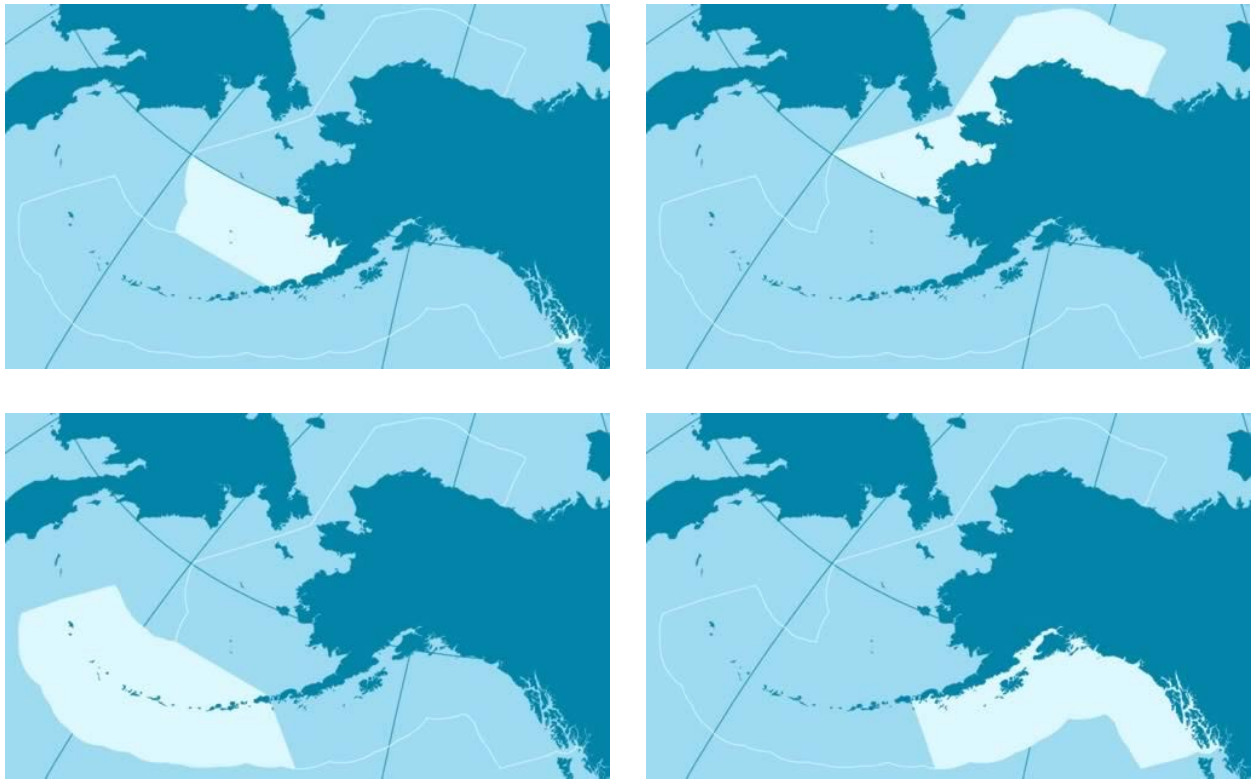
NOAA FISHERIES SERVICE

Context and tools for Ecosystem-Based Fisheries Management in Alaska



Kerim Aydin
Alaska Fisheries Science Center

NPFMC Ecosystem Research Workshop
November 8, 2017

NOAA FISHERIES SERVICE

Timeline of ecosystem-based fisheries management science

1980s: Proactive ecosystem measures in Alaska

Ecosystem models, 2M MT cap, forage fish ban

1990s: What is ecosystem-based management?

Academic panel reports (nationwide), development of Alaska Ecosystem Status Report (*"Ecosystem Considerations"*)

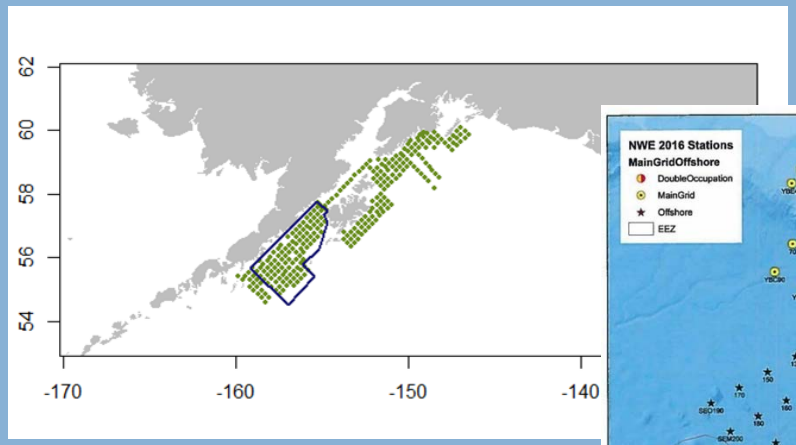
2000s: Product and tool development

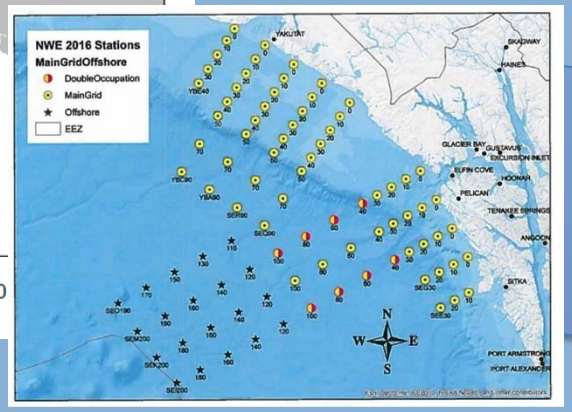
Models, analysis tools, observations (IERPs), conceptual models

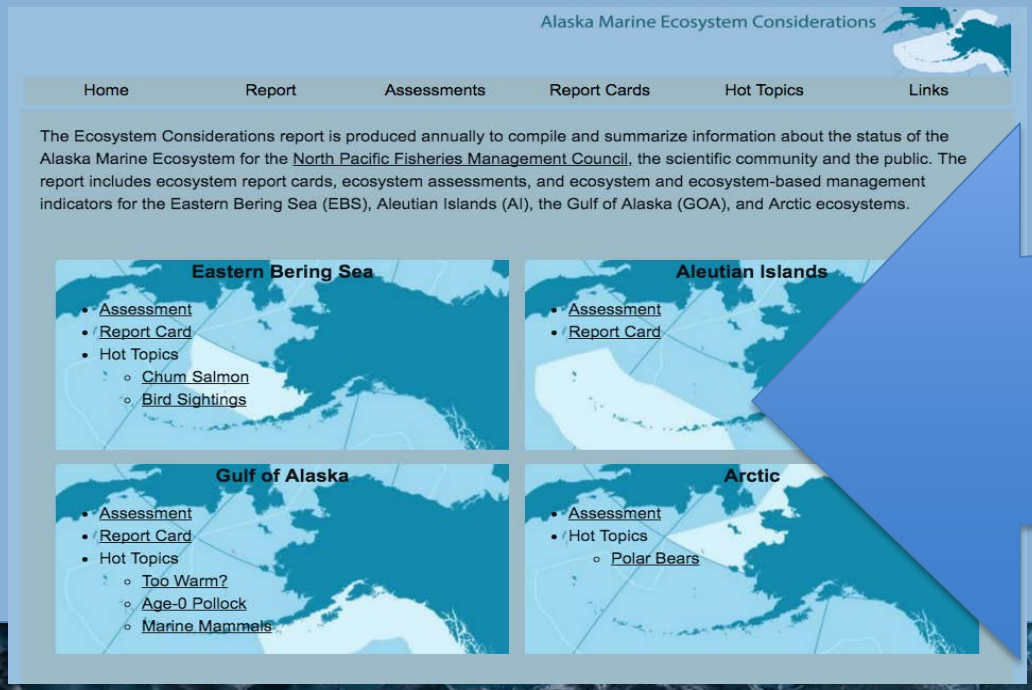
2010s: Development of formalized programs

