



**141st Meeting of the Scientific and Statistical Committee
September 14-16, 2021
Web Conference**

FINAL REPORT

4. Report from Pacific Islands Fisheries Science Center Director

Michael Seki provided the PIFSC Director's report, highlighting COVID-19 updates for research cruises and research activities, Territorial bottomfish stock assessment improvement efforts, review of potential mitigation measures to reduce fishing-related mortality on silky and oceanic whitetip sharks, and the ongoing main Hawaiian Islands (MHI) bottomfish survey and analysis. Other updates included the Hawaiian Monk Seal Research Program activities, Marine Turtle Biology and Assessment Program activities, the recently completed Marianas Archipelago Cetacean Survey, a published report on Community Participation Trends in Hawaii Commercial Fisheries, National Coral Reef Monitoring Program dive surveys around Oahu, the ongoing the Papahānaumokuākea Marine National Monument marine debris removal fall mission, and personnel updates.

An SSC member asked whether there were any ongoing studies of the Hawaii deep-set longline fishery's conversion from wire leaders to monofilament. PIFSC staff Keith Bigelow noted an earlier data report that analyzed catch rates by leader material based on historical data, and supported the idea of follow-up but did not have information on the voluntary conversion status. Council staff noted that based on information from industry representatives, at least two thirds of the fleet had converted with most of the remaining vessels in progress, and that pending rulemaking process for the regulatory requirement on leader material is expected to facilitate the fleet's full conversion. An SSC member noted that the report on Community Participation Trends and vulnerability indices was well done and would be very useful in improving the quality of social impact assessments. In response to a question from the Executive Director regarding the number of green turtle nesting observed in the MHI this year, Seki noted that the increase in nesting in the MHI may be a response to the reduction in habitat at East Island, although nesting activity at Tern Island is also high this year with at least 1,000 individuals identified this year.

5. Program Planning and Research

A. Essential Fish Habitat Model for the Main Hawaiian Island Uku

SSC member, Erik Franklin, University of Hawaii, presented the preliminary results of the model based delineation of essential fish habitat in the Western Pacific. The description of essential fish habitat is required for federally managed fishery species. Species distribution models (SDMs) have been utilized in marine science and conservation to identify and predict suitable habitats for many species. SDMs can involve a range of models that vary in structure and complexity. Boosted regression tree models were fit to fishery-independent data to define the geographic extent of essential fish habitat (EFH) of sub-adult/adult life stages of a federally managed snapper species, *Aprion virescens*, commonly called “Uku”, in the main Hawaiian Islands. Due to differences in survey data collection methods, separate SDM models for Uku were constructed for shallow (0-30 m depth) depths using NOAA fish diver surveys and deeper (30-300 m) depths using NOAA and UH baited stereo-video camera arrays. For shallow models, aspect (i.e., direction that habitat slope faces), depth, and wave heights were strong predictors of Uku occurrence, while depth was the predominant habitat variable for the deep model. Output from the SDMs were used to create maps delineating Uku EFH including continuous probability of occurrence maps as well as categorical maps showing EFH “hot spots”, “core habitats”, and “basic EFH”, based on 25%, 50%, and 95% quantiles of predicted occurrence, respectively.

For shallow depths, Uku hot spots were 0% of the MHI, core habitat was 0.2%, basic EFH was 55.4%, and other habitat was 44.4%. For deep depths, Uku hot spots were 0.09% of the MHI, core habitat was 2.4%, basic EFH was 59.8%, and other habitat was 37.3%. The maps are a visual display of the predicted quantitative relationship between Uku and their habitat and can be used to inform marine conservation and management activities in the main Hawaiian Islands. These analyses represent the first model-based approach to delineating EFH for a U.S. Western Pacific stock and could serve as a framework for the EFH descriptions of other managed species in the region. A future phase of this work will expand the environmental covariates in the SDMs to include dynamic variables such as seawater temperature, salinity, productivity, and current velocity.

