**INTER-AMERICAN TROPICAL TUNA COMMISSION**

**SCIENTIFIC ADVISORY COMMITTEE**

# 13TH MEETING

**(*by videoconference*)**
**16-20 May 2022**

# REPORT OF THE MEETING

# PROVISIONAL AGENDA

| | Documents |
|---|---|
| 1. Opening of the meeting | |
| 2. Adoption of agenda | |
| 3. Research planning: | |
| a. Staff activities and research work plan | SAC-13-01 |
| 4. Review of the implementation of recommendations adopted at previous SAC and Working Group meetings: progress and outcomes | SAC-13-02 |
| 5. The fishery: | |
| a. The tuna fishery in the EPO in 2021 | SAC-13-03 |
| b. National reports | |
| c. Longline observer program reports | SAC-13-04 |
| d. Transshipment observer program | |
| 6. Stock assessments: | |
| a. Investigation on potential bias on the tropical tuna catch estimates caused by the COVID-19 pandemic | SAC-13-05 |
| b. Stock status indicators (SSIs) for tropical tunas in the EPO | SAC-13-06 |
| c. Workplan for the bigeye and yellowfin tuna benchmark assessments: summary report on the 1st workshop on improving the risk analysis for tropical tunas in the EPO (model diagnostics) | |
| d. Stock assessment for skipjack in the EPO | |
| i. Interim skipjack assessment | SAC-13-07 |
| ii. Spatiotemporal tagging model for skipjack in the EPO | SAC-13-08 |
| e. Updates from ISC Working Groups: | |
| i. Pacific bluefin tuna | |
| ii. North Pacific albacore tuna | |
| f. Other species | |
| i. South EPO swordfish assessment: benchmark assessment | SAC-13-09 |
| ii. South Pacific albacore: benchmark assessment | |
| 7. Modelling: | |
| a. Workplan for tropical tuna Management Strategy Evaluation (MSE): progress report | |
| 8. Data collection: | |
| a. Workplan for the implementation of an electronic monitoring (EM) program for the tuna fishery in the EPO: progress report | |
| b. Development and implementation of the IVL scheme for bigeye catches: update | |
| 9. FADs: | |
| a. Report of the Working Group on FADs | |
| 10. Ecosystem and bycatch: | |
| a. Ecosystem considerations | SAC-13-10 |
| b. Report of the Working Group on Bycatch | |
| c. Dolphin research: update | |
| d. Proposed TORs for Ecosystem and Bycatch WG | |
| 11. Sharks: | |
| a. Vulnerability status for sharks in the EPO: EASI-fish assessment | SAC-13-11 |
| b. Improvements on shark data collection for EPO coastal fisheries: ABNJ2 | SAC-13-12 |

| | | |
|---|---|---|
| 12. | Life history: | |
| | a. Review of research at the Achotines Laboratory | SAC-13-13 |
| 13. | Staff recommendations to the Commission | SAC-13-14 |
| 14. | SAC recommendations to the Commission | |
| 15. | Other business | |
| 16. | Adjournment | |

## 1. OPENING OF THE MEETING

The Director *ad interim*, Jean-François Pulvenis, opened the meeting. He was accompanied presentially by the Chair of the Commission as well as by the three candidates to the position of Director who were invited to the meeting to ensure that they would stay current on the work of the Commission, for an optimized start in his function of the one that would be designated as the new Director on 1 August 2023.

## 2. ADOPTION OF THE AGENDA

The provisional agenda was adopted. The United States noted that the question of the MSE for the North Pacific albacore would be addressed also under agenda item 6(e)(ii) on the ISC update on this stock.

## 3. RESEARCH PLANNING

### a. Staff activities and research work plan

The IATTC Coordinator of Scientific Research, Alexandre Aires-da-Silva, presented the document on staff activities and research work plan (SAC-13-01). This document describes the staff's research and work plans, as well as brief summaries of the 64 research projects that are currently under way or planned for the near future and funded under the 5-year Strategic Science Plan (2019-2023). The summaries include, for each project, background information, a work plan, and a progress report, as well as details of its relevance and purpose, external collaborators, duration, and deliverables; also, for existing projects, an update on activities since the previous year's report (the 'reporting period'; September 2021-March 2022 in this report).

**Discussion**:

- A participant asked about what kind of cooperation was needed from the private and governmental sectors in order to facilitate greater success in tagging efforts, and in particular, efforts to tag SKJ. First cautioning that a full response to this question should come from Dan Fuller when he returns from the tagging cruise currently underway, Alexandre Aires-da-Silva responded that with respect to governments, one thing that was needed was help in getting permits to allow IATTC to tag fish in marine reserves and National Parks, where the fishing pressure and competition with commercial vessels is absent. From the industry, the most helpful form of cooperation would be in the sharing of real-time FAD buoy data or the locations of select FADs with significant biomass below them, which could increase our tagging success and reduce the amount of search time. On this point, ISSF indicated that they have had access to buoy data from the industry for similar purposes and offered to help facilitate the same for future IATTC tagging efforts. TUNACONS also offered their support for future efforts.
- A participant noted recent progress of ISC in executing benchmark assessments for blue sharks in 2022 and planned for shortfin mako sharks in 2024, and then asked for an update on efforts to assess hammerhead sharks. Alexandre Aires-da-Silva first responded that IATTC was aware of the ISC's progress and that with the recent hiring of new IATTC scientific staff for the Ecosystem and Bycatch Program, it is planned that these new staff members will collaborate and engage more directly in the shark assessment work conducted by the ISC Shark Working Group, in much the same way that IATTC scientists currently collaborate with ISC on the assessment of temperate tunas. Regarding assessments for hammerhead sharks and silky sharks, he noted that the IATTC has plans for progress in 2023, but that challenges remain for the success of those efforts because tremendous data gaps remain. In the meantime, he indicated that the EASI-Fish assessment for every EPO shark species that

will be presented later in the meeting should be helpful. Finally, he noted that although IATTC staff expects to be expanding the artisanal shark sampling efforts previously conducted in Central America to include new CPCs, using a new round of GEF ABNJ funds, the continuation of the same previously developed program in Central America has not been possible because of a lack of funding to support this work.

- A participant asked about IATTC plans for continuing BIO-FAD research following the conclusion of the current grant cycle of funding from the EU. Alexandre Aires-da-Silva confirmed that this grant is ending and that IATTC has no additional funds allocated to FAD research on the immediate horizon and that all work to date had been funded by the EU. He noted that in the coming year IATTC would be revisiting the 5-year Strategic Science Plan and that BioFADs would no doubt be a high-priority item of focus.
- A participant asked for an update on the use of close-kin mark recapture analysis, which had been mentioned previously as a promising tool for silky sharks and bigeye tuna. Alexandre Aires-da-Silva responded that IATTC staff continue to believe that this method holds great promise and opportunity, and that IATTC is planning a proposed feasibility study, but that funding for a large-scale project does not yet exist.

## 4. REVIEW OF THE IMPLEMENTATION OF RECOMMENDATIONS ADOPTED AT PREVIOUS SAC AND WORKING GROUP MEETINGS: PROGRESS AND OUTCOMES

Alexandre Aires-da-Silva provided a summary of the progress towards implementing previous recommendations (SAC-13-02).

**Discussion**:

- A participant noted that the wording of what was reflected under item 3.5 was confusing because there was a staff recommendation that the SAC endorsed, and then it appears that the IATTC scientific staff subsequently changed its mind and withdrew the recommendation, saying they had enough data. The Director *ad interim* acknowledged that the wording in the document was confusing and committed to undertake an edit of that section to indicate that the staff considers that the recommended specific action is no longer required all the necessary gear configuration information is currently provided.

## 5. THE FISHERY

### a. The tuna fishery in the EPO in 2021

Alexandre Aires-da-Silva presented a review of the fishery in 2021 (SAC-13-03), 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 670,000 metric tons (t) of yellowfin, skipjack, bigeye, and Pacific bluefin tunas by purse-seine, longline and recreational gears in the EPO in 2021 were about 5% higher than in 2020, due to a 15% increase in YFT catch and a 9% increase in SKJ catch.

b. Catches by species and flag: Ecuadorian vessels took about 42% of the total tuna catch in the EPO in 2021, down from 46% in 2020. This included 60% of the skipjack and 54% of the bigeye. Mexican vessels caught 43% of the yellowfin and nearly all the bluefin.

c. Yellowfin: Most of the yellowfin catch was taken in the DEL fisheries during the first three quarters of the year, with smaller amounts taken in the OBJ-N and OBJ-E fisheries in the last three quarters. Large yellowfin (120-160 cm) were caught almost exclusively in the DEL fisheries, primarily in the DEL-N fishery in the first three quarters, the DEL-I fishery in the first and second quarters, and the DEL-S fishery in the first quarter. Smaller yellowfin (<60 cm) were taken in the OBJ-N and OBJ-E fisheries primarily in the first and second quarters. The average weight of yellowfin in 2021, 7.9 kg, was much lower than the 2020 average of 10.6 kg, but was similar to the average of prior years (6.3-7.7 kg). The 2021 size distribution was similar to that of previous years, with fish in the 120-150 cm range most commonly encountered.

d. Skipjack: Most of the skipjack catch was taken in the OBJ-N, OBJ-E and OBJ-S fisheries in all four quarters, and in the NOA-S fishery in the first and second quarters. The largest skipjack (60-70 cm) were caught in the OBJ-N fishery in the second and third quarters. The smallest (<40 cm) were caught primarily in the OBJ-N, OBJ-E and OBJ-S fisheries in the third quarter.

e. Bigeye: Most of the bigeye catch was taken in the OBJ-N fishery in the second and third quarters, and in the OBJ-S fishery throughout the year. Lesser amounts were caught in the OBJ-E fishery in the second quarter. The average weight of bigeye in 2021 (5.2 kg) was consistent with the previous five years (4.7-5.2 kg). The majority of bigeye caught in 2021 was in the 40-80 cm range, with much less of the larger bigeye >100 cm than in previous years.

f. Pacific bluefin: The 2021 purse-seine fishing season continued the trend of starting earlier than any previous year: in 2021, bluefin were first caught in early January, and the fishery was closed in late January, when the annual catch limit was reached. Most of the catch is transported live to grow-out pens near the coast of Mexico.

