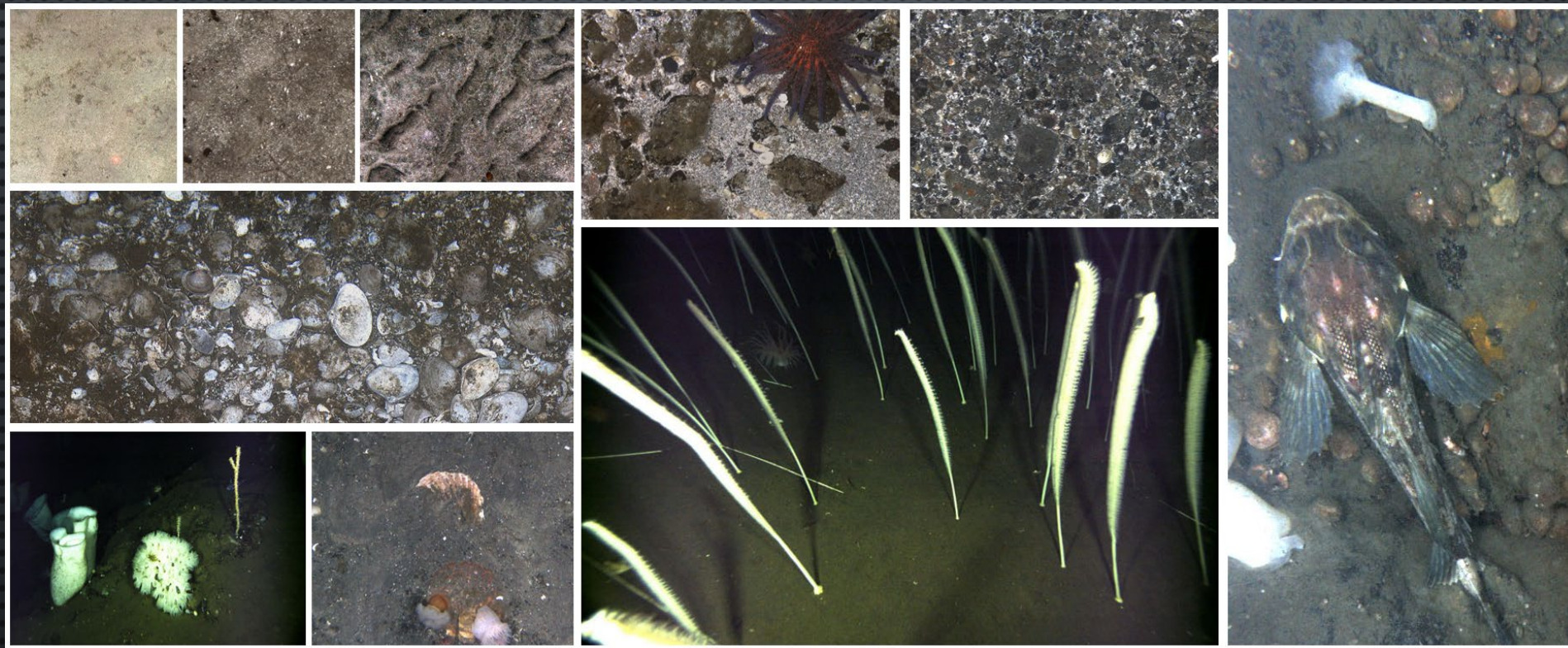
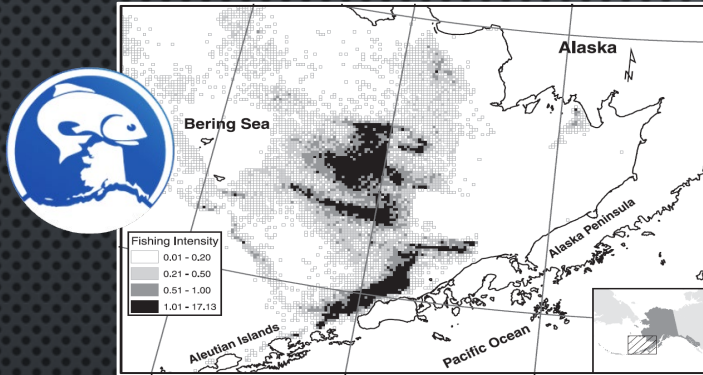




EFH COMPONENT 2: FISHING EFFECTS EVALUATION



EFH FISHING EFFECTS FOUNDATIONS



Long-term Effects Index (LEI)

