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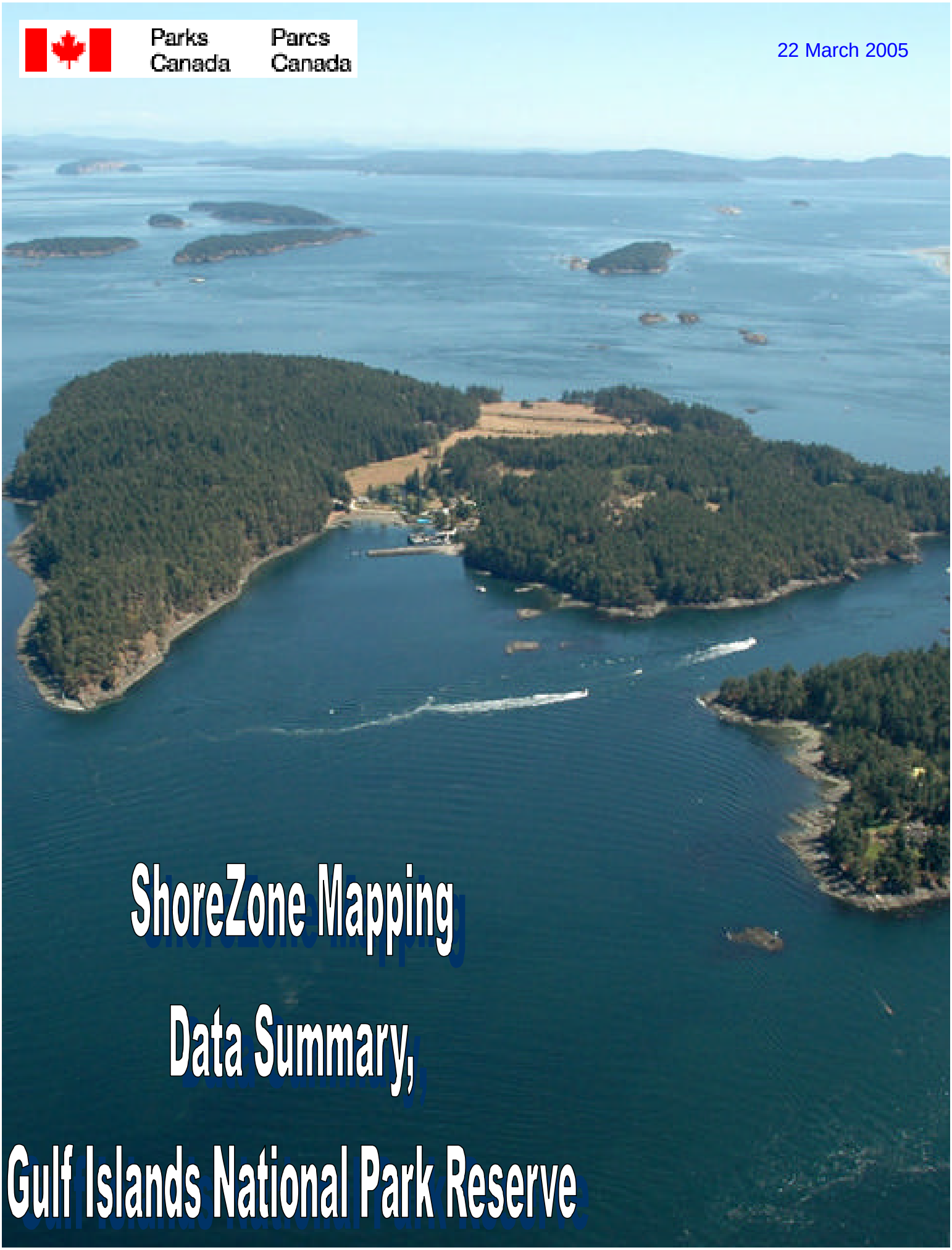
22 March 2005



ShoreZone Mapping

Data Summary,

Gulf Islands National Park Reserve

CORI Project: 04-35 22 March 2005

ShoreZone Mapping Data Summary, Gulf Islands National Park Reserve (v1)

by

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During the 2004 Gulf Islands National Park Reserve mapping project 1,155 km of coastline were imaged and 335 km of coastline were mapped. The mapped area includes d'Arcy Is, Sidney Is, Moresby Is, Pender Is, Portland Is, Prevost Is, Mayne Is, and Saturna Is (Fig.1).

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 the Gulf Islands National Park Reserve are summarized in Table 1, as represented on a 1:20,000 scale digital map.

The average **unit** length over the 335 km of mapped shoreline is 165 m, providing considerable resolution in recording alongshore variation of both physical and biological features.

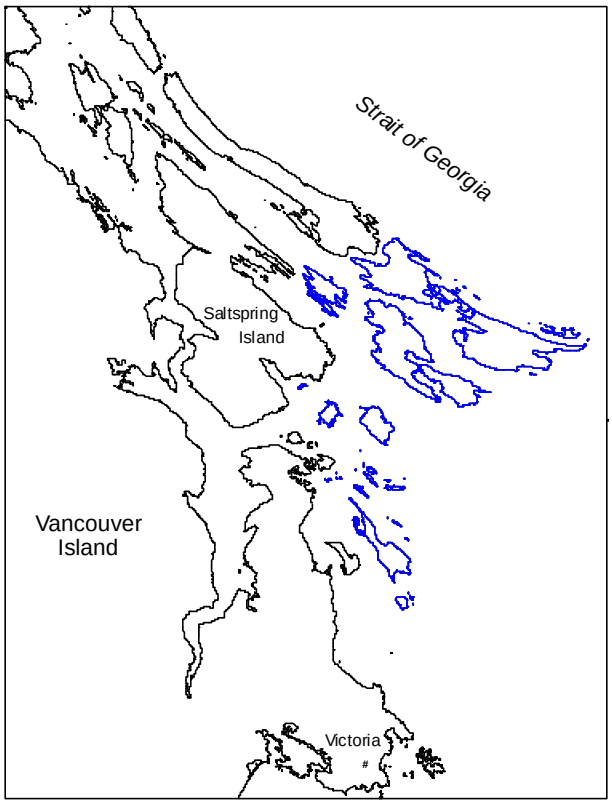

Figure 1. Coastline mapped in 2004 ShoreZone (blue).

