

**NOAA**  
**FISHERIES**

AFSC

# U.S. Arctic Research Activities

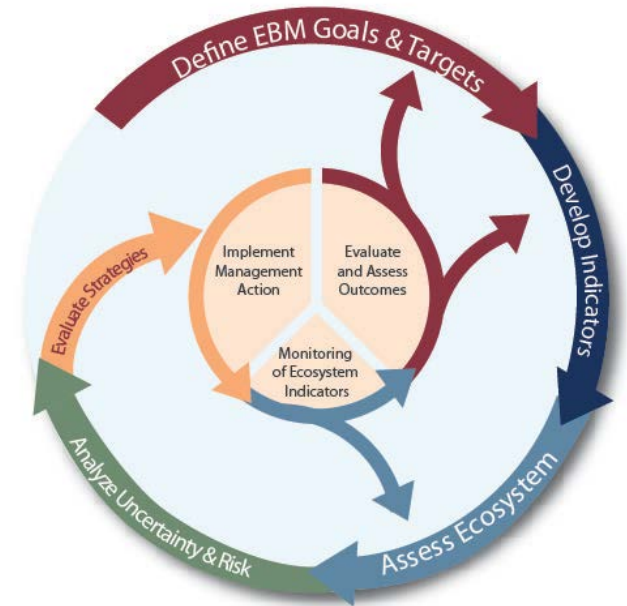
Prepared by: Libby Logerwell

Third Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean  
April 14, 2015

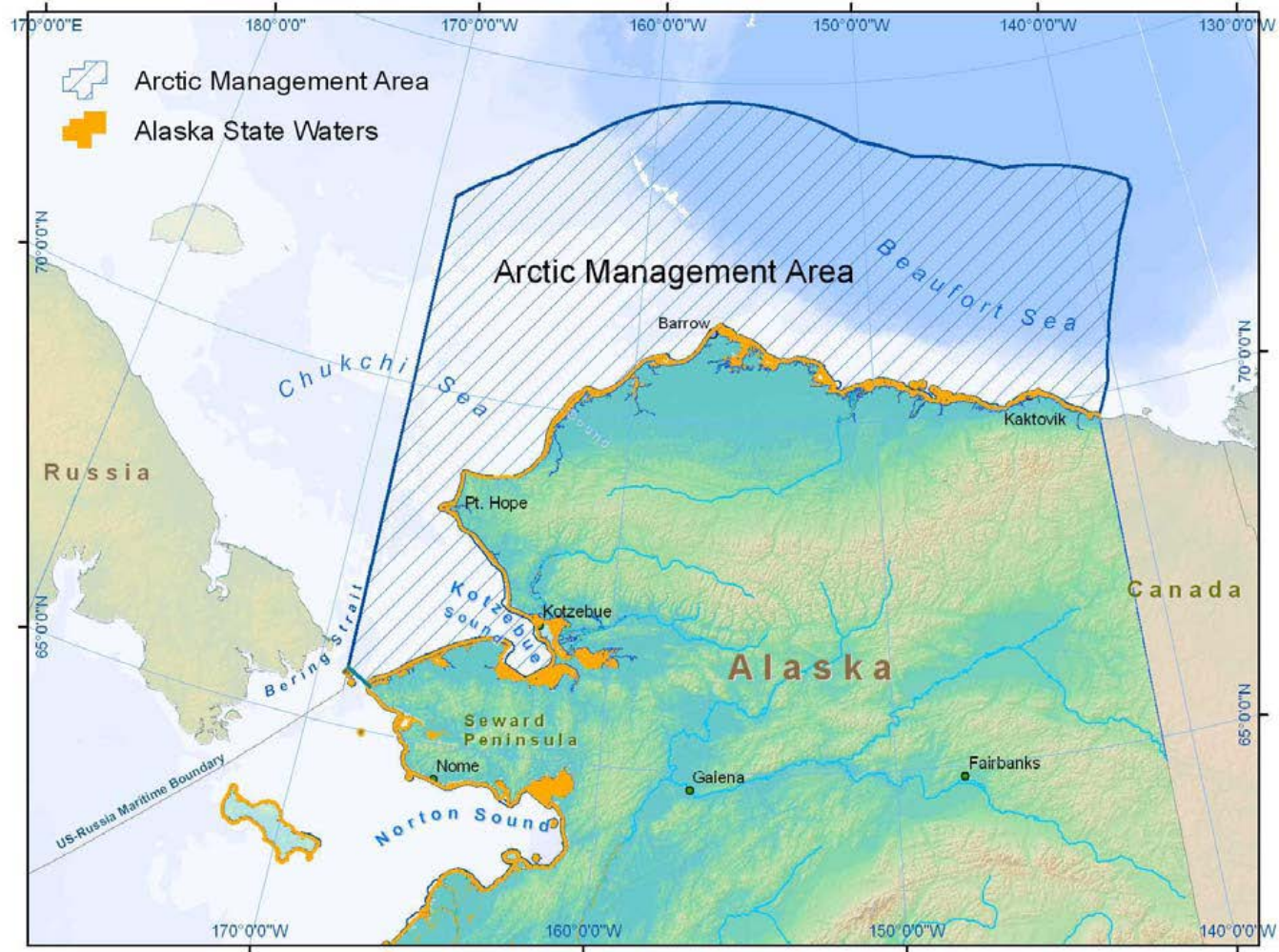
# NOAA's Integrated Ecosystem Assessment (IEA) Program

## IEAs Provide an Analytical Framework to Implement EBM

- Is a decision-support process that synthesizes and analyzes diverse data and ecosystem model outputs
- Is modular, iterative, scaleable, and adaptable
- Shares a common national framework, yet with regional variation in implementation
- Provides assessments of the ecosystem across and within multiple ocean-use sectors



# US Arctic Waters



Fisheries Management Plan for Fish Resources of the Arctic Management Area.  
North Pacific Fisheries Management Council, Anchorage, AK. August 2009



# Arctic Fishery Management Plan (2009)

- Scope: "...governs commercial fishing for all stocks of fish, including all finfish, shellfish, or other marine living resources, except commercial fishing for Pacific salmon and Pacific halibut"
- Arctic Management Policy: "...Council intends to ... adopt ... measures that **prevent unregulated fishing**, apply the Council's **precautionary, adaptive management policy** through **community-based or rights-based management**, apply **ecosystem-based management principles** that protect managed species from overfishing and **protect the health of the entire marine ecosystem**, and ... **include habitat protection and bycatch constraints**.
- Management Measures: ... prohibit commercial harvests of all fish resources of the Arctic Management Area until sufficient information is available to support the sustainable management of a commercial fishery.

# Distributed Biological Observatory (DBO)

- ❑ Location: Bering, Chukchi & Beaufort Seas
- ❑ Funding Source: NOAA, NSF
- ❑ The DBO serves as a 'change detection array', promoting standardized measurements of physical and biological parameters along a latitudinal gradient.
- ❑ Fish surveys include acoustic and bottom trawling (every 3-5 years)
- ❑ 2 new DBO regions in Beaufort
- ❑ 5-year pilot study completed, working on 10-year implementation plan
- ❑ Contact: Sue Moore, NOAA



<http://www.arctic.noaa.gov/dbo/>

# Arctic Ecosystem Integrated Survey (EIS)



Northern Bering Sea / Chukchi Sea  
Marine Research Project

**Surveys:** August – September 2012 and 2013

**Why:** To understand the distribution of marine fishes and shellfishes, and the plankton they depend upon for food, throughout the northern Bering Sea and Chukchi Sea

**Contact:** Catherine Coon, BOEM

A collaboration between:



With funding from:



