NOAA FISHERIES

Office of Protected Resources

Oceanic Whitetip Shark Recovery Planning Workshop

Workshop Summary · April 23-24, 2019
Honolulu, Hawaii

Cover photo: Oceanic whitetip shark
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List of Acronyms

CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora
DAR - Division of Aquatic Resources (Hawaii)
DLNR - Department of Land and Natural Resources (Hawaii)
EM – Electronic Monitoring
EEZ - Exclusive Economic Zone
ESA - Endangered Species Act
HLA - Hawaii Longline Association
IATTC - Inter-American Tropical Tuna Commission
IOTC - Indian Ocean Tuna Commission
IUU - Illegal, Unreported, and Unregulated (fishing)
NMFS - National Marine Fisheries Service
NOAA - National Oceanic and Atmospheric Administration
OPR - Office of Protected Resources
PIFSC - Pacific Islands Fisheries Science Center
PIRO - Pacific Islands Regional Office
PRD - Protected Resources Division
RFMO - Regional Fishery Management Organization
SEFSC - Southeast Fisheries Science Center
VMS - Video Monitoring System
WCPFC - Western and Central Pacific Fisheries Commission
WPRFMC - Western Pacific Regional Fisheries Management Council

Recovery Planning Workshop Summary

Purpose and Overview

The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS or NOAA Fisheries) Office of Protected Resources held a workshop to gather information and perspectives on how to recover the oceanic whitetip shark (Carcharhinus longimanus) to the point where protections under the Endangered Species Act (ESA) are no longer needed. The workshop was held April 23-24, 2019, at the Ohana Waikiki East Hotel in Honolulu, Hawaii.

This invitational workshop was designed to bring participants together in order to obtain informed and creative input into the recovery components (see below) of the oceanic whitetip shark. NMFS will use this information to make decisions about potential recovery actions and criteria for this species. Although this Workshop Summary is inclusive of the conversation at the workshop, the Recovery Plan may not reflect all of the ideas raised during the workshop. NMFS will seek public comment on the Draft Recovery Plan.

The workshop was not a consensus-seeking meeting; rather, participants were asked to provide their professional or personal opinion as it related to threats to or recovery of the oceanic whitetip shark. Therefore, it should be emphasized that the recommendations listed below in this report are not the consensus opinion of NOAA or the group of participants as a whole. Many recommendations represent the opinion of just one or a few stakeholders. Experts from a range of relevant disciplines were invited to participate in the workshop. We made efforts to include expertise in the following topic areas: biology, life history, stock assessment science, commercial fishing, federal and state fisheries management, and recovery planning (see Table 1). The workshop was open to the public and public comment was invited at the end of each day.

The workshop was focused on the following objectives:

- Discuss and develop potential recovery actions to reduce and/or ameliorate threats to oceanic whitetip sharks
- Provide input on potential recovery criteria to delist species

For oceanic whitetip shark recovery planning efforts, NMFS is using a new approach [1]to the recovery planning process, developed by the U.S. Fish and Wildlife Service. This process is different from the traditional approach in that it breaks recovery planning into three independent parts (described below). Information and feedback from this workshop will help inform the recovery components for the oceanic whitetip shark. The recovery components for the oceanic whitetip shark will consist of the following:

- Recovery Status Review. This stand-alone document will summarize the species' current and future status and assess threats. Traditionally this information was included in the background of a Recovery Plan but often became outdated quickly. The process of revising a Recovery Plan makes it difficult to keep this information up-to-date and useful for resource managers. By keeping the background separate from the Recovery Plan (now the recovery strategy, criteria, actions, and time and cost estimates) and up-to-date, information can be kept more relevant

[1] While this new recovery planning approach is mandatory for the U.S. Fish and Wildlife Service, it is optional for NMFS. Currently, NMFS has approximately 6 recovery planning efforts underway using this new approach.

and used to inform a variety of recovery activities including ESA section 7 analyses, ESA 5- year reviews of the status of the species and conservation plans developed under Section 10 of the ESA. The 2017 Oceanic Whitetip Shark Status Review Report (Young et al. 2017) will serve as the basis for the Recovery Status Review.

