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U.S. NAVY HOMEPORT DISPOSAL SITE INVESTIGATIONS IN PORT GARDNER, WASHINGTON, 1986 AND 1987

Bottomfish Assessments

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Robert L. Lauth, Robert F. Donnelly, John H. Stadler,
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FINAL REPORT

to

Washington Sea Grant, U.S. Navy and U.S. Army Corps of Engineers

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Approved R. C. Fran.
Director

ABSTRACT

As part of the U.S. Navy Homeport Project, demersal fish populations were sampled on a quarterly basis in and around a proposed dredge disposal site (RADCAD) in Port Gardner during 1986 to 1987. Sampling was conducted at depths ranging from 20 m to 135 m using a 7.6-m otter trawl and a 3-m beam trawl.

Abundance, biomass, species, richness, and species diversity were highest at the 40- and 80-m depths. Observed seasonal differences in abundance and biomass were attributed to seasonal concentrations of Pacific hake and ratfish. Species diversity was found to be highest during Autumn quarter sampling. Flatfish were examined for the presence of liver tumors and infestations of the blood worm (*Philometra* sp.) and found to be in good health with low incidences of either condition.

The proposed disposal site (110 m to 120 m in depth) appeared typical of other locations within Puget Sound at similar depths, with lower abundance, biomass, species diversity, and species richness when compared to shallower depths within the study area. Twenty-five species of fish were captured at the RADCAD site, with five species predominating in the catches: ratfish, slender sole, Dover sole, English sole and Pacific hake.

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As part of a joint scientific project coordinated by Glen Jamieson and Dwight Heritage of the Pacific Biological Station, Nanaimo, B.C., the *Pisces IV* submersible, support vessel *Pender* and crews for both vessels were loaned to the project at no cost by the Department of Fisheries and Oceans, Institute of Ocean Sciences, Sidney, British Columbia under the direction of Jonathan Davis. Frank Chambers, Chief Pilot for *Pisces IV* and his crew provided smooth diving operations with their professional and expert services. The crew of the U.S. Navy tug *Manhattan* provided valuable towing services for the *Pisces IV* and *Pender* to and from Port Gardner.

The trawling operations were conducted from the R/V *Kittiwake* under the capable guidance of Charles Eaton. Report preparation and editing was provided by Marcus Duke and Frederick Johnson.

INTRODUCTION

Construction of the U.S. Navy Homeport facility in Everett, Washington, will require the dumping of dredged materials at an aquatic dumpsite. To assess existing bottomfish populations, and to provide baseline data for post-disposal monitoring, a series of trawl surveys was conducted during 1986 and 1987 in and around the proposed RADCAD (Revised Application Deep Confined Aquatic Dumpsite) site in Port Gardner.

Fish are generally more mobile than benthic invertebrates and are presumably better equipped to escape the most direct effects of dumping (e.g., being buried). However, dredge disposal may be indirectly detrimental to fishes because certain species may utilize an area for feeding, spawning or as a nursery.

Since many bottomfish species feed on benthic invertebrates, the value of an area as a bottomfish feeding habitat can be determined by examining the benthos (Luntz and Kendall 1982). A change in the structure of the benthic community could have adverse effects on bottomfish populations. Numerous studies have documented changes in the benthic and bottomfish communities. Work in Upper Chesapeake Bay and in Long Island Sound has demonstrated that the benthic community may completely recover 18 months after dumping of dredge materials has ceased (Chesapeake Biological Laboratory 1970; Schubel et al 1979). Hughes et al. (1978) found that the dumping of dredged material in Elliott Bay, Puget Sound, had no lasting effects on the benthic community at the disposal site. However, a similar study has shown reductions in species diversity, density and biomass at disposal sites in Long Island Sound (Serafy et al. 1977). At a disposal site in Oregon, off the mouth of the Columbia River, the benthic community was more diverse, but with lower biomass, while the demersal fish species diversity, species richness and catch-per-unit-effort (CPUE) declined following the disposal of dredged materials. Such varying results suggest that factors such as depth and material type influence the rate at which benthic communities recover (Grassle 1977; Schubel et al. 1979; Desbruyeres et al. 1980).

Huet (1965) suggested that changes in benthic sediment composition may interfere with fish reproduction. Disposal of dredged material may also decrease the available shelter and result in increased inter- and intraspecific competition (Elner and Hamet 1984).

Fish health may be adversely affected by dumping of contaminated materials. Fin erosion disease and liver disease in flatfish have been associated with the presence of PCBs and chlorinated hydrocarbons in benthic sediments (Sherwood 1976, 1978; Pierce et al.1977; Cross 1982; Rosenthal et al.1984). Increases in suspended sediments due to dumping have also been shown to affect fish. For example, Johnson and Wildish (1981) found that herring will avoid dredge spoils.

In addition, suspended sediments that clog the gills of fish can cause asphyxiation (Sherk et al. 1974).

In order to minimize the impact of dredge disposal upon the bottomfish community, we need to know which fish species are present and in what numbers. Furthermore, we must understand the temporal and spatial patterns of use by these fish species and the motivations for their presence in the area.

The purpose of this study was to assess the bottomfish community at the proposed RADCAD site in terms of species diversity, species richness, abundance, biomass, patterns of utilization and, for flatifsh, their state of health.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted within the confines of Port Gardner (Fig. 1). The bathymetry is typical of Puget Sound with steep side slopes and a gently sloping flat bottom. The Snohomish River enters at the northeast corner of Port Gardner and has created a delta with a steep embankment ranging in depth from from 0 m to 100 m. The generally flat bottom begins at about 100 m depth in the northeast and slopes downward to the southeast. The bottom is composed of sand and mud.

Sampling Design

The sampling design was a stratified regimen based on depth and season. Results of other studies in Puget Sound (Donnelly et al. 1984a; Wingert and Miller 1979) indicated that depth and season are important variables of the benthic fish assemblages and the sampling scheme should be stratified to obtain meaningful data on the fish community.

Fish Sampling

Eighteen stations were sampled during Winter and Spring of 1986 (Fig. 2 and Table 1). The RADCAD stratum was the proposed disposal at depths from 110 m to 120 m. Strata 135M and 100M were located on the flat bottom of Port Gardner at depths of 120-145 m and 90-110 m, respectively. Stratum 80M was located at 80 m on the river delta slope. Strata 40M and 20M were located at the 40-m and 20-m depth contours on the southeast side of Port Gardner. Station E was added during Summer 1986 sampling and stations G and H were added during Autumn 1986 sampling. During Winter of 1987, one additional day of sampling was conducted on six RADCAD stations and one 100M strata station.

Environmental Sampling

Subsurface (near bottom) and surface water temperature, salinity and dissolved oxygen samples were collected at the RADCAD, 135M, 40M and 20M strata during each biological sampling season (Fig. 2). In addition, light penetration measurements were taken at the same strata and seasons.

Description of the Sampling Gear

Two different trawls, an otter trawl and a beam trawl, were used to collect bottom fish. The number of stations sampled differed within each stratum for the otter trawl and beam trawl (Fig. 2 and Table 1). The beam trawl was used as the primary research tool in a separate and extensive study focusing on crab and shrimp resources in Port Gardner (Dinnel et al. 1988). The stations and strata sampled with the otter trawl (the primary fish capture tool) were a subset of the beam trawl stations and strata. However, significantly lower numbers of bottomfish were collected using the beam trawl, so the data from comparable strata were used to supplement the otter trawl results despite the difference in sampling gear. The number of stations sampled was 48 during Winter and Spring 1986; 53 during Summer 1986; 55 during Autumn 1986; and 21 during Winter 1987.

Otter Trawl

A 7.6-m otter trawl (Fig. 3) was used to capture bottomfish in Port Gardner. The otter trawl was a semi-balloon design with bridle, otter doors and net (Mearns and Allen 1978). The bridle was 22.7-m long and made of 1.5-cm braided nylon. The otter doors were 51 cm by 80 cm and weighed 23 kg. The body of the net was made of 3.5 cm stretch mesh covered with 2.5 cm stretch mesh to prevent chafing. The otter trawl was deployed from the 16-m research vessel **Kittiwake**. The effective fishing width of the net was 3.8 m (Donnelly et al. unpublished data). Each sample (or catch-per-unit-effort, CPUE) consisted of the otter trawl towed for a distance of 370 m at a target ground speed of 4.2 km per hour (1295 m^2).

Beam Trawl

A 3-m plumb staff beam trawl was also used to sample bottom organisms (Gunderson and Ellis 1986). The beam trawl consisted of a 3-m bridle, a 3-m bar (or beam), two 9.5-kg tom weights, tickler chain and netting (Fig. 3). The body of the net was made of 20-mm stretch mesh and the cod end was 10-mm stretch mesh. A piece of heavy 80-mm stretch mesh was attached to the underside of the cod end to act as chafing gear. The effective fishing width of the beam trawl was 2.3 m (Paul Dinnel, personal communication). The beam trawl was towed 232 m at a target ground speed of 2.5 km per hour (534 m^2).

Secchi Disc

Light penetration was measured with a Secchi disc (30.5 cm diameter). The Secchi disc was lowered over the lee side of the *Kittiwake*, and the depth at which the instrument was no longer visible was recorded.

Niskin Bottle

A plastic Niskin bottle (5 l) was used to collect subsurface water for salinity, dissolved oxygen and temperature. Water samples were dispensed into standard salinity and dissolved oxygen bottles. Temperature was obtained with a hand-held thermometer as soon as the samples were brought on board the vessel.

Surface Bucket

A plastic bucket (10 l) was used to collect surface water. The salinity, dissolved oxygen and temperature samples were treated in the same way as the Niskin bottle samples.

Sample Preservation

Biological

All fish collected in the field were placed in plastic bags, put on ice and later transferred to a freezer for storage. Each bag was labeled inside and outside to ensure proper identification.

Environmental

Dissolved oxygen samples were fixed in the field using the techniques of Carpenter (1965) and stored on ice. Samples taken for salinity measurements were also stored on ice. Light penetration and temperature data were recorded in the field.

Sample Processing

Biological

Fish samples were removed from the freezer and allowed to thaw. Fish were separated by species and all flatfish, gadids (Pacific cod, Pacific tomcod, Pacific hake, and walleye pollock), surf perch (pile perch, shiner perch and striped seaperch) and ratfish were further separated by size (i.e., juvenile or adult). Flatfish and gadid species juveniles were defined as being less than or equal to 120 mm in length. Surf perch were considered juveniles if they were less than or equal to 100 mm in length. The tips of ratfish tails were often missing; therefore, a length from snout to the end of the second dorsal fin, as well as total length (when possible), was recorded. Juvenile ratfish were defined as less than or equal to 150 mm to the end of the second dorsal fin. The length of each fish, the total number and weight for each species and juvenile or adult status for most fish were recorded. When a large number of individuals per species and/or life history stage were present in a sample, a subsample of at least 30 randomly selected individuals was measured and weighed.

Female English sole were examined in the field for sexual maturity to determine if Port Gardner was used as a spawning ground. Sexual maturity was defined as females with ripe and running eggs. Gross (macroscopic) examination for fin erosion, skin tumors, liver tumors and blood worms (*Philometra* sp.) was conducted on all flatfish species; no attempt was made to look for these same diseases and parasites on any other species of fish.

Flatfish were examined for fin erosion in the field. Fin erosion typically affects the anal and dorsal fins and varies in severity from minor defects to extensive destruction of the fins. The less severe cases exhibit partial loss, fusion, or destruction of the fin rays, typically accompanied by hemorrhages and granulated tissue on the surface of the fin. Along the free edge of the diseased fin there is usually a line of hyperpigmentation. In the most severe cases, parts of the fins exhibit complete loss of fin rays, and the remaining tissue becomes greatly scarred, retracted, flaccid and deformed (Wellings et al. 1976).

Flatfish were examined in the laboratory for the presence of skin tumors. Skin tumors, which occur in several species of flatfish (Southern California Coastal Water Resources Project (SCCWRP) 1973), are found as two main types: angioepithelial nodules (AEN) and epidermal papillomas (IEP) (Angell et al. 1975; McArn et al. 1968; Miller and Wellings 1971). Field and laboratory experiments have shown the tumor types to be different stages of the same disease (McArn et al. 1968). AEN tumors, located anywhere on the external surface of the fish, are 1 mm to 5 mm in diameter, hemispherical, pink to red, smooth-surfaced and sessile lesions (Miller et al. 1977) and are typically found on small (usually juvenile) flatfish. EP tumors were circular, 5 mm to 50 mm in diameter, brown to black, and with the outer surfaces similar to cauliflower in appearance.

A random subsample (about 20%) of all adult flatfish livers was examined macroscopically for liver tumors and other obvious abnormalities. Liver tumors are known to occur among several species of flatfish (Malins et al. 1982; Landolt et al. 1984). The liver is involved in a wide variety of physiological activities and, in fish, it has been shown to be sensitive to the effects of contaminants (Sinnhuber et al. 1977).

All flatfish were examined in the laboratory for bloodworm (*Philometra* sp.), a relatively common internal parasite of marine flatfish. The bloodworms are clearly visible and are typically located in the subcutaneous areas near or at the base of the fins. Bloodworms can be large, up to 100-mm length by 2-mm diameter, and are bright red (Amish 1976). The external appearance of the parasite in the fish resembles a dull red blister, less than 10 mm long.

Environmental

Dissolved oxygen samples were processed by the School of Fisheries Water Quality Laboratory, University of Washington, by the methodology of Carpenter (1965). Salinity was determined by a Wheatstone bridge at the School of Oceanography, University of Washington.

Data Analyses

All the data were collected and recorded on forms following the National Ocean Data Center (NODC) format. Analyses were done using both a hand calculator and computer programs.

Abundance and Biomass

Abundance and biomass CPUE (defined as the catch per tow; see other trawls, description of the sampling gear) values were computed for each stratum, season and gear type. The results were presented graphically. Total and average abundance and biomass values and their standard deviations for each stratum and each fish species were tabulated by season.

Species Diversity

The species diversity index (H') combines the number of fish species and their relative abundances. This index can be useful when comparing assemblages from different habitats (Pielou 1975). Species diversity was calculated for each strata, season, and gear type. The formula used for species diversity, after Pielou (1978), was:

$$H' = \sum_{i=1}^{n} p_i \ln p_i$$

where p_i is the proportion of the community that belonged to the i^{th} species and n is the number of species.

Species Richness

Species richness, defined as the total number of species caught, was calculated for each strata from the combined otter trawl and beam trawl data. Pielou (1975) discusses the use of community indices and considers species richness a useful tool in ecological studies of aquatic communities.

Species Clusters

A numerical classification (or cluster analysis) technique was used to identify species assemblages. Advantages of this technique include the ability to: (1) provide objective criteria that can be applied to a large data set to arrive at a summary; (2) base the analysis upon quantitative catch data; and (3) evaluate the results at different levels of statistical similarities. Data preparation involved creating a data matrix composed of catch data (numbers or weight) for a set of species among a set of strata within each season. The data were transformed ($\log_{10}$ (observation +1)) to reduce and normalize the variability. After transformation, resemblance measures were computed between species which resulted in a matrix of resemblance values. A hierarchical clustering technique was used (Boesch 1977; Clifford and Stephenson 1975) to combine species based upon similarities (or dissimilarities) of their attributes in a stepwise fashion. The dissimilarities were computed using the Bray-Curtis distance measure (Beals 1984; Bray and Curtis 1957). A dissimilarity index of 0.75 was used as a cutoff for grouping species.

Species Composition

The dominant species caught in each strata and season were tabulated by relative abundance. The most abundant species were graphed and shown by strata (Kenkel and Orloci 1986).

Length-frequency

Length-frequency histograms were constructed for the five most abundant species found in the RADCAD strata (English sole, hake, slender sole, Dover sole and ratfish) using all fish captured. No attempt was made to standardize the histograms based on the number of trawls in each stratum. The results were displayed graphically in three forms: (1) all seasons and strata combined; (2) by season and strata; and (3) by sex and life history stage where possible (i.e., large enough sample size to result in a meaningful graph).

Determination of age at size and/or reproductive age at size was inferred from the literature as follows: English sole (Holland 1954; Angell 1972), Pacific hake (Pedersen 1985), Dover sole (Hagerman 1952). Slender sole and ratfish literature on age at size was not available.

Station Clusters

Cluster analysis was used to identify clusters of stations for two purposes: (1) to identify a possible reference (control) site or sites for future monitoring after dredge disposal begins, and (2) to verify the basis for the selection of strata. The technique was the same as that used for species clustering. Details on the technique are given earlier, substituting site for species.

RESULTS

Fifty-eight species of fish were caught during the course of this study (Table 2). Forty-four species were caught by the otter trawl and 49 by the beam trawl. Table 2 lists both common and scientific names for the fishes caught during this study, but for the sake of brevity, only common names of species will be used throughout the remainder of this report.

Abundance and Biomass

Otter trawl abundance CPUE ranged from 4 to 337 fish, while the beam trawl abundance CPUE ranged from 3 to 100 fish per trawl. Otter trawl biomass CPUE ranged from 0.12 kg to 35 kg, while beam trawl biomass CPUE ranged from 0.15 kg to 2 kg per trawl.

In general, the otter trawl abundance and biomass CPUE values showed consistent trends throughout the study period (Fig. 4). The 80M stratum consistently had the highest abundance and biomass CPUE values for all seasons and, along with the RADCAD and 135 strata, peaked during Winter 1986.

The beam trawl abundance and biomass CPUE values were usually highest during Winter and Spring (Fig. 5). The 40M stratum had the highest abundance and biomass CPUE values during all sampling periods except Summer. The RADCAD, 135M and 100M strata had low abundance CPUE values during all seasons but had intermediate biomass CPUE values for Winter and Spring.

Abundance and biomass CPUE values and their standard deviations for all species, strata, seasons and gear types are listed in Appendix Tables 1 through 10.

Species Diversity

Species diversity of fish caught by otter trawl varied by season and stratum (Fig. 6). In general, Winter and Summer species diversities fluctuated little between strata. During Spring, the 40M and 80M strata had high values relative to other strata. In contrast, the deep strata (RADCAD, 135M and 100M) had high values compared to the other strata during Autumn.

Beam trawl species diversities also varied by season and strata (Fig. 7). Winter, Spring and Summer species diversities generally decreased with depth. During Autumn, there was no apparent trend in species diversities.

Species Richness

For all seasons combined, species richness, within each stratum decreased with depth except for the 20M stratum (Fig. 8). The lowest species richness was found at 135M while the highest was at 40M. Species richness increased from Summer to Autumn for all strata (Fig. 9). The

RADCAD and 135m strata yearly patterns were similar, while seasonal values for all other strata appeared to fluctuate considerably.

Species Composition and Relative Abundance

Tables 3 and 4 list the most common species caught (greater than or equal to 1% of abundance CPUE value or occurring at least three out of the four seasons) by otter trawl and beam trawl for each stratum during each sampling period. Species composition and relative abundance varied between strata, and between seasons within a stratum. Abundance and biomass CPUE values and their standard deviations for all species caught are listed in Appendix A. All samples were taken during the study period.

135M-depth Stratum

Otter trawl sampling of the 135M stratum yielded 20 species. Of these species, only 5 (English sole, ratfish, slender sole, Dover sole and Pacific hake) were collected throughout the year and dominated in relative abundance. In terms of relative abundances, the dominant species changed from season to season; however, the order of dominance was generally as follows: slender sole, ratfish, Dover sole, English sole and Pacific hake.

The beam trawl caught 22 species of which 2 (slender sole and ratfish) occurred throughout the year. Three other species (Dover sole, blackfin poacher and longnose skate) were found during three of four seasons. Slender sole were either first or second in relative abundance during each sampling period.

115M-depth Stratum RADCAD)

Twenty-five species of fish were caught by the otter trawl at the RADCAD stations. Of these, 4 species (ratfish, slender sole, Dover sole, and English sole) occurred during each sample period. In addition, Pacific hake were present during 4 out of 5 sample periods. The total abundance of these five species represented a high percentage of the catch. Ratfish had the highest relative abundance during four out of five seasons, followed by English sole, slender sole and Dover sole.

The beam trawl catches for all seasons contained 17 species of fish, only two of which were found throughout the study period (slender sole and ratfish). Ratfish had the highest relative abundance during Winter 1986 and Spring and Summer 1987 and equal to English and slender sole for the highest relative abundance during the Autumn sampling period. Slender sole dominated in relative abundance during Winter 1987.

100M-depth Stratum

Otter trawl sampling within the 100M stratum yielded 17 species. Of these 17 species, 6 (English sole, Dover sole, slender sole, Pacific hake, quillback rockfish and ratfish) were present throughout the sampling period. Ratfish and English sole dominated in relative abundance two out of four seasons; Dover sole and Pacific hake were next in relative abundance followed by slender sole and quillback rockfish.

Sampling with the beam trawl resulted in the capture of 20 species of fish. Four species (slender sole, Dover sole, rex sole and ratfish) were found during all sampling periods. Pacific hake, spinyhead sculpin, blackfin eelpout, blackbelly eelpout, plainfin midshipman and blackfin poacher were encountered three of four seasons. Ratfish were the highest in relative abundance during all sampling periods; slender sole were second in relative abundance for three of four seasons and Dover sole were third in relative abundance for the first three sampling periods.

80M-depth Stratum

Twenty-one species were captured by the otter trawl at the 80M stratum. Nine of the 21 species (English sole, slender sole, flathead sole, Dover sole, quillback rockfish, blackbelly eelpout, blacktip poacher, Pacific hake and ratfish) were present in all seasons. English sole had the highest relative abundance with ratfish, hake and slender sole usually dominating the remainder of the catch. Flathead sole ranked low in relative abundance and 80M was the only stratum where they were consistently found throughout the year.

The beam trawl collected 27 species of fish, and English sole, slender sole, rex sole, Pacific hake, ratfish, plainfin midshipman, slim sculpin, blacktip poacher and bluebarred prickleback were found throughout the year. Another 7 species were found three of four seasons (flathead sole, Dover sole, blackbelly eelpout, staghorn sculpin, northern ronquil, Pacific tomcod and spinyhead sculpin). Slender sole and ratfish had the two highest relative abundance values for all seasons except during Spring, when ratfish and Dover sole dominated.

40M-depth Stratum

Thirty-one species were collected by the otter trawl at the 40M stratum. Five species (English sole, rock sole, Dover sole, speckled sanddab and quillback rockfish) were present in the catches throughout the sampling period. English sole had the highest relative abundance for all seasons except Summer, when Pacific cod were prevalent.

The beam trawl captured 30 species of fish throughout the year. Eleven species (English sole, slender sole, Dover sole, rex sole, quillback rockfish, blackbelly eelpout, plainfin midshipman, slim sculpin, pygmy poacher, snake prickleback and ratfish) were found during each season. An additional five species occurred three of four seasons (speckled sanddab, rock sole, northern ronquil, Pacific tomcod and roughback sculpin). For each sampling period, species in highest relative abundance varied between shiner perch, English sole, blackbelly eelpout and slender sole for Winter, Spring, Summer and Autumn, respectively.

20M-depth Stratum

Eleven species were collected by the otter trawl in the 20M stratum. Speckled sanddab and rock sole were found during all sample periods and ranked highest in relative abundance during Winter and Spring; English sole (found during three seasons) and shiner perch (found during two seasons) had the highest relative abundances for Summer and Autumn.

Twenty-seven species were caught by beam trawl; eight were caught throughout the year (English sole, rock sole, slender sole, slim sculpin, Dover sole, snake prickleback, quillback rockfish and northern ronquil). Five other species (pygmy poacher, roughback sculpin, speckled sanddab, plainfin midshipman and C-O sole) were found three of four seasons. Species in highest relative abundance varied for each sampling period between rock sole, speckled sanddab, blackbelly eelpout and slender sole for Winter, Spring, Summer and Autumn, respectively.

Species Clusters

The results of the species cluster analysis for each season are shown in Table 5. There were four to five main groups for each season with the composition changing with each season. Five species (English sole, Pacific hake, Dover sole, slender sole and ratfish) tended to group together in the same or closely related groups throughout the study period. In addition to the main groups, subgroups ranging from 0 to 4 were found. The composition of the subgroups, like the main groups, changed from season to season.

Abundance and Length Frequency Analysis of Fishes Common to the RADCAD Stratum

Pacific Hake

Pacific hake were present only in the RADCAD, 135M, 100M and 80M strata (Fig. 10). The largest catches of hake occurred during Winter 1986; other sampling periods had relatively low numbers. During all sampling periods, the greatest abundance CPUE values for hake were at the 80M stratum.

Length-frequency plots of Pacific hake show the presence of a wide range of year classes within the study area (Fig. 11). The Winter 1986 samples contained fish from the year classes

1985 through 1981 and older. Fish from the 1981 and older year classes could not be distinguished from each other. Several year classes older than 1981 may have been represented by larger fish (greater than 379 mm).

Winter 1986 and Spring samples had a similar range of year classes, while there were fewer year classes during Summer. The 1986 year class (average 65 mm) first appeared in the Autumn samples along with fish from the earlier year classes. Samples from the Winter 1987 collections contained fish from the 1985 through 1982 and older year classes, but no fish from the 1986 year class. Winter 1986 and 1987 samples contained age distributions that were similar to each other, consisting of fish approximately 2 years and older.

Generally, the hake found in the RADCAD stratum were 2 years and older (Fig. 12). The majority of fish larger than 379 mm were collected during Winter 1986 and 1987 in the RADCAD site. The young-of-the-year hake occurred exclusively in the 135M stratum during Autumn (Fig. 13). Year class representations for the 100M stratum were similar to the RADCAD stratum for Winter 1986 and 1987 (Fig 14). The catches at the 80M stratum consisted primarily of the 1985 and 1984 year classes during all sampling periods (Fig. 15). Relatively few fish were taken from the 1983 year class, and no fish from the 1982 and older year classes.

English Sole

English sole were present in all strata during all sampling periods except the Spring samples at the 20M stratum (Fig. 17). The RADCAD, 135M and 20M strata had low abundance CPUE values for English sole compared to the 80M and 40M strata. The 80M stratum had the highest CPUE values for all seasons except Winter, when the 40M stratum CPUE values dominated. The RADCAD stratum had low numbers of English sole during all sampling periods.

Length-frequency plots of English sole indicate the presence of at least 7 year classes within the study area (1986-1980; Fig. 17). English sole from year classes prior to 1980 could not be distinguished from each other; however, English sole larger than 293 mm (males) and 363 mm (females) may represent older year classes. Only three year classes were present in the samples from Winter 1987. Size distributions for female English sole indicated a larger average size compared to male English sole for all seasons. No ripe females were captured.

Catches of English sole from the RADCAD stratum consisted primarily of fish 3 years and older (Fig. 18). The RADCAD stratum had an age distribution similar to the 135M stratum (Fig.-19).

The catch at the 100M stratum was composed predominately of older fish, although a few young fish were also taken (Fig. 20). Three-year-old fish dominated the catches of both sexes in the 80M stratum for Winter, Summer and Autumn (Fig. 21). Age distributions in the 40M stratum were dominated by young male English sole in both Winter and Autumn samples (Fig. 22).

Slender Sole

Slender sole were generally found in all strata and had peak abundance CPUE at the 80M stratum during all sampling periods (Fig. 23). The remaining strata had relatively low abundance CPUEs for all seasons except Winter, when the RADCAD and 135M strata increased.

The peak of the length-frequency distributions occurred between 161 mm and 220 mm (Fig. 24). Slender sole less than 121 mm (juveniles) were caught less frequently than the adults. The juveniles occurred during the Winter and appeared to recruit into the adult population during the Summer and Autumn. Adult length-frequency distributions were similar throughout the study period and in the deeper strata (Fig. 25).

Dover Sole

Dover sole were generally found in low abundance compared with English sole and slender sole (Figs. 16, 23 and 26). The distribution of Dover sole was restricted to the 40M and deeper strata and did not show any consistent abundance CPUE patterns between strata or seasons.

Length-frequency histograms of both sexes combined are shown in Figure 27. Most of the individuals ranged in size from 191 mm to 390 mm. The Winter size distribution had two peaks at 195 mm and 265 mm. The size range for Summer was similar to Winter, but the peaks occurred at 265 mm and 315 mm. A small peak occurred during Autumn between 191 mm and 240 mm. With the exception of the small Dover sole (less than 115 mm) caught during the Spring and Summer, there did not appear to be any differences between the size ranges throughout the study period.

Ratfish

Ratfish occurred only in the 80M and deeper strata (Fig. 28), with catches peaking during Winter. The abundance CPUE peaked at the RADCAD stratum in Winter. During Spring, Summer and Autumn, peaks occurred at the 80M or 100M strata.

The length-frequency distributions of the adults were similar for the RADCAD, 135M and 100M strata during Winter 1986 and similar for the RADCAD and 100M strata during Winter 1987 (Figs. 30-32). Juvenile ratfish (less than 150 mm) occurred irregularly throughout the RADCAD, 135M, 100M and 80M strata (Figs. 30-33). A broad size range of juveniles was evident for the sample at the RADCAD and 135M strata during Winter 1986.

Station Clusters

Results of the station cluster analysis are summarized in Figure 34. The RADCAD stratum generally grouped with the other deep strata. The 80M stratum formed a distinct group throughout the year. In general, the 40M and 20M strata grouped together and either formed distinct subgroups (Winter) or were intermingled.

Flatfish Health

English sole, slender sole, Dover sole, flathead sole, rex sole, rock sole and speckled sanddab all showed indications of blood worm infestations (Table 6). The incidence of *Philometra* sp. varied between species, seasons and strata, but did not show a discernable pattern. One skin tumor was noted on a slender sole caught in the 100M stratum. There was zero incidence of fin erosion. Gross examination of flatfish livers revealed three cases of liver tumors: two English sole from the 100M stratum during Spring and one starry flounder from the 20M stratum during Autumn.

Environmental Data

Water temperatures were generally higher at the surface than the bottom during Spring, Summer and Autumn; this situation was reversed during Winter (Table 7). In general, salinities were lower at the surface than the bottom, while dissolved oxygen values showed an opposite trend. Water clarity varied throughout the year, with the offshore stations generally showing greater clarity than inshore stations.

DISCUSSION

Biological Considerations

Results indicated that similarities existed between RADCAD and other strata within Port Gardner. Abundance, biomass, species richness and species diversity were usually much lower at the RADCAD, 135M, 100M and 20M strata compared to the 80M and 40M strata. Previous studies in Puget Sound have shown similar trends. Donnelly et al. (1984a and b), Donnelly et al. (1986) and Moulton et al. (1974) found species diversity and species richness to be greatest at intermediate (40 to 50 m) depths; abundance and biomass have also been shown to be higher at intermediate depths (Donnelly et al. 1984a and b; Donnelly et al. 1986). Differences in bottom topography between strata may account for some of the variability. The 80M, 40M and 20M strata occurred on a steep slope whereas the RADCAD, 135M and 100M strata occurred on the flat bottom. The 80M stratum stations were all located on the lower slope of the river delta and were in an area which was previously used as a dump site for dredged materials (Dave Jamison, personal communication). Such physical differences may influence the structure of a fish community (Becker 1984; SCCWRP 1973).

Temporal differences also occurred in measures of the fish community. Abundance and biomass were highest during Winter for otter trawl catches and highest during either Winter or Spring for beam trawl catches. The peak in abundance and biomass during Winter 1986 at RADCAD appeared to be due to high concentrations of Pacific hake and ratfish. Species richness at all strata increased from Summer to Autumn. Species diversity at the RADCAD, 135M and 100M strata was always highest during Autumn. The increase in species diversity at the deeper strata was due to an increased number of species captured during the Autumn without a corresponding increase in abundance or biomass. However, results of other studies (Donnelly et al. 1984a and b; Moulton et al. 1974; and Miller et al. 1976) do not show the same patterns, possibly because the present study was limited to a single year of sampling. Therefore, the trends in seasonal variability discussed above may not hold true from year to year.

RADCAD Focus

On the basis of previous studies (Donnelly et al. 1984a and b) the RADCAD site appeared to be typical of other locations at a depth of 100 m in Puget Sound. These same studies found abundance and biomass to be generally low at depths of 100 m or more. The species diversities found in the RADCAD site showed similar seasonal patterns and values to other studies at similar depths.

Most species were caught in low numbers and occurred sporadically. Some species (e.g., shiner perch, Winter 1986 at 80 m and Pacific cod, Summer at 40 m) showed a significant peak in abundance during one season, then occurred at very low abundances throughout the rest of the year. Pacific hake, English sole, slender sole, Dover sole and ratfish usually dominated at the RADCAD, 135M, 100M and 80M strata and were usually found together throughout the study period. The 40M and 20M strata displayed the greatest variability of species composition and relative abundance for all seasons.

Pacific hake appeared to migrate within the study area as they aged. Young-of-the-year fish were found at the deepest depths during Autumn and seemed to then migrate to shallower depths in Winter as 1-year-olds. These fish concentrated at 80 m, where they remained throughout the year. After reaching the age of 2 years, the hake began to move deeper and became dispersed over the deeper strata. During Winter, Pacific hake tended to migrate into the RADCAD stratum. Many of these fish were greater than 310 mm in length (the size of 50% maturity of females) and may have been passing from their prespawning staging area in Saratoga Passage through Port Gardner to their spawning grounds in Port Susan (Pederson 1985). At all other times of the year, older Pacific hake were in low abundance.

English sole seemed to undergo migrations between different strata. Generally the younger fish were found in the shallow strata, while the older ones were found at greater depths. This suggests that English sole moved into deeper water as they aged. Ketchen (1956) and English (1976) indicated such movement was correlated with size and, further, Ketchen (1956) found a pronounced shift of abundance into shallow water during spring; however this latter phenomenon was not seen in Port Gardner. Also, English sole are known to undergo migrations between different areas (Ketchen 1950), but no evidence was found to indicate migration of this type in Port Gardner. The RADCAD site contained few English sole at anytime and those that were present were usually large, older individuals. In Puget Sound, English sole spawn from January through April (Smith 1936); therefore, the low abundance in Winter and the lack of ripe females suggests that the RADCAD site was not being used as a spawning area.

Slender sole abundance decreased during Spring and Summer and then increased in Autumn. Most captured individuals exceeded the size of 50 percent maturity (Hart 1973) and, since slender sole spawn during Spring (Smith 1936), the decrease in abundance in Port Gardner suggests an outmigration to spawning grounds located elsewhere.. The length-frequency distributions indicated that larger fish were usually limited to the deeper strata.

Hagerman (1952) found that Dover sole underwent a spawning migration in Autumn into waters deeper than those found in Port Gardner. The abundance and length-frequency patterns of Dover sole at the RADCAD site suggest a resident population except for Autumn, when they seemed to leave the area, perhaps to spawn.

Ratfish abundance patterns in the study area suggest migratory behavior. Peak abundance depths varied with season. Since ratfish are known to eat a wide range of prey (Sathyanesan 1966), this variability may represent the utilization of alternate food resources during the different seasons. Quinn et al. (1980) found that young ratfish were located at depths deeper than older individuals, and the species was most abundant at 75 m. In contrast, large and small ratfish in Port Gardner were found together at all depths from 80 m and deeper, and were usually most abundant at the RADCAD and 135M strata.

<u>Exploited Fishes in Port Gardner</u>

Four of the five most common fish species found in Port Gardner are, at least to some degree, commercially exploited. Pacific hake are heavily exploited in the Saratoga Passage/Port Gardner/ Port Susan area (Pedersen 1985). Pedersen (1985) also indicated that in recent years Pacific hake have been marketed exclusively for human consumption. English sole are caught by commercial and sport fisheries in Port Gardner and throughout Puget Sound. Pacific hake and English sole dominate the commercial catches in the Port Gardner area (Pattie 1986). Slender sole are not targeted by either the commercial or sport fishery; however, occasional individuals become large enough to be kept by the commercial fishery (Greg Bargman, personnel communication). Dover sole is a commercially exploited species, but generally occurs in low enough abundance in the Port Gardner area to be considered incidental in the commercial catches. Ratfish are not exploited, but do occur in fairly high abundance throughout the deeper parts of the study area and other parts of Puget Sound (Donnelly et al. 1984 a and b; Miller et al. 1977). While all bottomfish may not be exploited, it is important to bear in mind that they still play important roles in the overall ecology of the marine community.

Flatfish Health

Flatfish appeared to be in good health in Port Gardner, based upon macroscopic examination for bloodworms, fin erosion, skin tumors and liver tumors. Malins et al. (1982) also found a low incidence of liver disorders, based on microscopic examination of rock sole and English sole livers from Port Susan, which is adjacent to Port Gardner.

Gear Efficiency and Sampling Effort

Gear efficiency of the otter trawl and beam trawl was not assumed to be 100%, and it is unknown how the catches compare with actual abundance. Mesh size may select for fish that could not slip through the net. Towing speed could also affect the catch by selecting for fishes that swim slower than trawl velocity. Furthermore, avoidance of the trawl by some fishes may be due to certain behavior (e.g., burying). However, the use of two gear types with different selectivity probably provides a better indication of the species present.

Unlike the beam trawl, the otter trawl has a history of use in Puget Sound for fish capture. However, beam trawl data offer unique insights. The beam trawl caught slightly more species of fish than the otter trawl (49 vs 44), but the otter trawl caught a greater abundance and biomass of fish. A total of 58 species of fish were caught by both gear types. Historically 136 species have been identified in the Everett area (DeLacy et al. 1972). Many of the species known for Port Gardner are diadromous, pelagic and/or occur in shallow water areas not sampled during this study. Approximately twice as many beam trawl samples, compared to otter trawl samples, were collected. Clearly, as more samples were collected, the probability of capturing the less common species increased. Species richness comparisons between strata, containing different sample sizes, should be viewed with some caution. Regardless of large sample sizes, the RADCAD and 135M strata still had lower species richness values than the shallower portions of the study area.

Environmental Considerations

Dissolved oxygen, salinity and temperature were similar to values found elsewhere in Puget Sound (Donnelly et al. 1984b; Miller et al. 1976). Dissolved oxygen was always near saturation both at the surface and near the bottom. Surface salinity was generally lower during the Winter and Spring months, probably because of freshwater input from rain and snow melt. Surface temperature was under considerable atmospheric influence, and thus typically was colder at the surface during the Winter months. Water clarity was generally best at the offshore stations, probably because nutrient and silt input from the Snohomish River influenced primary production at the nearshore stations.

Recommendations

On the basis of this study, the 135M and 100M strata are recommended as reference sites for future monitoring during and after the disposal of dredge spoils. That the 135M stratum was a closer match to RADCAD was probably due to similar depths and their distance from the slope; but also including the 100M stratum as a reference station would help monitor the possible impact on the area adjacent to the RADCAD.

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TABLES AND FIGURES

Table 1. Sampling schedule for Port Gardner bottom fish.

Season	Strata	Number of Otter Trawls	Number of Beam Trawls
Winter 1986 (February 11 - 14)	RADCAD	3	3
	135M	4	9
	100M	2	10
	80M	3	12
	40M	3	7
	20M	3	7
Spring 1986 (April 14 - 21)	RADCAD	3	3
	135M	4	9
	100M	2	10
	80M	3	12
	40M	3	7
	20M	3	7
Summer 1986 (June 24 - July 2)	RADCAD	4	4
	135M	4	10
	100M	2	13
	80M	3	12
	40M	3	7
	20M	3	7
Autumn 1986 (September 8 - 15)	RADCAD	4	6
	135M	6	10
	100M	2	14
	80M	3	11
	40M	3	7
	20M	3	7
Winter 1987 (December 10 -12 January 15)	RADCAD	6	7
	100M	1	14

Table 2. Bottomfish species caught in the Port Gardner area using each gear type. Species are grouped by families and are listed in alphabetical order by their scientific name within families. A=adult, J=juvenile.

