: lances realizados al este de 95°O. La combinación del área de captura y el tipo de lance empleado (NOA, OBJ o DEL) define los estratos establecidos por el PRM.

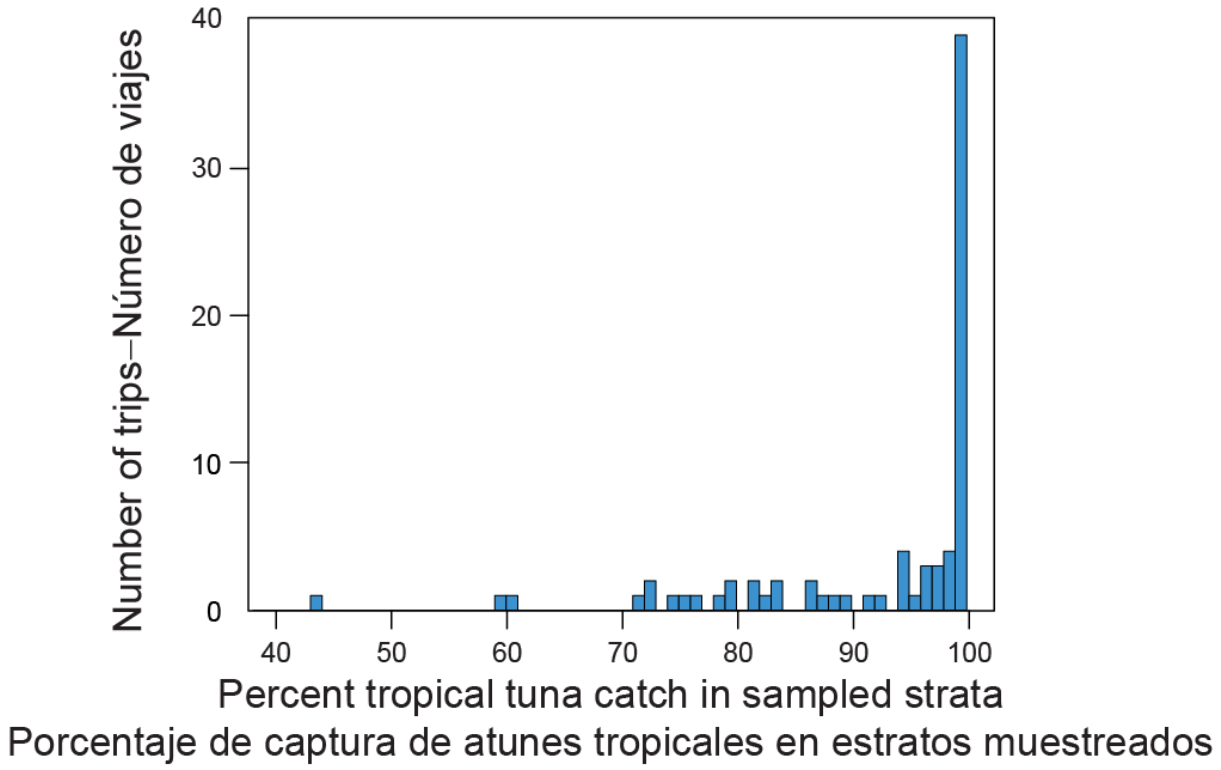

FIGURE 3. Frequency distribution of the percentage of tropical tuna catch of a trip that was present in the EMP-sampled strata for the trip (tropical tuna catch obtained from sets made outside the EPO is not considered in this figure; wells with catch from outside the EPO were not sampled by the EMP and did not factor into the EMP estimation). Not included are the data of two trips (out of 80) for which it was not possible to make trip-level CV estimates.

FIGURA 3. Distribución de frecuencia del porcentaje de captura de atunes tropicales, por viaje, presente en los estratos muestreados por el PRM (la captura de atunes tropicales obtenida de lances realizados fuera del OPO no fue considerada en esta figura; bodegas con capturas realizadas fuera del OPO no fueron muestreadas y por tanto no fueron un factor en las estimaciones del PRM). No se incluyen los datos de dos viajes (del total de 80) para los que no fue posible realizar estimaciones para los que no fue posible realizar estimaciones de CV a nivel de viaje.

