Scientific Excellence • Resource Protection & Conservation • Benefits for Canadians
Excellence scientifique • Protection et conservation des ressources • Bénéfices aux Canadiens

QUOTA OPTIONS AND RECOMMENDATIONS FOR THE 1995 GEODUCK CLAM FISHERY

R. Harbo, G. Thomas and K. Hobbs

Department of Fisheries and Oceans
Operations Branch
South Coast Division
3225 Stephenson Point Road
Nanaimo, B.C.
V9T 1K3

1995

Canadian Manuscript Report of Fisheries and Aquatic Sciences 2302

Fisheries and Oceans Pêches et Océans

Canada

Canadian Manuscript Report of Fisheries and Aquatic Sciences

Manuscript reports contain scientific and technical information that contributes to existing knowledge but which deals with national or regional problems. Distribution is restricted to institutions or individuals located in particular regions of Canada. However, no restriction is placed on subject matter, and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Manuscript reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1–900 in this series were issued as Manuscript Reports (Biological Series) of the Biological Board of Canada, and subsequent to 1937 when the name of the Board was changed by Act of Parliament, as Manuscript Reports (Biological Series) of the Fisheries Research Board of Canada. Numbers 901–1425 were issued as Manuscript Reports of the Fisheries Research Board of Canada. Numbers 1426–1550 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Manuscript Reports. The current series name was changed with report number 1551.

Manuscript reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport manuscrit canadien des sciences halieutiques et aquatiques

Les rapports manuscrits contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui traitent de problèmes nationaux ou régionaux. La distribution en est limitée aux organismes et aux personnes de régions particulières du Canada. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports manuscrits peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports manuscrits sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annuel des publications scientifiques et techniques du Ministère.

Les numéros 1 à 900 de cette série ont été publiés à titre de manuscrits (série biologique) de l'Office de biologie du Canada, et après le changement de la désignation de cet organisme par décret du Parlement, en 1937, ont été classés comme manuscrits (série biologique) de l'Office des recherches sur les pêcheries du Canada. Les numéros 901 à 1425 ont été publiés à titre de rapports manuscrits de l'Office des recherches sur les pêcheries du Canada. Les numéros 1426 à 1550 sont parus à titre de rapports manuscrits du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 1551.

Les rapports manuscrits sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Manuscript Report of
Fisheries and Aquatic Sciences 2302

1995

QUOTA OPTIONS AND RECOMMENDATIONS FOR THE 1995 GEODUCK CLAM FISHERY

by

R. Harbo, G. Thomas[2], and K. Hobbs

Department of Fisheries and Oceans
Operations Branch
South Coast Division
3225 Stephenson Point Road
Nanaimo, B.C.
V9T 1K3

[2]North Coast Division
417 2nd Avenue West
Prince Rupert, B.C.
V8J 1G8

Cat. No. Fs 97-4/2302E ISSN 0706-6473

Correct citation for this publication:

Harbo, R. M., G. Thomas and K. Hobbs. 1995. Quota options and recommendations for the 1995 geoduck clam fishery. Can. Manuscr.Rep. Fish. Aquat. Sci. 2302: xi + 141 p.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

Harbo, R. M., G. Thomas and K. Hobbs. 1994. Quota options and recommendations for the 1995 geoduck clam fishery. Can. MS Rep. Fish. Aquat. Sci. 2302: xi + 141 p.

The geoduck fishery began in British Columbia in 1976, and has grown to be the major invertebrate fishery in value and only recently (since 1991) second to red sea urchins in landings. The commercial geoduck divers have landed approximately 123 million lb. (> 55,780 t) to 1994.

A range of biomass estimates, harvest rates to date and reduced quotas set for the 1995 fishery are provided in this document. A coast wide quota of 4,621,650 lb. (2096 t) is recommended for 1995, an I.V.Q. of 84,030 lb. (38.1 t) for 55 licences. This is a 6.9 % reduction from the 1994 I.V.Q. of 90,000 lb. It is proposed to fish 30 quotas in the north (2,520,900 lb.), 14 on the W.C.V.I. (1,176,420 lb.) and 11 in Inside waters (924,330 lb.).

The reduction in 1995 resulted from a continued critical review and adjustment of landings, geoduck densities and estimates of fishing areas or geoduck "beds". Closures of some beds are recommended for 1995 and reduction in quotas for some beds based on a 50 year fishing cycle.

The recommended quota options may be six to nine times greater than the lowest risk option or a third or a half of the high risk options.

RÉSUMÉ

Harbo, R. M., G. Thomas and K. Hobbs. 1995. Les quotas de pêche à la panope pour 1995 : options et recommandations. Can. MS Rep. Fish. Aquat. Sci. 2302: xi + 141 p.

La pêche de la panope de la Colombie-Britannique a débuté en 1976 et est devenue la pêche d'invertébrés dont les revenus sont les plus importants; ses débarquements ne sont inférieurs à ceux de la pêche de l'oursin rouge que depuis récemment (1991). En 1994, la récolte de panope des plongeurs commerciaux avait atteint 123 millions de livres environ (> 55,780 t).

On trouvera dans le présent document des estimations de biomasse, les taux de récolte jusqu'à ce jour et les quotas réduits fixés pour l'ensemble de la côte en 1995, soit un quota individuel par bateau de 84,030 livres (38.1 t) pour les 55 permis. Il s'agit d'une réduction de 6.9% par rapport au quota individuel de 1994 qui était de 90,000 livres. La répartition des quotas proposée est: 30 pur le nord (2,525,900 lbs), 14 pour la côte ouest de l'île Vancouver (1,176,420 lbs) et 11 pou le détroit (924,330 lbs).

La réduction imposée pour 1995 résulte d'examens détaillés et de corrections constamment apportées aux débarquements, à la densité des panopes et aux superficies de pêche estimées (gisements de panopes). La fermeture de gisements est recommandée pour 1995, de méme que la réduction des quotas de certains gisements reposant sur un cycle de pêche de 50 ans.

Les valeurs des quotas recommandées peuvent être de six à neuf fois supérieures à la valeur correspondant au risque le plus faible ou de trois à deux fois inférieeures àla valeur correspondant à un risquele plus faible ou de trois à deux fois inférieures à la valeur correspondant à un rique élevé.

SUMMARY

The commercial fishery for geoduck clams began in British Columbia in 1976. Since that time the commercial fishery has landed over 123 million lb. (55,780 t) to 1993.

Individual Vessel Quotas (I.V.Q.'s) have been in effect since 1989. The total calculated quota for the coast is divided by 55 licences for an annual I.V.Q. The north coast, southern inside waters and the west coast of Vancouver Island were then divided by the I.V.Q. to determine the number of area licences. Some rounding was done to have whole numbers of quotas in an area. Some minor exploratory quotas were set in the north with designated areas to harvest if no new stocks were found.

For the 1995 quota options, the hectares of known commercial fishing areas were measured from harvest logs and original densities were reduced from earlier years to 0.45 and 0.7 geoduck/m^2 (from 1.0) for southern inside waters, 1.4 geoducks/m^2 (from 2) for the west coast of Vancouver Island. A density of 2.0 geoducks/m^2 was used for productive Subareas of northern Area 12. Densities of 1.0 to 3.5 geoducks/m^2 were used for beds in the north coast. A medium risk yield option of 1%, from a range of 0.3 to 2.0%, was recommended for all areas in 1995.

There is continued concern that the fishery is depleting the most accessible stocks of the highest quality. Some fishing areas have been lost because of contamination. Some harvest sites with minor landings have been scaled down in area while the estimates of areas for other beds were reduced following consultation with fishers in 1994.

For the south coast, 517 beds measured 13,271 ha. There were 258 beds inside for 7,590 ha and 259 beds on the W.C.V.I. for 5,681 ha. In the north, a total of 313 beds measured 3,275 ha. There were 148 beds in the Q.C.I. for 1204 ha, 61 beds in the Prince Rupert district for 992 ha and 104 beds in the Central coast district for 1079 ha. This includes areas fished through 1992. Beds and hectares in the Prince Rupert and Central Coast areas have been adjusted to reflect the actual Geoduck Management Area boundaries, rather than the Pacific Fishery Management area boundaries. The average density of geoducks in northern harvest beds is estimated to be greater than in the south. A range of biomass estimates, harvest rates to date and reduced quotas set for the 1995 fishery are provided in this document.

The recommended quota options may be six to nine times greater than the lowest risk option or a third or a half of the high risk options.

1995 GEODUCK QUOTA RECOMMENDATIONS

A coast wide quota of 4,621,650 lb. (2096 t) when divided by the 55 licences results in an I.V.Q. of 84,030 lb. (38.1 t). This is a 6.9 % reduction from the 1994 I.V.Q. of 90,000 lb. (40.8 t).

It is proposed to fish 30 quotas in the north (2,520,900 lb. or 1,143 t), 14 on the W.C.V.I. (1,176,420 lb. or 534 t) and 11 in Inside waters (924,330 lb. or 419 t).

The reduction in 1995 resulted from a continued critical review of geoduck densities and estimates of fishing areas or geoduck "beds". For the first time in the 1995 review, the landings for areas were adjusted by a factor of fish slip landings/logbook landings. This accounted for catch that was not reported on logbooks and increased the estimated removal of stock from the various beds. Closures of some beds are recommended for 1995 and reduction in quotas for some beds considered over a 50 year cycle.

For areas that have been heavily harvested, a 50 year cycle was considered. A reduced quota was set for areas based on the then number of years remaining to be fished in a 50 year cycle and the balance of the quota that could be removed over that period. This reduced fishing approach was considered preferential to long term closures in many areas. Closures were recommended for areas where 50% or more of the estimated stock was removed, pending surveys and further evaluations.

REDUCTION OF QUOTAS IN THE 1995-96-97 ROTATION

By 1994, 71 % of the total catch has been landed from the south coast (25 % from inside waters and 46 % from the west coast of Vancouver Island) and 29 % from the north coast (6.8% from the Q.C.I., 22.2% from the central coast and Prince Rupert districts). It is recommended that effort in the south in the rotation period 1995-96-97 be reduced in many beds. Harvest rates are also proposed to be decreased in the north coast. The reductions resulted in fewer licences assigned to harvest in the south and more in the north but fishing at a more conservative harvest level.

The following factors account for lower quotas in the 1995 fishery:

i) conservation closures were set where total landings were estimated to be >50% of the original biomass.

ii) reduced quotas in the South Coast were calculated based on a 50 year fishery cycle. If an area had been heavily fished (on average,>1% annual harvest rate) then a lower harvest rate was applied for the remaining years of a 50 year cycle.

iii) most exploratory fisheries have been eliminated and 1995 quotas were calculated on known, commercially harvested sites. Over time, the estimated stocks from beds found in exploratory areas could not support the initial exploratory quotas.

iv) The overall quota for Area 24 has been decreased until more is known about the geoduck stocks in that area. It has supported a significant proportion of the fishery to 1994. A closure of the Yellow Bank/Elbow Bank area should be continued for 1995.

v) reduced average densities were used for most areas of the coast in 1995:

Inside waters: for beds larger than 75 ha a density of 0.45 geoducks/m2 was used based on survey results of large beds at Marina Island and Comox Bar; for beds less than 75 ha, a maximum of 0.7 geoduck/m^2 was used. An exception was made for northern Subareas of Area 12 where an average density of 2 geoducks/m^2 was used.

West Coast of Vancouver Island: 1.4 geoducks/m^2 was used for the west coast of Vancouver Island,

North Coast: 1 to 3.5 geoducks/m^2 were used for areas in the north coast.

vi) many bed areas (ha) were reduced following an assessment of the fishing history of each bed, the area (ha) assigned, the annual and total landings and qualitative assessments of the fishers.

vii) Historically, greater landings have been reported on fish slips than on harvest logs, although quotas are calculated form harvest log data. For the first time, landings for South Coast areas reported in harvest logs were adjusted for fish slip landings, i.e. factored by (fish slip landings/log landings). This resulted in heavier exploitation rates in some areas than previously used in assessments.

1.0 INTRODUCTION

The geoduck fishery began in British Columbia in 1976, and has grown to be the major invertebrate fishery in value and third ranking in landings, next to crab and red sea urchins in 1993. Table 1 gives the annual landings and landed values, 1976 to 1993. By the end of 1993, >55,780 t (123 million lb.) have been landed. Annual landings peaked in 1987 at 5735 t (12.6 million lb.), but landed values continued to increase and they were $23.2 million in 1993. Values have increased again in 1994.

The fishery is described by Cox (1979), Harbo and Peacock (1983), Harbo et al.(1986, 1987, 1992), Farlinger and Bates (1985) and Farlinger and Thomas (1988).

Geoduck (*Panopea abrupta*, Conrad 1849) are distributed along the entire coast of British Columbia. The fishery started in the inside waters of Vancouver Island in 1976, and in the following year, significant stocks were found in Clayoquot Sound, on the west coast of Vancouver Island. The fishery did not expand into the north coast until 1980 due to the remoteness and the lack of processing capability,

Summaries of landings by statistical areas are given in Table 2 (south) and Table 3 (north); 71 % of the landings came from the south coast (25% inside waters and 46% from the west coast of Vancouver Island) and 28% from the north coast.

1.1 GEODUCK BIOLOGY

Geoducks are large burrowing clams, with an average landed weight of approximately 1 kg. They are among the oldest animals in the world, often reaching ages in excess of 100 years.

In spite of the large numbers of geoducks, their fecundity and longevity, the recruitment of juveniles into the populations are low. There are several papers describing the life history of geoducks (Anderson 1971, Breen and Shields 1983, Goodwin 1976, Goodwin and Pease 1987,1989, Goodwin and Shaul 1984, Goodwin et al. 1979, Sloan and Robinson 1984).

Spawning takes place from March to July. Although the females may contain in excess of 20 million eggs, they are "dribble" or batch spawners (spawning several times over the season) releasing one to two million eggs at a time.

Larval stages have been described from hatchery programs (Goodwin et al. 1979; Goodwin and Shaul 1984). At settlement the shell develops along with a foot and byssal threads. The small geoduck can travel along the bottom by a sand-byssal thread parachute.

At a shell length of 2 mm, they burrow into the substrate. The depth occupied is related to shell length and siphon length. Clam "seed" from the Washington state hatchery is normally 8 to 20 mm shell length when released on clam leases.

At settlement and for the first two years, juvenile geoducks are vulnerable to number of predators. At the surface of the substrate they are easy prey of numerous snails, sea stars, crabs (*Cancer productus* and *C. gracilis*), shrimp and fishes (Goodwin and Pease 1989). Fast growing clams bury to a refuge of 60 cm or more in two years (Hal Beattie, pers. comm).

Geoducks are a major component of the subtidal biomass of marine animals. Average abundances are estimated at 1.7 clams/m^2 in Puget Sound, Washington (Goodwin and Pease 1989) and densities of 0.45 to 3.5 clams/m^2 are estimated for British Columbia areas.

Adults are separate sexes, and 50% are sexual mature at a shell length of 75 mm, at two to eight years of age. Initial growth rates are fast and they reach a near maximum shell length and size after 10 years.

2.0 MANAGEMENT OPTIONS FOR THE GEODUCK FISHERY

Table 4 summarizes the quotas, landings and management actions taken in the geoduck fishery, 1989 to 1995, since the implementation of the I.Q. fishery management.

There have been several reports documenting the fishery (as detailed above), but options other than quota management have not been proposed. Other management strategies such as minimum size limits can not be applied to this clam fishery. Once removed, geoducks are not capable of reburying into the substrate.

Breen (1982) recommended quotas for the geoduck fishery but pointed out quotas depend on accurate available estimates of virgin biomass. Jamieson (1986) reviewed the geoduck management approach and the problems with invertebrate fishery management in general and Sloan (1985) discussed the feasibility of improving geoduck stock assessment.

Time and area closures alone, without quotas, were not effective in controlling catch levels in this fishery. The divers were highly efficient, capable of harvesting up to five or more geoducks per minute. Licence limitation was effected in 1981 and there are currently 55 eligible licences for the geoduck and horse clam dive fisheries.

Harbo et al. (1992,1993,1994) review the quota management and detail quotas set in the fishery. As the fishery has progressed,

the number of quota management areas were increased in an attempt to spread out effort, find new fishing grounds and to reduce the potential for local over harvesting. With the implementation of a three year rotation of areas, the number of quota management units has increased. For the rotation 1989 to 1991, there were 78 quotas set. For 1992-93-94 rotation, this increased to 170 quota management units ; 60 in 1992, 47 in 1993 and 62 in 1994 (Table 4). For 1995, 78 management units have been proposed; 37 in the north, 16 in southern inside waters and 25 for the W.C.V.I.

All landings since 1989 have been monitored at designated landing ports by contracted port observers. Also, in 1989, a three year rotational area fishery was set. Rotational fisheries were implemented primarily for management reasons, to reduce the annual number of delivery ports for validation of quotas. The I.V.Q. program has been extended to 1995.

3.0 DETERMINATION OF GEODUCK QUOTAS

Harbo et al.(1992) reviewed the history of quota management in the geoduck fishery and presented the quotas set in 1991. Quotas for 1992 and 1993 (Harbo et al., 1993) and 1994 (Harbo et al., 1994) were developed in consultation with area committees of fishers .

Determination of quotas has primarily been undertaken by management biologists (Fisheries Branch). Most quotas set were within the large ranges of potential stock and annual yield options. Some exploratory quotas were also set.

Tables 5.1 and 5.2 summarize the annual quotas for north and south coast districts, 1979 to 1994 and the proposed 1995 district quotas. Detailed annual quotas by management area to 1991 are listed in Harbo et al. (1992). Quotas for the first three year rotation, 1989 to 1991, and 1992-93 are given in Harbo et al. (1993). The 1994 quota options are given in Harbo et. al 1994.

4.0 QUOTA CALCULATIONS

Quota calculations are derived using the following formula:

$$\text{Quota} = (\text{HARVEST RATE}) \times (B_o)$$

where

HARVEST RATE = 0.01 (within the recommended range of 0.0075 to 0.02; Breen, 1982,1992; Campbell 1992) annually

B_o= ORIGINAL BIOMASS = (AREA x DENSITY) = (HA X TONNES/HA)

AREA = ha as measured from harvest sites on nautical charts

DENSITY = wt. of geoduck/unit area assuming an average weight of 1.065 kg/geoduck (Harbo et al. 1983) :

= 7.445 t/ha or 16,435 lb./ha for 0.7 geoduck/m^2
= 10.65 t/ha or 23,500 lb./ha for 1 geoduck/m^2
= 14.9 t/ha or 32,871 lb./ha for 1.4 geoduck/m^2
= 37.3 t/ha or 82,200 lb./ha for 3.5 geoducks/m^2

For 1992 to 1994, the highest density used in the north coast quota calculations was 3.5 geoducks/m^2 . In past years, and in 1991 some areas had been assigned higher densities of 5 geoducks/m^2 (Harbo et al. 1992). A summary of standard weights and conversions used for quota calculations are listed in Table 6.

The three main factors (harvest rates, area and geoduck densities) in the equation are discussed below.

For 1995, a 50 year cycle was examined for south coast areas, assuming that 50% of the original biomass would be harvested in 50 years of fishery. For the first time the landing estimates used from harvest logs have been factored by landings validated or reported on sales slips and missing on harvest logs, to reflect a more complete harvest history. As a result, reduced quotas have been set for areas that have been heavily fished. Some areas that were closed in 1992 reopened at a reduced fishing rate in 1995. This is detailed in following sections.

4.1 HARVEST RATES OR YIELD ESTIMATES

In spite of the large spawning biomass, geoducks have very low annual recruitment rates (Goodwin and Shaul 1984). Juvenile geoducks are difficult to survey in B.C. waters (Jamieson, pers. comm.; Campbell, pers. comm.). All of the available information indicates that population turnover rates are low and we have continued to use a 1% annual yield for evaluating 1994 quota options .

Recruitment of geoduck clams is generally considered to be nearly constant and low. The effect of fishing on recruitment is not known, although evidence from studies (Goodwin and Shaul, 1984) indicated that there is a relationship between adult and juvenile abundance. Juveniles were less abundant in harvested areas.

The management goal of the geoduck fishery is to provide a long term sustainable yield. Annual quotas are derived from estimates of standing stock and of productivity.

A yield per recruit analysis was done using Ricker's 1975 model and another model developed by Breen (1982). Growth, recruitment and mortality were expressed as a percentage of virgin

biomass. Breen (1982) suggested that quotas should be kept within 0.75 to 2.0% of the virgin biomass depending on the stock-recruitment relationship. The recruitment effects noted by Goodwin and Shaul (1984) suggested using the lower end of the estimate, 1%. Results from a study in British Columbia in 1989 (Noakes and Campbell, in prep.) confirmed the low productivity and also suggested that the range was reasonable.

PSARC-92 papers examined yield models and sustainable fishing patterns for geoduck populations in B.C. (Irvine et al. 1993). Breen suggested that the current 1% level was conservative while Campbell suggested that exploitation rates be kept within 0.3 to 0.5% of the original biomass. Further studies on recruitment and natural mortality were recommended to produce reliable estimates of sustainable yield.

Rates of growth, mortality and recruitment are available from Washington state studies (Goodwin, 1976; Goodwin and Shaul, 1984 and others) and from studies in British Columbia (Breen, unpublished data; Bernard, 1982; Breen and Shields, 1983; Harbo et al. 1983). Mortality in British Columbia populations is estimated to be less than 0.05 (Sloan and Robinson, 1984; Harbo et al. 1983; Noakes and Campbell, in prep.). Individuals as old as 146 years were found in those studies and the average age varied from 28 years at Elbow Bank, Clayoquot Sound (Area 24) to 61 at Spider Anchorage (Area 7). Harbo et al. (1983) found geoduck began to recruit to the fishery at age 4 and were fully recruited at 12 years.

Numerous studies confirm relatively rapid growth for 8 to 15 years. After 15 years growth in shell length apparently ceases and weight only increases at a slow rate after this time (Goodwin and Shaul, 1984; Harbo et al. 1983). In most populations geoducks reach maximum size after 10 years of growth (Anderson 1971; Goodwin 1976; Breen and Shields 1983; Harbo et. al 1983).

Landings in Washington State were as high as 3922 t (8.6 million lb.) in 1977 and were 2017 t in 1987 (Goodwin and Pease 1989). Landings there vary according to the number and size of the tracts leased annually. The maximum sustained yield for these stocks was estimated to be 2% of the harvestable stocks (74,829 t) or 1497 t annually. The actual harvest rate has been set at 3% or 2245 t annually due to a program to reseed the clam beds with hatchery reared seed as the beds are leased and fished out.

4.2 ESTIMATED AREAS OF COMMERCIAL GEODUCK FISHING

Estimates of geoduck "bed" (discrete harvest site) areas are derived from harvest charts submitted by fishers. Bed information is transcribed to a set of reference nautical charts and measured on a computer driven digitizing tablet with Gap1 software.

This method of determining area may overestimate the size of the beds. The error is probably large, considering that the fishers harvest clumps or aggregations of geoducks within a "bed". Surveys at Marina Island showed a patchy distribution with large contiguous area with zero counts (A.Campbell, pers.comm.)

Prior to 1986, some beds were outlined following depth contours and substrate types on the nautical charts assuming it was all viable geoduck habitat. In other instances, several fishing sites were joined to form a larger "bed" resulting in an expanded area with more hectares. The large areas assigned have been compensated by assuming lower densities of geoducks to be used in quota calculations.

Harvest logbook data was first used in quota evaluation in 1984. The submission of harvest logbooks detailing catch and effort and harvest locations has been mandatory since 1976. The fishers have cooperated in this program and the data base has been utilized in the review of annual fishing plans since 1984.

Harbo et al. (1986) first published area estimates of geoduck beds harvested as shown on harvest logs, 1978 to 1984 . The areas had been measured from nautical charts using a planometer. The estimates in 1984, were 10,180 ha for the south coast and 704 ha for the north coast. These estimates have been revised each year and are presented in Table 7 and Appendix 1.

Additional harvest beds were identified each year adding to the total area. Revised estimates of geoduck fishing areas are given in Table 7 for the south coast, 517 beds for 13,271 ha (1992) and for the north coast fishing areas, estimated to be 313 beds measuring 3,275 ha (1992).

As a comparison, Goodwin (1978b) reported a total of 13,678 ha of geoduck habitat, between 10 and 60 feet in Puget Sound, Washington, with an estimated 117,653,000 geoducks.

Quota calculations for 1995 were derived following a series of meetings held with fishers, May to July, 1994 to review the geoduck fishing beds in each area to be fished in 1995. The total landings and bed area from various beds were compared. Both removal data and comments from fishers indicated that some bed areas may be overestimated.

Harbo et al. (1993) set arbitrary criteria to evaluate beds from landings in the harvest log data:

-beds with no reported landings were not considered
-beds with cumulative landings <5000 lb. were assigned an area of 1 ha
-beds with cumulative landings >5000 lb. but <10,000 lb. were

assigned an area of 2 ha
-beds with cumulative landings >10,000 but <20,000 lb. were assigned an area of 5 ha
-beds with cumulative landings >20,000 lb. but <50,000 lb. were assigned an area of 25 ha

Some beds were reduced in size based on advice from fishers and by comparing the size to other beds with similar landings over time. Very few beds were increased in size with 1991 harvest log additions, and only beds with landings recorded on harvest logs were considered initially. Some exploratory quotas were set for 1992-93 and 1994 for management purposes. This allowed for a more gradual reduction of annual vessel quotas.

4.3 GEODUCK BIOMASS

4.3.1 AVERAGE WEIGHTS

For the purposes of quota calculations in all areas an average fresh weight of 1.065 kg is used (Harbo et. al 1983). Some areas and types of substrate may have large or small geoducks and further data should be collected on average weights.

Weights are usually taken at the first point of landing, with very little water loss. Water loss increases over the time of delivery taking from half a day to 4 days. Water loss in the first two days averages approximately 5% and may be as high as 8% after 3 days (A.M.R. unpublished data).

4.3.2 AVERAGE DENSITIES

Another source of uncertainty in quota calculations is the estimated average density of geoducks over a large area. Harvest locations, habitat or "beds" have been measured at 1 ha to 631 ha (Harbo et. al 1986, 1992,1993). Estimates are based on surveys where they are available, information from fishers and survey data from Washington State.

Initial surveys were discussed by Harbo et al. (1986) and Harbo et al. (1992). Exploratory surveys by Cox and Charman (1979), suggested low densities of geoducks in British Columbia, 0.02 to 2.2 t/ha (0.002 to 0.21 geoducks/m^2) over large areas (>100 ha). However, unpublished data from later surveys (1980) of areas on the west coast of Vancouver Island, indicate densities from 1.6 t/ha to 16.8 t/ha (0.15 to 1.58 geoducks/m^2).

To calculate quota options for 1995, different densities were used for three areas of the coast:

i) Inside waters of the south coast:
Areas 11, 13, 14:
= 4.79 t/ha or 10,566 lb./ha for 0.45 geoducks/m^2 for large beds, ≥75 ha.
= 7.46 t/ha or 16,435 lb./ha for 0.7 geoduck/m^2 for beds < 75 ha

These densities correspond to the original densities of geoducks estimated from surveys at Marina Island in 1992 (Campbell et. al; in prep.) and Comox Bar in 1993 (Campbell et al.; PSARC 94-20). They are less than the overall density of geoducks (0.86) found by Goodwin (1978b).

Area 12A and 12B: 21.3 t/ha or 46,958 lb./ha for 2 geoducks/m^2

Area 12C to 12G: 10.65 t/ha or 23,479 lb./ha for 1 geoduck/m^2

Higher densities were estimated for the northern Subareas of Area 12 due to the reports from fishers and the high level of removals from these beds. The densities for other units in Area 12 were left unchanged from 1992 estimates, pending further studies and surveys in Area 12. Details are provided in Appendix 2 discussions of quotas for these areas 12-A and 12-B.

ii) West coast of Vancouver Island;
Areas 23, 24 and 27:
= 14.91 t/ha or 32,871 lb./ha for 1.4 geoducks/m^2

Fishers advised that densities on the west coast were twice that or more than stocks in the inside waters. Much of the habitat is sand.

Estimates from unpublished surveys (1980), summarized in Harbo et al. (1986) for Area 23, yielded a mean density of 0.30 geoducks/m^2 over an area of 3,368 ha outside of the Pacific Rim Park Reserve. Fishers have harvested 58 beds (2292 ha) in Area 23 (Appendix 1; Table 1.7). The highest removals from the fishery in a bed in Area 23, a single fishing location, was estimated to be 18.0 t/ha (1.69 geoducks/m^2) over 5 ha in the Chain Islands Group (Area 23).

In Area 24, a bed of 46 ha located at Clifford Pt. - McNeill Peninsula, contained a mean density of 20.83 t/ha or 1.95 geoducks/m^2 (1980, unpublished MRB data; pers. comm. B. Cox).

As a comparison, the average abundance of geoducks in Puget Sound in sand and mud bottoms at water depths of 6 to 18 m is estimated to be 1.7 g/m^2 (Goodwin and Pease 1987).

iii) North coast:
Areas 1 to 10: from 1 to 3.5 geoducks/m^2
= 37.3 t/ha or 82,200 lb./ha for 3.5 geoducks/m^2

The fishers reported the greatest densities of geoducks in the north coast supported by catch and effort data (Harbo et. al 1986).

For 1992 and 1993, the highest density used in the north coast was 3.5 geoducks/m^2. In past years, and in 1991 some areas were assigned higher densities of 5 geoducks/m^2 (Harbo et al. 1992). Following surveys of beds in the north coast in 1991, there was concern that the beds were not as large as marked out on charts and may not have as high densities as were being assigned (Farlinger and Thomas, 1991 PSARC, in prep.). As a result, the highest densities used for quota calculations since 1992 and for 1995 were 3.5 geoducks/m^2.

There are two locations in British Columbia where higher densities of 5 geoducks/m^2 or 53.3 t/ha geoducks have been used, in past years, 1991 and earlier: Spider Anchorage in the central coast (Area 7) where surveys show 6.25 to 9.76 geoducks/m^2 (Harbo, unpublished data) and the lower east side of the Queen Charlotte Islands where fishers report unusually high densities.

Density estimates for commercial geoduck leases in Washington vary greatly. Density estimates over the period 1984 to 1986 for the geoduck tracts leased annually were 18 to 68 t/ha (1.6 to 6.4 gdk/m^2) over beds ranging from 16 to 116 ha (Goodwin, pers. comm.).

Jamison et al. (1984) has reported considerable numbers of geoducks in Washington at depths between 18.5 and 111 m, shown by remote video. On over 6,000 ha of bottom, he estimated a visible population of 25.8 million geoducks (4.9 t/ha or 0.43 geoducks/m^2) without any correction for "show" factors, or those geoducks that were not visible to the camera.

Sloan (1985) reviewed the history and problems of geoduck stock assessment. The major problem in surveying geoducks is that they are not always visible or "showing". Geoduck clams spend considerable time with their siphons retracted (Goodwin 1977). The other problem is determining the area (ha) of the bed. A small area will typically have a high density. The larger the bed, the lower the average density.

5.0 ESTIMATES OF STANDING STOCK IN BRITISH COLUMBIA

Table 7 presents very preliminary estimates of geoduck stocks in British Columbia based on logbook returns including 1992. Over the period of 17 years, 1976 to 1992, 830 beds or harvest areas have been identified by fishers. Given the estimated average

geoduck densities discussed above, an original biomass of 248,348 t is estimated for the coast; 55% in the south and 45% in the north.

The estimate for the south coast Inside Waters of 135,759 t is similar to Goodwin and Pease (1989) estimate of the total standing stock of subtidal geoduck clams in Puget Sound; 126,984 t before commercial fishing began in 1970. Of this, only 74,829 t were actually harvestable (59%) because many of the beds were polluted, not economically or physically accessible, or were in conflict with other water uses. Goodwin (1978b) reported a total of 13,678 ha of geoduck bearing area, between 10 and 60 feet in Puget Sound, Washington, with an estimated 117,653,000 geoducks. This gives an average density of approximately 9.15 t/ha (0.86 geoduck/m^2).

Table 8 presents the data for areas to be fished in 1995, the number of beds, estimated harvest areas, landings adjusted for fish slips and log returns, the estimated removals of geoducks from locations, the years fished and an assessment of the rate of fishing. The actual fishing rates of removals for all areas exceed the recommended rates of removal, i.e. 1% of the original biomass on an annual basis.

Table 9 gives some preliminary estimates of areas (at least 31 beds; 1032 ha est.) under contaminated closures or permanent closures. There are permanent park closures in the Pacific Rim National Park on the west coast of Vancouver Island and in portions of the Checleset Bay Ecological Reserve (Area 26). There are research area closures at Bamfield (Area 23), Ritchie Bay (Area 24) and Gabriola Island (Area 17). A portion of Ahous Bay, Vargas Island (Area 24) is closed as a research area and whale sanctuary.

There are currently 13 beds (or portions of beds) closed in Inside Waters. A review of beds and closures due to contamination is required for the west coast of Vancouver Island.

6.0 ESTIMATES OF GEODUCKS REMOVED BY FISHING

Summaries of the number of geoducks removed over time are calculated and shown in Table 10. Removals from specific areas to be fished in 1995 are shown in Table 8. The removal rates have been the greatest on the north coast , 4.88 t/ha or 0.46 geoducks/m^2 over 14 years of harvest, partly as a consequence of larger quotas based on higher estimated original densities.

The low removal rate for the inside waters, 1.86 t/ha or 0.17 geoducks/m^2 is a result of lower quotas assigned to that area and the very large areas identified on the harvest charts. This low level of removals suggests that the harvest area is over estimated. For some smaller beds, removals are as high as 2.2 geoducks/m^2 over 5 ha but the large beds in Area 14 at Comox have low removals calculated, 0.1 to 0.2 geoducks/m^2 over 200 to 600 ha beds.

Removals on the west coast are generally higher than those for the inside, resulting from higher estimates of stock and high landings. For example, some small beds of 1 to 5 ha, there have been removals of 1.4 to 1.4 geoducks/m^2. For a large bed in Area 26 at the Mission Group, 1.76 geoducks/m^2 have been removed over 208 ha. In Area 25, at Rolling Roadstead, 343 ha, the calculated removals have been 0.47 geoducks/ m^2. For a Tofino bed at Elbow Bank, (est. at 90 ha) the calculated removals are 0.94 geoducks/m^2.

Annual rates of removal (t/ha) by the fishery, were based on landings and the length of the fishery. They were compared to annual rates recommended, calculated by using 1% of the densities assumed for quota calculations (0.45, 0.7, 1, 2 geoduck/m^2 southern Inside Waters; 1.4 geoducks/m^2 west coast of Vancouver Island; and 3.5 for geoduck quota units in the north coast).

The geoduck removal rates were calculated by:

GEODUCK REMOVALS (no./m^2)= *(no. of geoducks reported harvested) / (measured bed area)*

where:

NO. GEODUCKS HARVESTED= *(cumulative landings (t) over time from an Area (TableS 2 and 3)) / (standard weight of a geoduck)*

STANDARD WEIGHT OF A GEODUCK= *1.065 kg/ geoduck (Harbo et al.,1983)*

NO. OF GEODUCKS/TONNE= *(1000 kg/tonne) / (1.065 kg/geoduck) = 939 geoducks/tonne*

MEASURED BED AREA (m^2)= *(sum of the ha of geoduck beds in an Area, as shown in harvest logs and measured from nautical charts) x (10,000 m^2 / ha)*

TOTAL AREA (m^2) = *(ha of geoduck beds as measured from harvest logs) x (10,000 m^2/ha)*

The total harvest to date exceeds the current estimates of stock and production as shown in Tables 7 and 8. This has been compensated for by quota reductions in 1995. However, the quotas may increase in the future as new fishing grounds are measured and the effects of years of over harvesting diminish.

7.0 UNCERTAINTIES IN YIELD OPTIONS

There are great number of uncertainties in the quota calculations. The recommended quota options (medium risk) may be 6 to 9 times greater than the low risk option or a third or a half of the high risk option.

The most conservative level of annual yield is at 0.3%. At most, we may be overestimating the virgin biomass (currently available to the fishery) by two to three times. The biomass estimates are affected by both area (ha), densities and average weights of geoducks.

The highest risk option would be at an annual yield of 2% and at current estimates of virgin biomass.

There are several uncertainties about the stocks:

i) The extent of geoduck habitat is underestimated by estimating and measuring only areas where fishing has been reported. Only fishable stocks from 10 feet to 60 to 70 feet are considered. Geoduck stocks are known to extend well beyond these depths.

ii) Density estimates are chosen at values less than the high abundance reported by fishers because of the large bed areas measured. The highest densities used in calculations are 3.5 geoducks/m^2, in the north coast.

As discussed in earlier sections, high densities have been surveyed in small beds (< 40 ha) and calculated removals have been high in beds < 5 ha.

Table 11 presents estimates of removals of geoducks by the fishery and estimates the original densities required to support the level of fishing to date at a 1% harvest rate. This table shows that surveys of some beds will not likely support the level of fishing date and that a strategy of reduced fishing is appropriate.

8.0 1995 QUOTA OPTIONS AND RECOMMENDATIONS

Table 12 presents a summary of the recommended quotas for 1995; a coast wide quota of 4,621,650 lb. (2096 t) when divided by the 55 licences yields an I.V.Q. of 84,030 lb. (38.1 t) This is a 6.9 % reduction from the 1994 I.V.Q. of 90,000 lb.

The quota reduction in 1995 resulted from a continued revision of geoduck densities and estimates of fishing areas or geoduck "beds". Closures and quota reductions recommended for 1995 are listed in Table 13, while table 14 shows closures and reductions for 1992 to 1994.

8.1 SOUTH COAST- INSIDE WATERS - 1995 QUOTA RECOMMENDATIONS

The fishery for 1995 is the first year of the area rotations and is similar to the 1992 fishery described by Harbo et. al (1993). The 1992 quota for Inside Waters was 624.6 t (1,377,000 lb.). (Table 12).

The 1995 fishery plan calls for a 33 % reduction in quota from

the 1992 fishery in the same areas. This has been developed by a process of review of the landings, logbook data and meetings with the area licence holders.

The average density of geoducks has been reduced from 1/m^2 in 1992 to 0.45 and 0.7 geoducks/m^2 for 1995 calculations. In Area 12-A and 12-B average densities increased to 2.0 m^2 and for 12C to 12G they remained at 1 geoduck/m^2. Some beds fished in 1992 have been closed for the 1995 rotation to distribute fishing effort over the beds (Table 13).

It is proposed to fish 11 quotas of 84,030 lb. for 1995 in Inside Waters; 924,330 lb. (419 t). Quotas are summarized in tables 12 and 15 while detailed descriptions of areas and quota options are given in Appendix 2.

8.2 SOUTH COAST - WEST COAST VANCOUVER ISLAND. - 1995 QUOTA RECOMMENDATIONS

It is proposed to fish 14 quotas of 84,030 lb. for 1995 on the W.C.V.I. for 1,176,420 lb. (534 t). This is a 33 % reduction from the 1992 fishery (Table 12). Quotas are summarized in Tables 12 and 15 detailed area descriptions and quota options are given in Appendix 3.

Some beds closed in 1992 in Area 23 and 27 have been reopened for the 1995 fishery. Reduced quotas for these beds and others were calculated based on a 50 year fishing period (Appendix 3; Tables 3.1 to 3.4).

The fishery for 1995 is the first year of the three year area rotations. The 1995 fishery plan calls for a 33% reduction in quota from the 1992 fishery. The average density of geoducks has been reduced from 2/m^2 in 1992 to 1.4 geoducks/m^2 for 1995 calculations.

There is concern about local over harvesting of easily accessible beds of the highest quality. Landings from individual beds reported on harvest logs likely reflect a minimum figure for those beds. Not all landings are reported on harvest logs and not all harvest logs are returned with chart information of sufficient accuracy to code the landings to individual beds. Harvest log data indicate that individual beds and some areas have very high harvest rates based on landings and measured areas. Continued conservation closures are proposed for 1995, listed in Table 9.

8.3 NORTH COAST - CENTRAL COAST - 1995 QUOTA RECOMMENDATIONS

The 1995 northern fishery moved to the central coast, portions of Areas 6 to 10, as part of a three year rotational fishing plan.

Recommended quotas are summarized in Table 17 and detailed in Appendix 4.

There were 30 quotas of 84,030 lb. for a northern total of 2,520,903 lb. (1143.5 t) (Tables 12 and 17). The quotas for the central coast for 1995 were decreased by 4.5 % from 1992.

In 1992, the quota set for these areas was 2,639,250 supporting 23 licences at an I.V.Q. of 114,750 lb. (Table 4).

There was a shift of 3 licences to the north in 1995 from the west coast Vancouver Island. Two licences moved from the southern west coast of Vancouver Island to Inside Waters.

Minor exploratory area quotas in Area 7 (B6), Princess Alice Island, and in Area 6 (D3), Kitasu Bay, (Table 17) were set after consultation with fishers.

9.0 CONCLUSIONS AND RECOMMENDATIONS

There is substantial loss of fisheable product on the south coast due to pollution closures.

There is concern about local over harvesting of easily accessible beds of the highest quality. If the biomass (original) estimates are reasonable, it appears that the overall harvest rate is slightly higher than it should have been and that local over harvesting may be a problem. Conservative levels of harvest should be maintained, quotas should not be increased until research has been undertaken on the distribution and abundance of geoduck clams.

The current three year rotational fishery should be maintained and additional "sub-rotations" be derived, so that geoduck beds are fished only once every six or nine years. This may have a positive effect on recruitment.

9.1 RECOMMENDATIONS

1. A bed should be closed to harvesting once it has been exploited to 50% of the estimated original biomass. Criteria should be developed for how long such closures should last, and what management strategy should be used once the beds are reopened.

The 1995 quota recommendation, based on the above recommendation, is a reduction to 4,621,655 lb. (2096.4 t) divided into 55 equal individual vessel quotas of 84,030 lb. each (38.1 t).

For 1995, in Inside waters 11 I.V.Q's of 84,030 lb. were set for a total of 924,331 lb. (419.3 t). On the west coast of Vancouver Island, 14 I.V.Q.'s of 84,030 lb. each were set, for a total of

1,176,421 lb. (533.6 t) and on the North coast, 30 I.V.Q.'s quotas of 84,030 lb. were set for n total of 2,520,903 lb. (1143.5 t).

2. Surveys are required to determine the bed areas and geoduck densities in each management area. A program of surveys should be continued, surveying one or more areas per year. The Subcommittee supports the surveys planned for the North Coast and with co-management programmes. Fishers knowledgeable of stocks in an area should be interviewed to determine their estimate of the extent of the beds. Biological samples representative of the population should be collected in coordination with these surveys.

3. Weight data should be analysed for geoducks from each management area and management unit where possible from market sampling. THe data and analyses should be reviewed by PSARC.

4. Surveys of beds harvested heavily some years ago should be completed, and data on recruitment should be analysed and presented at PSARC as quickly as possible.

