

**Habitat management in North Pacific groundfish fisheries
in relation to
Marine Sustainability Certification Habitat Standards**

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List of Acronyms

AFSC	Alaska Fisheries Science Center
AI	Aleutian Islands
AP	Advisory Panel
BS	Bering Sea
BSAI	Bering Sea/Aleutian Islands
CAB	Conformity Assessment Body
CEA	Core EFH Area
CIA	Catch-In-Areas (database)
CPUE	Catch per unit effort
EcoFOCI	Ecosystems and Fisheries, Oceanography Coordinated Investigations (database)
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
FAO	Food and Agricultural Organization
FCR	MSC Fisheries Certification Requirements and Guidance v. 2.0
FE	Fishing Effects (model)
FMP	Fishery Management Plan
GIS	Geographical Information System
GOA	Gulf of Alaska
HAPC	Habitat Area of Particular Concern
HCA	Habitat Conservation Area
HCZ	Habitat Conservation Zone
HPA	Habitat Protection Area
LEI	Long-term Effects Index (model)
MRAG	Marine Resources Assessment Group
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSC	Marine Stewardship Council
MSST	Minimum Stock Size Threshold
NEFMC	New England Fishery Management Council
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPFMC	North Pacific Fisheries Management Council
PI	Performance Indicator
PISG	Performance Indicator and Scoring Guidepost
SG	Scoring Guidepost
SGB	Substratum-Geomorphology-Biota
SSC	Scientific and Statistical Committee
UoA	Unit of Assessment
VME	Vulnerable Marine Ecosystem
VMS	Vessel Monitoring System

1 Introduction

The Marine Stewardship Council (MSC) conducts a sustainable fishery certification program that grants fisheries a “blue label” certification if they meet an international set of standards established by the MSC. The goal of the program is to promote and reward sustainable fishing practices. The certification is a valuable asset to a fishery as it is a recognized indicator to consumers that the resources harvested by the fishery meet the highest standards of sustainability. A primary component of the MSC sustainability certification is an assessment of the impact a fishery has on marine habitats and the management policies directed at minimizing these impacts. In North Pacific groundfish fisheries, habitat-specific management policies are a component of a complex management framework. The Marine Conservation Alliance contracted with the authors of this paper to describe how information available from analyses conducted for the North Pacific Fishery Management Council’s (NPFMC’s) recent Essential Fish Habitat (EFH) 5-year review could inform how these habitat management policies align with the requirements necessary to attain the MSC sustainability certification under the most recent v2.0 Standards. The purpose of the document is to make this information available for the Marine Conservation Alliance and its members representing MSC certified fisheries to draw upon when they are up for certification. The Scope of Work is attached as Appendix B.

2 North Pacific fisheries management overview

2.1 Management structure

The Magnuson-Stevens Fisheries Conservation and Management Act (MSA) is the primary governing act for fisheries management in the United States’ federal waters (3-200 nm from the coast). Among other provisions, the MSA established eight regional management councils (Councils) to regulate federal fisheries through the use of Fishery Management Plans (FMPs). Commercial fisheries that operate in the Exclusive Economic Zone (EEZ) off the coast of Alaska fall under jurisdiction of the NPFMC. The NPFMC is divided into four distinct management regions – Gulf of Alaska (GOA), Aleutian Islands (AI), Bering Sea (BS), and Arctic (Figure 1). Management of Bering Sea and Aleutian Islands (BSAI) is currently combined within FMPs despite having different characteristics (e.g. habitat, fishing pressure, etc.).

North Pacific fishery resources are managed via six FMPs: (1) *FMP for BSAI King and Tanner Crabs*, (2) *FMP for the Scallop Fishery off Alaska*, (3) *FMP for the Salmon Fisheries in the EEZ off Alaska*,

(4) *FMP for the Fish Resources of the Arctic Management Area*, (5) *FMP for Groundfish of the GOA*, and (6) *FMP for the Groundfish of the BSAI Management Area*. The focus of this document will be habitat management provisions laid out by the two groundfish FMPs (GOA and BSAI), however, many of the management policies overlap with other FMPs as well.

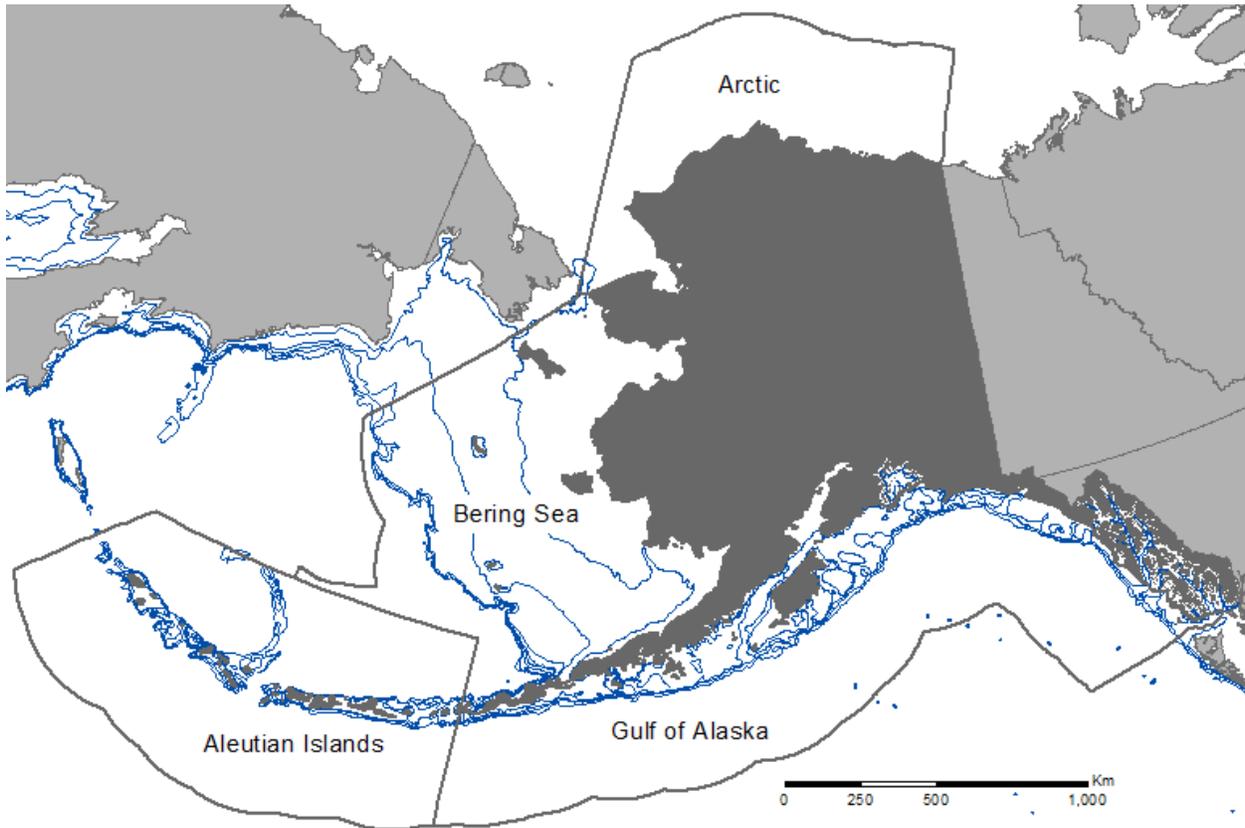


Figure 1. Map of Gulf of Alaska, Aleutian Islands, Bering Sea, and Arctic Management Areas. The blue lines are 50 m depth contours up to 1,000 m.

2.2 Management process

The management process in the North Pacific is complex with many committees, stakeholders, and public involvement in multiple review stages for nearly all aspects of policy development. Expertise on individual stocks is provided by Stock Authors who conduct analyses that become the basis for setting catch limits. The BSAI groundfish, GOA groundfish, scallops, and crabs all have formal Plan Teams comprised of experts in their respective subject from agencies, institutions, or universities in Alaska and Washington (see <https://www.npfmc.org/fishery->

[management-plan-team/goa-bsai-groundfish-plan-team/](#) for more information). Plan Teams provide review, recommendation, and information on relevant economic and ecosystem considerations to the Council based on the information provided by Stock Authors. Issues requiring scientific input are reviewed by the Scientific and Statistical Committee (SSC), and most issues are reviewed by the Advisory Panel (AP) before going to the Council. The SSC is composed of experts in science or economics and ensures the validity and accuracy of analyses used in management actions. The AP is composed of members of the fishing industry and other stakeholders, including environmentalists. The Council provides the final recommendation to the National Marine Fisheries Service (NMFS) on every proposed fisheries management action, with final approval required by the Secretary of Commerce. Stakeholders and members of the public are welcome to submit written comments on any public review draft and provide public testimony during meetings of the SSC, AP, and Council. These comments become part of the official record associated with the management action. In addition to these permanent committees, others may be formed *ad hoc* depending on the issues brought before the Council.

