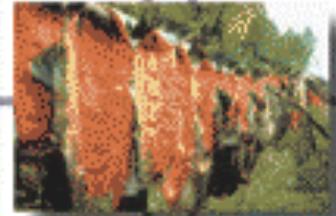
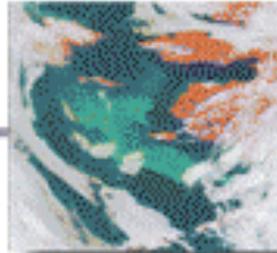


BEST



Bering Ecosystem Study Program



What is BEST?



- **A program designed to understand and predict the consequences of climate change for Bering Sea marine ecosystems**
- **End to End: Climate, physics, primary production, zooplankton, fish, seabirds, marine mammals and people**
- **Strong social sciences component expected**



History of BEST

Ecosystem Studies of Sub-Arctic Seas



Global Ocean Ecosystem Dynamics

- **Sept. 2002: Laguna Beach, Initial Planning**
- **Mar. 2003: Seattle, Science Plan Workshop**
- **Oct. 2004: Science Plan Published**
- **Mar. 2005: Science Steering Committee**
- **May 2005: Open Implementation Workshop**
- **Aug. 2005: Implementation Plan to NSF**
- **Sept. 2005: Announcement of Opportunity**
- **Apr. 2007: Commencement of Field Program**

BEST Research Priorities

- **Primary Focus:**

How is the Disappearance of Sea Ice Affecting the marine ecosystem of the eastern Bering Sea and the people dependent on it?



- **Secondary Modules:**

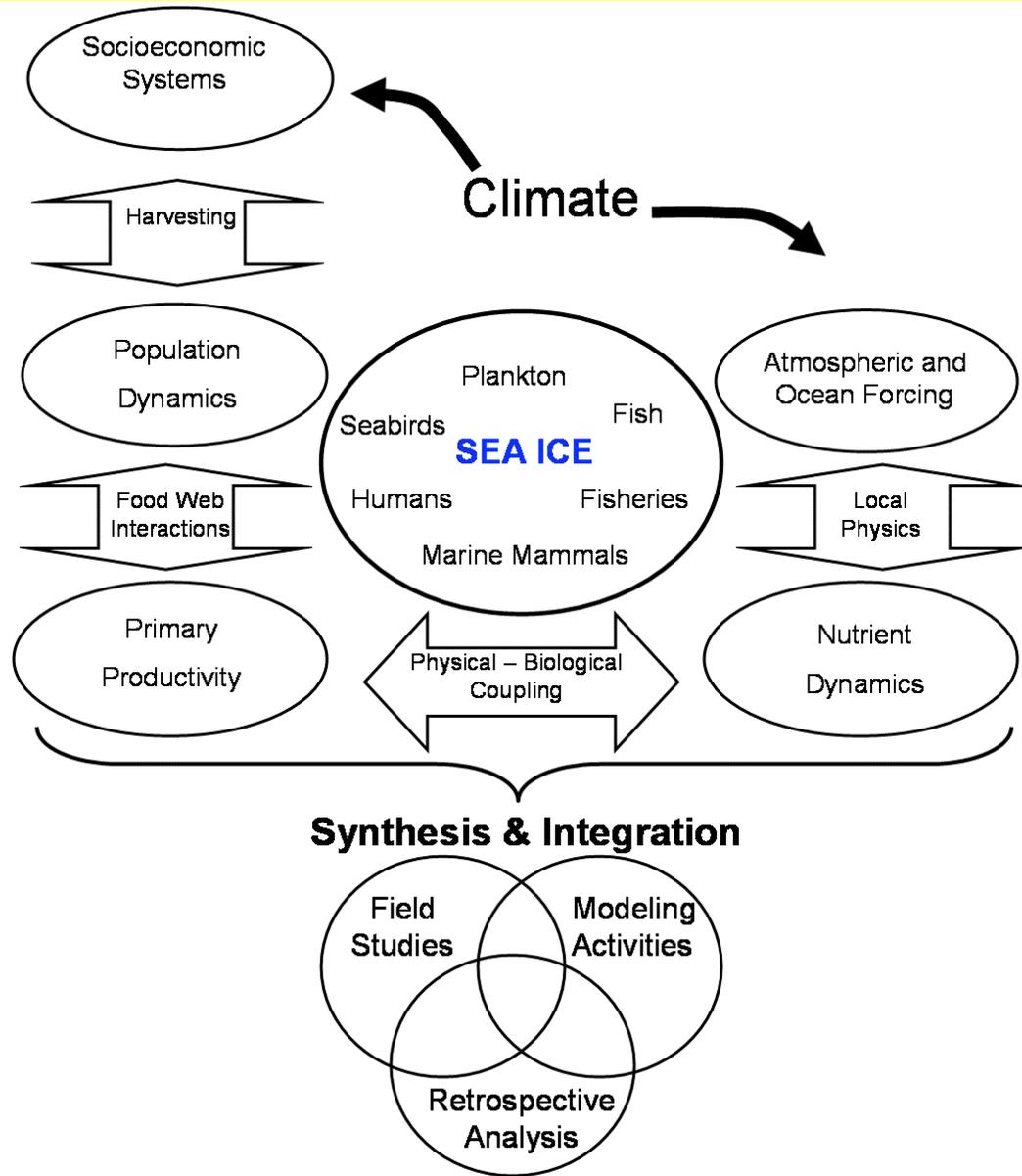
a) **What controls the abundance of nutrients on the shelf and what is the influence of climate variability?**

