

# 2016 Review of Essential Fish Habitat

## Council Decisions for October 2016

- Do FMPs need to be updated to redefine EFH?
  - Stock author assessments
- Which maps should be used to redefine EFH?
  - Stock author assessments
  - Plan Team recommendations

# 2016 Review of Essential Fish Habitat

- EFH Review required every 5 years
  - NS2 – based on the best scientific information available
  - NS6 – take into account and allow for variations among, and contingencies in fisheries, fishery resources, and catches
- For 2015/16 review focus placed on
  - EFH description and identification
  - Fishing activities that may affect EFH
  - Non-fishing activities

# EFH Species Descriptions

600.815 (a)(1)(ii)(B). FMPs must demonstrate that the **best scientific information available was used in the description and identification of EFH**, consistent with National Standard 2.

600.815 (a)(1)(iii)(B). Councils should **strive to describe habitat based on the highest level of detail (i.e., Level 4)**. If there is no information on a given species or life stage, and habitat usage cannot be inferred from other means, such as information on a similar species or another life stage, EFH should not be designated.

EFH Levels within EFH Regulation (50 CFR Part 600)

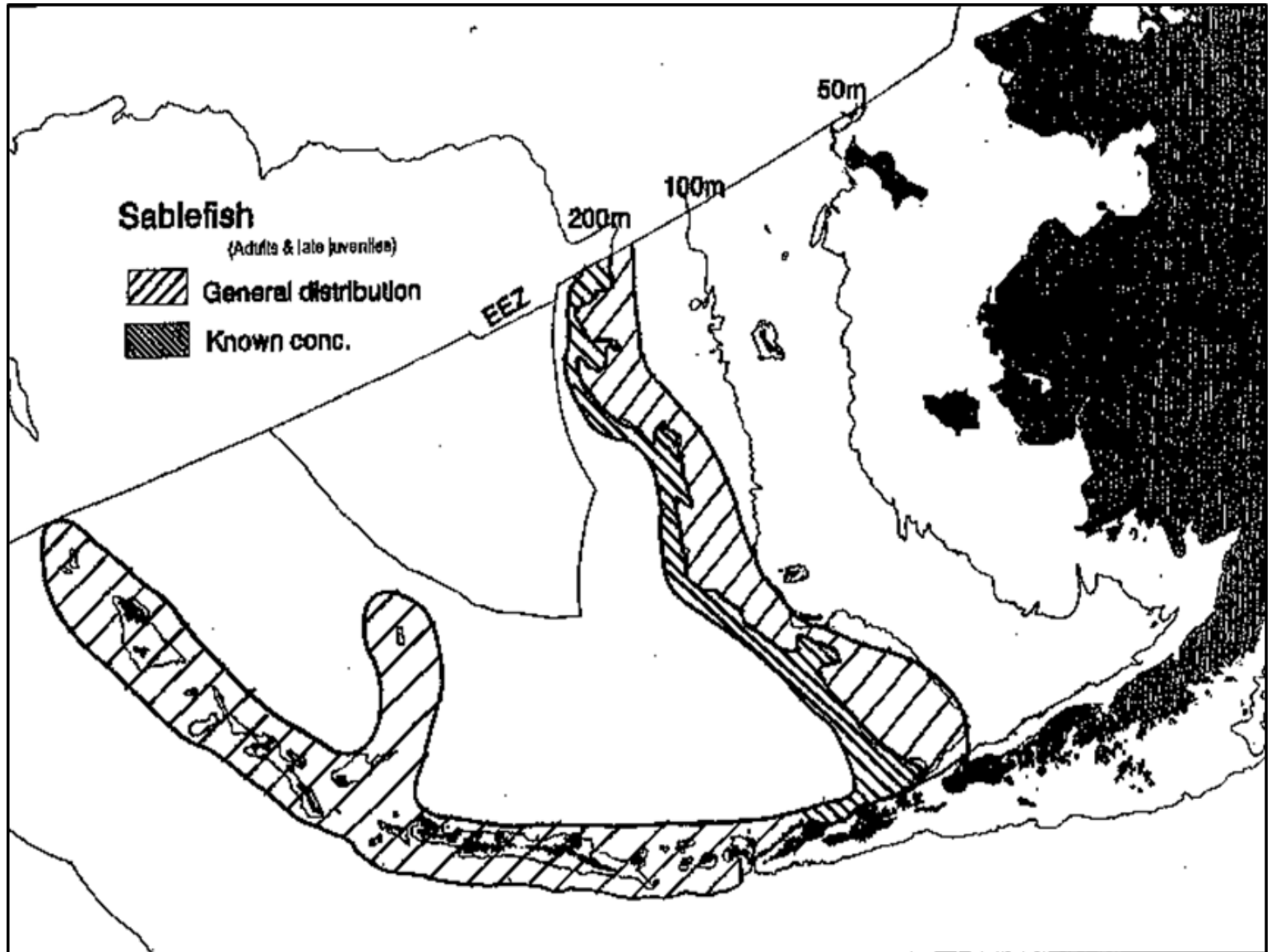
Level 1 - *Distribution data are available* for some or all portions of the geographic range of the species.

Level 2 - *Habitat-related densities* of the species are available

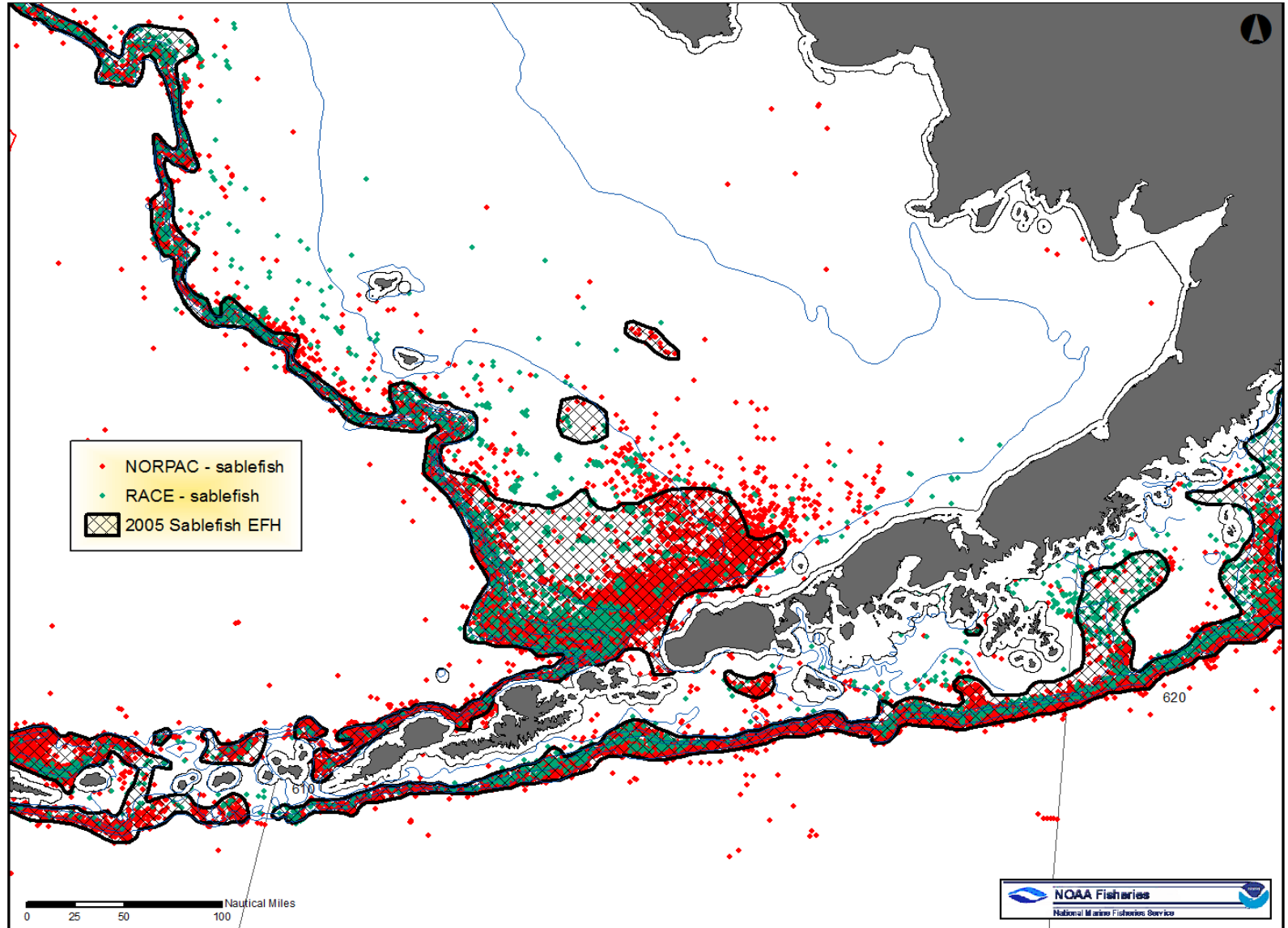
Level 3 - *Growth, reproduction, or survival rates* within habitats are available.

