INTER-AMERICAN TROPICAL TUNA COMMISSION

1st WORKSHOP ON DATA IMPROVEMENT (C-03-05):

INDUSTRIAL LONGLINE

(***by videoconference***)
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WORKSHOP ON DATA PROVISION IMPROVEMENT: INDUSTRIAL LONGLINE FISHERIES IN THE EASTERN PACIFIC OCEAN

Contents

1. BACKGROUND

The Antigua Convention has been in force for over a decade, but the pace of provision of the data types required by the staff to adequately meet the commitments and obligations under the Convention, as well as its objectives and those of the ongoing IATTC's Strategic Science Plan (2019-2023, IATTC-93-06a) and the staff's future research activities, has lagged. As an extension of SAC-12-09, the purpose of this document is to focus on the ways and means of improving data collection and submission for large-scale tuna longline fishing vessels[1], herein referred to as the "industrial longline fishery". To this end, we briefly summarize the expansion of IATTC staff's research to better address the broader ecological components of the Antigua Convention that require improved data provision for target and non-target species, particularly for the industrial longline fishery, but also encourage participants of the 1st workshop on data provision improvement to review SAC-12-09, specifically section 3.2 Large Longline fleets, for further details.

Several drivers have prompted the staff to review IATTC's Resolutions related to data provision, primarily Resolution C-03-05, as they constitute the foundation of staff's scientific research to demonstrate ecological sustainability within the scope of the Convention. These include scientific drivers (e.g., technical challenges with the stock assessments of the tropical tuna species, see SAC-11-06; SAC-11-07; IATTC-95-05), political drivers (e.g., the growing awareness by the international community of the potential ecological impacts of fishing and tuna fisheries interactions with threatened or vulnerable species), market and conservation drivers (e.g., fishery certification), and fisheries drivers (e.g., increase in the number of FAD sets).

Briefly, two major data challenges associated with the industrial longline fishery have been identified as areas of concern that relate to (i) target species, and (ii) species caught as bycatch. Stock assessments for the tropical tuna species have been hampered by restricted access to high resolution time series of operational-level data that is required for performing the sophisticated analyses involved in assessing stock status (see SAC-11-06; SAC-11-07; IATTC-95-05). Ecological analyses have also been limited to inadequate rudimentary data-poor methodologies to accommodate the poor quality data available for most bycatch species (e.g. see SAC-13-10, SAC-13-11) and gear types, especially industrial longline. The current inadequacies in data may be in part due to a lack of clarity on requirements for submitting data on bycatch species in the data provision Resolution C-03-05, or simply a complete absence of submission requirements for necessary data. Improvements in the scope and quality of data are fundamental to the staff's ability to undertake scientifically defensible analyses that can be used to provide sound advice on new or existing conservation and management measures (CMMs). The industrial longline fishery is one of the most important fisheries in the eastern Pacific Ocean (EPO) for several reasons. It is the main fishery contributing to catches of some species (e.g., swordfish) or large size classes of some species shared with other EPO tuna fisheries (e.g. large bigeye tuna). Furthermore, longline data are used to develop indices of abundance for tropical tuna species and for identifying, prioritizing, and conducting research to assess ecological sustainability for species caught as bycatch. Therefore, it is timely to collaborate on the development of a standardized data-reporting template for this fishery.

With these issues at the fore, the goal of the workshop is to respond to a recommendation by the SAC (SAC-12-RPT), to hold a series of workshops, by gear type, on data provision to develop standardized reporting templates and to ultimately update Resolution C-03-05 to align data reporting requirements with the Antigua Convention, and to harmonize them, where possible, with FAO and other tuna Regional Fisheries Management Organization's (t-RFMOs) data collection and reporting standards (SAC-12-16

[1] Here understood as those vessels fishing for tunas and tuna-like species, i.e., pelagic species such as swordfish and sharks

see section B.3. "General Data Provisions"). The focus of this workshop is on the collection and provision of data by longline vessels greater than 20 m length overall. Data collection and provision by smaller longline vessels will be the topic of a future workshop.

This document provides details on:

a) data gaps in the industrial longline data submitted to the IATTC,

b) the staff's previous and current collaborations with other RFMOs to share experiences in industrial longline data reporting for the purposes of harmonization among t-RFMOs,

c) case studies to illustrate the impact of the data quality as well as observed and potential benefits of improved data reporting for both the target species and species caught as bycatch,

d) the staff's initial proposed standardized template of data fields, and lastly

e) options for the data reporting process, emphasizing the submission of both new and historical data.

2. DATA GAPS

The text in this section is adapted from SAC-12-09 as it relates to the industrial longline fishery. Data quality and quantity for the industrial longline fishery lags considerably behind that of the purse-seine fishery of large vessels[2], for which there is 100% observer coverage and substantial port sampling. Data from the industrial longline fisheries is significantly less detailed, as the observer coverage required is only 5% (Resolution C-19-08) and no port sampling is carried out by the IATTC staff. The majority of the data comes from CPCs submissions in compliance with Resolution C-03-05. Further, the formats and quality of data submitted to the IATTC for the industrial longline fishery also varies extensively (see e.g. SAC-07-03d, SAC-08-07b, SAC-08-07d, SAC-08-07e). In summary there are 3 types of data submitted to the IATTC: (1) "TASK I" data, (2) "TASK II" data, and (3) observer data.

"TASK I" catch statistics are gross annual removals, i.e., total annual EPO catches, submitted by individual CPCs in summarized form to the IATTC annually. These data have served the Stock Assessment Program as the main catch data for countries with small-scale longline fleets and to check the Task II industrial longline catch data for completeness, and the Ecosystem and Bycatch group as the primary data source for reporting minimum annual catches of bycatch species from longline gear in the EPO in IATTC's *Ecosystem Considerations* report (e.g., SAC-13-10). TASK I effort statistics are the number of fishing vessels, by gear, operating in the Antigua Convention Area.

"TASK II" catch and effort data are aggregated in space (i.e., 1°x1° "level 2" or 5°x5°, "level 3") and time (monthly) as defined in Resolution C-03-05 and the corresponding data provision guidelines (e.g., IATTC Memo Ref: 0123-410, dated April 4, 2022). Moreover, the Memo states that CPCs have the option of reporting 'level 2' and 'level 3' catch and effort data in a raised or unraised format, but often there is no indication of whether data were raised or not and if so, what methodology was used to raise the data. No 'level 1' ("operational-level" or set-by-set) data have been routinely reported (but access has been given by some CPCs to the scientific staff for collaborative work under specific circumstances see 2.1 and 4.1), while submission of at least 'level 3' data is mandatory. Information on fishing strategy or equipment, (i.e., factors that may influence catchability), is not submitted, other than one CPC that reports data aggregated by hooks between float (HBF) categories, which was data previously used in the yellowfin and

[2] The Agreement for the International Dolphin Conservation Program (AIDCP) provides that all purse-seine vessels with a carrying capacity greater than 363 metric tons operating in the EPO shall carry an observer. The observer makes a comprehensive record of fishing operations.

bigeye tuna assessments (e.g., SAC-09-05, SAC-10 INF-F). Furthermore, the TASK II data include a combination of data types, and may originate from logbook programs, because some CPCs report catches in numbers of individuals, others as weights, and some provide both units but do not specify the methodology used to convert numbers to weights or vice versa or whether both units are recorded. Because these "TASK II" data are aggregated spatially and temporally, contain little to no data on gear configuration information, and no vessel identifiers, their use is questionable for deriving reliable indices of abundance and standardized length frequencies or to explore hypotheses of stock structure, which constitutes one of the main uncertainties in the assessment of tropical tunas.

Observer data are also provided for longline vessels >20 m length overall, and is an invaluable data source for several purposes, but the current 5% observer coverage requirement under Resolution C-19-08 has been shown to be insufficient for expanding catches to fleet totals (BYC-10 INF-D). Such observer data will not be covered in these workshops, because longline observer data are covered under Resolution C-19-08, rather than C-03-05 which is the focus of this workshop series.

Although submission of these various data types is important, facilitated access to time series of high-resolution operational-level data, inclusion of additional data fields and improvement in data quality and reporting rates are essential for the staff to fulfill their increasing workload under the Antigua Convention and IATTC's Strategic Science Plans (SSP).

2.1. Stock assessment

The main objective of the Stock Assessment Program is to analyze the current and past condition and trends of the target tuna and tuna-like stocks in the EPO. The stock assessment staff has recently encountered challenges with assessing the stock status of the tropical tunas. The assessments are done using statistical catch at age models fit to catches, indices of abundance and size composition data.

Information gaps for the submitted TASK II data, include lack of indication of whether catch data were raised to fleet totals, absence of methodology for raising catch data if applicable, inconsistent reporting units (i.e., numbers or weights) and absence of conversion methodology for converting numbers to weights and vice versa. It is preferred to fit the assessment models to the catches in the units in which the data were recorded, as the conversions between units are done within the assessment model and in this manner are kept consistent, and uncertainty on conversion factors can be addressed.

The main indices of abundance for tropical tunas are derived from the longline catch and effort data, because these fisheries catch the largest and oldest fish. The traditional method for obtaining the longline indices of abundance of yellowfin and bigeye tuna—which consisted of using standardized catch and effort data in a 1°x1° spatial resolution, associated hooks-per-basket (HPB), and corresponding length frequency data from the Japanese longline fleet—was insufficient to adequately represent the relative abundance of the stocks. In particular, the indices of abundance were overly sensitive to the addition of new CPUE data points from the Japanese fleets, whose effort has been spatially contracting over time (BET-02). Consequently, the precision and accuracy of the indices has decreased. As a result, the assessments for bigeye and yellowfin tuna were considered inadequate for providing management advice in 2018 and 2019, respectively (SAC-10-19).

A collaboration between IATTC staff and colleagues from Japan, Korea, Chinese Taipei and China was initiated to address issues with the indices of abundance and associated length compositions to improve assessments using their logbook data. This collaboration facilitated the development of new indices for the current yellowfin and bigeye benchmark assessments (SAC-11-06; SAC-11-07; IATTC-95-05) from high-resolution logbook data. The staff only had access to their data for a limited purpose and time through multiple MoUs between IATTC and the individual CPCs. These data were required for the sophisticated techniques used to assess stock status—they have greater spatial and temporal coverage, may include information related to catchability that are not routinely submitted to the IATTC (e.g., gear configuration), are required to be submitted to other RFMOs by its members that are also IATTC CPCs (WCPFC13)—yet they are not compulsory according to Resolution C-03-05. Additionally, time constraints on access to the appropriate datasets limit the staff's ability to perform additional work that is needed to (1) investigate potential shifts in target species and the effect of factors that may be related to catchability (OTM-30), (2) combine data from different fleets to produce better indices of abundance (because the indices would be based on a larger data set, with wider spatio-temporal distribution), and (3) address similar challenges when producing assessments for other tuna and tuna-like species, such as swordfish (SWO-01).

There is a significant gap between the data routinely submitted to the IATTC by CPCs with industrial longline fleets and the data needed to produce the best scientific information on the status of the stocks, as dictated by the Antigua Convention (Article VII, §1 , d). The key data sources exist: the logbook data collection including level 1 operational-level data are already mandated by each CPC for their fleets, and size composition data are obtained by CPCs. Making logbook information available to the IATTC staff on a routine basis and improving and documenting size composition data collection procedures will greatly increase the quality of the science for stock assessment and management of the tuna and tuna-like stocks under the auspices of the Antigua Convention.

