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Integrating Ecosystem Management with Global Climate Change

Doug DeMaster
Director, Alaska Fisheries Science Center
NOAA Fisheries

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Let's go to the "source" for EAM definitions:

United States Department of Commerce
National Oceanic and Atmospheric Administration

New Priorities for the 21st Century – NOAA's Strategic Plan

Updated for FY 2006-FY 2011

What is an ecosystem?

- An *ecosystem* is a geographically specified system of organisms (including humans), the environment, and the processes that control its dynamics.
- The *environment* compromises the biological, chemical, physical, and social conditions that surround organisms. Therefore, when appropriate, the term environment should be qualified as biological, chemical, physical, and/or social.

America's Oceans

United States Exclusive Economic Zone (U.S. EEZ)

ARCTIC OCEAN

ASIA

Alaska

CANADA

UNITED STATES

MEXICO

PACIFIC OCEAN

Midway Islands

North Mariana Islands

Hawaiian Islands

Guam

Wake Island

Johnston Atoll

Palmyra Atoll

Kingman Reef

Howland Island

Baker Island

Jarvis Island

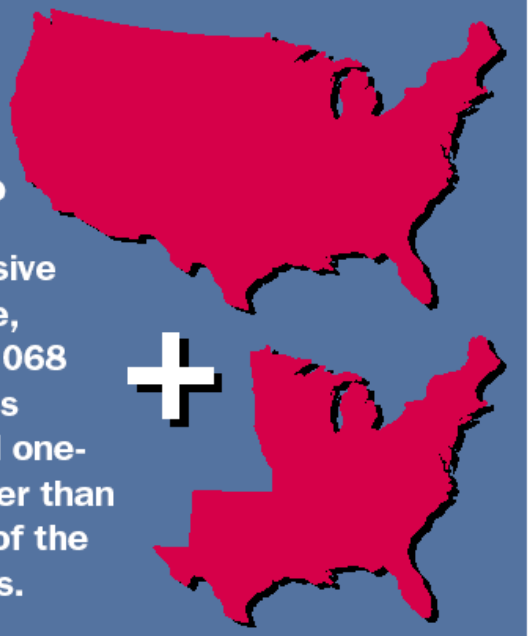
American Samoa

Puerto Rico & U.S. Virgin Islands

AUSTRALIA

How Big Is the U.S. EEZ?

The U.S. Exclusive Economic Zone, totaling 4,453,068 square miles, is nearly one and one-half times larger than the landmass of the lower 48 states.



What is an ecosystem approach to management?

- An *ecosystem approach to management* is geographically specified, adaptive, takes account of ecosystem knowledge and uncertainties, considers multiple external influences, and strives to balance diverse societal objectives. Implementation will need to be incremental and collaborative.

US Commission on Ocean Policy (Final Report 2004):

