

Iniskin – Iliamna Estuary Intertidal and Nearshore Marine Benthos

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Study Goals

- Build on and update historic data to extend long-term baseline
- Gain understanding of benthic assemblages



Study Objectives (Subtidal)

(Lee Ann Gardner, RWJ Consulting; Steve Jewett, UAF;
D. Lees, LEES)

➤ Subtidal recon at potential port sites (2004, 2008)

➤ Benthic infauna

➤ Diver transects

➤ ID important habitats (kelp, eelgrass)



Study Objectives (Intertidal)

- Build on background (1970s, 1996)
- Collect info on new sites
- ID important habitats (kelp, eelgrass, lagoons, rookeries)



Area Sampling History

➤ 1976-78 OCSEAP

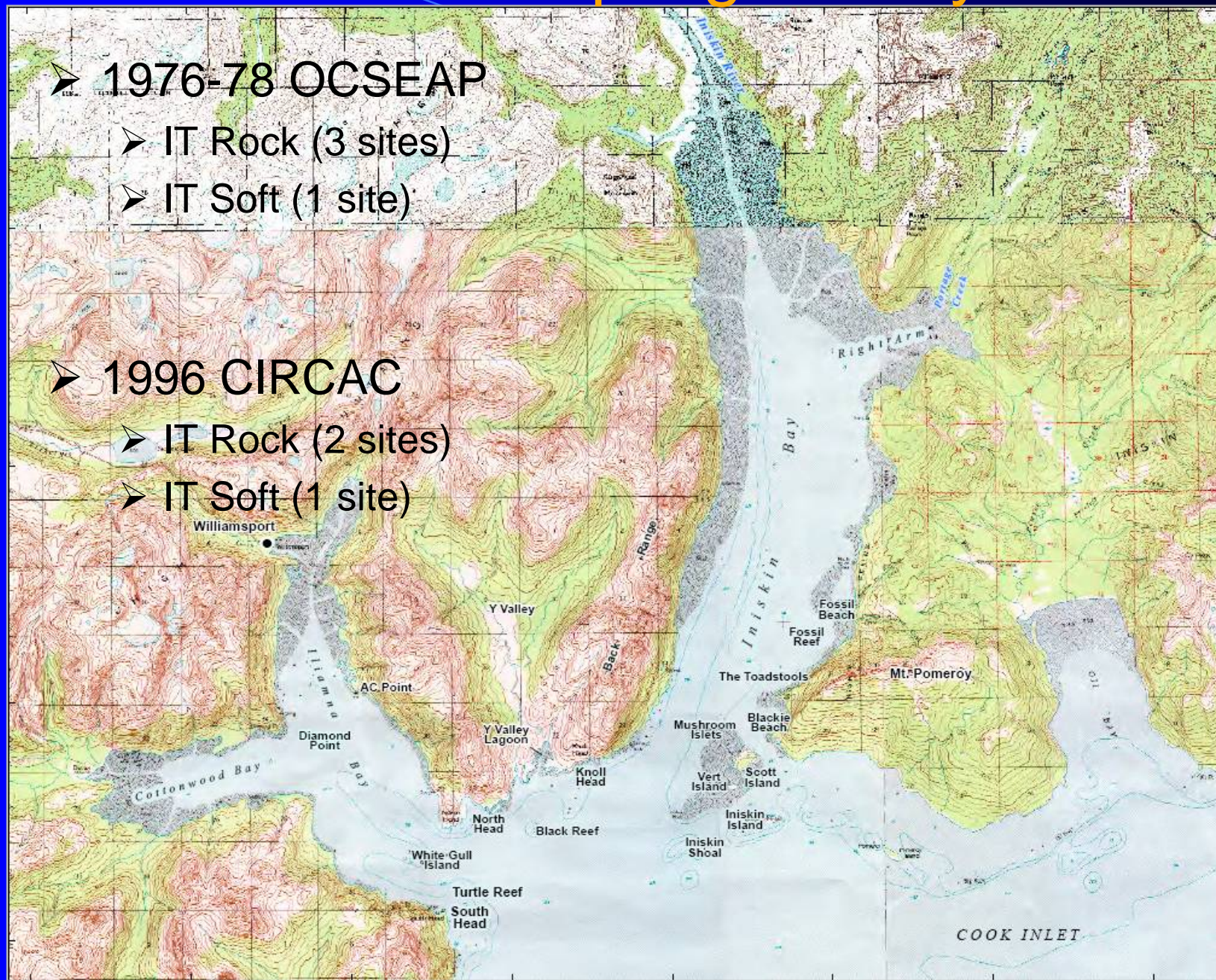
➤ IT Rock (3 sites)

➤ IT Soft (1 site)

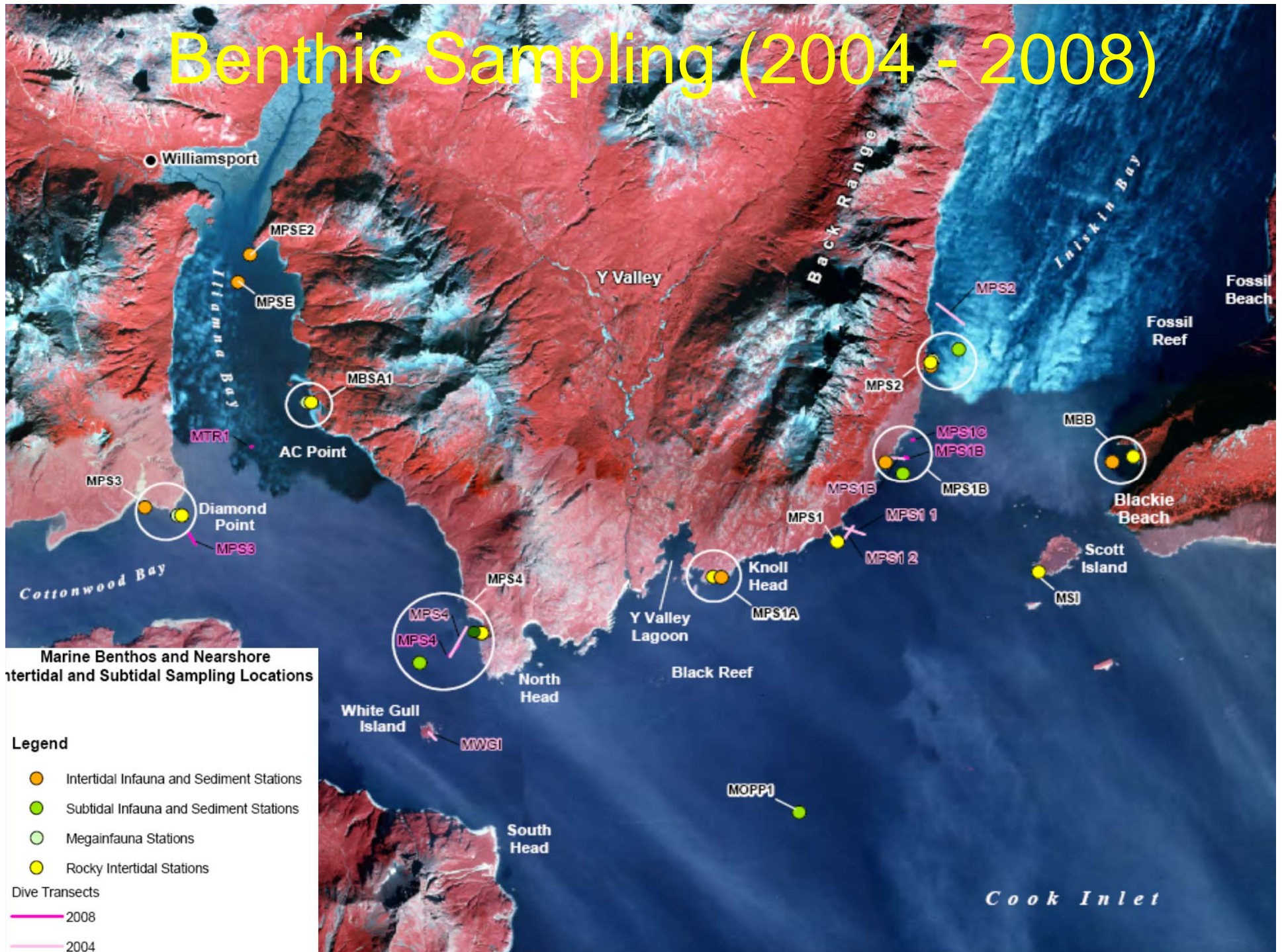
➤ 1996 CIRCAC

➤ IT Rock (2 sites)

➤ IT Soft (1 site)



