INTER-AMERICAN TROPICAL TUNA COMMISSION

SCIENTIFIC ADVISORY COMMITTEE

TENTH MEETING

San Diego, California (USA)
13-17 May 2019

REPORT OF THE MEETING

AGENDA

	Documents
1. Opening of the meeting	
2. Adoption of agenda	
3. Research planning:	
a. Staff activities and research plan	SAC-10-01
4. Review of the implementation of recommendations adopted at previous SAC meetings: progress and outcomes	SAC-10-02
5. The fishery:	
a. The tuna fishery in the EPO in 2018	SAC-10-03
b. National reports	
c. Longline observer program reports	SAC-10-04

15. Strengthening and streamlining the IATTC scientific process and the presentation to the Commission of the conclusions and recommendations of the SAC 16. Other business 17. Adjournment	

The tenth meeting of the IATTC Scientific Advisory Committee (SAC) was held in San Diego, California (USA), on 13-17 May 2019. The attendees are listed in Appendix 4.

1. OPENING OF THE MEETING

The Director of the IATTC and Chairman of the SAC, **Guillermo Compeán**, opened the meeting, for which a quorum had been achieved, and welcomed the participants.

Carlos Marín was appointed rapporteur for the meeting.

2. ADOPTION OF AGENDA

The provisional agenda was adopted.

3. RESEARCH PLANNING

3.a. Staff activities and research plan (SAC-10-01)

Alexandre Aires-da-Silva presented a summary of the IATTC staff's Strategic Science Plan, activities and research plan (SAC-10-01).

Key points:

The staff is currently pursuing 52 research projects, organized under the seven themes of the Strategic Science Plan:

1. Data collection for scientific support of management
2. Life history studies for scientific support of management
3. Sustainable fisheries
4. Ecological impacts of fishing: assessment and mitigation
5. Interactions among the environment, ecosystem, and fisheries
6. Knowledge transfer and capacity building
7. Scientific excellence

Discussion:

The **European Union** stated that the Strategic Science Plan proposed by the staff in 2018 represents great progress towards an effective structuring of the staff's research, and urged that the necessary steps be taken to formalize and publicize the Plan.

4. REVIEW OF THE IMPLEMENTATION OF RECOMMENDATIONS ADOPTED IN PREVIOUS SAC MEETINGS, PROGRESS AND OUTCOMES (SAC-10-02)

Alexandre Aires-da-Silva presented a summary table of follow-up actions (SAC-10-02) to recommendations made by the SAC.

Key points:

Of the 13 recommendations, nine are completed, two are in progress, and two are planned but pending funding.

Discussion:

a. The SAC agreed that, in the future, the document should include a summary of follow-up actions to

not only recommendations made by the SAC, but also those of working groups, such as those on FADs and bycatch, both of which had met recently.

b. The SAC discussed the timing of the planned assessments for south Pacific swordfish (Project H.7.b) and south Pacific albacore tuna, on which the staff needs to collaborate with the Secretariat of the Pacific Community (SPC) and CPCs[1], once the tropical tuna assessments are completed in 2020. The staff plans to present these assessments in 2021 and 2022, respectively. Funding is necessary to conduct a workshop with collaborators/CPCs for each of these assessments.

5. THE FISHERY

5.a. The tuna fishery in the EPO in 2018 (SAC-10-03)

Nick Vogel presented a review of the fishery in 2018 (SAC-10-03), based on the most detailed and recent data available. Not all data are available in time for the SAC meeting; for example, CPCs are not required to submit longline data until 30 June.

Key points:

a. **Catches**: The catches of 593,000 metric tons (t) of yellowfin, skipjack, bigeye, and Pacific bluefin tunas by purse-seine and recreational gears in the EPO in 2018 were lower than in 2017, but still higher than the 15-year average.

b. **Catches by species and flag**: Ecuadorian vessels took about 46% of the total tuna catch in the EPO in 2018, including 62% of the skipjack and 63% of the bigeye. Mexican vessels caught 43% of the yellowfin and nearly all the bluefin.

c. **Yellowfin**: Most of the catches in 2018 were taken in sets associated with dolphins along the coast of the Americas, principally south of Baja California, Mexico, and north and east from the Galapagos Islands to the coast of South America. Total catches of 237,000 t in 2018 were only 3% higher than the previous 5-year average. The average weight of yellowfin in 2018, 7.7 kg, was greater than in the previous two years, but lower than the 2013-2015 averages, which ranged from 9.0 to 10.0 kg.

d. **Skipjack**: Catches in 2018 declined in all areas from previous years, except around the Galapagos Islands, where they increased noticeably. Most of the catch was taken in floating-object sets throughout the EPO, except near Peru, where most of the catch came from unassociated sets. Total 2018 catches of 287,000 t were 6% lower than the previous 5-year average. The average weight of skipjack in 2018 (1.9 kg) was among the lowest for the 6-year period (1.8-2.5 kg).

e. **Bigeye**: Most of the 2018 catch of bigeye was taken in the northern and southern floating-object fisheries throughout the year, with lesser amounts caught in the equatorial floating-object fishery in the first and second quarters. The average weight of bigeye in 2018 (4.8 kg) was within the observed range of the previous three years (4.7-5.0 kg), but lower than the 2013-2014 average of 5.6 kg.

5.b. National reports

Three CPCs (Chile SAC-10-INF-c(b), EU-Spain SAC-10-INF-c(a), and Korea SAC-10-INF-c(c)) had submitted their national reports for consideration by the SAC.

Discussion:

The **European Union** invited all the other CPCs to submit such reports, and stressed their importance and usefulness for the Committee and the work of the Commission.

[1] IATTC Members and Cooperating Non-Members

5.c. Longline observer program reports (SAC-10-04)

Brad Wiley presented SAC-10-04, a summary of longline observer reporting by CPCs pursuant to Resolution C-11-08.

Key points:

a. The three reporting requirements established by the SAC under C-11-08 are:
   i. summary national reports;
   ii. operational-level longline observer data; and
   iii. metadata for the longline fleet.

b. Compliance by CPCs with these requirements is poor. The number of summary reports submitted for 2018 is lower than for 2017, and some CPCs with significant longline effort in the EPO did not submit reports. Only five CPCs reported even a portion of the required operational longline observer data, and only one CPC reported observer data for the entire 2013-2018 period. Only one CPC has submitted metadata about its longline fleet.

Discussion:

a. Many participants stressed the need for improved compliance with C-11-08. There were concerns expressed about confidentiality issues and about lengthy error-checking procedures in national databases that could make timely reporting difficult.

b. **Alexandre Aires-da-Silva** noted that the Strategic Science Plan identifies electronic monitoring as a potential method for improving data collection from both the longline and purse-seine fisheries; a pilot project is currently being implemented for the purse seine-fleet.

Brad Wiley presented a proposal for standardizing the reports required under C-11-08 (SAC-10 INF-H), noting that this is a matter for the SAC to decide; no endorsement by the Commission is needed.

Key points:

a. The staff recommended that the measure of fishing effort under C-11-08 be changed to "total hooks" from "effective fishing days." "Total hooks" is a better effort metric and most commonly reported by the CPCs and in the literature.

b. The staff proposed a new standard format and template for annual summary reports under C-11-08.

Discussion:

The SAC adopted both (1) the staff's recommendation to change the measure of fishing effort to total hooks and (2) its proposed standard format and template for annual summary reporting (Appendices 2 and 3), to be implemented in 2019.

Ricardo Belmontes described the observer program for at-sea transshipments from longline to carrier vessels, the data the program provides, and the potential for gathering more complete information on catches and bycatches (*e.g.*, sharks caught and transshipped). Fishing vessels do not always report location data for their catches, so the geographical origins of some transshipped catches are unknown; this needs to be improved.

5.d. The fishery on FADs in the EPO (SAC-10-05)

Martín Hall presented information on the FAD fishery (SAC-10-05).

Key points:

a. The number of FAD deployments increased substantially in 2017 and 2018, but the number of FADs recovered has remained stable.

b. The total number of sets of all types has been fairly constant over time, but the number of floating-object sets has increased, at the expense of dolphin and unassociated sets.

c. FAD deployment is seasonal; it moves from the Humboldt Current early in the year to around the Galapagos Islands and then farther west later in the year.

d. FAD depth has increased in recent years.

