Alaska Essential Fish Habitat - Research Program 2014

- *EFH fishing and non-fishing models*
- *Norton Sound red king crab habitat*
- *Projects funded through 2014 Alaska Region RFP process*

1) **Project Objective:** Review and implement fishing and non-fishing effects models for North Pacific EFH assessment

Project Funding Amount: $255,000

Task 1- Review and update LEI fishing effects model (2013/14) *60k HQ-funded*
Task 2 - Implement the updated LEI fishing effects model (2014/15) *75k RO-funded*
Task 3 - Develop non-fishing effects component (2014/15) *80k RO-funded*
Task 4 - LEI and fishing gear descriptions update (2015/16) *50k RO-funded*
Task 5 – EFH Species Distributions – GAM modeling (2015/16) *50k RO-funded*

Background

NOAA Fisheries and NPFMC are embarking on its second 5-year reassessment of the effects of fishing and non-fishing activities on essential fish habitat (EFH) in Alaska marine waters. The initial assessment employed the Long-term Environmental Index (LEI) model which combines information on fishing effort, habitat features, and the susceptibility and recovery of those features to and from fishing gear impacts to evaluate and describe the effects of fishing on habitat features. In its current form, the model does not incorporate information about the effects of non-fishing activities on EFH. The tasks listed above indicate the work currently underway or funded here.

Task Descriptions

Task 1 - Work includes reviewing the original model and working with NOAA scientists to understand the details of its structure, requirements, and implementation. Other models, including the SASI model, will be reviewed for applicable code and features. The review will culminate in a proposal for potential model structures for the next analysis, including alternatives for features and feasibility and tasks / resources required to implement them in later phases. Applying feedback from the initial work, NOAA Fisheries and the NPFMC will seek to implement a basic version of the model, sufficient to run the original data for comparison and validation with original results. This may include presentations to and discussions with groundfish plan team members and the Scientific and Statistical Committee of the NPFMC. The updated model will allow interactive association by NOAA and the NPFMC to consider the effects of fishing on EFH and to identify any alternatives for minimizing effects. Model results will be used in the upcoming 2015 EFH Review.

Task 2 - The updated LEI model developed will be fully implemented during Task 2. Based on feedback from NOAA and the NPFMC, the updated LEI model will be implemented to facilitate the assessment of alternative management actions, including spatial fishing restrictions, fishing gear modifications, and alternative specifications of EFH. The model will use updated data on fishing distributions from NOAA observer and VMS databases, updated habitat feature data (e.g. sediment type, water depth) provided by NOAA. A final report and any resulting publications from this work will be provided to NOAA and NPFMC. Reporting will include input to NOAA's document on the EFH assessment to describe the new model and its results.

Task 3 - An EFH non-fishing effects component will be developed for the LEI model. This task involves searching for and acquiring relevant non-fishing data sources, including but not limited to: permits from Corps of Engineers,

ADFG, ADEC, ADNR, USFWS, NMFS relating to docks, point and non-point effluent discharge, infrastructure, civil works projects, or any activities with the potential to impact managed resources; imagery from ShoreZone, Google Earth, or other coastal mapping sources; marine shipping routes; and Auke Bay Lab FishBase. These data sources will be documented and integrated into a geospatial database (GIS) in a format that is compatible with the LEI (Long-term Effect Index) model being updated by Alaska Pacific University and NMFS - Alaska Regional Office in Anchorage. The resulting non-fishing effects database will provide inputs into the LEI model that may be used for cumulative effects analysis by scientists or NMFS stock assessment authors. To determine the optimal approach for integrating these data into the LEI model the methods used around the US (and worldwide if applicable) to model cumulative non-fishing effects will be reviewed (e.g. Puget Sound Cumulative Impact Assessments. This task will likely be implemented as one or more pilot projects depending on the quality and quality of data acquired. Recently, NMFS\HCD conducted a shoreline assessment of man-made structures adjacent to or within marine waters of Sitka Sound, AK. The assessment started with ShoreZone, then looked deeper at altered marine intertidal areas and the nearby coastline. The assessment was a good start; however errors in category definition are apparent. The Sitka project could be revisited. Another strong candidate would be a subarea of the Arctic.

