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U.S. DEPARTMENT OF COMMERCE
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ABSTRACT

The Alaska Fisheries Science Center's 1998 West Coast triennial bottom trawl survey was conducted to assess stocks of groundfish inhabiting the continental shelf waters off the coasts of California, Oregon, Washington, and southern British Columbia. This was the eighth survey in an ongoing series to monitor long-term trends in the distribution and abundance of these groundfish populations.

Although the objectives of the 1998 survey were similar to those of the previous surveys in the series, we have made minor changes in the survey design over the years. The four most recent surveys have shifted emphasis away from estimating rockfish abundance, as had been the case from 1977 through 1986, toward better assessing a broader range of groundfish species. The current design also focuses upon precisely estimating the near-bottom component of the Pacific hake (*Merluccius productus*) and juvenile (age 1+) sablefish (*Anoplopoma fimbria*) resources. The survey encompassed the coastal waters from Pt. Conception, California, to central Vancouver Island, British Columbia (34°30'-49°15'N lat.). The depth range of the 1998 survey was the same as that in 1995, which had been extended for more complete coverage of the habitat of slope rockfish. The 1980-92 surveys had covered depths from 55 to 366 m; since 1995, we have surveyed between 55 and 500 m. A total of 536 stations were

occupied, of which 527 were successfully sampled. Catches included 168 different species of fish representing 55 families.

This report documents the survey design and methods used in 1998, summarizes biological and environmental data collected, and presents the results of standard analyses of distribution, abundance, and biological parameters for the commercially important groundfish species in the region. Data on water temperature, catch composition, relative abundance, and geographic distribution are reported. Estimates of biomass, population abundance, length composition and age composition are also presented. Data appendices are located in a separate companion volume.

CONTENTS

INTRODUCTION

In 1998, the eighth in an ongoing series of groundfish assessment surveys of the continental shelf resources off the coasts of California, Oregon, Washington, and southern British Columbia was carried out by the Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC). These bottom trawl surveys, initiated in 1977 and repeated triennially, have been designed to provide resource managers with fishery-independent data about the distribution, abundance, and biological characteristics of several commercially important species, particularly Pacific hake (also known as Pacific whiting), *Merluccius productus*, sablefish, *Anoplopoma fimbria*, and many of the shelf and slope rockfish (genus *Sebastes*) species (Wilkins 1996). Hydroacoustic surveys of the off-bottom component of the Pacific hake population have been conducted concurrently with these bottom trawl surveys by the Midwater Assessment and Conservation Engineering (MACE) Task of the RACE Division.

The first of these bottom trawl surveys, conducted in 1977 (Gunderson and Sample 1980), sampled between Pt. Hueneme, California (34°00'N lat.), and the U.S.-Canada border in depths ranging from 91 to 457 m. The sampling effort was stratified by depth and latitude according to fishery catch information. The following two surveys, conducted in 1980 (Coleman 1986) and 1983 (Weinberg et al. 1984), emphasized obtaining better biomass estimates of canary (*Sebastes pinniger*) and yellowtail rockfish

(*S. flavidus*), while maintaining the important general goals of a multispecies monitoring program. In 1980, strata were adjusted and sampling depths shifted to cover the 55-366 m depth interval, while the latitudinal boundaries extended from Monterey Bay, California (36°48'N lat.), to northern Vancouver Island, British Columbia (50°00'N lat.). The same area was surveyed using the same survey design in 1983 but only extended as far north as Vancouver Island's Estevan Point (49°15'N lat.). The results of the 1980 and 1983 surveys indicated that a better sampling design was needed to improve the precision of canary and yellowtail rockfish abundance estimates. Consequently, in 1986 the sampling effort was reallocated to concentrate on the 92-219 m depth interval north of 42°35'N latitude, where canary and yellowtail rockfish were thought to be most abundant (Coleman 1988). Results of these first four surveys were used to examine trends in the distribution and abundance of 14 of the more commercially important groundfish species (Dark and Wilkins 1994).

Despite efforts to improve the precision of rockfish abundance estimates over the first four iterations of the triennial survey, the large variances of the estimates remained a problem. We concluded that precise estimates of rockfish abundance were not possible using current trawl survey methods and realistic sampling levels. It was clear that higher priority should be given to obtaining the information that our survey was able to provide well. Consequently, beginning in 1989 the triennial bottom trawl survey was designed to monitor a broad

range of demersal species and also focus on providing precise estimates of the demersal component of the Pacific hake stock and sablefish pre-recruits (age 1+) (Weinberg et al. 1994, Zimmermann et al. 1994, Wilkins et al. 1998). Weinberg (1994) used the results of the 1977-92 surveys to describe rockfish community structure and species assemblages. His findings, as well as recent assessments of slope and shelf rockfish stocks (Rogers et al. 1996) indicated that more complete depth coverage of the habitats of these species during our surveys would improve our ability to assess them. In 1995, we redirected a portion of our samples from four small areas of high density sampling for Pacific hake and sablefish and placed them in a new, deeper depth stratum between 367 and 500 m that extended along the entire coast.

In 1998, the same area was surveyed using the same survey design in 1995. The specific objectives of the 1998 survey were:

1) to describe and assess the demersal component of the Pacific hake resource;

2) to describe and assess the abundance of the shallow component of the sablefish resource, specifically those 1.5 years old, because the abundance of these pre-recruits estimated from trawl survey data has been shown to be consistent with that inferred from commercial catch levels;

3) to describe and assess shelf and slope rockfish stocks throughout their entire depth ranges;

4) to monitor the status of other important groundfish stocks;

5) to determine the biological characteristics (e.g., size and age compositions, size at maturity, length/weight relationships and feeding habits) of key groundfish species;

6) to collect oceanographic data describing the habitat, including surface temperatures, bottom temperatures, and water column temperature profiles at each sampling station; and

7) to collect samples from a variety of species for biological studies that will be conducted by scientists at various fishery agencies and academic institutions.

This report documents the survey design and field procedures used, summarizes the data collected, and presents the results of the standard RACE analyses. Included are summaries of catches, relative densities, distributions, and estimates of biomass, population abundance, and size compositions for selected species. Age compositions are also included for three species for which ages have been determined from otoliths collections and length-weight relationships are described for many groundfish species. For the sake of brevity, our discussion concentrates on the primary target species of this survey, Pacific hake and sablefish, in the areas of most concern to management. Unabridged printouts of the results of analyses, which include

numerous species, are available upon request as appendices bound in a separate volume. Electronic data files and files containing results of analyses (e.g., size and age composition) can also be obtained from the authors upon request.

SURVEY METHODS

Survey Period and Sampling Area

The 1998 survey was conducted from 1 June to 9 August, which is earlier than the time period of most previous triennial surveys (mid-July through September). Operations began off Pt. Conception, California (34°30'N), and proceeded northward to central Vancouver Island off Estevan Point (49°15'N). We sampled stations between the depths of 55 and 500 m. The survey area has extended southward to Point Conception since 1989 to allow us to detect concentrations of juvenile Pacific hake and sablefish which may be present between Point Conception and Monterey Bay. Stations off Vancouver Island were sampled to help estimate density at the northern limit of the Pacific hake distribution and to collect more complete data sets on transboundary stocks such as yellowtail rockfish, Pacific ocean perch, *Sebastes alutus*, and lingcod, *Ophiodon elongatus*.

Vessels and Sampling Gear

Two commercial trawlers, the F/V *Vesteraalen* and the F/V *Dominator*, were chartered to conduct the bottom trawl survey.

Pertinent details about these vessels are presented in Table 1. Each vessel was equipped with dual net reels, modern electronics, and global positioning system (GPS) navigational aids.

The standard RACE high-opening Nor'eastern trawl, constructed of polyethylene mesh and equipped with bobbin roller gear, was used aboard both vessels throughout the 1998 survey (Fig. 1). This trawl has a 27.2 m headrope and a 37.4 m footrope. All trawls were rigged consistently to RACE survey gear standards employing three 55 m dandylines (1.59 cm steel cable) connected to each wing and fished with 2.1 × 1.5 m steel V-doors weighing approximately 567 kg each.

Measurements of the trawl's horizontal (wingtip to wingtip) and vertical opening (center of headrope to bottom) were collected throughout the duration of 437 (83%) of the successfully completed tows using a SCANMAR net mensuration system. Mean net widths and heights were calculated for each successfully measured trawl haul. The overall mean path width of the net was 14.57 m (range 12.96-16.66 m) for all measured trawl hauls by the F/V *Vesteraalen* and 12.86 m (range 10.89-14.64 m) for all measured trawl hauls by the F/V *Dominator*. In those instances when horizontal measurements were unavailable and good net height was available, the best predictor of average net width (m) was width regressed on net height using the following relationships:

F/V *Vesteraalen*

Net width = -0.9524 × H + 21.268

R/V *Dominator*

Net width = -0.6396 × H + 18.142

where: H = net height (m).

If no net height measurements were available (12 trawl hauls) the best predictor was regression of net width on inverse depth using the following equations:

F/V *Vesteraalen*

Net width = -91.944 / D + 13.550

R/V *Dominator*

Net width = -133.69 / D + 15.417

where: D = water depth (m).

These equations were derived by examining the relationship between mean net width and a set of variables known to be important in determining the horizontal opening of the net (Rose 1993).

Survey Area Stratification

The 1998 triennial survey sampled the entire survey area with a nearly uniform sampling density, which was similar to the

low-density levels used in surveys prior to 1995. Ten latitudinal strata of similar size (Fig 2.) were used during the analyses to ensure that catch rates of various species were extrapolated to meaningful areas of their respective habitats.

The survey area was also stratified by depth, since most groundfish species in the area exhibit a strong depth range preference. All West Coast triennial surveys prior to 1995 were divided into two major depth strata: 55-183 m representing a continental shelf habitat and 184-366 m representing the shelf break and the uppermost continental slope. Pacific hake and juvenile sablefish catch rates, in particular, are usually significantly higher in the shallower stratum. An additional deeper depth stratum (366-500 m) was added to the design of the survey beginning in 1995 so that the survey area would encompass the entire depth range of slope rockfish species.

Trawl Station Allocation

The 1998 survey replicated the 1995 station pattern. A systematic-random design was used to allocate trawl stations to best achieve the primary survey objectives, which were to estimate the abundance and biological characteristics of Pacific hake and juvenile sablefish stocks and concurrently monitor the condition of a broader range of commercially important groundfish species. Tracklines were laid across the survey area from the 55 m isobath due west extending to the 500 m isobath at intervals of 18.5 km along the coast. Stations were randomly placed along

tracklines at the rate of one station per 7.4 km in the shallow stratum and one station per 9.3 km in the two deeper stratum. At least one station was assigned to each depth stratum along each trackline segment. A total of 610 stations were established. The number of stations allocated to each stratum, as well as the number successfully sampled, are shown in Table 2.

Trawling Procedures

Stations were located using GPS and then surveyed with an echo sounder prior to towing. If the terrain was determined to be too rugged to tow upon successfully, then an alternative site was searched for within a 1 nautical mile (nmi) radius of the original site. If an alternate station was not found within 1 nmi, the search was extended to within 2.5 minutes of the original station's latitude and within 20 m of the original station's depth. If no favorable ground was located within about 2 hours, the station was declared untrawlable and abandoned.

Before starting the survey, the trawl warps on each vessel were measured with a wire meter and marked at 45.72 m (25 fm) increments. An exercise was then conducted to empirically establish the proper amount of trawl warp to deploy at a given depth to ensure that the net would fish solidly on the bottom. We did this by deploying the trawl and towing it at a speed of 1.54 m/sec (3.0 knots) over deep water, increasing the length of trawl warp by 183 m (100 fm) intervals and allowing the trawl to settle to an equilibrium depth at each warp length. A micro-

bathythermograph (MBT) was attached to the trawl headrope during this exercise and the settling depth was recorded for different trawl warp lengths. We tabulated the minimum length of trawl warp needed to fish the trawl at any given bottom depth and paid out an additional 90-150 m of warp to ensure solid bottom contact.

We made concerted efforts to deploy the sampling trawl in the same manner at each station so as to obtain standard samples. Skippers set the trawl and payed out the prescribed amount of trawl warp while traveling faster than the target towing speed. The vessel was slowed as the brakes were set on the trawl winches and the gear was allowed to sink toward bottom. Before reaching bottom, the speed of the vessel was increased to the target towing speed of 1.54 m/sec (3.0 knots) so that the trawl was nearly in its fishing configuration when it contacted the bottom. We used information from the Scanmar, MBT, electronic bottom contact sensor (BCS), and GPS to determine when and where the trawl reached bottom and settled into its equilibrium fishing configuration. After achieving equilibrium, the trawl was towed at 1.54 m/sec for 30 minutes. The net was retrieved as quickly as possible to clearly delineate the time and position of the endpoint of the sample. Skippers tried to maintain a constant depth while towing. If the gear was damaged during the tow severely enough to affect catch composition, the haul was considered unsatisfactory and the station was either repeated or abandoned. Unsuccessful tows were not used to calculate biomass

or population estimates. The two vessels fished alternate tracklines throughout most of the survey area to enable comparison of their relative fishing powers.

Catch Sampling and Oceanographic Data Collection

The procedures for catch processing documented by Gunderson and Sample (1980) were used in 1998. Briefly, catches which fit on the sampling table (about one metric ton (t)) were processed entirely, while larger catches were either weighed by an electronic load cell (up to 4.5 t) or measured volumetrically, then subsampled following methods described by Hughes (1976). Often, if only one species (e.g. Pacific hake or spiny dogfish (*Squalus acanthias*)) was a major component of the entire catch, only it was subsampled. Catches were then sorted by species, weighed, and enumerated. Fork length (FL) measurements were obtained by sex for primary and secondary target species[1] whenever they were caught. Lengths were also taken for other major components of the catch when time allowed.

Otoliths (used for age determination), along with individual specimen weight and maturity data, were collected from a variety of species. Collections for Pacific hake and sablefish were stratified by length interval (5 otoliths/sex/cm) for biological subareas. Collections for canary and splitnose

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[1]Primary target species are Pacific hake and sablefish. Secondary target species include canary rockfish, Pacific ocean perch, bocaccio, yellowtail rockfish, darkblotched rockfish, sharpchin rockfish, silvergray rockfish, yellowmouth rockfish, chilipepper, splitnose rockfish, blackgill rockfish, yelloweye rockfish, redstripe rockfish, Pacific sardine, and lingcod.

rockfish (*Sebastes diploproa*) were stratified by size intervals of 5 cm (50-100 otoliths/interval) for the entire survey area. Random collections were made for bocaccio (*S. paucispinis*), yellowtail rockfish, Pacific ocean perch, darkblotched rockfish (*S. crameri*), yelloweye rockfish (*S. ruberrimus*), yellowmouth rockfish (*S. reedi*), chilipepper (*S. goodei*), silvergray (*S. brevispinis*) rockfish, sharpchin rockfish (*S. zacentrus*), blackgill rockfish (*S. melanostomus*), redstripe rockfish (*S. proriger*), and Pacific sardine (*Sardinops sagax*). Fin rays were collected from lingcod for determining age. We collected stratified samples of individual fish weights (5 observations per sex/length interval from each state and from Canada) from several additional commercially important species. Other requests for meristic data and for samples of stomach contents, tissues, and whole fish were also fulfilled as time allowed.

Surface temperatures were measured with bucket thermometers and MBTs. Water column temperature profiles and bottom temperatures were also collected with MBTs.

Data Analyses

Several analyses are performed routinely on RACE bottom trawl survey data. These include:

1) estimation of relative abundance,
2) estimation of population biomass,
3) estimation of population numbers, and
4) estimation of the population's size composition.

We use the area-swept method described by Gunderson and Sample (1980) to calculate catch rates, which are in turn used to estimate population biomass and numbers. Briefly, this method entails standardizing species catch rates from each station into catch per unit effort (CPUE) in terms of kilograms or numbers per hectare trawled (kg/ha, no./ha) and calculating the arithmetic mean CPUE for each sampling stratum. Relative abundance (mean CPUE) of each species is then calculated for each International North Pacific Fisheries Commission (INPFC) area as the sum of the mean CPUEs of each appropriate sampling stratum weighted by their respective stratum areas. Population biomass and numbers in each stratum are estimated by multiplying the stratum mean CPUE by the stratum area. Stratum estimates are summed to provide biomass and population estimates for various portions of the survey area (e.g., INPFC areas, U.S. waters). In cases where our sampling strata straddle more than one INPFC area, we expand the overall sampling stratum mean CPUE to the area of that portion of the sampling stratum lying within the INPFC area.

The size composition of each species was estimated in a manner similar to the population estimate. Length-frequency data collected at each station were weighted by the CPUE (number/ha) of that species at that station, summed over all hauls in a stratum, and expanded to the stratum population estimate. As with population estimates, stratum estimates were summed to derive the estimated size compositions for various portions of the survey area.

Ages were determined from otolith or fin ray samples collected from groundfish species. The age compositions of these stocks were estimated by multiplying their population size composition by age-length keys (matrices of length vs. age) constructed from the age data from corresponding or appropriately pooled strata.

RESULTS

Haul, Catch, and Biological Data

During the 1998 survey, 527 of the 610 stations were successfully sampled within the 55-500 m depth bounds. Nine tows were unsuccessful due to damaged trawls, 61 stations were abandoned due to untrawlable bottom, and we were unable to sample 13 stations on the northernmost two tracklines due to lack of time. Sampling density ranged from 0 to 11.97 hauls per 1,000 km^2 in the shallow strata, from 3.73 to 19.07 hauls per 1,000 km^2 in the middle strata, and from 0 to 22.16 hauls per 1,000 km^2 in the deep strata (Table 2). Over the entire survey area, the sampling density was slightly higher in the deep strata (12.80 hauls per 1,000 km^2) than in the middle (10.16 hauls per 1,000 km^2) or the shallow (7.78 hauls per 1,000 km^2) strata. Overall, the average sampling density was also slightly higher in the U.S. portion of the survey area than in the Canadian portion. Figure 3 shows the location of successful tows by depth stratum.

A total of 168 fish species representing 55 families were identified to the species level over the course of the survey

(Table 3). Members from several additional families were taken but identified only to genus. Table 3 also lists the frequencies of occurrence, depth ranges, and the range of distribution by latitude for all fish taxa identified in trawl samples. The greatest number of species taken (n = 37) belonged to the rockfish (Scorpaenidae) family, followed by the flatfishes (Bothidae and Pleuronectidae) with 19, and the sculpins (Cottidae) with 9 species.

We measured the length of 307,054 fish. A summary of the number of fish measured is presented in Table 4 by species, INPFC area, and depth stratum. The number of specimens collected for other biological samples (age structures, length-weight relationships, maturity, food habits, etc.) are reported in Table 5. Appendix A (see separate Data Appendices volume) summarizes the catch data by haul for each vessel.

Temperature Data

Sea surface temperatures measured at 547 stations using a bucket thermometer ranged from 9.2° to 18.5°C. The overall mean surface temperature was 13.6°C. Temperature profiles of the water column (surface to bottom) were collected at 528 stations. Bottom temperatures from these stations ranged from 5.2° to 10.6°C, averaging 7.6°C. Figures 4 and 5 illustrate the observed surface and bottom temperatures, respectively, by latitude from the 1998 survey and compare these data with temperature data collected during the four previous triennial surveys (1986-1995).

Relative Abundance

The 20 most abundant groundfish species are presented by depth stratum for the individual INPFC areas in Table 6. The complete listings of the relative abundance of all fish and invertebrates ranked by mean CPUE for each INPFC area and depth stratum are presented in Appendix B (see separate volume of Data Appendices). Average total fish and invertebrate densities were highest in the Vancouver (235.5 kg/ha) INPFC area followed by the Eureka (210.8 kg/ha), Columbia (172.7 kg/ha), Monterey (145.6 kg/ha), and Conception(98.5 kg/ha) INPFC areas.

Pacific hake was the most abundant species overall, accounting for 45% of the total survey CPUE (80.3 kg/ha) and 49% in U.S. waters alone (85.4 kg/ha). The highest average CPUE for Pacific hake was in the Eureka INPFC area (144.8 kg/ha), where it comprised 69% of the area's total CPUE. Pacific hake were least abundant in the Conception INPFC area (17.5 kg/ha) where it accounted for 18% of all fish. Besides the Eureka INPFC area, Pacific hake also dominated samples in the U.S. portion of the Vancouver INPFC area (125.5 kg/ha), and in the Columbia (103.9 kg/ha) and Monterey (36.7 kg/ha) INPFC areas.

Dover sole (*Microstomus pacificus*) and spiny dogfish were the second and third most abundant fish species, respectively, both surveywide and in U.S. waters. The mean Dover sole catch rate was 10.51 kg/ha throughout the entire survey area, or about 6% of the CPUE. Spiny dogfish catch rates averaged 10.50 kg/ha surveywide, and made up about 6% of the CPUE.

Sablefish ranked fourth in relative abundance among all species both surveywide (7.7 kg/ha) and in U.S. waters (7.0 kg/ha), accounting for 4% of the catch in both areas. Mean catch rates of sablefish were highest in the Columbia INPFC area (10.6 kg/ha), followed by the Vancouver (10.2 kg/ha), Eureka (9.2 kg/ha), Monterey (2.7 kg/ha), and Conception (1.1 kg/ha) INPFC areas. Sablefish accounted for between 1.2% and 6.1% of INPFC area fish catches.

Catch composition and relative densities varied widely among geographic areas. In the total survey area, the four most abundant species after Pacific hake (80.3 kg/ha) were Dover sole (10.5 kg/ha), spiny dogfish (10.5), sablefish (7.7 kg/ha), and yellowtail rockfish (6.2 kg/ha). These five species as a group accounted for 65% of total CPUE. In U.S. waters only, four of these species were among the five most abundant species. Pacific hake (80.5 kg/ha) was most abundant, followed by Dover sole (10.6 kg/ha), spiny dogfish (7.1 kg/ha), sablefish (7.0 kg/ha), and rex sole (*Glyptocephalus zachirus*) (6.0 kg/ha). Moving from south to north and listed in order of abundance, the five most prominent species in the Conception INPFC area were shortbelly rockfish (*Sebastes jordani*) (18.0 kg/ha), Pacific hake, splitnose rockfish, Dover sole, and jack mackerel (*Trachurus symmetricus*); in the Monterey INPFC area: Pacific hake (36.7 kg/ha), Dover sole, chilipepper, splitnose rockfish, and Pacific herring (*Clupea pallasi*); in the Eureka INPFC area: Pacific hake (144.8 kg/ha), Dover sole, sablefish, rex sole, and spiny dogfish; in the Columbia INPFC area: Pacific hake (103.7 kg/ha),

sablefish, Dover sole, rex sole, and Pacific sanddab; in the U.S. Vancouver INPFC area: Pacific hake (125.5 kg/ha), spiny dogfish, yellowtail rockfish, arrowtooth flounder (*Atheresthes stomias*), and Dover sole; and in the Canadian Vancouver INPFC area: Pacific hake 40.1 kg/ha), spiny dogfish, arrowtooth flounder, yellowtail rockfish, and sablefish.

The catch composition also varied among depth strata. In the shallow stratum (55-183 m) for the entire survey area, Pacific hake (101.5 kg/ha) dominated catches, followed by spiny dogfish, yellowtail rockfish, Pacific sanddab, and Pacific herring. The five most abundant species in the middle depth stratum (184-366 m) were Pacific hake (65.3 kg/ha), splitnose rockfish, Dover sole, sablefish, and rex sole. The five most abundant species in the deep stratum (367-500 m) were Dover sole (27.5 kg/ha), Pacific hake, sablefish, rex sole, and splitnose rockfish.

Maps of the geographical distribution of the primary and secondary target species, based on catch rates at each station, are presented by species in Figures 6-34 in alphabetical order. Yelloweye and yellowmouth rockfish, despite being secondary target species, were not mapped because they were caught so infrequently. Distribution maps of the following selected additional groundfish species also appear:

Arrowtooth flounder	Aurora rockfish	Dover sole
English sole	Greenstriped rockfish	Longspine thornyhead
Pacific halibut	Pacific sanddab	Petrale sole
Redstripe rockfish	Rougheye rockfish	Shortbelly rockfish
Spiny dogfish	Stripetail rockfish	Shortspine thornyhead
Widow rockfish		

The distribution of each species is presented by relative density classifications (high, moderate, and low) in the distribution maps. For each species, all non-zero station catch rates were sorted in decreasing order and classified in either the top 10%, middle 30%, or lowest 60% of the catch rate values. Stations where the species was not caught are also shown. The distribution of sampling effort should be considered when viewing these charts since heavier sampling in an area may give the impression of high densities when, in fact, CPUE was only moderate or low.

