Regional Coastal Monitoring in the Inuvialuit Settlement Region: Ecosystem Indicators

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Darcy McNicholl, Emily Choy, Kristin Hynes, Danny Swainson, Kate Snow, Tracey Loewen, Jim Johnson, Carolina Giraldo, Jim Reist, Sonja Ostertag, Kayla Hansen-Craik, Gary Stern, Diane Ruben, Bruno Rosenberg, Kerri Pleskach, Dana Neumann, W. Walkusz, Ellen Lea, Erica Wall, Larry Dow.

Community Partnerships & Capacity

Shingle Point: Dennis Arey, Jordan McLeod, Andrew Gordon, Cody Kogiak, Cecilia Greenland, Jasmine Brewster. **Kendall Island**: John Day, Kendra Tingmiak, Melanie Rogers, Kenny Rogers, Kyle Conley. **EWF**: Lawrence Angasuk, Bertha Joe, Kayla Hansen-Craik, Paden Lennie. **Hendrickson Island**: Frank Pokiak, Verna Pokiak, Kate Snow, Shaeli Pokiak, Cole Felix. **Darnley Bay**: Brandon Green, Jody Illasiak, Bernadette Green, Bessie Ruben**. Sachs Harbour**: CJ Haogak, Betty Haogak. **Ulukhaktok**: Lillian Kanayok, Victoria Akhiatak, Corrie Joss, Cora Joss

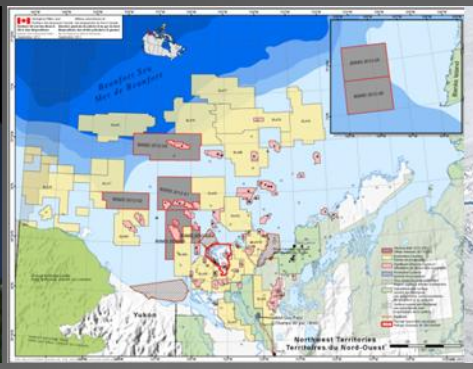
27 community members participated in the coastal monitoring supported in partnership with BREA

BREA Purpose and Priorities

- Contributes to BREA Purpose 1&3:
  - the project collects **regional information** that can assist project assessments;
  - and it **engages communities** and their priorities as it is developed with communities, community monitors, **capacity building for long term monitoring**

- Contributes to BREA Priorities:
  - the project feeds into '**Baseline fish information**' – emphasis on all coastal fish and beluga. Key focus to link with the offshore trawler program (using diet indicators)

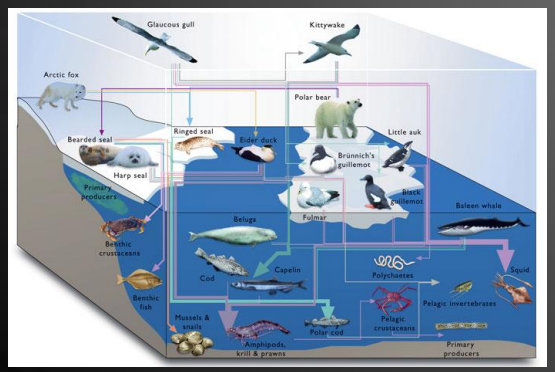
Cumulative Impacts and Monitoring…

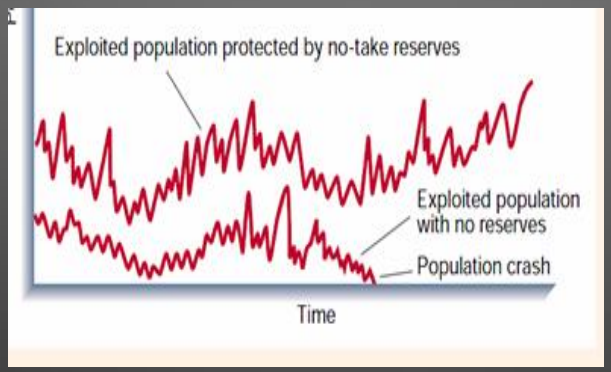



How do we prepare for the changes the region will be faced with in the near future?

Knowledge → **Long Term Data**

Ecosystem Connectivity	Variability (physical & biological)	Local Knowledge and perspectives





Objectives: Regional Coastal Monitoring

Goal: Characterize ecosystem linkages and to better inform decision makers on ecosystem responses to changes or stressors (e.g. climate)

Objectives:

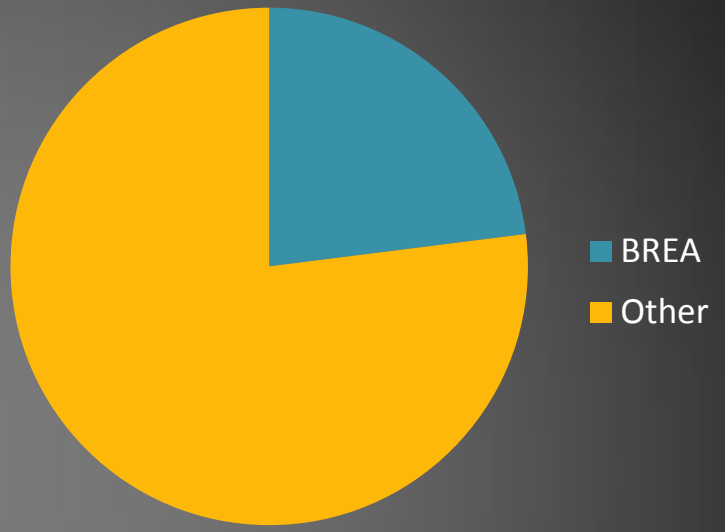
1) ecosystem linkages between coastal and offshore food webs using community based monitoring i) coastal fish, ii) beluga and iii) their supporting ecosystem (habitat) at harvest sites in the ISR
2) Use common indicators that define trophic interactions (e.g. stable isotopes, fatty acids) to understand food web linkages.

Outputs:

1) Baseline for ecosystem indicators
2) Framework for coastal ecosystem monitoring in the ISR
    1) Indicator perspective
    2) CBM perspective

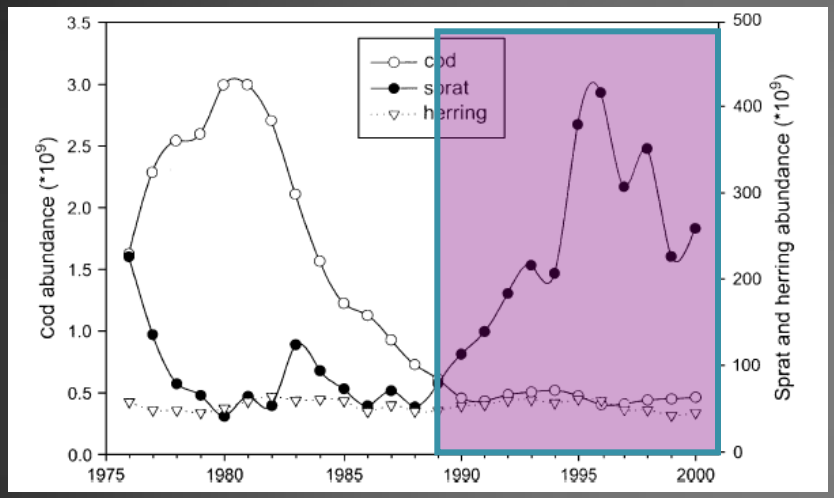
Project Funding and Partners

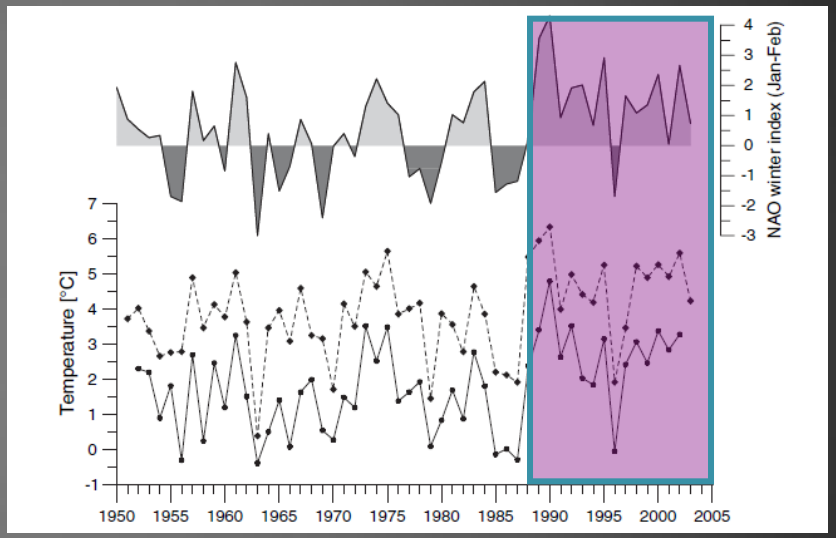
Funders	Project component
FJMC	Field component
DFO	Field and Staff
BREA	Indicator Lab Analysis
NCP	Contaminants (beluga)
CIMP	Synthesis/Framework

