EBM1 – The CBMP Arctic Coastal Biodiversity Monitoring Plan: Monitoring and reporting important changes in the biodiversity of Arctic coastal ecosystems – Plan development and evaluation

Co-Chairs: Tahzay Jones (USA) - Donald McLennan (Canada)

1. Tahzay Jones (USNPS): The Coastal Plan: Process, general structure and approach
2. Susse Weggeberg (Aarhus University) - Selection, quality assurance and prioritization of focal ecosystem components
3. Liudmila Sergienko (Petrozavodsk State University): Coastal ecosystems of the Russian Federation – status of information and prospects for intergated monitoring.
4. Paul Renaud (Akvaplan-niva Norwegian Institute for Water Research): If you build it they will come – A new coastal monitoring program for Svalbard

Session Discussion: Questions to speakers; input to Coastal Plan

CAFF / CBMP / CEMG

Coastal Plan: Process, General Structure, and Approach

Co-Leads:
Tahzay Jones, National Park Service
Donald McLennan, Polar Knowledge Canada

St. Lawrence Island – North Bering Sea– Photo: ShoreZone

Coastal Plan Approach

- Ecosystem-based approach
- Existing monitoring capacity and information
- Use TK, community based monitoring and science
- Identify a suite of coastal biodiversity indicators linked to key drivers and stressors - ecosystematic
- Identify optimal existing sampling schemes for chosen parameters
- Identify gaps in existing monitoring programs

ShoreZone Photo

The Process

The Beginning - (2014 – 2015)

Background development

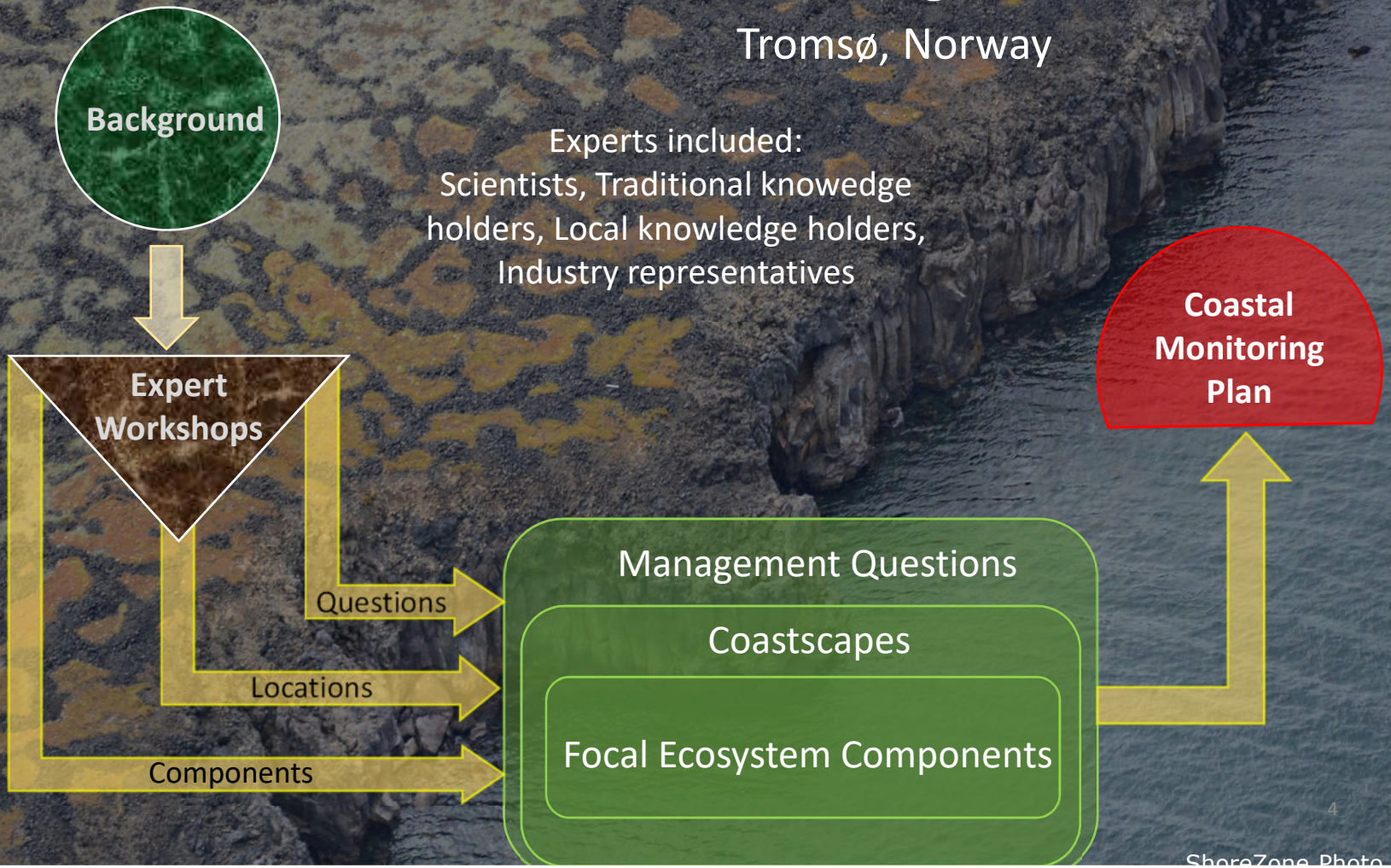
Experts meetings (2016, 2017, 2018)

