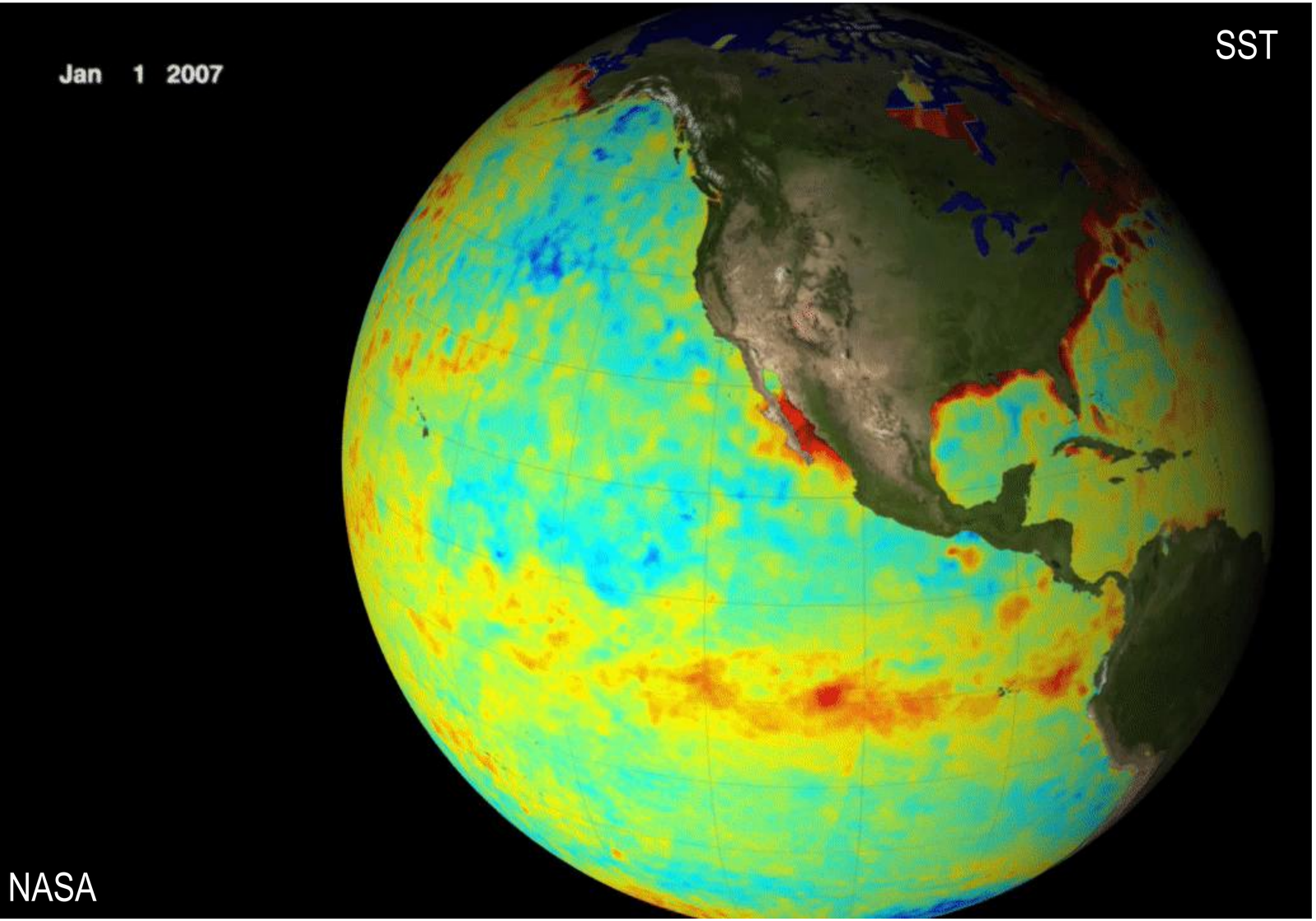
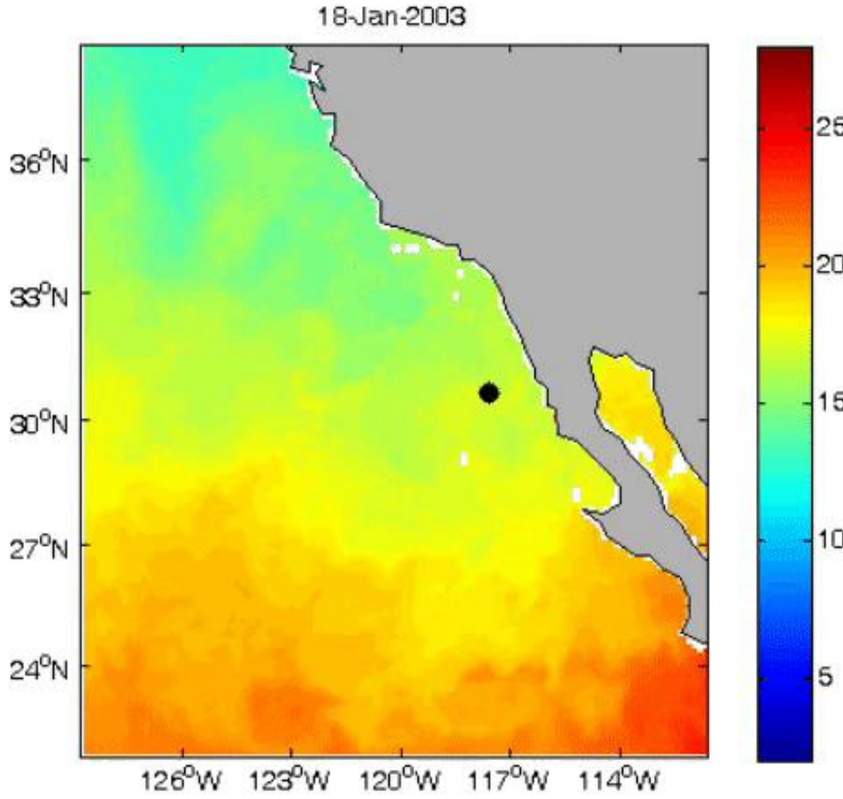
Dynamic Oceans and Dynamic Ecosystems

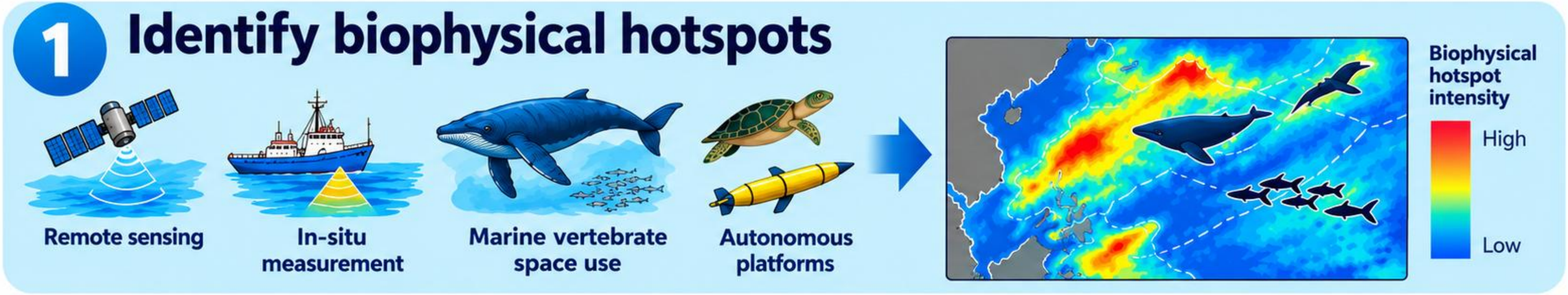


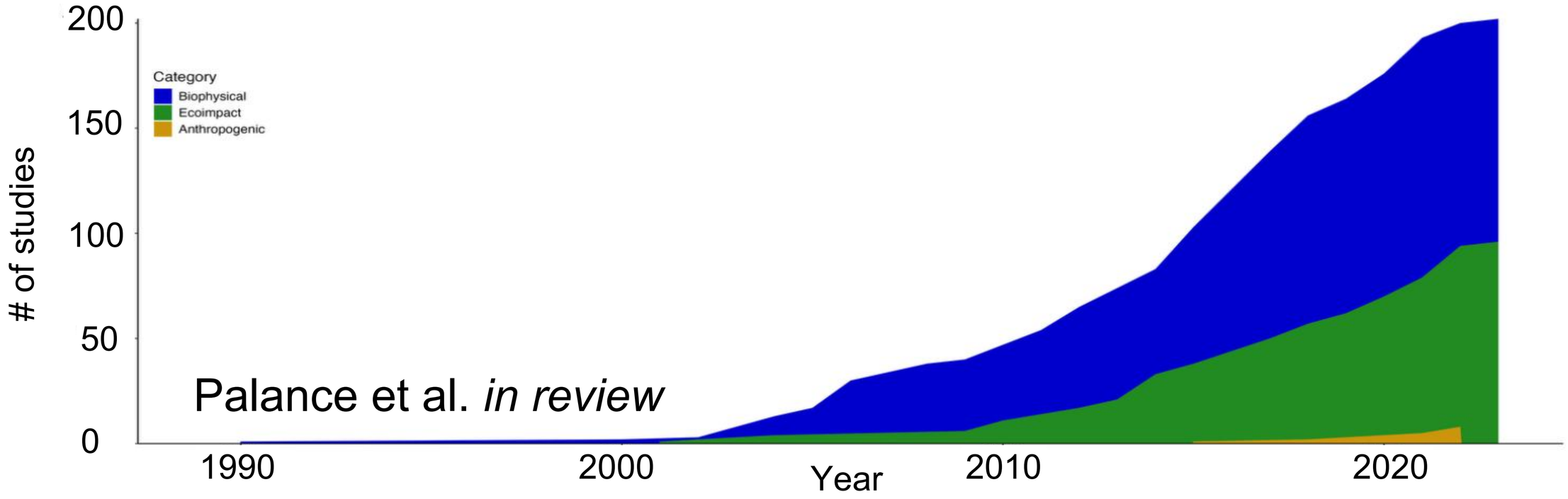


Elliott L. Hazen
University of Aarhus, Visiting Professor
University of Victoria – summer of 2027
UCSC Ecology and Evolutionary Biology
elh@ecos.au.dk; ehazen@ucsc.edu

