

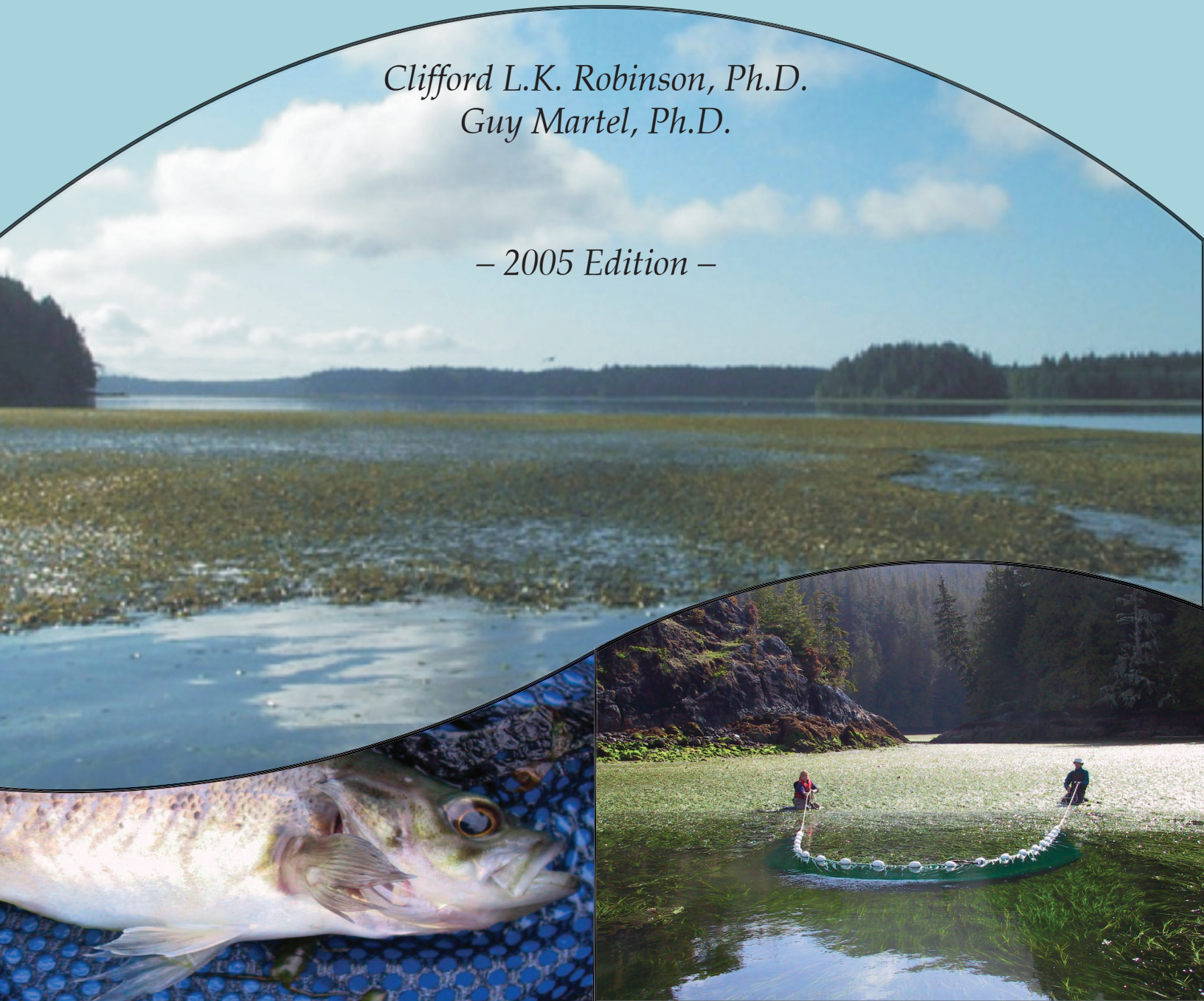


WESTERN AND NORTHERN SERVICE CENTRE

MONITORING FOR THE ECOLOGICAL INTEGRITY OF EELGRASS BEDS (*Zostera marina*) IN CANADA'S COASTAL NATIONAL PARKS OF BRITISH COLUMBIA

Clifford L.K. Robinson, Ph.D.
Guy Martel, Ph.D.

– 2005 Edition –



*Monitoring for the ecological integrity of eelgrass beds
(Zostera marina) in coastal National Parks of British Columbia*

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**WNSC
RESOURCE CONSERVATION
TECHNICAL REPORT**

**MONITORING FOR THE ECOLOGICAL INTEGRITY OF
EELGRASS BEDS (*Zostera marina*) IN COASTAL
NATIONAL PARKS OF BRITISH COLUMBIA**

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EXECUTIVE SUMMARY

The Canada National Parks Act Sec 8(2) states that "Maintenance or restoration of ecological integrity, through the protection of natural resources and natural processes, shall be the first priority of the Minister when considering all aspects of the management of parks." Ecological Integrity (EI) means, with respect to a park, "a condition characteristic of its natural region and likely to persist, including abiotic components and the structure/function of biological communities". An objective science-based monitoring program will be required to assess and monitor for changes in EI in Canada's National Parks.

Two National Park Reserves of Canada (NPRC) have marine components in the Pacific Bioregion (Pacific Rim NPRC and the Southern Gulf Islands NPRC). In addition, there is a proposed National Marine Conservation Area surrounding the third terrestrial park in coastal British Columbia (Gwaii Haanas NPRC – Haida Heritage Site). Because of the similar nature of the coastal near shore ecosystems among these three regions, Parks Canada should develop and apply a common coast wide monitoring approach. The overarching monitoring objectives for maintaining EI of near shore marine ecosystems in the Pacific Bioregion are:

1. Characterize the present (future) state of ecosystems, focusing on environmental and biological diversity.
2. Establish empirical limits of ecosystem component variation (in space and time).
3. Provide early diagnosis of "abnormal" ecosystem structure and function.

In this report, we discuss results from the second year of a program intended to monitor for the ecological integrity of a highly productive and highly sensitive near shore ecosystem, namely eelgrass (*Zostera marina*). Because of where they grow, eelgrass beds are potentially subjected to impacts from a wide variety of land-use and marine-use activities. For example, boating activities can directly, physically impact eelgrass, and activities such as logging or construction can quickly impact eelgrass bed structure and function through changes in water quality.

During the summer of 2005, 44 eelgrass beds were sampled for environmental properties, eelgrass bed properties, and fish community properties. This report provides a summary of information collected for each eelgrass bed sampled in four regions of interest to Parks Canada: beds in the proposed Gwaii Haanas National Marine Conservation Area surrounding Gwaii Haanas National Park – Haida Heritage Site, beds in Grice Bay, Pacific Rim

National Park Reserve and southern Clayoquot Sound, beds in the Broken Group Island unit of Pacific Rim National Park Reserve and Barkley Sound, and beds within and outside the Gulf Islands National Park Reserve.

The following information is compiled for each eelgrass bed: 1) information on bed location, 2) environmental properties, 3) eelgrass properties such as biomass and epiphyte load, and 4) fish communities.

ACKNOWLEDGEMENTS

Jennifer Yakimishyn, Clint Johnson and Scott Giroux have been instrumental in keeping the sampling programs operational in Pacific Rim, Gwaii Haanas and the Gulf Islands, respectively. Alice Gavin developed the report format.

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1.0 BACKGROUND

The *Canada National Parks Act* Sec 8(2) states that “Maintenance or restoration of ecological integrity, through the protection of natural resources and natural processes, shall be the first priority of the Minister when considering all aspects of the management of parks.” Ecological Integrity (EI) means, with respect to a park, “a condition characteristic of its natural region and likely to persist, including abiotic components and the structure/function of biological communities”. An objective science-based monitoring program will be required to assess and monitor for changes in EI in Canada’s National Parks.

Two National Park Reserves of Canada (NPRC) have marine components in the Pacific Bioregion (Pacific Rim NPRC and the Southern Gulf Islands NPRC). In addition, there is a proposed National Marine Conservation Area surrounding the third terrestrial park in coastal British Columbia (Gwaii Haanas NPRC – Haida Heritage Site). Because of the similar nature of the coastal nearshore ecosystems among these three regions, Parks Canada should develop and apply a common coast-wide monitoring approach. The overarching monitoring objectives for maintaining EI of nearshore marine ecosystems in the Pacific Bioregion are:

- 1.Characterize the status and trends of ecosystems, focusing on environmental and biological diversity;
- 2.Establish empirical limits of ecosystem component variations (in space and time); and,
- 3.Provide early diagnosis of “abnormal” ecosystem structure and function.

There are many coastal ecosystems in Pacific NPRs that will require monitoring to ensure conservation of nearshore ecological integrity. In this report, we discuss the rationale for establishing a monitoring program for what is arguably the most productive and sensitive (to human impacts) nearshore ecosystem, eelgrass (*Zostera marina*). In addition, previous research conducted in other

temperate areas has shown that eelgrass is a useful and meaningful indicator of greater ecosystem health.

Eelgrass prefers clear, oligotrophic and oxygenated waters of the shallow subtidal and intertidal (+2 m to –5 m relative to Chart Datum). Eelgrass beds are an important coastal ecosystem for several reasons. First, they directly support food chains through the secondary production of invertebrates associated with epiphytes (animals or algae growing on eelgrass blades). Second, eelgrass meadows indirectly support food chains through supplies of plant material to detrital pathways and adjacent ecosystems (e.g., mudflats). Third, eelgrass provides rearing and foraging habitat for invertebrates (e.g., Dungeness crabs), fishes and birds such as the Great Blue herons. Finally, eelgrass beds reduce impacts of shoreline erosion by waves and currents, help stabilize sediments, and act as an integral component of the shallow water nutrient recycling process.

Because of where they grow, eelgrass beds are potentially subjected to impacts from a wide variety of land and marine use activities. For example, boating activities may directly impact eelgrass through shading or churning of substrate by anchors or propellers. In addition, certain activities can quickly impact eelgrass meadow structure and function through changes in water quality. Perusal of the primary scientific literature indicates that a deterioration of water quality leads mainly to a reduction of light available for eelgrass. Increased nutrient levels in the water column may result in major blooms of phytoplankton, epiphytic algae, and increased macro algal populations. This in turn reduces light levels, preventing eelgrass seeds from germinating and causing old eelgrass blades to die because of lack of light. Similarly, an increase in water column turbidity from increased sediment load (from coastal river run-off or nearshore construction, etc) reduces light available to eelgrass. Ultimately, the major

consequence of decreased light availability is a decline in eelgrass density and biomass and a subsequent reduction in the size and function of eelgrass beds.

Eelgrass beds (EGBs) meet the majority of selection criteria developed for selecting indicator taxa for assessing ecosystem health (Hilty and Merenlender 2000). Their taxonomic status is clear, and there is one dominant species of eelgrass in nearshore coastal British Columbia (*Zostera marina*). There is a large and growing literature on the biology and life history of eelgrass, and tolerance limits to environmental conditions (e.g., temperature, salinity, light levels, etc) are well known. Eelgrass has a cosmopolitan distribution and has limited mobility (rhizomes can potentially spread 1-3 meters per year). There is plenty of evidence to indicate that eelgrass offers an early warning system in response to stress. For example, recent observations in the San Juan Islands (Wyllie-Echeverria et al. 2003) indicate that intertidal portions of many meadows were completely lost within two years. Eelgrass is easy to find because it is visible at low tide, and it occurs along 10-25% of the British Columbia coastline. Parks Canada is presently investigating relationships between changes in eelgrass

and other ecosystem components (e.g., fish assemblages) and documenting the variability in population parameters. Overall, eelgrass is one of the few marine species that offers such a complete attribute package for acting as an indicator of coastal ecosystem health.

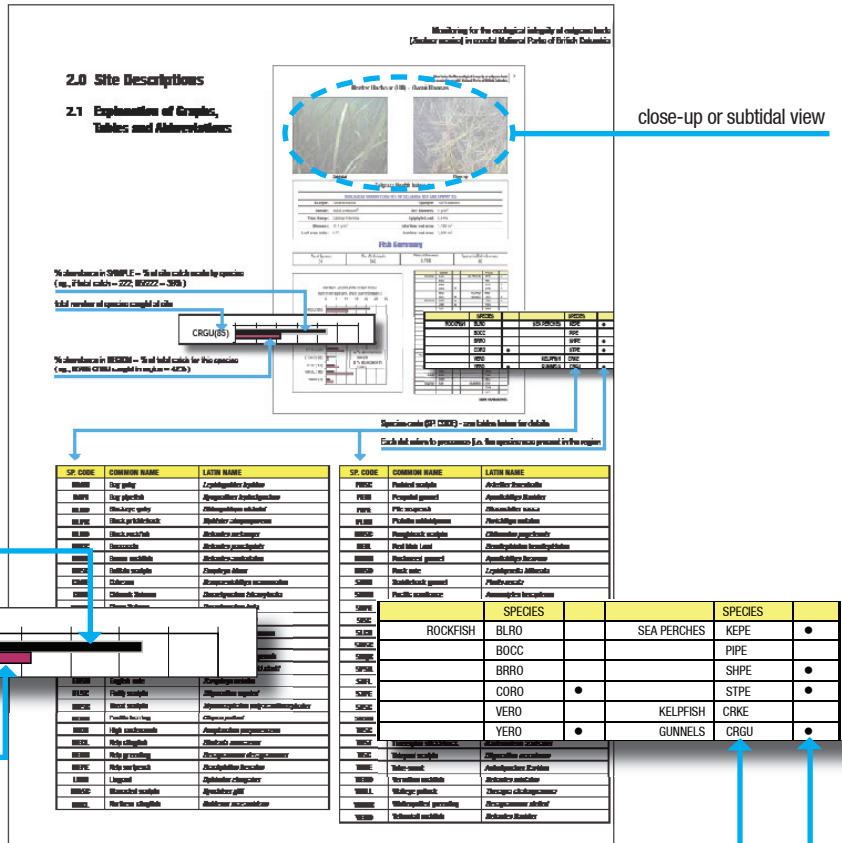
1.1. Eelgrass Inventory

Inventories of eelgrass meadows are required before detailed monitoring programs can be established. Parks Canada began the eelgrass meadow inventory program in 2004 in each of the four study regions. Because the 4 regions of interest are spread along the BC coast, the surveys were restricted to sampling eelgrass meadows within a temporal index period (see table below). The major criteria for selecting an eelgrass meadow was that it could be safely accessed on a lower low water tide during the index period. The maximum number of meadows that can be sampled within a region during a low tide window is 12. The Table below summarizes the number of meadows sampled during the index period for each region. Some 44 eelgrass meadows were sampled in 2005, and 32 of these were re-sampled from 2004.

Region	Sampling Period	Year	Total Meadows Sampled	Meadows Re-sampled	New Meadows
GWAI HAANAS	Mid July	2004	12	0	12
		2005	12	10	2
CLAYOQUOT SOUND	Mid June	2004	10	0	10
		2005	12	9	3
BARKLEY SOUND	July	2004	8	0	8
		2005	8	7	1
SOUTHERN GULF ISLANDS	Early August	2004	8	0	8
		2005	12	6	6

2.0 Site Descriptions

2.1 Explanation of Graphs, Tables and Abbreviations



% abundance in SAMPLE = % of site catch made by species
(eg., if total catch = 222; 85/222 = 38%)

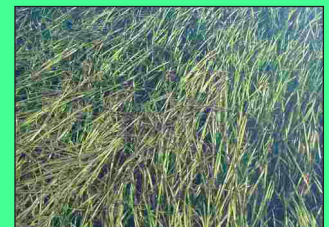
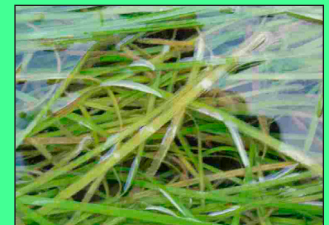
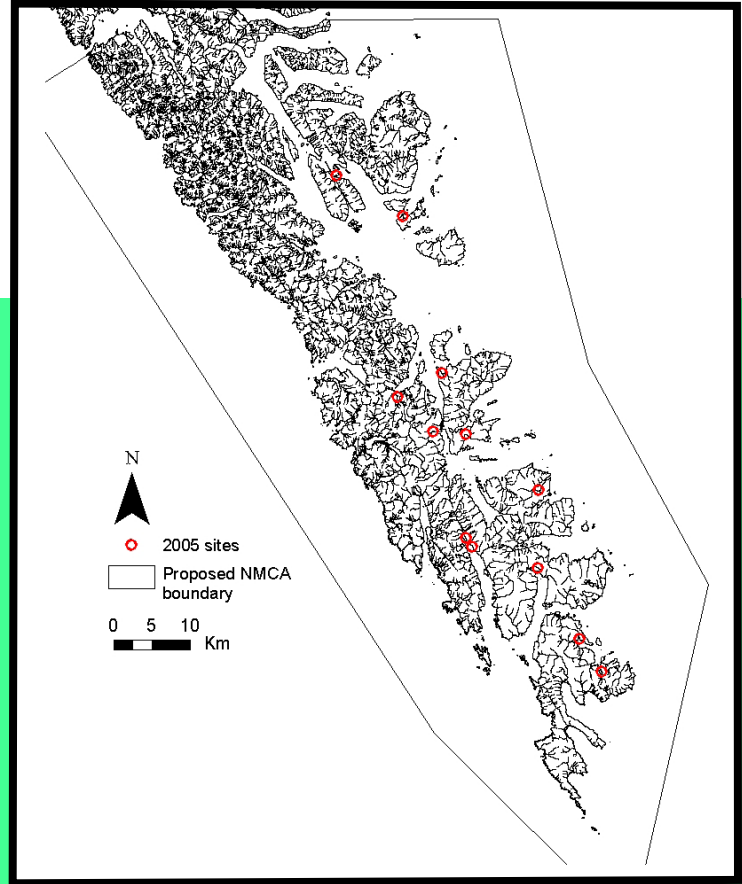
total number of species caught at site

% abundance in REGION = % of total catch for this species
(eg., 85/202 CRGU caught in region = 42%)

SP. CODE	COMMON NAME	LATIN NAME
BAGO	Bay goby	<i>Lepidogobius lepidus</i>
BAPI	Bay pipefish	<i>Syngnathus leptorhynchus</i>
BLGO	Blackeye goby	<i>Rhinogobios nicholsi</i>
BLPR	Black prickleback	<i>Xiphister atropurpureus</i>
BLRO	Black rockfish	<i>Sebastes melanops</i>
BOCC	Boccaccio	<i>Sebastes paucispinis</i>
BRRO	Brown rockfish	<i>Sebastes auriculatus</i>
BUSC	Buffalo sculpin	<i>Enophrys bison</i>
CABE	Cabezon	<i>Scorpaenichthys marmoratus</i>
CHIN	Chinook Salmon	<i>Oncorhynchus tshawytscha</i>
CHUM	Chum Salmon	<i>Oncorhynchus keta</i>
CORO	Copper rockfish	<i>Sebastes caurinus</i>
COSO	C-O sole	<i>Pleuronichthys coenosus</i>
CRGU	Crescent gunnel	<i>Pholis laeta</i>
CRKE	Crevice kelpfish	<i>Gibbonsia montereyensis</i>
CUTT	Cutthroat trout	<i>Oncorhynchus clarki clarki</i>
ENSO	English sole	<i>Parophrys vetulus</i>
FLSC	Fluffy sculpin	<i>Oligocottus snyderi</i>
GRSC	Great sculpin	<i>Myoxocephalus polyacanthocephalus</i>
HERR	Pacific herring	<i>Clupea pallasii</i>
HICO	High cockscomb	<i>Anoplarchus purpurescens</i>
KECL	Kelp clingfish	<i>Rimicola muscarum</i>
KEGR	Kelp greenling	<i>Hexagrammos decagrammus</i>
KEPE	Kelp surfperch	<i>Brachyistius frenatus</i>
LING	Lingcod	<i>Ophiodon elongatus</i>
MASC	Manacled sculpin	<i>Synchirus gilli</i>
NOCL	Northern clingfish	<i>Goblesox maeandricus</i>

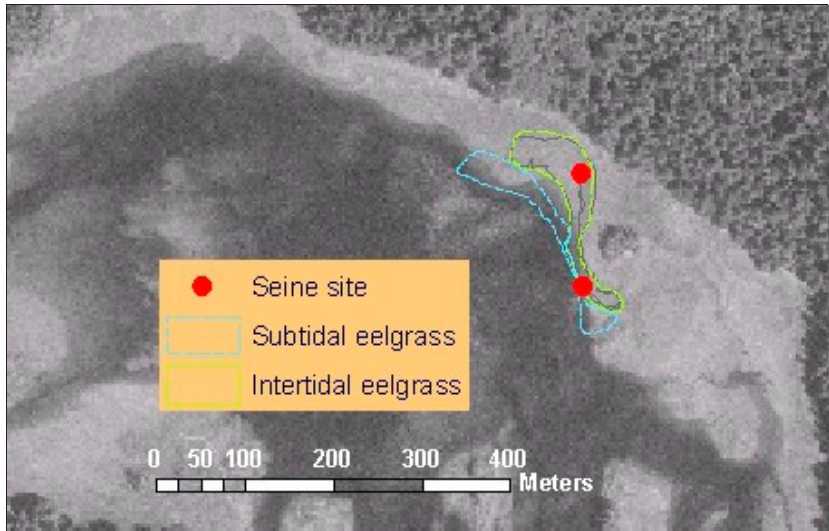
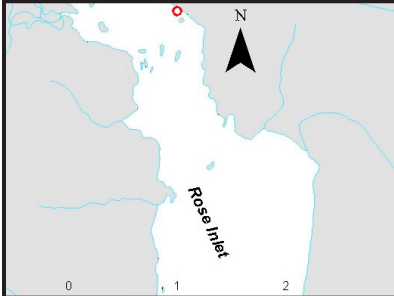
SP. CODE	COMMON NAME	LATIN NAME
PASC	Padded sculpin	<i>Artedius fenestratis</i>
PEGI	Penpoint gunnel	<i>Apodichthys flavidus</i>
PIPE	Pile seaperch	<i>Rhacochilus vacca</i>
PLMI	Plainfin midshipman	<i>Porichthys notatus</i>
RBSC	Roughback sculpin	<i>Chitonotus pugetensis</i>
REIL	Red Irish Lord	<i>Hemilepidotus hemilepidotus</i>
ROGU	Rockweed gunnel	<i>Apodichthys fucorum</i>
ROSO	Rock sole	<i>Lepidopsetta bilineata</i>
SAGU	Saddleback gunnel	<i>Pholis ornata</i>
SAND	Pacific sandlance	<i>Ammodytes hexapterus</i>
SHPE	Shiner surfperch	<i>Cymatogaster aggregata</i>
SISC	Siverspotted sculpin	<i>Blepsias cirrhosus</i>
SLCO	Slender cockscomb	<i>Anoplarchus insignis</i>
SMSC	Smoothhead sculpin	<i>Artedius lateralis</i>
SM[R	Pacific snake prickleback	<i>Lumpenus sagitta</i>
SPSA	Speckled sanddab	<i>Citharichthys stigmaeus</i>
STFL	Starry flounder	<i>Platichthys stellatus</i>
STPE	Striped seaperch	<i>Embiotoca lateralis</i>
STSC	Staghorn sculpin	<i>Leptocottus armatus</i>
SUSM	Surf smelt	<i>Hypomesus pretiosus</i>
TASC	Tadpole sculpin	<i>Psychrolutes paradoxus</i>
THST	Threespine stickleback	<i>Gasterosteus aculeatus</i>
TISC	Tidepool sculpin	<i>Oligocottus maculosus</i>
TUBE	Tube-snout	<i>Autorhynchus flavidus</i>
VERO	Vermilion rockfish	<i>Sebastes miniatus</i>
WALL	Walleye pollock	<i>Theragra chalcogramma</i>
WHGR	Whitespotted greenling	<i>Hexagrammos stelleri</i>
YERO	Yellowtail rockfish	<i>Sebastes flavidus</i>

2.2 Gwaii Haanas Site Descriptions

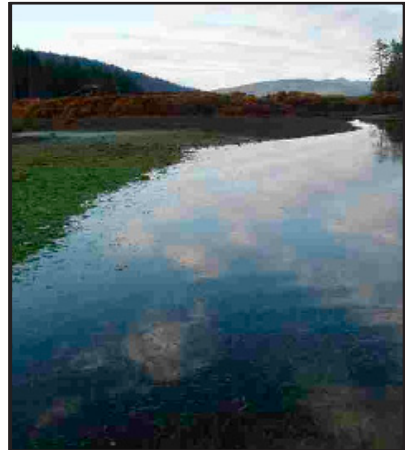
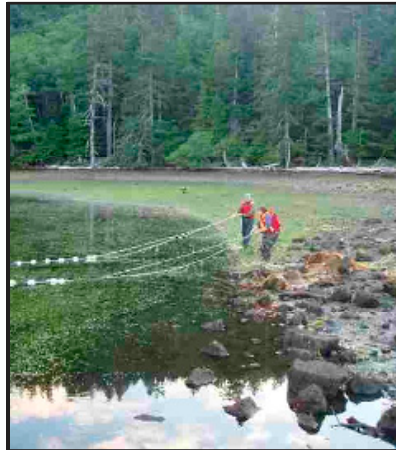


Rose Inlet

UTM Coordinates : 353774 E
 : 5785957 N
 Date Sampled: July 19, 2005 @ 6:25am
 Years Sampled: 2004, 2005
 Weather: cloudy & calm waters



Undisturbed (EDI 14), thick intertidal bed at the end of a large bay at the southern end of Gwaii Haanas. *Zostera marina* var. *typica* was present in the mid intertidal zone (*Z. marina* var. *phillipsi* was however more common). The bed was on a cobble/gravel beach and the intertidal eelgrass blades had no epiphyte load (0% DW). The subtidal portion of the bed was thick and surrounded by cobbles/mud and some extent of diatom-covered mudflats. The subtidal epiphyte load varied from low to medium (diatoms); some grazers such as chink shells were abundant in patches. There was no evidence of wasting disease but bruises were noted on several leaves. The eelgrass bed was close to low laminariales, colander and giant kelp stipes. Large plumose anemones (*Metridium*), slender crabs and several sea stars (sunflower, ochre, spiny pink and mottled) were present. The site had the second highest fish abundance in the region, most of which accounted for by shiner perch (80% of the catch). One juvenile vermillion rockfish was also caught. There were relatively few juvenile rockfish (9) for the region. Black rockfish were filmed above the eelgrass bed during high tide.



Physical Characteristics	
Environmental Index: 10	
Temperature: 13°C	Sediment Composition: Mud & gravel substrate
Salinity: 30.7 ppt	Silt-clay fraction: 3.9%
Chlorophyll a: 1.15 µg/L	Slope: Flat, <10°
Nitrate: N.D.	Estimated exposure: Protected
Fluorescence: 1.18 FU	Turbidity: 1.74 NTU

Rose Inlet (RI) - Gwaii Haanas



Subtidal



Close up

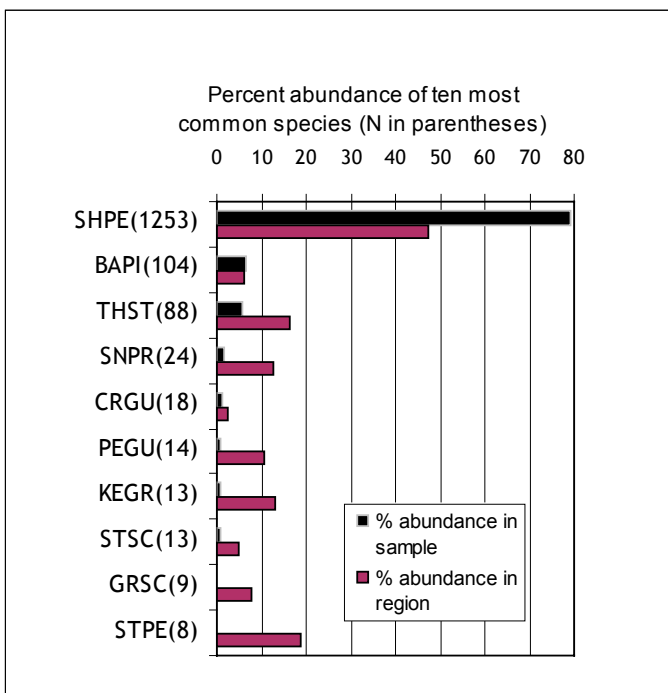
Eelgrass Health Index: 8

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype:	mostly <i>Zostera marina</i> var. <i>phillipsi</i> some <i>Zostera marina</i> var. <i>typica</i>	Epiphyte:	No epiphytes
Density:	1133.3 shoots/m ²	Dry Biomass:	0 g/m ²
Tidal Range:	Subtidal/intertidal	Epiphyte Load:	0%
Biomass:	96.8 g/m ²	Intertidal bed area:	7,005 m ²
Leaf area index:	1.41	Subtidal bed area:	4,822 m ²

Fish Summary

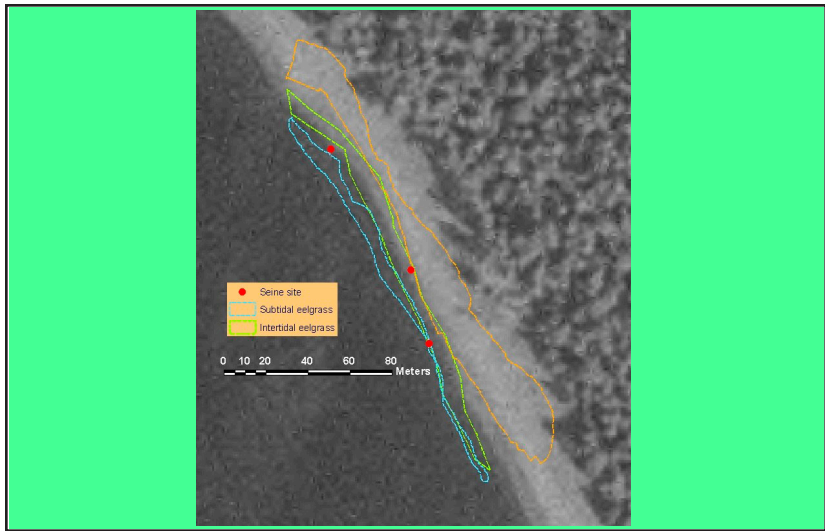
No. of Species: 22	No. of Individuals: 1580	Pielou's Evenness: 0.308	Taxonomic Distinctiveness: 91
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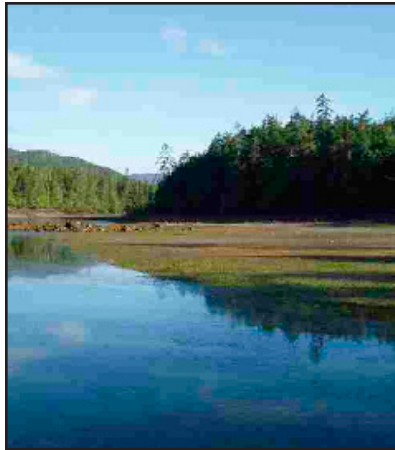
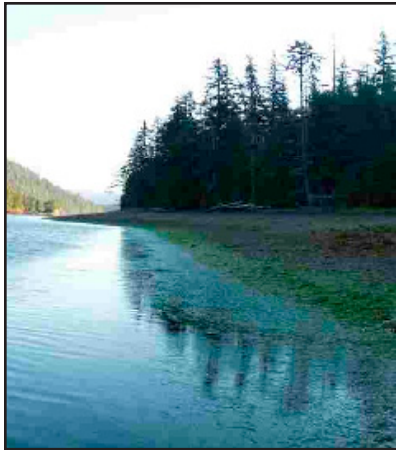
	SPECIES		SPECIES		
ROCKFISH	BLRO		SEA PERCHES	KEPE	•
	BOCC			PIPE	N/A
	BRRO			SHPE	•
	CORO	•		STPE	•
	VERO	•	KELPFISH	CRKE	N/A
	YERO	•	GUNNELS	CRGU	•
SCULPINS	BUSC	•		PEGU	•
	CABE			ROGU	
	FLSC			SAGU	N/A
	GRSC	•	PRICKLEBACKS	SNPR	•
	MASC			BLPR	
	PASC	•		HICO	
	RBSC			SLCO	
	REIL		FLATFISHES	COSO	
	SISC	•		ENSO	•
	SMSC			ROSO	
	STSC	•		SPSA	
	TASC			STFL	
	TISC		GREENLING	WHGR	
PLATED FISHES	THST	•		KEGR	•
	TUBE	•		PAGR	
	BAPI	•		LING	
CLINGFISHES	KECL	•	PREY FISHES	HERR	
	NOCL			SUSM	
GOBIES	BLGO			SAND	
	BAGO			WALL	
TOADFISH	PLMI	N/A	SALMONIDS	CHIN	
				CHUM	•
				CUTT	

Balcom Inlet

UTM Coordinates: 363023 E
 : 5773275 N
 Date Sampled: July 20, 2005 @ 6:15am
 Years Sampled: 2004, 2005
 Weather: calm waters



Southernmost site sampled in Gwaii Haanas, at the end of a small inlet. Thick, undisturbed (EDI 10) and narrow bed (3-4 m wide) on soft substrate - gravel/sand/shells. The epiphyte load was low to medium in the intertidal (although heaviest among Gwaii Haanas sites – 15% DW). The subtidal portion of the bed was also narrow, due to a steep drop; it started thin at its deepest limit where the substrate was mostly marl (shell, sand) with a diatom mat. It then became thick in the shallow subtidal zone. There was a high catch of prawn (*Pandalus* sp) in the beach seine net but few invertebrates were visible in the video, among which spiny pink and sunflower stars and Dungeness crab. No incidence of wasting disease. The ichthyofauna was unusual as there were few shiner perch caught (13) and in that sandlances and tubesnouts, two pelagic species, dominated the catches. Close to 85 % of all tubesnouts caught in Gwaii Haanas were caught at this site. There were 39 juvenile rockfish sampled, most of which copper. Few fishes were seen in the video (the majority of which being kelp perch) even though the eelgrass bed was immediately adjacent to a giant kelp bed.



Physical Characteristics

Environmental Index: 8

Temperature: 13°C	Sediment Composition: Gravel substrate
Salinity: 31.2 ppt	Silt-clay fraction: 6.7%
Chlorophyll a: 2.00 µg/L	Slope: Steep, >20°
Nitrate: N.D.	Estimated exposure: Protected
Fluorescence: 0.67 FU	Turbidity: 1.26 NTU

Balcom Inlet (BI) - Gwaii Haanas



Subtidal



Close up

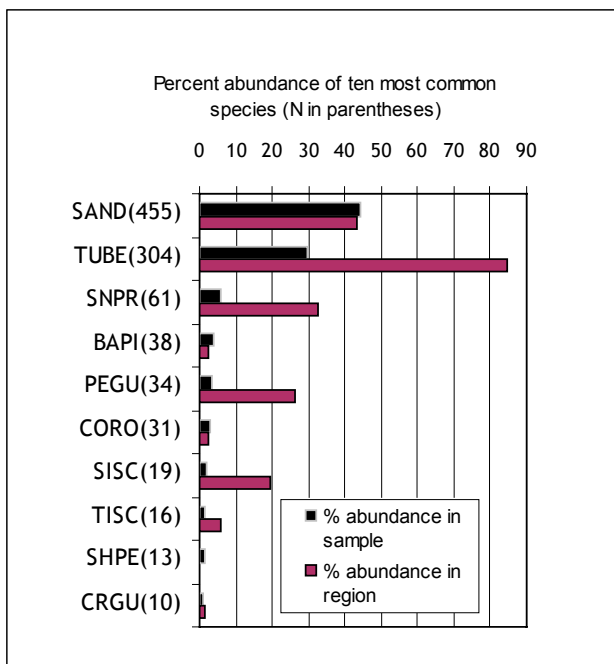
Eelgrass Health Index: 10

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 577.8 shoots/m ²	Dry Biomass: 25 g/m ²
Tidal Range: Subtidal/intertidal	Epiphyte Load: 511.90%
Biomass: 159.1 g/m ²	Intertidal bed area: 1,550 m ²
Leaf area index: 2.86	Subtidal bed area: 797 m ²

Fish Summary

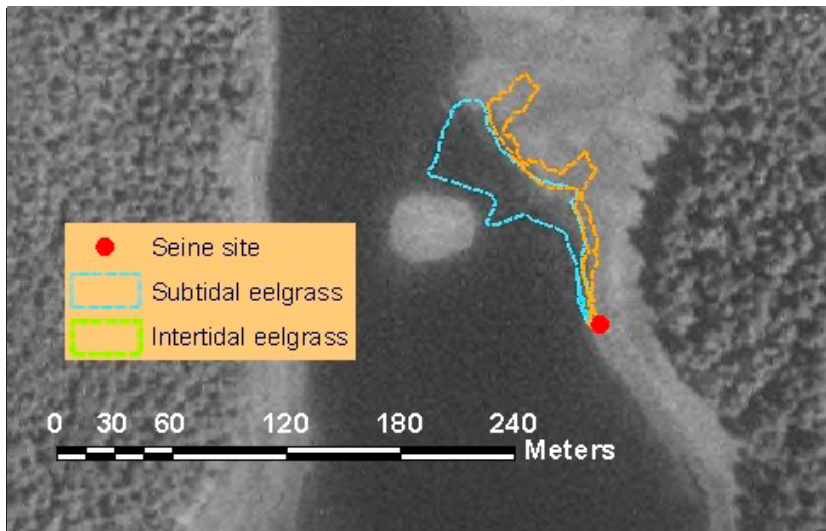
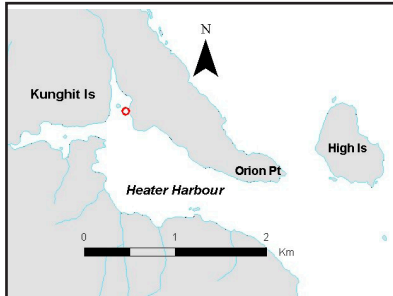
No. of Species: 25	No. of Individuals: 1023	Pielou's Evenness: 0.529	Taxonomic Distinctiveness: 92
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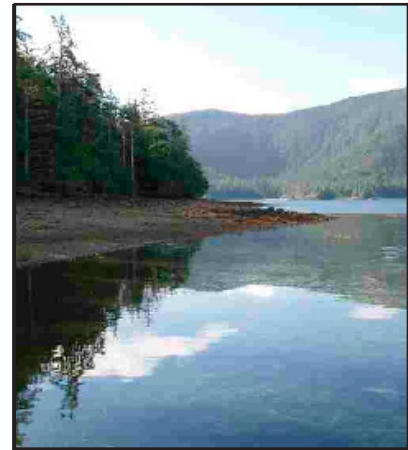
	SPECIES		SPECIES		
ROCKFISH	BLRO	•	SEA PERCHES	KEPE	•
	BOCC			PIPE	N/A
	BRRO			SHPE	•
	CORO	•		STPE	•
	VERO		KELPFISH	CRKE	N/A
	YERO	•	GUNNELS	CRGU	•
SCULPINS	BUSC			PEGU	•
	CABE			ROGU	
	FLSC			SAGU	N/A
	GRSC	•	PRICKLEBACKS	SNPR	•
	MASC	•		BLPR	
	PASC	•		HICO	
	RBSC			SLCO	
	REIL	•	FLATFISHES	COSO	
	SISC	•		ENSO	•
	SMSC			ROSO	
	STSC	•		SPSA	
	TASC			STFL	
	TISC	•	GREENLING	WHGR	•
PLATED FISHES	THST	•		KEGR	•
	TUBE	•		PAGR	
	BAPI	•		LING	
CLINGFISHES	KECL		PREY FISHES	HERR	•
	NOCL			SUSM	
GOBIES	BLGO			SAND	•
	BAGO	•		WALL	
TOADFISH	PLMI	N/A	SALMONIDS	CHIN	
				CHUM	
				CUTT	

Heater Harbour

UTM Coordinates : 359837 E
 : 5777274 N
 Date Sampled: July 20, 2005 @ 8:28am
 Years Sampled: 2004, 2005
 Weather: information not available



Thick undisturbed (EDI 12) intertidal bed on a flat gravel/cobble beach mid-way along a small bay. The intertidal epiphyte load was medium to low (9% DW), mostly diatoms. Giant kelp patches (*Macrocystis*) were adjacent to the south of the bed. The subtidal portion of the bed was also thick, and adjacent to a mudflat/diatom mat in deeper water. Few grazers were noted on the blades— mainly chink shells and the subtidal epiphyte load was low. No incidence of wasting disease, although some areas of the bed had several bruises or sunburns. The site harboured a dense pandalid shrimp population, and had the second lowest fish abundance in the region. The species evenness and diversity were high, and the catch was dominated by crescent gunnells and sticklebacks. Only two shiner perch were caught, which is unusual. There were 18 juvenile copper and one juvenile yellowtail rockfish caught.



Physical Characteristics

Environmental Index: 14

Temperature: 12°C

Sediment Composition: Gravel substrate

Salinity: 31.4 ppt

Silt-clay fraction: 8.4%

Chlorophyll a: 12.40 µg/L

Slope: Moderate, 10° - 20°

Nitrate: N.D.

