Seascape-scale modelling of benthic habitat disturbance from commercial fishing activities

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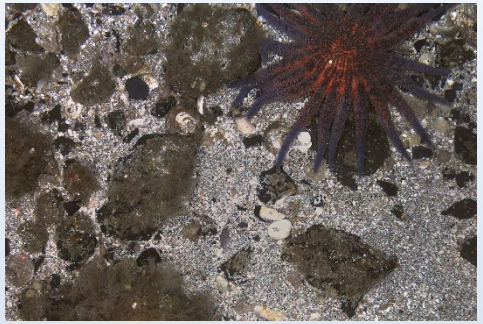
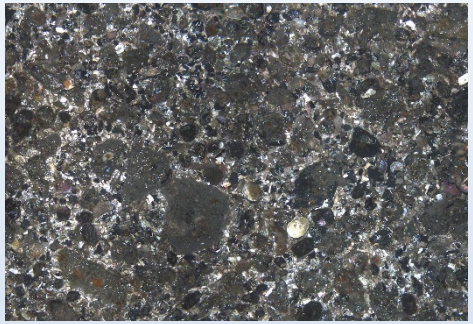
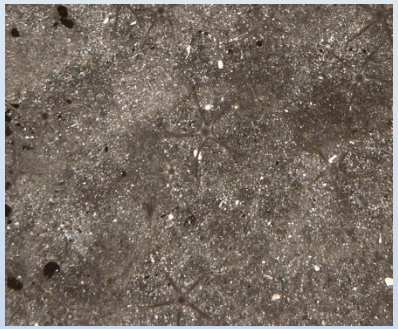
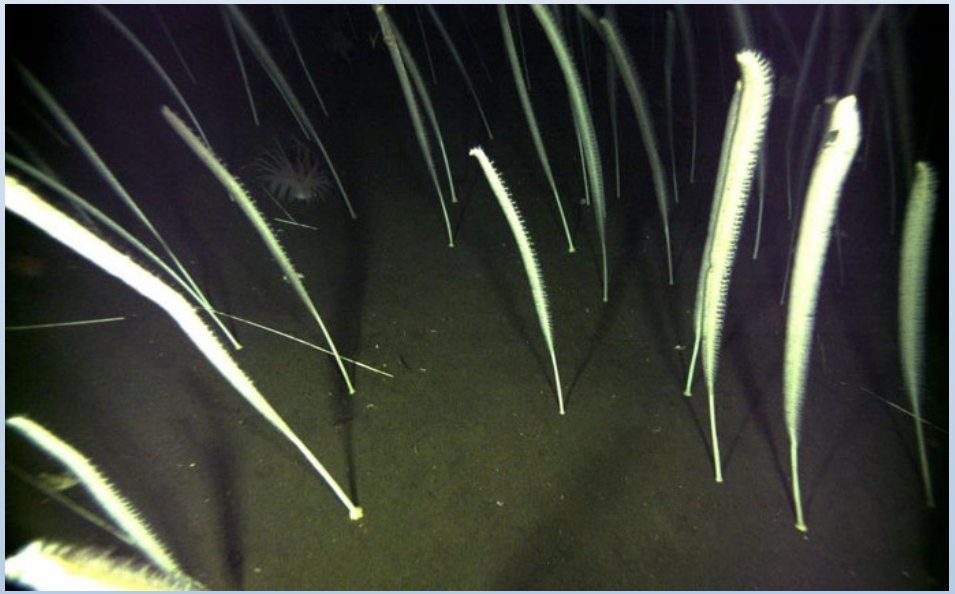
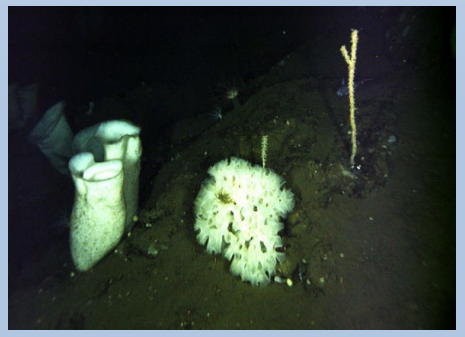
NOAA FISHERIES

Cornell University

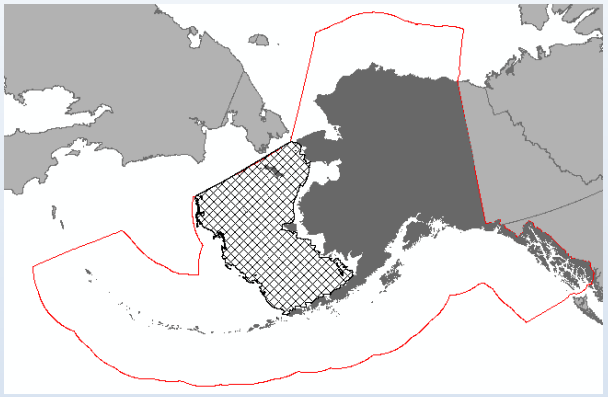
Benthic Habitat Features


Essential Fish Habitat (EFH)