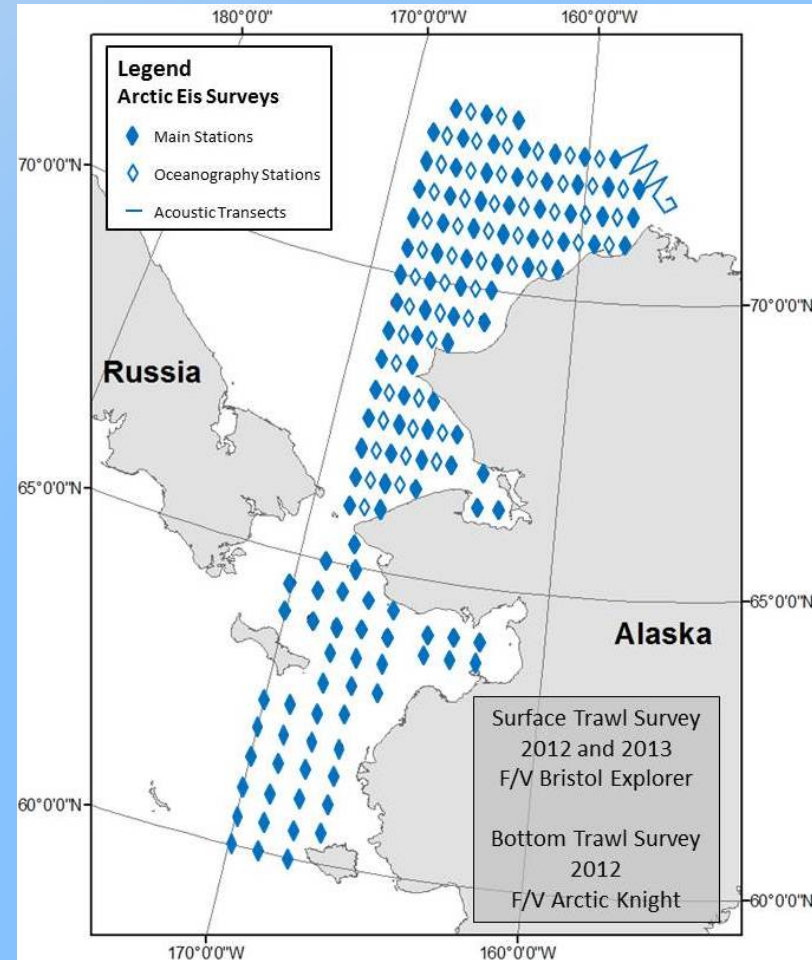
Community Coastal  
Impact Assistance Program

**CCIAP**



# Arctic Ecosystem Integrated Survey (EIS)

- ❑ **How:** Three surveys sampling a 30x30 mile grid:
- ❑ 2012 and 2013 - The F/V *Bristol Explorer*, conducts surface trawl (top 65'), mid-water trawl, and acoustic surveys to collect data on ocean circulation and physics, water chemistry, plankton, and fishes
- ❑ 2012 – The F/V Alaskan Knight, conducted bottom trawl surveys in the Chukchi Sea only to collect demersal fishes and invertebrates
- ❑ All surveys collect tissue samples and whole fish to study the biology of salmon, Arctic cod, saffron cod, snow crab, capelin, and other fish & invertebrates



# Distribution and Abundance of Age-0 Arctic and Saffron Cod: Aug – Sept, 2013

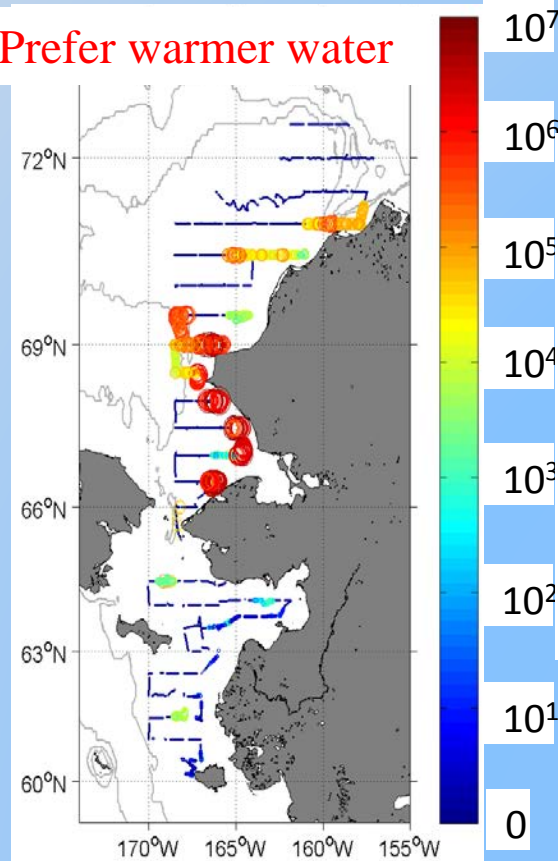
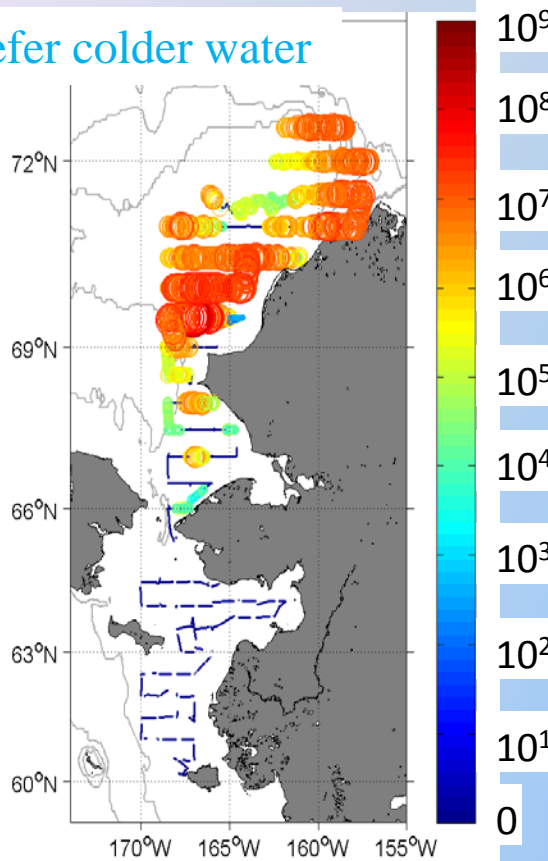


