North Pacific Fishery Management Council

Simon Kinneen, Chair | David Witherell, Executive Director
1007 W. 3rd Avenue, Suite 400, Anchorage, AK 99501
Phone 907-271-2809 | www.npfmc.org

C4 Essential Fish Habitat

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SSC Minutes Excerpt

Below is an excerpt of the minutes from the recent SSC review of the EFH methodology and results in February and October 2022. Following SSC review, staff have integrated recommendations and suggested modifications into the 2023 EFH 5-year review summary report, as presented to the Council in February 2023.

February 2022 EFH SSC review

The SSC received reports on Essential Fish Habitat (EFH) component 1, EFH descriptions, and EFH component 2, fishing effects analysis. Public testimony was provided by Jon Warrenchuk (Oceana), John Gauvin (Alaska Seafood Cooperative) and Cory Lescher (Alaska Bering Sea Crabbers). Additional written comments were received from Marissa Wilson (Alaska Marine Conservation Council), Jamie Goen (Alaska Bering Sea Crabbers), and Jon Warrenchuk and Ben Enticknap (Oceana).

Component 1 - Species Distribution Models

The SSC received reports from Jodi Pirtle (AKRO) and Ned Laman (AFSC) on advancing Essential Fish Habitat (EFH) descriptions and maps for the 2022 5-yr review. Additional information was provided by Jim Thorson (HPR, AFSC) and Gretchen Harrington (AKRO). The SSC thanks the analysts for their excellent work to improve EFH descriptions, for their efforts to solicit reviews and input from the stock assessment authors, Plan Teams and the SSC, and for their responsiveness to comments and suggestions. In particular, the SSC appreciates the concise background, summary of methods, clear examples and detailed summary tables for evaluating the new EFH descriptions. The SSC also appreciates agency staff who were available to answer questions about EFH processes and complex technical details.

Overall, the information provided in the discussion paper and attachments represents a substantial improvement and refinement of EFH descriptions over the previous review cycle. Some of the key improvements and refinements are:

- EFH descriptions were expanded to include more species and stages with up to three life stages by species for 32, 25 and 42 groundfish species in the EBS, AI and GOA, respectively, as well as for five crab species in the EBS, two in the AIs and octopus in all regions.
- EFH maps for all species were based on an expanded suite of five Species Distribution Models (SDMs) and EFH was quantified based on an ensemble model approach, wherein individual members of the ensemble are weighted based on out-of-sample predictive performance (root mean squared error or RMSE) from cross-validation. Updated SDMs and the model ensemble, which generally performed considerably better than the 2017 SDMs, were based on a carefully selected set of criteria for model comparisons.
- Uncertainty in the mapped abundances was quantified based on a cross-validation approach and the coefficient of variation (CV) was mapped along with the abundances.

- The analyses advance almost all species and life stages to EFH Level 2 descriptions based on habitat-related abundances and, for a subset of juvenile life stages, to EFH Level 3 descriptions based on habitat-related vital rates. This advancement to level 2 information for the first time provides a common numerical abundance metric for comparisons across models and not only made the ensemble approach possible but also sets the stage for greatly expanded uses of the SDMs that better reflect habitat quality, to the extent that high abundances are indicative of higher quality habitat. The transition to the use of SDMs that predict numerical abundance as the response variable also provides an improved basis for future incorporation of other fishery-independent and potentially fishery-dependent data sources to inform EFH definitions.

Given these clear advances, the SSC believes that a large majority of the EFH maps reflect the best available science for characterizing EFH. The SSC recognizes that the EFH distributions represent summer distributions at the time of the trawl surveys in most cases, whereas fish distributions may change seasonally and fishing activities occur throughout the year. For some of the species, stock assessment author expert reviews noted that the model fits to the survey data result in a poor representation of EFH due to data inadequacies; for example, where the spatial footprint of the species extends well beyond the survey area, where the survey gear sampling performance is limited for a particular species, or the species occupies habitats that are inaccessible to survey gears. In these cases, the NMFS bottom trawl surveys in particular do not adequately represent the full spatial distribution and abundance of a species / life stage. **Therefore, the SSC notes that, by themselves, the EFH maps for these species and life stages do not provide a sufficient basis for assessing adverse fishing effects or for EFH consultations. The SSC supports the ensemble SDM approach for EFH descriptions, but requests that the limitations of the data for these species and life stages are clearly highlighted and communicated to other analysts and to the public**. Concerns about the representativeness of survey information relative to species distribution are not new and have been a long-standing EFH research priority. This 5-yr review focused on model improvements that will facilitate the broad inclusion of additional data sources in the future.