- Recovery Plan. This second stand-alone document will provide a roadmap for the recovery of the oceanic whitetip shark, and will include an introduction, as well as the three statutory requirements for a Recovery Plan: 1) objective, measurable recovery criteria; 2) site-specific management actions; and 3) estimates of time and costs to recover the species.

- Recovery Implementation Strategy. We will also include a third stand-alone document, which step-down the recovery actions to activities that support the recovery action. The Recovery Implementation Strategy will be used for tracking progress and planning purposes.

This workshop summary is presented in six main sections: Purpose and Overview, Schedule, Participants, Recovery Actions Brainstorm, Recovery Criteria Brainstorm, and Next Steps.

A copy of the agenda and all other meeting-related materials are available on NMFS' oceanic whitetip shark website at https://www.fisheries.noaa.gov/species/oceanic-whitetip-shark.

Schedule

The two-day workshop was broken into three parts based on different threat-related themes:

- Tuesday April 23, 2019: Discussions focused on recovery actions related to commercial fisheries interactions
- Wednesday April 24, 2019: Discussions focused on recovery actions related to research, outreach and education, international coordination, as well as developing recovery criteria for the oceanic whitetip shark

Participants

The meeting was attended by a total of 44 workshop participants (35 invited experts and 9 other participants that either RSVP'd in advance or were walk-ins), representing a variety of expertise (Tables 1 and 2 below). Twenty-three of the invited experts were seated at the head table for one or more days and actively provided input and feedback. Due to space constraints, the rest of the workshop participants were seated in the audience for one or more days, but still made significant contributions to the discussions and participated in the breakout groups.

Table 1: List of invited workshop participants (in alphabetical order). Key: DLNR-DAR = State of Hawaii's Department of Land and Natural Resources Division of Aquatic Resources; OPR = NMFS Office of Protected Resources; PIFSC = NMFS Pacific Islands Fisheries Science Center; PIRO = NMFS Pacific Islands Regional Office; SEFSC = NMFS Southeast Fisheries Science Center

PARTICPANT NAME	STAKEHOLDER TYPE	AFFILIATION / EXPERTISE
Nathan Abe	Industry	Commercial fisher
Keith Bigelow	Federal Agency	PIFSC, Fisheries Research & Monitoring Division
Colby Brady	Federal Agency	PIRO Sustainable Fisheries Division, Protected Species Workshop Coordinator
John Carlson	Federal Agency	SEFSC, research fishery biologist
Felipe Carvalho	Federal Agency	PIFSC, Fisheries Research& Monitoring Division, stock assessments
Demian Chapman	Researcher	Florida International University
Shelley Clarke	Researcher	Common Oceans (ABNJ) Tuna Project, Food and Agriculture Organization of the United Nations
Therese Conant	Federal Agency	OPR, National Recovery Coordinator
Sarah Ellgen	Federal Agency	PIRO Sustainable Fisheries Division, Resource Mgmt Specialist
Mark Fitchett	Fishery Council	Western Pacific Regional Fishery Management Council, pelagic fisheries ecosystem scientist
Sonja Fordham	NGO	Sharks Advocacy International, President and CEO
Mike Fujimoto	State	DLNR-DAR fisheries biologist
Ann Garrett	Federal Agency	PIRO, Assistant Regional Administrator for Protected Resources
Dawn Golden	Federal Agency	PIRO, Section 7 Consultation Biologist
Krista Graham	Federal Agency	PIRO, Protected Resources Division, Species Liaison
Shelton Harley	Researcher	Western Pacific Regional Fishery Management Council Scientific and Statistical Committee member
Lesley Hawn	Federal Agency	PIRO, Section 7 Consultation Biologist
Melanie Hutchinson	Researcher	PIFSC, Fisheries Research & Monitoring Division, shark researcher
Asuka Ishizaki	Fishery Council	Western Pacific Regional Fishery Management Council, Protected Species Coordinator
Mia Iwane	Federal Agency	PIFSC, Socio-economics Division
Kristen Kelly	State Agency	DLNR- DAR- Section 6 grant Marine Wildlife Program
Eric Kingma	Industry	Hawaii Longline Association, Executive Director
Donald Kobayashi	Federal Agency	PIFSC Ecosystem Sciences; research fishery biologist
Sean Martin	Industry	Hawaii Longline Association, President
Morgan Miller	Federal Agency	PIRO Observer Program
Earl Miyamoto	State Agency	DLNR DAR, ESA Section 6 Marine Wildlife Program Coordinator
Ryan Okano	State Agency	DLNR DAR; fisheries biologist
John Peschon	Federal Agency	PIRO Observer Program
Susan Pultz	Federal Agency	PIRO Protected Resources Division, Branch Chief
Rick Reger	Industry	Commercial fisher