10.0 REFERENCES

Andersen, A.M.,Jr. 1971. Spawning, growth and spatial distribution of the geoduck clam, Panope generosa (Gould) in Hood Canal, Washington. Ph.D. Thesis. University of Washington, Seattle. 133 pp.

Breen, P. A. 1982 p. 14 -16 In Bernard, F. R.(ed.) Assessment of Invertebrate Stocks off the West Coast of Canada (1981). Can. Tech. Rep. Fish. Aquat. Sci. 1074:iv + 39p.

Breen, P. A. and T. L. Shields. 1983. Age and size structure in five populations of geoduck clams (Panope generosa) in British Columbia. Can. Tech. Rep. Fish. Aquat. Sci. 1169: iv + 62p.

Breen, P. A. 1992. Sustainable fishing patterns for geoduck clam (*Panopea abrupta*) populations in British Columbia. p.132 In: Irvine, J. R., R .D. Stanley, D. McKone, S. M. McKinnell, B. M. Leaman and V. Haist (Editors). 1993. Pacific Stock Assessment Review Committee (PSARC) Annual Report for 1992. Can. Manuscr. Rep. Fish. Aquat. Sci. 2196: 199 p.

Campbell, A. 1992. Yield and risk annalysis for the geoduck fishery in two areas of southern British Columbia. p.131 In: Irvine, J. R., R. D. Stanley, D. McKone, S. M. McKinnell, B. M. Leaman and V. Haist (Editors). 1993. Pacific Stock Assessment Review Committee (PSARC) Annual Report for 1992. Can. Manuscr. Rep. Fish. Aquat. Sci. 2196: 199 p.

Cox, R. K. 1979. The geoduck clam, Panope generosa : some general information on distribution, life history, harvesting, marketing and management in British Columbia. Marine Resource Branch, Ministry of the Environment, Fisheries Management Report No. 15: 25p .

Cox, R. K. and E. M. Charman. 1980. A survey of abundance and distribution (1977) of the geoduck clam Panope generosa in Queen Charlotte, Johnstone and Georgia Straits, British Columbia. Marine Resources Branch Fisheries Development Report 16: 122 p.

Farlinger, S. and K. T. Bates. 1985. Review of Shellfish Fisheries in Northern British Columbia to 1984. Can. MS Rpt. Fish Aquat. Sci. 1841: 35 p.

Farlinger, S. and G. A. Thomas. 1988. Review of Shellfish Fisheries in Northern British Columbia 1985 and 1986. Can. MS Rpt. Fish Aquat. Sci 1988: 38p.

Goodwin, L. 1976. Observation on spawning and growth of subtidal geoducks (Panope generosa Gould). Proc. Nat. Shellfish Assoc. 65: 49-58.

1977. The effects of season on visual and photographic assessment of subtidal geoduck clam (Panope generosa Gould) populations. Veliger 20(2):155-158.

1978. Some effects of subtidal geoduck (Panope generosa) harvest on a small experimental plot in Puget Sound, Washington. Progress Report No. 66 State of Washington Dept. Fisheries. 22p.

1978. Puget Sound subtidal Geoduck Survey Data. State of Washington. Dept. of Fisheries Progress Report 215: 30p.

Goodwin, L. and B. Pease. 1987. The distribution of geoduck (Panope abrupta) size, density and quality in relation to habitat characteristics such as geographic area, water depth, sediment type, and associated flora and fauna in Puget Sound, Washington. Wash. Dep. Fish. Tech. Rep. No. 102. 44 p.

1989. Species Profiles: Life histories and Environmental Requirements of Coastal Fish and Invertebrates (Pacific Northwest)--Pacific Geoduck Clam. U.S. Fish. Widl. Serv. Biol. Rep. 82 (11.120). U.S. Army Corps of Engineers, TR EL-82-4. 14pp.

Goodwin, L. and W. Shaul. 1984. Age, recruitment and growth of the geoduck clam (Panope generosa Gould) in Puget Sound, Washington. Progress Report No. 215 State of Washington, Dept. of Fisheries: 29p.

Goodwin, C.L., W. Shaul and C. Budd. 1979. Larval development of the geoduck clam (Panope generosa Gould). Proc. Natl. Shellfish. Assoc. 69: 73-76.

Harbo, R. M., B. E. Adkins, P. A. Breen and K. L. Hobbs. 1983. Age and size in market samples of geoduck clams (Panope generosa) Can. MS Rep. Fish. Aquat. Sci. 1714: iii + 78p.

Harbo, R., S. Farlinger, K. Hobbs and G. Thomas. 1992. A review of quota management in the geoduck clam fishery in British Columbia, 1976 to 1990 and quota options for the 1991 fishery. Can. MS Rep. Fish. Aquat. Sci. 2178: 135 p.

Harbo, R. M. and J. Fulton. 1987. Geoduck clam. p 79-88. In R. M. Harbo and G. S. Jamieson (Eds.) Status of invertebrate fisheries off the Pacific Coast of Canada. Can. Tech. Rep. Fish. Aquat. Sci. 1576:158 p.

Harbo, R. M., C. Hand and B. E. Adkins. 1986. The commercial geoduck clam fishery in British Columbia 1981 to 1984. Can. MS Rep. Fish. Aquat. Sci. 1873: 59p.

Harbo, R. M. and S. D. Peacock. 1983. The commercial geoduck clam fishery in British Columbia, 1976 to 1981. Can MS Rep. Fish. Aquat. Sci. 1712: vii + 40 p.

Harbo, R.M., G. Thomas and K. Hobbs. 1993. Quotas for the 1992-1993 geoduck clam fisheries. Can. MS Rep. Fish. Aquat. Sci. 2179: 209 p.

1994. Quota options and recommendations for the 1994 geoduck clam fishery. Can. MS Rep. Fish. Aquat. Sci. 2228: x + 115 p.

Irvine, J.R., R.D. Stanley, D. McKone, S.M. McKinnel, B.M. Leaman and V. Haist (Editors). 1993. Pacific Stock Assessment Review Committee (PSARC) Annual Report for 1992. Can. Manuscr. Rep. Fish Aquat. Sci. 2196: 199p.

Jamieson, G. S. 1986. A perspective on invertebrate fisheries management - the British Columbia experience, p 57-74 In G.S. Jamieson and N. Bourne (Eds.) North Pacific Workshop on stock assessment and management of invertebrates. Can. Spec. Publ. Fish. Aquat. Sci. 92.

Jamison, D., R. Heggen and J. Lukes. 1984. Underwater video in a regional benthos survey. Presented at Pacific Congress on Marine Technology, Honolulu, Hawaii. April 24-27, 1984.

Noakes, D. J. and A. Campbell. 1992. Use of geoduck clams to indicate changes in the marine environment of Ladysmith Harbour, British Columbia. Envirometrics 3(1):81-97.

Sloan, N. A. 1985. Feasibility of improving Geoduck Stock Assessment: history of the problem, recommended methods and their costs. In G. S. Jamieson (ed.).1983 and 1984 Invertebrate Management Advice, Pacific Region. Can. MS rep. Fish. Aquat. Sci. 1848.

Sloan, N. A. and S. M. C. Robinson. 1984. Age and gonad development in the geoduck clam, Panope abrupta (Conrad) from southern British Columbia, Canada, J. Shellfish Res.(4) :131-137.

ACKNOWLEDGEMENTS

Our thanks to the numerous fishers who have participated in meetings, who have provided their invaluable knowledge about stocks and fishing areas and who remain committed to managing a sustainable fishery. Much of the specific data on fishing areas has been provided on charts submitted by the fishers, with harvest logs.

Our thanks to the members of the Pacific Stock Assessment Review Committee (PSARC) Invertebrate Subcommittee and Claudia Hand for their review and valuable comments.

Table 1. Landings and landed values of geoduck clams in British Columbia, as reported on sales slips (1976 to 1988), and on validation logs (1989 to 1993).

Year	Total Landings (lb)	Total Landings (t)	Total Value[1] $10-3	Mean Price[2] ($·lb)	Mean Price[2] ($·kg)	Price Range[2] ($·lb)	Price Range[2] ($·kg)
1976	97,002	44	N/A	N/A	N/A	N/A	N/A
1977	540,898	245	89	0.17	0.37	N/A	N/A
1978	2,239,950	1,016	569	0.25	0.55	0.15 - 0.35	0.33 - 0.77
1979	5,429,886	2,463	1,669	0.31	0.68	0.13 - 0.40	0.29 - 0.88
1980	6,186,067	2,806	2,299	0.37	0.82	0.30 - 0.48	0.66 - 1.06
1981	5,961,405	2,704	2,162	0.36	0.79	0.32 - 0.70	0.71 - 1.54
1982	6,910,800	3,134	2,814	0.40	0.89	0.22 - 0.46	0.44 - 1.01
1983	5,810,913	2,635	1,804	0.31	0.68	0.00 - 0.60	0.00 - 1.32
1984	7,678,465	3,484	2,937	0.38	0.84	0.00 - 0.95	0.00 - 2.09
1985	11,838,624	5,370	4,599	0.40	0.89	0.00 - 1.00	0.00 - 2.20
1986	11,035,396	5,005	4,605	0.39	0.86	0.00 - 0.85	0.00 - 1.87
1987	12,643,298	5,735	6,184	0.49	1.08	0.00 - 1.05	0.00 - 2.31
1988	10,068,830	4,567	9,807	0.97	2.14	0.03 - 1.88	0.07 - 4.14
1989	8,784,247	3,985	12,571	1.43	3.15	0.25 - 1.75	0.55 - 3.85
1990	8,722,366	3,956	10,581	1.21	2.67	0.14 - 2.27	0.31 - 5.00
1991	7,346,864	3,333	9,659	1.29	2.84	0.58 - 2.55	1.27 - 5.62
1992	6,313,748	2,864	16,237	2.56	5.64	1.60 - 5.01	3.53 - 11.04
1993[3]	5,365,420	2,434	27,048	4.45	9.81	1.00 - 9.16	2.20 - 20.19
Total:	122,974,179	55,780	115,634				

[1] Price ranges taken from market reports and sales slips.

[2] Price paid to commercial fishermen

[3] Preliminary values

Table 2. Summary of geoduck landings (tonnes) by South Coast Management Area, as reported on sales slips (1976 to 1988) and on validation logs (1989 to 1993). A three year rotation of areas was initiated in 1989, with the exception of area 24.

	SOUTH COAST MANAGEMENT AREAS																				
	East Coast Vancouver Island											E.C.V.I.	West Coast Vancouver Island							W.C.V.I.	Annual
Year	11	12	13	14	15	16	17	18	19	28	29	Total	20	21	23	24	25	26	27	Total	Landings
1976				10			8		26			44								0	44
1977			14	9	77		137	2				239			6					6	245
1978			8	261	321	3	24	19	136			773	1	3	2	236	2			243	1016
1979		24	160	276	263	148	209	3	159			1,242			153	950	87	22	9	1221	2463
1980			97	215	17	301	225	34	91			980	5		288	841	321	303		1758	2738
1981			41	180	29	70	155	44	28			547	8		187	819	473	156	6	1648	2195
1982		83	14	144	33	103	17	1	14			409	14		174	1218	366	726		2498	2907
1983		16	29	340	29	42	13	2	10			481			84	1066	215	287	1	1653	2134
1984	8	302	150	285	54	129	128	1	118			1,175			219	628	442	443	2	1734	2909
1985	13	490	81	172	42	38	137	4	78			1,055	0		227	730	599	272	1050	2878	3934
1986	21	212	148	200	137	117	136	13	124		11	1,119	96		231	803	450	226	388	2194	3313
1987		275	112	286	98	159	265	103	50		100	1,448	40		247	661	552	398	241	2139	3587
1988	62	290	51	191	59	95	110	2	116	1	17	995	49		192	633	187	206	279	1546	2541
1989	5	662	203									870			538	633			345	1516	2386
1990				605		258						864				540		614	343	1497	2360
1991					258		181	37	244		14	734	1			416	702	153		1272	2006
1992		256	78	291								625			255	479			306	1040	1665
1993				349		182						531				497		220	124	840	1371
1976 to 1993	109	2610	1186	3814	1417	1645	1745	264	1194	1	142	14,129	214	3	2803	11149	4396	4025	3094	25685	39813

Inside Waters Total: 14,129 West Coast Total: 25,685

Table 3. Summary of geoduck landings (tonnes) by North Coast Management Area, as reported on sales slips (1980 to 1988), and on validation logs (1989 to 1993). A three year rotation of areas was initiated in 1989.

	NORTH COAST MANAGEMENT AREA											
Year	1	2E	2W	3	4	5	6	7	8	9	10	Annual Landings
1980		31			4					28	5	68
1981		11				84	6	370	18		20	509
1982								227				227
1983								202	299			501
1984		4		3		214	8	109	183	54		575
1985		341	213			291	60	494	37			1436
1986	7	254	325	120	125	323	24	392	2	103	17	1692
1987	137	391	179	134	95	287	484	222	91	11	117	2148
1988	119	462	45	77	150	191	423	309	250			2026
1989							149	1269	40		142	1600
1990				77	356	441	721					1596
1991	91	848	388									1327
1992							202	853	83	23	39	1199
1993				37	170	411	445					1063
1976 to 1993	354	2341	1150	448	900	2242	2521	4447	1003	219	340	15965

Table 4. Summary of quotas, landings and management actions from 1989 to 1994, 1995 (proposed).

Year	Management Units Areas	Quota (tonnes)	Landings[1] (tonnes)	Management	Eligible Licences	Vessels Fished[2]
	FIRST THREE YEAR ROTATION (78 UNITS)					
1989	North Coast - 7 management units	1,597	1,600	First year of trial I.Q. Coastwide quota divided equally	55	47
	South Coast - 13 management units	2,395	2,387	among 55 licences; 160,000 lb., 12 inside south, 21 west coast Vancouver Is., 22 north coast licences. First of three year area rotation.		
1990	North Coast - 4 management units	1,597	1,596	Second year of trial I.Q. 160,000 lb./licence.	55	46
	South Coast - 13 management units	2,395	2,361	Second year of the three year area rotation		
1991	North Coast - 19 management units	1,347	1,327	Third year of I.Q. 135,000 lb/licence (15.6% reduction)	55	47
	South Coast - 22 management units	2,020	2,006	Third year of area rotation.		
	SECOND THREE YEAR ROTATION (186 UNITS)					
1992	North Coast - 24 management units	1,197	1,199	First year of area rotation. I.Q. 114,750 lb/licence. (15% reduction)	55	45
	South Coast - 37 management units	1,666	1,665	23 licences North; 12 Inside South; 20 W.C.Vancouver Is.		
1993	North Coast - 27 management units	1,061	1,063	Second year of area rotation. I.Q. 97,500 lb/licence.(15% reduction)	55	44
	South Coast - 20 management units	1,371	1,371	24 licences North; 12 Inside South; 19 W.C.Vancouver Is.		
1994	North Coast - 32 management units	1,102	1091	Third year of rotation. I.Q. 90,000 lb./licence (7.7% reduction)	55	42
	South Coast - 30 management units	1,143	1136	27 licences North, 10 Inside South; 18 W.C.V.I.		
	THIRD THREE YEAR ROTATION					
1995	North Coast - 37 management units	1,144		Year 1 of the second area rotation. I.V.Q. 84,030 lb/licence (6.9% reduction)	55	
	South Coast - 41 management units	953		30 licences North, 12 Inside South; 13 W.C.Vancouver Is.		

1 Reported landings from sales slip submissions, revised from Harbo et. al. 1986. 1989 to 1993 landings are I.Q. validated weights.

[2] Some licences were transferred to other vessels or vessels were replaced so that more than one vessel may have reported landings on the same licence. Licences (quotas) were "stacked" on vessels after 1989.

Table 5.1. Summary of annual quotas (10^{-3} lb.), 1979 to 1995 in the geoduck clam fishery.

	South Coast						North Coast								
Year	Inside Waters		West Coast V.I.		Subtotal		QCI		Prince Rupert		Central		Subtotal		Coast Total
1979	NA		NA		4,500.0	(1)	NA		NA	NA	NA	NA	3,500.0	(1)	8,000.0
1980	1,700.0	(5)	2,800.0	(3)	4,500.0	(8)	NA		NA	NA	NA	NA	3,500.0	(1)	8,000.0
1981	876.0	(7)	3,125.0	(3)	4,001.0	(10)	600.0	(3)	575.0	(3)	950.0	(5)	2,175.0	(11)	6,176.0
1982	----------Coastwide quota set----------														6,500.0
1983	1,000.0	(1)	3,500.0	(1)	4,500.0	(2)	650.0	(1)	350.0	(1)	1,000.0	(1)	2,000.0	(3)	6,500.0
1984	1,500.0	(6)	3,100.0	(6)	4,600.0	(12)	650.0	(2)	350.0	(1)	1,000.0	(1)	2,000.0	(4)	6,600.0
1985	1,650.0	(10)	2,900.0	(9)	4,550.0	(19)	650.0	(3)	500.0	(1)	850.0	(1)	2,000.0	(5)	6,550.0
1986	2,025.0	(11)	3,500.0	(11)	5,525.0	(22)	1,350.0	(5)	850.0	(3)	1,050.0	(3)	3,250.0	(11)	8,775.0
1987	1,850.0	(13)	3,950.0	(14)	5,800.0	(27)	1,235.0	(6)	800.0	(3)	1,510.0	(7)	3,545.0	(16)	9,345.0
1988	1,750.0	(11)	3,350.0	(16)	5,100.0	(27)	950.0	(5)	800.0	(1)	1,725.0	(8)	3,475.0	(16)	8,575.0
1989	1,920.0	(4)	3,360.0	(5)	5,280.0	(9)	closed		closed		3,520.0	(4)	3,520.0	(4)	8,800.0
1990	1,920.0	(5)	3,360.0	(8)	5,280.0	(13)	closed		3,520.0	(5)	closed		3,520.0	(5)	8,800.0
1991	1,620.0	(10)	2,835.0	(12)	4,455.0	(22)	2,970.0	(19)	closed		closed		2,970.0		7,425.0
1992	1,377.0	(16)	2,295.0	(21)	3,672.0	(37)	closed		closed		2,639.3	(24)	2,639.3	(24)	6,311.3
1993	1,117.0	(7)	1,852.5	(13)	3,022.5	(20)	closed		2,340.0	(27)	closed		2,340.0	(27)	5,362.5
1994	900.0	(15)	1620.0	(15)	2,520.0	(30)	2,430.0	(32)	closed		closed		2,430.0	(32)	4,950.0
1995	924.3	(16)	1,176.0	(25)	2,100.8	(41)	closed		closed		2,520.9	(38)	2,520.9	(38)	4,621.7

( ) * number of subquotas specified for areas or portions of areas.

Detailed area quotas are given in Appendix 1.

Table 5.2. Summary of annual quotas (tonnes), 1979 to 1995 in the geoduck clam fishery.

	South Coast						North Coast								
	Inside		West Coast						Prince						Coast
Year	Waters		V.I.		Subtotal		QCI		Rupert		Central		Subtotal		Total
1979	NA		NA		2,041	(1)	NA	NA	NA	NA	NA		1,587	(1)	3,628
1980	771	(5)	1,270	(3)	2,041	(8)	NA	NA	NA	NA	NA		1,587	(1)	3,628
1981	397	(7)	1,418	(3)	1,815	(10)	272	(3)	261	(3)	431	(5)	986	(11)	2,801
1982	----------				Coastwide quota set		----------								930
1983	454	(1)	1,588	(1)	2,041	(2)	295	(1)	159	(1)	454	(1)	907	(3)	2,948
1984	680	(6)	1,406	(6)	2,086	(12)	295	(2)	159	(1)	454	(1)	907	(4)	2,993
1985	748	(10)	1,315	(9)	2,063	(19)	295	(3)	227	(1)	386	(1)	907	(5)	2,970
1986	919	(11)	1,588	(11)	2,506	(22)	612	(5)	386	(3)	476	(3)	1,474	(11)	3,980
1987	839	(13)	1,792	(14)	2,630	(27)	560	(6)	363	(3)	685	(7)	1,608	(16)	4,238
1988	794	(11)	1,520	(16)	2,196	(27)	431	(5)	363	(1)	782	(8)	1,576	(16)	3,772
1989	871	(4)	1,524	(5)	2,395	(9)	closed		closed		1,597	(4)	1,597	(4)	3,992
1990	871	(5)	1,524	(8)	2,395	(13)	closed		1,597	(5)	closed		1,597	(5)	3,992
1991	735	(10)	1,286	(12)	2,021	(22)	1,347	(19)	closed		closed		1,347	(19)	3,368
1992	625	(16)	1,041	(21)	1,666	(37)	closed		closed		1,197	(24)	1,197	(24)	2,863
1993	507	(7)	840	(13)	1,371	(20)	closed		1,061	(27)	closed		1,061	(27)	2,432
1994	408	(15)	735	(15)	1,143	(30)	1,102	(32)	closed		closed		1,102	(32)	2,245
1995	419	(16)	534	(25)	953	(41)	closed		closed		1,143	(38)	1,143	(38)	2,096

( ) * number of subquotas specified for areas or portions of areas.

Detailed area quotas are given in Appendix 1.

Table 6. Conversion factors used in geoduck quota calculations in British Columbia (1995).

Number of Geoducks per m^2	Virgin Biomass[1] (t/ha)	(lb/ha)	Annual Quota at 1% Harvest Rate (t/ha)	(lb/ha)	3 Year Quota at 1% Harvest Rate (t/ha)	(lb/ha)
0.45	4.79	10,566	0.0479	106	0.14	317
0.7	7.46	16,435	0.0746	164	0.22	493
1.0	10.65	23,479	0.1065	235	0.32	704
1.4	14.91	32,871	0.1491	329	0.45	986
2.0	21.3	46,958	0.2130	470	0.64	1409
3.0	31.9	70,437	0.3195	704	0.96	2113
3.5	37.3	82,176	0.3730	822	1.12	2467

[1] assuming 1 geoduck/m^2 = 10.65 t/ha @ average weight of
1.065 kg per geoduck (Harbo, et al, 1983); 2.35 lb. per geoduck.
1 ha = 10,000 m^2
1 mt = 2204.6 lb.
1 tonne = 1000 kg /((1 geoduck/m^2) /1.065)) = 939 geoducks
1 tonne/ha = 939 geoducks/ha x 1 ha/10,000 m^2 = 0.0939 geoducks/m^2

Original densities required based on harvest =
total Landings (lb.) / (# yrs fished X (235 lb. annual quota/geoduck @ 1%) X ha of beds)

Table 7. Estimated geoduck standing stock (1992) in open areas, annual quotas, reported landings (1993), years of quota landed and quota years fished to 1993 for different regions of the British Columbia coast.

Area Description		Number of Beds	Adjusted Harvest Area (ha) to 1994[1]	Geoduck Density[2] (t/ha)	Estimated Stock (t)	Annual Quota (t)	Reported Landings 1993 (t)	Years of Quota Taken (1993)	Years Fished[3]
Inside of Vancouver Island		19	230	10.65	2,450	24			
(Areas 11 to 19, 28 and 29)		31	218	21.3	4,643	46			
		16	3,601	4.79	17,249	172			
		192	3,541	7.46	26,416	264			
		258	7,590		50,758	508	14,129	27.8	18
West Coast Vancouver Island		259	5,681	14.91	84,704	847	25,684	30.3	17
(Areas 20 to 27)									
South Coast Total									
(Areas 11 to 27, 28 and 29)		517	13,271		135,461	1,355	39,813	29.4	18
Queen Charlotte Islands	a)	148	1,204	29.6 *	35,638	356	3,845	10.8	8
(Areas 1, 2E and 2W)	b)	148	1,204	37.3	44,909	449	3,845	8.6	8
Prince Rupert District		61	992	37.3	37,002	370	3,590	9.7	9
(Areas 3, 4, 5, ptn 6)									
Central Coast District		104	1,079	37.3	40,247	402	8,530	21.2	11
(Areas 6 (ptn.)to 10)									
North Coast Total		313	3275		112,887	1,129	15,965	14.1	11
Coastwide Total		830	16,546		248,348	2,483	55,778	22.5	18

[1] includes all beds, included in the 1994 analyses except those beds in contaminated or permanent closure areas.

[2] Geoduck density: 0.45 geoduck/m^2 = 4.79 t/ha; 0.7 geoduck/m^2 = 7.46 t/ha; 1 geoduck/m^2 = 10.65 t/ha; 1.4 geoduck/m2 = 14.91 t/ha; 2/m^2= 21.3 t/ha; 3.5/m^2 = 37.3 t/ha

[3] Quota Years fished: South Coast 1972 to 1993; North Coast 1980 to 1993. (with rotations - each area fished once every 3 years, except area 24)

* QCI average geoduck density 2.78 geoducks/m^2 or 29.6t/ha calculated from 1994 quota recommended and 1243 ha of adjusted harvest area.

Table 8. For areas in the 1995 rotation of the geoduck fishery, estimated open harvest areas (1992), landings (1993) and removal of geoducks, 1976 to 1993.

1995 Area Rotation Description	Reported Harvest Area[1] 1992 (ha)	Number of Beds	Range in Bed Size (ha)	Adjusted Landings[2] to 1993 (t)	Density of Geoducks Removed (t/ha)	Density of Geoducks Removed (#/m²)[3]	Years Fished	Annual Rate of Removal[4] (t/ha)	Recommended Rate of Removal[5] (t/ha)
Inside of Vancouver Island: (Areas 11,12, 13 and 14A,B,C)	3,278	101	1 - 612	6,442	1.97	0.18	20	0.10	0.05 to 0.2
West Coast Vancouver Island (Areas 23, 24, and 27)	3,663	178	1 - 339	15,751	4.30	0.40	19	0.23	0.15
South Coast Total (Areas 11,12,13,ptn 14, 23,24,27)	6,941	279	1- 612	22,193	3.20	0.30	20	0.16	0.09
Central Coast District (Areas: ptn. 6 to 10)	1,079	104	1 - 127	7,072	6.55	0.62	17	0.39	0.37
North Coast Total (Areas: ptn. 6 to 10)	1,079	104	1 - 127	7,072	6.55	0.62	17	0.39	0.37

[1] open harvest areas include new fishing areas up to and including the 1992 fishery, include area adjustements, scaling or remeasuring of beds in the 1994 analyses while caluculating 1995 quotas. Beds in contaminated or park closures are excluded.

[2] Adjusted landings are from a combination of sales slips and harvest logs. South Coast area landings have been adjusted to account for landings reported on sales slips in past years but missing from harvest log bed annalyses.

[3] Conversion: 1 geoduck/m² = 10.65 t/ha @ average weight of 1.065 kg per geoduck (Harbo, et al, 1983)

[4] Annual Rate of Removals by the fishery: = total landings (t) / (total hectares) / (years fished)
= t/ha/yr

[5] Annual Recommended Rate of Removal = (estimated average density of geoducks) x (10.65 t/ha) x (0.01 yield)
@ 0.45 gdk/m² = 0.45 x 10.65 x 0.01 = 0.05 (inside waters, south coast)
@ 0.7 gdk/m² = 0.07 x 10.65 x 0.01 = 0.07 (inside waters, south coast)
@ 1.0 gdk/m² = 10.65 x 0.01 = 0.1 (Areas 12C to 12G)
@ 1.4 gdk/m² =1.4 x 10.65 x 0.01 = 0.15 (west coast Vancouver Is.)
@ 2.0 gdk/m² =2.0 x 10.65 x 0.01 = 0.2 (Areas 12A and 12B)
@3.5 gdk/m² = 3.5 x 10.65 x 0.01 = 0.37 (north coast)

Table 9. Preliminary estimated areas and standing stock of geoduck beds or portions of beds in areas under contaminated or permanent closures, to 1995.

Stat Area	Sub Area	Bed Code	Description	Est. Ha Closed	Est.Density (#/m²)	Standing Stock (lb)	Contaminated Closure #	Other
INSIDE WATERS								
12	16	0202	Hardy Bay	10	1	234,790	12.1	
12	16	0301	Beaver Harbour	43	1	1,009,597	12.3	
13	13	0301	Drew Harbour (seasonal)	25	0.7	410,875	13.6	
13	2	0202	Willow Pt.	57	0.7	936,795	13.8/13.9	
14	11	4601	Comox Bar (portion)	350	0.45	3,698,100	14.1a	
14	4	5301	Qualicum Beach	136	0.45	1,436,976	14.6/14.7	
15	1	0703	(0701)Westview to Grief Pt	45	0.7	739,575	15.18	
16	21	1501	Gillies Bay	12	0.7	197,220	16.3	
16	5	1802	Porpoise Bay	7	0.7	115,045	16.7	
16	11	1604	Thunder Bay	1	0.7	16,435	16.21	
17	7	7102	Boulder Point	2	0.7	32,870	17.1	
17	16	6201	E. Mudge Island	82	0.45	866,412		Research Closure
19	8	0201	Towner/Patricia Bay	88	0.45	929,808	19.5/19.13	
19	8	0202	Coles Bay	13	0.7	213,655	19.8	
			Total Inside Waters:	871		10,838,153		
WEST COAST								
23	8	1201	S. Brabant-N. Peacock Ch.	3	1.4	98,613		Broken Group[1]
23	8	1701	NE Clarke Is.	6	1.4	197,226		Broken Group[1]
23	8	1702	E. Turret Is.	4	1.4	131,484		Broken Group[1]
23	5	2102	Marble Cove	6	1.4	197,226		Bamfield Marine Closure
23	4	2301	S. Flemming	9	1.4	295,839		Bamfield Marine Closure
23	5	2302	NW Flemming	7	1.4	230,097		Bamfield Marine Closure
23	5	2303	NW Flemming	13	1.4	427,323		Bamfield Marine Closure
24	6	0605	Whitesand Cove	42	1.4	UNKN		Marine Park
24	6	1202	S. Robert Point	7	1.4	230,097		Research Closure
24	6	1203	Dunlap Is.	5	1.4	164,355		Research Closure
24	6	0806	Ahous Bay	13	1.4	427,323		Whale Sanctuary
26	7	0504	SW of Theodore Pt.	1	1.4	32,871		Sea Otter Reserve
26	7	0502	Battle Bay - NW Bunsby Is.	7	1.4	230,097		Sea Otter Reserve
26	7	0505	N.Acous Pen.- Cuttle Is.	2	1.4	65,742		Sea Otter Reserve
26	7	0501	N. Checkaklis Is. - Bunsbys	30	1.4	986,130		Sea Otter Reserve
26	10	0503	West of Battle Bay	4	1.4	131,484		Sea Otter Reserve
			Total W.C.V.I.:	159		3,845,907 [1]		
NORTH COAST								
7	25	0704	West Hunter Island	2	3.5	164,352	7.8	
			Total North Coast.:	2		164,352 [1]		
TOTAL CLOSED AREA:				1032		14,848,412		

[1] There are additional areas in the Broken Group Islands, Pacific Rim Park Reserve, Area 23

[2] There are additional geoduck beds in area 26 but these may be harvested by sea otters.

Table 10. Estimated open harvest areas (1992), landings (1993) and removal of geoducks by the fishery, 1976 to 1993.

Area Description	Reported Harvest Area (ha)	Number of Beds	Range in Bed Size (ha)	Landings to 1993[2] (t)	Density of Geoducks Removed (t/ha)	(#/m²)[1]	Years Fished	Annual Rate of Removal[3] (t/ha)
Inside of Vancouver Island (Areas 11 to 19, 28 and 29)	7,590 57%	258	1 - 612	14,129	1.86	0.17	18	0.10
West Coast Vancouver Island (Areas 20 to 27)	5,681 43%	259	1 - 339	25,684	4.52	0.42	16	0.28
South Coast Total (Areas 11 to 27, 28 and 29)	13,272	517	1 - 631	39,813	3.00	0.28	17	0.18
Queen Charlotte Islands (Areas 1, 2E and 2W)	1,204 37%	148	1 - 41	3,845	3.19	0.30	8	0.40
Prince Rupert District (Areas 3, 4, 5, upper ptn. 6)	992 30%	61	1 - 181	3,590	3.62	0.34	12	0.30
Central Coast District (Areas 6 to 10)	1,079 33%	104	1 - 127	8,530	7.91	0.74	14	0.56
North Coast Total (Areas 1 to 10)	3,275	313	1 - 181	15,965	4.87	0.46	14	0.35

[1] Conversion: 1 geoduck/m² = 10.65 t/ha @ average weight of 1.065 kg per geoduck (Harbo, et al, 1983)

[2] landings from sales slips and validation logs

[3] Annual Rate of Removal = total landings (t) / (total hectares) / (years fished)
= t/ha/yr

Table 11. South coast geoduck management areas for the 1995 geoduck fishery, showing beds, estimated bed areas , densities, landings, removals, annual quotas, years of quota landed and original densities required.

Area	Subareas	No. of Beds	Area (ha)	Est.Original Density (#/m²)	Adjusted[1] Landings (lb.)	Removals[2] (#/m²)	Calculated[3] Quota @ Density	Annual Calculated Quota (lb.)	Calculated Yrs of Quota Taken[4]	# Years Fished to 1995	Original Density Required[5] (#/m²)
INSIDE WATERS:											
11: Seymour Inlet[6]	11-2	10	39	1.00	240,301	0.26	9,165	9,165	27	7	3.75
12A: Islands	12-11,-12,-13	18	102	2.00	1,302,012	0.54	47,940	47,940	27	11	4.94
12B: Goletas Ch.	ptns 12-15, -16	13	116	2.00	2,868,385	1.05	54,520	54,520	53	11	9.57
12C: False Head	12-17, ptn 12-16	8	38	1.00	320,674	0.36	8,930	8,930	36	16	2.24
12D: Malcolm /Black Bluff	ptn. 12-8	7	158	1.00	675,971	0.18	37,130	37,130	18	10	1.82
12E: Malcolm/Trinity Bay	ptn 12-6, ptn 12-8	1	26	1.00	421,725	0.69	6,110	6,110	69	10	6.90
12F: Malcolm Is East - South	12-5,-18, ptn -1	2	6	1.00	39,848	0.28	1,410	1,410	28	10	2.83
12G: Mainland Inlets	12-1 to -3, -20 to -48	1	2	1.00	10,654	0.23	470	470	23	11	2.06
Total Area 12:		50	448	1.0 to 2.0	5,639,269			156,510			
AREA 13:											
13A: S.E.Quadra Is.	13-12 to -14 incl	7	80	0.70	141,775	0.08	13,160	13,160	11	11	0.69
13B: Marina Island	ptn 13-15	1	74.3	0.70			12,222				
		1	205	0.45			21,679				
	sub-total:		279.3	0.45 to 0.7	1,855,801	0.28	33,901	33,901	55	17	1.77
13C: S.W.Cortes Is	ptns 13-14, -15 and -1	5	160	0.70	563,348	0.15	26,320	26,320	21	16	0.94
13D: N.W.Cortes Is.	13-16, 13-17	9	52	0.70	115,155	0.09	8,554	8,554	13	16	0.59
13E: Misc Other Areas	ptns of 13-1,-2,-4	3	7	0.70	17,199	0.10	1,152	1,152	15	16	0.65
Total Area 13:		26	578.3	0.45 to 0.7	2,693,278			83,087			
AREA 14:											
14A: Shelter Pt to Cape Lazo	14-13	2	30	0.70			4,935				
		4	1121	0.45			118,546				
	sub-total:	6	1151	0.45 to 0.7	2,172,000	0.08	123,481	123,481	18	13	0.62
14B: Comox Bar/Denman	ptns 14-7,-9, -10	1	25	0.70			4,113				
		2	868	0.45			91,791				
	sub-total:	3	893	0.45 to 0.7	2,894,063	0.14	95,904	95,904	30	17	0.81
14C: Baynes Snd.	pnt. 14-11,-8,-15	5	89	0.70			14,641				
		1	80	0.45			8,460				
	sub-total:	6	169	0.45 to 0.7	527,066	0.13	23,101	23,101	23	16	0.83
Total Area 14A,B,C:		15	2213		5593129			242484.75	23	17	0.63
Inside Waters Totals:		101	3278		14165977			491246.35	29	17	1.08

Table 11. continued

Area	Subareas	No. of Beds	Area (ha)	Est.Original Density (#/m²)	Adjusted[1] Landings (lb.)	Removals[2] (#/m²)	Calculated[3] Quota (lb.) @Density	Annual Calculated[3] Quota (lb.)	Calculated Years of Quota Taken[4]	# Years Fished to 1995	Original Density Required[5] (#/m²)
WEST COAST V.I.											
AREA 23:											
23A: Maggie River	ptns 23-9,-10,-11	6	157	1.4	1,944,032	0.53	51,653	51,653	38	16	3.29
23B: Toquart bay	ptn. 23-10	7	39	1.4	425,604	0.46	12,831	12,831	33	16	2.90
23C: Mayne Bay	ptns 23-9, -10	9	124	1.4	1,253,016	0.43	40,796	40,796	31	16	2.69
23D: Pinkerton Is.	ptns 23-6, -8	22	182	1.4	1,369,925	0.32	59,878	59,878	23	9	3.56
23E: Chain Group	23-4,-5, ptn -7	14	90	1.4	1,186,429	0.56	29,610	29,610	40	9	6.23
Total Area 23:		58	592		6179006			194,768	32	16	2.78
AREA 24:											
24A2: Yarksis/Wickaninish	n. ptn 24-8	4	233	1.4	1,604,462	0.29	76,657	76,657	21	16	1.83
24A3: Tonquin-Echachis	s. ptn 24-8	1	110	1.4	351,353	0.14	36,190	36,190	10	13	1.05
24A4: Epper-Dunlap	ptns 24-6,-7	9	122	1.4	1,265,601	0.44	40,138	40,138	32	17	2.60
24A5: Lemmens Inlet	24-9	3	101	1.4	717,425	0.30	33,229	33,229	22	16	1.89
24A6: Elbow-Yellow Bank	ptns 24-6,-7	7	182	1.4	4,290,288	1.00	59,878	59,878	72	17	5.90
24B1: Outside	ptn 24-6	13	564	1.4	7,343,605	0.55	185,556	185,556	40	16	3.46
24B2: Coomes Bank	ptn 24-6	1	339	1.4	2,188,117	0.27	111,531	111,531	20	16	1.72
24B3: Ahousat	ptns of 24-4, -6	3	237	1.4	2,026,478	0.36	77,973	77,973	26	16	2.27
24B4: Russell Channel	ptn 24-6	1	184	1.4	1,306,556	0.30	60,536	60,536	22	13	2.32
24C: Exposed/Sidney Inlet	24-1,-2,ptns -6 and -8	14	123	1.4	785,853	0.27	40,467	40,467	19	10	2.72
24D: Inlets[6]	24-3,-5,-10,-12,-13,-14	22	97	1.4	630,141	0.28	31,913	31,913	20	9	3.07
Total Area 24:		78	2,292		22,509,879			754,068	30	17	2.46
AREA 27:											
27A: Quatsino Sd.	ptn 27-7, 3 beds	7	112	1.4	624,379	0.24	36,848	36,848	17	10	2.37
27B: Cliffe to Lawn Pt.	ptn 27-2	3	40	1.4	153,639	0.16	13,160	13,160	12	10	1.63
27C: Forward Inlet	27-3	3	126	1.4	1,617,073	0.55	41,454	41,454	39	10	5.46
27D: Kains Island	ptn 27-1	2	46	1.4	218,882	0.20	15,134	15,134	14	10	2.02
27E: San Josef Bay	ptn 27-1	1	110	1.4	349,308	0.14	36,190	36,190	10	7	1.93
27F: Sea Otter Cove	ptn 27-1	2	15	1.4	269,926	0.77	4,935	4,935	55	7	10.94
27G: Outer Exploratory /Scott Is	ptns 27-1,-2; 111	0	0	-	-	-	-	-	0	-	-
27H: Klaskino Inlet	27-5	9	223	1.4	1,770,014	0.34	73,367	73,367	24	10	3.38
27I: Klaskish Inlet	27-6	15	107	1.4	1,543,536	0.61	35,203	35,203	44	10	6.14
Total Area 27:		42	779		6546757		256291	256291	26	10	3.58
W.C.V.I. Totals:		178	3663		35235642			1205127	29	17	2.41

[1] Adjusted landings are from a combination of sales slips and harvest logs. South Coast area landings have been adjusted to account for landings reported on sales slips in past years but missing from harvest log bed analyses.

[2] Removals (#/m²) = (total landings (t) x 939 geoducks/t) / (total ha x 10,000 m²/ha)

[3] Annual calculated quota @ 1% or original biomass = (area X density X 10,000m2 X 10.65t X 2.35 lb/gdk).

[4] Calculated Years of Quota Taken = total landings (lb.) / annual quota option

[5] Original Densities required based on harvest = total landings (lb.) / (# yrs fished) x (235 lb. annual quota/geoduck/m2 @ 1%)x (ha of beds)

[6] fishers advised poor stocks in these areas and recommended reduced fishing or closure for several rotations.

Table 12. Summary of geoduck quotas for the 1995 fishery, compared to quotas from the last area rotation (1992,1994).

Pacific Fishery Management Areas	1992 Quota	1995 Beds	1995 Ha	@Density # gdk/m²	1995 Calculated Quota (lb)[1]	1995 I.V.Q's (84,030 lb)	1995 I.V.Q's Rounded	Quota Adjustment to Round I.V.Q's	1995 Quota[2] Set
Inside Waters									
Area 12	565,000	50	448	1.4,2.0	180,887				180,887
Area 13	180,000	26	578	0.7, 0.45	118,444				118,444
Area 14	632,000	15	2,213	0.7, 0.45	640,929				624,999
Total:	1,377,000	91	3,239		940,260	11.2	11	-15,930 less	924,330 lb
									419 t
West Coast V.I.									
Area 23	565,000	58	592	1.4	284,472				284,471
Area 24 (1994)	511,000	43	2072	1.4	414,251				414,251
Area 27	676,378	43	779	1.4	463,360				477,697
Total:	1,752,378	144	3,443		1,162,083	13.8	14	14,336 plus	1,176,419 lb
									534 t
North Coast									
Central Coast: lower Area 6 to Area 10:									
Area A	924,000	36	408	3.5	1,006,128				1,006,128
Area B	380,000	17	151	3.5	375,104				376,692
Area C	514,000	28	208	3.5	512,928				512,928
Area D	821,250	23	312	3.5	625,152				625,152
Total:	2,639,250	104	1,079		2,519,312	29.98	30	1,588 plus	2,520,900 lb
									1,143 t
Coastwide Totals:	5,768,628	339	7,761		4,621,655	55.0	55.0		4,621,649 lb
									2,096 t

Total quota /55 licences: 84,030 lb. I.V.Q. (38.1 t)

An IVQ quota of 84,030 lb is a 6.9 % reduction from the 1994 I.V.Q of 90,000 lb.

[1] initial quotas are derived from a combination of calculations based on harvest log bed areas, and advice from fishers about bed closures and exploratory fishing areas

[2] quotas are adjusted to provide whole numbers of area licences.

Table 13. Geoduck Management Area closures and areas of concern in the 1995 fishery.