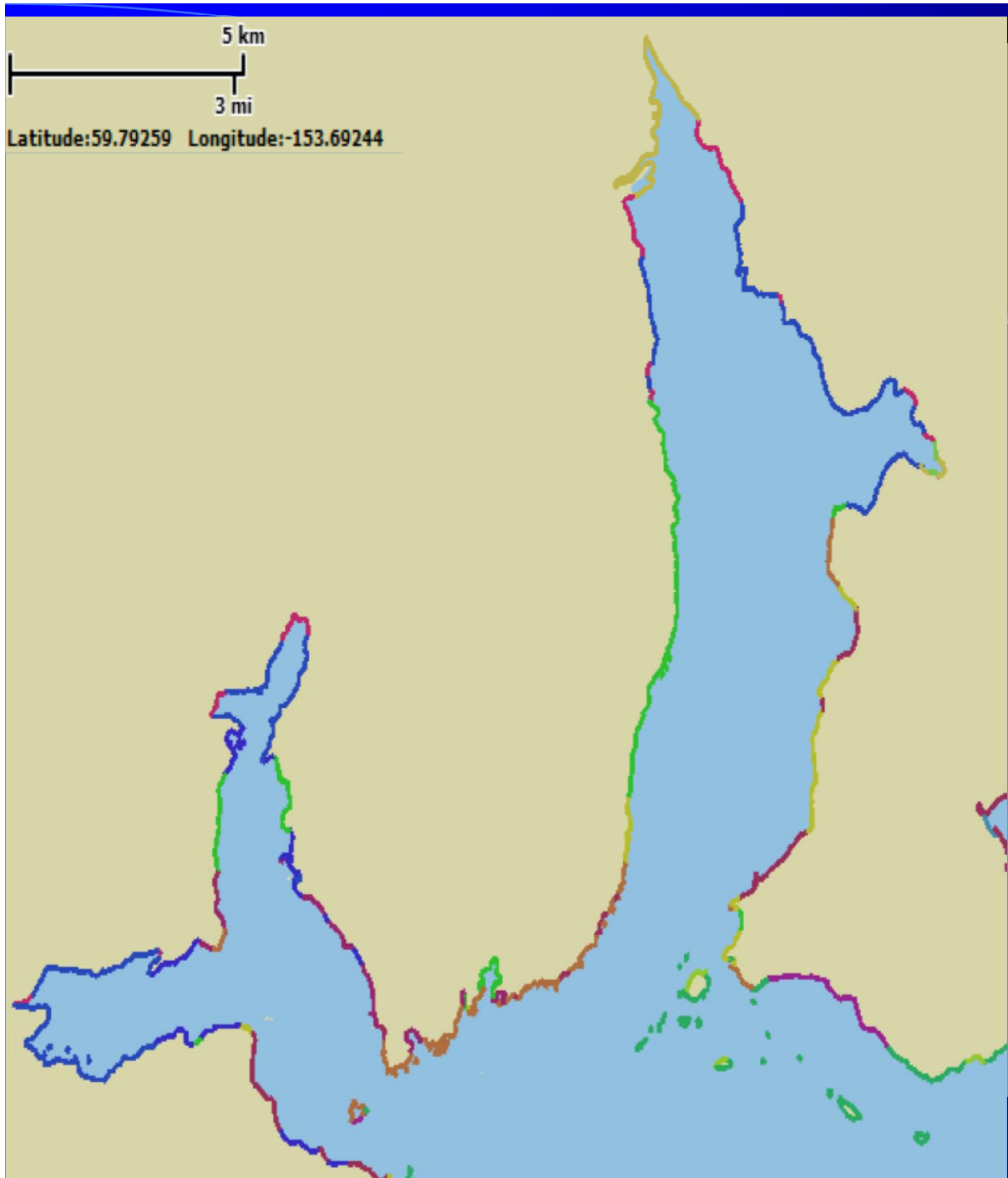
Benthic Sampling (2004 - 2008)



2004-2008 Field Work

- Habitat Mapping
- Rocky intertidal sampling
- Eelgrass mapping
- Soft intertidal infauna
- Tissue samples



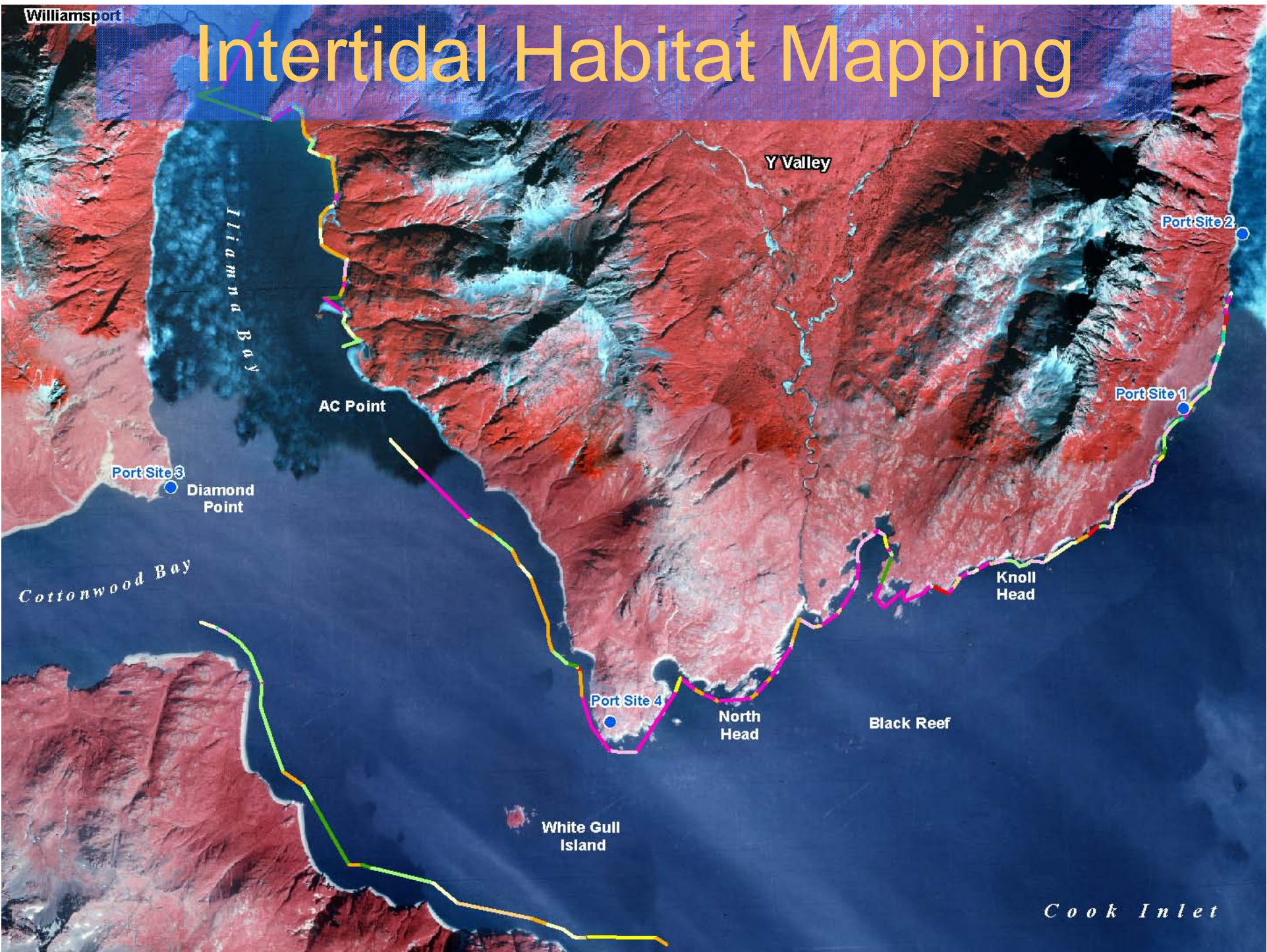


- Semi-Protected/Anthropogenic Permeable
- Semi-Protected/Current Channel
- Semi-Protected/Estuary
- Semi-Protected/Glacier
- Semi-Protected/Immobile/Rock
- Semi-Protected/Mobile/Sediment
- Semi-Protected/Partially Mobile/Sediment or Rock & Sediment
- Very Exposed/Immobile/Rock
- Very Exposed/Mobile/Sediment
- Very Exposed/Partially Mobile/Sediment or Rock & Sediment
- Very Protected/Anthropogenic Impermeable
- Very Protected/Anthropogenic Permeable
- Very Protected/Current Channel
- Very Protected/Estuary
- Very Protected/Glacier
- Very Protected/Immobile/Rock
- Very Protected/Mobile/Sediment
- Very Protected/Partially Mobile/Sediment or Rock & Sediment

Source: Shorezone

Williamsport

Intertidal Habitat Mapping



Cook Inlet

2004-2008 Rocky IT

- Rocky intertidal quadrat sampling
 - Fixed transects, elevations, quad positions
 - Photographs
 - Quantitative density/cover by species
- Tissue samples



