NOAA FISHERIES
Alaska Region

Scallop Plan Team Essential Fish Habitat & Fishing Effects Model Review

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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 must describe and identify EFH in fishery management plans (FMPs), minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to encourage the conservation and enhancement of EFH.

Scallop EFH Descriptions & Map – 2005/2010

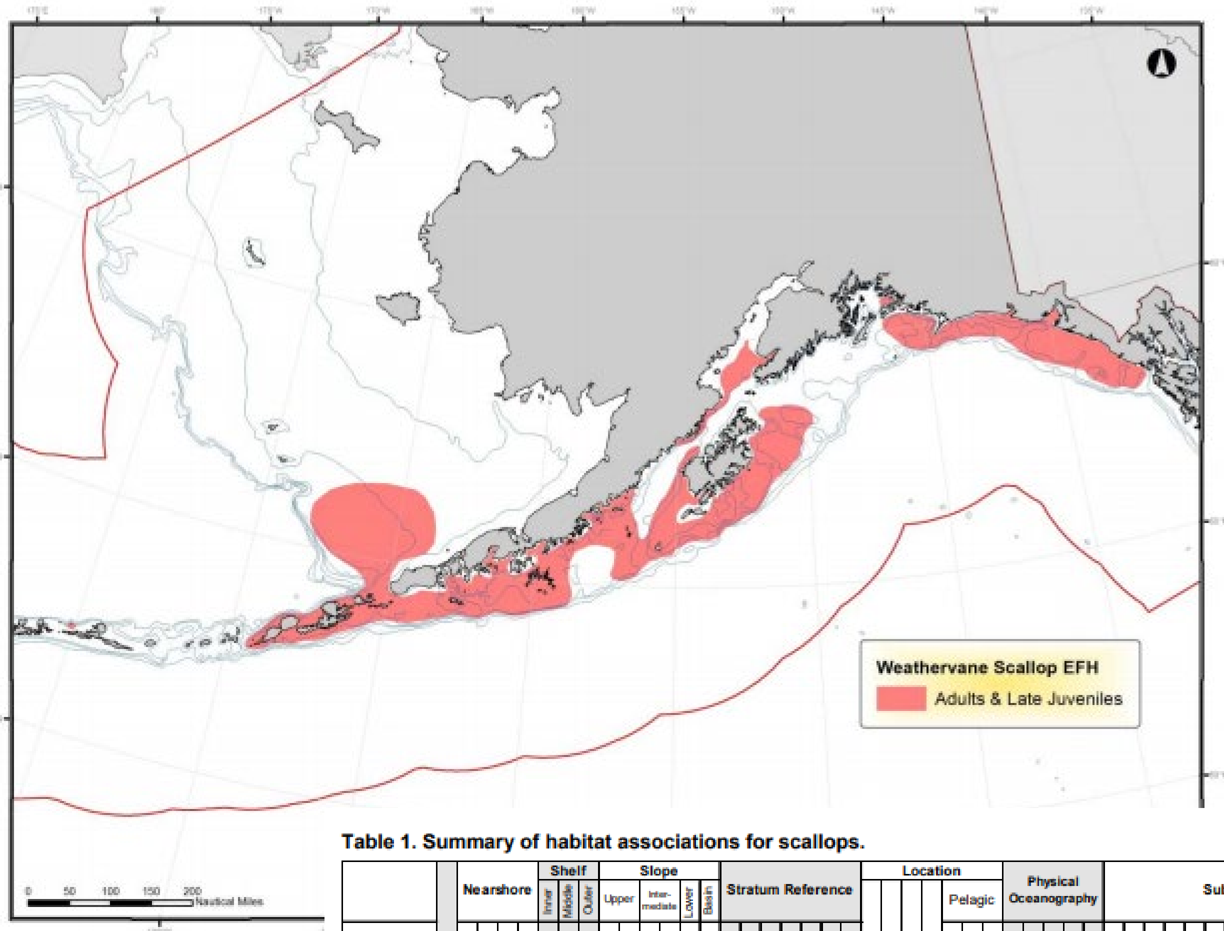


Table 1. Summary of habitat associations for scallops.