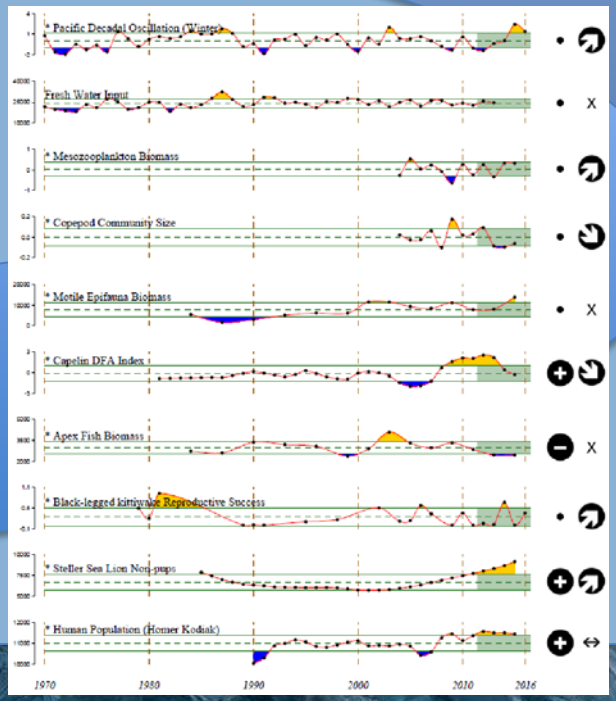
National and Local Roadmaps, Integrated Ecosystem Assessments