b) **What will be the ecosystem effects of a warmer and more stratified Bering Sea?**

c) **Regional studies:**

Northern Bering, Pribilof Islands, Aleutian Passes

Assembling an End-to-End Program



- Atmosphere / Ocean
 - Local Physics
 - Phys - Biol Coupling
 - Food Web Interactions
 - Harvesting / Fisheries
 - Social / Economic
-
- Modeling Activities
 - Field Research
 - Retrospective Studies

BEST Research Approach

- **Spring transition: April - May (40 days)**
- **How does climate drive ice conditions?**
- **How does sea ice affect the type, amount and fate of primary production?**
- **What processes control zooplankton biomass and community structure?**
- **How do these bottom-up factors interact with top-down mechanisms?**
- **What are the expected impacts on upper trophic-level organisms, including people?**

Climate Change and the Bering Sea Ecosystem: An Integrated, Interagency / Multi-Institutional Approach

Bering Sea Inter-Agency Working Group (BIAWG)

Alaska Ocean Observing System
Bering Ecosystem Study
NOAA Alaska Fisheries Science Center
NOAA Pacific Marine Environmental Lab.
North Pacific Research Board
U.S. Arctic Research Commission
U.S. Fish and Wildlife Service
U.S. Geological Survey
University of Alaska Fairbanks

NMFS White Paper: February 2006

Climate Change and the Bering Sea Ecosystem:
An Integrated, Interagency / Multi-Institutional Approach

Workshop held 8 April 2005
Seattle, WA



Walrus herd in the Chukchi Sea, June 2002
Photo courtesy of G. Sheffield.



February 2006



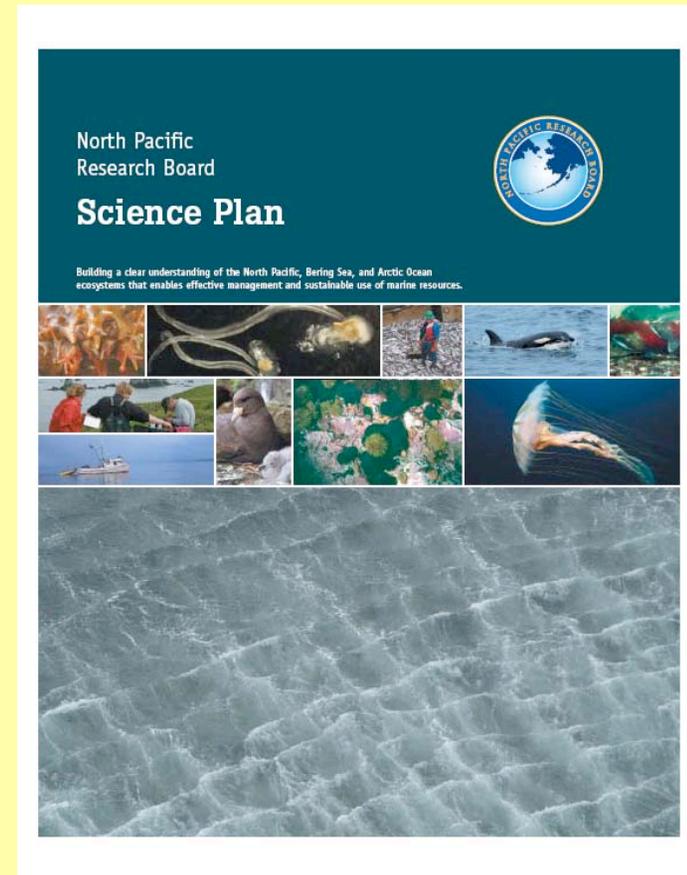
North Pacific Research Board

Future Research: ~\$15 MILLION RFP (2007)

Bering Sea Integrated Ecosystem Research Program (BSIERP)

Major component of the 2007 RFP, which will be released Oct. 6, 2006

Public review of draft program documents (July / Aug., 2006)