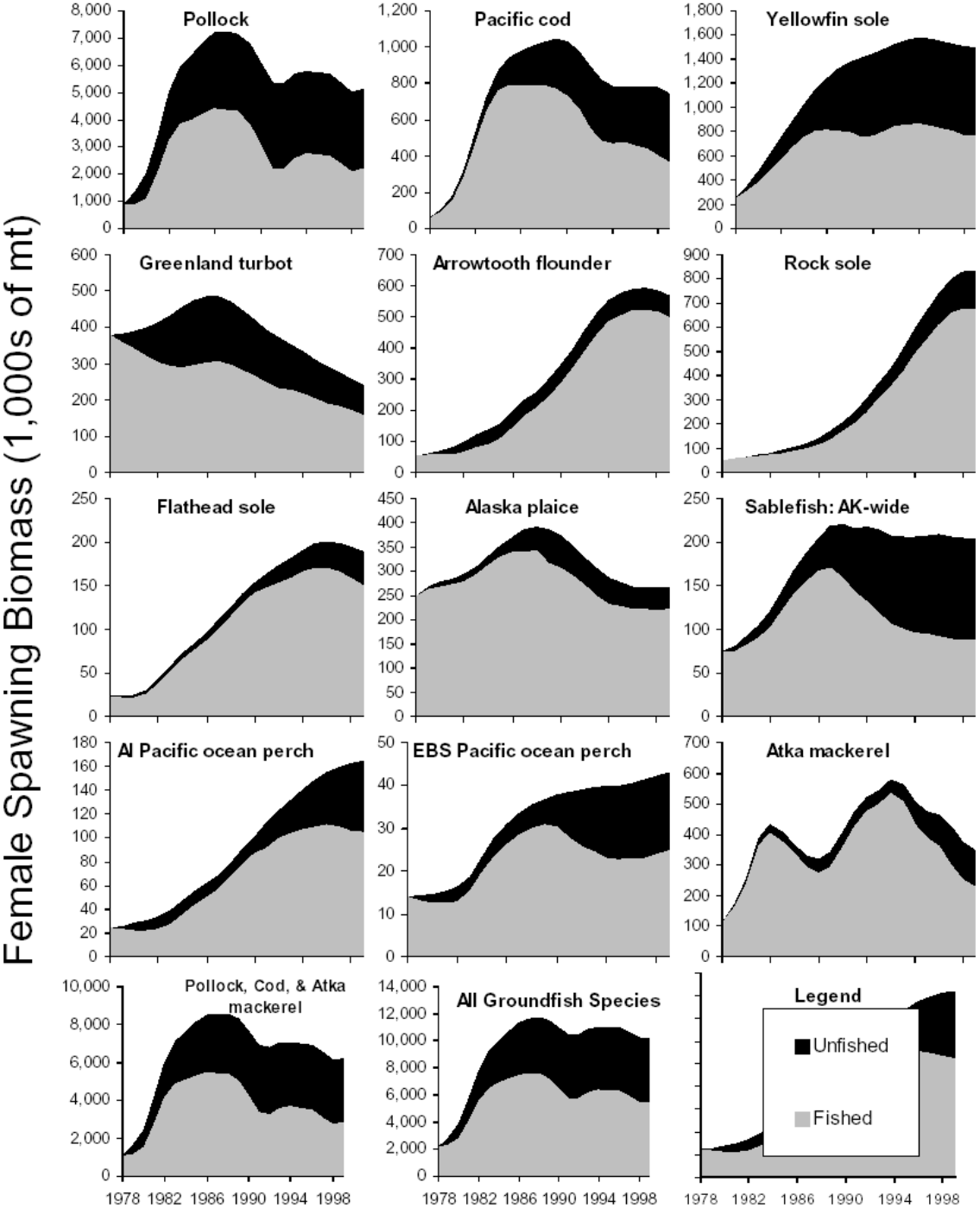
- Ecosystem-based Management: U.S. ocean and coastal resources should be managed to reflect the relationships among all ecosystem components, including human and nonhuman species and the environments in which they live.

Recent Publications

- July 2006 – Management of Living Marine Resources in an Ecosystem Context. DeMaster, Fogarty, Mason, Matlock, and Hollowed. NOAA TM-F/SPO-74. pp 15-28.
- Ruckelshaus, M., T. Klinger, N. Knowlton, and D.P. DeMaster. 2008. Marine ecosystem based-management in practice: Scientific and governance challenges. Bioscience 58(1): 53-63. .

EAM in Alaska EEZ

- Appropriately precautionary single species management (e.g., total removals)
- Appropriately precautionary management of bycaught species
- Appropriate protection of habitat
- Combination of fishery dependent and fishery independent management
- Adaptive management, where possible