Scientific Name	Common Name	Otter Trawl	Beam Trawl
FAMILY PETROMYZONTIDAE	Lampreys		
Lampetra tridentatus	Pacific lamprey	X	
FAMILY SQUALIDAE	Dogfish Sharks		
Squalus acanthias	spiny dogfish	X	X
FAMILY RAJIDAE	Skates		
Raja rhina	longnose skate	X	X
FAMILY CHIMAERIDAE	Chimeras		
Hydrolagus colliei	ratfish (A,J)	X	X
FAMILY CLUPEIDAE	Herrings		
Alosa sapidissima	American shad	X	
Clupea harengus pallasi	Pacific herring	X	
FAMILY OSMERIDAE	Smelts		
Spirinchus thaleichthys	longfin smelt (A)		X
FAMILY BATRACHOIDIDAE	Toadfishes		
Porichthys notatus	plainfin midshipman	X	X
FAMILIY GADIDAE	Codfishes		
Gadus macrocephalus	Pacific cod (A)	X	X
Microgadus proximus	Pacific tomcod (A,J)	X	X
Theragra chalcogramma	walleye pollock (A)	X	
FAMILY MERLUCCIIDAE	Hakes		
Merluccius productus	Pacific hake (A,J)	X	X
FAMILY OPHIDIIDAE	Brotulas		
Brosmophycis marginata	red brotula	X	X
FAMILY ZOARCIDAE	Eelpouts		
Lycodapus mandibularis	pallid eelpout	X	
Lycodes diapterus	black eelpout	X	X
Lycodopsis pacifica	blackbelly eelpout	X	X
FAMILY AULORHYNCHIDAE	Tubesnouts		
Aulorhynchus flavidus	tube-snout		X
FAMILY SYNGNATHIDAE	Pipefishes		
Syngnathus griseolineatus	bay pipefish		X
FAMILY EMBIOTOCIDAE	Surfperches		
Rhacochilus vacca	pile perch (A,J)	X	X
Cymatogaster aggregata	shiner perch (A,J)	X	X
FAMILY BATHYMASTERIDAE	Ronquils		
Ronquilus jordani	northern ronquil	X	X
FAMILY STICHAEIDAE	Pricklebacks		
Anoplarchus insignis	slender cockscomb		X
Lumpenus maculatus	daubed shanny		X
Lumpenus sagitta	snake prickleback	X	X
Plectobranchus evides	bluebarred prickleback		X
FAMILY PHOLIDAE	Gunnels		
Pholis laeta	crescent gunnel		X
Pholis ornata	saddleback gunnel		X
FAMILY SCORPAENIDAE	Rockfishes		
Sebastes maliger	quillback rockfish	X	X
FAMILY ANOPLOPOMATIDAE	Sablefishes		
Anoplopoma fimbria	sablefish (A)	X	X
FAMILY COTTIDAE	Sculpins		
Chitonotus pugetensis	roughback sculpin	X	X
Cottid sp.	UID sculpin	X	X
Dasycottus setiger	spinyhead sculpin	X	X
Enophyrs bison	buffalo sculpin		X
Gilbertidia sigalutes	soft sculpin	X	X
Icelinus borealis	northern sculpin	X	X
Leptocottus armatus	Pacific staghorn sculpin	X	X
Myoxocephalus polyacanthocephalus	great sculpin		X
Nautichthys oculfasciatus	sailfin sculpin	X	
Radulinus asprellus	slim sculpin	X	X
Rhamphocottus richardsoni	grunt sculpin		X

Table 2. cont'd.

Scientific Name	Common Name	Otter Trawl	Beam Trawl
FAMILY AGONIDAE	Poachers		
Agonopsis emmelane	northern spearnose poacher		X
Agonus acipenserinus	sturgeon poacher		X
Bathyagonus nigripinnis	blackfin poacher	X	X
Odontopyxis trispinosa	pygmy poacher		X
Xeneretmus latifrons	blacktip poacher	X	X
Xeneretmus triacanthus	bluespotted poacher	X	
FAMILY CYCLOPTERIDAE	Lumpfishes and Snailfishes		
Liparis sp.	UID snailfish	X	X
FAMILY BOTHIDAE	Lefteye Flounders		
Citharichthys sordidus	Pacific sanddab (A,J)	X	
Citharichthys stigmaeus	speckled sanddab (A,J)	X	X
Citharichthys sp.	sanddab (A,J)	X	X
FAMILY PLEURONECTIDAE	Righteye flounders		
Atheresthes stomias	arrowtooth flounder (A,J)	X	X
Glyptocephalus zachirus	rex sole (A,J)	X	X
Hippoglossoides elassodon	flathead sole	X	X
Lepidopsetta bilineata	rock sole (A,J)	X	X
Lyopsetta exilis	slender sole (A,J)	X	X
Microstomus pacificus	Dover sole (A,J)	X	X
Parophrys vetulus	English sole (A,J)	X	X
Platichthys stellatus	starry flounder (A)	X	
Pleuronichthys coenosus	C-O sole (A)	X	X
Psettichthys melanostictus	sand sole (A)	X	X

Table 3. Species composition and relative abundance for the otter trawl of the most common fish species (less than or equal to 1% of abundance CPUE value or occurring at least 3 out of 4 seasons) by strata and season. Fish are listed in decreasing order of abundance for all strata and seasons combined.

Species	RADCAD					135 M			
	W86	SP	SU	AU	W87	W86	SP	SU	AU
English sole	3.93	18.84	36.27	18.31	9.20	11.90	3.70	21.59	13.19
ratfish	47.19	20.29	34.31	7.04	40.00	33.33	20.37	10.23	4.86
slender sole	16.29	20.29	5.88	40.85	17.20	21.00	50.00	13.64	29.17
Dover sole	5.62	33.33	20.59	9.86	1.20	11.26	3.70	32.95	5.56
Pacific hake	21.35		1.96	2.82	20.80	15.37	12.96	4.55	15.97
speckled sanddab									
rock sole									
shiner perch									
Pacific cod								1.14	
Pacific tomcod				1.41					7.64
quillback rockfish	2.25	4.35		2.82	1.20	2.16		4.55	
spiny dogfish				4.23					
flathead sole									
blackbelly eelpout					1.20	0.65	1.85	1.14	
pile perch									
rex sole				2.82		1.30	5.56		
blacktip poacher	1.12	1.45			1.20	1.52		2.27	
pallid eelpout				1.41			1.85		13.19
blackfin poacher				2.82	1.20			3.41	3.47
blackfin eelpout								3.41	4.86
sand sole									
Pacific herring									
soft sculpin				2.82					
plainfin midshipman					2.40				
starry flounder									
Pacific staghorn sculpin				1.41					
snake prickleback									
C-O sole									
northern sculpin									
longnose skate					1.20			1.14	
sablefish		1.45							
red brotula				1.41					
northern ronquil									
Pacific sanddab									
slim sculpin									

Table 3. cont'd

Species	100 M					80 M			
	W86	SP	SU	AU	W87	W86	SP	SU	AU
English sole	29.82	48.06	34.41	15.25	29.23	33.10	32.04	46.74	46.69
ratfish	34.21	27.91	26.88	16.95	26.15	2.87	3.87	9.78	22.10
slender sole	2.63	13.18	3.23	6.78	13.85		19.72	8.15	18.23
Dover sole	11.40	3.10	4.30	15.25	0.77	2.17	3.17	1.09	1.10
Pacific hake	13.16	2.33	5.38	6.78	27.69	2.87	7.04	11.96	8.01
speckled sanddab									
rock sole									
shiner perch			1.08						
Pacific cod				5.08					
Pacific tomcod				3.39		2.77	0.70		
quillback rockfish	3.51		2.15	11.86		0.79	0.35	2.72	1.10
spiny dogfish			20.43	3.39				5.98	
flathead sole		1.55				7.61	5.99	3.80	0.83
blackbelly eelpout	0.88			1.69		1.98	14.79	9.24	0.55
pile perch									
rex sole	3.51	0.78		5.08			5.63		
blacktip poacher	0.88					0.99	4.58	0.54	
pallid eelpout									
blackfin poacher			2.15	1.69					
blackfin eelpout				3.39					
sand sole									
Pacific herring									
soft sculpin				3.39					
plainfin midshipman									
starry flounder									
Pacific staghorn sculpin									
snake prickleback									
C-O sole									
northern sculpin									
longnose skate									
sablefish									
red brotula									
northern ronquil									
Pacific sanddab									
slim sculpin									

Table 3. cont'd

Species	40 M				20 M			
	W86	SP	SU	AU	W86	SP	SU	AU
English sole	46.08	30.77	20.67	45.12	8.82		33.33	37.93
ratfish								
slender sole			1.68	5.58	8.82			3.45
Dover sole		15.38	1.12					
Pacific hake								
speckled sanddab	5.72	7.69		2.33	38.24	63.64	22.22	6.90
rock sole	7.10	24.36	6.15	6.98	23.53	27.27	7.41	10.34
shiner perch		6.41					25.93	37.93
Pacific cod			49.72					
Pacific tomcod	3.28		8.94	23.72				
quillback rockfish	2.12		1.12	4.19				1.72
spiny dogfish			3.35					
flathead sole			0.56		14.71			
blackbelly eelpout			0.56					
pile perch	27.33			3.72				
rex sole			1.68	1.86				
blacktip poacher		2.56						
pallid eelpout								
blackfin poacher								
blackfin eelpout								
sand sole		1.28				9.09		
Pacific herring			2.79				3.70	
soft sculpin								
plainfin midshipman		1.28	1.12					
starry flounder							3.70	1.72
Pacific staghorn sculpin							3.70	
snake prickleback	3.81							
C-O sole					2.94			
northern sculpin		2.56						
longnose skate								
sablefish								
red brotula								
northern ronquil				1.40				
Pacific sanddab				1.40				
slim sculpin		1.28						

Table 4. Species composition and relative abundance for the beam trawl of the most common fish species (less than or equal to 1% of abundance CPUE value or occurring at least 3 out of 4 seasons) by strata and season. Fish are listed in decreasing order of abundance for all strata and seasons combined.

	RADCAD					135 M			
	W86	SP	SU	AU	W87	W86	SP	SU	AU
slender sole	11.17	39.14	18.75	16.67	45.05	21.01	43.15	16.67	
ratfish	38.83	45.66	37.50	16.67	9.91	10.58	34.15	9.52	12.77
Dover sole	11.17	2.15	12.50	5.56		6.95	6.75	21.43	
blackbelly eelpout			6.25			52.61			
English sole	5.50			16.67					
plainfin midshipman	5.50			5.56	20.12				6.38
blackfin poacher		4.37	6.25	11.11	9.91		6.75	16.67	6.38
quillback rockfish			6.25					4.76	21.28
shiner perch									
slim sculpin									4.26
speckled sanddab								9.52	
rock sole									4.26
Pacific hake	11.17			11.11		1.74			4.26
Pacific staghorn sculpin		4.37							
rex sole							2.25	4.76	
blackfin eelpout								9.52	12.77
bluebarred prickleback									
roughback sculpin				5.56					
blacktip poacher						6.95	2.25		
pygmy poacher				5.56	5.11				
spinyhead sculpin					5.11		2.25	4.76	
Northern ronquil									
snake prickleback									
Pacific tomcod									2.13
longnose skate		4.37					2.25	2.38	2.13
pile perch									
flathead sole					5.11				
sand sole									
tubesnout									
snailfish sp.				5.56					
C-O sole									
red brotula									2.13
sturgeon poacher									2.13
spiny dogfish									
saddleback gunnel									
soft sculpin									2.13
longfin smelt									
buffalo sculpin									
walleye pollock									
arrowtooth fl.									
Pacific cod									

Table 4. cont'd.

	100 M					80 M			
	W86	SP	SU	AU	W87	W86	SP	SU	AU
slender sole	4.49	24.64	23.87	28.14	37.64	28.18	10.83	24.33	39.88
ratfish	33.71	39.13	44.11	32.08	27.27	19.09	15.33	32.58	20.83
Dover sole	13.48	18.84	11.48	2.51	2.55	6.04	14.57	4.92	
blackbelly eelpout	1.12	7.25		1.25		6.65	10.86		2.36
English sole	2.25	2.17			5.27	6.04	2.89	4.17	1.77
plainfin midshipman	3.37	0.72		1.25		5.75	3.17		16.04
blackfin poacher		1.45	6.95	10.22	1.27				
quillback rockfish					3.82	0.29			7.14
shiner perch	26.97					3.93	8.19		0.00
slim sculpin				5.20	1.27	3.64			2.36
speckled sanddab									
rock sole									
Pacific hake	5.62	0.72		1.25	3.82	0.62	1.05	3.50	
Pacific staghorn sculpin						0.62	7.14		
rex sole	1.12	0.72	4.83	1.25	1.27	3.05	2.38	2.83	
blackfin eelpout		0.72	2.42	3.76					
bluebarred prickleback				1.25		0.62	3.97	8.33	
roughback sculpin	1.12						2.63		
blacktip poacher		2.17			2.55		7.40		1.77
pygmy poacher									
spinyhead sculpin	2.25		2.42	1.25		1.20			
Northern ronquil						1.82			
snake prickleback							1.05		
Pacific tomcod				8.96		0.58			
longnose skate				1.25	1.27				
pile perch					9.09				
flathead sole	1.12					1.20			1.77
sand sole							2.92		
tubesnout									
snailfish sp.						0.29			
C-O sole						0.91			
red brotula		0.72	2.42		1.27				
sturgeon poacher		0.72							
spiny dogfish			2.42						
saddleback gunnel									
soft sculpin									
longfin smelt									
buffalo sculpin									
walleye pollock					1.27				
arrowtooth fl.	1.12								
Pacific cod						0.29			

Table 4. cont'd.

	40 M				20 M			
	W86	SP	SU	AU	W86	SP	SU	AU
slender sole	5.89	3.29	13.85	30.55	17.25	3.44	7.85	22.63
ratfish			2.12	1.80				
Dover sole	2.72	4.93	4.24	6.58		14.67	11.29	3.58
blackbelly eelpout	7.46	4.93	42.55	14.38			16.10	8.92
English sole	20.80	35.52	1.08	5.41	7.13	7.79	11.75	12.50
plainfin midshipman	2.58		3.72	10.77	1.21		3.93	2.96
blackfin poacher								
quillback rockfish	2.72	2.06	3.72	2.39	13.71	7.79		
shiner perch	27.26	8.21						
slim sculpin	3.73	3.69	6.37	7.80	4.75	6.04	11.29	11.92
speckled sanddab	6.46	12.32			5.96	24.98		5.38
rock sole	1.72	1.44			20.25	7.79	8.28	12.50
Pacific hake								
Pacific staghorn sculpin	9.75	10.26			2.96	1.75		
rex sole			6.37	1.80			2.62	
blackfin eelpout								
bluebarred prickleback							13.91	
roughback sculpin				1.80		4.28	1.73	10.13
blacktip poacher				1.80				
pygmy poacher			1.08	4.19		3.44	1.73	2.96
spinyhead sculpin			1.60					
Northern ronquil	1.58			3.60		6.04	1.73	1.21
snake prickleback		5.95		0.00	5.38	1.75	1.73	
Pacific tomcod				3.56				
longnose skate								
pile perch								1.17
flathead sole								
sand sole					4.17	1.75		
tubesnout					8.33			
snailfish sp.			2.12					
C-O sole					1.21	5.19		
red brotula								
sturgeon poacher								
spiny dogfish								
saddleback gunnel			1.08		1.21			
soft sculpin								
longfin smelt					1.79			
buffalo sculpin						1.75		
walleye pollock								
arrowtooth fl.								
Pacific cod								

Table 5. Species clusters of otter trawl-caught fish, all strata combined by season. A = adult, J = juvenile.

WINTER 86

GROUP	SUBGROUP	SPECIES
I	a	slender sole (A) ratfish (A) Pacific hake (A)
	b	English sole (A)
II	a	ratfish (J) rex sole (A) quillback rockfish Dover sole (J)
	b	slender sole (J) Pacific tomcod (A) blacktip poacher black eelpout
III		shiner perch (A) Pacific tomcod (J) flathead sole (A)
IV	a	sanddab (A) rock sole (J) shiner perch (J) rock sole (A) English sole (J)
	b	sanddab (J) sailfin sculpin C-O sole pile perch (A) staghorn sculpin arrowtooth flounder
V	a	spinyhead sculpin plainfin midshipman spiny dogfish Pacific lamprey
	b	snake prickleback speckled sanddab (A) pile perch (J) speckled sanddab (J) Pacific sanddab

SPRING 86

GROUP	SUBGROUP	SPECIES
I	a	slender sole (A) ratfish (A) Pacific hake (A)
	b	English sole (A)
	c	Dover sole (J)
II		sablefish ratfish (J) quillback rockfish
III	a	plainfin midshipman blacktip poacher
	b	snake prickleback slender sole (J) Pacific tomcod (A) flathead sole rex sole (J) rex sole (A) blackbelly eelpout
IV		sanddab (A) sand sole rock sole (A)
V	a	northern sculpin rock sole (J) slim sculpin shiner perch (A) English sole (J)
	b	sanddab (J) pallid eelpout walleye pollock

Table 5. cont'd.

SUMMER 86		
GROUP	SUBGROUP	SPECIES
I		English sole (A)
II	a	ratfish (J) Pacific hake (A)
	b	slender sole (A) Dover sole (J)
III	a	ratfish (A) quillback rockfish
	b	spiny dogfish blackbelly eelpout
IV	a	shiner perch (J) starry flounder rock sole (J) sanddab (A) rock sole (A) Pacific herring
	b	Dover sole (A) blackfin poacher slender sole (J) black eelpout
	c	Pacific cod spinyhead sculpin longnose skate blacktip poacher
	d	plainfin midshipman rex sole (A) flathead sole sanddab (J) staghorn sculpin

AUTUMN 86		
GROUP	SUBGROUP	SPECIES
I		slender sole (A) English sole (A)
II	a	rex sole (A) plainfin midshipman
	b	Dover sole (J)
	c	ratfish (A)
	d	ratfish (J) Pacific hake (A) blackbelly eelpout
III	a	spiny dogfish soft sculpin red brotula
	b	pallid eelpout Pacific hake (J) Pacific tomcod (J) blackfin poacher black eelpout
IV	a	speckled sanddab (A) rock sole (A) slender sole (J) roughback sculpin Pacific tomcod (A) pile perch (J) Pacific sanddab (J)
V	a	northern ronquil slim sculpin shiner perch (A) Pacific herring bluespotted poacher
	b	spinyhead sculpin starry flounder rock sole (J) speckled sanddab (J) English sole (J)
	c	Pacific cod flathead sole blacktip poacher

Table 6. Percent incidence and sample size (in parentheses) of the bloodworm (Philometra sp.) infection in flatfish shown by species, stratum and season in Port Gardner. W = Winter, SP = Spring, SU = Summer, AU = Autumn.

RADCAD

Flatfish Species	W	SP	SU	AU	W87
arrowtooth flounder					
C-O sole					
Dover sole	0(12)	0(1)	0(23)	0(8)	0(3)
English sole	0(8)	7.7(13)	0(37)	6.2(16)	0(23)
flathead sole	0(1)	0(23)			0(1)
Pacific sanddab					
rex sole	0(1)			0(2)	0(1)
rock sole					
sand sole					
slender sole	0(31)	0(32)	0(9)	0(32)	0(51)
speckled sanddab					
starry flounder					

80 M

Flatfish Species	W	SP	SU	AU
arrowtooth flounder				
C-O sole				
Dover sole	2.4(42)	0(55)	0(9)	0(5)
English sole	10.4(355)	6.9(102)	3.3(92)	6.4(172)
flathead sole	3.7(81)	5.9(17)	0(7)	0(6)
Pacific sanddab				
rex sole	6.6(15)	0(19)	0(4)	0(1)
rock sole	0(1)	0(2)		
sand sole		0(11)		
slender sole	0.5(189)	2(97)	0(50)	0(133)
speckled sanddab	0(4)			
starry flounder				

135 M

Flatfish Species	W	SP	SU	AU
arrowtooth flounder				
C-O sole				
Dover sole	0(56)	0(5)	0(9)	0(6)
English sole	1.8(55)	50(2)	5.3(19)	10.5(19)
flathead sole			0(29)	
Pacific sanddab				
rex sole	0(6)	0(3)	0(2)	
rock sole	100(1)			0(2)
sand sole				
slender sole	0(131)	0(46)	0(19)	0(50)
speckled sanddab				
starry flounder				

40 M

Flatfish Species	W	SP	SU	AU
arrowtooth flounder	0(2)	0(1)		
C-O sole				
Dover sole	0(20)	0(38)	0(17)	0(12)
English sole	1.4(585)	4.6(197)	0(38)	5.7(106)
flathead sole	0(11)		0(1)	0(1)
Pacific sanddab	0(1)			0(3)
rex sole	0(5)		0(12)	0(7)
rock sole	16.5(79)	25(28)	7.1(14)	0(16)
sand sole	0(7)	0(5)		
slender sole	0(47)	0(18)	0(29)	0(63)
speckled sanddab	1(99)	1.5(66)	0(1)	0(6)
starry flounder				

100 M

Flatfish Species	W	SP	SU	AU
arrowtooth flounder	0(1)			
C-O sole				
Dover sole	0(25)	0(30)	0(9)	0(11)
English sole	2.8(36)	9.2(65)	3.1(32)	11.1(9)
flathead sole	0(1)	0(2)		
Pacific sanddab				
rex sole	0(5)	0(2)	0(2)	0(1)
rock sole				
sand sole				
slender sole	6.7(31)	0(41)	8.3(12)	0(26)
speckled sanddab				
starry flounder				

20 M

Flatfish Species	W	SP	SU	AU
arrowtooth flounder				
C-O sole	0(3)	0(6)	0(1)	
Dover sole		0(17)	0(26)	0(6)
English sole	6.7(15)	0(9)	2.8(36)	0(42)
flathead sole	0(5)			
Pacific sanddab				
rex sole		0(1)	0(6)	
rock sole	7.7(39)	8.3(12)	0(21)	3.7(27)
sand sole	0(7)	0(3)		
slender sole	0(32)	0(4)	0(16)	0(40)
speckled sanddab	0(23)	0(36)	0(6)	0(13)
starry flounder			0(1)	0(1)

Table 7. Measurements of temperature, salinity, dissolved oxygen and water clarity by stratum and season at Port Gardner. W = Winter, SP = Spring, SU = Summer, AU = Autumn.

SITE	SURFACE				BOTTOM			
	TEMPERATURE °C							
	W	SP	SU	AU	W	SP	SU	AU
RADCAD	6.5	10.0	15.2	15.0	8.0	9.0	11.0	13.0
135M	6.0	10.3	13.6	14.4	7.8	9.2	11.8	12.0
100M	7.3	10.5			8.0	9.5		
80M	7.0	10.5	11.9	14.0	7.5	9.5	11.0	12.0
40M	6.5	10.7	10.5	14.0	7.5	9.0	11.5	13.0
20M		10.8	18.1	15.0		9.5	11.5	13.0
	SALINITY o/oo							
RADCAD		18.53	23.58			29.67	29.81	30.81
135M	29.68	22.98	24.29	28.23	26.42	29.98	29.79	30.56
100M	29.62				29.42	29.81		
80M	29.82	16.79	22.34	28.73	29.09	29.73		30.58
40M	18.59		29.82		23.12	29.49	29.77	30.33
20M			19.58	28.32		29.12	29.58	30.07
	DISSOLVED OXYGEN							
RADCAD	9.24	11.52	12.30	8.64	9.25	9.36	8.12	6.41
135M		10.93	12.85	9.44	9.49	9.18	7.74	7.38
100M					8.69	8.92		
80M	10.58	10.72	12.40		10.54	8.94	8.19	7.14
40M			14.20	7.17		8.13	8.72	7.40
20M			8.08	10.56	10.40	28.25	8.25	8.07

SURFACE LIGHT PENETRATION (m)

SITE	W	SP	SU	AU
RADCAD	5.5	4.3	4.5	4.0
135M	6.5	5.4	4.0	
100M	3.3	3.0		
80M	3.5	3.0	3.0	5.0
40M	3.8	3.2	3.0	5.0
20M		3.2	3.0	5.5

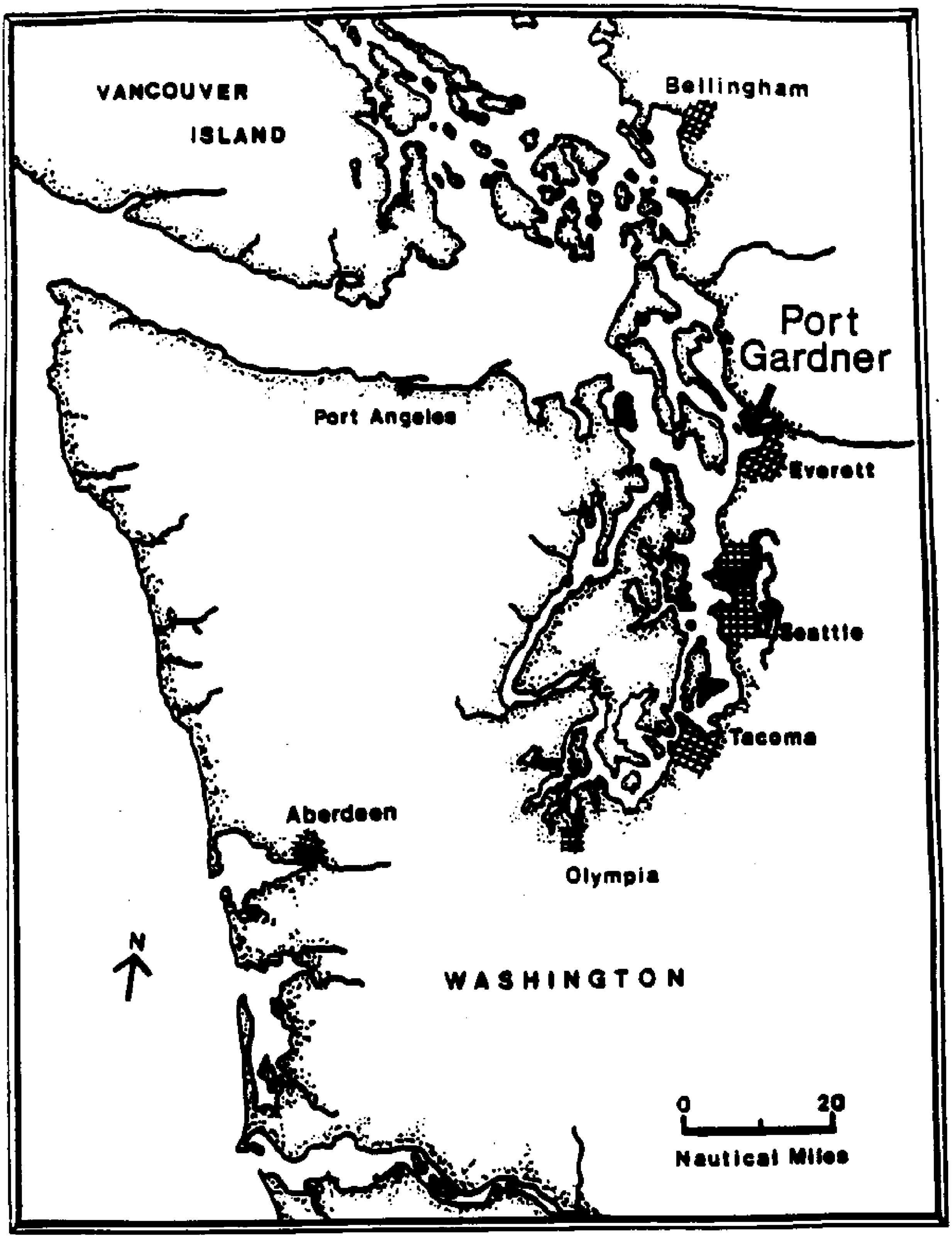

Figure 1. Map of western Washington showing the location of Port Gardner.

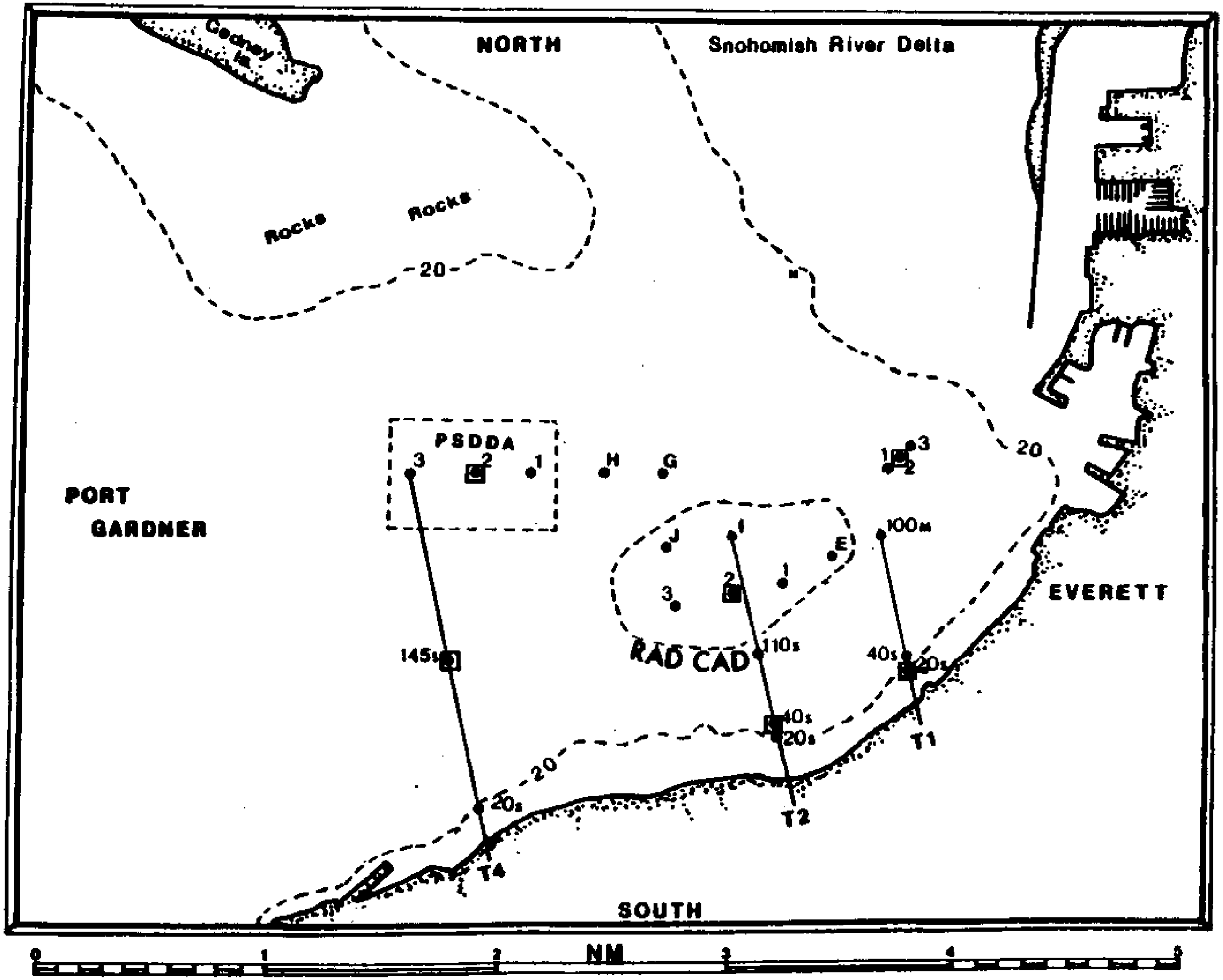

Figure 2. Map of Port Gardner showing otter trawl stations (●) and environmental sampling stations (□). Depths in meters. n = north, s = south, and m = middle.

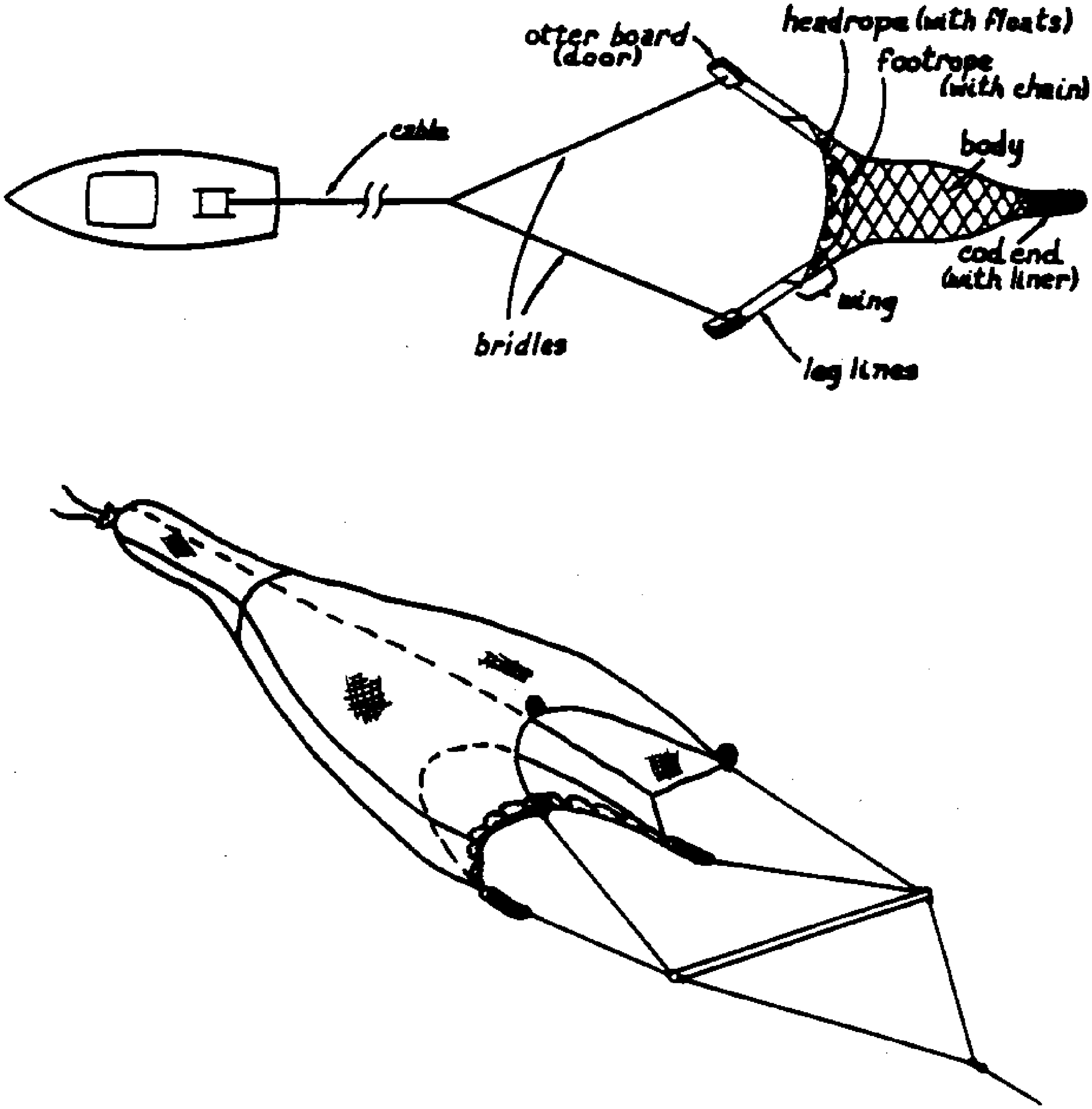

Figure 3. Diagrams of the otter trawl (top) and beam trawl (bottom) used in this study.

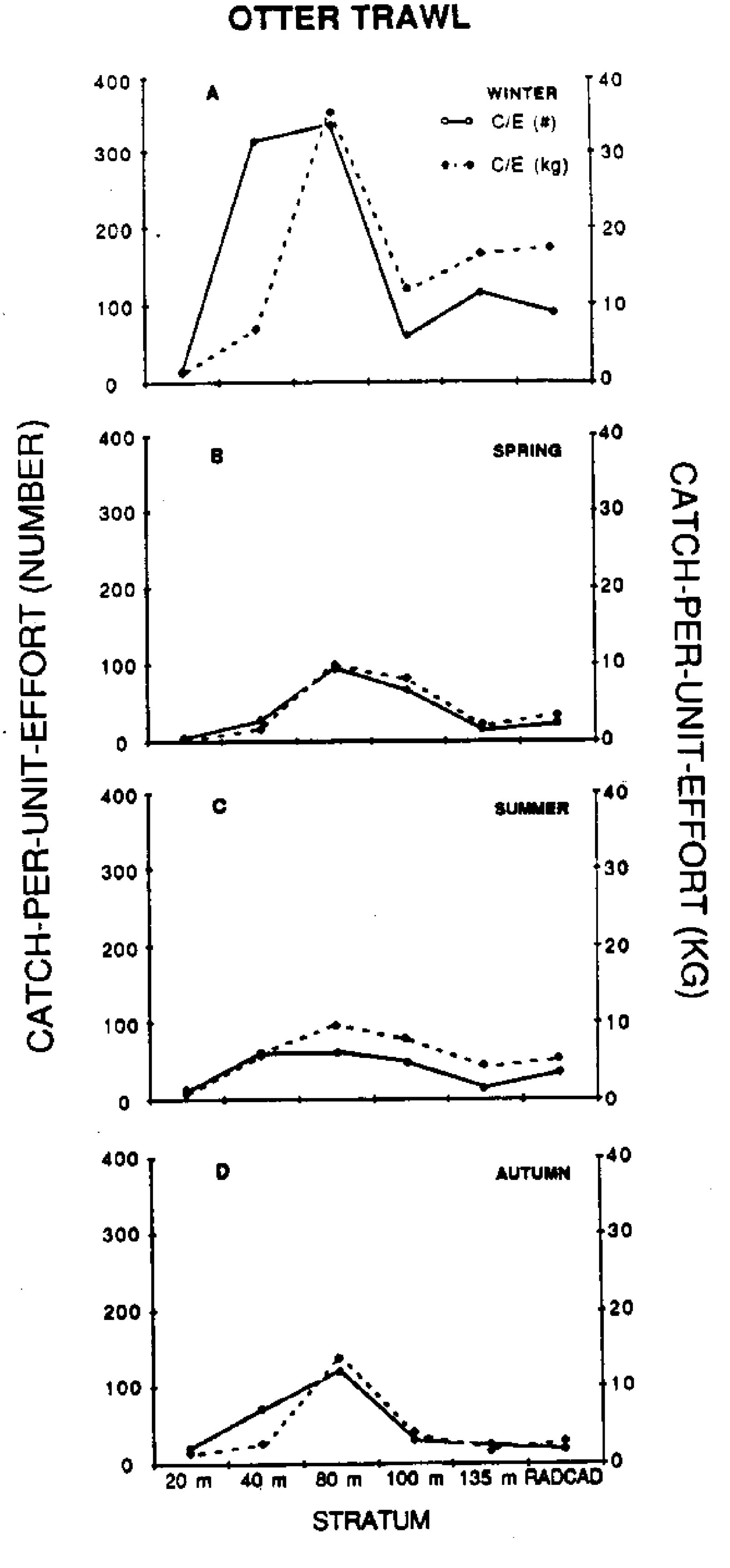

Figure 4. Catch-per-unit-effort abundance [C/E (#)] and catch-per-unit-effort biomass [C/E (kg)] of otter trawl caught bottomfish by stratum and season (A-D).