Rocky Shorelines

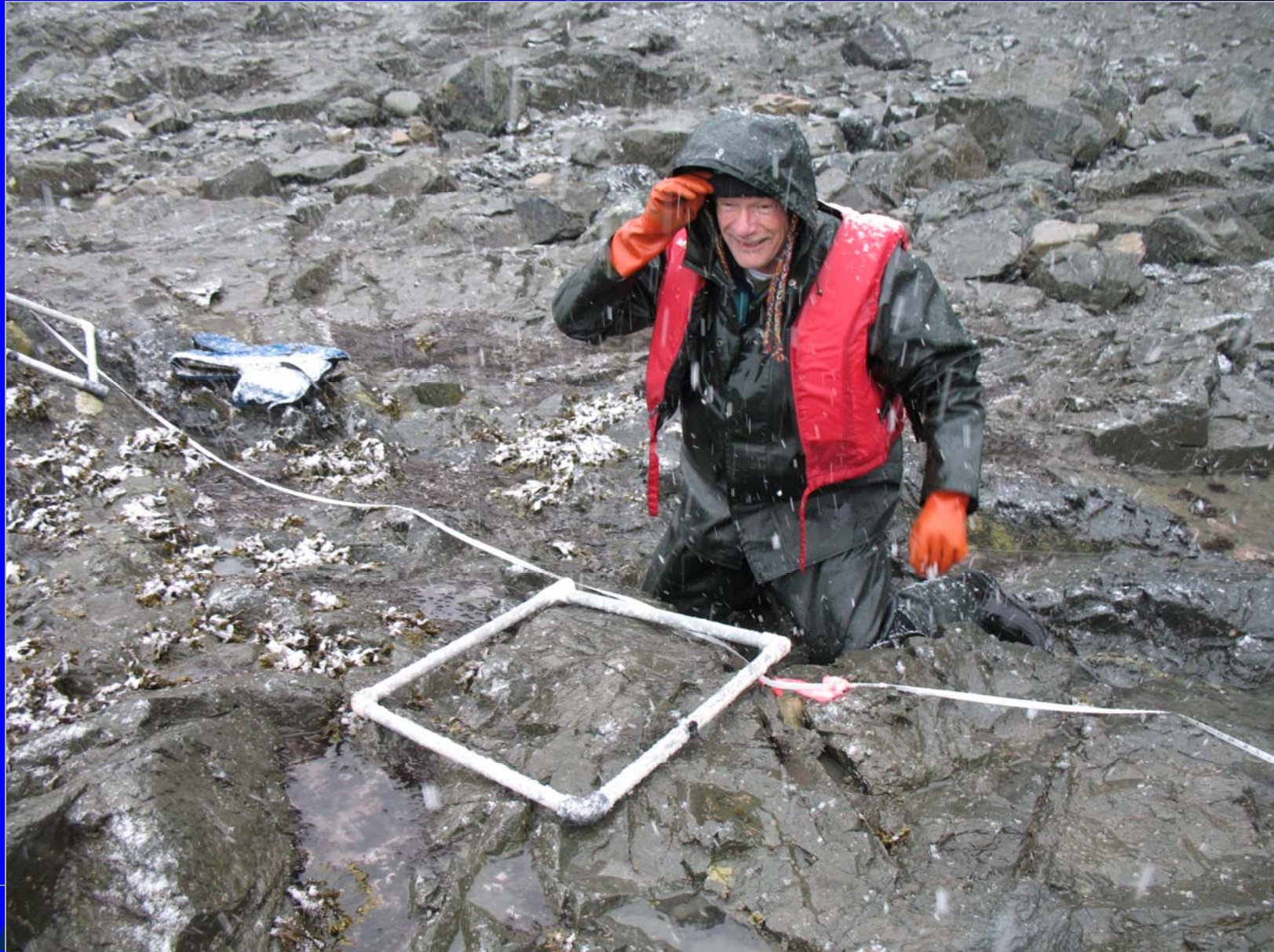


- Varied substrates
 - Bed rock benches and cliffs
 - Boulder/cobble

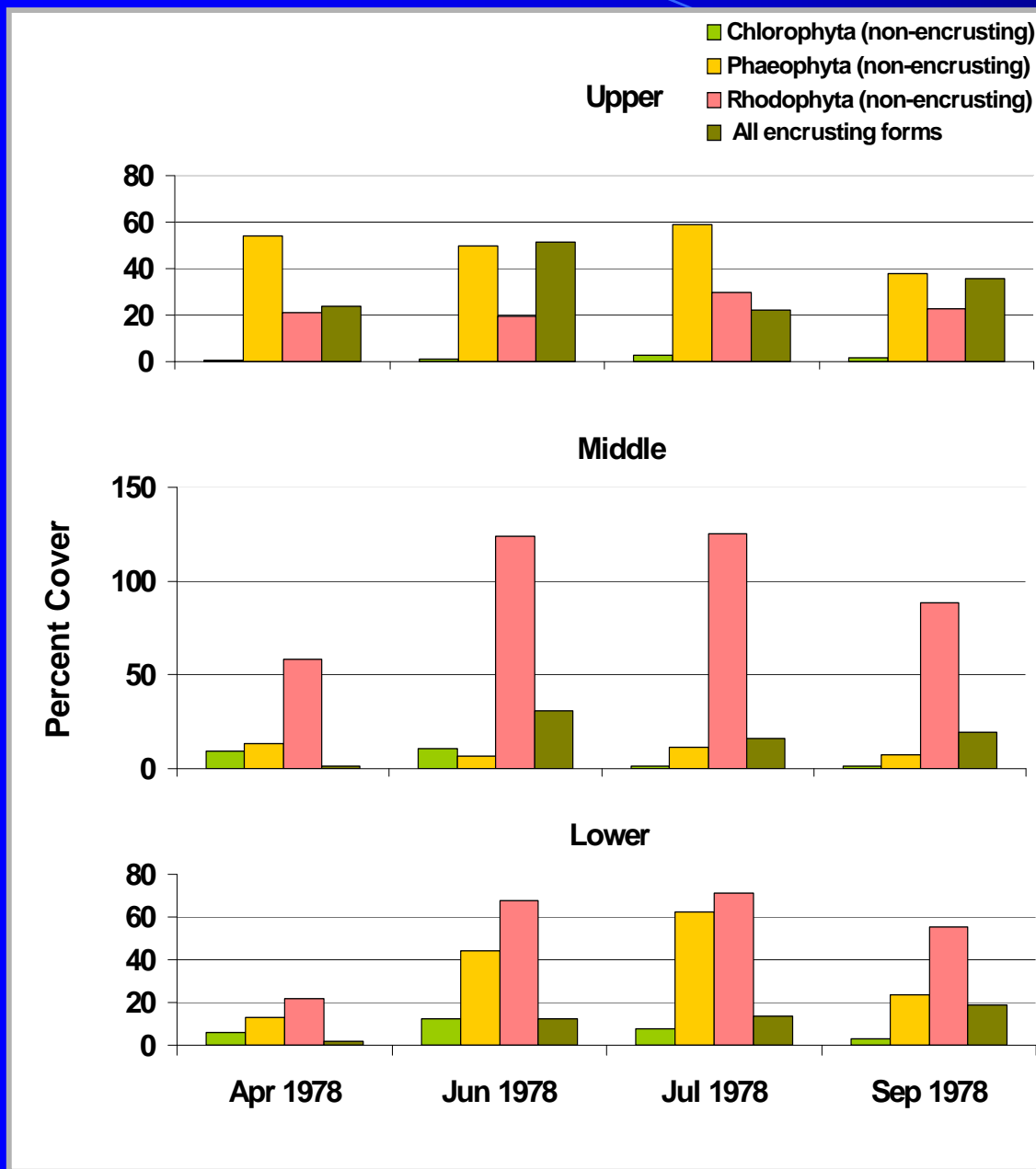


- Assemblages not rich or diverse (except low)

Winter Stressors = Intra-annual Var.

