INTER-AMERICAN TROPICAL TUNA COMMISSION

SCIENTIFIC ADVISORY COMMITTEE

15TH MEETING

La Jolla, California (USA)
10-14 June 2024

DOCUMENT SAC-15-13 REV

STAFF RECOMMENDATIONS (NON-TARGET SPECIES)

Section 1 on the tuna species will be available soon

2. NON-TARGET SPECIES

2.1. Silky sharks

The indices for large silky sharks, based on data from the purse-seine fishery on floating objects, have been updated through 2023 for the north and south EPO (**Figure 5**). Previous analyses (SAC-08-08a(i), Lennert-Cody et al., 2019) identified a correlation between north EPO indices, particularly those for small and medium silky sharks, and interannual variability in oceanographic conditions, and thus the indices for those size categories, and for all silky sharks, were not updated because of concerns about bias. Because of recent increases in the live release of silky sharks, two sets of indices for large silky sharks were computed, one including live release data and the other not. Taken together, the two sets of indices likely bracket the trend that would have resulted in both the north and south EPO if "finning"[1], shark handling, and data recording practices had continued unchanged since 1994. The real trend is considered to be closer to the index based on dead and live releases because sharks recorded as released alive in recent years would probably have been recorded as dead previously, and thus the dead and live release is likely a more consistent indicator. The terminal point of these indices suggests a relatively stable abundance level for over a decade, with the 2023 values slightly lower in both the south and north relative to the 2022 value, and thus no changes to management measures are recommended (**Figure 5**). However, the stock status is uncertain, and an assessment has not been possible due to the paucity of data, especially for the longline fleets of the EPO coastal nations, which are believed to have the greatest impact on the stock (SAC-05 INF-F, SAC-14 INF-L). Insufficient data for stock assessment is also a common problem for almost all shark species with which EPO fisheries interact. Therefore, in 2022 the staff used the ecological risk assessment method EASI-Fish to conduct the first comprehensive quantitative vulnerability assessment for 32 shark species caught in industrial and artisanal fisheries in the EPO (SAC-13-11). The assessment showed silky shark to be classified as "most vulnerable", having the second highest vulnerable rank among the 32 shark species assessed. In 2023, a focused EASI-Fish assessment was undertaken on silky shark and three hammerhead shark species to explore the potential efficacy of hypothetical conservation and management measures (CMM) (SAC-14-12), such as EPO-wide closures, and prohibition of the use of wire leaders. The assessment showed that the majority of measures reduced the vulnerability of silky sharks but no single CMM, or combined use of up to four CMMs in concert, resulted in silky shark being classified as "least vulnerable". As a result of handicapped stock assessment attempts and EASI-Fish outcomes, the staff has made recommendations for data collection as part of its work plan for addressing the stock assessments of sharks (see Section 6.1).

[1] Cutting the fins off sharks and discarding the carcass.

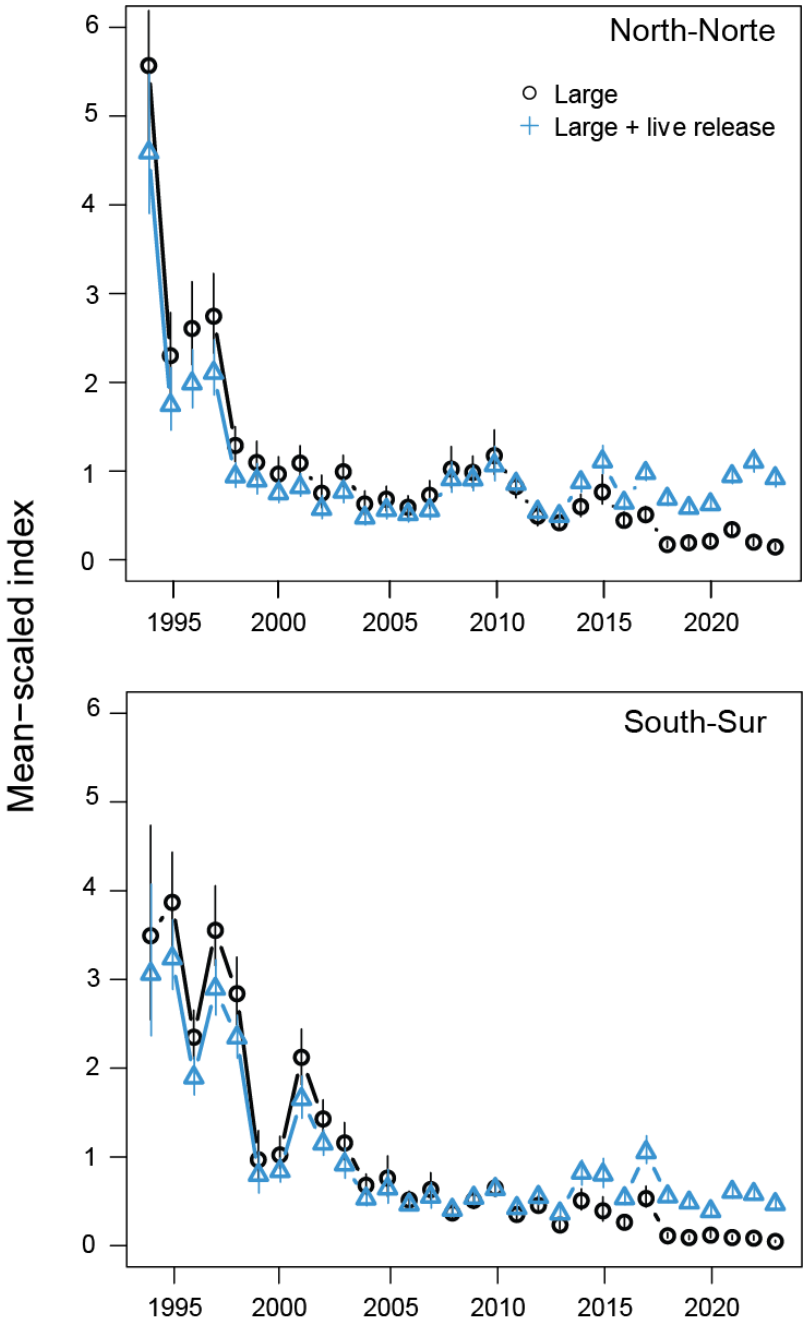

FIGURE 5. Mean-scaled standardized bycatch-per-set (BPS; in numbers of sharks per set) of large silky sharks in sets on floating objects, with and without live release, in the north (top) and south (bottom) EPO.