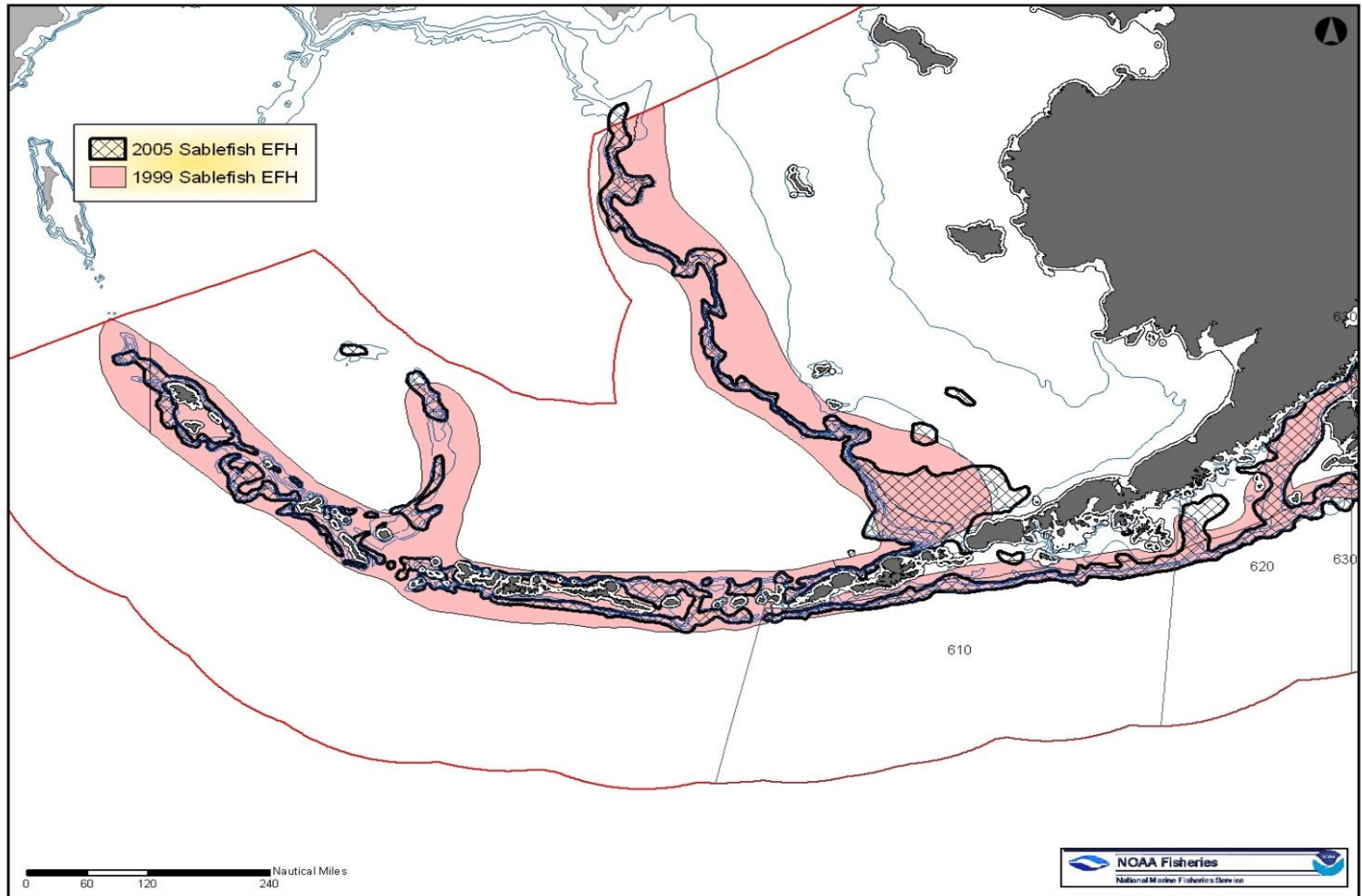
Level 4 - *Production rates* by habitat are available.

# Sablefish EFH, 1999



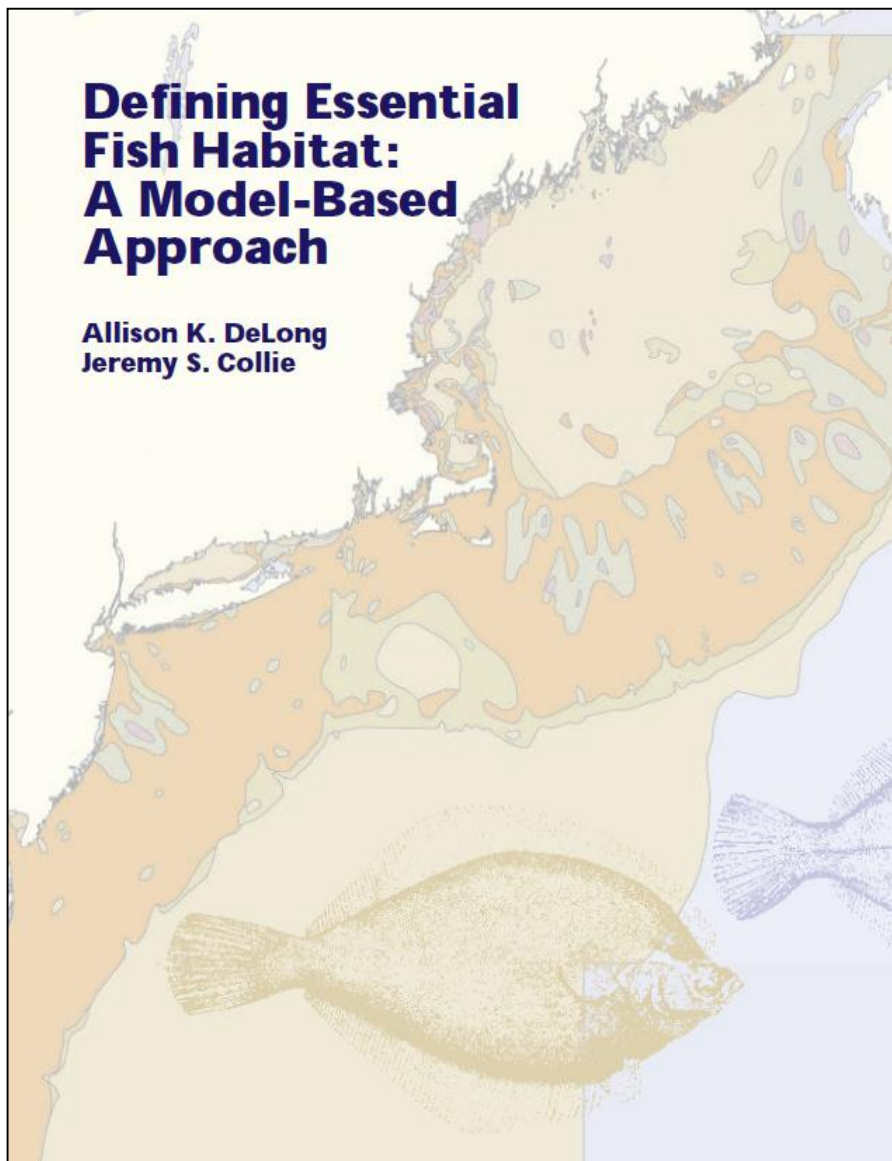
# Sablefish EFH, 2005/2010





# Defining Essential Fish Habitat: A Model-Based Approach

Allison K. DeLong  
Jeremy S. Collie



NOAA Technical Memorandum NMFS-AFSC-236

## A Refined Description of Essential Fish Habitat for Pacific Salmon Within the U.S. Exclusive Economic Zone in Alaska

by  
K. Echave, M. Eagleton, E. Farley, and J. Orsi

U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Alaska Fisheries Science Center

June 2012



# Approach– EFH Definitions in Alaska

- Uses species distribution modeling tuned to available data
- Divisions by season (Fall, Winter, Spring)
- Divisions by life history stage (egg, larvae, pelagic juvenile settled juvenile, adult)
- Funded by Alaska Regional Office