Biomass and Population Estimates

Abundance estimates in metric tons (t) of biomass and associated 90% confidence intervals are presented for various taxa in the total survey and by INPFC area and depth stratum in Tables 7-10. Similarly, estimates of population numbers are presented for important species groups in Tables 11-14. Detailed listings of biomass and population estimates are presented for the major species in Appendix C in the Data Appendices volume.

The on-bottom component of the Pacific hake population was estimated to be 497,084 t for the entire area (Table 7). Two of the five INPFC areas accounted for 71% of the total estimated Pacific hake biomass: 51% in the Columbia INPFC area and 20% in the Eureka area. Nine percent of the total estimated Pacific hake biomass (44,797 t) was found in Canadian waters. Pacific hake biomass was distributed mostly in the shallow stratum

(419,185 t or 84% of the total estimate), with 64,551 t (13%) in the middle depth stratum and 13,348 t (3%) in the deep stratum (Tables 8-10).

The total sablefish biomass estimate was 43,402 t (Table 7). The Columbia and Vancouver INPFC areas contributed 50% and 36%, respectively, of the total sablefish biomass between the depths of 55 and 500 m. Sablefish in Canadian waters (11,695 t) amounted to 27% of the total. The distribution of sablefish biomass was heaviest in the shallow stratum, with 23,860 t (55% of the total). We estimated that 11,976 t (28%) of sablefish was located in the middle depth stratum and 7,566 t (17%) was located in the deep stratum (Tables 8-10).

We should warn readers that the biomass and population estimates presented are likely to be conservative since only a portion of the stock may be available to the bottom trawl and some escapement may occur. Because of the lack of data on species-by-species catchability, abundance calculations are based on the assumption that all fish in front of the trawl and between the wingtips are captured. The degree of this conservative bias will vary among species. For instance, a large portion of the total Pacific hake stock is pelagic and would be missed by a bottom trawl. Also, because roller gear is used, escapement underneath the trawl is likely to occur, particularly for the flatfish species. Furthermore, the survey covers limited portions of the depth and geographic range of many of these species.

This survey is the main source of fishery-independent information on the abundance, distribution, and length and age-composition for most of these species. Other fishery-independent data sources used for stock assessments include the AFSC echo integration-trawl survey of the West Coast Pacific hake resource and the AFSC bottom trawl survey of upper continental slope groundfish resources (sablefish, Dover sole, and thornyheads). Stock assessment scientists from several fisheries agencies working on West Coast groundfish species utilize our survey results, along with commercial catch and effort data, in order to set the most appropriate catch levels.

Length Composition

Estimated population length compositions for several groundfish species are presented in alphabetical order by sex and INPFC area (Figs. 35-68). The length compositions for Pacific hake and sablefish include separate presentations of their length compositions by depth stratum. The length compositions of the remaining species are presented for the combined depths only. Computer files of estimated length compositions, by sex and INPFC area, are available upon request for any species from which length data were collected.

Four length modes were evident in the Pacific hake length distributions. For the total survey area, there was a small, discrete peak at 19 cm FL, but the majority of the population was found in the three overlapping modes with peaks centered at 31

cm, 37 cm, and 43 cm FL (Fig. 46). The overall population mean length was 35.9 cm FL. Hake ranged in length from 4 to 84 cm FL. The male and female components of the population were similar with the average length of females (37.2 cm FL) being only a little longer than that of the males (34.8 cm FL). The Conception INPFC area contained mostly small (< 25 cm FL) Pacific hake; the Monterey INPFC area had small, medium (25-32 cm FL) and large (> 32 cm FL) hake; the Eureka INPFC area contained mostly medium and large hake; and north of the Eureka INPFC area, we found mostly the small and large hake. Pacific hake lengths averaged 23.9, 30.5, 34.0, 37.7, 39.4, and 40.8 cm FL in the Conception, Monterey, Eureka, Columbia, U.S. Vancouver, and Canadian Vancouver INPFC areas, respectively. Mean lengths of Pacific hake generally increased with depth except for in the Monterey and Canadian Vancouver INPFC areas, where 40-50 cm FL fish were more numerous in the shallow stratum than in the middle stratum (Figs. 47 and 48). In other areas, hake were slightly longer in the middle strata than in the shallow strata. Hake in the deep strata were generally much longer than in shallower strata (Fig. 49).

Sablefish inhabit a wide range of depths, exceeding the bounds of this survey. Its size distribution can be described by data from this survey for only the shallow end of its range. At these depths, the estimated length distribution for sablefish was generally unimodal with a broad peak around 49 cm FL, except in the Conception INPFC area where the distribution was bimodal with

peaks at 32 and 45 cm FL (Fig. 57). The mode of smaller fish between 28 and 37 cm FL in the Conception area was found mostly in the shallower two strata (Figs. 58-60). Sablefish samples from throughout the survey area ranged from 8 to 88 cm FL, but the overall average length of the population was 52.8 cm FL. The average length of males was 51.1 cm FL and the average length of females was 54.8 cm FL. Juvenile sablefish (< 42 cm FL) accounted for about a third (34%) of the population in the Conception INPFC area. The juvenile proportion of the sablefish population in all the other areas was much less (0.2-6.1%). These numbers were noticeably down from 1995 when juvenile sablefish proportions in the INPFC areas ranged from 34% to 68%. Mean sablefish length (42.7 cm FL) was lower in the Conception INPFC area than in the other areas, where mean length ranged from 48.5 to 58.3 cm FL. Mean sablefish lengths in deep strata were greater than in the shallow strata in all INPFC areas (Figs. 58-60) except in the Vancouver INPFC area, where sablefish were scarce in the deep stratum.

Age Compositions

Otoliths or dorsal fin rays were collected from specimens of 20 groundfish species (Table 5) to determine their ages. To date, ages have been determined for the structures collected from Pacific hake, darkblotched rockfish, and yellowtail rockfish. The age composition of these species was estimated and is presented in Figures 69-71. For this report, each of these

species has been treated as a single, homogenous stock and all age data collected during the 1998 survey has been used to estimate the species's length-age relationship. When it has been appropriate, the age compositions of several of these resources have been estimated and presented in more geographic detail in stock assessment documents published by the Pacific Fishery Management Council.

The age composition of the Pacific hake resource (Fig. 69) shows that the population is primarily supported by fish from seven or eight year classes spawned in 1984, 1987, and 1993 to 1997. Fish from other year classes contribute relatively little to the size of this resource.

The darkblotched rockfish resource, on the other hand, is represented more evenly by fish between 2 and 8 years old (Fig. 70). The 1998 survey estimated fewer darkblotched rockfish of ages 10 years and older compared to the results of the 1995 survey (Wilkins et al. 1998). Yellowtail rockfish exhibited a similar profile (Fig. 71) except the age distribution is shifted to older fish with the bulk of the fish between 8 and 15 years old. These two rockfish species generally become fully available to the survey and commercial trawl gear when they are between 3 and 7 years old. Prior to that, they can be detected by the survey trawl when the younger age groups are notably abundant. Following their full recruitment to the gear, the age composition figures (Figs. 70-71) track the relatively constant decrease in

their abundance as they age, a normal result of natural and fishing-induced mortality.

Length-Weight Relationships

From the individual fish weight samples, we determined length-weight relationships using a linear least-squares regression model on log-transformed data. Results of these analyses are summarized in Table 15 for males, females, and for all fish combined (including unsexed fish, if data existed for them). The following equations describe the relationships for Pacific hake and sablefish:

Pacific hake:	$W = 0.0068387 \times L^{2.948661}$	for males
	$W = 0.0041574 \times L^{3.102999}$	for females
	$W = 0.0046151 \times L^{3.069480}$	for all sexes
Sablefish:	$W = 0.0022818 \times L^{3.364467}$	for males
	$W = 0.0021359 \times L^{3.377710}$	for females
	$W = 0.0022823 \times L^{3.362353}$	for all sexes

where:

W = estimated weight (g)

L = fork length (cm).

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Table 1.--Attributes of the vessels and net used during the 1998 triennial West Coast groundfish survey.

Vessel	Vessel length	Horsepower	Mean net width	Survey period
F/V *Vesteraalen*	38.0 m	1,710	14.57 m	1 June-9 August
F/V *Dominator*	38.0 m	1,900	12.86 m	1 June-9 August

Table 2.--Sampling stratum boundaries used for analyses, stratum areas (km^2), and realized sampling density (hauls/1,000 km^2) based on successful tows during the 1998 triennial West Coast groundfish survey. Strata have been grouped according to International North Pacific Fisheries Commission (INPFC) areas. Differences in totals are due to rounding.

	Shallow Strata (55-183 m)				Middle Strata (184-366 m)				Deep Strata (367-500 m)			
INPFC Areas / Latitude bounds	Code	Area (km^2)	Number of hauls	Hauls per 1,000 km^2	Code	Area (km^2)	Number of hauls	Hauls per 1,000 km^2	Code	Area (km^2)	Number of hauls	Hauls per 1,000 km^2
Vancouver												
48°20' - 49°40'	19	8,587.0	51	5.94	29	1,211.2	9	7.43	39	442.2	4	9.05
47°50' - 48°20'	18	2,282.2	20	8.76	28	874.6	7	8.00	38	241.0	0	0.00
47°30' - 47°50'	17	1,032.6	8	7.75	27	536.7	2	3.73	37	320.0	1	3.13
47°30' - 49°40'	--	11,901.8	79	6.64	--	2,622.5	18	6.86	--	1,003.2	5	4.98
Vancouver (Canada only)												
48°20' - 49°40'	19	8,224.4	48	5.84	29	941.7	6	6.37	39	442.2	4	9.05
Border - 48°20'	18	159.4	0	0.00	28	87.6	1	11.42	38	66.5	0	0.00
Border - 49°40'	--	8,383.8	48	5.73	--	1,029.3	7	6.80	--	508.7	4	7.86
Vancouver (U.S. only)												
48°20' - Border	19	362.6	3	8.27	29	269.5	3	11.13				
47°50' - 48°20'	18	2,122.8	20	9.42	28	787.0	6	7.62	38	174.5	0	0.00
47°30' - 47°50'	17	1,032.6	8	7.75	27	124.7	2	16.04	37	102.2	1	9.78
47°30' - Border	--	3,518.0	31	8.81	--	1,181.2	11	9.31	--	276.7	1	3.61
Columbia												
46°30' - 47°30'	17	3,378.0	26	7.70	27	412.0	4	9.71	37	217.8	1	4.59
44°40' - 46°30'	16	6,014.3	48	7.98	26	2,118.5	20	9.44	36	2,101.2	17	8.09
43°00' - 44°40'	15	6,250.0	44	7.04	25	1,508.1	16	10.61	35	775.0	10	12.90
43°00' - 47°30'	--	15,642.3	118	7.54	--	4,038.6	40	9.90	--	3,094.0	28	9.05
Eureka												
40°30' - 43°00'	14	4,090.6	38	9.29	24	1,076.2	16	14.87	34	736.6	14	19.01

Table 2.--Continued

Monterey												
38°00' - 40°30'	13	4,724.4	42	8.89	23	1,112.2	14	12.59	33	676.8	15	22.16
36°50' - 38°00'	12	3,735.0	30	8.03	22	493.9	7	14.17	32	354.4	7	19.75
36°00' - 36°50'	11	551.6	5	9.06	21	189.1	2	10.58	31	189.2	3	15.86
36°00' - 40°30'	--	9,011.0	77	8.55	--	1,795.2	23	12.81	--	1,220.4	25	20.49
Conception												
35°40' - 36°00'	11	167.1	2	11.97	21	104.9	2	19.07	31	113.2	2	17.67
34°30' - 35°40'	10	1,343.4	14	10.42	20	1,089.7	10	9.18	30	943.6	16	16.96
34°30' - 36°00'	--	1,510.5	16	10.59	--	1,194.6	12	10.05	--	1,056.8	18	17.03
1998 Totals												
U.S. Total		33,772.4	280	8.29		9,285.8	102	10.98		6,384.5	86	13.47
Entire Survey		42,156.2	328	7.78		10,727.1	109	10.16		7,111.0	90	12.66

Table 3.--Frequency of occurrence, depth and latitude ranges for fish species caught during the 1998 triennial West Coast groundfish survey.

Family and Scientific Name	Common Name	Frequency of Occurence	Minimum Depth (m)	Maximum Depth (m)	Mean Depth (m)	Latitude Range* South / North
Myxinidae	hagfishes					
Eptatretus deani	black hagfish	11	128	481	361	4145 / 4453
Eptatretus stouti	Pacific hagfish	2	107	367	237	4104 / 4144
Petromyzontidae	lampreys					
Petromyzontidae unident.	lamprey unident.	1	465	465	465	4242 / 4242
Lampetra tridentata	Pacific lamprey	6	131	405	268	4242 / 4822
Chimaeridae	ratfishes					
Hydrolagus colliei	spotted ratfish	322	56	491	193	3431 / 4915
Hexanchidae	cow sharks					
Hexanchus griseus	sixgill shark	4	79	164	129	3925 / 4344
Scyliorhinidae	cat sharks					
Scyliorhinidae unident.	cat shark unident.	1	486	486	486	4343 / 4343
Apristurus brunneus	brown cat shark	90	79	491	364	3434 / 4825
Apristurus kampae	longnose cat shark	3	237	491	349	3534 / 3724
Parmaturus xaniurus	filetail cat shark	22	115	491	394	3431 / 3734
Cephaloscyllium ventriosum	swell shark	1	70	70	70	3454 / 3454
Triakidae	houndsharks					
Galeorhinus galeus	soupfin shark	4	70	112	96	3523 / 4857
Mustelus sp.	smoothhounds	9	71	120	88	3704 / 3846
Mustelus henlei	brown smoothhound	20	59	281	100	3503 / 3844
Mustelus californicus	gray smoothhound	2	88	95	92	3534 / 3724
Carcharhinidae	requiem sharks					
Prionace glauca	blue shark	1	387	387	387	4355 / 4355
Dalatiidae	sleeper sharks					
Somniosus pacificus	Pacific sleeper shark	1	451	451	451	3504 / 3504
Squalidae	dogfish sharks					
Squalus acanthias	spiny dogfish	440	55	477	179	3434 / 4915
Squantinidae	angel sharks					
Squatina californica	Pacific angel shark	4	72	115	93	3433 / 3444
Torpedinidae	electric rays					
Torpedo californica	Pacific electric ray	52	59	387	129	3431 / 4736
Rajidae	skates					
Rajidae unident.	skate unident.	1	438	438	438	4425 / 4425
Raja binoculata	big skate	59	55	406	110	3434 / 4904
Raja inornata	California skate	10	59	427	155	3444 / 3951
Raja rhina	longnose skate	305	61	491	206	3431 / 4915
Raja stellulata	starry skate	1	95	95	95	3534 / 3534
Bathyraja aleutica	Aleutian skate	1	477	477	477	4734 / 4734
Bathyraja interrupta	Bering skate	165	63	491	281	3434 / 4914
Bathyraja parmifera	Alaska skate	1	91	91	91	4405 / 4405
Acipenseridae	sturgeons					
Acipenser medirostris	green sturgeon	1	74	74	74	4414 / 4414
Saccopharyngidae	swallowers					
Saccopharynx sp.		1	331	331	331	3435 / 3435
Clupeidae	herrings					
Clupea pallasi	Pacific herring	247	57	402	113	3433 / 4915
Alosa sapidissima	American shad	160	59	412	117	3503 / 4904
Sardinops sagax	Pacific sardine	56	57	213	98	3534 / 4904
Engraulidae	anchovies					
Engraulis mordax	northern anchovy	30	57	112	76	3444 / 4855
Argentinidae	argentines					
Argentina sialis	Pacific argentine	39	62	210	123	3434 / 3824

Table 3.--Continued.

Family and Scientific Name	Common Name	Frequency of Occurence	Minimum Depth (m)	Maximum Depth (m)	Mean Depth (m)	Latitude Range* South / North
Bathylagidae	deepsea smelts					
Bathylagus sp.	blacksmelt unident.	8	298	483	416	3435 / 4734
Leuroglossus schmidti	northern smoothtongue	1	335	335	335	4204 / 4204
Leuroglossus stilbius	California smoothtongue	3	417	447	432	3445 / 4145
Alepocephalidae	slickheads					
Alepocephalus tenebrosus	California slickhead	2	449	471	460	4026 / 4224
Platytroctidae (Searsiidae)	tubeshoulders					
Platytroctidae unident.	tubeshoulder unident.	1	331	331	331	3435 / 3435
Sagamichthys abei	shining tubeshoulder	4	373	458	419	3524 / 4845
Osmeridae	smelts					
Osmeridae unident.	smelt unident.	1	81	81	81	4915 / 4915
Thaleichthys pacificus	eulachon	45	79	322	147	4224 / 4914
Hypomesus pretiosus	surf smelt	6	55	98	73	4604 / 4904
Allosmerus elongatus	whitebait smelt	18	61	160	121	3825 / 4846
Spirinchus starksi	night smelt	4	56	111	82	4225 / 4555
Salmonidae	salmonids					
Oncorhynchus tshawytscha	chinook salmon	98	56	281	103	3441 / 4857
Oncorhynchus kisutch	coho salmon	7	61	209	128	4104 / 4845
Sternoptychidae	marine hatchetfishes					
Sternoptychidae unident.	hatchetfish unident.	5	331	471	409	3435 / 4224
Stomiidae	dragonfishes					
Aristostomias scintillans	shining loosejaw	4	331	471	394	3435 / 4504
Chauliodus macouni	Pacific viperfish	17	286	486	416	3434 / 4814
Idiacanthus antrostomus	Pacific blackdragon	3	379	477	427	3624 / 4054
Tactostoma macropus	longfin dragonfish	26	257	486	402	3435 / 4734
Synodontidae	lizardfishes					
Synodus lucioceps	California lizardfish	1	88	88	88	3724 / 3724
Paralepidae	barracudinas					
Lestidiops ringens	slender barracudina	2	291	453	372	3925 / 4505
Notolepsis risso	ribbon barracudina	1	477	477	477	4734 / 4734
Alepisauridae	lancetfishes					
Alepisaurus ferox	longnose lancetfish	1	79	79	79	4435 / 4435
Myctophidae	lanternfishes					
Myctophidae unident.	lanternfish unident.	105	104	491	349	3434 / 4904
Diaphus sp.		2	258	413	336	3913 / 3914
Diaphus theta	California headlightfish	2	286	322	304	4434 / 4436
Lampanyctus sp.		12	285	486	422	3435 / 4734
Lampanyctus ritteri	broadfin lanternfish	2	425	449	437	4026 / 4054
Lampanyctus regalis	pinpoint lampfish	1	367	367	367	4104 / 4104
Stenobrachius leucopsarus	northern lampfish	5	193	481	328	4305 / 4546
Symbolophorus californiensis	California lanternfish	13	258	477	395	3431 / 4012
Tarletonbeania sp.		1	342	342	342	4343 / 4343
Tarletonbeania crenularis	blue lanternfish	1	392	392	392	3434 / 3434
Merlucciidae	merluccid hakes					
Merluccius productus	Pacific hake	490	56	491	200	3431 / 4914
Moridae	codlings					
Antimora microlepis	Pacific flatnose	7	428	486	460	4026 / 4734
Gadidae	cods					
Gadus macrocephalus	Pacific cod	65	74	223	139	4445 / 4915
Microgadus proximus	Pacific tomcod	67	55	131	81	3846 / 4915
Theragra chalcogramma	walleye pollock	28	81	223	145	4354 / 4915
Macrouridae	grenadiers					
Albatrossia pectoralis	giant grenadier	2	449	471	460	4026 / 4224
Coryphaenoides acrolepis	Pacific grenadier	4	449	486	471	4026 / 4504
Malacocephalus laevis		1	462	462	462	3454 / 3454
Nezumia stelgidolepis	California grenadier	6	399	477	433	3624 / 4253

Table 3.--Continued.

Family and Scientific Name	Common Name	Frequency of Occurence	Minimum Depth (m)	Maximum Depth (m)	Mean Depth (m)	Latitude Range* South / North
Ophidiidae	cusk-eels					
Ophidiidae unident.	cusk-eel unident.	1	142	142	142	4604 / 4604
Chilara taylori	spotted cusk-eel	48	63	471	154	3441 / 4534
Batrachoididae	toadfishes					
Porichthys notatus	plainfin midshipman	109	57	213	98	3433 / 4855
Scomberesocidae	sauries					
Cololabis saira	Pacific saury	1	70	70	70	3454 / 3454
Scorpaenidae	scorpionfishes					
Sebastolobus alascanus	shortspine thornyhead	196	94	491	317	3434 / 4904
Sebastolobus altivelis	longspine thornyhead	39	193	486	427	3454 / 4734
Sebastes sp.	rockfish unident.	3	102	250	191	3805 / 4344
Sebastes aleutianus	rougheye rockfish	75	118	476	270	3655 / 4904
Sebastes alutus	Pacific ocean perch	98	119	458	279	3806 / 4913
Sebastes auriculatus	brown rockfish	1	61	61	61	3734 / 3734
Sebastes aurora	aurora rockfish	88	130	491	400	3434 / 4605
Sebastes brevispinis	silvergray rockfish	18	100	291	179	4416 / 4914
Sebastes caurinus	copper rockfish	4	63	97	78	3523 / 3825
Sebastes chlorostictus	greenspotted rockfish	18	100	379	165	3534 / 4803
Sebastes crameri	darkblotched rockfish	168	98	458	210	3514 / 4913
Sebastes diploproa	splitnose rockfish	152	95	465	269	3431 / 4904
Sebastes elongatus	greenstriped rockfish	214	71	294	152	3434 / 4914
Sebastes entomelas	widow rockfish	70	69	372	176	3625 / 4914
Sebastes flavidus	yellowtail rockfish	130	69	283	143	3805 / 4914
Sebastes goodei	chilipepper	81	62	410	162	3433 / 4416
Sebastes helvomaculatus	rosethorn rockfish	61	102	391	211	3434 / 4914
Sebastes jordani	shortbelly rockfish	41	73	292	170	3441 / 4903
Sebastes levis	cowcod	11	71	212	151	3534 / 4456
Sebastes maliger	quillback rockfish	5	55	82	70	4303 / 4906
Sebastes melanops	black rockfish	4	69	109	84	4614 / 4835
Sebastes melanostomus	blackgill rockfish	38	213	491	398	3434 / 4455
Sebastes miniatus	vermilion rockfish	1	79	79	79	4019 / 4019
Sebastes mystinus	blue rockfish	1	79	79	79	4019 / 4019
Sebastes ovalis	speckled rockfish	1	135	135	135	3805 / 3805
Sebastes paucispinis	bocaccio	37	71	370	163	3434 / 4914
Sebastes pinniger	canary rockfish	109	63	379	144	3547 / 4915
Sebastes proriger	redstripe rockfish	38	91	264	168	4114 / 4913
Sebastes ruberrimus	yelloweye rockfish	17	102	264	151	4236 / 4914
Sebastes babcocki	redbanded rockfish	82	125	438	255	3524 / 4913
Sebastes saxicola	stripetail rockfish	125	57	311	170	3433 / 4903
Sebastes semicinctus	halfbanded rockfish	28	71	248	111	3433 / 4317
Sebastes wilsoni	pygmy rockfish	13	79	188	129	3638 / 4903
Sebastes zacentrus	sharpchin rockfish	62	130	340	206	3534 / 4914
Sebastes rufus	bank rockfish	8	190	431	288	3434 / 4546
Sebastes borealis	shortraker rockfish	7	242	443	375	3905 / 4713
Sebastes reedi	yellowmouth rockfish	4	188	291	228	4505 / 4852
Sebastes rosenblatti	greenblotched rockfish	3	112	284	195	3547 / 3755
Triglidae	searobins					
Prionotus stephanophrys	lumptail searobin	1	72	72	72	3444 / 3444
Anoplopomatidae	sablefishes					
Anoplopoma fimbria	sablefish	310	71	491	255	3431 / 4914
Hexagrammidae	greenlings					
Hexagrammos decagrammus	kelp greenling	8	69	121	95	3653 / 4906
Ophiodon elongatus	lingcod	203	55	288	128	3434 / 4915
Zaniolepis latipinnis	longspine combfish	41	57	125	84	3433 / 4454
Zaniolepis frenata	shortspine combfish	5	160	375	221	3434 / 3547

Table 3.--Continued.