PARTICIPANT NAME	STAKEHOLDER TYPE	AFFILIATION / EXPERTISE
Emily Reynolds	Federal Agency	PIRO, International Fisheries Division, Fishery Policy Analyst
Joshua Rudolph	Federal Agency	PIRO, Protected Resources Division, Section 7 Consultation Biologist
Angela Somma	Federal Agency	OPR, Endangered Species Conservation Division, Chief
Geof Walker	Industry	Commercial fisher
Chelsey Young	Federal Agency	OPR, Endangered Species Conservation Division, Recovery Coordinator for oceanic whitetip shark

Table 2: List of other participants that came to the workshop and contributed to discussions

PARTICIPANT NAME	STAKEHOLDER TYPE	AFFILIATION / EXPERTISE
Raymond Clarke	Industry	South Pacific Tuna Corp, VP Project Development and Government Affairs
Crystal Dumbrow	Student	Scripps Institute of Oceanography
Kelly Gunn	NGO	Cardno
Thom Hooper	Federal Agency	OPR
Derek Kraft	PhD student	Hawaii Institute of Marine Biology
Marilyn Luipold	Industry	South Pacific Tuna Corp, Compliance Officer
Randy McIntosh	Federal Agency	PIRO, Protected Resources Division
Joel Moribe	Federal Agency	PIRO, Protected Resources Division
Lorraine Shaughnessy	NGO	Cardno

Numerous workshop participants provided presentations relating to the species or threats to the species. Day one concluded with an initial discussion regarding recovery actions related to commercial fisheries interactions. Chelsey Young provided a summary of the day to set the framework for continued discussions for Day two.

Other NMFS staff and members of the public were present for one or more days throughout the workshop. Opportunities for public comment were provided at the end of each day, but we did not receive any comments during the workshop. John Carlson and Chelsey Young served as the facilitators each day.

Recovery Actions Discussion

The ESA mandates that Recovery Plans be developed and implemented for the conservation and survival of ESA-listed species. Recovery Plans are not solely to guide recovery actions of NMFS; rather, they are meant to guide recovery actions of all stakeholders who may be involved or interested in conserving and recovering a species. Recovery Plans are meant to be guidance documents, not regulatory documents. Recovery Plans also typically identify critical research gaps that need to be filled in order to inform management actions.

Recovery actions typically fall within three categories: research, management, and monitoring, which

may include enforcement, outreach and education, and international coordination efforts. Each recovery action should explicitly relate to the causes of imperilment; contribute to achieving recovery; include short and long-term actions; be objective and measureable; and be concise and action-oriented. Examples of various types of recovery actions from the loggerhead sea turtle and smalltooth sawfish recovery plans were used throughout the workshop as examples for participants to help guide discussions.

Following an overview of recovery actions, workshop participants were divided into groups and asked to develop ideas on management, research, outreach and education, and international coordination as they pertain to the main threats to the oceanic whitetip shark (i.e., commercial fisheries interactions and inadequate regulations). Each group was asked to record all ideas. Once completed, a nominated member of each breakout group reported their ideas out to the rest of the room.

The following section provides the suite of potential recovery action ideas, in no particular order (i.e., they were not prioritized in any way), from participants. As mentioned previously, these actions do not represent consensus views of NOAA or the entire group of workshop participants. In some cases, they may represent a single individual's view or opinion. Recovery actions were also not weighed by the group in terms of their potential effectiveness, implementation, compliance, costs, etc. Actions are grouped according to the major topic themes (i.e., fisheries interactions, research, outreach/education, international coordination) and then sub-grouped under specific topics. A total of 73 potential recovery actions to conserve and recover the oceanic whitetip shark were identified and are listed below. It should be noted that some potential recovery actions have similar components since they were discussed during different days of the workshop.