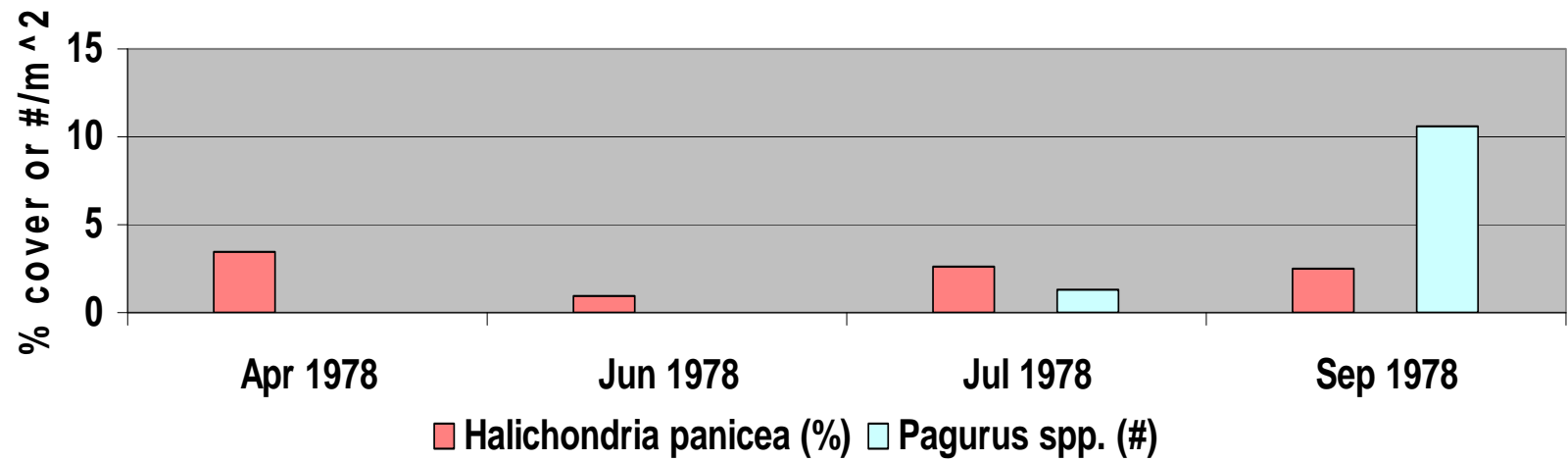


Rocky Intertidal Intra-annual Variability

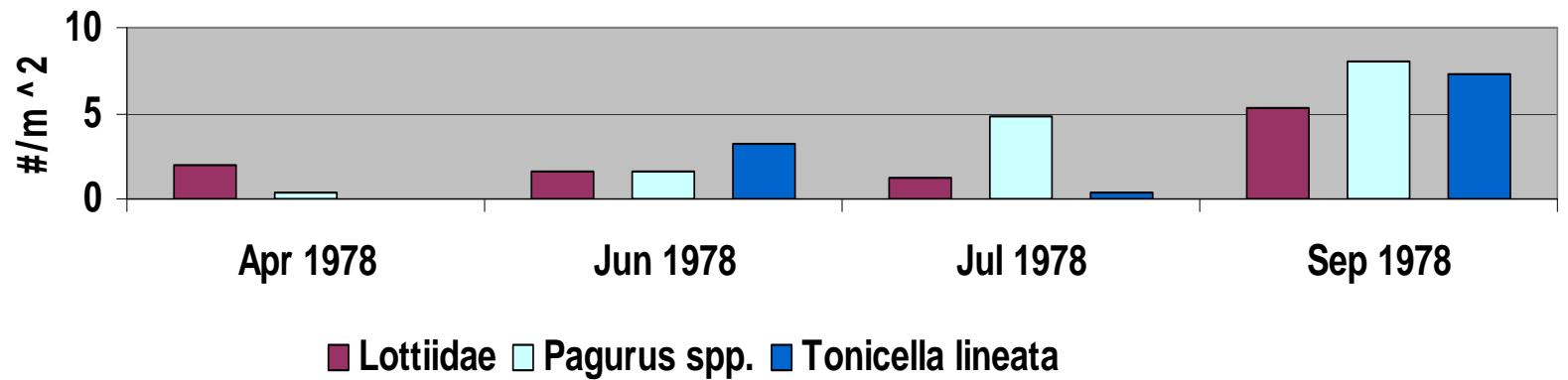


➤ Scott Island Intertidal Macro-Algae 1978

Scott I Macrofauna 1978--Middle Tidal Elevation



Scott I Macrofauna 1978--Lower Tidal Elevation



Source: Lees et al. 1980

Rocky Shorelines



- Upper intertidal
 - Barnacles, limpets, littorines, *Porphyra*
 - Few mussels, patchy *Fucus*
 - More spp. in sheltered cracks – reds, hermits, *Nucella*

Knoll Head (MPS1a) Upper – Q 1



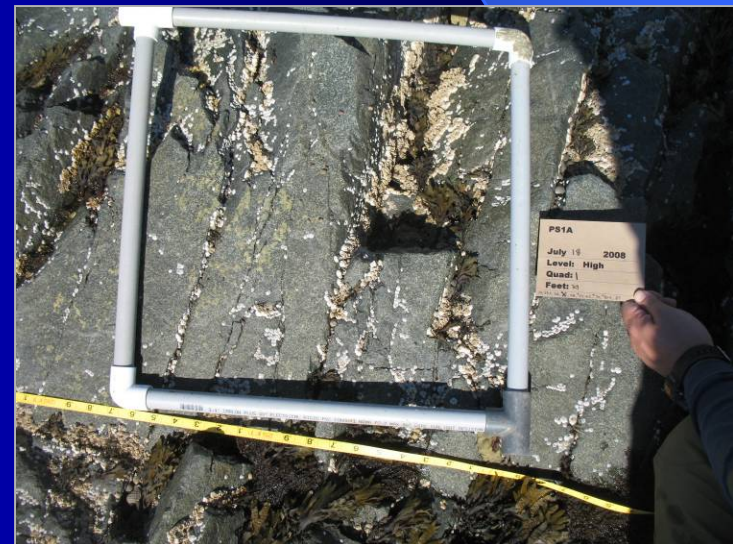
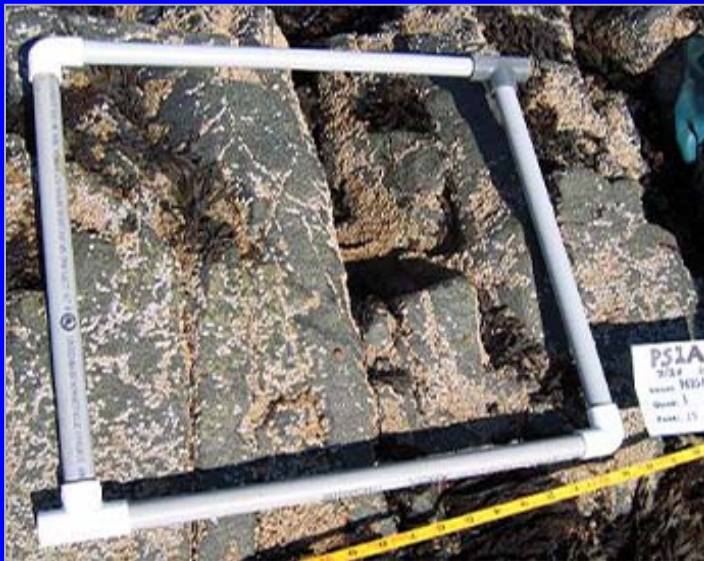
< 1996

2004 >



<2005

2008 >



Rocky Shorelines (cont.)



- Middle intertidal
 - Algae dominated – *Fucus*, *Palmaria* spp.
 - Few animals – barnacles, *Lacuna*, limpets, *Halichondria*

