

INTERTIDAL CLAM RESOURCES (Manila, Littleneck and Butter Clam)

Volume III: The Northern Inside Waters of Vancouver Island and the British Columbia Mainland

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**INTERTIDAL CLAM RESOURCES
(Manila, Littleneck and Butter Clam)
VOLUME III: THE NORTHERN INSIDE WATERS
OF VANCOUVER ISLAND AND THE
BRITISH COLUMBIA MAINLAND**

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ABSTRACT

Harbo, R., K. Marcus and T. Boxwell. 1997. Intertidal Clam Resources (Manila, littleneck and butter clam) Volume III: The Northern Inside Waters of Vancouver Island and the British Columbia Mainland. Can. Manuscr. Rep. Fish. Aquat. Sci. 2418: viii + 79 p.

This reports documents 229 clam beaches and 1447 hectares on the northern inside waters of Vancouver Island (NIW) and the British Columbia mainland, Pacific Fishery Management Areas 11 and 12. This area has significant butter clam and native littleneck clam stocks but few populations of Manila clams. Other species may be present, but have not been commercially exploited.

Most of the beaches identified are small "pocket" beaches with 198 beaches being less than 10 ha in size. The largest identified beach is 146 ha. It is important to note that this is not a complete inventory of all sites and generally only a portion of the identified beach area supports clam populations. The clam beach data are available in electronic formats.

Annual landings of intertidal clams have mostly been butter clams, with commercial production reported since 1936. Peak landings of butter clams were in 1962, in excess of 875 tonnes. Recent landings of butter clams have been from 50 to 100 t. Native littlenecks landings have consistently been from 30 to 100 t annually. No commercial populations of Manila clams are found in this area. Reported landings, although minor, are in error, either misidentified by species or area of catch. The spread of Manila clams from the Strait of Georgia appears to have been limited by cold water barriers of Seymour Narrows and Yuculta Rapids.

There have been few clam surveys in NIW. There are a number of beaches closed to commercial harvest for allocations to Aboriginal and recreational harvest. Some beaches are also closed due to fecal contamination. Historically, there has been a high level of outbreaks of biotoxins causing Paralytic Shellfish Poisoning (PSP) in this area with several incidents of human illness and deaths. There are a number of mussel monitoring stations sampled on a regular basis.

To date there have been no attempts to commercially culture manila clams in this area.

RÉSUMÉ

Harbo, R., K. Marcus and T. Boxwell. 1997. Intertidal Clam Resources (Manila, littleneck and butter clam) Volume III: The Northern Inside Waters of Vancouver Island and the British Columbia Mainland. Can. Manuscr. Rep. Fish. Aquat. Sci. 2418: viii + 79 p.

Ce rapport contient des données sur 229 plages et 1447 hectares, situés dans le secteur nord des eaux des détroits de l'île de Vancouver et la partie continentale de la Colombie-Britannique, dans les zones de gestion des pêches du Pacifique 11 et 12. On y retrouve des populations importantes de palourdes jaunes et de palourdes du Pacifique, mais peu de populations de palourdes japonaises. Il est possible que d'autres espèces de bivalves vivent dans ces secteurs, mais elles ne font pas l'objet d'une exploitation commerciale.

La plupart des plages désignées ne sont que de petites plages situées dans des anses : 198 d'entre elles couvrent moins de 10 ha de superficie, alors que la plus vaste mesure 146 ha. Il faut remarquer qu'il ne s'agit pas d'un inventaire complet de tous les sites et que l'on retrouve des populations de palourdes uniquement sur une partie des plages désignées. Les données sur les plages où vivent des palourdes sont également consignées sous diverses formes électroniques.

Ce rapport fournit les données sur les débarquements annuels de bivalves intertidaux, constitués en grande partie de palourdes jaunes, dont on rapporte la production commerciale depuis 1936. Les débarquements de palourdes jaunes ont atteint un pic de plus de 875 t en 1962. Les récents débarquements de palourdes jaunes ont atteint entre 50 et 100 t, ceux de palourdes du Pacifique se sont régulièrement situés entre 30 et 100 t par an. Aucune population commerciale de palourdes japonaises n'existe dans ce secteur, malgré des rapports de débarquements mineurs de cette espèce. Ces rapports sont le résultat d'une erreur d'identification soit d'espèce ou de région. L'extension des palourdes japonaises du détroit de Géorgie semble avoir été limité par les barrières d'eaux froides que constituent la passe Seymour et les rapides Yuculta.

Peu d'études sur les palourdes ont été menées dans le secteur nord. Un certain nombre de plages sont fermées à l'exploitation commerciale et sont réservées aux Autochtones et à la pêche sportive. D'autres plages sont également fermées en raison d'une contamination fécale. Dans le passé, il y a eu dans ce secteur de nombreuses poussées de biotoxines provoquant l'intoxication paralysante (PSP), ce qui a causé de nombreux cas de maladie et de décès. On retrouve un certain nombre de stations de surveillance des moules qui procèdent à des échantillonnages réguliers.

À ce jour, aucune tentative de culture commerciale des palourdes japonaises n'existe dans ce secteur.

1.0 INTRODUCTION

A series of three reports have been prepared to document clam beaches on the south coast of British Columbia that support populations of Manila, littleneck and butter clams, important to Aboriginal, commercial and recreational harvesters. The first report deals with beaches on the west coast of Vancouver Island (Harbo et al. 1997 a), the second with the southern inside waters of Vancouver Island and the mainland (Harbo et al. 1997 b). This report, Volume III, was prepared to document beaches on the northern inside waters of Vancouver Island and the British Columbia mainland. Pacific Fishery Management Areas 11 and 12 are illustrated in Fig. 1. The report identifies different sizes of beaches from <1 to 146 ha.

This report is not to be treated as a complete inventory of clam beaches and it only covers a limited number of species. There are many other additional areas of "pocket beaches" that support clam populations that have a tradition of harvest for Aboriginal, commercial or recreational purposes. These beaches will be added to this database as they are identified. There may be sites not included in this inventory where DFO or resource users may object to a tenure or other development.

It is necessary to identify as many beaches as possible to assist in identifying sites of conflict with other uses such as aquaculture and to protect them from other potential development, such as log storage facilities that may impact on the shellfish resources. A policy was adopted by DFO in the 1980's to maintain beaches in the "wild", common property fishery for intertidal clams. DFO supported the development of clam culture on existing oyster tenures only and objected to new tenures where there was a history of Aboriginal, commercial or recreational harvest (Bourne and Dickson 1990). The identification of the beaches is also important for protection or clean-up activities in the event of environmental emergencies such as oil spills.

1.1 Intertidal Clam Biology

This report documents intertidal clam resources but is limited in scope to include littleneck clams, butter clams and to a limited extent Manila clams.

There are a number of clam and other bivalve species harvested for food and commercial purposes. Common and scientific names of harvested clam species are detailed in Table 1. Cockles (*Clinocardium nuttallii*), butter clams (*Saxidomus gigantea*), littlenecks (*Protothaca staminea*), horse clams (*Tresus capax* and *T. nuttallii*), razor clams (*Siliqua patula*) and more recently Manila clams (*Venerupis philippinarum*) have been harvested by Aboriginal and recreational harvesters on the northern inside waters of Vancouver Island and the mainland coast (NIW). The commercial fishery on the NIW targets on littleneck clams (the 'steamer' clams) and butter clams. Others intertidal species of potential commercial interest include the soft-shell clam, *Mya arenaria*, introduced to the Pacific coast sometime in the early 1900's. The giant geoduck clams, *Panopea abrupta*, are only found on the lowest tides and are exploited subtidally by divers (Harbo et al. 1986).

The biology of the intertidal species are discussed by Quayle and Bourne (1972), Quayle (1960), and Bourne (1986a; 1987a). Life cycles of the Manila clam, littleneck clam, and butter clam are illustrated in Figs. 2 to 5.

1.2 Marine Toxins - Paralytic Shellfish Poisoning (PSP) and Amnesiac Shellfish Poisoning (ASP)

Bivalve shellfish and in some instances crabs may be affected by blooms of toxic algae. In British Columbia, toxic shellfish are known to occur along the entire coastline but outbreaks are localized. A discussion of PSP can be found in Quayle (1969), Quayle and Bourne (1972), Bond (1975), Medcof (1985) and Anderson (1989).

PSP toxins have been found in intertidal clams (littlenecks, Manilas, butter clams, razor clams), mussels, oysters, cockles and subtidal species of scallops (rock, pink and spiny, weathervane), geoducks and horse clams. PSP toxins have also been found occasionally in Dungeness crabs.

ASP toxin (demoic acid), have been found in razor clams, mussels, oysters, and geoducks. Dungeness crabs have also been found to accumulate ASP and some fishery closures have been effected (R. Chiang, DFO, Fish Inspection; pers. comm.).

1.2.1 History of marine toxins on the NIW

PSP monitoring has been in effect in BC since 1942 (Bond 1975). Regular monitoring of PSP on the Pacific coast has been in effect since 1963.

Since 1983, areas were closed to harvest under the Pacific Fishery Management Area Regulations until they were judged to be safe and opened. Areas were opened to the commercial and recreational fisheries when monitoring programs were established to ensure public health safety.

The harvest seasons for intertidal clams has traditionally been set from November to April, generally considered to be a lower risk time for PSP. Recent data provided by DFO Inspection Branch shows that April, May and June had the greatest number of blooms from 1987 through 1994. (Fig. 7).

Area 12 has been the site of several illnesses and some deaths from PSP (Rudy Chiang, pers. comm.). In May, 1980, there was one death and seven sick from eating butter clams from Health Bay, Gilford Island and three sick from eating butter clams from Shoal Harbour, Gilford Island. In May, 1985 4 people were sick from eating littleneck clams from the Burdwood Group, north of Gilford Island (Subarea 12-38) and two sick from eating butter clams from north of Gilford Island (Subarea 12-40). Again, in April, 1992 two people were sick from eating butter and littleneck clams from Moore Bay (Subarea 12-43).

1.2.2 Management program for marine toxins

A series of mussel monitoring stations, 7 on the NIW in 1995, have been set up by DFO to determine the presence of toxin blooms (Fig. 6). Stations were situated at Stories Beach, Cluxewe Beach, Tracy Harbour, Alert Bay, Cullen Harbour, Health Bay and Echo Bay. Samples from mussel stations are regularly provided by contractors, Fishery Officers and patrol vessel crews. In addition, commercial landings of clams are periodically sampled to determine levels of PSP. Outbreaks of PSP have been recorded in all areas and in most months of the year and may affect intertidal clam species and subtidal species of clams such as geoducks and horse clams (DFO 1993).

Closures in areas may be species specific according to a number of criteria including the level of toxins recorded, the species specific nature of uptake and retention of toxin, the pattern of blooms in surrounding areas, the numbers of samples tested, and others.

1.2.3 Contaminated areas on the NIW

There are number of closures on the northern inside waters of Vancouver Island due to fecal contamination, often from wildlife. The closures for 1997 are described in Appendix 3. To date, there have not been any harvests of clams from contaminated areas on the NIW for depuration or relay.

2.0 INTERTIDAL CLAM FISHERIES ON THE NIW

Clams of commercial interest on the NIW include butter clams and littleneck clams. Manila clams are limited in numbers and only found at a few locations. There are not sufficient numbers of Manila clams for commercial harvest in this area. Although there may be populations of soft-shell clams, there has been no commercial interest to date.

There are no estimates of landings of clams in recreational or Aboriginal food fisheries.

2.1 Early Commercial Clam Fisheries

The Thompson (1914) report on the shellfish beds of British Columbia makes reference to a clam cannery in Alert Bay, earlier than 1914, and the clams being dug by the local Indians. Thompson's descriptions include sites at Blunden Harbour, Hardy Bay, Beaver Harbour, White Beach Passage, Mound Island and others. The report is given in Appendix 6.

Early landings of butter clams were reported to be sold to the cannery at Sidney, which operated from 1905 to 1939, and to canneries at Nanaimo and Vancouver (BC Packers; see Quayle 1939). Clams (littlenecks, butter clams) and cockles were also sold fresh in Victoria and Vancouver.

The landings from the NIW prior to 1951 are not well documented. Quayle (1940) reported that the butter clam beaches in the Alert Bay region are nearly all quite small in size.

Prior to 1936, most of the production came from the Comox-Sidney area. From 1936 on, the Alert Bay region was exploited intensively. The fishery only operated from November to March, or April at the latest.

The minimum size limit of 1 1/2 inches was increased to 2 1/2 inches in 1939, which led to a drop in production. Since 1936, the diggers in the Comox-Sidney area reported reductions in individual landings.

Information on individual catch per man-tide was reported by Quayle (1940). The average catch per man-tide, 172 to 206 lb. per man-tide in the Alert Bay area (Old Village, Alert Bay and Chatham Channel) was significantly higher than that of the Strait of Georgia, 120 to 150 lb. per man-tide in the 1939-40 season.

2.2 Clam Fisheries From 1951 to 1995

The commercial clam fishery began just before the turn of the century, however landings were not reliably recorded until 1951. The commercial clam fisheries and fishery management have been described in Quayle and Bourne 1972, Bourne 1986(b), Bourne 1987(a) and 1987(b), Dickson and Hobbs 1990, Dickson 1992, and Webb and Hobbs 1996. Since 1971, strong markets and higher prices for littleneck and Manila clams have focused the intertidal fishery in southern BC on these two species. Landings in the fishery increased dramatically between 1984 and 1988. The landings of butter clams, which enter the market as a canned product, had been declining because of the high cost of processing and a shift in demand toward fresh steamer clams. However, recent efforts have been made to reactivate the butter clam fishery.

The commercial clam fishery has been managed as a common property fishery with licence holders competing each season for a share of the harvest. A variety of regulatory controls have been put in place to support conservation and management objectives and are intended to restrain the commercial harvesting efforts to sustainable levels.

The main conservation tool utilised in the clam fishery are minimum size limits of 63 mm shell length for butter clams, 90 mm for razor clams and 38 mm for littleneck and Manila clams.

Since 1990, in-season catch monitoring which tracks digger catch per tide and relative numbers of legal sized clams, has played a key role in active management of the fishery. Fishery openings are short and staggered to maintain market supply where possible. During the fishing season meetings are held with industry representatives in each area to determine the sequence of fishery openings and closures.

An individual commercial clam licence was first introduced in 1989, along with area licensing restrictions. The South Coast was initially divided into 5 "clam licence areas". In 1992 Area G (Queen Charlotte Sound) was split off from Area B (Southern Johnstone Strait/Campbell River). Fishers had to choose to fish only one of the licence areas annually (Fig. 8). Coastwide in 1995, 2448 clam licences were issued, including 120 licences for Area G, the northeast coast of Vancouver Island.

Significant problems in the management of the steamer clam fishery (littlenecks and Manilas) are the result of too many harvesters. Openings are reduced to a few days annually, income levels are low for most harvesters and illegal harvest is a significant problem.

A Clam Reform strategy has been initiated through extensive consultations which began in 1992 with clam fishery stakeholders, DFO, First Nations and the Province of BC. A pilot project was initiated in Licence Area C on the Sunshine Coast which consisted of licence limitation and community based management. As a result, individual diggers in Area C have earned on average three times more than harvesters from other licence areas and enforcement efforts have improved due to information received for the local community regarding illegal clam harvest activity.

As part of the proposed Clam Reform strategy, a system of licence limitation, establishment of community based management boards and improved First Nations access has been recommended for the entire commercial clam fishery, effective in January, 1998.

2.2.1. Commercial clam landings by species and area

Landings for BC and landings for the NIW, Area 11 and 12, are given in Tables 2 to 5 and are shown in Figs. 9 to 12. Landings presented represent the commercial clam fishery harvest only. There are no clam tenures in this area (to 1997).

The landings of clams from the NIW have declined over time due to the decline in markets for butter clams. The clam landings from NIW have recently been less than 1% of the annual total BC intertidal clam landings. Overall, the NIW has only accounted for 18% of the total intertidal clam production 1951 to 1995 (Tables 2 and 3; Fig. 10). Butter clam landings have declined over time due to the shift to fresh market steamer clams from processed canned products. The area has steadily produced limited quantities of littleneck clams but few if any Manila clams (reported landings of Manilas from Area 11 and 12 are likely errors in either species or area of catch).

Landings of butter clams were greatest in 1962, with reports of 877 tonnes (Table 3). Production in recent years has been from 50 to 100 tonnes annually. Processors comment that due to limited harvest, the butter clams are older with thicker shells and the meat recoveries are less (estimates of 13 %). The meat from butter clams from some beaches is whiter in colour and preferred by the processors who can the product. Harvesters are paid from \$0.20 to \$0.35 /lb. in the round.

For the total production of intertidal clams from the NIW of Vancouver Island, Area 11 has accounted for only minor or amounts that may be reporting errors.

2.3 Aboriginal Fisheries

First Nations peoples have a long history of harvesting clams on the Pacific coast, both for food purposes and in the commercial fishery. First Nations participation in clam fisheries has been taken into consideration through extensive consultations in the ongoing Clam Reform process.

A number of areas were closed to the commercial fishery in 1992, in order to assure First Nations access to clams for food, social and ceremonial purposes. These are listed in Appendix 2. *The selection of these beaches was based on recommendations from the Kwakiutl Territories Fisheries Commission (KTFC)*. Generally, recreational harvesting has also been permitted within the Aboriginal Harvest closure areas.

The presence of many middens on beaches throughout the area generally indicate the presence of clam stocks and historical Aboriginal harvest.

3.0 INTERTIDAL CLAM ASSESSMENTS

Few reported surveys of clam resources have been carried out on the northeast coast of Vancouver Island and the mainland since Thompson (1914). His observations on the beaches in this area are presented in Appendix 6 in the "Report on Queen Charlotte Sound". Thompson provides accounts of beaches from Port Hardy to Blunden Harbour and south to Cracroft Island.

Bourne et al. (1994) report on a few locations in the Alert Bay area, sites in Indian Channel and at the western end of Gilford Island, surveyed in 1991 and a few sites in southern Area 12 were visited in 1994 (G. Gillespie, pers. comm.). No commercial quantities of manila clams were found in these surveys.

4.0 CLAM BEACHES SORTED BY AREA FOR THE NIW

4.1 Clam Species (Butter and Littleneck Clams)

The beaches of interest at the time of the preparation of information were beaches that had quantities of butter clams and littleneck clams. Only a few Manila clams and clam shell have been found in this area and reports of landings in Fisheries Statistics are in error. The landings of manila may be errors in the reporting of species, i.e. they may have been littlenecks, or an error in the reported Area of catch.

No assessments have been made or reported regarding any exposed sandy beaches of Area 11 that may have populations of razor clams or sheltered muddy beaches with populations of soft-shell clams.

4.2 Clam Beach Inventory Methodology

The information on the clam beaches was obtained initially in 1986, from personal interviews with local Fishery Officers. Additional beaches have been added through consultation with Fishery Officers, Aboriginal harvesters, commercial harvesters and others. As identified earlier, not all sites of clam populations are identified. Beaches which had a long history of closure due to contamination were largely excluded from the initial data collection, as were numbers of beaches with historical evidence of Aboriginal harvest. Although some beaches have been recently added to the inventory, there are more beaches to mapped and measured in the future.

The type of harvesting at a beach location was originally designated by the local fishery officers in 1986 as commercial, Aboriginal or recreational use, with an associated "intensity code". These designations were arbitrary and have likely changed significantly according to markets and harvesting trends. For example, a beach with significant butter clams may not be a commercial beach under current market conditions. However, if there was a market demand for butter clams the status of many beaches may change and some additional areas be identified. For the purposes of this report, use and intensity data have been excluded pending revisions.

4.2.1 Charts of beach locations and measuring area (ha)

The beaches were first marked out by hand on a series of nautical charts which were used to create an electronic GIS (Geographic Information System). The beaches were then digitized and Savemap files created in QUIKMap version 4.0. The beach maps are sorted by Pacific Fishery Management Area and presented in Appendix 1.

The digital basemaps used are based on Canadian Hydrographic Service (CHS) paper charts and range in scales from 1:37,500 to 1:80,000. These basemaps were compiled by AXYS Software Ltd., in QUICKMap format. Beach areas were estimated from the polygons, first established in 1989 and the database has been continually updated since then under funding from both DFO and Environment Canada Shellfish Program. Each clam beach is defined as a geographical area in the GIS with associated attribute information. Clam beaches were defined on the GIS by "snapping" their boundaries to features in the digital map set.

Please note that beach areas were measured that encompassed the whole intertidal area and that only portions of the beach may bear clam populations. We have found that clam areas of commercial interest are often small relative to the overall size of the beach.

Hard copy charts were produced from QUIKMap savemaps which were customized to show all the areas with clam beaches reported. Clam beach data were imported from the associated dBase GIS files to a Microsoft Access database. Hard copy tables were produced from MS Access queries and reports using MS Excel 5.0 and MS Word 6.0.

All of the data in this report are available from DFO in QUICKMap and MS Access formats.

4.2.2 Beach closures for Aboriginal and recreational harvest

Appendix 2 provides a list, descriptions and figures for 11 beaches (107 ha) closed to commercial fishing and allocated for harvest for food, social and ceremonial purposes by First Nations.

4.2.3 Beach listings

The beaches have been initially sorted by Pacific Fishery Management Areas 11 and 12, on the northern inside waters of Vancouver Island and the British Columbia mainland (Fig. 1). Tables and maps for both Management Areas are presented in Appendix 1.

Summary tables of beaches sorted alphabetically by location name and sorted by beach number are given in Appendices 4 and 5, respectively, along with the estimates of beach area.

4.3 Summary of Beach Data

4.3.1 Area 11

Seven beaches (25 ha in total) were identified in Area 11, shown in Appendix Fig. 1.1. The beaches range from <1 to 8 ha (Appendix Table 1.1).

4.3.2 Area 12

There were 222 beaches (1422 ha) identified in Area 12, shown in Appendix Figs. 1.2.1. to 1.2.6. The beaches range from <1 to 146 ha (Appendix Table 1.2). The largest beaches identified were in Hardy Bay (74 ha), Blekinsop Bay (74 ha) and Beaver Harbour (146 ha).

5.0 DISCUSSION

There are a large number (229) of small beaches identified and probably a number of small locations missed in this inventory. Approximately 1447 ha of beach was identified, but the clam bearing portions of the beaches are much less. There has been a long traditional use of the beaches by First Nations and 11 beaches (107 ha) have been closed to commercial fishing for harvest for food, social and ceremonial purposes.

The testing for PSP and ASP is essential by the testing of mussels from stations along the coast. There are few sewage contaminated closures in the NIW, relative to inside waters of the Strait of Georgia.

5.1 Recommendations

1. Additional resource inventories are required to identify butter clam and littleneck beaches specifically. It may be important to document the distribution of other species such as soft-shell clams.
2. An analysis of the potential of beaches in Area 12 for clam culture is recommended.
3. Further studies are required on the growth and recruitment of intertidal clams in all areas.
4. Studies on the distribution and abundance of Manila clams are required.

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7.0. ACKNOWLEDGEMENTS

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Some data for clam beaches were provided by the Kwakiutl Territories Fisheries Commission (KTFC).

Table 1. Common and scientific names of intertidal bivalve species exploited in British Columbia.¹

Class	Order	Family	Common Names	Scientific Names
Bivalvia	Heterodonta	Cardiidae	Cockle <i>Also known as:</i> Nuttall cockle heart cockle	<i>Clinocardium nuttallii</i> (Conrad, 1837)
"	"	Pharidae Formerly: Family Solenidae	Razor clam	<i>Siliqua patula</i> (Dixon, 1789)
"	"	Veneridae	Manila clam <i>Also known as:</i> Japanese littleneck	<i>Tapes philippinarum</i> (A. Adams & Reeve, 1850) <i>Also known as:</i> <i>Venerupis</i> and <i>Ruditapes</i>
"	"	Veneridae	Pacific littleneck <i>Also known as:</i> native littleneck, rock cockle	<i>Protothaca staminea</i> (Conrad, 1837)
"	"	Veneridae	Butter clam	<i>Saxidomus giganteus</i> (Deshayes, 1839) <i>Also known as:</i> <i>Saxidomus gigantea</i>

¹Coan and Scott, 1997

Table 2. Annual commercial clam fishery landings (t) and landed values (\$000), 1951 to 1995, for British Columbia.