To determine fishing impacts (EFH component 2), additional information will need to be considered for some species and life stage combinations that are poorly represented by the survey data. If the Core EFH areas in these cases are used with the FE model to determine whether fishing impacts are more than minimal and not temporary, results may provide some insights relevant to a portion of the stock but will not be reliable indicators of overall fishing impacts. Additional data sources that could be considered are summarized in the documents provided and include observer data and longline surveys. **The SSC clearly heard from analysts that changing SDMs was not possible under the proposed timeline due to resource limitations. However, to the extent possible, the SSC recommends that the EFH maps be updated with additional information before running the FE models for species/life stages where the stock authors had substantial concerns about bottom trawl or other survey data accurately representing species distributions.** In some cases, this may require the SDM team to employ single SDM models (e.g., MaxEnt) rather than ensembles to accommodate disparate data types and as such the interpretation of EFH as 95% of the species population may differ (probability of occurrence versus numerical abundance). Where the incorporation of additional data is not feasible, the SSC suggests that the determination of adverse fishing effects for species without a reliable estimate for the Core EFH area could be based on estimated fishing effects determined over the smallest area that encompasses an exploited stock (i.e., where catches have historically occurred based on the catch-in-areas database), while determinations for juvenile and subadult stages may not be possible. Absent additional quantitative analyses, the determination would need to be based on expert assessments for the species in question.

Data limitations are of concern primarily for those species that inhabit the slope and untrawlable areas, but concerns differ among the species where stock assessment authors had low confidence in the EFH maps. **Therefore, to better understand the nature of the concerns and the data limitations across stocks, the SSC requests that the SDM team work directly with stock assessment authors to provide a summary table that evaluates the species for which elevated concerns were identified against the following minimal criteria and possibly additional criteria as identified by the SDM team:**

- Survey reliability: Does the trawl survey reliably sample the species abundance and distribution in the area surveyed?
- Seasonal representativeness: Does the summer distribution reflect the habitat of the species or are there indications that the distribution varies substantially among seasons?
- Spatial representativeness: Does the estimated EFH represent the distribution of the species within the FMP area or does the species extend substantially beyond the estimated EFH?

If any of these criteria are not met, the corresponding EFH map and text description should be clearly flagged as being potentially unreliable or only reliable as indicators of limited summer distributions. This will help users and analysts better understand and take into account the additional uncertainty that is not captured in the maps of model uncertainty (CV) provided in the documents. **To better communicate uncertainties about the overall reliability of the EFH descriptions to the public, the SSC suggests that the summary tables of model performance include a plain language reliability score (qualitative) based on both model performance criteria and any identified concerns.** This table and brief description could consist of a predictive performance summary of the model using a good, medium, or poor rating (currently described in the document for individual quantitative metrics); an assessment of reliability (e.g., adequate/not adequate for FE determinations) based on underlying data concerns described in the bullets above; and any other limitations the authors believe are important to communicate at a high level. The SSC also requests the authors consider, for the next review cycle, methods to better communicate uncertainty associated with the final maps of EFH and fishing impacts and intermediate products that may be available (e.g., SDM or FE outputs). During staff presentations, AKRO staff indicated a NMFS-led EFH SDM working group will be formed, and perhaps this would be a good topic for this working group to consider, noting that FE is a complementary product derived from SDM and may require a joint effort to provide a comprehensive discussion. Despite the limitations as noted above, the SDM results represent an impressive and substantial improvement over the 2017 review.