Knoll (MPS1a) Mid Rock

< 1976-78 OCSEAP



2008

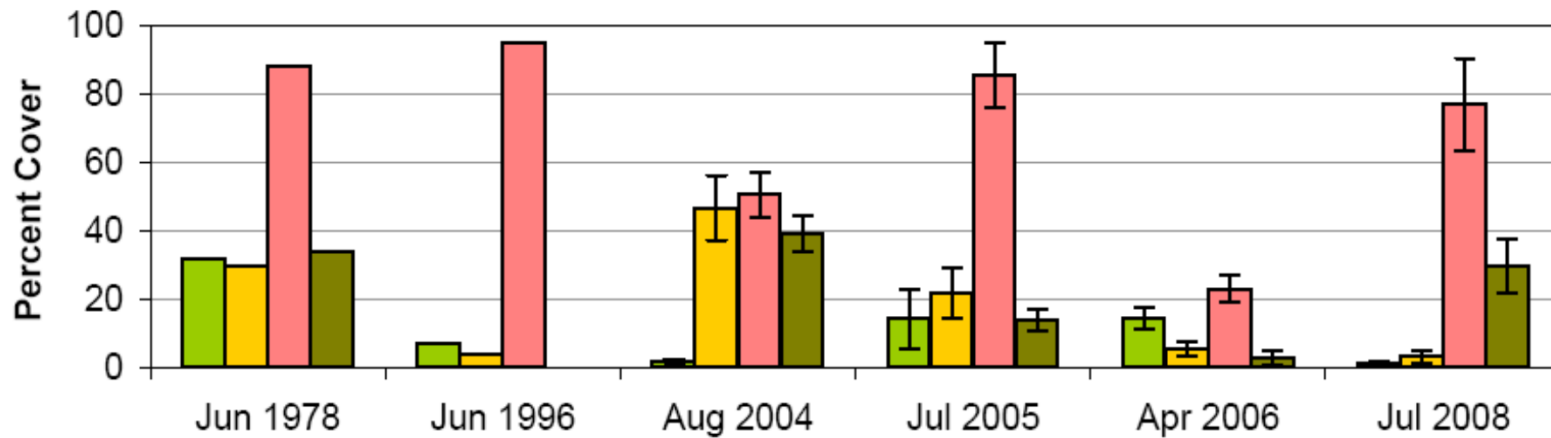




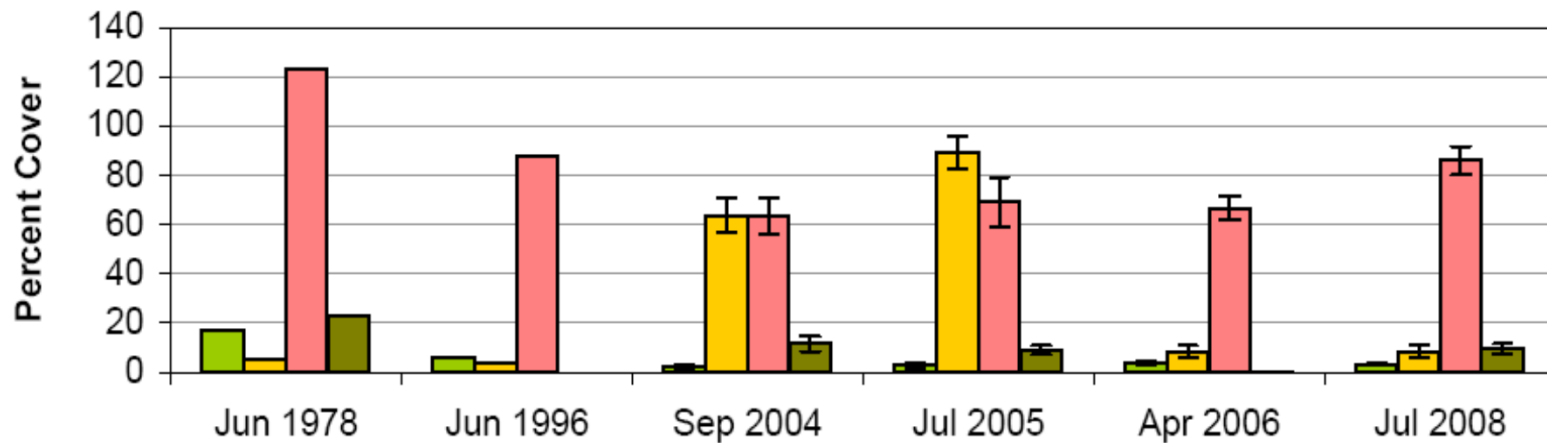
Mid – Elevation

MPS 1a - Middle

Algal Cover

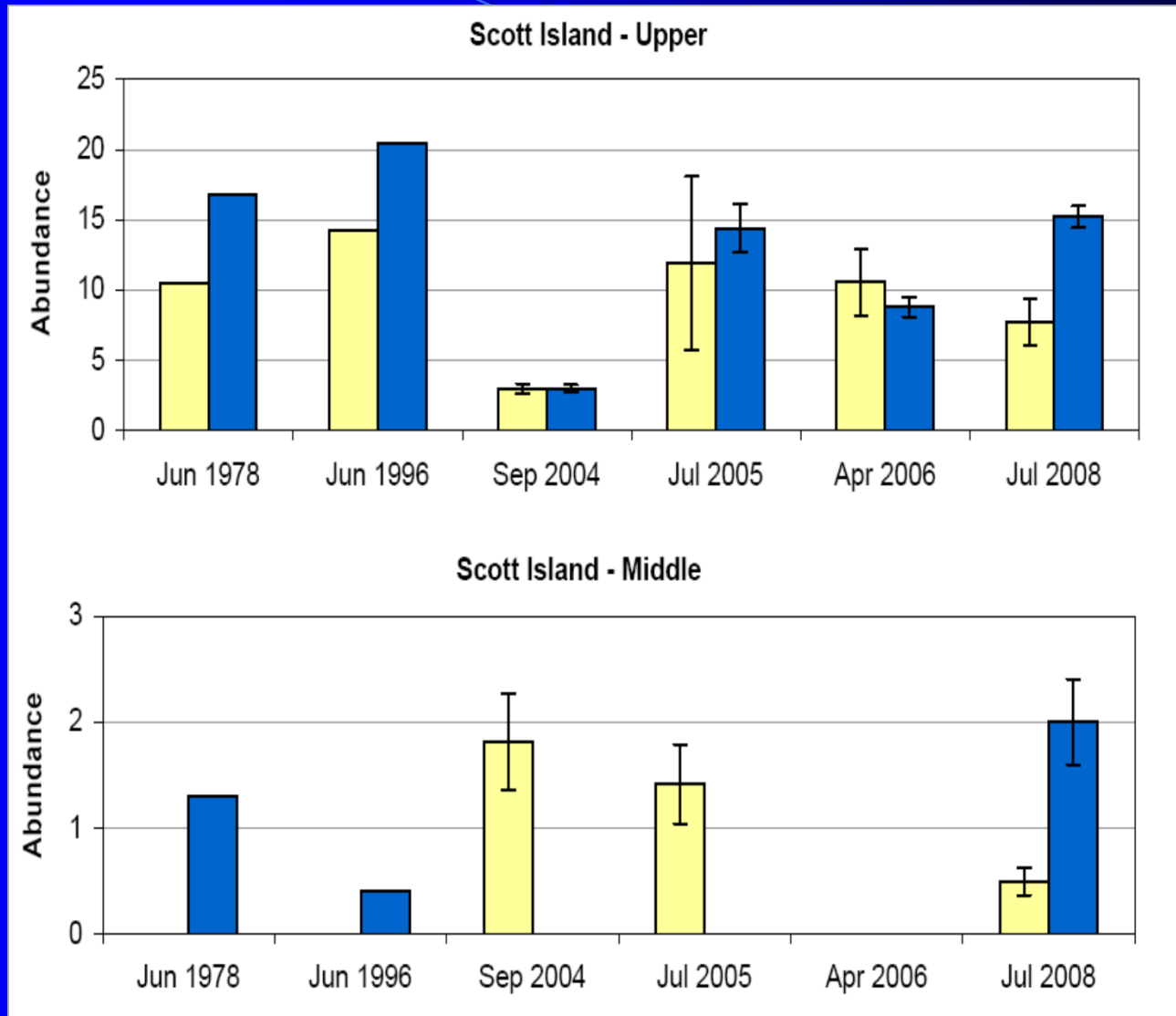


Scott Island - Middle

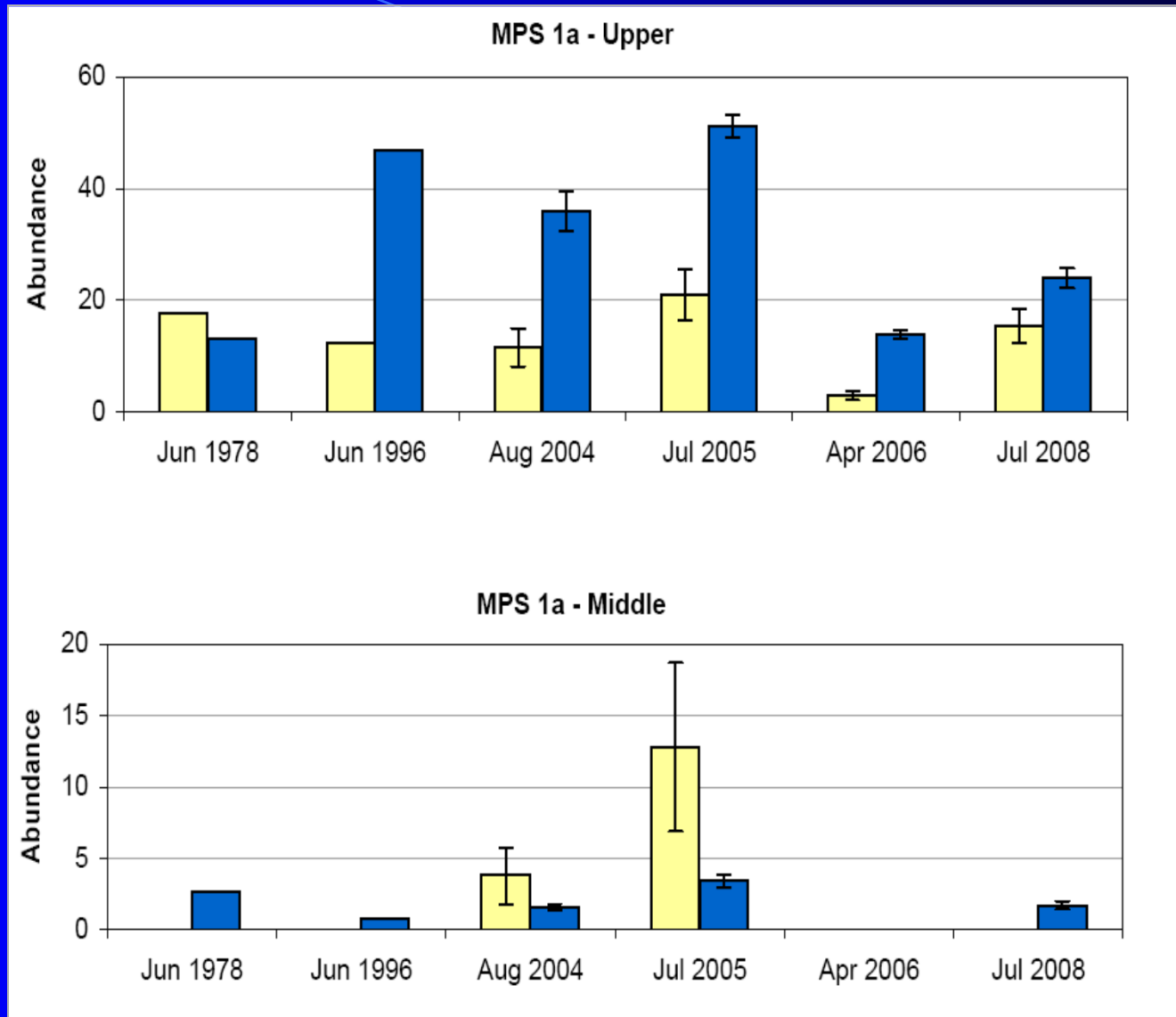


- Chlorophyta (non-encrusting)
- Phaeophyta (non-encrusting)
- Rhodophyta (non-encrusting)
- All Encrusting Forms

Upper/Mid El. Sessile Inverts (limpets, barnacles)



Upper/Mid El. Sessile Inverts (limpets, barnacles)



Rocky Shorelines (Lower)

Lower intertidal (boulder/bedrock flats)

- More diverse –
Saccharina, *Alaria*, several
reds, corallines
- More diverse fauna –
hermits, shrimp, chitons,
sea stars, limpets, blennies,
sponges
- Herring spawn
- In sediment pockets
 - Littlenecks, *Macoma* spp.,
Mya, *Glycera*,
Echiurus



Diver Transects (2004, 2008)

- Bedrock reefs
- Boulder flats
- Mixed pebble/cobble with silt
- Fairly uniform sand/silt



“Soft” Intertidal (2004 – 2008)



- Soft intertidal sampling
 - Transects, elevations, 0.009-m² cores
 - Photographs
 - Quantitative density/cover by species
 - “Mega-cores”, 0.25-m² (2005, 2008)
- Sed./Tissue samples

“Soft” Shorelines



- Wide range of soft substrates:

- Mud/silt
- “Gravel”
- Mixed
- Sand

- Stressors:

- Ice
- Glacial silt
- Wave action

Soft Shorelines (cont.)

