Coastal and Ocean Resources

MCORI Project: 19-12 **March 2020**

ShoreZone Habitat Mapping Summary Report

Prince Rupert Survey Area

Near Randall Island, north Dunira Islands

Prepared for:
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Prince Rupert Area Summary

2,448 km of shoreline mapped

10,432 shoreline units created

Average unit length is **235 m**

51% of the intertidal is classified as **Rock and Sediment-dominated** and **26%** is classed as **Sediment-dominated**

75% of the shoreline has a high Oil Residence Index value (residence of months to years)

3% of the shoreline has a **Shoreline Modification** of some type

19 biobands were classified in the **intertidal** with **Rockweed** and **Green Algae** being the most common (**over 75%** of units each)

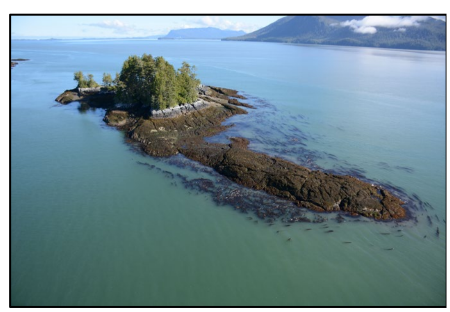
7 biobands were classified in the **supratidal** with **Black Lichen** (**80%** of units) and **Salt Marsh** (**51%** of units) being the most common

13 biobands were classified in the **subtidal** with **Bladed Brown Algae** being the most common (**43%** of units)

Prince Rupert

Wilcox Group

Green Island



Little Genn Island, Chatham Sound

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1 INTRODUCTION

ShoreZone is an imaging and habitat classification system for the coastal nearshore margin including the shallow subtidal, intertidal shoreline and supratidal fringe. One objective of ShoreZone is to produce a georeferenced, searchable inventory of the physical and biological attributes of coastal habitats. ShoreZone imagery and habitat attributes can provide a useful baseline from which to study change over time, while the attributes mapped (such as shoreline sediments, predicted oil residence and biotic communities) provide an important resource for scientists and managers. The ShoreZone mapping system provides a decision support tool with many potential uses including community planning, facilities citing, conservation planning, research and fisheries management, emergency planning and response, search and rescue, education and habitat modeling.

The ShoreZone system was developed in the 1980s and 1990s to map coastal habitats in British Columbia and Washington State (Howes 2001; Berry *et al.* 2004). In 2001 ShoreZone was implemented in Alaska, beginning with Cook Inlet, Outer Kenai, Katmai, and portions of the Kodiak Archipelago (Harper and Morris 2004). ShoreZone has since expanded to a spatially continuous database of over 75,000 km of coastal Alaska and 45,000 km of British Columbia, Washington and Oregon (see Figure 1). Figure 2 shows the extent of the shoreline mapped around Prince Rupert and is the section of shoreline covered by this summary report.

The ShoreZone imaging surveys conducted around Prince Rupert in June 2014, June 2015, and July 2019 acquired aerial video and digital still images of the coast during minus tides (zero-meter tide levels and lower). The imagery and associated audio commentary were used to map the physical and biological attributes of the shoreline. Approximately three quarters of the shoreline was mapped according the most recent ShoreZone coastal habitat mapping protocol (Cook *et al*. 2017) and a quarter was mapped according the to 2014 ShoreZone protocol (Harper *et al.* 2014). The purpose of this report is to provide a summary of the physical (Section 2) and biological (Section 3) data imaged and classified around the Prince Rupert survey area.

The length of shoreline mapped is 2,448 kilometers in 10,432 along-shore segments (units), averaging 235 m in length. The digital shoreline used for the ShoreZone habitat mapping was the CHS_Highwaterline_BCalbers.shp.

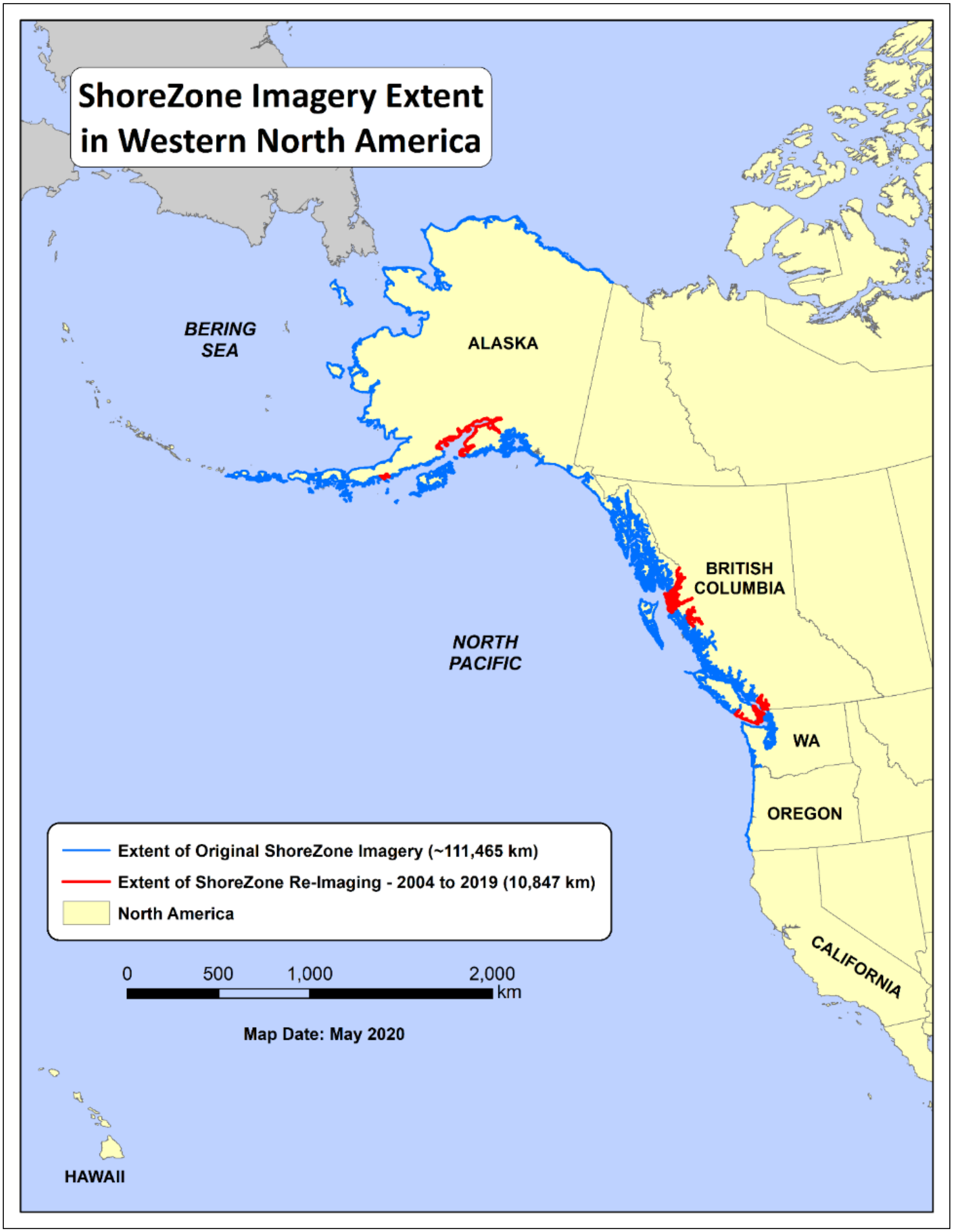

Figure 1. Extent of ShoreZone imagery in Alaska, British Columbia, Washington State and Oregon as of May 2020.

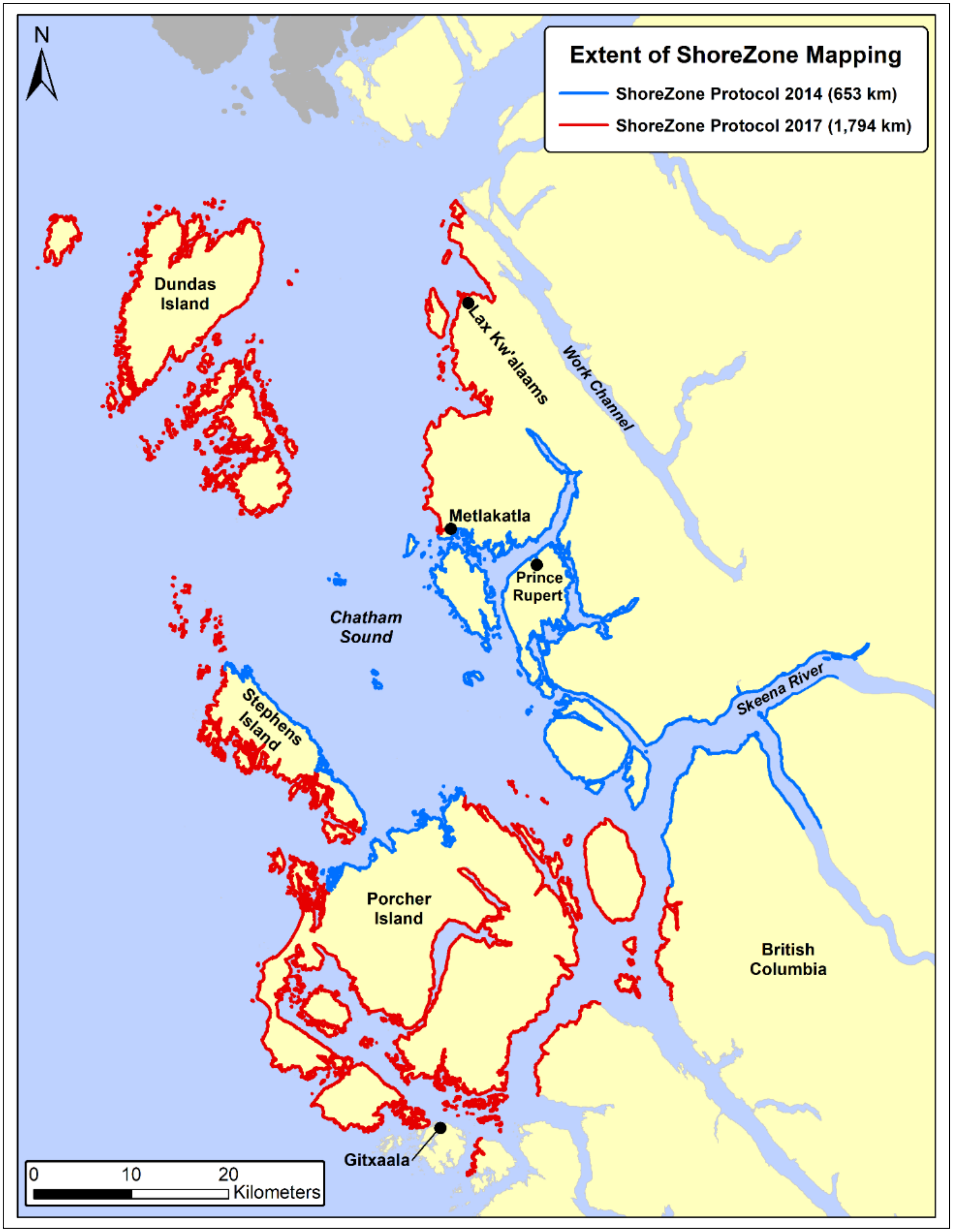

Figure 2. Extent of mapping for the Prince Rupert survey area.

2 BIOLOGICAL ATTRIBUTE DATA SUMMARY

2.1 Coastal Class

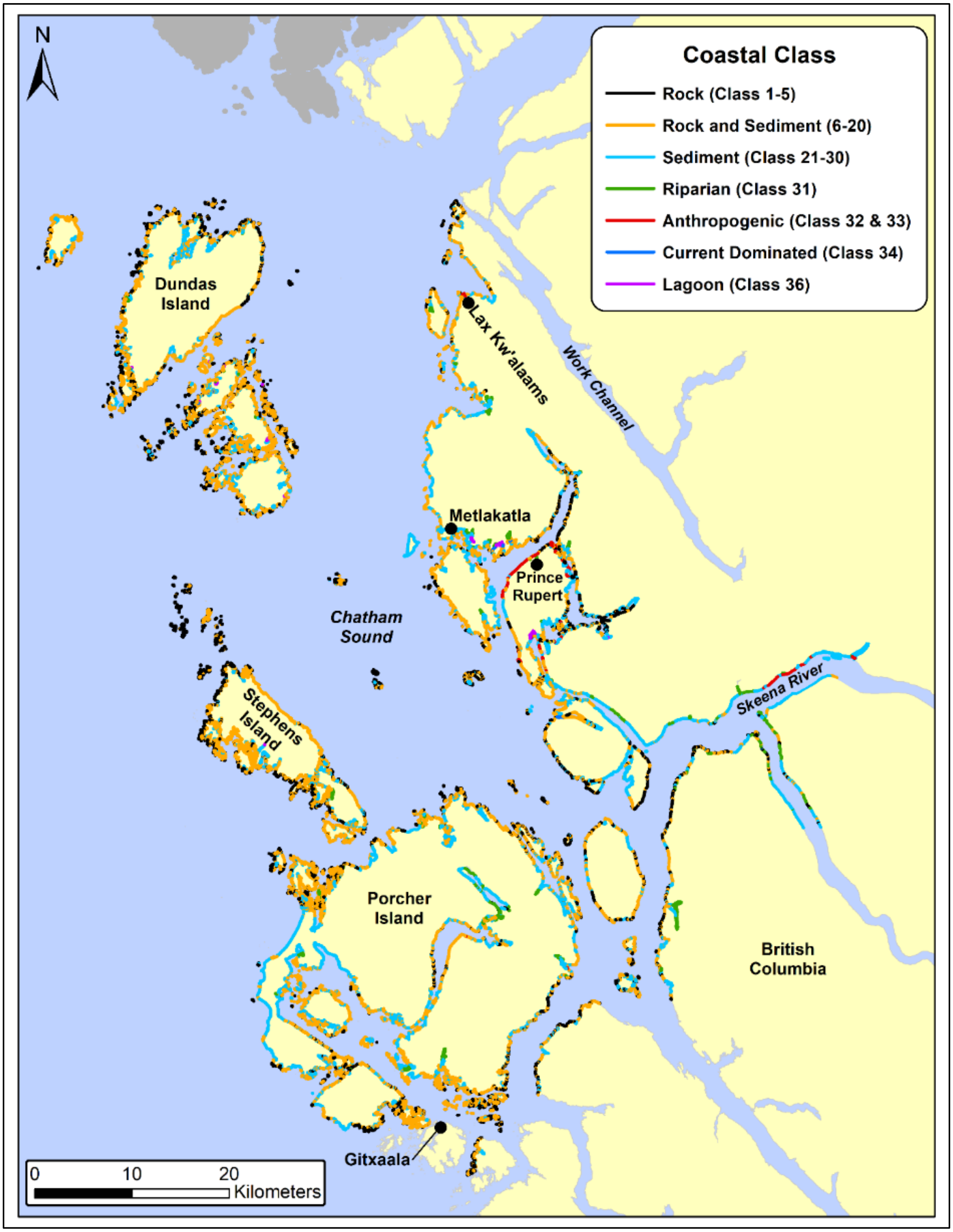

Figure 3. Map of the Coastal Class categories grouped by type (also known as Shore Type).

