DRAFT

Environmental Assessment for:

Amendment XX to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea/Aleutian Islands Area
Amendment XX to the Fishery Management Plan for Groundfish of the Gulf of Alaska
Amendment XX to the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs
Amendment XX to the Fishery Management Plan for the Salmon Fisheries in the Exclusive Economic Zone off the Coast of Alaska
Amendment XX to the Fishery Management Plan for Fish Resources of the Arctic Management Area

Essential Fish Habitat (EFH) Omnibus Amendments

Public Review Draft

April 2017

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1 Introduction and Purpose

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) includes provisions concerning the identification and conservation of Essential Fish Habitat (EFH). The Magnuson-Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The National Marine Fisheries Service (NMFS) and regional Fishery Management Councils (Councils) must describe and identify EFH in fishery management plans (FMP), minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to encourage the conservation and enhancement of EFH. Federal agencies that authorize, fund, or undertake actions that may adversely affect EFH must consult with NMFS, and NMFS must provide conservation recommendations to federal and state agencies regarding actions that would adversely affect EFH. Councils also have the authority to comment on federal or state agency actions that would adversely affect the habitat, including EFH, of managed species.

Each FMP contains the following EFH components:

1. EFH Descriptions and Identification;
2. Fishing activities that may adversely affect EFH;
3. Non-Magnuson-Stevens Act fishing activities that may adversely affect EFH;
4. Non-Fishing activities that may adversely affect EFH;
5. Cumulative impacts analysis;
6. EFH Conservation and Enhancement Recommendations;
7. Prey species list and any locations;
8. Habitat Areas of Particular Concern (HAPC) identification;
9. Research and Information needs; and
10. Requirement to review EFH every 5 years.

1.1 2016 EFH 5-Year Review

In 2016, the most recent 5-year EFH review was conducted for the North Pacific Fishery Management Council (Council) and documented in the Final EFH 5-year Review Summary Report (Summary Report, NPFMC 2016). The report reviewed EFH descriptions in all six of the Council's FMPs (Table 1): the Bering Sea/Aleutian Islands (BSAI) Groundfish FMP, Gulf of Alaska (GOA) Groundfish FMP, BSAI Crab FMP, Scallop FMP, Salmon FMP, and Arctic FMP.

The review evaluated new information on EFH, assessed information gaps and research needs, and identified whether any revisions to EFH are needed or suggested. The EFH 5-year Review for 2016 Summary Report, the 2011 EFH 5-year Review, and the environmental analysis from the 2005 EFH EIS are incorporated by reference in this analysis.

Table 1 List of Council Fishery Management Plans and status of EFH review

Fishery Management Plan	EFH Last Updated	Review Status
Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI Groundfish)	2011	NPFMC review in 2016 (including Plan Team)
Groundfish of the Gulf of Alaska (GOA Groundfish)	2011	NPFMC review in 2016 (including Plan Team)

Fishery Management Plan	EFH Last Updated	Review Status
Bering Sea/ Aleutian Islands King and Tanner Crab (BSAI Crab)	2011	NPFMC review in 2016 (including Plan Team)
Scallop Fisheries off Alaska (Scallop)	2011	NPFMC review in 2016 (including Plan Team) (No changes to EFH definitions warranted)
Salmon Fisheries in the EEZ off Alaska (Salmon)	2012	NPFMC review in 2016 using new peer-reviewed, published methodology (Echave et al., 2012) (Review provided by scientists from the NOAA/AFSC and ADFG)
Fish Resources of the Arctic (Arctic)	2009	NPFMC review completed in 2009 with adoption of FMP

Based on the review and the summary report, the Council identified various elements of the EFH descriptions and maps that merit revision. Accordingly, the Council initiated an analysis to address recommendations arising from the 5-year review. The Council's motion from October 2016 is summarized in Table 2, which also pairs each recommendation with the corresponding action included in this analysis.

Table 2 Summary of Council's recommended action resulting from the EFH 5-year review, October 2016

EFH component	Council FMP	Recommended change	Corresponding action in this analysis
EFH descriptions of individual species	BSAI Groundfish	**Update EFH descriptions** in the FMP consistent with the stock assessment authors' recommendations in Sections 5.1 through 5.26 of the Summary Report, NPFMC 2016. **Replace the existing EFH maps in the FMP with the 95th percentile maps by season (winter, spring, summer and fall) for each species and life stage** as shown in Appendix 1.	**Action 1**
	GOA Groundfish	**Update EFH descriptions** in the FMP consistent with the stock assessment authors' recommendations in Sections 6.1 through 6.26 of the Summary Report, NPFMC 2016. **Replace the existing EFH maps in the FMP with the 95th percentile maps by season for each species and life stage** as shown in Appendix 2.	**Action 2**

EFH component	Council FMP	Recommended change	Corresponding action in this analysis
	BSAI Crab	**Update EFH descriptions** in the FMP consistent with the stock assessment authors' bulleted recommendations in Section 7 of the Summary Report, NPFMC 2016. **Replace the existing EFH maps in the FMP with the 95th percentile maps by season for each species and life stage** as shown in Appendix 3.	**Action 3**
	Salmon	**Update only marine EFH descriptions** in the FMP consistent with the stock assessment authors' recommendations in Section 9 of the Summary Report, NPFMC 2016. **Replace the existing marine EFH maps in the FMP with the model-based maps for each species and life stage** as shown in Appendix 4.	**Action 4**
	Arctic	**Update EFH descriptions for all species** in the FMP consistent with the stock assessment authors' recommendations in Section 10 of the Summary Report, NPFMC 2016. **Replace the existing map for snow crab** in Appendix B of the FMP with the map(s) recommended by the Scientific and Statistical Committee[1], as noted in their April 2016 minutes. See Appendix 5 for updated descriptions and map.	**Action 5**
Non-fishing activities that may adversely affect EFH	All Council FMPs	Update EFH conservation recommendations for non-fishing activities in all Council FMPs	**Action 6**
HAPC	All Council FMPs	Initiate HAPC proposal process	**Action 7**
Research and information needs	All Council FMPs	Revise research priorities for EFH in all FMPs	**Action 8**

1.2 Purpose and Need Statement

The purpose of the eight proposed actions is to comply with the Final Rule implementing the EFH provisions of the MSA (50 CFR Part 600, Subpart J). The EFH Final Rule and each of the Council's FMPs state that a review of EFH components should be completed every 5 years and the EFH provisions should be revised or amended, as warranted, based on the best available information. To comply with the EFH Final Rule, the most recent 5-year review of EFH was completed in October 2016 and synthesized in a Final Summary Report (Summary Report, NPFMC 2016) presented to the Council. Based on the review, the Council determined that new information is available to revise many of the EFH descriptions

[1] The October 2016 Council motion indicates the map recommendation came from the stock assessment author, and that has been corrected in this document to show the map recommendation came from SSC review in April 2016.

and maps in the Council FMPs. There are eight actions included in this omnibus EFH amendment package, all of which are intended to update the Council FMPs to incorporate the best new information available. Descriptions of each action follow in the sections below. The proposed actions are FMP amendments only; there are no regulations that will be changed as a result of these amendments.

2 Description of Actions and Alternatives

This amendment package includes a series of actions for the various Council FMPs. The EFH 5-year review addressed all of the Council's FMPs. The review included the scallop FMP, however changes to EFH are not recommended for scallops. Alternative 2 in Actions 1-5, below, would amend the description of EFH in 5 of the 6 FMPs under the Council's purview. Alternative 2 in Action 6 refines and updates conservation recommendations to address the effects of non-fishing activities in Alaska on EFH, and is applicable to all of the Council FMPs. Under Alternative 2 in Action 7, the Council may initiate the HAPC proposal process. Finally, under Alternative 2 under Action 8, the Council may adjust its EFH research priorities for all Council FMPs.

More detail on the specific revisions proposed under Alternative 2 in Actions 1-8 is included in the sections that follow relating to the specific actions.

2.1 Action 1 – BSAI Groundfish

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH descriptions in the FMP consistent with the stock assessment authors' recommendations in Sections 5.1 through 5.26 of the Summary Report, NPFMC 2016. Replace the existing EFH maps in the FMP with the 95th percentile maps by season (winter, spring, summer and fall) for each species and life stage as shown in Appendix 1.

2.2 Action 2 – GOA Groundfish

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH descriptions in the FMP consistent with the stock assessment authors' recommendations in Sections 6.1 through 6.26 of the Summary Report, NPFMC 2016. Replace the existing EFH maps in the FMP with the 95th percentile maps by season for each species and life stage as shown in Appendix 2.

2.3 Action 3 – BSAI King and Tanner Crab

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH descriptions in the FMP consistent with the stock assessment authors' bulleted recommendations in Section 7 of the Summary Report, NPFMC 2016. Replace the existing EFH maps in the FMP with the 95th percentile maps by season for each species and life stage as shown in Appendix 3.

2.4 Action 4 – Salmon

Alternative 1 – No Action; status quo

Alternative 2 – Update only marine EFH descriptions in the FMP consistent with the stock assessment authors' recommendations in Section 9 of the Summary Report, NPFMC 2016. Replace the existing marine EFH maps in the FMP with the model-based maps for each species and life stage as shown in the Appendix 4.

2.5 Action 5 – Arctic Management Area

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH descriptions for all species in the FMP consistent with the stock assessment authors' recommendations in Section 10 of the Summary Report, NPFMC 2016. Replace the existing map for snow crab in Appendix B of the FMP with the map(s) recommended by the Scientific and Statistical Committee, as noted in their April 2016 minutes. See Appendix 5 for updated descriptions and map.

2.6 Action 6 – Non-Fishing Activities

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH conservation recommendations for non-fishing activities in all Council FMPs

2.7 Action 7 – HAPC

Alternative 1 – No Action; status quo

Alternative 2 – Initiate HAPC proposal process

2.8 Action 8 – EFH Research Priorities

Alternative 1 – No Action; status quo

Alternative 2 – Revise research priorities for EFH in all FMPs

3 Methodology

3.1 Revisions to EFH descriptions for each species

EFH descriptions consist of text descriptions and maps, all of which were re-evaluated in the 2016 EFH 5-year review.

The EFH description by life history stage, in text and in maps, is included in the FMP, as well as an indicator for how much habitat information is known about each life history stage. This is the legal description of EFH, based on which EFH consultations for fishing and non-fishing effects on EFH are held as directed by the Magnuson-Stevens Act. It is on the basis of these descriptions that evaluations are made by the agency about whether an activity is likely to impact EFH.

EFH Text and Map Description Review by Stock Authors

An integral part of an EFH Review is stock author review of EFH text descriptions, map delineations, and habitat information, including habitat association tables. Fishery stock assessment authors were asked to update existing EFH descriptions and, importantly, recommend EFH updates using the most recent and best available science. Most often, recommendations were editorial and updated basic life history information. However, new findings may warrant a new EFH Description. Evaluation of a new description occurs after the stock author reviews applicable science or research, then recommends change or a new EFH Description. A recommendation is forwarded to the stock assessment Plan Team for their consideration. A final recommendation is presented to the Council's SSC and subsequent Council review for any motion to initiate action.

Modeling Methods – Essential Fish Habitat Maps

Since the completion of the 2010 EFH review, substantial new data have been made available to describe habitat in the Large Marine Ecosystems (LMEs) around Alaska, and in some cases, the effects of habitat on abundance of species of interest. For this review, scientists at the Alaska Fisheries Science Center (AFSC) produced species distribution models of EFH for all major species of groundfish and invertebrates in the eastern Bering Sea (Laman et al. 2015), Aleutian Islands (Turner et al. 2015), and Gulf of Alaska (Rooney et al. 2015). These three tech memos lay out the modeling process in detail, and full citations are included in the reference section of this analysis.

Models and text descriptions of EFH were generated for each species where data exists for egg, larval, juvenile, and adult life history stages in four seasons. Data available for early life history stages (egg, larval, pelagic early juvenile) are primarily from the FOCI ECODAAT database. Summer distributions of juvenile and adult life history stages were modeled using the RACE bottom trawl survey database (RACEBASE). The seasonal adult distributions were modeled using commercial catch data from the observer database (CIA Database). All data were divided into four seasons for analysis: fall (October-November), winter (December-February), spring (March-May), and summer (June-September). Summer distributions were based on bottom trawl survey CPUE while fall, winter and spring distributions were based on presence-only catch data from fisheries observer records. Three types of distribution modeling were used for the bottom trawl survey data based on the frequency of occurrence for each species in the catch. For species that occurred in > 30% of bottom trawl hauls, a standard Generalized Additive Modeling (GAM) method was used to produce maps of predicted density. For species where frequency of occurrence was between 10% and 30% a hurdle model (Cragg 1971, Potts and Elith 2006) predicting spatial distribution of fishes was used. For species with < 10% frequency of occurrence, but > 50 presence observations, the maximum entropy (MaxEnt) modeling method was used to develop suitable

habitat models. The MaxEnt methodology was used for estimating species distribution for commercial catch data in the CIA database, as well as in the ECODAAT database. Separate training (80%) and testing (20%) data were randomly selected for all models developed in order to assess model performance.