Species	Life Stage	Nearshore: Freshwater	Nearshore: Estuarine	Nearshore: Intertidal	Nearshore: Subtidal	Shelf Inner: 1-50m	Shelf Middle: 51-100m	Shelf Outer: 101-200m	Slope Upper: 201-300m	Slope Upper: 301-500m	Slope Inter-mediate: 501-700m	Slope Inter-mediate: 701-1000m	Slope Lower: 1001-3000m	Slope Basin: >3000m	Stratum Reference: Shallows	Stratum Reference: Island Pass	Stratum Reference: Bay/Fjord	Stratum Reference: Bank	Stratum Reference: Flat	Stratum Reference: Edge	Stratum Reference: Gully
Weathervane scallop	M					x	x	x								x	x				
	LJ					x	x	x								x	x				
	EJ					x	x	x													
	L					x	x	x													
	E					x	x	x													

Life Stage	Location: Surface	Location: Near surface	Location: Semi-demersal	Location: Demersal	Location Pelagic: 1-200m (epi)	Location Pelagic: 201-1000m (meso)	Location Pelagic: >1000m (bathy)	Physical Oceanography: Upwelling areas	Physical Oceanography: Gyres	Physical Oceanography: Thermo/pycnocline	Physical Oceanography: Fronts	Physical Oceanography: Edges (ice, bath)
M				x				x	x			
LJ				x				x	x			
EJ				x					x			
L					x							
E				x								

Life Stage	Substrate: Organic Debris	Mud	Sand	Gravel	Mud & sand	Mud & gravel	Sand & mud	Gravel & mud	Gravel & sand	Gravel & sand & mud	Gravel & mud & sand	Cobble	Rock
M		x	x	x	x	x	x	x	x	x	x		
LJ		x	x	x	x	x	x	x	x	x	x		
EJ		x	x	x	x	x	x	x	x	x	x		
L													
E													

Life Stage	Structure: Bars	Sinks	Slumps/Rockfalls/Debris	Channels	Ledges	Pinnacles	Seamounts	Reefs	Vertical Walls	Man-made	Community Associations: Red King Crab	Tanner crab	Shrimps	Octopi	Flatfishes	Pacific cod	Benthic invertebrates	Oceano-graphic Properties: Temperature (Celsius)	Salinity (ppt)	Oxygen Conc (ppm)	Life Stage
M											x	x	x	x	x	x	x	1-9.6			M
LJ											x	x	x	x	x	x	x				LJ
EJ																					EJ
L																					L
E																					E

EFH 5-year Review

SSC Comments April 2016

The SSC understands the Scallop Plan Team chair's decision not to consider an update to weathervane scallop EFH at this time. It may well be prudent to wait to reconsider scallop EFH in another 5 years after implementation of new statewide surveys. However, the SSC wishes to point out that there already exist some new, relevant data that could be considered. Jessica Glass conducted a multivariate analysis of community composition on weathervane scallop beds in Alaska. Results may help fine-tune scallop EFH definitions. Significant ($p<0.05$) spatial differences in community structure were most strongly correlated with sediment, depth, and dredging effort. Temporal changes were weakly, yet significantly, correlated with freshwater discharge and dredging effort.

Scallop FMP (2014)

4. Habitat Objective: To protect, conserve, and enhance adequate quantities of essential fish habitat (EFH) to support scallop populations and maintain a healthy ecosystem Habitat is defined as the physical, chemical, geological, and biological surroundings the support healthy, self-sustaining populations of living marine resources. Habitat includes both the physical component of the environment which attracts living marine resources (e.g. salt marshes, sea grass beds, coral reefs, intertidal lagoons, and near shore characteristics) and the chemical (e.g. salinity, benthic community) and biological characteristics (e.g. scallop life stage histories, oceanography) that are necessary to support living marine resources. The quality and availability of habitat supporting the scallop populations are important. Fishery managers should strive to ensure that those waters and substrate necessary to scallops for spawning, breeding, feeding, or growth to maturity are available. It is also important to consider the potential impact of scallop fisheries on other fish and shellfish populations. Scallop EFH is described in Appendix D of this FMP.