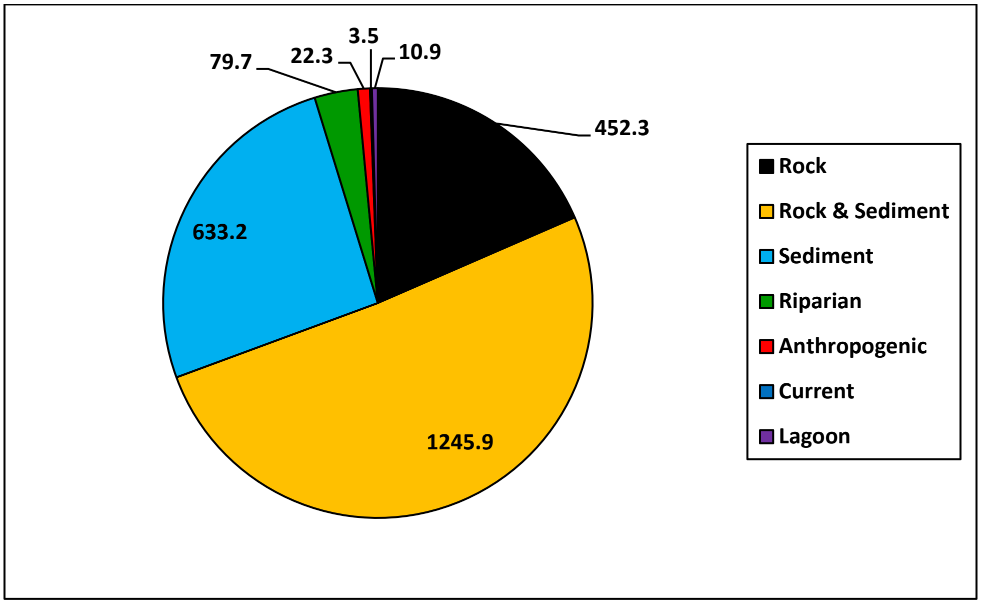

Figure 4. Grouped Coastal Class categories by shoreline length (km).

The Coastal Class is used to define along-shore coastal units based on the dominant process, geomorphic features and other attributes such as substrate size, across-shore width, and slope (Cook *et al*., 2017 after Howes *et al* 1994). The principal characteristics of each along-shore unit are used to assign one of 39 overall unit classifications. Rock and Sediment shorelines (50.9%) along with Sediment shorelines (25.9%) dominated the Prince Rupert survey area. Rock shorelines followed with 18.5%, while Riparian, Anthropogenic, Lagoon, and Current shorelines all comprised the rest of the coast (see Figures 3 and 4 for distribution and summary statistics). The description for each Coastal Class category in the survey area is given in Table 1. Photographic examples of the major Coastal Classes mapped in the Prince Rupert survey area are found in Appendix A, Table A-1.

Table 1. Summary of Coastal Classes for the Prince Rupert survey area.

Substrate Type	Shore Type		Sum of Unit Length (km)	# of Units	% Occurrence (by length)	Cumulative Occurrence (%, km)
	No.	Description				
Rock	1	Rock Ramp, wide	23	129	1	**19% 452 km**
	2	Rock Platform, wide	20	109	1	
	3	Rock Cliff	301	1574	12	
	4	Rock Ramp, narrow	107	698	4	
	5	Rock Platform, narrow	1	3	<1	
Rock & Sediment	6	Ramp w gravel beach, narrow	53	253	2	**51% 1,246 km**
	7	Platform w gravel beach, wide	25	94	1	
	8	Cliff with gravel beach	113	586	5	
	9	Ramp with gravel beach	143	815	6	
	10	Platform with gravel beach	1	3	<1	
	11	Ramp w gravel & sand beach,	311	1359	13	
	12	Platform with G&S beach, wide	330	943	14	
	13	Cliff with gravel/sand beach	46	286	2	
	14	Ramp with gravel/sand beach	178	1088	7	
	15	Platform with gravel/sand beach	1	4	<1	
	16	Ramp w sand beach, wide	22	78	1	
	17	Platform w sand beach, wide	11	36	<1	
	18	Cliff with sand beach	8	32	<1	
	19	Ramp w sand beach, narrow	5	28	<1	
Sediment	21	Gravel flat, wide	17	56	1	**26% 633 km**
	22	Gravel beach, narrow	14	84	1	
	24	Sand & gravel flat or fan	380	1207	16	
	25	Sand & gravel beach, narrow	75	358	3	
	26	Sand & gravel flat or fan	3	20	<1	
	27	Sand beach	1	6	<1	
	28	Sand flat	92	195	4	
	29	Mudflat	42	81	2	
	30	Sand beach	10	22	<1	
Organics	31	Organics/Estuarine	80	147	3	**3% 80 km**
Man-made	32	Man-made, permeable	21	93	1	**1% 22 km**
	33	Man-made, impermeable	1	6	<1	
Current	34	Channel	4	17	<1	**<1% 4 km**
Lagoon	36	Lagoon	11	22	<1	**<1% 11 km**
Totals:			***2,448***	***10,432***	***100***	***100%***

Note: This table only includes Coastal Classes observed in the Prince Rupert survey area.

2.2 Environmental Sensitivity Index (ESI)

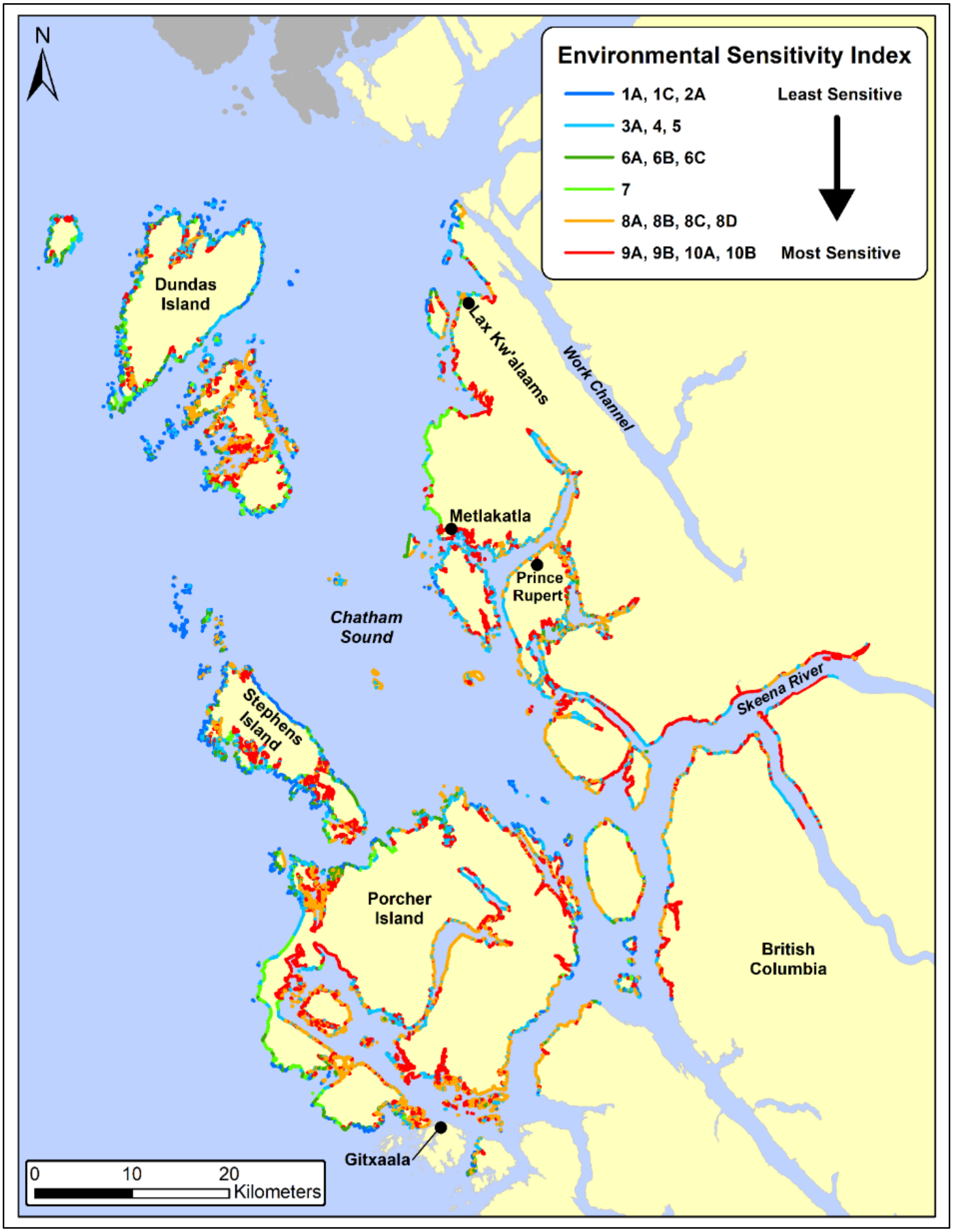

Figure 5. Distribution of the grouped ESI categories from least to most sensitive to oiling.

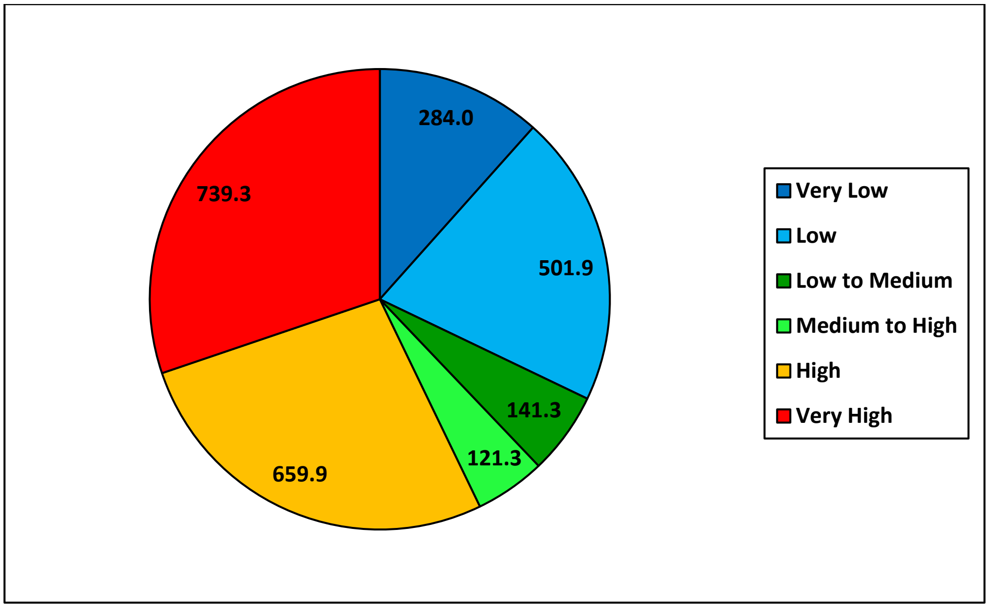

Figure 6. Grouped most sensitive ESI categories by shoreline length (km).

The NOAA Environmental Sensitivity Index (ESI) is a shoreline classification system developed to characterize coastal regions based on sensitivity to potential oil spills (Petersen *et al*. 2002). The ESI system uses wave exposure and principal substrate type to assign a rank of 1 to 10 (with 10 being the most sensitive to oil) to alongshore units. Up to three ESI numbers can be assigned to each ShoreZone unit (high, mid and low intertidal) if applicable. The highest ESI number for each unit, which is the most sensitive, is used in this analysis.

The majority of coastline around Prince Rupert is represented by the grouped High and Very High categories (57.2% of shoreline length). These sections of the shoreline have a potentially high sensitivity to oil. At the other end of the spectrum, only 32.1% of the shoreline was mapped with a potentially low sensitivity to oil (Figures 5 and 6). The summary of Coastal Class by ESI class can be seen in Table 2.

Table 2. Summary of Coastal Classes by ESI Class for the Prince Rupert survey area.

Environmental Sensitivity Index (ESI)		Sum of Unit Length (km)	# of Units	% of Total Shoreline Length
No.	**Description**			
1A	Exposed rocky shores; Exposed rocky banks	140	757	6
1C	Exposed rocky cliffs with boulder talus base	23	116	1
2A	Exposed wave-cut platforms in bedrock, mud, or clay	121	700	5
3A	Fine- to medium-grained sand beaches	33	147	1
4	Coarse-grained sand beaches	5	24	<1
5	Mixed sand and gravel beaches	464	2,152	19
6A	Gravel beaches (granules and pebbles)	2	11	<1
6B	Gravel beaches (cobbles and boulders)	139	710	6
6C	Rip rap	1	4	<1
7	Exposed tidal flats	121	298	5
8A	Sheltered scarps in bedrock, mud, or clay; sheltered rocky shores (impermeable)	301	1,705	12
8B	Sheltered, solid, man-made structures; sheltered rocky shores (permeable)	41	170	2
8C	Sheltered Rip Rap	18	82	1
8D	Sheltered rocky rubble shores	300	1,661	12
9A	Sheltered tidal flats	438	1,124	18
9B	Vegetated low banks	5	10	<1
10A	Salt- and brackish-water marshes	295	759	12
10B	Freshwater marshes	<1	2	<1
	Totals:	***2,448***	***10,432***	***100***

Note: ESI Classes not observed in this survey area were not included in the table.

2.3 Oil Residence Index (ORI)

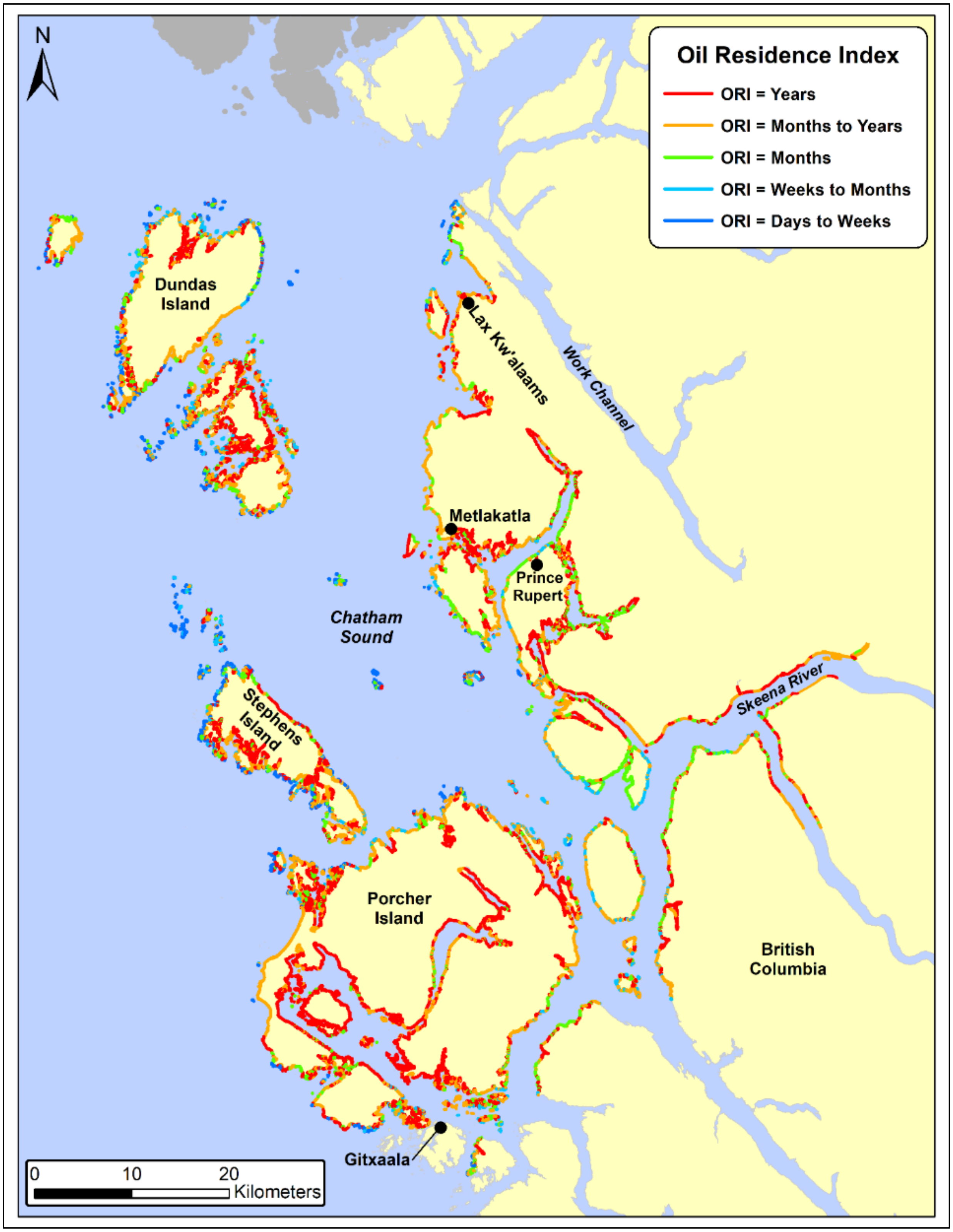

Figure 7. Distribution of the Oil Residence Index (ORI) categories.

