NOAA FISHERIES

Alaska Region

2015 EFH Five Year Review & Norton Sound Research Update

Ecosystem Committee

March 17, 2015

Ecosystem Committee Comments – September 2014

The Committee asked that models (LEI/ GAM) be reviewed by SSC & AFSC prior to implementation.

The Committee recommended that the timeline for the 5-year review be extended to:

- Accommodate incorporating the new data sources into the fishing effects model.
- Use of field data sources into both the GAM descriptive model and non-fishing effects.

Where are we in the process?

- Presented to SSC - February 2015
- Present to Ecosystem Committee – March 2015
- Fishing Effect Modeling – on track for June 2015 completion
- Species Description GAMs – on track for June 2015 completion
- Non-fishing and HAIP components progressing for June 2015 completion
- Prepared to give stock assessment authors a packet of information by species for review in late June/July, previous to fall stock assessment timetable (includes HAIP).
- Present Draft Report to NPFMC – December 2015

2015 EFH/HEPR RFP Funded projects

PI's	Title	Management Ranking	Scientific Score	Scientific Rank	Amount
Olson, Foy, Harris, Boswell	Examining the effects of offshore marine mining activities on Norton Sound red king crab habitat - Phase 2	1	3.5	6	83,883
Rooper, Laman, Cooper	Defining EFH for Alaska groundfish species, using species distribution modeling	2	3.7	3	96,553
Zimmermann	Bathymetry compilation: Eastern Bering Sea slope	3	3.5	4	84,312
Pirtle, Shotwell, Rooper	Improving based model EFH definitions for Gulf of Alaska groundfish species using combined species distribution models with high-resolution regional habitat metrics	4	3.3	7	90,662
Ryer, Copeman, Laurel	Optimal thermal habitats of FMP crab species in relation to the Bering Sea cold pool	5	4.1	1	76,500[3]
Yeung, Yang, Cooper	Effects of a shift from an extended cold period to a warm period in the eastern Bering Sea on juvenile flatfish habitats	6	3.5	5	31,400
Stone, Foy, Waller, Cairns	Physiological response of red tree coral to low pH scenarios in the laboratory	7	3.2	8	47,200
Rooper, Etnoyer, McGuinn, Stone	Simulating modeling of sustainable removals of Primnoa in the Gulf of Alaska based on field studies of size structure and recruitment rates	8	3.1	9	50,000
Jones, Wilson, Rooper, Spencer, Hanselman, Weber	Estimating rockfish abundance as a function of habitat in the Gulf of Alaska	9	3.0	10	51,750
Duffy-Anderson, Heintz	Essential overwinter fish habitats of juvenile walleye pollock in Prince William Sound	10	3.9	2	103,200