2.2. Ecosystem and bycatch

One objective of IATTC's Ecosystem and Bycatch Program is to identify, prioritize and conduct research that can be used by managers to ensure the ecological sustainability of tuna fisheries. Such ecological research is aimed at obtaining data and developing tools to assess ecological sustainability and subsequently guide the development and implementation of measures that fulfil the objectives of ecosystem approaches to fisheries management (EAFM). Staff have encountered challenges in developing reliable tools because they often require, at a minimum, an accurate list of species that are caught by the various fisheries, including industrial longline, operating in the EPO (e.g., ecological risk assessments (ERA)), along with retained and discarded catch estimates for these species (e.g., ecosystem models). Models are then used to identify and prioritize potentially vulnerable species for data collection, research, and management. The staff's responsibilities also include providing annual catch estimates for species caught as bycatch. However, data limitations—such as non-reporting of bycatch species by disposition, i.e.*,* retained or discarded, or reporting bycatch as aggregated taxonomic groups, e.g., "sharks"—not only compromise the reliability of outcomes from ecological tools, but also the bycatch estimates in routine reporting. Compliance with the provisions of Resolution C-03-05 in relation to bycatch species is generally poor, which significantly affects the staff's ability to fulfil its research and reporting obligations.

Animals caught as bycatch are sometimes included in the "TASK I" data of total annual catches and the corresponding "TASK II" monthly aggregated catches, but there is significant uncertainty as to whether the IATTC receives all bycatch data (i.e., all retained and discarded catches, by species) from each CPC with industrial longline data. This suspected partial reporting may be due to the language in Resolution C-03-05, which does not explicitly mention "non-target" or "bycatch" species. In contrast, the corresponding reporting guidelines on data provision (e.g., IATTC Memo Ref: 0123-410, dated April 4, 2022) explicitly mention these species. Consistency between these two documents should be further improved to avoid any possible confusion or hindrance in their implementation, including, through updating and revision of Resolution C-03-05.

Therefore, key gaps in the industrial longline data that relate to bycatch include the same as those for the target tunas (i.e., no indication whether catch data were raised to fleet totals, no reporting of methodology used for raising catch data, if applicable, inconsistent reporting units, i.e., numbers or weights, and absence of methodology for converting numbers to weights and vice versa), but arguably one of the most important issues is the reporting of bycatch by broad taxonomic groups instead of species-specific catches. Improving the quality of bycatch data reporting will allow the staff to develop better assessments of ecological sustainability and to produce the best possible science.

3. LESSONS LEARNED: T-RFMO EXPERIENCES IN CUSTODY OF INDUSTRIAL FISHERIES OPERATIONAL-LEVEL DATA

IATTC was the first t-RFMO ever created, in 1949. Scientific research to inform management decisions was always at the core of the IATTC mission, and the history of fishery science intermingles with the history of IATTC. It was at the IATTC that Milner Schaefer developed and published his world-famous Schaefer production model (Schaefer 1954) . Years later, two IATTC scientists Jerome Pella and Patrick Tomlinson, published another milestone in fisheries science, the Pella-Tomlinson production model (Pella and Tomlinson 1969). Tuna tagging was pioneered at IATTC too. Logbook data was central to scientific analysis early on, and the IATTC staff was always a trustworthy custodian of this confidential information obtained from CPCs. In fact, the oldest active IATTC confidentiality resolution, which guarantees the safekeeping and scientific use of operational-level data, dates from 1951 (C-51-01). The industrial purse-seine fleet has been sharing operational-level data with the IATTC staff since the start of their operations in the 1960's, and prior to that the same type of data was available from the pole-and-line fleet. The staff handles confidential purse-seine data in strict accordance not only with Resolution C-51-01, but also with Resolutions C-04-10, C-15-07 and IATTC Rule of Procedure XIII. The Agreement on the International Dolphin Conservation (AIDCP) mandates 100% observer coverage in the large purse-seine vessels. In this program, valuable data is obtained, which is used in many studies done by the staff that have improved the scientific basis for management decisions. For the industrial longline vessels, the IATTC scientific staff has been granted access to logbook operational-level data on a limited basis through MoUs, which proved invaluable to the advance of scientific research needed for stock assessment.

WCPFC is the only t-RFMO to receive operational-level longline data on a routine basis, outside of MoUs (see Scientific Data to be Provided to the Commission), with a high level of coverage across their time series (2004-2021) for many its members (SC18-ST-IP-10), some of which are also CPCs of IATTC. There are currently 14 WCPFC required scientific data fields in the general categories of vessel identifiers, trips, activities and catch information, and 9 additional fields for which data may be submitted to WCPFC (recreated here in Table 1a). Many of these data fields (e.g., number of hooks, number of branchlines or HBF, and set position) are useful for standardizing the CPUE for obtaining indices of abundance. Since these required data fields are already available and submitted to WCPFC by its members that also fish in the EPO, perhaps at a minimum, these same data fields can be added to a list of proposed required operational-level data fields to be submitted to IATTC, along with a few additional fields to improve CPUE standardization (Table 1b). The scientific provider for WCPFC, the Pacific Community (SPC), stores the data in secure servers and provides data analyses used in stock assessments of tropical tunas, southwest Pacific Ocean blue sharks and swordfish.

The types of longline data received by the t-RFMOs vary (see Table 2), but operational-level data has been used to provide scientific advice in all of them. At a minimum all t-RFMOs receive aggregated catch and effort data (e.g., TASK I annual totals and TASK II aggregated by month and 5°x5° spatial grid) with effort primarily expressed in number of hooks. Other t-RFMOs, with the exception of WCPFC as explained above, do not receive operational-level longline data directly, however through scientific collaborations and special arrangements, indices of abundances derived from operational-level data have been constructed and have been used in recent assessments of target species (e.g., IOTC–2017–WPM08–18, Hoyle *et al* 2019). These arrangements may include sharing the data with one analyst during a weeklong meeting while national scientists are present, after which the data are deleted, or assigning a person as a data custodian tasked with performing queries or analyses requested by a working group. One key difference between the IATTC and the other t-RFMOs is that IATTC has a full body of scientific staff whose duty is to continuously provide scientific advice to the Commission. Although IATTC staff's access to operational-level data has greatly been facilitated through MoUs, a more permanent arrangement of routine provision of operational-level longline data would allow staff to undertake key research on a continuous basis (i.e., including more factors in the CPUE standardization, development of combined fleet indices, comparison with purse-seine derived indices) and to facilitate timely provision of scientific advice.

4. CASE EXAMPLES AND INCENTIVES FOR IMPROVING DATA COLLECTION

4.1. Stock Assessment Examples

4.1.1 Tropical tuna assessments

Since 1999 bigeye and yellowfin tuna assessments have been conducted using integrated statistical catch-at-age models (Maunder and Punt 2013). Initially the models were implemented in A-SCALA (Maunder and Watters, 2003) fit to catches, length composition data and fisheries CPUE. For the longline fleets, the data from the Japanese fleet was used to represent all longline fleets selectivity and to produce indices of abundance for bigeye and yellowfin tuna (Tomlinson, 1998, Watters and Deriso 2000), as that fleet was the most widely distributed in the EPO. Since the start of its operations, the Japanese fleet expanded steadily from the WCPO towards the EPO, arriving to the coast of the Americas in the late 1960's, and by the mid-1980's, the Japanese fleet set about half its effort in the EPO (Miyabe and Bayliff, 1987; Nakano and Bayliff, 1992). Indices of abundance derived from the Japanese longline fleet became the main piece of information, after the catches, for the assessment of yellowfin and bigeye tuna, and most recently, skipjack tuna (SAC-13-07).

In theory, CPUE can be used as an index of abundance of a fish stock, if the catchability is constant in space, time and by vessel (Maunder and Punt 2004). In practice, CPUE will vary not only because of changes in abundance but also due to other factors that affect catchability, i.e., fishing gear configuration, fish and fishers' behavior, and oceanographic conditions. The effect of these factors should be removed to be able to use CPUE as an index of abundance. This process is done using statistical models and is referred to as "standardization" of the CPUE. Hinton and Nakano (1996) developed a habitat-based standardization procedure explicitly accounting for both horizontal and vertical fish distribution according to habitat preferences, by corresponding the HBF to the approximated depth of the gear. From 2006 to 2018, the indices of abundance for yellowfin and bigeye tuna were derived using delta-lognormal models including latitude and longitude, and its interactions, and the number of HBF, a proxy for gear depth, in a method described in SAR-07-07, on the 1°x1° by month and HBF aggregated data from the Japanese fleet. That fleet had decreased the total effort since the 1990's and contracted their area of operations in the EPO, which is now concentrated to areas closer to the WCPO, and areas in the south EPO off Chile and Perú. In the EPO, Japanese catches of swordfish had been increasing since 2005, indicating a potential change in fishing practices and target species for some vessels. The indices of abundance became more variable and less precise, which caused large changes in the estimated F (fishing mortality) multiplier in the 2018 bigeye tuna and the 2019 yellowfin tuna stock assessments. For yellowfin tuna, the longline index had an additional issue; this index was not in concordance with the index calculated for the purse-seine fishery associated with dolphins, indicating there were spatial effects (SAC-10-Inf-F). As a result, the staff considered the bigeye and yellowfin assessments to be unreliable for management advice in those years, and implemented a workplan to improve the stock assessments of tropical tuna in the EPO (SAC-10-01). Central to the plan was the improvement of the longline indices of abundance.

The IATTC staff has a long history of collaborative work with Japanese scientists which have resulted in multiple publications over several decades, mostly on the evolution of the Japanese fleet operations in the EPO (Suda and Schaefer, 1965; Kume and Schaefer, 1966; Kume and Joseph, 1969; Shingu et al., 1974;

Miyabe and Bayliff, 1987; Nakano and Bayliff, 1992; Okamoto and Bayliff, 2003; Matsumoto and Bayliff, 2008). Collaboration on improving the indices of abundance had also been done over the years. In document SAC-04-05B results from analyzing the catch and effort operational-level data were used to produce indices of abundance for bigeye tuna. The results showed that accounting for differences in fishing efficiency among vessels changed the index's long-term trend. This index was not used in the following assessments because of the difficulties in accessing the data. Under the data sharing agreement established with Japan for this collaboration, the member of the IATTC staff working as lead author in this study travelled to Japan, worked on a dedicated computer provided by the hosts, and was given access to the results of the analyses upon the conclusion of the investigation. Collaboration with the Japanese colleagues has continued through visits to the La Jolla offices (e.g. SAC-07-03d; SAC-07-04a, OTH-30), and the operational-level data were made available to the staff for the duration of visit of the Japanese colleague.

As part of the plan to improve the stock assessments of bigeye and yellowfin tuna, the project H1.b "Improve indices of abundance based on longline CPUE data", which included collaborative work with the main longline fleets that catch tropical tunas (Japan, Korea, Chinese Taipei and China) and a workshop (OTH-30), were implemented. The staff was given access to the operational-level data from the four fleets for brief periods and with different levels of restriction. For only one week the data for the four fleets was simultaneously available to the staff. From results of the preliminary analysis presented in the workshop, it became clear that including vessel effects is, at minimum, required for CPUE standardization. The use of spatio-temporal models with inclusion of length data was also shown to be important (OTH-30; Satoh et *al 2*021). The workshop participants drafted a list of recommendations regarding the use of longline CPUE to construct indices of abundance, including combining the data from different fleets. Korea shared operational-level data up to 2018 with the staff though MoUs and Korean scientists continued the collaboration with the staff after the workshop ((SAC-11-Inf-K SAC-11-Inf-L). Japan—through MoUs that are renewed every year—started to submit catch and effort data for yellowfin and bigeye (and a few additional species to investigate changes in target) by 1°x1° grid, by HBF and by vessel, from which better indices were developed. Spatiotemporal models including vessel effects fit to that Japanese data were then used in the 2020 benchmark assessment for bigeye tuna (SAC-11-06) and as indicator for yellowfin tuna (Figure B-4 in FSR 2020) due to potential spatial effects (SAC-10-Inf-F). More research, however, is needed to be able to combine the data from the different fleets into one index, investigating changes in targeting, and addressing the influence of other gear characteristics on catchability (OTH-30).