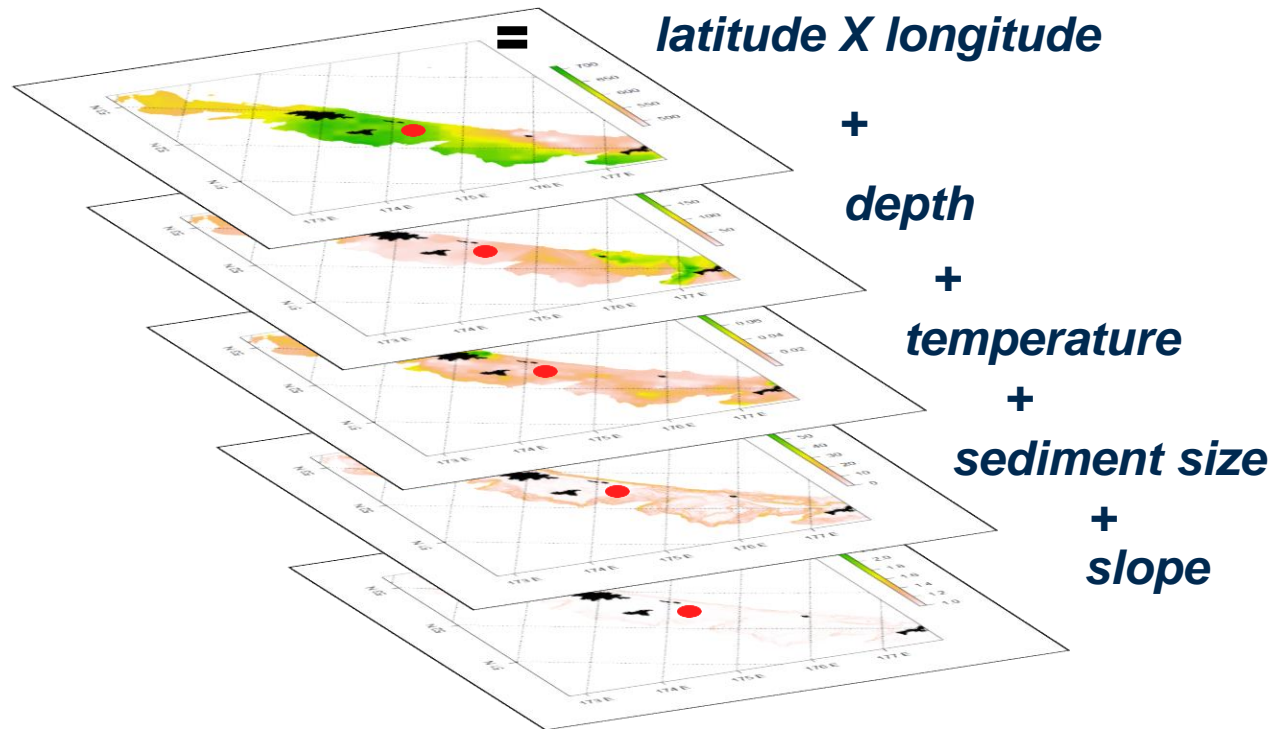


## Dependent data



- Bottom trawl surveys (1982-2014)
  - CPUE (GAM, hurdle GAM, Maxent)
  - Adults
  - Settled juveniles
  - Summer only
- EcoFOCI data (1994-2015)
  - Presence only (MaxEnt)
  - Eggs
  - Larvae
  - Pelagic juveniles
  - All seasons
- Catch in areas database (2005-2013)
  - Presence only (MaxEnt)
  - Fall, winter, spring
  - Adults only

# Method Part I. Term Selection & Model Fitting (GAM)



## Method Part II. Generalized Additive Modeling

$$y = s(\textit{latitude}, \textit{longitude}) + s(\textit{depth}) + s(\textit{temperature}) + s(\textit{slope}) + s(\textit{tide}) \\ + s(\textit{current}) + s(\textit{ocean\_color}) + s(\textit{grain\_size}) + \varepsilon$$



### Details:

Dismo package for MaxEnt

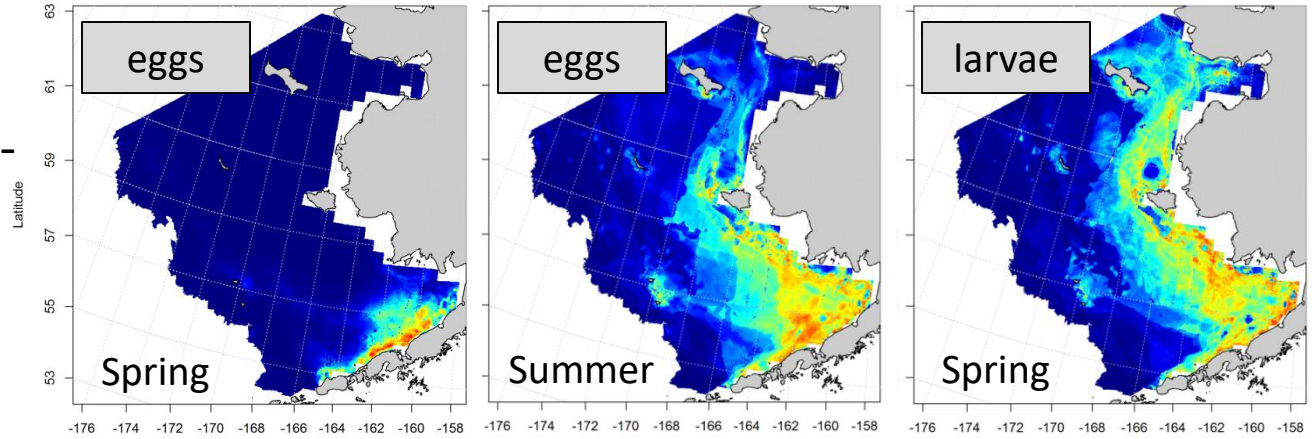
MGCV package for GAM

Presence-absence = Binomial distribution

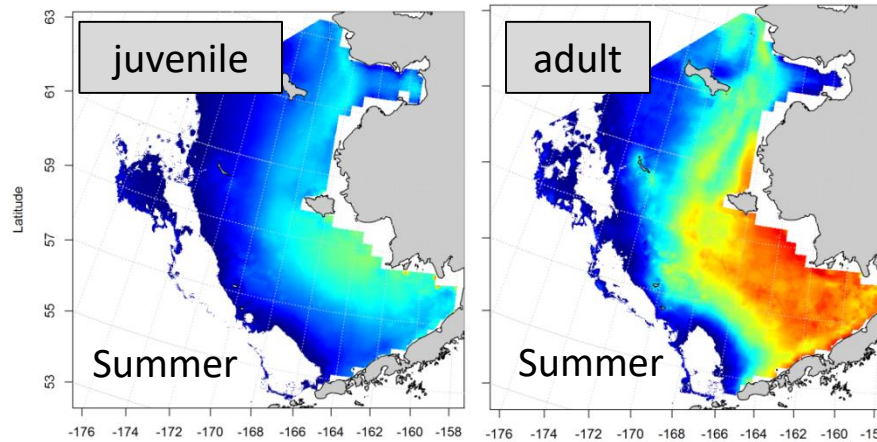
CPUE = 4<sup>th</sup> root transformation

k = 30 for bivariate term, 4 for univariate terms

ichthyoplankton survey -  
MaxEnt - presence only  
(probability)



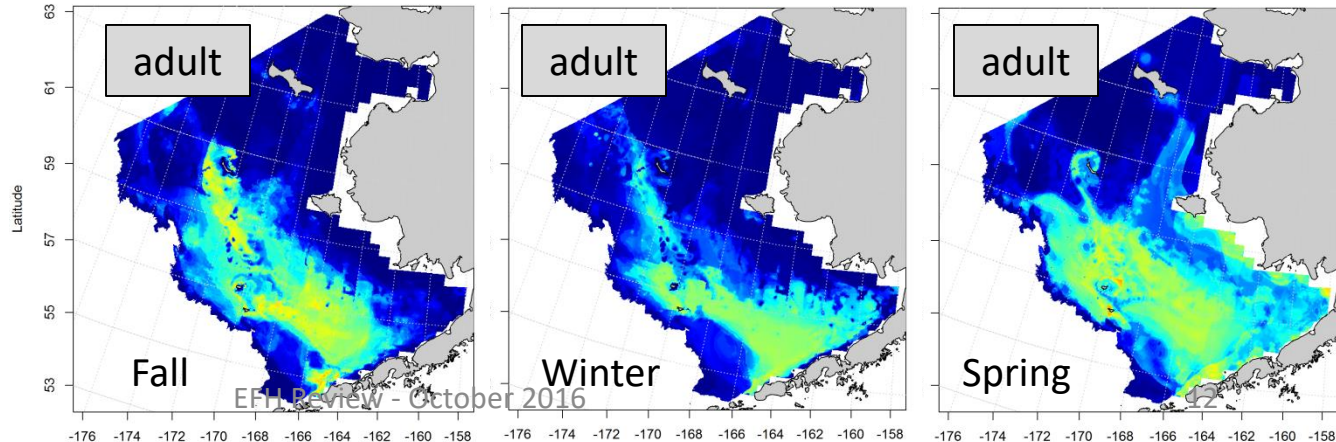
bottom trawl survey -  
GAM - abundance



yellowfin  
sole



observer catch -  
MaxEnt - presence  
only (probability)

