



NOAA
FISHERIES

AFSC

U.S. Arctic Research Activities

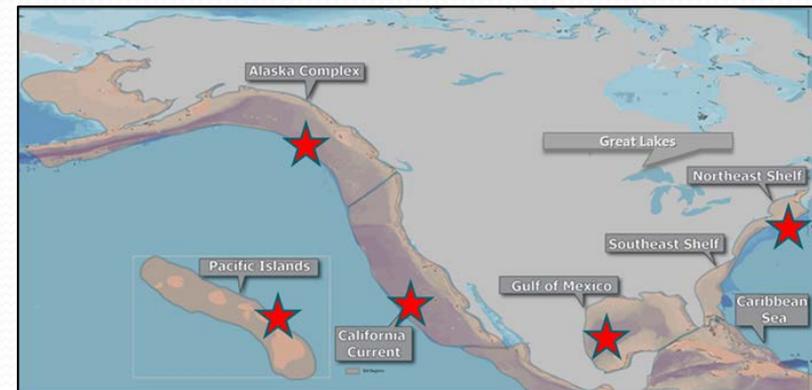
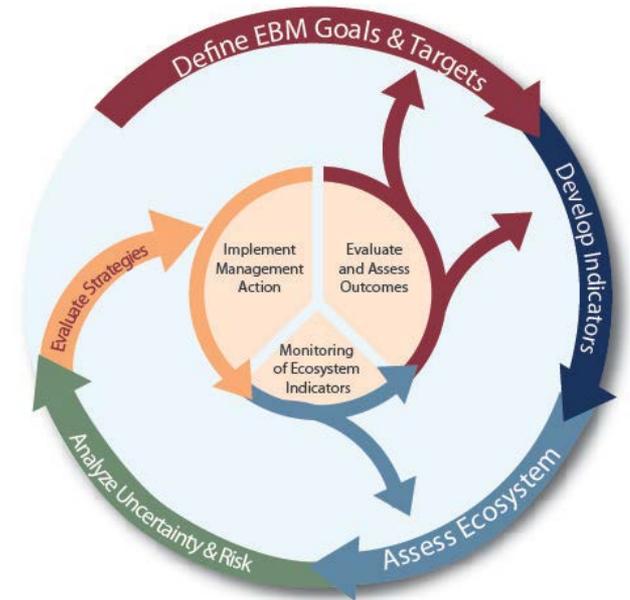
Prepared by: Libby Logerwell

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

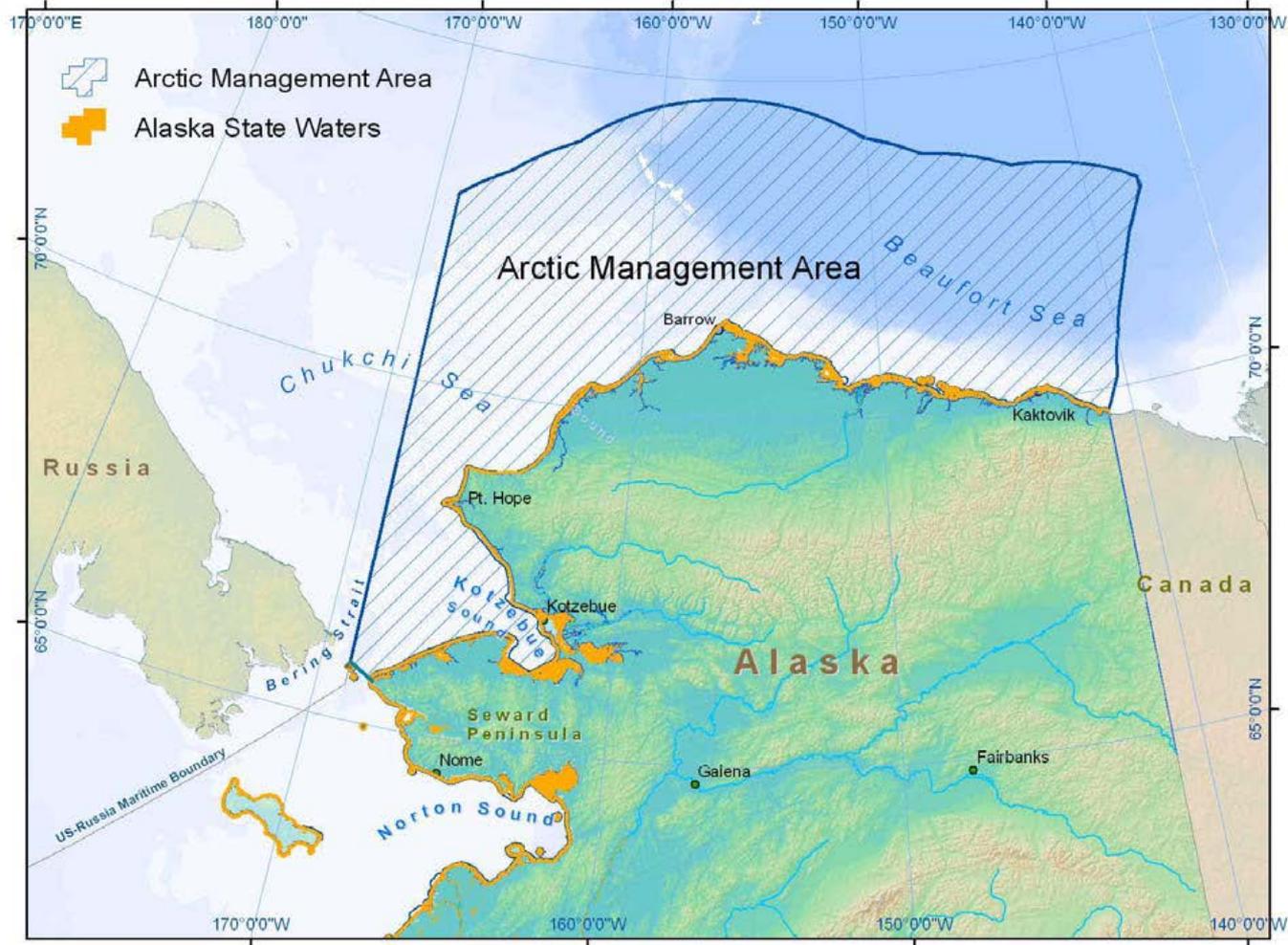
NOAA's Integrated Ecosystem Assessment (IEA) Program

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:

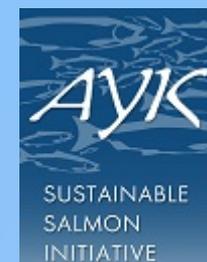


With funding from:



