ShoreZone
Mapping Data Summary,
Southeast Alaska

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**ShoreZone Mapping Data Summary,
Southeast Alaska (v2)**

by

Coastal & Ocean Resources Inc. and
Archipelago Marine Research Ltd.

Prepared for the
National Marine Fisheries Service
Auk Bay Lab

Archipelago Marine Research Ltd
525 Head Street, Victoria, BC
V9A 5S1 Canada
www.archipelago.ca

Coastal & Ocean Resources Inc
214 – 9865 W. Saanich Rd., Sidney, BC
V8M 5Y8 Canada
www.coastalandoceans.com

The 2004 "Southeast" ShoreZone mapping project concentrated in three different locales in Southeast Alaska as shown in Figure 1. A total of 1,639 km of shoreline were imaged in the Icy Strait, Lynn Canal, and Sitka Sound regions.

The mapping data from ShoreZone is in the form of points and lines. The **line** segments are the primary spatial features with **points** identifying features that are too small to be represented as a line segment. The spatial features for Southeast Alaska are summarized in Table 1, as represented on a 1:62,500 scale digital map.
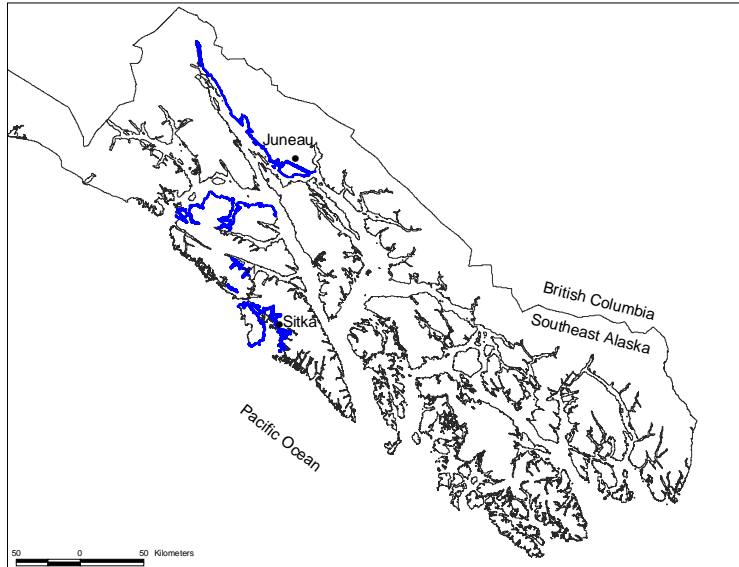
Figure 1. Coastline mapped in 2004 ShoreZone (blue).

The average **unit** length over the 1,639 km of mapped shoreline is 250 m, providing considerable resolution in recording alongshore variation of both physical and biological features.

Table 1 Unit Types and Length

Unit Type	Number	Length (km)
Point	1,152	-
Line	6,563	1,639
Polygons	122	
Totals:	**7,715**	**1,639**

Within each shoreline **unit**, the intertidal zone is further subdivided into **across-shore components**. These components are not represented on the maps; data attributes are recorded for each unit for forms, materials and biology (See Appendix A for Data Dictionaries). For the 7,715 units mapped, there are a total of 26,424 across-shore components, with an average of about four across-shore components per unit. There are almost 9,000 unique combinations of form and materials and over 1,100 unique combinations of biobands (Table 2).

Table 2 Across-Shore Characterization

Number of Across-Shore Components	Number of Unique Physical Combinations	Number of Unique Biological Combinations
26,424	8,826	1,132

Shore Types

Shore types represent repeatable assemblages of across-shore components and are the most easily visualized shoreline information (e.g. rock cliff, rock platform with sand and gravel beach, mudflat). An example of a Shore Type summary for one of the three regions mapped is shown in Table 3; these summaries are preliminary in that only part of the region has been mapped. Examples of major substrate summaries and spatial occurrence are presented in Figure 2.

Table 3 Example of Shore Types in Sitka Region

Coastal Class	Description	Length (km)	% Occurrence	Sum of %	Major Substrate Types
1	Rock ramp, wide	5.7	1%		
2	Rock platform, wide	29.1	5%		
3	Rock cliff, narrow	52.6	9%		
4	Rock ramp, narrow	55.0	9%		
5	Rock platform, narrow	11.8	2%	*25%*	*Rock*
6	Ramp w gravel beach, wide	1.9	0%		
7	Platform w gravel beach, wide	25.2	4%		
8	Cliff w gravel beach, narrow	19.5	3%		
9	Ramp w gravel beach, narrow	66.1	11%		
10	Platform w gravel beach, narrow	10.5	2%		
11	Ramp w S&G beach, wide	3.5	1%		
12	Platform w S&G beach, wide	18.5	3%		
13	Cliff w S&G beach, narrow	14.5	2%		
14	Ramp w S&G beach, narrow	22.4	4%		
15	Platform w S&G beach, narrow	4.3	1%		
16	Ramp w sand beach, wide	0.2	0%		
17	Platform w sand beach, wide	4.8	1%		
18	Cliff w sand beach, narrow	1.2	0%		
19	Ramp w sand beach, narrow	0.3	0%		
20	Platform w sand beach, narrow	0.4	<1%	*32%*	*Rock & Sediment*
21	Gravel flat, wide	5.7	1%		
22	Gravel beach, narrow	26.8	4%		
23	Gravel flat or fan, narrow	0.1	0%		
24	S&G flat, wide	49.5	8%		
25	S&G beach, narrow	51.2	8%		
26	S&G flat, narrow	5.5	1%		
27	Sand beach, wide	2.9	0%		
28	Sand flat, wide	4.5	1%		
29	Mudflat, wide	0.6	0%		
30	Sand beach, narrow	0.4	0%	*24%*	*Sediment*
31	Wetland/lagoon	92.8	15%	*15%*	*Wetland/Estuaries*
32	Man-made, permeable	22.8	4%		
33	Man-made, impermeable	0.5	0%	*4%*	*Man-Made*
34	Current dominated	2.1	0%	*<1%*	*Current Dominant*
		612.5	100%		

Juneau - Lynn Canal Region

man-made 4%
rock 12%
estuary/wetland 17%
rock & sediment 35%
sediment 32%

Icy Strait Region

channel/current 1%
rock 3%
man-made 1%
estuary/wetland 33%
rock & sediment 28%
sediment 34%

Sitka Region

man-made 4%
estuary/wetland 15%
rock 25%
sediment 24%
rock & sediment 32%

Juneau

Icy *Strait*

Admiralty
Island

Chichagof
Island

Sitka

Generalized Substrate
Rock
Rock + Sediment
Sediment
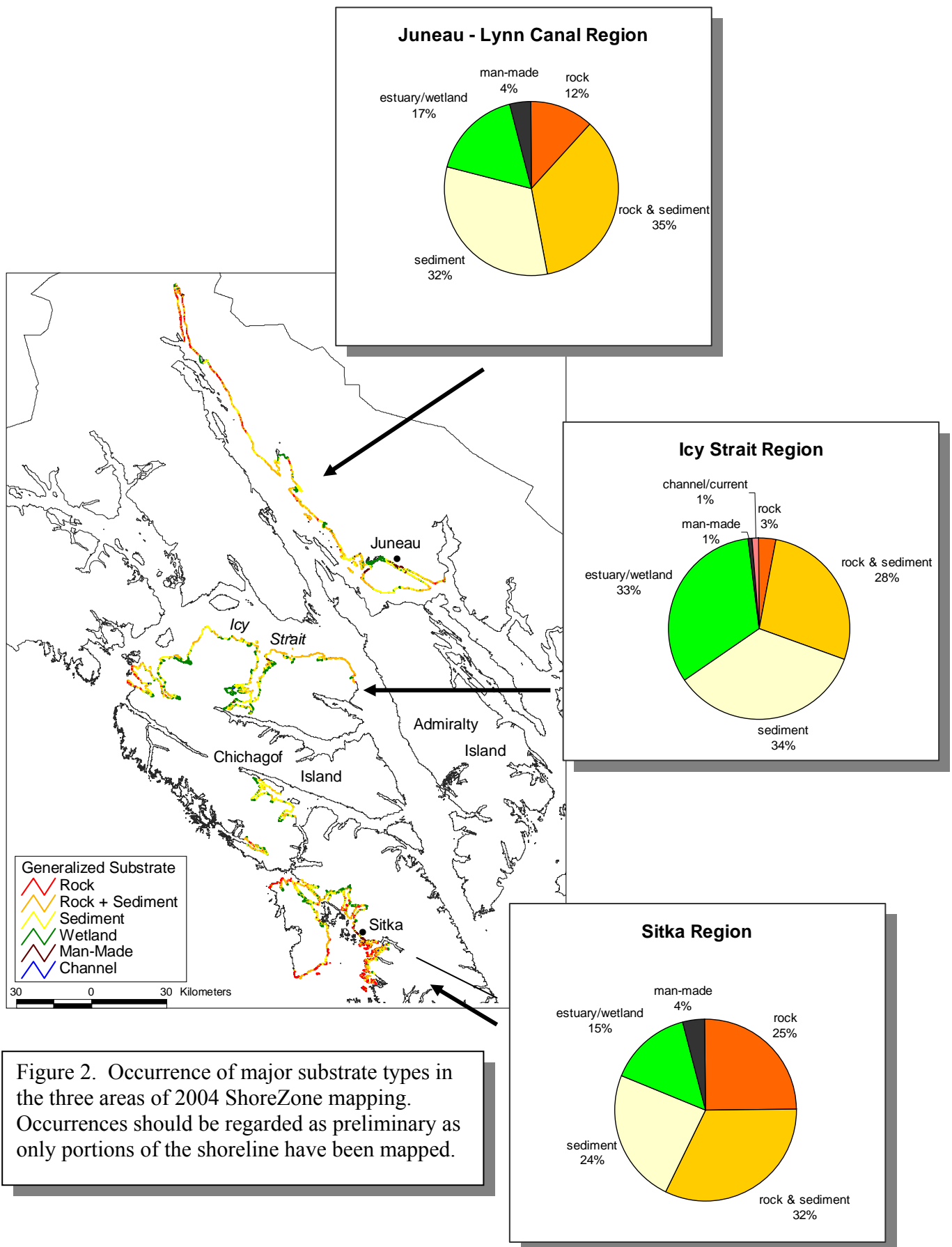Wetland
Man-Made
Channel

30   0   30   Kilometers

Figure 2. Occurrence of major substrate types in
the three areas of 2004 ShoreZone mapping.
Occurrences should be regarded as preliminary as
only portions of the shoreline have been mapped.

The preliminary mapping data (Fig. 2) show that the occurrence of substrate is quite different for the three areas mapped to date. The Sitka area has a much higher percentage of rock or rock+sediment shoreline whereas wetlands make up a substantial portion of the Icy Strait shoreline (33%). These summaries are *illustrative* of the type of data compilations that can be made but should be regarded as preliminary until the entire region has been mapped.

Wave Exposure

Wave exposure is another important element of shore character and strongly influences physical processes as well as the biotic character of the coast. In ShoreZone, exposures are estimated from observations of biotic assemblages in the intertidal zone. Intertidal species generally have specific energy tolerances (e.g., eelgrass prefers low exposure levels) and by carefully noting key indicator species and assemblages, exposure of each shore unit can be estimated.

Exposure categories and the distribution are summarized in Figure 3. Most of the mapped coast is low-energy shoreline with 88% consisting of very protected, protected, or semi-protected wave exposures. The only areas with higher energy (semi-exposed and exposed) are the southern end of Kruzof Island and Sitka Sound, and the area around Inian Peninsula and Inian Island.
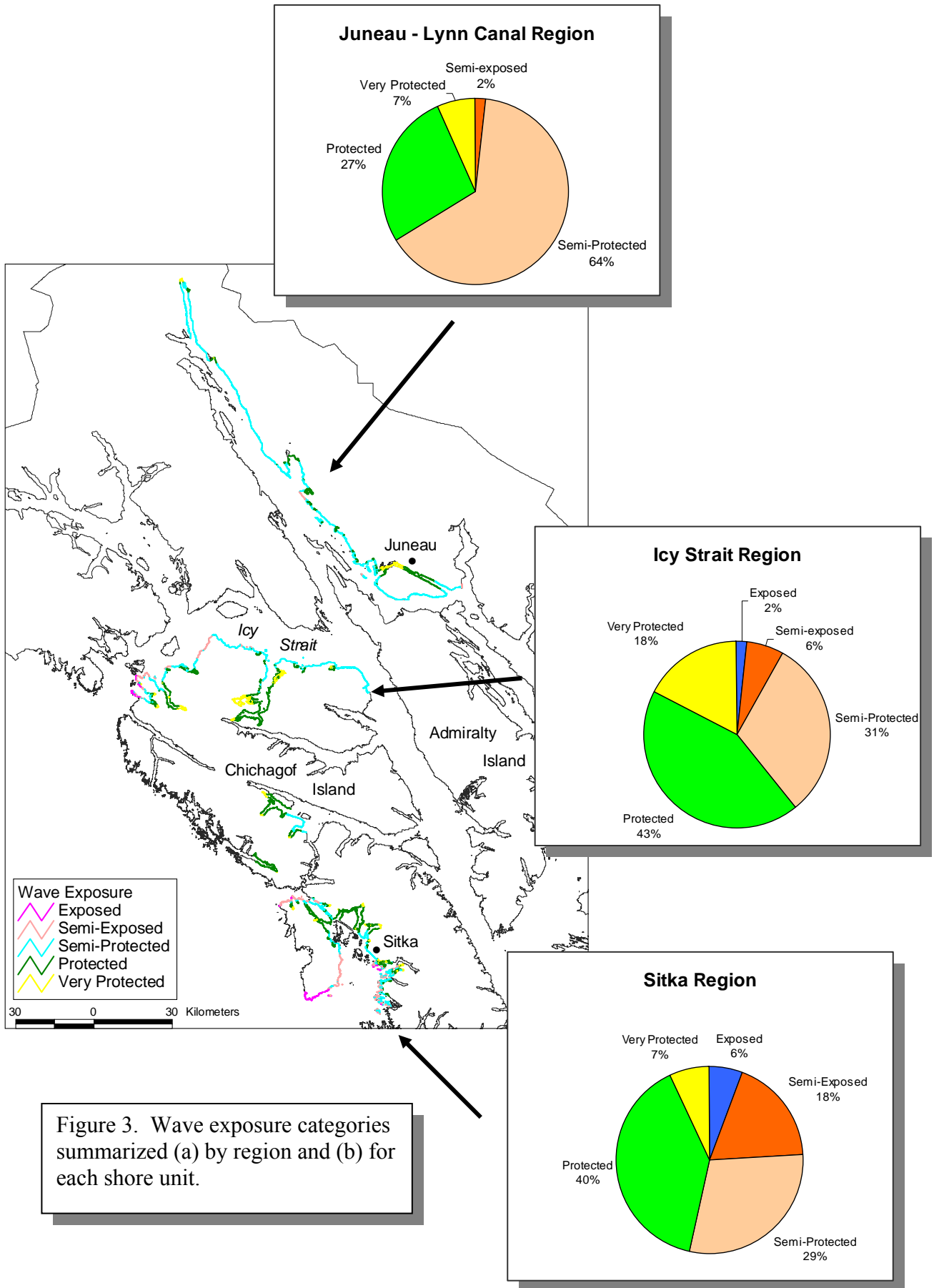
Figure 3. Wave exposure categories summarized (a) by region and (b) for each shore unit.

Shore Modification

Shoreline modification includes areas of seawalls, rip rap, docks, and dikes. Rip-rap is the most common type of modification in all the areas (Table 4). There are four areas in Southeast Alaska with shore modification in the

Table 4 Summary of Shore Modifications

Shore Modification Type	Juneau (km)	Icy Strait (km)	Sitka (km)
Concrete Bulkheads	1.52	0.37	0.67
Land Fill	11.32	4.59	5.35
Rip Rap	30.99	6.39	23.05
Sheet Pile	0.41	0.19	0.44
Wooden Bulkhead	1.81	0.60	0.14
Total (km):	*46.05*	*12.14*	*29.65*

intertidal zone: Juneau, Sitka, Hoonah, and Skagway (Fig. 4). The lengths of modified shoreline are preliminary, as only a portion of the region has been mapped to date. However, the major urbanized areas have been mapped, and the total of length of modified shoreline is in the order of 100 km.
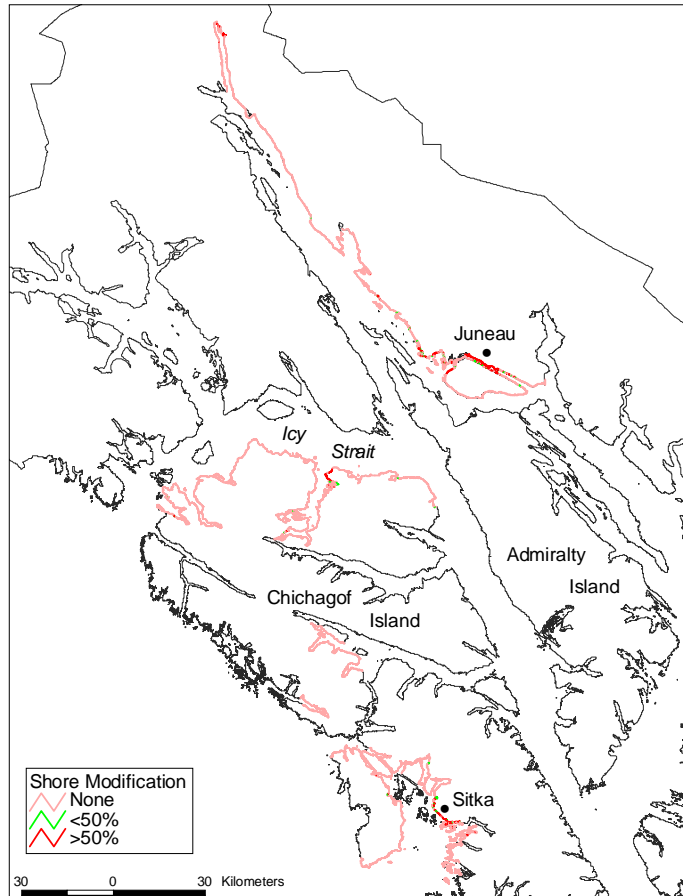

Figure 4 Summary of shore modifications (primarily landfill and rip rap) for mapped regions in Southeast Alaska

Oil Residence Index

The ShoreZone dataset is potentially useful for oil spill contingency planning. In addition to the imagery and biological mapping data, physical attributes of the shore can be used to estimate the potential oil residence based on knowledge of wave exposure levels and substrate types.

Impermeable surfaces such as rock or sheet piling have limited penetration of oil and generally a short residence times. Conversely, coarse sediments are highly permeable, can trap large volumes of oil and have lengthy oil residence periods. Wave action is the most effective process removing stranded oil from the shore. Generally high-energy shorelines have short oil residence and low-energy shorelines have lengthy oil residence.

An *Oil Residence Index* (ORI) is computed, based on exposure and substrate characteristics of each unit. 81% of the mapped coastline has high ORI occurrences (4 or 5). This occurrence is summarized in Table 5 and plotted in Figure 5.