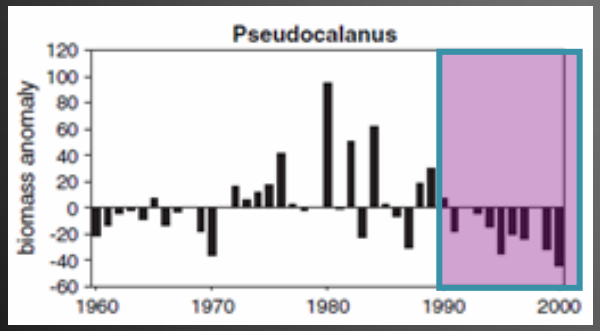


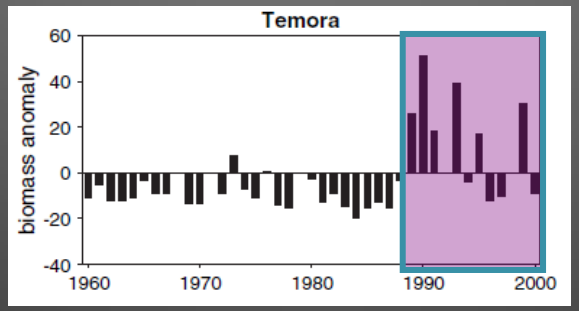
BREA Funds Supported
Dietary Indicator Analysis (stable isotopes, fatty acids
Analysis of up to 1000 fish from all sites/year
Analysis of up to 100 beluga from all sites/year