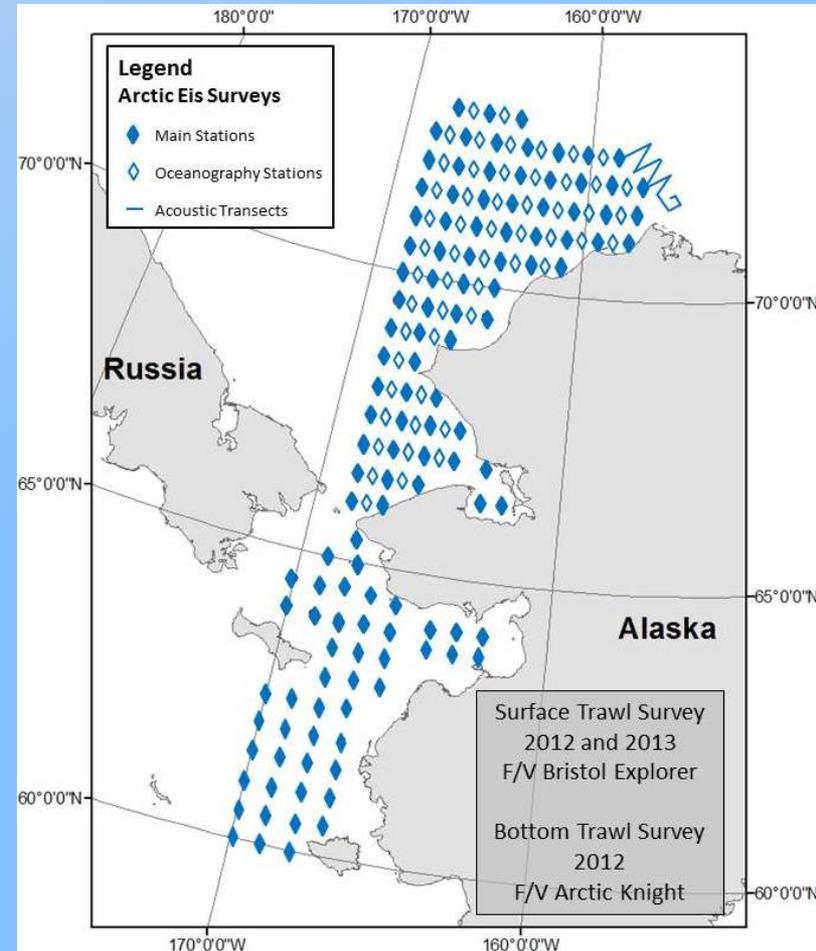
Community Coastal
Impact Assistance Program

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

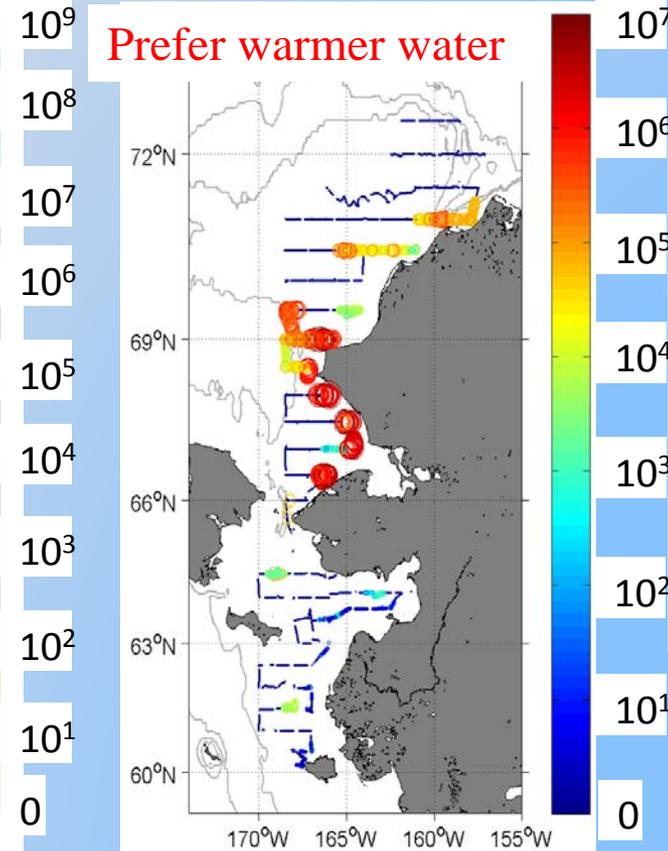
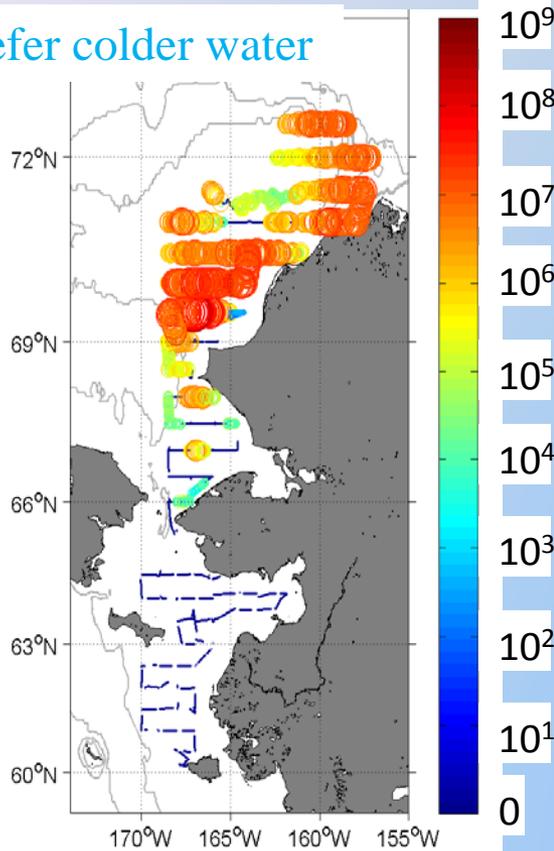