In addition to making SDM results widely available through the FMP and websites, the analysts plan to share code via a GitHub site for other analysts and researchers to use. The SSC strongly supports this approach to increase transparency and reproducibility. The SSC highlights that the authors used state-of-the-art models and defined EFH using an approach that was developed in an open and transparent way. While some of the decisions, such as the 5% encounter rate threshold for defining area occupied are *ad hoc* and can be influential, the SSC commends the team for striving for consistency and for rigorous and objective analyses based on those and other choices.

The SSC notes that there is tremendous value to these products that goes well beyond meeting MSA mandates. Primary uses are to inform the Fishing Effects analysis and EFH consultations. The document provides a brief summary of uses in research (e.g., on climate change impacts) and in a stock assessment context. In the latter context, ESP indices that are based on EFH information provide an on-ramp for using this information in the assessments. The utility of EFH products undoubtedly goes well beyond these examples, but information on their use by researchers, by the general public, and by agencies and other organizations for planning purposes, is not readily available.

The SSC recommends that this information be collected where possible to help inform both the next 5-yr review and how to better share the results more effectively and broadly to enhance their impact.

The SSC notes that, as another benefit to researchers, the EFH descriptions and the effects of different variables on abundance provide a wealth of information on ecologically relevant relationships and patterns. For example, the SSC notes that bottom depth, variables relating to current speed or tidal flows (a possible proxy for prey aggregations), bottom temperature, and substrate-related variables were frequently important. Differences between juveniles and adults were noted in their relative importance, with living substrates more often associated with juvenile life stages, while other substrate variables such as grain size or rockiness were often associated with juvenile or subadult life stages (as well as adults of some rockfish), and currents or temperatures appeared to be most often associated with adult stages. These patterns suggest the importance of physical and living structures for early life stages, possibly to reduce predation, and the role of currents and water masses for adult distributions, possibly reflecting prey availability.

The improved EFH definitions in many cases resulted in substantial differences in the size of the EFH area between the current analyses and those published previously. These appeared to be largely due to SDM model methodological differences and to the use of a single model in 2017 (relative to the current ensemble approach) and are to be expected given the substantial updates to the modeling approach, incorporation of updated or different habitat covariates and differences in the threshold used for defining area occupied. The EFH area often varied substantially among individual models, particularly for species with a small spatial footprint and highly variable catches. The SSC notes that the main reason for using an ensemble modeling approach was to address this variability across individual models. A particularly influential change between the approaches used in this and the previous review could be the definition of 'area occupied', which was fixed at including any area with an estimated encounter probability over 5%, whereas this threshold was previously determined on a species-specific basis. The SSC notes that defining EFH based on the area that contains a certain fraction of the total abundance (see below) would eliminate the need for this somewhat arbitrary and likely influential choice.

An important decision for the next review will be whether to modify the definition of EFH to better reflect the higher level of information (level 2 EFH) that is now available for almost all species and life stages. The definition of EFH used in the document follows the EFH definition set forward in the Final EIS on EFH in Alaska (NMFS 2005), but that definition is subject to interpretation. To more fully use the abundance-based level 2 information, **the SSC recommends that, for the next 5-yr review, the SDM team considers a measure that narrows EFH to encompass higher-density areas that cumulatively are home to 95% of the proportion of a species/stage based on either numerical abundance or biomass, rather than 95% of the total area occupied**. However, such a change could have substantial impacts on the resulting EFH area and on any analyses that use EFH (e.g., FE analysis) and would have to be carefully evaluated before implementation. The approach also has drawbacks for species that may consist of multiple stocks within an FMP area. For example, red king crab in the Bering Sea consists of three managed stocks (Bristol Bay, Pribilof Islands, Norton Sound) that are clearly distinguished under the current EFH definition. Re-defining EFH based on the area containing 95% of the abundance of the species would likely exclude the Pribilof Island region and Norton Sound from EFH because all of the highest abundances and over 95% of the total abundance likely occur in Bristol Bay. Similar issues would apply to stock groups that combine species with low and high abundance. This could be addressed by defining EFH separately by stock as suggested by the CPT. **Any revisions to the EFH definition should be carefully explored by the proposed NMFS-led EFH working group and during the development of the next EFH Research Plan to identify the advantages and disadvantages of different EFH definitions**.