Ecosystem Indicators…Example



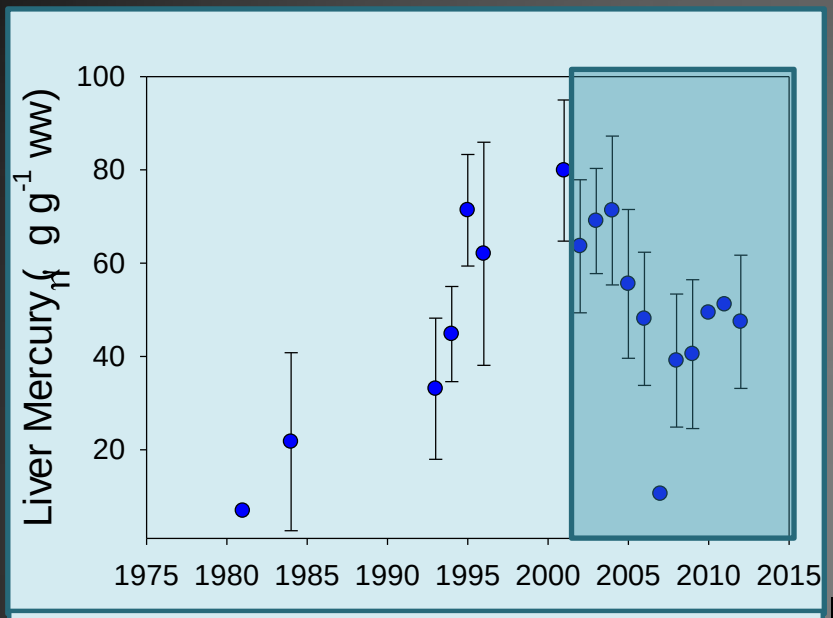


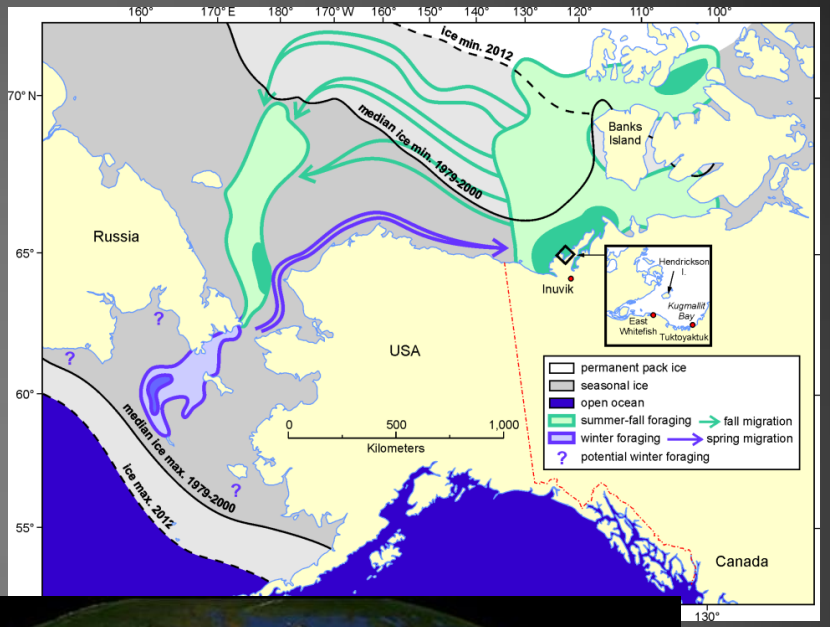


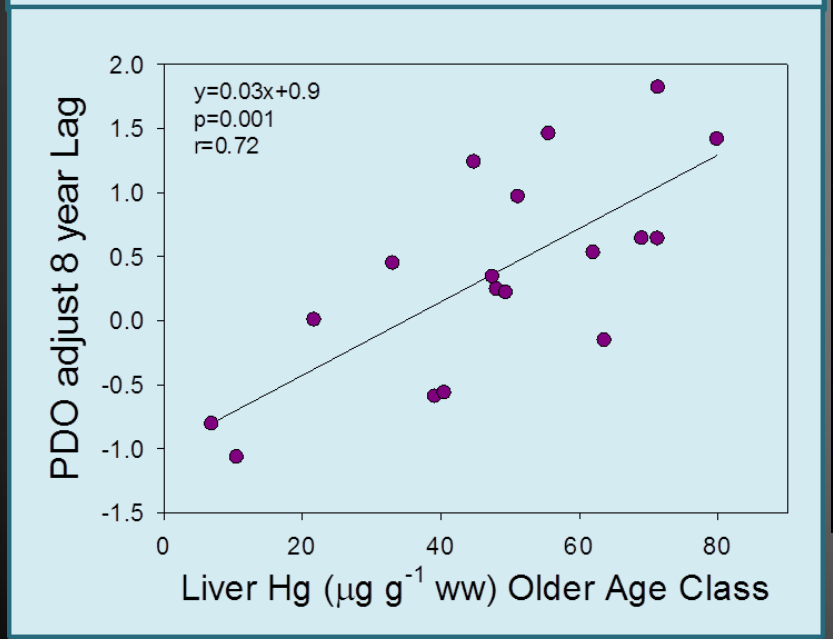


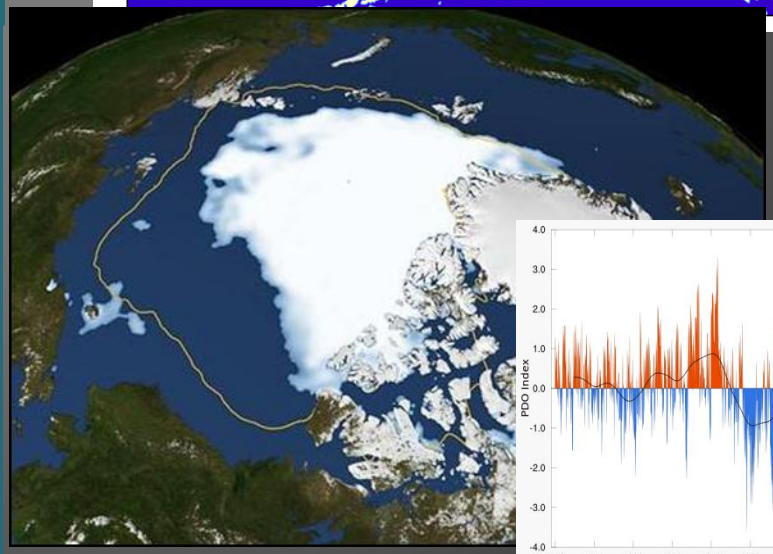
Alheit et al., 2005

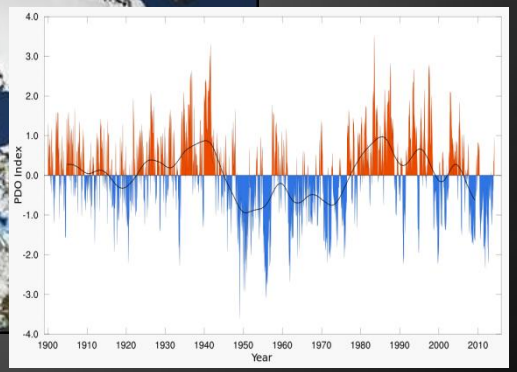
Mercury in Beluga Liver and Climate







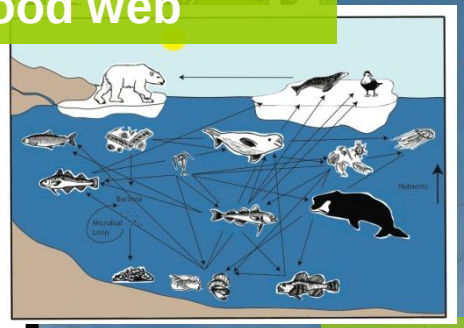




Loseto et al., 2015

Linking Coastal and Offshore Ecosystems

Beaufort Sea Food web

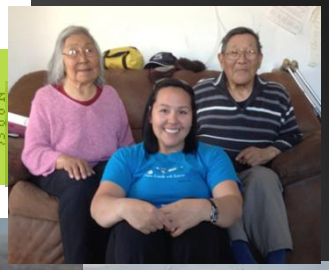


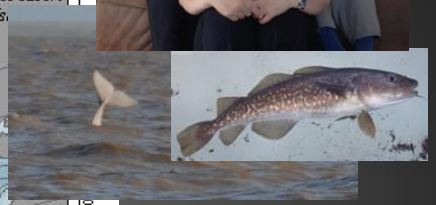
Diet Biomarker

Estuarine Fish and Ecosystem

Off Shore Fish

Opportunistic Beluga and cod





Beluga Health

Marine Fish and Ecosystem

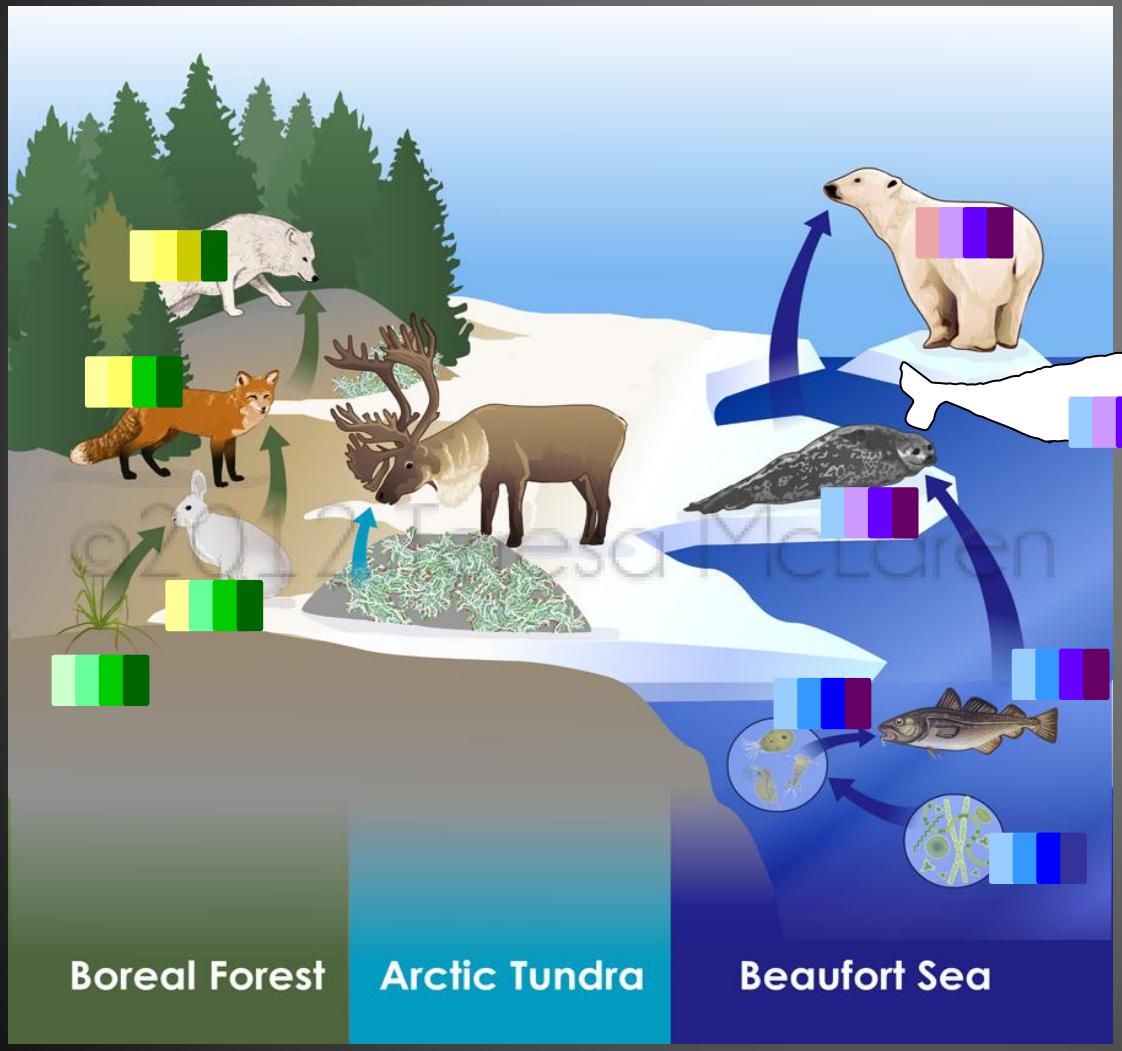
Beluga Monitoring and Capacity Building at several camps

Hendrickson Island

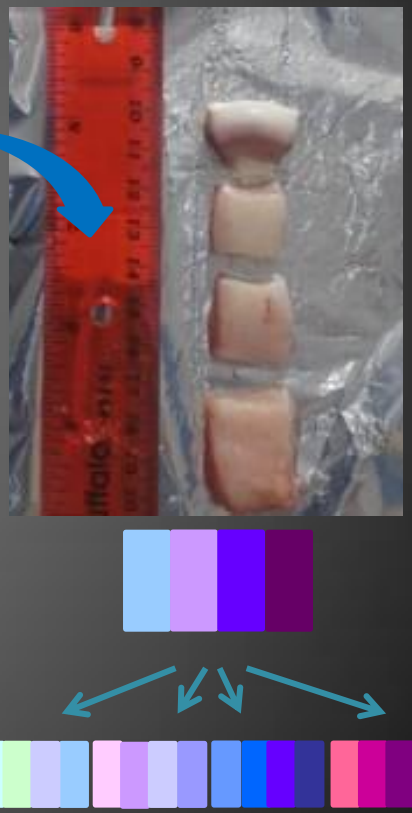
Kendall, East WhiteFish, Darnley Bay

Partnership with community Capacity Building

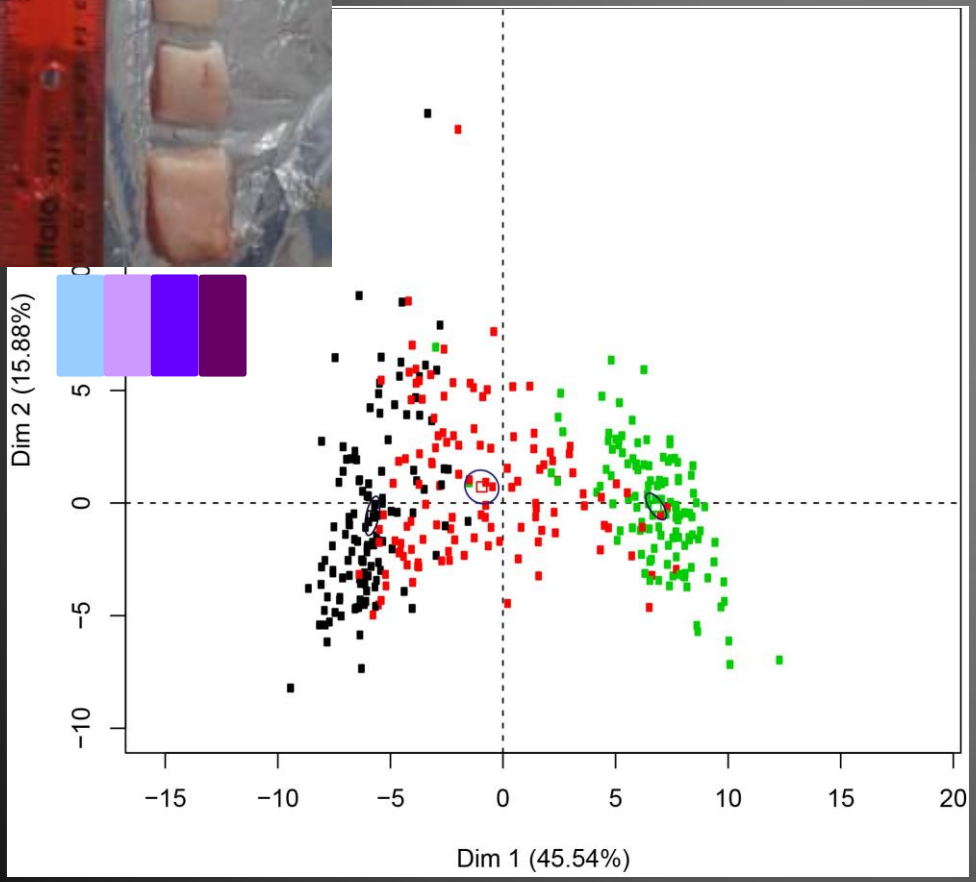
Indicators Funded under BREA: Diet Biomarkers (Fatty acids)