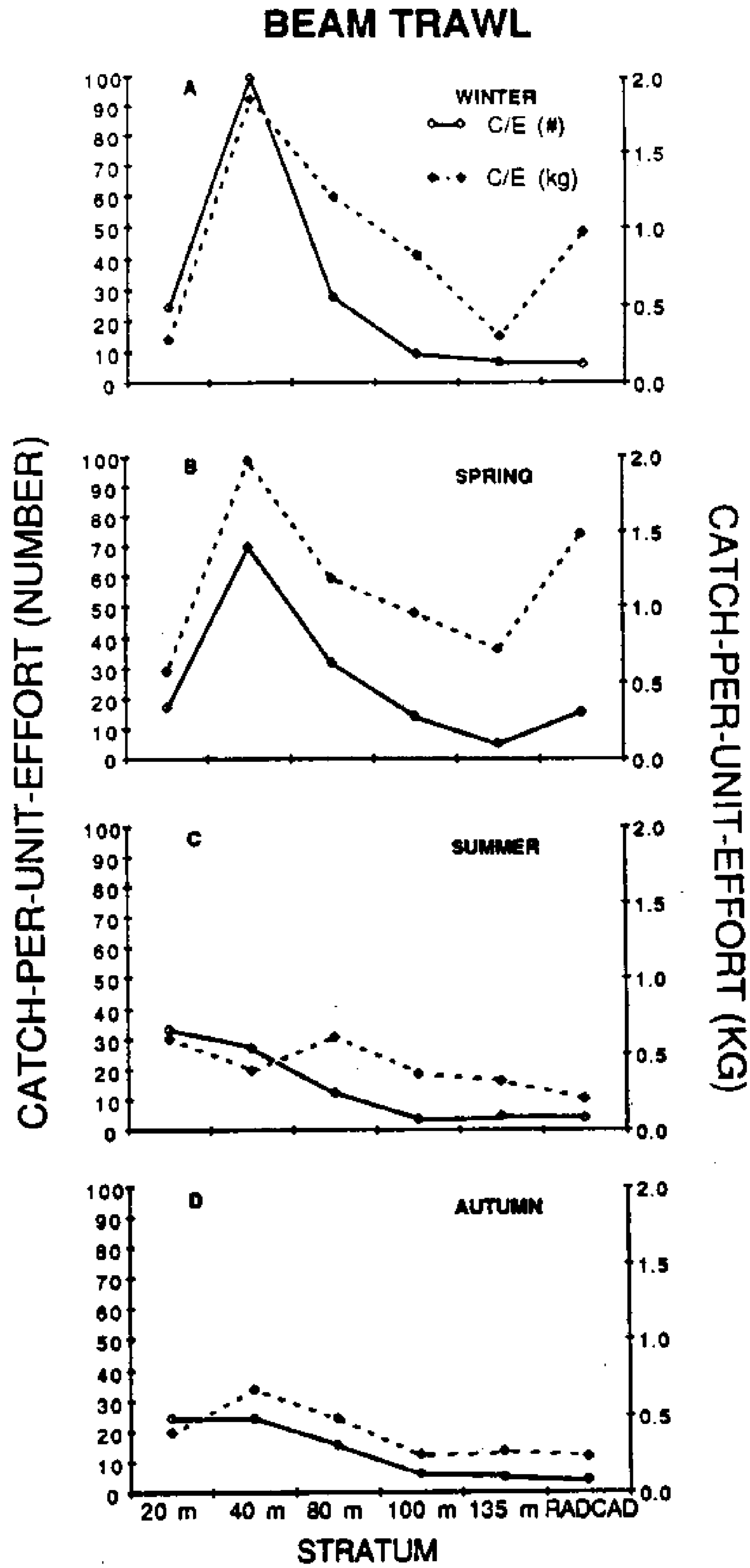

Figure 5. Catch-per-unit-effort abundance [C/E (#)] and catch-per-unit-effort biomass [C/E (kg)] of beam trawl caught bottomfish by stratum and season (A-D).

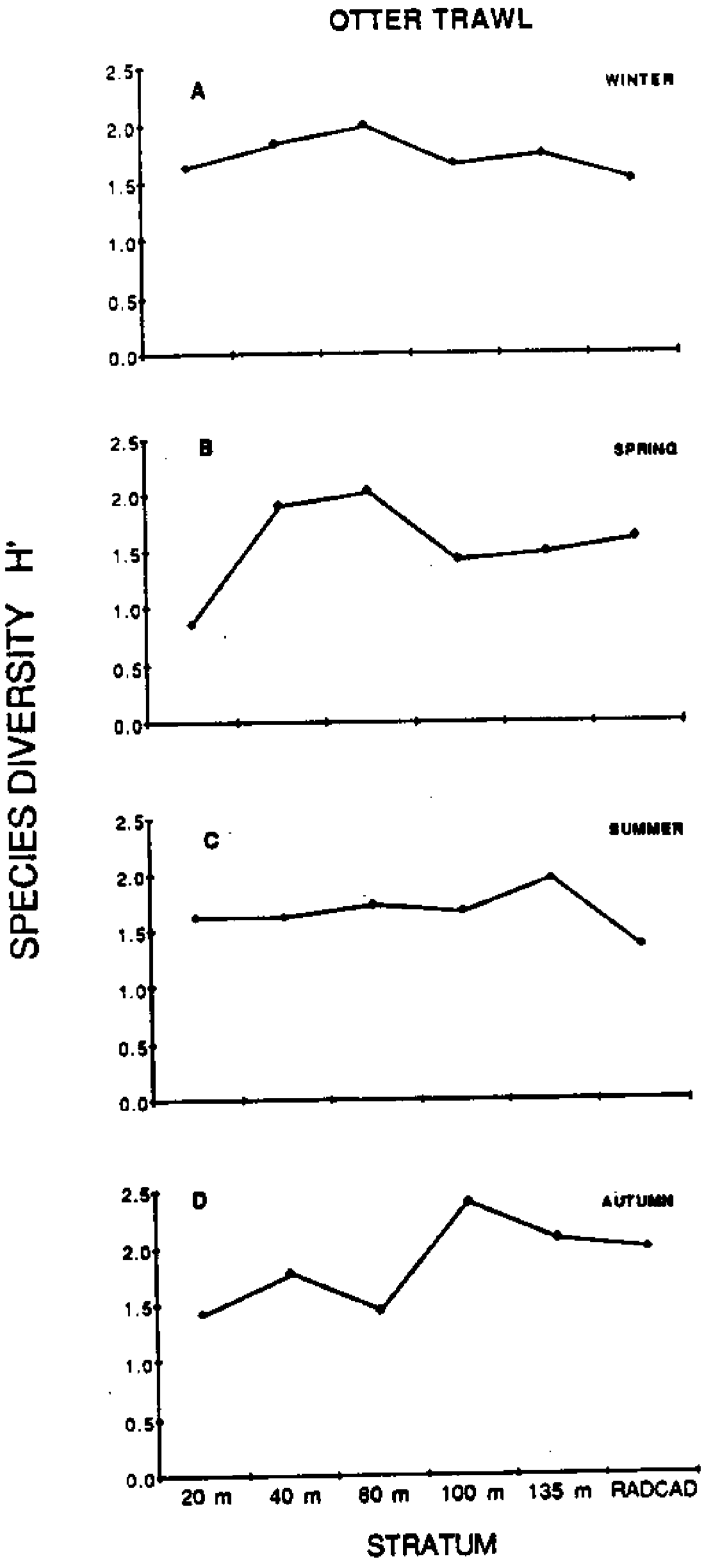

Figure 6. Species diversity (H') of otter trawl catches by stratum and season (A-D).

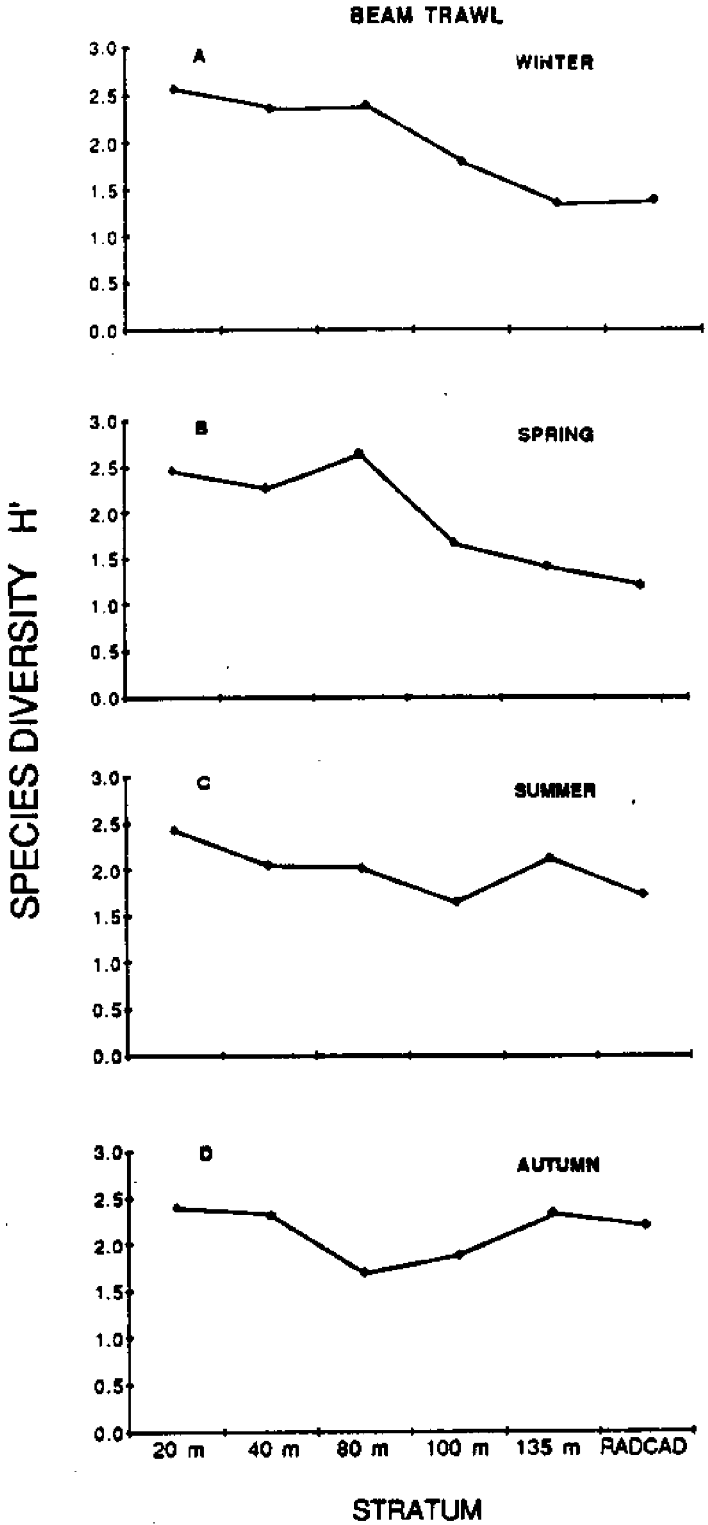

Figure 7. Species diversity (H') of beam trawl catches by stratum and season (A-D).

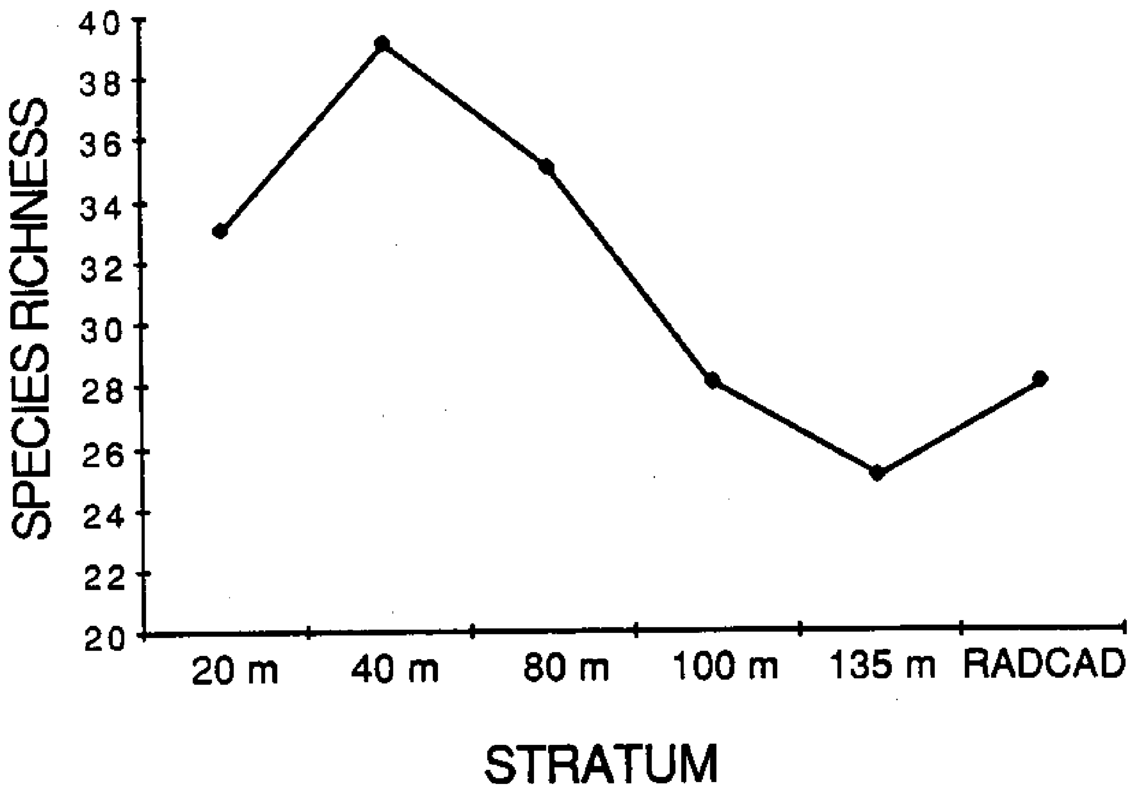

Figure 8. Species richness of otter trawl and beam trawl caught fish for all seasons combined by stratum.

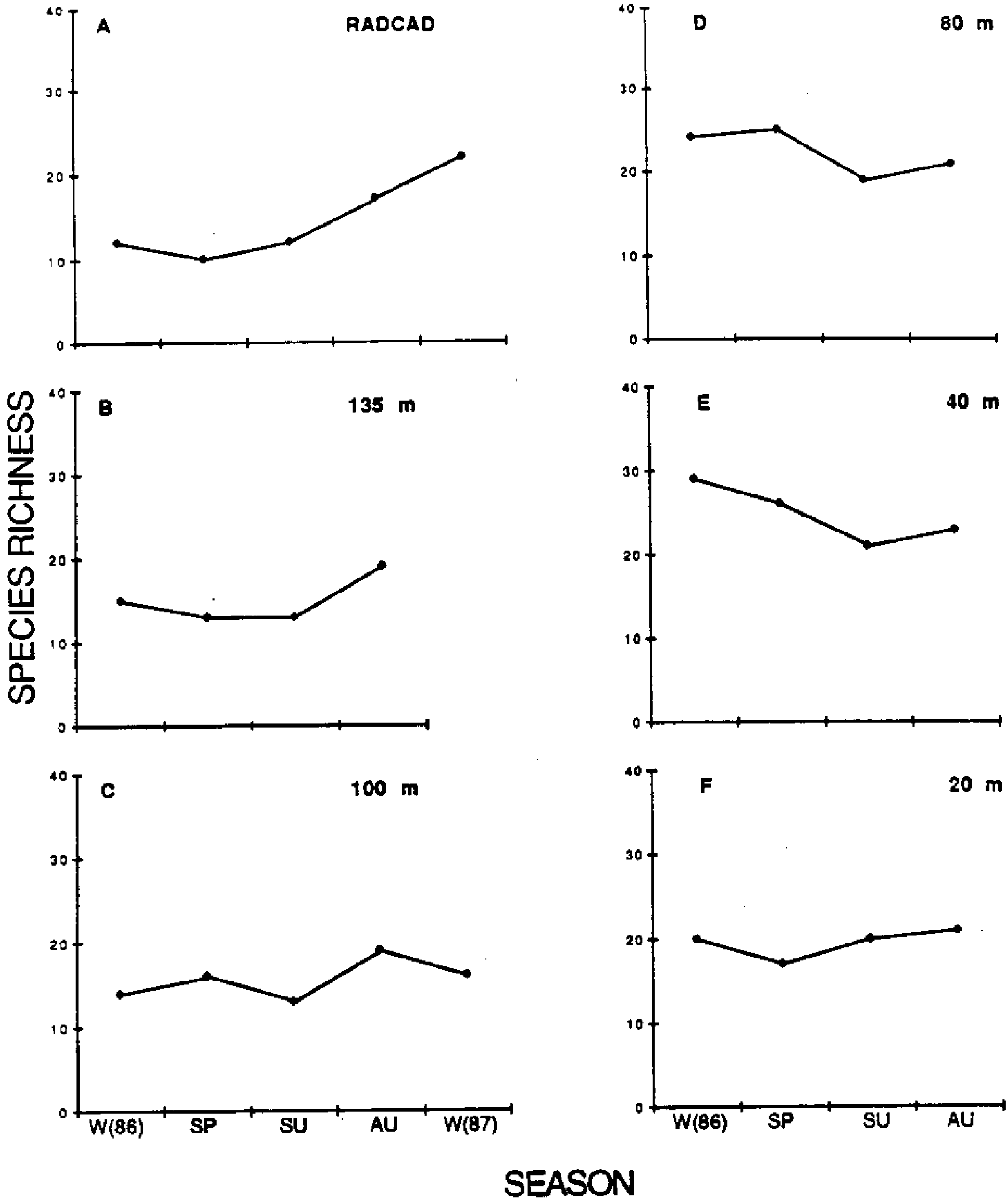

Figure 9. Species richness of combined otter trawl and beam trawl caught fish by season and stratum (A-F).

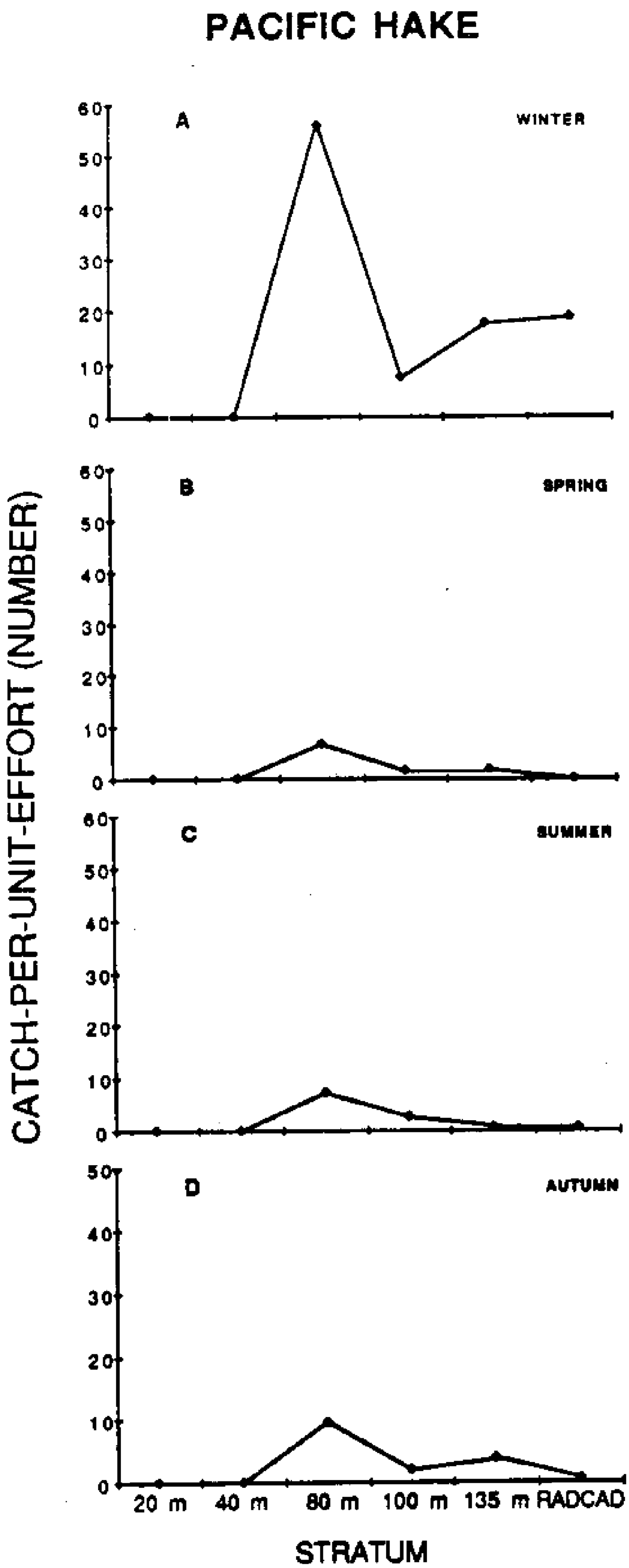

Figure 10. Catch-per-unit-effort abundance of Pacific hake by stratum and season (A-D).

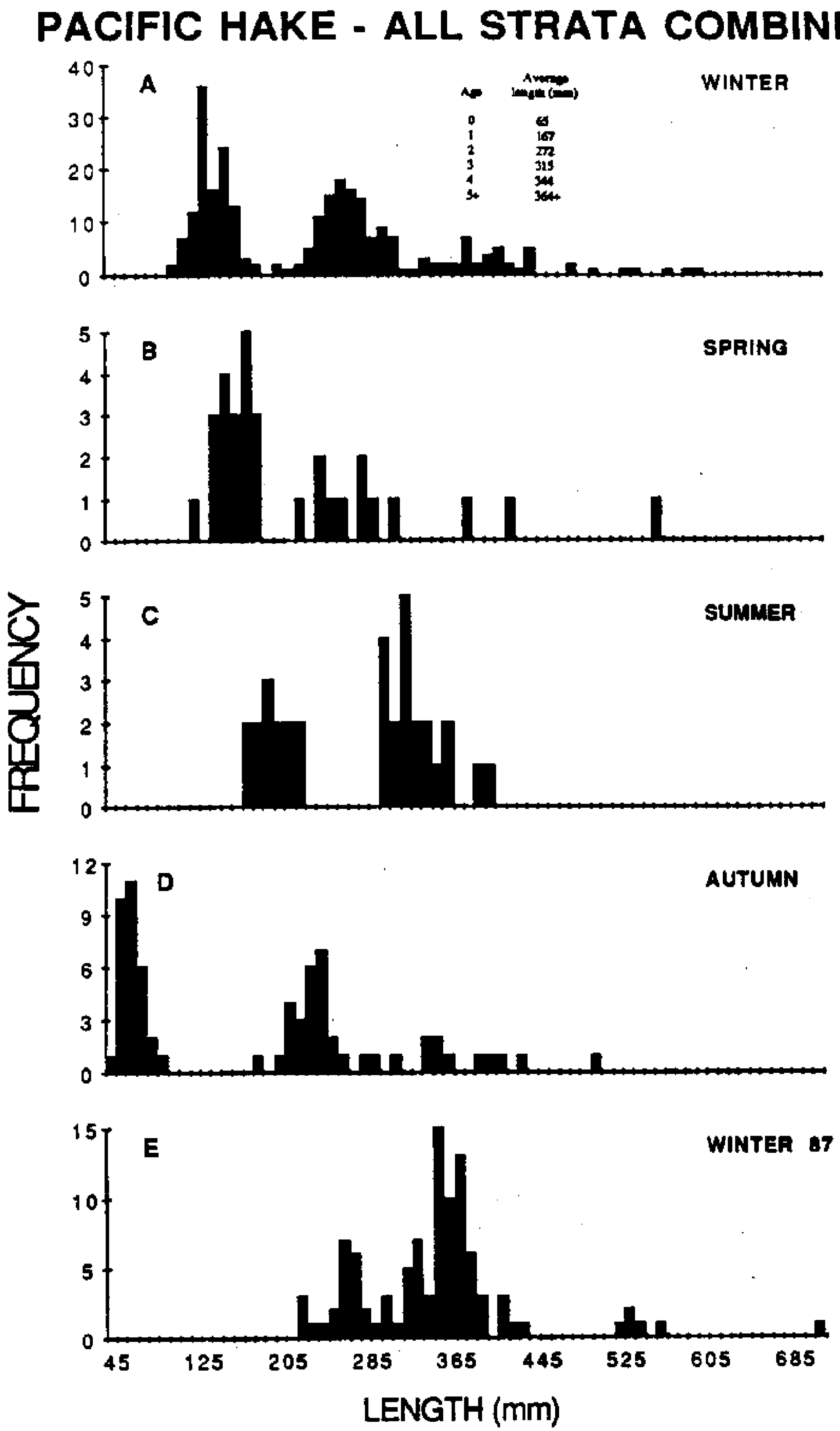

Figure 11. Pacific hake length-frequency plots for all strata combined by season (A-E). NOTE: The scale of the vertical axis changes between seasons. Average lengths (mm) at age are as follows: 65, 167, 272, 315, 344 and 364+ for ages 1 through 5+, respectively.

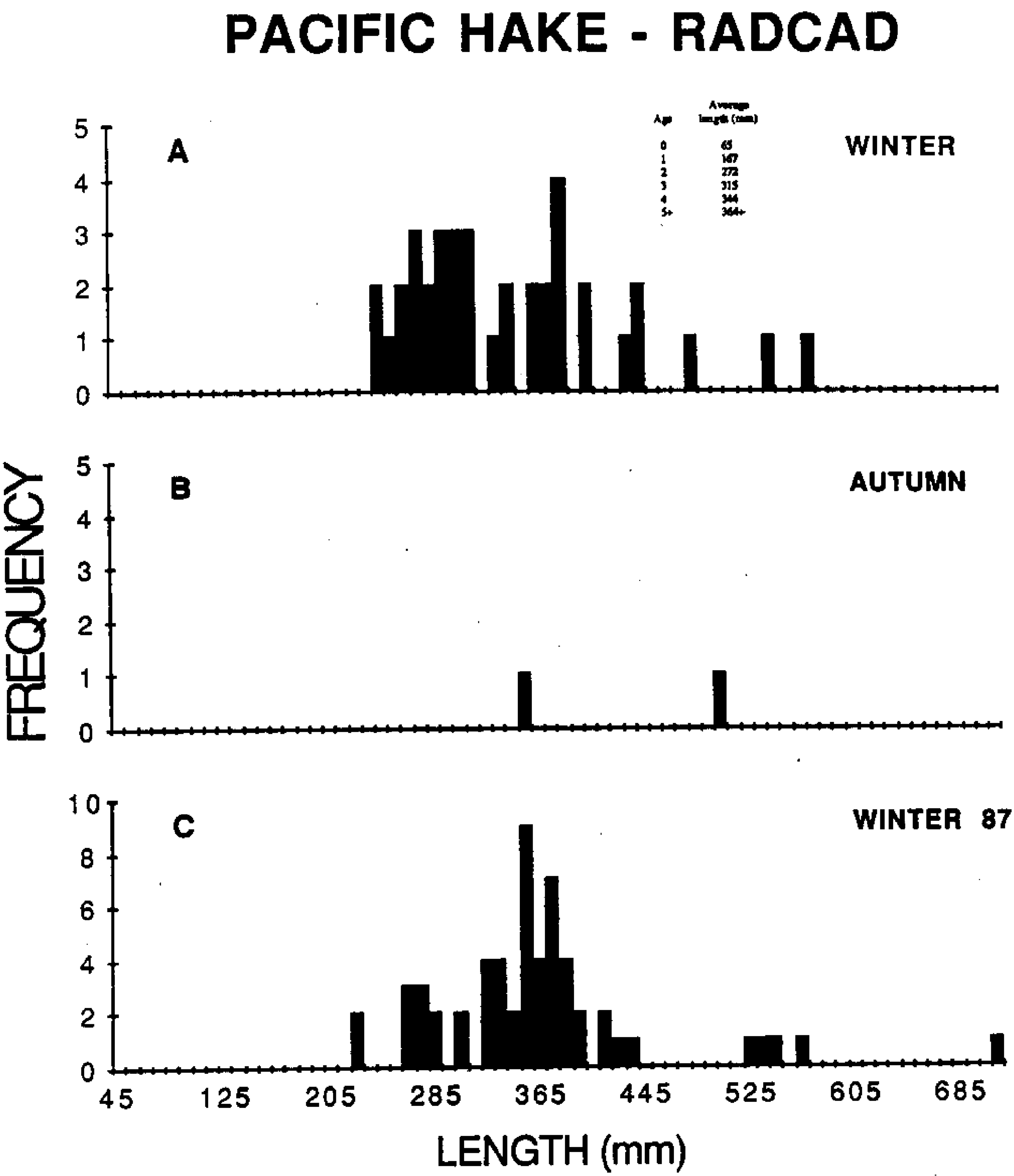

Figure 12. Pacific hake length-frequency plots for RADCAD stratum by season (A-C). NOTE: The scale of the vertical axis changes between seasons. (See Fig. 12 for lengths at age.)

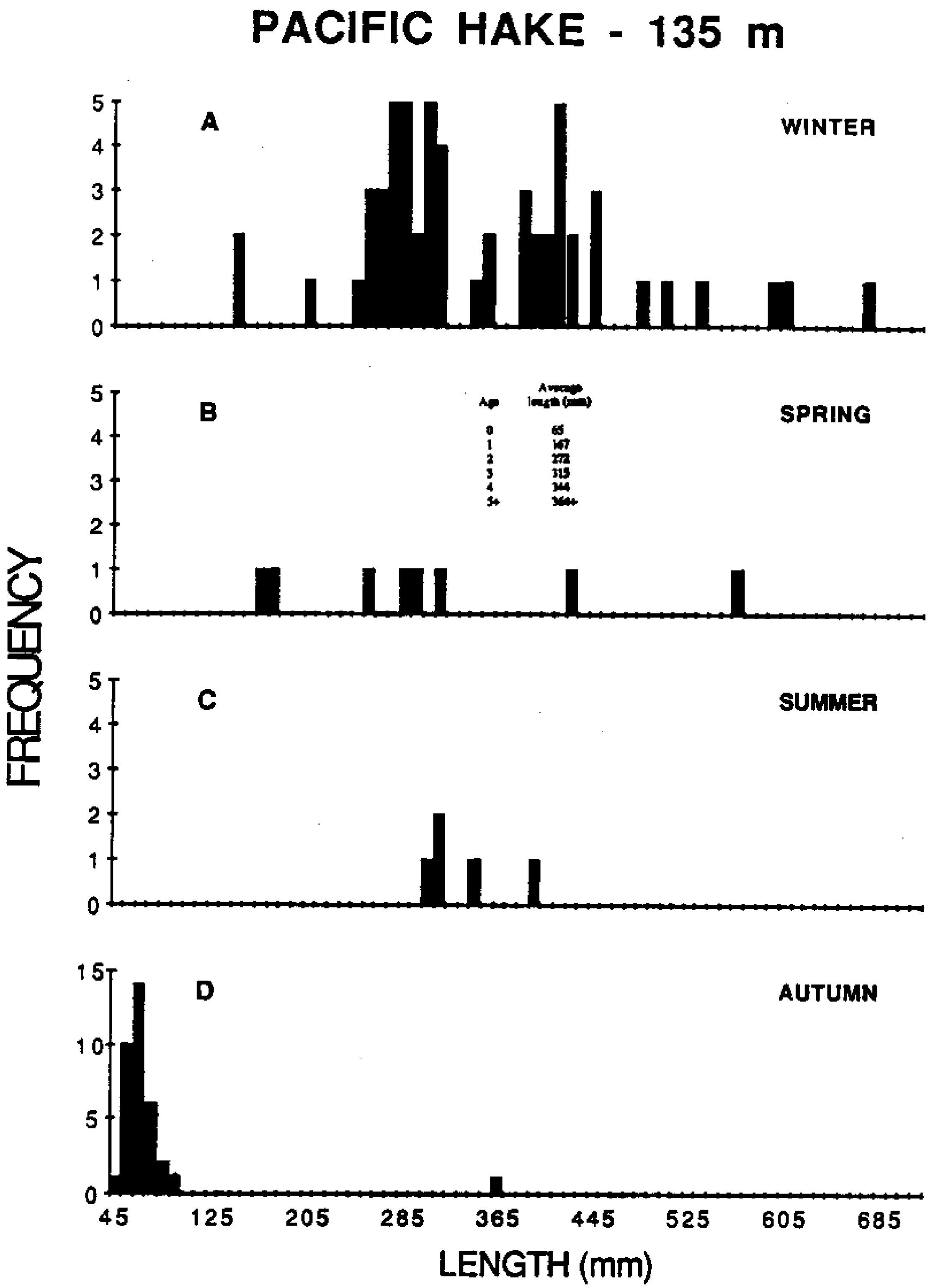

Figure 13. Pacific hake length-frequency plots for the 135m stratum by season (A-D). NOTE: The scale of the vertical axis changes between seasons. (See Fig. 12 for lengths at age.)

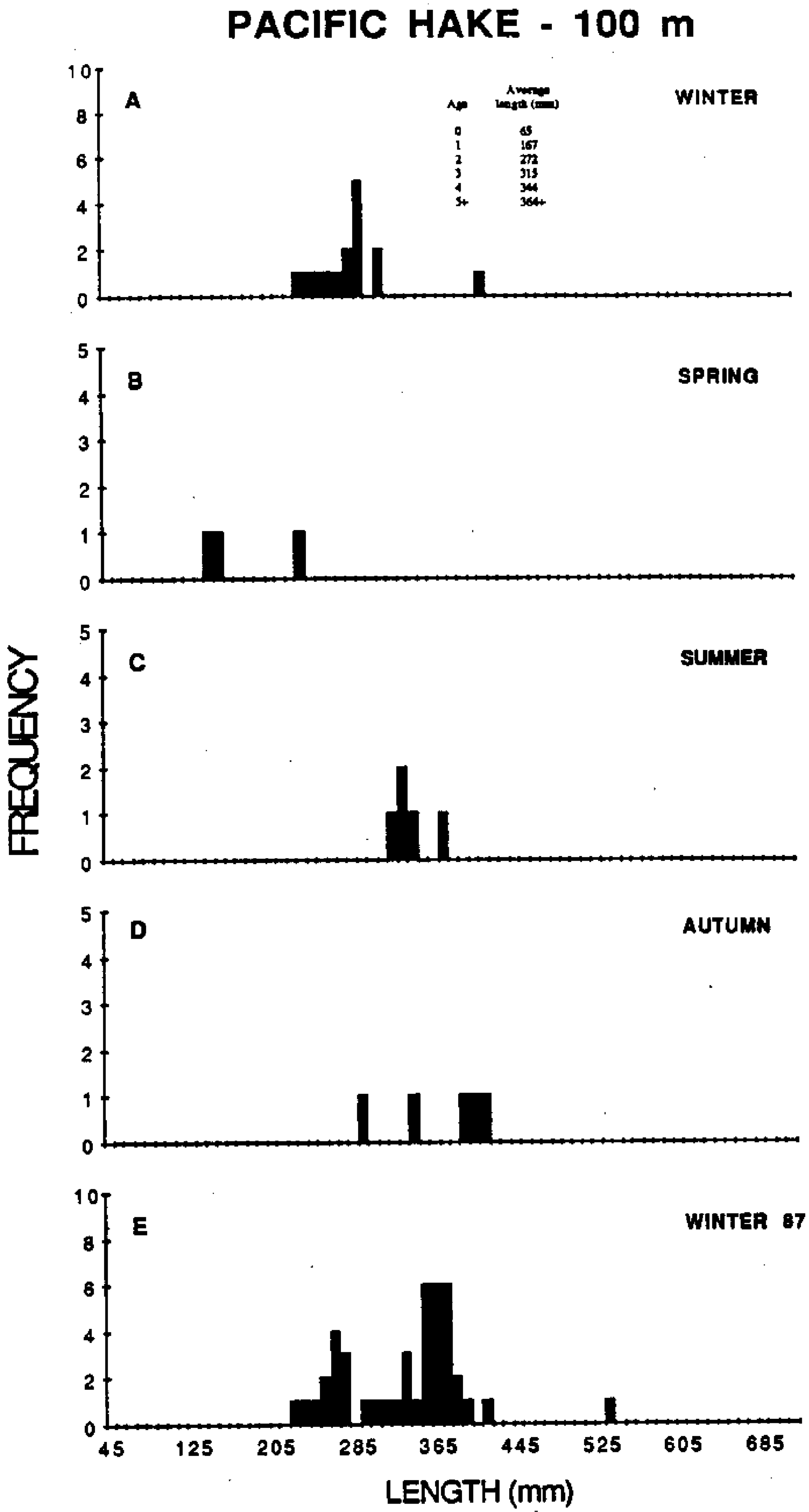

Figure 14. Pacific hake length-frequency plots for the 100m stratum by season (A-E). NOTE: The scale of the vertical axis changes between seasons. (See Fig. 12 for lengths at age.)

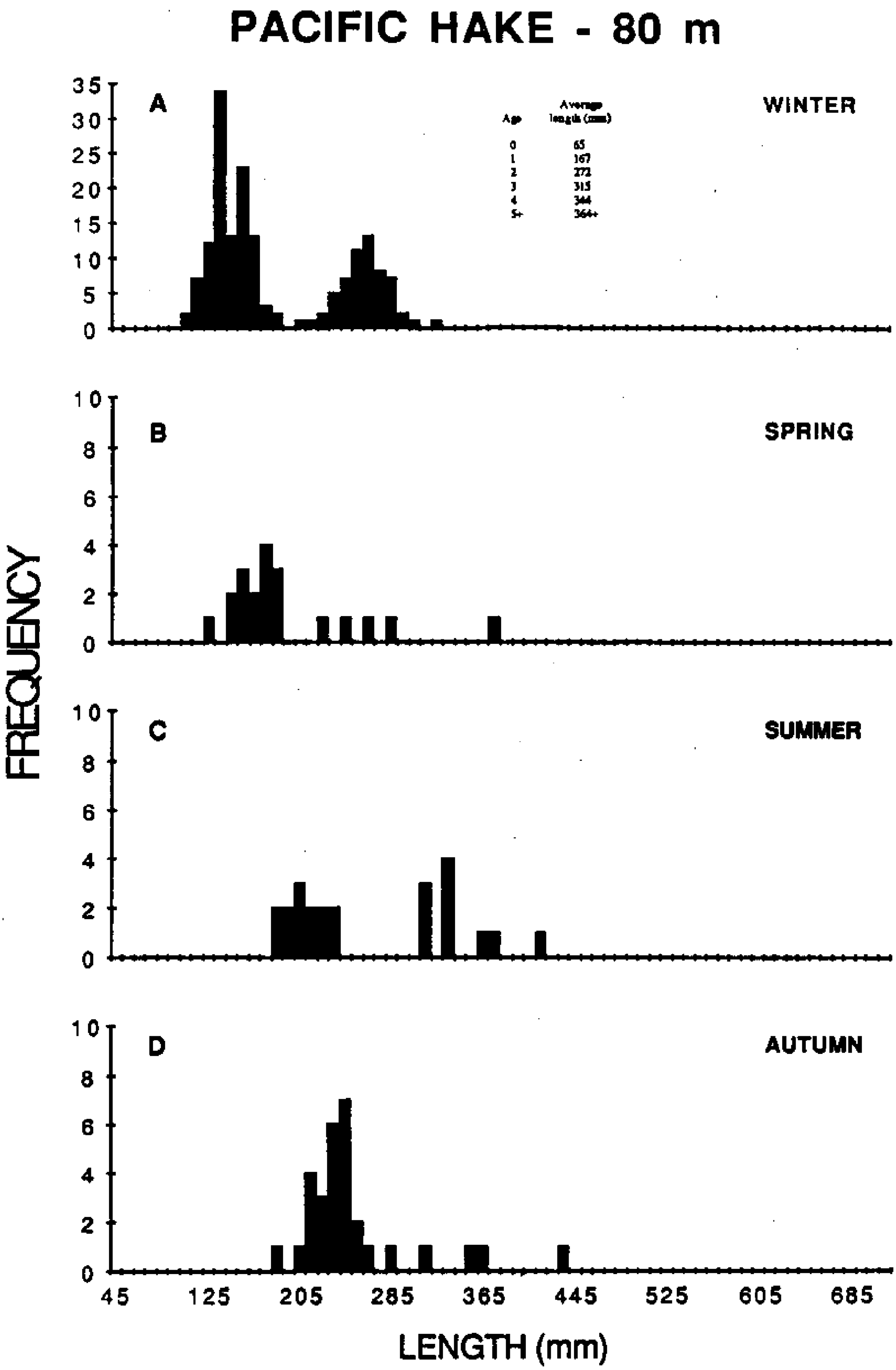

Figure 15. Pacific hake length-frequency plots for the 80m stratum by season (A-D). NOTE: The scale of the vertical axis changes between seasons. (See Fig. 12 for lengths at age.)