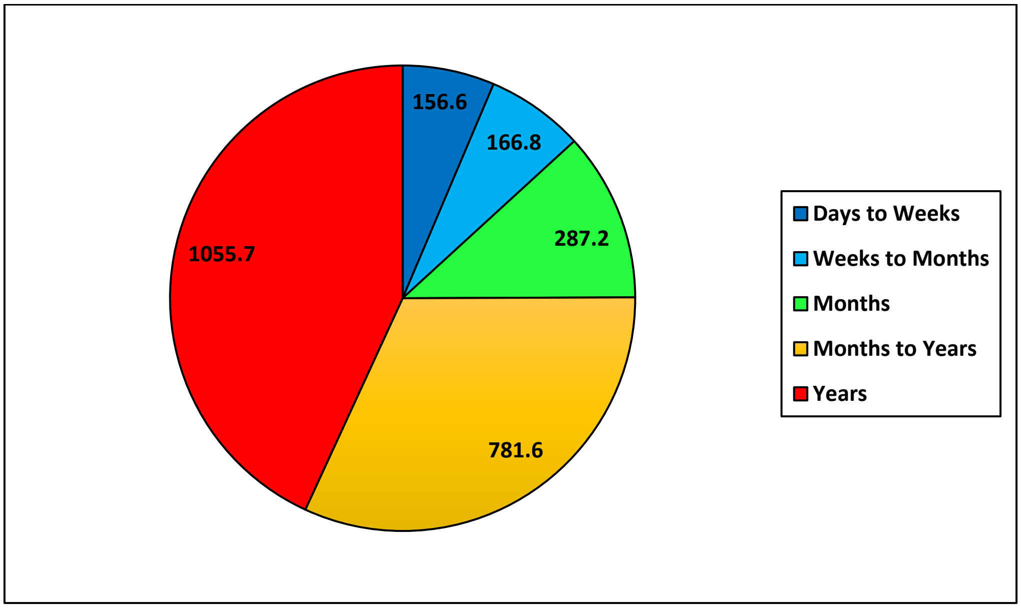

Figure 8. Oil Residence Index (ORI) categories by shoreline length (km).

The Oil Residence Index (ORI) is a rating between 1 and 5 with a value of 1 indicating a relatively short oil residence (days to weeks) while a value of 5 reflects potentially very long oil residence times (years). An ORI value is applied to each alongshore unit and to each across-shore component based on sediment texture and wave exposure (Cook *et al*. 2017). The ShoreZone ORI was developed by Dr. John Harper based on his many years of experience with cleaning up oiled shorelines, starting with the Exxon Valdez spill in Prince William Sound in Alaska. Lower wave exposures and mobile sediments lead to higher ORI values for 75% of the shore segments in the Prince Rupert survey area, indicating oil residence times are on the order of months to years (see Figures 7 and 8 for distribution and summary statistics).

2.4 ShoreZone Coastal Vulnerability

2.4.1 Flood Zone Width

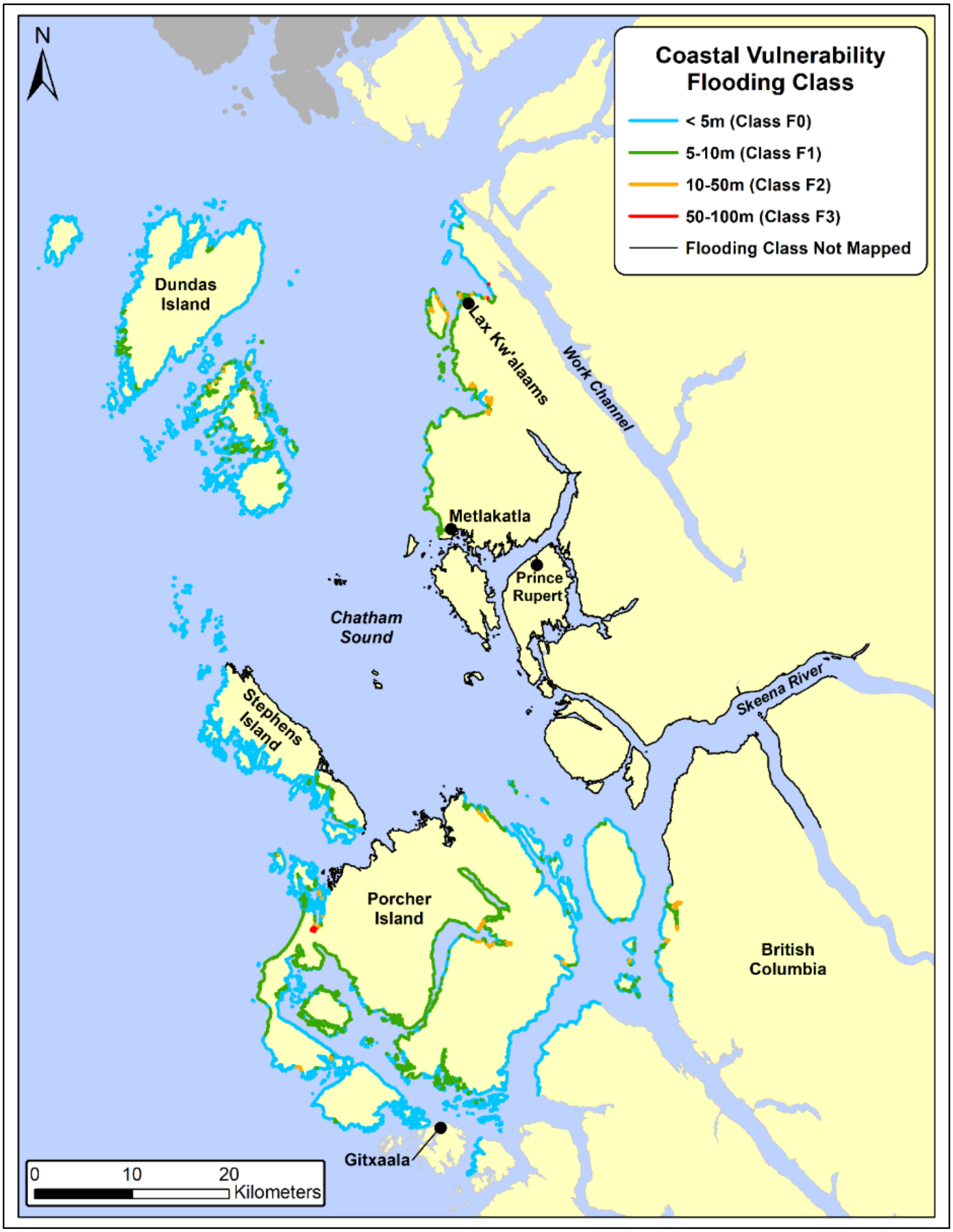

Figure 9. Distribution of the Coastal Vulnerability Flooding Class.

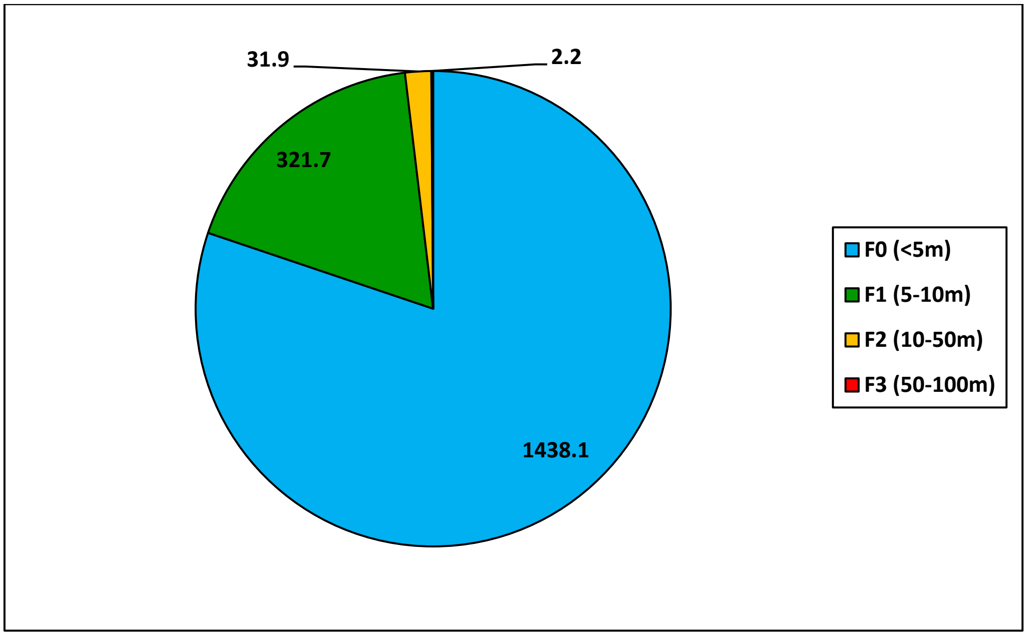

Figure 10. Flooding Class categories by shoreline length (km).

The Coastal Vulnerability Module (CVM) includes a classification of flooding sensitivity based on the across shore profile and photographic evidence of historical flooding such as an unambiguous marine debris line. The Flooding Class is an estimate of vulnerability to inundation of the terrestrial area beyond the supratidal. The distance to the debris line is measured and used to classify the flooding potential. Flat shorelines with very low gradients that show evidence of historical flooding have a higher risk of being inundated by storm surges. Potential for damage due to flooding is generally low in the study area, with 80.2% of the shoreline at a low risk of flooding <5m from MHW (see Figures 9 and 10 for distribution and summary statistics). The flooding class is a parameter of the Coastal Vulnerability Index (see Page 16). Note that approximately a quarter of Prince Rupert mapping in this report was completed under a different ShoreZone protocol which did not included the Coastal Vulnerability Module.

2.4.2 Coastal Vulnerability Observations

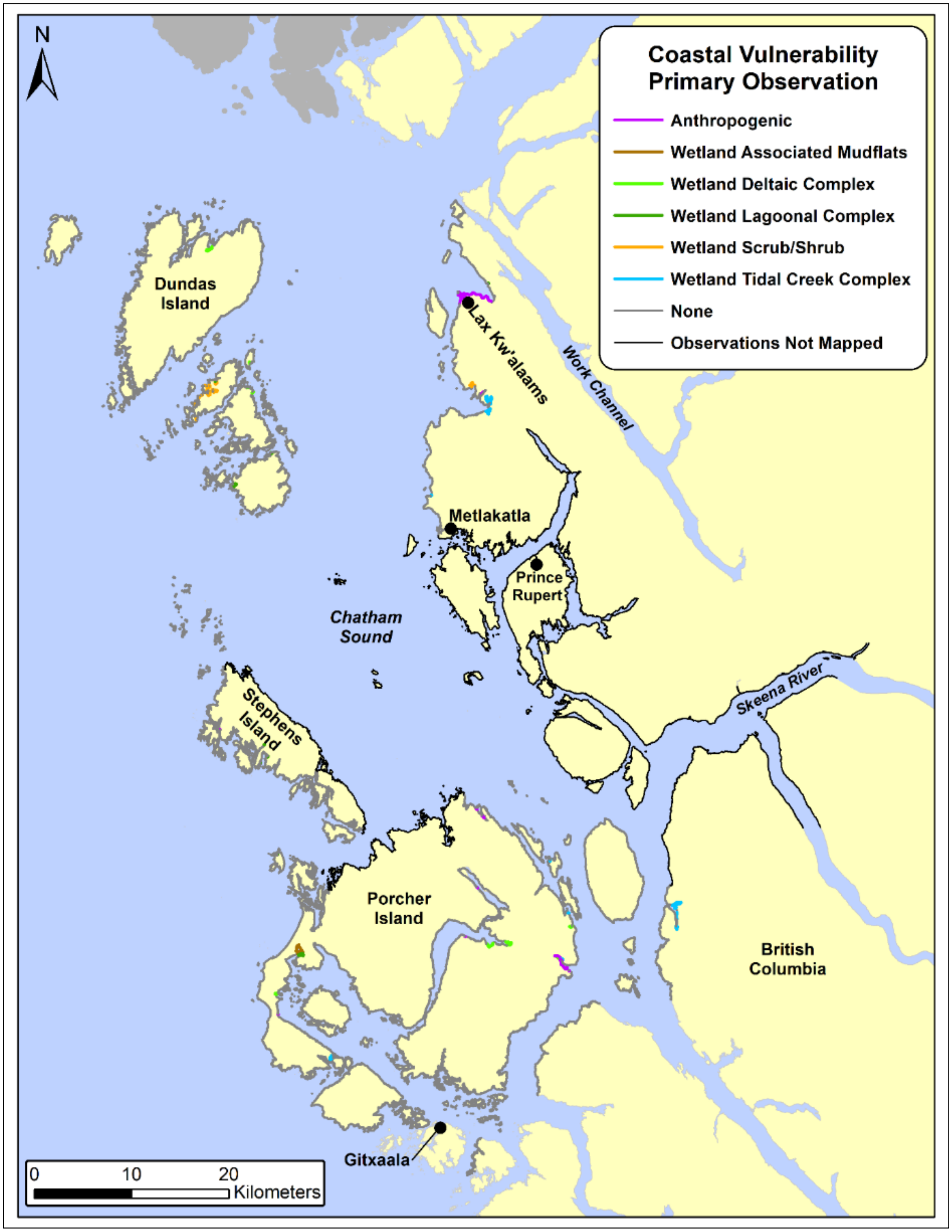

Figure 11. Distribution of the Coastal Vulnerability Observations categories.