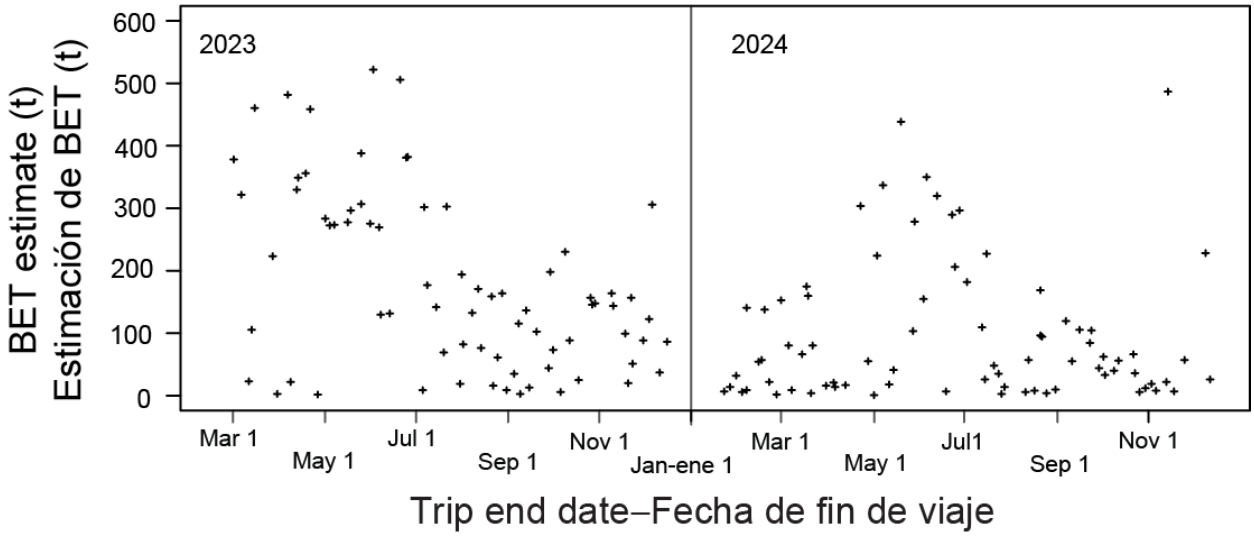

FIGURE 4. Trip-level estimates of BET catch (in metric tons), ordered according to the date of the end of the trip, between March 2023 and December 2024. Every cross symbol represents an individual trip. For any trip with strata that were not sampled by the EMP, the RDL estimate of BET, by stratum, was added to the EMP estimates for sampled strata to obtain the trip estimate. Not shown are the data of four trips (two in 2023 and two in 2024, out of a total 155 trips) for which it was not possible to make trip-level CV estimates.

FIGURA 4. Estimaciones de captura de BET a nivel de viaje (en toneladas métricas), ordenadas según la fecha de finalización del viaje, entre marzo 2023 y diciembre de 2024. Cada símbolo de cruz representa un viaje individual. Para cada viaje con estratos que no fueron muestreados por el PRM, la estimación de BET del RDL, por estrato, fue incluido a la estimación de estratos muestreados por el PRM para obtener la estimación a nivel de viaje. No se incluyen los datos de cuatro viajes (dos en 2023 y dos en 2024, de un total de 155 viajes) para los que no fue posible realizar estimaciones de CV a nivel de viaje.

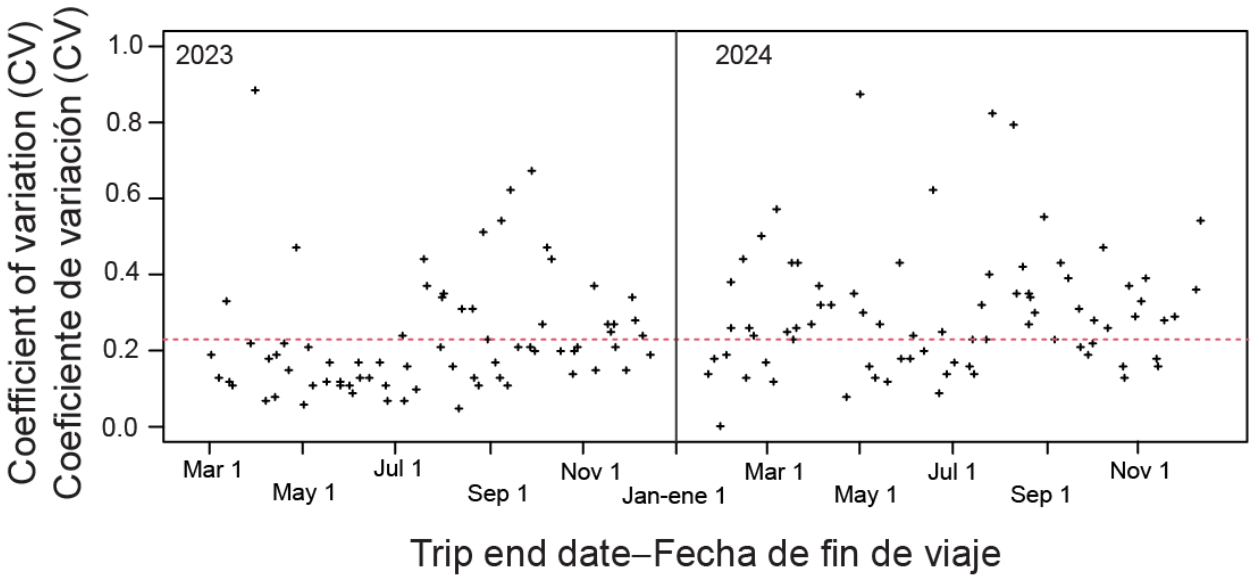

FIGURE 5. Coefficient of variation (CV) of BET catch estimates per trip sampled between January 2023 and December 2024. Each cross symbol represents a sampled trip. The red dashed line indicates the overall median CV value of 0.23. Not shown are the data of four trips (two in 2023 and two in 2024, out of a total 155 trips) for which it was not possible to make trip-level CV estimates.