Task 4 - The aim of this work is to assure that the ongoing reanalysis of the Effects of Fishing (EoF) on EFH and the update of Alaska fishing gears and practices area comparable with and account for all of the factors considered in the prior analyses. We will provide orientation, background, and specific information on the detailed implementation of the EoF analysis for the 2005 Environmental Impact Statement for EFH Identification and Conservation in Alaska. We will provide support to workshops to describe current fishing gear and practices necessary to analyze the EoF on EFH of Alaska: A series of workshops will be conducted with participants from each of the major marine fisheries conducted off of Alaska to record, quantify and understand the fishing gears and practices currently in use. These workshops will provide specific inputs and context for the upcoming analysis of the EoF on EFH. We will consult with the analysts conducting the upcoming analysis of the EoF on EFH on developing and selecting methods to account for changes in fishing gears since the 2005 analysis: Among the changes in fishing gear and practices since the previous analysis, some major changes have been implemented specifically to reduce the EoF on EFH. While the prior analysis drew from the worldwide literature to provide gear specific parameters, accounting for these changes will require particular attention to these specific modifications in the context of Alaska fishing gears.

Task 5 - This work will create distribution maps for groundfish and crab species based primarily on NOAA NMFS AFSC RACE survey data using GAM, GLM or combination of other models. Maps will be generated for each life stage (egg, larvae, juvenile, adult) and have a minimum 1 km2 scale. Specific work flows are provided below for egg/ larval and for juvenile/adult life stage maps.

Egg/larval stages:

1) work with FOCI to query their survey data for catches (only a subset of species will probably be available)
2) Predict presence/absence using GAM, GLM or combination of other models
3) Make prediction surfaces for GOA/AI and EBS based on these models

Juvenile/adult stages:

1) Query RACE bottom trawl survey data for CPUE
2) Split catch into juvenile and adult based on stock assessment maturities (or other method)
3) Predict CPUE (or presence/absence) using GAM, GLM, or combination of other models
4) Make prediction surfaces for GOA/AI and EBS based on models

This work will be conducted between March 2015 and March 2016 and will result in 1) a technical memo with detailed information and revisions of EFH descriptions and 2) a primary publication in a peer-reviewed

journal describing the methods and results.

2) **Project Objective:** Norton Sound Red King Crab Habitat Research

Project Funding Amount: $127,300

Task 1- Design a research strategy to identify Red king crab habitat in Norton Sound, Alaska (2013/14) *50k HQ-funded*

Task 2 - Examining the effects of offshore marine mining activities on Norton Sound red king crab habitat (2014/15) *77k EFH-funded plus 20k RO-funded equipment and software purchase*

Background

NOAA Fisheries and the North Pacific Fisheries Management Council (NPFMC) are currently engaged in a non-fishing activities discussion regarding Norton Sound Red King Crab (NSRKC) and potential effects from offshore mining activities. The NPFMC asked its Crab Plan Team to discuss concerns with seafloor mining and habitats needed to sustain NSRKC. The Team concluded that there is currently not enough habitat information to conduct a robust analysis, a situation we see often in marine waters. In response, the Alaska Region and Alaska Fisheries Science Center proposes to develop a crab habitat study in Norton Sound, Alaska that will be crucial to their efforts and likely useful to other regions/centers facing threats of unknown consequences. In FY13, a proposal will also be submitted to the annual AKR EFH RFP to secure matching funds for field work.

Task Descriptions

Task 1 - We will compile and synthesize existing information on Norton Sound to identify gaps in knowledge about the benthic habitats in the area and the habitat features used by NSRKC. This information will give the NPFMC and habitat managers a realistic assessment of what is known about crab habitat in general and what is known about it in the Norton Sound region and will be used to develop a NSEKC habitat survey yielding the generate data products needed to assess the vulnerability of specific habitat features to seafloor mining operations. This will serve as a means to begin assessing potential non-fishing effects on this crab stock and their habitat.

