AN OIL-SPILL CONTINGENCY PLAN FOR GROSWATER BAY, LABRADOR: SHORELINE CLASSIFICATION

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INTRODUCTION

The purpose of this investigation was to define shoreline characteristics of the Groswater Bay region, Labrador, as a means to assess the susceptibility of the coast to oil-spill impact. The study area extends from Ship Harbour (north) to Sandy Point (south) (Fig. 1). Groswater Bay is an 80-km long embayment which is the entrance to Lake Melville. The Lake Melville-Groswater Bay system is the largest embayment and the primary shipping and port area on the Labrador Coast.

METHODS

The study area was divided into eight segments. Data was compiled for each segment to characterize differing regions in Groswater Bay (Table 1).

The shore classification system was initially utilized by Rosen (1980) to define the morphology of the Makkovik region, Labrador. It is based on morphologic parameters (cobble, sand beaches; salt marsh; fractured, smooth rock) which can readily be identified with aerial overflight. A measure of wave energy along the shoreline is described by the height of the wave-wash zone above HWL (high water line) along rocky shorelines: 0-2 m, low energy; 2-6 m, moderate energy; 6 m, high energy.

A shoreline density index was devised to describe the amount of shoreline per given length of coast. This index is the ratio between the total shoreline length and the coastal length, measured by straight lines between major headlands. A higher index defines shore regions with highly indented shorelines or complex island-and-tickle morphology (Table 1). A given oil spill will contaminate more shoreline length in these areas.

With the exception of one community (Rigolet), the region is sparsely populated. The vulnerability of shorelines in this area is based on the ability of the coast to restore itself by natural physical processes. Any cleanup or containment activities can be concentrated on the most vulnerable regions, as defined herein.