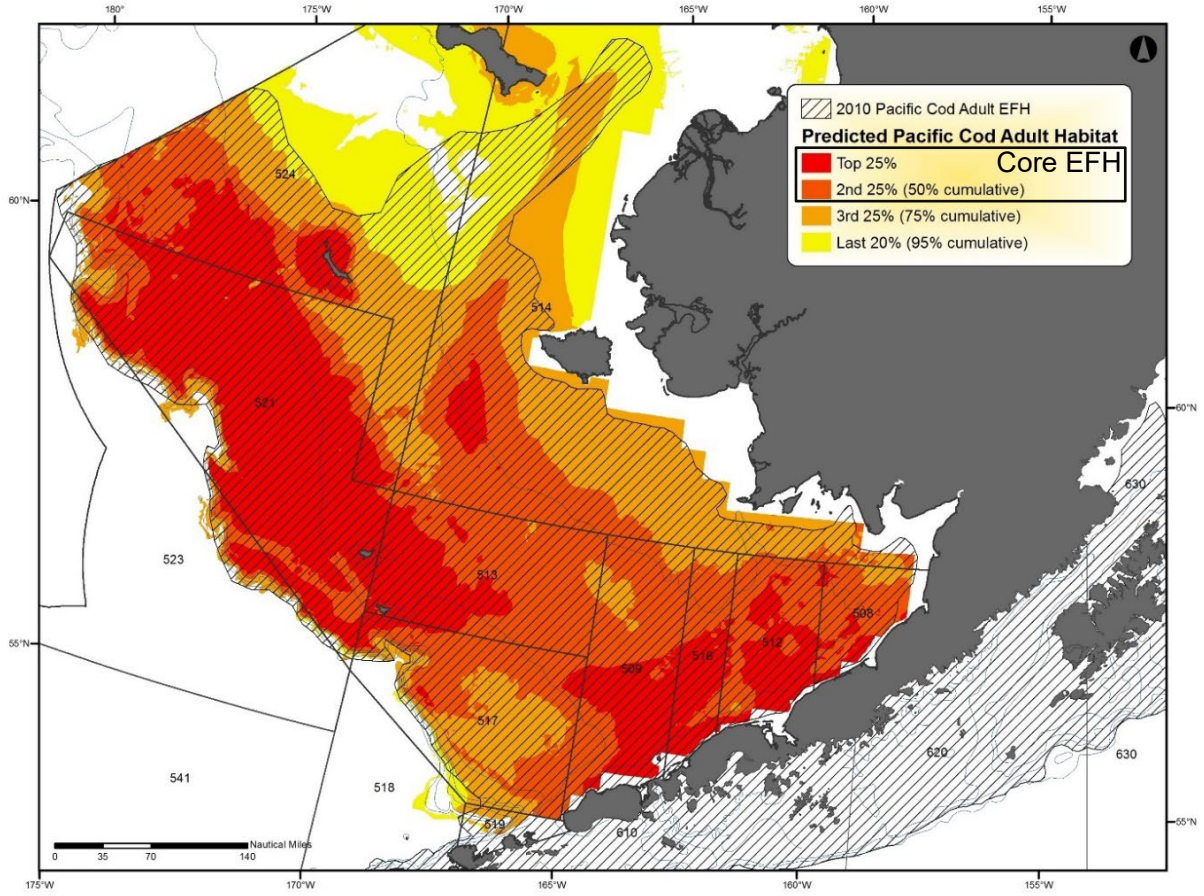


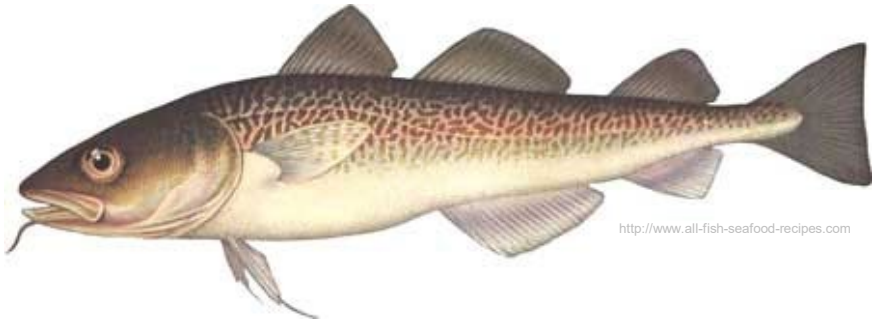
NOAA Technical Memorandum NMFS-AFSC-

Model-based Essential Fish Habitat Definitions for Aleutian Islands Groundfish Species

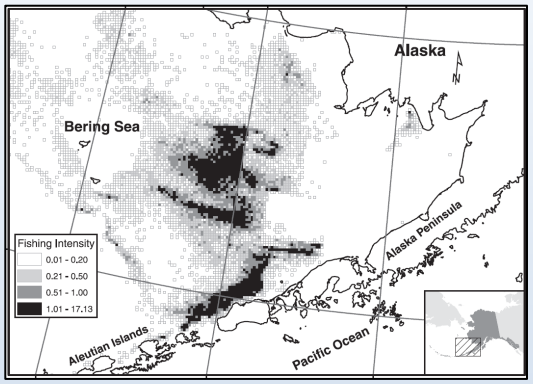
by
Turner, K, Rooper, CN, Rooney, S, Laman, E, Cooper, D, Zimmermann, M

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration National Marine Fisheries Service Alaska Fisheries Science Center
October 2015



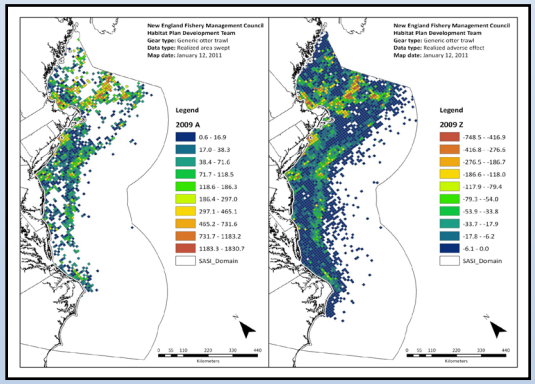


Modeling Habitat Disturbance



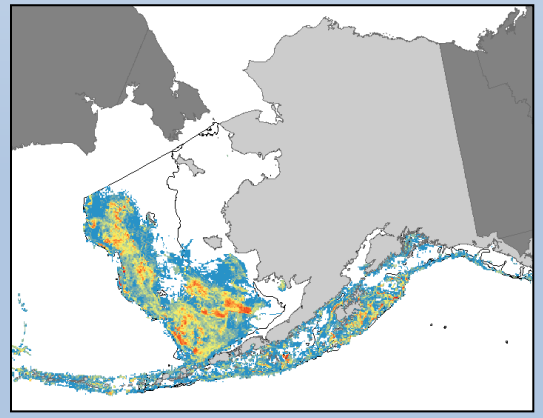
Long-term effects index (LEI)

- NPFMC 2005 & 2010 EFH reviews, Fujioka (2006)
- Continuous time, 5x5 km resolution, End-point
- 4 substrate types × 4 habitat features × 11 gear types



Swept Area Seabed Impacts (SASI)

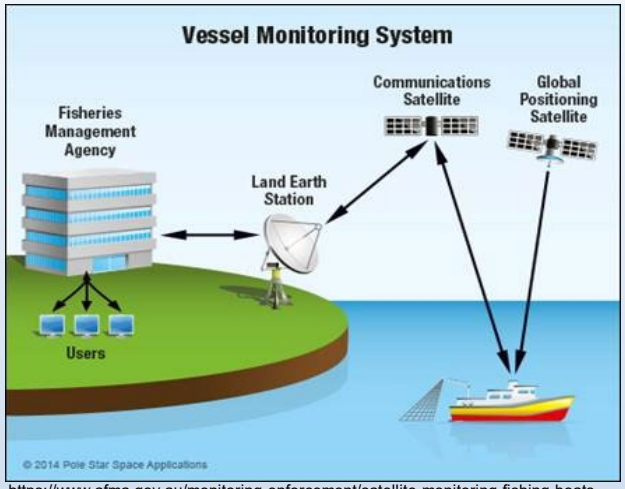
- NEFMC 2010 EFH review, Grabowski et al. (2014)
- Discrete time (annual), 10x10 km resolution, VTR
- 2 energy regimes × 5 substrate types × 27 substrate-specific habitat features × 9 gear types