3 Habitat management in the North Pacific

Groundfish management in the North Pacific consists of a myriad of policies with varying objectives. While many of these policies will reduce impacts to habitat without it being an explicit goal of the policy (e.g. closures to protect marine mammals, effort reductions via bycatch controls, etc.), the MSC sustainability certification assessment requires that habitat-specific management policies be in place (see Section 4.2.2 below for more detail). The EFH regulations establish the primary habitat management framework under which the North Pacific groundfish fisheries, and all other federally managed fisheries, operate. EFH provides a habitat objective on which to evaluate specific habitat protection strategies. In the North Pacific groundfish fisheries, these habitat protection strategies generally consist of habitat-specific closures and gear modifications.

3.1 Essential Fish Habitat

In 1996 the Sustainable Fisheries Act (16 U.S.C. § 1801-1884) amended the MSA and established the legal concept of EFH, defining it as “*those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity*” (16 U.S.C. § 1802(10)). Any marine animal or plant, with the exception of mammals and birds, are considered *fish* in the EFH definition (16 U.S.C. § 1802(12)). The management framework surrounding EFH mandates that Councils (1) identify and

describe EFH for all managed species, (2) minimize adverse fishing effects to EFH to the extent practicable, and (3) identify actions that encourage conservation of EFH (16 U.S.C. § 1853(a)(7)). “Adverse fishing effects” are those that reduce the quantity or quality of EFH, and Councils must act to minimize impacts if those impacts are “*more than minimal and not temporary*” (50 C.F.R. § 600.815(a)(2)(ii)). The NPFMC manages over 60 stocks, each with 4-5 life stages resulting in over 300 EFH descriptions (Nimick and Harris 2016). This results in the vast majority of the NPFMC-managed area being designated as EFH, thus affording some protection to almost all federally managed waters and habitat surrounding Alaska.

3.1.1 EFH 5-year review

Councils are required to review EFH at least every five years so that any new scientific information can be incorporated (50 C.F.R. § 600.815(a)(10)). After the Sustainable Fisheries Act passed in 1996, Councils were required to submit their first EFH Amendments for review by 1998. The initial NPFMC EFH Amendment (along with the amendments of four other Councils) resulted in litigation (see *American Oceans Campaign vs. Daley* 2005 for full case), which culminated in a determination that a more thorough assessment of alternatives and associated impacts was warranted under the National Environmental Policy Act (NEPA). Now, all EFH documents must meet NEPA standards (Nimick and Harris 2016).

3.1.1.1 NPFMC 2005 EFH Review

Due to the NEPA requirement, the first extensive NPFMC EFH Review was completed in 2005 in the form of an Environmental Impact Statement (EIS). EISs are in-depth reports on the consequences of proposed actions (in this case, describing and identifying EFH and minimizing adverse fishing effects to EFH). An EIS must include the positive and negative consequences of the proposed action, any adverse environmental impacts that would result, alternatives to the proposal (including no action), commitments of resources, and short-term uses of the environment versus long-term productivity (Kubasek and Silverman 2014).

EFH descriptions for the 2005 review were primarily limited to qualitative statements about the distribution of adult life stages (NPFMC 2017b). EFH for eggs and larvae was described based on presence/absence data. If enough information was available for adult and late juvenile stages, EFH was estimated based on the catch-per-unit effort (CPUE) data from observers and bottom trawl surveys (NPFMC 2005).

In the 2005 EFH Review, NPFMC adopted the Long-term Effects Index (LEI) model (Fujioka 2006) as a tool to assess seascape-scale fishing impacts to habitat throughout the North Pacific (NPFMC 2005). The LEI model produced an estimate of the long-term equilibrium amount of habitat disturbance if fishing effort remained constant over time and space (equilibrium is assumed reached when fishing impacts are balanced by recovery; NPFMC 2005).

For the LEI analysis in the 2005 EFH Review (NPFMC 2005), a basic sediment-based habitat map was constructed, which characterized the BS as a combination of mud and sand, or as “slope” habitat at depths below 200 m. GOA and AI were lacking in sediment data and were characterized as shallow, deep, or slope (NPFMC 2005). For a full description of the LEI model and its applications, see Appendix B of the Final EIS for the 2005 EFH Review (NPFMC 2005).

NPFMC’s assessment of the LEI results concluded that there were no “*more than minimal and not temporary*” fishing effects on EFH. Despite this result, the NPFMC noted that there were uncertainties within the parameter estimates, and as such, took a precautionary approach and expanded existing closures (NPFMC 2005). The LEI analysis was the first instance of any Council taking a quantitative approach to EFH. However, while the LEI model itself provided a quantitative assessment of impacted habitat, there was still no formalized strategy in place to identify areas of possible concern.

3.1.1.2 NPFMC 2010 EFH Review

The NPFMC reviewed EFH in 2010 in the context of any new information that was available. Small EFH designation changes were made to several groundfish species to incorporate new observer and survey data (NPFMC 2012a). No new fishing effects analyses were conducted (i.e. LEI was not rerun, nor any alternative models run) since new scientific information about habitat location, susceptibility, and recovery did not warrant a new model run, and in fact, added support to the parameters used in the 2005 analysis. Fishing effort had also decreased, and gear modifications had been implemented (see Section 3.2.2 below) since 2005, so it was concluded that there were still no fishing effects that were “*more than minimal and not temporary*” (NPFMC 2012a).

3.1.1.3 NPFMC 2015 EFH Review

The 2015 NPFMC EFH Review brought substantial changes to the entire EFH workflow. With an abundance of new scientific information available for nearly every life stage of all managed species, a more quantitatively rigorous approach to define EFH was developed. Previous EFH descriptions were primarily based on general statements about distribution of adult stages, and maps

hand-drawn by fisheries experts. In 2015, with more data available, model-based techniques using environmental covariates were developed to predict habitat suitability (Laman *et al.* 2017). This approach resulted in a geographic information system (GIS) database of EFH polygons representing the top 95% of suitable habitat for each life stage of nearly all managed species. The data used to support these advances were collected from NMFS bottom trawl surveys, the Catch-In-Areas (CIA) database (spatially explicit fishing effort), and the Ecosystems and Fisheries, Oceanography Coordinated Investigations (EcoFOCI) database. High-resolution fishing locations are acquired from a vessel monitoring system (VMS; NPFMC 2012b) and maintained by NMFS in the CIA database. The EcoFOCI database contains results from ichthyoplankton samples including fish egg and larvae CPUE, lengths, and location (<https://catalog.data.gov/dataset/afsc-race-ecofoci-ichthyoplankton-data-collected-in-support-of-foci-assessment-surveys-and-eco/resource/6777c491-bbd9-4956-8bab-a9275902d6d5>).

In addition to updating EFH definitions, there was interest by the NPFMC to update the LEI model. There was concern that dynamics of the LEI model, especially the assumption that fishing would remain constant in space and time, did not adequately address the realities of fishing impacts to habitat. Additionally, impact modeling work by the New England Fishery Management Council (NEFMC) highlighted advances in scientific information about habitat susceptibility and recovery (NEFMC 2011) that the NPFMC sought to incorporate into an updated impacts model. The result was the Fishing Effects (FE) model, which combined the most effective components of LEI with the NEFMC's model. The FE model (described in detail below) was approved for use by NPFMC, which led to a determination of no fishing effects that were “*more than minimal and not temporary*” (NPFMC 2017b).

3.1.1.3.a Fishing Effects model description

The FE model predicts fishing impacts to habitat on 5 km x 5 km grid cells on monthly time intervals throughout the North Pacific. The model output, referred to as “*habitat reduction*” in NPFMC documents, is the percentage of each grid cell that is impacted from fishing activities. The model works by tracking impacts in monthly time steps, while accounting for recovery from past impacts. Impacts are calculated using the fishing locations from the CIA database. The CIA database is a high-resolution GIS database of fishing locations in the North Pacific developed from VMS and maintained by NMFS. Each fishing activity in the CIA database is attributed by general gear type, vessel size, fishing depth, and other attributes that allow each VMS track to be linked to a specific

gear type in a database of North Pacific fishing gears. The key parameters obtained from the gear database are gear-specific nominal width, and contact adjustment. To calculate impacts, the gear-specific VMS tracks are first turned into swaths using the nominal width as a buffer and are overlaid on a habitat map in a GIS. The contact adjustment parameter represents what proportion of the total swath of a fishing event is actually in contact with the seafloor. The contact adjustment is particularly pertinent to the groundfish fleet as some groundfish are fished pelagically (primarily pollock), and flatfish-targeting vessels are required to have modified sweeps that reduce bottom contact (NPFMC 2016; NPFMC 2017c).

The FE model uses six sediment-based categories to define habitat: mud, sand, granule/pebble, cobble, boulder, and deep/rocky. A spatial distribution map of these sediments was developed for the FE model from a database of >230,000 sediment samples or observations throughout the North Pacific. The deep/rocky category is composed of cobble and boulder habitat deeper than 200 m, and was included to account for the habitat of vulnerable structure-forming biota in the North Pacific.

