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QUOTA OPTIONS AND RECOMMENDATIONS FOR THE 1994 GEODUCK CLAM FISHERY

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ABSTRACT

Harbo,R. M., G. Thomas and K. Hobbs. 1993. Quota options and recommendations for the 1994 geoduck clam fishery. Can. Manuscr. Rep. Fish. Aquat. Sci. 2228: x + 115 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 over 117 million lb. (> 53,346 t) to 1993.

A range of biomass estimates, harvest rates to date and reduced quotas set for the 1994 fishery are provided in this document. A coast wide quota of 4,950,000 lb. (2245.3 t) is recommended for 1994, an I.V.Q. of 90,000 lb. (40.8 t) for 55 licences. This is a 7.7 % reduction from the 1993 I.V.Q. of 97,500 lb. It is proposed to fish 27 quotas in the north (2,430,000 lb.), 18 on the W.C.V.I. (1,620,000 lb.) and 10 in Inside waters (900,000 lb.).

The reduction in 1994 resulted from a continued critical review of geoduck densities and estimates of fishing areas or geoduck "beds". Closures of some beds are recommended for 1994 and reduction in quotas for some beds.

RÉSUMÉ

Harbo, R.M., G.Thomas et K. Hobbs. 1994. Les quotas de pêche à la panope pour 1994 : options et recommandations. Can. Manuscr. Rep. Fish. Aquat. Sci. 2228: x + 115p.

La pêche à la panope a démarré en Columbie-Britannique en 1976. Elle est devenue la principale pêche aux invertébrés en valeur pour n'être dépassée que depuis 1991 par la pêche à l'oursin rouge géant en termes de débarquements. À aller jusqu'en 1993, les plongeurs commerciaux à la panope avaient remonté plus de 117 millions de livres (>53 346 t).

Cet article présente un ensemble d'estimations de la biomasse, de taux de récolte à ce jour et de quotas abaissés pour 1994. Pour cette année, on propose un quota pour l'ensemble de la côte de 4 950 000 lb (2245,3 t) et un quota individuel par bateau de 90 000 lb (40,8 t) pour 55 permis. Il s'agit d'un abaissement de 7,7 % par rapport aux quotas individuels par bateau de 1993, qui avaient été fixés à 97 500 lb. On propose d'accorder 27 quotas dans le Nord (2 430 000 lb), 18 sur la côte ouest de l'île Vancouver (1 620 000 lb) et 10 dans les eaux du détroit (900 000 lb).

L'abaissement des quotas proposé pour 1994 s'inscrit dans la foulée de la révision critique de la densité à la baisse de la panope ainsi que des estimations faites dans les secteurs de pêche

ou «gisements». On propose la fermeture de certains gisements pour 1994 et une baisse des quotas pour certains autres gisements.

PREFACE

The commercial fishery for geoduck clams began in British Columbia in 1976. Since that time the commercial fishery has landed over 117 million lb. (> 53,346 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 as 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 1994 quota options, the hectares of known commercial fishing areas were measured from harvest logs and original densities were reduced from earlier years to 0.7 geoduck/m^2 (from 1) for southern inside waters, 1.4 geoducks/m^2 (from 2) for the west coast of Vancouver Island and densities of 1 to 3.5 geoducks/m^2 for beds in the north coast. A medium risk yield option of 1% was recommended for all areas in 1994.

There is 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 eliminated from area calculations while the estimates of areas for other beds were reduced following consultation with fishers in 1993.

For the south coast, 503 beds measured 12,742 ha. There were 256 beds inside for 7251 ha and 247 beds on the W.C.V.I. for 5491 ha. In the north, a total of 291 beds measured 3155 ha. There were 148 beds in the Q.C.I. for 1204 ha, 37 beds in the Prince Rupert district for 617 ha and 106 beds in the Central coast district for 1334 ha). This includes areas fished through 1991. The average density of geoducks in northern harvest beds is estimated to be greater than in the south.

A range of biomass estimates and harvest rates to date are discussed. Recommendations for reduced quotas for the 1994 fishery are provided in this document.

1994 GEODUCK QUOTA RECOMMENDATIONS

A coast wide quota of 4,950,000 lb. (2245.3 t) when divided by the 55 licences results in an I.V.Q. of 90,000 lb. (40.8 t). This is a 7.7 % reduction from the 1993 I.V.Q. of 97,500 lb. (44.2 t). It is proposed to fish 27 quotas in the north (2,430,000 lb. or 1,102 t), 18 on the W.C.V.I. (1,620,000 lb. or 735 t) and 10 in

Inside waters (900,000 lb. or 408 t).

The reduction in 1994 resulted from a continued critical review of geoduck densities and estimates of fishing areas or geoduck "beds". Closures of some beds are recommended for 1994 and reduction in quotas for some beds.

REDUCTION OF QUOTAS IN THE 1992-93-94 ROTATION

Managers decided to limit quota reductions to 15% each year in 1992 and 1993 until further stock assessment and evaluation could be carried out. To give some stability to the industry, a two year plan was set with quotas for 1992 and 1993.

By 1993, 72 % of the total catch has been landed from the south coast (25.5 % from inside waters and 46.6 % from the west coast of Vancouver Island) and 28 % from the north coast (7.2% from the Q.C.I. and 20.8% from the central coast and Prince Rupert districts). A management decision was made to attempt to reduce effort in the south in the rotation 1992-93-94 by reducing the harvest rates in many beds. Harvest rates were also decreased in the north coast. The reductions resulted in fewer licences 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 three year rotation 1992-1993-1994:

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

ii) most exploratory fisheries have been eliminated and 1992-1994 quotas were calculated on known, commercially harvested sites. When beds were measured in exploratory areas they could not support the assigned exploratory quotas.

iii) 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 1992. A closure of Yellow Bank- Elbow Bank is set for 1994.

iv) reduced average densities were used for areas of the coast in 1994, a maximum of 0.7 geoduck/m^2 for Inside Waters; 1.4 geoducks/m^2 for the west coast of Vancouver Island, and 1 to 3.5 for areas in the north coast. This resulted in lower yield options for most areas.

Surveys in the north coast in 1991 and in the south coast suggested lower average densities when the area of the reported bed is measured from a nautical chart.

v) 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.

1.0 INTRODUCTION

The geoduck fishery began in British Columbia in 1976, and has grown to be the major invertebrate fishery in value and only recently (1991) second to red sea urchins in landings. Table 1 gives the annual landings and landed values, 1976 to 1992. By the end of 1992, >53,346 t (>117.6 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 $16 million in 1992.

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). Another report of the fishery, 1985 to 1989 is in preparation, Harbo et al.(in press).

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); 72 % of the landings came from the south coast (25.5% inside waters and 46.6% 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 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 0.7 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 1993, 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.

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 and 1994, this increased to 166 quota management units ; 60 in 1992, 47 in 1993 and 59 proposed for 1994 (Table 4). For 1994, 59 management units have been proposed; 32 in the north, 14 in southern inside waters and 13 for the W.C.V.I.

In 1989, a trial two-year period (1989-1990) was initiated for individual vessel quotas (I.V.Q.'s). They were divided equally among the 55 licence holders, and each had the opportunity to harvest 160,000 lb. Licence holders voluntarily selected one of the three areas for the season, North Coast (22 quotas), West Coast of Vancouver Island (21 quotas) and southern Inside Waters (12 quotas).

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, with quotas set for the two years, 1989 and 1990, as part of the I.Q. program. 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 1994.

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 were developed in consultation with area committees of fishers (Harbo et. al. 1993).

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 1993 and the proposed 1994 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).

4.0 QUOTA CALCULATIONS

Quota calculations are derived using the following formula:

Quota = (HARVEST RATE) x (B_0)

where

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

B_0= 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.

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 overestimates the size of the beds. The error is probably large, considering that the fishers harvest clumps or aggregations of geoducks within a "bed". At Marina Island, approximately 30 to 50% of the 5 m^2 quadrats on a transect had zero counts (Campbell et al., in prep.).

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, 503 beds for 12,742 ha (1990) and for the north coast fishing areas, estimated to be 290 beds measuring 3,194 ha (1991). These areas are reduced from 1990 estimates (Harbo et. al 1993).

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 1994 were derived following a series of meetings held with fishers, May to July, 1993 to review the geoduck fishing beds in each area to be fished in 1994. 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 substrates 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 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.

To calculate quota options for 1994,, different densities were used for three areas of the coast:

i) Inside waters of the south coast, Areas 11 to 19, 28 and 29:
= 7.455 t/ha or 16,435 lb./ha for 0.7 geoduck/m^2

This density is corresponds to the original densities of geoducks surveyed at Marina Island in 1992 (Campbell et. al; in prep.) and is less than the overall density of geoducks (0.86) found by Goodwin (1978b).

ii) West coast of Vancouver Island, Areas 20 to 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 25, yielded a mean density of 1.6 geoducks/m^2 over an area of 1,036 ha. Fishers have harvested 34 beds (1108 ha) in Area 25 (Appendix 2). The highest density of a bed, a single fishing location, was estimated to be 31.8 t/ha (2.99 geoducks/m^2) over 38 ha in Esperanza Inlet (Area 25)(1980,MRB unpublished data).

In Area 24, a bed of 46 ha located at Clifford Pt. - McNeil 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 in 1992 and 1993 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. Over the period of 16 years, 1976 to 1991, 794 beds or harvest areas have been identified by fishers. Given the estimated average geoduck densities discussed above, an original biomass of 244,374 t is estimated for the coast; 55% in the south and 45% in the north.

The estimate for the south coast Inside Waters of 135,963 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 gives some preliminary estimates of areas (some 30 beds; 955 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

The number of geoducks removed over time are calculated and shown in Table 9. The removal rates have been the greatest on the north coast , 4.72 t/ha or 0.44 geoducks/m^2 over 13 years of harvest, partly as a consequence of larger quotas based on higher estimated original densities.

The low removal rate for the inside waters, 1.88 t/ha or 0.18 geoducks/m^2 is a result of lower quotas assigned to that area and the large areas identified on the harvest charts. This low level of removals suggests that the harvest area is over estimated. For some 20 ha beds, removals are 0.46 geoducks/m^2 but the large beds in Area 19 at James Spit has low removals calculated, 0.14 geoducks/m2 over 447 ha.

Removals on the west coast are higher than those for the inside, resulting from higher estimates of stock and high landings. For example, some small beds of 1 ha, there have been removals of 0.77, 0.97 and 1.38 geoducks/m^2. For a large bed at Rolling Roadstead, 343 ha, the calculated removals have been 0.465. For a Tofino bed at Elbow Bank, (90 ha) the calculated removals are 0.94 geoducks/m^2.

Annual rates of removal (t/ha), based on the length of the fishery, were compared to theoretical rates calculated using 1% of the densities assumed for quota calculations (0.7 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 given Table 3 and 4) / (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 1992-93 and 1994. 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 are considered medium risk and may be 6 to 9 times greater than the lowest risk option or a third or a half of the highest risk option.

The lowest yield option would use the most conservative level of annual yield at 0.3% and a third of the current virgin biomass estimate. At most, we may be overestimating the virgin biomass by two to three times. The highest risk option would be at an annual yield of 2% and using an estimates of virgin biomass at 1.5 the current estimate.

There are several uncertainties about the stocks. The biomass estimates are affected by habitat area (ha), densities and average weights of geoducks.

i) The extent of geoduck habitat (ha) may be underestimated by 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 densities used in calculations for 1994 range from 0.7 to 3.5 geoducks/m^2.

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.

8.0 1994 QUOTA OPTIONS AND RECOMMENDATIONS

A summary of quotas and the three year rotation of areas initiated in 1989 is given in Table 10. Table 11 presents a summary of the recommended quotas for 1994; a coast wide quota of 4,950,000 lb. when divided by the 55 licences yields an I.V.Q. of 90,000 lb. This is a 7.7 % reduction from the 1993 I.V.Q. of 97,500 lb.

The quota reduction in 1994 resulted from a continued revision of geoduck densities and estimates of fishing areas or geoduck "beds". Closures recommended for 1994 are listed in Table 12.

8.1 SOUTH COAST- INSIDE WATERS-1994 QUOTA RECOMMENDATIONS

The fishery for 1994 is the third year of the area rotations and is similar to the 1991 fishery described for 1991 by Harbo et. al (1992). The 1991 quota for I.W. was 735 t (1,620,000 lb.) supporting 12 Inside licences at 135,000 lb. (61.24 t) each. Areas 15,17,18,19 and 29 were fished in 1991 (Table 9).

The 1994 fishery plan calls for a 30% or greater reduction in quota from the 1991 fishery. 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 1991 to 0.7 geoducks/m^2 for 1994 calculations. Some beds fished in 1991 have been closed for the 1994 rotation to distribute fishing effort over the beds (Table 12).

It is proposed to fish 10 quotas of 90,000 lb. for 1994 in Inside Waters; 900,000 lb. (486.5 t). This is a 44 % reduction from the 1991 fishery. Quotas are summarized in Table 13 while detailed descriptions of areas and quota options are given in Appendix 2.

8.2 SOUTH COAST - WEST COAST VANCOUVER ISLAND. - 1994 QUOTA RECOMMENDATIONS

The fishery for 1994 is the third year of the area rotations and is different from the 1991 fishery described for 1991 by Harbo et. al (1992). Several changes to the areas fished in 1992 and 1993 resulted from PSP blooms and new regulations (Oct.1992) that did not allow for processing of geoducks from PSP closed areas. In previous years, geoducks were harvested from PSP affected areas and processed to remove toxic parts. The processed siphon and body meats had low or non-detectable levels of toxin.

The 1991 quota for the W.C.V.I. was 1283 t (2,835,000 lb.) supporting 21 licences at 135,000 lb. (61.24 t) each. Areas 20,24,25 and portions of 26 were fished in 1991 (Table 10).

The 1994 fishery plan calls for a 30% or greater reduction in quota from the 1991 fishery. The average density of geoducks has been reduced from $2/m^2$ in 1991 to 1.4 geoducks/m^2 for 1994 calculations.

We are concerned 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. This led to conservation closures in 1992 and 1993, pending further evaluation. Further conservation closures are proposed for 1994, listed in Table 12.

Some beds fished in 1991 in Area 24 and 25 have been closed for the 1994 fishery (Table 12) to distribute fishing effort over the beds and to compensate for high levels of landings in past years. Area 20 was closed due to the hazards (strong currents, exposure to wind and waves) and difficulties of fishing this area.

It is proposed to fish 18 quotas of 90,000 lb. for 1994 on the W.C.V.I. for 1,620,000 lb. (734.8 t). This is a 33 % reduction from the 1991 fishery. Quotas are summarized in Table 14 and detailed area descriptions and quota options are given in Appendix 3.

8.3 NORTH COAST-QUEEN CHARLOTTE ISLANDS-1994 QUOTA RECOMMENDATIONS

The 1994 northern fishery will move to the Queen Charlotte Islands as part of a three year rotational fishing plan (Table 10). In 1991, the quota set for this area was 2,835,000 lb, supporting 21 licences at 135,000 lb.

The quotas for the Q.C.I. in 1994 were reduced by 14.3% from 1991. Because of the overall coast wide quota reductions, there will be 27 quotas of 90,000 lb. for a northern total of 2,430,000 lb. (1102.2 t) (Table 10).

There will be a shift of 3 licences to the north in 1994, one from the west coast Vancouver Island and two from the southern Inside Waters. As a result of the large number of beds in the Queen Charlotte Islands, the 1994 quota for the north is 90,000 lb. greater than the 1993 north coast quota for the Prince Rupert District.

There will be minor exploratory area quotas in Area 2W, Gowgaia and Englefield Bay, set after consultation with fishers (Table 15). Quotas are summarized in Table 15 and detailed area descriptions and quota options are given in Appendix 4 .

9.0 CONCLUSIONS AND RECOMMENDATIONS

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. The 1994 quota recommendation is a reduction to 4,950,000 lb. (2245.3 t) divided into 55 vessel quotas of 90,000 lb. (40.8 t).

It is proposed to fish 10 quotas of 90,000 lb. for 1994 in Inside Waters; 900,000 lb. (486.5 t), 18 quotas of 90,000 lb. for 1994 on the W.C.V.I. for 1,620,000 lb. (734.8 t) and 27 quotas of 90,000 lb. for a northern total of 2,430,000 lb. (1102.2 t).

2. Surveys are required to determine the bed areas and geoduck densities in each management area. A program of surveys should be considered, surveying one or more areas per year. Fishers knowledgeable of stocks in an area should be interviewed to determine their estimate of the extent of the beds.

3. Average weights should be determined for geoducks from each management area and management unit where possible.

4. A field assessment of recruitment to beds harvested heavily early in the fishery, 10 years or more, should be carried out.

5. A strategy to review local over-harvesting is required.

6. A preliminary sample from deep stocks, i.e. those stocks now below normal diving range should be taken and examined fro age,growth and sexual maturity. The contribution of recruitment to the shallow stocks should be determined.

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Table 1. Landings and landed values of geoduck clams in British Columbia, 1976 to 1992 as reported on sales slips (1976 to 1988) and on validation logs (1989 to 1992).

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	16,051	2.56	5.64	1.60 – 5.01	3.53 – 11.04
Total:	117,608,759	53,346	88,400				

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

[2] Price paid to commercial fishermen

Table 2. Summary of geoduck landings (tonnes) by South Coast Management Area 1976 to 1992, as reported on sales slips (1976 to 1988) and on validation logs (1989 to 1992). A three year rotation of areas was initiated in 1989, with the exception of area 24.

	SOUTH COAST MANAGEMENT AREAS																		
	East Coast Vancouver Island											West Coast Vancouver Island							Annual
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27	Landings
1976				10			8		26										44
1977			14	9	77		137	2						6					245
1978			8	261	321	3	24	19	136			1	3	2	236	2			1016
1979		24	160	276	263	148	209	3	159					153	950	87	22	9	2463
1980			97	215	17	301	225	34	91			5		288	841	321	303		2738
1981			41	180	29	70	155	44	28			8		187	819	473	156	6	2195
1982		83	14	144	33	103	17	1	14			14		174	1218	366	726		2907
1983		16	29	340	29	42	13	2	10					84	1066	215	287	1	2134
1984	8	302	150	285	54	129	128	1	118					219	628	442	443	2	2909
1985	13	490	81	172	42	38	137	4	78			0		227	730	599	272	1050	3934
1986	21	212	148	200	137	117	136	13	124		11	96		231	803	450	226	388	3313
1987		275	112	286	98	159	265	103	50		100	40		247	661	552	398	241	3587
1988	62	290	51	191	59	95	110	2	116	1	17	49		192	633	187	206	279	2541
1989	5	662	203											538	633			345	2386
1990				605		258									540		614	343	2360
1991					258		181	37	244		14	1			416	702	153		2006
1992		256	78	291										255	479			306	1665
1976 to 1992	109	2610	1186	3465	1417	1464	1745	264	1194	1	142	214	3	2803	10652	4396	3806	2970	38442

Inside Waters Total: 13,598 West Coast Total: 24,844

Table 3. Summary of geoduck landings (tonnes) by North Coast Management Area 1980 to 1992, as reported on sales slips (1980 to 1988), and on validation logs (1989 to 1992). 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
1976 to 1992	354	2341	1150	411	730	1831	2077	4447	1003	219	340	14903

Table 4. Summary of quotas, landings and management actions from 1989 to 1993, 1994 (proposed).

Year	Management Units Areas	Quota (tonnes)	Landings[1] (tonnes)	Management	Eligible Licences	Vessels Fished[2]
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	55	47
	South Coast - 22 management units	2,020	2,006	Third year of area rotation.		
1992	North Coast - 24 management units	1,197	1,199	First year of area rotation. I.Q. 114,750 lb/licence.	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		Second year of area rotation. I.Q. 97,500 lb/licence.	55	
	South Coast - 36 management units	1,371		24 licences North; 12 Inside South; 19 W.C.Vancouver Is.		
1994	North Coast - 32 management units	1,102		Third year of rotation. I.Q. 90,000 lb./licence	55	
	South Coast - 30 management units	1,143		27 licences North, 10 Inside South; 18 W.C.V.I.		

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 1994 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		2,800.0		4,500.0	(8)	NA		NA	NA	NA	NA	3,500.0	(1)	8,000.0
1981	876.0		3,125.0		4,001.0	(10)	600.0		575.0		950.0		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

( ) * 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 1994 in the geoduck clam fishery.

Year	South Coast						North Coast								Coast Total
	Inside Waters		West Coast V.I.		Subtotal		QCI		Prince Rupert		Central		Subtotal		
1979	NA		NA		2,041	(1)	NA	NA	NA	NA	NA		1,587	(1)	3,628
1980	771		1,270		2,041	(8)	NA	NA	NA	NA	NA		1,587	(1)	3,628
1981	397		1,418		1,815	(10)	272		261		431		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

( ) * 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 (1994).

Number of Geoducks per m²	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)
0.7	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/m² = 10.65 t/ha @ average weight of
1.065 kg per geoduck (Harbo, et al, 1983).
1 ha = 10,000 m²
1 mt = 2204.6 lb.
1 tonne = 1000 kg /((1 geoduck/m²) /1.065)) = 939 geoducks
1 tonne/ha = 939 geoducks/ha x 1 ha/10,000 m² = 0.0939 geoducks/m²

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 (1991) in open areas, annual quotas, landings (1992) and years of quota landed to 1992 for different regions of the British Columbia coast.

Area Description		Number of Beds	Adjusted Harvest Area (ha) to 1991[1]	Geoduck Density[2] (t/ha)	Estimated Stock (t)	Annual Quota (t)	Landings to 1992 (t)	Years of Quota Taken (1992)	Years Fished[3]
Inside of Vancouver Island (Areas 11 to 19, 28 and 29)		256	7,251	7.46	54,092	541	13,598	25.1	17
West Coast Vancouver Island (Areas 20 to 27)		247	5,491	14.91	81,871	819	24,844	30.3	16
South Coast Total (Areas 11 to 27, 28 and 29)		503	12,742		135,963	1,360	38,442	28.3	17
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 (Areas 3, 4, 5)		37	617	37.3	23,014	230	2,972	12.9	12
Central Coast District (Areas 6 to 10)		106	1,334	37.3	49,758	498	8,086	16.3	14
North Coast Total		291	3155		108,411	1,084	14,903	13.7	14
Coastwide Total		794	15,897		244,374	2,444	53,345	21.8	17

[1] includes beds closed for conservation purposes or scaled in area, but not beds in contaminated or premanent closure areas.

[2] Geoduck density 1 geoduck/m^2 = 10.65 t/ha; 2/m^2= 21/3 t/ha; 3.5/m^2 = 37.3 t/ha

[3] Years fished South Coast 1972 to 1993; North Coast 1980 to 1994 (with rotations

* 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. Preliminary estimated areas and standing stock of geoduck beds or portions of beds in areas under contaminated or permanent closures, in

Stat Area	Sub Area	Bed Code	Description	Est. Ha Closed	Standing Stock	Contaminated Closure #	Other
INSIDE WATERS							
12	16	0202	Hardy Bay	10	164,350	12.1	
12	16	0301	Beaver Harbour	43	706,705	12.3	
13	13	0301	Drew Harbour (seasonal)	25	410,875	13.6	
13	2	0202	Willow Pt.	57	936,795	13.8/13.9	
14	11	4601	Comox Bar (portion)	275	4,519,625	14.1a	
14	4	5301	Qualicum Beach	136	2,235,160	14.6/14.7	
15	1	0703	(0701)Westview to Grief Pt	45	739,575	15.18	
16	21	1501	Gillies Bay	12	197,220	16.3	
16	5	1802	Porpoise Bay	7	115,045	16.7	
16	11	1604	Thunder bay	1	16,435	16.21	
17	7	7102	Boulder Point	2	32,870	17.1	
17	16	6201	E. Mudge Island	82	1,347,670		Research Closure
19	8	0201	Towner/Patricia Bay	88	1,446,280	19.5/19.13	
19	8	0202	Coles Bay	13	213,655	19.8	
			Total Inside Waters:	796	13,082,260		
WEST COAST							
23	8	1201	S. Brabant-N. Peacock Ch.	3	98,613		Broken Group
23	8	1701	NE Clarke Is.	6	197,226		Broken Group
23	8	1702	E. Turret Is.	4	131,484		Broken Group
23	5	2102	Marble Cove	6	197,226		Bamfield Marine Closure
23	4	2301	S. Flemming	9	295,839		Bamfield Marine Closure
23	5	2302	NW Flemming	7	230,097		Bamfield Marine Closure
23	5	2303	NW Flemming	13	427,323		Bamfield Marine Closure
24	6	0605	Whitesand Cove	42	UNKN		Marine Park
24	6	1202	S. Robert Point	7	230,097		Research Closure
24	6	1203	Dunlap Is.	5	164,355		Research Closure
24	6	0806	Ahous Bay	13	427,323		Whale Sanctuary
26	7	0504	SW of Theodore Pt.	1	32,871		Sea Otter Reserve
26	7	0502	Battle Bay - NW Bunsby Is.	7	230,097		Sea Otter Reserve
26	7	0505	N.Acous Pen.- Cuttle Is.	2	65,742		Sea Otter Reserve
26	7	0501	N. Checkaklis Is. - Bunsbys	30	986,130		Sea Otter Reserve
26	10	0503	West of Battle Bay	4	131,484		Sea Otter Reserve
			Total W.C.V.I.:	159	3,845,907 [1]		
Total Closed Area:				955	16,928,167		

[1] There are considerable areas in the Broken Group Islands, area 23
There are additional geoduck beds in area 26 but these may be harvested by sea otters.