Table 5 Preliminary Summary of Oil Residence Index

Estimated Residence	ORI Code	Length (km)	% of Mapping
DAYS to weeks	1	101.85	6%
WEEKS to months	2	97.33	6%
weeks to MONTHS	3	109.57	7%
MONTHS to years	4	606.58	37%
months to YEARS	5	723.58	44%
TOTALS:		1,638.9	100%
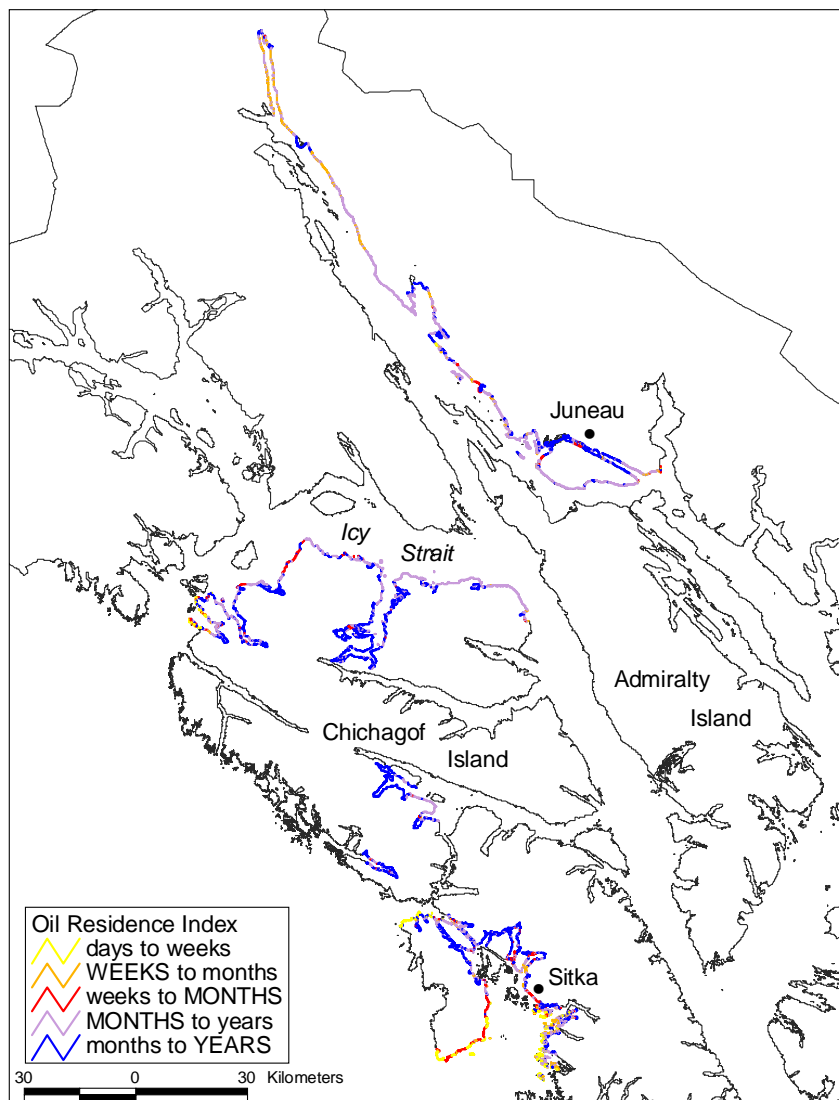
Figure 5 Distribution of Oil Residence Index in areas mapped Alaska.

Biological mapping includes both observed data and interpreted data. Observations of shore-zone biota from aerial video imagery are recorded as "biobands". Further summary classifications are determined for *biological exposure* and *habitat class* for each alongshore unit.

What is a Bioband?

A bioband is an observed coastal species assemblage with a characteristic colour and across-shore elevation. The biobands are named for the dominant species or species group, and the bioband patterns are visible from the air and are often seen as along-shore stripes or bands of colour and texture (Figure 6).

Figure 6. Example of *Biobands*, as distinct alongshore, linear stripes of colour and texture. These patterns are formed by assemblages of biota, usually defined by an abundance of one or two indicator species.

Some biobands are characterized by a single indicator species (e.g., the Blue Mussel band); others represent an assemblage of co-occurring species (e.g., the Mixed Red Algae band). The presence or absence of the bands and their distribution, mapped as *continuous* or *patchy* throughout an individual shore unit, are used to describe the species assemblages of the ShoreZone biological exposure categories and habitat classes. (Table 6 and Appendix B).

The occurrence of all Biobands, regardless of the ShoreZone exposure category is listed in Table 7 and shown in Figure 7; these estimates are preliminary in that only a small portion of the region has been mapped. At least one-third of the mapped shoreline length has wetland biobands in the supratidal (the Marsh Grasses (PUC) and Sedges (SED) bands). Dune Grass (GRA) occurs in over half of the shoreline and is often, but not always, associated with wetland areas. Common upper intertidal biobands of Rockweed (FUC) and Barnacles (BAR) both occur in two-thirds of the surveyed shoreline, and are nearly ubiquitous throughout the area. Over one-third of the mapped shoreline has the Red Algae (RED) band and lower intertidal bladed kelps are also common (the Alaria (ALA), Soft Brown Kelps (SBR) and the Dark Brown Kelps (CHB) biobands). Eelgrass (ZOS) is found on 20% of the mapped coastline.

Table 6. Summary of Bioband Definitions used in Southeast Alaska *

Zone	Bioband Name	Database Label	Colour	Diagnostic Indicator Species	Exposure **
Supratidal	Splash Zone	**VER**	Black or bare rock	Encrusting black lichens	Width varies with exposure.
Supratidal	Dune Grass	**GRA**	Pale blue-green	*Leymus mollis*	P to E
Supratidal	Sedges	**SED**	Bright green to yellow-green	*Carex sp.*	VP to SP
Supratidal	Marsh grasses, herbs and sedges	**PUC**	Light or bright green	*Puccinellia sp.* Other salt-tolerant herbs and grasses	VP to SE
Upper to Mid-Intertidal	Barnacle	**BAR**	Grey-white to pale yellow	*Balanus sp.* *Semibalanus sp.*	P to E
Upper to Mid-Intertidal	Rockweed	**FUC**	Golden-brown	*Fucus sp.*	P to SE
Upper to Mid-Intertidal	Green Algae	**ULV**	Green	*Ulva sp.* Other small green algae	P to E
Upper to Mid-Intertidal	Blue Mussels	**BMU**	Black or blue-black	*Mytilus trossulus*	P to E
Upper to Mid-Intertidal	Bleached Red Algae	**HAL**	Olive, golden or yellow-brown	Bleached foliose or filamentous red algae	P to SE
Upper to Mid-Intertidal	Red Algae	**RED**	dark to bright red (non-corallines) or pink (corallines)	*Odonthalia sp.* *Neorhodomela sp.* *Palmaria sp.* other red algae, and other coralline algae	P to E
Lower Intertidal and Nearshore Subtidal	Surfgrass	**SUR**	Bright green	*Phyllospadix sp.*	SP to SE
Lower Intertidal and Nearshore Subtidal	Alaria	**ALA**	Dark brown	*Alaria sp.*	SP to E
Lower Intertidal and Nearshore Subtidal	Soft brown Kelps	**SBR**	Yellow-brown, olive brown or brown.	*Laminaria saccharina* morph	VP to SP
Lower Intertidal and Nearshore Subtidal	Dark brown Kelps	**CHB**	Dark chocolate brown	Stalked *Laminaria sp.* *Lessoniopsis littoralis* other bladed kelps	SE to E
Lower Intertidal and Nearshore Subtidal	Eelgrass	**ZOS**	Bright to dark green	*Zostera marina*	VP to SP
Subtidal	Dragon Kelp	**ALF**	Golden-brown	*Alaria fistulosa*	SP to E
Subtidal	Macrocystis	**MAC**	Golden-brown	*Macrocystis integrifolia*	P to SE
Subtidal	Bull Kelp	**NER**	Dark brown	*Nereocystis luetkeana*	SP to E

* See details and illustrations for each bioband and exposure category in Appendix B.
** Wave Exposure Codes: VP = Very Protected, P = Protected, SP = Semi-protected, SE = Semi-exposed, E = Exposed

Lower intertidal biobands are often diagnostic of certain wave exposures (e.g., Surfgrass (SUR) in Semi-exposed and Eelgrass (ZOS) in Semi-protected and lower exposures) and, in fact, it is the co-occurrences of lower intertidal biobands that is used to distinguish between different shorezone habitats. Biobands and combinations of typical biobands are present or are absent at characteristic wave exposures and substrates. These characteristics of the shore-zone biota are used as the foundation for the biomapping classification system (see examples of regional maps of bioband distributions in Appendix B.).

Table 7. Preliminary Summary of *Bioband* Occurrence in Area Mapped

| Bioband Names	Code	Continuous (km)	Continuous %	Patchy (km)	Patchy %	Total (km)	% of Mapped
Splash Zone	VER	----	----	----	----	873.3	53%
Dune Grass	GRA	620.1	38%	240.5	15%	860.6	53%
Sedges	SED	153.6	9%	95.4	6%	249.0	15%
Marsh grasses & herbs	PUC	314.4	19%	177.3	11%	491.8	30%
Barnacle	BAR	839.6	51%	251.7	15%	1,091.3	67%
Rockweed	FUC	572.5	35%	458.8	28%	1,031.2	63%
Green Algae	ULV	251.5	15%	422.5	26%	674.0	41%
Blue Mussels	BMU	251.9	15%	189.4	12%	441.2	27%
Bleached Red Algae	HAL	26.4	2%	31.2	2%	57.6	4%
Red Algae	RED	347.6	21%	219.5	13%	567.1	35%
Surfgrass	SUR	29.0	2%	33.9	2%	62.8	4%
Alaria	ALA	190.1	12%	154.8	9%	345.0	21%
Soft Brown Kelps	SBR	403.1	25%	270.5	17%	673.5	41%
Dark Brown Kelps	CHB	94.6	6%	32.2	2%	126.8	8%
Eelgrass	ZOS	180.3	11%	143.4	9%	323.7	20%
Dragon Kelp	ALF	80.5	5%	62.8	4%	143.3	9%
Macrocystis	MAC	98.5	6%	43.3	3%	141.7	9%
Bull Kelp	NER	26.1	2%	34.5	2%	60.6	4%
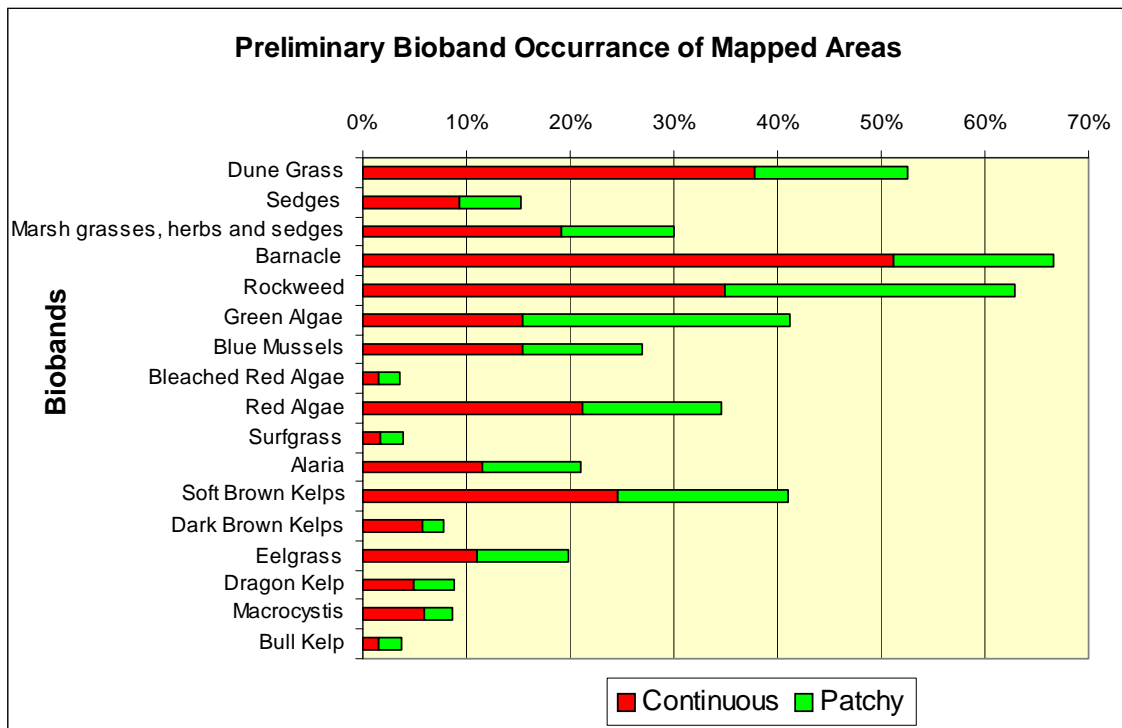
Figure 7. Preliminary occurrence of Biobands, as percent of total mapped shoreline length.

What is Biological Wave Exposure?

The biological wave exposure category is a summary attribute, interpreted by the biomapper, from the observed presence or absence in each shore unit. The same wave exposure categories used by the physical mappers (defined by fetch and fetch window estimates) have been assigned a set of indicator species and a 'typical' set of biobands (Appendix B, Table B-2 Exposure Categories). Typical indicator and associated species and biobands, together with a few example photographs from the Southeast mapping area are included in Appendix B as illustrated definitions of each exposure category.

Some biobands are observed in all wave exposure categories and are considered associated species bands (e.g., the Barnacle bioband) while others are closely associated with certain wave exposure categories and are clearer indicators of a particular exposure category (e.g., Dark Brown Kelps are always associated with higher wave exposures). The combination of biobands, with their indicator and associated species, and the overall assessment of the unit's biota by the biomapper determine the classification of the biological wave exposure category for each unit.

In the initial Southeast Alaska mapping area, there are five *Biological Exposure* categories:

- **Exposed:** wave fetch windows over 500 km.
- **Semi-exposed:** wave fetch windows in the range of 50 km to 500 km.
- **Semi protected:** wave fetch windows between 10 and 50 km.
- **Protected:** wave fetch windows less than 10 km.
- **Very Protected:** wave fetch windows less than 1 km.

The wave exposure as indicated by the biota in the shore unit is the most accurate index of the actual wave exposure at the shore unit and is the exposure estimate that is used in the Oil Residence Index (ORI) model (Appendix A, Table A - 5).

An important strength of the ShoreZone mapping methodology is the combination of physical and biological attributes. In terms of habitat for marine organisms, it is the combined physical and biological attributes of the shore that determine the distribution and ecological function of the organism.

What is Habitat Class?

Habitat Class is a *summary classification that combines both physical and biological characteristics observed for a particular shoreline unit*. It is intended to provide a simplified biophysical summary of the unit overall, based on the detailed attributes that have been mapped.

The species assemblages observed at a particular location are a reflection of both the physical characteristics of that shore segment, as well as the wave exposure. Thus, the species assemblage observed on an exposed shore with a mixture of rock and mobile sediment would be quite distinct from that found on a shore with a protected wetland complex. The interaction of the wave exposure and the substrate type determines the **mobility** of the substrate, which in turn, is reflected in the attached biota. Where the substrate is stable, (e.g., bedrock) well-developed epibenthic bioband assemblages occur. Where the substrate is mobile, the epibenthic community may be sparse or absent.

Three classes of stability that are used in ShoreZone habitat characterization are:

- **Immobile or stable** substrates such as bedrock, boulders, cobbles, or even pebbles on a low-exposure coast.
- **Partially mobile** substrates such as a rock platform with a beach or sediment veneer. The partial mobility of the sediment limits the development of a full bioband assemblage, as would occur on a stable rock shoreline.
- **Mobile** substrates where energy levels are sufficient to frequently move sediment, thereby limiting the development of epibenthic biota. These are bare sediment beaches.

The fifteen generalized *Habitat Classes* are described and occurrence summarized for the Southeast area as a whole, in Table 8. The distributions are plotted for the Sitka area (Figure 8), for Icy Strait (Figure 12) and for the Lynn Canal/Juneau area (Figure 16). Example photographs of the most common Habitat Classes for each of the three plotted areas are also included below (Figures 9, 10, 11 and 13, 14, 15 and 17, 18, 19,).

Nearly half of the mapped area was Partially Mobile, Protected or Semi-protected wave exposures (44%) and nearly one quarter of the mapped area was classified as Wetland (23%). Because the study area was centered at Sitka and Juneau, 4% of the shoreline was mapped as 'Man-made'. Higher wave exposure habitats were not common in the study area.

Table 8 Preliminary Summary of Biophysical Habitat Classes in Mapped Regions of Southeast ShoreZone Project. Note that only part of the area's coastline has been mapped so far.

	Biophysical Habitat Description	Habitat Classes *	Length (km)	% of Mapping
Exposed	**Stable Substrate:** Rocky shorelines with high wave exposure.	10 20	35.8	2%
	Partially Mobile Substrate: Rocky shorelines with sediments sufficiently mobile to limit epibenthos in some portions of the shore.	11 21	12.2	1%
	Mobile Substrate: No epibenthic community in intertidal due to dynamic substrate.	12 22	0.3	<1%
Semi-Exposed	**Stable Substrate:** Rocky shorelines with moderate to high wave exposure.	30	71.9	4%
	**Partially Mobile Substrate*:* Rocky shorelines with sediments that are sufficiently mobile to limit epibenthos in some portions of the shore.	31	74.9	5%
	Mobile Substrate: Small-size sediment shores generally have no epibenthic community. Cobble/boulder beaches may have biota. Dunes frequent in backshore.	32	8.6	1%
Semi-Protected	**Stable Substrate:** Rocky shorelines with moderate to low wave exposure.	40	133.2	8%
	Partially Mobile Substrate: Rocky shorelines with sediments sufficiently mobile to limit epibenthos in some portions of the shore.	41	410.3	25%
	Mobile Substrate: Small-size sediment shores generally have low biotic diversity. Cobble/boulder beaches usually support biota, especially in low intertidal/upper subtidal.	42	38.5	2%
Protected	**Stable Substrate:** Rocky shorelines with low wave exposure.	50 60	36.5	2%
	Partially Mobile Substrate: Rocky shorelines with sediments sufficiently mobile to limit epibenthos in some portions of the shore.	51 61	315.9	19%
	Mobile Substrate: Small-size sediment shores generally have low biotic diversity. Cobble/boulder beaches usually support biota, especially in low intertidal/upper subtidal.	52 62	56.5	3%
Wetland/ Estuary	**Estuary/ lagoon:** Generally low energy sediment shores with wetlands and marsh vegetation. Usually influenced by freshwater.	33 43 53 63	378.4	23%
Channel	**Current-Dominated Channel:** Channels where high tidal currents create anomalous assemblages of biota. Usually associated with lower wave exposure conditions in adjacent shore units.	34 44 54	6.4	<1%
Man-Made	**Anthropogenic Features:** unit modified by shorezone disturbances, such as rip rap, wharves or fill	36, 37 46, 47 56, 57 66, 67	59.9	4%
	TOTALS:		**1,638.9**	**100%**