Paragraph 7 of Resolution C-23-08 , which extends Resolution C-19-05 for another biennial period (2024-2025), requires CPCs to implement a three-month prohibition on the use of steel leaders in certain longline fisheries, and paragraph 8 requires the IATTC staff to present, at the SAC meeting in 2025, an analysis of the available data, including the shark fishery sampling program in Central America, with recommendations for improvement of the resolution, including adjustment of the prohibition period in paragraph 7. Resolution C-23-08 also directs the staff to consider the efficacy of the limits established by the resolution and if necessary, recommend revisions. However, the improved species-level catch and composition data required for this analysis are not yet available, so it remains a challenge for the staff to

evaluate the efficacy of the limits.

Such persisting data limitations, among others, which apply to both target and non-target species, motivated the staff to review current Resolutions pertaining to data provision that underpin all of its research, in particular, the Resolution on data provision, C-03-05. To this end, the staff prepared Document SAC-12-09 (see Section 3) with the overarching goal of creating a revised Resolution C-03-05 to broaden the scope and improve the quality of data provided for science, conservation and management, for both target and non-target species. An outcome from this work was a staff recommendation to the SAC to hold a series of workshops, by gear type, on data provision (SAC-12-16 see Section B.3. "General Data Provisions"). This recommendation was endorsed by the SAC and the first data improvement workshop was organized in January 2023, addressing the industrial longline fishery. A background document (WSDAT-01-01) and workshop report (WSDAT-01-RPT) were produced. Recommendations from this workshop are included in Section 3 of this document.

As part of additional steps taken by the staff to address data limitations, significant progress has been made in recent years in developing the foundations for a sampling program for shark fisheries in Central America (see Section B.4.1, SAC-11-13, SAC-14 INF-L). Made possible through funds provided by the FAO-GEF ABNJ ("Tuna 1) project, the European Union and theIATTC's capacity building, the sampling program in Central America has reached its completion in December 2021. The results supported a proposal that was presented at the 2021 98th Meeting (resumed) meeting of the Commission to establish a long term sampling program in Central America (IATTC-98-02c). Unfortunately, the necessary funds to implement the program are not available yet. If the sampling design of the current sampling program is expanded to other regions in the EPO (*e.g.,* South America, Mexico), both data collection and stock assessments for sharks in the EPO should improve. Very recently, resources to expand the Central American shark data collection improvements into other EPO coastal nations have been made available under a second part of the ABNJ project, the "Tuna 2" project (SAC-14 INF-M). Based on past and current experiences, and as a follow-up to a request made on paragraph 14 under Resolution C-23-07, the staff has prepared SAC-15-10 to provide CPCs with the necessary background on developing a sound shark sampling program in the region.

The management of silky sharks is hindered by the lack of a reliable stock assessment due to the absence of reliable time series of data typically used in stock assessment (catch, CPUE, and sex/size composition). Management of silky sharks could therefore, be greatly improved by implementing a close-kin mark-recapture study (CKMR) that would provide estimates of absolute adult abundance and adult natural mortality (SAC-12-14, SAC-14 INF-M). With funds provided by the ABNJ "Tuna 2" project and the European Union, the staff recently began exploring the feasibility of CKMR approaches for sharks in the region, including a simulation study and a conceptual model for silky sharks (Talwar et al. 2024; presentation EB-02 5.c.2). These efforts will continue in the coming years (SAC-14 INF-M). Until a reliable stock assessment can be undertaken, the staff plans to continue its use of data-limited assessment methods, such as EASI-Fish, to explore the potential efficacy of CMMs to guide managers in the intervening period (*e.g.,* CMMs specified under Resolution C-23-08) (SAC-14-12).

RECOMMENDATIONS:

Considering the recent improvements in shark fishery data collection in Central America (SAC-14 INF-L, SAC-15-10), as well as the upcoming opportunity to expand these data collection improvement efforts into other coastal states (SAC-14 INF-M, SAC-15-10):

CPCs should enhance reporting regarding their implementation of the following provisions of Resolution C-23-08:

1. Paragraph 7, prohibiting the use of steel leaders during a period of three consecutive months of each year for the relevant portions of their national fleets.
2. Paragraphs 11 and 12, which require notifying the Commission of the period of the prohibition, the number of vessels subject to the prohibition, and how compliance with the prohibition will be monitored.

Considering the potential benefits of Close-Kin Mark-Recapture:

3. Fund the development a conceptual model for hammerhead sharks, similar to the one described in Talwar et al. (2024; presentation EB-02 5.c.2) for silky shark.

2.2. List of shark species under the IATTC purview

There has been discussion among CPCs as to what shark species are under the purview of the IATTC. At its 101st meeting, the IATTC adopted Resolution C-23-07 "Conservation measures for the protection and sustainable management of sharks" which, among other things, requires *"…the IATTC scientific staff, in consultation with the SAC and EBWG, shall develop a draft list of shark species under the purview of the Commission in the Convention Area for its consideration"*. The IATTC staff prepared document SAC-15-09, which drew upon the results from IATTC's 2022 shark vulnerability assessment (SAC-13-11) and incorporated ancillary ecological and conservation information to present a range of options for the SAC and the EBWG to consider in developing a proposed interim list of species for potential adoption by the IATTC in 2024. The IATTC scientific staff present for consideration for adoption by the IATTC, at a minimum, a list of 19 oceanodromous and epipelagic species caught in the major industrial and artisanal pelagic fisheries in the EPO (list C of SAC-15-09).

RECOMMENDATIONS:

1. Adopt as an interim list of shark species under purview of IATTC, the list that includes the 19 oceanodromous and epipelagic species caught in the major industrial and artisanal pelagic fisheries in the EPO (list C of SAC-15-09).

2. Given no single organization is currently responsible for sharks in the EPO, the staff notes that additional species could warrant special attention due to their ecological importance, and suggest to cooperate in relevant research and data collection efforts, to the furthest extent possible.

