Science, Service, Stewardship

Coastal Habitats in Alaska: ShoreZone Mapping and Nearshore Fish Atlas

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NOAA FISHERIES SERVICE

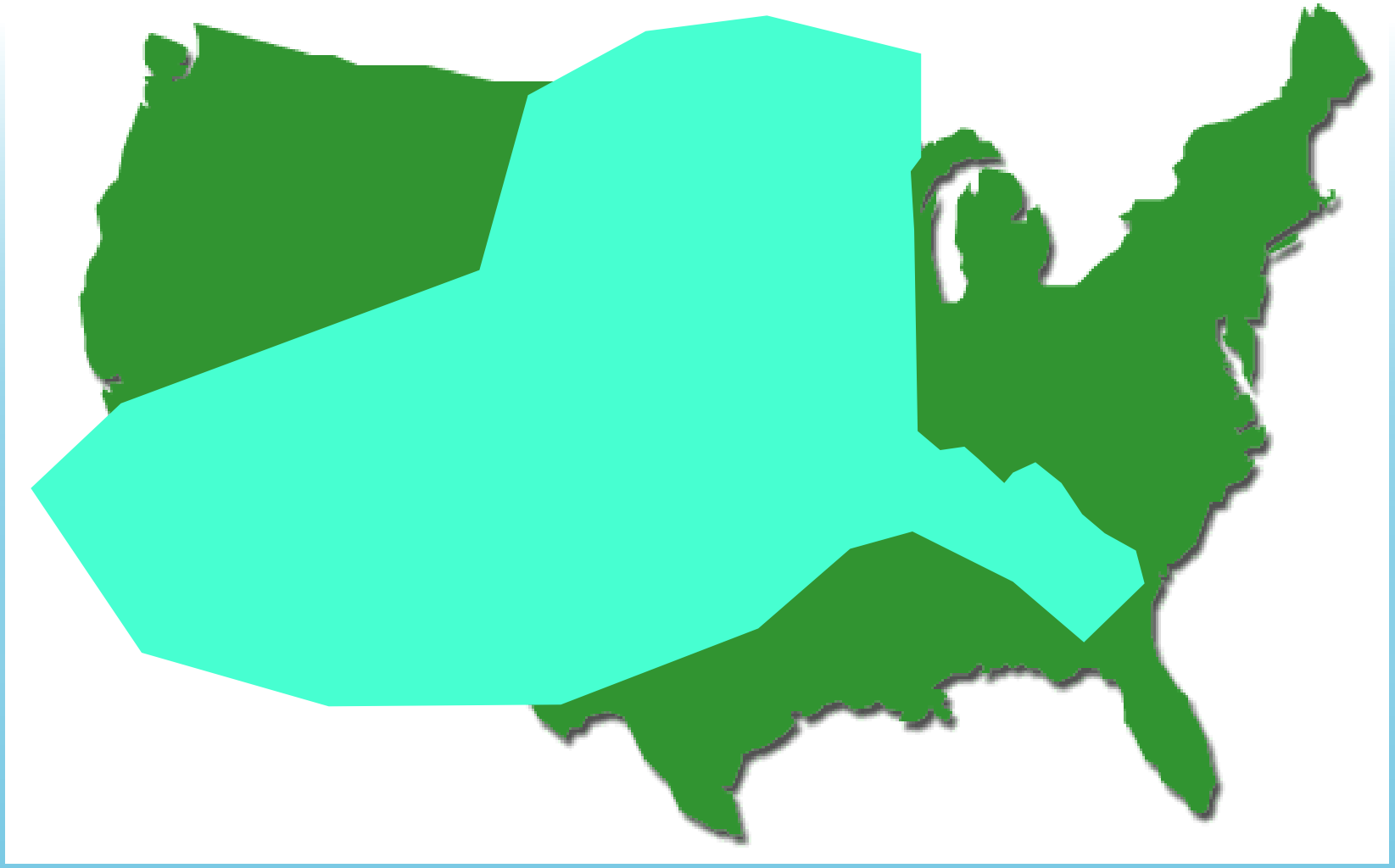
Overview

- ShoreZone
- Nearshore Fish Atlas
- Web Products

Issues in Alaska

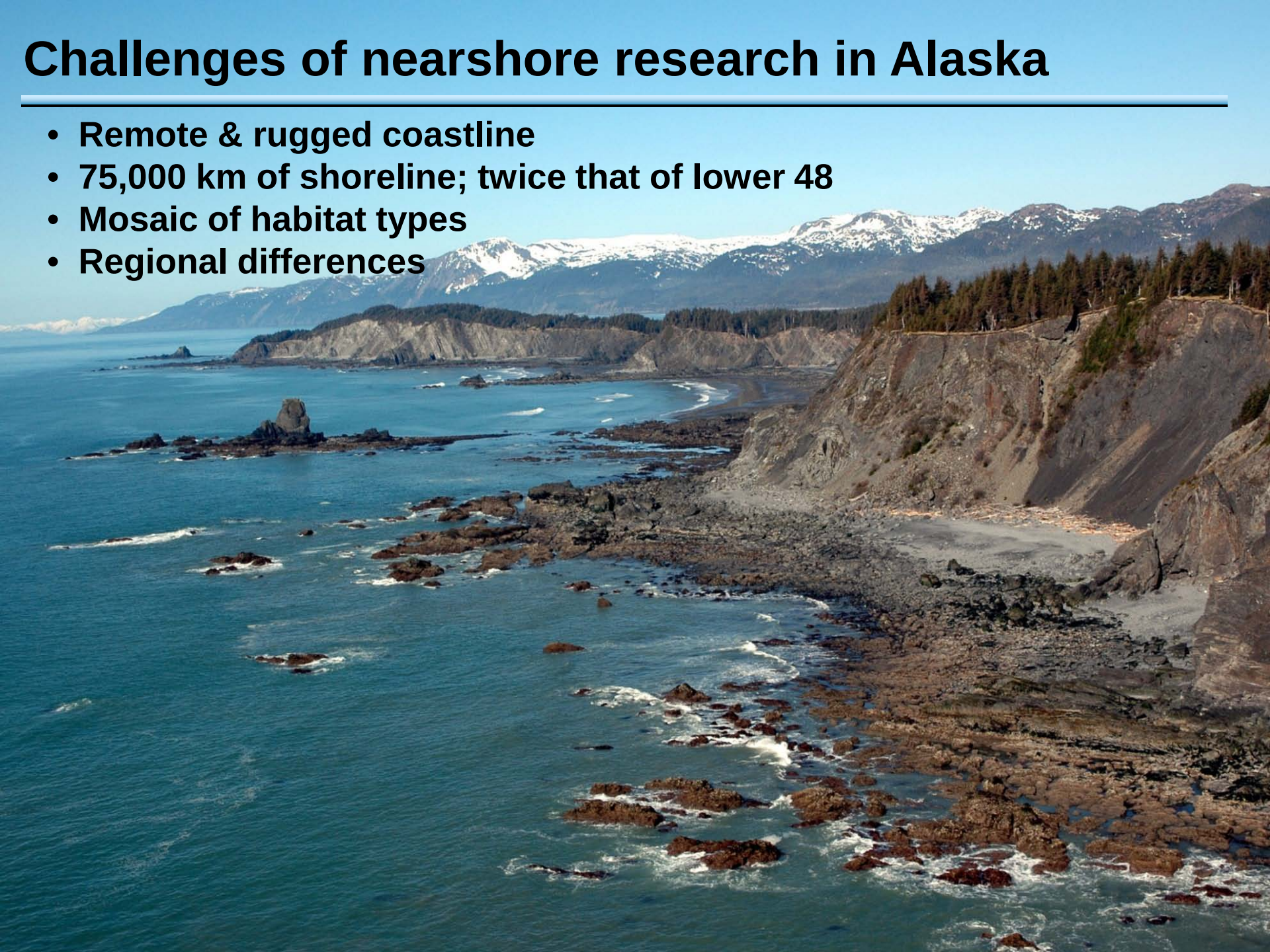
Alaska vs the lower continental US

Exclusive Economic Zone (EEZ) = 900,000 square miles



Challenges of nearshore research in Alaska

- Remote & rugged coastline
- 75,000 km of shoreline; twice that of lower 48
- Mosaic of habitat types
- Regional differences



Bligh Reef – *Exxon Valdez* oil spill (1989)

Lessons learned

<u>Lack of baseline information</u>:

- **Clean-up, damage assessment, restoration, recovery**
- **Charts, habitat maps, imagery**

<u>Lack of detail</u>

What is *ShoreZone*?

Standardized Coastal Habitat Mapping System

ShoreZone images and characterizes biophysical attributes in both along-shore and across-shore components in a spatially explicit environment.

wave exposure

geomorphology

sediment texture

intertidal/subtidal biota

supratidal biota

man-made features

Alaska ShoreZone Partners

“ To make physically and intellectually accessible ”

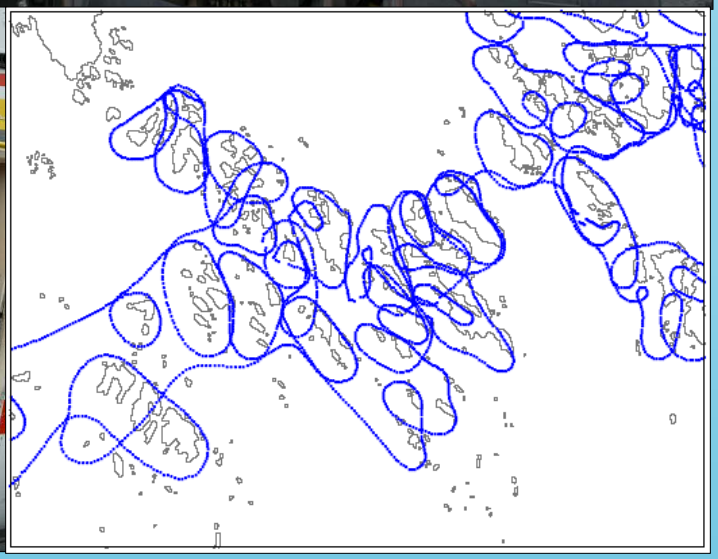
NOAA National Marine Fisheries Service
Alaska Department of Natural Resources
The Nature Conservancy
Cook Inlet Regional Citizens Advisory Council

Alaska Dept. of Fish and Game
Alaska Ocean Observing System
Archipelago Marine Research Ltd
Coastal and Ocean Resources Inc
Exxon Valdez Oil Spill Trustee Council
Kenai Peninsula Borough
Minerals Management Services National Park Service
North Pacific Research Board
Ocean Fund
PWS RCAC
PWS Science Center
Sitka Tribe of Alaska
The Skaggs Foundation
SEAK Petroleum Resources Organization
The Nature Conservancy
U.S. Coast Guard
U.S. Fish & Wildlife Service
U.S.D.A. Forest Service
UAF Geographic Information Network of AK

ShoreZone Method: Coastal Imagery

Mapping is based on video and still imagery:

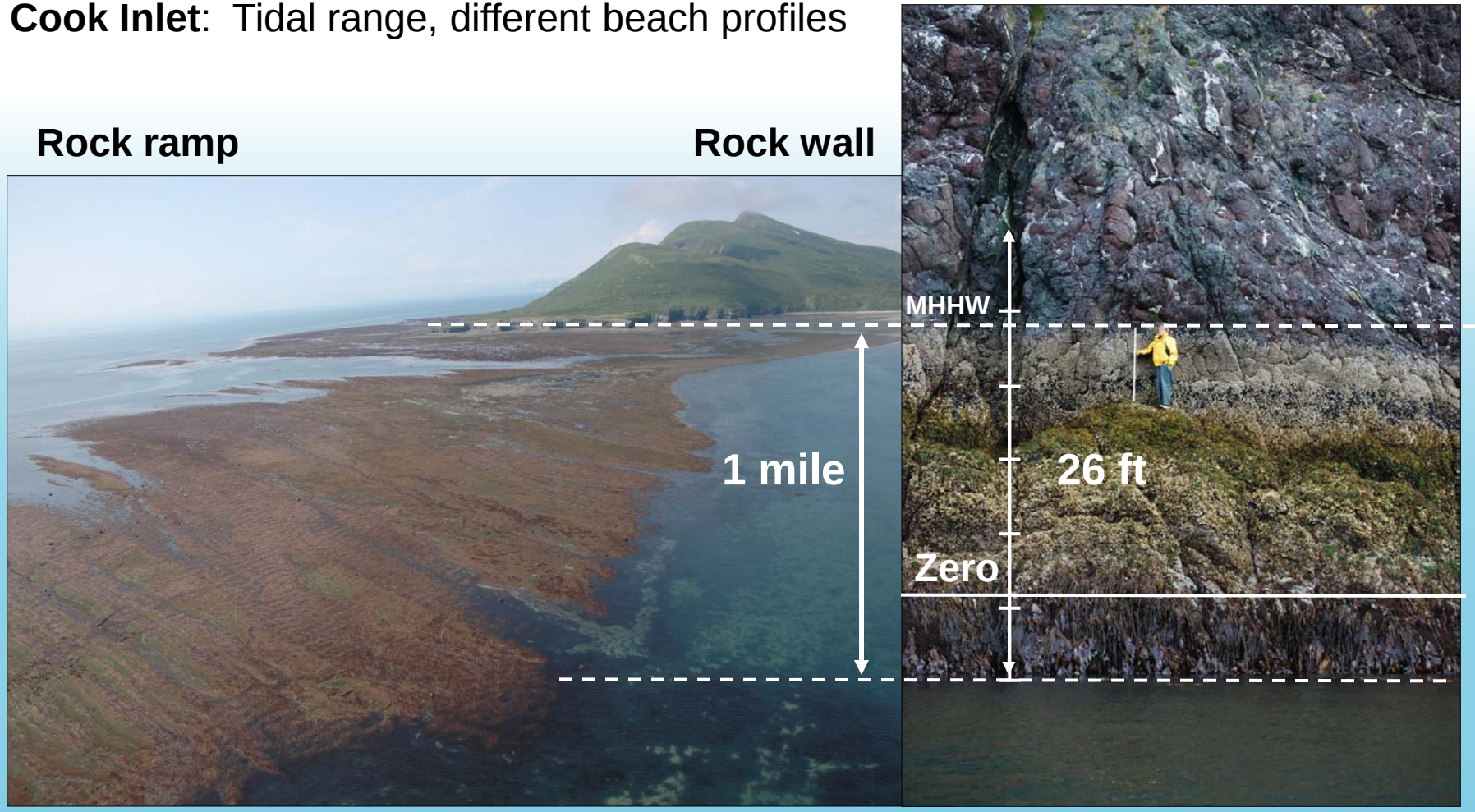
- **Low-altitude**
- **Oblique**
- **Spatially-referenced**
- **Collected during low tides**



ShoreZone Method: Why image at low tide?