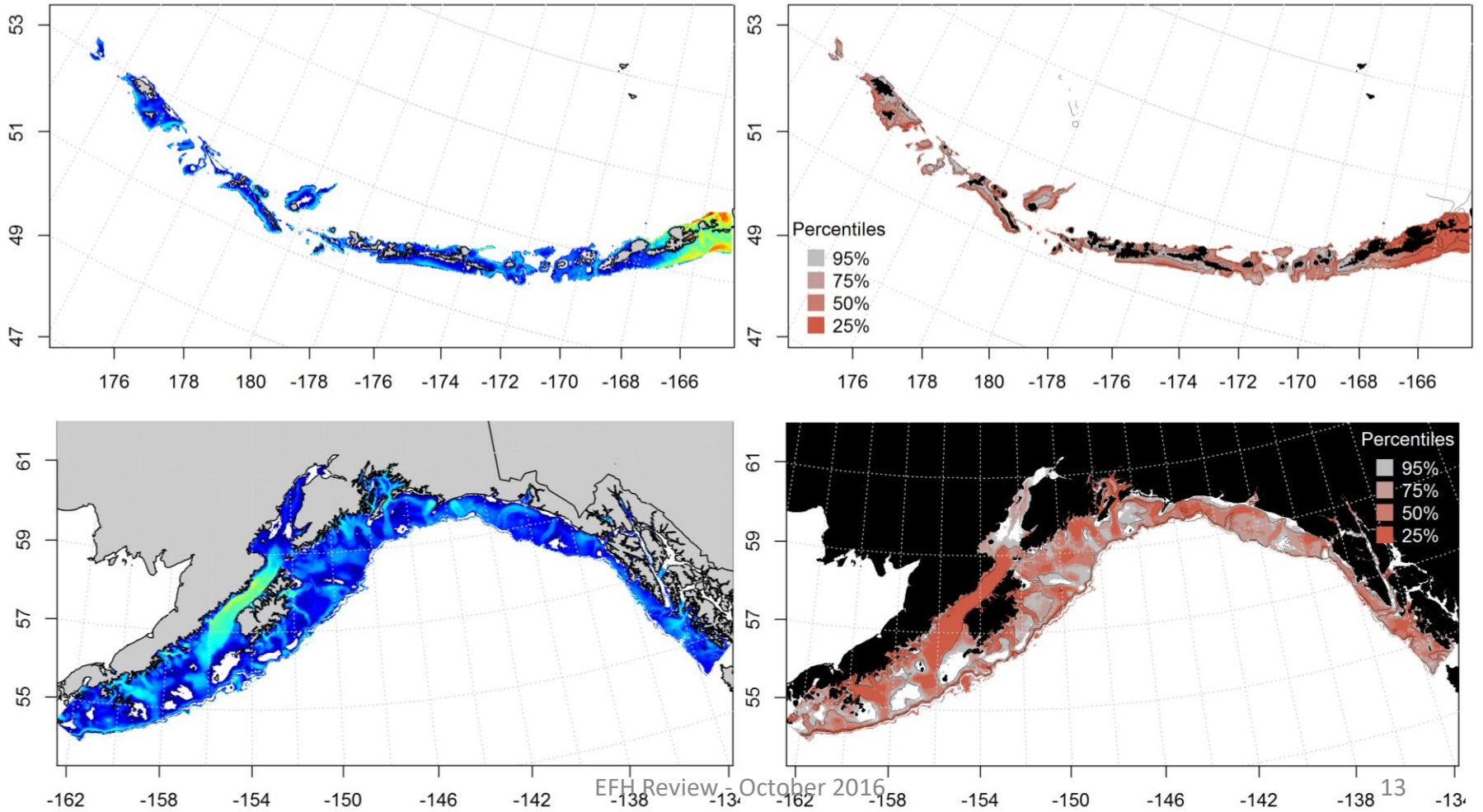




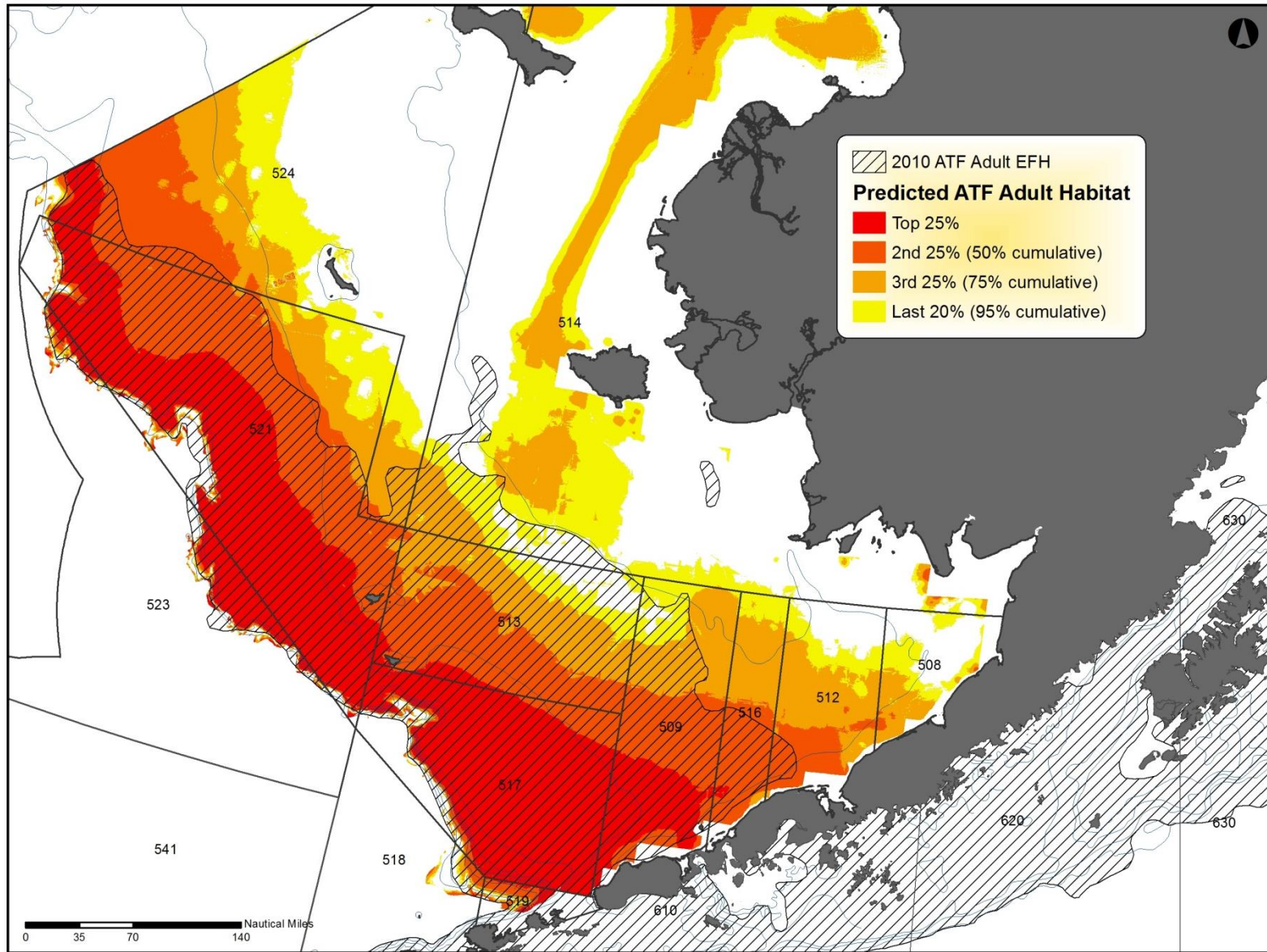
# AI and GOA too!