Geoduck Management Area	Sub-areas	Number of Beds Reported	Est. Ha Harvested	% Stock Harvested to 1994	Action 1995	Comments
11	all subareas	10	39		closed	37 years of quota landed, fishers recommend closure for another rotation. Last fihed in 1989.
12B: Goletas Channel	ptns 12-15,-16	13	116	53	closed	>50% of est. stock harvested last fished in 1989
12E: Malcolm Island /Trinity Bay	ptn 12-6	1	26	69	closed	>50% of est. stock harvested according to harvest log data annalyses. Last fished in 1992.
12G: Mainland Inlets	12-1 to -3,-20 to -48	1	2	23	exploratory quota set	calculated quota is 1120 lb. Fishers requested an additional exploratory quota - set at 30,000 lb.
13B: Marina Island	ptn 13-15	2	279	55	closed	>50% of est. stock harvested last fished in 1989
23D: Pinkerton Islands	ptns 23-6,-8	22	182	23	quota reduced	52% of reported landings are from the Alma Russel Islands - effort must be dispersed to other beds
24A6: Elbow/Yellow Banks	ptns 24-6, -7	7	182	72	closed	>50% of est. stock harvested according to harvest log data annalyses. Last fished in 1993.
24D: Inlets	24-3,-5,-10,-12,-13,-14	22	96		closed	small beds, overharvest concerns - last fished in 1990.
27F: Sea Otter Cove	ptn 27-1	1	14	55	closed	>50% of est. stock harvested according to harvest log data annalyses. Last fished in 1992.
27I: Klaskish Inlet	27-6	15	107	44	quota reduced	very high removal rates Reduced quota until beds are re-evaluated

Table 14. Areas closed due to conservation concerns in the geoduck fishery, 1992 to 1994

Geoduck Management Area	Subareas	Action	Year	Comments
INSIDE WATERS				
11	11-2	closed	1992	very small fishing area identified, poor quality
12A: North Islands	12-11,-12,-13	reduced	1992	concern over high harvest levels - further evaluation required
12B: Goletas Ch.	ptns 12-15, -16	closed	1992	concern over high harvest levels - further evaluation required
12G: Mainland Inlets	12-1 to -3, -20 to -48	closed	1992	very small fishing area identified
13B: Marina Island	ptn 13-15	closed	1992	overharvesting concerns
14B: Comox Bar/Denman	ptns 14-7, -10	open	1992	concern over high densities required to support level of fishing to date
15D: bed E. shore Harwood Is	ptn .15-3	closed	1994	heavily exploited bed on east shore of Harwood Island closed
16A: West Texada	16-21, -22	open	1993	evaluation of bed at Crescent Bay recommended - heavily exploited
16B: Lasqueti Island	16-19,-20, ptn 14-3	reduced	1993	suspect bed areas reported are too large
16C: East Texada Is, Northeast Pt. to Pt Upward	16-18	open	1993	evaluation and closure of bed 2101 recommended due to heavy exploitation
16D: Entrance to Jervis In.	16-1,-2,-11, ptn -17	reduced	1993	bed areas suspected as too large and were scaled down
17A: bed at Icarus Point	17-18	closed	1993	heavily exploited bed at Icarus Point closed to disperse effort to other beds.
17B: bed east Kuper/Thetis Is.	ptn 17-8,-2,-6	closed	1993	large heavily exploited bed closed to disperse effort to other beds in 17B.

Table 14. con't

Geoduck Management Area	Subareas	Action	Year	Comments
WEST COAST V.I.:				
23B: West of Stopper Is.	ptn. 23-10	ptn. closed	1992	reduced quota - large bed closed west of Stopper Island
23C: Mayne-Stopper -Bryant-Curwen [2]	ptns 23-9, -10	reduced	1992	fallback for exploratory area, Mayne Bay has a very heavy harvest history
23D: Alma Russel Is	ptn. 23-6	ptn. closed	1992	Alma Russel Islands closed due to overharvesting concerns
23E: Chain Group	23-4,-5, ptn -7	closed	1992	24 years of quota landed to 1992
24A2: Yarksis/Wickaninish	ptn 24-8	open	1992	closure was recommended
24A6: Yellow/Elbow Banks	ptn 24-6	closed	1993	heavily exploited - 41 to 58 years of quota landed
24B3: Ahousat [2]	ptns of 24-4, -6	rotational	1992	rotational rather than annual quota set due to heavy exploitation in the past
24B4: Russell Channel	ptn 24-6	rotational	1992	rotational rather than annual quota set due to heavy exploitation in the past
24C: Exposed/ Sydney Inlet	24-1,-2, ptns -6 and -8	closed	1992-1994	small fishing areas - closed since 1990
24D: Inlets	24-3,-5,-10, -12,-13,-14	closed	1992-1994	closed due to over harvesting concerns - small fishing areas
25C:Rosa Harbour	ptn. 25-13	closed	1994	heavily exploited - 22 to 31 years of quota taken to 1994.
26A: Inlets	ptns 26-7,-8,-10	open	1993	quota set larger than calculated for packer economics - re-evaluate beds
26B1: Mission Group	ptns of 26-1 and -6	closed	1993	heavily exploited - 47 years of quota taken to 1993.
26C: Central Kyuquot Inlets	ptn 26-2, -5, -6	closed	1993	heavily exploited - 27 years of quota taken to 1993.
27A: Quatsino Sd.	ptn 27-7, 3 beds	ptn. closed	1992	north shore closed due to heavy exploitation in past years
27C: Forward In.- Winter Hbr.	27-3	closed	1992	22 years of quota taken, concerns of overharvest, assessment recommended
27F: Sea Otter Cove	ptn 27-1	open	1992	closure was recommended due to overharvesting - 23 years of quota taken
27I: Klaskish In.	27-6	open	1992	closure was recommended due to overharvesting - 22 years of quota taken

Table 15. Geoduck management areas with calculated and set quotas for South Coast inside waters areas for the 1995 fishery.

Geoduck Management Area	Subareas	Last Year Fished	Former Quota (lb)	No. of Beds 1995	Area (ha) 1995	3 Year Calculated Quota (lb)	3 Year Set Quota (lb)
INSIDE WATERS:							
11: Seymour Inlet	11-2,11-3	1989	11,067	10	39	0	
Total Area 11:			11,067	10	39	0	0
12A: Islands	12-11,-12,-13	1992	100,000	18	102	84,065	80,121
12B: Goletas Ch.	ptns 12-15, -16	1989	incl.	13	116	0	
12C: False Head	12-17, ptn 12-16	1992	130,000	8	38	9,952	9,952
12D: Malcolm /Black Bluff	ptn. 12-8	1992	125,000	7	158	88,415 *	57,539
12E: Malcolm/Trinity Bay	ptn 12-6, ptn 12-8	1992	201,000	1	26	0	0
12F: Malcolm Is East - South	12-5,-18, ptn -1	1992	9,000	2	6	3,275	3,275
12G: Mainland Inlets	12-1 to -3, -20 to -48	1989	138,993	1	2	1,120 *	30,000
Total Area 12:			**703,993**	**50**	**448**	**186,827**	**180,887**
13A: S.E.Quadra Is.	13-12 to -14 incl	1992	40,000	7	80	44,196	44,089
13B: Marina Island	ptn 13-15	1989	incl.	2	279	0	0
13C: S.W.Cortes Is	ptns 13-14, -15 and -1	1992	112,000	5	160	34,716	43,357
13D: N.W.Cortes Is.	13-16, 13-17	1992	20,000	9	52	27,453	27,453
13E: Misc Other Areas	ptns of 13-1,-2,-4	1989	0	3	7	3,558	3,545
Total Area 13:			**172,000**	**26**	**578**	**109,923**	**118,444**
14A: Shelter Pt to Cape Lazo	14-13	1992	412,000	6	1,151	356,435	356,435
14B: Comox Bar/Denman	ptns 14-7, -9,-10	1992	200,000	3	893	189,702	189,702
14C: Baynes Snd.	pnt. 14-11,-8,-15	1992	28,000	6	169	78,862 [1]	78,862
Total Area 14:			**640,000**	**15**	**2,213**	**624,999**	**624,999**
Inside Waters Totals:			1,527,060	101	3,278	921,749	924,330

[1] 15, 530 lb. removed from area 14C to balance 11 I.V.Q's in Inside Waters

Notes : Harvesters requested an exploratory quota of 30,000 lb be assigned to area 12G in the mainland inlets. As a result, the Area 12D quota is reduced by 28,876 lb.

Area 14C: Baynes Sound - Beds suspected of coming under contaminated closure since the last fishery have been removed from 1995 calculations. A review of contaminated areas is required.

Table 16 . Geoduck management areas, calculated and set quotas for South Coast waters on the west coast of Vancouver Island for the 1995 fishery.

Geoduck Management Area	Subareas	Last Year Fished	Former Quota (lb)	No. of Beds 1995	Area (ha) 1995	1995 Calculated Quota (lb)	1995 Set Quota (lb)
WEST COAST V.I.							
23A: Maggie River	ptns 23-9,-10,-11	1992	240,000	6	157	56,148	56,148
23B: Toquart Bay	ptn. 23-10	1992	15,000	7	39	19,004	19,004
23C: Mayne Bay	ptns 23-9, -10	1992	165,000	9	124	69,263	69,263
23D: Pinkerton Is.	ptns 23-6, -8	1992	145,000	22	182	118,634	118,634
23E: Chain Group	23-4,-5, ptn -7	1989	closed (92)	14	90	21,422	21,422
Total Area 23:			**565,000**	**58**	**592**	**284,471**	**284,471**
24A2: Yarksis/Wickaninish	n. ptn 24-8	1994	77,000	4	233	65,442	65,442
24A3: Tonquin-Echachis	s. ptn 24-8	1994	36,000	1	110	39,366	9366
24A4: Epper-Dunlap	ptns 24-6,-7	1994	40,000	9	122	22,410	22,410
24A5: Lemmens Inlet	24-9	1994	33,000	3	101	27,722	27,722
24A6: Elbow-Yellow Bank	ptns 24-6,-7	1993	closed (94)	7	182	0	0
24B1: Outside	ptn 24-6	1994	125,000	13	564	56,648	58,412
24B2: Coomes Bank	ptn 24-6	1994	100,000	1	339	99,515	99,515
24B3: Ahousat	ptns of 24-4, -6	1994	50,000	3	237	54,963	54,963
24B4: Russell Channel	ptn 24-6	1994	50,000	1	184	46,421	46,421
24C: Exposed/Sidney Inlet	(24-1),-2,ptns -6 and -8	1990	closed (94)	14	123	30,893	30,000
24D: Inlets	24-3,-5,-10,-12,-13,-14	1990	closed (94)	22	97	0	0
Total Area 24:			**511,000**	**78**	**2292**	**443,380**	**414,251**
27A: Quatsino Sd.	ptn 27-7	1992	100,000	7	112	91,230	91,230
27B: Cliffe to Lawn Pt.	ptn 27-2	1992	50,000	3	40	37,784	37,784
27C: Forward Inlet	27-3	1989	closed (92)	3	126	34,035	34,035
27D: Kains Island	ptn 27-1	1992	70,000	2	46	40,286	40,286
27E: San Josef Bay	ptn 27-1	1992	175,000	1	110	101,763	101,763
27F: Sea Otter Cove	ptn 27-1	1992	50,000	2	15	0	0
27G: Outer Expl. /Scott Is.	111, ptns 27-1,-2	-	new in '95	0	0	14,337[1]	14,337
27H: Klaskino Inlet	27-5	1992	66,378	9	223	142,133	142,133
27I: Klaskish Inlet	27-6	1992	165,000	15	107	16,130	16,130
Total Area 27:			**676,378**	**42**	**779**	**463,361**	**477,698**
W.C.V.I. Totals:			**1,752,378**	**178**	**3,663**	**1,191,212**	**1,176,420**

[1] 14337 lb added to Area 27G to balance 14 I.V.Q.'s and provide exploratory fishing opportunity on the west coast.

Notes: Area 23D - Closure of beds at Alma Russell Islands recommended. Contaminated areas to be reviewed in areas with float homes.

Area 27A - Quatsino Sound - contaminated areas need to be identified.

Table 17 . Geoduck management areas and recommended quotas for the North Coast of British Columbia (Central Coast District) in 1995.

Geoduck Mgmt Area	Mgmt Area Description	Fisheries Statistical Area	# Beds 1995	#Ha 1995	3 Year Quota (lb) @3.5 gdk/m2; 1% harvest rate	Exploratory Quota (lb)	3 Year Rotational Quota (lb)	Total Quota (lb)	Total Beds	Total Ha
A1	McMullin Gp	ptn 7-18	3	49	120,834		120,834			
A2	Tribal Gp	ptn 7-18	2	9	22,194		22,194			
A3	Admiral Gp	ptn 7-18	2	11	27,126		27,126			
A4	Prince Gp	ptn 7-25	1	4	9,864		9,864			
A5	McNaughton Gp	ptns 7-17, -25	7	68	167,688		167,688			
A6	Simonds Gp	ptn 7-25	1	43	106,038		106,038			
A7	Goose Isl north	ptn 7-25	2	6	14,796		14,796			
A8	Goose Isl south	ptn 7-25	2	16	39,456		39,456			
A9	Spider Isl	ptn 7-27	3	15	36,990		36,990			
A10	Spider Anch	ptn 7-27	12	183	451,278		451,278			
A11	Kittyhawk Gp	ptn 7-27,7-28	1	4	9,864		9,864	1,006,128	36	408
B1	Mathieson/Moss	ptns 7-3,-9	5	8	19,728		19,728			
B2	Ivory Isl	7-8, ptn 7-9	2	28	69,048		69,048			
B3	Seaforth Ch	7-12, -22	3	18	44,388		44,388			
B4	St John Hbr	ptn 7-32	1	5	12,330		12,330			
B5	Cp Mark	ptn 7-32	1	64	157,824		157,824			
B6	Princess Alice Isl	ptn 7-1, 7-20	1	3	7,398	14,190	21,588			
B7	Thompson B	7-9,7-21	2	21	51,786		51,786			
B8	Joassa/Raymond	ptns. Area 7	2	4	9,864		0	376,692	17	151
C1	Sterling Isl west	ptn 8-2,8-4	2	37	91,242		91,242			
C2	Nalua Isl	7-26, ptn 7-27	8	49	120,834		120,834			
C3	Choked P	ptn 8-2	2	40	98,640		98,640			
C4	Hakai Pass	ptn 8-2, 8-3	4	20	49,320		49,320			
C5	Fitzhugh Snd	8-16, 9-12	1	2	4,932		4,932			
C6	Rivers In	ptn 9-1, 9-2, -11	3	20	49,320		49,320			
C7	Calvert Isl north	ptn 9-1	1	1	2,466		2,466			
C8	Calvert Isl south	ptn 9-1, 10-1,-2	2	16	39,456		39,456			
C9	Smith In north	ptns 10-3, -4	2	19	46,854		46,854			
C10	Smith In south	ptns 10-3, -4	3	4	9,864		9,864	512,928	28	208
D1	Laredo Ch	6-11, -14, -15	5	73	180,018		180,018			
D2	Laredo In	ptn 6-16, 6-19	6	23	56,718		56,718			
D3	Kitasu B	6-18	1	8	19,728	30,272	50,000			
D4	West Higgins Pass	ptns 6-16, -17	3	122	300,852		151,000			
D5	E Aristazabal Isl N	ptn 6	1	10	24,660		0			
D6	E Aristazabal Isl S	ptn 6-16	1	11	27,126		27,126			
D7	W Price Isl north	ptn 6-17	1	6	14,796		14,796			
D8	W Price Isl south	ptns 7-1, -2, 7-31	2	26	64,116		64,116			
D9	Milbank Snd	ptn 7-3	3	33	81,378		81,378	625,152	23	312
Total			104	1079	2,660,814	44,462	2,520,900	2,520,900	104	1079

APPENDIX 1. ANNUAL HARVEST AREAS BY DISTRICT AND MANAGEMENT AREA

Table 1.1. North Coast (Queen Charlotte Islands District) cumulative harvested area, cumulative number of beds fished, and new beds fished per year for geoducks, 1980 to 1992.

	Pacific Fishery Management Area									Annual Summary		
	1			2E			2W					
Year	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds
1980				62	3	(3)				62	3	(3)
1981				62	3	(0)				62	3	(0)
1982				62	3	(0)				62	3	(0)
1983				62	3	(0)				62	3	(0)
1984				81	4	(1)				81	4	(1)
1985				536	21	(17)	91	6	(6)	627	27	(23)
1986				640	28	(7)	170	14	(8)	810	42	(15)
1987	47	2	(2)	729	37	(9)	188	14	(0)	964	53	(11)
1988	102	2	(0)	952	61	(21)	346	25	(11)	1400	88	(35)
1989[1]	79	2	(0)	645	61	(0)	346	25	(0)	1070	88	(0)
1990	79	2	(0)	645	61	(0)	346	25	(0)	1070	88	(0)
1991	117	6	(4)	805	95	(34)	282	47	(22)	1204	148	(60)
1992	117	6	(0)	805	95	(0)	282	47	(0)	1204	148	(0)

[1] since the start of the I.V.Q. program in 1989, harvested area (beds) have been assessed prior to setting rotational area quotas. Beds have been adjusted in size through consultation with fishers or scaled with landing criteria. Beds in park or contaminated closures have been removed from the calculations and large beds subdivided and remeasured.

Appendix 1 (continued)

Table 1.2. North coast (Prince Rupert District) cumulative harvested area, cumulative number of beds fished, and new beds fished per year for geoducks, 1980 to 1992.

	Pacific Fishery Management Area									Annual		
	3			4			5			Summary[1]		
Year	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds
1980				140	1	(1)				140	1	(1)
1981				140	1	(0)	81	3	(3)	221	4	(3)
1982				140	1	(0)	81	3	(0)	221	4	(0)
1983				140	1	(0)	81	3	(0)	221	4	(0)
1984				140	1	(0)	387	6	(3)	527	7	(3)
1985				194	1	(0)	414	6	(0)	608	7	(0)
1986	58	6	(6)	266	6	(5)	431	6	(0)	755	18	(11)
1987	59	7	(1)	290	8	(2)	430	6	(0)	779	21	(3)
1988	67	8	(1)	314	12	(4)	480	8	(2)	861	28	(7)
1989	67	8	(0)	314	12	(0)	480	8	(0)	861	28	(0)
1990[2]	67	8	(0)	142	18	(6)	408	11	(3)	617	37	(9)
1991	67	8	(0)	142	18	(0)	408	11	(0)	617	37	(0)
1992	67	8	(0)	142	18	(0)	408	11	(0)	617	37	(0)

[1] Note that the Geoduck Management Area called Prince Rupert District includes the upper portion of Area 6 which adds 24 beds and 375 hectares to this summary up to and including 1992 data.

[2] since the start of the I.V.Q. program in 1989, harvested area (beds) have been assessed prior to setting rotational area quotas. Beds have been adjusted in size through consultation with fishers or scaled with landing criteria. Beds in park or contaminated closures have been removed from the calculations and large beds subdivided and remeasured.

Appendix 1 (continued)

Table 1.3. North Coast (Central Coast District) cumulative harvested area, cumulative number of beds fished, and number of new beds fished per year for geoducks, 1980 to 1992.

	Pacific Fishery Management Area															Annual Summary		
	6[1]			7			8			9			10					
Year	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds
1980										34	1	(1)				34	1	(1)
1981				146	9	(9)	3	1	(1)	34	1	(0)				183	11	(10)
1982				284	13	(4)	5	2	(1)	34	1	(0)				323	16	(5)
1983	29	2	(2)	297	17	(4)	5	2	(0)	34	1	(0)				365	22	(6)
1984	29	2	(0)	297	17	(0)	5	2	(0)	34	1	(0)				365	22	(0)
1985	72	3	(1)	429	20	(3)	62	2	(0)	34	1	(0)				597	26	(4)
1986	110	5	(2)	527	24	(4)	73	4	(2)	37	2	(1)	27	3	(3)	774	38	(12)
1987	328	19	(14)	571	26	(2)	73	4	(0)	39	3	(1)	92	6	(3)	1103	58	(20)
1988	354	26	(7)	584	28	(2)	136	13	(9)	39	3	(0)	92	6	(0)	1205	76	(18)
1989	412	28	(2)	855	46	(18)	137	14	(1)	39	3	(0)	99	6	(0)	1542	97	(21)
1990[2]	592	39	(11)	584	45	(0)	109	14	(0)	16	3	(0)	33	5	(0)	1334	106	(11)
1991	592	39	(0)	584	45	(0)	109	14	(0)	16	3	(0)	33	5	(0)	1334	106	(11)
1992	628	42	(4)	655	60	(15)	109	14	(0)	25	6	(3)	37	6	(1)	1454	128	(21)

[1] Note that the Geoduck Management Area called Central Coast does not include the upper portion of Area 6 (24 beds, 375 ha are actually included in Prince Rupert District up to and including 1992 data).

[2] since the start of the I.V.Q. program in 1989, harvested area (beds) have been assessed prior to setting rotational area quotas. Beds have been adjusted in size through consultation with fishers or scaled with landing criteria. Beds in park or contaminated closures have been removed from the calculations and large beds subdivided and remeasured.

Appendix 1 (continued)

Table 1.4. Mainland and east coast Vancouver Island (Campbell River District) cumulative harvested area, cumulative number of beds fished (excluding park and contaminated closures), and number of new beds fished per year for geoducks, 1978 to 1992.

	Pacific Fishery Management Area									Annual Summary		
	11			12			13					
Year	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds
1978							254	2	(2)	254	2	(2)
1979				44	2	(2)	488	10	(8)	532	12	(10)
1980				44	2	(0)	540	15	(5)	584	17	(5)
1981				44	2	(0)	540	15	(0)	584	17	(0)
1982				44	2	(0)	540	15	(0)	584	17	(0)
1983				44	2	(0)	540	15	(0)	584	17	(0)
1984	*			120	12	(10)	600	18	(3)	720	30	(13)
1985	*			745	21	(9)	730	18	(0)	1475	39	(9)
1986	*			806	24	(3)	744	23	(5)	1550	47	(8)
1987				872	30	(6)	744	23	(0)	1616	53	(6)
1988	34	10	(10)	889	33	(3)	787	27	(4)	1710	70	(17)
1989	39	10	(0)	1000	44	(11)	860	27	(0)	1899	81	(11)
1990[1]	39	10	(0)	893	44	(0)	581	27	(0)	1513	81	(0)
1991	39	10	(0)	893	44	(0)	581	27	(0)	1513	81	(0)
1992	39	10	(0)	448	50	(0)	578	26	(0)	1065	86	(0)

* landings reported on sales slips for area 11 but not on harvest logs.

[1] since the start of the I.V.Q. program in 1989, harvested area (beds) have been assessed prior to setting rotational area quotas. Beds have been adjusted in size through consultation with fishers or scaled with landing criteria. Beds in park or contaminated closures have been removed from the calculations and large beds subdivided and remeasured.

Appendix 1 (continued)

Table 1.5. Mainland and east coast Vancouver Island (Nanaimo & Victoria Districts) cumulative harvested area, cumulative number of beds fished (excluding park and contaminated closures), and number of new beds fished per year for geoducks, 1978 to 1992.

	Pacific Fishery Management Area																		Annual Summary		
	14			15			16			17			18			19					
Year	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds
1978	2097	7	(7)	586	7	(7)	200	5	(5)	263	5	(5)				595	3	(3)	3741	27	(27)
1979	2810	13	(6)	711	9	(2)	615	14	(9)	418	10	(5)				619	4	(1)	5173	50	(23)
1980	2976	16	(3)	711	9	(0)	758	19	(5)	614	19	(9)	90	2	(2)	842	10	(6)	5991	75	(25)
1981	3114	21	(5)	733	10	(1)	821	24	(5)	685	26	(7)	98	3	(1)	842	10	(0)	6293	94	(19)
1982	3154	22	(1)	733	10	(0)	826	25	(1)	688	27	(1)	98	3	(0)	842	10	(0)	6341	97	(3)
1983	3154	22	(0)	733	10	(0)	826	25	(0)	708	28	(1)	98	3	(0)	842	10	(0)	6361	98	(1)
1984	3154	22	(0)	755	12	(2)	857	28	(3)	757	31	(3)	98	3	(0)	842	10	(0)	6463	106	(8)
1985	3772	26	(4)	916	12	(0)	888	28	(0)	733	36	(5)	80	3	(0)	774	10	(0)	7163	115	(9)
1986	3775	26	(0)	916	12	(0)	1012	30	(2)	751	39	(3)	133	5	(2)	839	13	(3)	7426	125	(10)
1987	4120	29	(3)	964	13	(1)	1042	32	(2)	758	41	(2)	137	10	(5)	897	13	(0)	7918	138	(13)
1988[1]	4132	29	(0)	1074	21	(8)	963	28	(0)	773	44	(3)	137	10	(0)	897	13	(0)	7976	145	(7)
1989[2]	4204	33	(0)	855	21	(0)	909	24	(0)	710	42	(0)	112	7	(0)	796	12	(1)	7586	139	(0)
1990	2998	33	(0)	855	21	(0)	882	31	(7)	636	42	(0)	112	7	(0)	796	12	(0)	6279	146	(7)
1991	2465	30	(0)	804	26	(5)	690	30	(0)	606	57	(13)	89	11	(4)	681	12	(0)	5335	166	(22)
1992	3539	25	(0)	804	26	(0)	690	30	(0)	606	57	(0)	89	11	(0)	681	12	(0)	6409	161	(0)

[1] area 16, 1988, correction of statistical area boundary resulted in fewer beds and hectares.

[2] since 1989 harvested area (beds) have been assessed prior to setting rotational area quotas. Beds have been adjusted in size through consultation with fishers, scaled with a landing criteria, beds in park or contaminated closures removed from the calculations and large beds subdivided and remeasured

Appendix 1 (continued)

Table 1.6. Mainland District (Fraser River) cumulative harvested area, cumulative number of beds fished (excluding park and contaminated closures), and number of new beds fished per year for geoducks, 1986 to 1992.

	Pacific Fishery Management Area						Annual Summary		
	28			29					
Year	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds
1986				12	3	(3)	12	3	(3)
1987	28	2	(2)	145	7	(4)	173	9	(6)
1988	28	2	(0)	155	7	(0)	183	9	(0)
1989[1]	28	2	(0)	128	7	(0)	156	9	(0)
1990	28	2	(0)	128	7	(0)	156	9	(0)
1991[2]	28	2	(0)	88	9	(2)	116	11	(2)
1992	28	2	(0)	88	9	(0)	116	11	(0)

[1] statistical boundaries adjusted in 1990 analysis.

[2] since the start of the I.V.Q. program in 1989, harvested area (beds) have been assessed prior to setting rotational area quotas. Beds have been adjusted in size through consultation with fishers or scaled with landing criteria. Beds in park or contaminated closures have been removed from the calculations and large beds subdivided and remeasured.

Appendix 1 (continued)

Table 1.7. West Coast Vancouver Island (Management Areas 20 to 27) cumulative harvested area, cumulative number of beds fished excluding beds in parks or contaminated closures, and number of new beds fished per year for geoducks, 1978 to 1992.

	Pacific Fishery Management Area																		Annual Summary		
	20			23			24			25			26			27					
Year	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds	area (ha)	# beds	new beds
1978	*						265	2	(2)										265	2	(2)
1979				203	5	(5)	1021	13	(11)	66	1	(1)							1290	19	(17)
1980	*			316	11	(6)	1232	20	(7)	410	3	(2)	215	4	(4)				2173	38	(19)
1981	*			370	14	(3)	1256	23	(3)	444	6	(3)	215	4	(0)	35	1	(1)	2320	48	(10)
1982	*			422	19	(5)	1488	31	(8)	444	6	(0)	268	11	(7)	35	1	(0)	2657	68	(20)
1983				466	25	(6)	1507	32	(1)	456	7	(1)	327	14	(3)	64	2	(1)	2820	80	(12)
1984				476	26	(1)	1520	33	(1)	926	10	(3)	366	20	(6)	64	2	(0)	3352	91	(11)
1985	*			578	40	(14)	2565	41	(8)	1067	13	(3)	441	20	(0)	623	27	(25)	5274	141	(50)
1986	280	2	(2)	610	44	(4)	2704	49	(8)	1172	30	(17)	454	23	(3)	638	28	(1)	5858	176	(35)
1987	280	2	(0)	622	45	(1)	2874	57	(8)	1191	30	(0)	582	29	(6)	677	28	(0)	6226	191	(15)
1988	347	4	(2)	649	49	(4)	2908	62	(5)	1223	33	(3)	583	29	(0)	878	37	(9)	6588	214	(23)
1989[1]	347	4	(0)	660	56	(7)	2638	70	(8)	1243	34	(1)	584	29	(0)	882	36	(0)	6354	229	(16)
1990[1]	347	4	(0)	509	56	(0)	2562	77	(7)	1108	34	(0)	652	38	(9)	770	39	(3)	5948	248	(19)
1991	347	4	(0)	577	49	(o)	2308	78	(0)	1232	39	(4)	439	38	(0)	770	39	(0)	5673	247	(4)
1992	347	4	(0)	592	58	(8)	2292	78	(0)	1232	39	(4)	439	38	(0)	779	42	(4)	5681	259	(11)

* landings for area 20 recorded on sales slips but not on harvest logs.

[1] since the start of the I.V.Q. program in 1989, harvested area (beds) have been assessed prior to setting rotational area quotas. Beds have been adjusted in size through consultation with fishers or scaled with landing criteria. Beds in park or contaminated closures have been removed from the calculations and large beds subdivided and remeasured.

APPENDIX 2.

1995 GEODUCK MANAGEMENT AREAS AND QUOTA RECOMMENDATIONS FOR INSIDE WATERS

Area 11 Subarea 11-2 (Figures 1 and 3)
10 beds; 39 ha estimated

This Area was first opened in 1985 for an exploratory fishery, but no landings were reported on logs. There are sales slip reports for 1984-85-86; no landings reported for 1987 (Table 2). The first log reports were in 1988 for 45.3 t compared to 62 t on sales slips. The fishery has been reported from Subareas, 11-2 and 11-3.

The area was opened in Feb. 1989 with a three year quota of 75,000 lb. (34 t). This quota could not be achieved by the fishers and the mainland Area 12 exploratory quota of 75,000 lb. and the Area 11 quota were combined. For Area 11, in 1989, there were landings of 7.5 t on logs and 5 t on sales slips.

Considering the reported landings of 109 t on sales slip reports (Table 2), 37 years of quota has been landed if the original density was 0.7 geoduck/m^2 over 39 ha (Table 11).

RECOMMENDATION 11: Fishermen supported a closure of this area for 1995 and recommended periodic rotations.

AREA 12 - FISHERY HISTORY

Area 12 (Figure 1)
50 beds*, 448 ha in total for all subareas
(*plus 3 additional beds are under contaminated closures)

Area 12 is a very productive geoduck fishing area. Area 12 was first fished in 1979. There were minor landings in 1982 and 1983 and major fisheries began in 1984. By the end of 1993, 2610 had been landed, second only to Area 14 landings (3465 t) in Inside Waters.

Harbo et. al (1993) describe the history of the fishery and quotas. There was concern that most of the fishing activity in recent years had been out of Port Hardy and that the beds in Goletas Channel have been heavily exploited. As a consequence effort was directed in 1992 to the south of Hardy Bay and around Malcolm Island.

Although the number of beds has increased, some of the large beds (at False Head and in Trinity Bay) were remeasured in 1994 and the total area was estimated at 448 ha for open beds compared to the 1992 estimate of 893 ha; this is a 50% reduction in area.

Joint surveys were undertaken by the Underwater Harvesters

Association (G licence holders) and the K.T.F.C. at Trinity Bay in June, 1994 and in Goletas Channel in September, 1994.

In 1992, landings from each of the geoduck management units, 12-A to 12-G were monitored and validated. These landings were used in the cumulative landings for each unit when logs were not submitted.

Due to the productive beds in Area 12-A and 12-B, higher densities of 2 geoducks /m2 were used in reviewing 1995 quota options and 1 geoduck/m2 (unchanged from 1992) was used for the balance of Area 12 -C to 12-G.

Overall bed areas are reduced for Area 12; in 1995 the 50 geoduck beds were estimated at 448 ha, reduced as a result of more specific fishing information. In 1992, 41 beds were estimated at 893 ha (Harbo et al. 1993).

AREA 12 - 1995 QUOTAS AND RECOMMENDATIONS

AREA 12 TOTAL 1995-96-97: The total calculated quota for Area 12 for this rotation is 180,887 lb. (Tables 12, 13; Appendix 2:Table 2.3). This is a decrease for Area 12 since the rotation years 1992-1993-1994, 565,000 lb.(Table 12).

AREA 12-A Northern Islands, subareas 12-10 to 12-13 inclusive and a portion of 12-16 (Figure 3)
18 beds, 102 ha (previously 98 ha)

The islands northeast of Port Hardy, (12-10 to 12-13 inclusive) have 18 beds reported with an area of 102 ha.

This area was heavily fished in 1989 with high removals, up to 1.99 geoducks/m^2 in one small bed of 1 ha in one season. Harvest logs report 1,003,654 lb. over the equivalent of 11 years fishing, equivalent to 28 years of quota (Table 2.1) at 47,940 lb./year (1% harvest rate @ 2 geoduck/m^2 over 102 ha).

The fishers suggested that there may be exploratory fishing opportunities in the area of Bates Passage and Vansittart Island, subarea 12-12. It was initially recommended that there be no fishery for this area in 1992. However, a management decision was made to allow a 100,000 lb. fishery for 1992 based on the advice of the fishers that this area has substantial stocks.

The 1992 fishery took place in Subarea 12-11 at previously fished beds. No new beds were identified.

RECOMMENDATION:12-A: The reduced annual quota for the remaining 39 years of a 50 year cycle is 28,022 lb.. The three year rotational quota for 12A was set at 80,121 lb. (Table 15; Appendix 2, Table 2.1).

Subarea 12-11 (or portions) should be closed in 1995 to direct fishing effort to new areas.

Area 12-B Goletas Channel: Vancouver Island, Hope and Nigei Island in Goletas Channel; subarea 12-15 and the Vancouver Island shore of 12-16 (Figure 3)
13 beds, 116 ha

This area was closed for the three year period 1992-93-94 due to the high level of landings, 969 t over 6 years, 1984-1989.

There are high rates of removals, 2.2 geoducks/m^2 in a 5 ha bed, over three seasons.

i) In subarea 12-15, there are 12 sites coded as one bed along the Vancouver Island shore of Goletas Channel, measuring 31 ha; there are two sites at Nigei Island, one that has been measured at 15 ha but fished only once in 1984, for less than 10,000 lb. This site should be reduced in area to 2 ha; 2 beds, 33 ha a reduction from 46 ha or -13 ha. The other bed is only 1 ha. There is one bed at Hope Island for 8 ha.

ii) In subarea 12-16, in Goletas Channel along the Vancouver Island shore there are 11 sites forming 3 beds measuring 48 ha.

iii) Hardy Bay is under contamination closure:

iv) In subarea 12-16, from Daphne Point to Dillon Point including the Masterman Islands; 4 beds assigned 20 ha; originally measured 36 ha, one bed at Masterman Islands was reduced to 5 ha (<20,000 lb. landed in four years) from 21 ha; -15 ha.

RECOMMENDATION: 12-B: No fishery in 1995. It is estimated that greater than 50% of the original stock has been harvested (Table 15; Appendix 2, Table 2.1).

At an estimated original density of 2 geoducks/m2 over 116 ha, 53% of the stock has been landed. To support the level of fishing over the past 11 years at a 1% harvest rate an original density of 9.6 geoducks/m2 would be required (Table 11).

Area 12-C False Head: South and east of Dillon Pt. to Ledge Pt.; subareas 12-17 and a portion of 12-16 (Figure 3)
8 beds, 38 ha

Subarea 12-17, False Head to Singletree Point had been measured at 178 ha of reported fishing area, with low landings. This was remeasured at 29 ha (1994) based on the area of fishing reported on harvest logs in 1992. The shore from Singletree Pt. to

Ledge Pt. has only one small bed identified of 3 ha at Cluxewe River.

A separate quota was set for this area in 1992. Fishers felt that the concentrations were probably not as good as Goletas Channel beds, but may provide steady production.

The Fort Rupert Indian Band has protested against fishing in the Deer Islands, Beaver Harbour and at Thomas Point. Beds previously described in Beaver Harbour are in a contaminated closure. A small bed (13 ha) in the vicinity of the airport fronts an Indian Reserve at Thomas Point. Boundaries should be reviewed for discussion with fishers, from the small point immediately south east of Dillon Point to Ledge Point.

RECOMMENDATION 12-C: The calculated annual quota for 1995 at 1.0 geoducks/m^2 was 3,689 lb. The 1995 three year rotational quota was set at 9,952 lb. (Table 15; Appendix 2, Table 2.1). This is based on fishing at a reduced rate for the remaining 34 years of a 50 year cycle.

Area 12-D Malcolm Island, Graeme Pt. to Black Bluff; a portion of 12-8; (Figure 4)
7 Beds, 158 ha (1992- 5 beds, 175 ha)

This area includes a portion of subarea 12-8, Graeme Point to Black Bluff that has large beds identified to support a quota of 246,000 lb. Area 12-D had large landings, 400,000 lb. in a season, 1985 but the 1989 fishery was limited.

Fishers expressed concerns about the exposure to weather and vessel running time and thought this area was rocky in the shallows with perhaps good substrate for geoducks deeper.

The 1992 quota was set at 125,000 lb., less than the calculated option. Fishers were uncertain about stock in this area and advised that the measured area may be too large. Several small beds were scaled down in size by landing criteria for 1995 calculations.

RECOMMENDATION: 12-D: The calculated quota for the 1995 fishery is 88415 lb. at 1.0 geoducks/m^2 (Table 15; Appendix 2, Table 2.1)
The 1995 quota was reduced to 57,539 allow a 30,000 exploratory fishery in Area 12G, Mainland Inlets. The fishery will"fall back" to 12D if the quota cannot be reached in 12G.

Area 12-E Trinity Bay; portions of 12-6 and 12-8;(Figure 4)
1 bed, 26 ha (1992-300 ha)

Trinity Bay, Bowlder Point to Lizard Point (a portion of 12-6) had concerns expressed similar to 12-D. A very large exposed bed was reported on harvest logs in 1985 and the productive area for

geoducks was likely over-estimated.

The bed has been remeasured according to harvest locations reported in the 1992 fishery and a preliminary bed area and geoduck density survey was undertaken in June, 1994.

The 1992 quota set was 201,000 lb., only slightly less than the calculated quota of 210,000 lb. (Harbo et al, 1993). This was too high since the original area identified (300 ha) was overestimated. Based on current estimates, 38 years of quota have been landed, if the original densities were 1.4 geoducks/m^2.

RECOMMENDATION 12-E: A closure was recommended until further assessments are undertaken. Table 2.1 in Appendix 2 shows that >50% of the available stock in the 26 ha bed has been harvested: 51% using adjusted landings and assuming a density of 1.4 geoducks/m^2 or 71 % if the original densities were 1 geoduck/m^2 (Table 15; Appendix 2, Table 2.1)

Area 12-F Malcolm Island - east and south, subareas 12-5, 12-18, a portion of 12-6; (Figure 4)
2 beds, 6 ha (1992-13 ha)

Lizard Point to Donegal Head (one bed), and subarea 12-18 (one bed) could support a quota of 3275 lb. (Appendix 2, Table 2.1)

The fishers interviewed had no knowledge of geoduck beds in Areas 12-1 to 12-5. A bed in 12-1 was reported in the past, but no landings were reported on logs to support it.

The 1992 quota set was 9,000 lb.; (Harbo et al, 1993). Only 7,581 lb. were landed and validated in the 1992 fishery.

RECOMMENDATION 12-F: The calculated quota for 1995, based on 1.0 geoducks/m2 is 3,275 lb. for the 1995 fishery (Table 15, Appendix 2, Table 2.1)

Area 12-G Mainland Inlets; Subareas 12-7,12-27 to 12-48; (Figure 3)
1 bed, 2 ha (1992-10 ha)

There are additional beds identified (another 10 ha), but without reported logbook landings (Hopetown Pass; Kenneth Pass; Turnbull Cove; Kinnard Island). In 1992, the advisory committee commented that surveying had found little stock in Wells Passage area. In 1994, the advisory committee recommended an exploratory fishery for 12-G in Wells Pass and Blackfish Sound areas.

RECOMMENDATION 12-G: The 1995 calculated quota is 1,120 lb. Fishers requested that an exploratory fishery be allowed in this area , so

28,876 lb was transferred from Area 12D to this area, for a total three year rotational quota of 30,000 lb. (Table 15, Appendix 2, Table 2.1).

AREA 13 - FISHERY HISTORY

Area 13 (Figure 1)

Area 13 has been fished consistently since 1977, at the start of the geoduck fishery in B.C. Landings have fluctuated according to quota patterns. Harbo et al. (1994) describe the fishery and quotas.

The fishers advise that there is not much stock other than the beds at Marina Island. The majority of landings (71%) over time from Area 13 have been from the two Marina Island beds. The fishers advised that the Marina Island beds are similar in density and the log data supports this in that the rates of removals from both beds are the same. Fishers expressed concern about sustaining the level of harvest in these beds.

A survey undertaken in 1992 at Marina Island estimated the fishing grounds from 5 to 20 m depth to be 310 ha with an original density of 0.475 geoducks/m^2. The northern bed, 74 ha, which was surveyed intensively was estimated to have original densities of 0.727 geoducks/m^2.

AREA 13 - 1995 QUOTAS AND RECOMMENDATIONS

AREA 13 TOTAL 1995-96-97: The total calculated quota for Area 13 for this rotation is 118,444 lb. (Tables 12,13; Appendix 2:Table 2.2). This is a decrease for Area 13 since the rotation years 1992-1993-1994, 180,000 lb.(Table 12).

Area 13-A SE Quadra to Whiterock Pass; Subareas 13-12 to -14 (Figure 5)
7 beds, 80 ha (1994); (60 ha-1992)

In 1992, a portion of 13-14, southeast Quadra Island to Whiterock Pass was proposed for a rotational quota of 117,000 based on 1991 measurements of 164 ha.

Fishers felt the quota was too large for the area. Much of the bottom is muddy. After much discussion with the fishers, it was determined that this area was well surveyed with poor production and had generally small spots with low densities. The 3 beds reported from Francisco Point to Rebecca Spit on logs area were likely over-estimated and area was reduced based on formula of density of removals. The bed near Whiterock Pass was also reduced in area.

The highest season landing for this location was 38,000 lb. in

1989. A quota of 40,000 lb. was set for 1992 based on the calculations: 60 ha x 235 lb.= 14,100 lb. x 3 years = 42,300 lb. (Harbo et al, 1993).

For the 1995 quota calculations, some of the beds with area reduced in 1992 were increased using landings criteria, so that the bed areas for 13-A totalled 80 ha. Using a density of 0.7 geoducks/m^2 the calculated quota is 44,089 lb.

RECOMMENDATION 13-A: The calculated quota for 1995 is 44,196 lb. The 1995 quota was set at 44,089 lb. (Table 15, Appendix 2, Table 2.2).