2.3. Seabirds

Resolution C-11-02 should be revised to be consistent with the current state of knowledge regarding seabird mitigation techniques, as described in document SAC-08 INF-D. In addition, the two-column menu approach in C-11-02 should be replaced by a requirement to use at least two of three mitigation methods (line weighting, night setting, and bird-scaring lines) in combination, in a way that will meet the minimum standards recommended by the Agreement on the Conservation of Albatrosses and Petrels (ACAP) and BirdLife International. Other mitigation methods should not be approved until their effectiveness is proven.

BHRP guidelines for seabirds captured in IATTC longline and other hook and line fisheries have been developed (EB-01-01 Annex 1; also available in Annex 1 of document EB-02-03). These BHRP guidelines, recommended by the staff to be used to revise Resolution C-11-02 in 2023, were based on adopted

guidance from the ACAP, NOAA Fisheries, and New Zealand Fisheries and have been reviewed by ACAP staff. In the absence of BHRP guidelines for seabirds in the IATTC convention area, the approval of these interim BHRP guidelines is warranted and timely.

RECOMMENDATIONS:

1. Revise Resolution C-11-02 to be consistent with the current state of knowledge regarding seabird interactions and mitigation techniques as described in SAC-08-INF-D and Gianuca et al. (2023)).

2. Adopt interim best handling and release practice guidelines available in Annex 1 EB-02-03.

2.4. Sea turtles

A revised resolution on sea turtles (C-19-04) entered into force on 1 January 2021 requiring EPO tuna fisheries to implement various measures designed to reduce the bycatch of sea turtles, in particular the use of circle hooks and finfish baits in shallow longline sets. The low encounter rates of sea turtles by fishing vessels make these 'rare event' data difficult to analyze using conventional approaches for assessing the status of sea turtle populations. Therefore, a collaborative research project (BYC-11-01) between the IATTC, the Inter-American Convention on the Protection and Conservation of Sea Turtles (IAC), and international sea turtle experts employed the EASI-Fish approach as an alternative means to assess vulnerability status and to simulate conservation and management measures (CMMs) that may mitigate fishery-imposed risks to the critically endangered East Pacific population of leatherback sea turtle. This project was extended in 2021-2022 with several model improvements (*e.g.,* a new species distribution model and updated fishing effort data for artisanal fisheries) (BYC-11-02). Proxies for fishing mortality ($\tilde{F}_{2019}$) and the breeding stock biomass per recruit (BSR_{2019}) exceeded precautionary biological reference points ($F_{80\%}$ and $BSR_{80\%}$), classifying the EP leatherback turtle stock as "most vulnerable" in the reference year (2019). Of the 70 CMM scenarios, use of circle hooks, finfish bait, and to a lesser extent best handling and release practices were each predicted to decrease vulnerability when examined individually, by far the most effective scenarios involved using these three measures in concert, followed by using circle hooks with either finfish bait or best practices.

Following Resolution C-19-04, the IATTC organized a workshop to discuss the minimum hook size that would reduce sea turtle mortality. The workshop also addressed the ecosystem-level concerns and potential trade-offs regarding the expanded use of circle hooks in longline fisheries and discussed the potential impacts of gear types on various taxa, including sea turtles. However, a final agreement was not reached on a recommendation to the Commission for a minimum hook size as well as a schedule for implementing this recommended minimum hook size through a revision to the Resolution C-19-04 (WSHKS-01). As such, the EBWG recommended that the IATTC staff co-host a follow-up workshop with the goal of exploring/expanding on topics of interest/data-knowledge gaps identified by the Working Group to mitigate bycatch of sea turtles and to complete the outstanding requirements of Resolution C-19-04.

RECOMMENDATIONS:

1. Revise Resolution C-19-04 consistent with the simulated efficacy of CMMs assessed in BYC-11-02.

2. Conduct a follow-up workshop to reevaluate available data on circle hooks and reach an agreement on a recommendation for the adoption of a specific shape or minimum size of circle hook.

2.5. Best handling and release practices (BHRP) of vulnerable[2] species

Concerns about the incidental capture (*i.e*., bycatch) of vulnerable marine species, including marine mammals, seabirds, sea turtles, and elasmobranchs, have resulted in increased efforts to develop conservation and management measures. These measures often require that no retention takes place and that the best handling and release practices (BHRP) are employed to reduce the impacts of fishing on these populations. However, developing safe and effective BHRP guidelines is often a complex and iterative process that involves understanding fishery characteristics, handling and discard methods, and post-release survival rates. The IATTC staff are working towards creating BHRP guidelines that are safe, effective and practical for vulnerable species captured by the various fishing gears across the convention area. A workplan with phases, components, and activities (including a list of research priorities), as well as a framework, and a timeline towards BHRP adoption have been developed by the staff (EB-02-03).

At its 101st meeting, the IATTC adopted Resolution C-23-07 "Conservation measures for the protection and sustainable management of sharks" which, among other things, requires, "….*The IATTC scientific staff, in collaboration with the IATTC SAC and EBWG, shall develop and recommend to the Commission a set of best handling guidelines for the safe release of sharks for inclusion in this measure in 2024*". The IATTC staff, in collaboration with subject matter experts, developed BHRP for sharks in document SAC-15-11. The document compiles all scientific evidence in support of the recommended BHRPs for sharks.

The following are the IATTC staff recommendations reagarding the development of BHRPs for vulnerable species:

RECOMMENDATIONS:

Specifically on sharks:

1. Adopt the shark BHRP guidelines described in SAC-15-11.

Regarding the nature of BHRP guidelines for vulnerable species:

2. The Commission, in addition to endorsing the development of the guidelines and adopting them, should consider making their content legally binding, in part or in whole, through their incorporation in appropriate instruments, such as, among others, a general resolution with annexes covering all BHRPs, or individual resolutions on specific BHRPs.

Regarding the collection of data to support devolpment of BHRP guidelines for vulnerable species:

3. CPCs suport the staff in the collection of all relevant information on, among others, vessel and gear configuration details by target species and fishing gear, ongoing PRS studies, stranding networks, or other relevant activity.