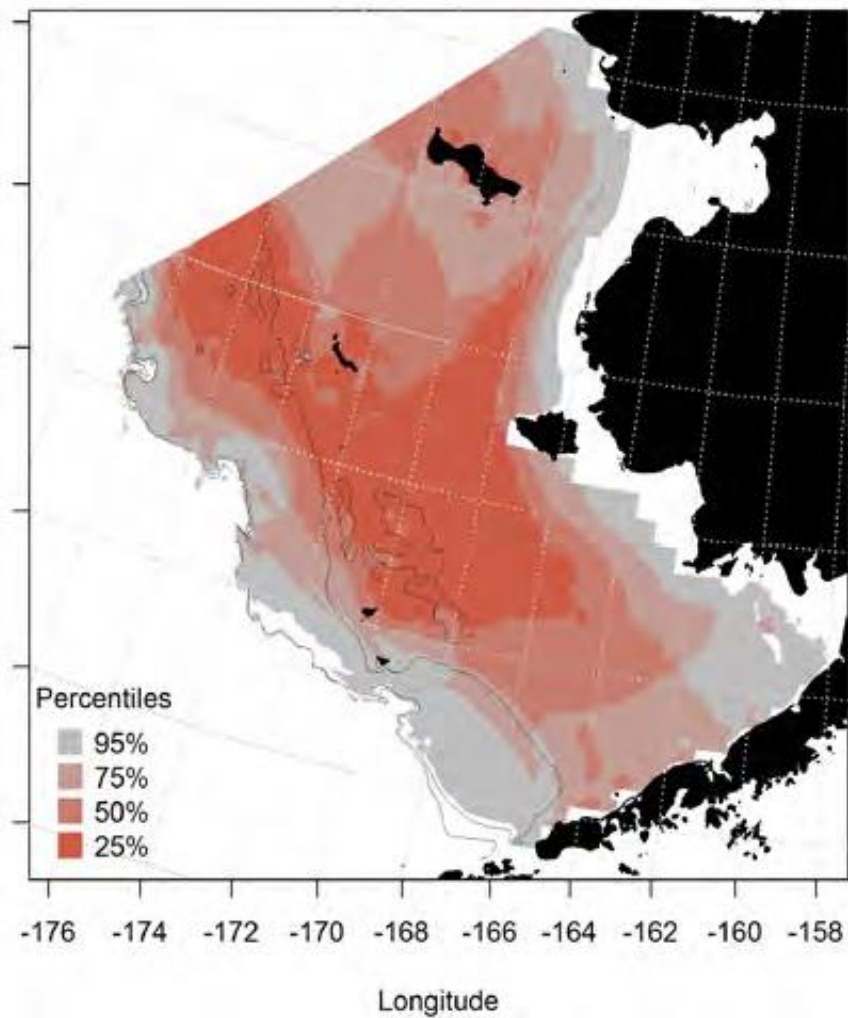
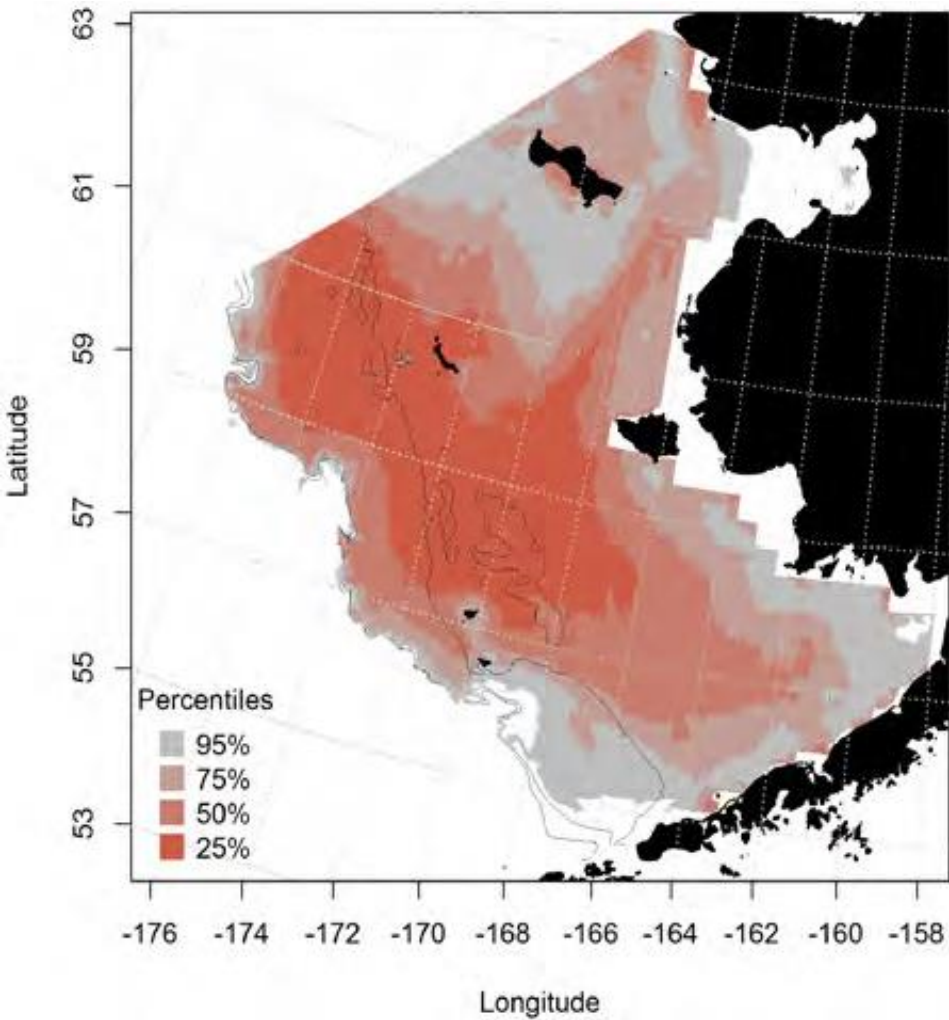
walleye pollock



# New EFH Descriptions







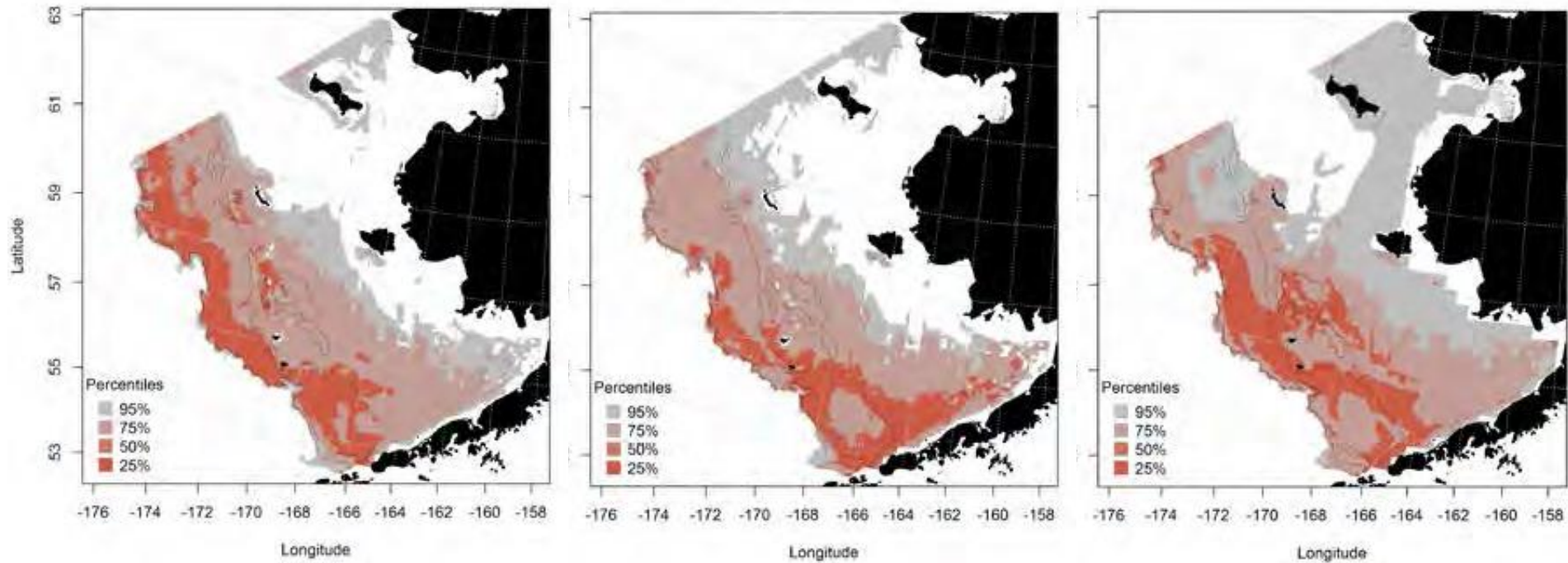
Predicted summer Essential Fish Habitat for pollock late juveniles (left) and adult (right) from summertime bottom trawl surveys (GAMs)