Those involved in both management and exploitation of scallop resources will actively review actions by other human users of the management area to ensure that their actions do not cause deterioration of habitat. Any action by a State or Federal agency potentially affecting scallop habitat in an adverse manner may be reviewed by the Council for possible action under the Magnuson-Stevens Act. The Council will also consider the effect on scallop habitat of its own management decisions in other fisheries.

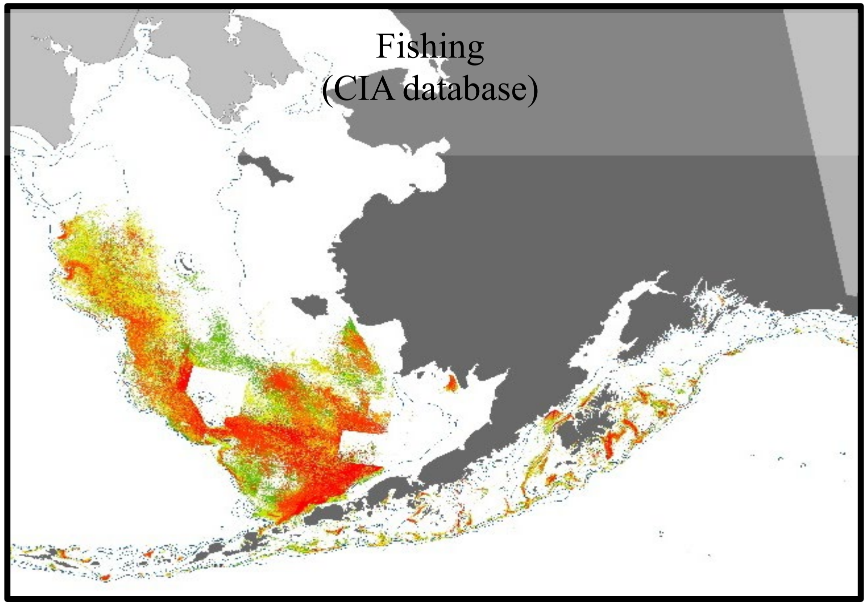
Weathervane Scallop SAFE (2019)