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



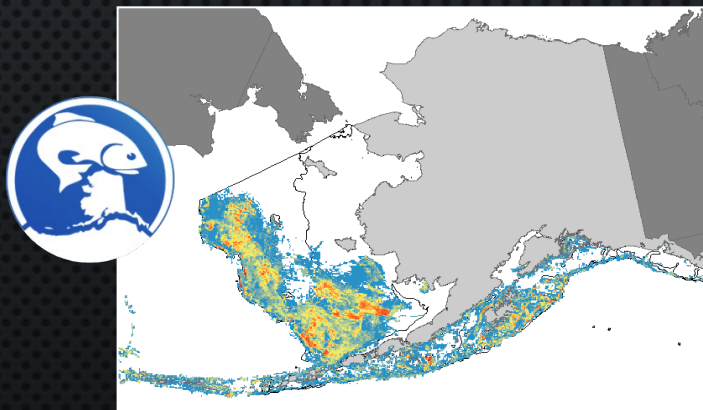
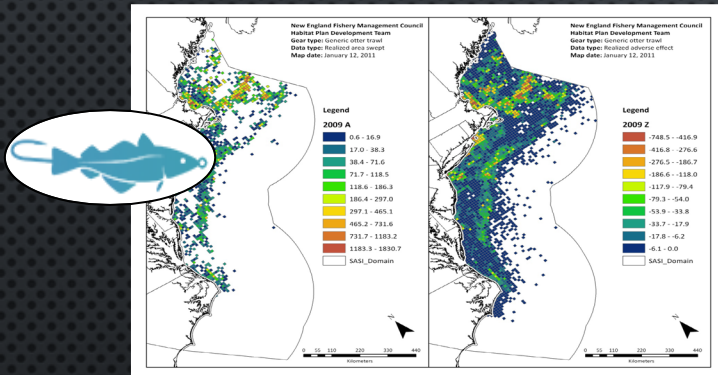
Swept Area Seabed Impacts (SASI)

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



Fishing Effects Model (FEM)

- NPFMC EFH Review since 2015, Smeltz et al. (2019)
- Discrete time (monthly) 2003 - 2022, Fishing event level
- 6 substrate types × 27 substrate-specific habitat features × 73 gear types



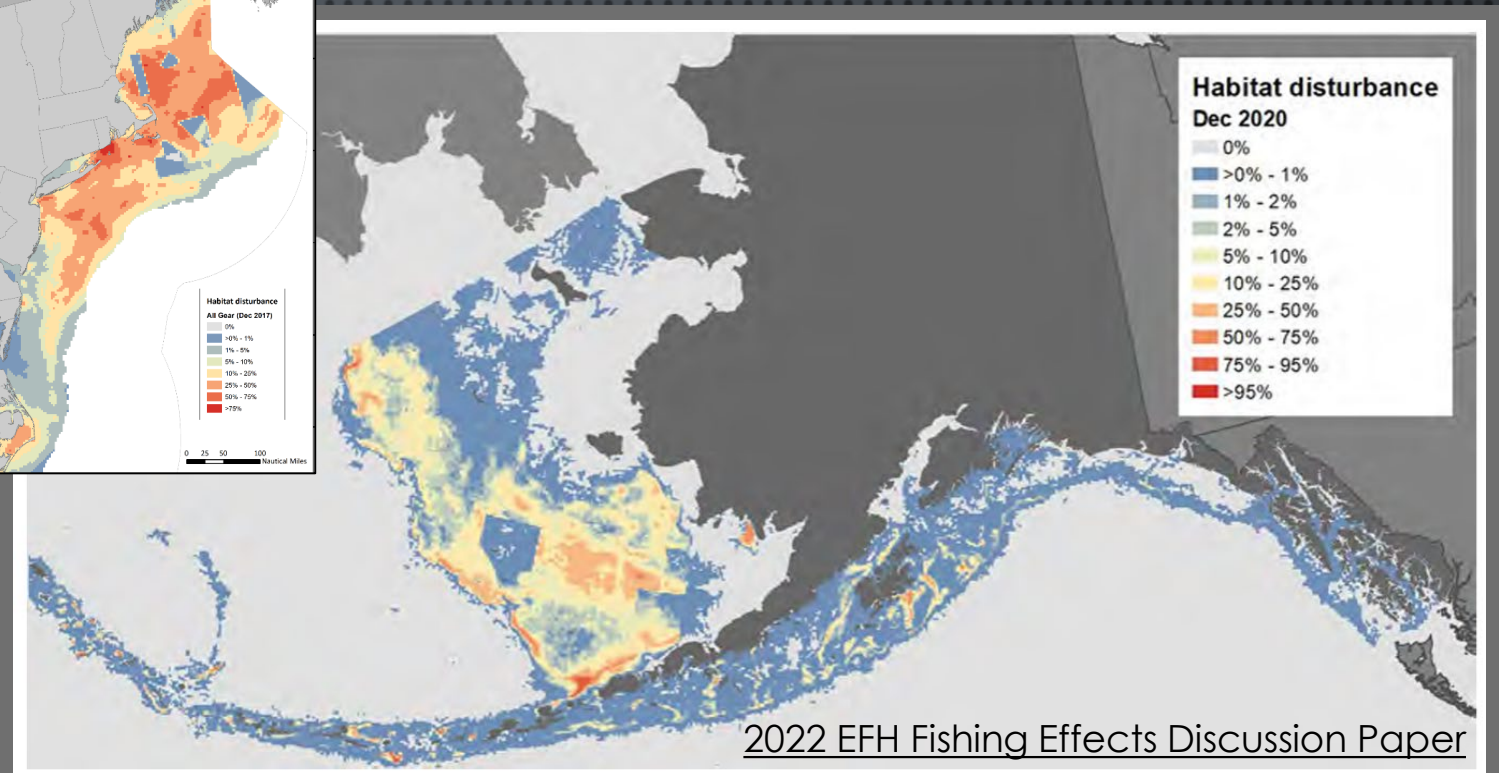
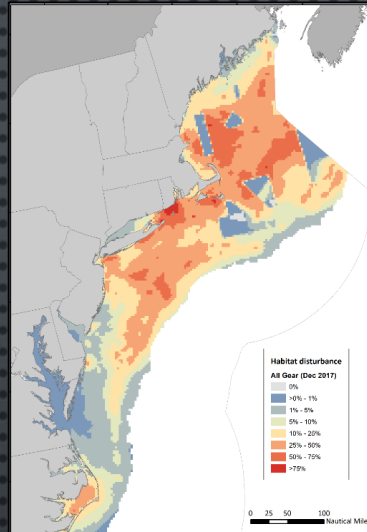
FISHING EFFECTS COMPONENTS AND PRINCIPLES