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 2,037 units mapped, there are a total of 8,210 across-shore components, with an average of about four across-shore components per unit. There are more than 3,000 unique combinations of form and materials and more than 300 unique combinations of biobands (Table 2).

Table 1 Unit Types and Length

Unit Type	Number	Length (km)
Point	14	-
Line	2,023	335
Totals:	**2,037**	**335**

Table 2 Across-Shore Characterization

Number of Across-Shore Components	Number of Unique Physical Combinations	Number of Unique Biological Combinations
8,210	3,028	324

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). All but two (gravel flat, narrow and sand+gravel flat, narrow) of the 34 possible shore type categories occur in the Gulf Island National Park Reserve (Table 3). Of these, the most prevalent shore types are rock cliff, narrow (12%), rock ramp, narrow (12%), and ramp with gravel beach (14%).

Table 3 Example of Shore Types in Gulf Islands National Park Reserve

Coastal Class	Description	Length (km)	% Occurrence	Sum of %	Major Substrate Types
1	Rock ramp, wide	5.8	2%		
2	Rock platform, wide	9.3	3%		
3	Rock cliff, narrow	40.3	12%		
4	Rock ramp, narrow	41.3	12%		
5	Rock platform, narrow	7.6	2%	*31%*	*Rock*
6	Ramp w gravel beach, wide	1.3	<1%		
7	Platform w gravel beach, wide	10.7	3%		
8	Cliff w gravel beach, narrow	18.1	5%		
9	Ramp w gravel beach, narrow	47.5	14%		
10	Platform w gravel beach, narrow	7.2	2%		
11	Ramp w S&G beach, wide	5.5	2%		
12	Platform w S&G beach, wide	19.4	6%		
13	Cliff w S&G beach, narrow	11.9	4%		
14	Ramp w S&G beach, narrow	26.4	8%		
15	Platform w S&G beach, narrow	3.4	1%		
16	Ramp w sand beach, wide	1.2	<1%		
17	Platform w sand beach, wide	0.8	<1%		
18	Cliff w sand beach, narrow	0.1	<1%		
19	Ramp w sand beach, narrow	2.3	1%		
20	Platform w sand beach, narrow	0.6	<1%	*47%*	*Rock & Sediment*
21	Gravel flat, wide	0.4	<1%		
22	Gravel beach, narrow	1.8	1%		
23	Gravel flat or fan, narrow	0	0%		
24	S&G flat, wide	15.5	5%		
25	S&G beach, narrow	16.4	5%		
26	S&G flat, narrow	0	0%		
27	Sand beach, wide	0.1	<1%		
28	Sand flat, wide	21.0	6%		
29	Mudflat, wide	3.7	1%		
30	Sand beach, narrow	1.1	<1%	*18%*	*Sediment*
31	Wetland/lagoon	9.1	3%	*3%*	*Wetland/Estuaries*
32	Man-made, permeable	2.9	1%		
33	Man-made, impermeable	0.7	<1%	*1%*	*Man-Made*
34	Current dominated	0.4	<1%	*<1%*	*Current Dominant*
		333.7	100%		

The generalized substrate types are summarized in Table 3 and Fig. 2. The mapping data show that mixtures of sediment and rock (e.g., thin sediment veneers over rock or rock cliffs with beaches) (47%) and rock (31%) are the most common substrate types. This result illustrates that it is overly simplistic to separate the shoreline into *just* rock and *just* sediment categories.

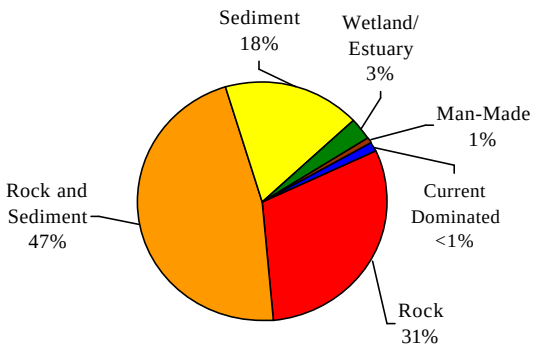

Figure 2 Relative occurrence of general substrate types.