**Discussion**:

- China noted that total catch in 2021 increased 8%, and OBJ sets have increased too, but BET catch has declined significantly. What is the explanation? Alexandre Aires-da-Silva responded that we can only hypothesize as to the decline in catch of BET. It could be (1) abundance, (2) availability, (3) the IVL scheme may be working, and vessels have avoided catches of BET, but also (4) misreporting should be considered. Enhanced port sampling with support from the Commissioners and industries will provide a better understanding. The United States pointed out that the IVL scheme was initiated in 2022, so that does not explain under and/or misreporting in 2021. Alexandre Aires-da-Silva responded that negotiations on IVL started in mid-2021, but again, these are all hypotheses for now.

### b. National reports

No national reports on national fisheries and research have been received.

### c. Longline observer program reports

Brad Wiley presented a summary of the longline observer program reports (SAC-13-04).

**Key points**:

- Of the 17 CPCs for which the requirements of C-19-08 is presumed to have applied in 2021, 9 submitted the required summary report (Annex A of C-19-08) regarding their longline observer program and the coverage rate achieved. Of these 9 reporting, 4 reported that they have met the 5% coverage requirement, 3 were only able to report preliminary rates, and 2 have indicated that they did not meet the required rate.

- The presenter noted that, as in some past instances, there appears to be a significant difference between observer coverage rates using the different metrics of effort allowed under the Resolution, with the measure of effort of "effective days fished" yielding a higher rate of coverage than the metric "number of hooks." For example, one CPC reported that for 2021 they observed 9% of the "effective days fished" (thus, being in compliance with the requirement), but only 1% of the total hooks deployed by their fleet. Similarly, another CPC provided updated information for their observer coverage in 2018, indicating that they observed 5.2% of the effective days fished, but only 2.6% of the total hooks deployed. When Resolution C-19-08 was being developed to replace Resolution C-11-08, IATTC scientific staff had recommended that "number of hooks" would be the best measure of effort for the purposes of calculating observer coverage rates.
- With respect to the submission of operational longline observer data to IATTC (Annex B of C-19-08), seven of the relevant CPCs have provided data for all of the relevant years, or otherwise indicated that they have no observer data to submit for the relevant year(s) (e.g., because they did not have an observer program).
- The Secretariat will be circulating individual letters to CPCs before the annual meeting, asking for clarification with respect to all presumed data gaps.

**Discussion**:

- El Salvador noted that last year they requested the removal of all longliners from the vessel register, except for one that is less than 20 m. Only longliners greater than or equal to 24 meters are affected, and no SLV longliners fit those criteria.
- Ecuador indicated that they had recent communications with staff for reporting under Annex A. The staff confirmed the summary data presented and some follow-up questions; the website of the IATTC shows the status of those reports. During the presentation and using Ecuador as an example, it was identified that there may be a disconnect of the number of days sampled, about 10%, and the number of hooks in those samples, about 1. Ecuador wanted to clarify that there has been communication with IATTC staff regarding the submission of original reports and inclusion of updated information in the presentation.
- Panama provided clarification that a report was provided for 2021, and an updated provision as required under annex A is underway. Previously, there was no observer program.

**d. Transshipment observer program**

Ricardo Belmontes presented a summary of the transshipment observer program (SAC-13 INF-B).

**Key Points:**

- The main scientific components of the transshipment observer program were presented. Despite this program, in accordance with the *ad hoc* resolution, has compliance objectives of verifying catches and transshipments that are made of tuna, billfish, and other species in the EPO, it was emphasized that the SAC can use the information generated by the program and also bring suggestions on what other type of information would be useful for their work.
- It was reiterated that the SAC recommended in the previous year that the captains of carrier vessels should be able to identify the sharks transshipped by species and register it in the declaration format.

**Discussion**:

- El Salvador raised the question about the ability of captains and observers to identify shark species. The staff should determine the need to properly identify sharks and report them in transshipment records. The staff responded that currently this is only a recommendation, therefore it is not enforced, and the issue needs to be brought to the Commission. Colombia asked if that is the reason why the fins should be attached to the bodies. This was spoken in agreement with El Salvador that it would be difficult to determine shark species from only the fins and that it would be a subject to discuss with the Commission.
- Conclusively, while the above cited measure is not enforced, efforts should be made to ensure that IATTC observers collect the desired information, to the extent possible, giving the difficulties faced during the identification of the transshipment.

## 6. STOCK ASSESSMENTS

### a. Investigation on potential bias on the tropical tuna catch estimates

Ananda Majumdar presented on potential bias on tuna catch caused by the COVID-19 pandemic (SAC-13-05).

**Key points**:

- The COVID-19 pandemic limited the ability of port samplers to take samples, resulting in a reduction in OBJ set samples for 2020 and 2021 of 66% and 35%, respectively, compared to 2019.
- The port-sampling data are used to calculate the species and size composition of the catch, and therefore play a very important role in the BSE catch estimation methodology.
- Port-sampling data collection was disrupted by the pandemic in some ports more than others and this causes bias in the BSE because some fleet segments preferentially unload in specific ports (SAC-13 INF-L).
- Spatial-temporal (CAR) models to estimate port-sampling species proportions from observer (logbook) data with overall good performance were developed.
- Simulation results suggest the CAR model performance is robust to the type of systematic data loss that occurred in 2020. As compared to the CAR estimates, the OBJ-set BSEs for BET in 2020 and 2021 represent an overestimation of about 18% in each year. The results for 2021 are preliminary, however, because the 2021 CAR estimates are based on data for 2020, which were also impacted by the pandemic. Further research needs to be conducted to determine the robustness of the 2021 CAR estimates.
- Simulations to evaluate the robustness of the CAR model 2021 estimates will be conducted as well. Development of fine-scale spatial-temporal models (e.g., 5°- month or 5°- quarter) will be undertaken and development of fine-scale models that are not constrained to be highly correlated with the BSE will also be undertaken.

**Discussion:**

- A participant asked about the bias proportion in space, if they are related to the amount of YFT, which identification is confounded with BET during the juvenile stages. Also, the participant noted that catches of juvenile YFT may be larger than what is currently known, and this point should be consid-

ered. Ananda Majumdar clarified that the analysis is not done on a sample-by-sample level; and commented that she hopes to model the relationship between observer estimates and port-sampling estimates on a fine scale to develop a better understanding of the process, exemplifying that there are challenges with the distinction between BET and YFT by observers.

- A participant mentioned that if an overestimate of 18% in BET was observed, an equivalent similar underestimation should be seen in YFT and asked why this was not observed. Another participant also questioned how the substitution tables were constructed, and stated that, at the beginning of the analysis, they had some concerns about underestimation of BET in the BSE, because the coverage was much lower during the pandemic. The participant expected that CAR estimates would be higher than BSE and asked as to why this is not the case. Ananda Majumdar explained that the substitution matrix for the CAR model mimics the BSE substitution matrix that was already in place, and that in the estimates, error is defined as BSE-new approach. Also, W is the correlation that is specified regarding how information is shared among spatial regions. It was noted that the differences are not related to misidentification of species, but rather missing data; and that a result of a simulation study that mimics data losses can show overestimations and underestimations at times; data is not static, and estimates will depend on where there are data that can be used for substitution.
- Ecuador asked what the characteristics of excluded data are. It was explained that they were from the same ports and from the same time of the year in which there were sampling disruptions because of the pandemic, simulating the same data loss that occurred in 2020 with the pandemic.
- USA asked when the port sampling is going to be normal again, and when a final analysis with new data from 2022 should be expected. Ananda Majumdar answered that normal port sampling was resumed in September 2021; and that further analysis will be shown in 2023.
- USA also inquired about the relation between the consistent bias in the YFT, in which CAR estimates are about 10% higher than BSE, and in SKJ that is consistently lower. Ananda Majumdar noted that there is not an explanation for that yet, but mentioned that the bias is not that high, and it is associated to a high correlation with the BSE.
- A final comment was made that the total catch of the 3 tropical species combined for CAR and BSE do not seem to match. Maybe for the comparison, it would be worth scaling to the same amount (so the % differences for each species are comparable and related to the same total combined catch). Following up on this comment, Ananda Majumdar provided a correction on the estimated values (table below).

| Estimated values | 2020 CAR | 2020 BSE | 2020 Bias | 2021 CAR | 2021 BSE | 2021 Bias |
|---|---|---|---|---|---|---|
| BET | 69 901 t | 78 208 t | 8 307 t<br>-12% | 48 088 t | 56 861 t | 8 773 t<br>-18% |
| SKJ | 190 243 t | 191 399 t | 1 156 t<br>-0.60% | 239 692 t | 225 132 t | - 14 560 t<br>(- 6%) |
| YFT | 53 924 t | 44 461 t | - 9 463 t<br>(- 18%) | 60 701 t | 66 488 t | 5 787 t<br>-10% |

**b. Stock Status Indicators (SSI) for tropical tunas in the EPO**

Haikun Xu presented on SSI (SAC-13-06).

**Key points**:

- Most SSIs based on the floating-object fishery suggest that the fishing mortality of all three species has increased, mainly due to the increase in the number of floating-object sets.
- The general increasing trend in the number of sets in the floating-object fishery since 2005, up until the onset of the COVID-19 pandemic, is reflected in increased catches, reduced catch-per-set, and reduced average length for all three species in the floating object fishery.
- Both the number of floating-object sets and closure-adjusted fishing capacity in 2020 and 2021 are below the *status quo* level (average condition in 2017-2019).

**Discussion:**

There were no questions or comments for the presentation.

**c. Workplan for the bigeye and yellowfin tuna benchmark assessments**

Mark Maunder presented a summary report on the 1st workshop on improving risk analysis for tropical tunas in the EPO, giving emphasis to model diagnostics.

**Key points**:

- The project objective is to improve the risk analysis methodology by defining more objective, transparent, and automated diagnostic-based metrics for weighting fishery stock assessment model ensembles.
- A Virtual Workshop on Model Diagnostics in Integrated Stock Assessments was conducted on Jan 31-Feb 3, 2022. The workshop was held under CAPAM, including invited speakers and ample time for discussion. There were over 200 participants.
- A future second workshop on weighting metrics is already being planned and organized.

