Agenda Item D.1
Situation Summary
November 2010

ECOSYSTEM SCIENCE INFORMATION SESSION

The Pacific Fishery Management Council (Council) is in the process of incorporating ecosystem-based fishery management principles through an Ecosystem-Based Fishery Management Plan (EFMP). The National Marine Fisheries Service (NMFS) and the Council's Ecosystem Plan Development Team (EPDT) have recommended regular reports on available ecosystem science and the status of the California Current Large Marine Ecosystem.

The Council and the EPDT have been reviewing ecosystem-based fishery management initiatives around the country, including the North Pacific Fishery Management Council's (NPFMC) Aleutian Islands Fishery Ecosystem Plan (FEP). At its September 2010 meeting in Boise, Idaho, the Council scheduled this information session and requested a more detailed presentation on Aleutian Islands FEP, particularly, the types of scientific information considered and examples of how that information is used in management.

The stated goal of the Aleutian Islands FEP is to "provide enhanced scientific information and measurable indicators to evaluate and promote ecosystem health, sustainable fisheries, and vibrant communities in the Aleutian Islands region" and "was developed to provide the [NPFMC] Council with an understanding of important relationships among ecosystem components, which are not always considered together by managers. The FEP also identifies areas of uncertainty, describes how the [NPFMC] Council may currently be addressing the associated risk, and provides suggestions for other tools the [NPFMC] Council may wish to consider."

The FEP provides background information and analyses on the Aleutian Islands ecosystem:

- Describes and synthesizes the Aleutian Islands ecosystem processes and interactions,
- Delineates the regulatory and bio-physical boundaries of the Aleutian Islands,
- Conducts a qualitative risk assessment of Aleutian Islands interactions,
- Uses management objectives of Aleutian Islands fisheries to identify priorities for the FEP,
- Identifies ecological indicators appropriate to monitor key ecosystem interactions,
- Identifies knowledge gaps and research needs, and
- Provides a framework by which ecosystem considerations identified herein could be implemented within the current [North Pacific] Council structure and management practice.

Reference Materials:

1. Agenda Item D.1.a, Attachment 1: Overview of the North Pacific Fishery Management Council's Aleutian Islands Fishery Ecosystem Plan.

Agenda Order:

a. Agenda Item Overview **Mike Burner**
b. North Pacific Fishery Management Council Report
c. Reports and Comments of Advisory Bodies and Management Entities
d. Public Comment
e. Council Discussion

PFMC
10/18/10

Agenda Item D.1.a
Attachment 1
November 2010

Overview of the

Aleutian Islands Fishery Ecosystem Plan

North Pacific
Fishery Management Council

Aleutian Islands Fishery Ecosystem Plan writing team

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Sarah Gaichas, NMFS AFSC	Ecosystem/food web modeling
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John Olson, NMFS AKRO	Habitat, GIS
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Francis Wiese, NPRB	Research, seabirds

Abbreviations

AFSC - Alaska Fisheries Science Center
ADF&G - Alaska Department of Fish and Game
AI - Aleutian Islands
AKRO - Alaska Regional Office
ESA - Endangered Species Act
FEP - Fishery Ecosystem Plan
GIS - Geographic Information Systems
NMFS - National Marine Fisheries Service
NOAA - National Oceanic and Atmospheric Administration
NPFMC - North Pacific Fishery Management Council
NPRB - North Pacific Research Board
PMEL - Pacific Marine Environmental Laboratory
USFWS - US Fish and Wildlife Service

Cover photo credits

Background: *Aleutian arch*, NOAA–Auke Bay Laboratories
Insets top to bottom: *auklets*, Ian Jones; *Atka mackerel*, Alaska Sea Life Center;
Steller sea lion, Alison Banks; *crab pot*, Kimberly Rand;
bubble gum coral, Alberto Lindner, NMFS, NOAA
Below: *cod and coral,* NOAA–Auke Bay Laboratories

NOAA-Auke Bay Laboratories

Steve Barbeaux, AFSC, NOAA

Foreword

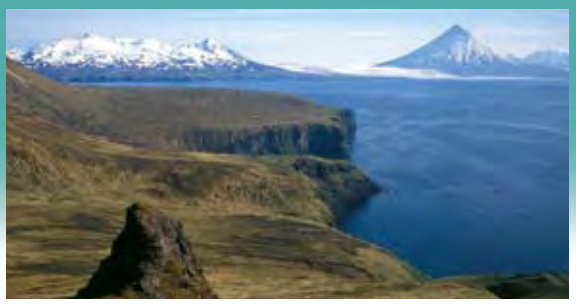
The North Pacific Fishery Management Council has developed the Aleutian Islands Fishery Ecosystem Plan (FEP) as a pilot project. With national attention on fishery managers to apply an ecosystem approach to management, the Council is continually adapting its management to better accommodate ecosystem relationships and strive for ecological balance. Consistent with this, the Council has designed a FEP that is relevant and applicable to Alaskan fishery management.

The Aleutian Island ecosystem is complex, and is the least predictable of the ecosystems in which the Council manages. The FEP is intended to be an educational tool and resource that can provide the Council with both an 'early warning system,' and an ecosystem context for fishery management decisions affecting the Aleutian Islands area. This document should help the Council respond to changing conditions in a proactive rather than reactive mode.

The FEP is to be a living document, in which ecosystem interactions, indicator status, research priorities, and data gaps are periodically updated. This first iteration of the FEP has been prepared by synthesizing currently available information about the Aleutian Islands ecosystem. While the Council recognizes that the FEP is a work in progress, the document can immediately be used to improve management action analyses, and to provide a broader understanding of actions affecting the Aleutian Islands ecosystem. Additionally, through the identification of indicators and the assessment of risk, the FEP provides directions and priorities for further study.

This brochure provides a brief summary of information found in the Aleutian Islands Fishery Ecosystem Plan. A disc containing the document in its entirety is included on the back page of this summary.

Contents



G.L. Thomson

center: NOAA Fisheries
right: Kevin Bell, USFWS

What is a Fishery Ecosystem Plan?

The goal of this FEP is to provide enhanced scientific information and measurable indicators to evaluate and promote ecosystem health, sustainable fisheries, and vibrant communities in the Aleutian Islands region.

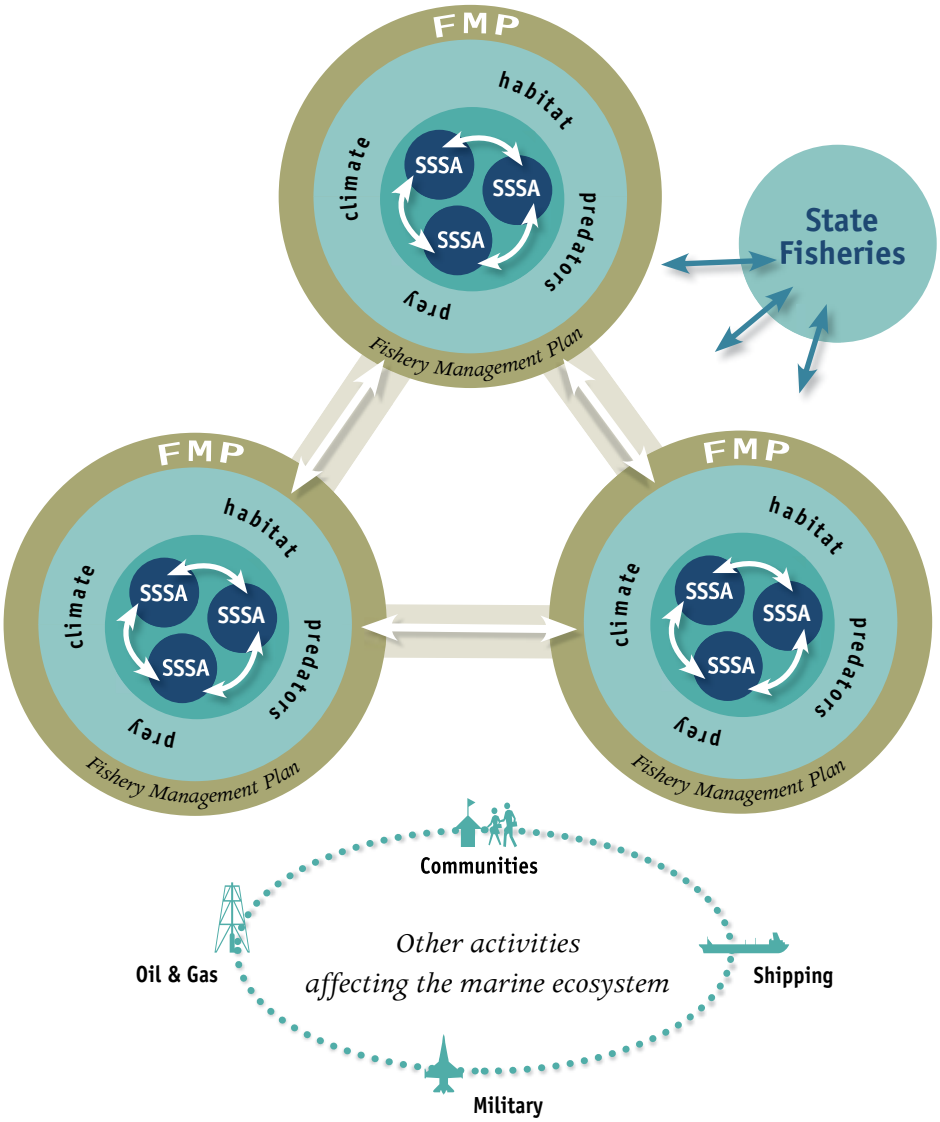
FEP Concept for Alaska*

- Policy and planning document.
- Encompasses all fisheries in the Aleutian Islands ecosystem.
- Implementation of specific changes to management continues to occur through existing fishery management plan processes.
- FEP is not a legal, binding document — it is an educational tool for the Council, to provide an ecosystem context for fishery management.

** Other regions may have a different concept and goals.*

Purposes

- Integrate information from the different Aleutian Islands fishery management plans (groundfish, crab, scallop, salmon).
- Identify indicators specific to the Aleutian Islands, to evaluate the status of the ecosystem over time.
- Develop and refine tools such as ecosystem models.
- Identify sources of uncertainty and research and data needs.
- Help the Council set management goals and understand cumulative effects.

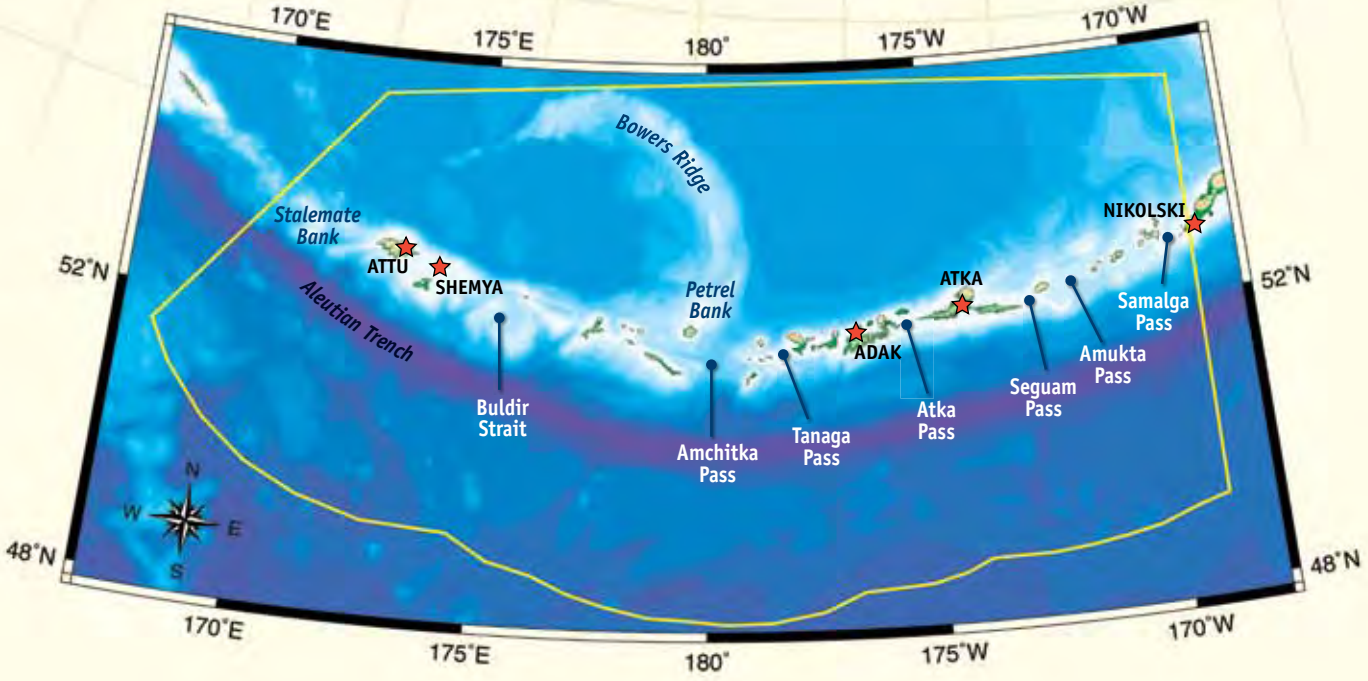


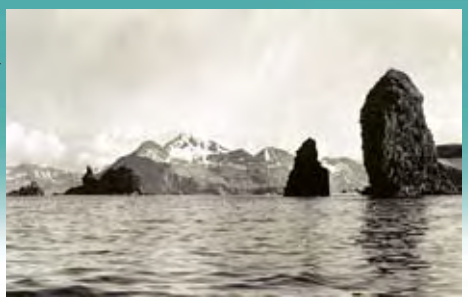
Scope of Fishery Ecosystem Plan

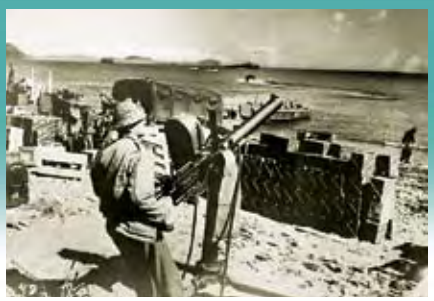
SSSA *Single species stock assessment*

Ecosystem Boundary

For the purposes of this Fishery Ecosystem Plan, the Aleutian Islands ecosystem is defined as the portion of the archipelago ranging from Samalga Pass (at 169°W) to the western boundary of the exclusive economic zone, at 170°E. Samalga Pass represents a known ecological boundary with the neighboring eastern Bering Sea and Gulf of Alaska ecosystems. This boundary is also approximately similar to an important management boundary for the Federal groundfish fishery.







left and center: NOAA Photo Library

University of Alaska Fairbanks, Rasmuson Library, UAF-1970-11-2

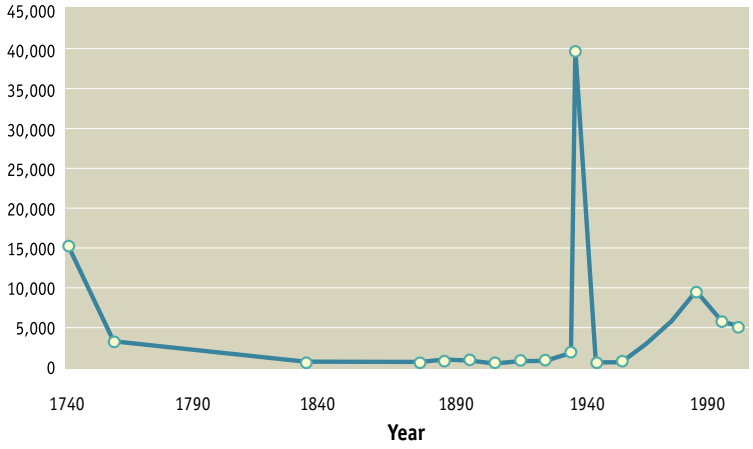
History of the AI Ecosystem

Human history of the Aleutians

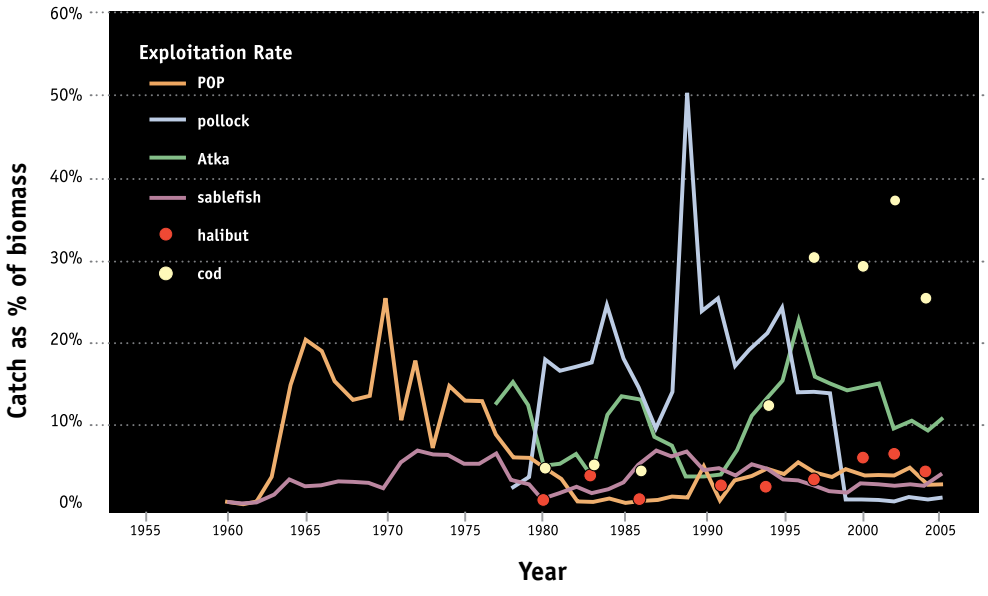
Aleuts have been present in the Aleutian archipelago for 10,000 years. At one time, there were over 100 villages in the islands, reflecting complex and flexible settlement patterns as people followed fish and marine mammal migrations. Russian contact in 1741 brought profound social change to the Aleuts, and considerable population decline due to epidemic, violent conflict, forced resettlement and impressed labor practices. Russian and American interests pursued the rich Aleutian marine resources over the next 150 years.