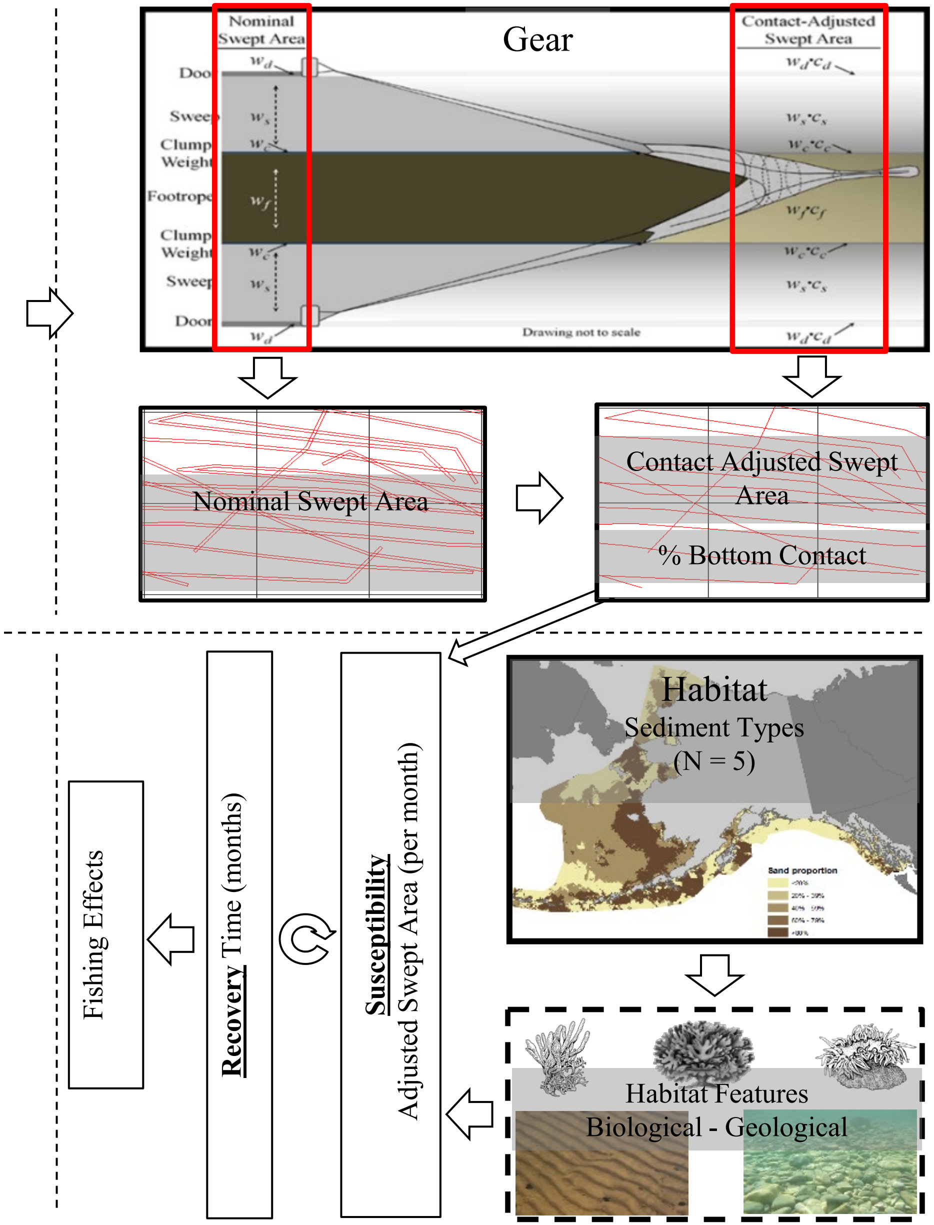
Ecosystem Effects on the Stock

Weathervane scallops are distributed in dynamic relationship to other benthic marine organisms as well as the non-living components of the marine ecosystem off Alaska. Spatiotemporal ecosystem dynamics, therefore, influence the abundance and distribution of scallops and other benthic community organisms. A recent study by Glass and Kruse (2017) provides analyses of continental shelf benthic communities off Alaska in areas historically and currently targeted by the commercial Weathervane scallop fishery. Based on observer records of bycatch from 1996–2012 the researchers found significant changes in community composition associated with a temperature regime shift in 1998. Differences in community structure in the Kodiak Northeast and Yakutat management districts were correlated with abiotic ecosystem features such as depth and sediment size. Species distribution models (SDM) were developed for most managed groundfish and crab species in Alaska as part of the Essential Fish Habitat (EFH) 5-year review (Simpson et al 2017). Scallops, however, were not included in this modeling effort due to a lack of data for SDMs.

Fishery Effects on Ecosystem

The Alaska weathervane scallop fishery occurs in continental shelf waters at depths 40–150 m in three main areas: the eastern Gulf of Alaska between Prince William Sound and Cape Spencer; around Kodiak Island; and in the eastern Bering Sea (Figure 1-1). There is strong evidence that scallop dredging reduces diversity, at least in the near term, however, the level of impact and the recovery rate tend to vary among habitat types (Collie et al. 2000; Kaiser et al. 2006). Past studies on the effects of scallop dredging in the Gulf of Alaska have found differences in community abundance and diversity for areas either open or closed to dredging (Stone et al. 2005). More recently, Glass and Kruse (2017) found evidence of recovery from disturbance by fishing gear in the Bering Sea scallop bed through increases in sessile benthic organisms during a period of decreased fishing activity. A Fishing Effects (FE) model was developed to assess the effects of fishing on managed species as part of the 2017 EFH 5-year review (Simpson et al 2017). However, catch data for scallops was not available. For the 2022 EFH 5-year review, model authors will seek to include scallop fishery data into the FE model to estimate habitat reduction across modeled scallop habitat.