SSC discussion focused on the covariates, particularly bathymetry, depth, aspect, and substrate composition, which were found to be important variables in the analyses. There was also some discussion on whether more dynamic covariates, such as prey abundance, currents, etc., could be included in the models and whether this approach could be applied to delineate Deep-7 bottomfish EFH.

The SSC thanked Franklin for a very informative presentation.

B. Report on the Bottomfish Fishery in the Opened Bottomfish Restricted Fishing Areas

SSC member Jason Helyer, Division of Aquatic Resources, presented a summary of the data from Fishery Reporting System on catch and effort from the four opened BRFAs (C in Makahū‘ena, Kaua‘i; F in Penguin Banks; J in Mokumana-Umalei Pt, Maui, and L in Lelewi Pt,

Hawai‘i Island). The data showed possible under reporting of fishing effort and landings. Much of the reported effort comes from Penguin Banks. Possible explanations include lack of awareness of the reporting requirement, lack of enforcement when it was still closed, non-reporting due to other reasons. In comparing the CPUE from the opened BRFAs with the adjacent areas to evaluate the efficacy of the BRFA, there are lots of assumptions to be made including the habitat areas are not the same and fish never left the BRFA boundaries. Assuming there is full enforcement, an effort displacement signal should be clear. There were serious data concerns thereby creating challenges to interpreting effort and landings in evaluating the effects of BRFA opening. It was clear that management and enforcement plays a role in the quality (or lack thereof) of the data reported to the State.

The SSC noted that the correction of catch reporting by a highliner from outside to inside the BRFA may be symptomatic of larger data issues.

SSC members echoed the data concerns expressed in the report and asked what steps HDAR would be taking to improve the accuracy and level of reporting of fishing effort inside and outside of the BRFAs. An SSC member indicated that there is a fair amount of distrust among the fishing community related to the establishment of the BRFAs (poor siting protocol, breach of 5-year trial period) which likely has contributed to misreporting and underreporting of fishing activity. In addition, the lack of baseline data prior to the BRFA closures precludes comparison to previous fishing effort and catch in those areas. Members also inquired about the status of a recommendation that HDAR improve catch location and boundary recognition for GPS units. However, this does not appear to have been implemented by HDAR. An SSC member suggested that anonymized cell phone tracking data might be useful towards resolving uncertainty about fishing activity in BRFAs.

SSC reiterates its previous recommendation to eliminate all BRFAs, given the change in stock status since their establishment and because their management utility has been superseded by annual catch limits.

The SSC recommends HDAR continue to improve fishery-dependent data collection through better fisher engagement in order to effectively manage the bottomfish fishery.

The SSC thanked Helyer for his presentation.

C. American Samoa Bottomfish Stock Assessment Improvement Plan

Felipe Carvalho, PIFSC Stock Assessment Program Lead, presented the various steps the Stock Assessment Program (SAP) will take, in collaboration with the stakeholders, to improve the assessment for the bottomfish MUS in American Samoa, with co-presenters Erin Bohaboy, Mia Iwane, and Marc Nadon. The next benchmark assessment is scheduled for WPSAR review in 2023. The Bottomfish Data Workshop will be held in November 2021. Starting at this 141st meeting, the SAP will give regular presentations to the SSC with updates on the assessment development. SAP will seek the SSC’s advice on key decision points in the assessment.

SSC discussion included questions about the planned steps to refine the species aggregations used in the stock assessment.

The SSC reiterates its recommendation that the next assessment should analyze shallow- and deepwater BMUS as separate stock complexes. The SSC also recommends that PIFSC further investigate changes in fishing operations and fishing power (e.g., vessels, gear, and technology) over the past few decades to inform the stock assessment.

The SSC recommends that it form a sub-committee to work with the PIFSC Stock Assessment Program in the development of the next benchmark stock assessment. SSC members Itano, Martell, Harley, Severance and Ochavillo expressed an interest in serving.