Year	LANDINGS (t)					LANDED VALUE (\$000)	TOTAL BC LANDINGS (t)
	Butter	Littleneck	Manila	Mixed	Razor		
1951	1,597	237	81	65	61	149	2,041
1952	2,490	224	184	65	57	222	3,020
1953	1,674	140	176	20	70	127	2,081
1954	1,314	66	204	5	123	104	1,712
1955	2,170	36	207	3	99	159	2,515
1956	1,454	14	99	*	108	102	1,676
1957	1,606	10	29	11	84	102	1,739
1958	987	18	15	6	75	65	1,101
1959	1,094	22	25	13	90	75	1,244
1960	1,800	41	6	23	101	133	1,971
1961	857	46	48	34	104	76	1,089
1962	1,533	92	69	43	77	139	1,813
1963	1,144	59	59	*	67	103	1,329
1964	570	69	26	1	48	59	714
1965	704	82	97	0	68	106	951
1966	831	105	149	1	35	125	1,121
1967	975	139	92	*	46	163	1,252
1968	399	91	164	15	12	98	681
1969	378	107	81	7	8	85	581
1970	792	144	79	15	18	184	1,049
1971	568	361	153	11	62	235	1,156
1972	645	631	265	1	17	382	1,559
1973	298	207	134	0	76	196	715
1974	531	328	182	0	69	383	1,110
1975	746	236	158	6	27	333	1,173
1976	655	173	199	70	82	340	1,179
1977	649	209	394	59	78	545	1,389
1978	383	159	753	245	47	834	1,587
1979	613	273	251	374	101	916	1,612
1980	760	358	288	151	75	1,001	1,632
1981	119	179	318	161	30	737	806
1982	102	242	598	155	68	1,135	1,165
1983	77	324	1,048	279	31	1,723	1,759
1984	130	294	1,677	410	100	2,757	2,610
1985	251	191	1,913	477	90	3,288	2,922
1986	158	284	1,893	371	142	3,801	2,848
1987	68	373	3,607	87	142	6,775	4,277
1988	134	290	3,909	27	155	7,770	4,515
1989	92	433	2,764	159	117	6,955	3,565
1990	109	465	1,456	339	114	5,279	2,483
1991	42	201	982	137	117	3,302	1,479
1992	132	116	914	124	55	2,861	1,341
1993	102	131	1,059	133	44	3,371	1,469
1994	174	94	1,376	88	105	4,410	1,838
1995**	101	140	1,292	3	140	4,724	1,677
Total:	32,010	8,433	29,472	4,193	3,434	66,429	77,516
% of BC Total:	41%	11%	38%	5%	4%		

Table 3. Annual landings (tonnes) of intertidal clams from the northern inside waters of Vancouver Island and the British Columbia mainland (Areas 11 and 12) as reported on sales slips, 1951 to 1995.

Year	Butter	Littleneck	Manila ¹	Mixed	Total Landings
1951	603	0.1			603
1952	476	4	.	0.2	481
1953	636	4		4	644
1954	322				322
1955	590				590
1956	530				530
1957	473	*			473
1958	351				351
1959	375				375
1960	615				615
1961	354				354
1962	877	2	0.3		879
1963	518	0.5		0.2	518
1964	437	5			442
1965	490	1			491
1966	563				563
1967	624			0.5	625
1968	181	1			182
1969	177	2 *			179
1970	508	1	2		511
1971	248	16	2		266
1972	275	29	2		306
1973	137	14	1		152
1974	181	42	1		224
1975	378	104	2	1	485
1976	200	81	1	0.5	282
1977	207	44	4	1	256
1978	118	27	9	7	161
1979	177	94	14	8	293
1980	89	44	14	7	154
1981	4	34	12	4	53
1982		15	5	9	29
1983		60	10	6	75
1984	12	43	11	2	67
1985	102	32	6	9	148
1986	20	36	4	16	77
1987	20	69	16	1	106
1988	113	55	15	*	183
1989	64	87	6		157
1990		58	2	2	61
1991	6	49	6	1	63
1992	12	63	4	1	80
1993	2	62	1	1	66
1994	52	50	0.3		102
1995	47	41			88
Total:	12,164	1,270	148	79	13,661
% of Total	89%	9%	1%	1%	(18% of B.C. Total)
(Areas 11 & 12):					

* Less than 500 kg.

¹ Manila clam landings data are in error and were misreported by either species or area.

Table 4. Annual landings (tonnes) of intertidal clams from Area 11, as reported on sales slips, 1951 to 1995.

Year	Butter	Littleneck	Manila ¹	Mixed	Total Landings
1951					
1952					
1953					
1954					
1955					
1956					
1957					
1958					
1959					
1960					
1961					
1962					
1963					
1964					
1965					
1966					
1967					
1968					
1969					
1970					
1971					
1972					
1973					
1974					
1975					
1976					
1977					
1978					
1979					
1980		1	1	*	2
1981					
1982					
1983					
1984			*		
1985					
1986					
1987					
1988			*		
1989		*			
1990					
1991					
1992					
1993					
1994					
1995					
Total:	0	1	1	0	2
% of Total	0%	50%	50%	0%	
(Area 11):					

* Less than 500 kg.

¹ Manila clam landings data in error - misreported by either species or area

Table 5. Annual landings (tonnes) of intertidal clams from Area 12, as reported on sales slips, 1951 to 1995.

Year	Butter	Littleneck	Manila ¹	Mixed	Total Landings
1951	603	0.1			603
1952	476	4		0.2	481
1953	636	4		4	644
1954	322				322
1955	590				590
1956	530				530
1957	473	*			473
1958	351				351
1959	375				375
1960	615				615
1961	354				354
1962	877	2	0.3		879
1963	518	0.5		0.2	518
1964	437	5			442
1965	490	1			491
1966	563				563
1967	624			0.5	625
1968	181	1			182
1969	177	2	*		179
1970	508	1	2		511
1971	248	16	2		266
1972	275	29	2		306
1973	137	14	1		152
1974	181	42	1		224
1975	378	104	2	1	485
1976	200	81	1	0.5	282
1977	207	44	4	1	256
1978	118	27	9	7	161
1979	177	94	14	8	293
1980	89	43	13	7	152
1981	4	34	12	4	53
1982		15	5	9	29
1983		60	10	6	75
1984	12	43	11	2	67
1985	102	32	6	9	148
1986	20	36	4	16	77
1987	20	69	16	1	106
1988	113	55	15	*	183
1989	64	87	6		157
1990		58	2	2	61
1991	6	49	6	1	63
1992	12	63	4	1	80
1993	2	62	1	1	66
1994	52	50	0.3		102
1995	47	41			88
Total:	12,164	1,269	147	79	13,659
% of Total (Area 12):	89%	9%	1%	1%	

* Less than 500 kg.

¹ Manila clam landings data in error - misreported by either species or area

Table 6. Summary of the number of clam beaches and beach areas (ha) for the northern inside waters of Vancouver Island (NIW) and the British Columbia mainland.

Management Area	No. of Beaches	Area of Beaches	Range of Areas	No. of beaches in size ranges (ha)						
				< 10	10 to < 20	20 to < 30	30 to < 40	40 to < 50	50 to < 60	60 +
11	7	24.9	0.95 to 7.8	7	0	0	0	0	0	0
12	222	1421.6	0.01 to 145.6	191	15	6	4	2	1	3
Total NIW:	229	1446.5	< 1 to 146	198	15	6	4	2	1	3
% of Total No. Beaches:				86.5%	6.6%	2.6%	1.7%	0.9%	0.4%	1.3%

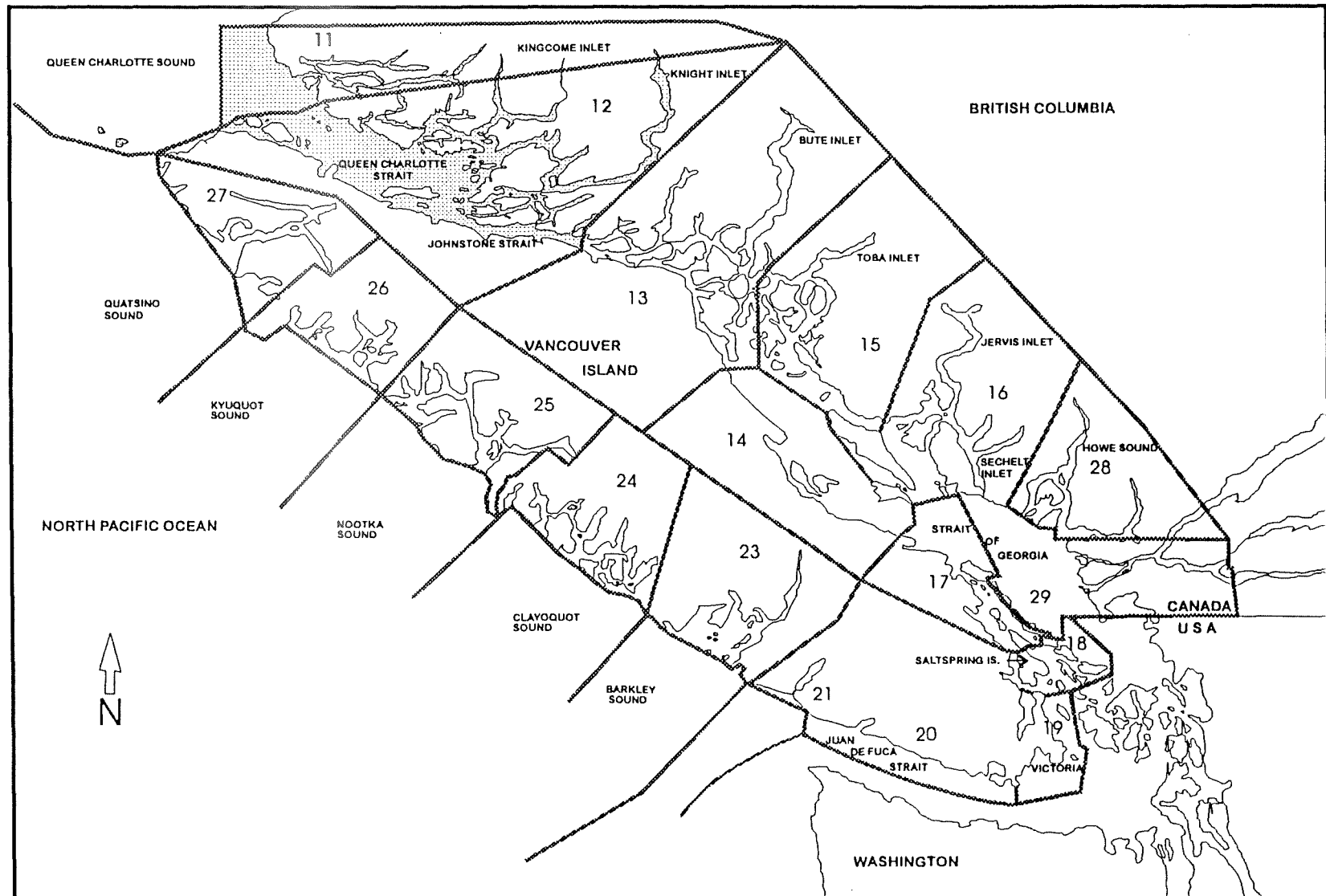


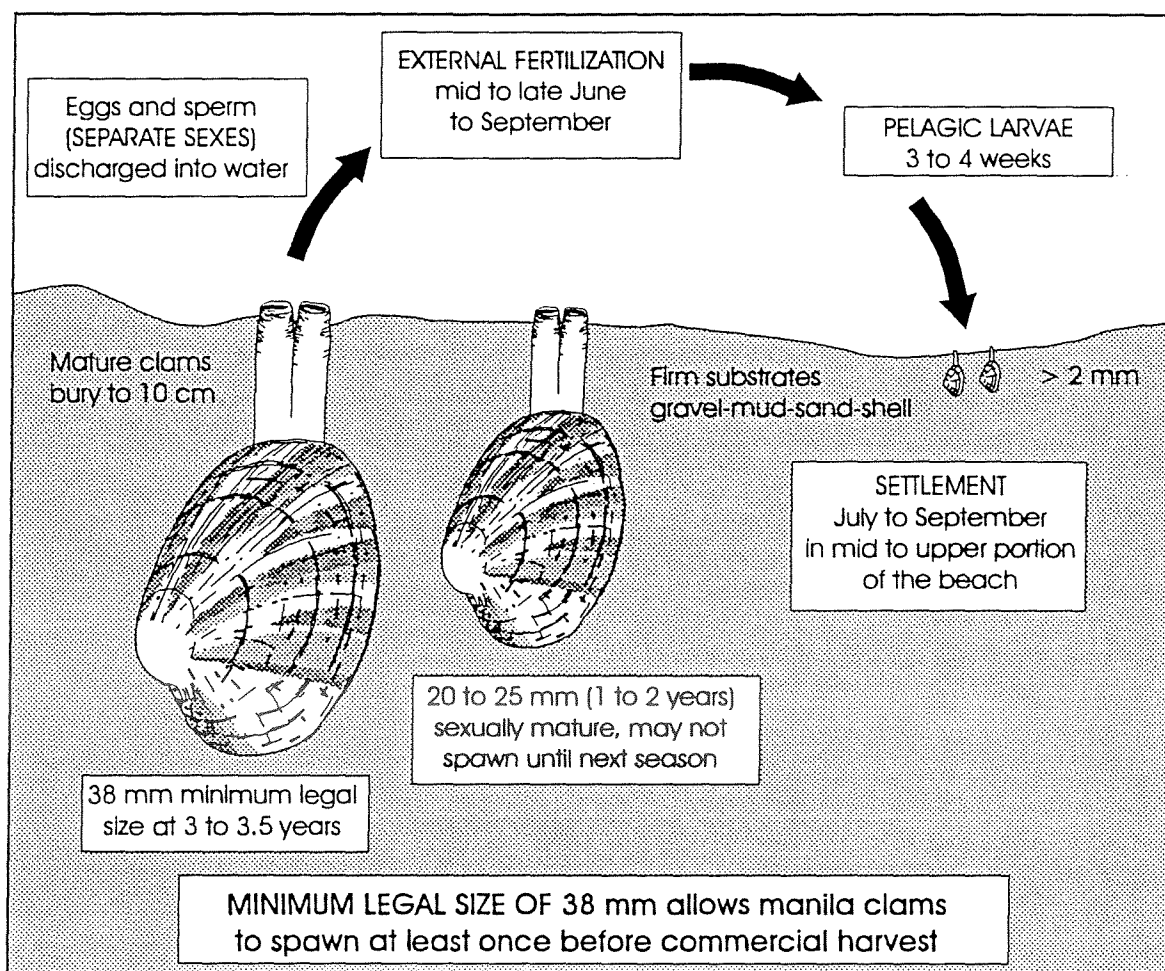
Figure 1. Pacific Fishery Management Areas 11 and 12, the northern inside waters of Vancouver Island (NIW) and the British Columbia mainland.

MANILA CLAM

Manila clams, *Venerupis philippinarum* (A. Adams and Reeve, 1850), also called *Tapes philippinarum*, were accidentally introduced to BC with Pacific Oyster seed from Japan in the 1930's. This clam spread quickly in the Strait of Georgia and, in the 1950's, along the west coast of Vancouver Island. In the 1960's manila clams spread to the Queen Charlotte Strait area and, in the 1970's, to the central coast area as far north as Bella Bella.

Manila clam shells are longer than they are high and the clam has a distinct oblong shape. The shells are heavy with radiating ridges crossing the concentric growth rings. The external colour varies from a greyish-white, through yellowish-buff to brown, often with geometric patterns of black and white in the young. The internal surface is smooth and yellowish-white with deep purple at the siphon (posterior) end. The inside edge of the shell is smooth and distinct from that of the native littleneck, which has regular shallow notches along the edges of the shell. The tip of the siphon is split, unlike the native littleneck. Manila clams measure up to 7.5 cm in length at 14 years.

LIFE CYCLE OF THE MANILA CLAM (*Venerupis philippinarum*)



Clams of British Columbia

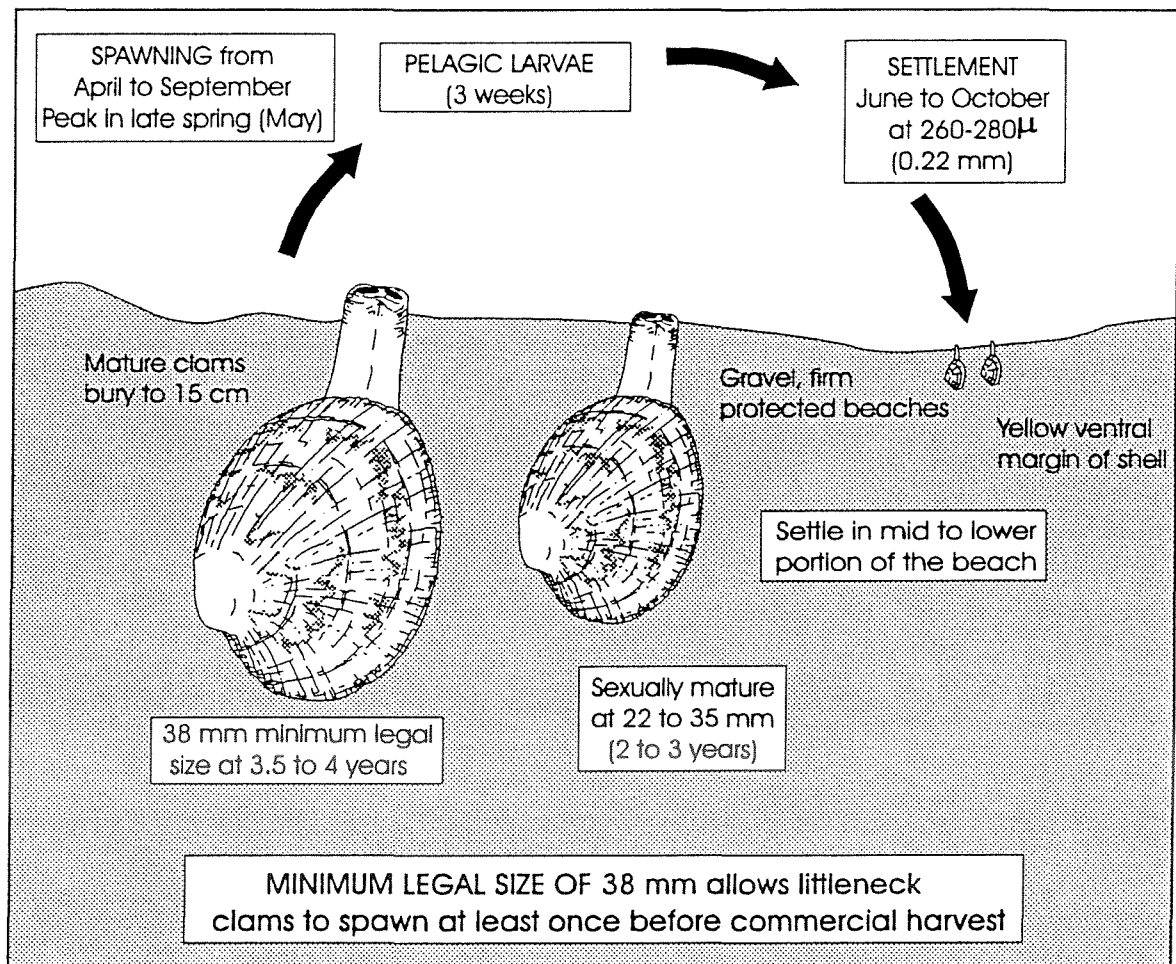
Figure 2. Life cycle of the Manila clam.

LITTLENECK CLAM

Littleneck clams, *Protothaca staminea* (Conrad, 1837), are medium size intertidal clams that may attain a shell length of 75 mm and ages to 14 years.

Littleneck shells are thick, oval to round with strong radiating ribs and less prominent concentric ridges. The external colour may vary from white to chocolate brown, often with angular patterns. The internal surface is smooth and white with fine notches on the margin. Unlike the manilla clam, the siphon tips are fused.

LIFE CYCLE OF THE LITTLENECK CLAM (*Protothaca staminea*)



Clams of British Columbia

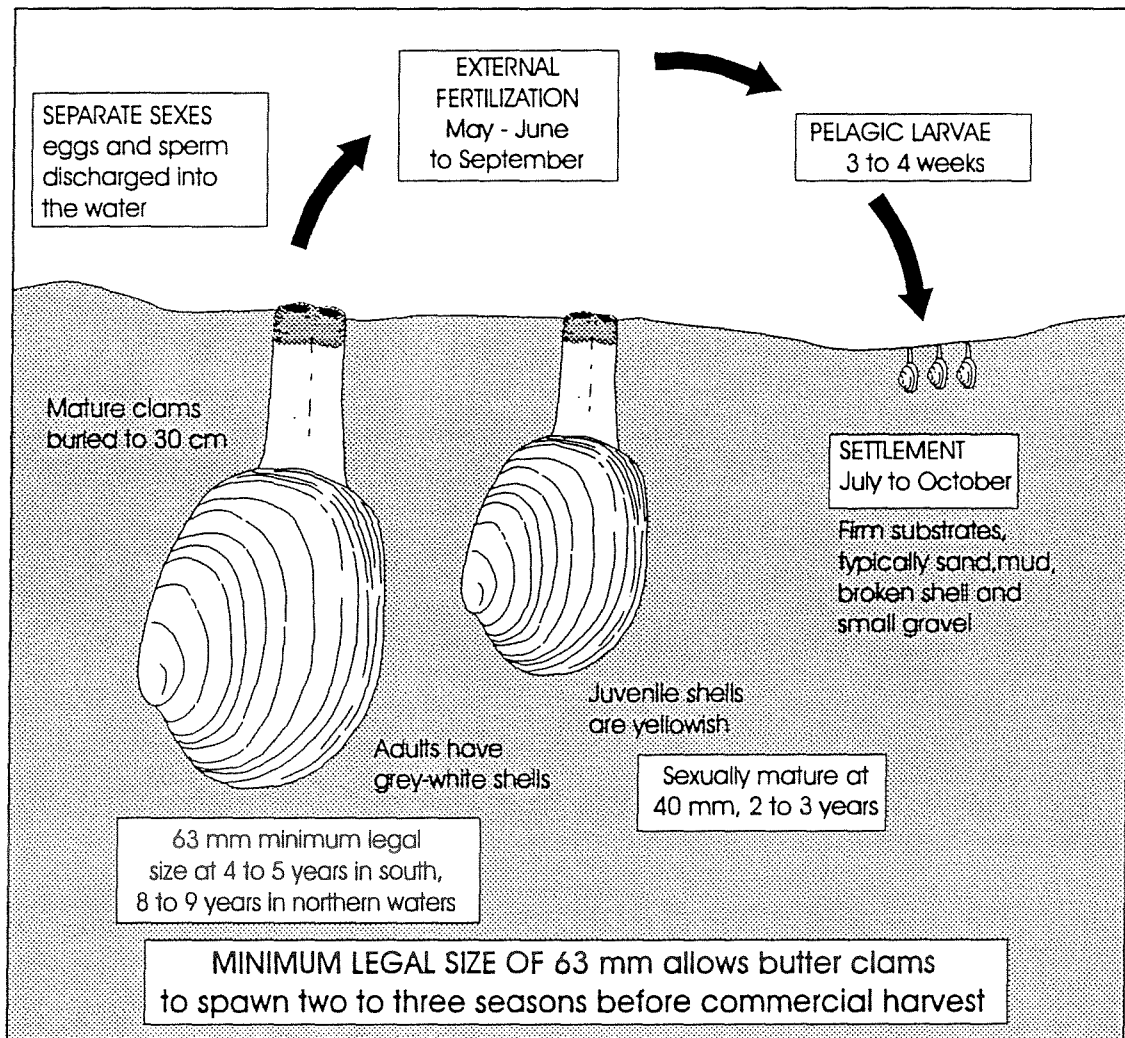
Figure 3. Life cycle of the littleneck clam.