Arctic cod

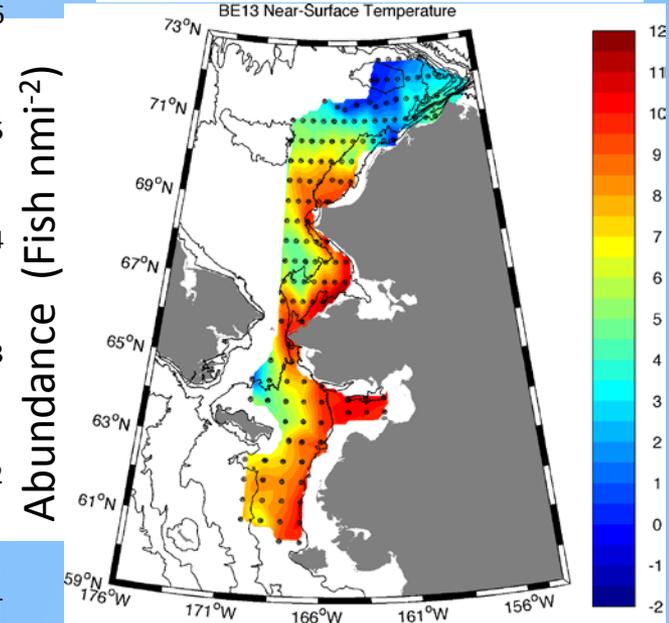
Prefer colder water

Saffron cod

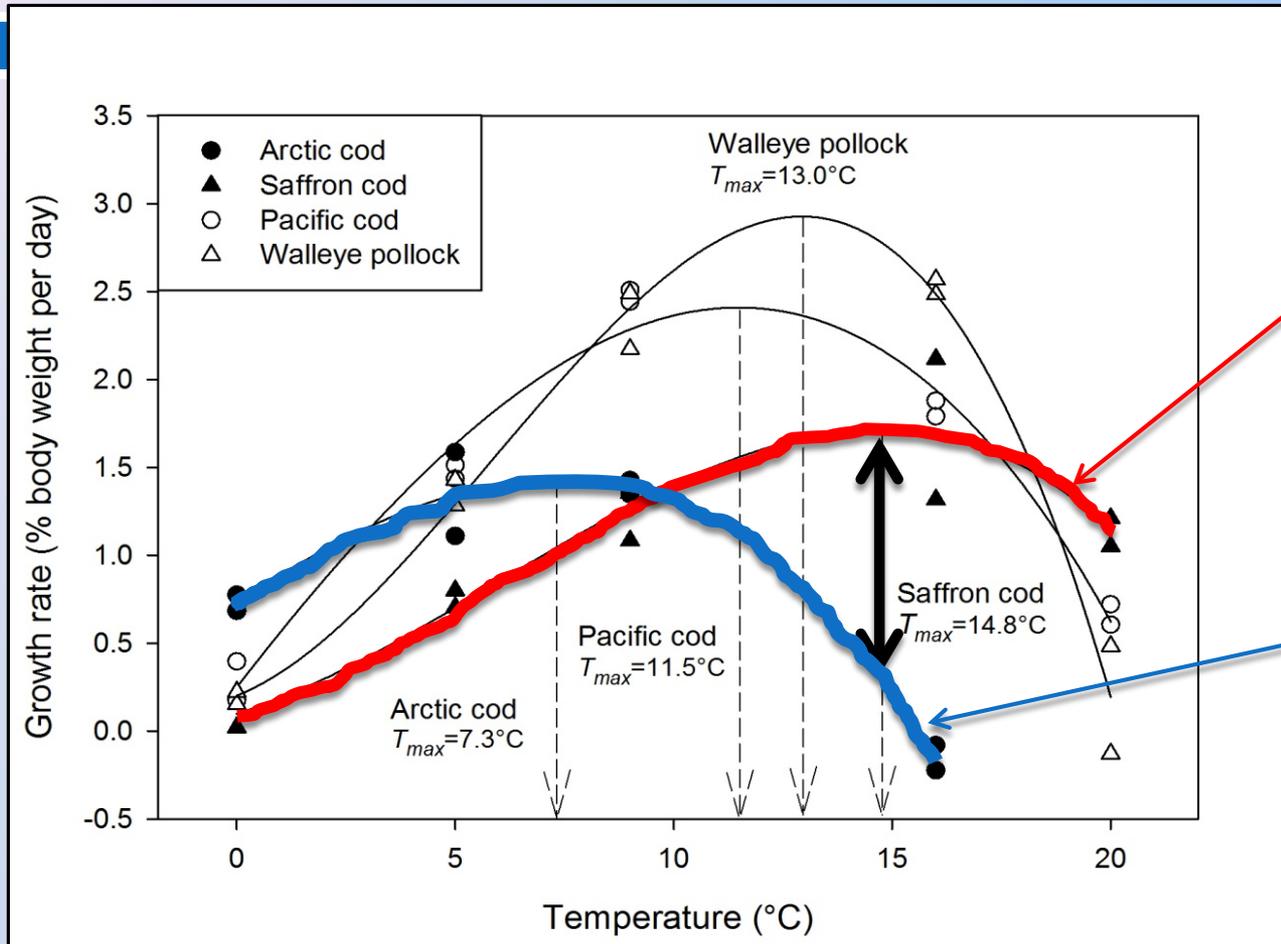
Prefer warmer water



Sea Surface Temperatures



Arctic: Growth Response in Relation to Temperature



Saffron cod

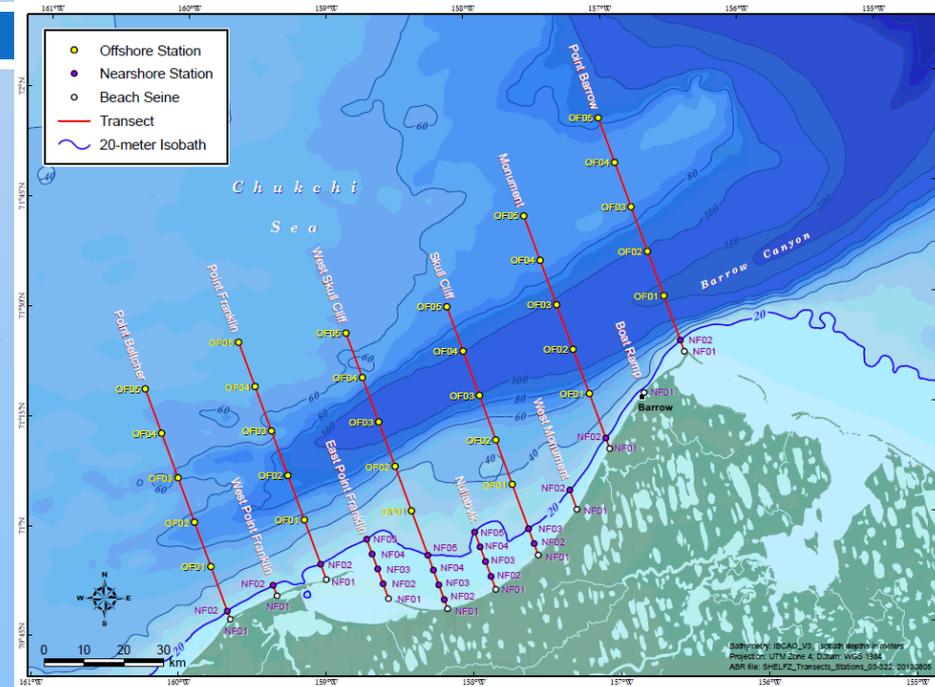


Arctic cod

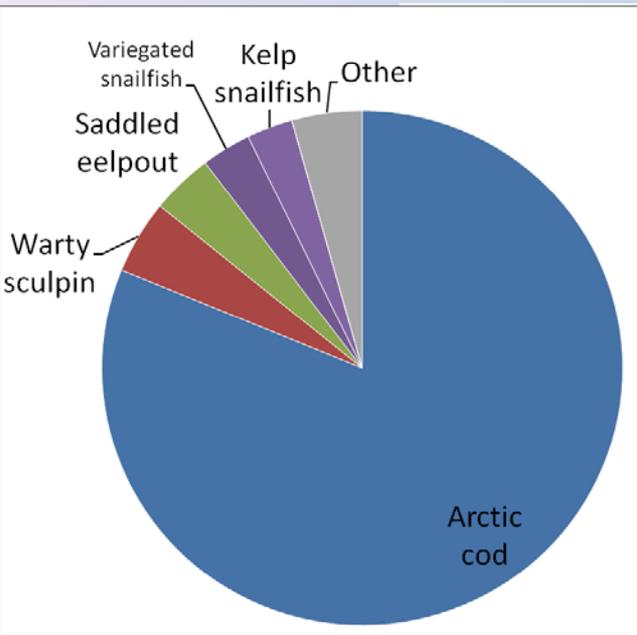
Contact: Ben Laurel, NOAA, AFSC (Newport)