Cook Inlet: Tidal range, different beach profiles

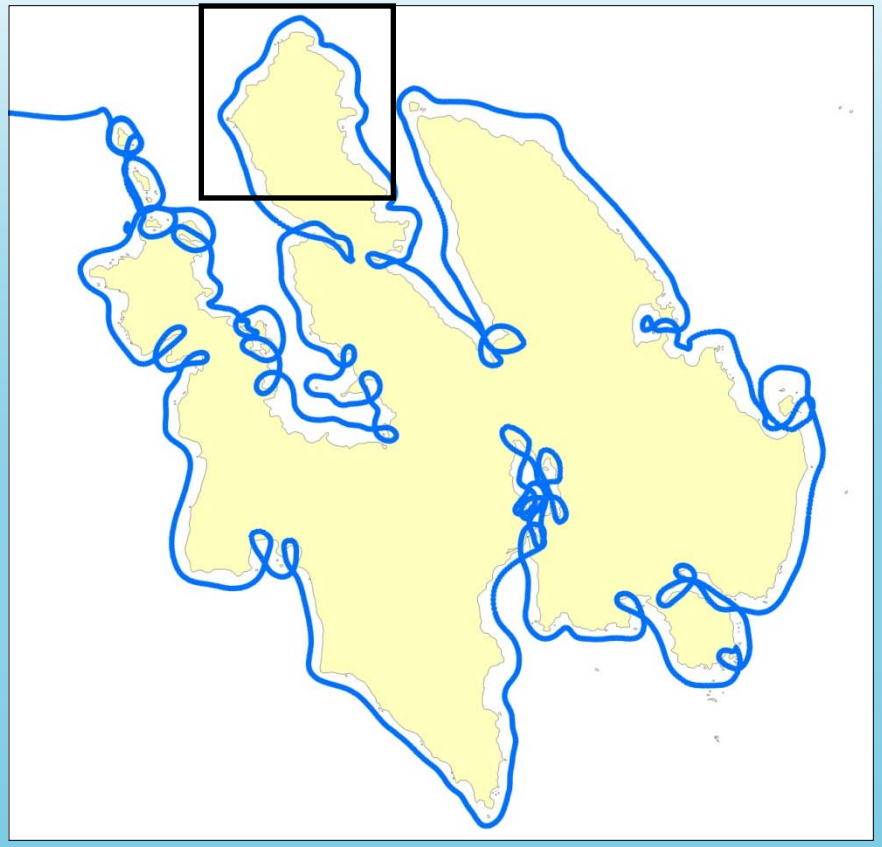
Rock ramp **Rock wall**



Kamishak Bay **Kachemak Bay**

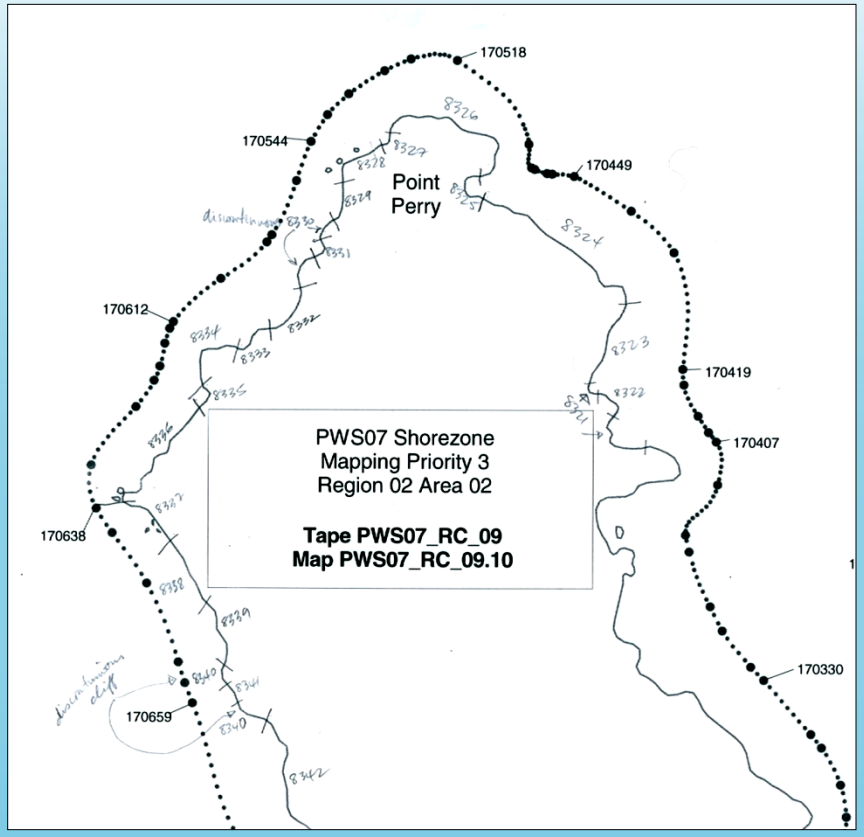
ShoreZone Method: Digital Shoreline

GPS flight trackline recorded at 1-second intervals:



→

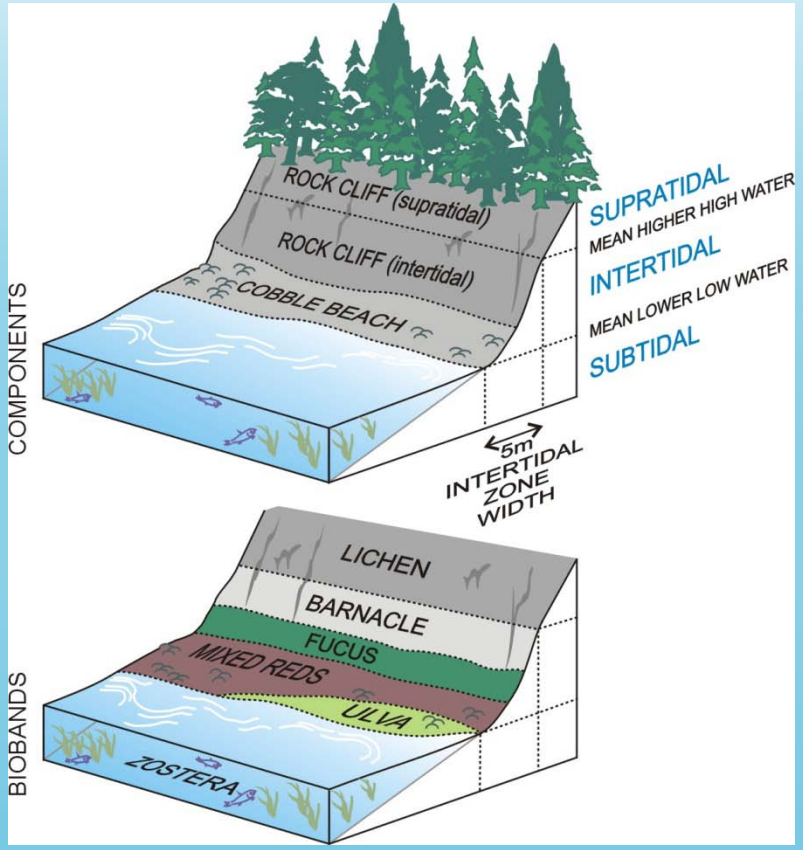
Navigation trackline and imagery are used to segment digital shoreline into along-shore units:



ShoreZone Method: Biophysical Mapping

Physical and biological features of across-shore zones are mapped with respect to relative tidal position

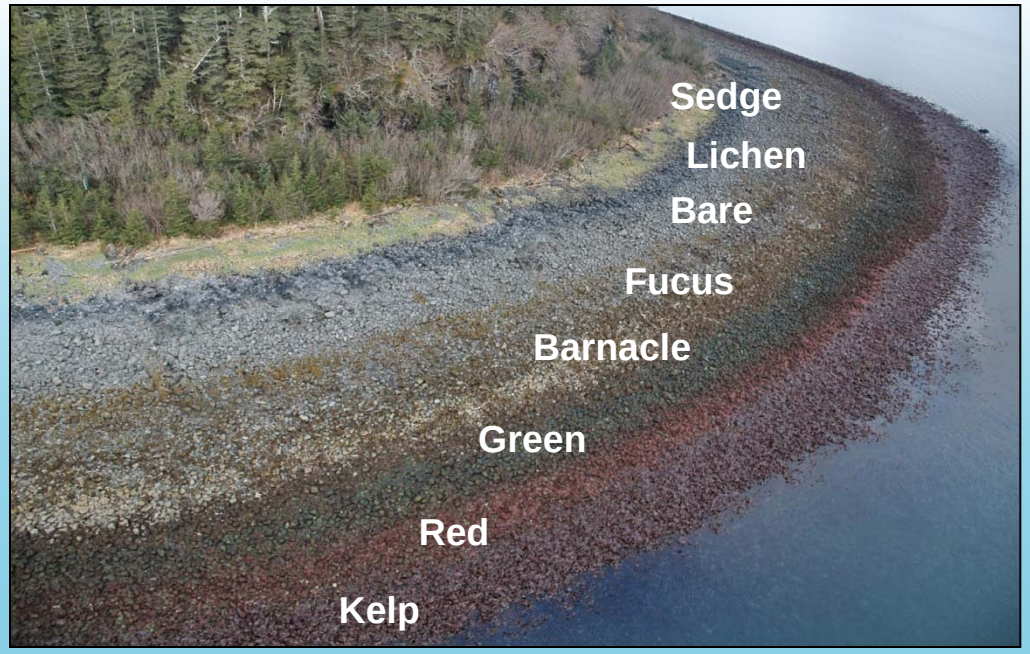
Physical (geomorphic) attributes:



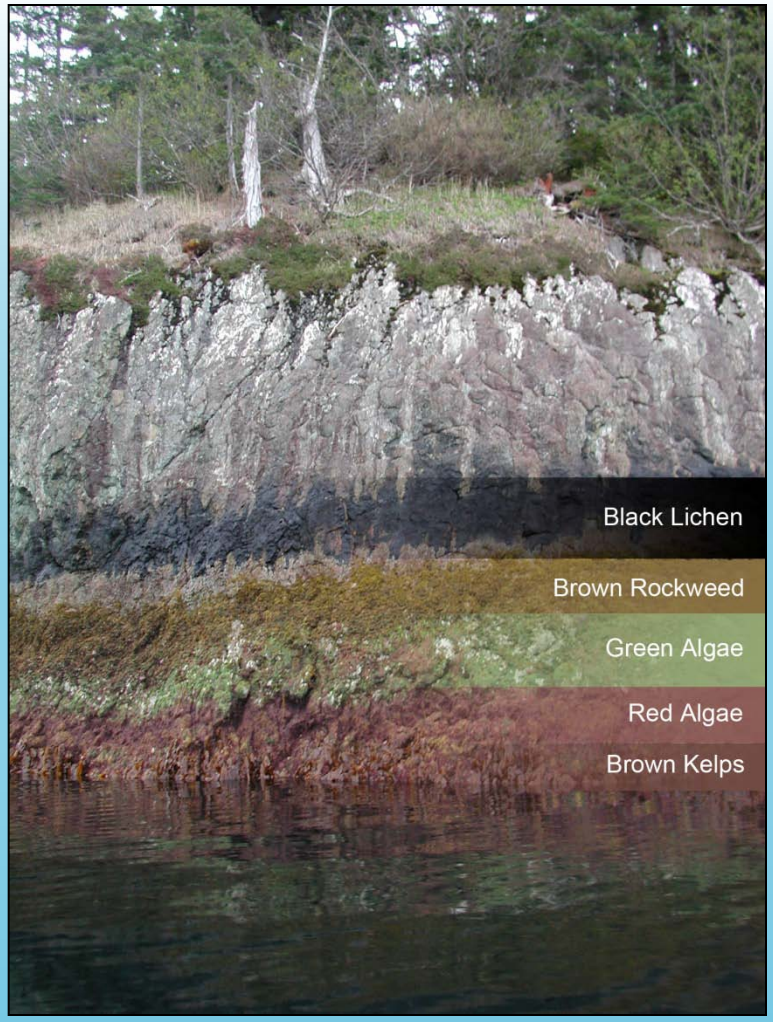
Biotic communities (“biobands”):

ShoreZone Method: Biobands

Biobands: assemblages having a characteristic color and across-shore elevation



Different patterns with different substrates



ShoreZone Method: Biobands

Clues to community structure

Red bioband =

assemblage of many species

ShoreZone Method: Biobands

Biology as indicators of exposure

ShoreZone Protocols: Shore Types

Table A-2. Classification of shore types employed in ShoreZone mapping
(derived from the Howes et al. [1994] "BC Class" system in British Columbia)