FIGURA 5. Coeficiente de variación (CV) de las estimaciones de captura de BET por viaje muestreado entre enero de 2023 y diciembre de 2024. Cada símbolo de cruz representa un viaje muestreado. La línea discontinua roja indica el valor mediano global de CV de 0.23. No se incluyen los datos de cuatro viajes (dos en 2023 y dos en 2024, de un total de 155 viajes) para los que no fue posible realizar estimaciones de CV a nivel de viaje.

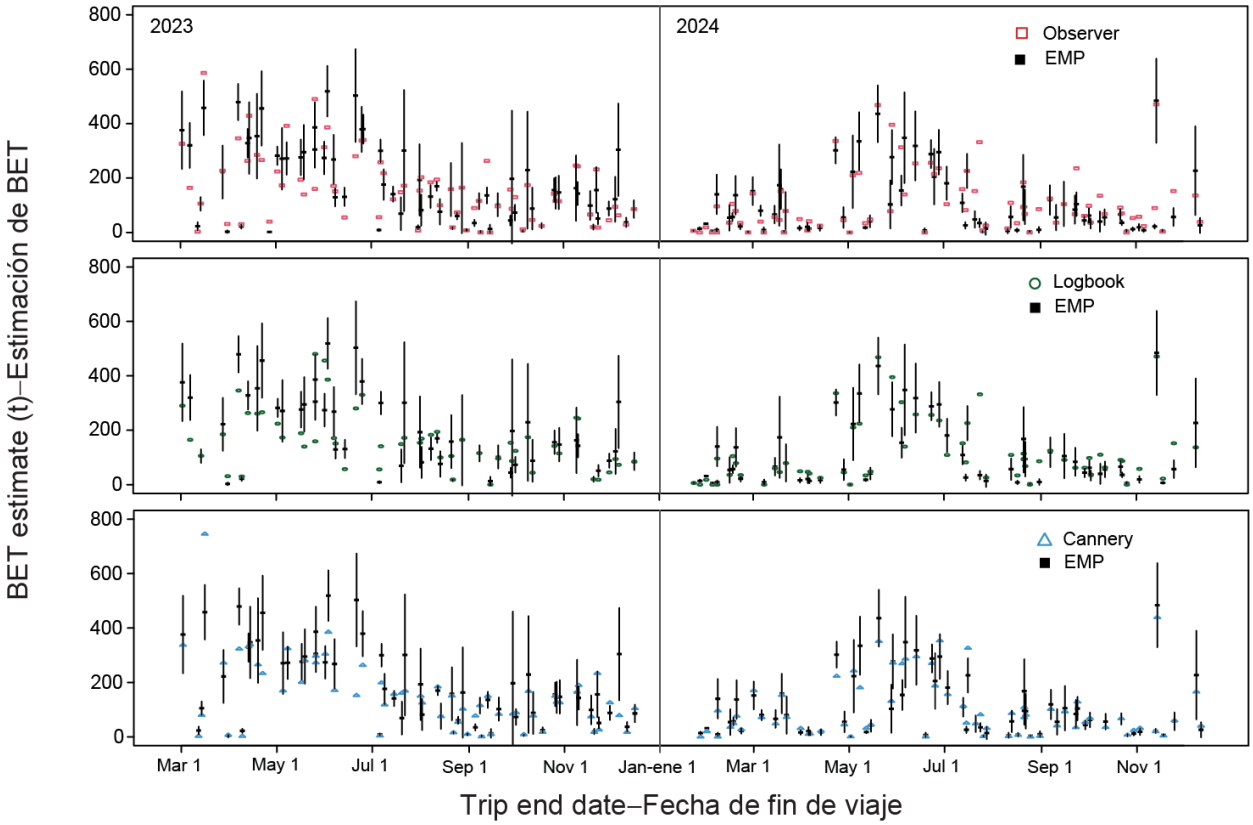

FIGURE 6. Estimated BET catch (in metric tons), by trip, for the EMP (black filled squares; vertical bars are the 95% confidence intervals), along with estimates from other data sources: observer (RDL; open red squares), first panel; logbook (open green circles), second panel; and, cannery (open blue triangles), third panel. Estimates shown in this figure were obtained from the IATTC web page on February 26 2025. The number of trips shown per panel differs, due to availability of the other data sources; top panel: 151 trips; middle panel: 114 trips; bottom panel: 131 trips. Not shown are the data of four trips (two in 2023 and two in 2024) for which it was not possible to make trip-level CV estimates.