Discussion:

The SAC discussed the increasing trend in FAD deployments, and the need to consider indicators for assessing the fishery's evolution. Some reasons for the trend were suggested: some FADs may be deployed in the western EPO but retrieved in the WCPFC area; FADs may be lasting longer; more FADs are now being deployed and lost; and a complex relationship between the fishery on FADs and the unassociated fisheries.

6. STOCK ASSESSMENTS

Alexandre Aires-da-Silva explained that the staff recently changed to using stock status indicators (SSIs) temporarily after problems arose with the stock assessments. Recently-acquired tools (spatiotemporal models) and data (from collaborative work with longline CPCs) are being used to investigate and resolve these issues.

6.a. Bigeye tuna: Indicators of stock status (SAC-10-06)

Mark Maunder presented SAC-10-06.

Key points:

a. All bigeye indicators, except catch, show apparent long-term trends, with their values in 2018 close to or exceeding the reference levels.

b. Indicators suggest increased purse-seine fishing mortality and reduced abundance of bigeye.

c. Indicators of days fished are probably biased.

d. The number of floating-object sets is increasing, due probably to increased efficiency in finding FADs with tunas; both the number of FAD deployments and the proportion of FADs with sonar have increased over time.

Discussion:

a. The SAC requested that, when the assessment report is updated, it include information on longline CPUEs and mean weight, and include results from both the current CPUE model and the spatiotemporal model.

b. **Japan** noted that 2018 longline indicators for its fleet are at historically low levels, and asked whether this was also the case with other longline fleets. **Mark Maunder** stated that the next update will include 2018 longline data and, if possible, mean weight data for longline catches; this would be covered in the presentation on the recent workshop on longline indices of abundance (section 7.a.ii). He also noted that, although the interpretation of indicators can be confusing, all indicators point to increased exploitation or overexploitation. This is reflected in the staff's recommendations.

6.b. Yellowfin tuna: Updated stock assessment (SAC-10-07)

Carolina Minte-Vera presented SAC-10-07.

Key points:

a. The annual recruitments during 2015-2017 were estimated to be at, or above, the average.

b. Recent fishing mortality (*F*) is slightly above the maximum sustainable yield (MSY) level.

c. Current spawning biomass is above the MSY level.

d. Recent biomass of fish aged 3+ quarters is above the MSY level.

e. The highest *F* has been on fish aged 2.75-5 years. The average annual *F* has been increasing for all age classes since 2009, but in 2017 it showed a slight decline for all age groups.

Discussion:

Carolina Minte-Vera discussed the effect of the FAD fishery on yellowfin MSY. The mix of the different fisheries is changing over time; the number of sets on floating objects, and the catch from those sets, are both increasing, and this negatively impacts MSY. The updated longline-derived index of abundance was influenced only by recent data, and not by rescaling of the time series. The change in the Kobe plot is also due to the change in recent data.

Carolina Minte-Vera discussed inconsistencies in the stock assessments of yellowfin (SAC-10 INF-F).

Key points:

a. The longline-derived indices of abundance, based from data from the Japanese fleet, are central to the stock assessments of yellowfin and bigeye. However, the level and geographical distribution of Japanese longline effort in the EPO have been decreasing, resulting in decreased sample size and coverage.

b. Inconsistencies were detected between indices based on longline data and on purse-seine data from dolphin sets.

c. The average length of the longline samples has been increasing since 2010.

Discussion:

a. At ICCAT, which has a similar process for improving the index of abundance, issues with the CPUE standardization were also found. One of them is that discards, which may vary over time, are not recorded. Discard information should be included in the CPUE operational data. Also, while the selectivities of the other longline fisheries are assumed to be the same as those of the Japanese fishery, they may be different. **Carolina Minte-Vera** noted that size-composition data collected by observers on longline vessels could be used to represent the catches, and better estimate the selectivity of those fisheries. However, the coverage, and the representativeness of the data, need to be checked. The average weight could be compared among fleets for CPCs that report longline catches both in numbers and in weight. A spatiotemporal standardized index for purse-seine catches in dolphin sets, developed by **Haikun Xu,** will be used in the assessment in the future.

b. **Alexandre Aires-da-Silva** stressed that the staff needs help from CPCs in understanding the longline data and producing better indices. The fact that a longline-based index of abundance could cause such a large interannual change in the yellowfin *F* multiplier is cause for concern. **Japan** expressed strong interest in contributing to improving the yellowfin and bigeye assessments, and in solving problems with the longline-based indices, by 2020.

c. The SAC agreed that the requirement for the staff to conduct assessments every year reduces the time available for research on improving the assessments. The interval between assessments could be increased, and indicators of population status could be monitored in the interim. The SAC requested that the staff prepare a proposal for a revised assessment schedule for its next meeting.

6.c. Yellowfin tuna: Indicators of stock status (SAC-10-08)

Carolina Minte-Vera presented yellowfin stock status indicators, based on data from longline and purse-seine fisheries over the whole EPO (SAC-10-08).

Key points:

a. Some indicators, such as standardized CPUE, point to low abundance; others, such as average size, do not. It is therefore not clear from the indicators whether yellowfin abundance is in fact reduced, or changes have occurred in the fisheries.

b. Of concern is the increase in floating-object sets, which has implications for the fishing mortality of juveniles.

Discussion:

a. The SAC discussed the lack of a CPUE for the purse-seine fishery on dolphins in the South EPO because the fishery is relatively small and variable; recently, however, the Venezuelan fleet has been experiencing high catch rates there. The spatiotemporal model developed by **Haikun Xu** for the EPO could be tried for this fishery.

b. Both longline catch and fishing effort, as well as sample sizes of size-composition data have been declining, and it is important to know whether the proportion of the catch sampled also declined in recent years. The sample size was very small in recent years compared to the past. It was suggested that changes in fisheries operations might have changed longline selectivity, but the staff examined several hypotheses (SAC-10-INF-F) and no one factor could be identified as the cause.

6.d. Skipjack tuna: indicators of stock status (SAC-10-09)

Mark Maunder presented several indicators of stock status that were data-based (catch, effort, CPUE, and mean weight) or model-based (biomass, recruitment, and exploitation rate) (SAC-10-09).

Key points:

a. Reference levels are based on the 5th and 95th percentiles.

b. Indicators did not detect any adverse impacts of the fishery.

c. Model-based indicators are probably biased.

d. Average weight was below its lower reference level during 2015-2017.

e. Average length is lower in the western EPO, but has been declining in all areas.

f. The long-term pattern in reduced average weight is probably due to increasing fishing mortality resulting from the increasing number of sets.

g. Current bigeye and yellowfin assessments are considered problematic, so skipjack status can no longer be inferred from the status of these species.

Discussion:

It was suggested that oceanographic variables should be considered in the analyses, as oscillations in the average weight of skipjack in the past could have been due to the effect of water temperature. The

average weight peaked during the 1983 and 1998 El Niño events, and fell during La Niña events.

6.e. Increase in floating-object sets

Jon López presented an analysis of the increase in floating-object sets (SAC-10 INF-K).

Key points:

a. The increase in the number of floating-object sets was investigated using data on catch and effort for all trips by purse-seine vessels departing during 2010-2018.

b. Trips were grouped into five categories, based on vessel size class, whether the vessel had a Dolphin Mortality Limit (DML), and the level of dolphin-set activity during the trip.

c. Results indicate that the increase in floating-objects sets since 2015 is due mainly to (1) a switch by Class 1-5 vessels from unassociated sets to floating-object sets, and (2) increased effort by Class-6 vessels with a DML that were not focused on fishing for tunas associated with dolphins.

Discussion:

a. The current limits on active FADs do not seem to be effective at limiting the number of FAD deployments, which increased in 2018. Also, the data on active FADs and FAD activity required under Resolutions C-17-02 and C-18-05, respectively, are not complete; this is a concern because they are the only source of information on FAD fishing by Class 1-5 vessels, which rarely carry on-board observers.

b. The staff's ability to estimate the effect of FAD fishing on the tuna stocks, and therefore the effectiveness of limits on active FADs, is limited by lack of access to the necessary data. This includes the high-resolution buoy data needed to estimate important quantities, such as time between deployment and first set, the total number of FADs in the water (with and without activated buoys), and the effect of FAD density on the size of tuna aggregations at FADs, especially relative to the amount of associated bycatch species.

c. Helicopters are useful not only in the dolphin-associated fishery, but also in the FAD and unassociated fisheries, and this factor could be considered in future analyses.

d. The SAC requested an estimate of the number of FADs that are active at any one time.