The importance of the longline data for the assessment of tropical tunas became even more evident with the 2022 skipjack assessment (SAC-13-07). Both the index of abundance, taken to be simply the nominal CPUE of the Japanese longline fleet, and the length frequency of the longline fleet, also from the data from the Japanese fleet, were key pieces of information in the assessment. Those two data components were most likely tied to the ability of the model to estimate absolute abundance, similar to the skipjack assessment in the western and central Pacific Ocean (SC18-SA-WP-01), where the authors state that "the size data from the longline fisheries are an important component of the model because they provide information regarding the presence of larger-sized skipjack that are not typically caught by the purse seine and pole-and-line surface fisheries."

Several problems with the assessments of yellowfin and bigeye tuna could not be addressed fully (e.g., effect of changes in target in the index of abundance, and spatial effects), and therefore a risk analysis approach was developed to consider those and other uncertainties (SAC-11-08). In the bigeye tuna assessment, the biomass trajectories are dissonant depending on the model's interpretation of the longline index and the longline length frequencies, showing how influential those data are. For the next benchmark assessments planned to be delivered in 2024, the ideal situation would be for the staff to have access to the historical and current operational-level data for the industrial longline fleets to be able to develop a multi-fleet index of abundance—as is done in other oceans (e.g., Hoyle et *al 20*19), or even in the Pacific Ocean by the WCPFC scientific provider (e.g., SC13-SA-WP-03)—associated with the size compositions. The spatial coverage should include areas adjacent to the EPO due to the uncertainty in stock structure for some species and the potential edge effects when fitting spatio-temporal models.

4.1.2 South EPO Swordfish

After more than a 10-year hiatus, the south EPO swordfish stock was assessed during 2021-2022 (IATTC-100-Inf-B). The assessment benefited from a wide collaboration network organized during the 1st Technical Workshop on Swordfish in the South EPO (SWO-01). The assessment was only possible due to many CPCs submitting their fine scale aggregated CPUE data without the need to establish a MoU (Chile, Japan) or under a MoU (Korea) or their operational-level data without a MoU (Spain, Ecuador) and a combination of those data with the length-composition data. In the case of Japan, a Japanese scientist dedicated one month to work closely with the staff to do the standardization of the operational-level CPUE data to derive an index of abundance using spatio-temporal models (SAC-13-Inf-N). Another important study derived from the collaborations with the national scientists compared the Korean and Japanese aggregated data (SAC-13-Inf-M). The finalization of the assessment work, however, was greatly delayed due to data issues. Because the data used were not part of the routine submission to the Commission, but rather consisted of special data requests, there were internal processes in each CPC that needed to occur that delayed the submission of data, which took time for the staff to process and understand each new data set.

4.2. Ecosystem and Bycatch Examples

4.2.1. EASI-Fish

Since 2010 IATTC staff have employed data-poor methods, namely ecological risk assessment (ERA), as a means to identify potentially vulnerable bycatch species that can then be the subject of research monitoring, assessment, or specific mitigation measures. Early methods, such as Productivity-Susceptibility Analysis, provided only a qualitative indicator of vulnerability, and so IATTC staff developed the EASI-Fish approach to provide a quantitative measure of vulnerability of the cumulative impacts of all EPO fisheries and data-poor species. The fundamental approach is to estimate the proportion of a species' distribution—predicted from a species distribution model (SDM) based on presences from fisheries data—that overlaps with the distribution of effort by each fishery, and also taking into account other factors that affect a species' susceptibility to capture and mortality such as size selectivity of the gear and handling and release practices. The estimated proportion of the stock susceptible to mortality is then converted to an estimate of instantaneous fishing mortality and compared to conventional per-recruit fisheries reference points (e.g. F_{MAX}) to determine vulnerability status. As such, the outcomes from EASI-Fish are highly sensitive to the spatial extent of both the underlying SDM and the effort footprint of each fishery, as well as gear selectivity assumptions. Two simple scenarios are presented that show how vulnerability status of the leatherback turtle dramatically improves with an increase in the spatial coverage of species presence and fishing effort data, which improved the predictive ability of the SDM and the estimation of fishery overlap on the species' distribution. A further three scenarios show how changes in assumptions of gear selectivity to industrial longline from fully realized selectivity across all size classes to a precise selectivity ogive significantly changes vulnerability status.

In 2019, the IATTC staff collaborated with the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) to undertake a vulnerability assessment of the critically endangered eastern Pacific leatherback turtle stock using the EASI-Fish approach. In the absence of a statistically derived SDM, the project team developed a proxy SDM based on an assumed generic stock boundary

(Wallace et al. 2010) (Figure 1). Fishing effort for the industrial longline fleet was obtained from the 5°x5° Task II data, while for most of the artisanal longline and gillnet fleets—believed to have the highest impacts on the species—no comprehensive spatially-explicit data were available. Therefore, a mosaic of information from limited published sources, often not representative of these fisheries (e.g., opportunistic surveys of fishing camps), were used to sketch the potential spatial distribution of the artisanal fleet's effort (Figure 1). Effort for the purse-seine fleet of Class 6 vessels (>363 mt) and the smaller Class 1–5 vessels—disaggregated by set type—was derived from observer data and Task II data, respectively. The 2019 assessment showed the stock was "most vulnerable" with the proxy for the fishing mortality in 2019 (F_{2019}) and the proxy for breeding stock biomass per recruit (BSR) being 248% and 74% of the $F_{80\%}$ and $BSR_{80\%}$ reference points, respectively (Figure 1).

In 2022, new spatially-explicit fishing effort data for artisanal longline and gillnet fleets was made available from data collected in a joint IATTC-WWF project on circle hooks and surveys undertaken in the IATTC GEF ABNJ project in Central America and observer data supplied by coastal fishing states, among others (Figure 1). The EASI-Fish assessment for leatherback turtle was revised and improved by developing a SDM using the new data and sophisticated analysis such as machine learning and boosted regression trees (BRT) (BYC-11-01). Together, these improvements significantly changed the outcomes of the assessment. Although the species remained as "most vulnerable", the perception of the status of the species became more optimistic with F_{2019} estimated to be 137% of $F_{80\%}$ and the proxy for the breeding stock per recruit (BSR_{2019}) 95% of $BSR_{80\%}$ (Figure 2).

The outcomes of EASI-Fish assessment—as well as traditional stock assessment models—is strongly influenced by assumptions of the size selectivity of a fishery's gear since it directly affects estimates of fishing mortality at age, in the case of EASI-Fish, length. In the EASI-Fish assessment for leatherback turtles, very little information was available on size selectivity, especially for the industrial and artisanal longline fisheries that have the highest frequency of interactions with the species. In the absence of reliable information, the usual precautionary approach is to assume full selectivity at length from the size at recruitment to the maximum length in the population (L_{MAX}). However, this approach can overestimate fishing mortality on small size classes, resulting in an overly pessimistic vulnerability status. When full selectivity was assumed for leatherback turtles in the industrial longline fishery, F_{2019} was estimated to be 465% of $F_{80\%}$ and the proxy for the breeding stock per recruit 13% of $BSR_{80\%}$ (Figure 3). Therefore, knife-edge (or uniform) selectivity from 100 cm curved carapace length (CCL) to L_{MAX} was recommended by experts to more realistically reduce fishing mortality on small-sized turtles that are generally restricted to neritic habitats that are exposed to very little industrial longline effort. This resulted in a significantly more optimistic vulnerability status. However, in a hypothetical scenario where reliable size-frequency data were available to develop a logistic size selectivity curve where 100 cm CCL turtles had 50% selectivity, the vulnerability status became even more optimistic, moving the species into the "least vulnerable" quadrant where both F_{2019} and BSR_{2019} did not exceed the reference points.

These simple scenarios focusing on reducing uncertainty in species presence locations, fishing effort footprint, and gear selectivity—using leatherback turtle as an example bycatch species—demonstrate how improved data quality from operational-level data for the industrial longline fleet could significantly increase the accuracy of vulnerability status of the stock. This would provide managers with more reliable information from which to base conservation and management advice.

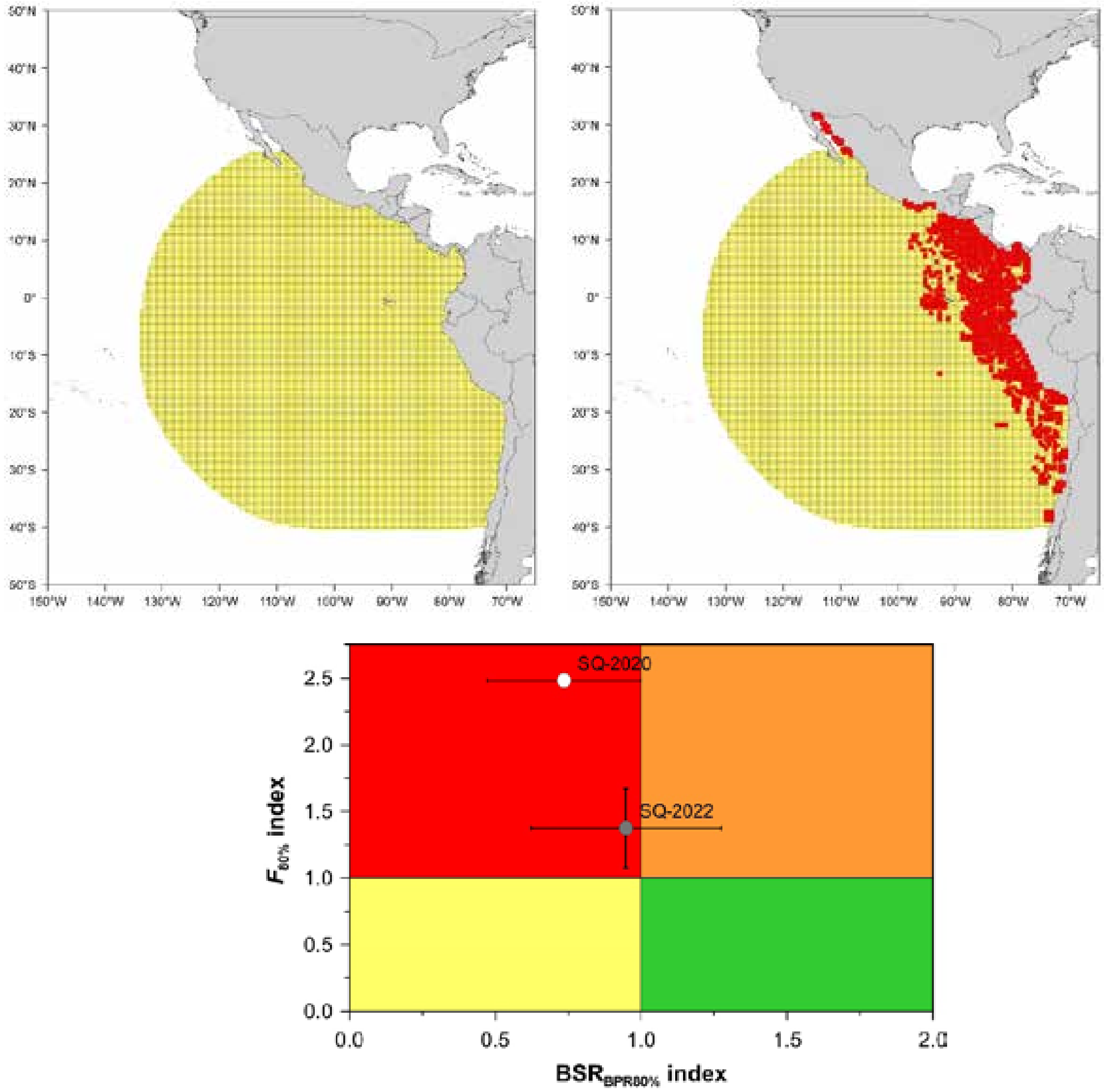

FIGURE 1. Maps showing the expert-derived stock distribution for the eastern Pacific stock of leatherback turtle (left panel) and the extent of overlap of fishing effort data pertaining to artisanal longline and gillnet fisheries (shown as combined effort represented by the red squares) (right panel), and the results from the 2020 EASI-Fish assessment (SQ-2020) for the year 2019 indicating the stock's "most vulnerable" status. The vulnerability status for the revised 2022 EASI-Fish assessment is shown as a comparison (SQ-2022).