* see Appendix A, Table A – 9 for list of definitions of Habitat Class codes.
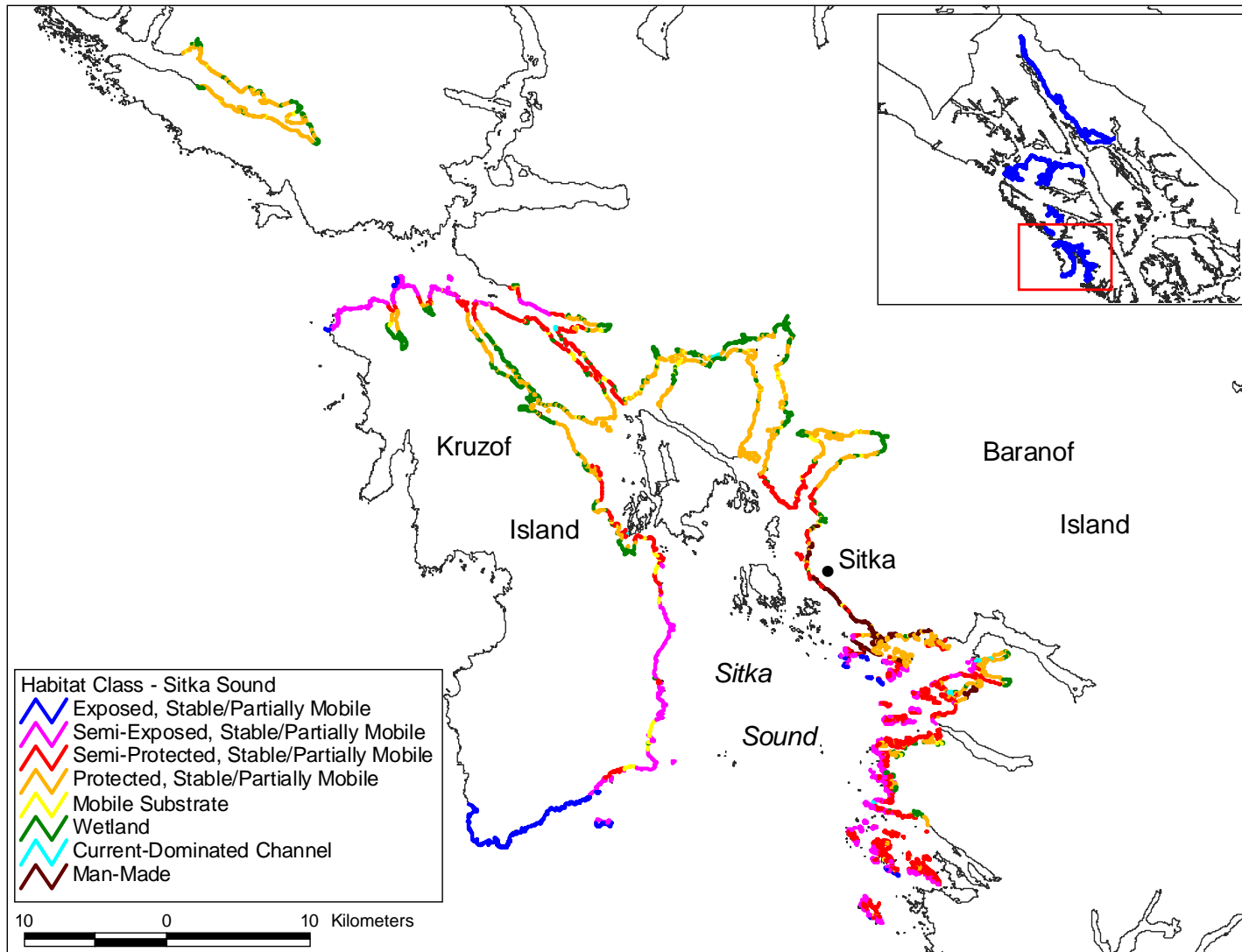
Figure 8. Distribution of Summary Habitat Classes in the Sitka Area, Southeast Alaska. See Figures 9, 10, 11 for example illustrations of the most commonly-occurring Habitat Classes in this area.

Figure 9. The most common Habitat Class in the Sitka area (Fig. 8) is Partially Mobile, Protected. This class was mapped in 25% of the shoreline. Typical biobands are shown here: upper intertidal Rockweed (FUC) and lower intertidal Green Algae (ULV).

Photo: SEAK04_J7_D1_00244.jpg

Figure 10. The second most common Habitat Class in the Sitka area (Fig. 8) is Partially Mobile, Semi-protected. These shorelines were mapped on 20% of the shoreline length, and usually show a mixture of immobile and mobile sediments, as in this example. The sediment is sufficiently mobile to preclude attached biota, while the bedrock platforms support the diagnostic bands for Semi-protected: Red Algae (RED), Soft Browns (SBR) and nearshore *Macrocystis* (MAC).

Photo: SEAK04_J6_D2_00032.jpg

Figure 11. The Sitka area (Fig. 8) has the most shoreline length in higher exposure Habitat Classes (about 18% of the area are in Immobile Semi-exposed or Exposed Classes). Typical biobands of these classes are wide splash zone (VER), and lush lower intertidal Dark Brown Kelps (CHB) and Red Algae (RED).
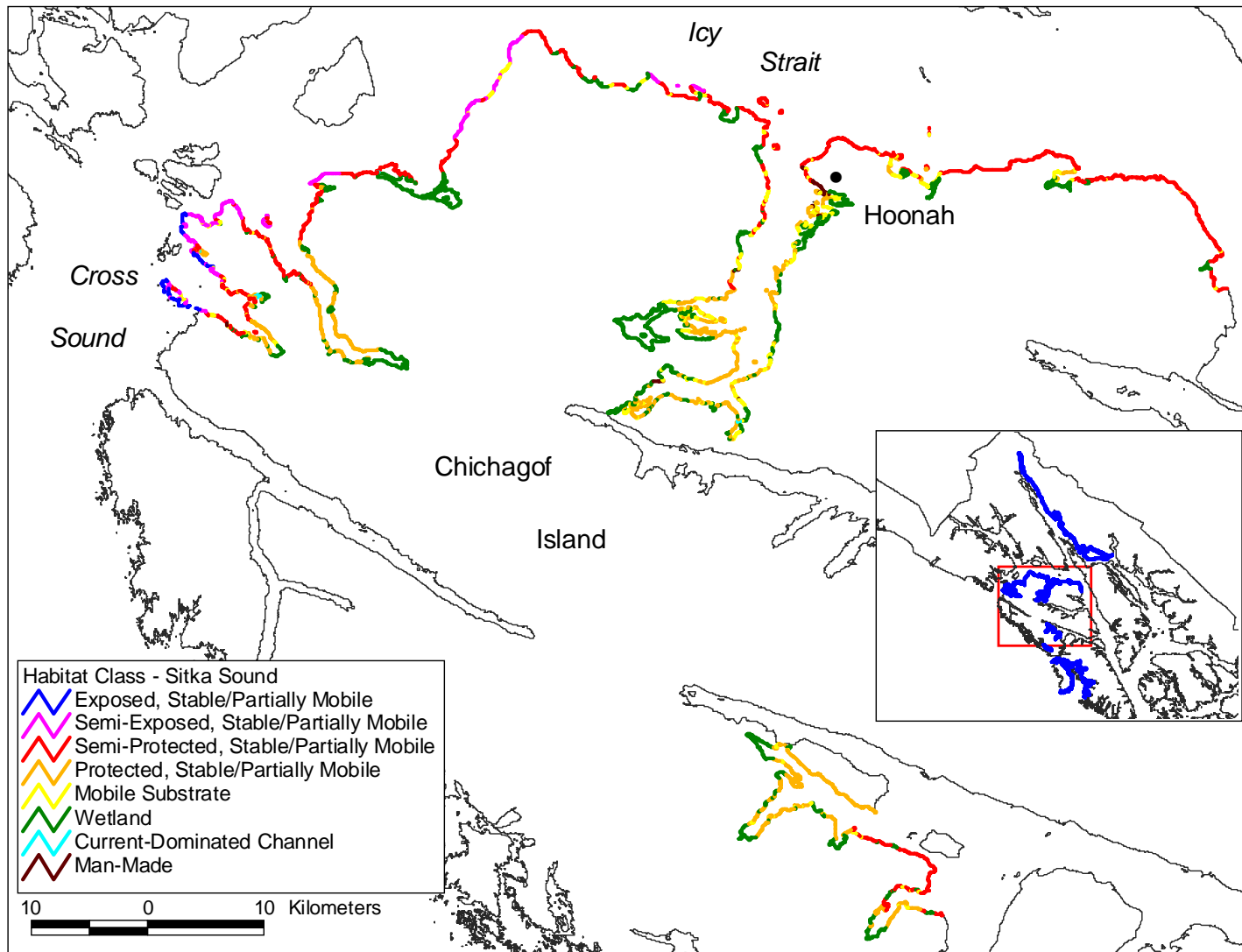
Photo: SEAK04_J7_D4_00320.jpg

Figure 12. Distribution of Summary Habitat Classes in the Icy Strait area, Southeast Alaska. See Figures 13, 14, 15 for example illustrations of the most commonly-occurring Habitat Classes in this area.

Figure 13. Most of the Icy Strait area shoreline (Fig. 12) looks like this: a wide sediment dominated beach. This Habitat Class, Partially Mobile, Protected, accounts for 30% of the coastal habitat in this area. Typical biobands are visible: fringing supratidal dune grass (GRA), patchy Rockweed (FUC) on the flats, and a Soft Brown Kelps (SBR) band at the lower intertidal.

Photo: SEAK04_J3_D2_00044.jpg

Figure 14. Nearly as common in the Icy Strait area (Fig. 12) is the Partially Mobile, Semi-protected Habitat Class, shown here. Note that even the boulders on the upper beach are mobile, and bare of epibiota, indicating the Semi-protected wave exposure. Lower intertidal bands visible are Alaria (ALA), Red Algae (RED) and nearshore Dragon Kelp (ALF).

Photo: SEAK04_J3_D1_00295.jpg

Figure 15. The Wetland 'Estuary' Habitat Class is the third most common habitat class in the Icy Strait area (Fig 12). About 16% of the shoreline in this area was classified as 'estuary/wetland', with some or all of the supratidal wetland biobands (Dune Grasses, (GRA); Marsh grasses & herbs (PUC); and Sedges (SED). All are lower (Semi-protected to Very Protected) wave exposures.
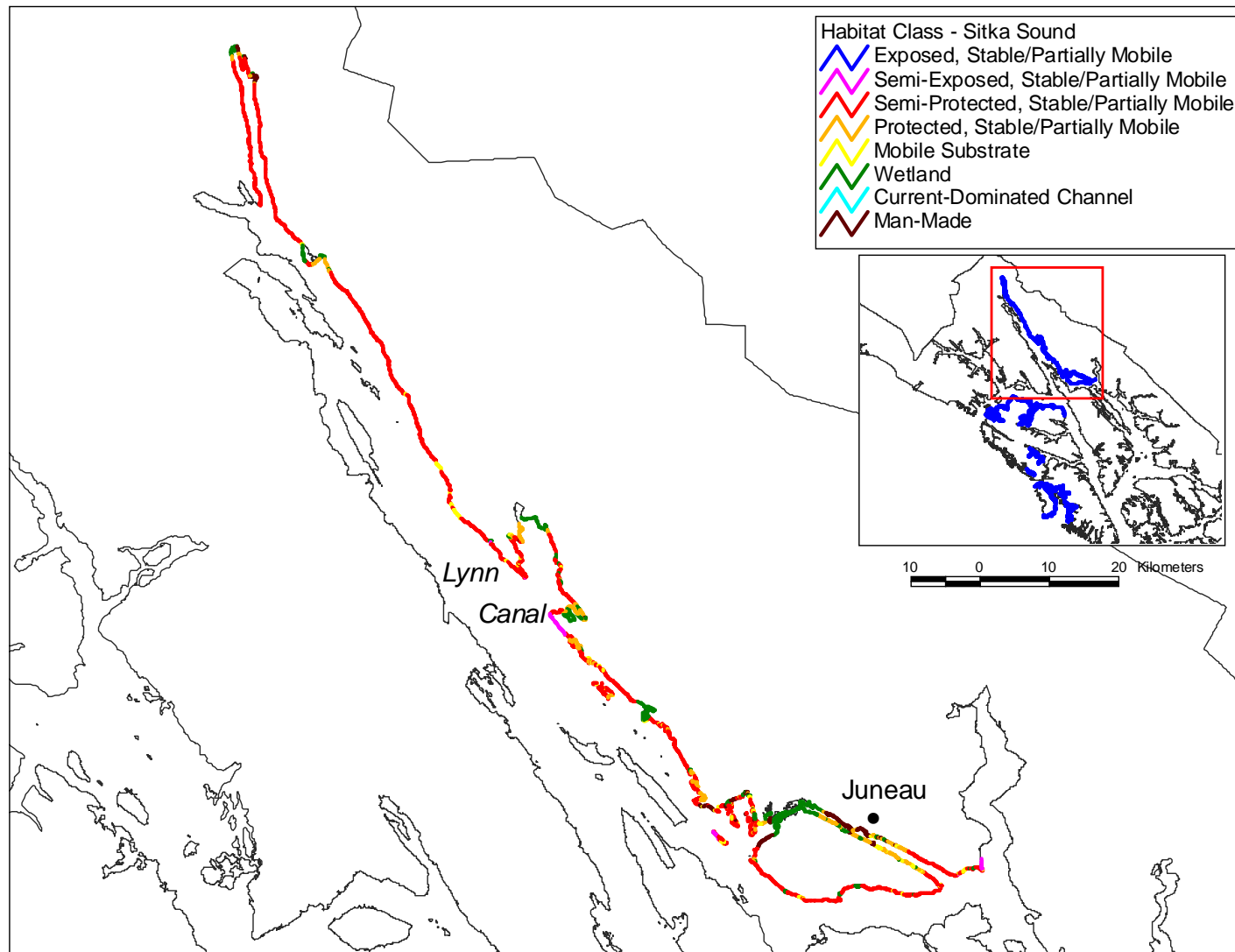
Photo: SEAK04_J3_D1_00320.jpg

Figure 16. Distribution of Habitat Classes in the Lynn Canal/Juneau area, Southeast Alaska. See Figures 17, 18, 19 for example illustrations of the most commonly-occurring Habitat Classes in this area.

Figure 17. The most common Habitat Class in the Lynn Canal/Juneau area (Fig. 16) is the Partially Mobile, Semi-protected class. Nearly half (49%) of the shoreline length in this area is of this type. In this example, note the partly bare upper beach, with Blue Mussels (BMU) in the mid-beach and nearshore Bull Kelp (NER).

Photo: SEAK04_J5_D2_00130.jpg

Figure 18. The second most common Habitat Class in the Lynn Canal area (Fig 16) is the Immobile, Semi-protected bedrock shoreline. In Lynn Canal itself, the shoreline is homogeneous, with long stretches of thick Blue Mussel band (BMU), as shown here. This Habitat Class makes up 15% of the shoreline in the Lynn Canal/Juneau area.

Photo: SEAK04_J4_D1_00032.jpg

Figure 19. The Partially Mobile, Protected Habitat Class is mapped in 8% of the shoreline in the Lynn Canal/Juneau area (Fig. 16). Here the fringing supratidal wetland bands are seen (Dune Grass (GRA) and Marsh Grasses & Herbs (PUC)). On the stable bedrock platform, the Rockweed (FUC) and Blue Mussel (BMU) bands are observed.

Photo: SEAK04_J5_D2_00159.jpg

APPENIDIX A

Data Dictionary

Data Dictionary for UNIT Table

Table A-1 Summary of Data Fields in the Unit Table

Field Names	Type	Description
UnitRecID	N	unique numerical number for each record
PHY_IDENT	T	unique alphanumeric identifier made up of the REGION, AREA, PHY_UNIT and SUBUNIT numbers (RR/AA/UUUU/SS)
REGION	T	coastal region number
AREAS	T	coastal area number
PHY_UNIT	T	physical shore unit number; the unit is the primary alongshore subdivision during the mapping
SUBUNIT	T	subunit number: "0" for main Unit and "1,2,3…" for variants or point features
TYPE	T	a description of Unit type: a (**L**)line-type unit, or a (**P**)oint variant
BC_CLASS	N	a number indicating the BC "coastal class" or "shoreline type" (see Table A-2)
ESIAL	T	a number code for the ESI coastal classification system (see Table A-3)
LENGTH_M	N	the unit alongshore length in M, calculated using GIS software
AREA_M2	N	the polygon area in Sq M, calculated using GIS software
GEO_MAPPER	T	last name of geology mapper
GEO_EDITOR	T	last name of individual responsible for reviewing and editing
GEO_MAP_DATE	D/T	date of original geological mapping
GEO_SOURCE	T	data sources for geological interpretation: (V)ideotape, (P)hoto-aerial, (T)opo maps, (C)harts, (O)ther
SCALE	T	scale of base maps used to delineate units
VIDEOTAPE	T	the videotape identifier number
HR	T	the "burned-in" tape time from the GPS that appears on the video image; "X" indicates no screen time was available
MIN	T	the "burned-in" tape time from the GPS that appears on the video image; "X" indicates no screen time was available
SED	T	the "burned-in" tape time from the GPS that appears on the video image; "X" indicates no screen time was available
MAP_NO	I	page number from the DeLorme Alaska Atlas where the Unit is plotted
CHART	T	NOAA chart number(s) for the Unit
EXP_OBSER	T	an estimate of the wave exposure as observed by geomorphologist during mapping based on Table A-4
EXP_CLASS	T	a numeric code for best exposure estimate where EXP_BIO is better than ESP_OBS (see Table A-4)
ORI	I	a code indicating the potential oil residence index, see Tables A-5 and A-6
SED_SOURCE	T	a code indicating the estimated sediment source for the unit, (B)ackshore, (A)longshore, (F)luvial, (O)ffshore
SED_ABUND	T	a code indicating the relative sediment abundance within the shore-unit, (A)bundant, (M)oderate, (S)carce
SED_DIR	T	one of the eight cardinal points of the compass indicating dominant sediment transport direction
CHNG_TYPE	T	a code indicating the stability of the shore unit, (A)ccretional, (E)rosional, (S)table
CHNG_RATE	N	the rate of change of the shoreline within the unit in m/yr
SHORENAME	T	the name of a prominent geographic feature near the unit;

		used to facilitate searches
UNIT_COMMENTS	T	a text field used for miscellaneous comments and notes during the mapping
SHORE_PROB	T	comment on nature of the shore problem, usually the difference between electronic shoreline and observed shoreline
SM1_TYPE	T	the *primary* type of seawall occurring within the unit where: BR = boat ramp; CB = concrete bulkhead; LF = landfill; SP= sheet pile; RR = rip rap and WB = wooden bulkhead
SM%	N	the estimated % occurrence of the *primary* seawall type in tenths (i.e., "2" = 20% occurrence within the unit)
SM1_M	N	the calculated length in meters of the *primary* seawall type
SM2_TYPE	T	the *secondary* type of seawall occurring within the unit where: BR = boat ramp; CB = concrete bulkhead; LF = landfill; SP = sheet pile; RR = rip rap and WB = wooden bulkhead
SM2%	N	the estimated % occurrence of the *secondary* seawall type in tenths (i.e., "2" = 20% occurrence within the unit)
SM2_M	N	the calculated length in meters of the *secondary* seawall type
SM3_TYPE	T	the *tertiary* type of seawall occurring within the unit where: BR = boat ramp; CB = concrete bulkhead; LF = landfill; RR = rip rap and WB = wooden bulkhead
SM3%	N	the estimated % occurrence of the *tertiary* seawall type in tenths (i.e., "2" = 20% occurrence within the unit)
SM3_M	N	the calculated length in meters of the *tertiary* seawall type
SMOD_TOTAL	N	the total % occurrence of seawall in the unit, in tenths
RAMPS	N	the number of boat ramps that occur within the shore zone of the unit or subunit. Ramps must impact some portion of the shore-zone and generally be constructed of concrete, wood or aggregate. Public boat ramps are shown as variants
PIERS_DOCK	N	the number of piers or wharves that occur within the unit. Piers or docks must extend at least 10m into the shore zone. Category does not include anchored floats
REC_SLIPS	N	the estimated number of recreational (or small) slips associated with the piers/docks of the unit based on small boat length (~<50')
DEEPSEA_SLIP	N	the estimated number of slips for ocean-going vessels (~>100')
ITZ	N	the sum of the across-shore width of all the intertidal components (B-Zone) within the unit