Arctic cod

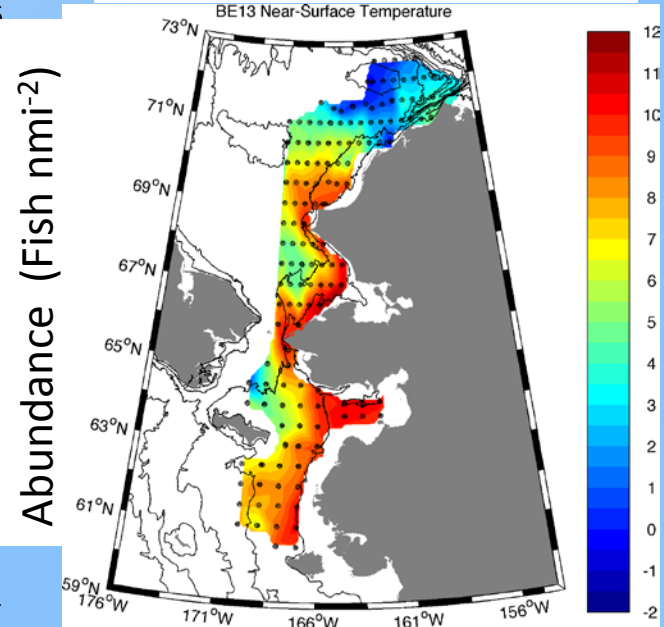
Saffron cod

Prefer colder water

Prefer warmer water

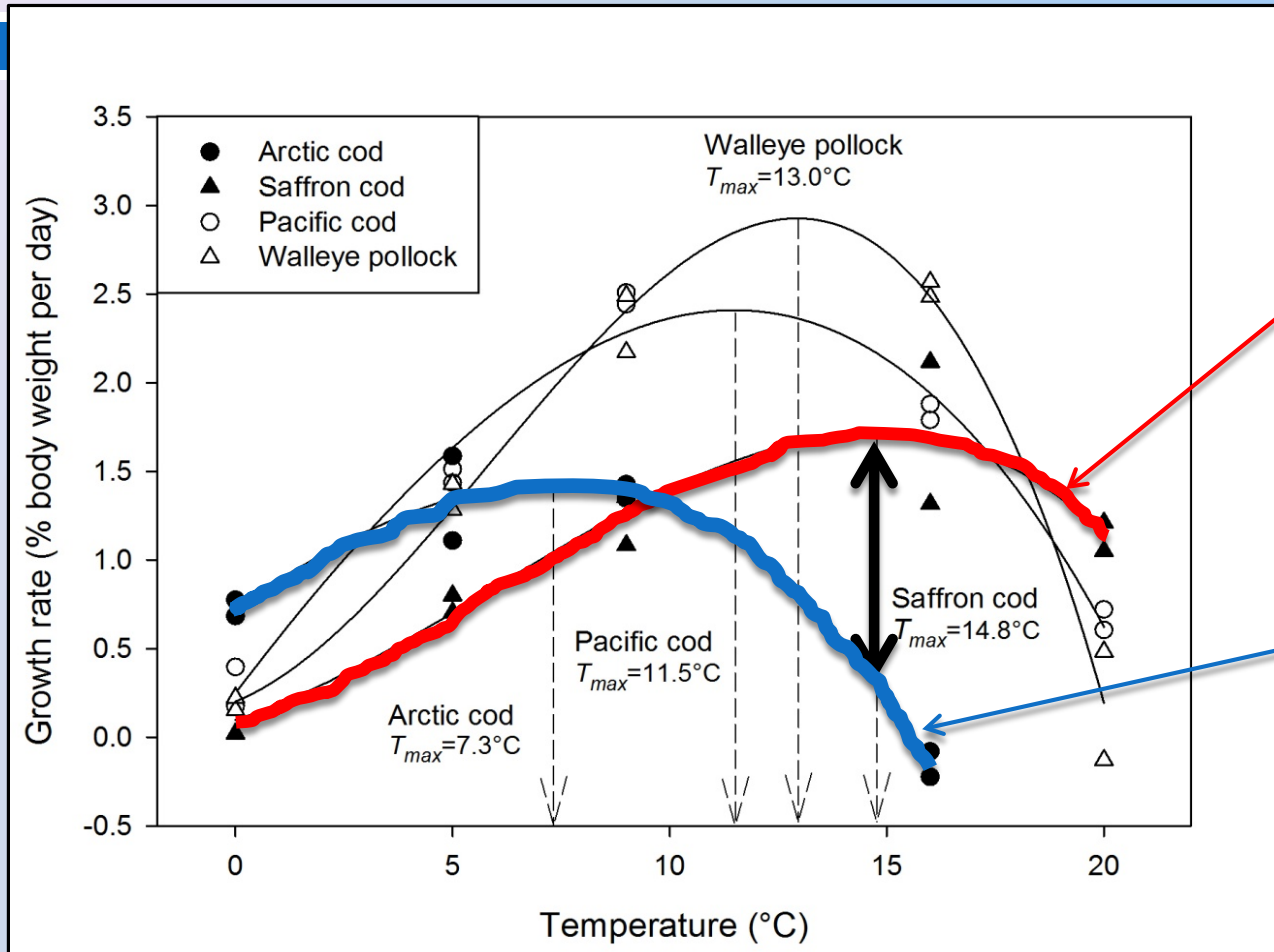


Sea Surface Temperatures





# Arctic: Growth Response in Relation to Temperature



Saffron cod

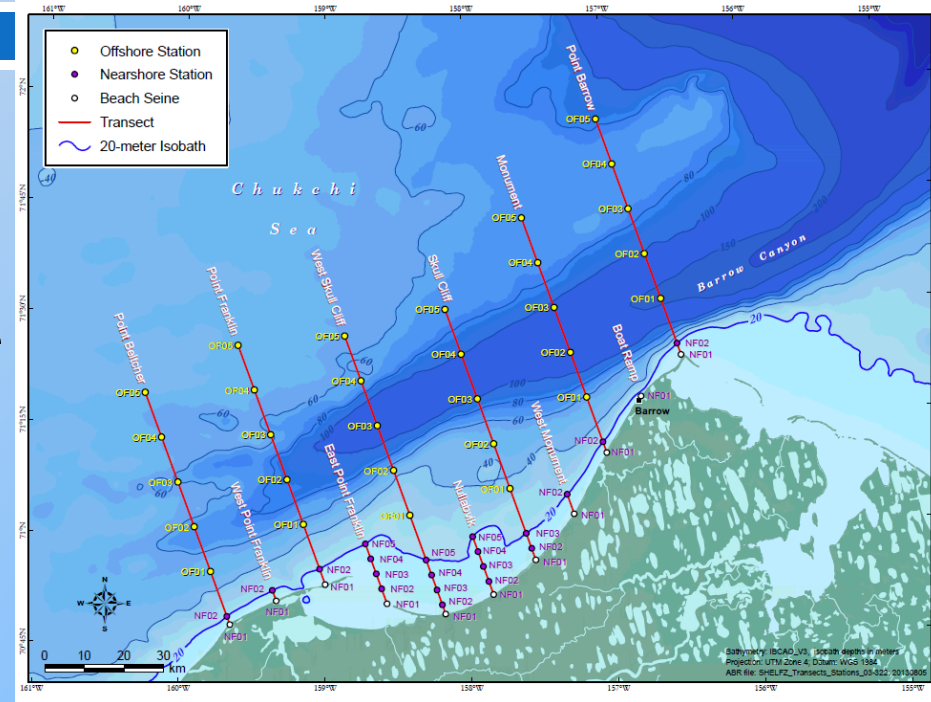


Arctic cod

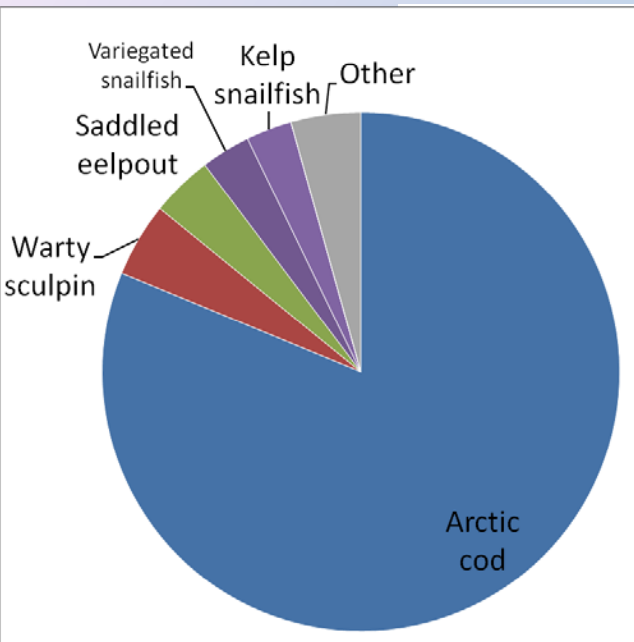
Contact: Ben Laurel, NOAA, AFSC (Newport)