FISHERIES INTERACTIONS

Research

1. Conduct additional research to collect more information on spatial interactions of oceanic whitetip sharks (e.g., where catches occur, what depth, where on the line, etc.) in domestic fisheries to help inform management measures.

2. Conduct additional research on gear modifications to increase survivorship of oceanic whitetip sharks when caught in commercial fisheries.

3. Expand existing research of at-vessel and post-release mortality rates of oceanic whitetip sharks in longlines and purse seines to improve stock assessments.

4. Conduct surveys of fishermen regarding the effectiveness of safe release techniques for oceanic whitetip sharks.

5. Continue research on bycatch mitigation measures to minimize interactions in purse seine and longline fisheries and share best practices (knowledge/technology transfer) with the international community.

6. Conduct research in collaboration with fishermen to identify environmental parameters that predict the presence of oceanic whitetip sharks (e.g., sea surface height anomaly, surface and subsurface temperatures, hook depth data) to develop avoidance strategies and reduce

interactions. These can then be used to develop products that fishermen can use at will to avoid particular areas at times where risk of encountering oceanic whitetip sharks outweighs target catch rate.

7. Quantify pre-catch loss by using electronic monitoring/cameras on gear to see how interactions occur before the animal is captured (e.g., evaluate what kind of depredation is occurring, look at gear, broken lines, bent hooks, etc.).

8. Research whether different bait types affect bycatch rates of oceanic whitetip sharks (e.g., less bloody bait).

9. Conduct research to improve understanding of the relative impact of targeted fishing vs. incidental bycatch in fisheries to determine which is having biggest impact on oceanic whitetip shark mortality.

10. Evaluate the prevalence of the different size classes caught in various fisheries and determine methods to mitigate impact (e.g., why are juveniles caught more frequently than adults? What is the behavior of juveniles that makes them more susceptible to capture?).

11. Analyze haulback mortality, handling and post-release mortality to determine where in the process oceanic whitetip sharks are dying and why; Many oceanic whitetips come up dead – is it because they are sensitive to differences in soak time? Research soak times as it relates to mortality (use sharks in general as a basis if oceanic whitetip shark data are sparse).

12. Improve scientist-fisher relationships to increase cooperative research opportunities and share stories/examples of good fisher/scientist relationships.

13. Evaluate impacts of domestic EEZ and international fisheries (get more information from other fisheries – e.g., are there important habitat areas to see if there is potential for RFMO regulations to affect these). It was noted that we can't assume WCPFC measures apply throughout entire Western and Central Pacific Ocean basin as some countries may apply their own ("compatible") measures – If those waters are the source of oceanic whitetips that we see in catch reporting or trade, we need to identify those areas as targets of intervention for on the ground conservation efforts).

14. Analyze all existing data for all fisheries (observer, logbook, etc.) to determine existing information from various fisheries (e.g., where should effort be focused, what do we need for minimal data requirements for population assessment work) and to look at impacts of various changes in management measures or gear with regard to assumed oceanic whitetip shark bycatch and effects on CPUE previous assumptions). Look to previous studies that have done this already (e.g., Rice et al. 2018), and explore further opportunities to improve standardization of CPUE estimates.

15. Develop limit reference points for oceanic whitetip shark after stock assessment.
    Noted that target vs bycatch distinction is an artificial distinction for this species (since we have a no-retention measure for species, although some targeting could be happening in areas not subject to WCPFC and IATTC measures).

Mitigation (Measures to Reduce Bycatch Mortality)

16. Evaluate the utility of implementing take limits in areas where spatial interactions are highest. It was noted that additional evaluation and research is needed to determine whether there are spatial patterns and rates and rates of concern.

17. With safety of crew as priority, develop tools and best practices for safe handling and gear removal (removing trailing gear) and other methods for reducing stress and injury to mitigate mortality, and improve survivorship when oceanic whitetip sharks are caught and released. Ground truth safe handling practices and revise if needed.

18. Develop and assess "fly-back" prevention devices to reduce the risk of lead weights flying back at crew when cutting large sharks free. This will increase safety of crew, and therefore enable improved handling.

