PACIFIC FISHERY MANAGEMENT COUNCIL SPONSORS A SUCCESSFUL SABLEFISH MANAGEMENT STRATEGY EVALUATION WORKSHOP

The Pacific Fishery Management Council, in collaboration with the National Marine Fisheries Service Alaska and Northwest Fisheries Science Centers, the Department of Fisheries and Oceans Canada, the Alaska Department of Fish and Game, the University of Washington, and the North Pacific Fishery Management Council, convened a workshop to solicit stakeholders' recommendations on the focus of a management strategy evaluation (MSE) for Northeast Pacific Sablefish. The Sablefish MSE Workshop occurred on April 27 and 28 via webinar. There were 59 attendees to the workshop and the workshop report is available at pacificsablefishscience.org and is also appended to this notice.

Presentations from agency and academic researchers serving on the Pacific Sablefish Transboundary Assessment Team (PSTAT) briefed attendees on the development of an operating model to better understand the dynamics of sablefish across its range. Participants in the workshop were educated on MSE approaches and provided their recommendations on management objectives, performance metrics, and management strategies for achieving desired outcomes. The PSTAT will consider this stakeholder advice as the MSE is refined. Participants opined the workshop was useful and encouraged further stakeholder engagement in future workshops.

Transboundary Sablefish Management Strategy Evaluation (MSE) Workshop Report

Report compiled by Maia Kapur, Brendan Connors, John DeVore, Kari Fenske, Melissa Haltuch, and Meisha Key

Introduction

Workshop goals

The Pacific Sablefish Transboundary Assessment Team (PSTAT), in collaboration with the Northwest Fisheries Science Center (NWFSC), Alaska Fisheries Science Center (AFSC), Department of Fisheries and Oceans (DFO), Alaska Department of Fish and Game (ADF&G), Pacific Fishery Management Council (PFMC), and North Pacific Fishery Management Council (NPFMC), held a public workshop to solicit feedback on the ongoing range-wide sablefish Management Strategy Evaluation (MSE). The workshop was held Tuesday, April 27 through Wednesday, April 28, 2021. A list of participants and the workshop agenda are available in Appendices A and B, respectively.

The purpose of the workshop was to share and gather information about sablefish science and management across the northeast Pacific by engaging fishery stakeholders, Alaska Natives and Tribal governments, First Nations, scientists, managers, and Non-governmental organization staff. The workshop introduced the basic premise, goals, and utility of a MSE and participants' roles in the process. The successful sablefish MSE experience from British Columbia was introduced, along with the range of time horizons for incorporating stakeholder input into this NE Pacific MSE. The Operating Model (OM) structure and justification for focusing on the NE Pacific, rather than the traditional regional approach to scientific analyses, was also presented and discussed. The first key focal point for participant feedback into this MSE process was in identifying fishery objectives. Participants were provided with an overview of the types of objectives commonly used for MSE and discussed potential objectives for this MSE (Appendix C). Participants were then provided with an overview of the types of performance metrics (quantities for evaluating whether or not objectives are met) commonly used for MSE and provided feedback on performance metrics to achieve potential objectives for this MSE. An overview of the current regional sablefish management procedures (the combination of stock assessment model and harvest control rule) and proposed near term (Phase I) MSE management procedures were discussed, identified, and prioritized along with additional ideas for MSE management procedures for future research (Phase II or beyond). During the workshop, five breakout groups (BOGs) shared their top priorities on objectives, performance metrics and management procedures. The intent was to identify those objectives, performance metrics, and management procedures where the majority of BOGs (more than two) identified similar priorities, rather than come to a consensus on priorities or to make management recommendations. A primary goal for Phase I of the PSTAT research project is to learn about sablefish dynamics across the NE Pacific and provide the best scientific advice to regional managers.

The following outcomes and objectives were met during the workshop.

Workshop Outcomes:
- Participants increased knowledge of sablefish science and management among regions.
- Participants increased knowledge of the development of the sablefish MSE tool.
- Participants provided feedback on inputs for Phase I Sablefish MSE, including objectives, performance metrics, and management procedures.
- Participants provided information to support a possible Phase II MSE.

Session 1 Objective: Participants learn who is participating and observing for the workshop; participants are reminded about norms; participants gain knowledge of the goal and purpose of the meeting.

Session 2 Objective: Participants gain knowledge of the basic premise, goals, and utility of an MSE and their role in the process. Participants gain knowledge of the MSE, which is expected to be an iterative process, with stakeholder input incorporated based on multiple time horizons (e.g., 2 years - Maia Kapur's PhD; medium term (subject to funding)). Introduce the successful sablefish MSE experience from British Columbia (history, key elements, lessons learned).

Session 3 Objective: Participants gain knowledge of why the focus is on the NE Pacific and the structure of the OM.

Session 4 Objective: Participants gain knowledge of the types of objectives commonly used for MSE and provide feedback resulting in a set of objectives for this MSE.