Population shifts occurred again with the advent of World War II, and the stationing of substantial US military forces in the islands. The US government forcibly evacuated the remaining eight Aleut villages in the archipelago, which after the war were resettled into half that many villages (Atka being the only one in the ecosystem). The military remained a presence through the decades of the Cold War, before scaling back almost entirely in the 1990s. The development of a global fishing industry began to affect Aleutian populations starting in the late 1960s.

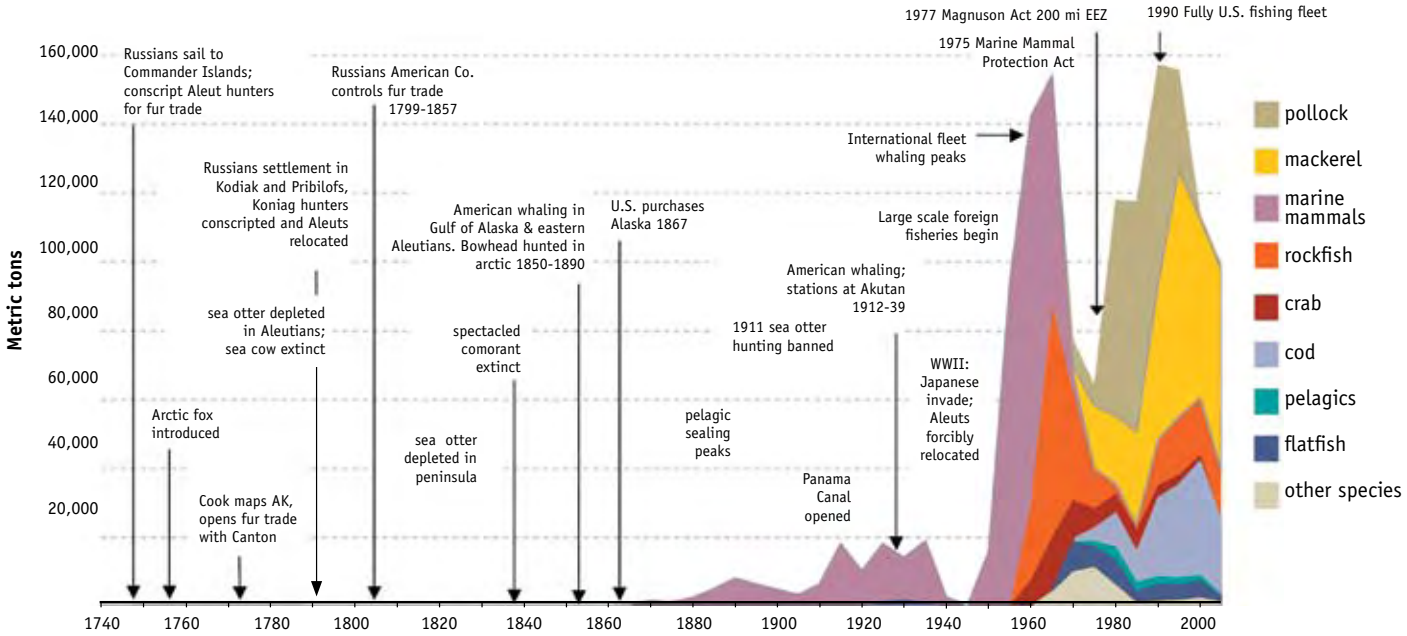
Estimated population trend of the Aleutian archipelago



Historic catch of major groundfish species



Commercial resource use, 1740-2005



(modified from Ortiz, I. 2007. Ecosystem Dynamics of the Aleutian Islands. Ph.D. Thesis. University of Washington, Seattle.)

Some early (pre-1950) biomass removals do not show up at this scale:

- An estimated 500,000 sea otters were removed from the Aleutian archipelago and the far western Gulf of Alaska between 1742 and 1792, which averages to approximately 250 tons of otters annually over this period.
- Salmon catch records show intermittent catches from 1911 through 1927 ranging from 24 to 1800 tons annually.

Historical relationships illustrate ecosystem connections

sea otters – kelp forests – marine communities

- Kelp forests support a diverse marine community, important for fish and nearshore birds.
- Sea otters prey on sea urchins, which eat kelp and prevent forests from growing.
- As kelp sites have been recolonized by recovering sea otter populations in the 20th century, kelp forests have increased.
- Recent sea otter declines will likely continue to have derivative impacts.

Dr. Randall Davis, Texas A&M University



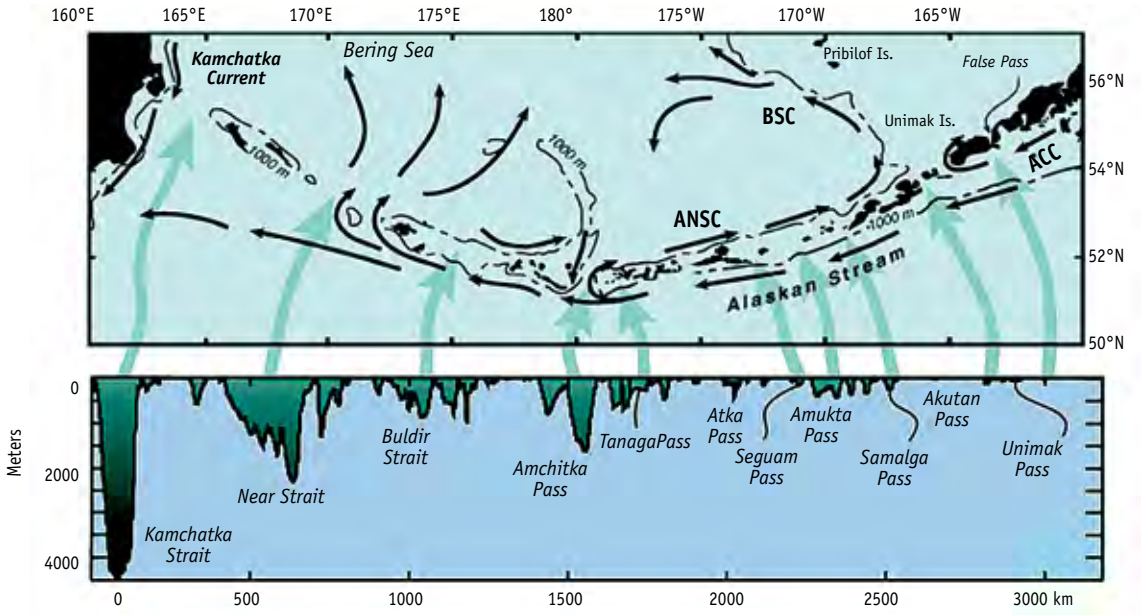
David Fraser

center: NOAA, Auke Bay Laboratories
right: David Fraser

Physical Relationships

The Aleutian archipelago consists of hundreds of small, volcanic islands, separated by oceanic passes that connect the waters of the North Pacific with the Bering Sea.

Circulation and depth of passes in the Aleutian archipelago



ANSC Aleutian North Slope Current
ACC Alaska Coastal Current
BSC Bering Sea Current

The mean circulation along the Aleutian Arc is shown together with geographic place names. The lower panel shows the depth of the passes in the Aleutian Arc.

Stabeno, P.J., Kachel, D.G., Kachel, N.B., Sullivan, M.E., 2005. Observations from moorings in the Aleutian Passes: temperature, salinity and transport. *Fisheries Oceanography* 14 (Suppl. 1), 39-54.

Benthic habitat

- Steep rocky slopes to the north and south surround a mostly submerged mountain range resting on the Aleutian ridge.
- Cold water coral and sponge communities are found on the steep slopes.
- Benthic communities provide important habitat for fish and invertebrates.

Oceanography

(Pelagic habitat)

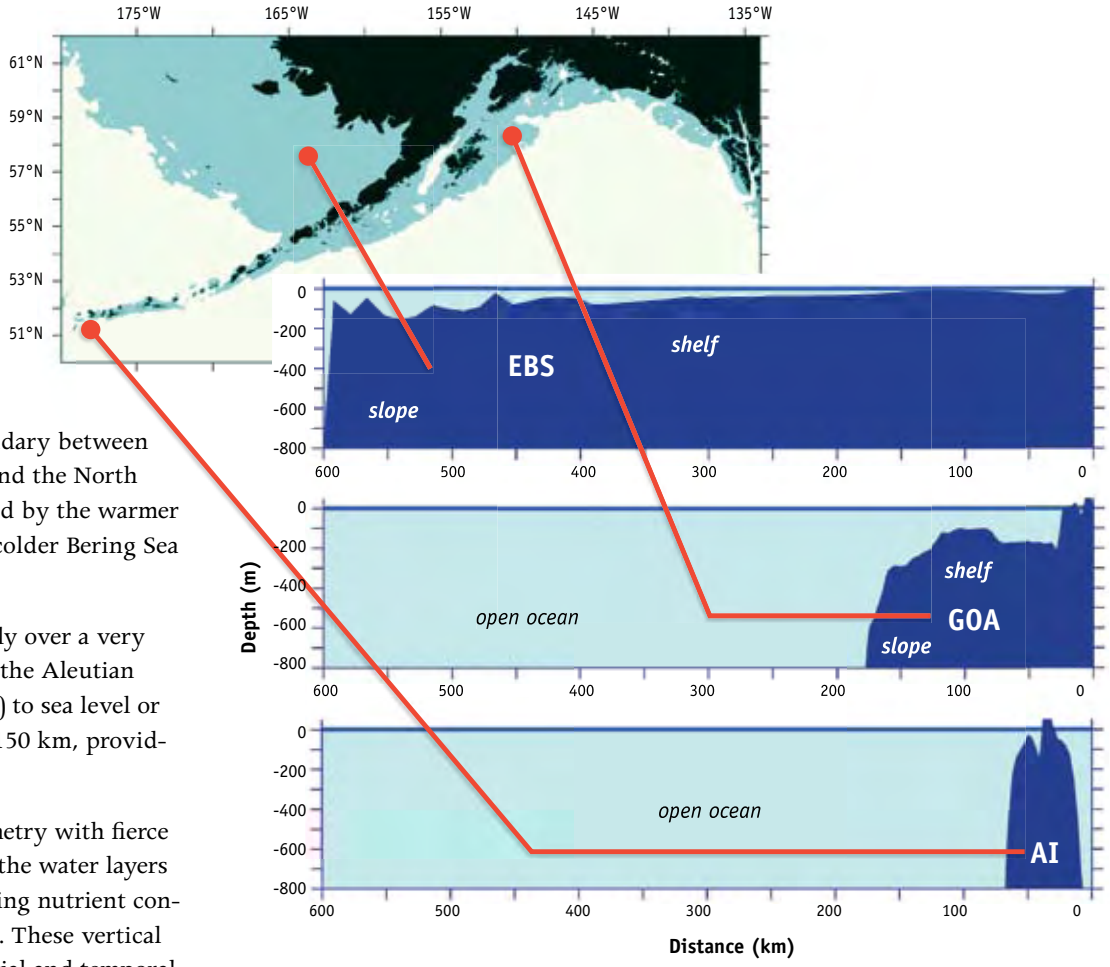
- Oceanic marine environment (rather than coastal), with primary influence from the Alaskan Stream.
- Fierce tidal currents within the passes allow salt, nutrients, and plankton from the deep to mix with surface water.
- Net northward transport of water from the Pacific is important to bring nutrients and biota to the Bering Sea.
- Currents may also present hazards for navigation and equipment.

Climate

(Terrestrial habitat)

- Wet and stormy maritime climate.
- Temperature variability and annual storm track determined by the strength and location of the Aleutian Low, a low pressure center.
- Contrary to the warming signal elsewhere, the Aleutian Islands have experienced a long-term cooling trend between 1956 and 2002.

Bathymetric profile of the Aleutian Islands



The narrow shelf of the Aleutian Islands fosters a strong oceanic influence on the ecosystem's biology. This bathymetric profile distinguishes the area from the neighboring shelf-dominated ecosystems of the eastern Bering Sea (EBS) and Gulf of Alaska (GOA), whose fisheries are also managed by the Council.

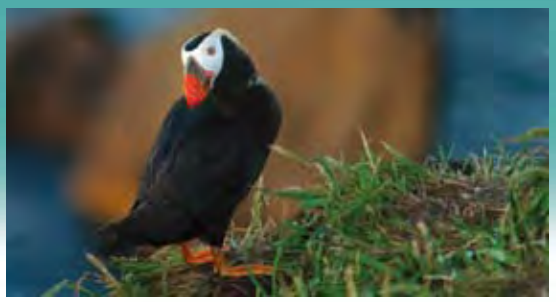
- The islands form a porous boundary between two ocean basins, the Bering Sea and the North Pacific. Thus, the islands are bathed by the warmer North Pacific on one side and the colder Bering Sea on the other.

- Bathymetry changes dramatically over a very short distance, from the depths of the Aleutian Trench (greater than 7,000 m deep) to sea level or above over a distance of less than 150 km, providing a diverse range of habitats.

- The interaction of steep bathymetry with fierce tidal currents results in mixing of the water layers (deeper and surface waters), affecting nutrient concentrations, salinity, and plankton. These vertical circulations can vary on small spatial and temporal scales, and can create areas of increased concentrations of prey for seabirds and other predators.

- The proximity of onshore, nearshore, and offshore systems allows for tight physical and biological connections between the open ocean, the shelf and slope environment, and nearshore and inshore.

NOAA, Auke Bay Laboratories



C. Loren Buck

center: Jeff Field right: Alison Banks

Biological Relationships

The complexity of the relationships in marine food webs can be overwhelming, so the FEP focuses on key species from economic, biological, and social perspectives to illustrate relationships within the ecosystem. Among these focus species, direct connections exist to all but two of the modeled predators and prey in the Aleutian Islands food web.

Focus species for the FEP

Protected status or social interest
(identified from 2000s data)

- marine mammals
- seabirds

High biomass
(identified from 2000s data)

- Atka mackerel
- pollock
- grenadiers
- myctophids
- squids

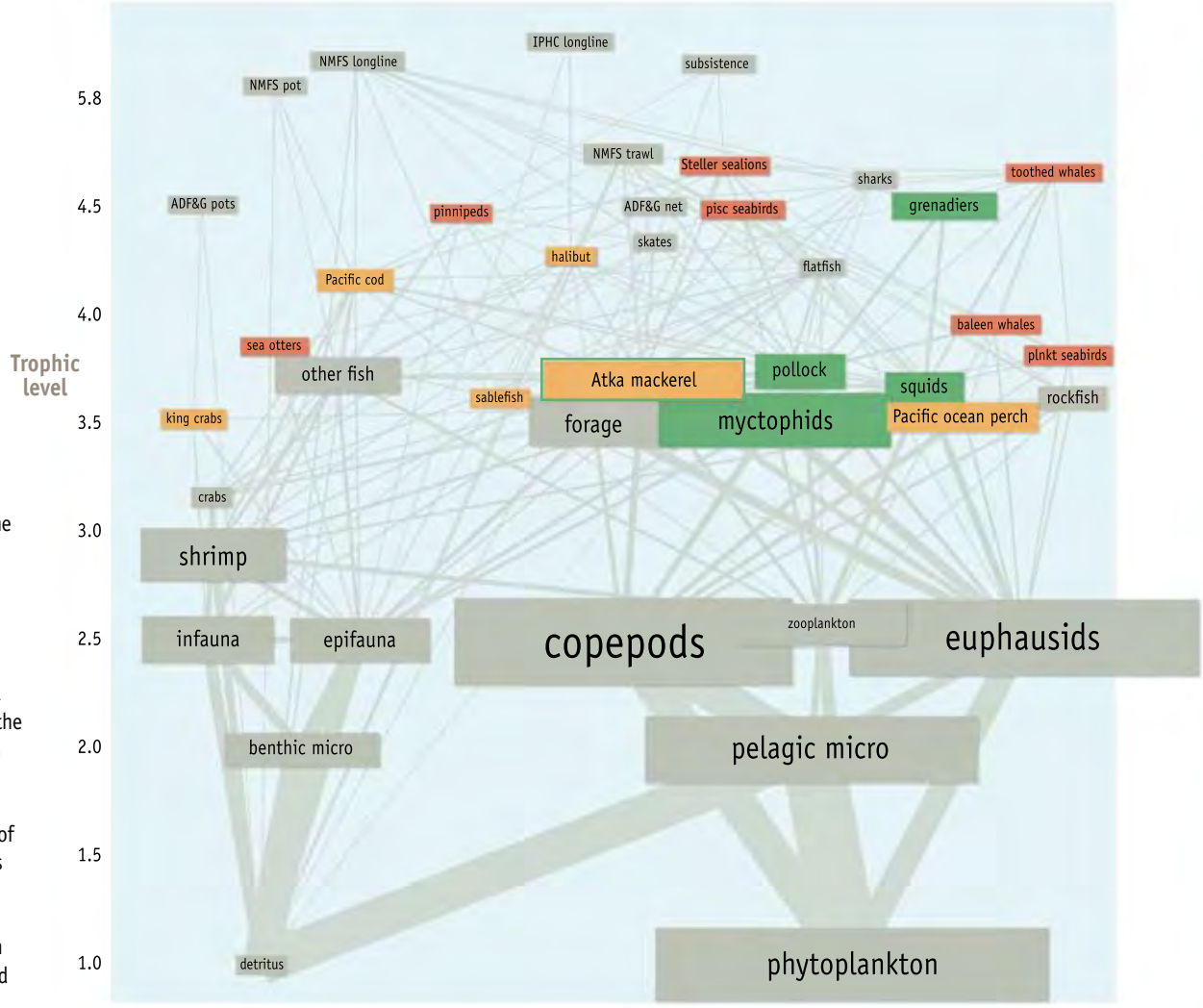
Commercial value

- king crab
- Pacific halibut
- Pacific cod
- Atka mackerel
- sablefish
- Pacific ocean perch

This is a simplified view of the full Aleutian Islands model food web that contains 134 predator/prey groups and 15 fisheries. Some groups have been amalgamated for this view. Box size is proportional to the estimated biomass in the ecosystem, the width of lines is proportional to estimated energy flow between boxes, and the vertical distribution of boxes in the figure represents the trophic level. Groups are positioned so that benthic energy pathways originate on the left side of the figure, and and pelagic pathways are on the right side.