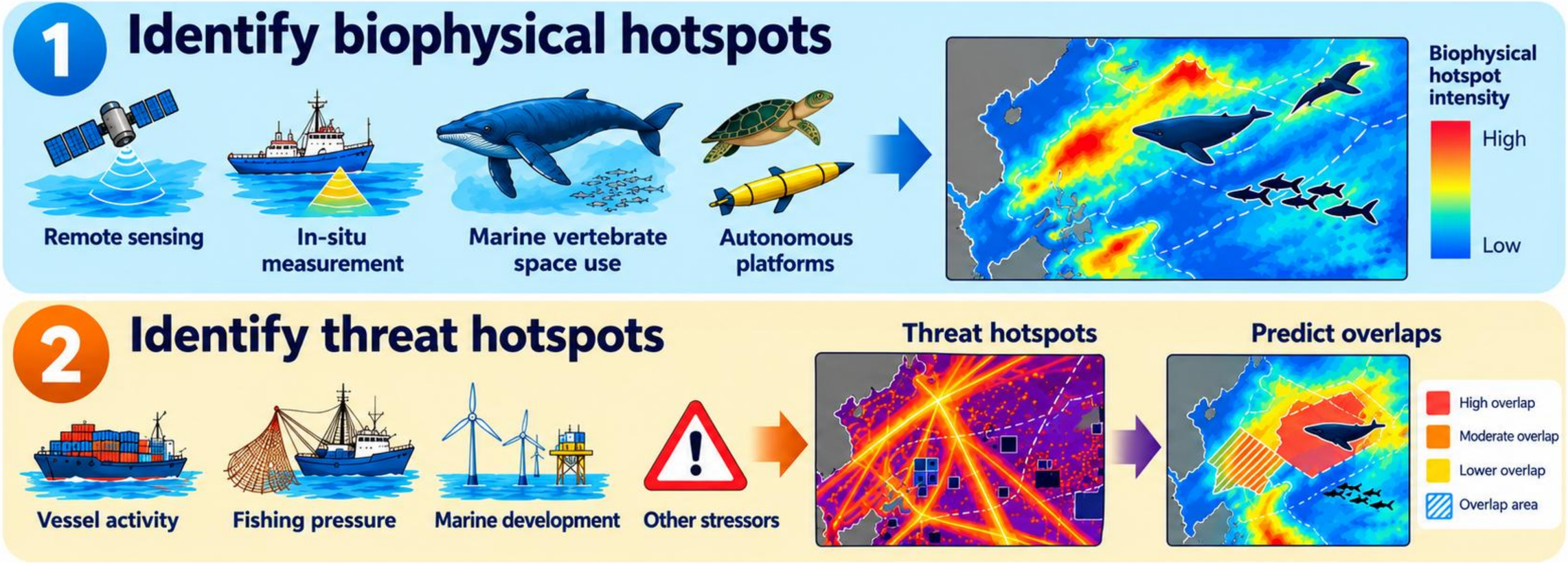
J. Cullen, H. Welch, S. Roberts, J. Suca, G. Mukai, M. Goodman, M. Hunsicker, O. Gemmell,
K. Holsman, S. Large, C. Wilson, J. Quinlan , R. Rykaczewski, and others!

What is dynamic ocean management?

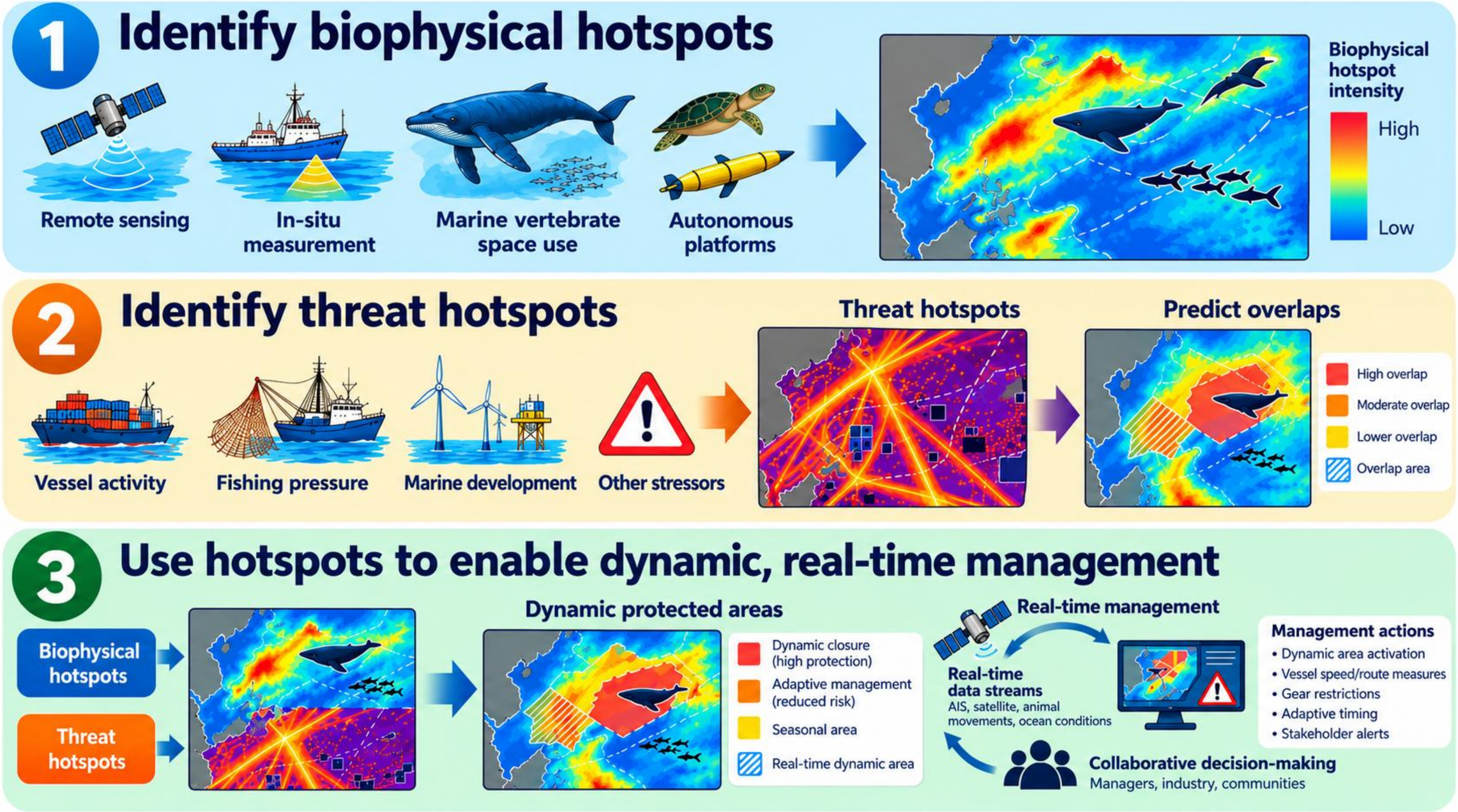




What is dynamic ocean management?



What is dynamic ocean management?



Regional Toolkits

Select a region to access operational models.



West Coast

Leatherback & Swordfish Tools



Gulf of America

Pelagic Longline Optimization



Hawaii

Deep-Set Longline Tools



South Atlantic

Coming Soon



Northeast

Coming Soon



Northwest

Coming Soon



Alaska

Coming Soon

About the Initiative

EcoCast Plus integrates real-time oceanographic data from Copernicus Marine Service (CMEMS) and ROMS models to generate daily predictive surfaces. Our goal is to maximize fishing opportunity while minimizing bycatch interactions.

System Status

- **Data Feeds:** Active (CMEMS/ROMS)
- **Models:** Operational

Technical Support:

Sarah Roberts (NOAA)

Josh Cullen (UCSC)

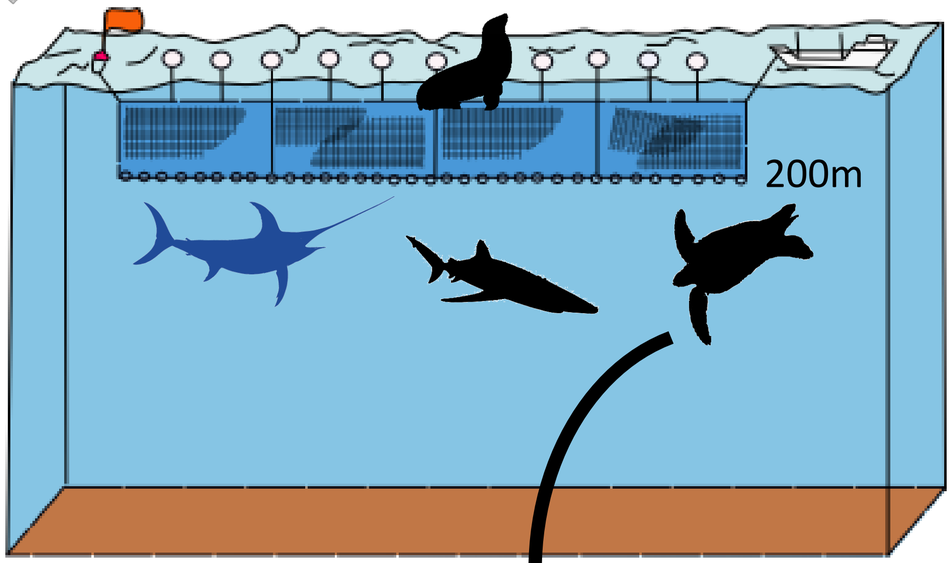
https://ecocast-plus.github.io/operationalization/

