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[Environmental atlas of southern

INTRODUCTION

The coastal zone of southeastern Newfoundland sustains an abundant variety of fish, birds, and marine mammals. Many species rely entirely on this environment for their existence. The renewable resources found in these waters provide both income and recreation to Canadians as well as the people of many foreign countries. Recently, the importance of the region as a location for offshore development and as an oil transportation route has intensified. Thus, the possibility of a major oil spill occurring has also increased.

This atlas compiles existing physical and biological baseline data at a scale of 1:350,000 for the nearshore zone of Newfoundland, extending from Fortune Bay to Bonavista Bay. A brief description of the region and its resources is provided below.

The major bathymetric feature of the region is the mass of irregular shallow banks which comprise the Grand Banks. Although depths over these banks are usually less than 50 meters, many nearshore areas are deeper than 180 meters.

The topography of the region is dominated by rocky sea cliffs, fjord-like inlets and pebble/cobble beaches. A simplified shoreline classification has been provided. A more detailed description of the shorezone (Scale 1:50,000) is contained in a report compiled by the Lands Directorate, Environment Canada (in press).

During winter and spring, sea ice is found primarily in the northern portion of the study area while the southern segment remains relatively ice free. Icebergs are common along the east coast of Newfoundland and are most numerous in April, May and June. An average of 400 bergs per annum can be expected to cross 48° N. Latitude.

Tides along this coastline are described as semi-diurnal with ranges less than two meters. Tidal velocities rarely exceed 0.25 M/Sec. but have been recorded as high as 1.75 M/Sec. near headlands. Wave energy is considered to be high over most of the coastal zone.

The climate can be described as temperate with mean summer temperatures of 15-18°C and mean winter temperatures of -3° to -7°C. Prevailing winds are generally northwest in winter and southwest in summer. Average wind speeds range from 21 KM/HR. in summer to 27 KM/HR. in winter.

Coastal waters are dominated by the cold Labrador current which flows primarily southward down the east coast of Newfoundland until reaching the vicinity of the Grand Banks. At this point the current encounters the warm Gulf Stream waters, causing extensive upwelling. Surface current speeds seldom exceed 0.5 M/Sec. in the region. Coastal upwelling has also been observed where currents are influenced by irregular bathymetric conditions such as those found in waters of southern Newfoundland.

Although residual surface currents generally flow in a south-westerly direction, they are often erratic and strongly influenced by the prevailing wind conditions.

Sea surface temperatures range from 0° to 1°C in winter to 12-14°C in summer. In sheltered areas, summer temperatures of 18-20°C have been recorded.

During summer months, phytoplankton concentrations of up to 500 mg C/m²/day have been found in nearshore Newfoundland waters. In April and May, intense phytoplankton blooms also occur in the vicinity of the Grand Banks. Biomass levels of 320 mgC/m²/day have been recorded during this time.

Copepods of the genus, *Calanus*, are the predominate zooplankton species occurring in coastal waters. The largest concentrations occur in the warm surface layers during summer.

Marginal commercial quantities of Irish moss are found in portions of Placentia Bay. Rockweeds are abundant throughout the region and have potential for commercial harvesting operations.

During summer squid are caught in the coastal zone when populations migrate into the region from southern waters. The fishery fluctuates greatly from year to year because of the short life span of the species.

Shellfish found within the region include giant scallops, Icelandic scallops, soft-shell clams and blue mussels, although all species occur in relatively small quantities. Intermittent scallop beds which are found in Placentia Bay support only a localized fishery. Mussels are harvested by dipnets mainly in Bonavista Bay.

Lobsters and snow crabs are the primary crustaceans caught commercially in the region. Lobsters are distributed throughout the region and rank third in landed value after cod and flatfish.

Snow crabs occur in commercial concentrations primarily around the Avalon peninsula and are most common in depths of 165 to 330 meters within 32 kilometers of shore. Larvae hatch from April to June and swim in the plankton for about four months before settling to the bottom.

Shrimp are found in isolated areas along the south coast of Newfoundland and support a small fishery. Small commercial quantities of shrimp occur in isolated areas along the southern coast and north of Cape Francis, in depths of 250 meters, within 30 KM of shore.

Numerous finfish species use the banks off southeastern Newfoundland as feeding and nursery areas. The most important commercial species are cod, American plaice, haddock, herring, mackerel, turbot and redfish.

Cod is the most important species in terms of both landed weight and value. Spawning occurs on the offshore banks during spring. In summer, cod move to coastal waters for feeding and support inshore fisheries. Cod are fished at all times of the year

in the offshore areas.

American plaice, the most valuable flatfish species, are primarily found in depths ranging from 75 to 275 meters throughout the coastal zone. During April and May, spawning occurs in both offshore and coastal waters. (The Bonavista Shelf is a primary spawning area).

Haddock are primarily concentrated on the Grand Banks although stocks have been depleted in recent years. Spawning occurs from April to August.

Herring are a pelagic species which occur in most bays along the southeast coast of Newfoundland. Separate stocks are located in Fortune Bay, St. Mary's - Placentia Bay and eastern Newfoundland. Spawning occurs predominately in the spring in all these areas. Overwintering concentrations can also be found in Placentia Bay as well as in eastern Newfoundland coastal waters.

Mackerel are seasonal migrants to Newfoundland coastal waters. They are most abundant during July and in late autumn. During June and July, spawning occurs primarily in the Gulf of St. Lawrence although recently, mackerel spawning has been discovered off southeastern Newfoundland.

Turbot occur in commercial quantities in Bonavista Bay, Trinity Bay and near the Grand Banks in very deep waters. Spawning occurs from November to January in offshore areas.

Redfish are another deep water species which occur throughout the region. Spawning takes place in May and June on the southwest slope of the Grand Banks.

Capelin are found over most of the coastal zone and are an important link in the food chain. Spawning occurs in May and June on the southeast shoal of the Grand Banks and on most beaches located in southeastern Newfoundland. A nursery area has been observed on the northern Grand Banks.

Spiny dogfish occur in commercial concentrations during summer months. Recently, a dogfish fishery has developed in Placentia Bay.

Bluefin tuna are found in coastal waters during summer. A small sport fishery takes place in Conception Bay.

Salmon migrate to rivers of coastal Newfoundland during May and June. After spawning (late summer) young and adults return to northwest Atlantic for feeding. An intensive fishery (mainly gillnets) takes place in coastal waters during these migration.

Sand lance, an important food species for cod, flatfish and salmon, inhabit most bays and estuaries of Newfoundland in depths of less than 90 meters in clean sand or gravel. Spawning occurs from mid-November to January.

Eels are abundant in most streams along the Avalon Peninsula, Trinity Bay and Bonavista Bay.

Waterfowl, including Canada geese, black ducks, common goldeneyes, scoters and mergansers, migrate through the region during spring (northward) and fall (southward). These birds are known to utilize brackish inlets and estuaries in most bays throughout the region for feeding and resting.

During November and December, large flocks of common eiders migrate from the north to overwinter in many coastal areas throughout eastern and southern Newfoundland. Depending on ice conditions, the northward movement of eiders begins in mid-March and lasts until early May.

Numerous shorebirds, including plovers, sandpipers, turnstones, and yellowlegs migrate through the region. These birds generally occupy brackish waters and mud flats at the head of bays and inlets.

A number of seabird colonies are located in coastal areas the largest of these are found at Cape St. Mary's and on the Witless Bay Islands. Seabirds are usually found at their breeding sites from March to October. Species present during the breeding season include black guillemots, dovekeys, razorbills, Atlantic puffins, common and thick billed murres, common and Arctic terns, black-legged kittiwakes double-crested cormorants, in addition to herring, black-backed, ring-billed, glaucous and Icelandic gulls. During spring, summer and winter, large pelagic concentrations also occur in Newfoundland coastal waters. The primary species found in these areas include murres, puffins, dovekeys, razorbills and kittiwakes.

In April and May, juvenile harp seals can be found in waters off eastern Newfoundland, when the pups drift on ice flows from southern Labrador. Northward migration takes place in late May and June.

Scattered populations of harbour seals are located throughout the region, the total Newfoundland population is estimated at 3,000 - 5,000 animals. Pupping occurs from mid-May to mid-June on islands or isolated beaches along the coast.

Grey seals are found in small scattered groups throughout southeastern Newfoundland. There are no known breeding areas in the region.

Many cetaceans are found in the nearshore zone. The most common species include white-sided dolphins, harbour porpoises, pilot whales, minke whales, humpback whales, sei whales and fin whales.

White-sided dolphins are found in coastal waters during summer when they move inshore to feed on capelin, herring, mackerel and squid.

Harbour porpoises are usually found in the region during summer months. This species is often accidentally captured in gillnets in coastal waters.

Pilot whales (pothead) are numerous in inshore Newfoundland waters during summer, feeding primarily on squid. An overwintering area for this species has been recorded in Trinity Bay.

When capelin are spawning, minke whales move to nearshore waters. During migration, these animals tend to segregate, with adult males usually keeping to the open sea while females and young are abundant in coastal waters.

Humpback whales are frequent visitors to coastal Newfoundland in summer when capelin and cod are plentiful. This species usually congregates in pods (groups) of 20-30 animals. About 1,000 humpback whales have been estimated to inhabit the north Atlantic region.

Sei whales occur in southern Newfoundland waters during August and September. This species is thought to migrate northward in spring and southward in autumn.

Fin whales are common in coastal Newfoundland during summer when the animals feed on capelin concentrations.

Other species which are found occasionally in this region include blue whales, killer whales, northern bottlenose and black right whales.

**ENVIRONMENTAL ATLAS
OF
SOUTHEASTERN NEWFOUNDLAND**

SECTION I

Southern Burin Peninsula

ENVIRONMENT CANADA

ENVIRONMENTAL PROTECTION SERVICE

ATLANTIC REGION

MARCH 1981

This environmental atlas of southeastern Newfoundland has been prepared by B. McGuire & Associates of Halifax, N.S. for the Marine Environment Branch of the Environmental Protection Service, Atlantic Region. The purpose of this atlas, similar to others in the series, is to supply a document which can be useful in planning for and responding to oil spills along the Atlantic Coast of Canada.

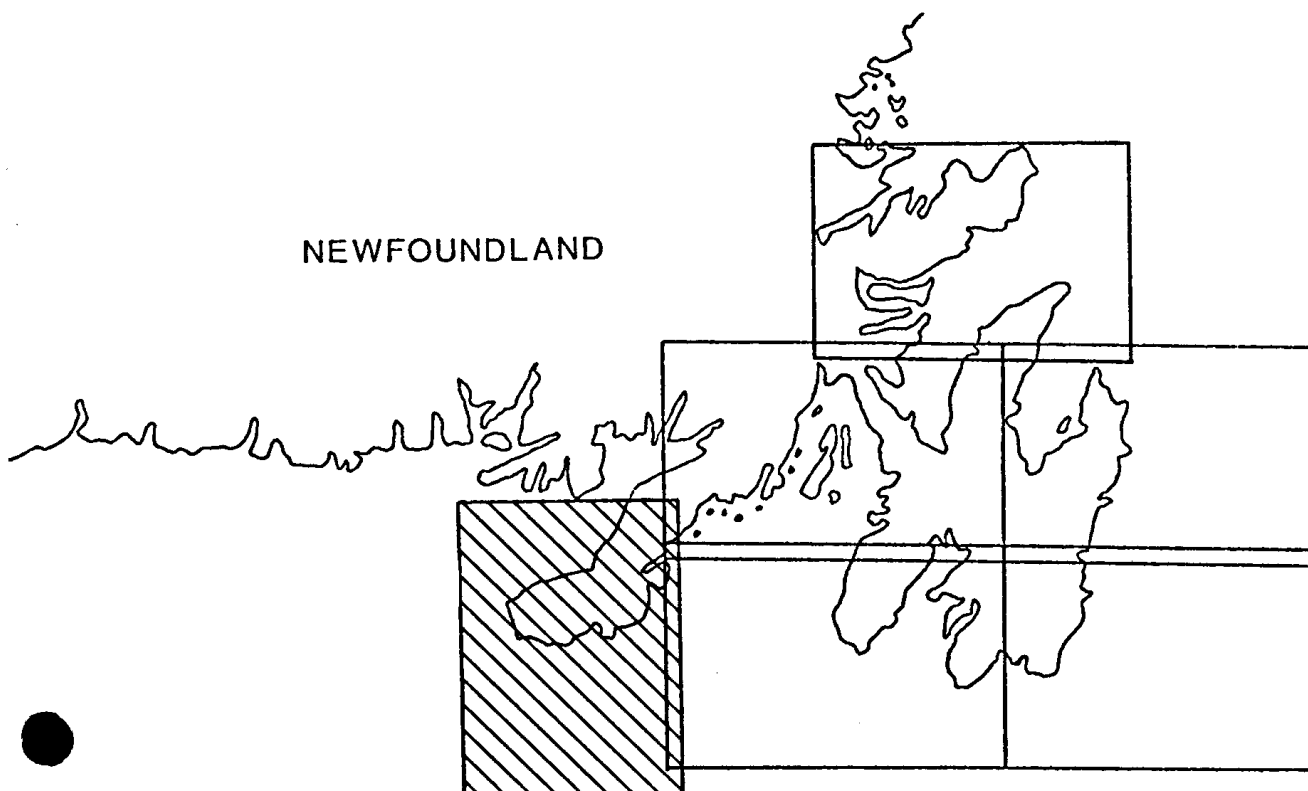
Both physical and biological environmental data have been compiled from literature and unpublished government sources. Where possible, areas considered vulnerable to oil spills have been emphasized.

This atlas also could be useful in the assessment of oil spill contingency plans, the development of operating conditions for offshore petroleum exploration and in the review of ocean dumping applications.

Southeastern Newfoundland has been subdivided into six sections:

- I. Southern Burin Peninsula
- II. Head of Fortune Bay, Placentia Bay (North), Trinity Bay (South)
- III. Southwestern Avalon Peninsula
- IV. Southeastern Avalon Peninsula
- V. Northeastern Avalon Peninsula
- VI. Trinity Bay (North) to Bonavista Bay (South)

These are shown by the sketch map below (the shaded portion indicates the area covered in this section).



Each section of the atlas contains two base maps, one depicting basic shoreline types and the other showing features such as lighthouses, airstrips, and bathymetric contours. A series of transparent acrylic overlays are used to describe biological and physical environmental parameters. In addition, a written section provides information on oil spill countermeasures and cleanup strategies.

The appendix contains monthly wind and visibility data, presented in a series of tables. Information is provided for the following coastal stations: Argentia, St. John's, and Bonavista. Tables listing tidal ranges and fish processing plants are also provided. A list of the references utilized has been included, however, personal communications and observations could not be cited.

The author expresses his appreciation for the cooperation provided by the following groups without whose assistance this report could not have been prepared: Atlantic Oceanographic Laboratory, Atmospheric Environment Service, Canadian Wildlife Service, Fisheries and Marine Service, Lands Directorate, Newfoundland Dept. of Fisheries, Parks Canada, Mobil Oil Ltd.

The scientific support of numerous Environment Canada personnel is also acknowledged. In particular, I would like to thank Mr. R.J. Percy, Mr. A. McIver, Mr. J. Swiss and Mr. J. Clark of E.P.S. as well as Mr. E. Hiscock and Mr. D. Taylor of the Lands Directorate for their help in the preparation of this report.

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Printing costs were funded by Mobil Oil Ltd.

KEY TO OVERLAYS:

A. MARINE MAMMALS

Immature Harp Seals (March to May).....	◇ ◇
Feeding Area For Whales (Summer).....	+ + +
Overwintering Area For Pilot Whales.....	x x x x x x

B. AVIFAUNA

Seabird Breeding Colony (May to September).....	*
Potential Migratory Waterfowl Stop-over Site (Spring & Fall).....	
Overwintering Habitat For Eiders.....	□ □ □ □ □ □ □ □ □
Large Pelagic Seabird Concentrations:	
Spring.....	~~SPG~~
Summer.....	~~SMR~~
Winter.....	~~WTR~~

C. FISHERIES

Major Commerical Species - Primary Fishing Areas:

NOTE - Lobsters are harvested in coastal waters throughout southeastern Newfoundland to depths of about 40 m.

Cod.....	C
Haddock.....	D
Red Fish.....	R
American Plaice.....	P
Herring.....	H
Mackerel.....	M
Turbot.....	T
Snow Crabs.....	└┐└┐

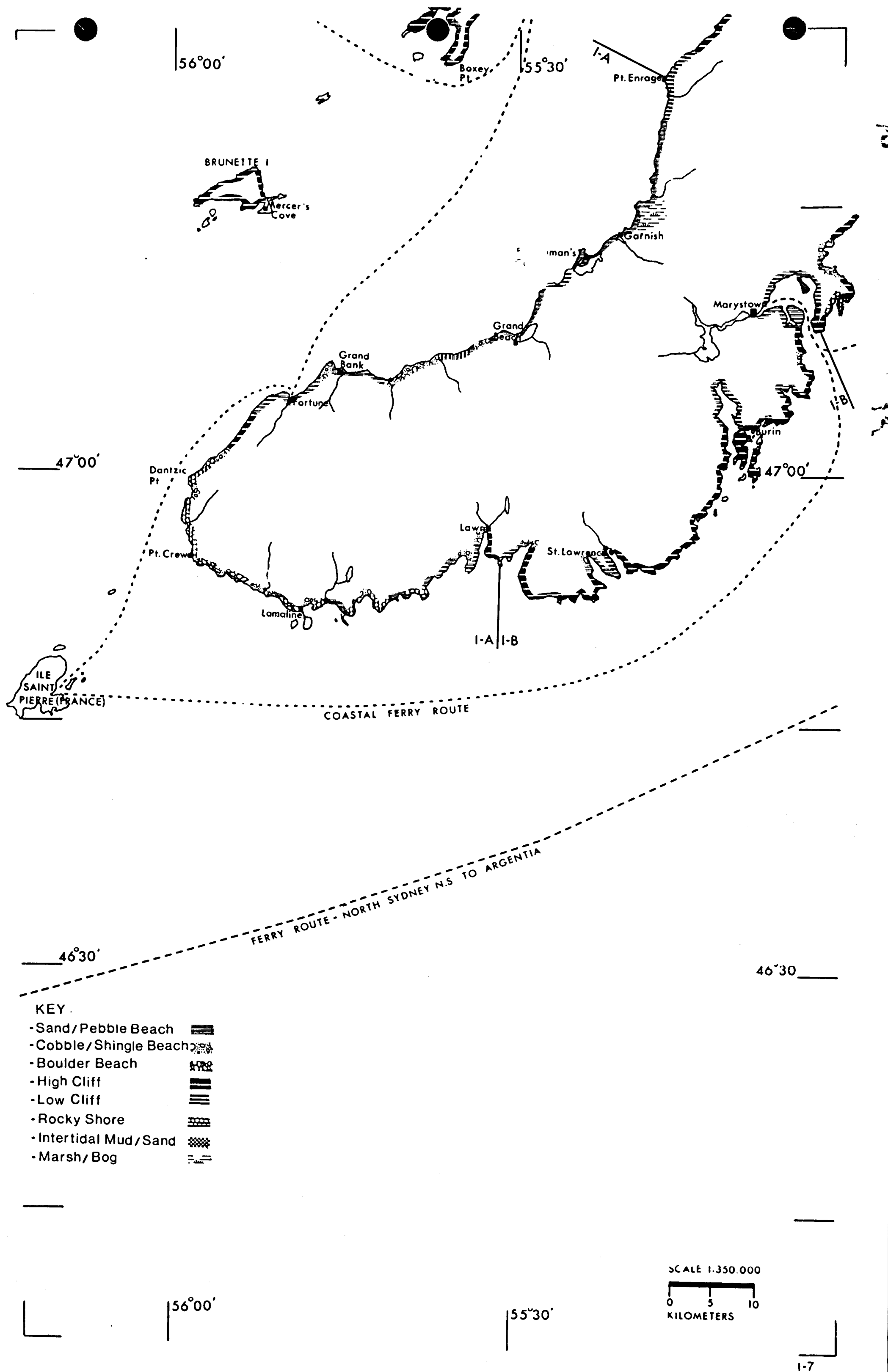
Generalized Migration Routes - Adults (Spring & Summer)	↖
for Atlantic Salmon - Smolts (Fall)	↗
Scallops (Intermittent Beds).....	○ ○ ○
Pink Shrimp (Summer).....	▲ ▲ ▲
Spiny Dogfish (Summer).....	✕ ✕
Squid (Summer) - variable.....	◆ ◆
Irish Moss Harvesting (Potential).....	■ ■
Capelin Spawning Concentrations (May-July).....	● ● ●
Overwintering Site For Capelin.....	● ● ●
Herring Spawning (Spring).....	□ □
American Plaice Spawning (Spring).....	▽ ▽ ▽
Salmon Spawning Stream (Summer).....	S
Eels.....	e
Smelts.....	m
Tuna - Sport Fishing (Summer).....	N
Fixed Fishing Gear (Trap or Net) - Primary Locations	†††
Fish Processing Plant.....	F
Trout Farming.....	▣

D. OCEANOGRAPHY

Residual Surface Currents..... (Indicates net movement of water only)	→
Sea Surface Temperature (°C):	
Spring.....	— ■ —
Summer.....	— — —
Fall.....	— ● —
Winter.....	— — —
Mean Concentration of Sea Ice (Winter):	
10/10.....	▣ ▣ ▣
> 5/10.....	▣ ▣

E. MISCELLANEOUS

International Biological Programme Site.....	☆
Dredging Disposal Sites.....	Ⓢ
Provincial Park.....	▲
Public Beach	★



56°00'

55°30'

BRUNETTE I

Mercer's Cove

Boxey Pt.

Pt. Enrage

Garnish

Marystown

Grand Beach

Grand Bank

Fortune

Dantzic Pt.

Pt. Crewe

Lamaline

Lawa

St. Lawrence

47°00'

ILE SAINT PIERRE (FRANCE)

COASTAL FERRY ROUTE

FERRY ROUTE - NORTH SYDNEY N.S. TO ARGENTIA

46°30'

46°30'

KEY

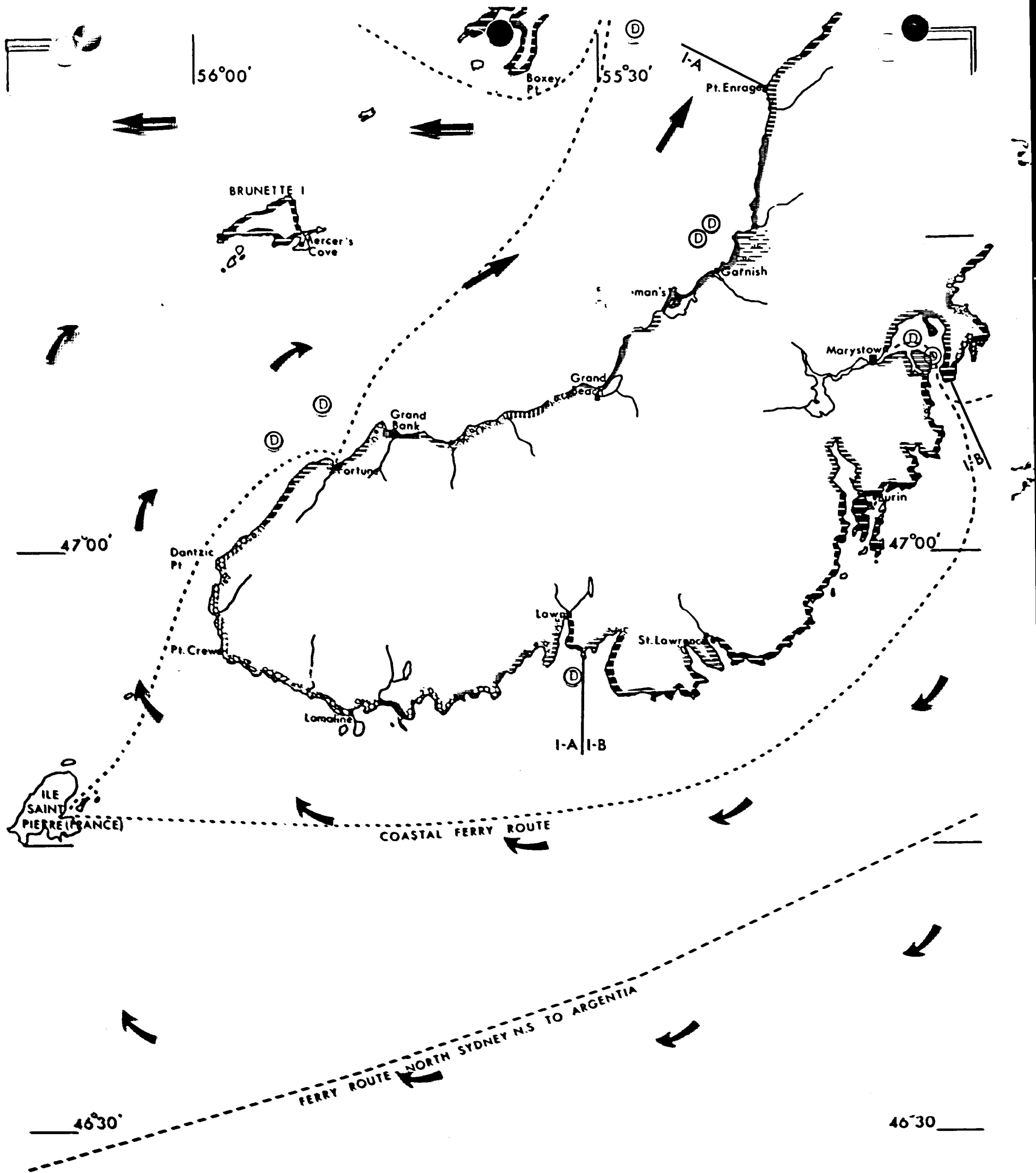
- Sand/Pebble Beach
- Cobble/Shingle Beach
- Boulder Beach
- High Cliff
- Low Cliff
- Rocky Shore
- Intertidal Mud/Sand
- Marsh/Bog

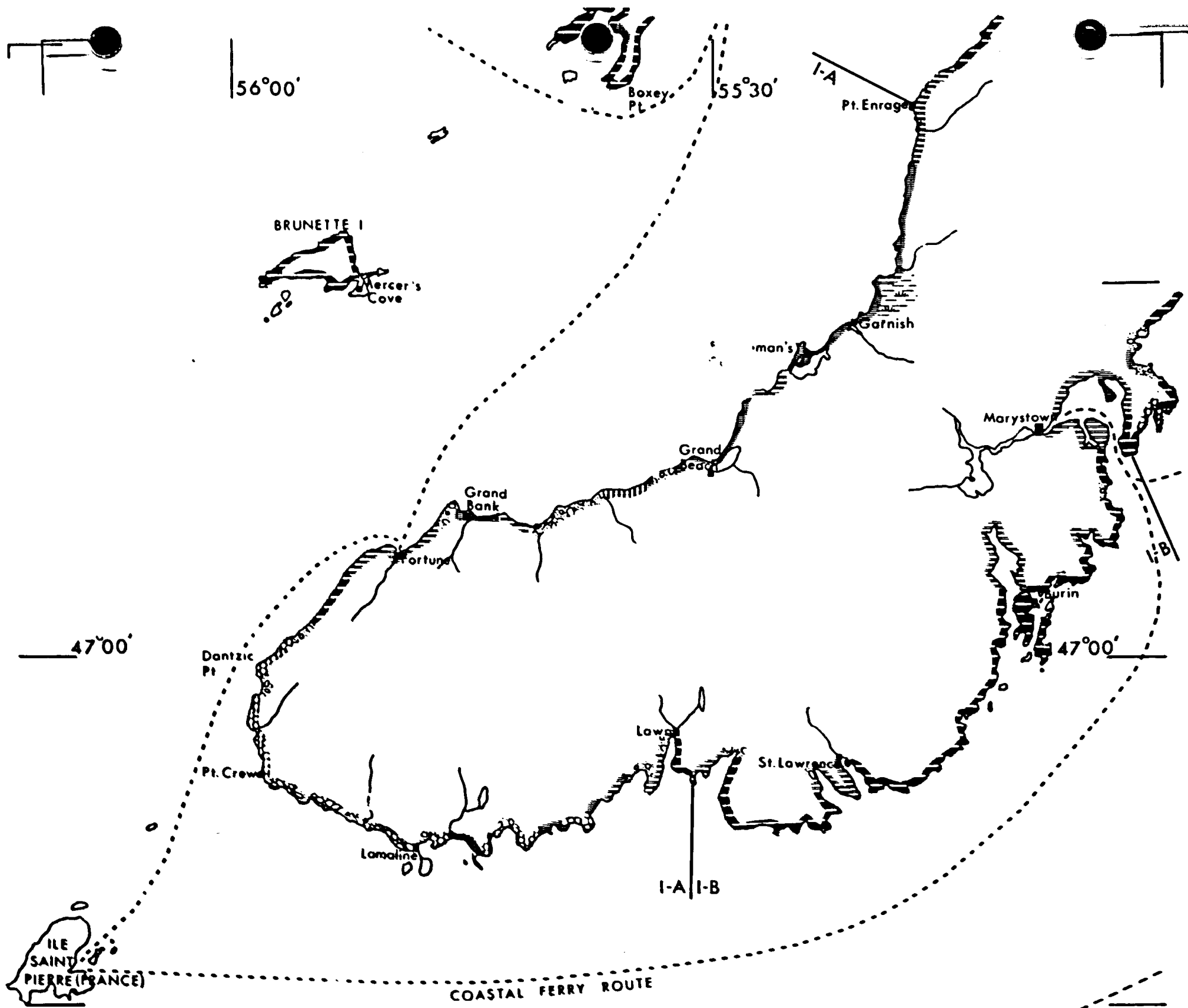
SCALE 1:350,000

0 5 10 KILOMETERS

56°00'

55°30'





KEY

- Sand/Pebble Beach
- Cobble/Shingle Beach
- Boulder Beach
- High Cliff
- Low Cliff
- Rocky Shore
- Intertidal Mud/Sand
- Marsh/Bog

SCALE 1:35000
0 5 10
KILOMETERS

56°00'

47°00'

46°30'

56°00'

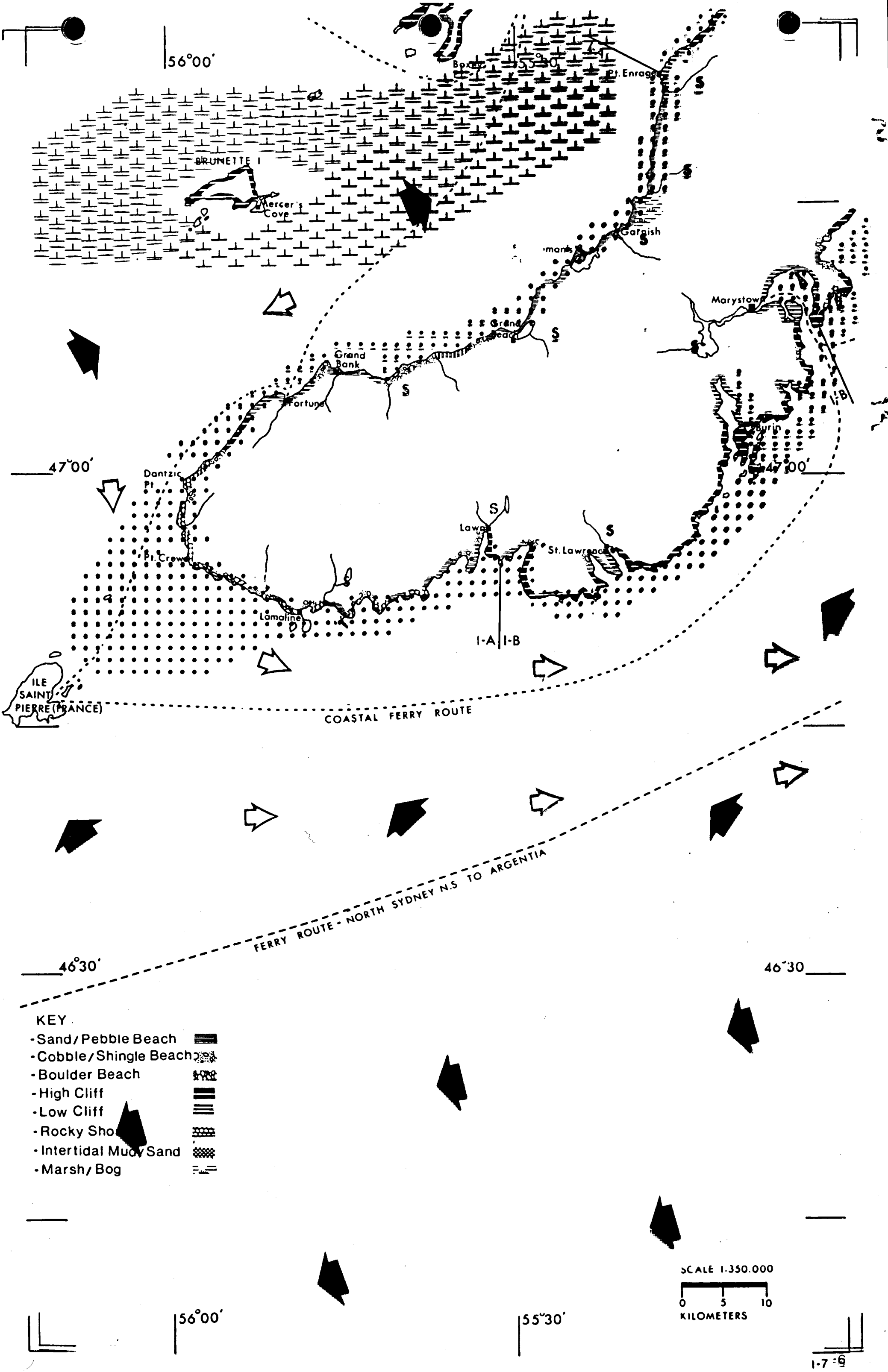
55°30'

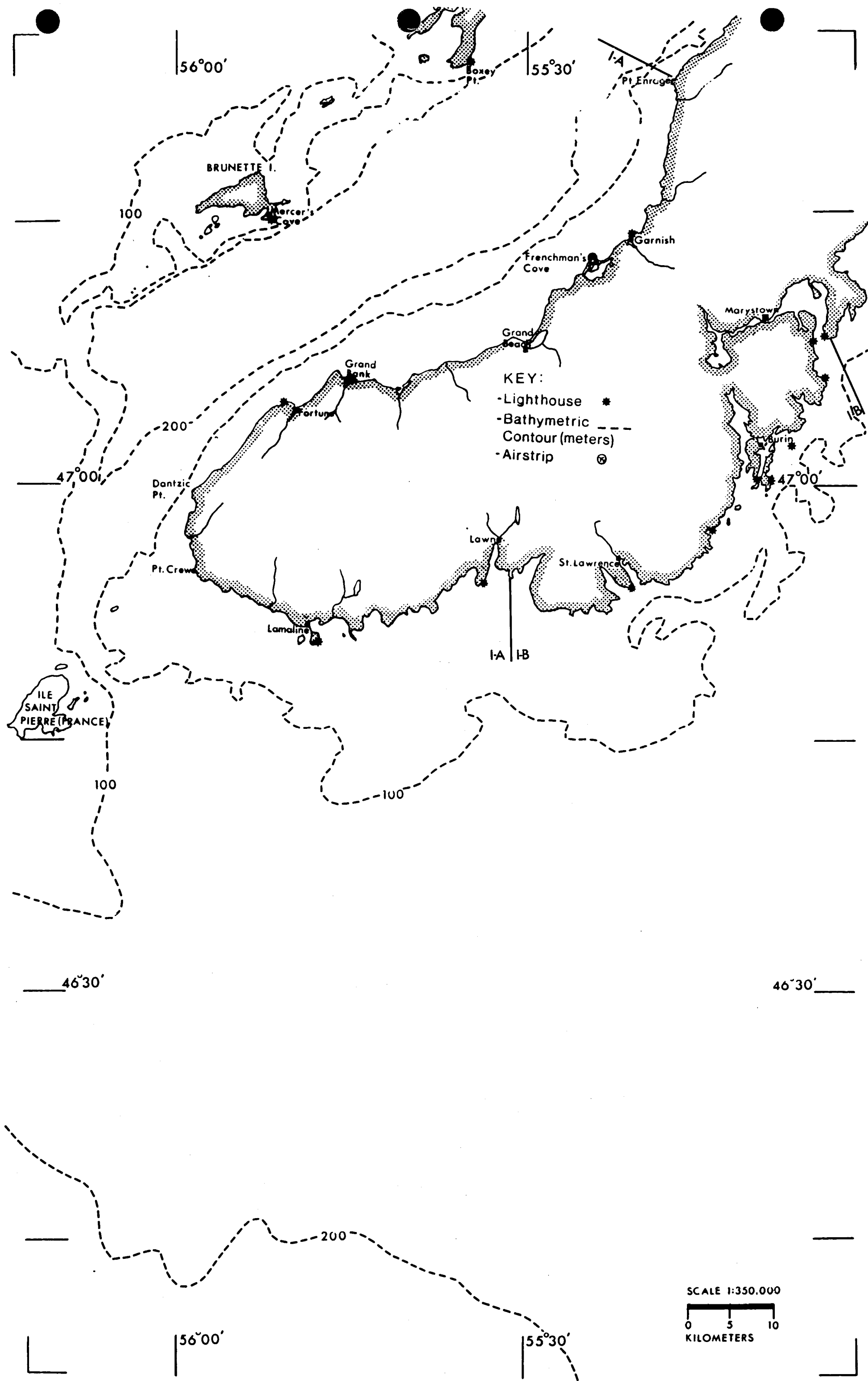
46°30'

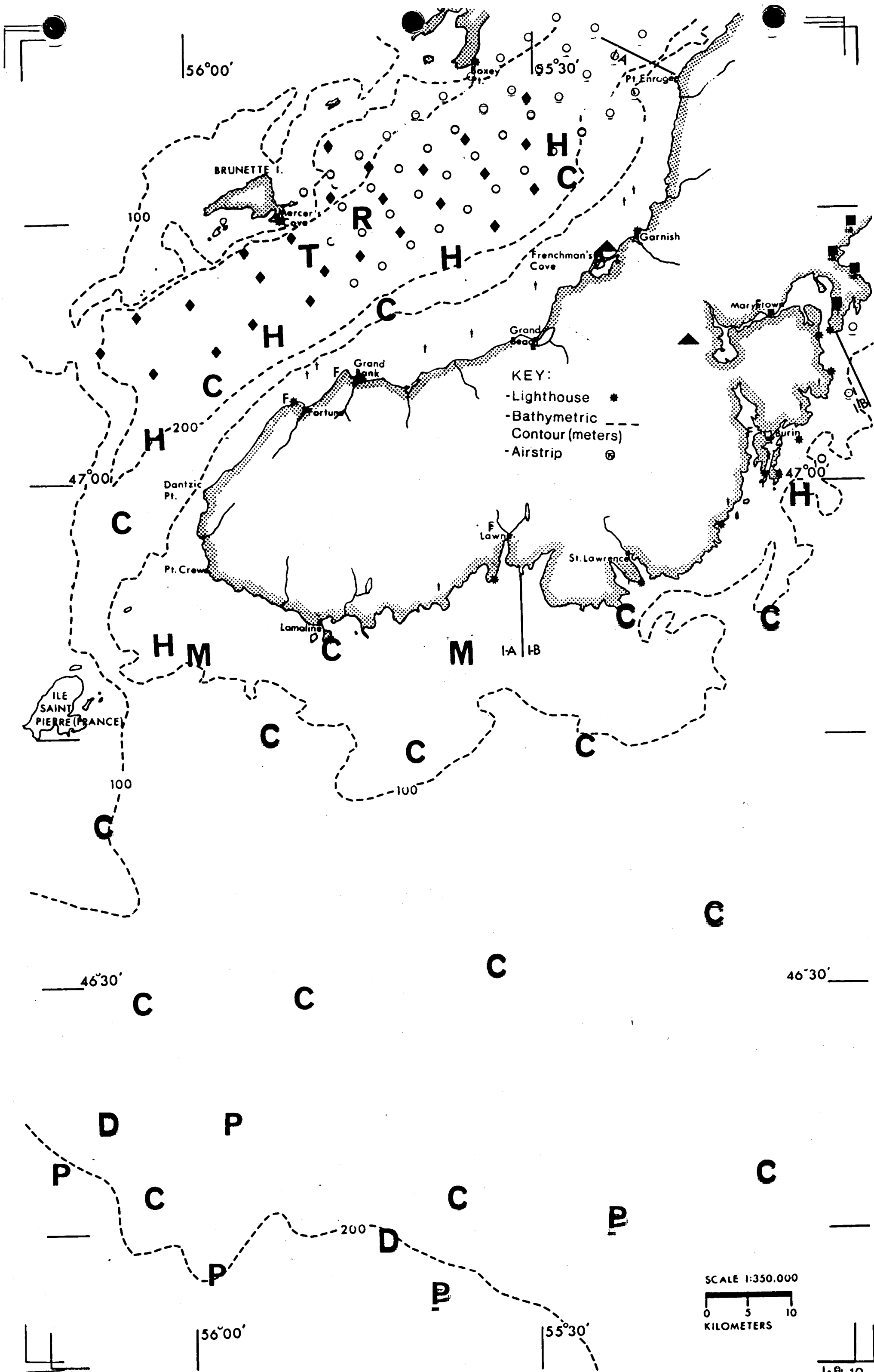
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KILOMETERS

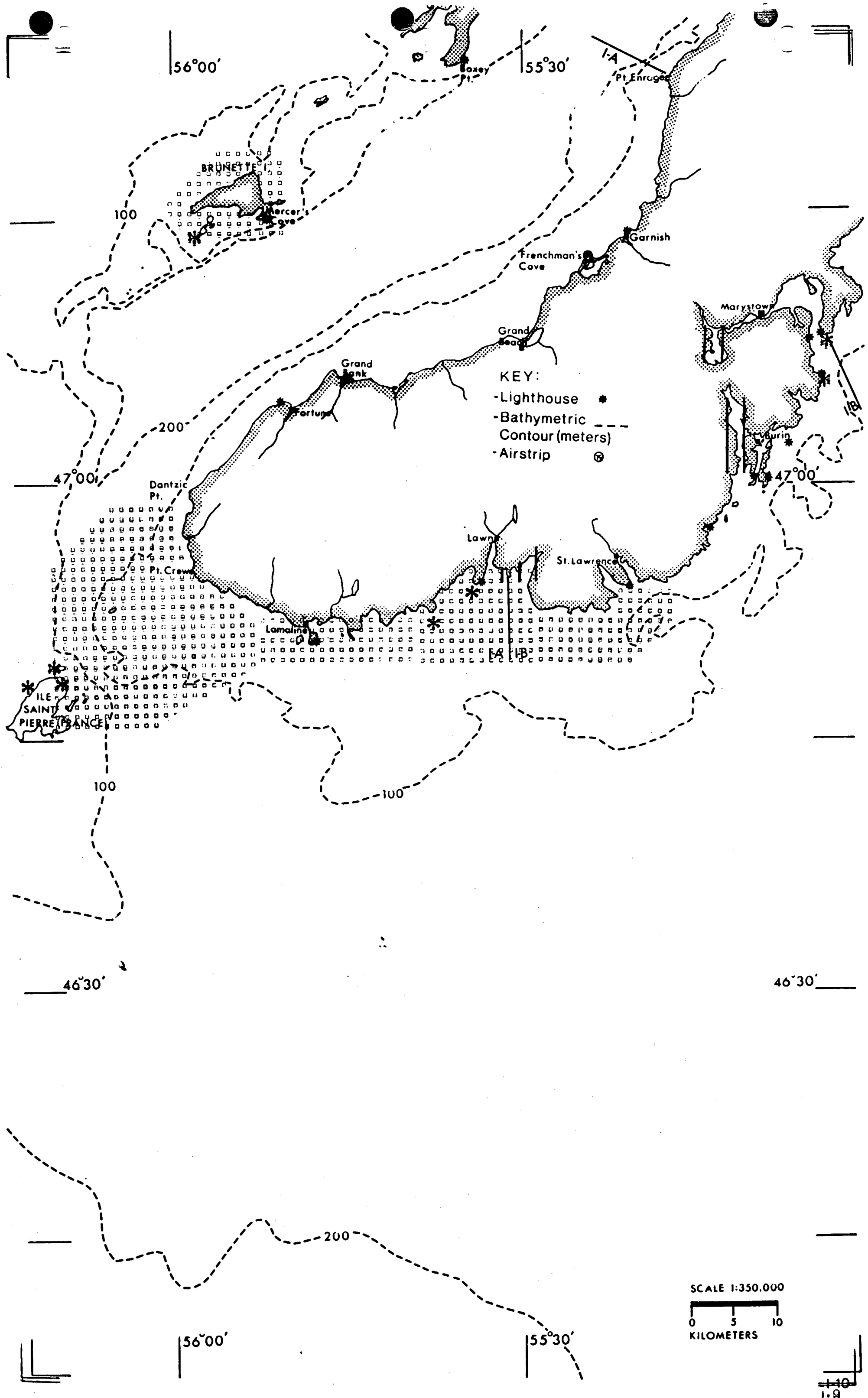
KEY

- Sand/Pebble Beach
- Cobble/Shingle Beach
- Boulder Beach
- High Cliff
- Low Cliff
- Rocky Sho
- Intertidal Mud/Sand
- Marsh/Bog









The nearest major airport is at St. John's, a distance of 300 kilometers.