Complementary distribution maps were generated that showed the location of EFH. These maps were produced as population quantiles from predictions of the distribution of suitable habitat (for species where MaxEnt modeling was used) or predictions of the distribution of abundance (for species where CPUE was modeled using either a GAM or hurdle GAM). For each map of model predictions 300,000 points were randomly sampled from the raster surface. These values were then ordered by cumulative distribution and zero abundance values were removed. Four population quantiles were selected from these cumulative distributions (5%, 25%, 50% and 75%). These quantiles were then used as break points to translate the model predictions (maps of suitable habitat or abundance) to map the distribution of categories of the amount of the species abundance or suitable habitat. For example, if the 5% quantile of species A was 0.024 individuals/ha, this meant that 95% of the population occurred at values higher than 0.024. Similarly, a 75% quantile of species A at 2.1 individuals/ha meant that values above 2.1 represented the top 25% of the population proportion, or the predicted highest abundance areas. The four categories for each species, life history stage, and season were mapped to show the distribution of the areas containing 95%, 75%, 50% and 25% of the population. It is important to note that these values were chosen somewhat arbitrarily (except 95% which is the current definition of EFH in Alaska), and other values could be equally appropriate.

With regard to salmon, all marine waters off Alaska have been designated as marine salmon EFH since the Council first identified EFH in 1998. In order to better define EFH for Pacific salmon, a new method was developed to calculate and map the coincidence of three environmental variables (sea surface salinity, sea surface temperature, and bottom depth) for each of the five salmon species at each maturity stage (Echave et al. 2012). This methodology results in updated EFH descriptions that reduce the area of designated EFH for Pacific salmon by 71.3% on average.

Stock assessment authors recommended updates to EFH descriptions for all FMPs except for the scallop FMP, and updated maps were recommended for all FMPs except for the scallop FMP. The complete EFH revisions are included in Appendices 1-6 of this document. These appendices represent the changes that would be made to the FMPs under Alternative 2 in Actions 1-6. The changes to the species' text and map descriptions are addressed in more detail under each specific action.

3.2 Impacts Assessment

The impact of the changes proposed under these amendments is not substantively different from that analyzed in the EFH EIS (NMFS 2005). While EFH text and map descriptions have changed somewhat, the impact of these changes are relatively the same, as compared to prior assessments. Within this analysis, individual life stages of EFH species have expanded and contracted in area due to changes in EFH description methodology. However, when current EFH is compared to prior EFH the cumulative size of EFH remains unchanged, as almost all waters are depicted as EFH for at least one species. This is due to broad fish distribution patterns, diverse habitat requirements, and the large number of species managed. Further, EFH is described for each species' life history stage. The number of EFH species assessed exceeds 75 species covered by six fishery management plans.

4 Action 1 – BSAI Groundfish FMP Amendments

4.1 Background – BSAI groundfish species

For the EFH 5-year review, each stock assessment author was asked to review the current FMP text describing EFH for species or species complex for the species they assess. Authors were asked to review EFH text descriptions, level of EFH information, habitat information, and the list of literature. Authors suggested necessary changes and updates, if appropriate, for each life history stage and to suggest any information or literature available since the 2010 revision that should be included in the EFH description. Authors were also asked to review and update, if appropriate, the habitat association tables from the FMP. Finally, authors were asked to review the current maps of EFH in the FMP and compare them to the new maps produced from the models described in section 3.1 and conclude whether existing maps adequately depict EFH for their species, or whether updated maps better represented EFH. In some cases, information is not sufficient to describe EFH or maps were not appropriate (e.g., species managed as complex rather than single species). In those cases, authors were asked to make that notation and make a recommendation to change EFH descriptions or maps.

Table 3 lists the species and species complexes for which EFH is currently identified in the BSAI Groundfish FMP. EFH has not been described for sharks due to insufficient information. EFH has not been described for grenadiers and the forage fish complex because they are ecosystem component species.

Table 3 Levels of EFH information currently available for BSAI groundfish by life history stage

Species	Eggs	Larvae	Early Juveniles	Late Juveniles	Adults
Pollock	1	1	2	2	2
Pacific cod	x	2	2	2	2
Sablefish	x	x	x	1	1
Yellowfin sole	1	1	1	1	1
Greenland turbot	1	1	1	2	2
Arrowtooth flounder	1	1	1	2	2
Kamchatka flounder	1	1	1	1	1
Northern rock sole	x	1	1	1	1
Alaska plaice	1	1	x	1	1
Rex sole	1	1	1	2	2
Dover sole	1	1	1	2	2
Flathead sole	1	1	2	2	2
Pacific ocean perch	*Sebastes* spp. early life stages grouped			2	2
Northern rockfish				2	2
Shortraker rockfish				2	2
Blackspotted/ rougheye rockfish			1	1	2
Other rockfish (dusky)				1	1
Thornyhead rockfish (shortspine)	x	x	2	2	2
Atka mackerel	1	1	x	1	2
Squids	x	x	x	1	1
Sculpins (Great, Yellow Irish Lord, Bigmouth)	x	x		x	2
Skates (Alaska, Bering, Aleutian)	1	x	1	2	2
Skates (Mud)	x	x	x	x	2
Sharks	x	x	x	x	x
Octopuses (Pacific Giant)	x	x	x	x	2

Species	Eggs	Larvae	Early Juveniles	Late Juveniles	Adults
Forage fish complex	x	x	x	x	x
Grenadiers	x	x	x	x	x

x	Indicates insufficient information is available to describe EFH
1	Indicates general distribution data are available for some or all portions of the geographic range of the species
2	Indicates quantitative data (density or habitat-related density) are available for the habitats occupied by a species or life stage
	One juvenile stage exists – see Late Juveniles

4.2 Description of Alternatives

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH descriptions in the FMP consistent with the stock assessment authors' recommendations in Sections 5.1 through 5.26 of the Summary Report, NPFMC 2016. Replace the existing EFH maps in the FMP with the 95th percentile maps by season (winter, spring, summer and fall) for each species and life stage as shown in Appendix 1.

4.2.1 Recommended revisions for individual species

A description of the recommendations is provided below for each individual species or species complex for which EFH is defined in the BSAI Groundfish FMP. The complete recommendations for each species, including maps, may be found in Appendix 1 of this document.

Pollock

- Expanded on existing description for early juveniles
- Updates to life history and general distribution information
- Updates to Literature
- Recommends use of updated maps to represent EFH
- Suggests Level 2 designation for pollock eggs, juveniles, and adults

Pacific cod

- Updates to EFH descriptions for larvae, early juveniles, late juveniles, and adults
- Expanded on life history and general distribution, trophic, and habitat and biological associations information
- Updates to literature
- Updates to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends Level 2 for larvae, early juveniles, late juveniles, and adults

Sablefish

- Reduced EFH description for larvae due to insufficient information
- Expanded on life history and general distribution, trophic, and habitat and biological associations information
- Updates to literature
- No changes to habitat association tables
- Recommends use of updated map showing 25-50% predicted habitat to describe EFH
- Recommends Level downgrade for larvae; others remain unchanged

Yellowfin sole

- Add EFH definitions to eggs, larvae, early juvenile life stages.
- Updates to life history and general distribution
- Updates to habitat and biological associations
- Updates to literature
- Change to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends Level 1 for eggs, larvae, early juvenile life stages; others remain at Level 1

Greenland Turbot

- No changes to EFH description
- Editorial update to EFH habitat information description
- Updates to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH

Arrowtooth flounder

- No changes to EFH description
- Update to life history and general distribution
- No changes to habitat or biological associations
- Updates to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH

Kamchatka flounder

- No changes to EFH description
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends remain at Level 1 (likely refers to late juveniles and adults)

Northern rock sole

- Updated EFH description for early juvenile life stage
- Updates to EFH habitat information description
- Updates to habitat associations
- Updates to literature

- Changes to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends Level 1 upgrade for early juveniles; all others remain unchanged

Alaska plaice

- Updated EFH description for larvae life stage
- Updates to EFH habitat information description
- Updates to habitat and biological associations table
- Updates to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends Level 1 upgrade for larvae; others remain unchanged

Rex sole

- No changes to EFH descriptions
- No changes to EFH habitat information description
- No changes to habitat and biological association table
- No changes to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH

Dover sole

- No changes to EFH descriptions
- No changes to EFH habitat information description
- No changes to habitat and biological association table
- No changes to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH

Flathead sole

- No changes to EFH descriptions
- No changes to EFH habitat information description
- No changes to habitat and biological association table
- Update to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends Level 2 for early juveniles, late juveniles, and adults; others remain at Level 1

Pacific Ocean perch

- Editorial updates to EFH description
- Updates to life history and general distribution
- Updates to habitat and biological associations text and table
- Updates to literature

- Changes to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends Level 2 for late juveniles and adults; others remain unchanged

Northern rockfish

- Editorial update to EFH descriptions
- Updates to life history and general distribution
- Updates to habitat and biological associations text and table
- Updates to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends Level 2 for late juveniles and adults; others remain unchanged

Shortraker rockfish

- No changes to EFH descriptions
- No changes to life history and general distribution
- No changes to habitat and biological associations text and table
- No changes to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH

Blackspotted and rougheye rockfish

- Updates to EFH descriptions for larvae and adult life history stages
- Updates to life history and general distribution
- No changes to habitat and biological associations
- No changes to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends Level 1 for late juveniles and Level 2 for adults; others remain unchanged

Dusky rockfish

- No changes to EFH descriptions
- Editorial change to life history and general distribution
- No changes to habitat and biological associations
- No changes to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends remain at Level 1

Thornyhead rockfish

- Author suggests breaking out Thornyhead rockfish to longspine and shortspine Thornyhead rockfish
- No changes to EFH descriptions
- No changes to life history and general distribution

- Editorial changes to habitat and biological associations
- No changes to literature
- Recommends use of updated maps to represent EFH

Atka mackerel

- Updates to EFH descriptions for eggs, late juvenile, and adult life history stages
- Expanded on life history and general distribution information
- Updates to relevant trophic information
- No changes to habitat and biological associations
- Updates to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH
- Recommends Level 1 for late juveniles, Level 2 for adults; other levels remain the same

Squid species

- No changes to EFH descriptions
- Changes to nomenclature
- Updates to life history and general distribution
- Updates to relevant trophic information
- Updates to habitat and biological associations
- Updates to literature
- Changes to habitat association tables

Skates

- No changes to EFH descriptions
- Expanded on life history and general distribution
- Updates to relevant trophic information
- Updates to habitat and biological associations
- Updates to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH

Sculpins

- No changes to EFH descriptions
- Editorial change to life history and general distribution information
- No changes to relevant trophic information
- No changes to habitat and biological associations
- No updates to literature
- Changes to habitat association tables
- Recommends use of updated maps to represent EFH

EFH Essential Fish Habitat is not currently defined for the following species and species groups.

Sharks

- No changes to EFH descriptions. EFH remains undefined.
- Changes to nomenclature
- Updates to life history and general distribution
- Updates to relevant trophic information
- Updates to habitat and biological association
- Updates to literature
- Changes to habitat association tables
- No maps available to describe EFH for BSAI sharks

Octopus

- No changes to EFH descriptions. EFH remains undefined
- Expanded on life history and general distribution information
- No changes to habitat and biological associations
- Updates to literature
- No changes to habitat association tables

Forage fish complex

- Recommended identifying EFH for adult life history stage
- Updates to life history and general distribution for capelin and eulachon
- Editorial changes to relevant trophic information for capelin and eulachon
- No changes to habitat and biological associations
- Updates to literature
- Changes to habitat association tables

Grenadiers

- Authors identified proposed EFH
- Added to habitat associations tables

At the October 2016 meeting, the Council moved to update EFH descriptions in the FMP consistent with the stock assessment authors' recommendations in Sections 5.1 through 5.26 of the Summary Report, NPFMC 2016. The Council also moved to replace the existing EFH maps in the FMP with the 95th percentile maps by season (winter, spring, summer and fall) for each species and life stage as shown in Appendix 1.

4.3 Expected effects of Alternatives

4.3.1 Alternative 1 – No action; status quo

In 2011, the Council and NMFS updated EFH for all species or complexes in the BSAI Groundfish FMP. The impacts analysis from the 2011 EA is incorporated here by reference. The no action alternative would result in no changes to EFH for any species or complexes in the BS. No changes to management would be necessary to minimize the adverse effects of fishing on EFH. Federal agencies authorizing or funding activities in the BS that may affect EFH would remain required to consult with NMFS HCD to identify

recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The overall impacts of the no action alternative are not significant.

4.3.2 Alternative 2 – Amend the FMP for groundfish of the BSAI to update EFH descriptions and replace maps

Alternative 2 will result in changes to the EFH descriptions and maps for all BSAI groundfish stocks to incorporate new data, and new models to identify EFH based on habitat characteristics. Application of new models and new data will, for some species, result in reclassification from Level 1 to Level 2 data, consistent with the intent of the EFH Guidelines. No changes to management would be required to address the impacts of commercial fishing on EFH. None of the proposed changes would require regulatory action. In most cases, the total area defined as EFH for groundfish and crab species in the BSAI increased compared to previous descriptions due to the use of species distribution models (GAMs and MaxEnt). Federal agencies that conduct, authorize, or fund activities in the area would still be required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The overall impacts of alternative 2 are not significant.

5 Action 2 – GOA Groundfish FMP Amendments

5.1 Background – GOA groundfish species

For the EFH 5-year review, each stock assessment author was asked to review the current FMP text describing EFH for species or species complex for which they have responsibility. Authors were asked to review EFH text descriptions, level of EFH information, habitat information, and the list of literature. Authors suggested necessary changes and updates, if appropriate, for each life history stage and to suggest any information or literature available since the 2010 revision that should be included in the EFH description. Authors were also asked to review and update, if appropriate, the habitat association tables from the FMP. Finally, authors were asked to review the current maps of EFH in the FMP and compare them to the new maps produced from the models described in section 3.1 and conclude whether existing maps adequately depict EFH for their species, or whether updated maps better represented EFH. In some cases, existing maps are not available, or management has changed such that existing maps were inappropriate (e.g., species managed as complex rather than single species). In those cases, authors were asked to make that notation and make a recommendation to change EFH descriptions or maps.