Increased integration of fieldwork and management advice



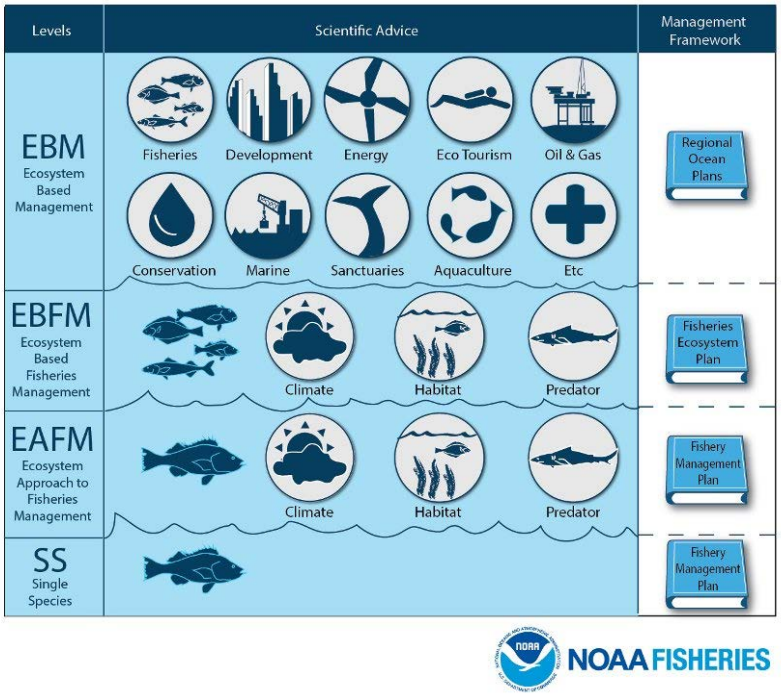






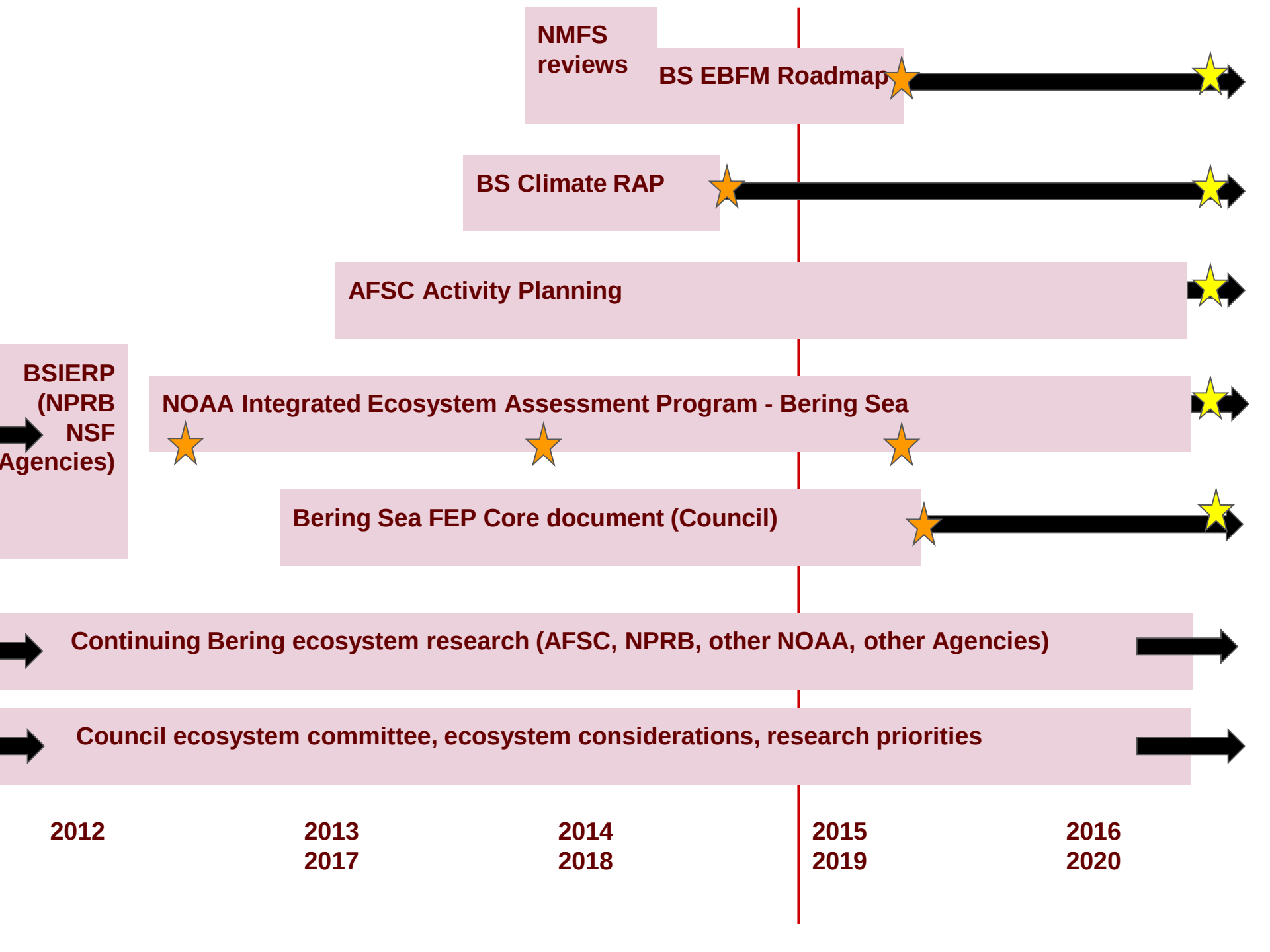
NOAA FISHERIES SERVICE

Development of national policy documents and programs



NMFS EBFM Roadmap

NOAA Integrated Ecosystem Assessment (IEA) Program


NMFS reviews
BS EBFM Roadmap
BS Climate RAP
AFSC Activity Planning
BSIERP (NPRB NSF Agencies)
NOAA Integrated Ecosystem Assessment Program - Bering Sea
Bering Sea FEP Core document (Council)
Continuing Bering ecosystem research (AFSC, NPRB, other NOAA, other Agencies)
Council ecosystem committee, ecosystem considerations, research priorities
2012
2013
2017
2014
2018
2015
2019
2016
2020

NOAA FISHERIES SERVICE

What is an Integrated Ecosystem Assessment?

A. It's a set of **best practices** and principles for EBM.

B. It's a **process** for delivering advice to management.

C. It's a **product**: "we have conducted an Integrated Ecosystem Assessment for the Bering Sea."

D. It's a NOAA **program** with a budget and deliverables.

A. All of the above.

NOAA FISHERIES SERVICE

PLACE-BASED

FOUR Large Marine Ecosystems - FOUR Integrated Ecosystem Assessment Programs

Eastern Bering Sea (EBS)

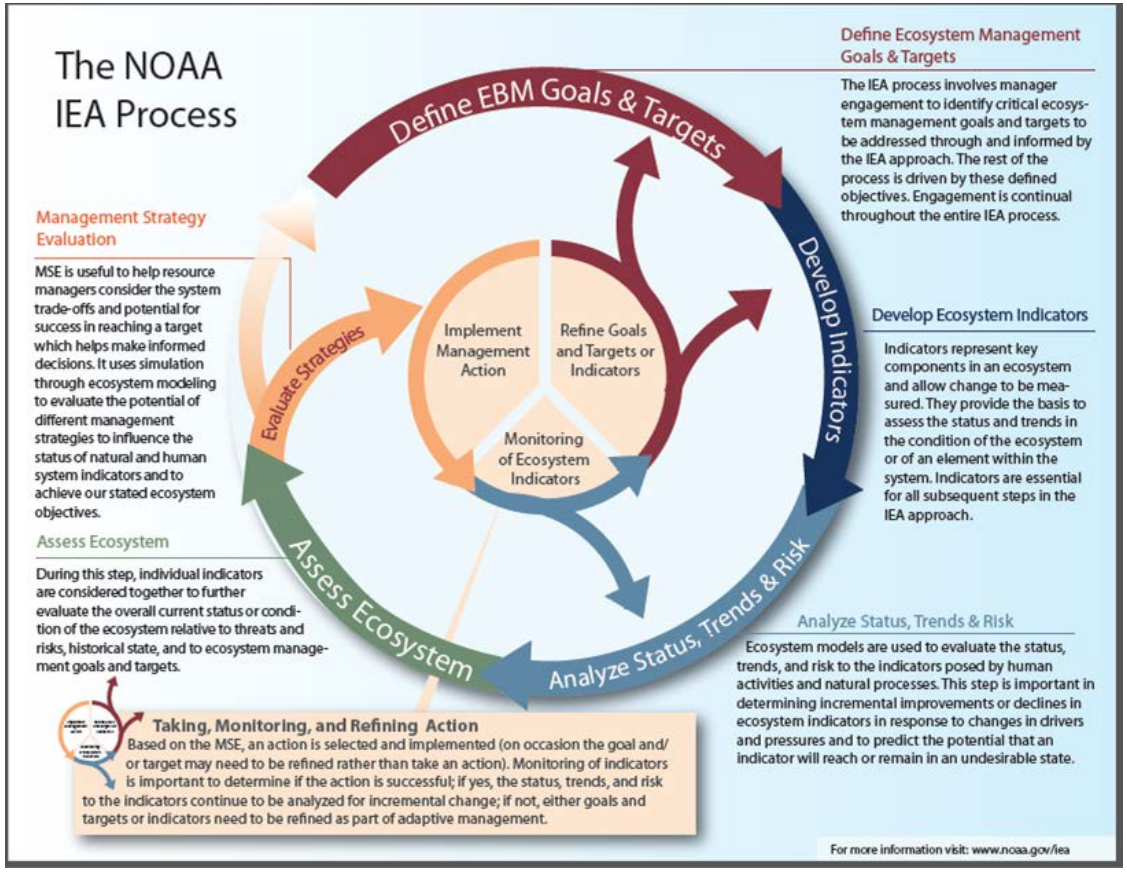
High Arctic

Aleutian Islands (AI)

Gulf of Alaska (GOA)