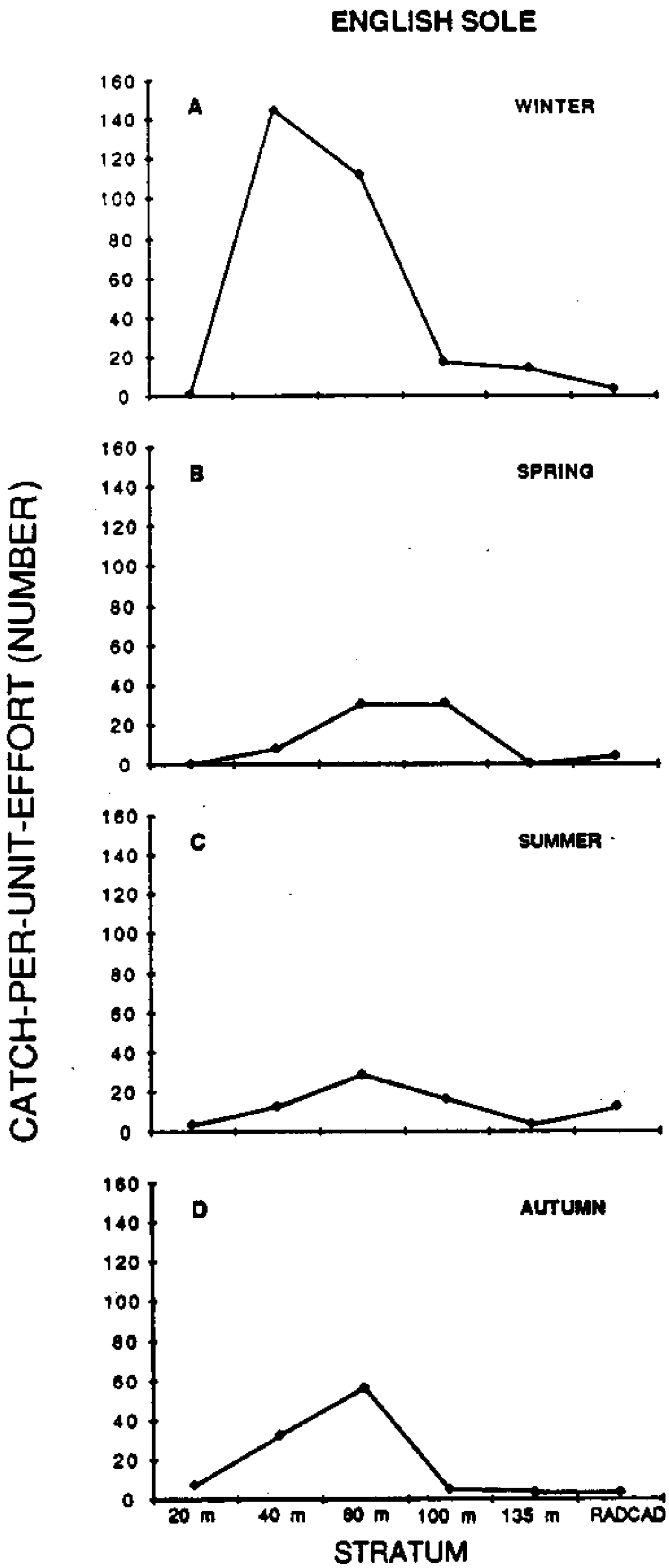

Figure 16. Catch-per-unit-effort abundance of English sole by stratum and season (A-D).

ENGLISH SOLE - ALL STRATA COMBINED

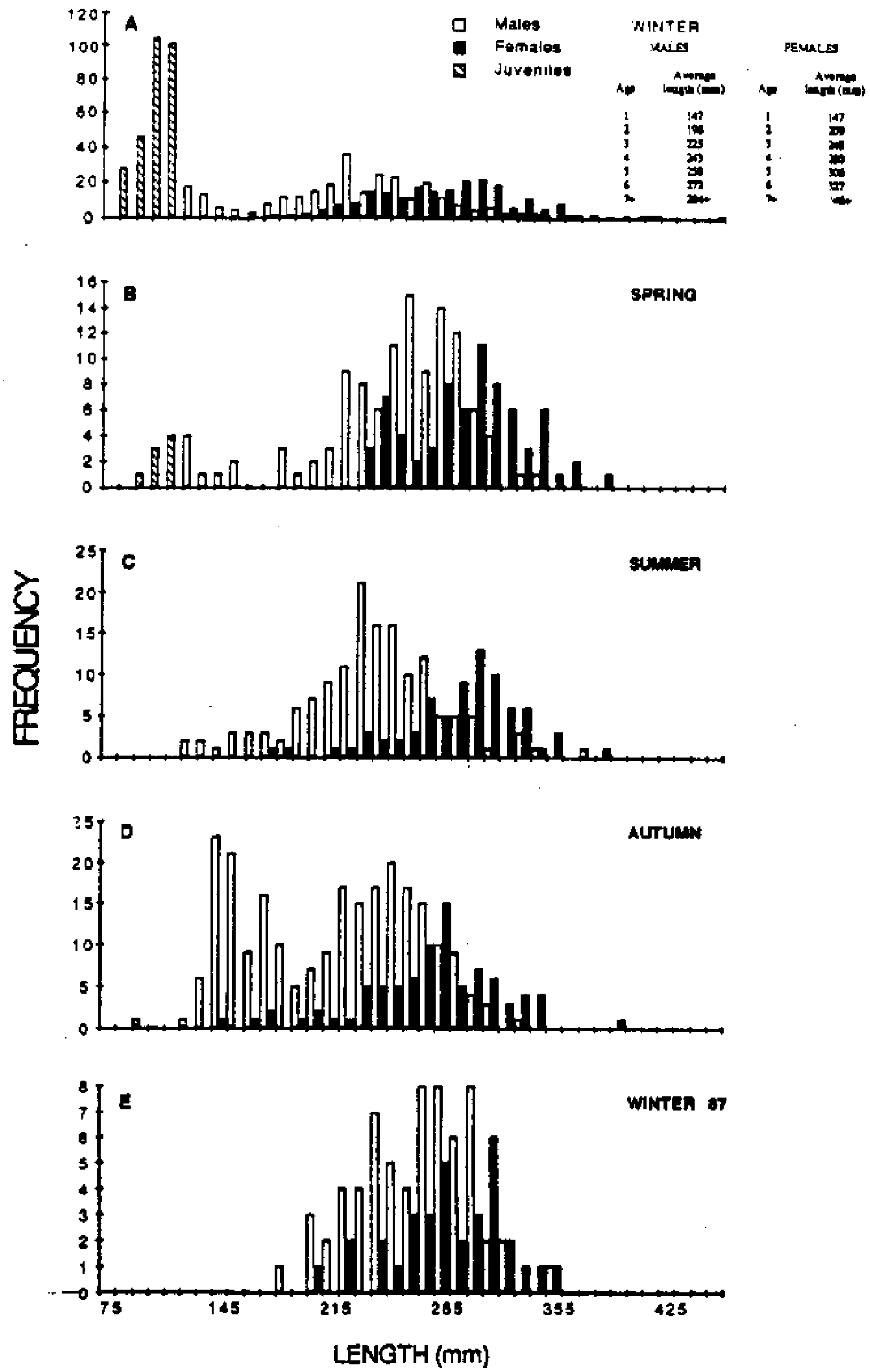

Figure 17. English sole length-frequency plots of males, females and juveniles for all strata combined by season (A-E). Average lengths (mm) at age are as follows: males—147, 196, 225, 243, 258, 272 and 284+ for ages 1 through 7+, respectively; females—147, 209, 248, 280, 306, 327 and 346+ for age 1 through 7+, respectively. NOTE: The scale of the vertical axis changes between seasons.

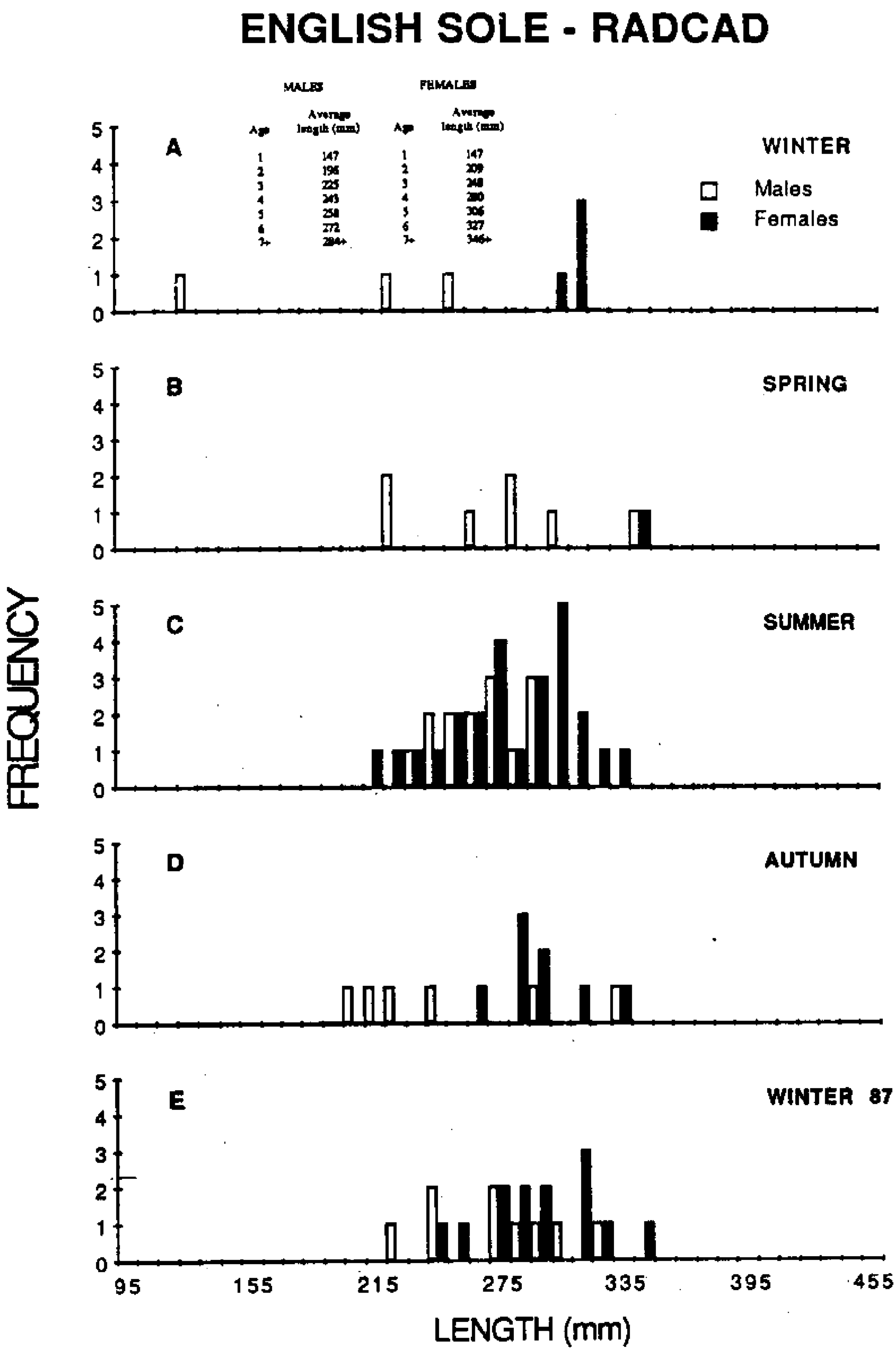

Figure 18. English sole length-frequency plots of males and females for the RADCAD stratum by season (A-E).

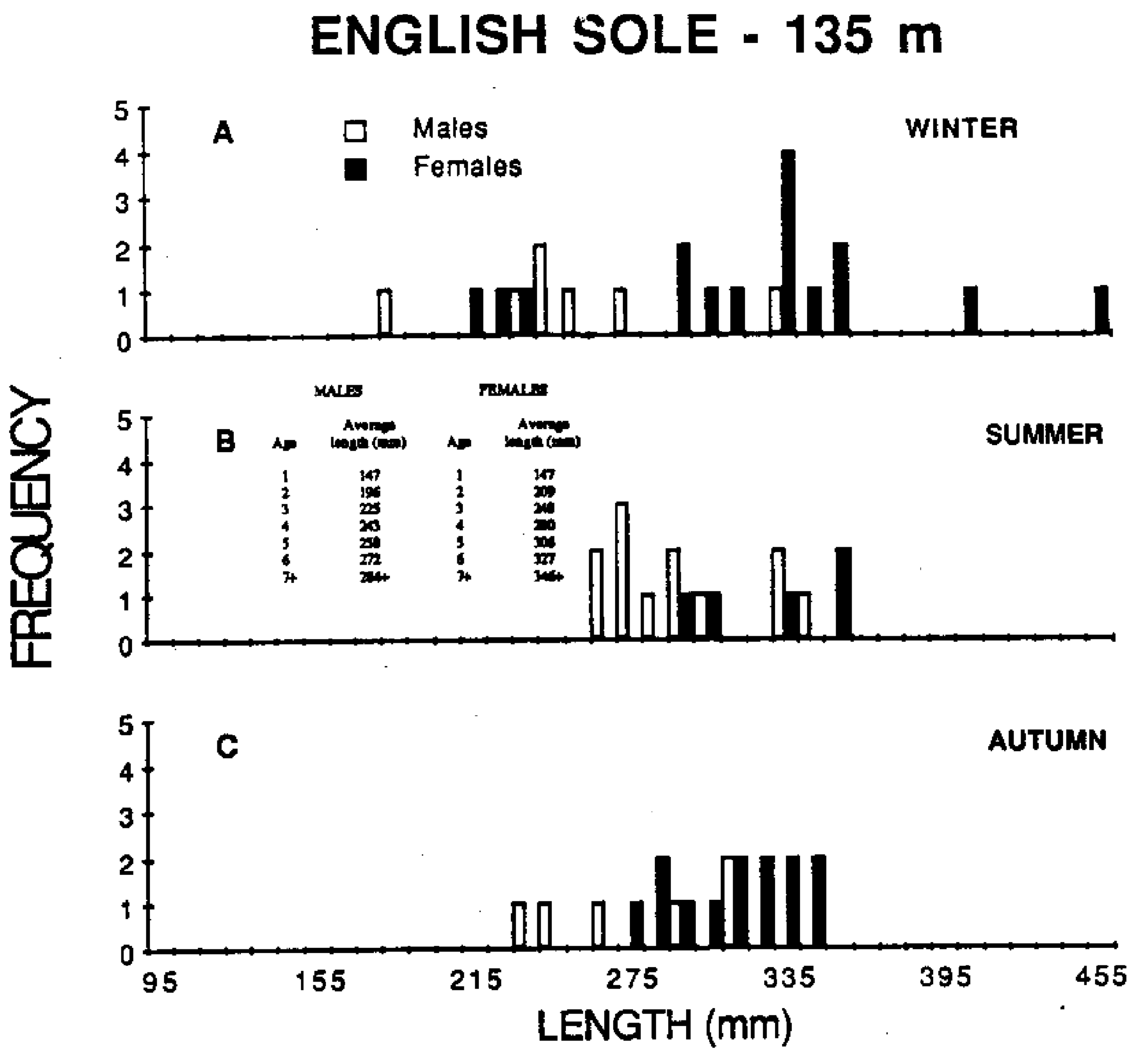

Figure 19. English sole length-frequency plots of males and females for the 135m stratum by season (A-C). (See Fig. 18 for lengths at age.)

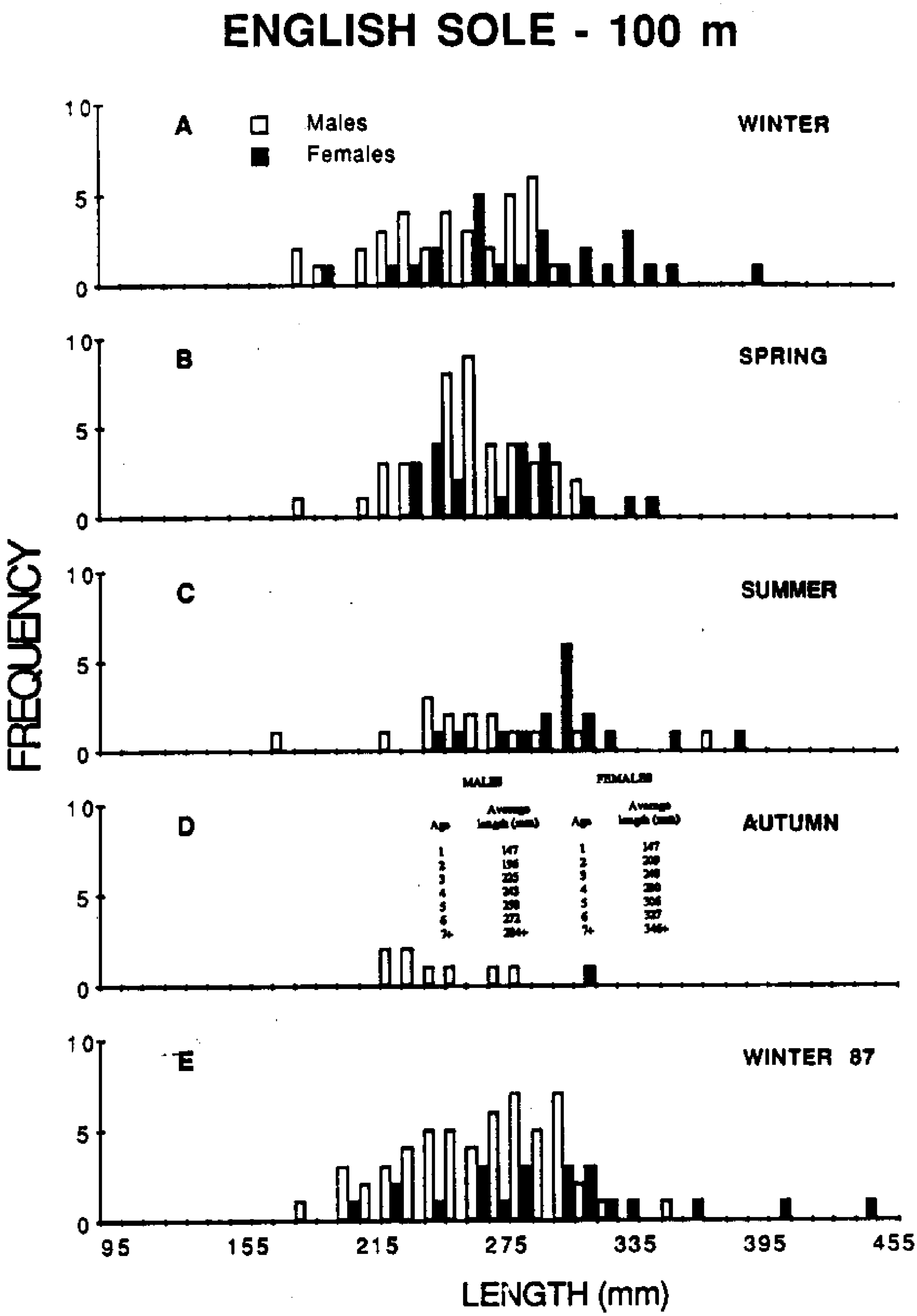

Figure 20. English sole length-frequency plots of males and females for the 100m stratum by season (A-E). (See Fig. 18 for lengths at age.)

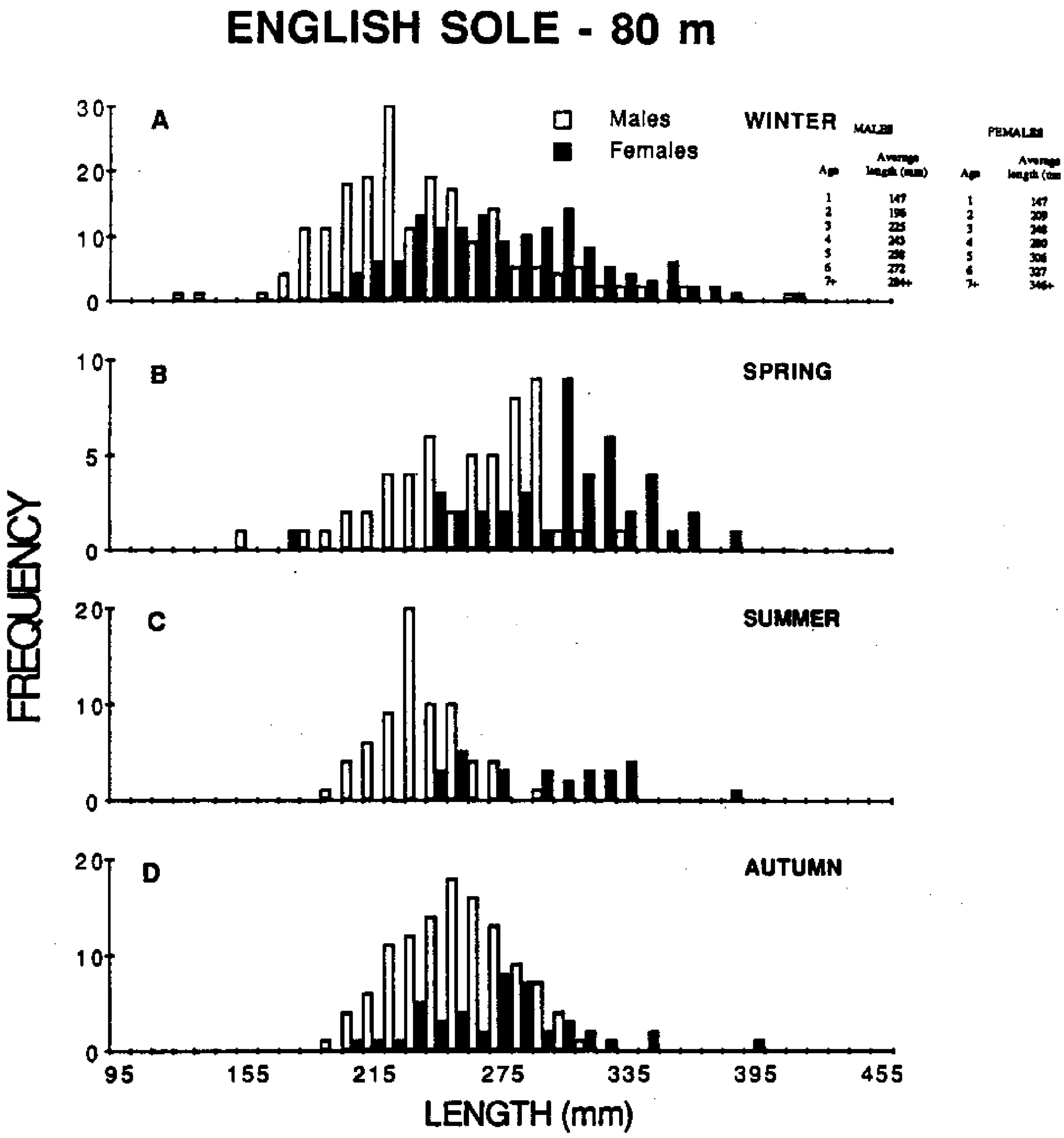

Figure 21. English sole length-frequency plots of males and females for the 80m stratum by season (A-D). (See Fig. 18 for lengths at age.) NOTE: The scale of the vertical axis changes between seasons.

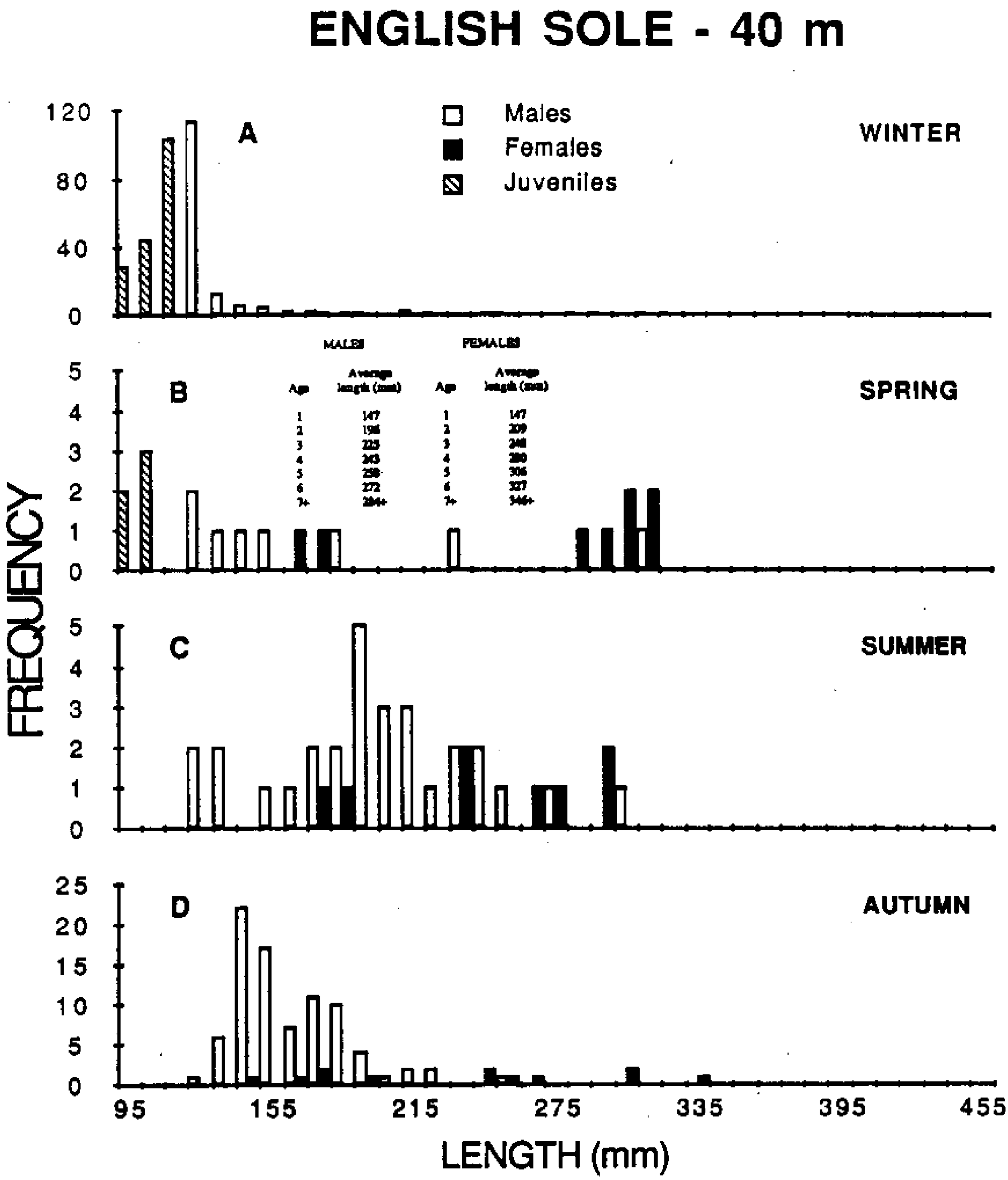

Figure 22. English sole length-frequency plots of males, females and juveniles for the 40m stratum by season (A-D). (See Fig. 18 for lengths at age.) NOTE: The scale of the vertical axis changes between seasons.

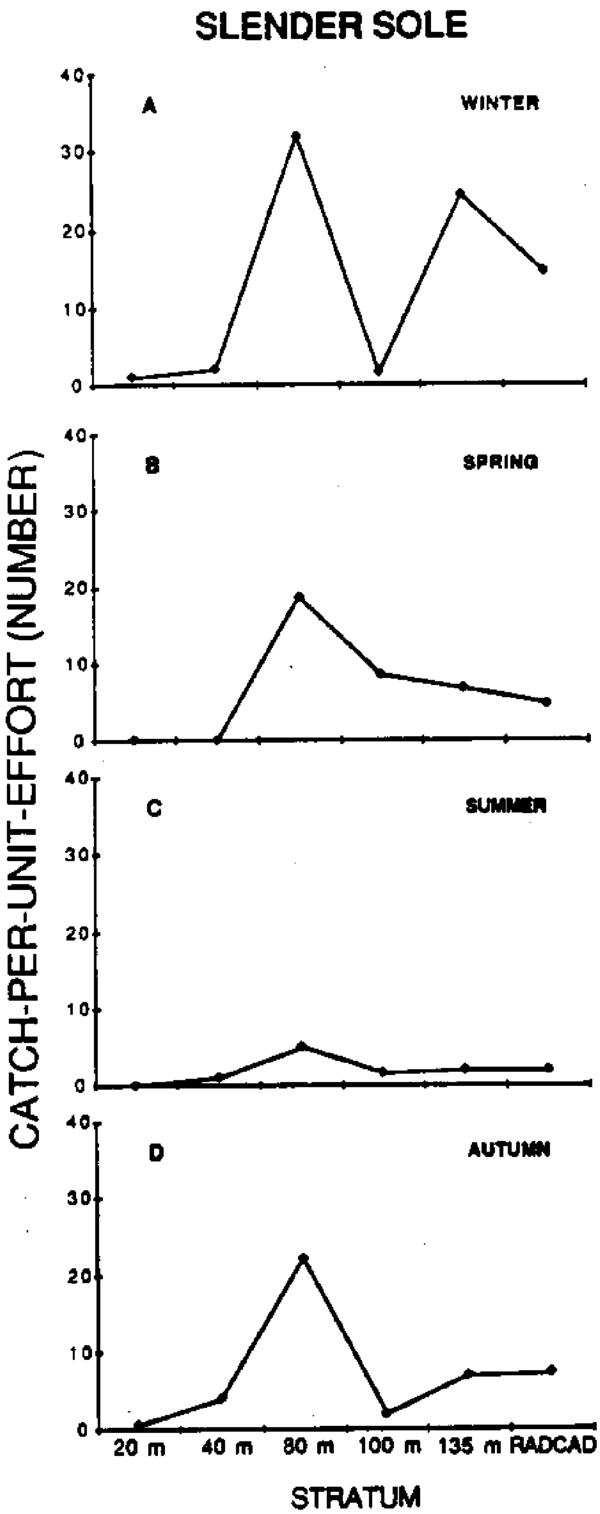

Figure 23. Catch-per-unit-effort abundance of slender sole by stratum and season (A-D).

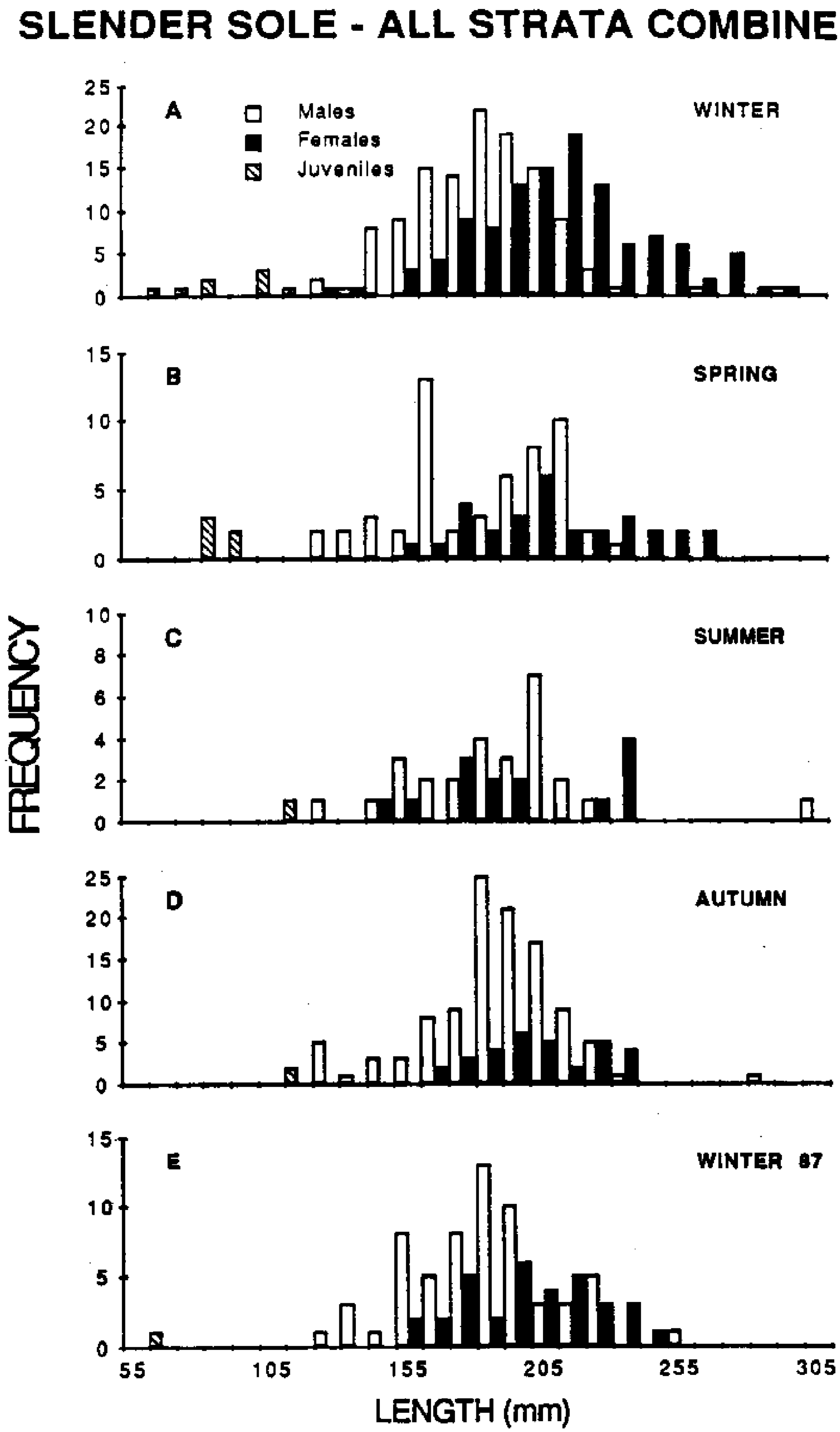

Figure 24. Slender sole length frequency plots of males, females and juveniles for all strata combined by season (A-E). NOTE: The scale of the vertical axis changes between seasons.

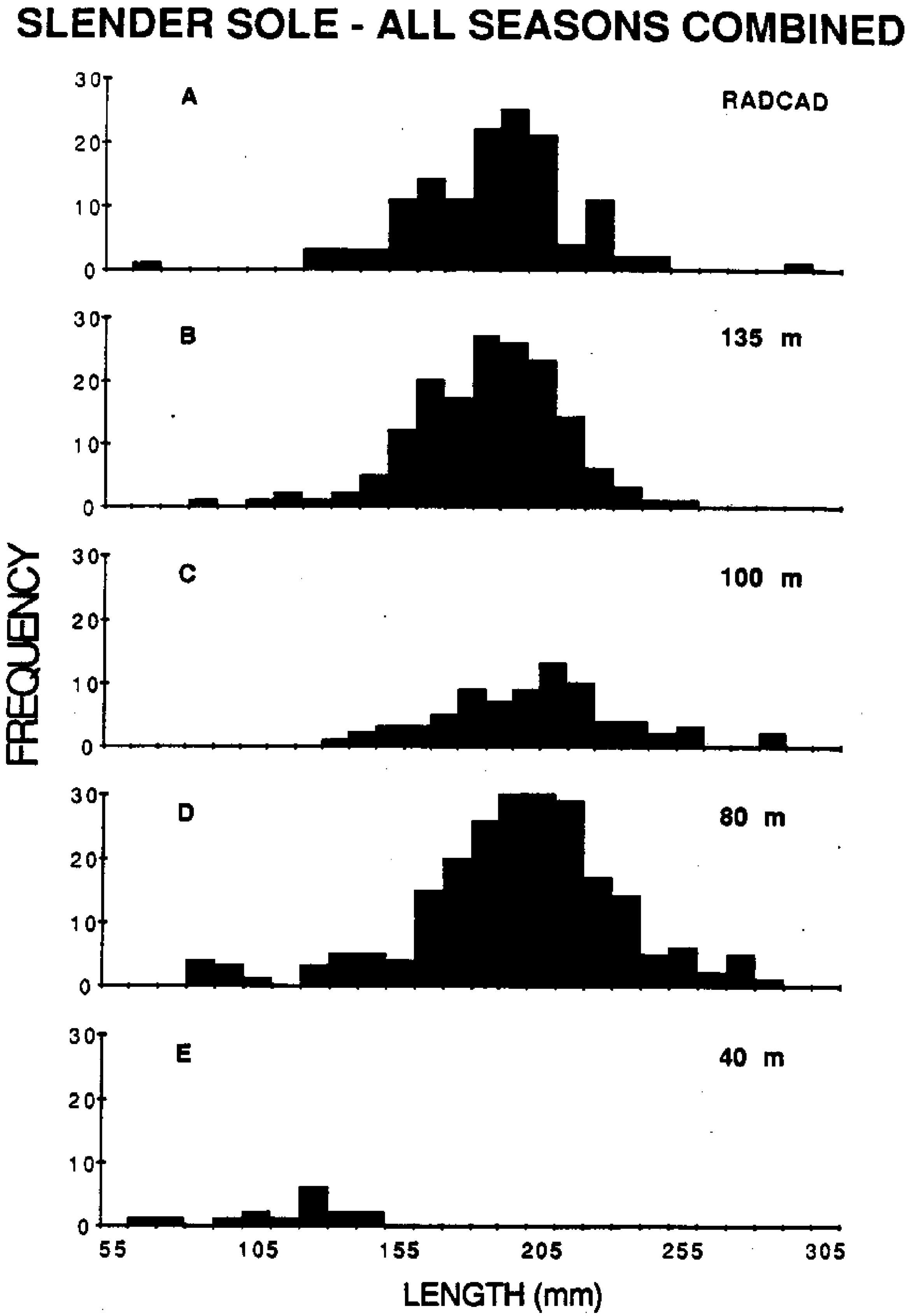

Figure 25. Slender sole length-frequency plots for all seasons combined by stratum (A-E).