# SHELFZ Shelf Habitat and EcoLOGY of Fish and Zooplankton

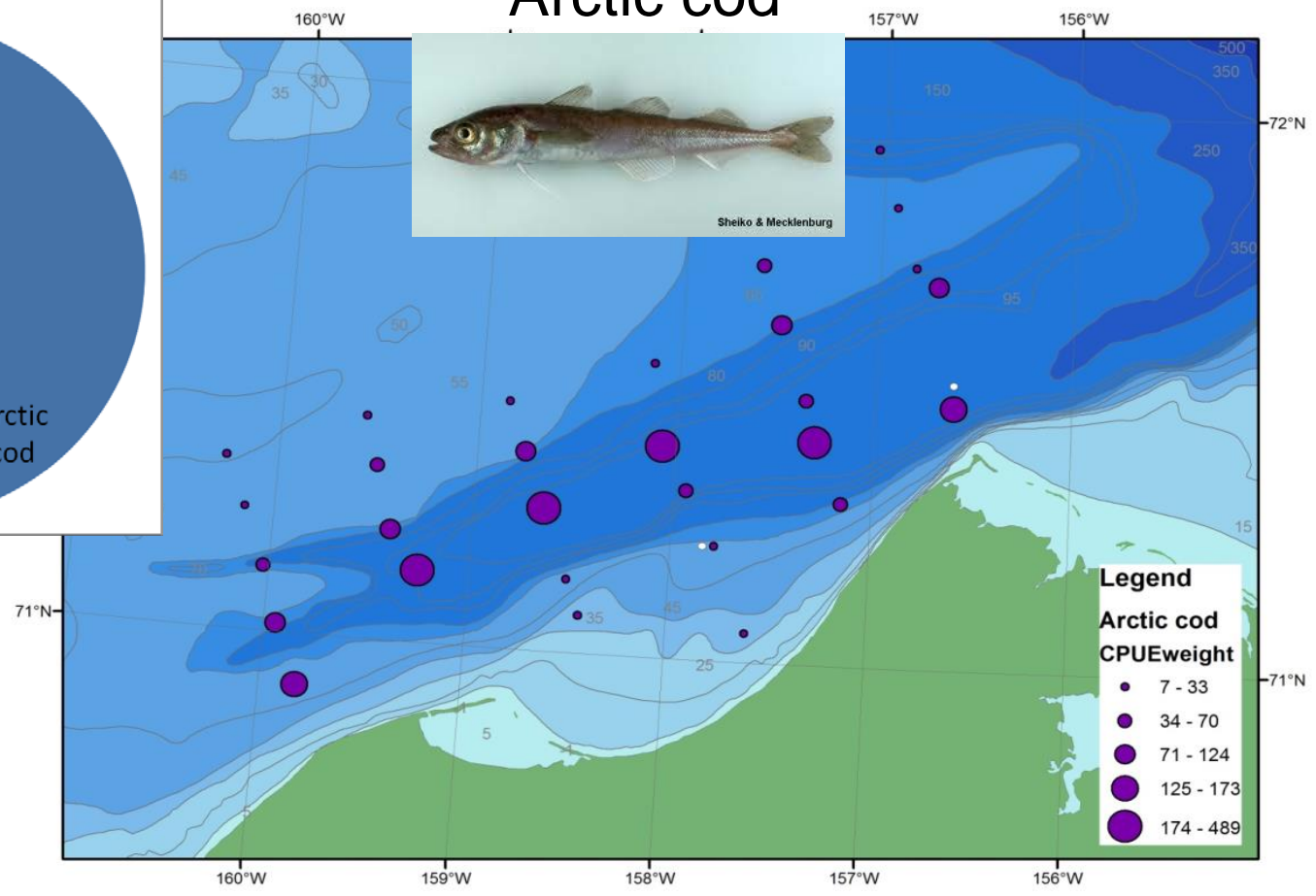
- Location: northeast Chukchi Sea
- Funding Source: CIAP-USFWS
- Institutions/agencies: North Slope Borough, Univ. Washington, Univ. Alaska, NOAA AFSC
- August – September 2013
- Objectives:
  - Collect Arctic baseline data on the habitat, abundance, distribution and species composition of zooplankton and fish.
  - Identify similarities and differences between Arctic Nearshore (< 20 m water depth) and offshore (> 20 m water depth) zooplankton and fish communities.
- Contact: Leandra de Sousa, Department of Wildlife, North Slope Borough



# SHELFZ Shelf Habitat and EcoLoGy of Fish and Zooplankton

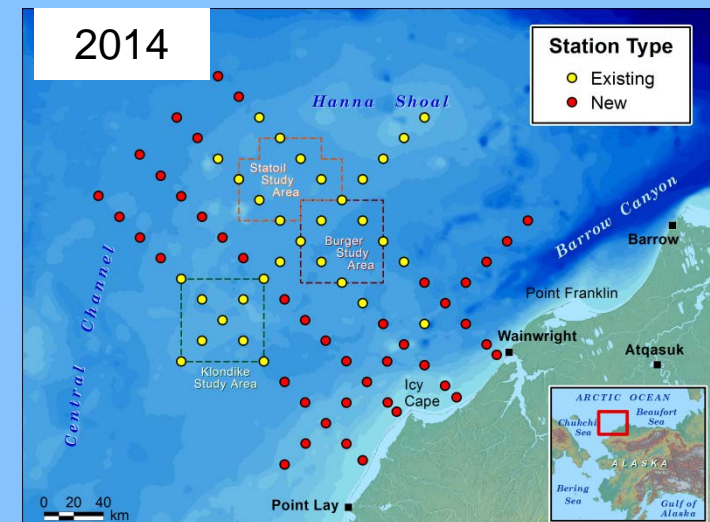
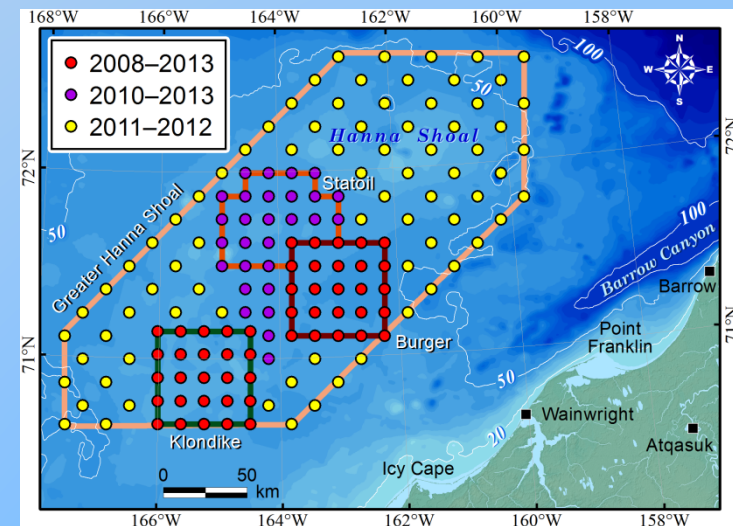