BUTTER CLAM

Butter clams, *Saxidomus gigantea* (Deshayes, 1839), are large intertidal clams that may attain a shell length of 130 mm and ages to 20 years. They form the greatest biomass of intertidal clams in British Columbia.

The shells are heavy and square to oval in shape. There is a strong prominent external hinge ligament. The exterior is gray-white (yellow in juveniles) with prominent concentric striations and deep winter checks. The internal surface is a dull white and smooth with large indented muscle scars. The siphon tips are black.

LIFE CYCLE OF THE BUTTER CLAM (*Saxidomus gigantea*)



Clams of British Columbia

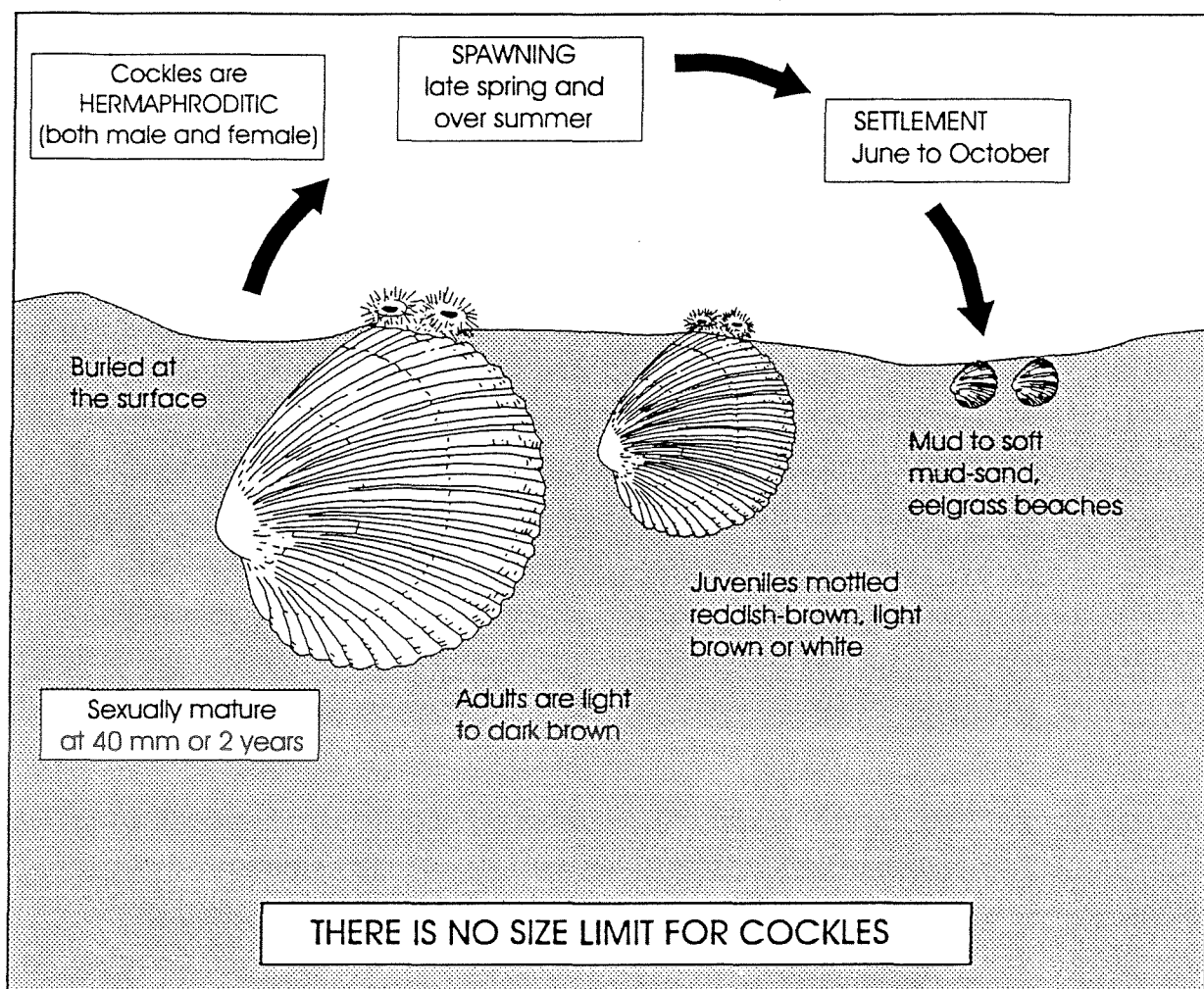
Figure 4. Life cycle of the butter clam.

COCKLE

Cockles, *Clinocardium nuttallii* (Conrad, 1837), are medium size with shell lengths to 140 mm and ages generally to 7 years, but some grow as old as 16 years. They are generally found in soft substrates in the lower intertidal zone and subtidally to 30 m.

The shells are thick with 34 to 38 prominent radial ribs and less prominent concentric growth rings. The exterior of adult shells are light to dark brown and juveniles have a mottled reddish brown, light brown or white colour. The internal surface of the shell is chalky white.

LIFE CYCLE OF THE COCKLE (*Clinocardium nuttallii*)



Clams of British Columbia

Figure 5. Life cycle of the cockle.

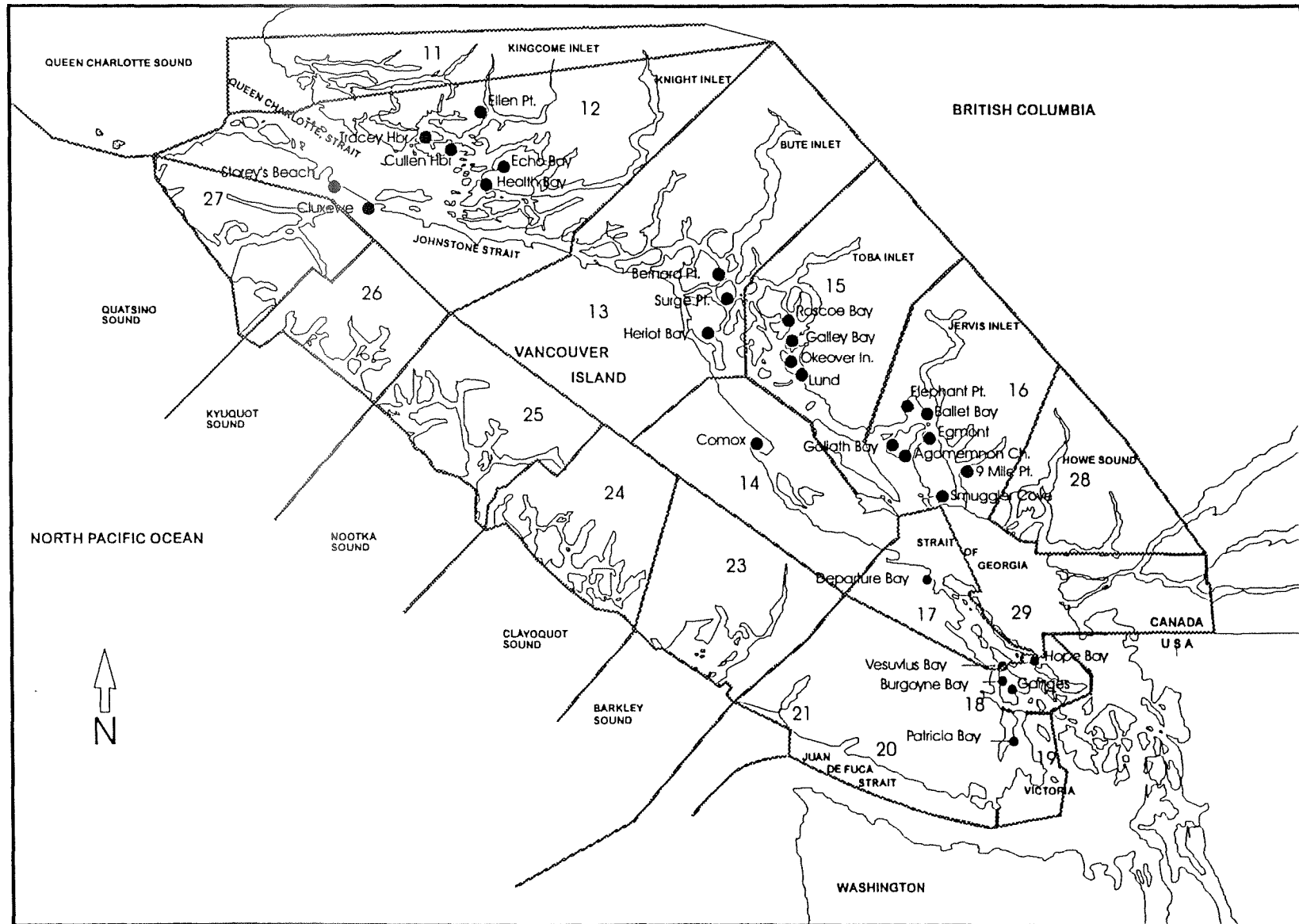


Figure 6. PSP monitoring stations in 1995 for the inside waters of Vancouver Island and the British Columbia mainland.

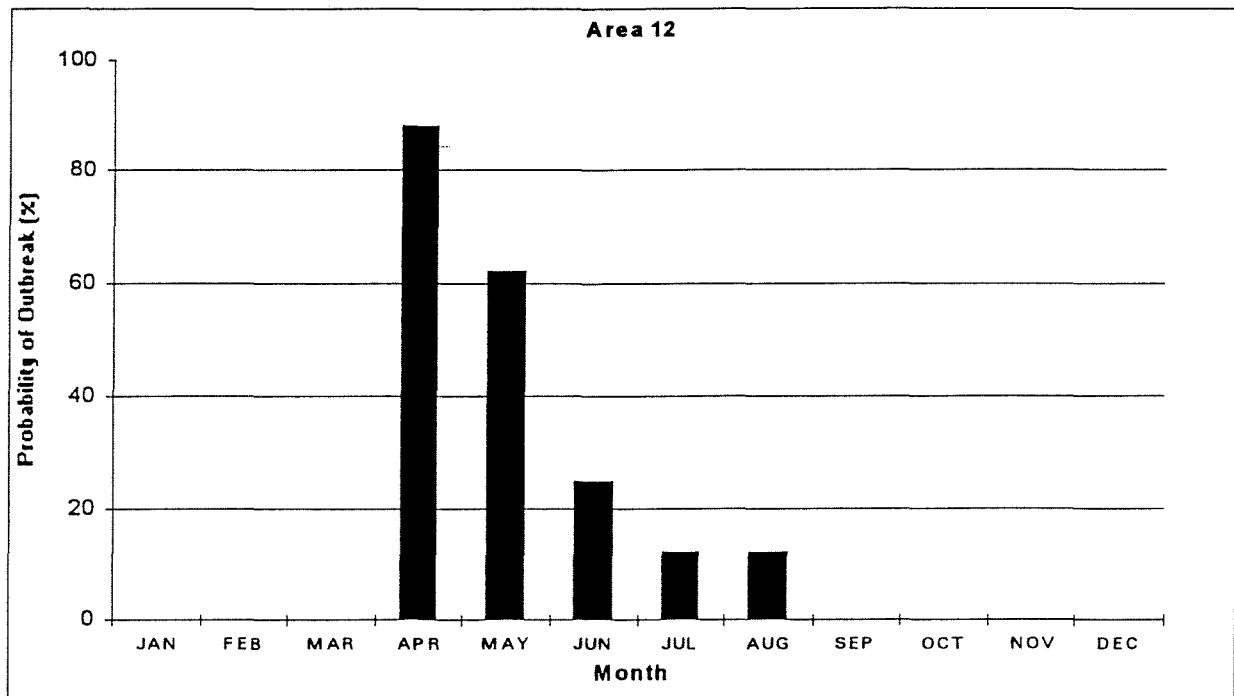


Figure 7. Average monthly PSP activities in the northern inside waters of Vancouver Island and mainland British Columbia, 1987 to 1994. PSP levels shown are greater than 210 μ /100g.

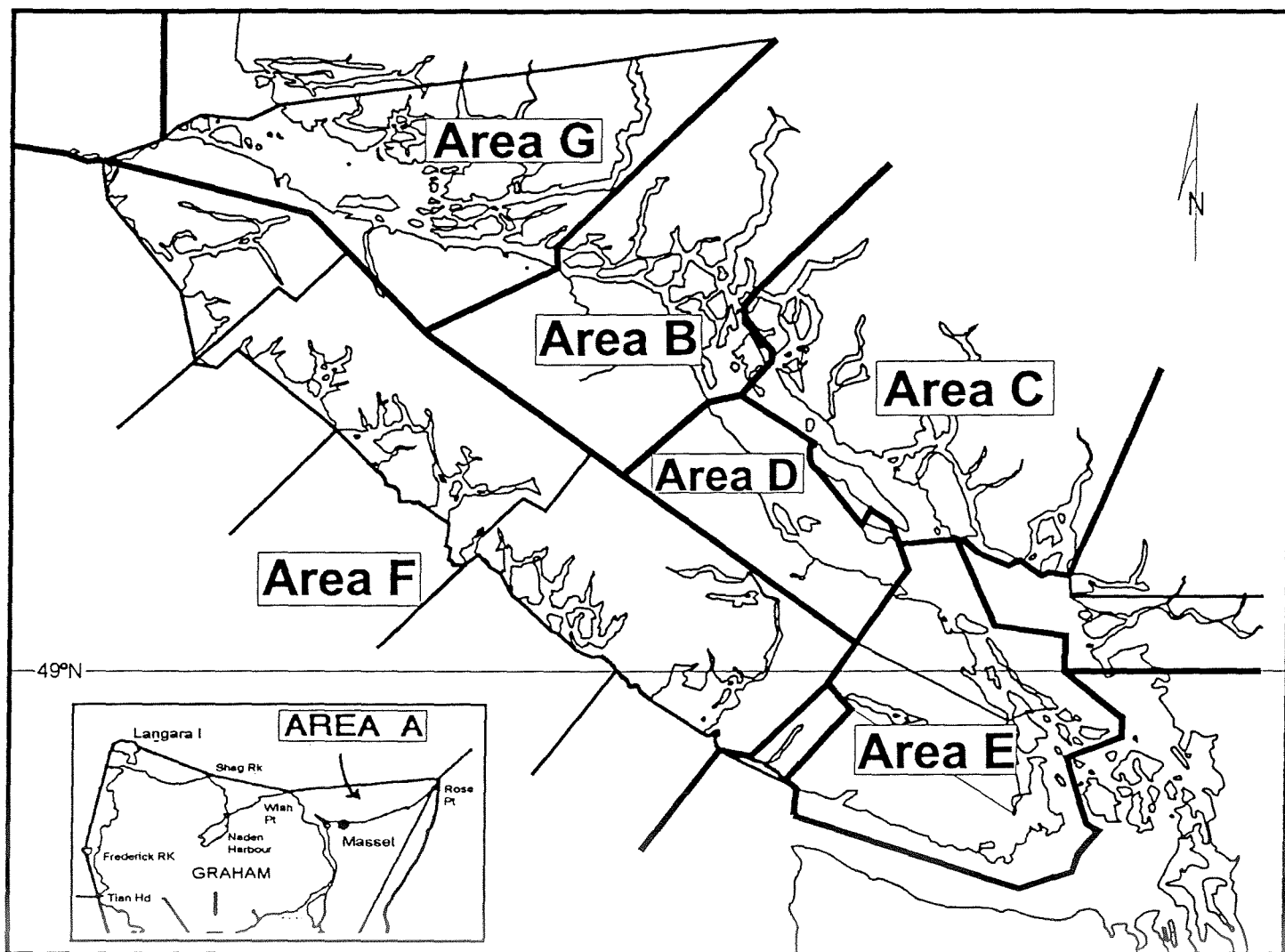


Figure 8. Commercial Clam Harvest Licence Areas (1997).

A: North Coast

B: Southern Johnstone Strait/Campbell River

C: Sunshine Coast

D: Upper Strait of Georgia

E: Lower Strait of Georgia (revised 1997)

F: West Coast of Vancouver Island

G: Queen Charlotte Sound (revised 1992)

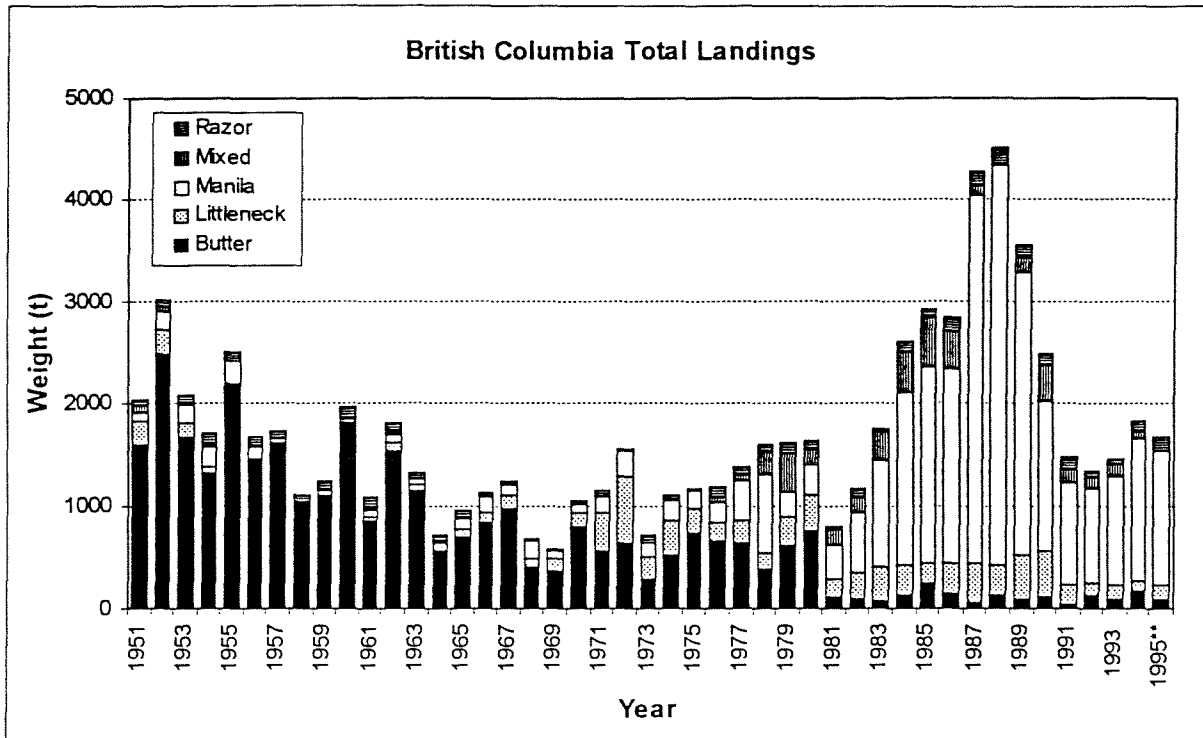


Figure 9. Landings (t) of intertidal clams from British Columbia, 1951 to 1995.

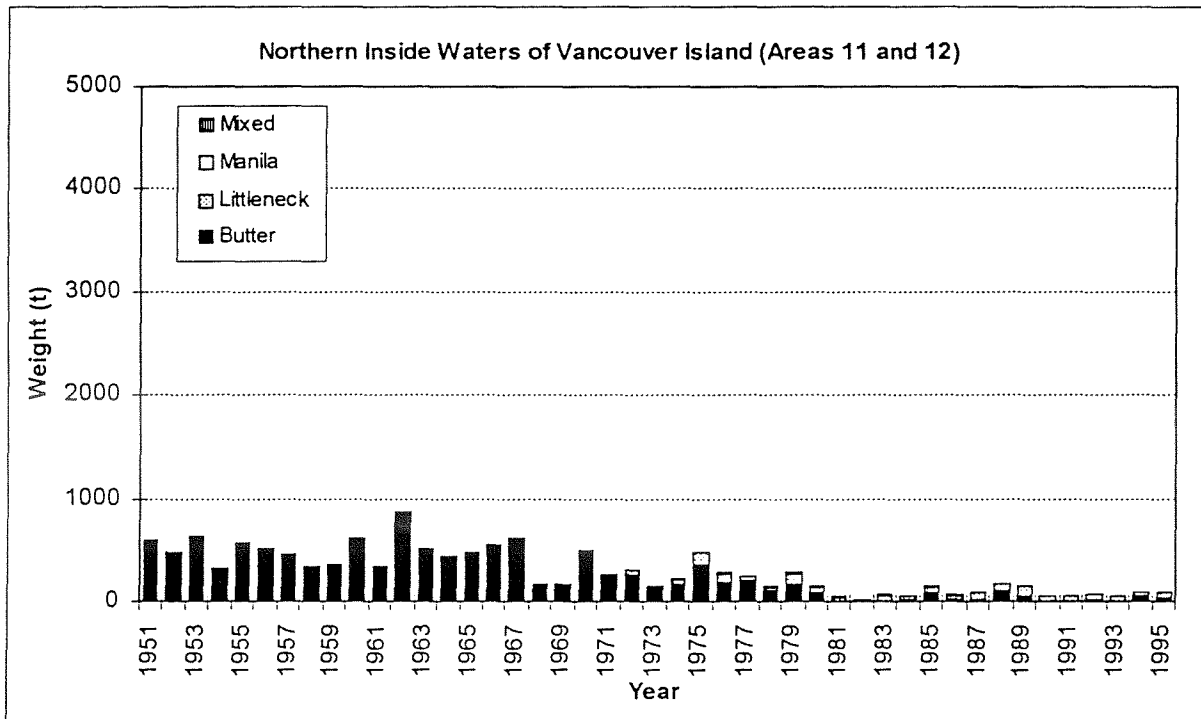


Figure 10. Landings (t) of intertidal clams from the northern inside waters of Vancouver Island and mainland British Columbia, Areas 11 and 12, 1951 to 1995.

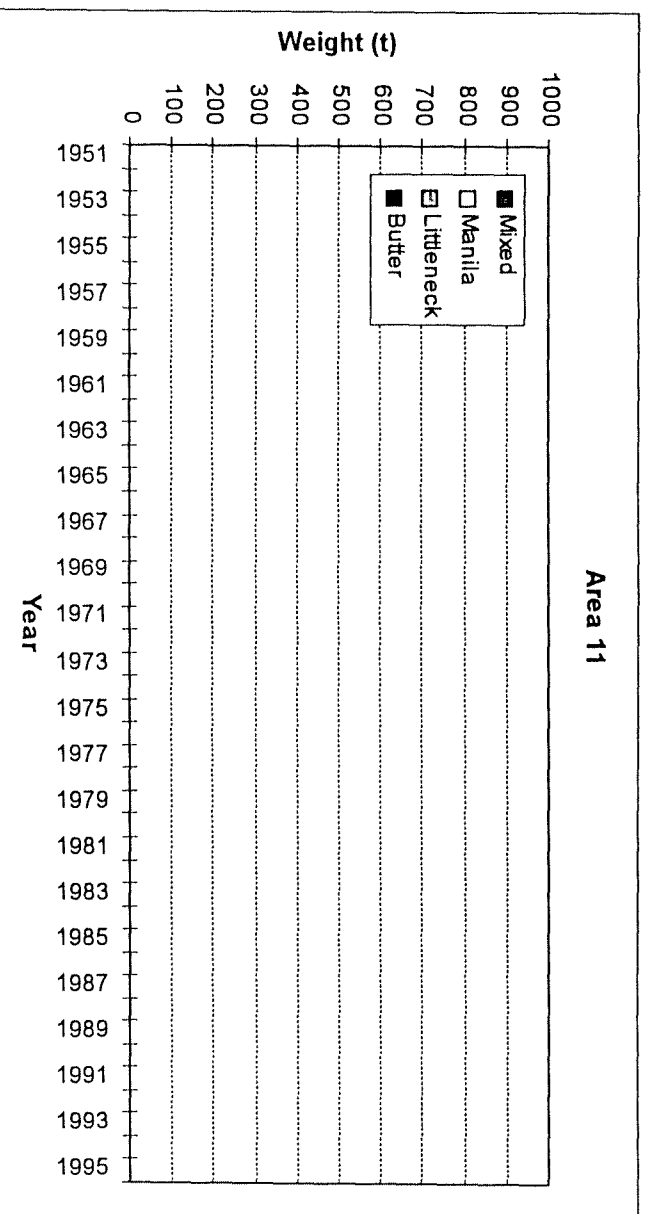


Figure 11. Landings (t) of intertidal clams, Area 11, 1951 to 1995.