Table 4 lists the species and species complexes for which EFH is currently identified in the GOA Groundfish FMP.

Table 4 EFH information levels currently available for GOA groundfish by life history stage

Species	Eggs	Larvae	Early Juveniles	Late Juveniles	Adults
Walleye pollock	1	1	2	2	2
Pacific cod	x	1	2	2	2
Sablefish	x	1	1	2	2
Yellowfin sole	1	1	2	2	2
Northern rock sole	1	1	2	2	2
Southern rock sole	1	1	1	2	2
Alaska plaice	1	1	2	2	2
Dover sole	1	1	x	2	2
Rex sole	1	1	x	2	2
Arrowtooth flounder	1	1	1	2	2
Flathead sole	1	1	2	2	2
Pacific ocean perch	*Sebastes* spp. early life stages grouped 1			1	1
Northern rockfish				2	2
Shortraker rockfish				2	2
Blackspotted/rougheye rockfish				1	1
Dusky rockfish				1	1
Yelloweye rockfish				1	1
Other Rockfish (sharpchin, harlequin)	1	x	x	1	1
Thornyhead rockfish	x	x	2	2	2

Species	Eggs	Larvae	Early Juveniles	Late Juveniles	Adults
Atka mackerel	1	x	x	1	1
Skates	1	x	1	2	2
Octopuses	x	x	x	x	2
Sharks	x	x	x	x	x
Sculpins	x	x		x	2
Squids	x	x	x	1	1
Forage fish complex	x	x	x	x	x
Grenadiers	x	x	x	x	x

x	Indicates insufficient information is available to describe EFH
1	Indicates general distribution data are available for some or all portions of the geographic range of the species
2	Indicates quantitative data (density or habitat-related density) are available for the habitats occupied by a species or life stage
	One juvenile stage exists – see Late Juveniles

5.2 Description of Alternatives

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH descriptions in the FMP consistent with the stock assessment authors' recommendations in Sections 6.1 through 6.26 of the Summary Report, NPFMC 2016. Replace the existing EFH maps in the FMP with the 95th percentile maps by season for each species and life stage as shown in Appendix 2.

5.2.1 Recommended revisions for individual species

A description of the recommendations is provided below for each individual species or species complex for which EFH is defined in the GOA Groundfish FMP. The complete recommendations for each species, including maps, may be found in Appendix 2 of this document.

Pollock

- Expanded on EFH description for early juveniles
- Updates to life history and general distribution
- Updates to literature
- Recommends use of MaxEnt maps to describe EFH, with suggestions for edits

Pacific cod

- Recommended updates to EFH descriptions for larvae, early juveniles, late juveniles, and adults
- Editorial changes to relevant trophic information
- Editorial changes to habitat and biological associations
- Changes to habitat association tables
- Recommends use of updated maps to describe EFH

Sablefish

- Changes to EFH descriptions for all life history stages
- Updates to life history and general distribution
- Updates to relevant trophic information
- Updates to habitat and biological associations
- Updated literature
- Changes to habitat association tables
- Recommends use of MaxEnt maps to describe juvenile stage EFH, with 25% cutoff
- Recommends use of updated maps to describe adult stage EFH, integrated and include longline survey
- Recommends downgrade egg life stage to "insufficient", upgrade early juveniles to Level 1, late juveniles to Level 2, and adults to Level 2

Yellowfin sole

- Editorial changes to life history and general distribution
- Updated table for habitat and biological associations
- Updated literature
- Recommends use of updated maps to describe EFH

Southern rock sole

- Editorial changes to life history and general distribution
- Editorial changes to habitat and biological associations
- Updated literature
- Recommends use of updated maps to describe EFH

Alaska plaice

- Updates to life history and general distribution
- Editorial changes to table for habitat and biological associations
- Updated literature
- Recommends use of updated maps to describe EFH

Rex sole

- Editorial change to life history and general distribution
- Updated literature
- Recommends use of updated maps to describe EFH
- Recommends Level 2 upgrade for late juvenile and adult life history stages; others remain unchanged

Dover sole

- Editorial changes to life history and general distribution
- Updated literature
- Recommend use of updated maps to describe EFH
- Recommends Level 2 upgrade for late juvenile and adult life history stages; others remain unchanged

Flathead sole

- Editorial change to life history and general distribution
- Updated literature
- Recommend use of updated maps to describe EFH
- Recommends Level 2 upgrade for late juvenile and adult life history stages; others remain unchanged

Arrowtooth flounder

- Editorial change to life history and general distribution
- Updated literature
- Recommends use of updated maps to describe EFH

Pacific Ocean perch

- Updates to EFH descriptions for eggs, larvae, and early juveniles
- Updates to life history and general distribution
- Editorial changes to relevant trophic information
- Editorial changes to habitat and biological associations
- Updated literature
- Recommends use of updated maps to describe EFH
- Recommends Level 1 upgrade for early juvenile life history stage; others remain unchanged

Northern rockfish

- Editorial changes to life history and general distribution
- Updated literature
- Recommends use of updated maps to describe EFH

Shortraker rockfish

- Changes to habitat association tables
- Recommends use of updated maps to describe EFH

Blackspotted and rougheye rockfish

- Updates to EFH descriptions for larvae, late juveniles, and adults
- Updates to life history and general distribution
- Updated literature
- Recommends combining data for blackspotted and rougheye rockfish to create EFH maps for the complex rather than individual species maps
- Comment – combining species data may allow elevation to Level 2
- Recommends Level 1 upgrade for late juvenile life history stage

Dusky rockfish

- Updates to EFH descriptions for eggs and late juveniles
- Editorial change to introduction of section
- Editorial change to relevant trophic information
- Editorial change to habitat and biological associations

- Updated literature
- Changes to habitat association tables
- Recommend use of updated maps to describe EFH
- Recommend using data other than trawl data
- Recommends "insufficient information" downgrade for larvae and Level 1 upgrade for late juveniles; other life history stages remain unchanged

Yelloweye rockfish

- Authors suggest defining EFH for Yelloweye and other *Sebastes* species as a species complex, as described in the *Other rockfish* section, below.

Thornyhead rockfish

- Changes to habitat association tables

Other rockfish

- Added to the table showing EFH information levels currently available for GOA groundfish
- Added EFH descriptions for all life history stages
- Recommended including other rockfish stock complex in the EFH descriptions
    - Authors presented four alternative methods to describe EFH for the *Sebastes* species complex
- Expressed concerns over using model based EFH descriptions
- Requested that the Council provide guidance to the EFH authors on how to proceed with defining EFH for the complex
- Changes to habitat associations tables
- Recommend combining individual species maps to represent EFH for the "other rockfish" complex
- Recommend "other rockfish" at Level 1

Atka mackerel

- Revised EFH description for larvae
- Expanded on life history and general distribution
- Editorial change to relevant trophic information
- Updates to table for habitat and biological associations
- Updated literature
- Changes to habitat association tables
- Insufficient information to model EFH for the GOA
- Recommends downgrade from Level 1 to "insufficient" for larvae; other life history stages remain unchanged

Squid species

- Updated nomenclature
- Expanded on life history and general distribution
- Updates to relevant trophic information
- Editorial change habitat and biological associations

- Updated literature
- Changes to habitat association tables

Skates

- Update to EFH definition for adults
- Updated introduction for skate complex
- Expanded on life history and general distribution
- Update to relevant trophic information
- Updates to habitat and biological associations
- Updated table for habitat and biological associations
- Updated literature
- Changes to habitat association tables
- Recommend use of updated maps to describe EFH

Sculpin species

- No changes

Sharks

- Updated scientific name of spiny dogfish (*Squalus suckleyi*)
- Expanded on life history and general distribution
- Updates to relevant trophic information
- Updates to habitat and biological associations
- Updated habitat and biological associations table
- Updated literature
- Changes to habitat association tables
- No maps to describe EFH

Forage fish complex

- Update to life history and general distribution for capelin and eulachon
- Editorial changes to relevant trophic information
- Updated literature
- Changes to habitat association tables
- No maps to describe EFH

Grenadiers

- Added to the table showing EFH information levels currently available for GOA groundfish
- Added EFH descriptions
- Added new section on grenadiers including:
    - Life history and general distribution
    - Relevant trophic information
    - Habitat and biological associations
    - Literature
- Created habitat association tables
- No maps to describe EFH

Octopus

- Created habitat association tables

At the October 2016 meeting, the Council moved to update EFH descriptions in the FMP consistent with the stock assessment authors' recommendations in Sections 6.1 through 6.26 of the Summary Report, NPFMC 2016. The Council also moved to replace the existing EFH maps in the FMP with the 95th percentile maps by season for each species and life stage as shown in Appendix 2.

5.3 Expected effects of Alternatives

5.3.1 Alternative 1 – No action; status quo

In 2011, the Council and NMFS updated EFH for all species or complexes in the GOA Groundfish FMP. The impacts analysis from the 2011 EA is incorporated here by reference. The no action alternative would result in no changes to EFH for any species or complexes in the GOA. No changes to management would be necessary to minimize the adverse effects of commercial fishing on EFH. Federal agencies authorizing or funding activities in the GOA that may affect EFH would remain required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The overall impacts of the no action alternative are not significant.

5.3.2 Alternative 2 – Amend the FMP for all groundfish species of the Gulf of Alaska to update EFH descriptions and replace maps

Alternative 2 will result in changes to the EFH descriptions and maps for all GOA groundfish stocks to incorporate new data, and new models to identify EFH based on habitat characteristics. Application of new models and new data will, for some species and life stages, result in reclassification from Level 1 to Level 2 data, consistent with the intent of the EFH Guidelines. No changes to management would be required to address the impacts of commercial fishing on EFH. None of the proposed changes would require regulatory action. In most cases, the total area defined as EFH for groundfish in the GOA increased compared to previous descriptions due to the use of species distribution models (GAMs and MaxEnt). Federal agencies that conduct, authorize, or fund activities in the area would still be required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The overall impacts of alternative 2 are not significant.

6 Action 3 – BSAI King and Tanner Crab FMP Amendments

6.1 Background – BSAI king and Tanner crab species

The BSAI king and Tanner crab FMP applies to commercial fisheries for red king crab, blue king crab, golden (or brown) king crab, Tanner crab, and snow crab.

Stock assessment authors were asked to review the current FMP text describing EFH for species or species complex for which they have responsibility. Authors were asked to review EFH text descriptions, level of EFH information, habitat information, and the list of literature. Authors suggested necessary changes and updates, if appropriate, for each life history stage and to suggest any information or literature that should be included in the EFH description. Authors were also asked to review and update, if appropriate, the habitat association tables from the FMP. Finally, authors were asked to review the current maps of EFH in the FMP and compare them to the new maps produced from the models described in section 3.1 and conclude whether existing maps adequately depict EFH for their species, or whether updated maps better represented EFH. The complete recommendations for each species, including maps, may be found in Appendix 3 of this document.

6.2 Description of Alternatives

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH descriptions in the FMP consistent with the stock assessment authors' bulleted recommendations in Section 7 of the Summary Report, NPFMC 2016. Replace the existing EFH maps in the FMP with the 95th percentile maps by season for each species and life stage as shown in Appendix 3.

6.2.1 Recommended revisions for individual species

- Authors suggest editorial revisions to descriptions of habitat types, general life history, and habitat descriptions for all crab species
- Updates to relevant trophic information
- Recommend use of updated maps to describe EFH
- Updates to habitat and biological associations
- Updates to habitat and diet tables
- Editorial revisions to fishery descriptions
- Updates to EFH description for red king crab early juveniles
- Updates to EFH description for blue king crab early juveniles
- Recommend Level 1 for early juvenile red king crab and blue king crab; other life stages remain unchanged
- Updates to habitat association table
- Updates to predator/prey associations table

At the October 2016 meeting, the Council moved to update EFH descriptions in the FMP consistent with the stock assessment authors' bulleted recommendations in Section 7 of the Summary Report, NPFMC 2016. The Council also moved to replace the existing EFH maps in the FMP with the 95th percentile maps by season for each species and life stage as shown in Appendix 3.

6.3 Expected effects of Alternatives

6.3.1 Alternative 1 – No action; status quo

In 2011, the Council and NMFS updated EFH for all species or complexes in the BSAI King and Tanner Crab FMP. The impacts analysis from the 2011 EA is incorporated here by reference. The no action alternative would result in no changes to EFH for any king or Tanner crab species in the BS. No changes to management would be necessary to minimize the adverse effects of fishing on EFH. Federal agencies authorizing or funding activities in the BS that may affect EFH would remain required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The overall impacts of the no action alternative are not significant.

6.3.2 Alternative 2 – Amend the FMP for BSAI King and Tanner Crabs to update EFH descriptions and replace maps

Alternative 2 will result in changes to the EFH descriptions and maps for BSAI king and Tanner stocks to incorporate new data, and new models to identify EFH based on habitat characteristics. None of the proposed changes would require regulatory action. No changes to management would be required to address the impacts of commercial fishing on EFH. In most cases, the total area defined as EFH for crab species in the BSAI increased compared to previous descriptions. Federal agencies that conduct, authorize, or fund activities in the area would still be required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The overall impacts of alternative 2 are not significant.