You Are what you Eat!



Beluga Diet Indicators: location

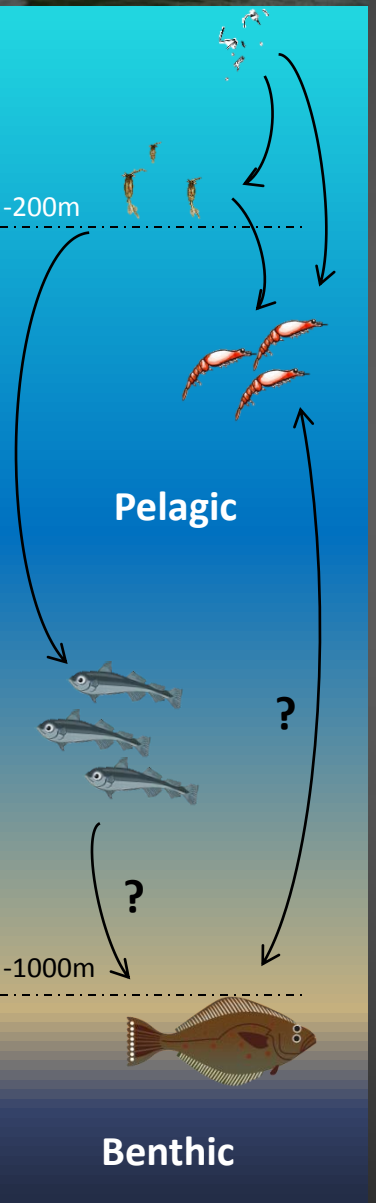


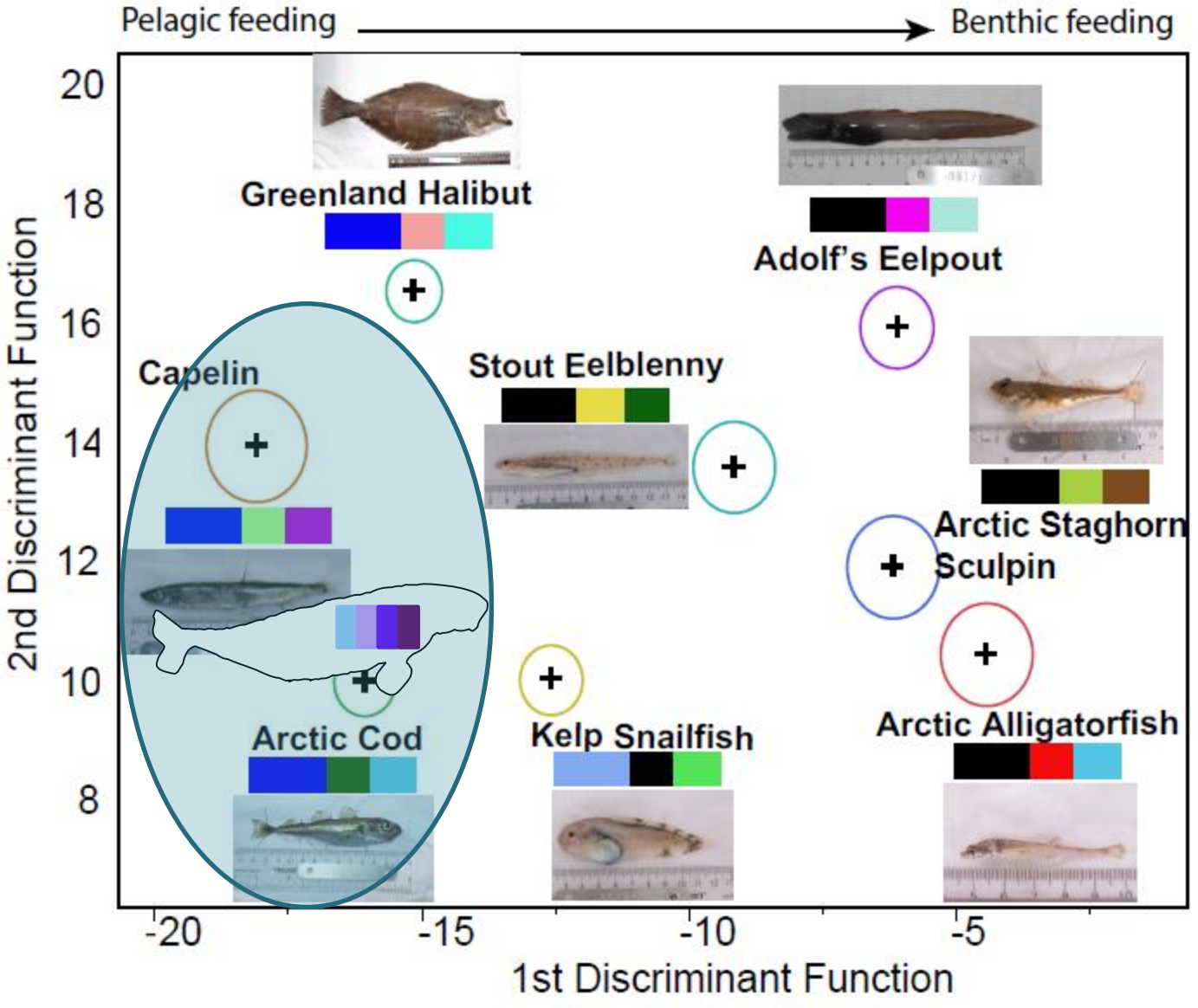
- All beluga harvest sites
- Understand diet
- Variability in diet