The SSC thanked Carvalho and his team for their presentation.

D. Review of the MSRA Five Year Research Priorities

Council staff presented the updates to the MSRA Five Year Research Priorities. All the Council research priorities, including Cooperative Research, Management Strategy Evaluation, Pelagic Research, and Social Science were integrated in this research priority document. The document was reviewed by SSC members and comments were incorporated in the current version. Updates to the priorities included focus on the climate change agenda of the current administration. The priority document will be submitted to the Secretary of Commerce and the Pacific Island Fisheries Science Center for consideration in their priority and budget development.

The SSC endorses the MSRA Five Year Research Priorities, noting the SSC also added a research priority on evaluating limit reference points for pelagic management units species in the Pelagic FEP.

E. Potential MSA Reauthorization Provisions Affecting the SSC

Council staff presented the highlights of H.R. 4690. This bill includes amendments and provisions that added new requirements to all the regional Councils. The inclusion of a definition of “subsistence” fishing, changes to the Sustainable Fisheries Fund, new provisions for Council member appointments, and changes to Essential Fish Habitat, data collection, and stock assessments are among the changes being tracked. The bill proposed additional responsibilities for the Council’s SSC in terms of providing scientific advice on effects of climate change, definition of “depleted”, monitoring of fishery performance and environmental conditions etc.

Staff reviewed the bill including how the changes will affect our fisheries. The bill was referred to the Committee on Natural Resources and to the Committee on Agriculture for further discussion and action and is at the beginning of the journey to becoming law.

SSC members highlighted a few potential regional issues regarding the proposed definition of *subsistence* fishing including; the definition of barter (also included in commercial fishing definition) and its relationship with Council’s definition of customary exchange, consideration of the scope of “family” covered in the language, and uncertainty regarding whether subsistence would only apply to federally-recognized tribes, certain indigenous groups or groups with specific legal standing.

F. SSC Three-Year Plan

Jim Lynch, SSC Chair, presented the elements of the revised SSC Three Year Plan. The plan provides the framework on the issues and topics the SSC will be tackling in the next three years. The current version of the plan addressed the comments from PIFSC and SSC members, and additional socio-economic priorities from the Social Science Planning Committee.

The SSC endorses the SSC Three-Year Plan.

G. Public Comment

There was no public comment.

6. Protected Species

A. Hawaii Longline Fishery Seabird Mitigation Measures

1. Results of the Tori Line Experimental Fishing Permit Study in the Hawaii deep-set longline fishery

Milani Chaloupka, SSC member, presented the results of a second tori line study conducted under an Experimental Fishing Permit (EFP). Field trials for the EFP study were conducted from February to June 2021. The field experiment comprised 87 sets deployed during 7 trips from 3 Hawaii-based deep-set longline (DSL) vessels. The partial factorial design involved random assignment on each trip to one of the two treatments (tori line, blue-dyed fish bait) for the initial set and then alternating the two treatments for each subsequent set in the trip. All the sets were deployed with line shooters, similar branchline weights and no offal discharge during setting operations. Nearly 99% of all the seabird interactions during this experiment were for black-footed (*Phoebastria nigripes*) and Laysan albatrosses (*Phoebastria immutabilis*).

A Bayesian modelling workflow was used to model statistically the albatross interactions (attempts to contact a baited hook, actual contacts with a baited hook) recorded using onboard stern-view video-based electronic monitoring. This modelling approach supports robust statistical inference about the comparative efficacy of the two mitigation measures evaluated (tori lines, blue-dyed bait). The analysis indicated that albatross attempts are 1.5 times less likely, contacts are 4 times less likely, and captures 14 times less likely on tori line sets compared to blue-dyed bait sets. The study showed that tori lines were a far more effective seabird bycatch mitigation measure than blue-dyed fish bait.