Table 9. Estimated open harvest areas (1991), landings (1992) and removal of geoducks, 1976 to 1992.

Area Description	Reported Harvest Area (ha)	Number of Beds	Range in Bed Size (ha)	Landings to 1992 (t)	Density of Geoducks Removed (t/ha)	Density of Geoducks Removed (#/m²)[1]	Years Fished	Annual Rate of Removal (t/ha)	Theoretical Rate of Removal (t/ha)
Inside of Vancouver Island (Areas 11 to 19, 28 and 29)	7,251 (57%)	256	3 - 631	13,598	1.88	0.18	17	0.11	0.11
West Coast Vancouver Island (Areas 20 to 27)	5,491 (43%)	247	2 - 265	24,844	4.52	0.42	16	0.28	0.21
South Coast Total (Areas 11 to 27, 28 and 29)	12,742	503	2 - 631	38,442	3.02	0.28	17	0.18	0.15
Queen Charlotte Islands (Areas 1, 2E and 2W)	1,204	148	1 - 41	3,845	3.19	0.30	8	0.40	0.37
Prince Rupert District (Areas 3, 4, 5)	617	37	1 - 181	2,972	4.82	0.45	12	0.40	0.37
Central Coast District (Areas 6 to 10)	1,334	106	1 - 127	8,086	6.06	0.57	14	0.43	0.37
North Coast Total (Areas 1 to 10)	3,155	291	1 - 181	14,903	4.72	0.44	13	0.36	0.37

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

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

Annual Theoretical Rate of Removal = (estimated average density of geoducks) x (10.65 t/ha) x (0.01 yield)
@1 gdk/m² = 1 x 10.65 x 0.01 = 0.11 (inside waters, south coast)
@2 gdk/m² = 2 x 10.65 x 0.01 = 0.21 (west coast Vancouver Is.)
@3.5 gdk/m² = 3 x 10.65 x 0.01 = 0.37 (north coast)

Table 10. Summary of quotas (lb.) and rotation of areas, 1989 to 1994.

Year	Inside Waters Areas	Inside Waters Quota	West Coast V.I. Areas	West Coast V.I. Quota	North Coast Areas	North Coast Quota	Annual Quota Total	Annual I.V.Q.
First Rotation (1989–90–91)								
1989	11,12,13	1,920,000	23,24,27A	3,360,000	lower 6, 7 to 10	3,520,000	8,800,000	160,000
1990	14,16	1,920,000	24,26,27H,27I	3,360,000	3,4,5,upper 6	3,520,000	8,800,000	160,000
1991	15,17,18, 19,29–5	1,620,000	20,24,25,26B1 26B2,26C	2,835,000	1,2E,2W	2,970,000	7,425,000	135,000
Second Rotation (1992–1993–1994)								
1992	12,13,14A, 14B,14C	1,377,000	23,24A,24A2, 24A3,24B,24B2 24B3,27A,27B, 27D,27E,27F, 27G,27H,27I	2,295,000	lower 6, 7 to 10	2,639,250	6,311,250	114,750
1993	14D,14E,16	1,170,000	24A,24A2,24A3, 24B,24B2,24B4, 26A,26B2, 26D,27H	1,852,500	3,4,5,upper 6	2,340,000	5,362,500	97,500
1994	15A,15B,15C 15D,15E,15F, 15G,17A,17B, 18A,18B,19A, 19B,19C,29–4 29–5	900,000	24A2,24A3,24A4,24A5 24A6,24B1,24B2,24B3, 24B4,25A,25B, 25C,25D	1,620,000	1,2E,2W	2,430,000	4,950,000	90,000

Table 11. Summary of 1994 geoduck quotas (lb.)

Area	# of Licences	I.V.Q.	Area Quota	# Management Unit Quotas
North Coast				
Queen Charlotte Islands	27	90,000	2,430,000	32
South Coast				
Inside Waters	10	90,000	900,000	15
West Coast Vancouver Is.	18	90,000	1,620,000	15
Totals (lb.)	55	90,000 [1]	4,950,000	62
Totals (t):		40.8	2,245.3	

[1] This is a 7.7% reduction from the 1993 I.V.Q. of 97,500 lb.

Table 12. South coast areas closed in 1994 due to conservation concerns or with reduced quotas.

Area	Subareas	No. of Beds	Area (ha)	Landings to 1992 (lb.)	Removals (#/m²)	Annual Quota (lb.)	Calculated Years of Quota Taken	# Years Fished	Original Density Required (#/m²)
INSIDE WATERS:									
15D: East shore of Harwood Is.	15-3	1	26	150,205	0.246	4,273	35	8	3.07
17A: Icarus Point	17-18	1	66	143,478	0.093	10,847	13	8	1.16
17B: East shore Kuper Is.	17-8	1	20	213,972	0.456	3,287	65	10	4.55
WEST COAST V.I.:									
24A4: Yellow Bank/Elbow Bank	ptn. 24-6	2	148	3,281,885	0.944	48,649	67	13	7.26
24C: Exposed and Sidney Inlet	24-1,24-2, 124-3,24-8	14	119	720,966	0.258	39,116	18	5	5.16
24D: Inlets	24-3 to -5, -10, 24-11,-13,-14	22	96	578,111	0.256	31,556	18	6	4.27
25C: Rosa Harbour	ptn. 25-13	2	58	521,541	0.38	19,065	27	9	4.25

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

Calculated Years of Quota Taken =
total landings (lb.) / annual quota option @ 1 (inside) or @ 2 (W.C.V.I.) geoducks/m²

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

Table 13. 1994 Geoduck management - Summary of proposed South Coast Inside Waters quotas (lb.). (15 management units)

Management Unit Statistical Area	Sub-areas	1991 Quotas @1 gdk/m²	1991 ha	1994 ha	3 Year Calculated Quotas @.7 gdk/m²	1994 Draft Quotas
INSIDE WATERS						
15A	Savary north:					
	ptn 15-2	87,000	124	124	61,150	12,300
15B	Savary south:					
	ptn 15-2	17,625	25	25	12,329	61,000
15C	Hernando:ptns					
	of -2 and -3	74,730	106	61	30,082	30,100
15E	Inlets: subarea 15-4			14	6,904	10,000
15F	Cortes/Redonda Islands:					
	subarea 15-5			62	30,575	30,000
15G	Twin Is: ptn 15-3			99	48,822	48,000
15D[1]	Remaining					
	subareas	389,735	600	419	206,629	207,000
Total Area 15:		569,090	855	804	396,491	398,400
17A[2]	Nanoose:					
	-19, -20	108,000	154	160	78,904	78,904
17B	Balance of					
	Area 17 *	293,085	482	446	219,945	216,000
29-5[3]	29-5,-4	30,000	42	45	22,192	22,000
Total Area 17 and 29-5:		431,085	678	651	321,041	316,904
18A	Boatswain Bank:					
	ptn of 18-7	33,000	45	45	22,192	22,000
18B	Balance of					
	Area 18	48,000	67	44	21,699	22,000
Total Area 18:		81,000	112	89	43,891	44,000
19A	19-7 to -12	closed	101	101	(closed)	(closed)
19B	James Is.	new in 1994	582	509	251,013	55,696
19C	Balance of					
	Area 19	new in 1994		172	84,821 **	85,000
Total Area 19:		538,825	683	782	335,834	140,696
INSIDE WATERS TOTAL:		1,620,000	2,328	2,326	1,097,257	900,000
				10 licences @ 90,000 lb. =		900,000 (408.2 t)

[1] 3 small quotas set in the old (1991) 15D (15E,F,G) to spread effort over area; closed E. side Harwood Is.
15A decreased and 15B increased to test southern groinds

[2] portion of Subarea 17-18 at Icarus Point to be closed in 1994

[3] fishing is encouraged in 29-4 and outside lower Valdes and Galiano Is.

* CLOSED E. side Kuper Is (40 ha bed 7301 in s/a -8,-2,-6); E. side Thetis Is.

** area 19B (James Island) quota decreased to round out 10 quotas of 90,000 lb. for inside waters as a conservation measure.

Table 14. 1994 Geoduck management – Summary of proposed West Coast Vancouver Island quotas (lb.) (15 management units)

Management Unit Statistical Area	Sub-areas	Last Year Fished	Former Quotas @2 gdk/m²	1994 HA	1994 Calculated Quotas @ 1.4 gdk/m²	1994 Proposed Quotas
WEST COAST						
Area 24: Annual Quota						
24-A1 redesignated A4,A5,A6		1992				
24-A2 (Yarksis)	n. ptn. 24-8	1993	70,000	233	76,602	77,000
24-A3 (Tonquin/Wick.)	s. ptn. 24-8	1993	43,500	110	36,164	36,000
* 24-A4 (Epper/Dunlap)	ptns. 24-6, -7	new 1994		122	40,109	40,000
* 24-A5 (Lemmens Inlet)	24-9	new 1994		101	33,205	33,000
24-A6 (Elbow Bank, Yellow Bank)		new 1994			(closure)	(closure)
Total Area 24A:			113,500	566	186,080	186,000
* 24-B1 (Outside)	ptn. 24-6	1993	275,000	563	185,095	125,000
24-B2 (Coomes Bank)	ptn. 24-6	1993	134,000	339	111,452	100,000
* 24-B3 (Ahousat)	ptns. 24-4 and -6	1992	180,000	191	62,794	50,000
* 24-B4 (Russell Ch.)	ptn. 24-6	1993	180,000	184	60,493	50,000
Total Area 24B:			769,000	1,277	419,834	325,000
Total Area 24:			882,500	1,843	605,914	511,000
Area 25 Three Yr. Rotational Quota						
* 25-A (Esperanza)	25-9,-12, ptn. -1	1991	560,000	442	435,943	431,000
25-B (Nuchatlitz)	25-14, ptn. -15	1991	785,000	586	577,970	578,000
25_C (Rosa Hbr)	ptn. 25-13	1991	100,000	58	(closure)	(closure)
25-D (Nootka)	25-3 to -8, -15	1991	100,000	146	144,000	100,000
Total Area 25:			1,545,000	1,232	1,157,913	1,109,000
TOTAL WEST COAST:			2,427,500	3,075	1,763,827	1,620,000
					18 LIC * 90,000 LB =	1,620,000 (734.8 t)

* should reduce fishing effort over time in these areas.

Table 15. 1994 Geoduck Management - Summary of proposed North Coast quotas (lb.) - 32 Management Units; Queen Charlotte Islands - Area 1, 2E (2-1 to 2-19) and 2W (2-31 to 2-100).

Management Unit	Statistical Subareas	# of Beds	Ha	Calculated or Recomm. Quota	Exploratory Quota	1994 Draft Quota
Area 2E (2-1 to 2-19)						
Skidegate	2-1	7	107	88,000		88,000
Cumshewa	2-3	7	54	66,000		66,000
Skedans	2-6,2-7	6	45	110,000		110,000
Tanu	2-8	12	38	93,000		93,000
U. Juan Perez	2-11	11	109	268,000		268,000
Marco/Hoskins	2-11	3	5	12,000		12,000
Werner Bay	2-12	3	13	32,000		32,000
L. Juan Perez	2-12,2-13	12	128	270,000		270,000
Poole	2-14	4	36	88,000		88,000
N. Skincuttle	2-14,2-15	4	19	46,000		46,000
S. Skincuttle	2-15	1	21	51,000		51,000
Collison Bay	2-14	2	15	36,000		36,000
Carpenter Bay	2-17,2-18	9	57	140,000		140,000
E. Hous.-Stew (Upper)	2-18	4	35	73,000		73,000
E. Hous.-Stew (Lower)	2-18	4	40	84,000		84,000
Heater/Keeweenah	2-18	3	24	59,000		59,000
Luxana /Howe Bay	2-19	3	59	100,000		100,000
Total Area 2E:		95	805	1,616,000	0	1,616,000
Area 2W (2-31 to 2-100)						
W. Hous.-Stew. (Moresby Isl.)	2-31	2	10	21,000		21,000
W. Hous.-Stew. (Kunghit Isl.)	2-31	3	75	158,000		158,000
Gordon Isl	2-31	1	25	61,000		61,000
Louscoone	2-31,2-32	4	37	91,000		91,000
Flamingo	2-35,2-36,2-37	4	8	20,000		20,000
Gowgaia	2-39,2-40,2-41	4	13	30,000	20,000	50,000
Englefield Bay	2-49 to 2-60				71,000	71,000
W. Skidegate	2-63,2-64,2-66,2-68	8	12	29,000		29,000
Kano	2-69,2-70,2-71	1	10	25,000		25,000
Rennel	2-73 to 2-84	4	33	25,000		25,000
Hippa	2-86, 2-87	6	30	85,000		85,000
Pt. Chanal	2-89,2-90,2-91	6	20	50,000		50,000
Pt. Louis	2-92 to 2-100	4	9	22,000		22,000
Total Area 2W:		47	282	617,000	91,000	708,000
Area 1						
Parry Pass	1-2,1-7	3	82	20,000		20,000
Virago Snd.	1-3	3	35	86,000		86,000
Total Area 1:		6	117	106,000	0	106,000
TOTAL NORTH COAST:		148	1,204	2,339,000	91,000	2,430,000
				27 LIC * 90,000 lb. =		2,430,000 [1] (1102.2 t)

[1] Average density calculates to 2.78 gdks/m²; 29.6 t/ha over 1243 ha estimated area.

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 1991.

	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)

[1] Bed sizes and closed beds were adjusted after consultation with industry

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 1991.

	Management Area									Annual Summary		
	3			4			5					
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[1]	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)

[1] Some very large beds with low landings were scaled down after consultation with fishermen.

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 1991.

	Management Area															Annual Summary		
	6			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[1]	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)

[1] Some very large beds with low landings were scaled down after consultation with fishermen.

Appendix 1 (continued)

Table 1.4. Mainland and east coast Vancouver Island (Campbell River District) cumulative harvested area, cumulative number of beds fished, and number of new beds fished per year for geoducks, 1978 to 1991.

	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)

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

[1] Very large beds with low landings were scaled down after consutation with fishermen and beds in contaminated closures were removed from calculations.

Appendix 1 (continued)

Table 1.5. Mainland and east coast Vancouver Island (Nanaimo & Victoria Districts) cumulative harvested area, cumulative number of beds fished, and number of new beds fished per year for geoducks, 1978 to 1991.

	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[3]	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)

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

[2] beds in contaminated and study areas were removed; reduced ha

[3] some bed areas were recalculated in 1990 after consultation with fishermen.

* beds were scaled with landing criteria or subdivided.

Appendix 1 (continued)

Table 1.6. Mainland District (Fraser River) cumulative harvested area, cumulative number of beds fished, and number of new beds fished per year for geoducks, 1986 to 1991.

	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)

1 statistical boundaries adjusted in 1990 analysis.

2 beds scales with landing criteria for 1994 analysis

Appendix 1 (continued)

Table 1.7. West Coast Vancouver Island (Management Areas 20 to 27) cumulative harvested area and cumulative number of beds fished, and number of new beds fished per year for geoducks, 1978 to 1991.

	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	(0)	2126	78	(0)	1232	39	(4)	439	38	(0)	770	39	(0)	5491	247	(4)

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

[1] Some areas were recalculated after consultation with fishermen.
Some beds with no landings or within closed areas (i.e. Sea Otter Reserve or contaminated areas) were removed from calculations.

APPENDIX 2

SOUTH COAST- INSIDE WATERS-1994 QUOTA RECOMMENDATIONS

The fishery for 1994 is the third year of the area rotations and is similar to the 1991 fishery described for 1991 by Harbo et. al (1992). The 1991 quota for I.W. was 735 t (1,620,000 lb.) supporting 12 Inside licences at 135,000 lb. (61.24 t) each. Areas 15,17,18,19 and 29 were fished in 1991 (Table 10)

The average density of geoducks has been reduced to 0.7 geoducks/m^2 for 1994 calculations from 1/m^2 in 1991.

Some beds fished in 1991 have been closed for the 1994 rotation to spread fishing effort throughout the beds (Table 12).

It is proposed to fish 10 quotas of 90,000 lb. for 1994 in Inside Waters; 900,500 lb. (486.5 t). This is a 33% reduction from the 1991 fishery. Quotas are summarized in Table 13.

AREA 15 (Figure 1)
26 beds; 804 ha (1993) estimated

The total area of 26 beds in Management Area 15 has been adjusted to 804 ha from an initial 1074 ha and 855 in 1991 (Appendix 1.5).

Separate quotas were set in 1991 for four portions of Area 15. Additional areas were broken out from 15-D (1991) for 15-E, 15-F and 15-G.

15-A North Coast of Savary Island (Figure 2)
1 bed, 124 ha estimated (1992)

A separate quota set in 1991 at 87,000 lb. (29,000 lb. annually) for the north coast of Savary Island (124 ha) to limit fishing at this site. It has been fished most years, 20,000 to 50,000 lb. annually.

The recommended quota for 1994 is 12,300 lb. The calculated three year option at 0.7 geoduck/m^2 over 124 ha is 61,150 lb. (Table 2.1). A shift in 1994 to the south shore is recommended.

15-B South Coast of Savary Island (Figure 2)
1 bed, 25 ha estimated (1992)

A separate quota of 17,625 lb. was set in 1991 for the south of Savary Island. There was little exploration in 1991 due to the low quota.

The recommended three year quota option for 1994 is 61,000 lb. The calculated quota for three years is 12,329 lb. (Table 2.2)

based on a scaled down area from low landings. The chart shows likely habitat and the bed is reported to be large by fishers. The shift from the north coast of Savary to the south shore was supported by the fishers for 1994.

15-C West Coast Of Hernando Island (Figure 2)
2 beds, 61 ha estimated (1992)

A bed on the west coast of Hernando Island (#403) was measured at 80 ha but had supported only minor landings over four years (16,224 lb.). The 1991 quota of 74,730 lb. was recommended for the west coast of Hernando Island to determine if stocks are present and to spread fishing effort throughout Management Area 15.

The area on the east coast of Hernando Island was fished in 1991 as part of 15-D described below.

The recommended quota for 1994 is 30,100 lb. The calculated quota for three years is 30,082 lb. (Table 2.3).

15-D Balance of Area 15 (Figure 4)

This area was further subdivided for 1994 as detailed below.

15-E Malaspina Inlet - Theodosia Inlet and Okeover Inlet (Figure 3)
2 beds, 14 ha estimated (1992)

A separate quota is planned for this area: 10,000 lb. (Table 2.4). This bed has not been fished since 1988.

15-F Cortes Island-Redonda Islands (Figure 3)
1 bed, 62 ha estimated (1992)

This area of Cortes Island has not been fished since 1983. A separate quota is planned in 1994: 30,000 lb. (Table 2.5).

15-G Twin Islands (Figure 3)
2 beds, 99 ha estimated (1992)

This bay on the east of Cortes Island includes Twin Islands subarea 15-3 (beds 301- 97 ha; 302 - 2 ha) had minor landings in 1991 (6084 lb.). A separate quota of 48,000 lb. is recommended for 1994 (Table 2.6).

15-D Balance of Area 15 (Figure 4)
17 beds, 419 ha estimated (1992)

The recommended three year quota in 1991 for the balance of Area 15 was 389,785 lb. to balance the inside quotas at 12 for 135,000 lb. This was less than the calculated quota but this area

was reduced because of the heavy fishing pressure. This reduction allowed for the same number of quotas for Inside Waters (12 quotas) as in 1989 and 1990 (Table 4).

In 1993, there was an error in the figure for the fishing plan and Blubber Bay, Texada Island (15-1) was fished. It will be closed in 1994.

The recommended quota for 1994 is 207,000 lb. The calculated quota for three years is 206,629 lb. (Table 2.7) A closure will be in effect for 1994 on the east shore of Harwood Island (Table 12).

A bed, Westview to Grief Pt, is under contaminated closure (Table 8).

AREA 17 (Figure 1)
58 beds, 651 ha estimated (1993)

17-A Nanoose (Figure 5): 1994 Fishery in Nanoose Bay only

3 beds, 160 ha (1993)

In 1991, a separate quota was set for 17-A, the Nanoose Bay to Neck Point, shoreline to spread fishing effort over Area 17. To simplify the boundaries subareas 17-18 to 17-20 inclusive were opened for fishing. The fleet, however, concentrated their efforts to 17-18 and 17-19 and did not fish 17-20.

It is recommended that 17-18 be closed from Blunden to Neck Point in 1994 (Table 12) and the quota be taken from the balance of 17-8,17-19 and 17-20 (Fig.5). The fishers plan to explore the islands north of Nanoose Bay.

The three year quota option for 0.7 geoduck/m^2 over 160 ha is 78,904 lb. (Table 2.8). This is the recommended quota for 1994.

17-B Balance of Area 17 (Figure 5)
47 beds, 446 ha estimated (1992)

The east shore of Kuper Island (Fig. 5) will be closed (Table 12) in 1994 to direct effort to other portions of Area 17.

The three year quota recommended for 1994 for the balance of Area 17 was based on 47 beds, 446 ha is 219,994 lb. (Table 2.9). A quota of 216,000 lb. is recommended for 1994.

AREA 29

Subarea 29-4 and 29-5 (Figure 4)
4 beds, 45 ha estimated (1992)

Three sites were charted, Kendrick Island and two locations along the N.E. coast of Valdes Island. The area may be overestimated.

The three year quota recommended for 1994 in subareas 29-4 and 29-5 at 0.7 geoduck/m^2 over 45 ha was 22,192 lb. (Table 26).

Fishers plan to harvest along Valdes -Galiano and to sites in 29-4. They include Whaler Bay, Galiano Island and sites to the south of Gossip Island (all coded as bed 7601 = 21 ha). The 1994 recommendation is 22,000 lb.

AREA 18 (Figure 1)
11 beds, 89 ha estimated (1993)

The largest bed reported in Area 18 was at Boatswain Bank, 45 ha, but only minor landings had been reported for this site prior to 1991.

18-A Boatswain Bank (Figure 5)
1 bed, 45 ha estimated

A separate quota of 33,725 lb. was set in 1991 for Boatswain Bank to determine if there were commercial stocks in the area. The fishery was open Nov. 7-12, 1991 and landed 32,975 lb.

The three year quota option at 0.7 geoduck/m^2 over 45 ha is 22,192 lb. (Table 2.11); the recommended quota for 1994 is 22,000 lb.

18-B Balance of Area 18 (Figure 1)
10 beds, 44 ha estimated

The 1991 quota for the balance of Area 18 was 48,000 lb. Most of the product was landed at Sturdies Bay in 1991 in late October and November. This was a hard time to fish this area.

The three year quota recommended for 1994 is 22,000 lb. (Table 2.12; the quota option was 21,619 lb.

AREA 19 (Figure 1)
14 beds, 681 ha (1993) estimated

The area in Area 19 was reduced to exclude beds in Saanich

Inlet that now fall under contaminated closures (Table 8).

Saanich Inlet should remain closed because of the risk of contaminated clams. Contaminated closures along the shoreline of Saanich Peninsula should be reviewed with consideration of extending the closure to close subtidal regions in the vicinity of the sewage outfalls.