The FE model calculates impacts in each grid cell every month based on the amount of seafloor contact by gear as well as the susceptibility of the habitat to the gear. Susceptibility is a measure of the probability that a habitat feature will be damaged by contact with gear. The habitat is also used to define the rate at which past impacts recover. The habitat specific susceptibility and recovery rates were adopted from a recent meta-analysis of impact and recovery studies (Grabowski *et al.* 2014). The Grabowski *et al.* (2014) work produced susceptibility and recovery rates for habitat features (e.g. corals, epifauna, sand waves, cobble piles) associated with various sediment types (the same as used in the FE model). The susceptibility and recovery rates were presented as ranges, reflecting uncertainty in the estimates. One important distinction between the FE model and the Grabowski *et al.* (2014) study was the inclusion of the deep/rocky habitat category in the FE model. It was included to address habitat that may contain species requiring substantially longer recovery times than those evaluated in the Grabowski *et al.* (2014) work. The deep/rocky habitat category included a 10-50 year recovery rate, whereas the maximum recovery rate for features in other habitat types was 10 years. The distribution of habitat features was not explicitly part of the FE model, but instead, susceptibility and recovery rates were aggregated for each sediment-based habitat type by calculating the mean susceptibility and recovery for all habitat features associated with a given sediment category. For a more detailed discussion of the FE model, see the *Essential Fish Habitat (EFH): 5-year Review for 2017* (NPFMC 2017b).

3.1.1.3.b Fishing Effects model results

Initial Fe model results produced for the NPFMC were aggregate impacts for the North Pacific at large (BSAI and GOA regions combined). Habitat reduction was estimated to be about 1.8% through December 2016, and had never exceeded 3.0% since 2003, the first year of model runs (Figure 2). An overall declining trend in habitat reduction (an improvement to habitat) was estimated since about 2010 and was attributed to the implementation of gear modifications in the groundfish fisheries.

While not presented publicly to the NPFMC, additional sensitivity analyses were run by the FE modeling team to demonstrate the effect of uncertainty in the model parameters (information provided upon request to NMFS, Alaska Fisheries Science Center [AFSC], Habitat Division). These results were made available for this paper. When susceptibility and recovery parameters were allowed to vary within their range, there was little overall effect on the model results. When fixing parameter values at the extreme impact end of their range (high susceptibility; low recovery), overall habitat reduction still remained below 5%. Using an even more extreme and unrealistic scenario where habitat features were assumed to be 100% susceptible to contact with gear and had no recovery, habitat reduction still remained below 15% by December 2016. This scenario essentially assumes the entire footprint of fishing effort since 2003 is currently impacted and has not recovered, and provides an absolute upper bound on habitat impacts from fishing. These analyses were not requested by the NPFMC, but are useful as a measure of model sensitivity.

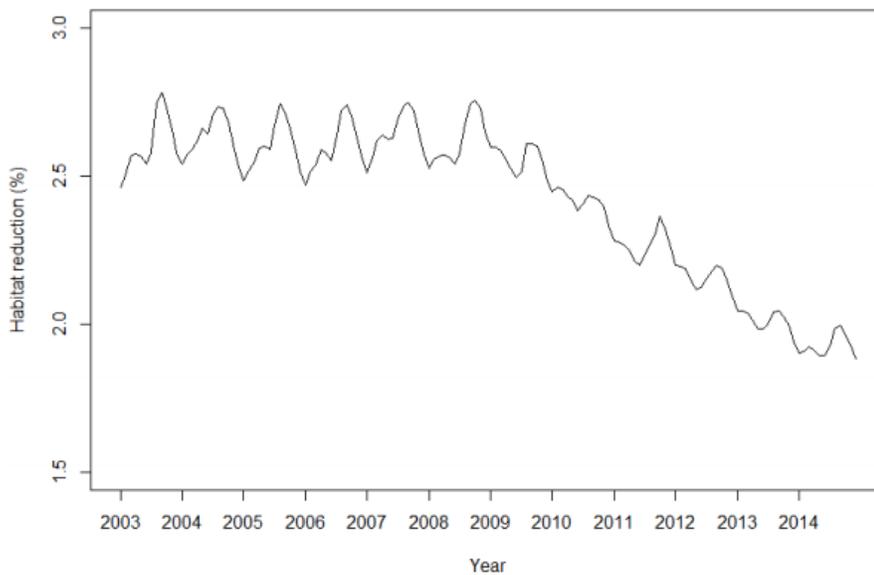


Figure 2. Habitat reduction (% impacted) from all fishing activities in the North Pacific (Aleutian Islands, Bering Sea, and Gulf of Alaska combined). Taken from Figure 2 of *EFH Fishing Effects Proposed Methods for Analysis*.

3.1.1.3.c Fishing Effects model assessment

In parallel to adopting the FE model as a tool for impact assessment, the NPFMC also adopted an assessment workflow to evaluate the results from the FE model and take a precautionary approach to habitat management. Prior to adoption of this workflow, a habitat-related concern would only be identified if a stock fell below its minimum stock size threshold (MSST), or through an *ad hoc* issue. The idea behind creating a formal framework to assess the FE model output was to help identify a potential habitat concern before it had a severe effect on a stock, and to help streamline the EFH review process by drawing focus to those areas first.

The workflow starts with the model-based habitat suitability outputs used as a basis to define EFH polygons. A smaller polygon referred to as the Core EHF Area (CEA), representing a species' more important habitat, was defined using a 50% habitat suitability threshold (compared to 95% for the EFH polygon). The aggregated impacts from the FE model were calculated within each species' CEA. Using these CEA impact assessments, two benchmarks were established (Figure 3). First, does the habitat reduction within the CEA exceed 10%? Second, does the time trend of habitat reduction inside the CEA correlate with life history parameters of that species (e.g. is declining habitat correlated to declining size-at-age)? If both of these conditions are met, it may indicate that habitat

reduction adversely affects a stock, and would then be elevated to Plan Teams for more in-depth analysis and evaluation of possible mitigation measures.

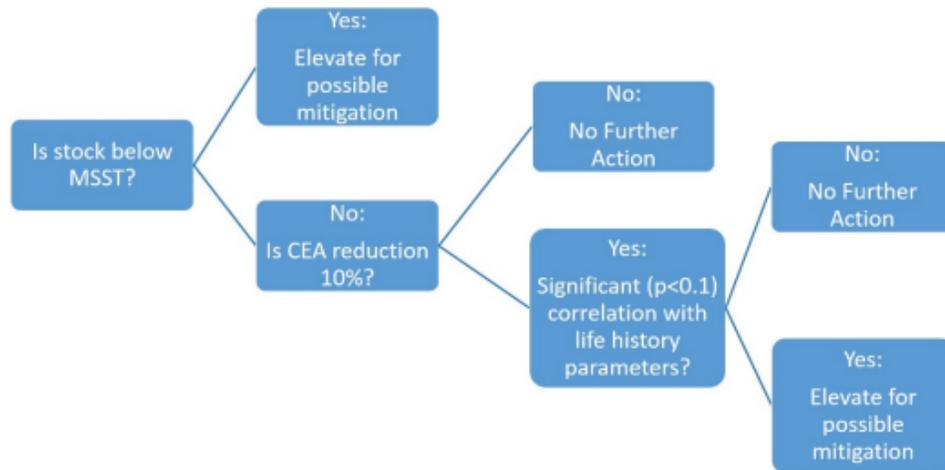


Figure 3. Essential Fish Habitat assessment workflow using Fishing Effects model output. (Adopted from NPFMC 2017b, Figure 4, pg. 75).

3.2 Habitat protections

The EFH workflow developed by the NPFMC provides a set of tools to assess and monitor adverse impacts to habitat. It is not designed, however, to be a proactive, in-season approach to minimize habitat impacts. Instead, spatial closures and gear modifications are the primary habitat management tools used by NPFMC to avoid impacts to EFH and other sensitive habitats.

3.2.1 Spatial closures

As a strategy to protect EFH, certain areas have been designated as EFH Conservation Areas with fishing restrictions to conserve habitat. There are currently three EFH Conservation Areas in Alaska: GOA Slope Habitat Conservation Areas (HCAs), AI HCA, and AI Coral Habitat Protection Areas (HPAs). The GOA Slope HCAs consist of ten areas totaling 2,100 nm² (Table 1; Figure 4) closed to non-pelagic trawling (NPFMC 2016). The purpose is to protect habitat for rockfish and other species, and protect coral (71 FR 6031). The AI HCA was created as a balance between preserving existing fishing grounds and protecting sensitive habitats. The closure was established in 2006 and essentially “froze the footprint” of commercial fishing in the AI. The entire AI is closed to non-pelagic trawling except the areas that supported the highest commercial catch in

the past, totaling 279,114 nm² of protected habitat, equaling about 95% of the AI management region (Table 1; Figure 4; 71 FR 6031). The AI Coral HPAs include six areas totaling 110 nm² (Table 1; Figure 4) that are closed to anchoring of fishing vessels and all bottom contact fishing gear (non-pelagic trawl, hook-and-line, pot, dredge, and dinglebar gears; NPFMC 2017b). Based on NMFS habitat research, NPFMC determined that these areas contained particularly sensitive organisms and needed stronger protections in place (71 FR 6031).