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

H: habitat undisturbed from fishing

h: habitat disturbed from fishing

I': monthly impact rate

ρ': monthly recovery rate

3.2.2 New Bedford-style scallop dredge

Table 10 shows scallop dredge gear S/R values, grouped by substrate and then by feature. Scores are the same for high and low energy unless otherwise noted. Table 11 summarizes the justifications for susceptibility scores for scallop dredge gear. Recovery scores for all gear types are combined into two tables at the conclusion of the matrix results section (Table 17, geological, Table 18, biological).

Table 10 . Scallop dredge matrices. Susceptibility (S) values are coded as follows: 0: 0-10%; 1: >10-25%; 2: >25-50%; 3: >50%. Recovery (R) values are coded as follows: 0: <1 year; 1: 1-2 years; 2: 2-5 years; 3: >5 years. The literature column indicates those studies identified during the literature review as corresponding to that combination of gear, feature, energy, and substrate. The studies referenced here were intended to be inclusive, so any particular study may or may not have directly informed the S or R score. Any literature used to estimate scores is referenced in Table 11 (Scallop dredge S), Table 17 (Geo R), and Table 18 (Bio R).

Gear: Scallop					
Substrate: Mud					
Feature name and class – G (Geological) or B (Biological)	**Gear effects**	**Literature high**	**Literature low**	**S**	**R**
Biogenic burrows (G)	filling, crushing	none	none	2	0
Biogenic depressions (G)	filling	11	11	2	0
Sediments, surface/subsurface (G)	resuspension, compression, geochem, sorting, mixing	42, 236, 256, 391	none	2	0
Amphipods, tube-dwelling (B) – see note	crushing	228, 359	217	1	0
Anemones, cerianthid burrowing (B)	breaking, crushing, dislodging, displacing	228	217	2	2
Corals, sea pens (B)	breaking, crushing, dislodging, displacing	228	none	2 (low energy only)	2 (low energy only)
Hydroids (B)	breaking, crushing, dislodging, displacing	11, 228	11	1	1

https://s3.amazonaws.com/nefmc.org/Fishing_Effects_Northeast_Report_edited-May-22-2020.pdf

https://www.nefmc.org/library/fishing-effects-model

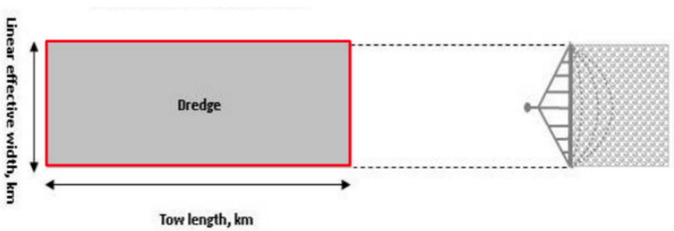
Area swept example, scallop dredge

Given these simplifying assumptions, the scallop dredge SASI model is

$$A_{scallop}(km^2) = d_t(w \cdot c),$$

where:

- d_t = distance towed in one tow (km)
- w = effective width of widest dredge component (km)
- c = contact index, all dredge components