<http://project.nprb.org/research/index>

Integrated Bering Sea Ecosystem Study



AYK-SSI
(interagency)



OPP
Arctic Natural
& Social
Sciences



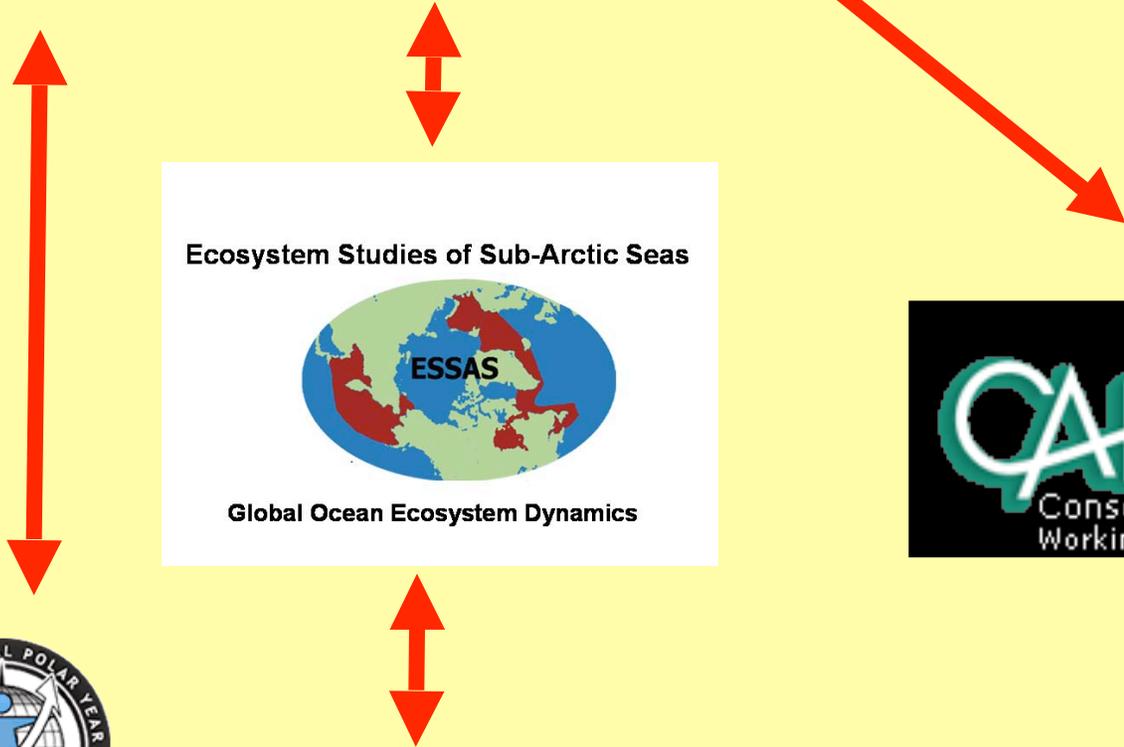
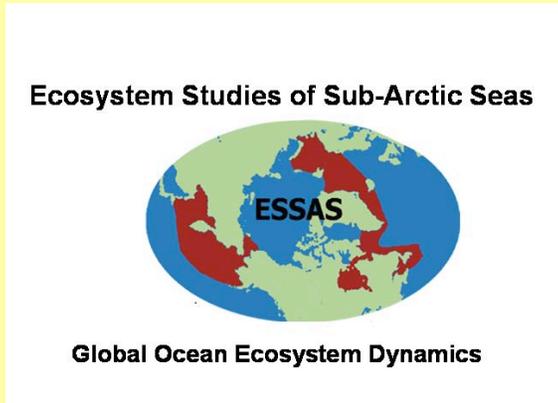
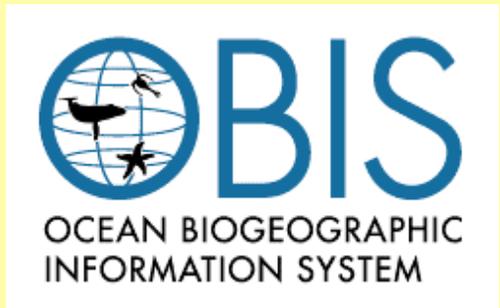
USFWS
USGS



AFSC
NMML
PMEL

Contributions Beyond the Bering Sea

*Integrated Bering Sea
Ecosystem Study*





North Pacific Research Board

Current Research: 44 Active Projects (2006)



Modeling Sea Ice / Productivity

Circulation / Larval transport

Population Structure / Dynamics

(fish, squid, pinnipeds, cetaceans)

Species-specific Habitats

(skates, rockfish, pinnipeds, cetaceans)

Community Structure

(plankton / seabirds – cetaceans)

Human Communities / Health

(commercial fishing, shellfish poisoning)