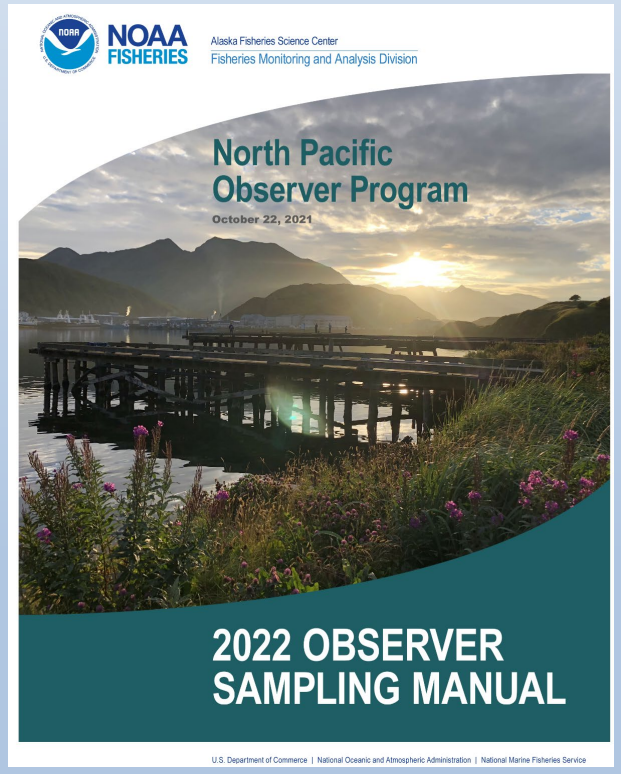
The Fishing Effects (FE) model

- NPFMC 2015 EFH Review, Smeltz et al. (2019)
- Discrete time (monthly) 2003- 2016, CIA
- 5 substrate types × 27 substrate-specific habitat features × 67 gear “types”

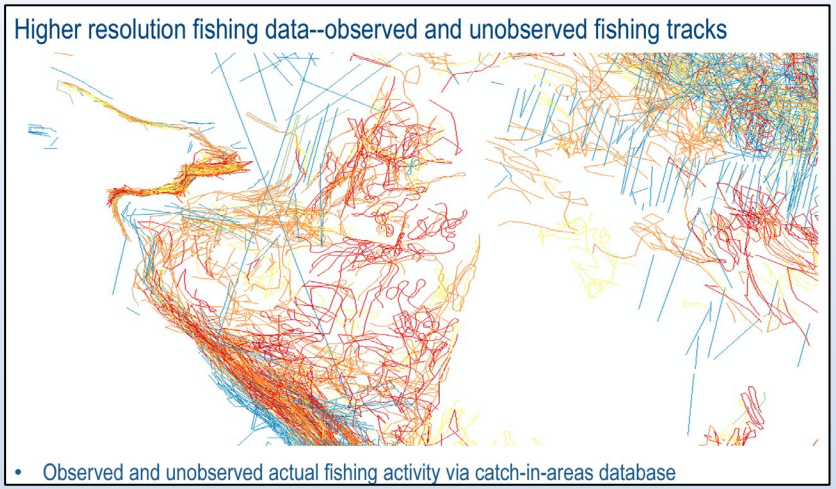
FE Model Inputs – Fishing Events



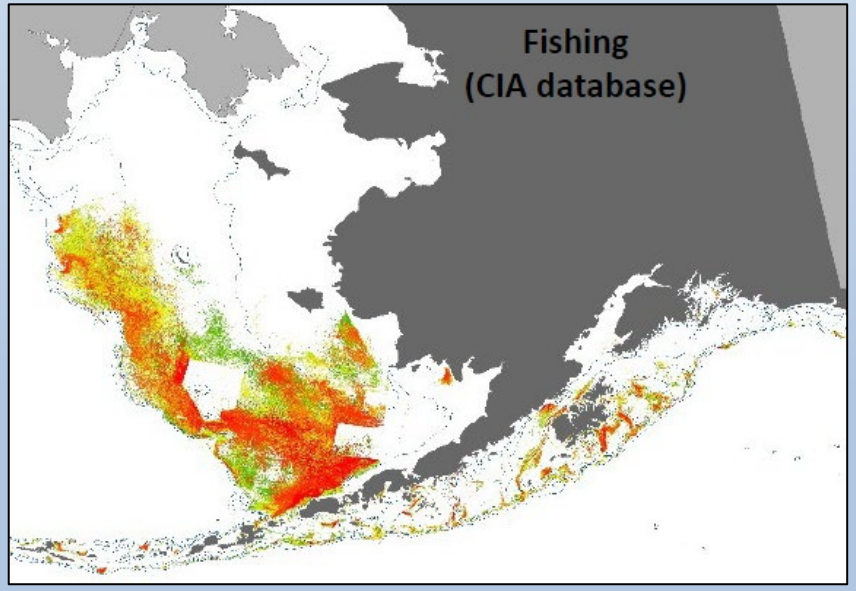
https://www.afma.gov.au/monitoring-enforcement/satellite-monitoring-fishing-boats