Session 5 Objective: Participants gain knowledge of the types of performance metrics commonly used for MSE and provide feedback resulting in a set of performance metrics for this MSE.

Session 6 Objective: Participants gain knowledge of proposed work based on regional management procedures to be completed for Maia Kapur's PhD (2-year time horizon). Participants identify and prioritize additional ideas for MSE management procedures (time horizon TBD).

Session 7 Objective: Participants gain knowledge of next steps in the project and who is responsible for action items.

Project background

The PSTAT was formally initiated in 2018 with the primary objective of bringing scientists together to discuss and analyze range-wide sablefish data, compare stock assessment methods, discuss concerns about sablefish trends in abundance and recruitment, share results of recent and ongoing sablefish research, and to examine the feasibility of collaboratively developing a set of range-wide operating models (OM) for use in Management Strategy Evaluation (MSE). The PSTAT project was initially composed of 12 scientists from Canada and the United States and included representatives from the Alaska Department of Fish and Game, the Alaska Fisheries Science Center, Fisheries and Oceans Canada, Simon Fraser University, the Northwest Fisheries Science Center, and the Pacific Islands Fisheries Science Center. The first formal meeting of PSTAT occurred April 26-27, 2018 in Seattle, WA, at a workshop to discuss sablefish research and assessment approaches. Discussion and recommendations from that workshop are documented in Fenske et al. (2019).

PSTAT scientists convened a second virtual workshop April 28-30, 2020 (virtually, due to COVID-19 travel restrictions). The meeting focused on technical discussions of the sablefish movement model, development of the operating model structure and indices of abundance, updates on growth and maturity research, and a day of discussion regarding future research on climate drivers of recruitment. PSTAT work products to date include a sablefish growth model (Kapur et al. 2020), development of a transboundary index of abundance, range wide reanalysis of maturity data (Williams et al. *In Prep.*), and a transboundary movement model paper in development (Rogers et al. *In Prep.*). This phase (Phase 1, MSE development and improving scientific advice to managers) is intended to be completed by 2023. The potential for subsequent research phases will be dependent upon the results of Phase 1, staff availability and funding, and participant interest.

Engagement with regional management bodies on sablefish MSE research has been ongoing. The PFMC received briefings on U.S. west coast sablefish MSE work and PSTAT Northeast Pacific range wide data analyses and development of the spatially explicit management strategy evaluation (MSE) between 2017 and 2020 and was supportive of PSTAT work. During November 2020, the PFMC recommended and subsequently supported this workshop to engage stakeholders. The Sablefish Science Committee of the Department of Fisheries and Oceans (Canada) received a presentation similar to that described in Session 3 in early 2021 and expressed their interest in and support of PSTAT work.

Introduction to Management Strategy Evaluation and Stakeholder Engagement (Session 2)

Two presentations were given during Session 2 that generated discussion and questions, rather than specific recommendations related to management objectives, performance metrics, or management procedures. These were provided as an introduction to the MSE process and illustrative examples of successful MSEs in other regions.

In the first Session 2 presentation, Melissa Haltuch presented management strategy evaluation as a structured process to evaluate tradeoffs between alternative management procedures. There was recognition of the differences in how fisheries are managed in the US and Canada, and how the language, or specific terminology, differs between regions. The PSTAT group will continue to be as explicit as possible when defining and using terminologies that may have different meanings for participants in future discussions.

In the second presentation, Sean Cox and Rob Kronlund presented an overview of the MSE process used in British Columbia and walked workshop participants through the history of MSE development in the region, as well as detailing lessons learned. The British Columbia process was initiated in 2006 and is revised and re-tested on a 3-year cycle (~1 year operating model revisions and 3 year management procedure application). The British Columbia experience developing an MSE and using it for management, illustrated that the objectives used for the British Columbia sablefish fishery are hierarchical, and can be summarized as; 1) avoid fishery disaster, 2) avoid fishery declines, 3) get to target sablefish biomass, 4) keep the fishery viable, and 5) be profitable for participants. It was noted that the second objective, avoid fishery decline, has been particularly impactful in determining which management procedures get rejected over the years. Stability in TAC was noted as an interest to some US participants but was absent from the objectives used in British Columbia. The reason for not including it as an objective was because reducing variability by limiting year-to-year changes in TAC takes the risk from the fishery and transfers it to the stock. Variability in annual TAC is closely tied to economic considerations, as changes in TAC can affect sablefish prices. British Columbia addresses this by limiting TAC increases to instances when the TAC will increase by 200 tons (or more) and implementing TAC decreases of any amount immediately (with no minimum change threshold).

Finally, it was evident that MSEs undertaken with the intention to change policy are iterative and often long-term (e.g., >10 year) processes, and we emphasize that the initial iterations of our present MSE are research-oriented. Funding and personnel will be required to bring this MSE to the scale of those presented in Session 2 and ongoing in the NE Pacific.