Distances Between Potential Cleanup Sites and Major Resource Centers

	Marystown		Distances (kilometers)		St. John's	
	BY LAND	BY SEA	Argenticia	BY L.	BY S.	BY L.
Garnish	26	195	292	300	332	540
Frenchman's Cove	29	193	295	298	335	538
Grand Beach	37	185	303	290	343	530
Little Barasway	43	181	309	286	349	526
Lanse au Loup	48	175	314	280	355	520
Fortune	58	165	324	270	365	510
Lamaline	76	100	342	175	382	385
Taylor's Bay	66	90	332	165	372	375
Lord's Cove	61	85	327	160	367	370
Lawn	49	70	315	150	355	360

Topographic Maps: (1:50,000) - L/13, 1M/3, 1M/4, 1M/6

Hydrographic Charts: 4016 (1:350,000), 4611 (1:25,000), 4525 (1:75,000), 4642 (1:15,000), 4626 (1:75,000)

Aerial Photographs: (1:50,000)-A19828-L11, A19828-L10, A19830-L9, A19830-L8, A19831-L7, A19831-L6, A19831-L5

SECTION 1 (B) Little Lawn Harbour to Mortier Bay

Description: This region is dominated by an upland plateau with numerous steep cliffs and fjord embayments sand/cobble or cobble/shingle beaches are common at the head of most bays and inlets. Wave energy is moderate in the coastal zone. During winter, local bays and inlets are normally frozen. Scattered sea ice has been observed occasionally in coastal waters. Total length of the shoreline is 195 kilometers. Bedrock Geology - Siltstone, arkose, volcanics Substrate - Rock, sand, gravel.

Width of Major Bays/Inlets - at narrowest point (meters)

Great St. Lawrence Harbour	1200
Little St. Lawrence Harbour	750
Corbin Harbour	200
Burin Inlet	300
Little Mortier Bay	800
Little Bay	150
The Narrows (Marystown)	150
Mortier Bay (Entrance)	950

Accessibility:

BY LAND: The main highway (#220) provides limited access to the coast at the following locations: Great St. Lawrence Harbour, Little St. Lawrence Harbour, and the west side of Burin Inlet between Salmonier and Salt Pond. South of St. Lawrence, there are several secondary roads leading to various small coves. Near Salmonier, highway #110 connects the coastal communities of Epworth, Wandsworth

SECTION I (A) Point Enragee (Fortune Bay) to Little Lawn Harbour.

Description: This region consists of a low coastal plain characterized by numerous cobble/pebble barrier beaches, tidal estuaries and barachois. A number of boulder beaches are found along the southern coast of the Burin Peninsula. Wave energy varies from high to moderately high. The coastal zone seldom freezes in winter. Total length of shore is 152 kilometers. Bedrock Geology- Volcanics, slate, siltstone, quartzite, conglomerate, Substrate - Boulder, pebbles, gravel, sand, some rock.

Width of Major Bays/Inlets - at narrowest point (meters)

Grand Bank Harbour	30
Little Garnish Barasway	20
Great Garnish Barasway	5
Grand Beach Barasway	10
Little Barasway	10
Lanse au Loup Barasway	20
Fortune Harbour	50
Point May Pond	100
Lord's Cove	600
Great Lawn Harbour	500

Accessibility:

BY LAND: The shoreline from Point Enragee to Garnish is not accessible by road (16 kilometers). From Garnish to Fortune the coastal zone can be accessed from a paved highway (#210) which runs parallel to the shore. From Fortune to Lories the main highway (#220) proceeds eastward about 2 kilometers from the coast. East of Loris, the road parallels the shoreline as far as Lawn. The coastline is inaccessible from Fortune Head to Beach Point, (12 kilometers). South of Beach Point, there are several cart tracks which permit access to the coast.

BY SEA: Most of the coastal zone can be accessed by boat. Caution must be taken between Garnish and Point Enragee due to many rocks and shoals dangerous to navigation. Suitable small boat harbours are located at:

Depth (meters)

Garnish	2-4
Grand Bank*	5-18
Frenchman's Cove	7-9
Fortune*	6-10
Allan's Island*	4-5
Taylor's Bay	11-15
Lord's Cove	6
Great Lawn Harbour*	6-15
Little Lawn Harbour	9-26

* - Government Wharf

BY AIR: There is a small air strip located at Frenchman's Cove.

and Corbin. Highway #220 joins the towns of Marystown and Burin. Near Burin, secondary roads link a number of small coastal villages. East of Marystown, a gravel road leads to Little Bay and Beau Bois.

The remainder of the coastal zone is not accessible by road - a distance totalling 138 kilometers.

BY SEA: Most of the coastline can be accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
St. Lawrence*	5-36
Little St. Lawrence	20-27
Corbin Harbour	4-16
Ship Cove*	4-24
Little Burin Harbour	15-17
Port au Bras	4-5
Fox Cove	18
Beau Bois Cove	4
Spanish Room	11-12
Little Bay*	15
Lower Mooring Cove	5-10
Marystown	6-10

* - Government Wharf

Numerous off-lying shoals are found between Corbin Harbour and Burin. There is a Canadian Coast Guard life boat station located at Ship Cove.

BY AIR: The nearest airport is located at St. John's (a distance of 250 kilometers).

Distance Between Potential Cleanup Sites and Major Resource Centers

	(kilometers)					
	Marystown		Argentia		St. John's	
	BY LAND	BY SEA	BY L.	BY S.	BY L.	BY S.
St. Lawrence	35	55	301	135	341	330
Little St. Lawrence	31	50	297	130	337	325
Corbin Harbour	28	40	294	120	334	320
Burin Inlet	16	35	282	115	322	315
Fox Cove	22	20	288	105	328	325
Marystown (Mortier Bay)	-	-	266	100	306	330

Topographic Maps: (1:50,000) - 1L/13, 1L/14, 1M/3

Hydrographic charts: 4016 (1:350,000), 4587 (1:12,000), 4616 (1:20,000), 4624 (1:80,000), 4625 (1:75,000), 4642 (1:15,000).

Aerial Photographs: (1:50,000) - A19831-L4, A19831-L5, A19830-L8

SECTION I - OILSPILL COUNTERMEASURES

Offshore protection should be considered as the first approach to prevent oil from reaching sensitive areas, i.e. estuaries and barachois. Where possible, diversion booms could be used to deflect oil away from these areas to designated collection sites. The use of dispersants in the coastal zone is not recommended.

Onshore protection methods which are feasible on the coastline include:

- a) ditch/dyke systems may be used to protect high priority areas such as estuaries and lagoons.
- b) artificial berms could be constructed on barrier beaches where oil might be worked into backshore areas.
- c) shoreline booms may be employed to seal inlets where currents are less than 0.5 M/sec. Where currents are greater than 0.5M/sec, inlets could be sealed by using heavy machinery, providing the areas are accessible.
- d) sorbents may be useful when used in conjunction with a ditch/dyke system on coarse sediment beaches.

Cleanup Methods: The most suitable methods for the various shoreline types are listed below:

<u>Shoreline Type</u>	<u>Recommended Cleanup Method(s)</u>
a) Sand/pebble beaches (accessible by land)	For large spills, mechanical equipment (motorized graders and elevating scrapers) have proven to be successful in removing oil. For small spills, manual removal is recommended.
b) Cobble/boulder beaches (accessible by land)	Small spills within access of settlements may be cleaned manually. For large spills, mechanical removal may be feasible; however, the removal material should be replaced with sediment from the backshore area. Mechanical equipment may be used to mix oiled sediments and accelerate the natural cleaning process. Sump collection and pump removal have proven to be effective in beach areas where oil is washed ashore over a period of several days.
c) Backshore areas	Low pressure hoses may be employed to flush oil to designated collection sites.
d) Inaccessible beaches	No action is recommended.

e) Rocky cliffs

No action is recommended unless a biologically sensitive site is threatened (i.e. bird colony). Then low pressure flushing may be feasible for collection in adjacent areas.

f) Estuaries/Barachois

No cleanup method is considered very effective without causing some environmental damage. If cleanup is necessary, manual removal, sorbents, or low pressure flushing may be employed.

ENVIRONMENTAL ATLAS
OF
SOUTHEASTERN NEWFOUNDLAND

SECTION II

**Head of Fortune Bay ,
Placentia Bay (North) ,
Trinity Bay (South)**

ENVIRONMENT CANADA

ENVIRONMENTAL PROTECTION SERVICE

ATLANTIC REGION

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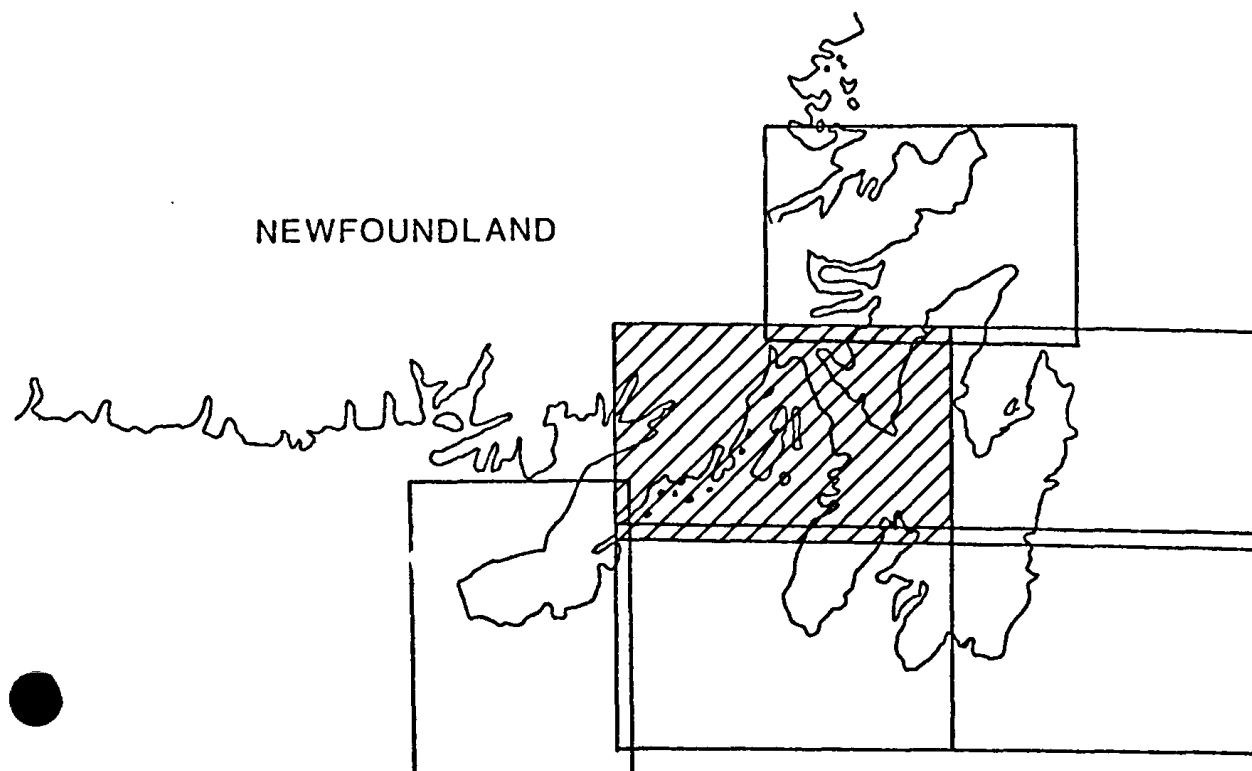
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The appendix contains monthly wind and visibility data, presented in a series of tables. Information is provided for the following coastal stations: Argentia, St. John's, and Bonavista. Tables listing tidal ranges and fish processing plants are also provided. A list of the references utilized has been included, however, personal communications and observations could not be cited.

The author expresses his appreciation for the cooperation provided by the following groups without whose assistance this report could not have been prepared: Atlantic Oceanographic Laboratory, Atmospheric Environment Service, Canadian Wildlife Service, Fisheries and Marine Service, Lands Directorate, Newfoundland Dept. of Fisheries, Parks Canada, Mobil Oil Ltd.

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KEY TO OVERLAYS:

A. MARINE MAMMALS

Immature Harp Seals (March to May).....	◇ ◇
Feeding Area For Whales (Summer).....	+ + +
Overwintering Area For Pilot Whales.....	x x x x x x

B. AVIFAUNA

Seabird Breeding Colony (May to September).....	*
Potential Migratory Waterfowl Stop-over Site (Spring & Fall).....	
Overwintering Habitat For Eiders.....	□ □ □ □ □ □
Large Pelagic Seabird Concentrations:	
Spring.....	SPG
Summer.....	SMR
Winter.....	WTR

C. FISHERIES

Major Commerical Species - Primary Fishing Areas:

NOTE - Lobsters are harvested in coastal waters throughout southeastern Newfoundland to depths of about 40 m.

Cod.....	C
Haddock.....	D
Red Fish.....	R
American Plaice.....	P
Herring.....	H
Mackerel.....	M
Turbot.....	T
Snow Crabs.....	⊥ ⊥

Generalized Migration Routes - Adults (Spring & Summer)	◀
for Atlantic Salmon - Smolts (Fall)	▶

Scallops (Intermittent Beds).....	○ ○ ○
Pink Shrimp (Summer).....	▲ ▲ ▲
Spiny Dogfish (Summer).....	✕ ✕
Squid (Summer) - variable.....	◆ ◆
Irish Moss Harvesting (Potential).....	■ ■
Capelin Spawning Concentrations (May-July).....	● ● ●
Overwintering Site For Capelin.....	● ●
Herring Spawning (Spring).....	□ □
American Plaice Spawning (Spring).....	▽ ▽ ▽
Salmon Spawning Stream (Summer).....	S
Eels.....	e
Smelts.....	m
Tuna - Sport Fishing (Summer).....	N
Fixed Fishing Gear (Trap or Net) - Primary Locations	†††
Fish Processing Plant.....	F
Trout Farming.....	▢

D. OCEANOGRAPHY

Residual Surface Currents.....	→
(Indicates net movement of water only)	

Sea Surface Temperature (°C):

Spring.....	— ■ —
Summer.....	— — —
Fall.....	— ● —
Winter.....	— — —

Mean Concentration of Sea Ice (Winter):

10/10.....	▢
> 5/10.....	▢

E. MISCELLANEOUS

International Biological Programme Site.....	☆
Dredging Disposal Sites.....	⊙
Provincial Park.....	▲
Public Beach	★

55°00'

KEY:

- Sand / Pebble Beach
- Cobble / Shingle Beach
- Boulder Beach
- High Cliff
- Low Cliff
- Rocky Shore
- Intertidal Mud / Sand
- Marsh / Bog

54°00'

TRINITY BAY

FORTUNE BAY

47°30'

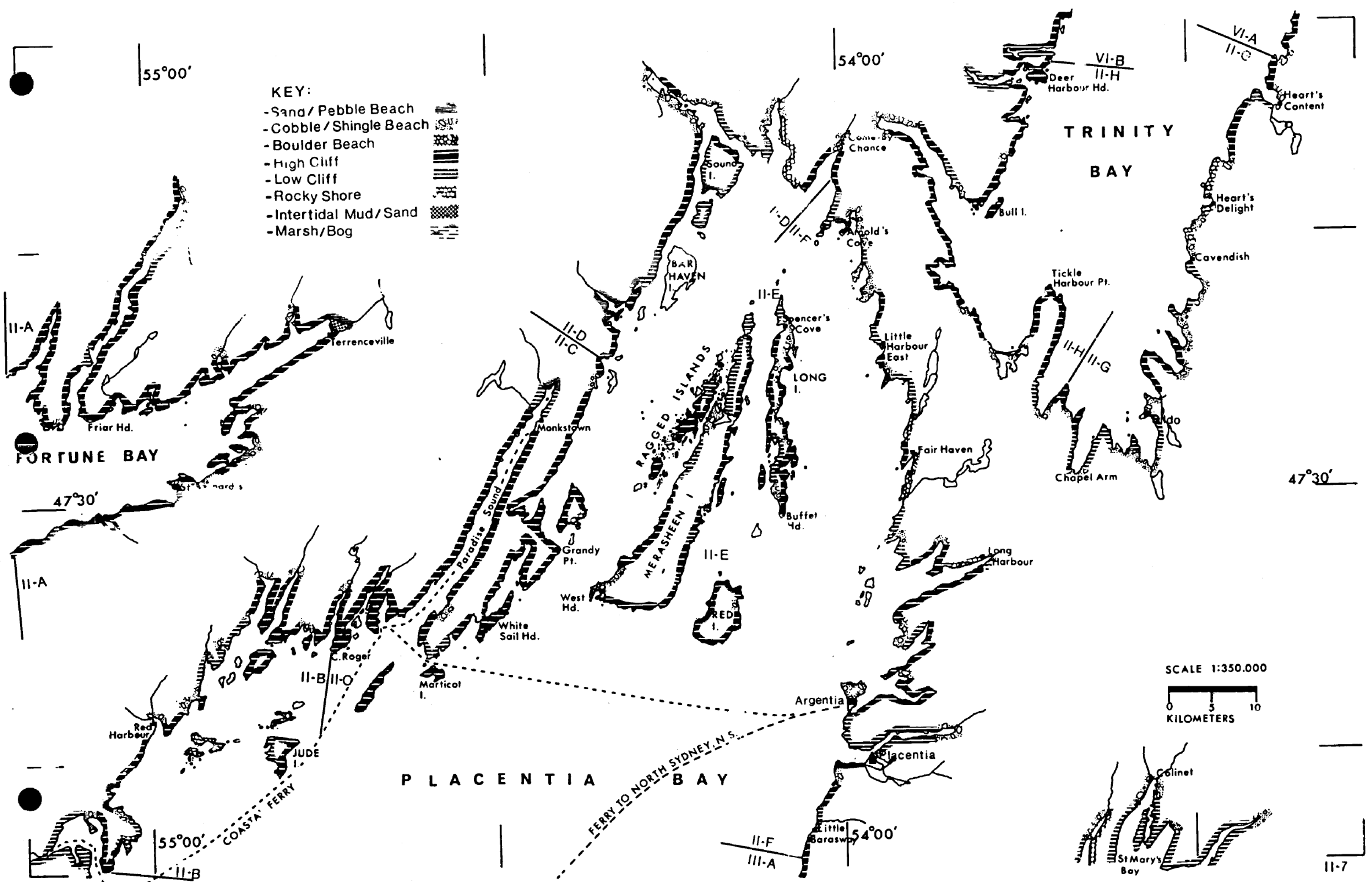
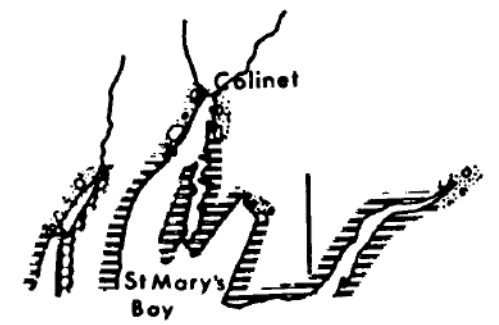
47°30'

SCALE 1:350,000



PLACENTIA BAY

FERRY TO NORTH SYDNEY N.S.



55°00'

KEY:

- Sand / Pebble Beach
- Cobble / Shingle Beach
- Boulder Beach
- High Cliff
- Low Cliff
- Rocky Shore
- Intertidal Mud / Sand
- Marsh / Bog

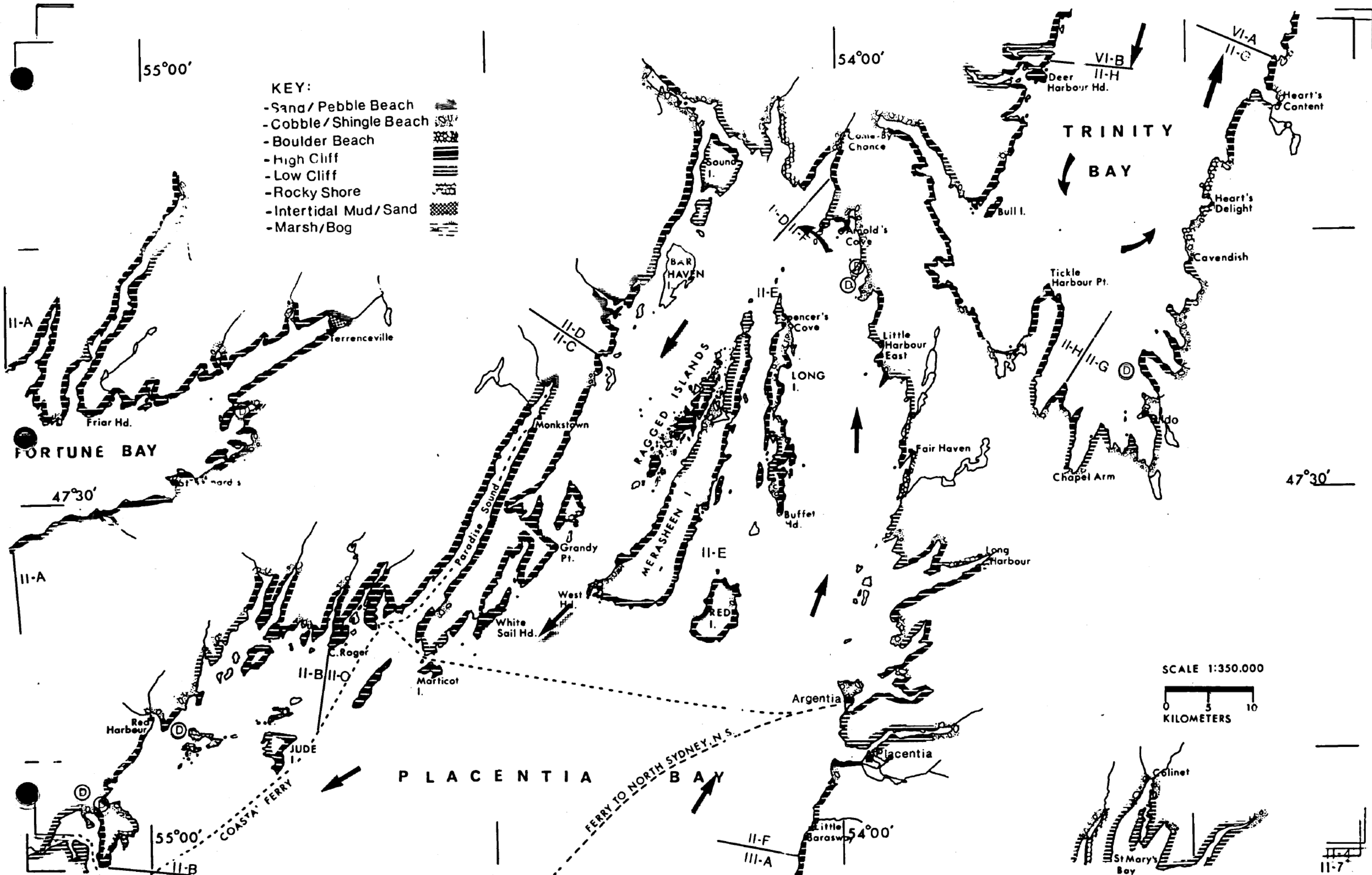


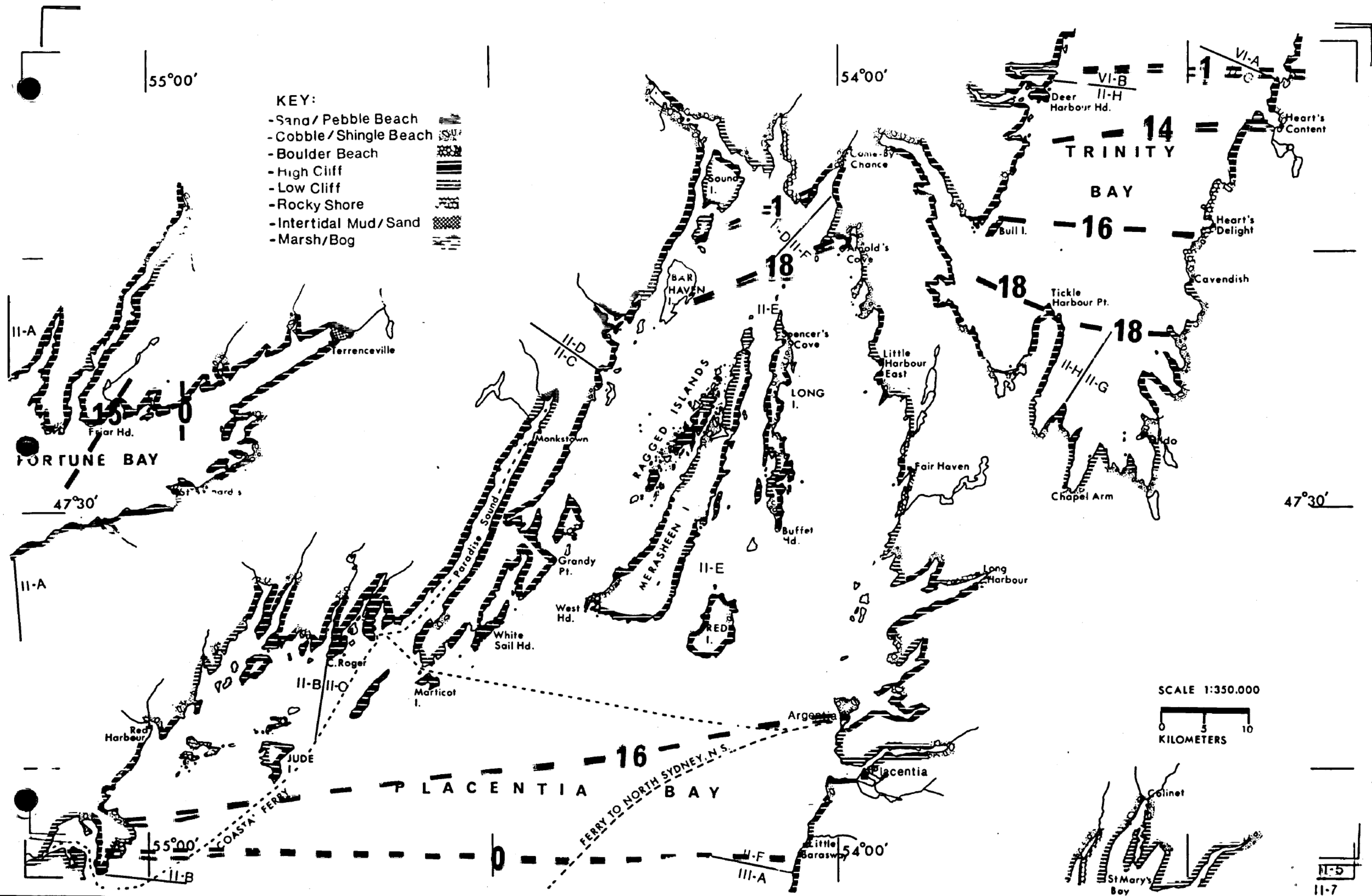
54°00'

TRINITY BAY

47°30'

SCALE 1:350,000





55°00'

KEY:

- Sand / Pebble Beach
- Cobble / Shingle Beach
- Boulder Beach
- High Cliff
- Low Cliff
- Rocky Shore
- Intertidal Mud / Sand
- Marsh / Bog

54°00'

VI-A
II-C

TRINITY
BAY

II-A

FORTUNE BAY

47°30'

II-A

II-B
II-O

II-D
II-C

II-E

II-H
II-G

47°30'

SCALE 1:350,000

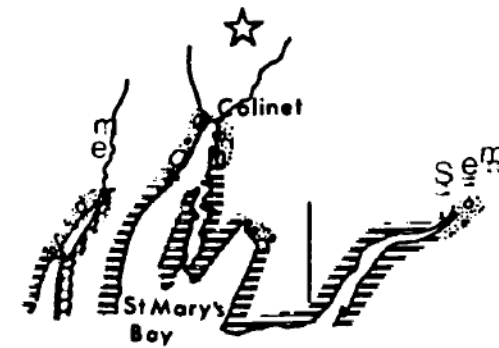
0 5 10
KILOMETERS

PLACENTIA BAY

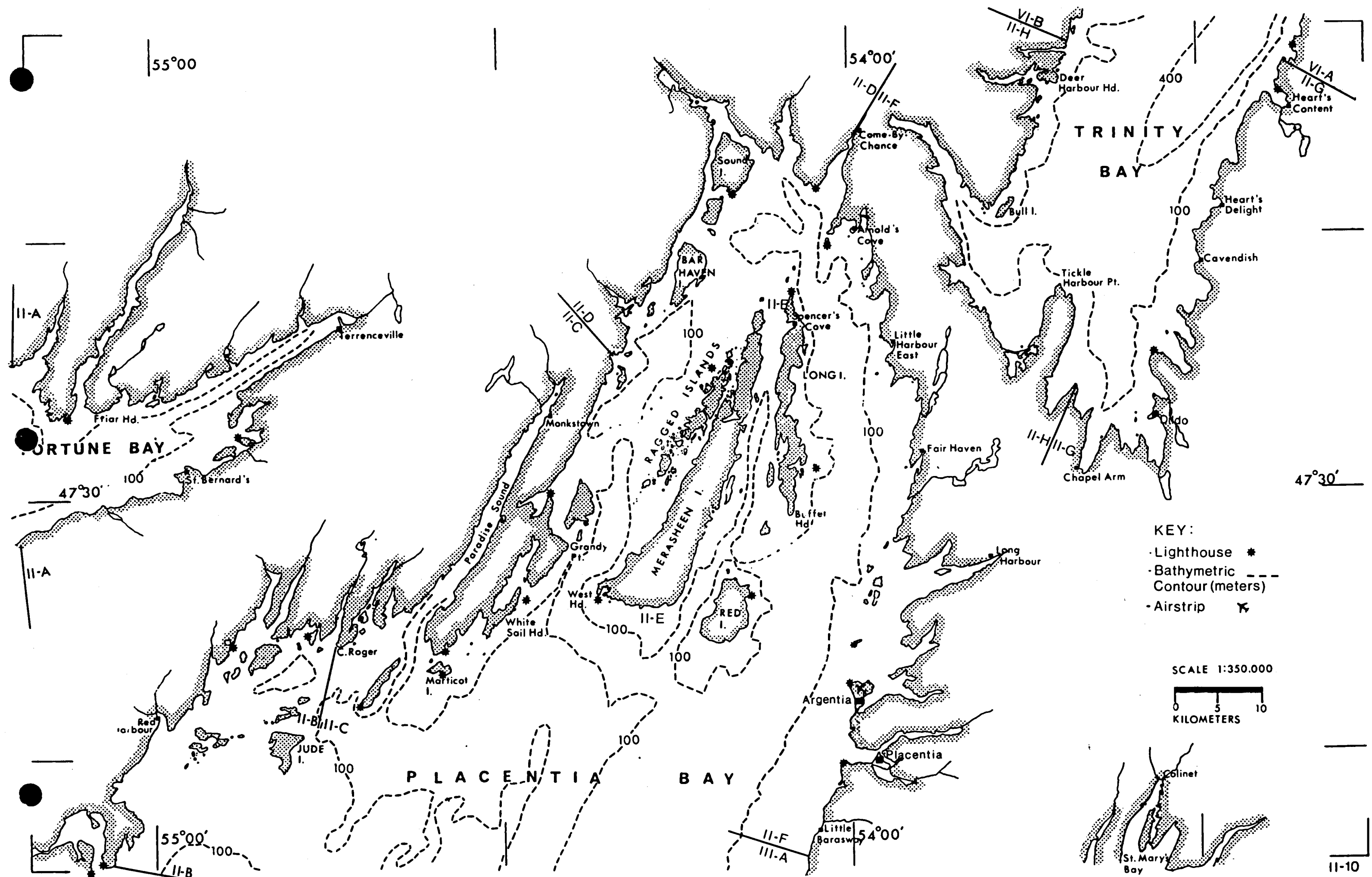
FERRY TO NORTH SYDNEY, N.S.

II-F
III-A

54°00'



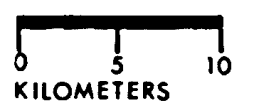
II-6
II-7

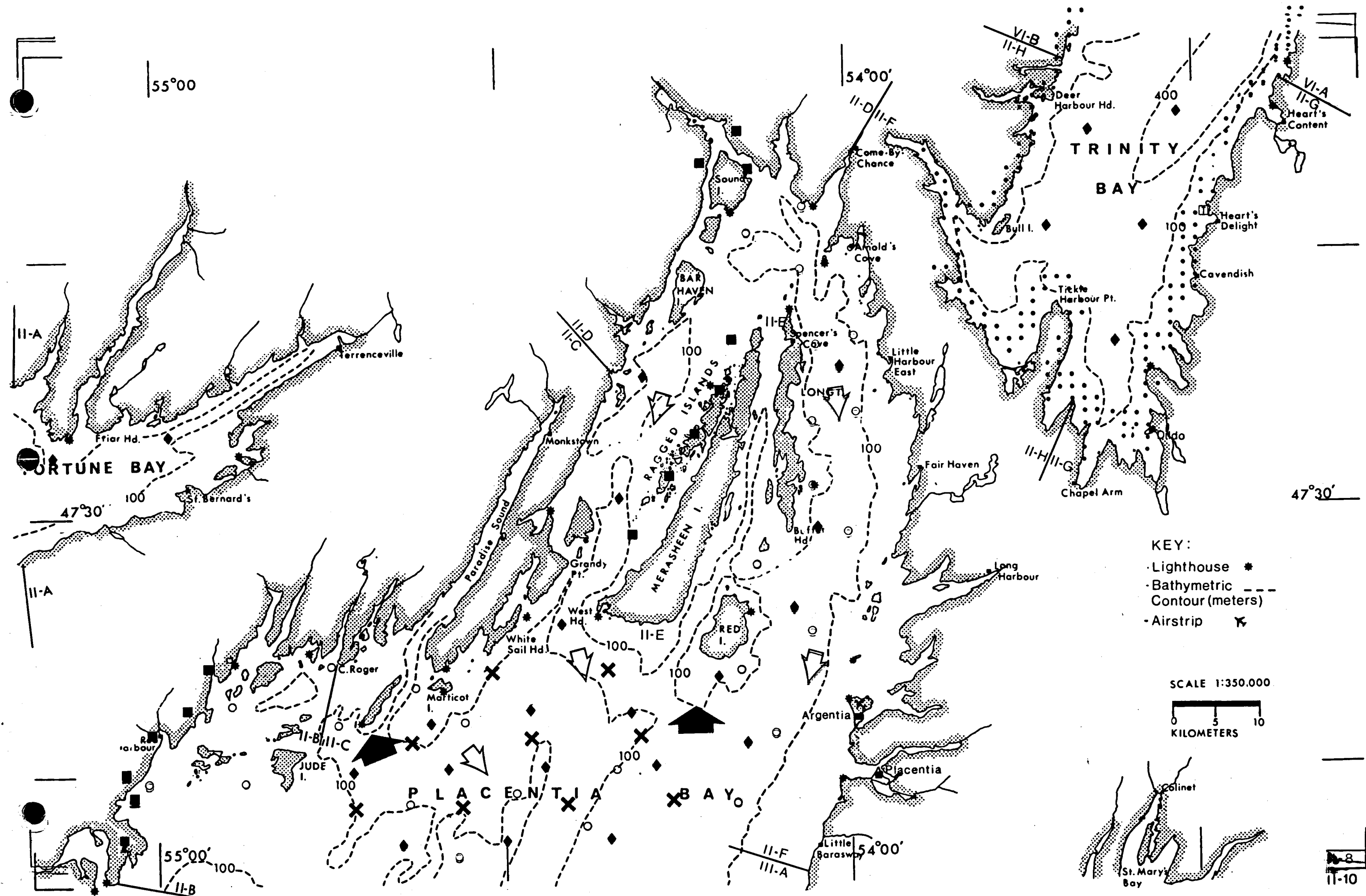


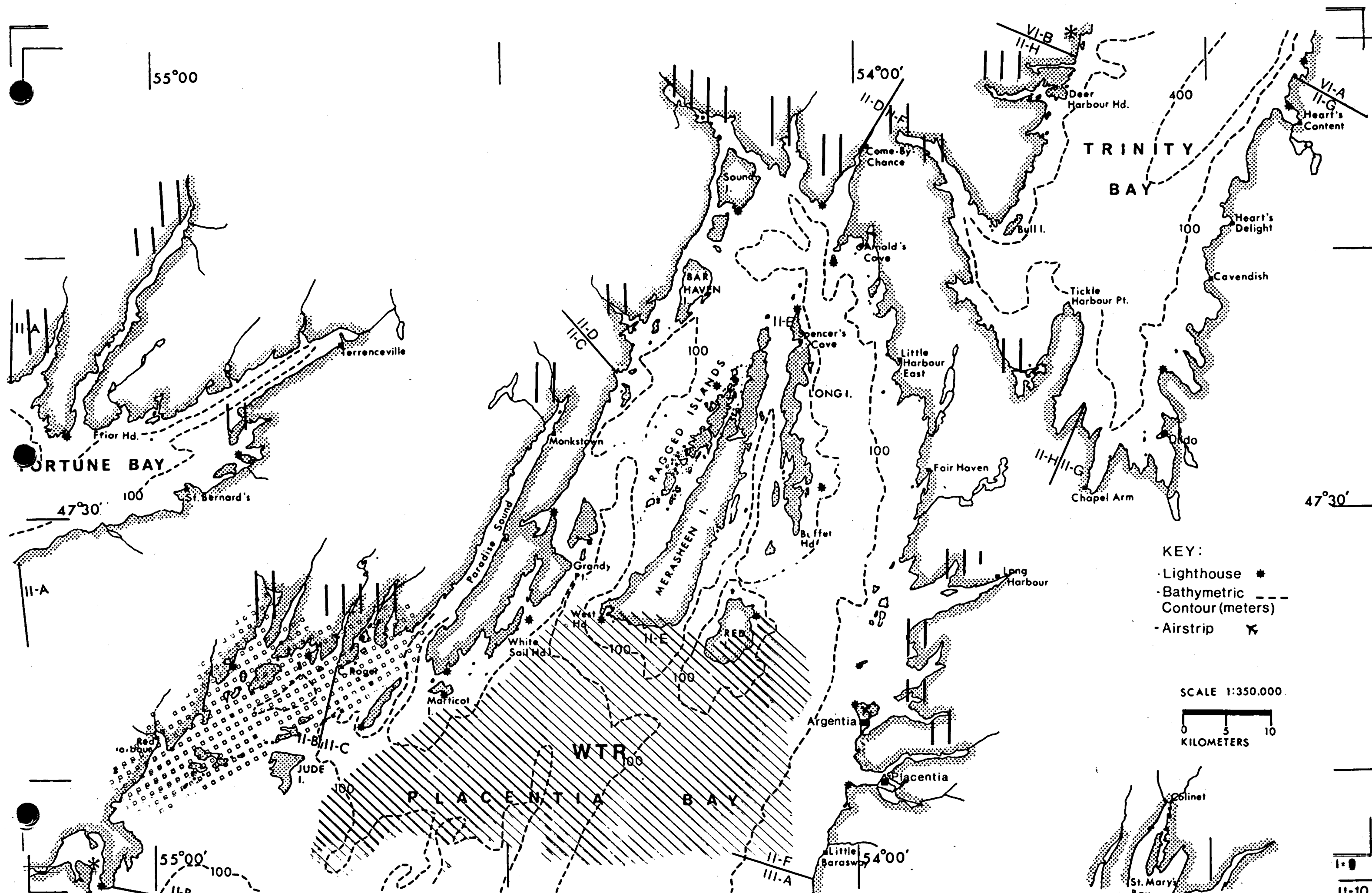
KEY:

- Lighthouse *
- Bathymetric --- Contour (meters)
- Airstrip ✕

SCALE 1:350,000

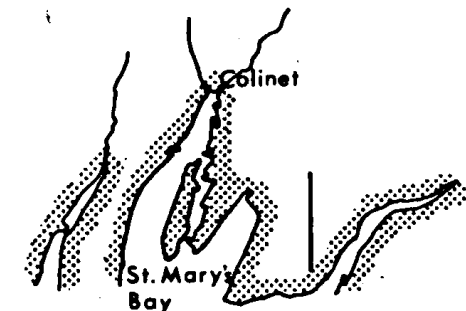






KEY:
· Lighthouse *
· Bathymetric ---
Contour (meters)
- Airstrip ✈

SCALE 1:350,000
0 5 10
KILOMETERS



SECTION II (A) Mal Bay to Point Enragee (Fortune Bay)

Description: This region is an upland plateau containing fjord embayments and numerous rocky sea cliffs.