SUBSTRATE	SEDIMENT	WIDTH	SLOPE	COASTAL CLASS	NO.
ROCK	N/A	WIDE (>30 m)	STEEP (>20°)	n/a	
			INCLINED (5-20°)	Rock Ramp, wide	1
			FLAT (<5°)	Rock Platform, wide	2
		NARROW (<30 m)	STEEP (>20°)	Rock Cliff	3
			INCLINED (5-20°)	Rock Ramp, narrow	4
			FLAT(<5°)	Rock Platform, narrow	5
ROCK & SEDIMENT	GRAVEL	WIDE (>30 m)	STEEP (>20°)	n/a	
			INCLINED (5-20°)	Ramp with gravel beach, wide	6
			FLAT (<5°)	Platform with gravel beach, wide	7
		NARROW (<30 m)	STEEP (>20°)	Cliff with gravel beach	8
			INCLINED (5-20°)	Ramp with gravel beach	9
			FLAT (<5°)	Platform with gravel beach	10
	SAND & GRAVEL	WIDE (>30 m)	STEEP (>20°)	n/a	
			INCLINED (5-20°)	Ramp w gravel & sand beach, wide	11
			FLAT (<5°)	Platform with G&S beach, wide	12
		NARROW (<30 m)	STEEP (>20°)	Cliff with gravel/sand beach	13
			INCLINED (5-20°)	Ramp with gravel/sand beach	14
			FLAT (<5°)	Platform with gravel/sand beach	15
	SAND	WIDE (>30 m)	STEEP (>20°)	n/a	
			INCLINED (5-20°)	Ramp with sand beach, wide	16
			FLAT (<5°)	Platform with sand beach, wide	17
		NARROW (<30 m)	STEEP (>20°)	Cliff with sand beach	18
			INCLINED (5-20°)	Ramp with sand beach, narrow	19
			FLAT (<5°)	Platform with sand beach, narrow	20
SEDIMENT	GRAVEL	WIDE (>30 m)	FLAT (<5°)	Gravel flat, wide	21
		NARROW (<30 m)	STEEP (>20°)	n/a	
			INCLINED (5-20°)	Gravel beach, narrow	22
			FLAT (<5°)	Gravel flat or fan	23
	SAND & GRAVEL	WIDE (>30 m)	STEEP (>20°)	n/a	
			INCLINED (5-20°)	n/a	
			FLAT (<5°)	Sand & gravel flat or fan	24
		NARROW (<30 m)	STEEP >20°)	n/a	
			INCLINED (5-20°)	Sand & gravel beach, narrow	25
			FLAT (<5°)	Sand & gravel flat or fan	26
	SAND / MUD	WIDE (>30m)	STEEP (>20°)	n/a	
			INCLINED (5-20°)	Sand beach	27
			FLAT (<5°)	Sand flat	28
			FLAT (<5°)	Mudflat	29
		NARROW (<30m)	STEEP (>20°)	n/a	
			INCLINED (5-20°)	Sand beach	30
			FLAT (<5°)	n/a	n/a
	ORGANICS	n/a	n/a	Estuaries	31
ANTHRO-POGENIC	Man-made	n/a	n/a	Man-made, permeable	32
			n/a	Man-made, impermeable	33
CHANNEL	Current	n/a	n/a	Channel	34
GLACIER	Ice	n/a	n/a	Glacier	35

Shore Type: Rock (BC Classes 1-5) — **Southeast Alaska**

Steep high cliff (Form "Cash"), fixed-wing aerial survey photo
Taiya Point, Lynn Canal (Unit 10/04/3200)

Low-tide, irregular rock platform with tidepools (Form "Pihp")
Yakobi Island (Unit 10/02/1632)

Shore Type: Rock and Sediment (BC Classes 6-20, continued) — **Kodiak Archipelago**

Wide (>30 m) platform (<5° slope) with gravel beach (BC Class 7)
Geese Channel (Unit 05/04/8011)

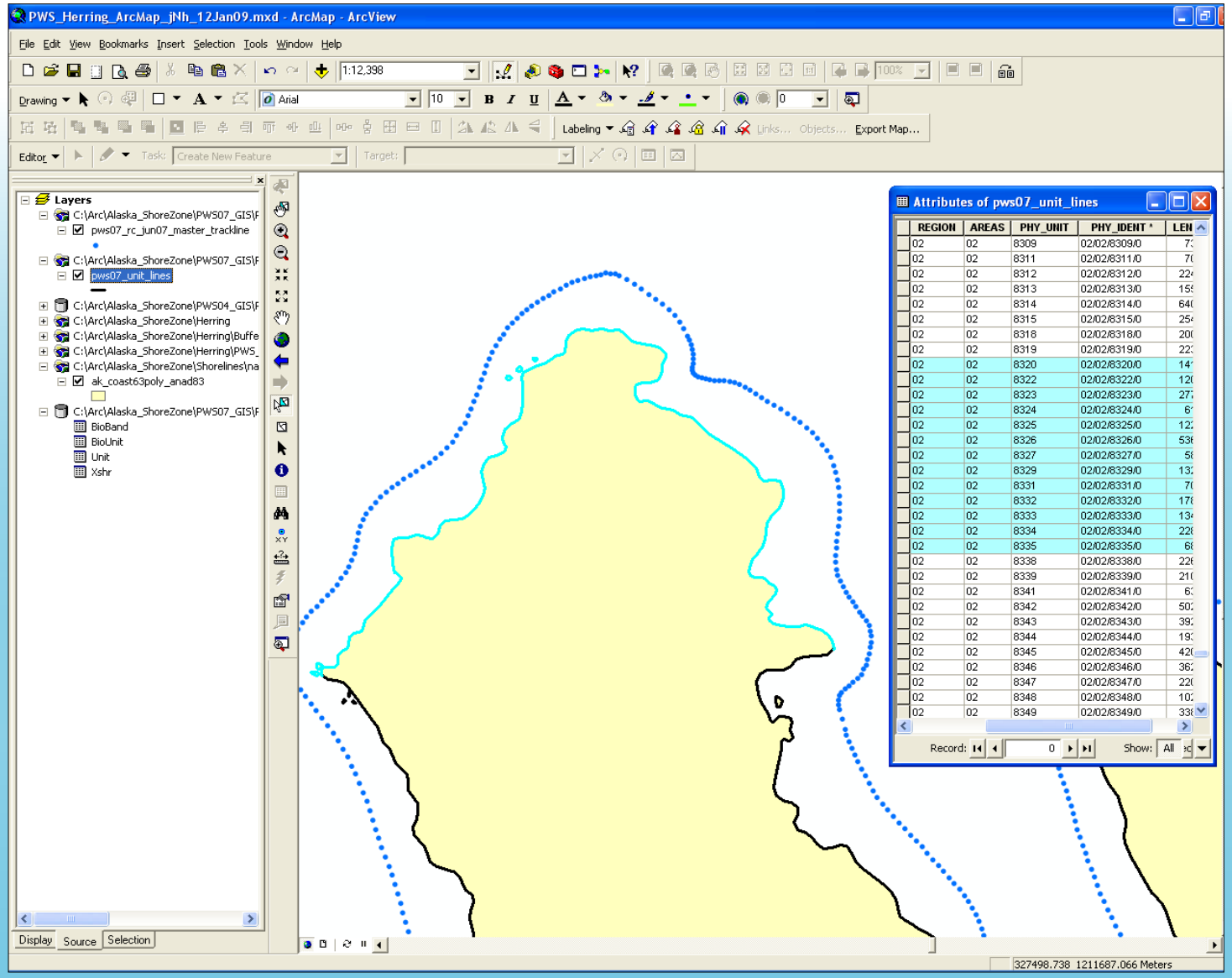
Steep cliff (>20°) with narrow (<30 m) gravel beach (BC Class 8)
Geese Channel (Unit 05/04/8030)

Shore Type: Glaciers (BC Class 35) — **Southeast Alaska**

Glaciers of Russel Fjord (Form "Ig")
Northern Yakutat Bay (Unit 09/02/0145)
SE05_ML_4494.jpg

Glaciers of Tsaa Fjord, with high cliffs and waterfalls (Forms "Ig," "Cash," and "Rm")
Icy Bay (Units 09/01/0345-0349)
SE05_ML_3976.jpg

ShoreZone: A Rigorous Geospatial Database



Summary Reports: Biobands - Eelgrass

The occurrence of each bioband mapped in Prince William Sound is summarized in Table 3.3 and Figure 3.4.

Table 3.3. Bioband abundances mapped in Prince William Sound.

Bioband Names	Code	Continuous		Patchy		Total (km)	% of Mapped
		(km)	%	(km)	%		
Dune Grass	GRA	1,467	26	845	15	2,312	41
Sedges	SED	241	4	163	3	404	7
Salt Marsh	PUC	960	17	803	14	1,763	31
Barnacle	BAR	3,445	62	1,393	25	4,838	87
Rockweed	FUC	3,486	62	1,385	25	4,871	87
Green Algae	ULV	3,011	54	1,748	31	4,759	85
Blue Mussel	BMU	188	3	745	13	933	16
Bleached Red Algae	HAL	437	8	866	16	1,303	24
Red Algae	RED	1,534	27	1,144	20	2,678	47
Alaria	ALA	452	8	246	4	698	12
Soft Brown Kelps	SBR	2,437	44	1,015	18	3,452	62
Dark Brown Kelps	CHB	161	3	132	2	293	5
Surfgrass	SUR	163	3	175	3	338	6
Eelgrass	ZOS	1,635	29	891	16	2,526	45
Dragon Kelp	ALF	5	<1	11	<1	16	<1
Bull Kelp	NER	74	1	47	1	121	2

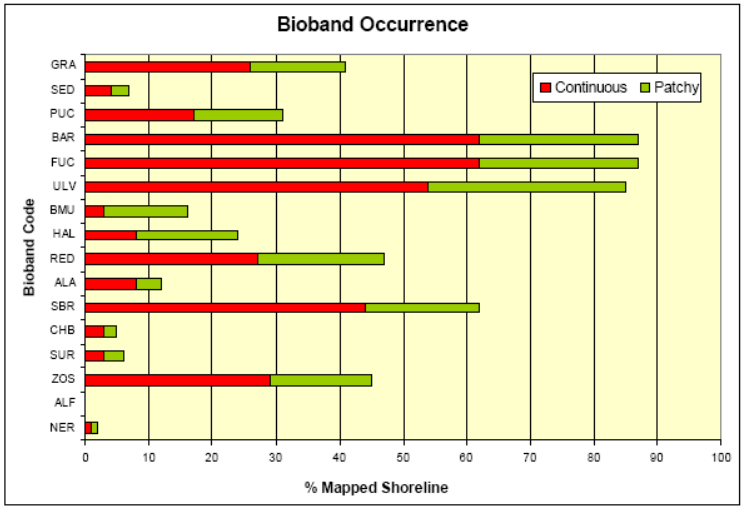
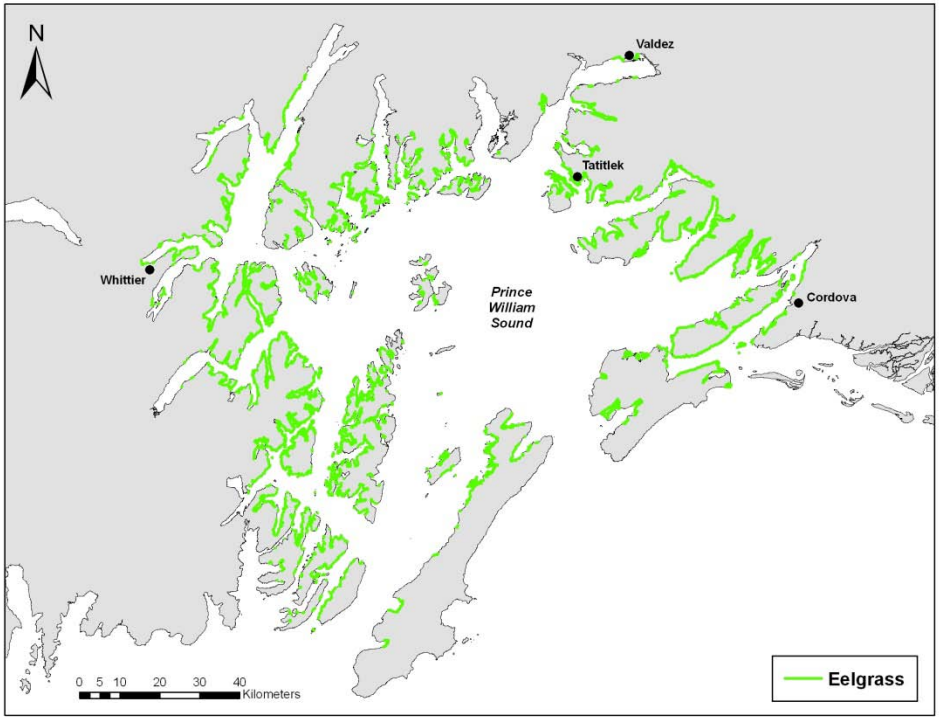
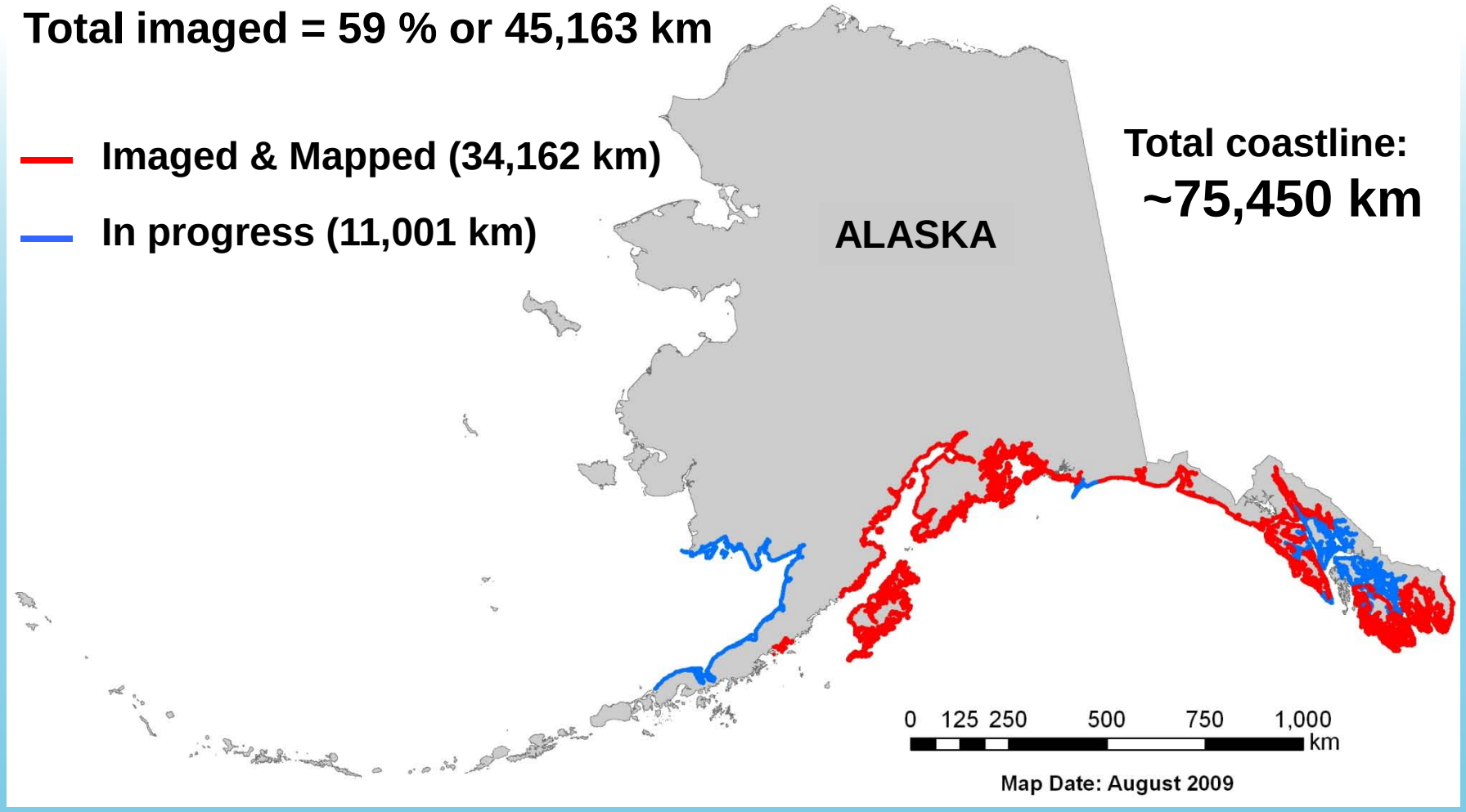


Figure 3.4. Occurrence of biobands mapped in Prince William Sound.