NE Pacific sablefish operating model (Session 3)

Maia Sosa Kapur provided an overview of the NE Pacific sablefish operating model (OM) that serves as the foundation for this MSE. She detailed the 6-area spatial structure of the model (Figure 1) and data inputs, which include fishery-dependent and -independent information on landings, discards, length and age compositions, and indices of abundance from each management region (California Current, British Columbia, and Alaska). The presentation emphasized the major uncertainties in the operating model, which include the nature of the stock-recruit relationship both within and between biological regions; the movement of individuals at age among regions; and the selectivity of various fleets that harvest and/or sample the sablefish population. Maia explained that some simplifications were necessary to produce a tractable operating model, namely adhering to a single spatial stratification design (with six areas) and limiting the inclusion of data to terminate at the end of 2019.

The group’s discussion focused principally on the selection of the spatial stratification, and the accommodation of discard data in the OM. For the former point, representatives from both

Alaska and the California Current expressed interest in finer-scale spatial stratifications. In the case of Alaska, a stratification was desired that could mimic the zones presently used to apportion quota to management sub-areas throughout the Alaska region; there are currently two sub-regions in the OM in Alaska whereas six areas are used in sablefish management for Alaska's federal waters. In the case of the California Current, participants expressed interest in biological differences that may occur at a finer scale than the break at 36° N lat. used in the present OM, which is part of the reason that some species in this area apportion quota north and south of 40°10' N lat.

Regarding discard rates, representatives from British Columbia emphasized how nearly a third of the annual recruitment is estimated to be discarded within their trawl fishery, so accounting for age- or size-based discards will be pertinent towards capturing population dynamics in that region. In British Columbia, the minimum size limit for sablefish was set at 55 cm (fork length), which was the length that corresponded to the age at ~50% maturity when the limit was set in the 1980s. Discarding was also mentioned as a concern in the U.S. West Coast, where sablefish are discarded in other non-targeted fisheries such as Hake. The impact of discards may have range wide implications, as the interaction between the discard of small fish, age-based movement, and regionally-varying recruitment are likely to be important to biomass trends across the NE Pacific.

The takeaway from this discussion is that future iterations of the OM should consider more fine-scale spatial stratification, possibly in tandem with an MSE designed to better answer questions about fleet- and area-specific allocation. However, it was acknowledged that conditioning a finer resolution OM would likely require additional data or explicit assumptions (e.g., fine-scale movement rates). In the current MSE phase, we will continue with the present spatial structure and take care in modeling non-targeted total catch via the inclusion of discard data.

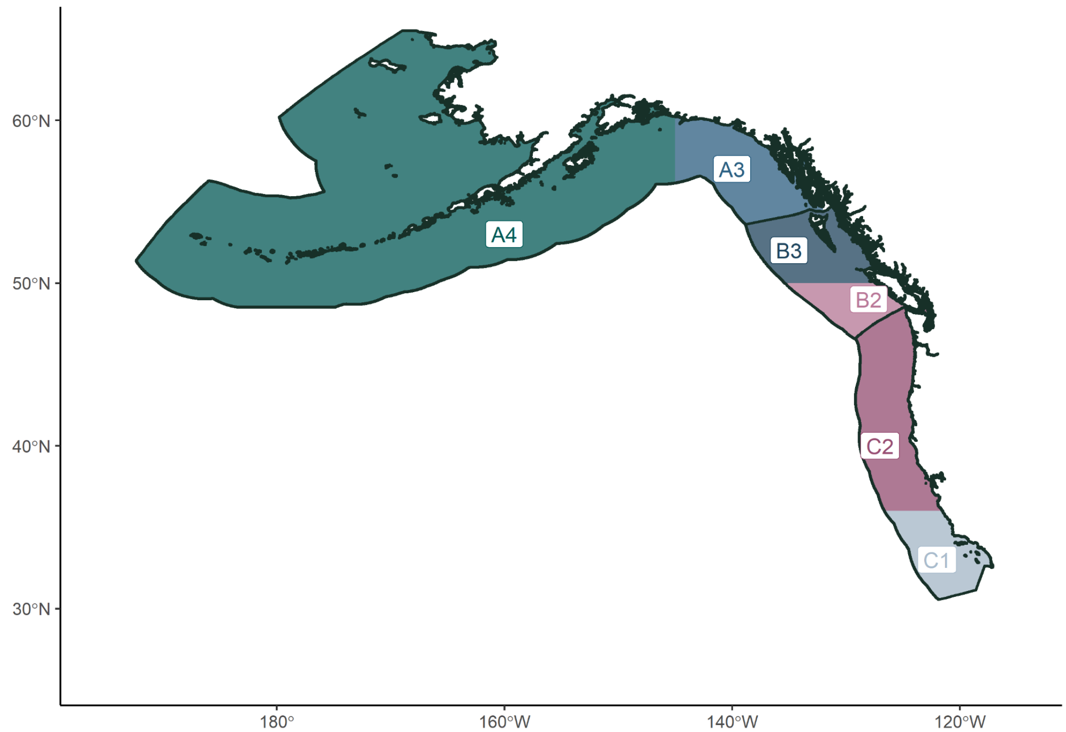

Figure 1. Six-area spatial stratification in operating model presented during Session 3. Subareas labeled with "A" are nested in the Alaska Exclusive Economic Zone (EEZ); "B" within Canadian waters, and "C" in the U.S. California Current. The latitudinal boundaries between C1 and C2 is at 36° N lat., between B2 and B3 at 50° N lat., and A3 and A4 are split by a vertical line at 146° W long. Subareas which share the same numeric designation are within the same stock and share life history traits and stock-recruit relationships.