- Link to Diet with fish and other prey sample collections

Emily Choy PhD

Offshore Fish – Frosti Program

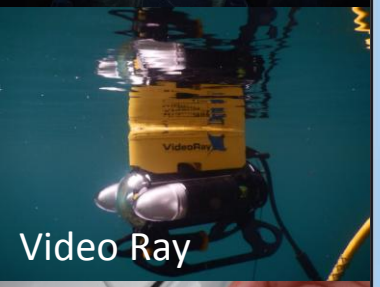


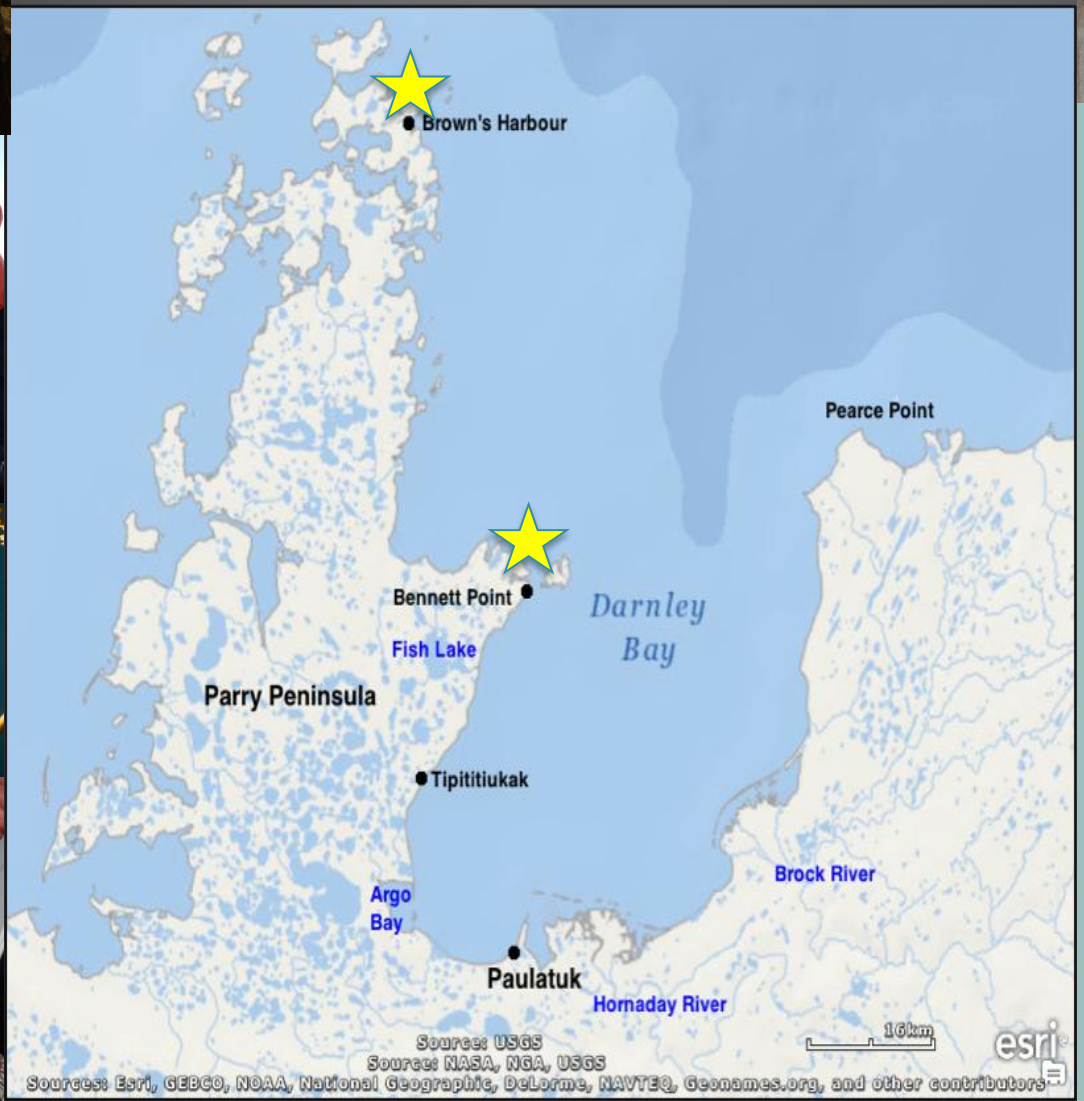


Paulatuk: Fish Monitoring

-Development of Baseline

-Link with Beluga diet



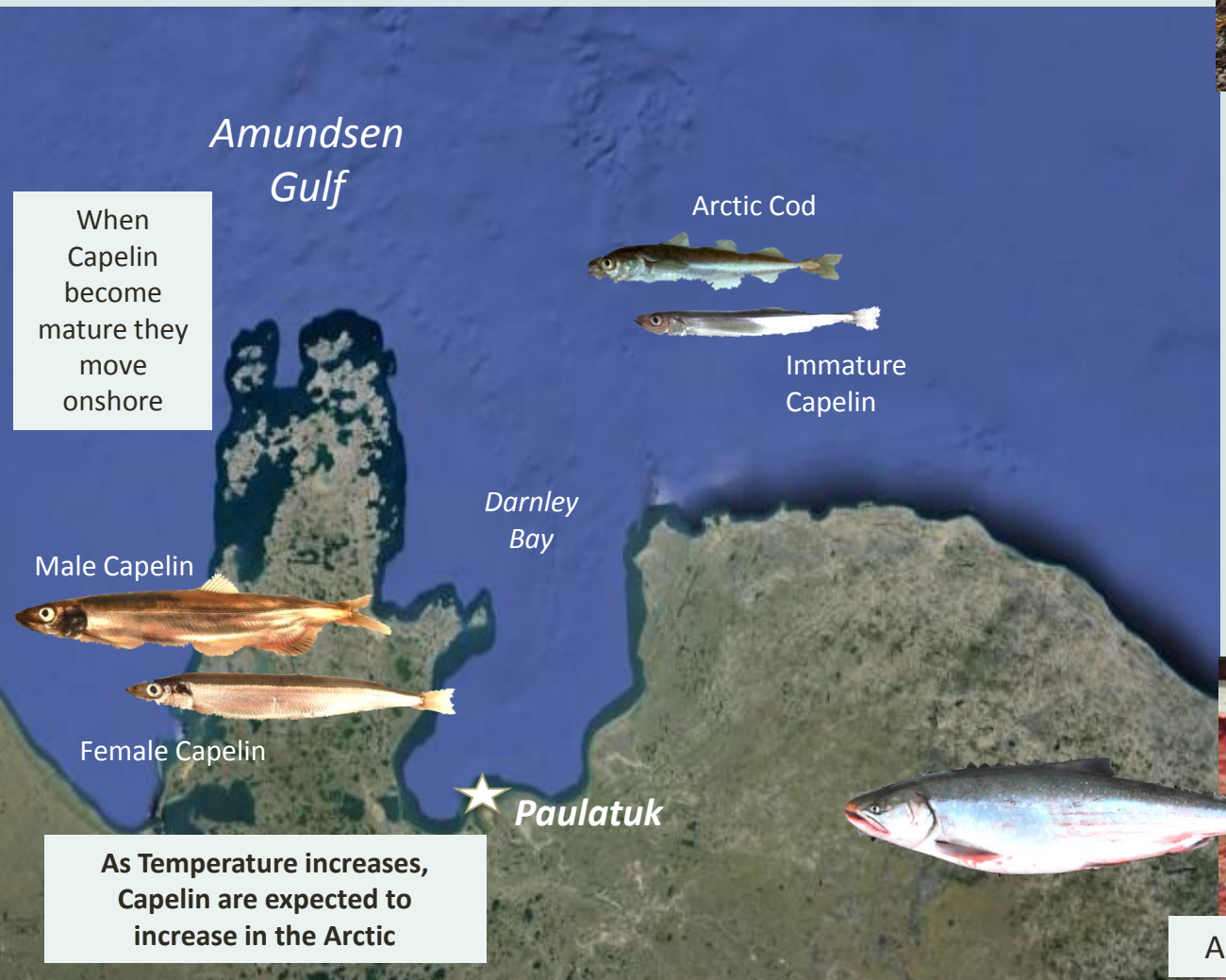


Key Findings

- 15 fish species identified
- Well established kelp and coralline algae community
- Capelin spawning at both locations
- Deep water species observed off Brown's
- Biological samples collected for offshore/coastal linkages

OFFSHORE: Arctic Cod and Juvenile Capelin

- Capelin and Arctic Cod collected in benthic trawl (2013)
- Stomach analysis: feeding on zooplankton (~80% diet overlap)
- Prey source for pelagic predators (halibut, seals, possibly Beluga)



NEARSHORE: Capelin

- Capelin spawned in July, 2014
- Nearshore habitat critical for maintaining Capelin population
- Aggregations of Capelin onshore serve as a prey source for coastal predators (Arctic Char, sea birds and possibly Beluga)

Arctic Char Stomach Contents

C. Gallagher

Sachs Harbour

- 2008, 2010, 2014 Beluga Harvests
- Cod and Sculpin Collection to support diet analyses
- Results from 2010 whale hunt revealed

- Bag of stomach contents:
- 8 partially digested greenland cod, 1 sculpin
- Earbones/otoliths: 122
  - 78 G.Cod, 23 Char, 13 A.Cod, 3 cisco, 5 unknown

Ulukhaktok Fish and Beluga


2012 Pilot Project: Beluga whales and Marine Fish Sampling

FJMC and DFO Community Based Monitoring: Sachs Harbour and Ulukhaktok

Why sample beluga whales and marine fish?