Fall

Winter

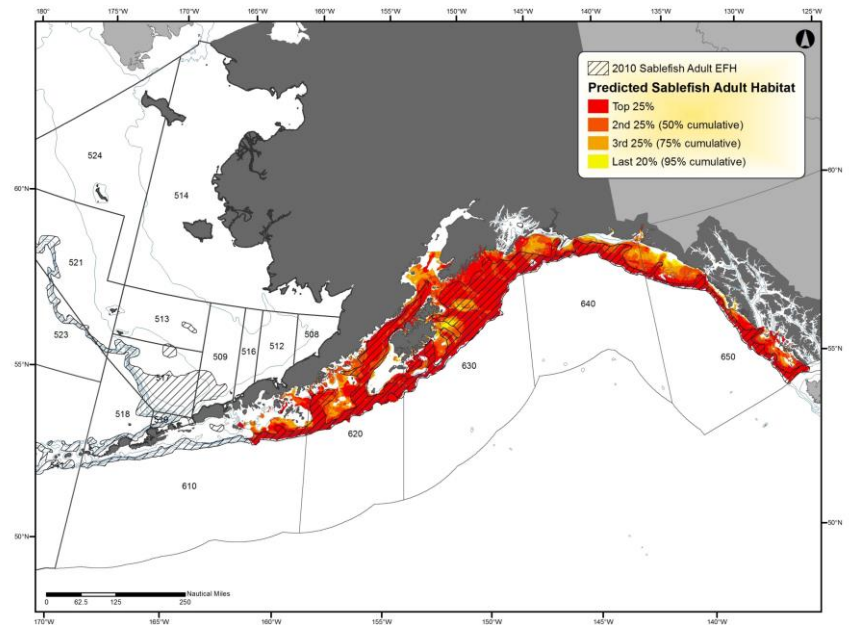
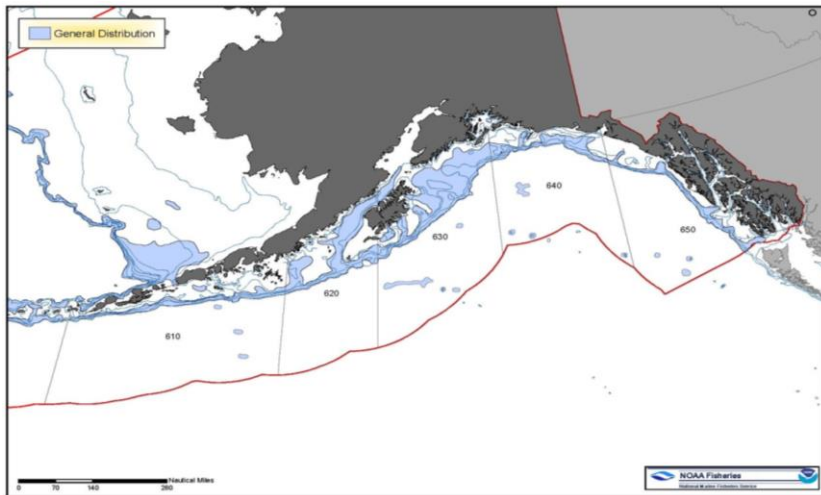
Spring



Predicted Essential Fish Habitat for pollock during the fall, winter, and spring from commercial fishery catches (MaxEnt)

# Stock assessment author review

- Authors reviewed existing text and maps
- Suggested updates to text, where appropriate
- Selected existing maps or new, model-based maps



# Bering Sea author assessment

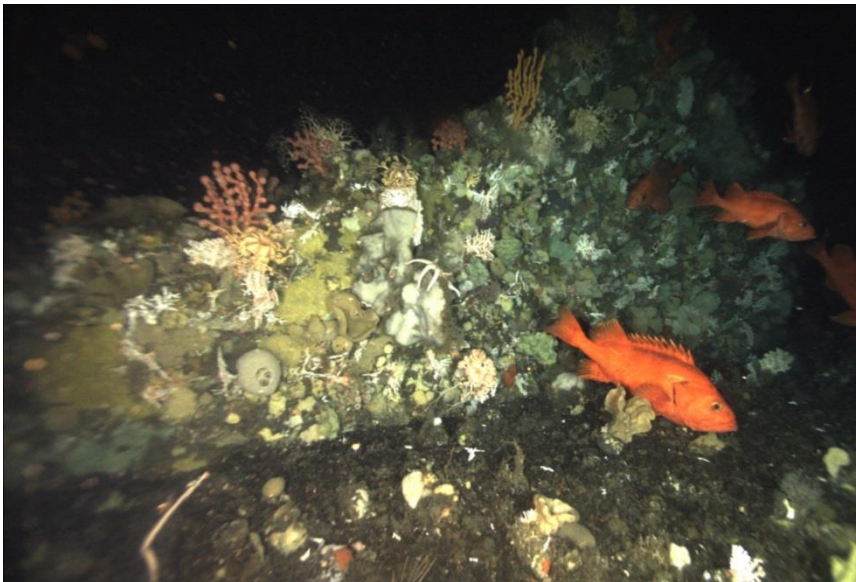
| Species                            | Text Revisions | Replace maps |
|------------------------------------|----------------|--------------|
| Pollock                            | ✓              | ✓            |
| Pacific Cod                        | ✓              | ✓            |
| Sablefish                          | ✓              | ✓            |
| Yellowfin sole                     | ✓              | ✓            |
| Greenland turbot                   | ✓              | ✓            |
| Arrowtooth flounder                | ✓              | ✓            |
| Kamchatka flounder                 | ✓              | ✓            |
| Northern rock sole                 | ✓              | ✓            |
| Alaska plaice                      | ✓              | ✓            |
| Rex sole                           | ✓              | ✓            |
| Dover sole                         | ✓              | ✓            |
| Flathead sole                      | ✓              | ✓            |
| Rockfish                           | ✓              | ✓            |
| Pacific Ocean perch                | ✓              | ✓            |
| Northern rockfish                  | ✓              | ✓            |
| Shortraker rockfish                | ✓              | ✓            |
| Blackspotted & rougheyeye rockfish | ✓              | ✓            |
| Dusky rockfish                     | ✓              | ✓            |
| Thornyhead rockfish                | ✓              | ✓            |
| Atka mackerel                      | ✓              | ✓            |
| Squid                              | ✓              | ✓            |
| Skates                             | ✓              | ✓            |

# GOA author assessment

| Species                          | Text Revisions | Replace maps |
|----------------------------------|----------------|--------------|
| Pollock                          | ✓✓             | ✓✓           |
| Pacific Cod                      | ✓✓             | ✓✓           |
| Sablefish                        | ✓✓             | ✓✓           |
| Yellowfin sole                   | ✓✓             | ✓✓           |
| Northern rock sole               | ✓✓             | ✓✓           |
| Southern rock sole               | ✓✓             | ✓✓           |
| Alaska plaice                    | ✓✓             | ✓✓           |
| Rex sole                         | ✓✓             | ✓✓           |
| Dover sole                       | ✓✓             | ✓✓           |
| Flathead sole                    | ✓✓             | ✓✓           |
| Arrowtooth flounder              | ✓✓             | ✓✓           |
| Pacific Ocean perch              | ✓✓             | ✓✓           |
| Northern rockfish                | ✓✓             | ✓✓           |
| Shortraker rockfish              | ✓✓             | ✓✓           |
| Blackspotted & Rougheye rockfish | ✓✓             | ✓✓           |
| Dusky rockfish                   | ✓✓             | ✓✓           |
| Yelloweye rockfish               | ✓✓             | ✓✓           |
| Thornyhead rockfish              | ✓✓             | ✓✓           |
| Atka mackerel                    | ✓✓             | ✓✓           |
| Squid                            | ✓✓             | ✓✓           |
| Skates                           | ✓✓             | ✓✓           |
| Sculpin                          |                | ✓✓           |