Most bays and inlets contain pebble/cobble or sand/pebble beaches. Intertidal sand/mud flats are found at the head of Fortune Bay. Wave energy on this coastline varies from low (Terrenceville) to moderate (Mal Bay), to high (St. Bernard's). The coastal zone seldom freezes in winter, except for small bays and inlets. Total length of the shoreline is 224 kilometers.

Bedrock Geology - Sandstone, conglomerate, volcanics, granite
Substrate - Irregular bottom consisting of sand, pebbles, cobbles, boulder, rock.

Width of Major Bays/Inlets - at narrowest point (meters)

Mal Bay	800
Long Harbour - Lobster Cove Point	950
Long Harbour - Tickle Head	150
Hare Harbour	150
Stone Cove	300
Big Conne	900
Femme Harbour	150
Little Bay de l'Eau	250
English Harbour East	200
Grand Le Pierre Harbour	100
Terrenceville Brook (estuary)	150
Mille Harbour	100
Little Harbour	150
Little Bay East	40
Ampleton Cove	50
St. Bernard's	300
Grand John	30

Accessibility:

BY LAND: The coastal zone from Mal Bay to English Harbour East is inaccessible by land (a distance of 98 kilometers). Highway #211 connects the settlements of English Harbour East and Grand Le Pierre with the main highway (#210). Terrenceville is accessible from a gravel road which joins highway #211. From Terrenceville to Little Harbour East, the coast is not accessible (a distance of 15 kilometers). Highway #56 connects the communities of Little Harbour East, Harbour Mille, Little Bay East, Bay L'Argent, Jacques Fontaine and St. Bernard's.

BY SEA: Most of the coastal zone can be reached by boat. Suitable small boat harbours are located at:

	Depth (meters)
Anderson Cove	11
English Harbour East*	7-8
Grand Le Pierre Harbour*	7-8
Terrenceville*	13-14
Mille Harbour	5-6
Little Bay East	3-4
Bay L'Argent*	4-5
St. Bernard's*	4-5

* - Government Wharf

A CN coastal ferry service from Terrenceville to English Harbour East and to several communities in Belle Bay.

BY AIR: The nearest airport is located at St. John's, a distance of 300 kilometers.

Distance Between Potential Cleanup Sites and Major Resource Centers

	Marystown		Argentia		St. John's	
	BY Land	BY Sea	BY L.	BY S.	BY L.	BY S.
Long Harbour	N/A	240	N/A	330	N/A	595
English Harbour East	103	250	213	340	253	605
Grand Le Pierre	97	265	207	355	247	620
Terrenceville	94	270	204	360	244	625
Little Harbour East	134	255	244	345	284	610
Little Bay East	125	250	235	340	275	605
Bay L'Argent	121	245	231	335	271	600
St. Bernard's	123	240	233	330	273	595

N/A - Not Accessible

Topographic Maps: (1:50,000) - 1M/6, 1M/7, 1M/10, 1M/11

Hydrographic Charts: 4016 (1:350,000), 4607 (1:36,800), 4609 (1:18,000)
4612 (1:12,500).

Aerial Photographs: (1:50,000) - A19835 A19832, A19830.

SECTION II (B) Mortier Bay to Cape Roger (including coastal islands).

Description: This region consists of an upland plateau with steep rocky cliffs and numerous cobble/shingle pocket beaches. The coastal zone is characterized by many rocky islands. Wave energy is moderately high in this region. During winter, the coastal areas seldom freezes except for sheltered bays and inlets.

Sea ice may drift into nearshore waters on rare occasions. Total length to the shoreline is 145 kilometers.

Bedrock Geology - Volcanics, slate, siltstone, arkose
Substrate - Mainly rock with some boulders.

Width of Major Bays/Inlets - at narrowest point (meters)

Jeane de Baie	50
Rock Harbour	100
Red Harbour	600
Rushoon Harbour	150
Baine Harbour	100
Boat Harbour West	450
Brookside	400

Bay de L'Eau (estuary)	350
Little Harbour	75
St. Josephs	100
Little Gallous Harbour	150
Cape Roger Bay	300
Oderin Harbour (Oderin I)	100

Accessibility:

BY LAND: Most of the coastal zone in this region is not accessible by road. Highway # 11 which proceeds northwest from Marystown provides access to the following communities: Rock Harbour, Jean de Baie, Red Harbour, Rushoon, Baine Harbour, Parker Cove and Brookside. From Brookside, a cart track leads to Bay de l'Eau estuary. The remaining shoreline areas are not accessible.

BY SEA: Most of the coastal zone can be accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
Flat Island Harbour	13
Oderin Harbour*	5
Red Harbour	11
West Broad Cove	18
East Broad Cove	13
Rushoon Harbour*	5
Boat Harbour*	18
St. Joseph's Harbour*	11
Cape Roger Bay	7

* - Government Wharf

Between Jean de Baie and Marticot Island, there are numerous off-lying islands and shoals which are dangerous to navigation. Other dangerous shoals are located near Jerseyman I and Gull I (Hydrog. Chart 4615).

BY AIR: The nearest airport is located at St. John's, a distance of 250 kilometers.

Distances Between Potential Cleanup Sites and Major Resource Centers

	(kilometers)					
	Marystown		Argentia		St. John's	
	By Land	By Sea	By L.	By S.	By L.	By S.
Rock Harbour	13	20	258	90	293	355
Red Harbour	22	30	224	95	284	360
Rushoon	35	37	233	85	268	350
Baine Harbour	40	40	228	87	263	352
Boat Harbour	50	48	218	85	253	350
Bay de l'Eau	56	50	224	82	259	347
Little Harbour West	N/A	52	N/A	78	N/A	343
St. Joseph's	N/A	55	N/A	76	N/A	341
Cape Roger Bay	N/A	58	N/A	72	N/A	337
Oderin Harbour	N/A	38	N/A	70	N/A	335
Flat Island Harbour	N/A	30	N/A	80	N/A	345

Topographic Maps: (1:50,000) 1M/2, 1M/3, 1M/6, 1M/7.

Hydrographic Charts: 4016 (1:350,000), 4615 (1:25,000), 4622 (1:80,000), 4624 (1:80,000).

Aerial Photographs: (1:50,000) A19830-L8, A19830-L9, A19835 A19830-L10.

SECTION II (C) Cape Roger to Davis Cove

Description: This section of coastline consists of an upland plateau with long fjord inlets, numerous steep rocky cliffs and localized cobble/shingle beaches. Wave energy varies from high at White Sail Head, moderate at Cape Roger and low at Davis Cove and Paradise Sound. Local bays and inlets freeze in winter, otherwise the coastal zone is usually ice free. Total length of shoreline is 215 kilometers.

Bedrock Geology - Volcanics, slate, siltstone, arkose, granite, granodiorite.

Substrate - Mainly rock with some boulders, local gravel and sand.

Width of Major Bays/Inlets - at narrowest point (meters)

Southwest Nonsuch Arm	150
Northwest Nonsuch Arm	200
Paradise Sound (entrance)	2000
Petit Forte Harbour	400
Little Paradise Harbour	250
Burnt Island	100
Presque Harbour (Beckford Cove)	600
St. Kyran's Harbour	550
Clattice Harbour - Southwest Arm	300
Clattice Harbour - Northwest Arm	250
Valen Harbour	50
Davis Cove	600
Toslow Cove	150

Accessibility:

BY LAND: The coastal zone cannot be accessed by road. The communities of Monkstown and Davis Cove are linked by a gravel road (10 kilometers). Several cart tracks are located in the vicinity of Clattice Harbour and St. Kyrans Harbour.

BY SEA: Most of the shoreline is accessible by boat. Suitable small boat harbours are located at:

	Depth (meters)
Petit Forte*	9-18
Monkstown*	7-8
Little Paradise Harbour	7-16
St. Kyran's Harbour*	12-20
Valen Harbour*	3-4
Clattice Harbour - Northwest Arm	29-33
Davis Cove*	10-15

* - Government Wharf

In Summer, a C.N. coastal ferry service operates between Marystown, Petit Forte, Monkstown and Argentia. Dangerous shoals are located in the centre of Petit Forte Harbour (Hydrog. Chart 4615) and in approaching Presque Harbour (Hydrog. Chart 4619).

BY AIR: The nearest major airport is located at St. John's, a distance of 220 kilometers.

Distances Between Potential Cleanup Sites and Major Resource Centers

	(By Sea Only) Kilometers		
	Marystown	Argentia	St. John's
Nonsuch Inlet	50	65	370
Petit Forte Harbour	55	60	365
Paradise Sound	60	55	360
Monkstown	85	80	385
Little Paradise	60	50	350
Presque Harbour	70	50	340
St. Kyran's Harbour	75	52	342
Clattice Harbour	85	60	350
Valen Harbour	80	55	345
Davis Cove	100	75	365

Topographic Maps: (1:50,000) 1M/7, 1M/9, 1M/10.

Hydrographic Charts: 4016 (1:350,000), 4622 (1:80,000), 4615 (1:25,000), 4619 (1:37,500).

Aerial Photographs: (1:50,000) A19832, A19836, A19835.

SECTION II (D) Davis Cove to Come-By-Chance

Description: This region consists of an upland plateau characterized by a fjord-like valley and an extensive river estuary. Pebble/cobble or cobble/boulder pocket beaches are also present. Wave energy is low in the coastal areas. Broken patches of sea ice frequently cover the coastal zone for at least part of the winter. The estuary at Come-By-Chance usually remains frozen all winter. Total length of shoreline is 160 kilometers.

Bedrock Geology - Granite, granodiorite, volcanics, slate, siltstone. Substrate - Primarily gravel, sand and mud, some boulders.

Width of Major Bays/Inlets - at narrowest point (meters)

Little Sandy Harbour	500
Great Sandy Harbour	150
Bar Haven	100
Swift Current	150
Pipers Hole River (estuary)	100
Goose Cove	200
North Harbours (estuary)	500
Come-By-Chance (estuary)	250

Accessibility:

BY LAND: At the head of Placentia Bay, the main highway (#210) parallels the shoreline from Pipers Hole River to Black River (a distance of 12 kilometers). The coastal communities of Garden Cove, Goose Cove and North Harbour are linked by gravel roads to highway #210. A paved road connects the town of Come-By-Chance to the Trans Canada Highway (#1). The remainder of the coastal zone cannot be accessed by land.

BY SEA: The majority of shoreline areas can be accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
Little Sandy Harbour	9
Great Sandy Harbour	11
Bar Haven*	7-11
North Harbour*	6-7
Swift Current*	3
Garden Cove*	9
Woody Island*	13
Come-By-Chance*	6-73

* - Government Wharf

At Come-By-Chance, there is an inactive oil refinery with docking facilities for supertankers.

BY AIR: The nearest airport is located at St. John's, a distance of 150 kilometers.

Distances Between Potential Cleanup Sites and Major Resource Centers

Distances (kilometers)

	Marystown		Argentia		St. John's	
	By Land	By Sea	By L.	By S.	By L.	By S.
Great Sandy Harbour	N/A	105	N/A	75	N/A	392
Bar Haven	N/A	110	N/A	65	N/A	382
Swift Current	125	135	146	75	181	392
North Harbour	137	125	134	66	169	383
Goose Cove	135	130	104	69	171	386
Come-By-Chance	163	130	104	63	143	380

N/A - Not Accessible

Topographic Maps: (1:50,000) 1M/9, 1M/16, 1N/13

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000), 4618 (1:37,500), 4619 (1:37,500), 4620 (1:15,000)

Aerial Photographs: A19834-L17, A19834-L18

SECTION II (E) Placentia Bay Islands.

Description: This region consists of numerous rocky islands and island remnants. The complex shore zone is comprised of steep rocky cliffs, rock platforms and localized pebble/cobble beaches. Wave energy ranges from high at the southern end of the region to low in the northern portions of this coastal zone. In winter, local bays remain frozen. On rare occasions, sea ice may drift into the area.

Total length of shoreline is 210 kilometers.

Bedrock Geology - Siltstone, arkose, granite, granodiorite, slate, greywacke.

Substrate - Rock, boulder, sand and mud.

Width of Major Bays/Inlets - at narrowest point (meters)

Merasheen Harbour	250
Bests Harbour	150
Great Brule	150
Spencers Cove	400
Northeast Harbour Buffett	200
Kingwell	150
Red Island Harbour	100
Harbour Buffett	250

Accessibility:

BY LAND: The Placentia Bay Islands cannot be accessed by land.

BY SEA: Most coastal areas can be reached by small boat although caution must be taken because of many shallow, rocky areas located here. Suitable small boat harbours are found at:

Depth (meters)

Jean de Gaunt Harbour	20
Merasheen Harbour*	5
Little Merasheen Harbour*	3
Little Brule Harbour	15-18
Red Island Harbour	4
Buffett Harbour	4
Haystack Harbour	9

* - Government Wharf

BY AIR: The nearest airport is located at St. John's, a distance of 150 kilometers.

Distance Between Potential Cleanup Sites and Major Resource Centers

By Sea Only - Distances (kilometers)

	Marystown	Argentia	St. John's
Merasheen (town)	70	35	310
Bests Harbour	95	65	340
Spencers Cove	115	50	325
Harbour Buffett	105	30	305
Red Island	90	20	295

Topographic Maps: (1:50,000) 1M/8, 1M/9

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000), 4617 (1:37,500), 4618 (1:37,500).

Aerial Photographs: (1:50,000) A19832, A19836.

SECTION II (F) Come-By-Chance to Little Barasway

Description: This region is a continuation of an upland plateau consisting of irregular steep rocky shores. Cobble/pebble or cobble/boulder pocket beaches are common at the head of most inlets. Wave energy is moderately high in the coastal zone. Local bays and estuaries freeze in winter. Total length of the shoreline is 262 kilometers. Bedrock Geology - Siltstone, arkose, conglomerate, slate. Substrate - Boulders, outcrops, gravel.

Width of Major Bays/Inlets - at narrowest point (meters)

Big Pond (Great Southern Harbour)	100
Little Harbour	200
Arnold's Cove	600
Little Southern Harbour	550
Fair Haven	50
St. Croix Bay	600
Long Harbour	300
Ship Harbour	400
Placentia Sound	350
Argentia Harbour	500
Fox Harbour	400

Accessibility:

BY LAND: Several gravel roads, branching from Highway #.1 provide access to the coast at the following locations: Arnold's Cove, Southern Harbour, Little Harbour East, Fair Haven, Mount Arlington Heights, Long Harbour, Ship Harbour, Fox Harbour, Argentia. Coastal areas south of Argentia can be accessed from Highway #100 which parallels the shoreline. The remainder of the coastal zone cannot be accessed by land.

BY SEA: Most areas can be accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
Arnold's Cove*	9-13
Little Harbour*	5
Little Southern Harbour*	13
Fair Haven*	13
Rattling Brook Cove**	11
Long Harbour*	3
Ship Harbour*	4
Fox Haven*	3
Argentia Harbour*	8-11
Placentia*	5

* - Government Wharf
** - Phosphorus Plant

A CN. Marine ferry service operates between Argentia and North Sydney, N.S.

BY AIR: The nearest airport is located at St. John's, a distance of 130 kilometers. An abandoned airstrip is found at Argentia.

Distance Between Potential Cleanup Sites and Major Resource Centers

	Marystown		Argentia		St. John's	
	By Land	By Sea	By L.	By S.	By L.	By S.
Arnold's Cove	178	140	92	55	143	360
Southern Harbour	184	132	86	50	137	355
Little Harbour	191	125	79	42	130	347
Fair Haven	195	120	75	35	126	340
Long Harbour	230	115	40	20	108	325
Ship Harbour	286	110	32	10	140	315
Fox Harbour	278	105	18	5	126	310
Argentia	266	100	-	-	131	305
Placentia	264	88	8	15	129	290

Topographic Maps: (1:50,000) 1N/4, 1N/5, 1N/12, 1N/13, 1M/1, 1M/16.

Hydrographic Charts: 4016 (1:350,000) 4017 (1:350,000), 4617 (1:37,500) 4618 (1:37,500), 4620 (1:15,000).

Aerial Photographs: (1:50,000) A19834-L18, A19838-L17, A19838-L16, A19838-L15, A19836-L14, A19836-L14, A19836-L13, A19835-L12, A19835-L11.

SECTION II (G) Hearts Content to Chapel Arm (Trinity Bay)

Description: This region consists of a discontinuous coastal plain with rocky sea cliffs and many open coves. Most bays and inlets have pebble/cobble pocket beaches. Wave energy varies from low to moderate. In winter, local bays remain frozen. During March and April, sea ice is common in the coastal areas. Total length of the shoreline is 104 kilometers. Bedrock Geology - Siltstone, arkose, conglomerate, slate, shales with limestone. Substrate - Rock, boulders, gravel.

Width of Major Bays/Inlets - at narrowest point (meters)

Chapel Arm (Entrance)	2300
Dildo Arm (Entrance)	2700
Dildo Arm (Dildo South)	600
New Harbour	500
Hopeall Bay	1000
Green Harbour	1100
Hearts Delight	650
Hearts Desire	900
Hearts Content	800

Accessibility:

BY LAND: Most coastal areas can be accessed from Highway #80 which parallels the coastline from Hearts Content to Dildo South (a distance of 48 kilometers). Shoreline areas which cannot be reached by land include - Hopeall Head, McLeod Point and Shuffleboard.

BY SEA: Most of Trinity Bay can be accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
Hearts Content	9-25
Hearts Desire*	11-24
Hearts Delight*	5-13
Cavendish*	3
Islington*	3
Whiteway*	3
Green's Harbour*	2
New Harbour*	2
Dildo*	4-5
Dildo South*	6-7
Chapel Arm	6-22

* - Government Wharf

BY AIR: St. John's airport is the nearest landing area for fixed wing aircraft (a distance of 65 kilometers). A sea plane anchorage is available at Hearts Content.

Distance Between Potential Cleanup Sites and Major Resource Centers

	Marystown		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Hearts Content	280	480	105	455	131	160
Hearts Desire	270	485	95	460	121	165
Hearts Delight	264	488	89	463	115	168
Green's Harbour	250	520	75	495	101	200
Hopeall Bay	247	523	72	498	98	203
New Harbour	243	528	68	503	94	208
Dildo	240	530	68	505	91	210
Chapel Arm	225	535	61	510	98	215

Topographic Maps: (1:50,000) 1N/11, 1N/12, 1N/13.

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000)
4577 (1:18,000).

Aerial Photographs: (1:50,000) A19836-L14, A19836-L15,
A19838-L16, A19838-L17, A19838-L18.

SECTION II (H) Chapel Arm to Deer Harbour Head (Trinity Bay)

Description: This region is comprised of a rounded plateau with numerous headlands, embayments and rocky sea cliffs. Pebble/cobble pocket beaches are common in most coves. An extensive pebble/cobble beach is located at Bellevue. Wave energy is moderate to low in the coastal zone. Local bays and inlets freeze in winter. During March and April, sea ice is generally present in Trinity Bay. Total length of shoreline is 143 kilometers. Bedrock Geology - Siltstone, arkose, conglomerate, slate, volcanics. Substrate - Rock, gravel, shelving.

Width of Major Bays/Inlets - at narrowest point (meters)

Long Cove	500
Collier Bay	1100
Little Chance Cove	550
Bellevue Beach Estuary (Colliers Arm)	100
Rantem Cove	1500
Bull Arm (Entrance)	1500
Bull Arm (Sunnyside)	800
Deer Harbour (Entrance)	700

Accessibility:

BY LAND: From Chapel Arm, highway #201 proceeds northwestly and connects several coastal communities with the main highway (#1). Collier and Bellevue Peninsulas are not accessible by road. The shoreline from Chance Cove north to Sunnyside also cannot be accessed by land. Near Sunnyside, a gravel road follows the north side of Bull Arm for approximately 6 kilometers. From Bull Arm to Deer Harbour, the coastal zone is not accessible by land.

BY SEA: The coastal zone can be accessed by boat at most locations. Suitable small boat harbours are located at:

	Depth (meters)
Norman's Cove*	1-6
Thornlea*	5-18
Bellevue	1-2
Chance Cove*	2-3
Sunnyside*	4

* - Government Wharf

BY AIR: The nearest airport is located at St. John's (a distance of 100 kilometers).

Distance Between Cleanup Sites and Major Resource Centers

	Distances(kilometers)					
	Marystown		Argentia		St. John's	
	By Land	By Sea	BY L	By S	By L	By S
Long Cove	229	530	52	505	102	210
Collier Bay	226	532	57	507	107	212
Bellevue Beach	185	525	50	500	112	205
Chance Cove	184	527	65	502	115	207
Bull Arm	N/A	510	N/A	485	N/A	190
Sunnyside	150	495	102	410	152	175
Deer Harbour	N/A	525	N/A	500	N/A	205

N/A - Not Accessible

Topographic Maps: (1:50,000) 1N/12, 1N/13.

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000)
4547 (1:10,000), 4544 (1:25,000)

Aerial Photographs: (1:50,000) A19836-L14, A19836-L15, A19838-L16,
A19838-L17, A19834-L18.

SECTION II OIL SPILL COUNTERMEASURES

Coastal environments which should receive priority in oil spill protection or cleanup strategies are: the estuaries at the head of Fortune Bay; the fjord and estuaries in the upper regions of Placentia Bay; the larger pebble/cobble beaches found in Trinity Bay.

Offshore Protection should be considered as the first approach to prevent oil from reaching nearshore areas. Where possible, diversion booms could be employed to deflect oil away from sensitive areas to designated collection sites. The use of dispersants in the coastal zone is not recommended.

Onshore protection methods which could be used in shoreline areas include:

- a) ditch/dyke systems - to protect sensitive areas where oil might contaminate low energy environments or be washed onto the backshore zone.
- b) artificial berms - constructed on sand/pebble or pebble/cobble beaches to prevent oil from reaching backshore areas.
- c) shoreline booms - may be deployed in bays or inlets where water currents are less than 0.5 M/Sec. If currents are determined as too severe, inlets could be sealed by heavy machinery, providing access is available.
- d) sorbents - when used in conjunction with ditch/dyke systems, sorbents can prevent oil from penetrating coarse sediment beaches.

Cleanup Methods: The most effective cleanup methods for the shoreline types contained in Section II are listed below:

<u>Shoreline Type</u>	<u>Recommended Cleanup Method(s)</u>
a) Sand/pebble beaches (accessible by land)	-For large spills, motorized graders and elevating scrapers are recommended. -For small spills, manual removal can be effective.
b) Coarse sediments beaches cobble/shingle/boulder	-Front end loaders* are useful in cleanup of large spills. -For small spills, manual removal is recommended. *Note: if large volumes of sediment are removed, it should be replaced, especially where pocket beaches are involved. -If cleanup is not required, mechanical equipment may be used to accelerate natural cleaning, providing wave energy is high. -Sump collection and pump removal may be effective if oil is washed ashore over a prolonged period.

c) Backshore areas

-Mechanical removal of small amounts of oil is recommended.
-Low pressure hoses may be used to flush oil to collection areas.

d) Inaccessible beaches

-No action is recommended.

e) Rocky shores (outcrops)

-No action is recommended unless settlements (i.e human activities) are affected.
-Where oil settles in crevices or pools, manual removal is possible.
-Low pressure flushing to collection sites is also feasible.

f) Rocky Cliffs

-No action is advisable, except where a biologically sensitive site (such as the bird sanctuary at Cape St. Mary's) is threatened.
-Manual removal or low pressure flushing may be effective.

ENVIRONMENTAL ATLAS
OF
SOUTHEASTERN NEWFOUNDLAND

SECTION III

**Southwestern Avalon
Peninsula**

ENVIRONMENT CANADA

ENVIRONMENTAL PROTECTION SERVICE

ATLANTIC REGION

MARCH 1981

This environmental atlas of southeastern Newfoundland has been prepared by B. McGuire & Associates of Halifax, N.S. for the Marine Environment Branch of the Environmental Protection Service, Atlantic Region. The purpose of this atlas, similar to others in the series, is to supply a document which can be useful in planning for and responding to oil spills along the Atlantic Coast of Canada.

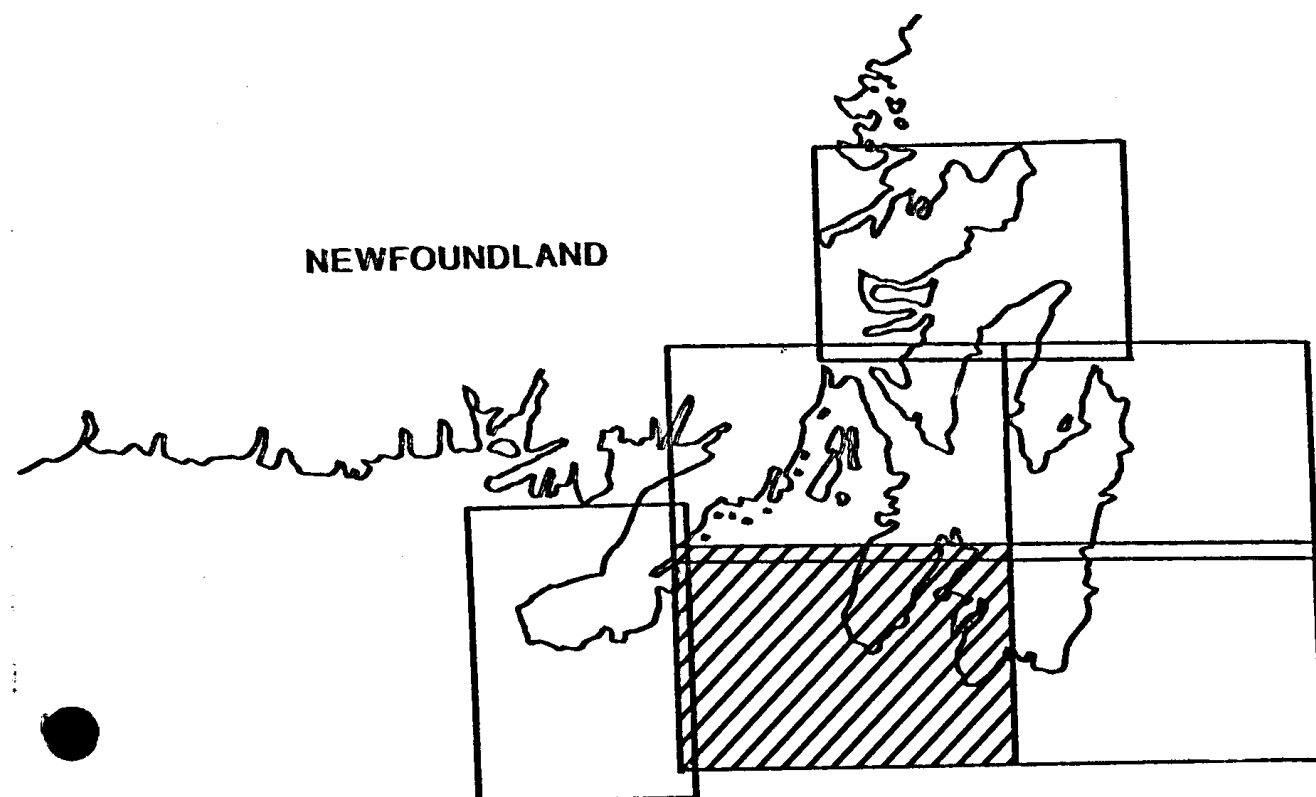
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This atlas also could be useful in the assessment of oil spill contingency plans, the development of operating conditions for offshore petroleum exploration and in the review of ocean dumping applications.

Southeastern Newfoundland has been subdivided into six sections:

- I. Southern Burin Peninsula
- II. Head of Fortune Bay, Placentia Bay (North), Trinity Bay (South)
- III. Southwestern Avalon Peninsula
- IV. Southeastern Avalon Peninsula
- V. Northeastern Avalon Peninsula
- VI. Trinity Bay (North) to Bonavista Bay (South)

These are shown by the sketch map below (the shaded portion indicates the area covered in this section).



Each section of the atlas contains two base maps, one depicting basic shoreline types and the other showing features such as lighthouses, airstrips, and bathymetric contours. A series of transparent acrylic overlays are used to describe biological and physical environmental parameters. In addition, a written section provides information on oil spill countermeasures and cleanup strategies.

The appendix contains monthly wind and visibility data, presented in a series of tables. Information is provided for the following coastal stations: Argentia, St. John's, and Bonavista. Tables listing tidal ranges and fish processing plants are also provided. A list of the references utilized has been included, however, personal communications and observations could not be cited.

The author expresses his appreciation for the cooperation provided by the following groups without whose assistance this report could not have been prepared: Atlantic Oceanographic Laboratory, Atmospheric Environment Service, Canadian Wildlife Service, Fisheries and Marine Service, Lands Directorate, Newfoundland Dept. of Fisheries, Parks Canada, Mobil Oil Ltd.

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KEY TO OVERLAYS:

A. MARINE MAMMALS

Immature Harp Seals (March to May).....	◇ ◇
Feeding Area For Whales (Summer).....	+ + +
Overwintering Area For Pilot Whales.....	x x x x x x

B. AVIFAUNA

Seabird Breeding Colony (May to September).....	*
Potential Migratory Waterfowl Stop-over Site (Spring & Fall).....	
Overwintering Habitat For Eiders.....	□ □ □ □ □ □
Large Pelagic Seabird Concentrations:	
Spring.....	SRG
Summer.....	SMR
Winter.....	WKR

C. FISHERIES

Major Commerical Species - Primary Fishing Areas:

NOTE - Lobsters are harvested in coastal waters throughout southeastern Newfoundland to depths of about 40 m.

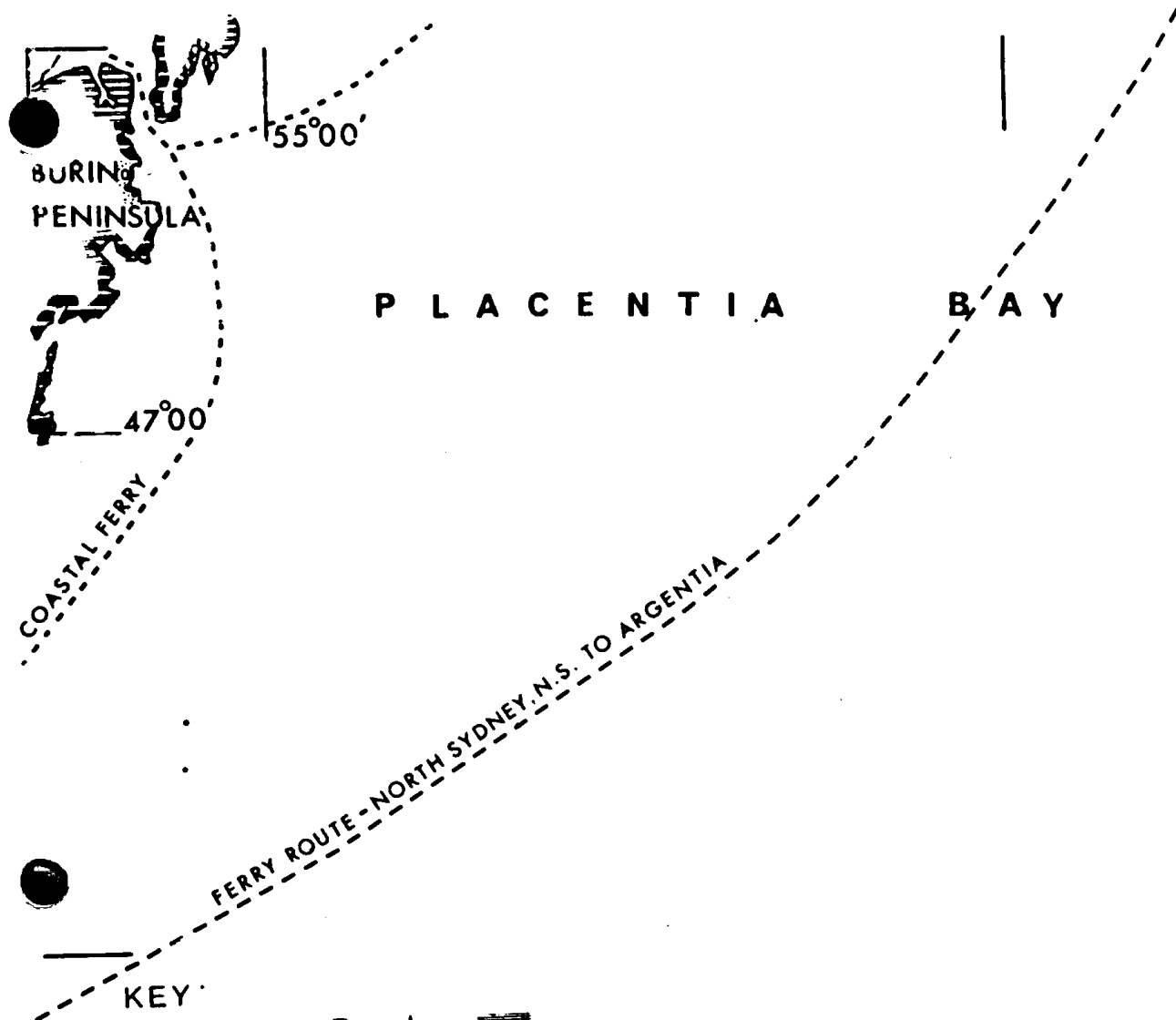
Cod.....	C
Haddock.....	D
Red Fish.....	R
American Plaice.....	P
Herring.....	H
Mackerel.....	M
Turbot.....	T
Snow Crabs.....	⊥ ⊥
Generalized Migration Routes - Adults (Spring & Summer)	↖
for Atlantic Salmon - Smolts (Fall)	➡
Scallops (Intermittent Beds).....	○ ○ ○
Pink Shrimp (Summer).....	▲ ▲ ▲
Spiny Dogfish (Summer).....	X X
Squid (Summer) - variable.....	◆ ◆
Irish Moss Harvesting (Potential).....	■ ■
Capelin Spawning Concentrations (May-July).....	● ● ●
Overwintering Site For Capelin.....	● ●
Herring Spawning (Spring).....	□ □
American Plaice Spawning (Spring).....	▽ ▽ ▽
Salmon Spawning Stream (Summer).....	S
Eels.....	e
Smelts.....	m
Tuna - Sport Fishing (Summer).....	N
Fixed Fishing Gear (Trap or Net) - Primary Locations	ttt
Fish Processing Plant.....	F
Trout Farming.....	☐

D. OCEANOGRAPHY

Residual Surface Currents.....	➡
(Indicates net movement of water only)	
Sea Surface Temperature (°C):	
Spring.....	— ■ —
Summer.....	— — —
Fall.....	— ● —
Winter.....	— — —
Mean Concentration of Sea Ice (Winter):	
10/10.....	— — —
>5/10.....	— — —

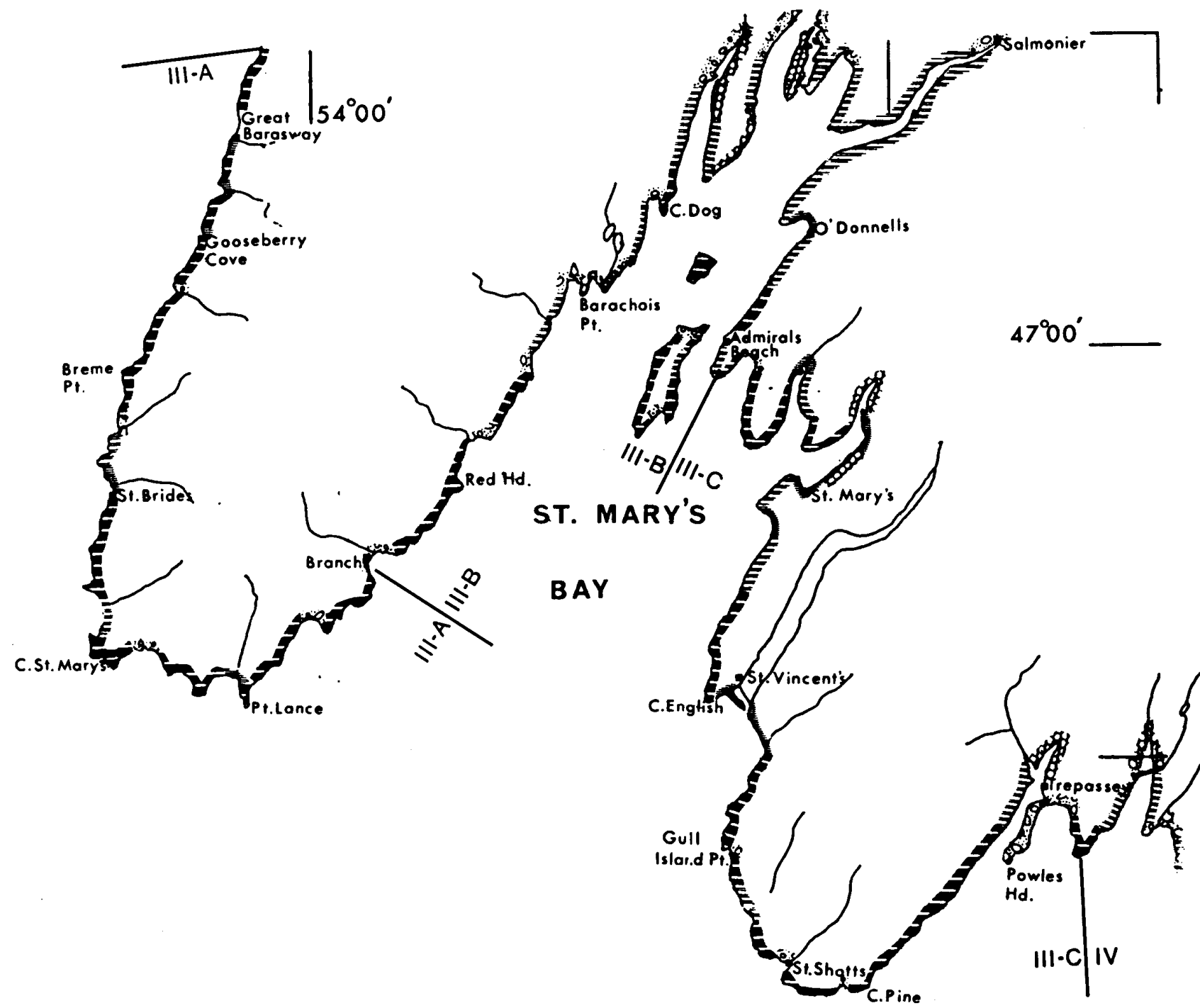
E. MISCELLANEOUS

International Biological Programme Site.....	★
Dredging Disposal Sites.....	⊙
Provincial Park.....	▲
Public Beach	★