Family and Scientific Name	Common Name	Frequency of Occurence	Minimum Depth (m)	Maximum Depth (m)	Mean Depth (m)	Latitude Range* South / North
Cottidae	sculpins					
Cottidae unident.	sculpin unident.	2	121	220	171	3805 / 4814
Chitonotus pugetensis	roughback sculpin	1	72	72	72	3734 / 3734
Enophrys taurina	bull sculpin	1	62	62	62	3745 / 3745
Hemilepidotus spinosus	brown Irish lord	1	113	113	113	4845 / 4845
Icelinus oculatus	frogmouth sculpin	1	213	213	213	4404 / 4404
Icelinus filamentosus	threadfin sculpin	83	78	476	175	3434 / 4914
Icelinus borealis	northern sculpin	1	161	161	161	4445 / 4445
Icelinus tenuis	spotfin sculpin	1	112	112	112	3638 / 3638
Leptocottus armatus	Pacific staghorn sculpin	2	63	73	68	4135 / 4154
Radulinus asprellus	slim sculpin	7	68	167	112	3804 / 4817
Agonidae	poachers					
Bathyagonus sp.	starsnout poacher unident.	1	224	224	224	4635 / 4635
Bathyagonus infraspinatus	spinycheek starsnout	2	87	323	205	4033 / 4033
Bathyagonus nigripinnis	blackfin poacher	5	67	481	358	3646 / 4504
Bathyagonus pentacanthus	bigeye poacher	4	142	403	266	4425 / 4744
Podothecus acipenserinus	sturgeon poacher	1	61	61	61	4904 / 4904
Xeneretmus latifrons	blacktip poacher	10	122	258	187	3735 / 4545
Xeneretmus leiops	smootheye poacher	3	257	291	269	4305 / 4505
Xeneretmus triacanthus	bluespotted poacher	3	196	429	294	4304 / 4355
Liparidae (Liparididae)	snailfishes					
Liparidae unident.	snailfish unident.	3	335	429	384	3726 / 4304
Careproctus sp.		5	394	462	425	3755 / 4404
Careproctus melanurus	blacktail snailfish	51	61	491	361	3434 / 4904
Liparis sp.		6	100	421	351	4048 / 4855
Paraliparis sp.		2	273	449	361	4026 / 4114
Rhinoliparis attenuatus	slim snailfish	1	462	462	462	4012 / 4012
Acropomatidae (Howellidae)	temperate ocean-basses					
Howella sherborni		1	394	394	394	4404 / 4404
Carangidae	jacks					
Trachurus symmetricus	jack mackerel	91	57	428	127	3434 / 4846
Sciaenidae	croakers (drums)					
Genyonemus lineatus	white croaker	45	59	119	84	3433 / 4114
Embiotocidae	surfperches					
Cymatogaster aggregata	shiner perch	4	55	69	60	3655 / 4904
Zalembius rosaceus	pink seaperch	66	57	199	97	3435 / 3925
Bathymasteridae	ronquils					
Bathymaster signatus	searcher	2	159	175	167	4702 / 4846
Ronquilus jordani	northern ronquil	2	169	199	184	4817 / 4855
Zoarcidae	eelpouts					
Bothrocara brunneum	twoline eelpout	7	367	486	447	3824 / 4425
Lycodapus sp.		4	402	486	447	3944 / 4343
Lycodapus fierasfer	blackmouth eelpout	1	480	480	480	3514 / 3514
Lycodapus mandibularis	pallid eelpout	1	453	453	453	3925 / 3925
Lycodes brevipes	shortfin eelpout	20	76	195	124	4553 / 4904
Lycodes cortezianus	bigfin eelpout	183	95	491	323	3431 / 4904
Lycodes diapterus	black eelpout	106	100	491	371	3431 / 4904
Lycodes pacificus	blackbelly eelpout	129	64	425	137	3434 / 4914
Stichaeidae	pricklebacks					
Stichaeidae unident.	prickleback unident.	2	137	137	137	4604 / 4644
Plectobranchus evides	bluebarred prickleback	1	149	149	149	4705 / 4705
Poroclinus rothrocki	whitebarred prickleback	1	111	111	111	4544 / 4544
Cryptacanthodidae	wrymouths					
Cryptacanthodes giganteus	giant wrymouth	3	165	202	188	4525 / 4825
Lyconectes aleutensis	dwarf wrymouth	2	212	213	213	4253 / 4416

Table 3.--Continued.

Family and Scientific Name	Common Name	Frequency of Occurence	Minimum Depth (m)	Maximum Depth (m)	Mean Depth (m)	Latitude Range* South / North
Anarhichadidae	wolffishes					
Anarrhichthys ocellatus	wolf-eel	3	55	77	69	4317 / 4904
Trichiuridae	scubbardfishes					
Trichiuridae unident.	scubbardfishes unident.	5	67	311	214	3443 / 3646
Scombridae	mackerels and tunas					
Scomber japonicus	chub mackerel	81	57	431	128	3441 / 4904
Stromateidae	butterfishes					
Stromateidae unident.	butterfish unident.	1	61	61	61	4633 / 4633
Peprilus simillimus	Pacific pompano	31	59	119	79	3443 / 4414
Bothidae	lefteye flounders					
Citharichthys sordidus	Pacific sanddab	290	55	223	107	3433 / 4915
Citharichthys stigmaeus	speckled sanddab	1	74	74	74	3625 / 3625
Hippoglossina stomata	bigmouth sole	1	82	82	82	3523 / 3523
Paralichthys californicus	California halibut	8	59	281	97	3454 / 3825
Xystreurys liolepis	fantail sole	1	72	72	72	3444 / 3444
Pleuronectidae	righteye flounders					
Atheresthes stomias	arrowtooth flounder	267	76	481	205	3832 / 4914
Embassichthys bathybius	deepsea sole	4	389	477	427	3755 / 4734
Eopsetta jordani	petrale sole	322	55	465	131	3431 / 4915
Glyptocephalus zachirus	rex sole	508	55	491	193	3431 / 4915
Hippoglossoides elassodon	flathead sole	64	96	224	142	4405 / 4914
Hippoglossus stenolepis	Pacific halibut	106	55	372	141	3844 / 4914
Isopsetta isolepis	butter sole	3	56	100	77	4214 / 4414
Lepidopsetta bilineata	southern rock sole	49	55	135	89	3625 / 4915
Lyopsetta exilis	slender sole	389	59	472	177	3434 / 4914
Microstomus pacificus	Dover sole	495	55	491	200	3431 / 4915
Parophrys vetulus	English sole	364	55	449	134	3433 / 4915
Platichthys stellatus	starry flounder	15	59	120	78	3754 / 4715
Psettichthys melanostictus	sand sole	13	56	85	69	3745 / 4904
Pleuronichthys coenosus	C-O sole	1	72	72	72	3444 / 3444

*ddmm=degrees and minutes of latitude

Table 4.--Number of length frequency measurements collected by International North Pacific Fisheries Commission area and depth stratum (m) during the 1998 West Coast triennial groundfish bottom trawl survey.

	Conception			Monterey			Eureka			Columbia			Vancouver		
Species	55-183	184-366	367-500	55-183	184-366	367-500	55-183	184-366	367-500	55-183	184-366	367-500	55-183	184-366	367-500
Brown cat shark			1												
Filetail cat shark		18	30			7									
Spiny dogfish	95			405	181	42	161	44		160					
Big skate				2						1					
Bering skate	2	7	7												
Longnose skate	3	3	34		1	5				3					
Pacific sanddab	821			4,490	31		2,810			11,188	39		3,373	1	
California halibut	7	1		7											
Arrowtooth flounder				1	1	2	46	98	94	1,207	818	96	2,629	511	82
Pacific halibut				8			9	4		105	55		241	10	1
Flathead sole										158	2		1,074	50	
Slender sole	54	454		245	352	154	1,343	487	76	2,267	1,637	147	918	425	3
Petrale sole	21	2		345	53	35	494	20		1,216	63		595	8	2
English sole	187	2		2,712	229	81	1,922	258		8,005	394	2	2,177	89	1
Dover sole	14	258	1,962	673	1,395	2,609	1,408	1,758	1481	6,296	3,867	1,811	3,274	939	224
Rex sole	111	544	1,203	1,819	850	1,570	3,399	1,602	1,120	13,301	4,381	1,436	4,772	1,101	284
Starry flounder				15						9					
Sand sole				4						99			1		
Southern rock sole				40						167			480		
Butter sole							1			20					
Curlfin sole	7			121	1		34			83			35		
Hornyhead turbot				24											
Sablefish	23	22	178	24	307	752	6	733	1,190	1,652	1,181	933	712	326	22
Northern anchovy	85			969						114			1		
Plainfin midshipman	112			83											
Jack mackerel	105			744	15	9				134	11		23		
Pacific herring	327			3,226		67	931			2,022	21	1	1,454	7	
American shad										411	47		226	21	

Table 4.--Continued.

	Conception			Monterey			Eureka			Columbia			Vancouver		
Species	55-183	184-366	367-500	55-183	184-366	367-500	55-183	184-366	367-500	55-183	184-366	367-500	55-183	184-366	367-500
Pacific sardine	1			1,767			3			159	2		193	1	
Pacific tomcod				4			46			582			629		
Pacific cod										23	5		232	57	
Walleye pollock											1		219	15	
Lingcod	14	1		165	36		38	16		172	100		260	9	
Kelp greenling													6		
Pacific hake	849	1,871	2,927	6,553	4,188	2,884	9,277	2,494	1,369	22,383	6,918	2,903	4,942	1,399	139
Chinook salmon	9			272	2		4	1		54			66		
Coho salmon							1	1		1			3	1	
White croaker	479			1,318											
Chub mackerel	1			262	1		85	7		695	14		24	5	
Pacific pompano	251														
Shortspine thornyhead		3	243	2	141	453	2	502	1,347	146	3,141	3,577	114	464	489
Longspine thornyhead			1,017		1	29			114			1,261			
Rougheye rockfish						6	1	2	3	137	35	41	52	24	182
Pacific ocean perch				1	3	4	53	64	5		977	133	615	874	82
Brown rockfish				1											
Aurora rockfish			766		11	1,432	1	10	514	2	6	334			
Silvergray rockfish											3		104	76	
Copper rockfish	3			3											
Greenspotted rockfish		1		153	11	1				4			1		
Darkblotched rockfish			2	11	65	3	179	378	6	1,149	981	12	392	212	5
Splitnose rockfish	217	1,692	1,026	20	2,608	1,106	296	1,367	25	11	3,142	75	5	295	5
Greenstriped rockfish	16	3		886	158		314	204		2,242	723		1,087	329	
Widow rockfish				236	197		6	46		32	42		111	243	1
Yellowtail rockfish				421			194			1,367	371		1,485	449	
Chilipepper	521	43		2,272	926		3	217	2	1	7				
Rosethorn rockfish		2		18	89		1	3		120	244	6	174	59	
Shortbelly rockfish	588	26		638	778			1			1		1		

Table 4.--Continued.

	Conception			Monterey			Eureka			Columbia			Vancouver		
Species	55-183	184-366	367-500	55-183	184-366	367-500	55-183	184-366	367-500	55-183	184-366	367-500	55-183	184-366	367-500
Cowcod	4			11	1			1			2				
Quillback rockfish										2			29		
Black rockfish										4			1		
Blackgill rockfish			142		57	143		8	1		3	6			
Vermilion rockfish				1											
Blue rockfish				43											
Speckled rockfish				7											
Bocaccio	5	1	1	31	21								15	6	
Canary rockfish				164	2	1	42	2		68	21		356	95	
Redstripe rockfish							1	18		195	3		771	422	
Yelloweye rockfish								1		6			22	1	
Redbanded rockfish			1		10	4		14	7	14	96	8	19	47	3
Stripetail rockfish	573	669		1,285	1,946		537	829		126	1,186		16	5	
Halfbanded rockfish	252			247	2					1					
Pygmy rockfish				8						64			64	1	
Sharpchin rockfish		1		35	181		36	94		18	557		88	423	
Bank rockfish		1	2		6	1					2				
Shortraker rockfish					1				3		3	7			
Yellowmouth rockfish											13			3	
Greenblotched rockfish				1	2										

Table 5.--Number of biological data samples collected during the 1998 triennial West Coast bottom trawl groundfish survey.

Species	Age structures*	Specimen weights	Maturity observations
Pacific sanddab	--	259	--
Pacific halibut	328	--	--
Slender sole	--	19	--
Petrale sole	--	12	--
Dover sole	116	239	--
Sablefish	832	832	811
Pacific herring	--	100	--
Pacific sardine	193	218	101
Lingcod	849	837	479
Pacific hake	776	776	545
Chinook salmon	--	16	--
White croaker	--	130	--
Chub mackerel	23	41	--
Rougheye rockfish	--	79	--
Pacific ocean perch	560	560	211
Aurora rockfish	--	140	86
Silvergray rockfish	153	153	63
Darkblotched rockfish	470	470	469
Splitnose rockfish	350	350	350
Yellowtail rockfish	1,581	1,611	1,110
Chilipepper	441	441	439
Blackgill rockfish	344	344	343
Bocaccio	146	146	130
Canary rockfish	378	380	242
Redstripe rockfish	280	280	71
Yelloweye rockfish	43	43	15
Sharpchin rockfish	349	349	214
Yellowmouth rockfish	16	16	13

*Dorsal finrays were collected from lingcod. Otoliths were collected from all other species.

Table 6.--Mean catch per unit of effort (CPUE, kg/ha) for the 20 most abundant groundfish species in each International North Pacific Fisheries Commission area and depth stratum during the 1998 West Coast triennial groundfish survey.

Conception Area 55-183 m		Conception Area 184-366 m		Conception Area 367-500 m		Conception Area 55-500 m	
Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)
Shortbelly rockfish	51.75	Splitnose rockfish	20.58	Pacific hake	32.71	Shortbelly rockfish	18.09
Jack mackerel	15.40	Stripetail rockfish	17.47	Splitnose rockfish	23.03	Pacific hake	17.52
Pacific sanddab	8.61	Pacific hake	16.75	Dover sole	22.55	Splitnose rockfish	14.44
Chilipepper	5.38	Rex sole	5.98	Rex sole	7.92	Dover sole	9.51
White croaker	4.11	Dover sole	2.56	Aurora rockfish	4.76	Jack mackerel	5.37
Pacific herring	1.95	Chilipepper	1.24	Sablefish	2.67	Stripetail rockfish	4.93
Spiny dogfish	1.32	Slender sole	0.87	Longspine thornyhead	2.29	Rex sole	4.72
Stripetail rockfish	1.08	Shortbelly rockfish	0.34	Blackgill rockfish	2.02	Pacific sanddab	3.00
Pacific hake	1.02	Spiny dogfish	0.25	Longnose skate	1.48	Chilipepper	2.19
Pacific argentine	0.97	Longnose skate	0.24	Bigfin eelpout	1.10	Aurora rockfish	1.86
English sole	0.83	Big skate	0.24	Black eelpout	0.88	White croaker	1.43
Pacific angel shark	0.83	Sablefish	0.22	Shortspine thornyhead	0.73	Sablefish	1.14
Halfbanded rockfish	0.83	Bigfin eelpout	0.22	Filetail cat shark	0.50	Longspine thornyhead	0.90
Petrale sole	0.64	Spotted ratfish	0.21	Spotted ratfish	0.43	Blackgill rockfish	0.79
Pacific pompano	0.45	Petrale sole	0.18	Pacific electric ray	0.29	Pacific herring	0.73
California halibut	0.40	Bering skate	0.18	Spiny dogfish	0.22	Longnose skate	0.64
Plainfin midshipman	0.37	Bocaccio	0.15	Bering skate	0.14	Spiny dogfish	0.61
Chinook salmon	0.35	Lingcod	0.13	Pacific herring	0.13	Bigfin eelpout	0.49
Pacific electric ray	0.26	Blackbelly eelpout	0.13	Brown cat shark	0.11	Black eelpout	0.35
Pink seaperch	0.22	Filetail cat shark	0.13	Petrale sole	0.05	Pacific argentine	0.34
Number of hauls	16	Number of hauls	12	Number of hauls	18	Number of hauls	46

Table 6.--Continued.

Monterey Area 55-183 m		Monterey Area 184-366 m		Monterey Area 367-500 m		Monterey Area 55-500 m	
Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)
Pacific hake	21.46	Pacific hake	102.62	Dover sole	45.61	Pacific hake	36.70
Pacific herring	14.32	Splitnose rockfish	46.71	Pacific hake	23.00	Dover sole	12.89
Chilipepper	12.23	Chilipepper	28.49	Rex sole	17.78	Chilipepper	12.78
Pacific sanddab	7.95	Dover sole	18.55	Sablefish	9.80	Splitnose rockfish	10.09
White croaker	7.48	Spiny dogfish	16.81	Splitnose rockfish	7.49	Pacific herring	8.82
Jack mackerel	7.40	Shortbelly rockfish	16.59	Aurora rockfish	4.21	Spiny dogfish	6.80
Pacific sardine	5.82	Stripetail rockfish	15.40	Spiny dogfish	3.50	Rex sole	5.94
Spiny dogfish	4.88	Rex sole	9.23	Shortspine thornyhead	2.83	Pacific sanddab	4.94
Yellowtail rockfish	4.45	Widow rockfish	4.62	Bigfin eelpout	2.66	Jack mackerel	4.65
Chub mackerel	3.94	Sablefish	3.99	Spotted ratfish	2.58	White croaker	4.61
Northern anchovy	2.64	English sole	2.02	Longnose skate	1.50	Stripetail rockfish	4.41
Stripetail rockfish	2.56	Spotted ratfish	1.55	Brown cat shark	1.40	Pacific sardine	3.58
English sole	2.04	Longnose skate	1.05	Blackgill rockfish	1.32	Shortbelly rockfish	3.31
Chinook salmon	1.78	Sharpchin rockfish	0.78	Longspine thornyhead	0.58	Yellowtail rockfish	2.74
Rex sole	1.11	Bigfin eelpout	0.74	Filetail cat shark	0.42	Sablefish	2.73
Widow rockfish	1.00	Shortspine thornyhead	0.72	English sole	0.37	Chub mackerel	2.43
Canary rockfish	0.77	Darkblotched rockfish	0.70	Bering skate	0.34	English sole	1.70
Petrale sole	0.68	Slender sole	0.64	Petrale sole	0.28	Northern anchovy	1.62
Big skate	0.66	Lingcod	0.56	Black eelpout	0.28	Widow rockfish	1.47
Greenstriped rockfish	0.62	Brown cat shark	0.55	Slender sole	0.21	Chinook salmon	1.10
Number of hauls	77	Number of hauls	23	Number of hauls	25	Number of hauls	125

Table 6.--Continued.

Eureka Area 55-183 m		Eureka Area 184-366 m		Eureka Area 367-500 m		Eureka Area 55-500 m	
Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)
Pacific hake	228.03	Pacific hake	58.63	Dover sole	33.08	Pacific hake	144.75
English sole	4.98	Dover sole	25.20	Sablefish	28.36	Dover sole	15.35
Pacific sanddab	4.75	Sablefish	14.20	Pacific hake	17.13	Sablefish	9.20
Dover sole	4.67	Rex sole	12.52	Rex sole	13.16	Rex sole	7.87
Rex sole	3.86	Spiny dogfish	10.02	Black eelpout	4.35	Spiny dogfish	5.06
Spiny dogfish	3.84	Splitnose rockfish	5.41	Brown catshark	4.31	English sole	3.23
Pacific herring	1.84	Stripetail rockfish	4.26	Shortspine thornyhead	4.03	Pacific sanddab	2.66
Petrale sole	1.27	Longnose skate	2.23	Aurora rockfish	2.74	Stripetail rockfish	1.64
Stripetail rockfish	1.14	Chilipepper	2.19	Spiny dogfish	2.70	Splitnose rockfish	1.36
Pacific halibut	1.07	Darkblotched rockfish	1.99	Bigfin eelpout	1.43	Longnose skate	1.12
Big skate	1.07	English sole	1.89	Arrowtooth flounder	1.37	Shortspine thornyhead	1.06
Yellowtail rockfish	0.94	Bigfin eelpout	1.32	Longnose skate	0.71	Pacific herring	1.03
Longnose skate	0.81	Spotted ratfish	1.20	Longspine thornyhead	0.25	Black eelpout	1.01
Slender sole	0.47	Arrowtooth flounder	1.03	Spotted ratfish	0.20	Brown catshark	0.96
Blackbelly eelpout	0.37	Shortspine thornyhead	0.98	Bering skate	0.17	Pacific halibut	0.78
Darkblotched rockfish	0.37	Lingcod	0.91	Splitnose rockfish	0.14	Petrale sole	0.76
Canary rockfish	0.34	Widow rockfish	0.79	Shortraker rockfish	0.12	Darkblotched rockfish	0.69
Lingcod	0.30	Pacific halibut	0.77	Rougheye rockfish	0.12	Bigfin eelpout	0.63
Chub mackerel	0.28	Bering skate	0.68	Giant grenadier	0.11	Arrowtooth flounder	0.62
Greenstriped rockfish	0.20	Slender sole	0.63	Slender sole	0.09	Big skate	0.60
Number of hauls	38	Number of hauls	16	Number of hauls	14	Number of hauls	68

Table 6.--Continued.

Columbia Area 55-183 m		Columbia Area 184-366 m		Columbia Area 367-500 m		Columbia Area 55-500 m	
Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)
Pacific hake	131.26	Pacific hake	84.09	Pacific hake	19.60	Pacific hake	103.86
Pacific sanddab	9.15	Sablefish	17.37	Dover sole	15.08	Sablefish	10.60
Sablefish	7.22	Dover sole	11.54	Sablefish	15.02	Dover sole	8.30
English sole	5.87	Splitnose rockfish	10.06	Shortspine thornyhead	7.75	Rex sole	6.26
Rex sole	5.62	Rex sole	9.70	Rex sole	4.12	Pacific sanddab	5.78
Dover sole	5.53	Sharpchin rockfish	7.05	Arrowtooth flounder	1.17	English sole	3.87
Spiny dogfish	5.00	Pacific ocean perch	6.34	Brown cat shark	1.01	Spiny dogfish	3.51
Pacific herring	4.91	Shortspine thornyhead	4.54	Aurora rockfish	0.80	Pacific herring	3.10
Yellowtail rockfish	2.59	Arrowtooth flounder	3.71	Longspine thornyhead	0.79	Shortspine thornyhead	2.22
American shad	2.41	Pacific halibut	3.57	Pacific ocean perch	0.77	Splitnose rockfish	2.18
Pacific halibut	1.98	Lingcod	3.30	Longnose skate	0.73	Yellowtail rockfish	2.14
Arrowtooth flounder	1.73	Yellowtail rockfish	2.35	Bigfin eelpout	0.66	Arrowtooth flounder	2.06
Greenstriped rockfish	1.52	Darkblotched rockfish	2.32	Spiny dogfish	0.64	Pacific halibut	2.02
Chub mackerel	1.51	Stripetail rockfish	2.16	Rougheye rockfish	0.51	American shad	1.57
Big skate	0.99	Spiny dogfish	1.20	Black eelpout	0.42	Sharpchin rockfish	1.51
Petrale sole	0.99	Longnose skate	0.89	Bering skate	0.25	Pacific ocean perch	1.48
Longnose skate	0.76	Greenstriped rockfish	0.85	Splitnose rockfish	0.19	Lingcod	1.15
Lingcod	0.71	English sole	0.74	Shortraker rockfish	0.13	Greenstriped rockfish	1.14
Jack mackerel	0.53	Slender sole	0.72	Spotted ratfish	0.10	Chub mackerel	0.96
Darkblotched rockfish	0.51	Bigfin eelpout	0.55	Slender sole	0.07	Darkblotched rockfish	0.83
Number of hauls	118	Number of hauls	40	Number of hauls	29	Number of hauls	187

Table 6.--Continued.