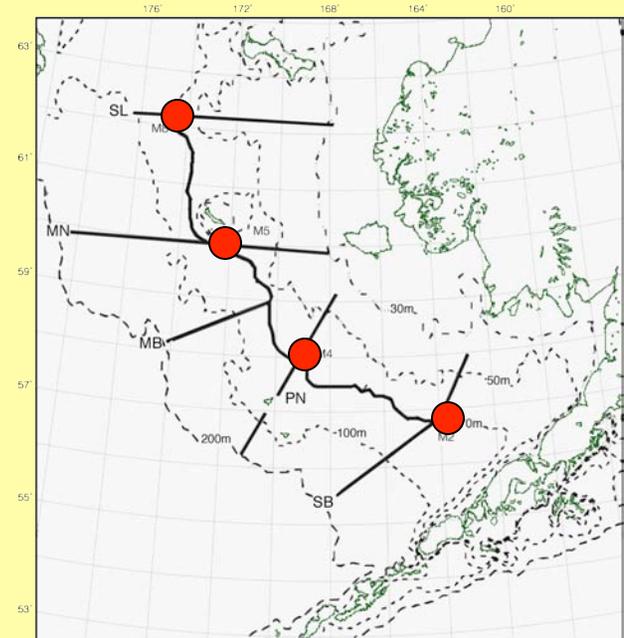
<http://project.nprb.org>



NOAA – Bering Sea Research

➤ Process-Oriented Studies:

- Eco-FOCI: Ecosystem & Fishery Oceanography Coordinated Investigations
- Bering Climate web-site
<http://www.beringclimate.noaa.gov>
- LOSI: LOss of Sea Ice



Planned Eco-FOCI activities:

- Moorings M2, M4, M5, M8
- Cross-shelf lines, extending from the inner shelf to the slope (500 m depth)



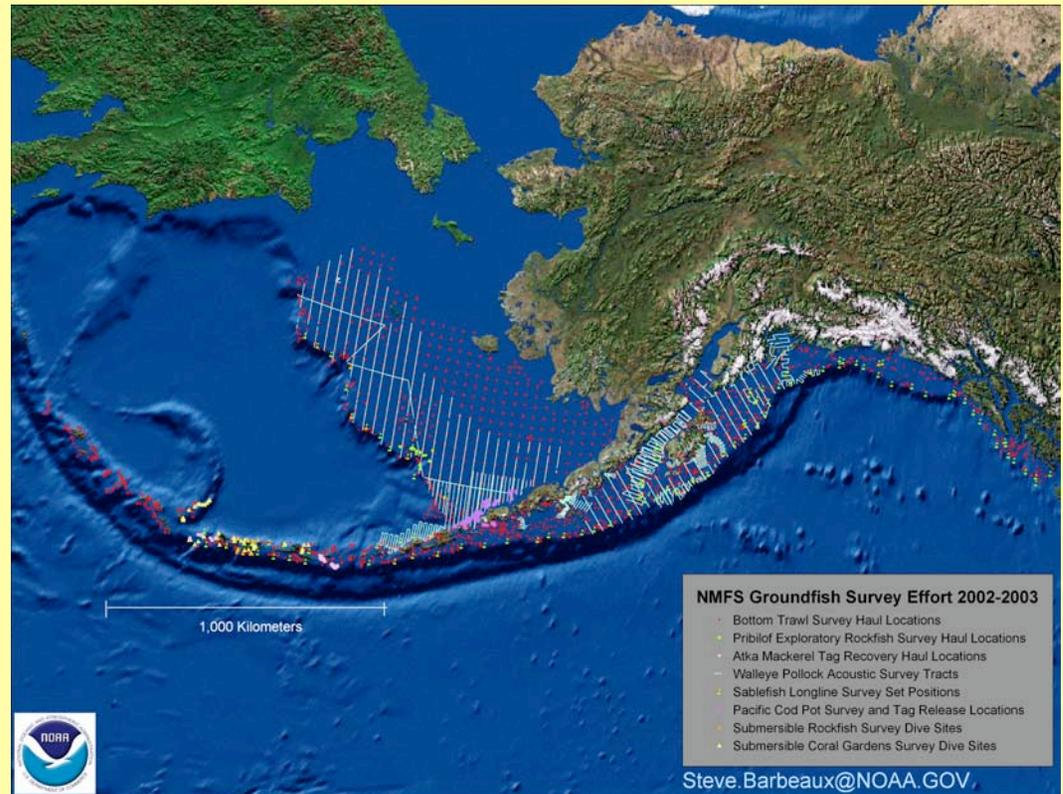
NOAA – Bering Sea Research

➤ Fishery Stock Assessments:

- REFM: Resource Ecology & Fisheries Management
- RACE: Resource Assessment & Conservation Engineering