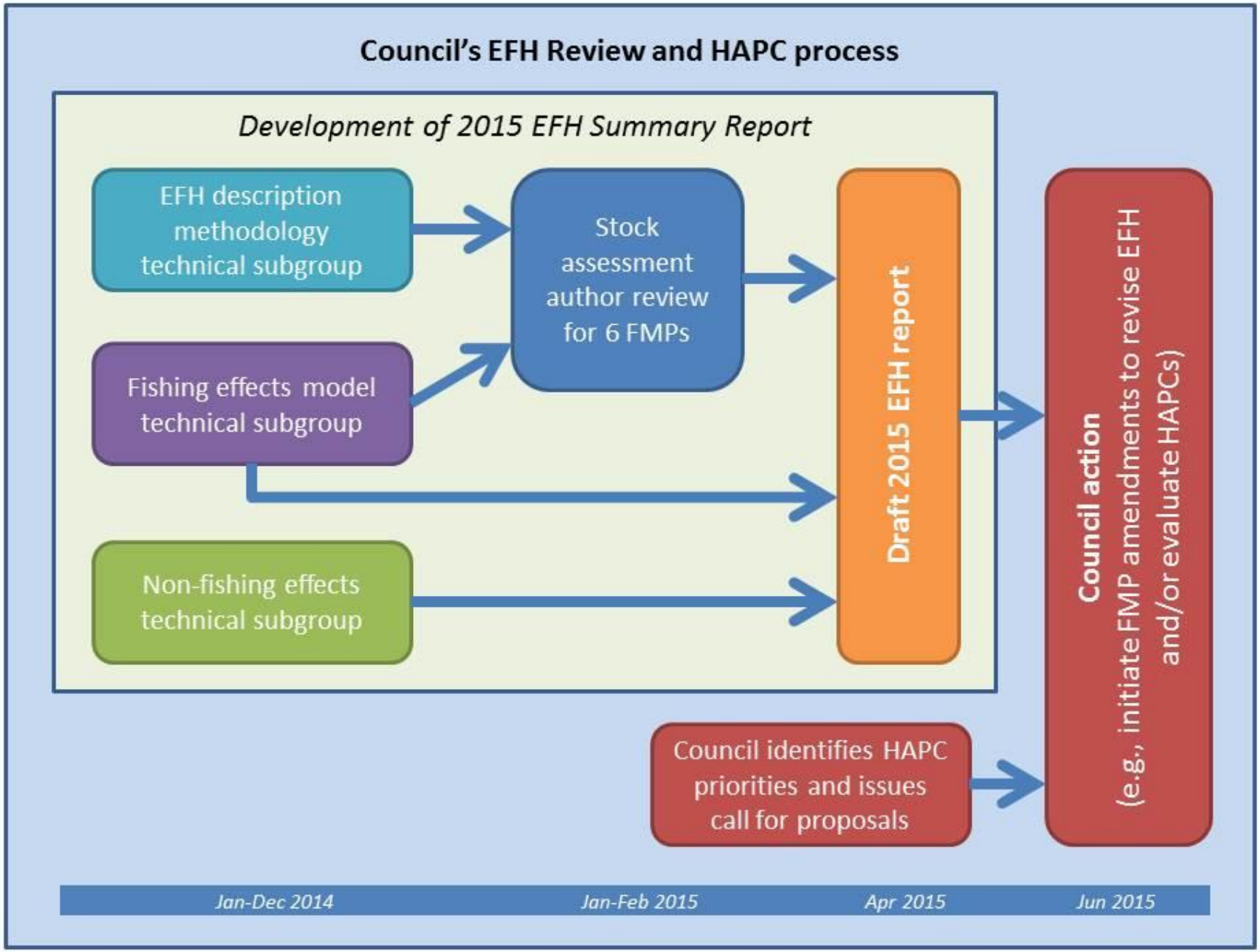
EFH FUNDING

Top five projects in 2015 will be funded (with NSRKC project being partially funded by HQ).

2014 - $860k

2015 - $280k (RO/HQ) + $80k (RO) + $75k (HQ) + $75k (AFSC) = $510k

$1.37 million for FY2014/2015


Council's EFH Review and HAPC process
Development of 2015 EFH Summary Report
EFH description methodology technical subgroup
Fishing effects model technical subgroup
Non-fishing effects technical subgroup
Stock assessment author review for 6 FMPs
Draft 2015 EFH report
Council identifies HAPC priorities and issues call for proposals
Council action
(e.g., initiate FMP amendments to revise EFH and/or evaluate HAPCs)
Jan-Dec 2014
Jan-Feb 2015
Apr 2015
Jun 2015

EFH Species Descriptions

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.

- 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 Species Descriptions Workshop

HCD funded a proposal by Chris Rooper, Ned Laman, and Dan Cooper (AFSC) to refine EFH using GAMs for the 2015 review. A workshop was held at AFSC on January 14, 2015 to discuss the proposal, methodology and potential results. The meeting was also attended via webinar by scientists in Seattle, Juneau, Kodiak and HQ. The agenda included the following list of topics:

- a general description of the approach and comments
- discussion of alternative modeling approaches
- suggestions on how to treat/include explanatory variables
- discussion of how to map the 95% boundaries?
- discussion of how to make decisions on which approach/variables to use for specific species while maintaining a simple framework for the approach?
- Model validation/ground trothing
- Expected products and timeline
- MaxEnt modeling for central GOA juvenile fishes using multiple data sources (Pirtle)

Questions EFH Team posed to SSC for the February 2015 meeting in Seattle:

Is the GAM approach being suggested appropriate for describing Essential Fish Habitat?

Reaffirm support for moving to a time discrete effects model, with added functionality (LEI model briefing document recommendations).

EFH Species Descriptions Review - SSC

The authors described four levels of species descriptions included in the EFH mandate. In the previous EFH assessment, species were described at Level 1 where the 95% of each species distribution range was determined using cumulative survey data and observed catch per unit effort. The species distribution modeling framework, as proposed by the authors, will provide data driven predictions of the 95% species distribution range, moving the species descriptions to Level 2, and will promote the possibility of habitat- based modeling in stock assessments. The authors propose using habitat measurements widely available from remote sensing, long-term monitoring programs at the AFSC such as survey catches (bottom trawl, but also pelagic surveys and ichthyoplankton surveys) since 1991 to provide a summer snapshot of each species', and/or species' life stage, distribution. Authors will use the best available data (presence/absence, or abundance data) for each species or species life stage. Expected products from the study include:

- A NOAA Technical Memorandum that describes the individual species modeling results, with maps of the distribution of each species in each region for all life history stages where modeling can be accomplished,
- ArcGIS coverages for each species, region and life history stage that can be incorporated into SAFE documents and used for further analyses, and
- a manuscript describing the general methodology and results for publication in a peer-reviewed journal.

The SSC supports the use of species distribution modeling for predicting species distribution

Fishing Effects Model Review - SSC

- **The SSC supports the authors' recommendation to examine fishing effects on habitat under a schedule of time-varying fishing effort and urges the authors to carefully consider the appropriate time step (e.g. monthly, seasonally, annually, multi-year) with consideration of the data and habitat recovery rates.**

- The SSC believes that moving to a time-discrete model would be a valuable advancement because, not only could fishing effort vary among time steps, but the productivity of the living substrate could also vary over time. In addition, using a time-discrete model would provide analysts with a covariate related to a fish life history that could allow them to evaluate the impact of habitat on fish species before populations decrease to a critical level, such as the minimum stock size threshold.

The SSC commends the authors on the work that has been done and attainment of funding grants to carry out the proposed work. Due to the extensive work required to complete these projects, SSC acknowledges that recommended analyses may not be completed within the timeframe originally predicted in the documents.