FIGURA 6. Estimación de captura de BET (en toneladas métricas), por viaje, para el PRM (cuadrados negros; las barras verticales son los intervalos de confianza del 95%), junto con las estimaciones de las otras fuentes de datos: observadores (RDL; cuadrados rojos huecos), primer panel; bitácoras (círculos verdes huecos), segundo panel; y enlatadoras (triángulos azules huecos), tercer panel. Las estimaciones mostradas en esta figura se obtuvieron de la página web de la CIAT el 26 de febrero de 2025. El número de viajes mostrado por panel difiere debido a la disponibilidad de las otras fuentes de datos: panel superior, 151 viajes; panel central, 114 viajes; panel inferior, 131 viajes. No se incluyen los datos de cuatro viajes (dos en 2023 y dos en 2024) para los que no fue posible realizar estimaciones de CV a nivel de viaje.

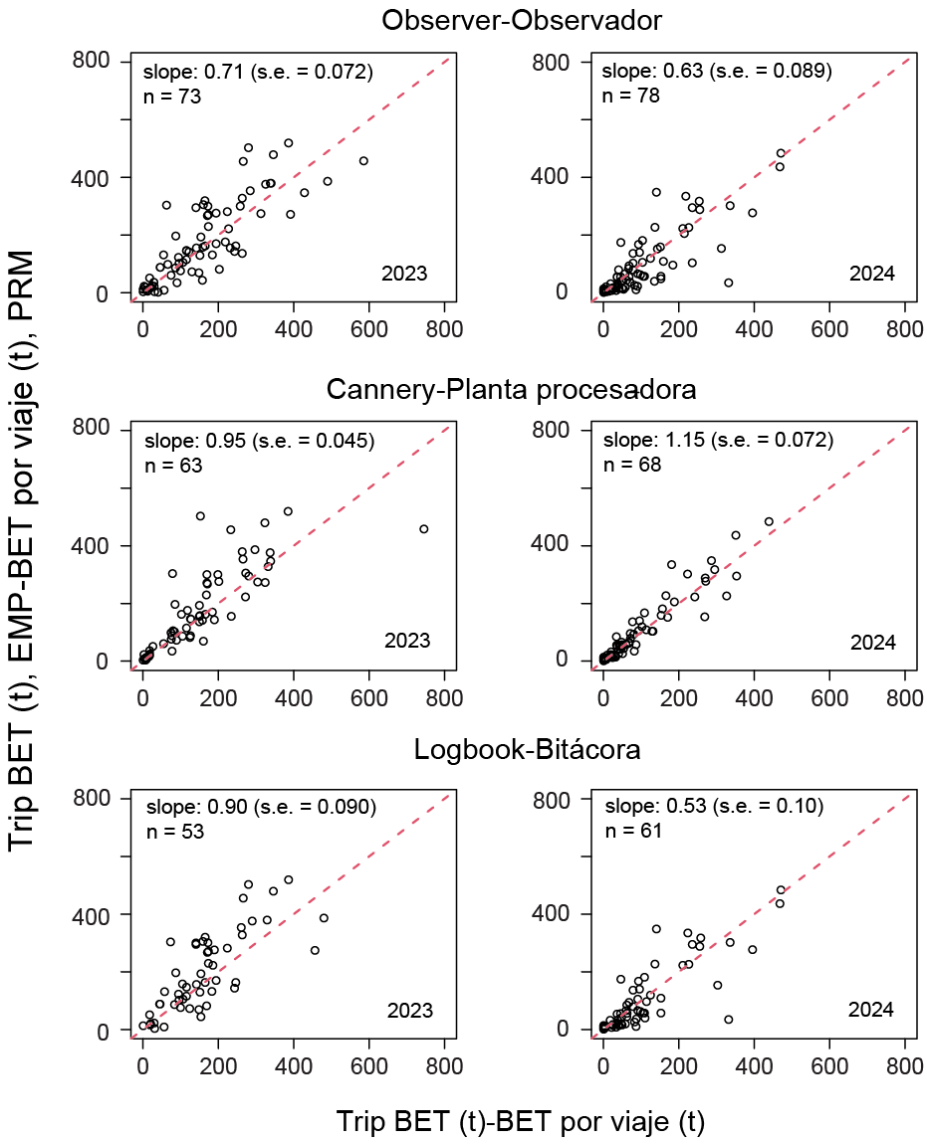

FIGURE 7. BET catch estimates (in metric tons), by trip, from the EMP versus estimates from the other three data sources, where available (observer: upper left; cannery: upper right; logbook: lower left), by year. Each open circle is an individual trip. "slope": slope estimate for the relationship (based on weighted least squares, with variance on the EMP estimates used as weights). "s.e.": standard error on the estimated slope. "n": number of trips shown in each plot. The red dashed line is the 1-to-1 line. Not included in the figure are the four trips for which it was not possible to make trip-level CV estimates. Estimates shown in this figure were obtained from the IATTC web page on 26 February, 2025.