Management objectives (Session 4)

Aaron Berger introduced workshop participants to the important role of defining fishery management objectives when undertaking MSEs. He emphasized that clear objectives are fundamental to evaluating the performance of management procedures and are the backbone of informed and transparent decision-making. In turn, MSE is a decision support tool for understanding tradeoffs among objectives. Aaron outlined the key components to consider when specifying objectives: (1) what you want or where you want to go, and (2) what to measure to achieve it and provided examples of common fishery management objectives that are considered in MSEs. He also highlighted that useful objectives are specific, quantifiable, and directional. Aaron introduced a set of proposed objectives for the first phase of the Sablefish MSE, as well as additional objectives for workshop participants to consider (Appendix C) in the breakout groups they then entered into after the presentation. Lastly, lessons learned were shared from other MSEs including specifying objectives is an iterative process, which need to be periodically revisited, as groups engaged in a MSE learn about the system and/or priorities and problems change; the process of collaboratively identifying objectives is often enlightening and can promote a more comprehensive understanding of perspectives and needs among all involved participants; and core objectives tend to have broad support.

Following the presentation, participants moved into breakout groups (BOGs) to discuss the specific objectives they would like to see considered by the Sablefish MSE over both the short and long term. They then shared the outcomes of their deliberations in a plenary discussion. Key objectives that emerged included (**prioritized by more than two BOGs*):

Biological objectives:

- Minimize risk of stock being overfished*
- Maintain stock biomass at or above B_{MSY}

Social and economic objectives:

- Minimize risk of fishery closure
    - Maintain minimum catch level
- Minimize annual catch variability*
    - Catch is linked to market stability and prices
    - Annual catch variation < 15% was noted as a preference
- Maximize long term profitability
- Maximize catch noted as a region-specific objective (which may be in conflict with maximizing long term profitability)

In addition to the objectives above, breakout groups discussed additional objectives of interest.

- Avoid inhibiting reproductive capacity of the stock, maintain spawning biomass so that future restrictions due to stock rebuilding will be avoided
- Avoid constraint on other targeted fish species; fixed gear fleets target sablefish while trawl is a multi-species catch, sablefish quota can constrain opportunities for catching other species
- Maintain equity across space (regions); spatial allocation linked to fairness and profitability. This was a common theme in discussions and linked to concerns that the OM as currently specified does not have the spatial resolution to address all participant concerns regarding catch allocation (between regions, within a region) or apportionment (between gears/fleets).
- Maximize flexibility in gear
- Maximize short-term catch
- Limit bycatch during high recruitment events
- Robust to climate and population variability

Careful identification of management objectives and performance metrics will assist in obtaining the best information from a MSE process. Three overall themes were identified in the suite of management objectives that were listed as priorities for the breakout groups: biological sustainability, economic profitability, and fair distribution of resources within and between regions and sectors. The MSE process does not capture or quantify every aspect of the information that can inform management decisions. Distribution of resources between regions, within regions, or between fishing sectors can be quantified to a large extent but determining equitability of decisions may not be possible.

Performance metrics (Session 5)

Brendan Connors discussed performance metrics as the currency used to evaluate how well management procedures meet objectives in an MSE. As such performance metrics directly flow from objectives and have specific attributes that make them quantifiable and therefore useful for understanding management procedure performance and tradeoffs among objectives. The first attribute is that performance metrics should be measurable, and are often either summary statistics (e.g., total catch, average catch, variability in catch, or average CPUE) or probability of metrics (e.g., falling below a specified stock size, stock growth from a low stock size, overfishing, becoming overfished, or fishery closures). The second attribute is that performance metrics should be time bound (e.g., short-term [5 years] or long-term [2 fish generations or next 30 years]). The third and final attribute of performance metrics is that they should be spatially explicit (e.g., specific to a single or multiple management or biological regions), which Brendan emphasized is particularly important for the spatially explicit coast wide Sablefish MSE that the workshop is focused on. Brendan then provided some examples of common fishery performance metrics and visuals that are used to illustrate Management Procedure performance against multiple objectives (e.g., grouped bar plots and radar/spider plots). Lastly, Brendan introduced a set of proposed performance metrics associated with the objectives introduced in the previous session for the first phase of the Sablefish Management Strategy Evaluation, as well as additional performance metrics for workshop participants to consider in the breakout groups they then entered into after the presentation.

The following performance metrics were discussed by breakout group participants and brought forward in full group discussion as key metrics of interest by two or more BOGs.