7 Action 4 – Salmon FMP Amendments

7.1 Background – Salmon species

The salmon species managed with the Salmon FMP include Chinook salmon, chum salmon, coho salmon, pink salmon, and sockeye salmon. Existing EFH was reviewed by a "review team" that consisted of scientists from the NOAA/AFSC and ADFG. As with other FMPs, the review team was asked to review EFH text descriptions, level of EFH information, habitat information, and the list of literature. Authors suggested necessary changes and updates, if appropriate, for each life history stage and to suggest any information or literature available since the 2012 revision that should be included in the EFH description. The team was also asked to review and update, if appropriate, the habitat association tables from the FMP. Finally, the team was asked to review the current maps of EFH in the FMP and compare them to the new maps produced from the models described in the Echave et al., 2012 Technical Memorandum and conclude whether existing maps adequately depict EFH for their species, or whether updated maps better represented EFH. The complete recommendations for each species, including maps, may be found in Appendix 4 of this document.

7.2 Description of Alternatives

Alternative 1 – No Action; status quo

Alternative 2 – Update only marine EFH descriptions in the FMP consistent with the stock assessment authors' recommendations in Section 9 of the Summary Report, NPFMC 2016. Replace the existing marine EFH maps in the FMP with the model-based maps for each species and life stage as shown in Appendix 4.

7.2.1 Recommended revisions for salmon species

The review team made the following recommendations:

- EFH remains at Level 1 designation
- Revisions to habitat descriptions
- Updated habitat association tables
- Adopt the summary information and maps in Echave et al. 2012 (EFH described with GAMs) to describe marine EFH for salmon

7.3 Expected effects of Alternatives

7.3.1 Alternative 1 – No action; status quo

Essential Fish Habitat for salmon was last updated in 2012. The no action alternative would result in no changes to EFH for any salmon species. No changes to management would be necessary to minimize the adverse effects of fishing on EFH. Federal agencies authorizing or funding activities in the BS that may affect EFH would remain required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The overall impacts of the no action alternative are not significant.

7.3.2 Alternative 2 – Amend the FMP for the Salmon Fisheries in the EEZ off Alaska to update marine EFH descriptions and replace maps

Alternative 2 will result in changes to the EFH descriptions and maps for all salmon stocks to incorporate new data, and new models to identify EFH based on habitat characteristics. None of the proposed changes would require regulatory action. The total area of marine EFH (all salmon species) decreased compared to previous descriptions. Federal agencies that conduct, authorize, or fund activities in the area would still be required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary, although the number of projects that require consultation may be reduced. The overall impacts of alternative 2 are not significant.

8 Action 5 – Arctic Management Area FMP Amendments

8.1 Background – Arctic species

The Arctic FMP describes EFH for Arctic cod, saffron cod, and snow crab.

For the EFH 5-year review, each stock assessment author was asked to review the current FMP text describing EFH for species or species complex for which they have responsibility. Authors were asked to review EFH text descriptions, level of EFH information, habitat information, and the list of literature. Authors suggested necessary changes and updates, if appropriate, for each life history stage and to suggest any information or literature available since the 2010 revision that should be included in the EFH description. Authors were also asked to review and update, if appropriate, the habitat association tables from the FMP. Finally, authors were asked to review the current maps of EFH in the FMP and compare them to the new maps produced from the models described in section 3.1 and conclude whether existing maps adequately depict EFH for their species, or whether updated maps better represented EFH. In some cases, existing maps are not available, or management has changed such that existing maps were inappropriate (e.g., species managed as complex rather than single species). In those cases, authors were asked to make that notation and make a recommendation to change EFH descriptions or maps. The complete recommendations may be found in Appendix 5.

8.2 Description of Alternatives

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH descriptions for all species in the FMP consistent with the stock assessment authors' recommendations in Section 10 of the Summary Report, NPFMC 2016. Replace the existing map for snow crab in Appendix B of the FMP with the map(s) recommended by the Scientific and Statistical Committee, as noted in their April 2016 minutes. See Appendix 5 for updated descriptions and map.

8.2.1 Recommended revisions for all species

What follows is a summary of responses from the stock authors.

- Author identified new information to describe EFH for Arctic and saffron cod eggs and larvae
- Author identified new information to describe benthic distribution of adult Arctic and saffron cod
- Created and revised habitat association tables for Arctic species

8.3 Expected effects of Alternatives

8.3.1 Alternative 1 – No action; status quo

Essential Fish Habitat for species in the Arctic was designated in 2009 when the Arctic FMP was published. The no action alternative would result in no changes to EFH for any arctic species. No changes to management would be necessary to minimize the adverse effects of fishing on EFH. Federal agencies authorizing or funding activities in the area that may affect EFH would remain required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The overall impacts of the no action alternative are not significant.

8.3.2 Alternative 2 – Update the FMP for Fish Resources in the Arctic Management Area to update EFH descriptions and replace map for snow crab

Alternative 2 will result in changes to the EFH descriptions for some Arctic stocks to incorporate new data to identify EFH. None of the proposed changes would require regulatory action. Federal agencies that conduct, authorize, or fund activities in the area would still be required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The overall impacts of alternative 2 are not significant.

9 Action 6 – EFH Conservation Recommendations for Non-Fishing Activities

9.1 Background

Non-fishing activities that may adversely affect EFH are very diverse and highly variable. For example, recent changes in regional climate patterns have altered sea ice distribution and sea surface temperatures. These changes have significantly influenced EFH attributes that support federally managed fisheries. Changing marine water condition has led to changes in trophic dynamics which have subsequently shifted the distribution and abundance of many fish species beyond historically recognized ranges. In some case these influences have led to reductions in the abundance and range of species depending on their life history requirements. More specific activities include impacts that may occur during the various phases of offshore oil and gas exploration, development and production. Other actions and impacts may result from harbor construction, navigation channel dredging, or fills and armoring near shore zones to support transportation infrastructure. The cumulative effects from multiple anthropogenic sources are also increasingly recognized as having synergistic effects that compile to degrade EFH attributes and associated ecosystem processes that support sustainable fisheries efforts.

The EFH regulations at 50 CFR 600.815(a)(4) specify that "FMPs must identify activities other than fishing that may adversely affect EFH." The regulations also specify that FMPs must identify actions to encourage the conservation and enhancement of EFH, including recommended options to avoid, minimize, or compensate for the adverse effects identified…especially in habitat areas of particular concern (50 CFR Part 600, Subpart K).

In 2005, Appendix G of the EFH EIS fulfilled the requirement to describe non-fishing activities that may have adverse effects on EFH and identify actions to encourage the conservation and enhancement of EFH. In 2010, NMFS Habitat Conservation Division (HCD) staff reviewed the original non-fishing activities evaluation in Appendix G of the EFH EIS and as abbreviated in the FMPs, and based on more recent scientific literature specific to Alaska, updated the analysis of each activity's potential to result in adverse impacts on EFH and recommended conservation measures to avoid, minimize, or compensate for adverse effects on EFH, as needed.

In 2016, NMFS HCD staff reviewed non-fishing activities from the 2011 report and concluded that much of the information remains relevant and requires simple updating. A new chapter presents a simple discussion of how climate change is influencing fisheries in Alaska. New introductions to chapters 3 through 6, were presented to illustrate the current scale and scope of EFH attributes in Alaska, but also our understanding of ecosystem processes the support various aspects of EFH, at the watershed and offshore scale. The body of literature addressing our current understanding of oil and gas development and spill response and response strategies has improved, so that section in chapter 6 was completely revised.

Non-fishing activities are already subject to a variety of regulations and restrictions under federal, state and local laws that would help minimize and avoid adverse effects of non-fishing activities on EFH. Therefore, the recommendations are general in nature and may overlap with certain existing standards for specific development activities. They are meant to highlight options to avoid, minimize, or compensate for adverse impacts and promote the conservation and enhancement of EFH. All of the suggested measures are not necessarily applicable to any one project or activity and are not binding on any action agency or permit applicant. Subject-specific recommendations are advisory and serve as proactive conservation measures that would help minimize and avoid adverse effects of these non-fishing activities

on EFH. Site-specific EFH Conservation Recommendations will be prepared per activity and as necessary during EFH Consultation [see: CFR 50 Part 600 Subpart K].

9.2 Description of Alternatives – New EFH Conservation Recommendations

Alternative 1 – No Action; status quo

Alternative 2 – Update EFH conservation recommendations for non-fishing activities in all Council FMPs.

For each of the non-fishing activities, staff reviewed each activity's potential to result in adverse impacts on EFH. Conservation measures are recommended to avoid, minimize, or compensate for adverse effects on EFH, if needed. The full 2016 Non-fishing Effects Report may be found in Appendix 6.

Table 5 identifies new EFH conservation recommendations that resulted from the review. Alternative 2 would add these conservation recommendations to each of the FMPs.

Table 5 New EFH Conservation Recommendations for Non-fishing Activities

Activity, Ecosystem Processes and/or EFH Attributes	**New Chapters, Sections, Information or EFH Conservation Recommendations in the 2017 review.** ***Previously existing sections with no changes from 2011, to Chapter Sections or EFH Recommendations, appear in italics.***
Chapter 1 - Section 1.4 Introduction: Purpose of the Document	**New Section** At the request of the NPFMC, Ecosystem Committee, Section 1.4 was added to explain how this report is compliant with and dovetails into other NOAA marine policy, directives and action plans. • NOAA Mission: Science, Service, and Stewardship: Responsibility for the stewardship of the nation's ocean and living marine resources and their habitat. • NOAA Strategic Plan: Presents commitment to represent marine ecosystems, our nation's coastline and marine resources, focusing on human wellbeing and sustainable fisheries. • NOAA Organizational Structure, Mission and Statutory Authority: Puts in motion a science-based, organizational structure to manage the nation's coastlines, oceans, atmosphere, and marine resources. • Alaska Fisheries Science Center (AFSC) Plan: Supports the need for continued scientific research to support EFH and sustainable fisheries. • AFSC Annual Guidance Memo: Reviews its scientific programs and focuses on those platforms that meet or exceed NOAA Fisheries mission critical goals. • Alaska EFH Research Plan: Coordinates Alaska EFH, Research Plan (Plan) with Science Center to fund research in support of EFH management needs.
Chapter 2 - Sections 2.1 – 2.3	**New Chapter and Sections** At the request of the NPFMC, present NOAA's current understanding of CC & OA. AKR-HCD framed the discussion in the context of marine ecosystem processes and fisheries.

Activity, Ecosystem Processes and/or EFH Attributes	New Chapters, Sections, Information or EFH Conservation Recommendations in the 2017 review. *Previously existing sections with no changes from 2011, to Chapter Sections or EFH Recommendations, appear in italics.*
Climate Change & Ocean Acidification (CC & OA)	• What is climate change and ocean acidification. • Basic atmospheric and oceanic carbon chemistry. • Recent projections from the Intergovernmental Panel on Climate Change (IPCC). • Metrics: Easily identified evidence versus not easily identified evidence. • Evidence of change in Alaska's Large Marine Ecosystems (LME). • Gulf of Alaska: Regime shifts and sea surface warming. • Bering Sea: Trophic dynamics and fish distributions. • Arctic: Atmosphere and ocean circulation, and sea ice declines • Potential adverse impacts • Conservation recommendations · Systematic sampling of a projects impacted region should be conducted to establish baseline measures of EFH indicators to discern between climate driven change or project driven impacts. · Data collection and monitoring efforts of key EFH indicators need to be established for the longest possible timeframes. · Key EFH indicators should be selected that represent; physical, chemical, and biological components, or can be the presence, absence, abundance, or distribution of key indicator species over time. · Mitigation measures and reasonable alternatives should consider impacts to EFH, indicators of fisheries under the long term pressing influence of climate change. · Foreseeable duration of monitoring should be commensurate with the project size, level of effect, and duration of project effects to EFH indicators. · Projects that will have decadal-scale effects should consult with or brief NMFS and the NPFMC for interpretation as to whether or not the activity will adversely affect any federally managed fishery resource. · Projects should include design alternatives to account for the potential of changing weather patterns, water levels, increased storm activity (buffering techniques), and exposure to higher energy environments. · Action agencies should hold combined meetings with local and regional biological resource managers and communities to detail climate change uncertainties, include communities and their resources at risk.
Chapter 3 – Sections 3.1 -3.3 Woodlands and Wetlands	**New Introduction and Sections** • Introduction and Current Condition • Alaska Metrics – Wetlands and Woodlands • Physical, Biological and Chemical Processes • Ecosystem Functions and Bio-chemical Processes
Chapter 3 – Sections 3.4	**Previously Existing Sections**
Upland Activities	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*

Activity, Ecosystem Processes and/or EFH Attributes	New Chapters, Sections, Information or EFH Conservation Recommendations in the 2017 review. *Previously existing sections with no changes from 2011, to Chapter Sections or EFH Recommendations, appear in italics.*
Silviculture	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Pesticides	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Urban & Suburban Development	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Transportation Infrastructure	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Chapter 4 – Sections 4.1-4.3 Headwaters, Streams, Rivers and Lakes	**New Introduction and Sections** • Introduction and Current condition • Alaska Metrics – Streams and Rivers • Physical, Biological and Chemical Processes • Ecosystem Functions and Bio-chemical Processes • Hyporheic EFH • Headwater EFH • Organic Nutrient • Marine Derived Nutrient • Riparian Zones • Hydrology and Water • Surface and Groundwater Regimes • Channel Morphology
Chapter 4 – Sections 4.4	**Previously Existing Sections**
Mining	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Mineral Mining	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Sand and Gravel	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Organic and Inorganic Debris	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Organic Debris Removal	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Inorganic Debris	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*