The large area of 447 ha measured at James Spit (bed # 8002) should be reviewed. This bed has been fished for 12 years with landings exceeding 1.1 million lb., a reported removal of only 0.106 geoducks/m^2 over the area. The size of this bed is likely too large. A separate quota/a closure for a rotation is proposed for 1994.

19-A Saanich Inlet Subareas 19- (Figure 7)
2 beds, 101 ha estimated (1992)

The beds are under contaminated closures; see Table 12. Other likely locations also fall within contaminated closures. No landings have been reported since 1981 (Table 2.13).

19-B James Island (Figure 7)
5 beds, 509 ha estimated (1992)

This area has the second highest landings in Inside Waters (Comox Bar, highest). Most of the 1991 Area 19 fishery was at James Island, landing 444,873 lb. In all, 1.8 million lb. have been reported from this location; 21.2 years of quota based on the large area assigned to the beds (Table 2.14).

A reduction in fishing effort is recommended for 1994, a quota of 55,696 lb., less than the quota option of 251,013 lb.

19-C Balance of Area 19 (Figure 7)
7 beds, 172 ha estimated (1992)

This is a new management unit for 1994 to spread effort from James Island. The recommended quota for 1994 is 85,000 lb. (Table 2.15).

INSIDE WATERS QUOTA AREA DESCRIPTIONS - 1994

AREA 15

Area 15-A: Savary North - Portion of subarea 15-2 described as:

"Areas along the north shore of Savary Island, from Indian Pt. to Mace Pt. inside the 50 meter depth contour"

Area 15-B: Savary South, Portion of subarea 15-2

"Areas along the south shore of Savary Island, from the south western most point (unnamed) to the southern edge (50 meter depth) of Stradiotti Reef thence to the the southern edge (50 meter depth) of Mystery Reef, thence northerly (following the 50 meter depth contour) to Mace Pt."

Area 15-C: West Coast Hernando Island, Portions of 15-2 and 15-3:

"That portion of 15-3 along the west shore of Hernando Island from Spillsbury Pt. light (north end of Hernando Island) bounded by a line to the southernmost point of Mitlenatch Island, and (portion of 15-2) thence to the west of a line drawn due south one nautical mile from Ashworth Pt. on Hernando Island."

Area 15-E: Inlets, Subarea 15-4

Area 15-F: Cortes - Redonda Islands, subarea 15-5

Area 15-G: Twin Islands, portion of subarea 15-3 described as:

" that portion of subarea 15-5 inside or northerly of a line from Sutil Point on Quadra Island true east to the shore of Malaspina Penninsula, thence northerly along the shore to Sarah POint, thence westerly to Mary Point on Quadra Island, thence southerly along the shore of Quadra Island to the point of commencement."

Area 15-D: Balance of Area 15

"Excluding areas described above in 15A,B,C,E,F,G, with the exception of contaminated areas and NOT including the east side of Harwood Island - a conservation closure described as the shore of the east side of Harwood Island from chart datum to .5 nautical mile from the most northerly unnamed point of Harwood Island,southerly along the eastern shore to the most southerly unnamed point of Harwood Island."

AREA 17

Area 17-A: Nanoose, subareas 17-19, 17-20 and a portion of 17-18

"a portion of 17-18 described as inside or southerly of a line from Dorcas Point southeasterly to the westernmost island of the Winchelsea Islands, thence due south to the light on Maude Island, thence westerly to Wallis Point, thence northwesterly along the Vancouver Island shore to the point of commencement at Dorcas Point."

Area 17-B: Balance of Area 17

"Sub-areas 17-1 to 17-17 inclusive, with the exception of contaminated and permanent closures AND excluding a bed closure on the east side of Kuper Island, in portions of subareas 17-8, 17-2 and 17-6, described as: inside a line .5 nautical mile from the east shore of Kuper Island, from Pennulakut Spit southerly to the Grappler Rock bouy (#285) off the south eastern shore of Tent Island, thence westerly to the most southerly point of Tent Island."

Area 29-5: Outside Valdes and Galiano Islands: subareas 29-4 and 29-5

AREA 18

Area 18-A: Boatswain Bank - portion of 18-7

"That portion of the bank, to the east of the contaminated closure line from Separation Pt. to Hatch Point, bounded by a line from Cherry Pt. to Cape Keppel, then to Moses Pt., hence to Hatch Pt."

Area 18-B: Balance of Area 18.

"Balance of Area 18, with exception of contaminated closures."

AREA 19

Area 19-B: James Island, portion of subarea 19-5 described as :

"That portion of subarea 19-5 inside a line from the James Island buoy (#227) in Cordova Channel, thence easterly to buoy (#228) in Sydney Channel, thence southerly to the D'Arcy Shoals buoy (#226.3), thence westerly to the buoy (#222.8) west of Little Zero Rk off Cordova Bay, thence northerly to the James Island buoy (#227) at the point of commencement."

Area 19-C: the balance of Area 19, described as:

"All sub-areas excluding the portion of 19-5 described as Geoduck Management area '19-B'; excluding Saanich Inlet, Sub-areas 19-7 to 19-12 inclusive and excluding contaminated closures."

Table 2.1 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 15 A - NORTH OF SAVARY; PORTION OF 15-2

REPORTED HARVEST AREAS: 124 HA (1992) # BEDS: 1
BED 501

CUMULATIVE LANDINGS TO 1992: 125.8 TONNES
277283 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	2038	15288	20383	30575	40767
1	2912	21839	29119	43679	58238
1.4	4077	30575	40767	61150	81534
2	5824	43679	58238	87358	116477
2.45	7134	53507	71342	107013	142684
3.5	10192	76438	101917	152876	203835

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	924	7	9	14	18
10.65	1321	10	13	20	26
14.91	1849	14	18	28	37
21.30	2641	20	26	40	53
26.09	3235	24	32	49	65
37.28	4622	35	46	69	92

COMMENTS:
A QUOTA WAS SET FOR THIS AREA TO REDUCE FISHING PRESSURE.
BED FISHED FOR 10 YEARS, 1978-1988,91; ANNUAL LANDINGS TO 88,000 LB.(91)
LOW REMOVAL RATE: AREA MAY BE OVERESTIMATED.

1994: REVERSE QUOTAS WITH S.SAVARY (15-B) TO MOVE EFFORT TO 15-B

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION= 3YR. X (ANNUAL SY @ 0.7/M2 GEODUCK @1%)
= 61,150

1991 QUOTA 87,000 LB.

THE RECOMMENDED 1994 QUOTA IS 12,300 LB.

Table 2.2 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 15 B - SOUTH OF SAVARY; PORTION OF 15-2

REPORTED HARVEST AREAS: 25 HA (1994 SCALED) # BEDS: 1
BED 502

CUMULATIVE LANDINGS TO 1992: 30.6 TONNES
67559 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	411	3082	4110	6164	8219
1	587	4403	5871	8806	11742
1.5	881	6605	8806	13209	17612
2	1174	8806	11742	17612	23483
3	1761	13209	17612	26419	35225
3.5	2055	15411	20548	30822	41096

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	186	1	2	3	4
10.7	266	2	3	4	5
16.0	399	3	4	6	8
21.3	533	4	5	8	11
32.0	799	6	8	12	16
37.3	932	7	9	14	19

COMMENTS:
A QUOTA WAS SET FOR THIS AREA TO DETERMINE STOCKS IN 1991.
THIS BED HAS BEEN FISHED FOR 5 YEARS, 1978-1988; ANNUAL LANDINGS TO 17,300 LB.
LOW REMOVAL RATE: AREA MAY BE OVERESTIMATED.
REDUCED IN AREA FROM 244 HA TO 25 HA. FOR 1991 QUOTA CALCULATIONS.

1991 FISHERY VALIDATED LANDINGS OF 17669 LB. LOGS SHOW 5449 LB. LOG LANDINGS MUST BE INCLUDED WITH 15A - N. SAVARY BED

1994: REVERSE QUOTA WITH N.SAVARY BED TO PROVE OUT FISHING AREA.

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION = 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 12329

1991 QUOTA 17,625

THE RECOMMENDED 1994 QUOTA IS 61,000 LB.

Table 2.3 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 15 C - WEST SIDE HERNANDO ISLAND ; PORTIONS OF 15-2 AND 15-3

REPORTED HARVEST AREAS: 61 HA (1992) # BEDS: 2 BEDS 401/402

CUMULATIVE LANDINGS TO 1992: 160.4 TONNES 353618 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	1003	7521	10027	15041	20055
1	1432	10744	14325	21487	28650
1.4	2005	15041	20055	30082	40109
2	2865	21487	28650	42974	57299
2.45	3510	26322	35096	52644	70191
3.5	5014	37603	50137	75205	100273

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	455	3	5	7	9
10.7	650	5	6	10	13
14.9	910	7	9	14	18
21.3	1299	10	13	19	26
26.1	1592	12	16	24	32
37.3	2274	17	23	34	45

COMMENTS:
A QUOTA WAS SET FOR THIS AREA IN 1991 TO DETERMINE STOCKS.
THIS BED HAS BEEN FISHED FOR 8 YEARS, 1978-1988,91; ANNUAL LANDINGS TO 31,000 LB.
LANDINGS IN 1991 WERE 74,217 LB
LOW REMOVAL RATE: AREA MAY BE OVERESTIMATED.

BED AREAS SCALED WITH LANDING CRITERIA FOR 1994 CALCULATIONS.
WEATHER SUITABLE TO FISH IN OCTOBER. FISHED IN MARCH/APRIL AND SEPTEMBER 1991.

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION = 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 30,082 LB

1991 QUOTA 74,730

THE RECOMMENDED 1994 QUOTA IS 30,100 LB.

Table 2.4 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 15 E - INLETS S/A 15-4

REPORTED HARVEST AREAS: 14 HA (1992) # BEDS: 2 BEDS 801/802

CUMULATIVE LANDINGS TO 1992: 27.7 TONNES 61083 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	230	1726	2301	3452	4603
1	329	2466	3288	4931	6575
1.4	460	3452	4603	6904	9205
2	658	4931	6575	9863	13151
2.45	805	6041	8055	12082	16110
3.5	1151	8630	11507	17260	23014

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	104	1	1	2	2
10.7	149	1	1	2	3
14.9	209	2	2	3	4
21.3	298	2	3	4	6
26.1	365	3	4	5	7
37.3	522	4	5	8	10

COMMENTS:

SPLIT FROM 15D IN 1994 TO DIRECT EFFORT TO THIS BED NOT FISHED SINCE 1988.

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION = 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 6,904 LB

THE RECOMMENDED 1994 QUOTA IS 10,000 LB.

Table 2.5 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 15 F- CORTES - REDONDA ISLANDS S/A 15-5

REPORTED HARVEST AREAS: 62 HA (1992) # BEDS: 1 BEDS 15-5/201

CUMULATIVE LANDINGS TO 1992: 39.0 TONNES 86079 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	1019	7644	10192	15288	20383
1	1456	10920	14560	21839	29119
1.4	2038	15288	20383	30575	40767
2	2912	21839	29119	43679	58238
2.45	3567	26753	35671	53507	71342
3.5	5096	38219	50959	76438	101917

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	462	3	5	7	9
10.7	660	5	7	10	13
14.9	924	7	9	14	18
21.3	1321	10	13	20	26
26.1	1618	12	16	24	32
37.3	2311	17	23	35	46

COMMENTS:

SPLIT FROM 15D IN 1994 TO DIRECT EFFORT TO THIS BED NOT FISHED SINCE 1983.

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION = 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 30,575 LB

THE RECOMMENDED 1994 QUOTA IS 30,000 LB.

Table 2.6 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 15 G - TWIN ISLANDS PTN S/A 15-3

REPORTED HARVEST AREAS: 99 HA (1992) # BEDS: 2 BEDS 15-3/301 /302

CUMULATIVE LANDINGS TO 1992: 64.5 TONNES 142258 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	1627	12205	16274	24411	32548
1	2325	17436	23248	34873	46497
1.4	3255	24411	32548	48822	65096
2	4650	34873	46497	69745	92994
2.45	5696	42719	56959	85438	113917
3.5	8137	61027	81369	122054	162739

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	738	6	7	11	15
10.7	1054	8	11	16	21
14.9	1476	11	15	22	30
21.3	2109	16	21	32	42
26.1	2583	19	26	39	52
37.3	3690	28	37	55	74

COMMENTS:

SPLIT FROM 15D IN 1994 TO DIRECT EFFORT TO THESE BEDS WITH MINOR LANDINGS SINCE 1986.

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION = 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 48,822 LB

THE RECOMMENDED 1994 QUOTA IS 48,000 LB.

Table 2.7 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 15 D - REMAINING AREAS OF 15; EXCEPTING SAVARY, HERNANDO IS., TWIN, INLETS, SQUIRREL

REPORTED HARVEST AREAS: 419 HA (1992) # BEDS: 17

CUMULATIVE LANDINGS TO 1992: 387.0 TONNES
853322 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	6888	51657	68876	103315	137753
1	9839	73796	98395	147592	196790
1.4	13775	103315	137753	206629	275505
2	19679	147592	196790	295184	393579
2.45	24107	180800	241067	361601	482135
3.5	34438	258286	344382	516573	688764

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	3124	23	31	47	62
10.65	4462	33	45	67	89
14.91	6247	47	62	94	125
21.30	8925	67	89	134	178
26.09	10933	82	109	164	219
37.28	15618	117	156	234	312

COMMENTS:
A QUOTA WAS SET FOR THIS AREA IN 1991 OF 389,785 LB.

FROM THE 1991 FISHERY 164 NEW HA (6 NEW BEDS) ADDED TO QUOTA AREA CALCULATIONS. BUT SOME BED AREAS WERE SCALED USING LANDING CRITERIA FOR 1994 CALCULATIONS

BED 15-3/0702 , EAST SHORE OF HARWOOD ISLAND, IS CLOSED (BUT HA INCLUDED)IN 1994 TO SHIFT EFFORT TO OTHER BEDS.

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION= 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 206,629 lb

THE RECOMMENDED QUOTA FOR 1994 IS 207,000 LB.

Table 2.8 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 17 A - SUBAREAS 17-18, -19, -20

REPORTED HARVEST AREAS: 160 HA (1992) # BEDS: 3
BEDS 6002/5901/6001

CUMULATIVE LANDINGS TO 1992: 144.7 TONNES
318972 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	2630	19726	26301	39452	52602
1	3757	28180	37573	56360	75146
1.4	5260	39452	52602	78904	105205
2	7515	56360	75146	112720	150293
2.45	9205	69041	92054	138082	184109
3.5	13151	98630	131506	197259	263012

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	1193	9	12	18	24
10.65	1704	13	17	26	34
14.91	2386	18	24	36	48
21.30	3408	26	34	51	68
26.09	4175	31	42	63	83
37.28	5964	45	60	89	119

COMMENTS:
A QUOTA WAS SET FOR THIS AREA IN 1991.
HIGHEST LANDINGS WERE IN 1981: 73,000 LB.; 1991 LANDINGS = 107,238 LB
AREA MAY BE OVERESTIMATED.

1994 RECOMMENDED CLOSURE IN S/A 17-18, BED 6001 (66 HA) WAS HEAVILY FISHED IN 1991 THIS BED AREA IS STILL INCLUDED IN QUOTA CALCULATION - CLOSURE WILL SHIFT EFFORT

RECOMMENDATIONS:

THREE YEAR QUOTA OPTION= 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 78904

1991 QUOTA 108,000 LB.

THE RECOMMENDED 1994 QUOTA IS 78,904 LB.

Table 2.9 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 17 B - REMAINING AREAS OF 17 EXCEPT 17-18

REPORTED HARVEST AREAS: 446 HA (1992) # BEDS: 47

CUMULATIVE LANDINGS TO 1992: 1093.0 TONNES
2410090 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	7331	54986	73315	109972	146629
1	10474	78551	104735	157103	209471
1.4	14663	109972	146629	219944	293259
2	20947	157103	209471	314206	418941
2.45	25660	192451	256601	384902	513203
3.5	36657	274930	366574	549860	733147

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	3325	25	33	50	66
10.65	4750	36	47	71	95
14.91	6650	50	66	100	133
21.30	9500	71	95	142	190
26.09	11637	87	116	175	233
37.28	16625	125	166	249	332

COMMENTS:
A QUOTA WAS SET FOR THIS AREA IN 1991 AT 293,085 LB.
7 BEDS WERE WITH MINOR LANDINGS WERE NOT INCL. IN THE 1991 CALCULATIONS.
BEDS WITH MINOR LANDING WERE SCALED USING LANDING CRITERIA IN 1994 CALCULATIONS

AREA MAY BE OVERESTIMATED.

THE 1991 FISHERY ADDED 42 HA (14 NEW BEDS).

1994: E. SIDE KUPER IS BEDS CLOSED - BEDS 17-2/7301, 17-8/7301, 17-6/7301
EST 40 HA STILL INCLUDED IN CALCULATED QUOTA - TO SHIFT EFFORT TO OTHER BEDS.

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION= 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 219944

THE RECOMMENDED QUOTA FOR 1994 IS 216,000 LB.

Table 2.10 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: AREA 29 - SUBAREAS 29-5, 29-4

REPORTED HARVEST AREAS: 45 HA (1992) # BEDS: 4
BEDS 501/7601
0106/0502

CUMULATIVE LANDINGS TO 1991: 202.2 TONNES
445860 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	740	5548	7397	11096	14794
1	1057	7926	10567	15851	21135
1.4	1479	11096	14794	22192	29589
2	2113	15851	21135	31702	42270
2.45	2589	19418	25890	38835	51781
3.5	3699	27740	36986	55479	73972

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	335	3	3	5	7
10.65	479	4	5	7	10
14.91	671	5	7	10	13
21.30	959	7	10	14	19
26.09	1174	9	12	18	23
37.28	1677	13	17	25	34

COMMENTS:
A QUOTA WAS SET FOR THIS AREA IN 1991.
AREA MAY BE OVERESTIMATED.

AREA 29-4 IS INCLUDED IN THIS AREA IN 1994.

BED AREAS ARE SCALED WITH LANDING CRITERIA IN 1994.

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION= 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 22192

1991 QUOTA 30,000 LB.

THE RECOMMENED QUOTA FOR 1994 IS 22,000 LB.

Table 2.11 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 18 A - BOATSWAIN BANK ; PORTION OF 18-7

REPORTED HARVEST AREAS: 45 HA (1992) # BEDS: 1
BED 101

CUMULATIVE LANDINGS TO 1992: 26.3 TONNES
58067 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	740	5548	7397	11096	14794
1	1057	7926	10567	15851	21135
1.4	1479	11096	14794	22192	29589
2	2113	15851	21135	31702	42270
2.45	2589	19418	25890	38835	51781
3.5	3699	27740	36986	55479	73972

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	335	3	3	5	7
10.65	479	4	5	7	10
14.91	671	5	7	10	13
21.30	959	7	10	14	19
26.09	1174	9	12	18	23
37.28	1677	13	17	25	34

COMMENTS:
A QUOTA WAS SET FOR THIS AREA IN 1991 TO DETERMINE STOCKS.
HIGHEST ANNUAL LANDING WAS 15,850 LB. IN 1986; 32,975 LB IN 1991.
AREA MAY BE OVERESTIMATED.

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION= 3YR. X (ANNUAL SY @0.7 GEODUCK/M2 @1%)
= 22192

1991 QUOTA 33,000

THE RECOMMENDED QUOTA FOR 1994 IS 22,000 LB.

Table 2.12 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 18 B - BALANCE OF AREA 18

REPORTED HARVEST AREAS: 44 HA (1992) # BEDS: 10

CUMULATIVE LANDINGS TO 1992: 78.6 TONNES
173332 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	723	5425	7233	10849	14466
1	1033	7749	10333	15499	20665
1.4	1447	10849	14466	21699	28931
2	2067	15499	20665	30998	41331
2.45	2531	18986	25315	37972	50630
3.5	3616	27123	36164	54246	72328

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	328	2	3	5	7
10.65	469	4	5	7	9
14.91	656	5	7	10	13
21.30	937	7	9	14	19
26.09	1148	9	11	17	23
37.28	1640	12	16	25	33

COMMENTS:
1991 FISHERY ADDED 3 NEW BEDS; 21 HA

BED AREAS WERE SCALED USING LANDING CRITERIA FOR 1994 CALCULATIONS

RECOMMENDATIONS:

THREE YEAR QUOTA OPTION = 3 YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @ 1%)
= 21699

1991 QUOTA 48,000 LB.

THE RECOMMENDED 1994 QUOTA IS 22,000 LB.

Table 2.13 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 19A: SAANICH INLET CONTAMINATED CLOSURES

REPORTED HARVEST AREAS: 101 HA (1993) # BEDS: 2

CUMULATIVE LANDINGS TO 1992: 27.6 TONNES
60906 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	1660	12452	16603	24904	33205
1	2372	17789	23718	35577	47436
1.4	3321	24904	33205	49808	66411
2	4744	35577	47436	71154	94872
2.45	5811	43582	58109	87164	116219
3.5	8301	62260	83013	124520	166027

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	753	6	8	11	15
10.65	1076	8	11	16	22
14.91	1506	11	15	23	30
21.30	2151	16	22	32	43
26.09	2635	20	26	40	53
37.28	3765	28	38	56	75

COMMENTS:

CONTAMINATED CLOSURES IN 19-7 TO 19-12 LED TO A REDUCTION OF 2 BEDS AND 101 HA.

NO LANDINGS REPORTED ON HARVEST LOGS SINCE 1981.

LANDINGS FROM HARVEST LOGS = 3.7 YEARS OF QUOTA @ .07 GDK/M²

RECOMMENDATIONS:

CLOSED IN 1991

CLOSED IN 1994

Table 2.14 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 19B: JAMES ISLAND

REPORTED HARVEST AREAS: 509 HA (1993) # BEDS: 5

CUMULATIVE LANDINGS TO 1992: 803.6 TONNES
1771911 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	8367	62753	83671	125506	167342
1	11953	89647	119530	179295	239059
1.4	16734	125506	167342	251012	334683
2	23906	179295	239059	358589	478119
2.45	29285	219636	292848	439272	585696
3.5	41835	313766	418354	627531	836708

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	3795	28	38	57	76
10.65	5421	41	54	81	108
14.91	7589	57	76	114	152
21.30	10842	81	108	163	217
26.09	13281	100	133	199	266
37.28	18973	142	190	285	379

COMMENTS:

THIS AREA HAS BEEN FISHED HEAVILY: THE SOUTHERN JAMES ISLAND
IS SECOND TO COMOX BAR FOR LANDINGS IN INSIDE WATERS
ANNUAL LANDINGS IN THE PAST HAVE BEEN AS GREAT AS 195,000 LB. IN 1979
LANDINGS IN 1991 WERE 444,873 LB. REORTED ON LOGS (148,291 ANNUALLY)
THE LARGEST BED, 8002-447 HA, IS TO THE SOUTH OF JAMES ISLAND

LANDINGS FROM HARVEST LOGS = 21.2 YEARS OF QUOTA @ .07 GDK/M²

RECOMMENDATIONS:
THE QUOTA SHOULD BE REDUCED FOR THIS AREA TO COMPENSATE FOR EARLIER FISHING.
STANDARD THREE YR QUOTA OPTION = 3 YR X (ANNUAL SY @ 0.7 GDK/M² X 1% = 251,013 LB.

THE 1994 QUOTA RECOMMENDED IS 55,696 LB. TO
MAKE 10 QUOTAS OF 90,000 LB. FOR INSIDE WATERS
THE REDUCTION OF QUOTA FOR THIS BED IS TO COMPENSATE
FOR LANDINGS TO DATE

Table 2.15 1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 19C : BALANCE OF 19 EXCLUDING SAANICH INLET AND JAMES IS (LESS CONTAMINATED AND CONSERVATION CLOSURES)

REPORTED HARVEST AREAS: 172 HA (1993) # BEDS: 7 ('94 closures 0101/

CUMULATIVE LANDINGS TO 1992: 164.6 TONNES /0102/8001/8002/8003)
362880 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	2827	21205	28274	42411	56548
1	4039	30293	40391	60587	80782
1.4	5655	42411	56548	84821	113095
2	8078	60587	80782	121174	161565
2.45	9896	74219	98958	148438	197917
3.5	14137	106027	141369	212054	282738

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	1282	10	13	19	26
10.65	1832	14	18	27	37
14.91	2565	19	26	38	51
21.30	3664	27	37	55	73
26.09	4488	34	45	67	90
37.28	6411	48	64	96	128

COMMENTS:
A QUOTA WAS SET FOR THIS AREA IN 1991 AND 1994
CONTAMINATED CLOSURES IN 19-7 TO 19-12 LED TO A REDUCTION OF 2 BEDS AND 103 HA.