Acoustic / Trawling / Pots /
Longlines / Submersible

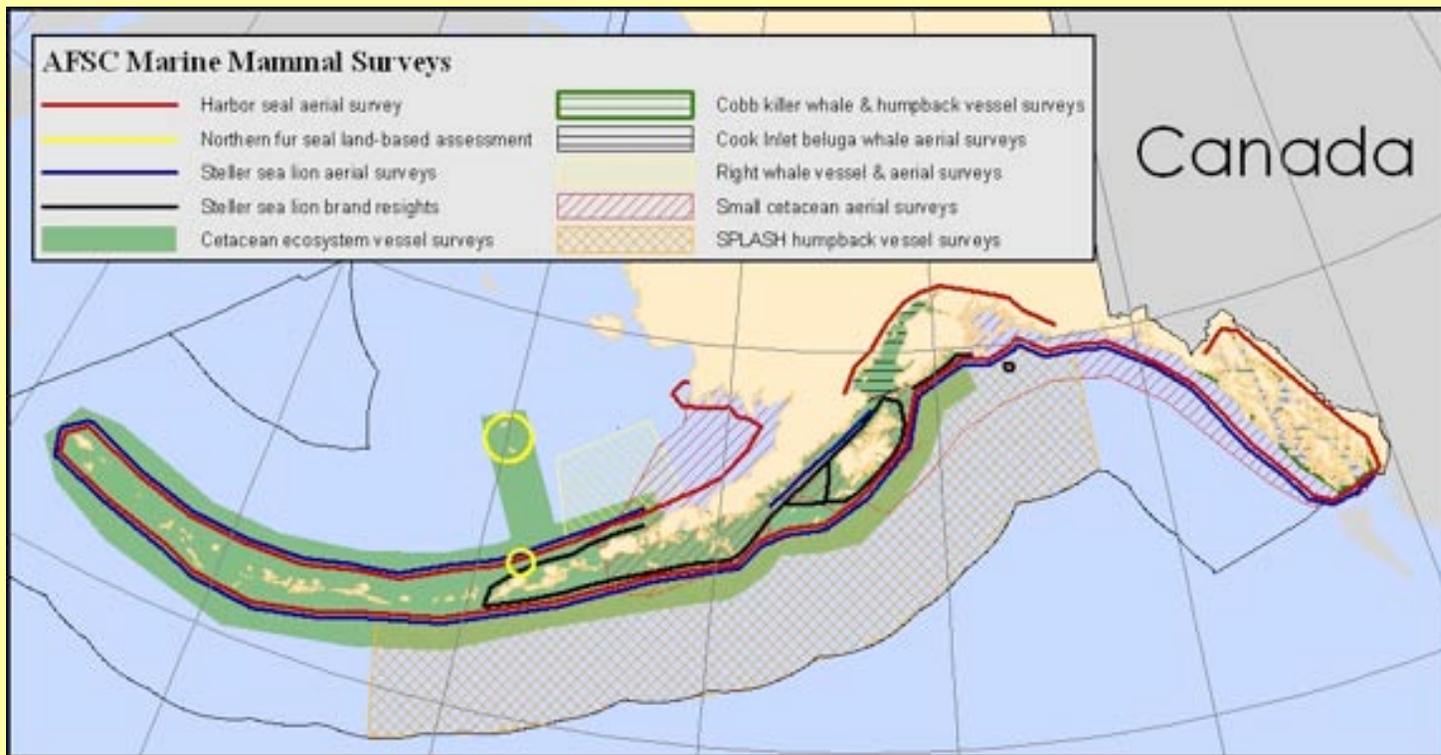




NOAA – Bering Sea Research

➤ National Marine Mammal Laboratory:

- shore-based counts and at-sea surveys
- ice-seal satellite tracking and surveys
- photo-identification and genetics