NOAA FISHERIES SERVICE

B: It's a Process



Stock assessment

Goal: Max. sustainable yield

Indicators: Stock biomass

Status: Surveys, reference points

Assess: Stock assessment

Evaluate: Adaptive management

NOAA FISHERIES SERVICE

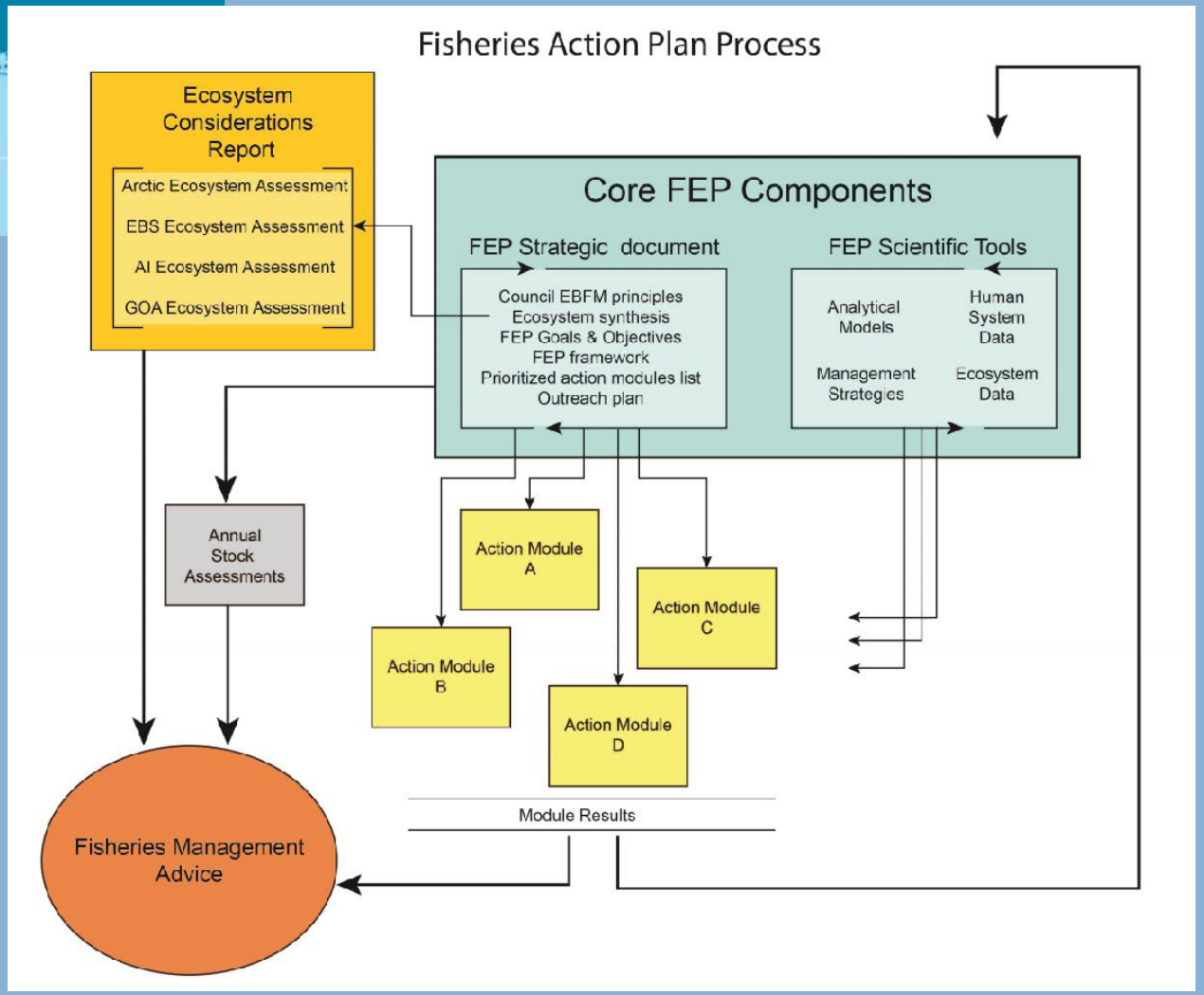
C: Products

- **Fisheries Ecosystem Plans (FEPs)**
- Conceptual Models
- Ecosystem Models
- Ecosystem Indicators
- Ecosystem Assessment
- Risk Assessments
- Management Strategy Evaluations

Eastern Bering Sea

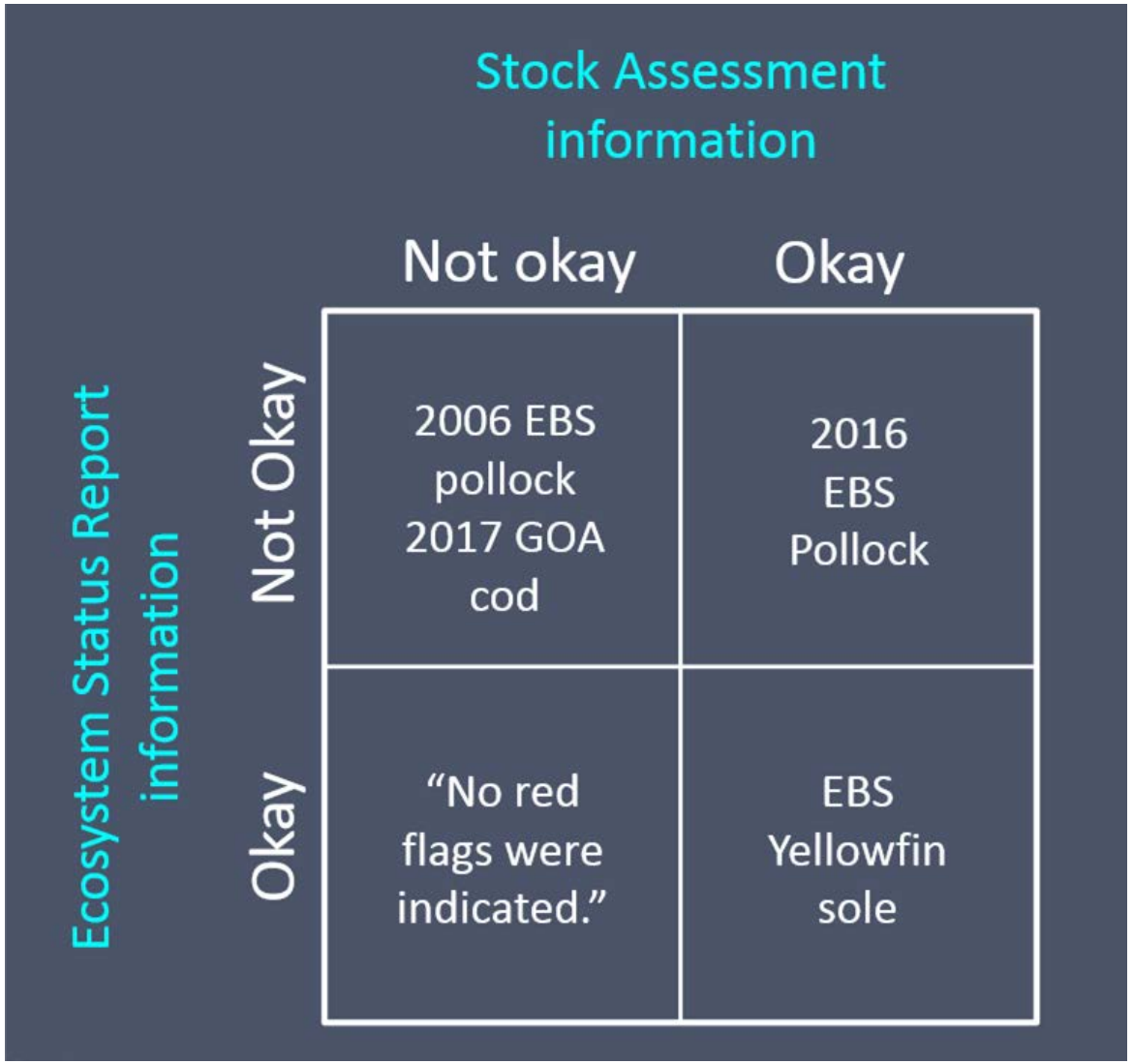
Fisheries Ecosystem Plan (completion ~Summer 2018)

- Developed by multi-agency team
- Transparent council processes for including ecosystem information in management
- Outreach
- Action modules integrate climate, EFH, human sectors, local/traditional knowledge
- Ecological framework of conceptual models
- Research and success tracking (“did we get there?”)