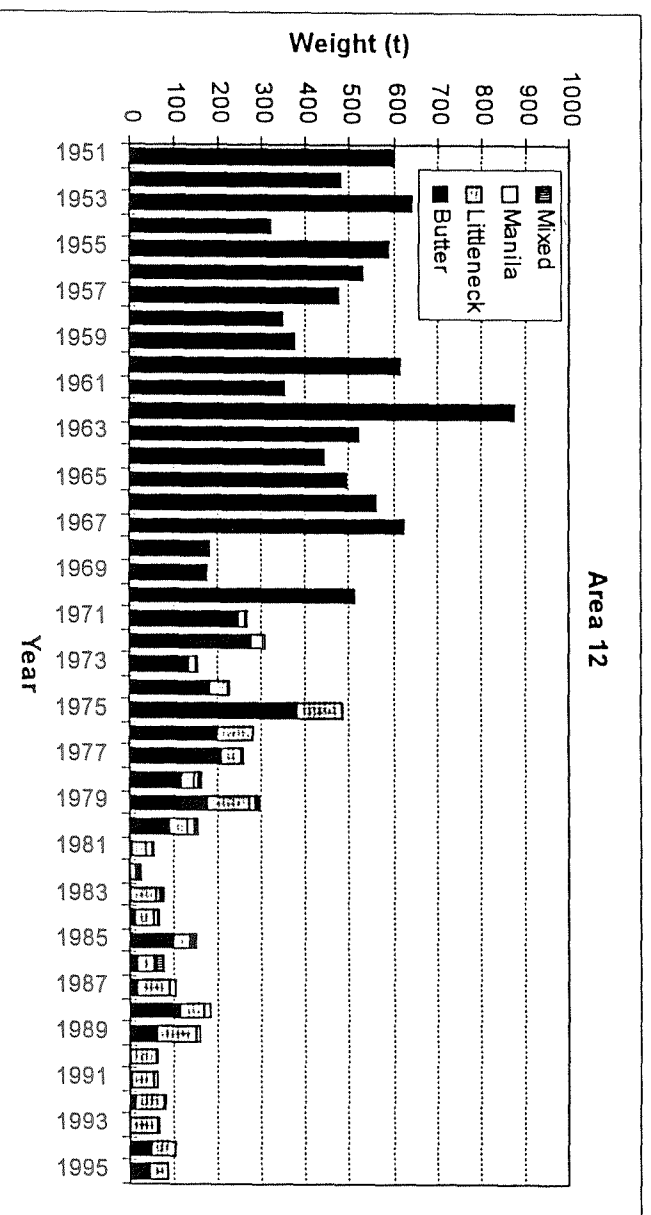
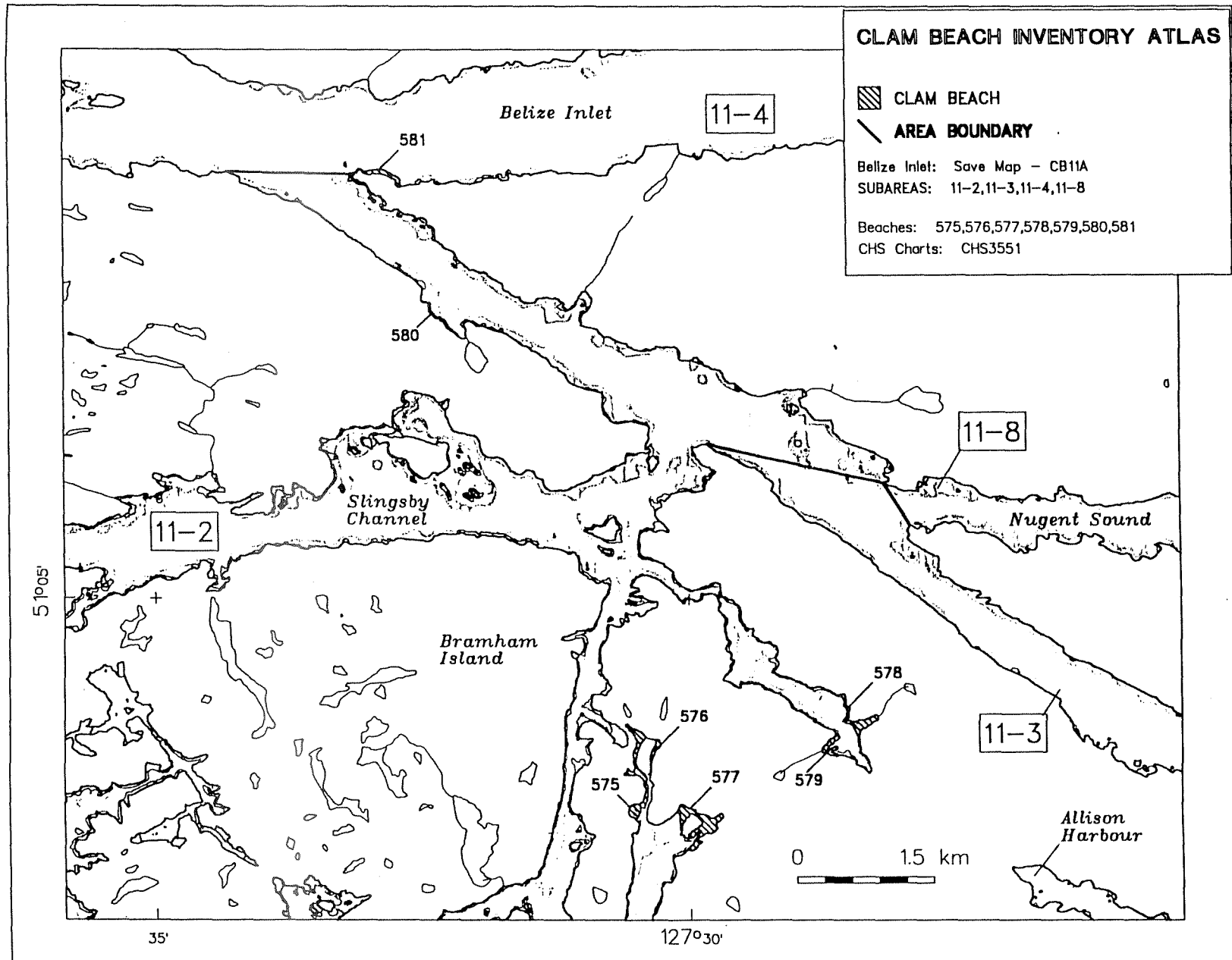


Figure 12. Landings (t) of intertidal clams, Area 12, 1951 to 1995.

APPENDIX 1.
CLAM BEACH TABLES AND MAPS
AREAS 11 AND 12

Appendix Table 1.1. British Columbia Clam Beach Inventory, sorted by Subarea for Management Area 11.

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
11	2	575	Allison Harbour	6.49	
11	2	576	Allison Harbour	0.95	
11	2	577	Allison Harbour	7.82	
11	2	578	Cougar Inlet	3.76	
11	2	579	Cougar Inlet	1.84	
11	2	580	Mignon Point	1.02	
11	2	581	Mignon Point	2.97	
<i>Total Beaches:</i>		7	<i>Total Beach Area:</i>	24.85	



Appendix Figure 1.1.

Appendix Table 1.2. British Columbia Clam Beach Inventory, sorted by Subarea for Management Area 12.

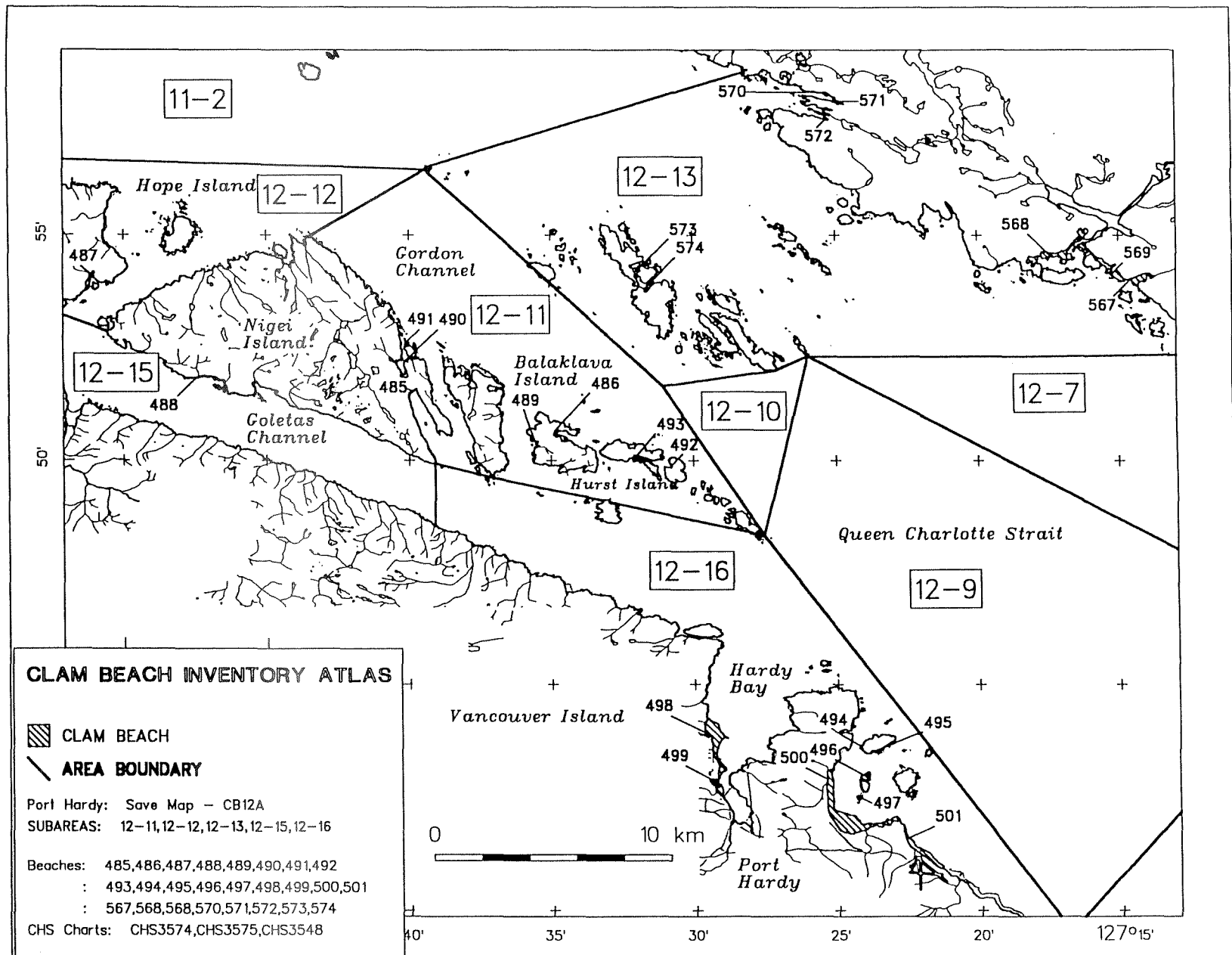
Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	1	192	Blenkinsop Bay	74.21	
12	2	860	Port Harvey	16.29	
12	2	861	Broken Islands, A	7.12	
12	2	862	Broken Islands, B	2.19	
12	6	565	Malcolm Island	13.2	
12	6	799	Henrietta Island	1.05	
12	6	803	Cedar Island, A	2.9	
12	6	804	Cedar Island, B	2.92	
12	6	805	Cedar Island, C	1.51	
12	6	806	Carey Group, A	2.52	
12	6	807	Carey Group, B	0.63	
12	6	808	Carey Group, C	0.86	
12	6	809	Carey Group, D	5.83	
12	6	810	Carey Group, E	3.07	
12	6	811	Mound Island, A	3.16	
12	6	812	Mound Island (S), B	6.7	
12	6	813	Mound Island (S), C	1.9	
12	7	777	Polking Horne Island	2.45	
12	11	485	Port Alexander	2.58	
12	11	486	Harlequin Bay, Hurst Island	8.2	
12	11	489	God's Pocket, Hurst Island	0.62	
12	11	490	Nigei Island (E)	13.54	
12	11	491	Nigei Island (E)	1.77	
12	11	492	Heard Island	0.68	
12	11	493	Bell Island	4.55	
12	12	487	Kalect Island, Bates Pass	8	
12	13	567	Cohoe Bay	22.43	
12	13	568	Blunden Harbour	56.68	
12	13	569	Blunden Harbour	44.16	
12	13	570	Shelter Bay	2.31	
12	13	571	Shelter Bay	2.45	
12	13	572	Shelter Bay	6.5	
12	13	573	Walker Group	8	
12	13	574	Walker Group	4.82	
12	15	488	Lemon Point	9.31	
12	16	494	Peel Island	0.58	
12	16	495	Peel Island	1.23	
12	16	496	Cattle Island	5.26	
12	16	497	Cattle Island	2.34	
12	16	498	Hardy Bay	73.85	
12	16	499	Hardy Bay	7.75	
12	16	500	Beaver Harbour	145.6	
12	16	501	Thomas Point - Keogh Shoals	35.24	
12	17	566	Cluxewe River Mouth	0	
12	22	850B	Bockett Islets	0.58	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	22	850A	Havannah Islets	0.64	
12	22	850C	Bockett Islets	0.7	
12	22	850D	Bockett Islets	1.84	
12	22	850E	Bockett Islets	2.48	
12	22	851	Hull Islands	4.13	
12	22	852	Indian Islands	3.47	
12	22	853	Root Point	4.54	
12	22	859	Bougey Bay	10.91	
12	23	854	Warren Island, A	1.25	
12	23	855	Warren Island, B	0.62	
12	23	856	Warren Island, C	0.6	
12	23	857C	Call Shoal (S)	0.47	
12	23	857A	Call Shoal (S)	0.6	
12	23	857D	Call Shoal (S)	1.15	
12	23	857B	Call Shoal (S)	1.3	
12	23	858	Call Inlet (Ribbon)	5.09	
12	25	525	Port Neville (Mouth)	4.46	
12	25	526	Port Neville (Mouth)	7.7	
12	25	527	Port Neville (Mouth)	3.42	
12	25	557	Port Neville (Head)	48.13	
12	25	558	Port Neville (Head)	23.8	
12	25	559	Port Neville (Head)	5.33	
12	25	560	Port Neville (Head)	2.08	
12	25	561	Port Neville (Head)	2	
12	25	562	Port Neville (Head)	21.71	
12	25	563	Port Neville (Head)	5.75	
12	26	513	Mamalilaculla	25.87	
12	26	514	Dead Point (S)	18.13	
12	26	515	Duck Cove	36.59	
12	26	516	Duck Cove	5.33	
12	26	517	Beware Passage	2.39	
12	26	518	Beware Passage	0.99	
12	26	519	Beware Passage	2.81	
12	26	520	Klaoitsis Island	12.01	
12	26	521	Cutter Cove	6.34	
12	26	528	Maple Cove	7.27	
12	26	814	Village Island (E), A	11.23	
12	26	815	Village Island (E), B	0.77	
12	26	816	Lady Island, A	3.31	
12	26	817	Lady Island, B	1.49	
12	26	818	Lady Island, C	0.91	
12	26	819	Lady Island, D	2.06	
12	26	820	Minstrel Island, A	4.38	
12	26	821	Minstrel Island, B	1.23	
12	26	822	Dorman Island, A	0.88	
12	26	823	Dorman Island, B	0.8	
12	26	824	Dorman Island, C	0.95	
12	26	825	Sambo Point, A	0.69	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	26	826	Sambo Point, B	1.36	
12	26	827	Sambo Point, C	1.24	
12	26	828	Clio Channel (N. Shore)	1.59	
12	26	829	Clio Channel (N. Shore)	2.73	
12	26	830	Clio Channel (N. Shore)	1.41	
12	26	831	Turner Bay (Sw), A	0.48	
12	26	832	Turner Bay (Sw), B	1.82	
12	26	833	Klaoitis Island, A	4.23	
12	26	834	Klaoitis Island, B	0	
12	26	835	Klaoitis Island, C	4.43	
12	26	836	Klaoitis Island, D	1.36	
12	26	837	Klaoitis Island, E	1.09	
12	26	838	Harbledown Island (E)	4.17	
12	26	839	Jamieson Island	2.23	
12	26	840	Wilson Pass (SE), A	1.17	
12	26	841	Wilson Pass (SE), B	1.81	
12	26	842	Kamano Island	1.16	
12	26	843	Beware Passage, D	3.15	
12	26	844	Mink Point, A	1.28	
12	26	845	Mink Point, B	1.15	
12	26	846	Cook Island	5.17	
12	26	847	Baronet Pass (W), A	5.23	
12	26	848	Baronet Pass (W), B	1.96	
12	26	849	White Beach Pass	1.57	
12	38	522	Burdwood Group	1.39	
12	38	523	Burdwood Group	0.37	
12	38	524	Burdwood Group	0.78	
12	38	790	Powell Point	0.69	
12	38	791	Powell Point (E)	1.27	
12	38	792	Shoal Harbour	13.61	
12	38	793	Cramer Pass	2.45	
12	38	794D	Horsford Point To Evans Point	0.1	
12	38	794C	Horsford Point To Evans Point	0.12	
12	38	794B	Horsford Point To Evans Point	0.19	
12	38	794A	Horsford Point To Evans Point	0.37	
12	38	794E	Horsford Point To Evans Point	0.46	
12	38	794F	Horsford Point To Evans Point	0.52	
12	38	795B	Baker Island (S)	0.27	
12	38	795A	Baker Island (S)	0.66	
12	39	502	Booker Lagoon	1.88	
12	39	564	Health Lagoon	38.17	
12	39	711	Joe Cove	8.64	
12	39	712	Monday Anchorage	13.63	
12	39	778B	Booker Lagoon (SW)	1.67	
12	39	778A	Booker Lagoon (W)	10.98	
12	39	779A	Booker Lagoon (E)	1.32	
12	39	779B	Booker Passage	1.52	
12	39	780	Olden Island	1.43	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	39	781	Cullen Harbour	0.79	
12	39	782	Wicklow Point	0.64	
12	39	783	Pemberton Point	1.3	
12	39	784	Pemberton Point (Ne)	1.45	
12	39	785	Jumper Island	1.26	
12	39	786	Nickless Islet To Notice Point	4.99	
12	39	787	Twin Lagoon (Fife Sound)	0.92	
12	39	788	Laura Bay	4.41	
12	39	789B	Trivett Island	0.93	
12	39	789A	Trivett Island	1.2	
12	39	796E	Eden Island	0.32	
12	39	796D	Eden Island	0.6	
12	39	796B	Eden Island	1.02	
12	39	796C	Eden Island	1.43	
12	39	796F	Eden Island	1.96	
12	39	796G	Eden Island	3.84	
12	39	796A	Eden Island	3.94	
12	39	797M	High Island	0.46	
12	39	797I	Marsden Island (S)	0.7	
12	39	797L	High Island (N)	1.58	
12	39	797E	Purves Cove, Bonwick Island	1.65	
12	39	797H	Crib Island (N)	1.66	
12	39	797F	Hudson Island	2	
12	39	797K	Hudson Island (S of)	2.07	
12	39	797B	Start Island	3.74	
12	39	797C	Bonwick Island (W)	4.03	
12	39	797G	Crib Island (S)	4.31	
12	39	797D	Betty Cove, Bonwick Island	8.99	
12	39	797A	Dusky Cove, Bonwick Island	9.87	
12	39	798C	Health Bay Area	2.11	
12	39	798D	Health Bay Area	4.99	
12	39	798A	Health Bay Area	10.89	
12	39	798B	Health Bay Area	15.62	
12	39	800	Gilford Island (W)	2.23	
12	39	801	Bear Hill, Gilford Island	14.02	
12	39	802A	Gilford Island (SW)	0.75	
12	39	802B	Gilford Island (SW)	1.31	
12	41	503	Claydon Bay	25.17	
12	41	504	Hopetown Passage	9.14	
12	41	505	Little Nimmo Bay	5.17	
12	41	506	Carriden Bay	13.47	
12	41	765	Burly Bay	8.56	
12	41	766	Sterling Point	3.55	
12	41	767B	Napier Bay (N)	0.64	
12	41	767A	Napier Bay (S)	4.31	
12	41	768B	Preston Point	0.79	
12	41	768A	Bath Point	1.26	
12	41	769	Fresh Water Cove	1.2	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	41	770B	Cane Point	0.83	
12	41	770A	Cane Point	0.9	
12	41	771B	Carter Passage (W)	0.67	
12	41	771A	Bourmaster Point (SE)	3.85	
12	41	772	Carter Passage	1.93	
12	41	773B	Carter Passage (E)	0.57	
12	41	773A	Broughton Point	1.14	
12	41	774H	Dickson Island	0.25	
12	41	774E	Dickson Island	0.42	
12	41	774G	Dickson Island	0.55	
12	41	774A	Dickson Island	1.04	
12	41	774I	Dickson Island	1.2	
12	41	774D	Dickson Island	1.34	
12	41	774B	Dickson Island	1.63	
12	41	774C	Dickson Island	1.76	
12	41	774F	Dickson Island	3.34	
12	41	775A	Percy Island	2.04	
12	41	775B	Percy Island	2.29	
12	41	776	Vincent Island	0.85	
12	42	507	Jennis Bay	13.06	
12	42	508	Richmond Bay	4.46	
12	42	509	Tancred Bay	6.07	
12	42	510	Everard Island	37.64	
12	42	511	Everard Island	4.86	
12	42	512	Muirhead Island	6.9	
12	42	758	Sutherland Bay	23.76	
12	42	759A	Muirhead Island	1.55	
12	42	760	Dove Island	2.25	
12	42	761	Charlotte Point (N of)	1.18	
12	42	762	Macgowan Bay	4.53	
12	42	763B	Davis Islet	0.52	
12	42	763A	Davis Bay	7.07	
12	42	764	Helen Bay	1.49	
<i>Total Beaches:</i>		222	<i>Total Beach Area:</i>	1421.6	