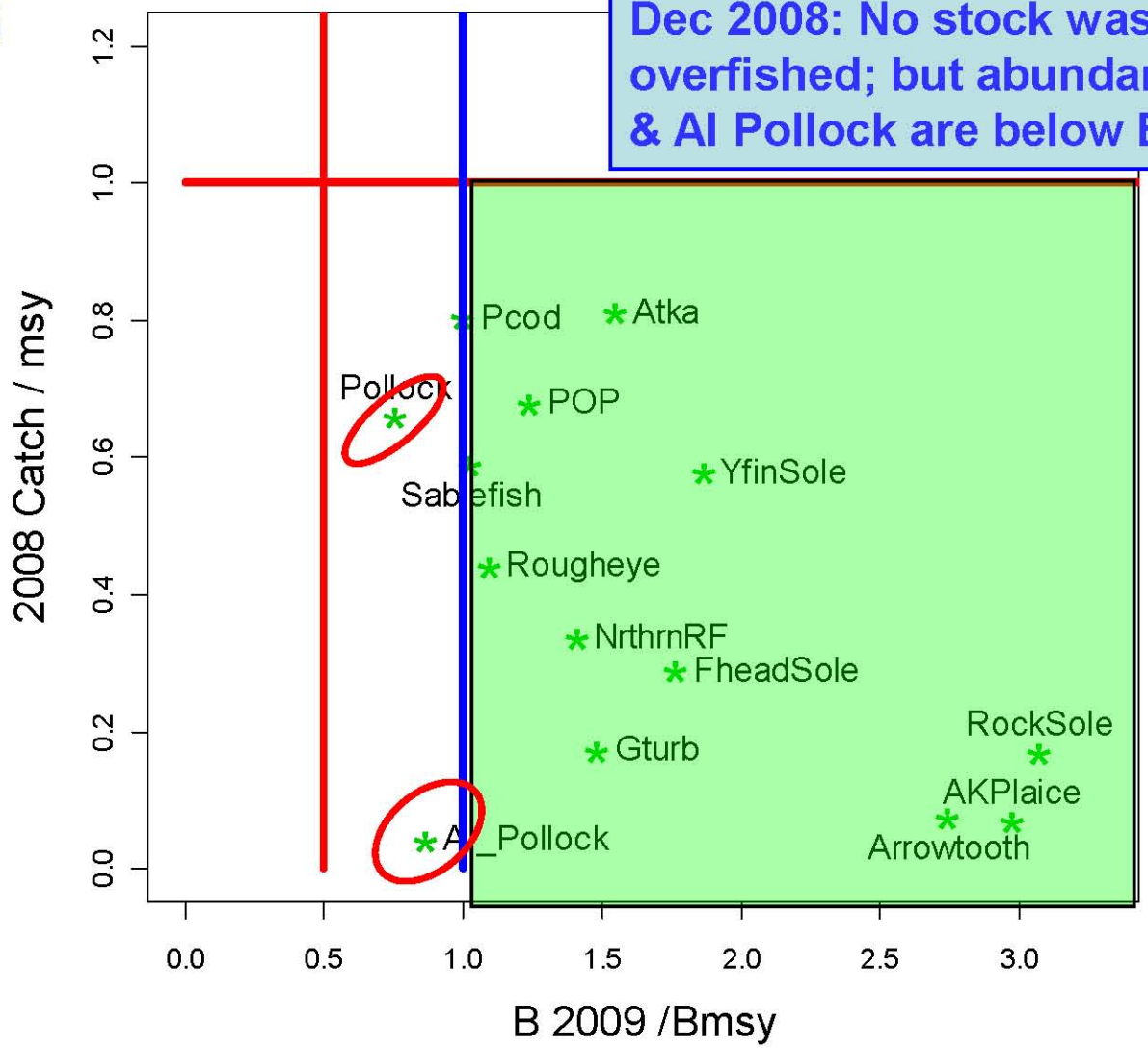


Bering Sea Groundfish Status: 1978-1999

2008

Bering Sea and Aleutian Islands Region

Dec 2008: No stock was being overfished; but abundance of EBS & AI Pollock are below Bmsy