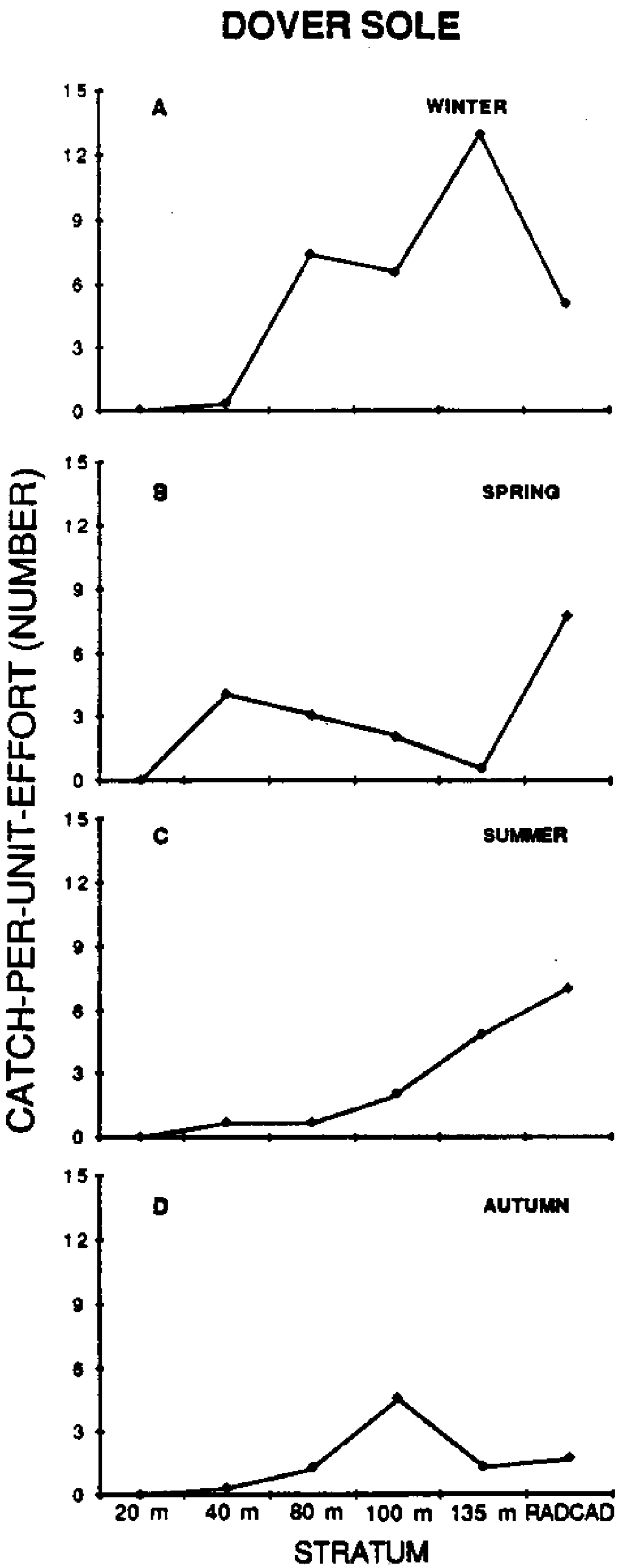

Figure 26. Catch-per-unit-effort abundance of Dover sole by stratum and season (A-D).

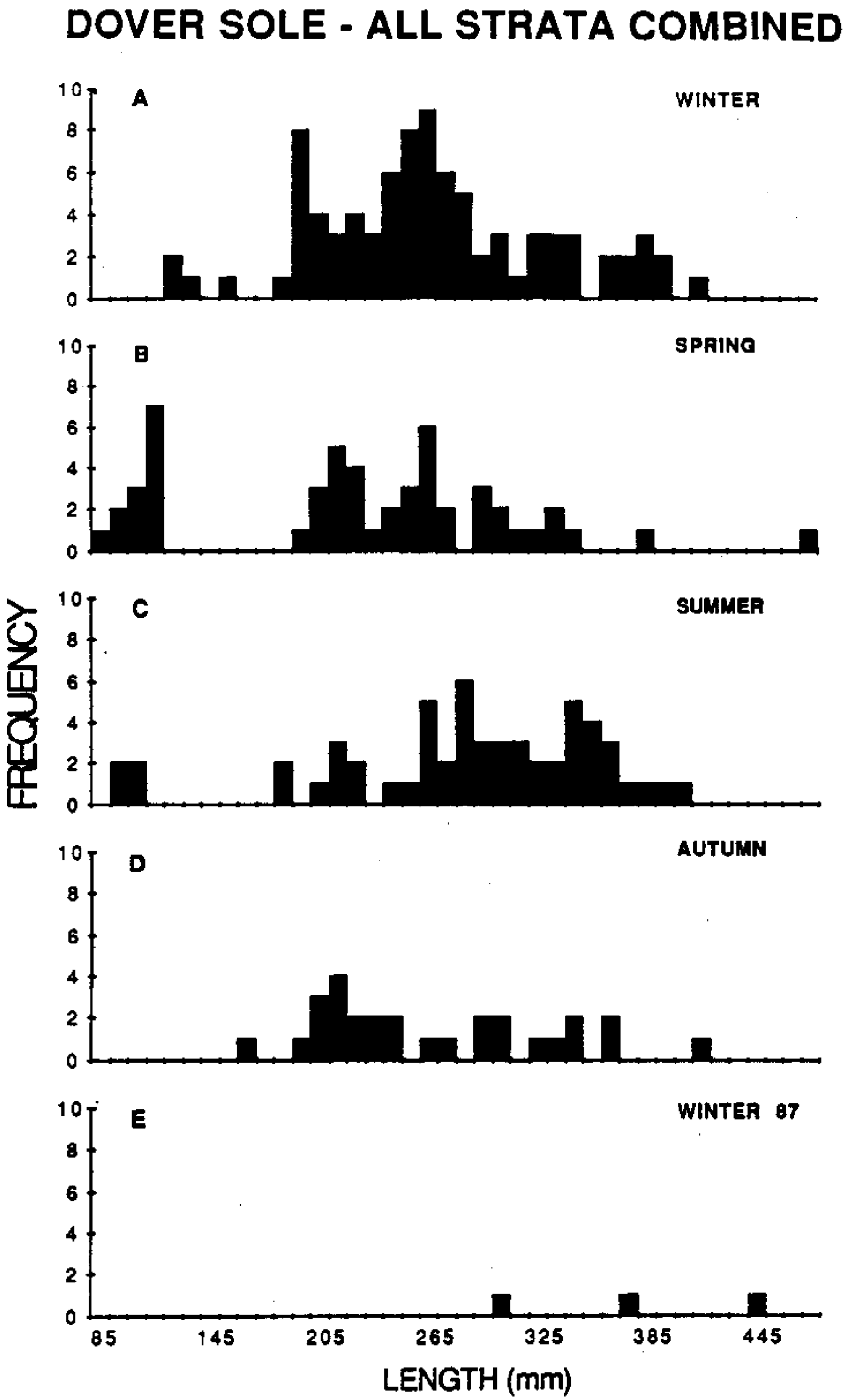

Figure 27. Dover sole length-frequency plots for all strata combined by season (A-E).

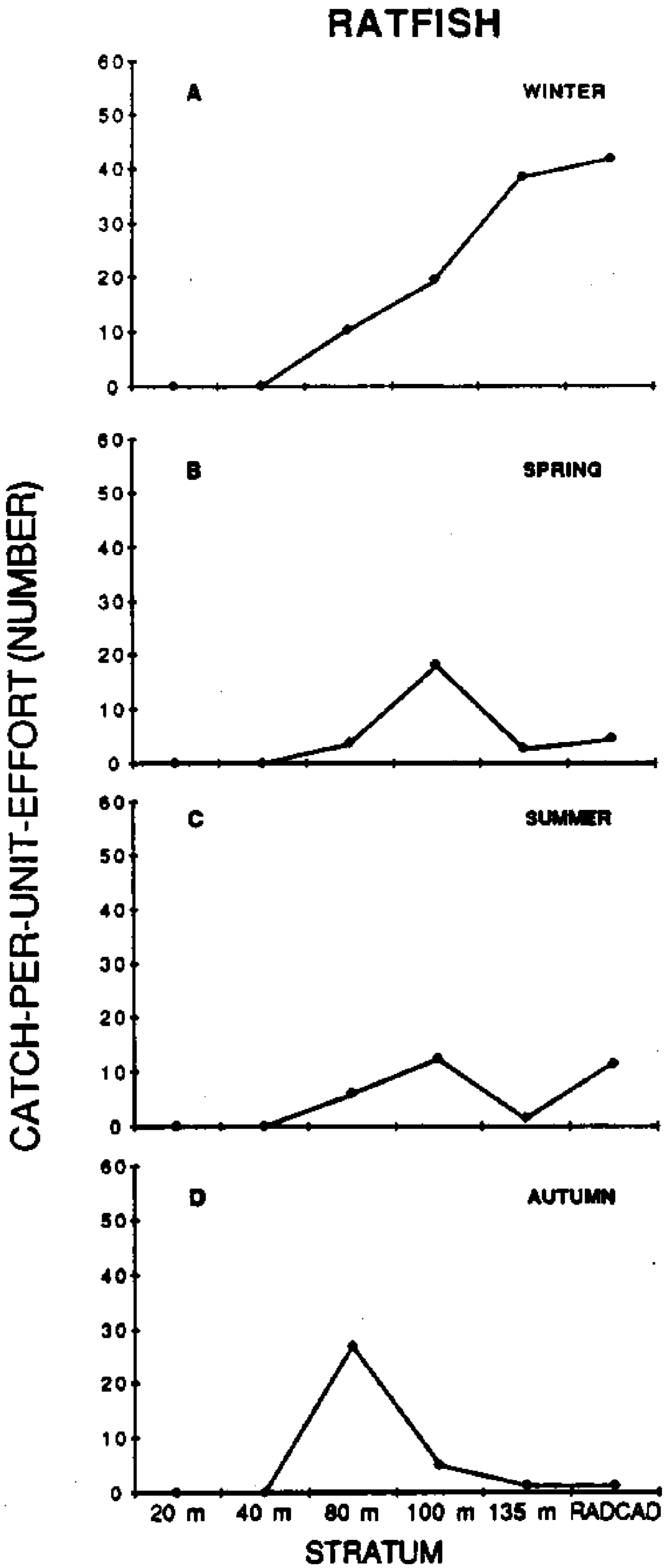

Figure 28. Catch-per-unit-effort abundance of ratfish by stratum and season (A-D).

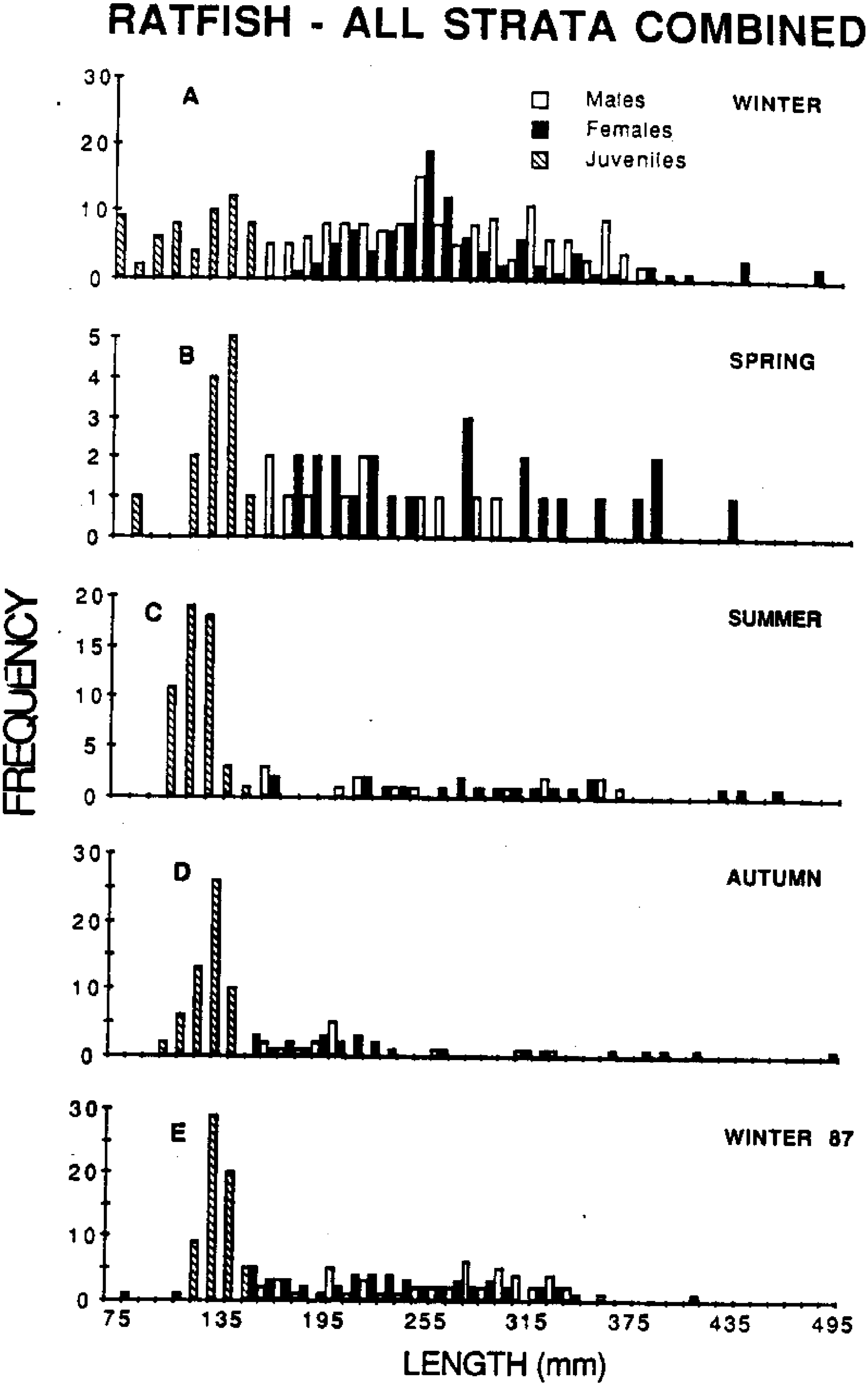

Figure 29. Ratfish length-frequency plots for males, females and juveniles for all strata combined by season (A-E). NOTE: The scale of the vertical axis changes between seasons.

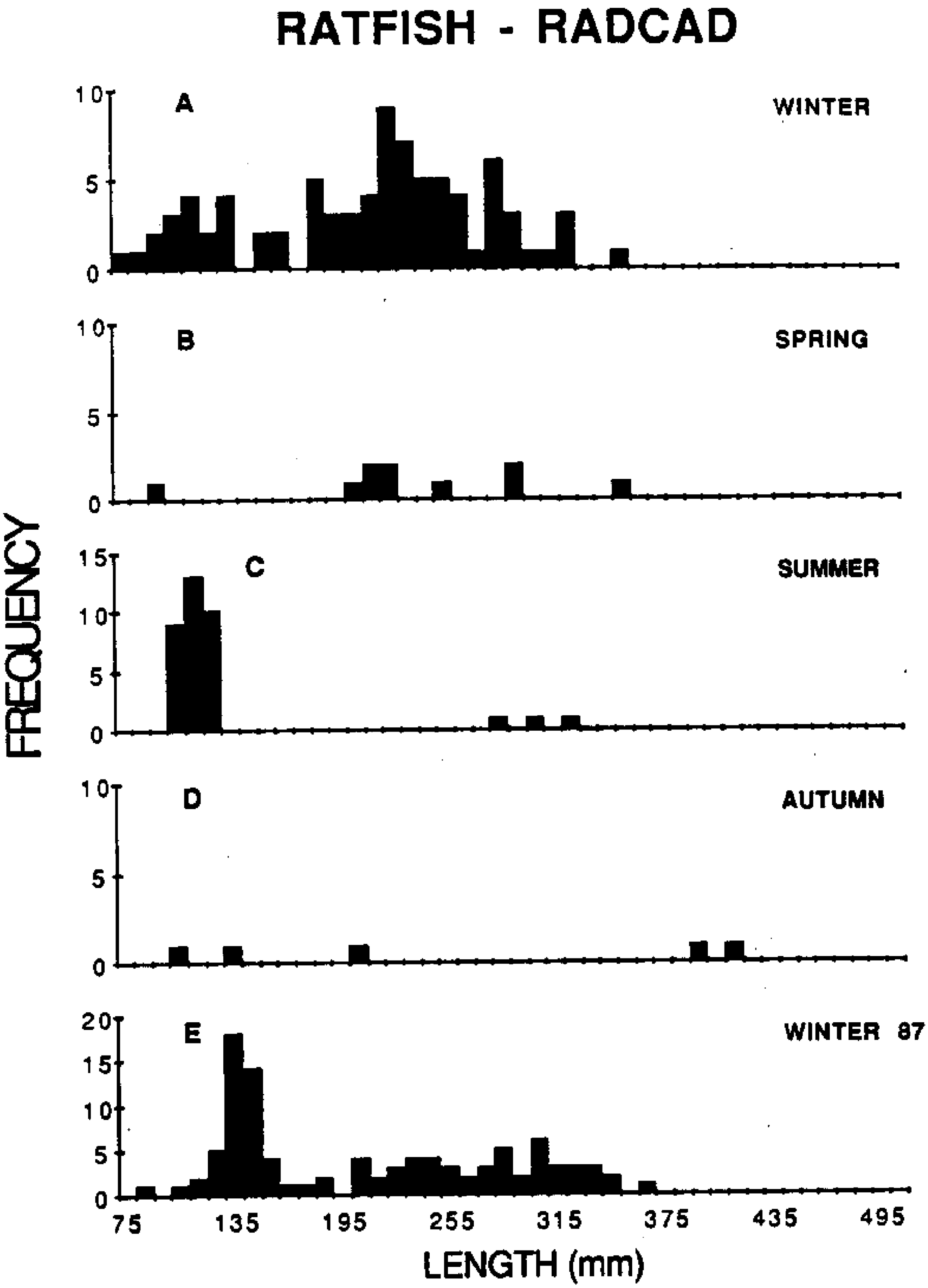

Figure 30. Ratfish length-frequency plots for RADCAD by season (A-E). NOTE: The scale of the vertical axis changes between seasons.

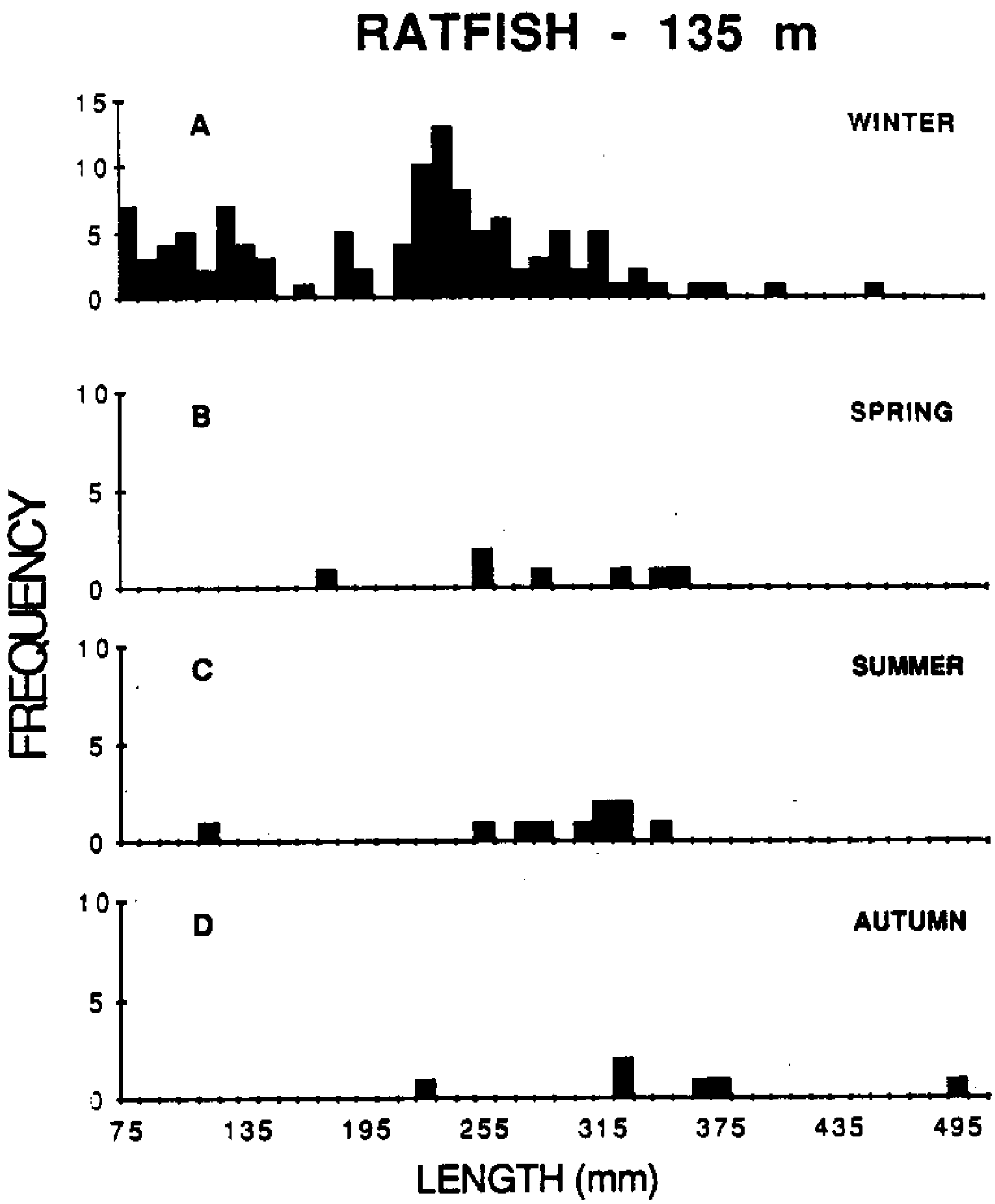

Figure 31. Ratfish length-frequency plots for 135m stratum by season (A-D). NOTE: The scale of the vertical axis changes between seasons.

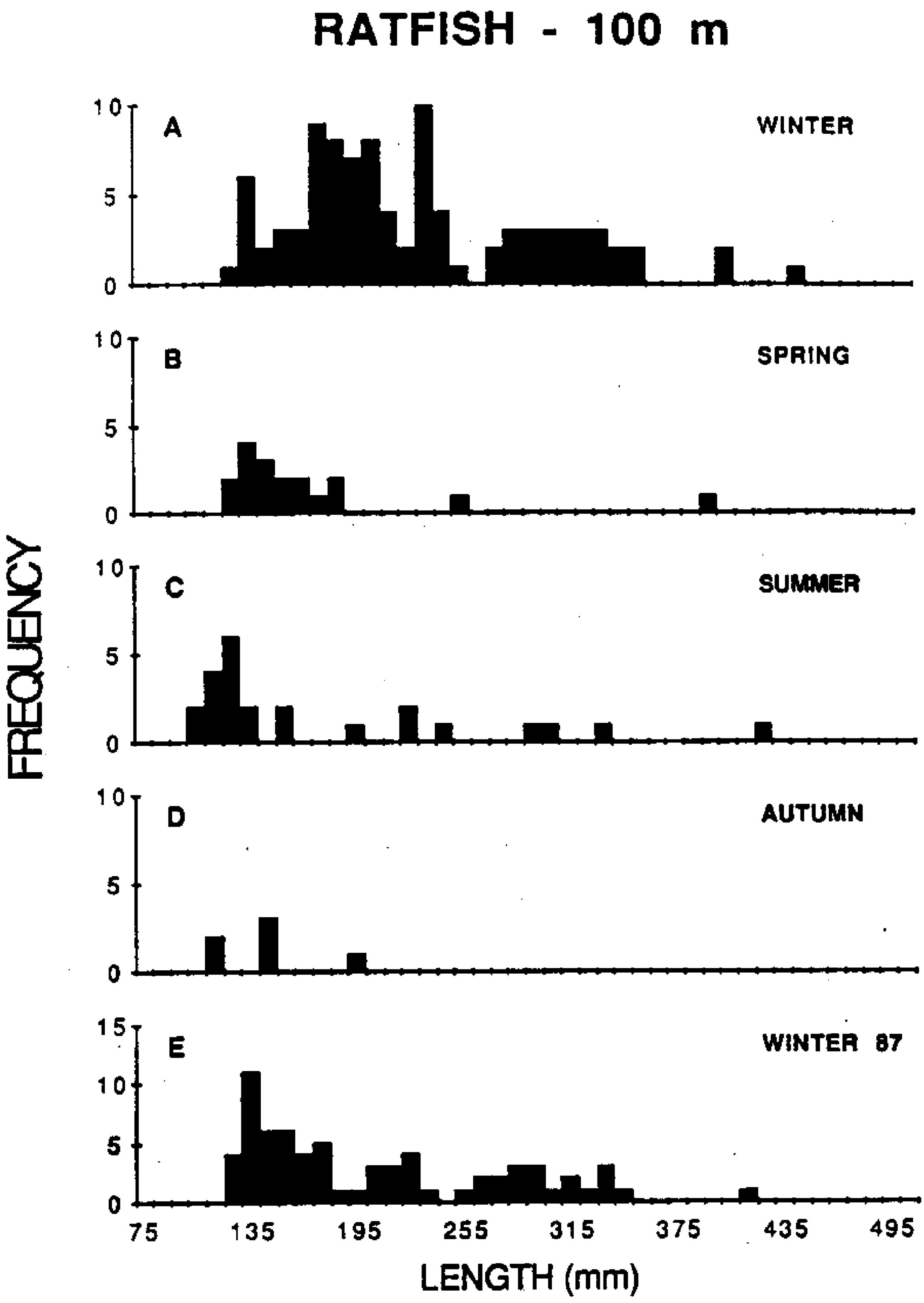

Figure 32. Ratfish length-frequency plots for 100m stratum by season (A-E). NOTE: The scale of the vertical axis changes between seasons.

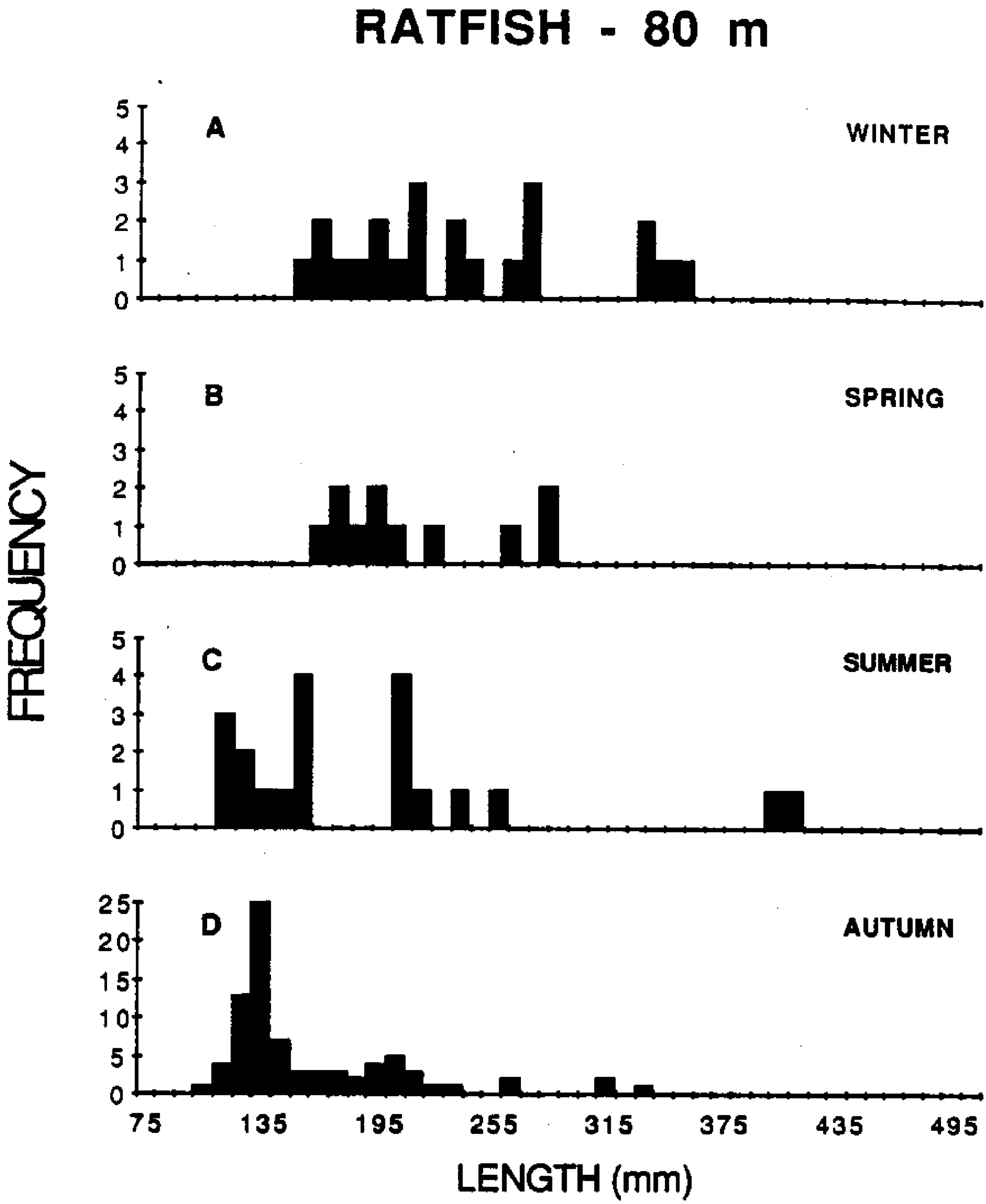

Figure 33. Ratfish length-frequency plots for 80m stratum by season (A-D). NOTE: The scale of the vertical axis changes between seasons.

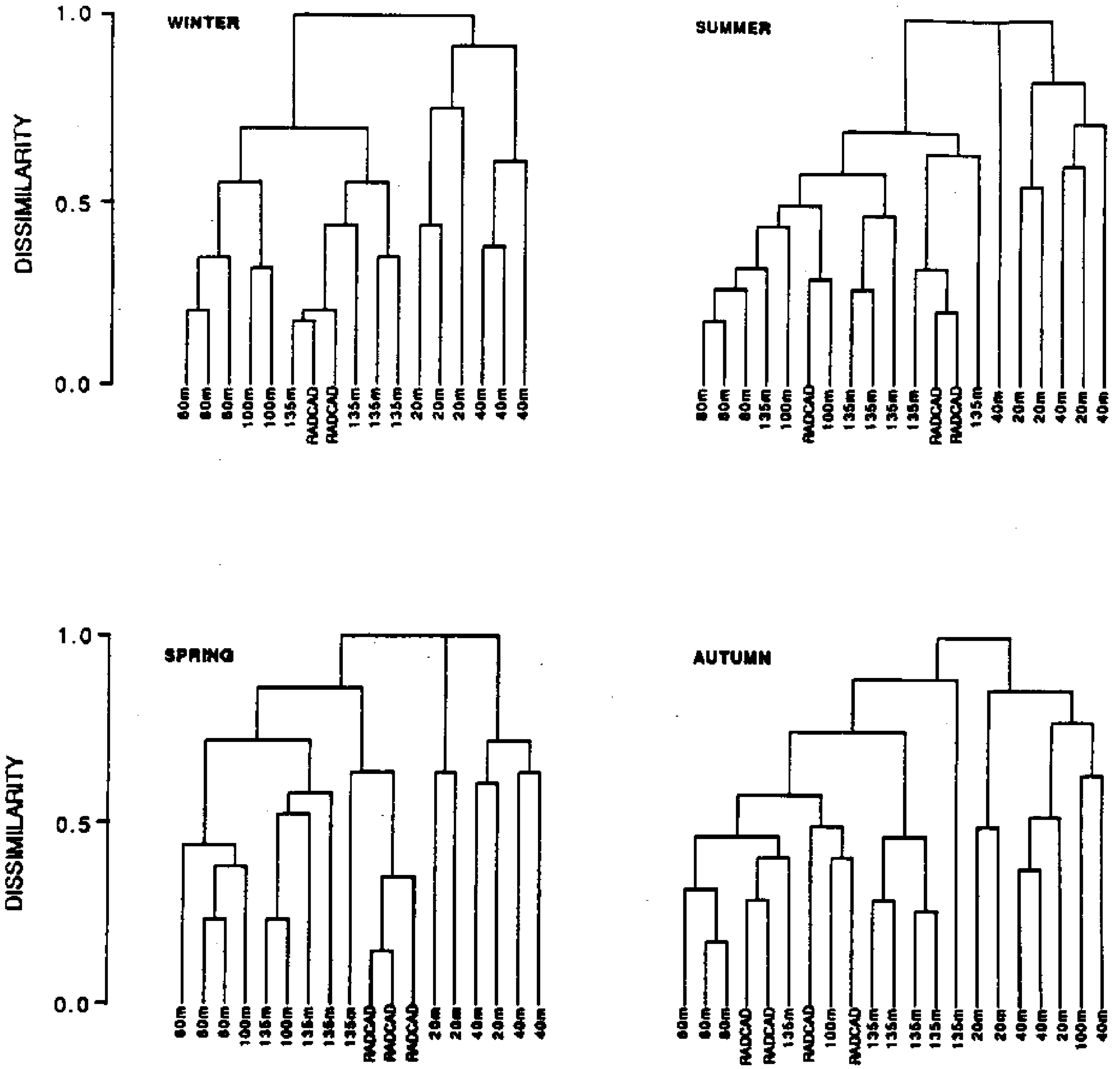

Figure 34. Dendrogram of Bray-Curtis distance measure between stations by season.

APPENDIX TABLES

Appendix Table 1. Total, average (catch per unit effort-CPUE) and standard deviation of abundance and biomass (g) for bottomfish species caught by otter trawl from the RADCAD, 135M, 100M, 80M, 40M and 20M strata in Port Gardner during Winter 1986. Species are listed in decreasing order of total abundance.

STRATUM RADCAD WINTER 86 OTTER TRAWL

Common Name	Sta 1		Sta 2		Sta 3							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biom	St Dev
ratfish - adult			44	8015	22	5920	66	33.00	15.56	13935	6967.50	1481.39
Pacific hake - adult			29	7490	9	4720	38	19.00	14.14	12210	6105.00	1958.69
slender sole - adult			21	975	8	410	29	14.50	9.19	1385	692.50	399.52
ratfish- juvenile			13	250	5	145	18	9.00	5.66	395	197.50	74.25
Dover sole - adult			7	1170	3	1260	10	5.00	2.83	2430	1215.00	63.64
English sole - adult			4	1010	3	490	7	3.50	0.71	1500	750.00	367.70
quillback rockfish			3	1700	1	520	4	2.00	1.41	2220	1110.00	834.39
blacktip poacher			2	32	0	0	2	1.00	1.41	32	16.00	22.63
flathead sole - adult			0	0	1	160	1	0.50	0.71	160	80.00	113.14

Appendix Table 1. cont'd.

STRATUM 135M WINTER 86 OTTER TRAWL

Common Name	Tran 4 1456 Abund	Tran 4 1456 Biomass	PSDDA Sta 1 Abund	PSDDA Sta 1 Biomass	PSDDA Sta 2 Abund	PSDDA Sta 2 Biomass	PSDDA Sta 3 Abund	PSDDA Sta 3 Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
ratfish - adult	8	3800	36	8740	11	2880	28	3855	122.00	30.50	13.45	19275.00	4818.75	2652.14
slender sole - adult	14	830	24	1260	26	1255	28	1390	126.00	31.50	6.22	4735.00	1183.75	243.97
Pacific hake - adult	1	410	39	9935	11	8690	5	1150	71.00	17.75	17.17	20185.00	5046.25	4961.60
English sole - adult	0	0	14	3805	3	795	4	980	34.00	8.50	6.08	5580.00	1395.00	1661.96
Dover sole - adult	28	4900	11	2455	0	0	0	0	43.00	10.75	13.23	7355.00	1838.75	2346.13
ratfish- juvenile	4	35	27	290	1	13	0	0	35.00	8.75	12.78	338.00	84.50	137.76
quillback rockfish	3	400	2	485	1	900	0	0	8.00	2.00	1.29	1785.00	446.25	369.08
blacktip poacher	2	30	3	20	0	0	1	14	7.00	1.75	1.29	64.00	16.00	12.54
rex sole - adult	0	0	1	150	1	25	0	0	3.00	0.75	0.58	175.00	43.75	71.81
blackbelly eelpout	2	50	0	0	0	0	0	0	3.00	0.75	1.00	50.00	12.50	25.00
slender sole - juvenile	0	0	0	0	2	10	0	0	3.00	0.75	1.00	10.00	2.50	5.00
arrowtooth flounder	0	0	1	300	0	0	0	0	1.00	0.25	0.50	300.00	75.00	150.00
Pacific cod	0	0	0	0	1	4000.5	0	0	1.00	0.25	0.50	4000.50	1000.13	2000.25
Pacific lamprey	0	0	1	9	0	0	0	0	1.00	0.25	0.50	9.00	2.25	4.50
Pacific tomcod - adult	0	0	0	0	1	100	0	0	1.00	0.25	0.50	100.00	25.00	50.00
plainfin midshipman	0	0	1	30	0	0	0	0	1.00	0.25	0.50	30.00	7.50	15.00
rex sole - juvenile	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
spiny dogfish	0	0	1	1495	0	0	0	0	1.00	0.25	0.50	1495.00	373.75	747.50
spinyhead sculpin	0	0	1	25	0	0	0	0	1.00	0.25	0.50	25.00	6.25	12.50
TOTAL	62	10455	162	28999	58	18669	66	7389	462.00	115.50	50.11	65511.50	16377.88	9668.16

Appendix Table 1. cont'd.

STRATUM 100M WINTER 86 OTTER TRAWL

Common Name	Tran 1 100M Abund	Tran 1 100M Biomass	Tran 2 110S Abund	Tran 2 110S Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomas	Ave Biomass	St Dev
ratfish - adult	37	6960	2	580	39.00	19.50	24.75	7540.00	3770.00	4511.34
English sole - adult	26	5006.2	8	1710	34.00	17.00	12.73	6716.20	3358.10	2330.77
Pacific hake - adult	10	1600	5	760	15.00	7.50	3.54	2360.00	1180.00	593.97
Dover sole - adult	2	564	11	3190	13.00	6.50	6.36	3754.00	1877.00	1856.86
quillback rockfish	2	860	2	1320	4.00	2.00	0.00	2180.00	1090.00	325.27
rex sole - adult	2	198.1	1	130	3.00	1.50	0.71	328.10	164.05	48.15
slender sole - adult	1	180.1	1	90	2.00	1.00	0.00	270.10	135.05	63.71
blackbelly eelpout	1	12.4	0	0	1.00	0.50	0.71	12.40	6.20	8.77
blacktip poacher	1	11.8	0	0	1.00	0.50	0.71	11.80	5.90	8.34
rex sole - juvenile	1	34.5	0	0	1.00	0.50	0.71	34.50	17.25	24.40
slender sole - juvenile	1	18.4	0	0	1.00	0.50	0.71	18.40	9.20	13.01
arrowtooth flounder	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
Pacific cod	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
Pacific lamprey	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
Pacific tomcod - adult	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
plainfin midshipman	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
ratfish- juvenile	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
spiny dogfish	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
spinyhead sculpin	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	84	15446	30	7780	114.00	57.00	38.18	23225.50	11612.75	5420.33

Appendix Table 1. cont'd.