- *Concern without decision-support can lead to precaution without precision.*
- *Precise fishing impacts management requires a science-driven, transparent decision-support tool that informs tradeoffs.*
- *Fishery food systems are complex and dynamic - decision-support tool design should expect uncertainty and support component updates.*

FISHING EFFECTS MODEL

- **Fishing Effects Model** is a decision-support tool. It employs spatially-explicit Vessel Monitoring System (VMS), Observer data, **gear dimensional and contact information** and literature-based habitat impact information to:
- Quantify and visualize fishing activity.
- Estimate fishing footprint and bottom contact.
- **Estimate cumulative impacts of fishing on Essential Fish Habitat.**



2022 EFH Fishing Effects Discussion Paper

Funding: NMFS ARO Hab Div., NPFMC, NEFMC, Atkinson Foundation (Cornell Univ.)

Science Publications: Grabowski et al., 2014, Smeltz et al., 2019, Sethi et al., 2026

Student Research: NPRB, PSMFC, AK Education Tax Credit Program

Management Peer Reviews: NEFMC SSC (4+), NPFMC SSC (4), more coming ...

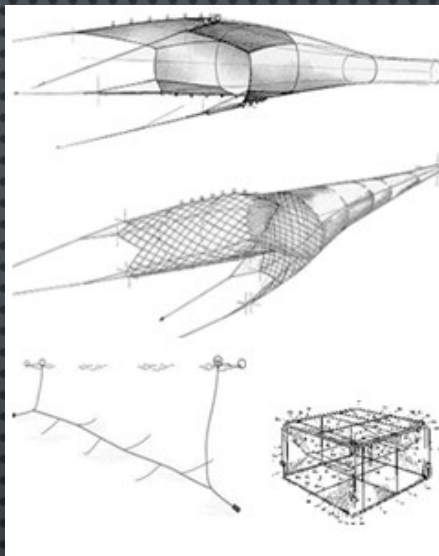
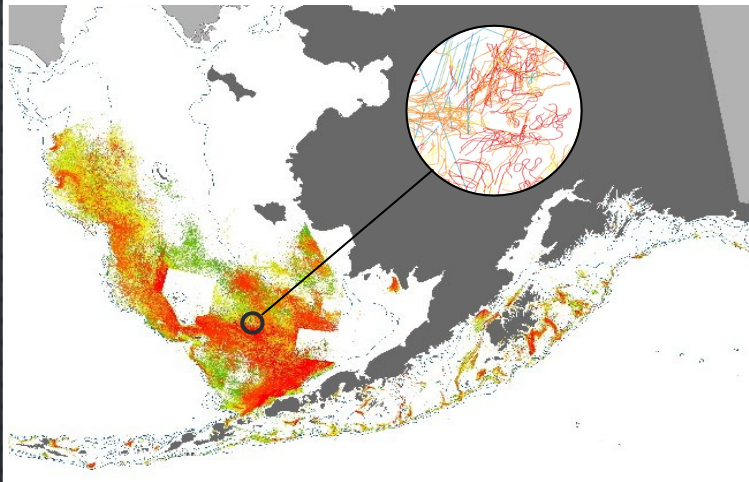
Management Publications: NEFMC. 2011, 2020, Simpson et al., 2017,