Activity, Ecosystem Processes and/or EFH Attributes	New Chapters, Sections, Information or EFH Conservation Recommendations in the 2017 review. *Previously existing sections with no changes from 2011, to Chapter Sections or EFH Recommendations, appear in italics.*
Dam Construction and Removal	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Commercial - Domestic Water	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Chapter 5 – Sections 5.1-5.3 Estuaries and Nearshore Zones	**New Introduction and Sections** • Introduction and Current Condition • Alaska Metrics – Estuaries and Nearshore Zones • Regional Coastal Ecosystems • Southeast and Gulf of Alaska • Aleutian Islands • Bering Sea • Arctic • Physical, Biological and Chemical Processes • Nearshore Fish Nurseries • Estuarine Processes • Terrestrial Carbon and Nitrogen • Ecosystem Functions and Bio-chemical Processes.
Chapter 5 – Sections 5.4	**Previously Existing Sections**
Dredging	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Material Disposal	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Disposal of Dredged Material	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Discharge of Fill Material	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Vessel Operations	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Invasive Species	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Pile Installation and Removal	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Pile Driving	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Flood Control	*Existing recommendations are adequate.* *Minor editorial comments.*

Activity, Ecosystem Processes and/or EFH Attributes	New Chapters, Sections, Information or EFH Conservation Recommendations in the 2017 review. *Previously existing sections with no changes from 2011, to Chapter Sections or EFH Recommendations, appear in italics.*
	New subject references and information provided.
Shoreline Protection	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Log Transfer Facilities	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
In-Water Log Storage	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Utility Cables and Pipelines	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Mariculture	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Alternative Energy	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Chapter 6 – Sections 6.1-6.3 Marine and Offshore Zones	**New Introduction and Sections** • Introduction and Current Condition • Alaska Metrics – Streams and Rivers • Large Marine Ecosystems (LMEs) • Gulf of Alaska • Eastern Bering Sea • Chukchi Sea • Beaufort Sea • Physical, Biological and Chemical Processes • Physical Oceanography • Currents through LME's • Shelf Breaks and Upwelling Nutrients • Role of Sea Ice • Marine Processes and Trophic Dynamics
Chapter 6 – Sections 6.4	**Previously Existing Sections**
Point Source Discharges	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Seafood Processing Waste	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Water Intake Structures	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
	Revised and Expanded Section

Activity, Ecosystem Processes and/or EFH Attributes	New Chapters, Sections, Information or EFH Conservation Recommendations in the 2017 review. *Previously existing sections with no changes from 2011, to Chapter Sections or EFH Recommendations, appear in italics.*
Oil and Gas Exploration, spill response and toxicology	• Different Phases - Exploration, Development, and Production, and difference disturbance mechanisms. • Seismic Disturbances, surveys vs operations. • Production Phase Discharges. • Oil Spills, viscosity and responses. • Polycyclic Aromatic Hydrocarbons (PAH's). • Nearshore versus Benthic Impacts • Spill Response Strategies and Mechanisms • Platform Decommissioning • Recommended Conservation Measures
Habitat Restoration, Enhancement	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*
Marine Mining	*Existing recommendations are adequate.* *Minor editorial comments.* *New subject references and information provided.*

9.3 Expected effects of Alternatives

9.3.1 Alternative 1 – No action; status quo

The no action alternative would result in no updates to the conservation recommendations for non-fishing activities Federal agencies that conduct, authorize, or fund activities in the area would still be required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary. The expected impacts of the no action alternative are not significant.

9.3.2 Alternative 2 – Update the EFH conservation recommendations for non-fishing activities in all Council FMPs

Under Alternative 2, recommendations for entities conducting non-fishing activities in EFH will be updated. Federal agencies that conduct, authorize, or fund activities in the area would still be required to consult with NMFS HCD to identify recommended measures, if necessary, to mitigate impacts to EFH that are more than minimal or not temporary.. There are no changes to regulations that will result from this alternative. The proposed action contemplated under Alternative 2 differs very little from the status quo, which was comprehensively analyzed in the EFH EIS (NMFS 2005), the EA implementing the Arctic FMP (NMFS 2009) and the 2010 EFH 5-year review. The expected impacts of Alternative 2 are not significant.

9.4 Outreach efforts for informing stakeholders of changes to the EFH conservation recommendations for non-fishing activities

NMFS Habitat Conservation Division (HCD) routinely informs stakeholders and the public of EFH consultation requirements through EFH Consultation training sessions, posting of NMFS official comment letters, and by making information readily accessible on the NMFS Website at https://alaskafisheries.noaa.gov/habitat/efh. HCD updated its "EFH Frequently Asked Questions" section of the website in October 2016.

EFH training occurs every couple of years or as specifically requested by interested parties. Specifically, NMFS invites federal, state, tribal, academic, and any interested consulting firms to attend EFH workshops. These discussions address how the Magnuson-Stevens Act, and associated EFH provisions, are applied to federal agencies, including NMFS, and their actions that may adversely affect EFH. A summary of fisheries management explains NMFS's role to manage healthy, sustainable fish stocks using a rigorous, public management process through the North Pacific Fishery Management Council. The training further details what is required of a federal action agency should they determine their activity may adversely affect EFH resources.

NMFS posts correspondence for actions where NMFS has offered comment to conserve EFH. NMFS' official comment letters give the public and natural resource developers, working with EFH, an idea as to what NMFS may specifically offer as EFH Conservation Recommendations. Posting occurs at: https://alaskafisheries.noaa.gov/habitat-consultations/search.

NMFS has presented the recommendations for non-fishing activities updates several times, including at the May 2016 National EFH Summit in Annapolis, Maryland. At the December 2016 Council meeting in Anchorage, NMFS presented the updated recommendations in front of the Council, Ecosystem Committee, Science and Statistical Committee, and at an evening meeting for the general public. Attendees were primarily agency (NOAA and U. S. Army Corps of Engineers), academia, or non-

governmental organization representatives. NMFS continued this public outreach by presenting the non-fishing activities update at the March 2017 American Fisheries Society Alaska Chapter meeting in Fairbanks, and April 2017 Western Alaska Interdisciplinary Science Conference in Dutch Harbor.

These many sources facilitate public access to use NMFS information for their decision making. Additionally, with respect to the proposed changes anticipated in this amendment, NMFS has contacted several of the resource development groups that provided comment on the non-fishing EFH conservation recommendations in the past (i.e., during the process culminating in the 2005 EFH EIS), to inform them that changes to the recommendations are being proposed. Some of the organizations that have been contacted include the Resource Development Council, Alaska Miners Association, Alaska Oil and Gas Association, and Alaska Forest Association. Comments from these and other stakeholders will be considered by the Council and NMFS prior to final action on this amendment.

10 Action 7 – HAPC

10.1 Background

Habitat Areas of Particular Concern (HAPC) are important tools for fishery managers. The HAPC process requires the consideration of adverse effects to sensitive and rare habitat areas exposed to stress from fishing or developmental activities. The Council works closely with NOAA Fisheries, stakeholders, and the public to identify HAPCs and to prepare conservation measures, as needed.

Essential Fish Habitat provisions provide a means for the Council to identify HAPCs. HAPCs are geographic sites that fall within the distribution of EFH for federally managed species. HAPCs are areas of special importance that may require additional protection from adverse fishing effects. EFH provisions provide a means for the Council to identify HAPCs (50 C.F.R. 600.815(a)(8)) within FMPs. Specific to fishery actions, HAPCs are areas within EFH that are rare and are either ecologically important, sensitive to disturbance, or may be stressed. Rarity is a mandatory criterion of all NPFMC HAPC proposals. Although the identification of HAPC is not required by statute or regulatory guidelines, the Council has a formalized process identified within its FMPs for selecting HAPCs.

In 2005, the Council revised its approach to designation of HAPC by adopting a site-based approach rather than habitat types, as had been the practice. In 2010 the Council chose to align the HAPC process with the EFH 5-year review cycle. However, the Council can initiate the HAPC process at any time if a specific need arises.

The HAPC process initiates when the Council sets management priorities. A subsequent request, or call, for HAPC proposals is issued. Any member of the public may submit a HAPC proposal. Potential contributors may include fishery management agencies, other government agencies, scientific and educational institutions, non-governmental organizations, communities, and industry groups. A call for proposals is announced during a Council meeting, published in the Federal Register, and advertised in the Council newsletter and other media such as the Council's website https://www.npfmc.org/. Scientific and technical information on habitat distributions, gear effects, fishery distributions, and economic data are accessible to the public. For example, NMFS' Alaska Region website https://alaskafisheries.noaa.gov has a number of valuable tools for assessing habitat distributions, understanding ecological importance, and assessing impacts. Information on EFH distribution, living substrate distribution, fishing effort, catch and bycatch data, gear effects, known or estimated recovery times of habitat types, prey species, and freshwater areas used by anadromous fish is provided in the EFH EIS (April 2005). The public would be advised of the rating criteria with the call for proposals.

The Council determines which of the proposals is forwarded for the next review step: scientific, socioeconomic, and enforcement review. The Council could then refer selected proposals to the Plan Teams, which evaluate the proposals for ecological merit.

A socioeconomic review of proposals would be conducted by Council or agency economists to assess socioeconomic impact. The Magnuson-Stevens Act states that EFH measures are to minimize impacts on EFH "to the extent practicable," thus socio-economic considerations have to be balanced against expected ecological benefits at the earliest point in the development of measures. NMFS' Final Rule for developing EFH plans states specifically that FMPs should "identify a range of potential new actions that could be taken to address adverse effects on EFH, include an analysis of the practicability of potential new actions, and adopt any new measures that are necessary and practicable" (50 CFR 600.815(a)(2)(ii)). In contrast to a process where the ecological benefits of EFH or HAPC measures are the singular initial focus and a later step is used to determine practicability, this approach would consider practicability simultaneously.

Proposals should also be rated on whether they identify affected fishing communities and the potential effects on those communities, employment, and earnings in the fishing and processing sectors and the related infrastructure, to the extent that such information is readily available to the public. Management and enforcement will also provide input during the review to evaluate general management cost and enforceability of individual proposals.

10.2 Description of Alternatives

Alternative 1 – No Action; status quo

Alternative 2 – Initiate HAPC proposal process

10.3 Expected effects of Alternatives

10.3.1 Alternative 1 – No action; status quo

The No Action Alternative will result in no call for HAPC nominations. The Council would not initiate any additional conservation or management recommendations for HAPC within the EFH described for all managed species in any of the FMPs. There would be no change to the status quo management of the current HAPC areas. The expected impacts of Alternative 1 are not significant.

10.3.2 Alternative 2 – Initiate HAPC proposal process

Alternative 2 would result in the Council initiating a call for HAPC nominations through a proposal process that focuses on specific sites consistent with the HAPC priorities designated by the Council. A subsequent NEPA analysis would be required for each potential action. The expected impacts of Alternative 2 are not significant.

11 Action 8 –Revision of EFH Priorities

11.1 Background – EFH research approach

One of the required components of the EFH provisions of each FMP is to include research and information needs. The Council's five FMPs (all except the Arctic FMP) include EFH research objectives, questions, activities, and a time frame, which were developed during the 2005 EFH EIS. During the 2010 5-year review of EFH, the Council's SSC provided a restated research objective and updated and expanded research activities.

The following is currently included as the research approach in the Council's FMPs. Underlined text indicates new text adopted during the 2010 review.

Objective

Establish a scientific research and monitoring program to understand the degree to which impacts have been reduced within habitat closure areas, and to understand how benthic habitat recovery of key species is occurring.

Research Questions

Reduce impacts. Does the closure effectively restrict higher-impact trawl fisheries from a portion of the GOA slope? Is there increased use of alternative gears in the GOA closed areas? Does total bottom trawl effort in adjacent open areas increase as a result of effort displaced from closed areas? Do bottom trawls affect these benthic habitats more than the alternative gear types? What are the research priorities? Are fragile habitats in the AI affected by any fisheries that are not covered by the new EFH closures? Are sponge and coral essential components of the habitat supporting FMP species?

Benthic habitat recovery. Did the habitat within closed areas recover or remain unfished because of these closures? Do recovered habitats support more abundant and healthier FMP species? If FMP species are more abundant in the EFH protection areas, is there any benefit in yield for areas that are still unfished without EFH protection?

Research Activities

- Fishing effort data from observers and remote sensing would be used to study changes in bottom trawl and other fishing gear activity in the closed (and open) areas. Effects of displaced fishing effort would have to be considered. The basis of comparison would be changes in the structure and function of benthic communities and populations, as well as important physical features of the seabed, after comparable harvests of target species are taken with each gear type.
- Monitor the structure and function of benthic communities and populations in the newly closed areas, as well as important physical features of the seabed, for changes that may indicate recovery of benthic habitat. Whether these changes constitute recovery from fishing or just natural ITEM C-4(1) MARCH/APRIL 2011 Public Review Draft, EFH Omnibus Amendments, February 2011 45 variability/shifts requires comparison with an area that is undisturbed by fishing and otherwise comparable.