**Discussion:**

There were no questions or comments on this presentation.

**d. Stock assessment for skipjack in the EPO**

**i. Interim skipjack assessment**

Mark Maunder presented on the interim SKJ assessment (SAC-13-07).

**Key points**:

- An assessment for skipjack was developed, and longline data and an echosounder buoy-based index of abundance were included.
- The assessment is similar to those used to provide management advice for bigeye and yellowfin.
- The length-composition data from the longline fishery suggest that the purse-seine fisheries have dome-shaped selectivity. Sensitivity analysis to the assumptions were conducted.
- The conclusion is that the skipjack stock is healthy, and generally robust to data usage and model assumptions.

**Discussion:**

- A participant asked if the potential impact of longline (LL) index reduction on SKJ is similar to what has been happening to BET and YFT (the LL CPUE for YFT and BET were not reliable in recent years due to the contraction of fishing ground). Mark Maunder answered that the current SKJ assessment does not use LL CPUE standardization yet, and that this potential issue is worthwhile to investigate as part of the benchmark assessment to be conducted in 2024. It is likely that LL composition data has larger impacts on assessment results than LL CPUE. Another participant asked if the benchmark assessment will be done as best-case assessment or as risk analysis as BET and YFT. It was explained that this decision will be made as ongoing research on the SKJ model exploration and development continues (e.g., the inclusion of the results of the spatiotemporal tagging analysis in the stock assessment model). However, Maunder commented that addressing SKJ in a risk analysis framework will be challenging given the other two planned benchmark assessments (YFT and BET), and there is also a need to improve risk analysis, among others.
- A participant asked how the tagging analysis is incorporated into the assessment. It was explained that it can be used in three different ways: 1) compare model estimates from the tagging model with the values used in the benchmark assessment; 2) fit the benchmark assessment model to the estimates of absolute biomass and fishing mortality from the tagging model; 3) fully integrate tagging data in the benchmark assessment model.
- Tagging can help estimate natural mortality, absolute abundance, exploitation rate (which is being done in WC Pacific) and it can also help with assumptions about degree on dome shape of selectivity curves. On the same matter, one participant expressed concerns about misfits at the tail of the longline composition data, and the participant was supportive of using tagging data to try to elucidate potential issues.
- A participant mentioned that the sensitivity analysis, removing echosounder data, shows surprising trends, and he asked if this happens due to the index or the size composition data. Maunder answered that catch-curve analysis may help in this case, and that at the end it shows an increase, suggesting that the composition data is consistent with higher biomasses. The echosounder index also shows a decline at the end, so removing it from the assessment can withdraw that impact.
- A participant mentioned that fitting the model to CPUE can bring some concerns about the coverage on area and weight of longline indices, so they asked what supports the use of surface indices. Maunder talked about two indices: the echosounder buoy, which is not influenced by catch decisions, and the catch-per-set index, that can show some issues on its interpretations. Maunder recognized initial concerns to include the latter index into the model, but that regardless, it is good to see some correspondence with other indices, even when it is not fit in the model.
- Another participant asked if the combination of the buoy index and the longline index would be the best to use. Maunder responded that so far indeed this seems to be the best choice. He also noted that catch-per-day fishing for surface indices may provide a better index of abundance than catch-per-set. On the same matter, one participant asked if there was any reassuring point on consistency between indices, and Maunder answered that yes, there is, and removing some indices of the assessment does not change dramatically the estimated trends on the SKJ stock.
- One participant questioned if there are any plans to include environmental impact analysis, assuming that recruitment is independent from stock size, and probably recruitment is affected by environmental variation, as it is observed in the western and central Pacific. Maunder commented that this point was considered during a previous assessment and they did not expect to observe a large impact in the assessment, but further investigation on this matter will be conducted on the benchmark assessment.

- One participant asked if the sizes of SKJ have been reduced over time. Maunder went through some model output figures available for different fisheries, and he showed some examples, such as the offshore OBJ fishery, that indicated some variability, but not decline. He briefly analyzed the Northern OBJ and Coastal OBJ fisheries which showed a slight decline, and he stated that longline data are too sparse to draw conclusions.
- A last comment came from a participant who suggested that, given that the vessels may know the abundance associated on their own FADs, it would make sense to estimate indices based on FADs that are not owned by vessels to hopefully be more at random. Maunder agreed and noted that it was a good idea to be explored in future work.

**ii. The spatiotemporal tagging model for skipjack**

The staff is collaborating with scientists at Denmark Technical University in the development of a novel spatiotemporal modeling approach to analyze the SKJ tagging data. Tobias Mildenberger presented on the spatiotemporal tagging model for SKJ (SAC-13-08).

**Key points**:

- A spatiotemporal tagging model allows estimation of the movement of SKJ in the EPO based on tagging data by means of the matrix exponential of the sum of the instantaneous advection and diffusion rates.
- Advection rate can be defined by local differences in the habitat preference which is a smooth representation of any number of environmental layers.
- A monthly model with 5° or 2.5° grid and two environmental layers, sea surface temperature and mixed layer depth, suggests high preference around the equator, 20°N and 30°S and 145°W and movement towards those regions.
- An estimated smooth function suggests that SKJ preferred a low MLD and intermediate SST around 24°C.
- This work is still ongoing and further steps will include utilizing spatiotemporal catch and effort data to estimate fishing and natural mortality rates as well as determining how the results can be integrated into the SKJ assessment (SAC-13-07).

**Discussion:**

- A participant asked about how to deal with the limited spatial domain of the tagging data and how the current approach can help us improve that. The presenter responded that tagging data are limited in space. The spatiotemporal approach will extrapolate for a larger area.
- A participant asked how the tagging model can be used to improve the benchmark assessment. Mark Maunder responded that it is a bit early to know, but that three options are likely: 1) compare the model estimates from the tagging model with the values used in the benchmark assessment; 2) fit the benchmark assessment model to the estimates of absolute biomass and fishing mortality from the tagging model; or 3) fully integrate tagging data in the benchmark assessment model. The second option is more likely.

**e. Updates from ISC working groups**

**i. Pacific bluefin tuna**

Hiromu Fukuda presented a summary of the latest assessment of Pacific bluefin tuna by the ISC Pacific Bluefin Working Group (PBFWG) conducted in March 2022 (SAC-13 INF-R).

**Key points:**

- A data update assessment was conducted with two additional years of data (1952-2020 FY).
- The model showed positive diagnostic results (ASPM, R0 profile, retrospective runs, hindcasting, goodness of fit).
- The PBF stock showed recovery of spawning stock biomass (SSB) that continues since 2011 and achieved its initial rebuilding target in 2019.
- Recent fishing mortality (2018-2020 average) was lower than that corresponding to the second rebuilding target (F20%SPR).
- Projections were conducted for the new CMM (as *status quo*) and other requested scenarios by the Joint IATTC-WCPFC-NC WG and showed that the second rebuilding target is achieved under all examined scenarios with higher probability than the reference level prescribed in the Harvest Strategy of this stock. The future catch is expected to be much larger than the *status quo* if the projection scenarios were tuned to achieve the second target in 10 years after achieving the initial target with a 60% probability.
- The proportion of catch between small and large bluefin affects to the expected future catch if the projection is tuned to achieve the second target in 10 years after achieving the initial target with a 60% probability.
- Robustness of the management quantities (e.g., probability of achieving rebuilding target) was examined for the alternative assumptions of the observation model and of the population dynamics model (productivity) through sensitivity analysis. The management information based on the 2022 base case model was robust to those alternative assumptions.

**Discussion:**

- A participant asked what proportion of the impacts the bycatch fleets have. The presenter indicated that about 5% of the total catch is contributed from bycatch.
- Following the presentation, Alexandre Aires-da-Silva presented the staff recommendations on Pacific bluefin tuna (see section 14). He indicated that there was a new resolution on Pacific bluefin tuna last year. The staff position is that an increase in catches could be considered, but the choice is up to the Commission regarding the rebuilding rate and the distribution of small and large fish in the catch.

### ii. North Pacific albacore tuna

A member of the SAC had requested that the staff summarize the result of the recently completed MSE for North Pacific albacore (NP ALB). Carolina Minte-Vera presented a summary of this work.

**Key points**:

- The MSE for NP ALB was completed; it involved a large amount of simulation work, which was possible due to the support from the USA that hired an analyst to test Harvest Control Rules (HCRs) proposed by the stakeholders during the MSE workshops. The objectives for the fisheries were also agreed upon in the workshop. They were operationalized into indicators to evaluate the performance of the HCRs.
- There were 16 HCRs proposed. They are all based on target, threshold and limit reference points constructed based on quantitates related to the spawning stock biomass. All HCRs maintain the population above undesirable levels with high probability. HCRs implemented as mixed controls (TAC, total allowable catch, for longline fisheries and effort limit for surface fisheries – troll and pole-and-line)

are more robust than HCRs implemented as TAC. HCRs that have threshold reference points closer to the target reference points have higher probability of management interventions.

- CPCs can see the performance of each HCR in the spider plots in the final report of the NP ALB MSE (SAC-12 INF-C), where values closer to 1 indicate better performance. There are trade-offs among objectives that need to be taken into account.
- CPCs are recommended to choose an HCR based on the results of the MSE.

**Discussion**:

- Several members, including the USA and Canada, supported the recommendation that the Commission should use the results of the MSE to adopt an HCR.

**f. Other species**

**i. South EPO swordfish assessment: benchmark assessment**

A background document (SAC-13-09) was posted which provided an update on this assessment. Due to time limitations, no presentation was made.

**ii. South Pacific albacore: benchmark assessment**

Claudio Castillo-Jordan from SPC presented a summary of the South Pacific albacore benchmark assessment (SAC-13 INF-S).