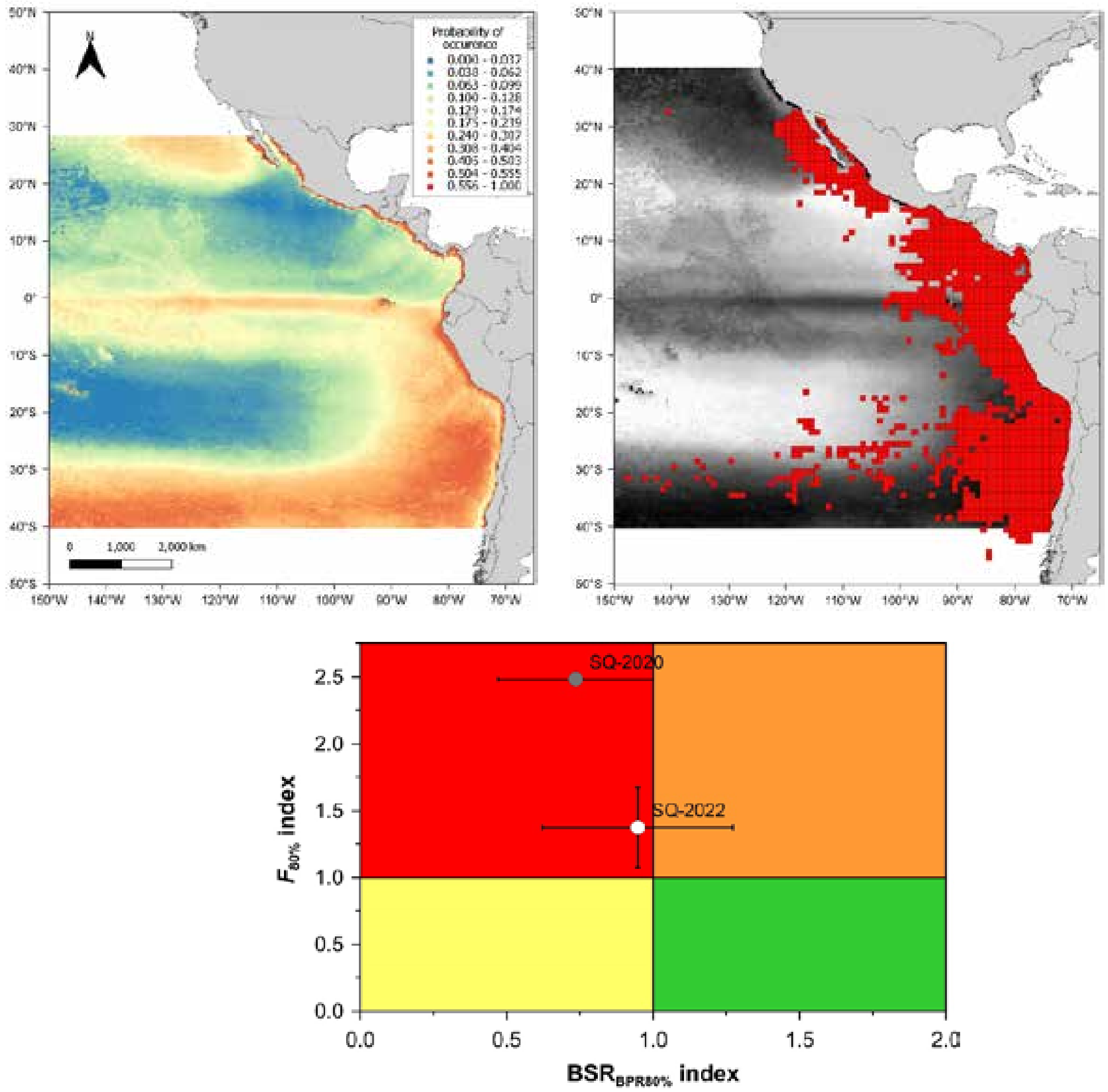

FIGURE 2. Maps showing the improved species distribution model for the eastern Pacific stock of leatherback turtle as determined by boosted regressions trees (left panel) overlaid with improved quality and quantity of fishing effort data pertaining to artisanal longline and gillnet fisheries (shown as combined effort represented by the red squares) (right panel), and the results from the 2022 EASI-Fish assessment (SQ-2022) indicating a significant reduction in vulnerability compared to the 2020 assessment (SQ-2020) for the 2019 assessment year.

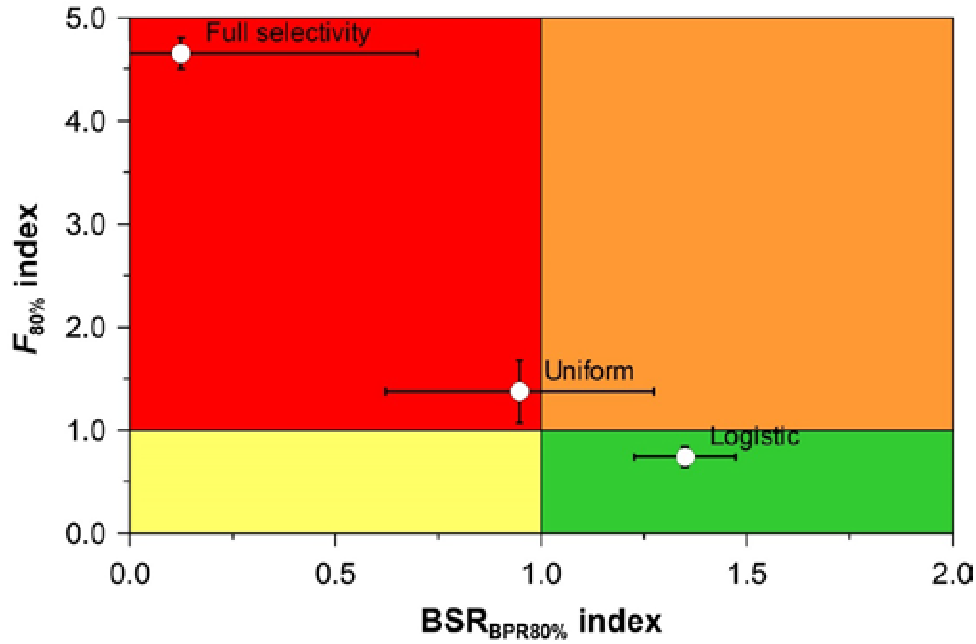

FIGURE 3. Vulnerability phase plot showing the predicted change in vulnerability status of leatherback turtle in the EPO under three size selectivity assumptions for the industrial longline fishery based on available data quality: i) no data (full selectivity-at-size), ii) expert opinion (uniform or knife-edge selectivity from 100 cm CCL to L_{MAX}), and iii) hypothetical high quality size-frequency data (logistic ogive where 50% selectivity was 100 cm CCL).

4.2.2. Fisheries interactions with species groups

The IATTC has been reporting fisheries interactions with species by broad taxonomic group (e.g., marine mammals, turtles, sharks) in its *Ecosystem Considerations* report since 2003 (e.g., see SAC-13-10). The primary data source used for reporting total catches comes from the observer data for large purse-seine vessels, with a fish carrying capacity of >363 mt. Trips made by these vessels have 100% observer coverage, and therefore the observer data are the most comprehensive source for species caught as bycatch. Although these data provide information regarding the effects of the large-vessel purse-seine fishery on the ecosystem, the effects of other important fisheries, primarily the industrial longline fishery, remain uncertain. For some species, the industrial longline fishery has greater removals than the large purse-seine fishery (e.g., the silky shark, *Carcharhinus falciformis*, see Figure J-3 SAC-13-10), yet the reported values are considered to be less than the actual removals because, among other reasons, the values may have been estimated using a mixture of different weight metrics (e.g., round, trunk or whole weight) without transforming them into whole weight. As a result, the IATTC staff are unable to report the 'true' magnitude of longline catches. Furthermore, data submitted by CPCs for the industrial longline fishery contain limited to no information on bycatch species, and oftentimes animals are aggregated into broad taxonomic groups (e.g., "sharks"), which precludes analyses of ecosystem impacts and impairs accurate reporting. This creates a conundrum for staff tasked not only with providing annual estimates of total catch for species in which the various EPO fisheries interact, but also with undertaking ecological risk assessments and constructing ecosystem models that require at a minimum a mere list of species interacting with the fishery. Revising Resolution C-03-05 to explicitly include data on bycatch, as well as instructions for the reporting process, will greatly improve the staff's ability to fulfill their obligations under the Antigua Convention and IATTC's SSP, namely to ensure IATTC is being proactive in pursuing ecological sustainability.

4.3. Biology examples

4.3.1. Issues with length-weight (L-W) relationships

Length-weight (L-W) relationships and conversion factors (e.g., processed to total weight) vary by region and year depending on biological and environmental factors. This variability can influence both stock and ecological assessments (e.g., EASI-Fish) and, when not accounted for, increase uncertainty. Additionally, catch estimations are affected by L-W relationships used to convert catch in numbers to weights and vice versa, and oftentimes catch is either reported in numbers or weights and sometimes both units with no explanation of the conversion methodology used, particularly for bycatch. In addition, length composition data is often recorded in weight and converted to length and therefore relies on the accuracy of the L-W relationship and conversion factors. L-W relationships and conversion factors for tunas are outdated by several decades (e.g., yellowfin: 1986, bigeye: 1966 and skipjack: 1959) and remain a data gap for many priority species (see SAC-13-11, SAC-09-12). Use of these imprecise and/or outdated relationships contribute to biased estimations. Moreover, alternative weight metrics may be reported as in sharks mentioned above. Different stocks or sub-stocks of the same species may also have different relationships. Evidence of structure in EPO stocks of tuna species has been shown from extensive tagging studies, meristic and morphometric analyses, and genetic work. Future assessment will account for putative stock structure and any differences in the relationships should be included. Changes in catch and composition estimations can initiate a response in management rendering improvements to conversion factors an essential component for providing better estimations. Inclusion of length type (e.g., fork length: fishes, total length: sharks; lower-jaw fork length: billfishes), weight type (e.g., whole weight, trunk weight), length and weight units (e.g., cm, kg, respectively), and any conversion methodology used (e.g., L-W relationship and corresponding types and units) in the reporting of industrial longline data will improve both stock assessments and ecological assessments, including improving catch estimations. Additionally, the staff have initiated a new project (F.3.a) to conduct a feasibility study to develop a sampling program for updating morphometric relationships and collecting biological samples for priority species in EPO tuna fisheries.