- Validate the LEI model and improve estimates of recovery rates, particularly for the more sensitive habitats, including coral and sponge habitats in the Aleutian Islands region, possibly addressed through comparisons of benthic communities in trawled and untrawled areas.
- Obtain high resolution mapping of benthic habitats, particularly in the on-shelf regions of the Aleutian Islands.
- Time series of maturity at age should be collected to facilitate the assessment of whether habitat conditions are suitable for growth to maturity.
- In the case of red king crab spawning habitat in southern Bristol Bay, research the current impacts of trawling on habitat in spawning areas and the relationship of female crab distribution with respect to bottom temperature.

Research Time Frame

Changes in fishing effort and gear types should be readily detectable. Biological recovery monitoring may require an extended period if undisturbed habitats of this type typically include large or long-lived organisms and/or high species diversity. Recovery of smaller, shorter-lived components should be apparent much sooner.

Research priorities defined under this approach remain at status quo since the last 5-year EFH review.

In addition, the following three Council-related EFH Priorities were listed in the Council's recent review of 2017-2022 Research Priorities (https://www.npfmc.org/wp-content/PDFdocuments/resources/NPFMC_Research_Priorities_2017-2021.pdf).

1. Evaluate efficacy of habitat closure areas and habitat recovery. Establish a scientific research and monitoring program to understand the degree to which impacts on habitat, benthic infauna, etc., have been reduced within habitat closure areas, and to understand how benthic habitat recovery of key species is occurring. This research considered important for near term planning and is partially underway.

2. Investigate skate egg concentration areas as EFH and HAPC Skate conservation and skate egg concentration areas. This research remains a priority for EFH and HAPC management within Council and NMFS research plans. This research is considered important for near term planning. No action is currently being taken.

3. Develop a GIS relational database for habitat, including development of a historical time series of the spatial intensity of interactions between commercial fisheries and habitat. Such a time series would evaluate the impacts of changes in fishing effort and type on EFH. This research is considered strategic and evaluation is underway.

11.2 Description of Alternatives

Alternative 1 - No Action; status quo

Alternative 2 - Revise research priorities for EFH in all FMPs

Current research objectives and activities for EFH are unchanged from the last 5-year review. During initial review of this analysis in April 2017, the SSC may choose to adopt updated research objectives and activities, based on stock author suggestions. The Council would then decide whether to include those changes in FMP amendments.

As part of the 5-year review, each stock assessment author provided a stock-specific evaluation of EFH research needs. Although it is not proposed that this list of information should be included in the FMPs, it may be used by the Council in the development of the overall annual research priorities.

Table 6 Stock-specific research notes from stock authors

Bering Sea / Aleutian Island Species	Research Notes from Stock Author
pollock	The current understanding of habitat preference for walleye pollock in the Aleutian Islands is limited. The bottom trawl survey is likely not a good estimate for pollock distribution and abundance in the Aleutian Islands. Small-scale acoustic surveys show the pollock are associated with the shelf break and the majority of walleye pollock in the Aleutians would not be available to a summer bottom trawl survey (Barbeaux and Fraser 2007). To understand essential habitat for AI walleye pollock, more acoustic survey work needs to be conducted in the Aleutian Islands. Accompanying this work would be additional research on acoustic species identification would need to be completed to differentiate walleye pollock aggregations from Pacific ocean perch and other rockfish species. Studies to determine the impacts of environmental conditions such as temperature regime and gyre strength on AI walleye pollock are needed.
pacific cod	Improved consistency for 'size at age' to identify life history stages.
sablefish	Given the high movement rates and widespread distribution of Alaska Sablefish, it is unlikely that fine-scale habitat preferences exist for Alaska Sablefish (Hanselman et al. 2015). Little is known about actual spawning locations for Alaska Sablefish and that would be useful to guide further determination of which habitat is Essential. There is limited information on the distribution and habitat requirements of eggs, larvae, and late juveniles. There is insufficient information on early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. Planktonic larvae have been found up to 500 km from shore, usually in upper water column (neuston), but little is known of the distribution of Alaska Sablefish until they are about 3 years old and appear in fishery and surveys. Studies to understand the recruitment dynamics of Alaska Sablefish as they relate to habitat are being conducted during the GOA Integrated Ecosystem Project but may need to continue after that Project concludes.
yellowfin sole	The EFH analysis has shown that there are some localized areas of higher habitat reduction in the Bering Sea and has estimated their cumulative effect on flatfish life history traits. However, there is limited information available on the distributions of eggs, larvae, juveniles or adults in these disturbed versus undisturbed areas necessary to contrast the success or failures in the breeding, feeding and growth to maturity of Bering Sea flatfish. Studies to provide and analyze this information are needed. In addition, information on the distribution and habitat requirements of eggs, larvae and newly metamorphosized juveniles and the variability of their stage duration are needed.
greenland turbot	Recruitment and survival processes controlled by environmental conditions are not fully understood and the distribution of early juvenile stages are mostly unknown. Climate change will likely impact this species substantially since it appears that larvae and/or juvenile survival may be positively correlated with the size of the cold-pool and overall shelf conditions (Barbeaux *et al.* 2016). Further research on habitat requirements of sub-adults and ontogenetic migration within this species and the impacts of climate on these processes and necessary habitat conditions are needed.
arrowtooth flounder	More information about the location and behavior associated with spawning and the distribution of larvae and early juvenile stages would be helpful for determining essential habitat for arrowtooth flounder in the Bering Sea and Aleutian Islands. Modeling studies of early life history of arrowtooth flounder have been performed for the Gulf of Alaska (Stockhausen, W. AFSC, pers. comm)
kamchatka flounder	The EFH analysis has shown that there are some localized areas of higher habitat reduction in the Bering Sea and has estimated their cumulative effect on flatfish life history traits. However, there is limited information available on the distributions of eggs, larvae, juveniles or adults in these disturbed versus undisturbed areas necessary to contrast the success or failures in the breeding, feeding and growth to maturity of Bering Sea flatfish. Studies to provide and analyze this information are needed. In addition, information on the distribution and habitat requirements of eggs, larvae and newly metamorphosized juveniles and the variability of their stage duration are needed.
northern rock sole	The EFH analysis has shown that there are some localized areas of higher habitat reduction in the Bering Sea and has estimated their cumulative effect on flatfish life history traits. However, there is limited information available on the distributions of eggs, larvae, juveniles or adults in these disturbed versus undisturbed areas necessary to contrast the success or failures in the breeding, feeding and growth to maturity of Bering Sea flatfish. Studies to provide and analyze this information are needed. In addition, information on the distribution and habitat requirements of eggs, larvae and newly metamorphosized juveniles and the variability of their stage duration are needed.
southern rock sole	The EFH analysis has shown that there are some localized areas of higher habitat reduction in the Bering Sea and has estimated their cumulative effect on flatfish life history traits. However, there is limited information available on the distributions of eggs, larvae, juveniles or adults in these disturbed versus undisturbed areas necessary to contrast the success or failures in the breeding, feeding and growth to maturity of Bering Sea flatfish. Studies to provide and analyze this information are needed. In addition, information on the distribution and habitat requirements of eggs, larvae and newly metamorphosized juveniles and the variability of their stage duration are needed.

Bering Sea / Aleutian Island Species	Research Notes from Stock Author
flathead sole	More information on flathead sole habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Better habitat mapping of the Bering Sea and Aleutian Islands would provide information for survey stratification and the extent of trawlable and untrawlable habitat. There is limited information on the distribution and habitat requirements of eggs, larvae, and late juveniles. There is insufficient information on early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. Little is known of the distribution of flathead sole until they are about 2 years old and appear in fishery and surveys. Flathead sole catchability appears to vary with temperature and with the extent of the cold pool. Further studies on the linkage between temperature and flathead sole habitat preferences are needed.
alaska plaice	The EFH analysis has shown that there are some localized areas of higher habitat reduction in the Bering Sea and has estimated their cumulative effect on flatfish life history traits. However, there is limited information available on the distributions of eggs, larvae, juveniles or adults in these disturbed versus undisturbed areas necessary to contrast the success or failures in the breeding, feeding and growth to maturity of Bering Sea flatfish. Studies to provide and analyze this information are needed. In addition, information on the distribution and habitat requirements of eggs, larvae and newly metamorphosized juveniles and the variability of their stage duration are needed.
rex sole	More information on Bering Sea rex sole habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Studies to determine impacts of environmental indicators such as temperature regime on rex sole are needed. More information on Aleutian Islands rex sole habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Studies to determine impacts of environmental indicators such as temperature regime on rex sole are needed.
dover sole	More information on Bering Sea Dover sole habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Studies to determine impacts of environmental indicators such as temperature regime on Dover sole are needed. More information on Aleutian Islands Dover sole habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Studies to determine impacts of environmental indicators such as temperature regime on Dover sole are needed.
Pacific ocean perch	Research on the densities of rockfish in untrawlable and trawlable habitats are ongoing and should remain a priority. The results of this research should help in estimating the proportion of POP in untrawlable grounds, and thus improve stock assessments. Estimates of densities in untrawlable grounds can be obtained from acoustic and optical sampling gear, and much of the field work to date using these sampling tools has focused on the GOA (where the GOA acoustic survey provides a sampling platform). Extending these field sampling of untrawlable habitats to the Aleutian Islands and the EBS slope would improve the BSAI stock assessment.
northern rockfish	Research on the densities of rockfish in untrawlable and trawlable habitats are ongoing and should remain a priority. The results of this research should help in estimating the proportion of northern rockfish in untrawlable grounds, and thus improve stock assessments. Estimates of densities in untrawlable grounds can be obtained from acoustic and optical sampling gear, and much of the field work to date using these sampling tools has focused on the GOA (where the GOA acoustic survey provides a sampling platform). Extending this field sampling of untrawlable habitats to the Aleutian Islands and the EBS slope would improve the BSAI stock assessment.
shortraker rockfish	More information is needed on habitat use of various life stages of shortraker rockfish in the BSAI. Information on the distribution and habitat use of the various life-history stages would improve our knowledge of stock productivity and population dynamics. Also, efforts should be made to estimate population abundance in “trawlable” and “untrawlable” habitats, and their relative trends over time. A concern with our trawl surveys is that we implicitly assume the trawlable habitats (where we have data) are equivalent to the untrawlable habitats.
blackspotted rockfish	See rougheye rockfish
rougheye rockfish	Research on the densities of rockfish in untrawlable and trawlable habitats are ongoing and should remain a priority. The results of this research should help in estimating the proportion of blackspotted/rougheye rockfish in untrawlable grounds, and thus improve stock assessments. Estimates of densities in untrawlable grounds can be obtained from acoustic and optical sampling gear, and much of the field work to date using these sampling tools has focused on the GOA (where the GOA acoustic survey provides a sampling platform). Extending this field sampling of untrawlable habitats to the Aleutian Islands and the EBS slope would improve the BSAI stock assessment.
dusky rockfish	AI only- More information on Aleutian Islands dusky rockfish habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Studies to determine impacts of environmental indicators such as temperature regime on dusky rockfish are needed.
yelloweye rockfish	No specific research items.

Bering Sea / Aleutian Island Species	Research Notes from Stock Author
hareliquin rockfish	AI only - More information on Aleutian Islands harlequin rockfish habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Studies to determine impacts of environmental indicators such as temperature regime on harlequin rockfish are needed.
thornyhead rockfish (shortspine)	More information on Bering Sea shortspine thornyhead habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Studies to determine impacts of environmental indicators such as temperature regime on shortspine thornyhead are needed.
atka mackerel	More information on Atka mackerel habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Better habitat mapping of the Aleutian Islands would provide information for survey stratification and the extent of trawlable and untrawlable habitat. There is limited information on the distribution and habitat requirements of eggs, larvae, and late juveniles. There is insufficient information on early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. Planktonic larvae have been found up to 800 km from shore, usually in upper water column (neuston), but little is known of the distribution of Atka mackerel until they are about 2 years old and appear in fishery and surveys. Studies to determine the impacts of environmental indicators such as temperature regime on Atka mackerel are needed.
squid	No research items identified.
octopus	More information on Bering Sea octopus habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. There is limited information on the seasonal or spatial distribution and habitat requirements of mating adults, females incubating eggs, planktonic paralarvae, or benthic juveniles. In general, little is known about the breeding season, growth rates, and time to maturity for octopus populations in the Bering Sea. Much more would need to be known in order to determine impacts of environmental indicators such as temperature regime on octopus. More information on Aleutian Islands octopus habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. There is limited information on the seasonal or spatial distribution and habitat requirements of mating adults, females incubating eggs, planktonic paralarvae, or benthic juveniles. In general, little is known about the breeding season, growth rates, and time to maturity for octopus populations in the Aleutian Islands. Much more would need to be known in order to determine impacts of environmental indicators such as temperature regime on octopus.
sharks Pacific sleeper shark spiny dogfish and salmon shark	Species are quite different from one another and subject to severe data limitations for the stock assessments and assessment of essential fish habitat. Pacific sleeper shark are a large species and difficult to study. To date, no mature Pacific sleeper sharks have been observed on any AFSC surveys and data to assess EFH is limited. Thus, it is not possible to know what habitats the adults inhabit. Juveniles occur in many areas, both survey and fishery, and multiple gear types. However, given the large size and highly mobile nature of the animal, it is difficult to discern if any specific habitat is essential. Neonates have not been encountered, thus nursery areas have not been identified. Essential fish habitat for the life history stages of spiny dogfish are also unknown. Near term females have been observed in some bays in Alaska, but neonates have not been encountered. Adults are highly migratory and habitat use is unknown. Salmon shark are a pelagic species, with little data available from AFSC surveys or fisheries to inform EFH analyses. Further, this species is highly migratory and likely spends a significant portion of time outside of Alaskan waters.
sculpins (Great, Yellow Irish Lord, Bigmouth)	There is a need for research on sculpin habitat utilization throughout their life history stages. It is also not known whether bottom trawling negatively impacts the habitat of adult sculpins.
skates (Alaska, Bering, Aleutian, Mud)	Bering Sea skate EFH research priorities 1. Determine how adult Alaska skates are using nursery areas (e.g. are nursery areas visited once or multiple times? Is there a seasonal pattern to deposition of eggcases in nursery areas? 2. Determine ontogenetic patterns in habitat use by Alaska skates, i.e. juvenile vs adult use of EBS shelf habitats. 3. Determine the effects of bottom contact gear on embryos and eggcases in known nursery areas. Aleutian Islands skate EFH research priorities 1. Identify nursery areas for skates (particularly whiteblotched, Alaska, and Aleutian skates) in the Aleutian Islands and associated habitat characteristics (e.g. depth, sediment type). 2. Identify the potential for movement of skates within the Aleutian Islands (e.g. through conventional or satellite tagging).
forage fish complex	No research items identified.