Ottawa, Canada

Anchorage, Alaska

Tromsø, Norway

Experts included:
Scientists, Traditional knowedge holders, Local knowledge holders, Industry representatives



ShoreZone Photo

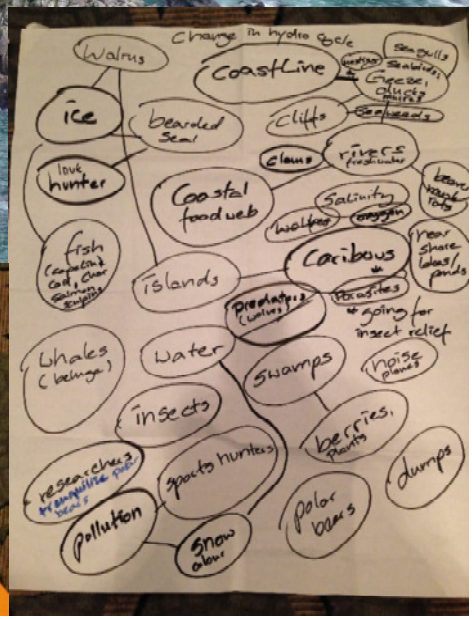
Traditional Knowledge Expertise in Meetings

Collectively the meetings included:

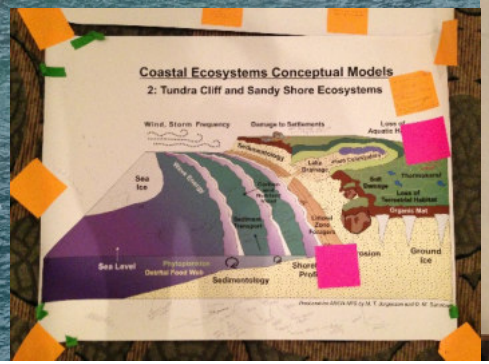
Inuit
Aleut
Sámi

Ottawa meeting focused on:
- Information for management questions
- Conceptual models
- Important biological connections and relations
- Threats and stressors