AREA MAY BE OVERESTIMATED. A BED AREA ERROR WAS CORRECTED IN 1993 ANALYSIS.

1994 CLOSURES ARE PROPOSED IN JAMES ISLAND AREA WHERE BEDS HAVE BEEN HEAVILY HARVESTED
THIS MAY RESULT IN REDUCED HECTARES OF FISHING AREA IN AREA 19.

BED AREAS HAVE BEEN SCALED USING LANDING CRITERIA FOR 1994 CALCULATIONS.

LANDINGS FROM HARVEST LOGS = 12.8 YEARS OF QUOTA @ .07 GDK/M²

RECOMMENDATIONS:
THREE YEAR QUOTA OPTION= 3YR. X (ANNUAL SY @ 0.7 GEODUCK/M2 @1%)
= 84821
1991 QUOTA 538,625 LB.

THE RECOMMENDED QUOTA FOR 1994 IS 85,000 LB.

APPENDIX 3.

SOUTH COAST - WEST COAST VANCOUVER ISLAND - 1994 QUOTA RECOMMENDATIONS

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 had been no PSP monitoring. Due to the potential of geoducks harvested from PSP risk areas entering the live market, there were changes in the rotation of areas over the period 1992-93-94 from the earlier rotation of 1989-90-92 (Table 10). These area quota transfers were necessary to provide an opportunity to take the vessel quotas in the licensed year.

AREA 20 (Figure 1)
3 beds, 311 ha estimated

This area is difficult to fish due to strong currents and exposure to winds and swell. Fishers advise that the quality of geoducks from this area is poor.

Only 2871 lb. were taken in July, 1991 . The balance of the Area 20 quota was taken later in the year, in October, in Area 24, Russell Channel, where a new quota division was created (24-B3; Fig.6); opened October 11 to October 25,1991.

A closure is recommended for the 1994 rotation.

AREA 24 (Figure 1)

Area 24 has supported more fishing than any other area on the coast (Table 2). The area was divided initially into two geoduck management areas, "inside" (24-A) and "outside" (24-B), in 1984.

In total, 17 beds, 566 ha have been identified for the "Inside" and 16 beds, 1843 ha for the "Outside" areas (Figures 8 and 9). There were 14 beds, 119 ha for 24-C, Sydney Inlet and the "Exposed" area and 22 beds, 96 ha for 24-D, the "Inlets".

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.

Since 1989, with the introduction of the three year rotational fishery, Area 24 was left with an annual quota. This was 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.

Area 24 - Inside (Figure 8)

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

24-A1 Inside (Figure 8)
17 beds, 393 ha estimated (1993)

This is 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.

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.

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 should be less quota allocated to the inside area than the "outside" in 1994.

The designation 24-A1 will no longer be used; it has been subdivided into 24-4,5,and 6.

24-A2 Inside (Figure 8)
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 is 77,000 lb.; the option at 1.4 geoducks/m^2 over 233 ha was 76,602 lb. (Table 3.1).

24-A3 Inside (Figure 8
1 bed, 110 ha estimated

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

The recommended quota for 1994 is 36,000 lb. , less than the

annual quota at 1.4 geoducks/m^2 over 110 ha for this area of 36,164 (Table 34). See the above comments for Area 24-A.

24-A4 Inside (Figure 8) Epper Pass-Dunlap Island
9 beds, 122 ha estimated

This is a new designation for 1994, a separation of Yellow Bank and Elbow Bank. This area has been heavily fished; 23 years of quota if the average initial densities were 1.4 geoducks/m^2. Landings for 1992 and 1993 are not yet available and have not been added in.

The 1994 recommended quota is 40,000 lb., approximately the calculated option (Table 3.3). Future fishing should be reduced or surveys undertaken.

24-A5 Inside (Figure 8) Lemmens Inlet
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 (Table 3.4).

24-A6 Inside (Figure 8) Yellow Bank-Elbow Bank
2 beds, 148 ha estimated (1993)

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.

Table 3.5 estimates 41 to 58 years of quota have been landed at these sites. A closure is recommended in 1994.

Area 24 Outside (Figure 9)

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 (Figure 9)
12 beds, 563 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 is 125,000 lb. , reduced to compensate for high landings in the past years; the calculated annual option is 185,095 lb. (Table 3.6). At 1.4 geoducks/m^2 estimated original density, 34 years of quota have been landed.

24-B2 Outside Coomes Bank (Figure 9)
1 bed, 339 ha estimated

This is one large bed measured at 339 ha. It had supported a large fishery in excess of 1.6 million lb. (732 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. (Table 3.7). The recommended quota for 1994 is 100,000 lb.

24-B3 Outside Ahousat (Figure 9)
2 beds, 191 ha estimated

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 (Table 8).

The quota recommended for 1994 is 50,000 lb.; this reduction is to compensate for heavy fishing to date landing an estimated 29 years of quota if original densities were 1.4 geoducks /m^2 over 191 ha (Table 3.8). This area was closed in 1993.

24-B4 Russell Channel (Figure 9)
1 bed, 184 ha estimated (1992)

Fishers were unable to attain the 75,000 lb. quota in Area 20 during the summer of 1991.

A new division of Area 24 (24-B4) was created in October 1991, with the intent to harvest the one large bed in Russell Channel that reported high landings in 1983 and 1984 but very little in recent years (Table 38). The remaining quota from Area 20 of 72,129 lb. was assigned to Area 24-B4 in the fall of 1991. The area was open October 11 to October 25,1991 with landings of 73,610 lb. reported.

The quota recommended for 1994 is 50,000 lb., this is less than the annual calculated option of 60,493 lb. (Table 3.9

Area 24-C Exposed Area - Hesquiat Harbour subarea 24-1, exposed portions of subareas 24-8 and 124-3, Sydney Inlet 24-2

(Figure 10)
14 beds 119 ha (1991)

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 for a total of 100 ha. This area has remained closed since 1991.

This area is recommended to be closed in 1994, pending further evaluation of stocks (Table 3.10).

Area 24-D Inlets (Figure 10)
22 beds, 96 ha

The "Inlet" areas were fished over the period 1985 to 1990, for landings of 1,187,125 lb.(538.5 t) (Table 3. 11). Most fishers have expressed concern that these areas have been overfished and they should remain closed until further evaluation.

AREA 25 (Figure 11)

For 1994, Area 25 was divided into four quota areas to spread fishing effort over the area.

25-A Esperanza Inlet-Port Eliza (Figure 11)
5 beds, 442 ha estimated (1992)

There had been heavy fishing pressure in this area, particularly at Rolling Roadstead (3.75 million lb.) off Catala Island.

There were five beds (68 ha) reduced in ha, due to low landings, less than 40,000 lb. Some new beds were found in the 1991 fishery (Appendix 1).

This area may have higher densities than others; a survey in 1978 (Cox pers. comm.) estimated 2.04 geoducks/m^2 over 426.7 ha.

The three year quota recommended for 1991 was 560,000 lb. The recommended quota for 1994 is reduced to 431,000 lb. The quotas for this area should be stepped down next rotation to compensate for the years of quota landed to date, estimated at 21 to 30 years (Table 3.11).

25-B Nuchatlitz Inlet-Port Langford (Figure 11)
4 beds, 586 ha estimated

This is estimated to be a large area that had only been fished three years in the past, 1984, 1985 and 1987. The services of a fish packer are required to make fishing this area viable, due to navigation difficulties and the distance to a landing port.

The three year quota option recommended for 1994 is 578,000 lb. (Table 3.12).

25-C Rosa Harbour (Figure 11)
2 beds, 58 ha estimated

This is a small location with one bed fished heavily; 22 to 31 years of quota landed (Table 3.13). The three year quota option recommended for 1991 was 100,000 lb.

A closure is recommended for 1994.

25-D Nootka Sound (Figure 9)
23 beds,146 ha estimated

This area is characterized by many small beds. An area (67 ha) of 14 small beds was scaled according to landings criteria, and reduced in ha due to the minor landings (ranging from 450 lb. to 34,000 lb.) for these beds.

The total area is likely overestimated due to the difficulty in measuring small beds (less than 1 ha) with the digitizing tablet used.

Fishers supported a lower quota of 100,000 lb. for 1994 (Table 3.14) .The three year quota option recommended for 1991 was 100,000 lb. (Table 42).

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WEST COAST VANCOUVER ISLAND QUOTA AREA DESCRIPTIONS - 1994

AREA 24-INSIDE AREAS:

For the 1994 fishery, 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.

Area 24-A2 : Portion of 24-8

Northern portion of 24-8; includes Yarksis and the northerly end of Wickaninish Island described as:

"A portion of 24-8, bounded by a line on the north from Rassier to Schindler Point, thence to Grice Point. Bounded on the south by a line from Moser Point, Vargas Island to the most northwesterly point of Wickanninish Island, then easterly along the shore to the beacon on the northeast shore of Wickanninish, thence to the mid-channel buoy, Y3, thence due east to Esowista Peninsula and thence north along the shore to Grice Point".

Area 24-A3: Tonquin-Echachis-Wickaninnish

"That portion of 24-8, Templar Channel south of a line from the beacon on the east shore of Wickaninnish Island. Thence north east to a Midchannel Buoy, Y3, thence due east to Esowista Peninsula; bounded by a line on the west from the most westerly point of Wickanninish Island thence due south to the southerly boundary of 24-8, a line from Cox Point to the most the most southwestern point of Lennard Island, thence to the most southwesterly point of Vargas Island, near Ahous Point".

Area 24-A4: Epper Pass - Dunlap Island

"that portion of sub area 24-6, as described in the Pacific Fishery Management Area Regulations, bounded 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 western most point of Morfee Island) true south to 49°12'60" N, 125°58'10" W on Vargas Is., thence following the shore of Vargas Island in an easterly direction to an unamed point on Vargas Island (near Macintosh Rock - local name - at 49°12'60" N, 125°57'30" W) thence true north to the Eugvik Rk. bouy, thence easterly to the most southern tip of Dunlap Island, thence northerly along the shore of Dunlap Island to the most northern point, thence due north to Kraan Island."

"That portion of 24-7 **excluding** that portion southerly or inside of a line from Kraan Island, thence northeasterly to the northern most point of Sarnac Island, southerly along the shore of Sarnac Island to the most southerly point, thence southeasterly to the unnamed point on Meares Island on the northern shore of Ritchie Bay, thence southwesterly along the shore of Ritchie Bay to Robert Point, thence back to the point of commencement at Kraan Island."

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.

Area 24-A5: Lemmens Inlet

"Subarea 24-9"

Area 24-A6: Elbow Bank-Yellow Bank

"That portion of subarea 24-6 inside or easterly of a line from an unamed point on Vargas Island (near Macintosh Rock - local name - at 49°12′60" N, 125°57′30" W) thence true north to the Eugvik Rk. bouy, thence easterly to the most southern tip of Dunlap Island, thence due east to the shore of Meares Is., thence southerly along the shore of meares Is. to Schindler Pt., thence northesterly to Rassier Pt., thence northerly along the shore of Vargas Is. to the point of commencement."

"That portion of 24-7 southerly or inside of a line from Kraan Island, thence northeasterly to the northern most point of Sarnac Island, southerly along the shore of Sarnac Island to the most southerly point, thence southeasterly to the unnamed point on Meares Island on the northern shore of Ritchie Bay, thence southwesterly along the shore of Ritchie Bay to Robert Point, thence back to the point of commencement at Kraan Island."

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

AREA 24-OUTSIDE AREAS

Area 24-B1: A portion of 24-6

"A portion of 24-6, "outside" or west of a straight line from a point on Vancouver Island, (at 49°13′60" N, 125°58′10" W) approximately 1/2 mile northwesterly of the western most point of Morfee Island, then true south to an unnamed point on Vargas Island (at 49°12′60" N, 125°58′10" W); and south of 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 a line that runs due south from Kutcous Point for **one half (0.5) nautical mile;** bounded on the south by the sub-area line from the most southwesterly point on Vargas Island, near Ahous Point, thence northwesterly along the surfline to Rafael Point on Flores Island".

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).

Area 24-B2: Calmus Pass/Coomes Bank

"that portion of sub area 24-6, as described in the Pacific Fishery Management Area Regulations, 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 western most point of Morfee Island) true south to 49°12.6′ N, 125°58.1′ W on Vargas Is.; thence westerly to the floating buoy Y11 in Calmus Passage (at 49°13.3′ N, 126°0.5′ W); thence north westerly 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; thence easterly along the shore of Vancouver Island to the point of commencement.

Area 24-B3: Outside-Ahousat

"That portion of 24-4, bounded on the north by a line from Clifford Point to the northern most point of McNeill Peninsula, and bounded on the south by a line from Yates Point to Clifford Point; and that portion of 24-6, bounded by the sub-area line at the north from Clifford Point to Yates Point, and bounded on the south by a straight line from Chetarpe Point bearing 302 degrees true in a northwest direction to a prominent point of land located .5 of a nautical mile southwest of Yates Point on Flores Island."

Area 24-B4: Russell Channel

"That portion of 24-6 south of a line from Yates Point on Flores Island to the unnamed point South of Chetarpe Indian Reserve on Vancouver Island, **thence southerly to Monks Islet light,** thence westerly to intersect a line one half nautical mile due south from Kutcous Point on Flores Island, thence westerly to the unnamed point south of Yates Point in Flores Island, thence following the shore to Yates Point."

AREA 25

Area 25-A: Esperanza Inlet - Port Eliza:

"Sub-areas 25-9; 25-11; 25-12 and a portion of 25-13 north and west of a line from Ferrer Point to a light at Middle Reef, thence to the north tip of Flower Islet, thence to the south west tip of Centre Island, thence due south to Nootka Island".

General description: This includes beds from Rolling Roadstead Catala Island into Esperanza Inlet.

Area 25-B: Nuchatlitz Inlet - Port Langford

"Sub-area 25-14 and a portion of 25-13 to the east of a line from Ferrer Point to the south west tip of Ensenada Islet then due north to the peninsula of Nootka Island".

General description: This includes beds from Ensenada Islet east into Nuchatlitz Inlet.

Area 25-C: Rosa Harbour and the entrance to Nuchatlitz Inlet.

"That portion of 25-13 bounded on the north and west by a line from Ferrer Point to the light at Middle Reef thence to the north tip of Flower Islet thence to south west tip of Centre Island thence due south to Nootka Island; and bounded on the south and east by a line from Ferrer Point to the south west tip of Ensenada Islet then due north to the peninsula of Nootka Island"

This area is recommended to be closed in 1994.

General description: beds from Flower Islet south to Nuchatlitz Island.

Area 25-D: Nootka Sound - Cook Channel - Zuciarte Channel

"Sub-areas 25-3 to 25-8, 25-15"

General description: this includes beds in Nootka Sound and islands in Cook Channel and Zuciarte Channel, the Villaverde Islands. No beds have been reported in the other sub-areas but they are open for exploratory fishing.

TABLE 3.1

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24-A2: NORTHERN PTN 24-8, YARKSIS AND N. END WICKANINISH I.

REPORTED HARVEST AREAS: 233 HA (1992) # BEDS: 4

CUMULATIVE LANDINGS TO 1993: 638 TONNES
1,407,320 POUNDS
(INCLUDING 1993 VALIDATED LANDINGS)

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (1000 LB.)			
(#/M.SQ.)	(1000 LB.)	0.75%	1.0%	1.5%	2.0%
0.7	3830	29	38	57	77
1	5472	41	55	82	109
1.4	7660	57	77	115	153
2	10943	82	109	164	219
2.45	13405	101	134	201	268
3.5	19151	144	192	287	383

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (MT)			
(MT/HA)	(MT)	0.75%	1.0%	1.5%	2.0%
7.5	1737	13	17	26	35
10.7	2481	19	25	37	50
14.9	3474	26	35	52	69
21.3	4963	37	50	74	99
26.1	6080	46	61	91	122
37.3	8685	65	87	130	174

COMMENTS:
BEDS 1301, 1302, 1303, 1403

1991 - BEDS SCALED WITH LANDING CRITERIA
BED 1301 REMEASURED IN 1993 - 84 HA.

LANDINGS FROM HARVEST LOGS = 12.9 YEARS OF QUOTA TAKEN @ 2 GEODUCKS/M²

QUOTA OPTION 2 GDK/M² AND 1% = 109,432

QUOTA OPTION 1.4 GDK/M² AND 1% = 76,602

RECOMMENDATIONS:

THE 1992 QUOTA WAS SET AT 70,000 LB.
THE 1993 QUOTA WAS SET AT 70,000 LB.

THE RECOMMENDED 1994 QUOTA IS 77,000 LB.

TABLE 3.2

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24-A3: SOUTHERN PTN 24-8, TONQUIN-ECHACHIS-WICKANINISH

REPORTED HARVEST AREAS: 110 HA (1991) # BEDS: 1

CUMULATIVE LANDINGS TO 1993: 133 TONNES
293,081 POUNDS
(INCLUDING 1993 VALIDATED LANDINGS)

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (1000 LB.)			
(#/M.SQ.)	(1000 LB.)	0.75%	1.0%	1.5%	2.0%
0.7	1808	14	18	27	36
1	2583	19	26	39	52
1.4	3616	27	36	54	72
2	5166	39	52	77	103
2.45	6329	47	63	95	127
3.5	9041	68	90	136	181

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (MT)			
(MT/HA)	(MT)	0.75%	1.0%	1.5%	2.0%
7.5	820	6	8	12	16
10.7	1172	9	12	18	23
14.9	1640	12	16	25	33
21.3	2343	18	23	35	47
26.1	2870	22	29	43	57
37.3	4100	31	41	62	82

COMMENTS:
BED 1401

DUE TO A PSP CLOSURE ONLY 10,554 LB OF THE 30,000 LB QUOTA WERE LANDED IN 1991.

ANNUAL QUOTA OPTION @ 2 GDK/M² = 51,663
ANNUAL QUOTA OPTION @ 1.4 GDK/M² 36,164

LANDINGS FROM HARVEST LOGS = 5.7 YEARS OF QUOTA TAKEN @ 2 GEODUCKS/M²
8.1 YEARS OF QUOTA TAKEN @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:

THE 1992 QUOTA WAS SET AT 30,000 LB.
THE 1993 QUOTA WAS SET AT 43,500 LB. (30,000 FOR 1993 PLUS 13,500 LB. OF 19,000 LB. NOT LANDED IN 1991). NOT ALL POUNDS WERE TRANSFERED FROM 1991 TO 1993 DUE TO OVERALL QUOTA REDUCTIONS.

THE RECOMMENDED 1994 QUOTA IS 36,000 LB.

TABLE 3.3

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS
AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24A4: PORTIONS 24-6,-7 - EPPER PASS/DUNLAP IS
** new in 1994 **

REPORTED HARVEST AREAS: 122 HA (1992) # BEDS: 9
1202/1002/1203/903/1007/1003/1101/1006

CUMULATIVE LANDINGS TO 1991: 418 TONNES /0906
922,057 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (1000 LB.) 0.75%	1.0%	1.5%	2.0%
0.7	2005	15	20	30	40
1	2865	21	29	43	57
1.4	4011	30	40	60	80
2	5730	43	57	86	115
2.45	7019	53	70	105	140
3.5	10027	75	100	150	201

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	910	7	9	14	18
10.7	1299	10	13	19	26
14.9	1819	14	18	27	36
21.3	2599	19	26	39	52
26.1	3183	24	32	48	64
37.3	4548	34	45	68	91

COMMENTS:
A PORTION OF 24-A1, YELLOW BANK AND ELBOW BANK CLOSED

ANNUAL QUOTA OPTION @ 1%, 2 GDK/M² = 57,299
ANNUAL QUOTA OPTION @ 1%, 1.4 GDK/M² = 40,109

LANDINGS FROM HARVEST LOGS = 16.1 YEARS OF QUOTA LANDED @ 2 GDK/M²
23.0 YEARS OF QUOTA LANDED @ 1.4 GDK/M²

RECOMMENDATIONS:

THE RECOMMENDED 1994 QUOTA IS 40,000 LB.

TABLE 3.4

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS
AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24A5: 29-9, LEMMENS INLET
** new in 1994 **

REPORTED HARVEST AREAS: 101 HA (1992) # BEDS: 3
/1601/1602/1603

CUMULATIVE LANDINGS TO 1991: 285 TONNES
628,100 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (1000 LB.) 0.75%	1.0%	1.5%	2.0%
0.7	1660	12	17	25	33
1	2372	18	24	36	47
1.4	3321	25	33	50	66
2	4744	36	47	71	95
2.45	5811	44	58	87	116
3.5	8301	62	83	125	166

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	753	6	8	11	15
10.7	1076	8	11	16	22
14.9	1506	11	15	23	30
21.3	2151	16	22	32	43
26.1	2635	20	26	40	53
37.3	3765	28	38	56	75

COMMENTS:
LEMMENS INLET BEDS NOT FISHED SINCE 1989. BED 1601, 95 HA, FISHED 4 YEARS
A PORTION OF 24-A1, YELLOW BANK AND ELBOW BANK CLOSED

ANNUAL QUOTA OPTION @ 1%, 2 GDK/M² = 47,436 LB.
ANNUAL QUOTA OPTION @ 1%, 1.4 GDK/M² = 33,205 LB.

LANDINGS FROM HARVEST LOGS = 13.2 YEARS OF QUOTA LANDED @ 2 GDK/M²
18.9 YEARS OF QUOTA LANDED @ 1.4 GDK/M²

RECOMMENDATIONS:

THE RECOMMENOED 1994 QUOTA IS 33,000 LB.

TABLE 3.5

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS
AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24A6: PTNS. S/A 24-7 AND 24-6 - YELLOW BANK AND ELBOW BANK
** new in 1994 - closed portion **

REPORTED HARVEST AREAS: 182 HA (1992) # BEDS: 7

CUMULATIVE LANDINGS TO 1992: 1590 TONNES
3,506,550 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (1000 LB.) 0.75%	1.0%	1.5%	2.0%
0.7	2992	22	30	45	60
1	4274	32	43	64	85
1.4	5984	45	60	90	120
2	8548	64	85	128	171
2.45	10471	79	105	157	209
3.5	14959	112	150	224	299

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	1357	10	14	20	27
10.7	1938	15	19	29	39
14.9	2714	20	27	41	54
21.3	3877	29	39	58	78
26.1	4749	36	47	71	95
37.3	6784	51	68	102	136

COMMENTS:

LANDINGS FROM HARVEST LOGS = 58.6 YEARS OF QUOTA LANDED @ 1.4 GEODUCKS/M²
41.0 YEARS OF QUOTA LANDED @ 2 GEODUCKS/M²

RECOMMENDATIONS:

IN 1994 24-A1 WAS FURTHER DIVIDED TO SPREAD FISHING EFFORT FROM TRADITIONALLY HEAVILY FISHED AREAS: QUOTAS WERE SET FOR LEMMENS INLET AND EPPER PASS; REMAINING BEDS IN 24-A1 (REDESIGNATED AS 24-A6) ARE CLOSED IN 1994.

TABLE 3.6

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS
AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24B1: PTN 24-6 "OUTSIDE"

REPORTED HARVEST AREAS: 563 HA (1992) # BEDS: 12

CUMULATIVE LANDINGS TO 1993: 2970 TONNES
6,549,783 POUNDS
(INCLUDING 1993 VALIDATED LANDINGS)

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (1000 LB.) 0.75%	1.0%	1.5%	2.0%
0.7	9255	69	93	139	185
1	13221	99	132	198	264
1.4	18509	139	185	278	370
2	26442	198	264	397	529
2.45	32392	243	324	486	648
3.5	46274	347	463	694	925

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	4197	31	42	63	84
10.7	5996	45	60	90	120
14.9	8394	63	84	126	168
21.3	11992	90	120	180	240
26.1	14690	110	147	220	294
37.3	20986	157	210	315	420

COMMENTS:

BEDS: 0701 TO 0704, 0706, 0707,0801, 0802, 0803, 0806,0607, 0902

IN 1991 SOME BEDS WERE SCALED IN AREA USING LANDING CRITERIA, WHILE OTHER BEDS INCREASED IN SIZE.