19. Evaluate the utility of implementing vessel or captain quotas for oceanic whitetip sharks (Industry noted that this would be problematic and would not support this); regulations like these may also be problematic for other protected species – might interact with more oceanic whitetip sharks but this may be better for loggerhead sea turtles or false killer whales).

20. Develop and trial bycatch reduction devices (e.g., cages that protect catch and other deterrents) to deter oceanic whitetip sharks from attacking bait or catch

21. Develop best methods for mitigating mortality and improving survivorship when oceanic whitetips are caught:
    a. Investigate gear modifications such as use of electropositive metals, escape panels, etc. to mitigate bycatch (however, studies indicate these modification will not work for oceanic whitetip (e.g., Hutchinson et al. 2012 and Itano et al. 2012, respectively).
    b. Investigate shorter soak times
    c. Determine magnitude of shark line effort and human dimension of shark lines; it was noted that there should be an evaluation of the effectiveness of the measure in WCPFC that bans either shark lines or wire leaders.

22. Work with industry to continue training of fishing crews on safe handling and release procedures– it was noted that HLA produced a video a while ago having to do with handling and release of false killer whales as part of standard procedures. Working towards developing further informational literature and short instructional videos, particularly in native language of crew members. Something similar could be developed for oceanic whitetip sharks, that could assist vessel owners and Capitan in training crew on best handling and release practices for the species.

Monitoring and Reporting

23. Improve observer coverage in domestic and international fisheries
    a. Develop more optimal sampling protocols to improve percent observer coverage
    b. Improve understanding of, and increase international observer coverage for vessels outside U.S waters (outline barriers to increasing implementation of observer coverage in RFMOs).

c. Use of electronic monitoring (EM) in lieu of observers physically present

24. Promote the use of vessel monitoring system (VMS) data to improve understanding of how longline "fishery footprints" change over time in order to estimate historical and present changes to oceanic whitetip shark impacts, including for unobserved trips.

25. Promote the development of artificial intelligence (A.I.) software application development, specifically utilizing computer vision algorithms, to improve protected species identification to enable autonomous computer census review of EM data; promote the development of A.I. strategies into EM hardware and software utilized on vessels, and improve realized efficiencies of post-processing review of EM data.

26. Promote the use and improvement of EM in domestic and international fisheries to analyze fishery footprints, collect information on spatial interactions of oceanic whitetips, and improve international estimates of impacts on oceanic whitetip sharks.

27. Improve reporting of bycatch in logbooks – separate protected species out to highlight those species and get more information.

28. Utilize satellite monitoring techniques to monitor fisheries and increase understanding of IUU fishing.

Management

29. Evaluate the efficacy of existing non-retention measures to determine their adequacy for conserving oceanic whitetip sharks; improved biological sampling by observers or captains could help improve stock assessments that may in turn help answer outstanding biological questions and help prioritize threats.

30. Assess impacts of bycatch mitigation regulations across protected species by conducting a complete ecosystem-based evaluation of the ecological impact of various mitigation practices that considers the changes in selectivity across protected taxa, and includes consideration of the condition of the stocks impacted; such as threatened and/or overfished (e.g., circle hooks implemented to reduce bycatch of sea turtles and false killer whales may result in higher rates of bycatch of oceanic whitetip)

31. Prioritize compliance and identify nation's financial capacity to comply with regulations (i.e., what is the measurable impact of the regulations we are implementing if all the nations agreeing to them are not financially capable, or there is lack of political will for complying?).

32. Assess via compliance monitoring which countries are "bad actors" in terms of high mortality levels of oceanic whitetip sharks and low compliance levels with existing regulations, and those countries that consistently fail to meet minimum RFMO biological observation requirements. Also, assess and identify bottlenecks to optimum observer coverage for each under-performing nation. However, it was noted that there will likely be data access issues associated with this.

33. Evaluate equity of existing/developing regulations to assess or predict on the ground sustainability of regulations.

Data Collection

34. Improve data collection and biological sampling of oceanic whitetip sharks under domestic observer program.
    a. Determine what types of information are needed in domestic fisheries (e.g., collect data on use of different types of hooks, location of hooks, release methods, trailing gear, etc.)
    b. Implement additional data collection elements for oceanic whitetip sharks in observer program (e.g., describe where shark is hooked/entangled in observer data)
    c. Specimen collection to get better life history parameters and population structure

35. Standardize data codes/collection (already be in existence) and utilize those international protocols that may already exist.