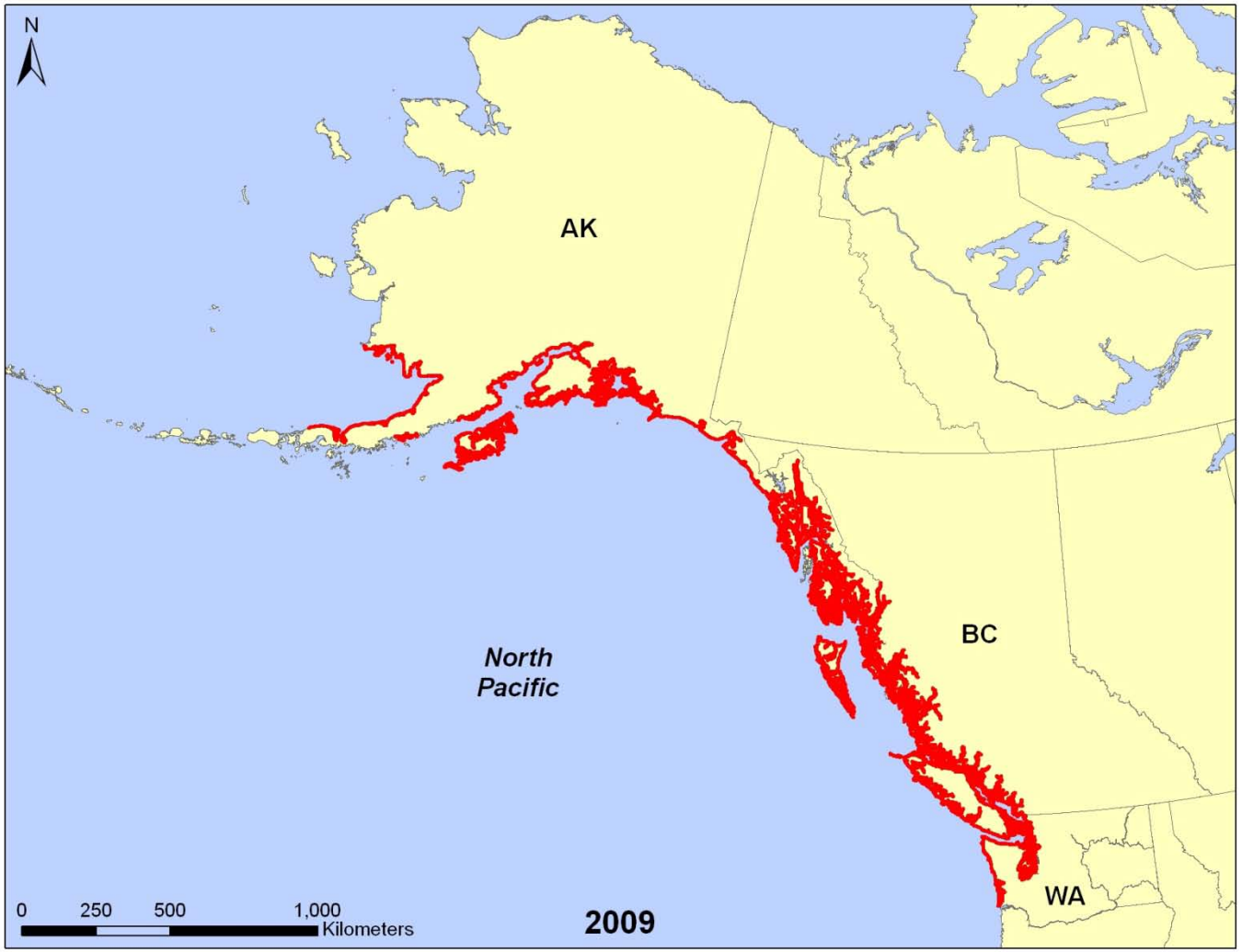


Alaska ShoreZone Progress (2009)



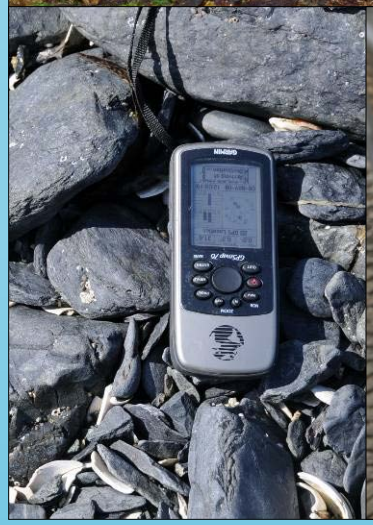
North Pacific ShoreZone:

Almost 100,000 km of contiguous coastline has been mapped from the Columbia River mouth to Bristol Bay, Alaska.



15 degrees of latitude

ShoreZone: Verification and Shore Stations



Applications of Alaska ShoreZone

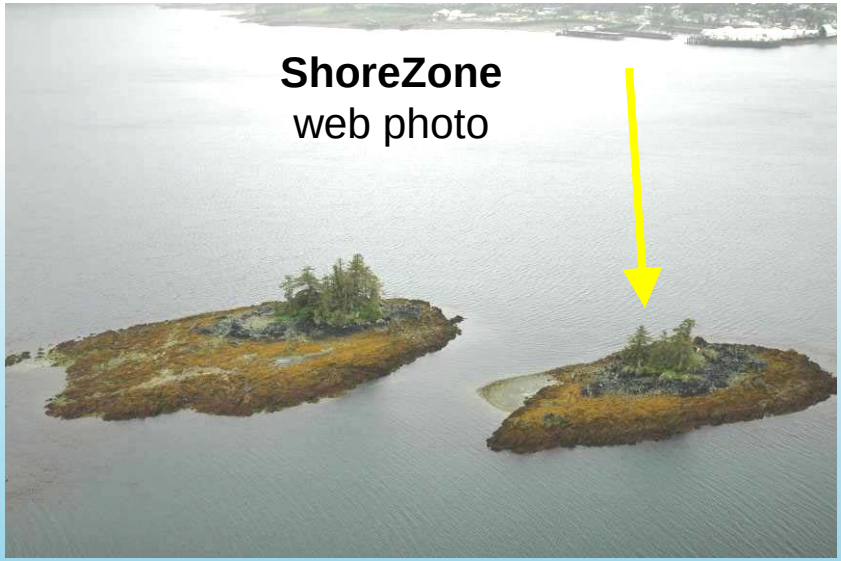
- First Responders
- Coastal Mgmt.
- Research
- Web products!

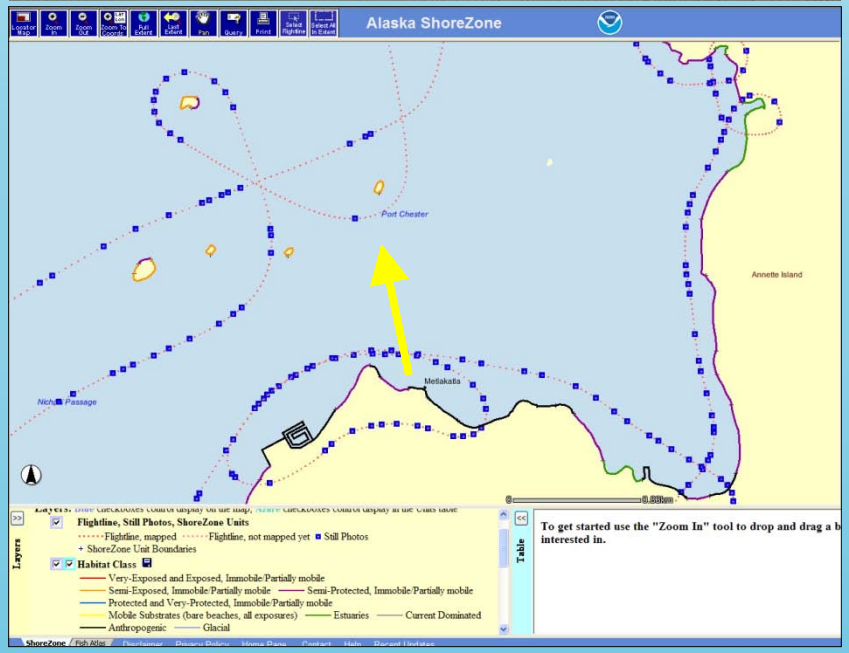
Applications: First Responders

Grounding of the ferry *Lituya*
Metlakatla Jan. 30, 2009

"…. *ShoreZone* provided valuable information prior to any response assets could arrive on scene. It was extremely helpful and we'll use it again next time."

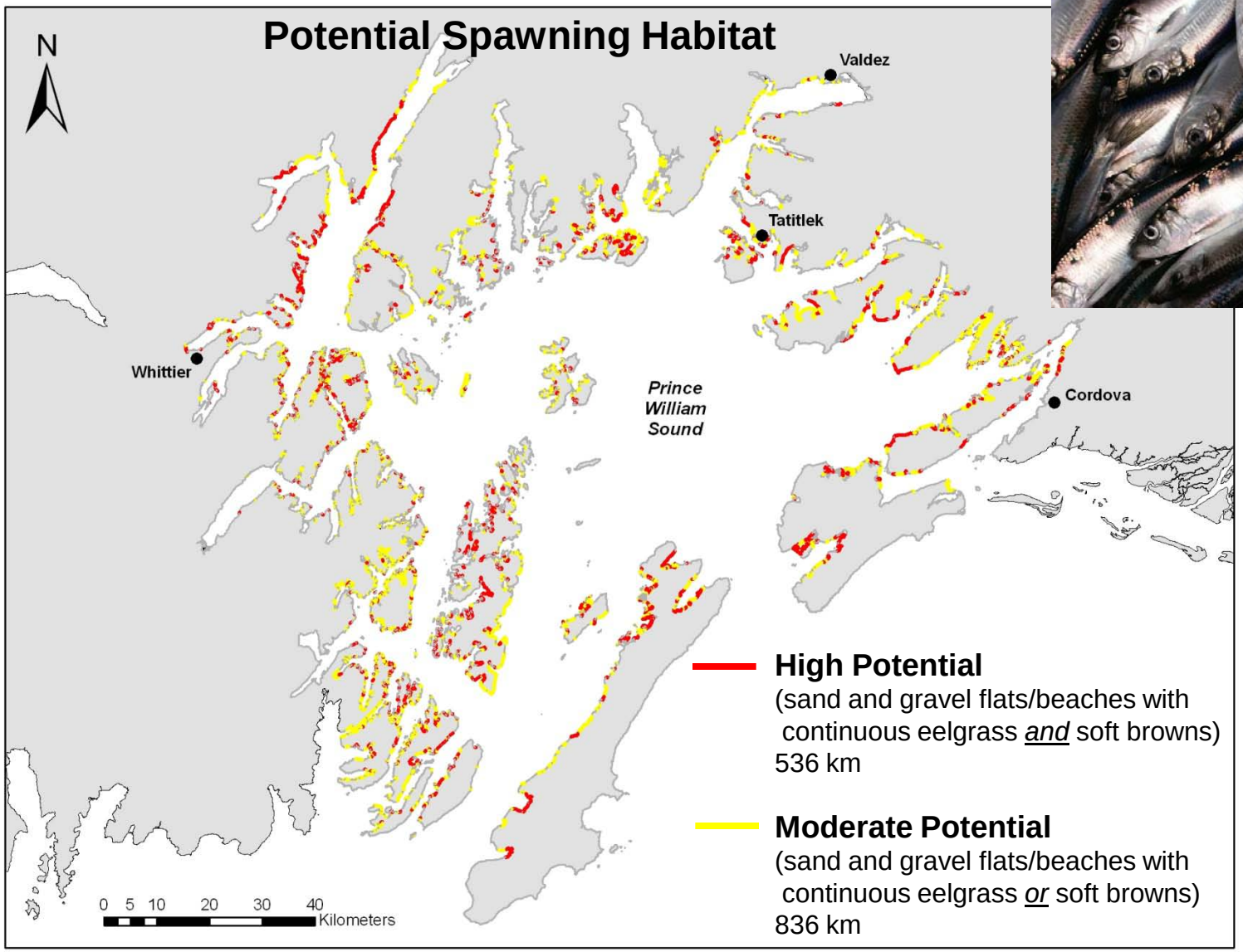
LT Chris Williammee, USGC
Incident Management Sector Juneau