BASIS

The Bering-Aleutian Salmon International Survey



Fisheries and Oceans
Canada

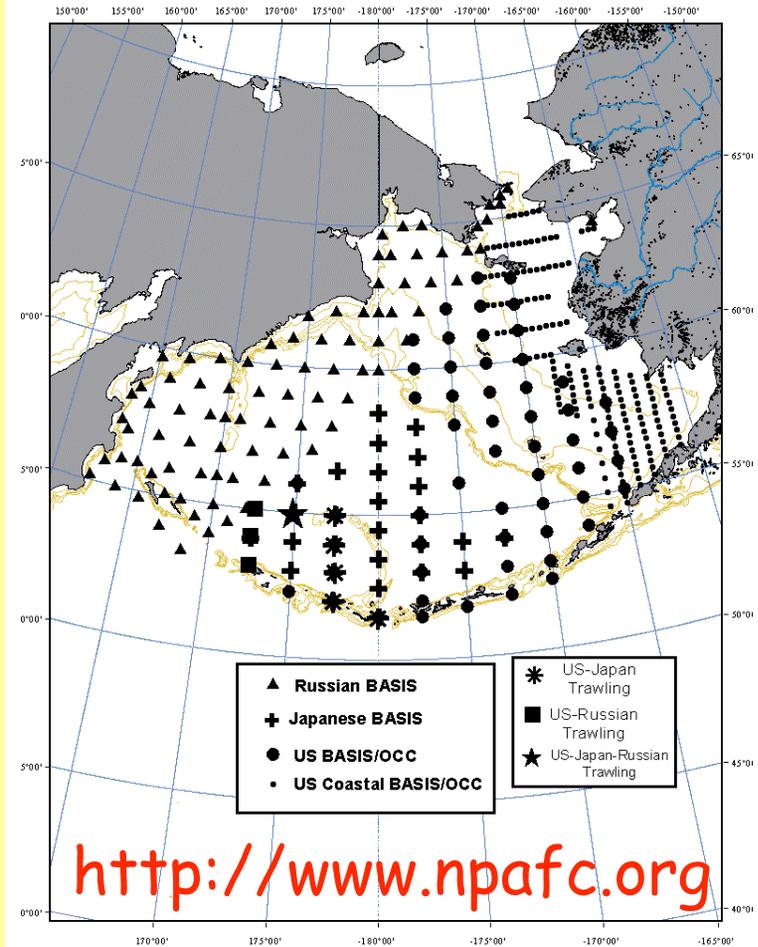


Objective: “Study aspects of ocean ecology of salmon in the Bering Sea”

Key Issues:

- **Salmon and Forage Fish**
changing ocean conditions and productivity
- **Climate Change**
sea ice loss, increase in water temperature
- **Fisheries Bycatch**
expanding salmon distribution due to warming

- Initiated by NPAFC in 2002
- Tri-national surveys: Russia, Japan, US
- Cooperative research: Canada, Korea



BASIS

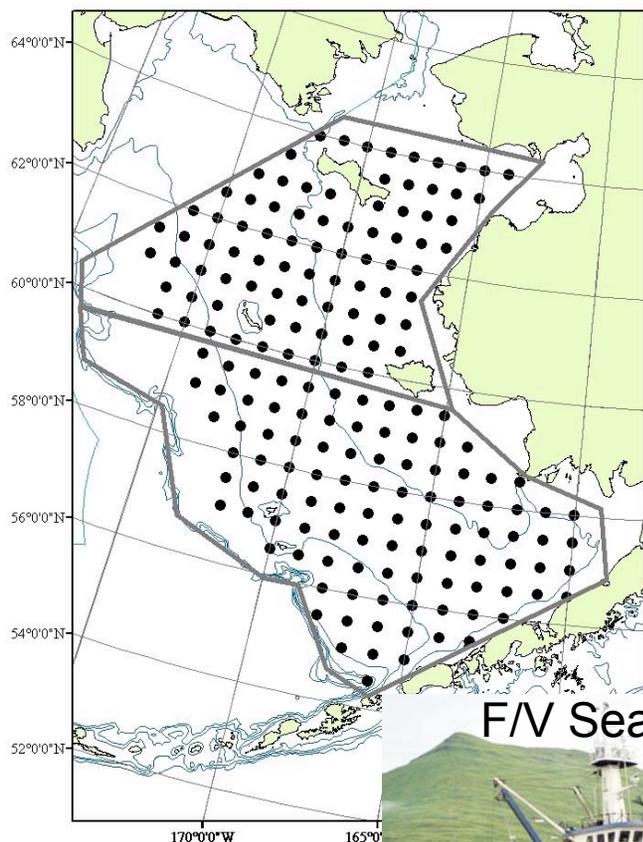
The Bering-Aleutian Salmon International Survey



Fisheries and Oceans
Canada



US BASIS Stations



F/V Sea Storm

August – October (60 days)

- Physical / Biological Oceanography
- Distribution in relation to ocean conditions: physics and prey
- Critical size and marine survival
- Spatially Explicit Habitat Quality
- Trophic Interactions

BASIS Working Group Points of Contact

Chairman: Jack Helle

Auke Bay Laboratory, NMFS, Juneau, AK

email: jack.helle@noaa.gov

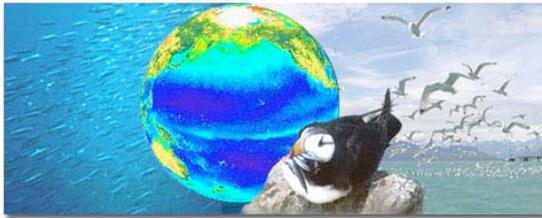


Alaska Fisheries Science Center

NATIONAL MARINE FISHERIES SERVICE



U.S. Geological Service



Ecosystems & Habitats

- [Coastal and Marine](#)