Table A-2 Rationale for BC Shore Types[1]

SUBSTRATE	SEDIMENT	WIDTH	SLOPE	Shore Type Code & Description
ROCK	n/a	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(1) Rock Ramp, wide
			FLAT(<5°)	(2) Rock Platform, wide
		NARROW (<30m)	STEEP(>20°)	(3) Rock Cliff
			INCLINED(5-20°)	(4) Rock Ramp, narrow
			FLAT(<5°)	(5) Rock Platform, narrow
ROCK + SEDIMENT	GRAVEL	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(6) Ramp w gravel beach, wide
			FLAT(<5°)	(7) Platform w gravel beach, wide
		NARROW (<30m)	STEEP(>20°)	(8) Cliff w gravel beach
			INCLINED(5-20°)	(9) Ramp w gravel beach
			FLAT(<5°)	(10) Platform with gravel beach
	SAND & GRAVEL	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(11) Ramp w gravel & sand beach, wide
			FLAT(<5°)	(12) Platform w G&S beach, wide
		NARROW (<30m)	STEEP(>20°)	(13) Cliff w gravel/sand beach
			INCLINED(5-20°)	(14) Ramp w gravel/sand beach
			FLAT(<5°)	(15) Platform with gravel/sand beach
	SAND	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(16) Ramp w sand beach, wide
			FLAT(<5°)	(17) Platform w sand beach, wide
		NARROW (<30m)	STEEP(>20°)	(18) Cliff w sand beach
			INCLINED(5-20°)	(19) Ramp w sand beach, narrow
			FLAT(<5°)	(20) Platform w sand beach, narrow
SEDIMENT	GRAVEL	WIDE (>30m)	FLAT(<5°)	(21) Gravel flat, wide
		NARROW (<30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(22) Gravel beach, narrow
			FLAT(<5°)	(23) Gravel flat or fan
	SAND & GRAVEL	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	n/a
			FLAT(<5°)	(24) Sand & gravel flat or fan
		NARROW (<30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(25) Sand & gravel beach, narrow
			FLAT(<5°)	(26) Sand & gravel flat or fan
	SAND/MUD	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(27) Sand beach
			FLAT(<5°)	(28) Sand flat
				(29) Mudflat
		NARROW (<30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(30) Sand beach
			n/a	
	ORGANICS/FINES	n/a	n/a	(31) Organics/Fines
ANTHRO-POGENIC	MAN-MADE	n/a	n/a	(32) Man-made, permeable
				(33) Man-made, impermeable
CURRENT-DOMINATED				(34) Channel
ICE				(35) Glacial ice shoreline

[1]Shore Type code is used to provide a generalized summation of the detailed physical data complied for each shore unit (from Howes *et al*. 1994).

Table A-3 ESI Shore Type Classification (after Peterson *et al* 2002)

ESI No.	Description
1A	Exposed rocky shores; Exposed rocky banks
1B	Exposed, solid man-made structures
1C	Exposed rocky cliffs with boulder talus base
2A	Exposed wave-cut platforms in bedrock, mud, or clay
2B	Exposed scarps and steep slopes in clay
3A	Fine- to medium-grained sand beaches
3B	Scarps and steep slopes in sand
3C	Tundra cliffs
4	Coarse-grained sand beaches
5	Mixed sand and gravel beaches
6A	Gravel beaches; Gravel Beaches (granules and pebbles)
6B	Rip rap; Gravel Beaches (cobbles and boulders)
6C	Rip rap
7	Exposed tidal flats
8A	Sheltered scarps in bedrock, mud, or clay; Sheltered rocky shores (impermeable)
8B	Sheltered, solid man-made structures; Sheltered rocky shores (permeable)
8C	Sheltered rip rap
8D	Sheltered rocky rubble shores
8E	Peat shorelines
9A	Sheltered tidal flats
9B	Vegetated low banks
9C	Hypersaline tidal flats
10A	Salt- and brackish-water marshes
10B	Freshwater marshes
10C	Swamps
10D	Scrub-shrub wetlands; Mangroves
10E	Inundated low-lying tundra

Table A-4 Exposure Matrix Used for Estimating Observed Exposure (EXP_OBS)*

Maximum Fetch (km)	Modified Effective Fetch (km)				
	<1	**1 - 10**	**10 - 50**	**50 - 500**	**>500**
<1	very protected	n/a	n/a	n/a	n/a
<10	protected	protected	n/a	n/a	n/a
10 – 50	n/a	semi-protected	semi-protected	n/a	n/a
50 – 500	n/a	semi-exposed	semi-exposed	semi-exposed	n/a
>500	n/a	n/a	semi-exposed	exposed	exposed

*Exposure definitions are the same categories listed in EXP_BIO – Table B-1.

Codes for exposures:

very protected	**VP**
protected	**P**
semi-protected	**SP**
semi-exposed	**SE**
exposed	**E**
very exposed	**VE**

Table A-6 Look-Up Table of Calculated ORI Classes Defined by Shore Type and Exposure

Shore Type	Calculated Exposure					
CLASS	VE	E	SE	SP	P	VP
1	1	1	1	2	3	3
2	1	1	1	2	3	3
3	1	1	1	2	3	3
4	1	1	1	2	3	3
5	1	1	1	2	3	3
6	2	3	5	4	4	4
7	2	3	5	4	4	4
8	2	3	5	4	4	4
9	2	3	5	4	4	4
10	2	3	5	4	4	4
11	1	2	3	4	5	5
12	1	2	3	4	5	5
13	1	2	3	4	5	5
14	1	2	3	4	5	5
15	1	2	3	4	5	5
16	1	2	3	3	4	4
17	1	2	3	3	4	4
18	1	2	3	3	4	4
19	1	2	3	3	4	4
20	1	2	3	3	4	4
21	2	3	5	4	4	4
22	2	3	5	4	4	4
23	2	3	5	4	4	4
24	1	2	3	4	5	5
25	1	2	3	4	5	5
26	1	2	3	4	5	5
27	2	2	3	3	4	4
28	2	2	3	3	4	4
29	999	999	999	3	3	3
30	2	2	3	3	4	4
31	5	5	5	5	5	5
32	2	2	3	3	5	5
33	1	1	1	2	2	2
34	999	999	999	4	4	4

Table A-5 Oil Residence Index

Persistence	Oil Residence Index	Estimated Persistence
Short	1	Days to weeks
	2	**Weeks** to months
↓	3	Weeks to **months**
	4	**Months** to years
long	5	Months to **years**

Data Dictionary for BIOUNIT Table

Table A-7 Summary of Data Fields in the BioUnit Table

Field Names	Type	Description
UnitRecID	N	unique numerical number for each record
PHY_IDENT	T	unique alphanumeric identifier made up of the REGION, AREA, PHY_UNIT and SUBUNIT numbers (RR/AA/UUUU/SS)
EXP_BIO	T	An estimate of the exposure based on observed indicator species (see detailed definitions in Table B - 2).
HAB_CLASS	T	Habitat Classification determined by the BIO mapper, that combines the EXP_BIO and the Physical features of the shoreline (see Table A-8).
HAB_OBS	N	the observed biotic assemblage from the imagery (not used in SE project, kept for backward compatible with earlier AK projects)
BIO_SOURCE	T	the source that was used to interpret shore-zone biota, (V)ideotape, (S)lide, (I)nferred
RIPARIAN% *	N	estimate of the percentage of alongshore length of the intertidal zone, where the shoreline is shaded by overhanging riparian vegetation, all substrate types (see additional note below)
RIPARIAN_M	N	length, in meters, of the unit shaded by overhanging riparian vegetation, all substrate types
BIO_UNIT_COMMENT	T	comment field
BIO_MAPPER	T	the last name of the biologist that provided the biological interpretation of the imagery
BIO_MAP_DATE	D/T	date of biological mapping
Photo	Y/N	marks if there is a photo (digital or slide) or a ground station associated with the unit

* Further description of the Riparian% attribute:

As an attribute in the BioUnit table, this category is intended to be an index for the potential habitat for upper beach spawning fishes.

The value recorded in the 'Riparian%' field is an estimate of the percentage of the unit's total alongshore length where riparian vegetation of trees and shrubs is shading the upper intertidal zone. Shading of the last higher high water line is a good estimate of riparian shading. Therefore, shading of wetland herbs and grasses is not included in the estimate, nor is any shading of the splashzone alone.

Shading must be visible in the upper intertidal zone, and the shading vegetation must be woody trees or shrubs. Riparian overhanging vegetation is also an indicator of lower wave exposures, where the splashzone is narrow. Shading may be on sediment-dominated or on rocky intertidal.

Table A - 8 Explanation and Definitions of Habitat Class Codes

Habitat Class is used to describe a summary of the biophysical characteristics of the whole unit, and is useful to provide a single attribute that describes the typical intertidal biota together with the geomorphology. That is, a 'typical' example of a Habitat Class would include a combination of biobands, and their associated indicator species (which determine the Biological Exposure category) and the geomorphological features of the Habitat Class.

The biomapper observes and records the biobands in the unit, if any, and determines the Biological Exposure Category. From the presence/absence of the biobands, the Exposure Category, the geomorphology and the spatial distribution of the biota within the unit, the Habitat Class is determined.

How to Read
the Habitat Class Code

Habitat Class Code

22

Exposed   Mobile, Sediment
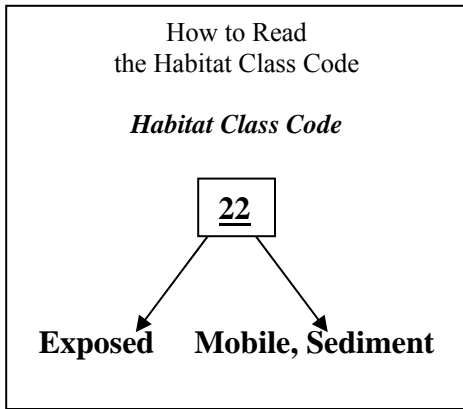
The codes used in the Habitat Class categories (see Text Box, left) are alphanumeric.

The first digit represents the code for the Biological Exposure and the second digit represents the inferred mobility category.

First Digit in Code

Biological Exposure Categories

1 – Very Exposed
2 – Exposed
3 – Semi-exposed
4 – Semi-protected
5 – Protected
6 – Very protected

Second Digit in Code

Inferred Mobility Categories

0 – Immobile, Bedrock or Sediment & Bedrock, or Sediment (can have lush epibenthic biota)
1 – Partially mobile, Sediment or Rock and Sediment
2 – Mobile, Sediment (bare beach)
3 – Estuary (wetland vegetation associated with freshwater stream, often with delta form)
4 – Current-dominated Saltwater Channel
5 – Glacier Ice
6 – Man-made – Impermeable Substrate
7 – Man-made – Permeable Substrate

Table A - 9. Definitions for Habitat Classes (shaded boxes in the Habitat Class matrix are 'Not Applicable' in most regions)**.**

Dominant Structuring Process	Substrate Mobility	Sediment	Description	Biological Exposure Category					
				Very Exposed VE	Exposed E	Semi-exposed SE	Semi-protected SP	Protected P	Very Protected VP
Wave Energy	*Immobile*	*Rock or Rock & Sediment or Sediment*	The epibiota in the immobile mobility categories is influenced by the wave exposure at the site. In high wave exposures, only solid bedrock shorelines will be classified as 'immobile'. At the lowest wave exposures, even pebble/cobble beaches may show lush epibiota, indicating an immobile Habitat Class.	10	20	30	40	50	60
	Partially-mobile	*Rock & Sediment or Sediment*	These units describe the combination of sediment mobility observed. That is, a sediment beach that is bare in the upper half of the intertidal with biobands occurring on the lower beach would be classed as 'partially mobile'. This pattern is seen at moderate wave exposures.

Units with immobile bedrock outcrops intermingled with bare mobile sediment beaches, as can be seen at higher wave exposures, could also be classified as 'partially mobile'. | 11 | 21 | 31 | 41 | 51 | 61 |
	Mobile	*Sediment*	These categories are intended to show the 'bare sediment beaches', where no epibenthic macrobiota are observed. Very fine sediment may be mobile even at the lowest wave exposures, while at the highest wave exposures, large-sized boulders will be mobile and bare of epibiota.	12	22	32	42	52	62
Fluvial/Estuarine Processes		*Estuary/Wetland*	Units classified as the 'estuary' types always include wetland biobands in the upper intertidal, are always associated with a freshwater stream or river and often show a delta form. Estuary units are usually in lower wave exposure categories.	13	23	33	43	53	63
Current energy		*Current-dominated channel*	Species assemblages observed in salt-water channels are structured by current energy rather than by wave energy. Current-dominated sites are limited in distribution and are rare habitats.	14	24	34	44	54	64
Glacial processes		*Glacier*	In a few places in coastal Alaska, saltwater glaciers form the intertidal habitat. These Habitat Classes are rare and include a small percentage of the shoreline length.	15	25	35	45	55	65
Man-modified		*Anthropogenic – Impermeable*	Impermeable man-made Habitats are intended to specifically note units classified as Coastal Class 32.	16	26	36	46	56	66
		Anthropogenic – Permeable	Permeable man-made Habitats are intended to specifically note shore units classified as Coastal Class 33.	17	27	37	47	57	67

Data Dictionary for Across-Shore Component Table (XSHR)
(Adapted from methods and codes outlined in Howes *et al* 1994)

Table A-10 Summary of Data Fields in the Component Table (XSHR)

Field Names	Type	Description
UnitRecID	N	unique record number that relates across-shore records to a unit record
XshrRecID	N	unique record number for each across-shore record
PHY_IDENT	T20	unique alphanumeric identifier made up of the REGION, AREA, PHY_UNIT and SUBUNIT numbers (RR/AA/UUUU/SS)
CROSS_LINK	T20	unique alphanumeric identifier of component made up of: REGION, AREA, PHYS_UNIT, SUBUNIT, ZONE and COMPONENT fields
ZONE	T1	a text code indicating the across-shore position of the component: (A) supratidal, (B) intertidal or (C) subtidal zone
COMPONENT	Is	further subdivision of Zones, numbered from highest elevation in across-shore profile within Zone to lowest.
Form1	T20	describes primary physical Form within each across-shore component (see Table A-11 for codes)
MatPrefix1	T1	veneer indicator field; blank = no veneer; "v" = veneer
Mat1	T20	describes substrate associated with primary form (see Table A-12 for codes)
FormMat1Txt	T50	translation of Form and Material codes into a sentence descriptor
Form2	T20	describes secondary physical Form within each across-shore component (see Table A-11 for codes)
MatPrefix2	T1	veneer indicator field; blank = no veneer; "v" = veneer
Mat2	T20	describes substrate associated with secondary form (see Table A-12 for codes)
FormMat2Txt	T50	translation of Form and Material codes into a sentence descriptor
Form3	T20	describes tertiary physical Form within each across-shore component (see Table A-11 for codes)
MatPrefix3	T1	veneer indicator field; blank = no veneer; "v" = veneer
Mat3	T20	describes substrate associated with tertiary form (see Table A-12 for codes)
FormMat3Txt	T50	translation of Form and Material codes into a sentence descriptor
Form4	T20	describes forth most common physical Form within each across-shore component (see Table A-11 for codes)
MatPrefix4	T1	veneer indicator field; blank = no veneer; "v" = veneer
Mat4	T20	describes substrate associated with forth-order form (see Table A-12 for codes)
FormMat4Txt	T50	translation of Form and Material codes into a sentence descriptor
WIDTH	N	the mean across-shore width of the component in meters
SLOPE	N	the estimated across-shore slope of the component in degrees; not coded in Carr Inlet
PROCESS	T4	the dominant coastal process affecting the morphology of the component (F)luvial, (M)asswasting, (W)aves, (C)urrents, (O)ther, (E)olean
COMPONENT_ORI	N	a numeric index between 1 and 5 that indicates the potential oil residency based on Table A-13

Table A-11 'Form' Code Dictionary. (after Howes *et al* 1994).

A = Anthropogenic
a	dolphin
b	breakwater
c	log dump
d	derelict shipwreck
f	float
h	shell midden
I	cable/ pipeline
j	jetty
k	dyke
m	marina
n	ferry terminal
log	booms
p	port facility
q	aquaculture
r	boat ramp
s	seawall
t	landfill, tailings
w	wharf
x	outfall or intake
y	intake
g	groin

B = Beach
b	berm
c	washover channel
f	face
I	inclined (no berm)
m	multiple bars&troughs
n	relic ridges, raised
p	plain
r	ridge (single intertidal bar)
s	storm ridge
t	low tide terrace
w	washover fan
v	veneer (modifier)

C = Cliff
a	eroding
p	passive

slope
I	inclined (20to35°)
s	steep (>35°)

Cliff cont.
height
l	low (<5m)
m	moderate (5-10m)
h	high (>10m)

modifiers
f	fan, apron
g	surge channel
t	terraced
r	ramp

D = Delta
b	bars
f	fan
l	levee
m	multiple channels
p	plain (no delta, <5°)
s	single channel

E = Dune
b	blowouts
I	irregular
n	relic
ponds	
r	ridge/swale
p	parabolic
v	veneer
w	vegetated

F = Reef
f	horizontal
I	irregular
r	ramp
s	smooth

I = Ice
g	glacier

L = Lagoon
o	open
c	closed

M = Marsh
f	drowned forest
h	high
l	mid to low (discontinuous)
c	tidal creek
e	levee
o	pond
s	brackish – supratidal
f	drowned forest

O = Offshore Island
b	barrier
c	chain of islets
t	table shaped
p	pillar/stack
w	whaleback

elevation
l	low (<5m)
m	moderate (5-10m)
h	high (>10m)

P = Platform
f	horizontal
g	surge channel
h	high tide platform
I	irregular
l	low tide platform
r	ramp
t	terraced
s	smooth
p	tidepool

R = River Channel
a	perennial
t	intermittent
m	multiple channels
s	single channel

T = Tidal Flat
b	bar, ridge
c	tidal channel
e	ebb tidal delta
f	flood tidal delta
l	levee
s	multiple tidal channels
t	flats
p	tidepool
w	plunge pool

I = Ice
g	glacier

Table A-12 'Material' Code Dictionary. (after Howes *et al* 1994).