Objectives	***Performance Metric(s)***
Minimize risk of stock being overfished	High probability of spawning stock > Reference Point (B_{MSY}), in each biological region over a 30-year period
Minimize annual catch variability	Proportion of years that the annual percent change in TAC/ACL exceeds 15%, in each management region over first 10 years of projections
	Annual percent change in TAC/ACL in each management region over first 10 years of projections

Additional performance metrics that stemmed from other objectives noted by BOGs included:

Objective	***Performance Metric(s)***
Maximize long term profitability	Mean fish length in the directed fishery over a ten year period, by biological region
Maximize catch	Average catch over first, last 5 years by management region
	Trend (increase, decrease, flat) over simulation period in each management region
Maintain minimum catch level	Catch above X (mt) in x% of years by management region and fleet

During the discussion, it was noted that several of the performance metrics were initially stated as thresholds with pass/fail results instead of probabilistic metrics which indicate degree to which the metric is met. Thresholds that are pass/fail can be less useful in understanding the tradeoffs to alternative management procedures but can be very useful in actual decision contexts where the pass-fail nature of performance metrics associated with objectives allows for greater transparency and efficiency in selecting a preferred management procedure to implement. In BOGs, participants discussed what ‘equity’ across spatial regions meant to them, and how it could be measured by a performance metric. While there was no clear resolution on this issue as a full group, bioeconomics information was identified as something that could be a part of future phases.

Management Procedures (Session 6)

Maia Sosa Kapur described the candidate management procedures for this MSE, which were defined as combinations of spatial assessment estimation models (EMs) and harvest control rules (HCRs). She presented three potential spatial assessment models, which varied in their faithfulness to the OM structure: 1) a model with the four biological areas (“stocks”), 2) a model that matches the OM (a six-area nested design) and 3) a model that is panmictic, or groups all regions together. These spatial stratifications refer to how OM-generated data are processed for use in the assessment, and the assumption of movement (or lack thereof) within the spatial assessment models. Subsequent discussion (post-workshop) revealed that conducting an assessment at the first biological-areas or “stock” stratification would not be tractable for this MSE, as those biological zones are not nested within the fleet- and management structure of the current NE Pacific sablefish fishery, so there are a total of three viable spatial assessment regimes for phase 1 (matching the OM, political boundaries, and panmictic). Specifically, the “stock” stratification presents a mismatch between the scale at which total allowable catches are set (management regions, allocated to fleets) and the scale at which exploitation rates are estimated within the assessment model. For example, the Alaskan Longline fleet operates in

OM areas A3 and A4. The MSE framework must produce a catch level (via HCRs) for all management regions, solve for the fleet-specific *F* given fleet-specific selectivity which would realize that catch, and then pass these values to the OM to generate another year of forecasted data for each of the six OM areas. If A3 and B3 were represented as a single biological area in the estimation model, it would be enormously difficult to specify within the estimation model how forecasted catches attained by the Alaska Longline fleet are based on exploiting only a portion of the available biomass in area "A3+B3", and all of area A4. This would, at minimum, require an estimate of the relative distribution of biomass within aggregated areas, the assumption that this distribution is constant each year, and a hypothesis about whether or not fleet selectivities may vary among areas (which requires the data to inform estimates of such selectivity). The risk of confounding between area-specific selectivity and actual population dynamic processes is high, so we have elected to not pursue this 4-area EM within the MSE. Fortunately, an EM which mimics the OM structure should capture the outcome of management strategies which consider the biological reality of the population.

Maia presented two sets of proposed harvest control rules, which control how the stock status (i.e., stock biomass relative to a target) translates into annual total allowable catches. The first set was the status quo HCRs, which are presently used in each management region. The second set replicated the NPFMC 'Tier 3' HCR for all three MSE regions. A third HCR option was left open for discussion with workshop participants. Workshop participants were encouraged to be judicious in providing recommendations for HCRs, since by assuming up to three spatial assessment regimes, each additional HCR set would add three simulation experiments.

During the Session 6 discussion, BC representatives suggested doing away with simulations involving the HCR from that region as it was custom-made for their regional MSE and is thus tuned to their own objectives and estimation model.

Generally, participants expressed interest in simplicity: spatial assessment models that are not over-complicated, and some suggested examining a single, empirical HCR applied to all regions. This empirical HCR could use something like a survey-based rule that tracks stock trends instead of a more complex measure of stock status. Similarly, a survey-based rule could apply a smoother to an estimate of relative abundance, which would avoid outsized responses to noise in the data. Since the status-quo HCRs are otherwise similar, the group suggested starting with a single one applied to all regions; if that initial test fails to meet the objectives, they suggest adjusting the control points (such as target biomass) to identify an HCR that meets objectives. Potentially, a "meta rule" could be explored that limits year-to-year variability in TACs to within 15% to address the objective discussed in Session 5. There was support for limiting high catches when stock sizes are high. Finally, participants expressed interest in HCRs responsive to climate-change induced effects on recruitment, which is a topic under consideration for Phase 2.