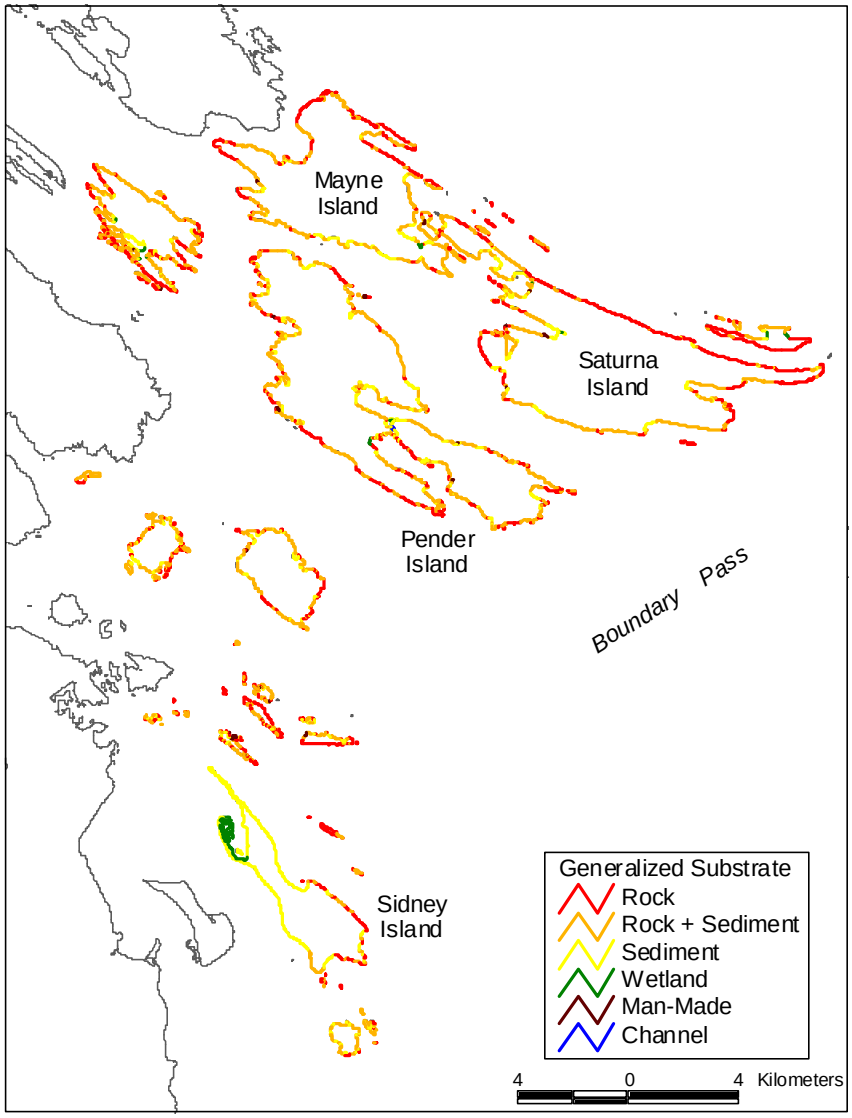

Figure 3 Distribution of general substrate types in the Gulf Islands National Park Reserve.

Most (78%) of the Gulf Islands National Park Reserve is comprised of rock or rock and sediment shoreline. Sediment makes up another 18% of the shoreline. The final three categories, wetland/estuary (3%), man-made (1%), and current dominated (<1%) are all relatively rare. Illustrations of the substrate types can be seen in Figures 4-8.

It is important to note that the total amount of man modified shoreline is 4%, as calculated from the detailed across-shore component information in the database. That is, not every unit that includes man-modified shoreline is classified as modified for the entire unit length. Often, the man-made component only comprises a small amount of the unit's shoreline. For example, if 80% of the shoreline is a rock ramp and 20% is riprap, the unit will be classified as rock ramp. It is also possible that another feature is more prominent than the man-made component. For example, a unit can have a 2m wide seawall behind a 100m wide sand flat. This unit would be classified as sand flat, wide. In both examples, though, the estimated shoreline length of man-modified feature is recorded in the dataset.

There are also some differences between the generalized substrate type and the habitat class defined by the biologists (see Table 8). These differences mostly occur in the wetland/estuary and current-dominated categories where the biological indicators observed by the biologists may result in a different categorization than the features observed by the physical mappers. For example, physical mappers classify any grassy or marshy feature as "wetland/estuary" in order to capture the sensitivity of the shoreline. The biologists would record the observed wetland biobands but may not designate the entire unit as an estuary habitat class. Similarly, the physical mappers may not see physical features of a 'current-dominated channel', where the biologists notice biobands that indicate current energy in the unit.

Figure 4 *Rock and Sediment Shore Type*--Much of the Gulf Islands shoreline is a mixture of rock and sediment. This example from Winter Cove on Samuel Island shows a rock ramp with a veneer of mixed sediment.

Photo: GIAVI04_2864.jpg

Figure 5 *Rock Shore Type*--Over 30% of the Gulf Islands National Park Reserve shoreline is rock cliff, ramp, or platform. This is an example of a rock platform from just off Gooch Island.

Photo: GIAVI04_1579.jpg

Figure 6 *Sediment Shore Type*--In the more sheltered areas of the Gulf Islands National Park Reserve there are sediment shorelines. This sand berm and beach is at the tip of Sidney Spit.

Photo: GIAVI04_1501.jpg

Figure 7 *Wetland/Estuary Shore Type*--Only very sheltered parts of the National Park Reserve have any wetland areas. This wetland is in the protected lagoon of Sidney Island.

Photo: GIAVI04_1508.jpg

Figure 8 *Man-Made Shore Type*--Most of the modified shoreline in the Gulf Islands National Park Reserve is rip rap or landfill. This example from Lyall Harbour on Saturna Island is a log load-out site with rip rap, landfill, and wooden docks.

Photo: GIAVI04_2880.jpg

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.

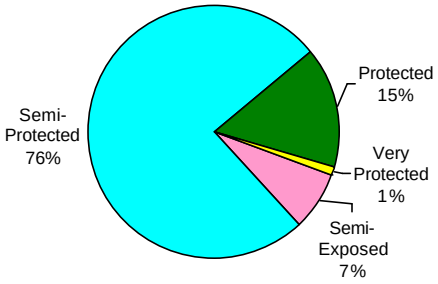

Figure 9 Wave exposure, based on observations of intertidal biota, summarized for the Gulf Islands National Park Reserve.

Exposure categories are summarized in Figure 9 and the distribution is shown in Figure 10. Most of the Gulf Islands National Park Reserve region is low-energy shoreline with 76% consisting of *semi-protected* wave exposures. *Protected* exposures (15%) occur in more protected bays such as Port Browning and Narvaez Bay and *very protected* exposures (1%) occur at the heads of some bays such as Annette Inlet. The only areas with higher energy (*semi-exposed*, 7%) are areas with direct exposure to the Strait of Georgia and current dominated shorelines such as the northwest facing coast of Tumbo Island, Saturna Island, and Mayne Island.