A = Anthropogenic

a	metal (structural)
c	concrete (loose blocks)
d	debris (man-made)
f	fill, undifferentiated mixed
o	concrete (solid cement blocks)
r	rubble, rip rap
t	logs (cut trees)
w	wood (structural)

B = Biogenic

c	coarse shell
f	fine shell hash
g	grass on dunes
l	trees, fallen not cut, dead
o	organic litter
p	peat
t	trees (alive)

C = Clastic

a	blocks (angular,>25cm)
b	boulders (round, subround,>25cm)
c	cobbles
d	diamicton (poorly sorted sediment containing a range of particles in a mud matrix)
f	fines or mud (mix of silt, clay)
g	gravel (mix pebble, cobble, boulder >2mm)
k	clay
p	pebbles
r	rubble (boulders>1m)
s	sand
$	silt
x	angular fragments (mix block & rubble)
v	**sediment veneer**

R = Bedrock

rock type:

I	igneous
m	metamorphic
s	sedimentary
v	volcanic

rock structure:

1	bedding
2	jointing
3	massive

U = Undefined

DESCRIPTION OF SUBSTRATE
Simplified from Wentworth scale

GRAVELS

boulder	> 25cm
cobble	6 to 25 cm
pebble	0.5 to 6 cm
granule	0.2 to 0.5 cm

SAND
from very coarse to very fine:
all between .5mm to 2 mm

FINES (MUD)
from silt to clay:
smaller than .5mm

The 'material' descriptor consists of one primary term code and associated modifiers (e.g. Cash). If only one modifier is used, indicated material comprises 75% of the volume of the layer (e.g.Cs), if more than one modifier, they are ranked in order of volume. A surface layer can be described by prefix 'v' for veneer (e.g. vCs/R).

Table A-13 Component ORI Matrix

(Refer to Table A-5 for definition of Oil Residence Index Codes.)

Component Substrate	VE	E	SE	SP	P	VP
rock	1	1	1	2	3	3
man-made, impermeable	1	1	1	2	2	2
boulder	2	3	5	4	4	4
cobble	2	3	5	4	4	4
pebble	2	3	5	4	4	4
sand w peb, cob, or boulder	1	2	3	4	5	5
sand v/o peb, cob, or boulder	2	2	3	3	4	4
mud	999	999	999	3	3	3
organics/vegetation	999	999	999	5	5	5
man-made, permeable	2	2	3	3	5	5

Data Dictionary for BIOBAND Table

Table A-14 Summary of Data Fields in the Bioband Table

	Type	Description
UnitRecID	N	unique record number that relates across-shore records to a unit record
XshrRecID	N	unique record number for each across-shore record
PHY_IDENT	T20	unique alphanumeric identifier made up of the REGION, AREA, PHY_UNIT and SUBUNIT numbers (RR/AA/UUUU/SS)
CROSS_LINK	T20	unique alphanumeric identifier of component made up of: REGION, AREA, PHYS_UNIT, SUBUNIT, ZONE and COMPONENT fields
Note: all Biobands are coded **P**atchy (<50% cover) or **C**ontinuous (>50% cover) except the VER band, coded by width **N**arrow (<1m), **M**edium (1-5m) or **W**ide (>5m). See Table B-1 for details.		
VER	T1	bioband for 'VERrucaria' black lichen in supratidal splash zone
PUC	T1	bioband for PUCcinellia and other salt tolerant grasses and herbs
GRA	T1	bioband code for dune GRAsses of supratidal
SED	T1	bioband for mixed sedge of supratidal
BAR	T1	bioband for continuous *Balanus/Semibalanus* BARnacle in upper intertidal
FUC	T1	bioband for FUCus-/barnacle of upper intertidal
ULV	T1	bioband for mixed filamentous and foliose green algae band, mid intertidal
HAL	T1	bioband for bleached mixed filamentous and foliose red algae
BMU	T1	bioband for blue mussels (*Mytilus trossulus)* of mid-intertidal, protected areas
RED	T1	bioband for mixed filamentous and foliose RED algae of lower intertidal
ALA	T1	bioband for stand of large or small morph of *Alaria spp*.
SBR	T1	bioband for unstalked large-bladed laminarins; in the lower intertidal and nearshore subtidal
CHB	T1	bioband for stalked bladed dark chocolate-brown kelps of lower intertidal/nearshore subtidal
SUR	T1	bioband for green SURfgrass of lower intertidal
ZOS	T1	bioband for *ZOStera* (eelgrass) of sheltered areas, lower intertidal and subtidal
ALF	T1	nearshore dragon kelp bioband
MAC	T1	Nearshore canopy kelp *Macrocystis* bioband
NER	T1	bioband for nearshore subtidal *NEReocystis* bull kelp

Note: Refer to Table 6 for brief definitions of Biobands or to Appendix B, Table B-1 for full detailed and illustrated definitions of Biobands.

Data Dictionary for BIOSLIDE Table

Table A-15 Summary of Data Fields in the BioSlide Table

Field Names	Type	Description
SlideID	N	A unique numeric ID given to each slide
UnitRecID	N	unique record number that relates across-shore records to a unit record
SlideName	T50	A unique alphanumeric name assigned to each slide or photo
ImageName	T75	Full image acronym and .jpg for photolink
TapeTime	D/T	Exact time during flight when jpg collected. Used to link photo to digital trackline and position.
SlideDescription	T255	a text field used for comments made by the biomapper to describe each slide
Good Example?	Y/N	Marks good example photos of shorezone features
ImageType	T10	Media type of original image "Digital" or "Slide"
FolderName	T50	name of the folder where the images are stored - required for hyperlink to digital image
PhotoLink	Hyper-link	clicking this link will open the photos related to each unit

Data Dictionary for GROUNDSTATIONNUMBER Table

Table A-16 Summary of Data Fields in the GroundStationNumber Table

Field Names	Type	Description
StationID	N	A unique numeric ID given to each ground station
UnitRecID	N	The unique ID from Unit Table to link data tables
Station	T50	Unique alphanumeric name assigned to each ground station
StationDescription	T255	a text field used for comments made by the biomapper to describe each ground station
Location	T50	General location of each ground station

APPENDIX B

Bioband Descriptions, Biological Exposure Definitions, Selected Maps of Bioband Distributions

Table B-1 The Supratidal Zone Bioband: Splashzone (VER)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associated Species
A	**Splash Zone**	**VER**	Black or bare rock	*Verrucaria sp.* Encrusting black lichens	Visible as a dark stripe, on bare rock, marking the upper limit of the intertidal zone. This band is observed on bedrock, or on low energy boulder/cobble shorelines. Note: This band is recorded by width • Narrow (N) = less than 1m • Medium (M) = 1m to 5m • Wide (W) = more than 5m	Width varies with exposure. N=VP-SP M=SP-SE W=SE-VE	*Littorina sp.*

Narrow to medium splash zone is visible in this image as a dark stripe on the upper portion of a boulder/cobble beach. This example is from a Semi-protected area of Lynn Canal, in Taiya Inlet.	The medium to wide VER band is above the barnacles and *Fucus* on a rock platform. This example is in a Semi-exposed area of Sitka Sound in Kanga Bay.
SEAK04_J4_D1_00031.JPG	SEAK04_J7_D5_00100.JPG

Table B-2 The Supratidal Zone Wetland Biobands: Dune Grass (GRA), Marsh Grasses & Herbs (PUC) and Sedges (SED).

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
A	**Dune Grass**	**GRA**	Pale blue-green	*Leymus mollis*	Found in the upper intertidal zone, on dunes or beach berms. This band is often the only band present on high-energy beaches. Terrestrial herb band will be found above this band depending on elevation.	P-E	
A	**Sedges**	**SED**	Bright green, yellow-green to red-brown. Often appears as a mosaic of greens.	*Carex ramenskii* *Carex lynbyei* *Carex sp.* *Eleocharis sp.* *Eriophorum sp.*	Appears in wetlands around lagoons and estuaries and sometimes as a fringing band below GRA along more protected shoreline. Usually associated with freshwater. This band can exist as a wide flat pure stand, commonly bordered by a PUC band.	VP-SP	* species referenced for this band from Cook Inlet ground survey reports: Bennett, 1996 and Tande, 1996.
A	**Marsh grasses, herbs and sedges**	**PUC**	Light, bright, or dark green, with red-brown	*Puccinellia sp.* *Plantago maritima* *Triglochin sp.* *Honkenya peploides*	Appears in wetlands around lagoons, marshes, and estuaries. Can also appear on dunes. This band is distinct from the dune grass band by its colour.	VP-SE	*Carex sp.*

The pale blue-green grass in the bottom right of this image is Dune Grass, marking the upper limit of supratidal vegetation. The next band seaward is a narrow strip of sedge, which can be identified by its colour of mosaic greens and height similar to that of the dune grass. The lowest wetland band is the Marsh grasses & Herbs, just above the *Fucus sp.* on the delta flat. This protected estuarine area is found on Baranof Island, in Nakwasina Sound.	All three wetland biobands are visible in this typical assemblage of estuarine bands, with the Dune Grass band in the uppermost, the Sedge band directly below, and the lowermost Marsh grasses & Herbs bioband. The Dune Grass is distinguishable from the other two bands by its pale blue-green colour. The SED and PUC bands are similar in appearance but the SED band often has a more mottled colour and is notably higher in relief compared to the more evenly coloured and lower lying PUC band. This estuary is located in a very protected region at the head of Idaho Inlet.
SEAK04_J7_D1_00132.JPG	SEAK04_J3_D2_00064.JPG
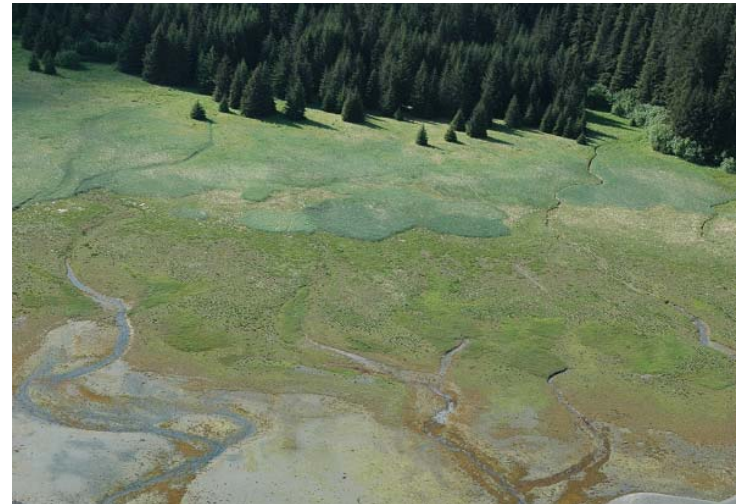
Table B-3 The Upper Intertidal Bioband: Barnacle (BAR)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
upper B	Barnacle	BAR	Grey-white to pale yellow	*Balanus sp. Semibalanus sp.*	Visible on bedrock or large boulders. Can form an extensive band in higher exposures where algae have been grazed away.	P-E	*Endocladia muricata Gloiopeltis furcata Porphyra sp. Fucus sp.*

This is a rock platform just past Lena Point in Lynn Canal with a narrow grey-white barnacle band in the upper portion, just above a dark band of mussels, and another wide pale yellow barnacle band below that. This area would be classified as high Semi-protected.	On Kruzof Island in Krestof Sound, this protected pebble/cobble beach has a wide and continuous pale yellow BAR band along the mid-section below the overhanging trees, which provide riparian shading.
SEAK04_J4_D3_00109.JPG	SEAK04_J6_D1_00178.JPG

Table B-4 The Upper Intertidal Zone Bioband: Rockweed (FUC)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
upper B	Rockweed	FUC	Golden-brown	*Fucus sp.*	Appears on bedrock cliffs and boulder, cobble or gravel beaches. Commonly occurs at the same elevation as the barnacle band.	P-SE	*Balanus sp. Semibalanus sp. Ulva sp. Pilayella sp.*

The Rockweed band is identified on this pebble beach by its characteristic golden colour. It forms a thick wide band in the upper intertidal zone in a Semi-protected area on Douglas Island in Stephens Passage.	This cobble/boulder beach found in Semi-protected Port Krestof of Krestof Sound. The continuous lush golden FUC band in the upper intertidal occurs just below the VER band and above the ULV band.
SEAK04_J5_D2_00100.JPG	SEAK04_J6_D1_00158.JPG

Table B-5 The Intertidal Zone Bioband: Green Algae (ULV)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
B	Green Algae	ULV	Green	*Ulva sp.* *Monostroma sp.* *Enteromorpha sp.* *Cladophora sp.* *Acrosiphonia sp.*	Found on a variety of substrates. This band can consist of filamentous and/or foliose green algae. Filamentous species often form a low turf of dark green.	P-E	Filamentous red algae.

The ULV band can be identified by its bright green colour, as seen here in the lower intertidal of this protected pebble beach. This beach is near Hoonah in Port Frederick of Icy Strait.	On this rock platform on Taigud Island in Sitka Sound near Redoubt Bay, the green algae forms a continuous bright yellow-green band in the lower intertidal at the water's edge.
SEAK04_J5_D1_00197.JPG	SEAK04_J7_D4_00311.JPG

Table B-6 The Intertidal Zone Bioband: Blue Mussel (BMU)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
B	**Blue Mussels**	**BMU**	Black or blue-black	*Mytilus trossulus*	Visible on bedrock and on boulder, cobble or gravel beaches. Appears in dense clusters that form distinct black patches or bands, either above or below the barnacle band.	P-VE	*Fucus sp. Semibalanus sp. Balanus sp.* Filamentous red algae.

The blue mussels seen throughout the Semi-protected area of Taiya Inlet in Lynn Canal form a wide dark black stripe at the water's edge, seen here at the bottom of this rock cliff. The lighter dark band above is the VER band.	On this Semi-protected pebble/cobble beach in Fritz Cove, near Auk Bay of Stephens Passage, the BMU band is found in the mid-intertidal zone and is a distinctly different light blue-grey colour.
SEAK04_J4_D1_00032.JPG	SEAK04_J4_D4_00049.JPG

Table B-7 The Intertidal Zone Bioband: Bleached Red Algae (HAL)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
B	**Bleached Red Algae**	**HAL**	Olive, golden or yellow-brown	Bleached foliose red algae *Palmaria sp.* *Odonthalia sp.*	Common on bedrock platforms, and cobble or gravel beaches. Distinguished from the RED band by colour. The bleached colour usually indicates lower wave exposure than where the RED band is observed, and may be caused by nutrient deficiency.	P-SE	*Halosaccion glandiforme* *Mazzaella sp.* Filamentous green algae

Bleached red algae can be recognised by its olive or flesh-toned colour as seen in the lower intertidal of this protected boulder/cobble beach on Partofshikof Island in Krestof Sound. The yellow-green algae above the bleached red algae are part of the ULV band.	On this rock platform, found in a Semi-protected area of Kutchuma Islands in Eastern Channel, the HAL band can be identified as the golden algae seen in the lower intertidal zone at the water's edge.
SEAK04_J6_D2_00017.JPG	SEAK04_J7_D3_00133.JPG

Table B-8 The Intertidal Zone Bioband: Red Algae (RED)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
B	**Red Algae**	**RED**	Corallines*:* pink or white Foliose or filamentous*:* Dark red, bright red, or red-brown.	*Corallina sp.* *Lithothamnion sp.* *Neoptilota sp.* *Odonthalia sp.* *Neorhodomela sp.* *Palmaria sp.* *Mazzaella sp.*	Appears on most substrates except fine sediments. Lush coralline algae indicates highest exposures; diversity of foliose red algae indicates medium to high exposures, and filamentous species, often mixed with green algae, occur at medium and lower exposures..	P-VE	*Pisaster sp.* *Nucella sp.* *Katharina tunicata* mixed large browns of the CHB bioband

This high Semi-protected boulder/rubble beach in Berners Bay of Lynn Canal has bright pink coralline algae forming the RED band at the waterline.	The red algae on this rock platform form a wide red-brown band that mixes into the ALA band in the lower intertidal below the FUC and BAR bands. This is a Semi-exposed area on Kanga Island in Kanga Bay of Sitka Sound.
SEAK04_J4_D2_00126.JPG	SEAK04_J7_D5_00100.JPG

Table B-9 The Lower Intertidal and Nearshore Zone Bioband: Surfgrass (SUR)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
B & C	Surfgrass	SUR	Bright green	*Phyllospadix sp.*	Appears in tidepools on rock platforms, often forming extensive beds. This species has a clearly defined upper exposure limit of semi-exposed and its presence in units of Exposed wave energy indicates a wide across-shore profile, where wave energy is dissipated by wave run-up across the broad intertidal zone.	SP-SE	Foliose and coralline red algae

There is a very wide continuous band of surfgrass in the subtidal of this rocky beach near Mountain Point on Kruzof Island in Sitka Sound. The wave exposure in this region is changing from Semi-exposed to Semi-protected heading in a northward direction.	This Semi-protected boulder/cobble beach along the runway of Sitka airport has a large bright green patch of Surfgrass in the subtidal and is surrounded by *Macrocystis sp*.
SEAK04_J6_D1_00133.JPG	SEAK04_J7_D2_00037.JPG

Table B-10 The Lower Intertidal and Nearshore Zone Bioband: Alaria (ALA)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
B & C	**Alaria**	**ALA**	Dark brown or red-brown	*Alaria marginata Alaria sp.*	Common on bedrock cliffs and platforms, and on boulder/cobble beaches. This often single-species band has a distinct ribbon-like texture, and may appear iridescent in some imagery.	SP-E	Foliose red algae *Laminaria sp.*

This semi-protected boulder/cobble beach, near Point Adolphus on Chichagof Island in Icy Strait, has a very wide thick red-brown ALA band extending down to the subtidal. The canopy kelp in the nearshore is *Alaria fistulosa* of the ALF band.	The individual fronds of *Alaria sp.* are visible in the lower intertidal zone of this steep cliff, draping over the coralline RED band at the waterline. Above the ALA band is a green ULV band, followed by a dark black BMU band, with a grey-white BAR band above and a medium charcoal grey splash zone at the top. This area near the Chilkat Islands State Marine Park in Lynn Canal, and is at the high end of the Semi-protected exposure category.
SEAK04_J3_D1_00294.JPG	SEAK04_J4_D1_00194.JPG.