ANNUAL QUOTA OPTION @ 1%, 2 GDK/M² = 264,421 LB.
ANNUAL QUOTA OPTION @ 1%, 1.4 GDK/M² = 185,095 LB.

LANDINGS FROM HARVEST LOGS = 25 YEARS OF QUOTA TAKEN @ 2 GEODUCKS/M²
35 YEARS OF QUOTA TAKEN @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:

THE 1992 QUOTA AND THE 1993 QUOTA WERE SET AT 275,000 LB.

THE RECOMMENDED 1994 QUOTA IS 125,000 LB.

TABLE 3.7

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS
AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24-B2: COOMES BANK - PTN 24-6

REPORTED HARVEST AREAS: 339 HA (1992) # BEDS: 1

CUMULATIVE LANDINGS TO 1993: 793 TONNES
1,748,728 POUNDS
(INCLUDING 1993 VALIDATED LANDINGS)

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (1000 LB.)			
(#/M.SQ.)	(1000 LB.)	0.75%	1.0%	1.5%	2.0%
0.7	5573	42	56	84	111
1	7961	60	80	119	159
1.4	11145	84	111	167	223
2	15922	119	159	239	318
2.45	19504	146	195	293	390
3.5	27863	209	279	418	557

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (MT)			
(MT/HA)	(MT)	0.75%	1.0%	1.5%	2.0%
7.5	2527	19	25	38	51
10.7	3610	27	36	54	72
14.9	5054	38	51	76	101
21.3	7221	54	72	108	144
26.1	8845	66	88	133	177
37.3	12636	95	126	190	253

COMMENTS:
ANNUAL QUOTA OPTION @ 1%, 2 GDK/M² = 159,216 LB
ANNUAL QUOTA OPTION @ 1%, 1.4 GDK/M² = 111,452 LB

LANDINGS FROM HARVEST LOGS = 11.0 YEARS OF QUOTA TAKEN @ 2 GEODUCKS/M²
15.7 YEARS OF QUOTA TAKEN @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:

A TWO YEAR WEST COAST QUOTA WAS BALANCED BY REDUCING 1992 QUOTA BY 40,000 LB.
AND INCREASING THE 1993 QUOTA BY 40,000 LB.
THE 1992 QUOTA WAS SET AT 120,000 LB. AND ADJUSTED INSEASON TO 185,937 LB.
AFTER A PSP CLOSURE IN AREA 27.

THE QUOTA FOR 1993 WAS SET AT 160,000 + 40,000 = 200,000 LB.

THE RECOMMENDED QUOTA FOR 1994 IS 100,000 LB.

TABLE 3.8

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS
AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24-B3: PTNS OF 24-4 AND 24-6, AHOUSAT

REPORTED HARVEST AREAS: 191 HA (1992) # BEDS: 2

CUMULATIVE LANDINGS TO 1992: 822 TONNES
1,813,151 POUNDS
(INCULDING 1992 VALIDATED LANDINGS)

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (1000 LB.)			
(#/M.SQ.)	(1000 LB.)	0.75%	1.0%	1.5%	2.0%
0.7	3140	24	31	47	63
1	4485	34	45	67	90
1.4	6279	47	63	94	126
2	8971	67	90	135	179
2.45	10989	82	110	165	220
3.5	15699	118	157	235	314

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (MT)			
(MT/HA)	(MT)	0.75%	1.0%	1.5%	2.0%
7.5	1424	11	14	21	28
10.7	2034	15	20	31	41
14.9	2848	21	28	43	57
21.3	4068	31	41	61	81
26.1	4984	37	50	75	100
37.3	7120	53	71	107	142

COMMENTS:
BEDS 0601 AND 0606 WERE SCALED BY REMOVALS OR WITH LANDING CRITERIA.
BED 0605 - WHITESAND COVE WAS CLOSED - REMOVED FROM CALCULATION.
1991: 24-B3 WAS DIVIDED INTO B3 AND B4.

ANNUAL QUOTA OPTION @ 1%, 2 GDK/M² = 89,706 LB.
ANNUAL QUOTA OPTION @ 1%, 1.4 GDK/M² = 62,794 LB.

LANDINGS FROM HARVEST LOGS = 20.2 YEARS OF QUOTA TAKEN @ 2 GEODUCKS/M²
28.9 YEARS OF QUOTA TAKEN @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:
BOTH AREAS 24-B3 AND 24-B4 MOVE FROM ANNUAL QUOTAS INTO A ROTATIONAL CYCLE.

AREA 24-B3 WAS SCHEDULED TO REMAIN CLOSED IN 1992, HOWEVER INSEASON ADJUSTMENTS
FOR PSP IN AREA 27 RESULTED IN A QUOTA OF 180,000 LB. SET.
THIS AREA REMAINED CLOSED IN 1993.

THE RECOMMENDED QUOTA FOR 1994 IS 50,000 LB.

TABLE 3.9

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24-B4: RUSSELL CHANNEL, A PORTION OF 24-6

REPORTED HARVEST AREAS: 184 HA (1992) # BEDS: 1

CUMULATIVE LANDINGS TO 1993: 530 TONNES
1,168,049 POUNDS
(INCULDING 1993 VALIDATED LANDINGS)

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (1000 LB.) 0.75%	1.0%	1.5%	2.0%
0.7	3025	23	30	45	60
1	4321	32	43	65	86
1.4	6049	45	60	91	121
2	8642	65	86	130	173
2.45	10586	79	106	159	212
3.5	15123	113	151	227	302

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	1372	10	14	21	27
10.7	1960	15	20	29	39
14.9	2743	21	27	41	55
21.3	3919	29	39	59	78
26.1	4801	36	48	72	96
37.3	6859	51	69	103	137

COMMENTS:

AREA 24-B4 - RUSSELL CHANNEL, WAS CREATED IN-SEASON 1991, TARGETTING ON BED 0603

ANNUAL QUOTA OPTION @ 1%, 2 GDK/M² = 86,418 LB.
ANNUAL QUOTA OPTION @ 1%, 1.4 GDK/M² = 60,493 LB.

LANDINGS FROM HARVEST LOGS = 13.5 YEARS OF QUOTA TAKEN @ 2 GEODUCKS/M²
19.3 YEARS OF QUOTA TAKEN @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:

AREA 24-B4 WAS CLOSED IN 1992.

THE QUOTA FOR 1993 WAS SET AT 180,000 LB, EQUIVILANT TO 2 YEARS OF FISHING (1992-1993).

THE RECOMMENDED 1994 QUOTA IS 50,000 LB.

TABLE 3.10

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24C: EXPOSED (24-1,-2 AND EXPOSED PORTIONS 124-3 AND 24-8)

REPORTED HARVEST AREAS: 119 HA (1992) # BEDS: 14
98 HA SYDNEY INLET
21 HA OTHER BEDS

CUMULATIVE LANDINGS TO 1990: 276 TONNES
720,966 POUNDS TOTAL
609,014 POUND FROM SYDNEY INLET
111,952 POUNDS FROM OTHER BEDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LBS)	ANNUAL SUSTAINABLE YIELD (1000 LB) 0.75%	1.0%	1.5%	2.0%
0.7	1956	15	20	29	39
1	2795	21	28	42	56
1.4	3912	29	39	59	78
2	5589	42	56	84	112
2.45	6847	51	68	103	137
3.5	9781	73	98	147	196

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	887	7	9	13	18
10.7	1267	10	13	19	25
14.9	1774	13	18	27	35
21.3	2535	19	25	38	51
26.1	3105	23	31	47	62
37.3	4436	33	44	67	89

COMMENTS:
5 BEDS, 21 HA IN EXPOSED; 9 BEDS, 98 HA IN SYDNEY INLET

LANDINGS FROM HARVEST LOGS = 18.4 YEARS OF QUOTA TAKEN FROM 24-C
LANDINGS FROM SYDNEY INLET = 15.6 YEARS OF QUOTA TAKEN FROM SIDNEY IN.

RECOMMENDATIONS:

SHOULD REMAIN CLOSED IN 1994. LAST FISHED IN 1990.

TABLE 3.11

1994 RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 24D: INLETS: 24-3 TO -5, -10,-11,-13,-14 EXCLUDING SYDNEY IN.

REPORTED HARVEST AREAS: 96 HA (1990) # BEDS: 22

CUMULATIVE LANDINGS TO 1990: 262 TONNES
578,111 POUNDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LBS)	ANNUAL SUSTAINABLE YIELD (1000 LB) 0.75%	1.0%	1.5%	2.0%
0.7	1578	12	16	24	32
1	2254	17	23	34	45
1.4	3156	24	32	47	63
2	4509	34	45	68	90
2.45	5523	41	55	83	110
3.5	7890	59	79	118	158

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.5	716	5	7	11	14
10.7	1022	8	10	15	20
14.9	1431	11	14	21	29
21.3	2045	15	20	31	41
26.1	2505	19	25	38	50
37.3	3578	27	36	54	72

COMMENTS:

BEDS SCALED ACCORDING TO LANDINGS

CLOSED IN 1991, 1992 AND 1993.

LANDINGS FROM HARVEST LOGS = 18 YEARS OF QUOTA TAKEN @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:

REMAIN CLOSED.

CLOSED IN 1994

Table 3.12

1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 25-A ESPERANZA INLET: 25-9, -11, -12 AND A PTN 25-13

REPORTED HARVEST AREAS: 442 HA (1992) # BEDS: 5
BEDS: 102,103,301,12-109
13-109

CUMULATIVE LANDINGS TO 1991: 2033.9 TONNES
4484784 POUNDS FOR 5 BEDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	7266	54493	72657	108986	145314
1	10380	77847	103796	155694	207592
1.4	14531	108986	145314	217972	290629
2	20759	155694	207592	311388	415184
2.45	25430	190725	254300	381450	508600
3.5	36329	272464	363286	544929	726572

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	3295	25	33	49	66
10.65	4707	35	47	71	94
14.91	6590	49	66	99	132
21.30	9415	71	94	141	188
26.09	11533	86	115	173	231
37.28	16476	124	165	247	330

COMMENTS:
BEDS WERE SCALED WITH LANDING CRITERIA FOR 1994 CALCULATIONS
LANDINGS FROM LOGS = 21.6 YEARS OF QUOTA LANDED @ 2 GEODUCKS/M²
30.9 YEARS OF QUOTA LANDED @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:
QUOTA OPTION @ 2 GDK/M2 AND 1% = 622,776
QUOTA OPTION @ 1.4 GDK/M2 AND 1% = 435,943

COX SURVEY DATA ESTIMATED 2.04 GDK/M² OVER 426.7 HA.
THIS AREA HAS BEEN FISHED SINCE 1980 - 12 YEARS; TAKEN 21.6 YEARS OF QUOTA.
HARVEST LOG DATA SHOWS REMOVALS OF 0.5 GDK/M² OVER 343 HA.
THEREFORE BRING DENSITY DOWN TO 1.4 GDK/M²
DOWN TO 1.4 GDK/M²

1991 QUOTA 560,000 LB.

THE RECOMMENDED QUOTA FOR 1994 IS 431,000 LB; REDUCED TO ROUND
18 LICENCES * 90,000 LB./LICENCE = 1,620,000 LB.

Table 3.13

1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 25-B :NUCHATLITZ INLET : 25-14 AND A PORTION 25-15

REPORTED HARVEST AREAS: 586 HA (1992) # BEDS: 4
BEDS: 201,202,203

CUMULATIVE LANDINGS TO 1991: 950.2 TONNES 1405
2095192 POUNDS FOR 4 BEDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	9633	72246	96328	144492	192657
1	13761	103209	137612	206418	275224
1.4	19266	144492	192657	288985	385313
2	27522	206418	275224	412836	550447
2.45	33715	252862	337149	505724	674298
3.5	48164	361231	481641	722462	963283

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	4369	33	44	66	87
10.65	6241	47	62	94	125
14.91	8737	66	87	131	175
21.30	12482	94	125	187	250
26.09	15290	115	153	229	306
37.28	21843	164	218	328	437

COMMENTS:
FISHED ONLY THREE YEARS, 1984,1985 AND 1987
HEAVY FISHING AT BED 202 (434 HA) FITZ I-BENSON PT.-HIXSON BLUFF
NEW BED IN MARY BASIN IN 1991 - 5 HA

LANDINGS FROM LOGS = 7.6 YEARS OF QUOTA LANDED @ 2 GEODUCKS/M²
10.9 YEARS OF QUOTA LANDED @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:

3 YEAR QUOTA OPTION @ 2 GDK/M2 AND 1% QUOTA OPTION @ 1.4 GDK/M2 AND 1%
= 825,671 = 577,970

THE RECOMMENDED 1994 QUOTA IS 578,000 LB.

Table 3.14

1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 25-C : ROSA HARBOUR : PORTION OF 25-13

REPORTED HARVEST AREAS: 58 HA (1992) # BEDS: 2
BEDS: 101 AND 104

CUMULATIVE LANDINGS TO 1991: 271.3 TONNES
(INCL 1991 VALIDATED LB) 598257 POUNDS FOR 2 BEDS

STOCK DENSITIES (#/M.SQ.)	STANDING STOCK (1000 LB.)	ANNUAL SUSTAINABLE YIELD (LB.) 0.75%	1.0%	1.5%	2.0%
0.7	953	7151	9534	14301	19068
1	1362	10215	13620	20430	27241
1.4	1907	14301	19068	28603	38137
2	2724	20430	27241	40861	54481
2.45	3337	25027	33370	50055	66739
3.5	4767	35753	47671	71506	95342

STOCK DENSITIES (MT/HA)	STANDING STOCK (MT)	ANNUAL SUSTAINABLE YIELD (MT) 0.75%	1.0%	1.5%	2.0%
7.46	432	3	4	6	9
10.65	618	5	6	9	12
14.91	865	6	9	13	17
21.30	1235	9	12	19	25
26.09	1513	11	15	23	30
37.28	2162	16	22	32	43

COMMENTS:
BED 101 FISHED FOR 8 YEARS; 490,699 LB.

LANDINGS FROM LOGS = 22.0 YEARS OF QUOTA LANDED @ 2 GEODUCKS/M²
31.4 YEARS OF QUOTA LANDED @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:

3 YEAR QUOTA OPTION @ 2 GDK/M2 AND 1% QUOTA OPTION @ 1.4 GDK/M2 AND 1%
= 81722 = 57205

1991 QUOTA 100,000 LB.

DUE TO HEAVY FISHING, 31 YEARS OF QUOTA LANDED, CLOSURE IS RECOMMENDED FOR 1994.

Table 3.15

1994-RANGE OF STOCK ESTIMATES BASED ON HARVEST LOG DATA AND SURVEYS
AND POSSIBLE ANNUAL SUSTAINABLE YIELDS

STATISTICAL AREA: 25-D : NOOTKA SOUND: 25-3 TO 25-8,25-15

REPORTED HARVEST AREAS: 146 HA (1992) # BEDS: 23

CUMULATIVE LANDINGS TO 1991: 326.3 TONNES
(INCL. 1991 VALIDATED LANDINGS) 719573 POUNDS FOR 10 BEDS ?
(check '91 fishing areas)

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (LB.)			
(#/M.SQ.)	(1000 LB.)	0.75%	1.0%	1.5%	2.0%
0.7	2400	18000	24000	36000	48000
1	3429	25714	34286	51428	68571
1.4	4800	36000	48000	72000	96000
2	6857	51428	68571	102857	137142
2.45	8400	63000	84000	125999	167999
3.5	12000	90000	119999	179999	239999

STOCK DENSITIES	STANDING STOCK	ANNUAL SUSTAINABLE YIELD (MT)			
(MT/HA)	(MT)	0.75%	1.0%	1.5%	2.0%
7.46	1088	8	11	16	22
10.65	1555	12	16	23	31
14.91	2177	16	22	33	44
21.30	3110	23	31	47	62
26.09	3810	29	38	57	76
37.28	5442	41	54	82	109

COMMENTS:
BEDS FISHED SINCE 1985
14 SMALL BEDS NOT COUNTED IN 1991, 67 HA; SMALL LANDINGS <35,000 LB.
FOR 1994 ALL BEDS WERE USED BUT SCALED WITH LANDING CRITERIA

LANDINGS FROM LOGS = 10.5 YEARS OF QUOTA LANDED @ 2 GEODUCKS/M²
15.0 YEARS OF QUOTA LANDED @ 1.4 GEODUCKS/M²

RECOMMENDATIONS:

QUOTA OPTION @ 2 GDK/M2 AND 1% = 205,713

QUOTA OPTION @ 1.4 GDK/M2 AND 1% = 144,000

1991 QUOTA 100,000 LB.

FISHERS RECOMMENDED AGAINST INCREASING QUOTA IN THIS AREA.

THE RECOMMENDED 1994 QUOTA IS 100,000 LB.

APPENDIX 4.

NORTH COAST - 1994 GEODUCK FISHERY QUOTA RECOMMENDATIONS

In 1994, the geoduck fishery in the North Coast will move to the Queen Charlotte Islands (Fisheries Management Areas 1, 2E, and 2W) as part of a three year rotational plan. The total recommended quota is 2,430,000 lb., primarily derived from calculated yields based on harvest log beds and assumed mean densities of 1, 3, or 3.5 geoduck/m^2. This information was rationalized with advice provided by fishermen and an ongrounds observer, so that in some locations recommended quotas may not equal calculated quotas. In some heavily harvested locations, quotas have been reduced from calculated levels by a number of means including, the removal of unproductive beds, assuming a reduced mean density, or simply adopting arbitrary limits recommended by fishermen. Alternatively, harvest has been augmented in a number of areas by assessment of a conservative, exploratory quota.

Recommended quotas and relevant assessment data are provided below by geoduck management area. Management units in 1994 have been further subdivided (into 32 units) from those used in the previous QCI fishery in 1991, to disperse fishing effort and protect preferred or sensitive fishing locations. Ideally, harvest quotas should be bed specific, and fishermen's cooperation will be solicited inseason to disperse effort over entire management areas. Beds and area (ha) have been measured from harvest logs submitted by fishers.

1.1 Skidegate Inlet - Subarea 2-1 (7 beds, 107 ha)

Skidegate Inlet has been fished in the two years, 1988 and 1991. The reported harvest log catch of 85,000 lb. greatly underestimates actual catch since landings of 83,900 lb. were validated in 1991 alone. A total of 6 beds with an area of 107 ha. have been identified in harvest logs , four of the beds new in 1991. The corresponding calculated yield for 3 years is 264,000 lb.; however, fishermen recommended a more conservative harvest level because of low densities in the inlet. The recommended quota is 88,000 lb., based on a yield calculated at 1 geoduck/m^2, a reduction from the 133,000 lb. allowed in 1991.

1.2 Cumshewa Inlet - Subarea 2-3 (8 beds, 87 ha)

Cumshewa Inlet has been fished in six years since 1980, with total landings from harvest logs estimated at 610,000 lb.. In 1991, three new beds were identified but these accounted for a limited increase in bed area. Fishermen have indicated some beds in Cumshewa were unproductive and recommended harvest not exceed 1991 levels (185,000 lb.). The major bed at Mathers Ck. was not fished

in 1991 and the ongrounds observer indicated catch rates were low in other beds. Based on this information, a recommended level of harvest was derived by applying a density of 1 g/m^2 to unproductive beds while maintaining 3.5 for other beds, and removing the Mathers Ck. bed from the harvestable base. The recommended quota for 1994 is 66,000 lb., substantially less than both the 1991 quota (185,000 lb.) and the calculated yield for 87 ha. at 3.5 g/m^2 (214,000 lb.).

1.3 Skedans - Subareas 2-3, 2-6, and 2-7 (6 beds, 45 ha)

Skedans Bay area was combined with Tanu Isl. in the Laskeek management area in 1991. Fishing effort was focused on new beds at Skedans and secondarily the Limestone Isl., while Reef Isl. was not fished. Catch rates and product quality were reportedly good and fishermen recommend harvest be maintained at levels similar to the previous fishery. The recommended quota based on an identified bed area of 45 ha. is 110,000 lb.. Fishermen are encouraged to take a portion of the allowable catch from the exposed site at Reef Isl.. Subarea 2-6 will be included in the management unit to provide for exploration.

1.4 Tanu - Subarea 2-8 (12 beds, 38 ha)

The Tanu Isl. area has been fished in only the two most recent fishing years, with a total of 198,000 lb. harvested. The area is characterized as supporting numerous small pockets of geoducks, bed area limited by a precipitous shoreline. A total of 12 beds with a combined area of 38 ha. have been identified of which six were new in 1991. The quota recommended for 1994 is 93,000 lb.. The combined quota for Skedans and Tanu Management Areas of 203,000 lb. is substantially greater than the 140,000 lb. allowed in 1991.

1.5 Upper Juan Perez - Subarea 2-11 (11 beds, 109 ha)

All available information indicates Upper Juan Perez Snd. is a productive geoduck area. Total landings from harvest logs are 417,000 lb. and substantial bed area has been identified (109 ha.). Catch rates in the 1991 fishery were reported to be relatively high and 5 new beds were identified. The recommended quota for 1994 is 268,000 lb., reduced from 1991 because beds at Marco Isl. were removed from the management area and assigned a separate quota.

1.6 Marco Isl./Hoskins Pt. - Subarea 2-11 (3 beds, 5 ha)

This area has been isolated from the rest of Subarea 2-11 to protect a bed heavily fished in 1991. The total identified bed area is 5 ha. and the recommended quota for 1994 is 12,000 lb..

1.7 Werner Bay - Subarea 2-12 (3 beds, 13 ha)

Three beds with an area of 13 ha. were identified in 1985, but have not been fished in recent years. This area has been isolated

to prevent displacement of catch to heavily fished beds on the north side of Burnaby Isl.. The recommended quota for 1994 is 32,000 lb..

1.8 Lower Juan Perez Snd. - Subarea 2-12 (12 beds, 128 ha)

Lower Juan Perez is one of the most important management areas in the QCI. In the five years fished since 1986 almost 2M lb. has been harvested. Bed area is extensive (128 ha.) and geoduck quality is reportedly excellent. The fishery continues to be focused on the U- shaped area between the east side of Huxley Isl. and north Burnaby Isl. to Saw Rf., and removal rates are far greater than is calculated to be sustainable. In order to protect these heavily fished beds, a reduced interim harvest rate has been applied by using a density of 3 g/m^2 in the yield calculation. The recommended quota for 1994 is 270,000 lb., a slight reduction from 1991, and fishing effort should be dispersed.

1.9 Poole Inlet - Subarea 2-14 (4 beds, 36 ha)

In 1991, Subareas 2-14 and 2-15 were combined in one management area, and the majority of the allowable catch was harvested from one bed on the south side of Skincuttle Inlet. To properly apportion the catch, the area has been divided into four management units, including Poole Inlet, North Skincuttle Inlet, South Skincuttle Inlet, and Collison Bay. In Poole Inlet, four beds have been identified with an area of 36 ha., but only one of these beds was fished in 1991. The recommended quota for 1994 is 88,000 lb..

1.10 North Skincuttle Inlet - Subarea 2-14 and 2-15 (4 beds, 19 ha)

This management area includes beds from Poole Pt. south to the Copper Isl.. Harvest logs indicate 63,000 lb. have been taken from the four beds identified in the area, but no fishing occurred here in 1991. The recommended quota for 1994 based on a bed area of 19 ha. is 46,000 lb..

1.11 South Skincuttle Inlet - Subarea 2-15 (1 bed, 21 ha)

The fishery in Skincuttle Inlet has been focused on the one identified bed located east of Harriet Hbr.. In the four years fished since 1986, a minimum of 368,000 lb. has been harvested, 190,000 lb. in 1991. The documented harvest rate far exceeds sustainable levels. The recommended quota for 1994 is 51,000 lb. and fishermen are encouraged to explore other fishing locations in the area.

1.12 Collison Bay - Subarea 2-14 (2 beds, 15 ha)

Collison Bay has been fished in two years, 1989 and 1991, and a total of 39,000 lb. has been harvested. The recommended quota for

1994 based on an identified bed area of 15 ha. is 36,000 lb..