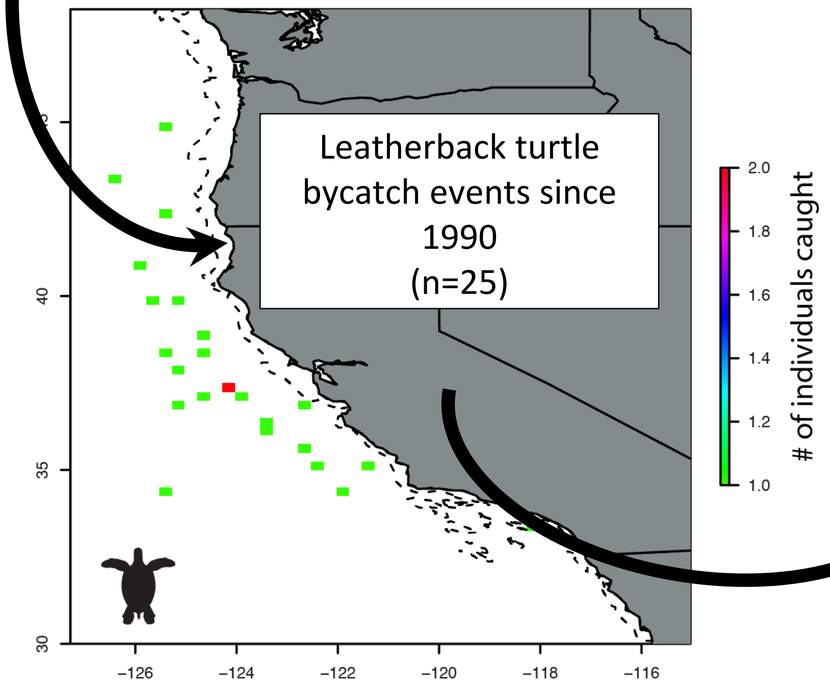


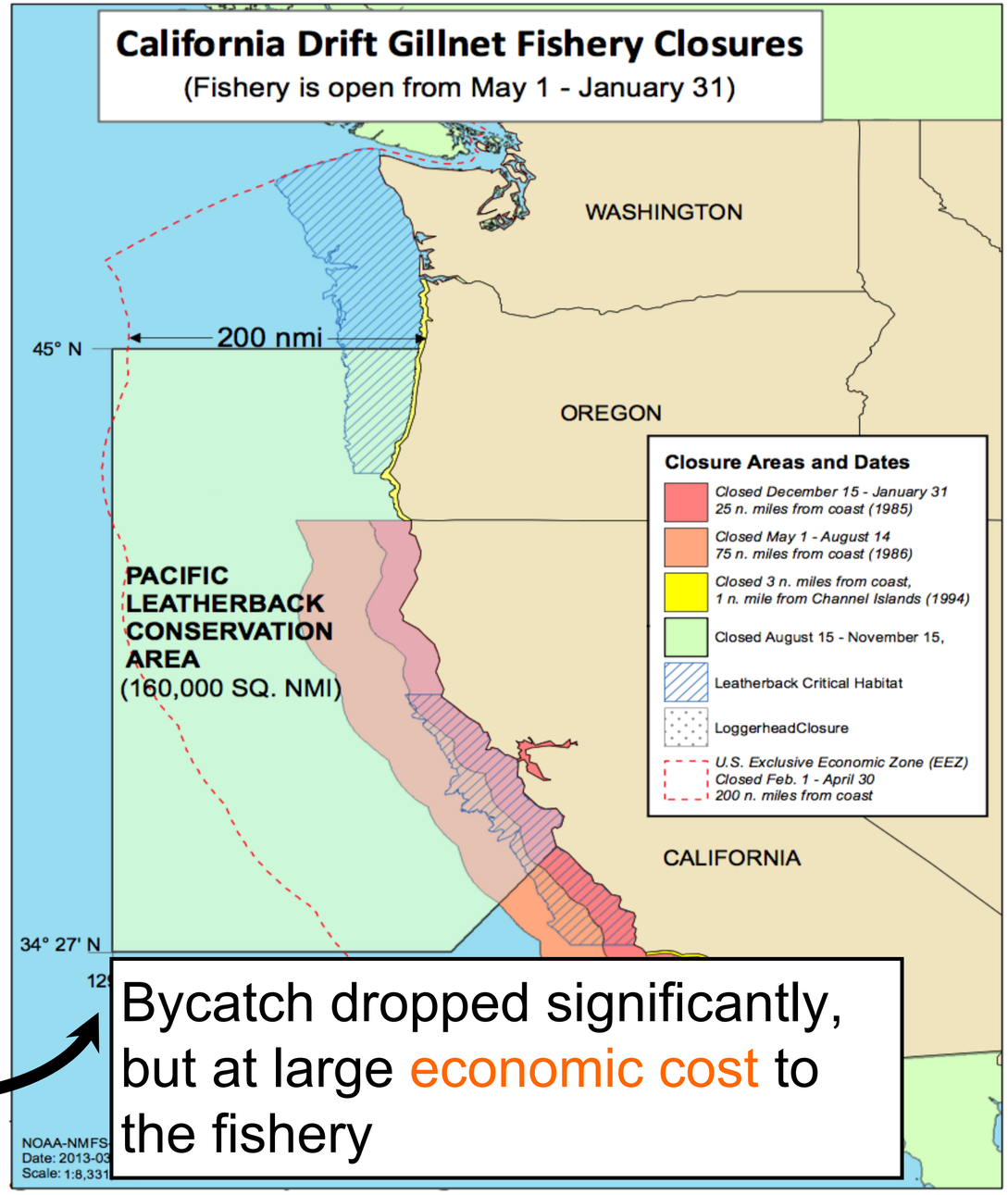
Scan me!