Current Tasks

Developing GAMs and FE model code to allow time-varying approach

Proofing the sediment data categories (mud, sand, pebble, cobble, boulder, rock) – over 280,000 individual points

Update habitat classification information – expand basic epifauna/epifauna/living substrate/non-living substrate

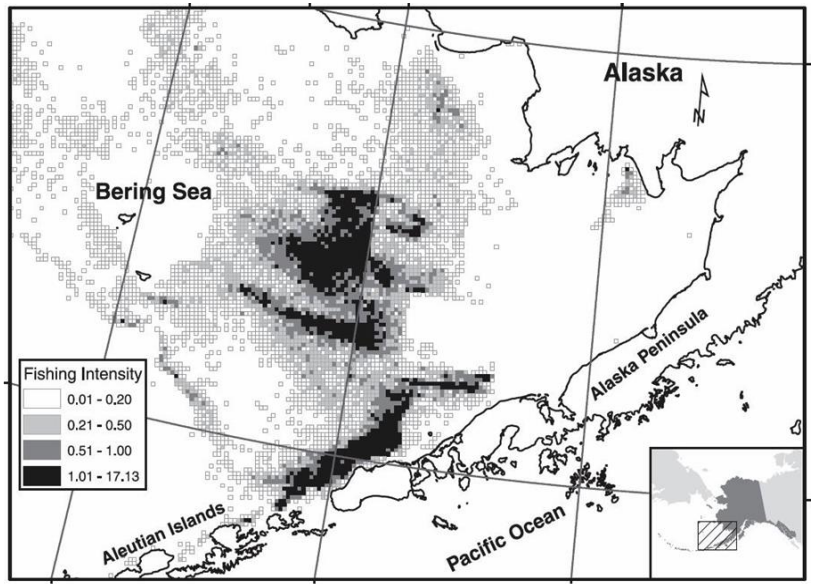
Update habitat categories – from a combination of depth (deep/shallow) and 4 sediment categories to a region-wide sediment type.

Update literature review – based on NE SASI model

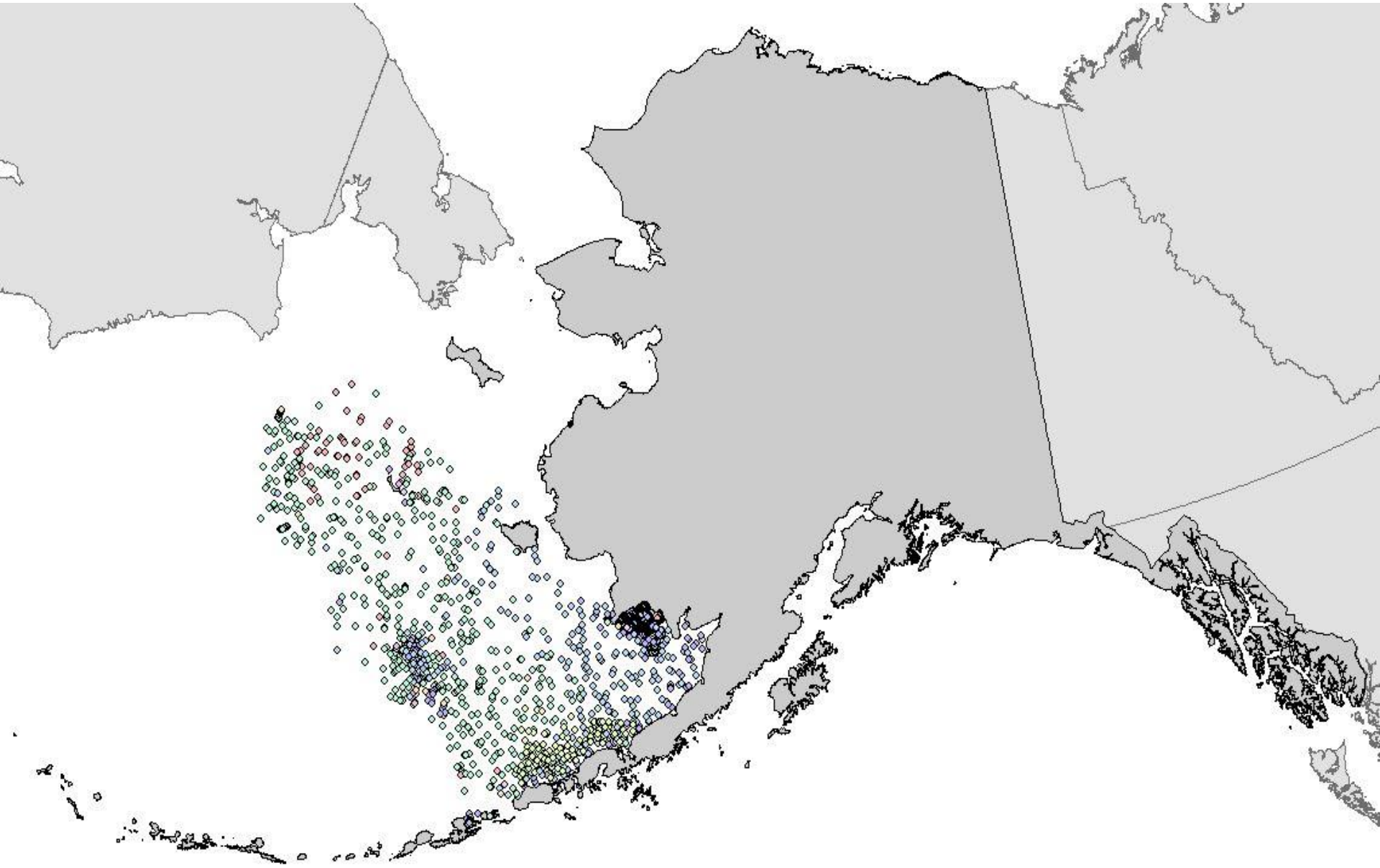
Provide standardized GAM/Effects inputs - NORPAC VMS/CIA database, RACE survey, bottom depth, seafloor slope, rugosity, bottom temperature, tidal current, bottom water layer current speed, aspect of seafloor relative to mean current direction, ocean productivity (ocean color), latitude/longitude, sediment sorting and phi