Bering Sea / Aleutian Island Species	Research Notes from Stock Author
grenadiers	Despite their abundance, giant grenadier <15 years old are nearly absent from surveys. Their habitat use from the larval stage through their appearance on the continental slope at ~ age 15 is unknown. It is not possible to tag grenadiers and track their movements and habitat use because they experience 100% mortality when brought to the surface. Therefore, it is unknown they use the water column or if they migrate during any life phases. Over 90% of giant grenadier caught in surveys are females and there is very little data on where males are distributed, but it is thought they reside in deeper waters (>1,000 m), at least during the summer months when survey occur. Information is needed for early life stages.

Gulf of Alaska Species	Research notes from Stock Authors
pollock	In general, little is known about the pollock juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. For example, it is unclear whether pollock during the juvenile stage temporarily adopt a more demersal distribution, and if so, what are the habitat requirements of this stage. Studies to determine the impacts of environmental factors on pollock growth and maturation are needed. Pollock fisheries in the GOA use mostly mid-water trawls. Studies of bottom contact with mid-water trawls have been conducted in the eastern Bering Sea, but not in the Gulf of Alaska, where the range of bottom types is different and smaller mid-water trawls are used. Studies specific to the Gulf of Alaska are needed.
pacific cod	The current understanding of habitat preference for Pacific cod by life stage in the Gulf of Alaska is limited. More information on ontogenetic preferences and requirements of GOA Pacific cod would be useful to improve our understanding of GOA Pacific cod EFH. In addition, a better understanding of the differences in GOA Pacific cod survey selectivity and availability between trawlable and untrawlable habitat would substantially enhance our understanding of fishery impacts on Pacific cod EFH. Studies to determine the impacts of environmental conditions such as temperature regime and gyre strength on GOA Pacific cod are needed.
sablefish	Given the high movement rates and widespread distribution of Alaska Sablefish, it is unlikely that fine-scale habitat preferences exist for Alaska Sablefish (Hanselman et al. 2015). Little is known about actual spawning locations for Alaska Sablefish and that would be useful to guide further determination of which habitat is Essential. There is limited information on the distribution and habitat requirements of eggs, larvae, and late juveniles. There is insufficient information on early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. Planktonic larvae have been found up to 500 km from shore, usually in upper water column (neuston), but little is known of the distribution of Alaska Sablefish until they are about 3 years old and appear in fishery and surveys. Studies to understand the recruitment dynamics of Alaska Sablefish as they relate to habitat are being conducted during the GOA Integrated Ecosystem Project but may need to continue after that Project concludes.
yellowfin sole	No research items identified.
arrowtooth flounder	Research on whether arrowtooth flounder are broadcast or batch spawners would be helpful. It would also be informative to know the role of arrowtooth flounder, if any, in the pelagic zone.
northern rock sole	Difficult to consistently differentiate southern rock sole from northern rock sole. As such, the analysis to determine the seasonal distribution of southern rock sole was done on the combined *Lepidopsetta* spp. Future sampling efforts should include genetic analysis to better determine misidentification of the two species by the observer and survey programs and to better understand the composition of the unknown category.
southern rock sole	See northern rock sole
flathead sole	More information on flathead sole habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Better habitat mapping of the GOA would provide information for survey stratification and the extent of trawlable and untrawlable habitat. There is limited information on the distribution and habitat requirements of eggs, larvae, and late juveniles. There is insufficient information on early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. Little is known of the distribution of flathead sole until they are about 2 years old and appear in fishery and surveys. Studies to determine the impacts of environmental indicators such as temperature regime on GOA flathead are needed.
alaska plaice	No research items identified.
rex sole	More information on rex sole habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Better habitat mapping of the GOA would provide information for survey stratification and the extent of trawlable and untrawlable habitat. There is limited information on the distribution and habitat requirements of eggs, larvae, and late juveniles. There is insufficient information on early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. Little is known of the distribution of rex sole until they are about 2 years old and appear in fishery and surveys. Studies to determine whether rex sole grow faster in some areas than in other areas and what habitat attributes may contribute to these differences would be useful as well.

Gulf of Alaska Species	Research notes from Stock Authors
dover sole	More information on Dover sole habitat preferences would be useful to improve our understanding of EFH. Better habitat mapping of the GOA would provide information for survey stratification and the extent of trawlable and untrawlable habitat. There is limited information on the distribution and habitat requirements of eggs, larvae, and late juveniles. There is insufficient information on early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. Little is known of the distribution of Dover sole until they are about 3 years old and appear in fishery and surveys.
Pacific ocean perch	More information on POP habitat preferences, particularly by season, would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Adults are found primarily offshore on the outer continental shelf and the upper continental slope in depths of 150-420 m. Seasonal differences in depth distribution have been noted by many investigators. In the summer, adults inhabit shallower depths, especially those between 150 and 300 m. In the fall, the fish apparently migrate farther offshore to depths of ~300-420 m. They reside in these deeper depths until about May, when they return to their shallower summer distribution (Love et al. 2002). This seasonal pattern is probably related to summer feeding and winter spawning. Better habitat mapping of the Gulf of Alaska would also be desirable and would provide information for survey stratification and the extent of trawlable and untrawlable habitat, a concern that is applicable to most rockfish species in the GOA. The distribution and habitat requirements during the early life history stages of GOA POP are limited. The species appears to be viviparous (the eggs develop internally and receive at least some nourishment from the mother), with internal fertilization and the release of live young. Insemination occurs in the fall, and sperm are retained within the female until fertilization takes place ~2 months later. The eggs hatch internally, and parturition (release of larvae) occurs in April-May. Information on early life history is very sparse, especially for the first year of life. POP larvae are thought to be pelagic and drift with the current, and oceanic conditions may sometimes cause advection to suboptimal areas (Ainley et al. 1993) resulting in high recruitment variability. There is also insufficient information on distribution and habitat requirements of early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem until they are about 2 years old and appear in fishery and surveys. Studies to determine the impacts of environmental indicators such as temperature regime on POP are needed.
northern rockfish	More information on northern rockfish habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Previous studies have identified the highest concentrations of northern rockfish in the NMFS bottom trawl surveys are associated with relatively rough bottom on shallow rises or banks on the outer continental shelf at depths of about 75-150 m (Clausen and Heifetz 2002), which is consistent with the CEA resulting here. However, better habitat mapping of the Gulf of Alaska would provide information for survey stratification and the extent of trawlable and untrawlable habitat, a concern that is also discussed in the research priorities for northern rockfish stemming from highly variable and uncertain bottom trawl survey abundance estimates (Hulson et al. 2015). The distribution and habitat requirements of GOA northern rockfish larvae are unknown. Like other *Sebastes* species, northern rockfish are presumed to be ovoviviparous with internal fertilization, although, larval northern rockfish cannot be unequivocally identified to species at this time, even using genetic techniques, so information on larval distribution and length of the larval stage is unknown. There is also insufficient information on distribution and habitat requirements of early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem until they are about 2 years old and appear in fishery and surveys. Studies to determine the impacts of environmental indicators such as temperature regime on northern rockfish are needed.
shortraker rockfish	More information on shortraker rockfish habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. There is little to no information on larval, post-larval, or juvenile shortraker rockfish, especially juveniles. Genetic techniques were used to identify a small number of post-larval shortraker rockfish from samples collected in epipelagic waters far offshore in the GOA, which is the only documentation of habitat for this life stage. No data exist on when juvenile fish become demersal in the GOA; in fact, few specimens of juvenile shortraker rockfish <35 cm fork length (FL) have ever been caught in this region, so information on this life stage is virtually absent. Studies are needed to locate and sample these young fish before their habitat requirements can be determined. In general, little is known about the distribution, habitat requirements, and interaction with other components of the ecosystem of shortraker rockfish < 35 cm FL, the smallest size they begin to appear in the fishery and surveys. Although more is known about adult fish, the specifics of their habitat requirements need further research and would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. For example, does a relationship exist between adult shortraker rockfish and Primnoa coral, and if so, to what degree of importance? More research needs to be done on the bottom habitat of the major fishing grounds to describe what biota are found on these grounds, and on what impact bottom trawling has on these biota.
blackspotted rockfish	See rougheye rockfish
rougheye rockfish	More information on RE/BS rockfish habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. There is little to no information on larval, post-larval, or juvenile RE/BS rockfish. No data exist on when juvenile rockfish become demersal in the GOA. Studies are needed to

Gulf of Alaska Species	Research notes from Stock Authors
	locate and sample these young fish before their habitat requirements can be determined. In general, little is known about the distribution, habitat requirements, and interaction with other components of the ecosystem of RE/BS rockfish prior to when they begin to appear in the fishery and surveys. Although more is known about adult fish, the specifics of their habitat requirements need further research and would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. More research needs to be done on the bottom habitat of the major fishing grounds to describe what biota are found on these grounds, and on what impact bottom trawling has on these biota.
dusky rockfish (dark)	More information on dusky rockfish habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. A better understanding of what particular biota is preferred may help understand impacts of bottom disturbance by fishing gear. Improved knowledge of juvenile habitat requirements would help us understand the habitat requirements of different life stages thus improving our ability to evaluate the effects of fishing.
thornyhead rockfish (shortspine)	More information on shortspine thornyhead habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. Unlike rockfish in the genus *Sebastes*, which retain fertilized eggs internally and release hatched, fully developed larvae, thornyheads spawn a bi-lobed mass of fertilized eggs which floats in the water column. Once the pelagic egg masses hatch, larval and juvenile thornyheads spend far more time in a pelagic life stage than the young of year rockfish in the genus *Sebastes*. Shortspine thornyhead juveniles spend 14-15 months in a pelagic phase. Shortspine thornyhead juveniles tend to settle into relatively shallow benthic habitats between 100 and 600 m and then migrate deeper as they grow. Studies to determine the impacts of environmental indicators such as temperature regime, especially during the egg, larval, and juvenile stage, are needed.
black rockfish	No research items identified. Completed by ADF&G.
Other Rockfish Yelloweye greenstripped harlequin pygmy quillback redbandeded redstripped rosethorn silvergray sharpshin	More information on OR/DSR habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. There is limited information on the distribution and habitat requirements of eggs, larvae, and late juveniles. There is insufficient information on early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. Planktonic larvae have been found up to 800 km from shore, usually in upper water column (neuston), but little is known of the distribution of OR/DSR until they are about 2 years old and appear in fishery and surveys. Studies to determine the impacts of environmental indicators such as temperature regime on OR/DSR are needed.
atka mackerel	More information on Atka mackerel habitat preferences would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. There is limited information on the distribution and habitat requirements of eggs, larvae, and late juveniles. There is insufficient information on early juveniles. In general, little is known about the early juvenile stage distribution, habitat requirements, and interaction with other components of the ecosystem. Planktonic larvae have been found up to 800 km from shore, usually in upper water column (neuston), but little is known of the distribution of Atka mackerel until they are about 2 years old and appear in fishery and surveys. Studies to determine the impacts of environmental indicators such as temperature regime on Atka mackerel are needed.
squid	No research items identified.
octopus	More information on Gulf of Alaska octopus habitat preferences at different life stages and seasons would be useful to improve our understanding of EFH, particularly in localized areas of higher habitat reduction. There is limited information on the seasonal or spatial distribution and habitat requirements of mating adults, females incubating eggs, planktonic paralarvae, or benthic juveniles. In general, little is known about the breeding season, growth rates, and time to maturity for octopus populations in the Gulf of Alaska. Much more would need to be known in order to determine impacts of environmental indicators such as temperature regime on octopus.
Sharks Pacific sleeper shark spiny dogfish and salmon shark	Species are quite different from one another and subject to severe data limitations for the stock assessments and assessment of essential fish habitat. Pacific sleeper shark are a large species and difficult to study. To date, no mature Pacific sleeper sharks have been observed on any AFSC surveys and data to assess EFH is limited. Thus, it is not possible to know what habitats the adults inhabit. Juveniles occur in many areas, both survey and fishery, and multiple gear types. However, given the large size and highly mobile nature of the animal, it is difficult to discern if any specific habitat is essential. Neonates have not been encountered, thus nursery areas have not been identified. Essential fish habitat for the life history stages of spiny dogfish are also unknown. Near term females have been observed in some bays in Alaska, but neonates have not been encountered. Adults are highly migratory and habitat use is unknown. Salmon shark are a pelagic species, with little data available from AFSC surveys or fisheries to inform EFH analyses. Further, this species is highly migratory and likely spends a significant portion of time outside of Alaskan waters.