A. DATA COLLECTION

3. TUNA TAGGING

Conventional tagging experiments (capture-mark-release) are a useful tool in fisheries science for obtaining important biological information on exploited fish populations. This can range from routine data, such as movements, stock structure, and growth, to more complex information, such as exploitation rates, natural mortality, and, in some cases, abundance estimates. By including electronic archival tags

[2] Unless specified otherwise, including but not limited to citations to vulnerability assessments and any qualitative/quantitative scores (e.g. BYC-10 INF-B; SAC-13-11), the staff's definition of "vulnerable species" refers to the species that, in the *sensu latu*, and due to their low-productive life-history traits (i.e. K species in r/K selection theory), are more vulnerable to the impacts of fisheries and other anthropogenic activities on these species or their habitat and ecosystem. This includes the marine mammals, seabirds, sea turtles and the elasmobranchs.

(ATs) in these experiments, researchers can gain insights into daily movements (horizontal and vertical), behavior, and habitat preferences. Combining information from both conventional and electronic tagging in stock assessments can reduce uncertainty, thus providing policymakers with more robust data for making management decisions.

Through financial support provided by the European Union and the IATTC, the multi-year Regional Tuna Tagging Project in the EPO was conducted by the IATTC during 2019-2023 (RTTP-EPO 2019-2020, Project E.4.a, SAC-14-07). The program consisted of a series of three tuna tagging cruises and aimed at advancing the biological information currently used in stock assessments and to help inform management decisions for the tropical tuna fishery in the EPO. The tagging data collected under the RTTP-EPO allowed for the development of a novel spatiotemporal Petersen-type model for skipjack tuna in the EPO. The model provides estimated absolute biomass utilising available tag recapture and catch data as well as movement patterns estimated by a tagging movement model (SAC-13-08, SAC-14 INF-E, SAC-15 INF-G). These estimates have been incorporated into the 2024 skipjack benchmark assessment (SAC-15-04).

Although the spatiotemporal tagging model is currently only available for skipjack (SAC-15 INF-G), the staff is planning to apply the approach to the other tropical tuna. This is particularly important at a time when the bigeye and yellowfin tuna assessments are facing serious challenges. In the bigeye tuna assessment, due to the pronounced decrease in the spatial coverage of the Japanese longline fleet in the EPO, the precision of the Japanese longline index of abundance has rapidly deteriorated since 2020 (SAC-15-02). Consequently, the longline index of abundance does not provide precise information on the temporal change of population abundance over the recent period. If this trend persists, the reliability of the bigeye stock assessment may become compromised in the near future considering that the Japanese index is the primary index informing the abundance trend of large bigeye. Although the staff intends to continue its collaboration with Asian CPCs to improve the longline index of abundance for bigeye tuna, there are other challenges with the data available. With respect to yellowfin tuna, there is evidence of strong spatial structure of yellowfin in the EPO and some form of a spatially structured assessment or separate assessments for different sub-stocks may be needed. Although there is a reliable dolphin-associated index of abundance for yellowfin in the northern EPO (the "core" region; SAC-15-03), the indices available for the southern region of the EPO are not reliable. Estimates of absolute abundance, such as those just developed from the spatiotemporal model for skipjack, will help overcome the challenges with the bigeye and yellowfin assessments.

RECOMMENDATIONS:

1. Conduct at least one tagging cruise every three years to coincide with the tuna assessment and management cycle.

2. Support the development of a framework to strengthen collaboration and participation of CPCs and the tuna fishing industry in the implementation of the tagging project:

    a. Facilitate the negotiation of dFAD sharing agreements with vessels and companies;

    b. Conduct tagging in partnership with CPCs using pole-and-line vessels fishing from coastal states;

    c. To address deficiencies in key biological parameters, conduct opportunistic tagging in collaboration with the recreational sector.

3. Investigate the feasibility of using sea cages for holding purse-seine captured tunas as a tagging method.

4. DATA FOR LARGE LONGLINERS

Recent challenges with the assessments of the target tuna fisheries demanded the use of sophisticated analyses that required fine-scale spatial and temporal resolution catch, effort and size data (SAC-11-06; SAC-11-07; IATTC-95-05) from the longline fleets operating far from the coasts and particularly in the high-

seas, which in some cases, are not routinely available to the staff. Challenges are also encountered by the staff when producing assessments for tuna-like species, such as swordfish (SWO-01), due to a lack of data. CPUE data from Japan forms the basis for the index of abundance used in the current assessments of bigeye, yellowfin, and for the first time, skipjack (SAC-13-07), and it is key to address hypotheses of spatial structure for yellowfin tuna in the EPO. However, the magnitude and spatial extent of effort by the Japanese fleet has decreased markedly in the EPO (SAC-15-02), thereby deteriorating the quality of the indices of abundance. Recent collaborative work with Japan, Korea, Chinese Taipei and China has improved the understanding of their logbook data for developing new indices of abundance. Data for this work were only made available to the staff via multiple MoUs between the IATTC and each CPC, which are renewed annually. The data regularly submitted by the CPCs related to the Resolution C-03-05 on data provision are aggregated spatially (1° x 1° or 5° x 5°) and contain little or no gear configuration information, and no vessel identifiers, which are important factors for better understanding changes in catchability and species targeting (OTM-30), both of which influence abundance indices. Operational-level data (high resolution 'level 1' catch and effort data as defined in C-03-05) with corresponding size information are necessary to improve the indices of abundance routinely used in the stock assessments for bigeye and yellowfin tuna, and will become increasingly important for other commercially important species such as swordfish, other billfish and sharks. These data already exist for most, if not all, large longline fleets (and for some coastal longline fleets), and are currently submitted to other t-RFMOs by IATTC CPCs (WCPFC13), and are similar to the data available to the staff for the purse-seine fishery. Therefore, these equivalent longline data should be expected to be made available to staff on an annual basis for the purposes of improving the quality of data reporting and research to facilitate fulfillment of mandates by the Antigua Convention.