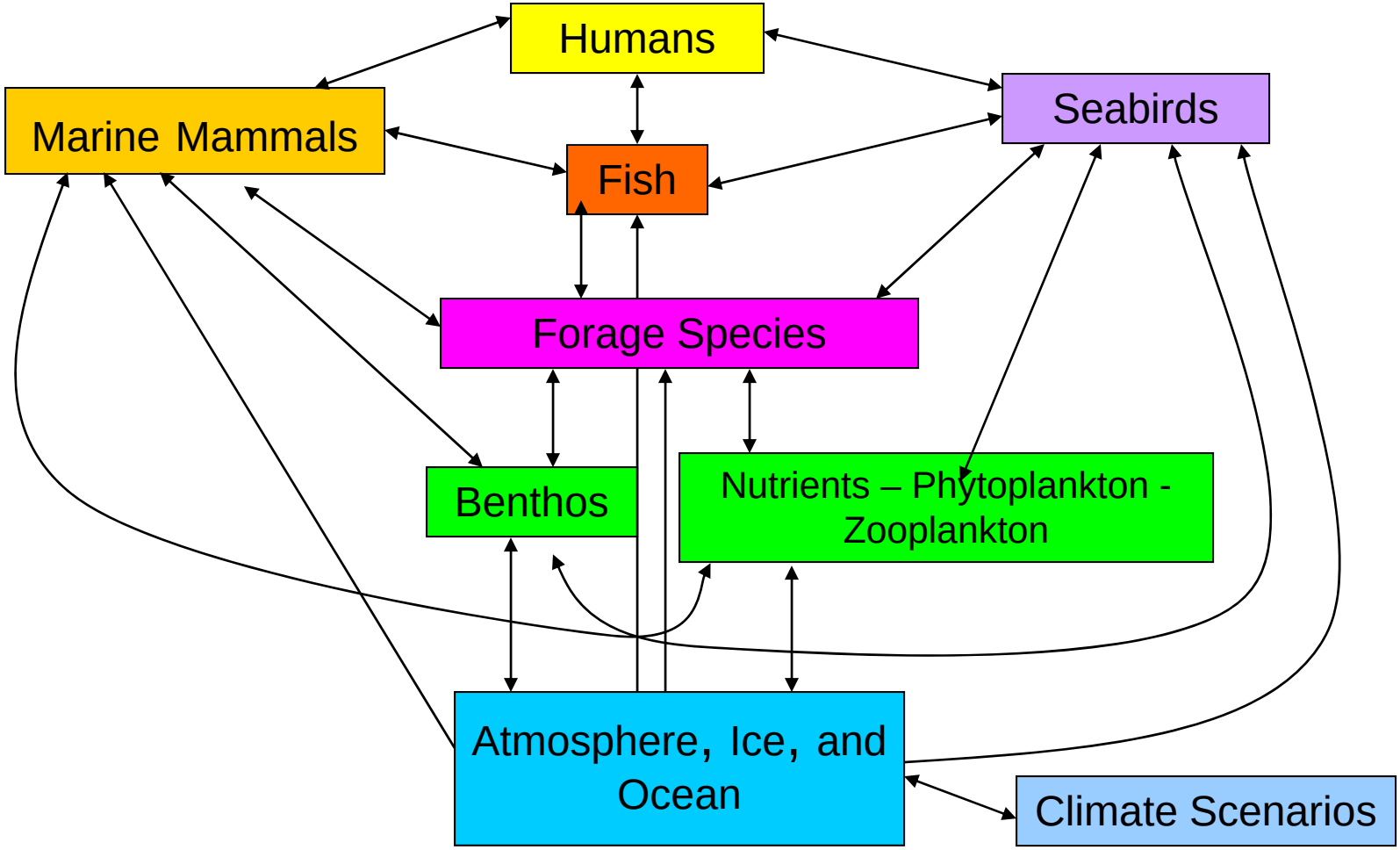
How Can We Include Uncertainty Associated with Regime Change, Global Warming, Loss of Sea Ice, and Ocean Acidification?