The SSC congratulated the tori line project team for a well-executed study. **The SSC endorsed the study's finding that tori lines are far more effective than blue-dyed fish bait for seabird bycatch mitigation.**

2. Options for Revising Seabird Mitigation Measures in the Hawaii Deep-set Longline Fishery (Action Item)

Council staff presented on the options for a regulatory amendment to allow the use of tori lines in lieu of blue-dyed bait and removing the strategic offal discharge requirement in the DSL fishery. The purpose of the action is to modify the seabird mitigation measures for the DSL fishery to reflect the results of the recent cooperative research and the best available scientific information, and to improve the overall operational practicality and mitigation efficacy of the required measures. The options include addition of tori lines as a third suite of measures, replacement of blue-dyed bait with tori lines, and modification of the strategic offal discard requirement (either to remove from the requirements or to refine the regulatory language to prohibit discards during setting when seabirds are most active).

The SSC discussed previous concerns for crew safety related to deploying tori lines. Current methods to deploy tori lines have been modified to address safety concerns and the new methods have been well received by participating fishers.

The SSC reiterated the findings of the Tori Line Experimental Fishing Permit Study in the

Hawaii deep-set longline fishery. The study was well executed and clearly showed that tori lines are more effective than blue-dyed bait for seabird bycatch mitigation. The SSC therefore recommends Option 3: Replace blue-dyed bait with tori line in the required measures for the Hawaii deep-set longline fishery.

The SSC discussed the modifications to the strategic offal discard requirement. **The SSC recommends Option 4a: Remove the requirement for strategic offal discards.**

Additionally, the SSC recommends the Council consider either an option for an additional regulation for not discharging fish waste immediately before and during setting, or incorporate best practices training to the currently required annual protected species training workshop.

The SSC noted that the DSLL fleet sets their gear during the day, hauls and processes their catch (and discards offal) during night-time hours. In the rare instance that hauling extends past sunrise, there is time between the end of processing catch and deploying the next set such that offal discard would be completed well before the start of the next setting operation. In the absence of a requirement to strategically discard offal during setting operations (as currently required), the fleet’s operational characteristics would preclude the scenario of fish waste being present when risks of seabirds interactions are highest.

B. SSC Working Group Issues Paper on Alternative Approaches to Reduce Impacts to False Killer Whales

The SSC at the December 2020 meeting formed a working group composed of SSC members Itano, Chaloupka, Severance and Lynch to develop recommendations on alternative approaches to weak hooks for reducing impacts to false killer whales in the Hawaii deep-set longline fishery. The working group developed a comprehensive issues document on the topic, which reviews the history of the False Killer Whale Take Reduction Team and their recommendations, past SSC recommendations, cetacean avoidance research and interaction reduction measures, and evaluates potential biological removal (PBR) and serious injury determinations as applied under the Marine Mammal Protection Act (MMPA). The initial draft paper was presented at the 140th SSC meeting in June, after which SSC members were requested to provide review and comments. Lynch presented the revised paper on behalf of the working group.

The SSC commended the excellent contributions from the working group members, specifically the suggestion of alternative methods to PBR for evaluation of FKW removals. These alternative methods should be looked at. The SSC noted that although the paper doesn’t fit very well for a single publication, it should be preserved and made publicly available in some way.

The SSC endorses the working group issue paper (Appendix A) and adopts the recommendations as follows:

- 1. Develop take reduction measures that recognize the already-low mortality rate of FKW caught in fishing gear.**
- 2. Conduct a post-release study on FKWs using satellite tags or other technology to assess mortality rates and sublethal effects. Develop cost-effective methods to determine robust estimates of sublethal effects attributable to capture and release**

from pelagic longline.