## Arctic cod

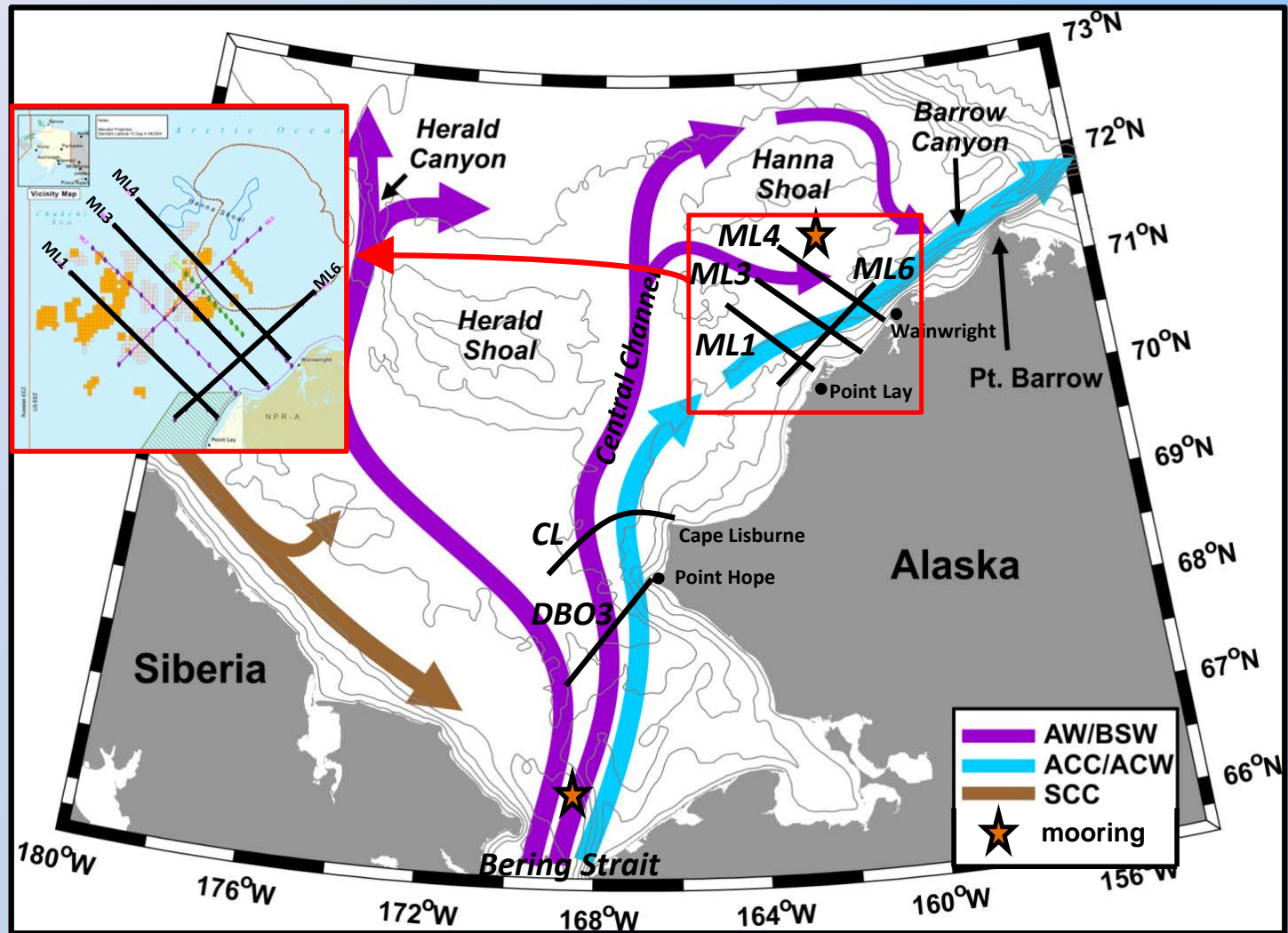


# Chukchi Sea Environmental Studies Program CESP

- ❑ 2008-2014
- ❑ Funding: ConocoPhillips, Shell Exploration, Statoil USA
- ❑ Objective: oceanography and ecology of area of potential oil and gas development
- ❑ Sampling: oceanographic stations, acoustic moorings, plankton tows, benthic grabs, benthic trawls, bird and mammal surveys
- ❑ Contact: Sheyna Wisdom, Olgoonik Fairweather LLC



# Arctic Marine Biodiversity Observing Network AMBON



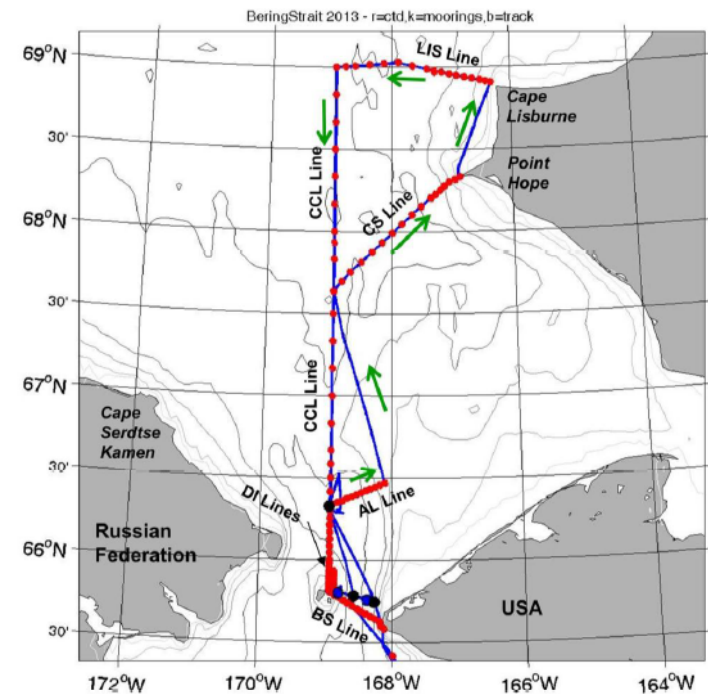
# Arctic Marine Biodiversity Observing Network

## AMBON

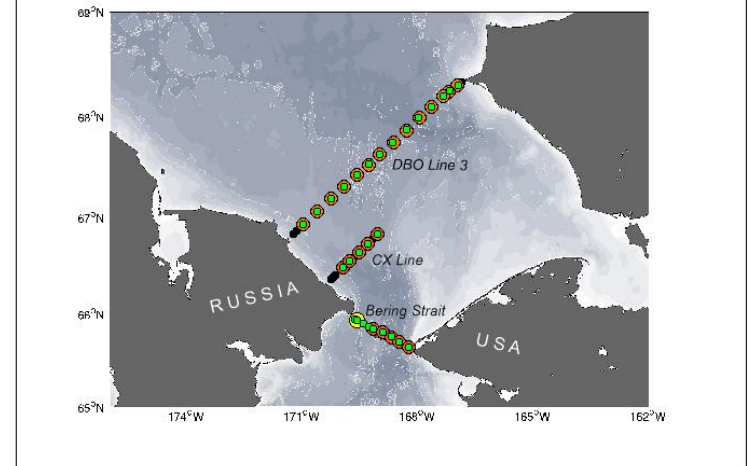
- ❑ 2015-2017
- ❑ Program managers: Cathy Coon (BOEM), Gabrielle Canonico (NOAA)
- ❑ Lead PI: Katrin Iken, UAF
- ❑ Objectives
  - ❑ close current gaps in biodiversity observation on the Chukchi shelf
  - ❑ integrate with research programs on the US Arctic shelf demonstrate at a regional level how a MBON could be developed in other places
  - ❑ link with programs on the pan-Arctic level
- ❑ Collections
  - ❑ bird and marine mammal observations
  - ❑ water column properties
  - ❑ microbes and small eukaryotic plankton, zooplankton
  - ❑ sediment characteristics and meiofauna
  - ❑ macrofauna, epifauna and fish

# Russian-American Long-term Census of the Arctic (RUSALCA)

- 2003 Memorandum of Understanding for World Ocean and Polar Regions Studies between NOAA and the Russian Academy of Sciences
- 2013-2014
  - Moorings for oceanography, bio-optics, whale acoustics, ocean acidification
  - CTD sections, water samples
  - Marine mammal observations
  - Seabird observations
- Fish surveys planned 2016
- US Contact: Kathy Crane, NOAA



RUSALCA STATIONS 2014



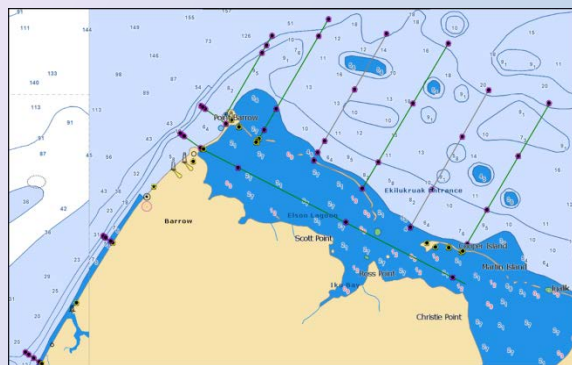
- Mooring, 2014
- Bottle Samples
- CTD
- Unsampled 2010 Stations

RUSALCA 2014  
depth in meters

# ACES – Arctic Coastal Ecosystem Survey

- Location: Chukchi, Beaufort, Elson Lagoon near Pt. Barrow
- Funding Source: BOEM/NPRB/NSB
- Study Group: near shore fishes
- Use of acoustics, trawls, beach seines, energetics, isotopes and elemental analysis to characterize distribution, abundance, diet and condition of nearshore fishes.
- Summer 2015 is final field year; 2016 and 2017 data analysis, publication

Contact: Ron Heintz, NOAA AFSC (Auk Bay)