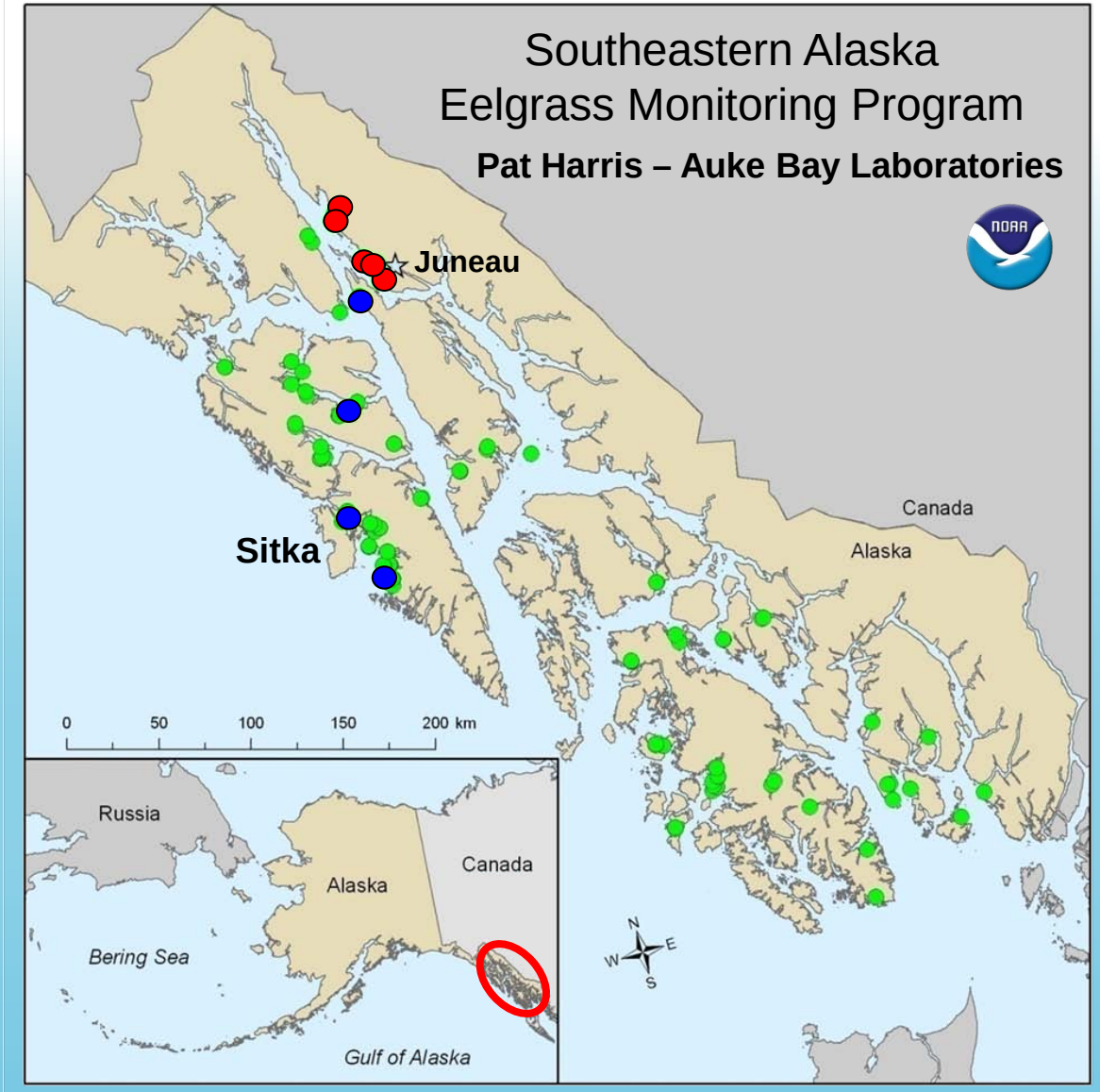


Applications:

Resource Management – Habitat Profiling for EFH



Applications: Research - monitoring



Applications: Invasive Species

Habitat Suitability Modeling

High risk areas for migration into SEAK waters

Salt Marsh Cordgrass, *Spartina*

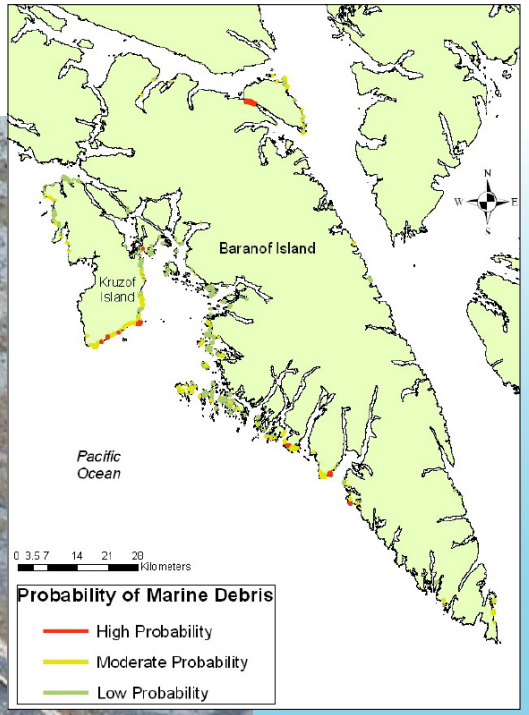
European Green Crab, *Carcinus maenas*

Green Crab Index

Linda Shaw - Habitat Conservation Division, Juneau AK
Coastal and Ocean Resources Inc.

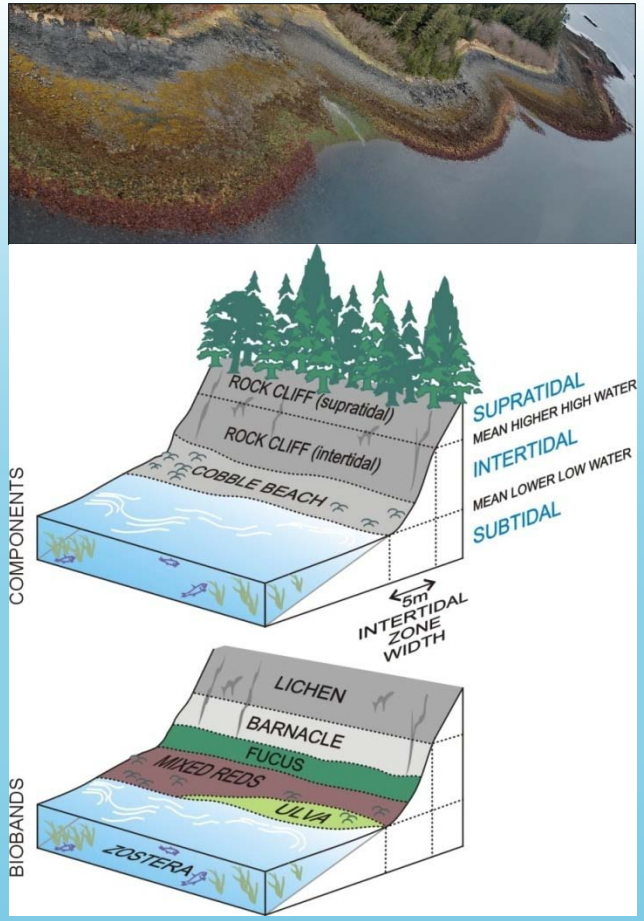
Applications: Marine Debris

Modeling catcher beaches



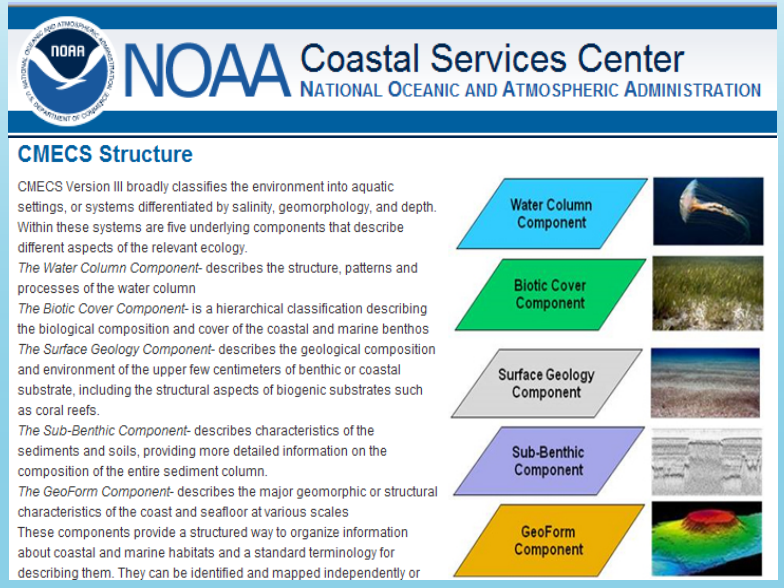
Applications: Marine Spatial Planning

ShoreZone



Crosswalk

Coastal and Marine Ecological Classification Standard (CMECS)



Applications: Coastal Archaeology

Ancient Clam gardens

Fish traps

Intertidal rock wall
Sitka Sound

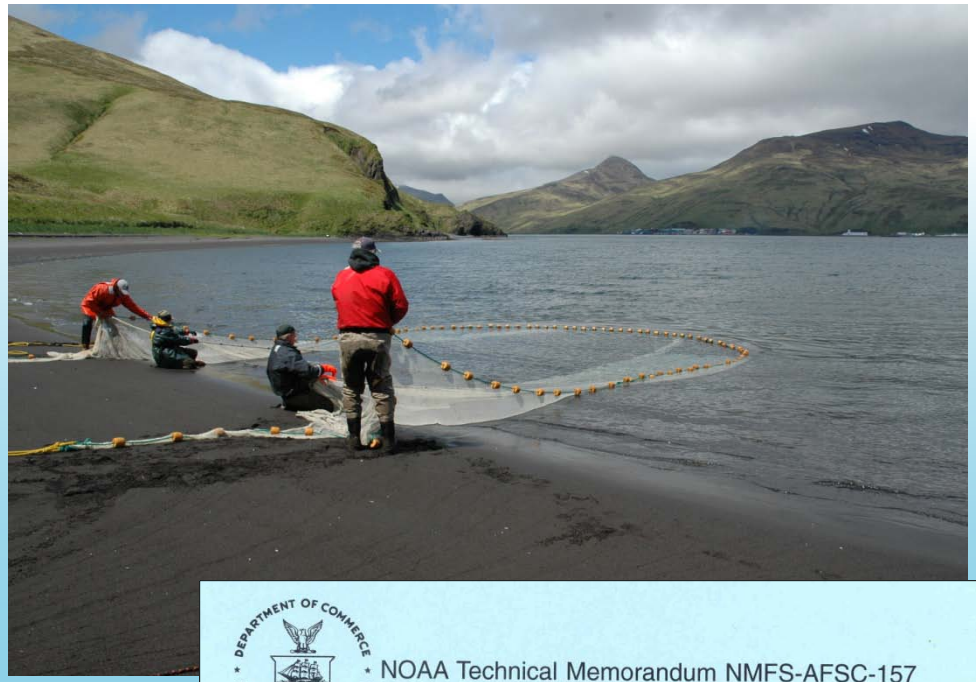
Nearshore Fish Atlas

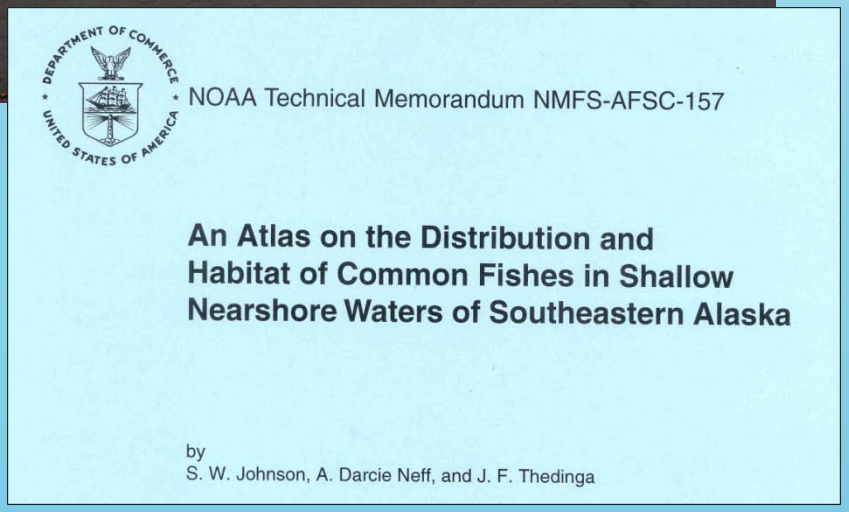
Fish distribution and habitat use

What is the Nearhore Fish Atlas?