U.S. Vancouver Area 55-183 m		U.S. Vancouver Area 184-366 m		U.S. Vancouver Area 367-500 m		U.S. Vancouver Area 55-500 m	
Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)
Pacific hake	166.66	Pacific hake	20.60	Pacific hake	4.60	Pacific hake	125.53
Spiny dogfish	43.98	Pacific ocean perch	20.10	Dover sole	4.55	Spiny dogfish	33.40
Yellowtail rockfish	42.28	Dover sole	17.86	Longspine thornyhead	3.00	Yellowtail rockfish	32.62
Arrowtooth flounder	21.64	Arrowtooth flounder	12.14	Shortspine thornyhead	2.65	Arrowtooth flounder	18.70
Pacific sanddab	8.43	Sablefish	12.14	Sablefish	1.24	Dover sole	7.89
Pacific halibut	7.12	Widow rockfish	8.92	Pacific flatnose	0.59	Sablefish	6.75
English sole	5.09	Spotted ratfish	8.81	Rex sole	0.42	Pacific sanddab	6.08
Sablefish	5.01	Yellowtail rockfish	8.37	Spotted ratfish	0.28	Pacific halibut	5.50
Dover sole	4.45	Spiny dogfish	6.63	Black eelpout	0.19	Spotted ratfish	5.40
Spotted ratfish	4.36	Rex sole	6.10	Brown catshark	0.18	Pacific ocean perch	5.17
Redstripe rockfish	3.84	Longnose skate	2.46	Deepsea sole	0.18	Widow rockfish	4.05
Widow rockfish	2.45	Shortspine thornyhead	1.98	Aleutian skate	0.15	English sole	3.90
Longnose skate	2.41	Darkblotched rockfish	1.51	Lanternfish unident.	0.07	Rex sole	3.20
Greenstriped rockfish	2.37	Pacific halibut	1.41	Lampanyctus sp.	0.04	Redstripe rockfish	2.78
Rex sole	2.26	Pacific cod	1.40	Pacific viperfish	0.04	Longnose skate	2.36
Lingcod	1.84	Bering skate	1.35	Longfin dragonfish	0.02	Greenstriped rockfish	1.86
Petrale sole	1.56	English sole	0.88	Blacksmelt unident.	0.01	Lingcod	1.35
Chinook salmon	0.98	Slender sole	0.71	Ribbon barracudina	0.01	Petrale sole	1.16
American shad	0.96	Greenstriped rockfish	0.58			Pacific cod	0.93
Big skate	0.95	Redbanded rockfish	0.57			American shad	0.82
Number of hauls	31	Number of hauls	11	Number of hauls	1	Number of hauls	43

Table 6.--Continued.

Canadian Vancouver Area 55-183 m		Canadian Vancouver Area 184-366 m		Canadian Vancouver Area 367-500 m		Canadian Vancouver Area 55-500 m	
Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)
Pacific hake	48.26	Yellowtail rockfish	92.51	Rougheye rockfish	26.97	Pacific hake	40.08
Spiny dogfish	46.29	Pacific ocean perch	46.41	Pacific ocean perch	16.07	Spiny dogfish	37.83
Arrowtooth flounder	17.73	Arrowtooth flounder	37.59	Dover sole	13.82	Arrowtooth flounder	19.67
Sablefish	13.23	Redstripe rockfish	21.82	Arrowtooth flounder	11.68	Yellowtail rockfish	18.96
Pacific herring	12.40	Sharpchin rockfish	15.83	Shortspine thornyhead	5.77	Sablefish	12.74
Yellowtail rockfish	9.81	Sablefish	15.29	Rex sole	5.00	Pacific herring	10.09
Dover sole	9.10	Widow rockfish	12.72	Pacific hake	4.91	Dover sole	9.62
Rex sole	5.88	Dover sole	10.81	Longnose skate	4.01	Pacific ocean perch	7.50
Pacific halibut	4.77	Greenstriped rockfish	10.31	Sablefish	2.40	Rex sole	6.01
Lingcod	3.94	Silvergray rockfish	7.98	Pacific halibut	0.62	Redstripe rockfish	4.41
English sole	3.92	Rex sole	7.48	Bigfin eelpout	0.30	Pacific halibut	4.29
Pacific sanddab	3.86	Canary rockfish	6.16	Petrale sole	0.27	Lingcod	3.34
Redstripe rockfish	2.24	Pacific hake	4.14	Spotted ratfish	0.24	English sole	3.33
Canary rockfish	1.71	Pacific halibut	3.11	Darkblotched rockfish	0.24	Pacific sanddab	3.14
Flathead sole	1.43	Darkblotched rockfish	2.52	Spiny dogfish	0.16	Greenstriped rockfish	2.24
Longnose skate	1.37	Splitnose rockfish	2.31	Redbanded rockfish	0.16	Canary rockfish	2.12
American shad	1.29	Shortspine thornyhead	1.80	Bering skate	0.12	Sharpchin rockfish	1.99
Greenstriped rockfish	1.24	Longnose skate	1.71	Splitnose rockfish	0.12	Rougheye rockfish	1.88
Pacific ocean perch	1.11	Spiny dogfish	1.33	Widow rockfish	0.06	Widow rockfish	1.65
Spotted ratfish	0.82	Pacific cod	1.30	English sole	0.04	Longnose skate	1.59
Number of hauls	48	Number of hauls	7	Number of hauls	4	Number of hauls	59

Table 6.--Continued.

Vancouver Area 55-183 m		Vancouver Area 184-366 m		Vancouver Area 367-500 m		Vancouver Area 55-500 m	
Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)
Pacific hake	94.72	Yellowtail rockfish	41.09	Rougheye rockfish	21.58	Pacific hake	76.10
Spiny dogfish	45.39	Pacific ocean perch	30.33	Pacific ocean perch	12.86	Spiny dogfish	35.96
Yellowtail rockfish	22.55	Arrowtooth flounder	22.04	Dover sole	11.96	Yellowtail rockfish	24.72
Arrowtooth flounder	19.26	Dover sole	15.12	Arrowtooth flounder	9.34	Arrowtooth flounder	19.26
Sablefish	10.00	Pacific hake	14.20	Shortspine thornyhead	5.15	Sablefish	10.21
Pacific herring	7.76	Sablefish	13.36	Pacific hake	4.84	Dover sole	8.89
Dover sole	7.28	Widow rockfish	10.40	Rex sole	4.09	Pacific ocean perch	6.52
Pacific halibut	5.69	Redstripe rockfish	8.54	Longnose skate	3.21	Pacific herring	6.02
Pacific sanddab	5.66	Rex sole	6.64	Sablefish	2.17	Rex sole	4.82
Rex sole	4.46	Sharpchin rockfish	6.16	Longspine thornyhead	0.60	Pacific halibut	4.80
English sole	4.38	Spotted ratfish	5.64	Pacific halibut	0.49	Pacific sanddab	4.38
Lingcod	3.11	Spiny dogfish	4.57	Spotted ratfish	0.25	Redstripe rockfish	3.73
Redstripe rockfish	2.87	Greenstriped rockfish	4.36	Bigfin eelpout	0.24	English sole	3.57
Spotted ratfish	2.21	Silvergray rockfish	3.13	Petrale sole	0.22	Spotted ratfish	2.72
Longnose skate	1.78	Canary rockfish	2.59	Darkblotched rockfish	0.19	Widow rockfish	2.66
Greenstriped rockfish	1.69	Longnose skate	2.17	Spiny dogfish	0.13	Lingcod	2.50
Canary rockfish	1.30	Pacific halibut	2.07	Redbanded rockfish	0.13	Greenstriped rockfish	2.08
American shad	1.16	Shortspine thornyhead	1.91	Pacific flatnose	0.12	Longnose skate	1.92
Widow rockfish	1.06	Darkblotched rockfish	1.90	Bering skate	0.10	Canary rockfish	1.47
Petrale sole	1.00	Pacific cod	1.36	Splitnose rockfish	0.10	Rougheye rockfish	1.17
Number of hauls	79	Number of hauls	18	Number of hauls	5	Number of hauls	109

Table 6.--Continued.

U.S. Survey Area 55-183 m		U.S. Survey Area 184-366 m		U.S. Survey Area 367-500 m		U.S. Survey Area 55-500 m	
Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)
Pacific hake	110.68	Pacific hake	69.51	Dover sole	28.17	Pacific hake	85.40
Spiny dogfish	8.91	Splitnose rockfish	17.79	Pacific hake	22.72	Dover sole	10.62
Pacific sanddab	8.11	Dover sole	14.89	Sablefish	12.95	Spiny dogfish	7.07
Yellowtail rockfish	7.12	Sablefish	11.28	Rex sole	10.29	Sablefish	7.02
Pacific herring	6.44	Rex sole	9.21	Splitnose rockfish	7.00	Rex sole	5.98
English sole	4.32	Stripetail rockfish	7.05	Shortspine thornyhead	4.22	Splitnose rockfish	5.18
Chilipepper	3.67	Chilipepper	6.92	Aurora rockfish	2.90	Pacific sanddab	4.86
Sablefish	3.63	Spiny dogfish	6.58	Spiny dogfish	1.70	Yellowtail rockfish	4.65
Dover sole	3.62	Pacific ocean perch	4.74	Brown cat shark	1.46	Pacific herring	3.85
Rex sole	3.45	Shortbelly rockfish	3.78	Bigfin eelpout	1.44	Chilipepper	3.70
Jack mackerel	3.16	Sharpchin rockfish	2.98	Longnose skate	1.10	English sole	2.85
Arrowtooth flounder	3.14	Arrowtooth flounder	2.93	Longspine thornyhead	0.98	Shortbelly rockfish	2.66
Shortbelly rockfish	3.07	Shortspine thornyhead	2.31	Spotted ratfish	0.90	Arrowtooth flounder	2.63
White croaker	2.29	Widow rockfish	2.28	Blackgill rockfish	0.81	Stripetail rockfish	2.09
Pacific halibut	1.85	Yellowtail rockfish	1.83	Arrowtooth flounder	0.62	Jack mackerel	1.92
Chub mackerel	1.77	Pacific halibut	1.67	Pacific ocean perch	0.27	Pacific halibut	1.47
Pacific sardine	1.61	Spotted ratfish	1.59	Bering skate	0.24	White croaker	1.37
American shad	1.19	Lingcod	1.59	Filetail cat shark	0.22	Shortspine thornyhead	1.31
Greenstriped rockfish	1.10	Darkblotched rockfish	1.54	Rougheye rockfish	0.22	Pacific ocean perch	1.09
Petrale sole	0.98	Longnose skate	1.23	English sole	0.11	Chub mackerel	1.06
Number of hauls	280	Number of hauls	102	Number of hauls	87	Number of hauls	469

Table 6.--Continued.

Entire Area 55-183 m		Entire Area 184-366 m		Entire Area 367-500 m		Entire Area 55-500 m	
Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)	Species name	Mean CPUE (kg/ha)
Pacific hake	101.54	Pacific hake	65.31	Dover sole	27.54	Pacific hake	80.34
Spiny dogfish	14.38	Splitnose rockfish	16.80	Pacific hake	21.93	Dover sole	10.51
Yellowtail rockfish	7.52	Dover sole	14.63	Sablefish	12.49	Spiny dogfish	10.50
Pacific sanddab	7.49	Sablefish	11.53	Rex sole	10.06	Sablefish	7.66
Pacific herring	7.31	Rex sole	9.10	Splitnose rockfish	6.70	Yellowtail rockfish	6.25
Arrowtooth flounder	5.28	Yellowtail rockfish	7.65	Shortspine thornyhead	4.29	Rex sole	5.98
Sablefish	5.03	Pacific ocean perch	7.41	Aurora rockfish	2.77	Pacific sanddab	4.67
Dover sole	4.42	Stripetail rockfish	6.60	Spiny dogfish	1.63	Splitnose rockfish	4.64
English sole	4.26	Chilipepper	6.48	Rougheye rockfish	1.39	Pacific herring	4.55
Rex sole	3.81	Spiny dogfish	6.24	Brown catshark	1.39	Arrowtooth flounder	4.54
Chilipepper	3.13	Arrowtooth flounder	5.16	Bigfin eelpout	1.39	Chilipepper	3.28
Jack mackerel	2.71	Sharpchin rockfish	3.80	Longnose skate	1.22	English sole	2.90
Shortbelly rockfish	2.62	Shortbelly rockfish	3.54	Arrowtooth flounder	1.11	Shortbelly rockfish	2.36
Pacific halibut	2.28	Widow rockfish	2.96	Black eelpout	1.06	Stripetail rockfish	1.86
White croaker	1.96	Shortspine thornyhead	2.28	Pacific ocean perch	0.97	Pacific ocean perch	1.80
Chub mackerel	1.51	Pacific halibut	1.76	Longspine thornyhead	0.93	Pacific halibut	1.78
Pacific sardine	1.39	Darkblotched rockfish	1.60	Spotted ratfish	0.87	Jack mackerel	1.71
American shad	1.20	Lingcod	1.56	Blackgill rockfish	0.78	Shortspine thornyhead	1.24
Lingcod	1.19	Spotted ratfish	1.53	Bering skate	0.23	White croaker	1.22
Greenstriped rockfish	1.12	Redstripe rockfish	1.42	Filetail cat shark	0.21	Lingcod	1.06
Number of hauls	328	Number of hauls	109	Number of hauls	91	Number of hauls	528

Table 7.--Estimates of fish biomass from the 1998 West Coast triennial bottom trawl survey by International North Pacific Fisheries Commission (INPFC) area for all depth strata combined (55-500 m). Precision of the estimates are presented as coefficients of variation (*CV*%). "T" denotes trace value. Differences in totals result from rounding.

Taxon	Estimated biomass (t) and *CV*% Total survey area		Percent of total fish biomass	Estimated biomass (t) and *CV*% by INPFC area													
				Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Cartilaginous																	
Skates and rays	10,305	*10*	0.98	385	*15*	1,661	*18*	1,168	*15*	3,683	*17*	1,503	*36*	1,905	*16*	8,400	*11*
Spiny dogfish	74,649	*13*	7.07	322	*23*	7,703	*34*	2,846	*25*	9,224	*10*	13,744	*37*	40,810	*18*	33,839	*17*
Other sharks	1,988	*16*	0.19	304	*24*	587	*21*	351	*28*	625	*38*	16	*63*	104	*98*	1,883	*16*
Total cartilaginous	91,765	*11*	8.69	1,131	*13*	10,724	*25*	4,585	*17*	14,465	*9*	17,035	*30*	43,824	*17*	47,941	*13*
Flatfish																	
Arrowtooth flounder	32,462	*16*	3.07	0	-	11	*35*	278	*12*	4,504	*10*	9,690	*38*	17,979	*18*	14,484	*26*
Dover sole	49,496	*6*	4.69	3,235	*18*	9,108	*13*	7,061	*14*	16,660	*9*	3,627	*11*	9,805	*13*	39,691	*6*
English sole	19,616	*8*	1.86	173	*25*	2,193	*8*	2,242	*34*	9,735	*10*	1,603	*18*	3,671	*19*	15,946	*8*
Pacific halibut	12,323	*25*	1.17	0	-	248	*45*	521	*43*	4,480	*30*	2,466	*21*	4,607	*55*	7,716	*19*
Pacific sanddab	31,633	*12*	3.00	1,295	*61*	7,452	*33*	1,944	*25*	15,727	*16*	2,134	*23*	3,080	*27*	28,553	*13*
Petrale sole	4,073	*8*	0.39	100	*21*	708	*15*	541	*21*	1,551	*12*	548	*26*	624	*22*	3,448	*8*
Rex sole	31,155	*5*	2.95	1,696	*30*	4,754	*11*	3,917	*9*	13,274	*8*	1,999	*9*	5,516	*12*	25,639	*5*
Total flatfish	186,173	*4*	17.63	6,705	*18*	25,156	*11*	16,794	*9*	67,242	*6*	22,705	*16*	47,570	*9*	138,603	*5*
Rockfish																	
Shortspine thornyhead	6,068	*10*	0.57	90	*25*	469	*36*	402	*14*	4,290	*13*	336	*26*	480	*23*	5,587	*10*
Bocaccio	437	*23*	0.04	11	*31*	130	*38*	0	-	0	-	143	*36*	152	*38*	285	*25*
Canary	3,352	*22*	0.32	2	*72*	672	*71*	146	*28*	252	*21*	458	*26*	1,822	*28*	1,530	*33*

Table 7.--Continued.

Taxon	Estimated biomass (t) and *CV%* Total survey area		Percent of total fish biomass	Estimated biomass (t) and *CV%* by INPFC area													
				Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Rockfish (cont.)																	
Chilipepper	17,121	*38*	1.62	702	*47*	16,168	*40*	239	*82*	12	*78*	0	-	0	-	17,121	*38*
Darkblotched	3,356	*18*	0.32	1	*69*	130	*57*	371	*45*	1,728	*23*	358	*34*	769	*45*	2,587	*18*
Greenstriped	6,268	*15*	0.59	3	*57*	586	*38*	127	*34*	2,647	*24*	1,423	*30*	1,483	*26*	4,785	*17*
Pacific ocean perch	11,527	*26*	1.09	0	-	9	*43*	81	*39*	3,084	*43*	4,495	*45*	3,859	*35*	7,668	*31*
Redstripe	5,487	*38*	0.52	0	-	0	-	5	*41*	256	*67*	1,882	*55*	3,344	*46*	2,144	*49*
Sharpchin	4,770	*54*	0.45	T	*69*	151	*87*	35	*38*	2,976	*75*	454	*71*	1,153	*88*	3,617	*62*
Shortbelly	11,111	*72*	1.05	8,510	*92*	2,599	*53*	T	*100*	1	*10*	T	*100*	1	*100*	11,110	*72*
Silvergray	1,443	*46*	0.14	0	-	0	-	0	-	16	*74*	280	*40*	1,146	*51*	297	*38*
Splitnose	18,916	*27*	1.79	4,781	*27*	9,040	*45*	634	*22*	4,176	*66*	103	*55*	180	*94*	18,735	*27*
Stripetail	8,926	*17*	0.85	1,788	*34*	5,311	*25*	924	*32*	874	*35*	21	*83*	7	*88*	8,919	*17*
Widow	5,511	*30*	0.52	T	*100*	1,712	*50*	97	*34*	294	*28*	2,241	*49*	1,167	*48*	4,344	*32*
Yellowtail	41,787	*22*	3.96	0	-	3,858	*67*	385	*84*	6,017	*21*	16,212	*34*	15,315	*34*	26,472	*24*
Total rockfish	152,403	*12*	14.43	17,092	*46*	42,317	*22*	3,718	*16*	27,837	*19*	28,722	*26*	32,718	*26*	119,685	*13*
Other fish																	
Lingcod	7,171	*29*	0.68	34	*38*	651	*34*	219	*37*	2,002	*38*	1,018	*26*	3,247	*53*	3,924	*25*
Pacific hake	497,084	*9*	47.07	5,559	*15*	39,986	*18*	100,852	*18*	254,323	*12*	51,566	*32*	44,797	*27*	452,287	*9*
Sablefish	43,402	*15*	4.11	365	*18*	1,909	*10*	3,634	*16*	21,904	*26*	3,894	*17*	11,695	*29*	31,706	*18*
Total fish	1,056,050	*5*	100.00	35,717	*23*	161,151	*11*	131,611	*14*	401,866	*9*	129,168	*14*	196,538	*9*	859,512	*6*

Table 8.--Estimates of fish biomass from the 1998 West Coast triennial bottom trawl survey by International North Pacific Fisheries Commission (INPFC) area for the shallowest depth stratum (55-183 m). Precision of the estimates are presented as coefficients of variation (*CV*%). "T" denotes trace value. Differences in totals result from rounding.

Taxon	Estimated biomass (t) and *CV*% Total survey area		Percent of total fish biomass	Estimated biomass (t) and *CV*% by INPFC area													
				Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Cartilaginous																	
Skates and rays	7,462	*13*	0.93	69	*40*	1,174	*25*	789	*20*	2,932	*21*	1,207	*44*	1,291	*16*	6,172	*14*
Spiny dogfish	68,067	*14*	8.44	208	*27*	4,227	*45*	1,569	*39*	8,594	*11*	13,250	*38*	40,219	*19*	27,847	*20*
Other sharks	917	*28*	0.11	189	*34*	281	*27*	T	*100*	340	*64*	5	*100*	102	*100*	815	*29*
Total cartilaginous	79,287	*13*	9.83	494	*19*	5,874	*34*	2,431	*26*	12,196	*10*	15,927	*32*	42,365	*18*	36,922	*15*
Flatfish																	
Arrowtooth flounder	24,842	*21*	3.08	0	-	3	*100*	66	*25*	2,645	*13*	7,567	*49*	14,561	*22*	10,281	*36*
Dover sole	19,991	*9*	2.48	6	*31*	515	*31*	1,912	*35*	8,352	*15*	1,801	*11*	7,405	*15*	12,586	*12*
English sole	18,493	*8*	2.29	140	*28*	1,815	*9*	2,038	*37*	9,415	*10*	1,535	*19*	3,550	*20*	14,943	*9*
Pacific halibut	10,325	*29*	1.28	0	-	248	*45*	439	*50*	3,065	*42*	2,190	*24*	4,383	*58*	5,942	*24*
Pacific sanddab	31,584	*12*	3.92	1,288	*61*	7,419	*33*	1,944	*25*	15,718	*16*	2,134	*23*	3,080	*27*	28,504	*13*
Petrale sole	3,856	*8*	0.48	79	*24*	621	*16*	520	*21*	1,493	*13*	540	*26*	602	*23*	3,254	*9*
Rex sole	16,908	*7*	2.10	24	*52*	1,006	*12*	1,578	*15*	8,508	*11*	1,123	*11*	4,669	*13*	12,239	*8*
Total flatfish	130,519	*6*	16.19	1,608	*48*	12,162	*20*	8,713	*14*	50,206	*7*	17,404	*21*	40,426	*10*	90,093	*7*
Rockfish																	
Shortspine thornyhead	175	*36*	0.02	0	-	1	*73*	1	*78*	101	*46*	30	*86*	43	*76*	132	*40*
Bocaccio	316	*27*	0.04	4	*41*	97	*48*	0	-	0	-	99	*48*	117	*41*	200	*33*
Canary	2,638	*25*	0.33	1	*100*	666	*72*	141	*29*	186	*20*	278	*32*	1,367	*32*	1,271	*39*

Table 8.--Continued.

Taxon	Estimated biomass (t) and *CV%* Total survey area		Percent of total fish biomass	Estimated biomass (t) and *CV%* by INPFC area: Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Rockfish (cont.)																	
Chilipepper	11,570	*45*	1.43	576	*57*	10,991	*47*	3	*83*	T	*100*	0	-	0	-	11,570	*45*
Darkblotched	1,600	*29*	0.20	0	-	9	*69*	151	*94*	750	*37*	138	*30*	553	*56*	1,047	*31*
Greenstriped	4,831	*17*	0.60	2	*80*	543	*41*	82	*47*	2,270	*28*	911	*25*	1,023	*31*	3,808	*19*
Pacific ocean perch	938	*64*	0.12	0	-	2	*100*	22	*100*	0	-	53	*54*	861	*66*	77	*47*
Redstripe	3,423	*46*	0.42	0	-	0	-	T	*100*	255	*67*	1,339	*74*	1,828	*60*	1,595	*63*
Sharpchin	160	*46*	0.02	0	-	8	*99*	14	*78*	10	*48*	20	*53*	107	*63*	53	*34*
Shortbelly	8,323	*94*	1.03	7,959	*98*	363	*61*	0	-	0	-	T	*100*	1	*100*	8,322	*94*
Silvergray	674	*77*	0.08	0	-	0	-	0	-	0	-	67	*56*	608	*82*	67	*56*
Splitnose	77	*49*	T	27	*90*	3	*57*	42	*69*	2	*46*	T	*56*	2	*73*	75	*51*
Stripetail	2,972	*32*	0.37	159	*69*	2,302	*39*	465	*55*	39	*94*	1	*61*	6	*99*	2,966	*32*
Widow	2,011	*41*	0.25	T	*100*	867	*65*	12	*52*	128	*46*	812	*69*	191	*43*	1,819	*44*
Yellowtail	31,325	*23*	3.88	0	-	3,858	*67*	385	*84*	4,716	*24*	13,768	*40*	8,597	*34*	22,728	*27*
Total rockfish	72,779	*19*	9.03	8,890	*87*	20,387	*34*	1,321	*38*	8,684	*18*	17,683	*37*	15,813	*29*	56,966	*22*
Other fish																	
Lingcod	5,644	*33*	0.70	25	*45*	545	*38*	122	*32*	1,060	*35*	727	*24*	3,165	*55*	2,479	*19*
Pacific hake	419,185	*10*	51.98	164	*48*	18,656	*30*	93,280	*19*	214,074	*14*	49,444	*34*	43,566	*28*	375,619	*11*
Sablefish	23,860	*25*	2.96	17	*80*	55	*44*	17	*64*	11,121	*42*	2,299	*24*	10,351	*32*	13,508	*35*
Total fish	806,367	*6*	100.00	15,727	*50*	97,408	*15*	107,027	*17*	310,646	*10*	107,34	*17*	168,211	*10*	638,156	*7*

Table 9.--Estimates of fish biomass from the 1998 West Coast triennial bottom trawl survey by International North Pacific Fisheries Commission (INPFC) area for the middle depth stratum (184-366 m). Precision of the estimates are presented as coefficients of variation (*CV*%). "T" denotes trace value. Differences in totals result from rounding.