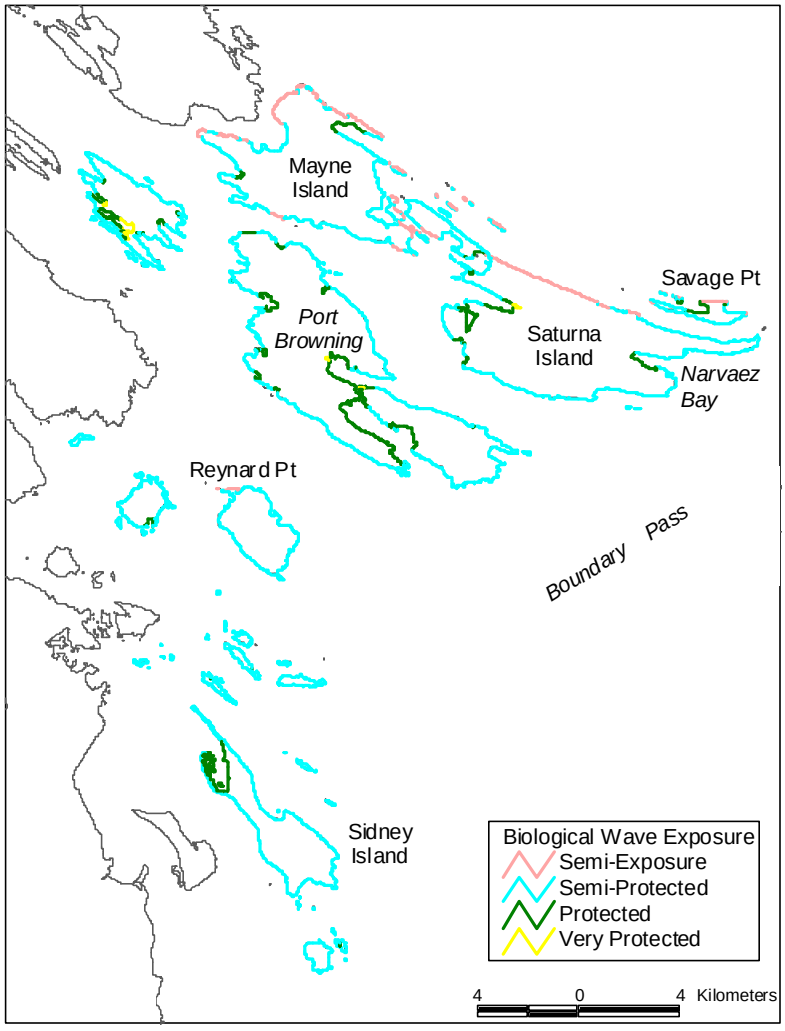

Figure 10 Spatial distribution of wave exposure, based on unit-by-unit observations of intertidal biota.

Shore Modification

Shoreline modification includes areas of seawalls, rip rap, docks, and dikes. There are many areas in the Gulf Islands National Park Reserve region with shore modifications in the intertidal zone. In total, just over 4% of the shoreline is modified. Most of this modification is landfill and rip rap (Table 4). The location of these modified shore segments can be seen in Figure 11.

Table 4 Summary of Shore Modifications

Type	Length (km)
Landfill	6.23
Rip Rap	6.13
Sheet Pile	0.14
Boat Ramp	0.21
Wooden Bulkheads	0.28
Concrete Bulkheads	1.30
Total:	**14.28**

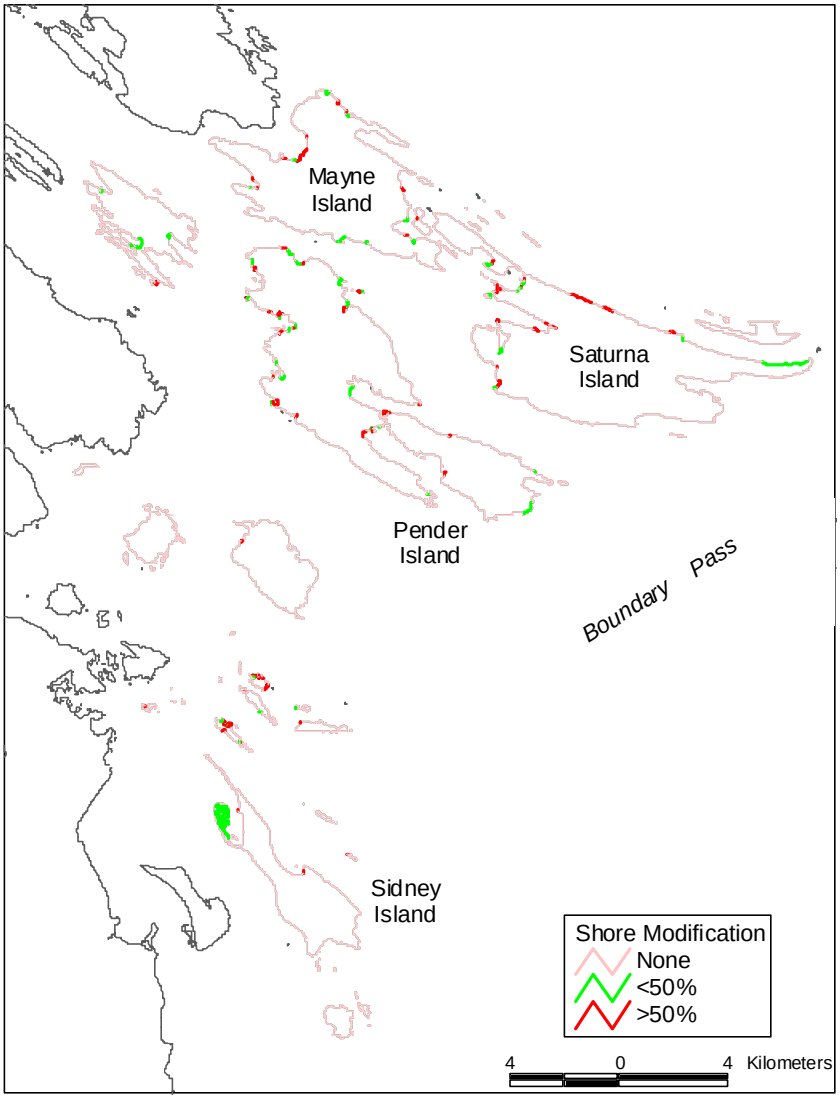

Figure 11 Summary of shore modifications (primarily landfill and rip rap) for the Gulf Islands National Park Reserve.