- Sand/gravel
 - Few plants or animals
- Mixed (incl. pockets in boulder beaches)
 - *Macoma* spp., *Mya*, *Glycera*, *Echiurus*
- Mud/silt
 - Bivalves (esp. *Mya*, *Macoma*) polychaetes, hermits

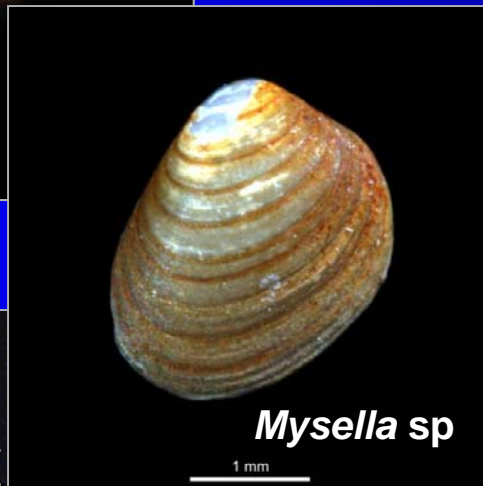


Intertidal Infauna (2004-2008)

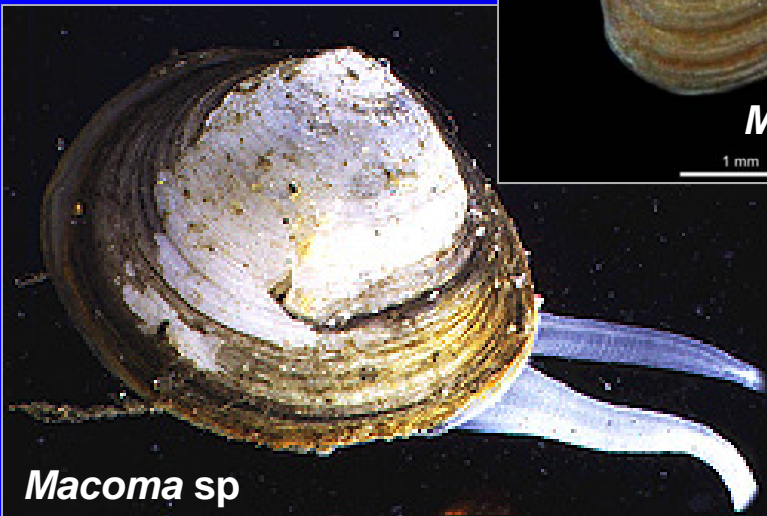
Nephtys sp



Mysella sp



Macoma sp



- Highly variable substrates, but
- Relatively uniform w/in stations
- High stress (ice, waves, silt)
- Less rich/diverse than ST
- Low gradient means few large predators (snails/stars)
- Dominants (biomass)
 - *Macoma* spp.
 - *Nephtys* spp.
 - *Mysella* sp
 - *Echiurus* sp.
 - *Cistenides* sp.
 - *Leitoscoloplos* sp.

Ranking of Dominant Intertidal Macroinfaunal Groups by Average Biomass

Station	2004			2005			2008		
	Group	Biomass (g/m ²)	SE	Group	Biomass (g/m ²)	SE	Group	Biomass (g/m ²)	SE
MPS3-Low	Mollusca	11.4	4.8	Annelida	21.1	5.9	Mollusca	130.8	123.8
	Annelida	8.3	2.3	Mollusca	6.6	4.3	Annelida	1.3	0.4
				Arthropoda	0.1	0.1			
MPS3-Mid	Mollusca	58.7	43.7	N/A			Mollusca	418.7	292.4
	Annelida	20.3	7.9				Annelida	3.6	0.9
	Misc. Taxa	5.8	5.8				Misc. Taxa	0.4	0.2
							Arthropoda	0.1	0.0
MPSE-Mid	Mollusca	90.2	16.1	Mollusca	6.9	3.4	Mollusca	242.5	40.9
	Annelida	7.6	3.5	Annelida	0.1	0.1	Annelida	1.5	0.4
	Misc. Taxa	1.0	1.0				Misc. Taxa	0.4	0.3
							Arthropoda	0.0	0.0
MPSE2-Mid	N/A			N/A			Mollusca	115.9	10.8
							Annelida	0.8	0.4
MBSA1-Mid	N/A			Mollusca	66.0	26.8	Mollusca	457.7	149.4
				Annelida	6.3	2.3	Annelida	1.5	0.8
							Misc. Taxa	0.1	0.1
MPS4-Mid	Mollusca	500.3	496.3	Annelida	8.1	2.6	Annelida	0.2	0.0
	Annelida	12.0	4.5	Mollusca	6.7	4.6	Misc. Taxa	0.0	0.0
MPS1A-Mid	Annelida	0.5	0.2	Mollusca	0.9	0.9	N/A		
	Mollusca	0.1	0.1	Annelida	0.8	0.6			
MPS2-Low	Annelida	8.3	2.8	Annelida	13.2	5.9	Annelida	0.9	0.5
				Mollusca	2.2	2.1	Mollusca	0.6	0.4
MBB-Low	Annelida	18.9	5.1	Annelida	15.1	6.5	Annelida	0.4	0.1
	Misc. Taxa	6.6	6.5	Mollusca	1.6	1.5			
	Mollusca	0.5	0.5						

Intertidal Infauna (2005 and 2008)

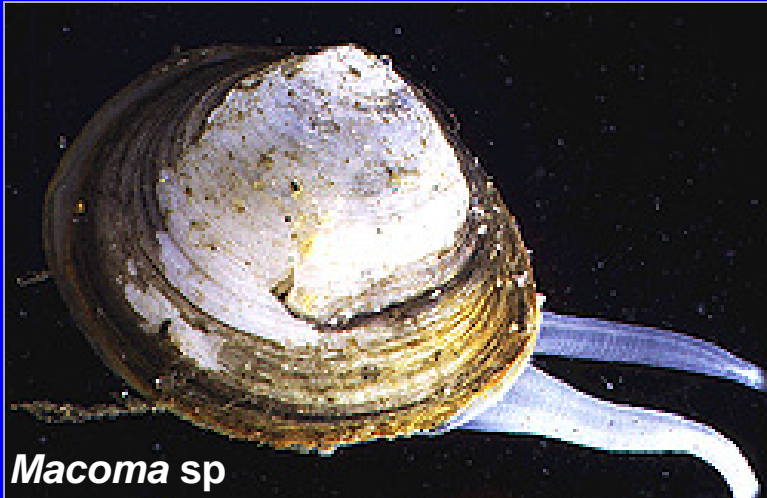
Megainfauna

Ranking of Dominant Megainfaunal Groups by Average Biomass

Station	Group	2005			2008					
		Biomass (g/m ²)	SE	Abundance #/m ²	SE	Biomass (g/m ²)	SE	Abundance #/m ²	SE	
MPS3-Low	Mollusca	2,281.1	N/A	420	N/A	N/A				
	Annelida	74.3	N/A	164	N/A	N/A				
	Arthropoda	8.8	N/A	20	N/A	N/A				
	Misc. Taxa	0.3	N/A	8	N/A	N/A				
MPS3-Mid	N/A				Mollusca	1147.5	N/A	120	N/A	
MBSA1-Mid	Annelida	0.4	0.3	16	4.0	Annelida	0.2	N/A	8	N/A
	Mollusca	0.2	0.2	16	16.0	Mollusca	223.2	148.7	528	272.0
	Arthropoda	0.1	0.1	8	4.0	Misc. Taxa	14.7	14.7	22	14.0
MPS2-Low	Misc. Taxa	274.9	N/A	8	N/A	Annelida	2.1	1.9	30	18.0
	Mollusca	50.3	N/A	56	N/A	Annelida	1.7	N/A	4	N/A
	Annelida	11.6	N/A	28	N/A	Mollusca	*	*	12	N/A
	Arthropoda	1.8	N/A	4	N/A					

(SE= standard error)

Subtidal Infauna (2004, 2008)



- van Veen sampling
- Relatively uniform substrate
- Higher var. w/in stations
- Lower stress
- More rich/diverse than IT
- More larger predators (snails/stars)
- Dominants (biomass)
 - *Macoma* spp.
 - *Nephtys* spp.
 - Terebellidae
 - *Lumbrineris* spp
 - *Praxillella* sp.
 - *Yoldia* sp.