**Key points**:

- The 2021 stock assessment of albacore tuna (*Thunnus alalunga*) across the South Pacific Ocean incorporates the Convention areas of the Western and Central Pacific Fisheries Commission (WCPFC) and the IATTC.
- A further three years of data are available since the last stock assessment was conducted in 2018; the model time period now extends from 1960 - 2019.
- This assessment is the first complete attempt at a spatially structured South Pacific-wide assessment, although a previous assessment applied an areas-as-fleets approach to the stock across the entire South Pacific. Key changes made in the progression from the 2018 reference case to the 2021 diagnostic case model include:

  - Updating all data to the end of 2019 and applying a new version of Multifan-CL (2.0.8.2).

  - Refinements to the geostatistical approach for standardisation of longline CPUE for the index fisheries.

  - Moving to a South Pacific-wide four region spatial structure with simplification of the model regions for the WCPFC area and use of an areas-as-fleet approach to stratify fisheries in the IATTC area.

  -Applying an areas-as-fleets approach to stratify fisheries within the 'overlap' area between the WCPFC and IATTC Convention areas (previous assessments defined separate model regions for this area).

  - Applying re-analysed otolith ageing data and a new approach to generating natural mortality (M)-at-age based on growth parameters.

  - Combining growth and M into a single axis of uncertainty, with two options; one involved growth parameters estimated from the reanalysed otoliths external to the model and the other used growth

parameters estimated from the length frequency data external to the model. The previous assessment applied a conditional-age-at-length approach.

- Inclusion of structural uncertainty axes for movement probabilities and recruitment distribution. This assessment used SEAPODYM model outputs to inform movement coefficients and recruitment distributions, along with alternative approaches that were similar to those of the previous assessment.

- The assessment also undertook a structural uncertainty analysis (model grid) for consideration in developing management advice.

- The general results of this assessment are as follows:

  - Spawning potential: Spawning potential for the South Pacific albacore stock declined from 1960 until the early 1980s, after which it stabilized for a period, before declining gradually as catches increased from the 1990s until 2010. A more notable decline in spawning potential is estimated to have occurred since 2015.

  - Depletion: The terminal depletion levels estimated by this assessment for the South Pacific stock as a whole are the most pessimistic across the model time period, with *SBrecent=SBF* =0 median of 0.47 (0.40 - 0.56, 10$^{th}$ and 90$^{th}$ percentiles) and *SBlatest=SBF* =0 median of 0.36 (0.27 - 0.44, 10$^{th}$ and 90$^{th}$ percentiles). However, none of the 72 models exceeded the WCPFC limit reference point (LRP) of 20%*SBF* =0. There is no target reference point applied for the stock at the scale of the entire South Pacific.

  - Fishing mortality: A steady increase in the South Pacific-wide fishing mortality on adult age-classes is estimated to have occurred over most of the assessment period, accelerating since the 1990s, with a rapid increase in the last five years. Juvenile fishing mortality increased until around 1990 and has remained stable at a comparatively low level since that time. Recent fishing mortality is estimated to be below *F*MSY (*Frecent=F*MSY median 0.26; 0.16 - 0.38, 10*th* and 90*th* percentiles) and none of the 72 models had recent *F* exceeding *F*MSY.

  - Close-Kin Mark Recapture (CKMR) methods that can provide information on population scale and stock structure, along with other fishery-independent information on uncertain biological processes, are strongly recommended for South Pacific albacore, noting that the feasibility of this method for South Pacific albacore is now outlined in the literature.

**Discussion**:

- The next assessment is planned for 2024. The relative impact between the EPO and WCPO fisheries is an important consideration. The report has a plot of fishery impacts.

- It was noted that the EPO contributes 10% of total catch, but the EPO has about 30% of the biomass of South Pacific albacore (although it changes over time), so it was queried what is the recruitment among the two areas and what is the general movement direction. The presenter responded that there are two assumptions about recruitment: 1) based on the estimates from SEAPODYM, and 2) only in regions 3 and 4 (it was not clear but it could be equal between the two areas). With SEAPODYM-based movement, the interaction between the areas is very low. The SC (Scientific Committee of WCPFC) down weighted the contribution of the SEAPODYM scenario.

- An update on the progress of MSE and possible IATTC collaboration was requested. The presenter noted that the SPC MSE team is currently working on the South Pacific albacore MSE. The IATTC MSE team is fully occupied on tropical tunas and have not been involved. Therefore, if collaboration is desired, some direction from the Commission is needed for the next steps.

- A participant inquired about the contribution that was made by the IATTC and the CPCs relating to the EPO data and its value to the assessment. Catch, length frequency, and data for the CPUE standardization were provided and the assessment could not be conducted without these data. However, only the Japanese CPUE data were used because there were differences in mean length among fleets. Additional catch and length composition data from other counties would improve the analysis.
- It was noted that the SPC used the uncertainty grid approach and the SC selected which models to include. An inquiry was made whether the IATTC will use this approach or should the SAC select the appropriate models. The staff responded that although the grid approach is not the same as the IATTC's risk analysis approach, the staff considers the grid approach the best available science and will take it into consideration for South Pacific Albacore.
- The IATTC staff then presented the recommendations for South Pacific albacore in response (see section 14). Specifically, Alexandre Aires-da-Silva presented the staff recommendation to continue collaborating with the SPC to monitor the status of South Pacific albacore, using SSIs and conducting another benchmark assessment in 3-4 years.

## 7. MODELLING

### a. Workplan for tropical tuna Management Strategy Evaluation (MSE): progress report

Juan Valero presented a progress report on the development of a workplan for tropical tuna MSE (SAC-13 INF-C).

**Key points**:

- Management Strategy Evaluation (MSE) for EPO tropical tunas is ongoing, starting with bigeye tuna.
- The work includes a technical component and a dialogue component via a series of MSE workshops.
- Two IATTC MSE workshops have been conducted (2019 and 2021, with a third one planned for 2022).
- MSE work for tropical tunas at IATTC is conducted by a contractor. Funding for tropical tuna MSE work has been funded by the European Union (2021-2023), funding for MSE work after 2023 has not been secured yet.

**Discussion**:

- Japan inquired as to the ultimate plan for the future MSE for tropical tunas in the EPO – will it be multi-species or three single-species MSE? Juan Valero explained that an individual species approach is being followed which starts with BET. There is a need to discuss in detail in the future what the plan should be for the next scientific strategic plan.
- PEW commented that this work would benefit by a Working Group that allows scientists to meet and share dialogue. The staff believes that the MSE work is bringing scientists and managers together to meet jointly and that this process benefits the development of tuna management in the EPO.

## 8. DATA COLLECTION

### a. Workplan for the implementation of an electronic monitoring (EM) program for the tuna fishery in the EPO: progress report

Marlon Román and Brad Wiley presented a summary of the progress on the electronic monitoring program for the tuna fishery in the EPO (SAC-13 INF-D).

**Key points**:

- The summary focused on the outcomes from the previous three workshops on electronic monitoring (EMS). At the same time, there was a request to the SAC for its support, suggesting to the Commission a creation of a Working Group for this topic.
- The document SAC-11-10 was reviewed per a request from the Commission; this review included EMS definitions and terms of reference adopted by the Commission during its 98th annual meeting.
- The workplan on the implementation of the EMS in the EPO was summarized. The EMS workshops developed staff recommendations on:
  - Institutional structure (document EMS-02-01)
  - Goals and scope of the EMS (document EMS-02-02)
  - EMS management considerations (document EMS-03-01)
- The recommendations from the workshops included the scientific rationale and participants' feedback for each recommendation. Most of the recommendations were oriented toward tuna management.

**Discussion:**

- PEW recognized the work done so far and remarked on the considerable progress on this initiative. PEW also encouraged the SAC to provide its recommendation to the Commission for the creation of an EM Working Group to support the IATTC EMS group.
- USA also supported the creation of an EM working group and asked what is expected from the SAC to move forward with the creation of such a group. The Director *ad interim* and Alexandre Aires-da-Silva responded that a recommendation on the creation of this group needs to be developed, including the need of additional resources required.

**b. Development and implementation of the IVL scheme for bigeye catches: update**

Cleridy Lennert-Cody described the updates on the IVL scheme for bigeye catches (SAC-13 INF-E).

**Key points**:

- Resolution C-21-04 established an IVL program to monitor bigeye tuna (BET) catches by trip. The Resolution includes two port-sampling components: an enhanced monitoring program and a pilot program, which has the purpose to develop and field-test sampling designs for the enhanced monitoring program.
- The pilot program will take place in two phases: Phase 1 (July – October 2022), to collect data for computer simulations to test sampling designs; and Phase 2 (November – December 2022), to field-test sampling designs from Phase 1.
- The sampling plan for Phase 1 must generate useful data without significantly impacting catch unloading. The protocol may be revised somewhat in July, following initial testing period. Phase 1 will be conducted primarily in the ports of Manta and Posorja, Ecuador, where much of the BET catch is unloaded.
- Trips and wells will be selected for sampling depending on their associated operational characteristics, and more than one well may be sampled per trip. Operational characteristics associated of interest include set type(s), area of fishing, and unloading method.

- Sampling will be conducted by teams of 4 samplers: one sampler at the well head counting "groups of fish" as they are unloaded and selecting every group for sampling; two samplers measure and identify to species each fish in every group of fish; and one sampler records the species identifications and length measurements.
- The catch of a well will be extensively sampled, with n ≤ 10, so that at least about 10% of the catch in a well is sampled.
- Vessel crew and unloader assistance necessary for the success of Phase 1 would be:

  · Providing space for samplers at and near the well head.

  · Assisting samplers in moving the group of fish to be sampled away from well head.

  · Returning the sampled group of fish to the next step in the unloading process.

  · Delay unloading briefly if the sampling team falls behind.
- Through computer simulations, questions will be addressed including:

  · Are there significant changes in the species and/or length composition of the catch over the course of the unloading processes, and are these related to set type, area of fishing or unloading method?

  · How many samples per well should be collected (and of how many fish) to best estimate the catch composition of a well and of a trip?

  · If more than one well of a trip contains catch from the same "stratum," should sampling be focused on obtaining at least one sample from each well or on obtaining multiple samples from one well?