This could be included in the proposed publication that was recommended in the discussion paper to provide guidance to analysts ahead of the next review, which "*... may encompass an evaluation of thresholds and percentile areas applied to the SDMs and EFH maps, including the selection of the EFH area or subarea used to support the EFH component 2 fishing effects analysis*". Such a review may also benefit from discussions across Fishery Management Councils to learn from EFH approaches in other regions.

With regard to EFH definitions, the SSC requests that the discussion paper and the Tech Memos, to the extent possible, clarify that EFH for this 5-yr review was defined based on a proportion of the area occupied (i.e., the footprint), rather than the area corresponding to a proportion of the population's total abundance. While this is clearly evident in the results presented, the description in the document is often ambiguous. For example, the documents refer to "the area circumscribing the top 95% of the SDM-predicted abundance" (Attachment 3, p. 6, lines 165-168), which is at odds with the definition that was used.

The SSC provides these additional, specific recommendations for the development of a new EFH Research Plan to guide the next 5-yr review:

- SDM modeling is a rapidly evolving field, including the development of joint species distribution models. There have been several high-level reviews of these types of models and model performance (*e.g., Norberg, A., Abrego, N., Blanchet, F.G., Adler, F.R., Anderson, B.J., Anttila, J., et al. (2019). A comprehensive evaluation of predictive performance of 33 species distribution models at species and community levels. Ecol. Monogr., 89, e01370.*). Although the analysts applied state-of-the-art approaches, the SSC suggests that the EFH Research Plan should consider an in-depth review of available approaches, including considerations of Joint SDMs. Such joint SDMs do not have to include all species in an area but could be limited to a carefully selected subset of species that have known associations.

- The SSC encourages further efforts to identify ways in which the EFH information can contribute to the stock assessment process through ESPs and other 'on-ramps'.

- The current EFH definitions focus on summer survey data only and provide a much-improved snapshot of summer distributions. **The SSC supports recommendations to extend the analyses in the future to use fishery-dependent data, longline surveys, acoustic surveys, etc.**, to both enhance maps of summer distributions and to define EFH at other times of the year where possible, building on the approach developed during the 2017 5-yr review. However, the SSC notes that this type of intercalibration exercise will require careful consideration of the relative catchability among different gear types, the spatial distribution of effort, and targeting behavior in the case of fishery-dependent data.

- **The SSC previously encouraged, and the discussion paper recommends, the move toward a more dynamic definition of EFH,** for example in time blocks, which would require careful consideration of the time frames used for defining EFH. The current EFH definitions use all available data but don't account for long-term changes in the underlying habitat or shorter-term variability in dynamic habitat components. The bridging analyses illustrate that the addition of new data alone can impact results, especially in previously under-sampled areas, possibly suggesting habitat changes in recent years. In cases where long-term trends are a concern, it would be sensible to select a recent period during which conditions have been relatively stable, for example after observed discontinuities in large-scale climate variability in 1988/89 or after 1999, when conditions were generally warmer. Defining an appropriate period could be supported by an analysis of the dynamic variables (e.g., Dynamic Factor Analysis, change-point analysis) to use a time period that best reflects more recent conditions. To the extent that the intent of EFH descriptions is to estimate the “potential habitat” available to a species and life stage, characterizing EFH under contrasting environmental conditions would be most useful. This approach could be used to explore changes in EFH in a changing climate and to capture trends and changes in habitat suitability. For example, for species whose distribution is strongly associated with water temperatures, EFH could be defined separately for warm and cool periods. Similarly, EFH could be defined for periods with contrasting ocean circulation patterns as captured by bottom currents or other dynamic variables. **The SSC recommends that both longer-term average EFH and EFH under contrasting conditions for those species whose distribution is known to be linked to changing ocean conditions be considered in the next 5-yr review**. The SSC looks forward to seeing an example of such an approach as part of the EFH determinations for the Arctic FMP, currently scheduled for June.