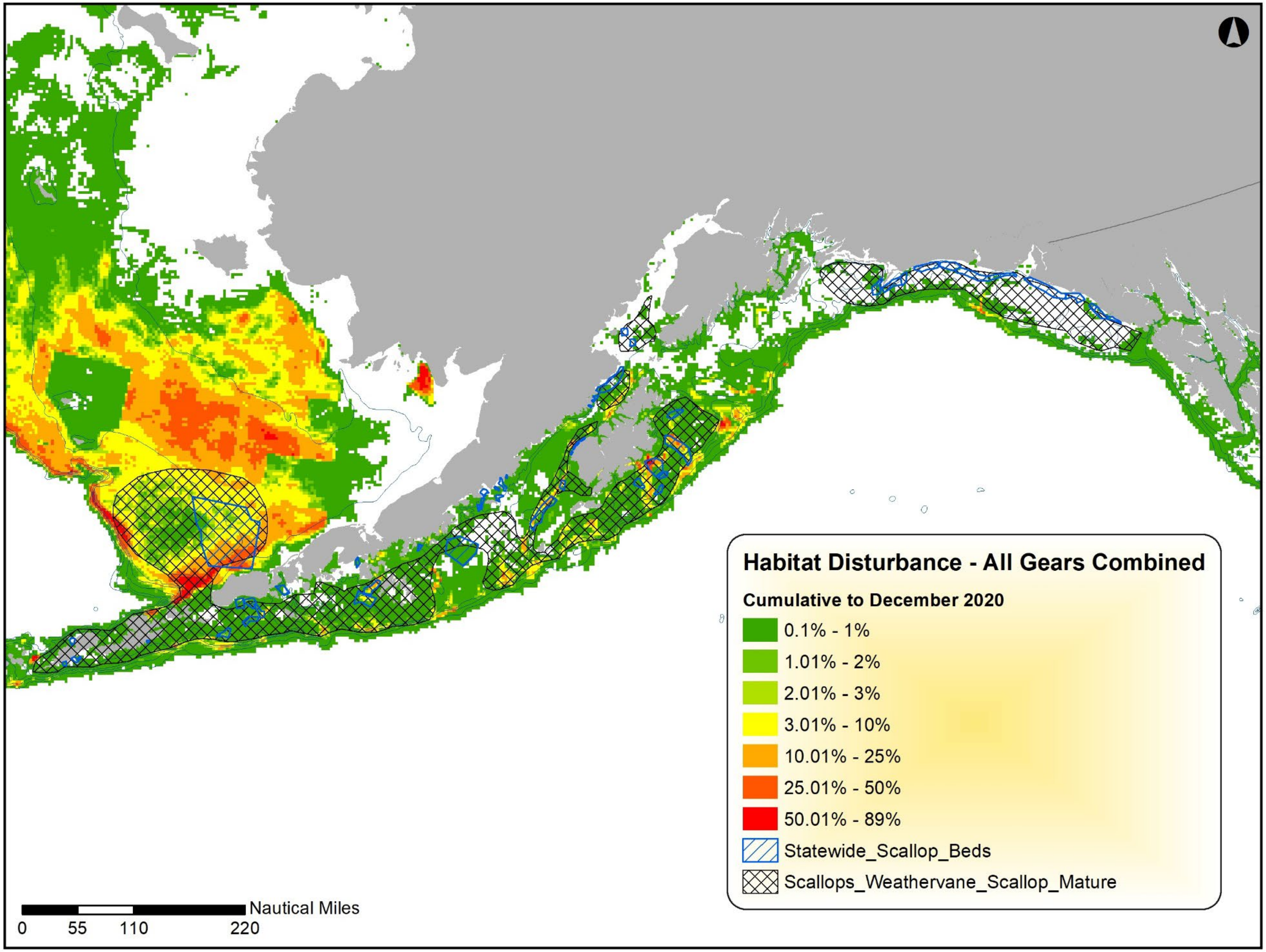


<u>Scallop Fishery Data</u>

52,140 events 2009-2020

~ 382nm2 area swept (no overlap)