The staff has prepared an extensive workplan to address several uncertainties in the stock assessment of yellowfin, bigeye tuna and other species that will require high-resolution CPUE data with corresponding size information. The staff has routine access to high-resolution data for most of the purse-seine fleet, but not for the longline fleet from which indices of abundance are mostly derived. The quality of stock assessments of tuna and tuna-like species undertaken by the staff will therefore continue to be severely compromised without access to these high-quality existing data.

Additionally, the Antigua Convention entered into force over a decade ago and expanded the mandate of the Commission to include non-target, dependent and associated species, and the effects of the fishery on the ecosystem. The data provision has lagged both in pace and types of data reported to the IATTC. This in turn has affected the staff's ability to adequately fulfill its obligations under the Convention and objectives under IATTC's Strategic Science Plan (2019–2023, IATTC-93-06a). Therefore, the staff—under the direction of a SAC- and Commission-endorsed staff recommendation (see SAC-12-16, General Data Provisions)—planned and facilitated the 1st workshop on improvements in data collection and provision with a focus on the industrial longline fishery (WSDAT-01) taking into consideration elements from SAC-12-09 on data gaps pertaining to all gear types. Preliminary staff recommendations to improve data collection and provision for the industrial longline fishery were presented at the workshop (WSDAT-01-01) to stimulate discussions on recommendations to revise resolution C-03-05. Input from workshop participants (WSDAT-01-RPT) was used to revise the staff's recommendations provided in SAC-14 INF-Q.

The SAC, in general terms, endorsed the recommendations on tunas presented by the staff in SAC-14-14 (SAC-14-16, paragraph 1d) as well as a recommendation that the Commission review and update Resolution C-03-05 on "Data Provision", taking into consideration document SAC-14 INF-Q (SAC-14-16, paragraph 7.1). Therefore, the importance of updating this resolution is reiterated by the IATTC staff.

RECOMMENDATIONS:
Following the SAC endorsed staff recommendation to review and updated Resolution C-03-05:

Encourage CPCs to update the data provision resolution (C-03-05) to better align data provision and submission requirements with the Antigua Convention's mandate to include non-target, dependent and associated species, and the effects of the fishery on the ecosystem. Consider the following recommendations summarized from SAC-14 INF-Q – see document for detailed recommendations:

Establish a resolution to report operational-level data (vessel-specific, set-by-set) longline data and include:

a. TASK I (Annual data): Compulsory reporting of effort, catch and disposition (retained and discarded) for tunas, billfishes and sharks.

b. TASK II (Operational-level data): Compulsory reporting of level 1, operational-level logbook data. c. TASK II (Aggregated data): Until establishment of the resolution, CPCs report TASK II catch and effort data at the finest spatial and temporal resolution possible, as a minimum by month and 5°x5°, raised to represent the total catch and effort, and indicating the statistical methods used to estimate total catches. For data previously submitted, indicate whether it was raised to fleet totals and describe the methodology. Such aggregated data shall also include the number of vessels in each grid cell.

d. Size composition data: Compulsory reporting of size composition data that are representative of the catches by the fisheries at the finest possible spatial and temporal resolution in the originally measured type and unit for tunas, billfishes and sharks brought onboard vessels indicating the time, location and number of set, trips and vessels sampled by time and location.

5. SHARKS AND RAYS

5.1. Improving data collection and stock assessments for sharks

Paragraph 1 of Resolution C-16-05 requires the IATTC staff to develop a workplan for completing full stock assessments for silky and hammerhead sharks. As noted in SAC-05 INF-F, SAC-05-11a, and SAC-07-06b(iii), improving shark fishery data collection in the EPO is an essential prerequisite.

The first comprehensive quantitative ecological risk assessment for sharks in the EPO was completed in 2022 (SAC-13-11) using the EASI-Fish approach, which identified 20 of the 32 species assessed exceeding biological reference points, thus rendering these species "most vulnerable". Of the 20 most vulnerable species, silky shark and three species of hammerheads were ranked highest. In 2023, an EASI-Fish assessment was undertaken on four of the most vulnerable shark species, silky shark and three hammerhead shark species, to explore the potential efficacy of hypothetical conservation and management measures (SAC-14-12), among others, EPO-wide closures, and prohibition of the use of wire leaders. The assessment showed that the majority of measures reduced the vulnerability of silky sharks but no single CMM, or combined use of up to four CMMs in concert, resulted in the species being classified as "least vulnerable". The EASI-Fish assessment and previous shark research undertaken by the staff have identified significant data deficiencies for vulnerable shark species, including silky and/or hammerhead sharks, in the EPO: 1) reliable catch and size composition data for coastal (*i.e.* 'artisanal') longline and gillnet fisheries (SAC-08-07b; SAC-08-07e), high-seas longline fisheries (SAC-08-07b; SAC-08-07e) and small[3] purse-seine vessels (SAC-08-06a), 2) basic biological information to parameterize EASI-Fish and stock assessments, such as length-weight and length-length relationships, maturity ogives and growth curves, and 3) species-specific and fishery-specific estimates of post-release survival. In particular, without data from a properly designed long-term sampling program for artisanal fisheries across EPO coastal

States (a significant part of component (1)), the IATTC staff will not be able to meet this requirement of Resolution C-16-05.

As a first step toward developing sampling designs for catch and size composition in artisanal fisheries, and for size composition in industrial longline fisheries, a wealth of information has been collected in five Central American countries under Project C.4.a, funded by FAO-GEF through March 2019, and through March 2020 by the IATTC capacity-building fund (SAC-11-13). Made possible through recent funds provided by the European Union, the sampling program in Central America has reached its completion in December 2021. The results supported a proposal that was presented at the 2021 98th Meeting (resumed) meeting of the Commission to establish a long term sampling program in Central America (IATTC-98-02c). Unfortunately, the necessary funds to implement such long-term program are not available to date. If these funds to initiate the long-term sampling program in Central America are secured and these efforts are expanded to other regions in the EPO (*e.g.,* South America, Mexico), both data collection and stock assessments for sharks in the EPO could improve. Resources to expand the Central American shark data collection improvements into other EPO coastal nations have recently made available under part 2 of the ABNJ project (SAC-13-12, SAC-14 INF-M, SAC-15-10).

RECOMMENDATIONS:

1. Establish, or strengthen, data collection programs for artisanal fisheries in EPO coastal States to obtain reliable catch and size composition data and biological information for assessments of vulnerability and stock status.