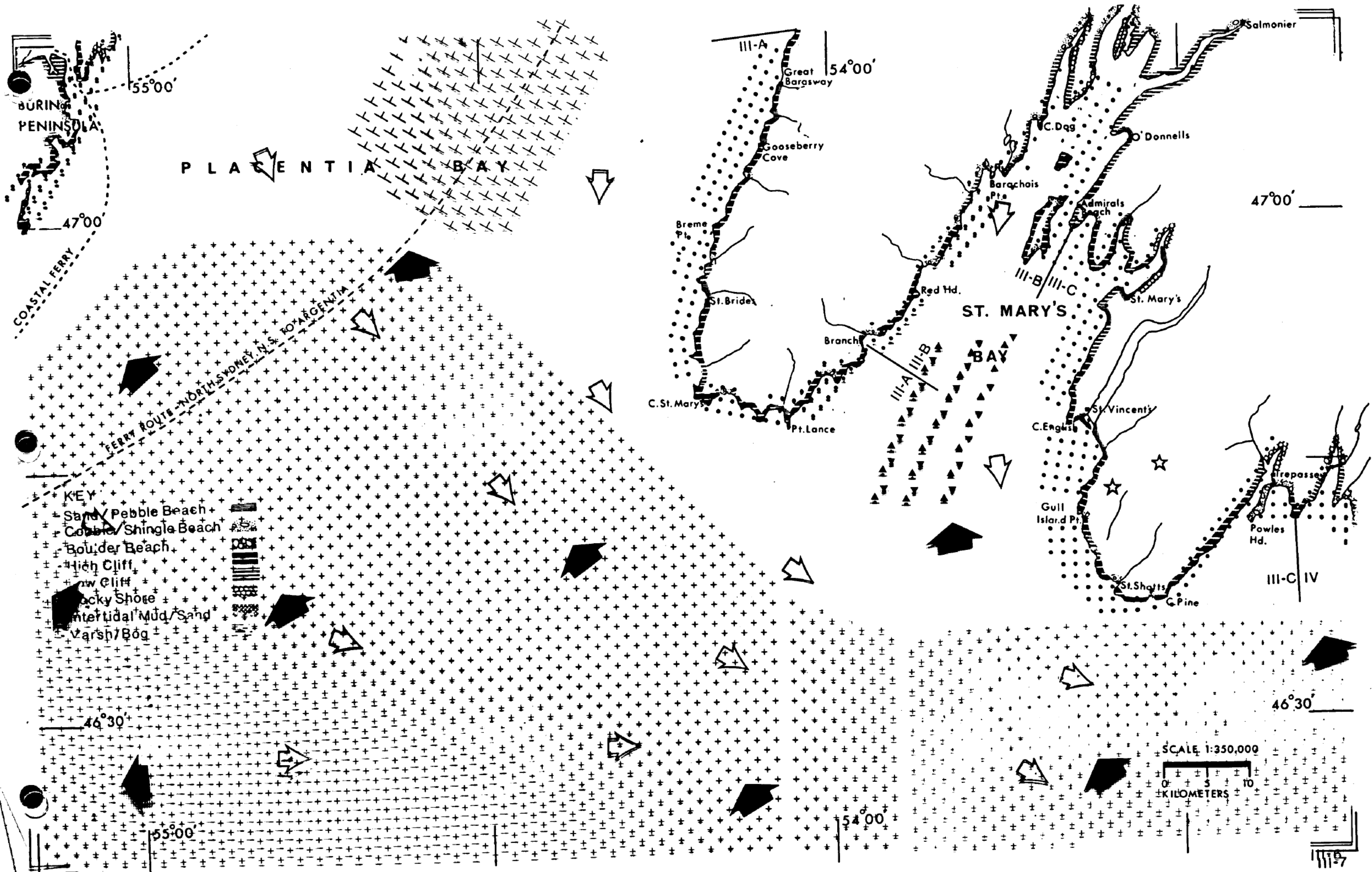
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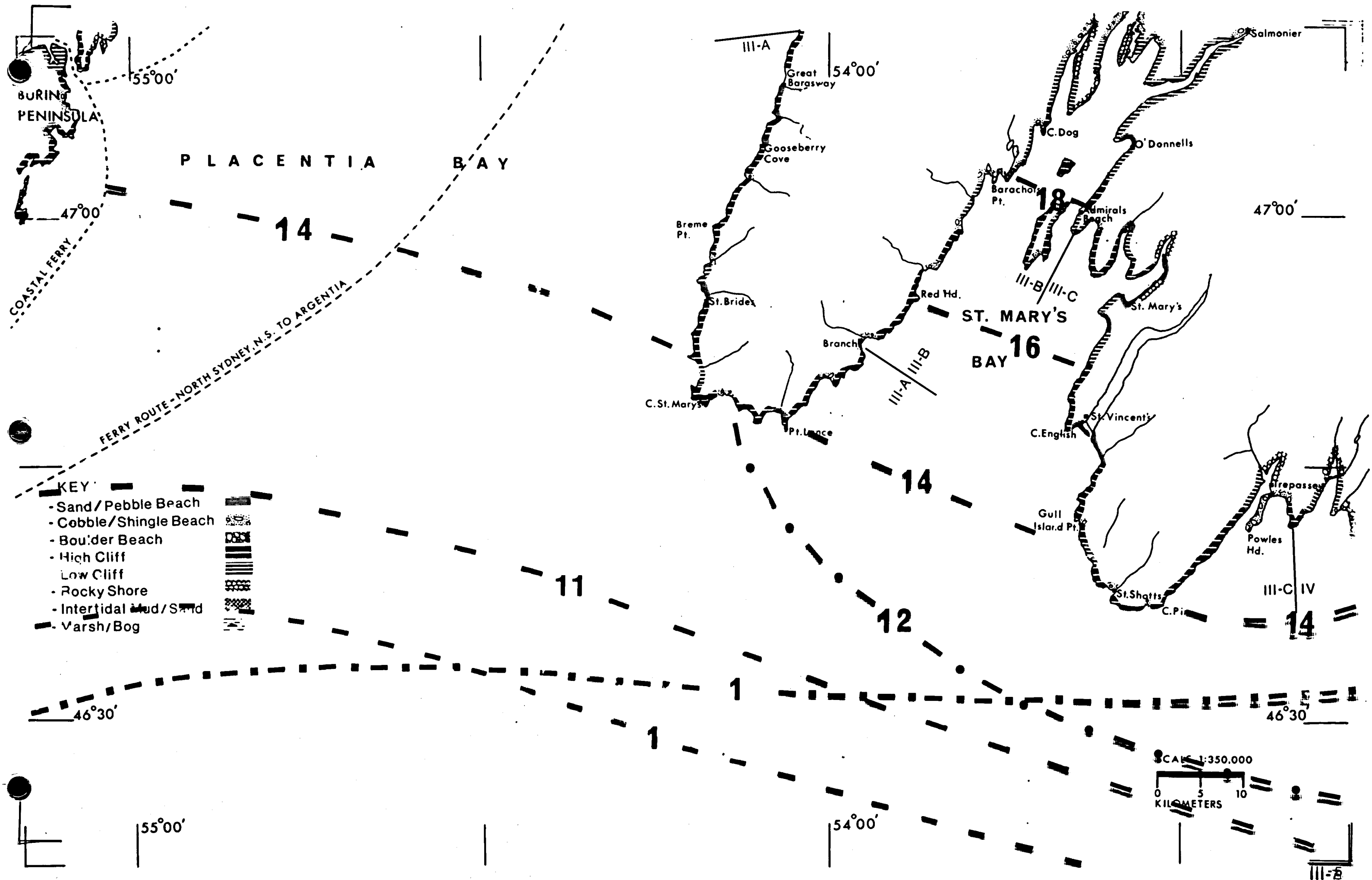
- Sand/Pebble Beach
- Cobble/Shingle Beach
- Boulder Beach
- High Cliff
- Low Cliff
- Rocky Shore
- Intertidal Mud/Sand
- Marsh/Bog

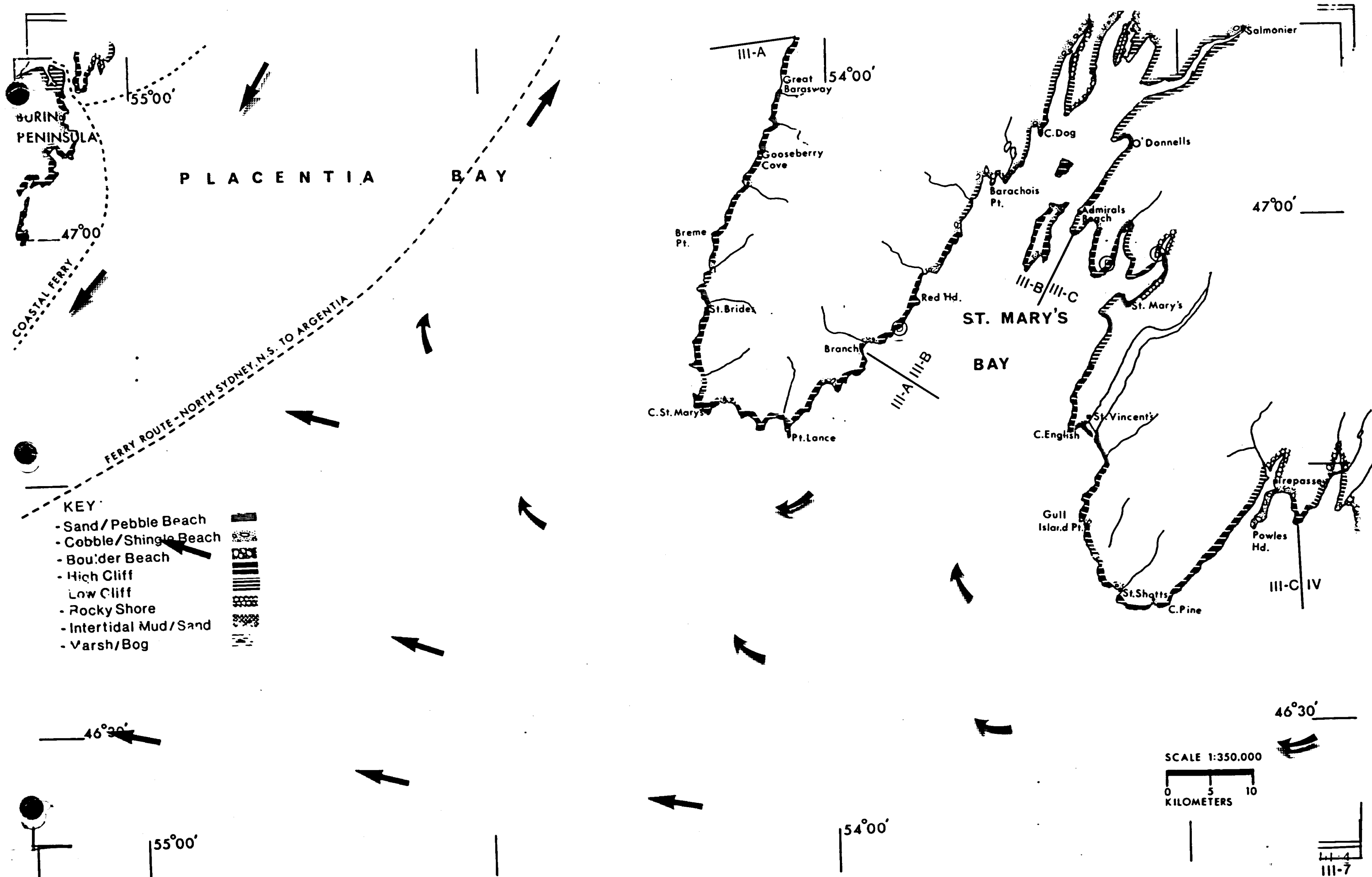


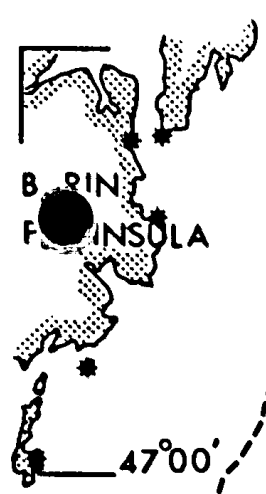
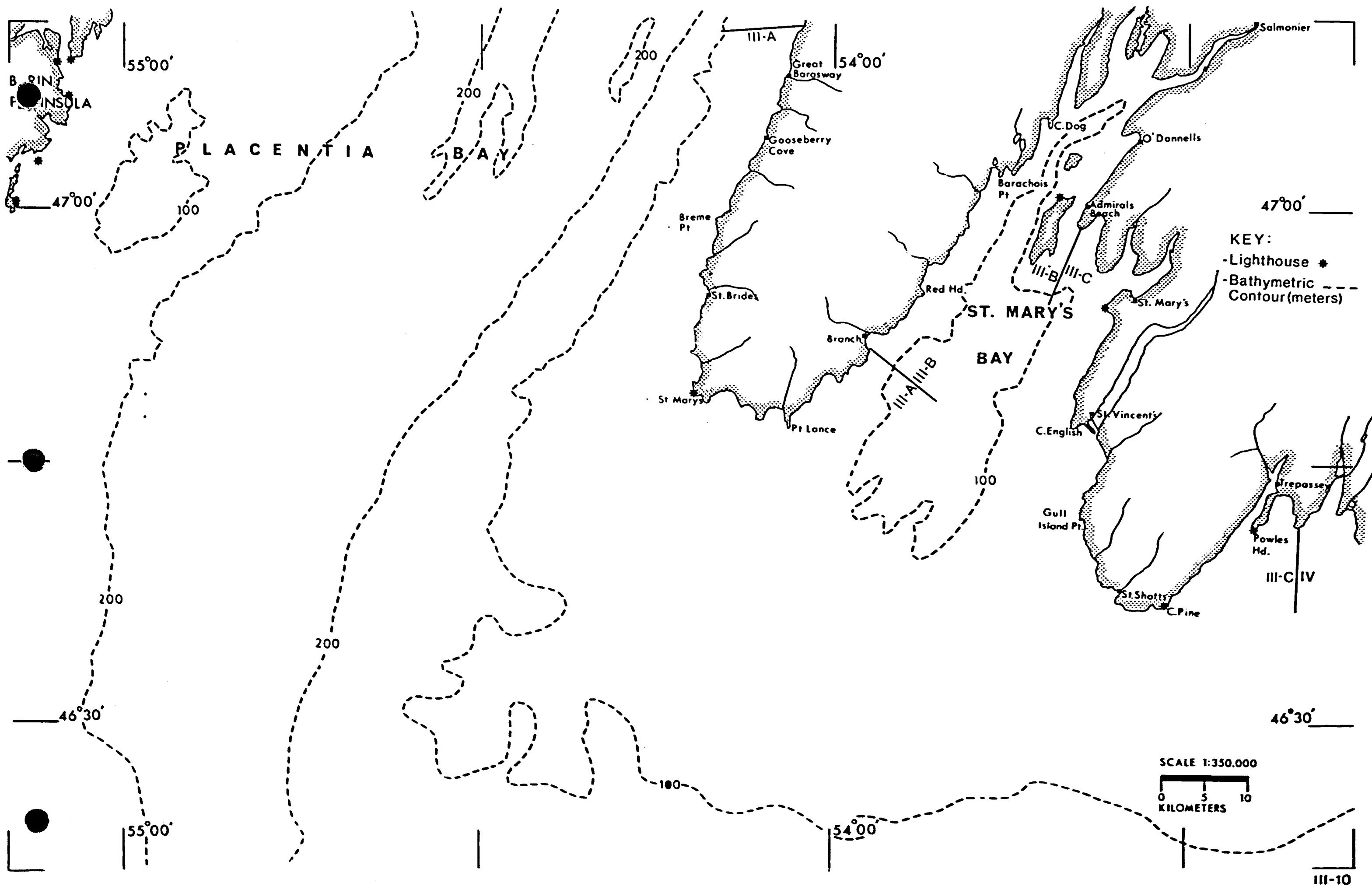
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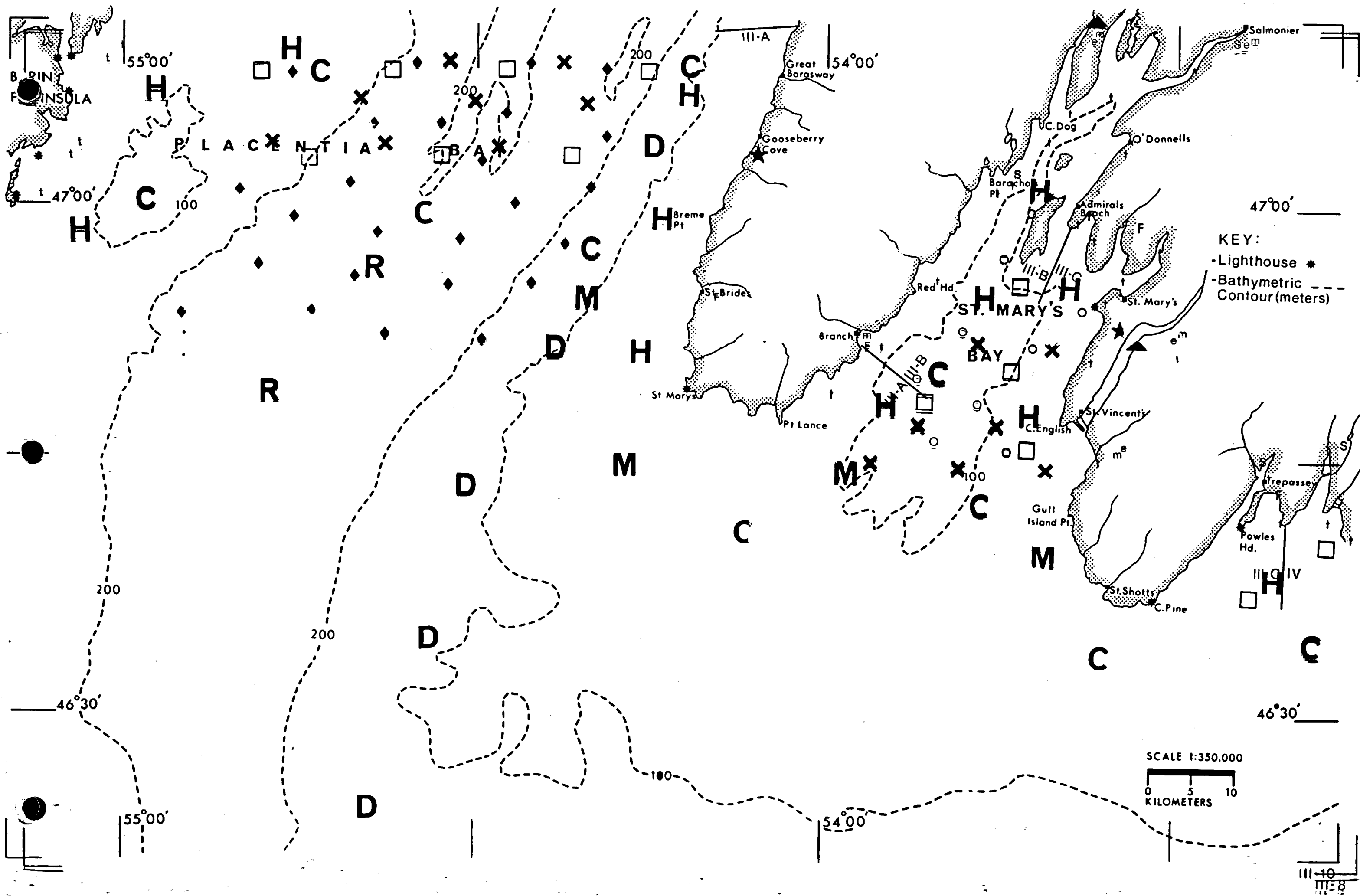


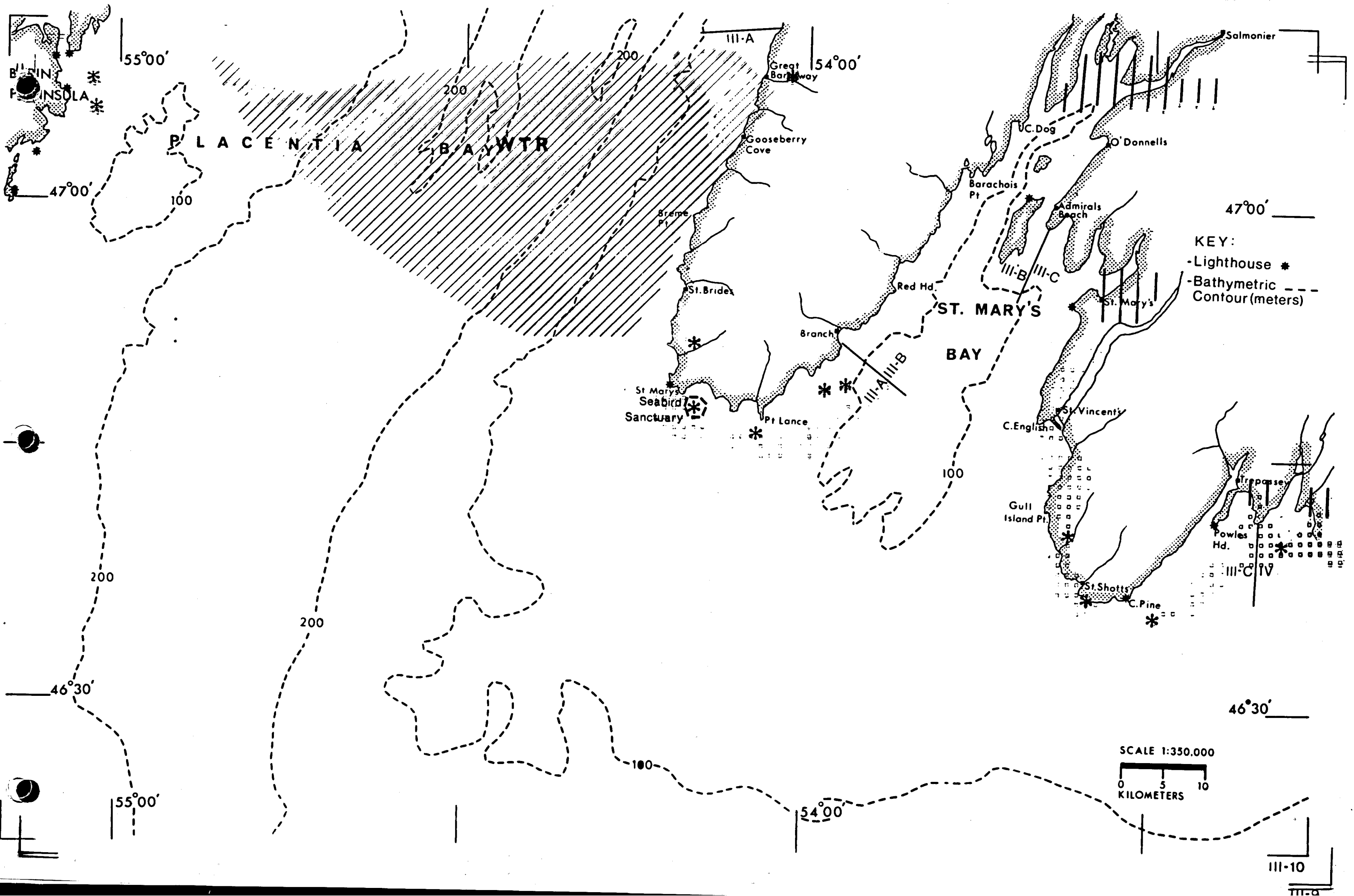




KEY:
-Lighthouse *
-Bathymetric Contour (meters) ---

SCALE 1:350,000
0 5 10
KILOMETERS





SECTION III (A) Little Barasway to Branch

Description: This area is a continuation of an upland plateau containing fjord-like embayments and steep rocky cliffs. Pebble/cobble or cobble/boulder pocket beaches frequent most inlets. Sand beaches are also found in some localities, such as Gooseberry Cove, Patricks Cove and Lance Cove. Wave energy is high along this stretch of coastline. In winter, sheltered bays and inlets remain frozen. During March and April, sea ice occasionally can be found in the coastal zone. Total length of the shoreline is 82 kilometers. Bedrock Geology - Siltstone, arkose, conglomerate, slate. Substrate - Boulders, gravel, sand, outcrops.

Width of Major Bays/Inlets - at narrowest point (meters)

Ship Cove	600
Distress Cove	500
Lance Cove	1400
Branch	1100

Accessibility:

BY LAND: Much of the coastal region is accessible by means of highway #100 which runs parallel to the shore between Placentia and St. Brides (a distance of 45 kilometers). From St. Brides, the highway proceeds westward to Branch (25 kilometers). Also, gravel secondary roads provide access to Point Lance and Cape St. Mary's. Coastal areas which cannot be reached by land include St. Brides to Cape St. Mary's; Cape St. Mary's to Lance Cove; and Pt. Lance to Branch.

BY SEA: The coastal zone can be reached by sea although caution must be exercised due to numerous off-lying rocks and shoals which restrict accessibility at many localities.

Suitable small boat harbours are located at:

	Depth (meters)
St. Brides	1-2
Lance Cove*	2
Branch	2

* - Government Wharf

BY AIR: The nearest airport is located at St. John's, a distance of 160 kilometers.

Distance Between Potential Cleanup Sites and Major Resource Centers

	Distance (kilometers)					
	Marystown		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Ship Cove	285	85	28	15	149	270
St. Brides	305	90	48	60	169	245
Lance Cove	351	100	92	85	205	220
Branch	337	120	78	100	191	230

Topographic Maps: (1:50,000) 1K/13, 1M/1, 1L/16.

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000), 4613 (1:25,000), 4622 (1:80,000).

Aerial Photographs: (1:50,000) A19829-L10, A19829-L9, A19829-L7, A19829-L6, A19829-L5, A19829-L4, A19829-L3.

SECTION III(B) Branch to Admiral's Beach (St. Mary's)

Description: This region is characterized by glacial trough embayments, low rocky cliffs, local barrier beaches and estuaries. Northeast of Branch the shoreline is dominated by several cobble/boulder beaches. Wave energy varies from moderately high at Branch to low at Colinet Harbour and Admiral's Beach. During March and April, sea ice may occasionally be present in St. Mary's Bay. Total length of shoreline is 165 kilometers. Bedrock Geology - Slate, siltstone, greywacke. Substrate - Sand, gravel, rock.

Width of Major Bays/Inlets - at narrowest point (meters)

Little Barachois	10
Big Barachois	20
North Harbour (entrance)	1500
North Harbour	200
Colinet Harbour (estuary)	150
Haricot Pond	20
Salmonier Arm	1100
Mussel Pond Cove (estuary)	15

Accessibility:

BY LAND: Northeast of Branch, highway #92 provides access to the west side of St. Mary's Bay at North Harbour. The coastal communities of Colinet, Haricot, Mount Carmel, Mitchells Brook can be reached by a gravel road (highway #93). On the east side of St. Mary's Bay, highway #94 connects O'Donnells and Admirals Beach with the main highway (#90).

BY SEA: At most sites, St. Mary's Bay can be accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
North Harbour	5
Colinet Harbour*	13
Salmonier Arm:	
Frozen Point*	4
St. Joseph's	16
Little Harbour	11
Cox Point*	11
Admirals Beach	6

* - Government Wharf

BY AIR: The nearest airport is located at St. John's, a distance of 120 kilometers.

Distances Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Marystown		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Big Barachois	N/A	140	N/A	125	N/A	225
North Harbour	255	155	62	140	103	235
Colinet	241	165	48	150	89	240
Haricot	246	160	53	145	94	235
Salmonier Arm	268	165	75	150	87	240
O'Donnells	276	150	83	135	95	225
Admiral's Beach	286	140	93	125	105	215

N/A - Not Accessible

Topographic Maps: (1:50,000) 1K1/3, 1N/3, 1N/4

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000), 4579 (1:24,300), 4606 (1:24,400), 4622 (1:80,000)

Aerial Photographs: (1:50,000) A19829-L4, A19829-L5, A19829-L6, A19829-L7, A19829-L8.

SECTION III (C) Admiral's Beach (St. Mary's Bay) to Cape Mutton (Trepassey Bay)

Description: This region consists primarily of a rounded upland plateau with glacial trough embayments, localized barrier and rocky cliffs. Most inlets contain sand or pebble/cobble beaches. Wave energy is generally high along this coastline. Local bays and inlets freeze in winter. Sea ice may occasionally drift into the coastal areas during March or April. Total length of shoreline is 154 kilometers.

Bedrock Geology - Slate, siltstone, greywacke, conglomerate.

Substrate - Rock, boulder, sand, gravel

Width of Major Bays/Inlets - at narrowest point (meters)

Shoal Bay	1300
Mall Bay	900
St. Mary's Harbour (outer)	1700
St. Mary's Harbour (inner)	400
St. Shotts Cove	500
Trepassey Harbour (outer)	1200
Trepassey Harbour (inner)	600
Mutton Bay	1500

Accessibility:

BY LAND: Highway #90 proceeds southward along the shore of St. Mary's Harbour and then parallels the west side of Holyrood Pond as far as St. Vincent's. East of St. Vincent's, highway #10 turns inland to Trepassey Harbour. Secondary roads connect Mall Bay and Riverhead with highway #90 and St. Shotts with highway #10. In Trepassey Bay, gravel roads lead to the navigation lights at Powles Head and Cape Pine. The major coastal areas which are not land accessible are: Admiral's Beach to Mall Bay, Gaskiers to Cape English, Peters River to St. Shotts, Cape Pine to Trepassey Harbour.

BY SEA: The coastal zone is easily accessible by boat. Suitable small boat harbours are located at:

Depth (meters)

Mall Bay**	11
St. Mary's Harbour - Graven Beach*	6
St. Mary's Harbour - St. Mary's**	11
Trepassey Harbour - Meadow Point**	11
Trepassey Harbour - Trepassey*	3-4

* - Government Wharf

** - Private Wharf

BY AIR: The nearest major airstrip is located at St. John's, a distance of 120 kilometers.

Distance Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Marystown		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Mall Bay	317	150	102	130	112	210
St. Mary's Harbour	325	152	100	132	110	208
Point LaHave	323	145	108	125	118	204
Holyrood Pond (St. Vincent's)	337	135	122	115	132	190
St. Shotts	365	145	150	125	160	170
Trepassey Harbour	362	175	147	155	145	160
Mutton Bay	367	178	152	158	140	155

Topographic Maps: (1:50,000) 1K/11, 1K/12, 1K/13, 1K/14, 1N/4.

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000), 4579 (1:24,300)

Aerial Photographs: (1:50,000) A19829-L1, A19829-L2, A19829-L3, A19829-L4, A19829-L5.

SECTION III OIL SPILL COUNTERMEASURES

Coastal environments which should receive priority in oil spill protection and cleanup strategies are the low energy embayments located in St. Mary's Bay and Trespassey Bay.

Offshore protection should be considered as the first approach to prevent oil from reaching nearshore areas. Where possible, diversion booms could be employed to deflect oil away from sensitive areas to designated collection sites. The use of dispersants in the coastal zone is not recommended.

Onshore protection methods which may be used in coastal areas include:

- a) ditch/dyke systems - to prevent oil from contaminating sensitive backshore areas.
- b) artificial berms - constructed on beaches where oil is likely to be washed into the backshore zone.
- c) shoreline booms - where tidal currents are less than 0.5 M/Sec. booms may be used to block small inlets. If currents are too strong, inlets could be sealed by heavy equipment (if area is accessible).
- d) sorbents - may be useful on coarse sediment beaches when used in conjunction with ditch/dyke systems.

Cleanup Methods: The recommended methods for the shoreline types found within Section III are listed:

<u>Shoreline Types</u>	<u>Recommended Cleanup Method(s)</u>
a) Sand/pebble beaches (accessible)	-For large spills, motorized graders and elevating scrapers are recommended. -For small spills, manual removal is normally sufficient.
b) Coarse sediment beaches (cobble/shingle/boulder)	-Small spills near settlements can be cleaned manually. -If determined necessary, large spills can be removed by using heavy machinery such as front end loaders*. *Note - if large volumes of sediment are removed, it should be replaced, particularly if pocket beaches are affected. -In high wave energy locations, mechanical equipment may be used to mix oiled sediments and accelerate natural cleaning. -Sump collection and pump removal have proven to be effective in beach areas where oil is washed over a period of several days.

c) Backshore areas

-Manual removal is recommended for small spills.
-Flushing with low pressure hoses may also be feasible.

d) Rocky shores

-Unless local human activities are affected, no action is recommended.
-Where cleanup is required, manual removal or low pressure flushing are recommended.

e) Rocky cliffs

-No action is recommended unless the site is considered sensitive (i.e biologically or for human uses).
-Where cleanup is necessary, low pressure flushing or manual cleanup may be feasible, provided the site is accessible by either land or sea.

ENVIRONMENTAL ATLAS
OF
SOUTHEASTERN NEWFOUNDLAND

SECTION IV

**Southeastern Avalon
Peninsula**

ENVIRONMENT CANADA

ENVIRONMENTAL PROTECTION SERVICE

ATLANTIC REGION

MARCH 1981

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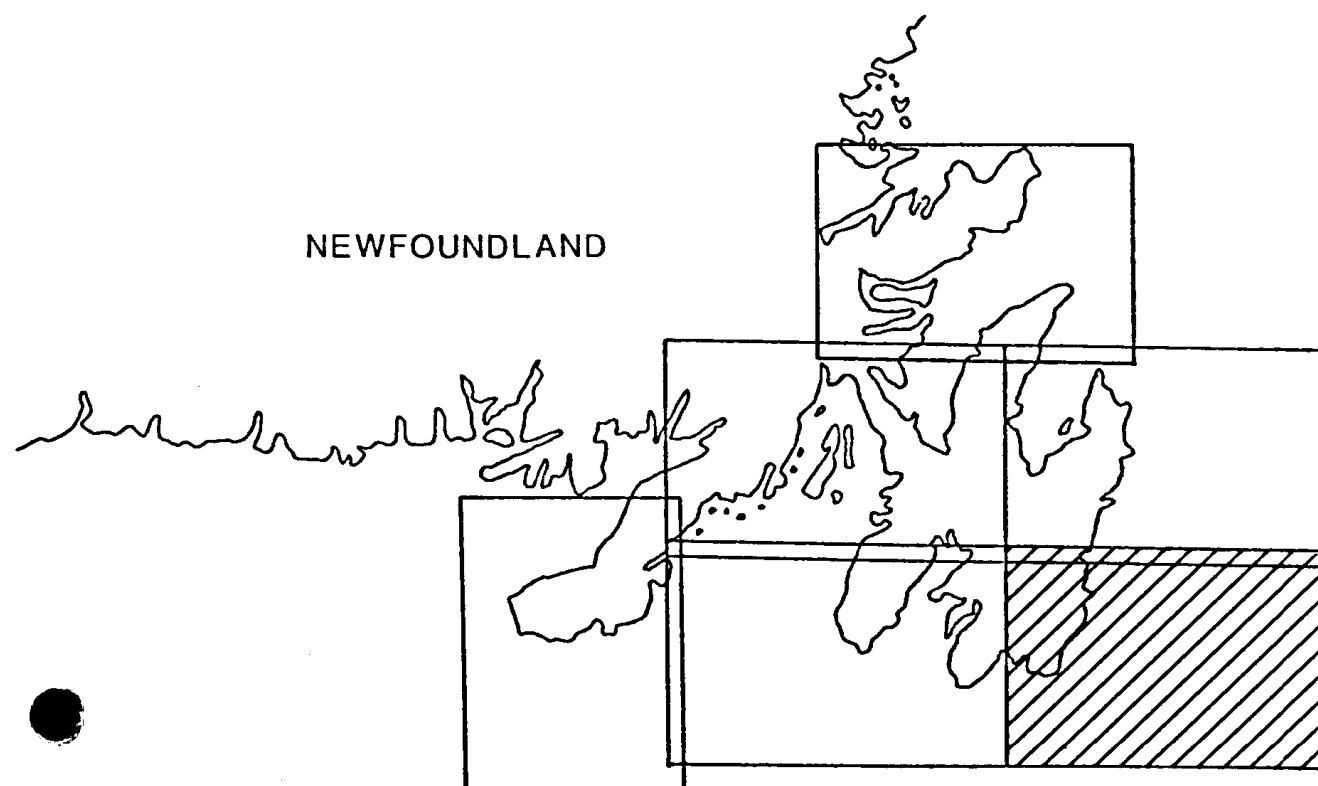
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Overwintering Area For Pilot Whales.....	x x x x x x

B. AVIFAUNA

Seabird Breeding Colony (May to September).....	*
Potential Migratory Waterfowl Stop-over Site (Spring & Fall).....	
Overwintering Habitat For Eiders.....	□ □ □ □ □ □
Large Pelagic Seabird Concentrations:	
Spring.....	SRG
Summer.....	SMR
Winter.....	WTR

C. FISHERIES

Major Commerical Species - Primary Fishing Areas:

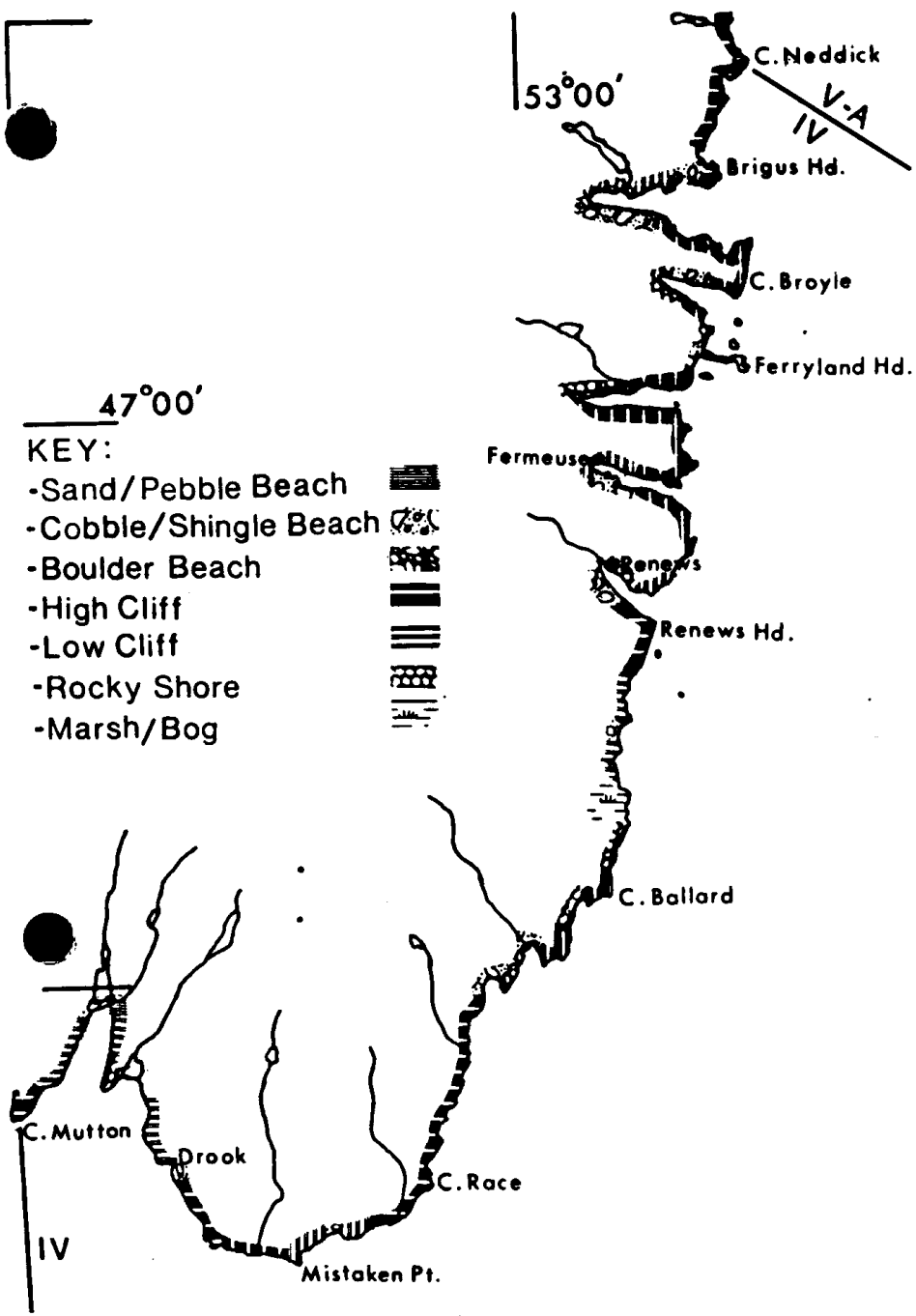
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Cod.....	C
Haddock.....	D
Red Fish.....	R
American Plaice.....	P
Herring.....	H
Mackerel.....	M
Turbot.....	T
Snow Crabs.....	⊥ ⊥ ⊥
Generalized Migration Routes - Adults (Spring & Summer)	◀
for Atlantic Salmon - Smolts (Fall)	▶
Scallops (Intermittent Beds).....	○ ○ ○
Pink Shrimp (Summer).....	▲ ▲ ▲
Spiny Dogfish (Summer).....	✕ ✕
Squid (Summer) - variable.....	◆ ◆
Irish Moss Harvesting (Potential).....	■ ■
Capelin Spawning Concentrations (May-July).....	● ● ●
Overwintering Site For Capelin.....	● ●
Herring Spawning (Spring).....	□ □
American Plaice Spawning (Spring).....	▽ ▽ ▽
Salmon Spawning Stream (Summer).....	S
Eels.....	e
Smelts.....	m
Tuna - Sport Fishing (Summer).....	N
Fixed Fishing Gear (Trap or Net) - Primary Locations	† † †
Fish Processing Plant.....	F
Trout Farming.....	⊠

D. OCEANOGRAPHY

Residual Surface Currents.....	→
(Indicates net movement of water only)	
Sea Surface Temperature (°C):	
Spring.....	— ■ —
Summer.....	— — —
Fall.....	— ● —
Winter.....	— —
Mean Concentration of Sea Ice (Winter):	
10/10.....	⊞ ⊞
> 5/10.....	⊞

E. MISCELLANEOUS

International Biological Programme Site.....	☆
Dredging Disposal Sites.....	⊙
Provincial Park.....	▲
Public Beach	★



52°00'

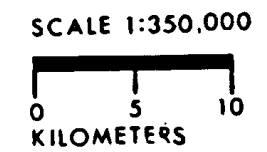
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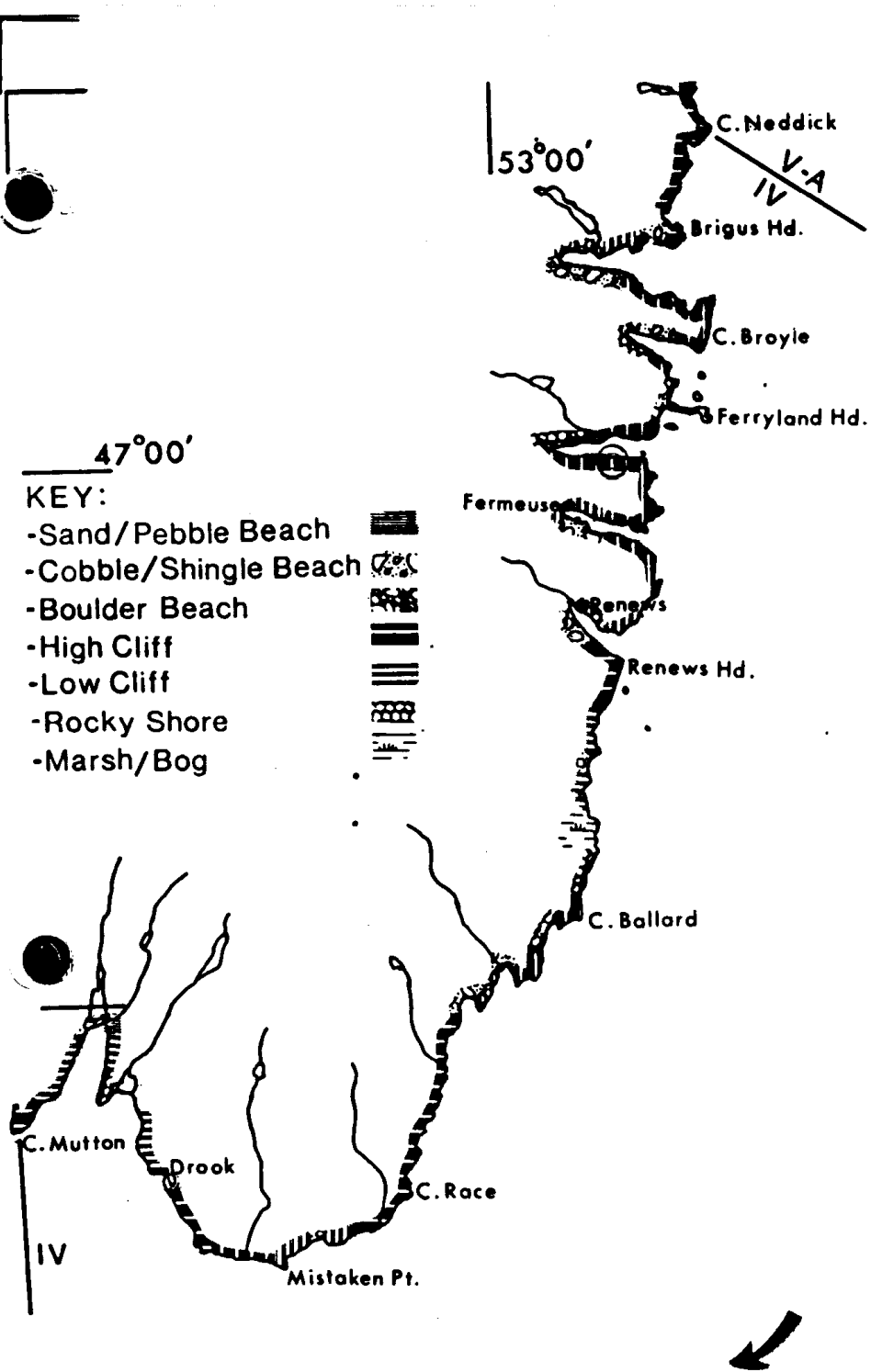
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46°30'