Food web of the Aleutian Islands ecosystem

(based on early 1990s diet data)



KEY
pisc = piscivorous
plnkt = planktonic
micro = micro-zooplankton

NMFS - Federal groundfish fisheries
ADF&G - State-managed fisheries
IPHC - halibut fishery

Analyses possible with the food web

Shared prey analysis

Understanding which species (or fisheries) share a prey base can provide some information as to whether those species are likely to be competing for prey. Atka mackerel, Pacific ocean perch, and myctophids share a common zooplankton prey base along with other species. The physical processes maintaining the pelagic prey base, which dominates the ecosystem, maintain the focal species at their current levels of productivity, but these processes are poorly understood and there is only limited monitoring of the prey base.

Species sensitivity analysis

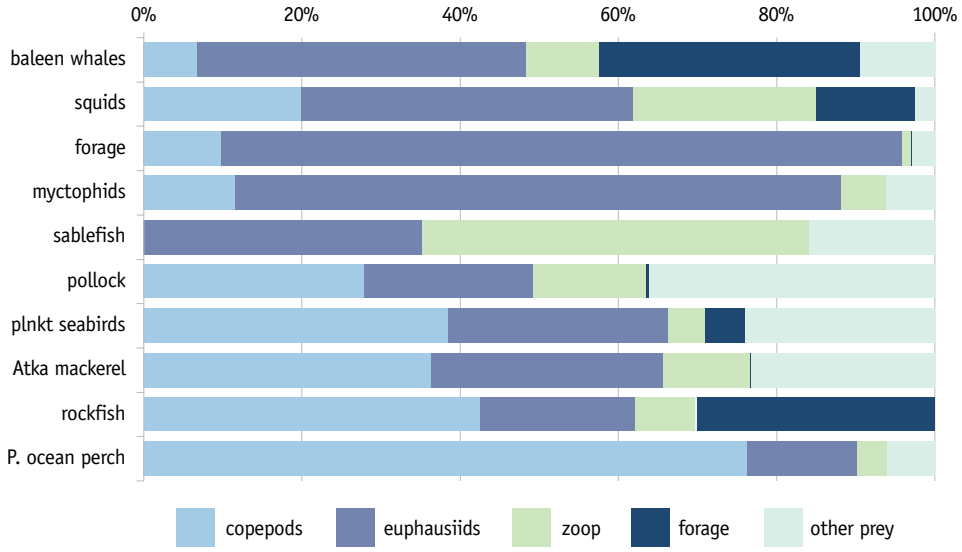
Simulating mortality changes within the food web model demonstrates how the impacts to one species might transmit to other species through food web relationships. For example, the Aleutian Islands ecosystem appears to be particularly sensitive to increased mortality of Atka mackerel, and relatively insensitive to increased mortality of Pacific ocean perch.

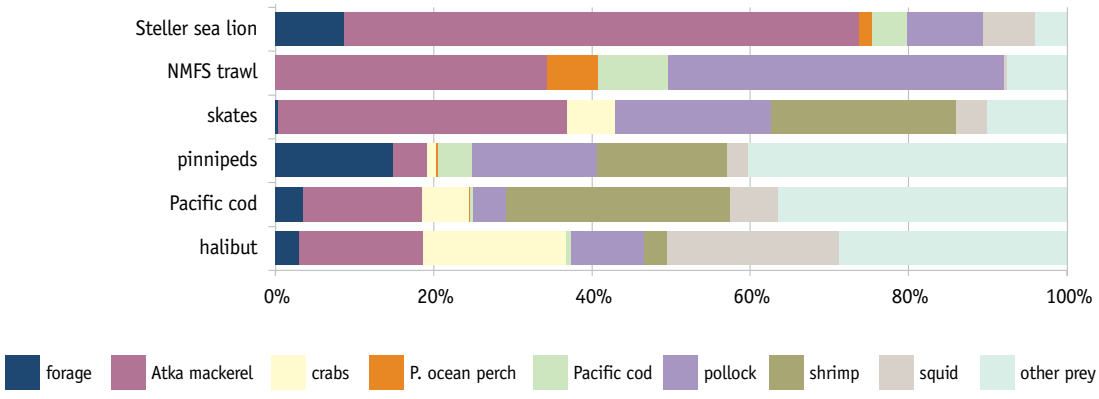
Role of species in the food web

Analyses of the relative interaction strengths between predators and prey can inform fishery managers when making decisions about appropriate harvest levels for species that interact.

Diet composition for species with a shared prey base

(groups with minimum 33% diet similarity)





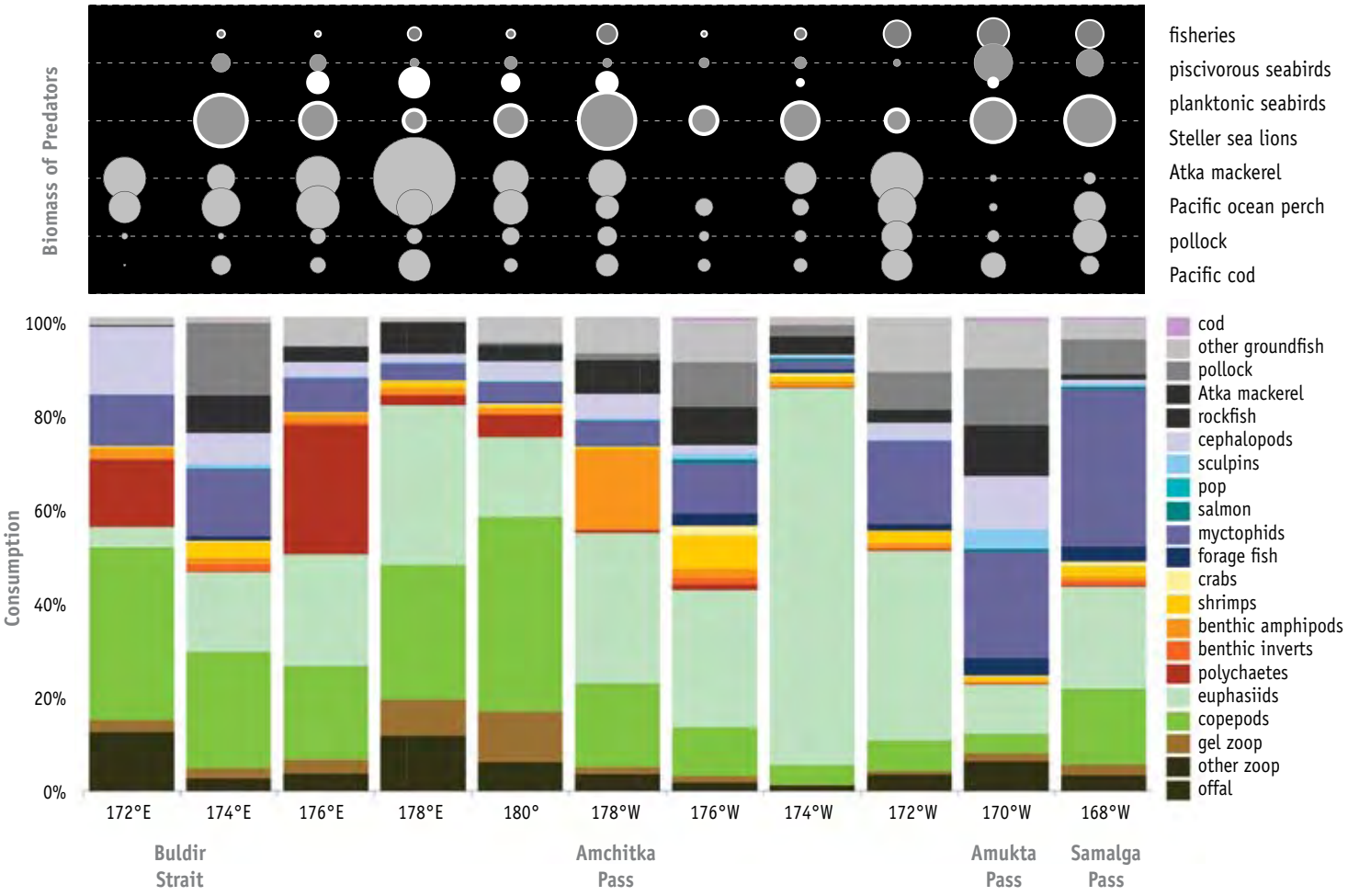
A. Grillo

Spatial variation within the Aleutian Islands

While the FEP focuses primarily on the Aleutian Islands ecosystem-wide spatial scale, local spatial patterns are apparent throughout the archipelago. Two main spatial patterns determine the structure of the Aleutian Islands food webs: the longitudinal gradient from east to west, and the vertical distribution of species on the shelf. Further attention to spatial variation has been identified as an area for further work.

Longitudinal variation in predator biomass and consumption

(data consolidated in 2 degree blocks)



Ian Jones

Seabirds in the Aleutian Islands

albatrosses ■ *shearwaters* ■ *murres* ■ *kittiwakes* ■ *auklets*
puffins ■ *fulmars* ■ *storm petrels* ■ *cormorants* ■ *gulls*

Species	Seasonality in AI	Est. population size
short-tailed albatross	summer and fall foragers	low hundreds
Laysan albatross	oceanic, year-round	thousands
short-tailed shearwater	oceanic in summer	hundreds of thousands
mottled petrels	oceanic in summer	thousands
marine waterfowl	winter	tens of thousands
through migrant birds	spring and fall	thousands

Marine mammals in the Aleutian Islands

whales ■ *seals* ■ *sea lions* ■ *sea otters*

Species	Seasonality in AI	Est. population size	Listed under ESA?
Steller sea lions	year-round	thousands	endangered
northern fur seals	spring/fall migration	hundreds of thousands	no
harbor seals	year-round	tens of thousands	no
sea otters	nearshore, year-round	thousands	threatened
whales and porpoises			
	resident populations, Alaska-wide range	e.g., some killer whales, blue whales	
	migrant populations that summer in Alaska	e.g., gray, humpback whales	

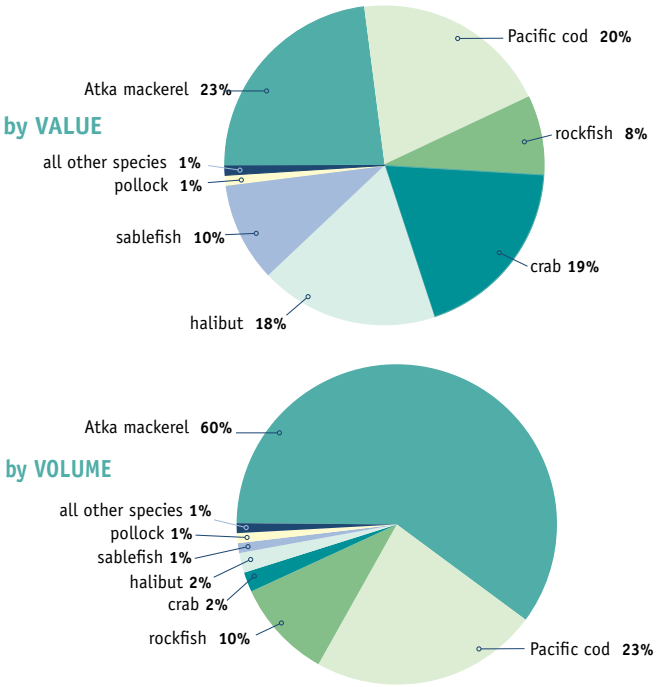
Lowell Fritz, NMML, NOAA

Nicole Kimball, NPFMC

center: Steve Barbeaux, AFSC, NOAA
right: Diana Evans, NPFMC

Socioeconomic Relationships

Fishery resources harvested in the FEP area in 2005



Number of vessels (V) harvesting and plants* (P) processing Aleutian Islands fish in 2005

	V	P
Atka mackerel	12	12
crab	9	6
flatfish	30	27
halibut	97	16
other groundfish	18	16
Pacific cod	45	27
pollock	22	23
rockfish	47	29
sablefish	41	23

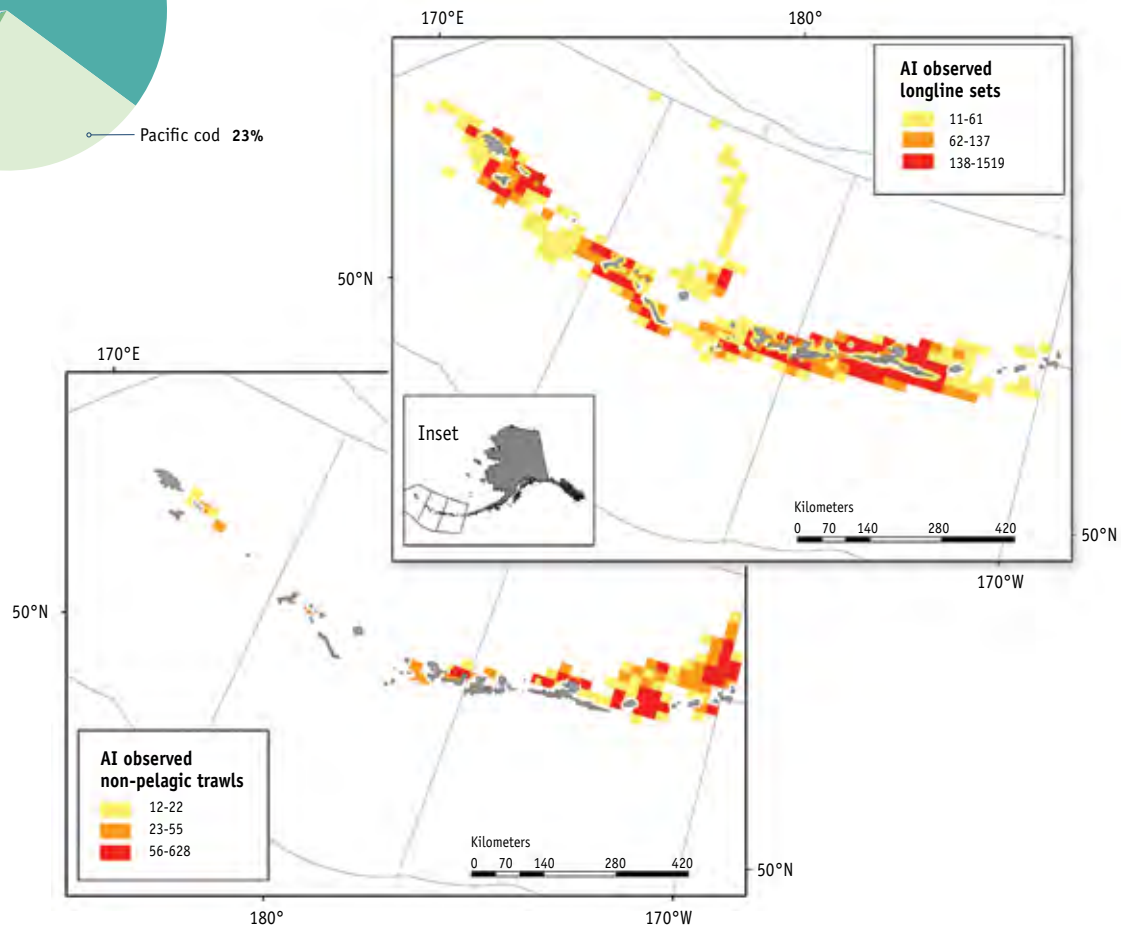
*inshore or offshore, in Aleutians and elsewhere.

Commercial fisheries

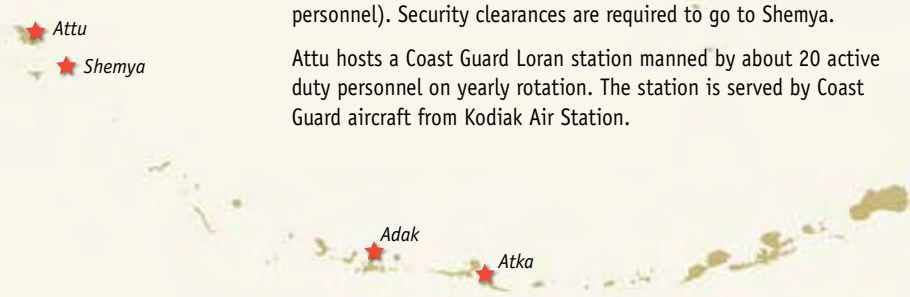
In 2005, the Aleutian Islands ecosystem produced 216 million pounds of fish, with an estimated ex-vessel value of 60 million dollars. Fish harvested in the ecosystem was processed throughout the Aleutians, western Alaska, and the Gulf of Alaska. 32 offshore processors (including catcher-processors, motherships, and other offshore sector participants) account for 89% of the total landings from the ecosystem, comprising 56% of ex-vessel value. The majority of offshore processing volume is devoted to Atka mackerel.

Spatial distribution of the Aleutian Island groundfish fisheries by gear group

Location of 95 percent of observed groundfish fishing effort in the Aleutian Islands ecosystem in 1990-2006. The maps illustrate the number of observed non-pelagic trawl tows or longline sets within a 400 km² area. Approximately 87% of trawl tows and 70% of longline sets are observed.



Communities in the FEP area



Shemya and Attu

Shemya is the site of Eareckson Air Station, a US Air Force base, which is currently occupied by about 300 people (mostly contractor personnel). Security clearances are required to go to Shemya.

Attu hosts a Coast Guard Loran station manned by about 20 active duty personnel on yearly rotation. The station is served by Coast Guard aircraft from Kodiak Air Station.