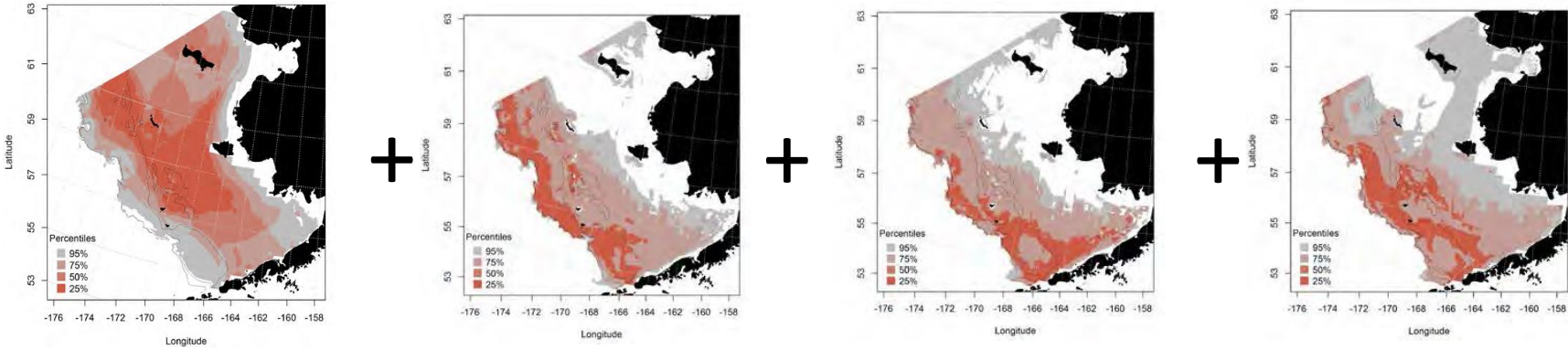
## Stock assessment author review

- Updates to EFH recommended for all FMPs  
*EXCEPT* scallop FMP
- Updated maps recommended for all FMPs  
*EXCEPT* scallop and Arctic FMP

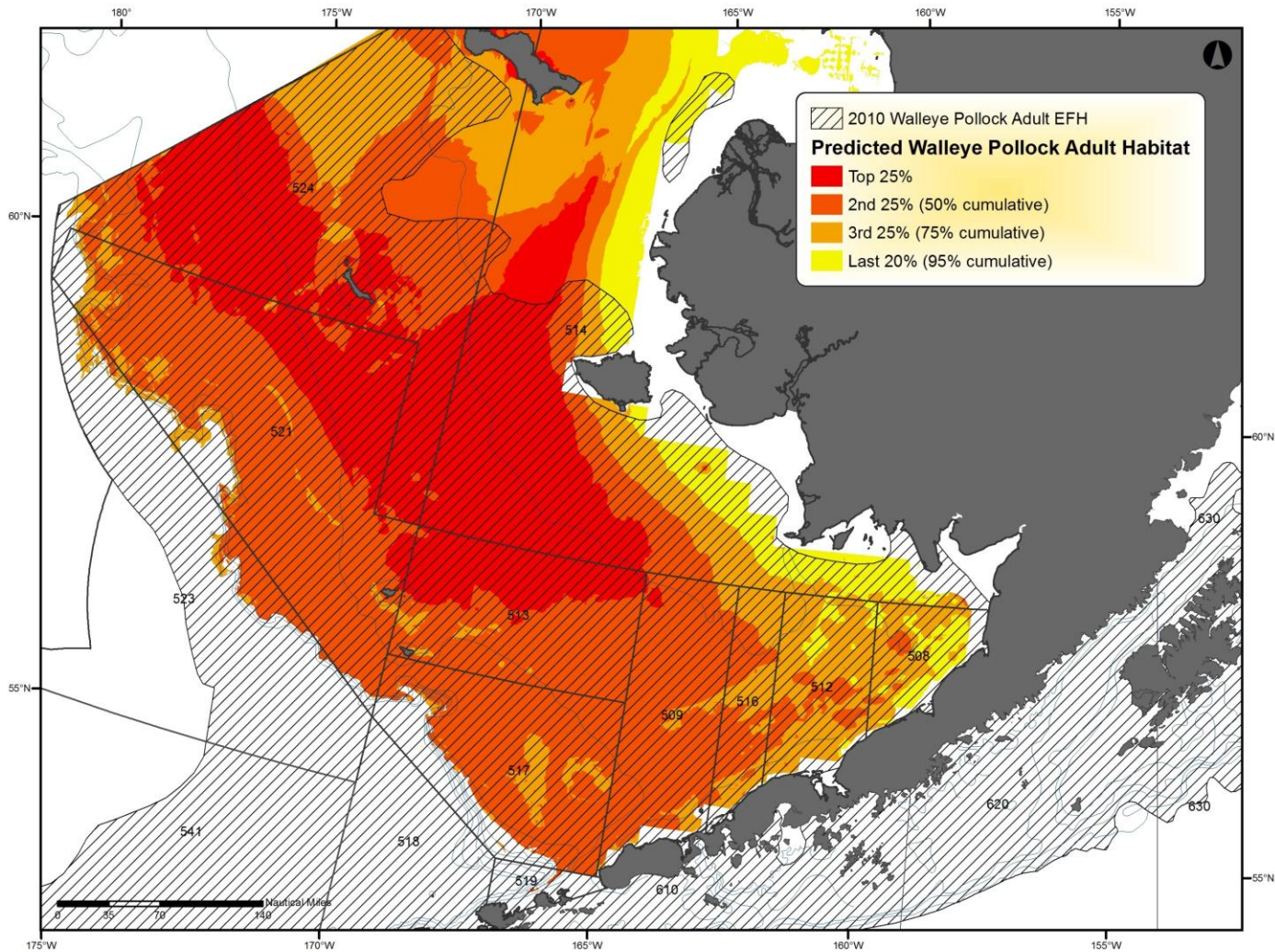




# Comprehensive, annual map



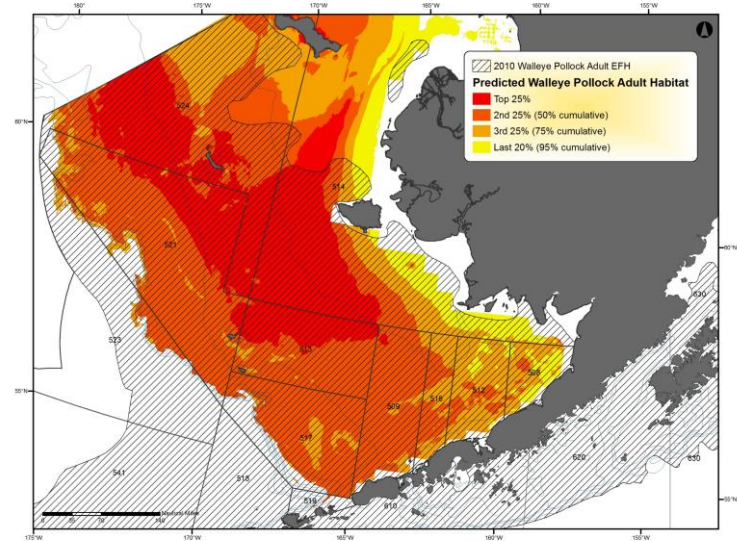
# Comprehensive, annual map





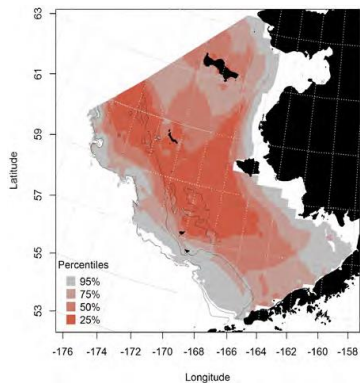
# Comprehensive, annual map

- Authors reviewed comprehensive maps in May 2016
- Asked to respond if problematic
  - No response = approval
- Received very few responses, all minor

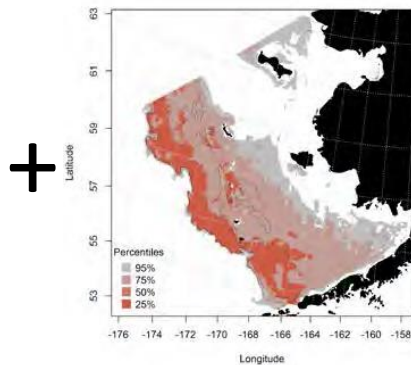


- Models and maps reviewed again by Plan Teams in September 2016 during review of Fishing Effects methods
- All Plan Teams expressed concerns about combining maps