53°00'

52°00'





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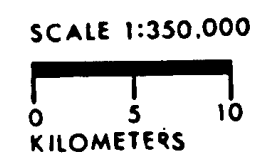
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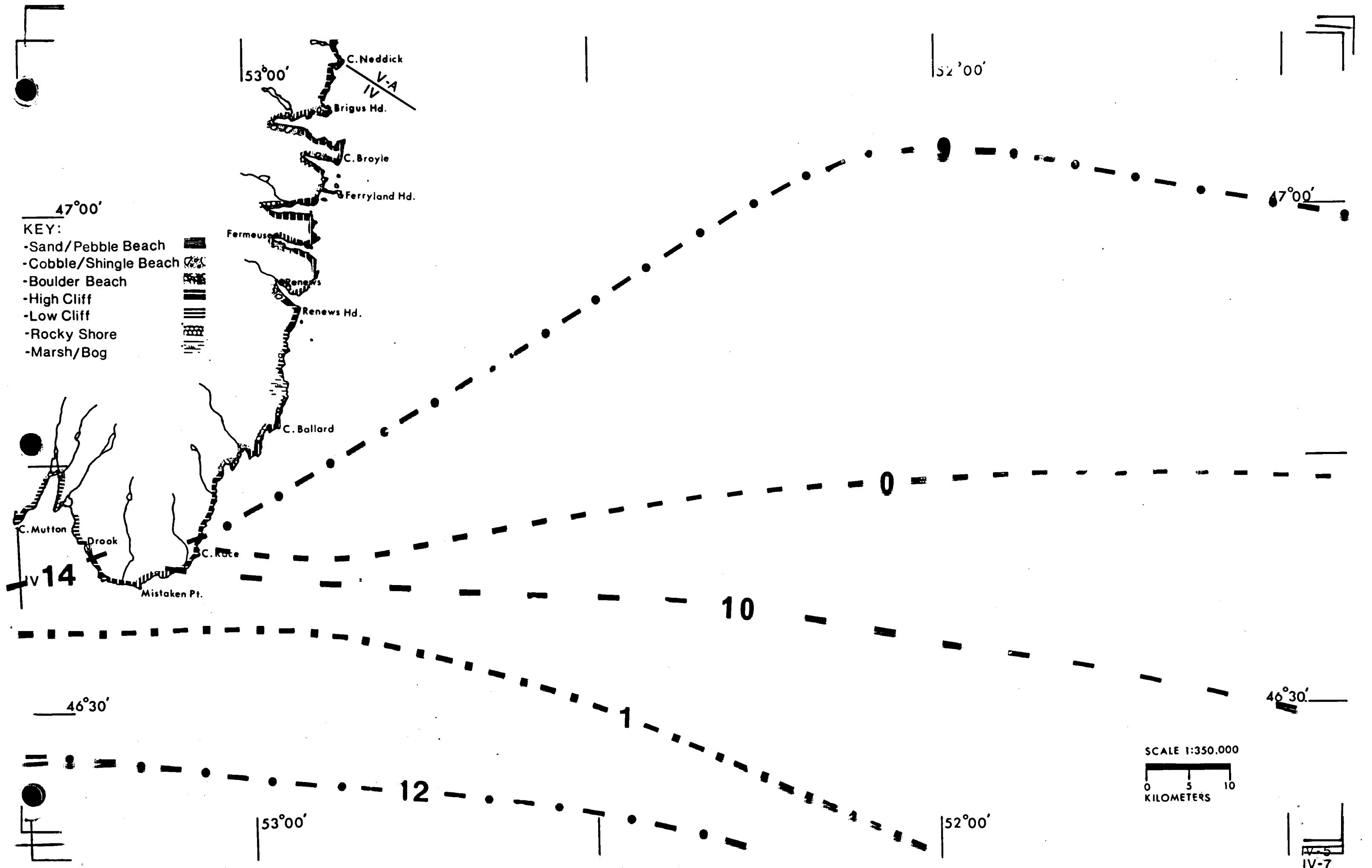
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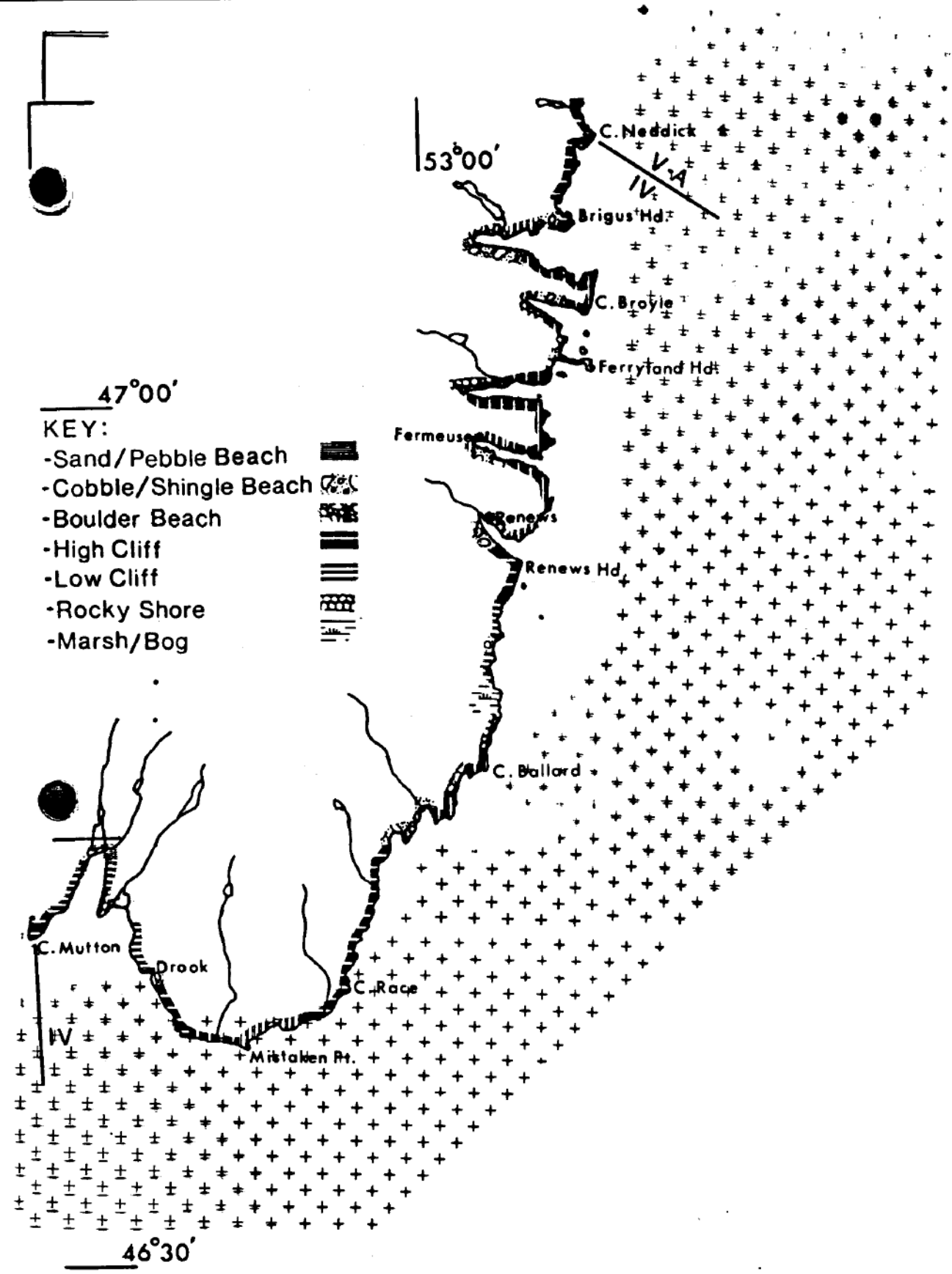
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IV-4
IV-7





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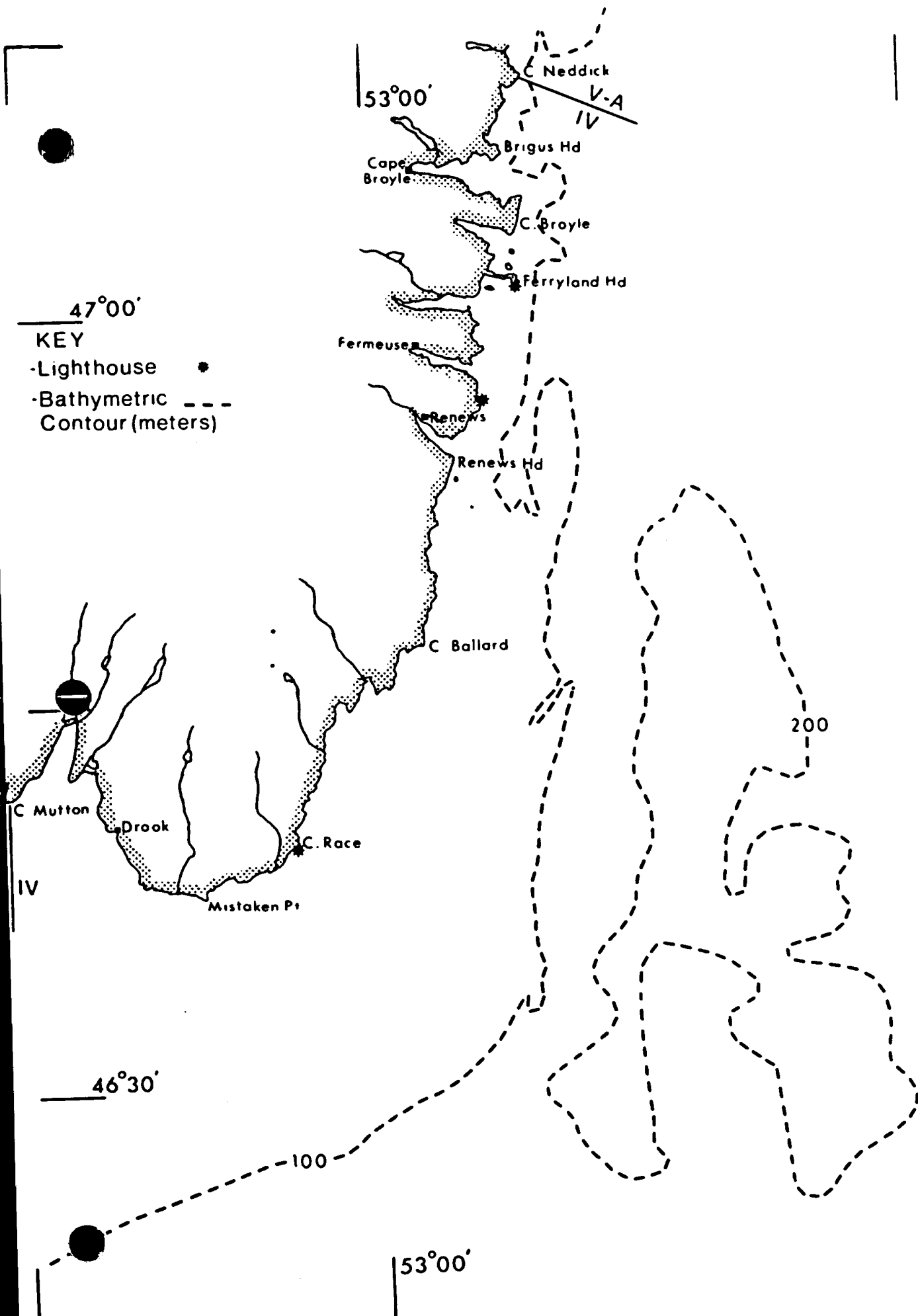
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KILOMETERS

47°00'

KEY

- Lighthouse
- Bathymetric Contour (meters)



52°00'

47°00'

46°30'

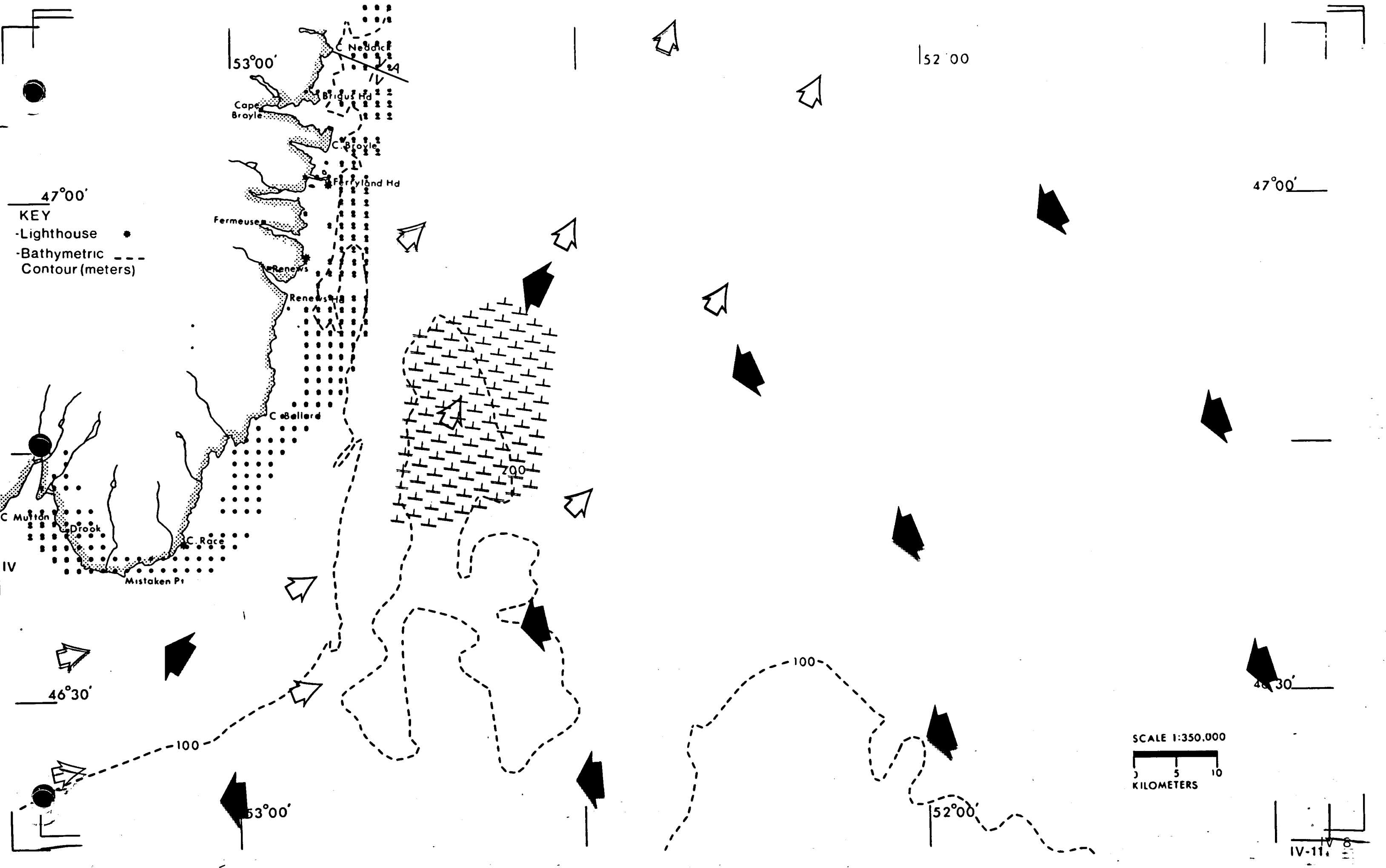
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KILOMETERS

52°00'

IV-11



47°00'

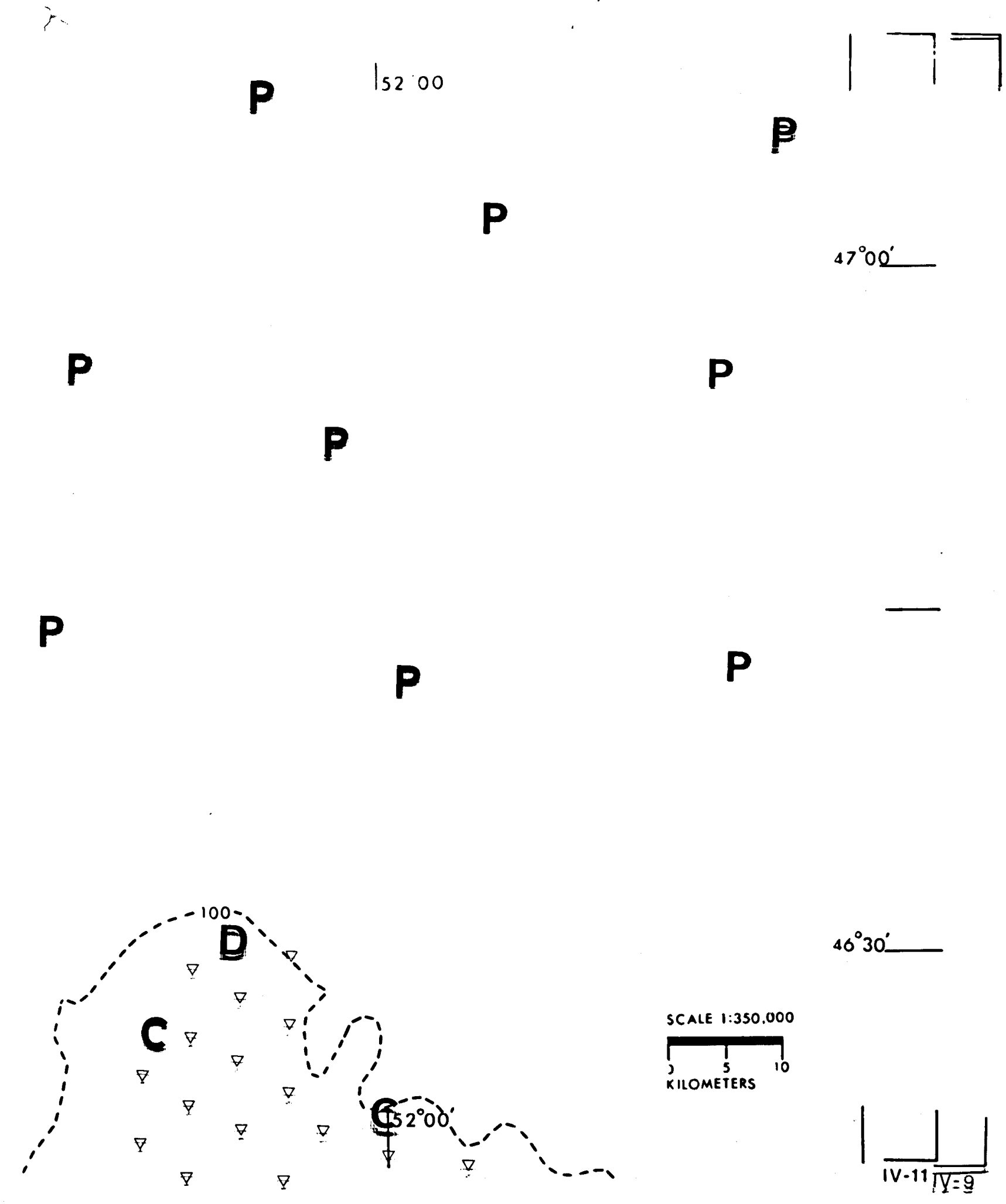
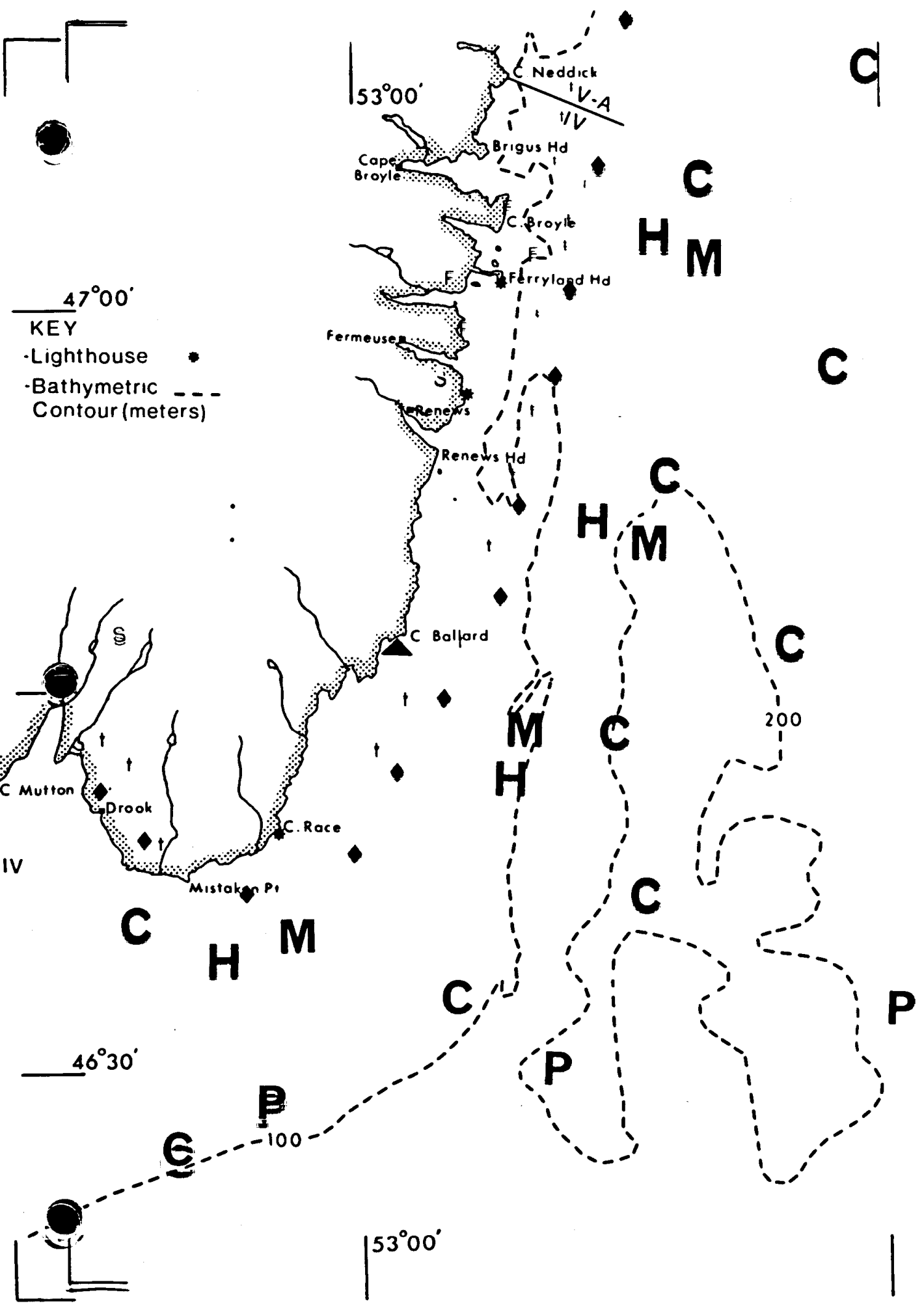
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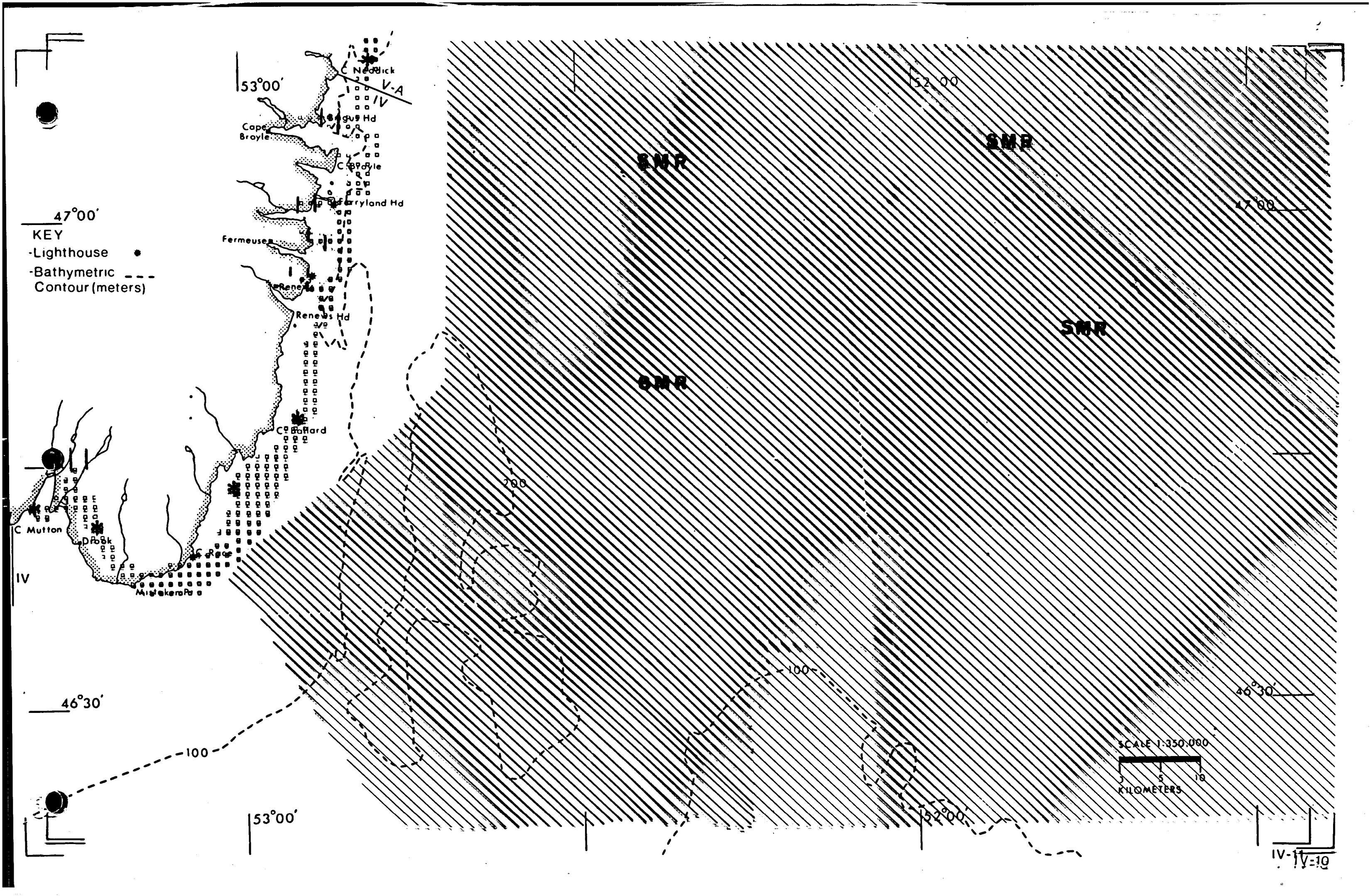
- Lighthouse •
- Bathymetric ---
- Contour (meters)

SCALE 1:350,000

0 5 10

KILOMETERS





47°00'

KEY

- Lighthouse •
- Bathymetric ---
- Contour (meters)

46°30'

53°00'

52°00'

SCALE 1:350,000

0 5 10

KILOMETERS

IV-10

SECTION IV Cape Mutton to Cape Neddick

Description: This region is a combination of a rounded plateau (Trepassey Bay) with glacial trough embayments and a low coastal plain (Cape Race - Cape Neddick). Rocky sea cliffs are the predominant shoreline feature of this area. Wave energy varies from moderate in Trepassey Bay to high at Cape Race. Pebble/cobble beaches can usually be located at the head of harbours in this coastal zone. Sea ice usually arrives in late February and generally leaves in April. Between Cape Race and Cape Neddick, icebergs are often sited in nearshore waters and can occur from March to July. Total length of shoreline is 160 kilometers. Bedrock Geology - Slate, siltstone, greywacke, conglomerate,. Substrate - Rock, sand, gravel, boulders.

Width of Major Bays/Inlets - at narrowest point (meters)

Biscay Bay (entrance)	1800
Biscay Bay (estuary)	50
Chance Cove	900
Renews Harbour (outer)	650
Renews Harbour (inner)	75
Fermeuse Harbour (entrance)	300
Fermeuse Harbour (Sheeps Head)	250
Aquaforte Harbour (entrance)	700
Aquaforte Harbour (town)	100
Calvert Bay	1000
Cape Broyle Harbour (Admirals Head)	1100
Cape Broyle Harbour (Carrier Point)	400

Accessibility:

BY LAND: The coastline can be accessed from highway #10 at Biscay Bay, Portugal Cove and most coastal areas from Cappahayden north to Cape Neddick. A gravel road joins Long Beach and Cape Race to the Main highway. The coastline from Cape Race to Cappahayden can be accessed by road through the provincial park at Chance Cove. The main areas which cannot be accessed by land are Cape Mutton to Biscay Bay; Renews Head; Bald Head to Aquaforte; Cape Broyle Harbour (southern portion); Brigus South to Cape Neddick.

BY SEA: Most of the coastline can be accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
Portugal Cove South	3-4
Biscay Bay	9
Chance Cove	7
Renews	5-6
Fermeuse Harbour: Admirals Cove	4
Sheeps Head	6-9
Lumley Cove	4-5
Aquaforte	6-15
Ferryland	6-7
Calvert	3-4
Cape Broyle	4-5

- * - Government Wharf
- ** - Private Wharf

BY AIR: The nearest airport is located at St. John's, a distance of 80 kilometers.

Distances Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Marystown		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By s
Biscay Bay	375	180	164	162	147	155
Portugal Cove South	381	183	160	165	131	150
Renews Harbour	396	240	217	225	90	90
Fermeuse Harbour	391	245	212	230	85	85
Aquaforte Harbour	384	250	207	235	78	80
Ferryland	378	252	199	247	72	78
Calvert Bay	374	255	195	240	68	75
Cape Broyle Harbour	368	260	189	245	62	70

Topographic Maps: (1:50,000) 1N/2, 1K/11, 1K/14, 1K/15

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000), 4567 (1:75,000), 4575 (1:25,000), 4576 (1:25,000)

Aerial Photographs: (1:50,000) A19829-L1, 19829-L2, A19829-L3, A19829-L4, A19829-L5, A19829-L6, A19829-L7

SECTION IV OIL SPILL COUNTERMEASURES

Coastal environments which should receive priority in oil spill protection or cleanup strategies are Biscay and Calver Bays; Renewes, Fermeuse, Aquaforte, and Cape Broyle Harbours.

Offshore protection should be considered as the first approach to prevent oil from reaching nearshore areas. Where possible diversion booms could be used to deflect oil away from sensitive shoreline areas to designated collection sites. The use of dispersants in the coastal zone is not recommended.

Onshore protection methods which are feasible in coastal areas include:

- a) ditch/dyke systems - to protect sensitive beach areas where oil might contaminate the backshore zone.
- b) artificial berms - constructed on sand/pebble or pebble/cobble beaches to prevent oil from reaching sensitive backshore areas.
- c) shoreline booms - may be deployed in bays or harbours where tidal currents are less than 0.5 M/Sec. If currents are found to be severe, inlets could be blocked by heavy machinery, providing access is available.
- d) sorbents - useful on coarse sediment beaches when used in conjunction with ditch/dyke systems.

Cleanup methods: The most suitable cleanup methods for shoreline types found in Section IV are listed below:

<u>Shoreline Type</u>	<u>Recommended Cleanup Method(s)</u>
a) Sand/pebble beaches (accessbile)	-For large spills, motorized graders and elevating scrapers are recommended. -For small spills, manual removal is usually effective.
b) Coarse sediment beaches cobble/shingle/boulder	-For large spills the use of heavy machinery such as front end loaders* is feasible. *Note - if large volumes of material are removed, it should be replaced, especially where pocket beaches are concerned. -For small spills, manual removal is recommended. -If cleanup is not necessary, mechanical equipment may accelerate the natural cleaning process by mixing oiled sediments. -Sump collection and pump removal could be feasible where oil is washed ashore over prolonged periods.

c) Backshore areas

-Manual removal is recommended for small spills.
-Flushing with low pressure hoses may also be useful.

d) Inaccessible beaches

-No action is recommended.

e) Rocky shores

-Unless local community activities are affected, no action is recommended.
-Where cleanup is necessary manual removal may be feasible.
-Low pressure flushing can remove oil for collection at adjacent sites.

f) Rocky cliffs

-No action is recommended unless the site is considered sensitive (biologically or for human activities).
-Where cleanup is required, low pressure flushing may be employed.
-If access if available, manual removal could be useful.

g) Marsh/bog

-No cleanup method is considered to be very effective. If cleanup is necessary, manual removal, low pressure flushing or sorbents may be used to keep environmental damage to a minimum.

ENVIRONMENTAL ATLAS
OF
SOUTHEASTERN NEWFOUNDLAND

SECTION V

**Northeastern Avalon
Peninsula**

ENVIRONMENT CANADA

ENVIRONMENTAL PROTECTION SERVICE

ATLANTIC REGION

MARCH 1981

This environmental atlas of southeastern Newfoundland has been prepared by B. McGuire & Associates of Halifax, N.S. for the Marine Environment Branch of the Environmental Protection Service, Atlantic Region. The purpose of this atlas, similar to others in the series, is to supply a document which can be useful in planning for and responding to oil spills along the Atlantic Coast of Canada.

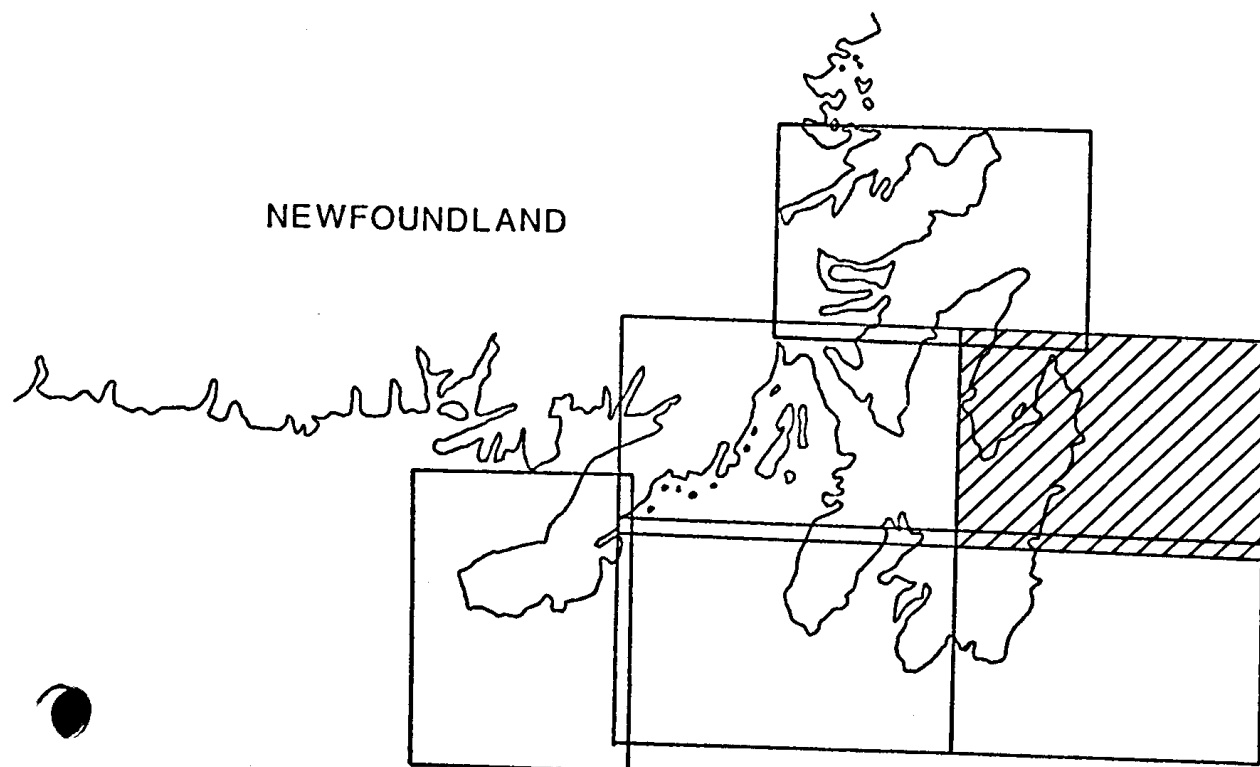
Both physical and biological environmental data have been compiled from literature and unpublished government sources. Where possible, areas considered vulnerable to oil spills have been emphasized.

This atlas also could be useful in the assessment of oil spill contingency plans, the development of operating conditions for offshore petroleum exploration and in the review of ocean dumping applications.

Southeastern Newfoundland has been subdivided into six sections:

- I. Southern Burin Peninsula
- II. Head of Fortune Bay, Placentia Bay (North), Trinity Bay (South)
- III. Southwestern Avalon Peninsula
- IV. Southeastern Avalon Peninsula
- V. Northeastern Avalon Peninsula
- VI. Trinity Bay (North) to Bonavista Bay (South)

These are shown by the sketch map below (the shaded portion indicates the area covered in this section).



Each section of the atlas contains two base maps, one depicting basic shoreline types and the other showing features such as lighthouses, airstrips, and bathymetric contours. A series of transparent acrylic overlays are used to describe biological and physical environmental parameters. In addition, a written section provides information on oil spill countermeasures and cleanup strategies.

The appendix contains monthly wind and visibility data, presented in a series of tables. Information is provided for the following coastal stations: Argentia, St. John's, and Bonavista. Tables listing tidal ranges and fish processing plants are also provided. A list of the references utilized has been included, however, personal communications and observations could not be cited.

The author expresses his appreciation for the cooperation provided by the following groups without whose assistance this report could not have been prepared: Atlantic Oceanographic Laboratory, Atmospheric Environment Service, Canadian Wildlife Service, Fisheries and Marine Service, Lands Directorate, Newfoundland Dept. of Fisheries, Parks Canada, Mobil Oil Ltd.

The scientific support of numerous Environment Canada personnel is also acknowledged. In particular, I would like to thank Mr. R.J. Percy, Mr. A. McIver, Mr. J. Swiss and Mr. J. Clark of E.P.S. as well as Mr. E. Hiscock and Mr. D. Taylor of the Lands Directorate for their help in the preparation of this report.

This project was completed under Dept. of Supply and Services contract #OSC80-00023. Printing costs were funded by Mobil Oil Ltd.

KEY TO OVERLAYS:

A. MARINE MAMMALS

Immature Harp Seals (March to May).....	◇ ◇
Feeding Area For Whales (Summer).....	+ + +
Overwintering Area For Pilot Whales.....	x x x x x x

B. AVIFAUNA

Seabird Breeding Colony (May to September).....	*
Potential Migratory Waterfowl Stop-over Site (Spring & Fall).....	
Overwintering Habitat For Eiders.....	□ □ □ □ □ □
Large Pelagic Seabird Concentrations:	
Spring.....	~~SPG~~
Summer.....	~~SMA~~
Winter.....	~~WTR~~

C. FISHERIES

Major Commerical Species - Primary Fishing Areas:

NOTE - Lobsters are harvested in coastal waters throughout southeastern Newfoundland to depths of about 40 m.