**Discussion**:

- The Colombia delegation asked which are the main points that could help minimize bias in the sampling project. Cleridy Lennert-Cody answered that the ideal would be to sample 100% of catches, but of course this would be impossible, so the project would focus on sampling 5% or 10%, depending on what is more practical and causes less interference with the unloading dynamics.
- The Colombia delegation commented that the pilot study and the program in general should consider, not only investigating the differences in BET catches according to the set type, but also the fishing areas, since a vessel in a fishing trip could make use of different areas as a fishing strategy. El Salvador expressed some concerns on the pilot study, indicating that the document is not clear on the information about whether the study is being implemented for an individual vessel limit rather than having a better estimation of the species catch composition and BET catches. Nicaragua commented that their understanding is that the pilot study and program are implemented to improve the catch estimation of BET and do not have an individual vessel limit, but they suggested that the name of the project would be better defined as "Pilot Project for Vessels Catch Statistics". Cleridy Lennert-Cody commented that right now there is a need to work within the constrains that are found in this moment, due to time and budget limitations in Phase I of the pilot program, but it would be preferred if the project could use the data of all the fleet and not only the FAD fishing fleet.
- El Salvador noted that the pilot study and program should be implemented in a way that does not disrupt the normal process of unloading the catch, and indicated that they are not clear on how the data would be used, so the creation of a workshop should be planned so the Members can have a better understanding of how this information is going to be collected and used. Nicaragua also expressed some concern on the unloading process, saying that they believe that a sampling program of this magnitude could disrupt the unloading process and cause some fish loss, and this is an important

point to be considered when planning the sampling protocol. The IATTC staff assured the Members that a sampling protocol is being developed that minimizes the delay in the unloading.

- El Salvador inquired about the help needed to conduct this project, and Cleridy Lennert-Cody answered that the help would be for Phase I of the pilot program, which is where the data collection for the analysis that will be done in Phase II is conducted. After careful consideration and consultation with port samplers, it was decided that sampling every 10$^{th}$ fish would be a good compromise that would not hinder unloading protocols.
- Ecuador, El Salvador and Colombia inquired about the ports that are going to be used on the pilot study, since virtually all are in Ecuador. El Salvador mentioned that they believe the study should have a broader spectrum, including fleets and ports in other countries. The IATTC staff explained that the use of two ports in Ecuador is based on the importance of those sites on BET catches, but it is also related with budget limitations. Also, the staff mentioned that the pilot study prioritized vessel/trips according to BET catches, but this does not mean that for the implementation of the Program, new vessels/trips would not be included in this process.

**9. FADs**

**a. Report of the Working Group on FADs**

Josu Santiago, Chair of the Working Group, summarized its recommendations.

**Discussion:**

- There were editorial suggestions but no substantive comments, and thus the SAC adopted the recommendations (see Appendix 1).

**10. ECOSYSTEM AND BYCATCH**

**a. Ecosystem Considerations**

A background document was posted which summarized IATTC's overview of the effects of the fishery on the ecosystem as well as environmental indicators that can assist with explanations of changes to catches (Document SAC-13-10). The report was not presented due to time limitations.

**b. Report of the Working Group on Bycatch**

Manuel Correa, Co-Chair of the Working Group, summarized its recommendations.

**Discussion:**

There was no discussion after the presentation, and it was decided that any comments would be submitted by delegations and incorporated into the Working Group report (see Appendix 1).

**c. Dolphin Research Update**

Alexandre Aires-da-Silva presented a short summary of dolphin research.

**Key points**:

- Two main areas of research are being pursued regarding dolphin research, including 1) dolphin cow-calf separation during chasing and backdown; and 2) a ship-based dolphin abundance survey. Regarding cow-calf separation research, the next step is a workshop to be conducted in summer 2022. Regarding a dolphin abundance survey, there have been several proposals submitted for funding of a ship-based survey, but to-date no funding has been provided. It is hoped that funding can be procured to support a ship-based survey to be conducted in summer or fall of 2023.

**Discussion**:

There was no discussion following the presentation.

**d. Proposed TORs for Ecosystem and Bycatch WG**

A document was presented at the 11th Meeting of the Working Group on Bycatch (BYC-11-03) which summarizes the proposed TORs for the Ecosystem and Bycatch Working Group. No presentation was made due to time limitations.

**11. SHARKS**

**a. Vulnerability assessment of sharks caught in eastern Pacific Ocean pelagic fisheries using the EASI-Fish approach**

Shane Griffiths presented the results of the first quantitative vulnerability assessment for shark species caught in EPO pelagic fisheries using the EASI-Fish approach (Document SAC-13-11).

**Key points**:

- Sharks are a common catch (target or bycatch) in industrial and small-scale artisanal pelagic fisheries in the eastern Pacific Ocean (EPO) but a lack of reliable data hinders stock assessment.
- Ecological Assessment for the Sustainable Impacts of Fisheries (EASI-Fish) was used as an alternative data-limited approach to quantify the vulnerability of shark species to the cumulative impacts of multiple fisheries in the EPO. A total of 49 shark species have been recorded to interact with EPO pelagic fisheries, of which 32 species were formally assessed using EASI-Fish for the reference year 2019.
- Estimates of fishing mortality ($\tilde{F}_{2019}$) and the spawning stock biomass per recruit ($SBR_{2019}$) in 2019 exceeded biological reference points ($F_{40\%}$ and $SBR_{40\%}$) for 20 species, classifying them as "most vulnerable", including hammerhead sharks (4 species), requiem sharks (10 species), threshers (*Alopias superciliosus and A. pelagicus*), mesopelagic sharks (3 species) and the commercially important blue shark (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*).
- 12 species were classified as "least vulnerable" (9 species) or 'increasingly vulnerable" (3 species).
- Key knowledge gaps identified were the location of fishing effort and the shark catch in artisanal fisheries and basic biological information for several species.
- In the absence of reliable data for stock assessments for hammerhead and silky sharks as planned under Resolution C-16-05, it was recommended that EASI-Fish be used as an alternative data-limited approach to assess species vulnerability and to explore the potential efficacy of CMMs—implemented in isolation or in combination—within the EPO to reduce fishery impacts on these species.

**Discussion:**

- Colombia stated that it is important to summarize the general feeling of delegates to strengthen Conservation and Management Measures (CMMs), especially for sharks that are highly vulnerable. A delegate asked for clarification on how information was obtained for these coastal species that do not interact with longline and purse-seine fisheries and encouraged increased data reporting for longline fisheries. Shane Griffiths answered that the presence-only data were obtained from EPO IATTC databases, purse-seine and longline observer data and Aquamaps to construct Species Distribution Models. He mentioned that, although spatial coverage of artisanal fleet effort is incomplete, there was still extensive overlap with these limited data.

- Costa Rica expressed concern about diversity and complexity in defining artisanal fisheries with varying characteristics and noted that these complexities have been addressed in different ways (e.g., the Central American ABNJ shark project). The Costa Rica national plan of action has 100% of landings inspected; and they believe it is important to continue to seek funding opportunities for data collection in Central America, urging for continued collaboration. Shane Griffiths commended their inspection work on landings and invited other delegations to work with Costa Rica to continue to improve the EASI-Fish assessment.
- El Salvador expressed concerns regarding mixture of data for the artisanal longline fisheries with varying fishing capabilities, which could affect management decisions for smaller vessels. Support was expressed for the continuation of sampling programs in the Central American region to update data in the analysis. Shane Griffiths commented that the longline fishery was divided into 1) artisanal vessels <20 m, and 2) the industrial longline fleet. The artisanal fleet effort was characterized using data from the IATTC circle hook experiment conducted throughout Latin America, and these data were supplemented with published reports from countries. It was reiterated that the spatial distribution of effort data for artisanal fleets are underrepresented so the vulnerability estimates should be considered to be minimum estimates.
- Nicaragua also expressed the importance of expanding information and strengthening databases to be able to have a better idea on what is occurring with sharks.
- Ecuador offered to share data on artisanal and industrial longline fleets to contribute to the EASI-Fish work on sharks stating.
- European Union believes that this tool is valuable to prioritize research but believes a pedagogy in how to interpret this plot is needed, because it resembles a Kobe plot used to define stock status in stock assessments, which can cause confusion with interpretation. Ecuador shared the same concerns about the plot, mentioning that the x-axis of spawner biomass per recruit leads to confusion. The biomass indicator might confuse CPCs in terms of population size. This confusion may be avoided by separating both axes into 2 plots: for vulnerability, and for size of each stock.
- Shane Griffiths explained that the use of a colored phase plot with the same colors as a Kobe plot was used so people know where to focus their attention but stressed that the plot does not describe whether stocks are being overfished or if overfishing is occurring, rather the plot describes whether species are categorized as “most vulnerable” or “least vulnerable”. It was explained that although a simple stock assessment model is incorporated into EASI-Fish, biological reference points cannot be used to define stock status because fishing mortality estimated in EASI-Fish is a proxy for fishing mortality. Shane Griffiths expressed openness to suggestions on how to better display results to avoid confusion.
- Ecuador continued the discussion sharing their belief that many shark species are resilient to fishing pressure, and there is a need to define how the results must be interpretated in terms of their vulnerability and resilience, which could contribute to a clear view on stock status in the Pacific Ocean. Also, Ecuador suggested that it was premature to interpret the results into a conservation measure when there are different data levels in some fleets to accurately represent each fishery.
- Shane Griffiths respectfully disagreed with the comment that sharks are resilient to fishing impacts, given their general slow growth, and low reproductive capacity, which makes them highly vulnerable to decline by fishing. He agreed that there may be a better way to represent the results, but he reminded that vulnerability status should not be confused with stock status. He then explained that EASI-Fish uses quantitative biological reference points (BRPs) as a common metric to assess relative long-term sustainability of each species. EASI-Fish goes beyond the subjective nature of the widely used

Productivity Susceptibility Analysis, which merely ranks the vulnerability of species relative to one another. Exceeding BRPs in EASI-Fish means it is likely that a species may experience a decline in the long term, but because there are so many data gaps, the species is more vulnerable to being overfished than another species. EASI-Fish does not produce an estimate of stock status because of limited data in that regard. It is unlikely that a second plot specific to abundance, as suggested by Ecuador, can be achieved.