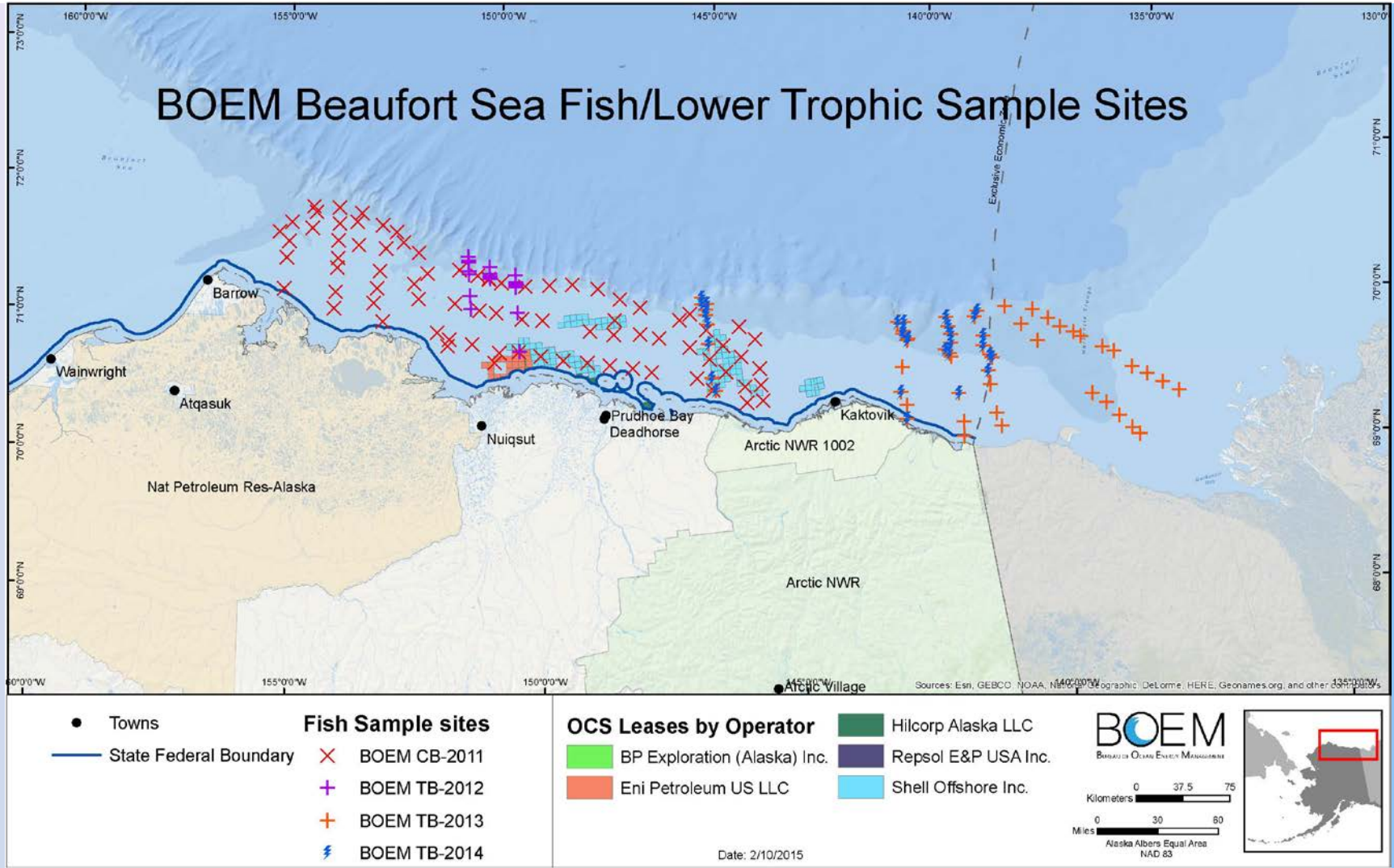


# Bureau of Ocean Energy Management (BOEM)

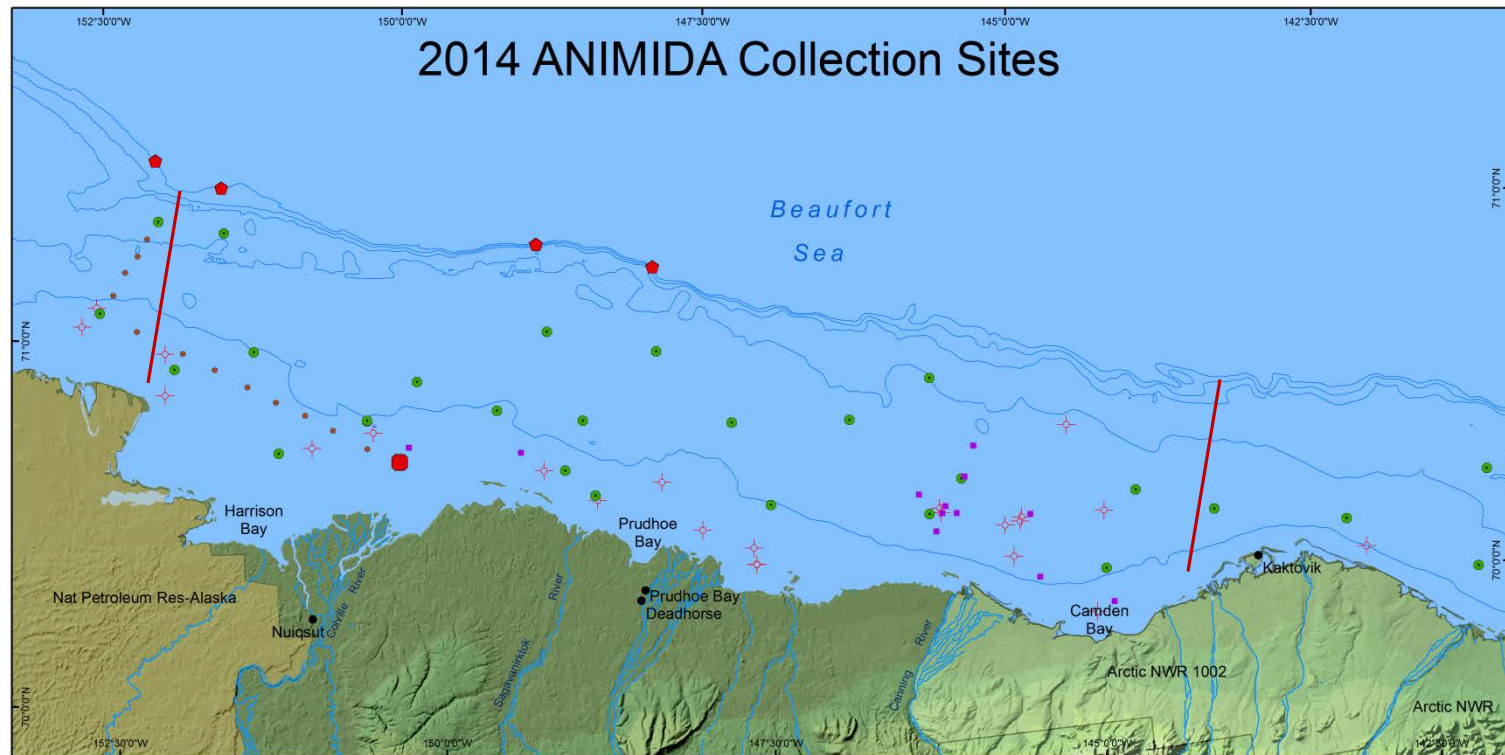
## Beaufort Sea Fish Surveys

- Institutions: BOEM, University of Alaska Fairbanks, Canada DFO
- Objectives
  - Establish a benchmark for marine fishes
  - Open water sampling, multiple years
- Transboundary surveys in 2013, 2014
- Sampling gears: bottom nets, midwater nets, oceanography, sediments and infauna
- Contact: Kate Wedemeyer, BOEM

# Bureau of Ocean Energy Management (BOEM) Beaufort Sea Fish Surveys



# BOEM Arctic Nearshore Impacts in Beaufort Sea Development Area (ANIMIDA) 2014-2017



## Legend

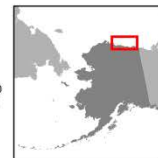
- |                       |              |                |          |
|-----------------------|--------------|----------------|----------|
| 2014 ANIMIDA Stations | Core Samples | Mooring        | DBO line |
| Biology/Chemistry     | CTD Casts    | Historic Wells |          |
| Chemistry             |              |                |          |

BOEM  
BUREAU OF OCEAN ENERGY MANAGEMENT

0 15 30  
Kilometers

0 12.5 25  
Miles

Alaska Albers Equal Area  
NAD 83



Biology: benthic grabs; phytoplankton, zooplankton nets; benthic invertebrate and fish trawls

# BOEM Marine Arctic Ecosystem Study (MARES)

- Continental shelf and slope of the Beaufort Sea between the Mackenzie River mouth (collaboration with Canadian scientists and agencies) to Barrow, Alaska
- First task orders will be initiated in 2015
- Objectives:
  - Identify and delineate areas of high biological productivity
  - Identify cultural, historic and subsistence resources which could be sensitive to human activities
  - Description of the biogeochemical-physical interactions and feedback processes in ice free and ice covered areas
  - Spatio-temporal description of ocean currents at different depths along the Beaufort continental shelf, including ice covered areas.