An additional type of spatial closures in the North Pacific are Habitat Areas of Particular Concern (HAPC). These are areas already designated as EFH that follow a formalized protocol to gain HAPC status. To designate a HAPC, NPFMC must consider the following qualities of the habitat area from 50 C.F.R. § 600.815(a)(8):

- (i) The importance of the ecological function provided by the habitat.*
- (ii) The extent to which the habitat is sensitive to human-induced environmental degradation.*
- (iii) Whether, and to what extent, development activities are, or will be, stressing the habitat type.*
- (iv) The rarity of the habitat type.*

NPFMC's HAPC Process Document (2010) outlines the HAPC designation process. NPFMC identifies priorities and calls for HAPC proposals, which can be submitted by anyone. In order to become a HAPC, a habitat area must be rare (quality *iv* of above) and have at least one of the other qualities. NPFMC staff first reviews HAPC proposals to ensure they align with NPFMC management priorities. The staff then presents the screened proposals to NPFMC, who decides which proposals to forward on for additional consideration. Those proposals go to the Plan Teams for review of ecological merit. A scientific and economic review is then conducted by the SSC. Enforcement feasibility is also considered. The remaining HAPC proposals are scored on each of the four qualities. The higher the score, the more appropriate the HAPC designation is considered to be. The level of information available for the proposed HAPC is also scored. The lower the score, the more likely the area is to be flagged as a possible research priority. The HAPC process is typically aligned with the EFH 5-year reviews, however, NPFMC did not initiate a HAPC proposal process in the most recent 2015 review cycle stating that there was no specific need, and if one arises, the proposal process can be initiated at any time (NPFMC 2017b).

There are currently 4 broad HAPCs in North Pacific waters, all consisting of multiple individual areas (https://alaskafisheries.noaa.gov/sites/default/files/hapc_ak.pdf): Alaska Seamount

HPAs, GOA Coral HPAs, Bowers Ridge Habitat Conservation Zone (HCZ), and Areas of Skate Egg Concentration. The AK Seamount HPAs consist of 16 seamounts in GOA and BSAI totaling 5,329 nm² (Table 1; Figure 4). All bottom contact fishing gear and anchoring of fishing vessels is prohibited in the Seamount HPAs (NPFMC 2016; NPFMC 2017c). GOA Coral HPAs consist of 5 areas totaling 13.5 nm² (Table 1; Figure 4) that are closed to all bottom contact fishing and fishing vessel anchorage (NPFMC 2016). Surveys of these areas showed dense coverage of a sensitive coral species that were determined to need more protection (71 FR 6031). Mobile bottom contact fishing gear (non-pelagic trawls, dredge, dinglebar gears) are prohibited in Bowers Ridge HCZ (NPFMC 2017c) as a precautionary measure before more research on this area can be done (71 FR 6031). The Areas of Skate Egg Concentration are six areas totaling 82 nm² and are a monitoring priority (80 FR 1378). NPFMC determined that these areas of egg concentration are not currently under distress from fishing or non-fishing activities and, therefore, were only designated as a monitoring priority so that they be given additional consideration for potential future proposed activities such as drilling or increased fishing (80 FR 1378).

In addition to the EFH Conservation Area and HAPC designated spatial closures, other gear-restricted closures exist in the North Pacific. The purpose of many of them is habitat protection, and are primarily closed to non-pelagic trawling. Other areas with restricted fishing are not closed specifically to protect habitat, but meet that goal as a side effect of its intended purpose. Table 1 summarizes all year-round area closures that protect benthic habitat from groundfish fishing (Figure 4).

3.2.2 Gear modifications

A complementary strategy to spatial closures as a tool for habitat management has been the implementation of required gear modifications. The NPFMC has encouraged research on different ways to decrease effects of fishing on habitat with a primary focus on reduction of seafloor contact by fishing gear. Cooperative research between the groundfish bottom trawl fleet and AFSC scientists resulted in the development of modified sweeps on bottom trawls. On conventional bottom trawls the sweeps account for the majority of seabed contact (Rose *et al.* 2010a). The research showed that using lifting elements on the sweeps raised them 2-4 inches above the seabed. Bottom contact and effects on epifauna (e.g. sea whips, basket stars) on sand and mud substrates were significantly reduced, while capture efficiency did not change (Rose *et al.* 2010b). As precautionary management, these modifications became a requirement for BSAI flatfish fisheries in 2011 and for Central GOA

flatfish fisheries in 2014. Non-pelagic trawl fisheries collectively accounted for a large proportion of the fishing impacts prior to the sweep modification implementation. Since their implementation, bottom contact has been expected to have decreased by 25%-80% (NPFMC 2017a). Scaling this effect to the North Pacific at large, the FE model demonstrated that raising the sweeps of non-pelagic trawls slightly off-bottom may have reduced total impacts throughout the North Pacific by 35% (information provided upon request to Habitat Division, AFSC).

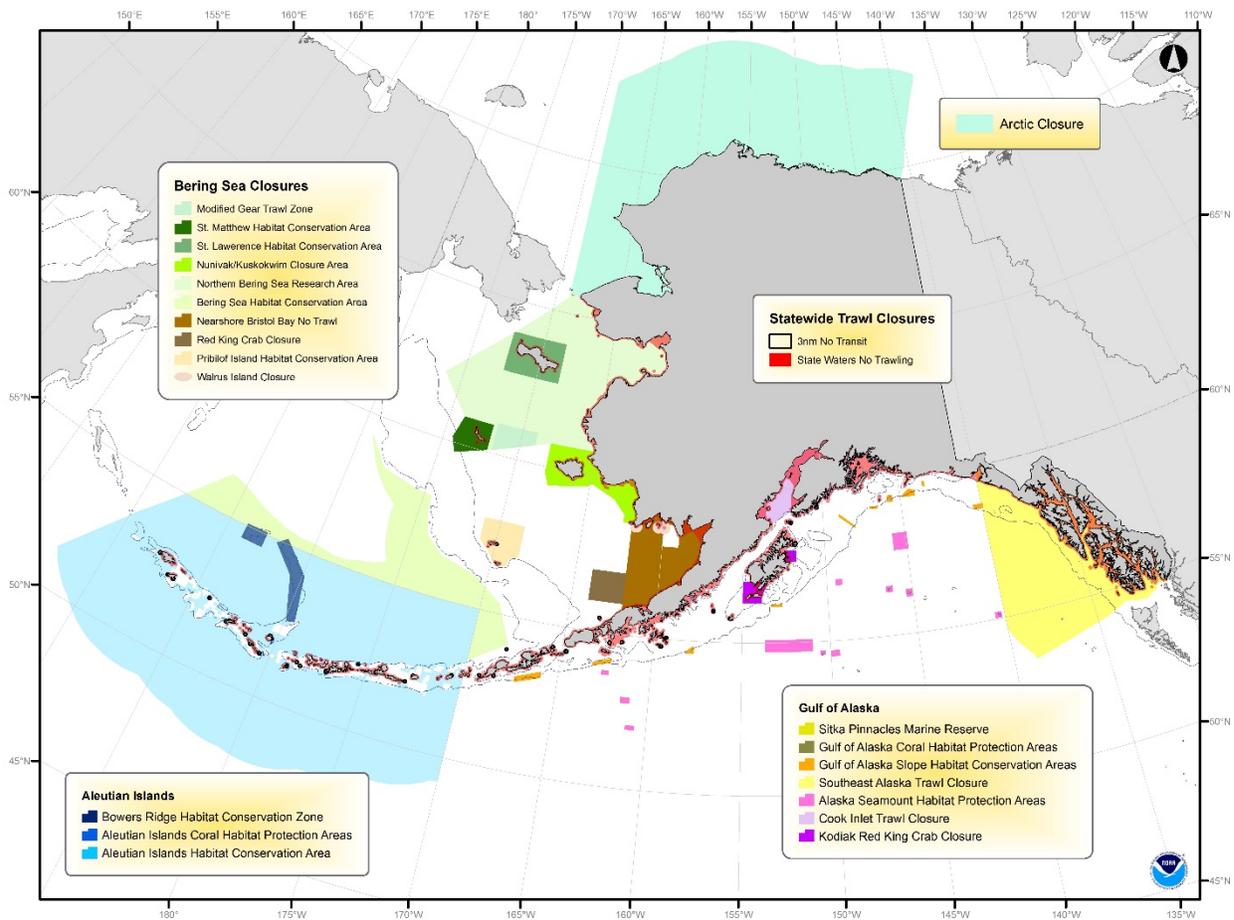


Figure 4. Map of year-round groundfish closures from *Ecosystem Considerations 2016 Status of the Eastern Bering Sea Marine Ecosystem* pg. 172 (NMFS 2016b).

Table 1. Summary of year-round bottom trawl area closures adapted from Table 10 pg. 173 in *EBS Ecosystem Considerations* (2016) and ebfm.marineconservationalliance.org. AI = Aleutian Islands; BS = Bering Sea; BSAI = Bering Sea/Aleutian Islands; GOA = Gulf of Alaska; HCZ = Habitat Conservation Zone; HCA = Habitat Conservation Area; HPA = Habitat Protection Area. HAPC = Habitat Area of Particular Concern; EFH = EFH Conservation Area; SSL = Steller sea lion.