Subtidal Infauna (2004 and 2008)

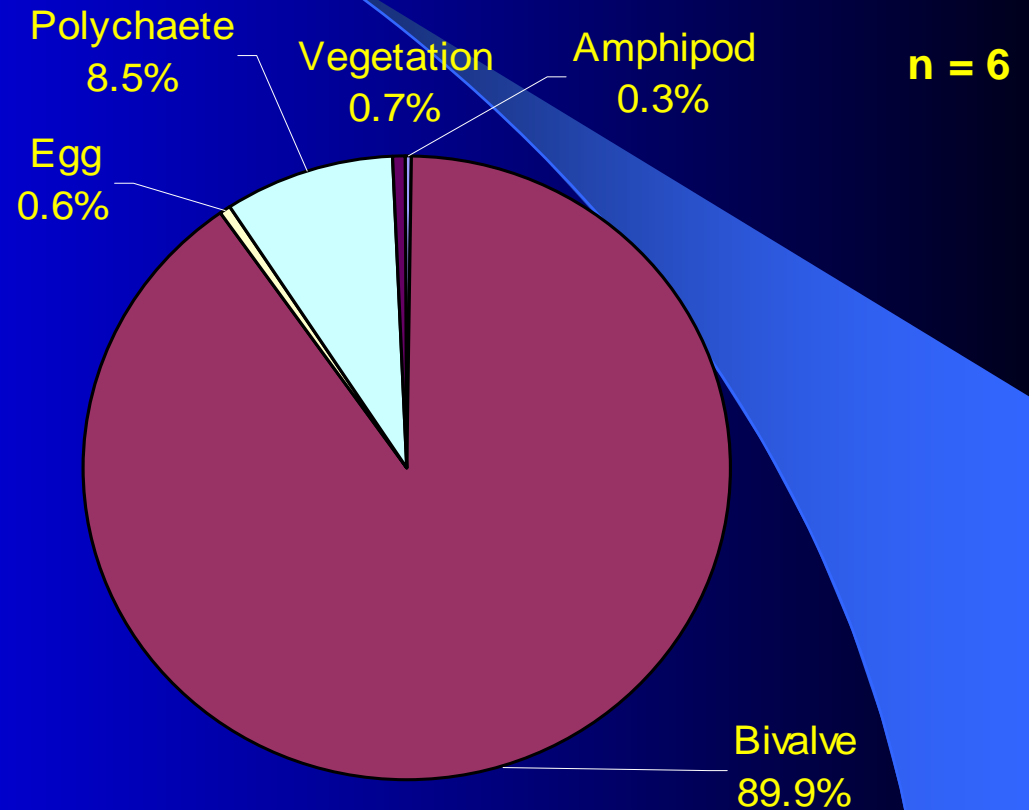
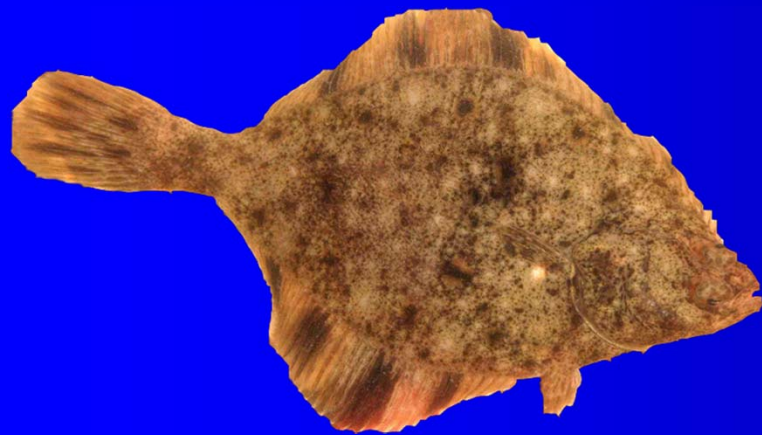
Ranking of Dominant Subtidal Macroinfaunal Groups by Average Biomass

Station	2004			2008		
	Group	Biomass (g/m ²)	SE	Group	Biomass (g/m ²)	SE
MPS4-Sub	Annelida	31.0	13.9	Annelida	1.1	0.2
	Mollusca	23.6	12.4	Arthropoda	0.5	0.3
	Arthropoda	0.1	0.0			
MPS1-Sub	Mollusca	261.4	101.8	Annelida	10.4	6.1
	Annelida	34.4	7.2	Mollusca	1.3	0.8
	Misc. Taxa	2.1	1.5			
	Arthropoda	0.5	0.2			
MPS2-Sub	Mollusca	161.2	81.3	N/A		
	Annelida	25.9	10.6			
	Misc. Taxa	12.6	11.1			
	Arthropoda	0.1	0.0			
MOPP1-Sub	Annelida	23.0	N/A	Mollusca	2.6	1.7
	Mollusca	2.2	N/A	Annelida	2.4	1.0
	Arthropoda	0.8	N/A	Arthropoda	0.02	0.01

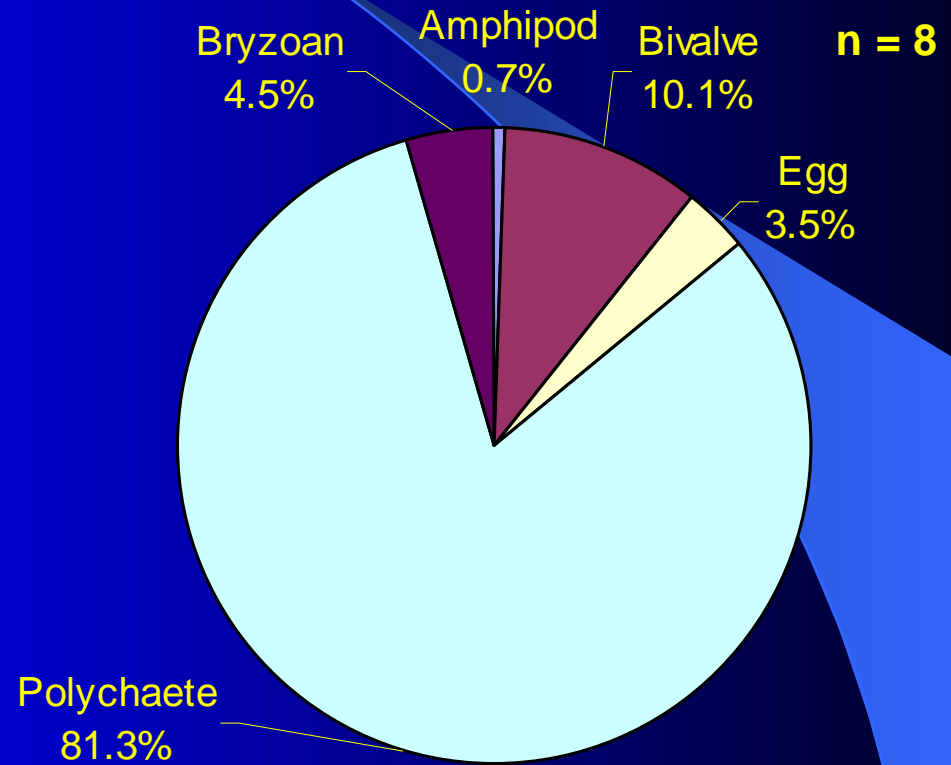
Infauna Summary

- **Annelids (mostly *Nephtys* species) and molluscs (mostly *Macoma* species) dominated samples**
- **Crustaceans were present mostly in the form of amphipods**
- **Sites differed dramatically in both density and biomass supported**
- **MDS analysis (not presented here) showed little similarity between sites even when geographically close**