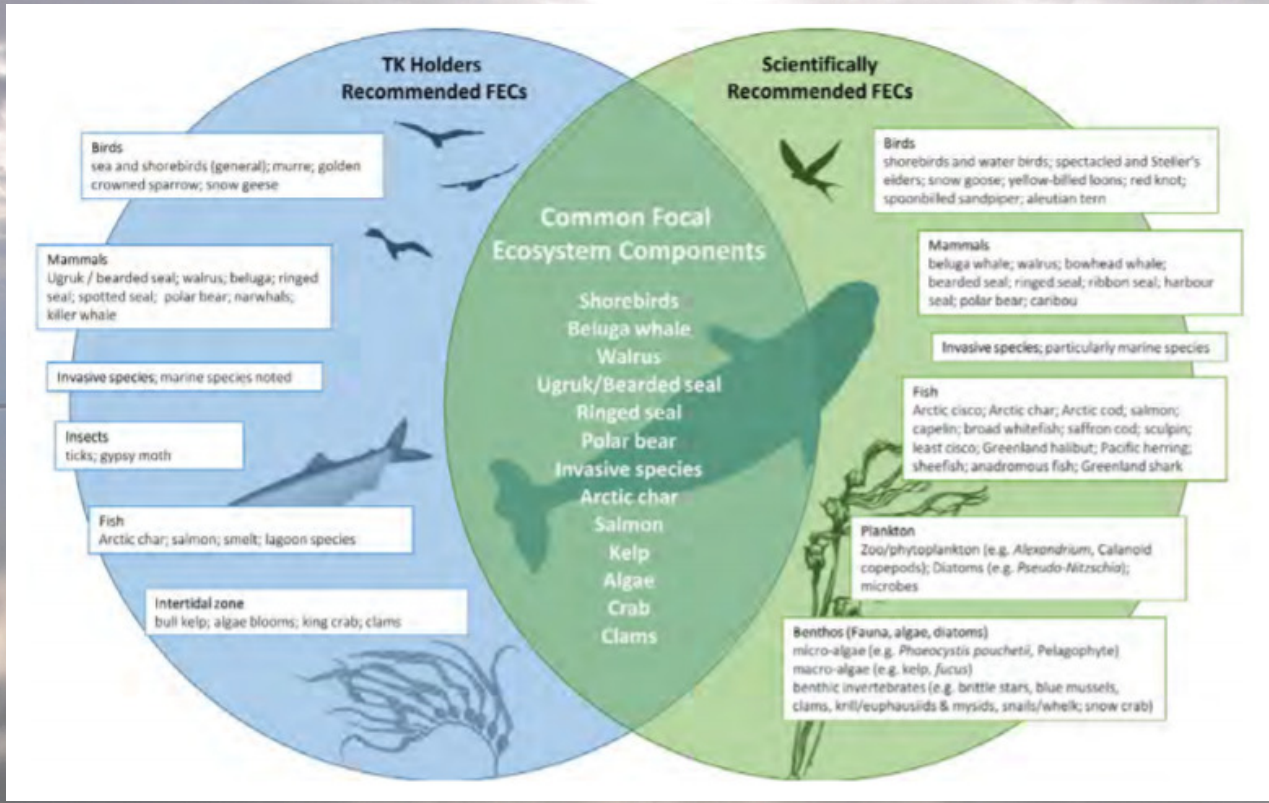
Anchorage meeting focused on:
- Focal Ecosystem Components
- Attributes
- Parameters



Tromsø meeting focused on:
- Coastscape Focal Ecosystem Components
- Attributes
- Parameters



Experts Process



Critical to coastal monitoring is establishing a platform for incorporating multiple knowledge systems in coastal assessments.