RESEARCH

Population Assessment

36. Conduct stock assessments in all ocean basins and improve assessments by improving shark catch estimates, incorporating shark finning, and improving at-vessel and post-release mortality estimates for each fishery.

37. Use upcoming WCPFC stock assessment to prioritize management and policy initiatives.

38. Conduct population projections of two scenarios of retention vs. non-retention measures.

Biology, genetics, life history

39. Increase and improve genetics sampling across regions
    a. Develop and recommend standardized genetic collection protocol for all ocean basins to improve genetic sampling and get a better understanding of stock structure (tissue banks).
    b. Eastern Pacific, Indian, and western Pacific Oceans identified as priorities for samples
    c. Online resource called OTLET has samples from Arabian Sea (not as many from other regions)

40. Increase cooperative research opportunities (working with HLA and other industry/sport fishing groups, citizen science for genetics – need to develop clear protocols.

41. Determine census population size – there are new ways to use parent-offspring relationships (microcapture experiment and determine census population size).

42. Conduct research to identify which life history stages are most susceptible to help evaluate/prioritize threats and assess recovery potential (reproductive habitat may not be as critical as it is for other protected species such as sea turtles).

43. Improve understanding of sex ratios of animals taken in fisheries (e.g., is 50/50 assumption valid?)

44. Conduct research on compliance to evaluate why compliance is not going as we expect it to – investigate economic tools we might have to incentivize compliance, at the individual and larger national scale levels.

45. Continue research on population structure and population trends (current and developing).

46. Continue research on reproduction to determine reproductive periodicity and seasonality.

47. Determine how habitat quality (e.g., prey abundance in a changing climate) will affect oceanic whitetip shark recovery. It was noted that PIFSC is currently conducting an assessment of "winners" vs "losers" under climate change scenarios using oceanic whitetip tagging data.

Socio-Economic

48. Conduct human dimensions research of non-users (in addition to fishers) that incorporates behavioral, social and economic sciences to contextualize attitudes and behaviors and help address whether we need to target attitude or behavioral changes in fishers, consumers, public, divers, and other stakeholders that care about sharks.

49. Synthesize existing data to inform recovery actions regarding what we already know about "bad actors" in terms of non-compliance, etc. However, data to achieve this are often not in the public domain or accessible, making this a difficult endeavor.

50. Continue and expand cooperative research programs between scientists and fishers to improve shark tagging, real-time data collection, and identification of other innovative approaches to improving gear selectivity and post-release survivorship.

51. Improve understanding of IUU fishing as that could be a big source of mortality for oceanic whitetip sharks.

52. Establish, or further coordinate and expand upon, cooperative research funding sources for oceanic whitetip shark research (may be opportunities for NOAA to help support E-NGO led efforts to collaborate on mutually beneficial topics and help connect academics to potential funding sources).

53. Work with Shark Conservation Fund – consortium of shark research organizations that determine common priorities and determine how to channel those funds among NGOs.

OUTREACH AND EDUCATION

54. Increase outreach and education to fishers to change perceptions and attitudes related to sharks and oceanic whitetip issues (e.g., nuisance frustration). Ideas for activities included:

    a. Drawing on cultural insights (e.g., Hawaiian culture) that can help promote a more positive image of sharks and oceanic whitetip sharks in particular

    b. Using videography and photography as an outreach and education tool to change

perceptions of sharks and their role in the ecosystems

c. Developing online learning management systems that can be cost effective. So much of the crew keep in touch with their families through social media, and providing some information for online resources can be supplemental to classroom materials

d. Evaluate efficacy and reach of educational initiatives in specific communities.

55. Conduct consumer outreach and education campaigns on seafood products that exploit elasmobranchs.

56. Raise awareness of best handling practices for oceanic whitetip sharks and population status using variety of methods, including social media and utilizing existing social structures in communities.

57. Leverage citizen science to increase information from public – spin off what they did for great whites where individual sharks are tracked (photo-ID) (being done in PIFSC).