Next steps (Session 7)

Throughout the virtual workshop, participants were randomly polled to keep engagement and to help shape the next steps (Appendix D). Some results differed from the results of the post workshop survey we sent to all participants to provide additional comments and to rank what they considered to be the most important future topics to discuss in Phase 1 and Phase 2. For example, during the workshop, the top two for Phase 2 were Environmental and Economic Considerations. The top two for each Phase (equally ranked) from the post workshop survey were the following:

Future Phase 1:
- How to capture discards in the Operating Model
- Management Procedures

Future Phase 2:
- Environmental considerations
- Within region spatial allocation

The following presents a tentative plan for the Phase 1 completion of this MSE in 2023. We expect this plan to evolve as technical and data-related challenges are encountered and addressed, and our goal is to produce an initial MSE framework that provides a foundation for future MSE iterations and research questions. The major milestones are as follows:

1. Finalize the operating model with six sub areas as presented in Figure 1, addressing discard data in all regions. Engage with BC stakeholders (and other regions, as needed) to refine treatment of discarding data within the model, potentially identifying sensitivity run(s) to capture uncertainty in this important process. Define sensitivities, if applicable, for other uncertainties such as movement rates and/or aspects of the recruitment process. **Target deadline: Late 2021**
2. Construct estimation models at spatial strata that are tractable within the nested-subarea OM framework; we plan to include estimation models that match the OM structure and that match the management regions. Time-permitting we will also include a panmictic estimation model. Define empirical HCR for use in step 3. **Target Deadline: Early 2022**
3. Evaluate management procedures that include combinations of the estimation models discussed above, and the following HCRs: (1) a status-quo HCR that represents the current management paradigm in AK and the California Current; use the AK (NPFMC Tier 3) HCR for British Columbia; (2) a single status-based HCR (NPFMC Tier 3) applied across all regions, and (3) a single empirical HCR applied across all regions. Revisit this step as needed if the aforementioned management procedures fail to meet most objectives. **Target Deadline: Mid 2022**
4. Report out Phase 1 results to stakeholders, gather feedback for phase 2 topics. Pursue funding/personnel for phase 2 MSE work. These topics might include finer-scale spatial strata within the OM; objectives and performance metrics related to economic questions such as fleet-specific allocation; and the evaluation of management strategies in the context of climate change. **Late 2022**

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Appendix A

Participants
John Budrick, California Department of Fish and Wildlife
*Merrick Burden, Environmental Defense Fund
Fabio Caltabellotta, Oregon State University
Michael Drexler, Ocean Conservancy
Dan Falvey, Alaska Longline Fishermen's Association
*Dan Holland, National Marine Fisheries Service Northwest Fisheries Science Center
William Jasper, Makah Tribe
James Johnson, Deep Sea Fishermen's Union
Samuel Johnson, Landmark Fisheries Research
Steve Joner, Makah Tribe
*Melissa Krigbaum, National Marine Fisheries Service Northwest Fisheries Science Center
Allen (Rob) Kronlund, Interface Fisheries Consulting, Ltd./Canadian Sablefish Association
Gwyn Mason, Department of Fisheries and Oceans Canada
Lynn Mattes, Oregon Department of Fish and Wildlife
Corey Niles, Washington Department of Fish and Wildlife
Mike Okoniewski, Pacific Seafoods
Todd Phillips, Pacific Fishery Management Council
Katherine Pierson, Oregon Department of Fish and Wildlife
André Punt, University of Washington
Gerry Richter, B&G Seafoods
*Corey Ridings, Ocean Conservancy
Whitney Roberts, Washington Department of Fish and Wildlife
Michele Robinson, Ocean Beat Consulting
Jim Seger, Pacific Fishery Management Council
Maggie Sommer, Oregon Department of Fish and Wildlife
Alexander Stubbs, Stubbs Marine

Observers
Grant Adams, University of Washington
Jim Armstrong, North Pacific Fishery Management Council
Ridouan Bani, University of Washington
Caren Barcelo, National Marine Fisheries Service Office of Science and Technology
Anne Beaudreau, University of Washington
Asia Beder, Alaska Department of Fish and Game
Mike Burner, Pacific Fishery Management Council
Gemma Carroll, National Marine Fisheries Service Alaska Fisheries Science Center
Sara Cleaver, North Pacific Fishery Management Council
Robert Eder, F/V Timmy Boy
Gretchen Hanshew, National Marine Fisheries Service West Coast Region
William Harris, Department of Fisheries and Oceans Canada
Adam Keizer, Department of Fisheries and Oceans Canada
Keeley Kent, National Marine Fisheries Service West Coast Region