SHELFZ Shelf Habitat and EcoLOGY of Fish and Zooplankton

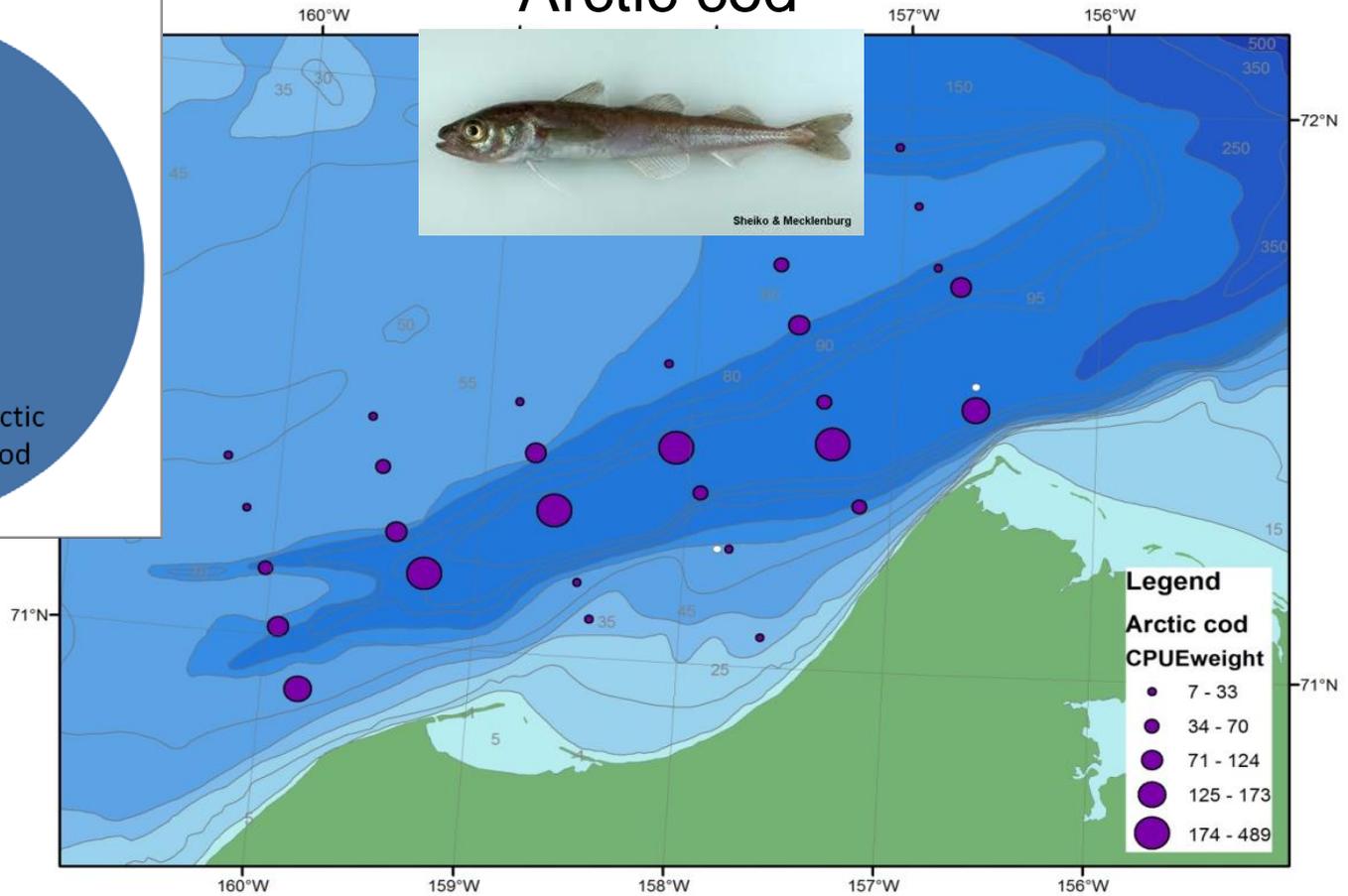
- Location: northeast Chukchi Sea
- Funding Source: CIAP-USFWS
- Institutions/agencies: North Slope Borough, Univ. Washington, Univ. Alaska, NOAA AFSC
- August – September 2013
- Objectives:
 - Collect Arctic baseline data on the habitat, abundance, distribution and species composition of zooplankton 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

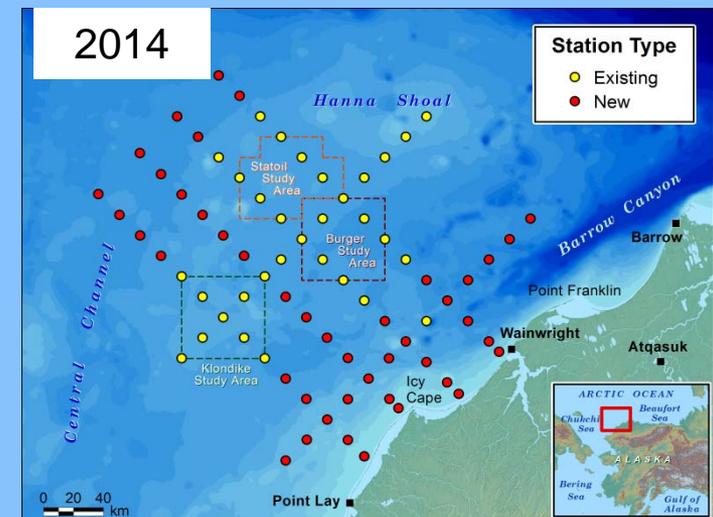
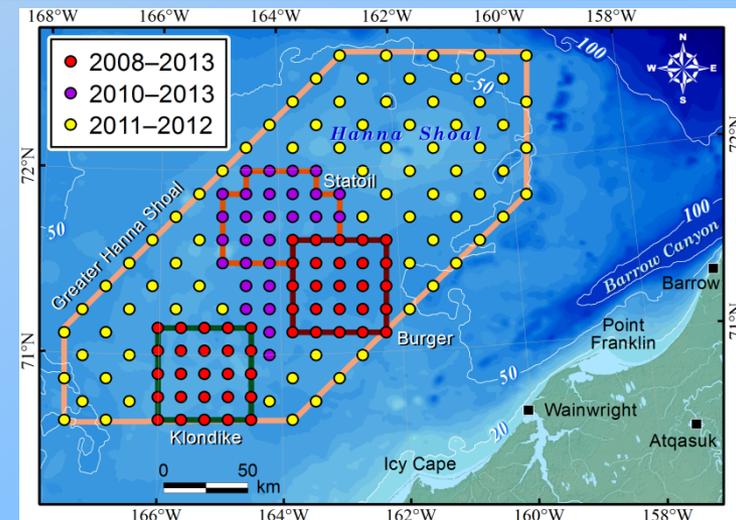