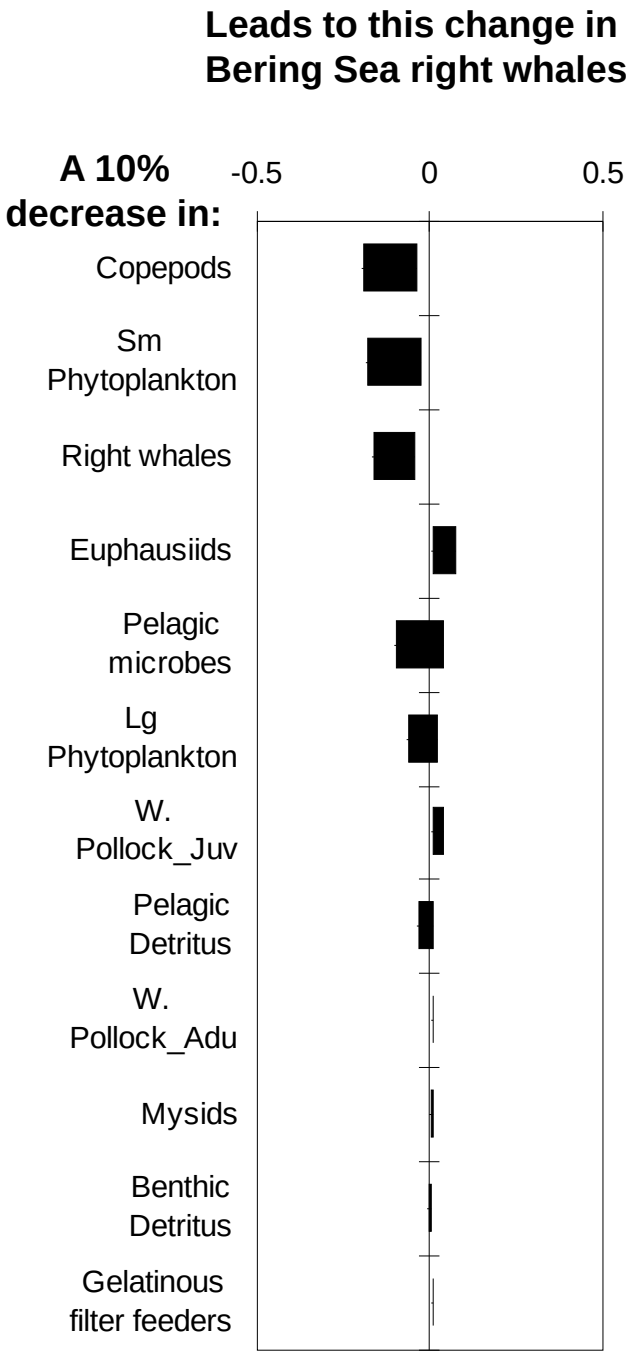
- Continue long-term observations
- Expand process studies (eg, NPCREP)
- Model development
- Collect data needed to test model predictions
- Expanded use of Management Strategy Evaluation

What Does Future Hold?

- Continued loss of sea ice in Bering Sea/Arctic
- Potential decoupling of sea ice and nutrient rich current
- Increase in summer blooms; decrease in spring blooms
- Increase in shoaling of corrosive water
- Potential reduction in primary production
- Potential for more “food” to midwater organisms; less “food” to the benthos

Bering Ecosystem Study (BEST) and Bering Integrated Ecosystem Research Program (BSIERP)





Quantifying interactions and uncertainty

- Use of EcoSim Models
- Test impact of decreases in other components on Eastern Bering Sea Right Whales
- Are Euphausiids food source or competitor for copepods?