NOAA FISHERIES SERVICE

Example FEP task: Formalize ecosystem warnings (while maintaining flexibility)

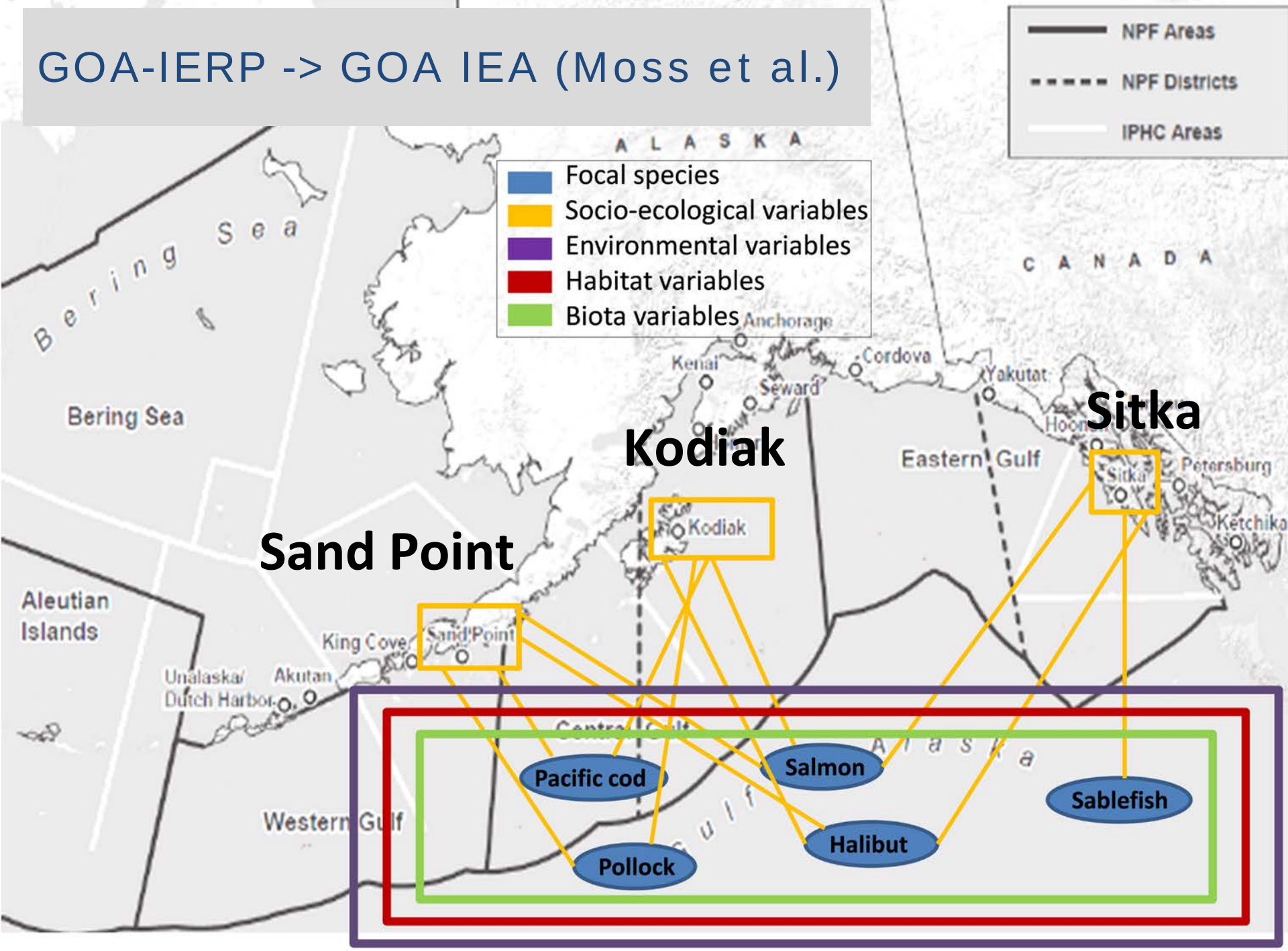


NOAA FISHERIES SERVICE

C: Products

- Fisheries Ecosystem Plans (FEPs)
- **Conceptual Models**
- Ecosystem Models
- Ecosystem Indicators
- Ecosystem Assessment
- Risk Assessments
- Management Strategy Evaluations

GOA-IERP -> GOA IEA (Moss et al.)



NOAA FISHERIES SERVICE

C: Products

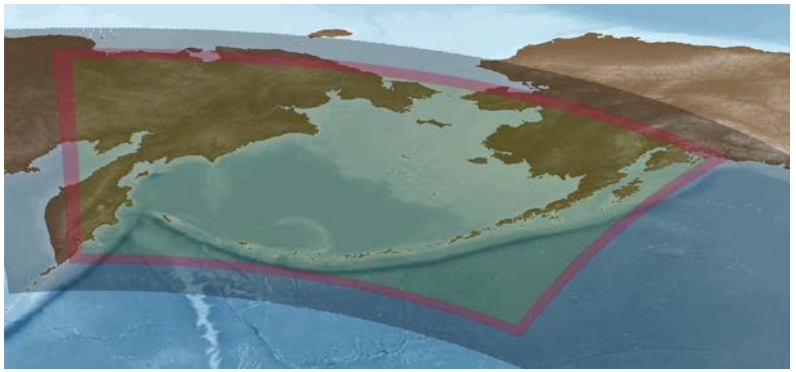
- Fisheries Ecosystem Plans (FEPs)
- Conceptual Models
- **Ecosystem Models**
- Ecosystem Indicators
- Ecosystem Assessment
- Risk Assessments
- Management Strategy Evaluations