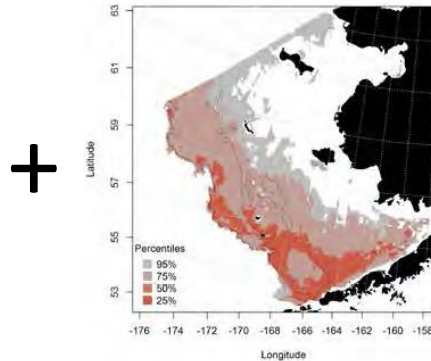
# Abundance



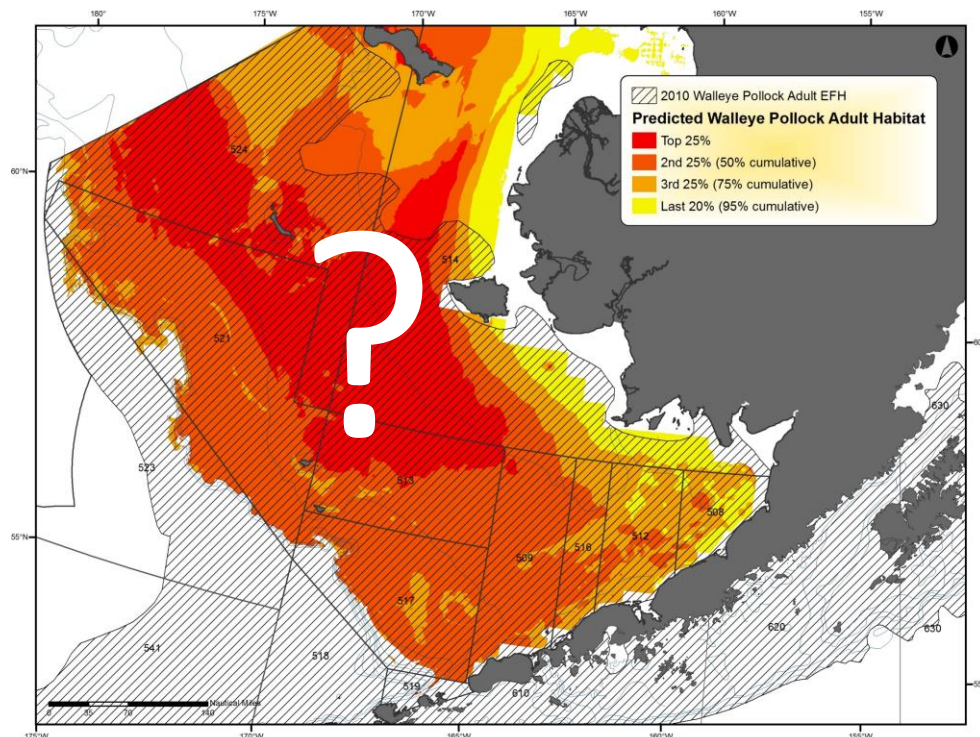
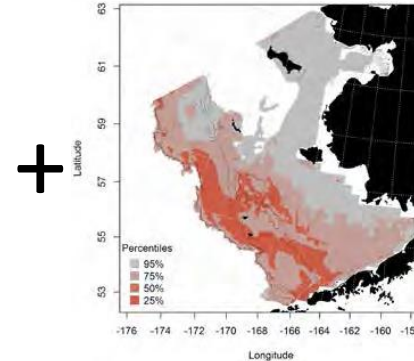
# Probability



# Probability



# Probability



## Plan Team Recommendations

- All Plan Teams recommended against using the single, comprehensive map as prepared
- All Plan Teams recommended using original seasonal maps
  - *Important seasonal differences in king crab*
- *IF* a single map is desired, plan teams recommended converting summer model to MaxEnt and combining similar outputs
  - *Converting from presence/absence data in GAMs to presence only data in MaxEnt*

## Council decisions

- Do FMPs need to be updated to redefine EFH?

Stock assessment author review

- Updates to EFH text recommended for all FMPs  
*EXCEPT* scallop FMP
- Updated maps recommended for all FMPs  
*EXCEPT* scallop and Arctic FMP



## Council decisions

- Which maps should be used to define EFH?

### Plan Team Recommendations

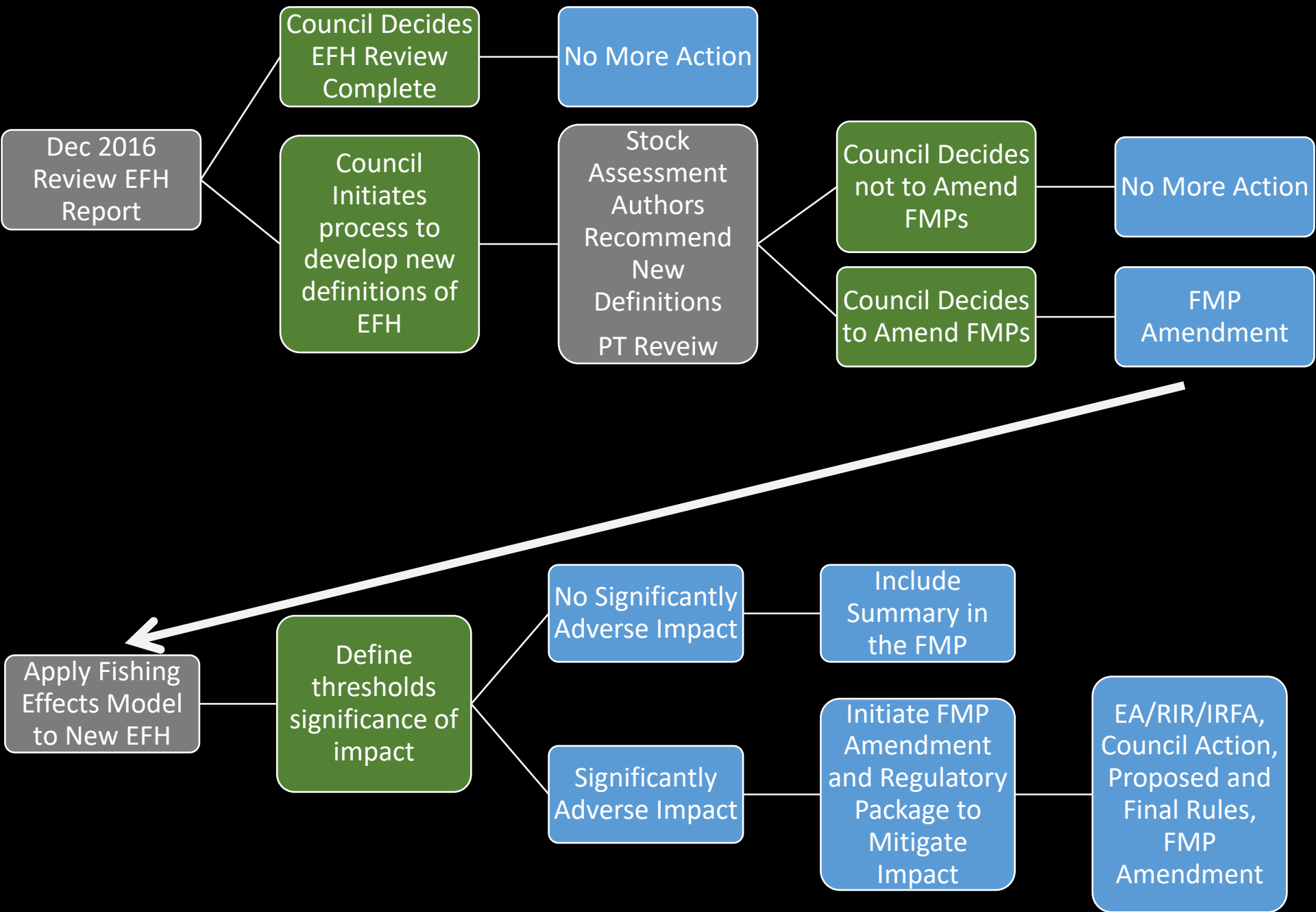
- Against using the single, comprehensive maps
- Recommended using original seasonal maps

*OR*

- Convert summer GAM to MaxEnt and combining similar outputs

## What happens next?

- *IF* changes to EFH are not warranted – nothing
  - Existing text and map descriptions of EFH remain
- *IF* changes to EFH are warranted
  - Initiate process to amend FMPs
  - New text and map descriptions will be included in FMP appendices
- *IF* EFH is redefined
  - Analyze effects of fishing on new EFH descriptions
    - Proposed methods to be presented to the Council in December
- *Regardless* of whether Council updates EFH
  - Decide whether to initiate HAPC proposal process
  - Decide whether to update EFH research Priorities





# Potential timeline

|                                |                 |  |
|--------------------------------|-----------------|--|
| April 2016                     | Council meeting | Preliminary EFH review at ECO, SSC, AP, Council                |
| October 2016                   | Council meeting | Final EFH review   |
| <i>October – December 2016</i> |                 | <i>Refine EFH definitions</i>                                  |
| December 2016                  | Council meeting | Review non-fishing effects report and Fishing Effects method   |
| <i>January – February 2017</i> |                 | <i>Stock assessment authors review EFH and Fishing Effects</i> |
| <i>March 2017</i>              |                 | <i>Plan Teams review EFH and Fishing Effects</i>               |
| April 2017                     | Council meeting | Final action on FMP Amendments                                 |