4.4. Policy examples

4.4.1. IATTC tuna conservation measures

The IATTC harvest control rule (HCR) for tropical tunas is anchored in target and limit reference points, which are based on levels of spawning biomass (S) or fishing mortality (F) that should be achieved or maintained, or that should be avoided because going beyond it could endanger the sustainability of the stock (Resolution C-16-02). The HCR further prescribes that action needs to be taken if the probability of exceeding either the F or S limit reference points is greater than 10%. In 2020, the staff used a risk analysis approach to estimate fishing mortality and spawning biomass and to evaluate the probability of exceeding the reference points (SAC-11-08). The approach addresses parameter uncertainty (i.e., precision of the estimates of parameters and derived quantities such as fishing mortality and spawning biomass given by how well a particular model fits the data) and structural uncertainty (i.e., using a series of models derived from alternative hypotheses that could be a reasonable representation of the stock dynamics). Both sources of variability will influence the estimates of the probabilities of exceeding the reference points. In that sense, the data that are used in the stock assessment models should be the best possible representation of the population. The results of the risk analyses showed that the yellowfin stock was healthy but were inconclusive for bigeye tuna as they showed a bimodal pattern: either the population was healthy (optimistic scenario) or there was around a 10% probability that the population had breached the limit reference point (pessimistic scenario). In the case of bimodality in the results, both the possibility that either the pessimistic or the optimistic scenario reflects reality need to be considered, and guided by the precautionary approach, the pessimistic scenario particularly needs to be addressed. These results, added to those of other indicators for the floating-object fisheries (SAC-12-05), made the staff reinforce the recommendations for additional precautionary measures to ensure that the *status quo* fishing mortality is not exceeded. Consequently, the Commission adopted additional measures for the 2022-2024 triennia (Resolution C-21-04). The indices of abundance and the standardized length frequencies derived from the Japanese longline fleet data played a central role not only when fitting the models but also when developing the hypotheses represented as alternative models. The quality of these data can directly affect the perception of the stock status, thus continuing the improvement of the indices of abundance, and associated length frequencies are key to accurately estimating risk. One of the issues observed in the BET assessment is that the expected depletion in the stock caused by an increase in the catch from the floating object fishery was not seen in the longline index of abundance or composition data. More detailed data from the longline fishery would allow the IATTC staff to further investigate this issue and possibly improve the assessment and management advice.

4.4.2. MSC certification

Several tuna and tuna-like fisheries in the EPO have been granted or are pursuing MSC (Marine Stewardship Certifications) of sustainable fisheries. The MSC certification is granted by independent bodies that analyze the fisheries against the MSC standards. The standards are centered in three principles: Principle 1 “Sustainable fish stocks” analyzes the target stock, Principle 2 “Minimizing environmental impact” analyzes the impact of the fishery on non-target species and the ecosystem, and Principle 3 “Effective fisheries management” analyzes the governance system. Good quality fisheries monitoring, estimation of stock status and estimation of impact on bycatch species are central to achieving high scores on the standards. The version 3.0 of the MSC standards (released 26 October 2022) specifically stated that if the stock is managed by a RFMO and operates on the high seas, the catch monitoring system should include independent observation of at least 30% of fishing events per year with coverage that is representative of fishing operations (MSC Fisheries Standard Toolbox v1.0). To be able to establish observer programs or electronic monitoring programs with good coverage, or to be able to assess current programs, the logbook data represent an invaluable resource from which to study statistical proprieties of the data and plan a monitoring design.

5. INDUSTRIAL LONGLINE DATA PROVISION

5.1. Staff recommendations

Based on the rationale presented above, the staff makes the following recommendations for industrial longline data provision:

RECOMMENDATIONS:

1. Report TASK I[3] effort, catch and disposition (retained or discarded) for tunas, billfishes and sharks (Table 3a) and expand it to include, to the highest taxonomic resolution possible, where available, other relevant taxa (Table 3b).

2. Ensure that the relevant national laws and regulations recognize the IATTC Secretariat as a custodian of confidential operational-level longline data needed for scientific research pursuant to the objective, rules, and relevant provisions of the Antigua Convention and measures adopted by the IATTC.

3.1 Mandate the reporting of TASK II, level 1, operational-level logbook data—for current and historical data, when available—using the data fields in Table 4, or at a minimum the fields in Tables 1a[4] and 1b, to be used in scientific research pursuant to the objective, rules, and relevant provisions of the Antigua Convention and measures adopted by the IATTC.

3.2. Until the coverage of the operational-level logbook data provided to the Commission is 100%, 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[5]. For data previously submitted, indicate whether it was raised and describe the methodology.

4. Mandate the reporting of size composition data[6] in the originally measured type and unit[7] for tunas, billfishes and sharks (Table 3a), and, if available, other relevant species (Table 3b), that are representative of catches by the fisheries at the finest possible spatial and temporal resolution[6], revising where feasible, previously submitted data.

5. Ensure that the updating and revision of Resolution C-03-05, as recommended by the SAC, includes the items above.

5.1.2. Template: Draft Proposal of data fields

The staff have compiled a list of proposed data fields related to vessel characteristics, trip-level and set-level information on effort and catch data to be reviewed and discussed at this workshop. The minimum data fields to be submitted would be similar to the ones already submitted to WCPFC (Table 1a), with the

[3] Where catch is defined as gross annual removals in metric tons and effort is the number of active fishing vessels in the Antigua Convention area and total number of hooks

[4] Fields reported to the WCPFC

[5] Following WCPFC (see Table 2 Estimation methods), provide reference to the coverage rates for each type of data (e.g. operational catch and effort data, records of unloadings, species composition sampling data) that is used to estimate the catches and to the conversion factors that are used to convert the processed weight of longline caught fish to whole weight information about the relationships and methods used to raise the data.

[6] Following WCPFC, the statistical and sampling methods that are used to derive the size composition data shall be reported to the Commission, including reference to whether sampling was at the level of fishing operation or during unloading, details of the protocol used, and the methods and reasons for any adjustments to the size data. Where feasible, this shall also be applied to all historical data.

[7] Indicating the measurement type (e.g. whole weight or dressed weight; fork length for tunas, lower-jaw fork length for billfish, total length for sharks) and unit (e.g. kg, cm).

addition of three fields that may be important for the standardization of the CPUE (Table 1b). Ideally, other data on vessel, trip and set characteristics should also be recorded to improve CPUE standardization. The complete list of ideal fields is in Table 4.

6. OPTIONS FOR DATA REPORTING MECHANISMS

In this section, we describe options for submitting longline data to the IATTC, using current methods employed by IATTC and the other t-RFMOs—focusing on logbook data—and recommend potential future tools for improved data reporting mechanisms, which are intended to be discussed among participants during the workshop to determine feasibility.

6.1. IATTC current data submission mechanisms

IATTC does not directly collect industrial longline logbook and size composition data from CPCs. Instead, catch and effort data are aggregated by flag, year, month and 5°x5°, or in some cases 1°x1°, with or without HBF information, and submitted via email as either an Excel or text file. Each CPC submits the data in a format of their design. IATTC staff have programmed scripts to read and process the files and add the data to the corresponding IATTC database tables. An advantage of this approach is that data providers have flexibility in formatting their data. Staff have expressed concern that data providers may not be able to properly prepare the dataset if IATTC required data to be submitted using a specific format, at least in the short-term. The idea behind this approach is to make data submission as easy and accessible as possible for the CPCs, and because dedicated programs have already been developed for reading the data, the staff can easily and efficiently process the data in a timely manner. A possible disadvantage of allowing for flexibility in data formats is that staff have observed inconsistent quality and consistency of data submitted when no special formatting is required. However, this observation may continue with or without special formatting requirements, such as a template of minimum required data fields. Even with such a template, some data providers may not match the template of data fields and may not submit data on all fields as requested.

As previously mentioned, operational-level logbook data for industrial longline vessels have been made available via specific MoUs between IATTC and each CPC for a limited time. The disadvantage of this approach is that staff have restricted access to the data or may not have access to the data long enough to complete research or to use in routine assessments. In addition, this puts time constraints that are often difficult to manage by the staff. With a recurrent mechanism of data submission, the staff could develop a dedicated and secure IATTC database, which would greatly streamline the research work.

6.2. WCPFC current data submission mechanisms

WCPFC14 Summary Report Attachment T provides reporting standards, specifications, and procedures for electronic reporting (also recreated here in Table 1a). Data are provided to WCPFC in one of the following file types: Microsoft Excel file; Comma separated values (CSV) text file; Text file (TAB delimited); text file (no delimiters); XML; JSON; NAF (see page 4: electronic formatting specifications). E-Reporting Apps are also available and increasingly used to obtain longline logbook data. These data are automatically transmitted to SPC's operational catch and effort database managed through the TUFMAN 2 system.

6.3. IOTC current data submission mechanisms

Longline data are collected by fishers with bound paper or electronic logbooks and data entry tools (IOTC Resolution 15/01). Data are then submitted to the IOTC Secretariat by email using IOTC's set of standardized Excel forms related to the different longline data types (see IOTC column in Table 2). For example, estimates of total annual retained catches in live weight by IOTC Area, species and type of fishery (Form 1RC), estimates of discard levels (dead individuals) in live weight (or number) by IOTC Area, species and type of fishery (Form 1DI), binary matrix of annual records of retained catches or discards by species and fishery group (Form 1DR), total annual number of fishing crafts operated by type of fishery, type of craft and craft size (Form 2FC), catch by species in number or live weight and effort in number of hooks set by 5° grid area and month strata (extrapolated to annual catch) (Form 3CE), and length/weight data by species, type of fishery and 5° grid area and month strata (Form 4SF). All of these IOTC forms may be downloaded here. Access to operational-level set-by-set longline data has been granted to staff of the IOTC Secretariat for some specific projects and is not routinely submitted.

6.4. ICCAT current data submission mechanisms

Similar to IOTC, ICCAT also has a set of standardized Excel forms for users to fill in. Each Excel form is specific to the type of data to be collected and submitted (see ICCAT column in Table 2). For example, ICCAT has a dedicated form for nominal annual catch of tuna, tuna-like species and sharks by region, gear, flag and species (Form ST02-T1NC), fleet characteristics (Form ST01-T1FC), catch and effort statistics by area, gear, flag, species and by month (Form ST03-T2CE), and size frequency data (Form ST04-T2SZ, ST05-T2CS). Similar to IATTC and IOTC, access to operational-level set-by-set longline data has been granted to specific scientists for particular projects.

6.5. Potential options and future tools for submitting data to IATTC

CPCs may continue to submit the data in a format of their design, ensuring data are provided for the staff's initial proposed minimum list of required data fields—similar to WCPFC's list of minimum required data fields—to be discussed at this workshop and as approved by the Commission. However, the IATTC staff recommends the following with the idea of easing the reporting burden on CPCs at the forefront of each of these options in the near future. For the longer-term option of online forms and e-reporting apps, the workflow would be automatized and with stricter data quality controls in place. Any update to the forms would be also synchronized automatically on devices. This option is obviously more complex in nature due to the higher investments in time and resources as much thought will be required to implement a web API associated with adequate data-entry devices to facilitate data collection.

RECOMMENDATION:

That the IATTC staff develop:

1. Standards, guidelines and templates for mandatory data fields, thereby allowing CPCs to submit the forms as long as they follow these templates in their preferred format (e.g. CSV, XLS).
2. Default digital templates in Excel to ease CPCs workflow.
3. Online forms and e-reporting apps, in the longer term.

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TABLE 1a. List of WCPFC longline logbook e-reporting data fields and field descriptions as provided in WCPFC14 Summary Report Attachment T: Standards, Specifications, and Procedures (Ssps) for Electronic Reporting in the Western and Central Pacific Fisheries Commission (see pages 20-28).