NOAA FISHERIES SERVICE

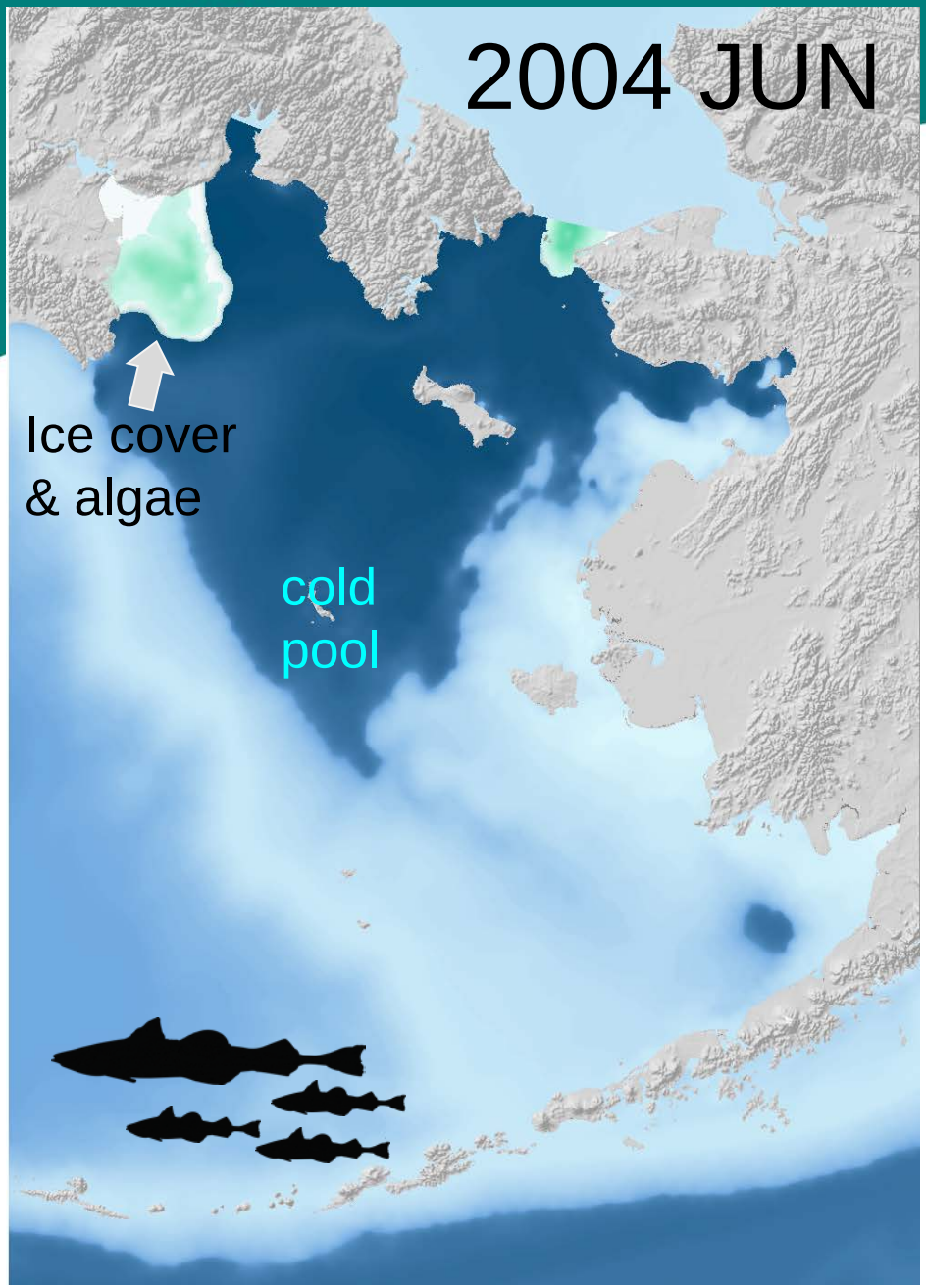
Bering ROMS/NPZ

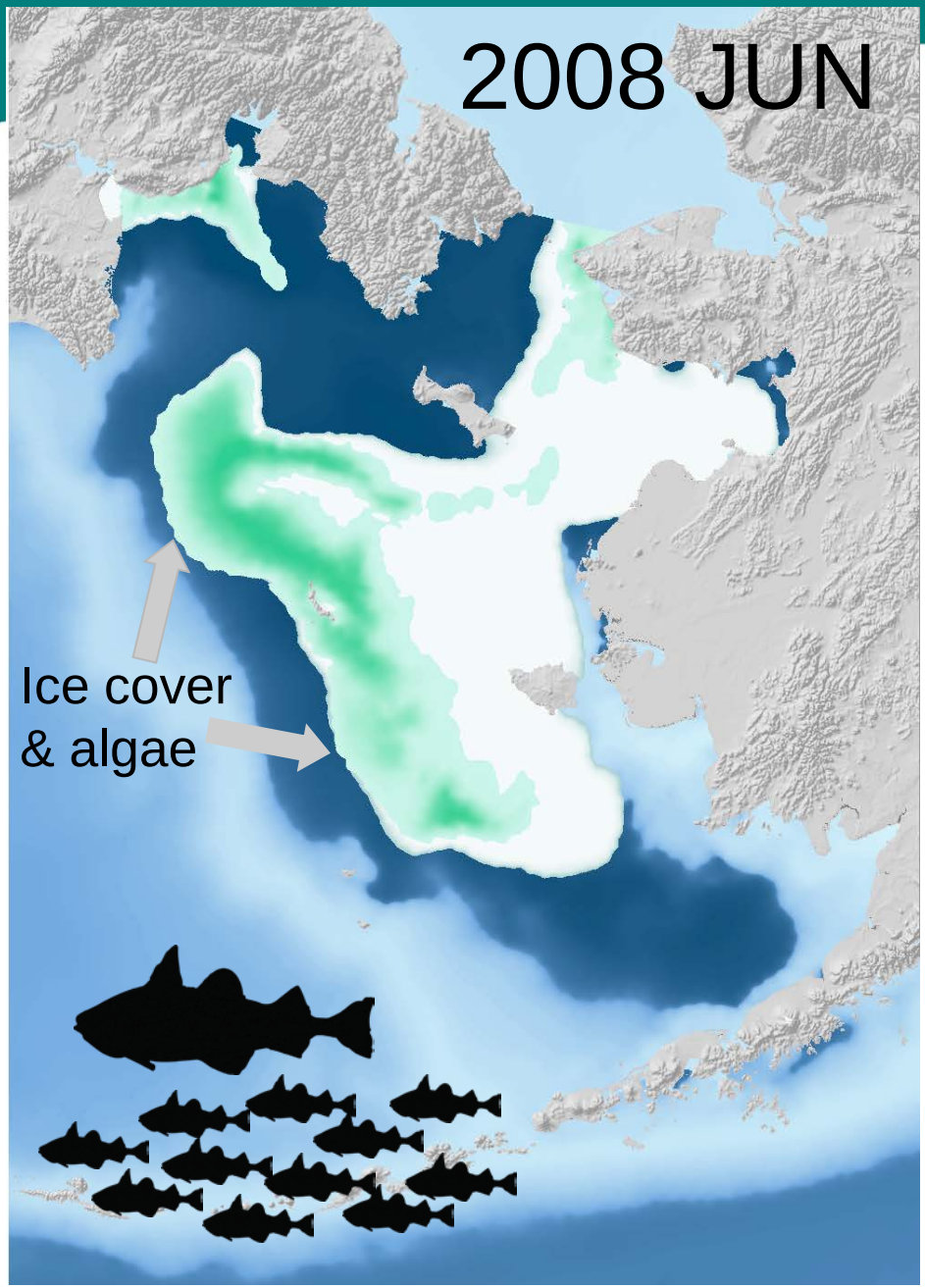
(Regional Oceanographic model with nutrients and plankton dynamics)

- Developed with NSF/North Pacific Research Board
- Ongoing IEA partnership (AFSC/PMEL)
- Significant advances in ice modeling, ice plankton



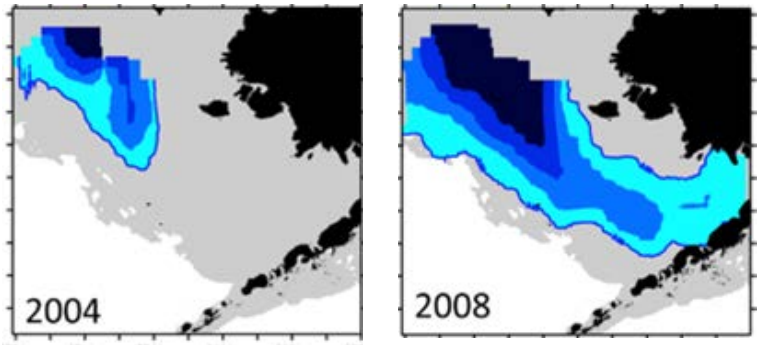
- Products
  - 46-year hindcast (1971-2017)
  - Nowcasts (annual)
  - 9-month forecast (annual)
  - Forecasts to 2100 with IPCC outputs
  - Rapid Climate Assessment
  - EFH predictive maps