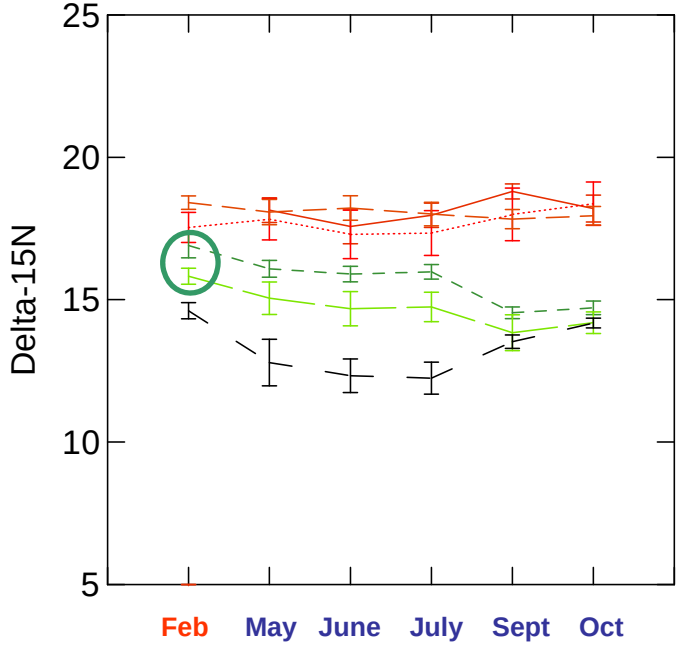
Seabird – Ecosystem contrasts

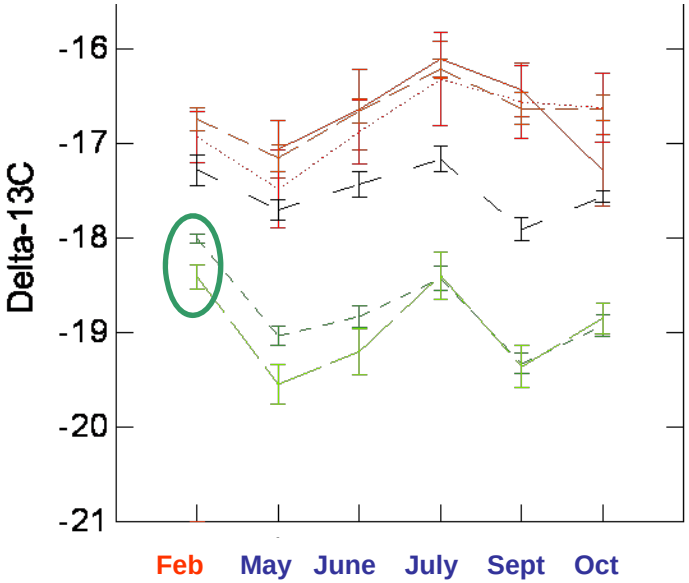
- Seabird feeding ecology can be used to:
  - Provide insight into ecosystem function
  - Test models used to predict impacts of climate change

Onshore Surface	Offshore Surface
Onshore Diving	Offshore Diving

Feather with three pieces clipped out for stable isotope analysis. Using stable isotope analysis, samples collected from different sections of this Laysan Albatross flight feather were used to assess the bird's diet at different times of year. Diet over a period of 7 weeks can be sampled from a single feather, and diet over a 4-month period can be sampled from five flight feathers.

A. Edwards – NOAA Seabird Study





NITROGEN

	n
BFAL,AK-fishing	13
BFAL,HI-fishing	9
BFAL,Historic	15
LAAL,AK-fishing	30
LAAL,HI-fishing	11
LAAL,Historic	15

BFAL = Red

LAAL historic = Black

LAAL longline = Green

CARBON

	n
BFAL,AK-fishing	13
BFAL,HI-fishing	9
BFAL,Historic	15
LAAL,AK-fishing	30
LAAL,HI-fishing	11
LAAL,Historic	15

Mean + SE

Alaska vs Hawaii

Birds identified by where they were salvaged from longlines during the breeding season (January to June).