EcoCast

An Eco-informatic Tool for Fisheries Sustainability





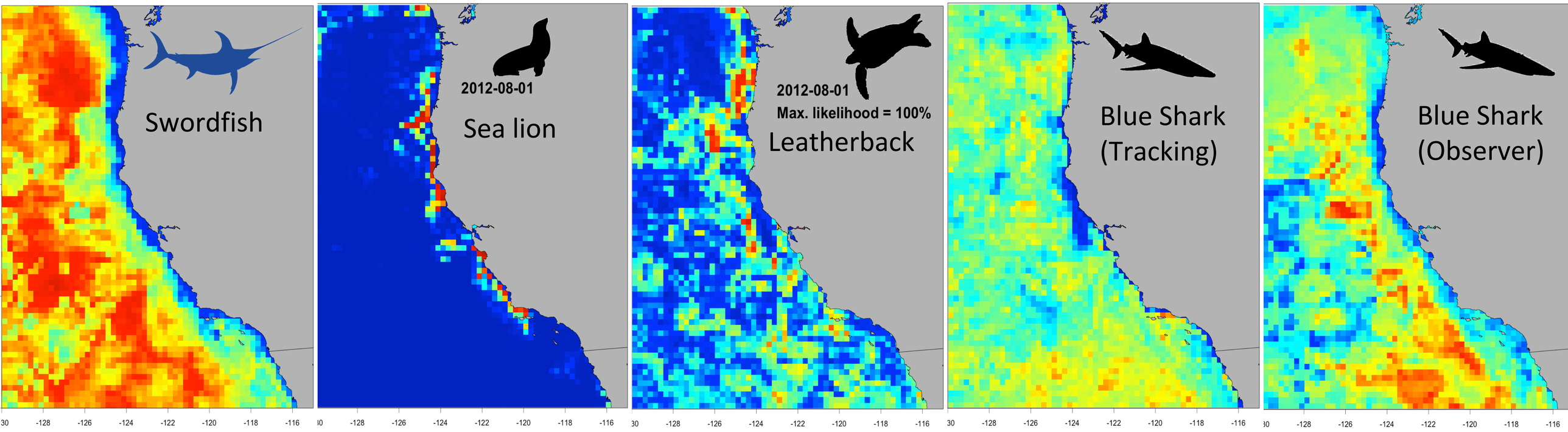


Bycatch dropped significantly, but at large economic cost to the fishery

EcoCast

An Eco-informatic Tool for Fisheries Sustainability

Individual species predictions

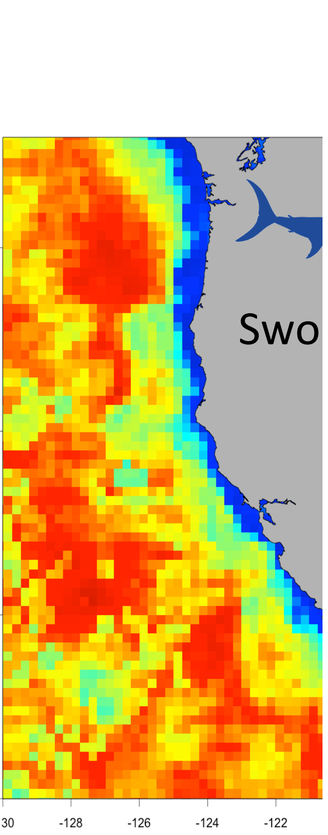


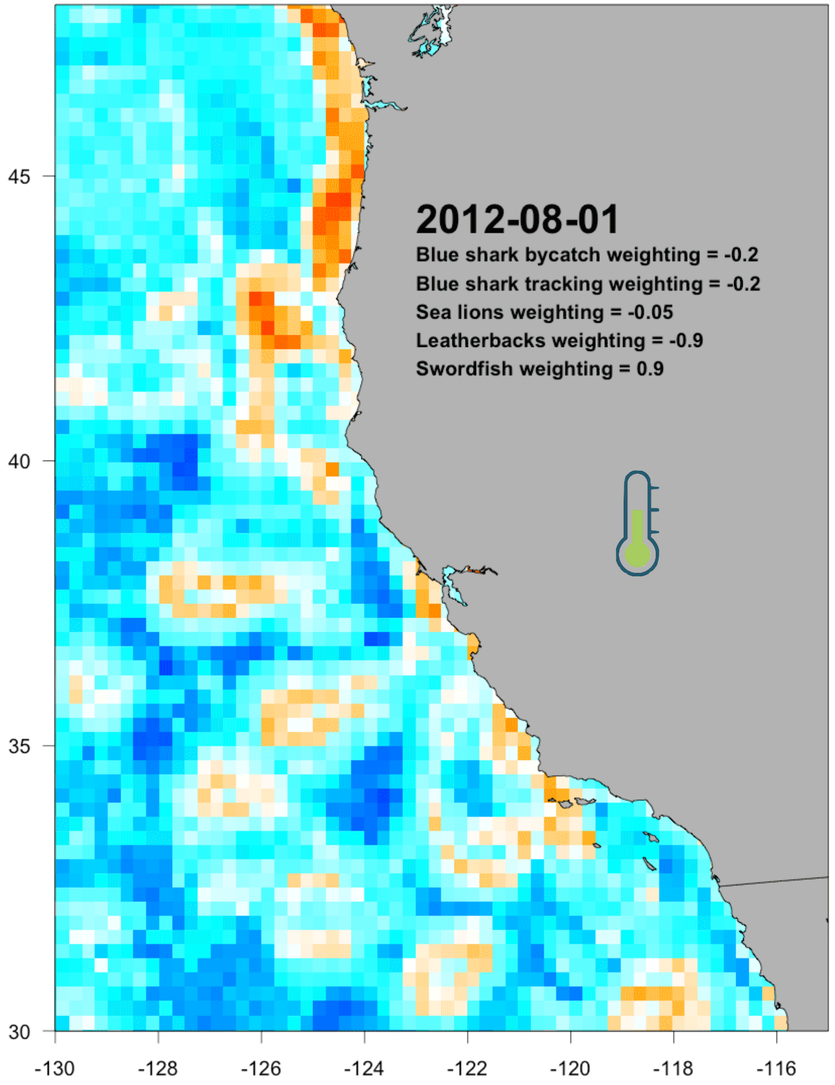
Hazen et al. 2018 *Science Advances*

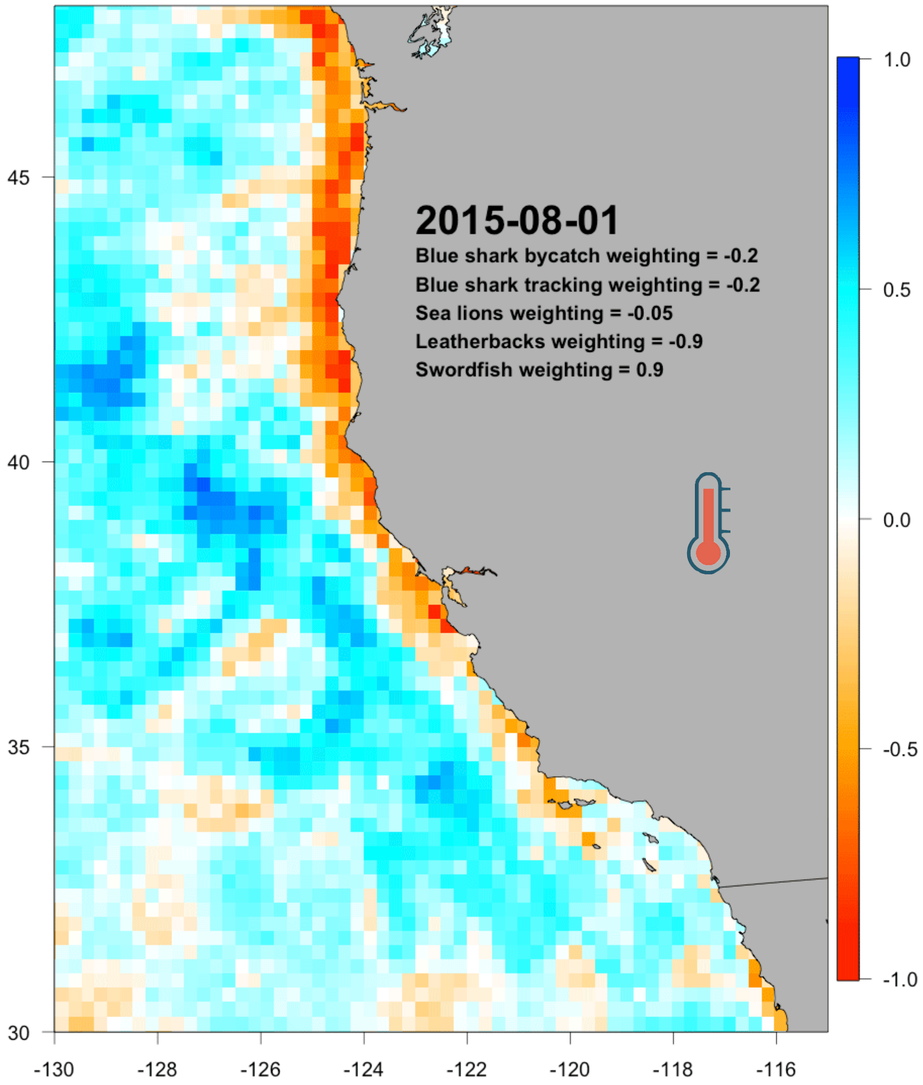
EcoCast

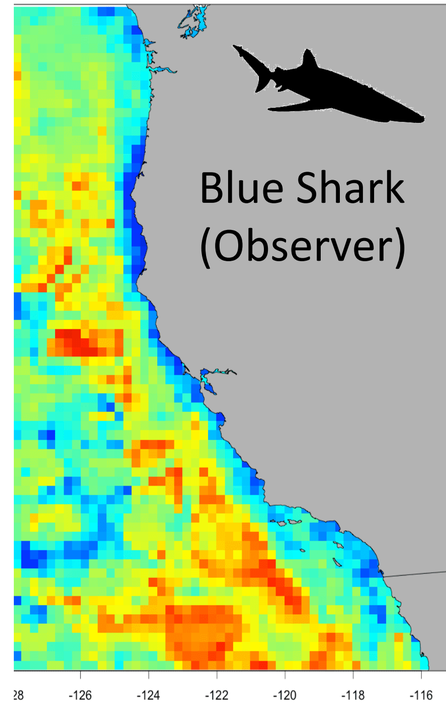
An Eco-informatic Tool for Fisheries Sustainability

Integrated species predictions



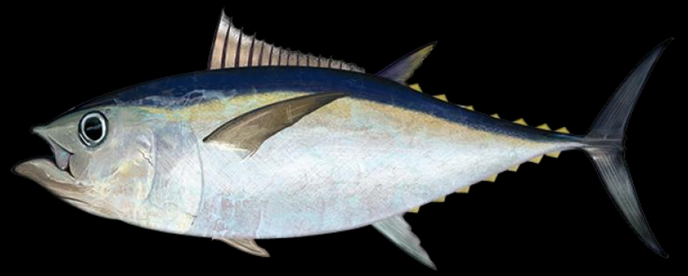






Hazen et al. 2018 *Science Advances*



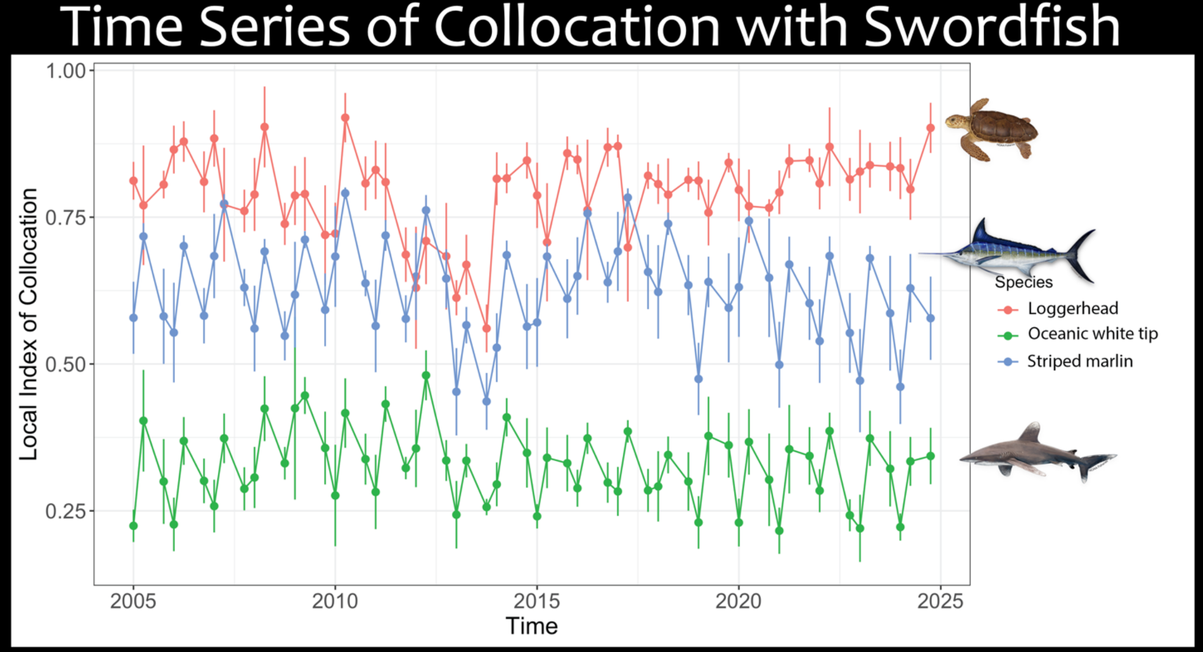


HICast

Gabi Mukai and Justin Suca

Origins of Project

- Began as exploration of drivers of catch rates across taxa within the Hawai‘i shallow-set longline fishery
- Included assessment of overlap among target (swordfish) and important bycatch taxa



Suca et al., *Int. Rev.*.

Suca et al. *in press* ICES JMS

EcoCast Plus | Home | West Coast | Southeast | Hawaii | Northwest | Alaska

HICast: Deep-set Longline Bycatch Reduction Tool

HICast Dashboard

1. Select Date

2026-09-07

2. Adjust Penalties

Bycatch Species Weighting

Leatherback Turtle

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

False Killer Whale

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

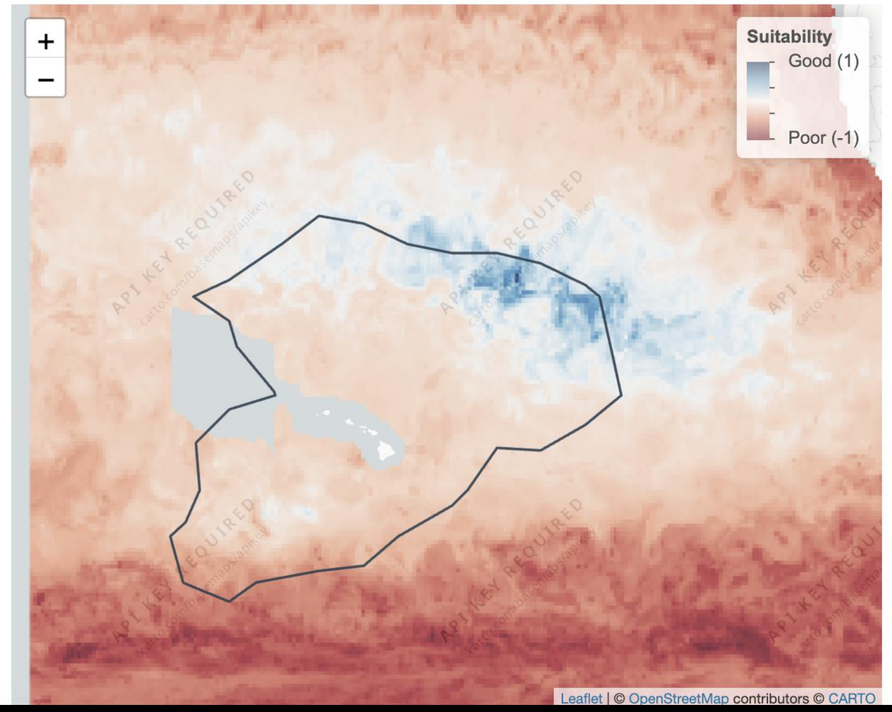
Olive Ridley

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

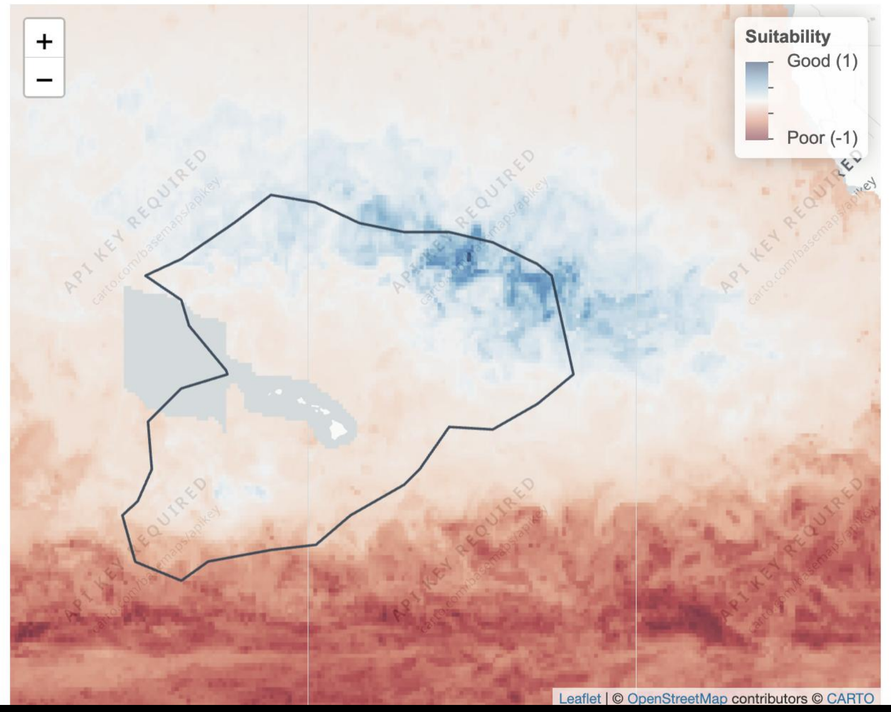
Black polygon denotes area used to generate models. Use predictions outside the black polygon with caution.