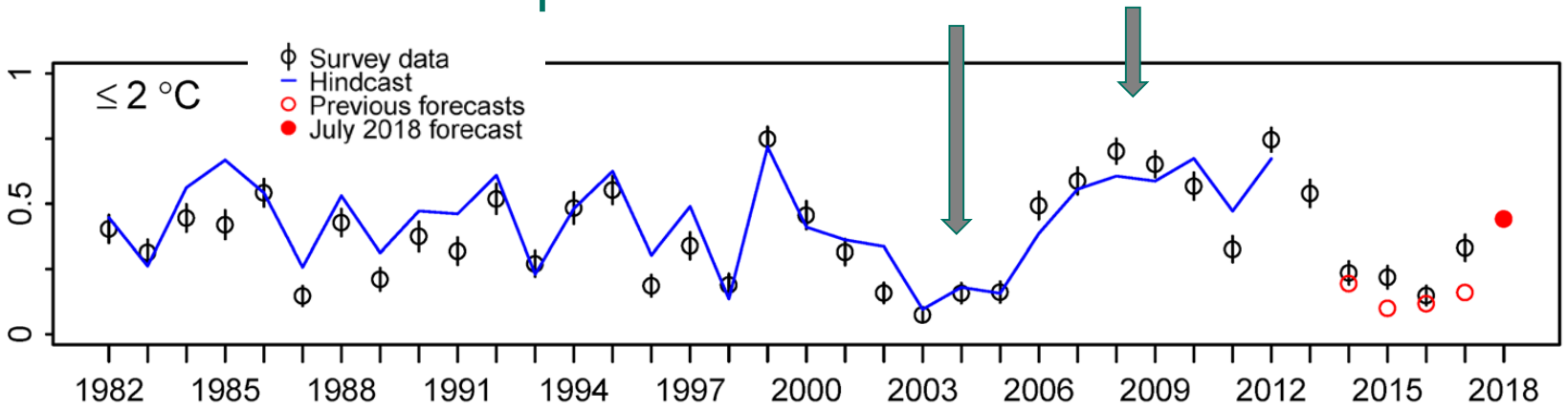

2004 JUN
Ice cover
& algae
cold
pool


2008 JUN
Ice cover
& algae

NOAA FISHERIES SERVICE

9-month (seasonal) forecast - cold pool





- Included in annual Bering Sea ecosystem status report (November prediction for following summer)
- Validation funded under NOAA MAPP Program - focus on ice prediction

NOAA FISHERIES SERVICE

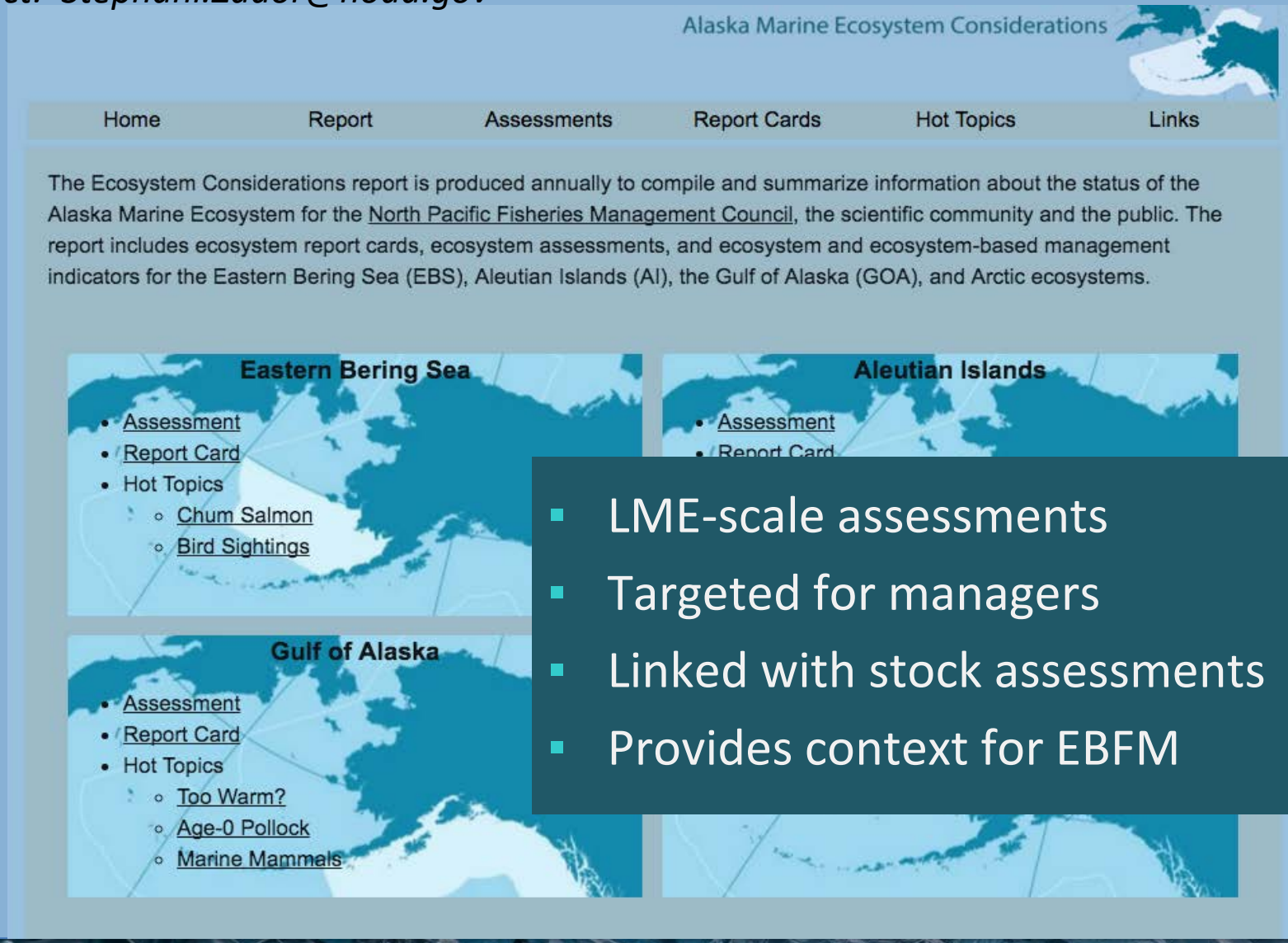
C: Products

- Fisheries Ecosystem Plans (FEPs)
- Conceptual Models
- Ecosystem Models
- **Ecosystem Indicators**
- **Ecosystem Assessment**
- Risk Assessments
- Management Strategy Evaluations