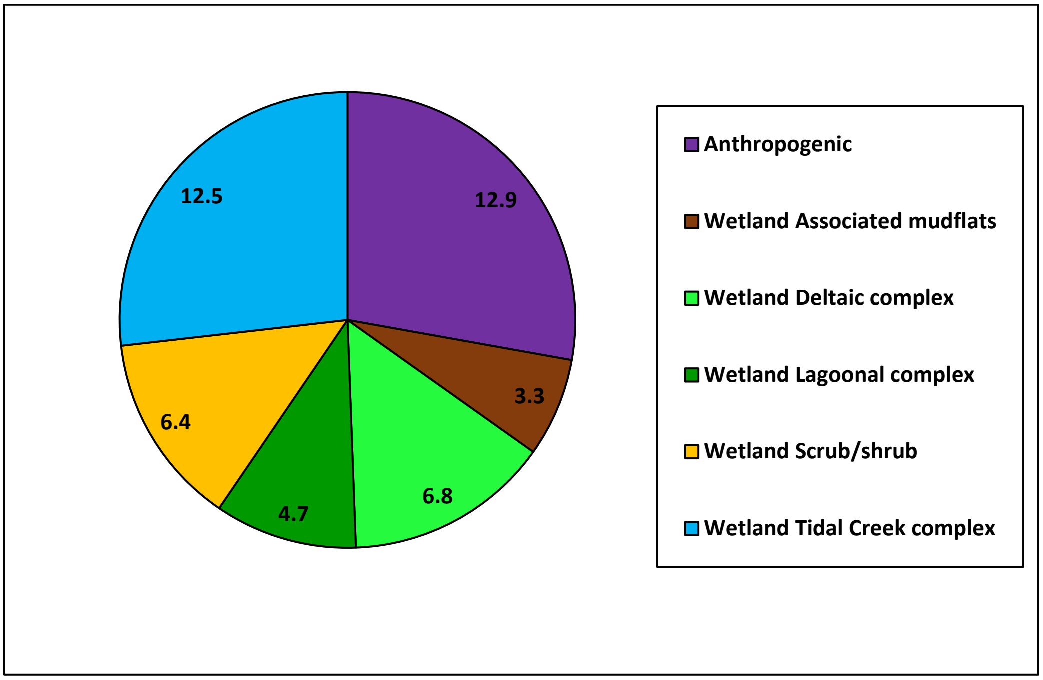

Figure 12. Coastal Vulnerability Observations categories by shoreline length (km). Category 'None' not shown.

The CVM Observations are features important for estimating the frequency and extent of coastal inundation. In the Prince Rupert area, apart from the 'None' category, the majority of observations were from Anthropogenic category with 27.8 km and the Wetland Tidal Creek complex category with 26.8 km (see Figures 11 and 12 for distribution and summary statistics). With regards to the Anthropogenic category it is important to point out that these areas are not necessarily areas of vulnerability, but areas potentially impacted. Note that approximately a quarter of Prince Rupert mapping in this report was completed under a different ShoreZone protocol which did not included the Coastal Vulnerability Module.

2.4.3 Coastal Vulnerability Index

The methods of Thieler and Hammer-Klose (2000) ((http://woodshole.er.usgs.gov/project-pages/cvi/) were adapted to calculate the Coastal Vulnerability Index (CVI) using five ShoreZone attributes: Shore Type, Max Tide Range, Shoreline Erosion index, Flood Zone Width, and Wave Height. See the most recent ShoreZone protocol for more details (Cook *et al*., 2017). When we first attempted to calculate the CVI for the portion of the shoreline funded in the Eastern Aleutians by OSRI, it did not match the observations of the mappers as it appeared to rank too much of the rocky, steep shoreline as High or Very High in terms of vulnerability to sea level rise. After analysis of the data, we determined this was due to the use of a relative ranking system where the values from the study area were only compared to each other to determine the CVI rank. To resolve this issue, we calculated an absolute value for each CVI rank which is described in the latest version of the protocol (Cook *et al*., 2017). The distribution of ranks in the survey area is shown in Figure 13. Note that the CVI could only be calculated for the mapping completed under the 2017 protocol as the appropriate attributes were not mapped as part of the 2014 ShoreZone protocol which was used for the mapping completed in 2015. Under the new absolute ranking system, all the shoreline mapped for this project is ranked as Low vulnerability to sea level rise. This is a consistent with mapper observations during review of the imagery and with the rocky nature of the shoreline, generally low wave exposure and the large tidal range of the area.

Figure 13. Distribution of Coastal Vulnerability index ranks in the Prince Rupert survey area.

2.5 Anthropogenic Shore Modifications

Figure 14. Distribution of types of the primary Shore Modifications. There may be other shore modifications in any given unit. That data would be found in the Shore Modifications table in the geodatabase.

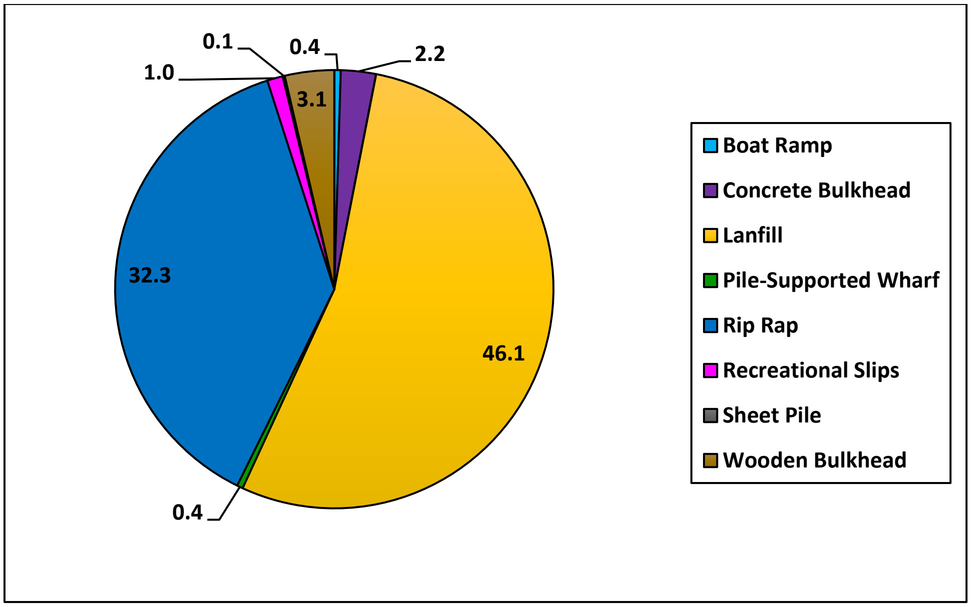

Figure 15. Shore Modifications by estimated shoreline length (km) of each modification type.

The Shoreline Modification attribute provides a thorough catalogue of the specific types of anthropogenic modification in each unit (Cook *et al*., 2017). This includes many modifications within a given unit. For example, if both riprap and a pile-supported wharf occur, both are catalogued in the appropriate zone of that unit with an estimate of the alongshore length of the unit that modification covers. A total of 3.5% of the shoreline (taking the estimated length of that modification within the unit into account) exhibits shore modifications in the Prince Rupert study area (Figure 14). Landfill was the most commonly recorded observation (53.8%) with Rip Rap (37.7%) and Wooden Bulkheads (3.6%) rounding out the top three shoreline modifications along the coast. The associated map (Figure 14) shows the distribution of primary shore modifications though it should be noted that any given modification is necessarily along the entire length of the indicated shore unit. The Geodatabase delivered with this report displays each shore modification with a specific length category (meters) along the shoreline pertaining to each unit as well as the specific zone (supratidal or intertidal) the modification occurs in. Note approximately a quarter of Prince Rupert mapping in this report was completed under a different ShoreZone protocol which mapped Recreational Slips and Wharfs in a different manner - one in which they cannot be represented proportionally by shoreline length. That particular data is in the Geodatabase for reference.

3 BIOLOGICAL ATTRIBUTE DATA SUMMARY

3.1 Biobands

Biobands represent assemblages of coastal biota found on the shoreline at characteristic wave exposures, substrate conditions and typical across-shore elevations. Biobands are spatially distinct, with alongshore and across-shore patterns of color and texture that are visible in aerial imagery (see Appendix A, Table A-2 for photographic examples of the common biobands from the Prince Rupert survey area). Full descriptions of all biobands, including indicator and associated species can be found in the ShoreZone protocol (Cook *et al*. 2017).

It is important to note that a nested bioband classification was developed and applied to all ShoreZone mapping completed after 2015. Changes to the bioband definitions include the application of a consistent naming convention and new four-digit codes for each bioband. A number of new biobands were added, and some were split to better describe the banding that has been observed as ShoreZone continues to move into new and unique areas. The mapping completed for DFO that is incorporated into this report was completed under the 2017 protocol while the mapping for the Port of Prince Rupert and Metlakatla First Nation was completed under the 2014 ShoreZone protocol (Harper and Morris, 2014) so did not include the new bioband names or metrics (see Figure 2 for exact areas mapped under each protocol).

In the 2014 ShoreZone protocol, only two descriptors were used for the distribution of biobands within each unit: Patchy (in <50% of the length of the unit) or Continuous (in >50% of the length of the unit). In the 2017 protocol, the specific elevation or zone of the intertidal determined how the bioband attributes were described. For example, biobands found in the supratidal (A Zone) and subtidal (C Zone) are described by percent of alongshore length of unit and a width category. The intertidal (B zone) biobands are described by percent of alongshore length of the unit and percent cover of the zone. All metrics are described in the 2017 ShoreZone protocol (Cook *et al*. 2017). The data presented in this report uses Patchy and Continuous as metrics as that is consistent across the two datasets. CORI has translated the mapping completed under the 2014 ShoreZone protocol to the 2017 protocol format in the geodatabase that accompanies this report. All bioband names are therefore now consistent across the datasets but other fields, such as % length and % cover will be blank for the older mapping.

Biobands mapped in the Prince Rupert area to date are summarized in Tables 3 and 4. The most commonly occurring intertidal biobands in the survey areas were Rockweed which was found in 89% of units while Green Algae and Barnacles were found in 79% and 70% of units, respectively. The most common supratidal bioband was Black Lichen, occurring in 80% of the units, while the supratidal/high intertidal Salt Marsh bioband was found in 51% of units. The most common low intertidal/subtidal biobands were Brown Bladed Kelps (43%), Soft Brown Kelps (25%) and Eelgrass (24%). All the most common biobands were typically associated with Semi-Protected to Protected partially mobile shorelines, which is a good description of the majority of this area. Distribution maps, statistics and observations about some specific biobands are found in the following pages.

Table 3. Bioband abundances for non-splash zone biobands mapped around Prince Rupert to date.

Bioband		**Patchy (<50% of unit)**		**Continuous (>50% of unit)**		**Total (km)**	**% of Total Mapped**
Name	**Code**	**(km)**	**%**	**(km)**	**%**		
Dune Grass	DUGR	171	7	21	1	192	8
Sedges	SEDG	8	<1	55	2	62	3
Salt Marsh	SAMB	570	23	669	27	1238	51
Barnacle	BARN	520	21	1191	49	1712	70
Rockweed	ROCK	438	18	1752	72	2190	89
Green Algae	GRAL	634	26	1289	53	1923	79
Blue Mussel	BLMU	60	2	15	1	75	3
Echinoderms	ECHI	26	1	1	<1	26	1
Bleached Red Algae	BRAL	47	2	12	1	59	2
Filamentous and Foliose Red Algae	FFRA	502	21	853	35	1356	55
Coralline Red Algae	CORA	68	3	18	1	87	4
Alaria	ALAR	3	<1	23	1	26	1
Soft Brown Kelp	SOBK	169	7	437	18	607	25
Dark Brown Kelp	DABK	9	<1	131	5	140	6
Brown Bladed Kelps	BRBA	225	9	821	34	1046	43
Anemones	ANEM	1	<1	0	<1	1	<1
Cnidarians	CNID	0.2	<1	0	<1	0.2	<1
Sponges	SPON	1	<1	0	<1	1	<1
Surfgrass	SURF	149	6	75	3	223	9
Eelgrass	EELG	254	10	327	13	581	24
Urchin Barrens	URBA	107	4	301	12	408	17
Giant Kelp	GIKE	194	8	272	11	466	19
Bull Kelp	BUKE	306	12	289	12	595	24
Canopy Kelp	BRCA	7	<1	7	<1	13	1

Table 4. Bioband abundances for splash zone biobands mapped around Prince Rupert to date.

Bioband		**Narrow (<1m)**		**Medium (1-5m)**		**Wide (>5m)**		**Total (km)**	**% of Total Mapped**
Name	**Code**	**(km)**	**%**	**(km)**	**%**	**(km)**	**%**		
Black Lichen	BLLI	892	36	930	38	144	6	1965	80
Splash Zone	SPZO	33	1	37	2	1	<1	71	3
White Lichen	WHLI	161	7	279	11	88	4	527	22
Yellow Lichen	YELI	0.3	<1	1	<1	1	<1	2	<1

Salt Marsh (SAMB) was the most commonly occurring supratidal, non-splash zone bioband and was found in 51% of units (see Figures 16 and 18 for a graph of proportion of the shoreline with that bioband and a distribution map). Salt Marsh can occur either in the supratidal or lower intertidal, both occurrences are incorporated here. Salt Marsh was fairly ubiquitous along the shoreline, mostly as a narrow strip of vegetation between the trees and intertidal zone (see Figure 17 for photo). This is an important habitat for many shoreline species and can provide important ecological services, such as filtering land-based nutrients which can help maintain the balance of other habitats such as eelgrass meadows (Valiela *et al*., 2000).

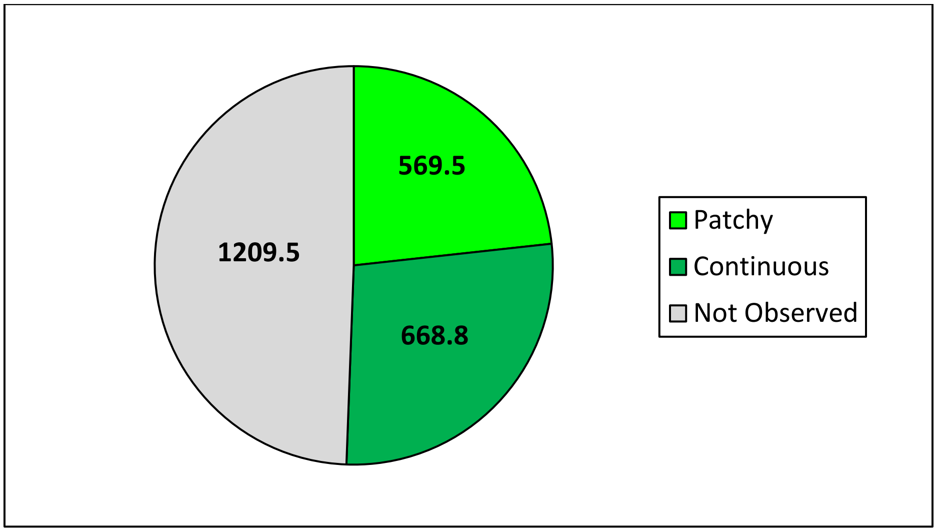

Figure 16. Proportion of shoreline length (km) of the supratidal/intertidal Salt Marsh (SAMB) bioband by shoreline length category.

Figure 17. Photo of a narrow strip of Salt Marsh bioband on Gurd Island in Porcher Inlet (bc15_sh_11051).

Figure 18. Distribution of the Salt Marsh (SAMB) bioband in the Prince Rupert survey area.