3. **Implement a Population Consequences of Disturbance (PCoD), comprised of a 4-level sequence ranging from observed changes in individual behaviour (level 1) to population-level effects such as impaired reproductive, survival or population growth rates (level 4). PCoD review of the FKW populations is important to derive a robust form of risk assessment. However, it is equally as important to regularly know the long-term status of each FKW population exposed to the Hawaii-based pelagic longline fishery. PCoD is a simple, robust and effective means to monitor and report on protected species bycatch in the Hawaii-based pelagic longline fisheries.**
4. **Develop a population dynamic-based model to assess the applicability of PBR for bycatch management. Use the results of such modelling to inform selection of appropriate take reduction measures for the US-based pelagic longline fishery.**
5. **Make use of the SSC process provided in the Magnuson-Stevens Act to help inform measures considered by the TRT and other parties in formulating a TRP. Subject SSC recommendations and work products to independent scientific peer review in published literature to confirm the validity of such recommendations and work products.**
6. **The Council and NMFS should adopt conformance-based monitoring of FKW captures in the Hawaii-based pelagic longline fisheries and report the conformance and any anomalies in the SAFE Report.**
7. **The Council should undertake a study to assess the economic impacts of FKW regulatory measures on Hawaii-based pelagic longline fisheries and report the results of such studies to NMFS. This study should be updated over time to assess the cumulative impacts of such regulatory measures on commercial fisheries.**

C. ESA Consultations for the Hawaii Deep-set Longline Fishery, American Samoa Longline Fishery, and Bottomfish Fisheries

Diana Kramer, PIRO PRD, presented on the current status of ESA consultations for the pelagic longline fisheries, US purse seine and bottomfish fisheries in the MHI and territories. The US purse seine consultation is expected to be completed by September 2021, the American Samoa longline and bottomfish consultations are expected to be completed by October 2021, and the Hawaii deep-set longline fishery consultation is expected to be completed by January 2022.

The SSC thanked Kramer for her presentation.

D. ESA and Marine Mammal Protection Act Updates

Kramer provided the ESA and MMPA updates, including the ESA Coral Recovery Workshop convened in May 2021, coral critical habitat, coral assessment and mitigation framework (Coral Tool), the 90-day finding in response to shortfin mako shark ESA listing petition, insular false killer whale recovery planning, false killer whale interactions in the Hawaii longline fishery, and the Final Environmental Impact Statement (FEIS) for enhancing protections for Hawaiian spinner dolphins.

The SSC requested a status update of a longline hook strength study being conducted by PIFSC to examine the economic impact of using weak circle hooks and their impact on retention of target and other retained catch. The SSC had previously requested a report to be presented at this meeting. Kramer noted that the field work for the study was completed but the report completion was delayed, and that a report will be provided to the 142nd SSC if the reviews are complete.

The SSC thanked Kramer for her presentation.

E. Public Comment

There was no public comment.

7. Pelagic Fisheries

A. Update on SWFSC Pelagic Fisheries Research

Barbara Muhling and Brad Erisman, SWFSC, provided an overview of pelagic fisheries research that may be relevant to the Western Pacific Region. This includes summaries on current efforts and priorities related to tunas (e.g. albacore and bluefin), opah, swordfish, and sharks. The SSC will have the opportunity to comment on the work plan, current studies, and completed work by SWFSC that may fulfill needs in the Council's Research Plan and complement other needs in the Pelagic Fisheries Research Plan.

The SSC thanked Muhling and Erisman for an informative presentation.

B. Investigating the Impact of Imports on the Hawaii Fish Market

Jonathan Sweeney, PIFSC, presented a conceptual frame for investigating the impact of imports on the Hawaii market. This is noting the Hawaii market in 2021 had an extreme shortage of foreign-sourced pelagic fish product, overall decreased supply in the local market – with locally-sourced product being dominant. This offers an analytical opportunity to separately identify impacts associated with domestic and import supply shocks. Sweeney and Justin Hospital (PIFSC) may propose to expand an existing set of demand models for priority Hawaii-landed species to include import effects on price. There are three primary deliverables from this effort: (1) An interactive visualization that will add imports to the existing market demand app, (2) A ranking of species by their average import sensitivity, (3) An assessment of market linkages between geographic markets on the US mainland and Hawaii's market. This presentation will be a project summary presentation with the following tasks to take place: acquisition of trade data, model specification, revising the already available R Shiny app, visualization of species ranked by import sensitivities, and a follow-up project presentation at the March SSC Meeting.