Taxon	Estimated biomass (t) and *CV*% Total survey area		Percent of total fish biomass	Estimated biomass (t) and *CV*% by INPFC area													
				Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Cartilaginous																	
Skates and rays	1,870	*17*	0.98	104	*32*	262	*29*	313	*24*	468	*22*	292	*28*	432	*50*	1,438	*12*
Spiny dogfish	5,721	*33*	3.00	22	*46*	3,076	*59*	1,079	*33*	467	*26*	494	*33*	583	*38*	5,138	*36*
Other sharks	168	*48*	0.09	23	*53*	101	*78*	34	*34*	8	*68*	1	*100*	2	*100*	166	*48*
Total cartilaginous	9,312	*23*	4.88	169	*26*	3,722	*49*	1,556	*27*	1,514	*33*	1,092	*24*	1,259	*40*	8,053	*25*
Flatfish																	
Arrowtooth flounder	6,693	*18*	3.51	0	-	3	*61*	111	*21*	1,558	*20*	2,119	*19*	2,901	*30*	3,791	*14*
Dover sole	14,358	*10*	7.52	326	*47*	3,265	*23*	2,712	*16*	4,562	*11*	1,704	*20*	1,789	*38*	12,569	*9*
English sole	1,074	*21*	0.56	32	*60*	332	*27*	204	*61*	318	*36*	69	*40*	119	*65*	955	*21*
Pacific halibut	1,970	*25*	1.03	0	-	0	-	82	*46*	1,415	*31*	276	*31*	196	*54*	1,774	*26*
Pacific sanddab	49	*44*	0.03	7	*62*	33	*52*	0	-	8	*100*	T	*100*	T	*100*	49	*44*
Petrale sole	163	*19*	0.09	17	*47*	51	*34*	21	*47*	56	*34*	7	*41*	11	*58*	152	*40*
Rex sole	9,044	*9*	4.74	784	*59*	1,629	*19*	1,348	*14*	3,806	*12*	850	*17*	626	*28*	8,417	*9*
Total flatfish	34,190	*7*	17.91	1,299	*48*	5,436	*17*	4,545	*13*	12,009	*10*	5,148	*13*	5,754	*19*	28,437	*7*
Rockfish																	
Shortspine thornyhead	2,505	*19*	1.31	2	*56*	128	*29*	105	*25*	1,823	*25*	264	*31*	182	*42*	2,323	*20*
Bocaccio	119	*41*	0.06	6	*46*	33	*51*	0	-	0	-	44	*47*	35	*89*	84	*33*
Canary	713	*46*	0.37	1	*100*	5	*73*	5	*69*	67	*56*	180	*44*	455	*55*	257	*36*

Table 9.--Continued.

Taxon	Estimated biomass (t) and *CV%* Total survey area		Percent of total fish biomass	Estimated biomass (t) and *CV%* by INPFC area															
				Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Rockfish (cont.)																			
Chilipepper	5,550	*69*	2.91	126	*32*	5,177	*73*	235	*83*	12	*79*	0	-	0	-	5,550	*69*
Darkblotched	1,718	*22*	0.90	0	-	118	*62*	214	*39*	960	*30*	220	*52*	205	*72*	1,513	*22*
Greenstriped	1,437	*34*	0.75	1	*81*	42	*78*	45	*39*	377	*22*	512	*71*	460	*47*	977	*39*
Pacific ocean perch	9,602	*30*	5.03	0	-	3	*74*	55	*40*	2,824	*47*	4,434	*45*	2,287	*48*	7,315	*33*
Redstripe	2,065	*66*	1.08	0	-	0	-	4	*44*	1	*65*	543	*59*	1,515	*70*	549	*58*
Sharpchin	4,610	*56*	2.41	T	*69*	142	*92*	21	*37*	2,966	*75*	434	*74*	1,046	*97*	3,564	*63*
Shortbelly	2,788	*62*	1.46	551	*92*	2,236	*61*	T	*100*	1	*100*	0	-	0	-	2,788	*62*
Silvergray	768	*53*	0.40	0	-	0	-	0	-	16	*74*	214	*50*	538	*58*	230	*46*
Splitnose	15,392	*32*	8.06	2,594	*29*	7,807	*52*	582	*24*	4,134	*66*	103	*55*	173	*98*	15,220	*32*
Stripetail	5,954	*20*	3.12	1,629	*37*	3,010	*32*	459	*32*	835	*36*	20	*87*	1	*77*	5,953	*20*
Widow	3,497	*40*	1.83	0	-	845	*76*	85	*38*	165	*36*	1,429	*66*	973	*67*	2,524	*45*
Yellowtail	10,462	*52*	5.48	0	-	0	-	0	-	1,301	*45*	2,443	*50*	6,718	*63*	3,744	*38*
Total rockfish	67,815	*19*	35.52	4,913	*18*	19,636	*32*	1,837	*16*	15,745	*31*	10,964	*34*	14,720	*48*	53,095	*17*
Other fish																			
Lingcod	1,528	*57*	0.80	9	*76*	106	*77*	98	*73*	942	*70*	292	*69*	82	*53*	1,446	*60*
Pacific hake	64,551	*18*	33.81	2,183	*23*	18,300	*26*	6,310	*26*	34,669	*30*	2,075	*26*	1,015	*28*	63,536	*18*
Sablefish	11,976	*27*	6.27	27	*61*	714	*19*	1,529	*37*	6,898	*44*	1,571	*22*	1,238	*45*	10,738	*29*
Total fish	190,916	*10*	100.00	8,671	*13*	48,208	*21*	16,083	*12*	72,248	*16*	21,493	*18*	24,213	*29*	166,703	*10*

Table 10.--Estimates of fish biomass from the 1998 West Coast triennial bottom trawl survey by International North Pacific Fisheries Commission (INPFC) area for the deepest depth stratum (367-500 m). Precision of the estimates are presented as coefficients of variation (*CV*%). "T" denotes trace value. Differences in totals result from rounding.

Taxon	Estimated biomass (t) and *CV*% Total survey area		Percent of total fish biomass	Estimated biomass (t) and *CV*% by INPFC area													
				Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Cartilaginous																	
Skates and rays	973	*13*	1.66	213	*19*	225	*20*	65	*36*	283	*25*	4	*60*	183	*46*	790	*12*
Spiny dogfish	861	*22*	1.47	92	*55*	399	*30*	199	*43*	163	*31*	0	-	7	*49*	854	*22*
Other sharks	902	*17*	1.53	93	*34*	205	*29*	317	*30*	276	*33*	11	*83*	0	-	902	*17*
Total cartilaginous	3,166	*10*	5.39	468	*22*	1,128	*18*	598	*21*	755	*15*	16	*62*	201	*41*	2,966	*11*
Flatfish																	
Arrowtooth flounder	927	*13*	1.58	0	-	5	*41*	101	*18*	301	*21*	4	*100*	516	*19*	411	*16*
Dover sole	15,147	*9*	25.77	2,902	*19*	5,328	*16*	2,437	*25*	3,746	*15*	123	*62*	611	*24*	14,536	*10*
English sole	49	*58*	0.08	1	*100*	45	*62*	0	-	1	*100*	0	-	2	*100*	47	*60*
Pacific halibut	27	*100*	0.05	0	-	0	-	0	-	0	-	0	-	27	*100*	0	-
Pacific sanddab	0	-	0.00	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Petrale sole	55	*47*	T	4	*50*	37	*61*	0	-	2	*100*	0	-	12	*100*	43	*53*
Rex sole	5,204	*10*	8.86	888	*21*	2,119	*18*	992	*21*	960	*17*	25	*83*	221	*32*	4,983	*10*
Total flatfish	21,464	*8*	36.52	3,798	*17*	7,558	*14*	3,536	*18*	5,027	*13*	153	*66*	1,391	*20*	20,073	*8*
Rockfish																	
Shortspine thornyhead	3,388	*10*	5.77	88	*26*	341	*48*	297	*16*	2,366	*12*	42	*36*	255	*30*	3,132	*10*
Bocaccio	2	*100*	0.00	2	*100*	0	-	0	-	0	-	0	-	0	-	2	*100*
Canary	1	*100*	0.00	0	-	1	*100*	0	-	0	-	0	-	0	-	1	*100*

Table 10.--Continued.

Taxon	Estimated biomass (t) and *CV%* Total survey area		Percent of total fish biomass	Estimated biomass (t) and *CV%* by INPFC area													
				Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Rockfish (cont.)																	
Chilipepper	1	*100*	0.00	0	-	0	-	1	*100*	0	-	0	-	0	-	1	*100*
Darkblotched	38	*37*	0.06	1	*69*	2	*56*	6	*63*	18	*43*	0	-	11	*100*	27	*32*
Greenstriped	0	-	0.00	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Pacific ocean perch	987	*58*	1.68	0	-	3	*58*	4	*45*	260	*30*	8	*100*	711	*79*	276	*29*
Redstripe	0	-	0.00	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Sharpchin	0	-	0.00	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Shortbelly	0	-	0.00	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Silvergray	0	-	0.00	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Splitnose	3,446	*33*	5.86	2,160	*47*	1,230	*35*	10	*100*	40	*50*	T	*100*	5	*100*	3,440	*33*
Stripetail	0	-	0.00	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Widow	3	*100*	0.01	0	-	0	-	0	-	0	-	0	-	3	*100*	0	-
Yellowtail	0	-	0.00	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Total rockfish	11,809	*12*	20.09	3,289	*28*	2,293	*15*	560	*11*	3,408	*9*	75	*23*	2,185	*47*	9,624	*11*
Other fish																	
Lingcod	0	-	0.00	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Pacific hake	13,348	*11*	22.71	3,212	*21*	3,030	*14*	1,262	*29*	5,581	*21*	47	*0*	217	*42*	13,131	*11*
Sablefish	7,566	*8*	12.87	321	*20*	1,140	*13*	2,089	*10*	3,886	*13*	24	*46*	106	*46*	7,460	*8*
Total fish	58,768	*5*	100.00	11,319	*11*	15,535	*7*	8,501	*10*	18,972	*8*	327	*43*	4,114	*28*	54,654	*4*

Table 11.--Estimates of fish population numbers (x 1,000) from the 1998 West Coast triennial bottom trawl survey by International North Pacific Fisheries Commission (INPFC) area for all depth strata combined (55-500 m). Precision of the estimates are presented as coefficients of variation (*CV*%). "T" denotes trace value. Differences in totals result from rounding.

Taxon	Estimated population number (x 1,000) and *CV*% Total survey area		Estimated population number (x 1,000) and *CV*% by INPFC area											
			Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Cartilaginous														
Skates and rays	4,993	*8*	341	*18*	1,147	*13*	830	*17*	1,534	*15*	385	*22*	756	*24*	4,237	*8*
Spiny dogfish	89,616	*12*	1,003	*30*	17,023	*36*	11,765	*42*	15,365	*11*	12,914	*27*	31,546	*19*	58,070	*15*
Other sharks	6,068	*27*	503	*26*	2,928	*54*	1,895	*26*	704	*27*	30	*78*	7	*72*	6,061	*28*
Total cartilaginous	116,639	*10*	2,233	*17*	23,489	*27*	15,129	*33*	19,495	*10*	17,660	*25*	38,633	*17*	78,006	*12*
Flatfish														
Arrowtooth flounder	30,641	*11*	0	-	17	*34*	401	*13*	5,640	*11*	8,127	*23*	16,456	*16*	14,185	*14*
Dover sole	168,547	*6*	12,655	*17*	36,756	*12*	26,168	*15*	57,773	*11*	10,179	*11*	25,016	*13*	143,531	*7*
English sole	120,244	*8*	1,278	*27*	16,045	*8*	12,212	*29*	69,304	*11*	7,997	*21*	13,409	*21*	106,836	*8*
Pacific halibut	1,466	*27*	0	-	26	*48*	30	*34*	446	*33*	357	*26*	607	*56*	859	*20*
Pacific sanddab	287,508	*10*	14,089	*49*	58,101	*28*	23,515	*24*	148,246	*14*	17,749	*21*	25,808	*27*	261,700	*11*
Petrale sole	10,083	*7*	197	*22*	1,714	*15*	1,696	*21*	4,160	*11*	1,070	*22*	1,247	*19*	8,836	*8*
Rex sole	270,415	*5*	13,101	*32*	41,077	*9*	47,218	*10*	125,170	*8*	12,464	*8*	31,385	*11*	239,030	*5*
Total flatfish	937,270	*4*	43,925	*20*	159,642	*11*	117,929	*8*	427,949	*7*	61,457	*9*	126,368	*7*	810,901	*5*
Rockfish														
Shortspine thornyhead	45,212	*10*	506	*33*	2,601	*19*	4,453	*17*	33,606	*13*	1,803	*26*	2,242	*23*	42,970	*11*
Bocaccio	223	*29*	24	*30*	129	*47*	0	-	0	-	34	*33*	37	*39*	186	*34*
Canary	2,892	*27*	2	*80*	651	*71*	115	*26*	259	*24*	280	*23*	1,585	*37*	1,307	*36*

Table 11.--Continued.

Taxon	Estimated population number (x 1,000) and *CV*% Total survey area		Estimated population number (x 1,000) and *CV*% by INPFC area													
			Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Rockfish (cont.)																
Chilipepper	54,392	*38*	2,963	*50*	50,919	*40*	489	*80*	21	*72*	0	-	0	-	54,392	*38*
Darkblotched	11,629	*16*	3	*69*	298	*43*	1,247	*52*	6,943	*21*	1,395	*32*	1,743	*37*	9,886	*17*
Greenstriped	25,559	*14*	48	*71*	3,759	*32*	1,159	*30*	11,945	*22*	4,216	*31*	4,433	*27*	21,127	*16*
Pacific ocean perch	17,910	*23*	0	-	14	*43*	248	*59*	5,501	*39*	5,147	*38*	7,001	*34*	10,909	*27*
Redstripe	12,717	*36*	0	-	0	-	32	*41*	902	*63*	4,103	*56*	7,680	*45*	5,037	*47*
Sharpchin	14,778	*51*	5	*66*	1,465	*88*	253	*38*	10,112	*71*	916	*66*	2,028	*81*	12,750	*57*
Shortbelly	242,883	*74*	190,842	*92*	52,034	*57*	2	*100*	2	*100*	T	*100*	4	*100*	242,880	*74*
Silvergray	777	*49*	0	-	0	-	0	-	7	*74*	141	*42*	628	*55*	149	*40*
Splitnose	123,395	*19*	39,242	*19*	45,316	*30*	7,687	*21*	29,759	*57*	951	*44*	441	*83*	122,955	*19*
Stripetail	97,100	*18*	21,351	*34*	61,166	*25*	8,061	*35*	6,338	*33*	125	*83*	59	*93*	97,041	*18*
Widow	4,968	*30*	1	*100*	1,790	*49*	93	*32*	239	*30*	1,928	*51*	918	*46*	4,050	*33*
Yellowtail	38,548	*21*	0	-	4,276	*67*	480	*87*	5,461	*22*	14,674	*33*	13,657	*32*	24,890	*23*
Total rockfish	726,344	*25*	263,787	*66*	237,955	*18*	25,304	*16*	118,111	*20*	36,598	*22*	44,588	*24*	681,756	*27*
Other fish																
Lingcod	2,969	*21*	46	*34*	566	*37*	127	*28*	732	*21*	352	*20*	1,146	*48*	1,823	*16*
Pacific hake	1,473,540	*9*	42,183	*25*	164,456	*25*	384,225	*22*	669,747	*13*	120,626	*29*	92,304	*26*	1,381,236	*10*
Sablefish	26,284	*15*	458	*20*	1,662	*10*	2,721	*17*	14,164	*26*	2,269	*18*	5,011	*23*	21,273	*18*
Total fish	4,202,877	*6*	421,964	*42*	1,172,782	*11*	568,587	*15*	1,343,460	*7*	261,772	*13*	434,311	*16*	3,768,566	*7*

Table 12.--Estimates of fish population numbers (x 1,000) from the 1998 West Coast triennial bottom trawl survey by International North Pacific Fisheries Commission (INPFC) area for the shallowest depth stratum (55-183 m). Precision of the estimates are presented as coefficients of variation (*CV%*). "T" denotes trace value. Differences in totals result from rounding.

Taxon	Estimated population number (x 1,000) and *CV%* Total survey area		Estimated population number (x 1,000) and *CV%* by INPFC area													
			Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Cartilaginous																
Skates and rays	2,807	*9*	69	*20*	574	*15*	490	*18*	997	*19*	228	*30*	449	*18*	2,358	*10*
Spiny dogfish	76,116	*13*	850	*34*	9,355	*47*	8,820	*56*	14,109	*12*	12,180	*28*	30,802	*20*	45,314	*17*
Other sharks	516	*22*	78	*36*	420	*27*	3	*100*	11	*57*	T	*100*	4	*100*	512	*23*
Total cartilaginous	90,626	*12*	1,118	*26*	10,951	*41*	9,443	*51*	16,001	*11*	16,147	*27*	36,966	*18*	53,660	*15*
Flatfish																
Arrowtooth flounder	24,557	*14*	0	-	3	*100*	119	*27*	3,676	*12*	6,473	*28*	14,286	*18*	10,271	*18*
Dover sole	69,906	*11*	81	*29*	3,179	*31*	8,682	*34*	32,382	*18*	5,638	*11*	19,944	*15*	49,962	*13*
English sole	116,507	*8*	1,102	*29*	14,419	*8*	11,739	*30*	68,224	*11*	7,851	*21*	13,172	*21*	103,335	*9*
Pacific halibut	1,296	*30*	0	-	26	*48*	23	*43*	331	*43*	331	*28*	584	*58*	712	*24*
Pacific sanddab	287,038	*10*	14,019	*49*	57,786	*29*	23,515	*24*	148,167	*14*	17,748	*21*	25,804	*27*	261,234	*11*
Petrale sole	9,683	*8*	167	*25*	1,567	*16*	1,661	*22*	4,014	*11*	1,051	*22*	1,224	*20*	8,459	*8*
Rex sole	158,411	*7*	336	*62*	12,166	*12*	23,608	*15*	86,541	*11*	8,213	*10*	27,547	*12*	130,864	*8*
Total flatfish	701,266	*5*	15,987	*42*	92,673	*18*	74,424	*11*	354,410	*8*	49,737	*10*	114,034	*8*	587,232	*6*
Rockfish																
Shortspine thornyhead	853	*39*	0	-	6	*71*	8	*56*	449	*51*	196	*91*	193	*71*	659	*44*
Bocaccio	162	*38*	14	*41*	97	*61*	0	-	0	-	23	*44*	28	*43*	134	*45*
Canary	2,504	*30*	2	*100*	646	*71*	112	*27*	217	*27*	185	*28*	1,343	*43*	1,161	*40*

Table 12.--Continued.

Taxon	Estimated population number (x 1,000) and *CV*% Total survey area		Estimated population number (x 1,000) and *CV*% by INPFC area													
			Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Rockfish (cont.)																
Chilipepper	44,003	*43*	2,694	*55*	41,297	*46*	8	*73*	4	*100*	0	-	0	-	44,003	*43*
Darkblotched	6,948	*23*	0	-	56	*54*	635	*93*	4,231	*31*	698	*29*	1,328	*45*	5,620	*26*
Greenstriped	20,049	*16*	38	*87*	3,427	*34*	817	*38*	10,253	*25*	2,601	*25*	2,912	*32*	17,136	*18*
Pacific ocean perch	3,055	*60*	0	-	3	*100*	139	*100*	0	-	202	*52*	2,710	*65*	344	*51*
Redstripe	8,670	*44*	0	-	0	-	3	*100*	895	*64*	3,020	*73*	4,752	*59*	3,918	*58*
Sharpchin	605	*34*	0	-	81	*93*	94	*79*	62	*49*	55	*48*	313	*53*	292	*39*
Shortbelly	186,062	*94*	178,519	*98*	7,539	*60*	0	-	0	-	T	*100*	4	*100*	186,058	*94*
Silvergray	396	*81*	0	-	0	-	0	-	0	-	32	*56*	363	*84*	32	*56*
Splitnose	3,050	*60*	1,619	*99*	49	*48*	1,314	*67*	40	*46*	7	*62*	20	*71*	3,030	*60*
Stripetail	39,292	*32*	3,328	*62*	30,622	*39*	4,817	*54*	463	*78*	7	*58*	55	*100*	39,237	*32*
Widow	2,005	*41*	1	*100*	1,034	*65*	15	*50*	103	*52*	680	*67*	172	*40*	1,833	*44*
Yellowtail	29,778	*22*	0	-	4,276	*67*	480	*87*	4,440	*25*	12,644	*38*	7,938	*33*	21,840	*26*
Total rockfish	364,155	*49*	190,285	*92*	99,214	*30*	8,449	*42*	22,219	*17*	20,734	*33*	23,254	*32*	340,901	*52*
Other fish																
Lingcod	2,625	*24*	41	*38*	493	*41*	101	*34*	564	*19*	299	*20*	1,128	*48*	1,497	*16*
Pacific hake	1,216,755	*11*	4,467	*59*	67,191	*22*	366,829	*23*	572,745	*14*	115,775	*30*	89,747	*26*	1,127,007	*11*
Sablefish	14,155	*26*	52	*81*	72	*42*	15	*57*	8,234	*41*	1,364	*24*	4,418	*26*	9,737	*35*
Total fish	3,279,453	*8*	277,415	*63*	849,869	*14*	473,402	*18*	1,057,284	*8*	226,105	*15*	395,379	*17*	2,884,074	*9*

Table 13.--Estimates of fish population numbers (x 1,000) from the 1998 West Coast triennial bottom trawl survey by International North Pacific Fisheries Commission (INPFC) area for the middle depth stratum (184-366 m). Precision of the estimates are presented as coefficients of variation (*CV*%). "T" denotes trace value. Differences in totals result from rounding.

Taxon	Estimated population number (x 1,000) and *CV*% Total survey area		Estimated population number (x 1,000) and *CV*% by INPFC area											
			Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Cartilaginous														
Skates and rays	1,609	*18*	108	*43*	375	*32*	305	*36*	384	*30*	154	*32*	283	*56*	1,326	*16*
Spiny dogfish	12,109	*36*	24	*46*	7,131	*59*	2,485	*32*	1,002	*37*	734	*37*	732	*42*	11,377	*38*
Other sharks	2,014	*77*	135	*51*	1,635	*94*	175	*38*	64	*49*	1	*100*	3	*100*	2,011	*77*
Total cartilaginous	19,254	*24*	341	*34*	9,980	*44*	3,438	*29*	2,403	*34*	1,478	*27*	1,614	*42*	17,640	*26*
Flatfish														
Arrowtooth flounder	5,522	*16*	0	-	7	*56*	163	*20*	1,771	*23*	1,653	*21*	1,927	*28*	3,594	*15*
Dover sole	49,587	*9*	2,185	*42*	13,777	*21*	9,785	*17*	15,811	*10*	4,199	*21*	3,830	*34*	45,757	*9*
English sole	3,614	*20*	174	*74*	1,511	*29*	473	*54*	1,077	*38*	145	*38*	234	*62*	3,380	*21*
Pacific halibut	167	*25*	0	-	0	-	7	*45*	114	*30*	26	*32*	20	*57*	147	*26*
Pacific sanddab	469	*41*	70	*58*	315	*49*	0	-	80	*100*	1	*100*	4	*100*	466	*42*
Petrale sole	340	*21*	24	*45*	101	*40*	35	*35*	143	*35*	19	*47*	18	*50*	322	*22*
Rex sole	74,327	*9*	6,798	*58*	14,386	*17*	14,202	*12*	31,859	*12*	4,150	*15*	2,932	*29*	71,395	*9*
Total flatfish	147,576	*7*	11,521	*43*	32,052	*16*	26,093	*12*	56,716	*10*	11,273	*15*	9,921	*22*	137,655	*7*
Rockfish														
Shortspine thornyhead	18,533	*21*	14	*62*	951	*29*	1,320	*32*	14,336	*27*	1,095	*28*	817	*46*	17,716	*22*
Bocaccio	60	*31*	9	*49*	31	*39*	0	-	0	-	11	*43*	9	*89*	51	*31*
Canary	387	*45*	1	*100*	3	*74*	3	*68*	42	*50*	95	*43*	242	*55*	145	*33*

Table 13.--Continued.