CATEGORY		LL Trip Level Data	WCPFC field
LL TRIP	TRIP IDENTIFIER	Internally generated. Can be NATURAL KEY or unique integer. NATURAL KEY would be VESSEL IDENTIFIER + DEPARTURE DATE	
	VESSEL IDENTIFIER	PROVIDE the WCPFC VID, for the VESSEL undertaking this trip. REFER TO APPENDIX A4 Using a vessel identifier field ("VID") removes the redundancy of including all vessel attributes with each trip record and ensures standardisation and consistency through referencing the main Vessel Registry database.	Mandatory
	COUNTRY OF CHARTER	PROVIDE the Country CHARTER responsible for chartering the vessel, where relevant. This only applies if the vessel has been chartered according to the requirements under WCFPC CMM 2012-05 – chartering notifications CHAR(2) WCPFC alpha-2 two-letter country code (refer to WCPFC codes web page)	Optional
	AGENT FOR UNLOADING	PROVIDE the name of the Agent for the Unloading. CHAR(50) Where possible, link this field to a reference table of authorised Agents for unloading. (referential integrity)	Optional
	TRIP NUMBER	PROVIDE the trip number undertaken by this vessel for the year. Trip number is sequential, starting at 1 for first trip of the year for each vessel.	Optional
	PRIMARY TARGET SPECIES	PROVIDE the Primary Target species for this trip. CHAR(3) REFER TO APPENDIX A7	Optional
	PORT/PLACE OF DEPARTURE	PROVIDE the Port of Departure CHAR(5). REFER TO APPENDIX A3 WCPFC LOCATION CODE. In the rare case that the port is not in the WCFPC LOCATION codes, then the actual port name can be included and a WCFPC LOCATION code will be generated. If the start of a trip coincides with recommencing fishing operations or transiting to a fishing area after transhipping part or all of the catch at sea then "ATSEA" code shall be reported in lieu of the port of departure.	Mandatory
	PORT/PLACE OF UNLOADING	PROVIDE the Port of Return for Unloading or indicate TRANSHIPMENT AT SEA. CHAR(5) UPPERCASE. REFER TO APPENDIX A3 WCPFC LOCATION CODE. In the rare case that the port is not in the WCFPC LOCATION codes, then the actual port name can be included and a WCFPC LOCATION code will be generated. If the end of a trip coincides with transhipping part or all of the catch at sea, then "ATSEA" code shall be reported in lieu of the port of unloading.	Mandatory
	DATE OF DEPARTURE	PROVIDE DATE and TIME of departure for this trip. REFER TO APPENDIX A1. ISO 8601 – Date only format If the start of a trip coincides with recommencing fishing operations or transiting to a fishing area after transhipping part or all of the catch at sea then date for the transhipment at sea shall be indicated.	Mandatory
	DATE and TIME OF DEPARTURE	PROVIDE TIME of departure for this trip. REFER TO APPENDIX A1. ISO 8601 - Date and times format The chronology of Departure date with respect to Date of arrival in port and the Days at sea must be valid.	Optional
	DATE OF UNLOADING	PROVIDE DATE of unloading or indicate DATE for the TRANSHIPMENT AT SEA. REFER TO APPENDIX A1. ISO 8601 – Date only format If the end of a trip coincides with transhipping part or all of the catch at sea, then date for the transhipment at sea shall be indicated.	Mandatory
	DATE and TIME OF UNLOADING	PROVIDE DATE and TIME of unloading or indicate TIME for the TRANSHIPMENT AT SEA. REFER TO APPENDIX A1. ISO 8601 - Date and times format If the end of a trip coincides with transhipping part or all of the catch at sea, then date for the transhipment at sea shall be indicated. The chronology of Departure date with respect to Date of arrival in port and the Days at sea must be valid.	Optional
LICENSE PERMIT DATA	FISHING PERMIT'/LICENSE NUMBERS	PROVIDE License/Permit number that the vessel holds for the period of the TRIP. CHAR(40) UPPER CASE. Where possible, include validation to ensure the Permit format relevant to the agreement (national or subregional) complies to the required format.	Optional
LL ACTIVITY/SET DATA	ACTIVITY	PROVIDE each ACTIVITY of the vessel within the DAY. REFER TO APPENDIX A5. The current WCPFC requirement is for this item to be reported for each set and for days on which no sets were made.	Mandatory
	DATE/TIME ACTIVITY	PROVIDE the NOON DATE/TIME for each day that the vessel is at sea when a set was not made on that day, OR the START DATE/TIME of the SET. REFER TO APPENDIX A1. Date and Time may be automatically generated through VMS or other GPS-type devices.	Optional

CATEGORY		LL Trip Level Data	WCPFC field
	START TIME OF SET	PROVIDE the start of the set. REFER TO APPENDIX A1. Date and Time may be automatically generated through VMS or other GPS-type devices.	Mandatory
	POSITION LATITUDE	PROVIDE the LATITUDE position when the set started. REFER TO APPENDIX A2. The WCPFC requirement stipulates that the position of start of set should be reported in units of at least minutes of latitude and longitude. If no sets are made on that day, the noon position is to be reported. Position coordinates may be automatically generated through VMS or other GPS-type devices.	Mandatory
	POSITION LONGITUDE	PROVIDE the LONGITUDE position when the set started. REFER TO APPENDIX A2. The WCPFC requirement stipulates that the position of start of set should be reported in units of at least minutes of latitude and longitude. If no sets are made on that day, the noon position is to be reported. Position coordinates may be automatically generated through VMS or other GPS-type devices.	Mandatory
	NUMBER OF BRANCHLINES	PROVIDE the NUMBER OF BRANCHLINES (synonymous to HOOKS BETWEEN FLOATS and BRANCHLINES between FLOATS) for this set. Field format: NUMBER(2). The "Number of Branchlines" are also commonly referred to as "Hooks between floats" or "Branchlines between FLOATS" for some fleets. The code must be within the valid range. Only relevant with ACTIVITY = "1 – FISHING SET"	Mandatory
	NUMBER OF HOOKS	PROVIDE the total number of HOOKs per set. Field format: NUMBER(4). The code must be within the valid range (e.g. < 5,000 hooks). Only relevant with ACTIVITY = "1 – FISHING SET"	Mandatory
LL CATCH DATA	SPECIES CODE	For each species taken in the set, PROVIDE the SPECIES CODE according to the FAO standard species code list. CHAR(3) UPPER CASE. REFER TO APPENDIX 8.	Mandatory
	CATCH NUMBER	PROVIDE the retained CATCH NUMBER OF FISH covering this species. INTEGER(6). Validate that it is within the acceptable range for this species. (Refer to the SPECIES_RANGE table provided)	Mandatory
	CATCH WEIGHT	PROVIDE the retained CATCH ESTIMATED WEIGHT (metric tons to three decimal places) for this species. Field format: DECIMAL(6,3). Validate that it is within the acceptable range for this species. (Refer to the SPECIES_RANGE table provided)	Optional
	DISCARDED / RELEASED NUMBER	PROVIDE the NUMBER of this species DISCARDED or RELEASED. INTEGER(6). Validate that it is within the acceptable range for this species. (Refer to the SPECIES_RANGE table provided)	Mandatory

TABLE 1b. Fields to be reported to the IATTC in addition to the Table 1a fields.

Data Type	IATTC (proposed logbook fields)
Vessel and gear characteristics	Mainline material (Record the material among multiple options: Nylon monofilament, Nylon multifilament, Natural material, Polyester, Polyethylene, Glass filament, Other (Specify))
Set-level information	DateTime beginning of daily fishing activities: UTC and vessel operational time (to be able to do time conversions)
	DateTime of set end (Record the date and time of the end of the set (MM-DD-YYYY-hh:mm) in vessel operational time
	Number of light sticks (Record the number of light sticks used.

TABLE 2. Comparison of the types of statistical data required by each tuna Regional Fishery Management Organization. * Pursuant to annual IATTC Memo Ref.: 0123-410, dated April 4, 2022, and Resolution C-03-05. Links to data requirements for each t-RFMO are provided in the column headers.

Type of data	Description of statistical data	IATTC*	WCPFC	IOTC	ICCAT
TASK I ANNUAL CATCHES	Annual catches	Gross annual removals (round weight of all fish caught or killed during fishing operations) and disposition (retained or discarded) of tuna and tuna-like species, and other species taken in fisheries which capture tuna and tuna-like species in the Antigua Convention Area. If the data provided are nominal catches (round weight of retained catch when there is no information on discards), please note this when providing the data. These catch data should be reported as round weight, in metric tons or in kilograms, by species, by year, gear and disposition (retained or discarded). If the round weights are estimated by conversion from processed or sampled weights or measurements, or by some other means, the method and the sample data used to obtain the estimates should be provided.	The following estimates of catches during each calendar year shall be provided to the Commission for each gear type: Catches of BET, SKJ, YFT, BLU and BLM in: 1) the WCPFC Statistical Area, and 2) the portion of the WCPFC Statistical Area east of the 150° meridian of west longitude; Catches of ALB, MLS, SWO and PBF in: 1) the Pacific Ocean south of the Equator, 2) the Pacific Ocean north of the Equator, 3) the WCPFC Statistical Area north of the Equator, 4) the WCPFC Statistical Area south of the Equator, and 5) the portion of the WCPFC Statistical Area east of the 150° meridian of west longitude; Catches of BSH, FAL, OCS, MAK, THR, POR (south of 20°S, until biological data shows this or another geographic limit to be appropriate), HAM (winghead, scalloped, great, and smooth), and RHN	See Resolution 15/02 on Mandatory Statistical Reporting Requirements Estimates of total annual retained catches in live weight by IOTC Area, species and type of fishery (Form 1RC: obligatory for IOTC spp. and Sharks (R-05/05); voluntary for other spp.) Annual retained catches of yellowfin tuna in live weight by IOTC Area, type of fishery and vessel category (≥24m LOA or <24m LOA and fishing outside the EEZ) (Form 1RC-YFT: obligatory (R-19/01 (para. 26)) Estimates of discard levels (dead individuals) in live weight (or number) by IOTC Area, species and type of fishery (Form 1DI: obligatory for IOTC spp., Sharks (R-05/05), Seabirds (R-10/06), Marine Turtles (R-12/04); Cetaceans (R-13/04); Whale sharks (R-13/05); voluntary for other spp.) Binary matrix of annual records of retained catches or discards by species and fishery group (Form 1DR: obligatory for IOTC spp. and elasmobranchs R-18/07)	Nominal annual catch of tuna, tuna-like spp. and sharks by region, gear, flag and species, and where possible by EEZ and High Seas catches should be reported in kilograms, round (live) weight Art. IX (ICCAT Convention); Rec. 05-09; Res. 66-01; Various conservation and management measures relating to individual species. Form ST02-T1NC. Information required for all CPCs. If no catches of any tuna or tuna like species have been made, this should be reported to the Secretariat
TASK I EFFORT	Annual effort statistics	Fishing power (fleet) statistics. The number of fishing vessels, by gear, operating in the Antigua Convention Area in each calendar year should be reported.	The number of vessels active in the WCPFC Statistical Area during each calendar year shall be provided to the Commission for each gear type. For longliners, pole-and-line vessels, and purse seiners, the number of vessels active shall be provided by gross registered tonnage (GRT) class. The GRT classes are defined as follows: Longline: 0–50, 51–200, 201–500, 500+; Pole-and-line: 0–50, 51–150, 150+ Purse seine: 0–500, 501–1000, 1001–1500, 1500+	Total annual number of fishing crafts operated by type of fishery, type of craft and craft size. Form 2FC for Fisheries targeting IOTC species. See FSA-Annex I, Article 4. Note this is voluntary.	Fleet characteristics: Number of fishing vessels by size classes, gear and flag Art. IX (ICCAT Convention); Rec. 05-09; Res. 66-01; Various conservation and management measures relating to individual species. Form: ST01-T1FC. Information required for all CPCs. If no fleet exists, this fact should be reported to the Secretariat