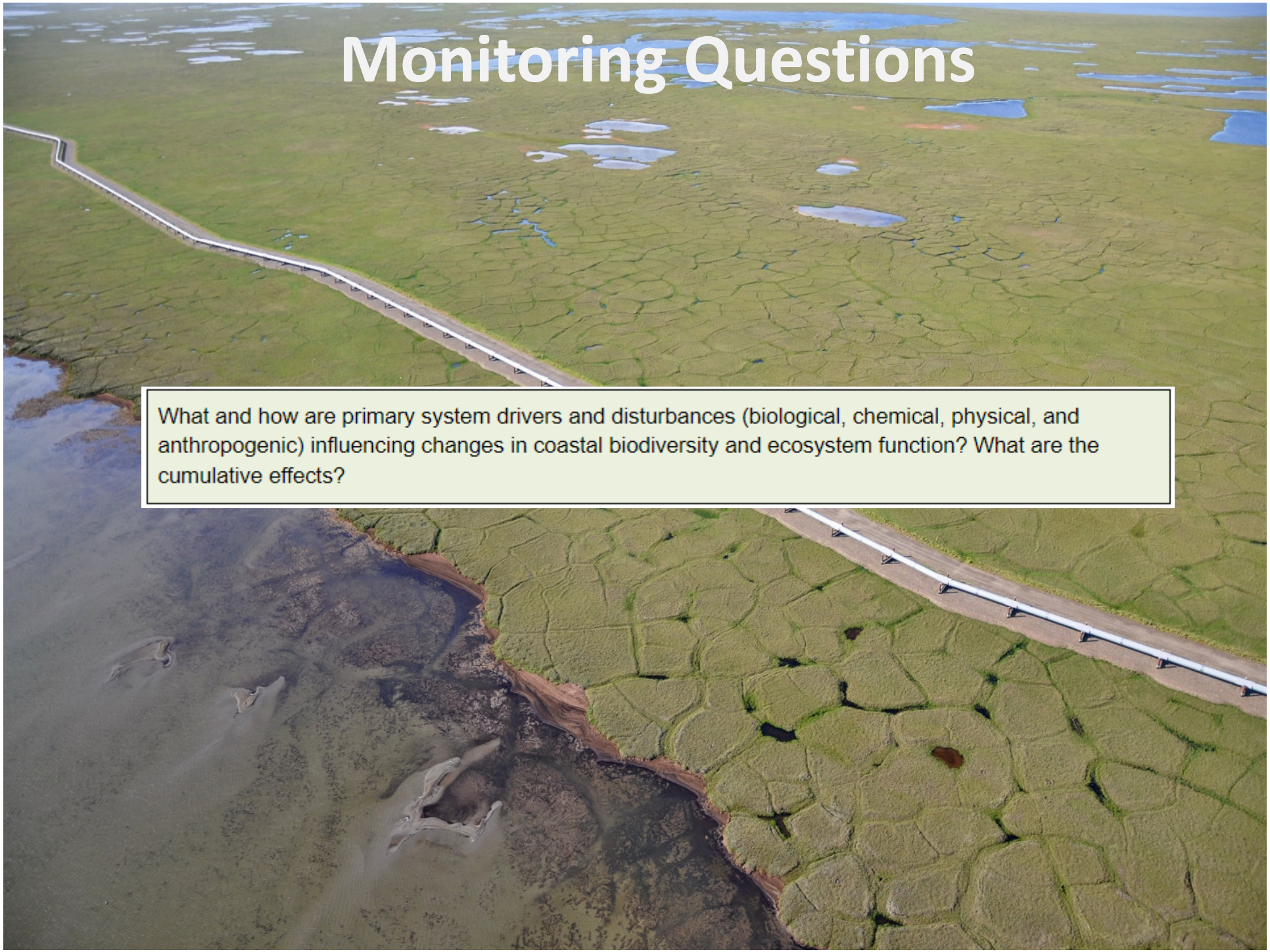
Monitoring Questions

What is the status and trend of Arctic coastal ecosystems in terms of their native species composition and condition, new and invasive species, geographic distributions, thresholds, phenological norms, and key processes and functions?						
native species composition	native species condition	new and invasive species	geographic distributions of new and native species	thresholds of species decline	phenological norms of native species	key processes and functions of coastal ecosystems

Monitoring Questions

If Arctic coastal biodiversity or community country food is significantly impacted by any of these factors acting alone or together, which species are affected, how are they affected (mechanisms and drivers of change), where are they affected (geographically), and what is the expectation for the effects of these impacts in the near to medium future (5-20 years)?			
which species are affected?	how are they affected (mechanisms and drivers of change)	where are they affected (geographically)	what is the expectation for the effects of these impacts in the near to medium future

Monitoring Questions



What and how are primary system drivers and disturbances (biological, chemical, physical, and anthropogenic) influencing changes in coastal biodiversity and ecosystem function? What are the cumulative effects?

Monitoring Questions

Do the following factors (individually and/or cumulatively) significantly impact Arctic coastal ecosystems and associated biodiversity generally, and specifically, do they significantly impact the availability, abundance and quality of country food for Arctic communities?							
direct and indirect effects of climate change	oil and gas activities	mining activities	shipping	commercial fishing: harvest and overharvest	community activities	long range and local contaminants	invasive alien species: especially marine invasive species

Coastscapes

Based on Socio-Ecological systems

Areas of the circumpolar Arctic coast with recurring physiographic features (steep to shallow bedrock, low, soft-sediment coastal plains, river estuaries, lagoons) where,

Similar terrestrial, marine and freshwater processes interact with physiographic features to create a relatively predictable range of habitats that support characteristic populations of coastal species

A particular coastscape will contain a relatively predictable range of habitat elements (e.g., beaches, mudflats, soft benthos, wetlands, rock cliffs, estuaries) and often will contain small elements of other coastscapes (e.g., rapidly-eroding shores often include lagoons or estuaries).