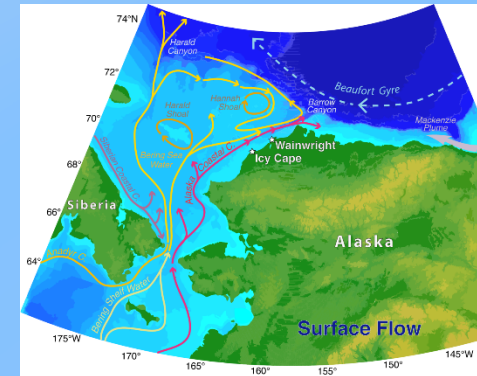
# Chukchi interdisciplinary projects



**CHAOZ:** Chukchi Acoustics, Oceanography, and Zooplankton Study (Chukchi lease area)  
2010-2015

**CHAOZ-X:** CHAOZ Extension Study (Waters feeding Hanna Shoal)  
2013-2017

**ARCWEST:** Arctic Whale Ecology Study (Waters feeding Barrow Arch)  
2012-2017

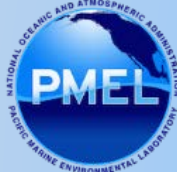


Modified from T. Weingartner

- Document the distribution and relative abundance of whales in areas of potential industrial activity
- Relate changes in those variables to oceanographic conditions, indices of potential prey density, and anthropogenic activities.

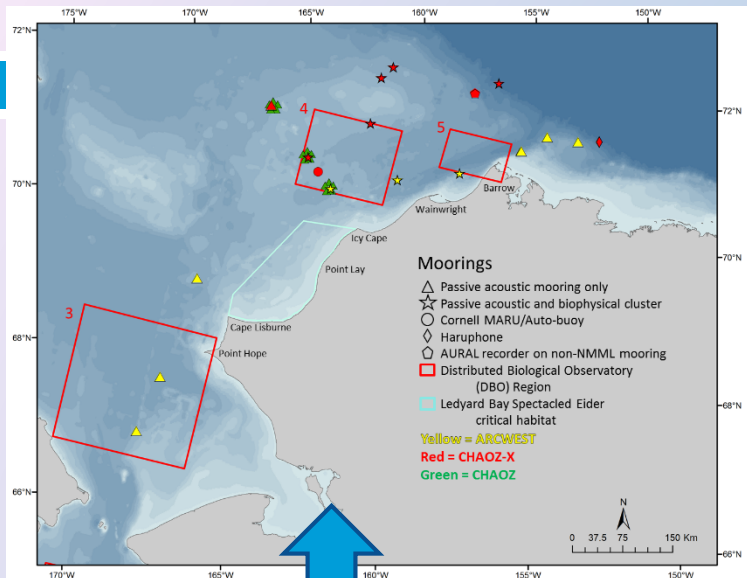


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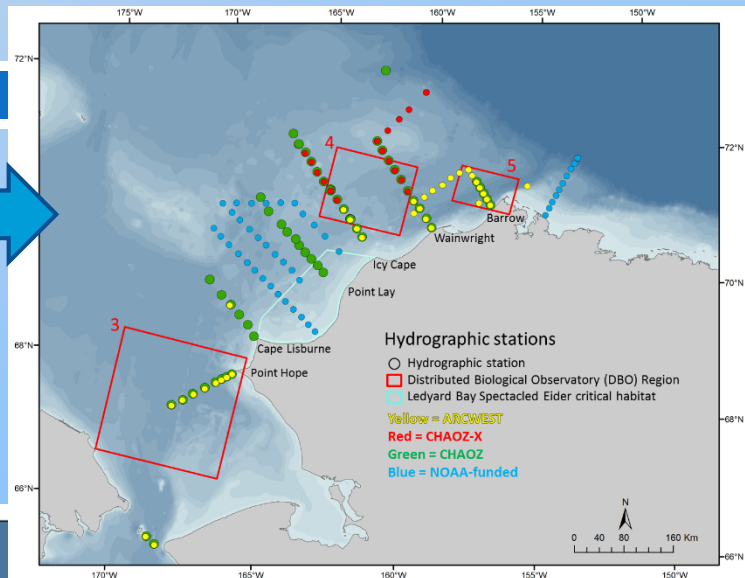
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# Project Effort (2010-2015)

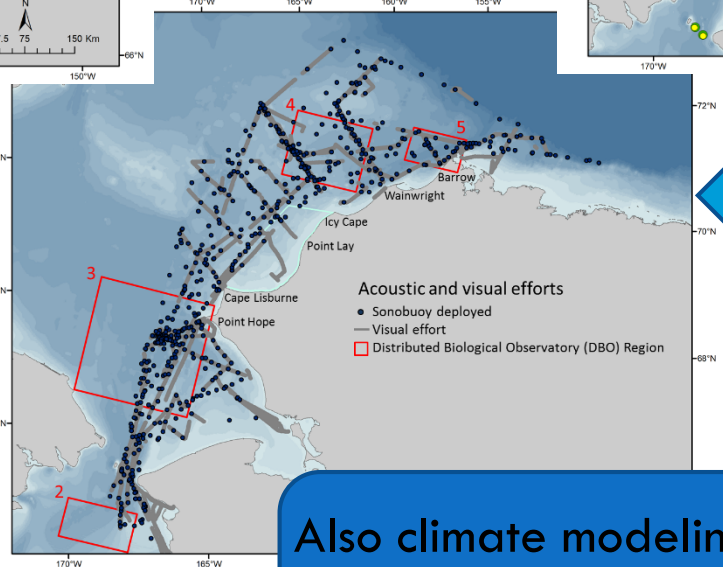


Long-term biophysical/  
passive acoustic mooring  
clusters

Biophysical  
sampling  
stations



Marine mammal  
visual surveys and  
passive acoustic  
monitoring and bird  
surveys



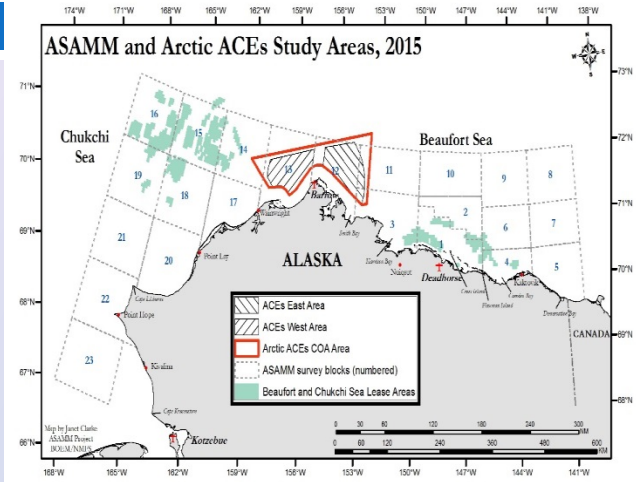
Also climate modeling, noise  
modeling, marine mammal  
tagging, and photo-id



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# Aerial Surveys of Arctic Marine Mammals (ASAMM)



- Western Beaufort Sea & Northeastern Chukchi Sea
- July – October 2015
- A 35-year time series (1979-2014)
- Daily and annual reports can be found at <http://www.afsc.noaa.gov/nmml/cetacean/bwasp/index.php>
- Collaborators: BOEM (funding agency), NMFS, NSB DWM, USFWS, USGS
- Megan.Ferguson@noaa.gov, Janet.Clarke@leidos.com

## ASAMM Objectives

- Describe the annual migration of bowhead whales across the Alaskan Arctic, significant inter-year differences, and long-term trends in the spatial distribution and timing of the migration
- Document relative abundance, spatial and temporal distribution, and behavior of marine mammals (cetaceans, ice seals, walruses, and polar bears)
- Provide an objective wide-area context for understanding marine mammal ecology in the Alaskan Arctic, to help inform management decisions and interpret results of other small-scale studies

# Ecology of ice-associated seals

- Bering Okhotsk Seal Survey, 2012-2013
  - Aerial survey, spring
  - Estimate abundance of ribbon, spotted, bearded & ringed seals
  - NOAA National Marine Mammal Laboratory, State Research and Design Institute for Fishing Fleet (Giprorybflot)
  - Funding: BOEM (US portion)
- Satellite-linked tagging, Bering Sea, 2014
  - Timing of hauling out, dive behavior & seasonal movements
  - Ribbon & spotted seals
- Contact: Michael Cameron, NOAA NMML