STRATUM 80M WINTER 86 OTTER TRAWL

Common Name	CAD 1 Abund	CAD 1 Biomass	CAD 2 Abund	CAD 2 Biomass	CAD 3 Abund	CAD 3 Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
English sole - adult	101	18050	58	8170	174	34755	333	111.00	58.64	60975	20325.00	13437.72
shiner perch - adult	5	120.51	11	300	187	4660	203	67.67	103.39	5080.51	1693.50	2570.63
Pacific hake - adult	58	5960	56	1760	24	1425	138	46.00	19.08	9145	3048.33	2527.13
slender sole - adult	45	3040	21	1250	25	1965	91	30.33	12.86	6255	2085.00	901.01
flathead sole - adult	18	2240	17	2135	42	5610	77	25.67	14.15	9985	3328.33	1976.68
Pacific hake - juvenile	24	285	5	60	0	0	29	9.67	12.66	345	115.00	150.25
ratfish - adult	22	2420	2	380	5	1245	29	9.67	10.79	4045	1348.33	1023.92
Dover sole - adult	7	1575	3	910	12	2575	22	7.33	4.51	5060	1686.67	838.10
blackbelly eelpout	1	16.9	3	39.4	16	234	20	6.67	8.14	290.3	96.77	119.38
Pacific tomcod - adult	0	0	5	480	12	166	17	5.67	6.03	646	215.33	243.77
Pacific tomcod - juvenile	4	82.9	2	20.4	5	41	11	3.67	1.53	144.3	48.10	31.85
blacktip poacher	4	27.9	3	28.5	3	35	10	3.33	0.58	91.4	30.47	3.94
quillback rockfish	3	290	1	150	4	1035	8	2.67	1.53	1475	491.67	475.72
rex sole - adult	0	0	3	375	3	345	6	2.00	1.73	720	240.00	208.39
slender sole - juvenile	3	41	1	9.06	1	3	5	1.67	1.15	53.06	17.69	20.42
shiner perch - juvenile	0	0	0	0	3	45	3	1.00	1.73	45	15.00	25.98
English sole - juvenile	1	11.5	0	0	1	13.5	2	0.67	0.58	25	8.33	7.29
ratfish- juvenile	0	0	2	33.58	0	0	2	0.67	1.15	33.58	11.19	19.39
spinyhead sculpin	0	0	0	0	2	105	2	0.67	1.15	105	35.00	60.62
American shad	0	0	1	124.58	0	0	1	0.33	0.58	124.58	41.53	71.93
plainfin midshipman	1	105.1	0	0	0	0	1	0.33	0.58	105.1	35.03	60.68
rock sole - adult	0	0	0	0	1	490	1	0.33	0.58	490	163.33	282.90
snake prickleback	0	0	0	0	1	15	1	0.33	0.58	15	5.00	8.66
TOTAL	297	34266	194	18226	521	54763	1012	337.33	167.19	105253.8	35084.61	19281.53

Appendix Table 1. cont'd.

STRATUM 40M WINTER 86 OTTER TRAWL

Common Name	Tran 1 40S Abund	Tran 1 40S Biomass	Tran 2 40S Abund	Tran 2 40S Biomass	Tran 4 40S Abund	Tran 4 40S Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomas	Ave Biomass	St Dev
English sole - adult	17	970	67	1920	140	1490	224.00	74.67	61.86	4380.00	1460.00	475.71
English sole - juvenile	157	1500	54	590	0	0	211.00	70.33	79.76	2090.00	696.67	755.67
pile perch - adult	4	40	7	105	129	2210	140.00	46.67	71.32	2355.00	785.00	1234.51
shiner perch - juvenile	16	90	41	255	34	200	91.00	30.33	12.90	545.00	181.67	84.01
rock sole - adult	13	2080	17	1480	22	1650	52.00	17.33	4.51	5210.00	1736.67	309.25
snake prickleback	0	0	0	0	36	1065	36.00	12.00	20.78	1065.00	355.00	614.88
pile perch - juvenile	0	0	1	10	26	310	27.00	9.00	14.73	320.00	106.67	176.16
speckled sanddab - adult	0	0	0	0	26	810	26.00	8.67	15.01	810.00	270.00	467.65
sanddab - adult	9	295	12	300	0	0	21.00	7.00	6.24	595.00	198.33	171.78
quillback rockfish	12	280	8	50	0	0	20.00	6.67	6.11	330.00	110.00	149.33
Pacific tomcod - juvenile	4	20	0	0	14	100	18.00	6.00	7.21	120.00	40.00	52.92
rock sole - juvenile	5	23.1	1	5	9	145	15.00	5.00	4.00	173.10	57.70	76.14
Pacific tomcod - adult	0	0	13	105	0	0	13.00	4.33	7.51	105.00	35.00	60.62
Pacific staghorn sculpin	3	120	7	225	2	380	12.00	4.00	2.65	725.00	241.67	130.80
sculpin	0	0	2	30	5	65	7.00	2.33	2.52	95.00	31.67	32.53
flathead sole - adult	5	500	0	0	1	110	6.00	2.00	2.65	610.00	203.33	262.74
sanddab - juvenile	6	95	0	0	0	0	6.00	2.00	3.46	95.00	31.67	54.85
slender sole - adult	0	0	6	40	0	0	6.00	2.00	3.46	40.00	13.33	23.09
shiner perch - adult	0	0	2	30	1	20	3.00	1.00	1.00	50.00	16.67	15.28
arrowtooth flounder	1	19.5	1	145	0	0	2.00	0.67	0.58	164.50	54.83	78.69
blackbelly eelpout	1	7.4	1	10	0	0	2.00	0.67	0.58	17.40	5.80	5.19
CO sole	1	60	0	0	0	0	1.00	0.33	0.58	60.00	20.00	34.64
Dover sole - adult	0	0	1	80	0	0	1.00	0.33	0.58	80.00	26.67	46.19
Pacific sanddab	0	0	0	0	1	15	1.00	0.33	0.58	15.00	5.00	8.66
rex sole - adult	0	0	1	55	0	0	1.00	0.33	0.58	55.00	18.33	31.75
sailfin sculpin	1	30	0	0	0	0	1.00	0.33	0.58	30.00	10.00	17.32
speckled sanddab - juvenile	0	0	0	0	1	25	1.00	0.33	0.58	25.00	8.33	14.43
TOTAL	255	6130	242	5435	447	8595	944.00	314.67	114.79	20160.00	6720.00	1660.56

Appendix Table 1. cont'd.

STRATUM 20M WINTER 86 OTTER TRAWL

Common Name	Tran 1 20S Abund	Tran 1 20S Biomass	Tran 2 20S Abund	Tran 2 20S Biomass	Tran 4 20S Abund	Tran 4 20S Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomas	Ave Biomass	St Dev
sanddab - adult	2	70	1	27	4	180	7.00	2.33	1.53	277.00	92.33	78.91
sanddab - juvenile	1	13.2	0	0	5	80	6.00	2.00	2.65	93.20	31.07	42.89
flathead sole - adult	1	200	0	0	4	310	5.00	1.67	2.08	510.00	170.00	157.16
rock sole - juvenile	2	7.8	2	8	1	5	5.00	1.67	0.58	20.80	6.93	1.68
slender sole - adult	0	0	0	0	3	610	3.00	1.00	1.73	610.00	203.33	352.18
rock sole - adult	2	660	1	230	0	0	3.00	1.00	1.00	890.00	296.67	335.01
English sole - juvenile	1	7	0	0	1	7.2	2.00	0.67	0.58	14.20	4.73	4.10
sculpin	0	0	0	0	1	7	1.00	0.33	0.58	7.00	2.33	4.04
CO sole	0	0	0	0	1	50	1.00	0.33	0.58	50.00	16.67	28.87
English sole - adult	1	320	0	0	0	0	1.00	0.33	0.58	320.00	106.67	184.75
TOTAL	10	1278	4	265	20	1249.2	34.00	11.33	8.08	2792.20	930.73	576.72

Appendix Table 2. Total, average (CPUE) and standard deviation of abundance and biomass (g) for bottomfish species caught by otter trawl from the RADCAD, 135M, 100M, 80M, 40M and 20M strata in Port Gardner during Spring 1986. Species are listed in decreasing order of total abundance.

STRATUM RADCAD SPRING 86 OTTER TRAWL

	Sta. 1		Sta 2		Sta 3							
Common Name	Abund	Biomass	Abund	Biomass	Abund	Biomass	Total Abund	Ave Abund	Stand Dev	Total Biom	Ave Biom	Stand Dev
Dover sole	5	885	10	1965	8	1395	23	7.67	2.52	4245	1415.00	540.28
slender sole - adult	5	285	3	150	6	295	14	4.67	1.53	730	243.33	80.98
English sole - adult	7	1375	0	0	6	295	13	4.33	3.79	1670	556.67	723.88
ratfish - adult	2	380	5	710	4	1330	11	3.67	1.53	2420	806.67	482.32
quillback rockfish	1	150	1	335	1	295	3	1.00	0.00	780	260.00	97.34
ratfish - juvenile	2	35	1	9	0	0	3	1.00	1.00	44	14.67	18.18
blacktip poacher	0	0	1	17	0	0	1	0.33	0.58	17	5.67	9.81
sablefish	0	0	1	500	0	0	1	0.33	0.58	500	166.67	288.68
TOTAL	22	3110	22	3686	25	3610	69	23.00	1.73	10406	3468.67	312.93

Appendix Table 2. cont'd.

STRATUM 135M SPRING 86 OTTER TRAWL

Common Name	PSDDA Sta 1 Abund	PSDDA Sta 1 Biomass	PSDDA Sta 2 Abund	PSDDA Sta 2 Biomass	PSDDA Sta 3 Abund	PSDDA Sta 3 Biomass	Tran 4 145S Abund	Tran 4 145S Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
slender sole - adult	10	500	9	480	7	255	1	10	27	6.75	4.03	1245	311.25	229.51
ratfish - adult	1	215	2	1100	0	0	8	1610	11	2.75	3.59	2925	731.25	754.86
Pacific hake - adult	2	180	1	405	0	0	4	1760	7	1.75	1.71	2345	586.25	799.85
Dover sole	1	250	0	0	1	220	0	0	2	0.50	0.58	470	117.5	136.23
English sole - adult	2	330	0	0	0	0	0	0	2	0.50	1.00	330	82.5	165.00
rex sole - juvenile	0	0	1	7	1	2	0	0	2	0.50	0.58	9	2.25	3.30
blackbelly eelpout	0	0	1	8	0	0	0	0	1	0.25	0.50	8	2	4.00
pallid eelpout	0	0	0	0	0	0	1	2	1	0.25	0.50	2	0.5	1.00
rex sole - adult	0	0	1	95	0	0	0	0	1	0.25	0.50	95	23.75	47.50
TOTAL	16	1475	15	2095	9	477	14	3382	54	13.50	3.11	7429	1857.25	1215.54

Appendix Table 2. cont'd.

STRATUM 100M SPRING 86 OTTER TRAWL

Common Name	Tran 1 100M Abund	Tran 1 100M Biomass	Tran 2 110S Abund	Tran 2 110S Biomass	Total Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
English sole - adult	61	10870	1	150	62.00	31.00	42.43	11020.00	5510.00	7580.18
ratfish - adult	20	145	2	50	22.00	11.00	12.73	195.00	97.50	67.18
slender sole - adult	15	830	2	55	17.00	8.50	9.19	885.00	442.50	548.01
ratfish - juvenile	14	220	0	0	14.00	7.00	9.90	220.00	110.00	155.56
Dover sole	2	655	2	1120	4.00	2.00	0.00	1775.00	887.50	328.80
Pacific hake - adult	1	85	2	210	3.00	1.50	0.71	295.00	147.50	88.39
flathead sole	2	450	0	0	2.00	1.00	1.41	450.00	225.00	318.20
rex sole - adult	2	210	0	0	2.00	1.00	1.41	210.00	105.00	148.49
blackbelly eelpout	1	11	0	0	1.00	0.50	0.71	11.00	5.50	7.78
Pacific tomcod - adult	1	140	0	0	1.00	0.50	0.71	140.00	70.00	98.99
quillback rockfish	1	605	0	0	1.00	0.50	0.71	605.00	302.50	427.80
pallid eelpout	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
rex sole - juvenile	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	120	14221	9	1585	129.00	64.50	78.49	15806.00	7903.00	8935.00

Appendix Table 2. cont'd.

STRATUM 80M SPRING 86 OTTER TRAWL

Common Name	CAD 1		CAD 2		CAD 3							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
English sole - adult	20	4470	36	6620	35	7090	91	30.33	8.96	18180	6060.00	1396.89
slender sole - adult	5	235	16	1020	30	1490	51	17.00	12.53	2745	915.00	634.05
blackbelly eelpout	6	90	15	230	21	455	42	14.00	7.55	775	258.33	104.14
Pacific hake - adult	4	420	8	360	8	390	20	6.67	2.31	1170	390.00	30.00
flathead sole	0	0	4	650	13	1695	17	5.67	6.66	2345	781.67	855.14
rex sole - adult	0	0	2	335	14	790	16	5.33	7.57	1125	375.00	396.52
blacktip poacher	3	40	3	27	7	50	13	4.33	2.31	117	39.00	11.53
ratfish - adult	3	170	4	435	4	295	11	3.67	0.58	900	300.00	132.57
Dover sole	0	0	0	0	9	1040	9	3.00	5.20	1040	346.67	600.44
slender sole - juvenile	0	0	2	10	3	9	5	1.67	1.53	19	6.33	5.51
Pacific tomcod - adult	0	0	1	25	1	40	2	0.67	0.58	65	21.67	20.21
plainfin midshipman	1	70	1	25	0	0	2	0.67	0.58	95	31.67	35.47
quillback rockfish	0	0	0	0	1	510	1	0.33	0.58	510	170.00	294.45
rex sole - juvenile	0	0	1	1	0	0	1	0.33	0.58	1	0.33	0.58
rock sole - adult	1	110	0	0	0	0	1	0.33	0.58	110	36.67	63.51
sablefish	0	0	0	0	1	430	1	0.33	0.58	430	143.33	248.26
snake prickleback	0	0	1	9	0	0	1	0.33	0.58	9	3.00	5.20
TOTAL	43	5605	94	9747	147	14284	284	94.67	52.00	29636	9878.67	4341.00

Appendix Table 2. cont'd.

STRATUM 40M SPRING 96 OTTER TRAWL

Common Name	Tran 1 40S		Tran 2 40S		Tran 4 40S							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
rock sole - adult	1	145	5	600	11	830	17.00	5.67	5.03	1575.00	525.00	348.60
English sole - adult	2	455	3	335	11	1420	16.00	5.33	4.93	2210.00	736.67	594.82
Dover sole	12	125	0	0	0	0	12.00	4.00	6.93	125.00	41.67	72.17
English sole - juvenile	0	0	0	0	8	90	8.00	2.67	4.62	90.00	30.00	51.96
sanddab - adult	2	50	0	0	4	120	6.00	2.00	2.00	170.00	56.67	60.28
quillback rockfish	0	0	0	0	5	200	5.00	1.67	2.89	200.00	66.67	115.47
shiner perch - adult	0	0	0	0	5	40	5.00	1.67	2.89	40.00	13.33	23.09
blacktip poacher	0	0	2	15	0	0	2.00	0.67	1.15	15.00	5.00	8.66
northern sculpin	0	0	1	9	1	2	2.00	0.67	0.58	11.00	3.67	4.73
rock sole - juvenile	0	0	0	0	2	15	2.00	0.67	1.15	15.00	5.00	8.66
plainfin midshipman	0	0	1	27	0	0	1.00	0.33	0.58	27.00	9.00	15.59
sand sole	1	125	0	0	0	0	1.00	0.33	0.58	125.00	41.67	72.17
slim sculpin	0	0	0	0	1	1	1.00	0.33	0.58	1.00	0.33	0.58
TOTAL	18	900	12	986	48	2718	78.00	26.00	18.29	4604.00	1534.67	1025.70

Appendix Table 2. cont'd.

STRATUM 20M SPRING 86 OTTER TRAWL

Common Name	Tran 1 20S		Tran 2 20S		Tran 4 20S							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
sanddab - adult	0	0	3	15	1	15	4.00	1.33	1.53	30.00	10.00	8.66
sanddab - juvenile	1	1	0	0	2	5	3.00	1.00	1.00	6.00	2.00	2.65
rock sole - juvenile	0	0	0	0	2	5	2.00	0.67	1.15	5.00	1.67	2.89
rock sole - adult	0	0	1	300	0	0	1.00	0.33	0.58	300.00	100.00	173.21
sand sole	0	0	1	12	0	0	1.00	0.33	0.58	12.00	4.00	6.93
TOTAL	1	1	5	327	5	25	11.00	3.67	2.31	353.00	117.67	181.68

Appendix Table 3. Total, average (CPUE) and standard deviation of abundance and biomass (g) for bottomfish species caught by otter trawl from the RADCAD, 135M, 100M, 80M, 40M and 20M strata in Port Gardner during Summer 1986. Species are listed in decreasing order of total abundance.

STRATUM RADCAD SUMMER 86 OTTER TRAWL

Common Name	Sta 1 Abund	Sta 1 Biomass	Sta 2 Abund	Sta 2 Biomass	Sta 3 Abund	Sta 3 Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
English sole - adult	32	6725	2	308	3	428.5	37	12.33	17.04	7461.5	2487.17	3674.03
ratfish - juvenile	27	477.5	3	54.5	1	21	31	10.33	14.47	553	184.33	254.44
Dover sole - adult	3	1415	11	2355.5	6	2011	20	6.67	4.04	5781.5	1927.17	475.82
slender sole - adult	3	129	2	106	1	57	6	2.00	1.00	292	97.33	36.77
ratfish - adult	4	1255	0	0	0	0	4	1.33	2.31	1255	418.33	724.57
Pacific hake - adult	1	180.5	0	0	1	318.5	2	0.67	0.58	499	166.33	159.72
black eelpout	0	0	1	28	0	0	1	0.33	0.58	28	9.33	16.17
Dover sole - juvenile	1	6	0	0	0	0	1	0.33	0.58	6	2.00	3.46
TOTAL	71	10188	19	2852	12	2834	102	34.00	32.23	15876	5292.00	4243.53

Appendix Table 3. contd.

STRATUM 135M SUMMER 86 OTTER TRAWL

Common Name	Traw 4 1458 Abund	Traw 4 1458 Biomass	Station G Abund	Station G Biomass	Station H Abund	Station H Biomass	PSDDA Sta 1 Abund	PSDDA Sta 1 Biomass	PSDDA Sta 2 Abund	PSDDA Sta 2 Biomass	PSDDA Sta 3 Abund	PSDDA Sta 3 Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
Dover sole - adult	4	1583	6	1955	4	494.5	2	472.5	5	1184.5	5	1772.5	26.00	4.33	1.37	7442.00	1240.33	639.85
English sole - adult	0	0	5	1840	5	1050	4	1088	3	626	2	362.5	19.00	3.17	1.94	4666.50	777.75	557.09
slender sole - adult	1	186	2	92.5	0	0	0	0	2	112	6	212	11.00	1.83	2.23	602.50	100.42	89.60
ratfish - adult	1	3970	3	1066	1	420	1	237	0	0	2	712.5	8.00	1.33	1.03	6394.50	1065.75	1469.64
Pacific hake - adult	1	181	3	711	0	0	0	0	0	0	0	0	4.00	0.67	1.21	892.00	148.67	284.84
quillback rockfish	0	0	1	270	1	380.5	1	363.5	0	0	1	253.5	4.00	0.67	0.52	1267.50	211.25	171.13
black eelpout	3	66	0	0	0	0	0	0	0	0	0	0	3.00	0.50	1.22	66.00	11.00	26.94
blackfin poacher	0	0	0	0	0	0	2	34.5	0	0	1	27.5	3.00	0.50	0.84	62.00	10.33	16.16
Dover sole - juvenile	1	4	0	0	0	0	1	5	0	0	1	5	3.00	0.50	0.55	14.00	2.33	2.58
blacktip poacher	0	0	1	23	1	120	0	0	0	0	0	0	2.00	0.33	0.52	143.00	23.83	48.00
blackbelly eelpout	0	0	1	19	0	0	0	0	0	0	0	0	1.00	0.17	0.41	19.00	3.17	7.76
longnose skate	0	0	0	0	1	1600	0	0	0	0	0	0	1.00	0.17	0.41	1600.00	266.67	653.20
Pacific cod	0	0	0	0	1	1500	0	0	0	0	0	0	1.00	0.17	0.41	1500.00	250.00	612.37
ratfish - juvenile	1	13	0	0	0	0	0	0	0	0	0	0	1.00	0.17	0.41	13.00	2.17	5.31
slender sole - juvenile	0	0	0	0	0	0	0	0	1	6	0	0	1.00	0.17	0.41	6.00	1.00	2.45
shiner perch - juvenile	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	12	5983	22	5665.5	14	5545	11	2221	11	1928	18	3346	88.00	14.67	4.46	24688.00	4114.67	1838.50

Appendix Table 3. cont'd.

STRATUM 100M SUMMER 84 OTTER TRAWL

Common Name	Tran 1 1066 Abund	Tran 1 1066 Biomass	Tran 2 1109 Abund	Tran 2 1109 Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
English sole - adult	28	6475.5	4	475	32.00	16.00	16.97	6950.50	3475.25	4242.99
spiny dogfish	1	707	18	2115	19.00	9.50	12.02	2822.00	1411.00	995.61
ratfish - juvenile	14	281	1	11	15.00	7.50	9.19	292.00	146.00	190.92
ratfish - adult	8	1941.5	2	522	10.00	5.00	4.24	2463.50	1231.75	1003.74
Pacific hake - adult	4	951.5	1	143	5.00	2.50	2.12	1094.50	547.25	571.70
Dover sole - adult	1	582	3	163	4.00	2.00	1.41	745.00	372.50	296.28
blackfin poacher	2	28.5	0	0	2.00	1.00	1.41	28.50	14.25	20.15
quillback rockfish	1	104.5	1	421	2.00	1.00	0.00	525.50	262.75	223.80
slender sole - adult	2	115	0	0	2.00	1.00	1.41	115.00	57.50	81.32
shiner perch - juvenile	1	10.5	0	0	1.00	0.50	0.71	10.50	5.25	7.42
slender sole - juvenile	1	6.2	0	0	1.00	0.50	0.71	6.20	3.10	4.38
TOTAL	63	11203	30	3850	93.00	46.50	23.33	15053.20	7526.60	5199.58

Appendix Table 3. cont'd.

STRATUM 60M SUMMER 86 OTTER TRAWL

Common Name	CAD 1		CAD 2		CAD 3							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
English sole - adult	23	3837.5	35	5263.5	28	7034	86	28.67	6.03	16135	5378.33	1601.34
Pacific hake - adult	8	1200	5	464.5	9	976.5	22	7.33	2.08	2641	880.33	377.06
blackbelly eelpout	3	119.5	10	408	4	141.5	17	5.67	3.79	669	223.00	160.59
slender sole - adult	5	187	7	581.5	3	175.5	15	5.00	2.00	944	314.67	231.16
ratfish - adult	3	376	3	1305	7	472	13	4.33	2.31	2153	717.67	510.91
spiny dogfish	7	1702.5	3	995	1	580	11	3.67	3.06	3277.5	1092.50	567.57
flathead sole	0	0	0	0	7	1194	7	2.33	4.04	1194	398.00	689.38
quillback rockfish	2	935	1	120	2	384	5	1.67	0.58	1439	479.67	415.84
ratfish - juvenile	0	0	1	14.5	4	68	5	1.67	2.08	82.5	27.50	35.82
Dover sole - adult	0	0	1	136	1	402.5	2	0.67	0.58	538.5	179.50	204.75
blacktip poacher	1	7.5	0	0	0	0	1	0.33	0.58	7.5	2.50	4.33
TOTAL	52	8365	66	9288	66	11428	184	61.33	8.08	29081	9693.67	1571.28

Appendix Table 3. cont'd.

STRATUM 40M SUMMER 86 OTTER TRAWL

Common Name	Tran 1 488 Abund	Tran 1 488 Biomass	Tran 2 488 Abund	Tran 2 488 Biomass	Tran 4 488 Abund	Tran 4 488 Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
Pacific cod	89	3719	0	0	0	0	89.00	29.67	51.38	3719.00	1239.67	2147.17
English sole - adult	15	1315.5	22	1870.5	0	0	37.00	12.33	11.24	3186.00	1062.00	960.67
Pacific tomcod - adult	0	0	16	833	0	0	16.00	5.33	9.24	833.00	277.67	480.93
rock sole - adult	6	239	5	606.5	0	0	11.00	3.67	3.21	845.50	281.83	305.51
spiny dogfish	2	583	4	7625	0	0	6.00	2.00	2.00	8208.00	2736.00	4244.02
Pacific herring	5	319.5	0	0	0	0	5.00	1.67	2.89	319.50	106.50	184.46
rex sole -adult	0	0	3	174.5	0	0	3.00	1.00	1.73	174.50	58.17	100.75
Dover sole - adult	0	0	1	50	1	67.5	2.00	0.67	0.58	117.50	39.17	35.03
plainfin midshipman	1	54.5	1	148.5	0	0	2.00	0.67	0.58	203.00	67.67	75.12
quillback rockfish	2	416	0	0	0	0	2.00	0.67	1.15	416.00	138.67	240.18
slender sole - adult	0	0	2	24.5	0	0	2.00	0.67	1.15	24.50	8.17	14.15
blackbelly eelpout	0	0	1	7	0	0	1.00	0.33	0.58	7.00	2.33	4.04
flathead sole	0	0	1	6.5	0	0	1.00	0.33	0.58	6.50	2.17	3.75
sanddab - adult	1	33	0	0	0	0	1.00	0.33	0.58	33.00	11.00	19.05
slender sole - juvenile	1	5	0	0	0	0	1.00	0.33	0.58	5.00	1.67	2.89
TOTAL	122	6684.5	56	11346	1	67.5	179.00	59.67	60.58	18098.00	6032.67	5667.43

Appendix Table 3. cont'd.

STRATUM 20M SUMMER 86 OTTER TRAWL

Common Name	Tran 1 20B Abund	Tran 1 20B Biomass	Tran 2 20B Abund	Tran 2 20B Biomass	Tran 4 20B Abund	Tran 4 20B Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
English sole - adult	1	249.5	2	249.5	6	439.5	9.00	3.00	2.65	938.50	312.83	109.70
shiner perch - juvenile	0	0	7	61.5	0	0	7.00	2.33	4.04	61.50	20.50	35.51
sanddab - adult	0	0	1	22	2	31	3.00	1.00	1.00	53.00	17.67	15.95
sanddab - juvenile	0	0	0	0	3	10.5	3.00	1.00	1.73	10.50	3.50	6.06
Pacific herring	0	0	1	28.5	0	0	1.00	0.33	0.58	28.50	9.50	16.45
Pacific staghorn sculpin	1	236	0	0	0	0	1.00	0.33	0.58	236.00	78.67	136.25
rock sole - adult	0	0	1	23.5	0	0	1.00	0.33	0.58	23.50	7.83	13.57
rock sole - juvenile	0	0	1	13	0	0	1.00	0.33	0.58	13.00	4.33	7.51
starry flounder	0	0	1	259.5	0	0	1.00	0.33	0.58	259.50	86.50	149.82
TOTAL	2	485.5	14	657.5	11	481	27.00	9.00	6.24	1624.00	541.33	100.63

Appendix Table 4. Total, average (CPUE) and standard deviation of abundance and biomass (g) for bottomfish species caught by otter trawl from the RADCAD, 135M, 100M, 80M, 40M and 20M strata in Port Gardner during Autumn 1986. Species are listed in decreasing order of total abundance.

STRATUM RADCAD AUTUMN 86 OTTER TRAWL

Common Name	Sta 1 Abund	Sta 1 Biomass	Sta 2 Abund	Sta 2 Biomass	Sta 3 Abund	Sta 3 Biomass	Sta E Abund	Sta E Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
slender sole - adult	8	535	8	455	7	425	6	240	29	7.25	0.96	1655	413.75	124.79
English sole - adult	4	670	6	1345	0	0	3	660	13	3.25	2.50	2675	668.75	549.13
Dover sole	0	0	4	970	1	415	2	220	7	1.75	1.71	1605	401.25	415.34
ratfish - adult	1	105	1	880	1	850	0	0	3	0.75	0.50	1835	458.75	471.21
spiny dogfish	1	430	0	0	1	465	1	400	3	0.75	0.50	1295	323.75	217.46
blackfin poacher	1	14	1	20	0	0	0	0	2	0.5	0.58	34	8.5	10.12
Pacific hake - adult	1	860	1	315	0	0	0	0	2	0.5	0.58	1175	293.75	405.66
quillback rockfish	1	340	0	0	1	385	0	0	2	0.5	0.58	725	181.25	210.09
ratfish - juvenile	0	0	0	0	1	14.5	1	32	2	0.5	0.58	46.5	11.625	15.21
rex sole - adult	2	250	0	0	0	0	0	0	2	0.5	1.00	250	62.5	125.00
soft sculpin	0	0	0	0	0	0	2	7	2	0.5	1.00	7	1.75	3.50
Pacific tomcod - juvenile	0	0	0	0	0	0	1	3.5	1	0.25	0.50	3.5	0.875	1.75
pallid eelpout	0	0	0	0	1	9	0	0	1	0.25	0.50	9	2.25	4.50
red brotula	0	0	0	0	0	0	1	25	1	0.25	0.50	25	6.25	12.50
spinyhead sculpin	0	0	1	70	0	0	0	0	1	0.25	0.50	70	17.5	35.00
TOTAL	19	3204	22	4055	13	2564	17	1587.5	71	17.75	3.77	11410	2852.5	1041.36

Appendix Table 4. cont'd.

STRATUM 135M AUTUMN 86 OTTER TRAWL

Common Name	PSDDA Sta 1 Abund	PSDDA Sta 1 Biomass	PSDDA Sta 2 Abund	PSDDA Sta 2 Biomass	PSDDA Sta 3 Abund	PSDDA Sta 3 Biomass	Sta G Abund	Sta G Biomass	Sta H Abund	Sta H Biomass	Tran 4 145S Abund	Tran 4 145S Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
slender sole - adult	2	69.5	16	760	6	240	3	125	8	400	1	75	36	5.83	5.56	1537.5	256.25	263.51
Pacific hake - juvenile	7	11	5	7	7	7.5	0	0	4	266	0	0	23	3.83	3.19	291.5	48.58	106.60
English sole - adult	3	785	2	640	3	960	4	1105	7	1730	0	0	19	3.17	2.32	4019	669.83	578.67
pallid eelpout	0	0	0	0	3	22.5	16	141	0	0	0	0	19	3.17	6.40	38.5	6.42	56.45
Pacific tomcod - juvenile	0	0	0	0	1	1.5	9	12.5	0	0	1	3	11	1.83	3.54	13.5	2.25	4.89
Dover sole	1	90	4	1610	0	0	2	575	1	445	0	0	8	1.33	1.51	2147	357.83	615.76
black eelpout	1	3.5	3	71.5	0	0	0	0	2	27	1	25	7	1.17	1.17	127	21.17	27.53
ratfish - adult	0	0	1	105	2	1390	0	0	3	510	1	315	7	1.17	1.17	2320	386.67	530.17
slender sole - juvenile	0	0	0	0	0	0	0	0	7	7.5	0	0	7	1.17	2.86	7.5	1.25	3.06
blackfin poacher	3	46	2	33	0	0	0	0	0	0	0	0	5	0.83	1.33	79	13.17	20.81
quillback rockfish	1	325	0	0	0	0	0	0	0	0	0	0	1	0.17	0.41	325	54.17	132.68
spiny dogfish	0	0	0	0	0	0	0	0	1	510	0	0	1	0.17	0.41	510	85.00	208.21
spinyhead sculpin	0	0	0	0	0	0	0	0	1	76	0	0	1	0.17	0.41	76	12.67	31.03
TOTAL	18	1330	33	3117	21	2622	34	1958.5	34	3971.5	4	418	144	24.00	12.05	11491.5	1915.25	1275.84

Appendix Table 4. cont'd.

STRATUM 100M AUTUMN 86 OTTER TRAWL

Common Name	Tran 2 110S Abund	Tran 2 110S Biomass	Tran 1 100M Abund	Tran 1 100M Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
ratfish - juvenile	8	180	2	80	10.00	5.00	4.24	260.00	130.00	70.71
Dover sole	7	575	2	405	9.00	4.50	3.54	980.00	490.00	120.21
English sole - adult	6	915	3	480	9.00	4.50	2.12	1395.00	697.50	307.59
quillback rockfish	3	485	4	665	7.00	3.50	0.71	1150.00	575.00	127.28
Pacific hake - adult	2	1035	2	475	4.00	2.00	0.00	1510.00	755.00	395.98
slender sole - adult	4	185	0	0	4.00	2.00	2.83	185.00	92.50	130.81
Pacific cod	3	695	0	0	3.00	1.50	2.12	695.00	347.50	491.44
rex sole - adult	1	0	2	100	3.00	1.50	0.71	100.00	50.00	70.71
black eelpout	0	0	2	55	2.00	1.00	1.41	55.00	27.50	38.89
Pacific tomcod - juvenile	0	0	2	4	2.00	1.00	1.41	4.00	2.00	2.83
soft sculpin	2	6.5	0	0	2.00	1.00	1.41	6.50	3.25	4.60
spiny dogfish	2	825	0	0	2.00	1.00	1.41	825.00	412.50	583.36
blackbelly eelpout	1	33	0	0	1.00	0.50	0.71	33.00	16.50	23.33
blacktip poacher	0	0	1	13.5	1.00	0.50	0.71	13.50	6.75	9.55
Pacific hake - juvenile	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
pallid eelpout	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
ratfish - adult	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
slender sole - juvenile	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
spinyhead sculpin	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	39	4934.5	20	2277.5	59.00	29.50	13.44	7212.00	3606.00	1676.78

Appendix Table 4. cont'd.

STRATUM 80M AUTUMN 86 OTTER TRAWL

Common Name	CAD 1		CAD 2		CAD 3							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biom	St Dev
English sole - adult	30	6170	72	10860	67	10970	169	56.33	22.94	27000	9000.00	3317.33
slender sole - adult	19	950	21	1090	28	1400	68	22.00	3.61	3440	1146.67	230.29
ratfish - juvenile	3	137.5	36	1090	16	240	55	18.33	16.62	1467.5	489.17	522.85
Pacific hake - adult	9	700	15	510	5	725	29	9.67	5.03	1935	645.00	117.58
ratfish - adult	3	412.5	5	1175	17	1510	25	8.33	7.57	3097.5	1032.50	562.46
Dover sole	0	0	2	370	2	246	4	1.33	1.15	616	205.00	188.22
quillback rockfish	0	0	2	610	2	545	4	1.33	1.15	1155	385.00	335.00
flathead sole	0	0	1	83	2	110	3	1.00	1.00	193	64.33	57.33
blackbelly eelpout	1	40.5	0	0	1	28.5	2	0.67	0.58	69	23.00	20.80
blackfin poacher	0	0	2	23.5	0	0	2	0.67	1.15	23.5	7.83	13.57
blacktip poacher	0	0	2	28	0	0	2	0.67	1.15	26	8.67	15.01
Pacific cod	0	0	1	2970	0	0	1	0.33	0.58	2970	990.00	1714.73
TOTAL	65	7411	159	18909	138	15774	362	120.67	49.34	41991.5	13997.17	5902.49

Appendix Table 4. cont'd.

STRATUM 40M AUTUMN 86 OTTER TRAWL

Common Name	Tran 1 488 Abund	Tran 1 488 Biomass	Tran 2 488 Abund	Tran 2 488 Biomass	Tran 4 488 Abund	Tran 4 488 Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
English sole - adult	17	370	52	2685	28	1765	97.00	32.33	17.90	4810.00	1603.33	1164.93
Pacific tomcod - juvenile	0	0	2	6.5	37	165	39.00	13.00	20.81	171.50	57.17	93.44
rock sole - adult	5	760	3	255	6	250	13.00	4.33	1.15	1265.00	421.67	293.02
Pacific tomcod - adult	12	60	0	0	0	0	12.00	4.00	6.93	60.00	20.00	34.64
slender sole - adult	4	90	3	38	4	120	11.00	3.67	0.58	248.00	82.00	42.57
quillback rockfish	6	350	2	112	1	31	9.00	3.00	2.65	493.00	164.33	165.81
pile perch - juvenile	6	30	2	21	0	0	8.00	2.67	3.06	51.00	17.00	15.39
speckled sanddab - adult	2	53	1	36	2	60	5.00	1.67	0.58	149.00	49.67	12.34
rex sole - adult	1	75	0	0	3	220	4.00	1.33	1.53	295.00	98.33	111.84
northern ronquil	0	0	1	5.5	2	23.5	3.00	1.00	1.00	29.00	9.67	12.29
Pacific sanddab - juvenile	1	8	2	30	0	0	3.00	1.00	1.00	38.00	12.67	15.53
rock sole - juvenile	2	39	0	0	0	0	2.00	0.67	1.15	39.00	13.00	22.52
shiner perch - adult	0	0	0	0	2	21	2.00	0.67	1.15	21.00	7.00	12.12
slim sculpin	0	0	0	0	2	4.5	2.00	0.67	1.15	4.50	1.50	2.60
bluespotted poacher	0	0	0	0	1	3	1.00	0.33	0.58	3.00	1.00	1.73
Dover sole	0	0	0	0	1	39.5	1.00	0.33	0.58	39.50	13.17	22.81
Pacific herring	0	0	0	0	1	4.5	1.00	0.33	0.58	4.50	1.50	2.60
roughback sculpin	1	24	0	0	0	0	1.00	0.33	0.58	24.00	8.00	13.86
slender sole - juvenile	1	9	0	0	0	0	1.00	0.33	0.58	9.00	3.00	5.20
TOTAL	58	1868	68	3187	88	2687	215.80	71.67	15.82	7752.00	2584.00	666.72

Appendix Table 4. cont'd.

STRATUM 20M AUTUMN 86 OTTER TRAWL

Common Name	Tran 1 288 Abund	Tran 1 288 Biomass	Tran 2 288 Abund	Tran 2 288 Biomass	Tran 4 288 Abund	Tran 4 288 Biomass	Tot Abund	Ave Abund	St Dev	Tot Biomass	Ave Biomass	St Dev
shiner perch - juvenile	0	0	3	36	19	175	22.00	7.33	10.21	210.00	70.00	92.60
English sole - adult	13	1300	5	510	3	325	21.00	7.00	5.29	2135.00	711.67	517.84
rock sole - adult	3	125	0	0	0	0	3.00	1.00	1.73	125.00	41.67	72.17
rock sole - juvenile	2	30	0	0	1	12	3.00	1.00	1.00	42.00	14.00	15.10
speckled sanddab - adult	1	23.6	0	0	2	48	3.00	1.00	1.00	71.50	23.83	24.00
slender sole - adult	0	0	0	0	2	116	2.00	0.67	1.15	115.00	38.33	66.40
English sole - juvenile	1	8.5	0	0	0	0	1.00	0.33	0.58	8.50	2.83	4.91
quillback rockfish	1	76	0	0	0	0	1.00	0.33	0.58	76.00	25.33	43.88
speckled sanddab - juvenile	0	0	0	0	1	17	1.00	0.33	0.58	17.00	5.67	9.81
starry flounder	0	0	1	415	0	0	1.00	0.33	0.58	415.00	138.33	239.60
TOTAL	21	1563	9	960	28	692	58.00	19.33	9.61	3215.00	1071.67	446.11

Appendix Table 5. Total, average (CPUE) and standard deviation of abundance and biomass (g) for bottomfish species caught by otter trawl from the RADCAD and 100M strata in Port Gardner during Winter 1987. Species are listed in decreasing order of total abundance.