Estimated exposure: Protected

Fluorescence: 7.12 FU

Turbidity: 5.73 NTU

Heater Harbour (HH) - Gwaii Haanas



Subtidal



Close up

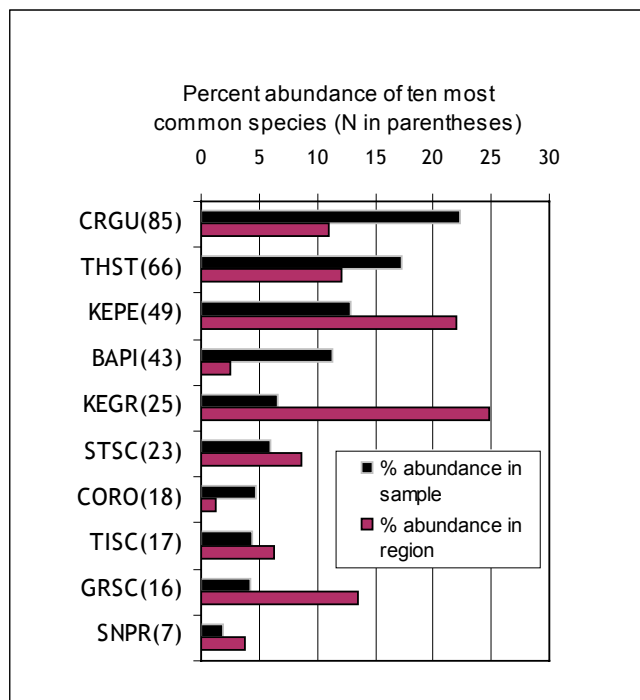
Eelgrass Health Index: 8

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 488.9 shoots/m ²	Dry Biomass: 5 g/m ²
Tidal Range: Subtidal/intertidal	Epiphyte Load: 8.64%
Biomass: 47.1 g/m ²	Intertidal bed area: 1,180 m ²
Leaf area index: 0.72	Subtidal bed area: 2,696 m ²

Fish Summary

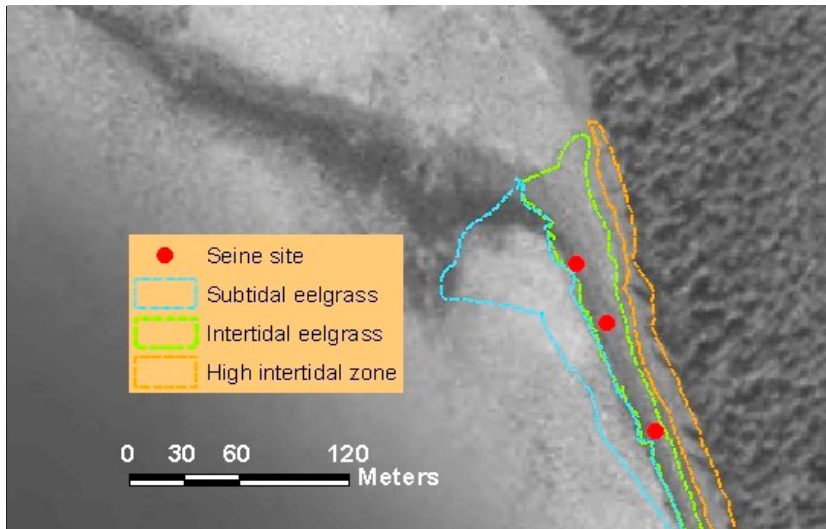
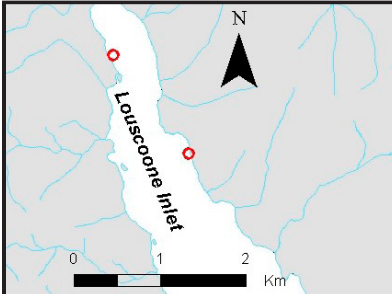
No. of Species: 24	No. of Individuals: 382	Pielou's Evenness: 0.756	Taxonomic Distinctiveness: 90
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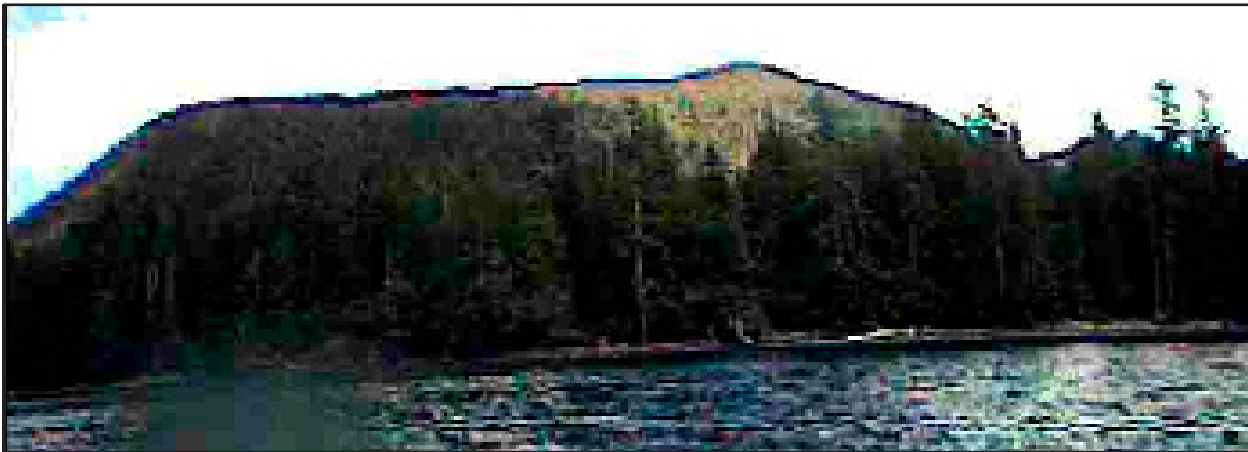
	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE ●
	BOCC			PIPE
	BRRO			SHPE ●
	CORO ●			STPE ●
	VERO		KELPFISH	CRKE
	YERO ●		GUNNELS	CRGU ●
SCULPINS	BUSC ●			PEGU ●
	CABE ●			ROGU
	FLSC			SAGU
	GRSC ●		PRICKLEBACKS	SNPR ●
	MASC			BLPR ●
	PASC ●			HICO
	RBSC			SLCO
	REIL ●		FLATFISHES	COSO
	SISC ●			ENSO
	SMSC ●			ROSO
	STSC ●			SPSA
	TASC			STFL
	TISC ●		GREENLING	WHGR ●
PLATED FISHES	THST ●			KEGR ●
	TUBE			PAGR
	BAPI ●			LING ●
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI		SALMONIDS	CHIN
				CHUM
				CUTT

Louscoone

UTM Coordinates : 345084 E
 : 5788026 N
 Date Sampled: July 21, 2005 @ 6:30am
 Years Sampled: 2004, 2005
 Weather: information not available



Thick and undisturbed (EDI 8) intertidal bed on the east side of the inlet. As was the case for the other Louscoone site, *Z. marina* var. *phillipsi* was dominant, with patches of *Z. marina* var. *typica* in the mid intertidal zone. The south end of the beach dropped steeply and harboured a giant kelp bed. The intertidal epiphyte load was low (7% DW). Many bivalves and gastropods occupied the area: cockles, gaper clams, butter clams, moonsnails, red turbans. Some large helmet crabs were present among the eelgrass. The subtidal portion of the bed was thin on the edges and thicker in the middle. Invertebrate egg masses were common on the blades and the epiphyte load ranged from high/medium adjacent to mudflat to low in the middle of bed. No incidence of wasting disease. The bed was surrounded by mud and laminariales; giant kelp stipes also grew near the bed. As in the other Louscoone site, juvenile rockfish were abundant (325 individuals caught) but only two species were present, copper and yellowtail. Kelp clingfish and bay gobies were unusually abundant, and kelp and striped perch were seen in the video.



Physical Characteristics

Environmental Index: 10

Temperature: 13°C

Sediment Composition: Gravel substrate

Salinity: 31.7 ppt

Silt-clay fraction: 1.0%

Chlorophyll a: 8.44 µg/L

Slope: Flat, <10%

Nitrate: N.D.

Estimated exposure: Semi-protected

Fluorescence: 3.60 FU

Turbidity: 2.06 NTU

Louscoone (L) - Gwaii Haanas



Subtidal



Close up

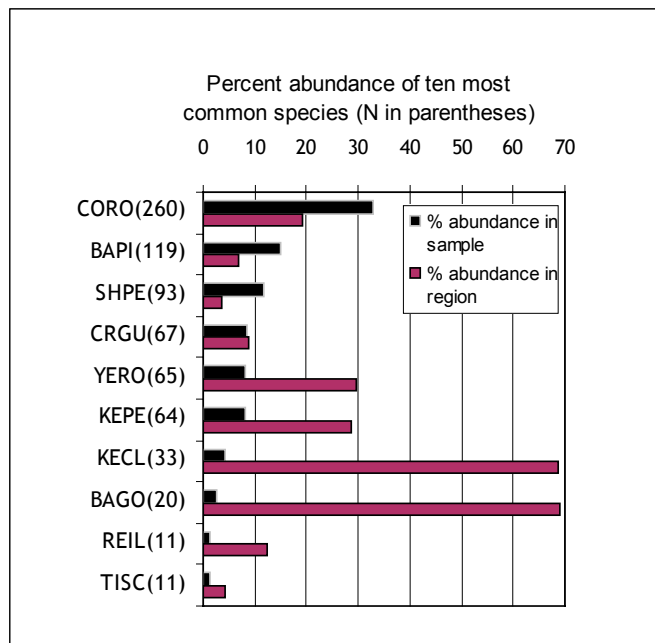
Eelgrass Health Index: 10

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i> var. <i>phillipsi</i> dominant	Epiphyte: 100% diatoms
Density: 777.8 shoots/m ²	Dry Biomass: 37 g/m ²
Tidal Range: Subtidal/intertidal	Epiphyte Load: 6.94%
Biomass: 443.9 g/m ²	Intertidal bed area: 4,615 m ²
Leaf area index: 5.51	Subtidal bed area: 5,810 m ²

Fish Summary

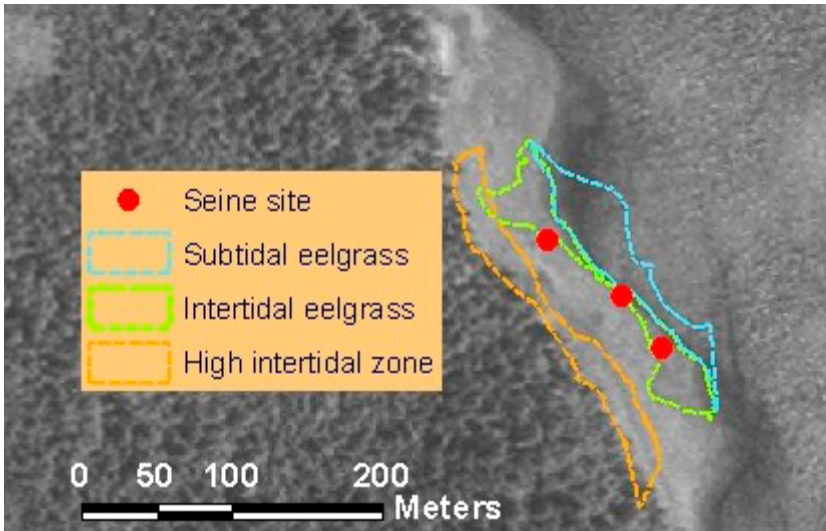
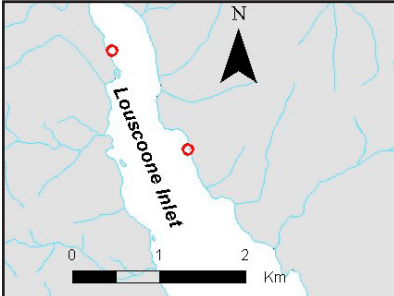
No. of Species: 20	No. of Individuals: 788	Pielou's Evenness: 0.718	Taxonomic Distinctiveness: 87
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	SPECIES		SPECIES		
ROCKFISH	BLRO		SEA PERCHES	KEPE	•
	BOCC			PIPE	N/A
	BRRO			SHPE	•
	CORO	•		STPE	•
	VERO		KELPFISH	CRKE	N/A
	YERO	•	GUNNELS	CRGU	•
SCULPINS	BUSC	•		PEGU	•
	CABE	•		ROGU	
	FLSC			SAGU	N/A
	GRSC		PRICKLEBACKS	SNPR	•
	MASC			BLPR	
	PASC	•		HICO	
	RBSC			SLCO	
	REIL	•	FLATFISHES	COSO	
	SISC	•		ENSO	
	SMSC	•		ROSO	
	STSC			SPSA	
	TASC			STFL	
	TISC	•	GREENLING	WHGR	
PLATED FISHES	THST			KEGR	•
	TUBE	•		PAGR	
	BAPI	•		LING	
CLINGFISHES	KECL	•	PREY FISHES	HERR	
	NOCL			SUSM	
GOBIES	BLGO			SAND	
	BAGO	•		WALL	
TOADFISH	PLMI	N/A	SALMONIDS	CHIN	
				CHUM	
				CUTT	

Head of Louscoone Inlet

UTM Coordinates: 344113 E
 : 5789092 N
 Date Sampled: July 21, 2005 @ 8:58am
 Years Sampled: 2004, 2005
 Weather: information not available



Thick and relatively undisturbed (EDI 10) intertidal bed on the west side of Louscoone inlet, on a cobble/loose gravel substrate with some mud patches. *Z. marina* var. *phillipsi* was dominant (95% of eelgrass) with *Z. marina* var. *typica* (5%) higher in the intertidal. There was a significant output of eelgrass pollen on the water surface at the time of sampling. The intertidal epiphyte load was low (5% DW). Some blue mud shrimp molts present, and the mottled sea star and the nudibranch *Hermisenda* were seen within the eelgrass bed. The intertidal epiphyte load was low (5%), mostly diatoms. No incidence of wasting disease. The subtidal bed was abutted to mud/debris on its deeper end. It was thin on the outside edges and its epiphyte load was medium to heavy along the edges and low in the middle. Many eelgrass limpets (*Lottia parallela*) were visible on the blades, as well as some chink shells; spiny pink star and plumose anemones *Metridium* were seen on the subtidal mudflat. The site had a high abundance of juvenile rockfish (207 individuals); yellowtail juveniles were the most abundant species (55% of the total of this species for the whole region). Copper, brown and vermilion rockfish juveniles were also caught. Striped seaperch were seen on the video but not recorded in catches.



Physical Characteristics

Environmental Index: 12

Temperature: 12°C	Sediment Composition: mud & gravel substrate
Salinity: 31.0 ppt	Silt-clay fraction: 7.0%
Chlorophyll a: 5.33 µg/L	Slope: Flat, <10°
Nitrate: 0.50 µmol	Estimated exposure: Very protected
Fluorescence: 3.17 FU	Turbidity: 2.9 NTU

Head of Louscoone Inlet (HL) - Gwaii Haanas



Subtidal



Close up

Eelgrass Health Index: 8

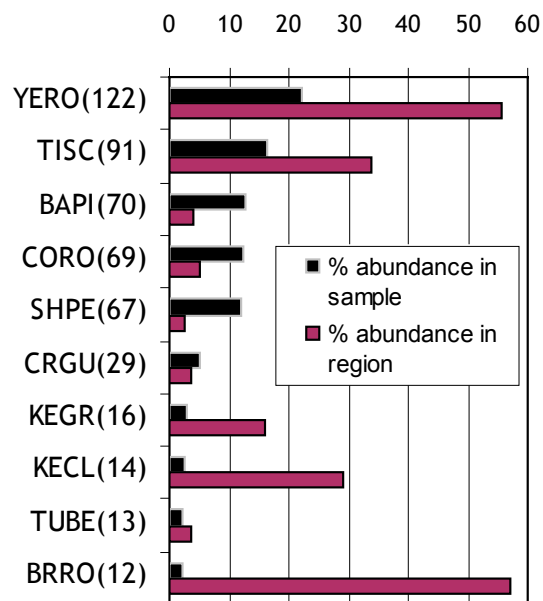
BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype:	95% <i>Zostera marina</i> var. <i>phillipsi</i> 5% <i>Zostera marina</i> var. <i>typica</i>	Epiphyte:	100% diatoms
Density:	422.2 shoots/m ²	Dry Biomass:	8 g/m ²
Tidal Range:	Subtidal/intertidal	Epiphyte Load:	5.49%
Biomass:	111.9 g/m ²	Intertidal bed area:	3,797 m ²
Leaf area index:	1.15	Subtidal bed area:	3,826 m ²

Fish Summary

No. of Species: 23	No. of Individuals: 553	Pielou's Evenness: 0.751	Taxonomic Distinctiveness: 82
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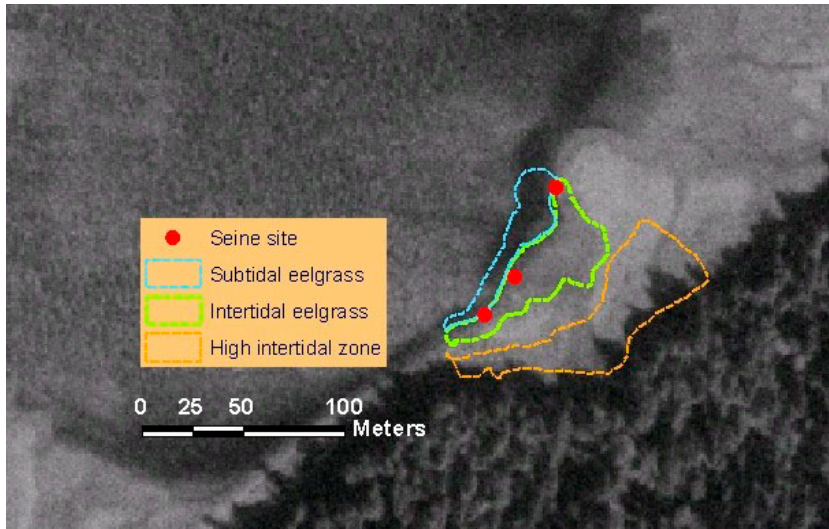
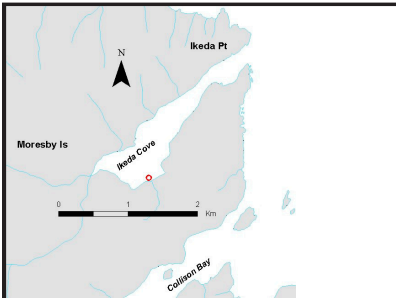
Percent abundance of ten most common species (N in parentheses)



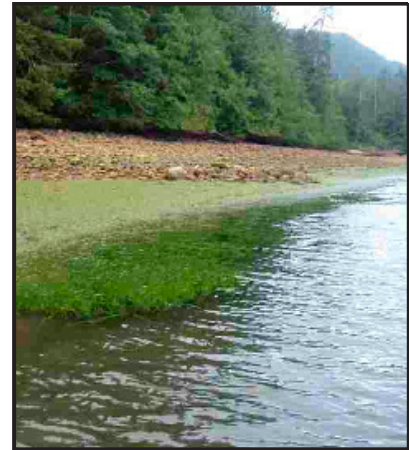
	SPECIES		SPECIES		
ROCKFISH	BLRO		SEA PERCHES	KEPE	•
	BOCC	•		PIPE	N/A
	BRRO	•		SHPE	•
	CORO	•		STPE	
	VERO	•	KELPFISH	CRKE	N/A
	YERO	•	GUNNELS	CRGU	•
SCULPINS	BUSC	•		PEGU	
	CABE	•		ROGU	
	FLSC			SAGU	N/A
	GRSC		PRICKLEBACKS	SNPR	•
	MASC			BLPR	
	PASC			HICO	
	RBSC			SLCO	
	REIL	•	FLATFISHES	COSO	
	SISC	•		ENSO	
	SMSC	•		ROSO	
	STSC	•		SPSA	
	TASC			STFL	
	TISC	•	GREENLING	WHGR	
PLATED FISHES	THST	•		KEGR	•
	TUBE	•		PAGR	
	BAPI	•		LING	
CLINGFISHES	KECL	•	PREY FISHES	HERR	
	NOCL			SUSM	
GOBIES	BLGO			SAND	
	BAGO	•		WALL	
TOADFISH	PLMI	N/A	SALMONIDS	CHIN	
				CHUM	•
				CUTT	

Ikeda Cove

UTM Coordinates : 353036 E
 : 5796049 N
 Date Sampled: July 22, 2005 @ 8:55am
 Years Sampled: 2005
 Weather: information not available



Thick and narrow eelgrass beds in a sheltered bay (EDI 10);the beds sampled were bounded with boulders outcrops and bisected by a small creek (sea hair was present in the higher intertidal) and lied on a soft mud beach with a steep slope (30°) in the shallow subtidal zone.The intertidal epiphyte load was medium for the 2005 sites but heavy for Gwaii Haanas (13% DW, mostly diatoms). The area was rich in invertebrates:blue mud shrimp molts,large bivalves(horse clams,butter clams,Macoma,blue mussels),abundant Native little neck clams,sea cucumber,mottled sea stars and pandalid shrimp. The subtidal portion of the bed was thick and surrounded by diatom-mat covered mudflats. The subtidal epiphyte load (diatoms) varied from low to medium to heavy in some patches. There was possible evidence of wasting disease or sun burns/bruising as many blades showed brown/black tips. The grazing gastropod Lacuna was common on eelgrass blades.The fish catches were the largest of the region,but this was skewed as they were dominated by two schools of pelagic species, juvenile herring and sandlances. The former accounted for 97% of this species' catches in the region. Juvenile rockfish were also abundant (214) but copper rockfish accounted for 208 of these.



Physical Characteristics

Environmental Index: 8

Temperature: 13°C	Sediment Composition: N/A
Salinity: 31.1 ppt	Silt-clay fraction: N/A
Chlorophyll a: 0.50 µg/L	Slope: N/A
Nitrate: N.D.	Estimated exposure: N/A
Fluorescence: 0.53 FU	Turbidity: 0.10 NTU

Ikeda Cove (IK) - Gwaii Haanas



Subtidal



Close up

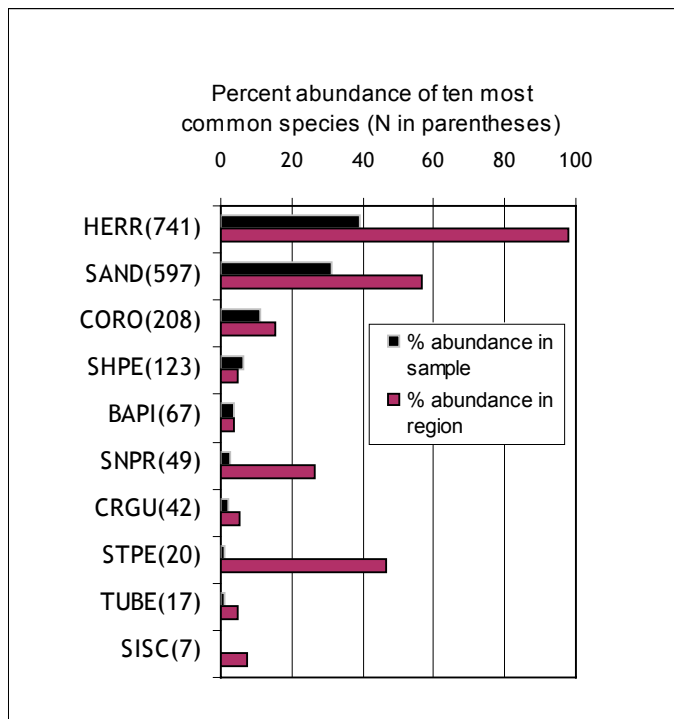
Eelgrass Health Index: 16

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 800.0 shoots/m ²	Dry Biomass: 26 g/m ²
Tidal Range: Subtidal / intertidal	Epiphyte Load: 13.35%
Biomass: 205.69 g/m ²	Intertidal bed area: 1,969 m ²
Leaf area index: 3.37	Subtidal bed area: 1,045 m ²

Fish Summary

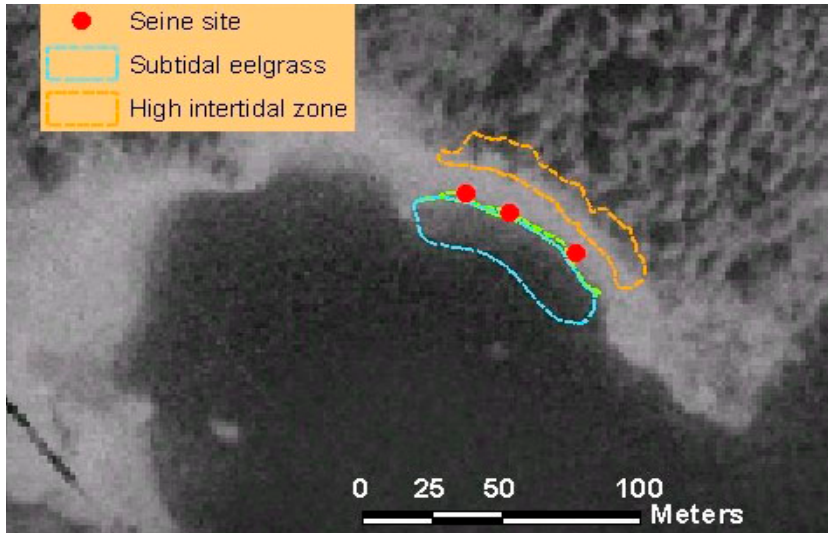
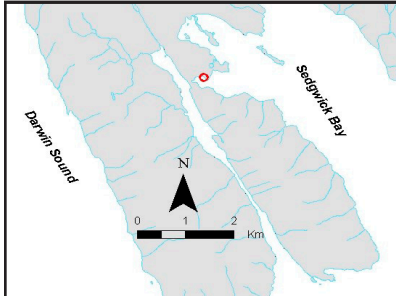
No. of Species: 22	No. of Individuals: 1905	Pielou's Evenness: 0.541	Taxonomic Distinctiveness: 95
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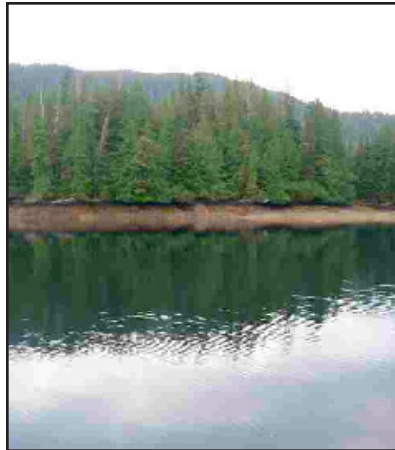
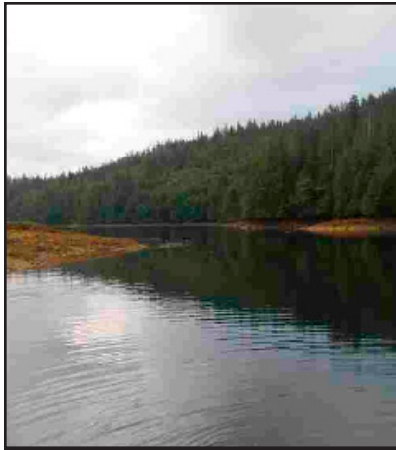
	SPECIES		SPECIES	
ROCKFISH	BLRO	•	SEA PERCHES	KEPE
	BOCC			PIPE
	BRRO			SHPE
	CORO	•		STPE
	VERO		KELPFISH	CRKE
	YERO	•	GUNNELS	CRGU
SCULPINS	BUSC			PEGU
	CABE			ROGU
	FLSC			SAGU
	GRSC	•	PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL	•	FLATFISHES	COSO
	SISC	•		ENSO
	SMSC			ROSO
	STSC	•		SPSA
	TASC			STFL
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST	•		KEGR
	TUBE	•		PAGR
	BAPI	•		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI	N/A	SALMONIDS	CHIN
				CHUM
				CUTT

Sedgwick

UTM Coordinates : 323596 E
 : 5834462 N
 Date Sampled: July 23, 2005 @ 7:58am
 Years Sampled: 2004, 2005
 Weather: information not available

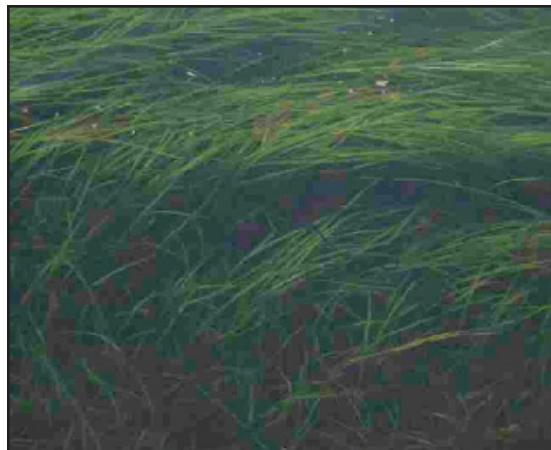


Narrow, constrained intertidal bed over cobbles and soft mud (EDI 14). There was a thick sea lettuce band in the mid intertidal zone. The intertidal epiphyte load was medium (10% DW; diatoms). Many native little neck and horse clams were present. The subtidal bed was dense and surrounded by giant kelp and colander kelp along its deeper edges. The subtidal epiphyte load ranged from medium to heavy (filamentous diatoms) and grazers were rare. There was possible evidence of wasting disease or sun burns towards the shallow subtidal edge. The catch was dominated by bay pipefish, and kelp perch were disproportionately abundant. There were only 24 juvenile rockfish caught, most of them copper.



Physical Characteristics	
Environmental Index: 8	
Temperature: 13°C	Sediment Composition: Gravel substrate
Salinity: 31.3 ppt	Silt-clay fraction: 4.1%
Chlorophyll a: 2.71 µg/L	Slope: Moderate, 10° - 20°
Nitrate: N.D.	Estimated exposure: Protected
Fluorescence: 2.79 FU	Turbidity: 0.28 NTU

Sedgwick (SE) - Gwaii Haanas



Subtidal



Close up

Eelgrass Health Index: 16

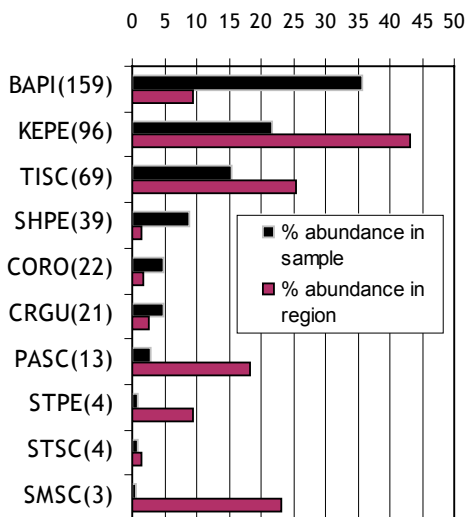
BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 488.9 shoots/m ²	Dry Biomass: 8 g/m ²
Tidal Range: Subtidal / intertidal	Epiphyte Load: 9.94%
Biomass: 70.4 g/m ²	Intertidal bed area: 89 m ²
Leaf area index: 1.28	Subtidal bed area: 1,291 m ²

Fish Summary

No. of Species: 20	No. of Individuals: 445	Pielou's Evenness: 0.636	Taxonomic Distinctiveness: 93
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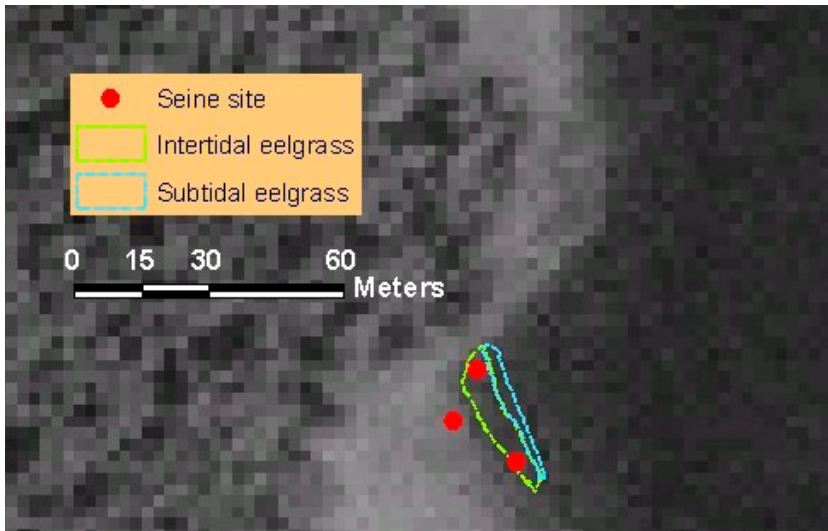
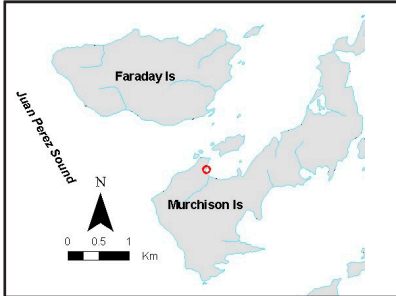
Percent abundance of ten most common species (N in parentheses)



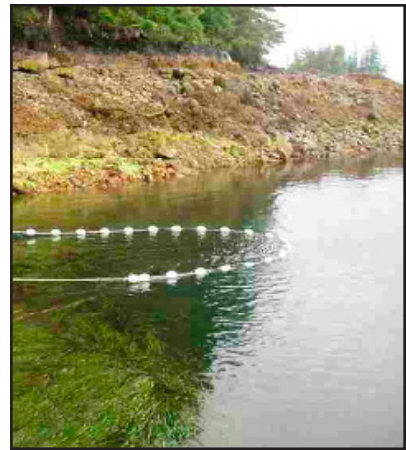
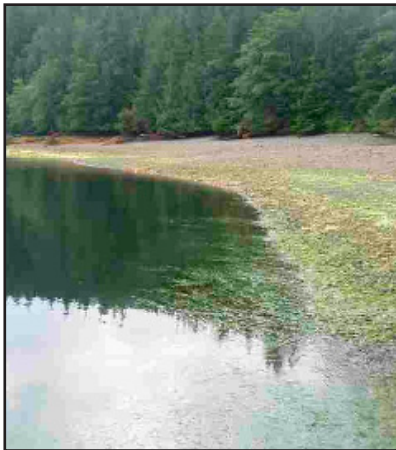
	SPECIES		SPECIES		
ROCKFISH	BLRO		SEA PERCHES	KEPE	•
	BOCC			PIPE	N/A
	BRRO	•		SHPE	•
	CORO	•		STPE	•
	VERO		KELPFISH	CRKE	N/A
SCULPINS	YERO		GUNNELS	CRGU	•
	BUSC	•		PEGU	•
	CABE			ROGU	
	FLSC			SAGU	N/A
	GRSC	•	PRICKLEBACKS	SNPR	
	MASC			BLPR	
	PASC	•		HICO	
	RBSC			SLCO	•
	REIL	•	FLATFISHES	COSO	
	SISC	•		ENSO	
	SMSC	•		ROSO	
	STSC	•		SPSA	
	TASC			STFL	
	TISC	•	GREENLING	WHGR	•
	PLATED FISHES	THST			KEGR
TUBE				PAGR	•
BAPI		•		LING	•
CLINGFISHES	KECL		PREY FISHES	HERR	
	NOCL			SUSM	
GOBIES	BLGO			SAND	
	BAGO			WALL	
TOADFISH	PLMI	N/A	SALMONIDS	CHIN	
				CHUM	
				CUTT	

Murchison

UTM Coordinates : 332556 E
 : 5829857 N
 Date Sampled: July 23, 2005 @ 10:20am
 Years Sampled: 2004, 2005
 Weather: cloudy & calm waters



Narrow, relatively undisturbed (EDI 8) intertidal bed at the edge of a large, gently sloping gravel beach. Sea hair was abundant on the bedrock at the north end of the beach. There were filamentous diatoms in much of the intertidal zone. Both intertidal and subtidal epiphyte loads were low (8% DW; diatoms). Geoducks were present intertidally. The subtidal bed was thick, surrounded by marl deeper and adjacent to a dense bed of colander kelp and laminariales close to the shallow subtidal edge, which itself merged into muddy substrate and woody debris. No incidence of wasting disease. Kelp crabs and chink shell were seen on eelgrass blades. The site had the highest abundance and diversity of juvenile rockfish of any of the 2005 sites: 386 fish among five species, most of which copper. One juvenile bocaccio and seven brown rockfish were also caught.



Physical Characteristics	
Environmental Index: 12	
Temperature: 12°C	Sediment Composition: Gravel substrate
Salinity: 31.6 ppt	Silt-clay fraction: 2.8%
Chlorophyll a: 8.44 µg/L	Slope: Moderate, 10° - 20°
Nitrate: N.D.	Estimated exposure: Protected
Fluorescence: 5.00 FU	Turbidity: 0.30 NTU

Murchison (MU) - Gwaii Haanas



Subtidal



Close up

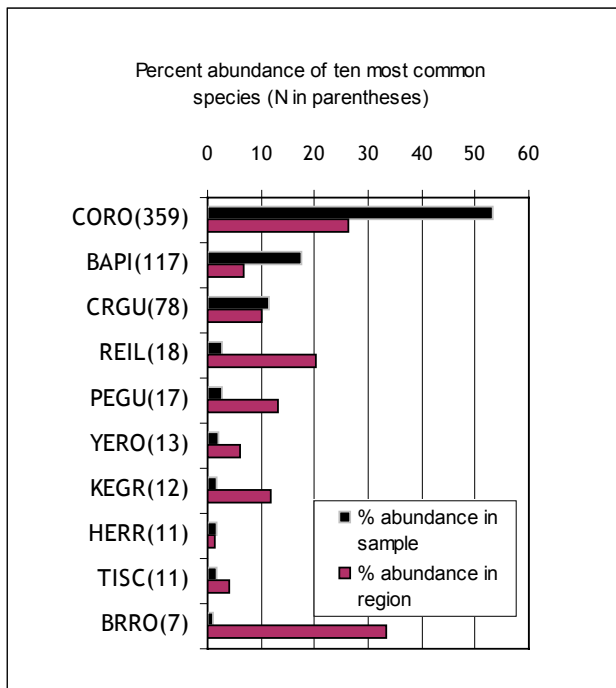
Eelgrass Health Index: 8

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 411.1 shoots/m ²	Dry Biomass: 5 g/m ²
Tidal Range: Subtidal / intertidal	Epiphyte Load: 8.41%
Biomass: 51.2 g/m ²	Intertidal bed area: 179 m ²
Leaf area index: 1.09	Subtidal bed area: 73 m ²

Fish Summary


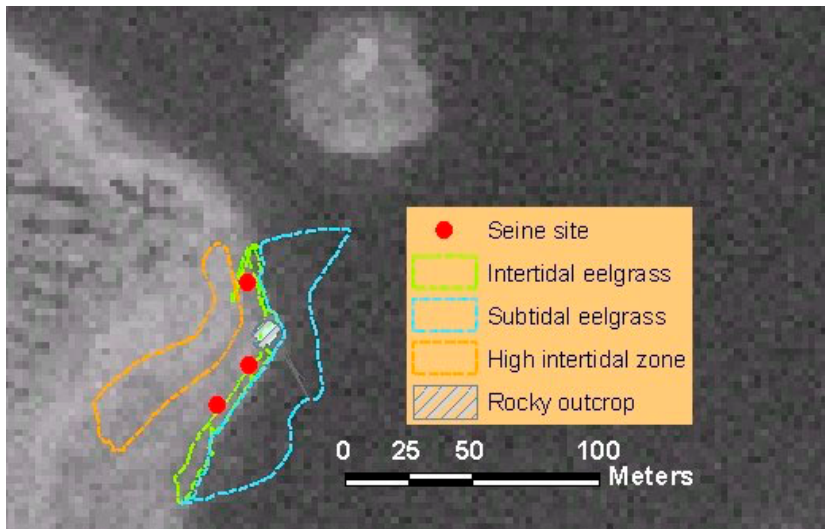
No. of Species: 22	No. of Individuals: 672	Pielou's Evenness: 0.531	Taxonomic Distinctiveness: 88
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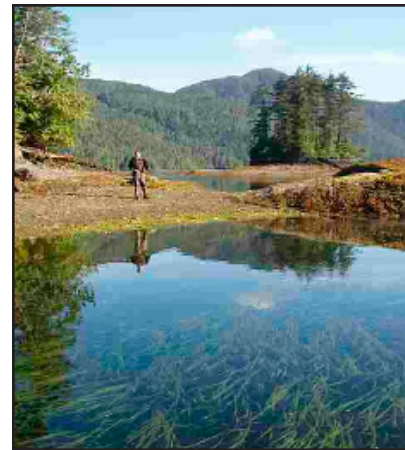
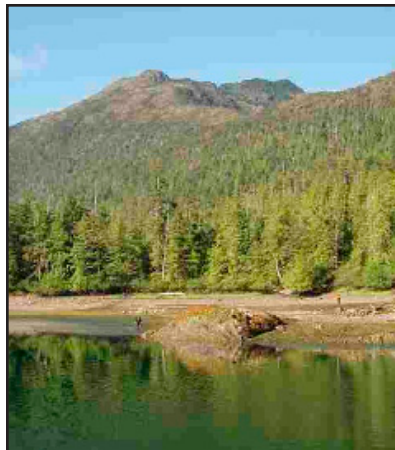
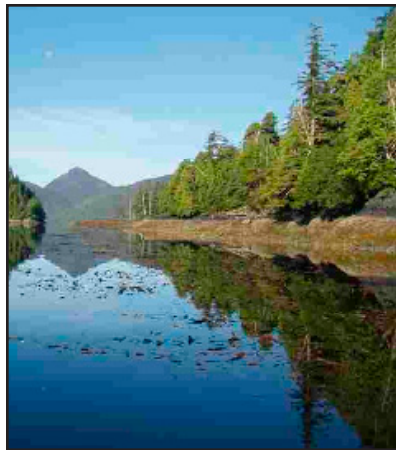
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	BOCC	•		PIPE	N/A
	BRRO	•		SHPE	
	CORO	•		STPE	
	VERO		KELPFISH	CRKE	N/A
SCULPINS	YERO	•	GUNNELS	CRGU	•
	BUSC	•		PEGU	•
	CABE	•		ROGU	
	FLSC			SAGU	N/A
	GRSC	•	PRICKLEBACKS	SNPR	
PLATED FISHES	MASC			BLPR	
	PASC	•		HICO	
	RBSC			SLCO	
	REIL	•	FLATFISHES	COSO	
	SISC			ENSO	•
	SMSC			ROSO	
	STSC	•		SPSA	
	TASC			STFL	
	TISC	•	GREENLING	WHGR	•
	THST			KEGR	•
CLINGFISHES	TUBE			PAGR	•
	BAPI	•		LING	•
	KECL		PREY FISHES	HERR	•
	NOCL			SUSM	
	BLGO			SAND	
GOBIES	BAGO			WALL	
	PLMI	N/A	SALMONIDS	CHIN	
				CHUM	
TOADFISH			CUTT		

Skaat

UTM Cordinates : 333779 E
 : 5806560 N
 Date Sampled: July 24,2005 @ 8:53am
 Years Sampled: 2004
 Weather: sunny & calm waters

Narrow intertidal bed on weak sloped (5°) gravel beach bisected by a rocky outcrop (EDI 6). Some patches of soft mud. The intertidal epiphyte load was low (6% DW), primarily diatoms and the subtidal epiphyte load ranged from medium to high (diatom frills). No incidence of wasting disease. Geoduck, native little neck clams, blue mussels, and mottled sea stars were present in the intertidal. The subtidal bed was thick, with low subtidal edge along muddy substrate covered with flotsam. A high load of egg masses (nudibranchs and gastropods) attracted numerous perches and crabs; bubble shells were common. Other invertebrates seen were kelp crabs (*Pugettia producta*), red rock crabs and hooded nudibranchs (*Melibe leonina*). The site had the lowest fish catches of the region (325 fishes), with bay pipefish and crescent gunnels being the most abundant. Great sculpins (38 /119 caught in total) were more abundant than usual. There were only three copper rockfish juveniles caught. Mixed schools of perches (shiner, striped and kelp) were seen on the video. Kelp perch were common in the video.