An online database

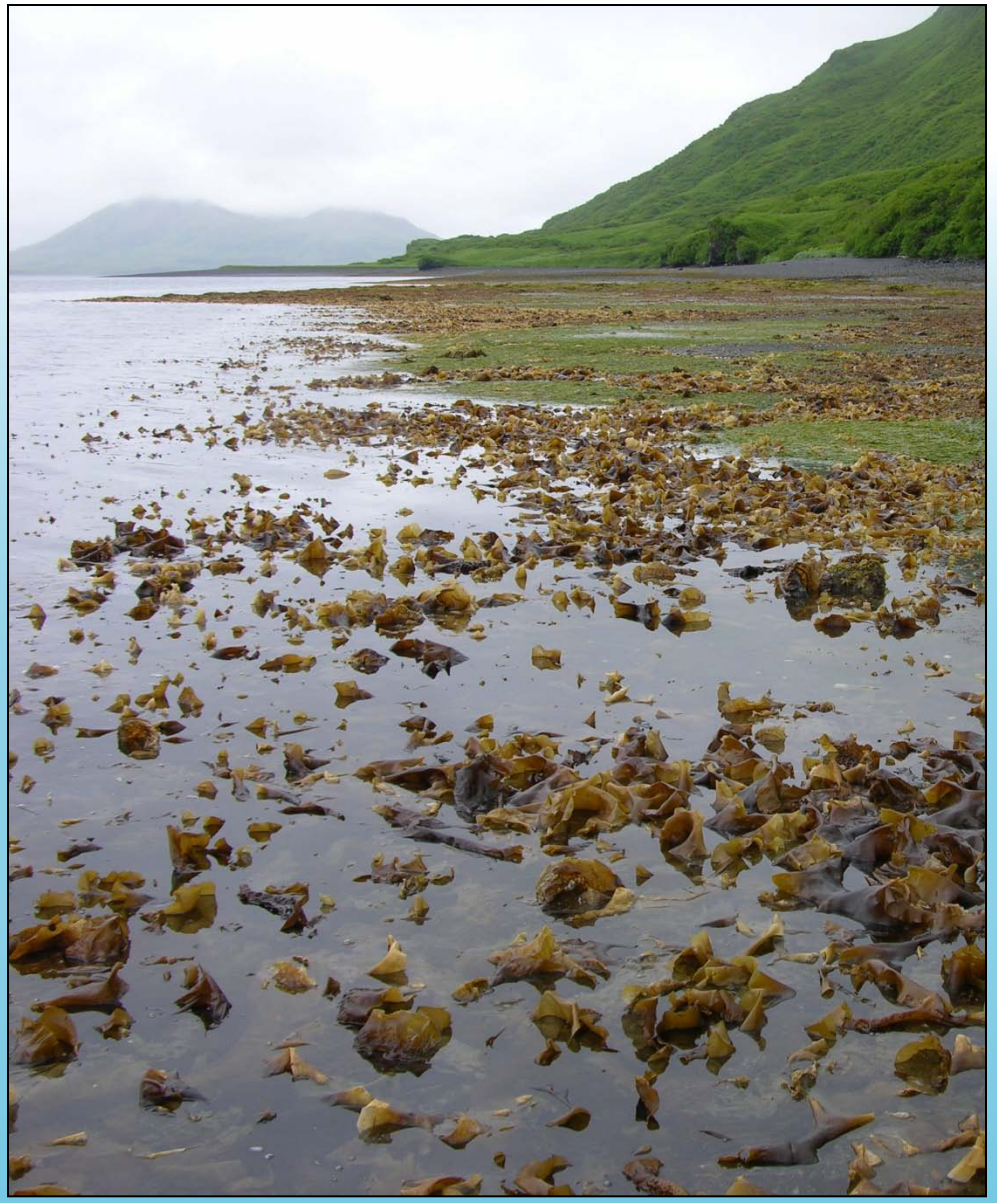
- **Spatially-explicit info on distribution & habitat use**
- **1998 to present**
- **Integrated with online ShoreZone in 2006**
- **Dynamic**
- **Database contains:**
  - **975 beach seine hauls**
  - **669,409 fish**
  - **104 fish species (25% FMP)**
  - **and growing each year**





Essential Fish Habitat (EFH)

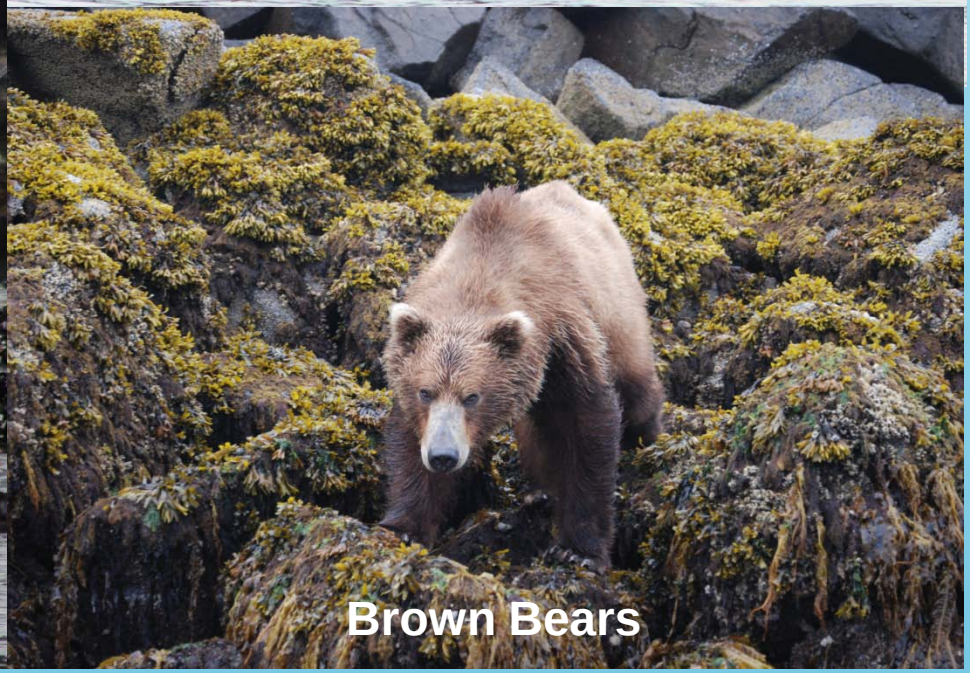
- **MSFCMA mandates the description of EFH for all life stages of all FMP spp.**
- **EFH = waters & substrates necessary for spawning, breeding, feeding, or growth.**
- **Identifying EFH requires info on distribution & habitat use; lacking for most FMP spp.**



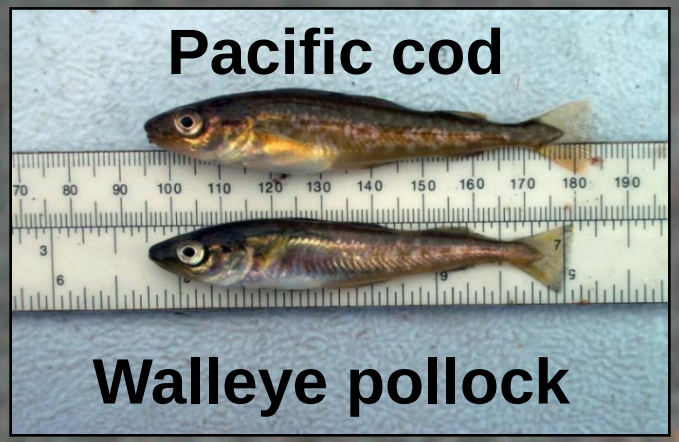
Shallow Nearshore Defined

Intertidal and subtidal habitats of brackish and saltwater which extend offshore to a depth of 10m

Why the shallow, nearshore?



Important for FMP species - especially forage fishes



Regional Study Areas of Alaska

Arctic

Prince William Sound

Aleutian Islands

Cook Inlet

Southeastern

Methods - sampling different habitats

Seasonal Sampling – "Deadliest Catch"

Diel Sampling

Fish Catch

Habitat

Applications: managers can track changes in fish distribution and habitat that may result from climate change

Repository for long-term datasets

- **Changes in species composition**
- **Relative abundance**

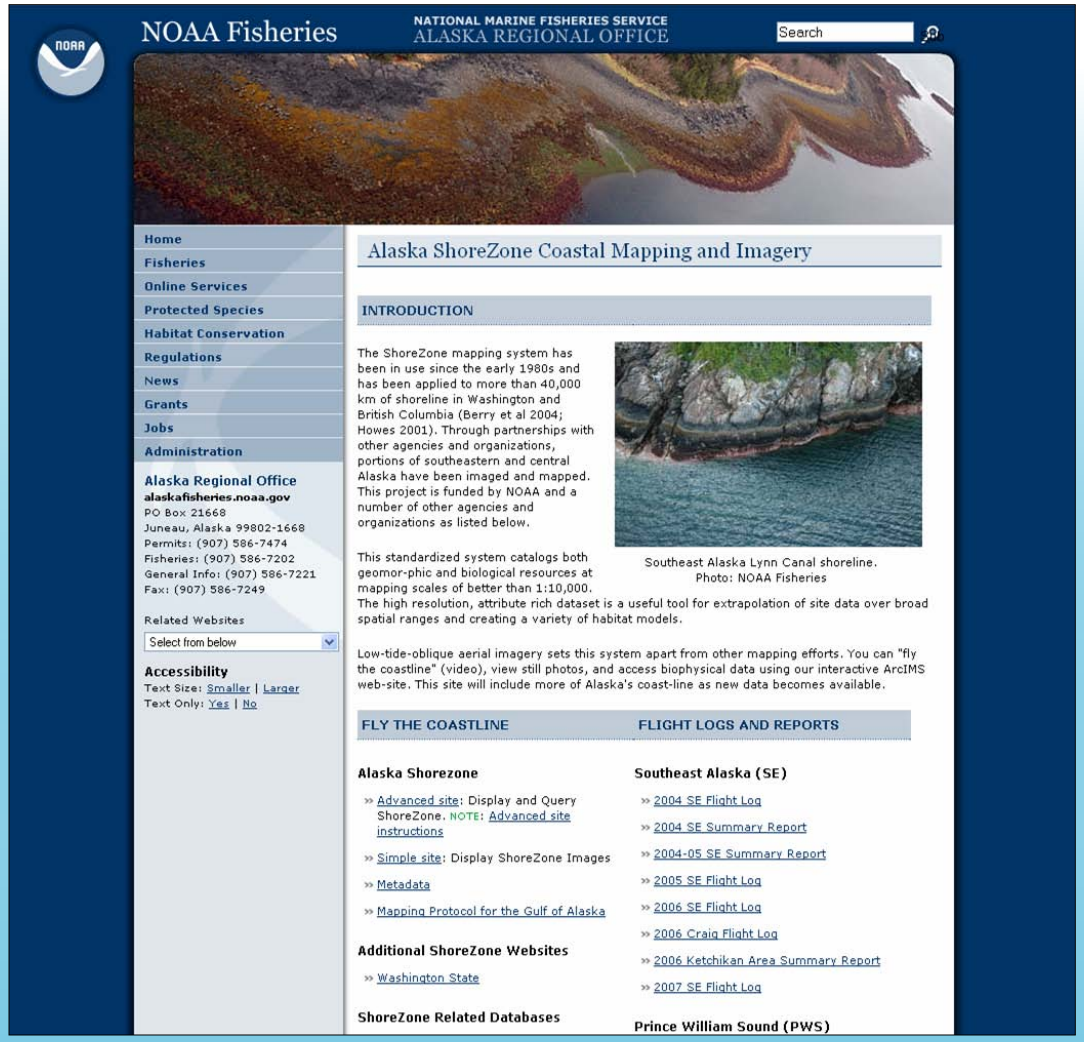
Integrated Web Products

“ To make physically and intellectually accessible ”

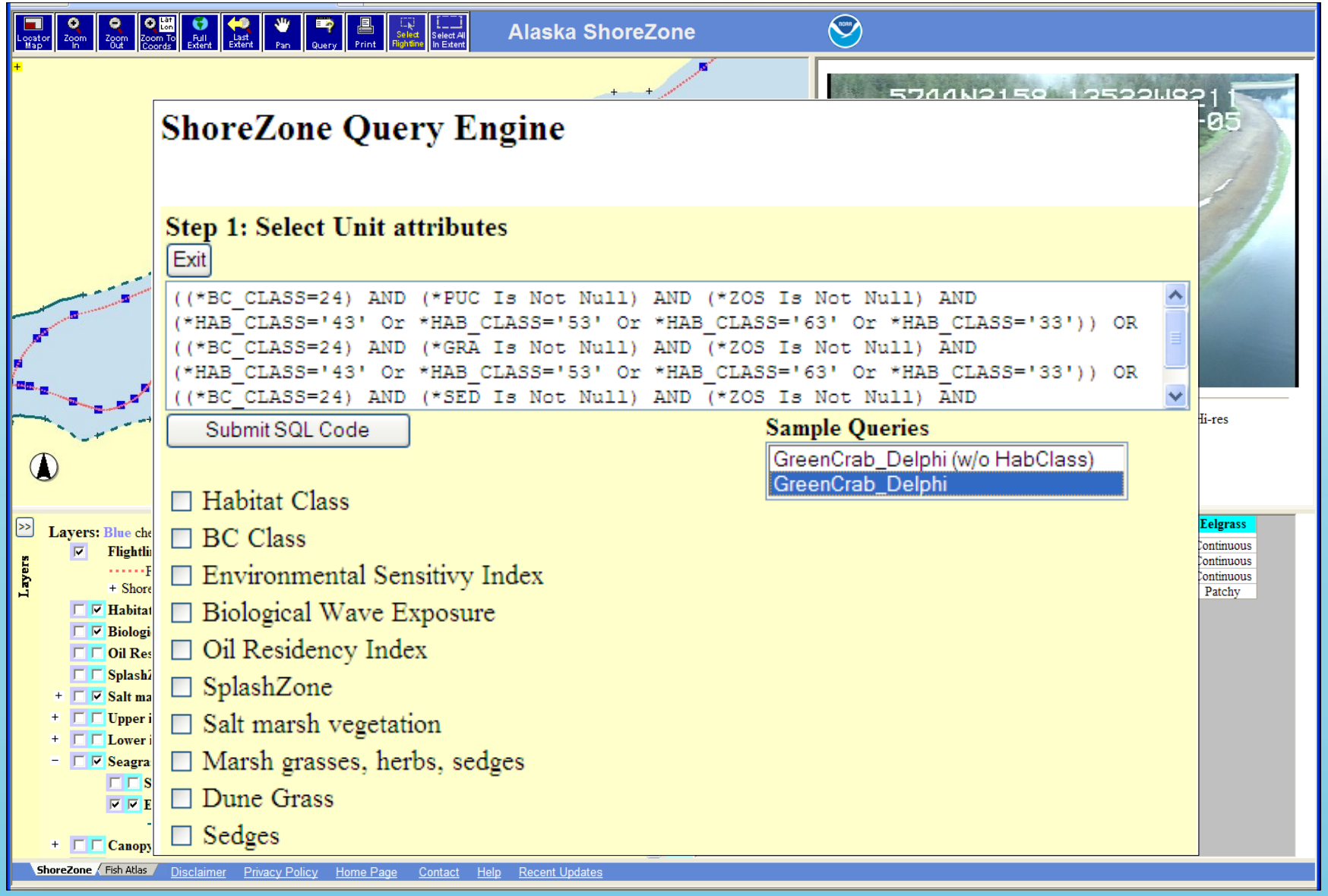
Alaska ShoreZone Online

www.alaskafisheries.noaa.gov/maps/szintro

- A collaboration between SZ partners and NOAA AK Regional Office (Steve Lewis)
- Website is constantly being updated
- New features are being added
- Terabytes of information
  ~ 3 million images



Interactive Geospatial Database Online



Nearshore Fish Altas Online

www.alaskafisheries.noaa.gov/habitat/fishatlas

NOAA Fisheries

NATIONAL MARINE FISHERIES SERVICE
ALASKA REGIONAL OFFICE

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Juneau, Alaska 99802-1668
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Nearshore Fish Atlas of Alaska