Urchin Barrens (URBA) are subtidal areas where the lack of predators such as Sea Otters over the long term and sea stars in the shorter term (Schultz *et al*., 2016) has allowed sea urchins to proliferate. This bioband occurs in 17% of the mapped units to date (see Figures 19 and 21 for a graph of proportion of the shoreline with that bioband and a distribution map). The urchins graze down the kelp and expose the underlying substrate, which is often covered by coralline red algae. Bladed Kelp and Canopy Kelp biobands generally co-occur with the Urchin Barrens bioband as a narrow strip in the upper subtidal. This narrow strip is the zone where wave action prevents the urchins from grazing; however, around Dundas Island (which was imaged in 2019) the Urchin Barrens were actually extending up into the intertidal and piles of urchins were even noted out of the water (see photo in Figure 20). The density of urchins in the subtidal around Dundas Island appeared to be higher than along other parts of the coastline, although it should be noted that other areas were imaged before the worst effects of the sea star wasting disease were likely to have been felt. Urchin Barrens were observed along the outer portions of the coast, generally in Semi-Protected and higher exposures.

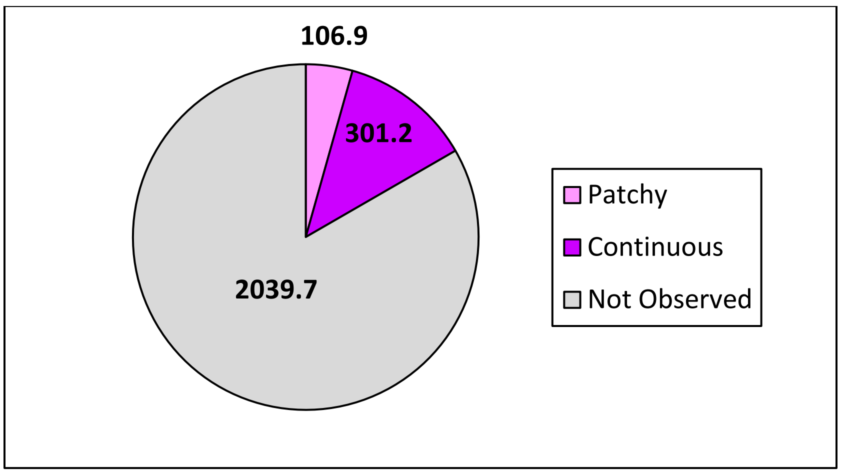

Figure 19. Distribution of the subtidal Urchin Barrens bioband by shoreline length (km).

Figure 20. Example of the Urchin Barren bioband extending into the intertidal on Dundas Island (bc19_dd_01224). The high density of urchins are also visible in the subtidal.

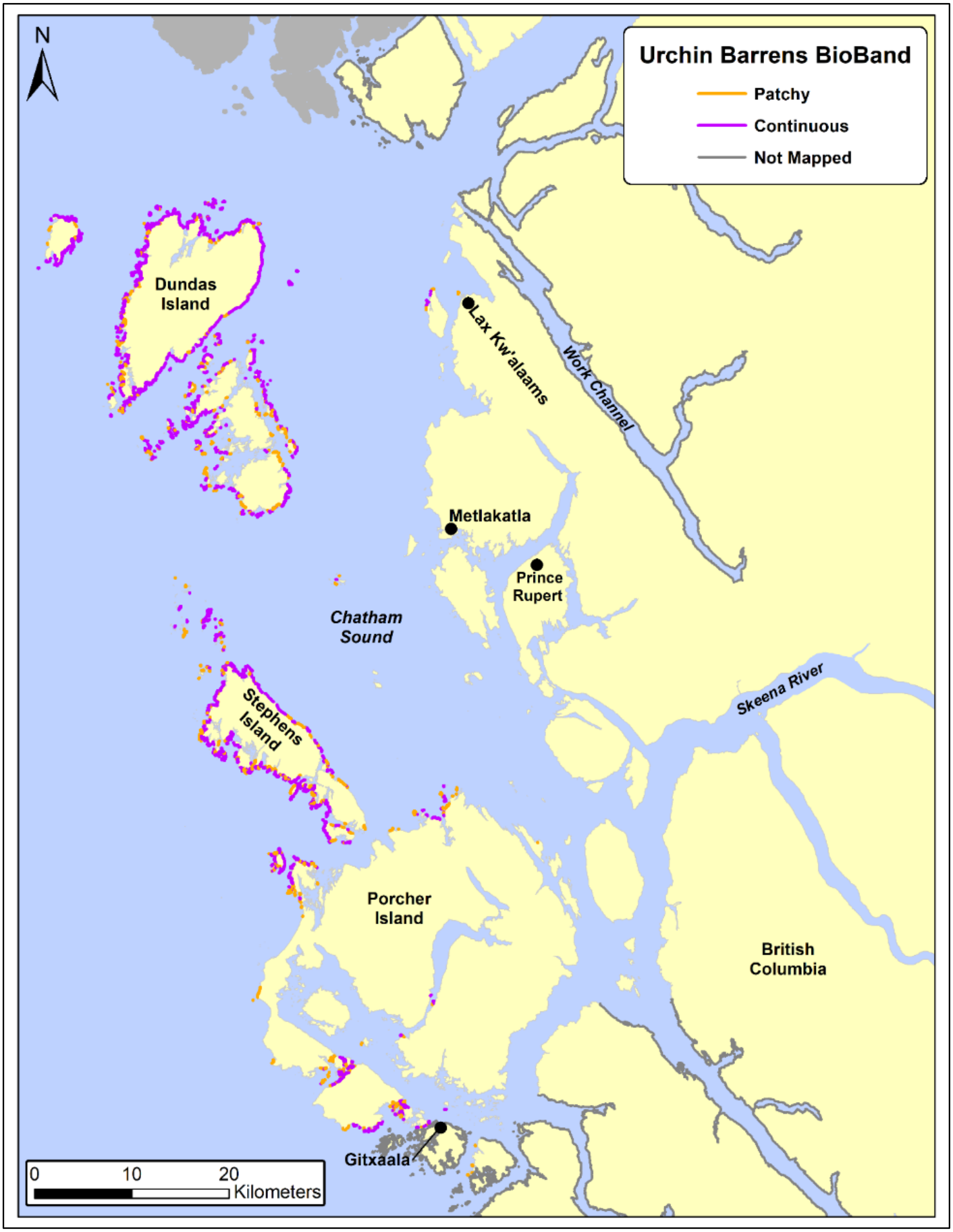

Figure 21. Distribution of the Urchin Barrens (URBA) bioband in the Prince Rupert survey area. Please note that Bladed Kelps (SOBK/DABK/BRBA) and Canopy Kelps (GIKE/BUKE) can co-occur with Urchin Barrens as a narrow strip in the upper subtidal/lower intertidal zone.

There are two canopy kelps that have been observed in the Prince Rupert mapping completed to date, Bull Kelp (BUKE) and Giant Kelp (GIKE). Canopy kelps form valuable habitat for other algae, fish and invertebrates and are an important part of a healthy coastline. Bull Kelp can handle more exposed parts of the coast while Giant Kelp tended to be in areas that were Semi-Protected/Protected. Where the two canopy kelps co-occur, the Giant Kelp is generally found inshore of the Bull Kelp bed. Giant Kelp is also less tolerant of lower salinity so was not found in the area around the mouth of the Skeena River, to the south of Prince Rupert. See Figures 22 and 23 for statistics on the distribution of the individual canopy kelp biobands and a distribution map for both in Figure 24.

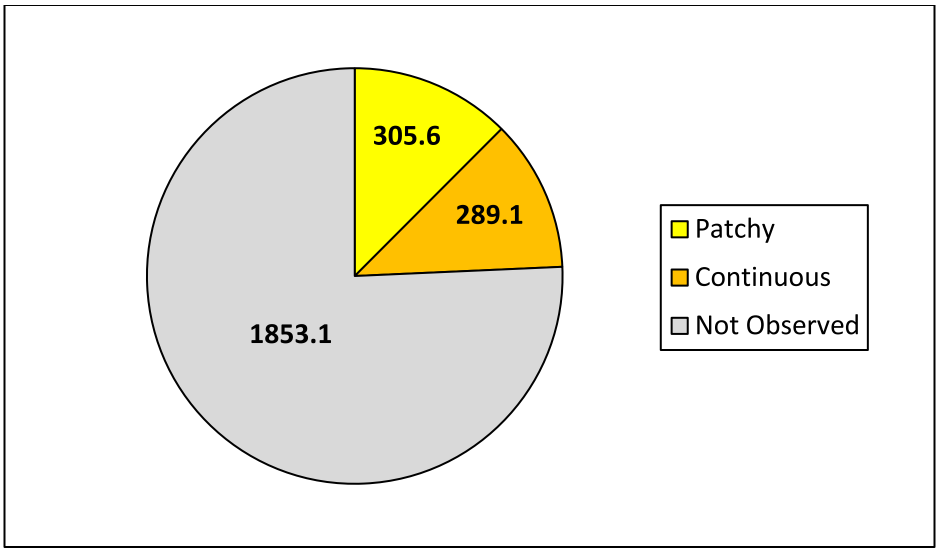

Figure 22. Distribution of the subtidal Bull Kelp (BUKE) bioband by shoreline length (km).

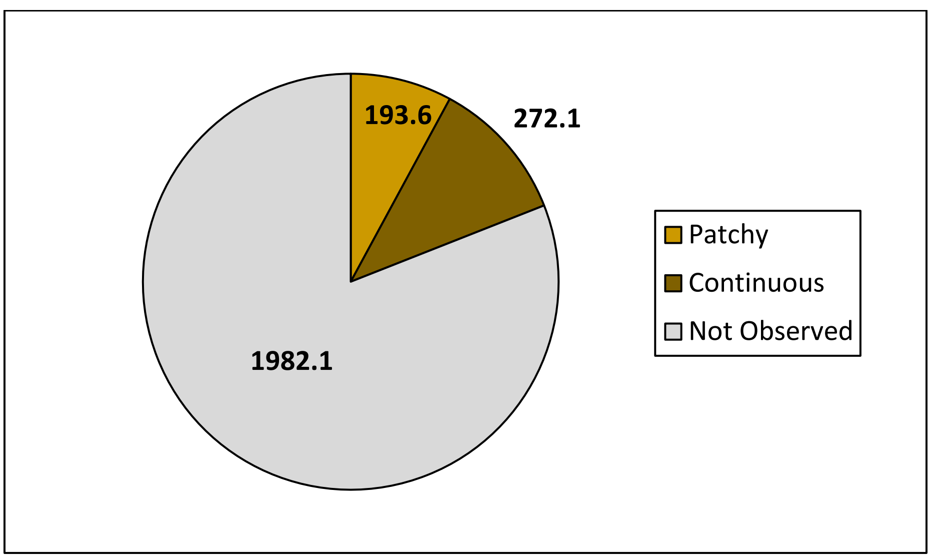

Figure 23. Distribution of the subtidal Giant Kelp (GIKE) bioband by shoreline length (km).

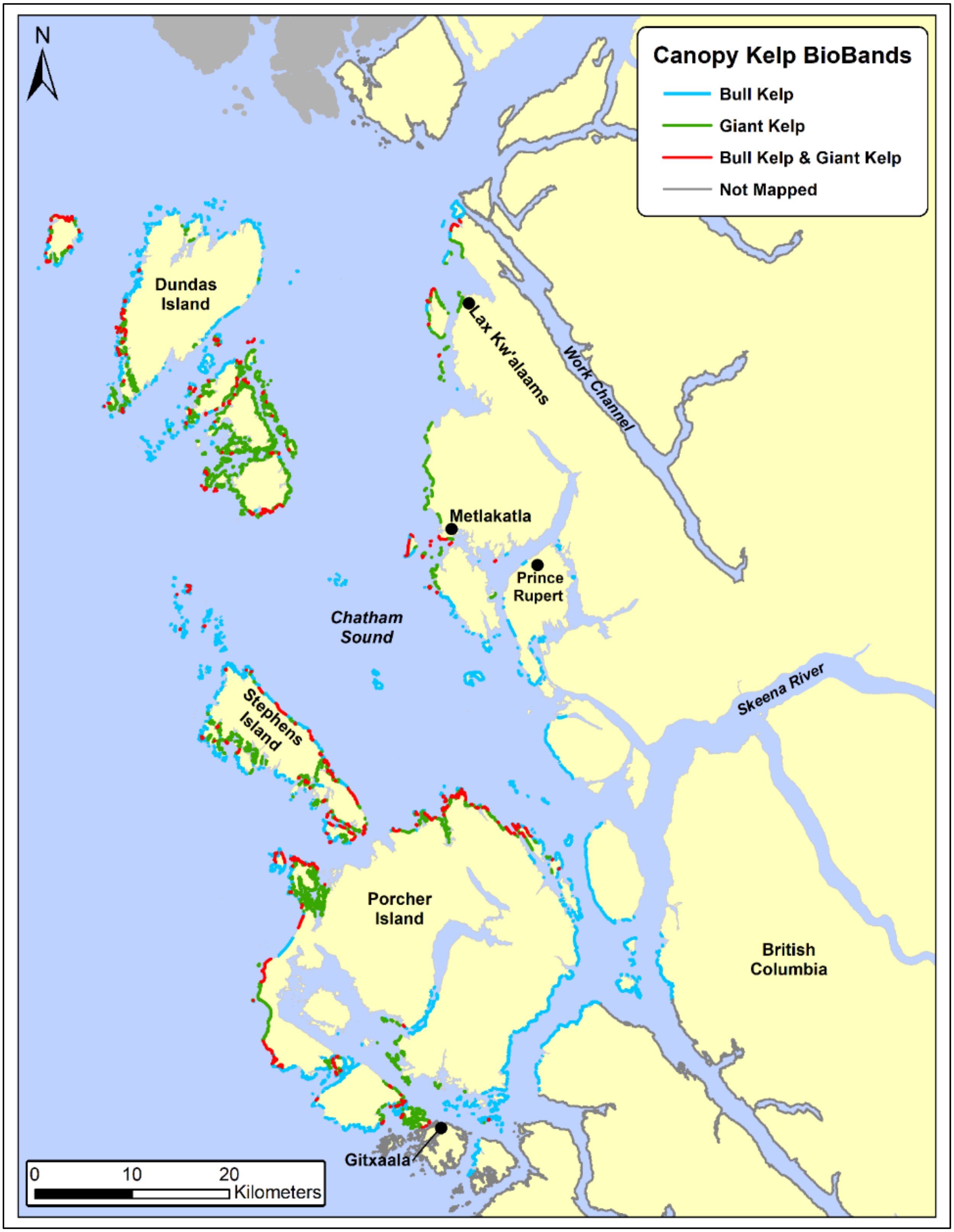

Figure 24. Distribution of the canopy kelp biobands, Bull Kelp (BUKE) and Giant Kelp (GIKE) in the Prince Rupert survey area.

There are two seagrasses that have been observed in the Prince Rupert mapping completed to date, Eelgrass (EELG) and Surfgrass (SURF). Seagrasses are an important component of coastal ecosystems with Eelgrass beds forming in sandy substrate at Semi-Protected and lower exposure while Surfgrass generally attached to hard substrate on Semi-Protected or Semi-Exposed beaches. Eelgrass beds are nursery habitats for juvenile fish and also sequester and store atmospheric carbon (called 'Blue Carbon') in addition to other valuable ecosystem services. See Figures 25 and 26 for statistics on the distribution of the individual seagrass biobands and a distribution map for both in Figure 27.