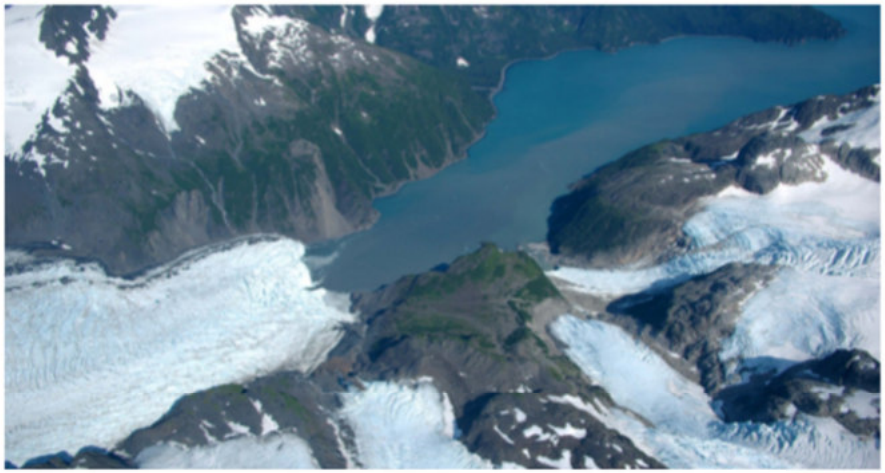
Represent what people in the coastal regions consider their coastal environment.