Physical Characteristics

Environmental Index: 8

Temperature: 13°C	Sediment Composition: N/A
Salinity: 31.4 ppt	Silt-clay fraction: N/A
Chlorophyll a: 0.82 µg/L	Slope: N/A
Nitrate: N.D.	Estimated exposure: N/A
Fluorescence: 0.41 FU	Turbidity: 0.46 NTU

Skaat (SK) - Gwaii Haanas



Subtidal



Close up

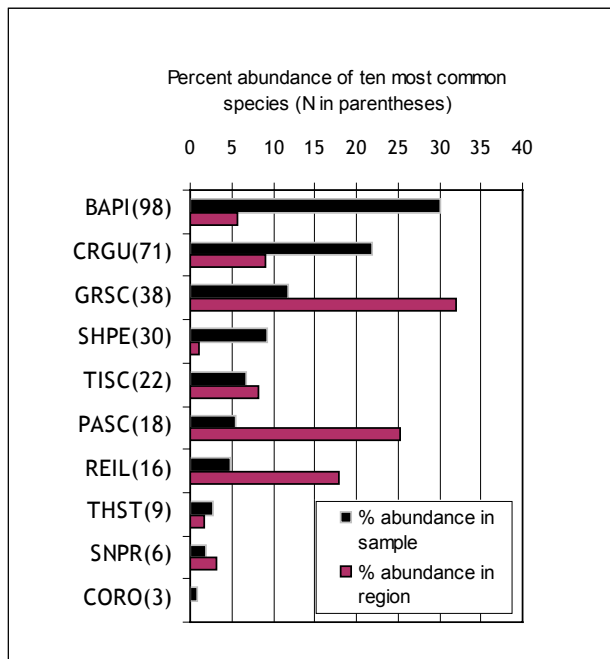
Eelgrass Health Index: 12

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 777.8 shoots/m ²	Dry Biomass: 4 g/m ²
Tidal Range: Subtidal/intertidal	Epiphyte Load: 5.49%
Biomass: 63.3 g/m ²	Intertidal bed area: 512 m ²
Leaf area index: 1.14 m ² per m ²	Subtidal bed area: 2,455 m ²

Fish Summary

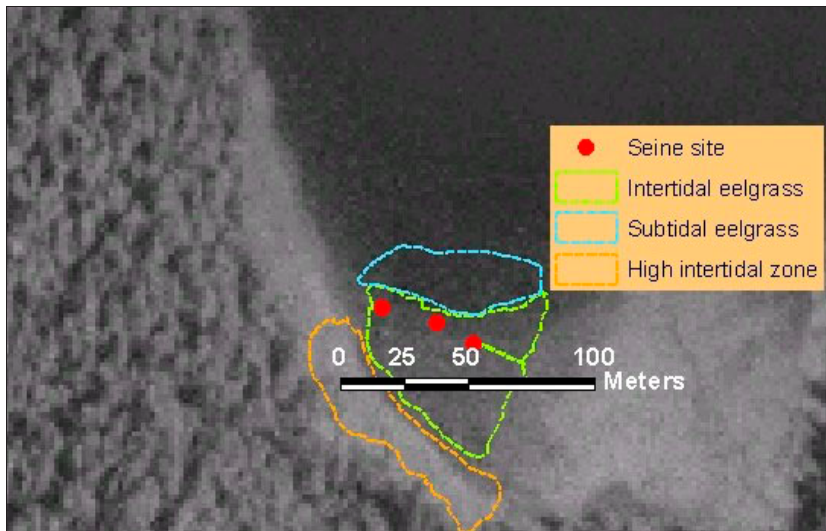
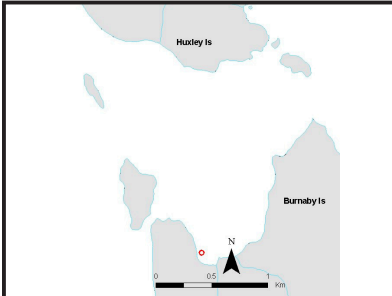
No. of Species: 19	No. of Individuals: 325	Pielou's Evenness: 0.713	Taxonomic Distinctiveness: 90
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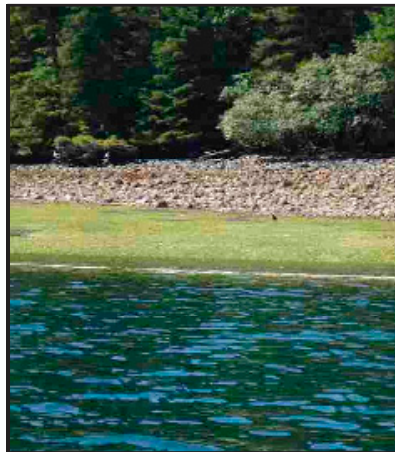
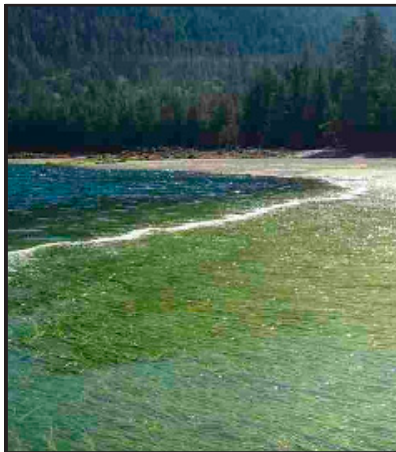
	SPECIES			SPECIES	
ROCKFISH	BLRO	●	SEA PERCHES	KEPE	
	BOCC			PIPE	N/A
	BRR0			SHPE	●
	CORO			STPE	●
	VERO		KELPFISH	CRKE	N/A
	YERO		GUNNELS	CRGU	●
SCULPINS	BUSC	●		PEGU	●
	CABE	●		ROGU	
	FLSC			SAGU	N/A
	GRSC	●	PRICKLEBACKS	SNPR	●
	MASC			BLPR	
	PASC	●		HICO	●
	RBSC			SLCO	●
	REIL	●	FLATFISHES	COSO	
	SISC	●		ENSO	
	SMSC	●		ROSO	
	STSC	●		SPSA	
	TASC			STFL	
	TISC	●	GREENLING	WHGR	
PLATED FISHES	THST	●		KEGR	
	TUBE			PAGR	
	BAPI	●		LING	
CLINGFISHES	KECL		PREY FISHES	HERR	
	NOCL			SUSM	
GOBIES	BLGO			SAND	
	BAGO			WALL	
TOADFISH	PLMI	N/A	SALMONIDS	CHIN	
				CHUM	
				CUTT	

Section Cove

UTM Coordinates : 339254 E
 : 5810121 N
 Date Sampled: July 24, 2005 @ 11:06am
 Years Sampled: 2004, 2005
 Weather: sunny & a light breeze on shore



Large, relatively undisturbed (EDI 8) and thick intertidal bed on a shallow sloped gravel and sand beach surrounded by large cobbles and bedrock. Eelgrass mixed with sea hair reached unusually high in the intertidal zone. The intertidal epiphyte load was low (5%; diatoms). The subtidal bed was patchy, with alternating thin and thick patches; its lower subtidal limit was along mud/gravel and laminariales. The subtidal epiphyte load was medium (diatom frills) along the edges and low in the middle of patches. There were high densities of sun burnt shoots in some places. Kelp crabs were common among eelgrass and there were few grazers; geoducks and gaper clams were seen within the bed, along with the mottled sea stars and Orthasterias. The catches ranked fourth in Gwaii Haanas and were dominated by bay pipefish (37% of the regional catch). Many juvenile rockfish (193) were caught, mostly copper, and one bocaccio. Sandlance schools were seen above the eelgrass but not sampled. Black rockfish were filmed above the eelgrass. A few large salmonids were also filmed above the bed at high tide. Black tailed deer have often been observed to forage on this bed at low tide.



Physical Characteristics

Environmental Index: 12

Temperature: 15°C

Sediment Composition: Fine mud substrate

Salinity: 31.0 ppt

Silt-clay fraction: 4.1%

Chlorophyll a: 5.00 µg/L

Slope: Flat, <10°

Nitrate: N.D.

Estimated exposure: Protected

Fluorescence: 1.94 FU

Turbidity: 5.44 NTU

Section Cove (SC) - Gwaii Haanas



Subtidal



Close up

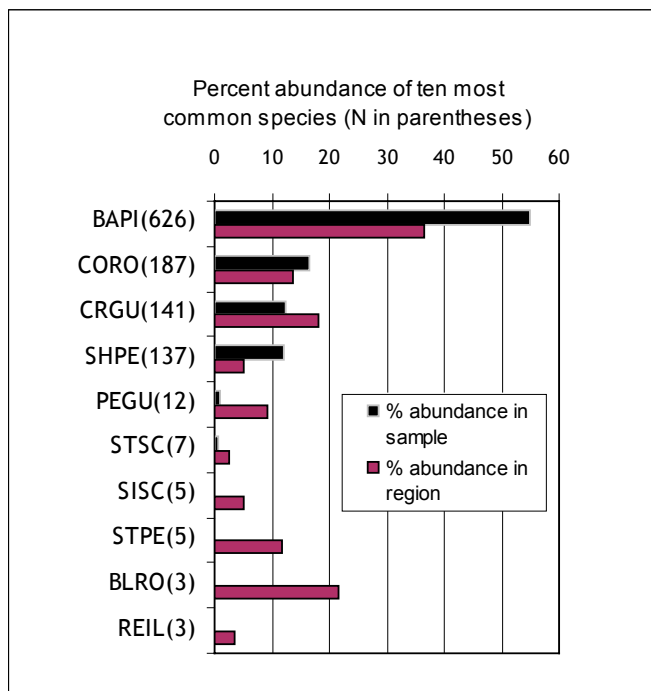
Eelgrass Health Index: 12

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 800.0 shoots/m ²	Dry Biomass: 7 g/m ²
Tidal Range: Subtidal / intertidal	Epiphyte Load: 5.88%
Biomass: 118.6 g/m ²	Intertidal bed area: 2,939 m ²
Leaf area index: 1.92	Subtidal bed area: 1,304 m ²

Fish Summary

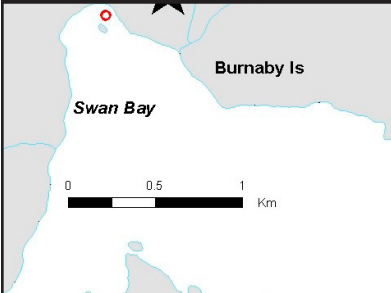
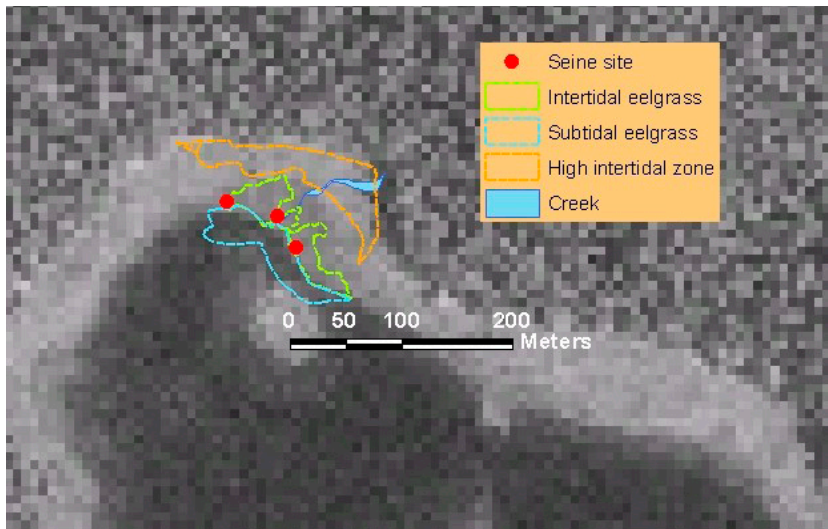
No. of Species: 20	No. of Individuals: 1141	Pielou's Evenness: 0.462	Taxonomic Distinctiveness: 97
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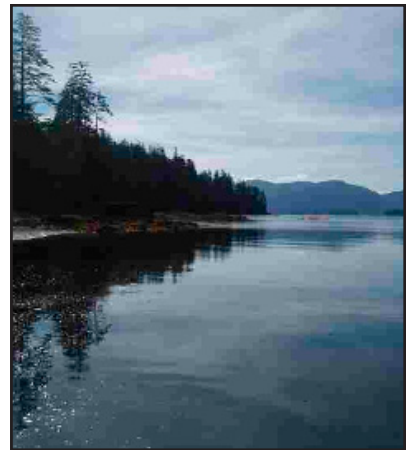
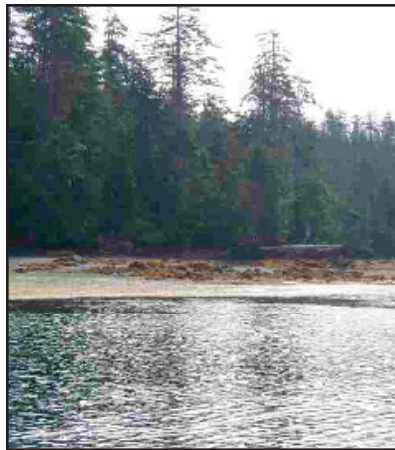
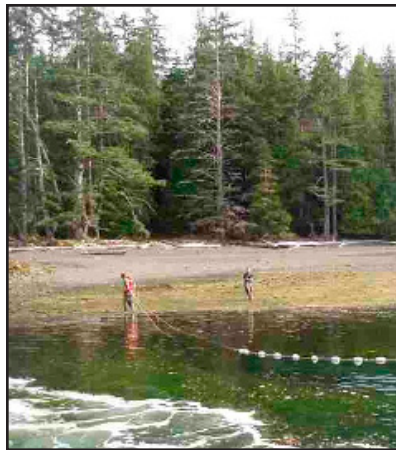
	SPECIES		SPECIES	
ROCKFISH	BLRO	•	SEA PERCHES	KEPE
	BOCC	•		PIPE
	BRRO			SHPE
	CORO	•		STPE
	VERO		KELPFISH	CRKE
	YERO	•	GUNNELS	CRGU
SCULPINS	BUSC			PEGU
	CABE			ROGU
	FLSC			SAGU
	GRSC		PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL	•	FLATFISHES	COSO
	SISC	•		ENSO
	SMSC			ROSO
	STSC	•		SPSA
	TASC			STFL
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST			KEGR
	TUBE	•		PAGR
	BAPI	•		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI	N/A	SALMONIDS	CHIN
				CHUM
				CUTT

Swan Bay

UTM Coordinates : 343023 E
 : 5802415 N
 Date Sampled: July 25, 2005 @ 9:30am
 Years Sampled: 2004, 2005
 Weather: light onshore breeze & clear

Dense, relatively undisturbed (EDI 10) bed on a weak sloped gravel beach bisected by a small creek (0.5 m wide) seeping into the eelgrass bed. Some sea hair patches intertidally. The substrate was primarily soft mud and gravel, with woody debris at the water's edge. There were no intertidal epiphytes on the blades and the epiphyte load was light subtidally. No incidence of wasting disease. Ghost shrimp burrows were near the creek's mouth. The subtidal portion of the bed was patchy with sea lettuce growing along its edges. Eelgrass grew thick in the middle of some patches. The site had the third highest catches in Gwaii Haanas, dominated by shiner perch (46% of the region's total). Higher than usual numbers of silver spotted sculpins (45/97 for region) and an also high number of juvenile rockfish, all copper. Black bears have been observed foraging on the shore of this bed.



Physical Characteristics

Environmental Index: 10

Temperature: 13°C	Sediment Composition: Fine mud substrate
Salinity: 30.6 ppt	Silt-clay fraction: 22.7%
Chlorophyll a: 0.52 µg/L	Slope: Moderate, 10° - 20°
Nitrate: 1.37 µmol	Estimated exposure: Very protected
Fluorescence: 0.22 FU	Turbidity: 0.58 NTU

Swan Bay (SW) - Gwaii Haanas



Subtidal



Close up

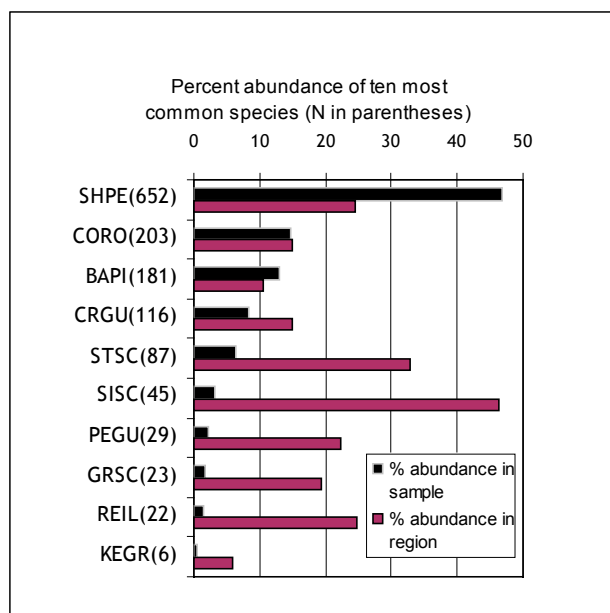
Eelgrass Health Index: 8

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: No epiphytes
Density: 911.1 shoots/m ²	Dry Biomass: 0 g/m ²
Tidal Range: Subtidal/intertidal	Epiphyte Load: 0%
Biomass: 95.0 g/m ²	Intertidal bed area: 3,185 m ²
Leaf area index: 1.33	Subtidal bed area: 3,376 m ²

Fish Summary

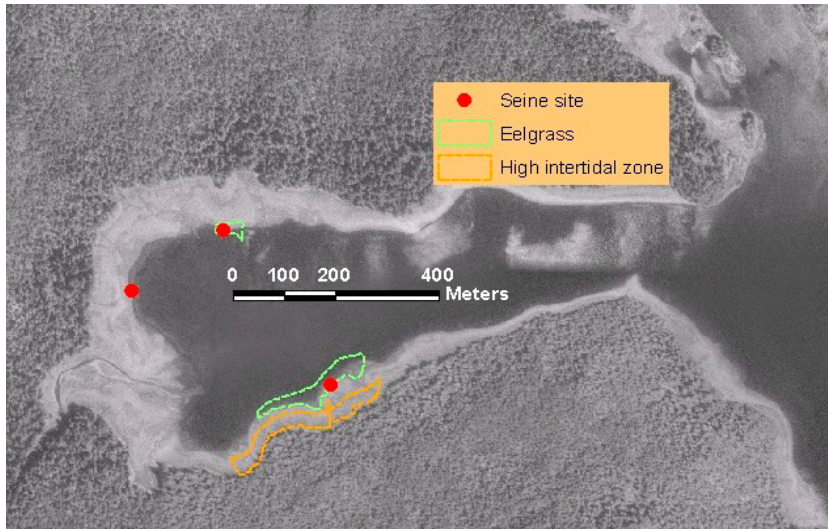
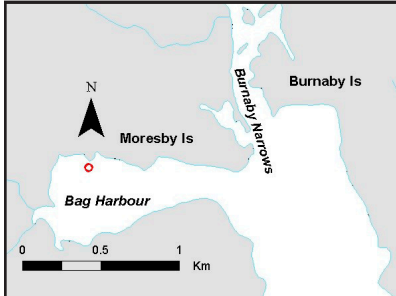
No. of Species: 18	No. of Individuals: 1391	Pielou's Evenness: 0.603	Taxonomic Distinctiveness: 91
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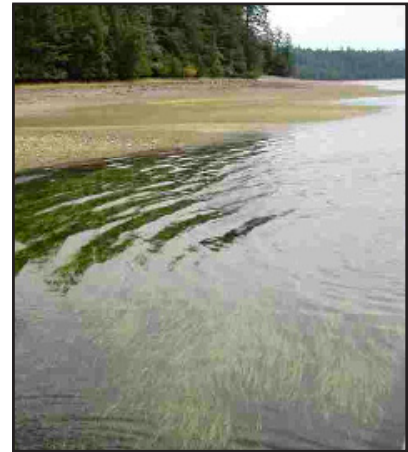
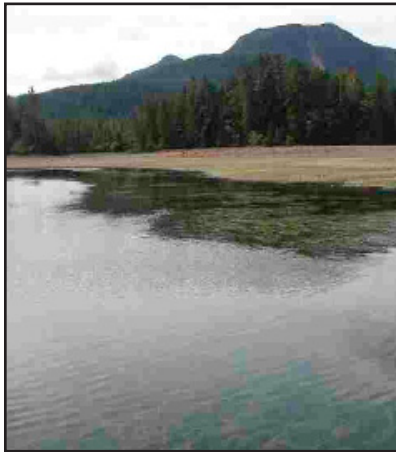
	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE
	BOCC			PIPE
	BRRO			SHPE
	CORO	•		STPE
	VERO		KELPFISH	CRKE
	YERO		GUNNELS	CRGU
SCULPINS	BUSC	•		PEGU
	CABE	•		ROGU
	FLSC			SAGU
	GRSC	•	PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL	•	FLATFISHES	COSO
	SISC	•		ENSO
	SMSC			ROSO
	STSC	•		SPSA
	TASC			STFL
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST	•		KEGR
	TUBE			PAGR
	BAPI	•		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI	N/A	SALMONIDS	CHIN
				CHUM
				CUTT

Bag Harbour

UTM Coordinates: 338820 E
 : 5802426 N
 Date Sampled: July 25, 2005 @ 12:12pm
 Years Sampled: 2004, 2005
 Weather: windy & cloudy



Long narrow and undisturbed (EDI 10) bed along the shores of an enclosed bay. Three different sides of the bay were sampled. The epiphyte load was the second highest in Gwaii Haanas (14% DW) and the bed was also notable for a high isopod (*Idotea ressecata*) density. Mottled sea stars were common in the intertidal zone and juvenile red rock crabs molts were present. The subtidal bed was patchy but thick, with diatom mat-covered mudflat filling between the patches subtidally. Most of the shallow subtidal substrate was gravel & mud, shells. The subtidal epiphyte load varied from high (mostly diatom) near the subtidal edges to medium in the middle. No incidence of wasting disease. Dungeness crab, moonsnail egg masses, aggregations of bat stars were present along some subtidal edges, and plumose anemones and spiny pink stars were seen on the mud subtidally. Juvenile sticklebacks (67% of the total for the region) were the most common fish caught. Staghorn sculpins and English soles (the latter catches accounting for 80% of the individuals caught in the region) were also relatively abundant. Only one rockfish (black) caught. Also of note was one coho salmon fry.



Physical Characteristics	
Environmental Index: 8	
Temperature: 15°C	Sediment Composition: Fine mud substrate
Salinity: 30.9 ppt	Silt-clay fraction: 7.7%
Chlorophyll a: 1.84 µg/L	Slope: Moderate, 10° - 20°
Nitrate: 0.02 µmol	Estimated exposure: Very protected
Fluorescence: 0.60 FU	Turbidity: 0.73 NTU

Bag Harbour (BH) - Gwaii Haanas



Subtidal



Close up

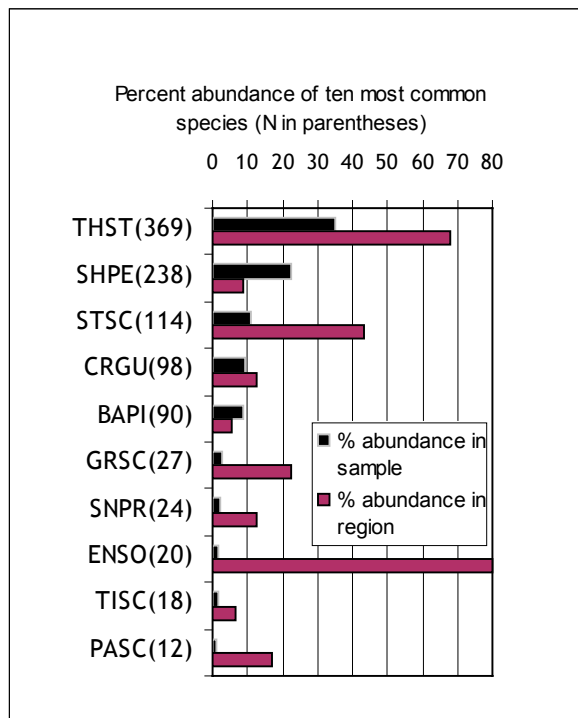
Eelgrass Health Index: 16

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 1344.4 shoots/m ²	Dry Biomass: 12 g/m ²
Tidal Range: Subtidal/intertidal	Epiphyte Load: 11.06%
Biomass: 98.3 g/m ²	Intertidal bed area: 8,096 m ²
Leaf area index: 1.64	Subtidal bed area: N/A

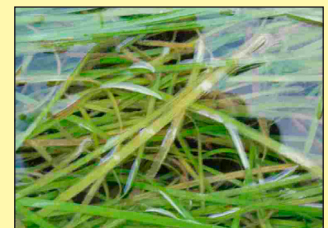
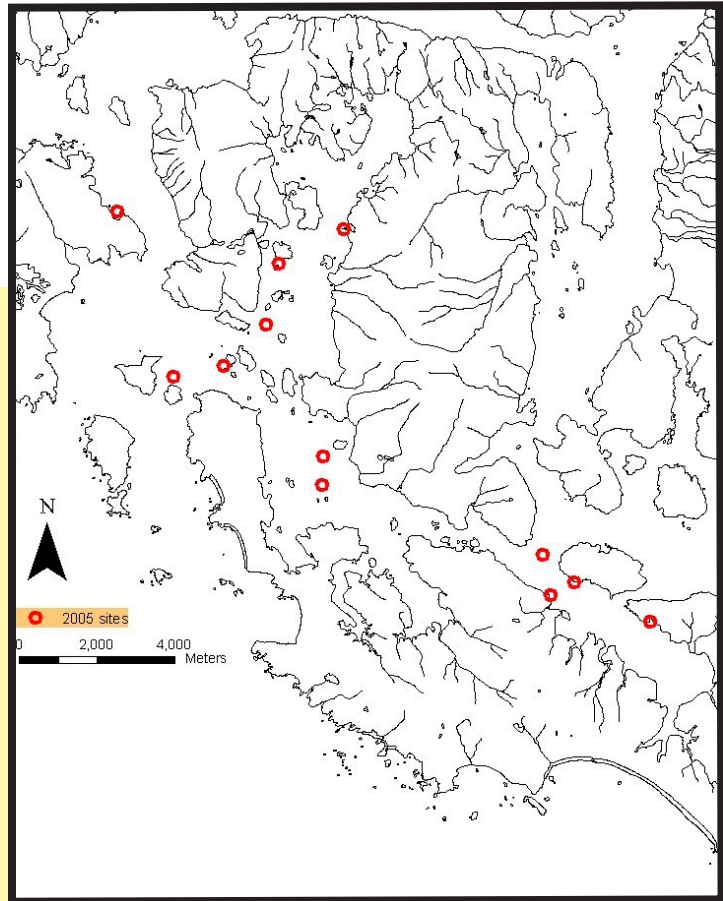
Fish Summary

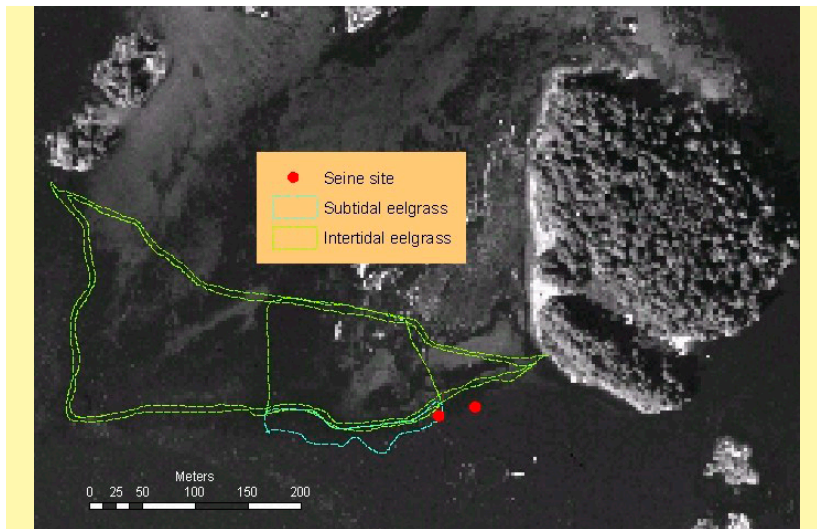
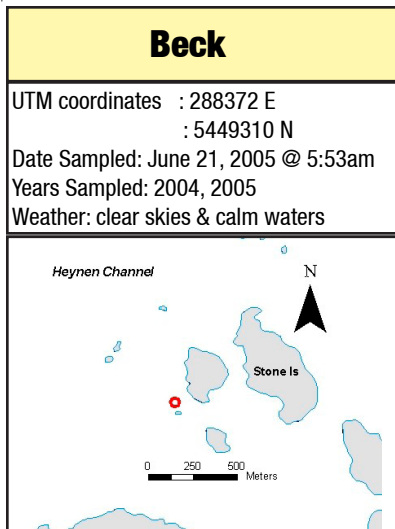
No. of Species: 19	No. of Individuals: 1051	Pielou's Evenness: 0.662	Taxonomic Distinctiveness: 92
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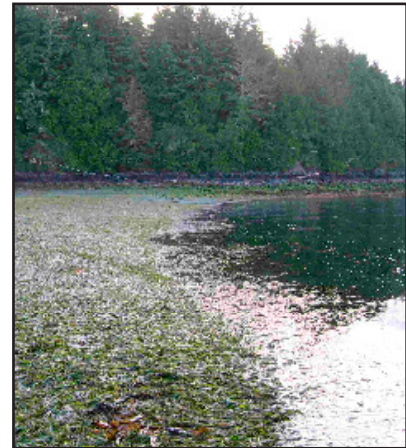
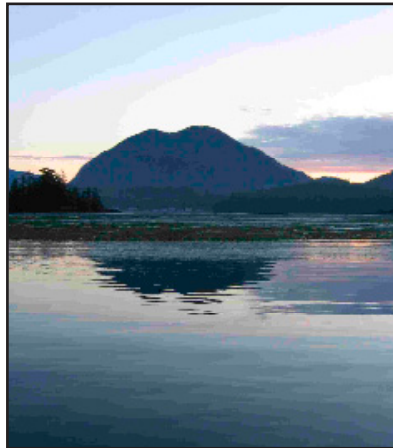
	SPECIES		SPECIES	
ROCKFISH	BLRO	•	SEA PERCHES	KEPE
	BOCC			PIPE
	BRRO			SHPE
	CORO			STPE
	VERO		KELPFISH	CRKE
	YERO		GUNNELS	CRGU
SCULPINS	BUSC	•		PEGU
	CABE			ROGU
	FLSC			SAGU
	GRSC	•	PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL	•	FLATFISHES	COSO
	SISC	•		ENSO
	SMSC			ROSO
	STSC	•		SPSA
	TASC			STFL
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST			KEGR
	TUBE			PAGR
	BAPI	•		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI	N/A	SALMONIDS	CHIN
				CHUM
				CUTT

2.3 Clayoquot Sound Site Descriptions





Somewhat disturbed bed (EDI 18), close to Tofino and in a high boat traffic area. Patchy and sandy intertidal bed continuing in the subtidal area. Many polychaetes tubes or phoronids¹ and butter clams shells subtidally. Stalked jellyfish were present among blades and Dungeness crabs were common. Intertidal epiphyte load was medium (17% DW) while the subtidal epiphyte load ranged from medium to high; there was little, if any, evidence of wasting disease. Shiner perch made up a higher percentage of the catch than the average for the region. Many fishes were seen on the video (flatfish, greenling, shiners), plus a great sculpin and what appeared to be a black rockfish.



Physical Characteristics

Environmental Index: 12

Temperature: 14°C

Sediment Composition: Sand substrate

Salinity: 27.1 ppt

Silt-clay fraction: 1.3%

Chlorophyll a: 0.71 µg/L

Slope: Moderate, 10°- 20°

Nitrate: 1.10 µg/L

Estimated exposure: Semi-protected

Fluorescence: 1.20 FU

Turbidity: 0.73 NTU

Beck (B) - Clayoquot Sound



Subtidal



Close up

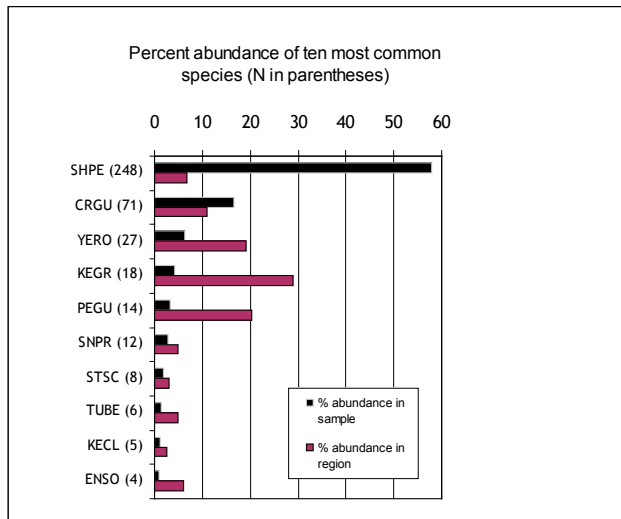
Eelgrass Health Index: 12

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

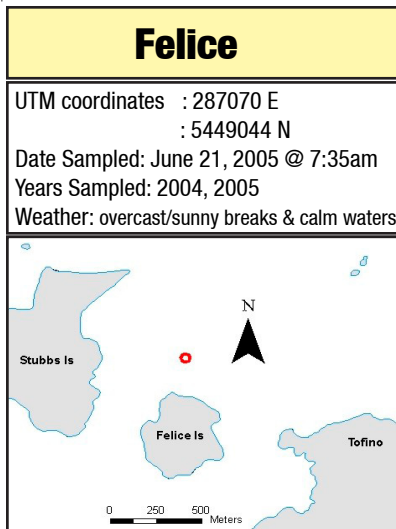
Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Enteromorpha linza</i> , <i>Smitora naiadum</i> & <i>Plenosporium vancouverianum</i>
Density: 575.0 shoots/m ²	Dry Biomass: 34 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 20.69%
Biomass: 160.3 g/m ²	Intertidal bed area: 2,645 m ²
Leaf area index: 4.091	Subtidal bed area: 3,118 m ²

Fish Summary

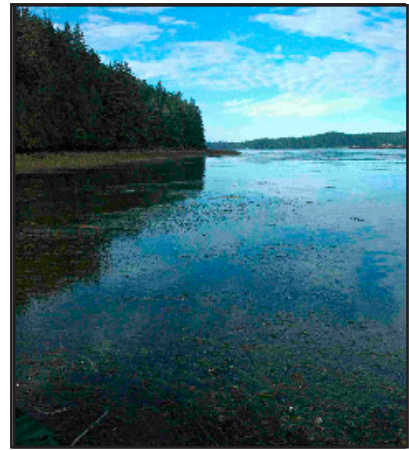
No. of Species: 19	No. of Individuals: 429	Pielou's Evenness: 0.531	Taxonomic Distinctiveness: 79
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	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE
	BOCC			PIPE
	BRRO			SHPE
	CORO	•		STPE
VERO	VERO		KELPFISH	CRKE
	YERO	•	GUNNELS	CRGU
	BUSC			PEGU
	CABE	•		ROGU
FLSC	FLSC			SAGU
	GRSC	•	PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC			HICO
RBSC	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO
	SMSC	•		ROSO
STSC	STSC	•		SPSA
	TASC			STFL
	TISC		GREENLING	WHGR
	THST	•		KEGR
PLATED FISHES	TUBE	•		PAGR
	BAPI	•		LING
	KECL	•	PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
	PLMI		SALMONIDS	CHIN
				CHUM
			CUTT	



Thick bed near Tofino in well travelled area, with medium disturbance (EDI 12). The subtidal portion of the bed was thick and surrounded by sandy patches with many butter clam shells. The intertidal epiphyte load was medium (11% DW) and ranged from medium to high subtidally; the wasting disease incidence among blades was assessed as moderate to high. The site had a low abundance of fishes for the region but the only two buffalo sculpins and half of the cabezons caught in Clayoquot Sound (3) were caught there. The site also boasted a higher than usual incidence of tubesnouts.



Physical Characteristics

Environmental Index: 10

Temperature: 14°C

Sediment Composition: Sand substrate

Salinity: 27.4 ppt

Silt-clay fraction: 1.3%

Chlorophyll a: 3.53 µg/L

Slope: Moderate, 10° - 20°

Nitrate: 0.04 µmol

Estimated exposure: Semi-protected

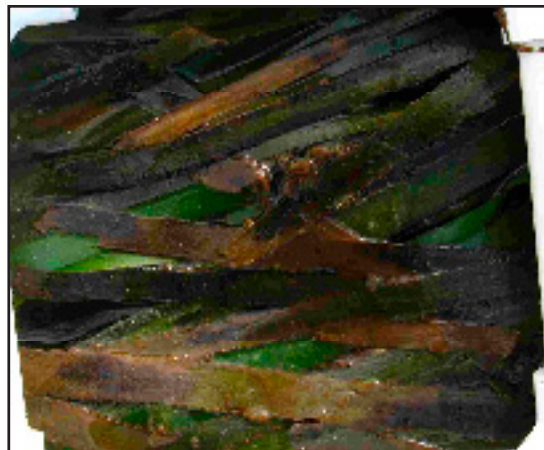
Fluorescence: 1.18 FU

Turbidity: 0.63 NTU

Felice (F) - Clayoquot Sound



Subtidal



Close up

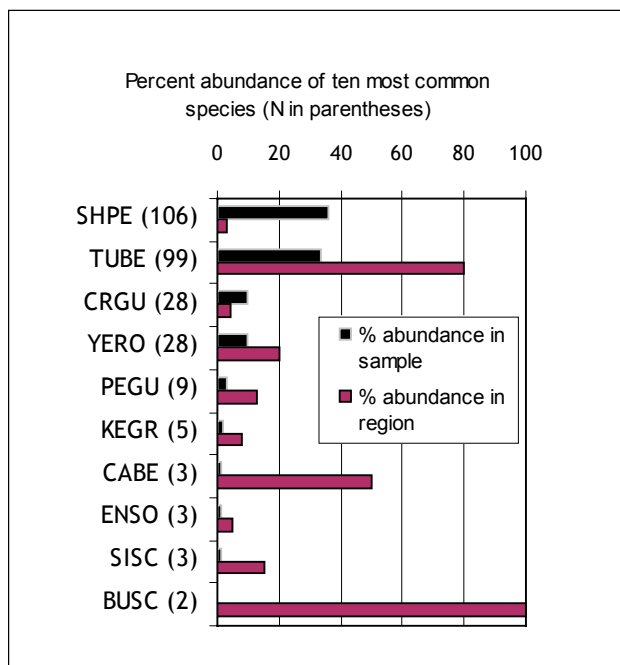
Eelgrass Health Index: 12

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: diatoms or decaying <i>Smithora naiadum</i>
Density: 412.5 shoots/m ²	Dry Biomass: 31 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 11.91%
Biomass: 279.9 g/m ²	Intertidal bed area: 310,200 m ²
Leaf area index: 5.14	Subtidal bed area: 13,000 m ²

Fish Summary

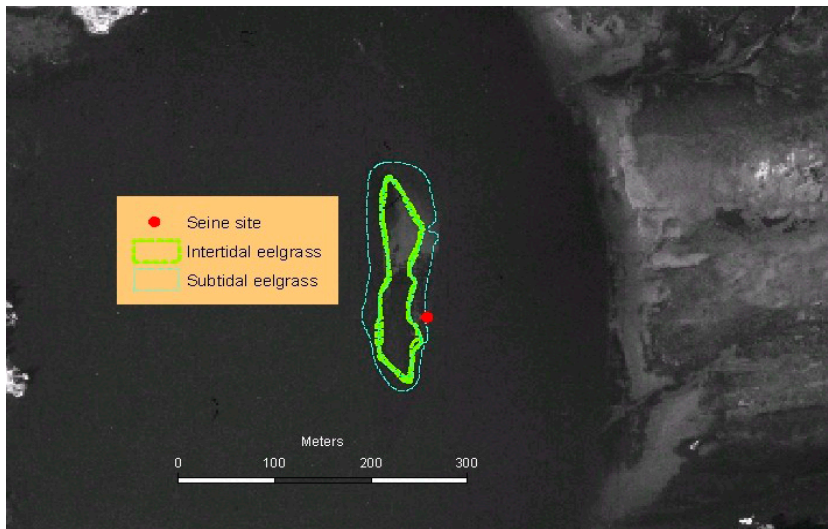
No. of Species: 17	No. of Individuals: 296	Pielou's Evenness: 0.602	Taxonomic Distinctiveness: 93
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	SPECIES		SPECIES		
ROCKFISH	BLRO		SEA PERCHES		
	BOCC		PIPE	•	
	BRRO		SHPE	•	
	CORO		STPE		
VERO	VERO		KELPFISH	CRKE	
	YERO	•	GUNNELS	CRGU	
SCULPINS	BUSC	•	PEGU	•	
	CABE	•	ROGU		
	FLSC		SAGU	•	
	GRSC		PRICKLEBACKS	SNPR	
	MASC		BLPR		
	PASC		HICO		
	RBSC		SLCO		
	REIL		FLATFISHES	COSO	
	SISC	•	ENSO	•	
	SMSC		ROSO		
PLATED FISHES	STSC		SPSA	•	
	TASC		STFL		
	TISC		GREENLING	WHGR	
	THST	•	KEGR	•	
	TUBE	•	PAGR		
	BAPI		LING		
	CLINGFISHES	KECL	•	PREY FISHES	HERR
		NOCL		SUSM	
	GOBIES	BLGO		SAND	
		BAGO		WALL	
TOADFISH	PLMI		SALMONIDS	CHIN	
			CHUM		
			CUTT		

Arakun

UTM coordinates : 289446 E
 : 5450380 N
 Date Sampled: June 22, 2005 @ 6:20am
 Years Sampled: 2004, 2005
 Weather: overcast & calm waters

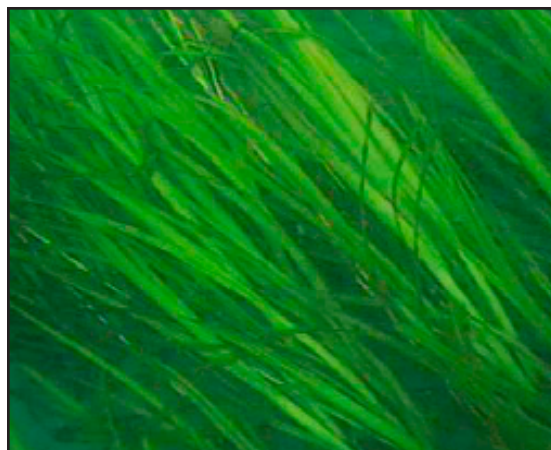


Small, patchy, isolated and relatively undisturbed (EDI 12) bed in a current-swept area (presence of sand ridges in the subtidal); *Z. marina* var. *typica* was present at higher elevations. The subtidal portion appeared patchy with thin to medium shoot densities and was interspersed with sandy patches with shells. The subtidal epiphyte load was high but medium (11% DW) in the intertidal. Incidence of wasting disease, if present, was low. The most common macrophytes were Turkish towel, sea lettuce and the *Gracilaria/Gracilariopsis* complex. Bat stars and leather stars were common in the intertidal while red rock and Dungeness crabs were common subtidally. Arakun had one of the lowest fish abundance for the region but close to half of the saddleback gunnels and the only school of sandlances in the region were caught here. Kelp greenlings were also common.