Zaleski et al., 2024, Bachman et al., 2025, Zaleski et al., 2026 and more....

FISHING EFFECTS MODEL – WORKFLOW

Fishing Module

Fishing Events

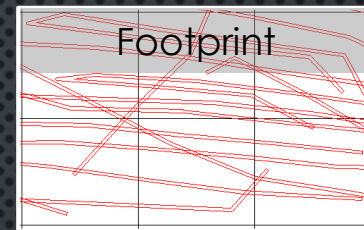


APPENDIX 2 GEAR PARAMETERS

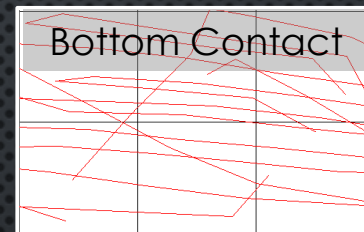
Table A2.1. The gear parameter table provides the metrics used in the Fishing Effects model for each gear type, listed by fishery. Vessel types are either catcher vessels (CVs) or catcher-processors (CPs), and the definitions for gear type and target species and other species caught and retained can be found [here](#). Contact adjustments are reported as either a range (low to high) or single metric if they were the same.

Fishery	Vessel type	Area	Gear	Target Sp.	Other Sp.	Vessel Length (ft)	Season	Depth Range (fath.)	Nominal Width (m)	Contact Adjustment
BS Pollock Pelagic Trawl	CV	BS	PTR	P	B, all others	125-151	B	≥90	115	0.2 - 0.6
BS Pollock Pelagic Trawl	CV	BS	PTR	P	B, all others	125-151	B	60-90	109	0.2 - 0.6
BS Pollock Pelagic Trawl	CV	BS	PTR	P	B, all others	125-151	B	<60	96	0.2 - 0.6
BS Pollock Pelagic Trawl	CV	BS	PTR	P	B, all others	151-300	A	≥90	132	0.2 - 0.6
BS Pollock Pelagic Trawl	CV	BS	PTR	P	B, all others	151-300	A	60-90	124	0.2 - 0.6
BS Pollock Pelagic Trawl	CV	BS	PTR	P	B, all others	151-300	A	<60	106	0.2 - 0.6
BS Pollock Pelagic Trawl	CV	BS	PTR	P	B, all others	151-300	B	≥90	163	0.2 - 0.6
BS Pollock Pelagic Trawl	CV	BS	PTR	P	B, all others	151-300	B	60-90	154	0.2 - 0.6
BS Pollock Pelagic Trawl	CV	BS	PTR	P	B, all others	151-300	B	<60	137	0.2 - 0.6
BS Pollock Pelagic Trawl	CP	BS	PTR	P	B, all others	all	A	≥90	142	0.7 - 0.9
BS Pollock Pelagic Trawl	CP	BS	PTR	P	B, all others	all	A	60-90	133	0.7 - 0.9
BS Pollock Pelagic Trawl	CP	BS	PTR	P	B, all others	all	A	<60	114	0.7 - 0.9
BS Pollock Pelagic Trawl	CP	BS	PTR	P	B, all others	all	B	≥90	175	0.8 - 1
BS Pollock Pelagic Trawl	CP	BS	PTR	P	B, all others	all	B	60-90	166	0.8 - 1
BS Pollock Pelagic Trawl	CP	BS	PTR	P	B, all others	all	B	<60	147	0.8 - 1