FIGURA 7. Estimaciones de captura de BET (en toneladas métricas), por viaje, del PRM versus estimaciones de las otras tres fuentes de datos, conforme a su disponibilidad (observadores: superior izquierdo; enlatadoras: superior derecho; bitácoras: inferior izquierdo), por año. Cada círculo hueco es un viaje individual. "pendiente": pendiente estimada para la relación (basado en mínimos cuadrados ponderados, con la varianza de la estimaciones del PRM utilizada como peso). "s.e.": error estándar de la pendiente estimada. "n": número de viajes mostrados en cada gráfico. La línea discontinua roja es la línea 1 a 1. No se incluyen los datos de cuatro viajes para los que no fue posible realizar estimaciones de CV a nivel de viaje. Las estimaciones mostradas en esta figura se obtuvieron de la página web de la CIAT el 26 de febrero de 2025.

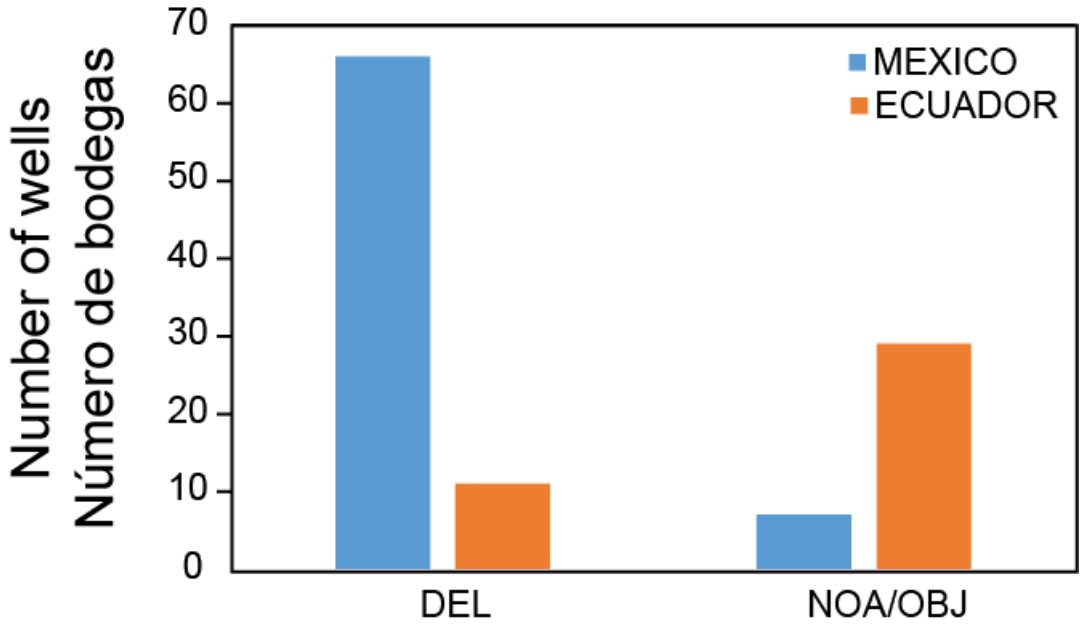

FIGURE 8. Number of wells sampled by Project C.1.b during 2024, by set type and country.
FIGURA 8. Número de bodegas muestreadas por el Proyecto C.1.b durante 2024, por tipo de lance y país.