Area 13-B Marina Island Beds, portion 13-15; (Figure 5)
2 beds, 279 ha (316 in 1992)

The two beds surrounding Marina Island have been heavily fished and account for 71% of all landings reported for Area 13. Total landings of 1,641,212 lb. on logs. (Harbo et al, 1993). This is approximately 52% of the estimated original biomass. The northern bed (101) has been more heavily exploited, 85% of the original biomass.

RECOMMENDATION 13-B: No fishery in 1995.(Table 15, Appendix 2, Table 2.2.).

Area 13-C SW Cortes Island, Whaletown to Sutil Point
portions of subareas 13-14, 13-15 and 13-1; (Figure 5)
5 beds, 160 ha

This area has not been as heavily fished as Marina Island. There are some contaminated closures in this unit at Manson's Landing. In 1992, a quota of 112,000 lb. was set based on 1 geoduck/m^2.

In 1995, beds larger than 75 hectares were assumed to have lower densities of geoduck. One bed of 132 ha was assumed to have a density of o.45 geoducks/m^2; 4 beds with a total of 38 ha were assumed to have densities of 0.7 geoducks/m^2.

RECOMMENDATION 13-C: In 1995 the calculated quota was 34,716 lb. (Appendix 2:Table 2.2). This is based on a reduced quota for 34 years remaining of a 50 year cycle. The 1995 set quota was 43,357 lb.

Area 13-D NW Cortes, east of Read Island to Rendezvous Island,
Subareas 13-16 and 13-17 ; (Figure 5)
9 beds, 52 ha (34 ha - 1992)

This unit has 9 small beds with 52 ha reported on logs and

minor landings. Fishers reported hard digging (mud) and spotty concentrations.

The highest annual landings for this location was 41,000 lb. in 1979. The 1992 quota set was 20,000 lb. and all the landings, 20,634 lb., were taken from one site in Plunder Pass.

RECOMMENDATION 13-D: 1995 - Plunder Pass site recommended to be closed. The calculated and set quota for area 13D is 27,453 lb. for 1995 (Table 15; Appendix 2:Table 2.2). This is based on 34 years remaining of a 50 year cycle.

Area 13-E Other subareas: Johnstone Strait (13-32); Gowland Harbour (13-4); Willow Point (13-2) and Cape Mudge (13-1) (Figure 5)
3 beds, 7 ha

Fishers felt there was not a suitable fishing area from Boulder to Willow Point area; too rocky. A large bed had been identified at Cape Mudge, with no landings on logs but no one in the advisory committee had experience there. The fishers agreed that Wilby Shoals may have some stock.

Mitlenatch Island (in 13-1) may have stock, but fishing to date has only identified beds in the subarea 15-03 near the island. The question of fishing in the vicinity of the provincial park will have to be discussed.

The fishers of the advisory committee were not aware of any beds in the area of Kelsey Bay, subarea 13-32. An exploratory survey in June, 1994 did not find any geoducks and most of the area was rock.

A quota of 8,000 lb. was set for 1992 (Harbo et al,1993). Fishers were unable to find suitable fishing area. This quota was transferred in-season to Area 14-C.

With the removal of the bed in Current Pass, the calculated quota for 1995 is 3545 lb.

RECOMMENDATION 13-E: A calculated quota of 3,558 lb. was estimated for the balance of Area 13, at Cape Mudge and from Big Rock to Willow Point. The quota was set at 3545 lb. (Table 15; Appendix 2: Table 2.2).

CONTAMINATED AREAS - Area 13

In Area 13, two beds were permanently closed, 29 ha in Manson's Landing and approximately 31 ha in Willow Point area.

There is also a seasonal closure at Drew Harbour, May 1 to September 30, due to potential contamination from recreational boating activities; 1 bed (with 4 sites coded), 25 ha estimated.

AREA 14 - FISHERY HISTORY

Area 14 (Figure 1)
25 beds, 3539 ha estimated (to 1994)

Area 14 has been fished since 1976, 3814 t to 1994 for approximately 27% of the landings from inside waters (Table 2).

The area of commercial fishing ground was assumed to be very large from the beginning (Appendix 1, Table 1.5), over 2000 ha in 1978. After 1989, the size of some of the very large beds was suspected to be overestimated. For quota calculations, some beds were scaled down using average removals or landings criteria. Quotas were calculated in 1992 using an assumed density of 1.0 geoducks /m^2. After the 1992 fishery a survey was recommended.

A survey of a portion of one of the large beds at Comox Bar was undertaken in 1993 (Campbell et al. -1994 PSARC WP- 94-16). The survey found a mean density of 0.300 geoducks/m^2 (95% C.L. 0.286-0.316) over 305 ha surveyed. The original biomass over 433 ha, 5 to 20 m depth range, was estimated at 0.43 geoducks /m^2. This is very similar to Marina Island original mean density estimates over 310 ha of 0.475 geoducks/m^2. As a consequence for large beds, >75 ha, average densities of 0.45 geoducks/m^2 were used. For beds <75 ha, 0.7 geoducks/m^2 were used.

The large bed at Comox Bar was remeasured, after the survey, on a new metric chart, from the 5 to 20 m depth range. A large contaminated area was excluded from the bed. The revised area of the bed at was estimated to be a total of 612 ha; 433 ha in the southern portion and 179 ha in the northern portion.

AREA 14-1995 QUOTAS AND RECOMMENDATIONS

AREA 14 TOTAL 1995-96-97: The total calculated quota for Area 14 for this rotation is 624,999 lb. (Tables 12,15; Appendix 2:Table 2.3). This is a slight reduction for Area 14 since the rotation years 1992-1993-1994, 632,000 lb.(Table 12).

For 14D and 14E, the calculated quota is 373,709 lb. for the 1996 fishery (Appendix 2:Table 2.3).

Area 14-A Cape Lazo north to Shelter Point; subarea 14-13;
(Figure 6)
6 beds, 1151 ha (1994)

The northern portion of this area, from the vicinity of Oyster River and north, was fished from 1978 to 1982, 1984. Landings were not made again in subarea 14-13 until 1987, when a separate opening was set. Except for a small landing from Oyster Bay (5108 lb.) in 1988, the focus for the fishery has been beds at the southern end of 14-13, landing at Comox.

The southern portion, from south of Oyster River to Cape Lazo was fished 2 years; 1978, 1979, was not fished again until the fleet was forced to by subdividing Area 14 in 1987, 1988 and 1990.

Without subarea quota divisions, substantial landings came from this portion in 1990; 346,160 lb. on logs (approx. 77% of the 1990 Area 14 quota).

This is a large area to fish and long runs to offloading facilities at either Comox or Campbell River. From Cape Lazo to Shelter Point is approximately 12 nautical miles (22 km). The bottom is mostly sand and due to the exposure of the shore to winds and wave action, the shows of clams are poor in winter.

The historical quotas for this area were 100,000 lb. and 200,000 lb. A three year quota of 412,000 lb. was set for 1992(-93-94). The validated landings were 411,914 lb. taken over the period, July to October. The 1992 quota was arrived at arbitrarily by evaluating all inside waters for 1992-1993 and considering a 15% reduction of quotas in each year. The quota assigned in 1992 is far less than the quota option in Table 3.13 (Harbo et al, 1993), which appears to be grossly inflated.

This area should be evaluated and surveyed. It is one of the largest measured areas (1151 ha) and largest quota assigned for inside southern waters. Fishers advise that there are clams all along the shoreline although sometimes spotty.

RECOMMENDATION 14-A:
Quotas for four beds >75 ha (143+188+295+495=1121 ha) were determined at lower densities, 0.45 geoducks/m^2 than the 2 smaller beds (30 ha) where 0.7 geoducks/m2 was used.

The calculated quota option for 3 years was 356,435 lb. for 1995 (Table 15, Appendix 2:Table 2.3). The quota was set at 356,435 lb. This is only a 14% reduction from the quota of 412,000 lb. in 1992 and should be reassessed before the next rotation.

Area 14-B Comox Bar: bed south of Pallisar Rock; portions of subareas 14-7, 14-9 and 14-10; (Figure 6)
3 beds; 893 ha (some area under contaminated closure)
(#4601: 612 ha, 4901: 256 ha and 4902: reduced to 25 ha)

The bed at Comox Bar (4601) is partially under closure for

sewage contamination. This is a large bed, originally assigned 769 ha and represented 18% of the bed area in Area 14 in the 1990 estimates. The bed as charted from harvest logs runs from Cape Lazo to the navigation bell buoy (P54) and then along the eastern shore of Denman Island. This bed was surveyed in 1993 and remeasured in 1994 to a total of 612 ha of open fishable area (17% of open area calculated in 1994). Fishers advise that the most productive areas to the north of Comox Bar now fall within the contaminated closure (350 ha were remeasured in 1994). The bed is most productive from Pallisar Rock off Sandy Island, southeast along the eastern shore of Denman Island. The northern portion of the bed near Cape Lazo, northeast of the contaminated closure was remeasured at 179 ha. The total estimated open bed area for bed 4601 is 612 ha for 1995 quota calculations.

There is another large bed to the south, #4901- 417 ha; remeasured on a new chart for 256 ha (1991). The bed #4902 (55 ha) at the southeast end of Denman Island, Lambert Channel has been fished 8 years, for 39,024 lb.; approximately 5000 lb. annually.

The bed in the vicinity of the ferry landing on Denman Island in Lambert Channel has been coded on logs as a part of the northern bed off Komas Bluff (4902).

A quota of 200,000 lb. was set for 1992, less than the standard option of 263,000 lb.(Table 3.14, Harbo, et al 1994).

At a density of 1 geoduck/m^2, landings of 2,390,345 lb. are 21 years of quota fished in 19 years of harvest. An original density of 0.62 is required to support 19 years of fishing, 1978 to 1991, over 893 ha @ 1%.(Table 11).

RECOMMENDATIONS 14-B : The calculated and set quota was 189,702 lb. for 1995 (Table 15, Appendix 2:Table 2.3). This is based on a reduced fishing quota for the remaining 33 years of a 50 year cycle. This is only a 5% reduction for this area from the arbitrary quota of 200,000 lb. set for the fishery in 1992.

Area 14-C Baynes Sound: Longbeak Point to Boyle Point, west shore of Denman and Union Point to Maplegard Point; subareas 14-11,14-15 and 14-8. (Figure 6)
6 beds; 169 ha : 89 ha @ 0.7 geoducks/m^2; 80 ha @ 0.45 geoducks/m^2
(193 ha in 1991)

There may be problems of sewage contamination in southern Baynes Sound, at Deep Bay to Ships Point. Eliminating the 5 beds identified in this area leaves 6 beds and 169 ha. The estimate of 169 ha may be too large based on past fishing in Baynes Sound. This area quota could be reduced to balance the number of quotas in

Inside Waters if required.

There are four beds in subarea 14-11 for 113 ha; 30 ha at the Comox Cone Marker; 80 ha west of Seal Islets and 2 ha at Union Point. The three beds are outside the contaminated closure. There are several new closures proposed for this area that may affect the availability of geoducks.

Fishers advise that in 14-11, the site at Gartley Point, bed #4704 is not productive and much of it is either rocky or muddy. It has been measured at 39 ha but was reduced and assigned 1 ha. The last time it was fished was in 1989 for 595 lb.

There is one bed in 14-15, Henry Bay measured at 43 ha.

In subarea 14-8, there are six beds for 37 ha with 2 to 35,000 lb. cumulative landings.

The 1992 quota was set initially at 20,000 lb. based on fishers's recommendations. This was considerably less than the calculated quota of 145,000 lb. (Table 3.15, Harbo et al, 1994). The density and area estimates were suspected to be too large. Fishers were unable to find stock in area 13-E. The 13-E quota of 8,000 lb. was transferred in-season to area 14-C, for a total 1992 quota of 28,556 lb..

RECOMMENDATION 14-C: The 1995 quota is 78,862 lb. (Table 15; Appendix 2:Table 2.3). This quota was reduced to balance the number of inside water quotas to 11 (Table 12).

DESCRIPTIONS OF 1995 SOUTH COAST GEODUCK MANAGEMENT AREAS:

INSIDE WATERS 1995

AREA 12

Geoduck Management Area 12-A: Islands
Subareas 12-10 to 12-13 inclusive and that portion of 12-16 within 0.5 nautical mile of Duncan Island.

Geoduck Management Area 12-B: Goletas Channel
Subarea 12-15 and that portion of 12-16 north of a line True east from an unnamed point 0.1 nautical mile south of Dillon Point and excluding the waters within 0.5 nautical miles of Duncan Island.

Geoduck Management Area 12-C: False Head
Subarea 12-17 and that portion of 12-16 south of a line True east from the unnamed point 0.1 nautical mile south of Dillon Point.

Geoduck Management Area 12-D: Malcolm Island-Graeme Pt. to Black Bluff
A portion of 12-8 bounded by a line from Pultney Point on Malcolm Island, thence to False Head, thence to Staples Island, thence to Black Bluff on Malcolm Island.

Geoduck Management Area 12-E: Malcolm Island-Trinity Bay
A portion of subarea 12-6 westerly of a line True north from Lizard Point and that portion of 12-8 easterly of a line from Black Bluff to Staples Island.

Geoduck Management Area 12-F: Malcolm Island east and south
Subareas 12-5, 12-18 and that portion of 12-6 south and westerly of a line from Bold Head on Swanson Island to Lizard Point on Malcolm Island.

Geoduck Management Area 12-G: Mainland Inlets
Subareas 12-7 and 12-27 to 12-48 inclusive.

AREA 13

Geoduck Management Area 13-A: SE Quadra Island
Subareas 13-12 to 13-14 inclusive.

Geoduck Management Area 13-B: Marina Island (closed in 1995)
That portion of 13-15 which includes waters surrounding Marina Island from the shoreline to the 20 metre depth contour.

Note: The intent is to close the known geoduck beds in the immediate vicinity of Marina Island.

Geoduck Management Area 13-C: SW Cortes Island
Portions of 13-15, 13-14 and 13-1 described as: That portion of subarea 13-15 within 0.5 nautical mile of the shore of Cortes Island and excluding the waters surrounding Marina Island to the 20 m depth contour. Those portions of 13-14 and 13-1 within a 1.5 nautical mile radius of Sutil Point.

Note: The intent is to open the southwest shore of Cortes Island from Whaletown to Sutil Point but not including beds at Marina Island.

Geoduck Management Area 13-D: NW Cortes Island
Subareas 13-16 and 13-17.

Geoduck Management Area 13-E: Other areas
Subareas 13-2 and 13-4, and a portion of 13-1 westerly of a line from Francisco Point to Mitlenatch Island.

AREA 14

Geoduck Management Area 14-A: Shelter Point to Cape Lazo
Subarea 14-13.

Geoduck Management Area 14-B: Comox Bar and the east shore of Denman Island
Portions of subareas 14-7, 14-9 and 14-10 described as: That portion of 14-7 within 0.5 nautical miles of Denman Island. That portion of 14-9 north of a line from the Comox Bar buoy 'P54' through to buoy 'P56'. That portion of 14-10 excluding the waters within 1 nautical mile radius of Phipps Point on Hornby Island.

Geoduck Management Area 14-C: Baynes Sound
Subareas 14-8, 14-11 and 14-15.

Table 2.1 . Estimates of geoduck original stock (lb), stock harvested and remaining stock to be harvested over the course of a 50 year fishery.

AREA : 12 **DENSITY:** 1.0 GDK/M^2 for 12C,D,E,F (no change from 1992)

G.M. Area	# Beds	Estimated Bed Area (ha)	Est. Original Stock (lb)	Reported Landings (lb)	Adjusted Landings (lb)	% Stock Harvested	% Stock Remaining @ 1% Harvest Rate	Removals (#/m2)	Remaining Years to Fish 50 - yrs fished	Adjusted Annual Quota (lb)	3 Year Rotational Quota (lb)
12C: False Head	8	38	892,202	247,625	320,674	36	14	0.36	34	3,689	9,952
12D: Malcolm/Black Bluff	7	158	3,709,682	521,985	675,971	18	32	0.18	40	29,472	88,415
12E: Malcolm/Trinity Bay	1	26	610,454	325,656	421,725	69	-19	0.69	40	0	0
12F: Malcolm/East & South	2	6	140,874	30,771	39,848	28	22	0.28	40	1,092	3,275
12G: Mainland Inlets	1	2	46,958	8,227	10,654	23	27	0.23	39	373	1,120
Subtotal:	19	230	5,400,170	1,134,264	1,468,872	21	29			34,626	103,877

AREA : **DENSITY:** 2.0 GDK/M^2 FOR 12A, 12B (new for 1995)

G.M. Area	# Beds	Estimated Bed Area (ha)	Est. Original Stock (lb)	Reported Landings (lb)	Adjusted Landings (lb)	% Stock Harvested	% Stock Remaining @ 1% Harvest Rate	Removals (#/m2)	Remaining Years to Fish 50 - yrs fished	Adjusted Annual Quota (lb)	3 Year Rotational Quota (lb)
12A: Islands	18	102	4,789,716	1,005,415	1,302,012	27	23	0.54	39	28,022	84,065
12B: Goletas Channel	13	116	5,447,128	2,214,969	2,868,385	53	-3	1.05	39	0	0
Subtotal:	31	218	10,236,844	3,220,384	4,170,397	31	19			28,022	84,065
TOTAL:	**50**	**448**	**15,637,014**	**4,354,648**	**5,639,269**	**28**	**22**			**62,647**	**187,942**

Adjusted Landings Factor: 1.295 (reported landings factored by landings reported on sales slips and not harvest logs, by statistical area.)

Original Stock = Ha X Est. biomass at density (1.4 or 2.0) geoducks/m^2
Landings = combination of logs, sales slips and validated landings
% Stock Harvested = Landings / Original Stock*100
% Stock Remaining = ((Original Stock X .01% harvest rate X 50 years) - Landings)/ Original Stock X 100
Years Remaining to Fish = 50 years - actual number of years the area has been fished
Adjusted Annual Quota based on % of harvestable stock remaining spread over the remaining years to fish a 50 cycle.
= (% stock remaining/yrs remaining X 100) X original stock

Table 2.2. Estimates of geoduck original stock, stock harvested and remaining stock to be harvested over the course of a 50 year fishery.

AREA : 13 **DENSITY: 0.7 GDK/M^2 FOR BEDS <75 HA .45 GDK/M^2 FOR BEDS >75 HA**

Geoduck Management Area	# Beds	# Beds < 75 ha	# Beds > 75 ha	Estimated Bed Area to 1992 (ha)	Bed Area < 75 ha	Bed Area > 75 ha	Est. Original Stock < 75 ha (lb)	Est. Original Stock > 75 ha (lb)	Total Est. Original Stock (lb)	Reported Landings to 1992 (lb)	Adjusted Landings (lb)	% Stock Harvested	% Stock Remaining @ 1% Harvest Rate	Removals (#/m2)	Remaining Years to Fish 50 - yrs fished	Adjusted 7 Quota (lb)	3 Year Rotational Quota (lb)
13A: S.E.Quadra Is.	7	7	0	80	80	0	1,314,800	0	1,314,800	138,995	141,775	11	39	0.08	35	14,732	44,196
13B: Marina Island	2	1	1	279	74.3	205	1,221,121	2,166,030	3,387,151	1,819,413	1,855,801	55	-5	0.28	33	0	0
13C: S.W.Cortes Is	5	4	1	160	38	122	624,530	1,289,052	1,913,582	552,302	563,348	29	21	0.15	34	11,572	34,716
13D: N.W.Cortes Is.	9	9	0	52	52	0	854,620	0	854,620	112,897	115,155	13	37	0.09	34	9,181	27,543
13E: Misc Other Areas	3	3	0	7	7	0	115,045	0	115,045	16,862	17,199	15	35	0.10	34	1,186	3,558
TOTAL	26	24	2	578	251	327	4,130,116	3,455,082	7,585,198	2,640,469	2,693,278	36	14	0.20		36,671	110,013

Adjusted Landings Factor: 1.020 (reported landings factored by landings reported on sales slips and not harvest logs, by statistical area.)

Original Stock = Ha X Est. biomass at density of geoducks/m^2
Landings = combination of logs, sales slips and validated landings
% Stock Harvested = Landings / Original Stock*100
% Stock Remaining = ((Original Stock X .01% harvest rate X 50 years) - Landings)/ Original Stock X 100
Years Remaining to Fish = 50 years - actual number of years the area has been fished
Adjusted Annual Quota based on % of harvestable stock remaining spread over the remaining years to fish a 50 cycle.
= % remaining X 1/yrs remaining X original stock

Table 2.3. Estimates of geoduck original stock, stock harvested and remaining stock to be harvested over the course of a 50 year fishery.

AREA : 14 (1995 rotation) **DENSITY: 0.7 GDK/M2 FOR BEDS < 75 HA; 0.45 FOR BEDS >75 HA**

Geoduck Management Area	Total # Beds	# Beds < 75 ha	# Beds > 75 ha	Total Bed Area to 1992 (ha)	Bed Area < 75 ha	Bed Area > 75 ha	Est. Original Stock < 75 ha (lb)	Est. Original Stock > 75 ha (lb)	Total Est. Original Stock (lb)	Reported Landings (lb)	Adjusted Landings to 1992 (lb)	% Stock Harvested	% Stock Remaining @ 1% Harvest Rate	Removals (#/m2)	Remaining Years to Fish 50 - yrs fished	Adjusted Annual Quota (lb)	3 Year Rotational Quota (lb)	
14A: Shelter Pt to Cape Lazo	6	2	4	1151	30	1121	493,050	11,844,486	12,337,536	1,578,567	1,772,731	14	36	0.07	37	118,812	356,435	
14B: Comox Bar/Denman	3	1	2	893	25	868	410,875	9,171,288	9,582,163	2,408,158	2,704,361	28	22	0.13	33	63,234	189,702	
14C: Baynes Snd.	6	5	1	169	89	80	2,777,515	845,280	3,622,795	365,220	410,142	11	39	0.10	34	31,597	78,862	*
TOTAL	**15**	**8**	**7**	**2213**	**144**	**2069**	**3,681,440**	**21,861,054**	**25,542,494**	**4,351,945**	**4,887,234**	**19**	**31**		**33**	**213,643**	**624,999**	*

Area 14C calculated quota was 94,792 lb - reduced by 15,930 lb to round I.V.Q.'s

AREA : 14 (1996 rotation) **DENSITY: 0.7 GDK/M2 FOR BEDS < 75 HA; 0.45 FOR BEDS >75 HA**

Geoduck Management Area	Total # Beds	# Beds < 75 ha	# Beds > 75 ha	Total Bed Area to 1992 (ha)	Bed Area < 75 ha	Bed Area > 75 ha	Est. Original Stock < 75 ha (lb)	Est. Original Stock > 75 ha (lb)	Total Est. Original Stock (lb)	Reported Landings (lb)	Adjusted Landings to 1992 (lb)	% Stock Harvested	% Stock Remaining @ 1% Harvest Rate	Removals (#/m2)	Remaining Years to Fish 50 - yrs fished	Adjusted Annual Quota (lb)	3 Year Rotational Quota (lb)
14D	4	1	3	404	56	348	920,360	3,676,968	4,597,328	801,540	900,129	20	30	0.09	37	37,798	113,395	
14E	6	2	4	922	65	857	1,068,275	9,055,062	10,123,337	1,648,377	1,851,127	18	32	0.09	37	86,771	260,314	
TOTAL	**10**	**3**	**7**	**1326**	**121**	**1205**	**1,988,635**	**12,732,030**	**14,720,665**	**2,449,917**	**2,751,257**	**19**	**31**		**33**	**124,570**	**373,709**	

Adjusted Landings Factor: 1.123 (reported landings factored by landings reported on sales slips and not harvest logs, by statistical area.)

Original Stock = Ha X Est. biomass at 0.7 or 0.45 geoducks/m^2

Landings = combination of logs, sales slips and validated landings

Adjusted Landings = (Total landings from all sources / landings with reported area) X landings with area (3465 t / 3085 t = 1.123)

% Stock Harvested = Landings / Original Stock*100

% Stock Remaining = ((Original Stock X .01% harvest rate X 50 years) - Landings)/ Original Stock X 100

Years Remaining to Fish = 50 years - actual number of years the area has been fished

Adjusted Annual Quota based on % of harvestable stock remaining spread over the remaining years to fish a 50 cycle.

= % remaining X 1/yrs remaining X Original stock

APPENDIX 3.

1995 GEODUCK MANAGEMENT AREAS AND QUOTA RECOMMENDATIONS FOR THE WEST COAST OF VANCOUVER ISLAND.

In years prior to 1991, geoducks were harvested and processed at times of minor PSP blooms (Paralytic Shellfish Poisoning) on the west coast of Vancouver Island and in the north coast where there has been no PSP monitoring. This option has not been available since 1991.

AREA 23 - FISHERY HISTORY

Area 23 (Figure 1)

The fishery in Area 23 has taken place since 1977, at the start of the fishery. Landings have been consistently high, 150 to 250 t, as a result of quotas set for the area.

Initial quotas in 1980, assigned 500,000 lb. to Areas 20,21 and 23 combined. This increased to 525,000 lb. (238 t) in 1981. The first separate quota for Area 23 was 400,000 lb. (181 t) in 1985. This was increased to 500,000 lb. in 1987 and then back to 400,000 lb. in 1988.

The three year quota set in 1989 was 1,200,000 lb. (544 t) for all subareas of Area 23. The area was then closed for 1990 and 1991.

Due to a change in PSP regulations in late 1991, fishing in Area 23 was postponed until 1992. The 1991 quota was transferred to and landed in Area 26. It was not possible to fish Area 27, as originally scheduled for this rotation, in November-December due to weather conditions.

There are two major portions of Area 23 closed permanently; the Broken Group Islands of the Pacific Rim National Park and a research area near Bamfield. These areas are known to contain geoduck stocks.

In 1992, Area 23 was divided into five units, 23-A to 23-E to assign quotas.

Stock surveys were carried out in Area 23 in 1978 (Harbo et al. 1986).

AREA 23 - QUOTAS AND RECOMMENDATIONS

AREA 23 TOTAL 1995-96-97: The total calculated quota for Area 23 for this rotation is 284,472 lb. (Tables 12, 16; Appendix 3:Table 3.1). This is a 50% decrease for Area 23 since the rotation years

1992-1993-1994, 565,000 lb.(Table 12).

Stocks of geoducks in the Broken Islands Group, Barkley Sound are closed as part of the Pacific Rim Park reserve (Figures 7 and 8). Surveys were carried out in this area in 1978, an estimated 2653 ha of geoduck habitat were identified with an estimated biomass of 5476 t (Harbo et al. 1986).

AREA 23-A Maggie River; portions of 23-9,23-10 and 23-11 (Figure 9)
6 beds, 157 ha (171 ha in 1992)

There are six beds with high rates of removals; 1.4 geoducks/m^2 in a 2 ha bed and 0.43 geoducks/m^2 removed over 110 ha. This compares to estimated removals of 0.46 geoducks/m^2 at north Marina Island (74.3 ha).

In 1992, the three year quota option was 80,370 lb. X 3 years = 241,110 lb. (Harbo et al, 1993). The 1992 quota set was 240,000 lb.

One site in N.E. Newcombe Channel, bed 401, 18 ha, had no landings since 1980, when 22,300 lb. were landed. Effort should be directed to this site. A requirement was set for an ongrounds observer to monitor fishing effort in this bed during the 1995 opening of area 23-A.

RECOMMENDATION 23-A: The three year quota for 1995 was set at the calculated amount of 56,148 lb. (Table 16; Appendix 3:Table 3.1)

AREA 23-B Toquart Bay - Pipestem Inlet; portion of 23-10 (Figure 9)
7 beds, 39 ha (1992 -4 beds, 10 ha)

The majority of landings have come from the west shore of Toquart Bay, north of the Indian Reserve (I.R.); bed 601, 26 ha; 305,820 lb. The balance of the area has only supported minor landings in the past, 34,745 lb.

The 1992 quota set was 15,000 lb. based on a reduced area of 10 ha, excluding bed 601. A closure was set in 1992 at the bed west of Stopper Island where 90% of the landings (a total of 340,565 lb.) for this unit came from. For 1995 calculations, bed 601 was included.

RECOMMENDATION 23-B: Recommend fishing at a reduced harvest rate for the balance of a 50 year fishery. An estimated 33% of the stock has been landed. The quota was set at the calculated amount for 1995 of 19,004 lb. (Table 16; Appendix 3:Table 3.1)

AREA 23-C Mayne Bay - Stopper Islands - Bryant Islands - Curwen Island; portions of 23-9, 23-10 (Figure 9)
9 beds, 124 ha

This area has been heavily fished in the past. Appendix 3: table 3.1 shows that based on a 50 year fishery, with a calculated annual quota of 23,088 lb. 31% of the original stock has been harvested in 16 years. This table shows that 54 years of quota (calculated @ 23,088 lb annually) has been harvested from Area 23-C.

There are several beds in the vicinity of Stopper Islands, other small islands (Bryant, Curwen and St. Ines) and 62 ha in Mayne Bay. The highest rates of removals are 0.58 geoducks/m^2 over 9 ha. The estimated removal rate for all beds in 23-C is 0.43 geoducks/m^2 (Table 3.1)

A management decision was made in 1992 to allow for a 35,000 lb. quota with a provision for adding 130,000 lb. if the fleet could not attain the quota in 27-G exploratory. The Mayne Bay area was harvested for 166,118 lb. in 1992.

RECOMMENDATION 23-C: The calculated and set quota for 1995 was 69,263 lb. (Table 16; Appendix 3:Table 3.1)

AREA 23-D Pinkerton Islets - Canoe I.- Howard Point to Pill Point; portions of subareas 23-6 and 23-8 (Figure 9)
22 beds, 182 ha
(16 beds, 114 ha in 1992 excluding Alma Russel Islands)

Approximately 52% of the reported landings on logs have come from the Alma Russel Islands. Their area is included in the quota calculation (3 beds, 51 ha), but they should be closed in 1995 to spread effort into other beds.

A closure was set in 1992 for the Alma Russel Islands. The calculated option for the reduced area of 114 ha was 162,000 lb.(Harbo et al,1993). A more conservative quota of 145,000 lb. was set for 1992.

RECOMMENDATION 23-D : Contaminated closures may be necessary due to float homes. Reduced fishing effort at 118,643 lb. was recommended for 1995. (Table 16; Appendix 3:Table 3.1).

AREA 23-E Chain Group - Tsartus Island - Edward King Island (Figure 9)
14 beds, 90 ha

There are 14 small beds ranging from 2 to 13 ha. There have been high removals at some locations: 1.65 g/m^2 over 5 ha; 1.09 g/m^2

over 6 ha; 0.51 g/m^2 over 13 ha.

There had been nine years of fishing to 1991. The fishery was closed in 1992 due to over harvesting concerns (Harbo et al, 1993). Based on the area identified, 90 ha, and landings adjusted for missing catch on logs, 991,169 lb., 40% of the original stock has been harvested from this area (Table 3.1)

RECOMMENDATION 23-E: The calculated and the set quota for 1995 was 21,422 lb., based on a 50 year cycle. (Table 16; Appendix 3:Table 3.1)

AREA 24 - FISHERY HISTORY

AREA 24 (Figure 1)

Area 24 has supported more fishing than any other area on the coast (Table 2). To protect herring spawn grounds, the area was divided initially into two GEODUCK management areas, "inside" (24-A) and "outside" (24-B), in 1984. The inside areas, 24-A, were portions of 24 that supported herring spawn or herring fisheries. These areas were closed traditionally from Feb. 15 to April 15.

In 1985 an exploratory region, 24-C , "Exposed" was set to promote exploratory fishing in more exposed portions of area 24 that could not be fished until summer months. Traditionally all quotas had been reached early in the year so that the more exposed areas were not fished or explored.

In 1986 another management area was designated, 24-D, "Inlets" to promote further exploration in the inlets where there was great interest in siting salmon fish farms.

In total, 24 beds, 748 ha have been identified for the "Inside" and 19 beds, 1324 ha for the "Outside" areas (Figures 10 and 11). There were 14 beds, 123 ha for 24-C, Sydney Inlet and the "Exposed" area and 22 beds, 97 ha for 24-D, the "Inlets" (Figure 12).

Since 1989, with the introduction of the three year rotational fishery, Area 24 has continued to maintain an annual quota. This was initially set since there was a processing plant located in Tofino, many fishers lived in Tofino and the economy of Tofino benefited from the annual fishery. All geoducks are now shipped out live from Area 24 to plants in Vancouver.

The total landings from 17 years of fishing, 1978 to 1994 (inclusive), are estimated to be 11,381 tonnes (22.5 million lb.), including 1994 preliminary landings. To 1994 approximately 19% of the area 24 catch was missing from logbook bed analyses. The bed landings have been adjusted in Table 3.2 by a factor of 1.09 to

reflect this difference.

AREA 24 - QUOTAS AND RECOMMENDATIONS

AREA 24 TOTAL 1995: The total calculated quota for Area 24 , an annual fishery, was 414,251 lb. (Tables 12, 16; Appendix 3:Table 3.2.) This is a 50% decrease for Area 23 since the rotation years 1992-1993-1994, 565,000 lb.(Table 12).

Area 24 - Inside (Figure 10)

In 1994, for the first time, the "inside" area was subdivided into five geoduck management and quota units designated 24-A2, 24-A3, 24-A4, 24-A5 and 24-A6.

24-A1 Inside (Harbo et al, 1993)
redescribed in 1994

The designation 24-A1 will no longer be used; it was subdivided into 24-A4, A5 and A6 for the 1994 fishing season.

This was traditionally the major fishing area in the "inside" areas, a portion of subarea 24-6, subarea 24-7 and 24-9. Major grounds are Elbow Bank, Maurus Channel and Yellow Bank.

Fishers supported the recommendation that Elbow Bank and Yellow Bank be closed for the 1994 season and effort shifted to other portions, with new quotas in 1994 for Lemmens Inlet (24-A5) and Epper Pass-Morfee-Dunlap (24-A4). There was less quota allocated to the inside area than the "outside" in 1994.

24-A2 Inside Yarksis/Wickaninish (Figure 10)
4 beds, 233 ha estimated

This area, a portion of 24-8, had been heavily fished at Yarksis and north of Wickanninish. In the analysis for 1994 quotas scaled beds were included and some beds were remeasured.

The recommended quota for 1994 was 77,000 lb.; the option at 1.4 geoducks/m^2 over 233 ha was 76,602 lb. (Harbo et al, 1994).

In 1995, based on a 50 year fishery, 21 % of original stock has been harvested (Table 3.3), calculated with an assumed density of 1.4 geoducks/m^2.

RECOMMENDATION 24-A2: The calculated and set quota for 1995 was 65,441 lb. (Table 16; Appendix 3:Table 3.3)

24-A3 Inside Tonquin/Echachis (Figure 10)

1 bed, 110 ha estimated

There had been heavy fishing at only one site off Tonquin Island, a portion of 24-6.

The recommended quota for 1994 was 36,000 lb. , less than the annual calculated quota at 1.4 geoducks/m^2 over 110 ha for this area of 36,164 (Harbo et al, 1994).

According to 1995 calculations (Table 3.3) 10% of original stock has been harvested.

RECOMMENDATION 24-A3: The calculated quota for 1995 was 39,366 lb. (Tables 12,14; Appendix 3:Table 3.3). To allow for exploratory fishing, 30,000 lb of this quota was transferred to area 24C (Exposed/Sidney Inlet). The quota set for 1995 in area 24-A3 was 9366 lb.

24-A4 Inside Epper Pass-Dunlap Island (Figure 10)
9 beds, 122 ha estimated

This was a new designation for 24-A4, a separation of Yellow Bank and Elbow Bank. This area has been heavily fished; removals up to and including 1994 landings are estimated at 0.44 geoducks/m^2.

The 1994 recommended quota was 40,000 lb., approximately the calculated option (Harbo et al, 1994). Future fishing should be reduced or surveys undertaken.

RECOMMENDATION 24-A4: The calculated and set quota for 1995 was 22,410 lb. (Tables 16; Appendix 3:Table 3.3).

24-A5 Inside Lemmens Inlet (Figure 10)
3 beds, 101 ha estimated

This is a new designation for 1994, a separation from 24-A1. These beds have not been fished since 1989 due to "poor" quality relative to other beds in Area 24.

The area has been heavily fished in the past relative to the area assigned and average initial densities estimated at 1.4 geoducks/m^2 (Harbo et al, 1994).

RECOMMENDATION 24-A5: The calculated and set quota for 1995 was 27,722 lb. (Tables 16; Appendix 3:Table 3.3).

24-A6 Inside Yellow Bank-Elbow Bank (Figure 10)
7 beds, 182 ha estimated (1994)

This is a new designation for 1994, a separation from 24-A1. The areas for Elbow Bank and Yellow Bank were remeasured in 1993,

eliminating shallow grounds and reduced the bed areas ; Elbow Bank from 268 ha to 90 ha and Yellow Bank from 137 ha to 58 ha.

Harbo et al,(1994) estimated 41 to 58 years of quota have been landed at the two main sites (148 ha) sites. A closure was recommended in 1994.

Further analyses in 1994 indicates that 72% of original stock has been harvested form from 24-A6 and that removals are 1.00 geoducks/m^2 (Table 3.3).

RECOMMENDATION 24-A6: A continued closure was recommended for 1995 (Tables 16; Appendix 3:Table 3.3.).

Area 24 Outside (Figure 11)

In 1994, the "outside" area are subdivided into three quota units designated 24-B1, 24-B2 and 24-B3 and 24-B4.

24-B1 Outside portion of 24-6, (Figure 11)
13 beds, 564 ha estimated

There had been heavy fishing pressure at 6 of the 10 beds identified in a portion of subarea 24-6. A large bed at Hobbs Islet was reduced from 29 to 10 ha based on the historical landings over the area. In the analyses for 1994 quotas, all beds were included. However, some beds were scaled with landings criteria (Harbo et. al 1993) for reduced ha or remeasured.

The recommended quota for 1994 was 125,000 lb., reduced to compensate for high landings in the past years; the calculated annual option is 185,095 lb. . The analyses in 1993 found that at 1.4 geoducks/m^2 estimated original density, 34 years of quota had been landed. (Harbo et al, 1994)

Based on a projected 50 year fishery to harvest 50% of the original stock, 1994 analyses estimate that 39 % of available stock has been harvested in 16 years of fishing. Removals are estimated at 0.55 geoducks/m^2 (Table 3.3). Harvest of the remaining 61% of original stock over 34 years (50 yrs - 16 yrs) yields an annual quota of 58,412 lb.

RECOMMENDATION 24-B1: The calculated and set quota for 1995 was 58,412 lb. (Table 16, Appendix 3:Table 3.3).

24-B2 Outside Coomes Bank (Figure 11)
1 bed, 339 ha estimated

This is one large bed measured at 339 ha. It had supported a large fishery in excess of 1.9 million lb. adjusted landings (886 t) to the end of 1992.

To spread fishing effort over the 24-B outside area an annual quota was assigned to this bed in 1991. The annual quota for 1.4 geoducks /m^2 over 339 ha was 111,452 lb. (Harbo et al, 1994). The recommended quota for 1994 was 100,000 lb.

For 1995, an estimated 20% of original stock has been harvested over 16 years of fishing. Removals are estimated at 0.27 geoducks/m^2.

RECOMMENDATION 24-B2: The calculated and set quota for 1995 was 99,515 lb. (Table 16; Appendix 3:Table 3.3).

24-B3 Outside Ahousat (Figure 11)
3 beds, 237 ha (remeasured 1994)

A separate annual quota was recommended for 1991 to spread fishing effort throughout Area 24. A bed at Whitesand Cove which has been closed as a grey whale sanctuary was removed from area calculations (Harbo et al, 1994).

The quota recommended for 1994 was 50,000 lb.; this reduction was to compensate for heavy fishing to 1994, landing an estimated 29 years of quota if original densities were 1.4 geoducks /m^2 over 191 ha (Harbo et al,1994). This area was closed in 1993.

For 1995 quotas, based on a 50 year fishery to harvest 50% of original stock (Table 3.2) 26% of original stock has been harvested in 16 years of fishery. Removals are estimated at 0.36 geoducks/m^2. The remaining 24% of stock available for harvest yields an annual quota of 54,963 lb.

RECOMMENDATION 24-B3: The calculated and set quota for 1995 was 54,963 lb. (Table 16; Appendix 3:Table 3.3).

24-B4 Russell Channel (Figure 11)
1 bed, 184 ha estimated (1992)

Fishers were unable to attain the 75,000 lb. quota in Area 20 during the summer of 1991. The remaining quota from Area 20 of 72,129 lb. was assigned to Area 24-B4 in the fall of 1991. 24-B4 was closed in 1992 and opened in 1993 with a quota of 180,000 lb. (Harbo et al, 1994).

The quota recommended for 1994 was 50,000 lb., less than the annual calculated option of 60,493 lb.

For 1995 quota calculations, an estimated 22% of original stock has been harvested in 13 years of fishing, with estimated removals of 0.36 geoducks/m^2 (Table 3.3).

RECOMMENDATION 24-B4: The annual quota calculated for 1995 was 46,421 lb. (Table 16; Appendix 3:Table 3.3).

Area 24-C Exposed Area - Hesquiat Harbour subarea 24-1, exposed portions of subareas 24-8 and 124-3, Sydney Inlet 24-2 (Figure 12)
14 beds 123 ha (1994)

There have been five beds in the exposed areas, reported fished in the years 1985, 1986, 1989 and 1990 for 111,952 lb.(50.8 t) in total. Fishers report that there are very small fishing areas and they were only able to land 770 lb. in 1990. These beds should remain closed until further evaluation.

Sydney Inlet (subarea 24-2) was added to 24-C "Exposed" area in 1985 and with the exception of a closure in 1988, had been fished annually until 1990, for reported landings of 609,014 lb. (276 t) . There are 9 beds reported in Sydney Inlet, for a total of 98 ha. For 1994 analyses 2 beds were scaled with landing criteria (Harbo et al,1994). This area has remained closed since 1991. The total landings for Sydney Inlet and the exposed areas to 1990 was 720,966 lb. (327 t), adjusted to 785,853 lb.(356 t) in Table 3.2.

For 1995 quotas, 19% of the original stock has been harvested in 10 years of fishing. Removals are estimated at 0.27 geoducks/m^2. Fishers have had concerns in the past about apparent low densities in these beds, However in 1995 they requested an opportunity for an exploratory fishery once again. A quota of 30,000 lb. was set, transferred form area 24-A3.

RECOMMENDATION 24-C: The quota for 1995 was set at 30,000 lb. (Table 16; Appendix 3:Table 3.3)

Area 24-D Inlets (Figure 12)
22 beds, 96 ha

The "Inlet" areas were fished over the period 1985 to 1990, for landings of 578,111 lb.(262 t)(Harbo et al,1994) adjusted to 630,141 lb. (286 t) in Table 3.2. Most fishers have expressed concern that these areas have been overfished and they should remain closed until further evaluation.

Analyses for 1995 quotas indicate that 20% or more of original stock has been harvested in 9 years of fishing, with removals estimated at 0.28 geoducks/m^2. (Table 3.3).