Management Area	Closure	Restrictions	Purpose	Classification	Area (nm ²)
AI	Bowers Ridge HCZ	No mobile bottom contact fishing gear	Habitat	HAPC	5,286
	Aleutian Islands HCA	No bottom trawling	Habitat	EFH	279,114
	Aleutian Islands Coral HPA	No bottom contact fishing gear	Habitat	EFH	110
BS	Pribilof Islands HCA	No trawling	Habitat		7,000
	Bering Sea HCA	No bottom trawling	Habitat		47,100
	St. Matthews Island HCA	No bottom trawling	Habitat		4,000
	St. Lawrence Island HCA	No bottom trawling	Habitat		7,000
	Nunivak Island, Etolin Strait, and Kuskokwim Bay HCA	No bottom trawling	Habitat		9,700
	Northern Bering Sea Research Area	No bottom trawling unless with exempted fishing permit	Research		66,000
	Red King Crab Savings Area	No bottom trawling	Crab protection		4,000
	Nearshore Bristol Bay Trawl Closure	No trawling			19,000
	Walrus Islands Groundfish Closure	No fishing	Walrus protection		2,775
BSAI/GOA	Alaska Seamount HPA	No bottom contact fishing gear	Habitat	HAPC	5,329
	SSL Critical Habitat	No fishing	SSL protection		259,740
GOA	GOA Coral HPA	No bottom trawling	Habitat	HAPC	13.5
	GOA Slope HCA	No bottom trawling	Habitat	EFH	2,100
	Kodiak King and Tanner Crab Closures Type I	No bottom trawling	Crab protection		1000
	Cook Inlet non-Pelagic Trawl Closure	No bottom trawling	Crab protection		
	Southeast Outside Trawl Closure	No trawling			52,600
	Sitka Pinnacles Marine Reserve	No commercial fishing			3.1
Arctic	Arctic Closure Area	No commercial fishing	Habitat and research		148,393

4 MSC sustainability standards

4.1 Standards overview

The *MSC Fisheries Certification Requirements and Guidance* (FCR; version 2.0, October 2014) establishes Fisheries Standards (hereafter referred to as the Standards) that are designed to provide a consistent set of requirements that third-party conformity assessment bodies (CABs) can use to assess the sustainability of a fishery. In addition to establishing the Standards, the FCR provides written guidance to the MSC Fisheries Certification Requirements, which provide detail and clarification to assist CABs in their evaluations of the Fisheries Standards. The current MSC FCR (v2.0) has been in effect since April 1, 2015.

The MSC Fisheries Standards are comprised of three Core Principles: 1) Sustainable target fish stock, 2) Environmental impact of fishing, and 3) Effective management. Within each principle is a set of components, each with a hierarchical structure of performance indicators and scoring guideposts (PISGs) that a CAB uses for assessment. The remainder of this document focuses on the Habitat component of Principle 2.

4.2 MSC Principle 2 habitat component

The focus of Principle 2 of the MSC Standards is the *environmental impact of fishing*, with an overall stated goal of:

Fishing operations should allow for the maintenance of the structure, productivity, function, and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends (MSC 2014 pg. 6).

Scoring of Principle 2 is organized into five components: 1) primary species, 2) secondary species, 3) endangered, threatened, or protected species, 4) habitat, and 5) ecosystem. Each of these components contain three performance indicators (PIs): Outcome, Management, and Information. Each PI is comprised of several scoring issues, each with their own scoring guideposts (SGs). The Standards define requirements to reach a SG of 60, 80, and 100 for each of the PIs. An SG100 is the best score for a PI; inability to meet SG60 for any PI would be an automatic failure to meet the MSC Standards. The remainder of this document focuses on the Principle 2 Habitat component, organized by PI and scoring issue. For each PI, the SG requirements will be described first, with key

defining terms given in bold. Discussion will follow of how habitat management strategies of the North Pacific groundfish fisheries relate to these definitions. The alphanumeric index given in parentheses next to each PI heading is in reference to indexing hierarchy used by the MSC Standards.

4.2.1 Habitat PI 1: Outcomes

PI 2.4.1 The Unit of Assessment (UoA; the entity that is assessed for certification) does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates (MSC 2014 Table SA19, pg. 52).

Scoring issues:

- a. Commonly encountered habitat status
- b. Vulnerable marine ecosystem (VME) habitat status
- c. Minor habitat status

4.2.1.1 Commonly encountered habitats (PI 2.4.1.a)

The SGs for *commonly encountered habitats* are dependent on whether the UoA is **unlikely** (SG60), **highly unlikely** (SG80), or there is **evidence** that the UoA is highly unlikely (SG100) to “reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.” The Standards define *serious or irreversible harm* as,

...changes caused by the UoA that fundamentally alter the capacity of the habitat or ecosystem to maintain its structure and function.

For the habitat component, this is the reduction in habitat structure, biological diversity, abundance, and function such that the habitat would be unable to recover to at least 80% of its unimpacted structure, biological diversity, and function within 5-20 years, if fishing were to cease entirely (MSC 2014 Table SA8, pg. 32).

To meet the threshold of **evidence** (SG100), there must be greater than an 80% probability that the fishery does not cause *serious or irreversible harm* to the habitat.

The FE model, as used for the EFH assessment, may be a suitable approach to scoring PI 2.4.1.a. The output from the FE model is the proportion of habitat reduction where 0% represents habitat in an unimpacted state and 100% represents complete removal of habitat features and

functional habitat. The Grabowski *et al.* (2014) meta-analysis on which the susceptibility and recovery parameters were drawn, aimed to evaluate how the functional value of the habitat would respond to fishing. While impacts and recovery of structure, biological diversity, and abundance were not an explicit component of these parameters, it is reasonable to assert that habitat functionality would require intact (or recovered) structure, diversity, and abundance.

Calculation of habitat reduction for an entire fishery requires a defined area over which to aggregate FE model output. The FCR states that the 80% threshold is based on the managed area of the UoA (MSC 2014 GSA3.13.5, pg. 219), thus the spatial domain to calculate habitat reduction for the groundfish fishery would be the BSAI and GOA management units described in the FMPs (Figure 1). This aligns with the spatial domain of the FE model as used by the NPFMC, with the caveat that results from the FE model were restricted to depths less than 1000 m, reflecting the maximum practical depth of fishing activities in the North Pacific. As discussed above in Section 3.1.1.3.a, habitat reduction for North Pacific as a whole is estimated at about 1.8%, which is substantially lower than the 20% habitat reduction threshold used to define *serious or irreversible harm*. Additional sensitivity analyses suggest that there is very low probability that as a whole, more than 20% of the habitat in the North Pacific is impacted by fishing, given that under a complete impact, no recovery scenario, habitat was not reduced by more than 15%.

Complete scoring of PI 2.4.1.a, requires assessing impacts to *commonly encountered habitats* of the groundfish fishery. As discussed before, the FE model operates using six sediment-based habitat categories. This approach is less descriptive than the substratum-geomorphology-biota (SGB) habitat characterization required by the Standards (MSC 2014 GSA3.13.2, pg. 212 and Table GSA6 pg. 214). While the FE model includes the substratum component of the SGB classification scheme, the spatial distribution of geomorphology and biota were not explicitly included in the current implementation of the FE model. However, much is known about the geomorphology and biotic distribution in the North Pacific such that conclusions may be drawn about impacts to SGB habitat categories.

Groundfish fishing occurs primarily on mud and sand sediment on the BS continental shelf, which has flat geomorphology. Sea pens (*Alcyoniina* spp., a soft coral) are prevalent throughout the Eastern BS shelf (Stone and Rooper 2017), though not necessarily abundant. Generally, the dominant biota are small erect/encrusting/burrowing fauna. More vulnerable hard corals in the BS are found beyond the shelf break at depths >200 m, but at relatively low densities compared to elsewhere in the North Pacific. Hard corals are particularly rare in the Eastern BS due to the relative

lack of hard substrate (large substratum in SGB classification). The deep/rocky sediment category was included in the most recent FE model runs to account for the habitat requirements of long-lived large erect biota, a characteristic of *potential VMEs*. The GOA contains more low to high relief topography compared to the flat BS shelf, and has more ubiquitous presence of large erect biota (Stone and Rooper 2017). The AI are much steeper with more high relief geomorphology compared to the BS or GOA. However, when fishing non-pelagically, groundfish gear is difficult to use on slopes and susceptible to damage from hard substrate. Thus, even when fishing in the AI and GOA, which tend to be steeper and rockier, fishing is limited to localized areas of low relief fine substratum. Large erect biota is ubiquitous throughout the AI (Stone and Rooper 2017).

Splitting the FE model output by these habitat designations provides a better measure of habitat reduction by SGB classification (Table 2). *Commonly encountered habitats* will generally be the fine substratum habitats with estimated habitat reduction up to 2.3% in the fine substratum/flat geomorphology/small biota habitat of the BS, and <1% habitat reduction in the fine substratum/low geomorphology/large biota habitats of the AI and GOA. FE model scenarios that include no recovery, and represent the most extreme and unlikely degree of impact, is <8% for the fine substratum/low geomorphology/large biota habitat and up to 20% for the fine substratum/flat geomorphology/small biota habitat in the BS. Of note is that the *serious or irreversible harm* determination of *commonly encountered habitats* considers what the habitat reduction would be with 5-20 years of recovery and no fishing. Given that the recovery in these habitats is generally less than five years (Grabowski *et al.* 2014), these *commonly encountered habitats* would likely be completely recovered within this time frame.