Appendix Figure 1.2.1

CLAM BEACH INVENTORY ATLAS

CLAM BEACH

AREA BOUNDARY

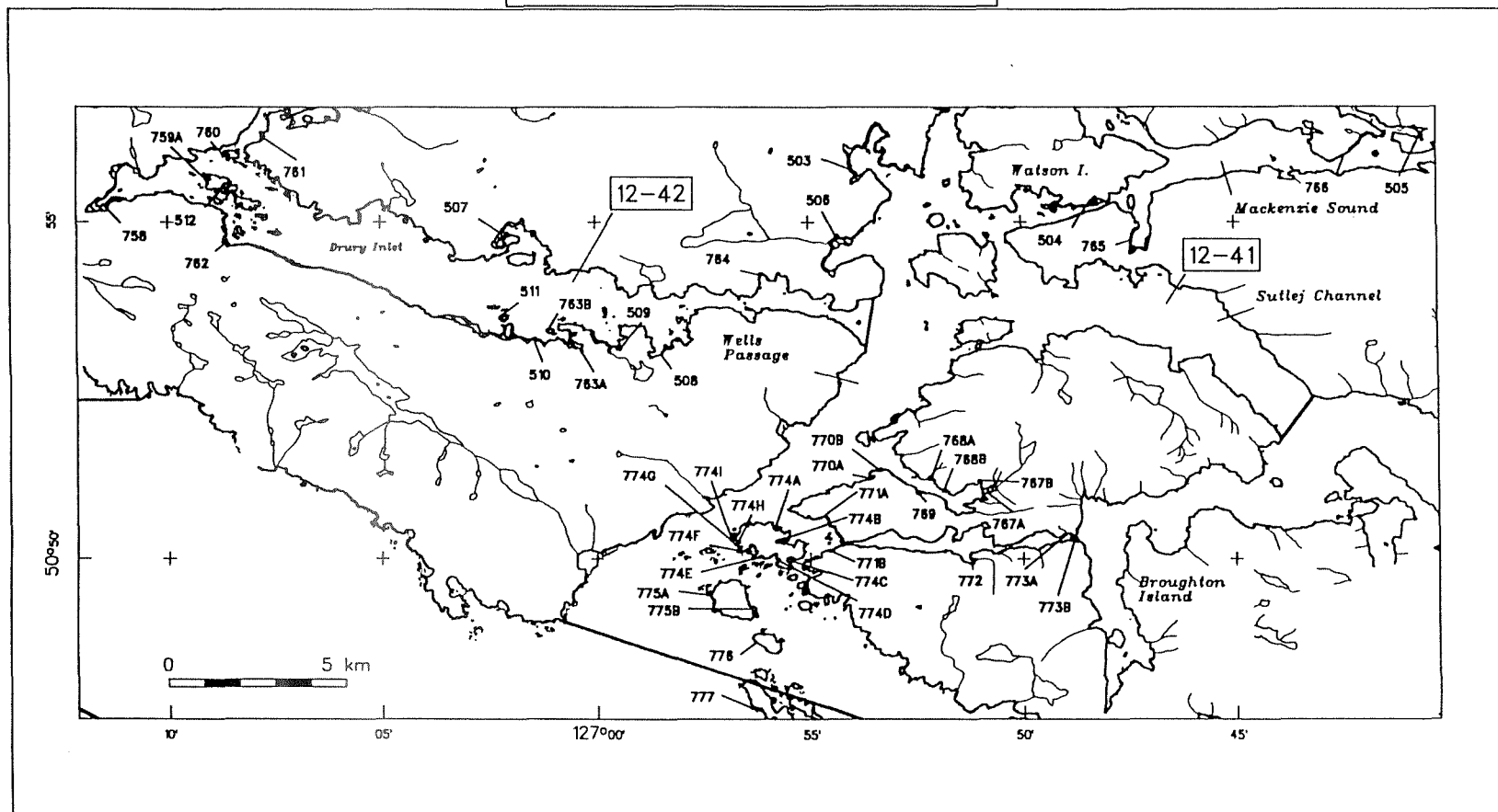
Wells Passage: Same Map - CB12B

SUBAREAS: 12-7,12-40,12-41,12-42

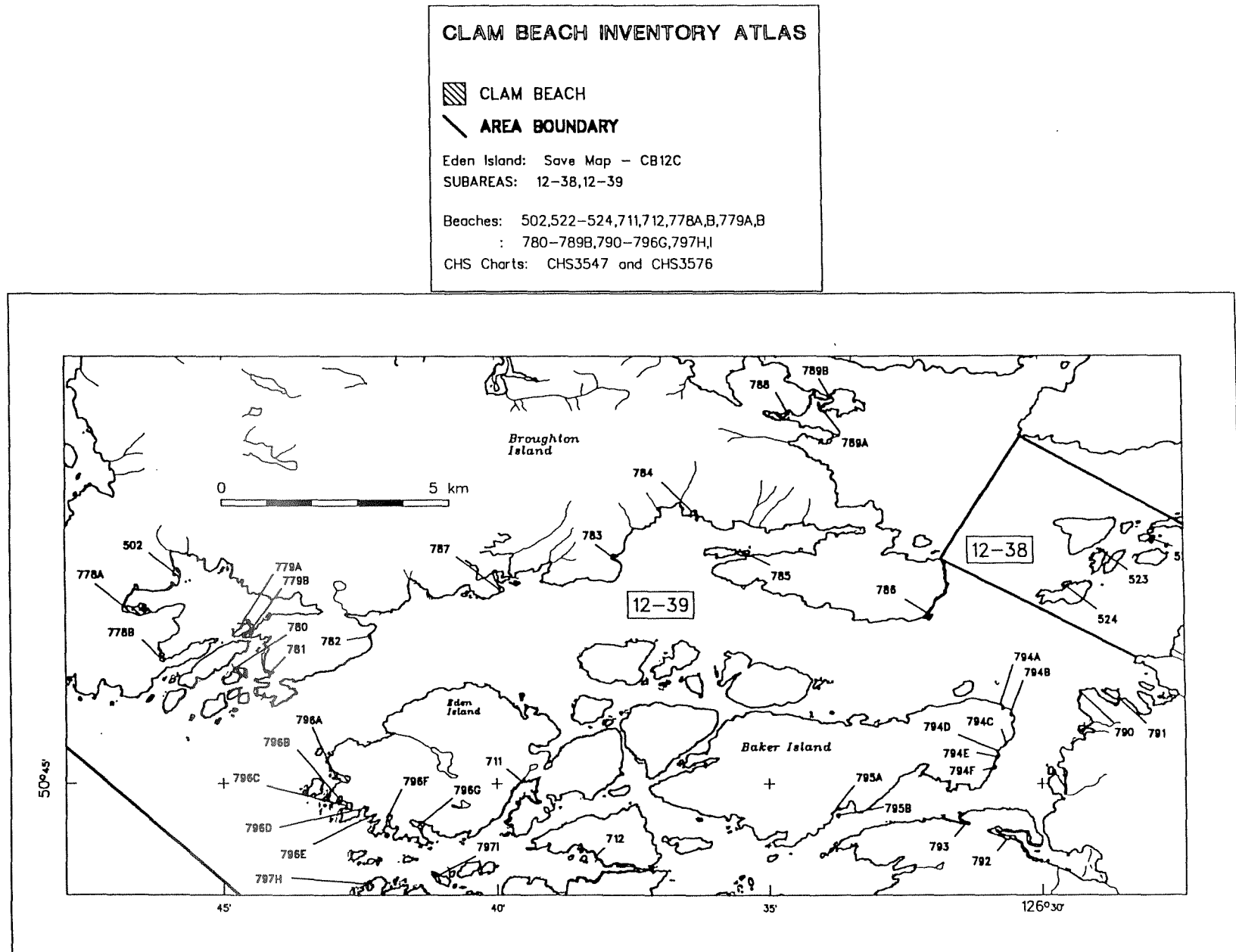
Beaches: 503-509,510-512,758,759A,760-769

: 770A-777

CHS Charts: CHS3547 and CHS3576



Appendix Figure 1.2.2.



Appendix Figure 1.2.3.

CLAM BEACH INVENTORY ATLAS

 CLAM BEACH

 AREA BOUNDARY

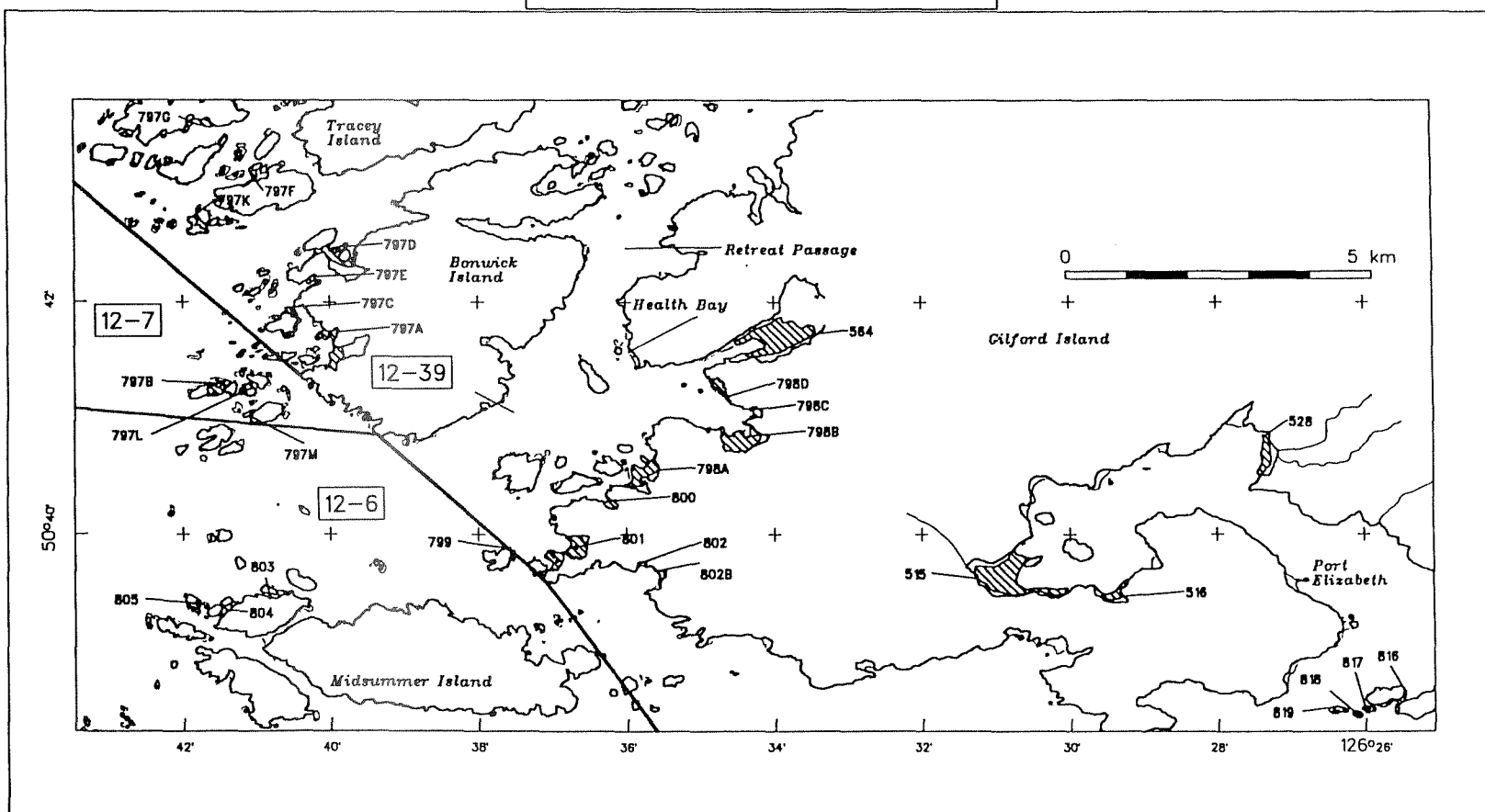
Gilford Island: Same Map - CB12D

SUB-AREAS: 12-6, 12-7, 12-39

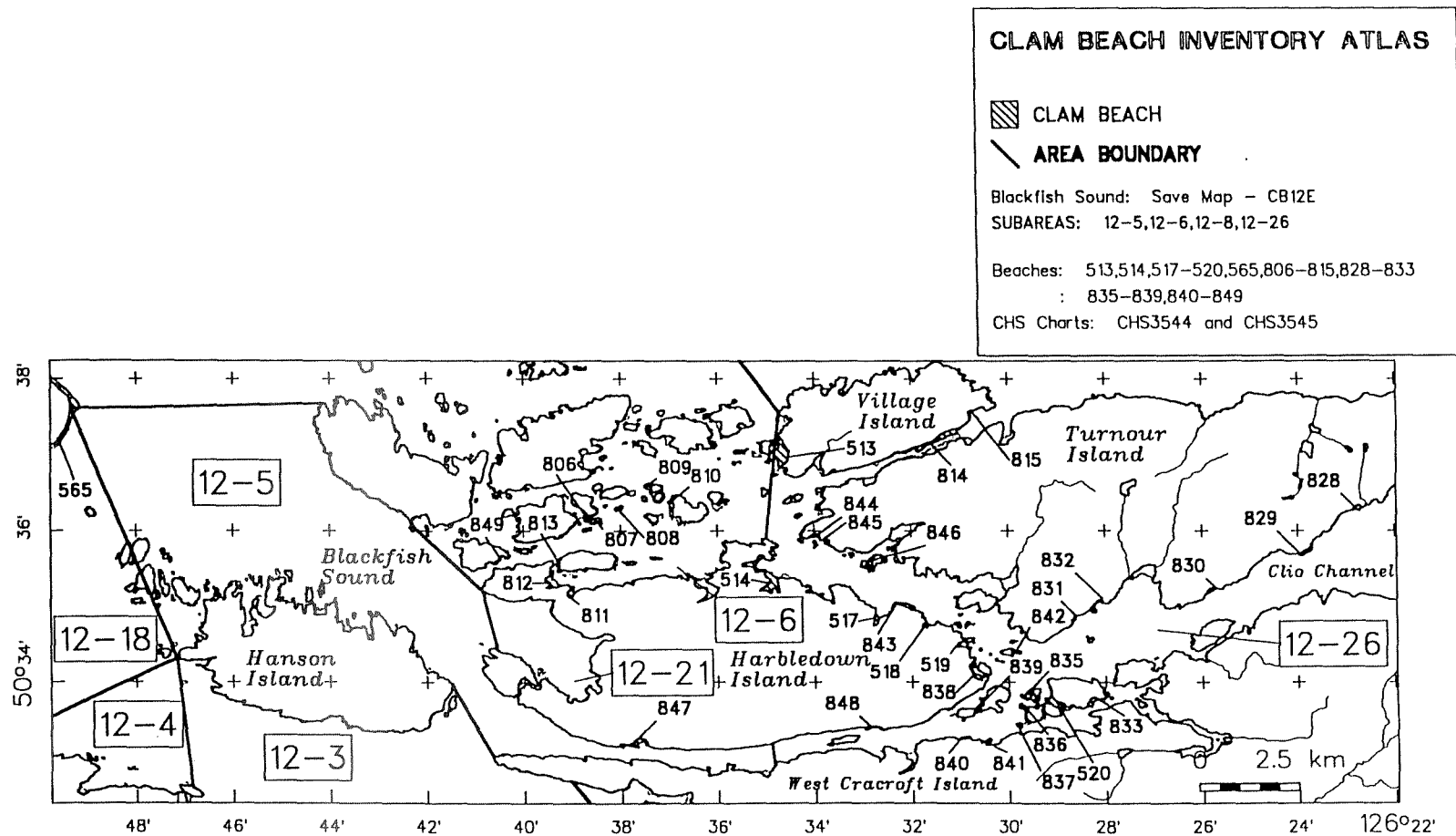
Beaches: 515, 516, 528, 564, 797A-G, 797I, 797L

: 797M, 798A-D, 800-805, 816-819

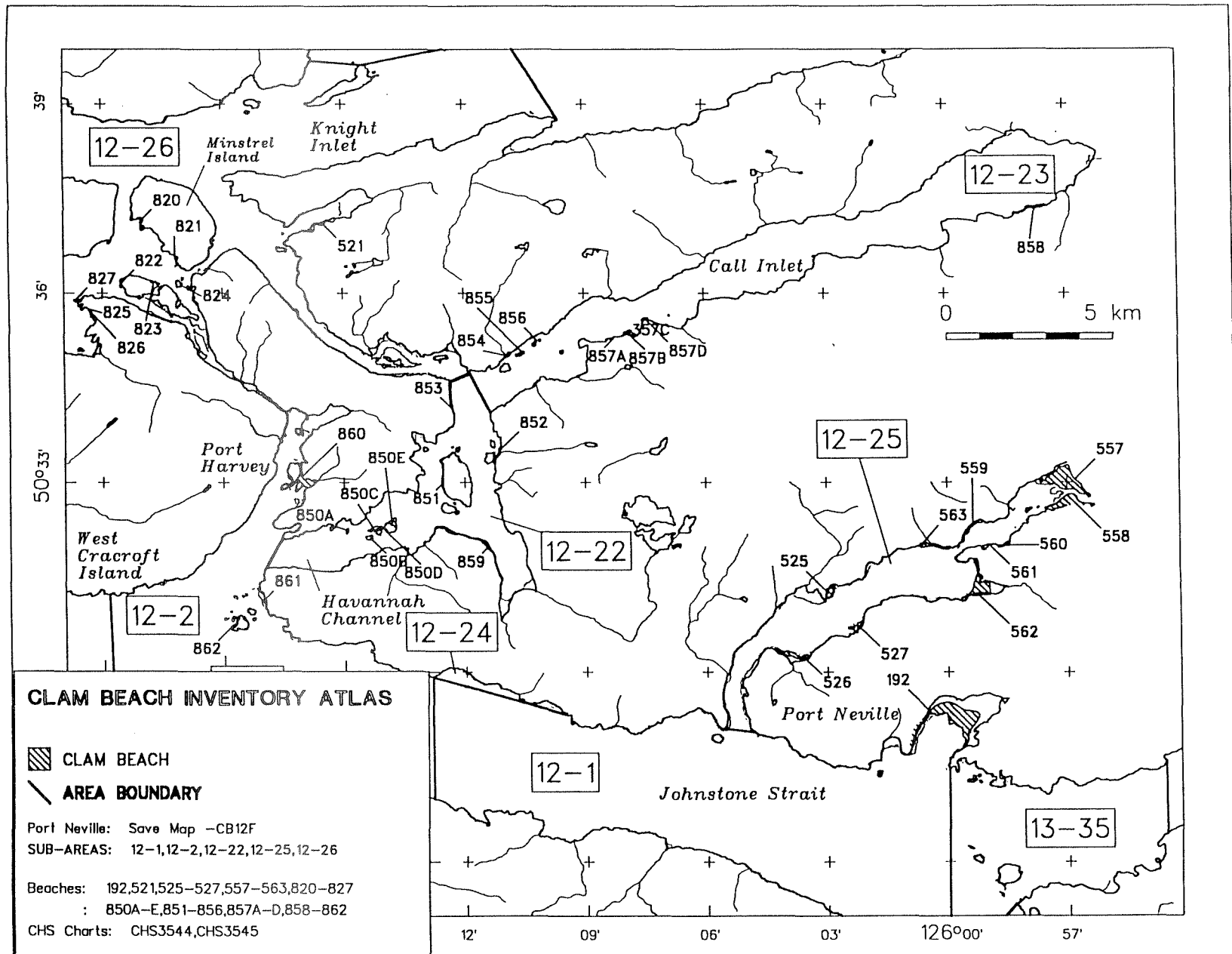
CHS Charts: CHS3545, CHS3546



Appendix Figure 1.2.4.



Appendix Figure 1.2.5.



Appendix Figure 1.2.6.

APPENDIX 2.

**DESCRIPTIONS, TABLE AND MAPS OF AREAS CLOSED
TO THE COMMERCIAL INTERTIDAL CLAM FISHERY,
AREAS 11 AND 12 , FOR ABORIGINAL OR RECREATIONAL
HARVEST, INCLUDING PARK CLOSURES**

**From the 1997 DFO Pacific Region Management Plan for Intertidal
Clams (Manila, Littleneck, Butter and Razor Clams)**

Descriptions of areas closed to the commercial intertidal clam fishery (1997) in Area 12, as allocations for Native food, social and ceremonial harvest, recreational harvest or Park/Reserve closures¹.

Area 12

The following portions of Areas 12-6 and 12-26: All the intertidal foreshore of the southwest portion of Village Island located between Warr Bluff and the western entrance to Canoe Passage. (Recreational and Aboriginal for food, social and ceremonial purposes)

Area 12-38 - Burdwood Islands Group: All the intertidal foreshore of the Burdwood Group of Islands located true east of Pearse Peninsula on Broughton Island. (Recreational and Aboriginal for food, social and ceremonial purposes)

Area 12-39 - Betty Cove: All the intertidal foreshore of Betty Cove on Bonwick Island. (Recreational and Aboriginal for food, social and ceremonial purposes)

Area 12-39 - Blunden Passage: All the intertidal foreshore of Blunden Passage located between Tracey Island and Baker Island. (Recreational and Aboriginal for food, social and ceremonial purposes)

Area 12-39 - Fly and Insect Islands: All the intertidal foreshore of Fly Island and Insect Island. (Recreational and Aboriginal for food, social and ceremonial purposes)

Area 12-39 - Health Bay, Gilford Island: All the intertidal foreshore of Health Bay and Health Bay Lagoon lying inside or easterly of a straight line from the most southeasterly corner of the Indian Reserve near Health Bay, true south to the shore opposite. (Recreational and Aboriginal for food, social and ceremonial purposes)

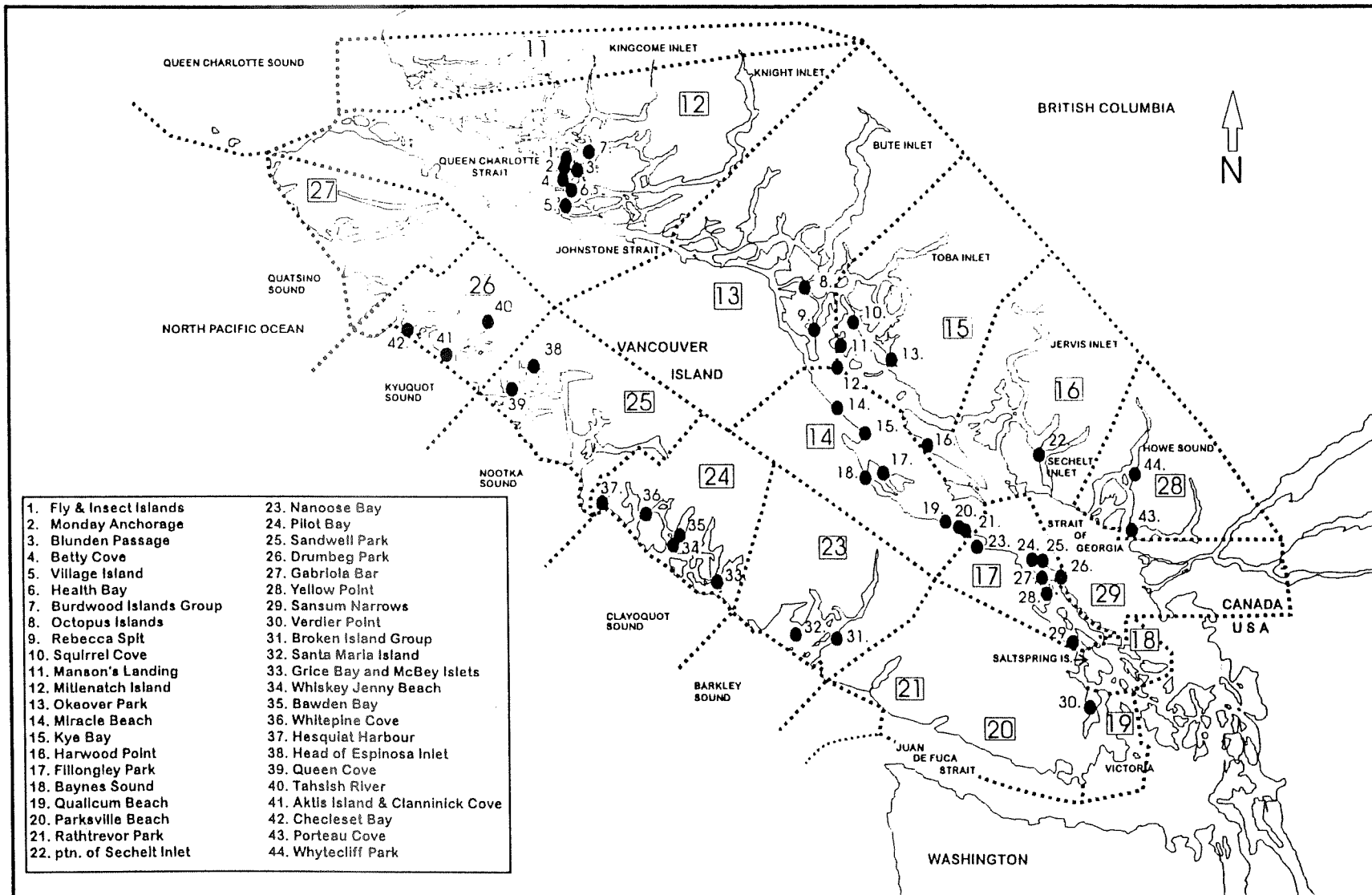
Area 12-39 - Monday Anchorage: All the intertidal foreshore of Monday Anchorage lying between Mars Island and Tracey Island. (Recreational and Aboriginal for food, social and ceremonial purposes)

¹These areas were first closed in the 1992 commercial clam fishery and are listed in the 1992 Intertidal Clam Management Plan.