RECOMMENDATION 24-D: Closure is recommended for 1995.
(Table 16; Appendix 3:Table 3.3)

AREA 27 - FISHERY HISTORY

AREA 27 (Figure 1)

Only minor landings were reported from Area 27 (<10 t) until 1985 when the fishery landed 1050 t. Up to and including 1984, the quota for Area 27 was combined with Area 26 and most of the effort was subsequently directed at Area 26.

In 1985, separate quotas were assigned to Area 27, and the area was divided into 27-A , Inlet subareas 27-7 to 27-11 and 27-B Exposed, 27-1 to 27-6 , an exploratory fishery with no quota (Fig. 11 to 13). This area included protected waters in 27-2, Winter Harbour and Forward Inlet. The fishery landed 953 t in this area before it was closed, Aug. 30,1985. Some portions of the area were closed earlier in June and July.

In 1986, Area 27 was divided into three portions, 27-A, subareas 27-2, 27-3, 27-7 to 27-11; 27-B, subareas 27-4 to 27-6 (Klaskino and Klaskish Inlets); and an exposed section described in-season from north of Kains Light to Cape Scott (27-2 portion, 27-1 and Cape Scott to Cape Sutil (12-14) (Fig. 14).

In 1988, the division of Area 27 remained the same but 300,000 lb. was set for 27-A Inside and 300,000 lb. for 27-B Outside-Inlets. No quota was set for the 27-C North Exposed area. Landings of 130 t were recorded for 27-C in 1988.

In 1989, a quota of 760,000 lb. was set for 27-A Inside, Subareas 27-2, 27-3 and 27-7 to 27-11 inclusive. This was for a three year rotation (a reduction from previous years)of the inside with 27-B Outside South to be fished in 1990 and 27-C in 1991. The fishery for 27-C North was delayed to 1992 for convenience of the fishers.

In 1992 Area 27 was divided into eight quota units, 27-A to 27-H to distribute effort and protect beds that have been heavily harvested in the past. The total quota was set at 676,378 lb. (307 t) based on a density of 2 geoducks/m2 and 770 ha. Landings for 1992 totalled 674,316 lb. (306 t) . The fishery was complicated by several closures for PSP. As a result, 273,622 lb. of quota was moved from 27-H (Klaskino Inlet) late in the season to portions of area 24 (24-A, 24-B2 and 24-B3). An exploratory quota was set in area 27-G, exposed portions of 27-1 and 27-2, but fishers were unable to locate stock and the quota was moved to area 23. (Harbo et al,1993).

AREA 27-1995 QUOTAS AND RECOMMENDATIONS

AREA 27 TOTAL 1995-1996-1997: The total calculated quota for Area 27, for the three year period, is 477,698 lb. (Tables 12, 16; Appendix 3:Table 3.4.) This is a 29% decrease for Area 27 since the

rotation years 1992-1993-1994, 676,378 lb. (Table 12).

AREA 27-A Quatsino Sound Subarea 27-7 (Figure 13)
7 beds ,112 ha

This area has been fished since 1985 with high removals at two (Nordstom Cove and Bedwell Island) of the four beds on the north shore.

Koprino Harbour has lots of bark on the bottom from log booms, no opportunity for fishing. The 1992 fishery was restricted to the south shore of subarea 27-7 only, with a quota of 100,000 lb. for the beds opened in 1992 (Harbo et al, 1993). Contaminated areas need to be identified.

From the 1992 fishery one new bed was described (1 ha). Landing criteria was used to scale some existing beds. Analyses for 1995 quotas, based on a 50 year fishery show that 17% of original stock has been harvested in 10 years of fishing (using all beds). Removals are estimated at 0.24 geoduck/m^2. (Table 3.4)

RECOMMENDATION 27-A : The calculated and set quota for 1995 for all beds is 91,230 lb. (Table 16; Appendix 3:Table 3.4).

Area 27-B Cliffe Point to Lawn Point, a portion of 27-2 (Figure 13)
3 beds, 40 ha estimated (1994)

Three beds have been identified with landings of 120,000 lb. (54 t) up to and including 1992. This is an exposed portion of the coast with hard packed bottom and is likely difficult to fish, especially for small vessels. The 1992 quota was 50,000 lb. and most was landed from Gooding Cove (to be remeasured).

Analyses for 1995 quotas, based on a 50 year fishery, show that 12% of original stock has been harvested in 10 years of fishing. Removals are estimated at 0.16 geoducks/m^2. (Table 3.4)

RECOMMENDATION 27-B: The calculated and set quota for 1995 is 37,784 lb. (Table 16; Appendix 3:Table 3.4)

Area 27-C Forward Inlet Inside Kains Point to Montgomery Point (Figure 13)
3 beds, 126 ha

This area has been fished heavily since 1983, with a total of 1,269,614 lb. (573 t) reported; The 1992 analyses estimated landings were equal to 31 years of quota at 1% and an average density of 1.4 geoducks/m^2 . Bed removals are as high as 0.74 geoducks/m^2 over a 36 ha bed. Fishers reported large numbers of small clams, "juveniles". The fishery was closed in 1992, pending

reassessment. (Harbo et al, 1993).

Analyses for 1995 quotas, based on a 50 year fishery, show that 39% of original stock has been harvested in 10 years of fishing. Removals are estimated at 0.55 geoducks/m^2. (Table 3.4)

RECOMMENDATION 27-C: The calculated and set quota for 1995 was 34,035 lb. (Table 16; Appendix 3:Table 3.4).

Area 27-D Kains Island - entrance to Quatsino Sound, a portion of 27-2 (Figure 13)
2 beds, 46 ha

These two beds support a modest fishery. There are geoducks, but fishers report low densities and probably deep.

The 1992 quota set was 70,000 lb. Landings totalled 69,116 lb.
Analyses for 1995 quotas, based on a 50 year fishery, show that 14% of original stock has been harvested in 10 years of fishing. Removals are estimated at 0.20 geducks/m^2.(Table 3.4).

RECOMMENDATION 27-D: **The calculated and set quota for 1995 was 40,286 lb.** (Table 16; Appendix 3:Table 3.4).

Area 27-E San Josef Bay; portion of 27-2; (Figure 14)
1 bed, 110 ha

There has only been minor fishing, 262,681 lb. recorded over the two fishing years 1988 and 1992 (92-93-94 rotation).

San Josef Bay was opened in 1992 with a quota of 175,000 lb. This was set higher than the quota option (Harbo et al, 1993) to balance the west coast quotas and meet the management decision to reduce quotas by 15% in each of 1992 and 1993. There has been little fishing at this site relative to the area identified.

Analyses for 1995 quotas, based on a 50 year fishery, show that 10% of original stock has been harvested in 7 years since this area was first fished. Removals are estimated at 0.14 geducks/m^2. (Table 3.4).

RECOMMENDATION 27-E: The calculated and set quota for 1995 was 101,763 lb. (Table 16; Appendix 3:Table 3.4).

Area 27-F Sea Otter Cove; portion of 27-2 ; (Figure 14)
1 bed, 14 ha

This area was fished 14 days in 1988. Fishers advise that

there may be more stock at this site than identified to date. There may be beds in Sea Otter Cove north of Helen Islands.

Analyses for 1992 quotas estimated 23 years of quota (@ 2 geoducks/m^2) had been taken over the 14 ha charted from harvest logs. This area should have been closed in 1992. However, to balance the 1992-1993 quotas a quota of 50,000 lb. was set. (Harbo et al, 1993).

Analyses for 1995 quotas, based on a 50 year fishery, show that 55% of original stock has been harvested in 7 years since this area was first fished. Removals are estimated at 0.77 geducks/m^2. (Table 3.3). This exceeds the criteria of harvesting to levels estimated to be 50% of the original stock. Closure is recommended.

RECOMMENDATIONS 27-F: Closure in 1995. (Table 16; Appendix 3:Table 3.4)

Area 27-G Exploratory: 27-1, ptn. 27-2, Scott Is.(111) (Figure 14)

Fishers recommended an exploratory fishery in 1992, from north of Kains Islet to Cape Scott, for 130,000 lb. A decision to include Restless Bight was made in-season, July 1992 when the quota for Cliffe Point to Lawn Point (27-B) was reached, but no fishing had taken place in Restless Bight. No landings were made in 27-G in 1992; the quota was moved to Area 23-C.

RECOMMENDATION 27-G: An exploratory fishery at the Scott Islands has been proposed. The minimum set quota of 14,377 lb. would balance the number of licences on the west coast of Vancouver Island for 1995.

Area 27-H Klaskino Inlet, subarea 27-5; (Figure 15)
9 beds; 223 ha (1994)

This area was first fished in 1985 as part of an exploratory fishery. Over the 10 year period, 1985-1994, 1,381,744 lb. (627 t) have been landed.

In a 12 ha bed at Anchorage Island, there have been 214,237 lb. landed, a removal of 0.94 geoducks/m^2.

The 1992 quota set was 340,000 lb., greater than the quota option of 318,000 lb. Due to PSP closures in the fall of 1992 only 66,378 lb. of quota was landed; 275,000 lb. quota was deferred to the 1993 fishery. (Harbo et al, 1993).

Bed areas were reduced from 243 ha to 226 ha by scaling down of beds based on landings criteria in 1992 and to 223 ha in the

1994 analyses.

Analyses for 1995 quotas, based on a 50 year fishery, show that 24% of original stock has been harvested in 10 years. Removals are estimated at 0.34 geducks/m^2. (Table 3.4).

RECOMMENDATION 27-H: The calculated and set quota for 1995 was 142,133 lb. (Table 16; Appendix 3:Table 3.4).
Note: The bed at Side Bay, 28 ha, should be investigated. This is a large area with few removals.

Area 27-I Klaskish Inlet, subarea 27- 6; (Figure 15)
15 beds, 107 ha
(13 beds, 101 ha -1992)

This area was combined with Klaskino in the past. In 1985, 194,950 lb. were recorded on logs. In 1990 there were 376,773 lb.

In 6 seasons, over a 10 year period, in a small 6 ha bed, at mouth of Klaskish Basin, 247,898 lb. were recorded; a removal of 2.17 geoducks/m^2. In a 3 ha bed, there were recorded landings of 119,487 lb. or 2.09 geoducks/m^2 removed.

This area should have been closed in 1992. However a management decision was made to reduce the 1992 and 1993 quotas by 15% each year and a fishery quota of 165,000 lb. was set. At the quota options for 1992, an estimated 22 years of quota had been taken (Harbo et al,1993).

The high removal rate suggests that there may be high densities in this area but the beds need to reevaluated for area (ha.). An original density of 6.14 geoducks/m^2 over 107 ha (Table 11) would be required to support the fishing to 1995.

Analyses for 1995 quotas, based on a 50 year fishery, show that 44% of original stock has been harvested in 10 years. Removals are estimated at 0.61 geducks/m^2. (Table 3.4).

RECOMMENDATION 27-I: The calculated and set quota for 1995 was 16,130 lb. (Table 16; Appendix 3:Table 3.4).

DESCRIPTIONS OF 1995 SOUTH COAST GEODUCK MANAGEMENT AREAS:

WEST COAST VANCOUVER ISLAND-1995

AREA 23

Geoduck Management Area 23-A: Maggie River
Subarea 23-11 and that portion of 23-10 westerly of a line from Castle Islet to the northeast boundary of the Indian Reserve immediately to the north of Maggie River at latitude 48°59.9'N, longitude 125° 22'W.

Geoduck Management Area 23-B: Toquart Bay, Pipestem Inlet
A portion of 23-10 north and easterly of a line from Harris Point on Vancouver Island to the northeast boundary of the Indian Reserve immediately to the north of Maggie River at latitude 48° 59.9'N, longitude 125° 22'W.

Geoduck Management Area 23-C: Mayne Bay
Subarea 23-9 and a portion of 23-10 lying southerly of a line from Harris Point to the northeast boundary of the Indian Reserve immediately to the north of Maggie River at latitude 48°59.9'N, longitude 125°22'W and lying easterly of a line from the northeast boundary of the Indian Reserve immediately to the north of Maggie River at latitude 48°59.9'N, longitude 125°22'W to Castle Islet.

Geoduck Management Area 23-D: Pinkerton Islands
Portions of 23-8 and 23-6 described as: That portion of 23-8 north of a line from Lyall Point to the Hand Island light, thence to the Prideau Island light, thence Howard Point on Vancouver Island. That portion of 23-6 north and west of a line from Baeria Rocks light to Pill Point on Sedall Island.

Geoduck Management Area 23-E: Chain Group
Portions of 23-4, 23-5 and 23-6 described as: That portion of 23-4 northeasterly of a line from Nanat Islet to Foucault Bluff, and that portion of 23-5 north of a line from the unnamed point on the northern side of Marble Cove, Tzartus Island, to the most southern tip of Swiss Boy Island, thence to Baeria Rocks light. That portion of 23-6 south and east of a line from Baeria Rocks light to Pill Point.

AREA 24 - INSIDE AREAS

For the 1994 fishery and continuing in 1995, Area 24-A1 is no longer used and has been further divided, into 24-A4 and 24-A5, with bed closures in heavily fished areas of Yellow Bank and Elbow Bank 24-A6.

Geoduck Management Area 24-A2 : A portion of Subarea 24-8

Northern portion of Subarea 24-8; includes Yarksis and the northerly end of Wickaninnish Island described as: A portion of Subarea 24-8, northerly of a line from Moser Point, Vargas Island to the most northwesterly point of Wickaninnish Island, then easterly along the shore to the most eastern point of Wickaninnish Island near the beacon thence due east to Esowista Peninsula.

Geoduck Management Area 24-A3: Tonquin-Echachis-Wickaninnish

That portion of Subarea 24-8, Templar Channel south of a line from the most eastern point of Wickaninnish Island near the beacon, due east to Esowista Peninsula, and bounded on the west by a line from the most westerly point of Wickaninnish Island thence due south to the southerly boundary of 24-8.

Geoduck Management Area 24-A4: Epper Pass - Dunlap Island

That portion of subarea 24-6 bounded on the southeast by a line commencing at Robert Point thence to the northernmost point of Dunlap Island, thence to the southeast point of Morfee Island, thence following the shoreline west to the most southwesterly point of Morfee Island, thence True south to Vargas Island and bounder on the west by a straight line from a prominent unnamed point on Vancouver Island (at 49°13'60"N, 125°58'10"W) approximately 1/2 mile northwesterly of the westernmost point of Morfee Island, True south to 49°12'60"N, 125°58'10"W on Vargas Is.

That portion of 24-7 north of a line from Kraan Island to the northern tip of Saranac Island, southerly along the shoreline of Saranac Island to the most southerly point, thence to the most northerly headland of Ritchie Bay.

The intent is to move the fishery from the heavily fished beds at Yellow Bank and Elbow Bank to other beds in Epper Pass and the remainder of area 24-7.

Geoduck Management Area 24-A5: Lemmens Inlet:

Subarea 24-9.

Geoduck Management Area 24-A6: Elbow Bank-Yellow Bank

Elbow Bank: That portion of subarea 24-6 bounded on the west by a line from the most southwesterly point of Morfee Island due south to Vargas Island. Bounded on the north by a line from the most southern tip of Morfee Island to the most southern tip of Dunlap Island, thence due east to the shore of Meares Island.

Yellow Bank: That portion of 24-7 bounded on the north by a line from Kraan Island to the northernmost point of Saranac Island to Robert Point. Bounded on the east by a line from Robert Point to the southernmost point of Saranac Island to the northernmost headland of Ritchie Bay.

General Description: Beds in the vicinity of Elbow Bank, Marus Channel, and Yellow Bank are closed.

AREA 24-OUTSIDE AREAS

Geoduck Management Area 24-B1: A portion of Subarea 24-6

A portion of 24-6, bounded on the east by a line from a point on Vancouver Island (at 49°13'60"N, 125°58'10"W) approximately 1/2 mile northwesterly of the westernmost point of Morfee Island, then True south to an unnamed point on Vargas Island (at 49°12'60"N, 125°58'10"W); and lying southerly of a line from the light at the southeast tip of Morfee Island to a floating buoy, Y11, in Calmus Pass, thence to the light at Monks Islet, then northwesterly to intersect a line that runs due south from Kutcous Point for **one half (0.5) nautical mile** (at latitude 49°14.4'N, longitude 126°5.3'W).

General description: A portion of a bed on the north shore of Vargas Island, beds in the vicinity of Hobbs It., Blunden Island, Bartlett-Shot-Shag-Leeke Islands. (Note permanent closure in Ahous Bay).

Geoduck Management Area 24-B2: Calmus Pass/Coomes Bank

That portion of subarea 24-6 bounded on the east by a straight line from a prominent unnamed point on Vancouver Island (at 49°13.6'N, 125°58.1'W) (approximately 1/2 mile northwesterly of the westernmost point of Morfee Island) True south to 49°12.6'N, 125°58.1'W on Vargas Is. Lying westerly and northerly of a line from the Morfee Island Light to the floating buoy Y11 in Calmus Passage, thence to the light on Monk's Islet; thence northerly to a prominent unnamed point (at 49°14.5'N, 126°0.4'W) just south of the Chetarpe Indian Reserve.

Geoduck Management Area 24-B3: Outside-Ahousat

That portion of Subarea 24-4 lying southerly of a line from

Clifford Point to the northernmost point of McNeill Peninsula and that portion of Subarea 24-6, lying northerly of a line from a prominent unnamed point (at 49°14.5'N, 126°0.4'W) just south of the Chetarpe Indian Reserve, to McKinn Islets thence True north to Flores Island.

Geoduck Management Area 24-B4: Russell Channel

That portion of Subarea 24-6 bounded on the north by a line from a prominent unnamed point (at 49°14.5'N, 126°0.4'W) just south of the Chetarpe Indian Reserve, to McKinn Islets thence True north to Flores Island. Bounded on the east by a line from a prominent unnamed point (at 49°14.5'N, 126°0.4'W) just south of the Chetarpe Indian Reserve to Monks Island, and lying northerly of a line that runs due south from Kutcous Point for **one half (0.5) nautical mile** (at latitude 49° 14.4'N, longitude 126° 5.3'W), thence to Monks Island light.

Geoduck Management Area 24C: Sydney Inlet and Exposed Areas (Hesquiat Harbour, La Croix Group, entrance to Father Charles Channel)

Subareas 124-3, 24-1, 24-2, and that portion of Subarea 24-8, the entrance to Father Charles Channel, south and west of a line from Moser point on Vargus Island to the most westerly point of Wickanninish Island, thence due south to the subarea boundary.

AREA 27

Geoduck Management Area 27-A: Quatsino Sound

Subarea 27-7.

Geoduck Management Area 27-B: Cliffe Point to Kwakuitl Point

A portion of 27-2 described as: That portion of 27-2 easterly of a line from Cliffe Point to Kwakuitl Point on Vancouver Island.

Geoduck Management Area 27-C: Forward Inlet

Subarea 27-3.

Geoduck Management Area 27-D: Kains Island

A portion of 27-2 described as: Those waters of 27-2 bounded on the east by a line True north from Cliffe Point to the shore opposite; on the north by a line from Montgomery Point to Kains Point; on the west from Cape Parkins to Kains Island light, and on the south from Kains Island light to Cliffe Point.

Geoduck Management Area 27-E: San Josef Bay

A portion of 27-1 described as: Those waters of subarea 27-1 east of a line from Hanna Point southeasterly to the unnamed point at the southern entrance to San Josef Bay.

Geoduck Management Area 27-F: Sea Otter Cove

A portion of 27-1 described as: Inside or north of a line from Hanna Point to the most southerly point of Winifred Island, thence from the most westerly point of Winifred Island to the most northwesterly point of Cape Russell.

Geoduck Management Area 27-G: Outer exploratory and the Scott Islands

Portions of subareas 27-1 and 27-2 described as: That portion of 27-2 outside or westerly of a line from Kwakuitl Point to Kains Island light, thence to Cape Parkins, thence northwesterly along the shore of Vancouver Island to Topknot Point. That portion of 27-1 from Topknot Point north to the unnamed point at the southern entrance to San Josef Bay and that portion of 27-1 from the most northwesterly point of Cape Russell to the most southwesterly point of Cape Scott.

Including exploratory fishing in the Scott Islands, areas 127-3 and 111.

Geoduck Management Area 27-H: Klaskino Inlet

Subarea 27-5.

Geoduck Management Area 27-I: Klaskish Inlet

Subarea 27-6.

Table 3.1. Estimates of geoduck original stock, stock harvested and remaining stock to be harvested over the course of a 50 year fishery.

AREA : 23

Geoduck Management Area	# Beds	Estimated Bed Area to 1992 (ha)	Est. Original Stock (lb)	Reported Landings to 1992 (lb)	Adjusted [1] Landings (lb)	% Stock Harvested	% Stock Remaining '@ 1% Harvest Rate	Removals (#/m^2)	Remaining Years to Fish 50 - yrs fished	Adjusted Annual Quota (lb)	3 Year Rotational Quota (lb)
23A: Maggie River	6	157	5,160,747	1,624,087	1,944,032	38	12	0.53	34	18,716	56,148
23B: Toquart Bay	7	39	1,281,969	355,559	425,604	33	17	0.46	34	6,335	19,004
23C: Mayne Bay	9	124	4,076,004	1,046,797	1,253,016	31	19	0.43	34	23,088	69,263
23D: Pinkerton Is.	22	182	5,982,522	1,144,465	1,369,925	23	27	0.32	41	39,545	118,634
23E: Chain Group	14	90	2,958,390	991,169	1,186,429	40	10	0.56	41	7,141	21,422
Total:	**58**	**592**	**19,459,632**	**5,162,077**	**6,179,006**	**27**	**23**	**0.44**		**94,824**	**284,472**

[1] Adjusted Landings Factor: 1.197 (reported landings factored by landings reported on sales slips and not harvest logs, by statistical area.)

FORMUALS USED:

Original Stock = Ha X Est. biomass at 1.4 geoducks/m2

Landings = combination of logs, sales slips and validated landings

% Stock Harvested = Landings / Original Stock*100

% Stock Remaining = ((Original Stock X .01% harvest rate X 50 years) - Landings)/ Original Stock X 100

Years Remaining to Fish = 50 years - actual number of years the area has been fished

Adjusted Annual Quota based on % of harvestable stock remaining spread over the remaining years to fish a 50 cycle.

= % remaining X 1/yrs remaining X Original stock

Table 3.2 . Area 24 annual and cumulative landings (lb) by Geoduck Management Area, from harvest logs and validation logs to 1994.
Totals have been adjusted with a factor to account for landings missing from harvest logs but reported on sales slips up to 1992.

Geoduck Management Area Description (1995)	Subareas	Landings (lb) 1978 to 1990	1991	1992	Total to 1992	Adjusted Landings[1]	1993	1994	'1993-94 Total	Total Adjusted Landings[2] (lb)
24A1: Inside		4,948,719	150,862	313255	**5,412,836**	**5,899,991**	**389,555** *			
24A1: Inside was divided into A4, A5, A6 for the 1994 fishing season, see below:										
24A2: Yarksis/Wickaninish	n. ptn 24-8	1,196,748	69,561	70319	1,336,628	1,456,925	70,692	76,845	147,537	1,604,462
24A3: Tonquin-Echachis	s. ptn 24-8	210,268	10,554	28214	249,036	271,449	44,045	35,859	79,904	351,353
24A4: Epper-Dunlap	ptns 24-6,-7				945,480	1,030,573	194,778 *	40,250	235,028	1,265,601
24A5: Lemmens Inlet	24-9				628,100	684,629	clsd	32,796	32,796	717,425
24A6: Elbow-Yellow Bank	ptns 24-6,-7				3,757,349	4,095,510	194,778 *	clsd	194,778	4,290,288
24B1: Outside	ptn 24-6	5,734,063	361,235	275489	6,370,787	6,944,158	274,613	124,834	399,447	7,343,605
24B2: Coomes Bank	ptn 24-6	1,441,876	161,641	189238	1,792,755	1,954,103	134,129	99,885	234,014	2,188,117
24B3: Ahousat	ptns of 24-4, -6	1,544,562	88,717	179872	1,813,151	1,976,335	clsd	50,143	50,143	2,026,478
24B4: Russell Channel	ptn 24-6	911,841	73,610	clsd	985,451	1,074,142	182,598	49,816	232,414	1,306,556
24C: Exposed/Sidney Inlet	24-1,-2,ptns -6 and -8	720,966	clsd	clsd	720,966	785,853	clsd	clsd	0	785,853
24D: Inlets	24-3,-5,-10,-12,-13,-14	578,111	clsd	clsd	578,111	630,141	clsd	clsd	0	630,141
Annual Totals:		17,287,154	916,180	1056387	19,177,814	20,903,817	1,095,632	510,428	1,606,060	22,509,877

[1] Adjusted landings factored by logs: 1.09

[2] Total Adjusted Landings = Adjusted landings to 1992 plus validated landings for 1993 and 1994.

* 24A1 was divided in 1994, 1993 landings have been estimated for A4 and A6 for 1993, A5 was closed. Totals include A1 from 1990 to 1992, not for total 1992 or 1993, 1994.

Table 3.3 . Estimates of geoduck original stock, stock harvested and remaining stock to be harvested over the course of a 50 year fishery.

AREA 24: Fished 17 years to 1994 **DENSITY:** 1.4 GDK/M2

Geoduck Management Area	# Beds	Bed Area to 1992 (ha)	Est. Original Stock (lb)	Reported Landings to 1992 (lb)	Adjusted Landings to 1992 (lb)	Reported Landings 1993-1994 (lb)	Adjusted Landings to 1994 (lb)	(1994) % Stock Harvested	@ 1% Harvest % Stock Remaining	Removals (#/m^2)	Remaining Years to Fish 50 - yrs fished	Adjusted Annual Quota (lb)	1995 Recommended Quota (lb)
24A1													
24A2: Yarksis/Wickaninish	4	233	7,658,943	1,336,628	1,456,925	147,537	1,604,462	21	29	0.29	34	65,441	65,441
24A3: Tonquin-Echachis	1	110	3,615,810	249,036	271,449	79,904	351,353	10	40	0.14	37	39,366	9,366 *
24A4: Epper-Dunlap	9	122	4,010,262	945,480	1,030,573	235,028	1,265,601	32	18	0.44	33	22,410	22,410
24A5: Lemmens Inlet	3	101	3,319,971	628,100	684,629	32,796	717,425	22	28	0.30	34	27,722	27,722
24A6: Elbow-Yellow Bank	7	182	5,982,522	3,757,349	4,095,510	194,778	4,290,288	72	-22	1.00	33	0	0
Subtotal:	24	748	24,587,508	6,916,593	7,539,086	690,043	8,229,129	33	17			154,940	124,940
24B1: Outside	13	564	18,539,244	6,370,787	6,944,158	399,447	7,343,605	40	10	0.55	34	56,648	58,412
24B2: Coomes Bank	1	339	11,143,269	1,792,755	1,954,103	234,014	2,188,117	20	30	0.27	34	99,515	99,515
24B3: Ahousat	3	237	7,790,427	1,813,151	1,976,335	50,143	2,026,478	26	24	0.36	34	54,963	54,963
24B4: Russell Channel	1	184	6,048,264	985,451	1,074,142	232,414	1,306,556	22	28	0.30	37	46,421	46,421
Subtotal:	18	1324	43,521,204	10,962,144	11,948,737	916,018	12,864,755	30	20			257,547	259,311
24C: Exposed/Sidney Inlet	14	123	4,043,133	720,966	785,853		785,853	19	31	0.27	40	30,893	30,000 *
24D: Inlets	22	97	3,188,487	578,111	630,141		630,141	20	30	0.28	41	23,515	0
Total:	**78**	**2292**	**75,340,332**	**19,177,814**	**20,903,817**	**1,606,061**	**22,509,878**	30	20	0.42	**35**	**466,894**	**414,251**

Adjusted Landings Factor: 1.09 (reported landings (1994) factored by landings reported on sales slips and not harvest logs (1992), by statistical area.)

FORMULAS USED:

Original Stock = Ha X Est. biomass at 1.4 geoducks/m^2

Landings = combination of logs, sales slips and validated landings

% Stock Harvested = Landings / Original Stock*100

% Stock Remaining = ((Original Stock X .01% harvest rate X 50 years) - Landings)/ Original Stock X 100

Years Remaining to Fish = 50 years - actual number of years the area has been fished

Adjusted Annual Quota based on % of harvestable stock remaining spread over the remaining years to fish a 50 cycle.

= % remaining X 1/yrs remaining X Original stock

Adjusted landings (1994) = landings to 1992 adjusted by landings factor, then 1993,1994 validated landings added.

* Fishers recommended a reduction in Area 24A3 for 1995 and an exploratory fishery in 24C for 30,000 lb.

Table 3.4 . Estimates of geoduck original stock, stock harvested and remaining stock to be harvested over the course of a 50 year fishery.

AREA : 27

Geoduck Management Area	# Beds	Estimated Bed Area to 1992 (ha)	Est. Original Stock (lb)	Reported Landings to 1992 (lb)	Adjusted Landings (lb)	% Stock Harvested	% Stock Remaining @ 1% Harvest Rate	Removals (#/m^2)	Remaining Years to Fish 50 - yrs fished	Adjusted Annual Quota (lb)	3 Year Rotational Quota (lb)
27A: Quatsino Sd.	7	112	3,681,552	487,415	624,379	17	33	0.24	40	30,410	91,230
27B: Cliffe to Lawn Pt.	3	40	1,314,840	119,937	153,639	12	38	0.16	40	12,595	37,784
27C: Forward Inlet	3	126	4,141,746	1,262,352	1,617,073	39	11	0.55	40	11,345	34,035
27D: Kains Island	2	46	1,512,066	170,868	218,882	14	36	0.20	40	13,429	40,286
27E: San Josef Bay	1	110	3,615,810	272,684	349,308	10	40	0.14	43	33,921	101,763
27F: Sea Otter Cove	2	15	493,065	210,715	269,926	55	-5	0.77	43	0	0
27G: Outer Exploratory	0	0	0	0	0	0	-	-	-	-	14,337
27H: Klaskino Inlet	9	223	7,330,233	1,381,744	1,770,014	24	26	0.34	40	47,378	142,133
27I: Klaskish Inlet	15	107	3,517,197	1,204,946	1,543,536	44	6	0.61	40	5,377	16,130
TOTAL:	**42**	**779**	**25,606,509**	**5,110,661**	**6,546,757**	**26**	**24**			**154,453**	**477,698**

Adjusted Landings Factor: 1.281 (reported landings factored by landings reported on sales slips and not harvest logs, by statistical area.)

FORMULAS USED:

Original Stock = Ha X Est. biomass at 1.4 geoducks/m2

Landings = combination of logs, sales slips and validated landings

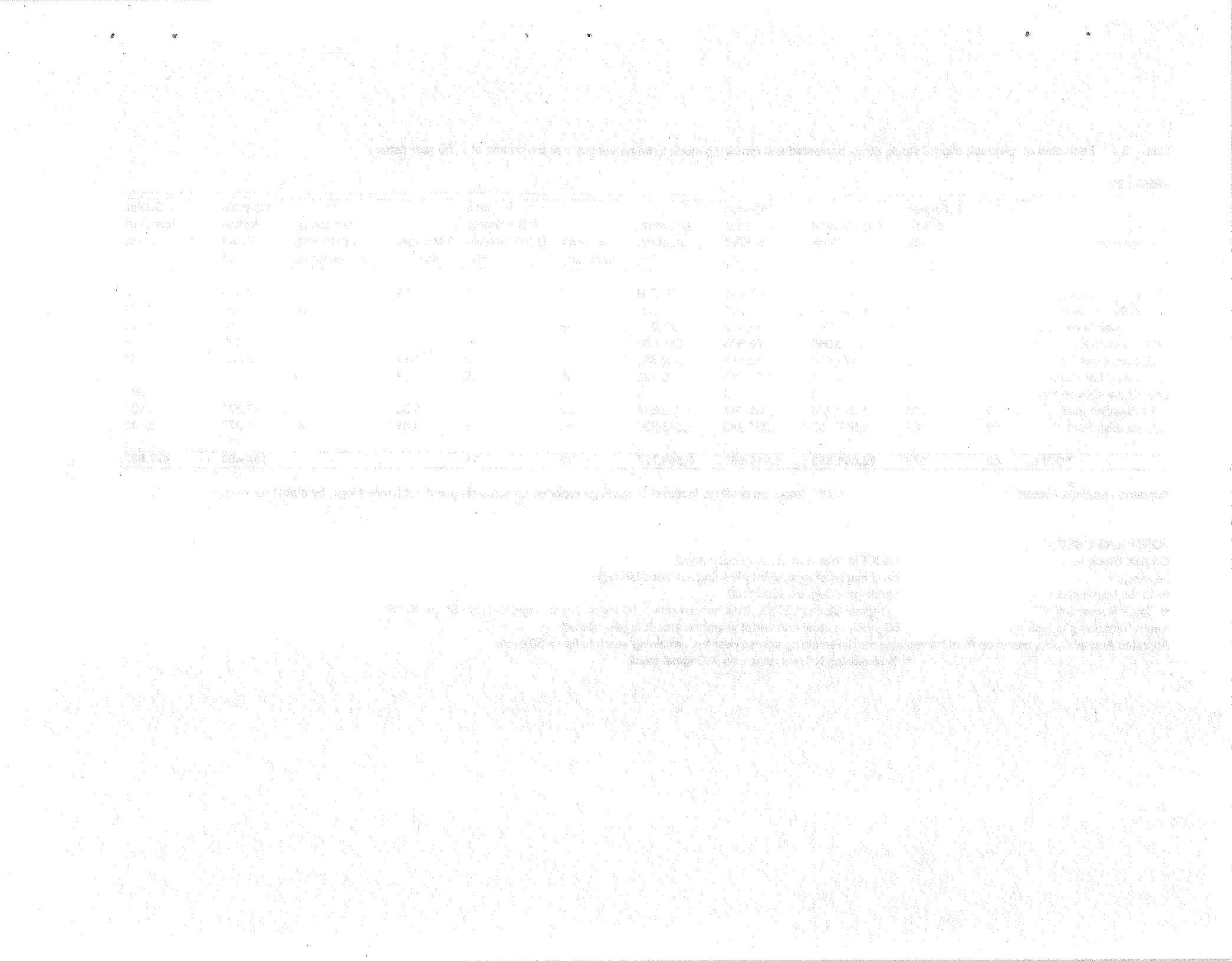
% Stock Harvested = Landings / Original Stock*100

% Stock Remaining = ((Original Stock (SST) X .01% harvest rate X 50 years) - Landings)/Original Stock X 100

Years Remaining to Fish = 50 years - actual number of years the area has been fished

Adjusted Annual Quota based on % of harvestable stock remaining spread over the remaining years to fish a 50 cycle.

= % remaining X 1/yrs remaining X Original stock



APPENDIX 4.

1995 GEODUCK MANAGEMENT AREAS AND QUOTA RECOMMENDATIONS FOR THE NORTH COAST OF BRITISH COLUMBIA

In 1995, the North Coast geoduck fishery will be occur in the same portion of the Central Coast district fished in the previous cycle year, 1992. The total recommended quota of 1143 t. (2,520,900 lb.) is apportioned between a greater number of management areas than in the previous cycle (37 in 1995; 24 in 1992) in order to disperse fishing effort and protect potentially overharvested fishing locations. In some locations, geoduck beds have been regrouped and management area boundaries have been modified. As in 1992, the management areas are grouped into four blocks (A through D), simply to facilitate inseason management of the fishery.

Management area quotas were derived primarily from calculations based on a total harvestable area of 1065 ha. in 101 beds, and a mean density of 3.5 geoduck/m^2. In a limited number of locations, the recommended quota is less than the calculated estimate of yield because of excessive removals in past fisheries. Two recently-surveyed locations have been removed from the harvest plan, based on fishers advice that the beds were relatively unproductive. Additional catch has been provided in a number of areas in which there is some evidence of increased harvest potential.

BLOCK A: (Figures 17 to 20)

Areas A1 to A3; McMullin Group, Tribal Group and Admiral Group - Subarea 7-18 (7 beds, 69 ha.)

Subarea 7-18 has been fished in 6 years over the period 1981 to 1992. The 7 beds identified in harvest logs are dispersed over the discrete island groups that make up the area. Most of the landings to date have been made in the McMullin Group and the Tribal Group. Only one new bed was identified in harvest logs in 1992; however, fishers stated there was undocumented exploration in the lower portion of the McMullin Group. The apparent increase in quota from 131,000 lb. in 1992 to 170,154 lb. in 1995 results from a recombination of management areas with those of the McNaughton Group. **For 1995, it is recommended the quota be divided between 3 management areas corresponding to island groups as follows:**

A1: McMullin Group	**120,834 lb.**
A2: Tribal Group	**22,194 lb.**
A3: Admiral Group	**27,126 lb.**

Areas A4 to A6; McNaughton Group, Prince Group and Simonds Group - portion of Subarea 7-25 and lower 7-17
(9 beds, 115 ha.)

This area is characterized by a large number of small beds and fishermen have indicated there is potential for expansion of bed area. The area has been fairly recently explored with most landings

made in four years of fishing between 1987 and 1992. Of the 1.34 million lb. landed in this area, a major portion (60 %) has been taken from the series of beds in the Simonds Group. No new beds were identified in 1992. The apparent reduction in the quota of 283,590 lb. for 1995 from 1992 results from a recombination of management areas with those of the McMullin Group. **It is recommended the quota be divided between three management areas in 1995 as follows:**

A4: Prince Group	**9,864 lb.**
A5: McNaughton Group	**167,688 lb.**
A6: Simonds Group	**106,038 lb.**

Areas A7 and A8; Goose Island - Portion of Subarea 7-25
(2 beds, 20 ha.)

Minor landings were first made in Goose Island in 1989 and a 50,000 lb. exploratory quota was fished in 1992. During the most recent fishery, new beds were identified in harvest logs at the northern end and along the eastern shore of the island. The calculated quota for 1995 is equal to the quota in 1992. **It is recommended the quota be divided between two management areas in 1995 as follows:**

A7: Goose Island North	**14,796 lb.**
A8: Goose Island South	**39,456 lb.**

Areas A9 to A11: Spider Island, Spider Anchorage and Kittyhawk Group - Subareas 7-27 and 7-28
(16 beds, 202 ha.)

Spider Anchorage has been a preferred fishing location since the inception of the fishery in the north coast. In excess of 3.1 million lb. of geoduck have been landed from this area since 1981. There is a trend in the fishery to move away from long established beds and, in 1992, substantial landings were made from one newly identified bed. The calculated quota for 1995 of 498,132 lb. is a slight increase from 1992. **It is recommended the quota be divided into three management areas as follows:**

A9: Spider Island	**36,990 lb.**
A10: Spider Anchorage	**451,278 lb.**
A11: Kittyhawk Group (ptn 7-27 and 7-28)	**9,864 lb.**

BLOCK B: (Figures 21 and 22)

Areas B1 to B3: Seaforth Channel, Mathieson/Moss, Ivory Island - Portion of Subarea 7-3 and Subareas 7-8, 9, 12, and 22
(10 beds, 54 ha.)

This area was first fished in 1986 with the focus of fishing in the vicinity of Ivory Island. Of the total of 580,013 lb. landed, 50 % has been taken from Ivory Island. In 1992, the fishery expanded to other portions of Seaforth Channel and Moss Passage, and a number of small new beds were identified. The total quota of 133,164 lb. for 1995 is a moderate increase from 1992. **It is recommended the quota be divided between three management areas:**

B1: Mathieson Channel/Moss Passage **19,728 lb.**
B2: Ivory Island **69,048 lb.**
B3: Seaforth Channel **44,388 lb.**

Areas B4 and B5: St. John Harbour, Cape Mark - Subarea 7-32
(2 beds, 69 ha.)

The fishery at Cape Mark has been intensive, focused on a large bed referred to as the "Bowling Alley". The area was closed in 1989 at the recommendation of fishers but reopened in 1992 with a conservative quota. Fishermen report good densities of geoduck remain in the area. **The recommended quota of 170,154 lb. remains unchanged from 1992, but should be divided between two management areas:**

B4: St. John Harbour **157,824 lb.**
B5: Cape Mark **12,330 lb.**

Area B6: Princess Alice Island - Subarea 7-20 and portion of 7-1
(1 bed, 3 ha.)

An exploratory quota of 20,000 lb. was fished in this area in 1992. One new bed was identified in harvest logs, but fishers and the ongrounds observer claim that other beds surveyed in the area were not documented. The calculated quota for the area equals only 7,398 lb.. **Based on the anecdotal information provided, it is recommended that the calculated quota be augmented by 14,190 lb. (equivalent to approximately 5.8 ha.) for a total of 21,588 lb..**

Area B7: Thompson Bay - Subareas 7-19 and 7-21
(2 beds, 21 ha.)

A total of only 108,000 lb. has been landed from Thompson Bay, primarily in 1989 and 1992. **The recommended quota of 51,786 lb. for 1995 is similar to 1992.**

Area B8: Joassa Ch./Raymond P. - Subareas 7-23 and 7-24
(2 beds, 4 ha.)

An exploratory quota of 50,000 lb. was fished in 1992. Fishermen have indicated that very little harvestable ground has been found and recommended no fishery for 1995. **Based on this recommendation, the area will be closed in 1995.**

BLOCK C: (Figures 16 and 17)

Areas C1 and C2: Nalua Pass, Stirling Is. West - Subarea 7-26 and portion of Subareas 7-27, 8-2, and 8-4
(10 beds, 86 ha.)

A total of 785,000 lb. has been taken from this area, primarily in fisheries since 1987. The bed area identified in logs was expanded slightly in 1992 resulting in an increase in total quota in 1995 to 212,076 lb.. **It is recommended the quota be divided between two management areas:**

C1: Stirling Island West **91,242 lb.**
C2: Nalau Island **120,834 lb.**

Area C3; Choked Pass - Portions of Subareas 8-1 and 8-2
(2 beds, 40 ha.)

Choked Pass has been intensively harvested in past fisheries, and was closed in 1989 to protect stocks. In 1992, a conservative catch ceiling of 148,000 lb. was applied to the area. In 1995, the original area (6 beds, 60 ha) was divided into Choked Pass and Hakia Pass (see C4) in order to disperse catch throughout the management area to protect heavily harvested beds. **The recommended quota for 1995 is 98,640 lb..**

Area C4; Hakai Pass - Portion of Subarea 8-2 and Subarea 8-3
(4 beds, 20 ha.)

A new geoduck management area for 1995, separated from the original Choked Pass area to disperse effort from some heavily harvested beds. **The recommended quota is 49,320 lb..**

Area C5; Fitzhugh Sound - Subareas 8-16 and 9-12
(1 bed, 2 ha.)

A 32,000 lb. exploratory quota was fished in 1992, but only a 2 ha. bed was identified in harvest logs and fishermen indicate harvestable area is limited. **The recommended quota in this area is 4,932 lb..**

Area C6; Rivers Inlet - Subareas 9-2 and 9-11 and portion of Subarea 9-1
(3 beds, 20 ha.)