Table B-11 The Lower Intertidal and Nearshore Zone Bioband: Soft Brown Kelps (SBR)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
B & C	Soft brown Kelps	SBR	Yellow-brown, olive brown or brown.	*Laminaria saccharina* *Cystoseira sp.*	This band is defined by non-floating large browns and can form lush bands in semi-protected areas. The kelp fronds have a ruffled appearance and can be encrusted with diatoms and bryozoans giving the blades a 'dusty' appearance.	VP-SP	*Alaria sp.* *Cymathere sp.* *Hedophyllum sessile* (bullate)

The ruffled brown kelp fronds of the SBR band can be seen in the subtidal of this current channel near the mouth of Deep Inlet in Sitka Sound. There is also a bright green ULV band on the Semi-protected rubble/boulder beach.	There is a very lush Soft Brown Kelp band in the lower intertidal and subtidal of this semi-protected boulder/cobble/rubble beach at Zeal Point in Neva Strait of Salisbury Sound. Above the SBR band is some patchy green algae of the ULV band and continuous Rockweed of the FUC band.
SEAK04_J7_D4_00142.JPG	SEAK04_J6_D2_00108.JPG

Table B-12 The Lower Intertidal and Nearshore Zone Bioband: Dark Brown Kelps (CHB)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
B & C	**Dark brown Kelps**	**CHB**	Dark chocolate brown	*Laminaria setchelli* *Laminaria bongardiana* *Laminaria yezoensis* *Lessoniopsis littoralis* *Hedophyllum sessile* (smooth)	Found at higher wave exposures, these stalked kelps grow in the lower intertidal. Blades are leathery and shiny smooth. A mixture of species occurs at the moderate wave exposures, while single-species stands of *Lessoniopsis.* occur at high exposures.	SE-VE	*Cymathere sp.* *Pleurophycus sp.* *Costaria sp.* *Alaria sp.* *Neoptilota sp.*

Individual stipes of *Laminaria setchelli* can be seen in the subtidal drooping over as the long blades stay submerged beneath the water of this exposed rock platform on Sinitsin Island just off of Kruzof Island in Salisbury Sound. The BAR band in the upper intertidal is dominated by an associate species *Porphyra sp*.	The smooth shiny blades of the CHB band can be seen at the water line and extending down into the subtidal where there is also *Nereocystis luetkeana* and *Macrocystis integrifolia* present. *Alaria marginata* is found draping over the rubble above the CHB band. This area at Hayward Point on Partofshikof Island in Salisbury Sound is classified as Semi-exposed.
SEAK04_J6_D1_00281.JPG	SEAK04_J6_D2_00062.JPG

Table B-13 The Lower Intertidal and Nearshore Zone Bioband: Eelgrass (ZOS)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
B & C	Eelgrass	ZOS	Bright to dark green	*Zostera marina*	Commonly visible in estuaries, lagoons or channels, generally in areas with fine sediments. Eelgrass can occur in sparse patches or thick dense meadows.	VP-SP	*Pilayella sp.*

There is a thick dense bed of bright green eelgrass in the subtidal of this Semi-protected boulder/cobble beach on Baranof Island in Mielkoi Cove of Sitka Sound. This is the highest wave exposure that eelgrass can be found in. The yellow-green algae forming bands in the lower intertidal of the beaches and reefs are part of the ULV band.	The ZOS band in this very protected estuary located at the head of Nakwasina Sound on Baranof Island forms an extensive meadow all across the sandy flats and down into the subtidal.
SEAK04_J7_D4_00259.JPG	SEAK04_J7_D1_00169.JPG

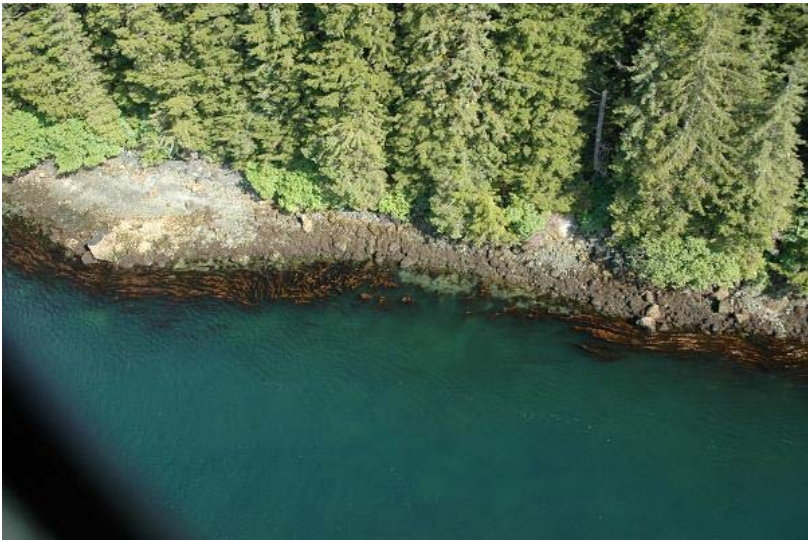# Table B-14 The Nearshore Subtidal Zone Bioband: Dragon Kelp (ALF)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
C	**Dragon Kelp**	**ALF**	Golden-brown	*Alaria fistulosa*	Canopy-forming alga with very long blade and hollow floating midrib, found in nearshore habitats. If associated with NER, it occurs inshore of the bull kelp.	SP-E	*Alaria sp. Nereocystis luetkeana*

The ALF band forms an extensive canopy in the subtidal of this Semi-exposed horizontal rock platform at Eagle Point just past Flynn Cove on Chichagof Island in Icy Strait. It can be identified by its long rope-like appearance as a result of the hollow floating midrib and long blade.	Individual long narrow strands of golden-brown dragon kelp can be seen in the subtidal of this boulder/cobble/pebble beach located north of Mud Bay on Chichagof Island in Icy Strait. This particular area marks a transition point between Semi-exposed and Semi-protected biological exposure categories.
SEAK04_J3_D1_00246.JPG	SEAK04_J3_D1_00310.JPG

Table B-15 The Nearshore Subtidal Zone Bioband: *Macrocystis* (MAC)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
C	**Macrocystis**	**MAC**	Golden-brown	*Macrocystis integrifolia*	Canopy-forming giant kelp, long stipes with multiple floats and fronds. If associated with NER, it occurs inshore of the bull kelp.	P-SE	*Nereocystis luetkeana* *Alaria fistulosa*

Macrocystis integrifolia can be identified by its long stipes with multiple floats and fronds as shown here forming an extensive band in the subtidal zone of a Semi-exposed island near Sitka airport in Sitka Sound.	The subtidal in this area is dominated by the golden brown kelp of the MAC band. This giant kelp forms extensive canopies all along the Semi-protected shore near Cape Burunof of Baranof Island in Sitka Sound.
SEAK04_J7_D2_00056.JPG	SEAK04_J7_D4_00208.JPG

Table B-16 The Nearshore Subtidal Zone Bioband: Bull Kelp (NER)

Zone	Bioband Name	Database Label	Colour	Indicator Species	Physical Description	Exposure	Associate Species
C	**Bull Kelp**	**NER**	Dark brown	*Nereocystis luetkeana*	A distinctive canopy-forming kelp with many long strap-like blades growing from a single floating bulb atop a long stipe. Can form an extensive canopy in nearshore habitats, usually further offshore than *Alaria fistulosa* and *Macrocystis*. Often indicates higher current areas if observed at lower wave exposures.	SP-VE	*Alaria fistulosa Macrocystis integrifolia*

The bull kelp in the subtidal can be identified by the long blades growing from a single floating bulb, with long hollow floating stipe. The kelp forms a thick canopy in the nearshore of this Semi-protected boulder/cobble/rubble beach on Chichagof Island in Elfin Cove of Cross Sound.	The *Nereocystis luetkeana* forms a narrow band nearshore this rock platform on Baranof Island in Nakwasina passage, indicating a higher wave energy than expected in this protected area; as a result, this particular area was classified as a Semi-protected current dominated channel.
SEAK04_J3_D2_00111.JPG	SEAK04_J7_D1_00137.JPG

Illustrated Biological Exposure Definitions

The ***biological wave exposure*** category is a summary attribute based on the observation of the biobands present and/or absent in each shore unit, and the interpretation of the biomapper. Assemblages of typical species have been determined to be useful for distinguishing between wave exposures, using information about species energy-tolerances taken from literature and expert knowledge.

Indicator and associated species, as well as their associated Biobands have been assigned to the same six wave exposure categories used by the physical mappers (defined by fetch and fetch window estimates). Example photos and the list of indicator and associated species and biobands are listed below for the five wave exposure categories we used in Southeast shorezone biomapping. The Very Exposed category does not occur in Southeast Alaska and but has been mapped on the Outer Kenai coast, in Kenai Fjords National Park, as well as on the southwest coast of Moresby Island, British Columbia.

Note that species and biobands listed for each wave exposure category are considered 'typical' but not 'obligates'. That is, not all species occur at every unit classified with this wave exposure. It is the combination of biobands and indicator species, as interpreted by the biomapper that determines the unit-wide wave exposure category.

Shore station species lists are normally used to add qualitative descriptions to bioband definitions and to augment the list of species associated with each bioband. However, in Southeast we have only a few ground station sites, and have used our experience from other Alaskan coastal surveys to compile these Biological Exposure species lists.

Table B-17 Typical and Associated Species and Biobands for:
Exposed Exposure Category

	Indicator species	Associated Species	Bioband Name	Bioband Code
Upper Intertidal		*Leymus mollis* *	Dune Grass	GRA
	Verrucaria - wide		Splash Zone	VER
		Balanus glandula/ Semibalanus balanoides	Barnacle	BAR
	Semibalanus carriosus		Barnacle	BAR
	Mytilus trossulus		Blue Mussel	BMU
Lower Intertidal	Coralline red algae		Red Algae	RED
	Alaria 'nana' morph		*Alaria*	ALA
	Lessoniopsis littoralis		Dark brown Kelps	CHB
	Laminaria setchellii		Dark brown Kelps	CHB
	Nereocystis luetkeana		Bull Kelp	NER

* observed in dunes on bare beaches

Table B-17 (cont). Examples of EXPOSED ShoreZone Units

Dark encrusting black lichens forming a wide band in the splashzone (VER bioband) with a co-occurring Barnacle (BAR) and Rockweed (FUC) band. The lower intertidal has the diagnostic biobands for Exposed: the Dark Brown Kelps (CHB band), with indicator species *Lessoniopsis*, overstory to a lush coralline red algae (RED) bioband.

The wide splash zone at this Exposed site shows the black lichen (VER) in the splashzone, and a thick Barnacle band (BAR) and *Lessoniopsis* in the Dark Brown Kelps (CHB band) extending down into the subtidal.

Table B-18 Typical and Associated Species and Biobands for:
Semi-exposed Exposure Category

	Indicator species	Associated Species	Bioband Name	Bioband Code
Upper Intertidal		*Leymus mollis* *	Dune Grass	GRA
	Verrucaria - wide		Splash Zone	VER
		Balanus glandula/ Semibalanus balanoides	Barnacle	BAR
		Fucus distichus	Rockweed	FUC
	Semibalanus carriosus		Barnacle	BAR
	Mytilus trossulus		Blue Mussels	BMU
Lower Intertidal and Nearshore Subtidal	diverse mixed red algae, including *Odonthalia, Palmaria* and others.		Red Algae	RED
	Neoptilota		Red Algae	RED
	Alaria 'marginata' morph		Alaria	ALA
	Phyllospadix sp.		Surfgrass	SUR
	Laminaria setchellii		Dark brown Kelps	CHB
	Laminaria yezoensis		Dark brown Kelps	CHB
	Laminaria bongardiana morph		Dark brown Kelps	CHB
	Hedophyllum smooth morph		Dark brown Kelps	CHB
	Alaria fistulosa		Dragon Kelp	ALF
		Macrocystis integrifolia	Macrocystis	MAC
	Nereocystis luetkeana		Bull Kelp	NER

Table B-18 (con't). Examples of SEMI-EXPOSED ShoreZone Units

The Semi-exposed Units often have the highest species diversity of the Exposure categories. This example of a rock platform has Red Algae (RED), *Alaria* (ALA), Dark Brown Kelps (CHB) and nearshore *Macrocystis* (MAC) bed..

This example of Semi-exposed is a boulder/cobble beach covered with thick Red Algae (RED) bioband. A nearshore bed of Dragon Kelp (ALF) is visible in the milky glacial waters.

At this Semi-exposed shore, the lower intertidal is dominated by coralline red algae (RED) with sparse *Alaria* (ALA). The upper intertidal has a Blue Mussel band (BMU), along with Rockweed (FUC) and Barnacle (BAR).

Table B-19 Typical and Associated Species and Biobands for:
Semi-protected Exposure Category

	Indicator species	Associated Species	Bioband Name	Bioband Code
Upper Intertidal		*Leymus mollis* *	Dune Grass	GRA
		Carex spp *	Sedges	SED
		Puccinellia *	Marsh grasses, herbs and sedges	PUC
		Triglochin *	Marsh grasses, herbs and sedges	PUC
		Plantago maritima *	Marsh grasses, herbs and sedges	PUC
	Verrucaria		Splash Zone	VER
Lower Intertidal and Nearshore Subtidal		*Balanus glandula/Semibalanus balanoides*	Barnacle	BAR
		Fucus distichus	Rockweed	FUC
	Semibalanus carriosus		Barnacle	BAR
	Mytilus trossulus		Blue Mussels	BMU
		Ulva/ foliose green algae	Green Algae	ULV
	Palmeria spp - bleached		Bleached Red Algae	HAL
	diverse mixed red algae including *Odonthalia*		Red Algae	RED
	Alaria 'marginata' morph		Alaria	ALA
	Zostera marina		Eelgrass	ZOS
	Cystoseira		Soft brown Kelps	SBR
	Cymathere		Soft brown Kelps	SBR
	Laminaria saccharina morph		Soft brown Kelps	SBR
	Nereocystis luetkeana		Bull Kelp	NER

* These species are associated with Wetland/ Estuary areas at this wave exposure.

Table B-19 (con't). Examples of SEMI-PROTECTED ShoreZone Units

At this Semi-protected shore, the bedrock supports a lush biota, including upper intertidal Rockweed (FUC), lower intertidal Green Algae (ULV) and nearshore *Macrocystis* (MAC).

The Blue Mussel band (BMU) is prominent in this Semi-protected shoreline. Note the thin band of Rockweed (FUC) and Barnacles (BAR) above the blue-black mussel band, and the bare-looking lower intertidal that has patchy filamentous Red Algae with coralline reds (RED).

This beach was classified as 'Mobile' Semi-protected and shows a band of lower intertidal/ nearshore subtidal eelgrass (ZOS), as well as a patchy nearshore Soft Brown Kelps (SBR) band.

Table B-20 Typical and Associated Species and Biobands for:
Protected and Very-protected Exposure Categories

		Indicator species	Associated Species	Bioband Name	Bioband Code
Upper intertidal			*Leymus mollis **	Dune Grass	GRA
			Carex spp *	Sedges	SED
			Puccinellia *	Marsh grasses, herbs and sedges	PUC
			Triglochin *	Marsh grasses, herbs and sedges	PUC
			Plantago maritima *	Marsh grasses, herbs and sedges	PUC
		Verrucaria		Splash Zone	VER
			Balanus glandula/Semibalanus balanoides	Barnacle	BAR
			Fucus with epiphyte *Pilayella*	Rockweed	FUC
		Mytilus trossulus		Blue Mussels	BMU
Lower Intertidal		*Ulva/* foliose green algae		Green Algae	ULV
		Zostera marina		Eelgrass	ZOS
		Laminaria saccharina morph (not in Very Protected)		Soft brown Kelps	SBR

* These species are associated with Wetland/ Estuary areas at this wave exposure.

Table B-20 (con't). Examples of PROTECTED and VERY PROTECTED ShoreZone Units

This beach in a Protected wave exposure is typical of lower energy, sediment dominated sites, where even smaller materials such as cobbles and pebbles are stable enough to support epibiota. Note the Rockweed (FUC) and Barnacle (BAR) bands on the upper beach. A fringing Marsh Grass (PUC) band is also present here, with Green Algae (ULV) and patchy Soft Brown Kelps (SBR) at the lower beach.

At this Protected wide beach, patchy Rockweed (FUC) and Blue Mussel (BMU) bands are visible. Typical of lower energy sites, the nearshore subtidal is bare. Man-made modifications are seen in the supratidal, where riprap and fill has impacted the natural riparian vegetation.

In the upper flats of wide wetlands, the Wave Exposure is classified as Very Protected. In these areas, the dominant energy is more likely to be fluvial than marine. The three supratidal bands diagnostic of wetland estuary sites are visible in this example, from the uppermost Dune Grass (GRA) band at the right; across the flats with the green of the Marsh Grasses & Herb complex (PUC) band, and along the stream channel at the top of the image, is bright green of Sedge (SED) band. Rockweed (FUC) is visible on the lower delta flats.

Mapped Distributions of Selected Biobands
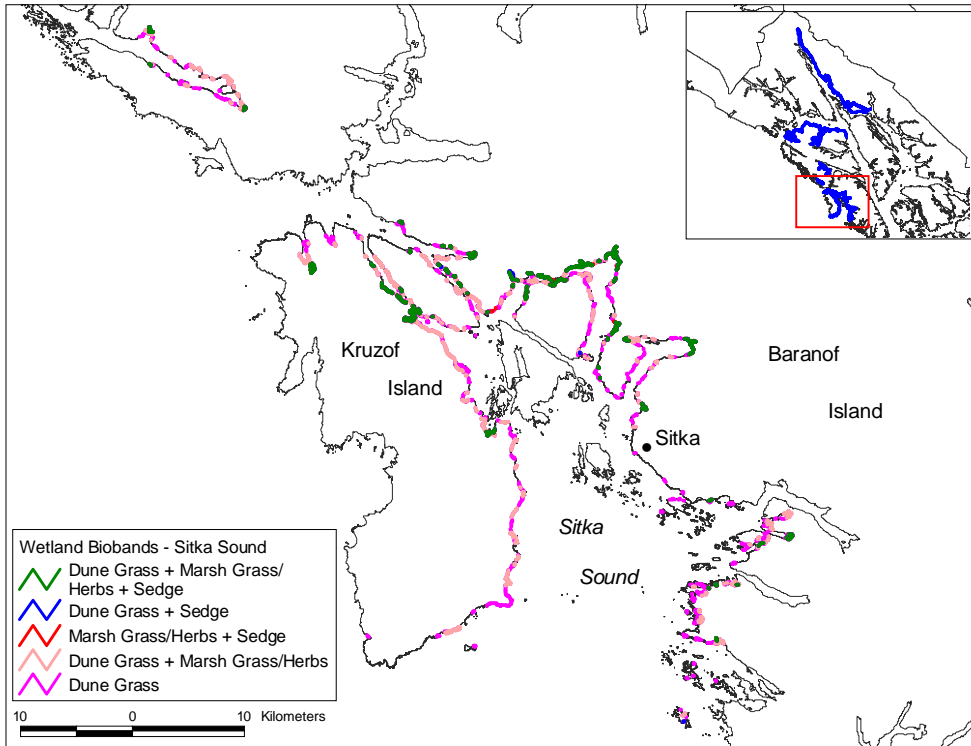
Figure B-1. Wetland Biobands in the Sitka Sound mapping area.
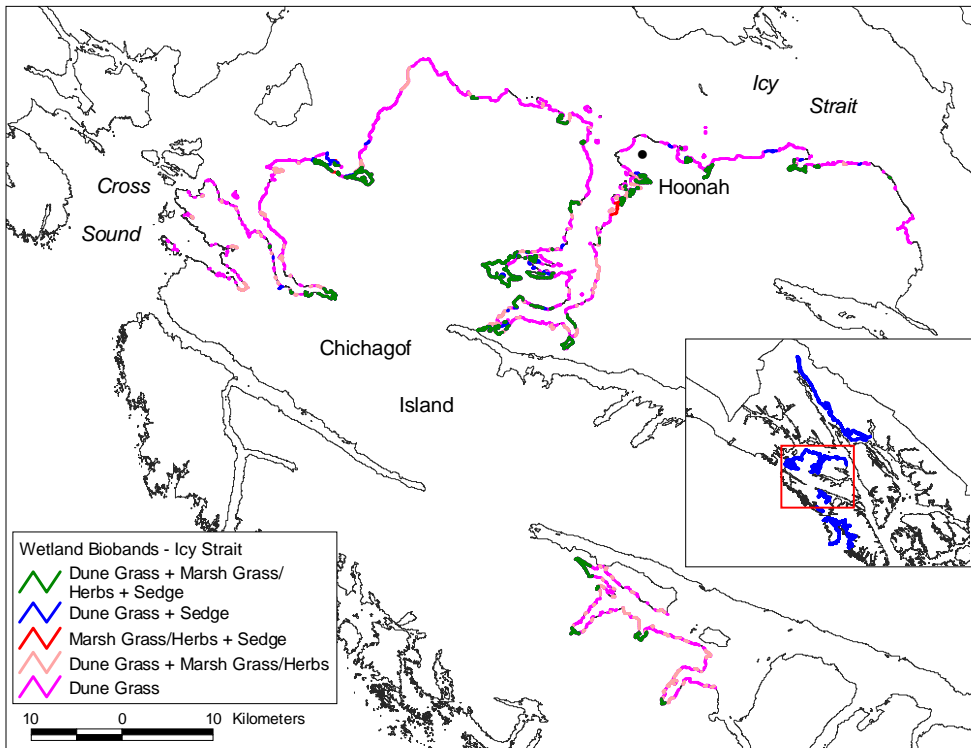
Figure B-2. Wetland Biobands in the Icy Strait mapping area.
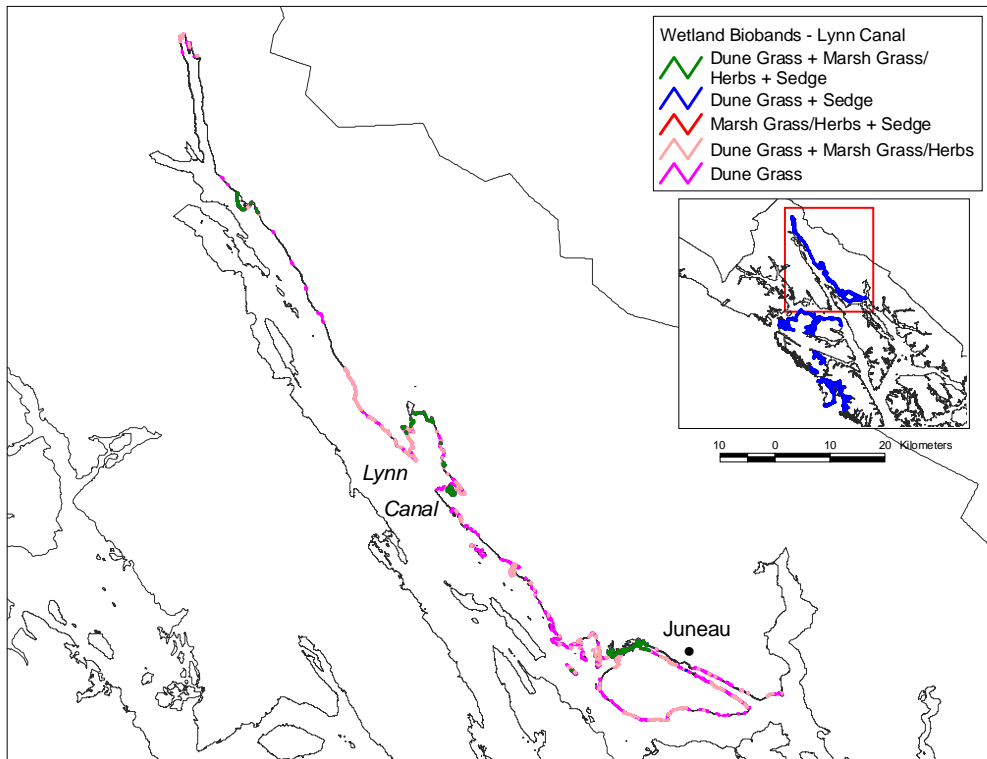
Figure B-3. Wetland Biobands in the Lynn Canal/Juneau mapping area.