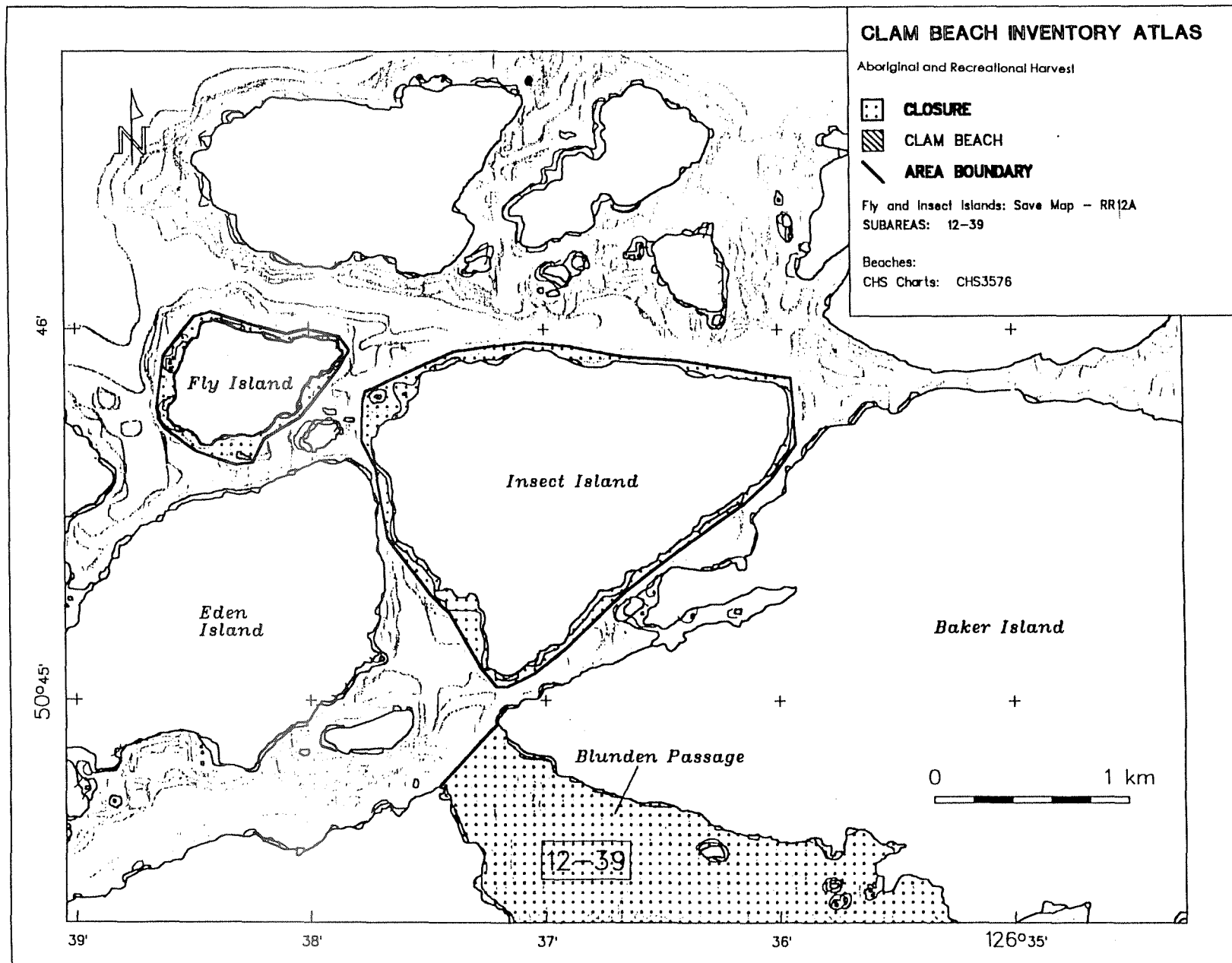
Appendix Table 2.1. Known clam beaches within Aboriginal harvest, park or recreational reserve closures, from the Clam Beach Inventory Database.

Area	Subarea	Beach #	Beach Location	Closure Name	Closure Type	Beach Area (ha)	Clam Area (ha)
12	26	515	Duck Cove	Village Island	Aboriginal harvest	36.59	
12	38	522	Burdwood Group	Burdwood Islands Group	Aboriginal harvest	1.39	
12	38	523	Burdwood Group	Burdwood Islands Group	Aboriginal harvest	0.37	
12	38	524	Burdwood Group	Burdwood Islands Group	Aboriginal harvest	0.78	
12	39	*		Fly and Insect Islands	Aboriginal harvest		
12	39	712	Monday Anchorage	Monday Anchorage	Aboriginal harvest	13.63	
12	39	*		Blunden Passage	Aboriginal harvest		
12	39	797D	Betty Cove, Bonwick Island	Betty Cove	Aboriginal harvest	8.99	
12	39	564	Health Lagoon	Gilford Island	Aboriginal harvest	38.17	
12	39	798D	Health Bay Area	Health Bay, Gilford Island	Aboriginal harvest	4.99	
12	39	798C	Health Bay Area	Health Bay, Gilford Island	Aboriginal harvest	2.11	
Total Beaches:			11				
Total Beach Area:			107.02				
Total Clam Area:			n/a				

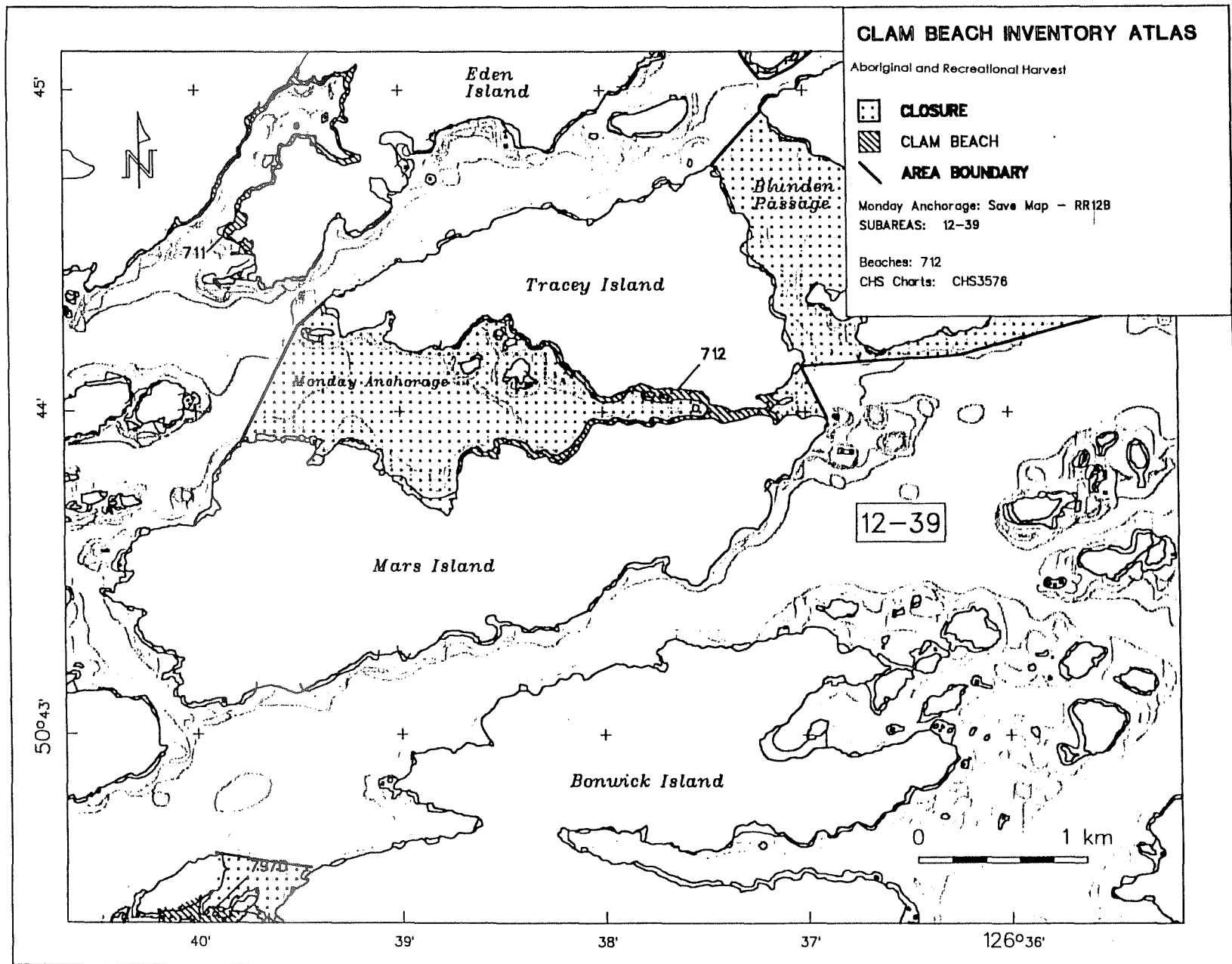
*Beach not coded



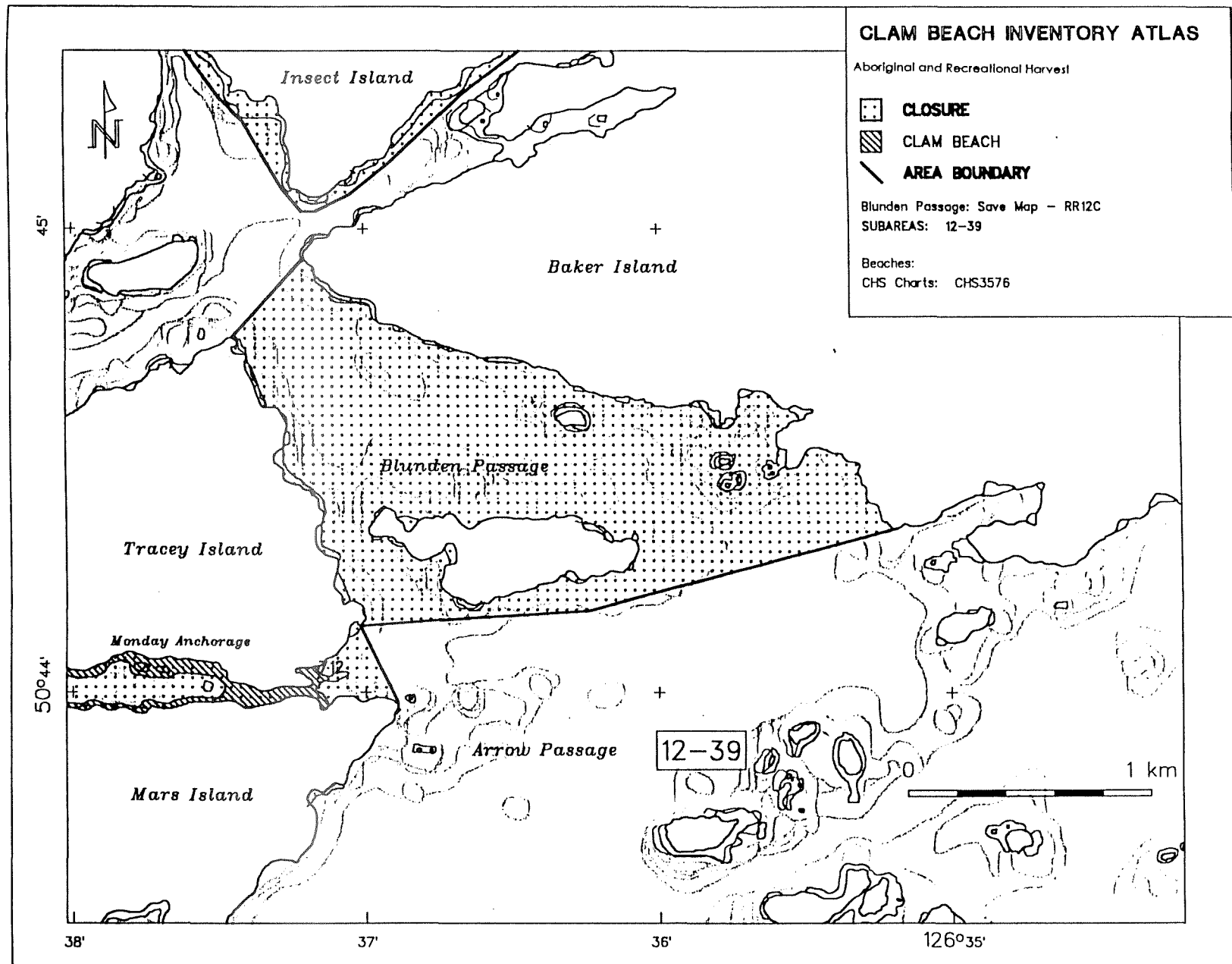
Appendix Figure 2.1. Commercial closures in 1997 for park, recreational or Aboriginal clam harvest.



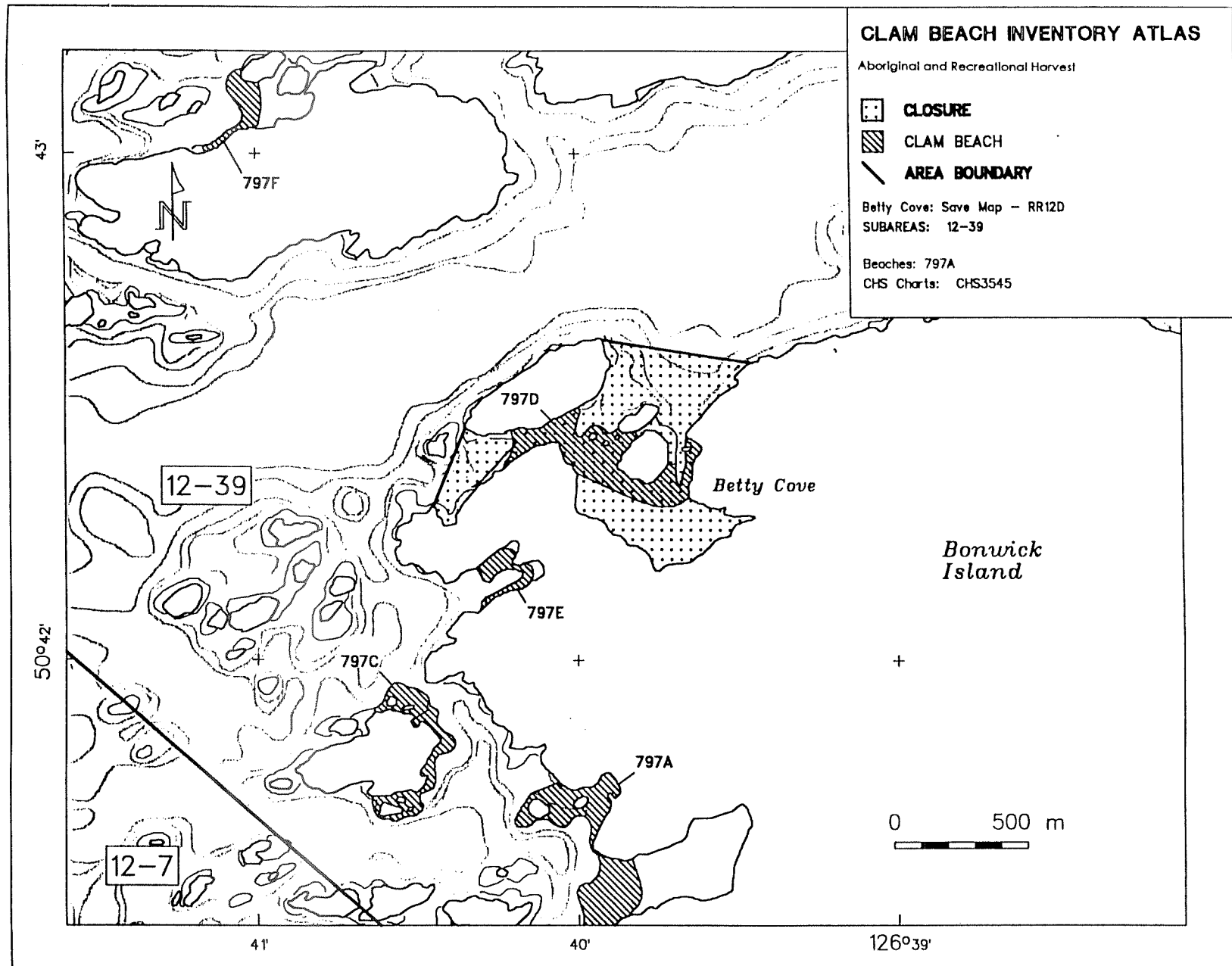
Appendix Figure 2.2.



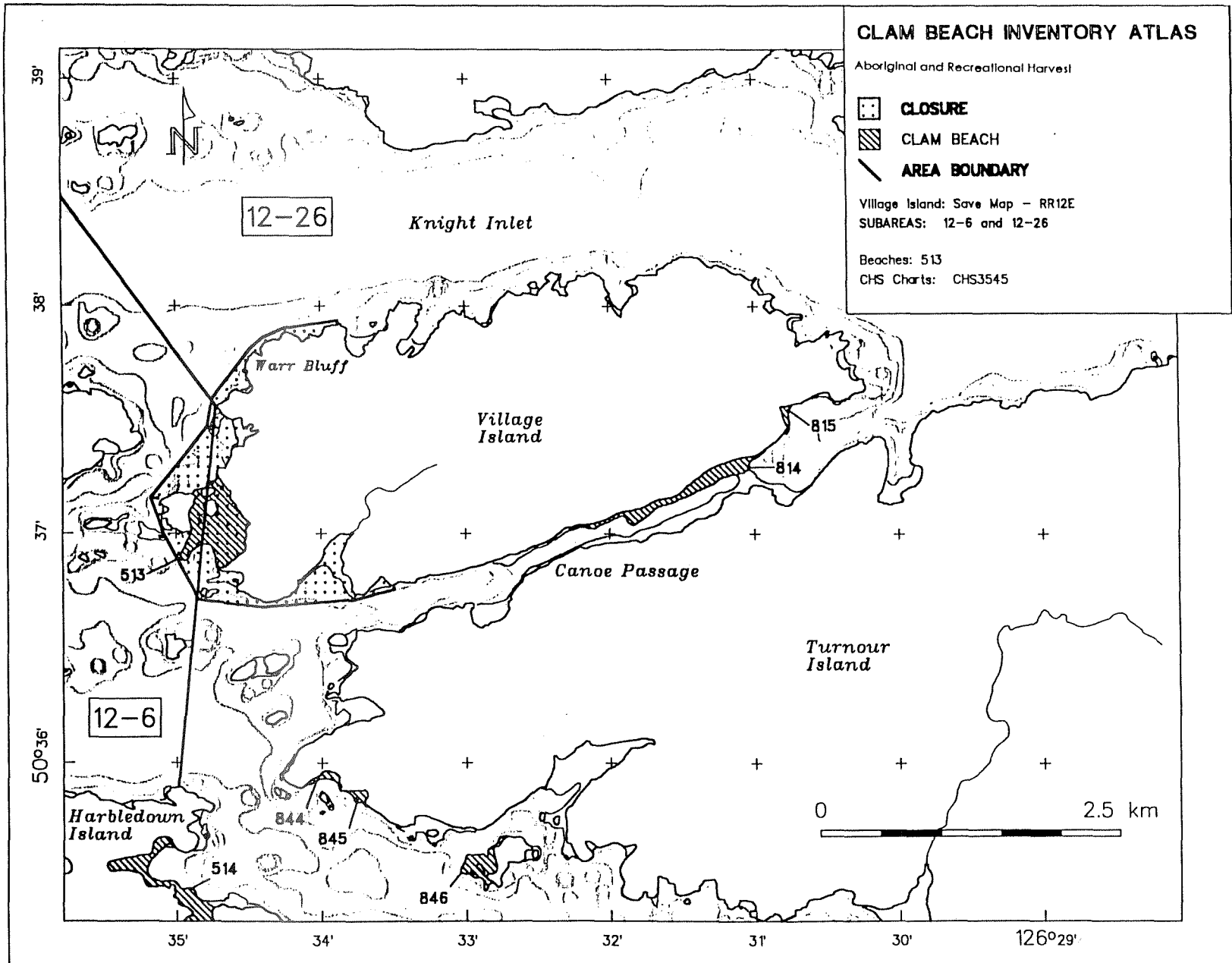
Appendix Figure 2.3.



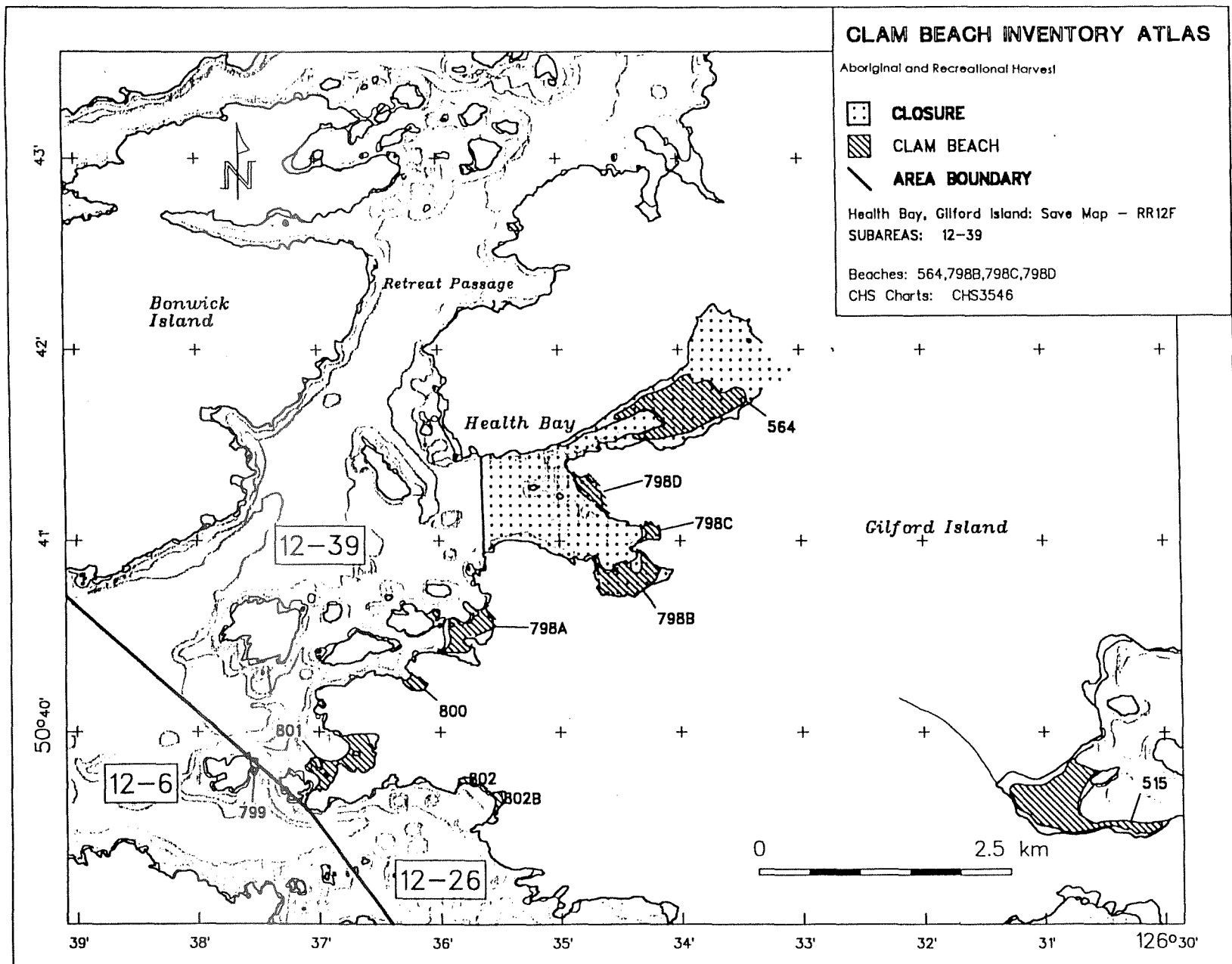
Appendix Figure 2.4.