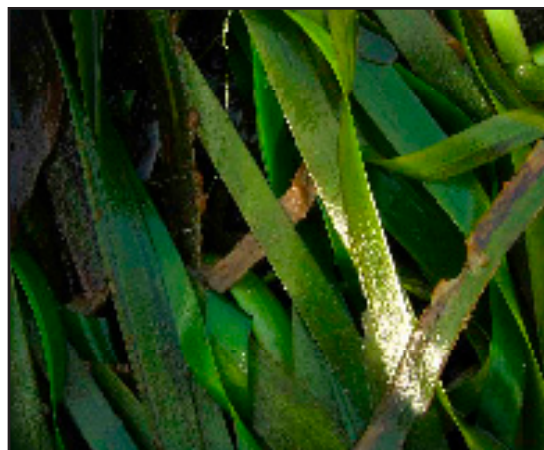


Physical Characteristics	
Environmental Index:16	
Temperature: 15°C	Sediment Composition: Fine mud substrate
Salinity: 27.8 ppt	Silt-clay fraction: 2.5%
Chlorophyll a: 2.14 µg/L	Slope: Steep, > 20°
Nitrate: 0.26 µmol	Estimated exposure: Semi-protected
Fluorescence: 1.71 FU	Turbidity: 1.65 NTU

Arakun (A) - Clayoquot Sound



Subtidal



Close up

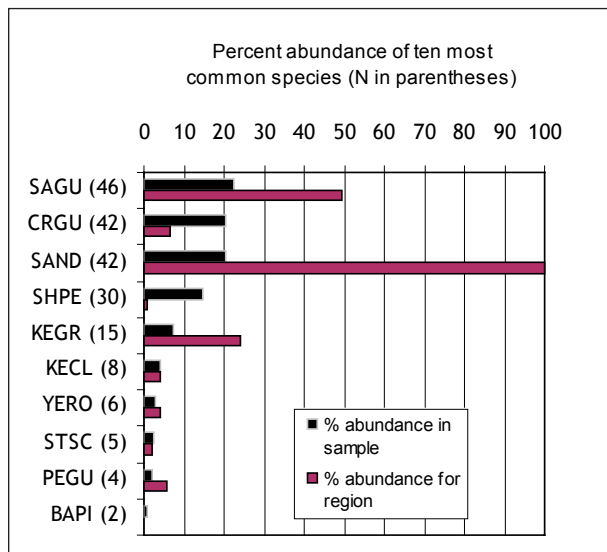
Eelgrass Health Index: 16

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i> var. <i>typica</i>	Epiphyte: <i>Smithora naiadum</i> , diatoms & <i>Enteromorpha linza</i>
Density: 375.0 shoots/m ²	Dry Biomass: 23 g/m ²
Tidal Range: Mostly subtidal	Epiphyte Load: 16.63%
Biomass: 133.4 g/m ²	Intertidal bed area: N/A
Leaf area index: 1.61	Subtidal bed area: 6,486 m ²

Fish Summary

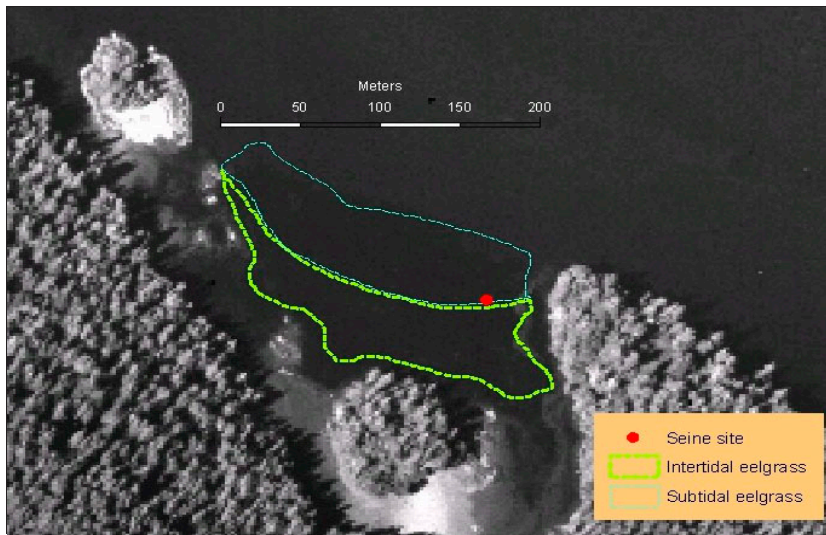
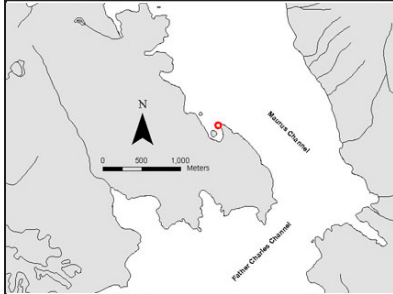
No. of Species: 16	No. of Individuals: 206	Pielou's Evenness: 0.740	Taxonomic Distinctiveness: 77
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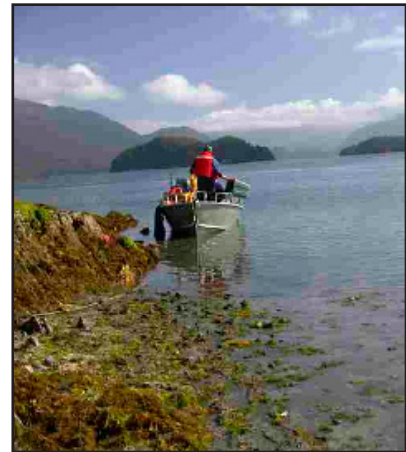
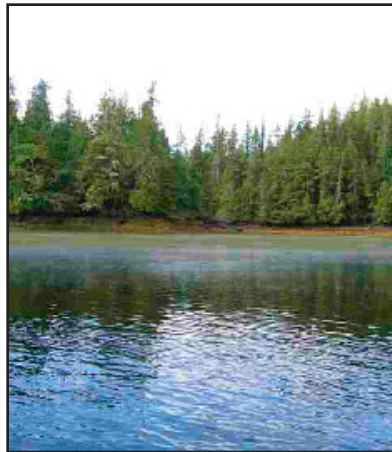
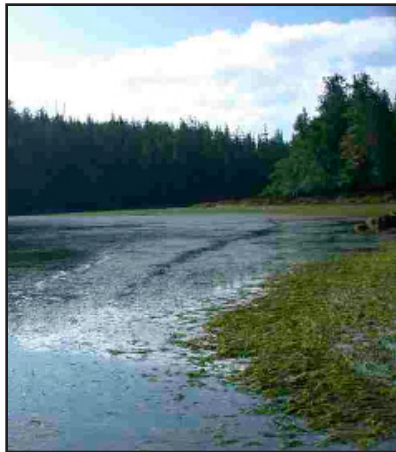
SPECIES		SPECIES	
ROCKFISH	BLRO	SEA PERCHES	KEPE
	BOCC		PIPE
	BRRO		SHPE
	CORO		STPE
	VERO	KELPFISH	CRKE
	YERO	GUNNELS	CRGU
SCULPINS	BUSC		PEGU
	CABE		ROGU
	FLSC		SAGU
	GRSC	PRICKLEBACKS	SNPR
	MASC		BLPR
	PASC		HICO
	RBSC		SLCO
	REIL	FLATFISHES	COSO
	SISC		ENSO
	SMSC		ROSO
	STSC		SPSA
	TASC		STFL
	TISC	GREENLING	WHGR
PLATED FISHES	THST		KEGR
	TUBE		PAGR
	BAPI		LING
CLINGFISHES	KECL	PREY FISHES	HERR
	NOCL		SUSM
GOBIES	BLGO		SAND
	BAGO		WALL
TOADFISH	PLMI	SALMONIDS	CHIN
			CHUM
			CUTT

Elbow Bank

UTM Coordinates : 285626 E
 : 5453293 N
 Date Sampled: June 22, 2005 @ 7:58am
 Years Sampled: 2004, 2005
 Weather: overcast & calm waters



Large, thick intertidal bed situated in a narrow bend subjected to a high incidence of boat traffic (EDI 14). The subtidal portion of the bed was also thick but narrow on a steep slope. The mid-channel substrate was predominantly gravel and shells. The epiphyte load was low, both intertidally (7% DW) and subtidally. Incidence of wasting disease (or possibly sunburns in this case) was moderate. Several sea pen and red rock crabs inhabited the area. Elbow Bank had proportionally few shiner perch as compared to other sites, but harboured most (16/20) of the silverspotted sculpins caught in Clayoquot Sound. Bald eagles were seen foraging on the intertidal bed.



Physical Characteristics

Environmental Index: 8

Temperature: 13°C

Sediment Composition: Fine mud substrate

Salinity: 29.1 ppt

Silt-clay fraction: 3.3%

Chlorophyll a: 0.38 µg/L

Slope: Flat, <10°

Nitrate: 0.09 µmol

Estimated exposure: Very protected

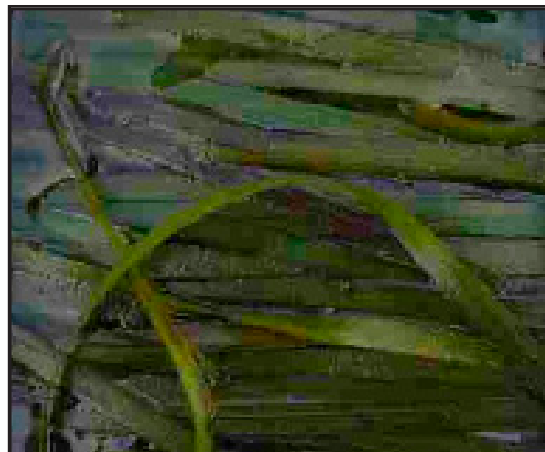
Fluorescence: 1.48 FU

Turbidity: 0.63 NTU

Elbow Bank (EB) - Clayoquot Sound



Subtidal



Close up

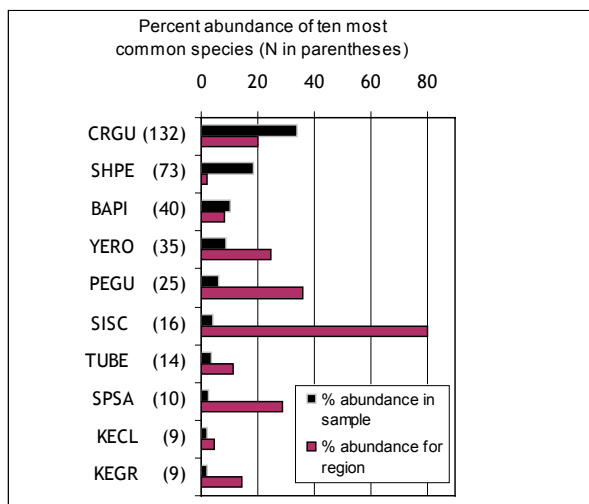
Eelgrass Health Index: 10

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

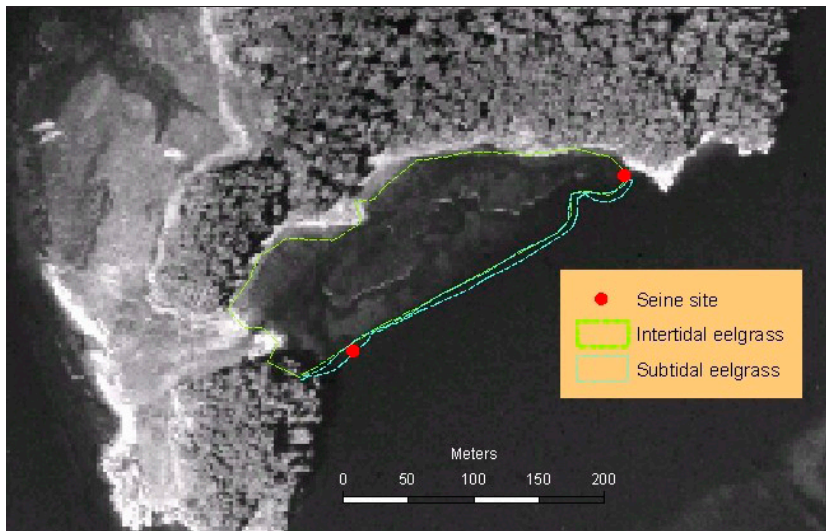
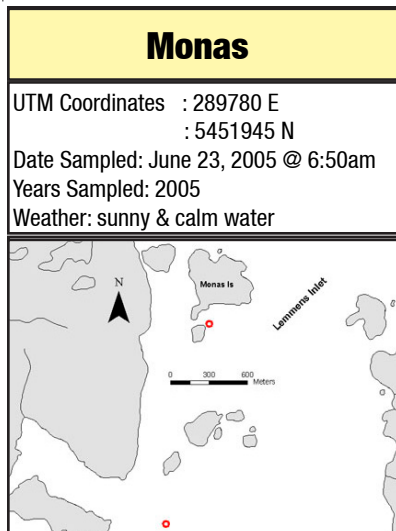
Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Plenosporium vancouverianum</i> , diatoms & <i>Smithora naiadum</i>
Density: 687.5 shoots/m ²	Dry Biomass: 16 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 7.16%
Biomass: 233.3 g/m ²	Intertidal bed area: 22,375 m ²
Leaf area index: 4.84	Subtidal bed area: 1,385 m ²

Fish Summary

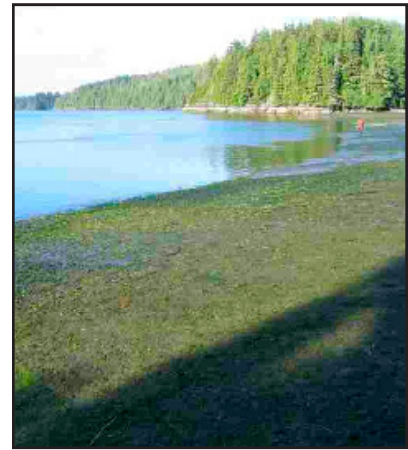
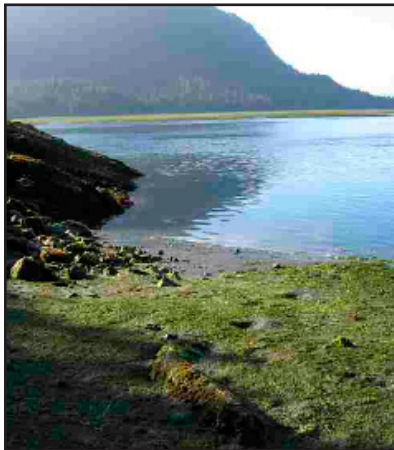
No. of Species: 19	No. of Individuals: 391	Pielou's Evenness: 0.731	Taxonomic Distinctiveness: 87
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	SPECIES		SPECIES		
ROCKFISH	BLRO		SEA PERCHES	KEPE	
	BOCC			PIPE	
	BRRO			SHPE	
	CORO	•		STPE	
VERO	VERO		KELPFISH	CRKE	
	YERO	•	GUNNELS	CRGU	
	SCULPINS	BUSC			PEGU
		CABE	•		ROGU
FLSC	FLSC			SAGU	
	GRSC		PRICKLEBACKS	SNPR	
	MASC			BLPR	
	PASC	•		HICO	
RBSC	RBSC			SLCO	
	REIL	•	FLATFISHES	COSO	
	SISC	•		ENSO	
	SMSC	•		ROSO	
STSC	STSC	•		SPSA	
	TASC			STFL	
	TISC	•	GREENLING	WHGR	
	PLATED FISHES	THST			KEGR
TUBE		•		PAGR	
BAPI	BAPI	•		LING	
	CLINGFISHES	KECL	•	PREY FISHES	HERR
		NOCL			SUSM
GOBIES	BLGO			SAND	
	BAGO			WALL	
TOADFISH	PLMI		SALMONIDS	CHIN	
				CHUM	
				CUTT	



Large intertidal area, thick bed with some patches, *Zostera marina* var. *typica* occupying higher grounds, with ghost shrimp mounds common in that same area. (EDI 14). A couple of channels bisected the site. The intertidal epiphyte load was medium (12 % DW), with *Ulva linza* epiphytic on many blades. The subtidal portion of the bed was thin, abutted to marl (sand and shells) substrate, and with a low to medium epiphyte load. Gaper clams were common subtidally. No incidence of wasting disease recorded. The site had the second highest fish abundance in the region and higher than usual abundances of snake prickleback and kelp perch.



Physical Characteristics

Environmental Index: 12

Temperature: 15°C

Sediment Composition: N/A

Salinity: 27.7 ppt

Silt-clay fraction: N/A

Chlorophyll a: 3.53 µg/L

Slope: N/A

Nitrate: 0.04 µmol

Estimated exposure: N/A

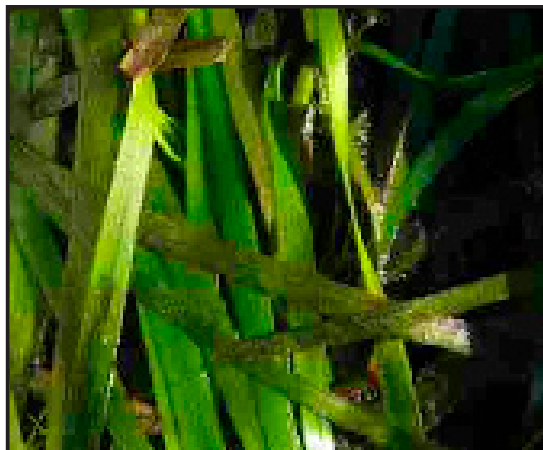
Fluorescence: 3.06 FU

Turbidity: 3.8 NTU

Monas (MO) - Clayoquot Sound



Subtidal



Close up

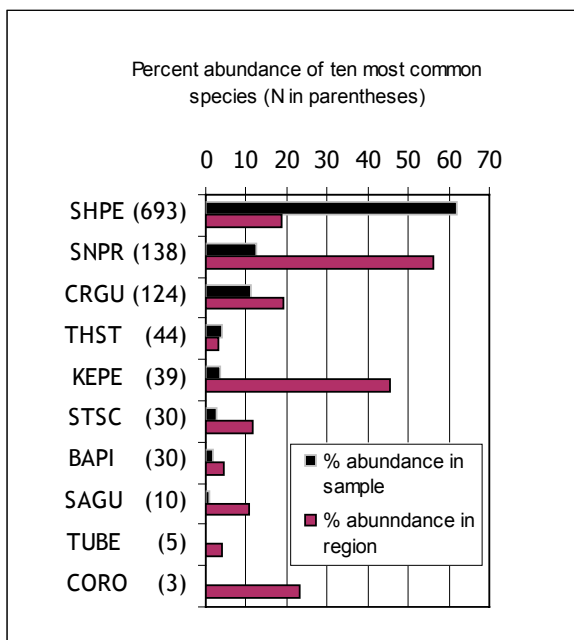
Eelgrass Health Index: 10

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

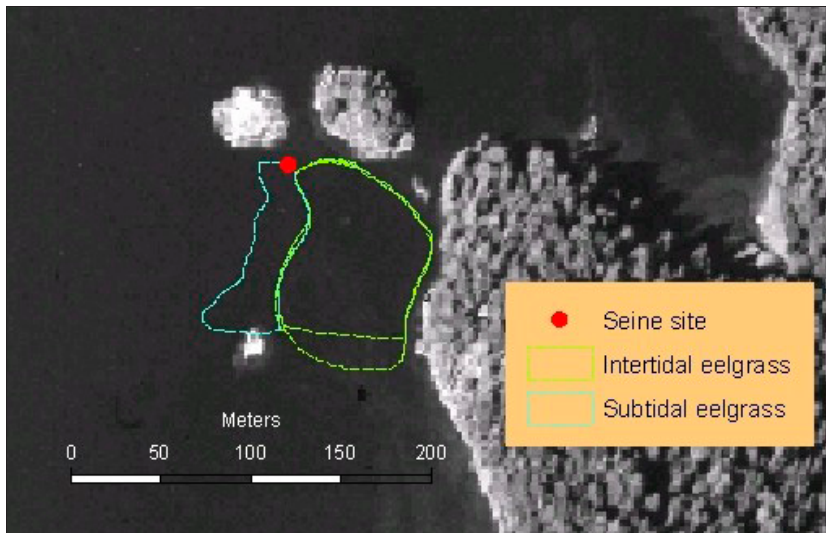
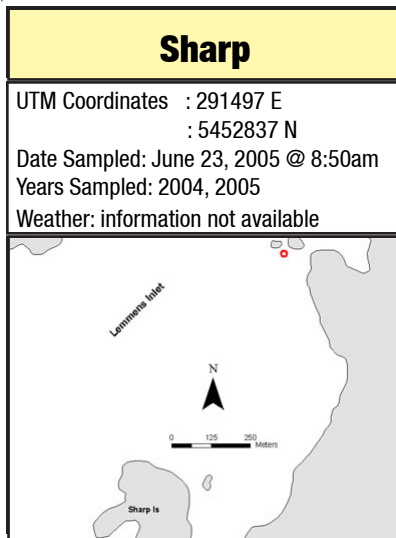
Ecotype: <i>Zostera marina</i> var. <i>typica</i>	Epiphyte: <i>Smitora naiadum</i> , <i>Enteromorpha linza</i> , Diatoms & <i>Plenosporium vancouverianum</i>
Density: 525.0 shoots/m ²	Dry Biomass: 30 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 13.13%
Biomass: 180.0 g/m ²	Intertidal bed area: 22,375 m ²
Leaf area index: 3.10	Subtidal bed area: 1,385 m ²

Fish Summary

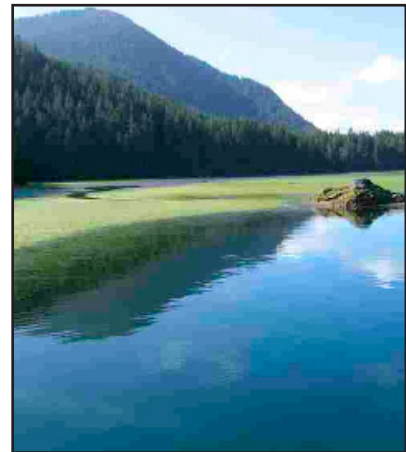
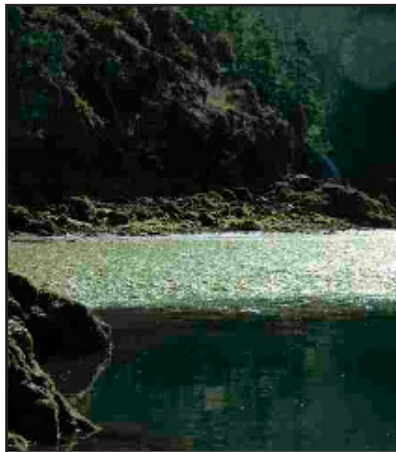
No. of Species: 17	No. of Individuals: 1122	Pielou's Evenness: 0.486	Taxonomic Distinctiveness: 72
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SPECIES		SPECIES	
ROCKFISH	BLRO	SEA PERCHES	KEPE ●
	BOCC		PIPE
	BRRO		SHPE ●
	CORO ●		STPE
	VERO	KELPFISH	CRKE
	YERO ●	GUNNELS	CRGU ●
SCULPINS	BUSC		PEGU ●
	CABE		ROGU
	FLSC		SAGU ●
	GRSC	PRICKLEBACKS	SNPR ●
	MASC		BLPR
	PASC		HICO
	RBSC		SLCO
	REIL ●	FLATFISHES	COSO
	SISC		ENSO
	SMSC		ROSO
	STSC ●		SPSA ●
	TASC		STFL
	TISC ●	GREENLING	WHGR
PLATED FISHES	THST ●		KEGR ●
	TUBE ●		PAGR
	BAPI ●		LING
CLINGFISHES	KECL ●	PREY FISHES	HERR
	NOCL		SUSM
GOBIES	BLGO		SAND
	BAGO		WALL
TOADFISH	PLMI	SALMONIDS	CHIN
			CHUM
			CUTT



Thick bed on soft, muddy substrate. Relatively undisturbed site (EDI 14). The subtidal portion of the bed was thin and abutted to a large mudflat area in deeper water. The intertidal epiphyte load was medium (12% DW) and the subtidal epiphyte load ranged from low to medium. Nudibranch egg masses were common on shallow water eelgrass blades. The incidence of wasting disease was low to moderate. Sea whips were unusually abundant and sea pens were present in the deeper, muddy area. Their main predator, the striped nudibranch *Armina californica*, was also present. Large spiny pink stars, slender and Dungeness crabs were common. Sanddabs were unusually common, and 28 of 30 bay gobies caught in Clayoquot Sound were caught at this site.



Physical Characteristics

Environmental Index: 12

Temperature: 15°C

Sediment Composition: Fine mud substrate

Salinity: 27.1 ppt

Silt-clay fraction: 13.4%

Chlorophyll a: 1.96 µg/L

Slope: Flat, <10°

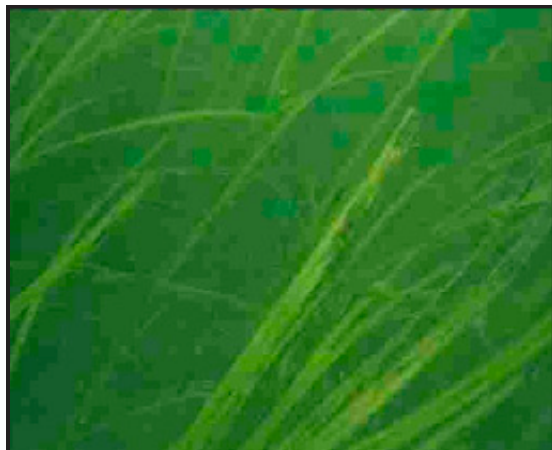
Nitrate: N.D.

Estimated exposure: Very protected

Fluorescence: 1.80 FU

Turbidity: 2.09 NTU

Sharp (S) - Clayoquot Sound



Subtidal



Close up

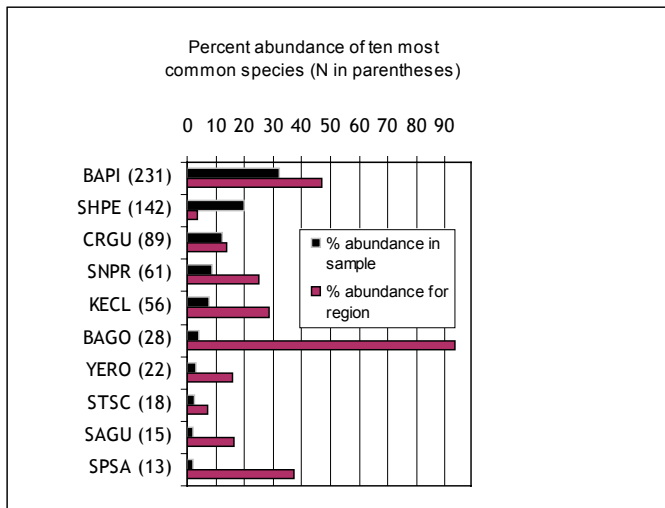
Eelgrass Health Index: 10

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

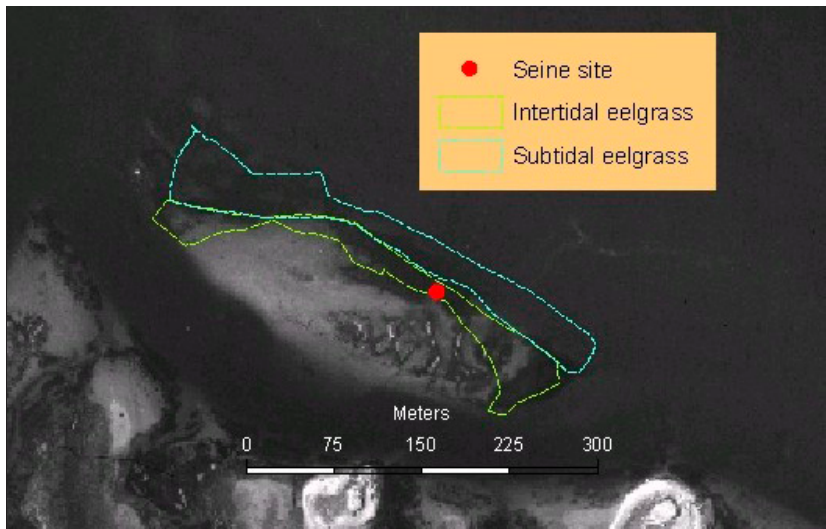
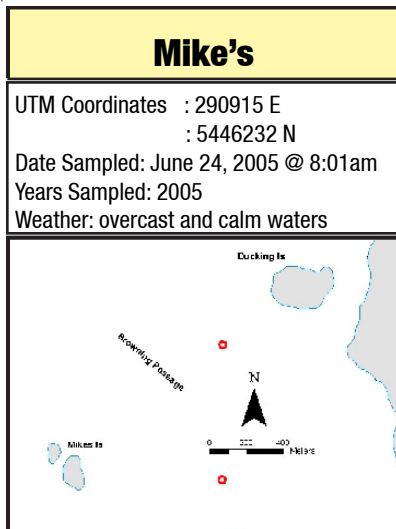
Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 812.5 shoots/m ²	Dry Biomass: 30 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 13.13%
Biomass: 214.9 g/m ²	Intertidal bed area: 22,375 m ²
Leaf area index: 4.51	Subtidal bed area: 1,385 m ²

Fish Summary

No. of Species: 21	No. of Individuals: 718	Pielou's Evenness: 0.699	Taxonomic Distinctiveness: 88
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	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE •
	BOCC			PIPE •
	BRRO			SHPE •
	CORO	•		STPE
	VERO		KELPFISH	CRKE
SCULPINS	YERO	•	GUNNELS	CRGU •
	BUSC			PEGU •
	CABE	•		ROGU •
	FLSC			SAGU •
	GRSC		PRICKLEBACKS	SNPR •
PLATED FISHES	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC	•		ENSO •
	SMSC			ROSO
	STSC	•		SPSA •
	TASC			STFL
	TISC	•	GREENLING	WHGR
	THST	•		KEGR •
CLINGFISHES	TUBE			PAGR
	BAPI	•		LING
	KECL	•	PREY FISHES	HERR
	NOCL			SUSM
	BLGO			SAND
GOBIES	BAGO	•		WALL
	BLAG			CHIN
	PLMI	•	SALMONIDS	CHUM
TOADFISH				CUTT



Thick bed on a narrow intertidal ledge (EDI 14), with a harbour seal rookerie at its west end. Many clam shows (probably bent-nose clams, *Macoma nasuta*) were visible in the intertidal. The subtidal portion of the bed was thin, surrounded by sandy, current-swept areas; the intertidal epiphyte load was medium (18% DW) but the subtidal epiphyte load was heavy, mainly composed of Smithora, ulvoids, and filamentous green (probably *Ulva linza*). There was no incidence of wasting disease. The middle of the channel was dominated by laminariales & Turkish towels, and occupied by several kelp greenlings. Phoronids were common in sandy areas. Pile perch and great sculpins, although not recorded in the catches, were filmed underwater. Shiner perch were unusually common in the samples, accounting for close to 60% of all fishes caught.



Physical Characteristics

Environmental Index: 10

Temperature: 14°C

Sediment Composition: N/A

Salinity: 26.7 ppt

Silt-clay fraction: N/A

Chlorophyll a: 0.11 µg/L

Slope: N/A

Nitrate: 0.08 µmol

Estimated exposure: N/A

Fluorescence: 0.94 FU

Turbidity: 1.13 NTU

Mikes (M) - Clayoquot Sound



Subtidal



Close up

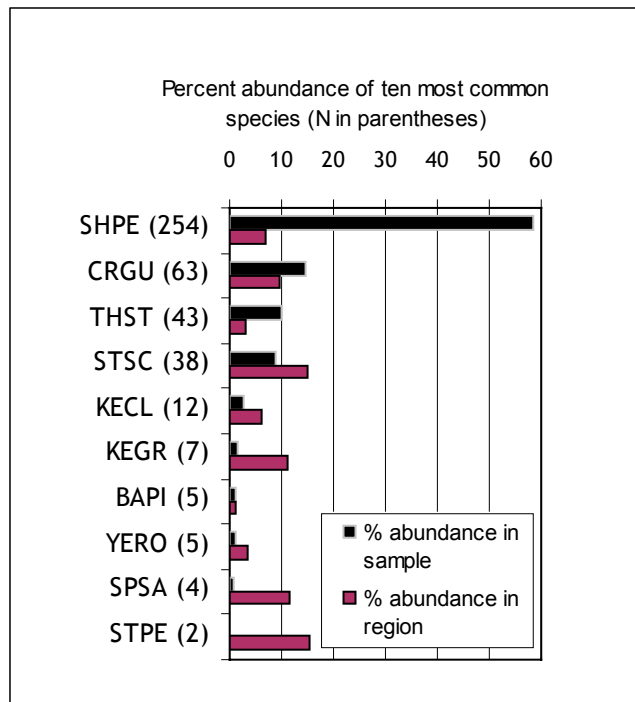
Eelgrass Health Index: 14

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Smithora naiadum</i> , <i>Enteromorpha linza</i> , <i>Plenosporium vancouverianum</i>
Density: 625.0 shoots/m ²	Dry Biomass: 38 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 18.51%
Biomass: 218.9 g/m ²	Intertidal bed area: 8,494 m ²
Leaf area index: 3.66	Subtidal bed area: 12,710 m ²

Fish Summary

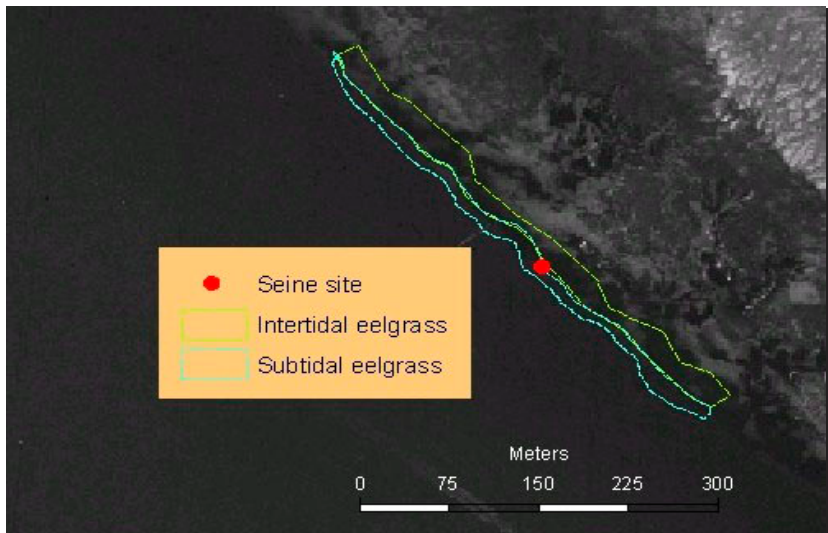
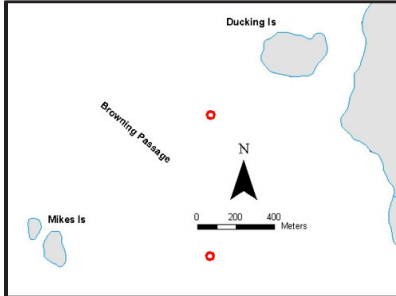
No. of Species: 12	No. of Individuals: 435	Pielou's Evenness: 0.563	Taxonomic Distinctiveness: 86
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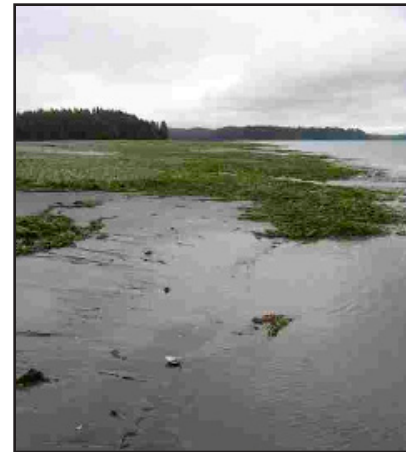
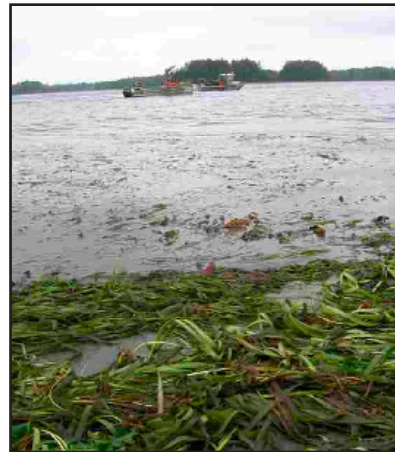
	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE
	BOCC			PIPE
	BRRO			SHPE ●
	CORO			STPE ●
	VERO		KELPFISH	CRKE
	YERO ●		GUNNELS	CRGU ●
SCULPINS	BUSC			PEGU ●
	CABE			ROGU
	FLSC			SAGU ●
	GRSC		PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC			HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO
	SMSC			ROSO
	STSC ●			SPSA ●
	TASC			STFL
	TISC		GREENLING	WHGR
PLATED FISHES	THST ●			KEGR ●
	TUBE			PAGR
	BAPI ●			LING
CLINGFISHES	KECL ●		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI		SALMONIDS	CHIN
				CHUM
				CUTT

Ducking

UTM Co-ordinates : 290918 E
 : 5446967 N
 Date Sampled: June 24, 2005 @ 9:38am
 Years Sampled: 2004, 2005
 Weather: overcast, NW wind moderate



Relatively undisturbed (EDI 16), thick bed across the channel from Mikes Island. Turkish towels were abundant intertidally, with *Ulva* sp patches among the eelgrass. The intertidal epiphyte load ranged from medium to heavy (20% DW) and was dominated by *Smithora* and *Ulva*. The subtidal portion of the bed was thick but patchy, and its surroundings were current-swept and sandy. The incidence of wasting disease was low. The subtidal epiphyte load ranged from medium to heavy, most of which diatoms and *Ulva*. As was the case for Mikes, shiner perch were unusually abundant in the samples, accounting for more than 85% of all fishes caught at this site. Bald eagles are frequently observed foraging on this bed.



Physical Characteristics	
Environmental Index: 10	
Temperature: 14°C	Sediment Composition: Mud & sand substrate
Salinity: 26.4 ppt	Silt-clay fraction: 2.8%
Chlorophyll a: 1.33 µg/L	Slope: Moderate, 10° - 20°
Nitrate: 0.83 µmol	Estimated exposure: Semi-protected
Fluorescence: 1.65 FU	Turbidity: 1.43 NTU

Ducking (D) - Clayoquot Sound



Subtidal



Close up

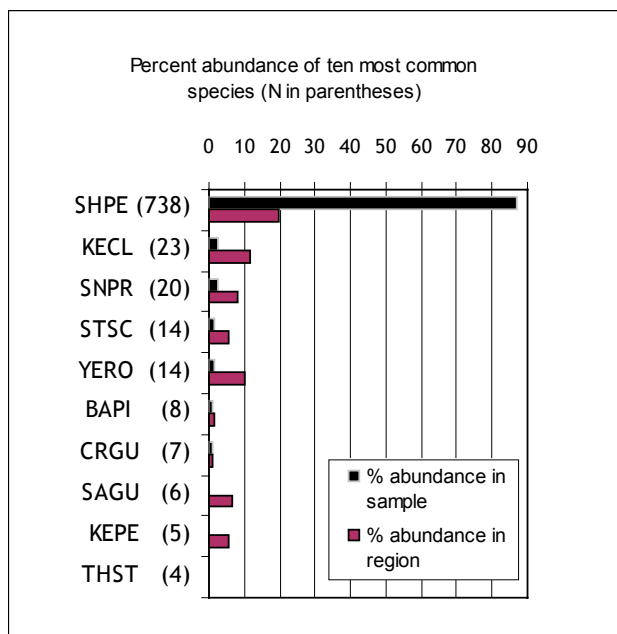
Eelgrass Health Index: 12

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Smithora naiadum</i> & <i>Enteromorpha linza</i>
Density: 677.8 shoots/m ²	Dry Biomass: 71 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 19.52%
Biomass: 353.8 g/m ²	Intertidal bed area: 8.720 m ²
Leaf area index: 0.50	Subtidal bed area: 5,400 m ²

Fish Summary

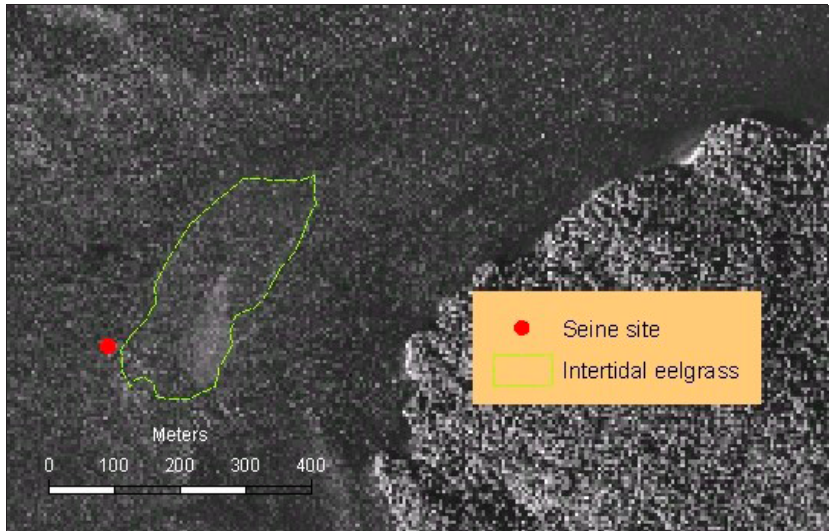
No. of Species: 16	No. of Individuals: 851	Pielou's Evenness: 0.253	Taxonomic Distinctiveness: 77
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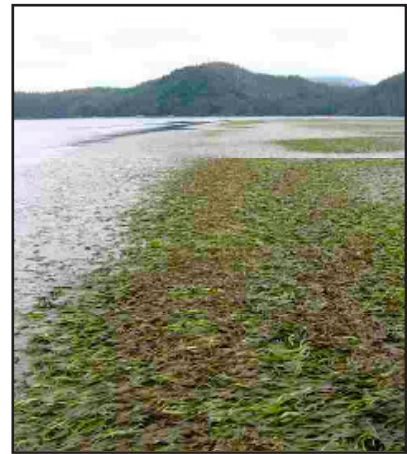
	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE •
	BOCC			PIPE •
	BRRO			SHPE •
	CORO			STPE •
	VERO		KELPFISH	CRKE
	YERO •		GUNNELS	CRGU •
SCULPINS	BUSC			PEGU •
	CABE			ROGU
	FLSC			SAGU •
	GRSC		PRICKLEBACKS	SNPR •
	MASC			BLPR
	PASC			HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO
	SMSC			ROSO
	STSC •			SPSA •
	TASC			STFL •
	TISC		GREENLING	WHGR
PLATED FISHES	THST •			KEGR
	TUBE			PAGR
	BAPI •			LING
CLINGFISHES	KECL •		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI		SALMONIDS	CHIN
				CHUM
				CUTT •

Auseth

UTM Coordinates : 296589 E
 : 5444424 N
 Date Sampled: June 25, 2005 @ 9:35am
 Years Sampled: 2004, 2005
 Weather: light breeze & overcast



Relatively undisturbed (EDI 12), continuous bed lodged in mid-channel between Auseth Point and Indian Island in Grice Bay. The intertidal area was mostly soft substrate (sand and mud) with localized sea hair patches. There was no underwater video available to describe the subtidal bed, hence the incidence of wasting disease was not recorded. Fairly heavy intertidal epiphyte load (33% DW), most of which *Smithora*. Shiner perch accounted for close to 70% of the total catch. The total fish catch at this site ranked the second lowest among Clayoquot Sound sites.