Near-Real-Time Maps

User Custom Weighting



Standard Weighting



Mukai et al. *in prep*

Forecasting bycatch potential in Pacific hake fishery

Mary Hunsicker + Olivia Gemmell - UW & NWFSC

Most abundant groundfish in CCE, comprises greatest volume of landings in west coast groundfish fishery

Goal: spatial and climate-informed forecasts, readily-available to anticipate bycatch potential and adjust fishing activities accordingly.

Build on past work modelling hake distribution and bycatch risk in hake fishery (Bolser, Gemmell, Malick, Matson, Sabal, Shirk)

Engage with partners to ensure product is useful to industry and PFMC



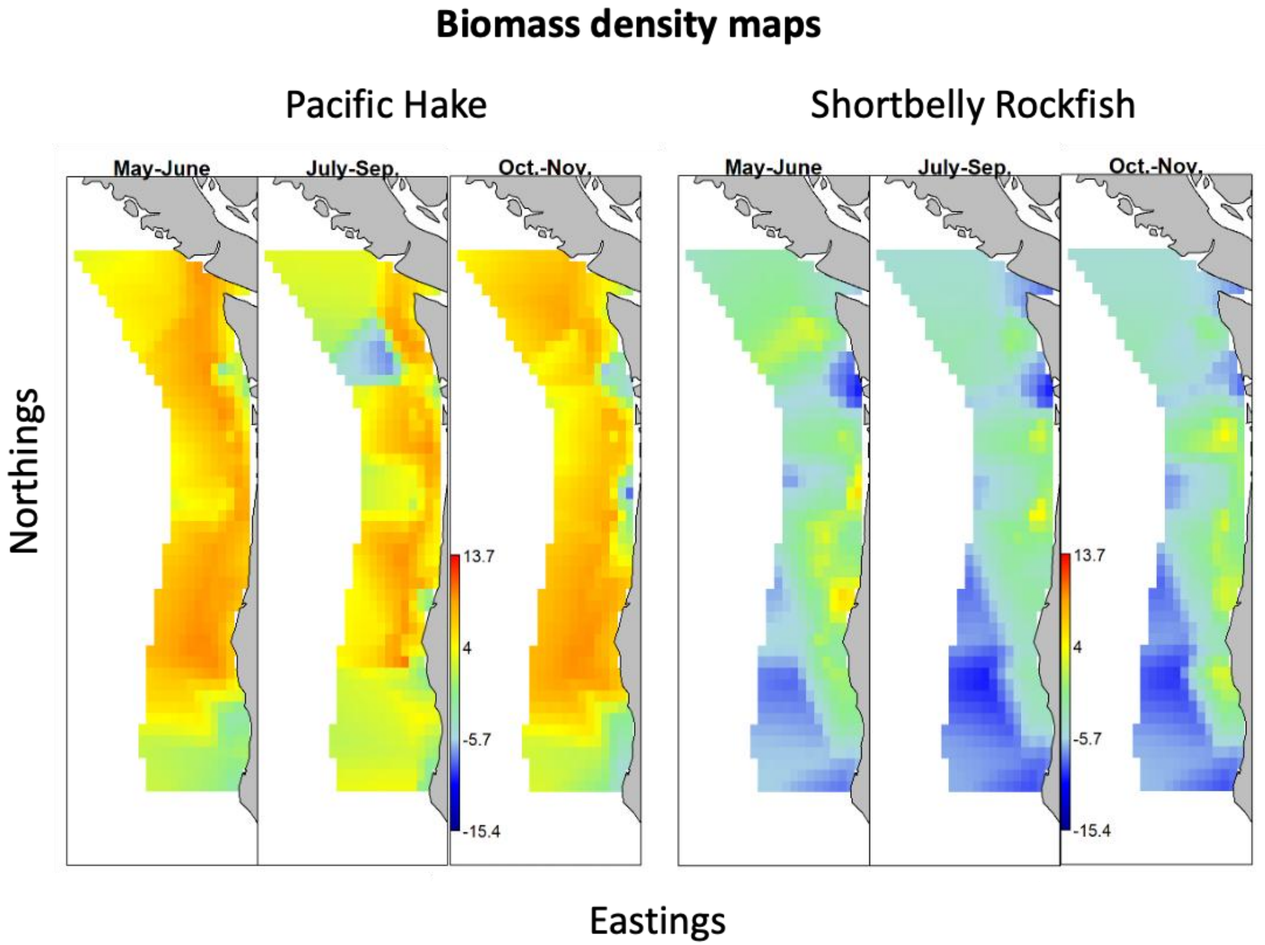
Forecasting bycatch potential in Pacific hake fishery

Objectives: model development and skills testing of model hindcasts and forecasts

Potential species: various rockfish spp., sablefish, salmon, mackerels

Data sources: at-sea hake observer program, hake/cps acoustic trawl survey, groundfish bottom trawl survey, groundfish observer program

MOM6 hindcasts and forecasts



Figures courtesy of Derek Bolser

Kirstin Holsman + Maurice Goodman - UW & AFSC

Pacific Cod SDM Explorer: Nome, Alaska

Part of the Alaska Climate and Ecosystem Dashboard

1. Select Climate Scenario

Select scenario | (hindcast) | low emissions | high emissions

2. Select Time Period

mid-century | end-of-century | (no time filter applied)

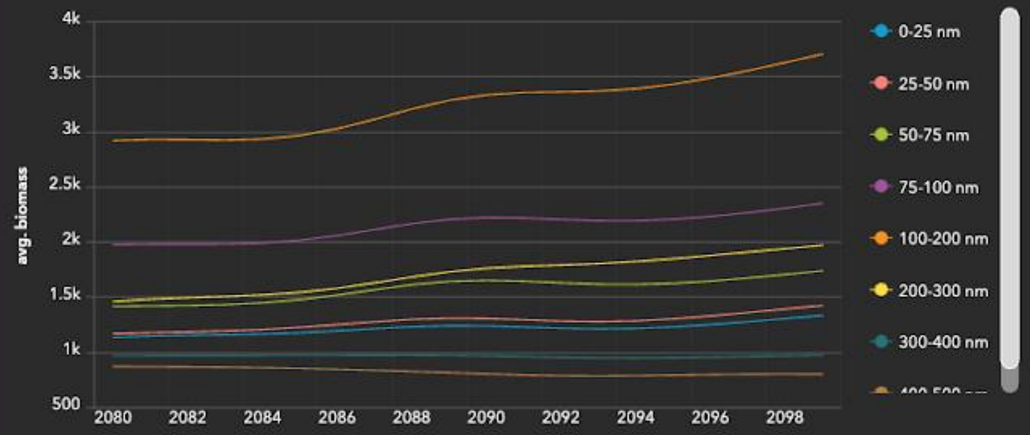
3. Select Map

biomass | probability of occurrence

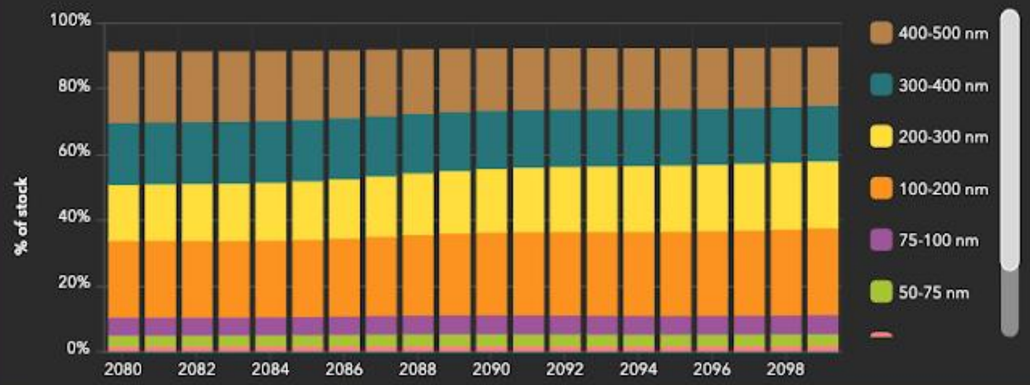
Filter by Vessel Distances

0-25 nm | 25-50 nm | 50-75 nm | 75-100 nm | 100-200 nm | 200-300 nm | 300-400 nm | 400-500 nm