The SSC discussed the role of international imports and influential species groups in the model which should be evaluated in future model iterations. The SSC also suggested that the effect of consumer choice, based on local fish prices versus imports and exports from Hawaii should be considered in future iterations of the model.

The SSC thanked Sweeney for the informative presentation.

C. Shark Depredation in the Mariana Archipelago

Carl Meyer, University of Hawaii, presented on shark depredation in the bottom and troll fisheries in Guam and Saipan, which is a long-running concern. To date there has been uncertainty and speculation about which shark species are responsible for depredating catches because most incidents are obscured from view below the surface and, even when sighted, sharks can be difficult to visually identify. The project collaborated with Guam and Saipan fishers to identify depredating shark species by analyzing transfer DNA collected from swab samples taken from shark-bitten fishes (when sharks bite hooked fish they leave traces of their DNA in the bite impression). Fishers were trained at workshops held in Guam and Saipan in early 2020 to collect samples and equipped with swab kits to take on fishing trips. Fishing was disrupted by the

COVID-19 pandemic but 4 fishers provided swab samples from 29 bottomfishing depredation events in waters off Guam and Saipan. Using DNA barcoding, the project successfully identified the shark species responsible for depredating catches in 26 (90%) out of 29 cases. A total of 5 shark species were identified from depredation swabs: silvertip shark (*Carcharhinus albimarginatus*), silky shark (*Carcharhinus falciformis*), grey reef shark (*Carcharhinus amblyrhynchos*), whitetip reef shark (*Triaenodon obesus*) and tiger shark (*Galeocerdo cuvier*). Three of five species identified (silvertip shark, grey reef shark and whitetip reef shark) are strongly reef-associated and the remaining two (tiger shark, silky shark) are strongly associated with shelf habitats and drop-offs. No threatened or endangered shark species (e.g. oceanic whitetip sharks, *Carcharhinus longimanus*) were detected interacting with the Marianas bottomfish fishery. The transfer DNA swab method is effective for identifying depredating sharks from damaged catches and was successfully implemented through a collaborative sampling program with local fishermen volunteering as “citizen scientists”. Future research should focus on additional depredation swab sampling to further characterize the depredating species and tracking studies of the known depredating species to determine their fidelity to fishing sites.

The SSC expressed its appreciation for the important work which has demonstrated the feasibility of identifying the shark species responsible for depredation events and supports the ultimate goal of working towards an effective deterrent for shark depredation.

The SSC clarified that the study involved 20 total fishery participants but primarily relied on a core group of 4 citizen science volunteers to collect the samples. The SSC suggested presenting the findings of the study back to the fishery communities of Guam and the CNMI.

The SSC suggested that the additional collection of species and size data for fish which are predated by sharks from fisherman who volunteer to collect samples could be used to assess the economic loss due to predation.

The SSC noted that while species identification from the samples was highly successful, the associated video camera footage was also a critical part of the work. The footage provided insights on the behavioral aspects of the depredation events which would be crucial for identifying potential solutions or mitigations.

The SSC encouraged the researchers to continue seeking funding to continue the study in Guam and CNMI as well as expand the study to the MHI Deep 7 bottomfish fishery because anecdotal evidence suggests that shark depredation is on the rise in the Hawaiian Islands.

The SSC thanked Meyer for the informative presentation.