- The SSC appreciates the move to life stage specific models for almost all groundfish stocks and encourages the team to prioritize life stage specific models for crab species based on available maturity data.
- **The SSC supports a recommendation brought forward by the CPT and in public testimony to consider mapping EFH by management area for separate stocks within an FMP area**. One example is red king crab in the Bering Sea, which consists of three distinct stocks.
- The SSC encourages the analysts to consider objective approaches to eliminate isolated areas where the model suggests elevated abundances that are not supported by any occurrences in the data and are spatially separated from the main distributional areas.
- The SSC appreciates the inclusion of the PR-AUC as an additional criterion for evaluating the SDM models as it provides useful information on model performance with respect to the presence of a species, particularly for relatively uncommon species. The SSC suggests including the PR-AUC and species prevalence as routine criteria in future model updates.
- The SSC encourages the analysts to explore options that account for both abundance and uncertainty in the definition of EFH.
- The SSC encourages the analysts to provide general comparisons of the abundances estimated in the EFH SDMs and those estimated in the stock assessments.
- The SSC supports the additional recommendations in Table 18 of the discussion paper and highlights the following priorities:
    - Further development of methods to combine multiple surveys to make full use of available data and to expand coverage beyond any one survey region.
    - Development of process studies to advance EFH description to level 3 and possibly 4, if appropriate. The SSC suggests that the EFH research plan consider a case study for the development of level 4 EFH description for at least one species / life stage to better understand the information and methods needed to advance to level 4.
    - With regard to considering additional covariates in the future, the SSC agrees with exploring the proposed variables in Table 79 of Attachment 3 but notes that some of these variables reflect surface features (e.g., Chl a) that may or may not be relevant to demersal fish and crab and might be considered a lower priority. The SSC suggests adding variables that are indicative of frontal structures, which often aggregate prey and

their predators. These could be defined by gradients in bottom temperature and salinity. The SSC further suggests exploring the use of variables that reflect the vertical structure of the water column.

- Inclusion of alternative data sources such as longline survey data, fishery-dependent data, acoustic data and other sources.

The SSC looks forward to the development of the EFH research plan and to future opportunities to provide input on the directions of this valuable effort. **The SSC was encouraged to learn about the proposed working group and agrees that this provides an excellent avenue to further explore ideas about how to improve EFH descriptions in the future to better inform the public and support decision making.**

Component 2 - Fishing Effect Model

The SSC received a report from John Olson (AKRO) and Scott Smeltz (Alaska Pacific University) on the structure, development and data inputs informing the FE model as part of the EFH evaluation process. The SSC thanks the authors for providing a clear and concise document. The SSC also appreciates agency staff who were available to answer questions about EFH processes and complex technical details. This presentation and the associated discussion paper provide a complete description of the underlying model structure and assumptions, including calculations describing how habitat features are averaged for a given sediment type to determine aggregate recovery time (Section 3.6, pg. 20), which had previously been requested by both the SSC and the public.

The SSC thanks the EFH authors for their efforts in model development and for providing the SSC with sufficient detail in the review materials to evaluate whether the FE model provides a reasonable basis for moving forward with using the FE model in this EFH review cycle and, ultimately, its use for evaluating whether fishing activities are having a 'more than minimal and not temporary' adverse effect on EFH for BSAI and GOA FMP species. Modeling methodology is largely unchanged from that used for the 2017 EFH review cycle. However, the authors highlighted changes made to the input data, the transition from a continuous to a discrete model, and described an error in the 2017 modeling code where longline and trawl inputs were transposed. **The SSC supports the current version of the FE model for analysis to evaluate fishing impacts for the 2022 5-year Essential Fish Habitat review cycle, after addressing SSC suggestions below as practicable.**