Pacific Cod Average Biomass by Vessel Distance from Nome

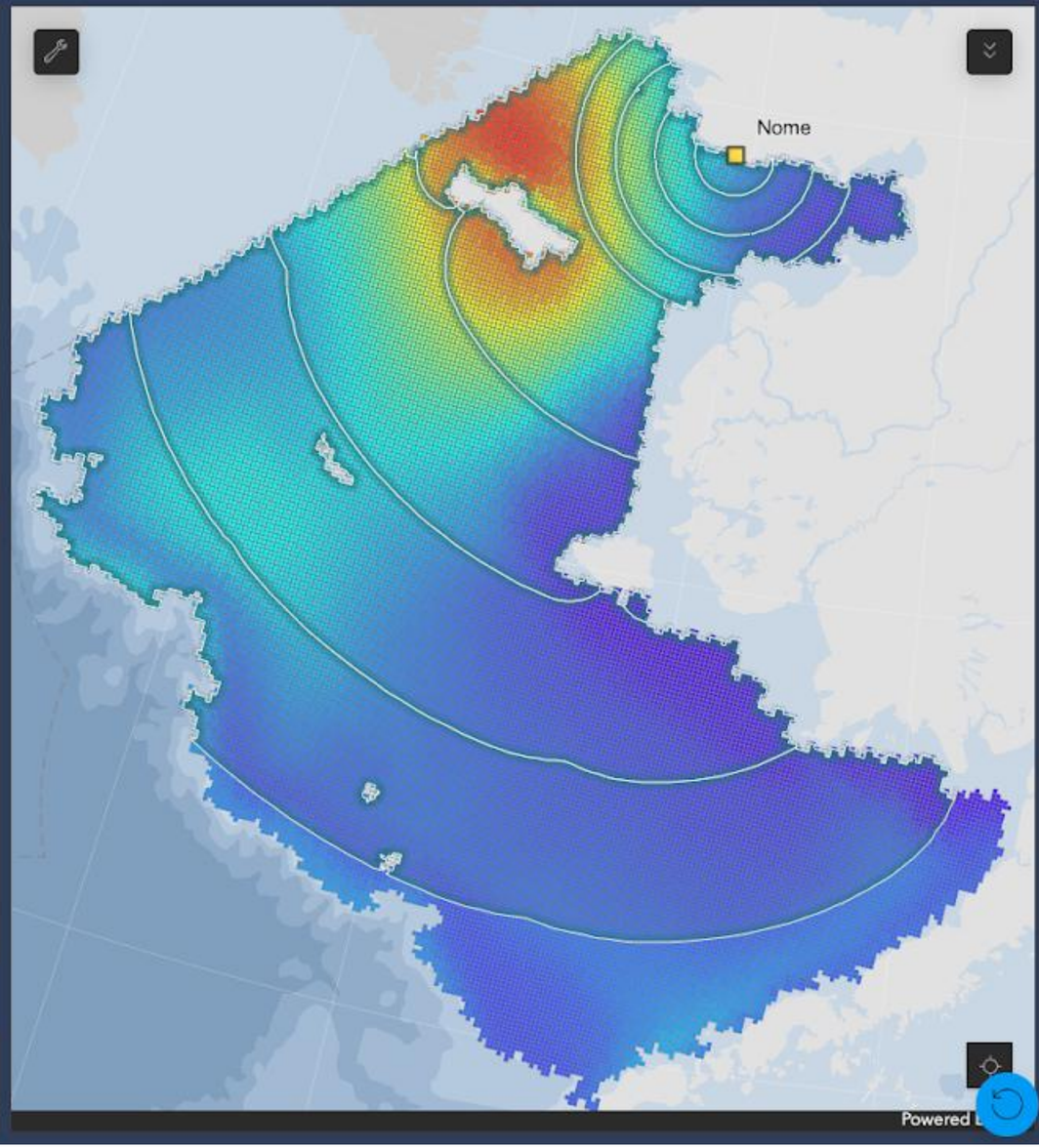


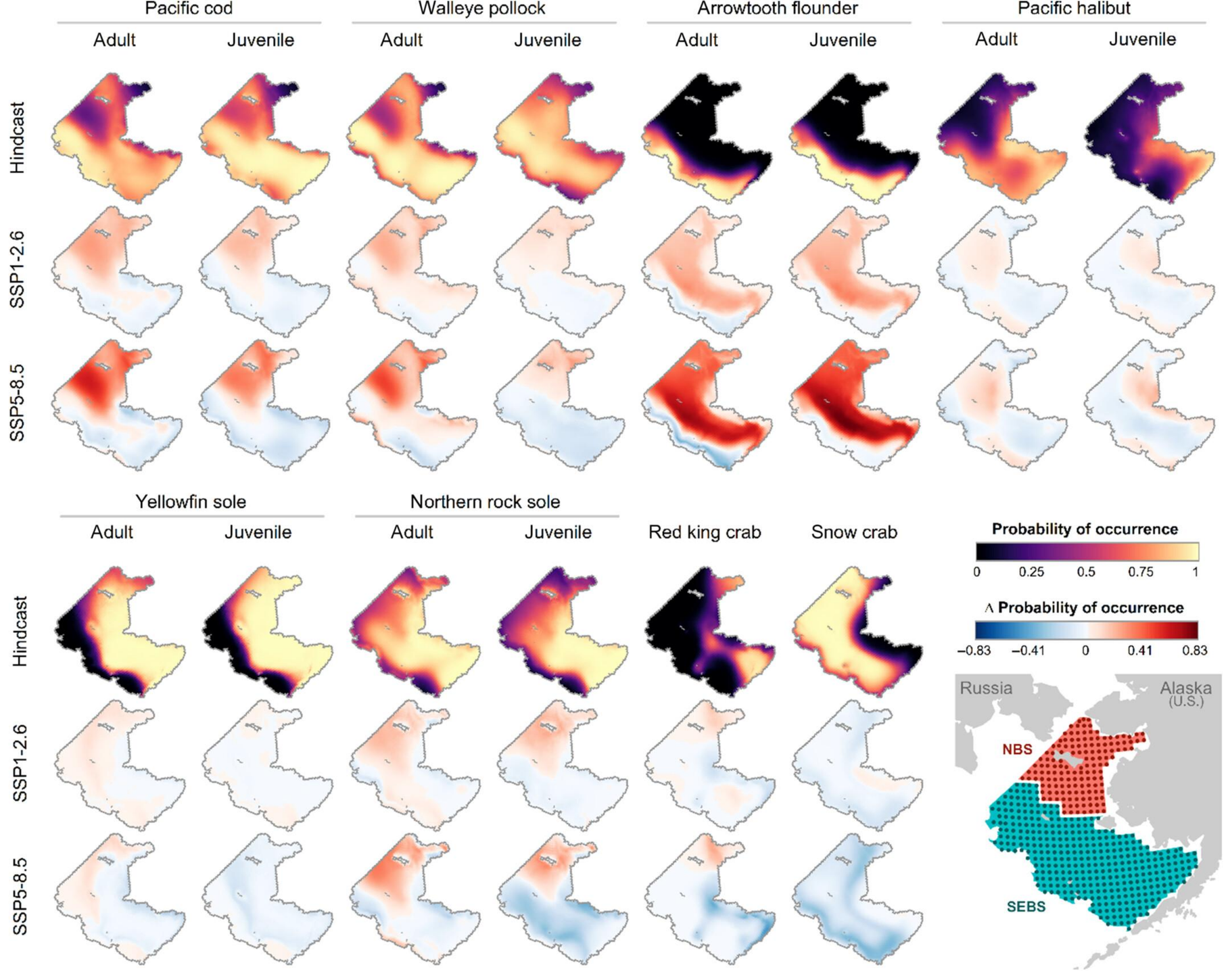
Pacific Cod Percent of Stock Available by Vessel Distance from Nome

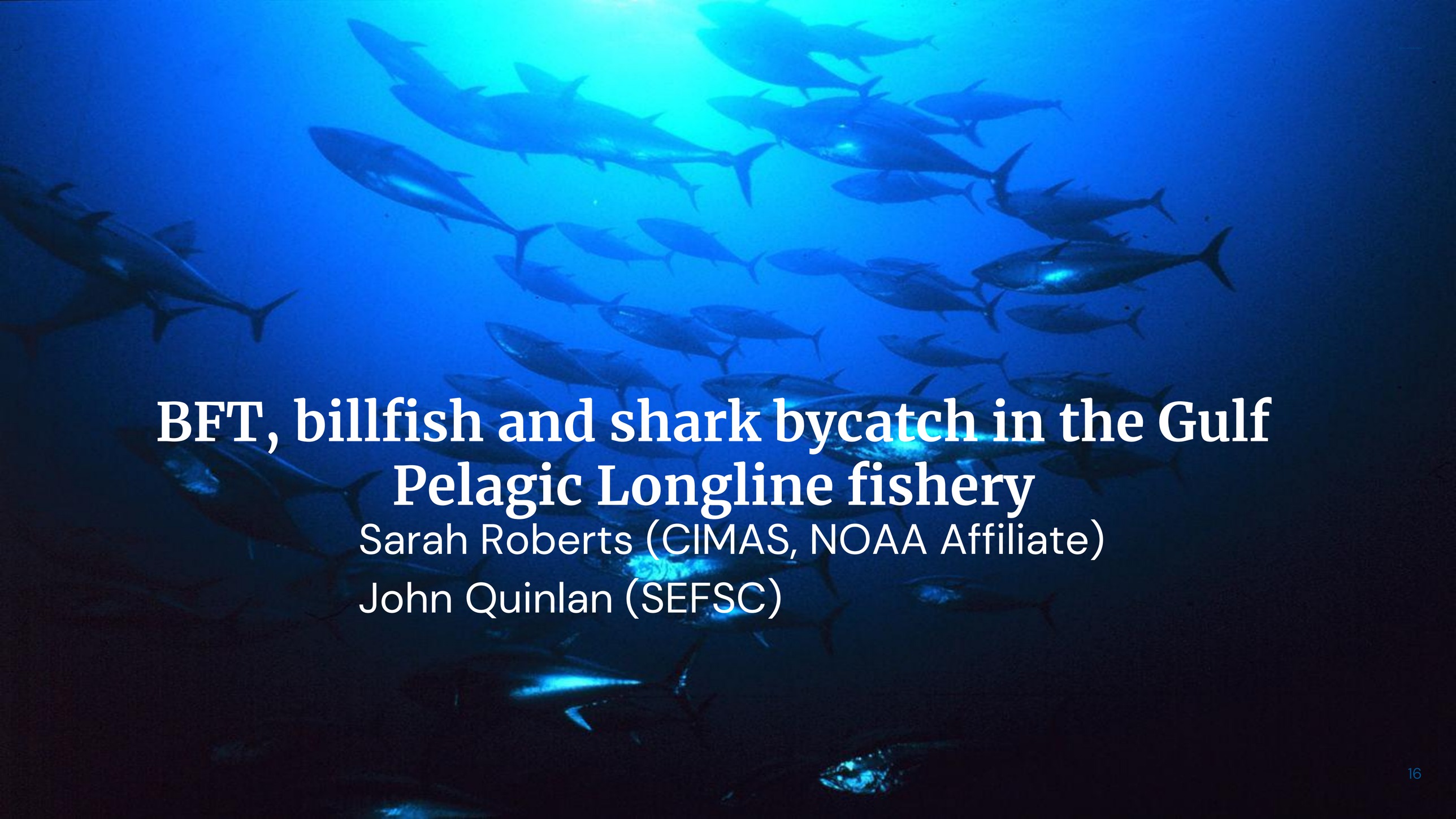


proportion of stock available | probability of occurrence

avg. depth	avg. dist. from Nome
-66m	318 nm




Pacific cod
Walleye pollock
Arrowtooth flounder
Pacific halibut
Adult
Juvenile
Hindcast
SSP1-2.6
SSP5-8.5
Yellowfin sole
Northern rock sole
Red king crab
Snow crab
Probability of occurrence
0
0.25
0.5
0.75
1
Δ Probability of occurrence
−0.83
−0.41
0
0.41
0.83
Russia
Alaska
(U.S.)
NBS
SEBS

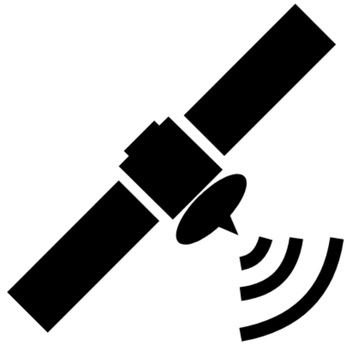


BFT, billfish and shark bycatch in the Gulf Pelagic Longline fishery

Sarah Roberts (CIMAS, NOAA Affiliate)

John Quinlan (SEFSC)