Qi Lee, University of Washington
Amber Lindstedt, Department of Fisheries and Oceans Canada
Michele Longo-Eder, Michele Longo-Eder Attorney at Law, LLC
Steve MacLean, North Pacific Fishery Management Council
Melissa Mandrup, California Department of Fish and Wildlife
Stacey Miller, National Marine Fisheries Service West Coast Region
Victoria O'Connell, F/V Cherokee
Haley Oleynik, National Marine Fisheries Service Office of Science and Technology
Maxime Olmos. Oregon State University
Megan O'Neil, Petersburg Vessels Owner's Association
Brad Pettinger, Pacific Fishery Management Council
Kristin Privitera-Johnson, University of Washington
Chris Rooper, Department of Fisheries and Oceans Canada
Colin Sayer, National Marine Fisheries Service West Coast Region
Kalei Shotewell, National Marine Fisheries Service Alaska Fisheries Science Center
Margaret Siple, National Marine Fisheries Service Alaska Fisheries Science Center
Jessica Tengvall, University of Bergen
Theresa Tsou, Washington Department of Fish and Wildlife
Matthieu Veron, University of Washington

PSTAT Members, Workshop Organizers, and Presenters
Aaron Berger, National Marine Fisheries Service Northwest Fisheries Science Center
Brendan Connors, Department of Fisheries and Oceans Canada
Sean Cox, Simon Fraser University
John DeVore, Pacific Fishery Management Council
Kari Fenske, National Marine Fisheries Service Alaska Fisheries Science Center
Daniel Goethel, National Marine Fisheries Service Alaska Fisheries Science Center
Dana Hanselman, National Marine Fisheries Service Alaska Fisheries Science Center
Melissa Haltuch, National Marine Fisheries Service Northwest Fisheries Science Center
*Kendra Holt, Department of Fisheries and Oceans Canada
Lisa Lacko, Department of Fisheries and Oceans Canada
*Kristin Marshall, National Marine Fisheries Service Northwest Fisheries Science Center
Maia Sosa Kapur, University of Washington
Diana Stram, North Pacific Fishery Management Council
*Jane Sullivan, National Marine Fisheries Service Alaska Fisheries Science Center
Ben Williams, National Marine Fisheries Service Alaska Fisheries Science Center

IT Support
Kris Kleinschmidt, Pacific Fishery Management Council
Sandra Krause, Pacific Fishery Management Council

Facilitator
Meisha Key, Key Coaching and Development

**Breakout Group Facilitators*

Appendix B

Workshop Agenda

Tuesday, April 27, 2021 – 1:30 P.M. (PDT)

1:30 – 2:15 p.m.	**Session 1: Welcome and Overview of Meeting**
2:15 – 3:35 p.m.	**Session 2: Introduction to Management Strategy Evaluation and Stakeholder Engagement** ● *Presentations (Melissa Haltuch, Sean Cox)* ● *Discussion*
3:35 – 3:50 p.m.	BREAK
3:50 – 4:45 p.m.	**Session 3: Introduction to the Northeast Pacific Sablefish Operating Model** ● *Presentation (Maia Sosa Kapur)* ● *Discussion*
4:45 – 5:00 p.m.	**Wrap Up and Adjourn**

Wednesday, April 28, 2021 – 9:30 A.M. (PDT)

9:30 – 9:45 a.m.	**Welcome and Recap Day 1**
9:45 – 11:05 a.m.	**Session 4: Identify MSE Objectives** ● *Presentation (Aaron Berger)* ● *Breakout groups* ● *Discussion*
11:05 – 11:20 a.m.	BREAK
11:20 a.m. – 12:50 p.m.	**Session 5: Identify MSE Performance Metrics** ● *Presentation (Brendan Connors)* ● *Breakout groups* ● *Discussio*n
12:50 – 1:50 p.m.	LUNCH
1:50 – 3:20 p.m.	**Session 6: Discussion of Proposed MSE Management Procedures and Future Management Strategies Research** ● *Presentation (Maia Sosa Kapur)* ● *Breakout groups* ● *Discussion*
3:20 – 3:25 p.m.	BREAK
3:35 – 4:30 p.m.	**Session 7: Wrap-Up and Next Steps**
4:30 p.m.	ADJOURN

Appendix C

C.1 Original straw person table of objectives, performance metrics, and management procedures

The following lists example objectives and performance metrics that can be discussed and refined during the 2021 sablefish MSE workshop. We anticipate implementing a subset (less than five) during the first iteration of the MSE. During Sessions 4 and 5, presenters will go over proposed objectives and describe alternatives. Participants are encouraged to discuss and propose their own objectives; we are not limited to those described here. Finally, rows highlighted in grey are those which are not able to be implemented in the first MSE iteration.