Arctic cod

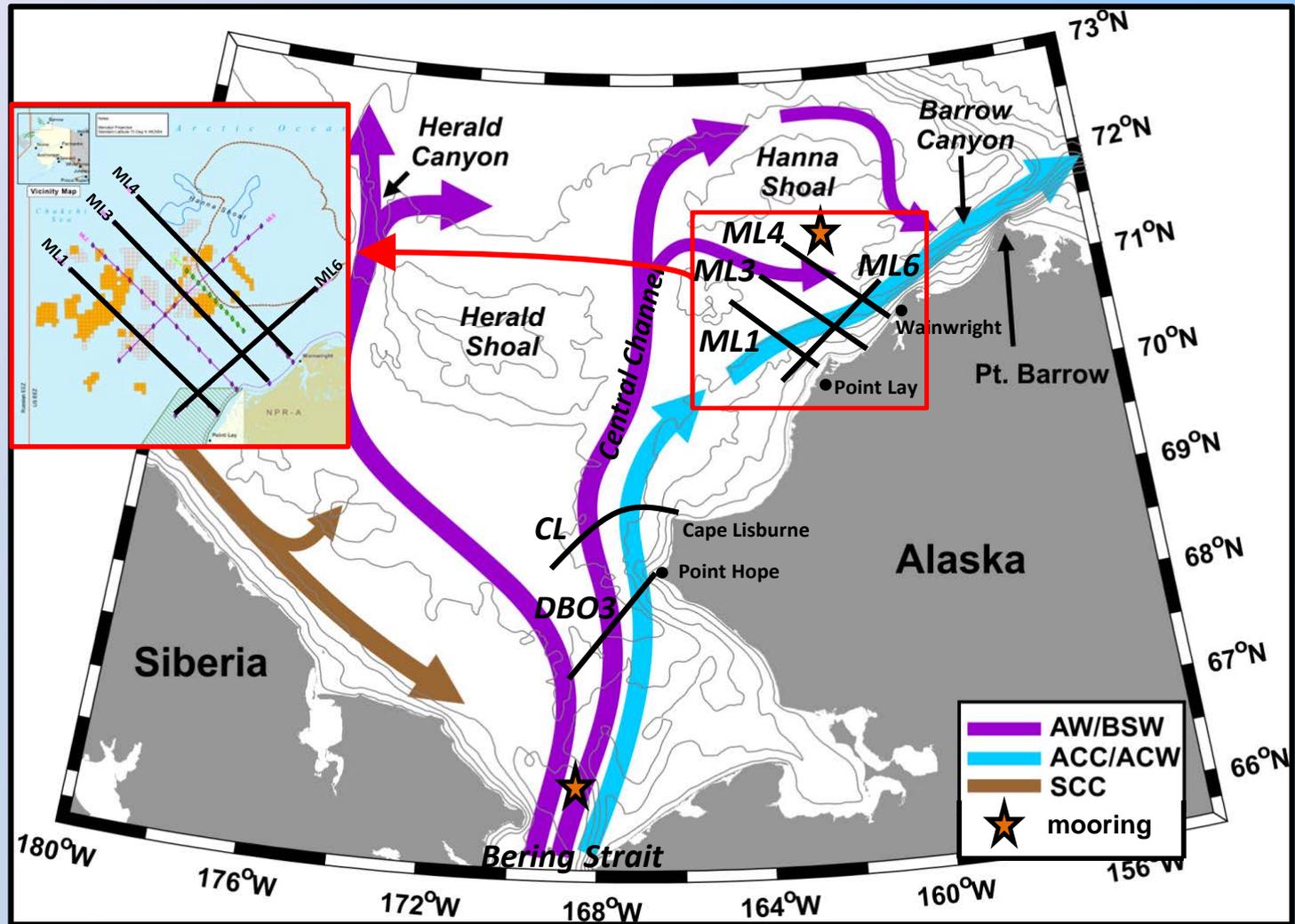


Chukchi Sea Environmental Studies Program CESP

- ❑ 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



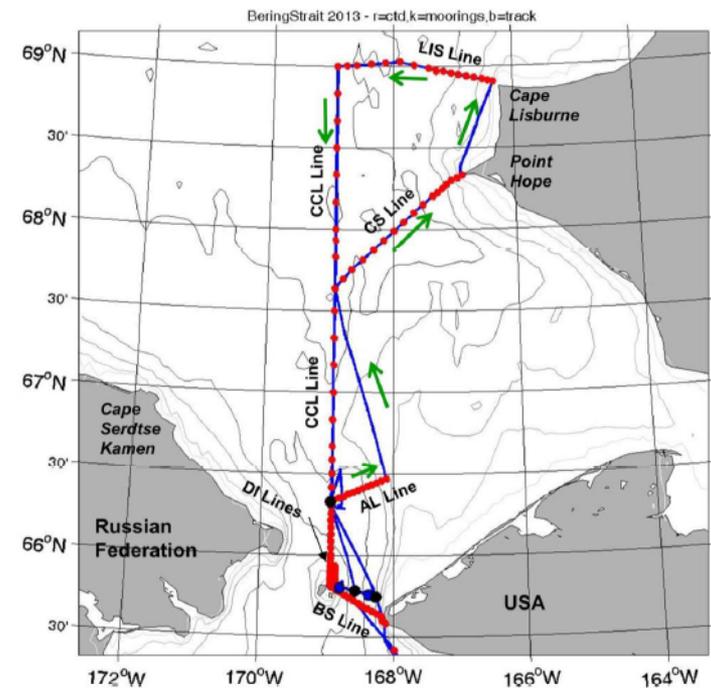
Arctic Marine Biodiversity Observing Network

AMBON

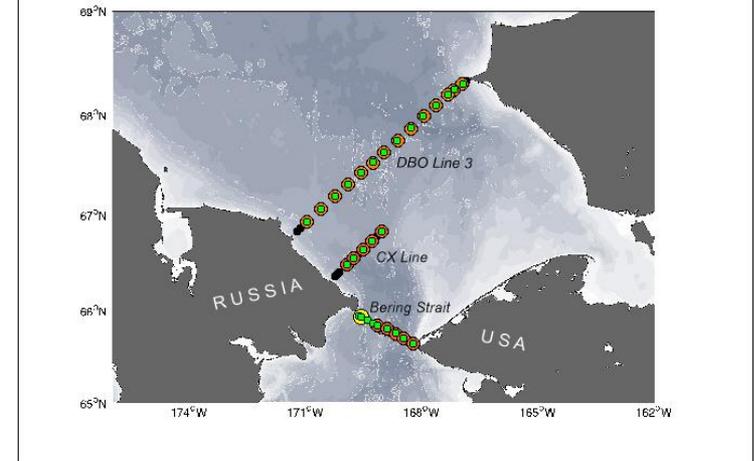
- ❑ 2015-2017
- ❑ Program managers: Cathy Coon (BOEM), Gabrielle Canonico (NOAA)
- ❑ Lead PI: Katrin Iken, UAF
- ❑ Objectives
 - ❑ close current gaps in biodiversity observation on the Chukchi shelf
 - ❑ integrate with research programs on the US Arctic shelf demonstrate at a regional level how a MBON 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