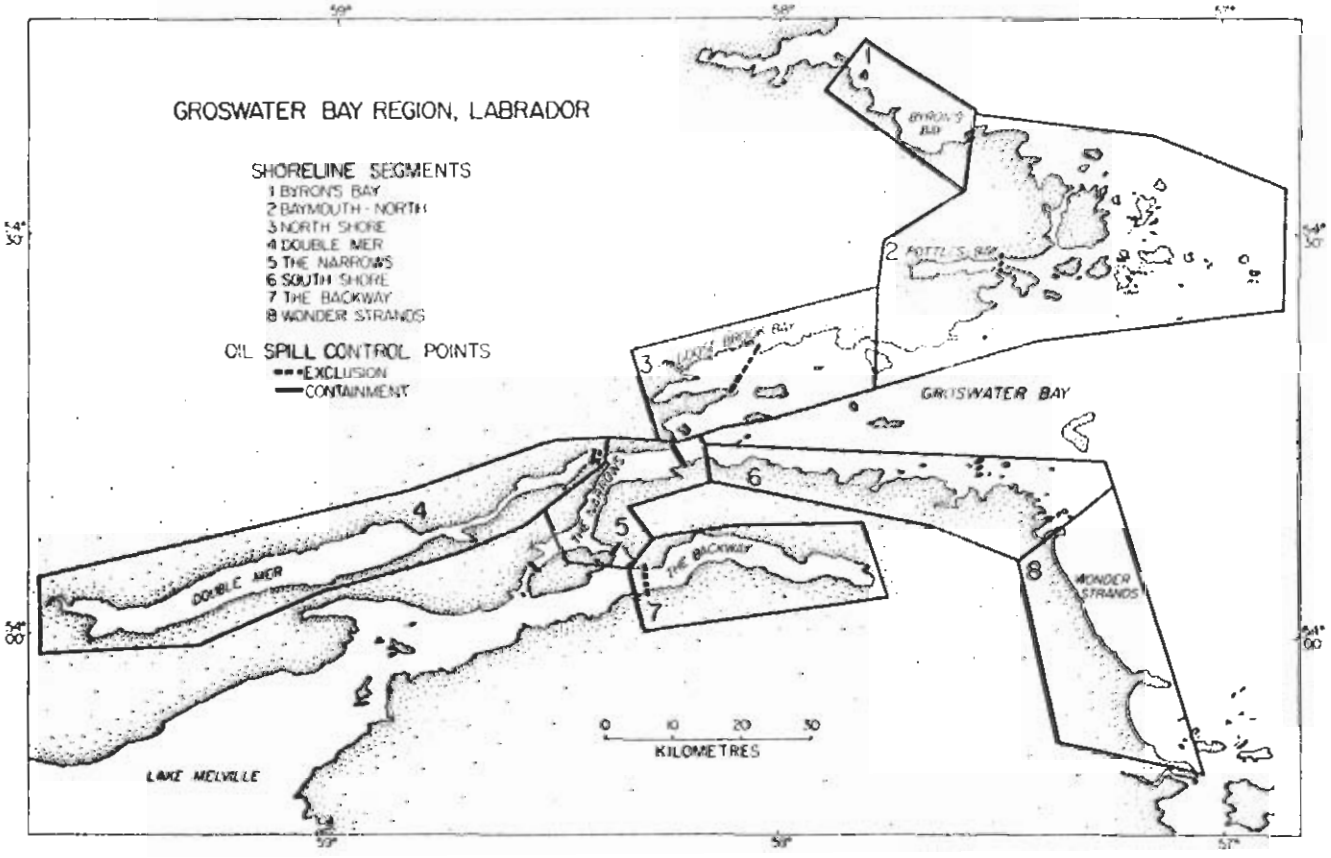

FIGURE 1 MAP OF THE GROSWATER BAY REGION SHOWING THE EIGHT SHORELINE SEGMENTS AND PROPOSED OIL SPILL CONTROL POINTS

TABLE 1 COASTAL ENVIRONMENTS OF THE GROSWATER BAY REGION, LABRADOR (The data has not yet been compiled for Double Mer)

	Marsh		Sand Beach		Cobble Beach		Smooth Rock						Fractured Rock						Total Segment Length	Shoreline Density Index
							Low Energy		Moderate Energy		High Energy		Low Energy		Moderate Energy		High Energy			
	%	km	%	km	%	km	%	km	%	km	%	km	%	km	%	km	%	km		
1 Byron's Bay	5	2	37	15	10	4	0	0	20	8	0	0	0	0	13	5	15	6	40	1.25
2 Baymouth North	16	67	2	9	23	99	10	45	17	74	6	24	15	66	6	23	5	21	428	5.48
3 North Shore	60	62	8	8	15	16	8	8	0	0	0	0	7	7	2	3	0	0	104	1.29
4 Double Mer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5 The Narrows	11	7	9	6	36	24	29	19	0	0	0	0	15	10	0	0	0	0	66	1.46
6 South Shore	37	44	10	12	16	19	20	24	1	1	3	3	10	13	3	4	0	0	120	2.15
7 The Backway	28	31	41	45	16	18	10	11	0	0	0	0	5	5	0	0	0	0	110	1.20
8 Wonder Strands	0	0	81	46	2	1	0	0	3	2	9	5	0	0	2	1	3	2	57	1.08
Total	23	213	15	141	20	181	12	107	9	85	3	32	11	101	4	36	3	29	915	2.16

Total Rock Shore: 42%/390 km

A more extensive geomorphic analysis of the central Labrador coast (Reinson *et al.*, in prep.) will be used to extend and refine the plan.

SEGMENT DESCRIPTIONS

1. Byron's Bay

This segment, extending from Cape Rouge to Ship Harbour, faces the Labrador Sea. It consists of rock shorelines (45 percent) with numerous embayed accretional sandy beaches. The largest are at Byron's Bay and Michael's River. The vegetation on the barrier dunes is a unique habitat composed of tundra and coastal species (personal communication, Paul Godfrey, 1978). An oil spill should not affect this habitat directly. The high wave energy exposure and low shore density index (1.25) should facilitate natural cleansing. However, any shore cleanup should be focused on the two major beach systems to prevent possible burial and long-term preservation of the contaminant.

2. Baymouth-North

This region, extending from Black Island to Cape Rouge, encompasses the peninsula that forms the northern bay entrance. This segment contains the largest amount of shoreline, resulting in a density index of 5.48. Most of this distance is composed of numerous islands separated by narrow straits (tickles). Although much of this segment is exposed to the full wave energy of the Labrador Sea, much of the coastal length lies in leeward settings, providing areas conducive to the collection of oil. However, there is minimal development of sedimentary intertidal zones; 59 percent of the area is rocky shores and 23 percent consists of cobble beaches. There are two major embayments. Abliuk Bight is 8 km long and virtually devoid of sediment and salt marsh. Pottles Bay is 15 km long and morphologically similar to "Goose Brook Bay" (q.v.), containing most of the marsh habitats in the segment. The narrow (1 km) entrace to Pottles Bay is the most efficient exclusion point, as most marsh is inside this point. The remainder of this segment can restore itself by natural processes in time, with minimal long-term damage.