Regional Maps of the Distribution of Combinations of Supratidal Wetland/Estuary Biobands.

The combination of the wetland biobands are the most diagnostic for the classification of shore units as 'Estuary'. Shorelines where sections of all three diagnostic bands co-occur are the largest wetland complexes. Only the Dune Grass band occurred frequently in isolation of the other two wetland bands.

The bioband combinations mapped in these figures are:
1. GRA + PUC + SED – good indicator of contiguous wetland/estuary areas
2. GRA + SED – good indicator of smaller wetland/estuary areas
3. PUC + SED – good indicator of smaller wetland/estuary areas
4. GRA + PUC – good indicator of fringing wetlands or smaller wetland/estuary areas
5. GRA – good indicator of dunes on mobile beaches or narrow fringing wetlands
These combinations of the supratidal wetland bands account for nearly all of the records of wetland biobands. That is, SED and PUC were rarely recorded without observation of the other wetland biobands as well.
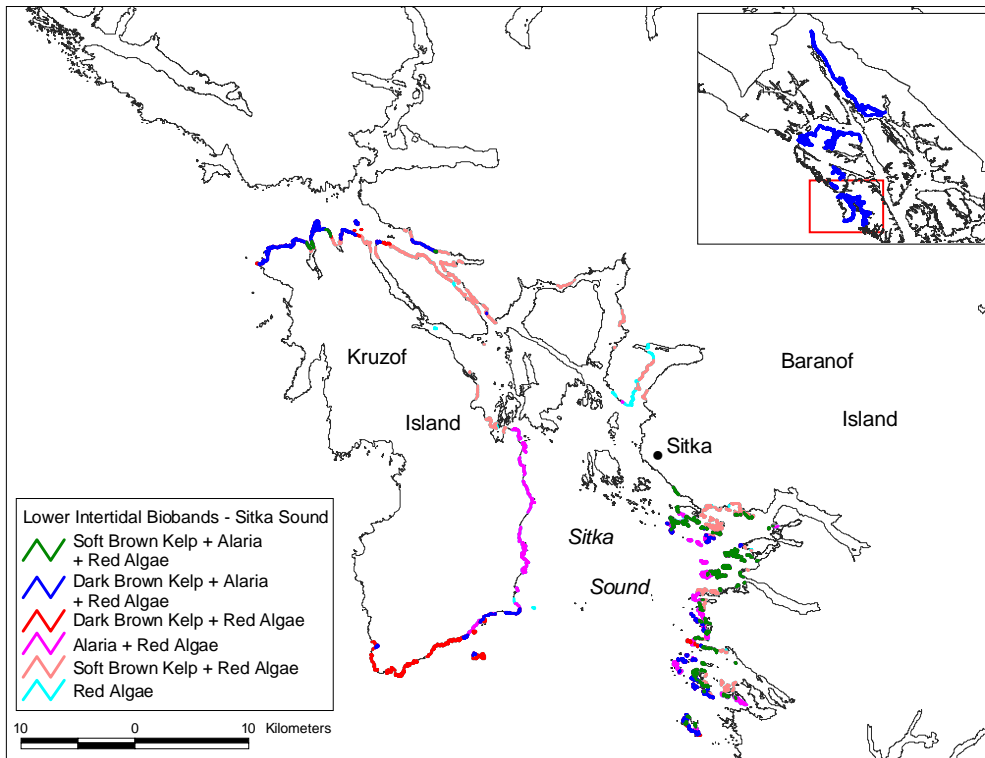
Figure B-4. Lower Intertidal Bioband Combinations in the Sitka Sound mapping
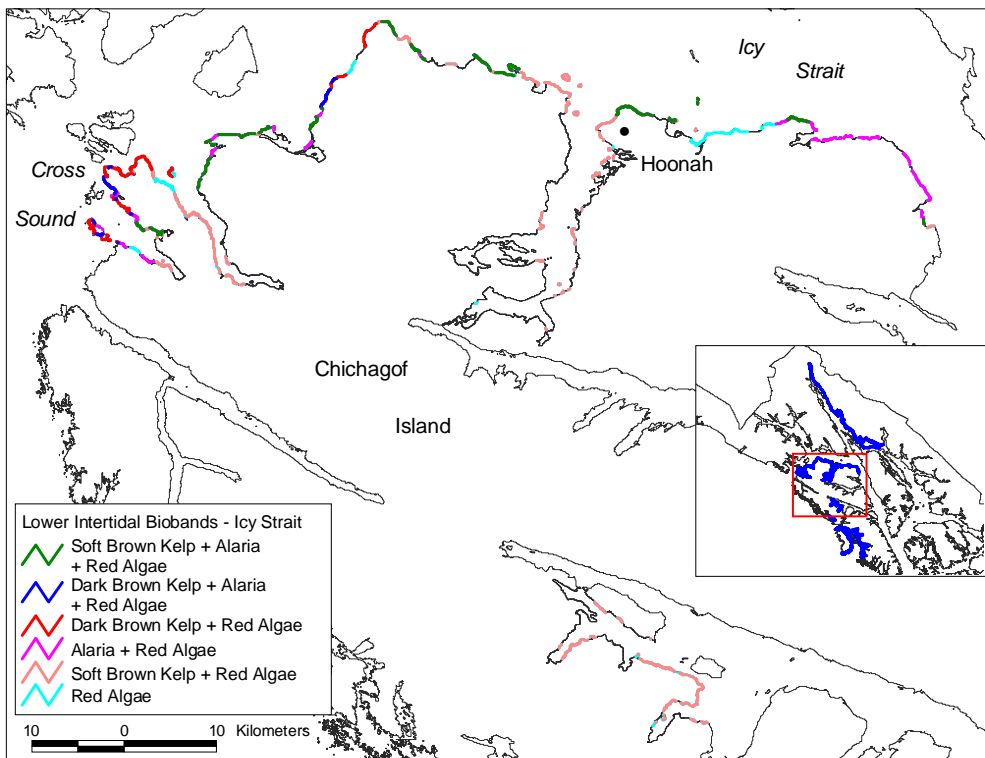
Figure B-5. Lower Intertidal Bioband Combinations in the Icy Strait mapping
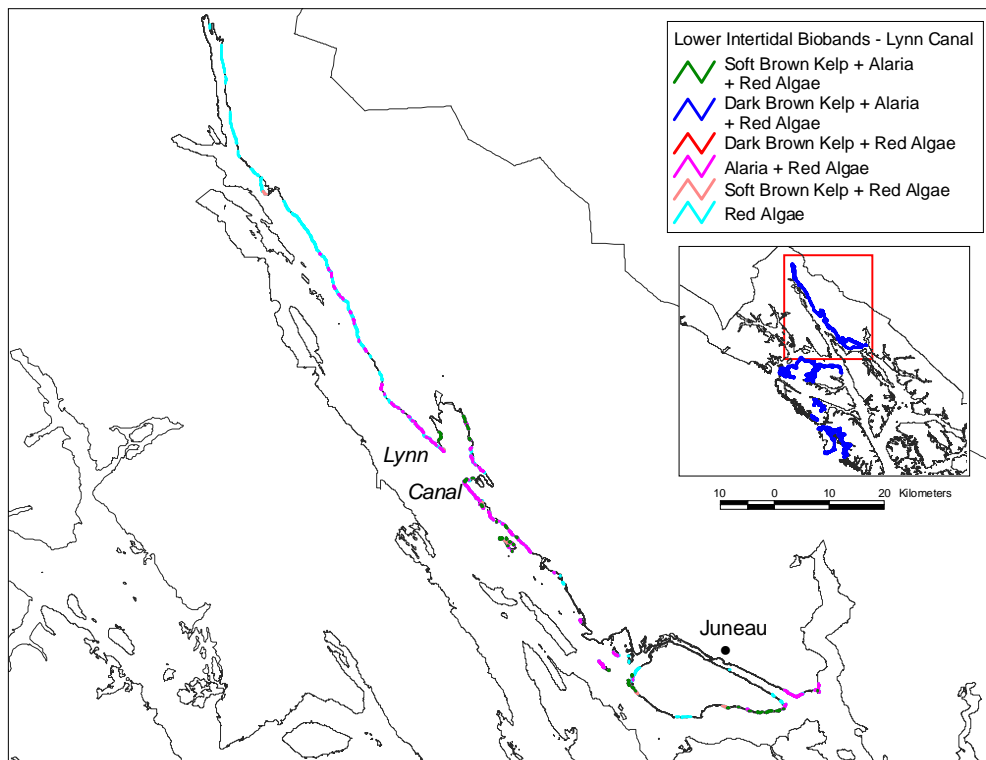
Figure B-6. Lower Intertidal Bioband Combinations in the Lynn Canal/Juneau

Regional Maps of the Distribution of Combinations of Lower Intertidal Biobands.

The combination of the lower intertidal biobands is the most diagnostic of differences between wave exposures and between regions. These combinations were determined for summary of the most commonly occurring combos of these biobands and together account for nearly all the records for the occurrences of these bands.

The bioband combinations mapped in these figures are:
1. SBR + ALA + RED – good indicator of High Semi-protected to Low Semi - exposed
2. CHB + ALA + RED – good indicator of Semi-Exposed to Low Exposed
3. CHB + RED – good indicator of Exposed
4. ALA + RED – good indicator of Semi-exposed to High Semi-protected
5. SBR + RED – good indicator of Semi-protected
6. RED alone – good indicator of Semi-protected
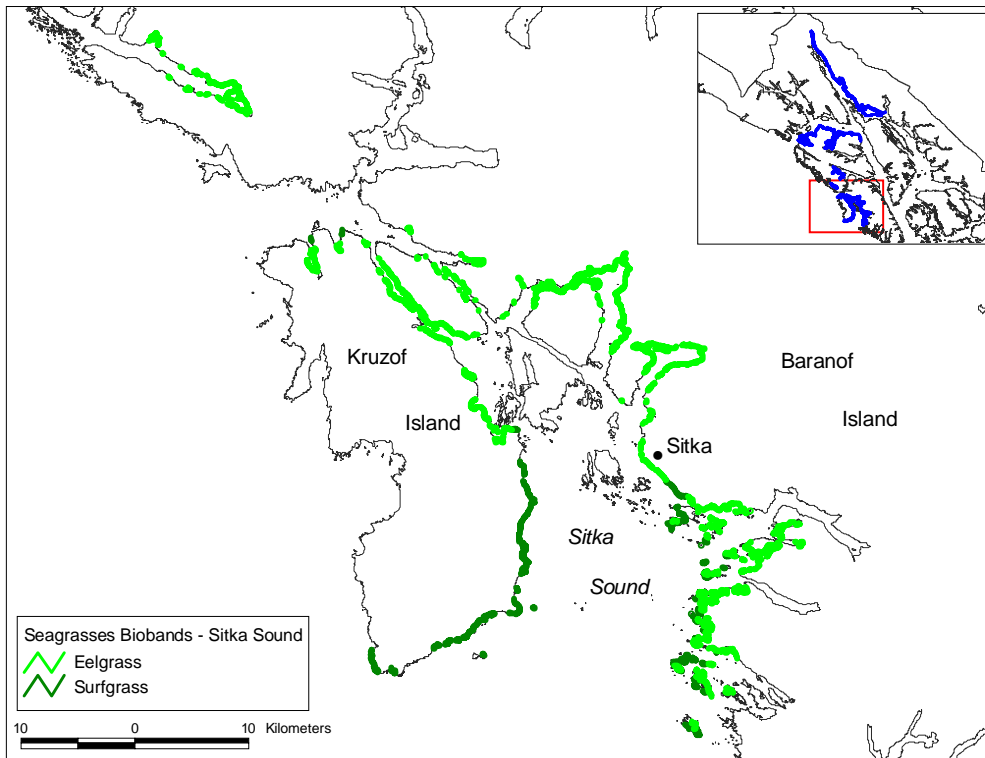
Figure B-7. Seagrass biobands in the Sitka Sound mapping area.
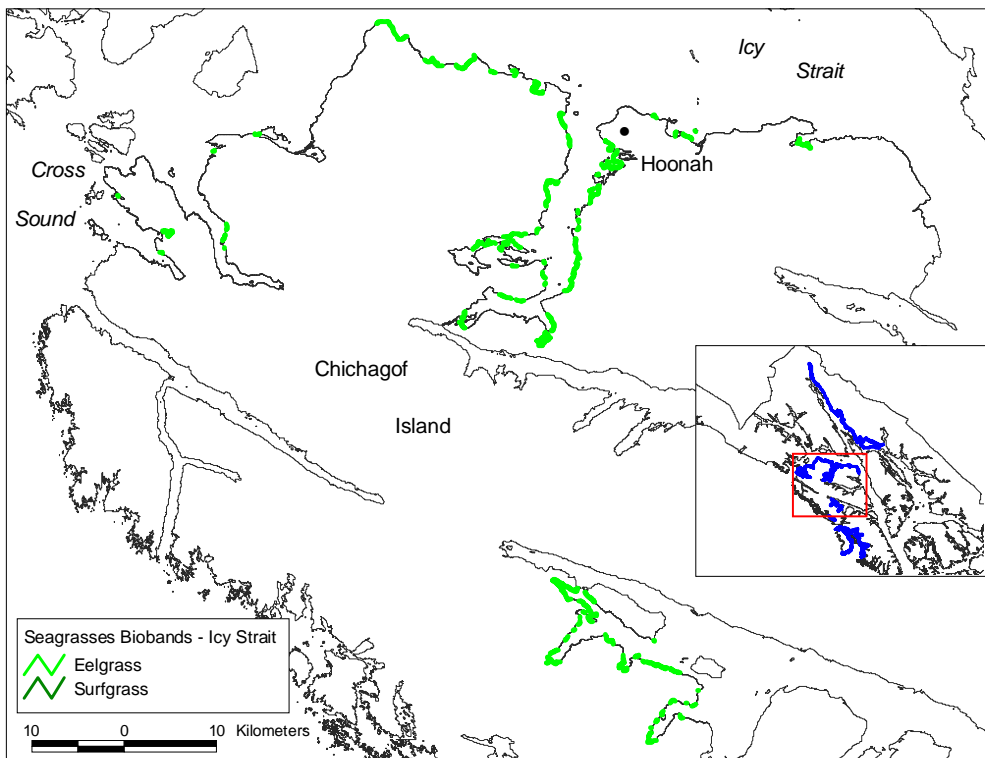

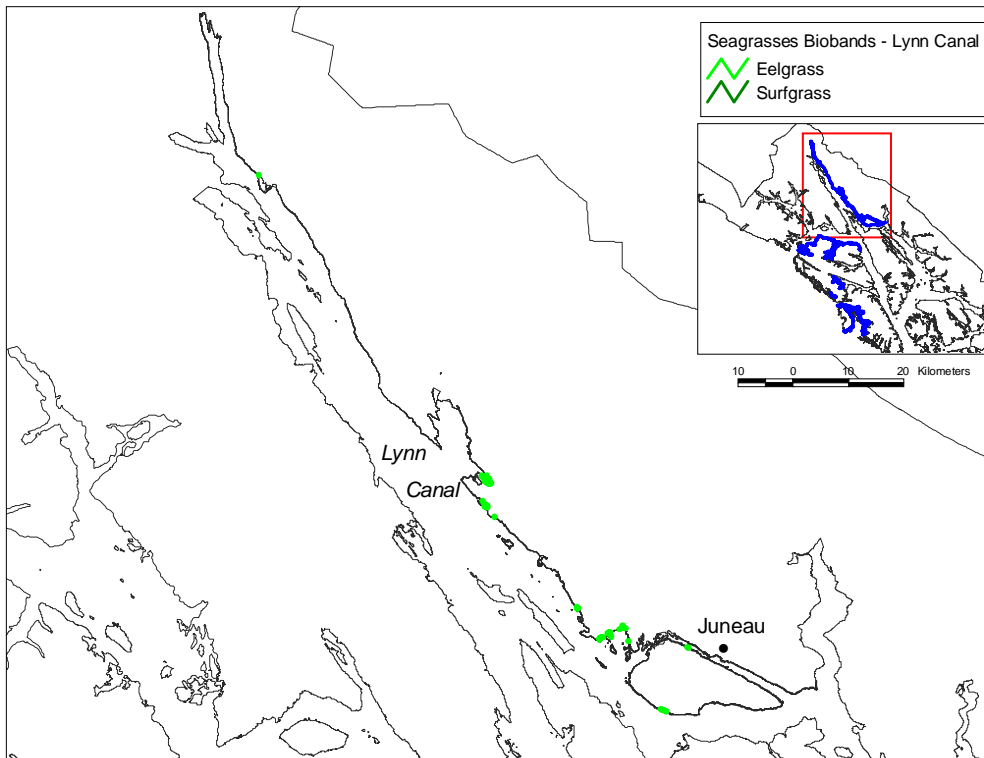Figure B-8. Seagrass biobands in the Icy Strait mapping area.