6.f. Availability of FAD data

Jon López presented information based on full or partial 2018 buoy data provided by 151 vessels from seven CPCs.

Key points:

a. In 2018, between 100 and 130 vessels reported daily, including a maximum of 105 Class-6 vessels, which, according to observer data, represented around 55% of Class-6 vessels with FAD deployments. Reporting rates for Class 1-5 vessels are unknown.

b. Active daily buoy values ranged between about 7,000 and 10,000 for vessels reporting in 2018. These values do not represent total FADs at sea, but the active FADs that were reported to the staff.

c. Vessel-specific analysis showed that most of these values are far from current limits.

Discussion:

a. The SAC discussed whether, given that the current limits on active FADs appear to be ineffective at controlling FAD activity, it would be useful for the staff to determine appropriate levels of active FADs, and propose other limits, including limits on numbers of deployments. The staff reiterated the

difficulty in relating the number of deployments with active FADs using current data and that high-resolution buoy data may help. Also, it reiterated the need for clear FAD management objectives to derive limits that meet requirements.

b. The potential for remote deactivation/activation of buoys is a concern, and implies that the numbers of active FADs available (even with full compliance with data submission) could be an underestimate of the number of FADs in the water. The resolution is clear on how FADs are to be activated, but is unclear about deactivations. Also, the resolution can be interpreted as allowing FADs to be activated aboard any vessel, regardless of their ownership, which is a source of concern for the staff.

c. The staff currently lacks the data necessary to conduct a quantitative evaluation of FAD impacts, particularly about limits on all FADs in the water. Without data on FAD history, it is not possible to investigate the relationship between active FADs, deployments, and catch rates. Changing the limit on the number of active FADs would require revising Resolution C-17-02, which establishes the limit.

6.g. Updates from ISC Working Groups

6.g.i. Pacific bluefin tuna (SAC-10 INF-M)

Shuya Nakatsuya reviewed the 2018-2019 activities of the ISC Working Group on Pacific bluefin tuna.

Key points:

SAC-10 INF-M includes responses by the Working Group to two requests by the IATTC-WCPFC NC Joint Working Group that met in September 2018:

1. Review the updated abundance indices, including recruitment index, up to 2017 to evaluate the need to change its scientific advice in 2018.
2. Conduct projections of harvest scenarios based on the 2018 assessment, and estimate a probability of achieving the initial and second rebuilding targets.

Discussion:

a. The full report, which will be available once it is approved by the ISC plenary in July, will contain the updated reference points based on the latest assessment.

b. Contradictory recruitment indices from two different fisheries illustrate the difficulty in monitoring the recruitment of Pacific bluefin, and the ISC will discuss further which recruitment index to use in the next assessment.

6.g.ii. North Pacific albacore tuna (SAC-10 INF-L)

Steve Teo reviewed the first round of MSE for North Pacific albacore tuna (SAC-10 INF-L). One workshop was held in 2019 in preparation for an MSE workshop, held during March 2019 in Yokohama, Japan.

Key points:

a. The objectives for the MSE workshop were: (1) examine the preliminary results of the initial round of MSE; (2) collate feedback from managers and stakeholders on future MSE improvements; and (3) develop recommendations for the WCPFC NC and IATTC.

b. The workshop participants recommended that the ISC albacore working group continue working on the MSE process for a second round, because the results presented from the first round were useful for understanding the tradeoffs and potential performance of candidate reference points and harvest control rules.

c. The participants developed a focused list of candidate reference points and harvest control rules to be examined for the second round of MSE, as well as a list of recommendations and future

improvements.

d. The provisional results of the North Pacific albacore MSE and the proposed work plan for the albacore working group will be reviewed by the ISC Plenary in July 2019, and may be subject to revision.

Discussion:

a. At the MSE workshop it was suggested that the results of the second round of MSE be provided before the stock assessment in early 2020. However, this would be hard to achieve, as substantial work is needed on the MSE models required for the second round, and it might delay the assessment work. The working group therefore decided to complete the assessment in early 2020 and the second round of MSE in late 2020-early 2021.

b. Regarding alternative ways of linking effort with fishing mortality, with variability and uncertainty, **Steve Teo** stated that several approaches were being tested, but no specific approach had been decided.

6.h. Other species

Sofia Ortega-García presented an overview of Pacific bonito biology and aspects of its historical fishery off Baja California, Mexico (SAC-10 INF-J).

Key points:

a. Because of high variability, it has been difficult to evaluate stock status.

b. The IATTC database (1959-2018) shows that almost all bonito catches come from unassociated sets, and that the greatest catches and catch per set in California waters occurred in the Gulf of Ulloa.

c. The greatest catches were recorded during the summer and fall.

d. In future, spatial models that include environmental variables and abundance indices will be used to determine stock status.

Discussion:

a. The SAC encouraged future work on bonito. It was noted that the study included only catches by purse-seine vessels fishing for tropical tunas and other catches reported to IATTC for other gears, and it is not known whether these catches represent the entire distribution of the species. Bonito is a highly productive species, and hence difficult to evaluate with conventional assessment models; it was suggested that indicators be used to monitor population status, as for tropical tunas.

b. Peru has been studying bonito in its waters because it is an important target species of artisanal fisheries, with catch and minimum size limits in place. Biological data are being collected and analyzed by universities in Peru.

c. The benefit of collaborative work was repeatedly acknowledged, especially since the IATTC staff does not have the resources to take the lead on assessing all species covered by the Antigua Convention. It was also noted that future work will include analyses to develop predictive models of species distributions, and this will help with information necessary for assessments.

7. MODELLING

7.a. Improving the bigeye tuna stock assessment

7.a.i. Report of the workshop on age and growth methodologies

Mark Maunder presented the results of the Workshop to evaluate bigeye and yellowfin tuna ageing

methodologies and growth models in the Pacific Ocean, held in January 2019. It had five objectives:

1. *Evaluate methodologies for counting daily and annual increments*. A technical meeting to compare methodologies was postponed due to the US Federal Government shutdown, but will take place as soon as possible, probably during 2019.

2. *Compare daily and annual increment counts from pairs of otoliths from both species*. Comparisons of EPO bigeye otoliths found differences between daily and annual increment counts for larger individuals. Further work on both species will be done at the postponed technical meeting.

3. *Compare growth rates from length-at-age data based on otolith increment counts with those from tagging data*. There is no evidence of inconsistency, but the comparisons are based on limited data.

   EPO tagging data suggest that there is two-stage growth, but daily otolith data do not. Also, growth rates differed by collection date and area.

   The WCPO tagging data included larger fish than the annual otolith data, and therefore estimate a higher L_∞.

4. *Evaluate the growth models being used in stock assessments for bigeye and yellowfin tunas in the EPO and WCPO.* The growth models ignore spatial variation. There are some inconsistencies in the length-composition data used in the assessment models and the growth models. Stock assessment results and management recommendations are sensitive to L_∞. Differences in the L_∞ used in the EPO and WCPO assessments of bigeye are representative of size composition in these stocks, as EPO fish grow to larger sizes. There is still uncertainty in the estimates of L_∞, and more data need to be collected.

5. *Develop a work plan to resolve any scientific and technical issues*. A technical workshop to compare methodologies and an exchange of additional otoliths from the EPO and WCPO should be done as soon as possible. The work plan should:
   a. Improve and document the protocols for daily and annual ageing.
   b. Conduct spatial analyses based on otolith weight, using all available otoliths.
   c. Extend the validation of daily and annual otolith counts across the Pacific by incorporating oxytetracycline marking in tagging programs.
   d. Extend the spatial/temporal/size distribution of EPO daily otolith data.
   e. Develop Pacific-wide assessments that can accommodate spatial variation in growth rates and reflect stock structure and movement hypotheses.

7.a.ii. Report of the workshop on longline indices of abundance (Project H.1.d)

Carolina Minte-Vera presented the preliminary results (based mostly on bigeye tuna) and the recommendations of the Workshop to improve the longline indices of abundance of bigeye and yellowfin tunas in the EPO, held in February 2019.