Steve Barbeaux, AFSC, NOAA

Adak

Population: 167 in 2005

Fishery participation

- 49 vessels delivered groundfish, 32 halibut, 12 crab
- Adak Fisheries provides processing and cold storage capacity

Nicole Kimball, NPFMC

Atka

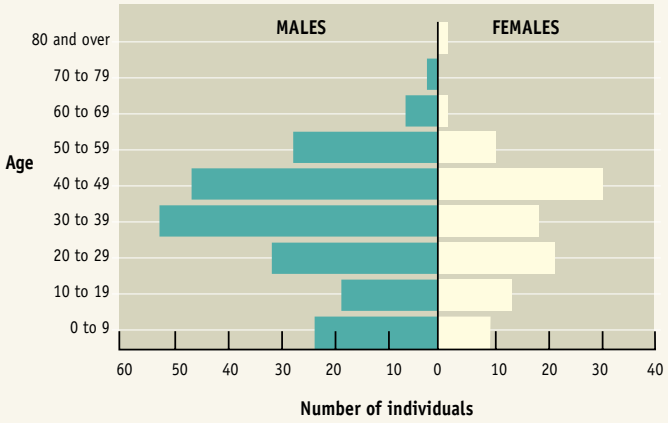
Population: 90 in 2005

Fishery participation

- 45 vessels delivered fish
- Part of Aleutian Pribilof Island Community Development Assoc.
- Small onshore processor for halibut

2000 Adak population*

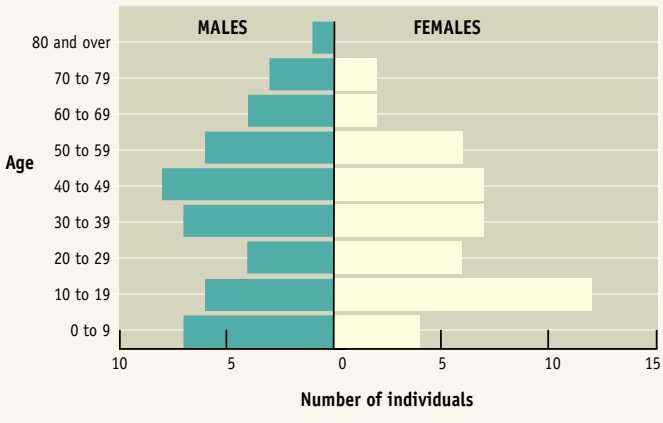
(by age and gender)



Adak's population by age and gender structure resembles the "labor shape," dominated by a bulge of working-age males, as is commonly observed for industrial towns, such as fish processing centers. The population structure of Adak is likely to change over time as the Aleut Corporation continues to actively seek to move Native families into the area.

2000 Atka population*

(by age and gender)



Atka's population by age and gender structure is most similar to the pyramidical "family shape," displaying a relatively even distribution between genders and a general decline by age. This structure is commonly found in Native villages, and often shows a reduction of 20-29 year olds out-migrating for educational opportunities.

*Data source: U.S. Census

Bill Wilson, NPPMC

Missile Defense Agency

Other human activities in the ecosystem

Tourism

Caribou hunting and bird watching represent the most significant tourism activity at the current time.

Oil and gas development

Most oil and gas development in Alaska and elsewhere affects the Aleutian Islands ecosystem through indirect effects of shipping traffic, as discussed below.

Military

The Environmental Protection Agency has been performing Superfund clean-up and restoration of Adak, and the sea-based X-band radar is scheduled to become a permanent installation there in February, 2008.

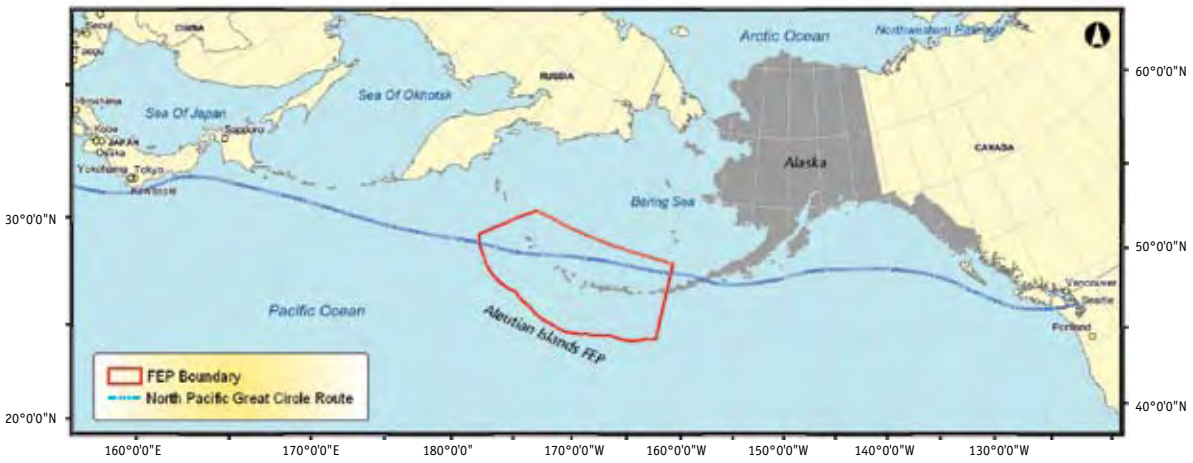
Shipping

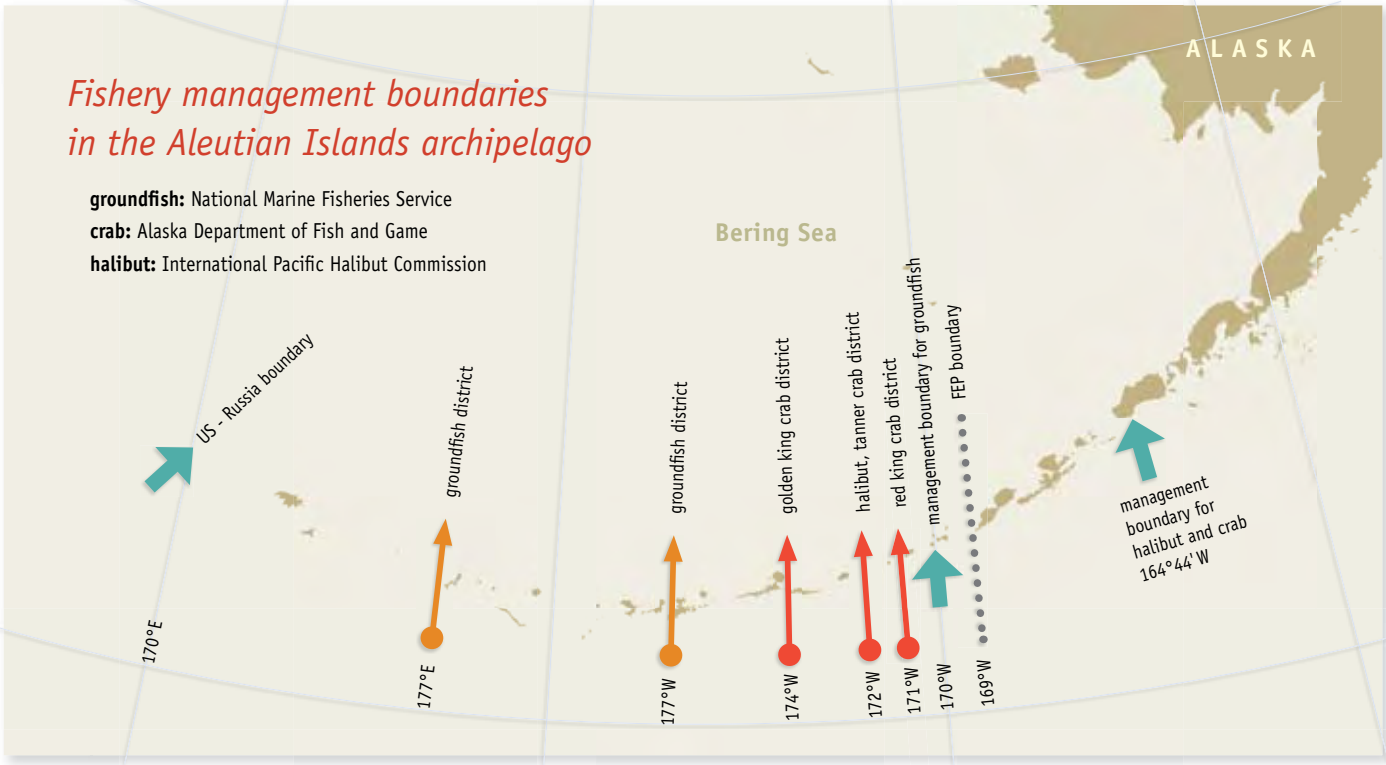
The Great Circle shipping route passes through the Near Islands, in the FEP area, with approximately 1600 container ships per year, and approximately 30-40 tankers. The 2004 *Selendang Ayu* shipping disaster off the coast of Unalaska (although just outside the fishery ecosystem area) brought into sharp relief the vulnerability of the ecosystem to impacts from shipping. The State of Alaska and the US Coast Guard are developing a risk assessment for the Aleutian Islands. Climate change could increase shipping activities in the area significantly, with the possible opening of an ice-free Northwest Passage.

Research

Research accounts for much of the non-fishery activity in the Aleutian Islands area, especially in the summer months.

North Pacific Great Circle Route and the FEP Boundary





Management Relationships

Fishery management relationships in the Aleutian Islands are complex because each of the responsible entities identifies a different geographical boundary for the Aleutian Islands management area, and recognizes different reporting districts within the area.

Fisheries

The following agencies are responsible for fishery management in the Aleutian Islands:

North Pacific Fishery Management Council / National Marine Fisheries Service

- Direct management of Federal groundfish fisheries
- Oversight of crab and scallop fisheries
- Allocative management of halibut fishery

Alaska Board of Fisheries / Alaska Department of Fish and Game

- Direct management of salmon, State waters groundfish fisheries, recreational and subsistence fisheries;
- Delegated management of crab and scallop fisheries

International Pacific Halibut Commission

- Biological management of halibut fishery

Other entities

There are many agencies (Federal, State, and local) with jurisdiction over activities (other than fisheries) affecting the marine ecosystem.

Federal

- National Marine Fisheries Service
- US Fish and Wildlife Service
- Bureau of Land Management
- Minerals Management Service
- Department of Defense/Alaskan Command/Pacific Command
- US Army Corps of Engineers
- US Coast Guard
- Department of Energy

State

- Department of Fish and Game
- Department of Natural Resources
- Department of Environmental Conservation

Local

- City of Adak
- City of Atka

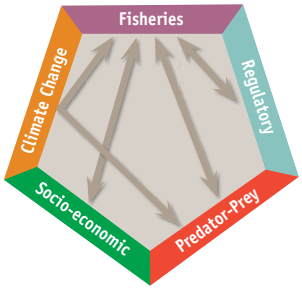
Nicole Kimball, NPFMC

center: Steve Barbeaux, AFSC, NOAA
right: Diana Evans, NPFMC

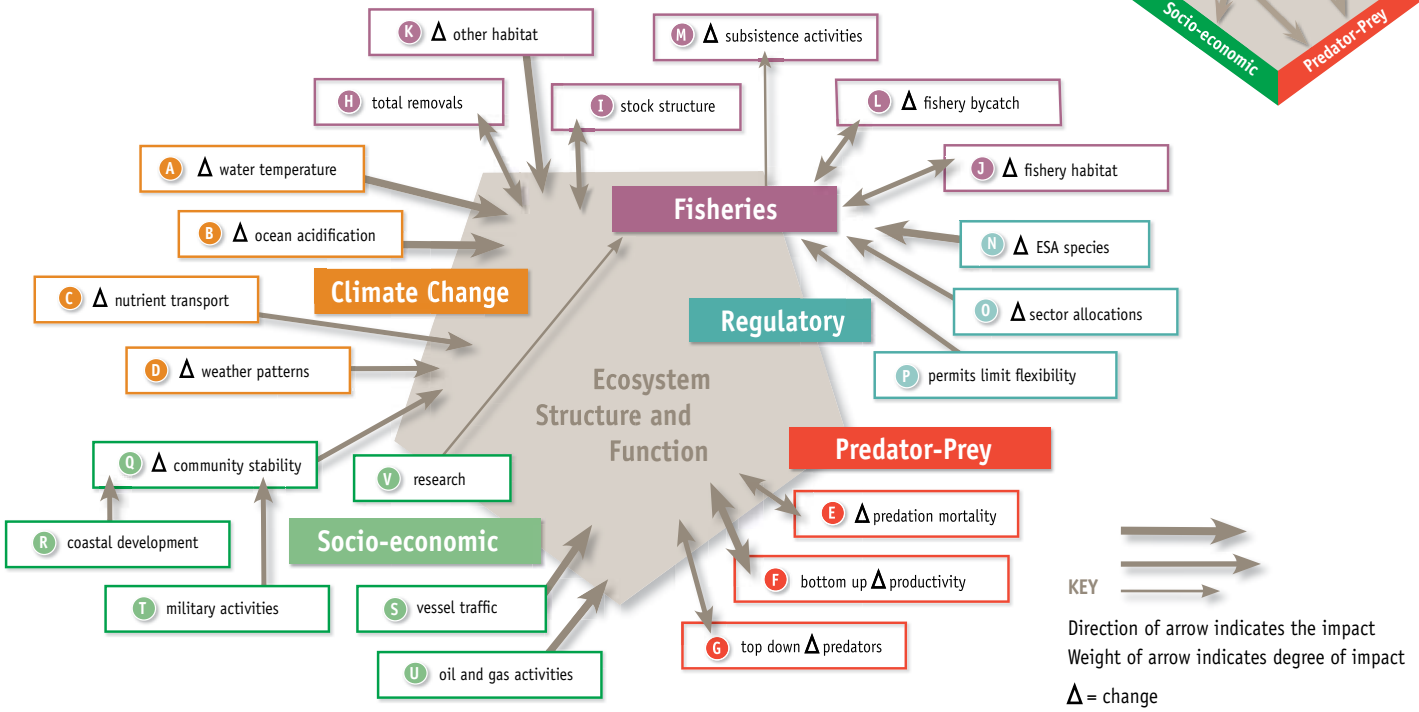
Risk Assessment

Non-Quantitative Risk Assessment

This first iteration of the Fishery Ecosystem Plan relies on a non-quantitative risk assessment to provide general guidance to the Council on priority areas and issues for management attention and further research and analysis. This process still follows the classic risk assessment framework, but relies on expert opinion and the building of consensus. A quantitative risk assessment may be a part of future iterations of the Fishery Ecosystem Plan.



Map of Aleutian Islands ecosystem interactions



Steps of the Risk Assessment

- What are the key interactions in the Aleutian Islands ecosystem?
- How is risk associated with these interactions currently addressed by managers?
- What else might be done to address any risk? Is further action warranted?
- What indicators should be used to monitor these interactions?
- What are the priority data gaps and research needs for the Aleutian Islands ecosystem?

Interactions

Climate and Physical

- A Changes in water temperature may impact ecosystem processes
- B Increased acidification of the ocean may impact ecosystem processes
- C Changes in nutrient transport through the passes and changes in the predominant current patterns that drive primary production impact ecosystem processes
- D Changing weather patterns impact ecosystem processes

Predator-prey

- E Fishing mortality and predation mortality both impact managed species
- F Bottom up change in ecosystem productivity impacts predators and fisheries
- G Top down changes in predation and fishing impact ecosystem structure and function

Fishing Effects

- H Total removals from the ecosystem due to fishing impact ecosystem productivity
- I Differences between spatial stock structure and the spatial scale of fishery management may impact managed species
- J Impact of one fishery on another through fishing impacts on habitat
- K Impact of a fishery on other biota through fishing impacts on habitat
- L Impact of bycatch on fisheries
- M Commercial fishery may impact subsistence uses

Regulatory

- N Changes in the population status of ESA-listed species impact fisheries through specific regulatory constraints
- O Sector allocations can impact the ecosystem and communities
- P Fishery participation permit systems (such as limited entry and harvest quotas) impact the flexibility of fishers to react to changing ecosystem conditions

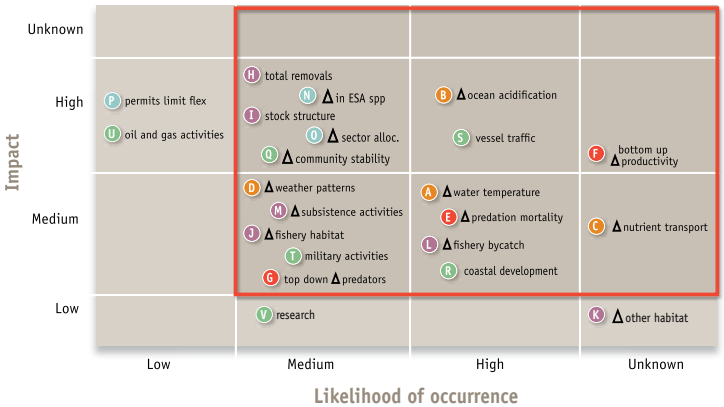
Other Socio-economic Activity

- Q Changes in fishery activities impact the sustainability of AI communities
- R Coastal infrastructure and development impact the ecosystem and communities
- S Vessel traffic, and risk of vessel grounding and spillage, may impact ecosystem productivity
- T Changes in the level of military activity in the area may impact communities
- U Oil and gas development may impact ecosystem productivity
- V Research activity may impact fisheries

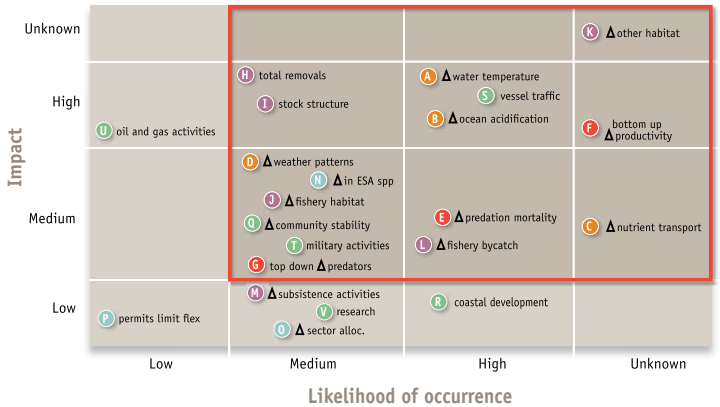
Likelihood of occurrence and impact assessment of the interactions

(based on the professional judgment of the Aleutian Islands Ecosystem Team)

Economic



Ecological



Red boxes in upper right hand quadrant highlights those interactions with a medium to high or unknown likelihood of occurrence or impact.



National Marine Fisheries Service

center: NOAA – Auke Bay Laboratories
right: NOAA Fisheries

Priorities and Considerations for the Council

Through the risk assessment, the FEP prioritizes the potential risk associated with the key ecosystem interactions. Some interactions are within the Council's ability to influence (e.g., fishery removals, bycatch), and others are not (e.g., climate change). For each of the 22 interactions, the FEP identifies how that risk is currently addressed by the Council, and what other actions the Council might consider to mitigate risk.

Examples of implications for management

Climate and Physical **B**

Risk assessment priority: High

Increased acidification of the ocean may impact ecosystem processes

What is the Council currently doing to address risk?

- This interaction is not within the Council's control.
- NOAA is researching acidification and the likely impacts in Alaskan waters.

What else might the Council do?

- Interact with NOAA program to encourage further investigation into the threshold effects of acidification on different parts of the ecosystem.
- Develop adaptive management techniques to mitigate adverse impacts.

Fishing Effects **H**

Risk assessment priority: High

Total removals from the ecosystem due to fishing impact ecosystem productivity

What is the Council currently doing to address risk?