Taxon	Estimated population number (x 1,000) and *CV%* Total survey area		Estimated population number (x 1,000) and *CV%* by INPFC area											
			Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Rockfish (cont.)																
Chilipepper	10,386	*72*	269	*41*	9,622	*78*	479	*81*	17	*84*	0	-	0	-	10,386	*72*
Darkblotched	4,627	*21*	0	-	239	*52*	605	*42*	2,685	*27*	697	*58*	402	*59*	4,225	*21*
Greenstriped	5,511	*29*	10	*73*	333	*82*	342	*48*	1,691	*23*	1,615	*69*	1,521	*48*	3,990	*31*
Pacific ocean perch	13,535	*26*	0	-	6	*73*	102	*41*	5,134	*42*	4,934	*40*	3,358	*43*	10,176	*29*
Redstripe	4,048	*65*	0	-	0	-	30	*44*	7	*57*	1,082	*58*	2,928	*70*	1,119	*56*
Sharpchin	14,173	*53*	5	*66*	1,384	*93*	159	*39*	10,049	*71*	861	*70*	1,715	*96*	12,459	*59*
Shortbelly	56,821	*68*	12,323	*95*	44,494	*66*	2	*100*	2	*100*	0	-	0	-	56,821	*68*
Silvergray	382	*56*	0	-	0	-	0	-	7	*74*	109	*51*	265	*61*	117	*48*
Splitnose	105,381	*22*	27,308	*20*	40,786	*33*	6,344	*21*	29,593	*57*	942	*45*	408	*89*	104,973	*22*
Stripetail	57,808	*21*	18,023	*38*	30,544	*30*	3,244	*32*	5,875	*35*	118	*88*	4	*75*	57,804	*21*
Widow	2,960	*42*	0	-	755	*76*	78	*37*	135	*35*	1,248	*71*	744	*56*	2,217	*48*
Yellowtail	8,769	*52*	0	-	0	-	0	-	1,020	*45*	2,030	*60*	5,719	*61*	3,050	*38*
Total rockfish	305,312	*15*	57,977	*22*	129,549	*24*	12,776	*13*	71,565	*33*	15,072	*29*	18,372	*42*	286,940	*16*
Other fish																
Lingcod	343	*44*	5	*71*	72	*76*	26	*41*	168	*63*	54	*60*	18	*55*	325	*46*
Pacific hake	229,432	*21*	29,297	*35*	91,606	*42*	14,824	*37*	86,772	*31*	4,768	*26*	2,165	*29*	227,267	*22*
Sablefish	7,273	*22*	65	*67*	629	*16*	1,178	*36*	3,970	*38*	893	*28*	538	*36*	6,735	*24*
Total fish	720,968	*11*	100,127	*14*	266,409	*23*	60,718	*11*	226,622	*16*	34,113	*14*	32,978	*22*	687,990	*11*

Table 14.--Estimates of fish population numbers (x 1,000) from the 1998 West Coast triennial bottom trawl survey by International North Pacific Fisheries Commission (INPFC) area for the deepest depth stratum (367-500 m). Precision of the estimates are presented as coefficients of variation (*CV*%). "T" denotes trace value. Differences in totals result from rounding.

Taxon	Estimated population number (x 1,000) and *CV*%		Estimated population number (x 1,000) and *CV*% by INPFC area											
	Total survey area		Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Cartilaginous																
Skates and rays	577	*11*	165	*22*	197	*19*	35	*27*	153	*15*	3	*8*	24	*55*	553	*11*
Spiny dogfish	1,391	*23*	129	*57*	537	*27*	459	*50*	254	*35*	0	-	12	*50*	1,379	*24*
Other sharks	3,538	*17*	290	*37*	872	*29*	1,718	*29*	629	*30*	29	*81*	0	-	3,538	*17*
Total cartilaginous	6,759	*12*	774	*25*	2,559	*20*	2,247	*21*	1,092	*17*	35	*60*	52	*26*	6,706	*12*
Flatfish																
Arrowtooth flounder	563	*14*	0	-	6	*39*	120	*20*	193	*26*	1	*100*	242	*24*	320	*17*
Dover sole	49,054	*11*	10,389	*19*	19,799	*17*	7,701	*28*	9,580	*18*	342	*64*	1,242	*20*	47,812	*11*
English sole	123	*60*	3	*100*	115	*64*	0	-	3	*100*	0	-	3	*100*	121	*61*
Pacific halibut	3	*100*	0	-	0	-	0	-	0	-	0	-	3	*100*	0	-
Pacific sanddab	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Petrale sole	61	*49*	6	*53*	46	*62*	0	-	3	*100*	0	-	5	*100*	56	*53*
Rex sole	37,676	*10*	5,967	*24*	14,525	*14*	9,407	*24*	6,770	*18*	102	*83*	906	*34*	36,770	*10*
Total flatfish	88,428	*8*	16,417	*16*	34,917	*13*	17,412	*18*	16,822	*15*	447	*68*	2,413	*23*	86,015	*8*
Rockfish																
Shortspine thornyhead	25,826	*10*	492	*34*	1,644	*24*	3,125	*20*	18,820	*12*	512	*58*	1,232	*25*	24,594	*10*
Bocaccio	1	*100*	1	*100*	0	-	0	-	0	-	0	-	0	-	1	*100*
Canary	1	*100*	0	-	1	*100*	0	-	0	-	0	-	0	-	1	*100*

Table 14.--Continued.

Taxon	Estimated population number (x 1,000) and *CV*% Total survey area		Estimated population number (x 1,000) and *CV*% by INPFC area													
			Conception		Monterey		Eureka		Columbia		U.S. Vancouver		Canadian Vancouver		Total U.S. area	
Rockfish (cont.)																
Chilipepper	2	*100*	0	-	0	-	2	*100*	0	-	0	-	0	-	2	*100*
Darkblotched	54	*33*	3	*69*	3	*54*	7	*67*	27	*38*	0	-	13	*100*	41	*29*
Greenstriped	0	-	0	-	0	-	0	-		-	0	-	0	-	0	-
Pacific ocean perch	1,321	*58*	0	-	5	*56*	7	*46*	366	*30*	11	*100*	932	*81*	389	*29*
Redstripe	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Sharpchin	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Shortbelly	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Silvergray	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Splitnose	14,964	*34*	10,316	*46*	4,481	*34*	28	*100*	125	*49*	1	*100*	12	*100*	14,951	*34*
Stripetail	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Widow	3	*100*	0	-	0	-	0	-	0	-	0	-	3	*100*	0	-
Yellowtail	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Total rockfish	56,877	*9*	15,525	*27*	9,192	*14*	4,079	*15*	24,326	*10*	792	*6*	2,962	*35*	53,915	*10*
Other fish																
Lingcod	0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Pacific hake	27,353	*10*	8,418	*17*	5,660	*13*	2,572	*27*	10,231	*21*	82	*3*	391	*41*	26,962	*10*
Sablefish	4,855	*7*	340	*20*	961	*13*	1,528	*11*	1,960	*11*	11	*26*	55	*36*	4,800	*7*
Total fish	202,457	*5*	44,422	*9*	56,504	*8*	34,466	*14*	59,555	*7*	1,555	*21*	5,955	*22*	196,502	*5*

Table 15.--The length-weight relationships from the 1998 triennial West Coast survey using a non-linear least squares fit for the following equation: Fish weight (grams) = a × {Fork length (cm)}^{b}

Species	Sex	Number sampled	Length-weight coefficients a	b	Predicted weight at length (g)		
					30 cm	50 cm	65 cm
Pacific hake	M	315	0.0068387	2.948661	155.1	699.3	1515.8
	F	461	0.0041574	3.102999	159.3	777.5	1755.1
	T	776	0.0046159	3.069480	157.9	757.2	1694.2
					40 cm	50 cm	65 cm
Sablefish	M	384	0.0022818	3.364467	560.2	1186.9	2869.2
	F	448	0.0021359	3.377710	550.6	1170.1	2838.4
	T	832	0.0022823	3.362653	556.6	1178.7	2848.2
					20 cm	25 cm	30 cm
Aurora rockfish	M	84	0.0176740	2.965924	127.7	247.5	425.0
	F	56	0.0151978	3.019403	128.9	252.8	438.3
	T	140	0.0165251	2.989394	128.1	249.5	430.4
					20 cm	35 cm	50 cm
Blackgill rockfish	M	197	0.0176444	2.957919	124.4	651.4	1870.8
	F	147	0.0179013	2.959046	126.7	663.5	1906.4
	T	344	0.0178840	2.956348	125.5	656.5	1884.6
					40 cm	50 cm	60 cm
Bocaccio	M	78	0.0054824	3.191058	710.0	1447.0	2589.1
	F	68	0.0070645	3.114748	690.4	1383.4	2441.0
	T	146	0.0063052	3.150003	701.8	1417.3	2517.0
					30 cm	40 cm	50 cm
Canary rockfish	M	213	0.0116610	3.093990	433.4	1055.6	2105.4
	F	167	0.0100855	3.126670	419.0	1029.9	2069.3
	T	380	0.0107935	3.111992	426.5	1044.1	2090.9
					20 cm	30 cm	40 cm
Chilipepper	M	242	0.0091625	3.108134	101.3	357.4	873.8
	F	197	0.0088327	3.100921	95.6	336.1	820.3
	T	441	0.0094681	3.090277	99.3	347.5	845.4
					25 cm	30 cm	35 cm
Chub mackerel	M	26	0.0181779	2.843261	171.5	288.0	446.4
	F	15	0.0398402	2.613595	179.5	289.0	432.4
	T	41	0.0202288	2.813093	173.2	289.2	446.2
					20 cm	30 cm	40 cm
Darkblotched rockfish	M	210	0.0115880	3.129598	136.7	486.2	1196.2
	F	253	0.0111571	3.142287	136.7	488.8	1206.9
	T	469	0.0118560	3.123245	137.2	486.8	1195.5
					25 cm	30 cm	35 cm
Dover sole	M	101	0.0033167	3.287533	130.8	238.1	395.3
	F	138	0.0049061	3.179062	136.4	243.6	397.6
	T	239	0.0040619	3.230840	133.4	240.5	395.7
					40 cm	60 cm	80 cm
Lingcod	M	281	0.0021309	3.362499	519.4	2030.5	5342.0
	F	566	0.0022088	3.350425	514.9	2003.2	5251.9
	T	849	0.0022320	3.348811	517.2	2010.9	5269.7
					20 cm	22 cm	24 cm
Pacific herring	M	30	0.0046417	3.213501	70.4	95.6	126.5
	F	70	0.0132141	2.869592	71.5	94.0	120.7
	T	100	0.0101949	2.954807	71.2	94.4	122.1

Table 15.--Continued.

Species	Sex	Number sampled	Length-weight coefficients a	b	Predicted weight at length (g)		
					20 cm	30 cm	40 cm
Pacific ocean perch	M	253	0.0137653	3.008622	113.0	382.7	909.4
	F	295	0.0112445	3.079214	114.0	397.5	963.9
	T	560	0.0115131	3.067020	112.6	390.4	943.5
					15 cm	20 cm	25 cm
Pacific sanddab	M	139	0.0023595	3.451390	27.0	73.0	157.6
	F	120	0.0022211	3.472088	26.9	73.1	158.6
	T	259	0.0022785	3.463324	27.0	73.0	158.2
					10 cm	15 cm	20 cm
Pacific sardine	M	48	0.0042433	3.299611	8.5	32.2	83.3
	F	170	0.0028677	3.447605	8.0	32.5	87.7
	T	218	0.0035289	3.366136	8.2	32.1	84.5
					30 cm	35 cm	40 cm
Petrale sole	T	12	0.0622666	2.485575	292.2	428.7	597.4
					25 cm	30 cm	40 cm
Redstipe rockfish	M	122	0.0031644	3.428432	196.4	366.9	983.7
	F	158	0.0090310	3.101079	195.4	343.9	839.2
	T	280	0.0086832	3.118050	198.4	350.3	859.0
					30 cm	40 cm	50 cm
Rougheye rockfish	M	46	0.0194031	2.932745	416.8	969.0	1864.3
	F	33	0.0139175	3.024390	408.3	974.6	1913.9
	T	79	0.0164260	2.978156	411.7	969.9	1885.1
					20 cm	30 cm	35 cm
Sharpchin rockfish	M	159	0.0071013	3.223167	110.9	409.6	673.2
	F	190	0.0081704	3.167654	108.0	390.2	635.8
	T	349	0.0083272	3.165994	109.5	395.4	644.2
					40 cm	50 cm	60 cm
Silvergray rockfish	M	80	0.0138809	2.997716	880.9	1719.7	2970.4
	F	73	0.0317769	2.786913	926.6	1725.8	2868.6
	T	153	0.0219625	2.880740	905.3	1721.8	2911.2
					15 cm	20 cm	25 cm
Slender sole	T	19	0.0052083	3.018561	18.5	44.0	86.4
					15 cm	25 cm	35 cm
Splitnose rockfish	M	190	0.0116303	3.109247	52.8	258.3	735.3
	F	160	0.0132957	3.070361	54.3	260.6	732.1
	T	350	0.0121905	3.095814	53.3	259.3	734.8
					15 cm	20 cm	25 cm
White croaker	M	65	0.0303273	2.680159	43.0	93.1	169.3
	F	65	0.0512738	2.516264	46.7	96.3	168.8
	T	130	0.0289563	2.702912	43.7	95.1	173.9
					30 cm	50 cm	70 cm
Yelloweye rockfish	M	24	0.0098484	3.167656	470.3	2372.0	6886.5
	F	19	0.0076595	3.228448	449.8	2340.1	6934.3
	T	43	0.0086480	3.199402	460.1	2358.3	6920.3
					40 cm	45 cm	50 cm
Yellow mouth rockfish	M	8	0.0034218	3.404593	974.1	1454.7	2082.4
	F	8	0.0164665	2.981582	984.6	1398.9	1915.2
	T	16	0.0092593	3.137042	982.4	1421.6	1978.4
					20 cm	40 cm	55 cm
Yellowtail rockfish	M	889	0.0109908	3.079317	111.5	942.5	2512.8
	F	722	0.0133214	3.024686	114.8	933.9	2446.8
	T	1611	0.0123220	3.046983	113.5	937.8	2474.8

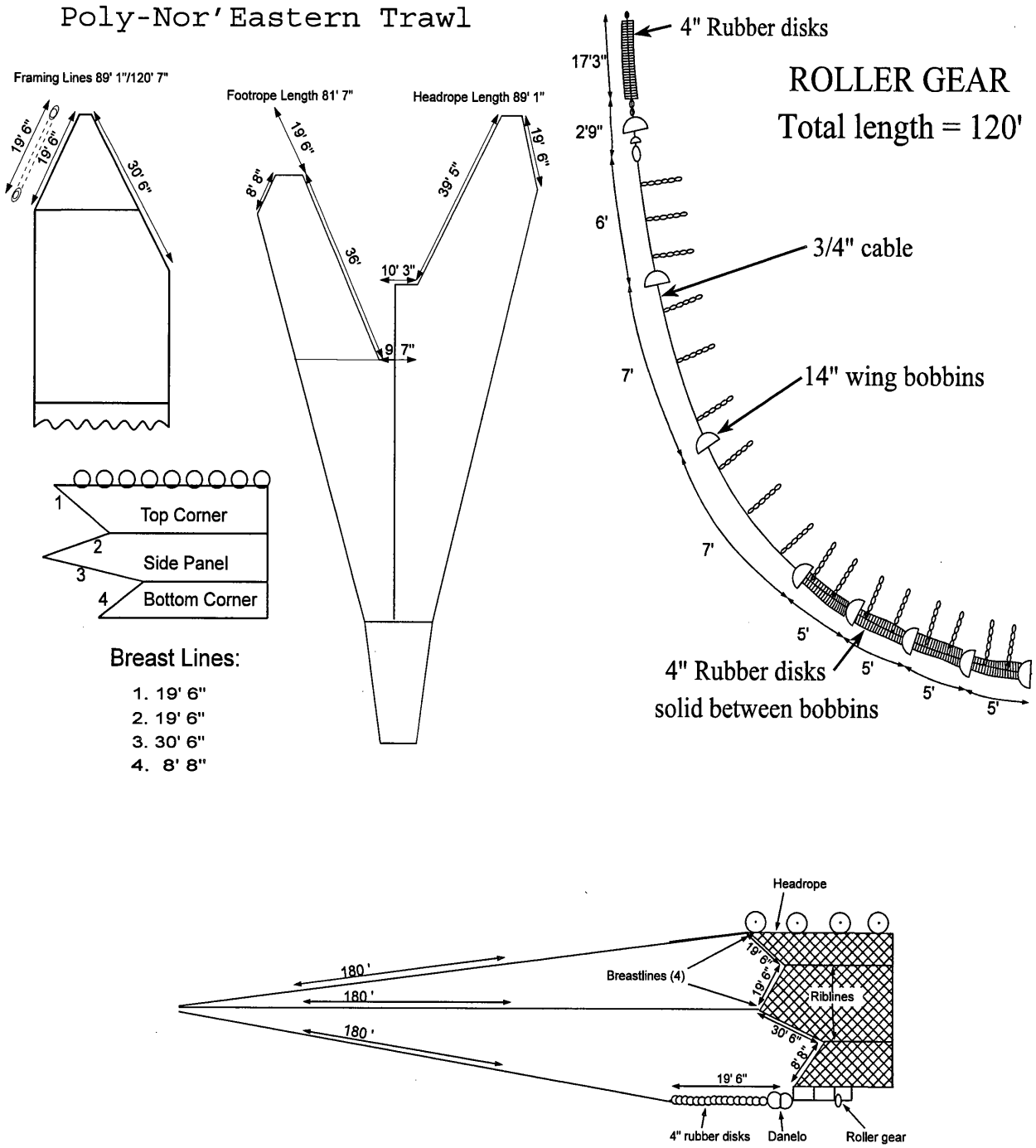

Figure 1.--The standardized poly-Nor'Eastern trawl and accessories used to sample groundfish during the 1998 West Coast triennial bottom trawl survey.

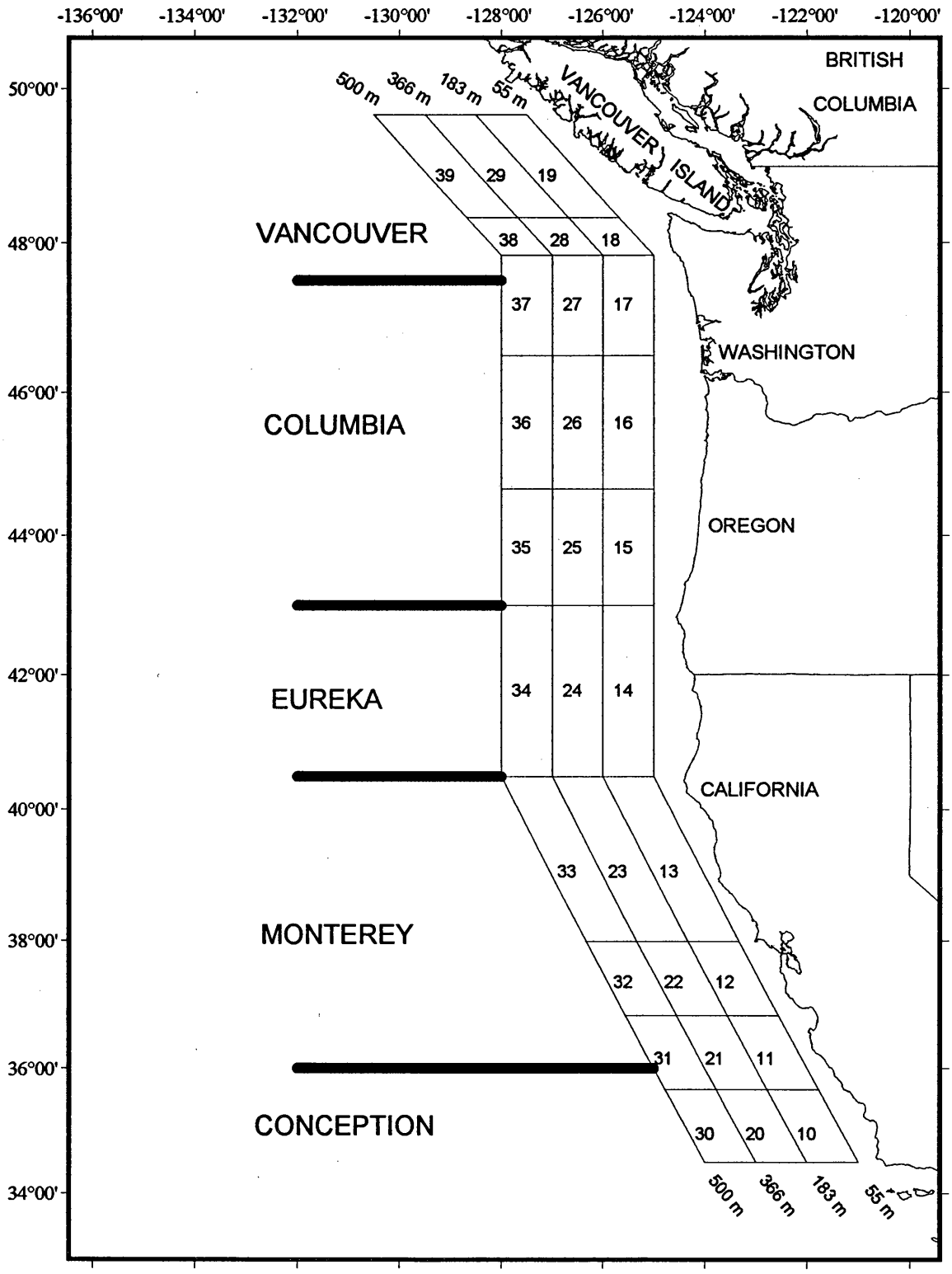

Figure 2.–The 1998 West Coast triennial bottom trawl survey area and stratification scheme (stratum numbers shown), also showing International North Pacific Fisheries Commission statistical areas.