2. Resume the IATTC Technical Meetings on Sharks to gather existing data and expert knowledge on data-poor sharks and fisheries, with the goal of improving population and ecological risk assessments (e.g., EASI-Fish) that can inform management decisions.

Given the scale and importance of the shark fisheries in Central America (SAC-14 INF-L, SAC-15-10) and the lack of fishery/biological sampling data from shark landings in that region (SAC-07-06b(iii)), the staff reiterates the following recommendation:

RECOMMENDATION:

Establish an IATTC field office in Central America near the port or ports where most shark landings occur.

Previous recommendations by the staff on data collection by observers on longline vessels and Class 1-5 purse-seine vessels are reiterated in Section 9.

5.2. Improving data collection and stock assessments for Mobulid rays

Resolution C-15-04 paragraph 6 requires the Commission, no later than in 2017, to establish a species-specific Mobulid ray data-collection program for all fisheries. With the development of a new field guide by the IATTC staff and partners for the identification of mobulid rays to species for Pacific Ocean fisheries now freely available to all CPCs, observer programs and fishing agencies, on the IATTC website, the ability to identify bycaught mobulid rays to species level has been greatly improved.

RECOMMENDATION:

CPCs should ensure that the new species identification field guide for manta and devil rays in Pacific Ocean fisheries, posted on the IATTC website, is used.

6. ECOSYSTEM CONSIDERATIONS

6.1. Feasibility study to develop a sampling program for updating morphometric relationships and collecting biological samples for priority species in EPO tuna fisheries

Length-weight (L-W) relationships are the foundation to a variety of research projects including stock assessments, ecological risk assessments (*e.g.,* EASI-Fish) and for converting catch reported in numbers to weights, and vice versa. These relationships can vary markedly in space and time and can greatly influence stock and risk assessment model outcomes. Despite this, L-W relationships for tunas are outdated (*e.g.,* yellowfin: 1986, bigeye: 1966 and skipjack: 1959) or inadequate for many priority species (see SAC-13-11, SAC-09-12, IATTC Special Report 25). Catch estimations are also affected by imprecise and/or outdated L-W relationships. Furthermore, species and size composition of the catch and fishing strategies differ significantly between longline (LL) and purse-seine (PS) fisheries (*e.g.,* see IATTC-98-01). Additionally, basic life history data for assessment models are absent or inadequate for most bycatch species. A proposed feasibility study (Project F.3.a) addresses these issues and a background paper (SAC-14 INF-J) summarizes the staff's internal discussions, provides background information, describes data deficiencies in morphometric relationships and biological sampling, and identifies potential sampling opportunities in 3 gradual phases. In SAC-14 INF-J, the staff built upon Project F.3.a and developed a hierarchical phased-based approach to update morphometric relationships and biological sampling for tunas, billfishes, and prioritized bycatch species, through the collaboration of staff, CPCs, industry and other relevant stakeholders. This project is complementary to other data improvement projects (SAC-12-09, WSDAT-01-01, WSDAT-01 Report) and also aims to align with work conducted in the Western and Central Pacific Ocean through SPC's Oceanic Fisheries Programme on the collection of morphometric data to build a comprehensive database on various length and weight types and to establish collection of biological samples. Concerns over the outdated morphometric relationships for tunas were discussed at the 1st external review of data used in stock assessments of tropical tunas in the eastern Pacific Ocean (RVDTT-01), and this inadequacy contributes to considerable uncertainty in catch estimates and the tuna stock assessments. Accordingly, the external review panel recommended the implementation of Project F.3.a (RVDTT-01).

RECOMMENDATION:

1. In collaboration with CPCs and relevant stakeholders, develop a feasibility study (Project F.3.a)—which may be upscaled using a hierarchical phase-based approach (see SAC-14 INF-J)—for a fishery-dependent sampling program to collect morphometric measurements and biological samples from tunas and other prioritized species.

7. FISH-AGGREGATING DEVICES (FADs)

The recommendations in this section are based on documents FAD-08-01, FAD-08-02 and FAD-08-03; some of them were endorsed by the *ad-hoc* Working Group on FADs, SAC-09, SAC-10, SAC-14 and IATTC-97-01, among others.

7.1. Provision of detailed historic buoy data

Under Resolution C-17-02 and C-20-06, CPCs were required to provide "daily information" on their active FADs, which was interpreted to mean a single data point per FAD per day, the selection criteria for which are unclear (*e.g.* no acoustic biomass information is required by the Resolution). This combination of low resolution and uncertain selection criteria meant that these data were of limited scientific utility. Also, CPCs were allowed to report data in different formats, sometimes highly summarized (without any information on FAD identification or trajectory), which again were of little use for science. Moreover, Resolution C-19-01 allows CPCs to use different methods for marking and identifying FADs. As a result, the data provided under C-17-02 and C-20-06 were inadequate even to allow connection of the various FAD-related IATTC. In recent years, the IATTC staff, the FAD-WG and even the SAC itself recommended the provision of raw buoy data as received by

original users (*i.e.*, vessels, fishing companies), including both trajectories and acoustic biomass information. Therefore, starting in 2022, under Resolution C-21-04, CPCs began to report this data following the format specified in Annex IV of C-21-04.

Although Resolution C-21-04 reduces the active FAD limits in 2022 and 2023, compared to the 2018-2021 period, analysis of raw buoy data for 2022-2023 (FAD-07-01, FAD-08-01) has shown an increase in the number of active FADs used by the fleet. However, the data available to the staff before and after 2022 are inconsistent in reporting rate and quality, and thus, the exact reasons for this increase remain unclear, but may range from improved data to actual increases in FAD usage.

Moreover, as noted by voluntary pilot studies using raw buoy data, including both trajectories and acoustic biomass information, at regional (*e.g.*, FAD-05-INF-E, FAD-06-03, FAD-07-03, SAC-13-07, FAD-08-02) and global scale (*e.g.*, IOTC-2020-WPTT20-14, SCRS/2019/075, SCRS/2024/044), scientific studies, including improved stock assessments of tropical tuna, require high-resolution, standardized long-time series data. Therefore, the staff recommends that CPCs provide the historic raw buoy data in order to conduct the appropriate scientific analyses, and in particular, to continue improving staff's understanding of FAD fishery dynamics and the assessment of skipjack (SAC-15-04) and other tropical tuna species.