Harvest logs indicate over 100,000 lb. has been landed from a bed at Open Bight in past fisheries, but no landings were made in this bed in 1992. Instead fishermen explored the area towards the head of Rivers Inlet and identified one new bed. **As a result, the recommended quota for 1995 is increased to 49,320 lb..**

Area C7; Calvert Island north - Portion of Subarea 9-1
(1 bed, 1 ha.)

A 50,000 lb. exploratory quota was applied to the area in 1992 but very little geoduck was taken and only a 1 ha. bed identified in harvest logs. **A minimal quota of 2,466 lb. is recommended for 1995.**

Area C8; Calvert Island south - Portion of Subarea 9-1 and Subareas 10-1 and 10-2
(2 beds, 16 ha.)

In 1989, more than 300,000 lb. was harvested from a 14 ha. bed at Cp. Calvert. In 1992, harvest was limited to approximately 40,000 lb. **A similar quota of 39,456 lb. is recommended again for 1995.**

Areas C8 and C9; Smith Inlet, North and South - Subareas 10-3 and 10-4
(5 beds, 19 ha.)

Harvest logs indicate approximately 170,000 lb. was taken in Smiths Inlet in 1986 and 1987, but no further harvest occurred until a 47,000 lb. quota was applied in 1992. Most of the harvest in 1992 occurred in the northern portion of the inlet where one new bed was identified. **As a result, it is recommended the quota for 1995 be increased to 56,718 lb., divided between two management areas:**

C9: Smith Inlet North	**46,854 lb.**
C10: Smith Inlet South	**9,864 lb.**

BLOCK D: (Figures 22 to 24)

Area D1; Laredo Channel - Portion of Subarea 6-10 and Subareas 6-11, 6-14, and 6-15
(6 beds, 73 ha.)

A total of 264,000 lb. has been harvested in Laredo Channel, most of this taken in 1990 and 1992 from a narrow bed along the northern tip of Aristazabal Island. Bed area identified in harvest logs was expanded in 1992 and fishermen indicate there are undocumented beds on the east shore of the channel. **The recommended quota is increased from 70,000 lb. in 1992 to 180,018 lb. in 1995.**

Area D2; Laredo Inlet - Subarea 6-19 and portion Subarea 6-16
(5 beds, 23 ha.)

A total of approximately 450,000 lb. has been taken from Laredo Inlet since 1988, most of this from a bed by Aitken Island. **In 1992, catch was limited to 56,718 lb., and the same quota is recommended for 1995.**

Area D3; Kitasu Bay - Subarea 6-18
(1 bed, 8 ha.)

Harvest log records are incomplete for the area, indicating a total harvest of only 15,000 lb.. No harvest logs with maps were submitted from the fishery in 1992 but 17,000 lb. of landings were validated. Anecdotal information from fishermen and preliminary evidence from a cooperative survey done in 1994 indicate a substantial harvestable base exists. Based on this information, a total quota for 1995 of 50,000 lb is recommended, of which 30,000 lb. (equivalent to approximately 12 ha.) is exploratory.

Area D4; Higgins Pass - Portions of Subarea 6-16 and 6-17
(3 beds, 122 ha.)

Higgins Pass has been heavily fished since 1985 and the area was closed in 1989 to protect stocks. In 1992, catch was limited to one-half the calculated yield and **this harvest level of 151,000 lb. is recommended again in 1995.**

Area D5; East Aristazabal Island North - Portion 6-16
(1 bed, 10 ha.)

A 50,000 lb. exploratory quota was fished in 1992 and 10 ha. harvestable area identified in harvest logs. **However, fishermen indicate the area contains little geoduck habitat and recommend no**

fishery for 1995.

Area D6; East Aristazabal Island South - Portions of 6-17 and 6-13 (1 bed, 11 ha.)

A large (200,000 lb.) exploratory quota was recommended for this area in 1992; however, only 100,000 lb. was landed. One fisher indicated inseason that no beds could be found but other fishers surveyed the area and identified 11 ha. of harvestable bed area. **A quota of 27,126 lb. is recommended. This area would be most effectively fished with the lower portion of Subarea 6-13.**

Area D7; West Price Island North - Portion Subarea 6-17
(1 bed, 6 ha.)

A total of 140,000 lb. has been reported on harvest logs for this area but only one small bed has been identified. **A quota of 14,796 lb. is recommended for 1995.**

Area D8; West Price Island South - Subarea 7-31
(2 beds, 26 ha.)

In only two years of fishing, 700,000 lb. has been harvested from the lower portion of west Price Island. Only 26 ha. of harvestable area has been identified in harvest logs; however, fishermen claim the harvestable area is substantially greater. **The recommended quota for the area is 64,116 lb..**

Area D9; Milbanke Sound - Portion Subarea 7-3
(3 beds, 33 ha.)

This area, which is the west shore of Milbanke Snd., was only recently fished and two of the three beds were identified in 1992. **The recommended quota for 1995 is 81,378 lb..**

NORTH COAST GEODUCK MANAGEMENT AREA DESCRIPTIONS - 1995

A1: McMullin Group
That portion of Subarea 7-18 west of a line from the northern tip of Goose Isl. to the most southeasterly tip of Stryker Isl..

A2: Tribal Group
That portion of Subarea 7-18 east of a line from the northern tip of Goose Isl. to the most southeasterly tip of Stryker Isl. and west of 128°17'5" longitude between Piddington Isl. and the southern Subarea boundary.

A3: Admiral Group
That portion of Subarea 7-18 east of 128°17'5" longitude between Piddington Isl. and the southern Subarea boundary.

A4: Prince Group
That portion of Subarea 7-25 east of 128°20' longitude, north of 51°59' latitude, and west of a line from Soulsby Pt. to Stubbs Pt. then to the northern most point of the McNaughton Group.

A5: McNaughton Group
That portion of Subarea 7-25 east of a line from Soulsby Pt. to Stubbs Pt. then to the northern most point of the McNaughton Group then following the western shore of the McNaughton Group to the southern most point then to Superstition Pt.; and that portion of Subarea 7-17 south of a line from German Pt. to Beak Pt..

A6: Simonds Group
That portion of Subarea 7-25 bounded on the west by the 128°20' line of longitude, in the north by the 51°59' line of latitude, and in the east by a line from Soulsby Pt. to Stubbs Pt. then to the northern most point to the McNaughton Group.

A7: Goose Island North
That portion of Subarea 7-25 north of 51°57' latitude and west of 128°20' longitude.

A8: Goose Island South
That portion of Subarea 7-25 south of 51°57' latitude and west of 128°20' longitude.

A9: Spider Island
That portion of Subarea 7-27 north of 51°50' latitude and west of Hurricane Isl..

A10: Spider Anchorage
That portion of Subarea 7-27 south of 51°50' latitude, including the areas known as Fulton Passage and Spider Anchorage, and west of 128°9'.

A11: Kittyhawk Group
All of Subarea 7-28 and that portion of Subarea 7-27 east of a line across the narrowest point in Spitfire Ch. between Hurricane Isl. and Hunter Isl., east of a line from the southern tip of Hurricane Isl. to the northern tip of Manley Isl., and north of a line from the most northeasterly point of Manley Isl. due east to 128°9' longitude.

B1: Mathieson Channel/Moss Passage
That portion of Subarea 7-9 north of a line from Schubert Pt. to Lang Pt., and that portion of Subarea 7-3 east of 128°30' longitude and north of a line bearing due west from Cross Pt..

B2: Ivory Island
All of Subarea 7-8 and that portion of Subarea 7-9 south of a line from Schubert Pt. to Lang Pt..

B3: Seaforth Channel
All of Subareas 7-12 and 7-22.

B4: St. John Harbour
That portion of Subarea 7-32 north of 52°10.8' latitude.

B5: Cape Mark
That portion of Subarea 7-32 south of 52°10.8' latitude.

B6: Princess Alice Island
All of Subarea 7-20 and that portion of Subarea 7-1 east of a line from Cp. Mark to Limit Isl..

B7: Thompson Bay
All of Subareas 7-19 and 7-21.

B8: Joassa Channel/Raymond Passage
All of Subareas 7-23 and 7-24.

C1: Sterling Island West
All of Subarea 7-26 and that portion of Subarea 7-27 east 128°9' longitude.

C2: Nalua Passage
All of Subarea 8-4 and that portion of Subarea 8-2 north of a line bearing 248° true from Koeye Pt. through Hakai Pass..

C3: Choked Passage
That portion of Subarea 8-1 south of a line bearing 248° true from Koeye Pt. through Hakai Passage, and that portion of Subarea 8-2 west of a line bearing 105° true from the Calvert Isl. shore to the southern tip of Starfish Isl. then following the western shore of Starfish Island north to the subarea boundary.

C4: Hakai Passage
All of Subarea 8-3 and that portion of Subarea 8-2 south of a line bearing 248° true from Koeye Pt. through Haikai Passage, and east of a line bearing 105° true from Calvert Isl. to the southern tip of Starfish Island.

C5: Fitzhugh Sound
All of Subareas 8-16 and 9-12.

C6: Rivers Inlet
All of Subareas 9-2 and 9-11 and that portion of Subarea 9-1 east of 127°50' longitude.

C7: Calvert Island North
That portion of Subarea 9-1 west of 127°50' longitude and north of a line running east from Harold Pt. to 127°50' longitude.

C8: Calvert Island South
That portion of Subareas 10-1 and 10-2 north of 51° 24' latitude, and that portion of Subarea 9-1 west of 127°50' longitude and south of a line running due east from Harold Pt. to 127°50' longitude.

C9: Smith Inlet North
That portion of Subareas 10-3 and 10-4 north of a line bearing due west from Barb Pt. to its intersection with the western boundary of Subarea 10-3 at 51°18' latitude.

C10: Smith Inlet South
That portion of Subareas 10-3 and 10-4 south of a line bearing due west from Barb Pt. to its intersection with the western boundary of Subarea 10-3 at 51°18' latitude.

D1: Laredo Channel
All of Subareas 6-11, 6-14, and 6-15, and that portion of Subarea 6-16 north of a line from Dallian Pt. to Tildesley Pt..

D2: Laredo Inlet
All of Subarea 6-19 and that portion of Subarea 6-16 east of line from Dallian Pt. to Wingate Pt..

D3: Kitasu Bay
All of Subarea 6-18.

D4: West Higgins Passage
That portion of Subarea 6-16 east of 128°50' longitude and south of a line from Wilby Pt. due west to 128°50' longitude; and that portion of Subarea 6-17 north of a line bearing due west from the Price Isl. shore through Jaffrey Rk..

D5: East Aristazabal Island North
That portion of Subarea 6-16 south of a line from Dallian Pt.

to Tildesley Pt. and west of 128°50' longitude.

D6: East Aristazabal Island South

That portion of Subarea 6-17 west of 128°50' longitude and that portion of Subarea 6-13 south of 52°27.6' latitude.

D7: West Price Island North

That portion of Subarea 6-17 east of 128°50' longitude, and south of a line bearing due west from the Price Isl. shore through Jaffrey Rk..

D8: West Price Island South

All of Subarea 7-31 and that portion of Subareas 7-1 and 7-2 north of 52°14.5' latitude.

D9: Milbanke Sound

That portion of Subarea 7-3 west of 128°30' longitude.

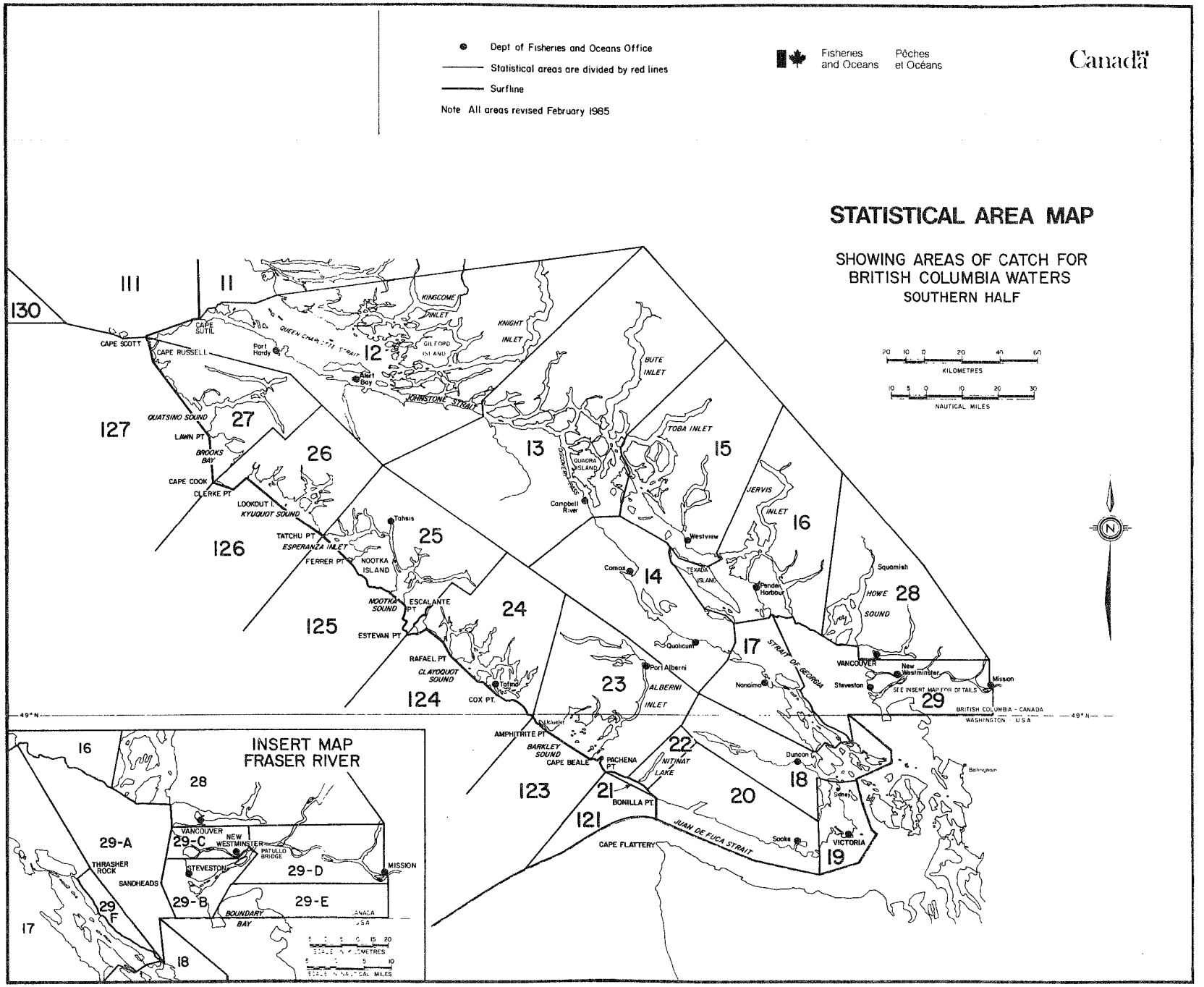


Figure 1. Pacific Fishery Management Areas, southern coast of British Columbia.

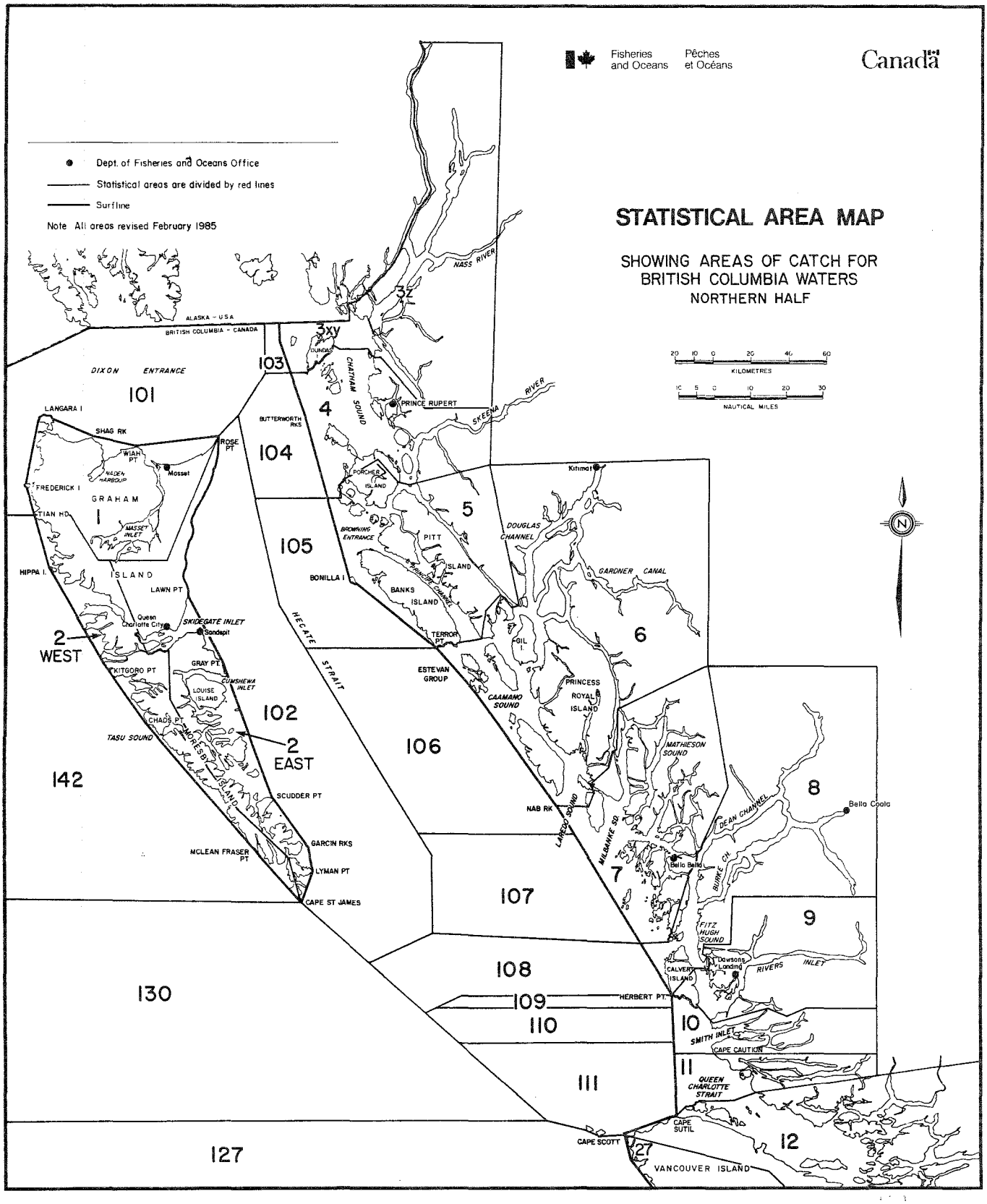
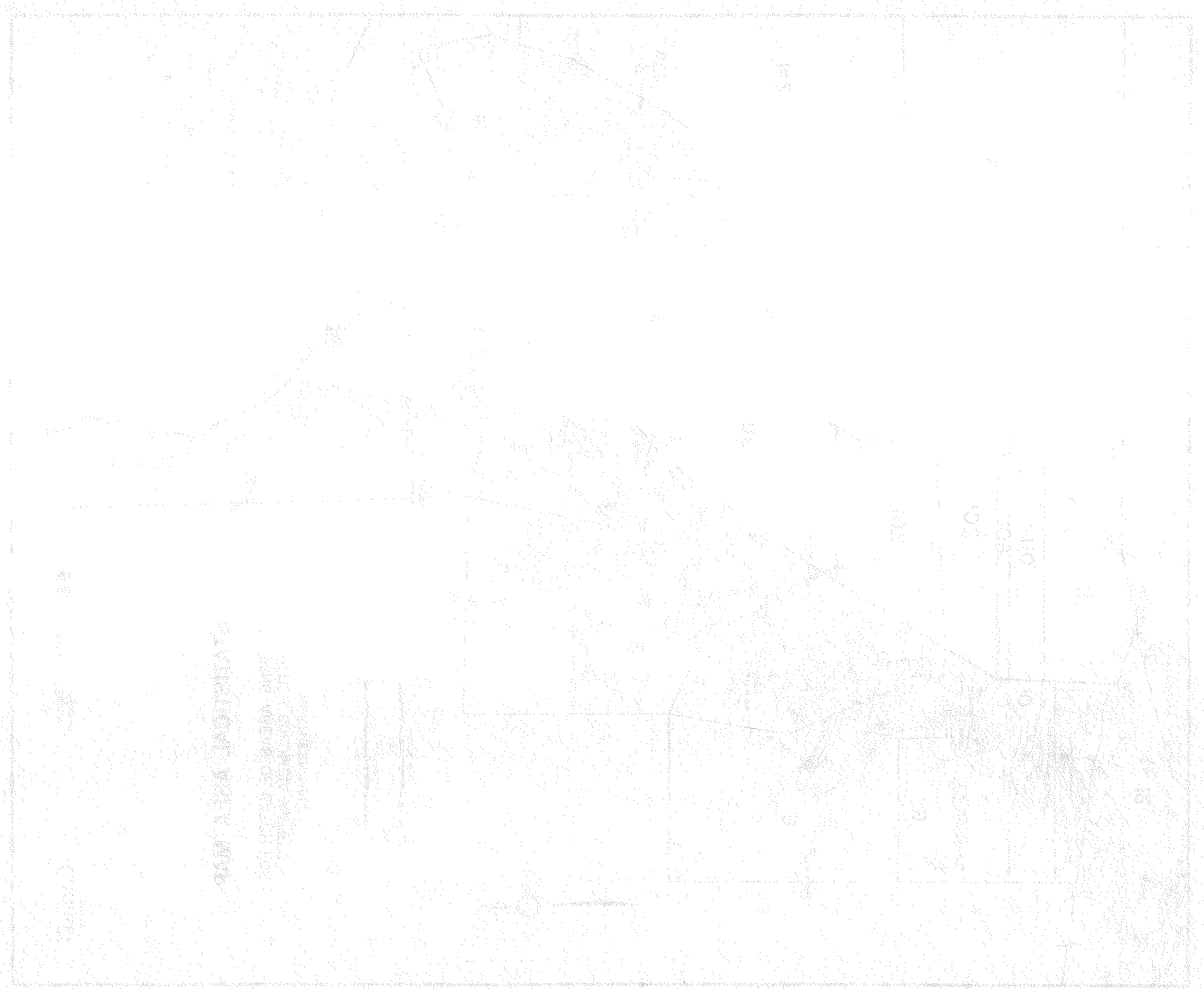


Figure 2. Pacific Fishery Management Areas, northern coast of British Columbia.



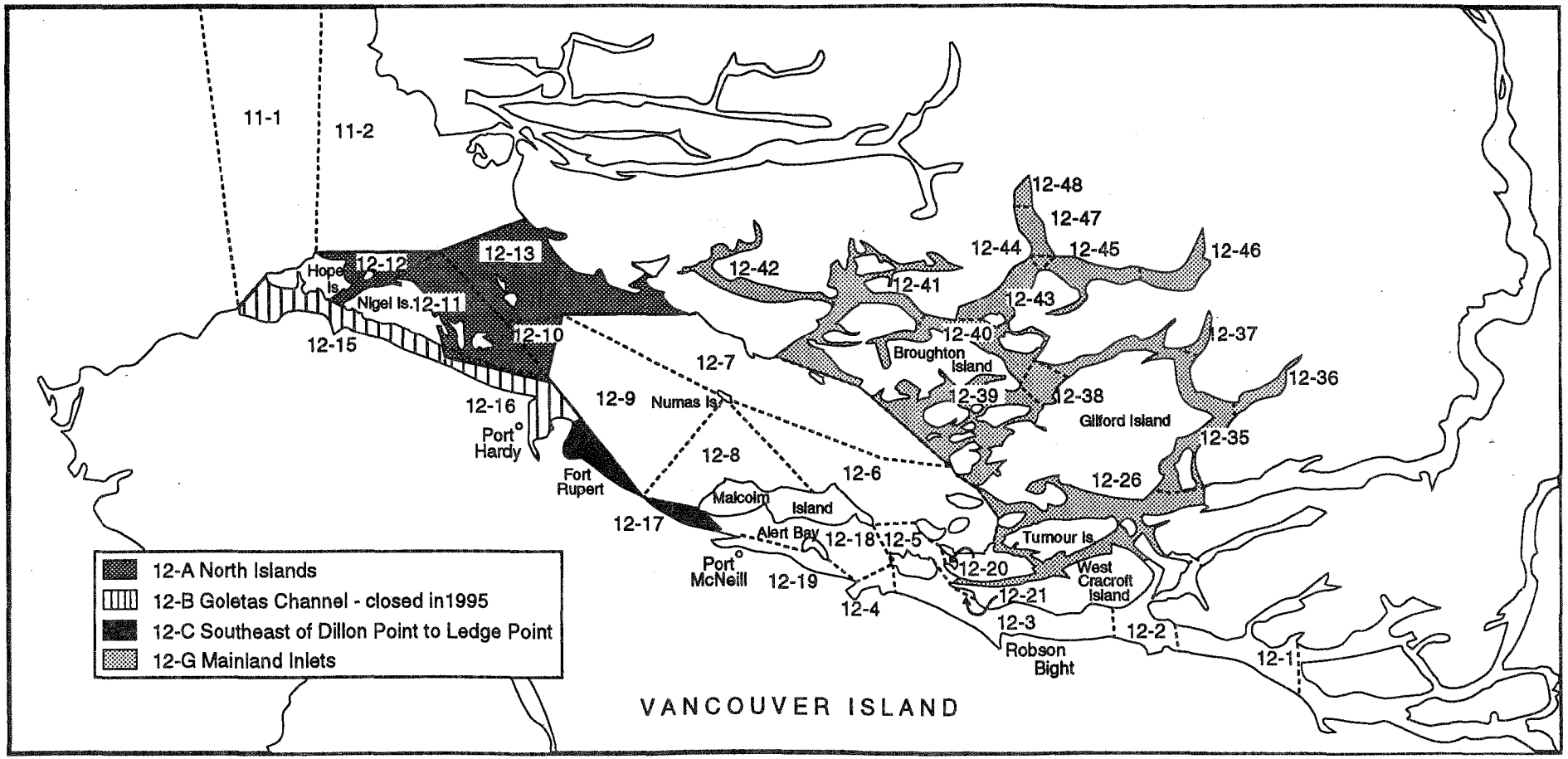


Figure 3. 1995 geoduck management areas 12-A, B, C, G: North Islands, Goletas Channel (closed in 1995), southeast of Dillon Point to Ledge Point, and the mainland inlets.

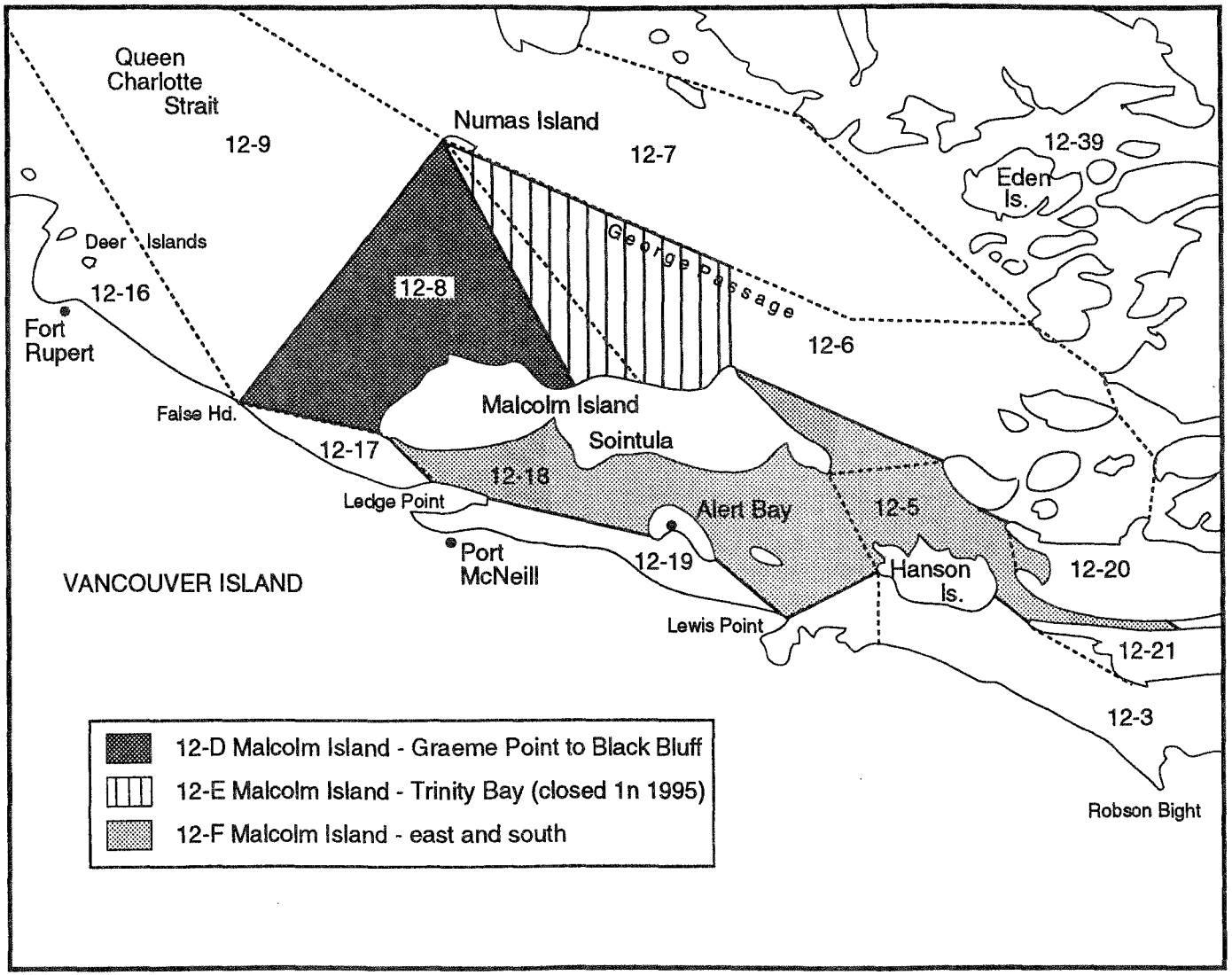
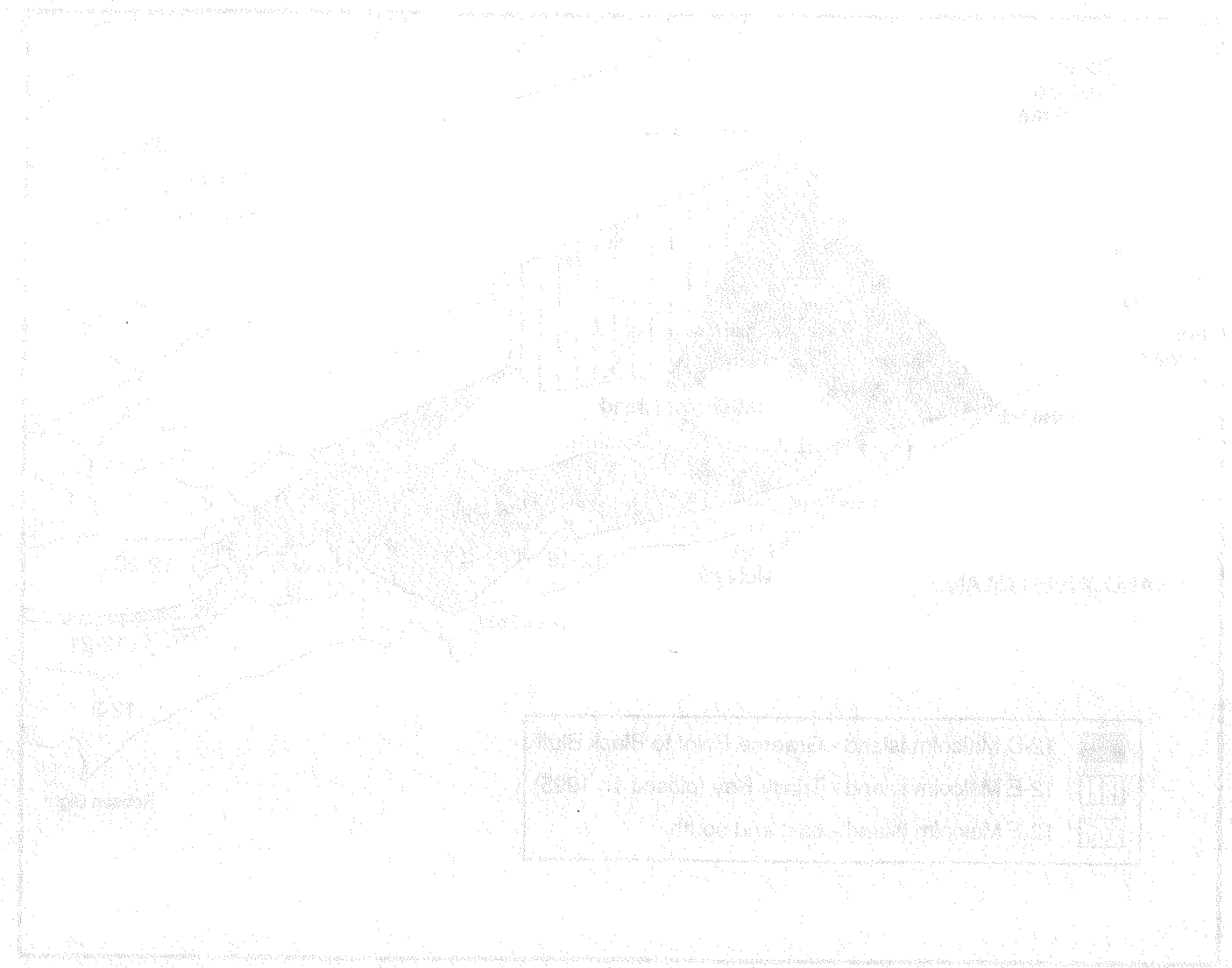


Figure 4. 1995 geoduck management areas: Areas12-D,12-E (closed in 1995) and 12-F: Malcolm Island area



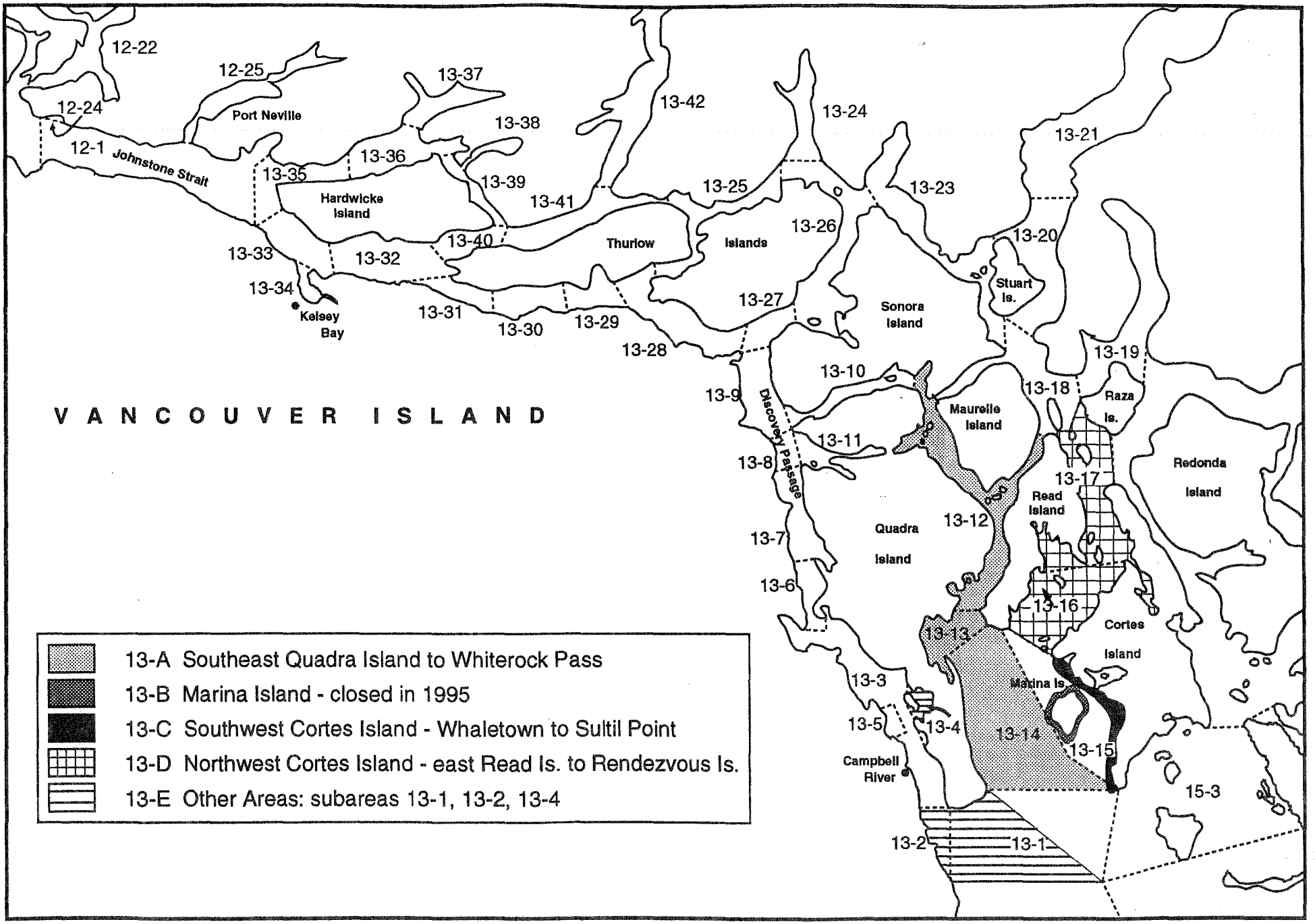


Figure 5. 1995 geoduck management areas 13-A, B, C, D, E: southeast Quadra Island to Whiterock Pass, Marina Island (closed in 1995), southwest Cortes Island - Whaletown to Sutil Point, northwest Cortes Island, east Read Island to Rendezvous Island, and other areas.

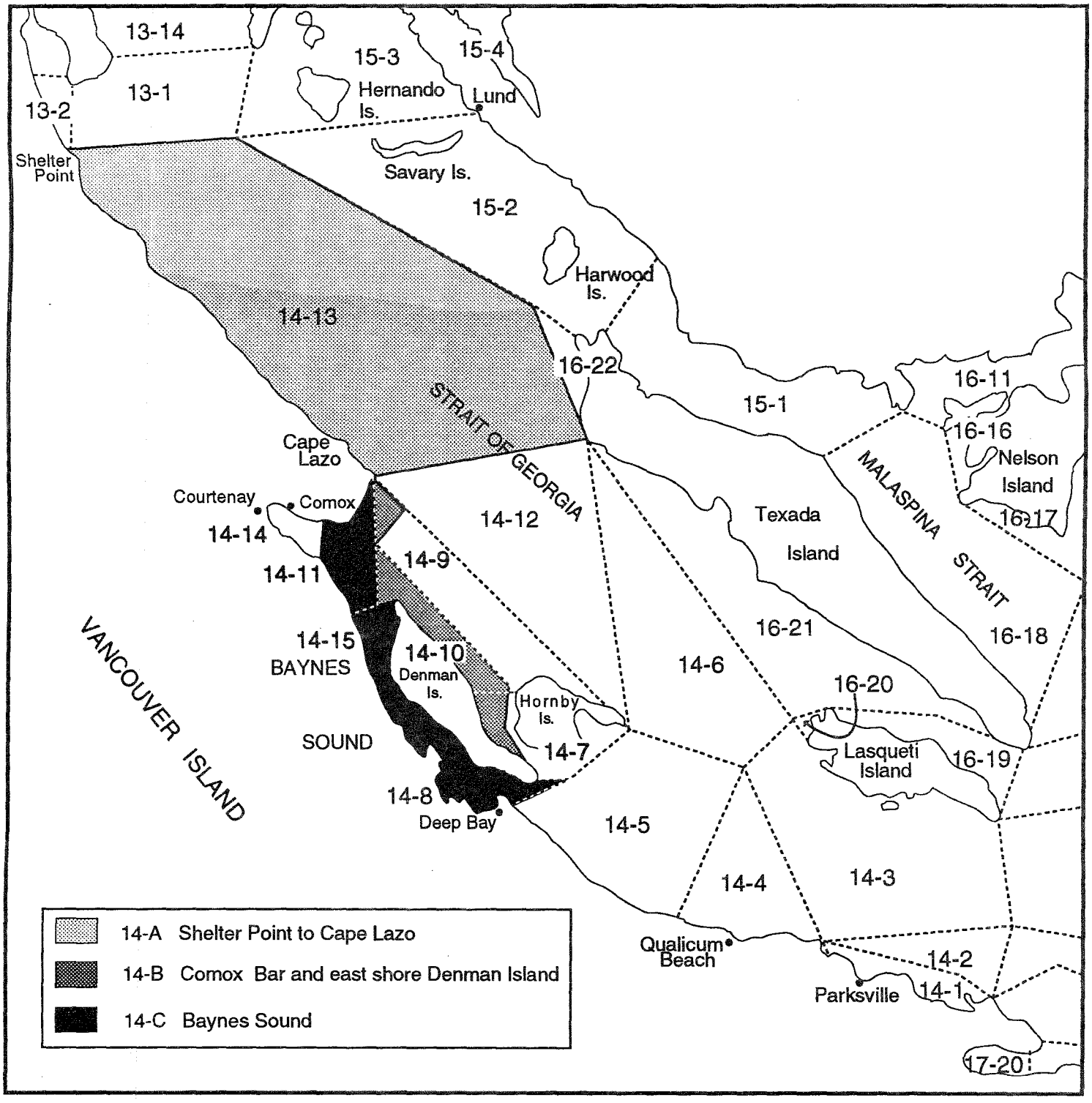
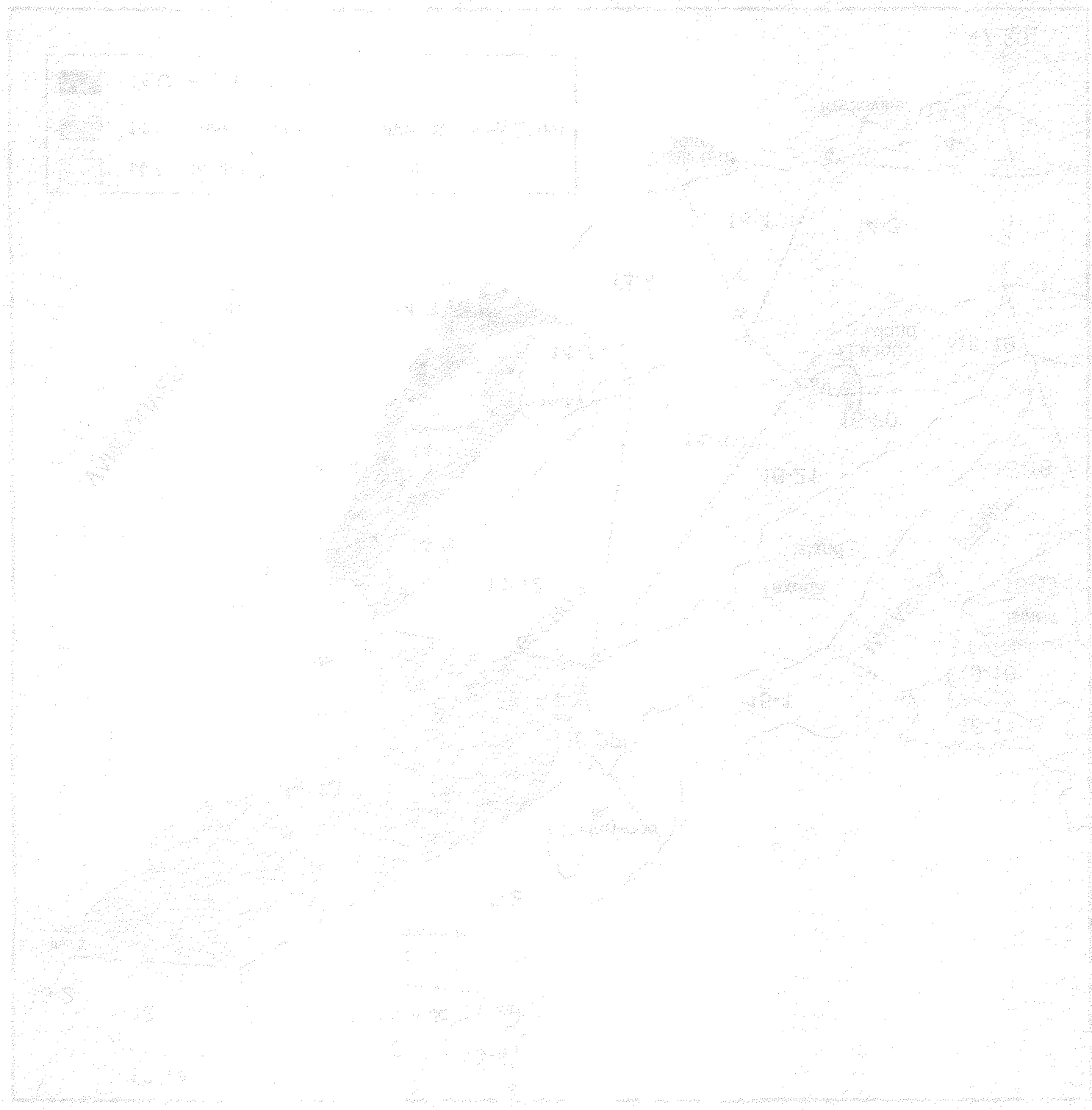


Figure 6 .1995 geoduck management areas: 14-A, B, C: Shelter Point to Cape Lazo, Comox Bar and east Denman Island, and Baynes Sound.