Oil Residence Index

Table 5 Summary of Oil Residence Index

Estimated Residence	ORI Code	Length (km)	% of Mapping
DAYS to weeks	1	15.92	5%
WEEKS to months	2	85.83	26%
weeks to MONTHS	3	28.39	9%
MONTHS to years	4	163.40	49%
months to YEARS	5	40.16	12%
	TOTALS:	**333.70**	**100%**

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 time. 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 and 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. The shoreline in the Gulf Islands National Park Reserve region has a range of oil residence. Most of the mapped coastline (70%) has high ORI occurrences (4 or 5). The lower ORI occurrences generally coincide with higher wave exposures along the northern coast of Tumbo, Saturna, and Mayne Islands. ORI occurrence is summarized in Table 5 and plotted in Figure 12.

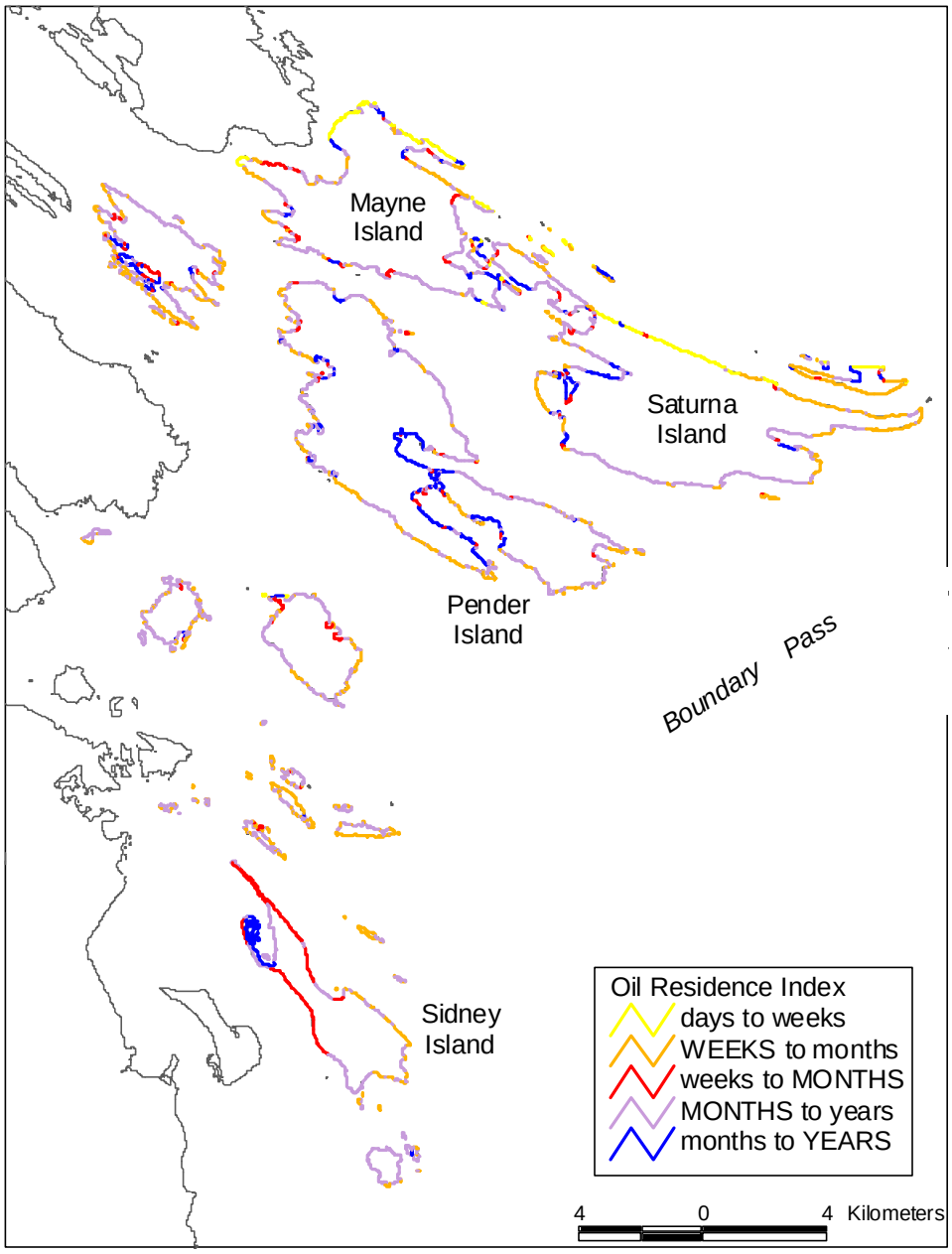

Figure 12 Distribution of Oil Residence Index in the Gulf Islands National Park Reserve.

Biological mapping includes both observed data and interpreted data. Observations of shorezone 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 13).

Figure 13 Example of *Biobands*, as distinct alongshore, linear stripes of colour and texture. Assemblages of biota, usually defined by an abundance of one or two indicator species, form these patterns.

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; Table 6 and Appendix B). 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.

The distribution of all biobands, regardless of the shorezone exposure category is listed in Table 7 and shown in Figure 14. Only a few kilometers of the shoreline in the Gulf Islands National Park Reserve area has wetland biobands in the supratidal (the 'Salicornia' [SAL] and Sedges [SED] bands). Dune Grass (GRA) can also be associated with wetlands but in the Gulf Islands it generally occurs alone. Common upper intertidal biobands of Barnacles (BAR) occur in three-quarters of the area, Rockweed (FUC) was recorded in over half the area, and over 90% of the shoreline included the Green Algae (ULV) band. The most common lower intertidal bands were Red Algae (RED2) and Soft Brown Kelps (SBR2), which were recorded in one-half and three-quarters of the shoreline. Both these bands are indicators of *semi-protected* wave exposures, which is primary exposure category in the park. Eelgrass (ZOS) was recorded in about one-quarter of the shoreline, while the Bull Kelp band (NER) was in over a third