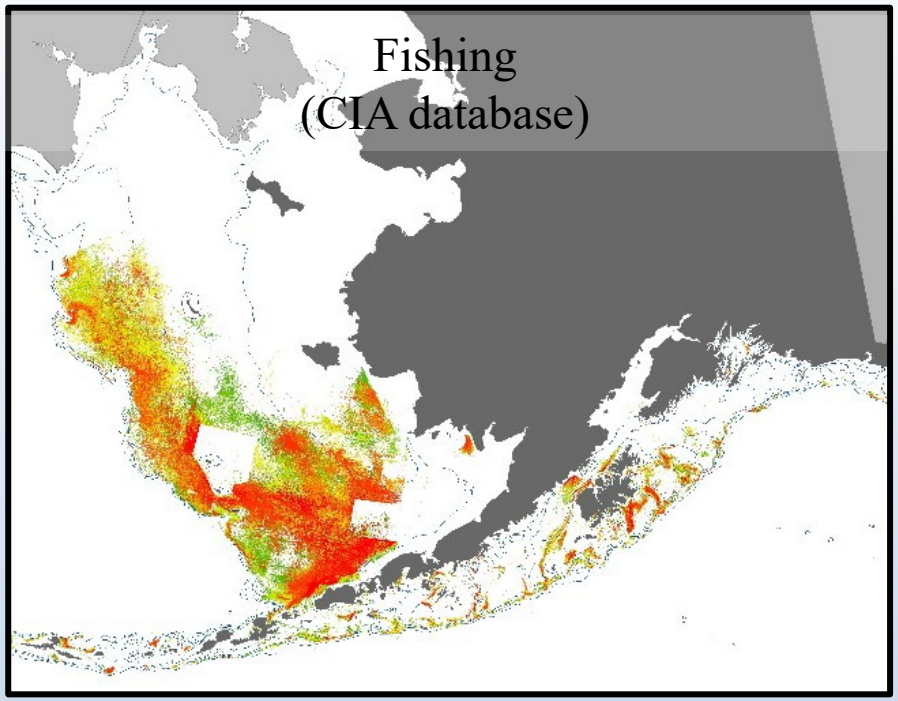


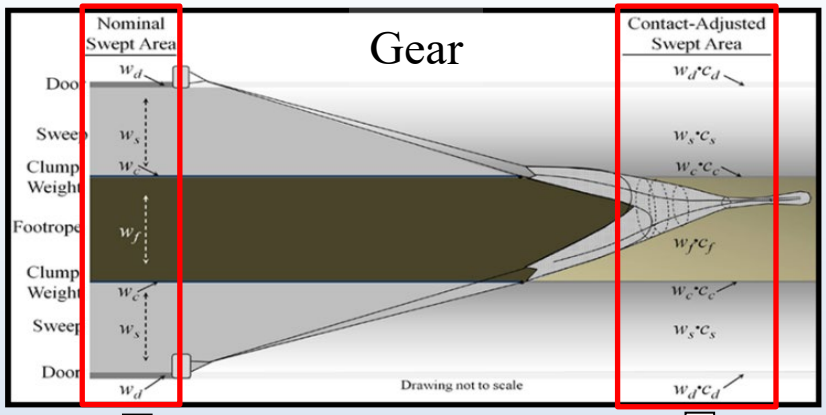
VMS-Observer Enabled Catch-In-Areas (CIA) Database

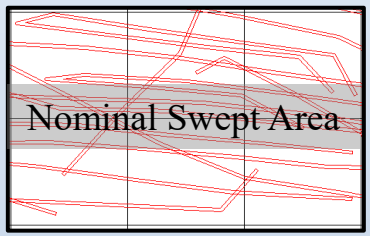


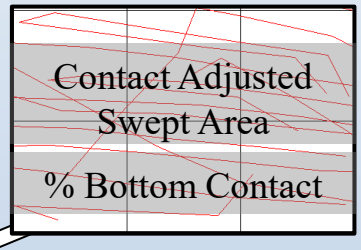
http://gfetw.org/wp-content/uploads/2020/06/Gray-and-Lewis-PDF.pdf



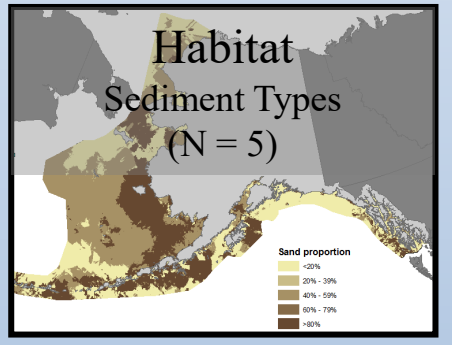








$$H_{t+1} = H_t(1 - I'_t) + h_t\rho'_t$$

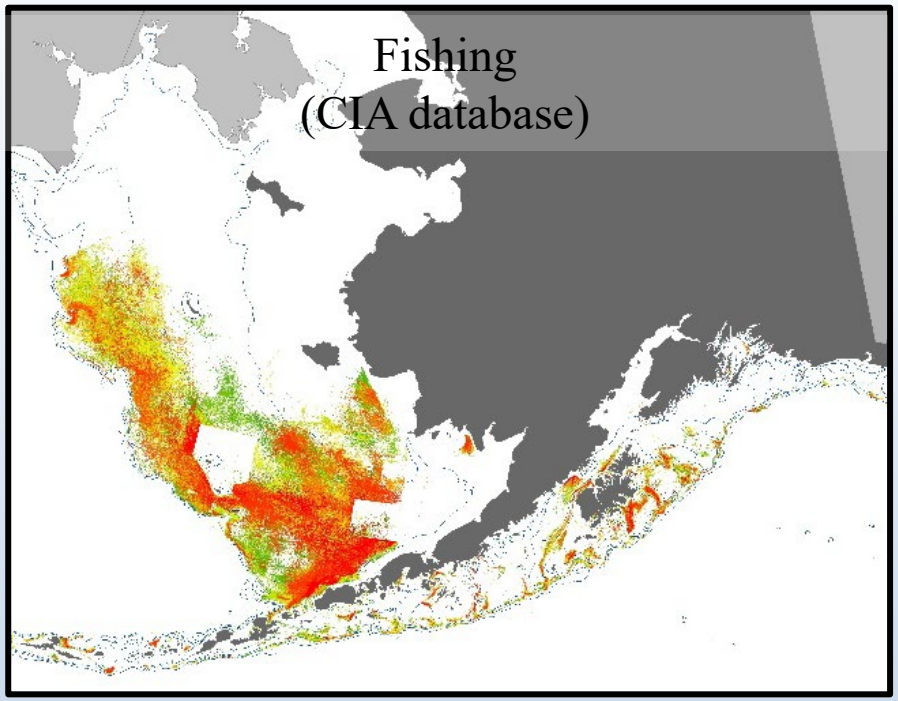


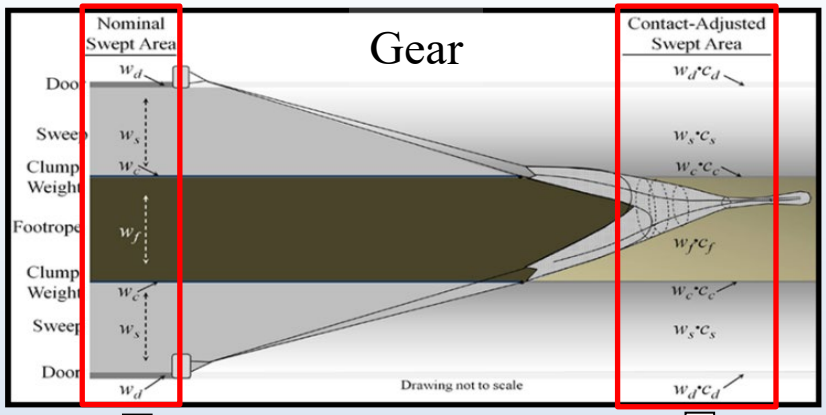
Adjusted Swept Area (per month)