Key points:

a. For the workshop, Korea, China, Chinese Taipei, and Japan shared their operational-level longline data, required for improving longline indices of abundance, with the IATTC staff and an external consultant.

b. The continuation of this collaborative work will allow the construction of better indices and may allow for studies of stock structure and fisheries structure, local trends in abundance, length-frequencies, natural mortality, growth, and length-frequencies by sex.

Discussion:

a. The operational-level longline data were available only at the workshop, and the use of the data is

subject to IATTC confidentiality rules and a Memorandum of Understanding. The methods are still being developed, and if no difference is found between models that require operational-level data and simpler models that do not, the operational-level data are not needed.

b. The SAC stressed the importance of ensuring the confidentiality of the operational data provided by CPCs.

7.a.iii. Report of the external review of the bigeye assessment (Project T.1.a)

Kevin Piner reported on the 2nd Review of the Stock Assessment of Bigeye Tuna in the EPO, held in March 2019 (Workshop report). The objectives were to: 1) identify the best available science for use in the assessment; 2) provide an independent review of the assessment approach; 3) provide advice on future research and data collection that will improve the assessment and the provision of management advice. The IATTC staff provided background documents, prepared documents and presentations specifically for the review, ran model requests, and responded to information requests by the Panel that addressed topics related to data issues, stock structure and spatial structure, biology, data weighting, uncertainty, and diagnostics.

Key points:

a. Two general approaches to modelling were evaluated: a) the 2018 base-case model, with fleets as areas; and b) a new area-specific model, with four re-defined areas.

b. A focus for the meeting was an apparent "recruitment regime shift." The assessment model estimates an increase in average recruitment in the mid-1990s that coincided with an increase in purse-seine catches in the EPO.

c. The reason for the recruitment shift was not definitively determined, but several potential hypotheses were identified.

The Panel's report included several conclusions and recommendations, as starting points for further research. The Panel recommended that the order of future investigations should be to adjust natural mortality and growth before any further extensive exploration of spatial structure. The current areas-as-fleets model should still be used, but investigation of the spatially-structured model should continue. Operational-level CPUE data and fine-scale composition data should be further investigated.

Discussion:

Kevin Piner suggested that the large drop in the *F* multiplier in the last update assessment seemed reasonable, given that the exploitation rate increased and the population decreased in the assessment.

Juan Valero presented new analyses performed by the staff in preparation for the external review of the bigeye assessment (SAC-10 INF-G).

Key points:

a. Bigeye assessment models show a shift in estimated recruitment in the mid-1990s. Several hypotheses have been postulated, and some have been investigated by implementing alternative models using the latest Stock Synthesis version, and a fleets-as-areas approach with a newer definition of spatial structure.

b. Estimating growth internally, assuming higher natural mortality for juveniles, dome-shaped selectivities for all fishing gears, and using historical catches, reduced the recruitment shift, but estimated a wide range of *F* multiplier values.

c. Although some spatial models with movement reduced the recruitment shift, they were highly

sensitive to assumed movement rates.

d. None of these models is being considered as a potential new base case for EPO bigeye.

Discussion:

In response to a suggestion to build a bigeye recruitment index based on purse-seine data, **Juan Valero** replied that building such indices from FAD data has proven difficult, given the life history of bigeye and that it is not the principal target species in FAD fisheries.

7.a.iv. Work plan to improve stock assessments of bigeye: update

Mark Maunder presented the work plan to improve the tropical tuna assessments.

Key points:

a. Although some of the activities under the bigeye work plan are specific to that species, several will also contribute to the yellowfin assessment.

b. The bigeye work plan was refined and rearranged to form a tropical tuna work plan to improve both assessments.

c. The work plan includes specific and general projects, some of which extend beyond 2020.

Discussion:

The independent review of the yellowfin assessment will be done at the end of 2019. The bigeye MSE is fully funded through 2020, with two workshops planned; funding will be sought to continue in 2021. It is scheduled for completion by 2023, when other tropical tunas will be added to the workplan.

7.b. Relationship between purse-seine vessel characteristics and fishing mortality (SAC-10-10)

Jon Lopez presented SAC-10-10, describing six related issues requiring quantitative analysis that were grouped into one project (J.2.a).

Key points:

a. The increasing effort of the purse-seine fleet in the EPO requires increasingly stringent management measures to conserve the stocks of tropical tunas.

b. The staff has recently been working on alternative management measures, as well as on quantifying the relationship between vessel characteristics and fishing mortality.

c. The staff is developing an adaptive and flexible environmentally-oriented conservation and management approach for bigeye, called *dynamic ocean management*, that may help improve selectivity and reduce mortality of non-target species, while maintaining catch rates of target species.

Discussion:

Jon Lopez answered questions about the analytical and data-collection methods, and validation of the models.

a. Bigeye models are able to predict the spatio-temporal distribution of the species in near-real time, but it is not clear how they could be made operational, as real-time closures are a different kind of management.

b. One potential consequence of this type of management is that it could lead to "races to fish" in areas subject to closure, but the method could also highlight "hotspots" for vulnerable species that should be managed on a specific temporal-spatial basis.

c. Similar models for target species are being developed to detect areas where non-target species can be avoided while target species are caught.

d. The SAC expressed interest in hearing about the continuing development of this method at next year's meeting.

7.c. Potential reference points and harvest control rules for dorado (*Coryphaena hippurus*) in the eastern tropical Pacific (SAC-10-11)

Juan Valero presented the results of three collaborative regional workshops on dorado held during 2014-2016, and three modeling reports (exploratory assessment, exploratory MSE, depletion estimator) as background for a discussion of candidate reference points and harvest control rules for dorado in the EPO (SAC-10-11).

Key points:

a. More data are available for the South EPO than for the North EPO.

b. During 2007-2014 catches in the South EPO fluctuated slightly below the MSY level, while spawning biomass fluctuated around the MSY level. Fishing mortality (*F*) fluctuated around levels consistent with yield-per-recruit (YPR) considerations, given seasonal fishery closures in Peru and Ecuador, the main dorado-fishing CPCs. However, the *F* estimated to produce the maximum YPR is poorly estimated.

c. Dorado is managed nationally. Management measures vary by country, from none to commercial fishing bans; those applied by Ecuador and Peru are consistent with YPR, and performed well against simulated alternatives, while maintaining the stock slightly above MSY levels.

d. Reference points and harvest control rules cannot be properly evaluated without first specifying management objectives, data collection, analyses, treatment of uncertainty, and other components of a harvest strategy.

Discussion:

a. Several participants from countries with important dorado fisheries expressed their appreciation and support for this research. However, funding is problematic: the FAO-GEF shark program could be expanded to include dorado, but funding for this project is currently exhausted, and it was suggested that the interested Members fund the work.

b. **Peru** expressed its intention to strengthen its data-collection program, including vessel logbooks, onboard observers, electronic monitoring in artisanal fisheries, and a pilot tagging program.

c. The SAC recommends that (1) the research on fishery indicators continue and (2) tagging and genetics studies be conducted.

8. DATA COLLECTION

8.a. EPO Regional Tuna Tagging Program (Project E.4.a)

8.a.i. Report of the workshop to review proposed activities

8.a.ii. Report on Phase 1

Alexandre Aires-da-Silva presented a review of the Workshop to Review the Proposed Activities of the IATTC Regional Tuna Tagging Program in the EPO and provided an update on the at-sea tagging study (Phase 1 of the tagging project, E.4.a). The tagging team, **Kurt Schaefer** and **Dan Fuller**, was currently at sea, and no reports are available yet.

Key Points:

A significant obstacle in preparing for this field study was obtaining the many permits necessary to fish in national EEZs and in marine protected areas. Ultimately, permits could not be obtained for the areas around the Galapagos Islands (Ecuador) and Malpelo Island (Colombia), which severely hampered the study.

Discussion:

The staff appealed for help from the SAC participants in obtaining permits for future phases of the project, and the participants discussed the need for funding strategies and collaborative efforts.

8.b. Electronic monitoring of purse-seine vessel activities and catches (SAC-10-12)

Marlon Román presented a study to determine whether electronic monitoring (EM) can collect reliable data on the fishing activities of purse-seine vessels (SAC-10-12). It could be used on vessels too small to carry observers, or on large vessels to supplement data collection by observers.