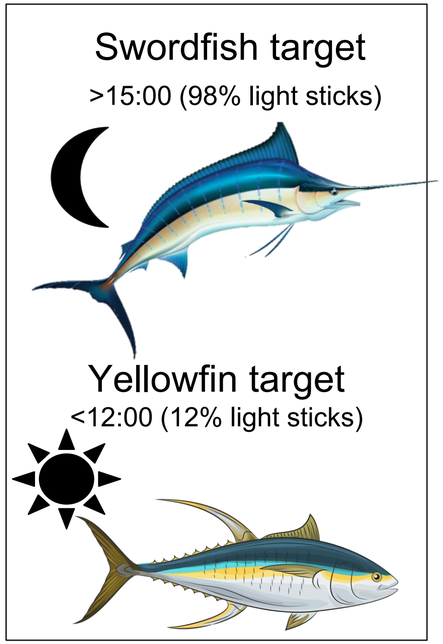
Modeling framework

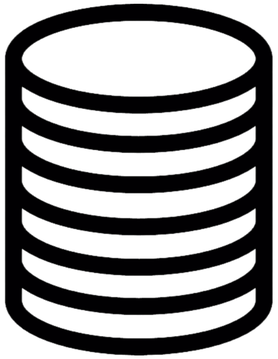


Satellites
Environmental Data

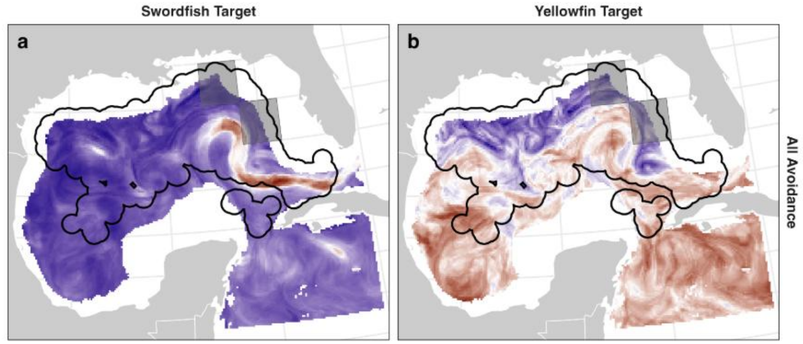


PLL Observer
Animal Occurrence Data





Stacked Ensemble Models
RF, GLM, GAM, BRT



Daily Predictions
Presence,
Environment,
Overlap

Temperature Observations To Avoid Loggerheads (**TOTAL**) tool

HOME | DATA ACCESS | TOOLS & TRAINING | ABOUT | CONTACT | QUICK LINKS

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Loggerhead Turtle Conservation

Background | Closure Rules | Conservation Area Status | Data Dashboard

Closure is not in effect

Closer dates: No closure dates have been announced

NMFS has not prohibited fishing with large-mesh drift gillnet gear in the Pacific Loggerhead Conservation Area this year

*Closure status provided by NOAA Fisheries West Coast Regional Office

Environmental Conditions

El Niño Status

Status: El Niño Advisory

Forecast:
Weak El Nino conditions are likely to continue through the Northern Hemisphere spring 2019 (~80% chance) and summer (~60% chance).

Updated: 14 March, 2019

*NOAA's Climate Prediction Center

Closure Area Sea Temperature

°C ◉ °F ○

	Oct	Nov	Dec	Jan	Feb	Mar
Temperature	19.4	18.7	16.9	15.4	14.9	15
Anomaly	1	1.5	1.4	0.7	0.4	0.6

Recent and historical monthly sea surface temperatures within the Loggerhead sea turtle conservation area. *GHRSST MUR dataset

TOTAL Bycatch Avoidance Tool

TOTAL Timeseries

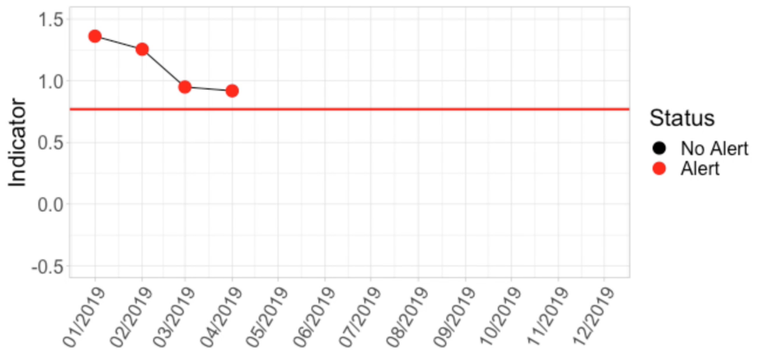
April 2019

Status: Alert

Indicator value: 0.90

Updated: April 9, 2019

This year's Temperature Observations To Avoid Loggerhead (TOTAL) values for the Loggerhead Conservation Area. An alert is indicated when indicator values (the timeseries) exceed a threshold of 0.77 (red horizontal line)



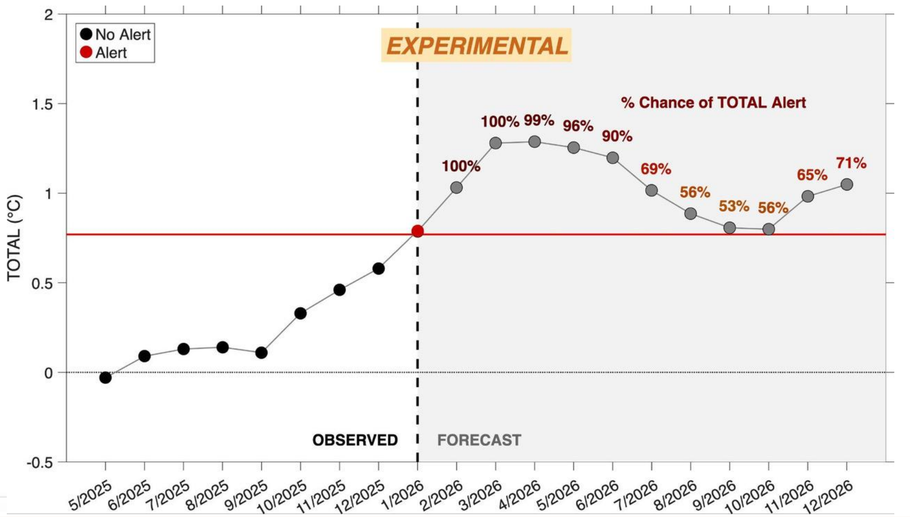
Tool Operationalization

https://coastwatch.pfeg.noaa.gov/loggerheads/

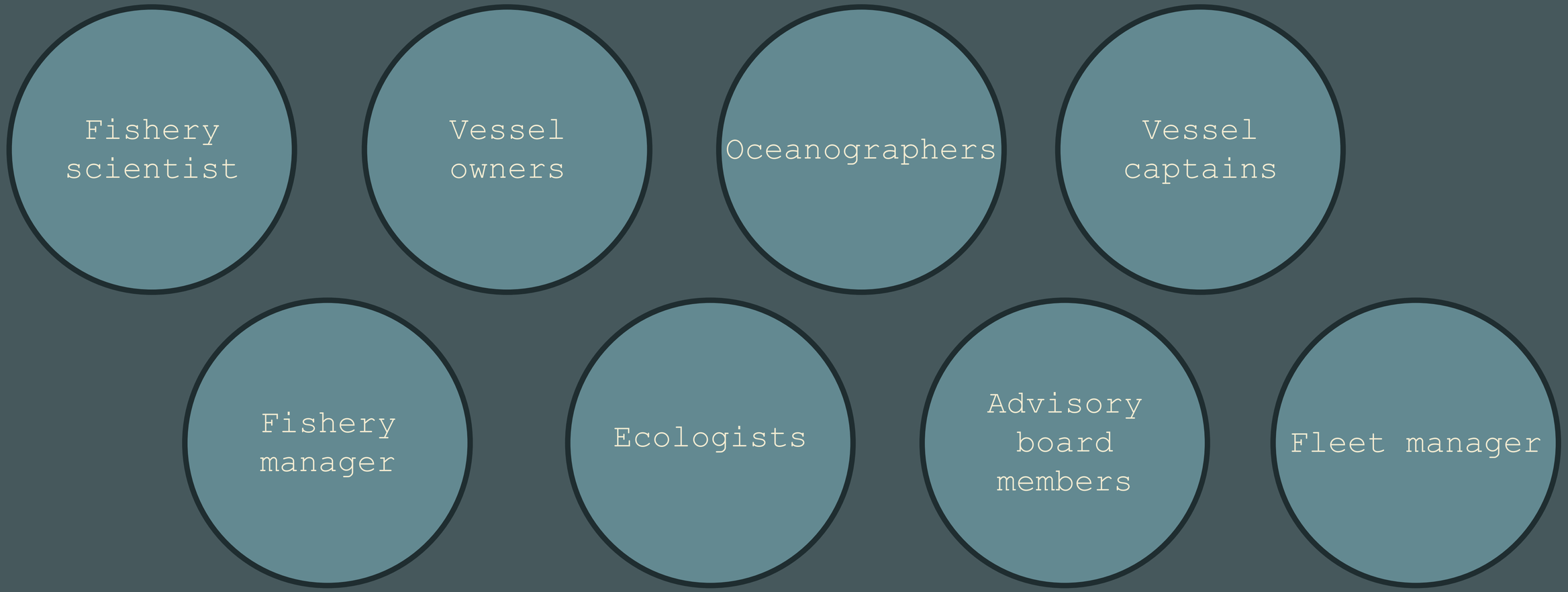
Forecasts in IEA

Forecast TOTAL

Mike Jacox and Chia-Wei Hsu



Tool by Heather Welch, website by Dale Robinson (UCSC)



DOM requires collaboration

Nazario et al. *2026*

Social view of DOM

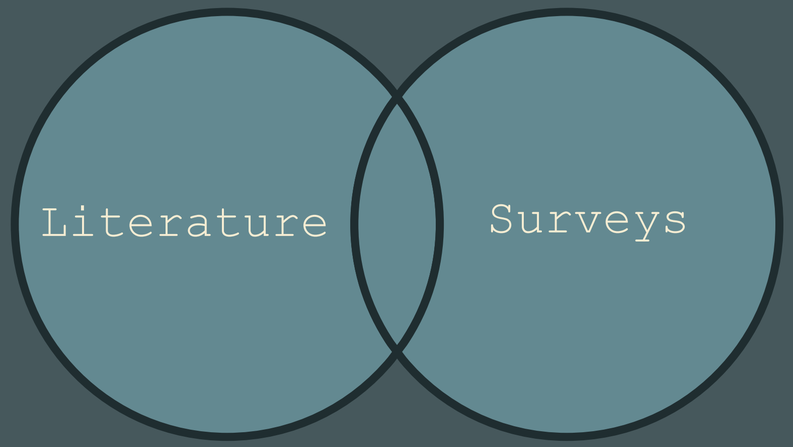


Bridges

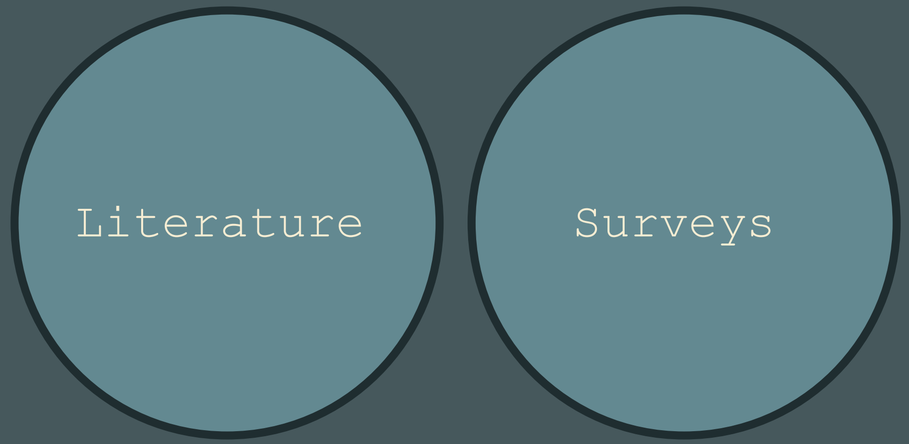


Barriers

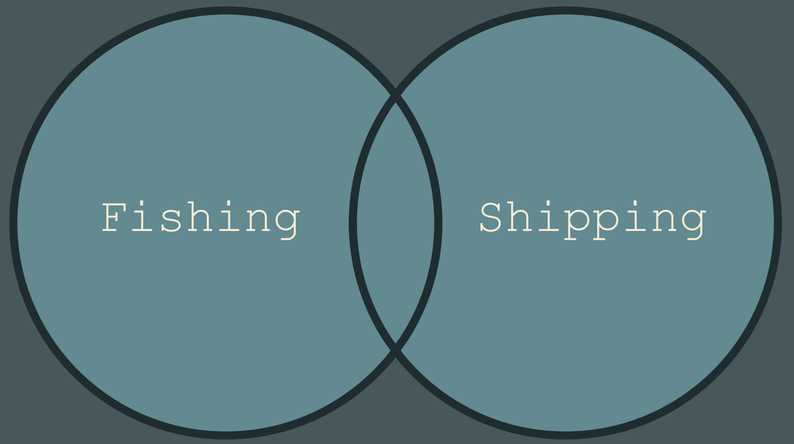
Aim #1: What are the bridges and barriers to DOM according to multiple perspectives?