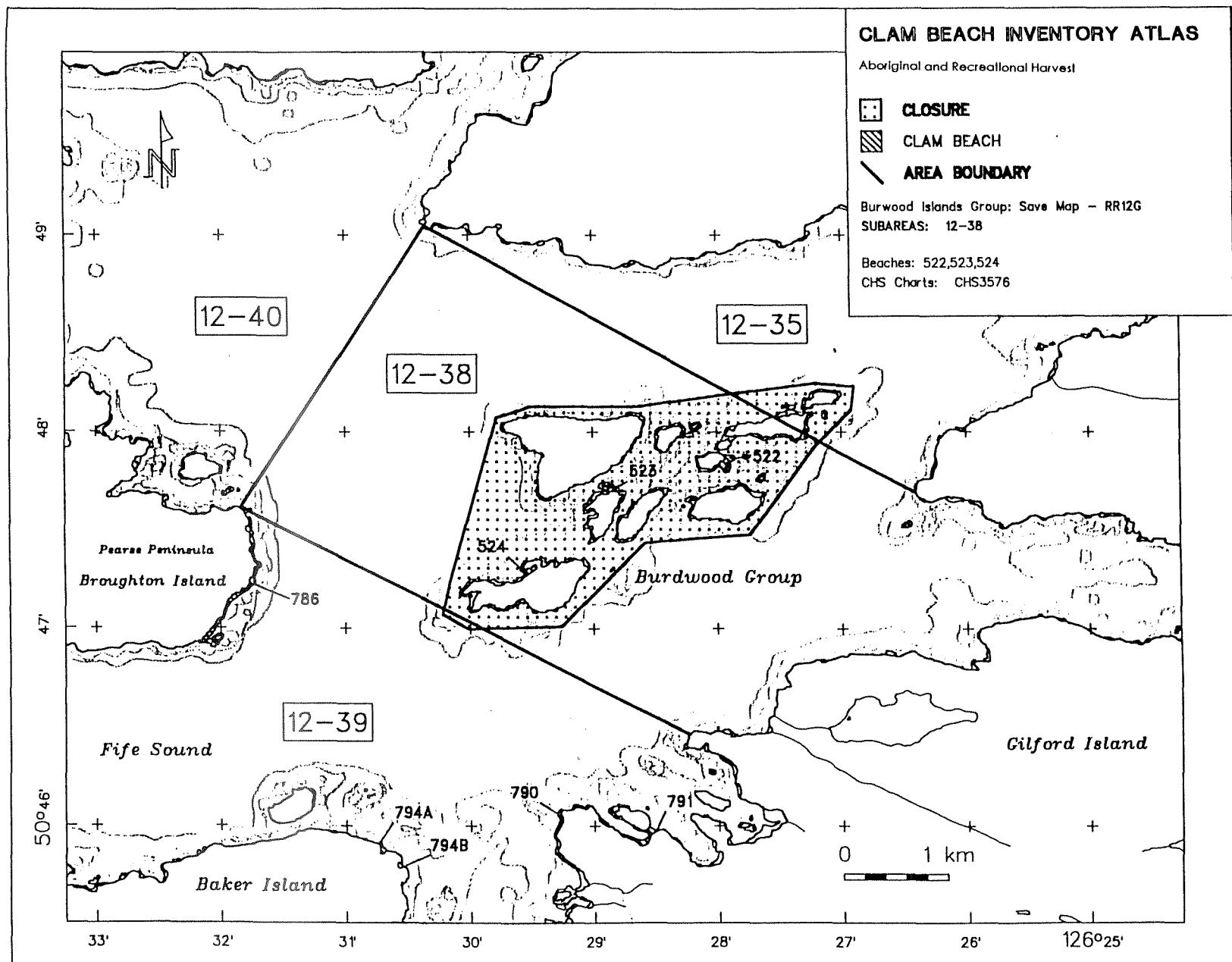
Appendix Figure 2.5.



Appendix Figure 2.6.



Appendix Figure 2.7.



Appendix Figure 2.8.

APPENDIX 3.

DESCRIPTIONS OF CONTAMINATED CLOSURES, AREAS 11 AND 12

**From the 1997 DFO Pacific Region Management Plan for Intertidal
Clams (Manila, Littleneck, Butter and Razor Clams)**

Note: This list is provided for general information only. Closures may change at any time. For up to date information, please contact the local Fisheries office.

SEWAGE CONTAMINATED AREAS 11 AND 12

Any Canadian fisheries waters of the Pacific Ocean within 125 m of

(a) any wharf, dock, platform or other structure used for vessel moorage; or

(b) any permanently anchored floating structures, including float homes, barges, platforms and vessels.

Area 11

(There are no contaminated closures identified in Area 11)

Area 12

1. That portion of Hardy Bay lying inside a straight line drawn from Daphne Point on the east side of Hardy Bay to Duval Point on the west side except the channel between Duval Island and Vancouver Island.
2. The waters and foreshore of Echo Bay, Gilford Island, lying within 300 m of any part of the boat moorage.
3. The waters and foreshore of Beaver Harbour, near Port Hardy, lying inside a straight line drawn from Thomas Point through Cormorant Rock to the shore of Vancouver Island, but not including the small unnamed island immediately to the south of Shell Island.
4. The waters and foreshore of Port Neville, including Baresides Bay, lying east of a straight line drawn from Collingwood Point to Hanatsa Point and thence due south to the opposite shore, and west of a north-south line drawn through the eastern tip of the largest unnamed islet.
5. The waters and foreshore of Hopetown Passage, Watson Island, lying inside a line drawn from Hopetown Point due east to the nearest point of land.
6. The waters and foreshore of Macgowan Bay, Drury Inlet, lying inside a line drawn from a point on shore at 50°54.82'N latitude and 127°08.62'W longitude, thence southeasterly to 50°54.65'N latitude and 127°08.40'W longitude on the opposite shore.
7. The waters and foreshore of a small unnamed bay, immediately west of the Everard Islets, Drury Inlet, lying inside a line drawn from a point on shore at 50°53.38'N latitude and 127°02.73'W longitude, thence easterly to a point on shore at 50°53.36'N latitude and 127°02.47'W longitude.

8. The waters and foreshore of Shoal Harbour, Gilford Island, lying inside a line drawn from a point on the west shore at 50°44.59'N latitude and 126°30.18'W longitude thence easterly to a point on shore at 50°44.59'N latitude and 126°29.98'W longitude.
9. The waters and foreshore of Cohoe Bay, Blunden Harbour, lying inside a line drawn from a point of land on the north shore at 50°54.00'N latitude and 127°14.64'W longitude thence south to a point on shore at 50°53.83'N latitude and 127°14.28'W longitude.
10. The waters and foreshore of Little Nimmo Bay located east of a line drawn from the headland on the south side of the bay at 50°56.30'N latitude and 126°41.25'W longitude, thence northerly to a point on the northern shore at 50°56.40'N latitude and 126°41.25'W longitude.
11. The foreshore along the southeast side of Turnour Island from the headland at 50°36.30'N latitude and 126°22.70'W longitude, thence westerly along the foreshore to a point at 50°36.25'N latitude and 126°22.95'W longitude.
12. The waters and foreshore of the southwestern head of Sutherland Bay, Drury Inlet, located inside a line drawn from the rock shoal on the southern foreshore, thence to the rock shoal on the northern foreshore.
13. The foreshore of the eastern portion of Maple Cove located in Port Elizabeth, Gilford Island.
14. The waters and foreshore of the western bay of Double Bay, Hanson Island, lying inside a line drawn from a point on shore 200 m north of the Double Bay resort due east to an unnamed island and from the southernmost tip of the unnamed island due south to the opposite shore.
- A. The waters and foreshore of Cutter Cove lying east of a line drawn from the southern headland of the cove, thence northerly to the westernmost point on the northern headland
MAY 31 TO SEPTEMBER 30.

APPENDIX 4.

TABLE OF CLAM BEACHES SORTED BY LOCATION NAME

AREAS 11 AND 12

Appendix Table 4.1. British Columbia Clam Beach Inventory, sorted by Location for Management Areas 11 and 12.

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
11	2	577	Allison Harbour	7.82	
11	2	576	Allison Harbour	0.95	
11	2	575	Allison Harbour	6.49	
12	38	795A	Baker Island (S)	0.66	
12	38	795B	Baker Island (S)	0.27	
12	26	847	Baronet Pass (W), A	5.23	
12	26	848	Baronet Pass (W), B	1.96	
12	41	768A	Bath Point	1.26	
12	39	801	Bear Hill, Gilford Island	14.02	
12	16	500	Beaver Harbour	145.6	
12	11	493	Bell Island	4.55	
12	39	797D	Betty Cove, Bonwick Island	8.99	
12	26	517	Beware Passage	2.39	
12	26	518	Beware Passage	0.99	
12	26	519	Beware Passage	2.81	
12	26	843	Beware Passage, D	3.15	
12	1	192	Blenkinsop Bay	74.21	
12	13	568	Blunden Harbour	56.68	
12	13	569	Blunden Harbour	44.16	
12	22	850B	Bockett Islets	0.58	
12	22	850D	Bockett Islets	1.84	
12	22	850C	Bockett Islets	0.7	
12	22	850E	Bockett Islets	2.48	
12	39	797C	Bonwick Island (W)	4.03	
12	39	779B	Booker Passage	1.52	
12	39	502	Booker Lagoon	1.88	
12	39	779A	Booker Lagoon (E)	1.32	
12	39	778B	Booker Lagoon (SW)	1.67	
12	39	778A	Booker Lagoon (W)	10.98	
12	22	859	Bougey Bay	10.91	
12	41	771A	Bourmaster Point (SE)	3.85	
12	2	861	Broken Islands, A	7.12	
12	2	862	Broken Islands, B	2.19	
12	41	773A	Broughton Point	1.14	
12	38	522	Burdwood Group	1.39	
12	38	524	Burdwood Group	0.78	
12	38	523	Burdwood Group	0.37	
12	41	765	Burly Bay	8.56	
12	23	858	Call Inlet (Ribbon)	5.09	
12	23	857A	Call Shoal (S)	0.6	
12	23	857B	Call Shoal (S)	1.3	
12	23	857C	Call Shoal (S)	0.47	
12	23	857D	Call Shoal (S)	1.15	
12	41	770B	Cane Point	0.83	
12	41	770A	Cane Point	0.9	
12	6	806	Carey Group, A	2.52	
12	6	807	Carey Group, B	0.63	
12	6	808	Carey Group, C	0.86	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	6	809	Carey Group, D	5.83	
12	6	810	Carey Group, E	3.07	
12	41	506	Carriden Bay	13.47	
12	41	772	Carter Passage	1.93	
12	41	773B	Carter Passage (E)	0.57	
12	41	771B	Carter Passage (W)	0.67	
12	16	496	Cattle Island	5.26	
12	16	497	Cattle Island	2.34	
12	6	803	Cedar Island, A	2.9	
12	6	804	Cedar Island, B	2.92	
12	6	805	Cedar Island, C	1.51	
12	42	761	Charlotte Point (N of)	1.18	
12	41	503	Claydon Bay	25.17	
12	26	830	Clio Channel (N. Shore)	1.41	
12	26	829	Clio Channel (N. Shore)	2.73	
12	26	828	Clio Channel (N. Shore)	1.59	
12	17	566	Cluxewe River Mouth	0	
12	13	567	Cohoe Bay	22.43	
12	26	846	Cook Island	5.17	
11	2	578	Cougar Inlet	3.76	
11	2	579	Cougar Inlet	1.84	
12	38	793	Cramer Pass	2.45	
12	39	797H	Crib Island (N)	1.66	
12	39	797G	Crib Island (S)	4.31	
12	39	781	Cullen Harbour	0.79	
12	26	521	Cutter Cove	6.34	
12	42	763A	Davis Bay	7.07	
12	42	763B	Davis Islet	0.52	
12	26	514	Dead Point (S)	18.13	
12	41	774E	Dickson Island	0.42	
12	41	774A	Dickson Island	1.04	
12	41	774B	Dickson Island	1.63	
12	41	774C	Dickson Island	1.76	
12	41	774D	Dickson Island	1.34	
12	41	774F	Dickson Island	3.34	
12	41	774G	Dickson Island	0.55	
12	41	774H	Dickson Island	0.25	
12	41	774I	Dickson Island	1.2	
12	26	822	Dorman Island, A	0.88	
12	26	823	Dorman Island, B	0.8	
12	26	824	Dorman Island, C	0.95	
12	42	760	Dove Island	2.25	
12	26	516	Duck Cove	5.33	
12	26	515	Duck Cove	36.59	
12	39	797A	Dusky Cove, Bonwick Island	9.87	
12	39	796C	Eden Island	1.43	
12	39	796E	Eden Island	0.32	
12	39	796B	Eden Island	1.02	
12	39	796D	Eden Island	0.6	
12	39	796G	Eden Island	3.84	
12	39	796A	Eden Island	3.94	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	39	796F	Eden Island	1.96	
12	42	510	Everard Island	37.64	
12	42	511	Everard Island	4.86	
12	41	769	Fresh Water Cove	1.2	
12	39	802B	Gilford Island (Sw)	1.31	
12	39	802A	Gilford Island (Sw)	0.75	
12	39	800	Gilford Island (W)	2.23	
12	11	489	God's Pocket, Hurst Island	0.62	
12	26	838	Harbledown Island (E)	4.17	
12	16	499	Hardy Bay	7.75	
12	16	498	Hardy Bay	73.85	
12	11	486	Harlequin Bay, Hurst Island	8.2	
12	22	850A	Havannah Islets	0.64	
12	39	798B	Health Bay Area	15.62	
12	39	798D	Health Bay Area	4.99	
12	39	798C	Health Bay Area	2.11	
12	39	798A	Health Bay Area	10.89	
12	39	564	Health Lagoon	38.17	
12	11	492	Heard Island	0.68	
12	42	764	Helen Bay	1.49	
12	6	799	Henrietta Island	1.05	
12	39	797M	High Island	0.46	
12	39	797L	High Island (N)	1.58	
12	41	504	Hopetown Passage	9.14	
12	38	794D	Horsford Point To Evans Point	0.1	
12	38	794B	Horsford Point To Evans Point	0.19	
12	38	794A	Horsford Point To Evans Point	0.37	
12	38	794E	Horsford Point To Evans Point	0.46	
12	38	794F	Horsford Point To Evans Point	0.52	
12	38	794C	Horsford Point To Evans Point	0.12	
12	39	797F	Hudson Island	2	
12	39	797K	Hudson Island (S of)	2.07	
12	22	851	Hull Islands	4.13	
12	22	852	Indian Islands	3.47	
12	26	839	Jamieson Island	2.23	
12	42	507	Jennis Bay	13.06	
12	39	711	Joe Cove	8.64	
12	39	785	Jumper Island	1.26	
12	12	487	Kalect Island, Bates Pass	8	
12	26	842	Kamano Island	1.16	
12	26	833	Klaoitis Island, A	4.23	
12	26	834	Klaoitis Island, B	0	
12	26	835	Klaoitis Island, C	4.43	
12	26	836	Klaoitis Island, D	1.36	
12	26	837	Klaoitis Island, E	1.09	
12	26	520	Klaoitsis Island	12.01	
12	26	816	Lady Island, A	3.31	
12	26	817	Lady Island, B	1.49	
12	26	818	Lady Island, C	0.91	
12	26	819	Lady Island, D	2.06	
12	39	788	Laura Bay	4.41	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	15	488	Lemon Point	9.31	
12	41	505	Little Nimmo Bay	5.17	
12	42	762	Macgowan Bay	4.53	
12	6	565	Malcolm Island	13.2	
12	26	513	Mamalilaculla	25.87	
12	26	528	Maple Cove	7.27	
12	39	797I	Marsden Island (S)	0.7	
11	2	580	Mignon Point	1.02	
11	2	581	Mignon Point	2.97	
12	26	844	Mink Point, A	1.28	
12	26	845	Mink Point, B	1.15	
12	26	820	Minstrel Island, A	4.38	
12	26	821	Minstrel Island, B	1.23	
12	39	712	Monday Anchorage	13.63	
12	6	812	Mound Island (S), B	6.7	
12	6	813	Mound Island (S), C	1.9	
12	6	811	Mound Island, A	3.16	
12	42	512	Muirhead Island	6.9	
12	42	759A	Muirhead Island	1.55	
12	41	767B	Napier Bay (N)	0.64	
12	41	767A	Napier Bay (S)	4.31	
12	39	786	Nickless Islet To Notice Point	4.99	
12	11	491	Nigei Island (E)	1.77	
12	11	490	Nigei Island (E)	13.54	
12	39	780	Olden Island	1.43	
12	16	494	Peel Island	0.58	
12	16	495	Peel Island	1.23	
12	39	783	Pemberton Point	1.3	
12	39	784	Pemberton Point (NE)	1.45	
12	41	775B	Percy Island	2.29	
12	41	775A	Percy Island	2.04	
12	7	777	Polking Horne Island	2.45	
12	11	485	Port Alexander	2.58	
12	2	860	Port Harvey	16.29	
12	25	562	Port Neville (Head)	21.71	
12	25	557	Port Neville (Head)	48.13	
12	25	558	Port Neville (Head)	23.8	
12	25	559	Port Neville (Head)	5.33	
12	25	561	Port Neville (Head)	2	
12	25	563	Port Neville (Head)	5.75	
12	25	560	Port Neville (Head)	2.08	
12	25	527	Port Neville (Mouth)	3.42	
12	25	525	Port Neville (Mouth)	4.46	
12	25	526	Port Neville (Mouth)	7.7	
12	38	790	Powell Point	0.69	
12	38	791	Powell Point (E)	1.27	
12	41	768B	Preston Point	0.79	
12	39	797E	Purves Cove, Bonwick Island	1.65	
12	42	508	Richmond Bay	4.46	
12	22	853	Root Point	4.54	
12	26	825	Sambo Point, A	0.69	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	26	826	Sambo Point, B	1.36	
12	26	827	Sambo Point, C	1.24	
12	13	572	Shelter Bay	6.5	
12	13	571	Shelter Bay	2.45	
12	13	570	Shelter Bay	2.31	
12	38	792	Shoal Harbour	13.61	
12	39	797B	Start Island	3.74	
12	41	766	Sterling Point	3.55	
12	42	758	Sutherland Bay	23.76	
12	42	509	Tancred Bay	6.07	
12	16	501	Thomas Point - Keogh Shoals	35.24	
12	39	789A	Trivett Island	1.2	
12	39	789B	Trivett Island	0.93	
12	26	831	Turner Bay (Sw), A	0.48	
12	26	832	Turner Bay (Sw), B	1.82	
12	39	787	Twin Lagoon (Fife Sound)	0.92	
12	26	814	Village Island (E), A	11.23	
12	26	815	Village Island (E), B	0.77	
12	41	776	Vincent Island	0.85	
12	13	573	Walker Group	8	
12	13	574	Walker Group	4.82	
12	23	854	Warren Island, A	1.25	
12	23	855	Warren Island, B	0.62	
12	23	856	Warren Island, C	0.6	
12	26	849	White Beach Pass	1.57	
12	39	782	Wicklow Point	0.64	
12	26	840	Wilson Pass (SE), A	1.17	
12	26	841	Wilson Pass (SE), B	1.81	
<i>Total Beaches:</i>		<i>229</i>	<i>Total Beach Area:</i>	<i>1446.45</i>	

APPENDIX 5.

TABLE OF CLAM BEACHES SORTED BY CLAM BEACH NUMBER

AREAS 11 AND 12

Appendix Table 5.1. British Columbia Clam Beach Inventory, sorted by Clam Beach Number for Management Areas 11 and 12.