INTERNATIONAL COORDINATION

Regional Fishery Management Organizations (RFMOs) Engagement

58. Increase U.S. engagement in RFMOs (particularly IOTC) with regard to oceanic whitetip shark protection and propose new measures or be proactive at RFMOs regarding compliance.

59. U.S. to advocate for RFMO requirements to report catches of oceanic whitetip sharks and their condition.

60. Obtain more data and increase observer coverage from other countries' fisheries equal to what we have in the U.S. – investigate other tools outside of RFMOs to accomplish this, including electronic monitoring.

61. Advocate for an evaluation by WCPFC of existing conservation and management measure that requires the banning of wire leaders or shark lines (CMM 2014-05) to determine its impact on reduction of oceanic whitetip catches.

62. Increase knowledge and understanding of international fisheries impacts to oceanic whitetip sharks and compliance levels with existing regulations. Ideas for activities included:

a. Analyze information from various international reporting mechanisms and identify which countries are actively involved in fishing and trade of the species (relates to compliance)

b. Determine whether any countries are still landing oceanic whitetip sharks and prioritize those countries for intervention

c. Prioritize fisheries in coastal Latin America (i.e. those that are not subject to IATTC resolutions) and non-high seas fisheries (e.g., archipelagic waters of Indonesia and

Philippines) for intervention with regard to bycatch and retention of oceanic whitetip shark; it was noted that IATTC is embarking on port sampling program specifically aimed at sharks and data would be forthcoming

i. Some non-high seas waters fall outside of purview of WCPFC and thus the ban on oceanic whitetip retention doesn't necessarily apply to fisheries operating in those waters (up to each member country to implement compatible measures in their domestic waters).
ii. Look at data to see if oceanic whitetip sharks are being caught in those waters; No or little observer data from those areas.

63. Increase enforcement of non-retention measures
    a. Focus should be more on compliance with respect to issues of non-compliance and potential loopholes (e.g., high seas transshipment of tuna and shark fins could be a significant area with inadequate monitoring– so instead of increasing enforcement, ban high seas transshipment or tighten controls);
    b. Strengthen port state measures – not all countries are signatories to the Agreement; provide resources to work with countries to strengthen port state measures and tighten transshipment controls.

64. Work with Industry to develop industry-led solutions that can be used as a model for the international community. It was noted that this would enhance buy-in and motivation from industry and fleet to work together and cooperate on best solutions.

Other International Coordination Efforts

65. Develop economic incentives in order to get international buy-in (e.g., fisheries certifications of "Shark safe" or something to that effect).

66. Advocate and assist other nations in improving data collection on oceanic whitetip sharks (analogous to U.S. proposal to WCPFC for sea turtles).

67. Promote CITES compliance by advocating for significant trade review of oceanic whitetip shark.

68. Work with other countries in transferring knowledge of best practices for gear removal and handling to other fisheries

    a. Liaise with U.S. fishing industry (i.e., HLA and others) to transfer proven mitigation measures (e.g., methods to improve survivorship, gear removal, etc.) to other fisheries internationally (similar to what's been done for other protected species)
    b. International education and outreach with other countries should be bi-directional (not just "here's what we have to offer").

69. Develop international capacity building programs related to oceanic whitetip shark safe handling and release, species ID, data collection protocols (e.g., train the trainers program) and develop feedback mechanisms on effectiveness of these programs.

70. Devote personnel to coordinate international conservation efforts for oceanic whitetip shark.

71. Evaluate international market structure and flow of fins and other illegal shark products.

72. Engage in-country and other non-RFMO entities to identify and address shark threats.

73. Build international alliances for research efforts, capacity building, enforcement efforts, and outreach.

Recovery Criteria Discussion

The ESA requires Recovery Plans to include objective, measurable criteria, which, when met, would result in a determination that the species be removed from the list (i.e., delisted). Developing objective, measurable criteria for a Recovery Plan focuses on two areas:

- **Biology-based criteria**
  These criteria will measure the performance of species over a meaningful period of time. These criteria can be tied to metrics relating to abundance, growth rate, and demographics (e.g., age and sex ratios, distribution of individuals among different subpopulations)