RECOMMENDATION:

CPCs should provide to the IATTC staff the historic raw buoy data received by original users (*i.e.,* vessels, fishing companies), including both trajectories and acoustic biomass information.

7.2. Remote identification of FADs

The quantification of FAD impacts requires efficient high-quality data collection methods, including accurate tracking and monitoring methods for individual FADs throughout their lifetime. Currently, FADs are identified using satellite-buoy identifiers (see Resolution C-19-01), and appropriately obtaining buoys' alphanumeric serial numbers has traditionally been difficult for observers, and not possible with current electronic monitoring (EM) capabilities (Legorburu et al. 2018). However, this information is key to merge and connect different IATTC databases and support scientific advance and the development of science-based management recommendations. The staff, the FAD Working Group and the SAC have reiterated the importance to access FAD/satellite buoy identifiers and repeatedly recommended to explore efficient ways to mark and track FADs (e.g., FAD-03-INF-A, SAC-11-INF-M). As such, the IATTC staff, in collaboration with industry partners, tested and evaluated the suitability of the LoRaWAN technology, with different configurations, to remotely and electronically identify FADs (i.e., satellite-linked echo-sounder buoys) in real conditions.

This technology, as described in document FAD-08-03, can reliably transmit information between a transmitter and a receiver at short-medium distances (i.e., 500 m) (e.g., satellite-buoy identification to vessels approaching the FAD), potentially addressing issues related to data collection of observers, both human and electronic, and satellite-buoy serial numbers. Moreover, this promising technology could be explored to be used in various fisheries data collection needs, such as using electronic scales to record tuna catches remotely and automatically in purse seiners, transshipments, or other systems, enhancing data accuracy and reliability.

With these elements into consideration, the IATTC staff makes the following recommendations:

RECOMMENDATION:

1. Consider the LoRaWAN technology for the development of sensors transmitting the FAD buoys' serial number to receivers located at distances no greater than 500 m.
2. Consider exploring the LoRaWAN technology for applications with other fishing activities that require remote and automatic data collection (e.g., electronic scales for weight estimates).

7.3. Regional data collection program on stranding FADs

At present, the characteristics and magnitude of the loss or abandonment of FADs in the EPO fisheries are not well known and neither its potential impacts on the environment and ecosystems, such as ghost fishing, impacts on sensitive habitats, and more generally marine pollution, although there is a generalized awareness and concern regarding the consequences of their stranding and the resulting damage to ecosystems.

In this context, the IATTC recognized the importance and urgency of the issue and adopted measures "*to prevent loss or drifting*" of FADs (Resolution C-23-03, paragraph 3) in addition to approving the recommendation that the *Ad Hoc* Working Group on FADs (FADWG) (FAD-07-05) had adopted and the SAC (IATTC-101-03) endorsed afterwards. This recommendation reads as follows:

> "3. *On stranding FADs*
>
> *3.1. Consider alternative mechanisms to continue monitoring buoys that are leaving the convention area or the fishing grounds and that are susceptible for deactivation, taking into account the implications with regard [to] the limits on active FADs per vessel.*
>
> *3.2. To the extent possible, provide data to the Secretariat on the entire trajectory of FADs, even when transiting outside the convention area or the fishing grounds, monitored through new FAD marking systems, the FAD's buoy or other systems.*
>
> *3.3. Consider putting in place a set of best practices for optimizing FAD retrieval.*
>
> *3.4. Promote FAD recovery programs, both from the land and from the sea, and establish standards to ensure the effectiveness of these programs.*
>
> *3.5. Create awareness of FAD strandings and encourage the expansion of the in-country data collection efforts on FAD strandings in the EPO to harmonize with SPC-WCPFC efforts in the WCPO.*
>
> *3.6. Develop solutions to process/recycle FAD materials in ports*."

To this end, CPCs were invited to participate in the development and implementation of an IATTC regional data collection program on FAD strandings (Memorandum Ref.: 0008410) aimed at (i) facilitating a better understanding of the extent of environmental impacts of drifting or stranded FADs both in the EPO, and in the WCPO, when crossing over to that area and (ii) contributing to improved management advice on FADs. Development of this program will harmonize IATTC's efforts with those already established by the WCPFC's data collection program described in FAD-07 INF-A. Harmonization of data collection in the WCPO and the EPO will foster Pacific-wide research as recommended by the SAC ("*Increase Pacific-wide collaboration on drifting FAD research*…" See document IATTC-101-03, recommendation 5.1); it will also foster and facilitate collaboration on FAD stranding events as well as guidance of potential management options, particularly for events that span both regions.

To date, five CPCs have responded to the memorandum and expressed interest in participating in a regional data collection program to harmonize with SPC-WCPFC's efforts. The initial interest by these CPCs, as well as the success of the eventual data collection program on stranding FADs, could significantly benefit from the participation of other CPCs in the region and from increasing awareness by local communities.

RECOMMENDATIONS:

1. CPCs participate in a regional data collection program on FAD strandings originating from EPO fisheries—following, to the extent possible, the system of data collection and dedicated data forms already established by the WCPFC and described in FAD-07 INF-A—to improve our understanding of the extent of environmental impacts of drifting or stranded FADs and to guide potential management options.

2. CPCs create awareness of FAD strandings by engaging local communities to communicate and disseminate information (e.g., through posters, radio and television broadcasts, and public speaking) and improve reporting of lost and abandoned FADs data found by fishers and/or local communities.