Objective *What do we care about?*	**Quantity of Interest** *What is measured?*	**Performance Metric** *How do we measure it?*
Minimize risk of stock being overfished	Size of spawning biomass	Probability spawning biomass is above 40% of unfished biomass in 50% of the years over a 30-year period
Minimize risk of fishery closure	*Number of years the fishery closes, probability of closure in a given 10-year period*	Probability fishery has less than **X**% chance of closure in any given 30 year period
Low risk of harvest rate reduction	Spawning biomass	Probability spawning biomass is above **X**% of unfished biomass in X% of years over a 30-year period; Probability spawning biomass is above X% of unfished biomass in **X**% of the years over a 30 year period; Probability $SSB / SSB_{40\%} \geq 1$; Probability $SSB_{current\_year} / SSB_{reference\_year}$ where reference year could be specified as unfished biomass in year 1 or SSB in another year
Minimize annual catch variability	Level of catch variability	Coefficient of variation in annual catch over first 10 years of projection; Probability change in ABC / allowable catch between -**X**% or +**Y**% for **N** years over a 30 year period
Maximize short-term catch	Total short-term catch	Sum of catch over first 10 projection years
Maximize long-term catch	Total long-term catch	Sum of catch over last **N** projection years in each management region
Maximize catch	Annual catch	Mean annual catch over a 30 year period
Maximize "old growth" age structure	Mean population age	Probability mean population age ≥ **X** in **X**% of years over a 30-year period in all management regions
Maximize "old growth" size structure	Mean population length	Probability mean population length ≥ **X** in **X**% of years over a 30-year period in all management regions
Maximize fishery profits *	Costs and revenues for each fleet per year	Sum of profits over last N projection years in each fleet and management region
Ensure fair allocation of quota to individual quota holders *	Distribution and variability of quota among quota holders	Probability **X**% of quota holders receive their expected quota in **Y**% of years within each management region

*requires future extensions to Operating Model

C.2 Updated table of objectives and performance metrics

The following presents an *updated* version of the table above, with emphasis on the objective and performance metrics we intend to address in phase 1. Phase 2 objectives are also included at the bottom in shaded cells; these will require future allocation of funds and personnel. It is evident that several objectives can be measured with the same or similar quantities of interest, and that the emphasis for phase 2 objectives is largely economic.

	Objective *What do we care about?*	**Quantity of Interest** *What is measured?*	**Performance Metric** *How do we measure it?*
Phase 1 Objectives & Performance Metrics: Biological	Minimize risk of stock being overfished	Size of spawning biomass	Probability spawning biomass is above 40% of unfished biomass in 50% of the years over a 30-year period
	Maintain stock biomass at or above B_{MSY}	Size of spawning biomass	Probability spawning biomass is above B_{MSY} in 50% of the years over a 30-year period
Phase 1 Objectives & Performance Metrics: Economic	Minimize risk of fishery closure	*Number of years the fishery closes, probability of closure in a given 10-year period*	Probability fishery has less than **X**% chance of closure in any given 30 year period
	Maintain minimum catch level	*Yearly catches*	Number of years in which catch falls below lowest observed (true) catch in each region over 30-year period
	Maximize catch on a regional basis	Sum of catch across all three regions	
	Minimize annual catch variability	Level of catch variability	Coefficient of variation in annual catch over first 10 years of projection; Probability change in ABC / allowable catch between -**X**% or +**Y**% for **N** years over a 30 year period ; Annual catch variation is less than 15%
Phase 2 Objectives*	Maximize long-term profitability profits *	Costs and revenues for each fleet per year	Sum of profits over last N projection years in each fleet and management region
	Encourage price and market stability	Costs and revenues for each fleet per year	Percent change in price is below threshold year-to-year; revenues do not vary more than a given percent year-to-year
	Ensure fair allocation of quota to individual quota holders *	Distribution and variability of quota among quota holders	Probability **X**% of quota holders receive their expected quota in **Y**% of years within each management region

*requires future extensions to Operating Model

Appendix D

Participants were polled throughout the virtual workshop to sustain engagement and to help shape the next steps. The following gives a brief summary of those results.

DAY 1

75% were curious and relaxed at the beginning of the meeting.

Who was there?

Scientist - Government	28%
Manager	26%
Scientist - Academia	19%
Fisherman/Woman	9%
NGO	9%
Other	7%
Processor	2%

100% thought Day 2 setup was a good way to provide feedback.

DAY 2

75% were still curious and relaxed at the beginning of the day, with curiosity being higher than the day before.

Preferred method of communication?

Virtual meetings (relatively short)	38%
Workshop like this one (relatively longer)	34%
Email	21%
Formal presentations via Council or Seminar series	7%

Future Phase 1 meeting topics?

Discuss how to capture discards in the operating model	30%
Discuss management procedures	22%
Discuss operating model uncertainties	22%
Revisit objectives	11%
See results	7%
Other	4%
Revisit performance metrics	4%

Medium term MSE topics (Phase II)?

Environmental considerations	32%
Economic considerations	25%
Within region spatial allocation	25%
Within region allocation between gears	11%
Other	7%

Future meeting frequency and timing?

Not until there are preliminary results	62%
In 6 months, whether there are results or not	15%
Other	12%
I don’t know what to suggest	4%
In 1 year, whether there are results or not	4%
Prior to preliminary results	4%

What word best describes your experience in this process?

Engaged	37%
Collaborative	30%
Optimistic	19%
Confused	7%
Heard / Understood	4%
Other	4%

100% agreed the outcomes were met and would participate in future working groups/workshops.