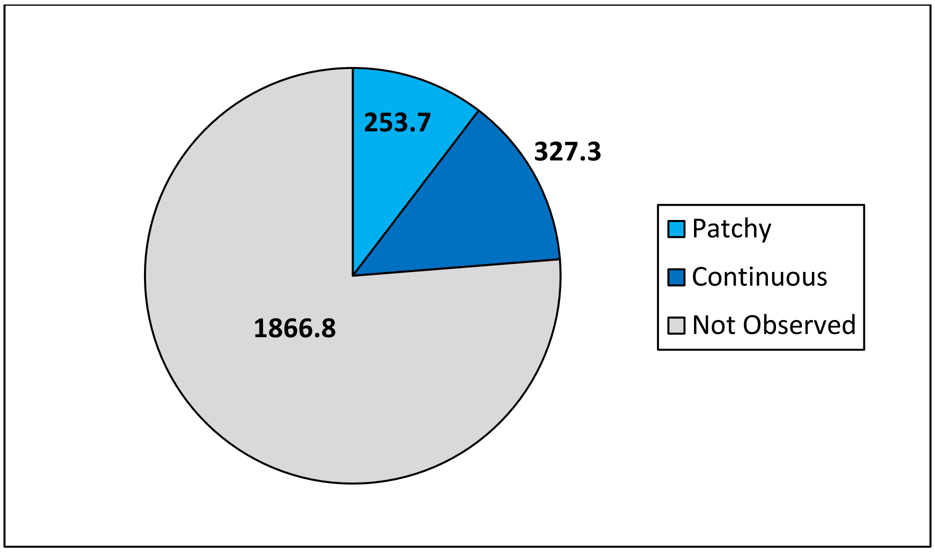

Figure 25. Distribution of the lower intertidal/subtidal Eelgrass (EELG) bioband by shoreline length (km).

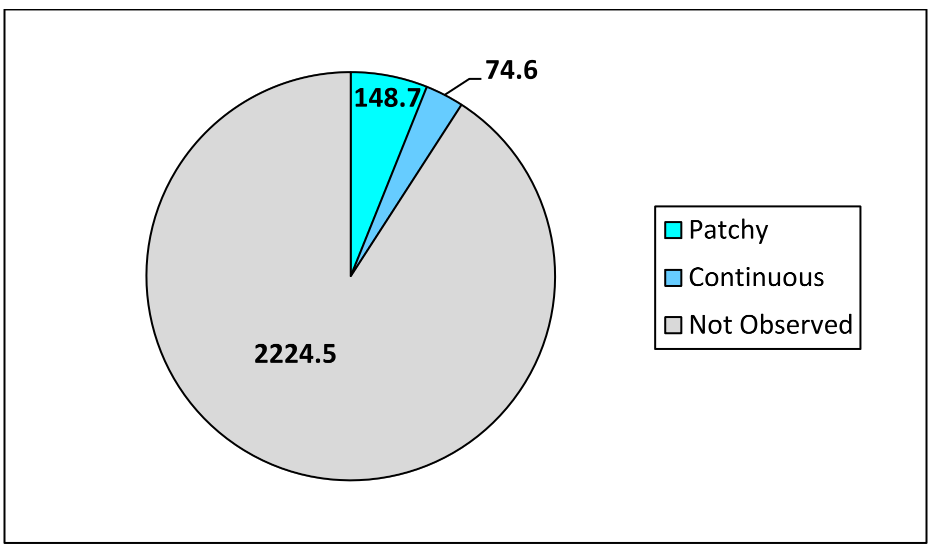

Figure 26. Distribution of the intertidal/subtidal Surfgrass (SURF) bioband by shoreline length (km).

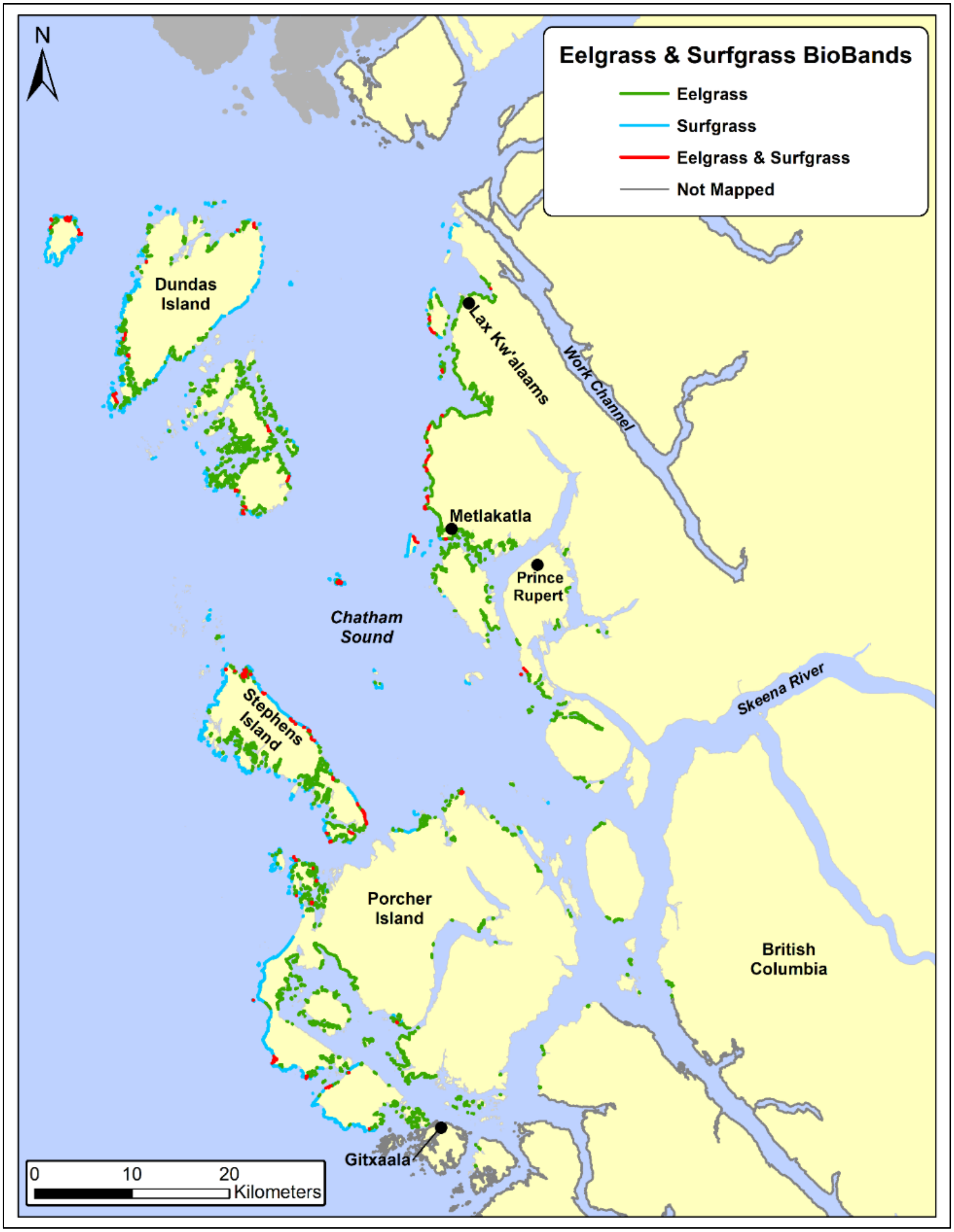

Figure 27. Distribution of the seagrass biobands, Eelgrass (EELG) and Surfgrass (SURF), in the Prince Rupert survey area.

3.2 Biological Wave Exposure

Biological wave exposure categories range from Very Protected (VP) to Very Exposed (VE) and are usually defined in ShoreZone on the basis of a typical set of biobands. When present, the observation and relative abundance of biota in each alongshore unit is used as a proxy to determine the wave exposure at that site. For definitions of the Biological Wave Exposures and the exposure ranges of the biobands, see the most recent ShoreZone protocol (Cook *et al*. 2017).

The distribution of the wave exposure categories mapped in the Prince Rupert survey area mapped to date are summarized in Figure 28 and a distribution map of the categories is shown in Figure 29. Most of the coastline (87.7%) was in the lower to moderate wave exposures (Very Protected to Semi-Protected), with most of that Protected (55.5%).

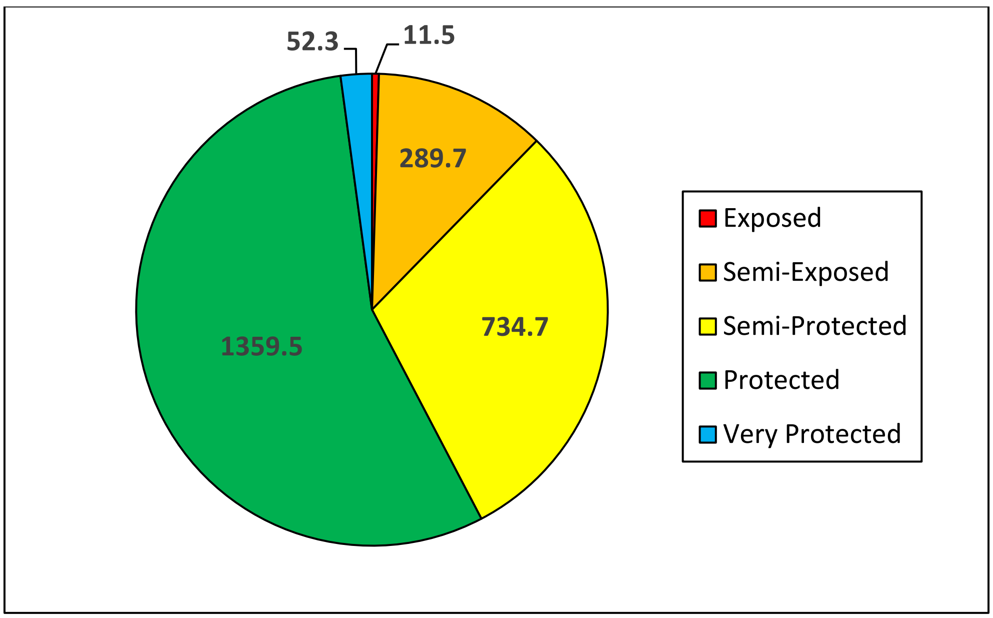

Figure 28. Distribution of Biological Wave Exposures mapped in the Prince Rupert area to date by shoreline length (km).

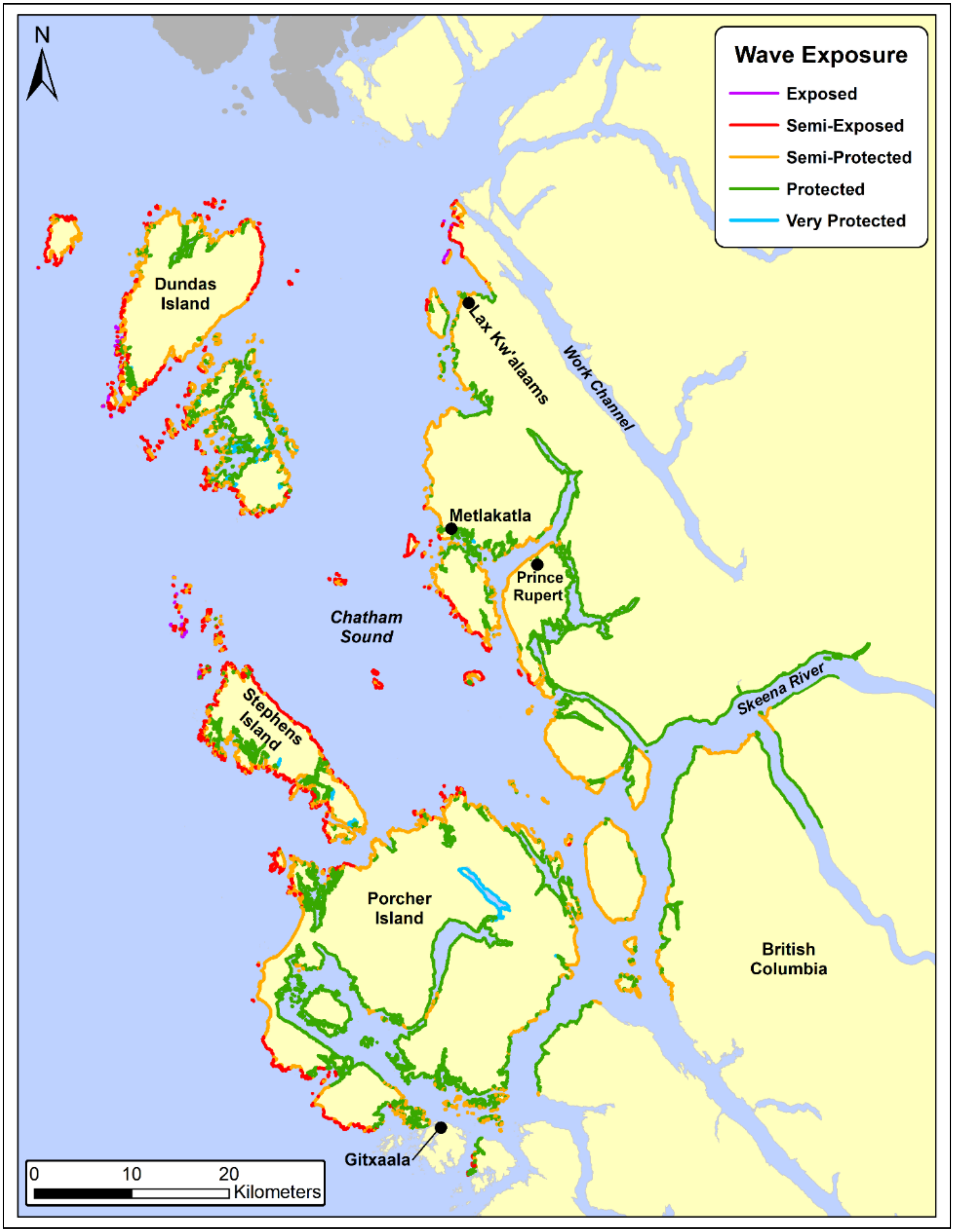

Figure 29. Distribution of the Biological Wave Exposure in the Prince Rupert area mapped to date.

3.3 Habitat Class

Habitat Class is a classification based on wave exposure and geomorphic characteristics observed on an alongshore unit. The habitat class is intended to provide a single attribute to characterize the biophysical features of each unit. The habitat class is assigned by the biological mapper and weighted according to the dominant structuring process. Wave exposure is the most common structuring process, and less commonly observed habitats are those structured by current, estuarine/fluvial processes, and anthropogenic structures. For habitat classes structured by wave exposure, substrate mobility determines the presence of epibenthic biota. Where the substrate is highly mobile, biota is sparse or absent, and where the substrate is stable, biota can be abundant. For further definitions and explanations of Habitat Class codes please see the most recent ShoreZone protocol (Cook *et al*. 2017).

The distribution of habitat class categories mapped for the Prince Rupert area to date are summarized in Figures 30 and 31. Partially mobile substrate is the dominant shoreline type (67.1%). Estuaries are not very common in this area with only 4.7% of the shoreline in that classification. The estuary habitat class is associated with spawning and nursery habitats for fish as well as breeding and foraging grounds for birds and other wildlife. However, although individual units may not have been classed as estuaries, the Skeena River is a significant influence in the area and much of the southern portion of the area surveyed could be considered estuarine in nature. The Anthropogenic habitat occurred in 0.9% of units as the only large developed areas are the Port of Prince Rupert and Port Edward.