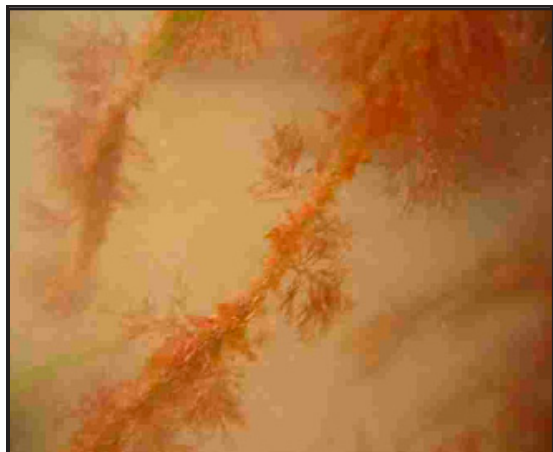


Physical Characteristics

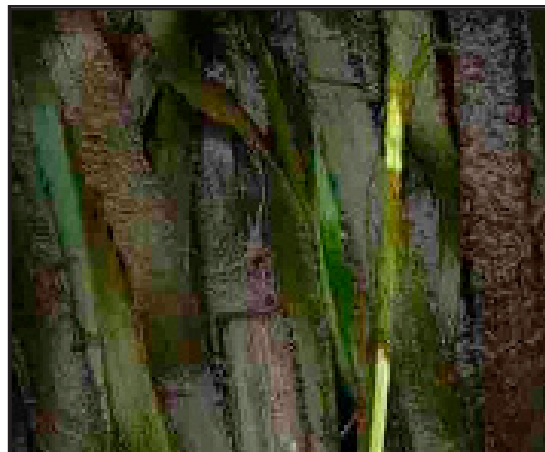
Environmental Index:10

Temperature: 15°C	Sediment Composition: Mud & sand substrate
Salinity: 23.4 ppt	Silt-clay fraction: 3.9%
Chlorophyll a: 1.94 µg/L	Slope: Steep, >20°
Nitrate: 0.04 µmol	Estimated exposure: Protected
Fluorescence: 1.70 FU	Turbidity: 0.08 NTU

Auseth (AU) - Clayoquot Sound



Subtidal



Close up

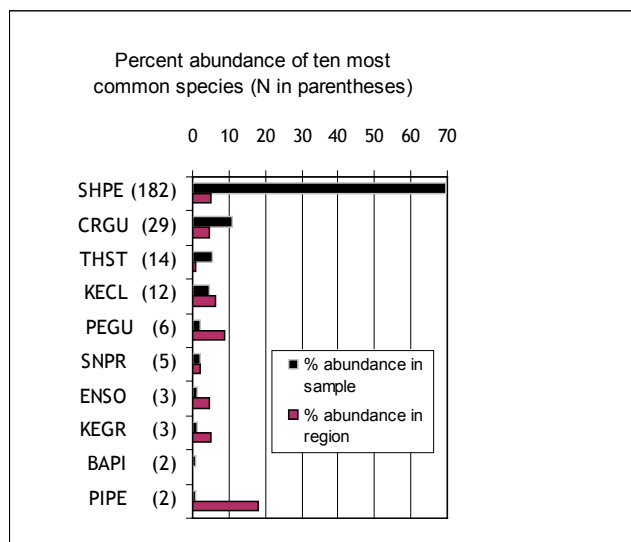
Eelgrass Health Index: 6

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

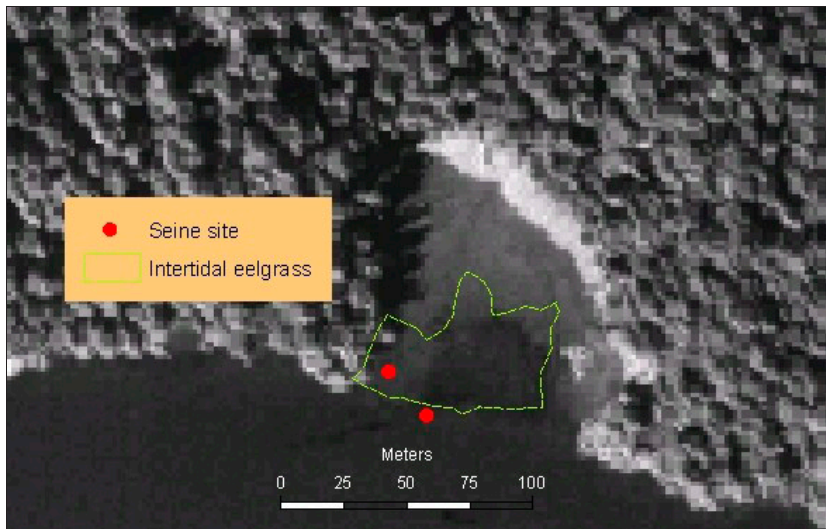
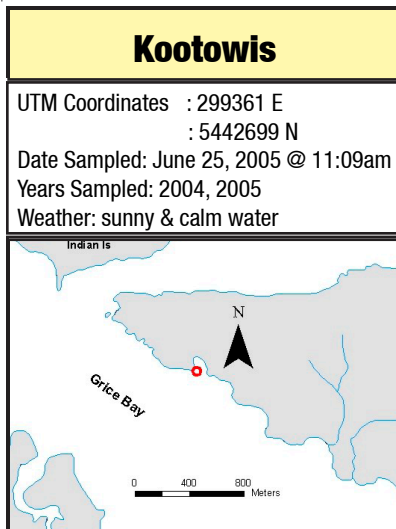
Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Smitora naiadum</i> & <i>Plenosporium vancouverianum</i>
Density: 355.6 shoots/m ²	Dry Biomass: 30 g/m ²
Tidal Range: Mostly Intertidal	Epiphyte Load: 13.13%
Biomass: 275.6 g/m ²	Intertidal bed area: 22,375 m ²
Leaf area index: 2.06	Subtidal bed area: 1,385 m ²

Fish Summary

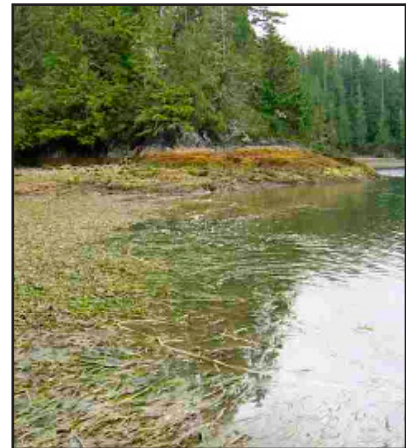
No. of Species: 14	No. of Individuals: 262	Pielou's Evenness: 0.462	Taxonomic Distinctiveness: 73
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	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE ●
	BOCC			PIPE ●
	BRRO			SHPE ●
	CORO			STPE ●
	VERO		KELPFISH	CRKE
	YERO		GUNNELS	CRGU ●
SCULPINS	BUSC			PEGU ●
	CABE			ROGU
	FLSC			SAGU ●
	GRSC		PRICKLEBACKS	SNPR ●
	MASC			BLPR
	PASC			HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO ●
	SMSC			ROSO
	STSC	●		SPSA
	TASC			STFL
	TISC		GREENLING	WHGR
PLATED FISHES	THST	●		KEGR ●
	TUBE			PAGR
	BAPI	●		LING
CLINGFISHES	KECL	●	PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI		SALMONIDS	CHIN
				CHUM
				CUTT



Relatively undisturbed (EDI 10), small indented bay in Grice Bay with a large, thick and continuous intertidal bed. No underwater video was available to describe the subtidal bed. The site had the third heaviest intertidal epiphyte load measured for all sites in 2005 (54% DW – median value), mostly diatoms. It had the third largest catch in the Clayoquot area, most of which sticklebacks (44% of the whole region catch). More than 50% of all plainfin midshipman and pile perch (6/11 in both cases) from Clayoquot Sound were also caught there. Many snake pricklebacks were seen slithering among the intertidal eelgrass but only three were caught in total.



Physical Characteristics

Environmental Index: 6

Temperature: 16°C

Sediment Composition: Fine mud substrate

Salinity: 23.7 ppt

Silt-clay fraction: 8.4%

Chlorophyll a: 1.25 µg/L

Slope: Flat, <10°

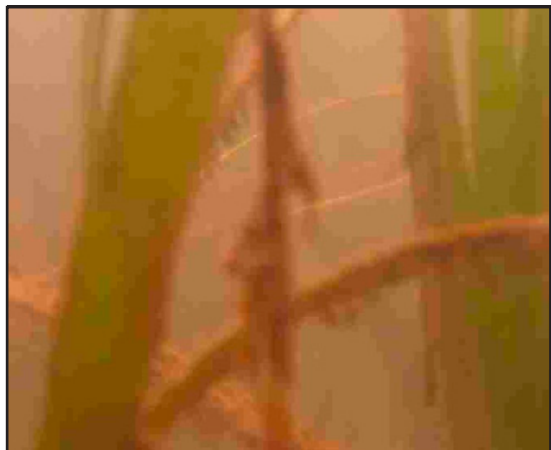
Nitrate: 0.05 µmol

Estimated exposure: Very protected

Fluorescence: 1.19FU

Turbidity: 0.69 NTU

Kootowis (K) - Clayoquot Sound



Subtidal



Close up

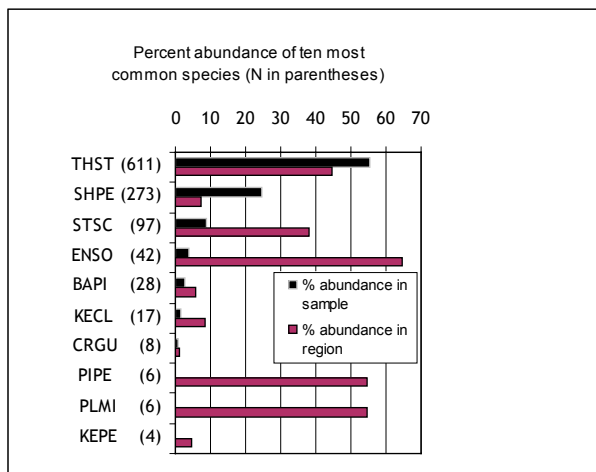
Eelgrass Health Index

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

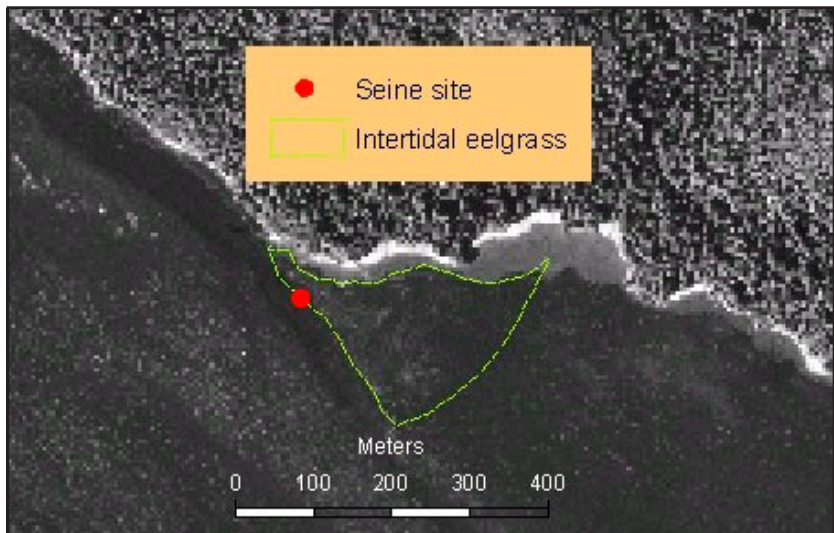
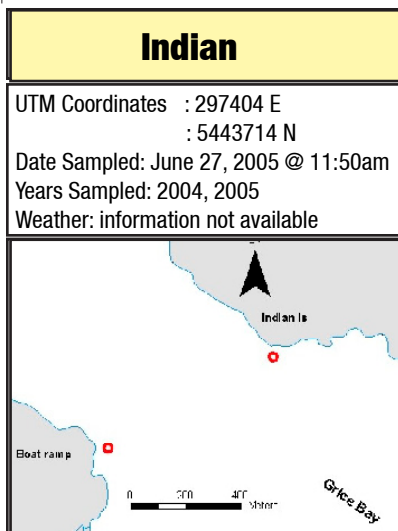
Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Enteromorpha linza</i> & diatoms
Density: 177.8 shoots/m ²	Dry Biomass: 222 g/m ²
Tidal Range: Mostly intertidal	Epiphyte Load: 71.29%
Biomass: 246.90 g/m ²	Intertidal bed area: 2,608 m ²
Leaf area index: 1.02	Subtidal bed area: N/A m ²

Fish Summary

No. of Species: 22	No. of Individuals: 1108	Pielou's Evenness: 0.445	Taxonomic Distinctiveness: 97
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SPECIES		SPECIES		
ROCKFISH	BLRO	SEA PERCHES	KEPE	•
	BOCC		PIPE	•
	BRRO		SHPE	•
	CORO		STPE	•
	VERO	KELPFISH	CRKE	
	YERO	GUNNELS	CRGU	•
SCULPINS	BUSC		PEGU	
	CABE		ROGU	
	FLSC		SAGU	•
	GRSC	PRICKLEBACKS	SNPR	•
	MASC		BLPR	
	PASC		HICO	
	RBSC		SLCO	
	REIL	FLATFISHES	COSO	
	SISC		ENSO	•
	SMSC		ROSO	
	STSC	•	SPSA	
	TASC		STFL	
	TISC	GREENLING	WHGR	
PLATED FISHES	THST	•	KEGR	•
	TUBE		PAGR	
	BAPI	•	LING	
CLINGFISHES	KECL	•	PREY FISHES	HERR
	NOCL		SUSM	
GOBIES	BLGO		SAND	
	BAGO	•	WALL	
TOADFISH	PLMI	•	SALMONIDS	CHIN
			CHUM	•
			CUTT	•



Relatively undisturbed (EDI 14), thick intertidal bed on soft mud, part of a larger one - the mapped area was approximately half of the whole bed. No underwater video available to describe the subtidal bed. Heavy intertidal epiphyte load (second highest for all sites sampled in 2005, 60% DW), mostly diatoms. There were many ghost shrimp burrows and varnished clam shells were abundant by the shoreline. The fish catch was dominated by sticklebacks and shiner perch. Five of the 13 striped seaperch caught in Clayoquot Sound were caught at this site. Mink were seen foraging on the bed.



Physical Characteristics

Environmental Index: 10

Temperature: 16°C

Sediment Composition: Fine mud substrate

Salinity: 24.4 ppt

Silt-clay fraction: 3.8%

Chlorophyll a: 0.67 µg/L

Slope: Steep, > 20°

Nitrate: 1.91 µmol

Estimated exposure: Protected

Fluorescence: 0.98 FU

Turbidity: 0.47 NTU

Indian (I) - Clayoquot Sound



Subtidal



Close up

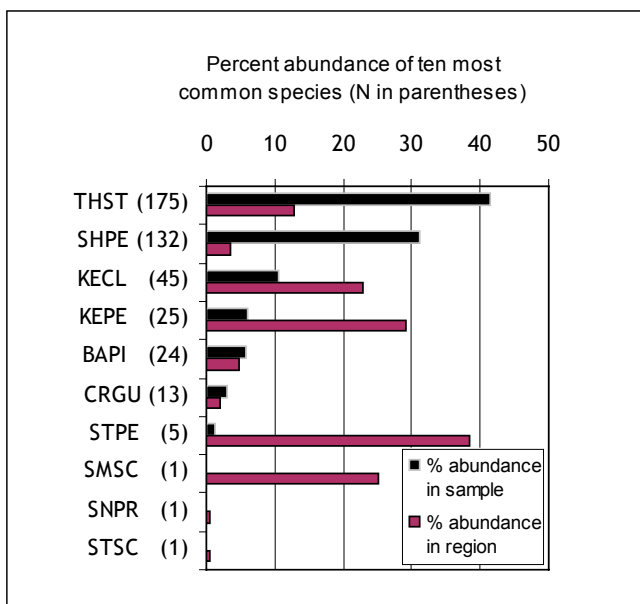
Eelgrass Health Index: 8

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Plenosporium vancouverianum</i> & diatoms
Density: 455.6 shoots/m ²	Dry Biomass: 107 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 69.16%
Biomass: 142.9 g/m ²	Intertidal bed area: 36,550 m ²
Leaf area index: 1.50	Subtidal bed area: N/A

Fish Summary

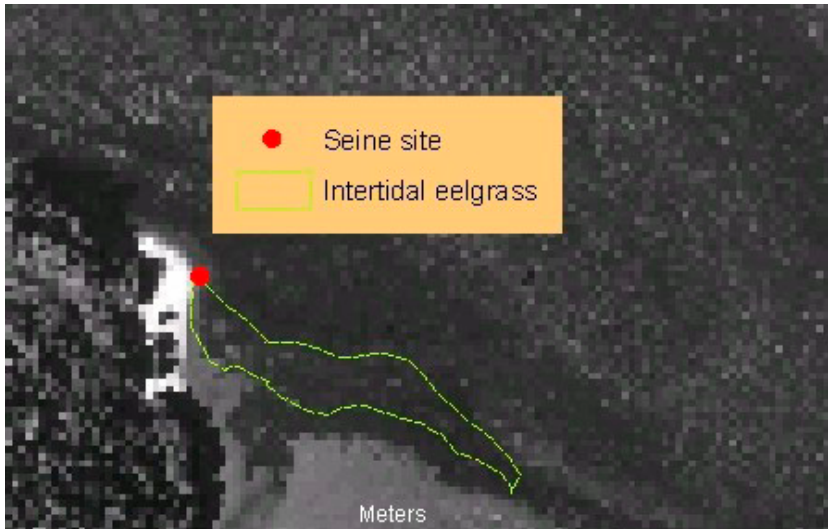
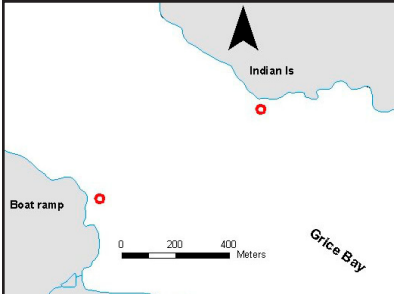
No. of Species: 10	No. of Individuals: 422	Pielou's Evenness: 0.652	Taxonomic Distinctiveness: 88
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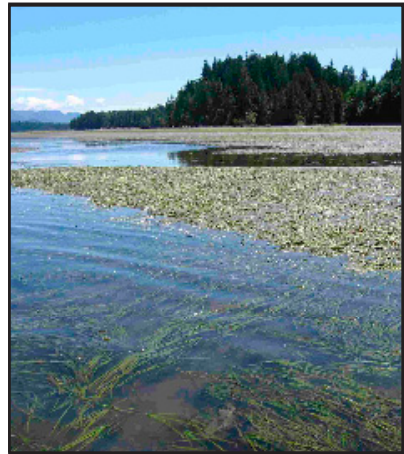
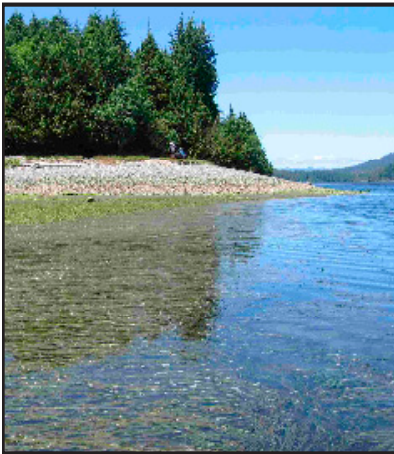
	SPECIES		SPECIES	
ROCKFISH	BLRO	SEA PERCHES	KEPE	●
	BOCC		PIPE	
	BRRO		SHPE	●
	CORO		STPE	●
	VERO	KELPFISH	CRKE	
	YERO	GUNNELS	CRGU	●
SCULPINS	BUSC		PEGU	
	CABE		ROGU	
	FLSC		SAGU	
	GRSC	PRICKLEBACKS	SNPR	●
	MASC		BLPR	
	PASC		HICO	
	RBSC		SLCO	
	REIL	FLATFISHES	COSO	
	SISC		ENSO	
	SMSC	●	ROSO	
	STSC	●	SPSA	
	TASC		STFL	
	TISC	GREENLING	WHGR	
PLATED FISHES	THST	●	KEGR	
	TUBE		PAGR	
	BAPI	●	LING	
CLINGFISHES	KECL	●	PREY FISHES	HERR
	NOCL		SUSM	
GOBIES	BLGO		SAND	
	BAGO		WALL	
TOADFISH	PLMI	SALMONIDS	CHIN	
			CHUM	
			CUTT	

Boat Launch

UTM coordinates : 296805 E
 : 5443384 N
 Date Sampled: June 27, 2005 @ 13:01
 Years Sampled: 2005
 Weather: sunny & windy



Site immediately adjacent to the boat launch at the end of Grice Bay Road, across the Indian site. Thin and narrow bed over soft mud (EDI 18). The intertidal portion was divided into two strips, one by the low tide line and the other further inshore. There were dense *Ulva* mats in the inshore strip. No underwater video available to describe the subtidal bed. The intertidal epiphyte load was the heaviest among all sites sampled in 2005 (64% DW, median value), mostly diatoms. The site had the highest total fish catch for Clayoquot Sound (20% of the total catch). Shiner perch and sticklebacks made most of that catch, and 16 of 21 starry flounders caught in Clayoquot were caught here.

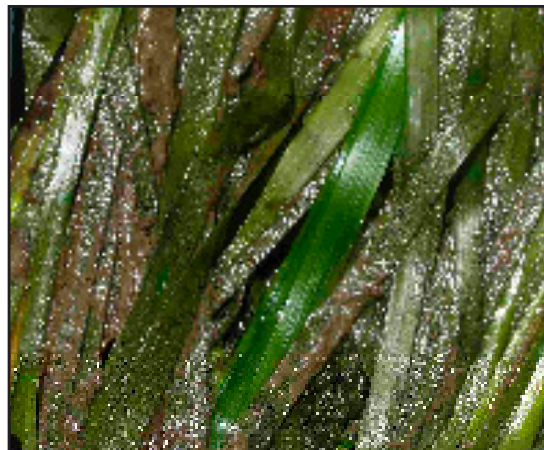


Physical Characteristics	
Environmental Index: 10	
Temperature: 17°C	Sediment Composition: N/A
Salinity: 24.7 ppt	Silt-clay fraction: N/A
Chlorophyll a: 2.04µg/L	Slope: N/A
Nitrate: 0.35µmol	Estimated exposure: N/A
Fluorescence: 1.53 FU	Turbidity: 1.25 NTU

Boat Launch (BL) - Clayoquot Sound



Subtidal



Close up

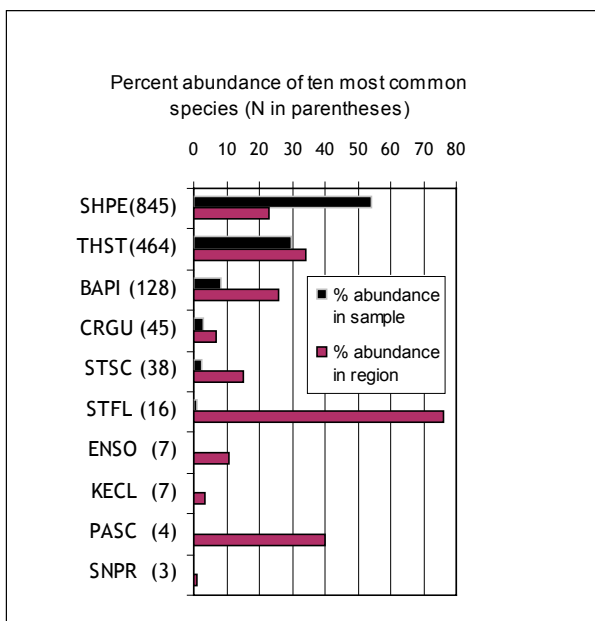
Eelgrass Health Index: 8

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Pleonosporium vancouverianum</i> , diatoms & <i>Enteromorpha linza</i>
Density: 337.8 shoots/m ²	Dry Biomass: 150 g/m ²
Tidal Range: Subtidal and intertidal	Epiphyte Load: 62.87%
Biomass: 206.4 g/m ²	Intertidal bed area: 9,251 m ²
Leaf area index: 3.20	Subtidal bed area: N/A

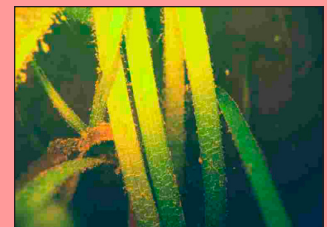
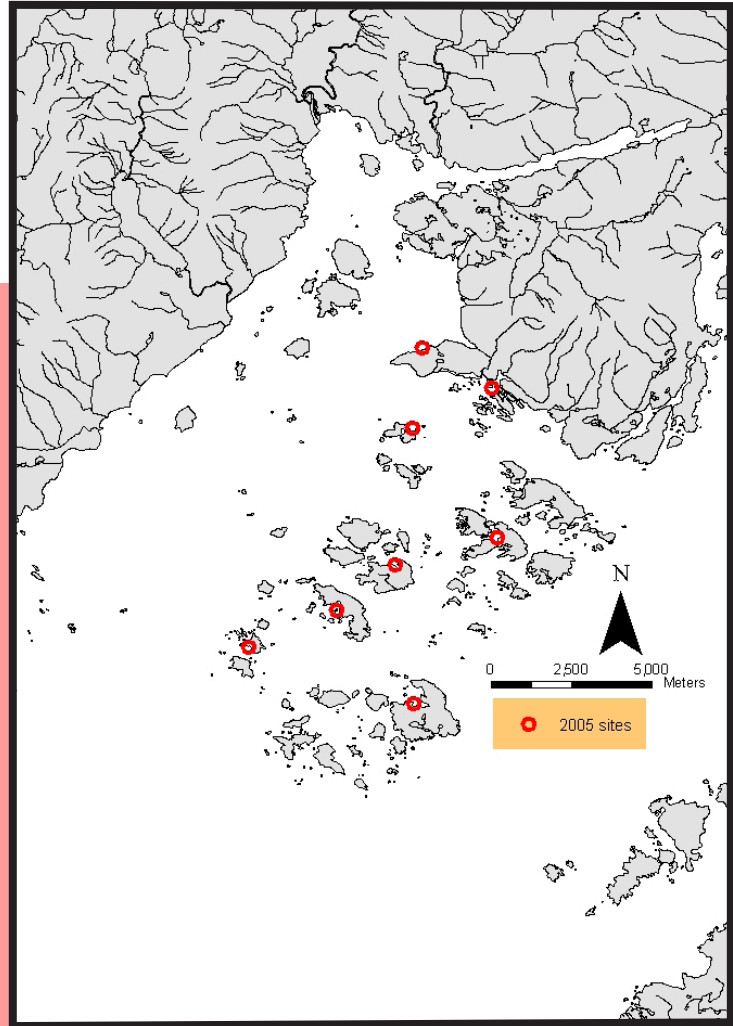
Fish Summary

No. of Species: 14	No. of Individuals: 1562	Pielou's Evenness: 0.468	Taxonomic Distinctiveness: 86
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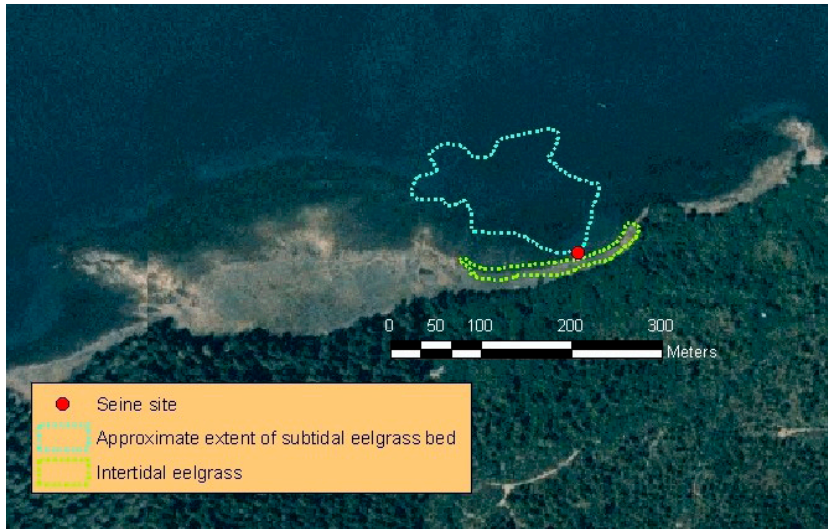
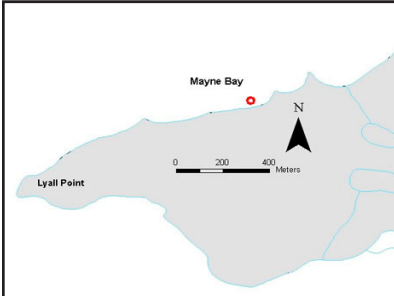
	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE •
	BOCC			PIPE
	BRRO			SHPE •
	CORO			STPE
	VERO		KELPFISH	CRKE
	YERO		GUNNELS	CRGU •
SCULPINS	BUSC			PEGU
	CABE			ROGU
	FLSC			SAGU •
	GRSC		PRICKLEBACKS	SNPR •
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO •
	SMSC			ROSO
	STSC	•		SPSA
	TASC			STFL •
	TISC		GREENLING	WHGR
PLATED FISHES	THST	•		KEGR
	TUBE			PAGR
	BAPI	•		LING
CLINGFISHES	KECL	•	PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO	•		WALL
TOADFISH	PLMI		SALMONIDS	CHIN •
				CHUM
				CUTT

2.4 Barkley Sound Site Descriptions

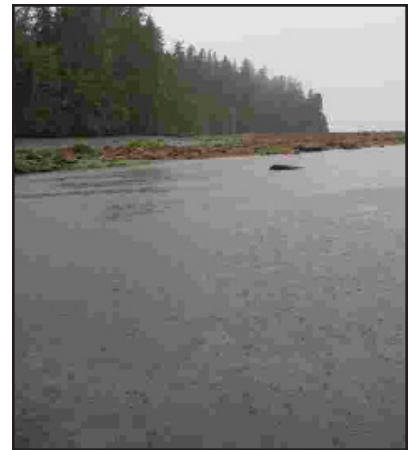
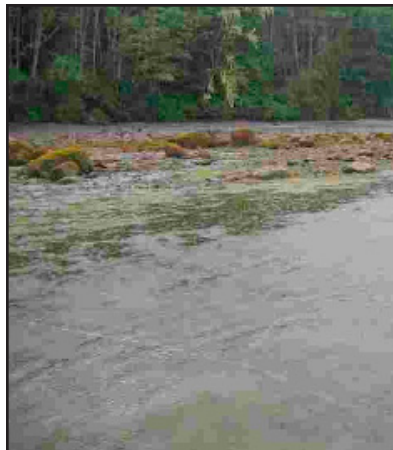
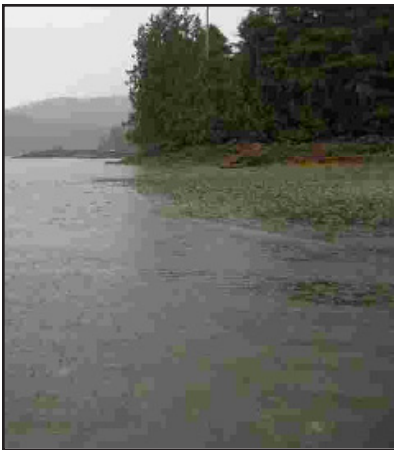


Mayne Bay

UTM Coordinates : 330962 E
 : 5425864 N
 Date Sampled: July 5, 2005 @ 6:10am
 Years Sampled: 2005
 Weather: Rain & calm waters



Patchy intertidal bed (EDI 12) over soft, muddy bottom and surrounded by other macrophytes such as Sargassum and Desmarestia. Both intertidal and subtidal epiphyte loads were medium to high — 39% DW in the intertidal, mostly diatoms in both inter- and subtidal. The subtidal bed was thin and bordered by sand and boulders/cobbles/mud (low energy environment). Giant kelp & laminariales patches were recorded nearby. The incidence of wasting disease was medium. Many invertebrates were seen, such as slender crabs, sea cucumbers (*Parastichopus* & *Cucumaria*), anemones (*Tealia*, cerianthids), and bat stars. Although the catches were the lowest in Barkley Sound, the ichthyofauna was diverse, as expected from the presence of macrophytes nearby. There were proportionally high incidences of kelp clingfish and staghorn sculpins. Rockfish juveniles were observed in the video but not recorded in the catches- these fish may have taken advantage of the high tide to move into the area.

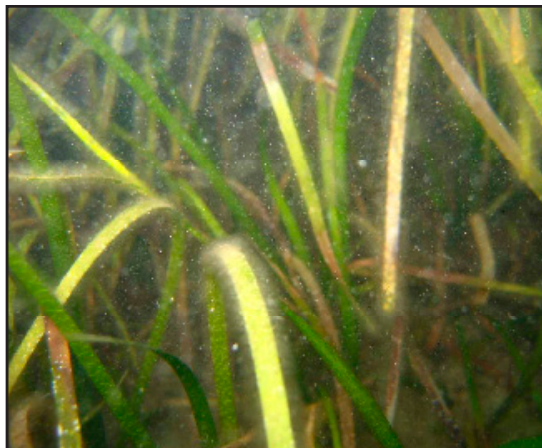


Physical Characteristics	
Environmental Index: 6	
Temperature: 17°C	Sediment Composition: N/A
Salinity: 29.1 ppt	Silt-clay fraction: N/A
Chlorophyll a: 1.11 µg/L	Slope: N/A
Nitrate: 0.01 µmol	Estimated exposure: N/A
Fluorescence: 1.56 FU	Turbidity: 1.20 NTU

Mayne Bay (MB) - Barkley Sound



Subtidal



Close up

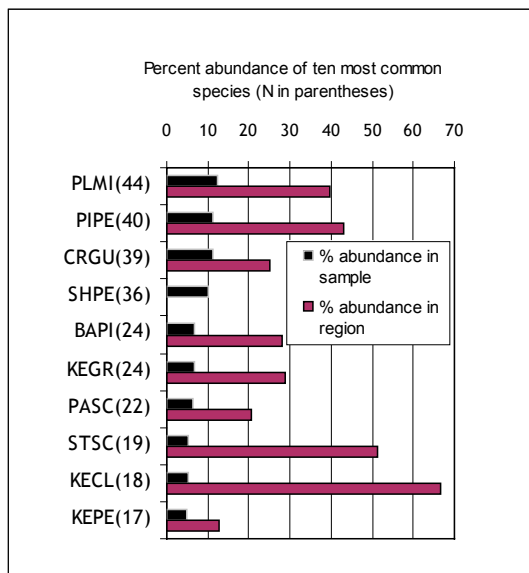
Eelgrass Health Index: 16

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

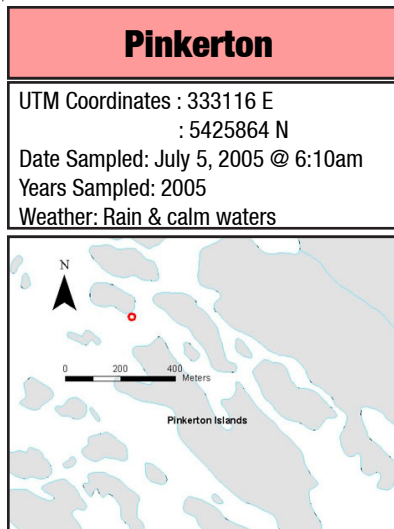
Ecotype: <i>Zostera marina</i>	Epiphyte: 100% Diatoms
Density: 1,033.3 shoots/m ²	Dry Biomass: 34 g/m ²
Tidal Range: Subtidal & Intertidal	Epiphyte Load: 36.9%
Biomass: 98.7 g/m ²	Intertidal bed area: 2,433 m ²
Leaf area index: 1.49	Subtidal bed area: 16,550 m ²

Fish Summary

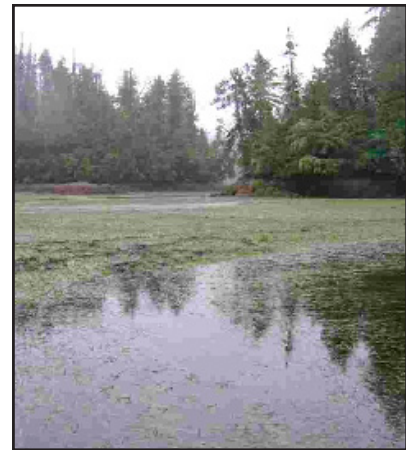
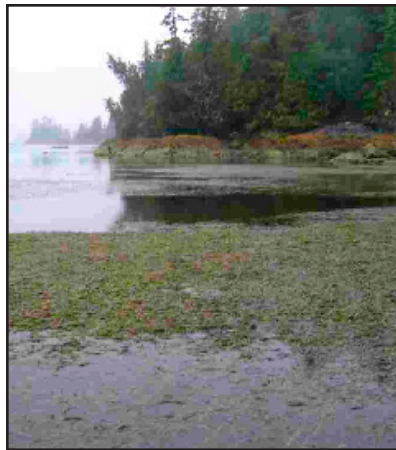
Number of different of Species: 26	Total number of Individuals: 351	Pielou's Evenness: 0.849	Taxonomic Distinctiveness: 87
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	SPECIES			SPECIES	
ROCKFISH	BLRO	•	SEA PERCHES	KEPE	•
	BOCC			PIPE	•
	BRRO			SHPE	•
	CORO			STPE	
	VERO		KELPFISH	CRKE	
	YERO	•	GUNNELS	CRGU	
SCULPINS	BUSC	•		PEGU	
	CABE	•		ROGU	
	FLSC			SAGU	
	GRSC	•	PRICKLEBACKS	SNPR	
	MASC			BLPR	
	PASC	•		HICO	
	RBSC	•		SLCO	
	REIL		FLATFISHES	COSO	•
	SISC			ENSO	•
	SMSC	•		ROSO	
	STSC	•		SPSA	•
	TASC			STFL	•
	TISC	•	GREENLING	WHGR	•
PLATED FISHES	THST	•		KEGR	•
	TUBE			PAGR	
	BAPI	•		LING	
CLINGFISHES	KECL	•	PREY FISHES	HERR	
	NOCL			SUSM	
GOBIES	BLGO			SAND	
	BAGO			WALL	
TOADFISH	PLMI	•	SALMONIDS	CHIN	
				CHUM	•
				CUTT	



Dense intertidal bed abutted to a large subtidal bed (EDI 16). Medium intertidal epiphyte load (18% DW), mostly diatoms. Sea hair clumps common within the intertidal portion of the bed. The subtidal portion of the bed was patchy, thin and surrounded by marl (gravel, shell, mud) on the deep side and abutted to a boulder slope on some inshore sides. Some sea lettuce clumps were scattered near the high subtidal edge. The subtidal epiphyte load was low, but incidence of the wasting disease was however high. Cerianthids (burrowing anemones) and bat stars were common; moonsnails, mottled stars, slender crabs, spiny pink stars were also seen. Most of the catch consisted of shiner perch (73% for this site) and the site harboured the only blackeye gobies caught in Barkley Sound. Many striped seaperch were seen on the video but not recorded in the catches.



Physical Characteristics

Environmental Index: 6

Temperature: 17°C	Sediment Composition: N/A
Salinity: 27.9 ppt	Silt-clay fraction: N/A
Chlorophyll a: 1.01 µg/L	Slope: N/A
Nitrate: 0.00 µmol	Estimated exposure: N/A
Fluorescence: 1.43 FU	Turbidity: 0.35 NTU

Pinkerton (P) - Barkley Sound



Subtidal



Close up

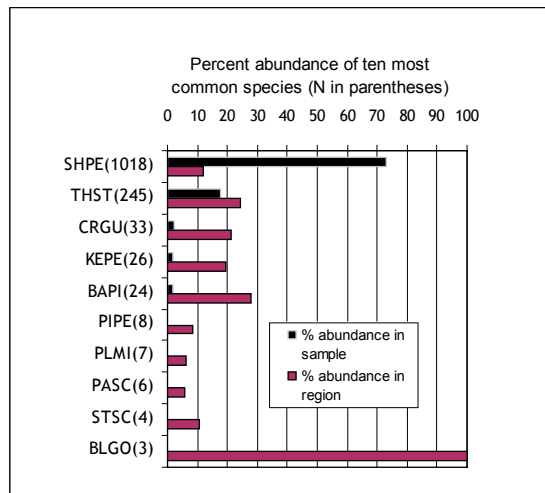
Eelgrass Health Index: 14

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: Diatoms with some silt-clay
Density: 477.8 shoots/m ²	Dry Biomass: 12 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 18.76%
Biomass: 61.1 g/m ²	Intertidal bed area: 392 m ²
Leaf area index: 2.99	Subtidal bed area: 4.642 m ²

Fish Summary

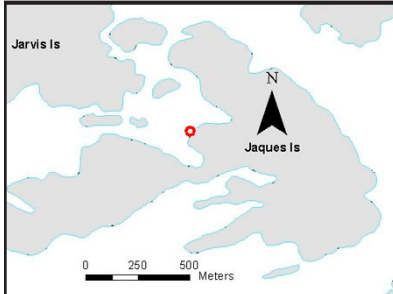
Number of different of Species: 22	Total number of Individuals: 1394	Pielou's Evenness: 0.315	Taxonomic Distinctiveness: 87
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	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE ●
	BOCC			PIPE ●
	BRRO			SHPE ●
	CORO			STPE
	VERO		KELPFISH	CRKE
	YERO	●	GUNNELS	CRGU ●
SCULPINS	BUSC			ROGU
	CABE	●		SAGU ●
	FLSC			
	GRSC		PRICKLEBACKS	SNPR ●
	MASC			BLPR
	PASC	●		HICO
	RBSC	●		SLCO
	REIL		FLATFISHES	COSO ●
	SISC			ENSO
	SMSC			ROSO
	STSC	●		SPSA ●
	TASC			STFL ●
	TISC	●	GREENLING	WHGR
PLATED FISHES	THST	●		KEGR ●
	TUBE			PAGR
	BAPI	●		LING
CLINGFISHES	KECL	●	PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO	●		SAND
	BAGO	●		WALL
TOADFISH	PLMI	●	SALMONIDS	CHIN
				CHUM
				CUTT

Jaques-Jarvis Lagoon

UTM Coordinates : 333305 E
 : 5421196 N
 Date Sampled: July 6, 2005 @ 6:15am
 Years Sampled: 2004, 2005
 Weather: rain & calm waters



No GIS Map available

Small, thin and relatively undisturbed bed (EDI 12), mostly subtidal, located in a sheltered area. The intertidal epiphyte load was low (8% DW) and composed of diatoms. No underwater video. Most of the catch was made up by sticklebacks and shiner perch (87% of the total number of fishes caught at this site). Eight of 12 bay gobies caught in Barkley Sound were caught at this site.



Physical Characteristics

Environmental Index: 8

Temperature: 16°C

Sediment Composition: Fine mud substrate

Salinity: 29.0 ppt

Silt-clay fraction: 18.6%

Chlorophyll a: 1.43 µg/L

Slope: Flat, <10°

Nitrate: 0.32 µmol

Estimated exposure: Very protected

Fluorescence: 2.77 FU

Turbidity: 0.03 NTU

Jaques-Jarvis Lagoon (JJ) - Barkley Sound



Subtidal



Close up

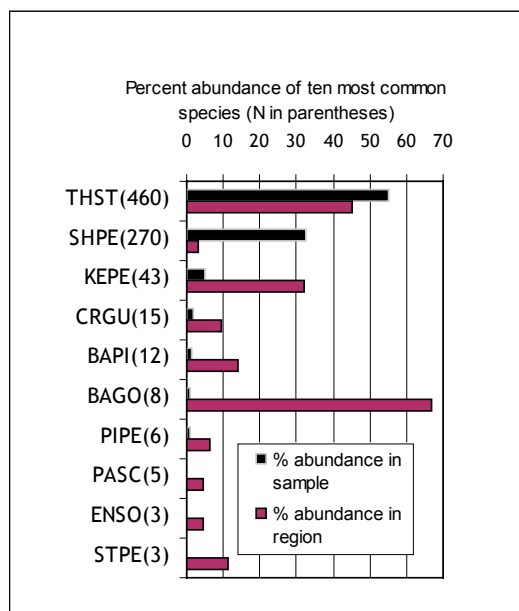
Eelgrass Health Index: 8

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 355.6 shoots/m ²	Dry Biomass: 12 g/m ²
Tidal Range: Subtidal and Intertidal	Epiphyte Load: 8.58%
Biomass: 134.2 g/m ²	Intertidal bed area: N/A
Leaf area index: 1.84	Subtidal bed area: N/A

Fish Summary

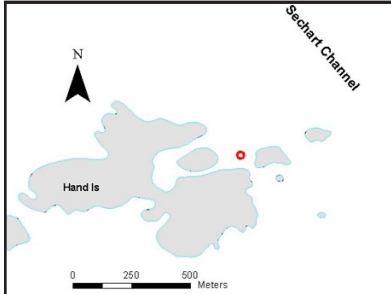
Number of different of Species: 16	Total number of Individuals: 835	Pielou's Evenness: 0.434	Taxonomic Distinctiveness: 91
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	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE ●
	BOCC			PIPE ●
	BRRO			SHPE ●
	CORO	●		STPE ●
	VERO		KELPFISH	CRKE
	YERO	●	GUNNELS	CRGU
SCULPINS	BUSC			PEGU
	CABE			ROGU
	FLSC			SAGU
	GRSC		PRICKLEBACKS	SNPR ●
	MASC			BLPR
	PASC	●		HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO ●
	SMSC			ROSO
	STSC	●		SPSA ●
	TASC			STFL
	TISC	●	GREENLING	WHGR
PLATED FISHES	THST	●		KEGR
	TUBE			PAGR
	BAPI	●		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO	●		WALL
TOADFISH	PLMI		SALMONIDS	CHIN
				CHUM
				CUTT

Hand Island

UTM Coordinates : 330668 E
 : 5424598 N
 Date Sampled: July 6, 2005 @ 7:57am
 Years Sampled: 2004, 2005
 Weather: information not available



Dense bed covering an extensive intertidal area, with a low to medium epiphyte load (11% DW, diatoms). The site lies close to a campsite, which may account for its disturbed state (EDI 16). No underwater video. This site had the highest total fish catches in Barkley Sound (26% of the total), but a low species evenness (93% of fishes caught were shiner perch and none of the other species topped 2%). This site also harboured half of the speckled sanddabs (15/30) caught in Barkley Sound.