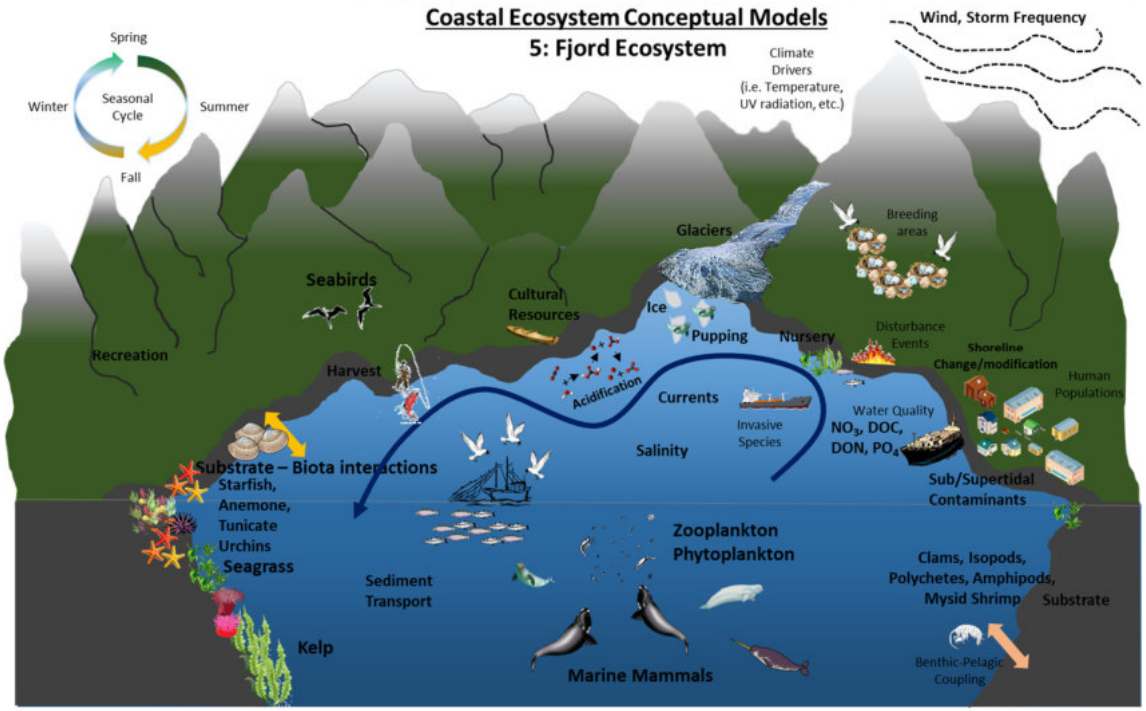
Coastscapes

Fjords	Long, narrow inlets with steep sides and cliffs usually formed by Quaternary sub-sea level glacial erosion. They are commonly headed by glaciers with associated meltwater streams, and feature frequent, small, lateral side streams with small deltas and estuaries. Fjords are the predominant coastscape in Norway, Iceland, Greenland, and the eastern Canadian Arctic.
Rocky Shores and Cliffs	Low-gradient to steep coasts (including sea cliffs) with exposed bedrock to the waterline that frequently include rock pools, beaches, and small wetlands. Scattered throughout the Arctic and often associated with the Fjord coastscape.
Low Gradient Soft Shores	Low-gradient coasts with varying thicknesses of surficial materials over bedrock, and characterized by mudflats, small wetlands, and beaches. Scattered throughout the Arctic, but cover large coastal areas of the Canadian Arctic Archipelago, along the Alaskan Chukchi and Beaufort Seas, and along the Russian and Iceland coasts.
Lagoons	Coasts that feature low-lying, shallow, brackish lake and wetland systems protected from the ocean by barrier bars and spits, usually connected by a relatively small stream that flows in both directions with the tide. Frequently flooded by storms that can significantly alter salinity and turbidity characteristics. Often occur with Rapidly eroding Shore and Low Gradient Soft Shores coastscapes that supply sediment for land building. Common in Russia, Alaska, and Canada along the Bering, Chukchi, and Beaufort Seas, and along the Iceland coast.
Estuaries	Estuaries develop at the mouths of most rivers where sediments are deposited as river-born sediment load enters the ocean. Often featuring extensive low-gradient networks of wetlands, streams, and brackish ponds with broad mudflats. Occur along the Arctic coast wherever rivers enter the sea; ranging from very small to very large estuaries such as the Lena, Ob, Yukon, and Mackenzie.

Coastscapes

Fjords





Criteria

Ecosystems			Relevance				
Sensitive to climate-driven ecosystem drivers	potential for causing ecosystem change	sensitive to anthropogenic stressors	Relevance to management questions	Significant for supporting community food security	Relevance to legislation	Relevance to diverse audiences	Cultural and/or science relevance

Monitoring Status			Geographic Status		
Presently being adequately monitored	Availability and sustainability of monitoring capacity, expertise and protocols	Ability to access existing data	Pan-Arctic Distribution	Occurrence across Coastscapes	Relative Importance of the Coastscape

Focal Ecosystem Components

Rocky Shores	Eroding Shores	Lagoons	River Estuaries	Low Gradient	Fjords
	waterfowl	waterfowl	waterfowl	waterfowl	waterfowl
Seabirds: omnivores	Seabirds: omnivores			Seabirds: omnivores	
Seabirds: diving planktivore	Seabirds: diving planktivore			Seabirds: diving planktivore	
Seabirds: surface piscivores	Seabirds: surface piscivores	Seabirds: surface piscivores	Seabirds: surface piscivores	Seabirds: surface piscivores	
Seabirds: diving piscivores	Seabirds: diving piscivores	Seabirds: diving piscivores		Seabirds: diving piscivores	
Seabirds: benthivore	Seabirds: benthivore	Seabirds: benthivore	Seabirds: benthivore	Seabirds: benthivore	Seabirds: benthivore
subtidal flora, intertidal macroalgae		subtidal flora, intertidal macroalga	subtidal flora, intertidal macroalga		subtidal flora, intertidal macroalga
Pinnipeds				Pinnipeds	Pinnipeds
whales			whales	whales	whales
Pelagic Fishes	Pelagic Fishes	Pelagic Fishes			Pelagic Fishes
Demersal Fishes		Demersal Fishes	Demersal Fishes		Demersal Fishes
		Salmonids	Salmonids		
	Phytoplankton		Phytoplankton		Phytoplankton
					Sub-Tidal/Inter tidal Macrofauna
	Meso - and Macro-Zooplankton				
				large herbivores	
		alien and/or invasive plants	alien and/or invasive plants		

Attributes and Parameters

Combining knowledge systems to generate attributes and parameters

FECs All Coastscapes	Attributes	Parameters
Waterfowl **Seabirds: omnivores** **Seabirds: diving planktivore** **Seabirds: surface piscivores** **Seabirds: diving piscivores** **Seabirds: benthivore**	Diversity	Community Alpha diversity
		Spatial Structure
		Species composition
	Phenology	Migration timing (dates)
		Migration routes (Location)
		Degree of Partial Migration
		Breeding area location changes (IK)
		nesting and rearing timing (date)
		Habitat Change (acres)
	Demography	Reproductive rate (no. of eggs, nesting success)
	Harvest and Accessibility	Harvest usability (IK)
		Hunting strategies and accessibility (IK)
		Harvest Success (CPUE, distance, fuel, time)
	Body Condition	taste, colour, meat, organs (IK)
		Egg thickness
		Contaminants (Hg, POPs)
		Disease - (frequency of outbreaks [die-offs, unusual mortalities, lesions])
	Behavior Ecology	Changes in movent behavior (IK)