Figure B-9. Seagrass biobands in the Lynn Canal mapping area.

Regional Maps of the Distribution of Lower Intertidal Seagrass Biobands.

Only a few units had co-occurrence of both of the seagrass bands (eelgrass and surfgrass) and those were observed near Sitka. These maps are summary of presence/absence of these two bands, and data about 'patchy' or 'continuous' distribution within the shoreunits where these bands are observed is included in the database.

Again, the regional differences in seagrass distribution is striking. Eelgrass was observed in only a few bays in the Lynn Canal area, whereas it is widely distributed in the protected waters of Icy Strait.

The majority of the surfgrass is found in the Sitka area, largely a reflection of the coastal habitat types in that region.
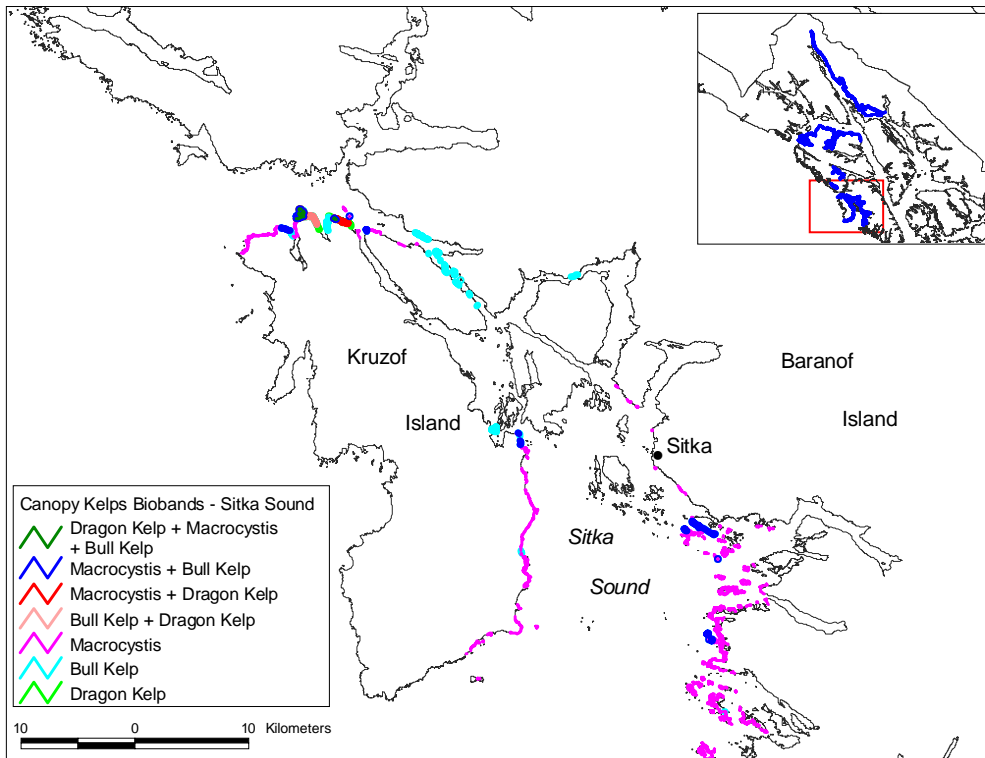
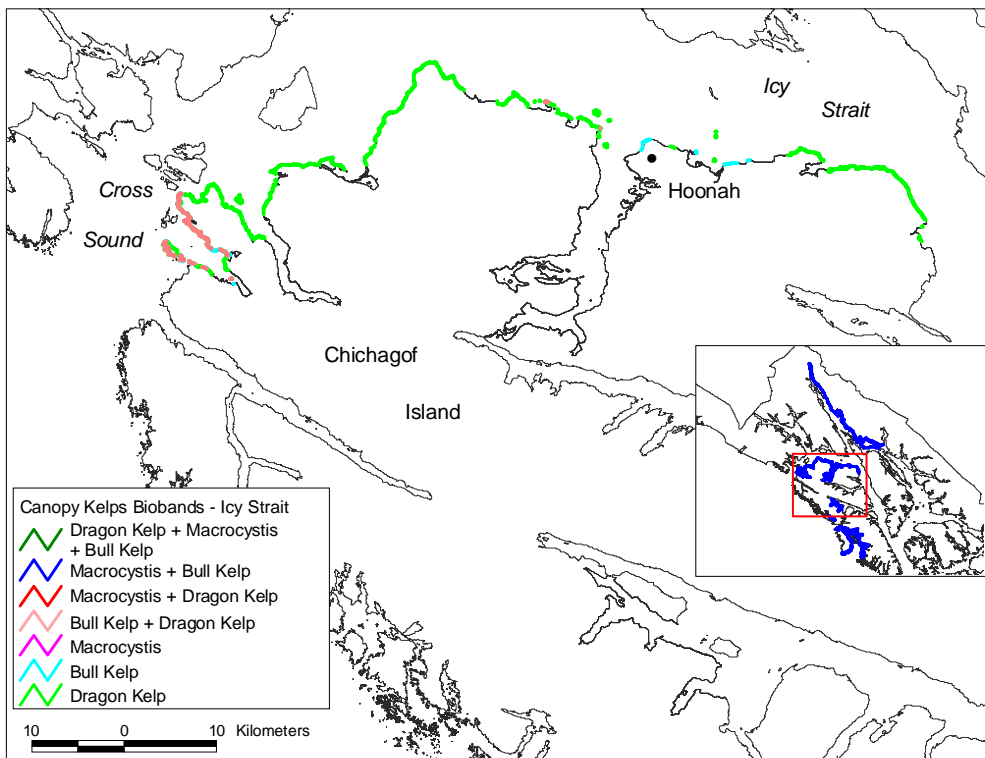Figure B-10. Canopy Kelp Distributions in Sitka Sound mapping area.

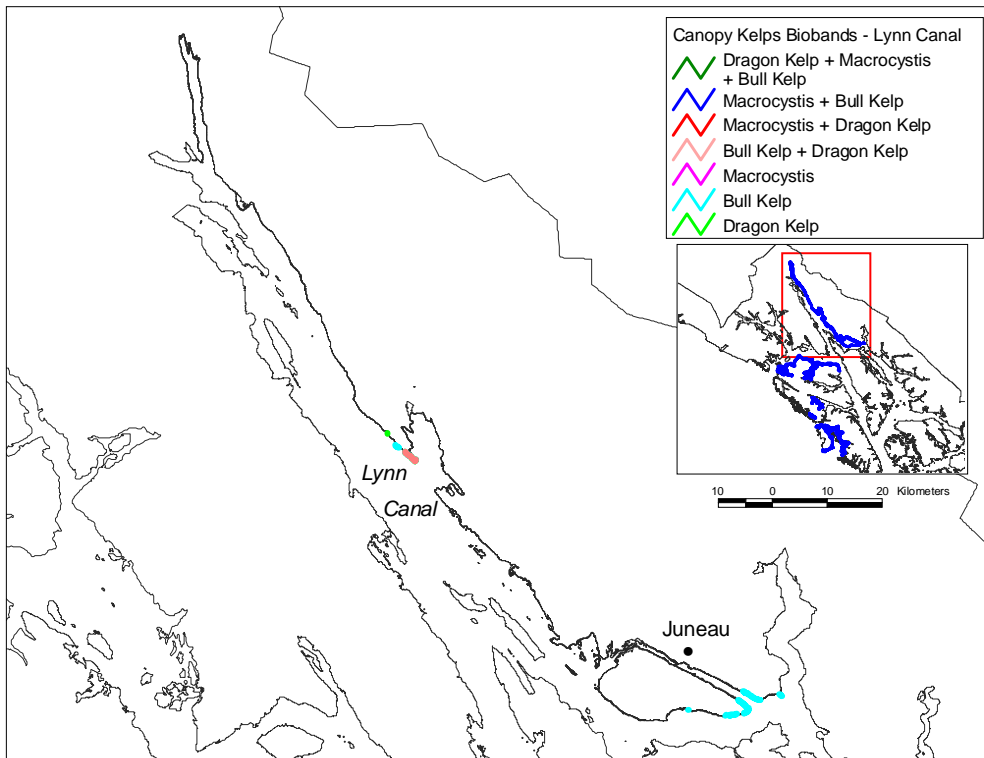Figure B-11. Canopy Kelp Distributions in Icy Strait mapping area.

Figure B-12. Canopy Kelp Distributions in Lynn Canal/Juneau area mapping

Regional Maps of the Distribution of Combinations of Nearshore Canopy Kelp Biobands.

Combinations of nearshore canopy kelps mapped are based on database summaries and the mapped themes account for the majority of the mapping of these bands. The three species co-occurred in only a few units, at the north end of Kruzof Island (green).

The Regional differences in the canopy kelp distribution is striking, with Dragon Kelp dominating in Icy Strait, *Macrocystis* dominant in Sitka Sound, and hardly any canopy kelps observed in the Lynn Canal area.

Combinations mapped are:
1. ALF + MAC + NER
2. MAC + NER
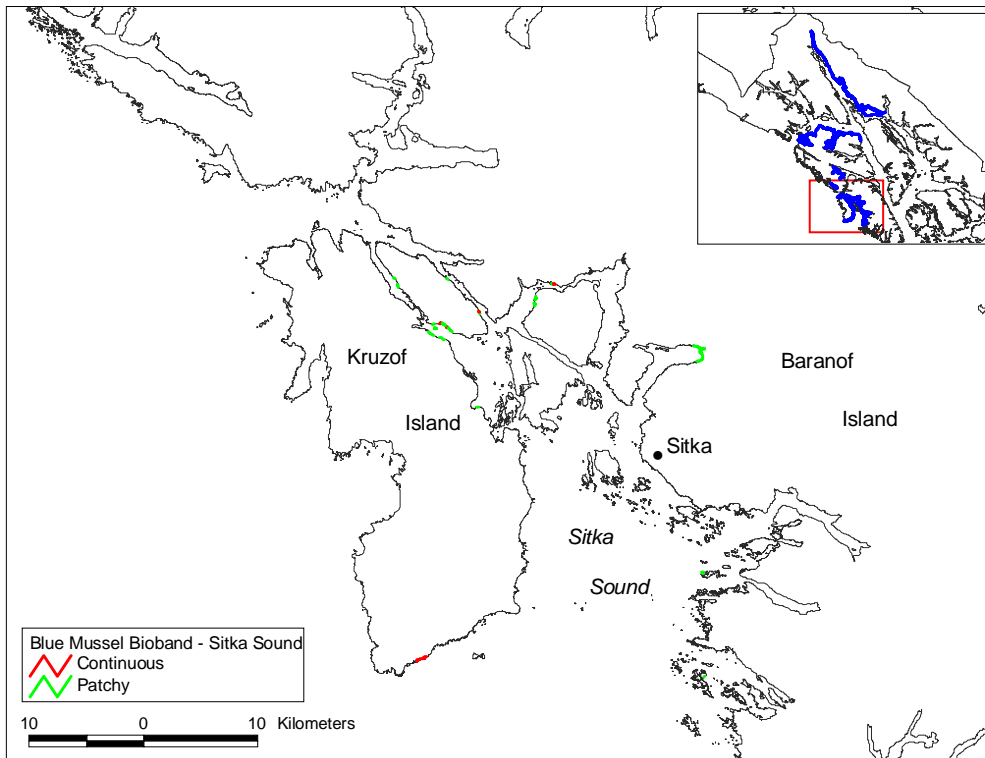3. MAC + ALF
4. NER + ALF
5. MAC
6. ALF
7. NER

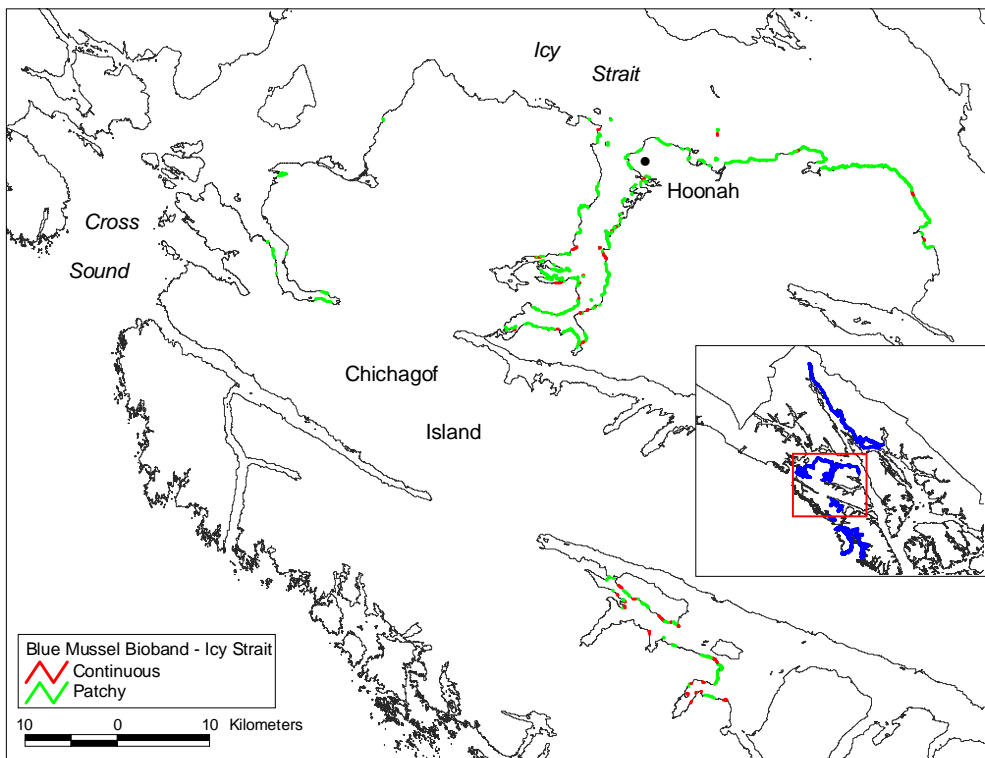Figure B-13. Distribution of Blue Mussel Bioband, Sitka Sound mapping area.

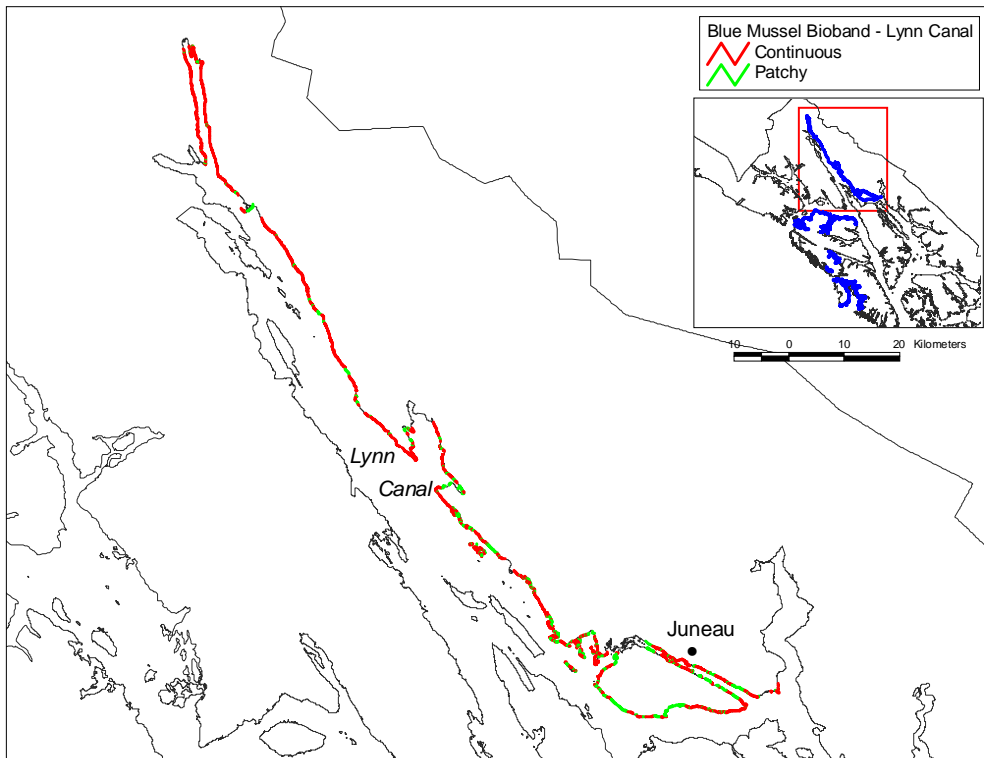Figure B-14. Distribution of Blue Mussel Bioband, Icy Strait mapping area.

Figure B-15. Distribution of Blue Mussel Bioband, Lynn Canal/Juneau area

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Regional Maps of the Distribution of Blue Mussel Bioband

The distribution of the Blue Mussel bioband has been mapped as a single-theme to highlight the regional differences in the band. The patterns highlight the different coastal habitats between regions.

In Lynn Canal, the immobile substrate and the fjord habitat has continuous Blue Mussel, while in Icy Strait, the Blue Mussel is mapped as patchy on the wide sediment shorelines. In the Sitka area, the Blue Mussel band is uncommon, and was mapped only in a few protected shorelines, associated with wetlands and lower wave exposures.

APPENDIX C

Summary of Electronic Data Files

Electronic data files associated with the Southeast Alaska ShoreZone data is as follows:

1) An Access97 database file [AVI_SEAlaska_Database_Draft] with two geology tables (Unit and Xshr) and two biology tables (BioUnit and BioBand) containing all the mapped data. This database also includes links to aerial photos and ground stations documented during the survey (tblBioSlide and tblGroundStationNumber respectively). Also included in the Access97 database are lookup tables for Habitat Class (Hab_Class) and the form and material codes (FormMatCodes). These lookup tables give descriptions of the codes in each of the related fields. Finally, there is a Regional Comments table and form.

2) 17 folders containing all photos taken during the aerial survey [SEAK04_June3_D1, SEAK04_June3_D2, SEAK04_June4_D1, SEAK04_June4_D2, SEAK04_June4_D3, SEAK04_June4_D4, SEAK04_June5_D1, SEAK04_June5_D2, SEAK04_June5_D3, SEAK04_June6_D1, SEAK04_June6_D2, SEAK04_June6_D3, SEAK04_June7_D1, SEAK04_June7_D2, SEAK04_June7_D3, SEAK04_June7_D4, SEAK04_June7_D5]. These photos must be in a precise location in order for the photolinks in the database to work. In the same folder as the database, create a folder called [Photos]. Put all 17 of the above folders, with the exact names, in this [Photos] folder.

3) ArcView files in Albers projection for the point, and line data. The point and linethemes all have a Phy_Ident field which is the primary key linking the ShoreZone data to the master database. Files are also included containing the associated unit breaks, the flightline track, and the photo points. The ArcView shape file names are:

   - se_draft_point_a.shp
   - se__draft_line_a.shp
   - se_draft_unitbreaks_a.shp
   - se_draft_flightline_a.shp
   - se_draft_photos_a.shp

4) A word document file with an electronic copy of the summary report [SE_Final_Report.doc].