Key points:

a. The low participation by Class 1-5 vessels resulted in a delay in the project.

b. Data collected at sea by EM and by on-board observers, will be compared to identify activities that can be recorded as accurately by EM as by the observer.

c. It has yet to be determined whether EM can produce size and species composition data, how much effort reviewing and analyzing the video involves, and if minimum standards can be developed for each fishery.

d. Four Ecuadorian vessels (two Class-6, one Class-5, and one Class-2) are participating in the project. EM equipment installed aboard three of the vessels has been tested in fishing operations.

Discussion:

The SAC discussed the next steps after this feasibility study, including an experimental design, minimum standards for evaluating the data collected, increased monitoring of longliners, and improving communication with vessel management and crews. There was much support for expanding the study, but no funding is available. **Ecuador**, which is conducting its own EM feasibility study, offered to collaborate with the IATTC staff. **Guillermo Compeán** welcomed this offer, and also thanked Colombia, Costa Rica, and ISSF for their cooperation.

9. FADs

9.a. Non-entangling and biodegradable FADs

9.a.i. Progress report

Martín Hall presented information on new FAD prototypes designed and tested by the industry to prevent entanglement of non-target species and to degrade, thus reducing the accumulation of debris on the coasts and high seas.

Key points:

a. In the early phase of the experiment, prototypes were developed and tested, but their longevity was an issue. Some captains and fleet managers took the initiative and built and tested other designs. Over 170 prototype FADs were deployed by the monitored vessels; 17 sets were made, with an average catch of around 25 t per set. Another 150 experimental FADs were deployed by other vessels.

b. Deployment and catch data on these prototypes were collected by IATTC field office staff; some show promise, both in durability (about 3-4 months) and in comparable catches to traditional FADs.

Discussion:

a. **Alexandre Aires-da-Silva** recalled that there are two ongoing experiments, which need to be addressed separately. The first consists of the testing of new FAD prototypes, mostly developed by the Ecuadorian fleet, as reported by Dr. Hall; the second (Project M.5.a) is an IATTC scientific experiment, funded by the EU, to develop and test non-entangling and biodegradable FADs, in collaboration with the industry. He summarized the issues surrounding the implementation of the second project.

b. The aim of the IATTC experiment is to develop biodegradable FADs that last 6-12 months. In close collaboration with the industry, prototypes have been identified, and a scientific experiment has been designed to test whether: 1) they can last at least 6 months; 2) their efficiency in aggregating fish is similar to that of conventional FADs.

c. The SAC discussed tracking of biodegradable FADs, and the value for future experiments of the experience gained in studies in the Indian Ocean. It was noted that this project will require some modification of the data collected on FADs, to allow them to be identified and tracked across multiple trips.

9.a.ii. Other activities

Gala Moreno presented a summary of worldwide FAD fishing and of efforts to reduce the impact of FADs (SAC-10-INF-I), supported by ISSF.

Key points:

a. FAD impact is mainly a function of size (volume and depth), and is mostly caused by the underwater component ("tail").

b. Only FADs constructed without netting can completely eliminate entanglement.

c. Large-scale tests of biodegradable FADs are in progress in three oceans, and results will soon be available to inform management.

d. Plastics should be avoided in the construction of FADs.

e. FAD strandings must be quantified, in order to: (1) identify priority areas for recovery of stranded FADs, based on the vulnerability of the ecosystem and the number of strandings, and (2) measure the efficiency of the initiatives taken to mitigate the loss and abandonment of FADs.

f. A good-practices guide for tuna purse seiners should be developed to reduce the loss and abandonment of FADs.

g. A definition of what constitutes a "biodegradable FAD" should be developed.

Discussion:

a. The SAC discussed progress in retrieving FADs, including compensation mechanisms to encourage retrievals and improved technology for retrieving FADs, but noted that there are no protocols for managing debris from stranded FADs. **Ecuador** described a project on FAD retrieval in the Galapagos Islands, and **Ernesto Altamirano** discussed the first phase of an IATTC project to survey CPCs on the impact of stranded FADs (Project M.5.b).

b. **Gala Moreno** noted that both shallow and deep FADs had the same capacity for aggregating fauna and attracted the same species compositions. However, this needed to be tested in more regions, as tuna behavior, oceanic currents, and thermocline depth, which could affect the species composition,

may differ among regions.

c. The SAC discussed self-propelled autonomous FADs, which would remain in the fishing grounds and could be long-lived. **Gala Moreno** explained that such devices already exist, and may be tested by the fleets in the future.

9.b. Report of the Joint Tuna RFMO Working Group on FADs

Josu Santiago, Chair of the Joint Tuna RFMO Working Group on FADs, presented a report of the 2nd Meeting of the working group, held the previous week in San Diego. The meeting, funded by the European Union and FAO, aimed at harmonizing FAD-related definitions, population indicators, and priorities of the four tuna RFMOs. The working group developed a five-year research plan, one critical element of which was access to high-resolution buoy position data for scientific studies. **Josu Santiago** stressed the importance of including the fishing industry in the group's discussions.

Discussion:

Part of the Working Group's mandate was to develop consistent common definitions and terminology for the FAD fishery for consideration at SAC-11 in 2020, although some organizations might elect to use their own definitions. Concerns were expressed about the impact of FADs on small tunas, the scientific basis for FAD limits, and the need for the industry to pay compensation for damage caused by lost and abandoned FADs.

10. ECOSYSTEM AND BYCATCH

10.a. Ecosystem considerations (SAC-10-14)

Leanne Fuller discussed how time series of bycatch data and environmental indicators can assist in explaining changes in catches, and how Ecological Risk Assessments (ERAs) can identify vulnerable species for research and mitigation (SAC-10-14).

Key points:

a. The data available on trophic interactions used to obtain parameters for ecosystem models—including a diet matrix of predator-prey interactions and estimates of the *Q*/*B* (consumption/biomass) ratio—are outdated. The latest ecosystem model uses trophic data from 1992-1994.

b. The current ecosystem model of the tropical EPO used by the IATTC staff has been updated with new catch data, using existing diet data, to produce ecological indicators for monitoring broad-scale ecosystem changes, but a new trophic sampling program is required to update trophic data for the construction of a new, spatially-explicit ecosystem model of the EPO.

Discussion:

The SAC discussed how ERAs can be translated into management. ERAs can identify vulnerable populations, which can guide research priorities and management actions. "What if" scenarios can explore the effects of hypothetical conservation and management measures (*e.g.*, spatial and/or temporal closures).

10.b. Towards standardized ecological indicators for monitoring ecosystem health: An updated ecosystem model of the tropical EPO (SAC-10-15)

Shane Griffiths highlighted the IATTC's mandate under the Antigua Convention to pursue an ecosystem approach to the management of EPO tuna fisheries. He explained the various ways that ecological sustainability of EPO tuna fisheries could be demonstrated, but ecosystem models are the most cost-effective approach. Unlike single-species stock assessments, they allow the trophic interactions among all components of the ecosystem to be accounted for. The IATTC has an ecosystem model to explore 'what if'

management and climate scenarios, but the basis of the model relies on very outdated trophic data. A proposal seeking funding to update the trophic information for the model, presented to the Commission in 2018, has yet to be approved; it will be presented again in 2019.

Key points:

a. Since 2017, the staff has reported annually on seven ecological indicators, derived from an updated Ecopath with Ecosim ecosystem model, that describe changes in the structure and dynamics of the ecosystem due to tuna fishing.

b. The model predicted that ecosystem integrity has changed substantially over the history of the fisheries, first due to the increase in industrial fishing in the 1970s, but most markedly since the expansion of the purse-seine fishery on floating objects around 1993.

c. The model simulated four hypothetical management measures relating to the floating-object fishery to predict the ecological consequences of continued increases in effort, and the potential impacts of implementing effort limits, primarily to reduce mortality on small bigeye, yellowfin and skipjack tunas.

d. The model simulations indicated that even a 50% reduction of the rate of floating-object fishery effort increase over the past 10 years will result in further degradation of ecosystem integrity, reducing the biomass of some target tuna species by up to 62%.

e. The model predicted that a combined limit of 15,831 sets (the 2016–2018 average) for the floating-object and unassociated fisheries would maintain the ecosystem structure in its present state and slightly increase the biomass of most target tuna species.

f. A significant reduction in purse-seine effort, and most likely longline effort as well, would be needed to restore the ecosystem to its state prior to the expansion of the FAD fishery.

g. Updated trophic information (*e.g.*, predator stomach contents and experimental determination of consumption rates) is needed to improve the model forecast outputs.