Analysis of the effects of fishing on habitat requires a synthesis of gear-specific impacts on different habitats, quantifiable metrics for the frequency and distribution of fishing effort that contacts benthic habitats, and physical and biological characteristics of seafloor habitats themselves. The FE model operates on a 5-kilometer by 5-kilometer grid across the Bering Sea, Aleutian Islands, and Gulf of Alaska, representing the proportion of undisturbed and disturbed habitat within each grid cell through a discrete time framework, where the cumulative impact of fishing events and subsequent recovery of habitat features are tracked at monthly time increments. Within the FE model the impact of a fishing event is calculated as the product of the nominal area swept, the proportion of gear that is in contact with the seafloor (contact adjustment), and the susceptibility of habitat features to a given gear type within a region. The recovery rate for disturbed habitat, within a given grid cell, is calculated for each sediment type as the average of all habitat features associated with that sediment and a recovery time that is randomly selected from a uniform distribution of recovery times (in years) assumed for each habitat feature. Public comment raised the question of whether it was reasonable to assume the average recovery time across all habitat features for a given sediment type. The SSC discussed this issue and **supports the current method of averaging recovery time across habitat features given the absence of a specific**

method and empirical information from which to make a priori assignment of the relative value (e.g., weighting) for different habitat features.

The FE model assumes a nominal width impacted by a fishing event, a bottom contact adjustment, and a susceptibility of different habitat features to each gear type. While the specific values assumed for these variables describing fishing impact are listed in the discussion paper (Appendix 2, pg. 44; Appendix 3, pg. 49), **the SSC requests, prior to finalizing the document, an expanded description of the origin of these assumed values from either the literature or local knowledge of the fishing industry. The SSC further recommends, prior to finalizing the 2022 FE model, that the authors work with Alaska Regional Office in-season management personnel to determine if fishery definitions are complete** (e.g., Appendix 2). The SSC notes that future iterations of FE may need to consider additional gear categories such as slinky or longline pots and encourages further research on these gear configurations.

FE model definitions for habitat feature susceptibility to specific fishing gears and the recovery time for different habitat features are drawn from a global analysis of fishing impacts by Grabowski et al. (2014). **With respect to the question of whether it is appropriate to use values derived from such a synthesis for parameterizing the FE model for the North Pacific, the SSC supports the decision to base the parameters on such a synthesis** and highlights that meta-analytical approaches for deriving reasonable values for unknown parameters is common practice within stock assessments for parameters such as natural mortality. **However, the SSC feels it is important to include data specific to the North Pacific to the extent practicable, given potential differences in the growth and recovery of habitat features at northern latitudes, and encourages the authors to incorporate results from the 2020-2024 Alaska Deep-Sea Coral and Sponge Initiative, when available, as well as any additional information on the distribution of habitat features across sediment types from NMFS survey products.** The SSC believes this may help inform the current assumption that long-lived habitat features with assumed recovery times of 10-50 years only occur in deep and rocky sediments below 300 meters. **Prior to finalizing the document, the SSC requests expanded descriptions of, and justifications for, the assumed recovery times detailed in the document.** In addition, the SSC recommends that the authors be explicit in indicating whether recovery times for a feature and substrate type are unknown versus not present (e.g., filling in blank cells in Appendix 3 of the document).

Unobserved fishing events are not currently included in the FE model assessment of fishing impacts, which may account for 7-12% of total unobserved fishing events where vessel monitoring system (VMS) data was available. The presenters noted that unobserved information has, for the most part, not been included in past EFH cycles, and that estimates of effort from unobserved events with VMS, derived from the Catch in Areas database (used to derive the 7-12% range), were substantially different than observed events. This is likely related to error/bias associated with algorithms that determine where fishing occurred and calculating an associated haul/set footprint. The SSC also notes that a large portion of unobserved events is due to vessels that do not have VMS (e.g., IFQ fishery) and thus considerable development work is likely required to include this information. **The SSC recommends that inclusion of unobserved fishing events, or the development of a multiplier for observed fishing events to expand the cumulative impact to account for unobserved fishing events including non-VMS fleets, is a top priority for future model development**. The SSC notes that impacts of BSAI crab fisheries are not included in the current FE model and suggests the authors work to include potential impacts from these fisheries, as feasible. **Prior to the June SSC review, the SSC recommends adding a map and/or table showing the extent of unobserved groundfish and halibut fishing relative to observed fishing for recent years and, to the extent possible, the authors should provide a qualitative discussion about how gaps in coverage may influence FE outputs. In addition, given that unobserved fishing events are not currently included in the FE model and that the proportion of observed fishing events**

varies across regions, the SSC recommends that impact metrics not be aggregated to the North Pacific scale.