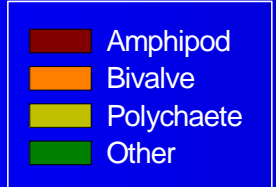
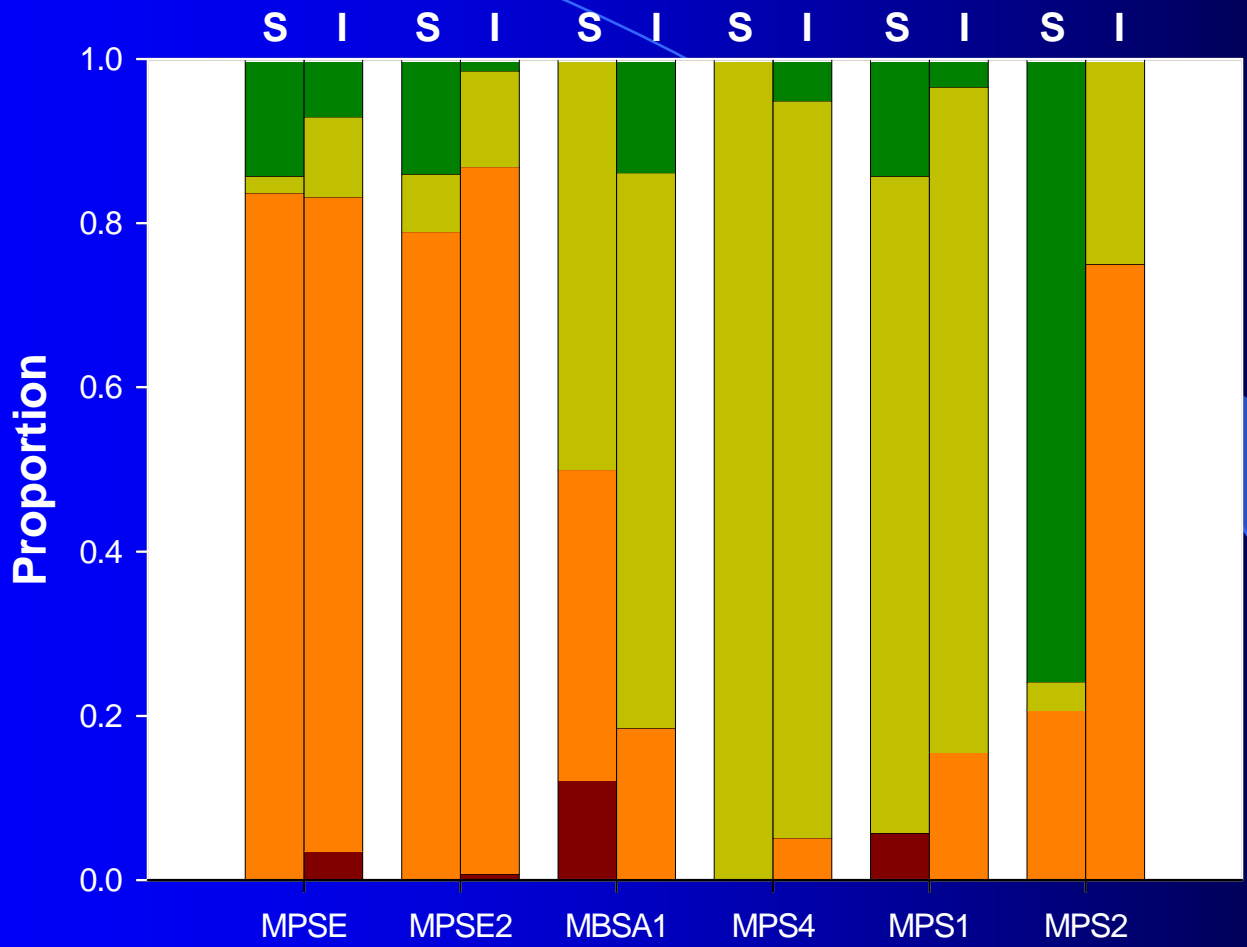
Index of Relative Importance Starry Flounder



Index of Relative Importance Yellowfin Sole



Comparison of Stomach Contents (S) to Prey Occurrence (I)



Location

S = SCA from sampled fish
I = Infauna Occurrence



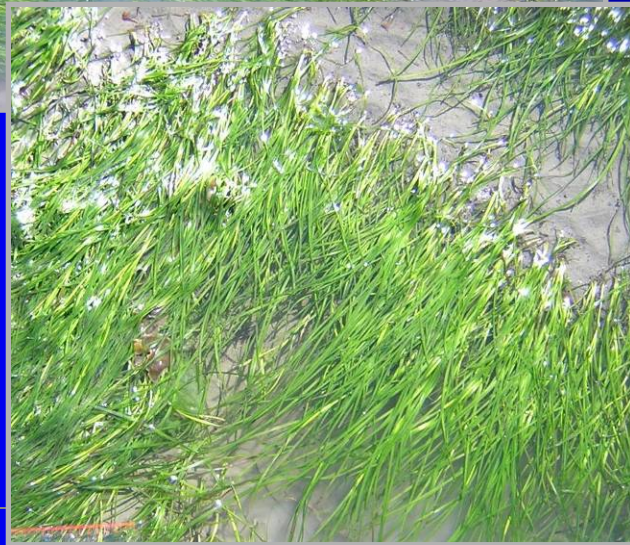
Habitats of Special Interest

➤ Kelp

- Common on all low IT/shallow ST rock (*Saccharina*, *Alaria*)
- Moderate beds off Knoll Head, North Head



Eelgrass



- Large aggregations of small patches in Iniskin
- Moderate aggregations of small patches in Iliamna
- Largest single patches seen on or near Blackie Beach, but gone in 2004
- Larger coverage than previously thought
- Approximately 450 acres in both bays

Lagoons

- AC Point – cusped spit with semi-enclosed lagoon
- Highly productive
- Habitat of significance
 - Juvenile salmon
 - Eelgrass

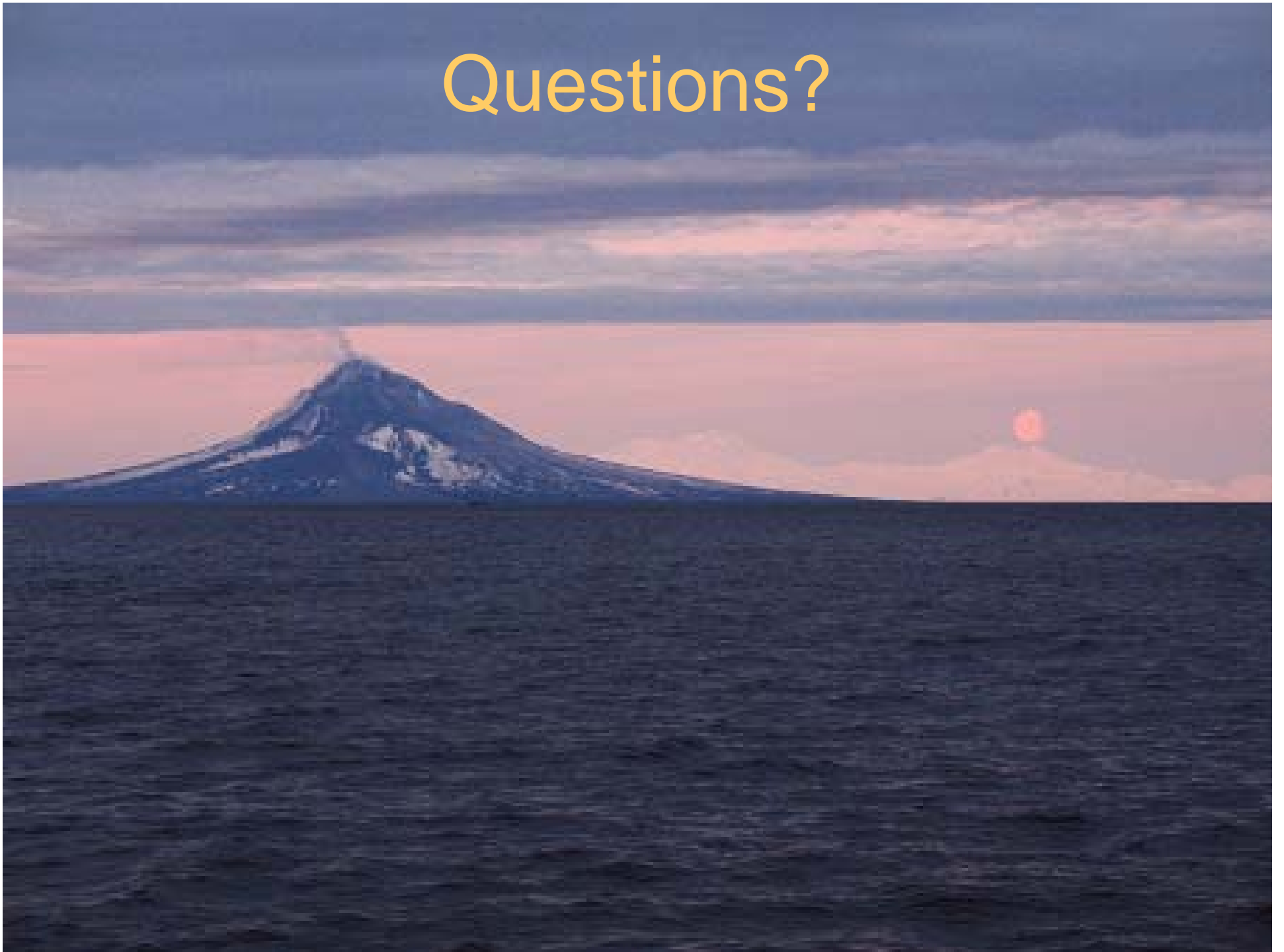


Littoral Summary

- **Diverse habitats**
- **High stress environment**
- **Low to moderate primary productivity**
- **Low to moderate diversity**
- **Coupling to benthic resources**

- **Probable importance to adjacent Lower Cook Inlet ecosystem**
 - **Organic input**
 - **Spawning/rearing area for herring**
 - **Nursery for salmon, other forage fish, and crab**

Questions?



Bird/Mammal Observations

- Bald eagles
- Peregrine falcon
- P. guillemots, puffins, murrelets, scoters, harlequins, eiders
- Seals
- Whales