1.13 Carpenter Bay - Subarea 2-17 and 2-18 (9 beds, 57 ha)

Carpenter Bay was first fished in 1989 and harvestable area was greatly expanded in 1991. A total of 221,000 lb. has been harvested and 57 ha. of bed area identified. The recommended quota for 1994 is 140,000 lb..

1.14 East Houston-Stewart Channel (Upper) - Subarea 2-18 (4 beds, 35 ha)

East Houston-Stewart Channel has been an important fishing area, producing almost 700,000 lb. in the fishery since 1986. Geoduck are reportedly abundant but a dark coloration reduces quality. Effort in 1991 continued to be focused on established beds and removal rates exceed sustainable levels. To protect heavily harvested beds, Subarea 2-18 has been divided into three, and the interim harvest rate reduced in critical areas. In the Upper Channel area, from Pt. Langford to Ross Isl., four beds have been identified with an area of 35 ha.. The recommended quota for 1994, based on a reduced density of 3 g/m^2, is 73,000 lb..

1.15 East Houston-Stewart Channel (Lower) - Subarea 2-18 (4 beds, 40 ha)

There have been four beds identified along the Lower Channel, from Orion Pt. to Hornby Pt., but beds and fishing effort have been concentrated in the Rose Hbr. area. The recommended quota based on a reduced density of 3 g/m^2 is 84,000 lb..

1.16 Heater Hbr. to Keeweenah Bay - Subarea 2-18 (3 beds, 24 ha)

A total of three beds with a combined area of 24 ha. have been identified in Heater Hbr., Montserrat Bay, and Keeweenah Bay. These beds have not been excessively harvested therefore, a quota for 1994 of 59,000 lb., based on 3.5 g/m^2 is recommended.

1.17 Luxana/Howe Bay - Subarea 2-19 (3 beds 59 ha)

Prior to 1991, an extensive bed area had been described for both Luxana and Howe Bays but catches had been disproportionately low. In 1991, recommended harvest levels were based on reduced bed areas, but fishermen were still unable to harvest the quota in Howe Bay. For 1994, an arbitrary ceiling recommended by fishermen of 100,000 lb. will be applied to entire Subarea 2-19. This quota is substantially less than calculated yield based on 3.5 g/m^2 (220,000 lb.) for the two inlets.

1.18 West Houston-Stewart Channel (Moresby Isl.)- Subarea 2-31 (2 beds, 10 ha)

The status of geoduck stocks in West Houston-Stewart Channel is similar to that described for the eastern portion of the channel. Large catches, exceeding 1M lb. in total, have been taken and removal rates have been excessive in critical beds. To protect known beds, interim harvest rates are reduced and as well, the bulk of Subarea 2-31 has been partitioned and beds at the mouth of Louscoone Inlet applied to that management area. On the Moresby Isl. side of the channel, two beds have been identified with a total area of 10 ha.. The recommended quota based on 3 g/m^2 is 21,000 lb..

1.19 West Houston-Stewart Channel (Kunghit Isl.) - Subarea 2-31 (3 beds, 75 ha)

The fishery in Subarea 2-31 has focused on the extensive beds on the Kunghit Isl. shoreline. A total of 860,000 lb. has been landed from beds, located mainly in the vicinity of Washington Rk., with an area of 75 ha.. Geoduck are reported to be numerous but the shoreline is precipitous and beds deep. The recommended quota for 1994 based on a reduced density of 3 g/m^2 is 158,000 lb..

1.20 Gordon Isl. - Subarea 2-31 (1 bed, 25 ha)

In 1991, a substantial bed with an area of 25 ha. was identified in the Gordon Isl. in 1991. The quota recommended for 1994 based on a density of 3.5 g/m^2 is 61,000 lb..

1.21 Louscoone Inlet - Subareas 2-31 and 2-34 (4 beds, 37 ha)

In 1994, the Louscoone management area has been expanded to include two beds formerly in the Houston-Stewart Ch. area. The four beds in the area have been fished intermittently since 1986 and a total of 170,000 lb. has been landed. The recommended quota for 1994 based on a bed area of 37 ha. is 91,000 lb..

1.22 Flamingo Inlet - Subarea 2-35, 2-36, 2-37 (4 beds, 8 ha)

Limited exploration has occurred in Flamingo Inlet, only 19,000 lb. in landings from 8 ha. has been documented in harvest logs. The recommended quota for 1994 is 20,000 lb..

1.23 Gowgaia Bay - Subareas 2-39, 2-40, and 2-41 (4 beds, 13 ha)

Limited fishing has occurred in Gowgaia Bay and a bed area of only 13 ha. has been identified. Fishermen state that geoduck quality is good and that there is likely room for expansion in the bay. Based on this advice, a quota totalling 50,000 lb. is recommended, of which 20,000 lb. is exploratory.

1.24 Englefield Bay - Subareas 2-49 to 2-60

Little exploration has occurred in this area so an arbitrary

quota of 50,000 lb., based on fishermens advice is recommended for 1994.

1.25 West Skidegate Channel - Subareas 2-63, 2-64, 2-66, and 2-68 (8 beds, 12 ha)

In 1991, all areas on the west side of Graham Isl. were combined in a single management unit. As part of that management unit, West Skidegate Channel received limited fishing effort and only 30,000 lb. were landed. Geoduck quality is reportedly good, however beds are small and deep. The recommended quota for 1994 based on a bed area of 12 ha. is 29,000 lb..

1.26 Kano Inlet - Subarea 2-69, 2-70, 2-71 (1 bed, 39 ha)

Harvest logs indicate most of the 96,000 lb. landed in Kano Inlet was taken in 1991. A large 39 ha. bed inside of Cadman Isl. has been identified in harvest logs; however, fishermen and the ongrounds observer advise the documented area is excessive. It is recommended that an interim harvest ceiling of 25,000 lb., recommended by fishermen, be applied to this area for 1994.

1.27 Rennel Snd. - Subareas 2-80 and 2-82 (4 beds, 33 ha)

Total landings of 70,000 lb. has been documented in harvest logs for the Rennel Snd. area, mostly from Seal and Tartu Inlets. Information from fishermen and the ongrounds observer indicates the bed area fished in 1991 is substantially less than the 33 ha. given in harvest logs. Based on this information, an arbitrary ceiling of 25,000 lb. is recommended for the area, to be dispersed equally between Seal and Tartu Inlets.

1.28 Hippa Isl. - Subarea 2-86,2-87 (6 beds, 30 ha)

Hippa Isl. area has been intensively fished since 1986 and a total of 521,000 lb. catch has been recorded from six beds. Geoduck are reportedly numerous but small and low quality. There is also some information to indicate the documented bed area is excessive, therefore, a quota of 85,000 lb. is recommended based on a bed area of 30 ha..

1.29 Pt. Chanal - Subarea 2-89 to 2-91 (6 beds, 20 ha)

Total landings of 160,000 lb. has been documented for Pt. Chanal but little fishing occurred in 1991. Information from the ongrounds observer indicates that beds in the area are small and are likely exaggerated in the logs. Based on this advice bed area was reduced from 34 to 20 ha., corresponding to a recommended harvest of 50,000 lb..

1.30 Pt. Louis - Subarea 2-92 to 2-100 (4 beds, 9 ha)

Pt. Louis was fished for the first time in 1991, and landings of 33,000 lb. were reported from a bed area of 9 ha.. Geoduck are reported to be good quality but beds are deep. The recommended quota for 1994 is 22,000 lb..

1.31 Parry Pass - Subarea 1-2 and 1-7 (3 beds, 82 ha)

Parry Pass has been fished in three years since 1987 and produced landings of 340,000 lb., though little catch was taken in 1991. Fishermen report the area is both difficult and dangerous to fish, therefore it is recommended that harvest be limited to 20,000 lb..

1.32 Virago Snd. - Subarea 1-3 (3 beds, 35 ha)

Virago Snd. was first fished in 1991, two beds with an area of 35 ha. were identified and 186,000 lb. landed. The recommended quota for 1994 is 86,000 lb.. The total quota for Area 1 has been reduced from 195,000 lb. in 1991 to 106,000 lb. in 1994.

1994 Geoduck Management Area Boundaries

Geo. Mgmt. Area	Location	Description
1	Skidegate Inlet	All of Subarea 2-1.
2	Cumshewa Inlet	Subarea 2-3 except for the Cumshewa Inlet shoreline from Girard Pt. to Skedans Pt..
3	Skedans	All of Subareas 2-6 and 2-7, and the portion of Subarea 2-3 SE of Girard Pt..
4	Tanu	All of Subareas 2-8 and 2-9.
5	Upper Juan Perez	Subarea 2-11 except for the Moresby Isl. shoreline west of Juan Perez Snd..
6	Marco Isl.	Portion of Subarea 2-11 west of Juan Perez Snd..
7	Werner Bay	Portion of Subarea 2-12 west of line from Werner Pt. to Newberry Pt..
8	Lower Juan Perez Snd.	Subarea 2-12 except the portion west of a line from Werner Pt. to Newberry Pt., and the portion of Subarea 2-13 that is Section Cove east of a line through Koga It. and section Isl..
9	Poole Inlet	Portion of Subarea 2-14 north of a line true east from Poole Pt. to the surfline.
10	North Skincuttle Inlet	Portion of Subarea 2-14 south of a line true east from Poole Pt. to the surfline and north of a line from Deluge Pt. true east to the Surfline; and the portion of Subarea 2-15 north of a line from Huston Pt. to Deluge Pt..
11	South Skincuttle Inlet	Portion of Subarea 2-15 south of a line from Huston Pt. to Deluge Pt..
12	Collison Bay	Portion of Subarea 2-14 south of a line from Deluge Pt. true east to the surfline.
13	Carpenter Bay	All of Subarea 2-17 and the portion of Subarea 2-18 north of a line from Garcin Rk. light true west to Moresby Isl..
14	East Houston - Stewart Channel (Upper)	Portion of Subarea 2-18 north of a line running east/west through the southern tip of Ross Isl..
15	East Houston-Stewart Channel (Lower)	Portion of Subarea 2-18 south of a line running east/west through the southern tip of Ross Isl.,and north of a line from Orion Pt. true east to the surfline.
16	Heater Hbr. to Keeweenah Bay	Portion of Subarea 2-18 south of a line from Orion Pt. true east to the surfline.

17	Luxana and Howe Bays	All of Subarea 2-19.
18	West Houston - Stewart Channel (Moresby Isl. shore)	Portion of Subarea 2-31 that is in the vicinity of the Moresby Isl. shore east of Cp. Fanny.
19	West Houston - Stewart Channel (Kunghit Isl. shore)	Portion of Subarea 2-31 that is in the vicinity of the Kunghit Isl. shoreline.
20	Gordon Isl.	Portion of Subarea 2-31 that is in the vicinity of Gordon Isl..
21	Louscoone Inlet	All of Subareas 2-32, 2-33, and 2-34, and the portion of 2-31 west of Cp. Fanny.
22	Flamingo Inlet	All of Subareas 2-35, 2-36, and 2-37.
23	Gowgaia Bay	All of Subareas 2-39, 2-40, and 2-41.
24	Englefield Bay	All of Subareas 2-49 to 2-60.
25	West Skidegate Channel	All of Subareas 2-63, 2-64, 2-66, and 2-68.
26	Kano Inlet	All of Subareas 2-69, 2-70, and 2-71.
27	Rennel Snd.	All of Subareas 2-73 to 2-84.
28	Hippa Isl.	All of Subareas 2-85, 2-86, and 2-87.
29	Port Chanal	All of Subareas 2-89, 2-90, 2-91.
30	Port Louis	All of Subareas 2-92 to 2-100.
31	Parry Pass	All of Subareas 1-2 and 1-7.
32	Virago Snd.	All of Subarea 1-3.

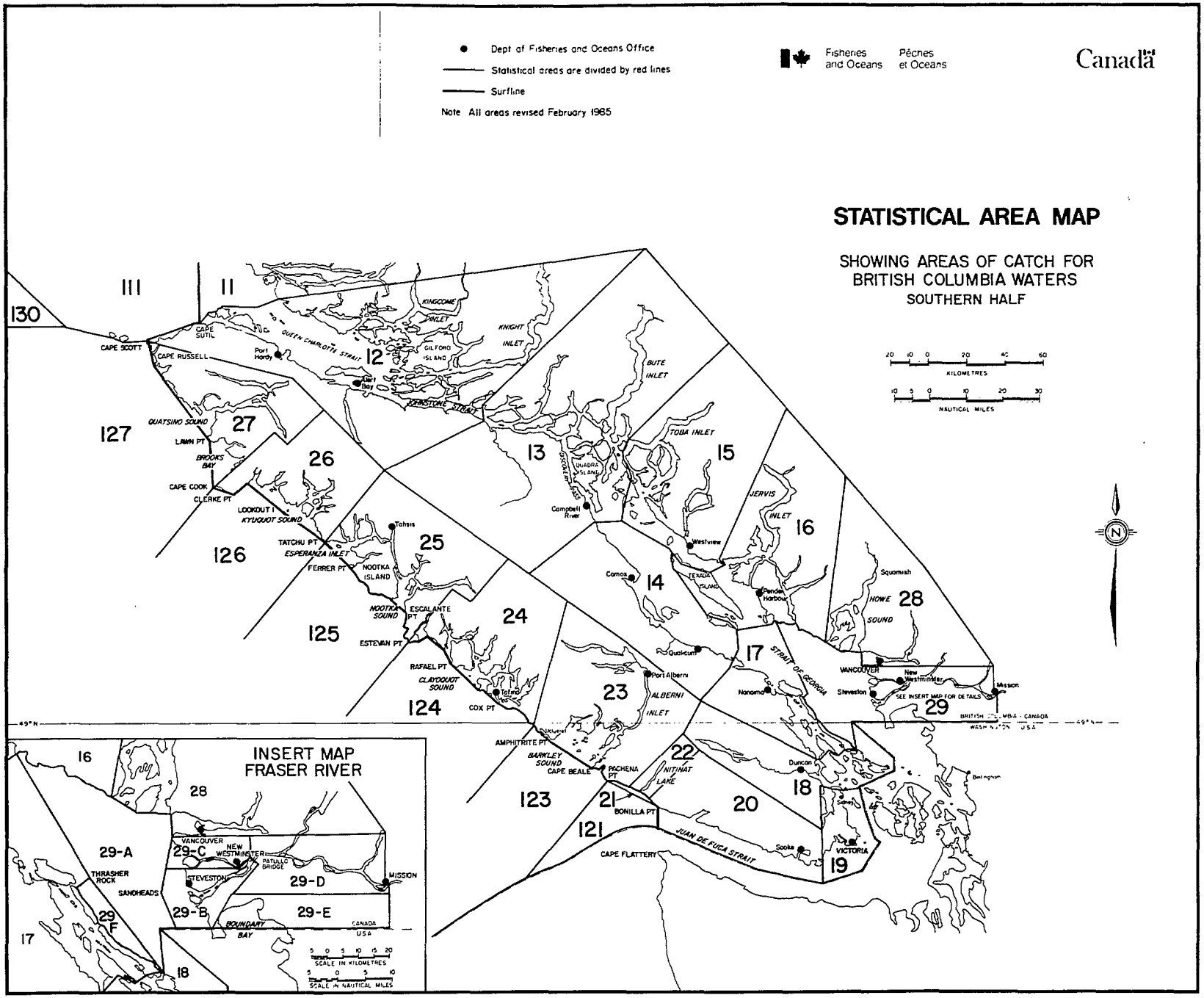


Figure 1. Pacific Fishery Management Areas, southern coast of British Columbia.

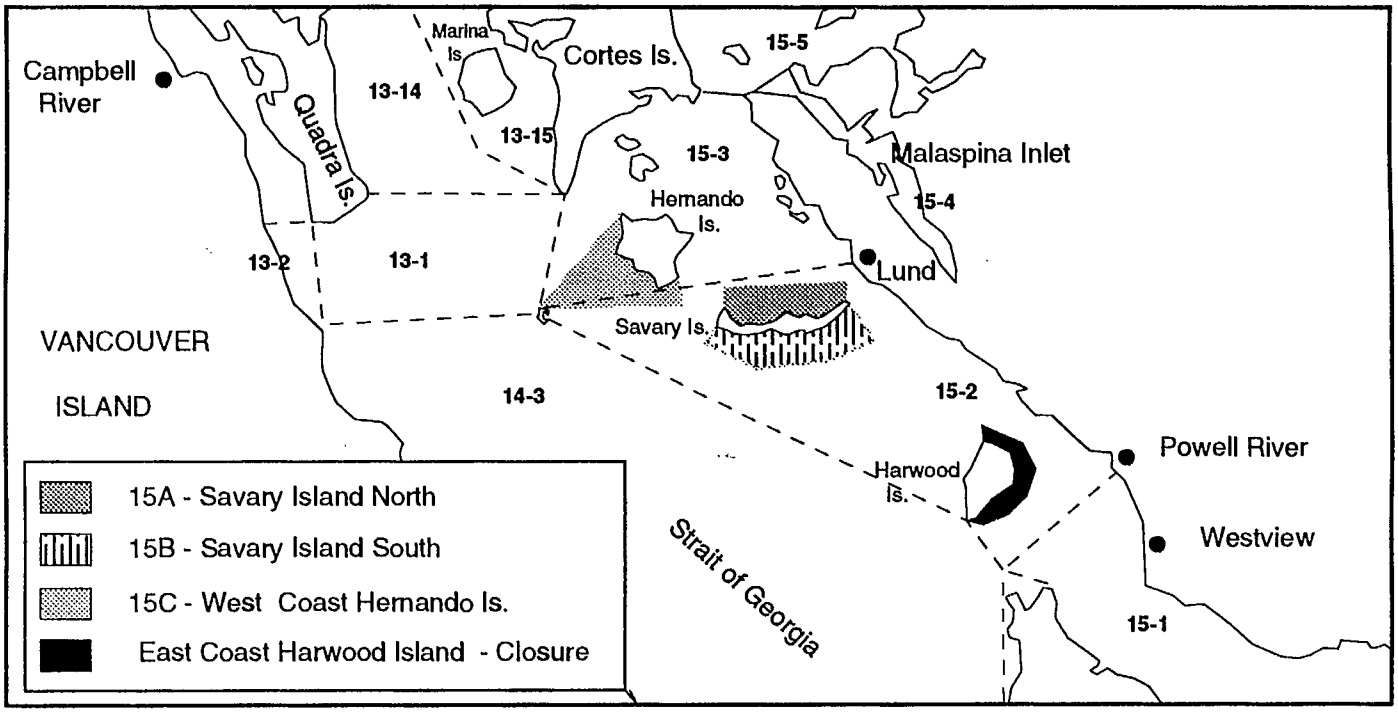


Figure 2. 1994 geoduck management areas 15-A, 15-B, 15-C and bed closure at Harwood Island.

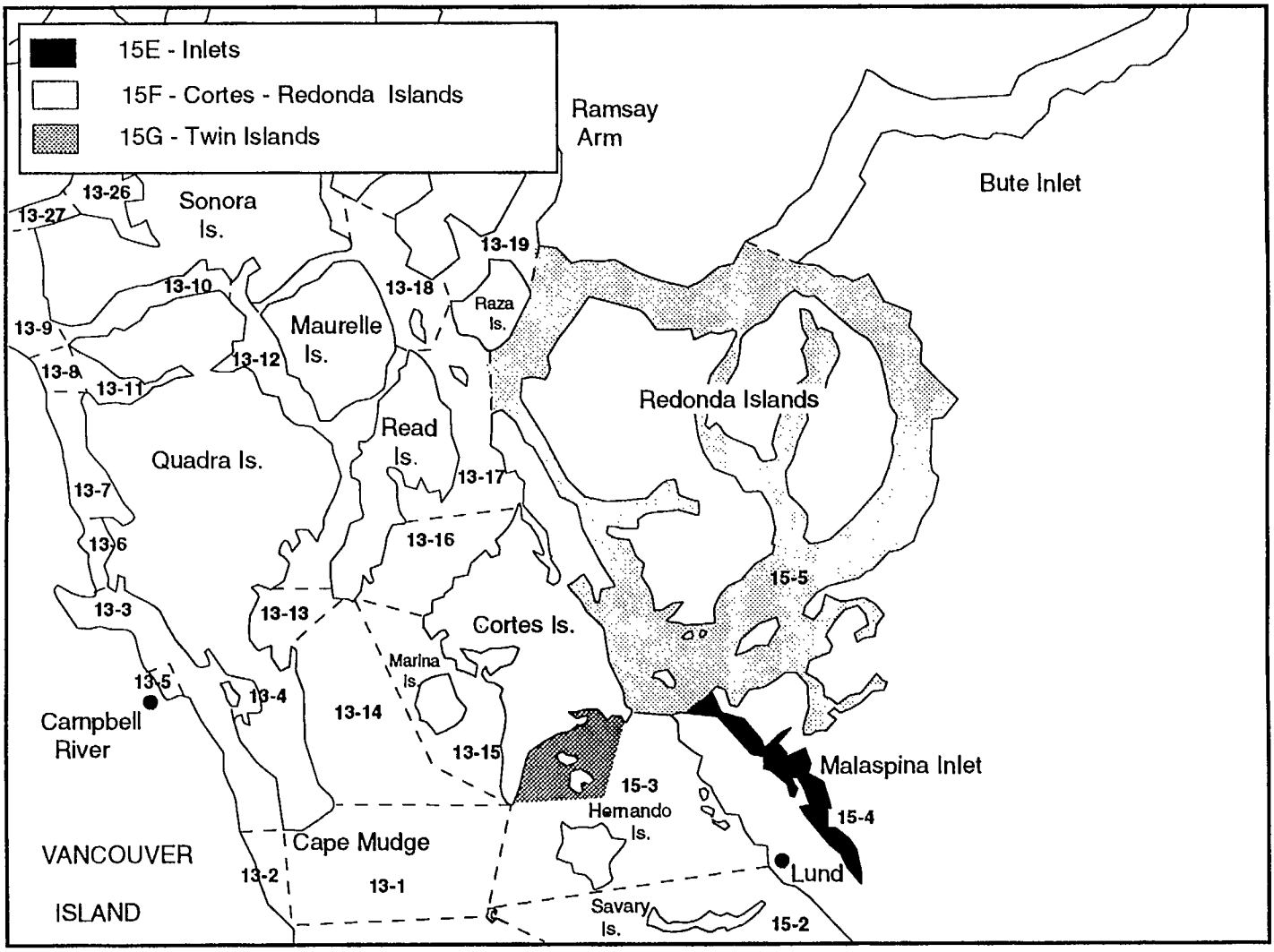


Figure 3. 1994 geoduck management areas 15-E, 15-F, 15-G .