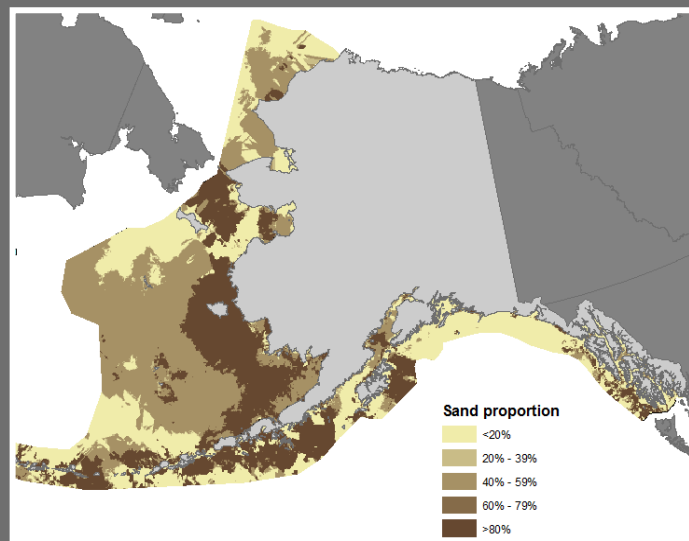
Footprint



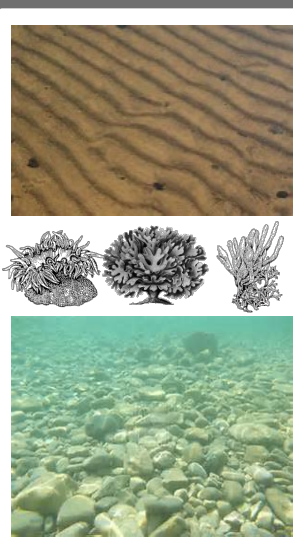
Bottom Contact



Habitat Sediments (N = 6)

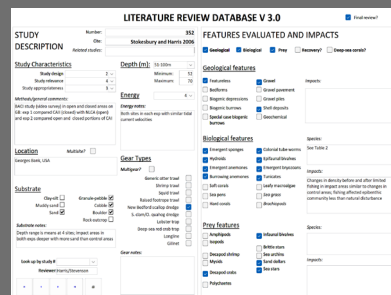


Features Geo / Bio (N = 27)



Impacts Literature

Susceptibility (Prop. Disturbed)



Recovery (Time to 95%)

Fishing Effects

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

Impacts (I')

Disturbed (h)

Undisturbed (H)

Recovery (ρ')

Habitat Module

FISHING EFFECTS MODEL – FISHING

GOA & BSAI 2003 - 2021:

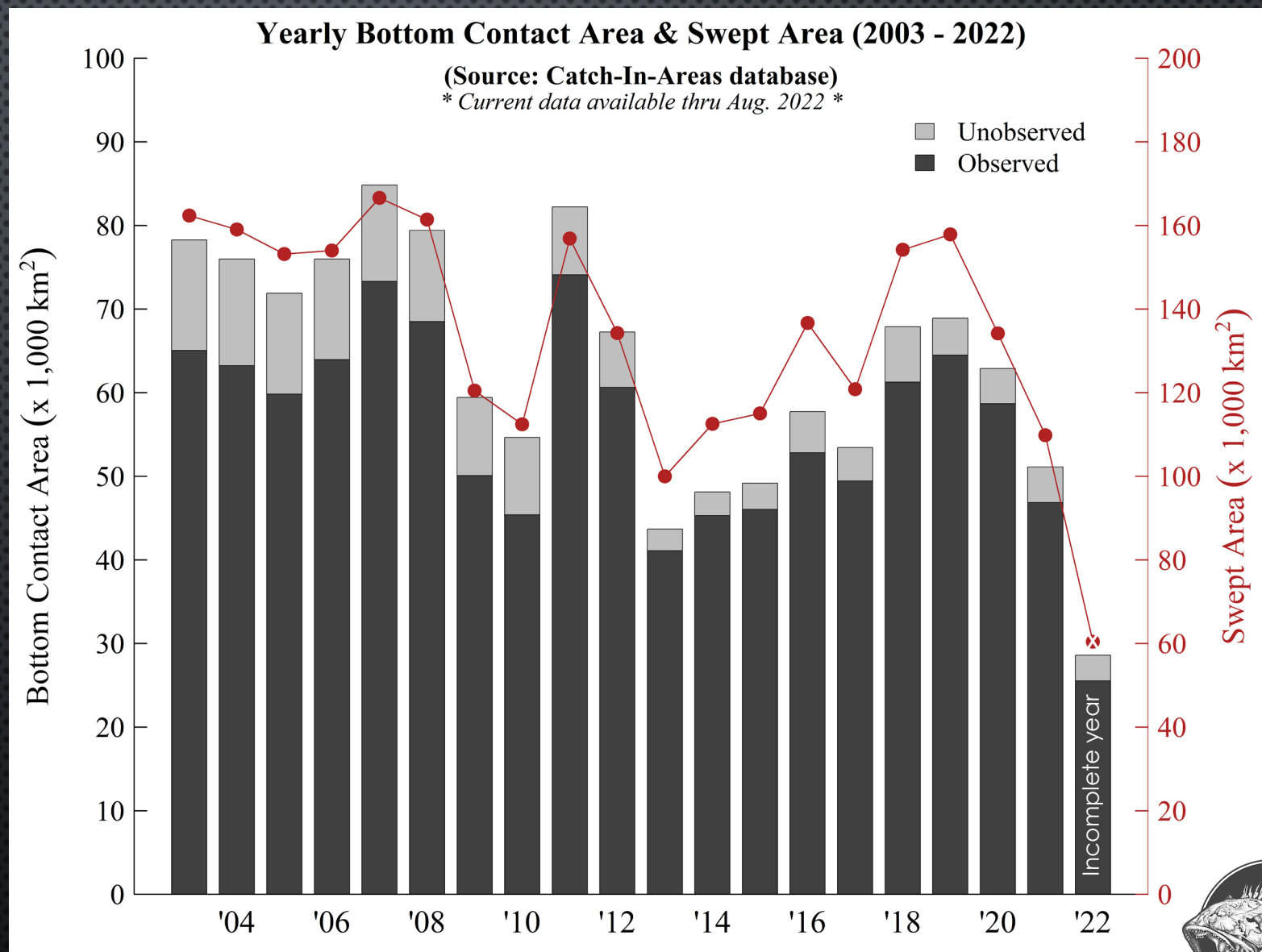
- All Gears (N = 73)
- 8 Million Fishing Events
- % Unobserved = 12 – 18%
- Swept Area = 100 – 167k km²
- Contact = 44 - 86k km²