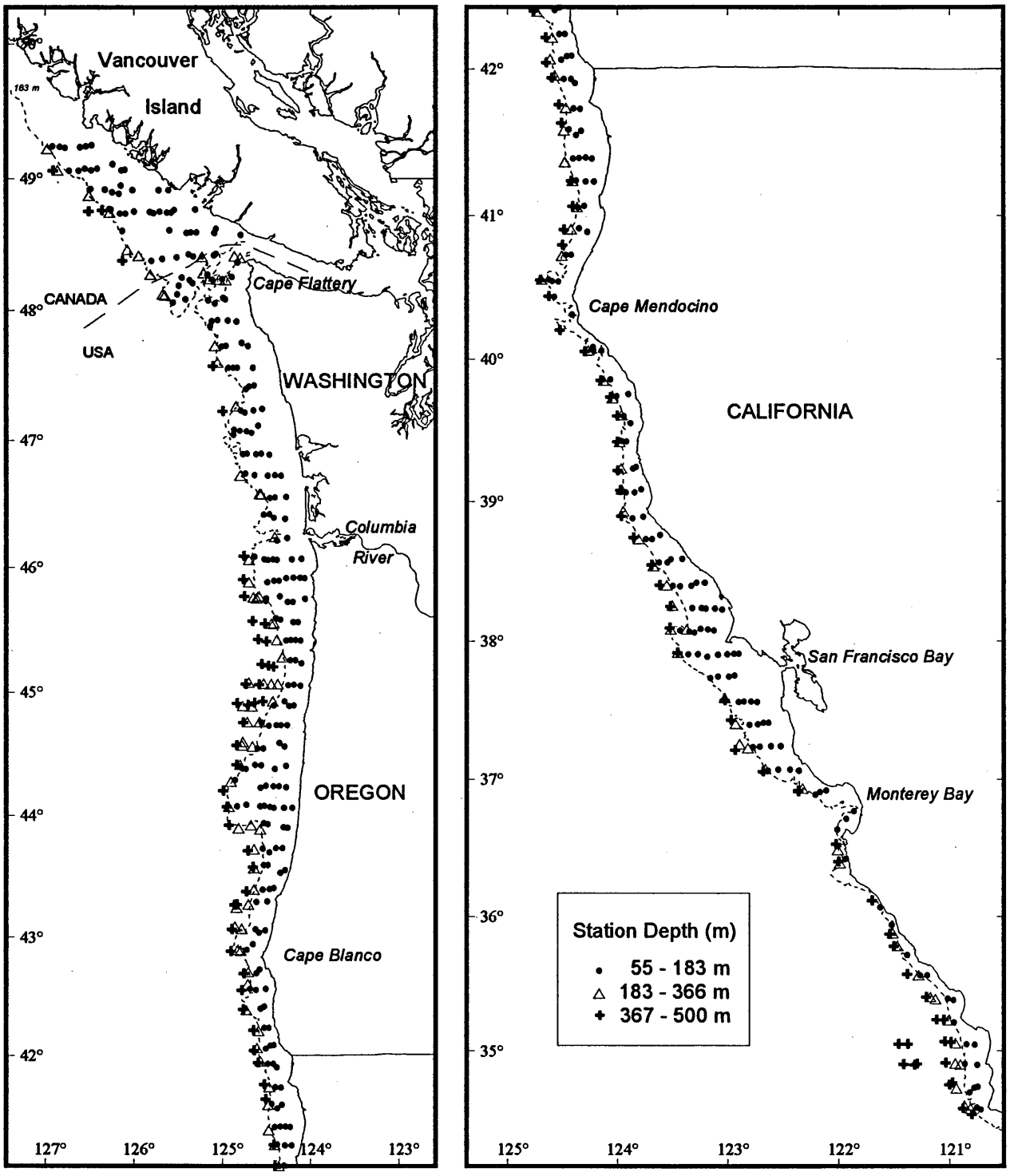

Figure 3.--Locations of stations successfully sampled in each stratum during the 1998 West Coast triennial bottom trawl survey.

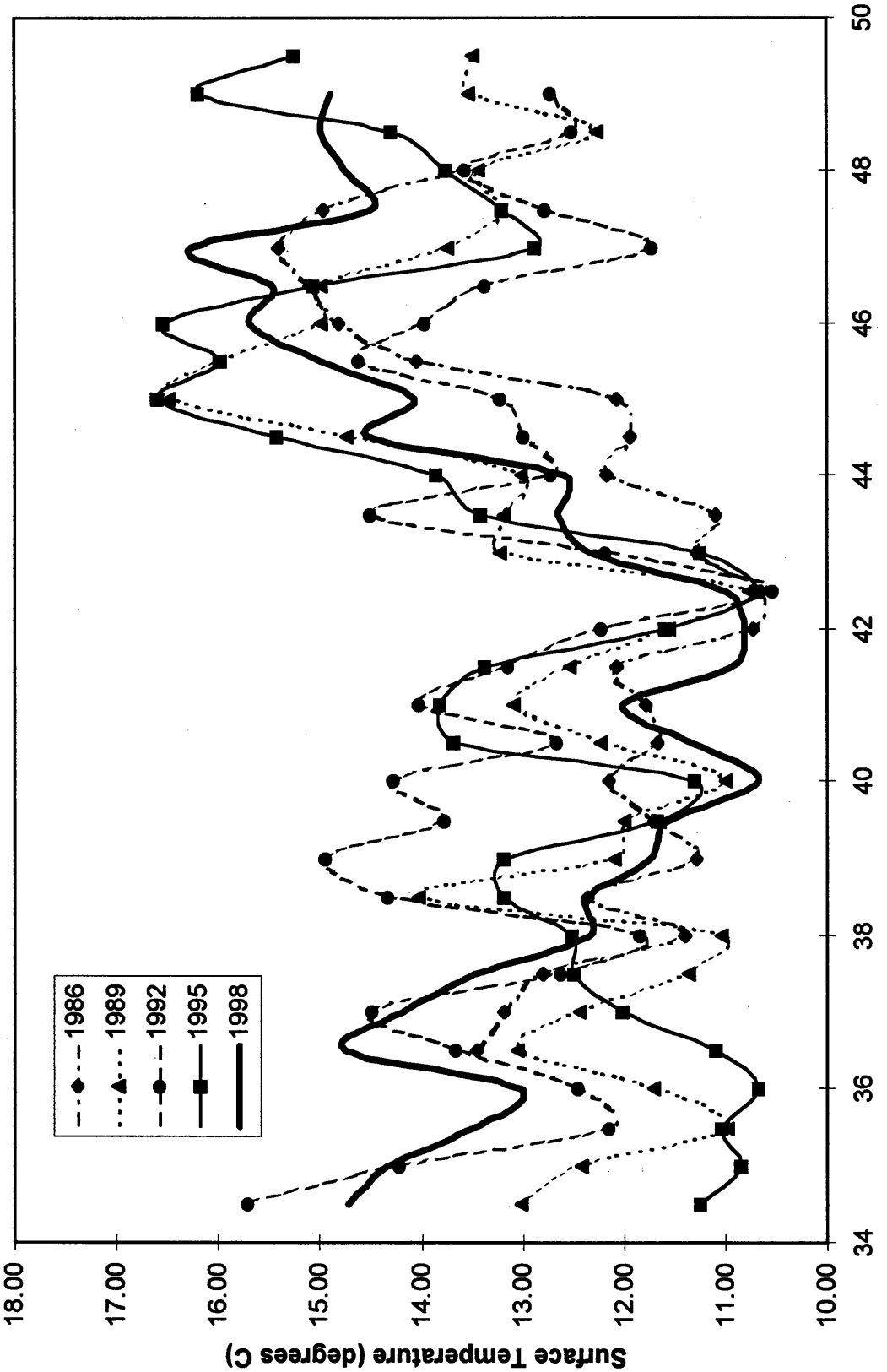

Figure 4.--Sea surface temperatures, averaged by one-half degree latitude, observed during the 1986-1998 West Coast triennial bottom trawl surveys.

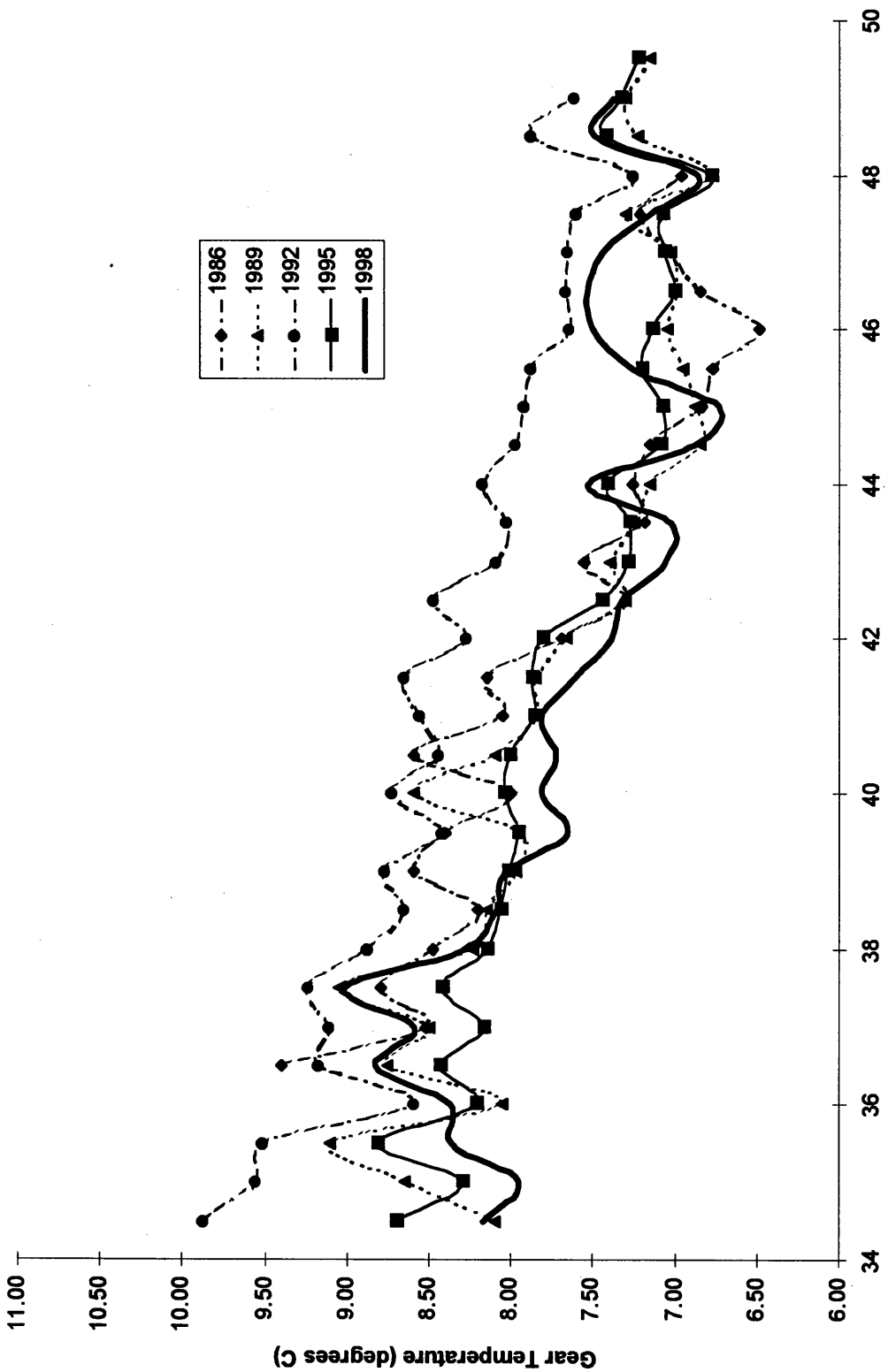

Figure 5.--Bottom temperatures, averaged by one-half degree latitude, observed during the 1986-1998 West Coast triennial bottom trawl surveys.

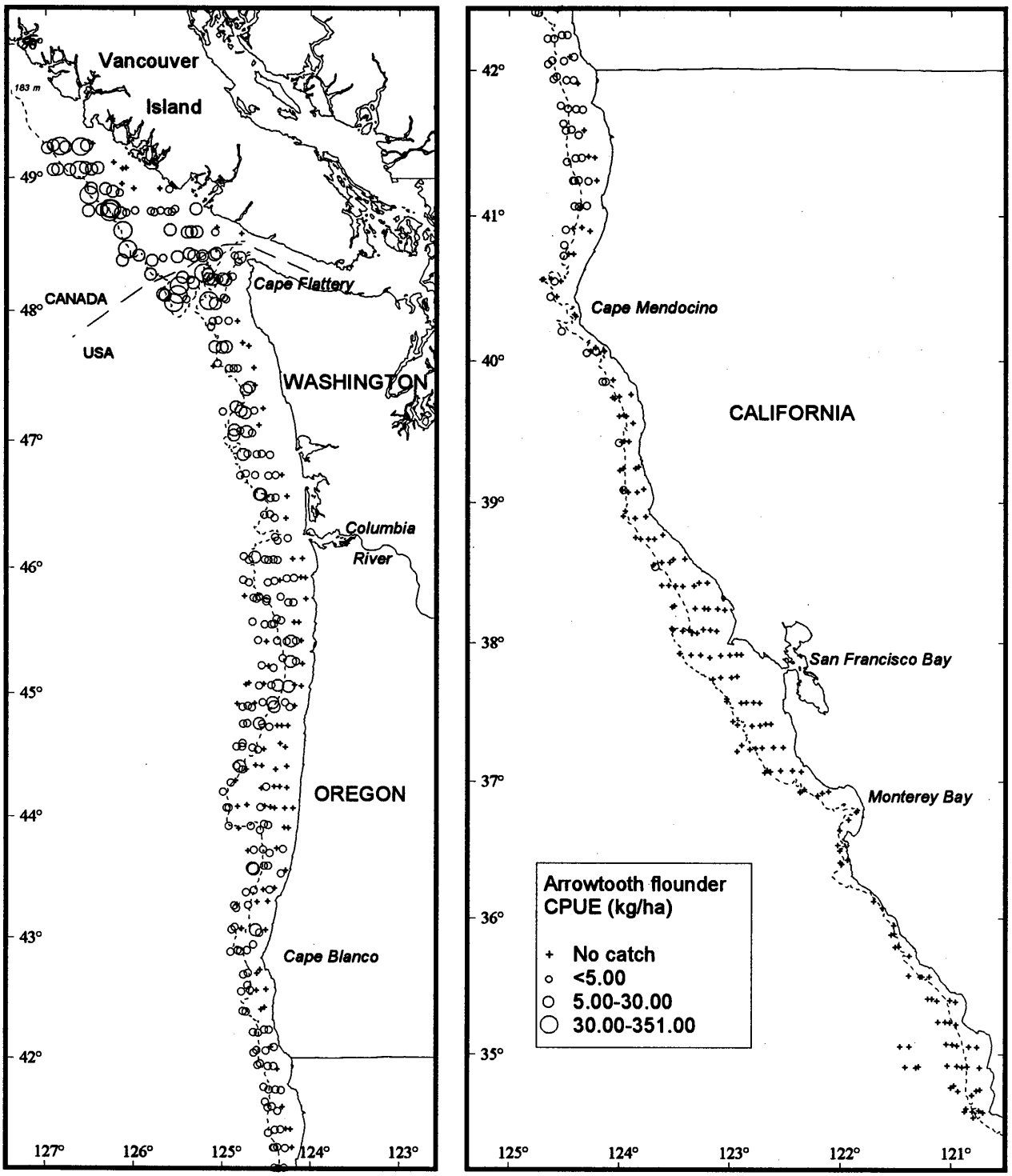

Figure 6.--Arrowtooth flounder distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