- A participant from Ecuador clarified that ECU also believes that sharks are not resilient to fishing impacts and reiterated their concern on the interpretation of the x-axis of the plot.

**b. Improvements on shark data collection for EPO coastal fisheries: ABNJ2**

A background document was posted on this topic (SAC-13-12). A second phase of the ABNJ project is about to begin and the project will fund the IATTC to expand its previous work in Central America to include other EPO coastal states. No presentation was made due to time limitations.

**12. LIFE HISTORY**

**a. Review of research at the Achotines Laboratory**

A document was posted which presents an update of the research conducted at the Achotines Laboratory (SAC-13-13). The document was not presented at the meeting due to time limitations. In addition, a narrated, expanded PowerPoint presentation was posted on YouTube (SAC-13-13_PRES).

**13. STAFF RECOMMENDATIONS TO THE COMMISSION**

Alexandre Aires-da-Silva presented the staff recommendations to the Commission on other topics (SAC-13-14). Discussion on the different recommendations are described in the above sections of this report.

**14. SAC RECOMMENDATIONS TO THE COMMISSION**

**1. TROPICAL TUNAS (YELLOWFIN, BIGEYE, AND SKIPJACK):**

**1.1. Management strategy evaluation (MSE):** Recognizing the importance of the ongoing MSE process for tropical tunas:

**(a)** that the Commission provide the appropriate resources, considering the proposal of the staff to be submitted at the next regular meeting of the Commission, in order to continue and complete the MSE process, including dialogue between scientists, managers, and other relevant stakeholders.

**1.2. Landings and processing plants sampling scheme:**

**(a)** That the work of the pilot project coordinated by the IATTC staff to strengthen the sampling of landings in port, referred to in paragraph 6 of Resolution C-21-04, initially focused upon Class-6 vessels and gradually applicable to other classes within the framework of the pilot program and its extension to all relevant ports, be carried out subject to the availability of economic resources and sampling personnel as well as prior coordination with the CPCs of the ports involved.

**(b)** That the IATTC staff endeavor to minimize any possible negative effects of sampling on the unloading operations of tuna vessels and on the unloaded product quality.

**(c)** That, within the framework of the pilot program, the staff consider whether the enhanced sampling program can be carried out at the processing plants, and report back to the SAC on this matter in 2023.

**1.3. Skipjack tuna:**

**(a)** While recognizing the interim nature of the first skipjack stock assessment, which was conducted by the scientific staff, who was congratulated for it by the SAC, that the Commission take into account the results of this assessment as well as the management advice issued by the staff.

**(b)** Given that more time was requested by the staff to integrate the tagging information and complete the assessment of skipjack tuna in the EPO and given that all three species of tropical tuna are managed together, that the staff conduct the skipjack tuna assessment in 2024, together with the bigeye and yellowfin tuna assessments.

**2. TEMPERATE TUNAS:**

**2.1. Swordfish:**

**(a)** That the IATTC staff publish on the IATTC website, within 2 months, the benchmark assessment of the swordfish stock in the EPO with its respective recommendations.

**(b)** That the staff also maintain in its scientific research plan periodic assessments on this species.

**2.2. North Pacific Albacore Tuna:** That the Commission use the results of the concluded MSE process to establish reference points and harvest control rules for the North Pacific albacore tuna.

**2.3. South Pacific Albacore Tuna:**

**(a)** That CPCs provide the fisheries information as recommended by the scientific staff, for the purpose of improving the stock assessment of South Pacific albacore tuna in conjunction with the Secretariat of the Pacific Community (SPC).

**(b)** That the staff also maintain in its scientific research plan periodic assessments on this species.

**3. DATA COLLECTION:**

**3.1. Data collection for sharks:** That the Commission provide adequate resources to establish or strengthen the data collection programs for shark species in the EPO, especially for fisheries carried out by EPO artisanal fisheries and for vulnerable species, including taking into account the proposal made by the IATTC staff in document IATTC-98-02(c) and the upcoming work under ABNJ Phase II (SAC-13-12).

**3.2. Electronic monitoring system (EMS):**

Recognizing the importance of implementing an electronic monitoring system in the EPO for the conservation and management of the fish stocks covered by the Antigua Convention:

**(a)** that the Commission provide the appropriate resources to continue and complete the work plan;

**(b)** that an EM Working Group be established in parallel with the EM Workshops.

**4. WORKING GROUP ON BYCATCH:**

**(a)** that the Commission replace the Bycatch Working Group with an Ecosystem and Bycatch Working Group;

**(b)** that the Commission adopt clear Terms of Reference for the Working Group.

**15. OTHER BUSINESS**

No issues were raised under this agenda item.

**16. ADJOURNMENT**

The meeting was adjourned on 20 May 2022.

**ANNEX A. LIST OF ATTENDEES**

| ASISTENTES - ATTENDEES | |
|---|---|
| **MIEMBROS - MEMBERS** | |
| **CANADÁ- CANADA** | |
| **JENNIFER SHAW*** | **SARAH HAWKSHAW** |
| Fisheries and Oceans Canada | Fisheries and Oceans Canada |
| jennifer.shaw@dfo-mpo.gc.ca | sarah.hawkshaw@dfo-mpo.gc.ca |
| **JOSÉ BENCHETRIT** | |
| Fisheries and Oceans Canada | |
| jose.benchetrit@dfo-mpo.gc.ca | |
| **CHINA** | |
| **XIAOJIE DAI*** | **YUNKAI LI** |
| Shangai Ocean University | Shangai Ocean University |
| xjdai@shou.edu.cn | ykli@shou.edu.cn |
| **JIANGFENG ZHU** | **YIQIAN SHI** |
| Shangai Ocean University | Shangai Ocean University |
| jfzhu@shou.edu.cn | Shiyiqian_SHOU@163.com |
| **ZHE GENG** | **FENG WU** |
| Shangai Ocean University | Shangai Ocean University |
| zhlv@shou.edu.cn | fwu@shou.edu.cn |
| **QINQIN LIN** | |
| Shangai Ocean University | |
| qinqinlin_lucky@yeah.net | |
| **COLOMBIA** | |
| **ANDRES ORTÍZ*** | **SANDRA MUÑOZ** |
| Autoridad Nacional de Acuicultura y Pesca | Ministerio de Agricultura y Desarrollo Rural |
| andres.ortiz@aunap.gov.co | sandra.munoz@minagricultura.gov.co |
| **LEONEL BOHORQUEZ** | **DIEGO CANELOS** |
| Ministerio de Relaciones Exteriores | Seatech International |
| leonel.bohorquez@cancilleria.gov.co | dcanelos@seatechint.com |
| **JAVIER GARCÍA** | **ENRIQUE DE LA VEGA** |
| Ministerio de Comercio, Industria y Turismo | Programa Nacional de Observadores |
| jgarciap@mincit.gov.co | edelavega@pescalimpia.org |
| **GUSTAVO LARA** | **GERMAN FONSECA** |
| Ministerio de Ambiente y Desarrollo Sostenible | Programa Nacional de Observadores |
| glara@minambiente.gov.co | observadores@pescalimpia.org |
| **COREA - KOREA** | |
| **YOUJUNG KWON*** | **GEUNRYEONG KIM** |
| National Institute of Fisheries Science | Ministry of Oceans and Fisheries |
| kwonuj@korea.kr | geunryeongkim@korea.kr |
| **JUNG-HYUN LIM** | |
| National Institute of Fisheries Science | |
| jhlim1@korea.kr | |
| **COSTA RICA** | |
| **MIGUEL DURÁN*** | **MAURICIO GONZÁLEZ** |
| INCOPESCA/ Instituto Costarricense de Pesca y Acuicultura | Cámara Nacional de la Industria Palangrera |
| mduran@incopesca.go.cr | mgonzgut@hotmail.com |
| **JOSÉ MIGUEL CARVAJAL** | **MOISES MUG** |
| INCOPESCA/ Instituto Costarricense de Pesca y Acuicultura | Fecop |
| jcarvajal@incopesca.go.cr | moisesmug61@gmail.com |
| **NIXON LARA** | |
| INCOPESCA/ Instituto Costarricense de Pesca y Acuicultura | |
| nlara@incopesca.go.cr | |
| | |
| **ECUADOR** | |