2013 – 2021

- ↓ % Unobserved Fishing

2019 - 2021:

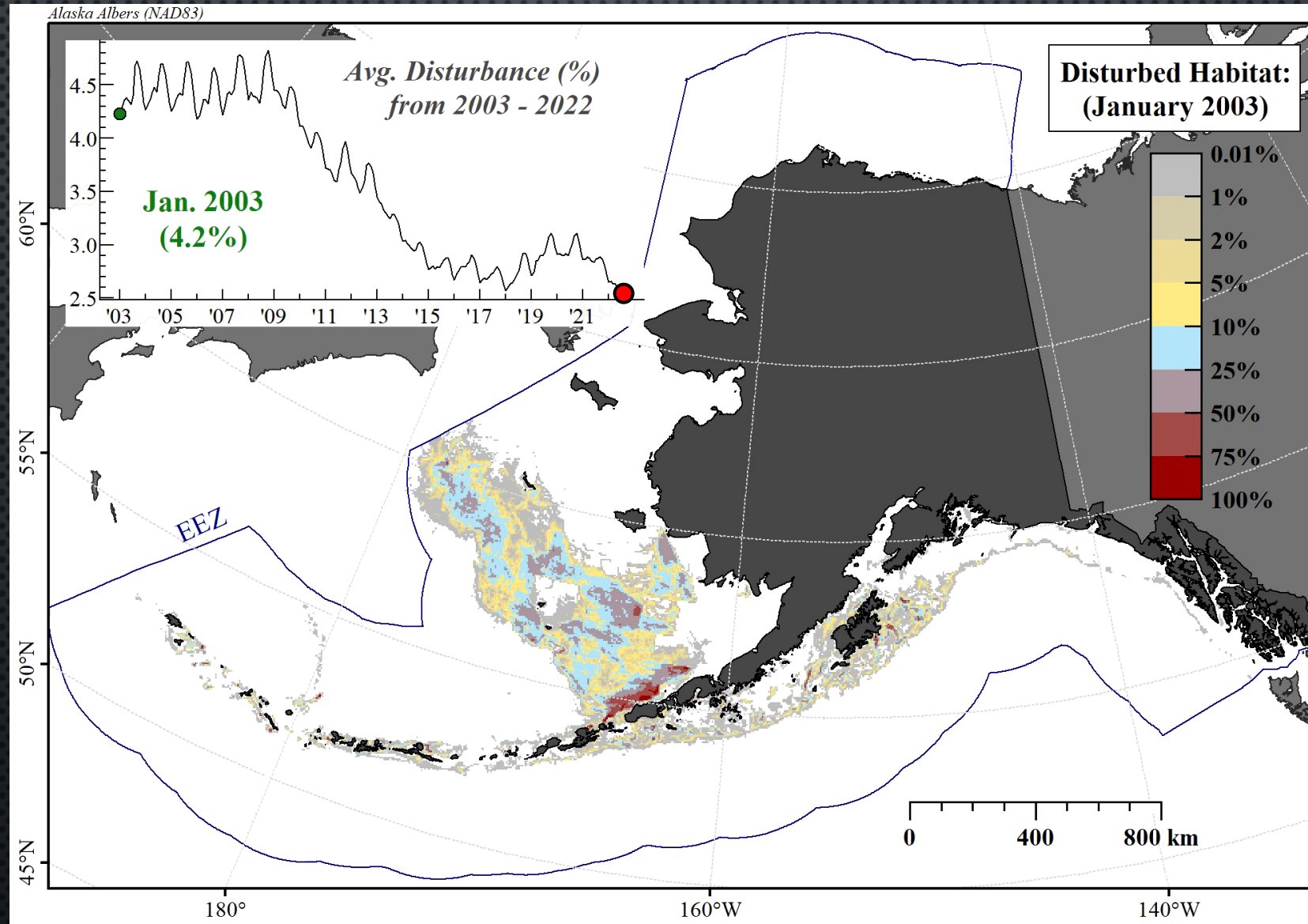
- ↓ Swept Area
- ↓ Contact



JIG = 3, POT = 4, HAL = 7, NPT = 24, PTR = 35



FISHING EFFECTS MODEL – HABITAT DISTURBANCE

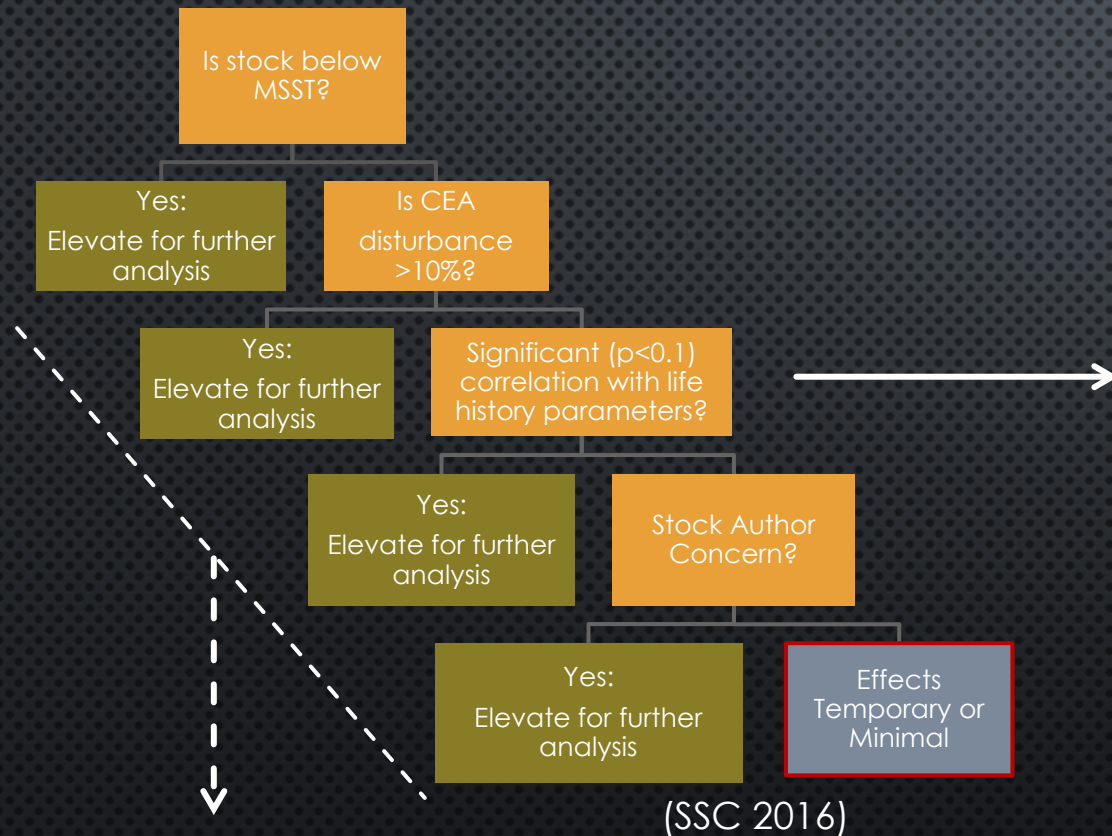


FISHING EFFECTS MODEL – EFH: ADVERSE FISHING EFFECTS

NPFMC Adverse Effects Framework

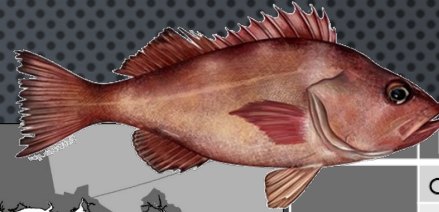
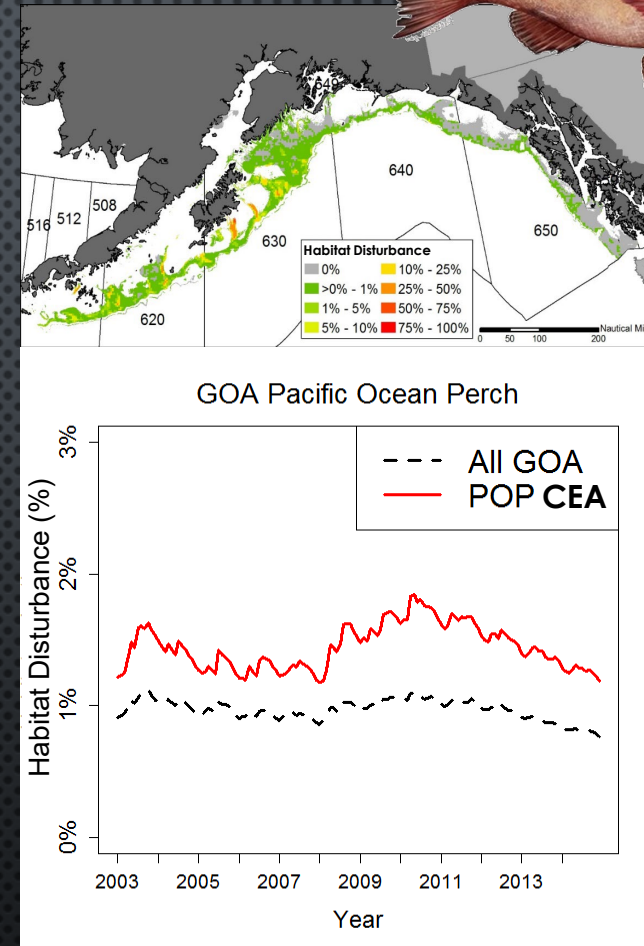
More than minimal AND not temporary

- FMP Species - Feeding, breeding and growth to maturity



Further Analysis:

- Informed by adverse effects evidence (e.g., $\uparrow FE : \downarrow \text{Recruitment}$)
- EFH Team, Stock Authors, Plan Teams, Council



	Element	ρ	p-value
Average size-at-age	age-3	-0.49	0.33
	age-4	-0.25	0.63
	age-5	-0.56	0.24
	age-6	-0.58	0.23
	age-7	-0.20	0.71
	age-8	-0.71	0.11