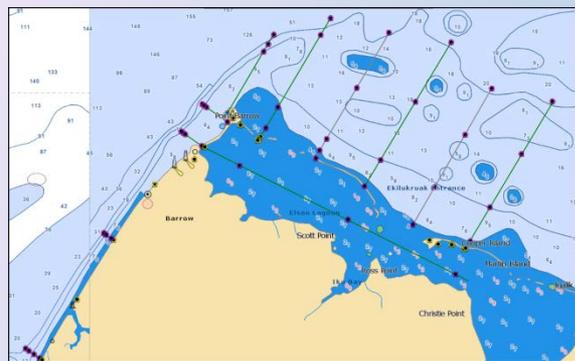


RUSALCA 2014 depth in meters

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

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)

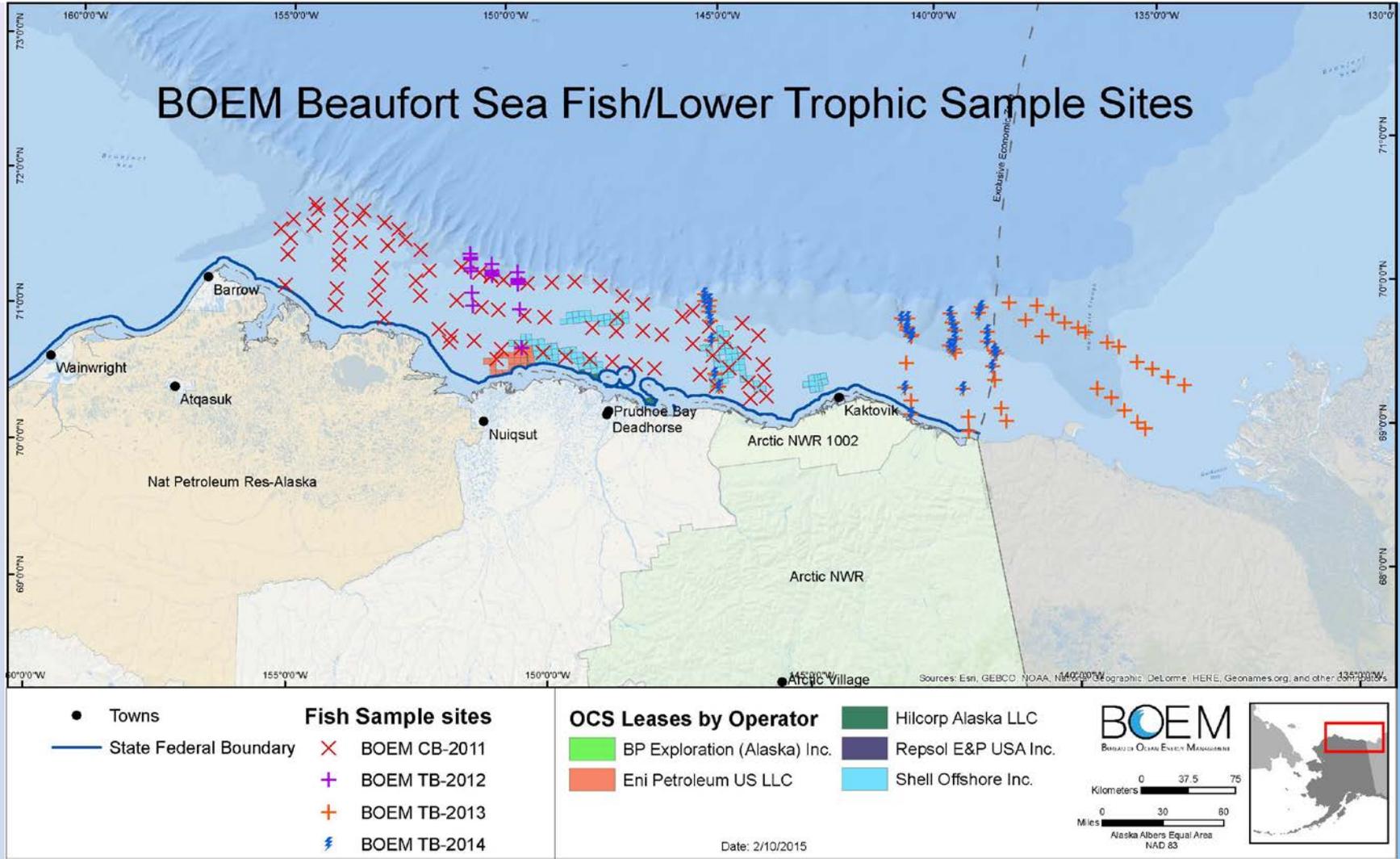


Bureau of Ocean Energy Management (BOEM)