3. North Shore

This segment, extending from Ticoralak Head to Black Island, is the most environmentally sensitive area in Groswater Bay. Although this is a relatively straight coast (density index = 1.29), over 60 percent of the shore has marsh development (62 km). A large bay, referred to as "Goose Brook Bay", encompasses most of the segment. This bay contains extensive boulder/mud flats, but no boulder barricades. The mud flats result from the input of two large rivers which transport fine-grained material into the system. The most extensive salt marsh in the Groswater region occurs at the mouth of Goose Brook (about 12 km^2). Fringe marsh lines the shore, at least intermittently, throughout the segment. The isolated sand beaches usually occur associated with the numerous creeks draining into the bay.

Cleanup of oil would be difficult, due to the boulder flats, extensive shoal areas and abundant marsh. However, containment of the pollutant outside the 5.5 km wide mouth of "Goose Brook Bay" would protect the most valuable marsh community in the region.

4. Double Mer

This shoreline is morphologically similar to the Backway. This 73-km long embayment is connected to the Narrows by an 0.7-km wide channel, which would make an efficient exclusion point for protecting over 150 km of marsh and beach-dominant shoreline.

5. The Narrows

The Narrows ranges from one to three km in width and is the only tidewater access to Lake Melville. High tidal currents keep the channel ice-free for most of the year. This low wave energy segment has a low shoreline density index (1.46) and is composed primarily of cobble beaches and rock. With less than 20 km of marsh and sand beaches, this segment should have a low priority for any cleanup procedures and may serve as a suitable containment area.

6. South Shore

The southern shore of Groswater Bay contains a complex shore morphology. The region is composed of numerous small embayments resulting in a high shoreline density index (2.15). Small salt marsh areas, confined to the heads of embayments, comprise 37 percent of this shoreline. This marsh is primarily fringe marsh, but more extensive marshes are developed at the heads of larger bays. Broad boulder/mud flats are prevalent in the intertidal zone and boulder barricades are common, while much of the outer shore is rock.

As this region is exposed to the full fetch of Groswater Bay to the north, contaminants will readily collect in the embayments and marsh areas. However, cleanup on this coast would be extremely inefficient and there are no natural features to facilitate containment.

7. The Backway

The Backway is a 35-km long bay with a mean width of 3.6 km. The segment contains highly sensitive shore environments. 28 percent of the shoreline is fringe marsh and 41 percent sand beaches. The marsh density increases toward the bay head. The Backway is characterized by a straight shore from (shore density index = 1.20), and boulder barricades are present intermittently. This is a low wave energy setting, which minimizes any natural cleaning potential. Because the 110-km long shoreline system is connected to Groswater Bay by a 3.5 km wide mouth at the Narrows, maximum protection is afforded by exclusion of contaminants at the mouth. Cleanup along this shoreline is feasible, but shipping should be excluded from this sensitive area.

8. Wonder Strands

This segment, flanking Groswater Bay to the south, is the longest sand beach (46 km) in Labrador, interrupted only by Cape Porcupine. The beach is straight and continuous, with numerous streams flowing over the beach. This area is exposed to high wave energy which should be an effective natural cleansing agent on this simple platform.

DISCUSSION

An oil spill in Groswater Bay is inevitable if development continues in that area. Cleanup or containment should initially be limited to the most sensitive environments. Cleanup of most shore areas would be difficult due to the poor accessibility, which in most areas is possible only by helicopters or small boats. Many sedimentary intertidal zones inside Groswater Bay have boulder barricades or boulder flats. Therefore, initial response to an oil spill should be based on a philisophy of containment and exclusion rather than shore cleanup.

Four locations (Pottles Bay, "Goose Brook Bay", Double Mer and The Backway, Fig. 1) contain the greatest length of sensitive shorelines relative to the expense of spill control. Essential protection of the coast will be attained if field preparations are designed to prevent oil from passing the exclusion points marked in Figure 1. These preparations include shore anchoring points, helicopter landing sites and a predetermined spill control regimen for each site. As well, consideration should be given to excluding all commercial shipping from these areas.

The Narrows is an area of high probability for oil spill due to the narrow passage on high tidal currents. The shore within this area is not very sensitive to spill, so the region should be viewed as a containment area. Preventing the passage of oil at four narrow straits, seals the area from both the Lake Melville and Groswater systems.

If preparations are made to control oil movements at the eight sites shown on Figure 1, of which probably no more than four will be utilized for any given spill, Groswater Bay will attain the maximum essential protection of environmentally sensitive areas.

ACKNOWLEDGEMENTS

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