D. Review of Impacts of the Papahānaumokuākea Marine National Monument Expansion

Council staff presented on a compendium of studies estimating impacts of the Papahānaumokuākea Marine National Monument Expansion and the Pacific Remote Island Areas (PRIAS) through an intervention in 2016 under the Antiquities Act. These studies include analyses from the Council in 2014 and more recently published peer-reviewed papers. One such paper is Lynham et al (2020) which contends “monument expansions had little, if any, negative

impacts on the fishing industry, corroborating ecological models that have predicted minimal impacts from closing large parts of the Pacific Ocean to fishing.” Chan (2020) used a measure of aggregate commercial catch rate and revenue to determine there were deleterious impacts to the Hawaii-based fishery after the intervention in 2016. Sweeney (2021) presented analysis that suggests that aggregate commercial catch rate and is a more robust measure of catch per unit effort (CPUE) and revenue per unit effort (RPUE) for Hawaii’s deep-set longline fishery than the one provided by Lynham et al (2020) and factors beyond monument expansion have a large influence on CPUE and RPUE trends. Council staff, examining outputs from the 2020 stock assessment diagnostic model, showed that increases in biomass of yellowfin and bigeye tuna accessible to longline fisheries also correspond to catch rate increases of the two combined species.

The SSC noted that the impacts of the Papahānaumokuākea Marine National Monument expansion on fisheries are unclear and a contentious topic. The conflicting results from the Chan (2020), Lynham et al. (2020), and Sweeney (2021) studies suggest the need for further analyses to clarify if the PMNM had a detectable impact on the Hawaii-based longline fisheries.

The SSC recommends that the Council develop a working group to: (1) conduct a comprehensive evaluation of the potential impact of the PMNM Expansion on the Hawaii pelagic longline fishery, (2) determine whether the PMNM is achieving the stated management objectives, and (3) consider dynamic area-based management approaches as an alternative to static closure approaches such as the PMNM. The output of such a WG would be a policy focused publication and that has implications for the international Biodiversity Beyond National Jurisdictions (BBNJ) and the US “30 x 30” initiatives.

E. Suitability of a Depletion-Based Limit Reference Point versus MSY for Highly Productive Pelagic Stocks

Council staff provided an overview of MSY and its associated reference points (and status determination criteria) in the Pelagic Fisheries Ecosystem Plan (FEP). The Council is obligated to evaluate its FEPs periodically. An overview of the use of MSY, its criticisms, and best practices from the literature was also synthesized. Council staff also presented on Brouwer and Hamer (2021), which was provided to the 17th Science Committee of the WCPFC. This paper introduced a logical framework for developing limit reference points (LRPs) for Southwest Pacific Striped Marlin and rationale for depletion-based reference points, which depart from those in the Pelagic FEP. For target species, two main types of reference points are required to gauge stock and fishery performance against management objectives: Target Reference Points (TRP) and LRPs. Depending on the species and fishery, billfish may be viewed as target, non-target or bycatch. This may have implications for determining LRPs, and specifically the risk of falling below those biologically critical levels. Similar to tuna, billfish are thought to be relatively productive and resilient to fishing due to their fast growth and high fecundity, but understanding billfish population trends and responses to fishing pressure is challenging due to data limitations. With the exception of perhaps swordfish and striped marlin, billfish species are often not documented in fishery logbooks, have varying levels of historical reporting and retention, and there is limited knowledge of biology and life history parameters. Several pelagic management unit species (PMUS) under the Pelagic FEP, like billfish as described by Brouwer and Hamer (2021), may lack complete catch information due to their internationally-exploited

nature. These species may also require the Council to take management action to account for the *relative impacts* of Council-managed fisheries, as opposed to domestic requirements such as the development of annual catch limits (ACL). The SSC was asked to provide comments on the utility of current reference points for PMUS and suggest any relevant or future research.

The SSC noted a dynamic carrying capacity moves away from a static MSY and accommodates changes to B_0 that can occur with environmental change.