Model Parameters: Fishing Intensity

25km^2 grid with data summarized by endpoint-only observed data (2005/2010)



Catch-in-areas (CIA) database, which incorporates observed and unobserved data utilizing VMS at varying spatial resolution down to 7km^2.



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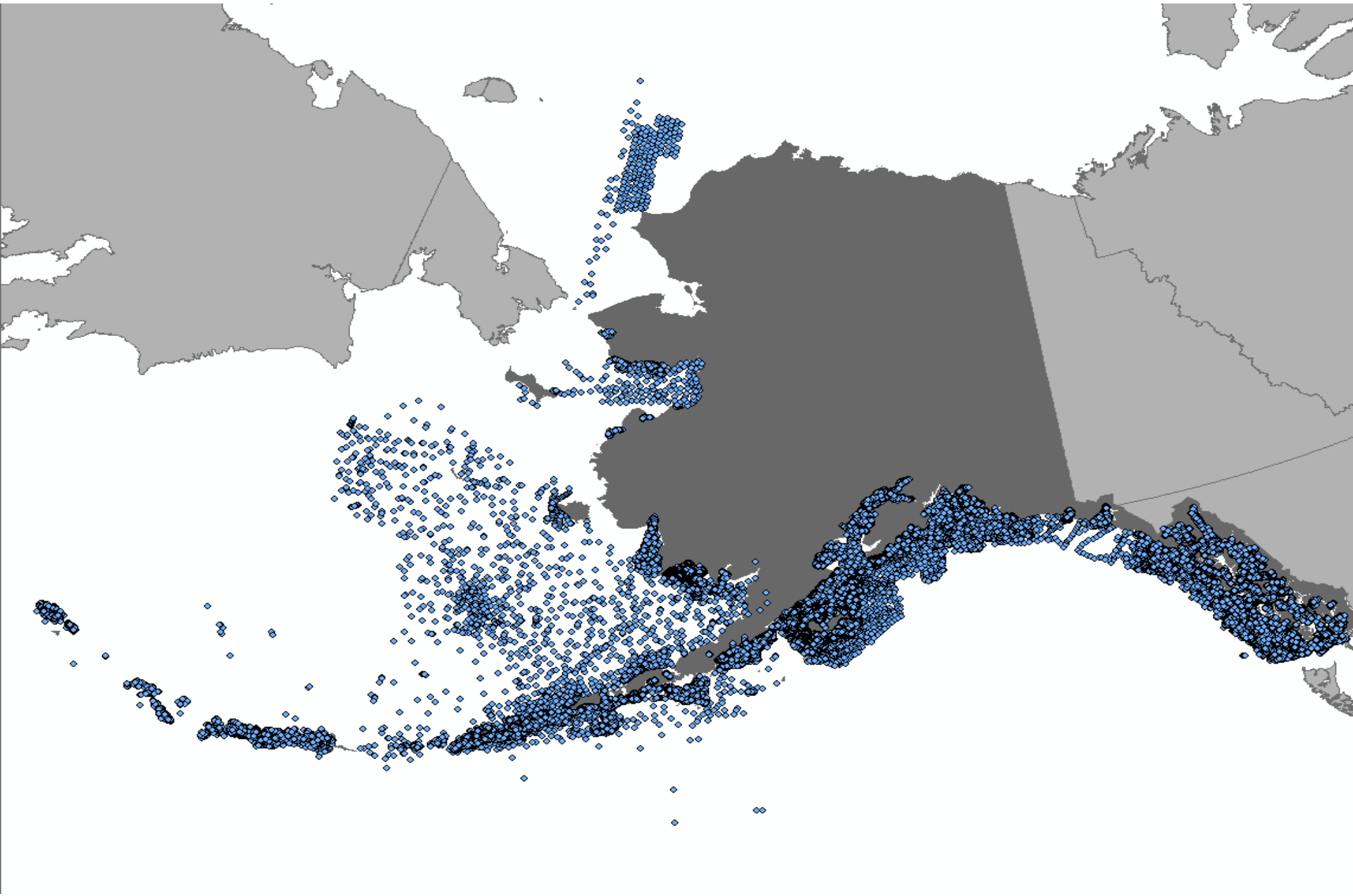


Additional Modeling Work

- Met with Craig Rose this last Thursday to discuss changes to habitat classes, sediment layers, and other model variables

- Also discussion on how to update the gear descriptions component as well as how to implement gear modifications into the FE model.