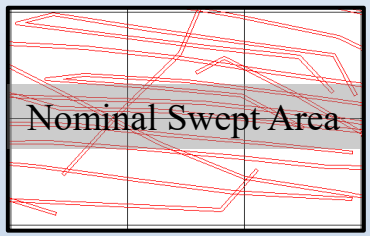
Susceptibility

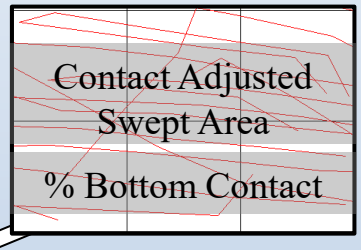
Recovery Time (months)

Fishing Effects









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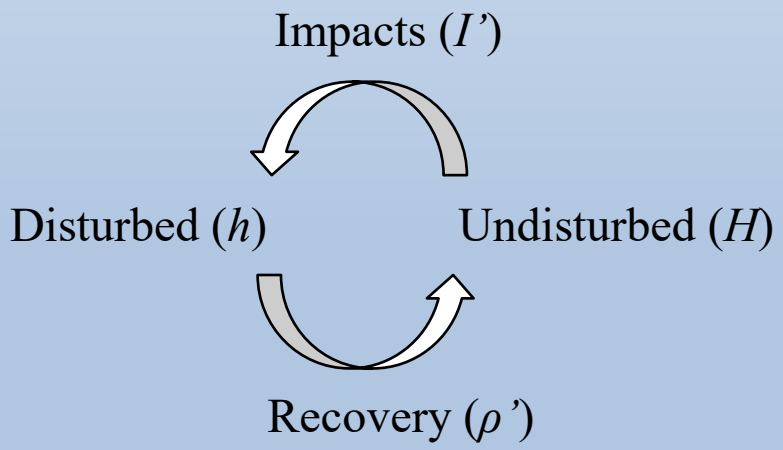
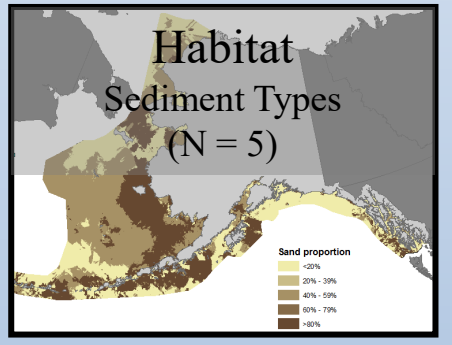