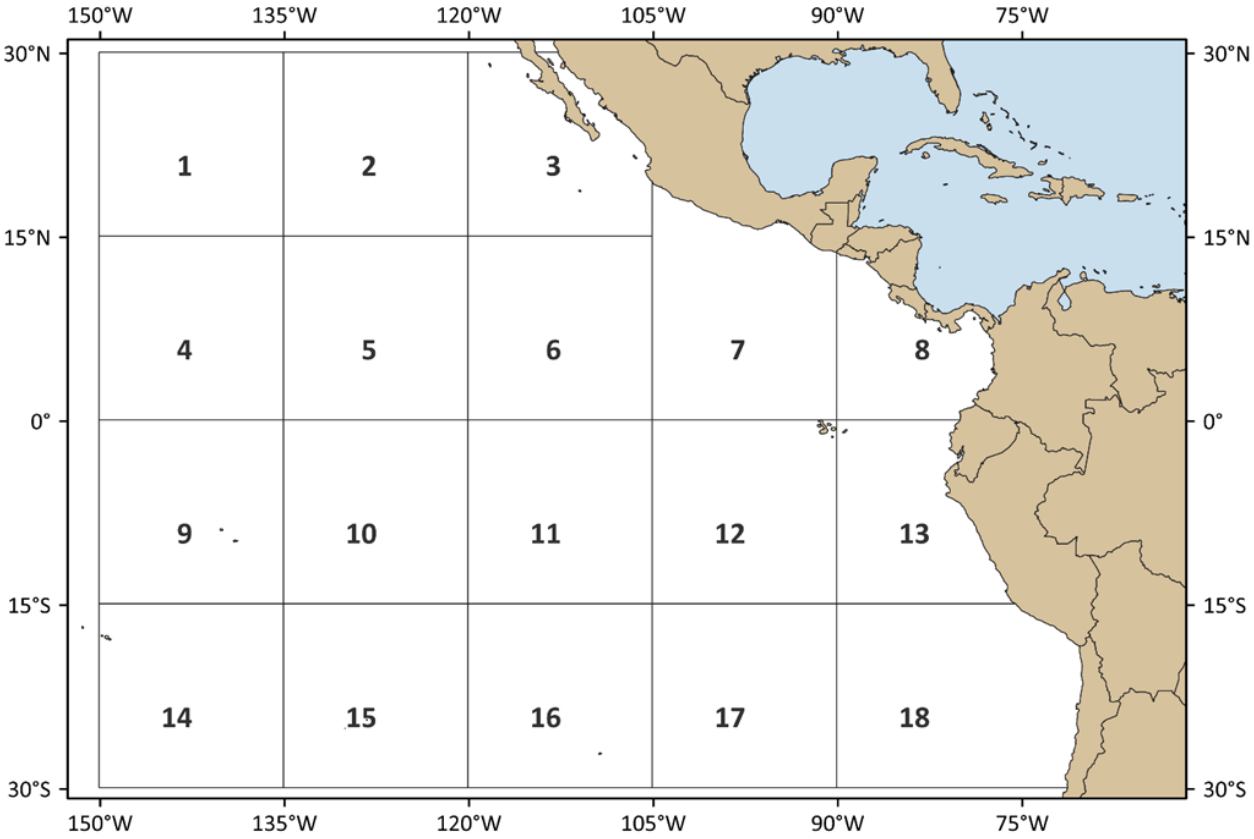

FIGURE 9. Areas where morphometric sampling will be attempted during the project duration. Each area is approximately 15° x 15° and was established to guide the prioritization of sampling efforts.
FIGURA 9. Áreas en las que se intentará realizar muestreos morfométricos durante la duración del proyecto. Cada área es de aproximadamente 15° x 15° y se estableció para orientar la priorización de los esfuerzos de muestreo.

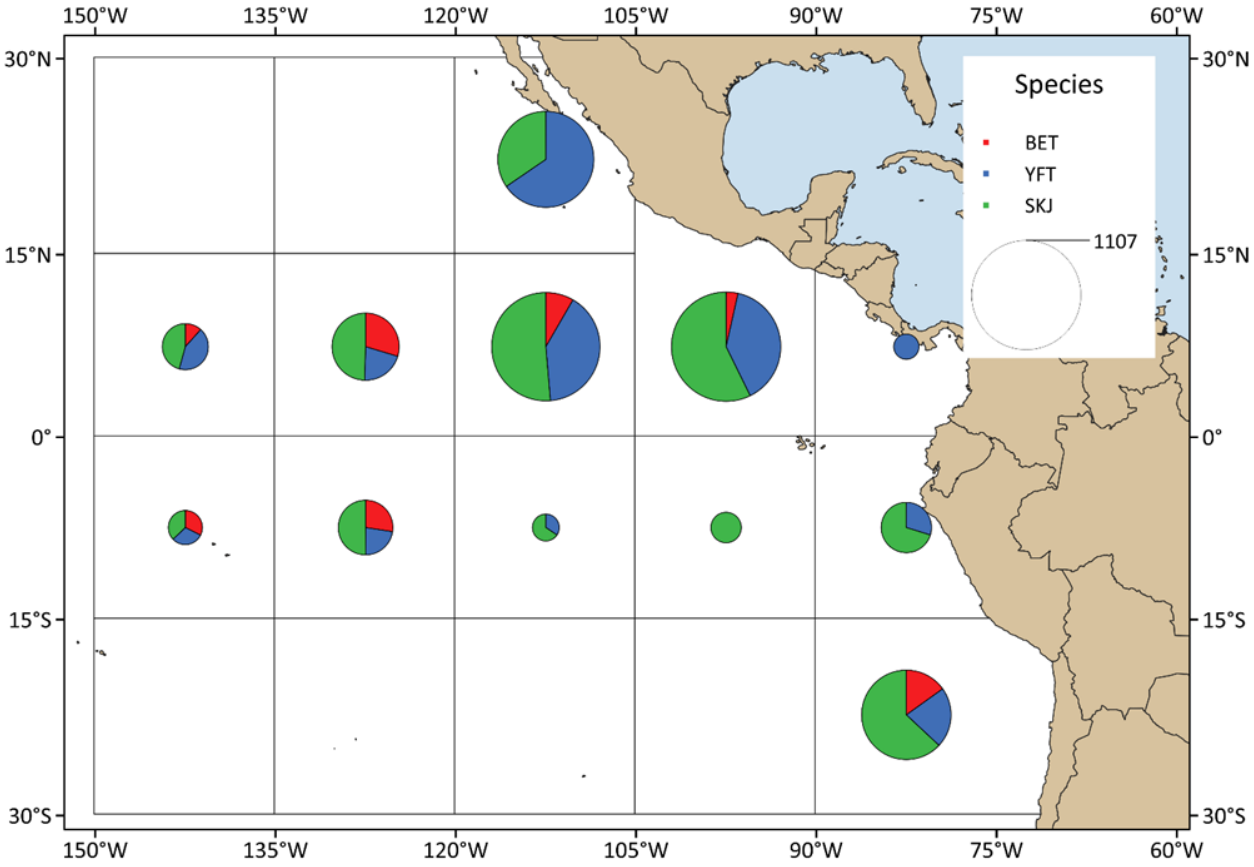

FIGURE 10. Distribution of morphometric measurements collected from bigeye (BET), yellowfin (YFT), and skipjack (SKJ) tunas, aggregated across all set types, between January 9 and March 15, 2025.