| | |
|---|---|
| **ANDRÉS ARENS*** | **LUIS AMBROSIO** |
| Ministerio de Producción, Comercio Exterior, Inversiones y Pesca | Tunacons |
| aarens@produccion.gob.ec | lambrosio66@gmail.com |
| **DANA ZAMBRANO** | **LUIGI BENINCASA** |
| Ministerio de Producción, Comercio Exterior, Inversiones y Pesca | Atunec |
| dzambranoz@produccion.gob.ec | luigibenincasa@gmail.com |
| **JOSÉ ANDRADE** | **OSCAR CAICEDO** |
| Ministerio de Producción, Comercio Exterior, Inversiones y Pesca | Transmarina |
| jandrade@produccion.gob.ec | leonelcaicedolc@hotmail.com |
| **GUSTAVO CHOMPOY** | **JORGE COSTAIN** |
| Ministerio de Producción, Comercio Exterior, Inversiones y Pesca | Transmarina |
| lchompoy@produccion.gob.ec | jcostain@transmarina.com |
| **LUCIANO DELGADO** | **JOSÉ GARCÍA** |
| Ministerio de Producción, Comercio Exterior, Inversiones y Pesca | Tunacons |
| ldelgados@produccion.gob.ec | jgarcia@tunacons.org |
| **REBECA ESPINOZA** | **MONICA MALDONADO** |
| Ministerio de Producción, Comercio Exterior, Inversiones y Pesca | Ceipa |
| respinoza@produccion.gob.ec | ceipa@ceipa.com.ec |
| **HENRY MERO** | **GUILLERMO MORÁN** |
| Ministerio de Producción, Comercio Exterior, Inversiones y Pesca | Tunacons |
| hmero@produccion.gob.ec **JONATHAN PINCAY** | gamv6731@gmail.com |
| Ministerio de Producción, Comercio Exterior, Inversiones y Pesca | **JUAN C. QUIROZ** |
| jpincaye@produccion.gob.ec | Tunacons |
| **DAVID VILLAVICENCIO** | jc.quirozespinosa@gmail.com |
| Ministerio de Producción, Comercio Exterior, Inversiones y Pesca | **PEDRO SANTISTEVAN** |
| dvillavicencio@produccion.gob.ec | Tunacons |
| **ESTEBAN ELIAS** | psantistevan@tunacons.org |
| Instituto Público de Investigación de Acuacultura y Pesca | **ANGELA SANTOS** |
| eelias@institutopesca.gob.ec | Corsea |
| **LEONARDO AGUIRRE** | info@corsea.com.ec |
| Negocios Industriales Real Nirsa S.A. | **LUIS TORRES** |
| laguirre@nirsa.com | Probecuador |
| | probecuador@gye.satnet.net |
| | **RAFAEL TRUJILLO** |
| | Cámara Nacional de Pesquería |
| | rtrujillo@camaradepesqueria.ec |
| | **MARCELO VELASTEGUI** |
| | Cámara Nacional de Pesquería |
| | fvelastegui@guayatuna.com.ec |
| **EL SALVADOR** | |
| **FRANCISCO SACA*** | **CRISTINA ARRANZ** |
| Ministerio de Agricultura y Ganadería | Oakcity Tuna Fishing Corporation |
| francisco.saca@mag.gob.sv | cristina.arranz@ctmcorporation.com |
| **RAÚL CORTÉZ** | **IKER GALINDEZ** |
| Ministerio de Agricultura y Ganadería | Unioceano El Salvador |
| raul.cortez@mag.gob.sv | iker.galinde@ugavi.com |
| **BERNAL CHAVARRIA** | **PILAR HAZ** |
| Ministerio de Agricultura y Ganadería | Unioceano El Salvador |
| bchavarria@lsg-cr.com | pilar.haz@coatun.com |
| **SARA ACENA** | **ANA MEJÍA** |
| Central Tuna Management Corporation | Unioceano El Salvador |
| sara.acena@ctmcorporation.com | ana.mejia@coatun.com |
| **ESTADOS UNIDOS DE AMÉRICA – UNITED STATES OF AMERICA** | |
| **STEVEN TEO*** | **RAYMOND CLARKE** |
| NOAA/National Marine Fisheries Service | Industry |

| | |
|---|---|
| steve.teo@noaa.gov<br>**CELIA BARROSO**<br>NOAA/National Marine Fisheries Service<br>celia.barroso@noaa.gov<br>**LYLE ENRIQUEZ**<br>NOAA/National Marine Fisheries Service<br>Lyle.Enriquez@noaa.gov<br>**CHRISTINA FAHY**<br>NOAA/National Marine Fisheries Service<br>Christina.Fahy@noaa.gov<br>**ANNETTE HENRY**<br>NOAA/National Marine Fisheries Service<br>annette.henry@noaa.gov<br>**KEVIN PINER**<br>NOAA/National Marine Fisheries Service<br>kevin.piner@noaa.gov<br>**WENDY PINIAK**<br>NOAA/National Marine Fisheries Service<br>wendy.piniak@noaa.gov<br>**VALERIE POST**<br>NOAA/National Marine Fisheries Service<br>valerie.post@noaa.gov<br>**DALE SQUIRES**<br>NOAA/National Marine Fisheries Service<br>dale.squires@noaa.gov<br>**WILLIAM STAHNKE**<br>NOAA/National Marine Fisheries Service<br>william.stahnke@noaa.gov<br>**YONAT SWIMMER**<br>NOAA/National Marine Fisheries Service<br>yonat.swimmer@noaa.gov<br>**DESIREE TOMMASI**<br>NOAA/National Marine Fisheries Service<br>desiree.tommasi@nooa.gov<br>**RACHAEL WADSWORTH**<br>NOAA/National Marine Fisheries Service<br>rachael.wadsworth@noaa.gov<br>**ELIZABETH HELLMERS**<br>California Dept. Fish & Wildlife<br>elizabeth.hellmers@wildlife.ca.gov<br>**MICHELLE HORECZKO**<br>California Dept. Fish & Wildlife<br>michelle.horeczko@wildlife.ca.gov<br>**ANDRE BOUSTANY**<br>Monterey Bay Aquarium<br>aboustany@mbayaq.org | ray.clarke@gmail.com<br>**MARK FITCHETT**<br>Western Pacific Regional Fishery Management Council mark.fitchett@wpcouncil.org<br>**WILLIAM FOX**<br>U.S. Commissioner<br>billx@mac.com<br>**SVEIN FOUGNER**<br>Hawaii Longline Association<br>fougneranalytics@gmail.com<br>**DOUGLAS FRICKE**<br>Pfmc Hmsas<br>fricked@comcast.net<br>**WILLIAM GIBBONS-FLY**<br>American Tunaboat Association<br>wgibbons-fly@atatuna.com<br>**DAVID ITANO**<br>Tnc<br>daveitano@gmail.com<br>**THERESA LABRIOLA**<br>Wild Oceans<br>tlabriola@wildoceans.org<br>**DOROTHY LOWMAN**<br>Industry<br>dmlowman01@comcast.net<br>**JOSH MADEIRA**<br>Monterey Bay Aquarium<br>jmadeira@mbayaq.org<br>**MATTHEW OWENS**<br>Tri Marine<br>mowens@trimarinegroup.com<br>**JIM SOUSA**<br>GS Fisheries Inc.<br>jim.sousa@marpacifico.net<br>**MICHAEL THOMPSON**<br>U.S. Commissioner<br>thompsonmike148@gmail.com<br>**BRETT WIEDOFF**<br>Pacific Fishery Management Council<br>brett.l.wiedoff@noaa.gov<br>**JOHN ZUANICH**<br>U.S. Commissioner<br>jztrading@aol.com |
| **GUATEMALA** | |
| **JULIO LEMUS***<br>Dirección de Normatividad de la Pesca y Acuicultura<br>juliolemusdipesca@gmail.com | **CARLOS MARTÍNEZ**<br>Dirección de Normatividad de la Pesca y Acuicultura<br>carlosmartinez41331@gmail.com |
| **JAPÓN - JAPAN** | |
| **SHUYA NAKATSUKA ***<br>Japan Fisheries Research and Education Agency<br>snakatsuka@affrc.go.jp<br>**HIROMU FUKUDA**<br>Japan Fisheries Research and Education Agency | **HIROSHI MINAMI**<br>Japan Fisheries Reserch and Education Agency<br>hminami@affrc.go.jp<br>**DAISUKE OCHI**<br>Japan Fisheries Research and Education Agency |

| | |
|---|---|
| fukudahiromu@affrc.go.jp<br>**TAKUMI FUKUDA**<br>Fisheries Agency of Japan<br>takumi_fukuda720@maff.go.jp<br>**SHINJI HIRUMA**<br>Fisheries Agency of Japan<br>shinji_hiruma150@maff.go.jp<br>**HIROTAKA IJIMA**<br>Japan Fisheries Research and Education Agency<br>ijima@affrc.go.jp<br>**MIKIHIKO KAI**<br>Japan Fisheries Research and Education Agency<br>kaim@affrc.go.jp<br>**MARKO JUSUP**<br>Japan Fisheries Research and Education Agency<br>jusup_marko00@fra.go.jp<br>**AYA MATSUSHIMA**<br>Fisheries Agency of Japan<br>aya_matsushima190@maff.go.jp | otthii80s@gmail.com<br>**KEISUKE SATOH**<br>Japan Fisheries Research and Education Agency<br>kstu21@fra.affrc.go.jp<br>**YOICHI TSUDA**<br>Japan Fisheries Research and Education Agency<br>u1tsuda@affrc.go.jp<br>**SACHIKO TSUJI**<br>National Research Institute of Fisheries Science<br>sachiko27tsuji@gmail.com<br>**HAYASHI FUKUDA**<br>Japan Tuna Fisheries Co-operative Association<br>ohashi@japantuna.or.jp<br>**NOZOMU MIURA**<br>Japan Tuna Fisheries Co-operative Association<br>miura@japantuna.or.jp<br>**YUJI UOZUMI**<br>Japan Tuna Fisheries Co-operative Association<br>uozumi@japantuna.or.jp |
| **MÉXICO – MEXICO** | |
| **ISABEL REYES***<br>Comisión Nacional de Acuacultura y Pesca<br>isabel.reyes@conapesca.gob.mx<br>**MICHEL DREYFUS**<br>Cicese<br>dreyfus@cicese.mx<br>**LUIS FLEISCHER**<br>Fidemar<br>lfleischer21@hotmail.com<br>**BERTHA SOLER**<br>Comisión Nacional de Acuacultura y Pesca<br>berthaa.soler@gmail.com | **SOFIA ORTEGA**<br>Cicimar<br>sortega@ipn.mx<br>**GUILLERMO GÓMEZ**<br>Gomez-Hall Associates<br>gomezhall@gmail.com<br>**ALVIN SUÁREZ**<br>Alianza del Pacífico por el Atún Sustentable<br>asuarez@pacifictunaalliance.org<br>**MARIANA RAMOS**<br>Alianza del Pacífico por el Atún Sustentable<br>mariana@pacifictunaalliance.org |
| **NICARAGUA** | |
| **RENALDY BARNUTY***<br>Inpesca<br>rbarnutti@inpesca.gob.ni<br>**ROBERTO CHACÓN**<br>Inpesca<br>rchacon@inpesca.gob.ni<br>**JOHNNY COREA**<br>Inpesca<br>jcorea@inpesca.gob.ni<br>**JULIO GUEVARA**<br>Inpesca<br>juliocgp@hotmail.com | **REYNA ARANA**<br>Atunes de Nicaragua,S.A.<br>karina.marquez3@gmail.com<br>**NYDUA MALTEZ**<br>Mantaraya Nicaragua S.A<br>tiffanymaltez@hotmail.com<br>**ARMANDO SEGURA**<br>Cámara de Pesca de Nicaragua<br>capenic@ibw.com.ni<br>**KAROLA SIRIAS**<br>Industry<br>k_27@hotmail.es |
| **PANAMÁ- PANAMA** | |
| **VIVIAN QUIROS***<br>Autoridad de los Recursos Acuáticos de Panamá<br>vquiros@arap.gob.pa<br>**RAÚL DELGADO**<br>Autoridad de los Recursos Acuáticos de Panamá<br>rauldelgadoq@gmail.com<br>**YESURI PINO**<br>Autoridad de los Recursos Acuáticos de Panamá<br>yesuri.pino@arap.gob.pa<br>**YARKELIA VERGARA** | **YASMIN VILLARREAL**<br>Autoridad de los Recursos Acuáticos de Panamá<br>yvillarreal@arap.gob.pa<br>**MARÍA P. DÍAZ**<br>Fipesca<br>mpdiaz@fipesca.com<br>**ARNULFO FRANCO**<br>Fipesca<br>arnulfofranco@fipesca.com |