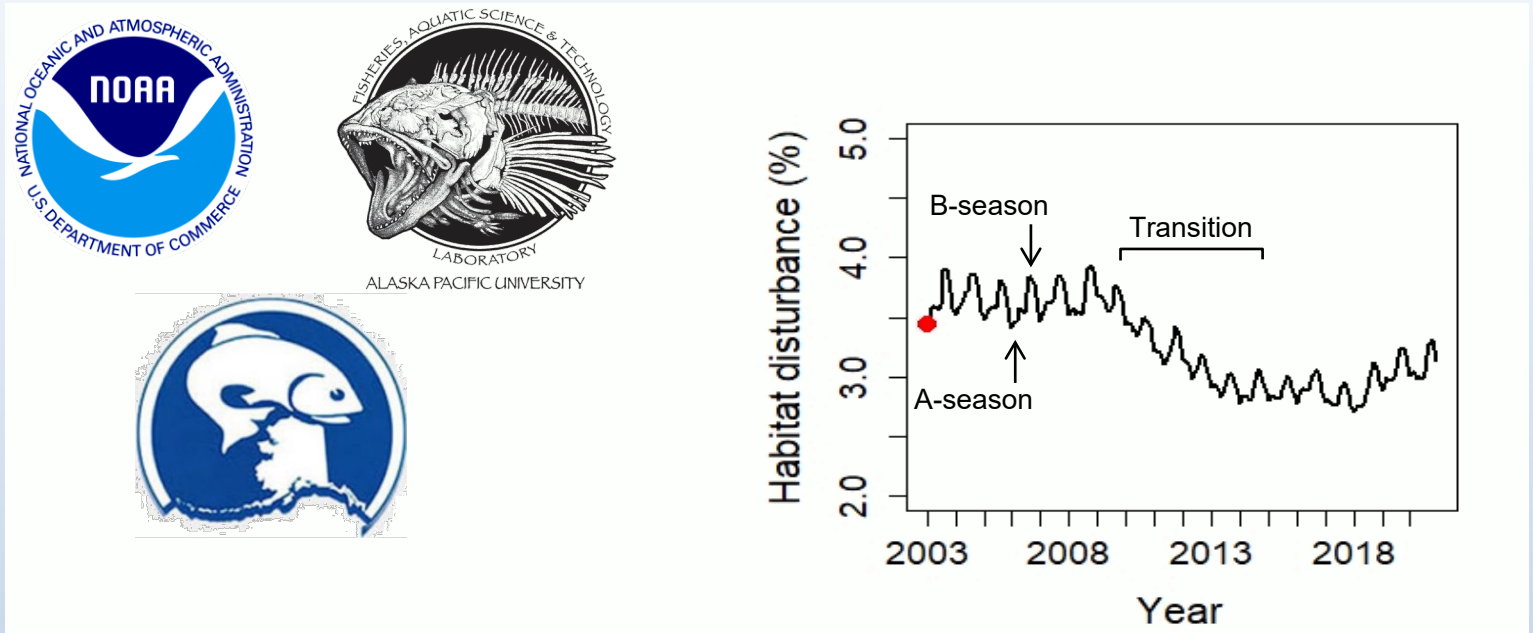


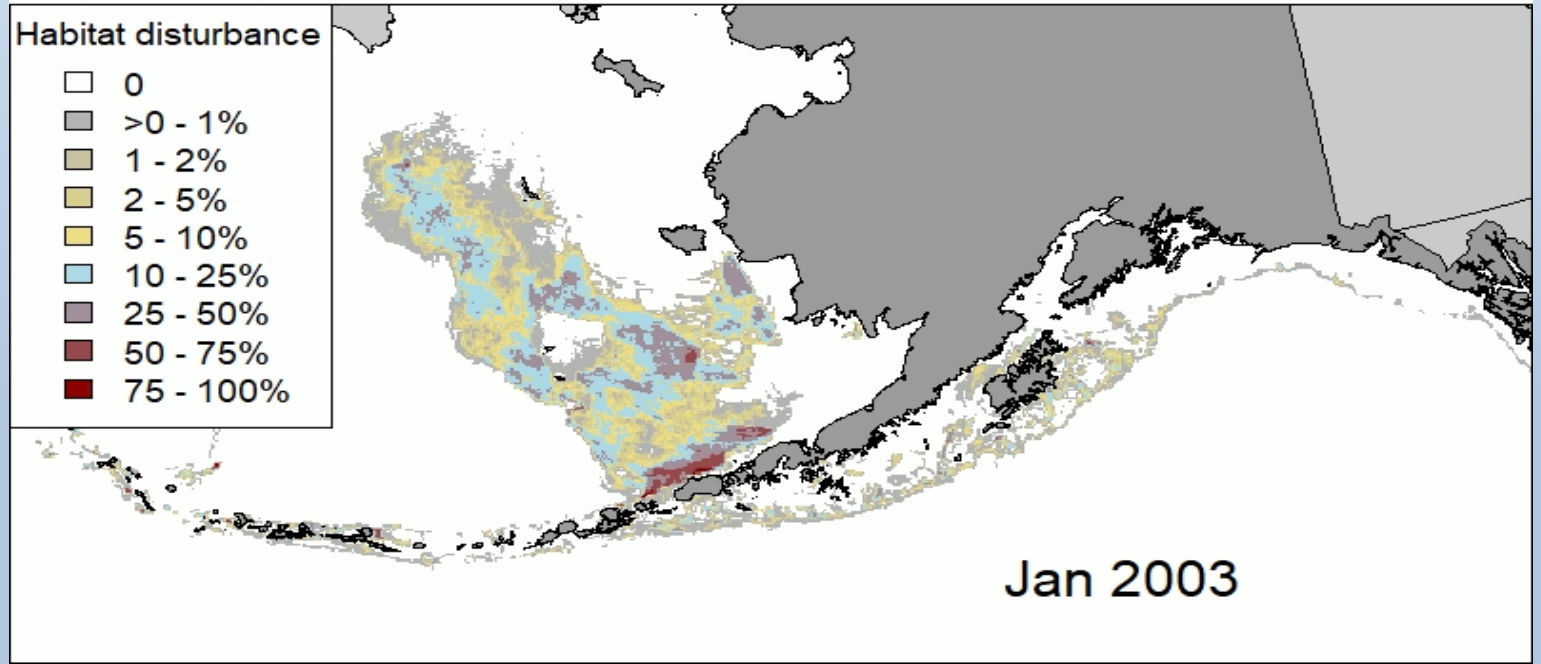
Susceptibility
Adjusted Swept Area (per month)

Recovery Time (months)

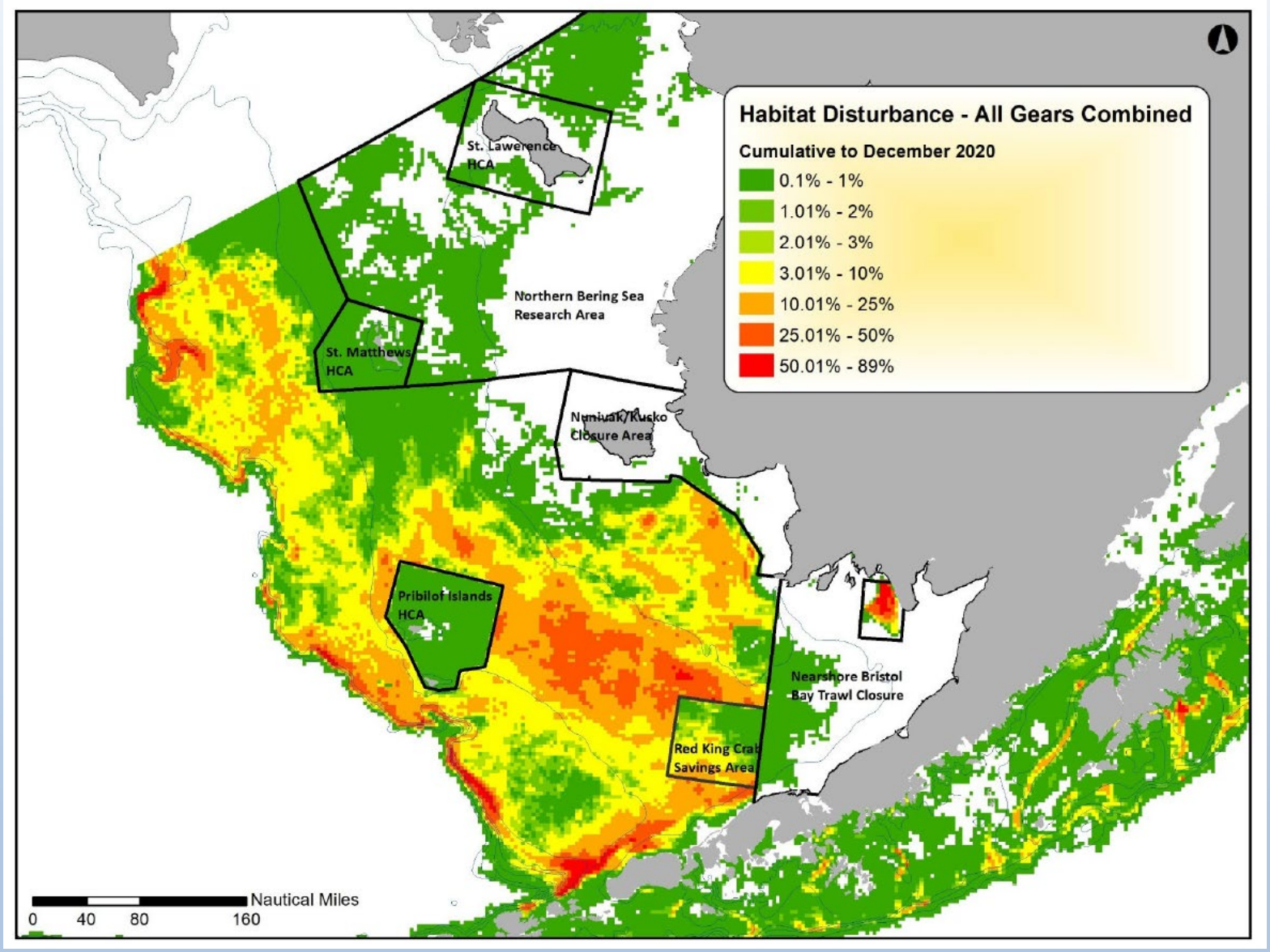
Fishing Effects

Fishing Effects Model





Fishing Effects model output – Dec 2020



North Pacific Fisheries Management Council
EFH 5-Year Review

Is habitat disturbance from fishing "*more than minimal, and not temporary*"?