- **Threats-based criteria**
  These criteria will focus on the reduction of threats that may have caused the species' decline or that limit recovery. The five ESA section 4(a)(1) factors that were considered during listing must be considered during delisting (i.e., habitat destruction or modification; overutilization; disease or predation; inadequacy of existing regulations; and other natural or manmade factors affecting its continued existence)

During the workshop, participants were provided an overview of recovery criteria and examples from recovery plans from the loggerhead sea turtle and smalltooth sawfish, they were asked to discuss potential recovery criteria for the oceanic whitetip shark. Initial discussions noted that a lack of information made it difficult to identify recovery criteria, and that the upcoming stock assessments for the Western and Central Pacific population will help to fill in data gaps necessary to better inform potential recovery criteria. Participants also encouraged consideration of different types of data that would be necessary to track progress towards reaching the recovery criteria.

Potential Biology-based Criteria to Delist:

- Increasing trend in overall biomass by X% over X number of years
  Or
- Increasing trend in relative abundance (e.g. catch rate) over x number of years

Potential Threats-based Criteria to Delist

- Fishing mortality is reduced to some acceptable level proportional to the population size (consider how interactions will increase with a recovering population)
  a. Significant decrease in number of oceanic whitetips killed and injured
  b. Increase in survivorship of released individuals to an acceptable number over time
- Proportion of oceanic whitetip sharks released alive is at least X in key foreign fleets over X number of years
- Prevalence of oceanic whitetip fins in international markets is reduced to an acceptable level

- Foreign nations with significant oceanic whitetip shark bycatch have implemented national legislation and have acceded to international and multi-lateral agreements to ensure long-term protection of oceanic whitetip sharks
- Use of shark lines declines to at least x level

Summary of Potential Recovery Criteria

Key feedback in the recovery criteria discussion over the entire workshop included consideration of the forthcoming stock assessments for the species being prepared for the Scientific Committee of the Western and Central Pacific Fisheries Commission. It was noted during the workshop that we do not have historical or current abundance estimates for the oceanic whitetip shark, so it is difficult to develop absolute abundance numbers to delist the species. Therefore, it was emphasized that relative abundance would be a more useful metric in terms of tracking population abundance as opposed to other traditional population dynamics metrics, such as estimated F values or biomass (SB) reference data points. In terms of threat-based criteria, emphasis was placed on observed decreases in oceanic whitetip shark retention, and increases in oceanic whitetip survival post-capture and release. A threat-based criteria showing a decrease in the level of oceanic whitetip shark fins in international markets was also suggested. Finally, this is not meant to be the final list of recovery criteria but instead is a solid start to developing recovery criteria for the oceanic whitetip shark.

Next Steps

This workshop summary will be posted on our Oceanic whitetip shark web page at https://www.fisheries.noaa.gov/species/oceanic-whitetip-shark. Additionally, the following actions will continue or commence:

- Update the 2017 Status Review Report to serve as the Recovery Status Review. As previously discussed, this information is typically included in the background section of a recovery plan, but we will separate the status of the species into its own living document and update it with any new information that has been published since the final rule was published in January 2018. We anticipate completing this in 2019.

- Convene an Atlantic Recovery Planning Workshop for the oceanic whitetip shark in fall of 2019.

- Draft the Oceanic Whitetip Recovery Plan. We anticipate completing a draft in 2020 and finalizing in 2021. This document will be peer reviewed and will go out for public comment.

- Draft the Recovery Implementation Strategy. We anticipate completing a draft in 2020 and finalizing in 2021.

Group Photo. Back row: Ray Clarke, Derek Kraft, Mark Fitchett, Don Kobayashi, Shelton Harley, Morgan Miller, Colby Brady, John Peschon, Joshua Rudolph, Melanie Hutchinson, Shelley Clarke, Geof Walker, Keith Bigelow, Sean Martin, Demian Chapman. Front row: Marilyn Leopold, Lesley Hawn, Sarah Ellgen, Mia Iwane, Dawn Golden, Emily Reynolds, Asuka Ishizaki, Therese Conant, Chelsey Young, John Carlson, Sonja Fordham, Krista Graham, Rick Reger, Angela Somma, Ann Garret, Crystal Dombrow, Felipe Carvalho, Nathan Abe.