Gulf of Alaska Species	Research notes from Stock Authors
sculpins (Great, Yellow Irish Lord, Bigmouth)	There is a need for research on sculpin habitat utilization throughout their life history stages. It is also not known whether bottom trawling negatively impacts the habitat of adult sculpins.
skates (Alaska, Bering, Aleutian)	Gulf of Alaska skate EFH research priorities 1. Identify nursery areas for skates (particularly big and longnose skates) in the Gulf of Alaska and associated habitat characteristics (e.g. depth, sediment type). 2. Identify the potential for movement of skates (particularly big and longnose skates) within the Gulf of Alaska (e.g. through conventional or satellite tagging).
forage fish complex	No research items identified.
grenadiers	Despite their abundance, giant grenadier <15 years old are nearly absent from surveys. Their habitat use from the larval stage through their appearance on the continental slope at ~ age 15 is unknown. It is not possible to tag grenadiers and track their movements and habitat use because they experience 100% mortality when brought to the surface. Therefore, it is unknown they use the water column or if they migrate during any life phases. Over 90% of giant grenadier caught in surveys are females and there is very little data on where males are distributed, but it is thought they reside in deeper waters (>1,000 m), at least during the summer months when survey occur. Information is needed for early life stages.

Bering Sea & Aleutian Island Crab	Research Notes from Stock Authors
Red king crab	The stock assessment author suggests that additional analysis is required for Bristol Bay red king crab to adequately assess potential changes needed for this stock.
Blue king crab	No research items identified.
Golden king crab	No research items identified.
Tanner crab	No research items identified.
Snow crab	No research items identified.

11.3 – Expected effects of Alternatives

11.3.1 Alternative 1 – No action; status quo

Under Alternative 1, the research priorities related to EFH in the Council's FMPs would not be updated. The research priorities identified in the 2010 EFH review would remain. The expected impacts of Alternative 1 are not significant.

11.3.2 Alternative 2 – Revise research priorities for EFH in all FMPs

Under Alternative 2, the research priorities related to EFH in the Council's FMPs would be updated according to the recommendation from the SSC, based on the information from stock assessment authors noted above. No changes to management would be required. None of the proposed changes would require regulatory action. The expected impacts of Alternative 2 are not significant.

12 Effects of Fishing on EFH

12.1 Background

In 2005, the Council amended five of its FMPs (BSAI Groundfish FMP, GOA Groundfish FMP, BSAI Crab FMP, Scallop FMP, and Salmon FMP) to address MSA requirements for EFH. The Council and NMFS developed a comprehensive environmental impact statement (NMFS 2005) evaluating alternatives and environmental consequences for three actions: (1) describing and identifying EFH for fisheries managed by the Council; (2) adopting an approach for the Council to identify Habitat Areas of Particular Concern within EFH; and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. With respect to the description and identification of EFH, it was identified that the action could have indirect negative effects for the industries and other entities that may face requirements (for federally managed fishing activities) or recommendations (for non-fishing activities) that are designed to protect fish habitats. It was also identified that there could be indirect positive effects for the habitats and species that could be protected by measures resulting indirectly from EFH description and identification. Such measures would include either required measures to minimize adverse effects of fishing on EFH or recommended measures to minimize effects of non-fishing activities on EFH.

The Council is required to minimize adverse effects of fishing on EFH that are more than minimal and not temporary in nature. The 2005 analysis concluded that no Council-managed fishing activities have more than minimal and temporary adverse effects on EFH. Nonetheless, in 2005, the Council initiated a variety of practicable and precautionary measures to conserve and protect EFH.

Fishing effects on EFH were reconsidered in the 2010 EFH 5-year review. The various factors that input to the fishing effects model used for the 2005 EFH EIS were considered and compared against new information available in 2010. The analysis found that the proposed amendments would result in relatively minor changes to the existing EFH descriptions, with none of the proposed changes requiring regulatory action. Fishing intensity had decreased overall, with moderate shifts causing increases or decreases in relatively limited areas, and there were no substantial changes to the model or otherwise that raised concerns for the effects of fishing on FMP managed species. Therefore, the 2010 EFH 5-year review concluded that no change to the 2005 conclusions on the evaluation of fishing effects on EFH was warranted based on new information from the preceding 5 years. The 2005 impacts analysis was incorporated by reference, including the discussions of uncertainty that were fully disclosed and analyzed in that document.

12.2 Impacts Assessment

During the current EFH review cycle, the Council requested updates to the model to predict the impacts of fishing on EFH. The Fishing Effects (FE) model was developed by the Alaska Regional Office – HCD and scientists at Alaska Pacific University to make input parameters more intuitive and to draw on the best available data. Like the previous Long-term Effects Index (LEI) model, the Fishing Effects model is run on 25km2 grid cells throughout the BS, AI, and GOA. It is based on the interaction between habitat impacts and recovery, which depends on the amount of fishing effort, the types of gear used, habitat sensitivity, and substrate. The FE model updates the LEI model in the following ways:

- The FE model is cast in a discrete time framework. Rates such as impact or recovery are defined over a specific time interval, compared to the LEI model which used continuous time. Using discrete time makes fishing impacts and habitat recovery more intuitive to interpret compared to continuous time.

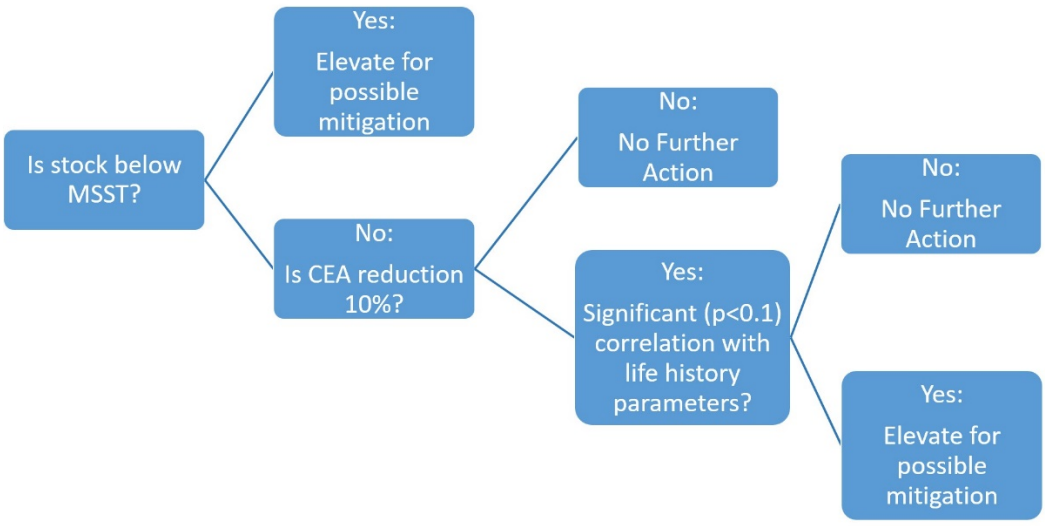
- The FE model implements sub annual (monthly) tracking of fishing impacts and habitat disturbance. While this was theoretically possible in the LEI model, the LEI model was developed primarily to estimate long term habitat disturbance given a constant rate of fishing and recovery. The FE model allows for queries of habitat disturbance for any month from the start of the model run (January 2003). This aids in the implications of variable fishing effort within season and among years.
- The FE model draws on the spatially explicit Catch-In-Areas (CIA) database to use the best available spatial data of fishing locations. The CIA database provides line segments representing the locations of individual tows or other bottom contact fishing activities. This provides a more accurate allocation of fishing effort among grid cells. In comparison, the LEI model used haulback locations summarized to the 25km2 grids to represent fishing activity. The description of fishing gears that may contact benthic habitat was also greatly improved with significant input from fishing industry representatives.
- The FE model incorporates an extensive, global literature review from Grabowski et al. (2014) to estimate habitat susceptibility and recovery dynamics. The FE model identifies 27 unique biological and geological habitat features and incorporates impact and recovery rates to predict habitat reduction and recovery over time. The FE model is also designed to be flexible to produce output based on any single habitat feature or unique combination of features.

Once the FE model has been run and a surface of predicted habitat reduction is produced, the 95% species descriptions for each species can be used as a mask and the cumulative fishing effect on that species can be calculated. It is important to note that because the FE model incorporates both impact to and recovery of benthic structures, the calculated habitat reduction for any grid is the cumulative value at that point in time.

12.3 Impacts Assessment Methods

In December 2016, the Council approved a three-tiered method to evaluate whether there are adverse effects of fishing on EFH (Figure 1). This analysis considers impacts of commercial fishing first at the population level, then uses objective criteria to determine whether additional analysis is warranted to evaluate if habitat impacts caused by fishing are adverse and more than minimal or not temporary.

Figure 1 Three-tiered method to evaluate effects of fishing on Essential Fish Habitat in Alaska.



Because EFH is defined for populations managed by Council FMPs, stock authors first considered whether the population is above or below the Minimum Stock Size Threshold (MSST), defined as 0.5*MSY stock size, or the minimum stock size at which rebuilding to MSY would be expected to occur within 10 years if the stock were exploited at the Maximum Fishing Mortality Threshold (MFMT). Stock authors were asked to identify any stock that is below MSST for review by the Plan Teams. Mitigation measures may be recommended by the Plan Team if they concur that there is a plausible connection to reductions of EFH as the cause.

To investigate the potential relationships between fishing effects and stock production, the stock assessment authors examined trends in life history parameters and the amount of disturbed habitat in the "core EFH Area" (CEA) for each species. The CEA is identified as the predicted 50 percent quantile threshold of suitable habitat or summer abundance (Laman et al. 2015, Turner et al. 2015, Rooney et al. 2015). Stock assessment authors evaluated whether 10 percent or more of the CEA was impacted by commercial fishing in November 2016 (the end of the time series). The 10 percent threshold was selected based on the assumption that impacts to less than 10 percent of the CEA means than more than 90 percent of the CEA (top 50 percent of suitable habitat or summer abundance) was undisturbed, and therefore represented minimal disturbance. If 10 percent or more of the CEA was impacted, the stock assessment authors examined indices of growth-to-maturity, spawning success, breeding success, and feeding success to determine whether there are correlations between those parameters and the trends in the proportion of the CEA impacted by fishing. If a correlation exists, positive or negative, stock assessment authors determined whether the correlation is significant at a p-value of 0.1. If a significant correlation was found, stock assessment authors used their expert judgement to determine whether there is a plausible connection to reductions in EFH as the cause. Stock assessment authors identified the correlation, and the significance in their reports.

Reports from the stock assessment authors were collated and presented to representatives of the GOA and BSAI Groundfish Plan Teams and the Crab Plan Team. Plan Team representatives reviewed the reports on March 7 2017. Representatives concurred with the stock assessment authors determinations in all cases. None of the stock assessment authors concluded that habitat reduction within the CEA for their species was affecting their stocks in ways that were more than minimal or not temporary. None of the authors recommended any change in management with regard to fishing within EFH.

13 Conclusions

The MSA includes provisions concerning the identification and conservation of EFH in each FMP. The EFH Final Rule and each of the Council's FMPs state that a review should be completed every 5 years, and EFH provisions should be revised or amended, as warranted, based on the best available information. The latest review was completed in October 2016. After review, the Council determined that new information is available to revise many of the EFH descriptions and maps in the Council FMPs. This EA identifies eight actions that the Council could take to update the Council's FMPs to incorporate the best new information available. The action alternatives described above would result in updates to EFH for the BSAI Groundfish, GOA Groundfish, BSAI Crab, Salmon, and Arctic FMPs; updates to the recommendations to reduce impacts to EFH from non-fishing activities; initiate a process to identify HAPC priorities and issue a call for proposals for HAPC nominations; and update the EFH research priorities in the Council's FMPs. None of the alternatives are inclusive, the Council could choose the action alternative for some Alternatives and the no-action alternative for others. Selecting action alternatives to update EFH for any of the Council's FMPs does not preclude the Council from revising EFH for one or more FMPs should new information become available that would warrant such a change. Final action would result in the next EFH review scheduled for 2022.

14 Preparation of Document

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Review of Arctic species EFH

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Review of Early Life Stage Histories

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Review of fishing effects

Bradley Harris, John V. Olson, Scott Smeltz, Craig Rose, Suresh Sethi

Review of non-fishing effects

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Appendices

Appendix 1 Essential Fish Habitat Text Descriptions
Adult Summer EFH Maps
Habitat associations, biological associations, predator/prey associations, and life histories of fishes in the Bering Sea and Aleutian Islands Groundfish Fishery Management Plan

Appendix 2 Essential Fish Habitat Text Descriptions
Adult Summer EFH Maps
Habitat associations, biological associations, predator/prey associations, and life histories of fishes in the Gulf of Alaska Groundfish Fishery Management Plan

Appendix 3 Essential Fish Habitat Text Descriptions
Adult Summer EFH Maps
Habitat associations, biological associations, predator/prey associations, and life histories of King and Tanner crab in the Bering Sea and Aleutian Islands Groundfish Fishery Management Plan

Appendix 4 Essential Fish Habitat Text Descriptions
Marine EFH Maps
Habitat associations, biological associations, predator/prey associations, and life histories of fishes in the Salmon Fishery Management Plan

Appendix 5 Essential Fish Habitat Text Descriptions
EFH Maps

Appendix 6 Impacts to Essential Fish Habitat from Non-fishing Activities in Alaska

Appendix 7 Fishing Effects Model Description