RADCAD STRATUM WINTER 87 OTTER TRAWL

	Sta 1		Sta 2		Sta 3		Sta 5		Sta 6		Sta E							
Fish Species	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abun	Ave Abun	St Dev	Tot Biom	Ave Biom	St Dev
ratfish - adult	7	1830	7	2470	10	3000	11	1600	10	865	12	2200	57	9.50	2.59	11965.0	1994.17	748.84
Pacific hake - adult	10	3410	9	6710	9	3660	9	2680	1	365	14	4820	52	8.67	4.47	20435.0	3405.83	1626.80
slender sole - adult	15	660	1	80	3	145	8	425	1	120	15	710	43	7.17	6.82	2120.0	353.33	288.46
ratfish - juvenile	6	205	16	460	5	130	2	37	0	0	14	360	43	7.17	6.08	1192.0	198.67	181.48
English sole - adult	3	545	7	1329	4	885.5	2	420	2	.275	5	1100	23	3.83	1.75	4554.5	759.08	412.83
plainfin midshipman	0	0	0	0	0	0	2	180	2	125	2	87.5	6	1.00	1.97	392.5	65.42	77.47
longnose skate	0	0	0	0	0	0	2	2380	1	800	0	0	3	0.50	2.00	3160.0	526.67	953.45
Dover sole - adult	1	1005	0	0	0	0	0	0	1	260	1	430	3	0.50	1.86	1695.0	282.50	395.90
quillback rockfish	0	0	1	240	1	540	1	470	0	0	0	0	3	0.50	1.94	1250.0	208.33	248.87
blackfin poacher	0	0	2	40	0	0	0	0	0	0	1	14.4	3	0.50	1.97	54.4	9.07	16.21
blackbelly eelpout	1	25	1	20	0	0	1	1.9	0	0	0	0	3	0.50	1.94	46.9	7.82	11.51
blacktip poacher	2	20	0	0	0	0	0	0	1	5.8	0	0	3	0.50	1.97	25.8	4.27	8.03
walleye pollock	0	0	1	500	0	0	0	0	0	0	0	0	1	0.17	2.00	500.0	83.33	204.12
dogfish	1	335	0	0	0	0	0	0	0	0	0	0	1	0.17	2.00	335.0	55.83	136.76
Pacific tomcod	0	0	0	0	0	0	0	0	0	0	1	260	1	0.17	2.00	260.0	43.33	106.14
rex sole - adult	0	0	0	0	0	0	0	0	1	100	0	0	1	0.17	2.00	100.0	16.67	40.82
Liparis sp.	0	0	0	0	0	0	1	12	0	0	0	0	1	0.17	2.04	12.0	2.00	4.90
Pacific lamprey	0	0	0	0	1	7.7	0	0	0	0	0	0	1	0.17	2.00	7.7	1.28	3.14
blackfin eelpout	0	0	0	0	0	0	0	0	1	7.4	0	0	1	0.17	2.00	7.4	1.23	3.02
pallid eelpout	0	0	0	0	1	2.7	0	0	0	0	0	0	1	0.17	2.00	2.7	0.45	1.10
TOTAL	46	8135	45	10829	34	8371	39	8086	21	2913	65	9782	250	41.67	21.03	48115.7	8019.3	2728.3

STRATUM 100M W87 OTTER TRAWL

	Tran 1	100M
Fish Species	Abund	Biomass
English sole - adult	78	15518
ratfish - adult	46	11025
Pacific hake - adult	42	13360
slender sole - adult	36	2370
ratfish - juvenile	22	100
Dover sole - adult	2	1090
Pacific lamprey	2	13
quillback rockfish	2	450
rex sole - adult	2	120
TOTAL	232	44846

Appendix Table 6. Total, average (catch per unit effort-CPUE) and standard deviation of abundance and biomass (g) for bottom fish species caught by beam trawl from the RADCAD, 136M, 100M, 80M, 40M and 20M strata in Port Gardner during Winter 1986. Species are listed by their common names in decreasing order of abundance.

RADCAD STRATUM WINTER 1986 BEAM TRAWL

SPECIES	Sta 1		Sta 2		Sta 3							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	Stand Dev	Total Biom	Ave Biom	Stand Dev
ratfish - ad	2	355	3	640	1	160	6	2.00	1.00	1155	385.00	241.40
ratfish - juv	3	25	0	0	1	5	4	1.33	1.53	30	10.00	13.23
Pacific hake	0	0	2	970	0	0	2	0.67	1.15	970	323.33	560.03
Dover sole - ad	2	200	0	0	0	0	2	0.67	1.15	200	66.67	115.47
slender sole - ad	0	0	1	75	0	0	1	0.33	0.58	75	25.00	43.30
English sole - ad	1	470	0	0	0	0	1	0.33	0.58	470	156.67	271.35
slender - juv	1	1	0	0	0	0	1	0.33	0.58	1	0.33	0.58
plainfin midshipman	1	17	0	0	0	0	1	0.33	0.58	17	5.67	9.81
TOTAL	10	1068	6	1685	2	165	18	6	4.00	2918	972.667	764.47

Appendix Table 6. cont'd.

STRATUM 135M WINTER 96 BEAM TRAWL

SPECIES	Tran 2 130N		Tran 3 130M		Tran 3 130N		Tran 4 145S		Tran 4 135N		Tran 5 165S		Tran 5 145M		PSDDA Sta 1		PSDDA Sta 2		PSDDA Sta 3							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Ab	Ave Ab	St Dev	Tot Biom	Ave Biom	St Dev
blackbelly eelpout	0	0	0	0	0	0	0	0	0	0	0	0	2	6	26	95	2	10	NA	NA	30	3.33	8.54	111	12.33	31.21
slender sole - ad	0	0	0	0	1	15	3	95	2	70	0	0	2	135	1	60	0	0	NA	NA	9	1.00	1.12	375	41.67	50.44
ratfish - ad	3	750	1	145	0	0	0	0	0	0	0	0	0	0	0	0	2	80	NA	NA	6	0.67	1.12	975	108.33	246.04
blacktip poacher	0	0	0	0	0	0	1	2	1	10	0	0	1	9	0	0	1	4	NA	NA	4	0.44	0.53	25	2.78	4.08
Dover sole - ad	0	0	0	0	0	0	0	0	1	22	1	18	1	685	0	0	1	195	NA	NA	4	0.44	0.53	920	102.22	227.49
slender sole - juv	0	0	0	0	1	3	0	0	0	0	1	5	0	0	1	9	0	0	NA	NA	3	0.33	0.50	17	1.89	3.22
Pacific hake - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	265	NA	NA	1	0.11	0.33	265	29.44	88.33
TOTAL	3	750	1	145	2	18	4	97	4	102	2	23	6	835	28	164	7	564	0	0	57	6.33	8.35	2688	298.67	322.57

Appendix Table 6. cont'd.

STRATUM 100M WINTER 86 BEAM TRAWL

SPECIES	Tran 1 100M		Tran 2 110S		Tran 2 110M		Tran 2 100N		Tran 3 110S		Tran 4 110S		Tran 5 110S		Tran 7 100N		Tran 7 100M		Tran 7 100S							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Ab	Ave Ab	St Dev	Tot Biom	Ave Biom	St Dev
ratfish - ad	2	230	1	270	0	0	10	715	2	540	1	195	5	1300	1	200	2	260	2	180	28	2.60	2.91	3890	389.00	377.63
slender sole - ad	0	0	1	35	3	205	0	0	4	205	1	25	2	145	3	70	8	260	2	85	24	2.40	2.37	1030	103.00	94.61
Dover sole - ad	0	0	0	0	0	0	0	0	1	210	0	0	5	890	3	95	0	0	1	145	10	1.00	1.70	1340	134.00	276.22
Pacific hake - ad	0	0	0	0	0	0	2	250	0	0	1	170	0	0	0	0	0	0	2	280	5	0.50	0.85	700	70.00	115.85
ratfish - juv	0	0	0	0	0	0	1	26	0	0	1	22	0	0	0	0	0	0	2	12	4	0.40	0.70	59	5.90	10.03
slender sole - juv	1	2	1	1	0	0	0	0	1	2	0	0	0	0	1	10	0	0	0	0	4	0.40	0.52	15	1.50	3.10
plainfin midshipman	0	0	0	0	2	155	0	0	0	0	0	0	0	0	0	0	0	0	1	37	3	0.30	0.67	192	19.20	49.11
blacktip poacher	2	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.20	0.63	25	2.50	7.91
Dover sole - juv	0	0	0	0	0	0	0	0	1	1.5	0	0	0	0	0	0	0	0	1	2.63	2	0.20	0.42	4.13	0.41	0.81
English sole - ad	1	102	0	0	0	0	0	0	0	0	0	0	0	0	1	80	0	0	0	0	2	0.20	0.42	182	18.20	38.72
spinyhead sculpin	0	0	0	0	0	0	0	0	1	50	1	30	0	0	0	0	0	0	0	0	2	0.20	0.42	80	8.00	17.51
arrowtooth flounder - juv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	0.10	0.32	3	0.30	0.95
blackbelly eelpout	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	3	0.30	0.95
flathead sole- ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	90	0	0	0	0	1	0.10	0.32	90	9.00	28.46
rex sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	135	1	0.10	0.32	135	13.50	42.69
sablefish	0	0	0	0	0	0	0	0	0	0	1	435	0	0	0	0	0	0	0	0	1	0.10	0.32	435	43.50	137.56
TOTAL	6	359	3	306	5	360	14	983	10	1009	6	877	12	2335	10	545	10	520	13	879.6	89	8.90	3.70	8183.13	818.31	598.28

Appendix Table 6. cont'd.

STRATUM 80M WINTER 84 BEAM TRAWL

SPECIES	Tran 1 80S		T1 80M		Tran 2 80S		Tran 3 80S		Tran 4 80S		Tran 5 80S		Tran 6 80M		Tran 6 80S		Tran 7 80M		CAD 1		CAD 2		CAD 3							
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Tot Ab	Ave Ab	St Dev	Tot Biom	Ave Biom	St Dev
ratfish - ad	4	370	1	110	7	465	3	285	21	1235	1	110	0	0	4	330	2	270	11	860	3	230	4	835	61	5.08	5.82	5100	425.00	387.77
slender sole - juv	2	2	15	35	5	35	10	15	1	2	0	0	13	35	2	2	0	0	1	8	7	17	1	1	57	4.75	5.28	152	12.67	14.59
slender sole - ad	0		8	170	7	185	1	20	3	75	5	185	1	75	3	220	2	55	1	65	5	220	0	0	38	3.00	2.70	1270	105.83	81.50
blackkip poacher	2	40	7	35	3	25	2	18	2	7	0	0	2	5	3	15	1	2	0	0	2	8	1	5	25	2.08	1.63	160	13.33	13.59
blackbelly eelpout	0	0	2	25	0	0	8	35	5	75	0	0	0	0	0	0	4	13	0	0	2	5	1	17	22	1.83	2.59	170	14.17	22.46
Dover sole - ad	0	0	0	0	2	110	4	145	7	732	0	0	0	0	1	60	1	45	2	155	1	115	1	85	19	1.58	2.07	1447	120.58	201.03
English sole - ad	1	75	2	480	2	125	1	65	2	125	0	0	2	510	1	90	2	130	2	162	1	50	3	600	19	1.58	0.79	2412	201.00	204.61
plainfin midshipman	0	0	2	325	3	50	1	20	0	0	1	26	2	120	2	80	0	0	2	105	2	105	4	135	19	1.58	1.24	966	80.50	91.71
shiner perch - juv	0	0	0	0	0	0	2	15	9	52	1	10	0	0	0	0	0	0	0	0	0	0	0	0	12	1.00	2.59	77	6.42	15.18
slim sculpin	0	0	0	0	2	3	6	29	2	34	0	0	2	6	0	0	0	0	0	0	0	0	0	0	12	1.00	1.81	72	6.00	12.10
rex sole - ad	0	0	0	0	3	100	2	135	1	95	0	0	0	0	0	0	0	0	1	41	0	0	1	105	8	0.67	0.98	476	39.67	53.15
northern ronquil	0	0	0	0	2	25	4	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0.50	1.24	75	6.25	15.54
flathead sole- ad	0	0	2	255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	205	0	0	4	0.33	0.78	460	38.33	90.16
sanddab sp.	0	0	0	0	0	0	0	0	4	132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.33	1.15	132	11.00	38.11
spinyhead sculpin	1	15	0	0	0	0	1	24	0	0	0	0	0	0	0	0	0	0	0	0	1	55	1	65	4	0.33	0.49	159	13.25	23.25
C-O sole - ad	0	0	0	0	0	0	0	0	3	425	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.25	0.87	425	35.42	122.69
bluebarred prickleback	0	0	0	0	2	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.17	0.58	15	1.25	4.33
Pacific hake - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	35	0	0	1	105	0	0	2	0.17	0.39	140	11.67	31.07
ratfish - juv	0	0	1	15	0	0	0	0	0	0	0	0	0	0	1	25	0	0	0	0	0	0	0	0	2	0.17	0.39	40	3.33	8.07
rex sole - juv	0	0	0	0	1	3	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.17	0.39	5	0.42	1.00
staghorn sculpin	0	0	2	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.17	0.58	45	3.75	12.99
Dover sole - juv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0.08	0.29	1	0.08	0.29
eelpout sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	0.08	0.29	3	0.25	0.87
English sole - juv	0	0	0	0	0	0	0	0	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	8	0.67	2.31
Pacific cod	0	0	0	0	1	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	110	9.17	31.75
Pacific tomcod - ad	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	15	1.25	4.33
Pacific tomcod - juv	0	0	0	0	0	0	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	25	2.08	7.22
quillback rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	305	0	0	0	0	1	0.08	0.29	305	25.42	88.05
shiner perch - ad	0	0	0	0	0	0	0	0	0	0	1	27	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	27	2.25	7.79
snailfish sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	0.08	0.29	3	0.25	0.87
TOTAL	11	517	42	1495	40	1251	47	883	61	2997	9	358	22	751	17	822	13	550	21	1701	28	1116	19	1854	330	27.50	16.37	14295	1191.25	741.41

Appendix Table 6. cont'd.

STRATUM 40M WINTER 86 BEAM TRAWL

SPECIES	Tran 1 40S		Tran 1 40N		Tran 2 40S		Tran 3 40S		Tran 4 40S		Tran 5 40S		Tran 6 40N		Tran 7 40N							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
shiner perch - juv	12	55	340	2010	0	0	1	5	3	12	95	495	1	5	50	270	502	62.75	114.97	2852	356.50	891.22
English sole - juv	39	340	3	40	30	280	5	40	4	30	0	0	0	0	25	410	106	13.25	15.54	1140	142.50	170.61
English sole - ad	0	0	36	2129	28	915	0	0	1	10	8	210	11	21	0	0	85	10.63	14.83	3285	410.63	782.10
staghorn sculpin	10	535	13	1905	10	245	0	0	0	0	2	126	19	2510	27	526	81	10.13	9.58	5845	730.63	948.39
blackbelly eelpout	0	0	25	120	24	90	0	0	0	0	3	10	25	195	0	0	77	9.63	12.50	415	51.88	74.73
sanddab sp.	21	480	3	100	10	260	3	50	1	20	2	65	5	95	3	65	48	6.00	6.65	1135	141.88	154.62
slender sole - juv	7	17	4	45	7	31.5	4	50	0	0	5	11	5	20	10	12	42	5.25	2.92	186.5	23.31	17.42
shiner perch - ad	0	0	0	0	26	205	0	0	0	0	0	0	2	50	0	0	28	3.50	9.12	255	31.88	72.11
slim sculpin	4	5	0	0	3	14	7	10	1	5	3	12	0	0	8	8	26	3.25	3.01	54	6.75	5.20
Dover sole - ad	0	0	6	107	11	200	0	0	0	0	7	345	0	0	0	0	24	3.00	4.38	652	81.50	129.47
plainfin midshipman	0	0	2	70	0	0	0	0	0	0	0	0	17	615	1	1	20	2.50	5.90	686	85.75	215.24
quillback rockfish	2	10	0	0	4	110	0	0	0	0	13	260	0	0	0	0	19	2.38	4.53	380	47.50	93.92
northern ronquil	0	0	0	0	2	30	2	10	0	0	3	40	4	30	0	0	11	1.38	1.60	110	13.75	16.85
pile perch - ad	1	12	8	287	1	10	0	0	0	0	0	0	0	0	0	0	10	1.25	2.76	309	38.63	100.48
Pacific tomcod - ad	0	0	9	135	0	0	0	0	0	0	0	0	0	0	0	0	9	1.13	3.18	135	16.88	47.73
rex sole - ad	0	0	4	205	1	20	0	0	0	0	2	80	1	85	0	0	8	1.00	1.41	390	48.75	72.74
rock sole - ad	4	100	0	0	1	12	0	0	0	0	3	450	0	0	0	0	8	1.00	1.60	562	70.25	157.28
slender sole - ad	0	0	5	390	0	0	0	0	0	0	2	30	1	15	0	0	8	1.00	1.77	435	54.38	136.05
blacktip poacher	1	1	2	20	1	2	0	0	0	0	3	8	0	0	0	0	7	0.88	1.13	31	3.88	7.06
flathead sole- ad	0	0	2	100	4	335	0	0	0	0	0	0	1	55	0	0	7	0.88	1.46	490	61.25	116.64
Pacific tomcod - juv	0	0	0	0	3	25	0	0	0	0	2	5	0	0	0	0	5	0.63	1.19	30	3.75	8.76
rock sole - juv	0	0	0	0	0	0	4	80	0	0	0	0	0	0	0	0	4	0.50	1.41	80	10.00	28.28
roughback sculpin	0	0	0	0	0	0	0	0	0	0	4	60	0	0	0	0	4	0.50	1.41	60	7.50	21.21
sand sole - ad	0	0	0	0	0	0	0	0	1	80	0	0	3	200	0	0	4	0.50	1.07	280	35.00	72.31
sculpin sp.	0	0	0	0	4	70	0	0	0	0	0	0	0	0	0	0	4	0.50	1.41	70	8.75	24.75
ratfish - ad	0	0	0	0	0	0	0	0	1	52	1	440	1	255	0	0	3	0.38	0.52	747	93.38	165.43
sand sole - juv	0	0	0	0	0	0	0	0	0	0	0	0	3	25	0	0	3	0.38	1.06	25	3.13	8.84
pygmy poacher	0	0	0	0	0	0	0	0	0	0	0	0	1	0.5	1	1.5	2	0.25	0.46	2	0.25	0.53
sturgeon poacher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	2	0.25	0.71	6	0.75	2.12
bay pipefish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.5	1	0.13	0.35	0.5	0.06	0.18
crescent gunnel	0	0	0	0	0	0	0	0	0	0	0	0	1	85	0	0	1	0.13	0.35	85	10.63	30.05
Dover sole - juv	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	1	0.13	0.35	2	0.25	0.71
snake prickleback	0	0	0	0	0	0	1	10	0	0	0	0	0	0	0	0	1	0.13	0.35	10	1.25	3.54
TOTAL	101	1555	464	7663	171	2855	28	257	12	209	166	2646	101	4282	128	1299	1161	145.13	140.48	20745	2593.13	2462.64

Appendix Table 6. cont'd.

STRATUM 20M WINTER 86 BEAM TRAWL

SPECIES	Tran 1 20S		Tran 2 20S		Tran 3 20S		Tran 4 20S		Tran 5 20S		Tran 6 20N		Tran 7 20N							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abunc	St Dev	Tot Biom	Ave Biom	St Dev
rock sole - juv	2	6	8	235	9	25	11	45	2	10	0	0	0	0	32	4.57	4.61	321	45.86	84.94
slender sole - juv	2	4	3	5	1	1.5	3	2.5	0	0	8	13	12	20	29	4.14	4.30	46	6.57	7.26
quillback rockfish	0	0	7	25	0	0	0	0	16	135	0	0	0	0	23	3.29	6.18	160	22.86	50.32
tubesnout	0	0	14	80	0	0	0	0	0	0	0	0	0	0	14	2.00	5.29	80	11.43	30.24
English sole - juv	0	0	0	0	0	0	0	0	0	0	8	50	4	15	12	1.71	3.15	65	9.29	18.80
snake prickleback	0	0	0	0	0	0	0	0	9	20	0	0	0	0	9	1.29	3.40	20	2.86	7.56
slim sculpin	0	0	0	0	1	2	0	0	3	9	2	2	2	3.8	8	1.14	1.21	16.8	2.26	2.91
sand sole - juv	0	0	0	0	0	0	0	0	0	0	4	16	1	1	5	0.71	1.50	17	2.43	6.00
speckled sanddab - ad	0	0	0	0	0	0	5	120	0	0	0	0	0	0	5	0.71	1.89	120	17.14	45.36
staghorn sculpin	0	0	1	25	0	0	0	0	0	0	2	15	2	25	5	0.71	0.85	65	9.29	12.05
longfin smelt - ad	0	0	0	0	0	0	0	0	0	0	3	8	0	0	3	0.43	1.13	8	1.14	3.02
sanddab sp.	0	0	1	10	0	0	0	0	1	10	0	0	1	1.4	3	0.43	0.53	21.4	3.06	4.77
C-O sole - ad	1	215			0	0	0	0	1	205	0	0	0	0	2	0.29	0.52	420	60.00	108.49
plainfin midshipman	0	0	0	0	0	0	0	0	0	0	1	2	1	1.2	2	0.29	0.49	3.2	0.46	0.81
rock sole - ad	0	0	0	0	0	0	2	60	0	0	0	0	0	0	2	0.29	0.76	60	8.57	22.68
saddleback gunnel	0	0	1	1.5	0	0	0	0	0	0	0	0	1	2.75	2	0.29	0.49	4.25	0.61	1.10
sand sole - ad	0	0	0	0	0	0	0	0	0	0	2	165	0	0	2	0.29	0.76	165	23.57	62.36
sculpin sp.	0	0	0	0	0	0	0	0	2	85	0	0	0	0	2	0.29	0.76	85	12.14	32.13
speckled sanddab - juv	0	0	0	0	0	0	2	34.5	0	0	0	0	0	0	2	0.29	0.76	34.5	4.93	13.04
bay pipefish	0	0	1	0.75	0	0	0	0	0	0	0	0	0	0	1	0.14	0.38	0.75	0.11	0.28
buffalo sculpin	0	0	0	0	0	0	0	0	1	165	0	0	0	0	1	0.14	0.38	165	23.57	62.36
daubed shanny	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	0.14	0.38	3	0.43	1.13
grunt sculpin	0	0	0	0	0	0	0	0	1	3	0	0	0	0	1	0.14	0.38	3	0.43	1.13
northern ronquil	0	0	0	0	0	0	0	0	1	30	0	0	0	0	1	0.14	0.38	30	4.29	11.34
shiner perch - juv	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	0.14	0.38	3	0.43	1.13
TOTAL	6	225	36	382.25	11	28.5	23	262	37	671	32	277	24	70.15	168	24.00	12.30	1915.9	273.70	213.58

Appendix Table 7. Total, average (catch per unit effort-CPUE) and standard deviation of abundance and biomass (g) for bottom fish species caught by beam trawl from the RADCAD, 136M, 100M, 80M, 40M and 20M strata in Port Gardner during Spring 1986. Species are listed by their common names in decreasing order of abundance.

RADCAD STRATUM SPRING 1986 BEAM TRAWL

	Sta 1		Sta 2		Sta 3							
SPECIES	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	Stand Dev	Total Biom	Ave Biom	Stand Dev
blackfin poacher	0	0	2	30	0	0	2	0.67	1.15	30	10.00	17.32
Dover sole - ad	0	0	0	0	1	460	1	0.33	0.58	460	153.33	265.58
longnose skate	0	0	2	1000	0	0	2	0.67	1.15	1000	333.33	577.35
ratfish - ad	5	770	7	1045	1	125	13	4.33	3.06	1940	646.67	472.24
ratfish - juv	6	65	2	35	0	0	8	2.67	3.06	100	33.33	32.53
slender sole - ad	4	285	8	340	5	195	17	5.67	2.08	820	273.33	73.20
slender sole - juv	1	4	0	0	0	0	1	0.33	0.58	4	1.33	2.31
staghorn sculpin	0	0	0	0	2	65	2	0.67	1.15	65	21.67	37.53
TOTAL	16	1124	21	2450	9	845	46	15.3333	6.03	4419	1473	857.53

Appendix Table 7. cont'd.

STRATUM 135M SPRING 86 BEAM TRAWL

SPECIES	Tran 2 130N		Tran 3 130M		Tran 3 130N		Tran 4 145S		Tran 4 135N		Tran 6 185S		Tran 5 145M		PSDDA Sta 1		PSDDA Sta 2		PSDDA Sta 3							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Ab	Ave Ab	St Dev	Tot Biom	Ave Biom	St Dev
slender sole - ad			2	110	4	250	1	30	2	155	1	55	0	0	2	110	5	410	1	60	18	2.00	1.58	1170	130.00	129.01
ratfish - ad			0	0	0	0	3	400	3	1550	6	1675	0	0	0	0	1	240	1	190	14	1.56	2.07	4055	450.58	674.06
blackfin poacher			1	23	0	0	0	0	0	0	0	0	0	0	0	0	2	30	0	0	3	0.33	0.71	53	5.89	11.82
Dover sole - ad			1	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	230	2	0.22	0.44	390	43.33	87.75
slender sole - juv			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	0.11	0.33	3	0.33	1.00
Dover sole - juv			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1.5	0	0	1	0.11	0.33	1.5	0.17	0.50
ratfish - juv			0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0.11	0.33	3	0.33	1.00
blacktip poacher			0	0	1	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.11	0.33	17	1.89	5.67
rex sole - juv			0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0.11	0.33	1	0.11	0.33
spinyhead sculpin			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	70	0	0	1	0.11	0.33	70	7.78	23.33
longnose skate			1	635	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.11	0.33	635	70.56	211.67
TOTAL			5	928	5	267	5	433	5	1705	7	1730	0	0	3	111	11	754.5	3	470	44	4.89	3.02	6398.5	710.94	639.67

ppendix Table 7. cont'd.

STRATUM 100M SPRING 88 BEAM TRAWL

PECIES	Tran 1 100M		Tran 2 110S		Tran 2 110M		Tran 2 100N		Tran 3 110S		Tran 4 110S		Tran 5 110S		Tran 7 100N		Tran 7 100M		Tran 7 100S							
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Tot Ab	Ave Ab	St Dev	Tot Biom	Ave Biom	St Dev
atfish - juv	6	173	0	0	2	26	5	145	1	20	0	0	0	0	4	45	4	60	7	70	29	2.90	2.64	538	53.80	61.06
Dover sole - ad	5	420	0	0	12	1640	1	215	1	210	2	80	1	80	2	80	1	12	1	320	26	2.60	3.57	2957	295.70	457.73
atfish - ad	4	165	0	0	0	0	5	900	4	600	7	970	0	0	1	70	1	155	3	335	25	2.50	2.46	3225	322.50	372.68
lender sole - ad	9	476	2	72	0	0	4	280	1	40	2	80	0	0	4	170	2	70	1	60	25	2.50	2.68	1237	123.70	149.25
lackbelly eelpout	0	0	0	0	1	20	0	0	0	0	2	55	0	0	1	25	6	80.3	0	0	10	1.00	1.89	180.3	18.03	28.38
lender sole - juv	0	0	0	0	7	255	0	0	1	3.5	0	0	0	0	0	0	1	4.1	0	0	9	0.90	2.18	262.6	26.26	80.39
English sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	270	1	280	0	0	3	0.30	0.67	550	55.00	115.97
lacktip poacher	0	0	0	0	0	0	2	11.6	0	0	0	0	0	0	1	10	0	0	0	0	3	0.30	0.67	21.6	2.16	4.57
lackfin poacher	0	0	0	0	0	0	0	0	0	0	1	15	0	0	0	0	0	0	1	15	2	0.20	0.42	30	3.00	6.32
lackfin eelpout	0	0	0	0	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	15	1.50	4.74
lainfin midshipman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	90	0	0	1	0.10	0.32	90	9.00	28.46
ed brotula	0	0	0	0	0	0	0	0	1	80	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	80	8.00	25.30
ex sole - ad	1	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	110	11.00	34.79
Pacific hake - ad	1	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	150	15 00	47.43
lathead sole- ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45	0	0	0	0	1	0.10	0.32	45	4.50	14.23
OTAL	26	1623	2	72	23	1655	17	1552	9	953.5	14	1200	1	80	16	715	17	751	13	790	138	13.80	8.07	9492	949.15	598.15

Appendix Table 7. cont'd.

STRATUM 80M SPRING 86 BEAM TRAWL

SPECIES	Tran 1 80S		Tran 1 80N		Tran 2 80S		Tran 3 80S		Tran 4 80S		Tran 5 80S		Tran 6 80M		Tran 6 80S		Tran 7 80N		CAD 1		CAD 2		CAD 3							
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	TotAb	Ave Ab	St Dev	Tot Biom	Ave Biom	St Dev
blackbelly eelpout	2	25	6	75	2	15	4	80	4	40	0	0	9	160	1	20	13	140	13	80	3	65	11	230	68	5.67	4.68	900.4	75.03	68.86
ratfish - ad	4	416	0	0	8	490	2	146	2	70	3	165	3	235	13	1070	1	90	3	200	4	222	11	1080	54	4.50	4.03	4192	349.33	367.63
slender sole - ad	7	240	0	0	1	7	0	0	2	80	1	160	5	285	2	65	6	170	7	270	8	400	15	625	53	4.42	4.40	2302	191.83	187.31
blacktip poacher	8	70	5	21	2	8	0	0	2	20	1	9	4	15	0	0	6	60	1	2	4	30	5	30	38	3.17	2.55	285	22.08	22.69
slender sole - juv	2	6	2	5	2	2	0	0	1	2	1	1.5	5	20	2	10	1	3	3	6	6	20	7	30	32	2.67	2.19	105.5	8.79	9.48
Dover sole - ad	7	352	0	0	2	70	5	130	1	15	0	0	0	0	3	435	0	0	1	35	1	73	1	140	21	1.75	2.22	1250	104.17	144.95
ratfish - juv	1	10	0	0	3	80	0	0	0	0	0	0	1	25	0	0	1	30	0	0	1	25	13	370	20	1.67	3.68	540	45.00	104.99
bluebarred prickleback	0	0	0	0	1	1.74	5	20	4	25	2	7	0	0	0	0	3	15	0	0	0	0	0	0	15	1.25	1.82	68.74	5.73	9.09
Pacific hake - ad	0	0	1	9	0	0	0	0	0	0	0	0	0	0	0	0	2	25	3	70	8	180	0	0	14	1.17	2.37	284	23.67	53.33
plainfin midshipman	2	135	2	200	2	122	0	0	0	0	0	0	1	35	3	95	2	185	0	0	0	0	0	0	12	1.00	1.13	772	64.33	78.58
English sole - ad	1	80	0	0	0	0	0	0	0	0	0	0	0	0	2	250	1	175	6	780	0	0	1	335	11	0.92	1.73	1620	135.00	233.83
flathead sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	2	115	0	0	0	0	6	890	0	0	0	0	8	0.67	1.78	1005	83.75	256.05
Dover sole - juv	1	2.5	0	0	2	3	0	0	2	5	0	0	0	0	0	0	0	0	1	1.2	0	0	1	2.3	7	0.58	0.79	14	1.17	1.67
Pacific tomcod - ad	2	40	0	0	0	0	0	0	0	0	1	30	0	0	0	0	0	0	2	40	0	0	0	0	5	0.42	0.79	110	9.17	16.76
rex sole - ad	0	0	0	0	0	0	1	30	1	45	0	0	0	0	0	0	0	0	2	190	1	32	0	0	5	0.42	0.67	297	24.75	54.52
slim sculpin	0	0	0	0	0	0	1	12	0	0	1	1.2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.17	0.39	13.22	1.10	3.45
quillback rockfish	0	0	0	0	0	0	0	0	0	0	1	102	0	0	1	210	0	0	0	0	0	0	0	0	2	0.17	0.39	312	26.00	64.94
rex sole - juv	0	0	0	0	0	0	1	2.6	0	0	0	0	0	0	0	0	1	3.2	0	0	0	0	0	0	2	0.17	0.39	5.8	0.48	1.14
saddleback gunnel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	10	0	0	0	0	2	0.17	0.58	10	0.83	2.89
shiner perch - juv	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	3	0.25	0.87
snake prickleback	0	0	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	15	1.25	4.33
pygmy poacher	0	0	0	0	1	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	1.1	0.09	0.32
northern ronquil	0	0	0	0	0	0	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	15	1.25	4.33
blackfin poacher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	1	0.08	0.29	6	0.50	1.73
spinyhead sculpin	0	0	0	0	0	0	1	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	80	6.67	23.09
daubed shanny	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.7	0	0	1	0.08	0.29	0.7	0.06	0.20
TOTAL	37	1376	17	325	26	800	21	495	20	305	11	478	30	890	27	2155	38	887	50	2674	37	1038	68	2858	378	31.50	15.19	14187.46	1182.29	881.16

Appendix Table 7. cont'd.

STRATUM 40M SPRING 86 BEAM TRAWL

SPECIES	Tran 1 40S Abund	Tran 1 40S Biomass	Tran 2 40S Abund	Tran 2 40S Biomass	Tran 3 40S Abund	Tran 3 40S Biomass	Tran 4 40S Abund	Tran 4 40S Biomass	Tran 5 40S Abund	Tran 5 40S Biomass	Tran 6 40N Abund	Tran 6 40N Biomass	Tran 7 40N Abund	Tran 7 40N Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
English sole - ad	13	300	0	0	2	40	0	0	14	1170	51	2010	12	360	92	13.14	17.82	3880	554.29	761.53
English sole - juv	52	510	1	8	2	25	1	7	2	22	19	215	4	60	81	11.57	18.95	847	121.00	186.49
sanddab sp.	26	690	0	0	2	60	4	95	3	330	16	435	9	285	60	8.57	9.38	1895	270.71	243.27
staghorn sculpin	2	50	0	0	2	282	3	60	0	0	20	1300	23	1215	50	7.14	9.91	2907	415.29	583.75
shiner perch - juv	13	80	0	0	0	0	0	0	0	0	24	145	1	5	38	5.43	9.48	230	32.86	57.58
snake prickleback	1	13	0	0	0	0	0	0	0	0	18	220	10	135	29	4.14	7.13	368	52.57	88.93
blackbelly eelpout	3	11	0	0	0	0	0	0	0	0	7	25	14	65	24	3.43	5.35	101	14.43	24.20
Dover sole - juv	3	10	1	1.9	11	30	5	11	3	6	0	0	1	3.7	24	3.43	3.74	62.6	8.94	10.12
slim sculpin	1	3	1	1.25	6	7	5	8	3	10	2	4	0	0	18	2.57	2.23	33.25	4.75	3.69
slender sole - juv	9	45	2	3	0	0	1	2	0	0	2	5	0	0	14	2.00	3.21	55	7.86	16.49
quillback rockfish	3	40	0	0	0	0	0	0	6	410	1	610	0	0	10	1.43	2.30	1060	151.43	252.09
rock sole - ad	1	35	0	0	0	0	0	0	6	510	0	0	0	0	7	1.00	2.24	545	77.86	191.00
northern ronquil	0	0	0	0	2	3	1	10	1	18	0	0	0	0	4	0.57	0.79	31	4.43	7.02
plainfin midshipman	2	225	0	0	0	0	0	0	0	0	0	0	2	80	4	0.57	0.98	305	43.57	85.38
pygmy poacher	0	0	1	1.7	1	0.6	1	0.73	1	1.5	0	0	0	0	4	0.57	0.53	4.53	0.65	0.72
sand sole - ad	0	0	0	0	0	0	0	0	0	0	4	150	0	0	4	0.57	1.51	150	21.43	56.69
Pacific tomcod - juv	1	10	0	0	0	0	0	0	0	0	2	15	0	0	3	0.43	0.79	25	3.57	6.27
rex sole - ad	0	0	0	0	0	0	0	0	0	0	1	40	2	65	3	0.43	0.79	105	15.00	26.61
roughback sculpin	0	0	2	35	0	0	1	8	0	0	0	0	0	0	3	0.43	0.79	43	6.14	13.07
Dover sole - ad	1	20	0	0	0	0	0	0	0	0	1	30	0	0	2	0.29	0.49	50	7.14	12.54
rock sole - juv	0	0	1	10	1	4.2	0	0	0	0	0	0	0	0	2	0.29	0.49	14.2	2.03	3.85
shiner perch - ad	0	0	0	0	0	0	0	0	0	0	2	45	0	0	2	0.29	0.76	45	6.43	17.01
slender sole - ad	0	0	0	0	0	0	0	0	0	0	2	120	0	0	2	0.29	0.76	120	17.14	45.36
sturgeon poacher	2	15	0	0	0	0	0	0	0	0	0	0	0	0	2	0.29	0.76	15	2.14	5.67
arrowtooth flounder - juv	1	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0.14	0.38	5	0.71	1.89
bluebarred prickleback	1	13	0	0	0	0	0	0	0	0	0	0	0	0	1	0.14	0.38	13	1.86	4.91
TOTAL	135	2075	9	60.85	29	451.8	22	201.73	39	2477.5	172	5369	78	2273.7	484	69.14	62.39	12909.58	1844.23	1865.47

Appendix Table 7. cont'd.

STRATUM 20M SPRING 86 BEAM TRAWL

SPECIES	Tran 1 20S		Tran 2 20S		Tran 3 20S		Tran 4 20S		Tran 5 20S		Tran 6 20N		Tran 7 20N							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
sanddab sp.	4	52	5	113.4	2	65	8	85	7	150	0	0	3	90	29	4.14	2.70	555.4	79.34	47.52
Dover sole - juv	2	6	2	8	0	0	0	0	0	0	3	10	10	20	17	2.43	3.55	44	6.29	7.34
rock sole - juv	0	0	0	0	0	0	3	18	4	20	0	0	2	15	9	1.29	1.70	53	7.57	9.55
quillback rockfish	0	0	6	73	0	0	0	0	3	20	0	0	0	0	9	1.29	2.38	93	13.29	27.37
slim sculpin	1	2	0	0	0	0	1	1.5	3	11	0	0	2	3	7	1.00	1.15	17.5	2.50	3.93
northern ronquil	0	0	0	0	2	20	0	0	5	110	0	0	0	0	7	1.00	1.81	130	18.57	41.00
English sole - juv	0	0	0	0	0	0	1	4.5	0	0	0	0	5	55	6	0.86	1.88	59.5	8.50	20.57
C-O sole - ad	0	0	2	460	0	0	0	0	4	810	0	0	0	0	6	0.86	1.57	1270	181.43	325.91
roughback sculpin	0	0	1	6	1	15	0	0	3	15	0	0	0	0	5	0.71	1.11	36	5.14	7.08
slender sole - juv	0	0	0	0	0	0	0	0	0	0	0	0	4	12.5	4	0.57	1.51	12.5	1.79	4.72
pygmy poacher	1	0.43	0	0	1	1.6	0	0	0	0	1	1	1	0.4	4	0.57	0.53	3.43	0.49	0.81
English sole - ad	0	0	0	0	0	0	0	0	0	0	1	15	2	245	3	0.43	0.79	260	37.14	91.83
staghorn sculpin	0	0	1	400	1	320	0	0	0	0	0	0	0	0	2	0.29	0.49	720	102.86	177.17
snake prickleback	0	0	0	0	0	0	0	0	0	0	0	0	2	10	2	0.29	0.76	10	1.43	3.78
sand sole - ad	0	0	1	230	0	0	0	0	1	60	0	0	0	0	2	0.29	0.49	290	41.43	86.11
buffalo sculpin	0	0	0	0	0	0	0	0	2	35	0	0	0	0	2	0.29	0.76	35	5.00	13.23
ratfish - ad	0	0	0	0	0	0	1	410	0	0	0	0	0	0	1	0.14	0.38	410	58.57	154.97
rex sole - juv	0	0	0	0	0	0	0	0	0	0	1	6	0	0	1	0.14	0.38	6	0.86	2.27
TOTAL	8	62.43	18	1288.4	7	421.6	14	519	32	1231	6	32	31	450.9	116	16.57	11.04	4005.33	572.19	506.44

Appendix Table 8. Total, average (catch per unit effort-CPUE) and standard deviation of abundance and biomass (g) for bottom fish species caught by beam trawl from the RADCAD, 136M, 100M, 80M, 40M and 20M strata in Port Gardner during Summer 1988. Species are listed by their common names in decreasing order of abundance.