FIGURA 10. Distribución de las medidas morfométricas recolectadas de atunes patudo (BET), aleta amarilla (YFT) y barrilete (SJK), agrupadas en todos los tipos de lance, entre el 9 de enero y el 15 de marzo de 2025.

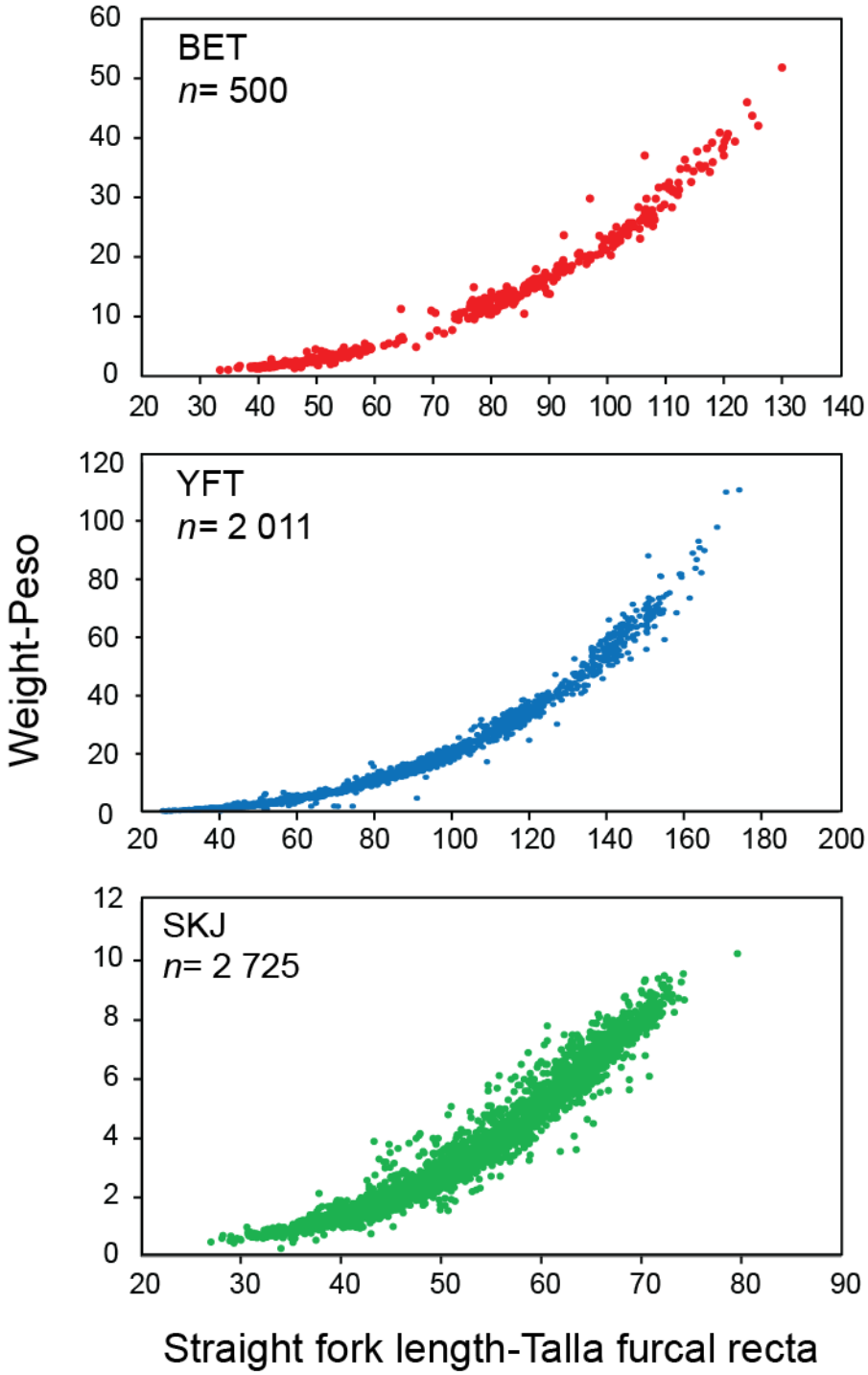

FIGURE 11. Relationship between length and weight for: bigeye (BET), yellowfin (YFT), and skipjack tunas (SKJ) collected by morphometric sampling teams in Manta, Ecuador, and Mazatlan, Mexico, between January 9 and March 15, 2025.