The SSC clarified that the conservation and management measures (CMMs) for PMUS are not established based on the same control rules for domestic and international fisheries, and that those differences need to be further evaluated.

The SSC recommends to the Council that the evaluation of alternative reference points for the PMUS be added as a pelagic research priority in the Five-Year Research Priorities.

F. International Fisheries

1. IATTC Science Advisory Committee

Andre Boustany, Monterey Bay Aquarium, presented on the IATTC Science Advisory Committee, which was held in May and June, 2021. Stock assessment results from yellowfin and bigeye tuna were presented. Yellowfin tuna are not overfished and not experiencing overfishing. However, the stock status on bigeye tuna is averaged over model assumptions that demonstrate a bimodal pattern. This may be indicative of a ‘regime shift’ in the fishery or ecosystem.

The SSC asked about the rationale for using the bimodal modelling approach for the eastern Pacific bigeye tuna stock assessment. Boustany replied that there is high uncertainty about this issue and the current approach is unsatisfactory to many on the committee. The model results combine both short and long term time series that straddle a change point which appeared to affect fishery productivity that took place around the origin of the drifting fish aggregating device fishery in the mid-1990s.

The SSC thanked Boustany for his presentation.

2. Report of the 2021 ISC Plenary

Mike Seki, PIFSC Director, presented on the ISC Plenary held virtually July 11-15, 2021. A new stock assessment for blue marlin was presented in addition to progress on a management strategy evaluation of North Pacific albacore. There is also updated conservation and management advice provided regarding bluefin tuna and striped marlin. A new benchmark striped marlin stock assessment will be expected in 2022.

The SSC noted that biological sampling for billfish and sharks within the ISC involves Taiwan, Japan, and the USA which are needed for improving the assessments going forward.

The SSC thanked Seki for his presentation.

3. Outcomes of the WCPFC 17th Science Committee Meeting

Council staff presented on outcomes of the 17th Science Committee Meeting of the WCPFC (SC17). A South Pacific albacore stock assessment was presented to the SC17. The stock is not overfished, nor experiencing overfishing. However, regional depletion in regions around American Samoa is of concern to the Council, given the poor performance of the American Samoa longline fishery.

4. Outcomes of the 2nd Tropical Tuna Workshop

Council staff presented the outcomes of the 2nd Tropical Tuna Workshop, held virtually September 6-10, 2021. The Council had worked with PIRO and PIFSC to introduce a framework on area-based management, separating the tropical areas from temperate areas, which was rejected by several Pacific Island delegations as being ‘overly complicated’ while they favored their zone (EEZ-based) management scheme. SC16 advice noted the temperate regions, where the Hawaii fleet operates, are a ‘buffer’ for the stock. Future analyses may review a schematic of catch and or effort scalars to be estimated and associated with a skipjack TRP.

The SSC noted that there were several different proposals by various countries for the 2021-2022 CMMs for Tropical Tunas in the Western and Central Pacific and that is the basis for a continuation of these Tropical Tuna Workshops since there has been no international consensus.

A. Public Comment

No public comments.

8. Other Business

A. Nov 30-Dec 2, 2021 SSC Meetings Dates

Lynch announced the dates of the next SSC meeting which will be held November 30, 2021 through December 2, 2021.

B. Case studies for the National SSC7 Meeting

Council staff presented on requests from the Steering Committee of the CCC's Science Coordinating Subcommittee for regional case studies on the three thematic areas of the National SSC 7 Workshop. These thematic areas are: (1) How to incorporate ecosystem indicators into the stock assessment process, (2) Developing information to support management of interacting species in consideration of ecosystem-based fishery management (EBFM), and (3) How to assess and develop fishing level recommendations for species exhibiting distributional changes. SSC members were asked to provide publications on case studies within these thematic areas. The workshop is rescheduled for August 15-17, 2022. The SSC has previously endorsed SSC members Harley, Franklin and Camacho to participate in the workshop.