- Accounting for total removals is currently a fishery managment priority.
- For groundfish, total removals are well managed for the joint Bering Sea/Aleutian Islands management area, but not always at the scale of the Aleutian Islands ecosystem.

What else might the Council do?

- Continue to evaluate the degree to which the Aleutian Islands ecosystem is distinct from the eastern Bering Sea, particularly with regard to genetic flow and trophic linkages.
- Consider the need to develop an overall limit on removals and/or fishery timing specific to the Aleutian Islands ecosystem.

Socio-economic Activity **Q**

Risk assessment priority: High

Changes in fishery activities impact the sustainability of AI communities

What is the Council currently doing to address risk?

- Priority for the Council, embodied in the National Standards; only partially within the Council's control.
- The Council considers community impacts of all management actions, and conducts a transparent management process that is open to the public.

What else might the Council do?

- Develop a community outreach strategy to encourage and facilitate participation by community members in Council process, particularly those from remote communities with complex and expensive access to meeting locations.

Overarching considerations

Recognize the Aleutian Islands ecosystem as a distinct entity

Fishery managers should consider the Aleutian Islands area described in this FEP as an ecosystem with unique characteristics. The Aleutians are frequently considered conjointly with the eastern Bering Sea, but are subject to different processes and properties. An ecosystem-wide monitoring plan is needed to improve understanding of the area.

Improve the process to account for ecosystem considerations in fishery management

No group in the Council process is currently assigned with the primary task of integrating ecosystem information and providing ecosystem-level advice. Ecosystem information is often qualitative or interpretative, and it is up to the Council, as policy-maker, to determine how to balance risks associated with unquantifiable 'ecosystem considerations'.

Dialogue with non-fishery agencies

It is important for the Council to interact with other agencies about activities affecting the ecosystem. The Council's participation in the Alaska Marine Ecosystem Forum is an important step in this regard. The Council may also choose to engage individually with other agencies on particular issues.

Kimberly Rand

Kimberly Rand

Alaska Marine Ecosystem Forum*

Biannual meetings bring together 11 Federal and 4 State agencies to address issues of shared responsibilities related to the marine ecosystems off Alaska's coast.

Purpose:

- Promote dialogue and information exchange.
- Improve agency coordination by sharing priorities and data.
- Allow agencies to understand the ecosystem impact of other activities.
- Provide opportunities for problem solving and joint work.

** established by Memorandum of Understanding in 2006.*

Bill Wilson, NPFMC

Next steps for the FEP

Immediate uses

Educational tool for fishery managers

- Synthesizes available ecosystem information on the Aleutian Islands from many sources.
- FEP information will feed into the management process at all levels (stock assessment authors and fishery analysts, Council's scientific advisory groups, Council).

Improve management analyses

- Resource for staff analyzing proposed management measures that affect the Aleutian Islands ecosystem.
- In particular, analyses should distinguish the Aleutian Islands and Bering Sea ecosystems when discussing impacts.

Indicator framework

- FEP analysis of key interactions creates framework for monitoring the Aleutian Islands ecosystem.
- Currently available indicators are identified, as well as desirable future indicators.

Ways to improve the FEP document

- The FEP is to be a living document, updated annually by the FEP team with new information, re-evaluated periodically (e.g., every 3-5 years) for ecosystem trends and key interactions.
- Some tasks for the FEP team: expand expertise on team, improve description and analyses, gather information on available indicators, seek to close data gaps.

Some directions for further work

- Quantify risk assessment, expand into comprehensive ecosystem assessment.
- Consider spatial patterns within the Aleutian Island ecosystem, also connections to surrounding ecosystems (both east and west).
- Develop Council policy on a "healthy ecosystem," or desirable and undesirable ecosystem states, in order to provide guidance as to how to account for qualitative ecosystem considerations.

Ian Jones

Photo opposite page: Carol Ladd, PMEL, NOAA

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For more information on the Fishery Ecosystem Plan, or to get involved in other Council activities, visit our website or contact the Council office.

www.fakr.noaa.gov/NPFMC

Produced by NPFMC under NOAA Award #NA17NMF4410033

J.A. Estes

Science, Service, Stewardship

Agenda Item D.1.b
Supplemental North Pacific PowerPoint
November 2010

Integrating ecosystem approaches within the Alaska fishery management process

Kerim Aydin, Sarah Gaichas, Anne B. Hollowed and Patricia A. Livingston

NOAA FISHERIES SERVICE

NOAA FISHERIES SERVICE

Outline

1. ***Overview of EBM objectives in US fisheries off Alaska***
2. ***Examples of current EBM management measures***
3. ***Reporting and tracking EBM***
   a. Status reports and indicators
   b. Modeling efforts to predict future impacts

4. ***Future research and management direction***

NOAA FISHERIES SERVICE

North Pacific Fishery Management Council
Ecosystem Approach to Management

Prevent Overfishing

Promote Sustainable Fisheries and Communities

Preserve Food Web

Manage Incidental Catch and Reduce Bycatch and Waste

Avoid Impacts to Seabirds and Marine Mammals:

Reduce and Avoid Impacts to Habitat

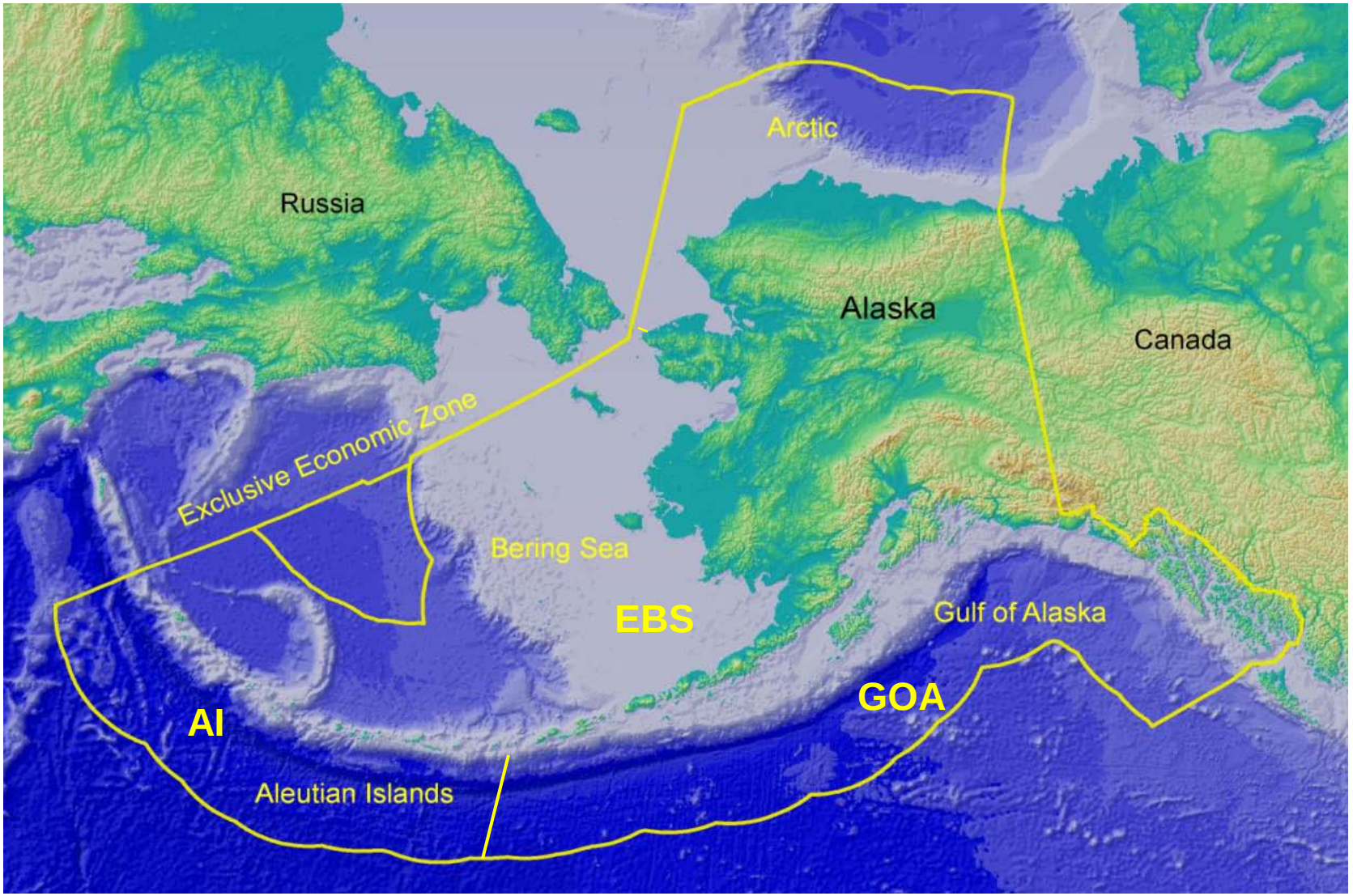
Promote Equitable and Efficient Use of Fishery Resources

Increase Alaska Native Consultation

Improve Data Quality, Monitoring and Enforcement

www.fakr.noaa.gov/tasking/management_FMP.pdf

Fishery Management Areas



NOAA FISHERIES SERVICE

Multi-species, Multi-fishery, Multi-Sector, Multi-Objective Management

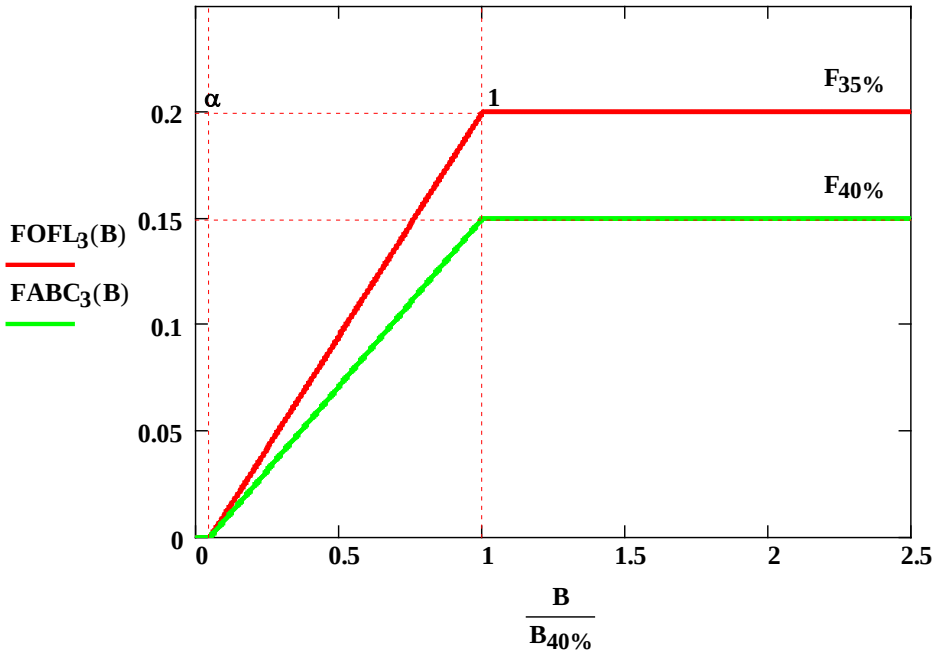
NOAA FISHERIES SERVICE

Current Groundfish Stock Status Relative to MSY and B(MSY)

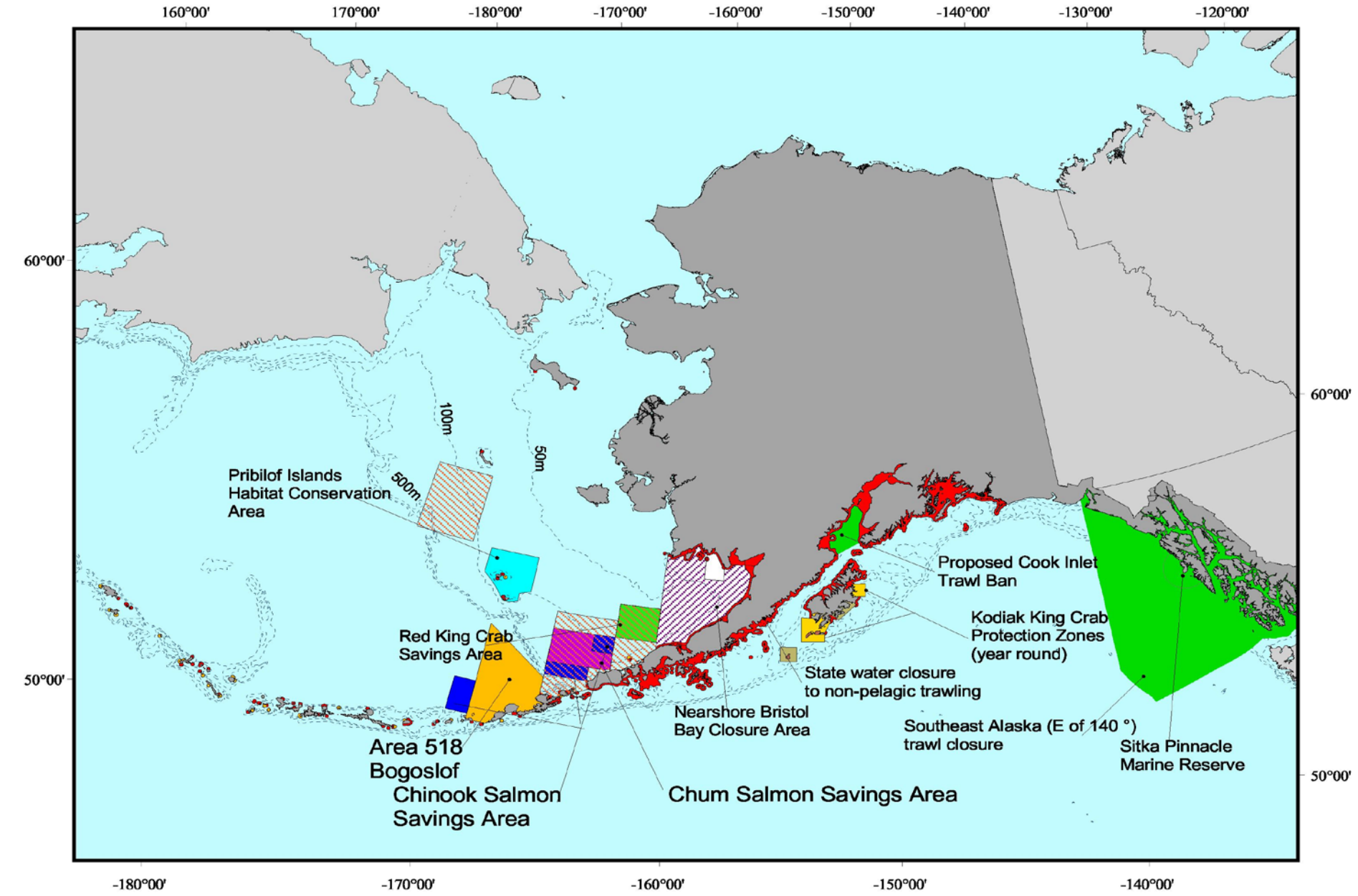
Control Rule

Multispecies management

- Individual TAC's should not be exceeded
- Basis is to use "lowest common denominator" species
- Fishery "openings" allowed based on anticipated bycatch rates
- Fishery "closures" occur based on real-time observer catch estimates and fish-ticket data.
- OY caps – 2 Million t BSAI



Catch ≤ TAC ≤ ABC < OFL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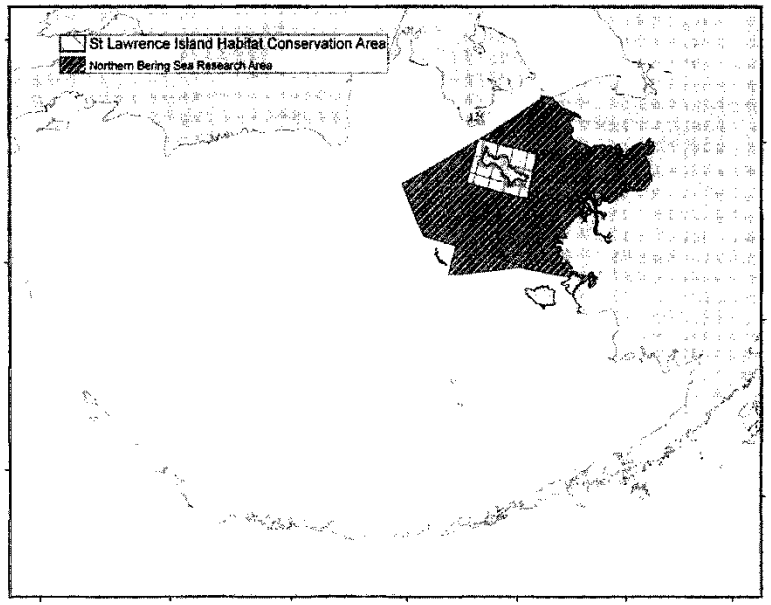
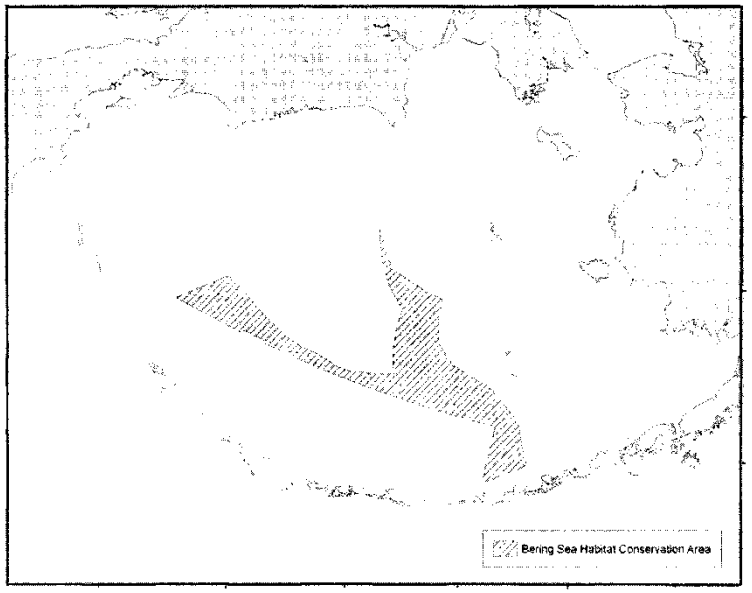
50°00'
100m
50m
500m
Pribilof Islands
Habitat Conservation
Area
Red King Crab
Savings Area
Area 518
Bogoslof
Chinook Salmon
Savings Area
Chum Salmon Savings Area
Nearshore Bristol
Bay Closure Area
State water closure
to non-pelagic trawling
Proposed Cook Inlet
Trawl Ban
Kodiak King Crab
Protection Zones
(year round)
Southeast Alaska (E of 140 °)
trawl closure
Sitka Pinnacle
Marine Reserve