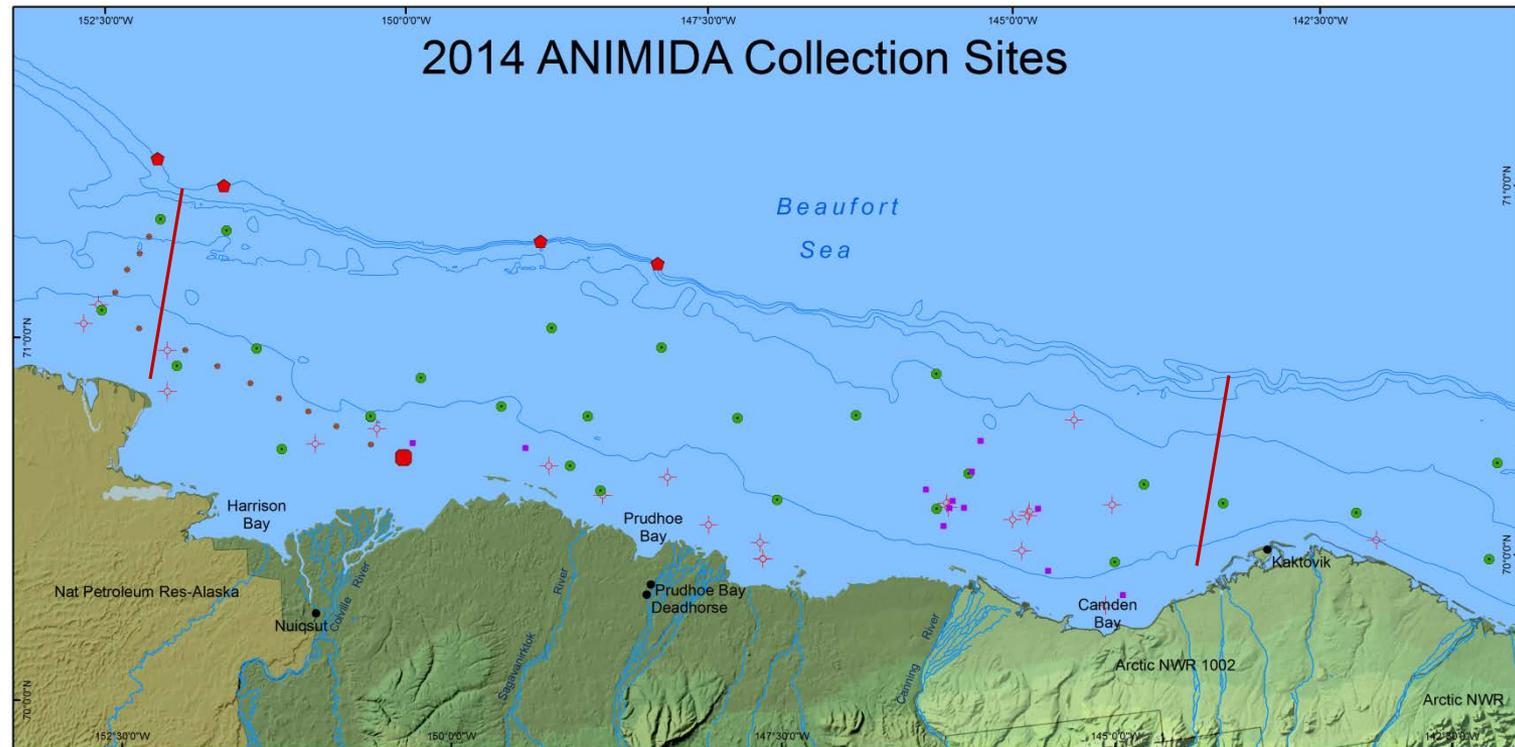
Beaufort Sea Fish Surveys

- 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

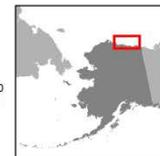
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|-----------------------|--------------|----------------|----------|
| 2014 ANIMIDA Stations | Core Samples | Mooring | DBO line |
| Biology/Chemistry | CTD Casts | Historic Wells | |
| Chemistry | | | |

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.





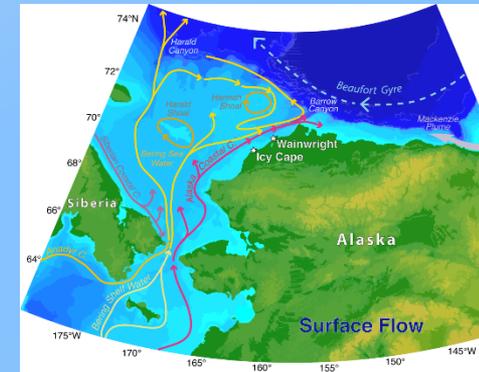
Chukchi interdisciplinary projects



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.

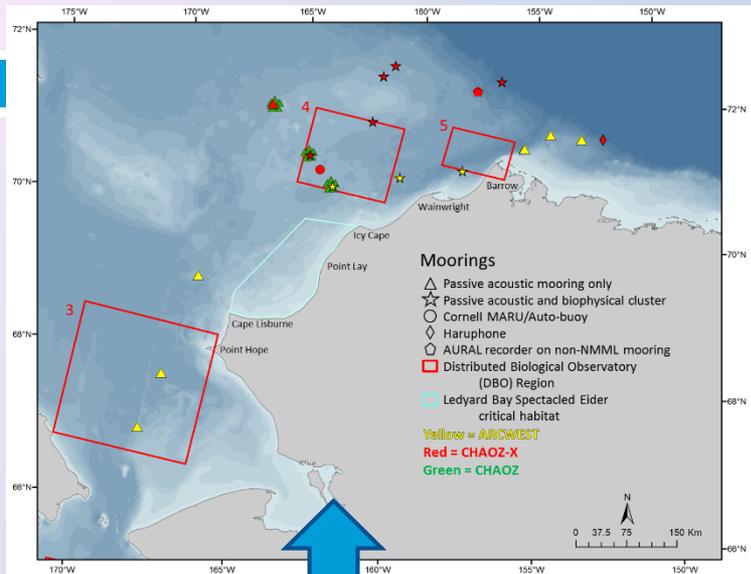


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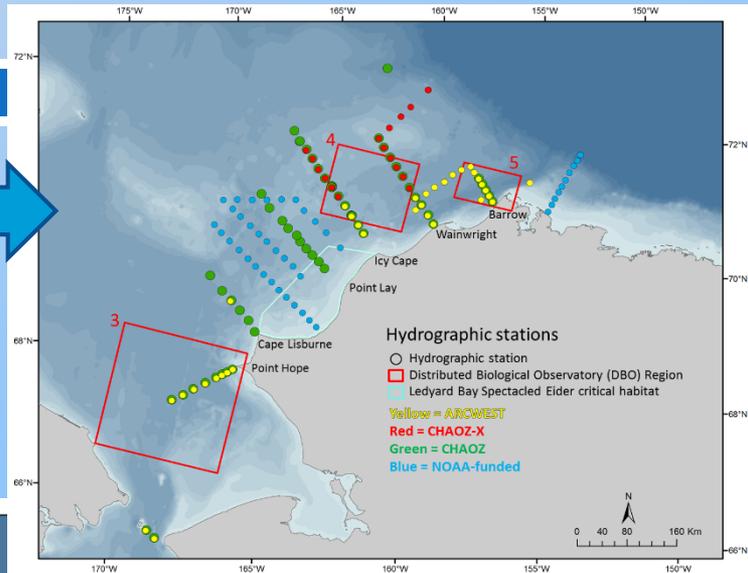
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Project Effort (2010-2015)