Request: Beluga and Fish Samples

Opportunistic Beluga Harvest Sampling

Marine Fish Sampling

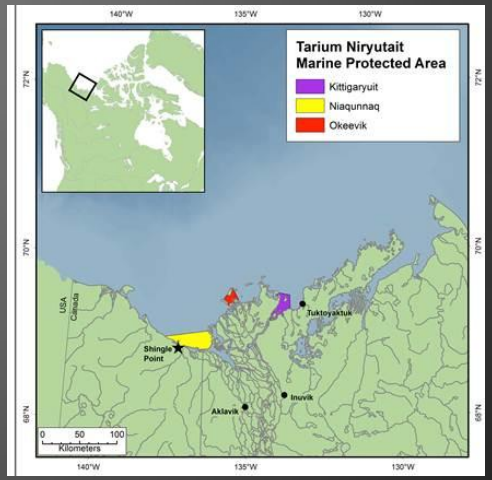
- Marine fish collections
- Greenland cod & sculpins
- 2014: unusual beluga harvest
- Appeared to be feeding
- Stomach contents:16
- Small fish (sandlance) and one with char, squid beaks

Defining Arctic Fish Food Web Structure Using Diet Indicators at Shingle Point

Jasmine Brewster

Master's student at the University of Manitoba

Department of Fisheries and Oceans



Objectives

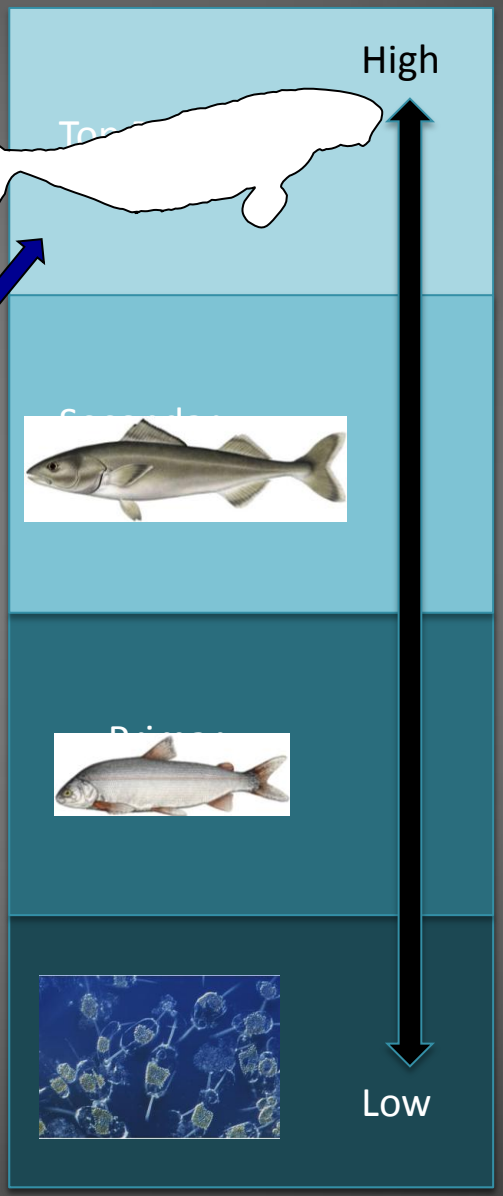
- 1) Characterize the Beaufort coastal fish food web structure using diet indicators
- 2) Use those linkages to define exposure of mercury in top predators such as beluga whales
- 3) Thereby provide baseline information to support the TN MPA monitoring and management.

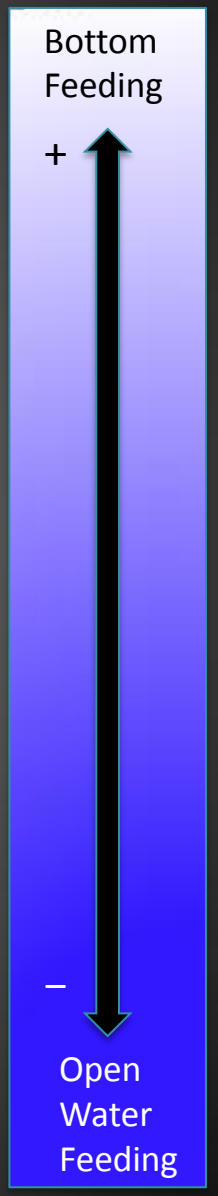
Type of Diet Indicator

Stable Isotopes

Nitrogen

Carbon





Methods

Fish Processing:

- 1175 of samples of the 16 species were processed (Table.1). Fish from 2011 to 2013 have been prepped for SI, FA and total mercury (THg) using known methodologies (Iverson et al., 1997; Post, 2002; Atwell et al., 1998).
- SI -using a continuous-flow isotope ratio mass spectrometer (CF-IR-MS) at the University of Waterloo.
- FA –using gas chromatography with flame ionization detection (GC-FID) at the Freshwater Institute in Winnipeg .
- THg will use Combustion Atomic Absorption Spectroscopy (C-AAS) on a Teledyne Leeman HYDRA IIc at the Centre for Earth Observation Science (CEOS), Winnipeg.

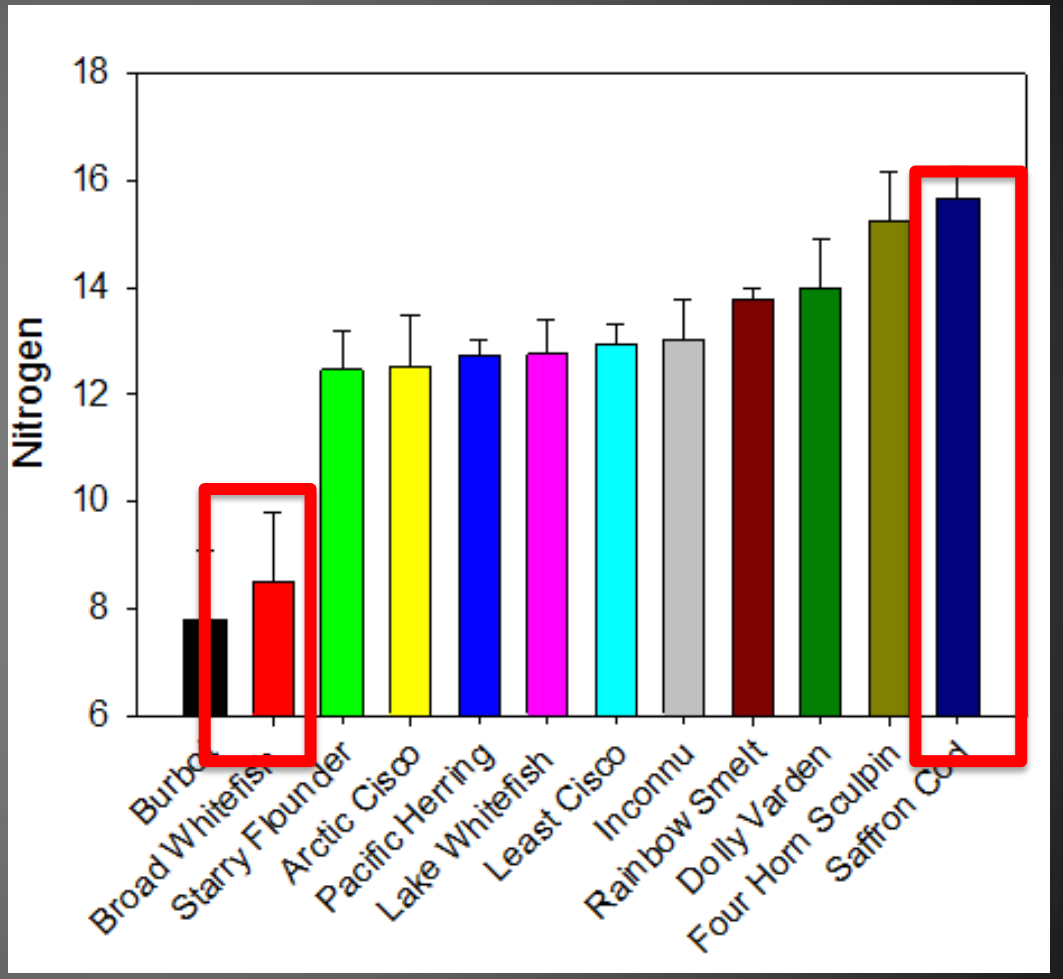


Figure 1. The species of fishes found at Shingle point and average stable isotope signatures for nitrogen.

Diet and Habitat Overlap ???