Table 6 Summary of Bioband Definitions, Gulf Islands National Park Reserve

Zone	Bioband Name	Database Label	Colour	Dominant Indicator Species	Exposure **
A	Splashzone	**VER**	black or bare rock	Encrusting black lichens (*Verrucaria* and others)	Width varies with exposure.
A	Dune Grass	**GRA**	dusty blue-green	Dune grass (*Leymus mollis*)	SE, SP, P, VP
	Sedges	**SED**	bright green to yellow green	Mixed sedge species. *(Carex*).	SP, P, VP
A	'Salicornia'	**SAL**	light/bright green	Salt-tolerant herbaceous plants, including: *Salicornia,* marsh grasses, dune grasses and others	SP, P, estuary
B	Barnacle	**BAR**	grey-white to pale yellow	*B. glandula*, *Chthamalus* and/or *S. cariosus.*	SP, P
B	Rockweed	**FUC**	golden brown	Rockweed (*Fucus* spp.)	SE, SP, P
B	Oyster	**OYS**	white	Japanese oyster (*Crassostrea gigas*)	SP, P
B	Blue Mussel	**BMU**	dark blue-black	blue mussel (*Mytilus trossulus*)	SE, SP, SP, P
B	Green Algae	**ULV**	bright green	foliose and filamentous greens (*Ulva, Monostroma, Enteromorpha)*	SP, P, VP
B	Bleached Red Algae	*HAL2*	olive, golden or yellow-brown	• definition specific for BC Strait of Georgia region low-turf of the moss-like mixed bleached filamentous red algae (*Gelidium, Gastroclonium*), coralline algae and other small reds; also the small brown alga *Leathesia*	SP, SE
B	Red Algae	**RED2**	dark brick red	• definition specific for BC Strait of Georgia region mixed filamentous and foliose red algae (*Neorhodomela, Odonthalia, Mazzaella* and others)	SP, SE, current-dominated passages
B	Soft Brown Kelps	**SBR2**	brown	• definition specific for BC Strait of Georgia region Mixed large blade brown algae: *Laminaria saccharina* morph, *Agarum* and/or brown alga *Sargassum* and others.	SP, P
B	Dark Brown Kelps	**CHB2**	dark chocolate brown	• definition specific for BC Strait of Georgia region Brown alga *Alaria*-dominated, usually mixed with RED2	SE, current-dominated passages
B	Surfgrass	**SUR**	green	***surfgrass (*Phyllospadix sp*). Often encrusted with epiphytic diatoms.***	SE, SP
C	Eelgrass	**ZOS**	dark green	eelgrass, (*Zostera marina* and introduced *Z. japonica*). Often encrusted with epiphytic blade red and/or mixed with ULV.	P, SP
C	Bull Kelp	**NER**	dark brown, shiny	bull kelp (*Nereocystis luetkeana*)	SE, SP, current affected areas

* based on: Morris, M. 2000. Georgia Strait Biomapping, Final Report, March 31, 2000. Unpublished Contract Rept for BC Land Use Coordination Office, Victoria, B.C. by Archipelago Marine Research Ltd., Victoria, B.C. 19pp.

** Wave Exposure Codes: VP = Very Protected, P = Protected, SP = Semi-protected, SE = Semi-exposed. The highest wave exposures (Exposed and Very Exposed) do not occur in this area

Table 7 Summary of *Bioband* Occurrence in Area Mapped

Bioband Names	Code	Continuous		Patchy		Total	% of
		(km)	%	(km)	%	(km)	Mapped
Splash Zone	VER	----	----	----	----	170.8	51%
Salicornia	SAL	9.5	3%	3.6	1%	13.0	4%
Dune Grass	GRA	21.0	6%	16.1	5%	37.1	11%
Sedges	SED	0.4	<1%	5.8	2%	6.3	2%
Barnacle	BAR	208.5	65%	44.4	13%	252.9	76%
Rockweed	FUC	73.5	23%	96.6	29%	170.1	51%
Green Algae	ULV	248.3	79%	61.0	18%	309.3	93%
Blue Mussels	BMU	16.5	5%	22.6	7%	39.1	12%
Bleached Red Algae	HAL2	6.4	2%	4.5	1%	10.9	3%
Oysters	OYS	1.0	<1%	3.4	1%	4.4	1%
Red Algae	RED2	90.0	27%	60.1	18%	150.2	45%
Surfgrass	SUR	1.6	<1%	4.2	1%	5.8	2%
Soft Brown Kelps	SBR2	202.2	61%	51.3	15%	253.5	76%
Dark Brown Kelps	CHB2	11.3	4%	9.5	3%	20.8	6%
Eelgrass	ZOS	62.6	22%	24.4	7%	86.9	26%
Bull Kelp	NER	71.1	21%	40.7	12%	111.8	34%