Discussion:

Regarding the cause and significance of the "trophic cascade" identified by these simulations, the main cause is fishing, the changes are likely substantial, and only the simulation allowing no further increase in floating-object sets would maintain the ecosystem in its current state. The staff is recommending a program to collect samples of stomachs from prey and predators for ecological analysis , and expand north and south beyond the tropical Pacific. This would allow the diet matrix, which defines the trophic flows among predators and prey, to be updated, and allow spatial disaggregation of the updated model to represent the entire EPO.

10.c. Report of the Working Group on Bycatch

Manuel Correia, co-chair of the Working Group on Bycatch, presented thirteen recommendations adopted by the Working Group at its meeting held in May 2019.

Discussion:

a. The discussion centered on the Working Group's recommendation to revise Resolution C-11-08 to increase observer coverage on longline vessels over 20 m length overall (LOA) to 20%. **Japan**, **China**, **Chinese Taipei**, **Korea**, and **Peru** argued that all CPCs should achieve 5% coverage first; a decision to increase coverage to 20% should be taken only after all CPCs have achieved that level and the resulting data have been evaluated.

b. **Colombia**, **Mexico**, **Nicaragua,** the **United States,** and the **European Union** argued that the current

coverage of 5% is insufficient to give a clear idea of longline bycatch, that 20% coverage is a level that is well-supported by the scientific literature, and that, since almost all CPCs have already reached 5% coverage, it is appropriate to increase the coverage, and to complement the observers' efforts with electronic monitoring systems.

c. The **European Union** noted that it has recently achieved 5% coverage, and the **United States** stated that its deep-set and shallow-set longline fleets have 20% and 100% coverage, respectively.

d. It was suggested that the Commission consider incentives and disincentives to increase longline observer coverage. Although the SAC did not reach consensus on the level of coverage, it supported both gradual increases in coverage in the future and continuing the current experiments with electronic monitoring systems.

e. The SAC adopted the other 12 recommendations by the Bycatch Working Group, which were incorporated into the SAC's recommendations to the Commission (Appendix 2).

11. SHARKS

11.a. FAO-GEF shark project: progress report

11.a.i. Pilot study for shark fishery sampling in Central America (SAC-10-16)

11.a.ii. Long-term shark fishery sampling program in Central America

Ricardo Oliveros-Ramos presented Phase 2 of a 2018-2019 pilot study to collect shark fishery data and develop and test sampling designs for a long-term sampling program for the shark fisheries of Central America (SAC-10-16).

Key points:

a. For small coastal artisanal vessels (the PNG fleet), the objectives were to identify landing sites, obtain an order-of-magnitude estimate of the shark catch, and produce a sampling design for catch and effort. For larger longline vessels that fish in coastal and offshore waters (the NPG fleet), the objective was to produce sampling designs for estimating the size and sex composition of the catch.

b. Additional data necessary to obtain an order of magnitude estimate for the entire region will be collected up until the end of 2019, and global order-of-magnitude estimates for Central America will be computed.

c. For the NPG fleet, it was found that the catch unloading process was not random with respect to species and size, and thus a super-sampling approach was implemented to collect detailed data on unloadings.

d. More super-samples will be collected during the remainder of 2019 to improve the representativeness of the simulator with respect to the main NPG trip types (dorado, shark) and to seasonality (rainy, dry seasons).

e. The sampling designs developed for both the PNG and NPG fleet components will form the basis for a long-term shark sampling program in Central America.

Discussion:

The SAC congratulated the staff for its excellent job on this extensive and complicated task, and recommended that funding be allocated to continue the project.

11.b. Purse-seine indicators for silky sharks in the EPO (SAC-10-17)

Cleridy Lennert-Cody presented an update of indices of relative abundance for large silky sharks in the

EPO (SAC-10-17).

Key points:

a. The indices for large silky sharks for 2018 decreased to about their 2016 values, following an increase in 2017.

b. Because of recent increases in the number of sharks recorded as released alive, indices that included these data were also calculated for large silky sharks, and showed a somewhat less-pessimistic long-term trend. However, there is concern that the size category of sharks released alive may be poorly estimated, and thus the increase in live release could bias the indices by size.

c. A recent Pacific-wide silky shark assessment highlighted the need for a better understanding of movements and stock structure of the species in the Pacific Ocean and Project H.5.a could be expanded to include additional research on the effects of inter-annual variability in oceanographic conditions (*e.g.*, El Niño and La Niña events) on silky shark distribution and movements.

Discussion:

The SAC discussed post-release survival of silky sharks. It was noted that the staff had just published research that found that post-release survival from longlines could be high if the proper release techniques are used (Project M.2.b).

12. LIFE HISTORY

12.a. Review of research at the Achotines Laboratory (SAC-10-18)

Dan Margulies presented a summary of the IATTC's research program on pre-recruit life stages of tunas conducted at the Achotines Laboratory, Republic of Panama (SAC-10-18). Most of the research is focused on studies of yellowfin.

Key Points:

a. Three current topics of research were described: studies of early-juvenile (0.5-6 months of age) yellowfin, comparative studies of the early life histories of yellowfin and Pacific bluefin, and studies of the effects of ocean acidification on the eggs and larvae of yellowfin.

b. Current and future research conducted at Achotines is now focused on investigating the early-juvenile stages of yellowfin, including growth dynamics and the occurrence of density-dependence in growth.

c. Growth of early-juvenile yellowfin is rapid (1.5-3.5 mm/day) and exhibits a large scope for growth, and growth variability in the early-juvenile stages may be important in influencing pre-recruit survival.

d. Comparative studies of the growth and survival of larval yellowfin and Pacific bluefin suggest that yellowfin larvae grow faster and exhibit higher survival under low or variable prey conditions, although Pacific bluefin larvae exhibit greater resistance to starvation.

e. Reproductive patterns of yellowfin and Pacific bluefin appear to reflect the growth and survival dynamics of their larvae. Yellowfin spawning patterns represent a "lottery" or "bet hedging" strategy where eggs and larvae are released in a wide variety of oceanic habitats with variable prey conditions for larvae, while Pacific bluefin spawning is restricted to discrete regions in the western Pacific characterized by mesoscale fronts and eddies that serve as concentrating and retention regions for larval prey.

f. Studies of ocean acidification effects on yellowfin eggs and larvae indicate that near-term (50- to 80-year IPCC projection) levels of acidification produce moderate decreases in mean survival and growth of yellowfin larvae. Histological analysis also indicates substantial sub-lethal damage on larval organ

systems which appears to be irreversible and probably contributes an additive mortality component that must be considered in any modeling studies of acidification effects.

Discussion:

a. Regarding the effect of acidification on prey of yellowfin larvae, **Dan Margulies** explained that the larvae in the study were fed with cultured prey, so matters such as changes in prey density and direct effects of acidification on prey survival had not been addressed, and would require a separate investigation.

b. Morphometric parameters (*e.g.*, egg weight) were considered along with somatic growth, mortality and samples to examine histological condition of organs.

c. **Nicaragua**, which is establishing a laboratory in the Caribbean for seabass and may look at tunas in future, expressed interest in the training courses regularly held at the Achotines Laboratory. **Dan Margulies** noted that education is an important part of the laboratory's purpose, and welcomed training of CPC scientists at Achotines.

13. STAFF RECOMMENDATIONS TO THE COMMISSION (SAC-10-19)

Alexandre Aires-da-Silva presented the staff's recommendations (SAC-10-19), many of which had already been presented and discussed under the relevant agenda items. All were endorsed by the SAC except 1.1.b (see discussions, Sections 6 and 7), 2.5 (due to confidentiality concerns expressed by Chinese Taipei), and 3.1.b (see discussion, section 10.c); also, 2.1 and 2.2 were revised following comments made at the meeting. The final recommendations are listed in Appendix 1.

14. SAC RECOMMENDATIONS TO THE COMMISSION

14.a. Recommendations adopted

The SAC held an extensive discussion on proposals for recommendations to the Commission, both those proposed at the SAC and those recommended by the Bycatch Working Group.