Legend		
Species	Colour	$\delta^{13}C$ mean $\pm$sd
ARCS		-24.519±1.705
ARFL		-23.911±1.256
BDWF		-27.567±2.810
BRBT		-26.020±1.556
DVCH		-26.199±1.163
FHSC		-23.748±0.700
INCN		-26.280±0.859
LKWF		-25.957±1.864
LNSK		-26.127±1.584
LSCS		-26.348±1.548
NRPK		-26.666±0.551
PCHR		-25.048±1.015
RBSM		-24.220±0.544
RDWF		-25.659±2.066
SFCD		-22.850±0.388
STFL		-24.800±1.125

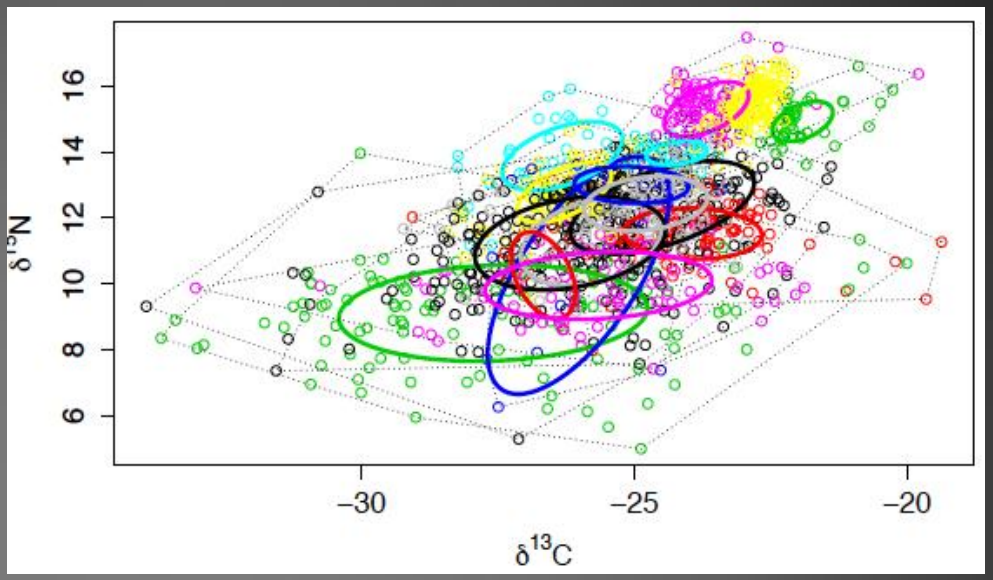


Fig 1. Ellipses using average carbon and nitrogen isotopes. This can indicate possible niche overlap

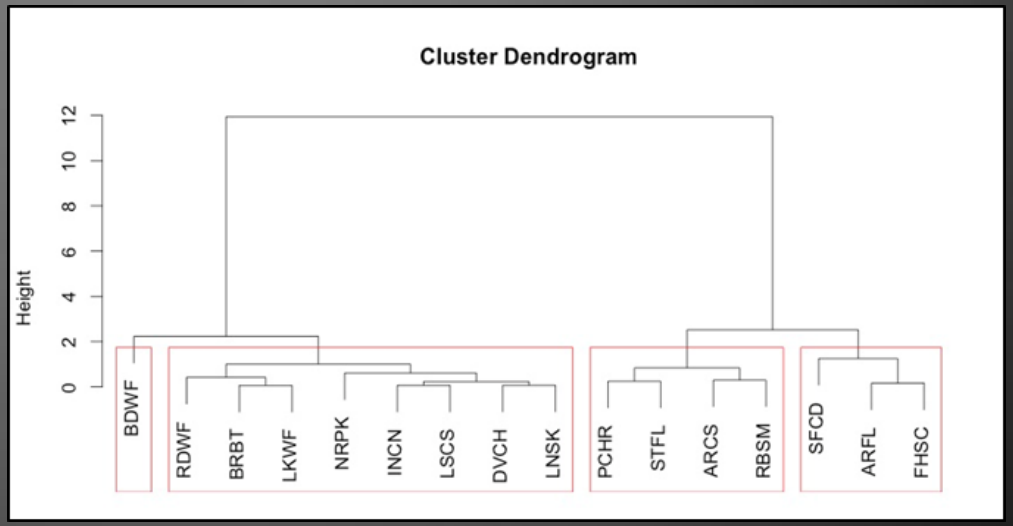
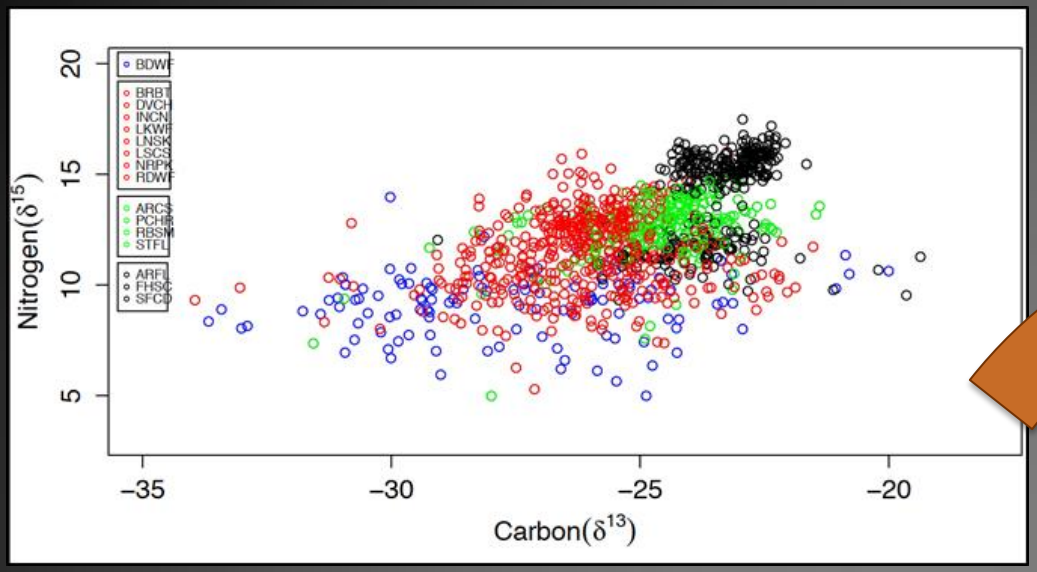
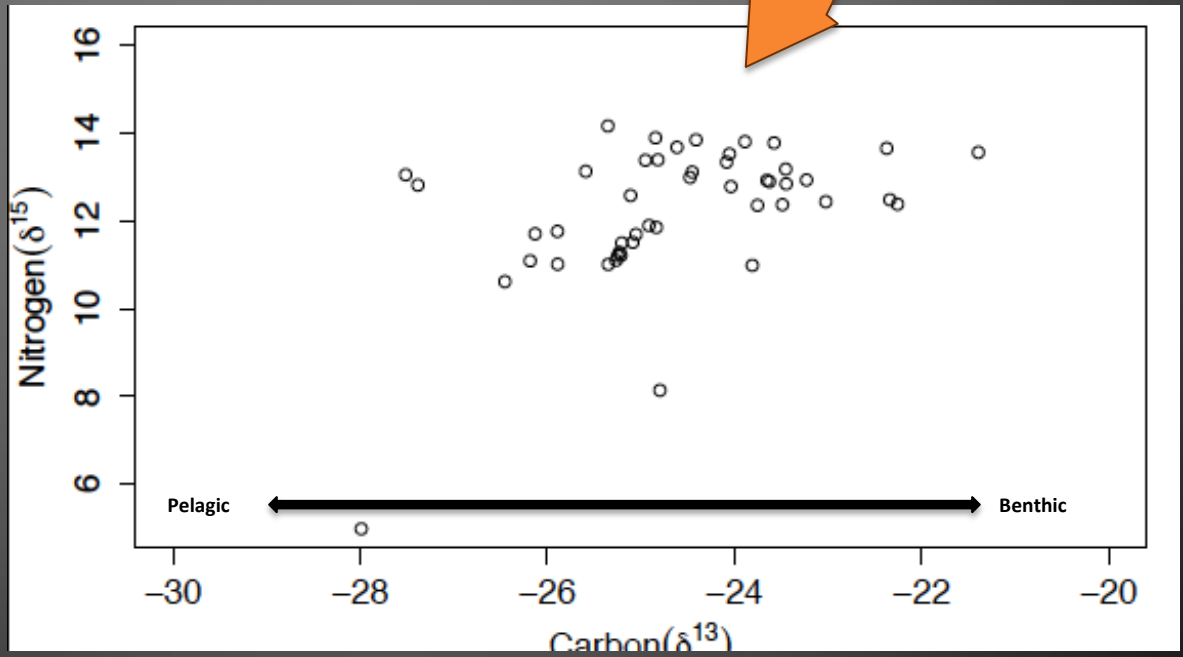


Figure 1. Ward's cluster analysis showing the similarities and differences between the 16 species of fish. Variables used were: *δ13C*, *δ15N*, and *δ34S*