Draft Recommendations from White Paper

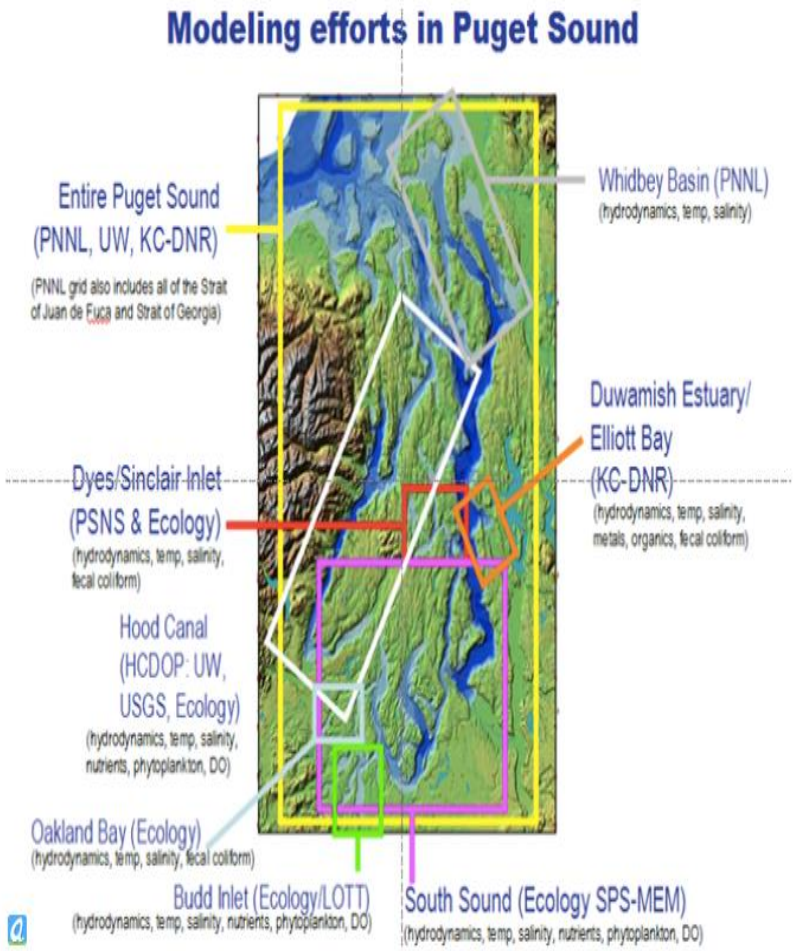
1. Use updated substrate distribution data
2. Use updated commercial fishing effort, including Catch-in-Areas database and VMS
3. Use the “corrected” versions of the Fujioka model provided in Fujioka 2006.
4. Develop R code to implement the time-varying fishing effort version of the Fujioka fishing impacts model
5. Reflect uncertainty in habitat feature sensitivity and recovery parameters
6. Develop functional or empirical models to allow simulation of management alternatives and assess changes to commercial fishing gear

Non-fishing Effects Model

Develop a user interface (GIS based) inventory o
where non-fishing activities occur.

- Locations of marine development areas
  - Physical structures - oil and gas exploration drill sites, platforms, outfalls docks, mines
  - Area based – marine depositional areas, discharge zones, plumes

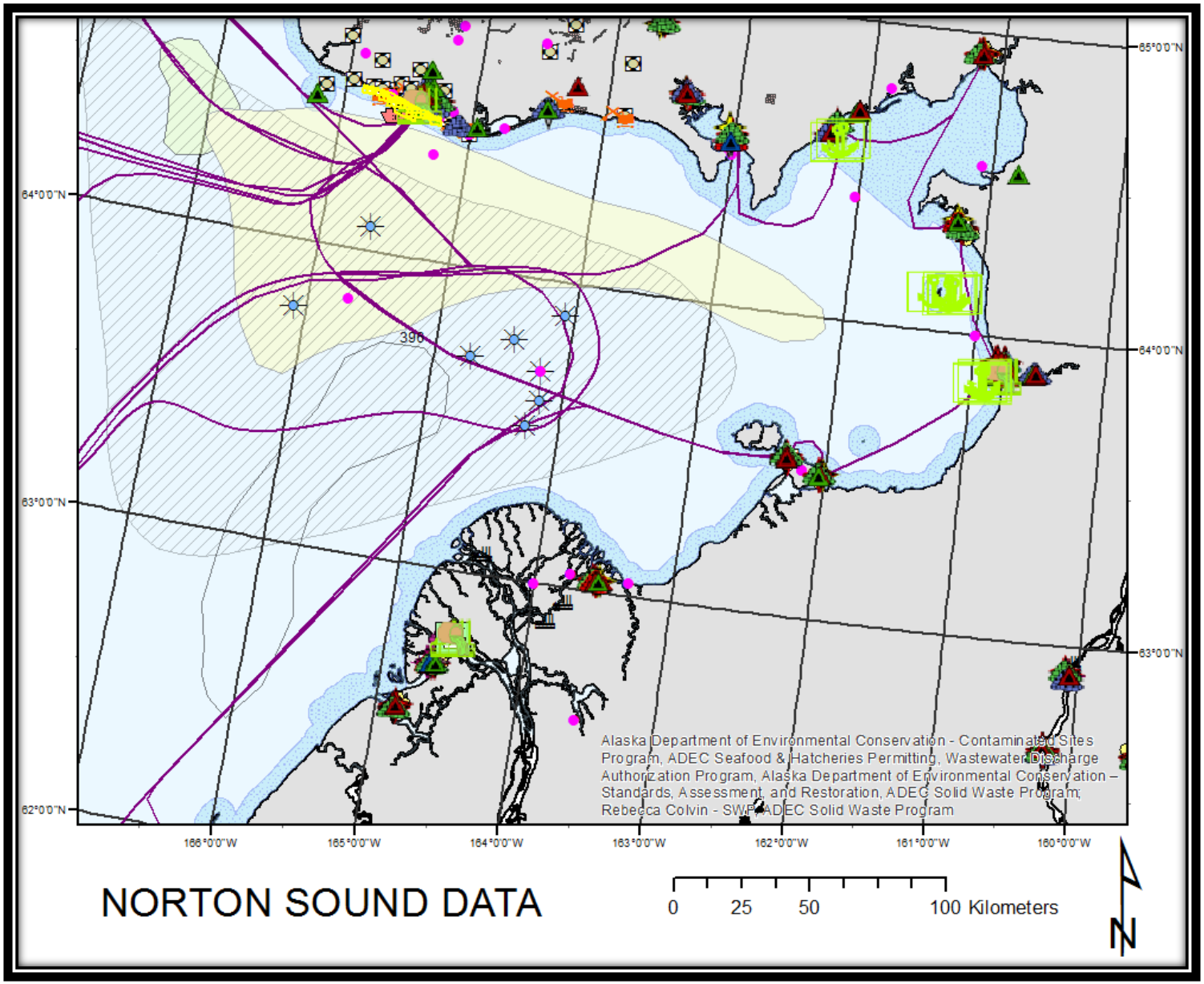
- Pilot project, possibly two in different environments (Sitka and Nome?).