To guide further FE model development and to address any lingering concerns about model structure, assumptions, or data inputs, **the SSC recommends review of the FE model by the Center for Independent Experts (CIE).** The SSC notes that the last CIE review of methods used for this purpose occurred in 2002 and was focused at the time on the predecessor to the current FE model, the Long-term Effects Index (LEI) model. The SSC suggests CIE review should be a top priority and should be conducted prior to FE model use in the next 5-year EFH cycle; however, the SSC does not feel that use of the FE model in the current EFH cycle should be contingent on CIE review. Terms of reference for the CIE review could include model structure, parameter assumptions, and data inputs including fishing effort, sediment data and EFH definitions.

With respect to the hierarchical process for identifying whether to elevate a species for possible mitigation due to fishing impacts, **the SSC notes that for groundfish species in Tier 4 and below there is no available definition for MSST and suggests that for these species analysis of disturbance to core habitat areas with the FE model should not depend on biomass relative to reference points.** The CPT highlighted issues related to stock author review processes for rebuilding stocks. The SSC notes that modeling efforts to define EFH may be informative to rebuilding plans and progress towards rebuilding (noting that a stock may be above MSST but not yet rebuilt). Therefore, the SSC encourages the use of habitat modeling outputs and methods, data inputs, and stock author input to help inform specific rebuilding plans and monitor progress towards rebuilding, as appropriate. However, the SSC does not recommend changes to the current hierarchical review process at this time given the detailed rebuilding analysis (including potential regulatory actions) and monitoring of rebuilding progress that is associated with the development and amendment of rebuilding plans, noting that these activities may occur outside of the 5-year EFH review interval.

Given the dependency of FE model predictions on Core Habitat Area as defined by EFH, the SSC suggests that consideration of stock author comments on the reliability of SDM-derived EFH designations based on the criteria outlined above (survey reliability, seasonal representativeness, spatial representativeness) should be used to determine whether the current EFH definition of Core Habitat Area is sufficient for use within the FE model. In cases where SDM-derived EFH definitions are deemed inadequate, the question of whether to elevate a species for possible mitigation should be based on other sources of information.

Finally, the SSC notes a discrepancy in the document that should be corrected: Page 17 indicates unobserved data is not incorporated into the model; whereas on page 8, the second paragraph indicates both observed and unobserved effort tracks are being included.

October 2022 EFH SSC Review

The SSC received a presentation from Sarah Rheinsmith (NPFMC), Jodi Pirtle (NOAA-AKRO), Molly Zaleski (NMFS-AKRO), and Scott Smeltz (Alaska Pacific University) on the advances and findings from the 2022 Essential Fish Habitat (EFH) 5-year Review. Public oral testimony was provided by Jon Warrenchuk (Oceana) and Cory Lescher (ABSC). Written comments were provided by Jaime Goen (ABSC), Marine Wilson (Alaska Marine Conservation Council) and Jon Warrenchuk (Oceana). The question before the SSC was whether the combination of the EFH species distribution model (SDM) approach (Component 1) and the Fishing Effects (FE) model (Component 2) represent a reasonable scientific basis for evaluating whether the effects of fishing are more than minimal and not temporary. **The SSC recommends the current EFH methodology and FE estimates as a reasonable basis for the**

determination of fishing impacts, and that no species needs to be elevated for mitigation due to fishing impacts. Based on the information provided, the **SSC finds that the 2022 FE evaluation supports the continued conclusion that the adverse effects of fishing activity on EFH are minimal and temporary in nature.**