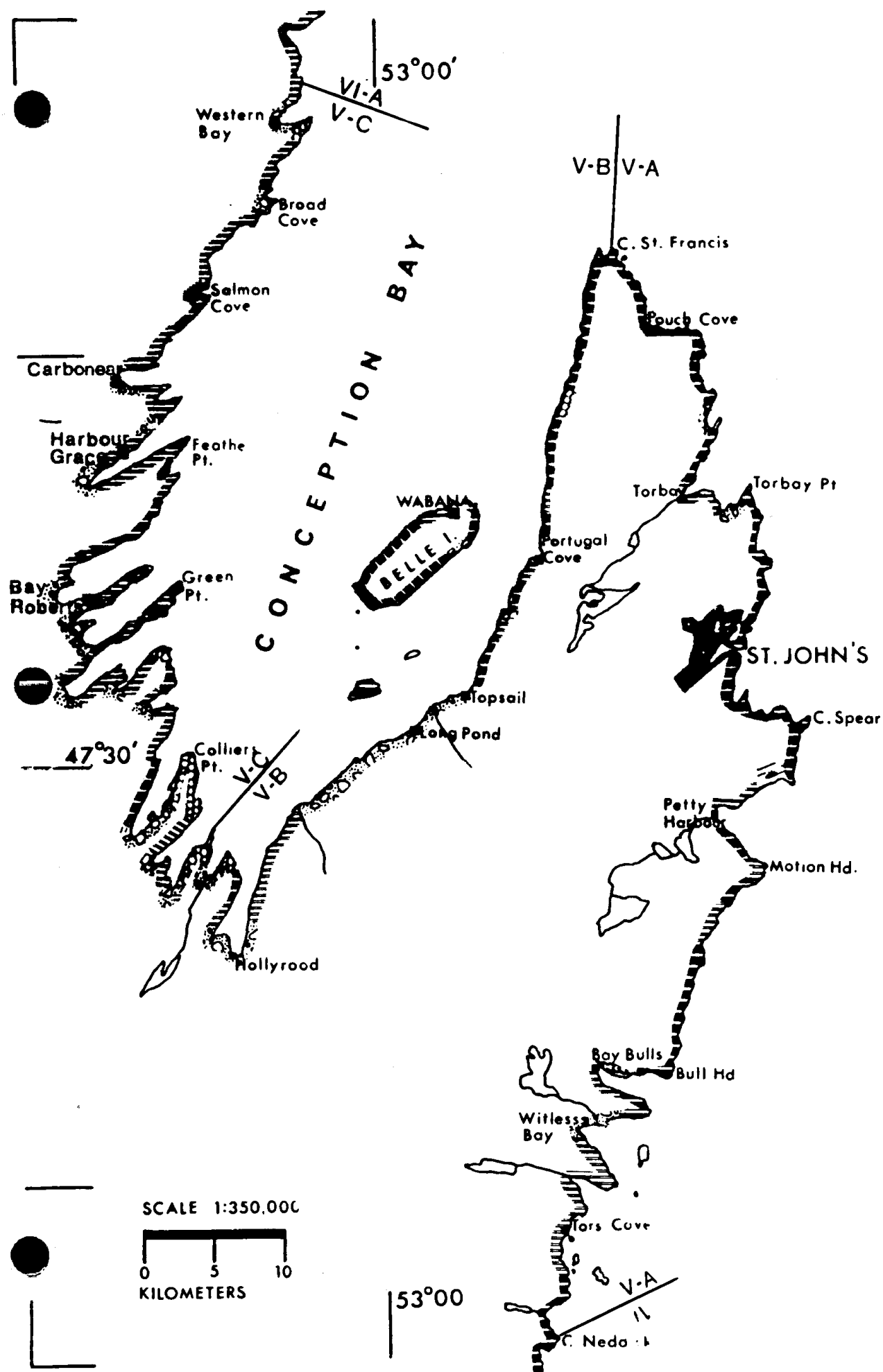
Cod.....	C
Haddock.....	D
Red Fish.....	R
American Plaice.....	P
Herring.....	H
Mackerel.....	M
Turbot.....	T
Snow Crabs.....	└┐└┐
Generalized Migration Routes - Adults (Spring & Summer)	◀
for Atlantic Salmon - Smolts (Fall)	▶
Scallops (Intermittent Beds).....	○ ○ ○
Pink Shrimp (Summer).....	▲ ▲ ▲
Spiny Dogfish (Summer).....	✕ ✕ ✕
Squid (Summer) - variable.....	◆ ◆
Irish Moss Harvesting (Potential).....	■ ■
Capelin Spawning Concentrations (May-July).....	● ● ●
Overwintering Site For Capelin.....	● ●
Herring Spawning (Spring).....	□ □
American Plaice Spawning (Spring).....	▽ ▽ ▽
Salmon Spawning Stream (Summer).....	S
Eels.....	e
Smelts.....	m
Tuna - Sport Fishing (Summer).....	N
Fixed Fishing Gear (Trap or Net) - Primary Locations	†††
Fish Processing Plant.....	F
Trout Farming.....	▣

D. OCEANOGRAPHY

Residual Surface Currents..... (Indicates net movement of water only)	→
Sea Surface Temperature (°C):	
Spring.....	— ■ —
Summer.....	— — —
Fall.....	— ● —
Winter.....	— — —
Mean Concentration of Sea Ice (Winter):	
10/10.....	▢ ▢ ▢
> 5/10.....	▢ ▢

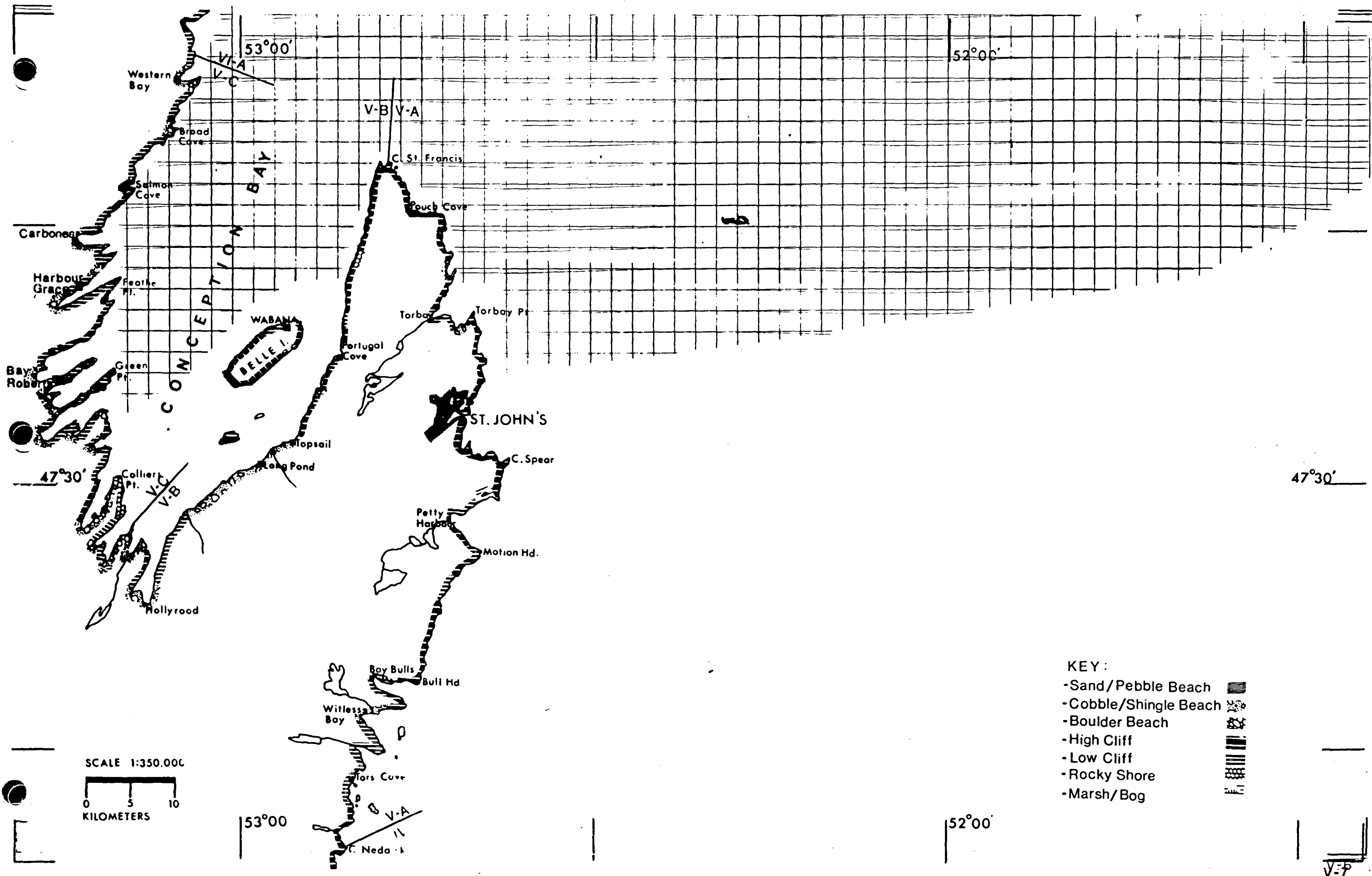
E. MISCELLANEOUS

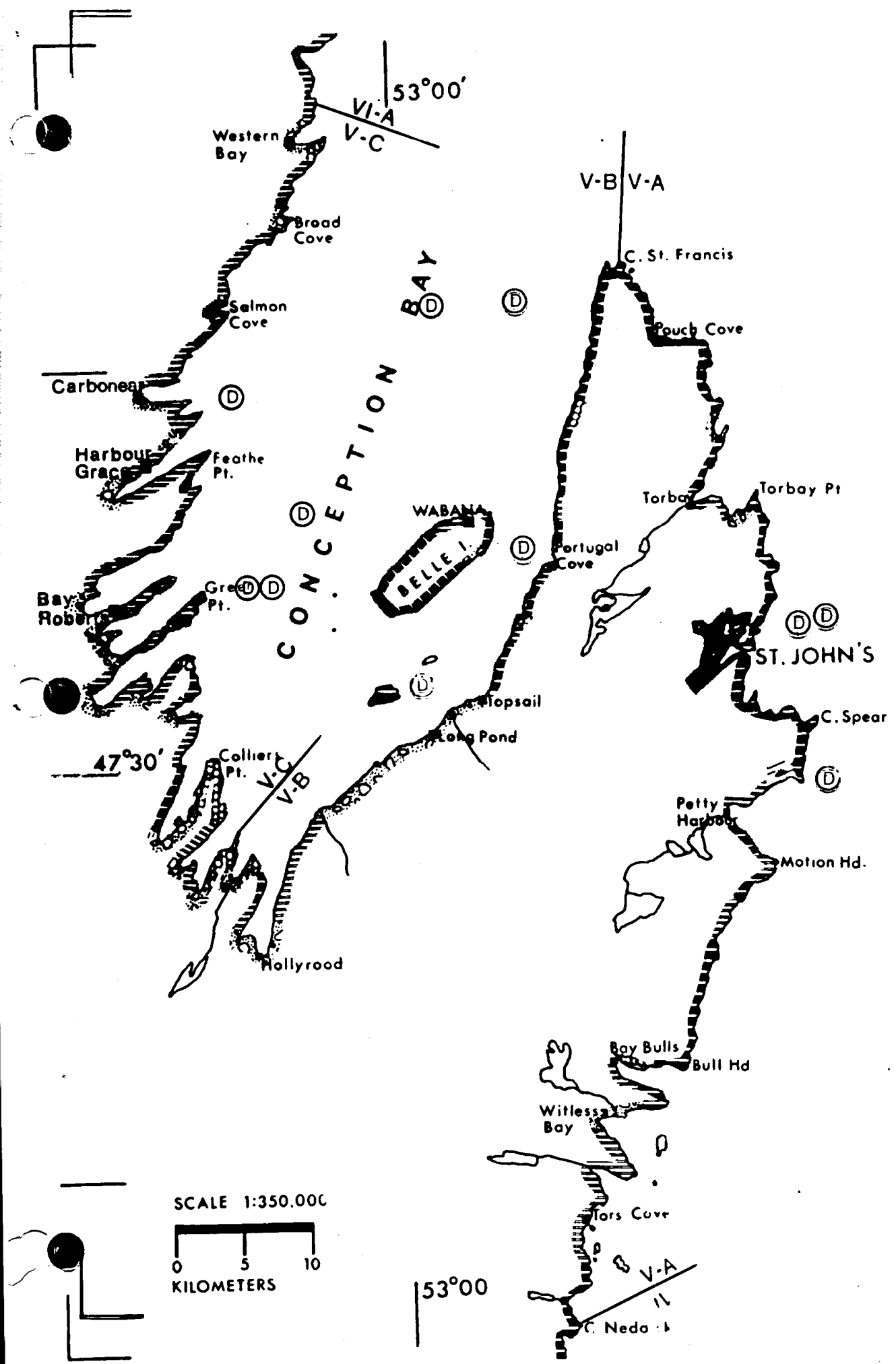
International Biological Programme Site.....	☆
Dredging Disposal Sites.....	Ⓢ
Provincial Park.....	▲
Public Beach	★



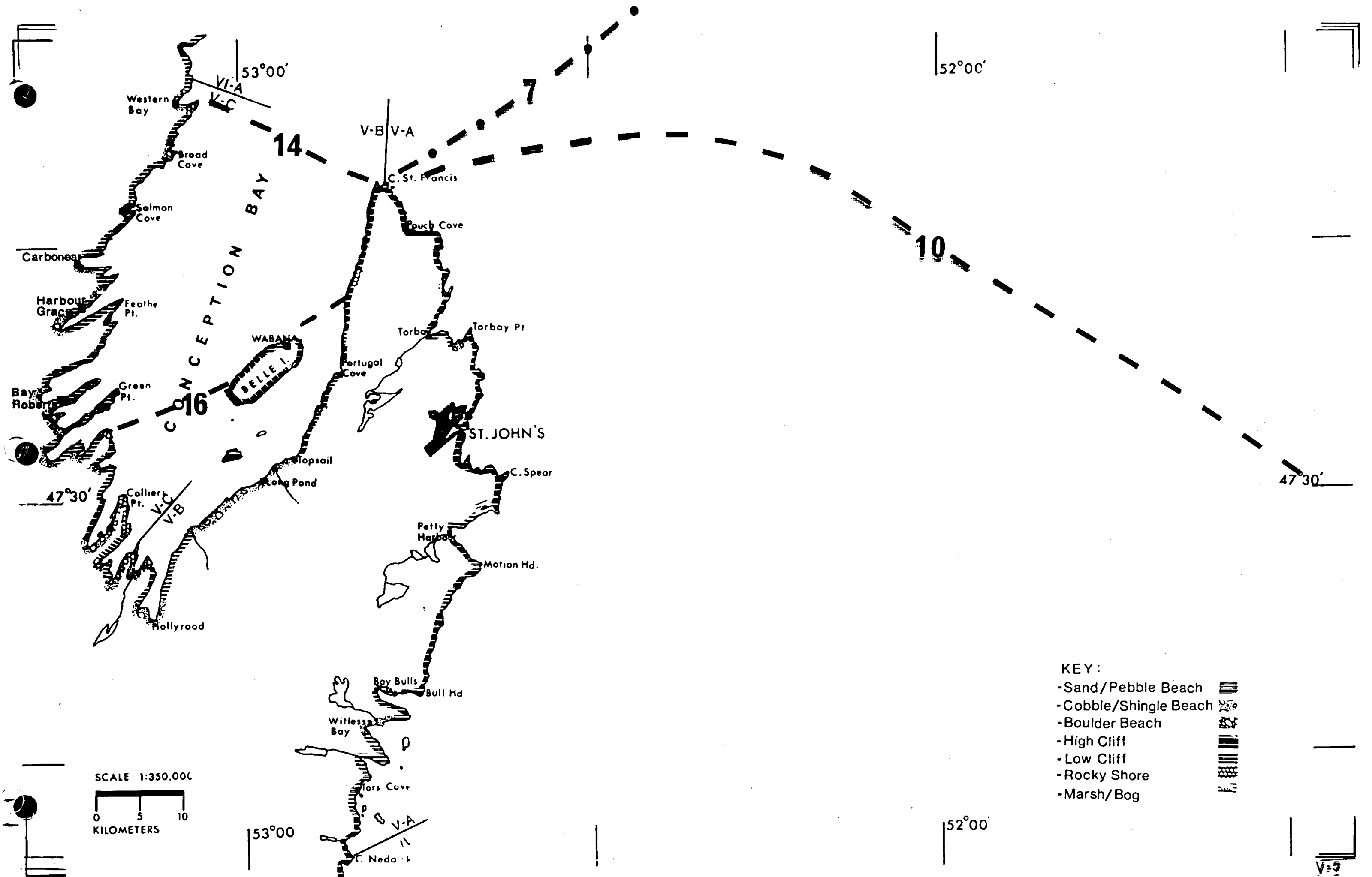
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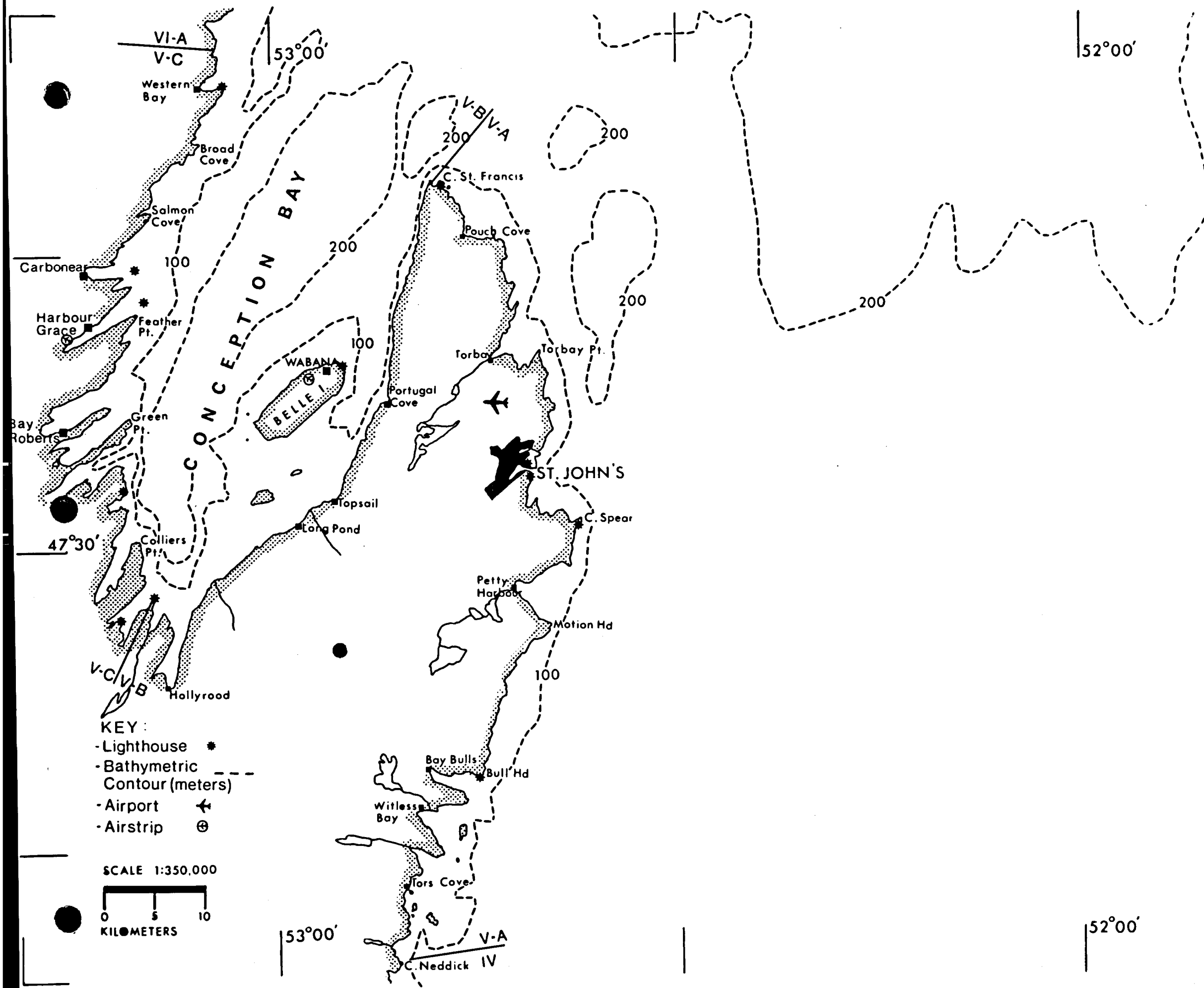
- Sand/Pebble Beach
- Cobble/Shingle Beach
- Boulder Beach
- High Cliff
- Low Cliff
- Rocky Shore
- Marsh/Bog



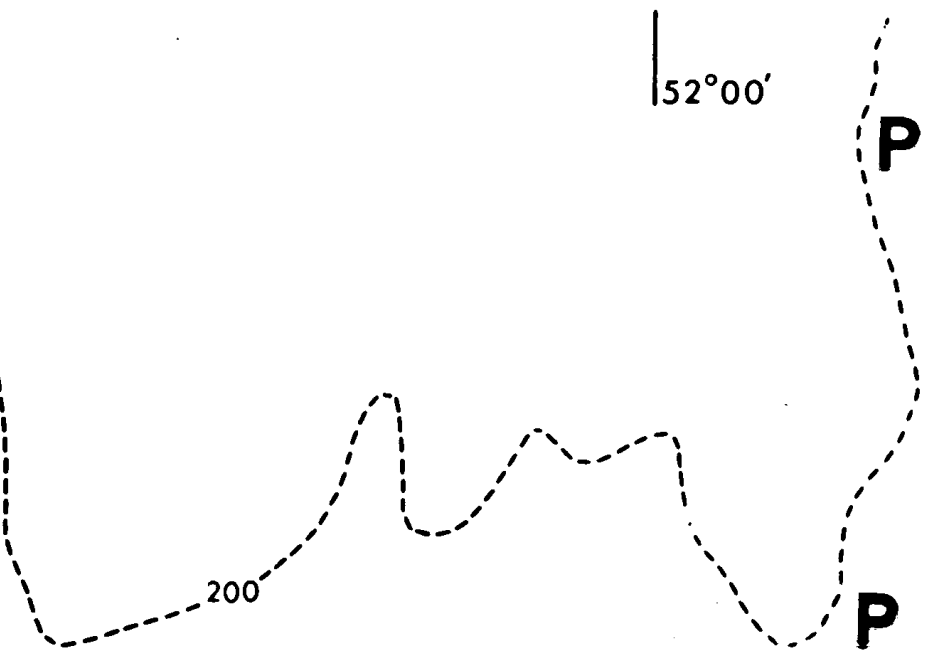
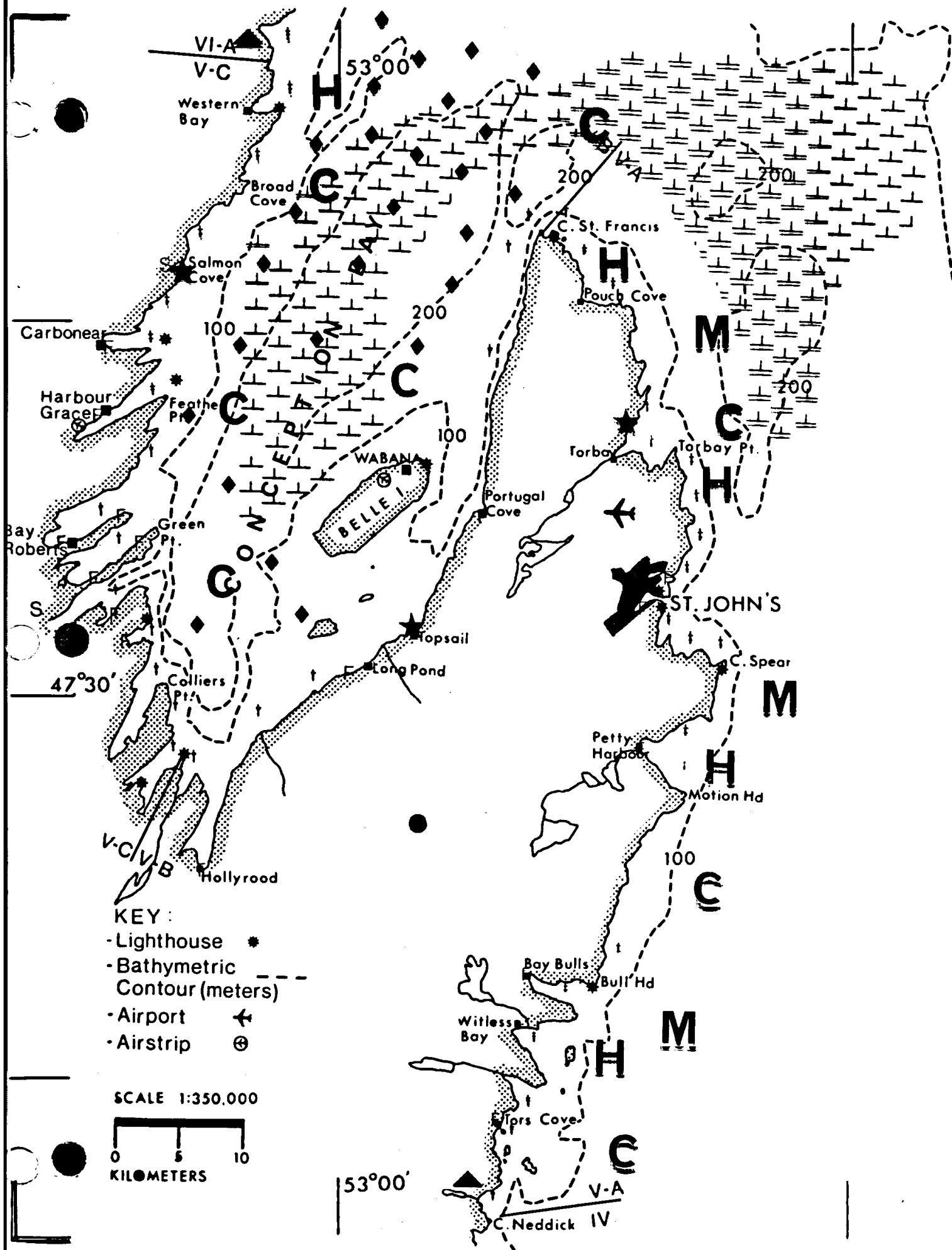


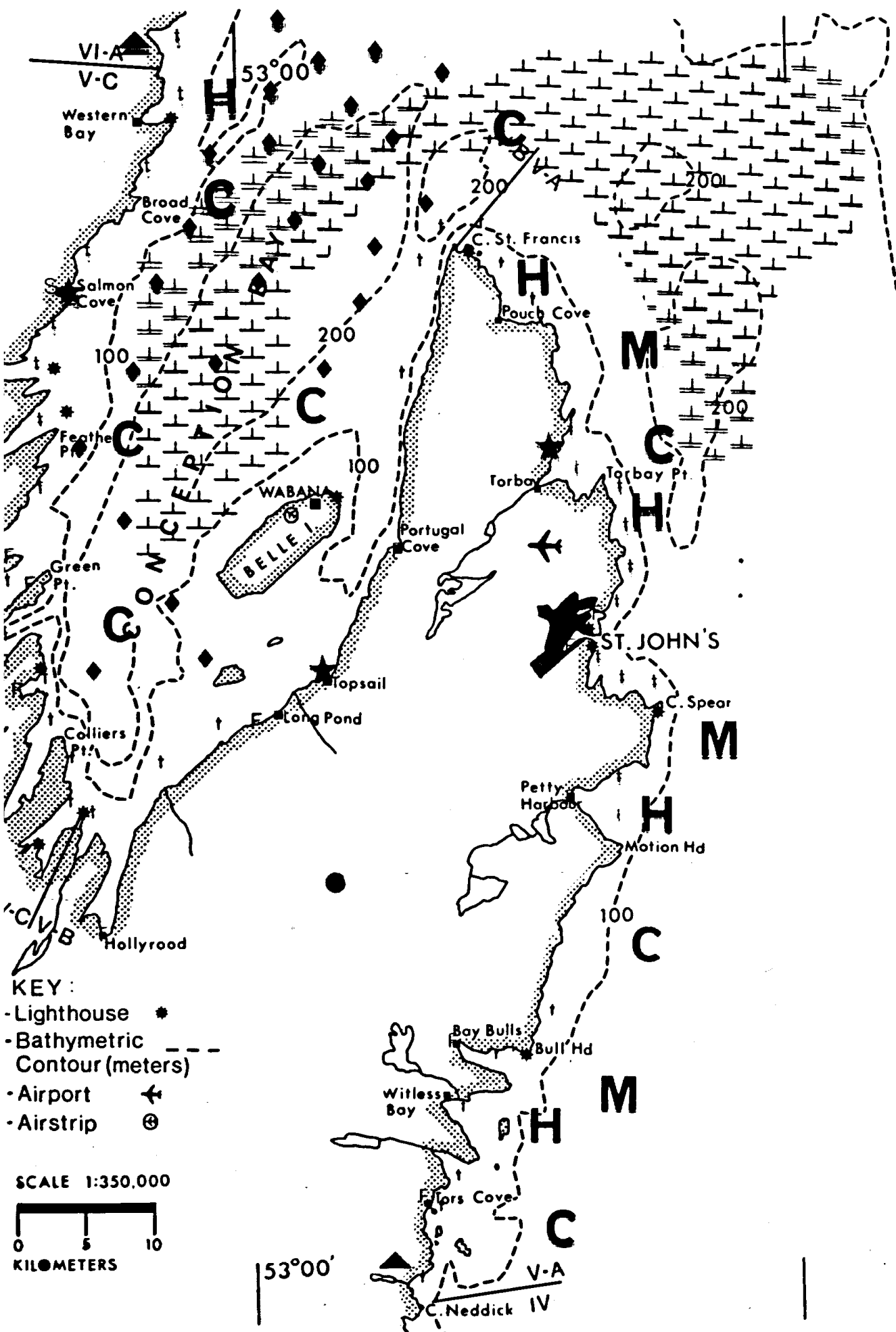
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 - Cobble/Shingle Beach
 - Boulder Beach
 - High Cliff
 - Low Cliff
 - Rocky Shore
 - Marsh/Bog





47°30'



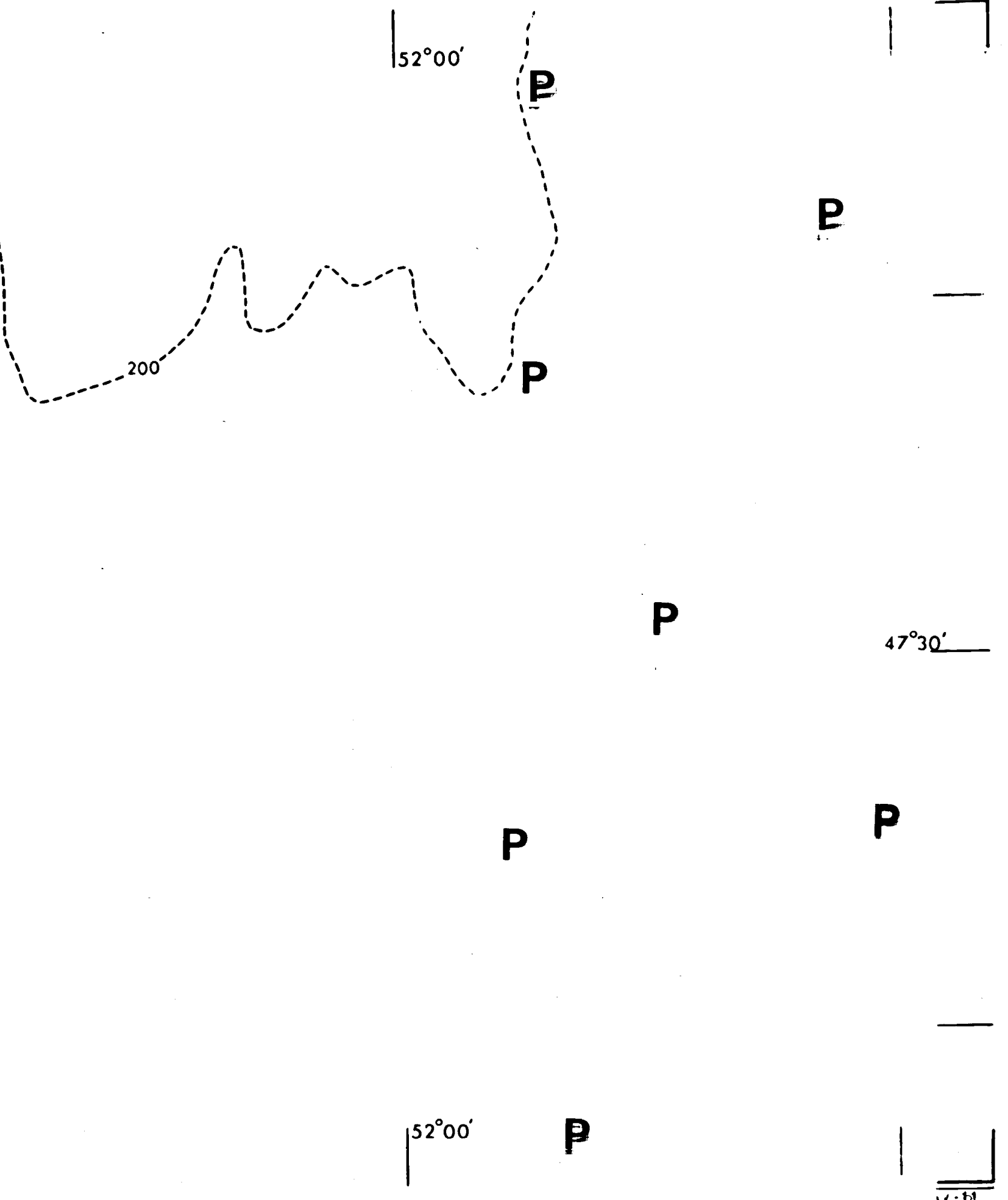


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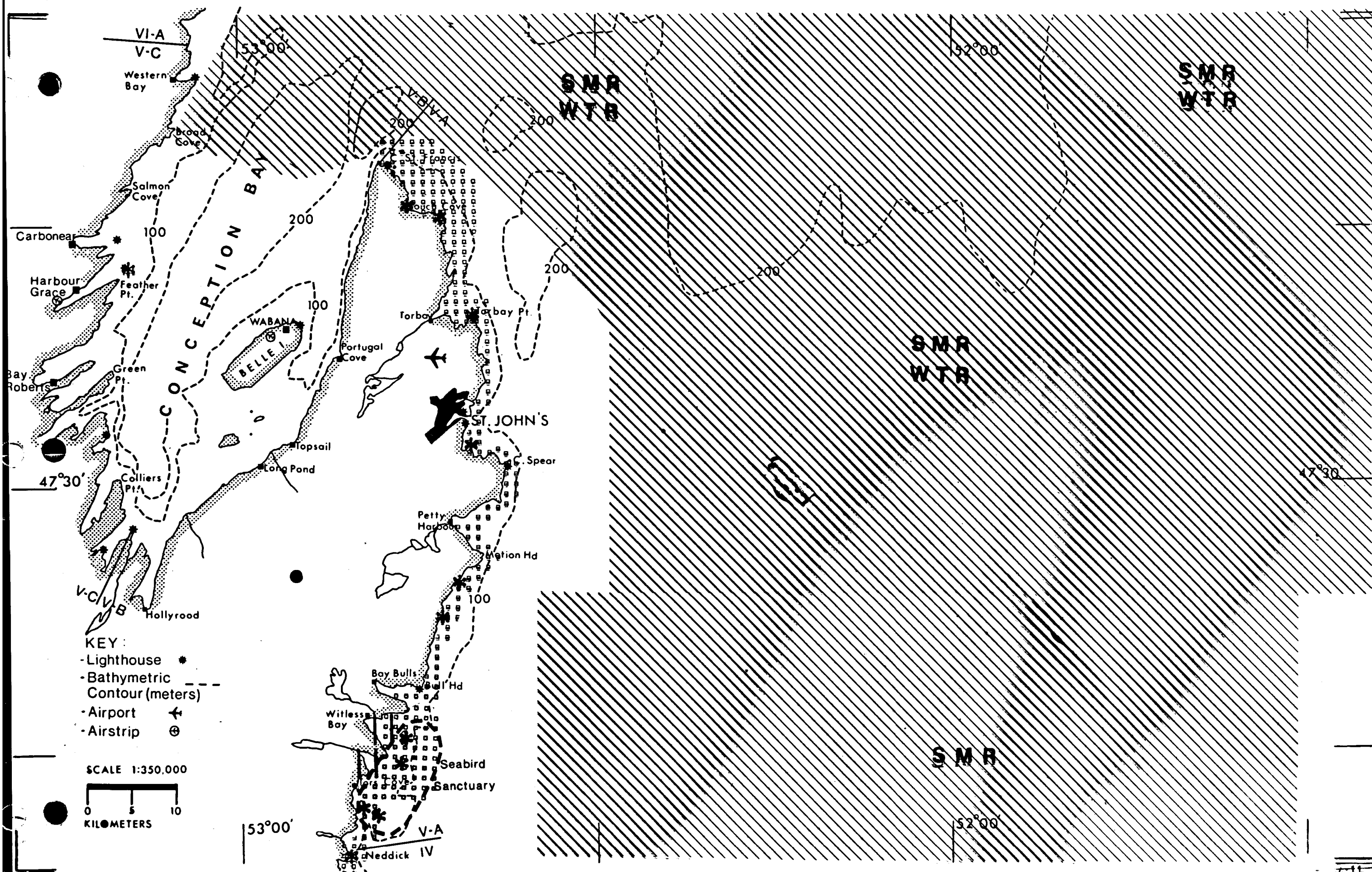
- Lighthouse *
- Bathymetric Contour (meters) ---
- Airport ✈
- Airstrip ⊕

SCALE 1:350,000

0 5 10
KILOMETERS



Y: 8'



SECTION V (A) Cape Neddick to Cape St. Frances

Description: The region consists of a rounded upland plateau, with glacial troughs, rocky sea cliffs and rugged headlands. Pocket beaches (pebble/cobble or cobble/boulder) can be found in most bays and inlets. Wave energy is high along this coastline. In winter, local harbours are frozen only for short periods of time (i.e there is no permanent winter freeze). Sea ice can usually be found in the coastal zone during March and April. In spring, icebergs occasionally may drift into coastal waters. Total length of shoreline is 115 kilometers. Bedrock Geology - Slate, siltstone, greywacke, arkose, conglomerate. Substrate - Rock, boulder, gravel, sand.

Width of Major Bays/Inlets - at narrowest point (meters)

Mobile Bay	1000
Witless Bay (Inner)	600
Bay Bulls (Inner)	400
Bay Bulls (outer)	2000
Motion Bay (Petty Harbour)	100
St. John's Harbour (Narrows)	60
Tor Bay Bight	550
Flat Rock Cove	500
Pouch Cove	1000

Accessibility:

BY LAND: From Cape Neddick north to St. John's, the coastal zone can only be accessed by Tors Cove, Mobile, Witless Bay, Bay Bulls, Petty Harbour, Cape Spear and St. John's. The coast can also be accessed at La Manche, Bauline East and St. Michaels. From St. John's north to Cape Francis, most of the shoreline can be land accessed. The only areas that cannot be reached are Signal Hill to Logy Bay and Small Point to Pouch Cove.

BY SEA: The coastal zone is readily accessible by boat. Suitable small boat harbours are located at:

	Depth (meters)
Tors Cove**	4-5
Witless Bay*	3-15
Bay Bulls*	2-22
Petty Harbour**	5-22
St. John's*	11
Torbay*	1-2

* - Government Wharf

** - Private Wharf

BY AIR: The major airport is located five kilometers north of St. John's.

Distance Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Marystown		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
LaManche	357	277	178	252	54	56
Tors Cove	348	281	169	256	45	52
Mobile	345	285	166	260	42	48
Witless Bay	341	287	162	262	38	45

Bay Bulls	341	292	162	267	35	40
Petty Harbour	329	310	154	285	23	22
St. John's	306	330	131	305	-	-
Tor Bay	316	345	141	320	10	18
Flat Rock Cove	322	347	147	322	16	20
Pouch Cove	328	357	153	332	22	30

Topographic Maps: (1:50,000) 1N/2, 1N/7, 1N/10, 1N/15.

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000), 4567 (1:75,000), 4586 (1:12,000), 4574 (1:37,500), 4565 (1:75,000), 4588 (1:3,000).

Aerial Photographs: (1:50,000) A19829-L8, A19829-L9, A19829-L10, A19835-L11, A19835-L12, A19836-L13, A19836-L14, A19836-L15, A19838-L16, A19838-L17.

SECTION V (B) Cape St. Francis to Harbour Main - including Bell I.

Description: The region is comprised of an upland plateau with a relatively smooth and regular shoreline. Rocky sea cliffs, local pebble/cobble and cobble/boulder beaches are common. Wave energy is moderately high on this coastline. In winter, the coastal zone is covered with sea ice when N.W. winds push the ice floes close to shore. This usually occurs from mid-January to early March. Total length of shoreline is 109 kilometers. Bedrock Geology - Volcanics, slate, shale with limestone, greywacke, sandstone, hematite. Substrate - Rock, boulders, cobbles, gravel.

Width of Major Bays/Inlets - at narrowest point (meters)

Portugal Cove	400
Long Pond	50
Topsail	10
Holyrood Bay (Outer)	1100
Holyrood Bay (South Arm)	1050

Accessibility:

BY LAND: From Portugal Cove to Harbour Main most of the coastal zone is accessible by means of a highway which runs parallel to the coast. The shoreline from Portugal Cove to Cape St. Francis is only accessible at Bauline. On Bell Island, a paved road circles the island.

BY SEA: At most location the coastline can be accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
Portugal Cove**	5-7
Long Pond*	2-4
The Beach (Bell I)*	2-5
Kelligrews**	1-2
Holyrood**	9-32
Chapel Cove*	2-4
Harbour Main*	5-22

* - Government Wharf

** - Private wharf

A frequent ferry service operates daily between Bell Island and Portugal Cove.

BY AIR: The main airport is located at St. John's (a distance of about 20 kilometers). There is an abandoned airstrip on Bell Island.

Distances Between Potential Cleanup Sites and Major Resource Centers
Distance (kilometers)

	Marystown		Argentia		St. John's	
	By Land	By Sea	ByL	By S	By L	By S
Bauline	325	380	150	355	22	50
Portugal Cove	310	388	135	363	12	58
Topsail	296	398	121	373	16	68
Long Pond	293	402	118	377	19	72
Indian Pond	280	412	105	387	32	82
Holyrood	268	420	93	395	49	90
Chapel Cove	274	415	101	390	57	85
Harbour Main	272	418	99	393	55	88
Wabana (Bell I)	313*	390	138*	365	15*	60

* - Via Ferry

Topographic Maps:(1:50,000) 1N/6, 1/N10, 1N/11

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000) 4574
(1:37,500), 4590 (1:14,600), 4581 (1:2,400)
4573 (1:15,000).

Aerial Photographs: (1:50,000) A19835-L12, A19836-L13, A19836-L14,
A19836-L15, A19838-L16, A19838-L17.

SECTION V (C) Harbour Main to Western Bay (Conception Bay)

Description: This region consists of an irregular ria-plain with several narrow headlands and steep rocky cliffs. Long embayments contain localized pebble/cobble or cobble/boulder beaches. Wave energy is moderate on this coastline. Local bays and inlets normally freeze in winter. Broken patches of ice are generally present from mid-January to early March.

Total length of shoreline is 168 kilometers.

Bedrock Geology - Slate, siltstone, greywacke, volcanics

Substrate - Large outcrops, boulders, gravel, sand.

Width of Major Bays/Inlets - at narrowest point (meters)

Gasters Bay (Inner)	200
Gasters Bay (Outer)	1300
Conception Harbour	250
Colliers Bay (Inner)	800
Colliers Bay (Outer)	1600
Brigus Bay	700
Cupids Cove	300
Bay de Grave	1600
Bay Roberts	1700
Bay Roberts Harbour	700
Spaniards Bay	1900

Harbour Grace	1300
Bistols Hope Cove	650
Carbonear Bay	1400
Salmon Cove	400
Western Bay	1300

Accessibility:

BY LAND: Nearly all of the coast can be accessed by land. Shoreline areas which cannot be reached by road include Seal Head, Brigus to Cupids, Western Bay Head.

BY SEA: Most coastal sites can be accessed by boat. Suitable small boat harbours are listed below:

	Depth (meters)
Avondale*	1-2
Conception*	3-13
Colliers*	4-5
Brigus*	5-7
Salmon Cove*	1-2
Cupids*	2-3
Bareneed*	3-6
Port de Grave*	3-4
Hibbs Hole**	1-2
Back Cove**	2-3
Ship Cove**	7-8
Coley's Point *	3-4
Bay Roberts *	6-7
North Cove (Spaniard's Bay)*	4-5
Spoon Cove*	2-3
Upper Island Cove*	2-3
Bryants Cove*	1-2
Harbour Grace*	4-6
Harbour Grace Southside*	2-4
Bistol's Hope Cove**	.3
Carbonear*	5-6
Freshwater Cove**	2-3
Blackhead**	1-2
Ochre Pit Cove**	4-5
Western Bay**	1-2

* - Government Wharf

** - Private Wharf

BY AIR: The nearest airport is located at St. John's, a distance of 40 kilometers. There is an abandoned airstrip at Harbour Grace.