Non-fishing Effects Model

PHASE 1 OBJECTIVES (2014 Funds; $80K)

1) Conduct preliminary review of existing nearshore research (Fish Atlas, EFH Research) and methodologies to assess non-fishing effects on EFH
2) Conduct preliminary review of methods to integrate climate driven habitat-wide stressors with non-fishing effect assessment
3) Develop shapefiles representing major activities and associated stressors and integrate within pilot study geodatabase
4) Produce visualizations and printed maps of assembled data
5) Identify major non-fishing activities and associated stressors within Norton Sound
6) Document preliminary research and findings to provide recommendations for future work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Alaska Department of Environmental Conservation - Contaminated Sites Program, ADEC Seafood & Hatcheries Permitting, Wastewater Discharge Authorization Program, Alaska Department of Environmental Conservation – Standards, Assessment, and Restoration, ADEC Solid Waste Program; Rebecca Colvin - SW, ADEC Solid Waste Program
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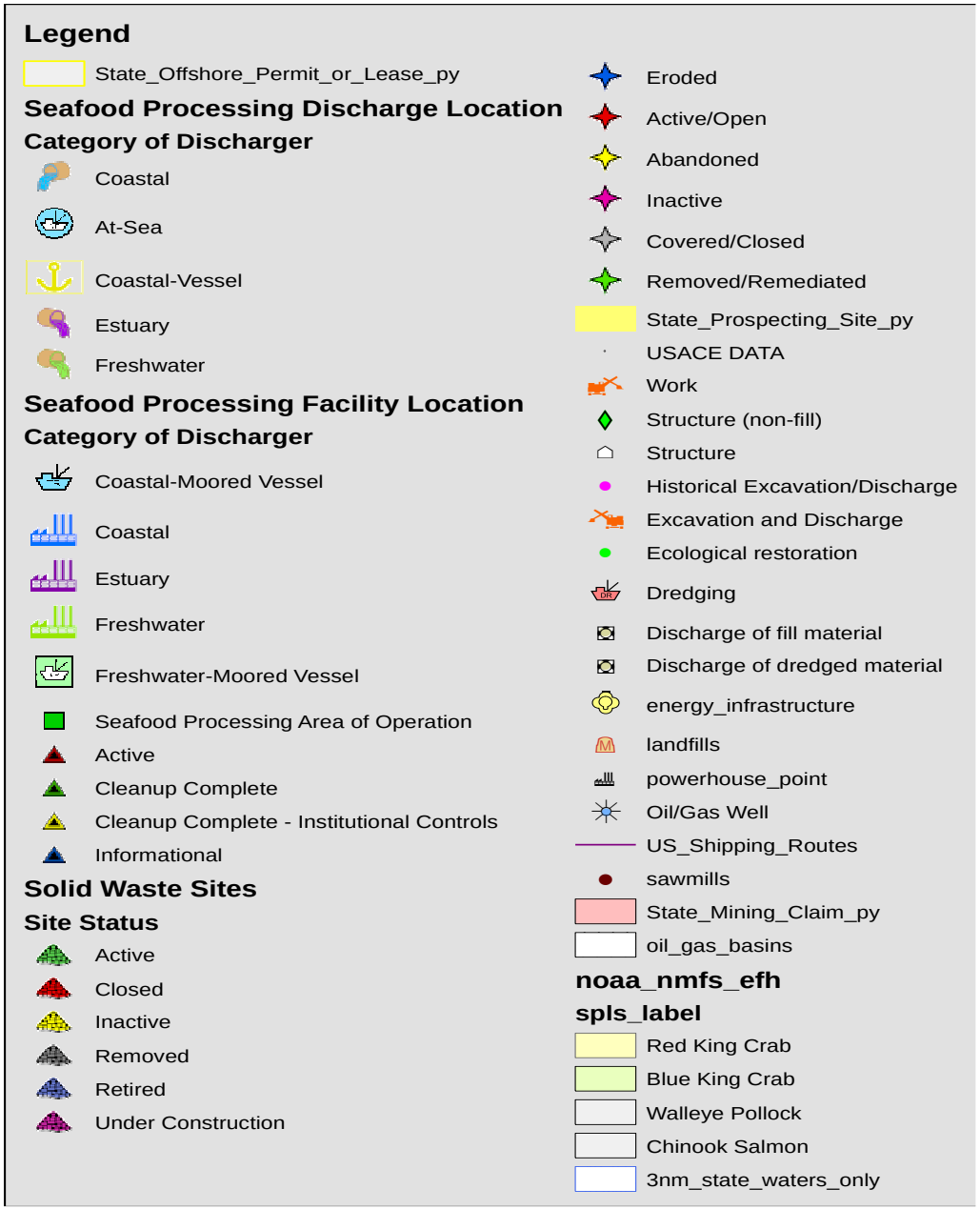
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Seafood Processing Discharge Location
Category of Discharger
Coastal
At-Sea
Coastal-Vessel
Estuary
Freshwater
Seafood Processing Facility Location
Category of Discharger
Coastal-Moored Vessel
Coastal
Estuary
Freshwater
Freshwater-Moored Vessel
Seafood Processing Area of Operation
Active
Cleanup Complete
Cleanup Complete - Institutional Controls
Informational
Solid Waste Sites
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Structure
Historical Excavation/Discharge
Excavation and Discharge
Ecological restoration
Dredging
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Blue King Crab
Walleye Pollock
Chinook Salmon
3nm_state_waters_only