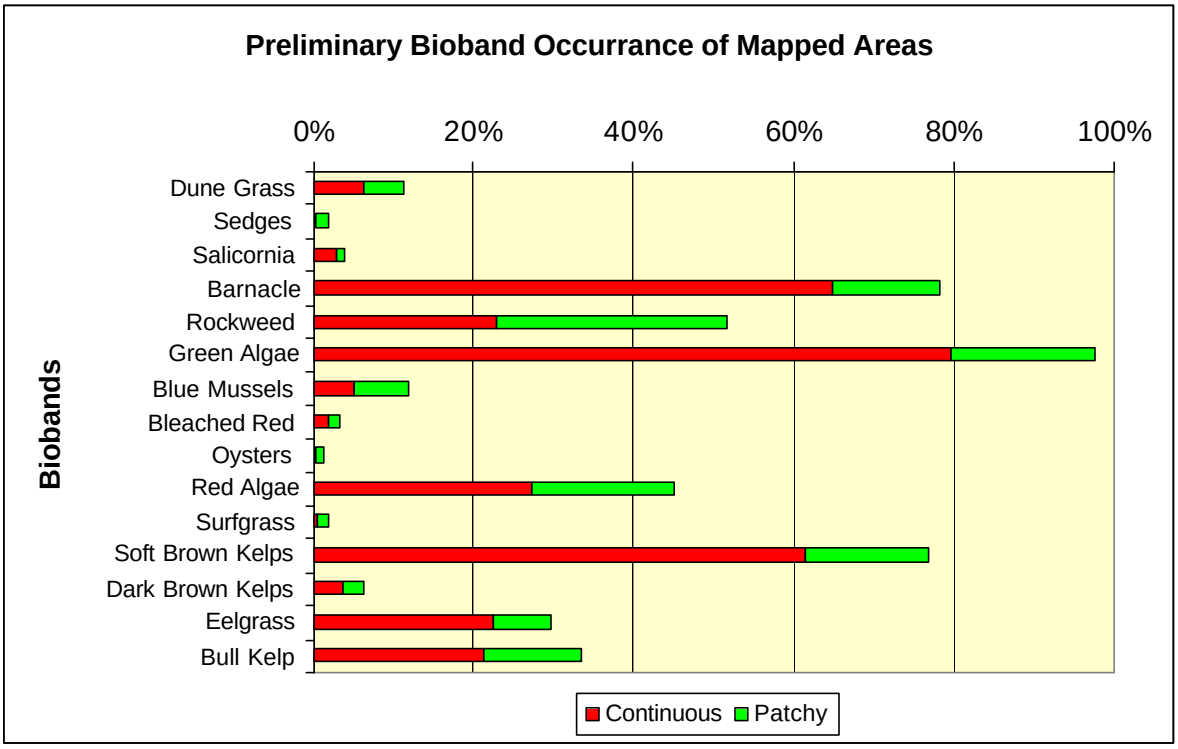

Figure 14 Preliminary occurrence of Biobands, as percent of total mapped shoreline length.

of the area. The relatively coomon occurrence of bull kelp s is anomalous with the wave exposures recorded and likely indicates that areas of high current energies. That is, bull kelp does not occur at lower wave energies (*protected* and *semi-protected*) unless there is current.

The lower intertidal biobands are often diagnostic in their occurrence at certain wave exposures (e.g., Dark Brown Kelps [CHB2] in *semi-exposed* and Soft Brown Kelps [SBR2] 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 classes (see examples of regional maps of bioband distributions in Appendix B.).

What is Biological Wave Exposure?

The biological wave exposure category is a summary attribute, interpreted by the biomapper, from the observation of the biobands present and/or absent 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 Table A-4 Exposure Categories). Typical indicator and associated species and biobands, together with a few example photographs from the Gulf Islands 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 not useful in classifying exposure (e.g., the *barnacle bioband*) while others are highly useful for classifying exposures (e.g., *dark brown kelps bioband* is always associated with higher wave exposures). The combination of biobands, 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 Gulf Islands National Park Reserve mapping area, there are four *Biological Exposure* categories:

- *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.

In the Strait of Georgia, only the units classified as semi-exposed are on the low side of the category. That is, the highest wave energy units in the study area are just barely in the semi-exposed category. The wave exposure as indicated by the biota in the shore unit is considered the most accurate index of the actual wave exposure at the shore unit.

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 different 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, largely depending on associated wave exposure.

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

- *Immobile or stable* substrates such as bedrock, boulders, cobble, 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 eleven generalized *Habitat Classes* that occur in the Gulf Islands National Park Reserve area are listed in Table 8. The distributions of habitat classes are plotted in Figure 15. Examples of the most common habitat classes follow the map in Figures 16-20.

Sixty-nine percent of the shoreline was classified as semi-protected, in stable or partially mobile habitats. Wetland habitat classes are very rare, and make up only about 1% of the study area. Current-dominated shorelines are about 4% of the study area, which is a relatively high proportion of the shore. Higher wave energies are also relatively rare, and only occur on the northwest facing shores of Mayne and Saturna Islands.

Table 8 Summary of Biophysical Habitat Classes in Gulf Islands National Park

	Biophysical Habitat Description	Habitat Classes *	Length (km)	% of Mapping
Exposed	**Stable Substrate:** Rocky shorelines with high wave exposure.	10 20	0.0	0%
	Partially Mobile Substrate: Rocky shorelines with sediments sufficiently mobile to limit epibenthos in some portions of the shore.	11 21	0.0	0%
	Mobile Substrate: No epibenthic community in intertidal due to dynamic substrate.	12 22	0.0	0%
Semi-Exposed	**Stable Substrate:** Rocky shorelines with moderate to high wave exposure.	30	14.6	4%
	Partially Mobile Substrate: Rocky shorelines with sediments that are sufficiently mobile to limit epibenthos in some portions of the shore.	31	0.9	<1%
	Mobile Substrate: Small-size sediment shores generally have no epibenthic community. Cobble/boulder beaches may have biota. Dunes frequent in backshore.	32	0.0	0%
Semi-Protected	**Stable Substrate:** Rocky shorelines with moderate to low wave exposure.	40	109.1	33%
	Partially Mobile Substrate: Rocky shorelines with sediments sufficiently mobile to limit epibenthos in some portions of the shore.	41	119.9	36%
	Mobile Substrate: Small-size sediment shores generally have low biotic diversity. Cobble/boulder beaches usually support biota, especially in low intertidal/upper subtidal.	42	16.3	5%
Protected	**Stable Substrate:** Rocky shorelines with low wave exposure.	50 60	5.7	2%
	Partially Mobile Substrate: Rocky shorelines with sediments sufficiently mobile to limit epibenthos in some portions of the shore.	51 61	35.5	11%
	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	8.9	3%
Wetland/ Estuary	**Estuary/ lagoon:** Generally low energy sediment shores with wetlands and marsh vegetation. Usually influenced by freshwater.	33 43 53 63	2.5	1%
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	12.8	4%
Man-Made	**Anthropogenic Features:** unit modified by shorezone disturbances, such as rip rap, wharves or fill	36, 37 46, 47 56, 57 66, 67	7.5	2%
	TOTALS:		**333.7**	**100%**

* see Appendix A, Table A – 9 for list of definitions of Habitat Class codes.