Distance Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Marystown		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Gasters Bay	246	418	71	393	70	88
Colliers Bay	252	420	77	395	76	90
Brigus Bay	260	412	85	387	84	82
Bay de Grave	264	415	89	390	88	85
Bay Roberts	269	417	94	392	93	87
Spaniard's Bay	272	419	97	394	96	89
Bryants Cove	282	400	107	375	106	70
Harbour Grace	279	405	104	380	103	75
Carbonear Bay	285	402	110	377	109	72
Salmon Cove	295	395	120	370	119	65
Western Bay	310	390	135	365	134	60

Topographic Maps: (1:50,000) 1N/12, 1N/13.

Hydrographic Charts: 4016 (1:350,000), 4017 (1:350,000), 4573 (1:15,000), 4572 (1:25,000), 4590 (1:14,600), 4565 (1:75,000).

Aerial Photographs: (1:50,000) A19835-L12, A19836-L13, A19836-L14, A19836-L15, A19838-L16, A19838-L17, A19834-L18.

SECTION V OIL SPILL COUNTERMEASURES

Coastal environments which should receive priority in oil spill protection and cleanup strategies include the numerous embayments indenting the western half of Conception Bay as well as several harbours located between Cape St. Francis and Cape Neddick (i.e. Torbay, St. John's, Petty Harbour, Bay Bulls, Witless Bay).

Offshore protection should be considered as the first approach to prevent oil from reaching nearshore areas. Where possible, diversion booms could be employed to deflect oil away from sensitive areas to designated collection sites. The use of dispersants in the coastal zone is not recommended.

Onshore protection methods which may be used in coastal regions include:

- a) ditch/dyke systems- used in preventing oil from reaching sensitive backshore areas such as lagoons.
- b) artificial berms - constructed on sand/pebble or pebble/cobble beaches to prohibit oil from being washed onto the backshore zone.
- c) shoreline booms - if tidal currents are less than 0.5 M/Sec. booms may be effective in sealing certain inlets. Where currents are too strong, heavy machinery may be employed to block the inlet (providing access is available).
- d) sorbents - can be useful on coarse sediment beaches if used in conjunction with ditch/dyke systems.

Cleanup methods: The recommended methods for shoreline types located within Section V are listed:

<u>Shoreline Type</u>	<u>Recommended Cleanup Method(s)</u>
a) Sand/pebble beaches (accessible)	-For large spills, motorized graders and elevating scrapers are recommended. -For small spills, manual removal is effective.
b) Coarse sediment beaches (cobble/shingle,boulder)	-For large spills, heavy machinery such as front end loaders may be used to remove oiled sediments* *Note - Replacement of large volumes of sediment is strongly recommended - especially if pocket beaches are affected. -Where wave energy is high, mechanical equipment may be used to mix oiled sediments and thus accelerate natural degradation. -Sump collection and pump removal have proven to be effective on beaches where oil is washed ashore over a prolonged period.
c) Backshore areas	-For small spills, manual removal is recommended. -Flushing with low pressure hoses may also be effective.
d) Inaccessible beaches	-No action is recommended.
e) Rocky shores (outcrops)	-Unless local communities are affected, no action is required. -Where cleanup is determined as necessary, manual removal may be applied. -Low pressure flushing can remove oil for collection at designated sites.
f) High cliffs	-No action is recommended unless the site is considered sensitive (biologically or for human activities). -If cleanup is required, low pressure flushing may remove oil to adjacent collection areas. -Providing access is available, manual removal may be feasible.
g) Marsh/bog	-Although no cleanup method is considered to be effective, manual removal, sorbents or low pressure flushing may be used to mitigate environmental damage.
h) Intertidal mud/sand	-No cleanup is advisable unless biologically important site is threatened. -Manual removal or light machinery may be used with caution.

ENVIRONMENTAL ATLAS
OF
SOUTHEASTERN NEWFOUNDLAND

SECTION VI

Trinity Bay (North) to
Bonavista Bay (South)

ENVIRONMENT CANADA

ENVIRONMENTAL PROTECTION SERVICE

ATLANTIC REGION

MARCH 1981

This environmental atlas of southeastern Newfoundland has been prepared by B. McGuire & Associates of Halifax, N.S. for the Marine Environment Branch of the Environmental Protection Service, Atlantic Region. The purpose of this atlas, similar to others in the series, is to supply a document which can be useful in planning for and responding to oil spills along the Atlantic Coast of Canada.

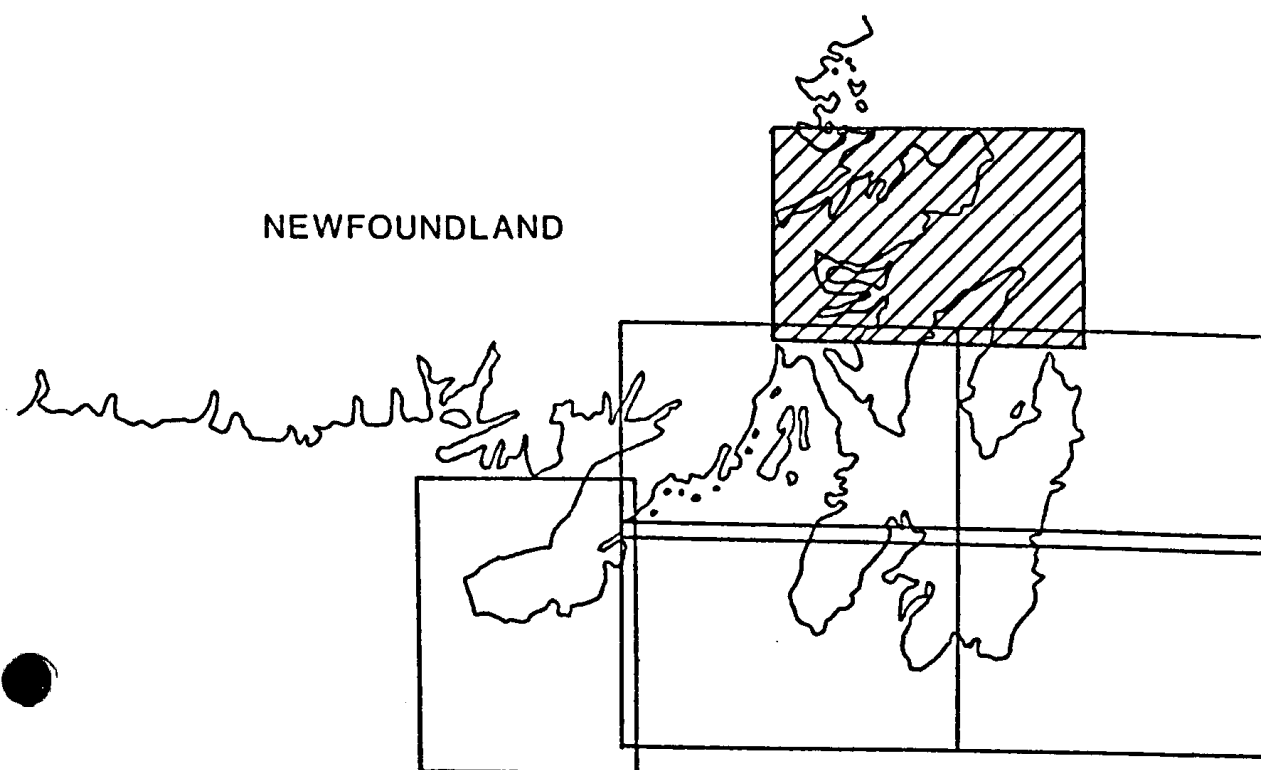
Both physical and biological environmental data have been compiled from literature and unpublished government sources. Where possible, areas considered vulnerable to oil spills have been emphasized.

This atlas also could be useful in the assessment of oil spill contingency plans, the development of operating conditions for offshore petroleum exploration and in the review of ocean dumping applications.

Southeastern Newfoundland has been subdivided into six sections:

- I. Southern Burin Peninsula
- II. Head of Fortune Bay, Placentia Bay (North), Trinity Bay (South)
- III. Southwestern Avalon Peninsula
- IV. Southeastern Avalon Peninsula
- V. Northeastern Avalon Peninsula
- VI. Trinity Bay (North) to Bonavista Bay (South)

These are shown by the sketch map below (the shaded portion indicates the area covered in this section).



Each section of the atlas contains two base maps, one depicting basic shoreline types and the other showing features such as lighthouses, airstrips, and bathymetric contours. A series of transparent acrylic overlays are used to describe biological and physical environmental parameters. In addition, a written section provides information on oil spill countermeasures and cleanup strategies.

The appendix contains monthly wind and visibility data, presented in a series of tables. Information is provided for the following coastal stations: Argentia, St. John's, and Bonavista. Tables listing tidal ranges and fish processing plants are also provided. A list of the references utilized has been included, however, personal communications and observations could not be cited.

The author expresses his appreciation for the cooperation provided by the following groups without whose assistance this report could not have been prepared: Atlantic Oceanographic Laboratory, Atmospheric Environment Service, Canadian Wildlife Service, Fisheries and Marine Service, Lands Directorate, Newfoundland Dept. of Fisheries, Parks Canada, Mobil Oil Ltd.

The scientific support of numerous Environment Canada personnel is also acknowledged. In particular, I would like to thank Mr. R.J. Percy, Mr. A. McIver, Mr. J. Swiss and Mr. J. Clark of E.P.S. as well as Mr. E. Hiscock and Mr. D. Taylor of the Lands Directorate for their help in the preparation of this report.

This project was completed under Dept. of Supply and Services contract #OSC80-00023. Printing costs were funded by Mobil Oil Ltd.

KEY TO OVERLAYS:

A. MARINE MAMMALS

Immature Harp Seals (March to May).....	◇ ◇
Feeding Area For Whales (Summer).....	+ + +
Overwintering Area For Pilot Whales.....	x x x

B. AVIFAUNA

Seabird Breeding Colony (May to September).....	*
Potential Migratory Waterfowl Stop-over Site (Spring & Fall).....	
Overwintering Habitat For Eiders.....	□ □ □ □
Large Pelagic Seabird Concentrations:	
Spring.....	SRG
Summer.....	SMR
Winter.....	WTR

C. FISHERIES

Major Commerical Species - Primary Fishing Areas:

NOTE - Lobsters are harvested in coastal waters throughout southeastern Newfoundland to depths of about 40 m.

Cod.....	C
Haddock.....	D
Red Fish.....	R
American Plaice.....	P
Herring.....	H
Mackerel.....	M
Turbot.....	T
Snow Crabs.....	⊥ ⊥
Generalized Migration Routes - Adults (Spring & Summer)	←
for Atlantic Salmon - Smolts (Fall)	→
Scallops (Intermittent Beds).....	○ ○ ○
Pink Shrimp (Summer).....	▲ ▲ ▲
Spiny Dogfish (Summer).....	× ×
Squid (Summer) - variable.....	◆ ◆
Irish Moss Harvesting (Potential).....	■ ■
Capelin Spawning Concentrations (May-July).....	● ● ● ●
Overwintering Site For Capelin.....	● ●
Herring Spawning (Spring).....	□ □
American Plaice Spawning (Spring).....	▽ ▽ ▽
Salmon Spawning Stream (Summer).....	S
Eels.....	e
Smelts.....	m
Tuna - Sport Fishing (Summer).....	N
Fixed Fishing Gear (Trap or Net) - Primary Locations	†††
Fish Processing Plant.....	F
Trout Farming.....	▣

D. OCEANOGRAPHY

Residual Surface Currents..... →
(Indicates net movement of water only)

Sea Surface Temperature (°C):

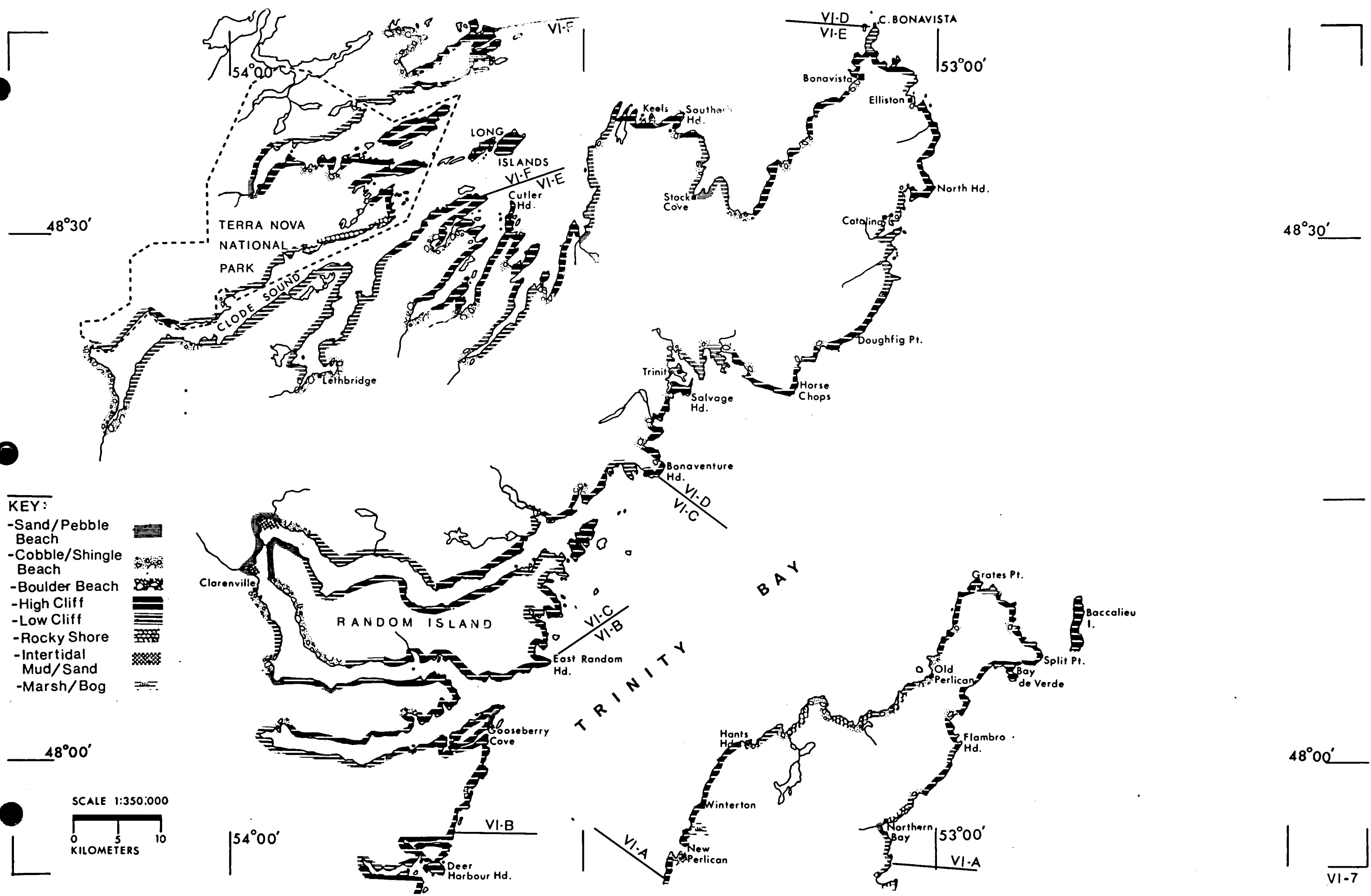
Spring.....	— ■ —
Summer.....	— — —
Fall.....	— ● —
Winter.....	— —

Mean Concentration of Sea Ice (Winter):

10/10.....	
> 5/10.....	

E. MISCELLANEOUS

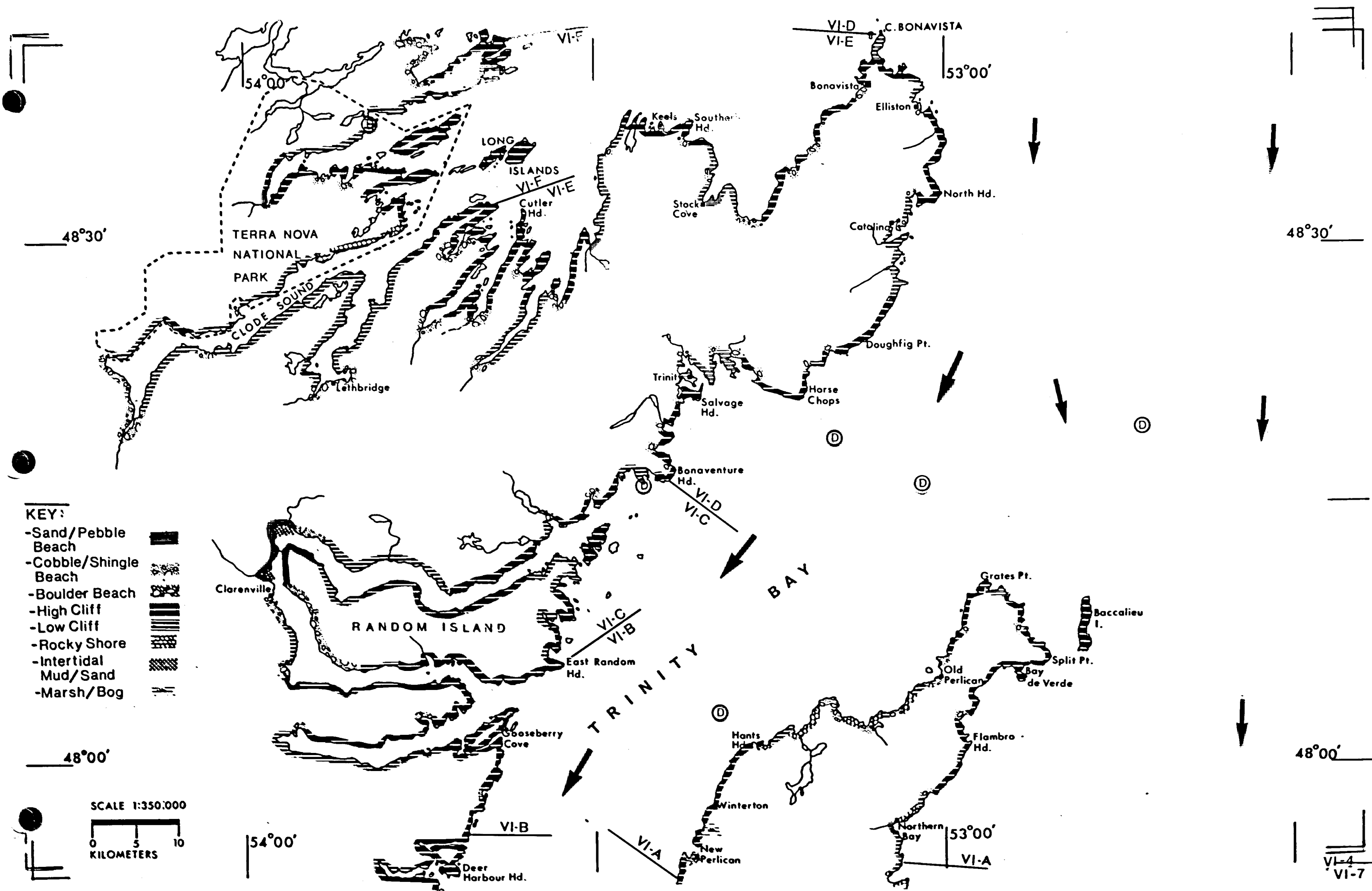
International Biological Programme Site.....	☆
Dredging Disposal Sites.....	⊙
Provincial Park.....	▲
Public Beach	★

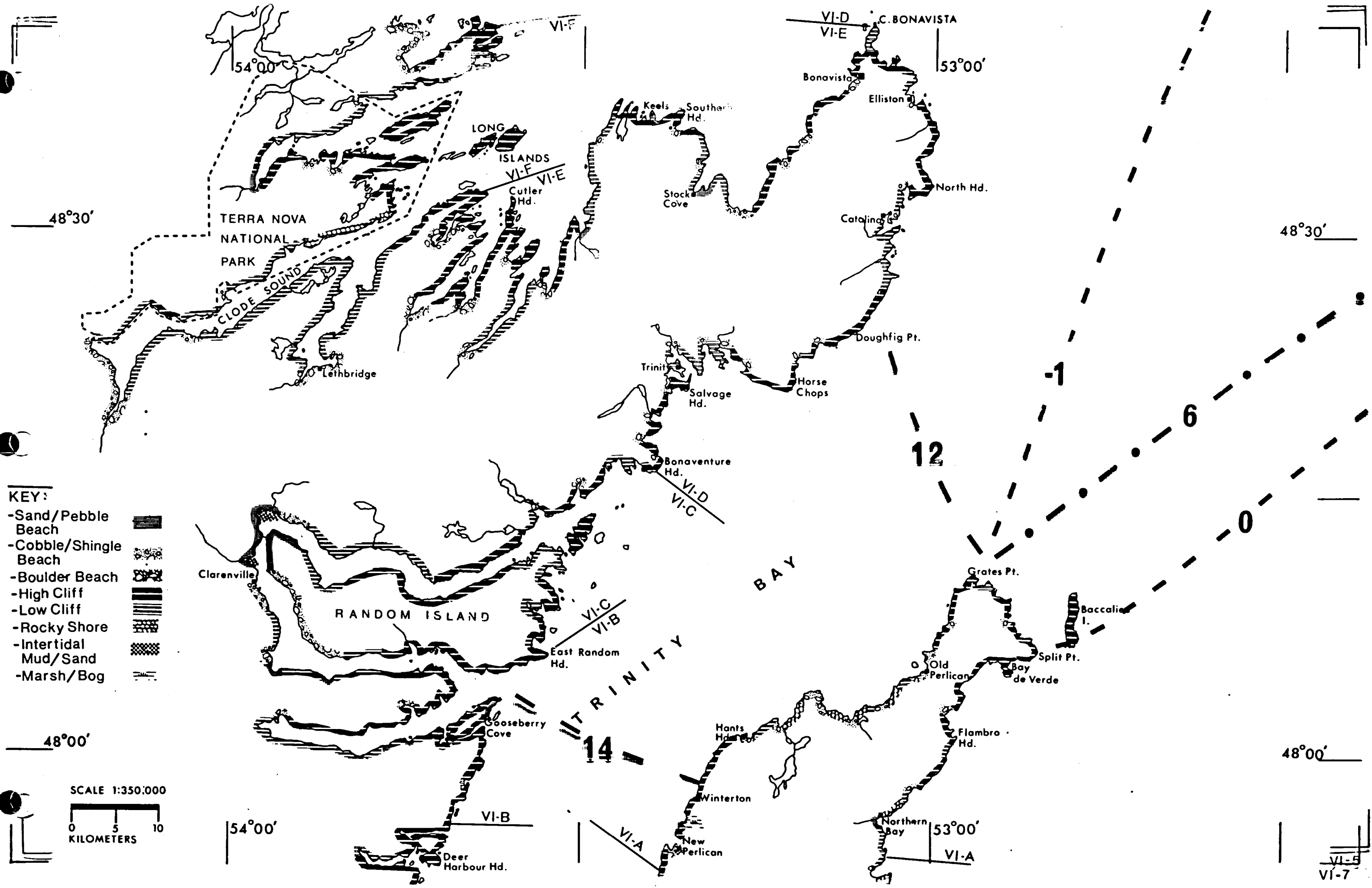


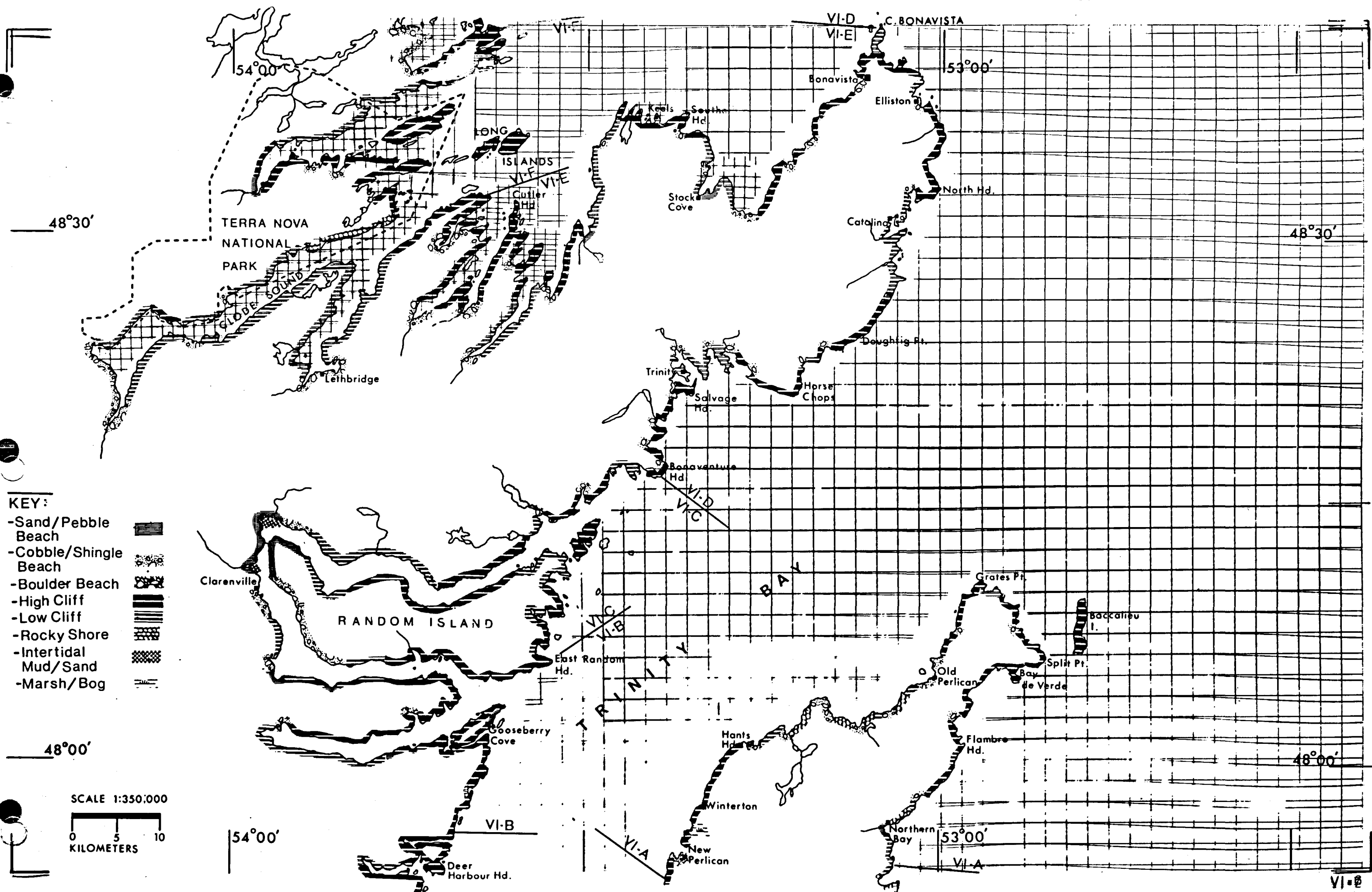
- KEY:**
- Sand/Pebble Beach
 - Cobble/Shingle Beach
 - Boulder Beach
 - High Cliff
 - Low Cliff
 - Rocky Shore
 - Intertidal Mud/Sand
 - Marsh/Bog

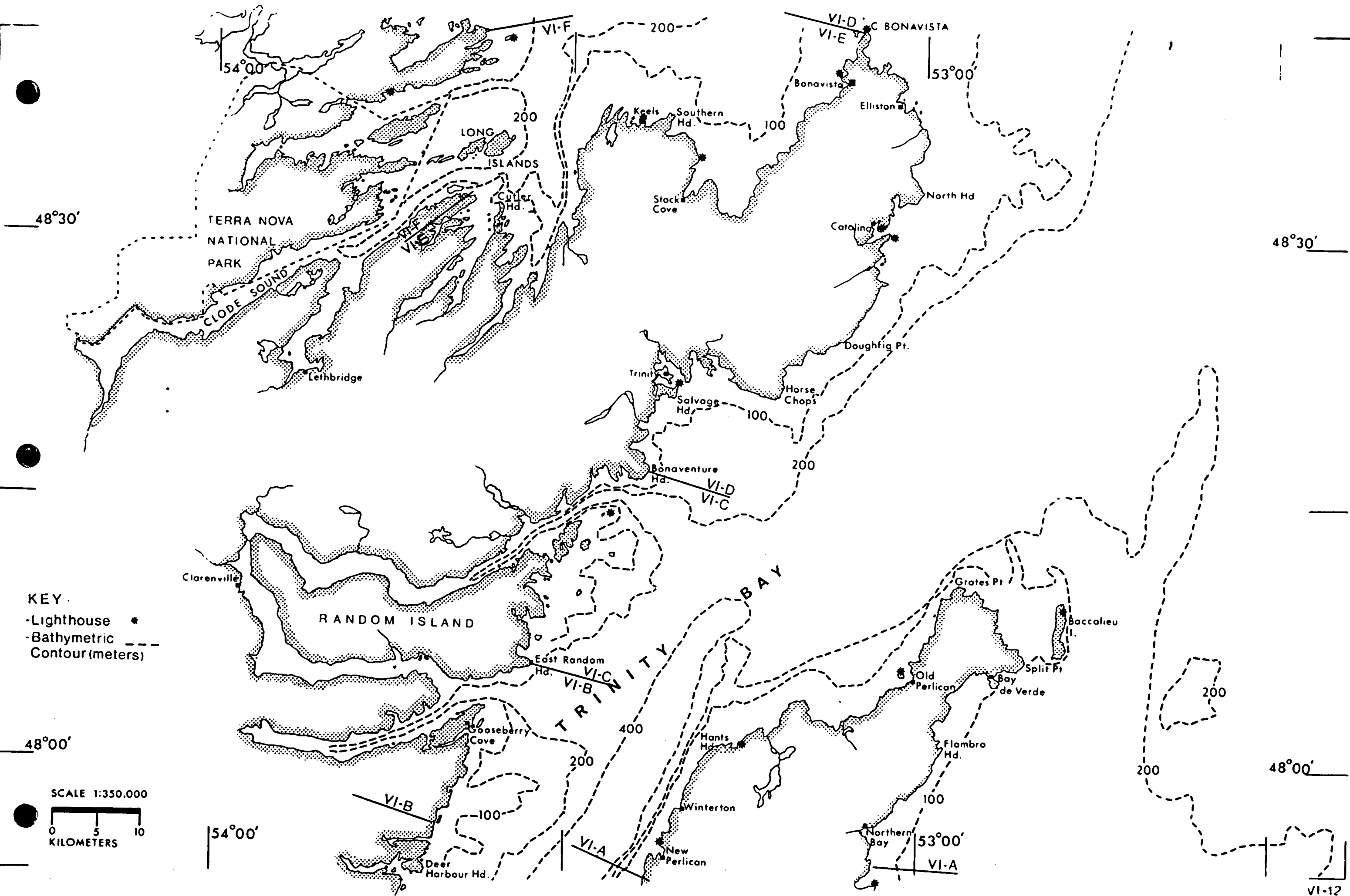
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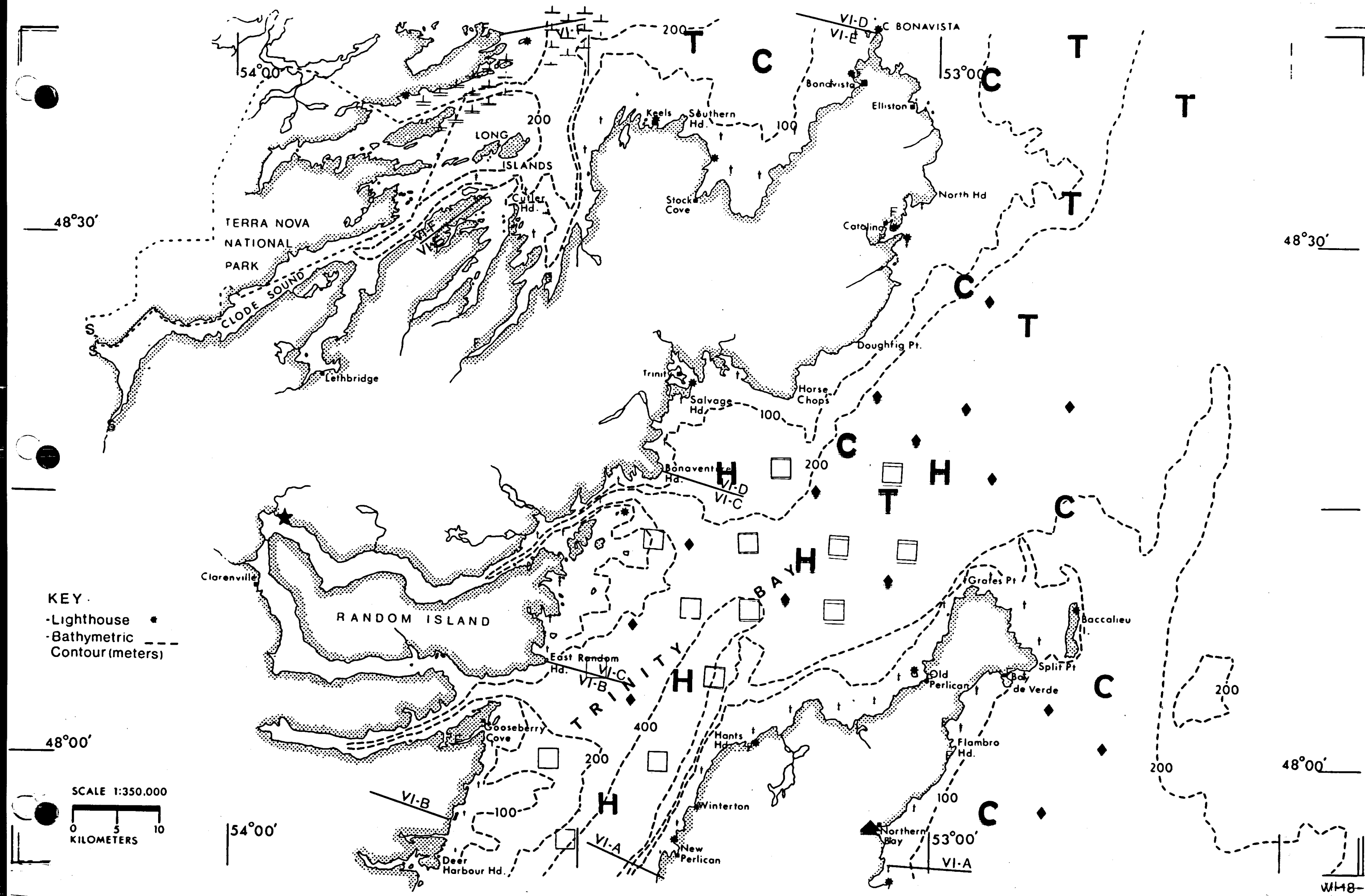
0 5 10
KILOMETERS





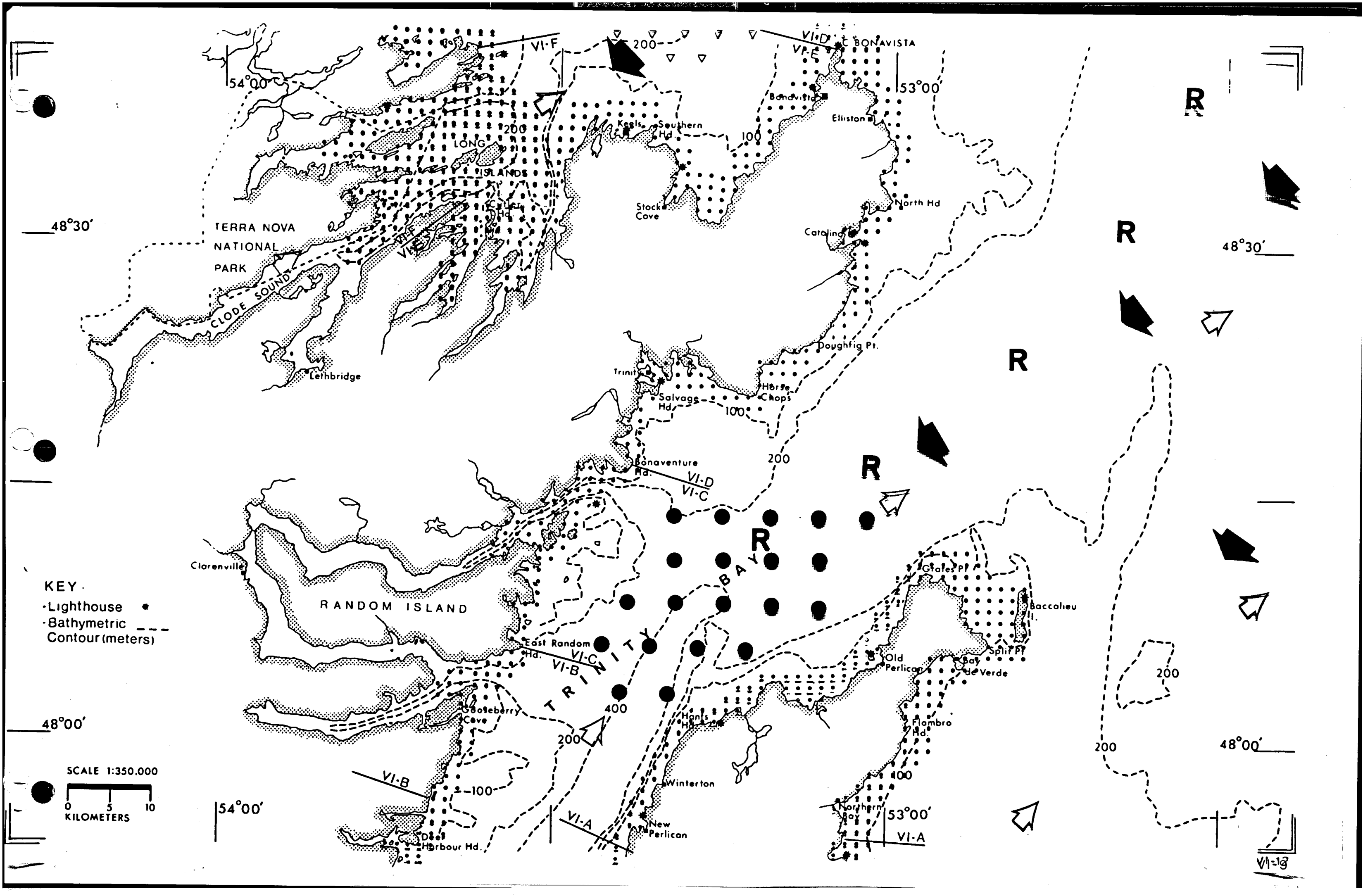


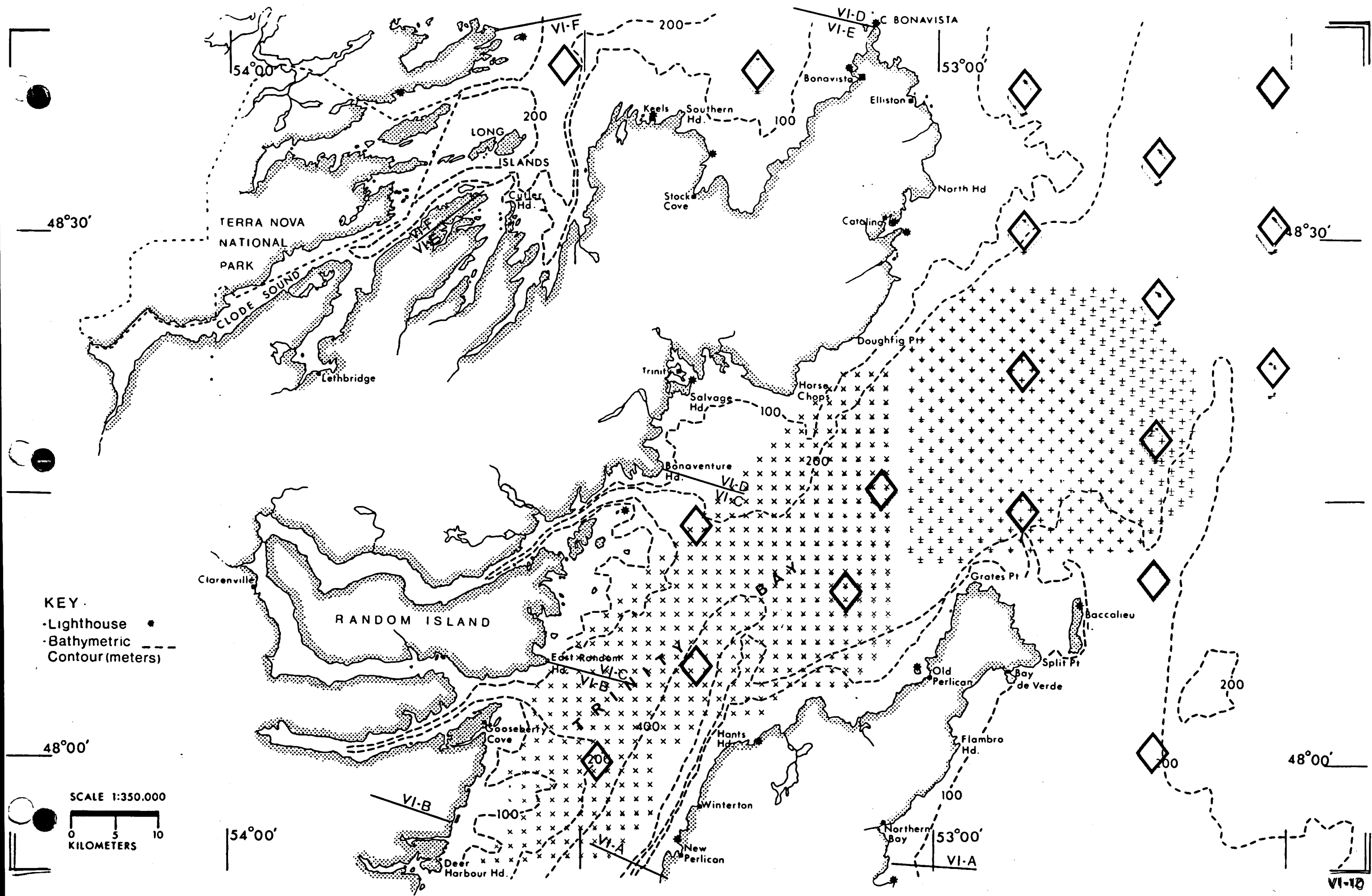




KEY
-Lighthouse •
-Bathymetric Contour (meters) ---

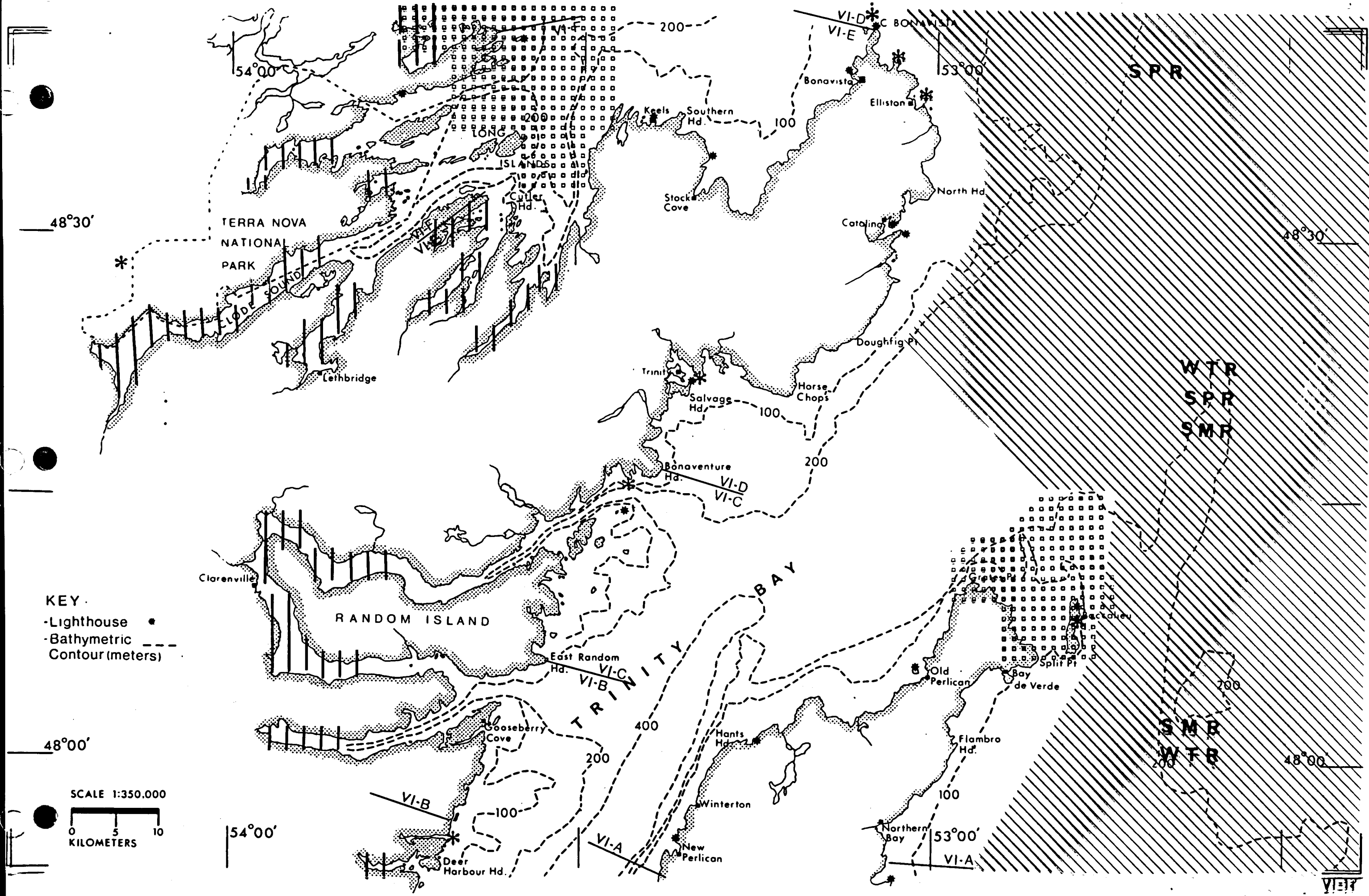
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0 5 10
KILOMETERS





KEY
• Lighthouse
- Bathymetric
--- Contour (meters)

SCALE 1:350,000
0 5 10
KILOMETERS



KEY
-Lighthouse •
-Bathymetric ---
Contour (meters)

SCALE 1:350,000
0 5 10
KILOMETERS

SECTION VI (A) Western Bay to Hearts Content (Bay de Verde Peninsula)

Description: This shore zone consists of an upland plateau as well as a discontinuous coastal plain. The region is characterized by many rocky sea cliffs. However, relatively few beaches are located here. Wave energy is high along this coastline. In winter, most of the coastal zone remains unfrozen. From February to April, patches of sea ice are common. Total length of the shoreline is 143 kilometers. Bedrock Geology - Siltstone, arkose, conglomerate, slate. Substrate - Rock, boulders, outcrops, local sand & gravel.