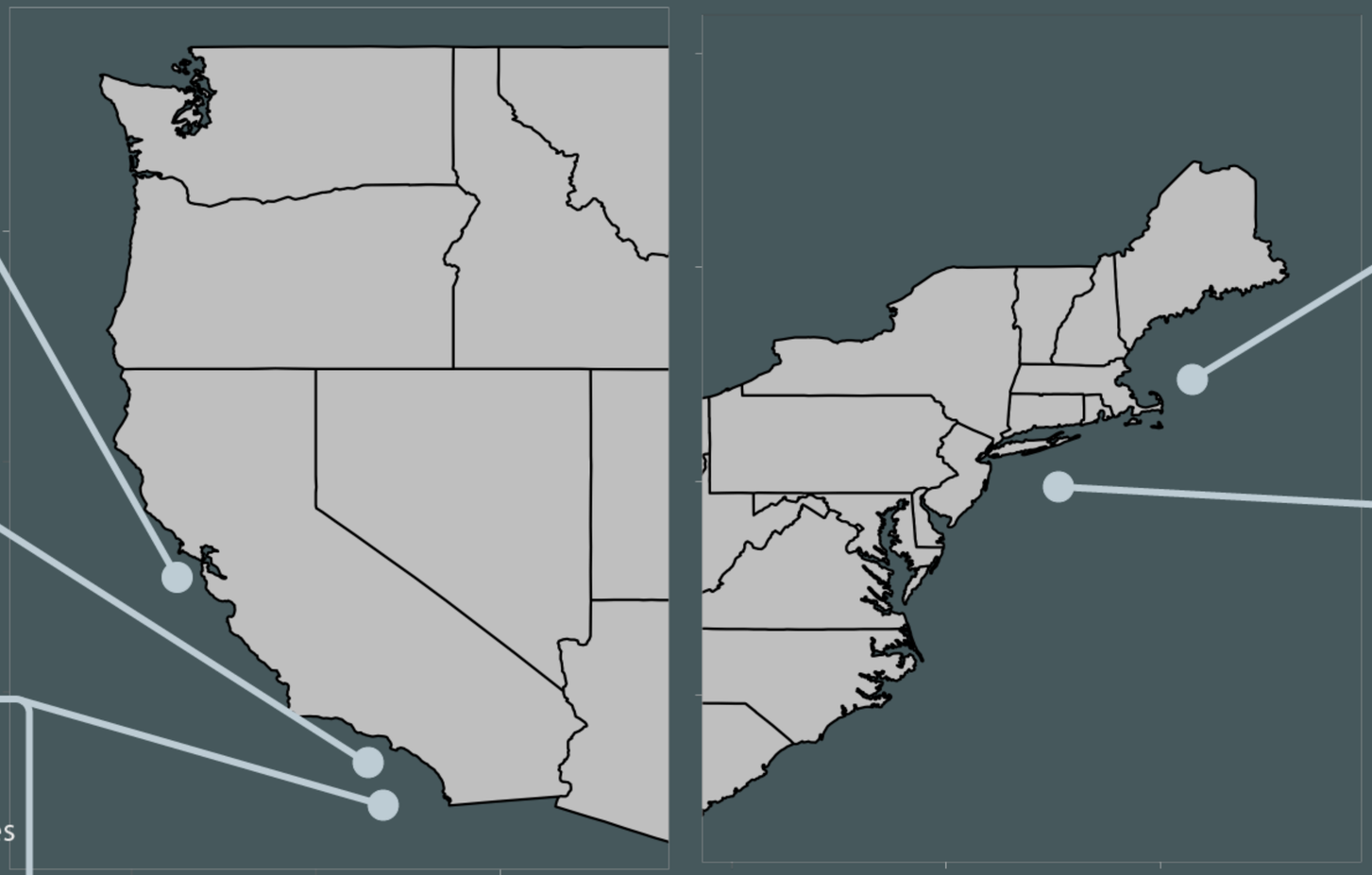
Aim #2: What new information have surveys added?



Aim #3: How do bridges and barriers vary between shipping and fishing?



Interest-holder survey



Whale Safe

Shipping vessels

Baleen whales

10 responses

EcoCast

U.S. West Coast Swordfish fisheries

Marine mammals, sea turtles

1 response

Yellowtail flounder bycatch avoidance program

U.S. Sea Scallop fishery

Yellowtail Flounder

8 responses

River herring bycatch avoidance program

U.S. Northwest Atlantic mid-water trawl fishery

River herring

3 responses

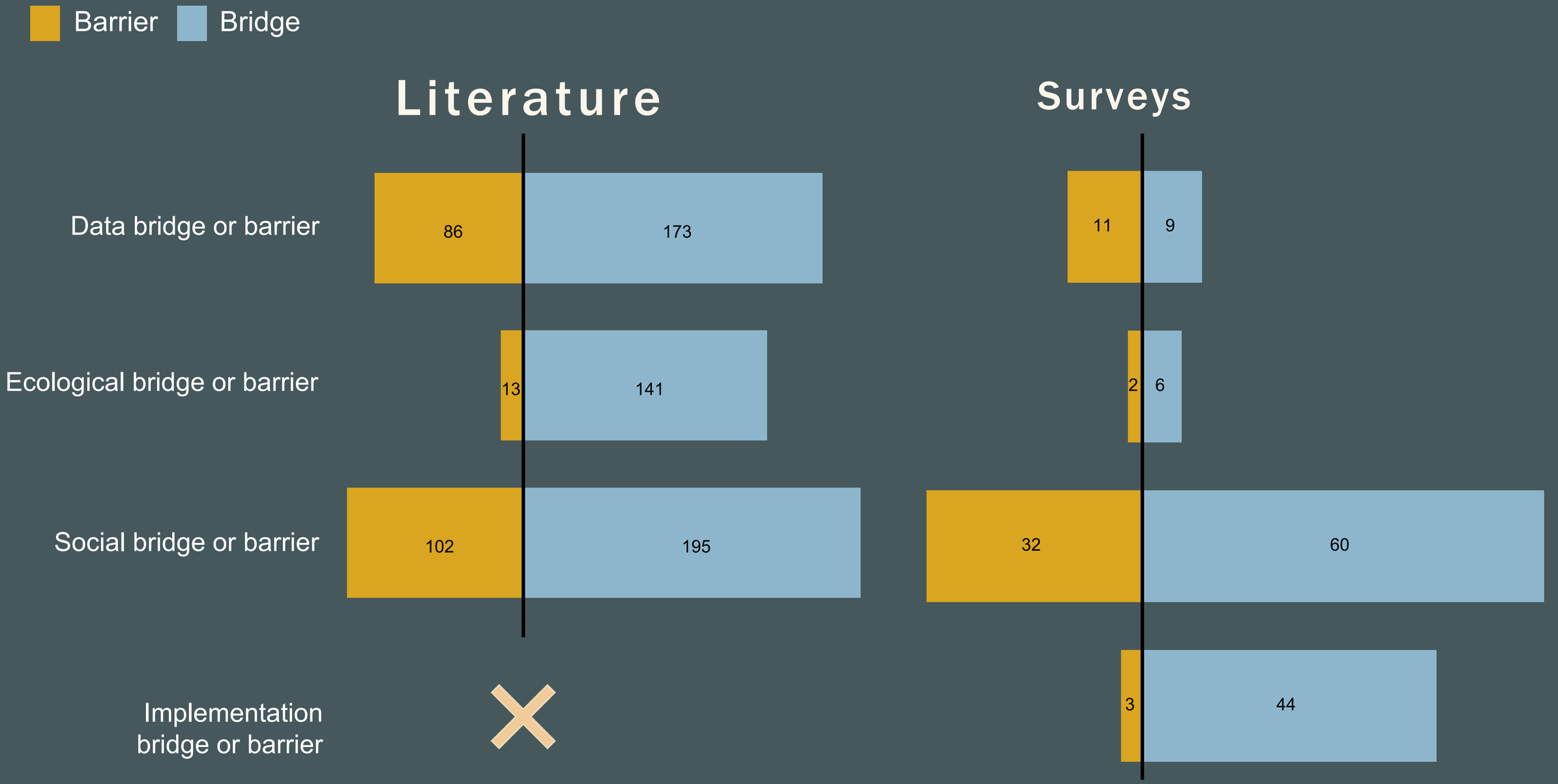
Nazario et al. *2026*

Interest-holder survey

DOM Survey

Q1: What worked with DOM, or what was “successful”?	“Fleet was informed of how close they were to hitting the catch caps, which was helpful to direct fishing effort”
Q2: What didn’t work with DOM, or what would you change?	“data showing whales were not struck or less whales were struck”

Nazario et al. *2026*



Theme prevalence varied by perspective

Nazario et al. *2026*

Conclusions

Goal: Work with fishers & managers to improve our ability to increase fishing sustainability for the next generation.

- **West Coast:** 

  - EcoCast is operational, being improved with fishers for EFPs.













Conclusions

- **West Coast:** 

  - EcoCast is operational, being improved with fishers for EFPs.
- **Pacific Islands:** 

  - HICast models are being presented to Hawaii Longline Association and PIRO for co-development of the tool.



BBC

NOAA NMML

NOAA SWFSC

Southwest Fisheries Science Center, NOAA Fisheries Service

Conclusions

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- **Pacific Islands:** 

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- **Gulf:** 

  - GulfCast website is operational and automated. Outreach with fishers underway.











Conclusions

- **West Coast:** **+ Hake!**
  - EcoCast is operational, being improved with fishers for EFPs.
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- **Gulf:**
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+ Alaska & Northeast!










Conclusions

+ Hake!

+ ????

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+ Alaska & Northeast!





BBC



NOAA NMML



NOAA SWFSC



Southwest Fisheries Science Center, NOAA Fisheries Service