10-30’ dredge width



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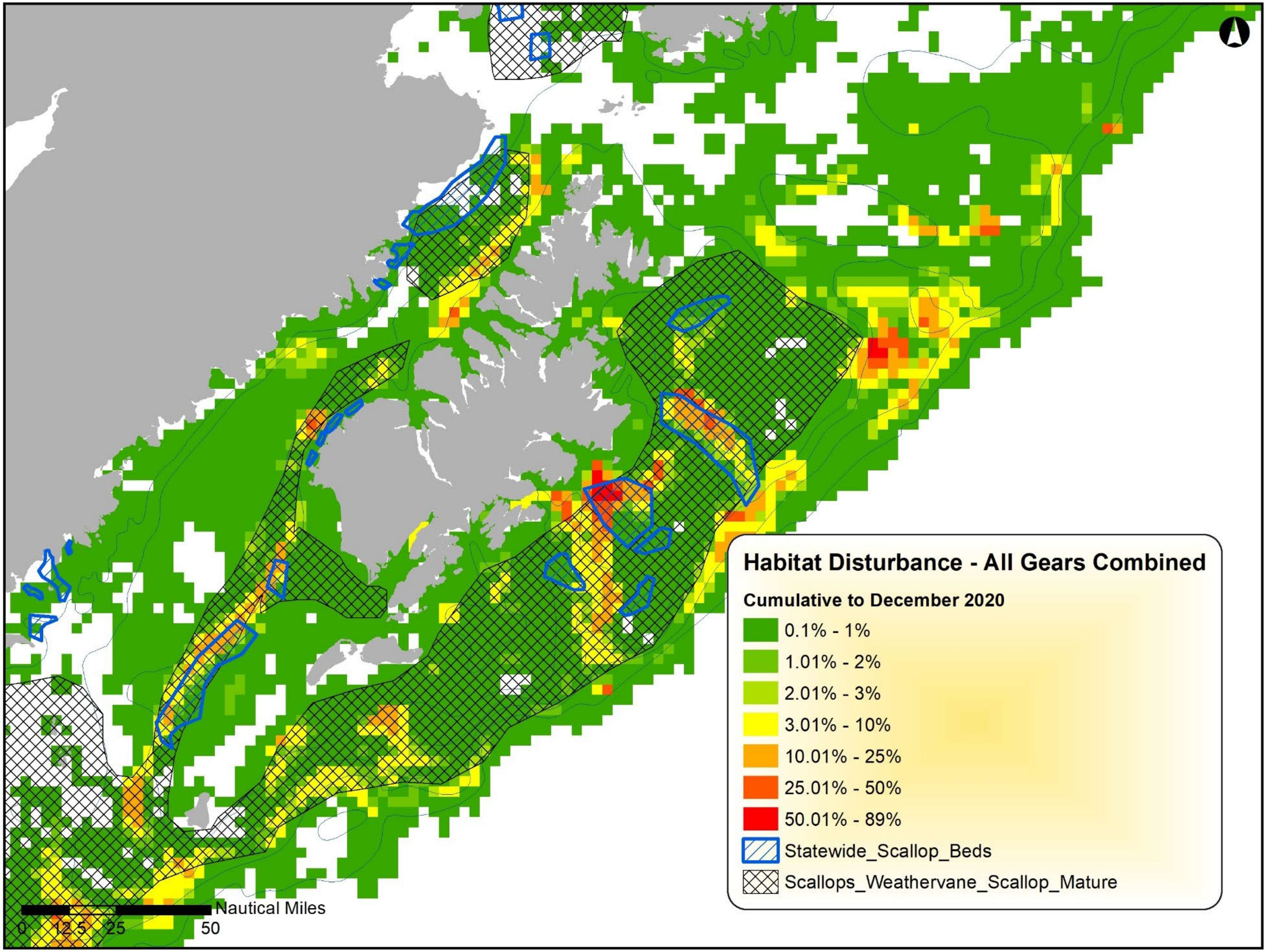