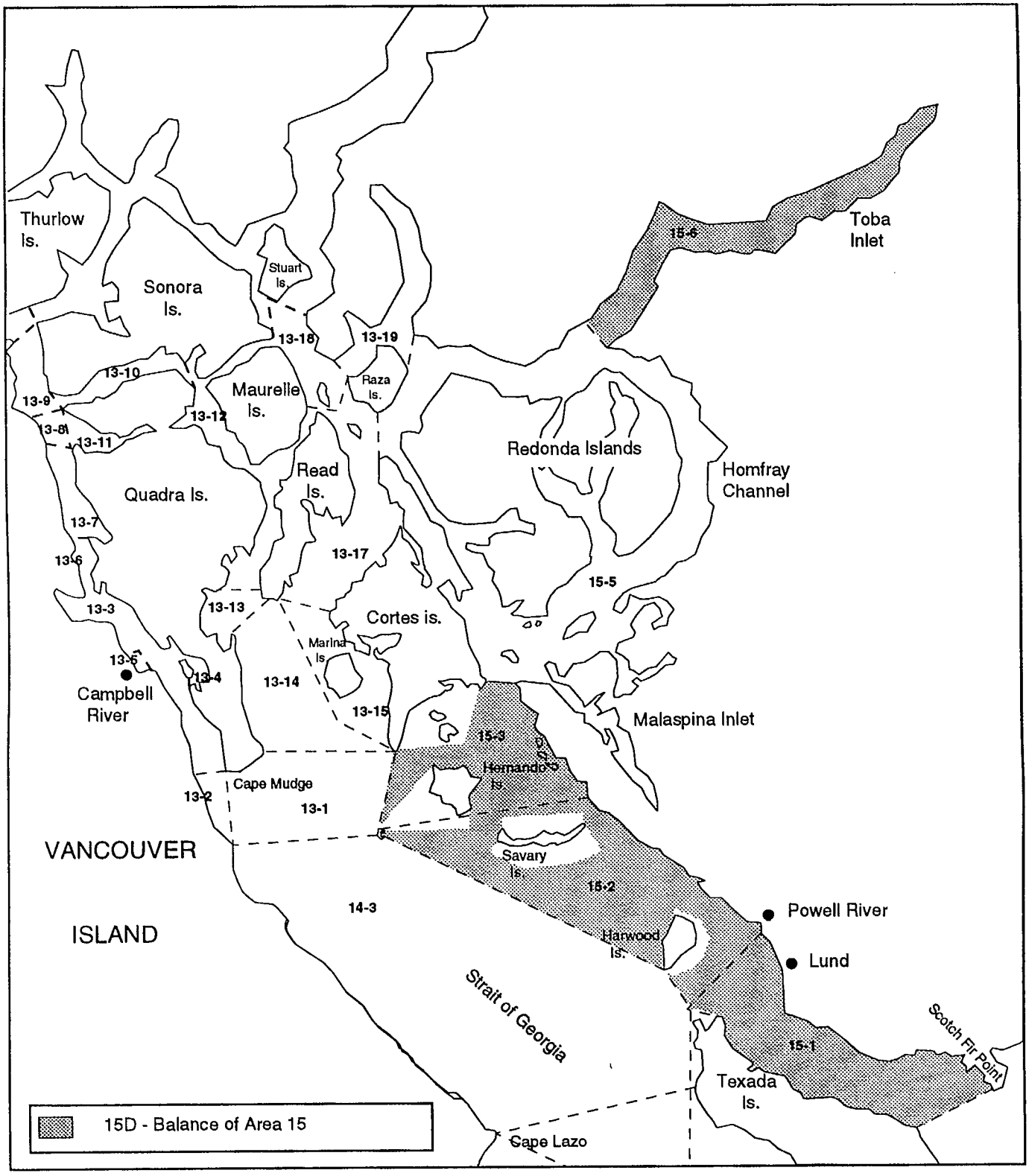


Figure 4. 1994 geoduck management areas 15-D, balance of Area 15.

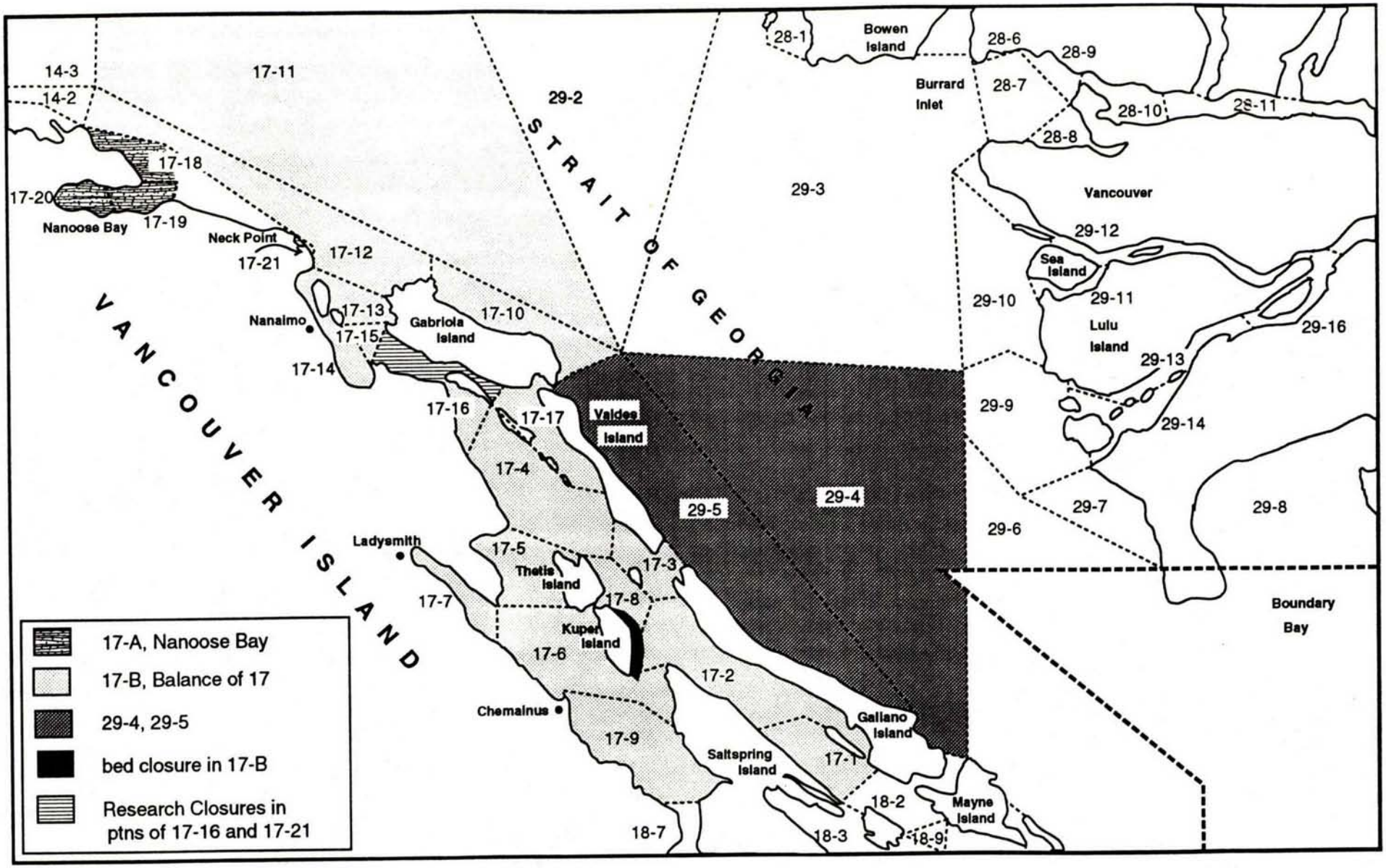


Figure 5. Geoduck management areas 1994: 17-A (subareas 17-19, 17-20, ptn. 17-18), 17-B (remaining subareas in Area 17, excluding the east shore of Kuper Island closure) , Areas 29-4, 29-5.

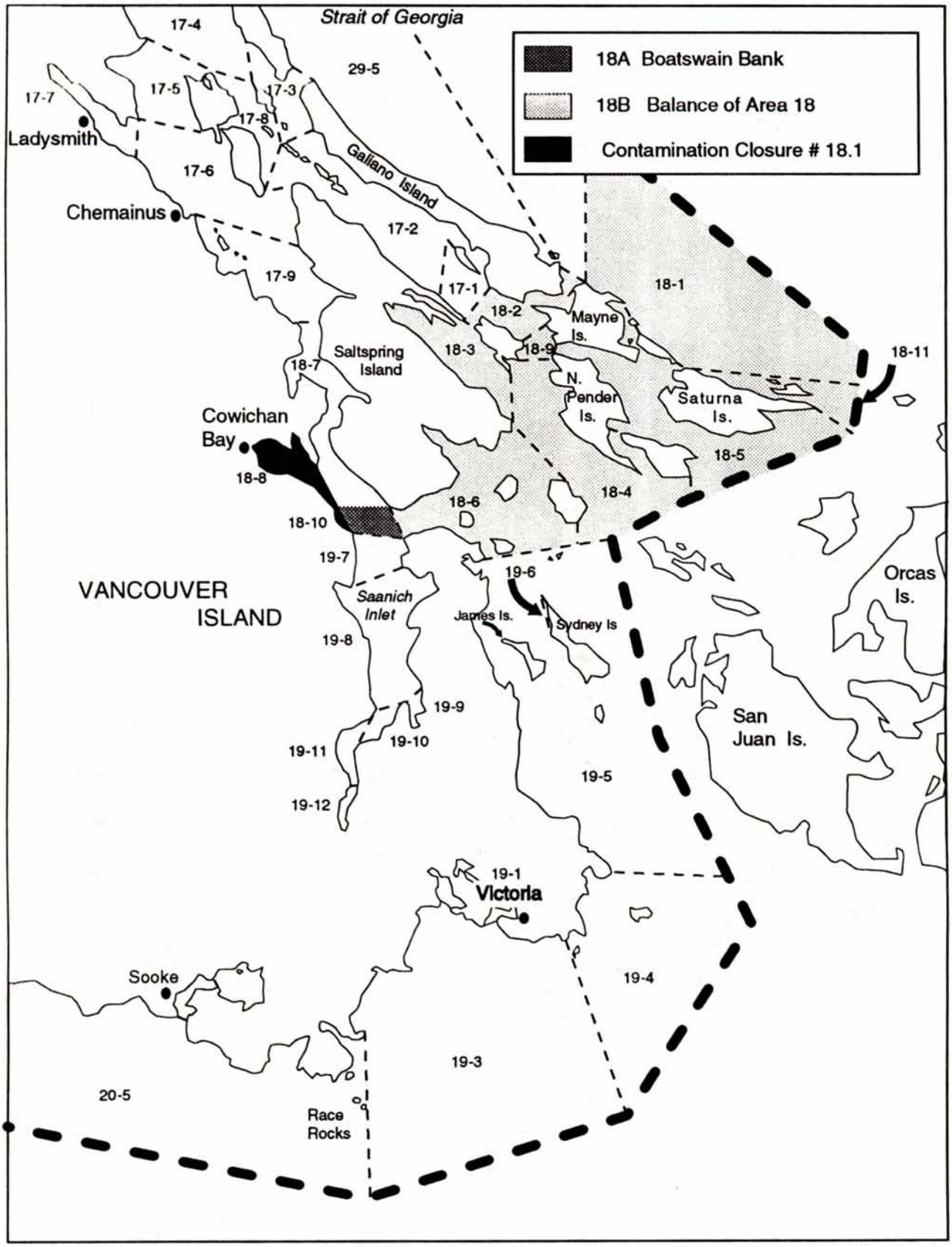


Figure 6. 1994 geoduck management areas 18A and 18B.

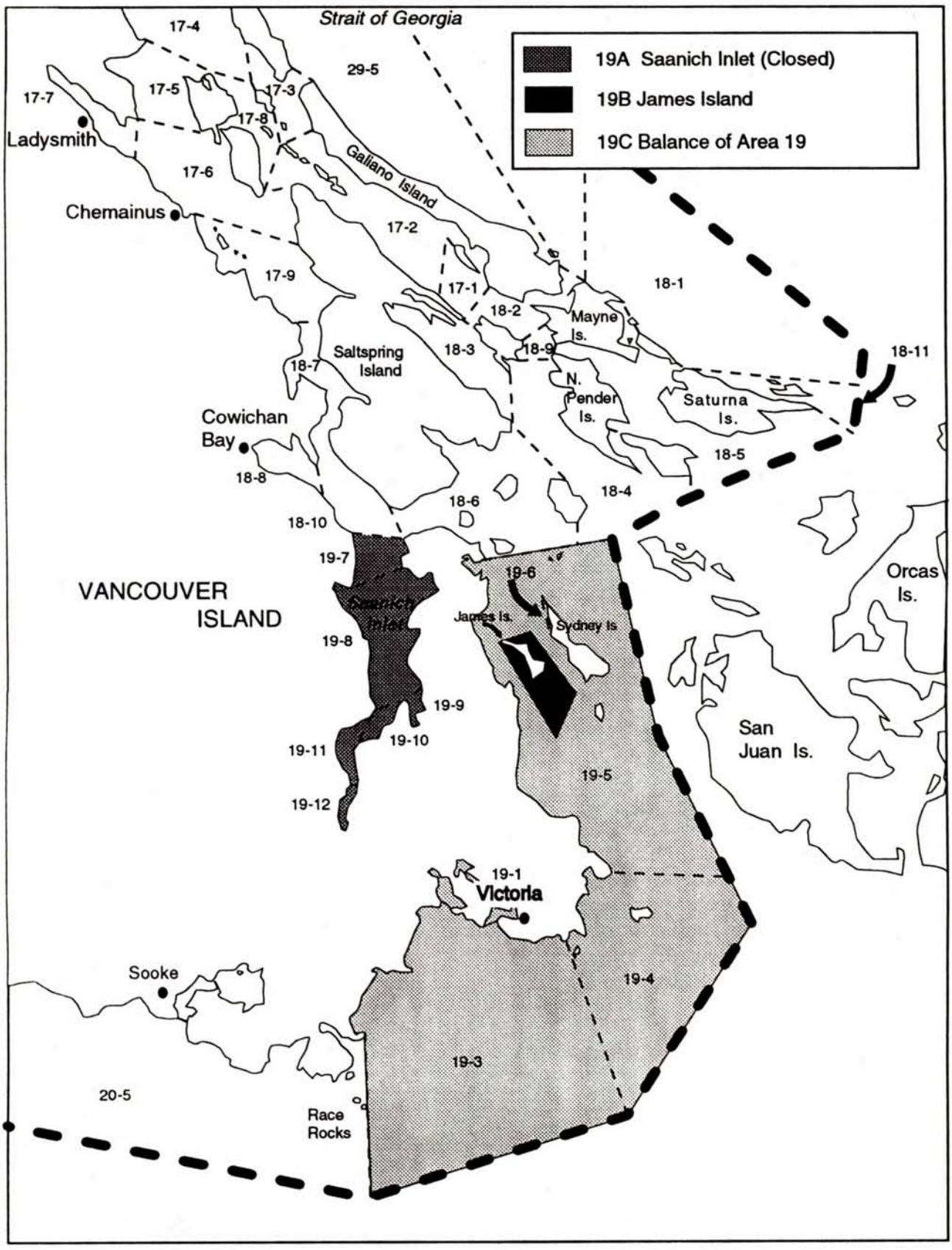


Figure 7. 1994 geoduck management areas 19A, 19B and 19C

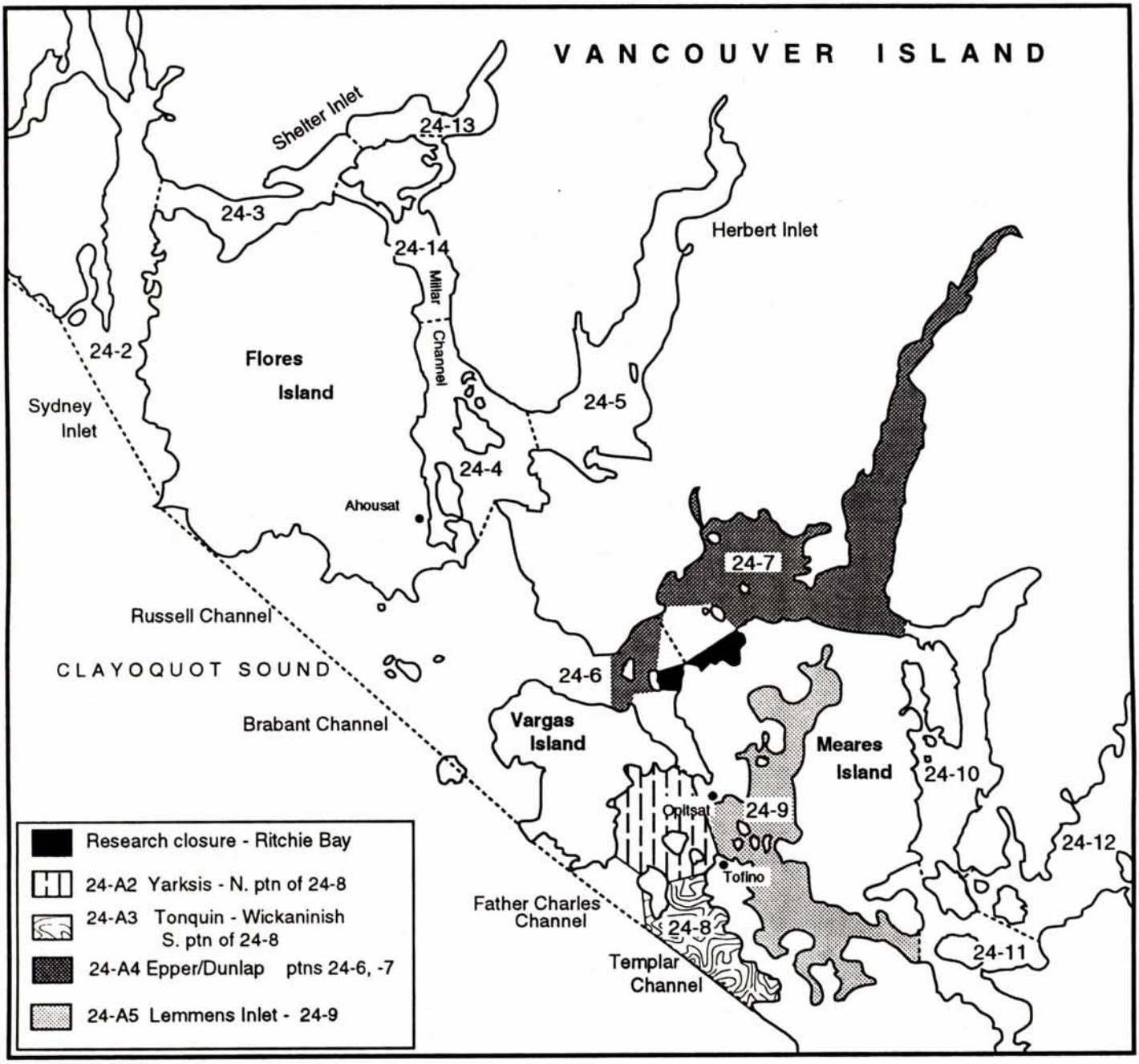


Figure 8. 1994 geoduck management areas: Area 24 Inside : 24-A2, 24-A3, 24-A4 and 24-A5.

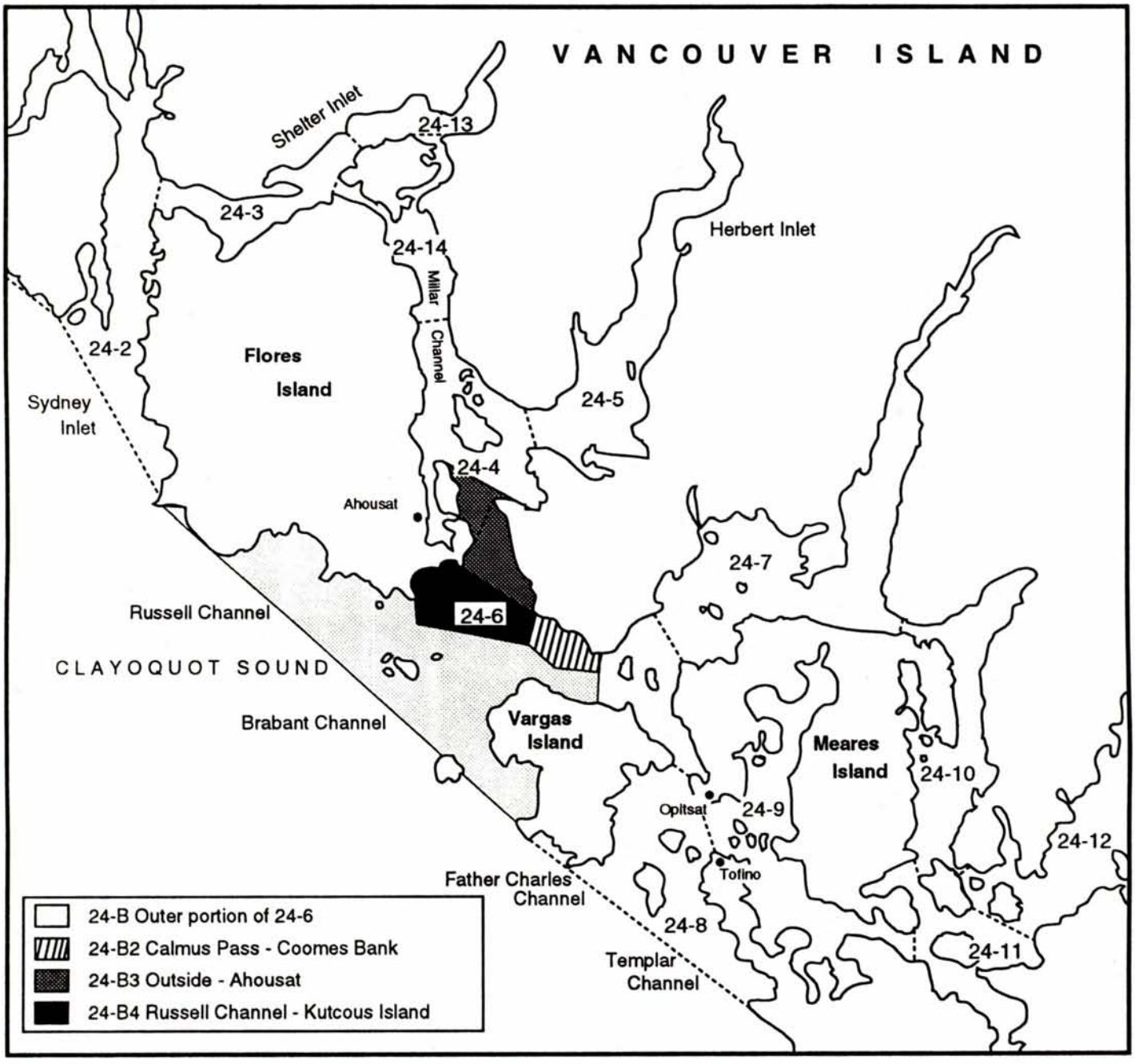


Figure 9. 1994 geoduck management areas: Area 24 Outside; 24-B1, 24-B2, 24-B3 and 24-B4.

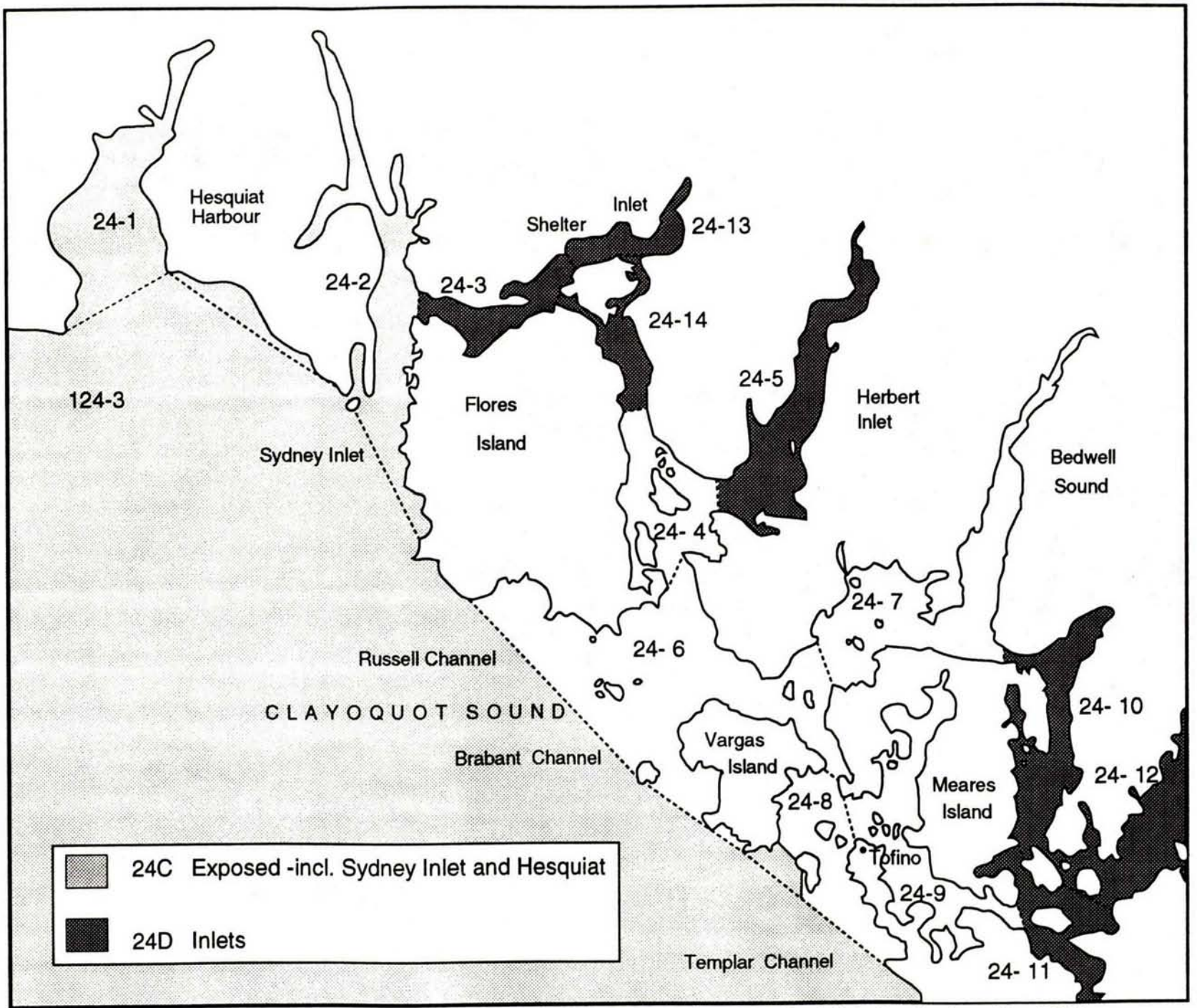


Figure 10. 1994 geoduck management areas: Area 24-C - Exposed and 24-D - Inlets (both closed in 1994).