Task 2 – There are three objectives: Develop literature-based mining effects susceptibility and recovery matrices; describe spatial distribution of winter mining effort; and develop and test acoustic-video methods for sampling and mapping seabed complexity. Seabed mining effects literature will be systematically reviewed using a custom MS Access Database tool (Figure 1) initially designed to support a fishing effects Vulnerability Assessment (NEFMC 2011). Literature-based geological and biological feature-level susceptibility and recovery information will be coded into matrices following methods detailed in Grabowski et al. (2013). These matrices are structured for implementation in the Swept-Area Seabed Impacts (SASI) Model which will allow the literature-based Vulnerability Assessment to be implemented spatially once the distributions of 1) mining activity and 2) geological and biological structures are mapped (NEFMC 2011). The SASI Model algorithm is designed for simulating potential and assessing realized adverse effects to allow managers to evaluate tradeoffs associated with a range of policy measures including effort reductions, area closures and gear modifications (NEFMC 2011). An example matrix for bottom trawl on cobble substrate is provided in Table 1. Literature review database details are provided in NEFMC (2011).

The temporal and spatial distributions of mining activities off Nome have not been assessed. Work is currently underway to document and map open-water mining operation types and locations based on information included in lease permit requests and local knowledge (PSMFC Project# 2013-0828). To augment this work we propose to survey and map the locations and types of thru-ice mining during spring in 2015. Using snowmobiles and hand-held GPS units (owned by the APU FAST Lab) we will record the locations and types of thru-ice mining. If possible,

we will sample water salinity, temperature and depth using a YSI Castaway (owned by the APU FAST Lab), and collect sediment type and seabed complexity information using a Light & Motion video camera (owned the NMFS Habitat Conservation Division) and GoPro stereo camera system.

The Yukon River sediments, shallow depths, frequent wind-driven wave events, and mining combine to create very poor underwater visibility conditions near Nome during late spring and summer months (Larsen et al. 1981; Nelson 1982; Demlow et al. 1989). As a result, the underwater video/ imaging methods typically used to sample and map geological and biological seabed features (e.g. Harris and Stokesbury 2010) are problematic in Norton Sound. Alternatively, dual-frequency identification (DIDSON, Sound Metrics) acoustic camera has proven to be a very effective in turbid conditions (Moursund et al. 2003), and owing to its high resolution and acoustic video recording capabilities it is commonly used in marine archaeology surveys . DIDSON acoustic cameras have been successfully used for seabed imaging in the Bering Sea (Rose et al. 2010a, Rose et al. 2010b) and acoustic "shadows" in the imagery can be used to measure seabed vertical relief (Negahdaripour et al. 2011). However, no studies have used DIDSON cameras to directly assess habitat complexity. HCD and APU have partnered with the Boswell Lab at Florida International University and will utilize an Autonomous Surface vehicle (ASV) that is equipped with DIDSON, Kongsberg M3 Multibeam, Simrad EK60 sounder, and Humminbird 998c HD Sidescan

3) 2014 EFH-funded RFP projects

The original 2013 EFH RFP was for $233,450 of funding, which initially selected Rooper, Olson, and Laurel projects. However, AKR HCD was successful obtaining Regional Office money to fund the remaining 5 projects for a total of $494,100 of directed EFH research projects.

Principal Investigators	Titles	Funding
Rooper, Sigler, Hoff	Ground truth the presence and abundance of coral habitat on the eastern Bering Sea slope both inside and outside canyon areas	$138,420
Zimmermann	Bathymetry and substrate compilation from smooth sheets: Gulf of Alaska and Norton Sound	$72,572
Laurel, Ryer, Copeman	Optimal thermal habitats of gadids in Alaskan waters	$68,000
Olson, Foy, Harris	Examining the effects of offshore marine mining activities on Norton Sound red king crab habitat	$77,330
Yeung, Yang, Cooper	High prey availability defines juvenile flatfish habitat quality in the eastern Bering Sea	$50,730
Malecha, Shotwell, Ammann	Recruitment and response to damage of an Alaskan gorgonian coral	$17,700
Hoff, Stone	Coral and Sponge diversity along the EBS slope with a focus on Pribilof and Zhemchug Canyons	$20,750
Stone, Waller	Matching pieces of the puzzle: validating the reproductive ecology of red tree corals in Gulf of Alaska habitats with extensive studies in shallow water	$48,575
Total		**$494,100**