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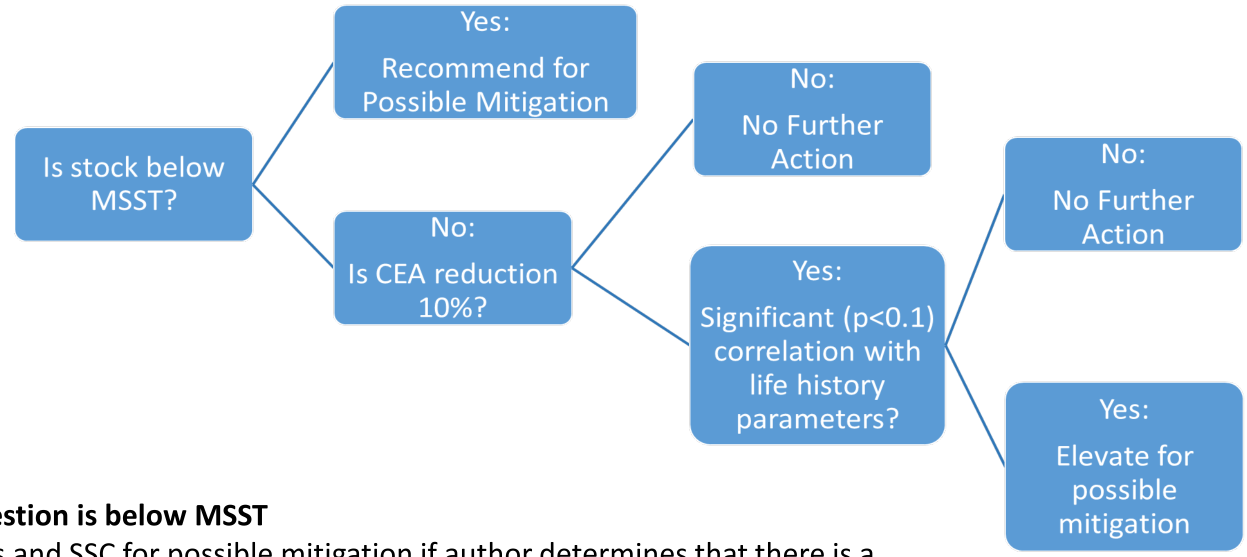

The steps of the analysis are:

1. **Determine whether the stock in question is below MSST**
   - If Yes, provide report to Plan Teams and SSC for possible mitigation if author determines that there is a plausible connection to reductions of EFH as the cause.
   - If No: Move on to step 2
2. **Determine whether 10% of the CEA is affected by commercial fishing (**the predicted 50 percent quantile threshold of suitable habitat of summer abundance as defined in the species distribution models)
   - If yes: Move on to step 3
   - If no: No further action required (additional analysis is appreciated, move on to step 3)
3. **Evaluate correlations between CEA habitat reduction and life history indices**
   - If significant at $p<0.1$: provide written report for Plan Teams and SSC
   - If not significant: No further action required
4. **Provide recommendations for EFH research activities and priorities for your species**
5. **Provide a written report for distribution to the appropriate Plan Teams, SSC, and Council.**

"The purpose of this criterion is not to determine whether any correlation is statistically significant, but rather to provide an objective threshold to ensure that a "hard look" has been taken for each species, as appropriate. Because multiple parameters will be examined for correlation to habitat reduction, it is possible that spurious significant ($p > 0.1$) correlations will be found. Whenever significant correlations are found, the expert judgement and opinion of the stock assessment authors will be important to determine whether there is a plausible connection to reductions in EFH as the cause, or if the result is spurious. If stock assessment authors determine that the correlation between the impacts to the CEA and life history parameter(s) suggest a stock effect, then they will raise that potential impact to the attention of the Plan Teams, SSC, and Council."

Methods to evaluate the effects of fishing on Essential Fish Habitat Proposal from the SSC subcommittee. December 2016

Subcommittee members: Liz Chilton, Bob Foy, Brandee Gerke, Anne Hallowed, Brad Harris, Dan Ito, Sandra Lowe, John Olson, Steve MacLean