Fish & Fisheries

- [Fisheries Projects](#)

Vision:

To provide scientific leadership and accurate, objective, and timely data, information, and research findings to address important natural resource issues and natural hazards assessments in Alaska and circumpolar regions



Mammals



- [Polar Bears](#)
- [Sea Otters](#)
- [Walrus](#)



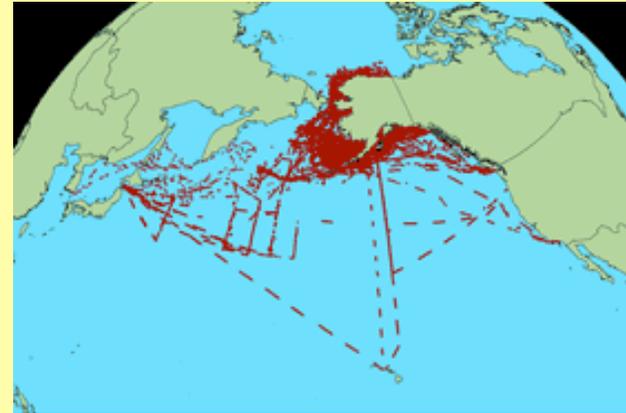
Birds

- [Seabirds](#)
- [Waterfowl](#)
- [Seaducks](#)
- [Shorebirds](#)
- [Loons](#)

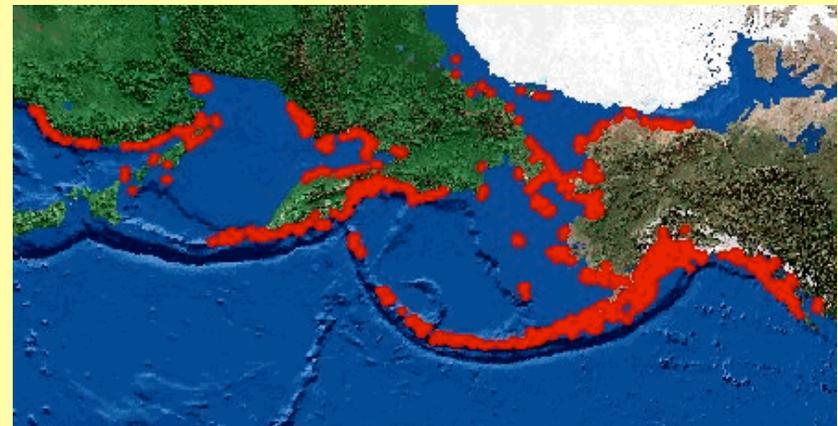
<http://alaska.usgs.gov/science/biology>



U.S. Fish and Wildlife Service



NORTH PACIFIC SEABIRD COLONY DATABASE



Objective: Monitoring of Natural Resources
Alaska Maritime Refuge



- Seabird colonies
- Marine mammal rookeries
- Sea otters
- Seabirds at-sea
- Marine mammals at-sea
- Fish
- Invertebrates



Alaska Ocean Observing System

Objective:

Develop a Regional Observing System within the Integrated Ocean Observing System

Key Issues:

- Improve prediction of climate change impacts
- Improve safety and efficiency of marine ops.
- More efficiently protect and restore healthy coastal ecosystems
- Sustain marine resources
- Mitigate effects of natural hazards
- Reduce public health risks
- Improve national security

(Adapted From: An Integrated and Sustained Ocean Observing System, Ocean.US 2002)