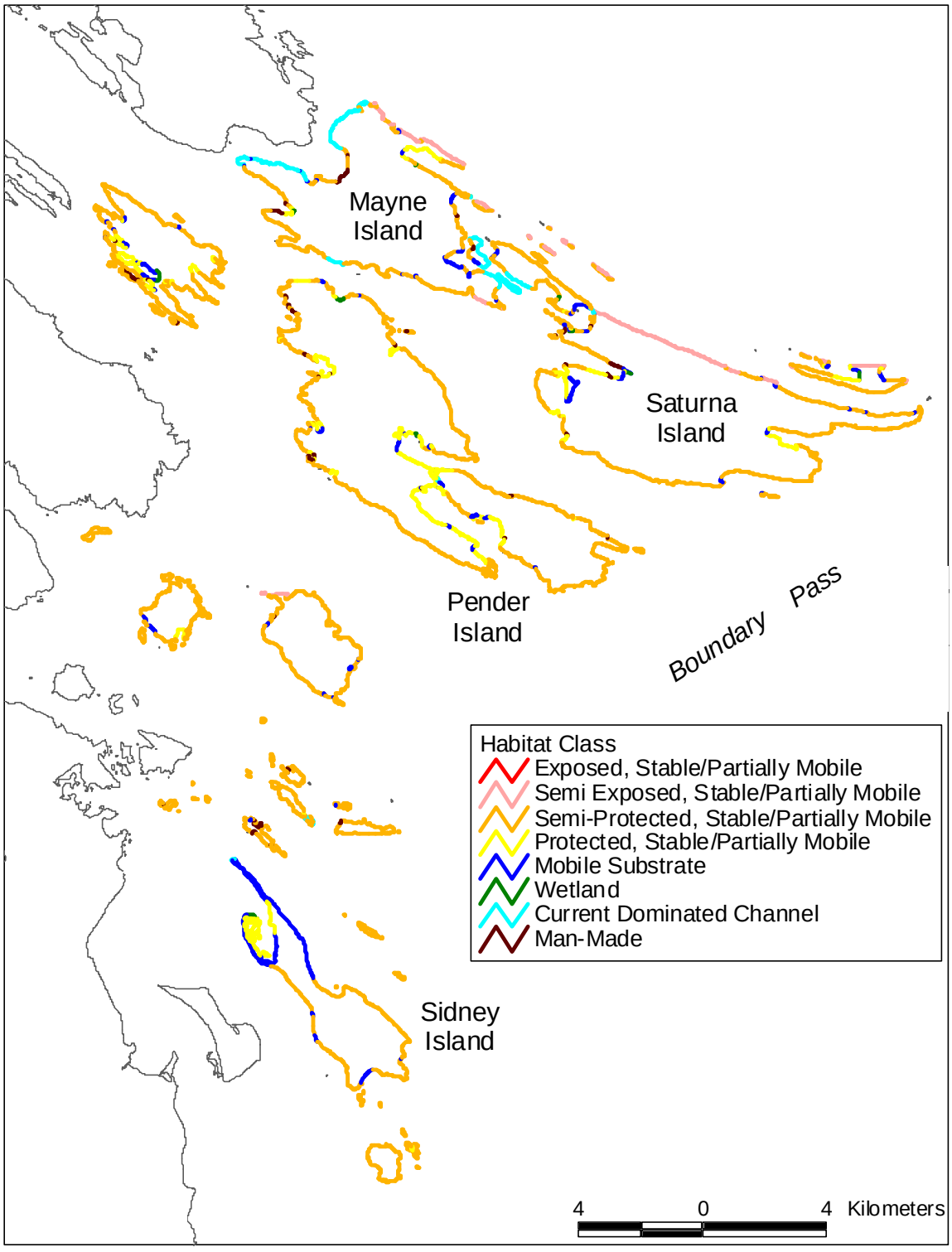

Figure 15 Distribution of Habitat Classes in the Gulf Islands National Park Reserve.

Figure 16 The most common habitat class in the Gulf Islands National Park Reserve is the *semi-protected, partially stable*, as seen in this example on D'Arcy Island. The Splashzone is of moderate width on the rock platform and Red Algae and Green Algae bands (RED2 and ULV) are visible. In the nearshore subtidal, are the Soft Brown Kelps (SBR2) and the Bull Kelp (NER) biobands.

Photo: GIAVI04_1438.jpg

Figure 17 *Semi-protected, stable* shorelines (Class 40) are the second most common habitat class in the Gulf Islands (33% of the shoreline length). Diagnostic biobands seen on this rock platform on Hood Island are Red Algae (RED2) at the waterline and Bull Kelp (NER) in the nearshore subtidal.

Photo: GIAVI04_2677.jpg

Figure 18 An example of a *current-dominated* habitat class is seen here in this example from the southeast end of Curlew Island. This channel was classified as semi-exposed and shows a lush Dark Brown Kelp band (CHB2) as well as red algae (RED2).

Photo: GIAVI04_2840.jpg

Figure 19 Approximately 11% of the shoreline in the Gulf Islands National Park Reserve was classified in the *protected, partially mobile* habitat class, as was this example in Annette Inlet on Prevost Island. The intertidal looks mostly bare of biobands with some Green Algae (ULV) and Barnacles (BAR). Underwater in the nearshore a few patches of Eelgrass (ZOS) are visible.

Photo: GIAVI04_2796.jpg

Figure 20 Only a small percentage of the shoreline in the Gulf Islands National Park Reserve was classified as *semi-exposed, stable* (4%), however these habitats are the areas of highest intertidal species diversity (along with the current-dominated passages) within the park. From this example on the north side of Tumbo Island, the dense Blue Mussel (BMU) band is seen. The lower ramp has lush Red Algae and Dark Brown Kelp bands (RED2 and CHB2), and thick Bull Kelp (NER) is the nearshore.

Photo: GIAVI04_2956.jpg