Physical Characteristics

Environmental Index: 14

Temperature: 15°C

Sediment Composition: mud & sand substrate

Salinity: 28.2 ppt

Silt-clay fraction: 7.7%

Chlorophyll a: 12.44 µg/L

Slope: Flat, <10°

Nitrate: 1.59 µmol

Estimated exposure: Protected

Fluorescence: 6.68 FU

Turbidity: 0.11 NTU

Hand Island (HI) - Barkley Sound



Subtidal



Close up

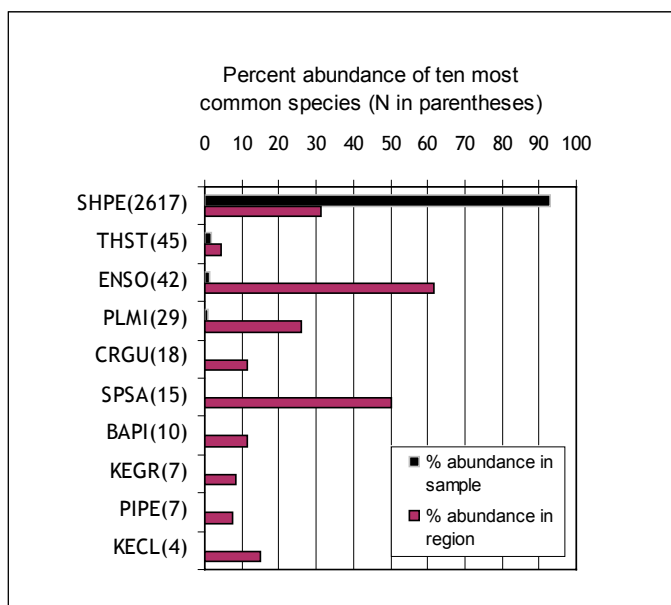
Eelgrass Health Index: 8

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

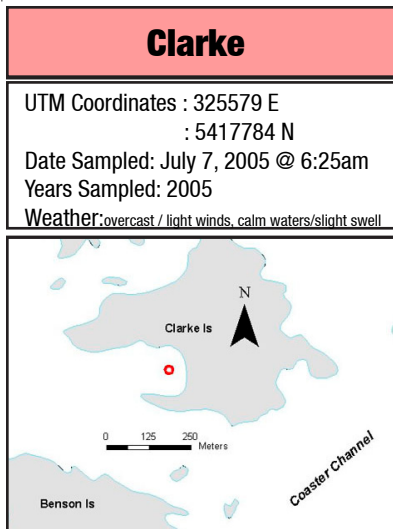
Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 1,244.4 shoots/m ²	Dry Biomass: 24 g/m ²
Tidal Range: Subtidal & Intertidal	Epiphyte Load: 10.48%
Biomass: 227.2 g/m ²	Intertidal bed area: 2,265 m ²
Leaf area index: 3.62	Subtidal bed area: 3,750 m ²

Fish Summary

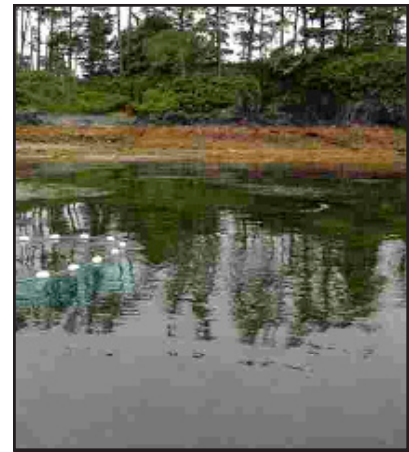
Number of different of Species: 21	Total number of Individuals: 2810	Pielou's Evenness: 0.13	Taxonomic Distinctiveness: 91
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	SPECIES			SPECIES	
ROCKFISH	BLRO	•	SEA PERCHES	KEPE	
	BOCC	•		PIPE	•
	BRRO			SHPE	•
	CORO			STPE	
	VERO		KELPFISH	CRKE	
	YERO		GUNNELS	CRGU	•
SCULPINS	BUSC			PEGU	
	CABE	•		ROGU	•
	FLSC			SAGU	
	GRSC		PRICKLEBACKS	SNPR	
	MASC			BLPR	
	PASC	•		HICO	•
	RBSC			SLCO	
	REIL		FLATFISHES	COSO	•
	SISC			ENSO	•
	SMSC	•		ROSO	
	STSC	•		SPSA	•
	TASC			STFL	•
	TISC		GREENLING	WHGR	
PLATED FISHES	THST	•		KEGR	•
	TUBE	•		PAGR	
	BAPI	•		LING	
CLINGFISHES	KECL	•	PREY FISHES	HERR	
	NOCL			SUSM	
GOBIES	BLGO			SAND	
	BAGO	•		WALL	
TOADFISH	PLMI	•	SALMONIDS	CHIN	
				CHUM	
				CUTT	



Thin, patchy beds nestled among several different habitats (EDI 12). Both intertidal and subtidal epiphyte loads were low (5% DW intertidally, diatoms in both cases). The subtidal bed consisted of small, thin patches surrounded by various habitats: Phyllospadix meadow, giant kelp bed, sea staghorn alga (*Codium*), urchin barren, sand/cobble area with dense ulvoid cover and marl (sand/shells gravel). There were many invertebrates such as moonsnails, bat stars, leather stars, spiny pink stars, red sea urchins, sea cucumbers (*Cucumaria*), and cerianthid anemones. No evidence of wasting disease. Fish species richness was high (23 species) and dominated by shiner perch. Many species (e.g., crevice kelpfish, silver spotted sculpins, penpoint gunnels) were only caught at this site. Two of 3 bocaccio caught in Barkley Sound were caught at this site as well as many yellowtail rockfish juveniles. A painted greenling was seen on the underwater video but this species was not recorded in the catches. This may once again be a case of a fish moving with the high tide to forage in the eelgrass meadow.



Physical Characteristics

Environmental Index: 4

Temperature: 15°C

Sediment Composition: N/A

Salinity: 29.5 ppt

Silt-clay fraction: N/A

Chlorophyll a: 0.38 µg/L

Slope: N/A

Nitrate: 0.00 µmol

Estimated exposure: N/A

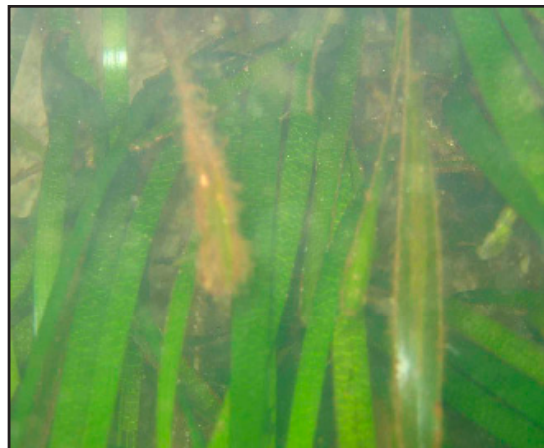
Fluorescence: 1.12 FU

Turbidity: 0.05 NTU

Clarke (C) - Barkley Sound



Subtidal



Close up

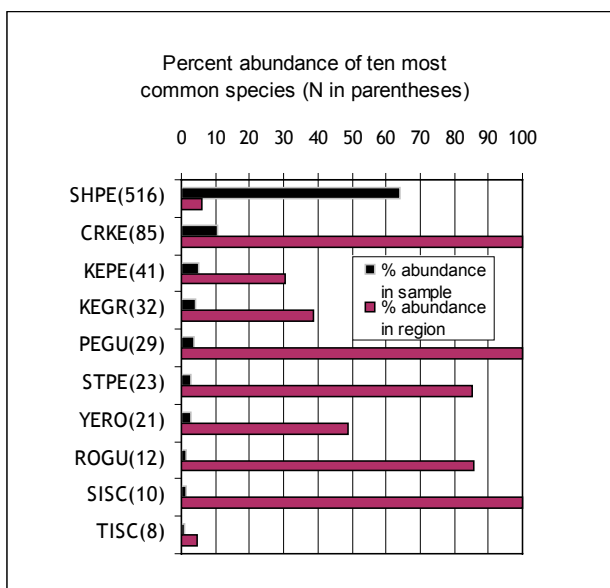
Eelgrass Health Index: 8

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: Round red globular algae & diatoms
Density: 733.3 shoots/m ²	Dry Biomass: 27 g/m ²
Tidal Range: Mostly subtidal	Epiphyte Load: 7.13%
Biomass: 434.2 g/m ²	Intertidal bed area: 2,099 m ²
Leaf area index: 5.26	Subtidal bed area: N/A

Fish Summary

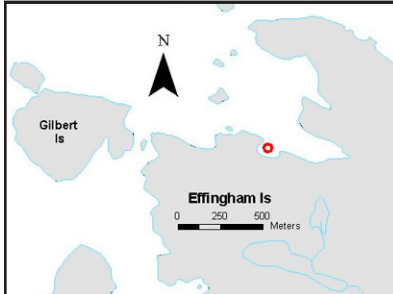
Number of different of Species: 23	Total number of Individuals: 805	Pielou's Evenness: 0.473	Taxonomic Distinctiveness: 84
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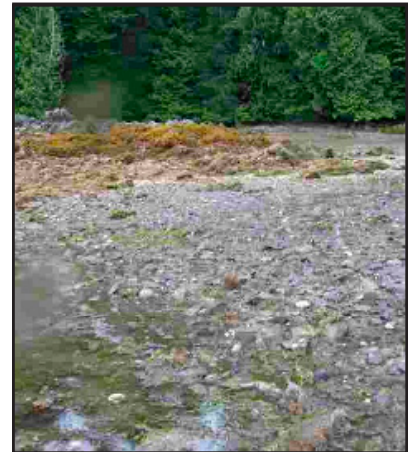
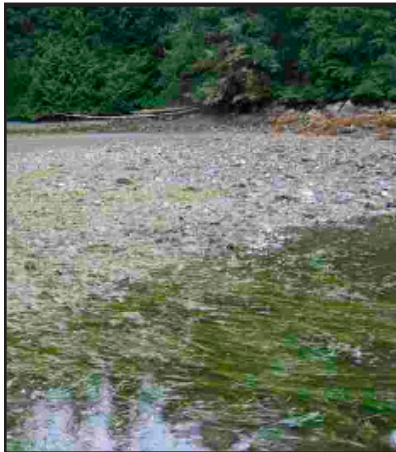
SPECIES			SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE
	BOCC	•		PIPE
	BRRO			SHPE
	CORO			STPE
	VERO		KELPFISH	CRKE
	YERO	•	GUNNELS	CRGU
SCULPINS	BUSC			PEGU
	CABE	•		ROGU
	FLSC	•		SAGU
	GRSC		PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC			HICO
	RBSC			SLCO
	REIL	•	FLATFISHES	COSO
	SISC	•		ENSO
	SMSC	•		ROSO
	STSC			SPSA
	TASC			STFL
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST			KEGR
	TUBE			PAGR
	BAPI	•		LING
CLINGFISHES	KECL	•	PREY FISHES	HERR
	NOCL	•		SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI	•	SALMONIDS	CHIN
				CHUM
				CUTT

Effingham

UTM Coordinates : 330695 E
 : 5416033 N
 Date Sampled: July 7, 2005 @ 10:22am
 Years Sampled: 2005
 Weather: Overcast & calm



Small, thin and mainly intertidal bed (EDI 14), over a substrate of gravel, cobbles and mud. Sailboats frequently anchor nearby. The intertidal epiphyte load was medium (19% DW) and mostly diatoms. No underwater video available for the subtidal portion of the bed. The site ranked second in Barkley Sound in overall fish numbers. Catches were dominated by shiner perch. Tidepool sculpins were unusually common (72% of all of all individuals caught in the region). Half of the starry flounders (3/6) were also caught at this site.



Physical Characteristics

Environmental Index: 8

Temperature: 15°C

Sediment Composition: N/A

Salinity: 30 ppt

Silt-clay fraction: N/A

Chlorophyll a: 1.51 µg/L

Slope: N/A

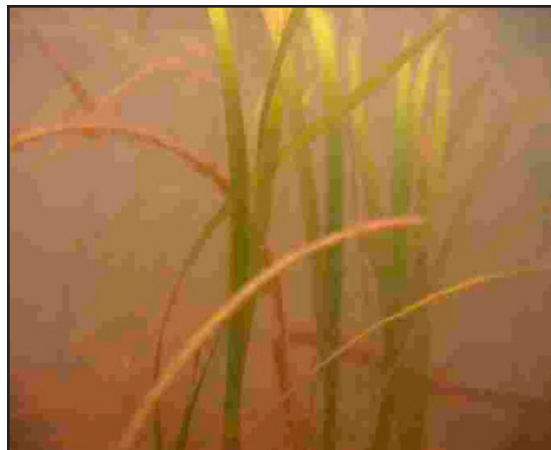
Nitrate: 0.08 µmol

Estimated exposure: N/A

Fluorescence: 1.94 FU

Turbidity: 0.15 NTU

Effingham (E) - Barkley Sound



Subtidal



Close up

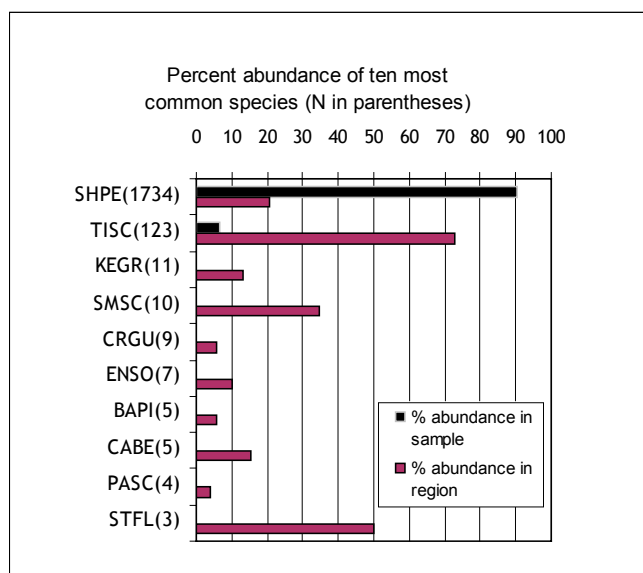
Eelgrass Health Index: 10

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 733.3 shoots/m ²	Dry Biomass: 215 g/m ²
Tidal Range: Intertidal	Epiphyte Load: 20.34%
Biomass: 743 g/m ²	Intertidal bed area: 2,258 m ²
Leaf area index: 1.13	Subtidal bed area: N/A

Fish Summary

Number of different of Species: 15	Total number of Individuals: 1921	Pielou's Evenness: 0.17	Taxonomic Distinctiveness: 93
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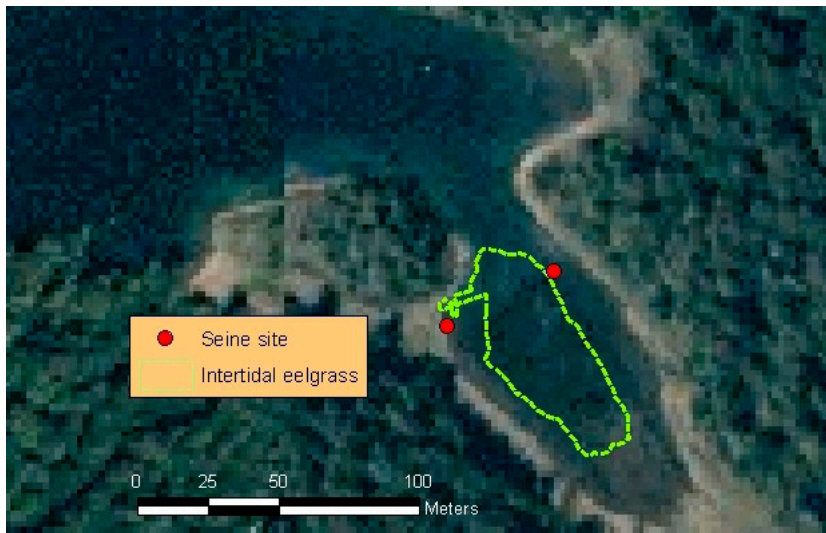
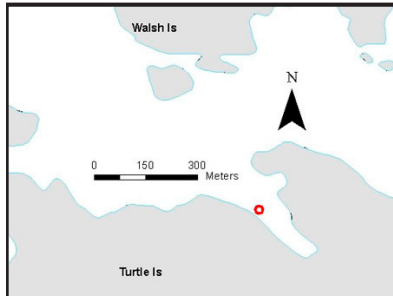


	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE
	BOCC			PIPE ●
	BRRO			SHPE ●
	CORO			STPE ●
	VERO		KELPFISH	CRKE
	YERO		GUNNELS	CRGU ●●
	SCULPINS	BUSC		REGU
CABE ●			ROGU	
FLSC			SAGU	
	GRSC		PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC ●			HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO ●
	SMSC ●			ROSO
	STSC ●			SPSA ●
	TASC			STFL ●
	TISC ●		GREENLING	WHGR
PLATED FISHES	THST			KEGR ●
	TUBE			PAGR
	BAPI ●			LING
CLINGFISHES	KECL ●		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI		SALMONIDS	CHIN
				CHUM
				CUTT

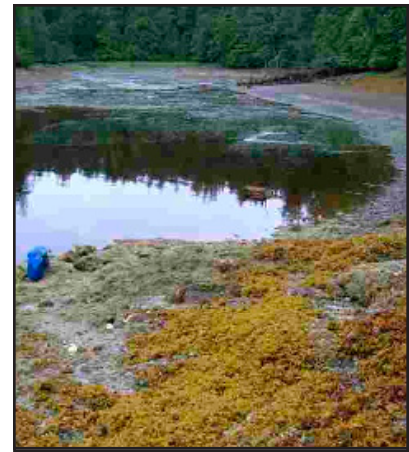
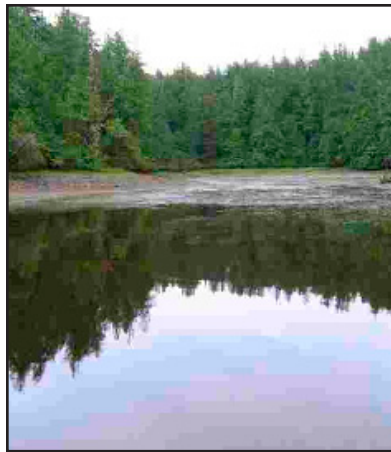
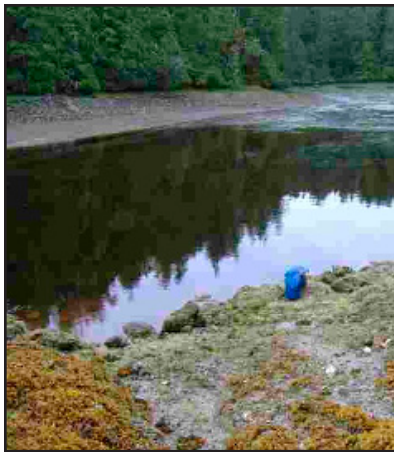
Joe's Bay

UTM Coordinates : 330119 E
: 5420364 N

Date Sampled: July 8, 2005 @ 6:45am
Years Sampled: 2004, 2005
Weather: windy & rainy



Fairly undisturbed (EDI 14), thin bed in a small, shallow and narrow embayment on Turtle Island. Sailboats frequently anchor nearby. The water had a high humic acid content ('tea stained') at the time of collection. The epiphyte load was medium in the intertidal (12% DW; mostly diatoms) and ranged from medium to high in the subtidal. The underwater portion of the bed was abutted to a large area of marl in deeper water and immediately adjacent to cobbles. The subtidal bed was thin and under stress. Wasting disease incidence was high. Cerianthids, ochre, pink and bat stars, moonsnail egg masses and many large siphons (probably gaper clams) were visible. Shiner perch were the most abundant species, and there were many padded sculpins (64/106 caught in Barkley Sound).



Physical Characteristics

Environmental Index: 6

Temperature: 15°C

Sediment Composition: Fine mud substrate

Salinity: 29.0 ppt

Silt-clay fraction: 4.8%

Chlorophyll a: 0.65 µg/L

Slope: Flat, <10°

Nitrate: 0.55 µmol

Estimated exposure: Very protected

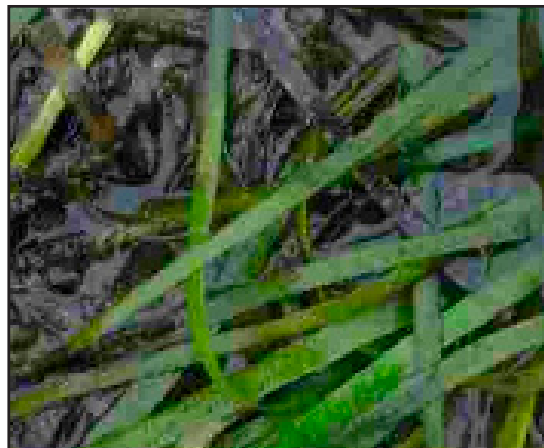
Fluorescence: 3.04 FU

Turbidity: 0.05 NTU

Joe's Bay (JB) - Barkley Sound



Subtidal



Close up

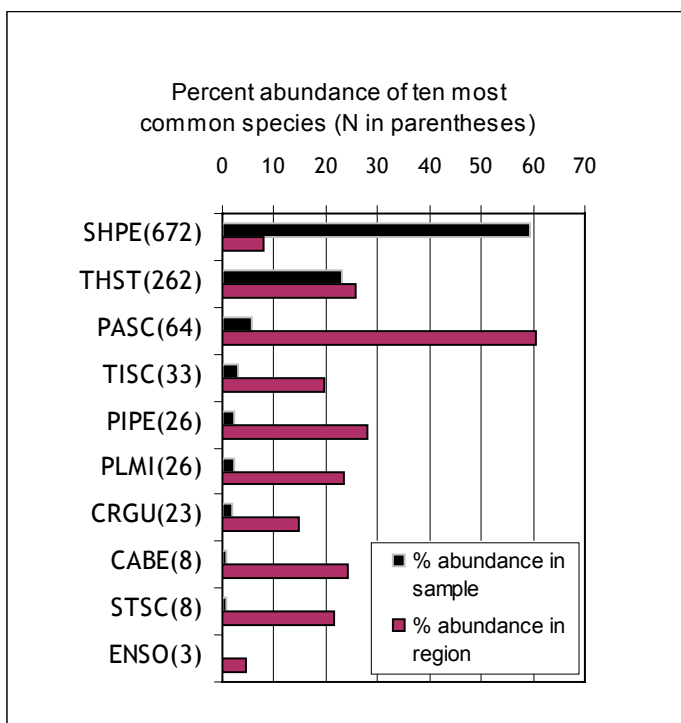
Eelgrass Health Index: 18

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Enteromorpha linza</i> & diatoms
Density: 733.3 shoots/m ²	Dry Biomass: 26 g/m ²
Tidal Range: Mostly intertidal	Epiphyte Load: 13.56%
Biomass: 227.2 g/m ²	Intertidal bed area: N/A
Leaf area index: 3.62	Subtidal bed area: 2,174 m ²

Fish Summary

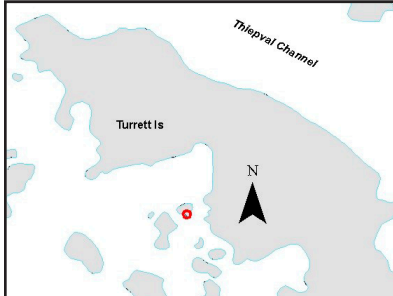
Number of different of Species: 15	Total number of Individuals: 1132	Pielou's Evenness: 0.477	Taxonomic Distinctiveness: 79
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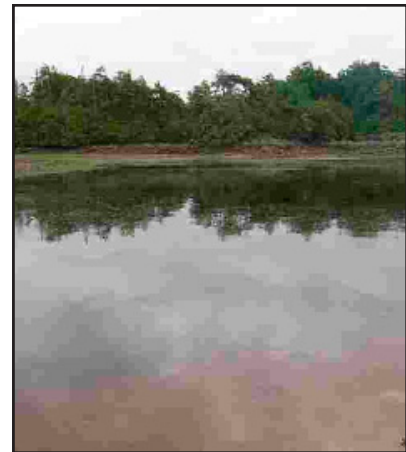
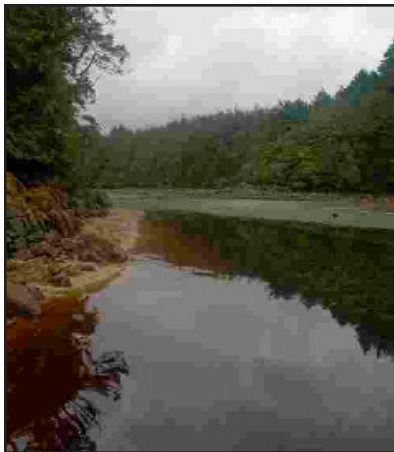
	SPECIES		SPECIES	
ROCKFISH	BLRO	•	SEA PERCHES	KEPE
	BOCC			PIPE
	BRRO			SHPE
	CORO			STPE
	VERO		KELPFISH	CRKE
	YERO	•	GUNNELS	CRGU
SCULPINS	BUSC			PEGU
	CABE	•		ROGU
	FLSC			SAGU
	GRSC		PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO
	SMSC	•		ROSO
	STSC	•		SPSA
	TASC			STFL
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST	•		KEGR
	TUBE			PAGR
	BAPI	•		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI	•	SALMONIDS	CHIN
				CHUM
				CUTT

Turret

UTM Coordinates : 328288 E
 : 5418952 N
 Date Sampled: July 8, 2005 @ 8:52am
 Years Sampled: 2004, 2005
 Weather: overcast & calm waters



Relatively undisturbed (EDI 8), extensive and thick bed in a sheltered site. The intertidal epiphyte load was medium (12% DW; diatoms). The underwater portion of the bed was also thick and dense and surrounded by muddy substrate (shells) and nearby laminariales. The subtidal epiphyte load ranged from low to medium and incidence of wasting disease was high. Many gastropods egg masses were seen on the eelgrass blades. Leather, bat and spiny pink stars, Dungeness and kelp crabs were present. The site ranked third in fish abundance in Barkley Sound but had low fish species richness as catches were dominated by shiner perch (96% of total catch). About one third of the yellowtail rockfish caught in Barkley Sound were caught here.



Physical Characteristics

Environmental Index: 12

Temperature: 15°C

Sediment Composition: Fine mud substrate

Salinity: 26.9 ppt

Silt-clay fraction: 5.3%

Chlorophyll a: 3.94 µg/L

Slope: Flat, <10°

Nitrate: 0.08 µmol

Estimated exposure: Very protected

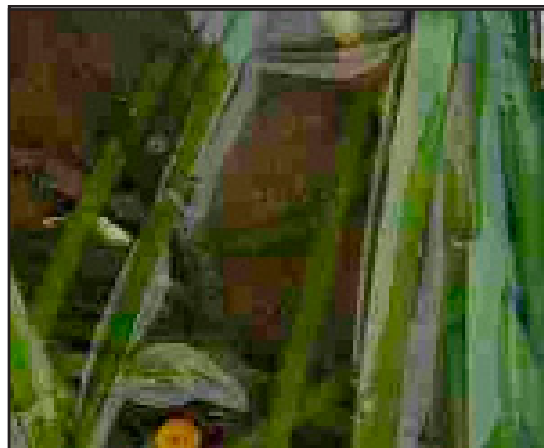
Fluorescence: 6.11 FU

Turbidity: 0.35 NTU

Turret (T) - Barkley Sound



Subtidal



Close up

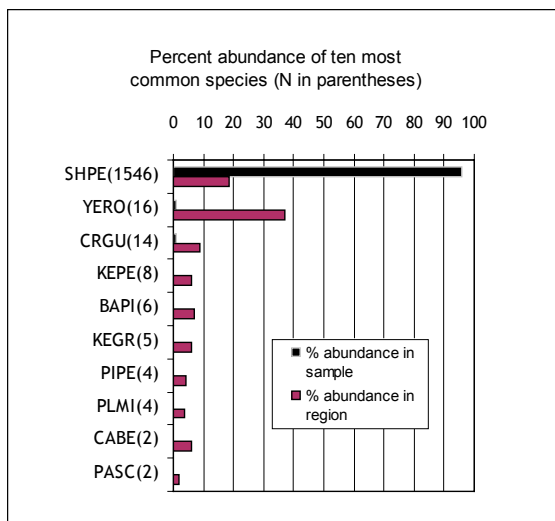
Eelgrass Health Index: 16

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: 100% diatoms
Density: 322.2 shoots/m ²	Dry Biomass: 12 g/m ²
Tidal Range: Intertidal and subtidal	Epiphyte Load: 12.02%
Biomass: 100.4 g/m ²	Intertidal bed area: 2,479 m ²
Leaf area index: 1.48	Subtidal bed area: 6,987 m ²

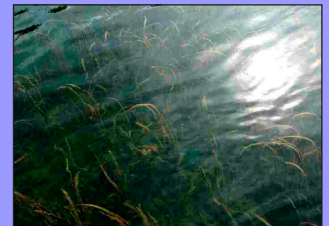
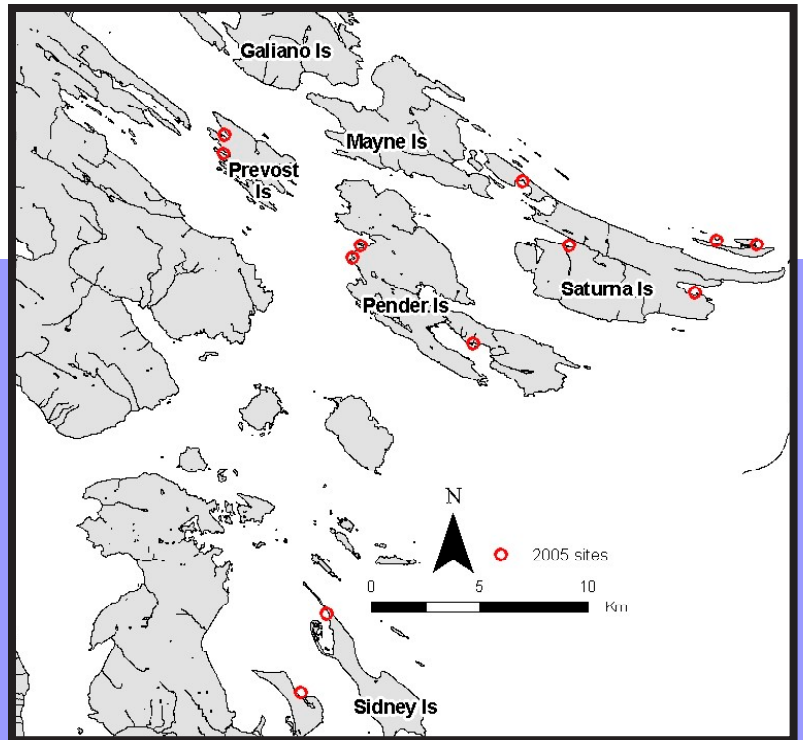
Fish Summary

Number of different of Species: 15	Total number of Individuals: 1614	Pielou's Evenness: 0.100	Taxonomic Distinctiveness: 87
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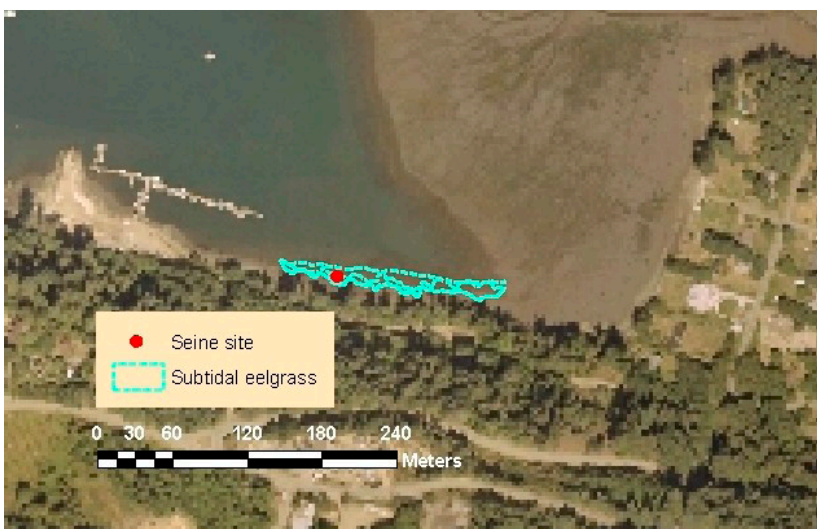
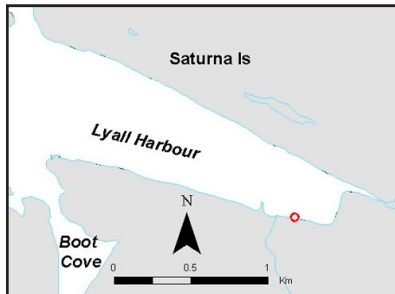
	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE
	BOCC			PIPE
	BRRO			SHPE
	CORO	•		STPE
	VERO		KELPFISH	CRKE
	YERO	•	GUNNELS	CRGU
SCULPINS	BUSC			PEGU
	CABE	•		ROGU
	FLSC			SAGU
	GRSC		PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO
	SMSC	•		ROSO
	STSC			SPSA
	TASC			STFL
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST			KEGR
	TUBE	•		PAGR
	BAPI	•		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI	•	SALMONIDS	CHIN
				CHUM
				CUTT

2.5 Gulf Islands Site Descriptions

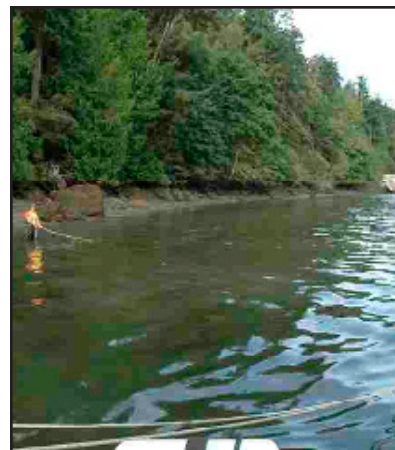


Lyall Harbour

UTM Coordinates : 486801 E
 : 5404618 N
 Date Sampled: August 1, 2005 @ 8:01am
 Years Sampled: 2004, 2005
 Weather: overcast & calm waters



Highly disturbed site (EDI 22) close to a small marina. Narrow and thin bed at the end of the bay, mostly subtidal over mud/sand/gravel substrate. The surrounding area was sand/mud with some sea lettuce and Gracilaria cover. The intertidal and subtidal epiphyte loads were heavy (48% DW in the intertidal) and dominated by diatoms mixed with some sea lettuce. Incidence of wasting disease could not be ascertained due to high epiphyte cover. Some siphons were seen protruding (probably horse clams). The site had the highest fish catches in the Gulf Islands region (21% of the total number), dominated by shiner perch (87% of individuals of this species caught). Five of the six snake pricklebacks caught in the region were caught at this site.



Physical Characteristics

Environmental Index: 8

Temperature: 16°C	Sediment Composition: Fine mud substrate
Salinity: 26.8 ppt	Silt-clay fraction: 1.8%
Chlorophyll a: 2.28 µg/L	Slope: Moderate, 10°-20°
Nitrate: 0.53 µmol	Estimated exposure: Very protected
Fluorescence: 1.64 FU	Turbidity: 0.53 NTU

Lyllal Harbour (LH) - Gulf Islands



Subtidal



Close up

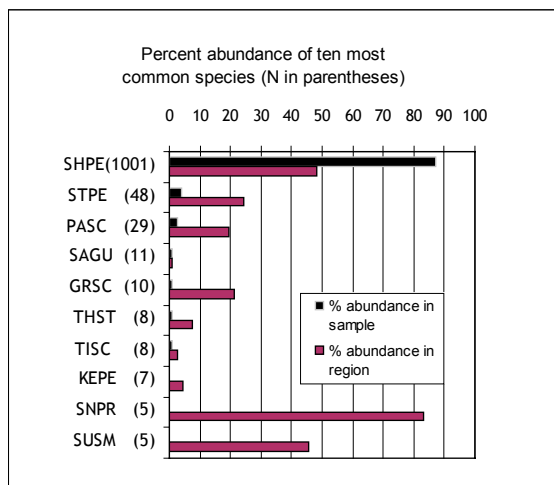
Eelgrass Health Index: 14

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

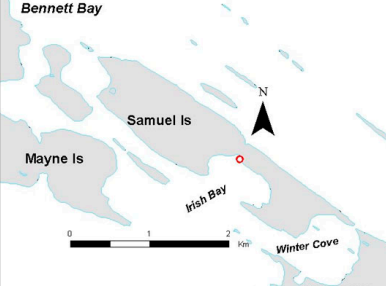
Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Ulva</i> & diatoms
Density: 211.1 shoots/m ²	Dry Biomass: 53 g/m ²
Tidal Range: Subtidal	Epiphyte Load: 45.58%
Biomass: 116.3 g/m ²	Intertidal bed area: N/A
Leaf area index: 1.34	Subtidal bed area: 1,896 m ²

Fish Summary

No. of Species: 18	No. of Individuals: 1147	Pielou's Evenness: 0.228	Taxonomic Distinctiveness: 88
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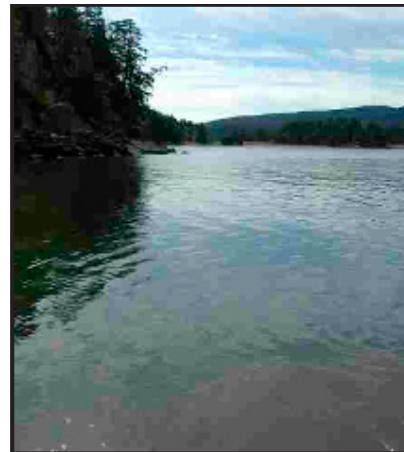
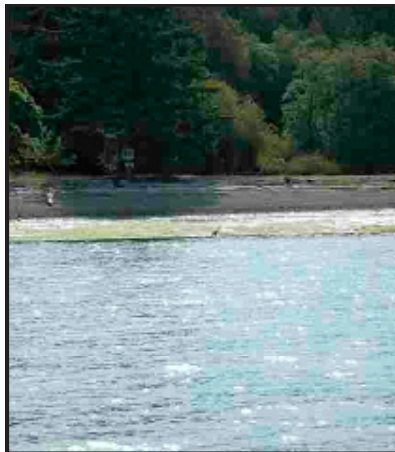
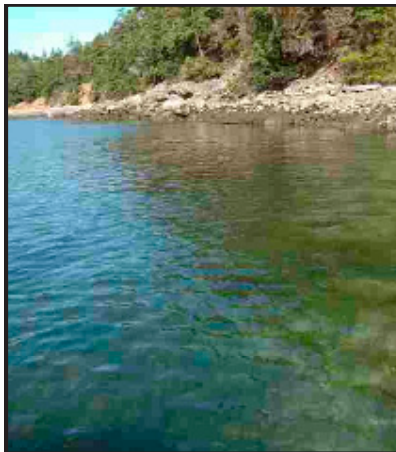


SPECIES		SPECIES	
ROCKFISH	BLRO	SEA PERCHES	KEPE
	BOCC		PIPE
	BRRO		SHPE
	CORO		STPE
	VERO	KELPFISH	CRKE
	YERO	GUNNELS	CRGU
SCULPINS	BUSC		PEGU
	CABE		ROGU
	FLSC		SAGU
	GRSC	PRICKLEBACKS	SNPR
	MASC		BLPR
	PASC		HICO
	RBSC		SLCO
	REIL	FLATFISHES	COSO
	SISC		ENSO
	SMSC		ROSO
	STSC		SPSA
	TASC		STFL
	TISC	GREENLING	WHGR
PLATED FISHES	THST		KEGR
	TUBE		PAGR
	BAPI		LING
CLINGFISHES	KECL	PREY FISHES	HERR
	NOCL		SUSM
GOBIES	BLGO		SAND
	BAGO		WALL
TOADFISH	PLMI	SALMONIDS	CHIN
			CHUM
			CUTT

Irish Bay	
UTM Coordinates : 484656 E : 5407660 N	
Date Sampled: Aug. 1, 2005 @ 10:30am	
Years Sampled: 2005	
Weather: sunny, light breeze & calm waters	
	



Thin and disturbed (EDI 22) subtidal bed in open bay over gravel over mud/sand and among understory of sea lettuce and laminariales. Some Gracilaria. The bed sampled was abutted to a sandstone shoreline. The epiphyte load was medium to heavy (30% DW, diatoms and Kornmannia; Smithora was seen in the underwater video). No incidence of wasting disease. The three species of perch accounted for 75% of the total catch with kelp perch being the second most abundant species at this site (46% of all kelp perch in caught in the region). Two copper rockfish juveniles were also caught.



Physical Characteristics

Environmental Index: 4

Temperature: 15°C	Sediment Composition: N/A
Salinity: 27.3 ppt	Silt-clay fraction: N/A
Chlorophyll a: 4.97 µg/L	Slope: N/A
Nitrate: N/A	Estimated exposure: N/A
Fluorescence: N/A	Turbidity: N/A

Irish Bay (IB) - Gulf Islands



Subtidal



Close up

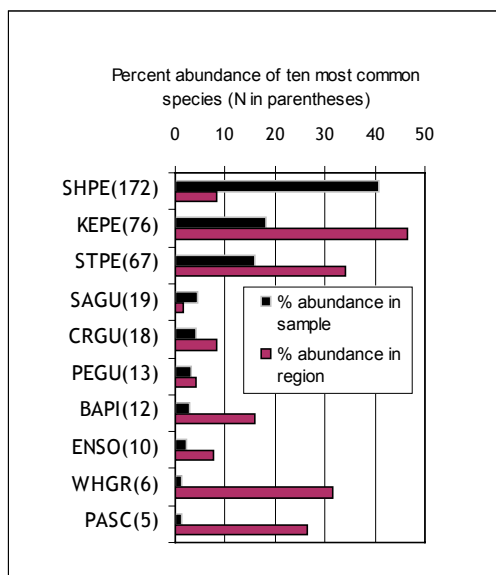
Eelgrass Health Index: 14

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: Diatoms & Ulva
Density: 277.8 shoots/m ²	Dry Biomass: 54 g/m ²
Tidal Range: Subtidal	Epiphyte Load: 37.27%
Biomass: 152.2 g/m ²	Intertidal bed area: N/A
Leaf area index: 2.68	Subtidal bed area: N/A

Fish Summary

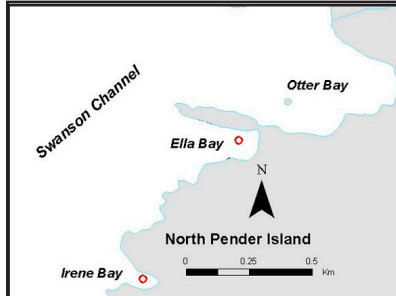
No. of Species: 20	No. of Individuals: 422	Pielou's Evenness: 0.645	Taxonomic Distinctiveness: 81
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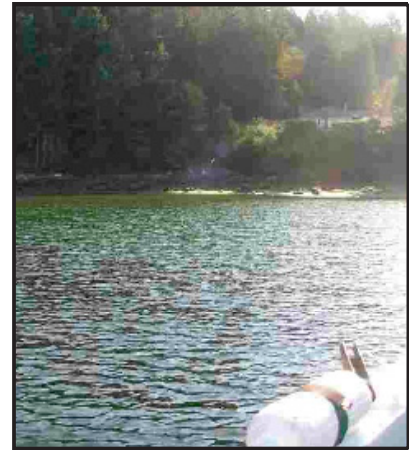
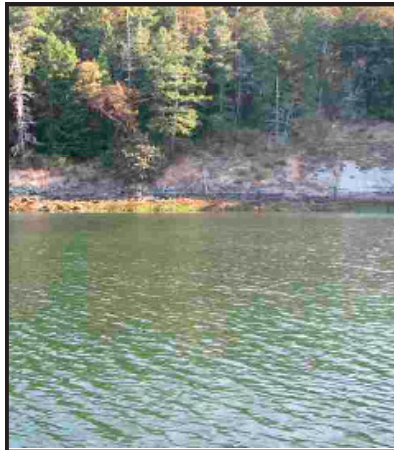
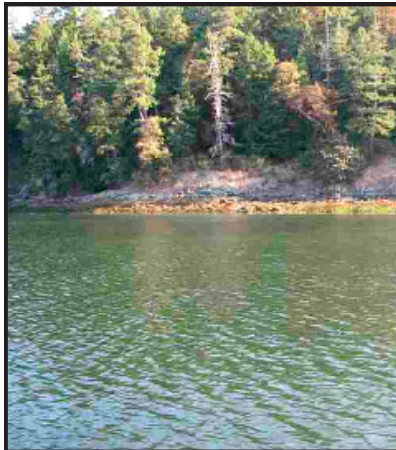
	SPECIES		SPECIES		
ROCKFISH	BLRO		SEA PERCHES	KEPE	•
	BOCC			PIPE	
	BRRO			SHPE	•
	CORO	•		STPE	•
	VERO		KELPFISH	CRKE	
	YERO		GUNNELS	CRGU	•
SCULPINS	BUSC			PEGU	•
	CABE	•		ROGU	
	FLSC			SAGU	•
	GRSC	•	PRICKLEBACKS	SNPR	
	MASC			BLPR	
	PASC	•		HICO	
	RBSC			SLCO	
	REIL	•	FLATFISHES	COSO	
	SISC			ENSO	•
	SMSC	•		ROSO	
	STSC	•		SPSA	
	TASC			STFL	•
	TISC	•	GREENLING	WHGR	•
PLATED FISHES	THST	•		KEGR	
	TUBE			PAGR	
	BAPI	•		LING	
CLINGFISHES	KECL		PREY FISHES	HERR	
	NOCL			SUSM	
GOBIES	BLGO			SAND	
	BAGO			WALL	
TOADFISH	PLMI	•	SALMONIDS	CHIN	
				CHUM	
				CUTT	

Irene

UTM Coordinates : 476801 E
 : 5404070 N
 Date Sampled: August 3, 2005 @ 9:10am
 Years Sampled: 2005
 Weather: Information not available



Patchy subtidal eelgrass bed (EDI 26) over sandy/gravelly bottom in a small and narrow bay. Eelgrass patches alternated between dense and thin. The bed had a dense understory and adjacent cover of *Ulva*. Algae such as *Gracilaria/Gracilariopsis* complex, Turkish towel, laminariales and sea lettuce were within and adjacent to the bed. The epiphyte load varied from medium to high (28% DW –mainly *Kornmannia* and diatoms). Gastropod eggs (likely chink shells) were visible on blades. No incidence of wasting disease. The site's catches were dominated by saddleback and penpoint gunnels (gunnels accounted for 60% of the fishes caught at the site). Shiner perch made up only 6% of the catch. Irene Bay's tubesnout catches accounted for 80% of the southern Gulf Islands tubesnout catch (24 of 30).