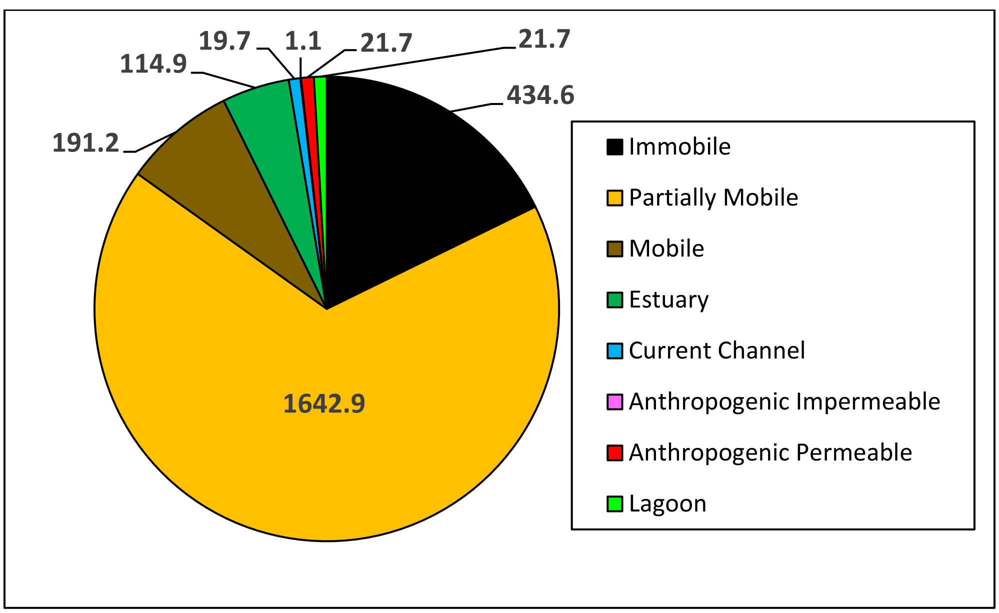

Figure 30. Distribution of Habitat Class categories in the Prince Rupert area Mapped to date by shoreline length (km).

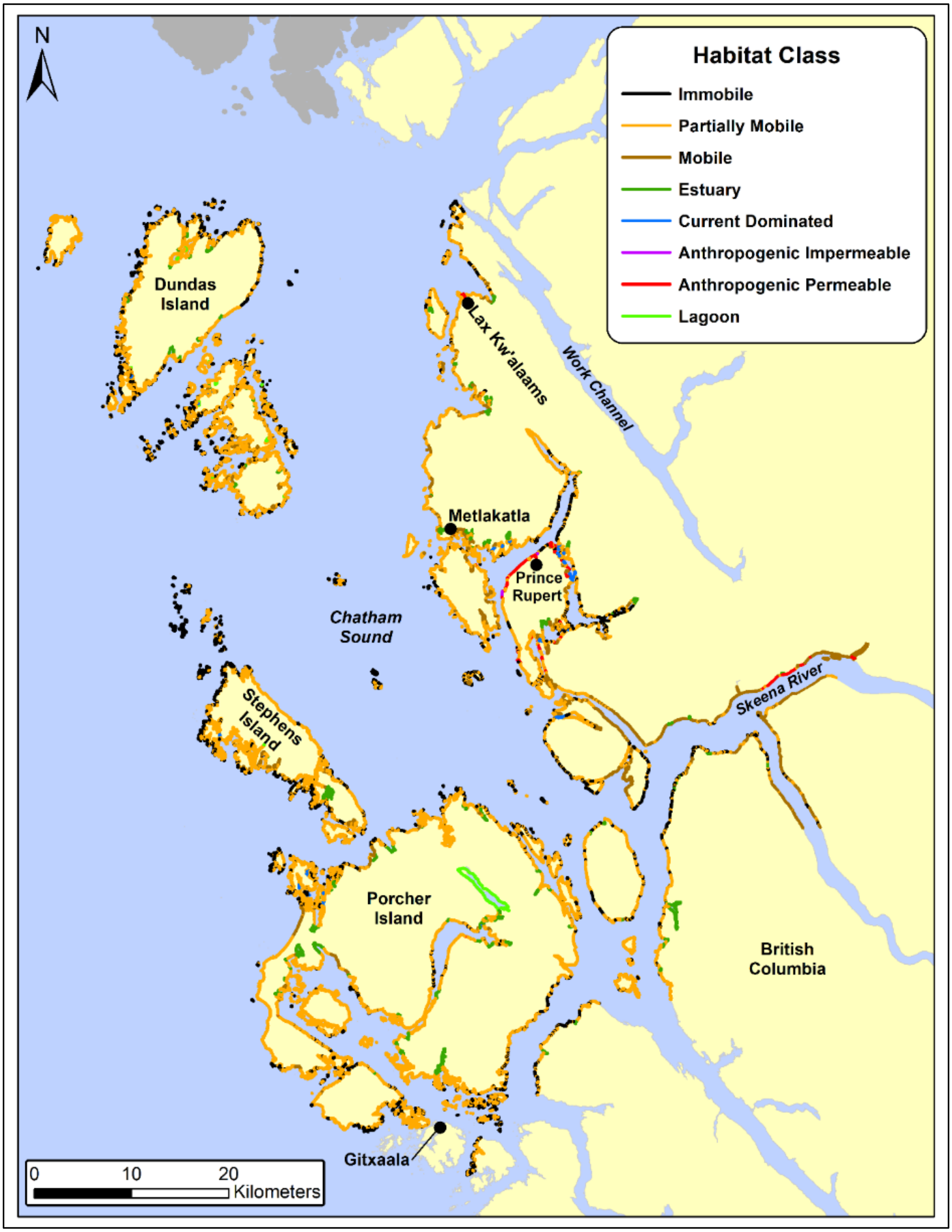

Figure 31. Distribution of Habitat Class categories in the Prince Rupert area mapped to date.

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5 Acknowledgments

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Protocols for data access and distribution are established by the program partner agencies. Please see www.ShoreZone.org for a list of partner agencies and related web sites. Video imagery can be viewed and digital stills for the US dataset can be downloaded online at www.ShoreZone.org and the BC imagery dataset can be accessed through the Coastal and Ocean Resources' ArcGIS site. The mapping geodatabases and summary reports (as well as ground survey data and reports) can be downloaded through the Coastal and Ocean Resources download center. Any hardcopies or published data sets utilizing ShoreZone products shall clearly indicate their source. For questions regarding the protocols or information in this report, please contact Sarah Cook, General Manager of Coastal and Ocean Resources at Sarah@coastalandoceans.com (250-658-4050). For data requests or analytical support contact Kalen Morrow at Kalen@coastalandoceans.com.

APPENDIX A

Photographic Examples of Coastal Classes and Biobands

Table A-1. Examples of the Coastal Classes around Prince Rupert (Page 37).
Table A-2. Examples of the most common Biobands around Prince Rupert (Page 46).

Table A-1. Examples of the Coastal Classes in the Prince Rupert Survey Area.

Photo bc14_pr_16093: Example of Coastal Class 2; Rock Platform, wide.
Goschen Island.

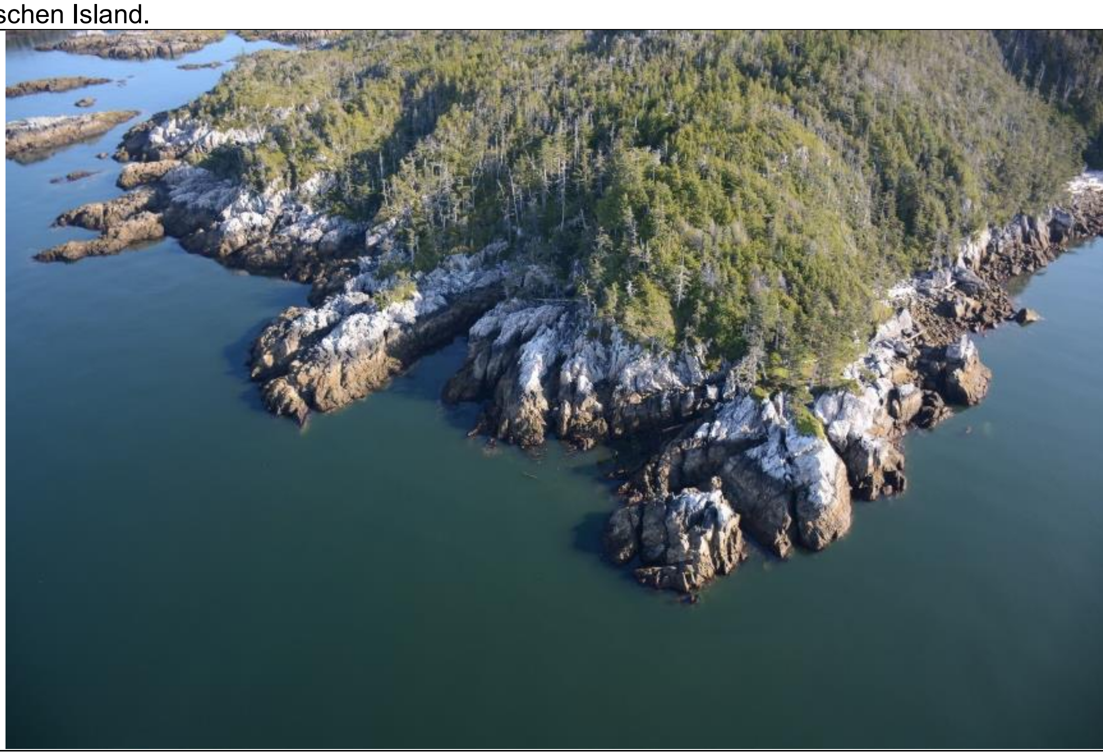

Photo bc15_sh_09996: Example of Coastal Class 3; Rock Cliff.
Stephens Island.

Photo bc14_pr_16259: Example of Coastal Class 4; Rock Ramp.
Goschen Island.

Photo bc14_pr_15972: Example of Coastal Class 6; Ramp with gravel beach, wide.
Goschen Island.

Photo bc15_sh_08837: Example of Coastal Class 8; Cliff with gravel beach.
Porcher Inlet.

Photo bc14_pr_15854: Example of Coastal Class 9; Ramp with gravel beach.
Goschen Island.

Photo bc14_pr_16584: Example of Coastal Class 12; Platform with gravel & sand beach, wide. Shakes Island.

Photo bc14_pr_15777: Example of Coastal Class 13; Cliff with gravel & sand beach. Goschen Island.

Photo bc15_sh_08533: Example of Coastal Class 14; Ramp with gravel & sand beach.
Porcher Inlet.

Photo bc14_pr_15925: Example of Coastal Class 21; Gravel Flat, wide.
Goschen Island.

Photo bc14_pr_15349: Example of Coastal Class 22; Gravel beach, narrow.
Porcher Island.

Photo bc15_sh_08101: Example of Coastal Class 24; Sand & gravel flat or fan.
Kitkatla Inlet.

Photo bc15_sh_08115: Example of Coastal Class 25; Sand & gravel beach, narrow.
Dries Inlet.

Photo bc14_pr_15286: Example of Coastal Class 28; Sand flat.
Porcher Island.

Photo bc15_sh_10379: Example of Coastal Class 31; Organics/Fines.
Prescott Island.

Photo bc14_pr_02754: Example of Coastal Class 32; Permeable man-made structures.
Prince Rupert.

Photo bc14_pr_01509: Example of Coastal Class 36; Lagoons.
Metlakatla.

Table A-2. Examples of the most common Biobands in the Prince Rupert survey area.

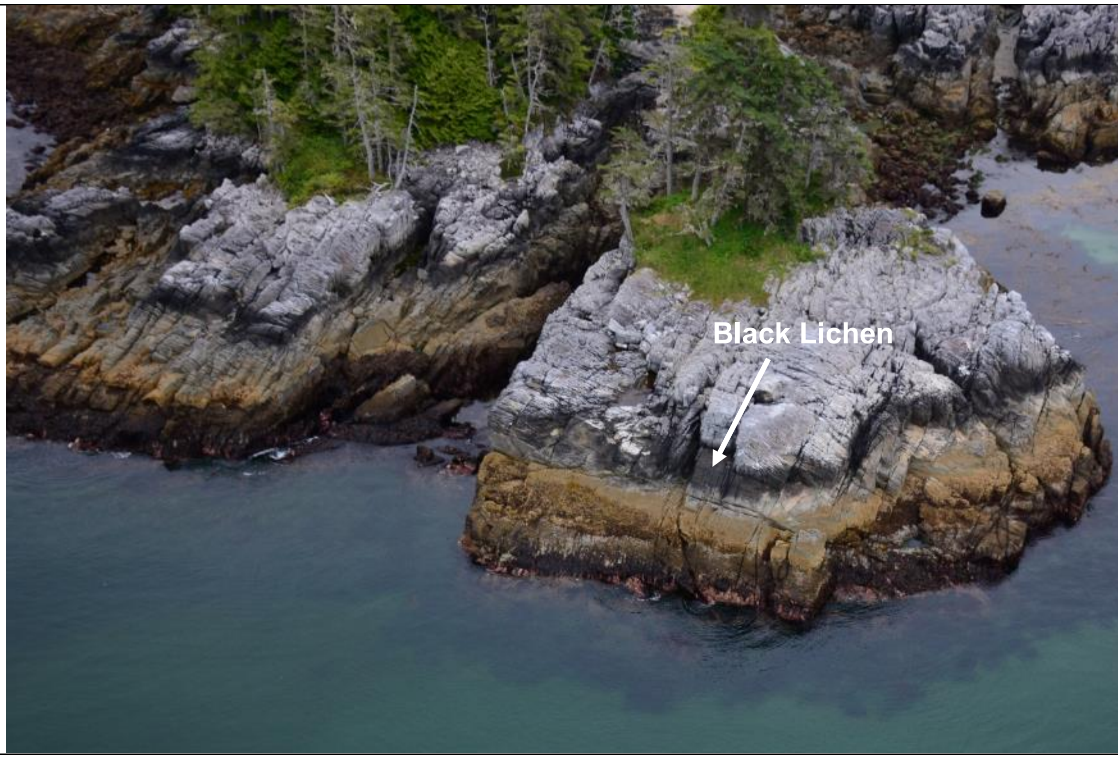

Photo bc19_dd_00111: Good example of the Black Lichen (BLLI) bioband which is a black band in the supratidal zone, usually caused by the lichen *Verrucaria* sp. Dundas Island.

Photo bc19_dd_01573: Good example of the blue-green Dune Grass (DUGR) bioband. Dundas Island.

Photo bc15_sh_09244: Good example of White Lichen (WHLI) bioband in the supratidal zone, above the Black Lichen band. Tree Nob Island group.

Photo bc14_pr_01900: Good example of Salt Marsh (SAMB) bioband in the supratidal/intertidal zone. Prince Rupert Harbour.