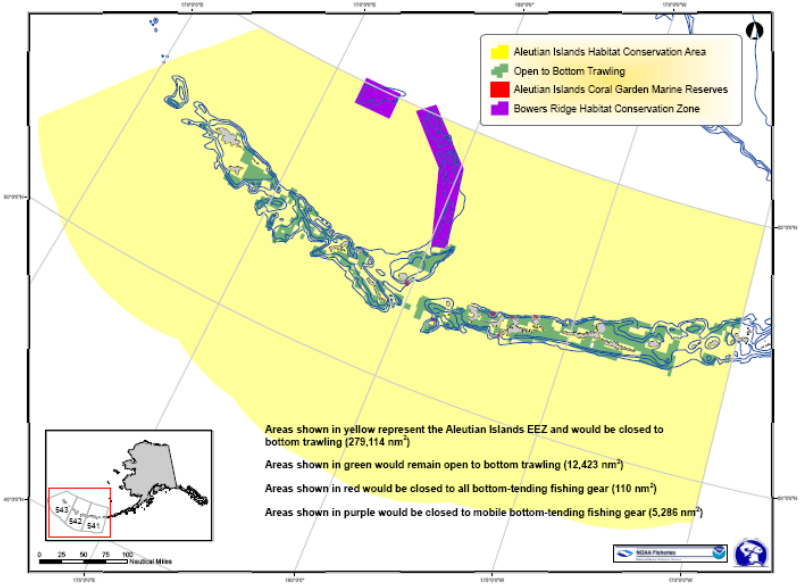


Bering Sea Research Area 2008



Bering Sea Habitat Conservation Area

Aleutian Islands Habitat Conservation Area 2007



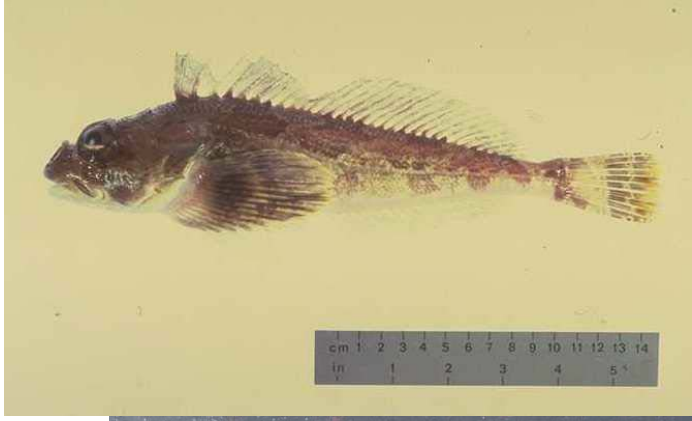
Prohibited species Management

- Prohibited species caps:P. halibut, BSAI crab, P. salmon (especially Chinook and Chum), P. herring
- Gear/Area closures
  - Bristol Bay Red King Crab Conservation Area
- Chinook salmon:
  - Hard cap + incentive programs
- Chum salmon: TBD

Pacific herring. Photo: JJ Vollenweider, NOAA Fisheries

Non-target Management

- Vulnerability assessment
  - Susceptibility: bycatch rate.
  - Productivity: vital rates
- Divide groups into complexes with similar life history characteristics: sculpin, shark, skates, octopus, squid
- Species identification of catch
- Accelerated life history studies



Forage Fish

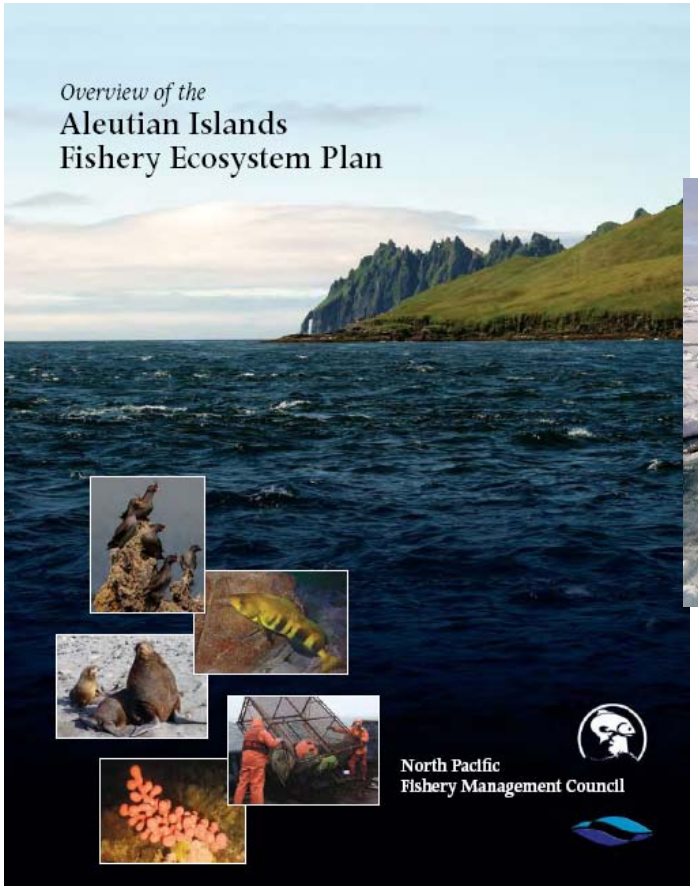
- Catch deterrents
  - Maximum Retention Allowance 2% of landed catch
- No directed fishery

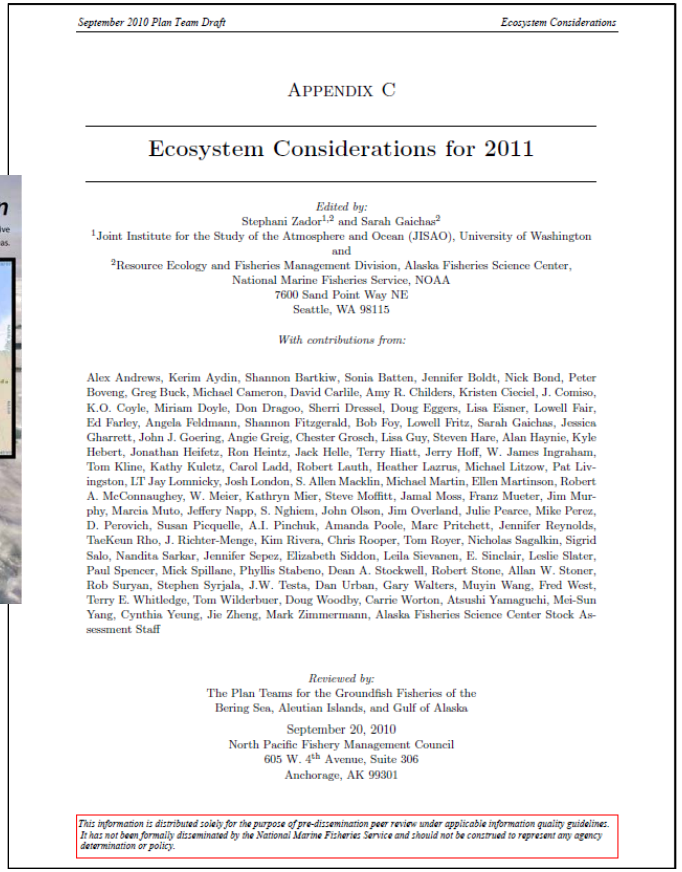
Collection of forage fish

Reduce Discard

- Full retention provisions on catcher vessels targeting cod and pollock
- Groundfish Retention Standards
- Bycatch avoidance research

More Ecosystem-based fishery management Activities





September 2010 Plan Team Draft *Ecosystem Considerations*

APPENDIX C

Ecosystem Considerations for 2011

Edited by:

Stephani Zador[1,2] and Sarah Gaichas[2]

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Reviewed by:

The Plan Teams for the Groundfish Fisheries of the
Bering Sea, Aleutian Islands, and Gulf of Alaska

September 20, 2010
North Pacific Fishery Management Council
605 W. 4th Avenue, Suite 306
Anchorage, AK 99301

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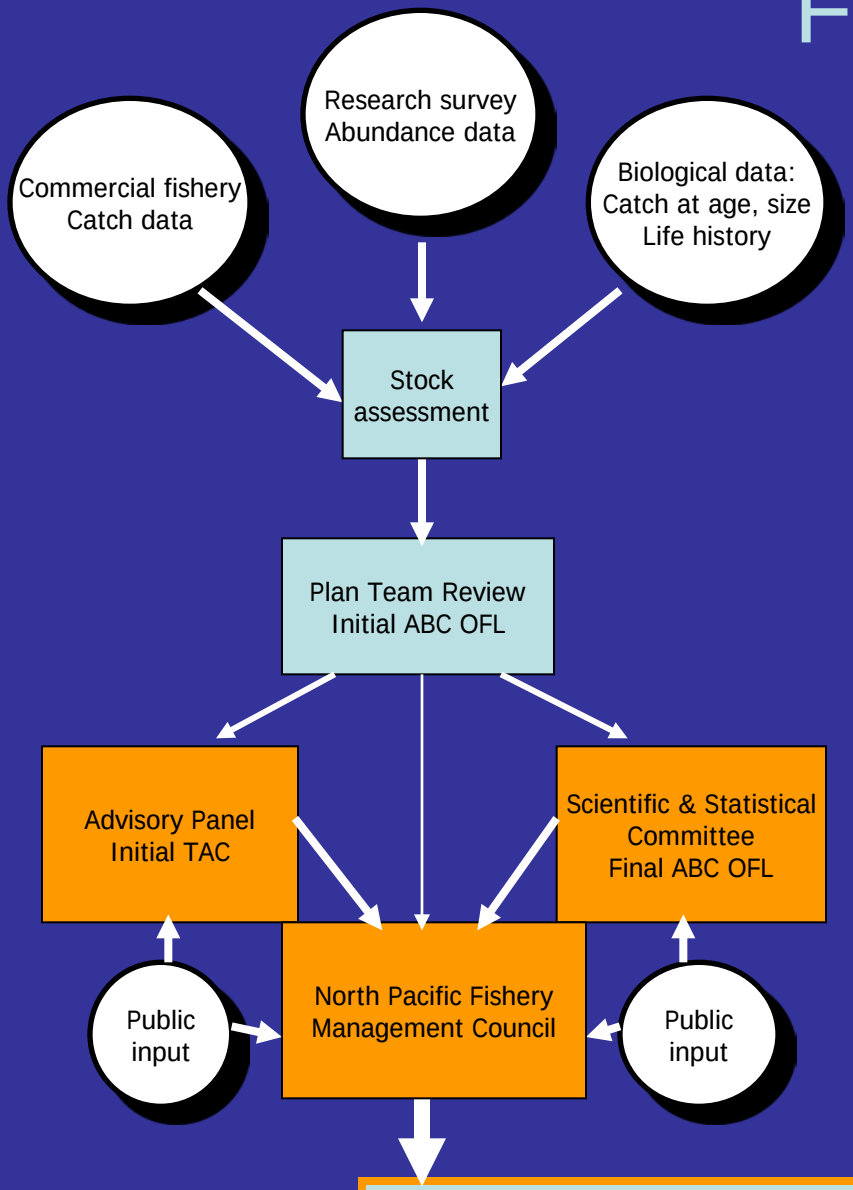
http://www.fakr.noaa.gov/npfmc/current_issues/ecosystem/AIFEP12_07.pdf

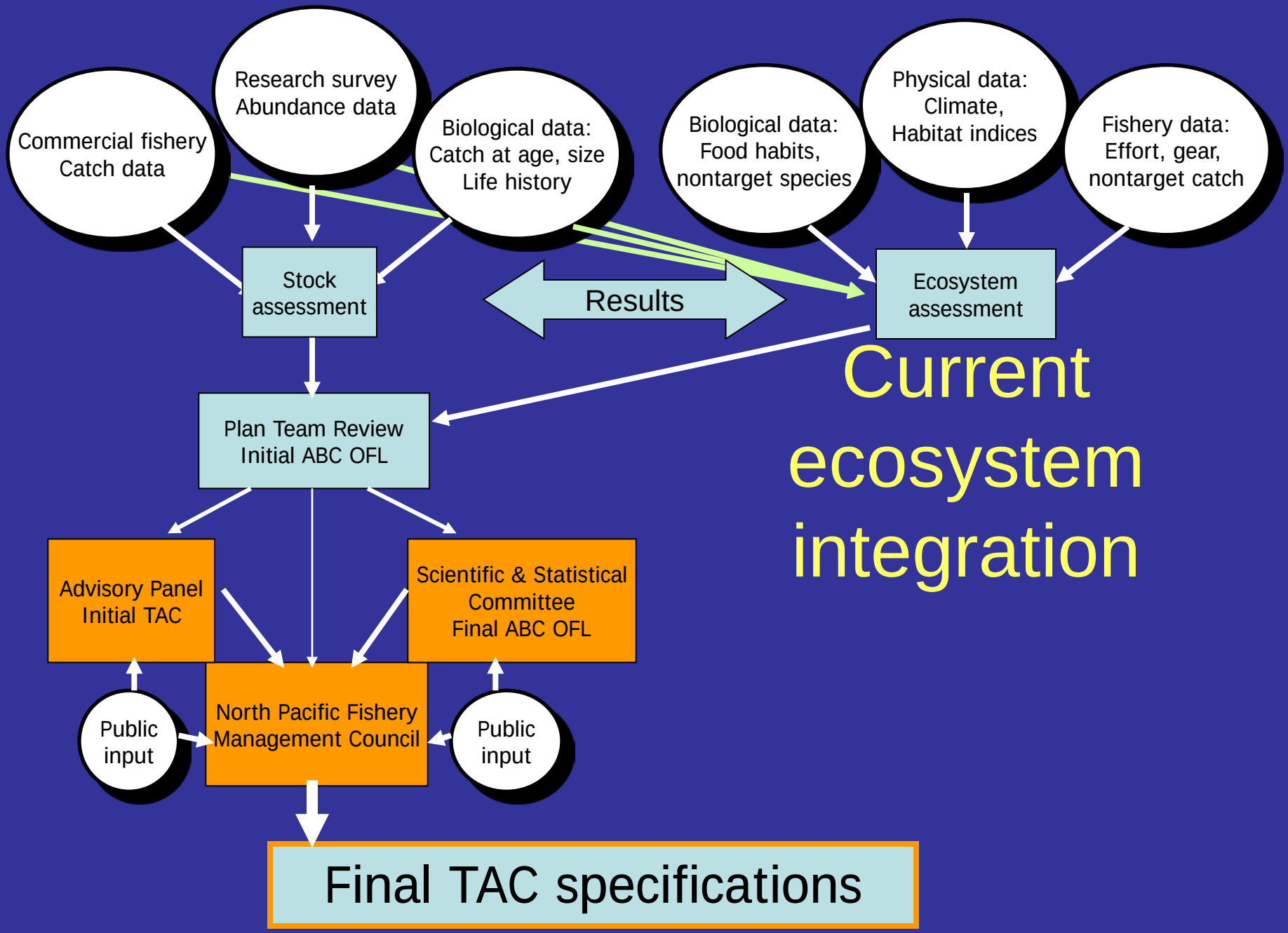
http://www.fakr.noaa.gov/npfmc/current_issues/Arctic/arctic.htm

http://www.afsc.noaa.gov/refm/docs/2009/ecosystem.pdf

Fishery management: annual process



Ecosystem Assessment ????