Physical Characteristics

Environmental Index: 8

Temperature: 14°C	Sediment Composition: N/A
Salinity: 27.1 ppt	Silt-clay fraction: N/A
Chlorophyll a: 2.85 µg/L	Slope: N/A
Nitrate: 0.42 µmol	Estimated exposure: N/A
Fluorescence: 2.15 FU	Turbidity: 0.31 NTU

Irene (IR) - Gulf Islands



Subtidal



Close up

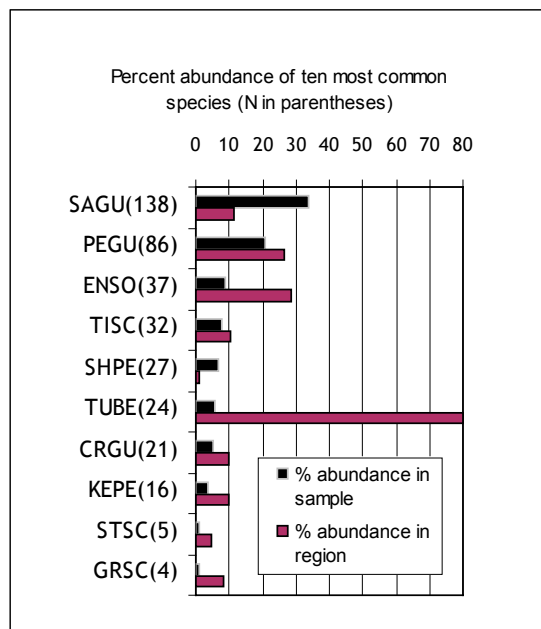
Eelgrass Health Index: 12

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

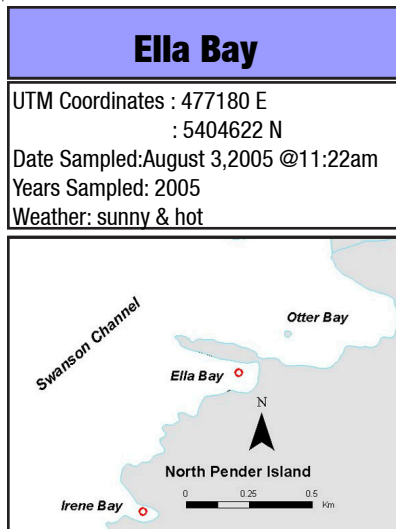
Ecotype: <i>Zostera marina</i>	Epiphyte: Diatoms & Ulva
Density: 814.3 shoots/m ²	Dry Biomass: 42 g/m ²
Tidal Range: Subtidal & small intertidal	Epiphyte Load: 28.9%
Biomass: 154.6 g/m ²	Intertidal bed area: N/A
Leaf area index: 1.98	Subtidal bed area: 1,143 m ²

Fish Summary

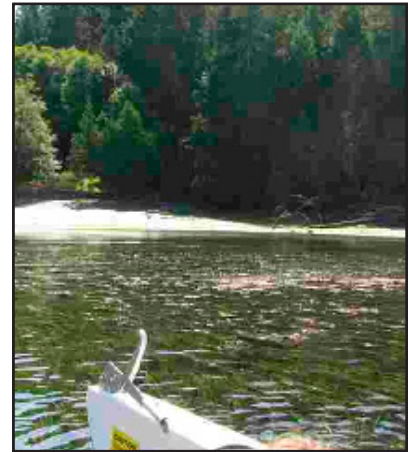
No. of Species: 21	No. of Individuals: 411	Pielou's Evenness: 0.690	Taxonomic Distinctiveness: 90
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SPECIES	SPECIES	SPECIES
ROCKFISH	BLRO	SEA PERCHES
	BOCC	KEPE
	BRRO	PIPE
	CORO	SHPE
	VERO	STPE
	YERO	KELPFISH
		CRKE
		GUNNELS
SCULPINS	BUSC	CRGU
	CABE	PEGU
	FLSC	ROGU
	GRSC	SAGU
	MASC	SNPR
	PASC	BLPR
	RBSC	HICO
	REIL	SLCO
	SISC	FLATFISHES
	SMSC	COSO
	STSC	ENSO
	TASC	ROSO
	TISC	SPSA
		STFL
		WHGR
PLATED FISHES	THST	GREENLING
	TUBE	KEGR
	BAPI	PAGR
		LING
CLINGFISHES	KECL	PREY FISHES
	NOCL	HERR
	BLGO	SUSM
GOBIES	BAGO	SAND
		WALL
TOADFISH	PLMI	SALMONIDS
		CHIN
		CHUM
		CUTT



Patchy subtidal eelgrass bed with dense patches in small and narrow bay adjacent to Irene Bay. (EDI 22) A heavy and dense understory cover of sea lettuce interspersed with laminariales clogged the seine nets. The video showed a heavy epiphyte load almost uniquely comprised of diatoms, and the subsequent analyses recorded it as heavy (53% DW; heaviest in the region and fourth highest among 2005 sites) and primarily composed of Smithora, diatoms and Kornmannia. No incidence of wasting disease. As in Irene Bay, saddleback gunnels were the most abundant fish caught. Shiner perch were the second most abundant species at this site. Gunnels accounted for 66% of the catch. A resident mentioned that this used to be prime sandlance habitat. A recently built seawall may have altered the original environment.



Physical Characteristics

Environmental Index: 10

Temperature: 15°C	Sediment Composition: N/A
Salinity: 27.2 ppt	Silt-clay fraction: N/A
Chlorophyll a: 4.97 µg/L	Slope: N/A
Nitrate: 0.61 µmol	Estimated exposure: N/A
Fluorescence: 3.21 FU	Turbidity: 0.28 NTU

Ella Bay (EL) - Gulf Islands



Subtidal



Close up

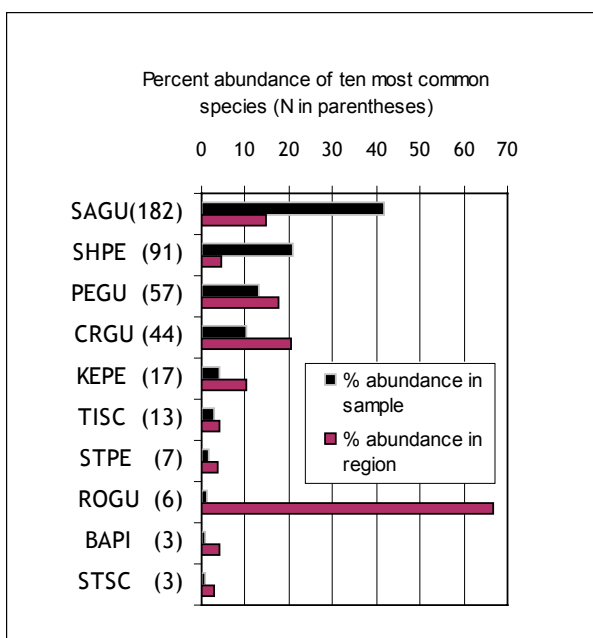
Eelgrass Health Index: 14

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Smithora naiadum</i> , diatoms & <i>Ulva</i>
Density: 622.2 shoots/m ²	Dry Biomass: 70 g/m ²
Tidal Range: Subtidal	Epiphyte Load: 51.21%
Biomass: 148.7 g/m ²	Intertidal bed area: N/A
Leaf area index: 1.55	Subtidal bed area: 5,872 m ²

Fish Summary

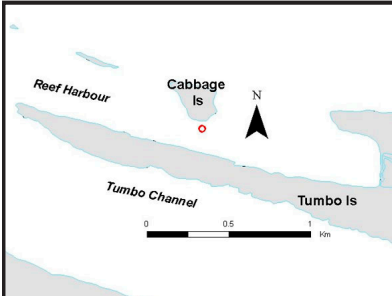
No. of Species: 17	No. of Individuals: 435	Pielou's Evenness: 0.624	Taxonomic Distinctiveness: 69
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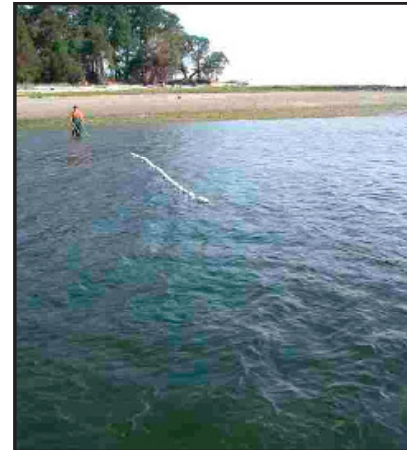
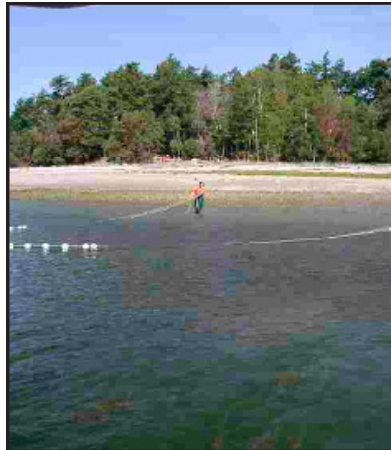
	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE •
	BOCC			PIPE
	BRRO			SHPE •
	CORO			STPE •
VERO			KELPFISH	CRKE
	YERO		GUNNELS	CRGU •
SCULPINS	BUSC			PEGU •
	CABE			ROGU •
	FLSC			SAGU •
	GRSC •		PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC •			HICO
	RBSC			SLCO
	REIL •		FLATFISHES	COSO
	SISC •			ENSO
	SMSC			ROSO
	STSC •			SPSA
	TASC			STFL
	TISC •		GREENLING	WHGR •
PLATED FISHES	THST •			KEGR
	TUBE			PAGR
	BAPI •			LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI •		SALMONIDS	CHIN
				CHUM
				CUTT

Cabbage

UTM Coordinates : 493634 E
 : 5404873 N
 Date Sampled: August 4, 2005 @10:10am
 Years Sampled: 2005
 Weather: sun & NE wind



Thick, stressed (EDI 26) and mostly subtidal bed in an area heavily used by boaters (moorage site, recreation). The site had the second heaviest epiphyte load in the region (47% DW; mostly *Ulva*, diatoms, *Smithora* and *Kornmannia*). Many bubble shells were on the blades and sea perch were feeding on their egg masses. A bed of laminariales was at the western edge of the eelgrass bed on Tumbo Island's rocky slope. Shiner perch were the most abundant species caught.



Physical Characteristics

Environmental Index: 10

Temperature: 19°C	Sediment Composition: N/A
Salinity: 19.8 ppt	Silt-clay fraction: N/A
Chlorophyll a: 2.81 µg/L	Slope: N/A
Nitrate: N.D.	Estimated exposure: N/A
Fluorescence: 2.15 FU	Turbidity: 0.31 NTU

Cabbage (CA) - Gulf Islands



Subtidal



Close up

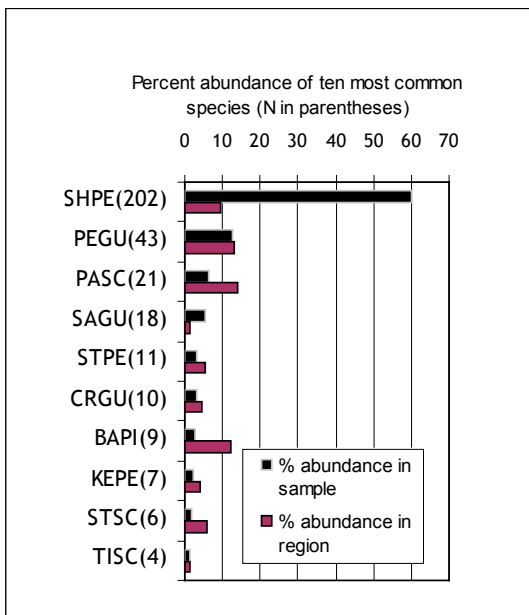
Eelgrass Health Index: 14

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Enteromorpha linza</i> , diatoms, <i>Ulva</i> & <i>Pleonosporium vancouverianum</i>
Density: 277.8 shoots/m ²	Dry Biomass: 72 g/m ²
Tidal Range: Subtidal & small intertidal	Epiphyte Load: 51.21%
Biomass: 163.3 g/m ²	Intertidal bed area: N/A
Leaf area index: 1.72	Subtidal bed area: 5,872 m ²

Fish Summary

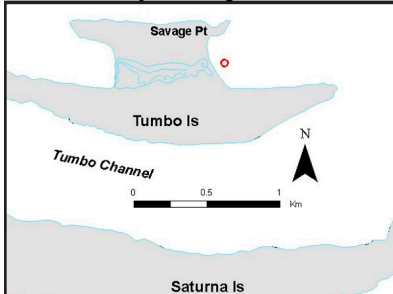
No. of Species: 14	No. of Individuals: 337	Pielou's Evenness: 0.572	Taxonomic Distinctiveness: 79
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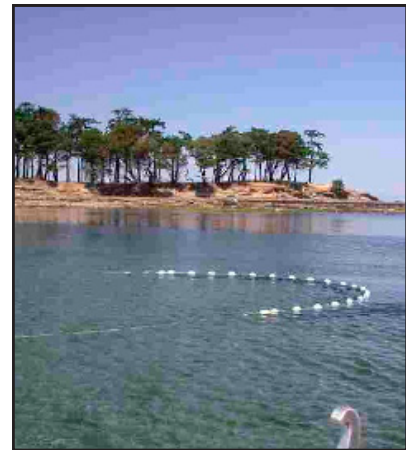
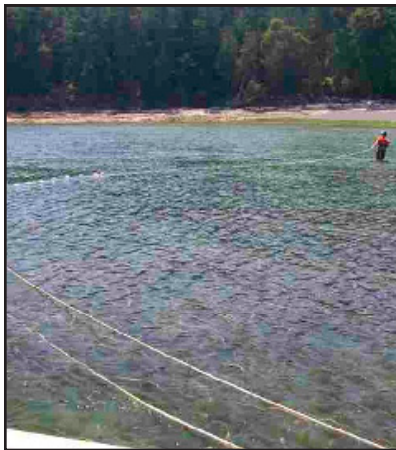
	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE •
	BOCC			PIPE
	BRRO			SHPE •
	CORO			STPE •
	VERO		KELPFISH	CRKE
	YERO		GUNNELS	CRGU •
SCULPINS	BUSC			PEGU •
	CABE			ROGU
	FLSC			SAGU •
	GRSC	•	PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL	•	FLATFISHES	COSO
	SISC			ENSO •
	SMSC			ROSO
	STSC	•		SPSA
	TASC			STFL •
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST			KEGR
	TUBE			PAGR
	BAPI	•		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI		SALMONIDS	CHIN
				CHUM
				CUTT

Tumbo Island

UTM Coordinates : 495476 E
 : 5404688 N
 Date Sampled: Aug. 4, 2005 @ 12:17pm
 Years Sampled: 2004, 2005
 Weather: sunny with a light NW wind



Thin and patchy subtidal bed on a gravel and mud substrate in the shallow subtidal, becoming sandy in the deeper area (EDI 28). Weak slope (1-3%). Dense understory of sea lettuce and some laminariales. A sea lettuce band lied between the shore end of the bed and the intertidal zone. The epiphyte load was heavy (diatoms, Kornmannia, Smithora) as judged from photos (no blades were collected). No incidence of wasting disease. Saddleback gunnells were abundant (42% of the catch) and gunnells accounted for 58% of fish caught. Juvenile English soles were unusually abundant (58 of the 130 individuals from this species caught in the region). Two juvenile copper rockfish were also caught.



Physical Characteristics

Environmental Index: 10

Temperature: 19°C

Sediment Composition: Mud & sand substrate

Salinity: 22.1 ppt

Silt-clay fraction: 6.1%

Chlorophyll a: 0.69 µg/l

Slope: Flat, <10°

Nitrate: 0.43 µmol

Estimated exposure: Protected

Fluorescence: 2.31 FU

Turbidity: 0.20 NTU

Tumbo Island (TI) - Gulf Islands



Subtidal



Close up

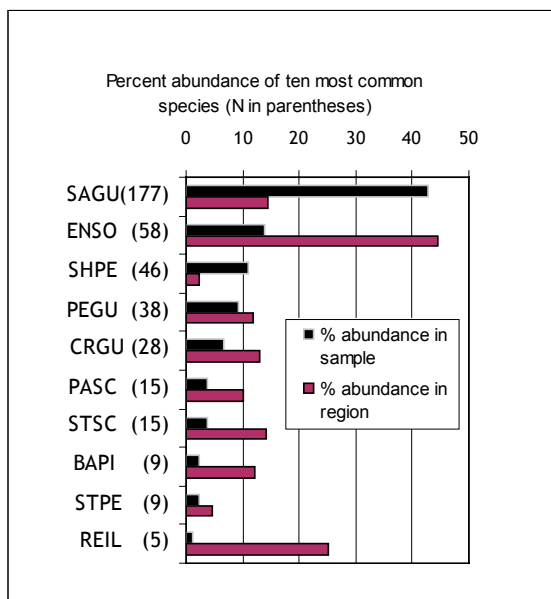
Eelgrass Health Index: 6

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: N/A
Density: N/A	Dry Biomass: N/A
Tidal Range: Subtidal	Epiphyte Load: N/A
Biomass: N/A	Intertidal bed area: N/A
Leaf area index: N/A	Subtidal bed area: 51,530 m ²

Fish Summary

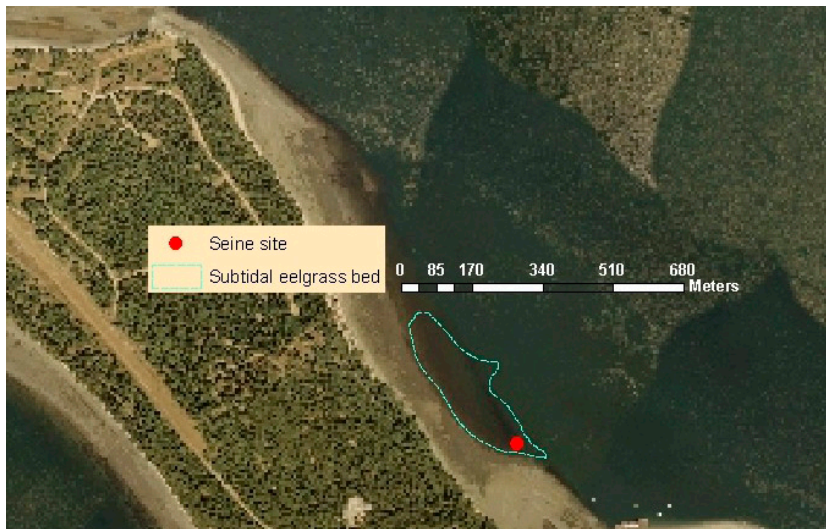
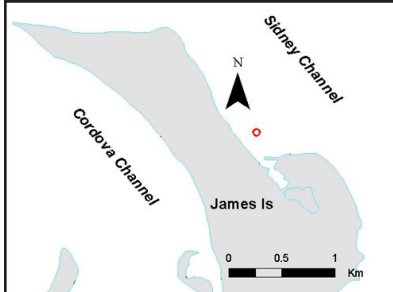
No. of Species: 18	No. of Individuals: 414	Pielou's Evenness: 0.667	Taxonomic Distinctiveness: 91
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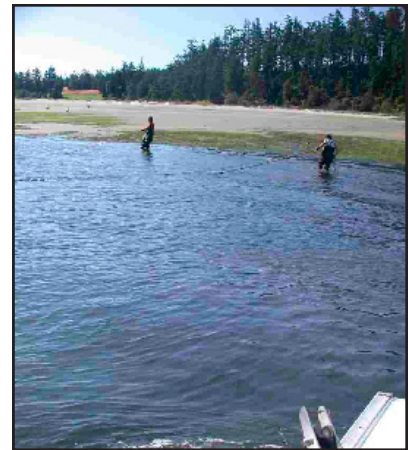
	SPECIES		SPECIES		
ROCKFISH	BLRO		SEA PERCHES	KEPE	•
	BOCC			PIPE	
	BRRO			SHPE	•
	CORO	•		STPE	•
	VERO		KELPFISH	CRKE	
	YERO		GUNNELS	CRGU	•
SCULPINS	BUSC	•		PEGU	•
	CABE	•		ROGU	
	FLSC			SAGU	•
	GRSC		PRICKLEBACKS	SNPR	
	MASC			BLPR	
	PASC	•		HICO	
	RBSC			SLCO	
	REIL	•	FLATFISHES	COSO	•
	SISC			ENSO	•
	SMSC			ROSO	
	STSC	•		SPSA	
	TASC			STFL	
	TISC	•	GREENLING	WHGR	•
PLATED FISHES	THST	•		KEGR	
	TUBE			PAGR	
	BAPI	•		LING	
CLINGFISHES	KECL		PREY FISHES	HERR	
	NOCL			SUSM	
GOBIES	BLGO			SAND	
	BAGO			WALL	
TOADFISH	PLMI		SALMONIDS	CHIN	
				CHUM	
				CUTT	

James Island

UTM Coordinates : 474410 E
 : 5383956 N
 Date Sampled: August 5, 2005 @ 9:51am
 Years Sampled: 2004, 2005
 Weather: Information not available



Thick but stressed (EDI 22) subtidal bed over muddy substrate adjacent to a golf course and a dock. A thick band of sea hair and sea lettuce between the high subtidal zone and the edge of the eelgrass bed harboured many juvenile Dungeness crabs (5-22 mm carapace width). The epiphyte load ranged from medium to heavy (18% DW), primarily diatoms and *Ulva linza*. Some juvenile green sea urchins (*Strongylocentrotus droebachiensis*) were recorded. A dogfish (*Squalus acanthias*) was seen swimming in the eelgrass bed. The video (filmed one month later) showed the bed as patchy, thin at times with laminariales in the understory and *Ulva* common in the surrounding area. The epiphyte load was heavy, with eelgrass blades covered with diatoms. Invertebrate egg masses (probably nudibranch) were also common on the blades. No incidence of wasting disease. The site had the second most abundant fish catches for the region, most of which made by juvenile saddleback gunnels (80% of the site catch and 46% of the region's saddleback catches). Buffalo and great sculpins were also unusually common.

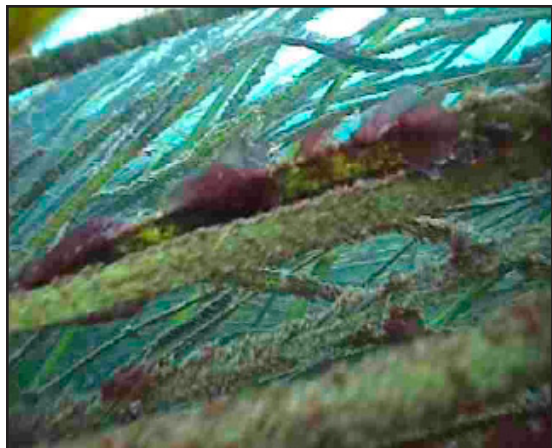


Physical Characteristics

Environmental Index: 6

Temperature: 14°C	Sediment Composition: Sand & fine gravel substrate
Salinity: 28.2 ppt	Silt-clay fraction: 2.1%
Chlorophyll a: 5.63 µg/L	Slope: Flat, <10°
Nitrate: 0.42 µmol	Estimated exposure: Semi-protected
Fluorescence: 1.49 FU	Turbidity: 0.03 NTU

James Island (JI) - Gulf Islands



Subtidal



Close up

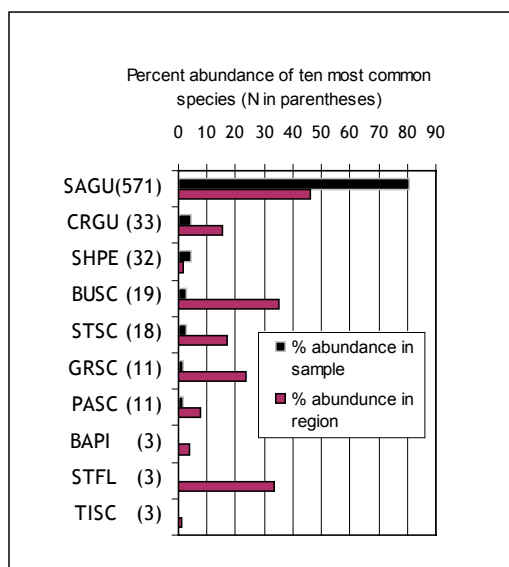
Eelgrass Health Index: 16

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: <i>Enteromorpha linza</i> , diatoms & <i>Ulva</i>
Density: 422.2 g/m ²	Dry Biomass: 20 g/m ²
Tidal Range: Subtidal & small intertidal	Epiphyte Load: 21.34%
Biomass: 99.2 g/m ²	Intertidal bed area: N/A
Leaf area index: 1.62	Subtidal bed area: 41.410 m ²

Fish Summary

No. of Species: 13	No. of Individuals: 710	Pielou's Evenness: 0.349	Taxonomic Distinctiveness: 81
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SPECIES		SPECIES	
ROCKFISH	BLRO	SEA PERCHES	KEPE
	BOCC		PIPE
	BRRO		SHPE
	CORO		STPE
	VERO	KELPFISH	CRKE
	YERO	GUNNELS	CRGU
SCULPINS	BUSC		PEGU
	CABE		ROGU
	FLSC		SAGU
	GRSC	PRICKLEBACKS	SNPR
	MASC		BLPR
	PASC		HICO
	RBSC		SLCO
	REIL	FLATFISHES	COSO
	SISC		ENSO
	SMSC		ROSO
	STSC		SPSA
	TASC		STFL
	TISC	GREENLING	WHGR
PLATED FISHES	THST		KEGR
	TUBE		PAGR
	BAPI		LING
CLINGFISHES	KECL	PREY FISHES	HERR
	NOCL		SUSM
GOBIES	BLGO		SAND
	BAGO		WALL
TOADFISH	PLMI	SALMONIDS	CHIN
			CHUM
			CUTT

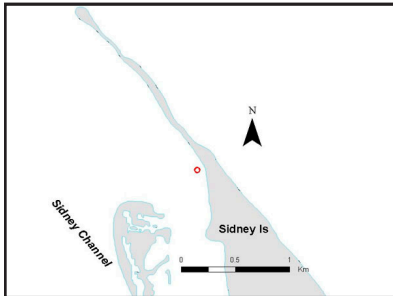
Sidney Spit

UTM Coordinates : 475597 E
: 5387573 N

Date Sampled: Aug. 5, 2005 @ 12:25pm

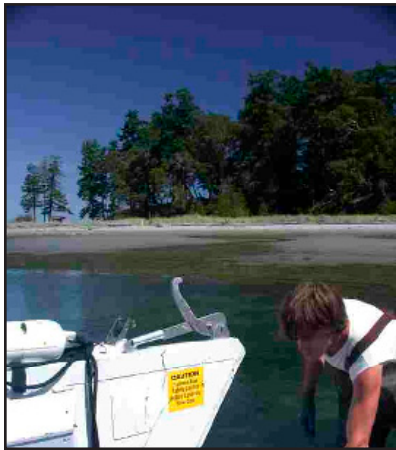
Years Sampled: 2004, 2005

Weather: sunny & calm waters



GIS Map not available

Thick, extensive, mostly subtidal bed but with a small intertidal component on muddy substrate. The site was located near the dock in a heavily used recreation area and ranked as disturbed (EDI 22). Bubble shells were spawning and clogged the nets, which may have decreased the catch efficiency. The epiphyte load, as judged from photos and video footage taken in September (no blades were collected), was heavy and consisted primarily of diatoms. No incidence of wasting disease. Shiner perch and sticklebacks were the most abundant fishes caught, and staghorn and buffalo sculpins were unusually abundant for the region. Great Blue herons are known to forage here.



Physical Characteristics

Environmental Index: 6

Temperature: 17°C

Sediment Composition: Mud & sand substrate

Salinity: 28.6 ppt

Silt-clay fraction: 17.2%

Chlorophyll a: 1.29 µg/L

Slope: Flat, <10°

Nitrate: 0.35 µmol

Estimated exposure: Very protected

Fluorescence: 0.70 FU

Turbidity: 0.04 NTU

Sidney Spit (SS) - Gulf Islands



Subtidal



Close up

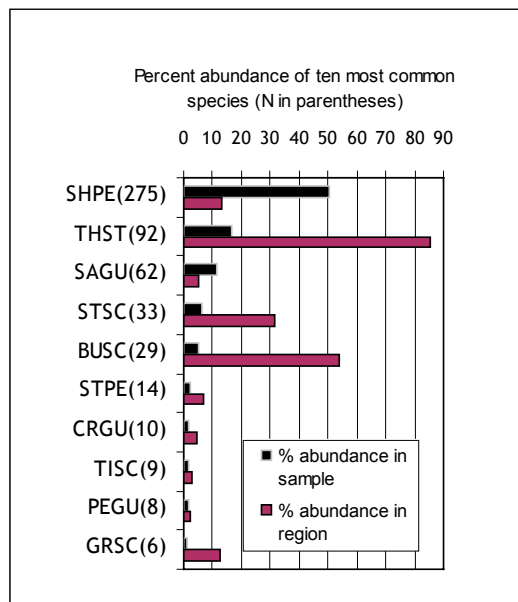
Eelgrass Health Index: 6

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: N/A
Density: 814.3 g/m ²	Dry Biomass: N/A
Tidal Range: Subtidal & small intertidal	Epiphyte Load: N/A
Biomass: 154.6 g/m ²	Intertidal bed area: N/A
Leaf area index: 1.98	Subtidal bed area: 69,050 m ²

Fish Summary

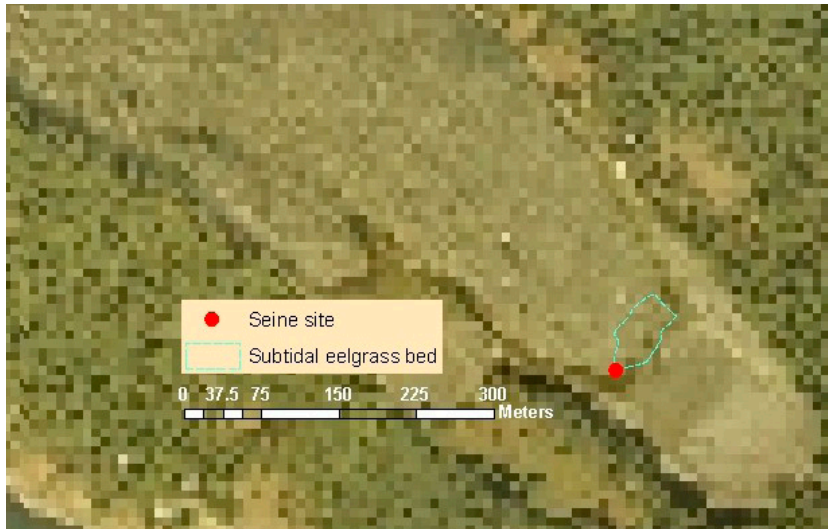
No. of Species: 15	No. of Individuals: 548	Pielou's Evenness: 0.613	Taxonomic Distinctiveness: 86
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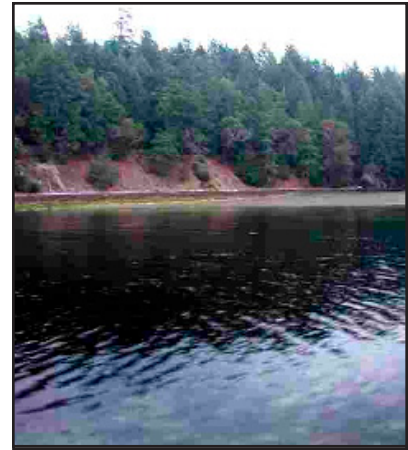
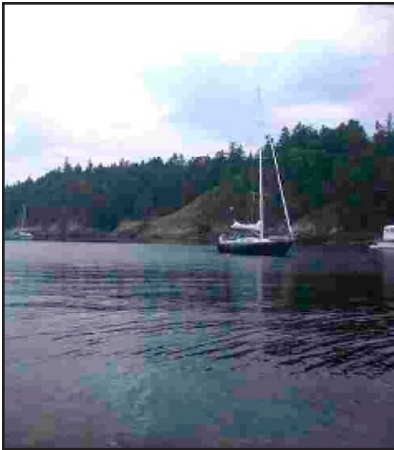
SPECIES		SPECIES	
ROCKFISH	BLRO	SEA PERCHES	KEPE
	BOCC		PIPE
	BRRO		SHPE
	CORO		STPE
	VERO	KELPFISH	CRKE
	YERO	GUNNELS	CRGU
SCULPINS	BUSC		PEGU
	CABE		ROGU
	FLSC		SAGU
	GRSC	PRICKLEBACKS	SNPR
	MASC		BLPR
	PASC		HICO
	RBSC		SLCO
	REIL	FLATFISHES	COSO
	SISC		ENSO
	SMSC		ROSO
	STSC		SPSA
	TASC		STFL
	TISC	GREENLING	WHGR
PLATED FISHES	THST		KEGR
	TUBE		PAGR
	BAPI		LING
CLINGFISHES	KECL	PREY FISHES	HERR
	NOCL		SUSM
GOBIES	BLGO		SAND
	BAGO		WALL
TOADFISH	PLMI	SALMONIDS	CHIN
			CHUM
			CUTT

James Bay

UTM Coordinates : 470854 E
 : 5409793 N
 Date Sampled: Sept. 14, 2005 @ 7:25am
 Years Sampled: 2004, 2005
 Weather: overcast with calm winds



Stressed (EDI 22) subtidal bed in a narrow bay on Prevost Island. Bed patchy, thin at times, on mud with an understory of laminariales. Sea lettuce common in the surrounding area. The epiphyte load as judged from the video was heavy, with blades covered with diatoms and Smithora. No incidence of wasting disease. Tidepool sculpins and plainfin midshipman juveniles (the latter accounting for 88% of the region's catch for this species) were the most abundant species. One juvenile copper rockfish was caught at this site.



Physical Characteristics	
Environmental Index: 14	
Temperature: 14°C	Sediment Composition: Fine mud substrate
Salinity: 27.8 ppt	Silt-clay fraction: N/A
Chlorophyll a: 16.64 µg/L	Slope: Moderate, 10° - 20°
Nitrate: 4.03 µmol	Estimated exposure: Very protected
Fluorescence: 2.82 FU	Turbidity: 0.64 NTU

James Bay (J) - Gulf Islands



Subtidal



Close up

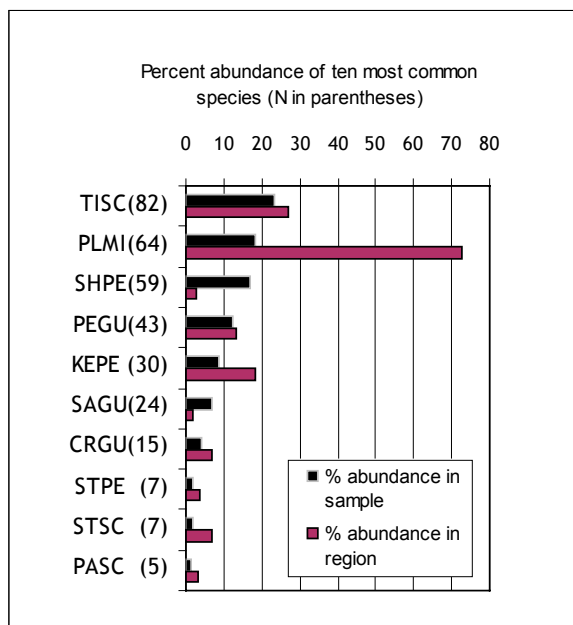
Eelgrass Health Index: 6

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: N/A
Density: N/A	Dry Biomass: N/A
Tidal Range: Subtidal & small intertidal	Epiphyte Load: N/A
Biomass: N/A	Intertidal bed area: N/A
Leaf area index: N/A	Subtidal bed area: 2,503 m ²

Fish Summary

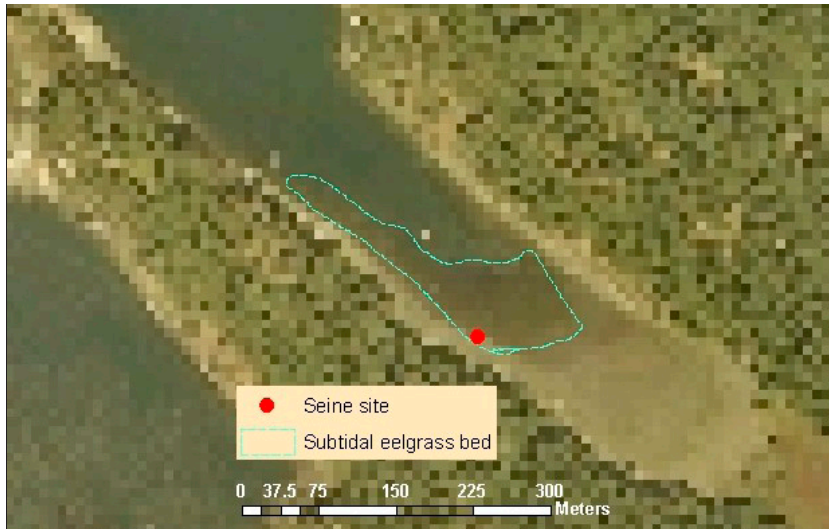
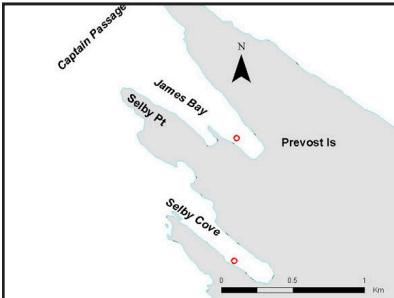
No. of Species: 18	No. of Individuals: 353	Pielou's Evenness: 0.755	Taxonomic Distinctiveness: 88
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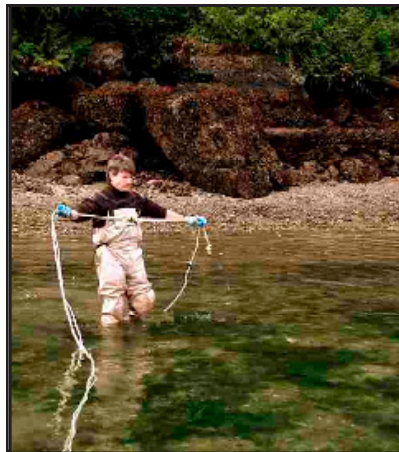
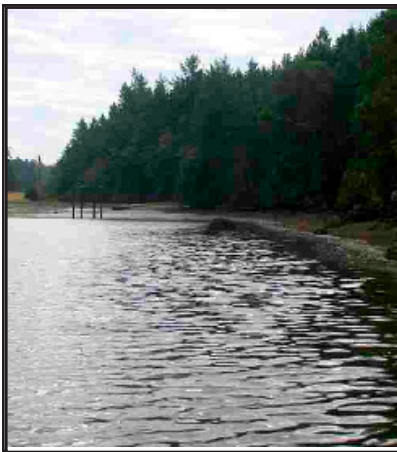
SPECIES		SPECIES	
ROCKFISH	BLRO	SEA PERCHES	KEPE •
	BOCC		PIPE
	BRRO		SHPE •
	CORO •		STPE •
	VERO	KELPFISH	CRKE
	YERO	GUNNELS	CRGU •
SCULPINS	BUSC •		PEGU •
	CABE		ROGU
	FLSC		SAGU •
	GRSC	PRICKLEBACKS	SNPR
	MASC		BLPR •
	PASC •		HICO
	RBSC		SLCO
	REIL •	FLATFISHES	COSO
	SISC •		ENSO
	SMSC		ROSO
	STSC •		SPSA
	TASC		STFL
	TISC •	GREENLING	WHGR
PLATED FISHES	THST		KEGR
	TUBE •		PAGR
	BAPI •		LING
CLINGFISHES	KECL	PREY FISHES	HERR
	NOCL		SUSM
GOBIES	BLGO		SAND
	BAGO		WALL •
TOADFISH	PLMI •	SALMONIDS	CHIN
			CHUM
			CUTT

Selby Cove

UTM Coordinates : 470840 E
 : 5408935 N
 Date Sampled: Sept. 14, 2005 @ 9:58am
 Years Sampled: 2005
 Weather: Information not available



Subtidal bed in a narrow bay south of James Bay (EDI 22). The eelgrass bed was dense on a muddy bottom, its surroundings covered with diatom mats. A scattered band of sea lettuce lied between the intertidal zone and the shallower end of the bed. The substrate was primarily boulders and cobbles in the low intertidal. Algae belonging to the *Gracilaria/Gracilariopsis* complex were common near the eelgrass. The epiphyte load as judged from the video was heavy, with blades covered with diatoms; egg masses (likely nudibranch) were also common on the blades, and bubble shells were abundant. No incidence of wasting disease. Oysters (*Crassostrea gigas*) were common in the intertidal zone. The site had the second lowest fish abundance in the Gulf Islands, perhaps due to sampling in September. As with James Bay, tidepool sculpins were the most abundant fish caught.