Table 2. Cross reference of Fishing Effects (FE) model sediment-based habitat categories by region with SGB habitat classifications. Note that the “No recovery” scenario is used as a sensitivity analysis of the model and was not a requested habitat analysis by the North Pacific Fisheries Management Council. SGB = substratum-geomorpholgy-biota; BS = Bering Sea; AI = Aleutian Islands; GOA = Gulf of Alaska; VME = vulnerable marine ecosystem.

FE habitat category	Region	SGB habitat classification			Standards status	Hab. reduction	No recovery scenario
		Substratum	Geomorph.	Biota			
Mud	BS	Fine	Flat	Small	<i>commonly encountered</i>	2.2%	20.0%
	AI	Fine	Low relief	Large	<i>commonly encountered</i>	<0.1%	0.6%
	GOA	Fine	Low relief	Large	<i>commonly encountered</i>	0.5%	4.3%
Sand	BS	Fine	Flat	Small	<i>commonly encountered</i>	2.3%	18.4%
	AI	Fine	Low relief	Large	<i>commonly encountered</i>	0.9%	4.8%
	GOA	Fine	Low relief	Large	<i>commonly encountered</i>	0.9%	7.7%
Granule/pebble	BS	Medium	Flat	Large	<i>minor</i>	2.3%	9.3%
	AI	Medium	High relief	Large	<i>minor</i>	1.0%	5.0%
	GOA	Medium	High relief	Large	<i>minor</i>	0.7%	4.7%
Cobble	BS	Large	Flat	Large	<i>minor</i>	<0.1%	0.3%
	AI	Large	High relief	Large	<i>potential VME</i>	1.6%	9.9%
	GOA	Large	High relief	Large	<i>minor</i>	0.2%	1.8%
Boulder	BS	Large	Flat	Large	<i>minor</i>	0%	0%
	AI	Large	High relief	Large	<i>potential VME</i>	<0.1%	0.1%
	GOA	Large	High relief	Large	<i>minor</i>	0.5%	3.6%
Deep/rocky	BS	Large	High relief	Large	<i>potential VME</i>	0.9%	2.9%
	AI						
	GOA						

4.2.1.2 VME habitat status (PI 2.4.1.b)

For *VME habitat status*, the scoring is the same for *commonly encountered habitats*, with the exception that the interpretation of *serious or irreversible harm* is stricter such that reductions in habitat structure and function cannot fall below 80% of the unimpacted level. This means that recovery cannot be accounted for when considering *serious or irreversible harm* to a VME. Guidelines on this scoring issue state that habitat that requires substantially more than 20 years, or do not recover, should be categorized as a VME. However, habitats that do not require more than 20 years to recover, but still fall under the VME designation must still be scored by the stricter VME definition of serious or reversible harm (MSC 2014 GSA 3.13.4.1 pg. 219). In practice, the MSC reportedly directs its CABs to consider impacts to VMEs compared to a baseline of the state of the habitat in 2006. This is when international guidelines for management of deep sea fisheries were ratified by the United Nations General Assembly. The FE model values consider habitat impacts against the baseline of a pristine environment, thus, the impact estimates presented throughout this section should be considered a conservative assessment compared to the MSC requirements.

The MSC Standards identify VMEs in the same way that the Food and Agriculture Organization (FAO) does. A VME will possess one or more of the following traits: rare or unique, functionally significant habitat, fragile, comprised of species that do not recover easily, or are structurally complex (MSC 2014 GSA 3.13.3.2, pg. 215). The FAO also identifies the following organisms as indicator species of *potential VMEs*: “*certain coldwater corals and hydroids, some types of sponge-dominated communities, and communities composed of dense emergent fauna*” that are structurally important to the habitat (MSC 2014 GSA 3.13.3.2, pg. 215).

Marine Resources Assessment Group (MRAG) Americas, an accredited CAB, provided the following guidance from the MSC pertaining to VMEs: “*within the outcome PI, only accepted, defined, or identified VMEs should be considered*” (Appendix A of this document). There are no identified VMEs in Alaskan waters (<http://www.fao.org/in-action/vulnerable-marine-ecosystems/vme-database/en/vme.html>). Given that VME habitat status is considered under no recovery, it is appropriate to apply the no recovery scenario of the FE model while evaluating the fishing impacts to *potential VMEs*. Even under this scenario, there has not been a habitat type that has fallen below 80% unimpacted habitat since 2003 (Table 2). The NPFMC does, however, identify HAPCs that are comparable to the intention of identifying VMEs, and closes these to non-pelagic trawling (with the exception of the Areas of Skate Egg Concentration; see Section 3.2.1). There are also coldwater corals, sponges, and tall emergent epifauna (sea whips) in Alaskan waters that may meet the FAO’s

qualifications as *potential VME* indicators. Using these indicators, habitats that may be considered *potential VMEs* are deep/rocky habitats (from the FE habitat categories) and large substratum habitats of AI, which all have less than 10% habitat reduction under the no recovery scenario (Table 2). Video surveys corroborate these estimates from the FE model. Surveys conducted in the Eastern BS slope and canyon regions, where *potential VME* habitat may occur (deep/rocky habitats), found direct evidence of fishing at 12.8% survey locations. However, only 2.9% of corals, 0.3% of sponges, and 9% of sea whips in the study had observed damage, though damage from fishing or natural causes was indiscernible (Rooper *et al.* 2016).

Not including the Arctic Management Area, a total of 5,442 nm² of habitat has been closed to all bottom contact fishing gear, and an additional 503,914 nm² has been closed to non-pelagic trawling (note that some of these closures overlap, which is not accounted for in the stated area). Most of these are closed to protect habitat that is considered sensitive and in need of stronger protection measures (i.e. corals and sponges). Corals are widely distributed throughout Alaskan waters (Stone and Shotwell 2007) and are most commonly found in rocky habitat (Stone and Rooper 2017). The areas that support the richest communities of corals (deep, steep, and rocky) are typically those in which bottom trawling for groundfish does not occur due to the risk of damaged or lost gear (Stone and Shotwell 2007). Sponges occur on similar substratum as corals. Sponges have also been identified as the most common emergent epifauna in the AI (Stone 2006). The prevalence of coral and sponges in the AI has resulted in over 95% of the area being closed to bottom trawling (AI HCA closures), thus eliminating most fishing impacts. Sea whips and true soft corals are prevalent in the soft sediments of the BS shelf and have been characterized as being medium and high abundance, respectively (Stone and Shotwell 2007).

4.2.1.3 Minor habitat status (PI 2.4.1.c)

The SGs for *minor habitats* follow the same standards as *commonly encountered habitats*. It is dependent on whether the UoA is **unlikely** (SG60), **highly unlikely** (SG80), or there is **evidence** that the UoA is highly unlikely (SG100) to “reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.”

The *minor habitats* encountered by the groundfish fishery are granule/pebble, cobble, or boulder habitats, as the groundfish fleet generally fishes on fine substratum to reduce damage to gear. These sediment-based habitat categories will correspond to medium or large substratum, and flat to high relief geomorphology depending on the region (Table 2). In all cases of *minor habitats*, the

FE model estimated impacts to be less than 3%, well below the 20% threshold of *serious or irreversible harm*.

4.2.2 Habitat PI 2: Management

PI 2.4.2 There must be a strategy in place designed to ensure the fishery does not pose a risk of serious or irreversible harm to the habitats (MSC 2014 Table SA20 pg. 54).

Scoring issues:

- a. Management strategy in place
- b. Management strategy evaluation
- c. Management strategy implementation
- d. Compliance with management requirements

4.2.2.1 Management strategy in place (PI 2.4.2.a)

The SGs from lowest to highest for the *management strategy in place* scoring issue are that there are management **measures** (SG60), **partial strategy** (SG80), or **strategy** (SG100). Generally, the scoring depends on the degree to which there is a “cohesive and strategic arrangement” of actions that specifically target habitat impacts as a direct objective of the management framework. Examples are provided in the *Guidelines* for each of the scoring levels (MSC 2014 Table GSA8, pg. 224). An example of a **measure** is a closure implemented to protect juveniles that indirectly protects habitat as well, but habitat protections are not its primary objective. An example of a **strategy** relevant to the groundfish fisheries is provided:

Demersal trawl UoA in inshore and offshore areas – Overarching management framework takes an ecosystem-based fisheries management approach involving impact assessments for management plans (including impacts on habitats), spatial controls like closures to protect essential fish habitat, effort reduction rules, and buyout/lease-back arrangements incentivizing the use of less bottom-contacting gear to catch fish quotas (MSC 2014 Table GSA8, pg. 227).