RADCAD STRATUM SUMMER 1988 BEAM TRAWL

SPECIES	Sta A Abund	Sta A Biomass	Sta 1 Abund	Sta 1 Biomass	Sta 2 Abund	Sta 2 Biomass	Sta 3 Abund	Sta 3 Biomass	Tot Abund	Ave Abund	Stand Dev	Total Biom	Ave Biom	Stand Dev
ratfish - juv	4	74.5	2	25.5	0	0	0	0	6	1.50	1.91	100	25.00	35.12
Dover sole - ad	0	0	0	0	1	219.5	1	204	2	0.50	0.58	423.5	105.88	122.42
tadpole sculpin	2	3	0	0	0	0	0	0	2	0.50	1.00	3	0.75	1.50
slender sole - ad	2	71	0	0	0	0	0	0	2	0.50	1.00	71	17.75	35.50
blackbelly eelpout	0	0	0	0	1	11	0	0	1	0.25	0.50	11	2.75	5.50
blackfin poacher	1	11	0	0	0	0	0	0	1	0.25	0.50	11	2.75	5.50
quillback rockfish	1	192	0	0	0	0	0	0	1	0.25	0.50	192	48.00	96.00
slender sole - juv	1	7	0	0	0	0	0	0	1	0.25	0.50	7	1.75	3.50
TOTAL	11	358.5	2	25.5	2	230.5	1	204	16	4.00	4.69	618.5	204.63	137.15

Appendix Table 8. cont'd.

STRATUM 135M SUMMER 86 BEAM TRAWL

SPECIES	Tran 2 130N		Tran 3 130M		Tran 3 130N		Tran 4 145S		Tran 4 135N		Tran 6 165S		Tran 6 145M		PSDDA Sta 1		PSDDA Sta 2		PSDDA Sta 3							
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	TotAb	AveAb	St Dev	Tot Biom	Ave Biom	St Dev
Dover sole - ad	1	324	0	0	1	370	6	281.5	0	0	0	0	0	0	0	0	0	0	0	0	8	0.80	1.87	975.5	97.55	158.45
blackfin poacher	0	0	1	15	0	0	0	0	1	9.5	0	0	4	29	1	10	0	0	0	0	7	0.70	1.25	63.5	6.35	9.74
slender sole - ad	0	0	1	19	1	72.5	2	111	0	0	1	60.5	1	55	0	0	1	33	0	0	7	0.70	0.67	351	35.10	36.58
blackfin eelpout	0	0	0	0	0	0	4	105	0	0	0	0	0	0	0	0	0	0	0	0	4	0.40	1.26	105	10.50	33.20
sanddab sp.	0	0	0	0	0	0	4	53.5	0	0	0	0	0	0	0	0	0	0	0	0	4	0.40	1.26	53.5	5.35	16.92
ratfish - juv	0	0	0	0	0	0	0	0	0	0	0	0	1	8	1	26.5	1	9	0	0	3	0.30	0.48	43.5	4.35	8.55
quillback rockfish	1	159	0	0	0	0	1	319	0	0	0	0	0	0	0	0	0	0	0	0	2	0.20	0.42	478	47.80	107.60
rex sole - juv	0	0	1	4	0	0	0	0	0	0	1	2.5	0	0	0	0	0	0	0	0	2	0.20	0.42	6.5	0.65	1.42
spinyhead sculpin	0	0	1	57	1	70.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.20	0.42	127.5	12.75	27.07
Dover sole - juv	0	0	0	0	0	0	1	7.5	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	7.5	0.75	2.37
longnose skate	0	0	0	0	0	0	1	540	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	540	54.00	170.76
ratfish - ad	0	0	0	0	0	0	1	410	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	410	41.00	129.65
TOTAL	2	483	4	95	3	513	20	1828	1	9.5	2	63	6	92	2	36.5	2	42	0	0	42	4.20	5.79	3161.5	316.15	563.85

Appendix Table 8. cont'd.

STRATUM 100M SUMMER [illegible] BEAM TRAWL

SPECIES	T1 100M		T2 110S		T2 110M		T2 100N		T3 110S		T4 110S		T5 110S		T7 100N		T7 100M		T7 100S		Sta B		Sta C		Sta D							
	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Ab	Blom	Tot Ab	Ave Ab	St Dev	Tot Blom	Ave Blom	St Dev
ratfish - ad	0	0	5	549	0	0	2	238	1	77	3	806	3	636	0	0	0	0	1	165	1	80	0	0	0	0	18	1.23	1.59	2530.2	194.63	282.45
slender sole - ad	0	0	1	30	0	0	0	0	0	0	0	0	0	0	3	58	2	51	0	0	1	18	1	32	0	0	8	0.62	0.96	186.5	14.35	21.32
Dover sole - ad	0	0	1	53	0	0	0	0	0	0	0	0	0	0	2	457	0	0	1	361	0	0	0	0	1	356	5	0.38	0.65	1227	94.38	171.49
blackfin poacher	0	0	0	0	0	0	1	12.5	0	0	1	20.5	0	0	0	0	0	0	0	0	1	14	0	0	0	0	3	0.23	0.44	46.5	3.58	7.03
ratfish - juv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	30	1	11	1	102	0	0	0	0	0	0	3	0.23	0.44	142.5	10.96	28.65
slender sole - jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	1	6	2	0.15	0.38	13	1.00	2.45
blackfin eelpout	0	0	0	0	0	0	0	0	0	0	0	0	1	18	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.28	18	1.38	4.99
dogfish	0	0	1	257	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.28	257	19.77	71.28
red brotula	0	0	0	0	0	0	0	0	0	0	1	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.28	136	10.46	37.72
rex sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	162	0	0	0	0	0	0	1	0.08	0.28	162	12.46	44.93
rex sole - juv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	1	0.08	0.28	4	0.31	1.11
spinyhead sculpin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45	0	0	0	0	0	0	0	0	0	0	1	0.08	0.28	45	3.46	12.48
TOTAL	0	0	8	889	0	0	3	249	1	77	5	964	4	654	7	590	3	62	4	790	3	89	2	39	3	366	43	3.31	2.39	4767.7	366.75	363.46

Appendix Table 8. cont'd.

STRATUM 80M SUMMER [illegible] BEAM TRAWL

SPECIES	Tran 1 80S		Tran 1 80N		Tran 2 80S		Tran 3 80S		Tran 4 80S		Tran 5 80S		Tran 6 80M		Tran 6 80S		Tran 7 80N		CAD 1		CAD 2		CAD 3							
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	TotAb	Ave Ab	St Dev	Tot Biom	Ave Biom	St Dev
ratfish - ad	1	28	1	36	6	340	1	55	0	0	0	0	1	74	12	1647	4	345	0	0	0	0	2	162.5	28	2.33	3.55	2687.5	223.96	465.36
slender sole - ad	1	28	2	10	1	23	0	0	1	31.5	1	55	2	73	4	170	7	185	2	59.5	0	0	0	0	21	1.75	2.01	633	52.75	63.19
ratfish - juv	3	58	0	0	6	44	0	0	0	0	0	0	0	0	1	45	6	52.5	2	46.5	1	49.5	1	35	19	1.58	2.07	330.5	27.54	24.89
slender sole - juv	0	0	5	134	0	0	1	5.5	2	5	0	0	0	0	1	7	3	11.5	1	5.5	0	0	1	4.5	14	1.17	1.53	173	14.42	37.84
bluebarred prickleb	1	3.5	1	8.5	0	0	1	8.5	2	16	1	0.5	0	0	1	4.5	5	16.5	0	0	0	0	0	0	12	1.00	1.41	56	4.67	5.14
blackbelly eelpout	0	0	3	137	0	0	1	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	514	11	0.92	2.11	673	56.08	149.46
blacktip poacher	0	0	0	0	1	8	2	6	0	0	0	0	0	0	1	14.5	6	35	0	0	0	0	1	11	11	0.92	1.73	74.5	6.21	10.42
English sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	771.5	0	0	0	0	0	0	2	321.5	6	0.50	1.24	1093	91.08	233.36
Dover sole - ad	0	0	0	0	1	55	0	0	1	66.5	0	0	0	0	2	258.5	0	0	0	0	0	0	1	196	5	0.42	0.67	576	48.00	87.92
Pacific hake - ad	0	0	1	151	0	0	1	35	0	0	0	0	0	0	0	0	0	0	1	119	0	0	2	330.5	5	0.42	0.67	635.5	52.96	101.70
Dover sole - juv	0	0	0	0	0	0	2	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.17	0.58	7.5	0.63	2.17
rex sole - ad	0	0	0	0	1	27	1	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.17	0.39	60	5.00	11.75
rex sole - juv	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	4	2	0.17	0.39	6	0.50	1.24
northern ronquil	0	0	0	0	0	0	0	0	0	0	1	11	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	11	0.92	3.18
Pacific tomcod - ad	0	0	0	0	0	0	1	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	33	2.75	9.53
plainfin midshipman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	65	0	0	1	0.08	0.29	65	5.42	18.76
red brotula	0	0	0	0	0	0	0	0	1	143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	143	11.92	41.28
slim sculpin	0	0	0	0	0	0	0	0	1	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	1.5	0.13	0.43
soft sculpin	0	0	0	0	0	0	0	0	0	0	1	4.5	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	4.5	0.38	1.30
TOTAL	6	117	13	476	15	487	11	204	8	266	4	71	3	147	28	2918	31	646	6	231	2	115	18	1579	144	12.00	9.19	7263.5	605.29	837.72

Appendix Table 8. cont'd.

STRATUM 40M SUMMER 86 BEAM TRAWL

SPECIES	Tran 1 40S		Tran 2 40S		Tran 3 40S		Tran 4 40S		Tran 5 40S		Tran 6 40N		Tran 7 40N							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
blackbelly eelpout	3	24.5	11	25.5	7	11	2	3.5	5	99	8	36	44	20.5	80	11.43	14.88	219	31.29	31.57
slender sole - ad	2	46.5	0	0	1	58	0	0	4	118	0	0	10	372	17	2.43	3.64	594.5	84.93	133.76
slim sculpin	2	10	1	2	0	0	0	0	3	14	1	2.5	6	15	12	1.71	1.80	43.5	6.21	6.59
slender sole - juv	1	5	0	0	4	16	0	0	0	0	0	0	4	24	9	1.29	1.89	45	6.43	9.73
Dover sole - juv	3	10.5	2	8	1	1.5	0	0	0	0	0	0	2	10	8	1.14	1.21	30	4.29	4.97
rex sole - ad	0	0	2	132	0	0	0	0	0	0	1	39	5	198	8	1.14	1.86	369	52.71	80.31
Dover sole - ad	1	27.5	1	20	0	0	0	0	0	0	2	162.5	3	70	7	1.00	1.15	280	40.00	59.53
plainfin midshipman	0	0	0	0	0	0	0	0	0	0	3	213.5	4	163.5	7	1.00	1.73	377	53.86	93.10
quillback rockfish	0	0	0	0	0	0	0	0	7	190	0	0	0	0	7	1.00	2.65	190	27.14	71.81
bluebarred prickleback	0	0	0	0	0	0	1	0.5	0	0	5	3.5	0	0	6	0.86	1.86	4	0.57	1.30
blacktip poacher	1	5	0	0	0	0	0	0	0	0	2	13.5	2	7	5	0.71	0.95	25.5	3.64	5.22
rex sole - juv	0	0	0	0	0	0	0	0	0	0	3	14	1	5	4	0.57	1.13	19	2.71	5.31
snake prickleback	0	0	0	0	1	2	0	0	0	0	0	0	3	28.5	4	0.57	1.13	30.5	4.36	10.67
ratfish - ad	2	98	1	32	0	0	0	0	0	0	0	0	0	0	3	0.43	0.79	130	18.57	37.00
spinyhead sculpin	0	0	0	0	0	0	0	0	3	188	0	0	0	0	3	0.43	1.13	188	26.86	71.06
English sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	2	117	2	0.29	0.76	117	16.71	44.22
pygmy poacher	0	0	0	0	0	0	1	1.5	1	1.5	0	0	0	0	2	0.29	0.49	3	0.43	0.73
saddleback gunnel	0	0	0	0	0	0	0	0	2	10	0	0	0	0	2	0.29	0.76	10	1.43	3.78
grunt sculpin	0	0	0	0	0	0	0	0	1	3	0	0	0	0	1	0.14	0.38	3	0.43	1.13
ratfish - juv	0	0	1	8	0	0	0	0	0	0	0	0	0	0	1	0.14	0.38	8	1.14	3.02
TOTAL	16	227	19	227.5	14	88.5	4	5.5	26	623.5	25	483.5	85	1031	188	26.86	26.69	2686	383.71	357.06

Appendix Table 8. cont'd.

STRATUM 20M SUMMER 86 BEAM TRAWL

SPECIES	Tran 1 20S		Tran 2 20S		Tran 3 20S		Tran 4 20S		Tran 5 20S		Tran 6 20N		Tran 7 20N							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
blackbelly eelpout	1	6	7	53.5	0	0	0	0	0	0	29	217	0	0	37	5.29	10.77	276.5	39.50	80.69
bluebarred prickleback	0	0	0	0	0	0	0	0	1	1	31	25.25	0	0	32	4.57	11.66	26.25	3.75	9.49
slim sculpin	5	13	3	10	2	5	1	2.5	3	22.5	2	5	10	31.5	26	3.71	3.04	89.5	12.79	10.64
English sole - ad	1	56.5	5	214	3	308	0	0	9	278	5	697.5	0	0	23	3.29	3.30	1554	222.00	245.85
Dover sole - juv	2	10.5	8	39	6	36.5	4	22.5	0	0	0	0	2	10.5	22	3.14	3.02	119	17.00	16.11
rock sole - juv	2	24	1	3	0	0	0	0	14	145.5	0	0	0	0	17	2.43	5.16	172.5	24.64	54.01
quillback rockfish	8	132	0	0	0	0	0	0	2	61	0	0	2	36	12	1.71	2.93	229	32.71	49.92
plainfin midshipman	1	37	1	28	1	105	1	38.5	0	0	0	0	5	203	9	1.29	1.70	411.5	58.79	72.66
slender sole - ad	3	102.5	0	0	1	13	0	0	1	29.5	3	241.5	1	51.5	9	1.29	1.25	438	62.57	86.71
slender sole - juv	4	21	3	11	0	0	0	0	0	0	1	3	1	12	9	1.29	1.60	47	6.71	8.16
Dover sole - ad	0	0	1	33	0	0	1	60	0	0	2	44.5	0	0	4	0.57	0.79	137.5	19.64	25.72
English sole - juv	0	0	1	12	0	0	0	0	2	28	0	0	1	13	4	0.57	0.79	53	7.57	10.77
northern ronquil	0	0	0	0	4	18	0	0	0	0	0	0	0	0	4	0.57	1.51	18	2.57	6.80
pygmy poacher	0	0	1	2.5	1	1	1	0.5	1	2	0	0	0	0	4	0.57	0.53	6	0.86	1.03
rex sole - ad	2	76.5	0	0	0	0	1	41	0	0	1	37.5	0	0	4	0.57	0.79	155	22.14	30.30
roughback sculpin	1	19	0	0	0	0	0	0	3	33	0	0	0	0	4	0.57	1.13	52	7.43	13.31
snake prickleback	1	18	0	0	0	0	0	0	0	0	0	0	3	22	4	0.57	1.13	40	5.71	9.83
rex sole - juv	0	0	0	0	0	0	0	0	0	0	2	10.5	0	0	2	0.29	0.78	10.5	1.50	3.97
rock sole - ad	0	0	1	23	0	0	0	0	0	0	0	0	1	31	2	0.29	0.49	54	7.71	13.38
C-O sole - ad	0	0	1	235	0	0	0	0	0	0	0	0	0	0	1	0.14	0.38	235	33.57	88.82
sturgeon poacher	0	0	0	0	0	0	0	0	1	20	0	0	0	0	1	0.14	0.38	20	2.86	7.56
TOTAL	31	516	33	664	18	486.5	8	165	37	620.5	76	1282	28	410.5	230	32.86	21.20	4144.25	592.04	344.95

Appendix Table 9. Total, average (catch per unit effort-CPUE) and standard deviation of abundance and biomass (g) for bottom fish species caught by beam trawl from the RADCAD, 135M, 100M, 80M, 40M and 20M strata in Port Gardner during Autumn 1986. Species are listed by their common names in decreasing order of abundance.

RADCAD STRATUM AUTUMN 1986 BEAM TRAWL

SPECIES	Sta A Abund	Sta A Biomass	Sta E Abund	Sta E Biomass	Sta 1 Abund	Sta 1 Biomass	Sta 2 Abund	Sta 2 Biomass	Sta 3 Abund	Sta 3 Biomass	Tot Abund	Ave Abund	Stand Dev	Total Biom	Ave Biom	Stand Dev
ratfish - juv	0	0	1	5	1	19	0	0	0	0	2	0.40	0.55	24	4.80	8.23
snailfish sp.	0	0	0	0	1	0.5	0	0	0	0	1	0.20	0.45	0.5	0.10	0.22
English sole - ad	1	157	0	0	1	146	0	0	1	174.5	3	0.60	0.55	477.5	95.50	87.77
plainfin midshipmen	1	200	0	0	0	0	0	0	0	0	1	0.20	0.45	200	40.00	89.44
Pacific hake - juv	0	0	0	0	0	0	1	1	1	0.5	2	0.40	0.55	1.5	0.30	0.45
slender sole - ad	1	16.5	1	61	0	0	1	45	0	0	3	0.60	0.55	122.5	24.50	27.46
blackfin poacher	1	13.5	0	0	0	0	0	0	1	13.5	2	0.40	0.55	27	5.40	7.39
ratfish - ad	0	0	0	0	0	0	0	0	1	72	1	0.20	0.45	72	14.40	32.20
roughback sculpin	0	0	0	0	0	0	0	0	1	0.5	1	0.20	0.45	0.5	0.10	0.22
Dover sole - ad	0	0	0	0	0	0	0	0	1	245	1	0.20	0.45	245	49.00	109.57
pygmy poacher	0	0	0	0	0	0	0	0	1	0.1	1	0.20	0.45	0.1	0.02	0.04
TOTAL	4	387	2	66	3	165.5	2	46	7	506.1	18	3.6	2.65	1170.6	234.12	238.74

Appendix Table 9. cont'd.

STRATUM 135M AUTUMN 86 BEAM TRAWL

SPECIES	Tran 2 130N		Tran 3 130M		Tran 3 130N		Tran 4 145S		Tran 4 135N		Tran 5 165S		Tran 5 145M		Sta G		Sta H		PSDDA Sta 2							
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
quillback rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	360	0	0	10	1.00	3.16	360	36.00	113.84
slender sole - ad	0	0	1	22	2	100	0	0	0	0	0	0	3	129	0	0	1	65.4	1	57.5	8	0.80	1.03	373.9	37.39	47.99
blackfin eelpout	0	0	1	5.6	1	3	0	0	1	4	0	0	1	4	0	0	0	0	2	35.5	6	0.60	0.70	52	5.20	10.86
ratfish - ad	2	195	0	0	0	0	2	490	0	0	0	0	0	0	0	0	0	0	1	143.5	5	0.50	0.85	828.5	82.85	159.89
blackfin poacher	1	23	0	0	1	0.5	0	0	0	0	1	80	0	0	0	0	0	0	0	0	3	0.30	0.48	103.5	10.35	25.51
plainfin midshipman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	387.6	0	0	3	0.30	0.95	387.6	38.76	122.57
Pacific hake - juv	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	1	1	2	0.20	0.42	3	0.30	0.67
slim sculpin	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0.3	0	0	2	0.20	0.42	1.3	0.13	0.32
longnose skate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	220	1	0.10	0.32	220	22.00	69.57
Pacific tomcod - juv	0	0	1	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	1.5	0.15	0.47
ratfish - juv	0	0	0	0	1	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	25	2.50	7.91
red brotula	0	0	0	0	0	0	1	200	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	200	20.00	63.25
rock sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	34.1	0	0	1	0.10	0.32	34.1	3.41	10.78
rock sole - juv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	18.9	0	0	1	0.10	0.32	18.9	1.89	5.98
soft sculpin	0	0	0	0	0	0	1	2.5	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	2.5	0.25	0.79
tadpole sculpin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2.9	0	0	1	0.10	0.32	2.9	0.29	0.92
TOTAL	3	218	3	29	5	128.5	4	692.5	1	4	1	80	6	136	0	0	18	869.2	6	457.5	47	4.70	5.12	2614.7	261.47	307.41

Appendix Table 8. cont'd.

STRATUM 100M AUTUMN 86 BEAM TRAWL

SPECIES	T1 100M		T2 110S		T2 110M		T2 100N		T3 110S		T4 110S		T5 110S		T7 100S		Sta B		Sta C		Sta D		Sta F							
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Tot Ab	Ave Ab	St Dev	Tot Biom	Ave Biom	St Dev
slender sole - ad	3	89	2	83.5	0	0	0	0	1	40.1	1	13.5	2	130	1	29	2	124	2	68	2	54	0	0	16	1.33	0.98	631.1	52.59	46.86
ratfish - juv	0	0	1	16	0	0	0	0	2	37.2	0	0	0	0	7	170	2	42	1	28.5	0	0	0	0	13	1.08	2.02	293.7	24.48	48.55
ratfish - ad	0	0	2	140	0	0	0	0	2	290	1	665	1	68.5	2	65	1	430	0	0	2	70	1	79.8	12	1.00	0.85	1696.3	141.36	185.07
blackfin poacher	0	0	1	13	0	0	0	0	0	0	0	0	0	0	0	0	4	36	0	0	2	25	1	20.5	8	0.67	1.23	94.5	7.88	12.67
Pacific tomcod - juv	0	0	0	0	0	0	0	0	7	25.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0.58	2.02	25.3	2.11	7.30
slender sole - juv	0	0	0	0	0	0	0	0	0	0	3	2	0	0	2	1	0	0	0	0	0	0	1	0.9	6	0.50	1.00	3.9	0.33	0.64
slim sculpin	0	0	0	0	0	0	0	0	4	11.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.33	1.15	11.8	0.98	3.41
blackfin eelpout	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	1	4.5	1	4	0	0	3	0.25	0.45	14.5	1.21	2.23
Dover sole - ad	0	0	0	0	0	0	0	0	1	214	0	0	0	0	1	36.5	0	0	0	0	0	0	0	0	2	0.17	0.39	250.3	20.86	61.66
blackbelly eelpout	0	0	0	0	0	0	0	0	1	86.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	86.5	7.21	24.97
bluebarred prickleback	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5.5	0	0	0	0	0	0	0	0	1	0.08	0.29	5.5	0.46	1.59
northern ronquil	0	0	0	0	0	0	0	0	1	18.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	18.3	1.53	5.28
Pacific hake - juv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0.08	0.29	2	0.17	0.58
plainfin midshipman	0	0	1	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.08	0.29	103	8.58	29.73
rex sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	15	0	0	0	0	0	0	0	0	1	0.08	0.29	15	1.25	4.33
spinyhead sculpin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	124	0	0	1	0.08	0.29	124	10.33	35.80
TOTAL	3	89	7	356	0	0	0	0	19	723	5	570.5	3	196.5	15	322	10	638	4	101	8	277	4	103.2	78	6.50	5.78	3375.7	281.31	248.60

Appendix Table 9. cont'd.

STRATUM 80M AUTUMN 88 BEAM TRAWL

SPECIES	Tran 1 80N		Tran 2 80S		Tran 3 80S		Tran 4 80S		Tran 5 80S		Tran 6 80M		Tran 8 80S		CAD 1		CAD 2		CAD 3							
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Tot Ab	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
slender sole - juv	0		1	1	8	6.5	14	8	6	11	16	10.5	9	7	1	9	2	2	0	0	58	5.80	5.96	54	5.40	4.13
ratfish - juv	1	30.7	2	43	0	0	0	0	10	260	1	34.5	0	0	9	245	4	92	8	198.5	35	3.50	4.01	903.7	90.37	104.25
plainfin midshipman	1	68.3	0	0	0	0	1	75	1	57	5	545	8	620	6	368	3	168	2	92.5	27	2.70	2.75	1991.8	199.18	228.27
ratfish - ad	1	46.6	1	60	4	350	1	95	1	95	0	0	0	0	1	48	0	0	3	131.5	12	1.20	1.32	826.1	82.61	104.18
slender sole - ad	2	64.3	0	0	1	24.5	0	0	2	80	1	78	0	0	1	45.5	2	68	0	0	9	0.90	0.88	360.3	36.03	35.66
blackbelly eelpout	0	0	0	0	0	0	0	0	3	66	1	12	0	0	0	0	0	0	0	0	4	0.40	0.97	98	9.80	27.04
slim sculpin	0	0	0	0	0	0	4	5.5	0	0	0	0	0	0	0	0	0	0	0	0	4	0.40	1.26	5.5	0.55	1.74
blacktip poacher	0	0	1	9.5	0	0	0	0	0	0	1	2.5	1	11	0	0	0	0	0	0	3	0.30	0.48	23	2.30	4.28
English sole - ad	1	126	0	0	0	0	0	0	0	0	1	161	0	0	0	0	1	120	0	0	3	0.30	0.48	407	40.70	66.36
flathead sole- ad	0	0	0	0	0	0	0	0	0	0	3	485	0	0	0	0	0	0	0	0	3	0.30	0.95	485	48.50	153.37
pygmy poacher	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	3	0.30	0.95	1	0.10	0.32
bluebarred prickleback	0	0	0	0	0	0	0	0	1	9	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	9	0.90	2.85
Dover sole - ad	0	0	1	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	28	2.80	8.85
Pacific hake - juv	0	0	0	0	1	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	1.3	0.13	0.41
rex sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	19	0	0	0	0	1	0.10	0.32	19	1.90	6.01
soft sculpin	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0.10	0.32	1	0.10	0.32
spinyhead sculpin	0	0	1	64.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.10	0.32	64.5	6.45	20.40
staghorn sculpin	0	0	0	0	0	0	0	0	0	0	1	16	0	0	0	0	0	0	0	0	1	0.10	0.32	16	1.60	5.06
TOTAL	6	325.9	7	206	15	381.3	20	183.5	24	608	34	1347	18	638	19	732.5	12	450	13	422.5	168	16.80	8.28	5294.2	529.42	338.66

Appendix Table 9. contd.

STRATUM 40M AUTUMN 86 BEAM TRAWL

SPECIES	Tran 1 40S		Tran 2 40S		Tran 3 40S		Tran 4 40S		Tran 5 40S		Tran 6 40N							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
slender sole - juv	4	3	2	9.9	10	4.5	6	12	1	10	22	14	45	7.50	7.79	53.4	8.90	4.29
blackbelly eelpout	3	45	5	76	3	30	0	0	2	52	11	110	24	4.00	3.79	313	52.17	37.89
plainfin midshipman	1	18	0	0	0	0	0	0	0	0	17	180	18	3.00	6.87	198	33.00	72.37
slim sculpin	1	4	0	0	6	4	1	1	6	29.5	0	0	13	2.17	2.64	38.5	6.42	11.46
Dover sole - ad	2	38	4	46.4	1	13	0	0	2	250	1	20	10	1.67	1.37	367.4	61.23	93.99
English sole - ad	1	84	4	64.2	0	0	3	120	0	0	1	280	9	1.50	1.64	548.2	91.37	108.08
pygmy poacher	0	0	0	0	1	0.3	1	2	5	3	0	0	7	1.17	1.94	5.3	0.88	1.30
northern ronquil	1	14	0	0	1	22	0	0	4	66	0	0	6	1.00	1.55	102	17.00	25.70
slender sole - ad	0	0	1	19.9	1	35	0	0	3	95	1	44	6	1.00	1.10	193.9	32.32	35.54
Pacific tomcod - juv	0	0	0	0	2	5.5	0	0	2	11.5	1	3	5	0.83	0.98	20	3.33	4.58
quillback rockfish	0	0	0	0	0	0	0	0	4	158	0	0	4	0.67	1.63	158	26.33	64.50
blacktip poacher	1	9	0	0	0	0	0	0	0	0	2	9	3	0.50	0.84	18	3.00	4.65
ratfish - ad	0	0	0	0	0	0	0	0	3	2150	0	0	3	0.50	1.22	2150	358.33	877.73
sand sole - ad	0	0	1	14.5	1	16	1	35	0	0	0	0	3	0.50	0.55	65.5	10.92	13.97
roughback sculpin	0	0	0	0	0	0	1	16	2	2	0	0	3	0.50	0.84	18	3.00	6.42
bluebarred prickleback	1	2.5	0	0	0	0	0	0	0	0	0	0	1	0.17	0.41	2.5	0.42	1.02
Dover sole - juv	1	10	0	0	0	0	0	0	0	0	0	0	1	0.17	0.41	10	1.67	4.08
flathead sole- ad	0	0	0	0	0	0	0	0	0	0	1	114	1	0.17	0.41	114	19.00	46.54
Pacific tomcod - ad	1	145	0	0	0	0	0	0	0	0	0	0	1	0.17	0.41	145	24.17	59.20
rock sole - ad	0	0	0	0	0	0	0	0	1	155	0	0	1	0.17	0.41	155	25.83	63.28
saddleback gunnel	0	0	0	0	0	0	0	0	1	12.5	0	0	1	0.17	0.41	12.5	2.08	5.10
sanddab sp.	0	0	1	11.7	0	0	0	0	0	0	0	0	1	0.17	0.41	11.7	1.95	4.78
shiner perch - ad	0	0	0	0	0	0	0	0	1	16	0	0	1	0.17	0.41	16	2.67	6.53
TOTAL	17	372.5	18	232.6	26	130.3	13	186	37	3010.5	57	784	167	27.83	16.59	4715.9	785.98	1114.95

Appendix Table 9. cont'd.

STRATUM 20M AUTUMN 86 BEAM TRAWL

SPECIES	Tran 1 20S		Tran 2 20S		Tran 3 20S		Tran 4 20S		Tran 5 20S		Tran 6 20N							
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Tot Abund	Ave Abund	St Dev	Tot Biom	Ave Biom	St Dev
slender sole - juv	3	14.7	0	0	0	0	1	2	2	1.5	28	19.6	34	5.67	11.00	37.8	6.30	8.58
English sole - ad	3	140	3	147.4	9	340	4	110	2	45	0	0	21	3.50	3.02	782.4	130.40	117.50
slim sculpin	0	0	0	0	10	21.9	6	4.5	0	0	4	3.5	20	3.33	4.13	29.9	4.98	8.52
roughback sculpin	1	11.7	1	1	3	35.8	10	7	2	5	0	0	17	2.83	3.66	60.5	10.08	13.29
rock sole - juv	2	25.1	5	23.7	3	2.8	0	0	6	10	0	0	16	2.67	2.50	61.6	10.27	11.55
blackbelly eelpout	0	0	0	0	0	0	0	0	0	0	15	66.8	15	2.50	6.12	66.8	11.13	27.27
plainfin midshipman	0	0	0	0	0	0	0	0	0	0	5	150	5	0.83	2.04	150	25.00	61.24
pygmy poacher	0	0	0	0	0	0	1	10	1	1	3	1	5	0.83	1.17	12	2.00	3.95
rock sole - ad	0	0	3	754.7	0	0	0	0	2	160	0	0	5	0.83	1.33	914.7	152.45	301.90
speckled sanddab - juv	0	0	2	25.5	0	0	0	0	3	50	0	0	5	0.83	1.33	75.5	12.58	20.98
slender sole - ad	0	0	0	0	0	0	0	0	2	60	2	25.9	4	0.67	1.03	85.9	14.32	24.66
Dover sole - ad	1	56.3	0	0	0	0	0	0	2	150	0	0	3	0.50	0.84	206.3	34.38	60.95
Dover sole - juv	2	24.5	0	0	0	0	0	0	1	15	0	0	3	0.50	0.84	39.5	6.58	10.63
northern ronquil	0	0	0	0	2	15	0	0	0	0	0	0	2	0.33	0.82	15	2.50	6.12
sanddab sp.	0	0	0	0	1	9.6	1	12	0	0	0	0	2	0.33	0.52	21.6	3.60	5.63
speckled sanddab - ad	0	0	1	22.8	0	0	0	0	1	30	0	0	2	0.33	0.52	52.8	8.80	13.82
northern spearnose poa	0	0	0	0	1	1.2	0	0	0	0	0	0	1	0.17	0.41	1.2	0.20	0.49
Pacific hake - juv	0	0	0	0	0	0	0	0	0	0	1	1.4	1	0.17	0.41	1.4	0.23	0.57
pile perch - ad	0	0	0	0	0	0	0	0	1	16.5	0	0	1	0.17	0.41	16.5	2.75	6.74
pile perch - juv	0	0	0	0	0	0	0	0	1	12.5	0	0	1	0.17	0.41	12.5	2.08	5.10
quillback rockfish	0	0	0	0	1	21.9	0	0	0	0	0	0	1	0.17	0.41	21.9	3.65	8.94
shiner perch - juv	0	0	1	8.4	0	0	0	0	0	0	0	0	1	0.17	0.41	8.4	1.40	3.43
snailfish sp.	0	0	0	0	1	1.1	0	0	0	0	0	0	1	0.17	0.41	1.1	0.18	0.45
snake prickleback	1	14.9	0	0	0	0	0	0	0	0	0	0	1	0.17	0.41	14.9	2.48	6.08
sturgeon poacher	1	31.7	0	0	0	0	0	0	0	0	0	0	1	0.17	0.41	31.7	5.28	12.94
TOTAL	14	318.9	16	983.5	31	449.3	23	145.5	26	556.5	58	268.2	168	28.00	15.99	2721.9	453.65	296.26

Appendix Table 10. Total, average (catch per unit effort-CPUE) and standard deviation of abundance and biomass (g) for bottom fish species caught by beam trawl from the RADCAD and 100M strata in Port Gardner during Winter 1987. Species are listed by their common names in decreasing order of abundance.

RADCAD STRATUM WINTER 1987 BEAM TRAWL

SPECIES	Sta A Abund	Sta A Biomass	Sta E Abund	Sta E Biomass	Sta I Abund	Sta I Biomass	Sta J Abund	Sta J Biomass	Sta 1 Abund	Sta 1 Biomass	Sta 2 Abund	Sta 2 Biomass	Tot Abund	Ave Abund	Stand Dev	Total Biom	Ave Biom	Stand Dev
ratfish - ad	0	0	0	0	0	0	1	390	1	186.5	0	0	2	0.33	0.52	576.5	96.08	162.17
plainfin midshipman	0	0	0	0	0	0	3	250	1	73.7	0	0	4	0.67	1.21	323.7	53.95	100.47
pygmy poacher	0	0	0	0	0	0	0	0	1	18.9	0	0	1	0.17	0.41	18.9	3.15	7.72
slender sole - ad	1	11	3	295.8	0	0	1	36.7	0	0	1	66.5	6	1.00	1.10	410	68.33	114.34
slender sole - juv	0	0	0	0	2	2.2	0	0	0	0	1	0.54	3	0.50	0.84	2.74	0.46	0.88
flathead sole - ad	0	0	0	0	0	0	0	0	0	0	1	29.7	1	0.17	0.41	29.7	4.95	12.12
blackfin poacher	0	0	0	0	0	0	0	0	0	0	2	39.1	2	0.33	0.82	39.1	6.52	15.96
spinyhead sculpin	0	0	0	0	0	0	0	0	0	0	1	41.1	1	0.17	0.41	41.1	6.85	16.78
TOTAL	1	11	3	295.8	2	2.2	5	676.7	3	279.1	6	176.94	20	3.33	1.86	1441.74	240.29	248.32

Appendix Table 10. cont'd.

STRATUM 100M WINTER 1987 BEAM TRAWL

SPECIES	T1 100M		T2 110S		T2 110M		T2 100N		T3 110S		T4 110S		T5 110S	
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom
slender sole - ad	6	200	0	0	3	137.2	0	0	0	0	0	0	1	18.85
ratfish - ad	1	40.9	2	390	0	0	1	41.4	1	223.3	1	200	0	0
ratfish - juv	0	0	0	0	1	39	1	18.6	0	0	0	0	0	0
plainfin midshipman	1	1.5	1	16.3	0	0	0	0	0	0	0	0	0	0
slender sole - juv	3	6.5	0	0	0	0	0	0	0	0	0	0	0	0
English sole - ad	0	0	0	0	1	220	0	0	0	0	0	0	0	0
Pacific hake - ad	0	0	0	0	2	600	0	0	0	0	0	0	0	0
quillback rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0
blacktip poacher	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dover sole - ad	1	48.5	0	0	0	0	0	0	0	0	0	0	0	0
blackfin poacher	0	0	0	0	0	0	0	0	0	0	0	0	0	0
longnose skate	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red brotula	0	0	0	0	0	0	0	0	1	57.1	0	0	0	0
rex sole - ad	0	0	0	0	0	0	0	0	0	0	0	0	0	0
slim sculpin	0	0	0	0	0	0	0	0	0	0	1	4.5	0	0
walleye pollock - juv	0	0	0	0	1	6.1	0	0	0	0	0	0	0	0
TOTAL	12	295.4	3	408.3	8	1004.3	2	58	2	280.4	2	204.5	1	18.85

SPECIES	T7 100N		T7 100M		T7100S		Sta B		Sta C		Sta D		Sta F	
	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom	Ab	Biom
slender sole - ad	4	135.2	0	0	1	50	1	25.4	0	0	4	70.2	2	121.1
ratfish - ad	1	325	0	0	1	48.9	0	0	1	136.2	0	0	2	111.2
ratfish - juv	2	44.8	0	0	3	74.6	0	0	1	25.6	1	23	1	38
plainfin midshipman	1	76.4	0	0	0	0	0	0	2	32.1	0	0	2	138.3
slender sole - juv	0	0	1	1.3	0	0	2	3.8	1	1.5	0	0	0	0
English sole - ad	0	0	1	114	0	0	0	0	0	0	1	290.2	1	155.9
Pacific hake - ad	0	0	0	0	0	0	0	0	1	24.7	0	0	0	0
quillback rockfish	1	464.5	0	0	2	595	0	0	0	0	0	0	0	0
blacktip poacher	0	0	0	0	0	0	0	0	0	0	2	28.2	0	0
Dover sole - ad	0	0	0	0	0	0	0	0	0	0	1	330.8	0	0
blackfin poacher	0	0	0	0	1	1.4	0	0	0	0	0	0	0	0
longnose skate	0	0	0	0	0	0	1	440	0	0	0	0	0	0
red brotula	0	0	0	0	0	0	0	0	0	0	0	0	0	0
rex sole - ad	0	0	0	0	0	0	1	19	0	0	0	0	0	0
slim sculpin	0	0	0	0	0	0	0	0	0	0	0	0	0	0
walleye pollock - juv	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	9	1045.9	2	115.3	8	767.9	5	488.2	6	222.1	9	742.4	8	562.5

Appendix Table 10. cont'd.

SPECIES	STRATUM 100M WINTER 1987 BEAM TRAWL (CONT'D.)					
	Tot Ab	Ave Ab	St Dev	Tot Biom	Ave Biom	St Dev
slender sole - ad	22	1.57	1.96	757.96	54.14	67.46
ratfish - ad -	11	0.79	0.70	1516.90	108.35	130.17
ratfish - juv	10	0.71	0.91	259.60	18.54	23.28
plainfin midshipman	7	0.50	0.76	264.60	18.90	40.44
slender sole - juv	7	0.50	0.94	13.10	0.94	1.93
English sole - ad	4	0.29	0.47	780.10	55.72	98.62
Pacific hake - ad	3	0.21	0.58	624.70	44.62	159.98
quillback rockfish	3	0.21	0.58	1059.50	75.68	194.07
blackdip poacher	2	0.14	0.53	28.20	2.01	7.54
Dover sole - ad	2	0.14	0.36	377.30	26.95	88.33
blackfin poacher	1	0.07	0.27	1.40	0.10	0.37
longnose skate	1	0.07	0.27	440.00	31.43	117.59
red brotula	1	0.07	0.27	57.10	4.08	15.26
rex sole - ad	1	0.07	0.27	19.00	1.36	5.08
slim sculpin	1	0.07	0.27	4.50	0.32	1.20
walleye pollock - juv	1	0.07	0.27	8.10	0.58	2.16
TOTAL	77	5.50	3.52	6212.05	443.72	337.51