Type of data	Description of statistical data	IATTC*	WCPFC	IOTC	ICCAT
TASK II CATCH & EFFORT	Aggregated catches	TASK II level 2: 1°x1°-month aggregated data TASK II level 3: 5°x5°-month aggregated data	If the coverage rate of the operational catch and effort data that are provided to the Commission is less than 100%, then catch and effort data aggregated by time period and geographic area that have been raised to represent the total catch and effort shall be provided. Longline catch and effort data shall be aggregated by periods of month and areas of 5° longitude and 5° latitude. Purse-seine and ringnet catch and effort data shall be aggregated by periods of month, areas of 1° longitude and 1° latitude, and type of school association. Catch and effort data for other surface fisheries targeting tuna shall be aggregated by periods of month and areas of 1° longitude and 1° latitude. If the coverage rate of the operational catch and effort data that are provided to the Commission is less than 100%, then catch and effort data that have been raised to represent the total catch and effort shall also be aggregated by periods of year and areas of national jurisdiction and high seas within the WCPFC Statistical Area. Catch and effort data aggregated by periods of month and areas of 5° longitude and 5° latitude that have been raised to represent the total catch and effort, and unraised longline catch and effort data stratified by the number of hooks between floats and the finest possible resolution of time period and geographic area, covering distant-water longliners may also be provided for the Pacific Ocean east of the eastern boundary of the WCPFC Statistical Area	LONGLINE: Catch by species in number or live weight and effort in number of hooks set by 5° grid area and month strata (extrapolated to annual catch). (Form 3CE obligatory for IOTC spp. (R-15/02), Sharks (R-12/09; R-15/01; R-15/02; R-17/05; R-18/02), and voluntary for other bycatch (R-15/01; R-15/02)) LONGLINE: Catch by species in number (or live weight) and effort in number of hooks set by 1° grid area and month strata (extrapolated to annual catch). (Form 3CE voluntary for IOTC spp. (R-15/01; R-15/02) and Sharks (R-12/09; R-15/01; R-15/02; R-17/05; R-18/02)) See Resolution 15/02: Estimates of the total catch by species and gear, if possible quarterly, that shall be submitted annually (separated, whenever possible, by retained catches in live weight and by discards in live weight or numbers) for all species under the IOTC mandate as well as the most commonly caught elasmobranch species according to records of catches and incidents as established in Resolution 15/01 on the recording of catch and effort data by fishing vessels in the IOTC area of competence (or any subsequent superseding Resolution). Concerning cetaceans, seabirds and marine turtles, data should be provided as stated in Resolutions 13/04 on Conservation of Cetaceans, Resolution 12/06 on reduction the incidental bycatch of seabirds in longline fisheries and Resolution 12/04 on the conservation of marine turtles (or any subsequent superseding resolutions).	Catch and effort statistics by area, gear, flag, species and by month Art. IX (ICCAT Convention); Rec. 05-09; Res. 66-01; Various conservation and management measures relating to individual species. Form ST03-T2CE. Information required for all CPCs. See Requests for statistics on ATL tunas and sharks Monthly catch (all species catch composition) and effort statistics, disaggregated by fleet, gear, month, and geographical squares (longline: 5x5 or higher resolution, other gears: 1x1 or higher resolution). Preferably, observed data obtained from various sources (logbooks, auction sales, port sampling, landing ports, transhipments, etc.). Could also be equivalent estimations, raised to Task 1 nominal catches Form: ST03-T2CE

Type of data	Description of statistical data	IATTC*	WCPFC	IOTC	ICCAT
TASK II CATCH & EFFORT	Operational-level (logbook) catch and effort data	TASK II level 1: The IATTC staff collects operational data directly from the majority of purse-seine (PS) and pole-and-line (LP) vessels that fish for tunas in the Convention Area. The information that should be reported includes details of starting and ending position of sets, time gear set and retrieved, and other data which are specific to each gear and affect its efficiency, such as gear configuration (including, for longlines, total number of hooks fished, number of branch lines between floats, number of lightsticks, etc.), use of FADs or aircraft, and hook type. The catch for each operation should be reported by species, in both numbers and weight if available. Estimates of coverage rates by gear should be provided.	(e.g. individual sets by longliners and purse seiners, and individual days fished by pole-and-line vessels and trollers) shall be provided to the Commission. It is recognized that certain members and cooperating non-members of the Commission may be subject to domestic legal constraints, such that they may not be able to provide operational data to the Commission until such constraints are overcome. Until such constraints are overcome, aggregated catch and effort data and size composition data shall be provided. It is also recognized that certain members and cooperating non-members of the Commission may have practical difficulties in compiling operational data for fleets comprised of small vessels, such as certain sectors of the fisheries of Indonesia, the Philippines and small island developing states. Information on operational changes in the fishery that are not an attribute in the data provided is to be listed and reported with the data provision. CCMs are to provide, to the extent possible, the number of individual vessels per stratum and area covered by their operational data with the aggregated catch and effort data they submit to the Commission. Information on operational changes in the fishery that are not an attribute in the data provided is to be listed and reported with the data provision. Information on operational changes in the fishery that are not an attribute in the data provided is to be listed and reported with the data provision.See Attachment K, Annex I. Standards for the provision of Operational Level Catch & Effort Data set-by-set data is a requirement for operational longline catch and effort data … See tables at the end of https://meetings.wcpfc.int/node/16231	No specific mention of operational-level logbook data but see reference to data resolution in 15/02: For the work of relevant working parties under the IOTC Scientific Committee, longline data should be of a resolution of 1° grid area and month or finer. These data would be for the exclusive use of IOTC Scientific Committee and its Working Parties, subject to the approval of the data owners and IOTC Resolution 12/02 Data confidentiality policy and procedures and should be provided for scientific use only in a timely fashion. Access to set-by-set data has been granted to staff of the Secretariat through some specific projects, mostly in the context of CPUE analysis for deriving time series of abundance indices, *e.g.,* work on SWO with Seychelles and neritic tunas with I.R. Iran. As part of the collaborative work on joint longline CPUE which includes scientists from the main longline fleets operating in the Indian Ocean (Japan, China, Republic of Korea, and Seychelles), scientists attending the workshops had access to operational data of all fleets on the condition of signing a Non-Disclosure Agreement and removing all data at the end of the meeting. The IOTC Resolution 12/02 as well as the recent FAO administrative circular 2022/07 define the nature of the data sets and the rules of confidentiality that prevail for their use and dissemination.	No logbook data are routinely received. access to set-by-set data was granted to specific scientists for particular projects, or for this species group in a specific condition.

Type of data	Description of statistical data	IATTC*	WCPFC	IOTC	ICCAT
TASK II SIZE DATA	Length/weight size frequency data	Lengths and weights of individual tunas and tuna-like fishes in the catch should be provided at the highest spatial-temporal resolution possible (*i.e.* Level 1 if known). Type of measurement and condition of the fish should be noted for each measurement. When catch and effort data are reported at Level 2 or 3, catch-at-size data should be reported by gear, area, and month as well, if possible. In all cases, catch-at-size data should be reported at the finest resolution possible. Details of the design of the sampling program should be provided.	Length and/or weight composition data that are representative of catches by the fisheries shall be provided to the Commission at the finest possible resolution of time period and geographic area and at least as fine as periods of quarter and areas of 20° longitude and 10° latitude. Length-class intervals defined as: SKJ&ALB 1cm; YFT&BET ideally 1cm, but not more than 2cm; Billfish ideally 1cm, but not more than 5cm. The weight size class intervals are defined as Tunas and Billfish spp. 1kg. CCMs shall indicate whether lengths and/or weights are rounded up or rounded down to the unit specified.	Length/weight data by species, type of fishery and 5° grid area and month strata. Form 4SF. Obligatory for IOTC spp. (R-15/02) and Sharks (R-17/05) 15/02: Size data shall be provided for all gears and for all species according to paragraph 4 and following the guidelines set out by the procedures described in the Guidelines for the reporting of fisheries statistics to the IOTC. Size sampling shall be run under strict and well described random sampling schemes which are necessary to provide unbiased figures of the sizes taken. Sampling coverage shall be set to at least one fish measured by ton caught, by species and type of fishery, with samples being representative of all the periods and areas fished. Alternatively, size data for longline fleets may be provided as part of the Regional Observer Scheme where such fleets have at least 5% observer coverage of all fishing operations. Length data by species, including the total number of fish measured, shall be submitted by a 5° grid area by month, by gear and fishing mode (e.g. free-swimming schools or schools in association with floating objects for the purse seiners). Documents covering sampling and raising procedures shall also be provided, by species and type of fishery.	TASK II Size data: Actual size frequencies of fish sampled by area, gear, flag, species and by month and by sex if possible. Art. IX (ICCAT Convention); Rec. 05-09; Res. 66-01; Various conservation and management measures relating to individual species (Form ST04-T2SZ; information required for all CPCs) TASK II: Catch-at-size data: for BFT, ALB, YFT,BET and SKJ tunas and SWO, by gear, sampling area and by month or quarters, and by sex and by 5x5 degree squares if possible. The ICCAT form 3-6 to show sampling coverage and data substitutions is also required. Art. IX (ICCAT Convention); Rec. 05-09; Res. 66-01; Various conservation and management measures relating to individual species. (Form: ST05-T2CS; information required for all CPCs) There are two different forms for submission of this data one is for catch at size (raised to the catch) and another for sampling data. See https://www.iccat.int/en/submitSTAT.html

Type of data	Description of statistical data	IATTC*	WCPFC	IOTC	ICCAT
TASK II Aggregated catch estimations (i.e. raised or unraised options for reporting data)	Estimation methods	If the round weights in the TASK II catch and effort statistics are estimated by conversion from processed or sampled weights or measurements, or by some other means, the method and the sample data used to obtain the estimates should be provided.For Level 2 and Level 3 aggregated data, there are two options for provision of data to the Commission. In either case, the data should be developed, whenever possible, from logbook and unloading data, and the method should be fully documented. RAISED: The total number of vessels operating in a time-area stratum should be reported. The total number of operations of gear made in an time-area stratum should be provided by gear-configuration stratum, with associated gross removals (or nominal catch, if information on discards is not available) by species, in both numbers and round weight, if available. In this option, summarized logbook and landing data (the sample data) are used to develop estimates that are then raised to totals. The coverage rates, and detailed descriptions and calculations for the method used to obtain the estimates of total catch and effort by strata are to be provided. UNRAISED: The data from logbook and unloading records are summarized to provide sample statistics of fishing effort and catch by species in numbers of fish and round weight, within area-time-gear configuration strata, as discussed in Raised Option. The number of individual vessels from which the observations were obtained in an area-time stratum are also reported. Estimates of the total number of vessels operating by area, and of total catch by area-time, should be provided in as much detail as possible, if available.*note: limited if any info on estimation is received	The statistical methods used to estimate the annual and seasonal catches shall be reported to the Commission, with reference to the coverage rates for each type of data (e.g. operational catch and effort data, records of unloadings, species composition sampling data) that is used to estimate the catches and to the conversion factors that are used to convert the processed weight of longline-caught fish to whole weight.The statistical and sampling methods that are used to derive the size composition data shall be reported to the Commission, including reference to whether sampling was at the level of fishing operation or during unloading, details of the protocol used, and the methods and reasons for any adjustments to the size data. Where feasible, this shall also be applied to all historical data.	Resolution 15/02 Mandatory Statistical Reporting Requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs): Longline fisheries: catch by species, in numbers or weight, and effort as the number of hooks deployed shall be provided by 5° grid area and month strata. Documents describing the extrapolation procedures (including raising factors corresponding to the logbook coverage) shall also be submitted routinely. For the work of relevant working parties under the IOTC Scientific Committee, longline data should be of a resolution of 1° grid area and month or finer. These data would be for the exclusive use of IOTC Scientific Committee and its Working Parties, subject to the approval of the data owners and IOTC Resolution 12/02 Data confidentiality policy and procedures, and should be provided for scientific use only in a timely fashion. Effort units reported should be consistent with those effort requirements of Resolution 15/01 or any subsequent revision of such resolution. Information on estimation is available in the metadata fields "ESTIMATION (EST)" and "DATA PROCESSING METHOD (DPR)" of IOTC form 3CEFor size data in 15/02: Documents covering sampling and raising procedures shall also be provided, by species and type of fishery.	See TASK II Catch & Effort above: Requests for statistics on ATL tunas and sharks Monthly catch (all species catch composition) and effort statistics, disaggregated by fleet, gear, month, and geographical squares (longline: 5x5 or higher resolution, other gears: 1x1 or higher resolution). Preferably, observed data obtained from various sources (logbooks, auction sales, port sampling, landing ports, transshipments, etc.). Could also be equivalent estimations,raised to Task 1 nominal catches Form: ST03-T2CE The 5 by 5 data needs to be raised to the fleet total, and the raising process is done internally by each CPC. There has been request to submit meta-data information explaining the procedure for raising the catches, but not much has been submitted. Most CPCs would obtain their catch data from landing information plus sampling.