Ecosystem Considerations Reports

http://access.afsc.noaa.gov/reem/ecoweb/

Contact: Stephani.Zador@noaa.gov



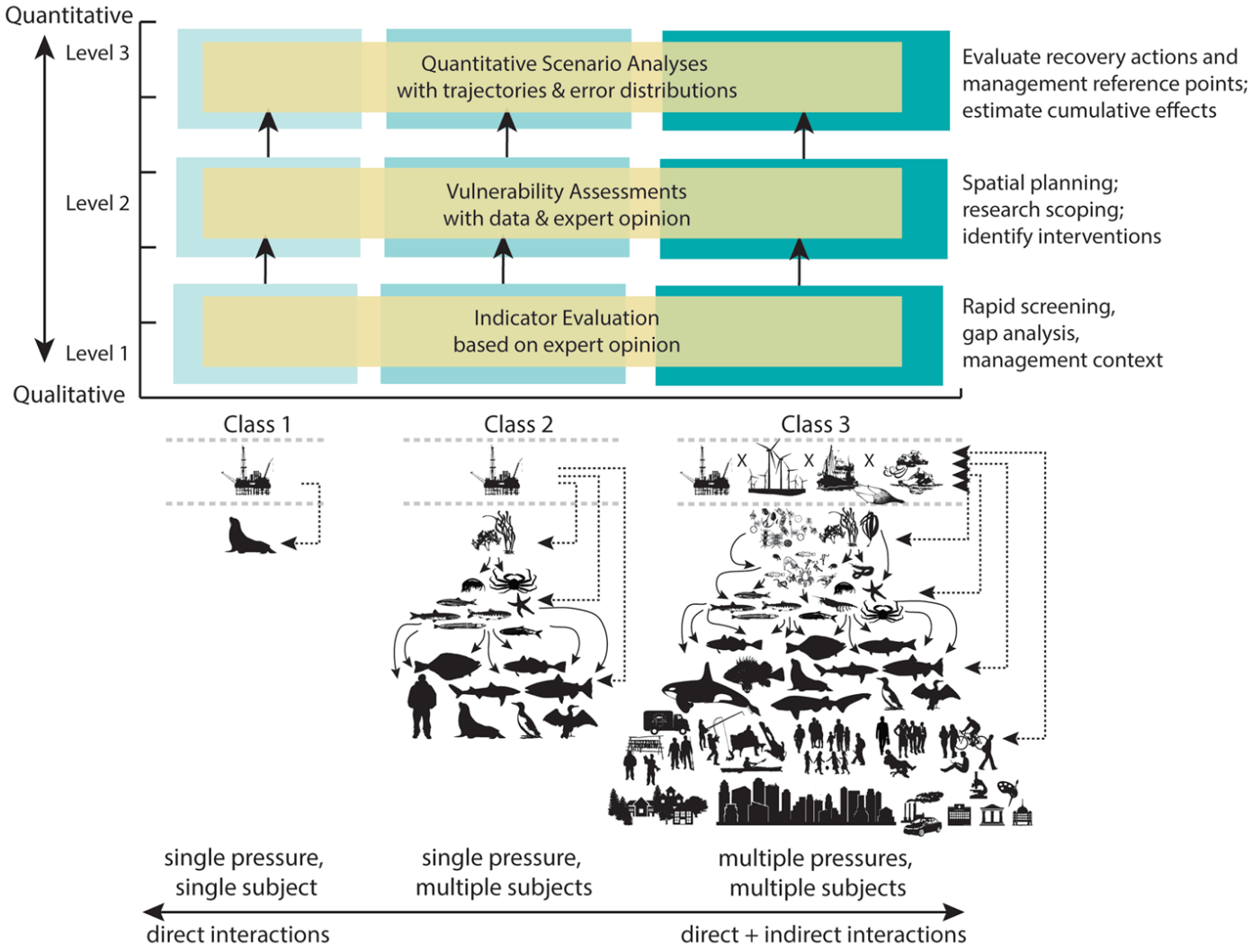
- LME-scale assessments
- Targeted for managers
- Linked with stock assessments
- Provides context for EBFM

NOAA FISHERIES SERVICE

C: Products

- Fisheries Ecosystem Plans (FEPs)
- Conceptual Models
- Ecosystem Indicators
- Ecosystem Assessment
- Ecosystem Models
- **Risk Assessments**
- Management Strategy Evaluations

Ecosystem Risk Assessment



Holsman et al. 2017

NOAA FISHERIES SERVICE

C: Products

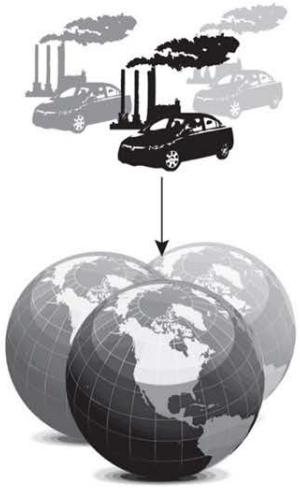
- Fisheries Ecosystem Plans (FEPs)
- Conceptual Models
- Ecosystem Indicators
- Ecosystem Assessment
- Ecosystem Models
- Risk Assessments
- **Management Strategy Evaluations**

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Alaska CLIMate Project

Anne Hollowed (AFSC, SSMA/REFM)
Kirstin Holsman (AFSC, REEM/REFM)
Alan Haynie (AFSC ESSR/REFM)
Stephen Kasperski (AFSC ESSR/REFM)
Jim Ianelli (AFSC, SSMA/REFM)
Kerim Aydin (AFSC, REEM/REFM)
Trond Kristiansen (IMR, Norway)
Al Hermann (UW JISAO/PMEL)
Wei Cheng (UW JISAO/PMEL)
André Punt (UW SAFS)

FATE: Fisheries & the Environment
SAAM: Stock Assessment Analytical Methods
S&T: Climate Regimes & Ecosystem Productivity



IPCC Scenarios (x3)

AR4 A1B
AR5 RCP6.0
AR5 RCP8.5

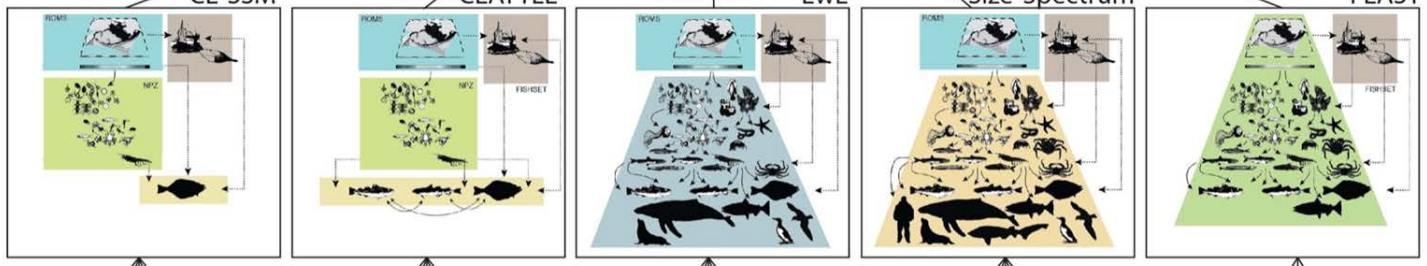
Global Climate Models (x 11)

ECHO-G (AR4 A1B)
MIROC3.2 med res. (AR4 A1B)
CGCM3-t47 (AR4 A1B)
CCSM4-NCAR- PO (AR5 RCP 6.0 & 8.5)
MIROCESM-C- PO (AR5 RCP 6.0 & 8.5)
GFDL-ESM2M*- PO (AR5 RCP 6.0 & 8.5)
GFDL-ESM2M*- PON (AR5 RCP 6.0 & 8.5)

Future Climate Scenarios

Bering Sea Models

CE-SSM | CEATTLE | EwE | Size-Spectrum | FEAST



By-catch, MSY
Status quo, MEY, No fishing
Harvest Control Rules (x5)

By-catch, MSY
Status quo, MEY, No fishing
Harvest Control Rules (x5)

By-catch, MSY
Status quo, MEY, No fishing
Harvest Control Rules (x5)

By-catch, MSY
Status quo, MEY, No fishing
Harvest Control Rules (x5)

Fleet dynamics
Status quo, No fishing
Harvest Control Rules (x3)

multiple non-linear pressures

multiple non-linear interacting pressures

Climate-enhanced Biological Models

Fishing Scenarios

https://www.afsc.noaa.gov/REFM/REEM/ACLIM.htm