For Example

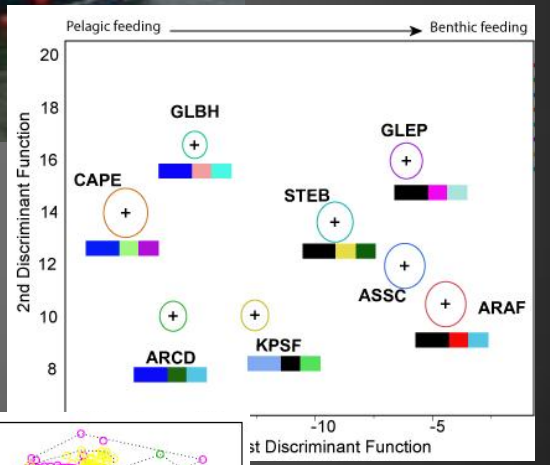


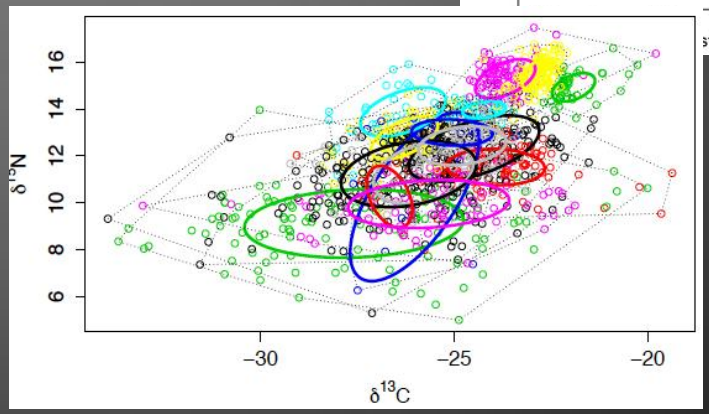
FJMC and HTC recommendations for a questionnaire: incorporate traditional knowledge and local knowledge of the fish species at Shingle Point



Future work and continuation…

- Diet Indicator Analyses of fish and beluga
- Develop linkages with offshore Frosti program
- Future field: continue with Coastal Monitoring (funding Pending)
- Develop framework for CBM and indicator work for long term monitoring





Research Handouts

Fall 2014
Volume 1, Issue 1

Fisheries and Oceans Canada

BELUGA BULLETIN

Inside this issue:

A successful summer of research and monitoring

Since the 1980s the Inuvialuit have collaborated with DFO and FJMC in monitoring beluga harvests in the ISR. This monitoring program has grown to represent one of the world's longest and most comprehensive monitoring programs for beluga whales.

with beluga monitors at Hendrickson Island, East Whitefish and Kendall. to

knowledge with scientific knowledge of beluga whales.

In more recent years there have been focused research projects located at key harvest sites to improve our understanding about belugas and their health. This year, researchers worked close

Unusual wha

The unusually high number of belugas hunted Ulukhaktok this summer prompted the DFO and the FJMC to send Kate Snow to Ulukhaktok to record observations and train hunters on sampling whales. Kate interviewed 10 people and asked questions about specific beluga whale observati

Winter 2015
Volume 2, Issue 1

Fisheries and Oceans Canada

BELUGA BULLETIN

Prepared by Sonja Ostertag

Winter Update: Beluga Monitoring and Research in the ISR

Lisa Loseto, Section Head, Ecosystems Impacts, Fisheries and Oceans Canada

Inside this issue:

Please enjoy the winter-spring issue of the DFO-FJMC beluga bulletin. This issue focuses on sharing updates and early findings on beluga research, monitoring and other related activities. The purpose of the beluga bulletin is to share more information about the beluga-based research and monitoring, with all the communities in the ISR.

The studies taking place in the ISR on beluga whales are like none other in the world. The ISR has the longest known beluga monitoring program that will reach 35 years this summer. This is an astounding accomplishment that has been made possible by the partnerships and perseverance by many.

We would like to acknowledge the willingness of the hunters who continue to share their samples and the whale monitors who lead on collecting samples and measurements.

Mentoring youth and inspiring students to become involved in science has consistently been a priority for the beluga research team. Eight community members were engaged as **community research assistants** and summer students for the 2014 Field Program. Presentations about the ISR beluga research program were given to nine school classes in Paulatuk, Inuvik, Tuktoyaktuk and Ulukhaktok and the ENRTP class at Aurora College.

The summer of 2014 remains an interesting one for beluga sampling that we are currently investigating.

The DFO is leading a number of studies that are not presented in this issue:

- The age of harvested whales is being approximated by analyzing the number of growth layer groups in the dentine of their teeth.
- The stomach contents from belugas harvested in Ulukhaktok this summer.
- The types of fat, stress levels, contaminants, and viruses and parasites in tissue.
- Passive acoustic monitoring of beluga vocalizations and baseline natural and human noise in Kugmallit Bay.

We look forward to sharing more updates and findings in our June issue!

Lisa Loseto presented her program to the Inuit Circumpolar Council's General Assembly.

Small fish taken from the stomach of a beluga whale harvested in August in Ulukhaktok.

Shingle Point Fish Species

Species Names	Picture	Habitat	Function	Where they feed	Diet
Arctic Cisco (*Coregonus autumnalis*)		Freshwater→estuaries	To spawn & overwinter	Open water and bottom feeding	-Shellfish, insects, small fishes, and worms
		Marine→	Summer migrations along coast, summer feeding & growth and matures		
Arctic Flounder (*Liopsetta glacialis*)		Marine→	Non-migratory, but enters coastal waters to feed	Bottom feeding	-Small fishes and shellfish
		Coastal/estuarine→			
Broad Whitefish (*Coregonus nasus*)		Freshwater→	Moves upstream to spawn	Young: Open water feeding Adult: Bottom feeding	-Young feed on zooplankton. -Adults on shellfish
		Coastal/estuarine→	Summer only to feed, grow and mature		
Burbot (*Lota lota*)		Freshwater→	Non-migratory, but enters freshened coastal waters to feed	Open water feeding and possibly benthic feeding	-Young feed on insect larvae, and shellfish. -Adults feed on fishes
		Coastal/estuarine→			
Dolly Varden (*Salvelinus malma*)		Freshwater→	Young over winter, grow, and Adults spawn	Open water and bottom feeding	-Young feed on insects, shellfish, and fish eggs. -Adults feed on insects, fishes, and shellfish
		Marine→	Summer only to feed, grow/mature		
Four Horn Sculpin (*Myoxocephalus quadricornis*)		Marine→	Non- migratory (moves inshore and offshore seasonally)	Bottom feeding	-Shellfish and fishes
		Coastal/estuarine→			
Inconnu (*Stenodus leucichthys*)		Marine→estuarine	Summer marine feeding and growth	Bottom and Open water feeding	-Adults feed on small fishes. -Young feed on insect larvae and planktonic shellfish
		Freshwater→	To spawn and overwinter		
Lake Whitefish (*Coregonus clupeaformis*)		Freshwater→	To spawn and overwinter	Bottom feeding	-Feed on insect larvae, shellfish, fishes and fish eggs, (including their own)
		Coastal/estuarine→	To feed, grow/mature		
Longnose Sucker (*Catostomus catostomus*)		Freshwater→	Non-migratory, but enters freshened coastal waters to feed	Bottom feeding	-Feeds on shellfish
		Coastal/estuarine→			
Least Cisco (*Coregonus sardinella*)		Offshore/ Coastal/estuarine→	Summer feeding, grow/mature	Open water feeding	Feed on planktonic shellfish and also plants
		Freshwater→	Spawn and overwinter		
Northern Pike (*Esox lucius*)		Freshwater→	To spawn and feed	Open water feeding	Young feed on shellfish; Adults feed on crayfish, frogs, fishes (and are cannibals
		Coastal/estuarine→	Summer only in freshened nearshore water to feed, grow/mature, and reduce parasitism		
Saffron Cod (*Eleginus gracilis*)		Marine→	To feed, grow/mature	Bottom feeding	Are opportunistic feeders; feed on fish and shellfish
		Coastal/estuarine→	Moves inshore to spawn and overwinters further offshore		
Starry Flounder (*Platichthys stellatus*)		Marine→	May move more offshore in winter	Bottom feeding	Feed on shellfish, worms, brittle stars and small fishes
		Coastal/estuarine→			
Pacific Herring (*Clupea pallasii*)		Marine→	Migratory behaviour is not fully understood. Will move more offshore to feed, grow/mature	Open water feeding	Young feed on shellfish larvae; adults feed on shellfish and small fishes
		Coastal/estuarine→	To spawn		
Rainbow Smelt (*Osmerus mordax*)		Marine→	To feed, grow/mature	Open water	Feeds on shellfish, copepods, and small fishes
		Freshwater→	To spawn		
Round Whitefish (*Prosopium cylindraceum*)		Freshwater→	To spawn	Bottom feeding	Feeds on shellfish, fishes and fish eggs
		Coastal/estuarine→	To feed, grow/mature		

*Fishes that migrate from freshwater to marine will stop in the coastal/estuarine environment to adjust to the change in environment.

Pictures by: Dana Neumann, Tracey Loewen, and Colin Gallagher
Table created by: Jasmine Brewster (University of Manitoba) , Lisa Loseto and Jim Reist

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Thank You Quyanaini

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