| | |
|---|---|
| Autoridad de los Recursos Acuáticos de Panamá yvergara@arap.gob.pa | |
| **PERÚ - PERU** | |
| **JOSÉ SALCEDO*** <br> Instituto del Mar del Perú <br> jsalcedo@imarpe.gob.pe <br> **ANA ALEGRE** <br> Instituto del Mar del Perú <br> palegre@imarpe.gob.pe <br> **JAVIER QUIÑONES** <br> Instituto del Mar del Perú <br> jquinones@imarpe.gob.pe | **PABLO MARÍN** <br> Instituto del Mar del Perú <br> pmarin@imarpe.gob.pe <br> **GERSSON ROMAN** <br> Instituto del Mar del Perú <br> groman@imarpe.gob.pe |
| **TAIPEI CHINO – CHINESE TAIPEI** | |
| **SHENG-PING WANG*** <br> National Taiwan Ocean University <br> wsp@mail.ntou.edu.tw <br> **HSIANG-YI YU** <br> Fisheries Agency <br> hsiangyi@ms1.fa.gov.tw | **SHU-MAN PAI** <br> Fisheries Agency <br> shuman0823@ms1.fa.gov.tw <br> **HUI-SHAN MA** <br> Overseas Fisheries Development Council <br> sandrama7@gmail.com |
| **UNIÓN EUROPEA – EUROPEAN UNION** | |
| **JOSU SANTIAGO*** <br> Azti Tecnalia <br> jsantiago@azti.es <br> **JOSÉ BAEZ** <br> Instituto Español de Oceanografía <br> josecarlos.baez@ieo.es <br> **CARLOS BARCIELA** <br> Orpagu <br> cbarciela@orpagu.com | **MIGUEL HERRERA** <br> Opagac <br> miguel.herrera@opagac.org <br> **GORKA MERINO** <br> Azti Tecnalia <br> gmerino@azti.es |
| **VENEZUELA** | |
| **JEIRIS GALICIA*** <br> Ministerio del Poder Popular de Pesca y Acuicultura <br> jgalicia.minpesca@gmail.com <br> **PEDRO GUERRA** <br> Ministerio del Poder Popular de Pesca y Acuicultura <br> DE.CENIPA@GMAIL.COM | **FREDDY BUSTILLOS** <br> Insopesca <br> fxpesca@gmail.com <br> **ALVIN DELGADO** <br> Fundatun <br> fundatunpnov@gmail.com |
| **NO MIEMBROS COOPERANTES – COOPERATING NON-MEMBERS** | |
| **BOLIVIA** | |
| **LIMBERT CORTÉZ*** <br> Ministerio de Defensa <br> limbert.cortez@protonmail.ch | **HUGO ALSINA** <br> Alsina et al. <br> hugo@alsina-et-al.org |
| **CHILE** | |
| **CAMILA BUSTOS*** <br> Subsecretaria de Pesca y Acuicultura <br> lbustos@subpesca.cl | **PATRICIO BARRIA** <br> Instituto de Fomento Pesquero <br> patricio.barria@ifop.cl |
| **ORGANIZACIONES INTERNACIONALES – INTERNACIONAL ORGANIZATIONS** | |
| **VERÓNICA CÁCERES** <br> IAC <br> secretario@iacseaturtle.org <br> **CLAUDIO CASTILLO** <br> SPC <br> claudioc@spc.int | **PAUL DE BRUYN** <br> Indian Ocean Tuna Commission <br> paul.debruyn@fao.org |
| **ORGANIZACIONES NO GUBERNAMENTALES – NON-GOVERNMENTAL ORGANIZATIONS** | |
| **ORION CRUZ** <br> Defenders of Wildlife <br> OCruz@defenders.org | **CRAIG HEBERER** <br> The Nature Conservancy <br> craig.heberer@tnc.org |

| | |
|---|---|
| **TEDDY ESCARABAY**<br>Sustainable Fisheries Partnership<br>eddy.escarabay@sustainablefish.org | **VISHWANIE MAHARAJ**<br>World Wildlife Fund<br>vishwanie.maharaj@wwfus.org |
| **ESTEBAN FRERE**<br>BirdLife International<br>estebanfrere@yahoo.com.ar | **GALA MORENO**<br>International Seafood Sustainability Foundation<br>gmoreno@iss-foundation.org |
| **GRANTLY GALLAND**<br>The Pew Charitable Trusts<br>ggalland@pewtrusts.org | **ALEXIA MORGAN**<br>Sustainable Fisheries Partnership<br>alexia.morgan@sustainablefish.org |
| **JAMES GIBBON**<br>The Pew Charitable Trusts<br>jgibbon@pewtrusts.org | **NICOLAS PAYETTE**<br>The Ocean Conservancy<br>nicolas.payette@ouce.ox.ac.uk |
| **PABLO GUERRERO**<br>World Wildlife Fund<br>pablo.guerrero@wwf.org.ec | **SARA PIPERNOS**<br>The Ocean Foundation<br>spipernos@oceanfdn.org |
| **DAVID GUERSHMAN**<br>The Ocean Foundation<br>dgershman@oceanfdn.org | **REBECCA REGNERY**<br>Humane Society International<br>rregnery@hsi.org |
| **ALEJANDRA GOYENECHEA**<br>Defenders of Wildlife<br>agoyenechea@defenders.org | **BETH VANDEN HEUVEL**<br>American Tunaboat Association<br>bvandenheuvel@capefisheries.com |
| **OBSERVADORES – OBSERVER** | |
| **KATHERINE ALVAREZ**<br>AACH Holding Co., LLC<br>kalvarez@gammaseafood.com | **VERONICA MORA**<br>Conservation Mahi Mahi<br>verucca29@hotmail.com |
| **MICHAEL CONROY**<br>West Coast Fisheries Consultants<br>mike@wecofm.com | **GUILLERMO MORAN**<br>Oregon State University<br>moranbog@oregonstate.edu |
| **PÍNDARO DÍAZ**<br>Consultant<br>pindaro@cmarl.unam.mx | **ANDERS NIELSEN**<br>DTU Aqua<br>an@aqua.dtu.dk |
| **MARTIN HALL**<br>Industry<br>mhall665@gmail.com | **RUBEN ROA**<br>Consultant<br>ruben.roa.ureta@mail.com |
| **GREG HAMMMANN**<br>Marine Instruments<br>ghammann@marineinstruments.es | **SARAH ROYER**<br>Consultant<br>sroyer@hpu.edu |
| **TOBIAS MILDENBERGER**<br>DTU Aqua<br>tobm@aqua.dtu.dk | |
| **SECRETARÍA – SECRETARIAT** | |
| **JEAN FRANCOIS PULVENIS, Director a.i.**<br>jpulvenis@iattc.org | **DAN MARGULIES**<br>dmargulies@iattc.org |
| **MARISOL AGUILAR**<br>maguilar@iattc.org | **JOYDELEE MARROW**<br>jmarrow@iattc.org |
| **ERNESTO ALTAMIRANO**<br>ealtamirano@iattc.org | **MARK MAUNDER**<br>mmaunder@iattc.org |
| **RICARDO BELMONTES**<br>rbelmontes@iattc.org | **CAROLINA MINTE VERA**<br>cminte@iattc.org |
| **YOLE BUCHALLA**<br>ybuchalla@iattc.org | **JEFF MORGAN**<br>jmorgan@iattc.org |
| **GUILLERMO COMPEÁN**<br>gcompean@iattc.org | **ALFONSO MIRANDA**<br>amiranda@iattc.org |
| **MANUEL CORREIA**<br>manuelcorreia.a@gmail.com | **CHRISTINE PATNODE**<br>cpatnode@iattc.org |
| **BARBARA CULLINGFORD**<br>bcullingford@iattc.org | **MARLON ROMAN**<br>mroman@iattc.org |

| | |
|---|---|
| **ALEXANDRE DA SILVA**<br>adasilva@iattc.org | **ANDRES ROMERO**<br>aromero@iattc.org |
| **LEANNE FULLER**<br>lfuller@iattc.org | **ROBERT SARAZEN**<br>rsarazen@iattc.org |
| **MONICA GALVÁN**<br>mgalvan@iattc.org | **SALVADOR SIU**<br>ssiu@iattc.org |
| **SHANE GRIFFITHS**<br>sgriffiths@iattc.org | **ENRIQUE UREÑA**<br>eurena@iattc.org |
| **MELANIE HUTCHINSON**<br>melaniehutch11@gmail.com | **JUAN VALERO**<br>jvalero@iattc.org |
| **CLERIDY LENNERT**<br>clennert@iattc.org | **KATYANA VERT-PRE**<br>vertpre.katyana@gmail.com |
| **JON LOPEZ**<br>jlopez@iattc.org | **NICK VOGEL**<br>nvogel@iattc.org |
| **PAULINA LLANO**<br>pllano@iattc.org | **BRAD WILEY**<br>bwiley@iattc.org |
| **ANANDA MAJUMBAR**<br>amajumdar@iattc.org | **HAIKUN XU**<br>hkxu@iattc.org |

*HEAD OF DELEGATION-JEFE DE DELEGACIÓN

NOTE: IF YOUR INFORMATION IS INCORRECT, PLEASE LET US KNOW. THANKS.

NOTA: SI SU INFORMACIÓN ES INCORRECTA, POR FAVOR DEJENOS SABER. GRACIAS.