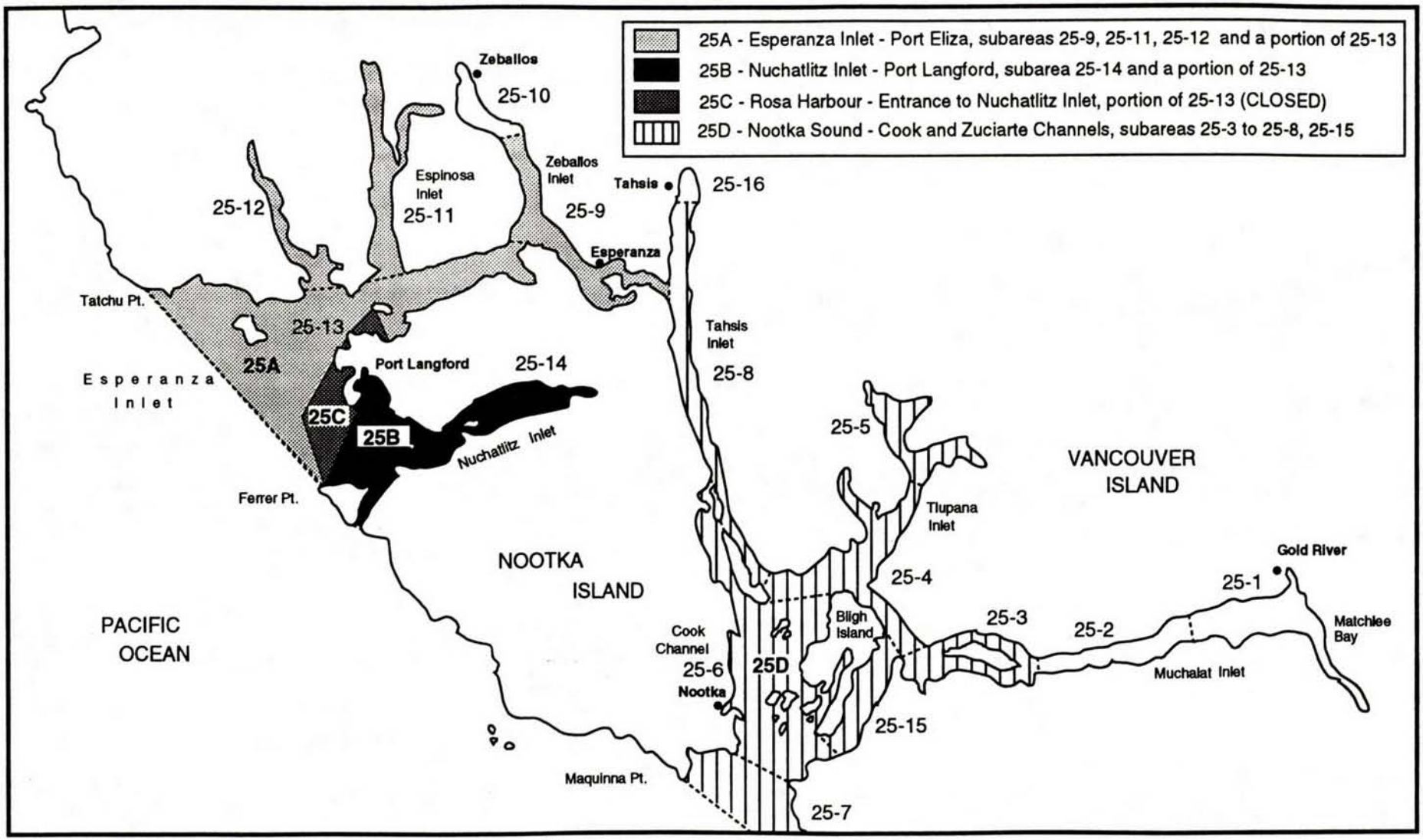


Figure 11.1994 geoduck management areas: Areas 25-A, 25-B, 25-C, and 25-D.

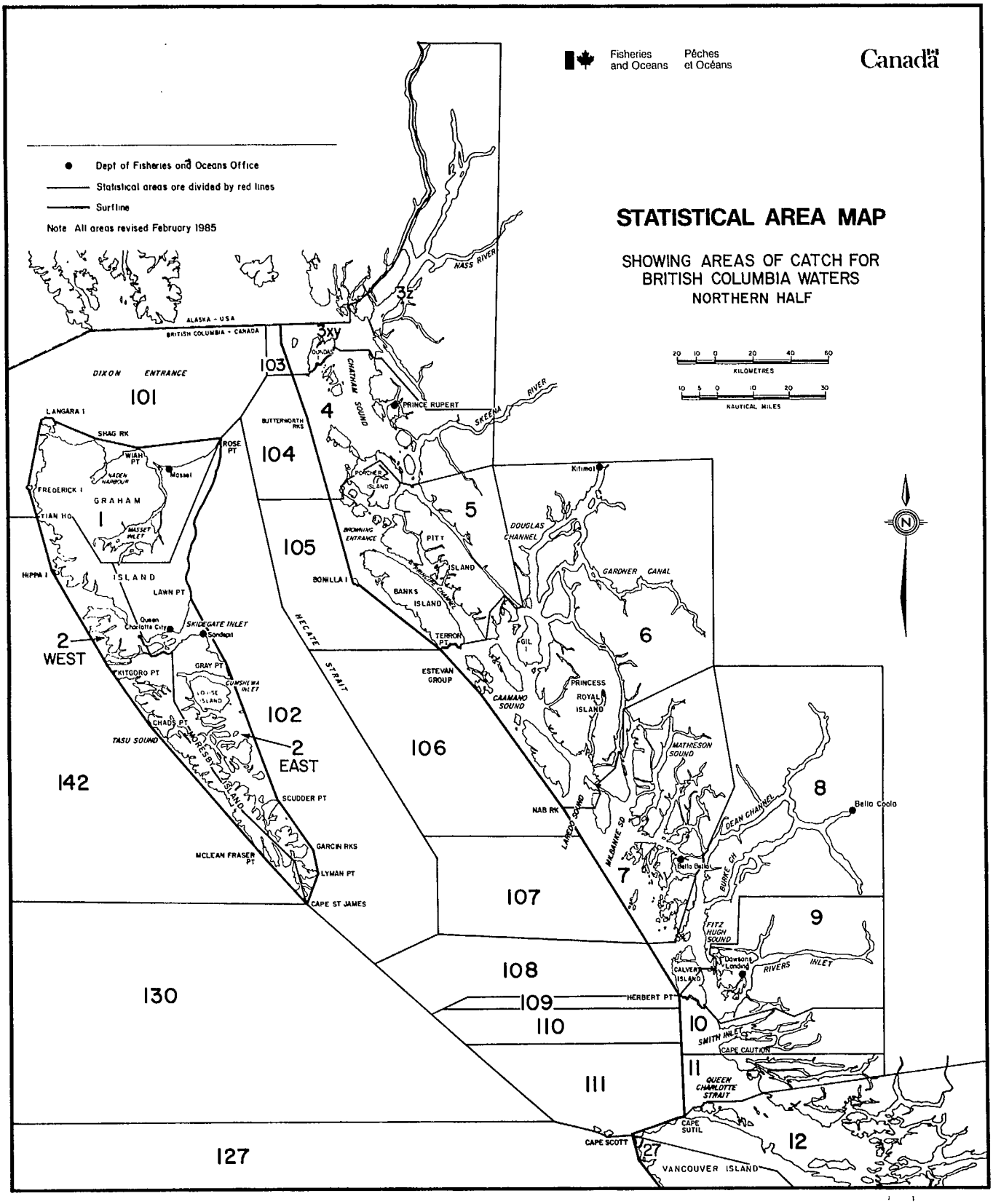


Figure 12. Pacific Fishery Management Areas, northern coast of British Columbia.

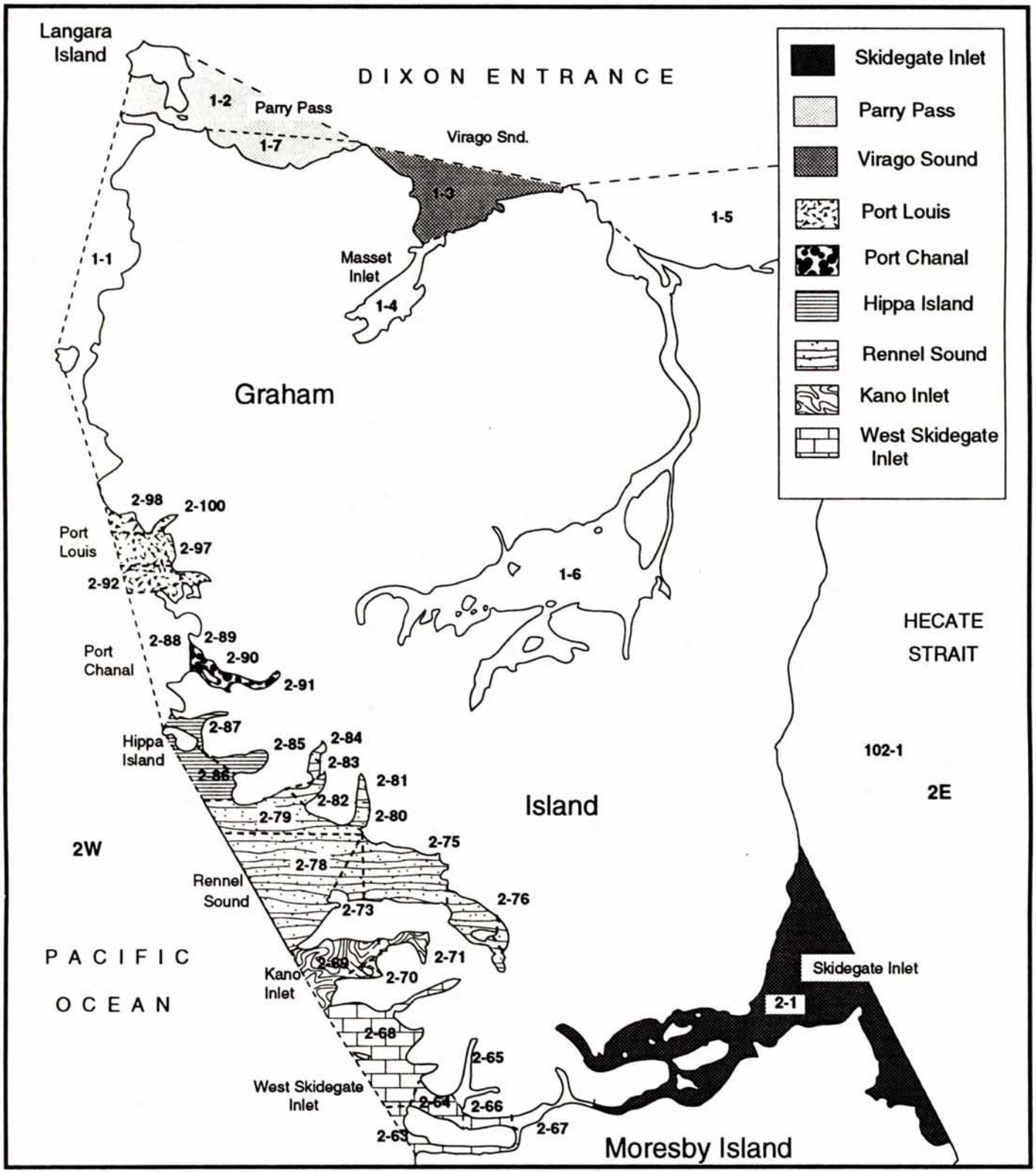


Figure 13. 1994 geoduck management areas: northern Queen Charlotte Islands

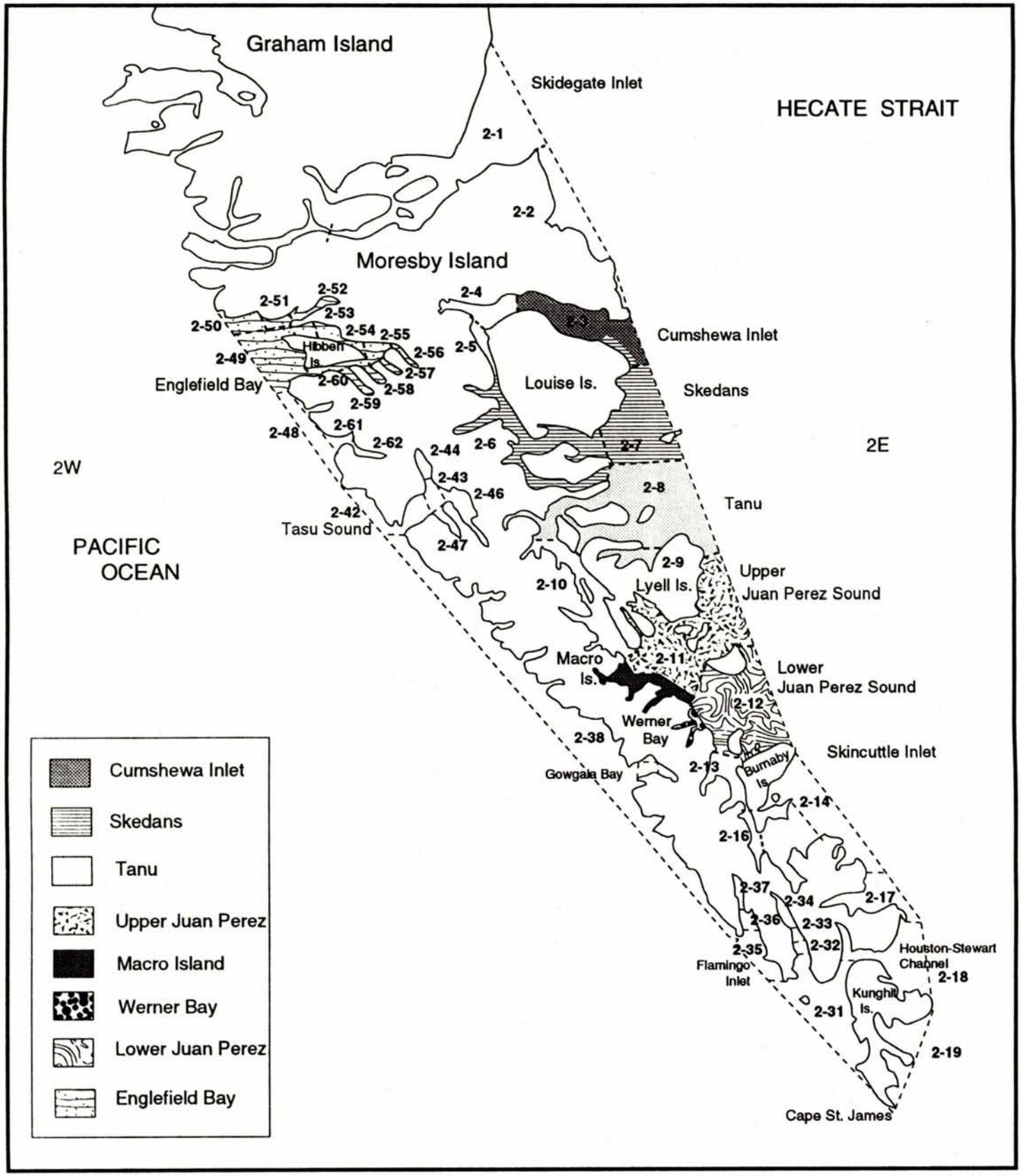


Figure 14. 1994 geoduck management areas: south central Queen Charlotte Islands.

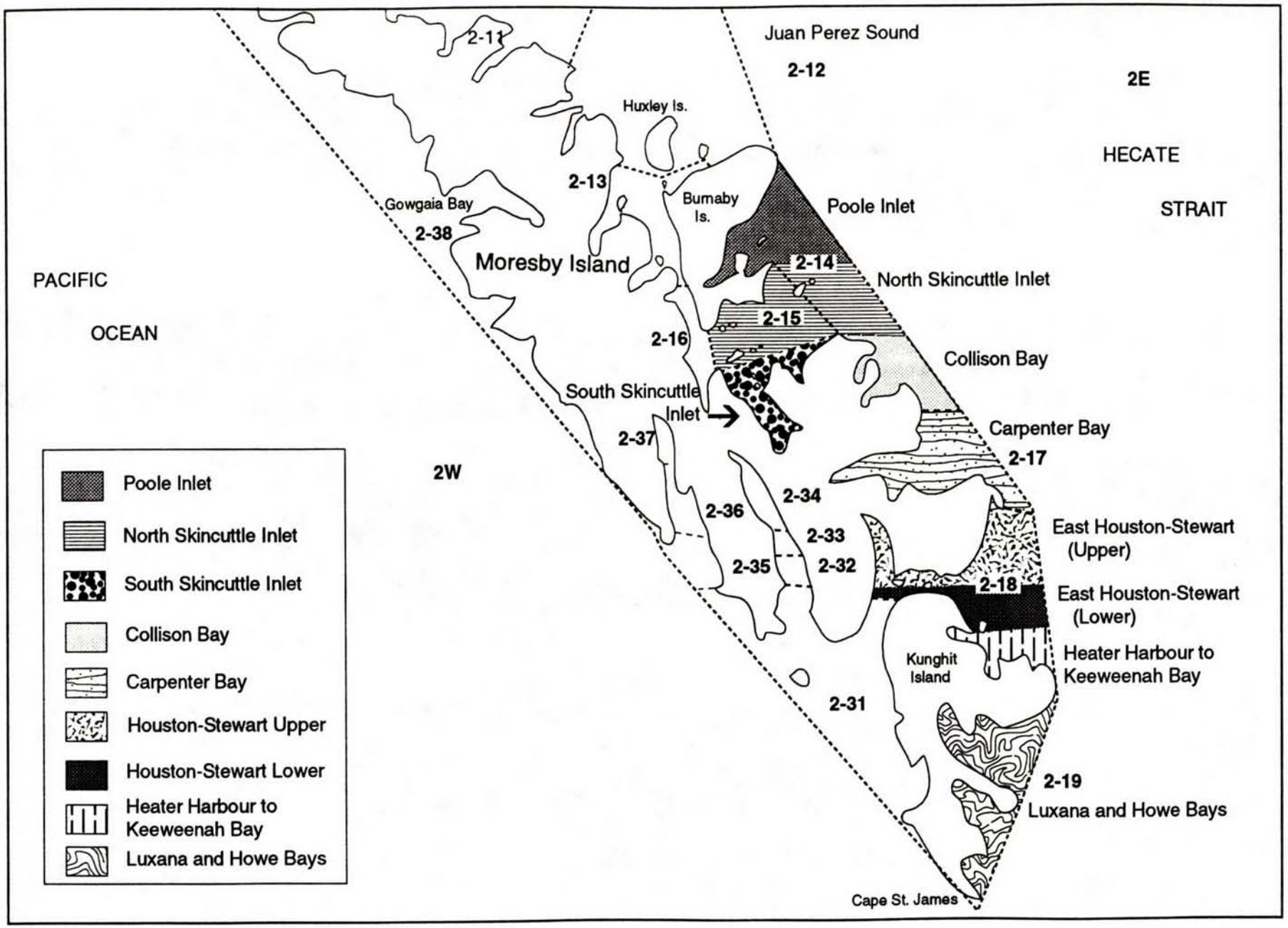


Figure 15. 1994 geoduck management areas: southeastern Queen Charlotte Islands.

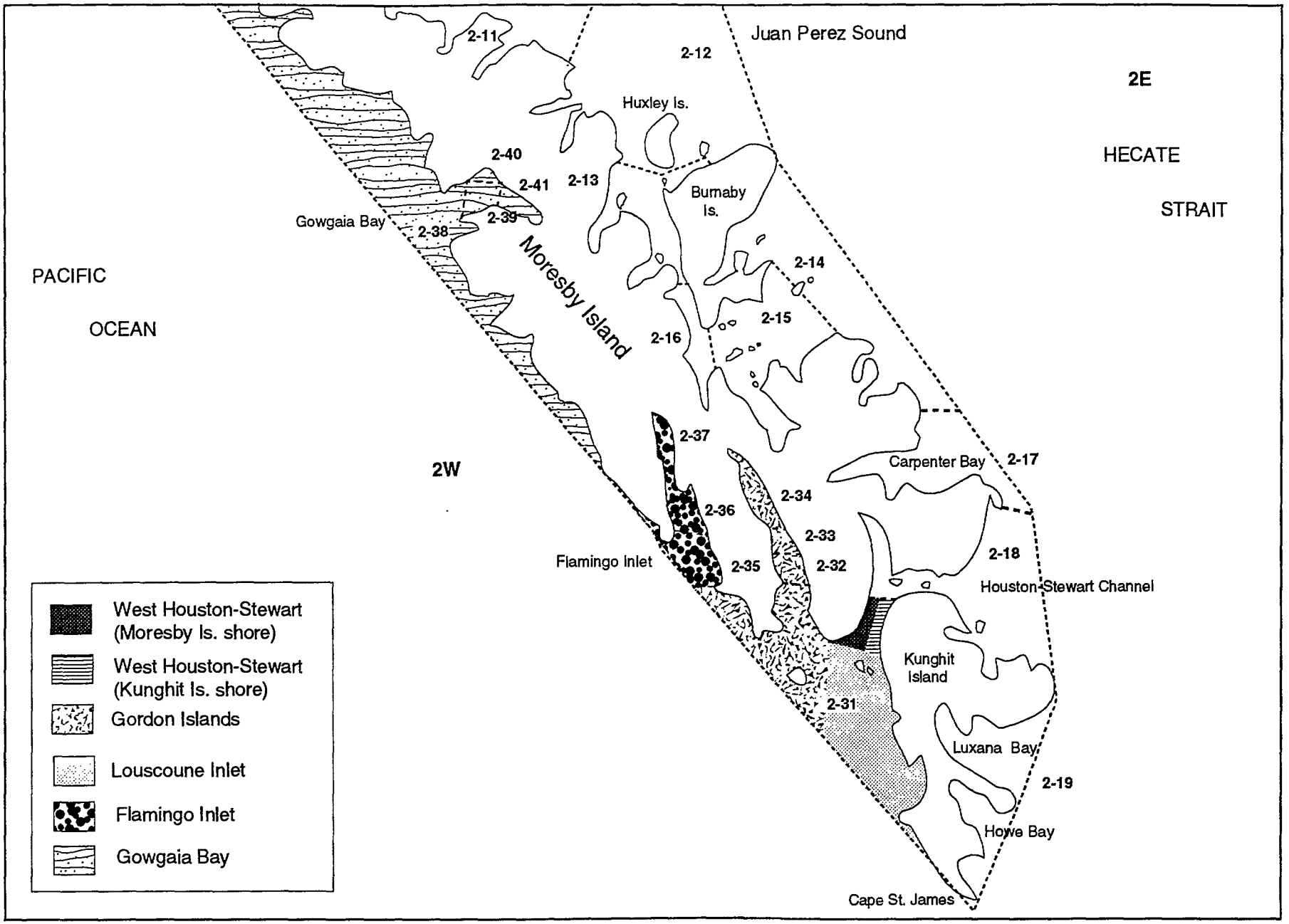


Figure 16. 1994 geoduck management areas: southwestern Queen Charlotte Islands.