NEARSHORE FISH PHOTOS

The following is a partial list of species captured, mostly by beach seining. A few species (e.g., Pacific halibut, yelloweye rockfish), were captured by jigging; jig catch data will be included in a later update of this website. The photo catalog will be updated as more fish photos become available. More information about the species may be accessed through the Fish Atlas database.

cods - Gadidae
- Arctic cod (*Boreogadus saida*)
- Pacific cod (*Gadus macrocephalus*)
- Saffron cod (*Eleginus gracilis*)
- Walleye pollock (*Theragra chalcogramma*)

fathead sculpins - Psychrolutidae
- Soft sculpin (*Psychrolutes sigalutes*)

gobies - Gobiidae
- Bay goby (*Lepidogobius lepidus*)
- Blackeye goby (*Rhinogobiops nicholsii*)

greenlings - Hexagrammidae
- Juvenile greenling (*Hexagrammidae*)
- Kelp greenling (*Hexagrammos decagrammus*)
- Lingcod (*Ophiodon elongatus*)
- Masked greenling (*Hexagrammos octogrammus*)
- Painted greenling (*Oxylebius pictus*)
- Rock greenling (*Hexagrammos lagocephalus*)
- Whitespotted greenling (*Hexagrammos stelleri*)

gunnels - Pholidae

ronquils - Bathymasteridae
- Northern ronquil (*Ronquilus jordani*)
- Searcher (*Bathymaster signatus*)
- Smallmouth ronquil (*Bathymaster leurolepis*)

sailfin sculpins - Hemitripteridae
- Crested sculpin (*Blepsias bilobus*)
- Sailfin sculpin (*Nautichthys oculofasciatus*)
- Silverspotted sculpin (*Blepsias cirrhosus*)

salmonids - Salmonidae
- Arctic cisco (*Coregonus autumnalis*)
- Chinook salmon (*Oncorhynchus tshawytscha*)
- Chum salmon (*Oncorhynchus keta*)
- Coho salmon (*Oncorhynchus kisutch*)
- Cutthroat trout (*Oncorhynchus clarkii*)
- Dolly Varden (*Salvelinus malma*)
- Least cisco (*Coregonus sardinella*)
- Pink salmon (*Oncorhynchus gorbuscha*)
- Sockeye salmon (*Oncorhynchus nerka*)
- Steelhead trout (*Oncorhynchus mykiss*)

http://mapping.fakr.noaa.gov/?theDB=FishAtlas_de...

Common name: **Saffron cod**
Scientific name: *Eleginus gracilis*
Family: cods - Gadidae

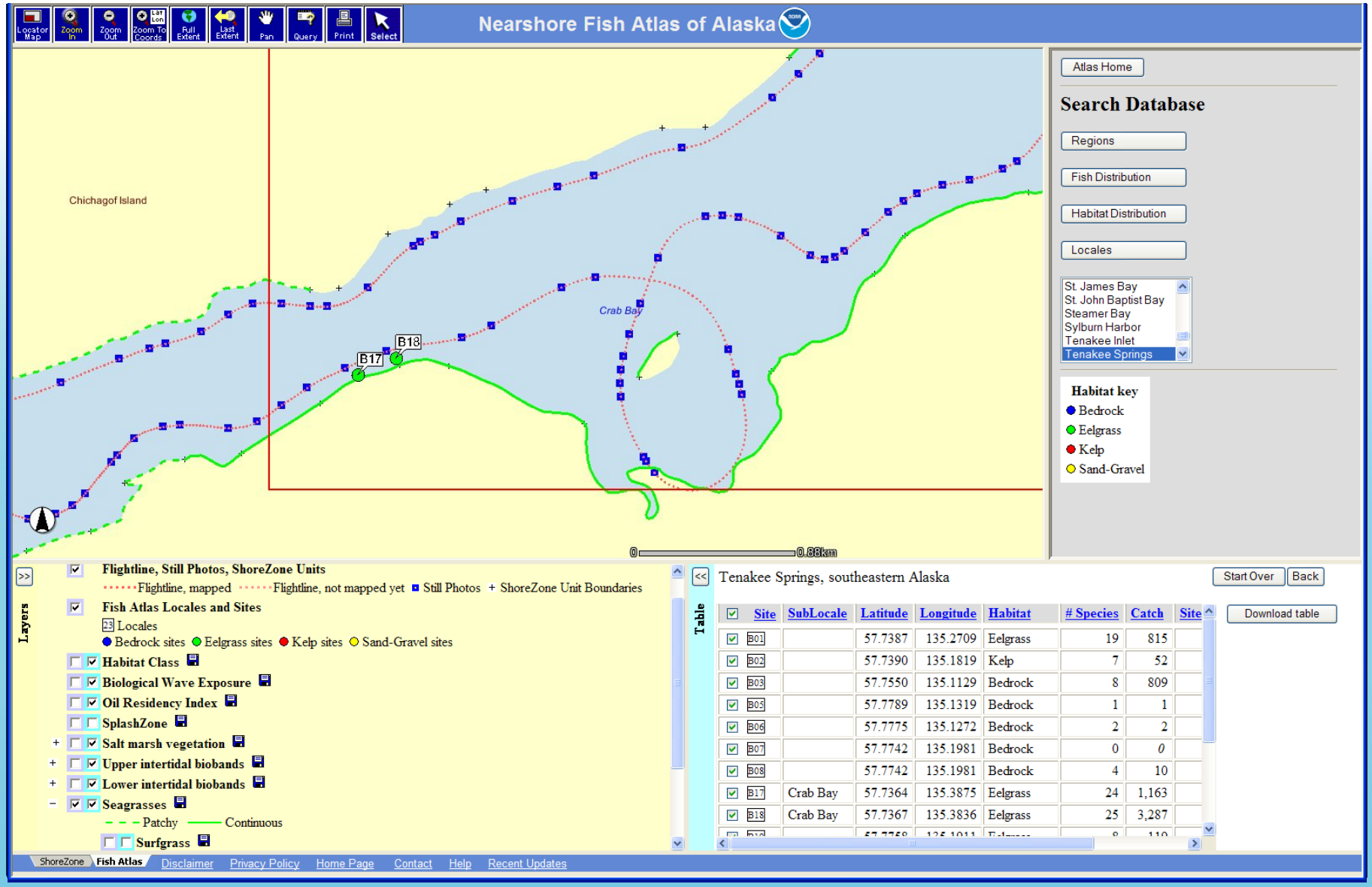
juvenile (265 mm)

adult (365 mm)

juvenile (138 mm)

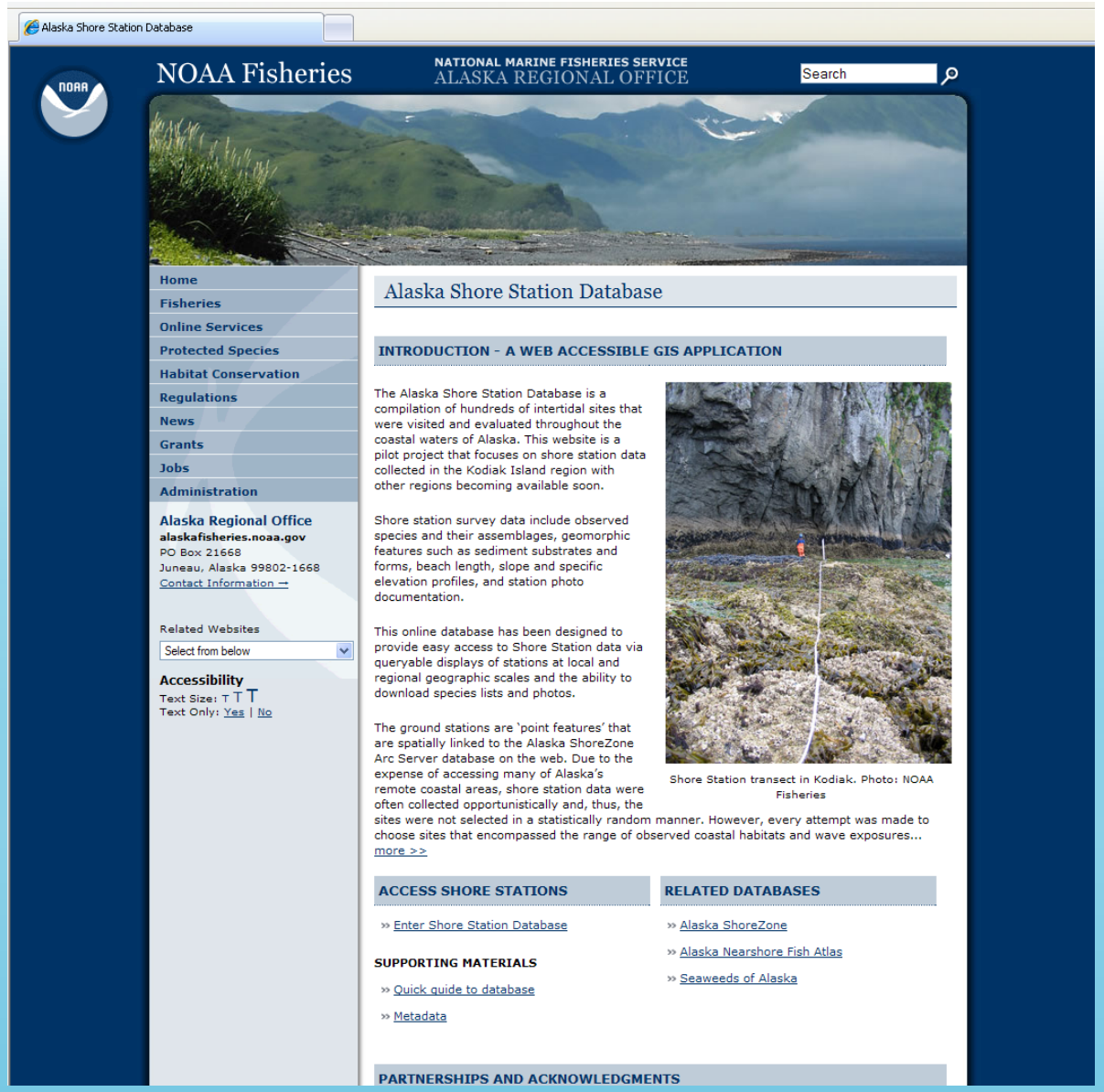
young-of-the-year (75 mm)

Nearshore Fish Altas Online

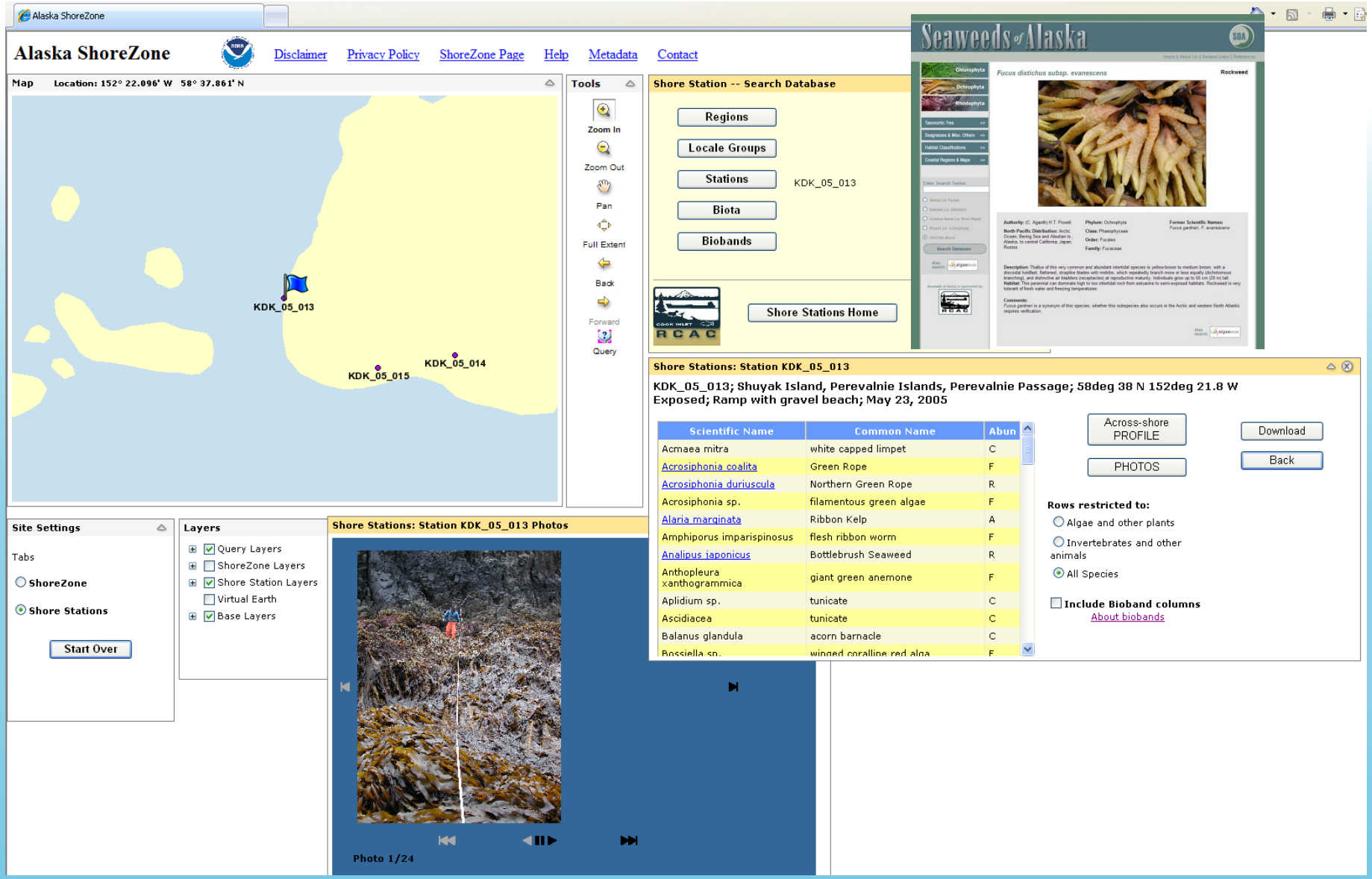


Shore Station Database

- A collaboration between NOAA Fisheries and Cook Inlet Regional Citizens Advisory Council
- Hundreds of stations throughout Gulf of Alaska.
- On the ground physical measurements and biological inventory.
- Identifies regional differences.