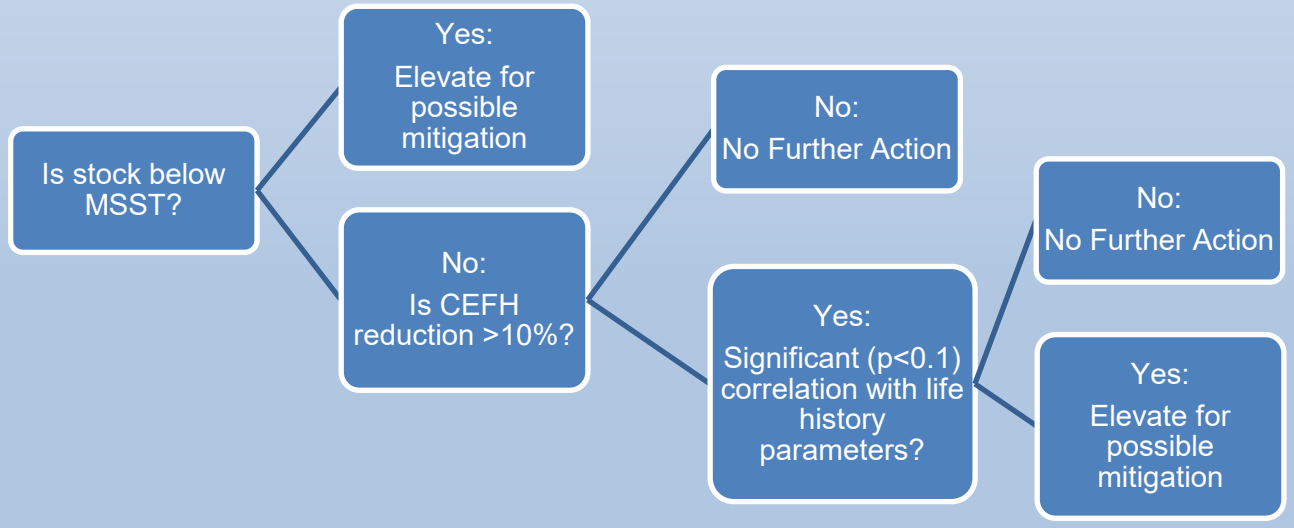
For NPFMC managed stocks with an Essential Fish Habitat (EFH):

<u>More than Minimal</u>

-Does habitat reduction within each specie's Core EFH (upper 50%) exceed 10%?

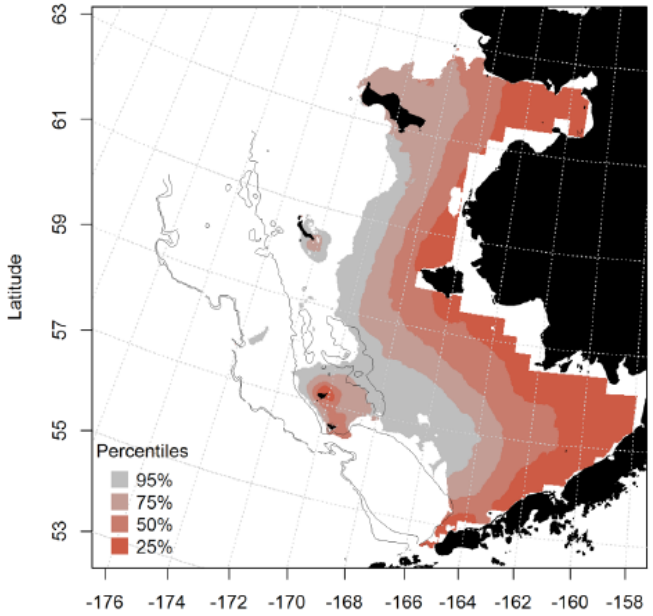
<u>Not Temporary</u>

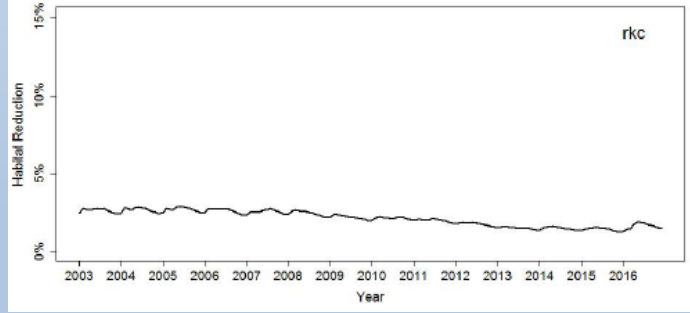
-Is the disturbance time trend negatively correlated with life history parameters?*



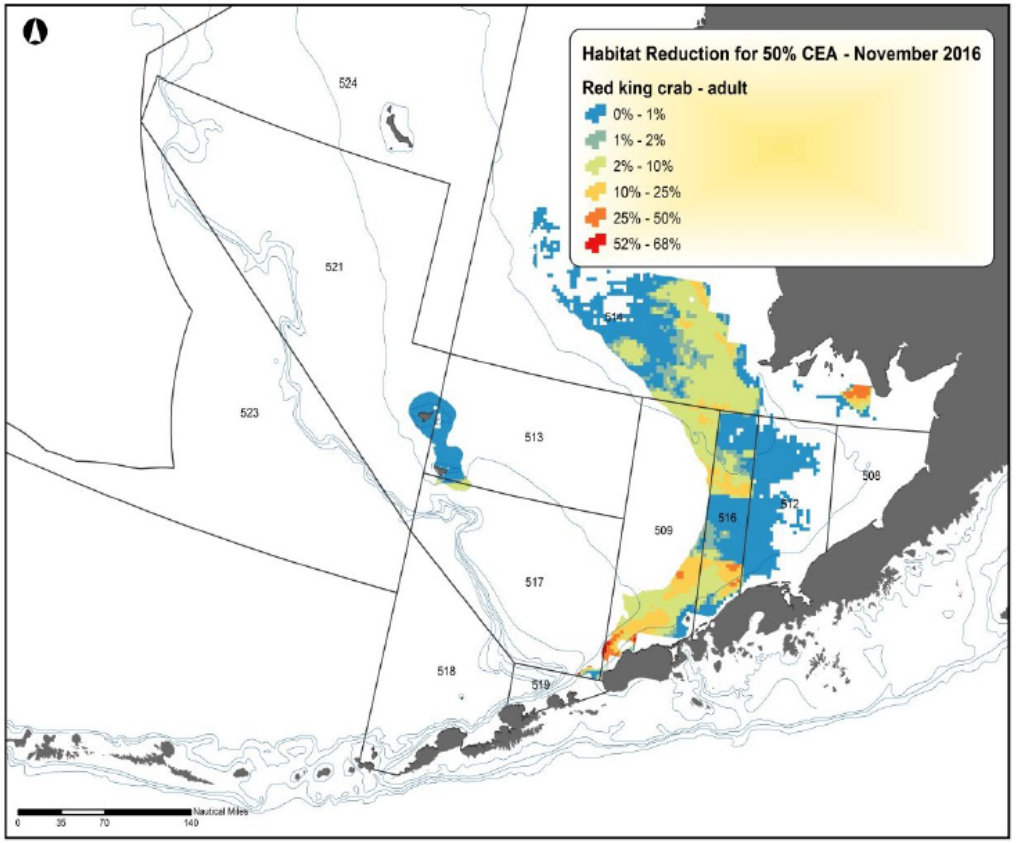
2017 Stock Author Review – Bristol Bay red king crab