The groundfish fisheries in the North Pacific fall under the BSAI and GOA FMPs both of which state “*reduce and avoid impacts to habitat*” as a primary objective (NPFMC 2016 pg. 6; NPFMC 2017c pg. 6). Habitat-specific management strategies implemented to meet this objective are the

EFH framework, and the spatial closure and gear modification habitat protections, details of which are discussed in Section 3. Following the FCR example of a **strategy**, the groundfish fishery has an “*ecosystem-based fisheries management approach involving impact assessments*” (EFH), “*spatial controls to protect essential fish habitat*” (habitat closures), and “*incentivize[s] the use of less bottom-contacting gear to catch fish quotas*” (gear modifications). In addition to these habitat-specific strategies, North Pacific habitats benefit from management **measures** put in place for other purposes (see Table 1 for examples of areas closed to non-pelagic trawling for purposes other than habitat conservation).

4.2.2.2 Management strategy evaluation (PI 2.4.2.b)

The scoring guidelines for PI 2.4.2.b are based on whether management measures are **considered likely** to work (SG60), or, assuming there is a partial strategy/strategy in place, whether there is an **objective basis for confidence** (SG80), or **testing supports high confidence** (SG100) that the partial strategy/strategy will work based on information directly about the UoA and/or habitats. The FCR provides context on how to distinguish between terms. Generally, SG60 involves expert knowledge from diverse sources, including “*studies of similar species or ecosystems in other places*”; SG80 requires that some information be collected on habitat impacts, but not systematically; and SG100 requires that systematic monitoring and/or research be conducted.

A National Standard set forth by the MSA is that Councils use the best scientific information available (16 U.S.C. § 1851(301)(a)(2)). The species-specific EFH polygons used several data sources to create model-based habitat distributions using environmental covariates. The FE model assesses impacts to these EFHs using high-resolution VMS data to determine the location of fishing activities. The susceptibility and recovery parameters used in the model are adopted, in part, from “*studies of similar species or ecosystems in other places*,” however robust sensitivity analyses test the sensitivity of the results to these parameters, with indication that even when considering extreme parameter scenarios, the habitat impacts from fishing are still relatively low.

The confidence that HAPCs and other habitat closures meet their objective will depend on whether all areas of vulnerable habitat are properly identified and managed as a closure, and whether there is compliance by the fleet to avoid these areas. Identification of a HAPC is a multi-step process (see Section 3.2.1 for more information) with many review opportunities. With the high degree of public involvement in the NPFMC, especially from non-governmental organizations, it is likely that a proposal would be put forth as a habitat need is identified. Compliance with these closures is high given the high level of VMS coverage, and high percentage of onboard observers

(see Section 4.2.2.4 below for discussion of compliance). The ability to enforce HAPC or other closures is a consideration during evaluation of the proposal.

Confidence in the efficacy of the gear modifications requirements follows from preliminary studies conducted prior to implementation (e.g. Rose 2005, NMFS 2009). These studies found that modifications to non-pelagic trawl gears can lead to a significant decrease in impacts to large erect biota while maintaining target catch rates. These studies were necessary during initial evaluation of whether gear modifications would be an effective management strategy to minimize impacts to habitat.

4.2.2.3 Management strategy implementation (PI 2.4.2.c)

The scoring guidelines for PI 2.4.2.c require there to be **some quantitative evidence** (SG80) or **clear quantitative evidence** (SG100) that the partial strategy/strategy is implemented successfully.

Implementation of NPFMC habitat management strategies is inextricably linked to the quantitative assessment produced by the FE model and associated workflow. Through the EFH process, the NPFMC follows its own specified criteria to identify “*more than minimal, and not temporary*” impacts using the FE model as a basis on which to make the determinations (Figure 3). This process is conducted using analyses and through meetings open to the public.

4.2.2.4 Compliance with management requirements (PI 2.4.2.d)

The scoring guidelines for PI 2.4.2.d depend on whether there is **qualitative** (SG60), **some quantitative** (SG80), or **clear quantitative** (SG100) evidence that the UoA and associated activities comply with both its management requirements and with protection measures afforded. The FCR state that **clear quantitative evidence**, “*should include verified electronic data and some other method of external verification*” (MSC 2014 GSA 3.14.4 pg. 229).

Compliance by the groundfish fleet is accomplished through both VMS tracking and onboard observers. VMS devices are required on vessels that have a permit for directed fishing for pollock, Pacific cod, or Atka mackerel (50 C.F.R. § 679.7(a)(18)), vessels that fish for sablefish in the BSAI (50 C.F.R. § 679.42(k)(2)), that participate in the GOA Rockfish Program (50 C.F.R. § 679.7(n)(3)), that operate in the AI (50 C.F.R. § 679.28(f)(6)), that has bottom trawl or dredge gear onboard in the GOA (50 C.F.R. § 679.28(f)(6)), or that participates in the Crab Rationalization Program (50 C.F.R. § 680.23(d)). This results in a high level of VMS coverage in the groundfish fleet, particularly vessels with non-pelagic trawls, which is the type of gear that most of the habitat

area closures affect. Onboard observer coverage is dependent on the fishery and vessel size. Catcher/processors and Motherships, which produce the bulk of the harvest, are generally required to have two observers at all times. Some catcher vessels are also required to have full coverage if they participate in transferable prohibited species catch, and others are randomly selected for coverage each year. Longline catcher/processors targeting groundfish may only carry one observer. Overall, 98% of the retained groundfish catch was on observed hauls in BSAI and 36% in GOA in 2016 (AFSC-ARO 2017).

4.2.3 Habitat PI 3: Information

PI 2.4.3 Information must be adequate to determine the risk posed to the habitat by the fishery and the effectiveness of the strategy to manage impacts on the habitat (MSC 2014 Table SA21 pg. 55).

Scoring issues:

- a. Information quality
- b. Information adequacy for assessment of impacts
- c. Monitoring

4.2.3.1 Information quality (PI 2.4.3.a)

The types and distribution of main habitats must be **broadly understood** (SG60), the nature, distribution, and **vulnerability** of the main habitats must be known to a level appropriate with the scale and intensity of the UoA (SG80), or the distribution of all habitats must be known over their range with particular attention to vulnerable habitats (SG100).

Sediment data and depth are mapped for the North Pacific and are the basis for EFH habitat information and the FE model. The 2005 and 2010 EFH Reviews used sediment maps based on ~2,000 survey observations throughout the North Pacific. The 2015 EFH Review increased this resolution substantially by compiling over 230,000 sediment observations to develop habitat distribution maps. The observations are denser near shore and average ~10.5 km between points in the Eastern BS (NPFMC 2017b). Few samples were taken deeper than 500 m or in rocky habitats. To map over for the whole EEZ for use in the FE model, an indicator Kriging approach (Geostatistical Wizard, ArcMap v10.2) was used (see the 2015 EFH Review for a more detailed description; NPFMC 2017b).

Distribution of biota is relatively well understood from annual surveys. AFSC has conducted annual bottom trawl surveys since 1979 with a primary aim to collect size, age, and relative abundance (CPUE) information on groundfish and crab species, but invertebrates are also documented. Additionally, physical information such as sea temperature and sediment are recorded. Vulnerable organisms such as corals, sponges, and sea whips, have been mapped in the AI, GOA, and Eastern BS (Rooper *et al.* 2014; Rooper *et al.* 2016; Stone and Rooper 2017) using species distribution models based on bottom trawl survey data. Camera surveys found that the distribution models based on bottom trawl survey data were accurate, especially for corals (Rooper *et al.* 2016).

When assessing habitat **vulnerability**, the NPFMC used the best available science to date from the Grabowski *et al.* (2014) meta-analysis. Since its publication, additional studies of fishing impacts to habitat have been performed and published to add to the knowledge of habitat vulnerability (this new information was included in the FE model; NPFMC 2017b). Two were of particular relevance to the North Pacific. McConnaughey and Syrjala (2014) tested the effects of trawling on a previously un-trawled area in the Eastern BS. A large storm event occurred in the middle of the experiment, and the results suggested that storm events have more impact than bottom trawling in that area. Lindholm *et al.* (2015) examined the effects of trawling after different periods of time up to a year on sandy habitat on the continental shelf in central California. There were no differences in structure-forming epifauna (e.g. sea whips) nor mobile invertebrates. There was only one sampling period in which there was a significant difference between topographic structure (e.g. sand waves) between trawled and un-trawled areas, reiterating that soft-sediment habitats are not as vulnerable to fishing effects as hard-bottom.

4.2.3.2 Information adequacy for assessment of impacts (PI 2.4.3.b)

Scoring PI 2.4.3.b requires that information must be adequate to understand the main impacts of gear used in main habitats (SG60), it must allow for identification of the main impacts of the UoA on the main habitats with reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear (SG80), or the physical impacts of the gear on all habitats must be quantified fully (SG100).

The information used by NPFMC about the physical impacts to habitat by fishing gear is discussed in **vulnerability** in Section 4.2.3.1 above.

The NPFMC has nearly-comprehensive, high-resolution information about the location, timing, and extent to which federally managed fishing gear is used within the North Pacific from the

CIA database. The database contains VMS data from fishing vessels since 2003 along with associated haul and vessel attributes such as vessel length, gear type, date of haul, and target species. Per the MSA, these data are confidential (16 U.S.C. § 1881(b)), though results from aggregations of these data can be made public.