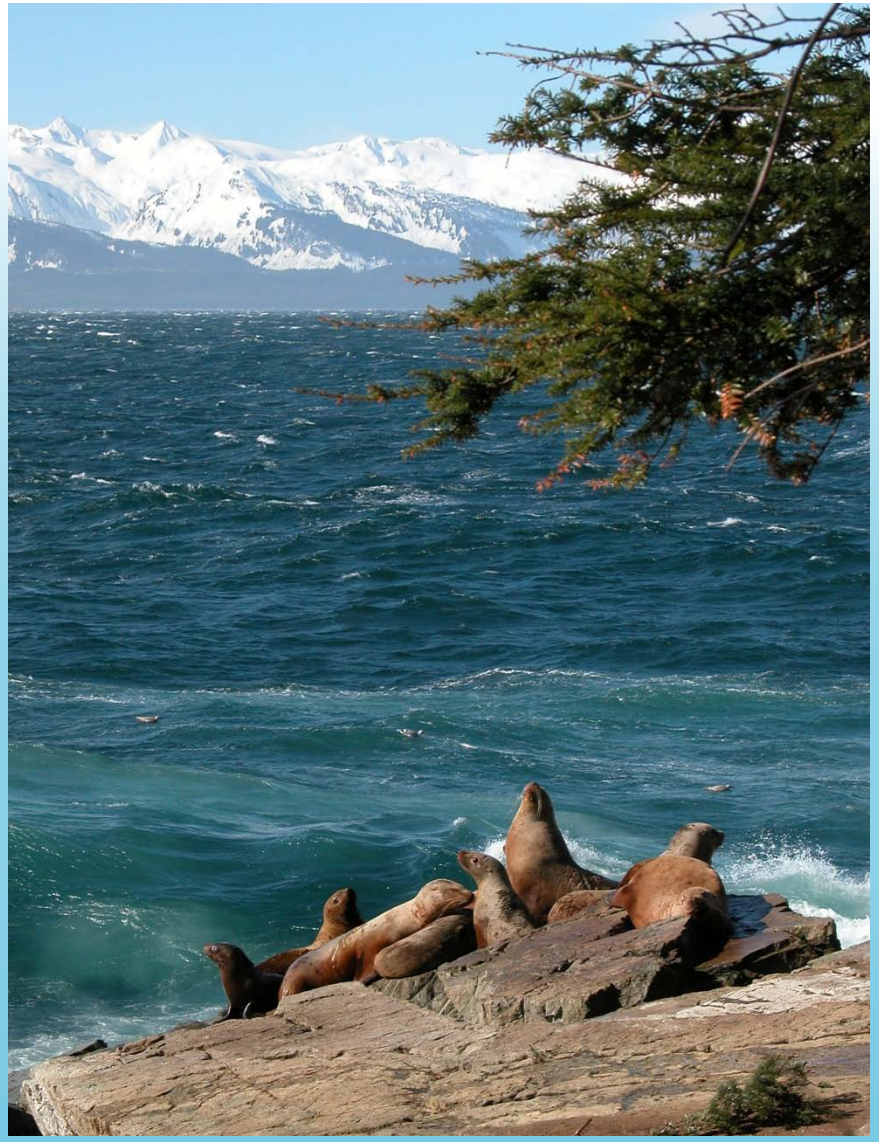


Shore Station Database – new Arc Server

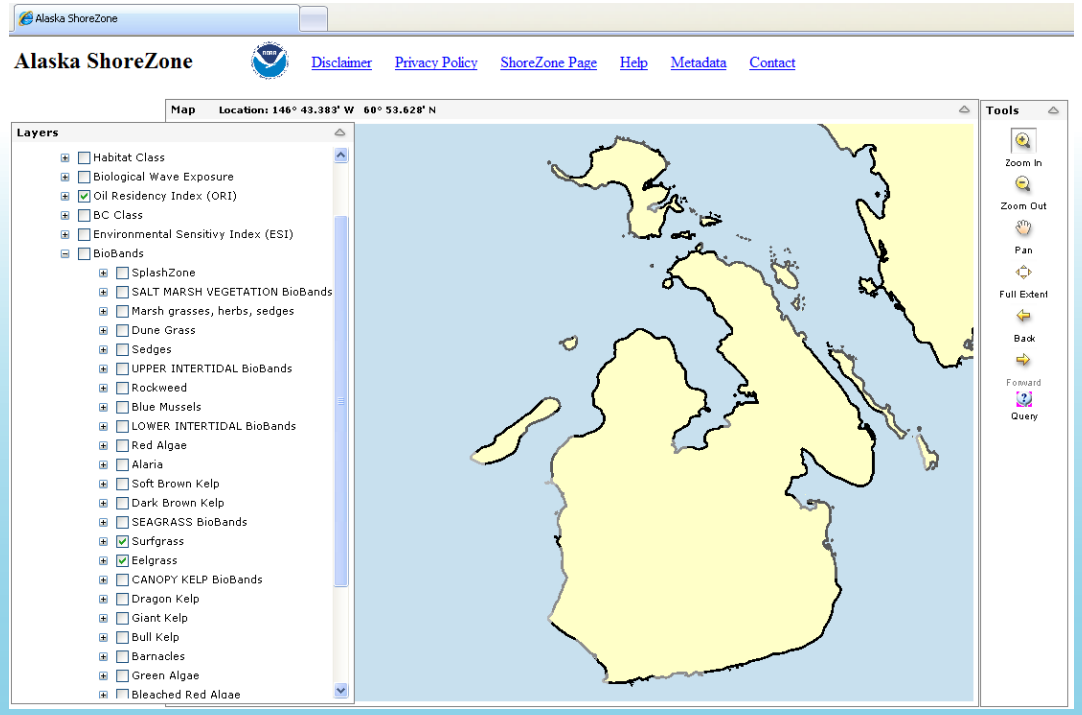


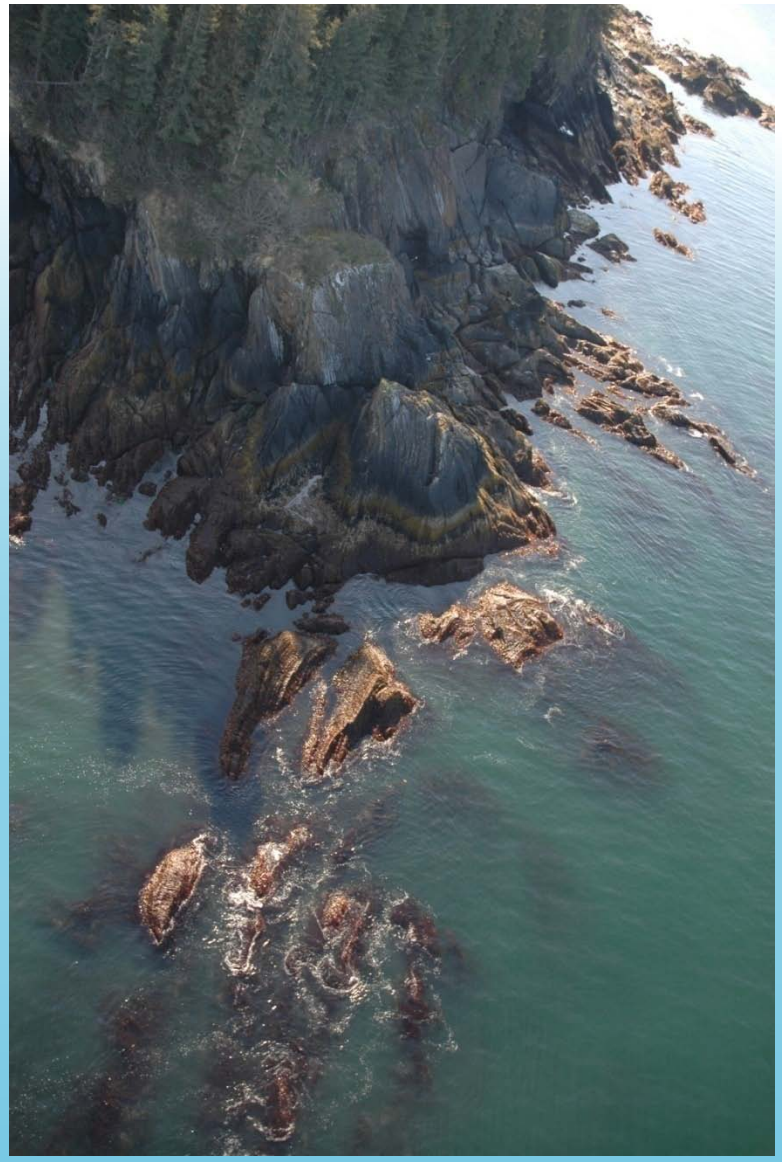
Who cares / Who benefits?

- **First Responders**
  NOAA Hazmat, USCG, etc.
- **Habitat Managers**
  EFH consults, ESA, etc.
- **Scientists**
  Monitoring, new species, etc.



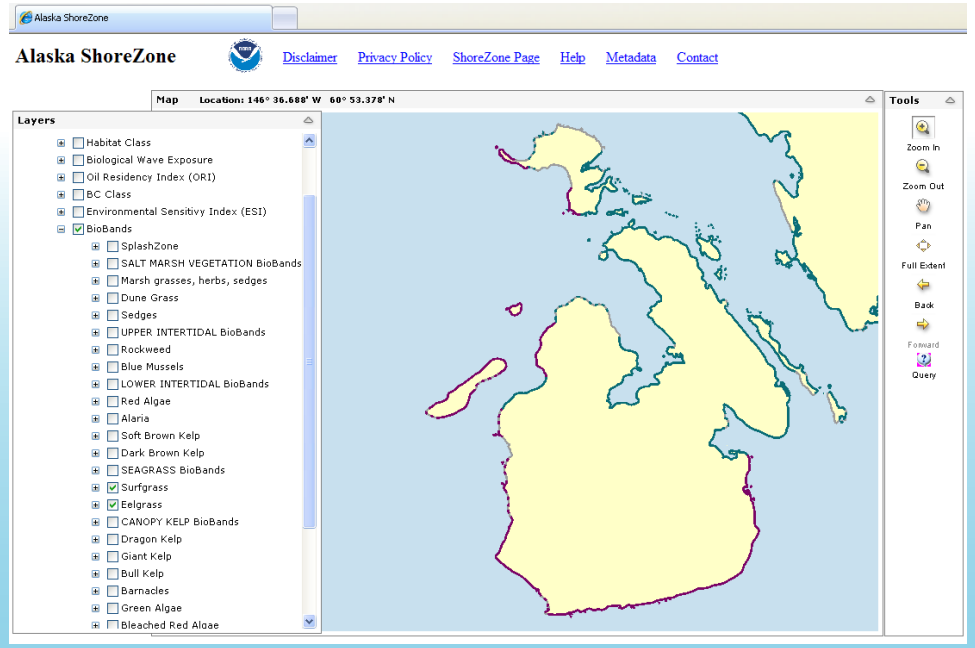
Exxon Valdez oil spill revisited with ShoreZone





- **Oil Residency Index**

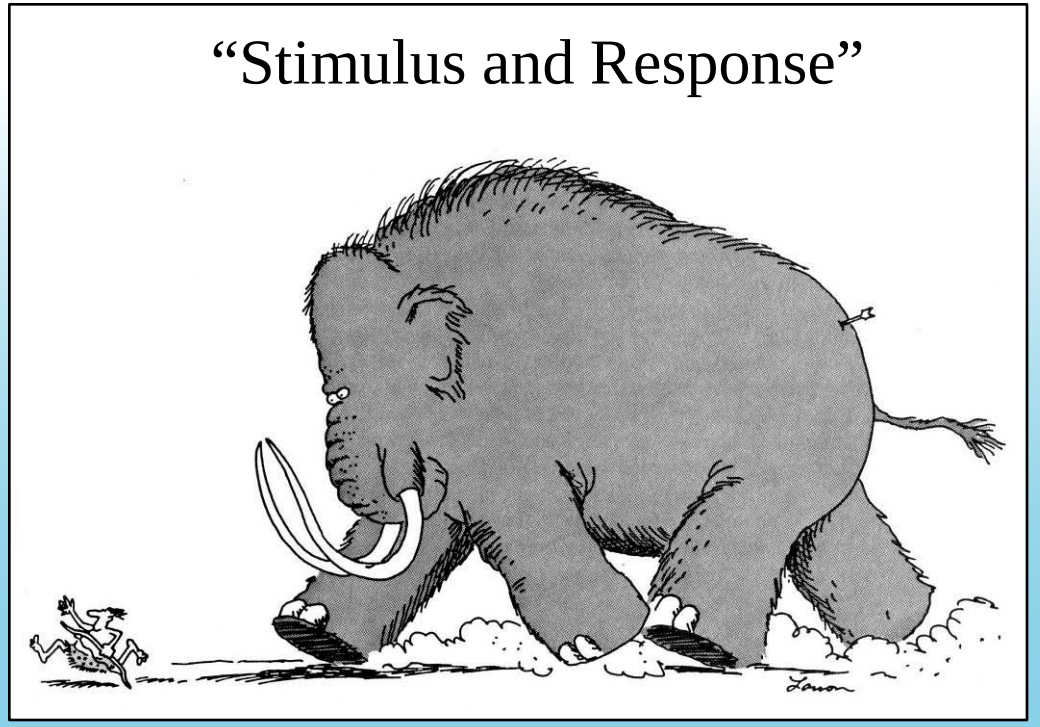
ShoreZone – a tool for many users



- **Sensitive Habitats**

Alaska ShoreZone – Future Needs

- **Continue mapping**
- **Web: add server nodes**
  - **New Arc Server**
  - **GINA**
  - **Google Earth?**
- **Communication**
  - **tutorials - online & offline**
- **Develop new applications**
  - **first responder tools**
  - **International datasets**



G. Larson – Far Side

- **Secure Funding**

Thank You – www.alaskafisheries.noaa.gov/maps