Core EFH (CEA) area defined as 50% cumulative distribution





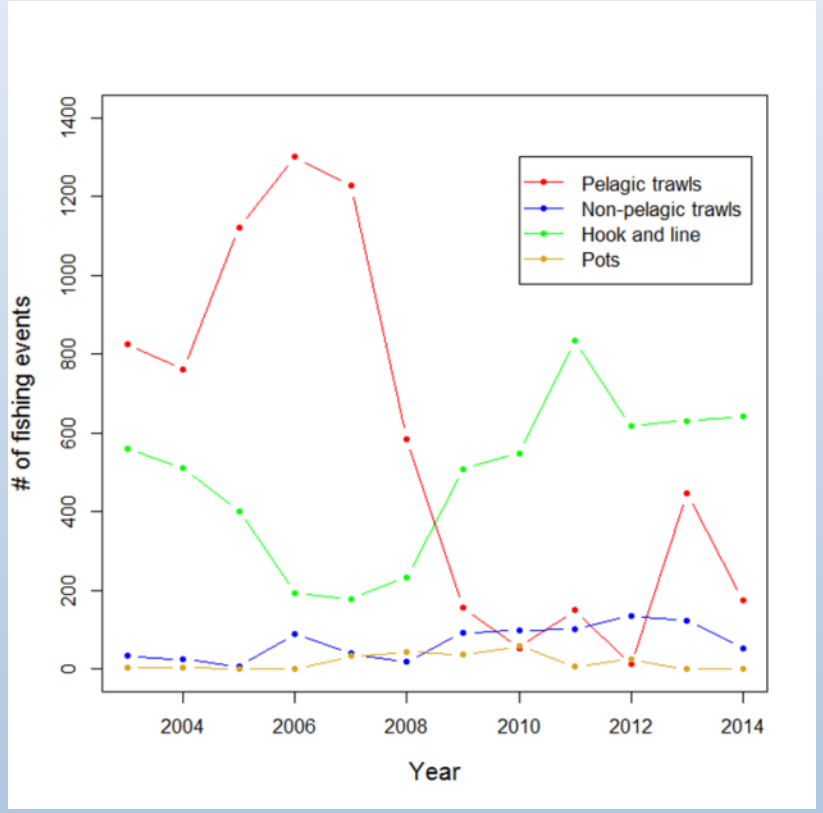
Proportion of habitat reduction (November 2016)



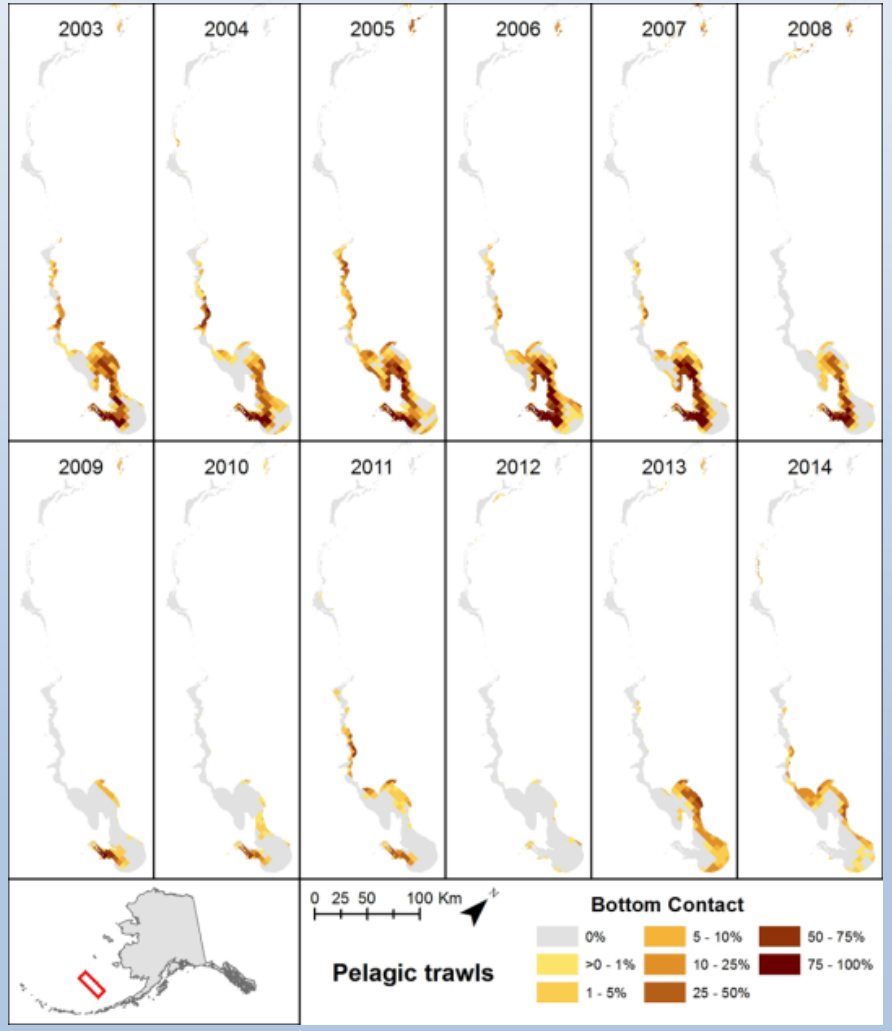
Ecosystem Considerations

EBS Corals - Fishing Effort

Time series of events by gear



Time series of spatial pattern of bottom contact



Thank You

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