Non-fishing Effects Model

LONG-TERM OBJECTIVES (no funds committed)

1) Apply documented methodologies from Phase 1 to additional pilot study areas including portions of Alaska's arctic coastline and Cook Inlet
2) Develop and implement methodology to delineate habitat types within pilot study areas
3) Develop ArcGIS Citation Data Model (CDM) in order to transparently link cumulative impact scores with source documentation
4) Develop pilot model to calculate cumulative impact scores for individual grid cells
5) Integrate both fishing and non-fishing effect components within model framework
6) Design and develop web interphase to store, share, and visualize model data
7) Design and implement a coded bibliography database and conduct extensive scientific literature review as component to assign impact and recovery scores for stressor type – habitat feature combinations
8) Design and implement a scientist – stakeholder workshop as component to assign impact and recovery scores for stressor type – habitat feature combinations
9) Produce cumulative impact maps linked with conservation recommendations on pilot study areas
10) Write detailed protocol on carrying out state-wide non-fishing cumulative assessment

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Norton Sound 2015 Update

Norton Sound Red King Crab – 2014 Field Season

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 RFP-funded plus 20k RO-funded equipment and software purchase*

Field work was completed in April, July, and August. This includes GPS of thru-ice mining, ASV survey of public mining area, and establishing contacts with ADFG, NSEDC, Kawerak, and mining/fishing participants. On-board survey of a mining vessel for crab bycatch was also conducted. We also hauled commercial crab pots with an active fishery participant.

Multibeam imagery is currently being processed and report will be finished by original date of May 2015.

Examining the effects of offshore mining activities on habitat features important for Norton Sound red king crab (*Paralithodes camtschaticus*)

Mabel Baldwin-Schaeffer[1], Brad Harris[1], John Olson[2], Robert Foy[3]

[1] Fisheries, Aquatic Science & Technology (FAST) Lab – Alaska Pacific University, [2] NOAA Habitat, [3] Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA

[1] 4101 University Dr., Anchorage, AK 99508, mbaldwin-schaeffer@alaskapacific.edu

Background

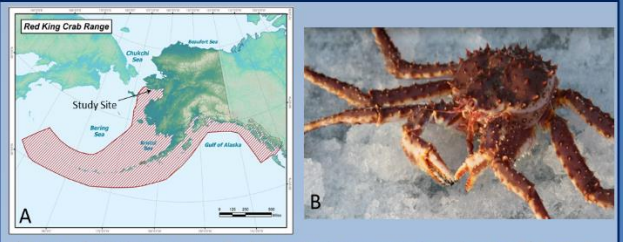
The intensity and distribution of Norton Sound seabed mining operations off Nome, Alaska are increasing rapidly due to high gold prices, advances in underwater mining technologies and a reality television series produced by the Discovery Channel. Since 1996, the number of permitted offshore mining operations has grown from 3 to more than 200 and the total area designated for mining has increased from 320 to nearly 24,000 acres.