	age-9	-0.25	0.63
	age-10	-0.60	0.21
	age-11	0.02	0.97
	age-12	-0.40	0.43
	age-13	-0.38	0.46
	age-14	0.42	0.41
	age-15	-0.14	0.79
LVB params	L_{∞}	0.56	0.33
	K	-0.64	0.24
	t_0	-0.64	0.24
Assessment output	Spawning biomass	0.43	0.17
	Total biomass	0.37	0.24
	Recruitment	0.33	0.30

PRECAUTION AND UPDATES

Input/ process	Primary source	Precautionary Treatment	Literature / Council record
Gear size / bottom contact	Expert / skipper input; NMFS review; gear studies	Conservative gear width and contact estimates used; low–high contact ranges retained.	Smeltz et al. 2019 NPFMC 2025
Impact	Gear-impact literature; habitat vulnerability review	Conservative (higher) estimates of impact.	Grabowski et al. 2014 NPFMC 2017
Recovery	Recovery literature; Alaska coral studies	Conservative (slower) estimates of recovery.	Grabowski et al. 2014 NPFMC 2017, 2022
Adverse Effects	Species and Area Stock Assessment Authors	Hierarchical. 10% CEA, links to mechanisms, Author discretion.	NPFMC 2016

FEM Component Updates Underway

Fishing events

Catch-In-Areas database rebuild/QA and updated for FE analyses.

Gear parameters

Nominal widths and bottom-contact parameters updated with GII outputs.

Habitat

Sediment/habitat data updated for the Habitat Module.

Impact & Recovery

Literature-derived susceptibility and recovery tables updated with new scientific literature.

Structure is stable

The core FEM workflow remains a spatial, monthly decision-support model connecting fishing effort, gear contact, habitat disturbance, and recovery.

THANKS

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NEFMC SSC
NEFMC Habitat PT
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