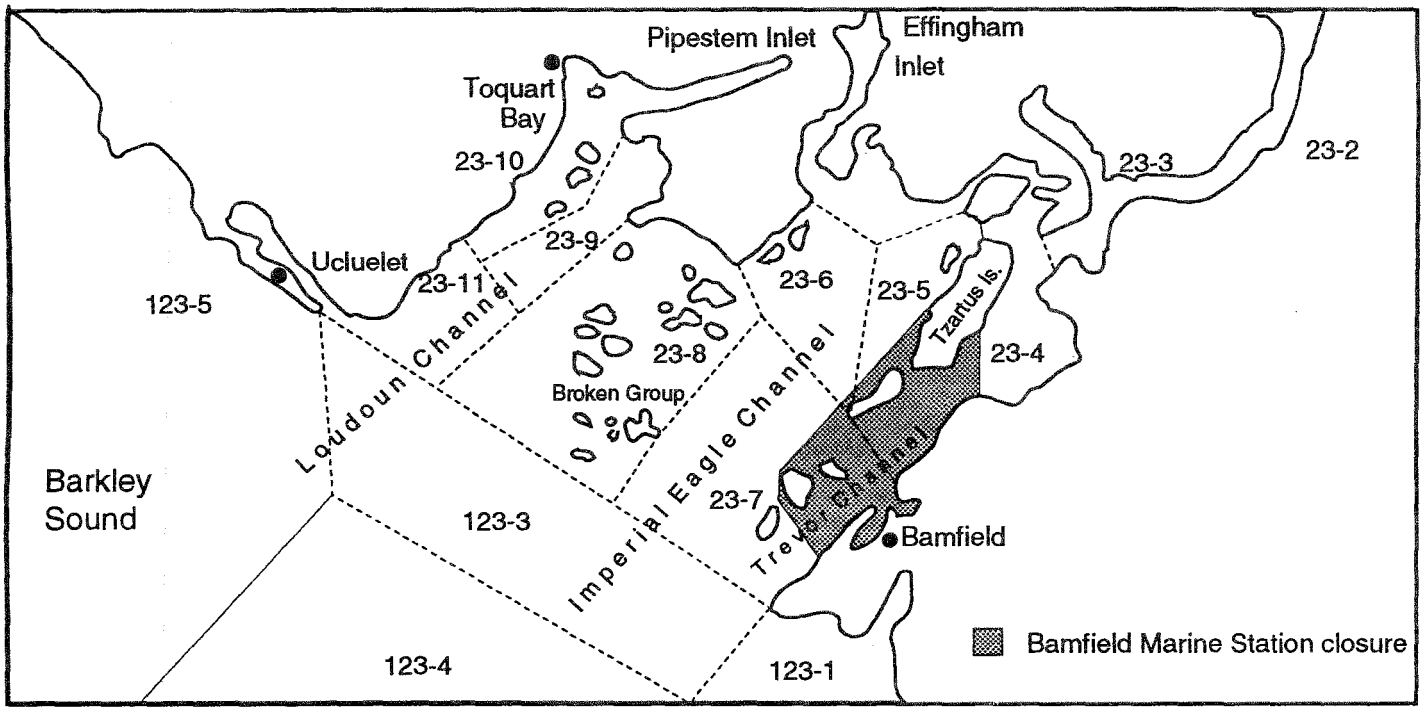


Figure 7. Area 23: Bamfield Marine study area closure: All of the waters of Pacific fishery Management area 23 bounded by a line commencing at the light at Whittlestone Point and running directly to the southern tip of Haines Island; from the northwestern tip of Haines Island to the southern tip of Seppings Island ; from the northwestern tip of Seppings Island to Kirby Point on Diana Island; from Kirby Point directly to the northwest tip of Fry Island; thence to the nearest adjacent point on Tsartus Island; from Foucault Bluff on Tsartus Island to the northwest tip of Nanat Island; from the eastern tip of Nanat Island to the nearest adjacent point on Vancouver Island and thence along the coastline of Vancouver Island to the point of commencement.

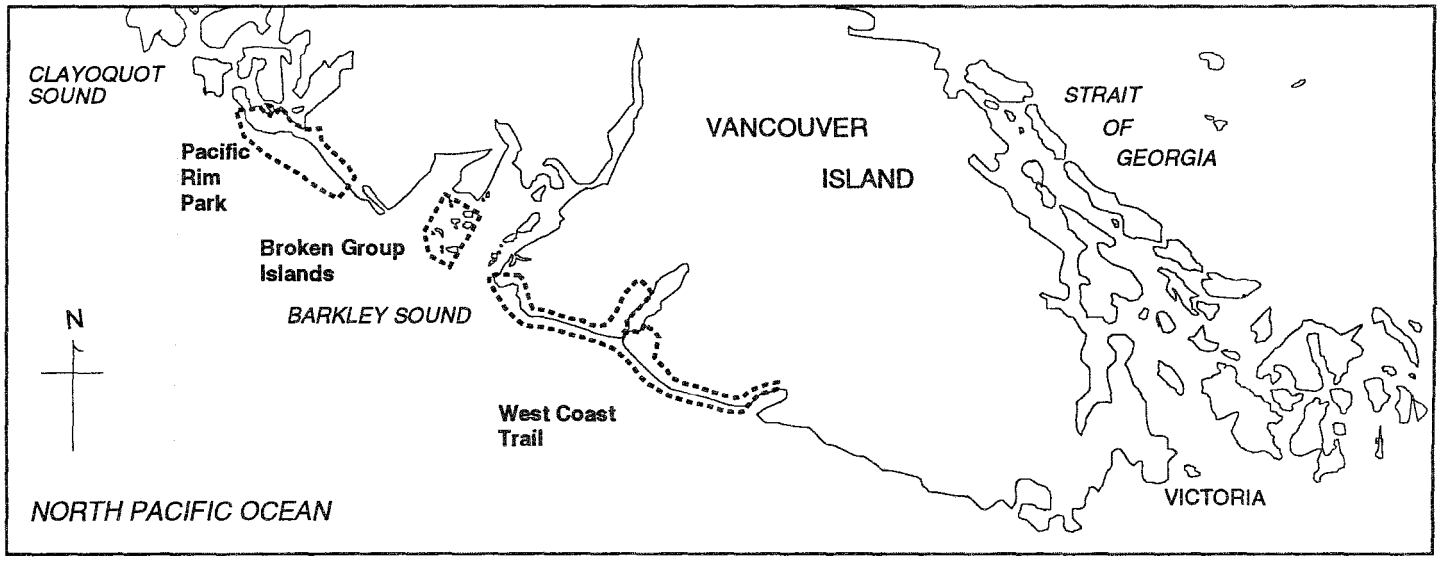
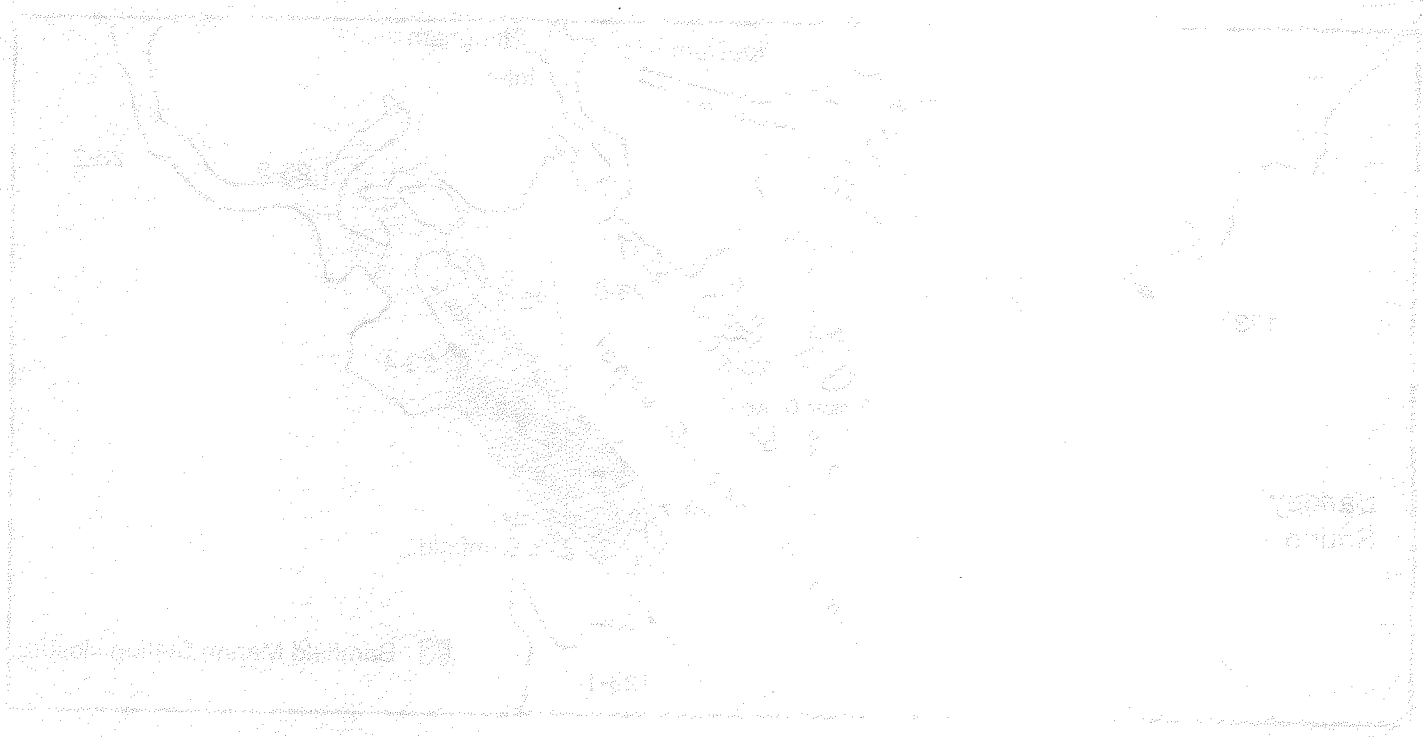


Figure 8. Area 23: Pacific Rim Park closure, including Broken Group Islands and the West Coast Trail. No geoduck stocks have been found in the Long Beach or West Coast trail sections of the park.



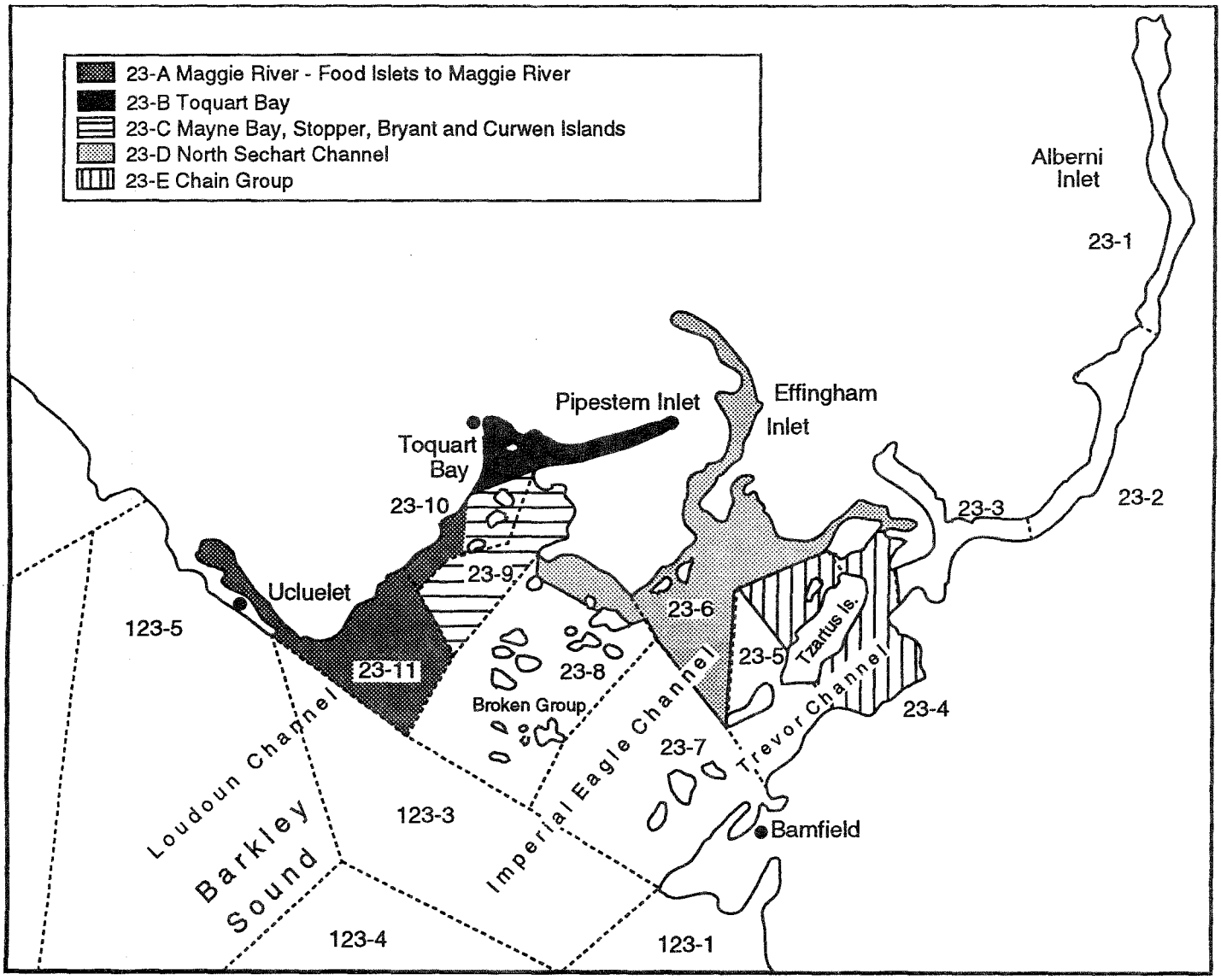


Figure 9. 1995 geoduck management areas: Area 23-A,B,C,D,E: Maggie River, Toquart Bay, Mayne Bay, North Sechart Channel and the Chain Group.

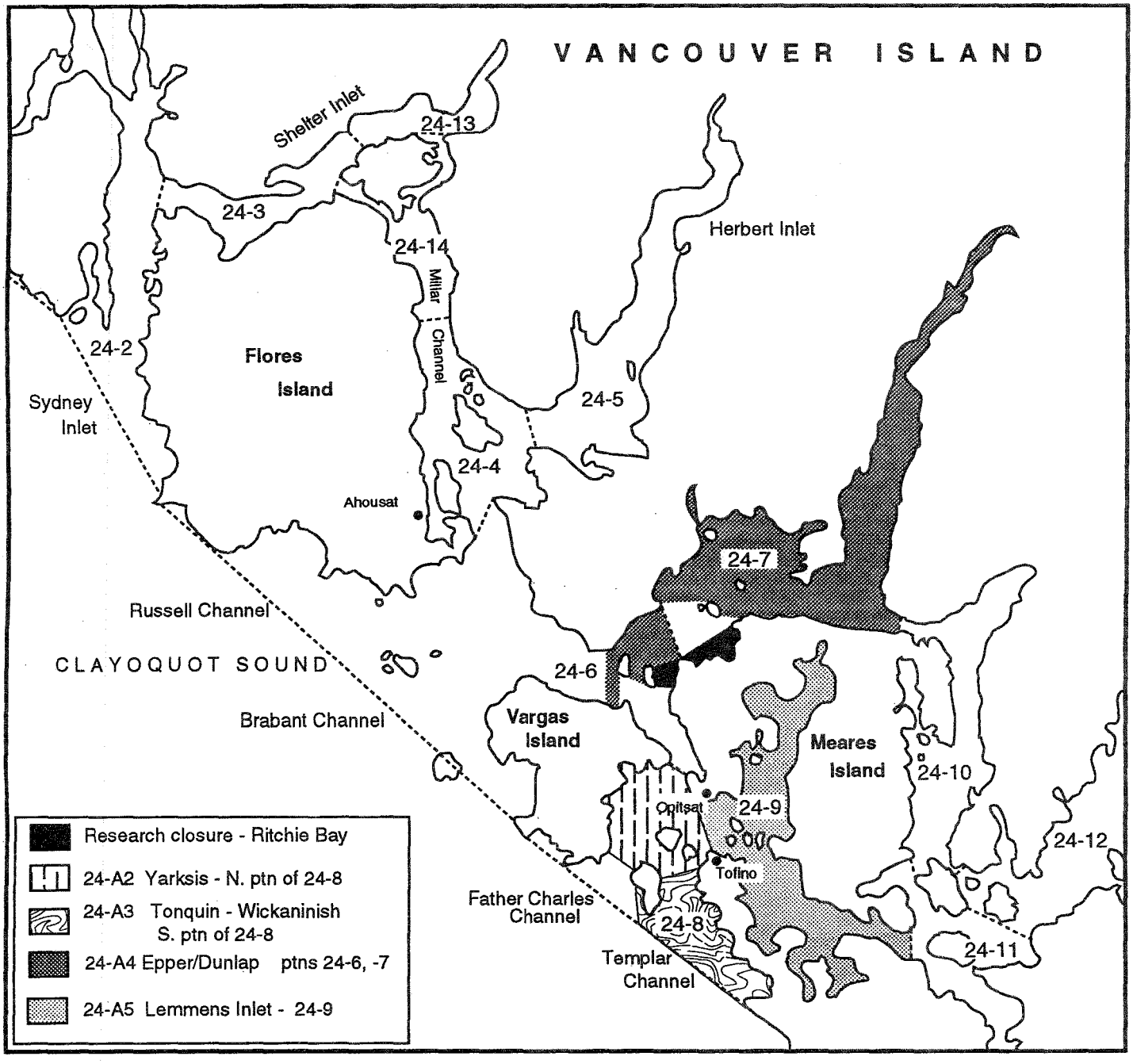


Figure 10. 1995 geoduck management areas: Area 24 Inside : 24-A2, 24-A3, 24-A4 and 24-A5.

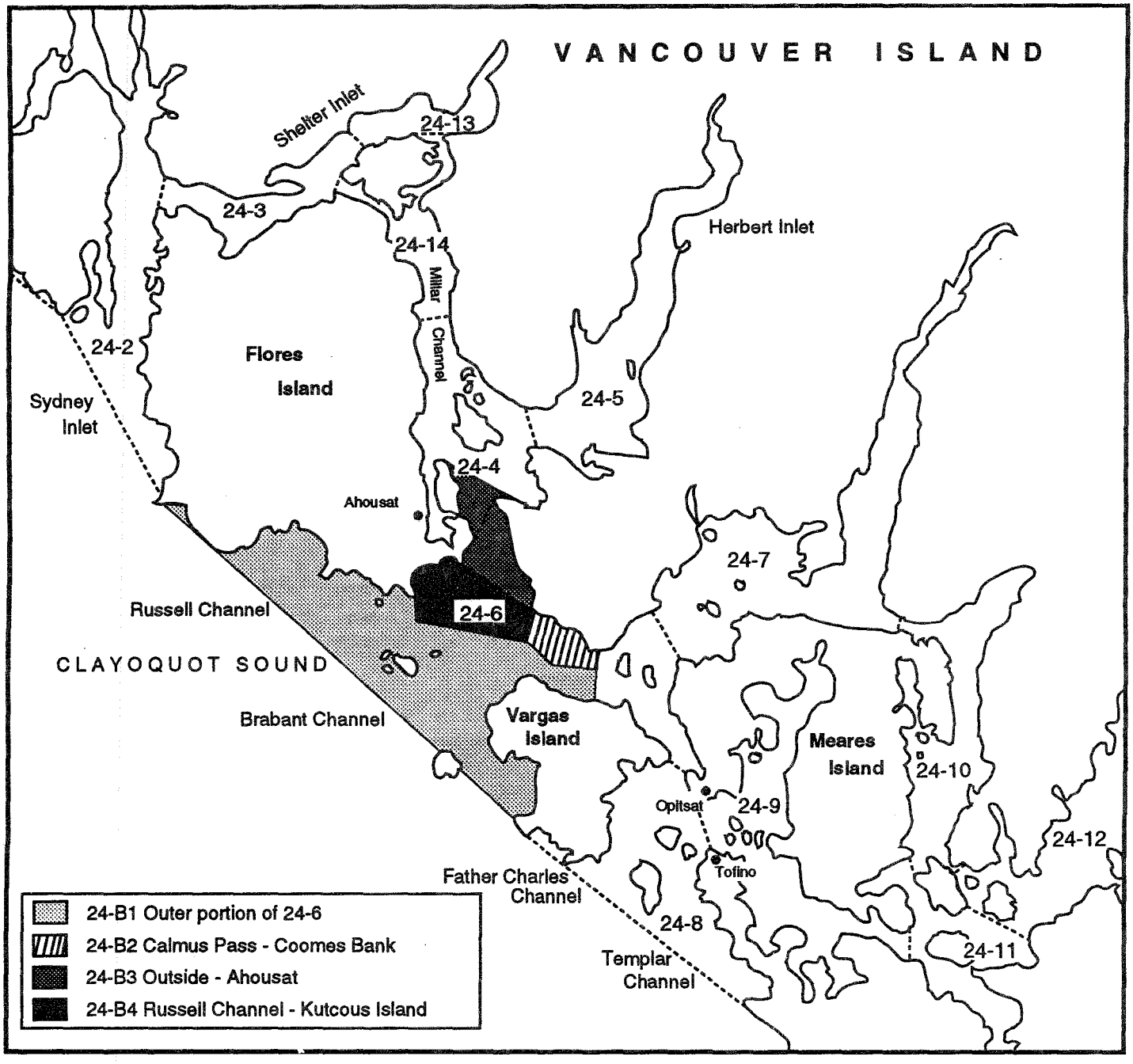


Figure 11. 1995 geoduck management areas: Area 24 Outside; 24-B1, 24-B2, 24-B3 and 24-B4.

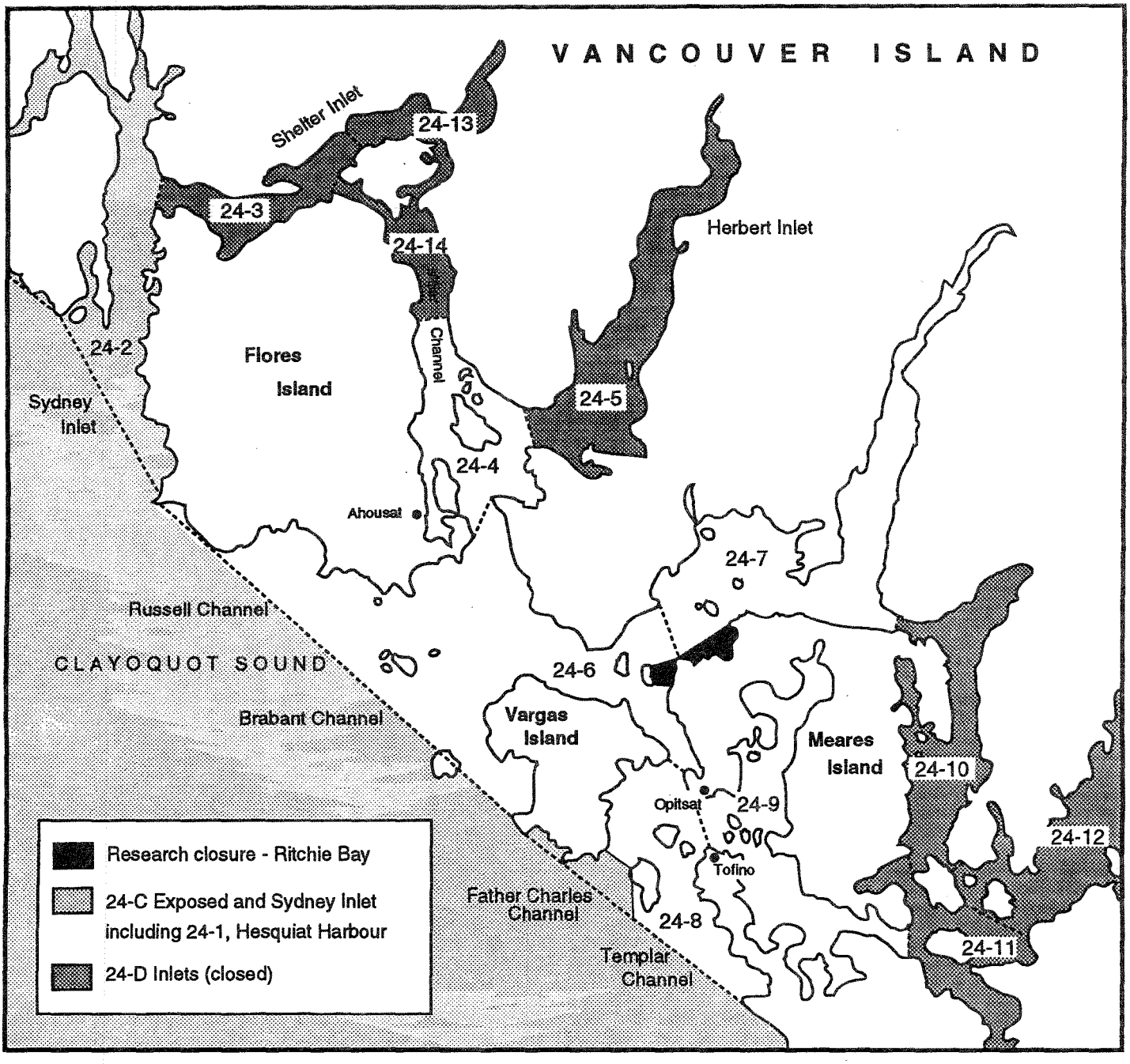


Figure 12. 1995 geoduck management areas: Area 24C - Exposed, Sydney Inlet and Hesquiat Harbour; Area 24-D - Inlets (closed).

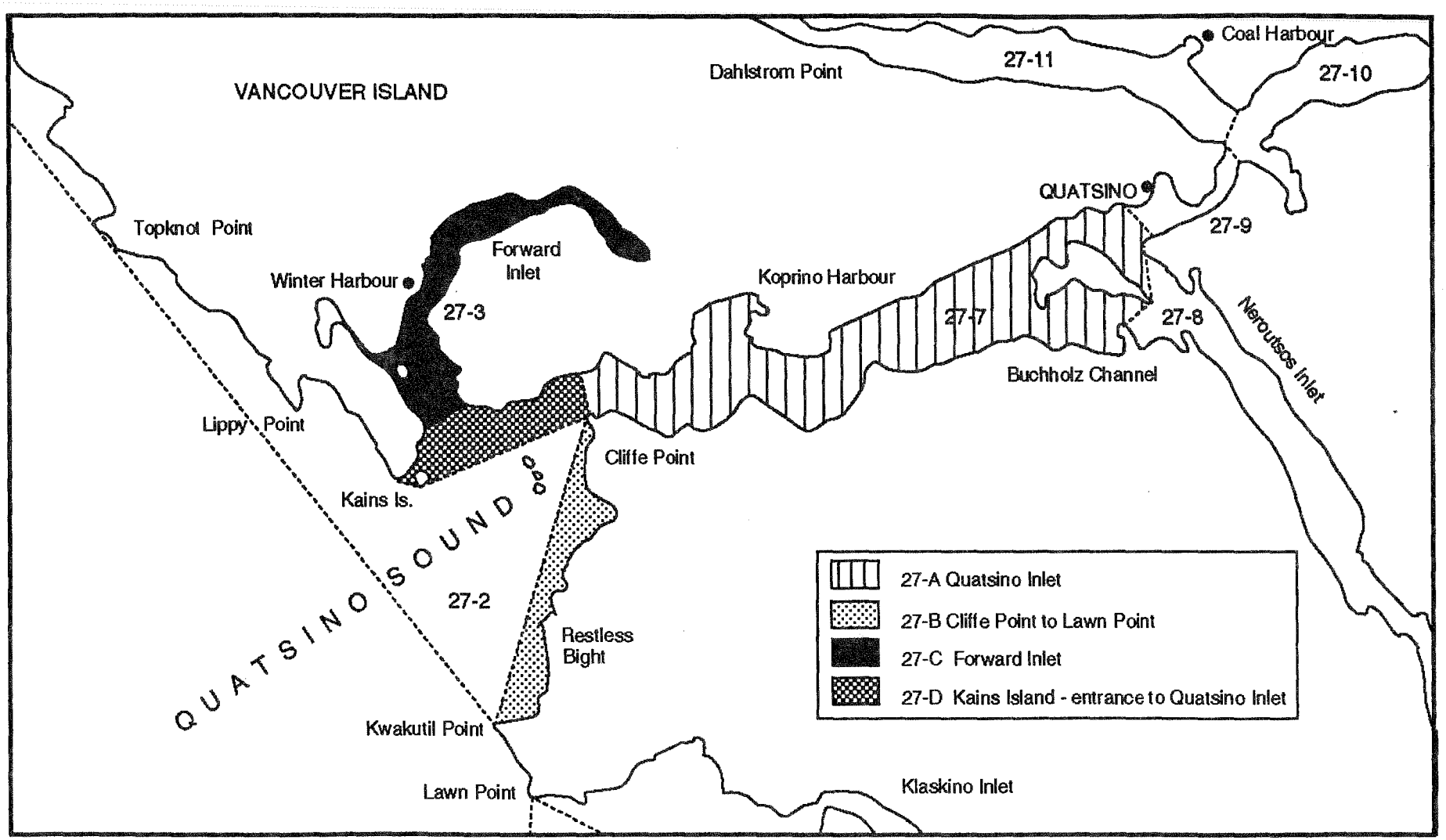
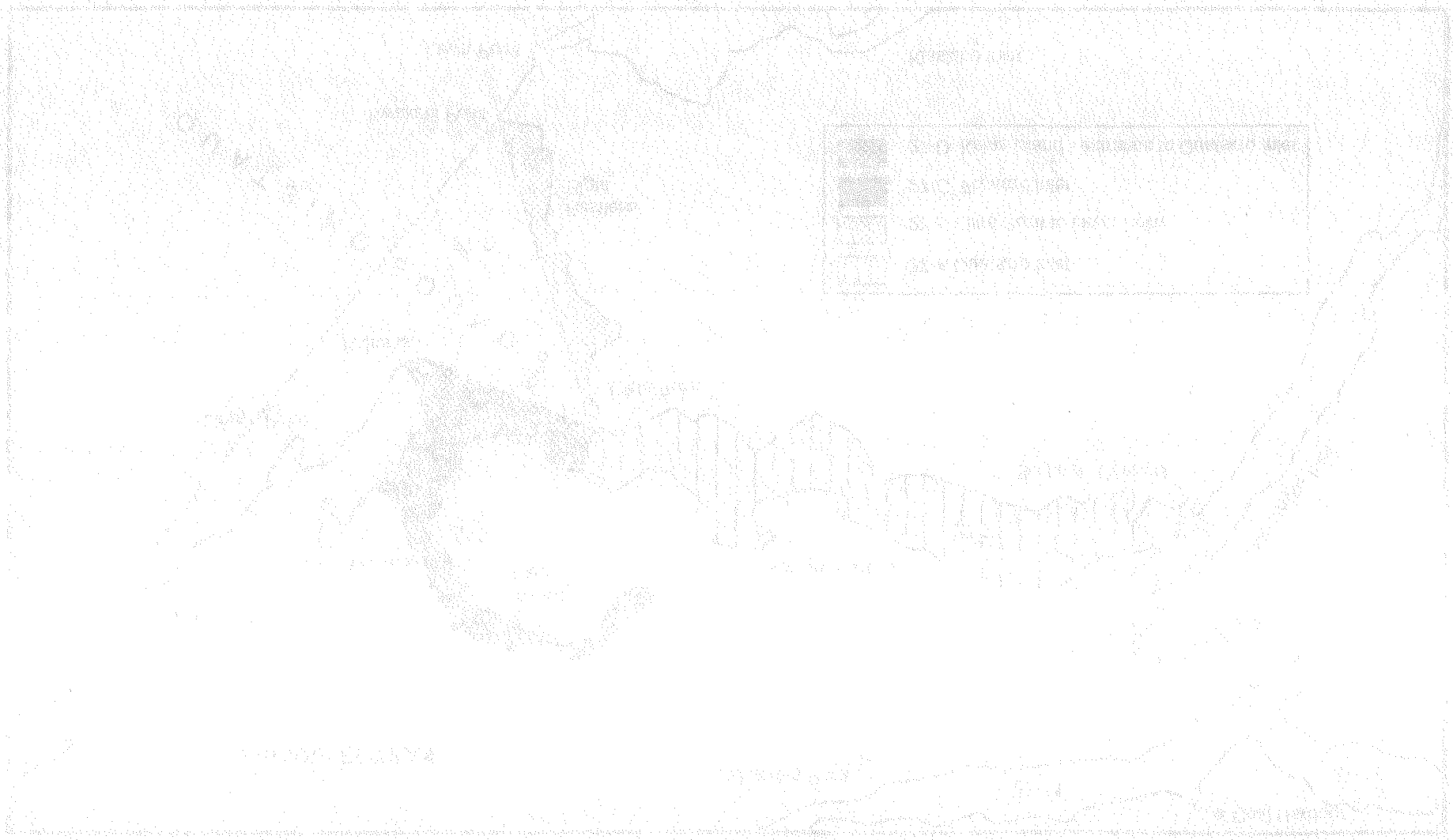


Figure 13. 1995 geoduck management areas: Areas 27-A,B,C,D: Quatsino Inlet, Forward Inlet, Cliffe Point to Lawn Point, and Kains Island.



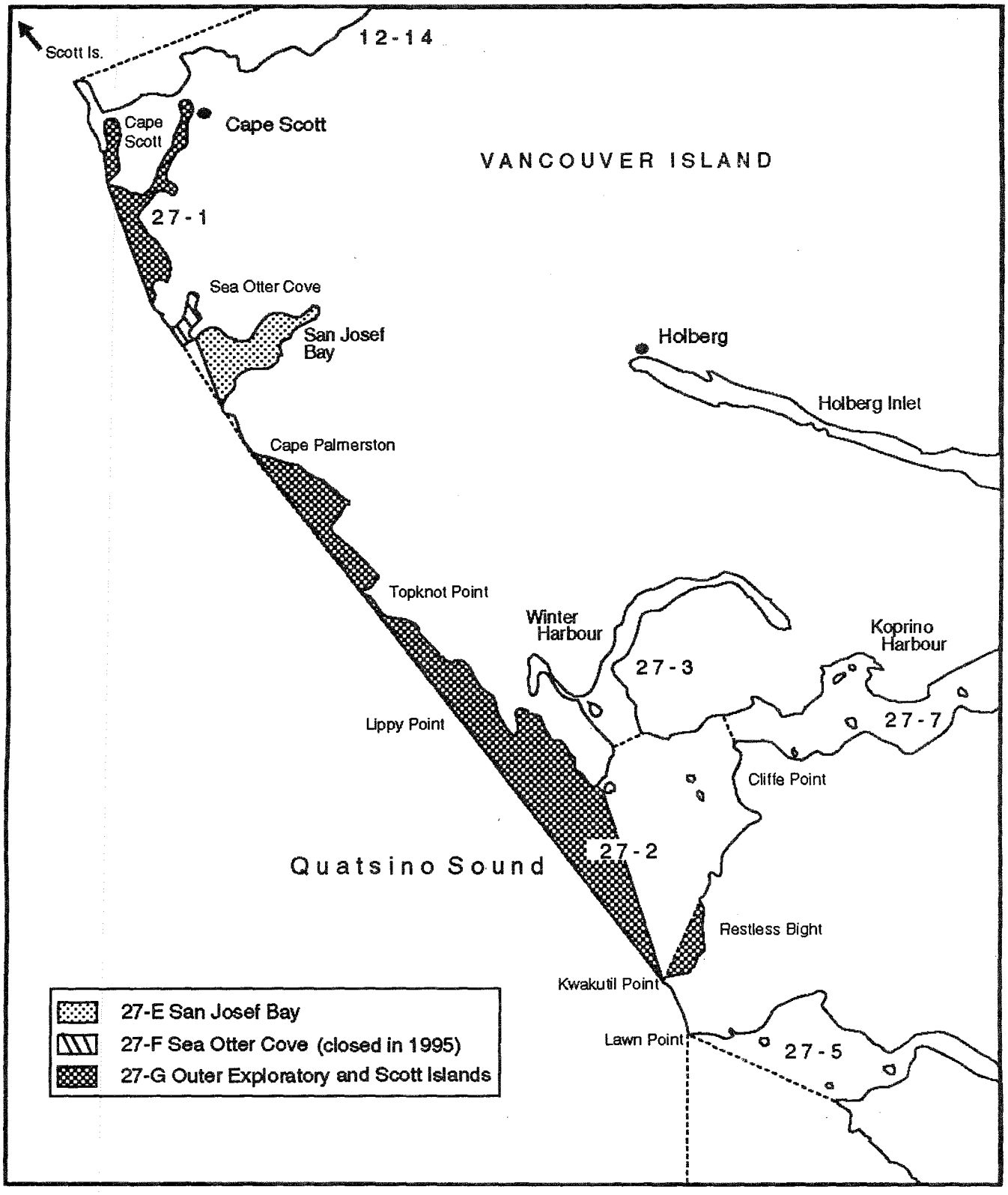


Figure14. 1995 geoduck management areas: Areas 27-E,F,G: San Josef Bay, Sea Otter Cove (closed in 1995) and Outer Exploratory areas, including the Scott Islands.

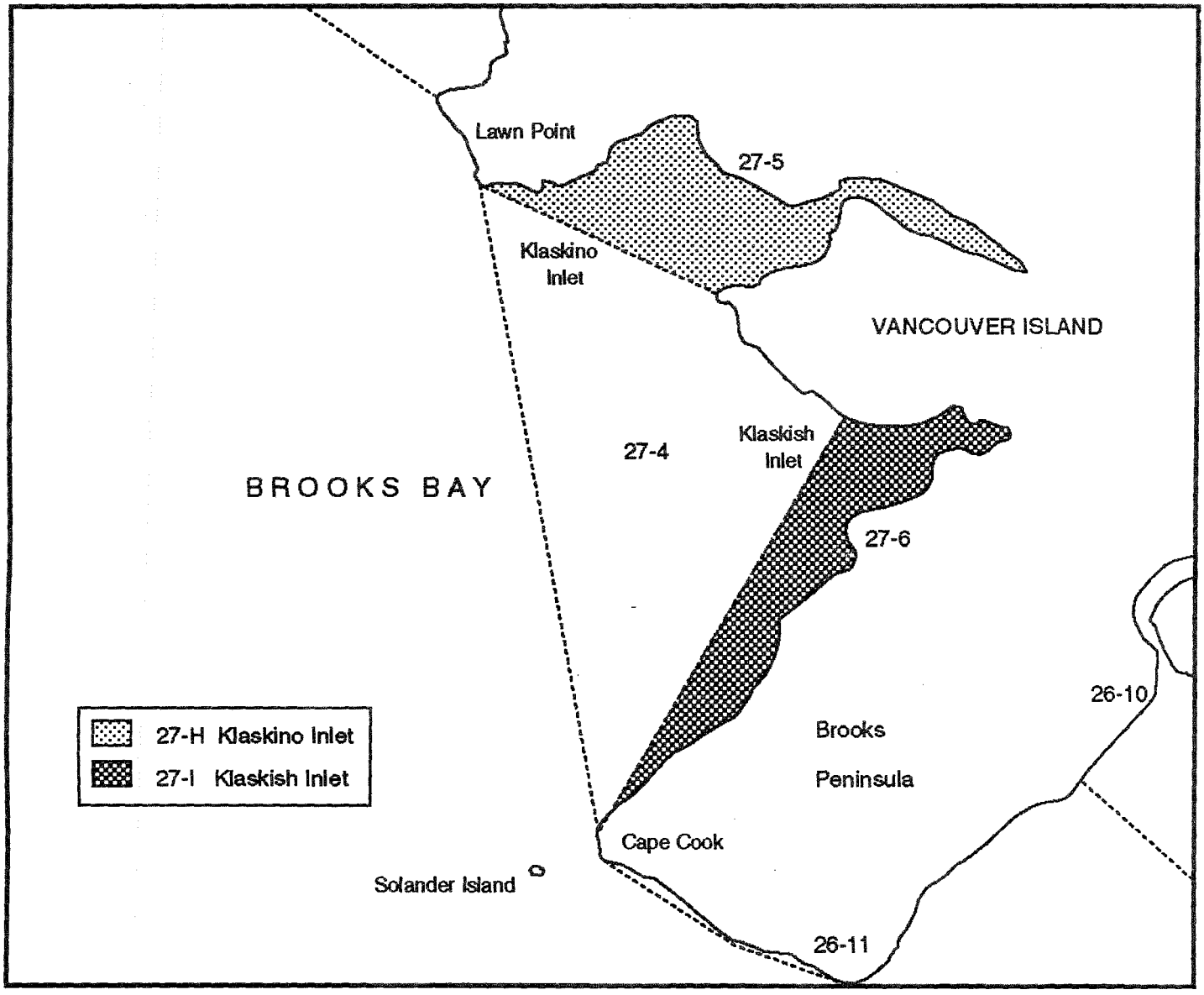


Figure 15. 1995 geoduck management areas: Areas 27-H and 27-I; Klaskino and Klaskish Inlets.