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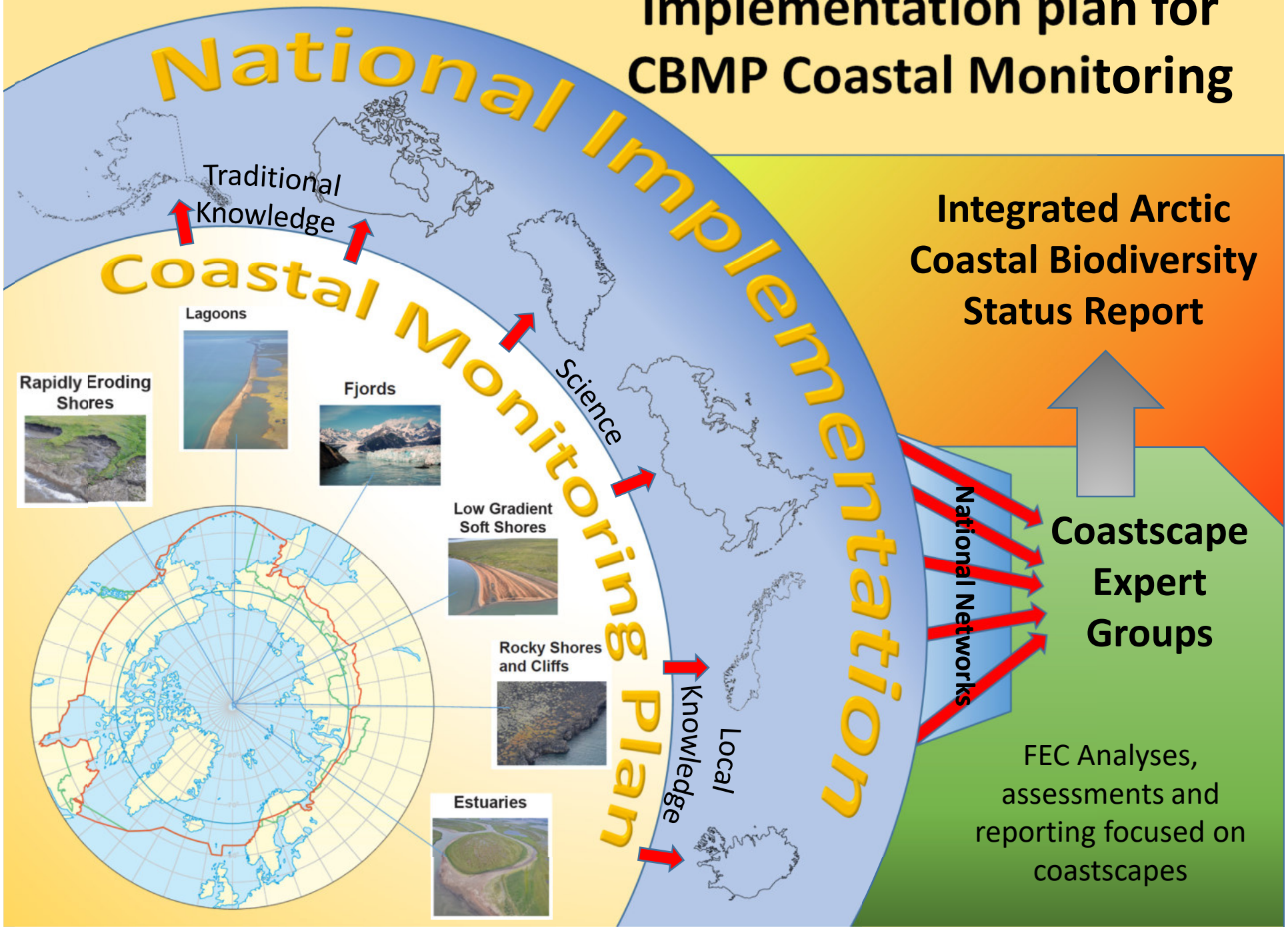
Implementation plan for CBMP Coastal Monitoring



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Lopp Lagoon– Chukchi Coast – Photo: ShoreZone