# Data synthesis projects

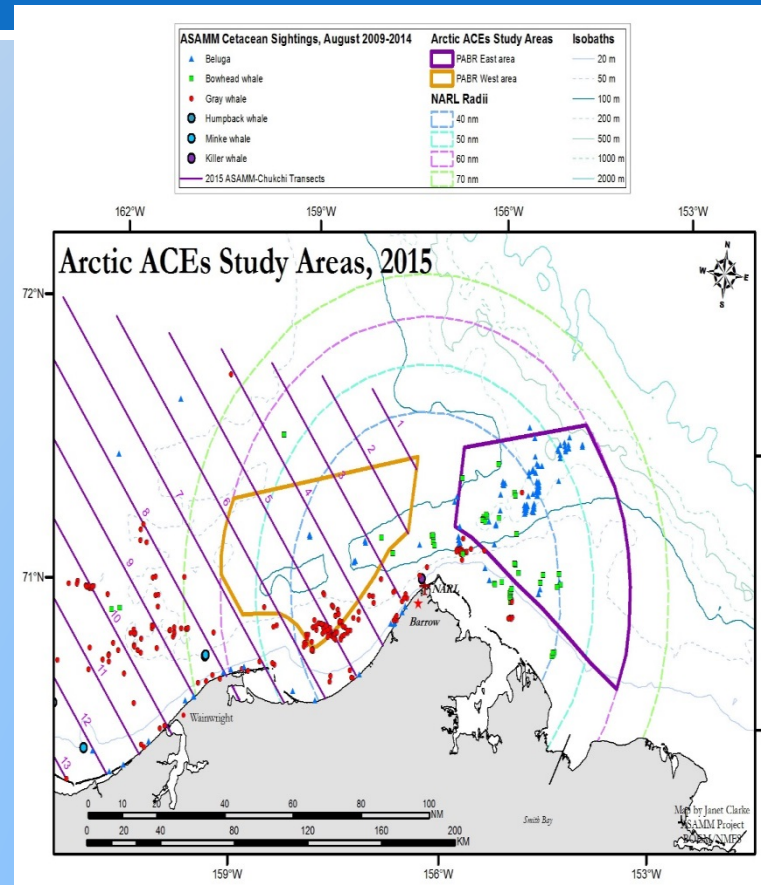
- Synthesis of Arctic Research (SOAR) – Physics to marine mammals in the Pacific Arctic (BOEM)
- Recent and Historical Distribution and Ecology of Demersal Fishes in the Chukchi Sea Planning Area (OCS Study BOEM 2012-073)
- Retrieval of Historical Arctic Fisheries Survey Data (OCS Study BOEM 2012-084)
- Ecological Analysis of Western Beaufort Sea Data (OCS Study BOEM 2014-014)

# Extra slides

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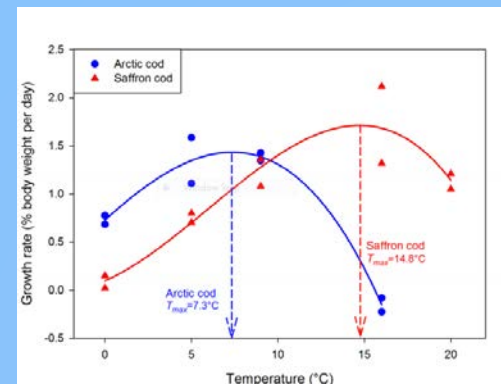
# Arctic Aerial Calibration Experiments

- Northeastern Chukchi Sea and Western Beaufort Sea
- ~August 13-30, 2015
- Overarching objective of Arctic ACEs is to conduct a 3-way comparison of large whale data and derived statistics from the following:
  - Observers in a manned aircraft
  - Digital photographs from cameras mounted in a manned aircraft
  - Digital photographs from cameras mounted to an UAS
- Collaborators: BOEM, NOAA, Navy, Shell
- [Robyn.Angliss@noaa.gov](mailto:Robyn.Angliss@noaa.gov),  
[Megan.Ferguson@noaa.gov](mailto:Megan.Ferguson@noaa.gov)



# Arctic cod in a warming environment

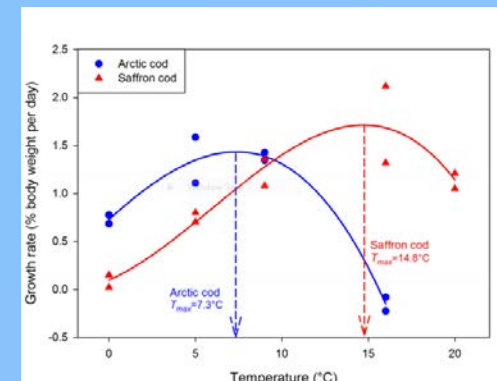
- ❑ Location: Newport Oregon, Prudhoe Bay
- ❑ Funding Source: NPRB
- ❑ Laboratory study establishing thermal limits of arctic cod and saffron cod
- ❑ 2015 lab work on egg/larval stages
- ❑ Contact: Ben Laurel, NOAA AFSC (Newport)



# Arctic cod in a warming environment

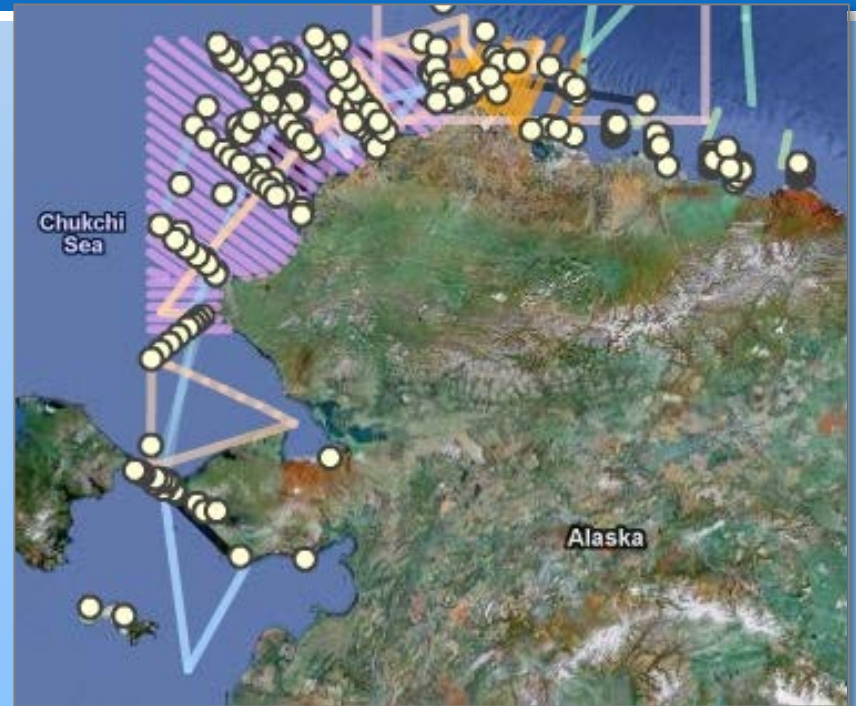
## Publications

- Laurel et al. Temperature-dependent growth and behavior of juvenile Arctic cod and co-occurring North Pacific gadids, accepted, Polar Biology
- Copeman, Saffron cod lipid/fatty acids, submitted, Polar Biology
- Copeman, Arctic cod lipid/fatty acids, submitted, Polar Biology



# Synthesis of Arctic Research (SOAR) - Physics to marine mammals in the Pacific Arctic

- ❑ Location: Pacific Arctic sector
- ❑ Funding Source: BOEM
- ❑ Principle Investigators: S. Moore & P. Stabeno (NOAA)
- ❑ Study Group: Comprehensive
- ❑ Description: NOAA-led multidisciplinary group of Arctic scientists working together to integrate information from completed and ongoing marine research in the Pacific Arctic.
- ❑ Contact: Sue Moore, NOAA



<http://www.arctic.noaa.gov/soar>

# SHELFZ Shelf Habitat and Ecology of Fish and Zooplankton

Nearshore (< 20 m)

R/V *Ukpik* (50 feet)



- 1) CTD
- 2) Tucker Trawl and CalVET
- 3) Plumb staff beam trawl (5 m footrope)
- 4) Midwater trawl (Alluette 6x4 m)
- 5) Fisheries Acoustics
- 6) Beach Seine

Offshore (> 20 m)

F/V *Alaska Knight* (143 feet)



- 1) CTD
- 2) Tucker Trawl and CalVET
- 3) 83–112 Eastern otter trawl (34 m footrope)
- 4) Midwater trawl (Marinovich 6x4 m)
- 5) Fisheries Acoustics