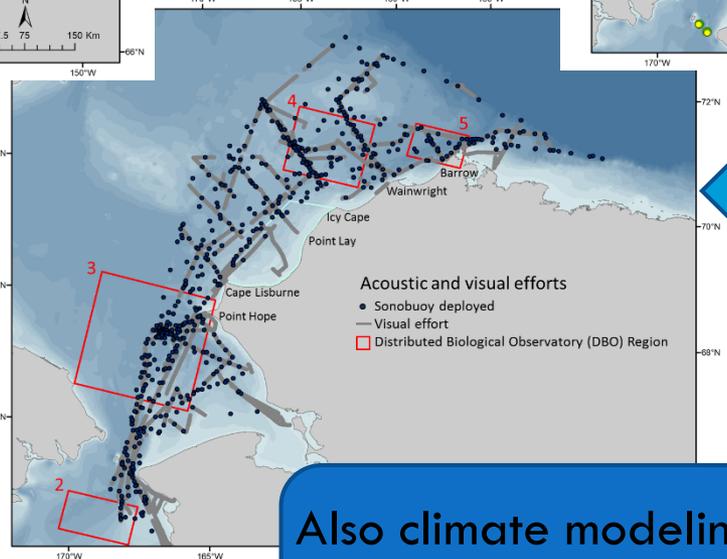


Long-term biophysical/
passive acoustic mooring
clusters

Biophysical
sampling
stations



Marine mammal
visual surveys and
passive acoustic
monitoring and bird
surveys



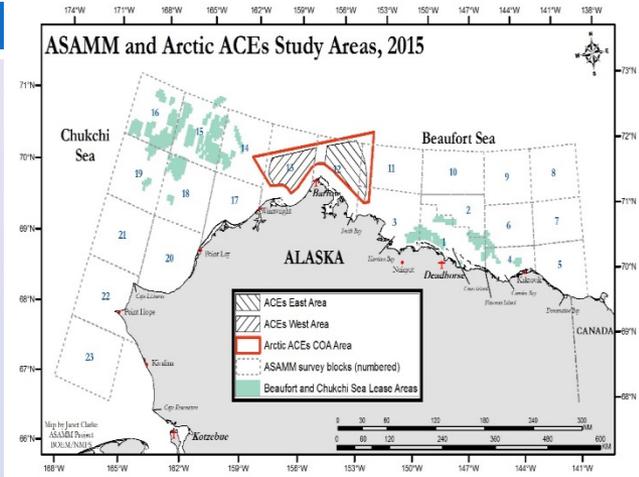
Also climate modeling, noise
modeling, marine mammal
tagging, and photo-id



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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

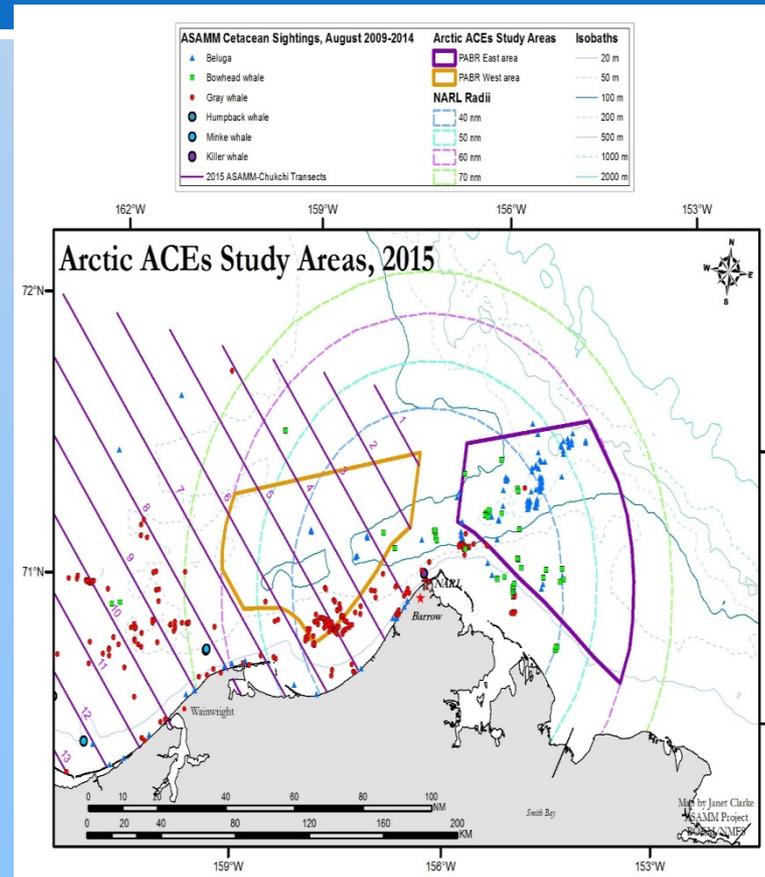
Data synthesis projects

- 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

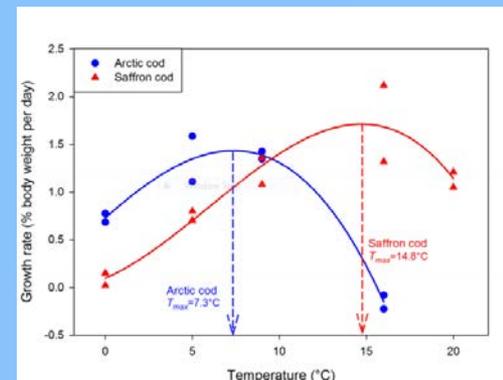
Arctic Aerial Calibration Experiments

- 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,
Megan.Ferguson@noaa.gov



Arctic cod in a warming environment

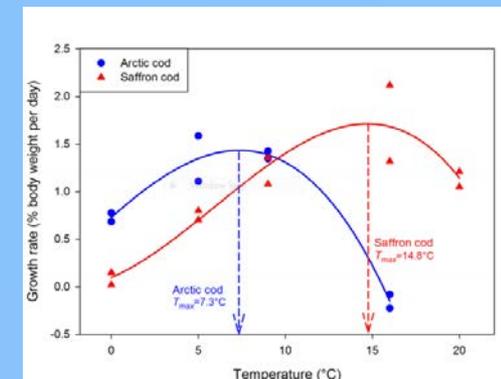
- ❑ Location: Newport Oregon, Prudhoe Bay
- ❑ Funding Source: NPRB
- ❑ Laboratory study establishing thermal limits of arctic cod and saffron cod
- ❑ 2015 lab work on egg/larval stages
- ❑ Contact: Ben Laurel, NOAA AFSC (Newport)



Arctic cod in a warming environment

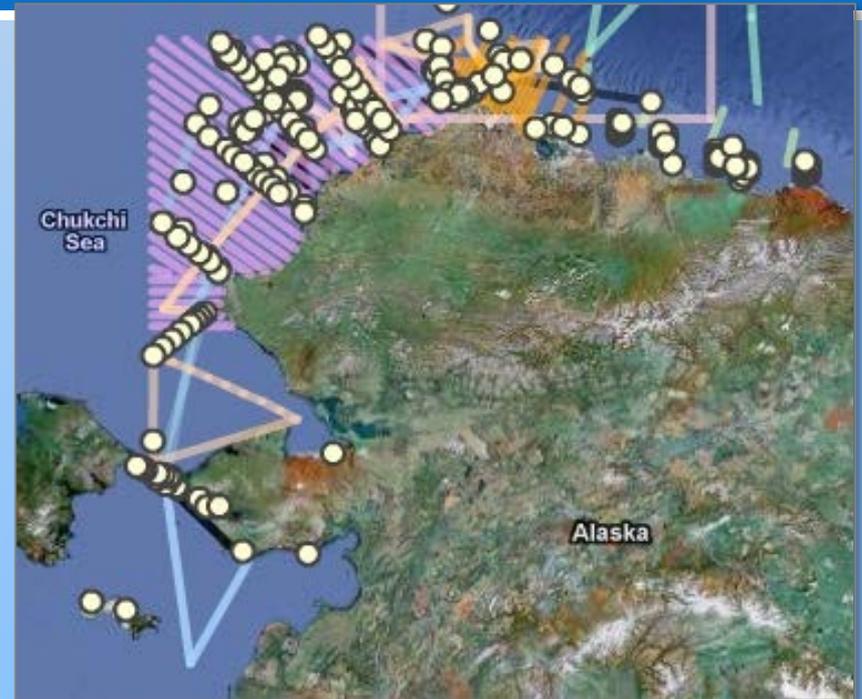
Publications

- 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