The SSC notes that both the current SDM approach to defining EFH and the FE model represent substantial methodological advances since the 2017 EFH review process. EFH designation is now based on multiple habitat-based SDMs, an objective cross-validation approach is used to quantify performance, and a model ensemble has been implemented to generate combined predictions based on model performance. EFH designation has also been expanded to multiple life history stages using updated length-based criteria and the analysis incorporates additional sources of abundance and habitat information to inform EFH for early life stages. The SSC appreciates recent advances by the EFH team to correct an error in the treatment of area-swept effort and the plain-language summaries by stock authors describing the reliability of EFH designations with respect to survey data, and both seasonal and spatial representativeness. The SSC further highlights the utility of transparent and reproducible code for the EFH SDM analysis that is provided in the form of a publicly accessible GitHub repository. Likewise, analysts have made significant progress in improving the FE model during the current 5-year EFH review. Notably, an error transposing susceptibility between two gear types has been corrected, the defined set of gear categories has been expanded along with refinement of bottom contact adjustments based on the literature and public input, and, importantly, the FE analysis now includes data from both observed and unobserved fishing events. The SSC notes that an associated survey of assessment authors indicated no or low concern for 84% of SDM EFH maps and no or low concern for FE model evaluations of 70% of stocks. The SSC appreciates the substantial efforts by EFH Component 1 and Component 2 teams in advancing the EFH analysis in this cycle and incorporation of feedback from stock assessment authors and the SSC throughout the process.

The SSC discussed the apparent mismatch between the multiple life stages for which EFH has been defined and the evaluation of fishing effects for only adult life stages. **The SSC suggests consideration during the next 5-year EFH review cycle of whether subsequent evaluations should consider other life stages for which EFH has been defined**, with explicit consideration of whether SDM-based EFH definitions for other life stages are sufficiently representative for FE evaluation given potential limitations in the data available to inform EFH definitions for earlier life stages.

Responding to author requests, the SSC considered available options for determining EFH and evaluating fishing effects in the next 5-year review in cases where data limit accurate SDM EFH definition for particular species or life stages. The SSC supports EFH and FE evaluation for species complexes or by combining data across species' life history stages as necessary to adequately determine EFH and evaluate fishing effects. The SSC encourages authors to consider whether alternative approaches for identifying core habitat areas might be utilized, incorporating knowledge from stock assessment authors, fishery participants, and other sources of Local Knowledge and Traditional Knowledge. While the SSC recognizes this represents a departure from the current SDM approach, this may be appropriate in specific cases for poorly indexed species or life stages.

While the SSC finds the current EFH evaluation methodology is appropriate for the current 5-year EFH review, it has several recommendations for research during the next review cycle. In prioritizing research during the next review cycle, the SSC encourages further consideration of what products or areas of research are necessary to satisfy EFH regulatory requirements as compared to what would benefit fishery management more generally, and whether a working group of EFH analysts and SSC members should be created to guide future research in this area.

With respect to EFH research in the next 5-year review cycle the SSC has the following recommendations:

- EFH SDM intercalibration of bottom trawl survey data with data from fixed gear surveys including the NMFS Longline Survey and IPHC Setline Survey. While the SSC appreciated the description of the overlap between current EFH definitions and NMFS Longline Survey locations, the SSC notes that with the current discontinuation of the EBS slope bottom trawl survey and reduction in sampling of deeper strata within the GOA bottom trawl survey, information on species' occurrence and abundance in deeper habitats will become more important in the future.
- Exploration of the extent to which fishery-dependent data can help inform future EFH SDM analyses, while highlighting the inherent problem of preferential sampling associated with fishery-dependent information.
- Expansion of EFH definitions to other life stages and seasons where appropriate, based on available data to inform occurrence, abundance, and habitat associations.
- Reporting of species-specific habitat disturbance from the FE model by major gear classes would be beneficial in considering habitat impacts in a strategic manner.

The SSC refers EFH authors to its comments from February 2022 for further recommendations regarding future EFH evaluation.

The SSC encourages continued consideration of long-lived benthic habitat features and the extent to which current definitions of depth distribution and recovery times within the FE model are appropriate, and whether they can be refined in the future given available data. Finally, the SSC notes that while presence-absence and abundance data have been used successfully in the SDM analysis to define EFH, it may be appropriate in the future to consider whether there is additional information that may be used to highlight habitats that are asymmetrically important to population productivity including critical spawning or rearing habitats.