8. OBSERVER COVERAGE

8.1. Purse-seine fishery

8.1.1. Observer coverage of purse-seine vessels of less than 364 t carrying capacity

No formal, fleet-wide on-board observer program exists for Class 1-5 purse-seine vessels, and as a result, trips by many small[4] purse-seine vessels are not sampled by observer programs (SAC-08-06a; SAC-12-09, SAC-14-11). However, data collection has been improving due to a voluntary observer program, established in 2018. Initially, observer coverage was low due to the voluntary nature of the program. Therefore, vessel logbooks and cannery unloading records are the principal sources of data on the activities of these vessels. However, these data sources generally do not contain information on tuna discards, and the data are less complete and detailed than those collected by observers. In addition, bycatch information is only rarely recorded in logbooks, which hampers efforts to conduct assessments for such species. Electronic monitoring (EM) for this fleet component is currently being explored (Project D.2.a; SAC-10-12), and some capabilities of EM detected in the pilot study are detailed in Appendix 2 of SAC-11-11; however, EM data collection is not likely to begin at any significant level prior to January 2025, given the steps that need to be completed for implementation of an EM System in the EPO (SAC-12-10; SAC-12-11, EM-02-01). Therefore, a formal, non-voluntary, fleet-wide observer program is recommended to routinely obtain the data necessary for estimating the quantity and species composition of bycatches by these vessels and to understand the strategies and dynamics of their operations. Based on a previous study of EPO data for Class-6 vessels fishing on floating objects (IOTC Proceedings WPDCS-01-09, 4: 48–53), an initial sampling coverage of at least 20% of all trips of the small-vessel fleet component is recommended.

RECOMMENDATION:

Establish a formal, non-voluntary, fleet-wide observer program for purse-seine vessels of less than 364 t carrying capacity, with a sampling coverage of at least 20%.

8.2. Longline fishery

8.2.1. Observer coverage

Resolution C-19-08 requires that at least 5% of the fishing effort by longline vessels greater than 20 m length overall (LOA) carry a scientific observer. However, recent analyses undertaken by IATTC staff with the new operational-level data collected by observers onboard large longline vessels showed that, at such a low level of coverage, the data are not representative of the fishing activities of the entire fleet and cannot even be used to produce accurate estimates of total catch of target species such as bigeye tuna and yellowfin tuna (BYC-10 INF-D). Therefore, the staff concludes that 5% coverage is too low for calculating accurate estimates of the total catches of bycatch species caught by these vessels, particularly those species caught infrequently, such as sea turtles, seabirds and some sharks of conservation concern. In fact, several studies of sampling coverage for other longline fisheries have shown that 20% coverage is considered the minimum level required for estimating total catch of bycatch species. Both the staff and the SAC have recommended that this level of coverage be adopted for longline vessels over 20 m LOA (SAC-10 INF-H).

RECOMMENDATION:

The staff maintains its recommendation of at least 20% observer coverage of longline vessels over 20 m length overall.

[4] Carrying capacity ≤ 363 t.

9. ELECTRONIC MONITORING

9.1. Implementing an electronic monitoring system for the tuna fisheries

Electronic monitoring (EM) is increasingly being used worldwide to record the activities of fishing vessels, to complement human observer programs, and where on-board observer coverage is too low or non-existent. Accordingly, per request of the Scientific Advisory Committee during its 10th meeting in 2019, and pursuant to paragraphs 9 and 10 of Resolution C-19-08, the IATTC staff, at the 11th meeting of the SAC in 2020, presented the document SAC-11-10, containing information on the potential of an Electronic Monitoring System (EMS), a description and evaluation of the minimum standards of its components, and the actions that would be required for its implementation. To further discuss the elements contained in document SAC-11-10, the *1st Workshop on Implementation of an EMS in the EPO* was held in April 2021. Presented at this workshop, the document EMS-01-01 recommended several actions for endorsement by the Commission. Among these was a workplan formulated by IATTC staff (EMS-01-02-Rev), which proposed a series of workshops to consider and analyze the EMS components and subcomponents in a hierarchical and chronological order. The associated Terms of Reference of these EMS workshops and a set of definitions were adopted through the Resolutions C-21-02 and C-21-03, respectively, during the 98th Meeting of the IATTC. In observance of Resolution C-21-02, and according with the workplan adopted for the implementation of an EMS in the EPO, the staff organized in fall 2021 the 2nd Workshop of an EMS in the EPO to discuss aspects on the institutional structure, goals and scope of the EMS (see EMS-02-01 and EMS-02-02 Rev.). A 3rd Workshop was organized in spring 2022 to discuss considerations related to the management of an EMS for the EPO (see EMS-03-01). During SAC-13, the staff presented a compilation of workshop participants' comments and concerns, revising its preliminary recommendations of the 2nd and 3rd workshop as necessary (SAC-13-INF-D). Subsequently, during the 100th IATTC Meeting, Resolution C-22-07, established an *Ad Hoc* working group on EM (EMWG), which creates a forum for Members to discuss and make recommendations on issues that could not be addressed in the EM workshops. However, the workplan, now with a more educational approach, continued with the planned workshops (EMS-02-01). A 4th Workshop took place in December 2022 to discuss matters related to technical standards and data collection priorities of an EMS (see EMS-04-01 and EMS-04-02). A 5th Workshop took place in Spring 2023 to discuss the financial considerations of an EMS (see EMS-05-01). The staff has compiled all the comments and concerns of the 4th and 5th workshop participants and revised its preliminary recommendations as necessary (SAC-14-INF-H). The 6th and final workshop of this workplan was held in December 2023, focusing on the logistical and data analysis and reporting standards of an EMS (see EMS-06-01). In parallel, the 1st meeting of the *Ad Hoc* EMWG was organized in Novermber 2023, where the best approach for implementing an EMS in the EPO to be adopted by the Commission was discussed. After deliberation, the EMWG decided to first focus on the preparation of a set of draft of interim minimum standards on EMS for the Commission's consideration and potential adoption. The first draft set of interim standards (WGEM-02-01), prepared in coordination with the IATTC staff, were presented by the EMWG co-chairs and discussed at the 2nd meeting of the *Ad Hoc* EMWG in April 2024. Based on the comments and suggested edits received, the draft interim standards, , will be further revised and considered by the 2nd meeting of the *Ad Hoc* EMWG (resumed), before the annual meeting of the Commission.

RECOMMENDATION

Without prejudging the future work of the EM working group as defined in its terms of reference, the Commission should adopt interim minimum standards for an EPO EMS, based on the draft prepared by the Working Group, and taking into consideration, as appropriate, the recommendations of the IATTC staff and the results of the six EM workshops (SAC-15 INF-Q).