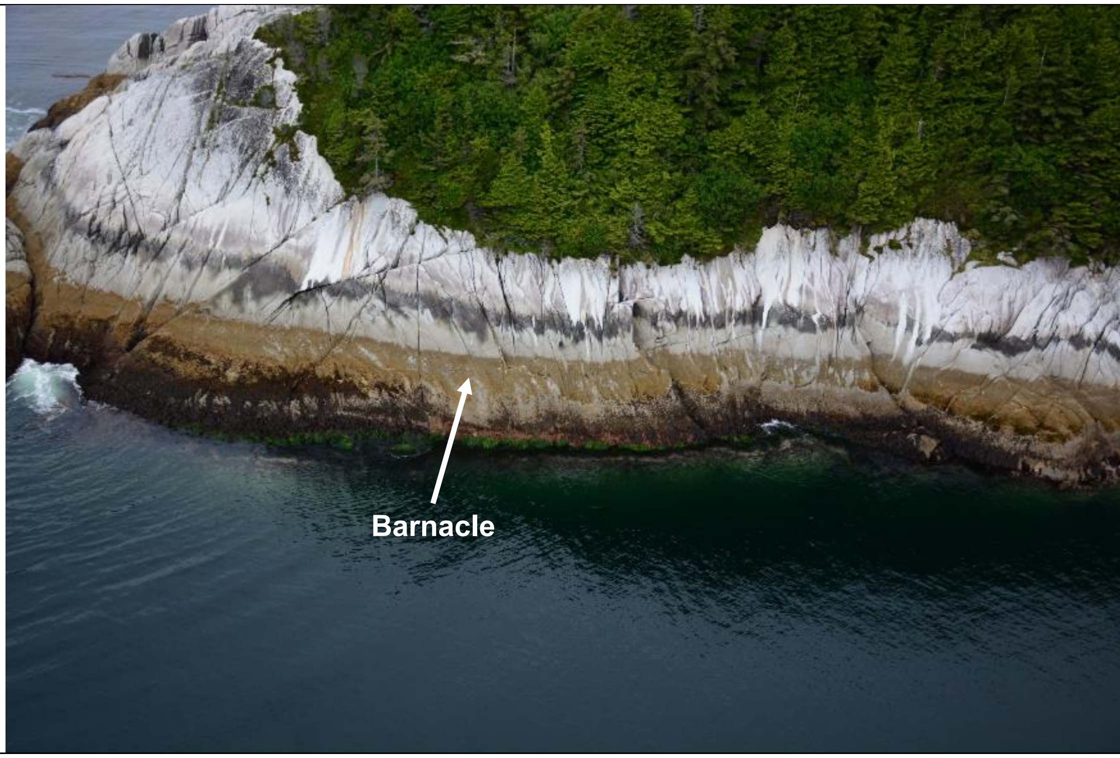

Photo bc19_dd_00610: Good example of the beige Barnacle (BARN) bioband in the high intertidal zone. Dundas Island.

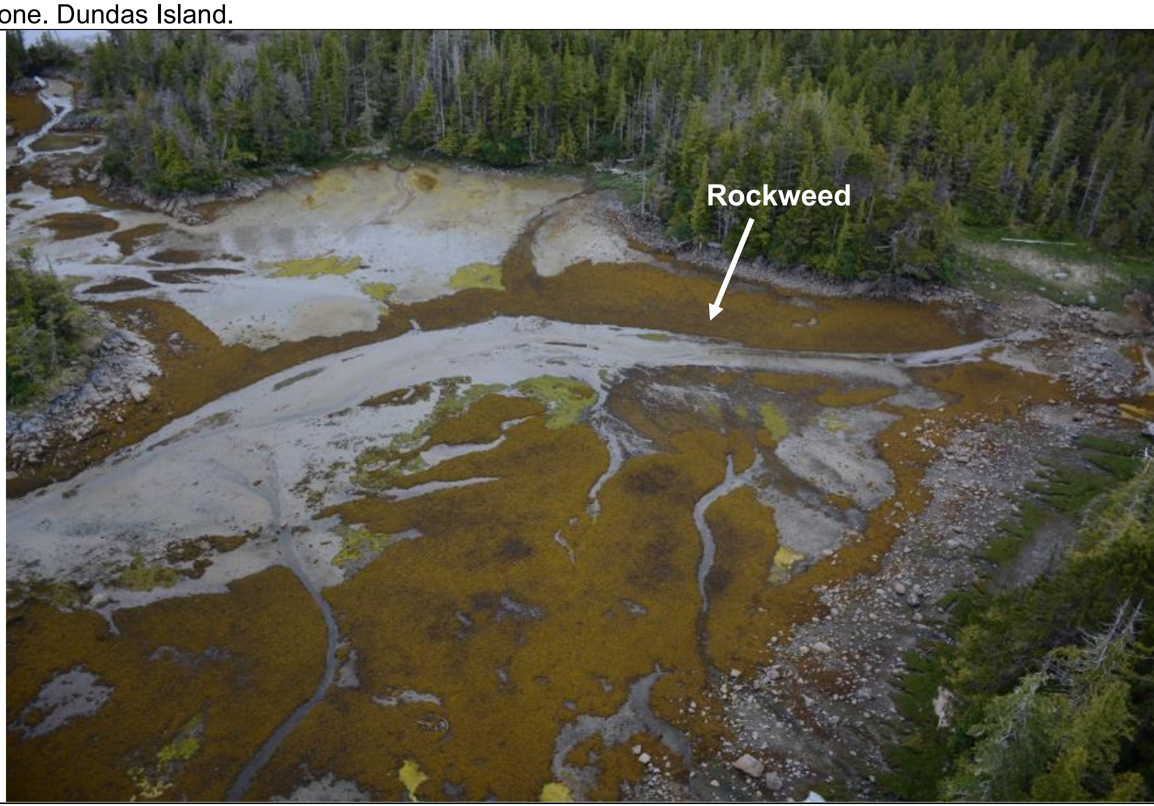

Photo bc14_pr_16606: Good example of the golden-brown Rockweed (ROCK) bioband. Porcher Inlet.

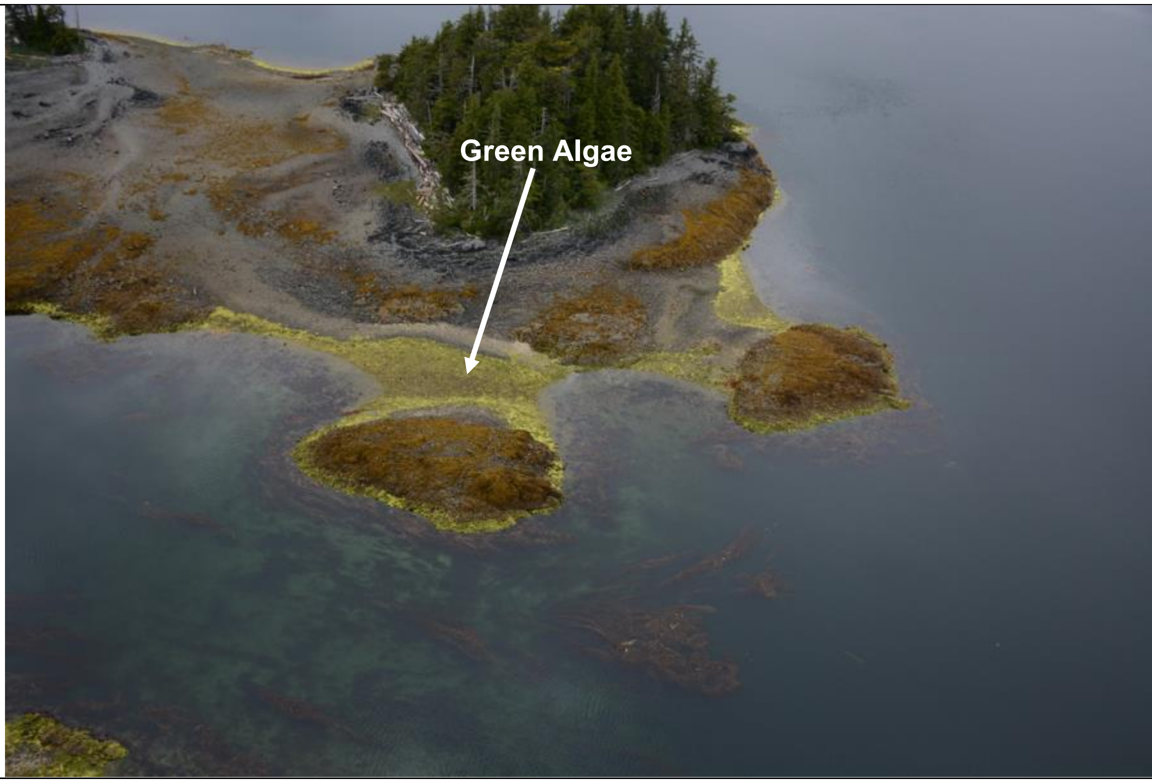

Photo bc15_sh_13705: Good example of the Green Algae (GRAL) bioband in the lower intertidal. Melville Island group.

Photo bc14_pr_16766: Good example of kelps at the waterline (BRBA or SOBK biobands). Porcher Island.

Photo bc14_pr_01538: Example of the Eelgrass (EELG) bioband in the lower intertidal/subtidal. Metlakatla pass.

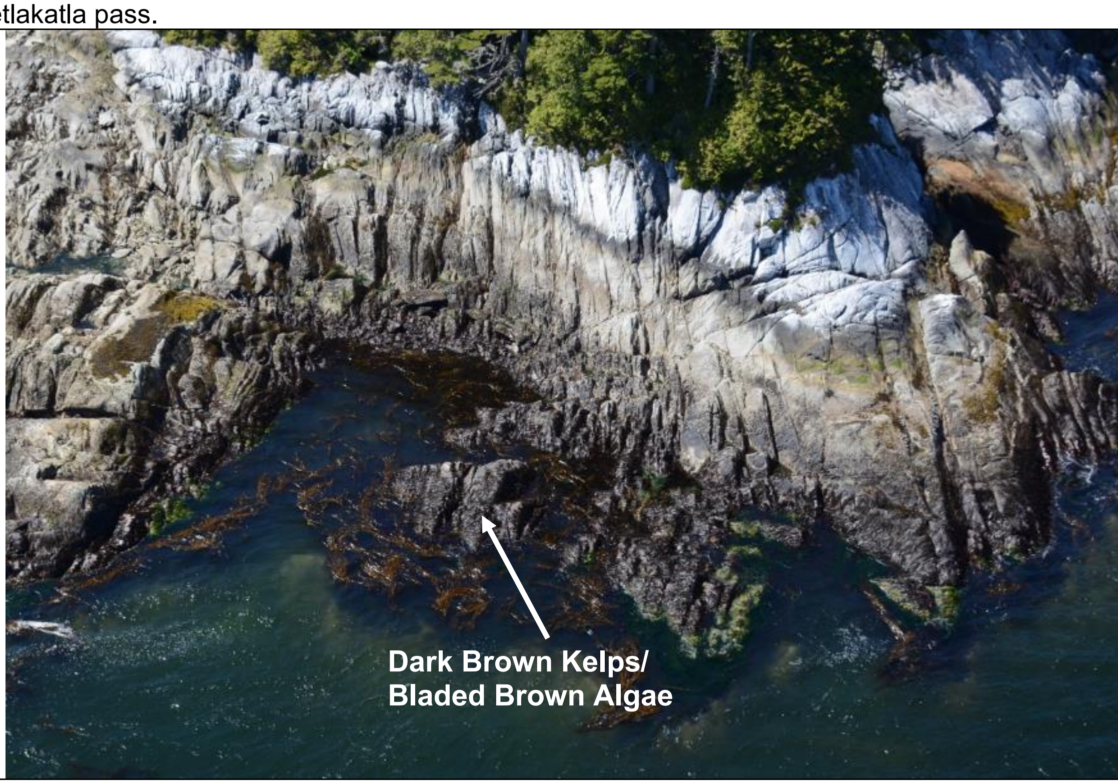

Photo bc15_pr_14515: Good example of a kelps (BRBA or DABK biobands) and Surfgrass (SURF) bioband in the lower intertidal and subtidal. Stephens Island.

Photo bc15_sh_10623: Good example of the bright green Surfgrass (SURF) bioband in the lower intertidal. Stephen Island.

Photo bc14_pr_15140: Good example of the Bull Kelp (BUKE) bioband in the nearshore. Outer Porcher Island.

Photo bc14_pr_16542: Good example of the Giant Kelp (GIKE) bioband in the nearshore. Near Porcher Island.

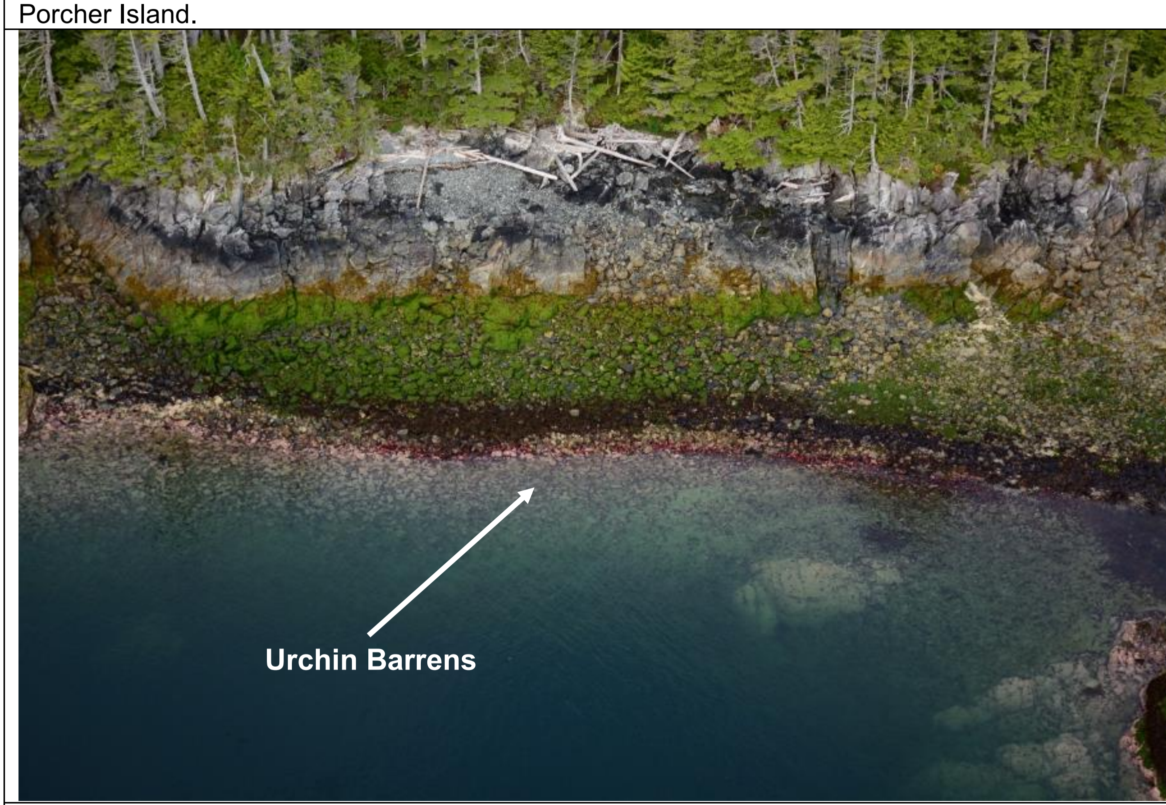

Photo bc19_dd_01224: Good example of the Urchin Barrens (URBA) bioband in the nearshore. Dundas Island.