<http://www.aos.org>

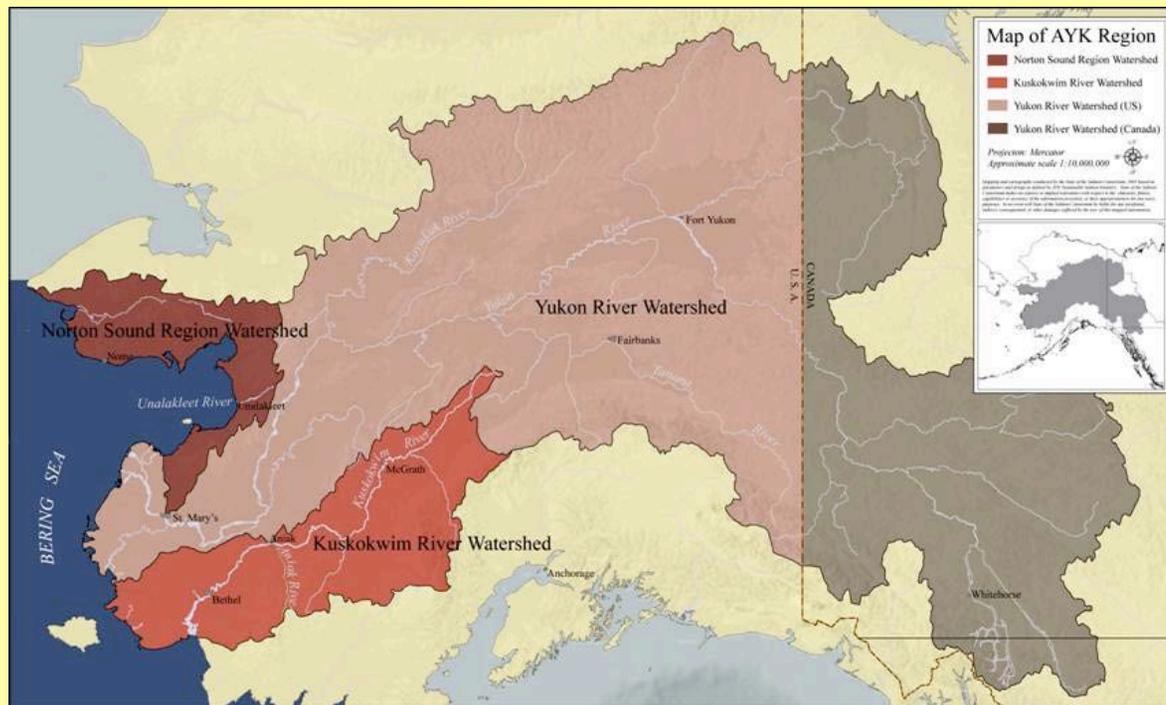
AYK-SSI

Arctic - Yukon - Kuskokwim Sustainable Salmon Initiative



Objective: “... understanding the trends and causes of variation in salmon abundance and fisheries...”

Current Research: 22 Active Projects (2006)



13 Population Ecology

4 Fisheries Management

2 Run Reconstruction

3 Local Traditional Knowledge

<http://www.aykssi.org>

AYK-SSI



Arctic - Yukon - Kuskokwim Sustainable Salmon Initiative

Future Research: \$ 4.5 M RRP (2007)

The RRP is organized around a conceptual foundation, several overarching questions and three research frameworks:

- 1) Salmon Life Cycle
- 2) Human Systems
- 3) Synthesis and Prediction

ARCTIC-YUKON-KUSKOKWIM
SALMON RESEARCH & RESTORATION PLAN



ARCTIC YUKON KUSKOKWIM
SUSTAINABLE SALMON INITIATIVE
SCIENTIFIC TECHNICAL COMMITTEE
June 30, 2006

<http://www.aykssi.org/prod>



Alaska Department Fish & Game - Wildlife Conservation and Fisheries -

Objective:

To protect, maintain, and improve the fish, game, and aquatic plant resources of the state, and manage their use and development for the maximum benefit of the people.

Priorities:

- Optimize economic benefits from fish and wildlife resources.
- Enhance public participation in management
- Increase public knowledge about fish and wildlife populations



<http://www.adfg.state.ak.us>



Alaska Department Fish & Game

- Subsistence -

Objective:

To scientifically, quantify, evaluate and report information about customary and traditional uses of Alaska's Fish and wildlife resources

Priorities:

- Research, quantify, and disseminate information to the public about customary and traditional uses by Alaskans of fish and wildlife resources
- Provide scientifically-based information for evaluating opportunities for customary and traditional resource uses

Studies

- wild resource harvest / use
- seasonality of harvesting
- methods of harvesting
- methods of processing
- harvest levels
- sharing / trading foods
- geographic areas used
- cultural and economic values
- groups sharing resources
- trends in resource use patterns



Steps Towards Multi-Institutional Collaboration and Integration

- Interagency Coordination:

BIAWG meetings / white paper

Bering Sea Indicators (NOAA/NPRB)

Bering Ecosystems Meeting: July '06

- Information Exchange:

NOAA's Bering Climate Web-site

Alaska Marine Science Symposium

- Collaborative Cruises:

NOAA Sea Ice '06, BEST '07



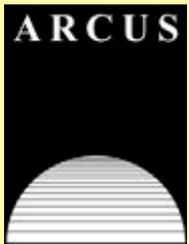
BEST Information Sources

- **Web Sites:**

<http://www.arcus.org/Bering>

<http://www.fish.washington.edu/best>

- **Science Plan, available in Hard Copy at:**



**Arctic Research Consortium of the U.S. (ARCUS)
3535 College Road, Suite 101, Fairbanks, AK 99709
Phone: 907-474-1600; Fax: 907-474-1604**

- **Planning Office: c/o George L. Hunt, Jr.**



**School of Aquatic & Fishery Sciences
University of Washington, Seattle
Email: geohunt2@u.washington.edu**