Problems:

- Mining activities may adversely impact benthic structures (e.g. cobbles, shell hash, hydroids) thought to be important for Norton Sound red king crab (*Paralithodes camtschaticus*, NSRKC).
- Without benthic structures, juvenile crabs are subject to higher rates of mortality due to inadequate food, predation and physical disturbances, such as waves and currents.
- The photo/video methods typically used to assess benthic structures are problematic in Norton Sound due to near-zero visibility conditions resulting from Yukon River sediments, shallow depths and frequent wind-driven wave events.

Project Aims

1) *Develop collaborative partnerships in Nome to support a mining impacts study.*
2) *Test new acoustic methods for sampling and mapping seabed complexity in shallow highly turbid waters.*



A) Map of Alaska showing Red King Crab range and study site. B) NSRKC

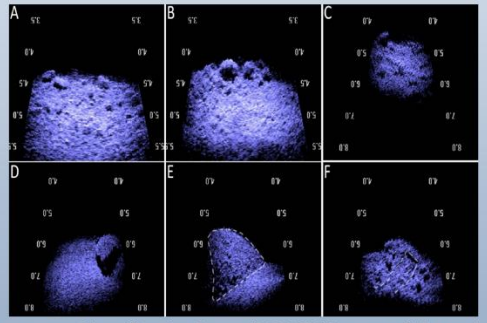
Approach

We developed partnerships with Alaska Department of Fish & Game, Norton Sound Economic Development Corporation, commercial and subsistence crab fishers, tribal organizations, and the mining industry to incorporate meaningful local participation in studying the impacts of mining on benthic habitats.

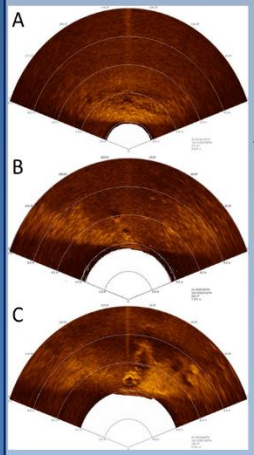
We tested an Autonomous Sampling Vessel (ASV) in the western public mining area directly offshore of Nome while mining operations were ongoing. The ASV was developed jointly by Florida International University and SeaRobotics. The ASV can run pre-programmed transects collecting repeatable, high-resolution, spatially-referenced physical and biological data which are telemetered in real-time back to a base station. It is equipped with a calibrated horizontally aimed split-beam echosounder (Simrad EK60, 120 kHz), an imaging sonar (Soundmetrics DIDSON, 1.8 MHz) and a wide-swath multibeam echosounder (Kongsberg Mesotech M3).

A) ASV survey (red box) in the western public mining area; 123 transects spaced 2.5 m apart and totaling 70 km. B) ASV underway off Nome, AK. C) ASV (red circle) on transect with suction dredge and excavation mining operations ongoing.

Analyses (ongoing)



Dual Frequency Identification Sonar (DIDSON) images of the seabed in the West Nome Beach Public Mining Area showing a complex of gravel-cobble sediments and vertical epifauna (A - C), a 0.5m high boulder (D), and 2m high excavator tailings pile (E, outlined by dashed line) and excavator bucket sweep marks (F, outlined by dashed line).



M3 multibeam sonar imagery showing complex benthic structure (A, B) and pits resulting from suction dredging (C).

Next Steps:

In summer 2015 we will:

1. Re-survey the 2014 transects to assess the persistence of benthic mining alterations.
2. Use satellite tags to identify female NSRKC spawning locations and likely larval settlement areas.
3. Survey a new area thought to be important for NSRKC recruitment and test ASV ability to directly identify and count adult NSRKC on the seabed.

Acknowledgements

Dr. Stephen Jewett, Micah Huss, Kevin Boswell, Adam Zenone, Kawerak Inc., Vernon Adkinson, Adem Boeckmann, Charlie Lean, Scott Kent and Jen Bell. Funding from NOAA Essential Fish Habitat Program and the Pollock Conservation Cooperative

Norton Sound Red King Crab – 2015 Field Season

Assessing the Persistence of Benthic Mining Alterations - *We will conduct a 3-day ASV survey to re-sample the July 2014 West Nome Beach Public Mining Area transects. We will assess to what extent the mining benthic alterations detected in 2014 have persisted through the year. Specifically we will re-examine the locations of known excavation and suction dredge benthic alterations to determine 1) if they detectable, and 2) if detectable alterations have decreased in size (area, depth, height).*

Mapping a NSRKC Recruitment Area - *In 2015, we will 1) convene a workshop with these partners to delineate the specific survey location in more detail and 2) conduct a 5-day ASV survey of the area. In addition to mapping the seabed to characterize benthic structure we will explore the use of the ASV acoustic imagery to directly identify and count NSRKC on the seabed*

Tagging to Identify Spawning and Larval Settlement Areas - *Ten female crab collected during ADFG trawl surveys in September 2015 will be tagged with a pop-up satellite tag on the carapace with marine epoxy using the same attachment method regularly used in Kodiak by AFSC researchers. The satellite tag will collect data on depth and movement. The tags will be programmed to release and float to the surface in the spring of 2016 after the typical molting period providing the exact location of larval release and mating. Movement data will be used to validate that the crab was still alive at the time of tag release.*

To conclude:

- Held a workshop on EFH Descriptions
- SSC review of Species Descriptions and Fishing Effects Model methodology
- On track for a late June/July review to SAA
- Non-fishing Effects model continues to evolve
- NSRKC research will continue in 2015