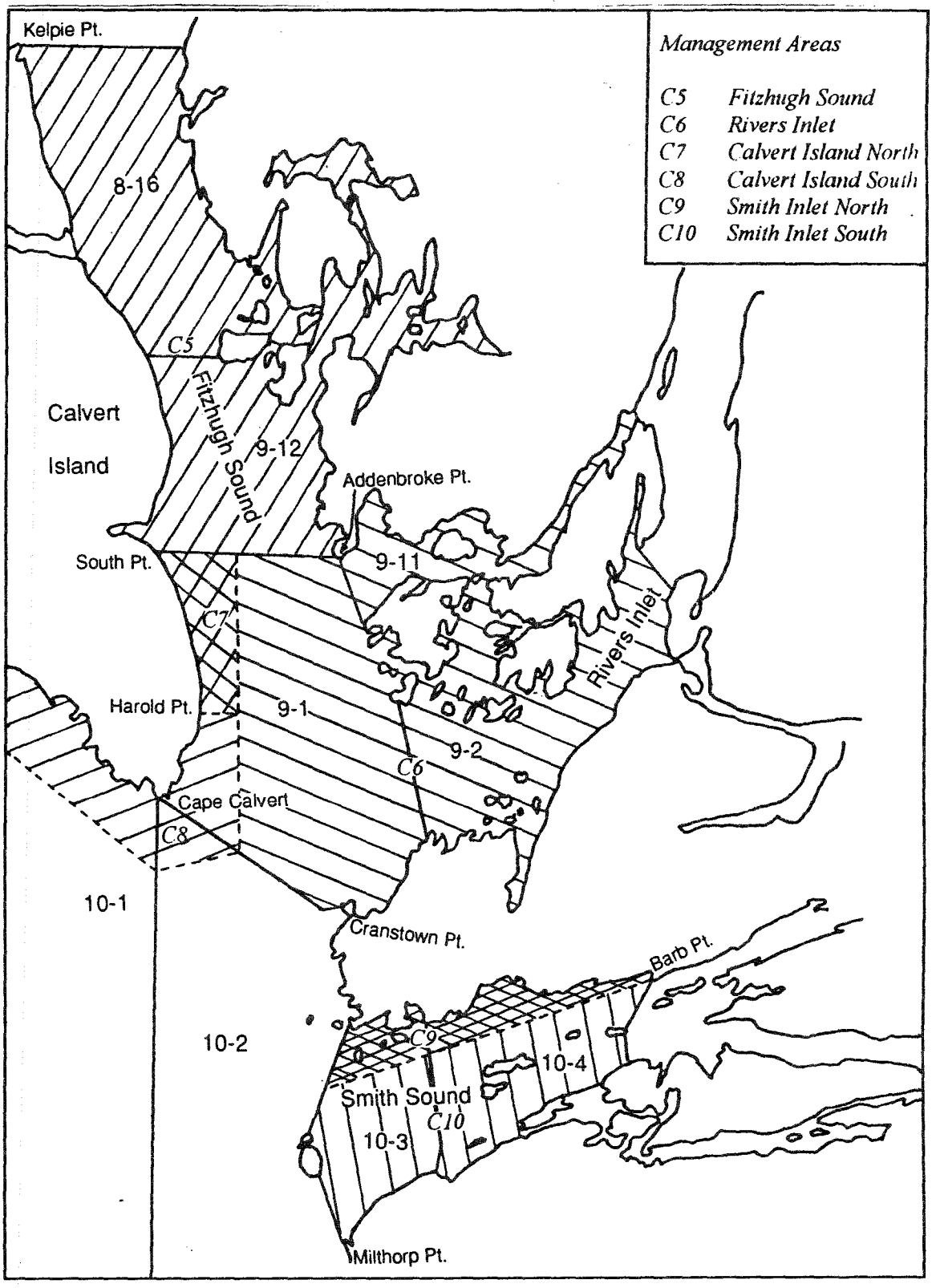
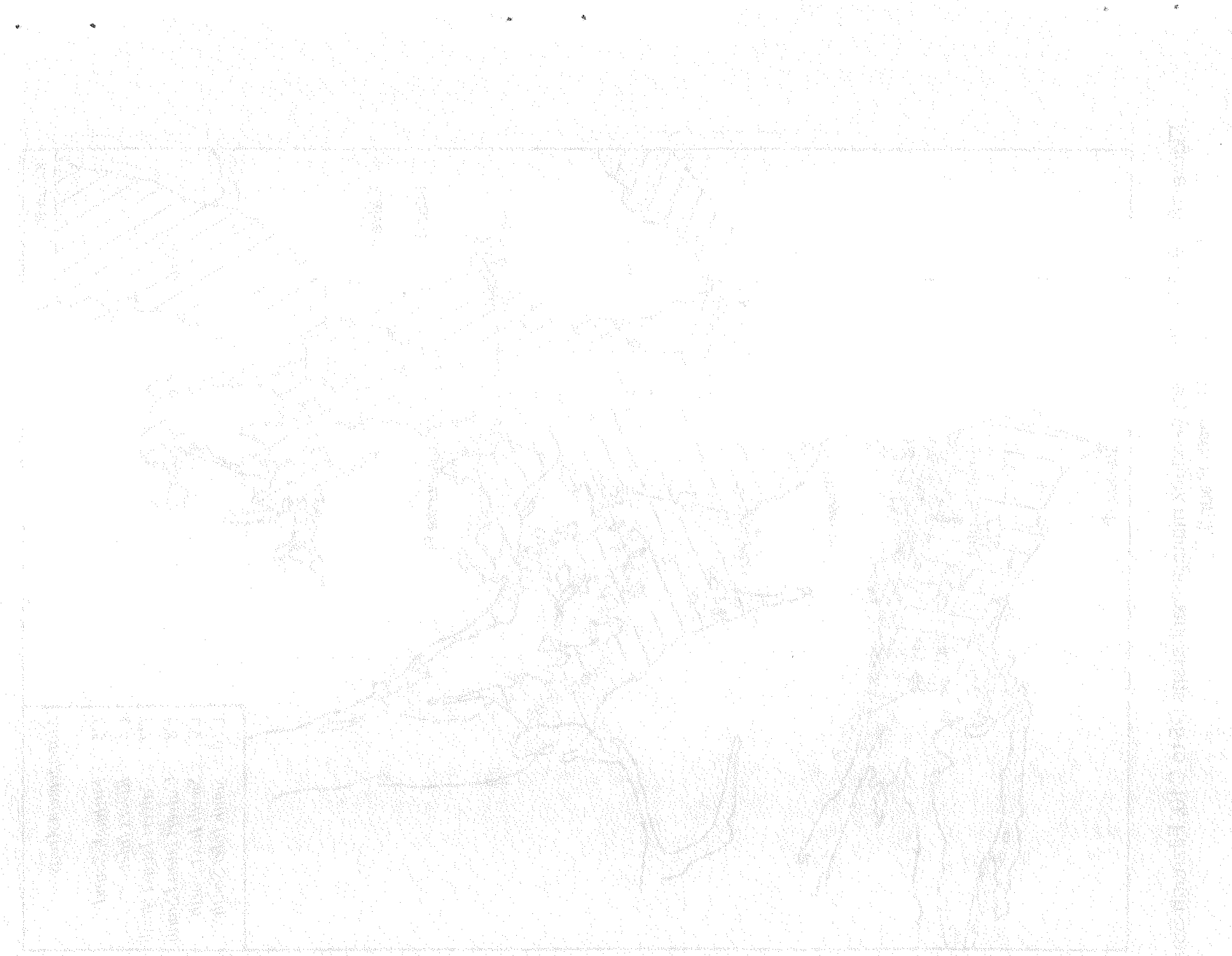


Figure 16. 1995 North Coast geoduck management areas C5 to C10; Fitzhugh Sound, Rivers Inlet and Smith Sound.



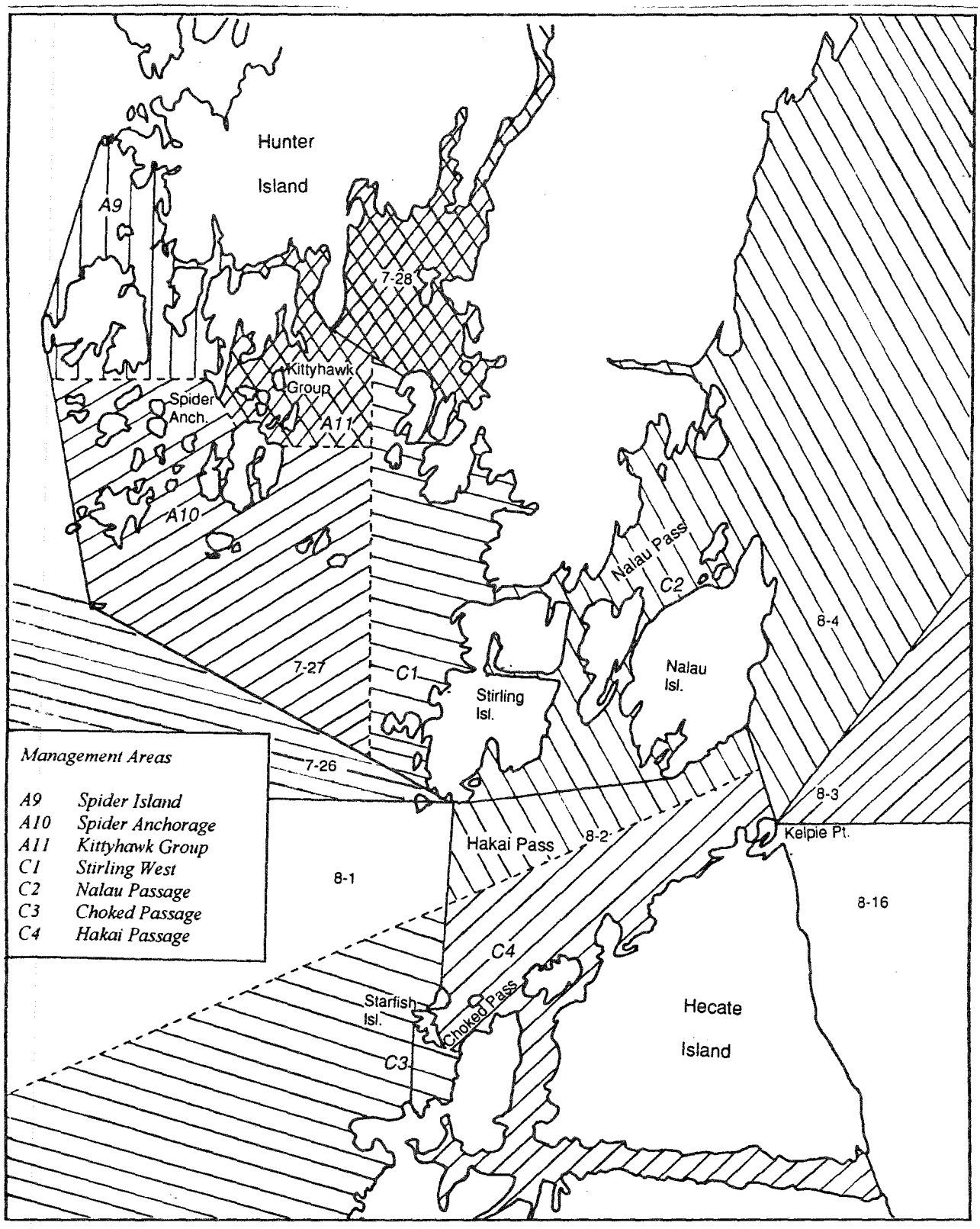


Figure 17. 1995 North Coast geoduck management areas: A9, A10, A11, C1 to C4; Spider Anchorage to Choked Pass

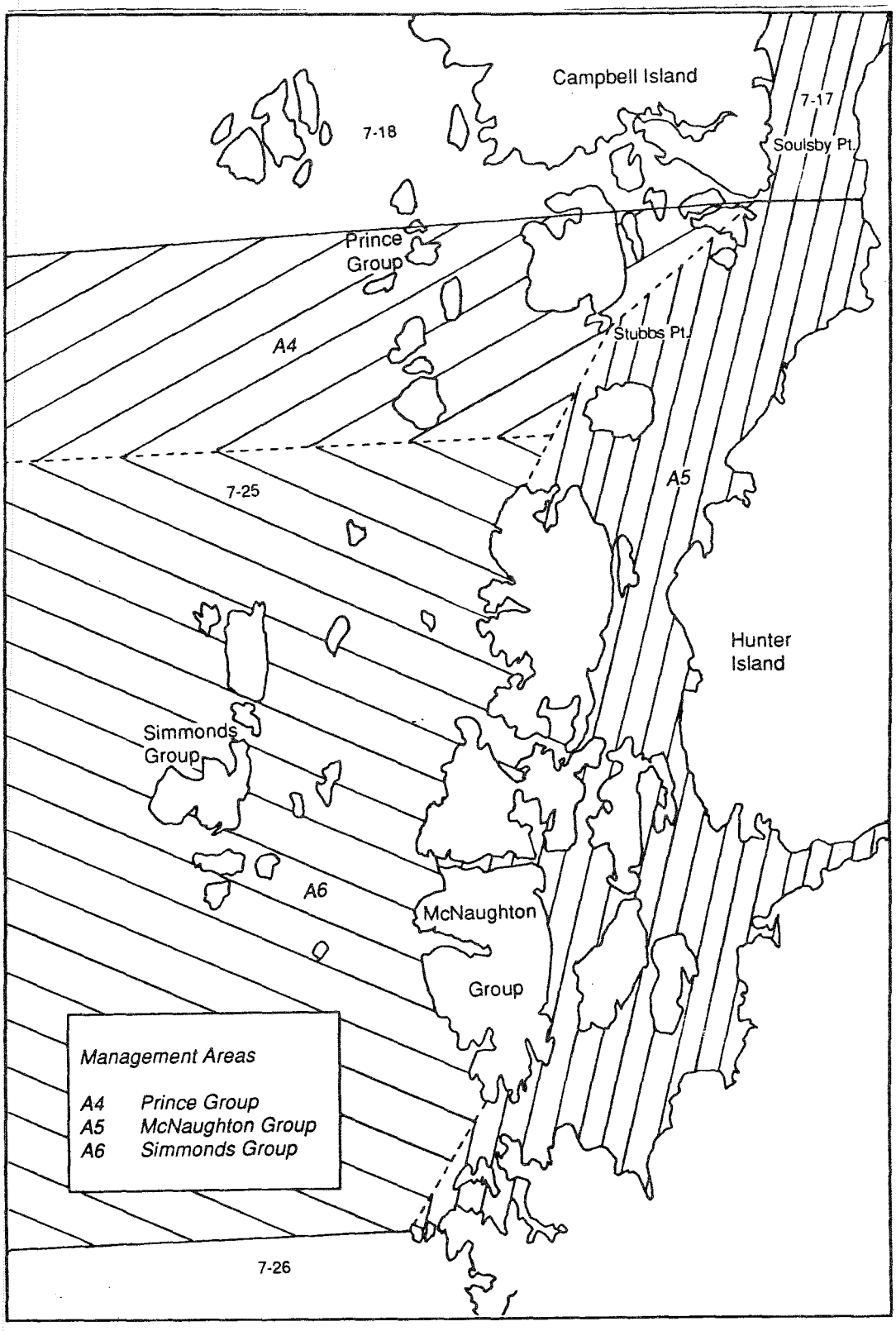


Figure 18. 1995 North Coast geoduck management areas: A4, A5, A6; Prince Group, McNaughton Group, Simmonds Group.

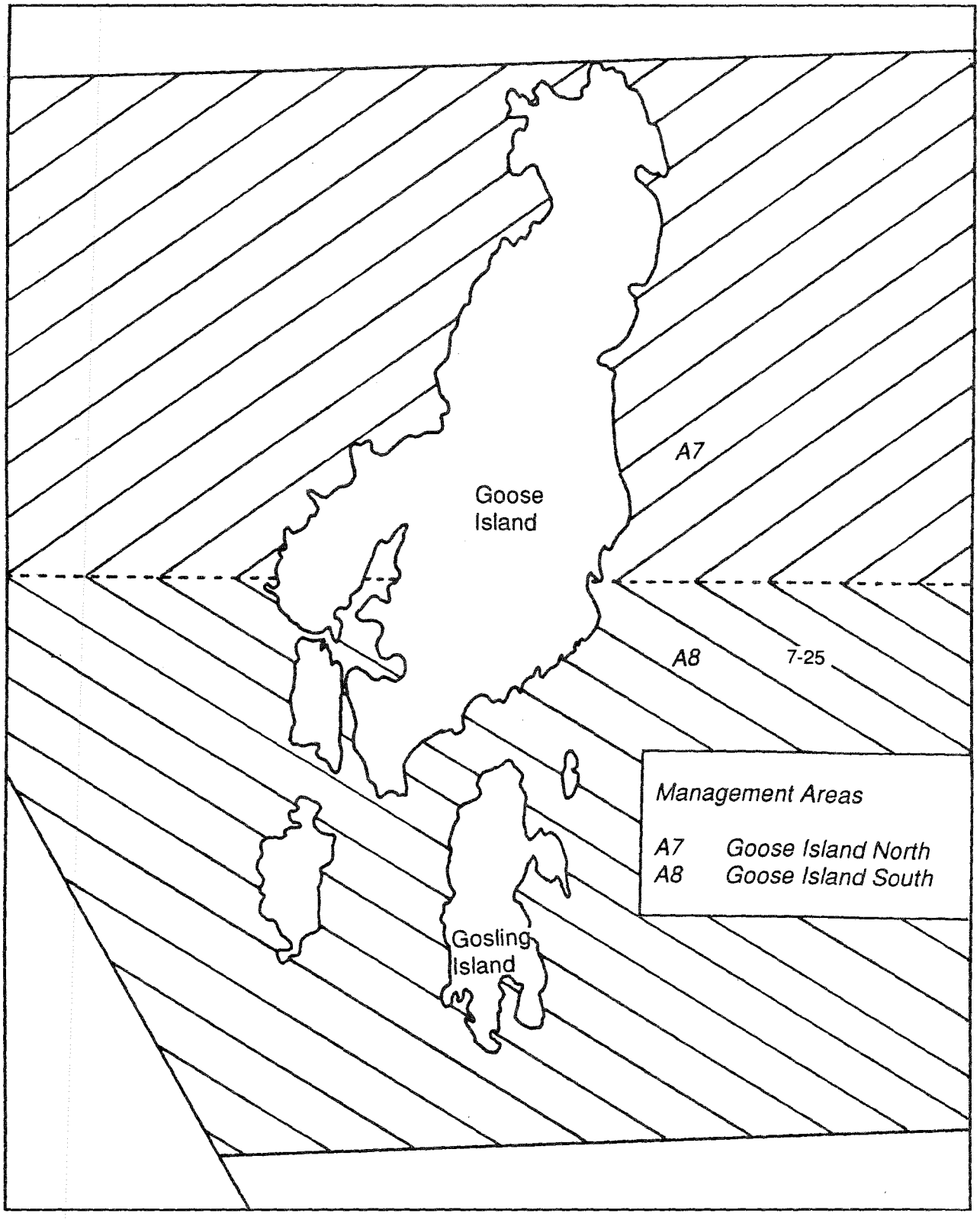


Figure 19. 1995 North Coast geoduck management areas: A7 and A8; Goose Group.

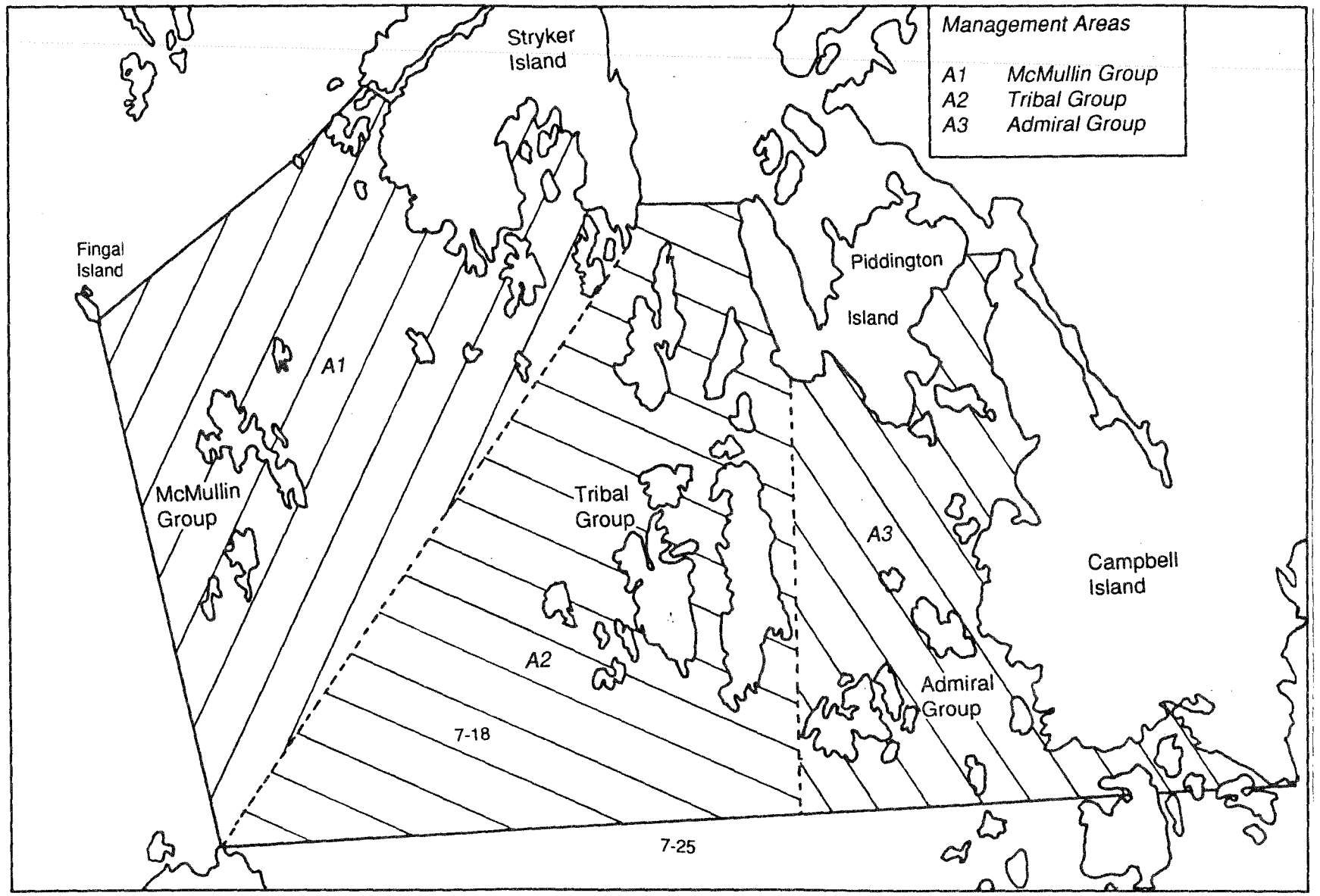


Figure 20. 1995 North Coast geoduck management areas: A1, A2, and A3; McMullin Group, Tribal Group, and Admiral Group.

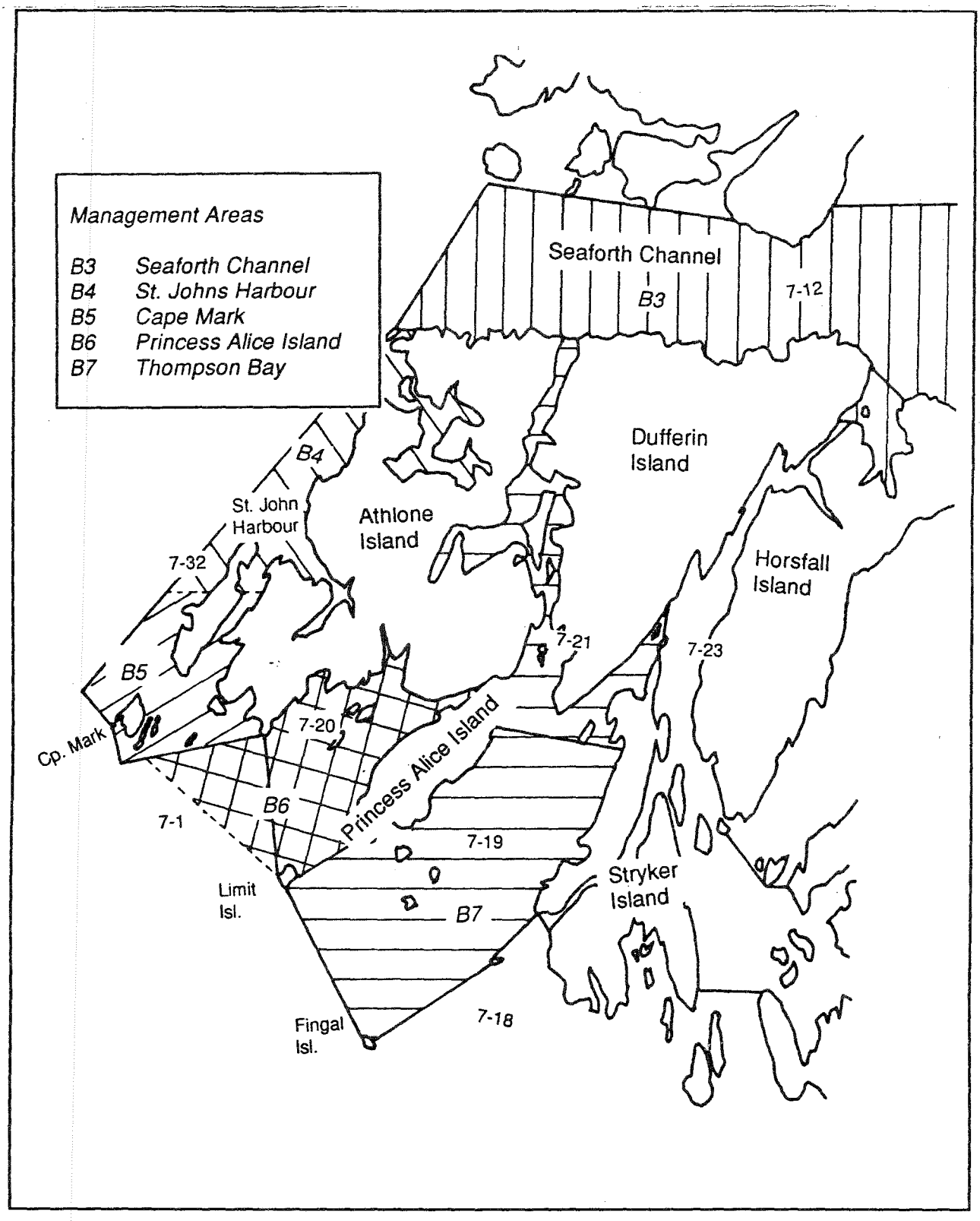


Figure 21. 1995 North Coast geoduck management areas: B3 to B7; Seaforth Channel to Thompson Bay.

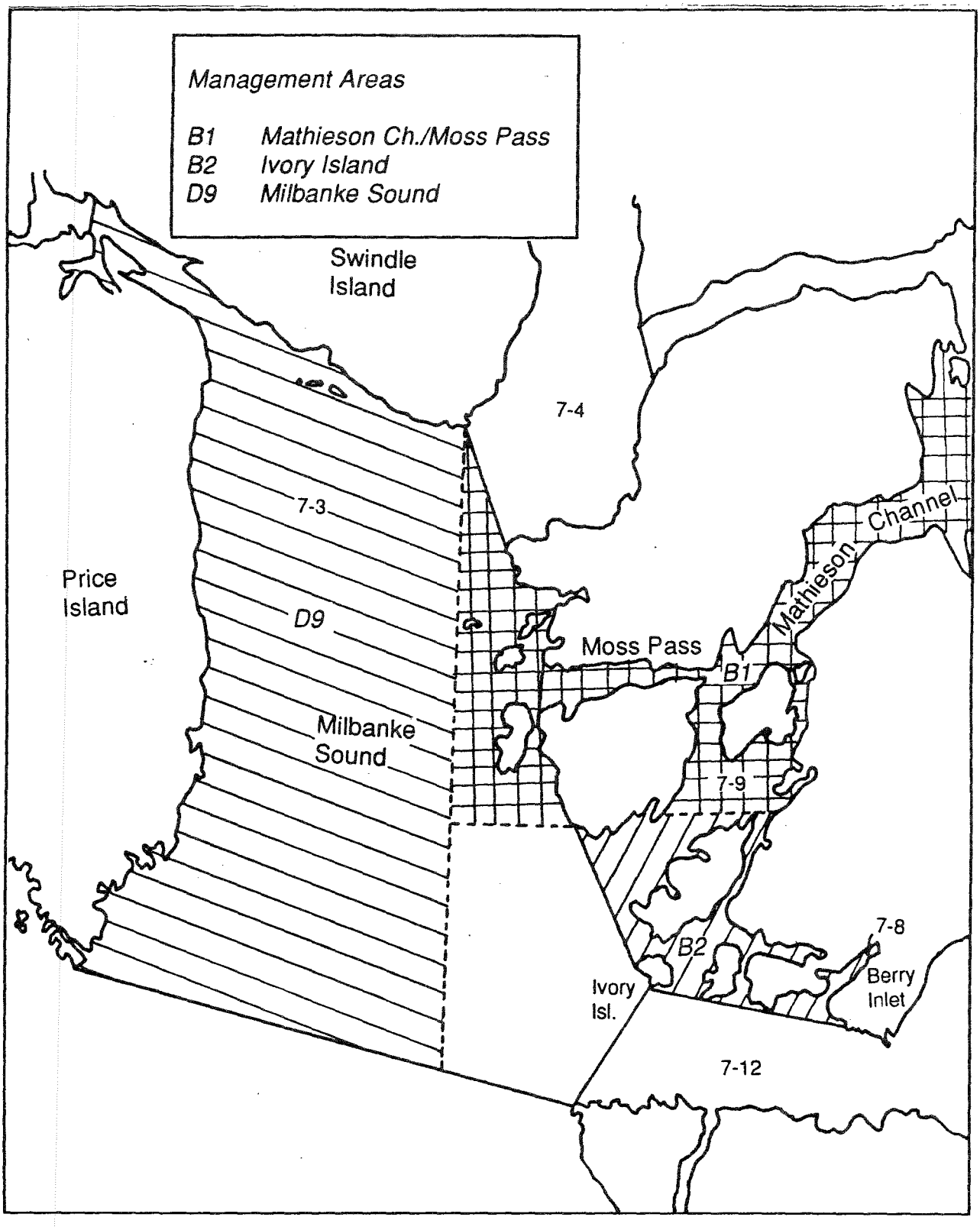
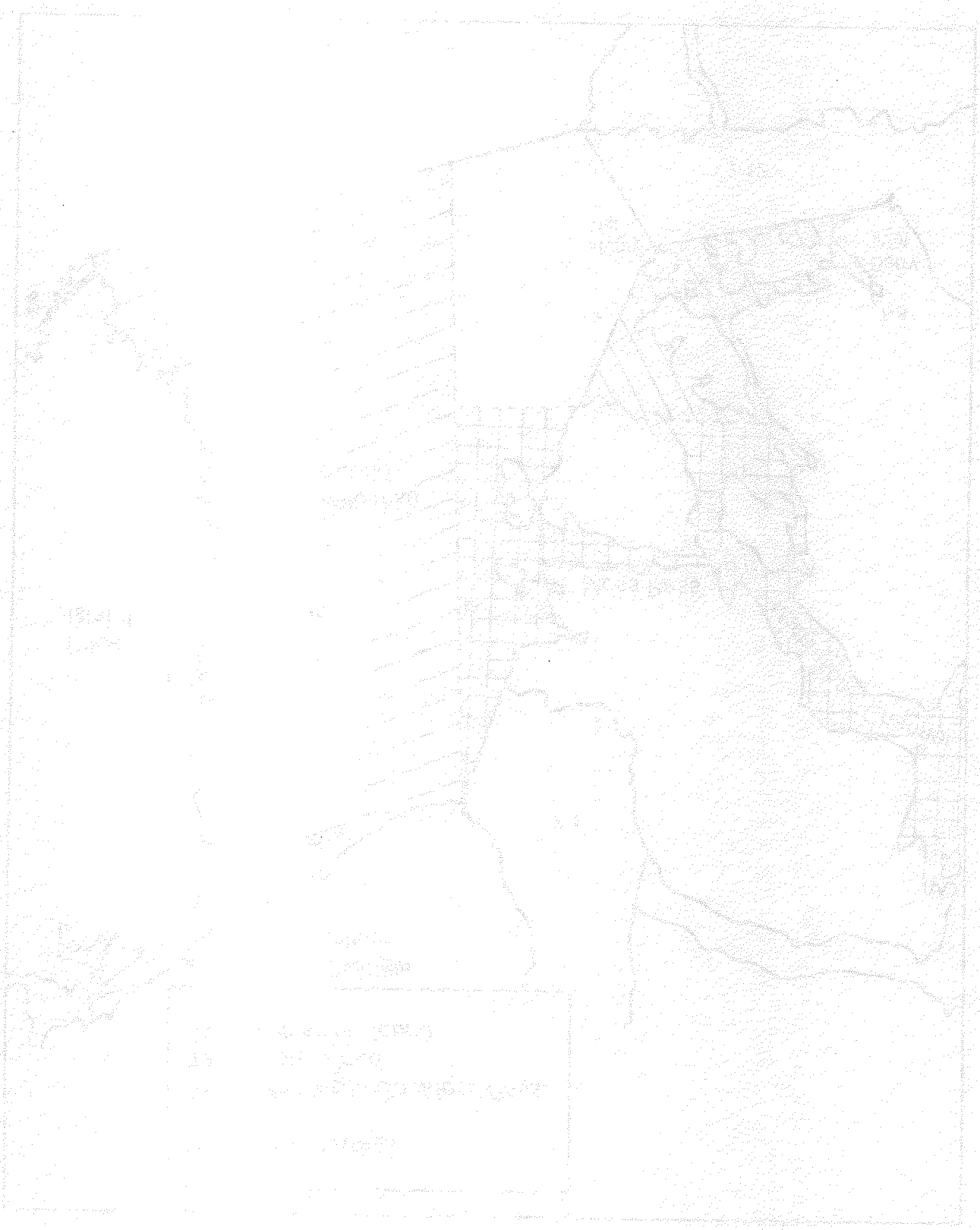


Figure 22. 1995 North Coast geoduck management areas: B1, B2, and D9; Mathieson Channel / Moss Pass, Ivory Island, Milbanke Sound.



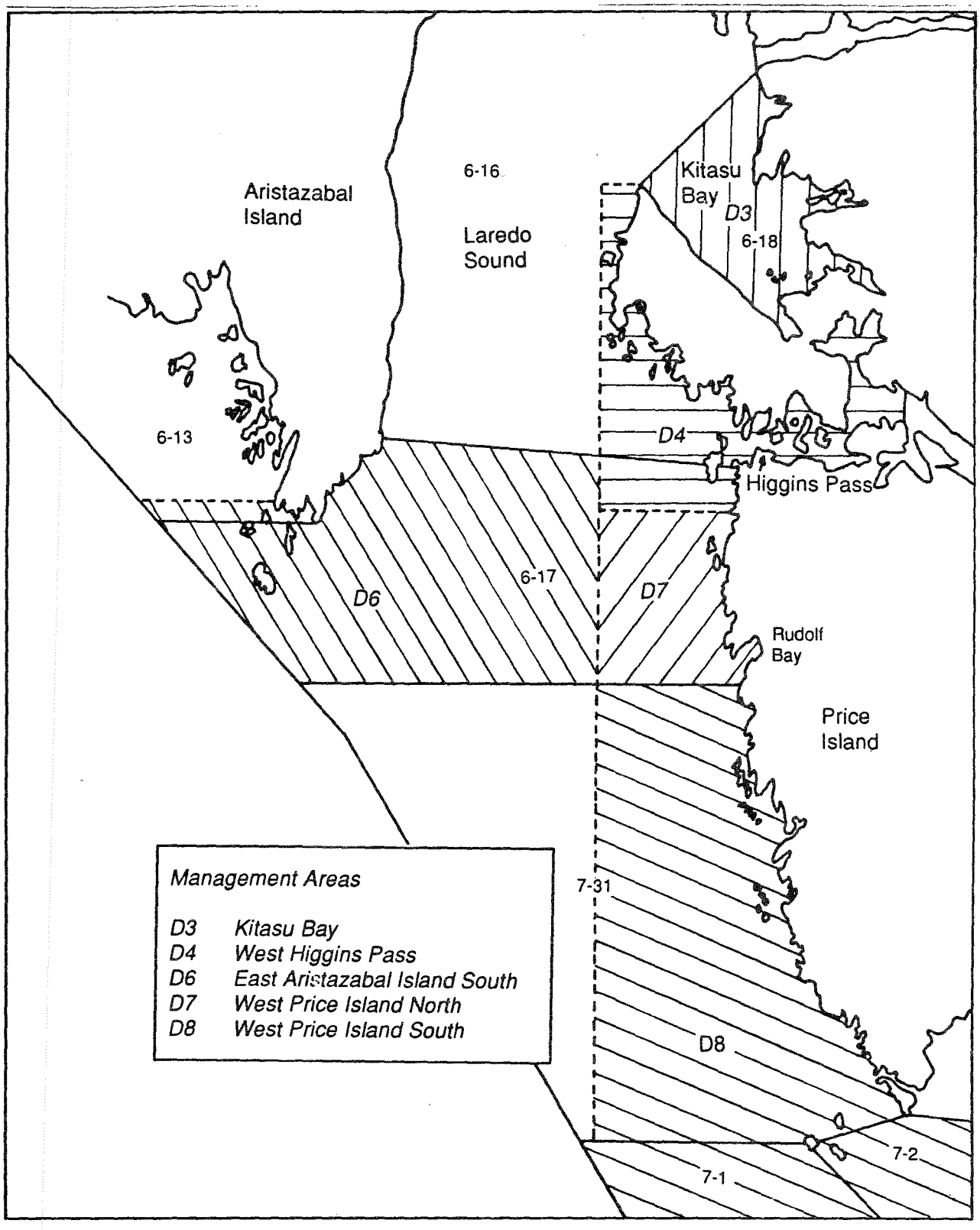


Figure 23. 1995 North Coast geoduck management areas: D3, D4, D6, D7 and D8; Kitasu Bay to West Price Island South.

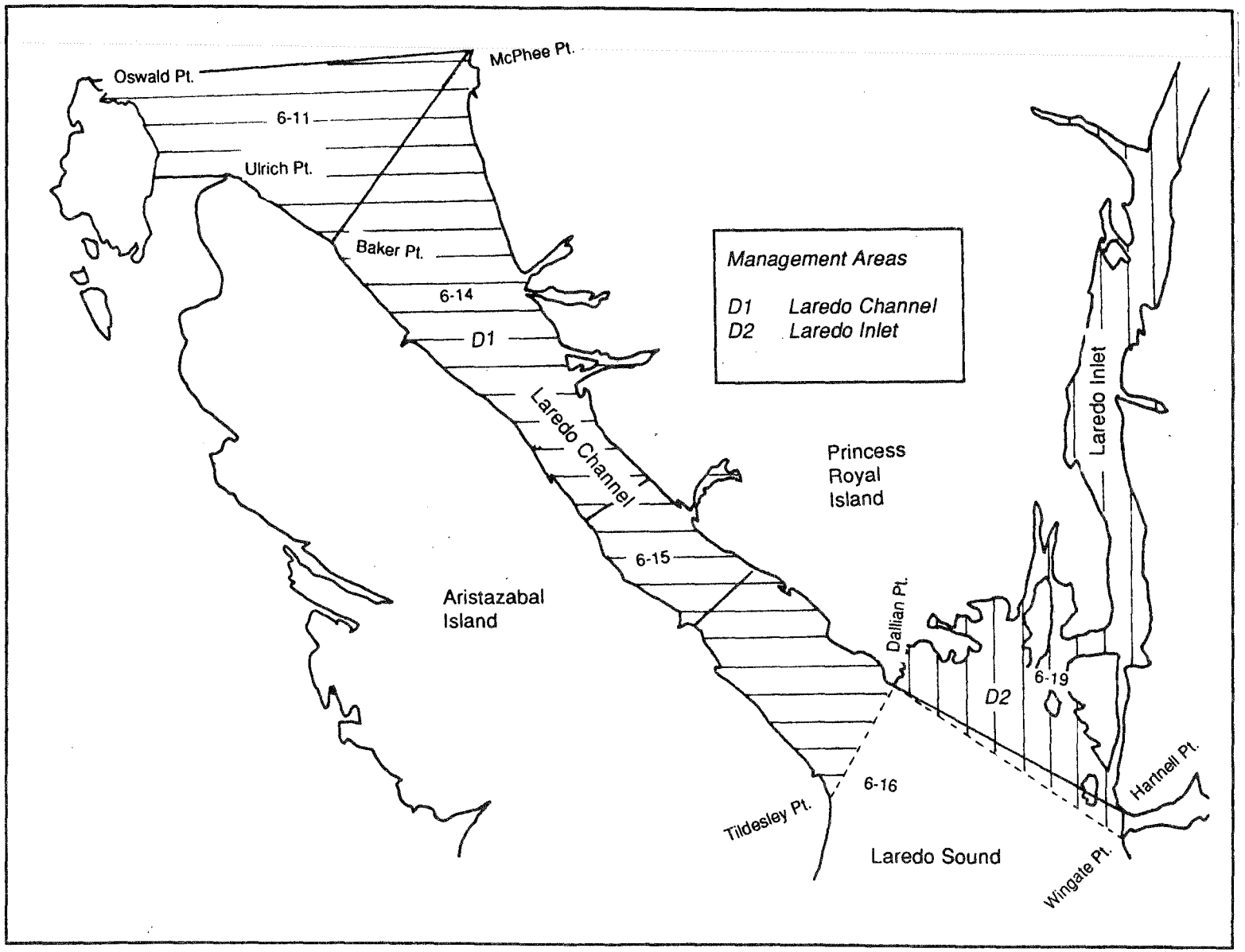


Figure 24. 1995 North Coast geoduck management areas: D1 and D2; Laredo Inlet and Laredo Channel.