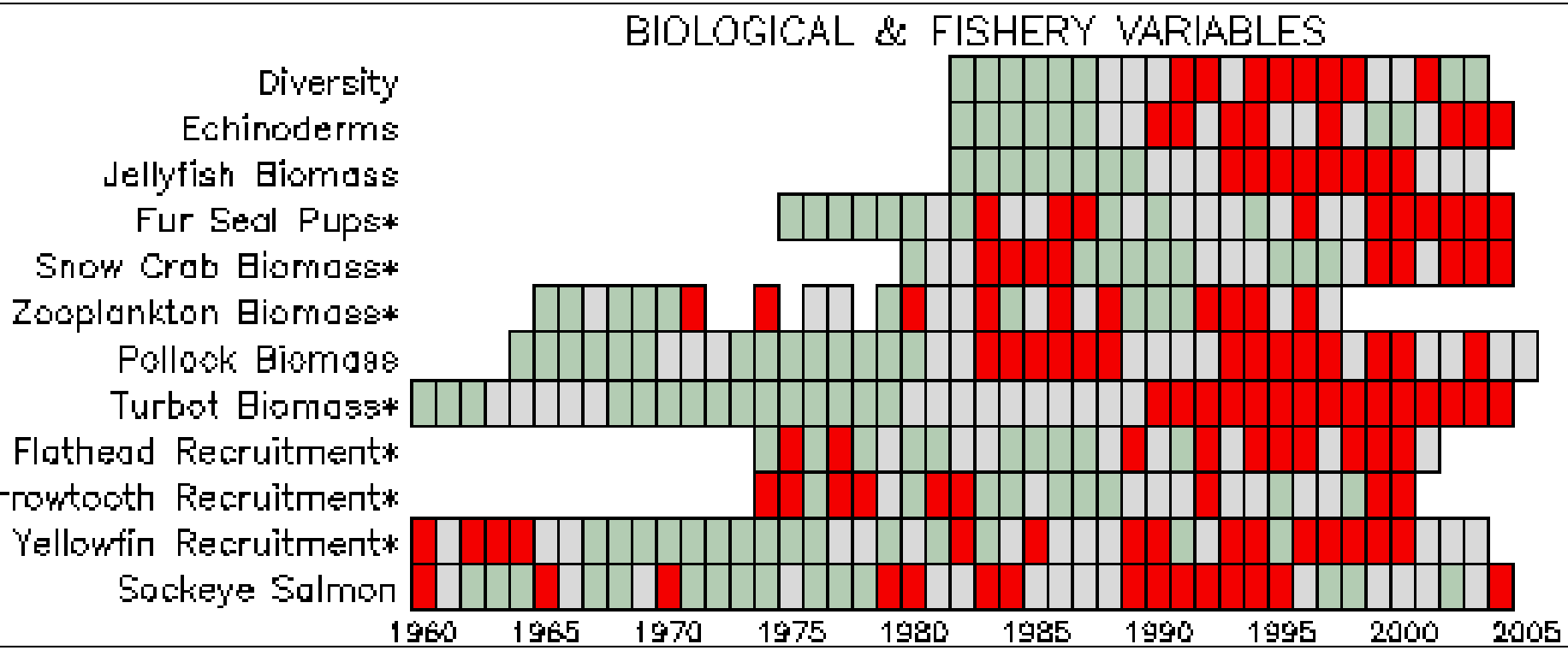
HOWEVER, isotopes values are representative of the non-breeding season (May-Oct). Except Feb = breeding season for active breeders.

LAAL

Feb – Greatest Variability

Sept-Oct – Least Variability

(both Carbon and Nitrogen)


BIOLOGICAL & FISHERY VARIABLES
Diversity
Echinoderms
Jellyfish Biomass
Fur Seal Pups*
Snow Crab Biomass*
Zooplankton Biomass*
Pollock Biomass
Turbot Biomass*
Flathead Recruitment*
rowtooth Recruitment*
Yellowfin Recruitment*
Sockeye Salmon
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005

Ringed seals

Pups in under-snow lairs in coastal fast ice: feeds in water column/under ice

Bearded seals

Pups/feeds in pack ice zone over shelf, in areas of rich benthic productivity

Varying dependence on sea ice

Pups/molts in marginal ice zone, perhaps as a predator avoidance strategy

Ribbon seals

Pups in pack ice – uses land haulout sites during summer

Spotted seals

Recommendation:

- Design 5 year study with our partners at PMEL, UA, NPRB, NSF, MMS, ADFG, ASLC, UW, etc.
- Expect ecosystem impacts of commercial and subsistence fishing, regime change, global warming, loss of sea ice, and ocean acidification.
- Expect strong interactions
- $3 million per year for at least 5 years