Current ecosystem integration

Including ecosystem considerations in each stock assessment

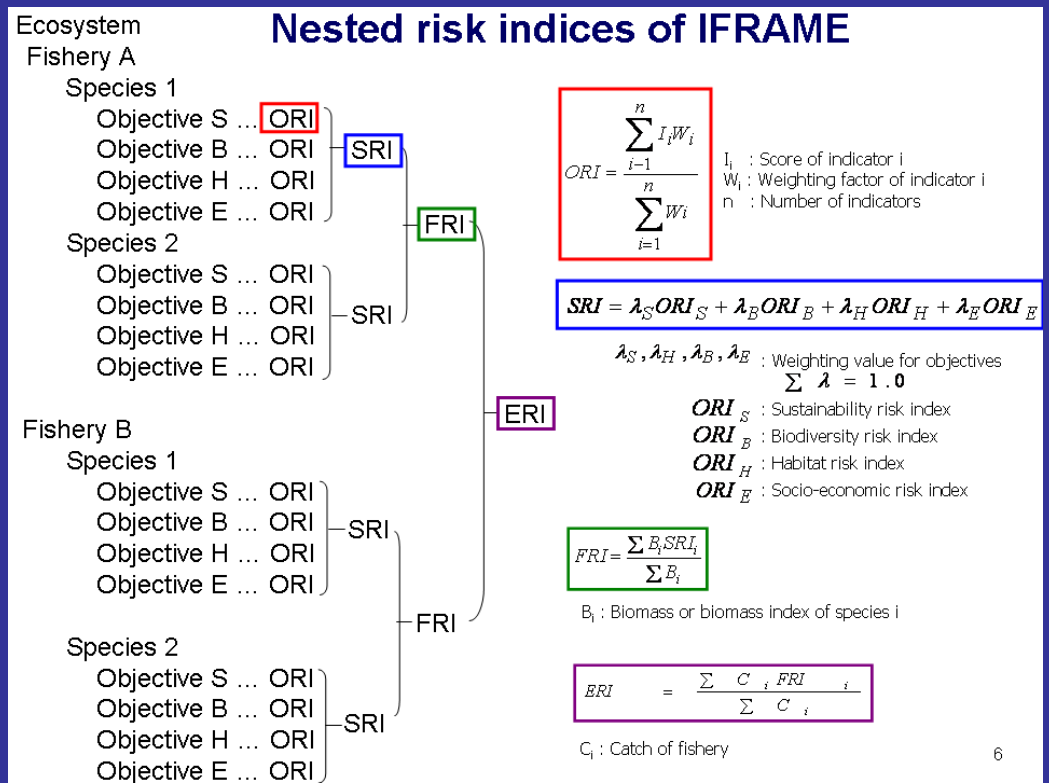
(Lowe et al. 2007)

Table 15.14. Ecosystem effects

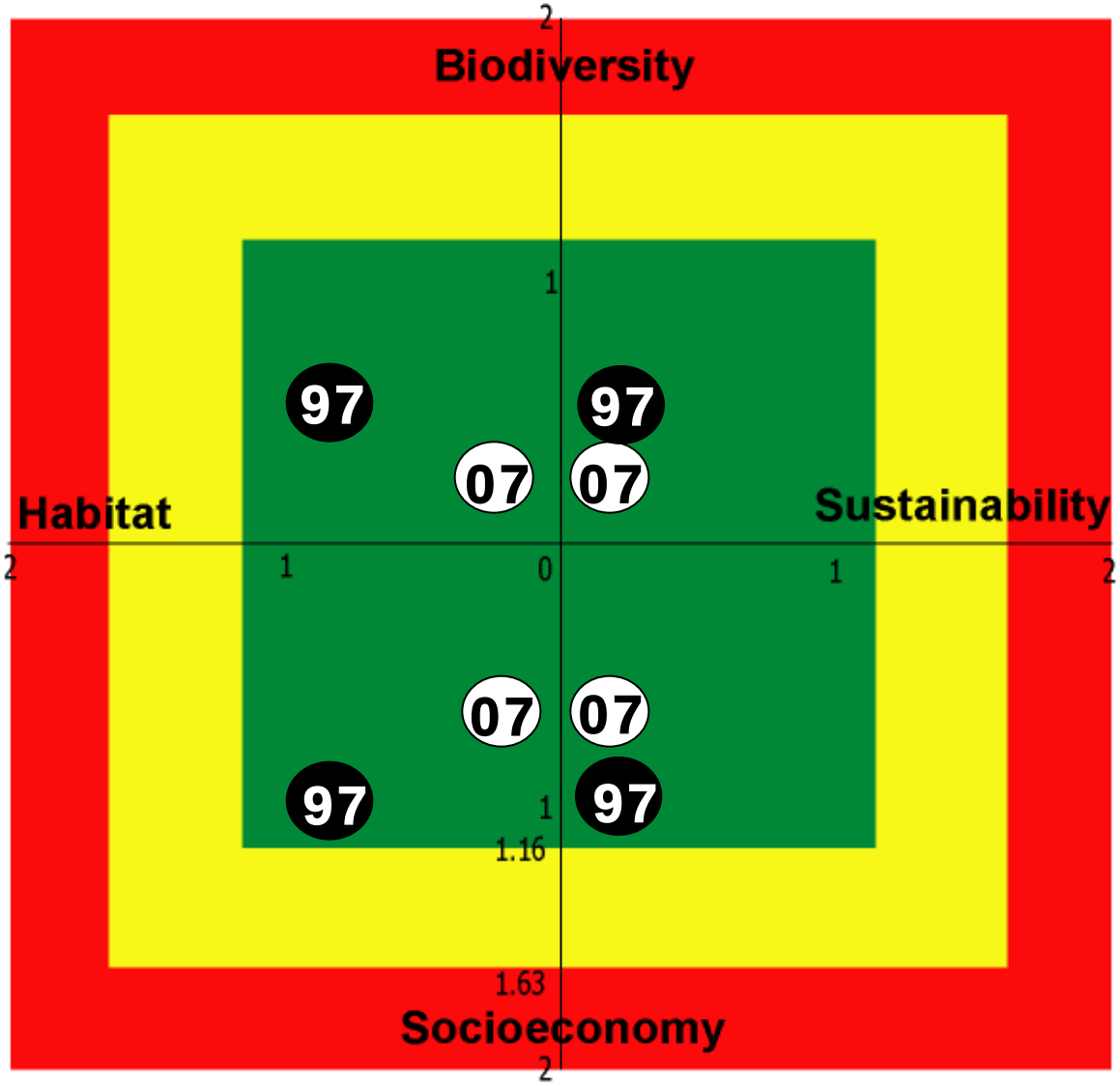
Ecosystem effects on Atka mackerel			
Indicator	Observation	Interpretation	Evaluation
Prey availability or abundance trends			
Zooplankton	Stomach contents, ichthyoplankton surveys	None	Unknown
Predator population trends			
Marine mammals	Fur seals declining, Steller sea lions increasing slightly	Possibly lower mortality on Atka mackerel	No concern
Birds	Stable, some increasing some decreasing	Affects young-of-year mortality	No concern
Fish (Pacific cod, arrowtooth flounder)	Pacific cod and arrowtooth abundance trends are stable	None	No concern
Changes in habitat quality			
Temperature regime	2006 AI summer bottom temperature slightly below average (excl. 2000)	Could possibly affect fish distribution	Unknown
***The Atka mackerel* effects on ecosystem**			
Indicator	Observation	Interpretation	Evaluation
Fishery contribution to bycatch			
Prohibited species	Stable, heavily monitored	Likely to be a minor contribution to mortality	Unknown
Forage (including herring, Atka mackerel, cod, and pollock)	Stable, heavily monitored	Bycatch levels small relative to forage biomass	Unknown
HAPC biota (seapens/whips, corals, sponges, anemones)	Low bycatch levels of seapens/whips, sponge and coral catches are variable	Unknown	Possible concern for sponges and corals
Marine mammals and birds	Very minor direct-take	Likely to be very minor contribution to mortality	No concern
Sensitive non-target species	Skate catches are variable and have averaged 87 t from 2003-2005, which is about 14% of the AI skate catch over this time period	Data limited, need species-specific catch information	Possible concern
Other non-target species	Sculpin catch is variable, large increase in bycatch in 2004	Unknown	Unknown
Fishery concentration in space and time	Steller sea lion protection measures spread out Atka mackerel catches in time and space. Fishery has expanded and concentrates in other areas outside of critical habitat	Mixed potential impact (fur seals vs Steller sea lions). Areas outside of critical habitat may be experiencing higher exploitation rates.	Possible concern
Fishery effects on amount of large size target fish	Depends on highly variable year-class strength	Natural fluctuation	Probably no concern
Fishery contribution to discards and offal production	Offal production—unknown The Atka mackerel fishery contributes an average of 690 (58%), and 6,100 t of the total AI trawl non-target and Atka mackerel discards, respectively.	The Atka mackerel fishery is one of the few trawl fisheries operating in the AI. Numbers and rates should be interpreted in this context.	Unknown
Fishery effects on age-at-maturity and fecundity	Unknown	Unknown	Unknown

Goal: formal ecosystem thresholds

- Example: 2 million MT cap on total removals from the Bering Sea.



Preliminary risk assessment diagram for the EBS trawl fishery



$FRI_{97} = 0.665$, $FRI_{07} = 0.291$

December 2009 NPFMC SSC Requests

Make information more directly useful in management decisions

- Investigate lack of strong year classes in light of Ecosystem Considerations indices and data.
- Promote more interaction between stock assessment and ecosystem authors to enable testing of ecosystem ideas in stock assessments

Synthesize disparate fragments of data into interpretive reports to

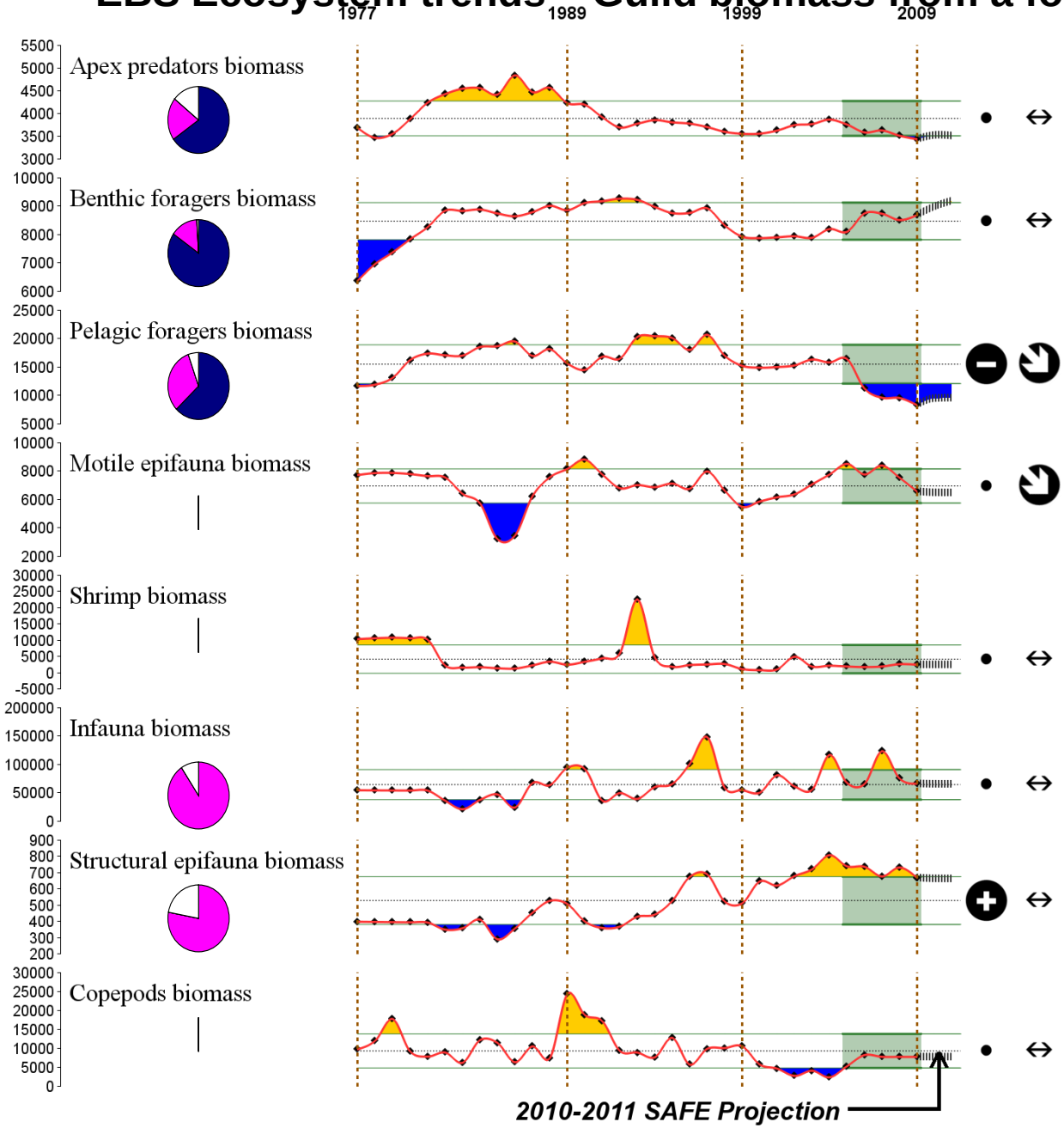
- Help assessment authors put their assessments in an ecosystem context
- Increase future research effort by highlighting importance to fisheries management

ECOSYSTEM ASSESSMENT/REPORT CARD

- Regional (AI, EBS, GOA specific)
- This year EBS only
- Big picture status, trends, interactions between
  - Physical/climate
  - Habitat
  - Primary producers and zooplankton
  - Benthic community
  - Fish community
  - Non-fishery apex predators (marine mammals, birds)
  - Fisheries and human communities
- Synthetic statement of ecosystem status

The Ecosystem Assessment – visualizing trends:

EBS Ecosystem trends – Guild biomass from a food web (E2E) model



Time series data source

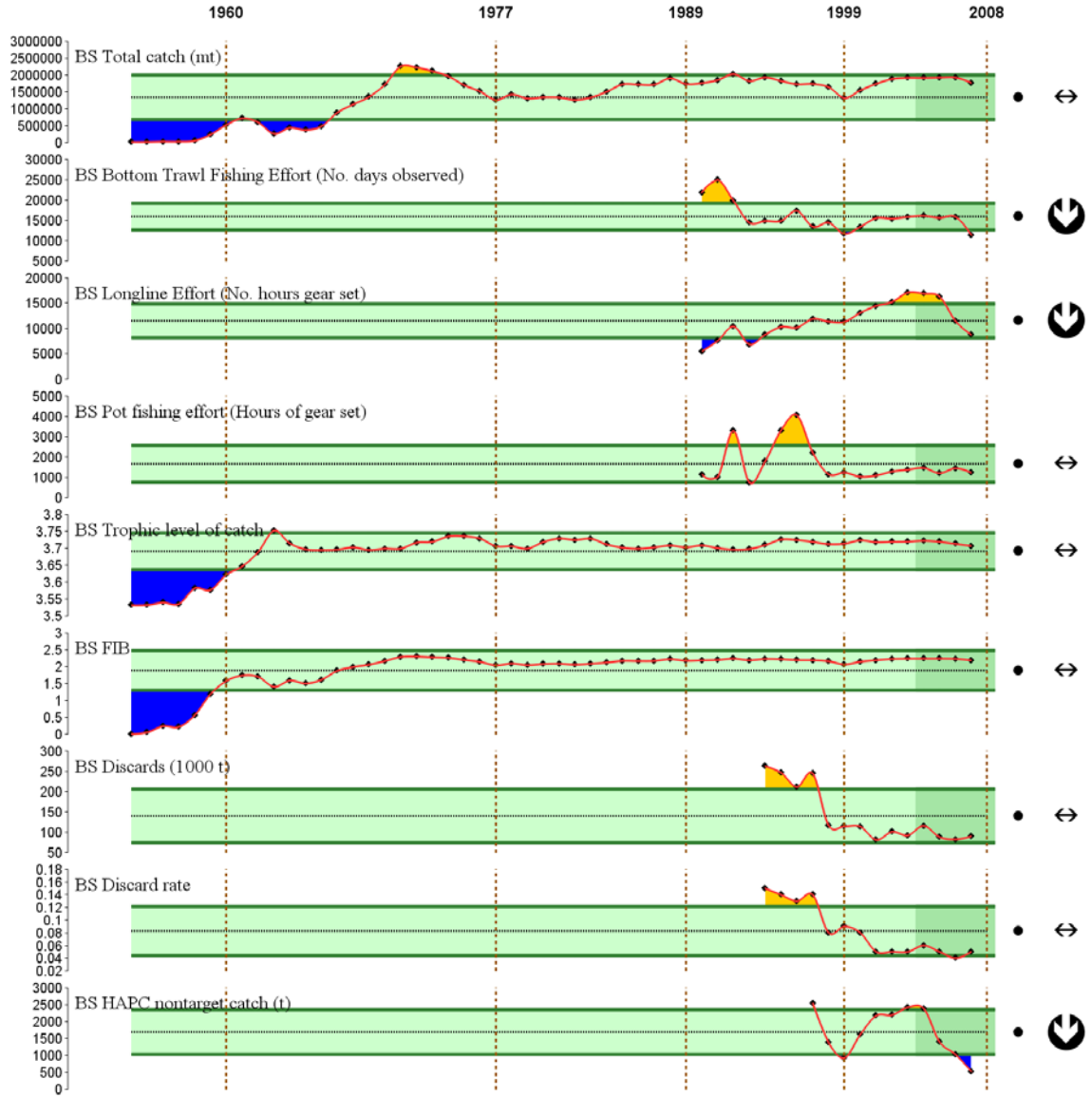
- Assessment
- Survey
- Catch
- Mass balance

2004-2009 (five-year) mean

- > 1 s.d. above mean
- >1 s.d. below mean
- within 1 s.d. of mean
- X less than 2 data points

2004-2009 (five-year) trend

- increase by >1 s.d. over five years
- decrease by >1 s.d. over five years
- ↔ change <1 s.d. over five years
- X less than 3 data points



Total catch

Bottom trawl effort

Longline effort

Pot effort

Trophic level of catch

FIB index

Discards

Discard rate

HAPC nontarget catch

2003-2008 (five-year) mean

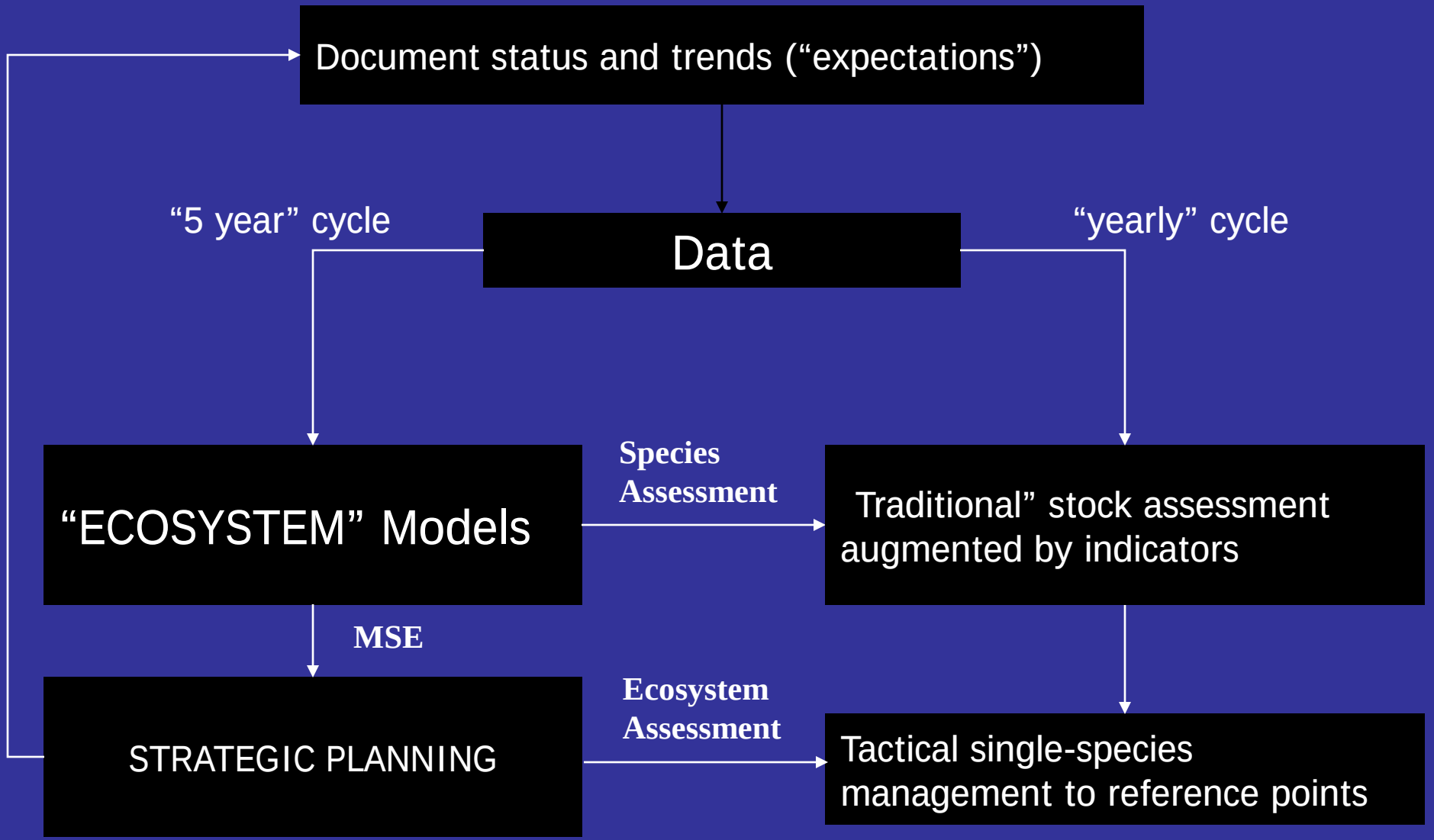
- ⊕ > 1 s.d. above mean
- ⊖ >1 s.d. below mean
- • within 1 s.d. of mean
- X less than 2 data points