Physical Characteristics	
Environmental Index: 14	
Temperature: 13°C	Sediment Composition: N/A
Salinity: 28.3 ppt	Silt-clay fraction: N/A
Chlorophyll a: 7.01 µg/L	Slope: N/A
Nitrate: 7.78 µmol	Estimated exposure: N/A
Fluorescence: 2.28 FU	Turbidity: 0.72 NTU

Selby Cove (SEC) - Gulf Islands



Subtidal



Close up

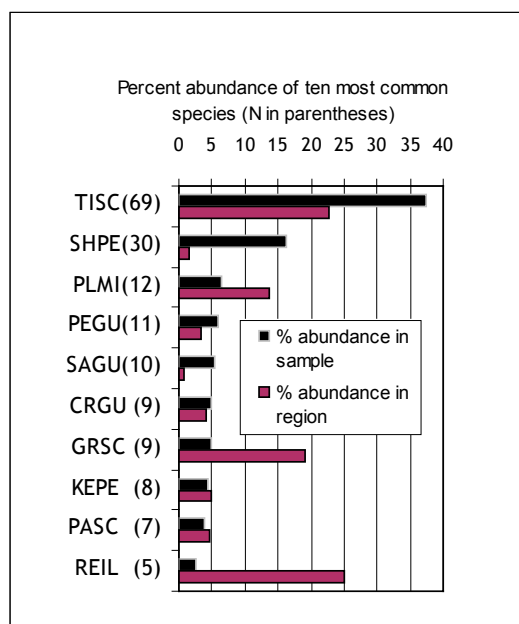
Eelgrass Health Index: 6

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: N/A
Density: N/A	Dry Biomass: N/A
Tidal Range: Subtidal	Epiphyte Load: N/A
Biomass: N/A	Intertidal bed area: N/A
Leaf area index: N/A	Subtidal bed area: 14,380 m ²

Fish Summary

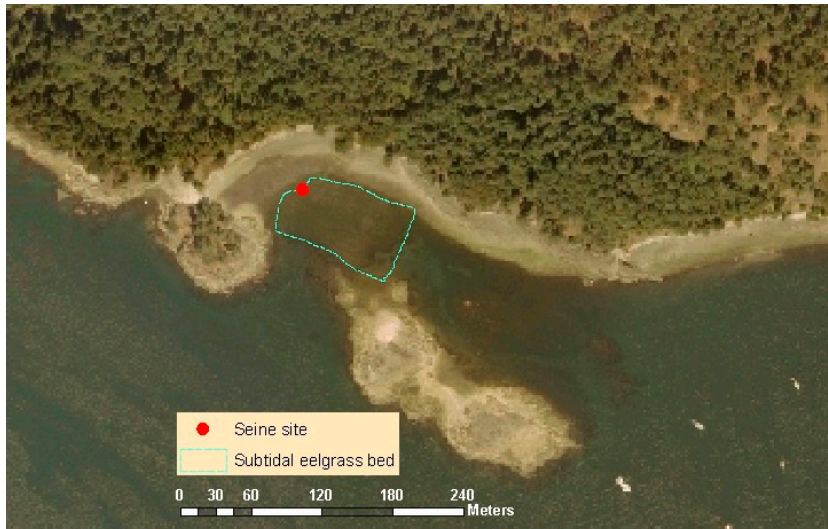
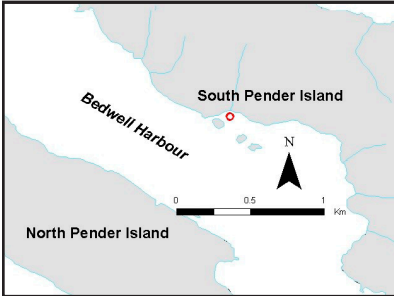
No. of Species: 17	No. of Individuals: 185	Pielou's Evenness: 0.764	Taxonomic Distinctiveness: 83
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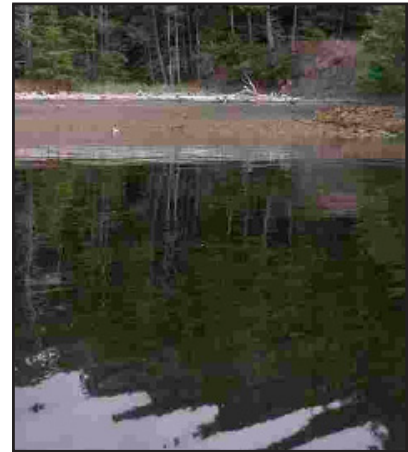
SPECIES		SPECIES	
ROCKFISH	BLRO	SEA PERCHES	KEPE
	BOCC		PIPE
	BRRO		SHPE
	CORO		STPE
	VERO	KELPFISH	CRKE
	YERO	GUNNELS	CRGU
SCULPINS	BUSC		PEGU
	CABE		ROGU
	FLSC		SAGU
	GRSC	PRICKLEBACKS	SNPR
	MASC		BLPR
	PASC		HICO
	RBSC		SLCO
	REIL	FLATFISHES	COSO
	SISC		ENSO
	SMSC		ROSO
	STSC		SPSA
	TASC		STFL
	TISC	GREENLING	WHGR
PLATED FISHES	THST		KEGR
	TUBE		PAGR
	BAPI		LING
CLINGFISHES	KECL	PREY FISHES	HERR
	NOCL		SUSM
GOBIES	BLGO		SAND
	BAGO		WALL
TOADFISH	PLMI	SALMONIDS	CHIN
			CHUM
			CUTT

Beaumont

UTM Coordinates : 482354 E
 : 5400132 N
 Date Sampled: Sept. 15, 2005 @ 8:45am
 Years Sampled: 2004, 2005
 Weather: Information not available



Patchy subtidal bed in a gravel/cobble sheltered cove. The bed was thin at times and interspersed with woody debris and some laminariales; it was categorized as disturbed (EDI 26) and its surrounding area was diatom mat-covered mud, with many siphons (possibly roughmyas) protruding. The epiphyte load was heavy with blades covered with diatoms. Shiner perch dominated the fish catches and bay pipefish were unusually common (37% of all individuals of this species caught in the region).



Physical Characteristics	
Environmental Index: 10	
Temperature: 13°C	Sediment Composition: Fine mud substrate
Salinity: 28.7 ppt	Silt-clay fraction: 15.4%
Chlorophyll a: 2.42 µg/L	Slope: Moderate, 10° - 20°
Nitrate: 1.35 µmol	Estimated exposure: Very protected
Fluorescence: 1.68 FU	Turbidity: 0.17 NTU

Beaumont (BM) - Gulf Islands



Subtidal



Close up

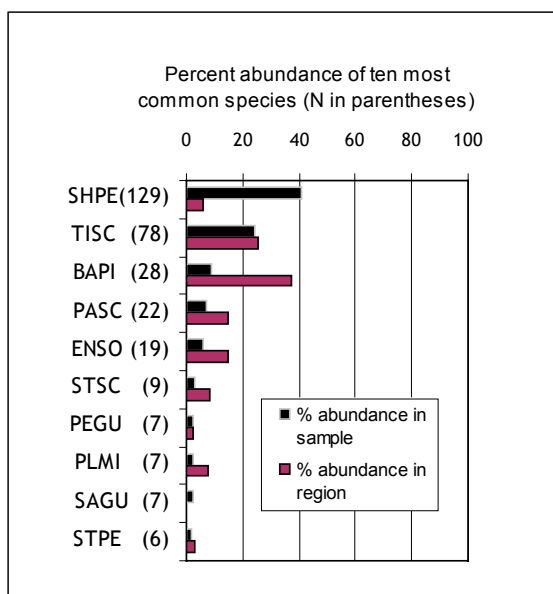
Eelgrass Health Index: 6

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: N/A
Density: N/A	Dry Biomass: N/A
Tidal Range: Subtidal	Epiphyte Load: N/A
Biomass: N/A	Intertidal bed area: N/A
Leaf area index: N/A	Subtidal bed area: 6,177 m ²

Fish Summary

No. of Species: 16	No. of Individuals: 318	Pielou's Evenness: 0.654	Taxonomic Distinctiveness: 90
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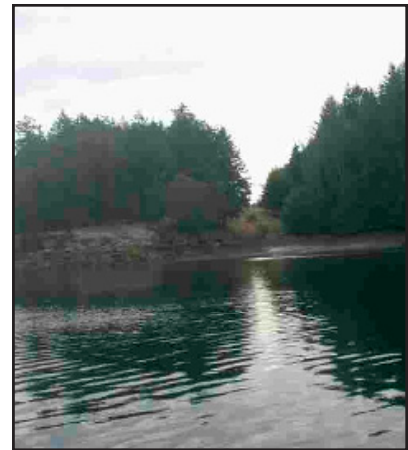
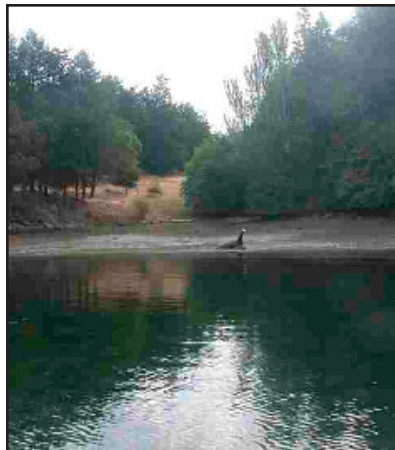
	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE
	BOCC			PIPE
	BRRO			SHPE
	CORO	•		STPE
	VERO		KELPFISH	CRKE
	YERO		GUNNELS	CRGU
SCULPINS	BUSC	•		PEGU
	CABE			ROGU
	FLSC			SAGU
	GRSC		PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO
	SMSC			ROSO
	STSC	•		SPSA
	TASC			STFL
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST	•		KEGR
	TUBE			PAGR
	BAPI	•		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI	•	SALMONIDS	CHIN
				CHUM
				CUTT

Narvaez

UTM Coordinates : 492635 E
: 5402426 N
Date Sampled: Sept. 15, 2005 @10:20am
Years Sampled: 2005
Weather: Information not available



Thin and small subtidal bed at the tip of the north point of a small cove. (EDI 22) The subtidal eelgrass shoots were heavily loaded with epiphytes (diatoms) and well spaced. No incidence of wasting disease. The understory was covered by sea lettuce on mud/sand bottom, with some laminariales scattered throughout. Slender crabs and sunflower stars were common. Many fishes were seen in the video, such as shiner and striped perch, English soles (the latter not recorded in the catches) and (possibly) juvenile rockfish. Although this site had the lowest fish abundance, it harboured an unusual ichthyofauna: 12/19 of all juvenile copper rockfish, 7/10 slender cockscombs, and 6/11 surf smelts caught in the whole region.



Physical Characteristics	
Environmental Index: 12	
Temperature: 12°C	Sediment Composition: N/A
Salinity: 28.5 ppt	Silt-clay fraction: N/A
Chlorophyll a: 2.54 µg/L	Slope: N/A
Nitrate: 13.22 µmol	Estimated exposure: N/A
Fluorescence: 1.25 FU	Turbidity: 0.12 NTU

Narvaez (N) - Gulf Islands



Subtidal



Close up

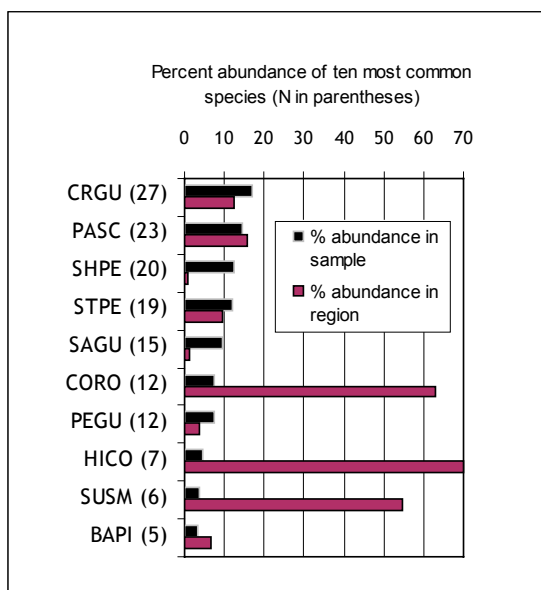
Eelgrass Health Index: 6

BIOLOGICAL CHARACTERISTICS OF EELGRASS BED AND EPIPHYTES

Ecotype: <i>Zostera marina</i>	Epiphyte: N/A
Density: N/A	Dry Biomass: N/A
Tidal Range: Subtidal	Epiphyte Load: N/A
Biomass: N/A	Intertidal bed area: N/A
Leaf area index: N/A	Subtidal bed area: 3,171 m ²

Fish Summary

No. of Species: 16	No. of Individuals: 160	Pielou's Evenness: 0.875	Taxonomic Distinctiveness: 81
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	SPECIES		SPECIES	
ROCKFISH	BLRO		SEA PERCHES	KEPE
	BOCC			PIPE
	BRRO			SHPE
	CORO	•		STPE
	VERO		KELPFISH	CRKE
	YERO		GUNNELS	CRGU
SCULPINS	BUSC			PEGU
	CABE			ROGU
	FLSC			SAGU
	GRSC	•	PRICKLEBACKS	SNPR
	MASC			BLPR
	PASC	•		HICO
	RBSC			SLCO
	REIL		FLATFISHES	COSO
	SISC			ENSO
	SMSC			ROSO
	STSC			SPSA
	TASC	•		STFL
	TISC	•	GREENLING	WHGR
PLATED FISHES	THST			KEGR
	TUBE	•		PAGR
	BAPI	•		LING
CLINGFISHES	KECL		PREY FISHES	HERR
	NOCL			SUSM
GOBIES	BLGO			SAND
	BAGO			WALL
TOADFISH	PLMI		SALMONIDS	CHIN
				CHUM
				CUTT

3.0 DESCRIPTION OF SAMPLING METHODS

In section 3 of this report we describe the sampling approaches used for the collection of each environmental, eelgrass and fish parameter.

3.1 Environmental Properties - Field Sampling

Measurements of water temperature, salinity, and dissolved oxygen were taken using a YSI meter replicate at each eelgrass bed after each beach seine (3 measurements total). Measurements were taken 50 cm below the surface, and recorded to the nearest decimal place. Replicate surface water samples were also taken at each site. The one litre Nalgene bottle should be rinsed twice with surface water, and then filled, labelled and placed in a coleman cooler.

3.2 Environmental Properties - Laboratory Sampling

3.2.1 Equipment

- Filtering apparatus (1L reservoir base, circular plastic screen, 500 ml top reservoir, rubber tubing attached to hand pump, and plug for one side of reservoir base)
- Microfiber filter paper (4.7 cm diameter, 1 per sample)
- 20 ml plastic Nalgene® bottle (1 per sample)
- Tin foil, charcoal pencil, waterproof paper for labels



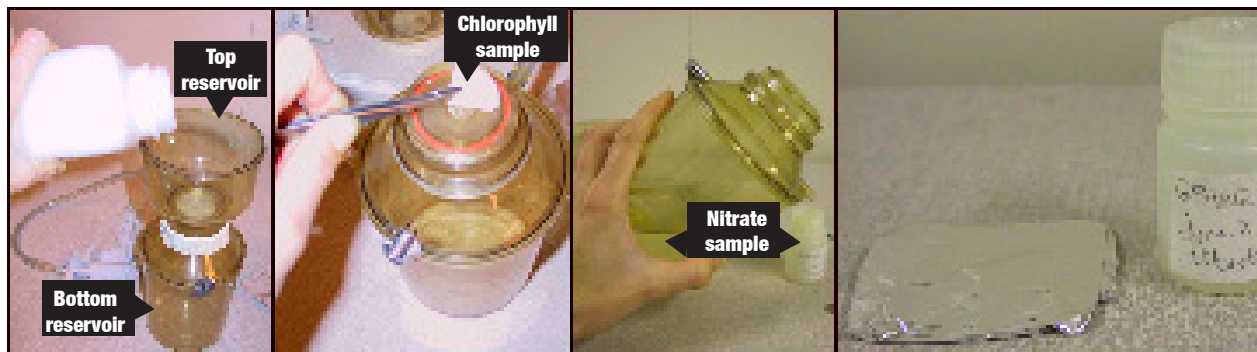
FIGURE 2.1 Nitrate, chlorophyll and fluorescence lab equipment

- Distilled water, fluorometer, eyedropper, lens paper

3.2.2 Nitrate and chlorophyll lab protocol

1. Keep water samples cool until you work them up, and work up water samples the same day they are collected.
2. Cut a square piece of tin foil (15 cm X 15 cm), and include a label written on waterproof paper (site name, sampling date, and amount of water filtered).
3. Using the charcoal pencil write the site name, sampling date and amount of water filtered on the outside of the 25 ml Nalgene bottle.
4. Using forceps, place one glass microfiber filter paper (4.7 cm) on the water filter apparatus.

FIGURE 2.2 Nitrate and chlorophyll lab analysis steps



Do not touch the filter paper with your fingers, as it will contaminate the sample.

5. Assemble water filter apparatus and lightly shake the 1 l water sample. Shaking water sample ensures that particles are evenly distributed throughout the sample.
6. Pour 500 ml into the top filter apparatus reservoir.
7. Strain water through the filter by creating a suction using the hand pump attached to base of apparatus. Continue pumping until all the water has been filtered into the base reservoir.
8. Look at the filter paper and if the paper is still white filter another 500 ml. If the filter paper is brown then no more water filtering is required. Always write down the amount of water you filter. The lab requires this information to work up the samples.
9. Once an adequate amount of water is filtered remove filter paper with forceps by folding in half and then in quarters. Place folded filter paper in tin foil and include a label written on waterproof paper.
10. Pour approximately 20 ml of the filtrate (water in the reservoir base) into the labelled 25ml Nalgene bottle. Remember that this sample will be frozen so leave adequate space for liquid expansion as it freezes.
11. Put both the chlorophyll (filter paper wrapped in tin foil) and nitrate (filtrate in 25 ml Nalgene bottle) in a freezer. The samples must stay frozen and will later be shipped to a lab for further analysis.
12. Always rinse the filter apparatus with distilled water between samples.

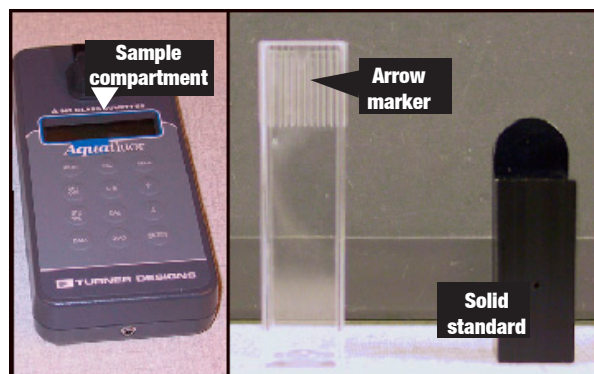
3.2.3 Fluorometer lab protocol

1. Turn on fluorometer and calibrate the meter by first inserting the solid black cubette (solid standard) into the sample compartment and close the lid. Press the <CAL> button and then the <ENT> to measure the fluorescence signal of the solid standard.
2. Next you will be required to place your calibration solution into the sample compartment. Use one of the clear plastic cubette filled with distilled water to the lines. Hold the cubette with two fingers on the lined area on the top of the tube to avoid putting fingerprints on the clear plastic. Use an eyedropper to slowly fill the clear cubette, this will ensure that no bubbles are present in the cubette. Wipe the outside of the clear cubette

with lens paper, therefore you will not scratch the plastic.

3. Insert the clear cubette filled with distilled water (calibration solution) into the sample compartment. Note the placement of the arrow on the top of cubette and always insert the cubette in this direction for future measurements. Press <ENT> and the fluorometer is calibrated for all your subsequent samples.
4. The fluorometer will turn off if it is left idle and you will lose your calibration. To prevent this from happening just press the <READ> button every once in awhile. However, if the fluorometer does turn off you will need to recalibrate the instrument.
5. Gently shake the 1L Nalgene bottle containing your water sample before you take every sample. Use the eyedropper to acquire and pour the water sample into the SAME clear plastic cubette you used to measure your calibration solution. Rinse the cubette three times with the water sample and then fill the cubette to the line with the water sample.
6. Wipe the outside of the cubette with lens paper to remove all water droplets and place it into the sample compartment. Ensure that the arrow on cubette is in the same position as when it was used for calibration.
7. Close the compartment and press <READ>. Record the fluorescence value onto the site description data sheet (p.23).
8. Repeat steps 5 to 7 two more times. Always rinse the clear plastic cubette with distilled water between each sample.
9. Three separate fluorescence signals should be taken for each sample.

FIGURE 2.3 Fluorometer and cubettes



3.3 Eelgrass Properties – field methods

We have used standard methods reported in several good overviews available in this scientific literature. The reader should consult the following references for more detailed information.

- Bortone, S.A. (ed) 2000. Seagrasses: monitoring, ecology, physiology, and management. CRC Marine Science Series. 318 pp.
- Kirkman H. 1996. Baseline and monitoring methods for seagrass meadows. Journal of Environmental management. 47:191-201.
- Short, F.T. and R.G. Coles (eds.) 2001. Global Seagrass Research Methods. Elsevier Science B.V., Amsterdam. 472 pp.
- Precision Identification Biological Consultants 2002. Methods for mapping and monitoring eelgrass habitat in British Columbia. Report to Environment Canada. 38 pp.

In this study, the selection of a 10 X 10 cm quadrat was necessary (compared to the standard 25 X 25 cm) to reduce the impacts of destructive sampling in the eelgrass beds (eelgrass shoots need to be removed to scrape epiphytes and weigh). Below we discuss the results of this quadrat on parameter estimates.

3.3.1 Equipment

- 10 cm X 10 cm sampling quadrat
- Clear plastic tube (5 cm diameter, 30 cm long)
- Square piece of sheet metal (10 cm x 10 cm)
- 27 cm X 28 cm Ziploc® bags (each bag labelled as described under sampling protocol)
- 1 cooler
- 1 bucket

- GPS
- Boat

3.3.2 Pre-Field Sampling Protocol

1. Ziploc bag labelling
 - 12 Ziploc bags for each site (6 for eelgrass samples and 6 for sediment samples)
 - Using a permanent marker label each bag with the date, site identification code, and sample number
2. Program the coordinates for each site location into a GPS.
3. Consult a local tide table to determine sampling dates with low tides 0.6m (2.0ft) or less. Some eelgrass bed sites may be sampled at higher tidal heights. Preliminary bed assessments will help to determine this. Each bed will be sampled within a 2-hour window before and after low tide.

3.3.3 Eelgrass Field Sampling Protocol

1. Use programmed GPS coordinates to find each site or record coordinates if the site is being sampled for the first time. This ensures that future sampling efforts will occur in the same area.
2. Record the time you take the eelgrass and sediment samples and then tidal height can be calculated at a later time.
3. Go to water's edge, as low in the intertidal as you can go without too much water becoming a problem.
4. Randomly drop the quadrat, try not to drop where there is the most eelgrass. It is tempting so try closing your eyes when you drop the quadrat.

FIGURE 3.4 Eelgrass field sampling protocol



5. Gently move the shoots within the quadrat so that you can see the base of each eelgrass shoot within the quadrat.
6. Collect all the eelgrass shoots within the quadrat as close to the sediment as possible. You do not need to collect the roots, but try to pick them as close to the roots as you can.
7. Place the eelgrass and any attached epiphytes (algae growing on the blades) into a labelled Ziploc bag and seal.
8. Proceed to collect 2 sediment samples, refer to protocol below.
9. After 1 eelgrass and 2 sediment samples are taken, walk 10 steps along shore and repeat eelgrass and sediment sampling.
10. Always separate your sample areas by approximately 10 steps.
11. Repeat steps 4 through 9 to collect another eelgrass sample in the same location.
12. The first 3 samples you will collect 1 bag of eelgrass and 2 bags of sediment at each sampling location. You do NOT collect sediment with the last 3 eelgrass samples.
13. You will collect a total of 6 bags of eelgrass at each site.
14. Put all samples in the cooler and you will transfer into freezer back at the lab.

3.3.4 Sediment Field Sampling Protocol

Soft substrates, such as mud and sand characterize the benthic habitats that seagrass colonize. In seagrass studies assessing sediment composition and structure can help to better understand factors affecting nutrient dynamics, eutrophication, and seagrass health (Erftemeijer and Koch 2001). For example, an indirect measurement of fluid energy is sediment composition. Course, sandy

sediment indicates high energy, whereas fine silty sediment indicates low energy (Fonseca et al. 1982). Therefore, we provide techniques for collection and analysis of seagrass sediment characteristics.

1. Take the clear plastic tube and push it approximately 5 cm into the mud adjacent to where you sampled the eelgrass. Push the eelgrass aside to avoid getting it in the sediment sample.
2. Once the tube is in the mud dig your hand into the mud and hold the sediment in your tube as you pull it up.
3. Once you have removed the tube from the ground you can slowly pour off excess water in the tube. DO NOT pour out any of the fine surface organic material it is an important component of the sample. Remember it the top 5 cm of the sediment sample you want to collect.
4. If you have too much sediment in the tube (more than 5 cm) then slowly let some fall through the bottom of the tube. Use the square piece of sheet metal to cut through the sediment and shorten the sample.
5. Put the sample into a Ziploc bag and don't worry if there is water in the sample. It is better to have some water in the sample than to lose the surface sediments suspended in the water.
6. Repeat steps 1 through 6 to get another sediment sample from the same location.
7. You will have 2 sediment samples from your first 3 eelgrass samples, for a total of 6 sediment samples for each site. Do not sample sediment for the last 3 eelgrass quadrats.
8. Put all samples in the cooler and you will transfer into freezer back at the lab.

FIGURE 3.5 Sediment field sampling protocol



Sediment corer pushed 5 cm into the sediment.

Dig your hand into the mud to secure sediment sample in the corer as you pull it up.

Use the metal to cut the sediment samples to be 5 cm deep.

Place sediment in a labelled Ziploc bag.

3.4 Eelgrass Properties – lab analysis

3.4.1 Equipment

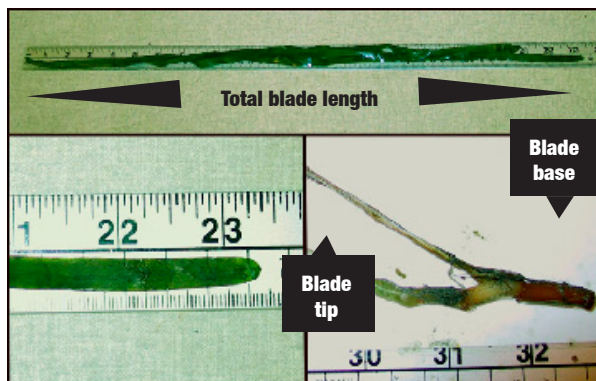
- Eelgrass lab data sheets (pp.24 & 25)
- Clipboard and pencil
- 1 laminated sheet of paper (approximately 28 cm X 22 cm)
- 1 Razor blade
- 1 metre ruler
- Drying oven (80°C)
- Balance (resolution at least 0.1g)
- 30 large aluminium tins (for drying seagrass, tart tins: 7.5 cm base diameter, 12 cm top diameter, 4 cm deep)
- 30 small aluminium tins (for drying epiphytes, smaller tins: 6.5 cm diameter, 1.5 cm deep)

3.4.2 Eelgrass Lab Analysis

1. Remove 6 frozen eelgrass bags from freezer and thaw samples. To prevent data recording confusion work up the eelgrass samples taken from a single site together.
2. Photocopy eelgrass lab data sheets provided on pages 24 and 25 and record all data on these sheets.
3. While eelgrass samples are thawing label and weigh 6 large and 6 small aluminium tins.
4. Work up one bag of eelgrass at a time.
5. Measure the total length of the longest blade for each shoot to the nearest millimetre. Begin measurement from the shoot base, where the roots end, and finish at the tip of the blade. If the blade is broken make a note of this on the data sheet.

Blade length

FIGURE 2.6 Blade length



6. Blade width is measured on the same blade as length was measured. Width measurement is taken about 1 cm above where the shoot grows out of the sheath. Measure blade width to the nearest millimetre.
7. Count and record the number of senescent shoots, new shoots and all other shoots per blade.
8. Count and record the total number of shoots collected in each sample.
9. Record only the total length and the presence of all reproductive shoots in the sample.

Blade width

Number of blades per shoot

Number of shoots per sample

Number of reproductive shoots

FIGURE 2.7 Blade width

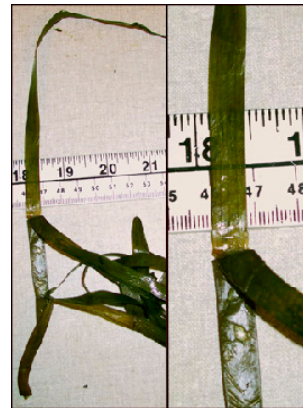
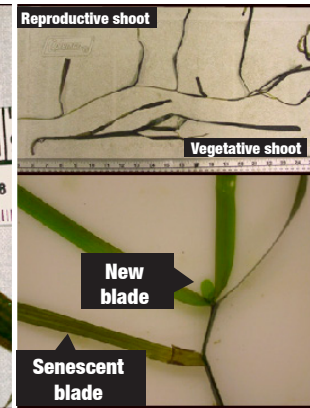


FIGURE 2.8 Shoot and blade types

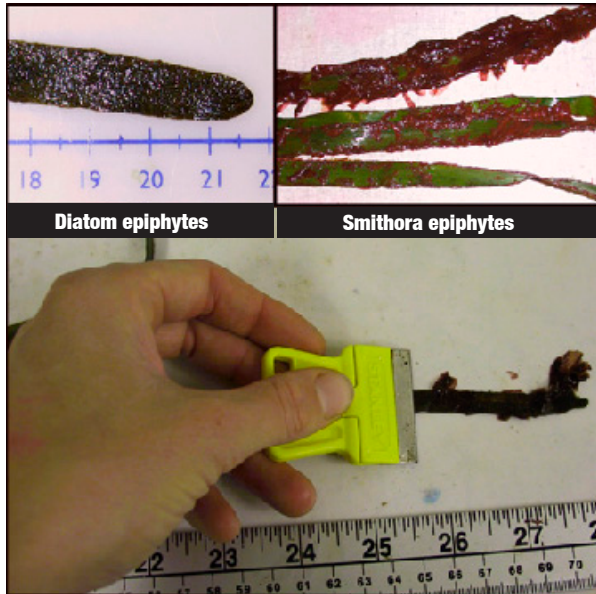


10. Gently scrape all algal epiphytes off the eelgrass blades in each sample. Use a razor to scrape the epiphytes onto a plastic laminated sheet of paper. This ensures easy transfer of the epiphytes into the aluminium tin. Also scrape off the animal epifaunal community, but do NOT include them in your biomass samples. Appropriately discard these organisms.
11. Epiphytic algal category and relative abundance will be assessed for each sample. Use the following epiphytic algal categories:
 - Diatoms = fine brown filamentous algae
 - *Smithora* = red blades
 - *Enteromorpha* = green blades
 - Filamentous red = filamentous red algae

Epiphytes

Relative abundance of each type of epiphytic algae will be given in percentages. For example: 20% *Smithora*, 10% *Enteromorpha*, 70% Diatoms. You do need to include a percentage of algal type if it is not present.

FIGURE 2.9 Epiphytic Algae



12. Record a single measurement of epiphytic algal proportions and relative abundance for the entire sample (one per bag of eelgrass).

Eelgrass and Epiphyte Biomass

13. Place the separate eelgrass and epiphyte samples into the drying set at 80°C. If you are interested in organic carbon or nitrogen content the samples should not be dried at a temperature >60°C. Record the date and time the samples were placed in the oven.



FIGURE 2.10 Wet eelgrass & scraped epiphytes

14. Remove dried samples to weigh in 24 hours or until the samples have reached a constant weight.

15. Weigh the samples immediately after removal from oven as dried algae quickly reabsorb water. If a desiccator is available use this to weigh samples in, but it is not necessary.
16. Record the dry weight of each sample to the nearest 0.01g.
17. Place dried eelgrass and epiphytes in a bucket and appropriately dispose of the samples.

3.5 Sediment Properties - Lab Analysis

3.5.1 Equipment

- Sediment lab data sheets (p.26)
- Clipboard and pencil
- 63µm mesh sieve (#230)
- 500 ml spray bottle
- Distilled water
- 250 ml glass beaker
- Stirring rod
- Spoon
- 4L ice cream bucket
- Drying oven (100°C)
- Balance (resolution at least 0.1g)
- 30 large aluminium tins (for drying silt-clay fraction, tart tins: 7.5 cm base diameter, 12 cm top diameter, 4 cm deep)
- 30 small aluminium tins (for drying >63µm sediment, smaller tins: 6.5 cm diameter, 1.5 cm deep)

2.5.2 Sediment Lab Analysis

1. Remove 3 frozen sediment bags from freezer and thaw samples.
2. Photocopy sediment lab data sheets provided on page 25. Record all data on these sheets.
3. While sediment samples are thawing label and weigh 3 large and 3 small aluminium tins.
4. Work up one bag of sediment at a time
5. Quarter sediment sample and weigh approximately a 20g wet sediment sample.

FIGURE 2.11 Sediment lab analysis equipment



6. Put the 20g wet sediment sample into a 250 ml glass beaker and stir sample for one minute. This ensures that the clay particles do not amalgamate.
7. Place the sieve over a clean 4L ice bucket and pour the stirred sediment onto the sieve.
8. Use the spray bottle to ensure all sediment particles are removed from beaker. Next spray sediment sample to wet sieve the silt-clay particles through the sieve. Continue to spray sediment until all the silt-clay particles have gone through the sieve.
9. Scoop sediment left in the sieve into the smaller aluminium tin; this is the $>63\mu\text{m}$ sediment particles.

FIGURE 2.12 Sediment wet sieving



10. Use the spray bottle to pour all the silt-clay ($<63\mu\text{m}$) particles in the ice cream bucket into the larger aluminium tin. If there is too much liquid use two aluminium tins.
11. Place the separate silt-clay and $<63\mu\text{m}$ samples into the drying set at 100°C . If you are interested in organic carbon content the samples should not be dried at a temperature $>60^{\circ}\text{C}$. Record the date and time the samples were placed in the oven.
12. Remove dried samples to weigh in 24 hours or until the samples have reached a constant weight.
13. Weigh the dried sediment samples immediately after removal from oven to ensure they do not reabsorb water. If a dessicator is available use this to weigh samples in, but it is not necessary.

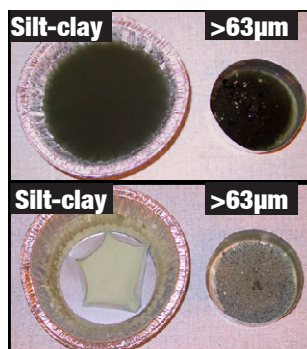


FIGURE 2.13 Wet & dried sediment samples

14. Record the dry weight of each sample to the nearest 0.01g.
15. Place dried sediment in a bucket and appropriately dispose of the samples.

3.6 Fish Sampling Methods

A variety of sampling techniques have been employed to sample fish species in eelgrass. Methods include passive sampling gear such as gill, drop and pop nets, to active sampling gear including seines and trawls. A monitoring program requires using a method that is inexpensive, effective at sampling a variety of fish species, and is easily deployed multiple times within a short time window. Previous work has identified beach seining as a sampling methodology that meets these criteria (Connolly 1994, Edgar et al. 2001). Therefore, fish diversity within eelgrass beds was sampled using a small beach seine, 2-3 personal and a small aluminium boat.

3.6.1 Equipment

- Beach seine (10.0 m long, 3.0 m in height at the centre and tapering to a 1.0 m height at either end with 4.0 mm mesh throughout the net, having a 3 m drop in the centre, and tapering to 1m at the wings. Two 15.0 m long lines were attached at each end, one on the lead line and the other on the float line, each marked at a 10.0 m distance from the net)
 - 2 dip nets
 - 2 buckets
 - 3 Rubbermaid® totes (50 cm X 30 cm X 50 cm)
 - 2 pairs of chest waders
 - 2 fish measuring boards (30 cm long)
 - Clipboard and pencils, Fish data sheets (3 per site, printed waterproof paper)
 - Fish identification books (“Coastal Fishes of the Pacific Northwest” Lamb and Edgell 1986, “Pacific Fishes of Canada” Hart 1988, “A Guide to Fishes in Eelgrass Beds of Pacific Rim and Gwaii Haanas National Parks Reserves” Yakimishyn and Robinson 2003)
 - Site description and environmental parameter data sheets (1 per site, printed waterproof paper, see Appendix 1)
 - 1 litre plastic Nalgene® bottles (1 per site), 1 Coleman cooler
 - Temperature-salinity probe, GPS, Digital camera

3.6.2 Fish field sampling protocol

1. Use programmed GPS coordinates to find each site or record GPS coordinates if site has not been previously sampled. This ensures that future sampling efforts will occur in the same general area.
2. Each site must be sampled during daylight hours within a 2-hour window before or after a low tide of 0.6m (2.0ft) or less.
3. Typically, two beds can be sampled each day during the low tide. Sites should be relatively close geographically to ensure shorter travel distances.
4. Two individuals wearing chest waders, using a motor driven boat will deploy the beach seine. One individual or an anchor would be dropped off on the bed, holding two lines from one end of the seine. The net and 10 m of rope will be stretched perpendicular to shore. When fully extended, the seine should be stretched parallel to shore, then the second individual will be dropped off on shore, and two individuals will pull the seine to shore. An area approximately 10 m X 10 m area (100 m²) of the eelgrass bed will be sampled.
5. Record the time and approximate depth of each beach seine set. Seine depth is estimated when the net is fully extended parallel to shore.
6. Once the beach seine is brought to shore, the seine containing fish will be taken to the boat.
7. All fish will be dip netted out of the beach seine and placed into totes containing fresh seawater aboard the boat. Keep all replicate fish beach seines separate.
8. All fish are counted, identified using field guides (Lamb and Edgell 1986, Yakimishyn and Robinson 2003) and recorded on fish data sheets.

FIGURE 3.14 Fish field sampling protocol



Beach seine fed out and stretched perpendicular to shore



Beach seine stretched parallel to shore and then pulled to shore



Beach seine at boat and fish caught are netted into buckets



All fish species caught are counted and identified



Fish fork length measured to nearest millimetre

9. The fork lengths of at least the first 25 individuals of each fish species need to be measured to the nearest millimetre and then returned to the ocean.
10. Triplicate sets are required for each site, with a minimum 10-metre distance between each haul to avoid the physical disturbance effect caused by pulling the beach through the eelgrass.

3.7 Additional References of Interest

Connolly, R.M. (1994) Comparison of fish catches from a buoyant pop net and a beach seine net in a shallow seagrass habitat. *Marine Ecology Progress Series*, 109, 305-309.

Davidson, D.M. and Hughes, D.J. (1998) *Zostera biotopes (Volume 1). An overview of dynamics and sensitivity characteristics for conservation management of marine SACs.* Scottish Association for Marine Science (UK Marine SACs Project). 95 p.

Duarte, C.M. (1991) Seagrass depth limits. *Aquatic Botany* 40:363-377.

Duarte, C.M. and Kirkman, H. (2001) Methods for the measurement of seagrass abundance and depth distribution. pp. 141-154. *In: F.T. Short and R.G. Coles (eds.) Global Seagrass Research Methods.* Elsevier Science B.V., Amsterdam.

Edgar, G.J. and Shaw, C. (1995) The production and trophic ecology of shallow-water fish assemblages in southern Australia III. General relationships between sediments, seagrasses, invertebrates and fishes. *Journal of Experimental Marine Biology and Ecology*. 194: 107-131.

Edgar, G.J., Mukai, H. and Orth, R.J. (2001) Fish, crabs, shrimps and other large mobile epibenthos: measurement methods for their biomass and abundance in seagrass. pp.293-312. *In: F.T. Short and R.G. Coles (eds.) Global Seagrass Research Methods.* Elsevier Science B.V., Amsterdam.

Ertfemeijer, P.L.A. and Evamaria, W.K. (2001) Sediment geology methods for seagrass habitat. pp. 345-367. *In: F.T. Short and R.G. Coles (eds.) Global Seagrass Research Methods.* Elsevier Science B.V., Amsterdam.

Fonseca, M.S., Fisher, J.S., Zieman, J.C. and Thayer, G.W. (1982) Influence of seagrass, *Zostera marina* L., on current flow. *Estuarine, Coastal and Shelf Science*. 15: 351-364.

Granger, S. and Iizumi, H. (2001) Water quality measurement methods for seagrass habitat. pp.293-312. *In: F.T. Short and R.G. Coles (eds.) Global Seagrass Research Methods.* Elsevier Science B.V., Amsterdam.

Hart, J.L. (1988) *Pacific fishes of Canada.* Fisheries Research Board of Canada, Bulletin 180: 740 p.

Jackson, E.L., Rowden, A.A., Attrill, M.J., Bossey, S.J. and Jones, M.B. (2001) The importance of seagrass beds

as a habitat for fishery species. *Oceanography and Marine Biology: An Annual Review*, 39, 269-303.

Kendrick, G.A., Walker, D.I. and McComb, A.J. (1988) Changes in distribution of macro-algal epiphytes on stems of the seagrass *Amphibolis Antarctica* along a salinity gradient in Shark Bay, Western Australia. *Phycologia* 27: 201-208.

Kendrick, G.A. and Lavery, P.S. (2001) Assessing biomass, assemblage structure and productivity of algal epiphytes on seagrasses. pp. 199-222. *In: F.T. Short and R.G. Coles (eds.) Global Seagrass Research Methods.* Elsevier Science B.V., Amsterdam.

Lamb, A. and Edgell, P. (1986) Coastal fishes of the Pacific Northwest. British Columbia: Madeira Park: Harbour Publishing. 224p.

Lekve, K., Stenseth, N.C., Gjosaeter, J., Fromentin, J., and Gray, J.S. (1999) Spatio-temporal patterns in diversity of a fish assemblage along the Norwegian Skagerak coast. *Marine Ecology Progress Series*. 178: 17-27.

Orth, R.J. and Heck, K.L. 1980. Structural components of eelgrass (*Zostera marina*) meadows in the lower Chesapeake Bay - fishes. *Estuaries*. 3(4): 278-288.

Paerl, H.W., Pinckney, J.L., Fear, J.M., and Peierls, B.L. (1998) Ecosystem responses to internal and watershed organic matter loading: consequences of hypoxia in the eutrophying Neuse River Estuary, North Carolina, USA. *Marine Ecology Progress Series*. 166: 17-25.

Rasmussen, E. (1977) The wasting disease of eelgrass (*Zostera marina*) and its effect on environmental factors and fauna. pp. 1-52. *In: C. P. McRoy and C. Helfferich (eds.) Seagrass ecosystems: a scientific perspective.* Marcel Dekker Inc., New York.

Tomasko, D.A. and Lapoint, B.E. (1991) Productivity and biomass of *Thalassia testudinum* as related to water column and nutrient availability and epiphyte levels: field observations and experimental studies. *Marine Ecology Progress Series*. 75: 9-17.

Wagner, C.M. and Austin, H.M. (1999) Correspondence between environmental gradients and summer littoral fish assemblages in low salinity reaches of the Chesapeake Bay, USA. *Marine Ecology Progress Series*. 177: 197-212.

Yakimishyn, J.L. and Robinson, C.L.K. 2003. A guide to fishes in eelgrass beds of Pacific Rim and Gwaii Haanas National Park Reserves. British Columbia: Parks Canada. 66p.

Yakimishyn, J.L. 2003. Monitoring spatial and temporal patterns structuring eelgrass (*Zostera marina*) fish diversity in Clayoquot Sound. Master of Science. University of Victoria. 174 p.

Yakimishyn, J.L., C.L.K. Robinson, and P. Dearden (2004). The utility of beach seining for assessing fish diversity in eelgrass beds of Pacific Coastal National park Reserves. Paper submitted to the 4rth Science and Management of Protected Areas Conferences, Victoria, 2004.