FIGURA 11. Relación entre talla y peso para: atunes patudo (BET), aleta amarilla (YFT) y barrilete (SJK) recolectados por equipos de muestreo morfométrico en Manta, Ecuador, y Mazatlán, México, entre el 9 de enero y el 15 de marzo de 2025.

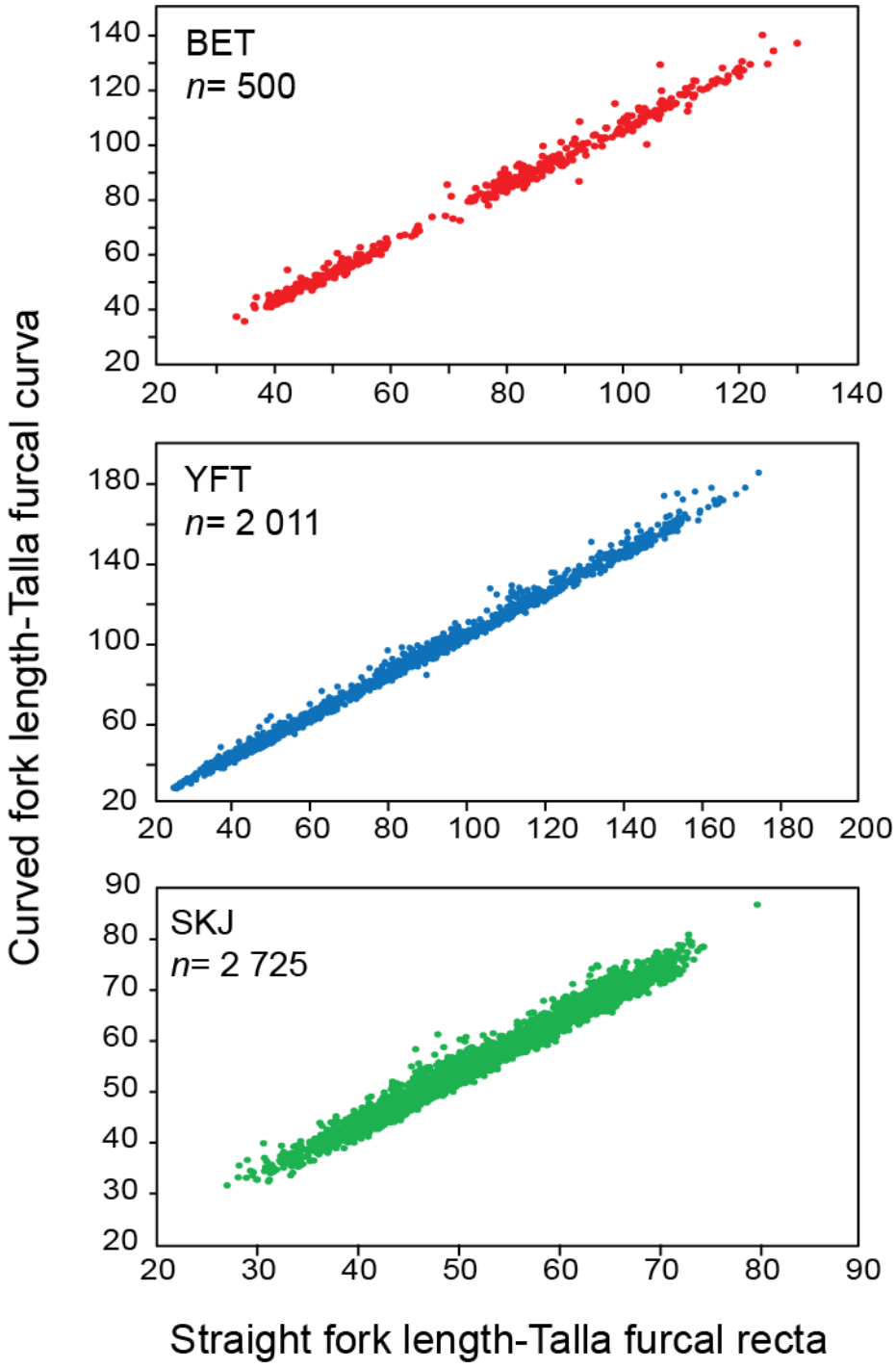

FIGURE 12. Relationship between straight fork length and curved fork length for bigeye (BET), yellowfin (YFT), and skipjack tunas (SKJ) collected by morphometric sampling teams in Manta, Ecuador, and Mazatlan, Mexico, between January 9 and March 15, 2025.

FIGURA 12. Relación entre la talla furcal recta y la talla furcal curva de los atunes patudo (BET), aleta amarilla (YFT) y barrilete (SJK) recolectados por equipos de muestreo morfométrico en Manta, Ecuador, y Mazatlán, México, entre el 9 de enero y el 15 de marzo de 2025.