For the discussion, the staff combined and redrafted several proposals made by individual CPCs into a single document with 15 draft recommendations, which the SAC then considered one by one. It finally adopted 13 recommendations to submit to the Commission.

The SAC also adopted 12 of the 13 recommendations proposed by the Bycatch Working Group, which thereby also became SAC recommendations and, if adopted by the Commission, will be included in the staff's report to SAC-11 in 2020 on the implementation of measures.

The proposals adopted for recommendation to the Commission are shown in Appendix 2.

14.b. Recommendations not adopted

Conservation of tropical tunas

The SAC discussed the staff's recommendations on the management of tropical tunas (1.1.a and 1.1.b) but did not adopt them. It agreed that measures additional to the provisions of Resolution C-17-02 are needed, but did not support the staff's recommendation to limit the number of sets on FADs and unassociated sets combined, mainly due to a concern for a race to fish.

The SAC recommends that the IATTC staff develop complementary proposals, such as an adjustment of the current limits on floating objects established in Resolution C-17-02, the ban on remote deactivation or reactivation of buoys, a limit on the annual purchases of buoys per vessel, and CPC-based limits. These proposals will be presented at the next meeting of the Commission.

Observer coverage of longline fleets

The following recommendation by the Bycatch Working Group was discussed by the SAC, but not adopted:

"*Revise Resolution C-11-08 to increase longline observer coverage on vessels >20 m LOA to 20% and consider ways to supplement observer requirements with electronic monitoring.*"

15. STRENGTHENING AND STREAMLINING THE IATTC SCIENTIFIC PROCESS AND THE PRESENTATION TO THE COMMISSION OF THE CONCLUSIONS AND RECOMMENDATIONS OF THE SAC

The **European Union** indicated that this meeting illustrated some of the ways that SAC meeting procedures could be improved, such as deadlines for submission of proposals for recommendations and limiting recommendations to matters arising directly from discussions at the meeting. Several participants agreed, and **Colombia** suggested that measures and arrangements be developed and adopted.

16. OTHER BUSINESS

No other business was discussed.

17. ADJOURNMENT

The meeting was adjourned on 17 May 2019.

Appendix 1. Staff Recommendations to the Commission

INTER-AMERICAN TROPICAL TUNA COMMISSION

SCIENTIFIC ADVISORY COMMITTEE

TENTH MEETING

San Diego, California (USA)
13-17 May 2019

STAFF RECOMMENDATIONS

The Staff makes the following recommendations. The detailed description and rationale for the recommendations can be found in SAC-10-19.

1. MANAGEMENT

1.1 TROPICAL TUNAS

1.1.a. *Maintain the provisions of the current resolution (C-17-02).*

1.1.b. *For the purse-seine fishery, limit the total annual number of floating-object and unassociated sets combined (OBJ+NOA) by Class-6 vessels in 2020 to 15,723. Once the limit is reached, only dolphin associated (DEL) sets will be allowed during the rest of that year, and all vessels without a Dolphin Mortality Limit must return to port.*

1.2. PACIFIC BLUEFIN TUNA

1.2.a. *The current resolution (C-16-08) is adequate and, for this reason, no additional recommendations are made.*

1.2.b. *Increased catches based on the scenarios analyzed are possible under the harvest strategy prepared by the Joint Tuna RFMO Working Group. The choice of catch scenario should take into account the desired rebuilding rate and the distribution of catch between small and large bluefin.*

1.3. NORTH PACIFIC ALBACORE TUNA

The current resolutions (C-05-02, C-13-03, C-18-03) should be continued.

1.4. SILKY SHARKS

1.4.a. *CPCs subject to the terms of paragraph 7 of Resolution C-16-06 should implement a prohibition on the use of steel leaders during a period of three consecutive months during April-September of each year for the relevant portions of their national fleets.*

1.4.b. Pursuant *to Paragraphs 9 and 10 of Resolution C-16-06, CPCs should notify the Commission of the period of the prohibition, the number of vessels subject to the prohibition, and how compliance with the prohibition will be monitored.*

1.5. SEABIRDS

Revise Resolution C-11-02 consistent with the current state of knowledge regarding seabird mitigation techniques.

2. DATA COLLECTION

2.1. SHARKS

2.1.a. *Implement Phase 1 of the long-term sampling program (Project C.4.b), using sampling methods and*

logistics developed under Project C.4.a.

2.1.b. *Establish an IATTC field office in Central America near some of the ports where most shark landings occur.*

2.1.c. *Require all vessel captains to complete the transshipment declaration forms of Resolution C-12-07 by species, for all shark catches.*

2.2. RAYS

Conduct a post-release survival tagging pilot study for Mobulid rays in all purse-seine set types, following the guidelines in Annex I of Resolution C-15-04.

2.3. ECOSYSTEM

In collaboration with CPCs, develop a fishery-dependent ecological sampling program to collect stomach and tissue samples from key predators for ecological analyses of contents, stable isotopes and fatty acids.

2.4. FADs

2.4.a. *CPCs should provide the FAD data from each fishing trip to the IATTC staff as soon as they receive them at the end of that trip.*

2.4.b. *CPCs should report any interactions with FADs exclusively on the standard form developed by the IATTC staff (FAD form 9/2018).*

2.4.c. *CPCs should provide to the IATTC staff buoy data corresponding to, at a minimum, one position per day, and every "search window" (when the vessel is communicating more frequently than usual with the buoy in order to locate it).*

2.5. FISHING GEAR

Require that vessels submit the purse-seine and longline gear description forms appended to Document SAC-05-05. Any significant modifications made to the gear subsequently should be reported on these forms prior to departing port with the modified gear.

3. OBSERVER COVERAGE

3.1.**a** *Establish an observer program for purse-seine vessels of less than 363 t carrying capacity, with a sampling coverage of 20%.*

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

4. DATA COLLECTION

4.1.**a.** *CPCs should submit all operational longline observer data collected from 1 January 2013 to present, consistent with the recommendation by SAC-08.*

4.1.b. *Adopt a standardized format for the annual longline observer data reports by CPCs, such as the one proposed in SAC-10-INF-H.*

4.1.c. *Adopt number of hooks as the effort metric for longline fisheries in the EPO.*

Appendix 2. SAC Recommendations to the Commission

INTER-AMERICAN TROPICAL TUNA COMMISSION

SCIENTIFIC ADVISORY COMMITTEE

TENTH MEETING

San Diego, California (USA)
13-17 May 2019

SAC RECOMMENDATIONS TO THE COMMISSION

The tenth meeting of the Scientific Advisory Committee (SAC) makes the following recommendations to the Commission:

1. TROPICAL TUNAS

1.1. Conservation

The SAC requests that the IATTC staff present to the meeting of the SAC in 2020 a set of options for management measures for tropical tunas, consistent with the staff's work plan to improve the stock assessments of tropical tunas.

1.2. Stock assessments

a. The SAC supports the staff's work plan to improve the stock assessments of tropical tunas in time for the Commission to consider management measures for 2021 and subsequent years.

b. The SAC recognizes that the current schedule of annual benchmark or update assessments of bigeye and yellowfin tunas makes it difficult for the IATTC staff to perform the necessary research to improve those assessments, as well as to develop assessments for other stocks requested by the Commission. Therefore, the SAC recommends that the IATTC staff develop, and present to the SAC, an alternative assessment schedule, with benchmark or update assessments scheduled in coordination with the management schedule, and indicator analyses in the intervening years to assess whether additional management measures are required.

c. The SAC recommends that the IATTC staff continue working with CPCs to review data reporting, in terms of the quantity and quality required for the improved stock assessments.

d. The SAC recommends that the IATTC staff continue its collaboration with the WCPFC in stock assessments.

1.3. Management Strategy Evaluation

The SAC supports the IATTC staff's work plan (SAC-10-01a) to move forward with Management Strategy Evaluation workshops in 2019 and 2020 for tropical tunas with stakeholders, scientists, and managers. Therefore, the SAC recommends that the Commission continue to provide funds to support this work.

2. DORADO

The SAC recommends that the IATTC staff continue working with CPCs on research on the stock status of dorado (*Coryphaena hippurus*) in the EPO.