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	1	192	Blenkinsop Bay	74.21	
12	11	485	Port Alexander	2.58	
12	11	486	Harlequin Bay, Hurst Island	8.2	
12	12	487	Kalect Island, Bates Pass	8	
12	15	488	Lemon Point	9.31	
12	11	489	God's Pocket, Hurst Island	0.62	
12	11	490	Nigei Island (E)	13.54	
12	11	491	Nigei Island (E)	1.77	
12	11	492	Heard Island	0.68	
12	11	493	Bell Island	4.55	
12	16	494	Peel Island	0.58	
12	16	495	Peel Island	1.23	
12	16	496	Cattle Island	5.26	
12	16	497	Cattle Island	2.34	
12	16	498	Hardy Bay	73.85	
12	16	499	Hardy Bay	7.75	
12	16	500	Beaver Harbour	145.6	
12	16	501	Thomas Point - Keogh Shoals	35.24	
12	39	502	Booker Lagoon	1.88	
12	41	503	Claydon Bay	25.17	
12	41	504	Hopetown Passage	9.14	
12	41	505	Little Nimmo Bay	5.17	
12	41	506	Carriden Bay	13.47	
12	42	507	Jennis Bay	13.06	
12	42	508	Richmond Bay	4.46	
12	42	509	Tancred Bay	6.07	
12	42	510	Everard Island	37.64	
12	42	511	Everard Island	4.86	
12	42	512	Muirhead Island	6.9	
12	26	513	Mamalilaculla	25.87	
12	26	514	Dead Point (S)	18.13	
12	26	515	Duck Cove	36.59	
12	26	516	Duck Cove	5.33	
12	26	517	Beware Passage	2.39	
12	26	518	Beware Passage	0.99	
12	26	519	Beware Passage	2.81	
12	26	520	Klaoitsis Island	12.01	
12	26	521	Cutter Cove	6.34	
12	38	522	Burdwood Group	1.39	
12	38	523	Burdwood Group	0.37	
12	38	524	Burdwood Group	0.78	
12	25	525	Port Neville (Mouth)	4.46	
12	25	526	Port Neville (Mouth)	7.7	
12	25	527	Port Neville (Mouth)	3.42	
12	26	528	Maple Cove	7.27	
12	25	557	Port Neville (Head)	48.13	
12	25	558	Port Neville (Head)	23.8	
12	25	559	Port Neville (Head)	5.33	
12	25	560	Port Neville (Head)	2.08	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	25	561	Port Neville (Head)	2	
12	25	562	Port Neville (Head)	21.71	
12	25	563	Port Neville (Head)	5.75	
12	39	564	Health Lagoon	38.17	
12	6	565	Malcolm Island	13.2	
12	17	566	Cluxewe River Mouth	0	
12	13	567	Cohoe Bay	22.43	
12	13	568	Blunden Harbour	56.68	
12	13	569	Blunden Harbour	44.16	
12	13	570	Shelter Bay	2.31	
12	13	571	Shelter Bay	2.45	
12	13	572	Shelter Bay	6.5	
12	13	573	Walker Group	8	
12	13	574	Walker Group	4.82	
11	2	575	Allison Harbour	6.49	
11	2	576	Allison Harbour	0.95	
11	2	577	Allison Harbour	7.82	
11	2	578	Cougar Inlet	3.76	
11	2	579	Cougar Inlet	1.84	
11	2	580	Mignon Point	1.02	
11	2	581	Mignon Point	2.97	
12	39	711	Joe Cove	8.64	
12	39	712	Monday Anchorage	13.63	
12	42	758	Sutherland Bay	23.76	
12	42	759A	Muirhead Island	1.55	
12	42	760	Dove Island	2.25	
12	42	761	Charlotte Point (N of)	1.18	
12	42	762	Macgowan Bay	4.53	
12	42	763A	Davis Bay	7.07	
12	42	763B	Davis Islet	0.52	
12	42	764	Helen Bay	1.49	
12	41	765	Burly Bay	8.56	
12	41	766	Sterling Point	3.55	
12	41	767A	Napier Bay (S)	4.31	
12	41	767B	Napier Bay (N)	0.64	
12	41	768A	Bath Point	1.26	
12	41	768B	Preston Point	0.79	
12	41	769	Fresh Water Cove	1.2	
12	41	770A	Cane Point	0.9	
12	41	770B	Cane Point	0.83	
12	41	771A	Bourmaster Point (SE)	3.85	
12	41	771B	Carter Passage (W)	0.67	
12	41	772	Carter Passage	1.93	
12	41	773A	Broughton Point	1.14	
12	41	773B	Carter Passage (E)	0.57	
12	41	774A	Dickson Island	1.04	
12	41	774B	Dickson Island	1.63	
12	41	774C	Dickson Island	1.76	
12	41	774D	Dickson Island	1.34	
12	41	774E	Dickson Island	0.42	
12	41	774F	Dickson Island	3.34	
12	41	774G	Dickson Island	0.55	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	41	774H	Dickson Island	0.25	
12	41	774I	Dickson Island	1.2	
12	41	775A	Percy Island	2.04	
12	41	775B	Percy Island	2.29	
12	41	776	Vincent Island	0.85	
12	7	777	Polking Horne Island	2.45	
12	39	778A	Booker Lagoon (W)	10.98	
12	39	778B	Booker Lagoon (SW)	1.67	
12	39	779A	Booker Lagoon (E)	1.32	
12	39	779B	Booker Passage	1.52	
12	39	780	Olden Island	1.43	
12	39	781	Cullen Harbour	0.79	
12	39	782	Wicklow Point	0.64	
12	39	783	Pemberton Point	1.3	
12	39	784	Pemberton Point (NE)	1.45	
12	39	785	Jumper Island	1.26	
12	39	786	Nickless Islet To Notice Point	4.99	
12	39	787	Twin Lagoon (Fife Sound)	0.92	
12	39	788	Laura Bay	4.41	
12	39	789A	Trivett Island	1.2	
12	39	789B	Trivett Island	0.93	
12	38	790	Powell Point	0.69	
12	38	791	Powell Point (E)	1.27	
12	38	792	Shoal Harbour	13.61	
12	38	793	Cramer Pass	2.45	
12	38	794A	Horsford Point To Evans Point	0.37	
12	38	794B	Horsford Point To Evans Point	0.19	
12	38	794C	Horsford Point To Evans Point	0.12	
12	38	794D	Horsford Point To Evans Point	0.1	
12	38	794E	Horsford Point To Evans Point	0.46	
12	38	794F	Horsford Point To Evans Point	0.52	
12	38	795A	Baker Island (S)	0.66	
12	38	795B	Baker Island (S)	0.27	
12	39	796A	Eden Island	3.94	
12	39	796B	Eden Island	1.02	
12	39	796C	Eden Island	1.43	
12	39	796D	Eden Island	0.6	
12	39	796E	Eden Island	0.32	
12	39	796F	Eden Island	1.96	
12	39	796G	Eden Island	3.84	
12	39	797A	Dusky Cove, Bonwick Island	9.87	
12	39	797B	Start Island	3.74	
12	39	797C	Bonwick Island (W)	4.03	
12	39	797D	Betty Cove, Bonwick Island	8.99	
12	39	797E	Purves Cove, Bonwick Island	1.65	
12	39	797F	Hudson Island	2	
12	39	797G	Crib Island (S)	4.31	
12	39	797H	Crib Island (N)	1.66	
12	39	797I	Marsden Island (S)	0.7	
12	39	797K	Hudson Island (S of)	2.07	
12	39	797L	High Island (N)	1.58	
12	39	797M	High Island	0.46	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	39	798A	Health Bay Area	10.89	
12	39	798B	Health Bay Area	15.62	
12	39	798C	Health Bay Area	2.11	
12	39	798D	Health Bay Area	4.99	
12	6	799	Henrietta Island	1.05	
12	39	800	Gilford Island (W)	2.23	
12	39	801	Bear Hill, Gilford Island	14.02	
12	39	802A	Gilford Island (Sw)	0.75	
12	39	802B	Gilford Island (Sw)	1.31	
12	6	803	Cedar Island, A	2.9	
12	6	804	Cedar Island, B	2.92	
12	6	805	Cedar Island, C	1.51	
12	6	806	Carey Group, A	2.52	
12	6	807	Carey Group, B	0.63	
12	6	808	Carey Group, C	0.86	
12	6	809	Carey Group, D	5.83	
12	6	810	Carey Group, E	3.07	
12	6	811	Mound Island, A	3.16	
12	6	812	Mound Island (S), B	6.7	
12	6	813	Mound Island (S),C	1.9	
12	26	814	Village Island (E), A	11.23	
12	26	815	Village Island (E), B	0.77	
12	26	816	Lady Island, A	3.31	
12	26	817	Lady Island, B	1.49	
12	26	818	Lady Island, C	0.91	
12	26	819	Lady Island, D	2.06	
12	26	820	Minstrel Island, A	4.38	
12	26	821	Minstrel Island, B	1.23	
12	26	822	Dorman Island, A	0.88	
12	26	823	Dorman Island, B	0.8	
12	26	824	Dorman Island, C	0.95	
12	26	825	Sambo Point, A	0.69	
12	26	826	Sambo Point, B	1.36	
12	26	827	Sambo Point, C	1.24	
12	26	828	Clio Channel (N. Shore)	1.59	
12	26	829	Clio Channel (N. Shore)	2.73	
12	26	830	Clio Channel (N. Shore)	1.41	
12	26	831	Turner Bay (Sw), A	0.48	
12	26	832	Turner Bay (Sw), B	1.82	
12	26	833	Klaoitis Island, A	4.23	
12	26	834	Klaoitis Island, B	0	
12	26	835	Klaoitis Island, C	4.43	
12	26	836	Klaoitis Island, D	1.36	
12	26	837	Klaoitis Island, E	1.09	
12	26	838	Harbledown Island (E)	4.17	
12	26	839	Jamieson Island	2.23	
12	26	840	Wilson Pass (SE), A	1.17	
12	26	841	Wilson Pass (SE), B	1.81	
12	26	842	Kamano Island	1.16	
12	26	843	Beware Passage, D	3.15	
12	26	844	Mink Point, A	1.28	
12	26	845	Mink Point,B	1.15	

Area	Subarea	Clam Beach #	Location	Beach Area (ha)	Clam Area (ha)
12	26	846	Cook Island	5.17	
12	26	847	Baronet Pass (W), A	5.23	
12	26	848	Baronet Pass (W), B	1.96	
12	26	849	White Beach Pass	1.57	
12	22	850A	Havannah Islets	0.64	
12	22	850B	Bockett Islets	0.58	
12	22	850C	Bockett Islets	0.7	
12	22	850D	Bockett Islets	1.84	
12	22	850E	Bockett Islets	2.48	
12	22	851	Hull Islands	4.13	
12	22	852	Indian Islands	3.47	
12	22	853	Root Point	4.54	
12	23	854	Warren Island, A	1.25	
12	23	855	Warren Island, B	0.62	
12	23	856	Warren Island, C	0.6	
12	23	857A	Call Shoal (S)	0.6	
12	23	857B	Call Shoal (S)	1.3	
12	23	857C	Call Shoal (S)	0.47	
12	23	857D	Call Shoal (S)	1.15	
12	23	858	Call Inlet (Ribbon)	5.09	
12	22	859	Bouhey Bay	10.91	
12	2	860	Port Harvey	16.29	
12	2	861	Broken Islands, A	7.12	
12	2	862	Broken Islands, B	2.19	
<i>Total Beaches:</i>		229	<i>Total Beach Area:</i>	1446.45	

APPENDIX 6.

HISTORICAL DESCRIPTIONS OF CLAM FISHERIES AND

FISHING LOCATIONS IN THE INSIDE WATERS OF

VANCOUVER ISLAND AND THE BRITISH COLUMBIA MAINLAND

EXCERPTS FROM "THE REPORT ON SHELLFISH BEDS OF BRITISH COLUMBIA"

By W.F. Thompson (1914)

REPORT ON QUEEN CHARLOTTE SOUND

Queen Charlotte Sound comprises the large body of water included between the northern end of Vancouver Island and the mainland. In the present report the southern boundary is regarded as Cracroft Island, and the northern as a line drawn between Hardy Bay and the mouth of Blunden Harbour. The long inlets were not explored beyond their mouths, as it is a general rule that shell-fish are not found in them in commercial abundance.

General Information

Hardy Bay may be reckoned roughly as about 250 miles from Victoria, and the sound proper from Hardy Bay to the islands at its head thirty-two miles. From the sound to the Gulf of Georgia, there are a series of long passages, the most used by the larger boats being Seymour Narrows. Through the Sound all the boats bound for northern British Columbia pass, as well as many of the Alaskan boats from the United States and Victoria and Vancouver. A number of these call at Alert Bay, on Cormorant Island, near the Vancouver Island shore, and this may be regarded as the chief shipping-point of the sound. From Vancouver small steamers are run through the inland passages and into the mouths of the inlets with the mails weekly, and will call whenever traffic offers. There are numerous logging camps which are thus cared for. Post-offices are found at Alert Bay, Hardy Bay, Simoom Sound, Harbledown Island, and Port Harvey.

An agricultural population is totally lacking because of the mountainous character of the country, save on parts of Vancouver Island. In the past what is termed "hand-logging", the logging of small tracts by single men, brought a considerable number into the country, but this is not carried on to the extent that it formerly was, and the loggers are for the most part the employees of companies. Salmon-canneries are run at several places in the sound or its adjacent inlets.

The Indians of the district dwell at Fort Rupert, Alert Bay, Old Vancouver, Mama-liliculla, Karlukwees, Blunden Harbour, and at other places outside of the area investigated. They are not numerous and during the summer months are largely absent at the canneries. They are said to depend to a certain degree on clams, but only during the winter months. When the clam-cannery was in operation at Alert Bay the clams were dug by these Indians.

The whole of the sound is surrounded by mountains, deserving the name of hills towards its mouth, but the inlets run into the high coast ranges. The hills near Blunden Lagoon are 200 to 700 feet high; near Hardy Bay, up to 600 feet; along Broughton Strait and Wells Pass, about 1,000 feet; on Gilford, Cracroft, and eastern Broughton Island, 1,500 feet; while the shores of Knight and Kingcome Inlets rise to 5,000 and 7,000 feet. The majority of the islands are small, of 100 to 300 feet elevation. The shores, as would be expected, rise quickly from deep water, from

40 to 50 fathoms in the narrow inlets, from 20 to 30 among the islands and along the northern coast as far as Blunden Harbour, but between Hardy Bay and Alert Bay the shoaling is gradual and a beach of greater or less width is found. The sound is open to the north-west winds, and these daily raise a heavy wash during certain seasons of the year, the wave-action being very heavy on the exposed beaches, as may be seen at the head of the sound.

In such a region as this it is obvious that clam-beds will be found only in small areas where a bay or cove shelters a beach, where creeks have washed down a gravel delta, or on the narrow beaches worn by the waves.

Species and General Distribution

The most important of the species is undoubtedly *Saxidomus giganteus* (the butter-clam). The summer-clam (*Schizotharus nuttali*), the cockle (*Cardium corbis*), the little-neck (*Paphia staminea*), and the mussel (*Mytilus edulis*) were found on most of the beds. The best of the butter-clam beds were found at Hardy Bay, and numerous smaller ones were found on the islands. *Mytilus californianus* (the larger mussel) was not found so far into the sound, but is known to be present in the outside waters.

The clam-beds are found only in very small beaches, as a rule, scattered through the islands and straits. The beach of the small bays and coves are usually barren, or nearly so, in some cases probably because of the salinity, in others because of the shifting mud and sand they may be made of. Their clams are usually found at the outer corners, where the water is well mixed, the ground firm, and the shelter from storms sufficient. The beds well up the inlets are the poorest and the most sparsely inhabited, possibly because of the poor condition existing for them there—namely, low salinity, low temperature, etc. The great bulk of the water in proportion to the very small beach available for the clams might conceivably result in the failure of the young to become lodged, after the free-swimming stage, in a suitable bottom.

Despite the presence of the large inlets around the sound and near the passages to the southward, it seems necessary to believe that the tidal currents through Johnstone Strait results in the conditions as far as Port Neville being practically those of the open ocean water. The abalone (*Haliotis gigantea*) and the large rock-oyster (*Hinnites giganteus*) are considered to be forms which are not very resistant to changes in salinity etc., yet they are to be found at Port Neville and in Call Creek respectively. Whether the factor to be considered is the thorough mixing of the water by the tidal currents or the possibility that the resultant of the flood and ebb into the Gulf of Georgia is a continual passage of water southward, it was not feasible to determine with any probability.

The lack of gravel or silt deposits lends the clam-beds in certain regions a characteristic white colour, due to the accumulation of pure shell in windrows. These are found on the island beds especially, and lend in one case to the naming of a certain channel "White Beach Passage." These white beaches are not always clams, for barnacle-shell are frequently thus collected, but as a rule they may be taken as indications of a favourable area for clams. Notable instances of such beds are in Beaver Harbour and on Insect Island.

DETAILED DESCRIPTIONS OF BEDS

Blunden Harbour

This harbour is the most northerly which was inspected in the sound, and in many ways is very interesting, although not of great value. It is about fifteen miles from Hardy Bay, which is directly across the sound from it. In it is an Indian village of small size, largely abandoned during the summer months. The nearest white population is at Hardy Bay, and no steamers call at it with either mail or freight.

The harbour proper may be distinguished from Bradley Lagoon, which branches from its eastern end and is accessible only during certain stages of the tide. The front of the outer basis is formed by a long, rocky-shored island, with a passage at either end. On the mainland shore behind it lie fairly extensive beaches. The largest covers about 15 or 20 acres in front of the Indian village and shows butter-clams in moderate abundance in a part, although the western end is largely weeds, with a few cockles and crabs. A smaller bed to the east of the harbour has 3 acres of clam-beds. A large lagoon called Deer Lagoon, with a few clams, but not of much value, runs dry during low tide near the entrance to Bradley Lagoon. The outer beaches of the coast-line near the harbour-mouth are poorly stocked and heavily weeded. In general the region is not suited for commercial exploitation as far as the clams are concerned.

Bradley Lagoon is connected with the harbour by a narrow channel, in which the entrance at low tide is many feet below the upper end, so that at such times there is a strong rapid or fall running, and it is possible to take a boat through only at high-water slack. The range of the tide in the lagoon is but 3 or 4 feet, as far as could be told by the shore-line. Considerable fresh water enters at various points, and the banks with the trees on them are high enough to shelter the narrowest parts from any action of the wind. The basin is composed of three arms: a long, very narrow, and shallow one running to the north-eastward a broader and deeper arm to the north-west, and a very short one to the south-east. Considerable fresh water enters at various points.

The North-eastern Arm is not over 10 feet deep at its upper end, and but little deeper near the proximal end. The bottom is uniformly a slimy ill-smelling ooze or light silt which is easily stirred up, and hangs in suspension in the water for a considerable time. The shores are shallow flats of this mud where they are not rocks. Apparently the disturbance caused by the winds and the tides is not enough to mix the water, for the surface tasted but slightly brackish, while water brought up from a depth of 8 feet was strongly salty. The animal life is not great in variety. Dark-coloured and thin-shelled oysters were present in a definite belt around the shore-line between depths of $2\frac{1}{2}$ to 3 or 4 feet. The upper boundary of this belt may be delimited by the effect of the upper layer of fresh water, although the freezing weather during the winter probably has a strong effect. *Mytilus edulis* (the small inland mussel) grows to a very small size in the fresh water at the surface, but of normal size below, showing the same effect of fresh water as is sometimes seen at the heads of the larger inlets. One or two very small cockles, an annelid worm, and one or two small starfish were all that were found by dredging but in the latter became more abundant near the entrance of the lagoon. A small brine-shrimp was found in great numbers in the

surface layer of water. Oysters were found only in the slight expansions of the arm at its upper end.

The larger North-western Arm has a similar bottom to that of the previous one, but the water is much deeper; the shores, although low, are rocky except at the head, and the surface of the water was not as fresh at the time as that of the other arm. Mussels and clam-shells were seen on its beaches, but no live ones, and no oysters. This area has been leased for oyster-planting, but the depth of the greater part and the fine sediment on the bottom may render it impracticable. The South-eastern arm is similar to this, being its extension.

Shore-Line of Vancouver Island, Bordering on Queen Charlotte Sound

The only important beds in this area seem to be those in Beaver Harbour. Hardy Bay, the westernmost area investigated, is an open harbour, with large gravel beaches along the western side of the head and at the head. At the time of inspection it was rumored that it was to be made the terminal of a railroad, and there was in consequence a number of people there. It is less than thirty miles from Alert Bay. The head of the harbour is without many clams, but a few are to be found in the gravel beaches of the western side, on the white beaches of the spits, and on the flats of the Tsulquate River. The whole does not offer more than 2 or 3 acres of good clam-beds.

On the south shore of Beaver Harbour, just to the east of Hardy Bay, is situated an abandoned Hudson's Bay trading-post and an Indian village. The harbour is sheltered by a number of islands. The extensive tide-flats along the inner shores of the harbour are firm sand, with occasional stretches of mud and a great deal of eel-grass, and in them are found cockles, summer-clams, and white-sand clams in less than commercial abundance. On the bay side of Peel Island are 2 or 3 acres of very stony ground, with a great abundance of clams. Another acres is found on the western side of the inner face of this island. The small bights along the northern edge of the harbour have a few clams only. The Cattle Islands have between them an excellent bed of butter-clams and some summer-clams, of about 2 acres in extent. The southern side of the largest island has a bed of 2 acres in lesser abundance. The Shell Islets have but very few clams, the white beaches being formed almost entirely of the shell of barnacles. The beaches on Deer Island are not of much account, being badly washed by the waves, but 1 or 2 acres are apparently well stocked. On these islands in Beaver Harbour are the most striking examples of the "white beaches" of the sound. From them came a great many of the clams which were at one time canned at Alert Bay.

Between Beaver Harbour and Alert Bay there is not much that may be called valuable, although there is a great deal of beach. A few portions were spoken of as having some clams, but these were not regarded as of much use, and the character of the shore-line did not promise well for clams.

Islands At the Head of the Sound

These are of all sizes, from mere rock pinnacles to some which are over twenty miles in length. The smaller are grouped in the edge of the sound and the larger just to the east of them,

the channels behind the larger islands being portions of the inlets, which find their entrance to the sound between them. As mentioned above, the beds are small and scattered, situated on small beaches and creek delta, and for the most part distinguished by the accumulation of white shell on them. The waterfronts of the Indian villages are almost always white, sometimes because of the presence of natural clam-beds, and at other times because of the shells thrown on them by the Indians, for the villages are seemingly located in part with an eye to the easy obtaining of clams.

White Beach Passage

This is at the west end of Harbledown Island, and obtains its name from the white beach below some Indian huts on the south side of the island between the passage and Farewell Harbour. This is ½ acre in extent and abundantly stocked with clams, most the butter-clam (*Saxidomus giganteus*).

Mound Island

This is a small island a mile east of the preceding. On its inner (south) side is found an acre of butter-clams on a gravel-flat. At its west end is the site of an old Indian village, and below this a one-tenth acre of butter-clams. The Indians from Old Vancouver are said to obtain clams here.

Dead Point, Harbledown Island

In the bay to the east is the Harbledown Post-office, and on the side to the west is the Indian village called Old Vancouver. There are but few clams at either place.

Beware Passage, between Harbledown Island and Turnour Island

In the small bay, which has a dumb-bell shaped island in its front, are two very small beds of clams. At the Indian village of Karlukwees is a white beach with a small clam-bed. Across from it on the west end of Klaoitsis Island is another white beach on an old village site, with a small clam-bed. The lagoon back of this island has a gravel bottom without clams.

Clio Channel, between Turnour and Cracroft Islands

A small bed of one-tenth of an acres of butter-clams is present in Air Bay, near the grassy point. Four small areas of similar size lie on the small islands in front of Lagoon Cove and between Minstrel and Chatham Islands. The lagoons are typical salt-water lagoons, and are said to go dry at certain tides.

Mama-liliculla

An Indian village on Village Island. Between the village and the surrounding islets the bottom all goes dry at the lowest tides, exposing 10 to 15 acres of muddy weeded bottom with many large boulders, and with only occasional clams.

Indian and Cary Islands

These two groups of islands have several small beds of clams on their sheltered sides and in their coves, but the clams are not as abundant as in some of the other beds. The Indians from Mama-liliculla are said to come to Alder Island, the largest of the Cary Group, for their clams.

Gilford Island, the Western Coast

Along the mouth of Knight Inlet and in Port Elizabeth no beaches were observed. Just north of Bare Hill Point are two small beaches. Between Health Bay and Bare Hill are numerous islands, with white beaches on good-sized flats behind them. The beds are, however, not of the heavily stocked kind, and cockles predominate. In the South Arm of Health Bay are two small clam-beds on either angle of the flat, and the lagoon is apparently without clams. There are sparse numbers in all the small coves and bays from here north, but no place has a commercial abundance of them.

Eden, Baker, and Bonwick Islands

No beaches worth consideration were met with on Bonwick, Crib, Hudson, Mars, and Tracy Islands, nor on the islets surrounding Sunday Harbour and Monday Harbour. Around the latter the beaches are all rock, the shores wind-swept, with stunted trees. White beaches with small but well-stocked beds were found at the eastern end of Davies; at the north entrance of Old Passage (between Baker and Insect Islands); in the southern bight of Dumb-bell Island, this larger than the preceding; in a cove on the north side of Eden Island opposite Joe's Cove; a large beach (1¼ to 1½ acres) on the south side of Insect Island, and another small one (¼ acre) on Eden Island; a very small one on the end of Innis Island; and another on a small unnamed island between Bonwick and Fox Islands.

Wells Pass and its Branches, Drury Inlet, MacKenzie Sound, and Sutlej Channel

These were not investigated because no large beds were expected in such a region, and reports were to the effect that there was nothing to be found, save a few in parts of MacKenzie Sound. Where there are any clam-beds it is probable that they are typical inlet beds.

On all these small islands beds are traces of Indian camps, and it is evident that they come to them for much of their supply of clams, and also to dry those which they keep for winter. As they were not in their villages during the time of the visit, it was difficult to obtain any idea as to their use at present. That they will travel ten or twelve miles for clams is probable from the information obtained from the loggers of the region.