TABLE 3a. Principal tunas, billfishes, and sharks (species in grey) for which data should be provided.

Common name	**Scientific or family name**	**ASFIS code**
Albacore tuna	*Thunnus alalunga*	ALB
Bigeye tuna	*Thunnus obesus*	BET
Pacific bluefin tuna	*Thunnus orientalis*	PBF
Skipjack tuna	*Katsuwonus pelamis*	SKJ
Yellowfin tuna	*Thunnus albacares*	YFT
Unidentified tunas nei[8]	Scombridae nei	TUN
Eastern Pacific bonito	*Sarda chiliensis*	BEP
Striped bonito	*Sarda orientalis*	BIP
Unidentified bonitos	*Sarda* spp.	BZX
Black skipjack tuna	*Euthynnus lineatus*	BKJ
Black marlin	*Istiompax indixa*	BLM
Blue marlin	*Makaira nigricans*[9]	BUM
Striped marlin	*Kajikia audax*	MLS
Sailfish	*Istiophorus platypterus*	SFA
Shortbill spearfish	*Tetrapturus angustirostris*	SSP
Unidentified billfishes, but **not** including swordfish [8]	Istiophoridae nei	BIL
Swordfish	*Xiphias gladius*	SWO
Blue shark	*Prionace glauca*	BSH
Silky shark	*Carcharhinus falciformis*	FAL
Oceanic whitetip shark	*Carcharhinus longimanus*	OCS
Shortfin mako	*Isurus oxyrinchus*	SMA
Longfin mako	*Isurus paucus*	LMA
Mako sharks nei[8]	*Isurus* spp. nei	MAK
Bigeye thresher shark	*Alopias superciliosus*	BTH
Pelagic thresher shark	*Alopias pelagicus*	PTH
Thresher sharks nei[8]	*Alopias* spp. nei	THR
Great hammerhead shark	*Sphyrna mokarran*	SPK
Scalloped hammerhead shark	*Sphyrna lewini*	SPL
Smooth hammerhead shark	*Sphyrna zygaena*	SPZ
Scalloped bonnethead shark	*Sphyrna corona*	SSN
Scoophead shark	*Sphyrna media*	SPE
Bonnethead shark	*Sphyrna tiburo*	SPJ
Hammerhead sharks nei[8]	Sphyrnidae nei	SPY
Whale shark	*Rhincodon typus*	RHN

[8] nei: Not elsewhere included. These catches are known only to the indicated taxonomic level.
[9] Classified previously in some data systems as *Makaira mazara* (BLZ, Indo-Pacific blue marlin)

TABLE 3b. Selected principal taxa of interest known to be caught by vessels and gears fishing for species under the purview of the Commission in the Antigua Convention Area. Catches of species not shown on this list should be reported using the common name, and the scientific name if known, as well as the ASFIS 3-alpha code if available. Note that codes have not been assigned for all species. Resolutions pertaining to certain taxa and general data provision are provided in Annex B of the IATTC Annual Memo (IATTC Memo Ref: 0123-410, dated April 4, 2022), which includes guidelines for data provision and corresponds to C-03-05. This table may be modified as needed.

Common name	**Scientific or family name**	**ASFIS code**
Salmon shark	*Lamna ditropis*	LMD
Blacktip shark	*Carcharhinus limbatus*	CCL
Sharks nei	Elasmobranchii nei	SKX
Unidentified fishes	Osteichthyes nei	MZZ
Pelagic stingray	*Pteroplatytrygon violacea*	PLS
Stingrays nei	*Dasyatis* spp.	STI
Giant manta	*Mobula birostris*	RMB
Devil fish	*Mobula mobular*	RMM
Munk's devil ray	*Mobula munkiana*	RMU
Chilean devil ray	*Mobula tarapacana*	RMT
Smoothtail manta	*Mobula thurstoni*	RMO
Manta rays nei	*Mobula* spp.	RMV
Common dolphinfish	*Coryphaena hippurus*	DOL
Dolphinfishes nei	Coryphaenidae	DOX
Wahoo	*Acanthocybium solandri*	WAH
Jacks, crevalles nei	*Caranx* spp.	TRE
Rainbow runner	*Elagatis bipinnulata*	RRU
Amberjacks nei	*Seriola* spp.	AMX
Opahs nei	*Lampris spp.*	LAP
Snake mackerels, escolars nei	Gempylidae	GEP
Pomfrets, ocean breams nei	Bramidae	BRZ
Olive Ridley turtle	*Lepidochelys olivacea*	LKV
Green turtle	*Chelonia mydas*	TUG
Loggerhead turtles	*Caretta caretta*	TTL
Hawksbill turtle	*Eretmochelys imbricata*	TTH
Leatherback turtle	*Dermochelys coriacea*	DKK
Petrels nei	*Procellaria* spp.	PTZ
Shearwaters nei	*Puffinus* spp	PQW
Seagulls nei	*Larus* spp.	LHX
Boobies and gannets nei	Sulidae spp.	SZV
Pantropical spotted dolphin	*Stenella attenuata*	DPN
Spinner dolphin	*Stenella longirostris*	DSI
Striped dolphin	*Stenella coeruleoalba*	DST
Common dolphin	*Delphinus delphis*	DCO

TABLE 4. Recommended template of data fields (vessel and gear characteristics and operational-level logbook) for industrial longline vessels proposed to be collected and submitted by individual CPCs to IATTC to facilitate stock assessments of target species and vulnerability assessments of species caught as bycatch. 4a: provides metadata fields for vessel, gear characteristics; and trip-level gear information; 4b: set-level information., 4c: set-level catch information, 4d: set-level size composition data

4a. Trip-level information

Data Type	IATTC proposed logbook fields
Vessel and gear characteristics	Flag (Vessel flag abbreviation)
	Unique Vessel Identifiers: Vessel name Vessel call sign) IMO (International Identification IMO number) (if available) IATTC Vessel number (IATTC Vessel register number assigned to all vessels) (for vessels having operated after 2002) Assigned code that allows the vessel to be identified over time (for vessels operated before 2002 and not afterwards)
	Length over all (Length of the vessel (meters))
	Gross tonnage (Vessel Gross Registered Tonnage) per C-18-06
	Vessel electronics: Radar equipped (Y/N) Echo sounder (Y/N) Global Positioning System (GPS) (Y/N) Sea Surface Temperature (SST) gauge (Y/N) Search light Sonar (Y/N) Omnidirectional Sonar (Y/N) Radio/ Satellite Buoys (Y/N) Acoustic Doppler Current Meter Y/N) Expendable Bathythermograph (XBT) (Y/N) Satellite imagery, remote sensing and modelling information service (e.g fisheries oceanography analysis) Y/N Other (specify)
	Refrigeration type: ( ) blast frozen, ( ) refrigerated sea water, ( ) ice, ( ) other ___
	Mainline material (Record the material among multiple options: Nylon monofilament, Nylon multifilament, Natural material, Polyester, Polyethylene, Glass filament, Other (Specify))
	Branch line material(s) (Record the material of the branchline. A branch line can consist of one type of material like monofilament or it can be made up of many different materials like braided nylon wire trace and mono filament, etc.)
Trip-characteristics	Departure Date (Date and time the vessel departs from port (MM- DD -YYYY))
	Departure Port (Name of the port of departure or transshipment (if ports are close to the IATTC regional offices, the logbook information could complement port sampling in the future)
	Arrival Date (Date and time of vessel's return to port at the completion of its trip (DD-MM-YYYY-hh:mm))
	Arrival Port (Name of the port of arrival or transshipment (If the ports are close to the IATTC regional offices, the logbook information could complement port sampling in the future))
	Was an observer onboard (Y/N)

4b. Set-by-set information

Data Type	For each set
Set-level information	Target species of target type or target species groups
	DateTime beginning of daily fishing activities: UTC and vessel operational time (to be able to do time conversions)
	DateTime of set start (Record the date and time of the start of the set)[10]
	DateTime of set end (Record the date and time of the end of the set) [10]
	DateTime of haul start (Record the date and time the first buoy of the mainline is hauled from the water to start the haul [10]
	DateTime of haul end (Record the date and time the last buoy of the mainline is hauled from the water to end the haul)[10]
	Haul direction (Record whether the haul was from 1=Start to finish or 2=Finish to start)
	Latitude at start of set [11]
	Longitude at start of set [12]
	Latitude at end of set [11]
	Longitude at end of set [12]
	Latitude at haul start [11]
	Longitude at haul start [12]
	Latitude at haul end [11]
	Longitude at haul end [12]
	Wire trace (For each set indicate whether wire trace was used: 0 (no wire trace used); 1 ("SOME LINES", e.g. the vessel used wire traces on certain branch line positions during the set); 2 ("ALL LINES", e.g. wire traces were used on all lines during the set))
	Use of shark line (a hook attached to the float or at the float line)
	Number of hooks in the set (Total number of hooks in each set.)
	Number of floats
	Number of hooks between floats
	Float line length (meters) (Length of the line that is attached to the floats)
	Branch line length(meters) (Length of the branch line)
	Was a shooter used? (Y/N) If yes, Line shooter speed (Line shooter speed (meters/second))
	Vessel speed (Vessel speed when setting (knots)) (OPTIONAL ONLY IF NO POSITIONS)
	Hook type (For each set, record the type of hook or hooks used)
	Line shooter speed (Line shooter speed (meters/second))
	Hook size (For each set, record the size of the hooks used)
	Bait type: Record bait (e.g. fish?, squid?, artificial?)
	Blue dyed bait used (Was the bait dyed blue? (Y/N))
	Number of light sticks (Record the number of light sticks used)
	Maximum depth of the fishing gear: Unknown ( ), estimated ( ), measured ( ) , how was max depth determined (estimated, TDR, other measuring gauge)Number of light sticks (Record the number of light sticks used.)
	How was max depth determined (estimated, TDR, other measuring gauge) (OPTIONAL)
Catch data	Species code: Provide the ASFIS species code for each species taken in the set (aligns with WCPFC) Catch number: Provide the total number of fish (by species) (Total number of fish caught of each listed species) (aligns with WCPFC) Catch weight: Provide the total weight (by species[13] (Total weight[14] nearest kg) of fish caught for the reporting day Discarded/Released number (PROVIDE the NUMBER of this species DISCARDED or RELEASED)
Size information for individual fish	If length or weight data is collected for a set, provide it associated with the set information

[10] Record in vessel operational time in the format MM-DD-YYYY-hh:mm

[11] Record the latitude in degrees and minutes and indicate ‘N’ or ‘S’ for north and south respectively

[12] Record the longitude in degrees and minutes and indicate ‘W’ or ‘E’ for west and east respectively

[13] Species in Tables 3a and 3b

[14] Indicate whether round weight, gilled and gulled, or other processing