3. DATA

3.1. Electronic monitoring

a. The SAC recommends that the Electronic Monitoring (EM) initiatives implemented on purse seiners,

both Classes 1-5 and Class 6, which will improve data collection for the purse-seine fleet, are also tested in the longline fleet.

b. The SAC requests that the staff prepare a proposal on EM minimum standards and data collection and reporting requirements for both purse-seine and longline fleets, to be reviewed at the next meeting of the SAC.

3.2. FAD data

a. The SAC reiterates the importance of all CPCs providing to the IATTC staff the same raw buoy data received by the original users, in accordance with the recommendation of the Ad Hoc Working Group on FADs of May 2018, adopted by the SAC at its 9th meeting.

b. The SAC recommends that the IATTC staff review the data collection procedures associated with the fishery on floating objects, to identify indicators that adequately represent the number of effective floating objects, levels of deployment, and losses.

c. The SAC recommends that the information on *FAD form 09-2018 Ver. 2* be recorded by the observer on purse-seine vessels with an observer aboard, and that the captain be required to provide the observer with the identification code of the FADs and, as appropriate, the other information in Annex 1 of Resolution C-18-05. On purse-seine vessels without an observer aboard, the captain shall be responsible for recording the information on the form.

3.3. Longline CPUE

The SAC recommends that the staff continue investigating with CPCs issues related to longline CPUE, and to continue investigating the joint longline standardized CPUE index.

4. PROGRESS REPORTS ON RECOMMENDATIONS BY WORKING GROUPS

The report on the progress and outcomes of recommendations adopted by previous SAC meetings (SAC-10-02) was found to be very useful by the SAC. However, the SAC recommends that the IATTC staff also include in future reports the progress and outcomes of the recommendations by working groups adopted by the SAC.

RECOMMENDATIONS BY THE BYCATCH WORKING GROUP ADOPTED BY THE SAC

5. BYCATCH AND RELATED ISSUES

The SAC also recommends the following recommendations adopted by the ninth meeting of the Bycatch Working Group:

5.1. General

1. Request the IATTC scientific staff to develop a list of minimum standards for electronic monitoring on purse-seine and longline vessels, for the consideration of the SAC. (*redrafted and incorporated in the recommendations of the SAC as recommendation 3.1.b – see above*).

2. Request the IATTC scientific staff to analyze the available operational-level longline observer data for bycatch at the 2020 WG meeting, during the "Summary Report on Bycatch in the EPO" presentation.

5.2. Bycatch mitigation

3. Encourage collaboration of CPCs to supply data for IATTC Class 1-5 purse-seine vessels and artisanal fisheries according to procedures currently being developed by IATTC scientific staff in collaboration with other organizations.

4. Encourage additional research on Mobulids, including post-release survival, genetics, and population studies.
5. The WG supports the request of the IAC [Inter-American Convention for the Preservation and Conservation of Sea Turtles] in the development of IATTC conservation measures to reduce bycatches and mortality of leatherback turtles (*Dermochelys coriacea*), including circle hooks, fish bait, spatial management and safe handling and release.
6. The WG recommends that the IATTC staff work with the IAC to assess the vulnerability of leatherback turtles in the EPO using different management scenarios.
7. The WG encourages additional studies to determine impacts of gillnet illumination on catch composition in additional locations.

5.3. Purse-seine best practices

8. In the near future, move toward the use of non-entangling FADs without any netting and encourage research on biodegradable materials.
9. Promote the application of proven best practices of bycatch release on purse seiners and encourage research to develop safe-handling techniques to improve the post-release survival rates of sensitive fauna.
10. Additional electronic tagging experiments should be conducted in order to evaluate post-release survival rates.

5.4. Seabirds

11. The WG requests a review and update of the mitigation options in Resolution C-11-02, including potential harmonization with WCPFC seabird regulations and ACAP guidelines.

5.5. Marine mammal safe handling and release guidelines

12. The WG requests that marine mammal identification guides and safe handling and release guidelines be posted on the IATTC website.

ACTIONS TAKEN BY THE SAC

The SAC took the following actions under Resolution C-11-08, which empowers the SAC to determine how longline fishing effort is measured by CPCs within the context of the required observer coverage rate, and also tasks the SAC with establishing the formats for reporting under the Resolution. Both of these decisions are consistent with IATTC staff recommendations presented in Section 7.2.2 and explained in greater detail in SAC-10-INF-H.

1. Adoption of the standardized format for the annual longline observer summary reports by CPCs recommended by IATTC staff in SAC-10-INF-H (and reproduced in Appendix 3).
2. Adoption of “number of hooks deployed” as the effort metric for longline fisheries for the purpose of calculating longline observer coverage under Resolution C-11-08.

Appendix 3. Template for annual summary reports on fleet information and observer data for longline vessels >20m operating in the EPO. Adopted by the 10th Meeting of the IATTC Scientific Advisory Committee, May 2019.

CPC	Name

FLEET INFORMATION (vessels >20 m LOA)									
	Both set types combined			Shallow sets (<15 HPB/HBF[1] or <100 m max hook depth)			Deep sets (≥15 HPB/HBF or ≥100 m max hook depth)		
Period covered	Date range DD-MMM-YY – DD-MMM-YY			Date range DD-MMM-YY – DD-MMM-YY			Date range DD-MMM-YY – DD-MMM-YY		
Area fished	from (XXX)°W to (XXX)°W and from (XX)°S/N to (XX)°S/N			from (XXX)°W to (XXX)°W and from (XX)°S/N to (XX)°S/N			from (XXX)°W to (XXX)°W and from (XX)°S/N to (XX)°S/N		
	Total Fleet	Observed	% observed	Total Fleet	Observed	% observed	Total Fleet	Observed	% observed
No. of vessels that fished									
No. of trips									
No. of effective days fishing									
No. of sets									
No. of hooks (in thousands) *(If unknown, approx. no. of hooks/set, using a *)*									
Predominant[2] hook type/size (IATTC code)									
Predominant bait type[3]									

[1] Hooks per basket / Hooks between floats
[2] 'Predominant' means most common, i.e., >50%
[3] Bait codes: SQ – squid; F – fishes (*e.g. Scomber* spp.); A – artificial lure (*e.g.* plastic jig)

NON-RETAINED SPECIES (vessels >20 m LOA)										
		No. of individuals observed								
		Both set types combined			Shallow sets (<15 HPB/HBF[1] or <100m max hook depth)			Deep sets (≥15 HPB/HBF or ≥100m max hook depth)		
		Released			Released			Released		
Species code	Species	Alive	Dead	Condition unknown	Alive	Dead	Condition unknown	Alive	Dead	Condition unknown
DKK	Leatherback (*Dermochelys coriacea*)									
TTL	Loggerhead (*Caretta caretta*)									
TUG	Green (*Chelonia mydas*)									
LKV	Olive ridley (*Lepidochelys olivacea*)									
	Add rows for additional species as required									
Sharks and rays										
FAL	Silky (*Carcharhinus falciformis*)									
OCS	Oceanic whitetip (*Carcharhinus longimanus*)									
BSH	Blue shark (*Prionace glauca*)									
SMA	Shortfin mako (*Isurus oxyrinchus*)									
SPL	Scalloped hammerhead (*Sphyrna lewini*)									
SPZ	Smooth hammerhead (*Sphyrna zygaena*)									
SPK	Great hammerhead (*Sphyrna mokarran*)									
RMB	Giant manta ray (*Manta birostris*)									
	Add rows for additional species as required									
Marine mammals										
FAW	False killer whale (*Pseudorca crassidens*)									
DRR	Risso's dolphin (*Grampus griseus*)									
SGF	Guadalupe fur seal (*Arctocephalus townsendi*)									
	Add rows for additional species as required									
Seabirds										
DQS	Antipodean albatross (*Diomedea antipodensis*)									
DPK	Waved albatross (*Phoebastria irrorata*)									
DIZ	Laysan albatross (*Phoebastria immutabilis*)									
DAQ	Short-tailed albatross (*Phoebastria albatrus*)									
	Add rows for additional species as required									
Billfishes										
MLS	Striped marlin (*Kajikia audax*)									
SSP	Shortbill spearfish (*Tetrapturus angustirostris*)									
BUM	Blue marlin (*Makaira nigricans*)									
	Add rows for additional species as required									

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