4.2.3.3 Monitoring (PI 2.4.3.c)

Scoring of PI 2.4.3.c requires that adequate information must continue to be collected to detect any increase in risk to the main habitats (SG80), or changes in all habitat distributions over time must be measured (SG100).

Monitoring via bottom trawl surveys is conducted annually. Information collected in these surveys would provide the first indication of changes to habitat distributions or other biological or physical trends. Analyses from these surveys, and other research efforts, are published annually in ecosystem status reports for the AI (NMFS 2016a), Eastern BS (NMFS 2016b), and GOA (NMFS 2016c). Sea temperature, currents, climate models, phytoplankton, zooplankton, **benthic communities**, jellyfish, sea birds, fishing stocks, non-fished species, etc. are some of the topics that are monitored for broad scale ecosystem changes in these reports.

The EFH process itself requires a complete review every five years to ensure that the most up-to-date information is used. This includes reviewing species' EFH maps, as well as reviewing and rerunning an impacts model. This will likely be the FE model in the 2020 review, unless an improved model is developed.

Additional monitoring efforts include the Northern Bering Sea Research Area and the Arctic Management Area. These areas are currently closed to commercial fishing with a goal to monitor these areas in order to establish baseline data to directly measure fishing effects, should the areas ever be opened to commercial fishing (NPFMC 2009; NPFMC 2017c).

5 Conclusions

Sustainable harvest of marine resources and an ecosystem-based approach to management is a goal of both the MSC and the NPFMC. Paramount to these objectives is minimizing fishing impacts to benthic habitats. The management process in the North Pacific is transparent, scientifically-based, and open to public input, which produces effective and sound management policies. Substantial resources are devoted to research and monitoring to ensure these policies are

successful. The result is an overall habitat management framework in the North Pacific that clearly demonstrates a strong effort to meet its goal of sustainability.

The EFH framework, as well as habitat closures and gear modifications, provide the primary policy tools to support habitat management in the North Pacific groundfish fisheries. Describing these policies in relation to the MSC Habitat Standards provides valuable insight, not just for the purpose of achieving certification, but also for identifying where current management practices can improve. The primary shortcoming of habitat management in the North Pacific, especially in regard to the MSC Habitat Standards, is a historical lack of information about the distribution of benthic biota. There has, however, been a substantial increase in the last few years of model-based distribution maps, especially for more vulnerable organisms such as corals, sponges, and sea whips. Better incorporation of this information into impacts modelling would not only support attainment of MSC certification, but would also be the necessary next step to maintain a “best available science” approach to management.

6 References

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Appendix A: Guidance on v2 Habitat Standards Interpretation from MRAG Americas

MSC provides a specific interpretation of what defines a VME on its ‘interpretations log.’ Since the interpretations website is only open to certifiers, we summarize below the MSC’s guidance on how to interpret the new standard for purposes of determining whether fisheries meet it or not.

We interpret the new standard to mean that even in the case of ‘potential VMEs’ there has to be recognition by the competent authority in order for them to be assessed as VMEs under the habitats requirements. Because your fisheries happen within the US EEZ, the FAO descriptions of VMEs or potential VMEs don’t apply unless they were designated as such by national or state authorities. Same goes for areas that stakeholders think should be VMEs. However, the first part of the final sentence in the answer below regarding precautionary management in situations of potential VMEs does open the door for some different interpretations on the management PI. We would interpret “the UoA is expected to be precautionary and recognize potential VMEs” as allowing the competent authority to define precautionary management, and indicate why the habitats are not designated VME, and how the management adequately protects the habitats. Or something along those lines.

Q: Who identifies a VME within an assessment?

A: The CAB shall consider those VMEs and potential VMEs (as defined by the FAO Guidelines; see GSA3.13.3.2) that have been accepted, defined or identified as such by a local, regional, national, or international management authority/governance body. In many cases, the management authority/governance body may have accepted classification designations made by regional, national, or international non-government organisations, such as OSPAR and IUCN. The FAO VME database (www.fao.org/in-action/vulnerable-marine-ecosystems/vme-database/en/) may be a useful tool but should not be considered exhaustive and does not cover areas under national jurisdiction. Identification of VMEs by the UoA or by NGOs may be used if accepted by the management authority/governance body. It should be noted that within the management PI, the UoA is expected to be precautionary and recognize potential VMEs; within the outcome PI, only accepted, defined or identified VMEs should be considered.

- 2. Even though your fishery occasionally encounters organisms that are considered by FAO to be indicators of VMEs, they are just that—indicators. So in the absence of better information, it might make sense to take extra precaution in management of fisheries in areas where these are encountered just in case there was a VME or potential VME down there. However, in the case of the Alaska fisheries in particular, there is better and more detailed information available on actual habitat types within the fished (and unfished) areas. As assessors we are compelled to use the best available data so the assessment team would not ignore good information on actual habitats in order to use a single indicator of potential habitat.*
- 3. It is not usually the way of MSC to specify a specific management tool that must be used to address impacts or potential impacts. This is what makes the emphasis on move-on rules unusual within the requirements. This was raised by a certifier at a recent meeting with MSC and they recognized the problem and indicated that the move on provision mentioned within the requirement was likely to be intended as a ‘for example’ only. This was raised in the context of the perverse outcomes that can be generated by move-on rules,*

for example, forcing boats into areas of lower CPUE thus increasing the bottom contact, etc. I believe MSC is in the process of considering this specific issue and will likely issue a clarification along these lines, but likely not until the next version of the standard. We can certainly follow up with them on this to find out what they are doing about it.

Appendix B: Scope of Work

Purpose. Assist the Marine Conservation Alliance (MCA) in interpreting the North Pacific Fisheries Management Council's (NPFMC) 2017 Essential Fish Habitat (EFH) review (and other habitat-related actions) within the framework of the Marine Stewardship Council (MSC) v2 certification standards.

Scope of work. T. Scott Smeltz and Aileen Nimick will use materials from the NPFMC's 2016-2017 Essential Fish Habitat five-year review, materials from other NPFMC actions, and relevant scientific studies/papers to assist the MCA in interpreting the methods and outputs from the EFH review (and other habitat-related actions) within the framework of the MSC v2 certification standards. Smeltz and Nimick will produce a white paper for the MCA with the intent to provide all the necessary information to address MSC Principle 2 Habitat standards (see <https://www.msc.org/documents/scheme-documents/fisheries-certification-scheme-documents/fisheries-standard-version-2.0>).

The aim of the paper will be to assist MCA's work with certification assessors in determining whether or not existing habitat protection measures for federally managed fisheries in the North Pacific region meet MSC v2 habitat standards generally and v2 VME habitat protection specifically (e.g. VME designation, move-on provisions).

The white paper will be structured around the three MSC v2 habitat performance indicators (Outcome, Management, and Information), summarized below from MSC guidance to clients/assessors, along with additional guidance summarized by MRAG (Appendix A).

Habitat performance indicators summarized/ excerpted from the MSC v2 Fisheries Standard:

PI 2.4.1 The fishery must not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the fishery operates.

1. "Serious or irreversible harm to structure or function" means changes caused by the fishery that fundamentally alter the capacity of the habitat or ecosystem to maintain its structure and function. This is the reduction in habitat structure, biological diversity, abundance and function such that the habitat would be unable to recover to 80% of the state that it would recover to if fishing ceased within 5-20 years.

2. Additionally there are specific requirements for Vulnerable Marine Ecosystems require that they be maintained at 80% of their un-fished state at all times.

PI 2.4.2 There must be a strategy in place designed to ensure the fishery does not pose a risk of serious or irreversible harm to the habitats.

PI 2.4.3 Information must be adequate to determine the risk posed to the habitat by the fishery and the effectiveness of the strategy to manage impacts on the habitat.

Following that outline, the white paper will:

- 1) Provide a clear and concise description of the technical work including the EFH fishing effects model, data, and analyses in the EFH five-year review.
- 2) Provide a review of the groundfish and other fisheries' cumulative effects as they relate to each habitat type (e.g. sand, mud, deep water rocky habitat) and fisheries management area (EBS, AI, GOA) along with any uncertainty resulting from classification of habitat type or gear that is used.
- 3) Describe the process that stock assessment scientists undertake to determine if fishing effects are having adverse impacts on EFH for each species.
- 4) Describe the review process conducted by the Groundfish Plan Teams, NPFMC's Science and Statistical Committee, stakeholders, and the public.
- 5) Describe the NPFMC's process for incorporating the technical findings into their decision-making process in response to the EFH mandate and standards in place for considering habitat areas of particular concern (HAPC).
- 6) Provide citations for all of the above to facilitate locating materials for follow up work by those using the white paper as a roadmap to help them understand the EFH documents.

Tasking. Nimick will summarize the EFH reviews and habitat related actions and discuss the interplay between EFH mandates and FAO-based MSC v2 habitat standards. Smeltz will provide technical summaries of the fishing effects model and related outputs. Both will contribute to document preparation including annotated references with their relation to MSC standards.

Location of work. Anchorage, AK

Timeline. June 2017 – Compile references for this review

July 2017 – Conduct review and draft white paper; Provide draft document to MCA

August 2017 – Address MCA comments; finalize document

Deliverables. Final white paper to MCA on 9/1/17