2003-2008 (five-year) trend

- increase by >1 s.d. over five years
- decrease by >1 s.d. over five years
- ↔ change <1 s.d. over five years
- X less than 3 data points

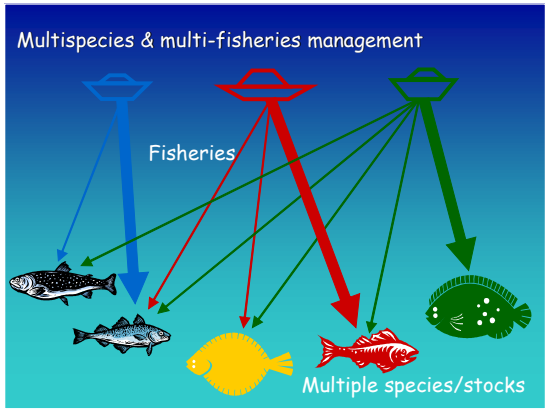
Bering Sea Fishing effects on ecosystem

A possible "Ecosystem Assessment Strategy



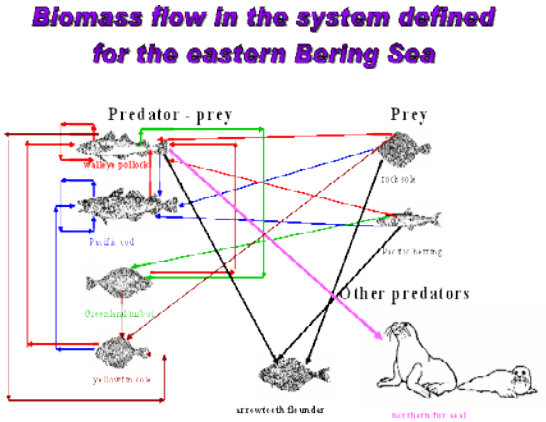
Operational Readiness

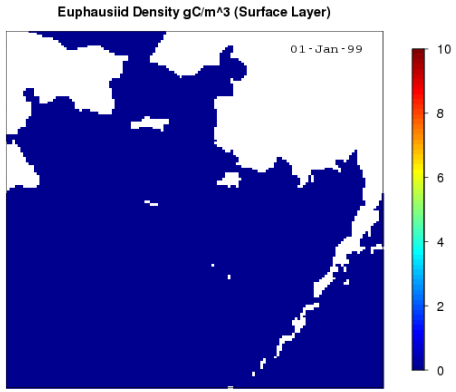
- **An "operational ensemble?"**
- The importance of developing such an ensemble approach was highlighted in a CAMEO workshop on end-to-end modeling (Steele et al.) and at the National Ecosystem Modeling (NEMoW) workshops.



Multispecies Bycatch Model (Ianelli)

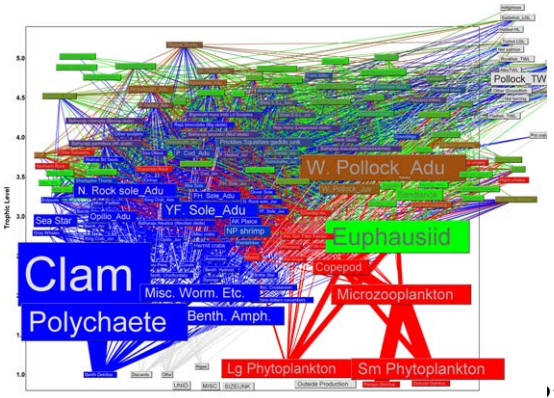
MSVPA/ Multispecies Statistical Model (Jurado-Molina et al.)





Forage and Euphausiid Abundance in Space and Time (FEAST); Aydin et al. North Pacific Research Board

Ecopath/Ecosim and Ecosense (Aydin et al.)



AI FEP team: multidisciplinary expertise

Physical oceanography

Ecosystem indicators

Food web modeling

Seabirds and mammals

Pollock assessment

Atka mackerel assessment

Rockfish assessment

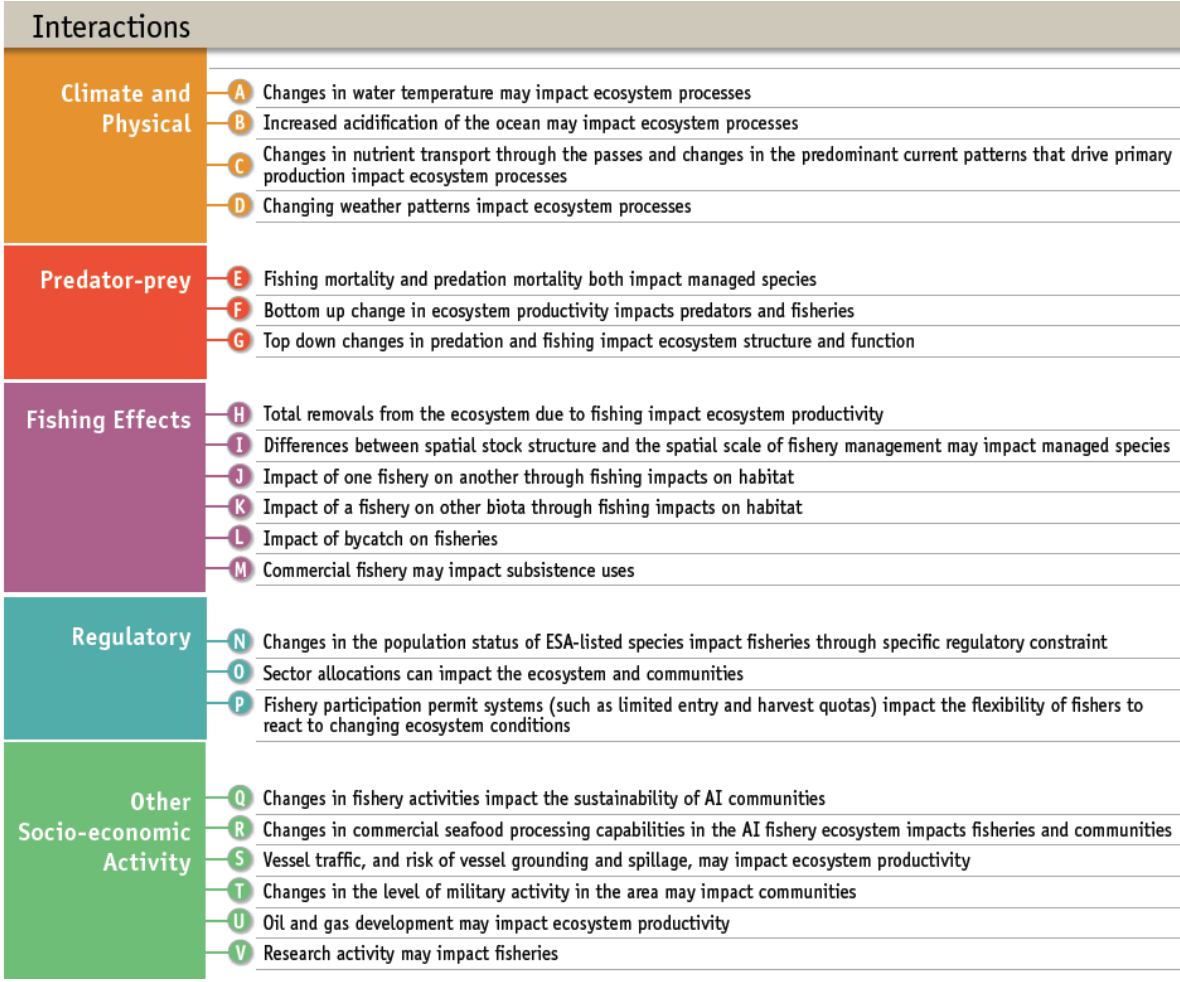
Crab bio and state fisheries

Habitat, GIS

FEP policy, implementation

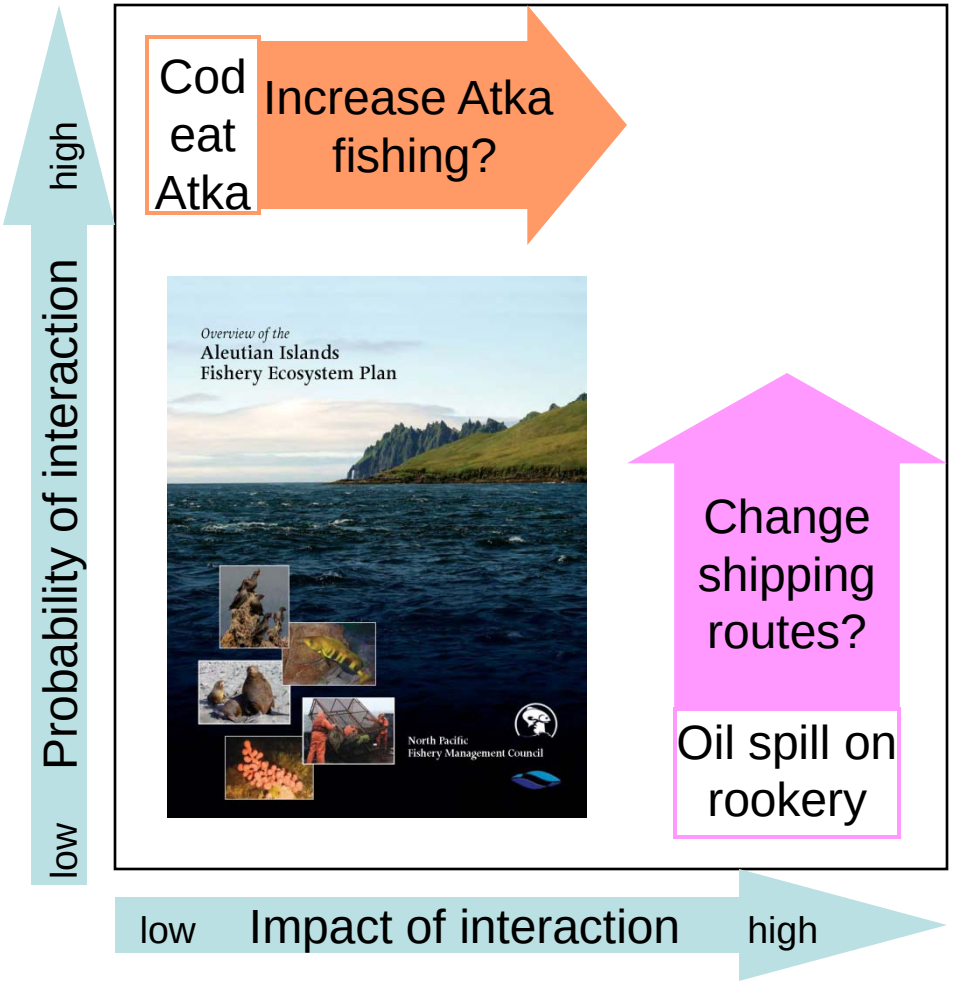
Research priorities

Anthropology, socioeconomics



Overlap membership with NPFMC groundfish, crab Plan Teams

Developing the Suite of Indicators: Identifying Interactions for Risk Assessment



% Atka in cod diet
Cod condition, weight at age
Cod and Atka biomass (SAFE)

Vessel traffic near rookeries
Changing storm tracks
Increased shipping

Risk Assessment

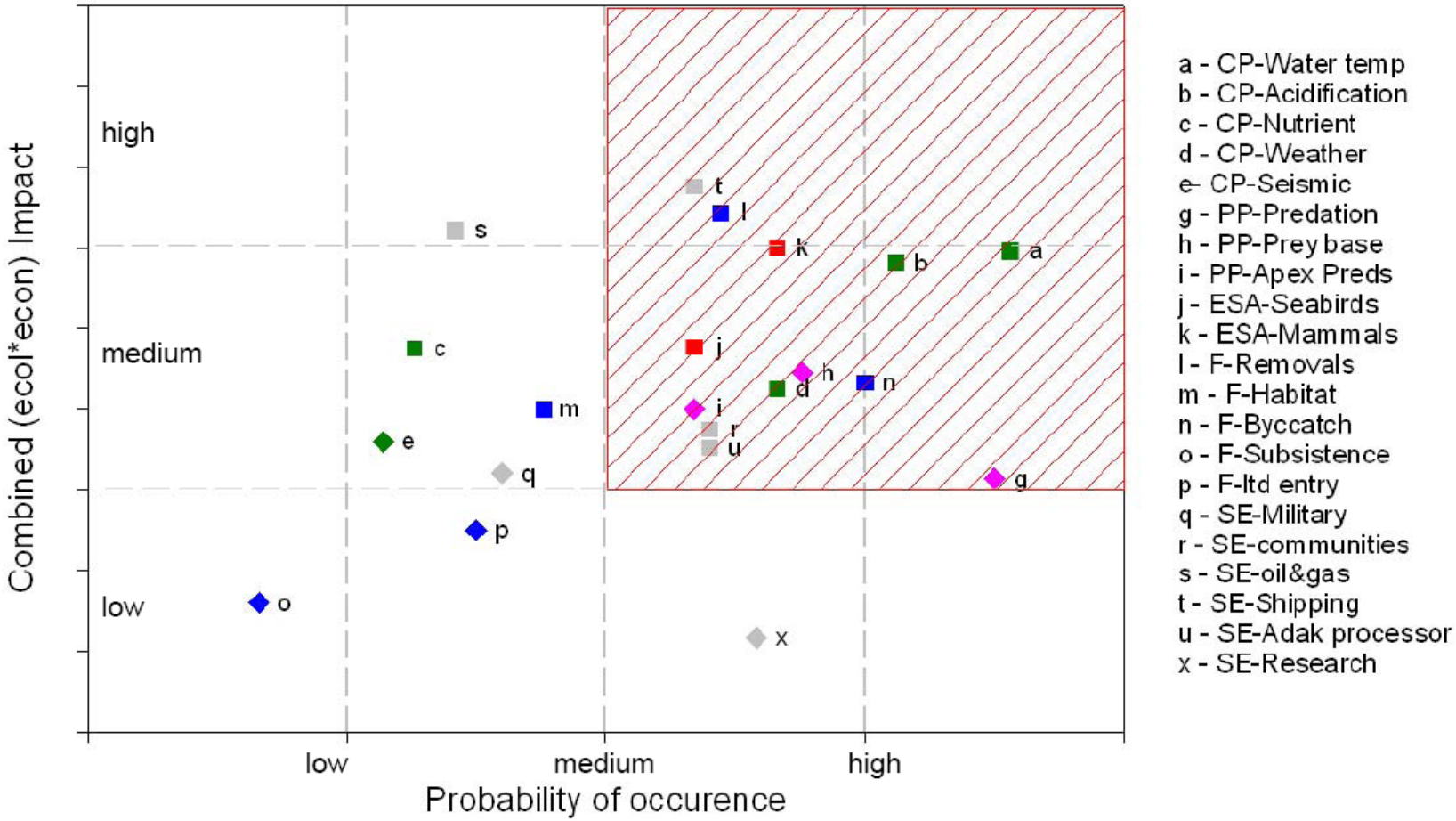


Figure 4-4 **Characterization of interactions in terms of probability of occurrence and a combined ecological multiplied by economic impact. Shaded area in upper right quadrant highlights those interactions with a medium to high probability of occurring and likely impact.**

Arctic Fishery Management Plan: Final

- Detailed fishery management
  - Categories include target and ecosystem component species
  - OY reduced to 0 (cost, ecosystem)

- Ecosystem approach to fishery management—no modeling, yet

The New York Times

Energy & Environment

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U.S. Bans Commercial Fishing in Warming Arctic

By ALLISON WINTER of Greenwire
Published: August 21, 2009

The Obama administration approved a management plan yesterday for Arctic fisheries that prevents the expansion of commercial fishing into vast swaths of sea whose ice is being melted by rising temperatures.

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NOAA FISHERIES SERVICE

Evaluation of NPFMC harvest strategy relative to principles of EAM

- Management policy aligns well with principles of EAM.
- Complex system of management results in multi-sector management.
- Precautionary harvest policies appear to be sustainable.
- Predictive tools are needed to account for the interactions to assess how proposed changes ripple through the system.

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Future Issues and Modeling

- Integrated Ecosystem Assessments feasible because of comprehensive monitoring and assessment program within AFSC.
- Further research needed on key relationships:
  - Catch quotas and trawl distribution and intensity.
  - Catch quotas and incidental catch rate.
  - Improved understanding of life history of non-target species.
- Forecasting: IFRAME +Technical Interactions, climate+mgt

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North Pacific Ecosystem Experience

How did we get here?

- Iterative—a continuing dialogue started in the early 1990s
- Long term data streams—started in late 1970s
- Investment in full time employees for ecosystem analyses
- Demonstrated utility of ecosystem information

How do we make further progress?

- System-level management thresholds
- Prioritize team synthesis of ecosystem, stock information
- Ecosystem data standard (not special) collection
- Improved ecosystem data processing (like age/growth)
- Improved support for model development and maintenance