Width of Major Bays/Inlets - at narrowest point (meters)

Northern Bay	900
Capelin Cove	700
Bay de Verde (town)	250
Red Cove Head	650
Grates Cove	500
Old Perlican	1000
Brownsdale Cove	550
New Chelsea Cove	300
Hants Harbour	300
Winterton Cove	400
New Perlican (Bloody Pt.)	400

Accessibility:

BY LAND: Highways (#70 and #80) provide good access to most coastal areas. Regions which cannot be easily reached by road include: Red Head Cove to Bay de Verde (9 kilometers); Hants Harbour to Winterton (9 kilometers); Low Point to Bay de Verde (7 kilometers) and Red Head Cove to Grates Cove (8 kilometers).

BY SEA: There are no difficulties in accessing the coast by boat. Suitable small boat harbours are located at:

Depth (meters)

Burnt Island**	1-2
Burnt Pt.**	1-2
Job's Cove**	1-2
Lower Island Cove *	1-2
Bay de Verde*	6-7
Red Head Cove**	1-2
Grates Cove*	1-2
Old Perlican*	2-3
Sibleys Cove*	3-4
Hants Harbour*	8-9
Winterton Cove*	3-4
New Perlican *	3-4

* - Government Wharf
** - Private Wharf

BY AIR: The nearest airport is located at St. John's, a distance of 75 kilometers.

Distances Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Marystown		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Northern Bay	303	395	129	370	148	65
Caplin Cove	320	400	146	375	165	70
Bay de Verde	336	405	162	380	181	75
Baccalieu Island	N/A	408	N/A	383	N/A	78
Grates Cove	340	420	166	395	185	90
Brownsdale Cove	310	440	135	415	161	110
New Chelsea	301	445	126	420	152	115
Hants Harbour	298	448	123	423	149	118
Winterton	290	460	115	435	141	130

N/A - Not Accessible

Topographic Maps:(1:50,000) 1N/14, 2C/2, 2C/3.

Hydrographic Charts: 4017 (1:350,000), 4565 (1:75,000), 4563 (1:75,000), 4577 (1:18,000).

Aerial Photographs: (1:50,000) A19834-L18, A19834-L19, A19834-L20 A19835-L21, A19835-L22.

SECTION VI (B) Deer Harbour Head to East Random Head
Trinity Bay

Description: The region consists of a discontinuous coastal plain with many steep rocky cliffs. Bays and inlets contain sand/pebble or cobble/pebble beaches. Wave energy varies from high in headland areas (Bonaventure Head, East Random Head, Deer Harbour Head) to low in the major inlets (Southwest Arm - Random Sound and Northwest Arm - Random Sound). Most coastal inlets remain frozen in winter. Sea ice is present in the region from February to april. Total length of shoreline is 195 kilometers. Bedrock Geology - Siltstone, arkose, conglomerate, slate, volcanics, shales with limestone. Substrate - Boulders, cobble, sand, mud, some outcrops.

Width of Major Bays/Inlets - at narrowest point (meters)

St. Jones Harbour (Entrance)	300
Round Harbour	150
Hearts Ease Inlet (Entrance)	600
Southwest Arm - Fox Harbour	300
Little Hearts Ease Hbr.	200
Hodges Cove	800
Northwest Brook	150
Hatchet Cove	200
St. John's Within Hbr.	400
Fords Harbour	300
Northwest Arm - Black Duck Cove	250
Deep Bight	300
Shoal Harbour	500
Hickman's Harbour	600

Accessibility:

BY LAND: Most of the shore zone within South West Arm is accessible via two gravel roads. These connect several coastal communities to the Trans Canada Highway (#1). The southern portion of North West Arm is accessible from Deep Bight to Clarenville, while the northern shore of North west Arm can be reached by land as far as Hickman's Harbour. The major regions which cannot be accessed by land are: Deer Harbour to Goosebury Cove (35 kilometers), Adeytown to St. Jone Within (30 kilometers), Hickmans Harbour to East Random Head (17 kilometers).

BY SEA: Most of the coastal zone is easily accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
St. Jones Harbour	7-16
Goosebury Cove*	5-6
Long Beach*	4
Hatchet Cove*	2-3
St. Jones Within Harbour*	4
Hodges Cove*	2-3
Little Hearts Ease Harbour*	3-4
Southport*	4-7
Clarenville*	5-6
Weybridge**	1-2
Lady Cove*	5-6
Hickman's Cove*	6-7

* - Government Wharf

** - Private Wharf

BY AIR: The nearest airport is located at St. John's (a distance of 120 kilometers). Gander International Airport is about 150 kilometers from the region.

Distance Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Clarenville		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
St. Jones Harbour	N/A	50	N/A	465	N/A	170
Gooseberry Cove	45	40	159	450	199	155
Little Hearts Ease	41	35	155	455	195	160
Northwest Brook	18	50	129	475	169	180
St. Jones Within	30	35	143	460	183	165
Adeytown	12	10	137	480	177	185
Clarenville	-	-	149	487	189	192
Shoal Harbour	3	3	151	490	191	195
Hickmans Harbour	32	25	184	470	224	175

N/A - Not Accessible

Topographic Maps: (1:50,000) 1N/13, 2C/4

Hydrographic Charts: 4017 (1:350,000), 4544 (1:25,000) 4545 (1:36,000), 4546 (1:36,000), 4578 (1:12,000)

Aerial Photographs: (1:50,000) A19834-L19, A19835-L20, A19835-L21, A19835-L22.

SECTION VI (C) East Random Head to Bonaventure Head

Description: The coastal zone consists primarily of a discontinuous coastal plain with numerous rocky cliffs. Most bays or inlets are characterized by cobble/pebble and/or pebble/sand pocket beaches. Wave energy varies greatly on this coast line ranging from high in the vicinity of Bonaventure Head to low in Smith Sound. Most bays and inlets are ice-covered in winter. Sea ice is common in the area from February to April.

Total length of shoreline is 156 kilometers.

Bedrock Geology - Slate, siltstone, shales with limestone.

Substrate - Scattered boulders, localized sand, mud, some outcrops.

Width of Major Bays/Inlets - at narrowest point (meters)

Random Head Harbour	900
Deer Harbour	100
Little Harbour	300
Smith Sound - Lower Lance Cove	500
Snooks Harbour	250
Flowers Cove	300
Popes Harbour	500
British Harbour	200
Ireland's Eye Harbour	50
Kealeys Harbour	200
New Bonaventure	500
Old Bonaventure	300

Accessibility:

BY LAND: The southern portion of Smith Sound is accessible by road, only at the following locations: Snooks Harbour to Aspey Brook (5 kilometers) Britannia to Aspen Cove (3 kilometers), Britannia to Lance Cove Head (2 kilometers). On the Northern Shore of Smith Sound, the coast line can be accessed from Georges Brook to New Burnt Cove (28 kilometers). A gravel road proceeds southward from Trinity, connecting the towns of Old Bonaventure, New Bonaventure and Kerleys Harbour (18 kilometers). Major portions of the coastline not land accessible are: East Random Head to Lance Cove Head (56 kilometers); Aspen Cove to Aspey Brook (8 kilometers); New Burnt Cove to Kerleys Harbour (28 kilometers).

BY SEA: Nearly all coastal areas can be accessed by boat. Suitable small boat harbours are located at:

	Depth (meters)
Deer Harbour*	5-6
Lance Cove Head*	5-6
Britannia*	3-4
Petley*	3-4
Aspen Cove*	3-4
Burgoyne's Cove*	2-3
Clifton*	2-3
Snooks Harbour*	2-18
Aspey Brook**	1-2
Milton*	1-4
Little Harbour (Popes Harbour)*	2-3
Popes Harbour	7-9
British Harbour*	1-4

New Bonaventure Harbour* 3-4
Old Bonaventure Harbour* 1-2

* - Government Wharf
** - Private Wharf

BY AIR: The nearest airports are located at St. John's (120 kilometers) and Gander (140 kilometers).

Distance Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Clarenville		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Deer Harbour	N/A	48	N/A	440	N/A	145
Britannia	32	25	189	452	229	157
Snooks Harbour	18	15	165	465	205	170
Georges Brook	8	6	159	473	199	178
Clifton	28	22	187	455	227	160
Popes Harbour	N/A	40	N/A	445	N/A	150
New Bonaventure	74	60	236	435	276	140
Old Bonaventure	76	62	238	435	278	140
Irelands Eye	N/A	50	N/A	440	N/A	145

N/A - Not Accessible

Topographic Maps: (1:50,000) 2C/3, 2C/4, 2C/5, 2C/6.

Hydrographic Charts: 4017 (1,350,000) 4545 (1:36,000),
4546 (1:36,000).

Aerial Photographs: (1:50,000) A19835-L22, A19835-L23, A19835-L24

SECTION VI (D) Bonaventure Head to Cape Bonavista

Description: The morphology of the region consists of an upland plateau with moderate to low cliffs. The coast is indented with several wide inlets, most of these contain cobble/shingle pocket beaches. Wave energy is high on this coastline. Local bays and inlets freeze in winter. Sea ice is usually present in the coastal zone from February to April.
Total length of shoreline is 132 kilometers.
Bedrock Geology - Siltstone, arkose, conglomerate, slate, volcanics.
Substrate - Sand, boulders, outcrops.

Width of Major Bays/Inlets - at narrowest point (meters)

Trouty Cove	600
Southwest Arm (Trinity)	300
West Arm	100
Northwest Arm	550
Cap Cove	250
Robinhood Bay	400
Champney's Cove	450
English Bay	1100
Melrose Harbour	500
Catalina Harbour (Entrance)	700

Little Catalina Harbour	500
Elliston Cove	400
Spillars Cove	300
Lance Cove	200

Accessibility:

BY LAND: Between New Bonaventure and English Harbour, most of the coast can be reached by gravel roads, which are connected to the main highway (#230). The highway then proceeds northeast to Catalina and continues north to Bonavista. The towns of Little Catalina, Maberly, Elliston, Lancaster, Lance Cove, Spillars Cove can also be accessed by gravel roads. The major coastal areas which are not accessible by land are: Horse Chops to Melrose (23 kilometers) Melrose to Port Union (6 kilometers), Catalina to Little Catalina Harbour (4 kilometers), Little Catalina Harbour to Maberly (12 kilometers), Elliston Cove to Spillars Cove (4 kilometers).

BY SEA: Although most shoreline areas can be accessed by sea several detached rocky shoals which are dangerous to navigation. These are described on Hydrographic Charts 4562 and 4569. Suitable small boat harbours are located at:

Depth (meters)

Trinity*	4-5
Fisher Cove**	- -
Job's Head*	4-5
Port Rexton*	1-3
Robinhood Bay	7-17
Champney's West*	4-5
English Harbour*	1-2
Catalina*	4-6
Port Union**	4-5
Little Catalina Harbours*	7-8
Elliston*	1-2

* - Government Wharf
** - Private Wharf

BY SEA: The nearest airports are located at St. John's (a distance of 140 kilometers) and Gander (a distance of 150 kilometers).

Distances Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Clarenville		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Trouty Harbour	66	70	225	437	265	142
Trinity Harbour	60	78	219	435	259	140
Robinhood Harbour	68	80	226	431	266	136
Champney's Cove	72	82	229	428	269	133
Melrose Harbour	90	100	242	425	282	130
Catalina Harbour	96	105	246	430	286	135
Little Catalina Harbour	105	110	251	433	291	138
Elliston Cove	112	120	260	447	300	152
Lance Cove	115	125	265	455	305	160

Topographic Maps: (1:50,000) 2C/6, 2C/11.

Hydrographic Charts: 4017 (1:350,000), 4562 (1:75,000),
4563 (1:75,000), 4569 (1:25,000), 4570
(1:15,000) 4571 (1:12,500)

SECTION VI (E) Cape Bonavista to Chance Head (Chandler Reach)

Description: This coastal zone consists primarily of a ria upland containing rocky sea cliffs, irregular headlands and numerous embayments. Cobble/shingle pocket beaches are common at the head of most inlets. Wave energy is high in most coastal regions, except major embayments where wave energy is moderate to low. In winter, local bays and inlets remain frozen. Sea ice is usually found in near shore waters from late January to early May. Total length of the shoreline is 215 Kilometers. Bedrock Geology - Siltstone, arkose, conglomerate, slate, volcanics. Substrate - Sand, gravel, outcrops.

Width of Major Bays/Inlets - at narrowest point (meters)

Bayleys Cove	800
Bonavista Harbour	600
Newman's Cove	400
Knight's Cove	350
Rolling Cove	650
King's Cove	300
Broad Cove	700
Castle Cove	1300
Keels Cove	250
Deep Cove	300
Tickle Cove	500
Open Hall	600
Plate Cove	500
Indian Arm	700
Southern Bay -Entrance	900
-Charleston	400
Kate Harbour	900
Sweet Bay - Southwest Arm	900
- Northwest Arm	1100
Little Chance Harbour	300
Great Chance Harbour	200

Accessibility:

BY LAND: Between Bonavista and Southern Bay, highway #235 parallels the shoreline and provides access to most coastal sites. A number of communities are joined by secondary roads. These include: Broad Cove, Keels, Tickle Cove, Red Cliff, Summerville, Sweet Bay and Winter Brook.

Major regions not accessible by land are:

Bonavista to Birchy Cove	8 kilometers
Hadderville to Knights Cove	5 kilometers
Kings Cove Head to Broad Cove	6 kilometers
Southern Head	5 kilometers
Keels to Tickle Cove	16 kilometers
Plate Cove to Indian Arm	8 kilometers
Charleston to Sweet Bay (S.W.Arm)	38 kilometers
Sweet Bay (N.W. Arm to Chance Head)	44 kilometers

BY SEA: Most coastal areas can be reached by boat. Suitable small boat harbours are located at:

	Depth (meters)
Bayleys Cove**	-
Bonavista*	4-5
Newman's Cove*	3-4
King's Cove*	4-5
Broad Cove*	2-3
Keels Cove*	1-2
Red Cliff*	2-3
Open Hall**	3-4
Plate Cove*	2-3
Summerville*	1-3
Charleston*	1-2
Princetown*	3-4
Sweet Bay*	3-4

* - Government

** - Private Wharf

BY AIR: The nearest airports are located at Gander, a distance of 120 kilometers and St. John's, a distance of 150 kilometers.

Distances Between Potential Cleanup Sites and Major Resource Centers

	Distance (kilometers)					
	Clareville		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Bonavista	114	140	259	465	301	170
Rolling Cove	86	160	233	490	273	195
Broad Cove	84	155	231	490	271	195
Keels	87	158	234	495	274	200
Deep Cove	N/A	162	N/A	497	N/A	202
Plate Cove	67	175	214	507	254	212
Southern Bay	52	190	199	520	239	225
Southwest Arm (Sweet Bay)	57	192	204	515	244	220
Northwest Arm (Sweet Bay)	47	195	194	517	234	222
Great Chance Harbour	N/A	185	N/A	515	N/A	220
Little Chance Harbour	N/A	187	N/A	513	N/A	218

N/A - Not accessible

Topographic Maps: (1:50,000) 2C/5, 2C/11, 2C/12

Hydrographic Charts: 4017 (1:350,000), 4562 (1:75,000), 4569 (1:25,000).

SECTION VI (F) Chance Cove Head to Shag Islands (including Terra Nova National Park)

Description: This region consists mainly of an upland plateau with numerous offshore islands and long narrow bays. Cobble/shingle pocket beaches are common at the head of most bays and inlets. Wave energy is low in most coastal areas. Exceptions are the offshore islands where wave energy is high. The bays and inlets are frozen in winter. Sea ice is normally found in the coastal zone from late January to early May. Total length of shoreline is 260 kilometers. Bedrock Geology - Slate, siltstone, greywacke, conglomerate, arkose, volcanics. Substrate - Boulders, mud, gravel.

Width of Major Bays/Inlets - at narrowest point (meters)

Goose Bay - Entrance	1400
- at Lethbridge	700
- Southwest Arm	350
- Holloway Cove	600
Clode Sound (Entrance)	1400
Northwest Arm - Entrance	1000
Port Blandford	800
Lions Den	900
Newman Sound - South Broad Cove	350
- Minchin Cove	250
- Big Brook Estuary	200
- North Brook Cove	1000
- Happy Adventure	250
- Sandy Cove	1000
Barrow Harbour	700
Broomclose Harbour	300
Bishops Harbour	400

Accessibility:

BY LAND: The shoreline of Goose Bay, from Jameston to Cannings can be reached by road (highways # 230 & # 234). Clode Sound, Between Bunyan's Cove and Charlottetown, can be accessed from highway #233 and Trans Canada Highway (#1). Newman Sound is accessible only via the Parks Canada roads near the head of Sound and at the village of Happy Adventure. The major coastal areas which are not accessible by land are as follows:

Chance Cove Head to Jameston	16 KM
Cannings Cove to Chain Rock Cove	18 KM
Charlottetown to Big Brook	75 KM
Long Islands	25 KM
Swale Island	22 KM
Salton's Brook to Happy Adventure	20 KM
Sandy Cove to Shag Island	32 KM

BY SEA: Most coastal areas can be accessed by boat. Suitable small boat harbours are located at:

Depth (meters)

Jamestown*	3-4
Portland*	1-2
Cannings Cove**	3-4
Musgravetown*	3-4
Charlottetown*	6-7
Port Blandford*	1-2
Happy Adventure*	1-2
South Broad Cove	5-37
Terra Nova Nat. Park (Campsite)*	3-4

* - Government Wharf
** - Private Wharf

There is a charter vessel which operates tours of Newman Sound during the summer months.

BY AIR: The nearest airports are located at Gander (100 kilometers) and St. John's (150 kilometers).

Distances Between Potential Cleanup Sites and Major Resource Centers

	Distances (kilometers)					
	Clareville		Argentia		St. John's	
	By Land	By Sea	By L	By S	By L	By S
Goose Bay: Jamestown	35	198	212	545	230	250
Lethbridge	24	208	201	557	219	262
Cannings Cove	33	200	210	545	228	250
Clode Sound:						
Bunyan's Cove	40	212	217	560	235	265
Port Blandford	30	225	207	572	225	277
Charlottetown	50	210	227	555	245	260
Lions Den	N/A	190	N/A	535	N/A	240
Newman Sound:						
South Broad Cove	N/A	195	N/A	540	N/A	245
Big Brook	62	205	239	550	247	255
Happy Adventure	90	188	267	535	275	240
Barrow Harbour	N/A	180	N/A	530	N/A	235

N/A - Not Accessible

Topographic Maps: (1:50,000) 2C/5, 2C/12, 2D/8.

Hydrographic Charts: 4017 (1:350,000), 4520 (1:286,000).

SECTION VI OIL SPILL COUNTERMEASURES

The primary coastal environments which should receive priority in oil spill protection and cleanup strategies are the numerous deep embayments located on the west side of Trinity Bay as well as those found along the southern portion of Bonavista Bay.

Offshore protection should be considered as the first approach to prevent oil from reaching nearshore areas. Where possible, diversion booms could be employed to deflect oil away from sensitive areas to designated collection sites. The use of dispersants in the coastal zone is not recommended.

Onshore protection methods which may be used in coastal areas include:

- a) ditch/dyke systems - to protect sensitive beach areas where oil might contaminate the backshore zone.
- b) artificial berms - constructed on sand/pebble or pebble/cobble beaches to prevent oil from reaching sensitive backshore areas.
- c) shoreline booms - may be deployed in bays or harbours where tidal currents are less than 0.5 M/Sec. If currents are found to be severe, inlets could be blocked by using heavy machinery (if suitable access is available).
- d) sorbents- useful on coarse sediment beaches when used in conjunction with ditch/dyke systems.

Cleanup methods: The most suitable cleanup methods for shoreline types contained within Section VI are listed below:

<u>Shoreline Type</u>	<u>Recommended Cleanup Method(s)</u>
a) Sand/pebble beaches (accessible)	-For large spills, motorized graders and elevating scrapers are recommended. -For small spills, manual removal can be effective.
b) Coarse sediment beaches (cobble/shingle/boulder)	-For large spills, the use of front end loaders can remove oiled sediments*. *Note - if large amounts of sediments are removed it should be replaced, particularly if pocket beaches are involved. -For small spills, manual removal is recommended if accessible, otherwise no action is advised. -If cleanup is not necessary mechanical equipment may mix oiled sediments to aid natural degradation (this is applicable only to areas which have easily access).

- b) cont'd
 - Sump collection and pump removal could be feasible where oil is deposited on shore over a period of several days.
- c) Backshore areas
 - Manual removal or low pressure flushing are recommended.
- d) Inaccessible beaches
 - No action is recommended.
- e) Rocky shores
 - Unless local community uses are affected, no action is recommended.
 - Where cleanup is required, low pressure flushing or manual removal may be feasible.
- f) Rocky cliffs
 - No cleanup method is considered to be very effective.
 - The most feasible methods include manual removal, low pressure flushing or sorbents.
 - These methods produce the minimal amount of environment damage.
- h) Intertidal mud/sand
 - No cleanup is advisable unless the area is determined as biological important.
 - When used with care, manual removal or light machinery may be feasible.

APPENDIX

MONTHLY WIND DATA - SOUTHEASTERN NEWFOUNDLAND

A. Argentia (1956-69)

	<u>Velocity (KM/HR)</u>												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
N	24.6	23.5	24.8	23.4	20.3	16.3	15.2	18.7	22.1	26.1	29.4	28.5	22.7
NNE	25.6	26.4	28.5	27.0	21.8	19.2	15.7	18.9	22.4	22.9	24.5	24.2	23.0
NE	21.4	20.9	26.2	22.1	18.2	17.6	13.9	15.7	16.8	20.2	20.8	21.3	19.7
ENE	18.6	19.8	22.2	19.2	14.4	15.2	12.5	14.6	13.6	16.5	19.2	18.2	16.9
E	17.1	20.3	19.7	20.5	14.2	13.6	11.4	13.3	12.2	12.6	16.0	14.4	15.5
ESE	26.6	28.3	30.2	27.8	21.2	20.8	14.1	18.6	19.2	20.5	23.5	28.5	23.2
SE	32.2	33.0	30.7	26.1	23.7	21.7	19.8	21.9	19.0	25.9	29.3	32.5	26.4
SSE	31.0	27.8	25.8	24.5	25.0	22.6	19.7	20.2	21.6	24.0	32.5	28.6	25.3
S	27.4	25.1	28.5	24.8	23.7	23.5	22.7	20.3	20.3	20.6	27.7	28.6	24.5
SSW	32.2	29.6	24.6	25.3	23.4	22.7	22.6	22.2	23.4	23.4	29.0	31.7	25.8
SW	32.0	30.4	25.6	21.3	17.9	16.2	16.8	18.4	20.5	24.3	26.1	32.2	23.5
WSW	34.1	32.8	28.2	24.8	20.6	16.3	17.9	21.1	22.9	25.4	32.2	34.1	25.9
W	30.2	29.4	27.0	23.2	18.2	15.2	15.4	20.2	22.2	26.7	27.7	29.0	23.7
WNW	25.9	26.7	23.0	20.8	16.3	14.4	15.4	15.5	18.7	20.8	24.2	25.9	20.6
NNW	22.7	24.6	22.4	20.8	23.2	14.1	14.6	18.2	16.5	23.4	23.5	27.0	20.9
All Directions	27.0	26.4	25.0	23.0	20.5	19.2	19.2	19.7	20.3	22.2	25.9	27.4	23.0

Percentage Frequency

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
N	6	6	11	8	8	5	3	3	6	5	5	7	6
NNE	5	6	11	9	7	6	3	3	6	4	5	4	6
NE	4	5	6	4	5	4	2	3	3	3	5	4	4
ENE	4	5	5	3	3	3	3	2	3	3	4	4	4
E	4	5	4	3	3	2	2	3	4	3	3	3	3
ESE	4	5	3	3	2	2	2	2	2	3	2	3	3
SE	4	4	2	2	2	1	2	3	1	4	4	3	3
SSE	5	4	2	3	4	3	3	5	3	5	7	4	4
S	6	5	6	9	11	12	18	12	11	8	8	7	9
SSW	6	6	9	20	29	37	41	35	26	16	11	8	20
SW	6	6	6	9	8	10	9	12	10	9	6	7	8
WSW	11	10	8	7	4	4	3	7	8	11	9	12	8
W	11	10	8	4	2	2	1	3	6	8	8	11	6
WNW	10	9	6	3	1	1	1	1	2	5	9	10	5
NW	7	7	5	4	2	1	1	2	3	5	7	6	4
NNW	5	6	6	6	5	3	2	2	3	6	5	5	5
CALM	2	1	2	5	4	4	4	2	3	2	2	2	2

B. Bonavista (1959-72)

Velocity (KM/HR)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
N	31.2	24.6	27.0	26.9	23.2	20.3	20.6	24.3	24.6	19.1	29.6	30.7	26.1
NNE	27.2	23.7	29.0	23.2	20.3	19.8	18.4	23.8	22.2	27.8	29.6	25.9	24.3
NE	29.8	24.3	28.0	24.8	19.2	17.9	16.5	19.4	20.0	28.3	19.3	27.0	23.7
ENE	30.1	30.4	27.7	26.4	18.7	18.7	16.5	16.0	21.4	26.7	29.8	29.0	24.3
E	35.5	28.6	29.1	24.3	19.2	17.8	17.4	19.0	19.4	26.2	25.1	30.1	24.3
ESE	34.2	31.8	24.8	22.7	20.2	18.4	17.6	21.4	20.3	28.5	26.7	31.5	24.8
SE	30.2	32.8	25.9	22.1	20.0	19.0	18.4	20.3	21.6	26.2	27.4	30.6	24.5
SSE	29.8	27.4	23.5	22.1	20.2	19.5	19.4	22.1	21.4	26.9	28.3	30.7	24.3
S	24.6	23.8	24.5	21.4	20.6	21.9	20.3	21.8	20.6	24.2	24.2	24.8	22.7
SSW	25.0	24.3	26.4	24.6	25.1	25.8	23.8	24.8	24.3	24.0	23.0	23.7	24.6
SW	25.8	24.8	25.0	25.3	25.1	26.2	25.3	24.6	26.2	26.1	24.6	25.6	25.4
WSW	35.2	32.6	28.2	26.1	23.4	23.4	24.0	25.4	27.0	29.3	29.9	33.4	28.2
W	40.0	34.1	30.4	27.2	22.2	21.4	20.2	24.0	17.5	32.8	35.9	37.4	29.4
WNW	35.0	35.2	28.3	29.1	24.3	24.2	21.1	23.5	29.9	31.0	32.9	35.0	29.1
NW	34.1	34.1	29.0	29.4	25.6	23.4	24.0	27.0	29.0	31.8	30.1	33.9	29.3
NNW	34.4	30.4	28.5	28.6	25.9	24.6	23.7	26.9	18.4	34.4	34.1	32.0	29.4
All Directions	32.8	29.9	26.9	25.3	22.1	22.1	21.4	21.4	24.6	28.8	28.9	31.0	25.6

Percentage Frequency

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
N	4	5	6	7	6	4	3	4	6	6	4	6	5
NNE	3	3	5	3	2	3	1	2	4	2	3	4	3
NE	3	4	5	5	3	2	2	3	4	3	5	3	3
ENE	2	3	4	4	3	3	2	2	3	2	3	2	3
E	3	3	5	5	5	5	4	3	3	2	3	3	4
ESE	3	4	4	6	7	6	6	4	5	3	3	3	4
SE	3	5	4	5	8	7	9	6	4	4	5	4	5
SSE	4	5	3	4	4	5	6	6	4	5	6	4	5
S	5	5	5	3	4	6	7	7	5	6	7	6	6
SSW	5	5	5	5	7	9	9	10	6	6	7	5	7
SW	6	5	8	8	14	19	20	17	12	10	8	7	11
WSW	9	11	10	10	9	11	15	14	16	13	9	10	11
W	20	12	9	9	7	6	6	9	11	13	13	18	11
WNW	14	12	7	6	5	3	1	3	5	8	10	11	7
NW	9	9	9	8	5	4	3	4	5	8	8	8	7
NNW	5	8	9	10	8	5	4	4	6	8	5	5	6
CALM	2	1	2	2	3	2	2	2	1	1	1	1	2

C. St. John's (1955-72)

	Velocity (KM/HR)												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
N	29.3	27.0	27.4	29.3	27.0	21.8	18.6	23.5	22.7	26.4	25.9	29.0	25.6
NNE	28.2	26.4	29.1	26.2	23.2	20.3	18.1	20.6	22.2	28.2	26.6	27.7	24.8
NE	26.9	24.6	26.1	20.9	19.2	17.6	14.7	17.4	17.8	22.7	24.0	22.4	21.3
ENE	30.1	26.1	30.1	23.2	19.4	17.9	15.8	18.2	16.3	21.8	22.1	22.7	21.9
E	26.1	26.2	24.2	19.8	18.1	16.3	13.3	18.1	16.3	19.0	22.4	16.1	20.5
ESE	26.7	29.3	23.5	20.0	17.9	16.8	16.2	17.6	18.9	20.5	24.0	26.4	21.4
SE	26.9	27.2	23.7	20.8	17.4	16.8	15.2	17.6	18.1	21.8	23.4	25.9	21.3
SSE	29.4	28.6	28.2	24.0	20.2	18.9	19.0	19.8	19.8	24.8	24.8	28.3	23.8
S	27.2	24.5	25.4	23.2	21.4	20.8	19.8	20.6	21.4	24.5	27.7	26.4	23.5
SSW	24.2	24.6	24.3	25.3	23.5	21.4	21.3	21.4	22.9	23.2	26.1	24.2	23.5
SW	24.3	23.8	23.8	25.9	24.8	24.3	23.4	22.6	22.7	21.8	24.0	25.3	24.0
WSW	29.4	29.1	28.3	27.5	26.9	26.7	25.3	24.0	24.6	24.5	26.7	28.2	26.7
W	30.6	29.9	27.0	25.3	25.4	24.6	23.4	22.7	24.3	26.6	26.1	28.0	26.2
WNW	28.0	30.4	28.0	26.2	24.2	21.8	19.7	20.8	22.9	23.7	26.9	29.4	25.1
NW	23.5	25.3	25.4	25.6	24.6	21.6	19.7	21.3	20.8	22.6	24.5	25.6	23.4
NNW	27.4	29.0	25.9	29.1	27.8	22.9	23.7	22.1	22.1	26.6	26.1	27.2	25.8
All Directions	26.9	27.0	26.1	25.1	23.2	22.2	21.3	21.6	21.9	23.7	25.0	26.4	24.2

Percentage Frequency

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
N	5	5	7	8	6	5	2	3	5	6	4	5	5
NNE	5	4	8	6	7	5	3	3	5	3	4	3	5
NE	4	4	6	5	5	5	3	3	5	3	4	4	4
ENE	2	3	3	3	3	2	2	1	2	1	3	2	2
E	3	2	3	3	3	2	2	2	2	2	3	2	2
ESE	2	3	3	3	3	2	2	2	2	2	2	2	2
SE	3	5	4	5	5	5	5	4	3	3	4	3	4
SSE	3	5	4	4	4	4	4	4	3	3	4	4	4
S	6	6	5	5	6	6	8	8	5	7	9	7	7
SSW	5	5	4	4	6	6	7	8	6	6	8	6	6
SW	8	8	7	8	8	10	12	13	11	10	10	10	10
WSW	11	10	13	15	18	24	27	26	20	17	12	12	17
W	17	15	12	11	12	12	14	14	15	15	13	15	14
WNW	12	11	8	6	4	4	3	3	6	6	8	10	7
NW	7	7	6	7	4	3	2	3	4	7	6	8	5
NNW	4	5	5	6	4	3	2	2	4	7	4	5	4
CALM	3	2	2	1	2	2	2	1	2	2	2	2	2

TIDAL RANGES - SOUTHEASTERN NEWFOUNDLAND

	Mean Tide (m)	Large Tide (m)
Grand Bank	1.5	2.0
Burin	1.5	2.2
Come-By-Chance	1.6	2.5
Argentia	2.2	2.6
St. Bride's	1.6	2.5
Branch Cove	1.4	2.1
Trepassey	1.3	1.9
Bay Bulls	1.0	1.5
St. John's	0.9	1.4
Holyrood	0.9	1.5
Harbour Grace	0.9	1.4
Heart's Content	1.0	1.5
Clareville	0.5	0.7
Port Union	0.8	1.2
Newman Sound	0.8	1.3

VISIBILITY

	NUMBER OF DAYS/YEAR:	
	(A) Fog	(B) Precipitation
St. Lawrence	155	58
Argentia	183	42
Chance Cove	155	47
St. John's	125	54

FISH PROCESSING PLANTS - SOUTHEASTERN NEWFOUNDLAND

	<u>Location</u>	<u>Type of Processing</u>
1.	Southeastern Fisheries Ltd. Bay l'Argent	Cured
2.	Bonavista Cold Storage Co. Ltd Grand Bank	Fresh & Frozen
3.	Booth Fisheries Canadian Co. Ltd. Fortune	Fresh & Frozen
4.	H.B. Dawe Ltd. Lawn	Cured
5.	Fishery Products Ltd. Burin	Fresh & Frozen
6.	Atlantic Fish Processors Division Atlantic Consolidated Food Ltd. Marystown	Fresh & Frozen
7.	National Sea Products Ltd. Arnold's Cove	Fresh & Frozen
8.	H.B. Dawe Ltd. Southern Harbour	Cured
9.	Little Harbour Fisheries Fairhaven	Fresh & Frozen
10.	Newfoundland Quick Freeze Ltd. Jerseyside	Fresh & Frozen
11.	Newfoundland Quick Freeze Ltd. St. Bride's	Fresh & Frozen
12.	W.J. Moores Ltd. Branch	Cured
13.	Newfoundland Quick Freeze Ltd. Admiral's Beach	Fresh & Frozen
14.	Newfoundland Quick Freeze Ltd. Riverhead	Cured
15.	Fishery Products Ltd. Trepassey	Fresh & Frozen
16.	Bonavista Cold Storage Ltd. Fermeuse	Fresh & Frozen
17.	Aqua Fisheries Aquaforte	Fresh & Frozen
18.	William Morry Ferryland	Cured

19.	Calvert Fish Industries Calvert	Fresh & Frozen
20.	Tors Cove Fisheries Ltd. Tors Cove	Fresh & Frozen
21.	Witless Bay Fish Meal Witless Bay	Cured
22.	Newfoundland Quick Freeze Ltd. Witless Bay	Fresh & Frozen
23.	Bay Bulls Sea Products Bay Bulls	Cured
24.	Bidgoods Ltd. Petty Harbour	Cured, Frozen, Canned
25.	National Sea Products St. John's (South Side)	Fresh, Cured, Frozen
26.	St. John's Sea Products St. John's (South Side)	Fresh & Frozen
27.	Steers Ltd. St. John's	Cured
28.	Cabot Seafoods Ltd. Quidi Vidi, St. John's East	Fresh, Frozen, Cured
29.	Fort Amherst Seafoods Quidi Vidi, St. John's East	Fresh, Frozen, Cured
30.	Storey Fisheries Ltd. Portugal Cove	Cured
31.	Conception Bay Sea Foods Foxtrap	Fresh & Frozen
32.	Bell Island Development Assn. Bell Island	Cured
33.	Fishery Products Ltd. Holyroad	Fresh & Frozen
34.	J.W. Hiscock & Sons Ltd. Brigus	Cured, Fresh, Frozen
35.	Ocean Kist Products Coley's Point	Cured, Fresh, Frozen
36.	Bay Roberts Fisheries Ltd. Bay Roberts	Cured
37.	Ocean Harvesters Ltd. Harbour Grace	Cured, Fresh, Frozen
38.	Earle Bros. Fisheries Ltd. Carbonear	Cured, Fresh, Frozen
39.	H.B. Dawe Ltd. Cupids	Cured, Fresh, Frozen
40.	W & J Moores Ltd. Carbonear	Cured
41.	Ocean Harvesters Ltd. Port de Grave	Fresh & Frozen
42.	George Dawe & Sons Ltd. Port de Grave	Cured
43.	Jason Enterprises Ltd. Bareneed	Fresh & Frozen
44.	Quinlan Bros Ltd. Lower Island Cove	Fresh & Frozen
45.	Quinlan Bros Ltd. Bay de Verde	Fresh & Frozen
46.	Quinlan Bros Ltd Grates Cove	Fresh & Frozen
47.	Ocean Harvesters Ltd. Old Perlican	Fresh & Frozen
48.	E.J. Green & Co Ltd. Winterton	Fresh & Cured
49.	Thomas St. George & Sons Ltd. Heart's Desire	Cured

50.	P. Jones & Sons Ltd Hants Harbour	Cured, Canned
51.	Higdon Sea Foods New Harbour	Cured
52.	Woodman Fisheries Ltd. New Harbour	Fresh & Frozen
53.	Newfoundland Quick Freeze Ltd. Dildo	Fresh & Frozen
54.	Arctic Fishery Products Ltd. Dildo South	Fresh & Frozen
55.	Newfoundland Fur Farmers Co-op Dildo South	Fresh & Frozen
56.	Newfoundland Quick Freeze Ltd Dildo South	Fresh & Frozen
57.	George Warren & Sons Ltd. Little Heart's Ease	Cured
58.	Southport Products Ltd. Southport	Cured
59.	Arthur Dean Southport	Cured
60.	Fisherman's Union Trading Co. Ltd. Port Union	Cured
61.	Mifflin Fisheries Ltd. Catalina	Cured
62.	Fishery Products Ltd. Catalina	Fresh & Frozen
63.	Bonavista Cold Storage Co. Ltd.	Fresh, Frozen, Canned
64.	R.C. Fry Summerville	Cured
65.	Arctic Fishery Products Ltd.	Fresh, Frozen, Cured

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