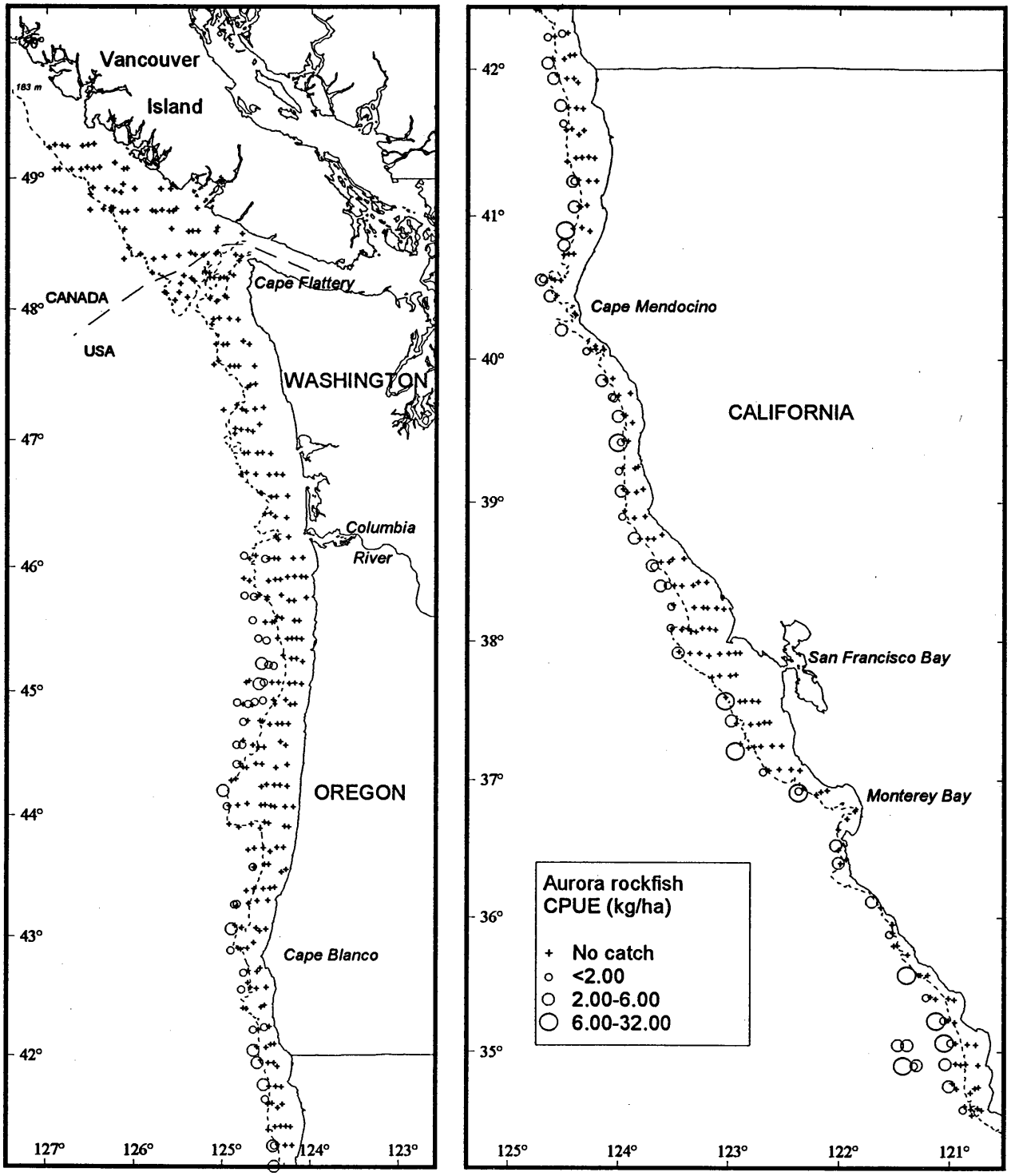

Figure 7.--Aurora rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

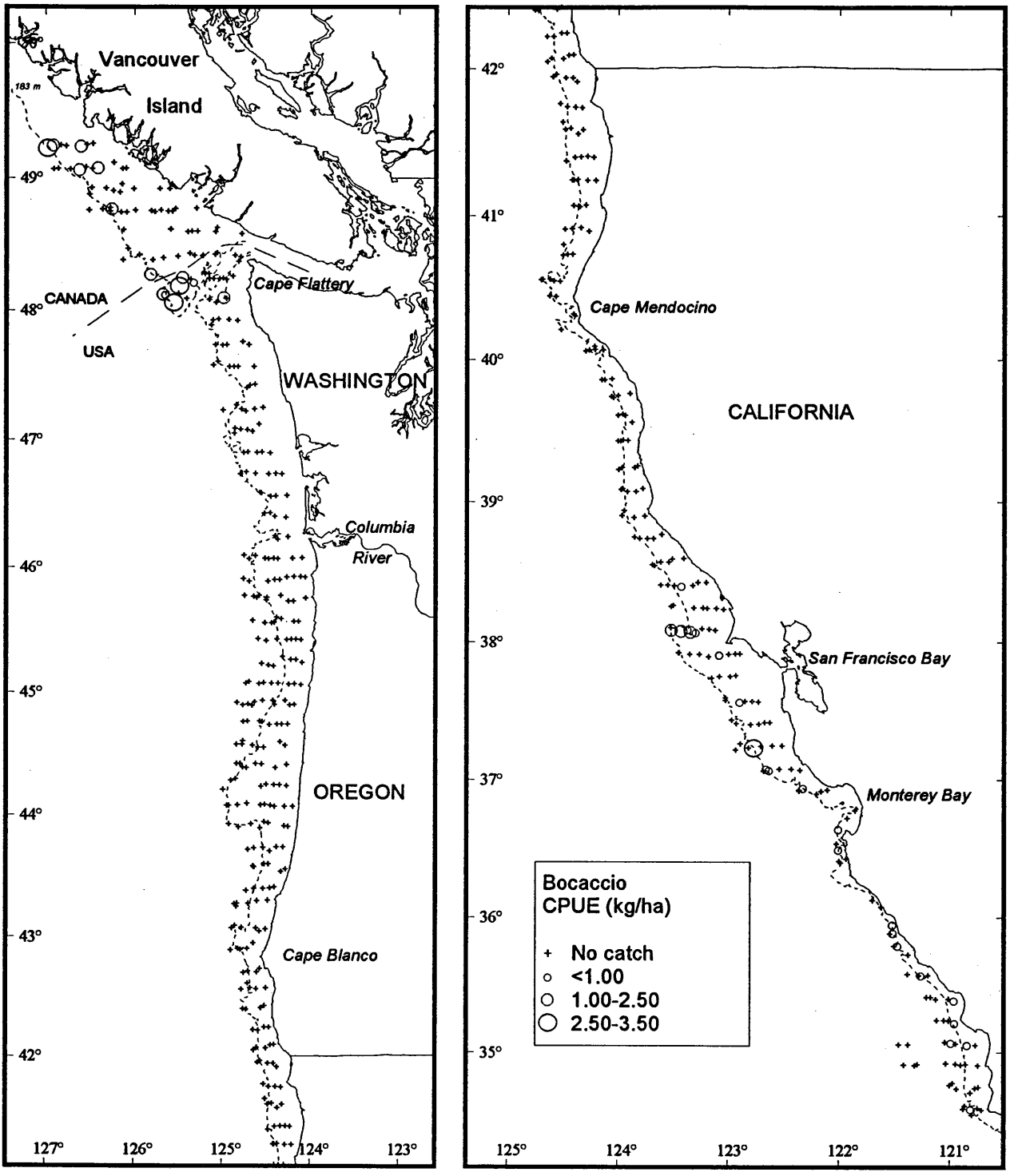

Figure 8.--Bocaccio distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

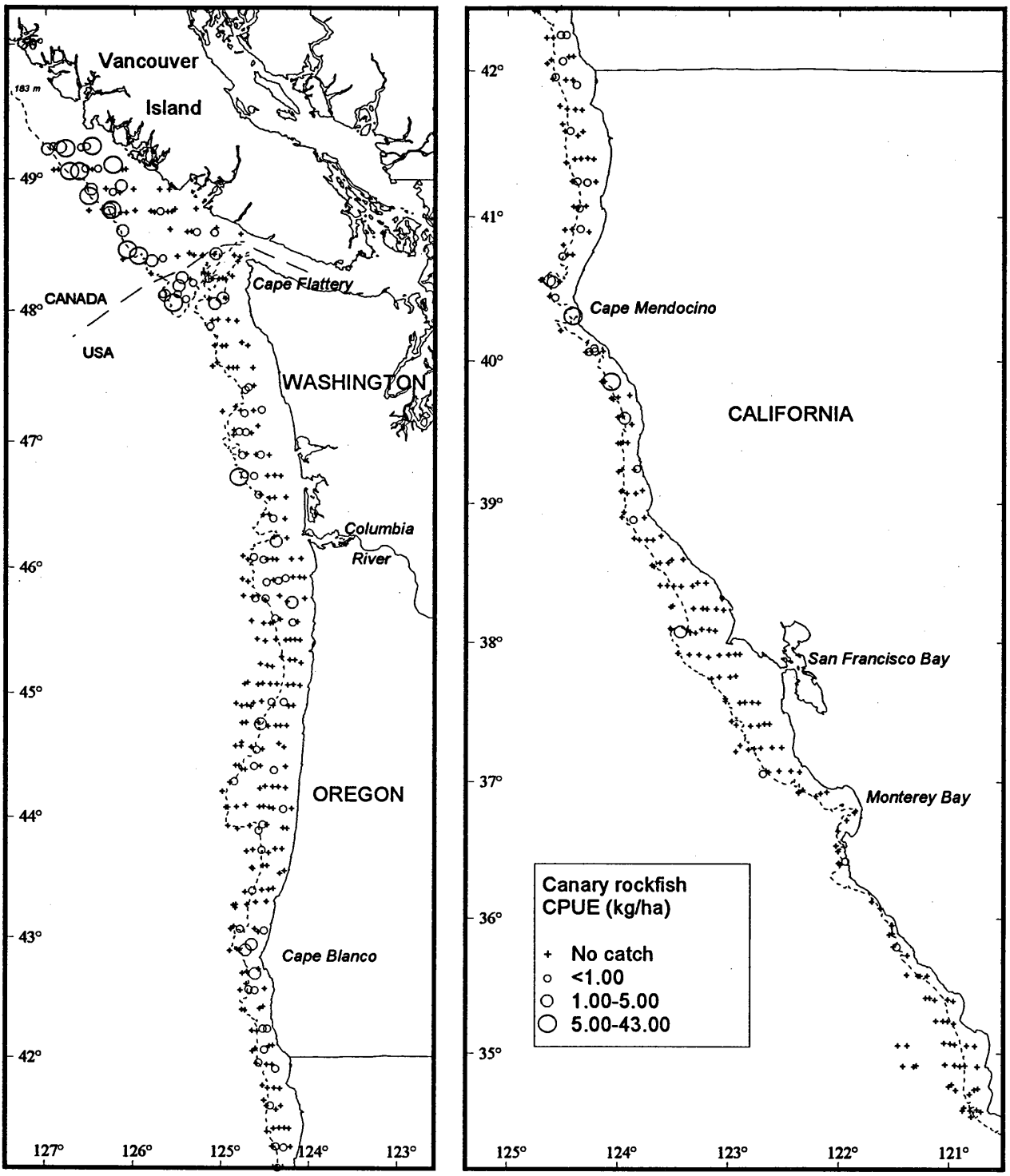

Figure 9.--Canary rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

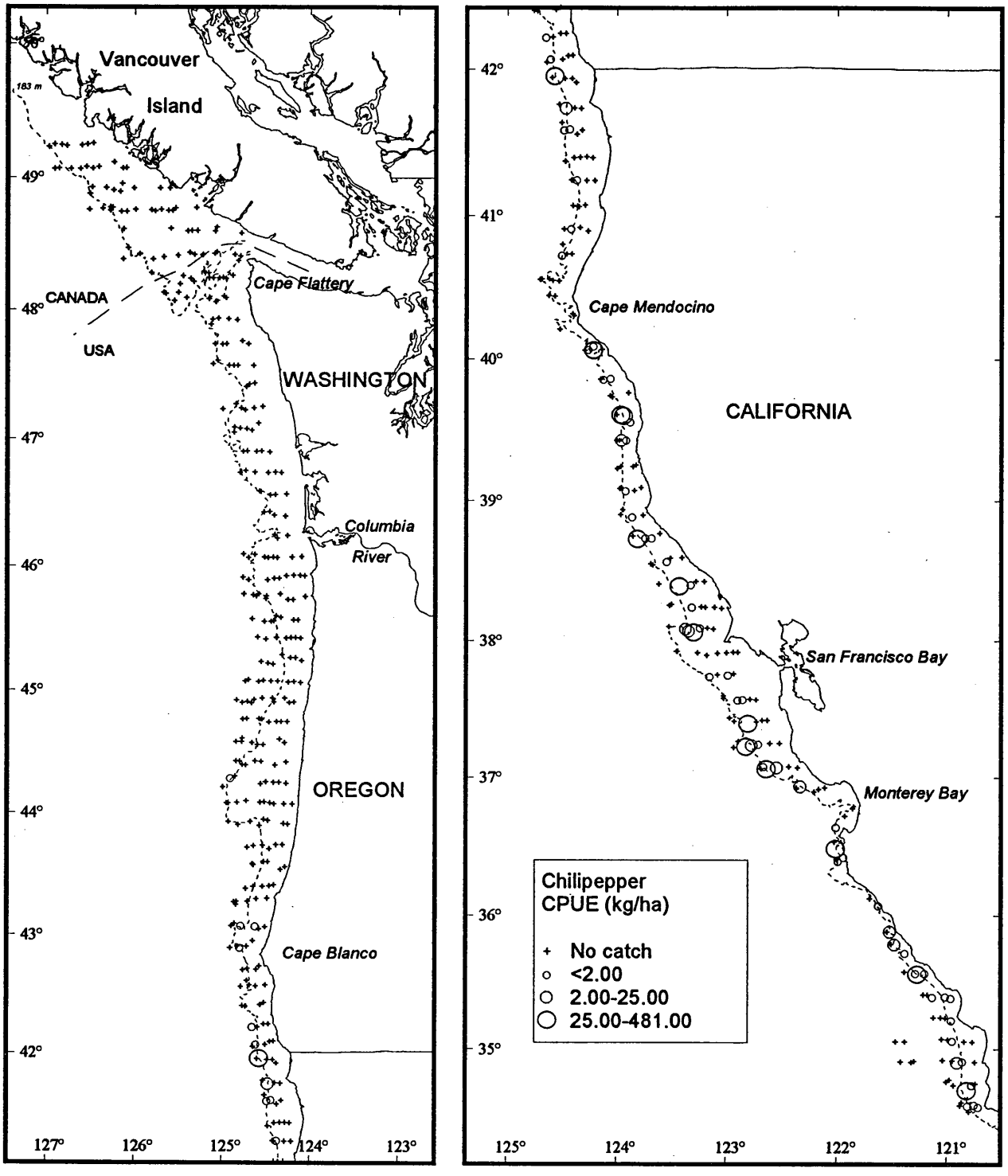

Figure 10.--Chilipepper distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

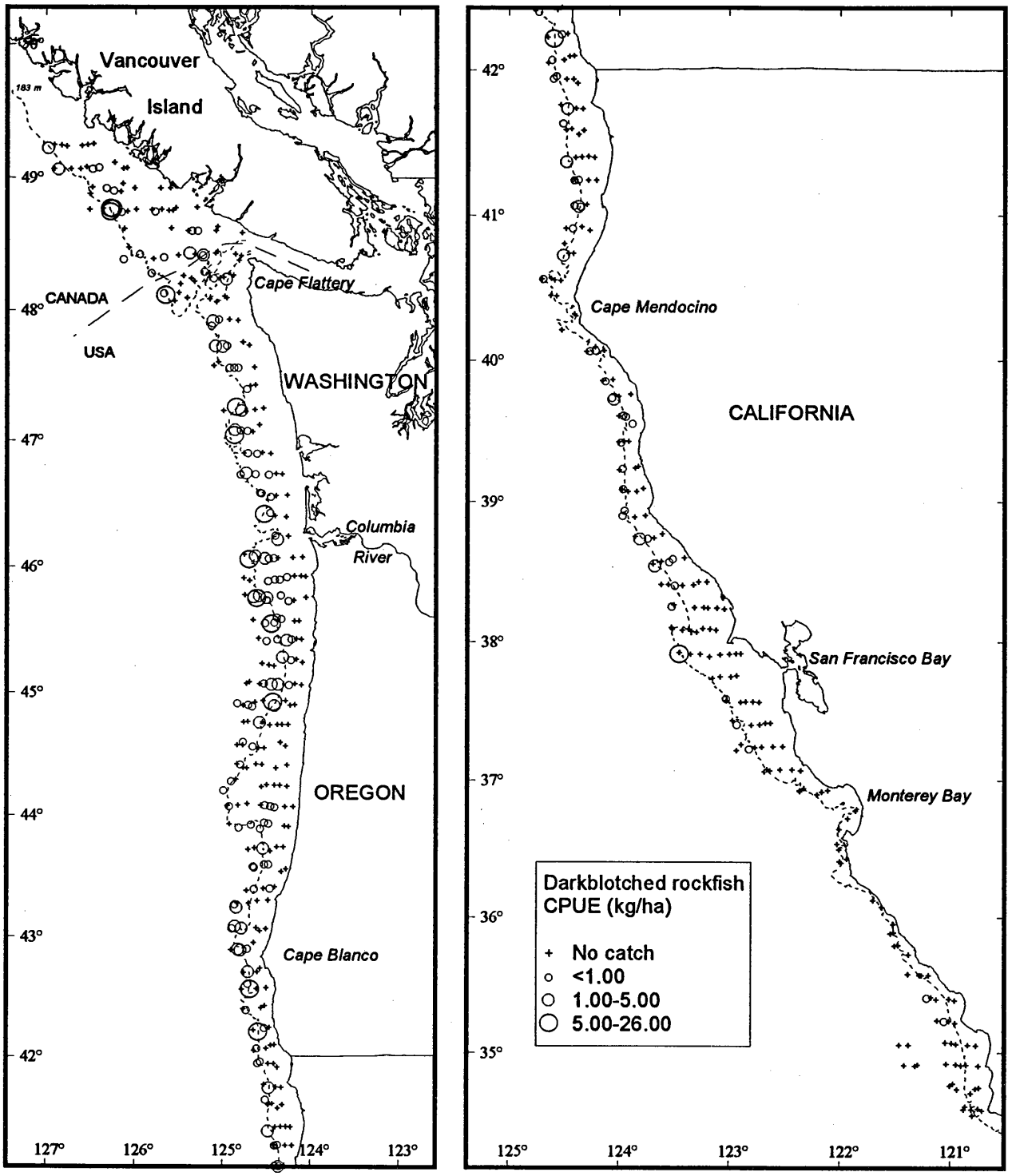

Figure 11.--Darkblotched rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

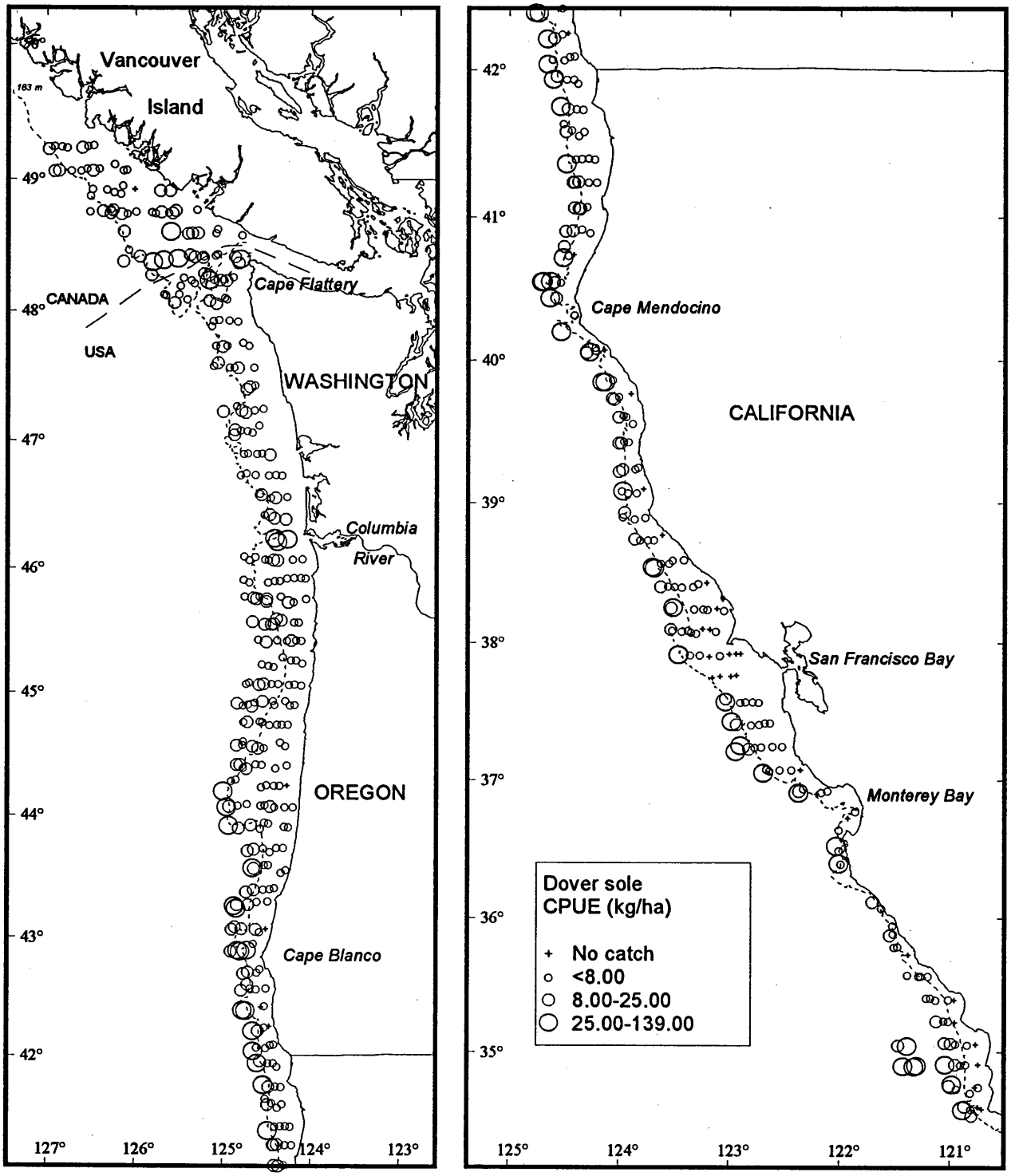

Figure 12.--Dover sole distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

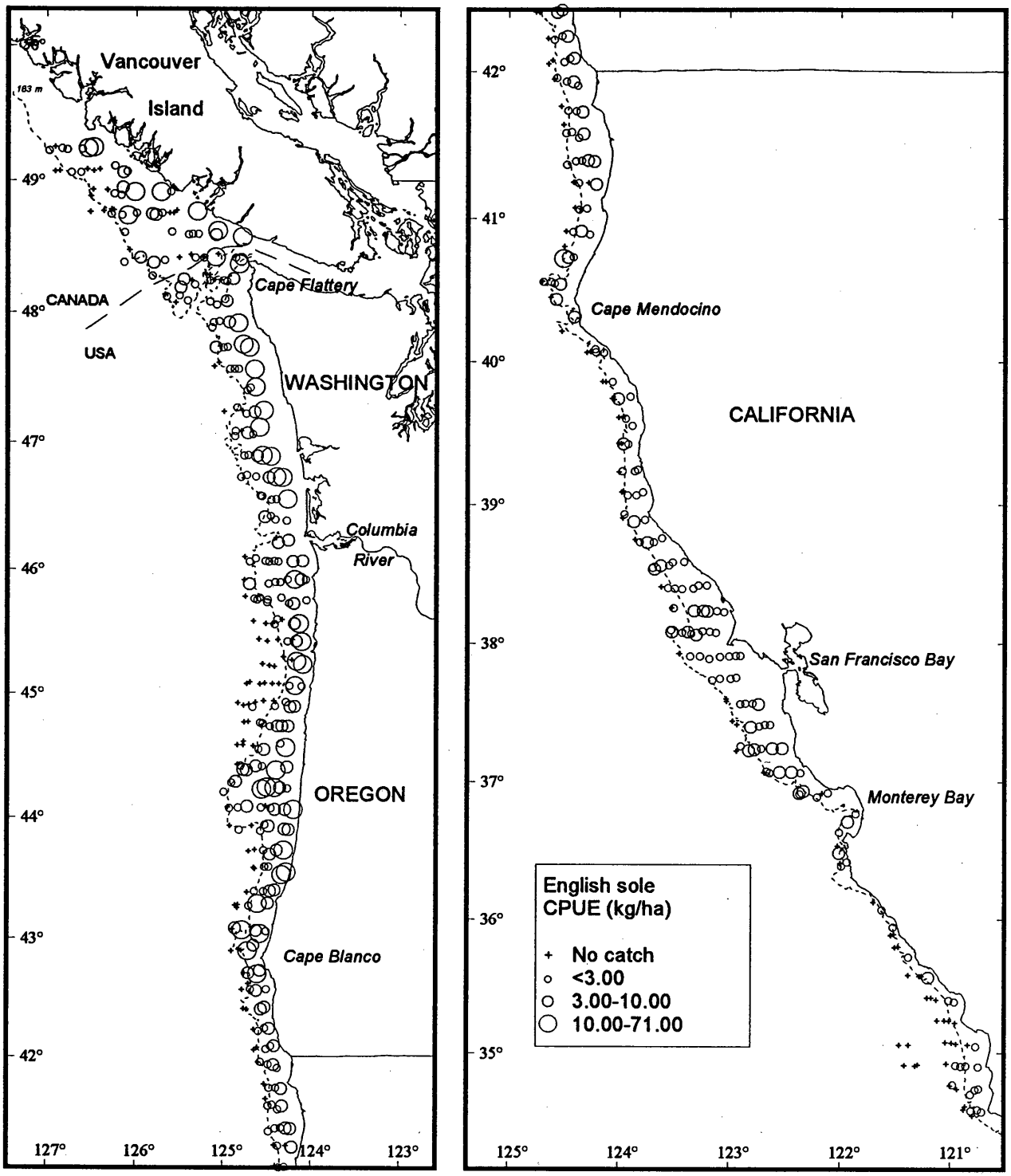

Figure 13.--English sole distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

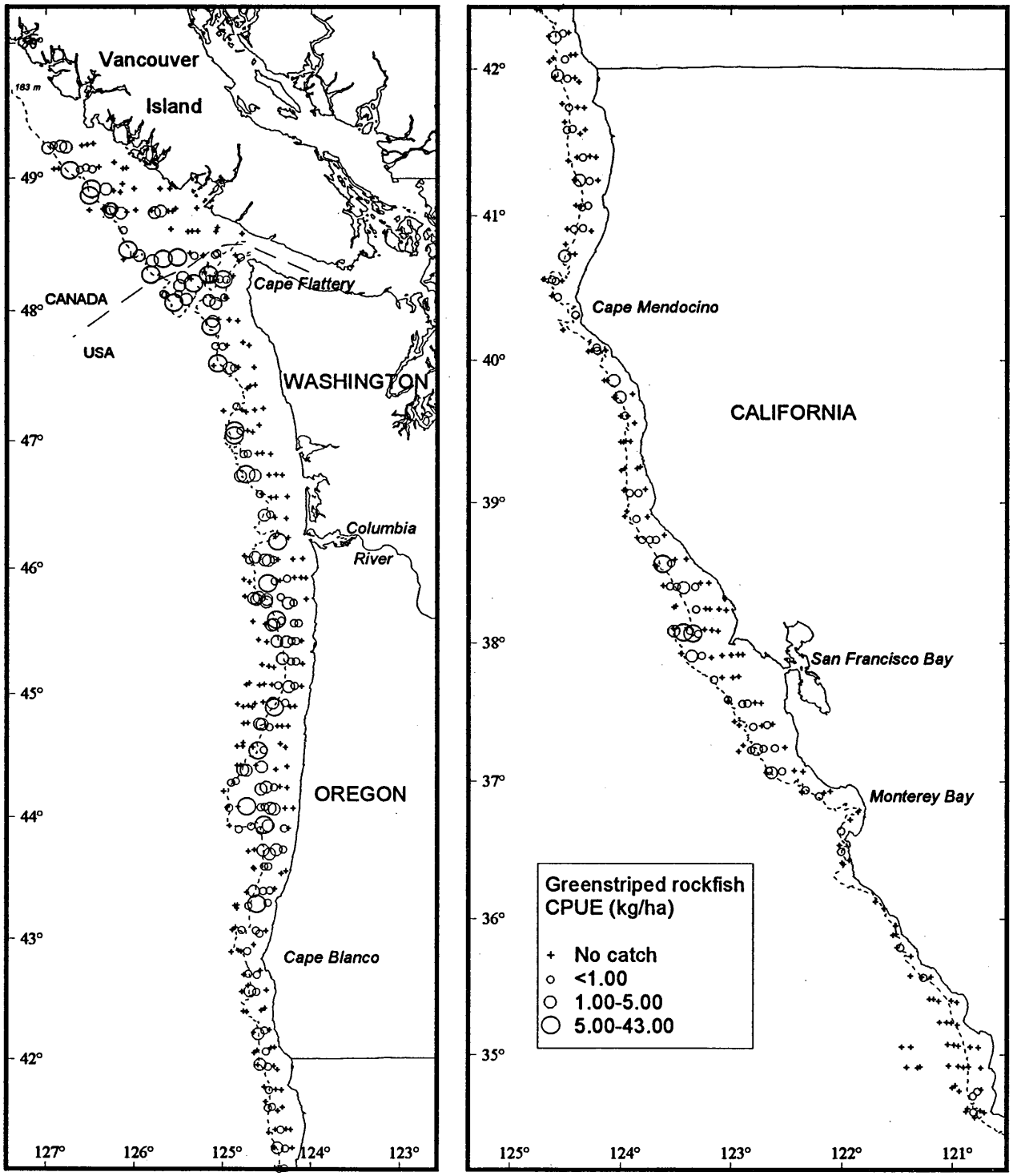

Figure 14.--Greenstriped rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

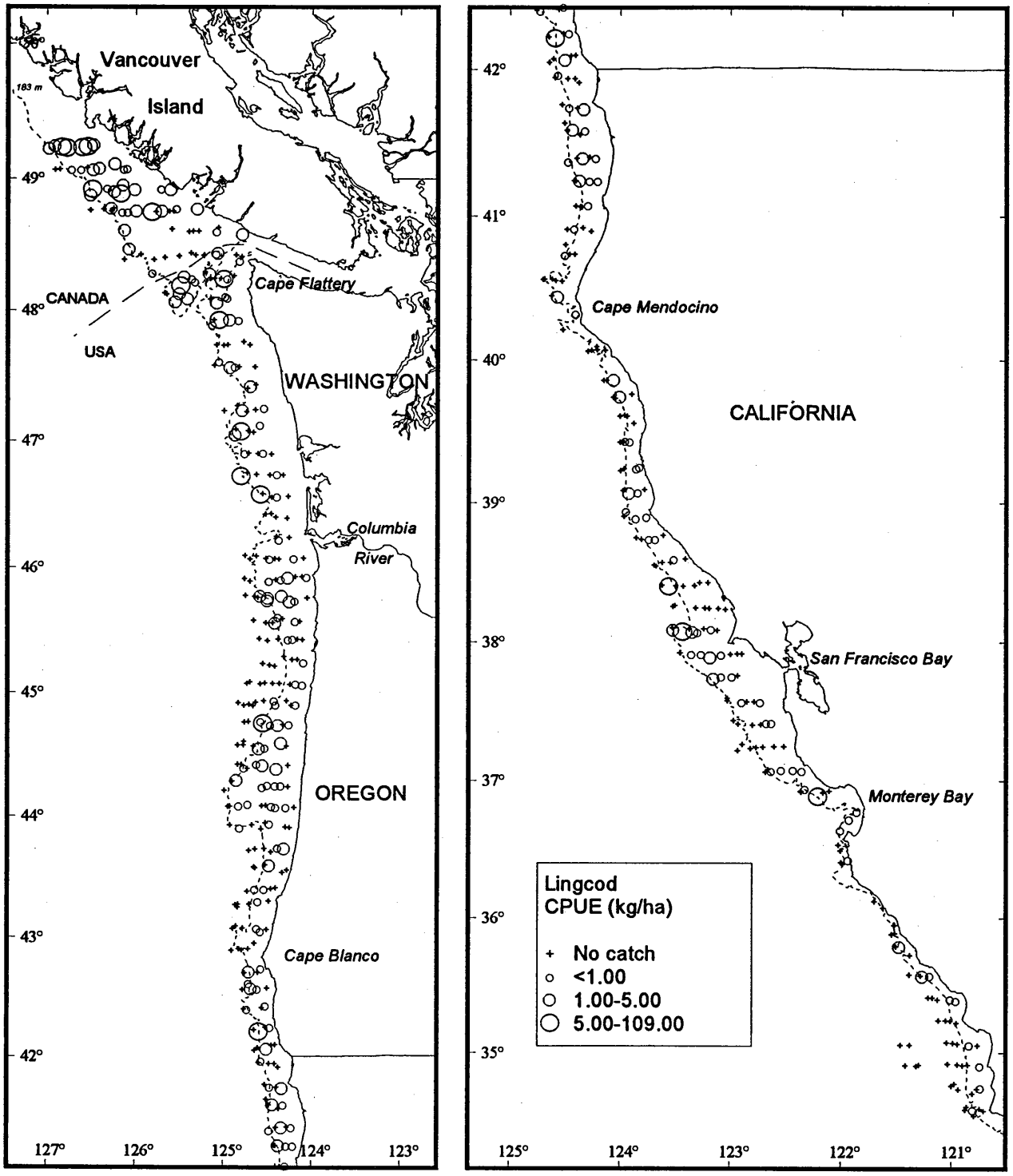

Figure 15.--Lingcod distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

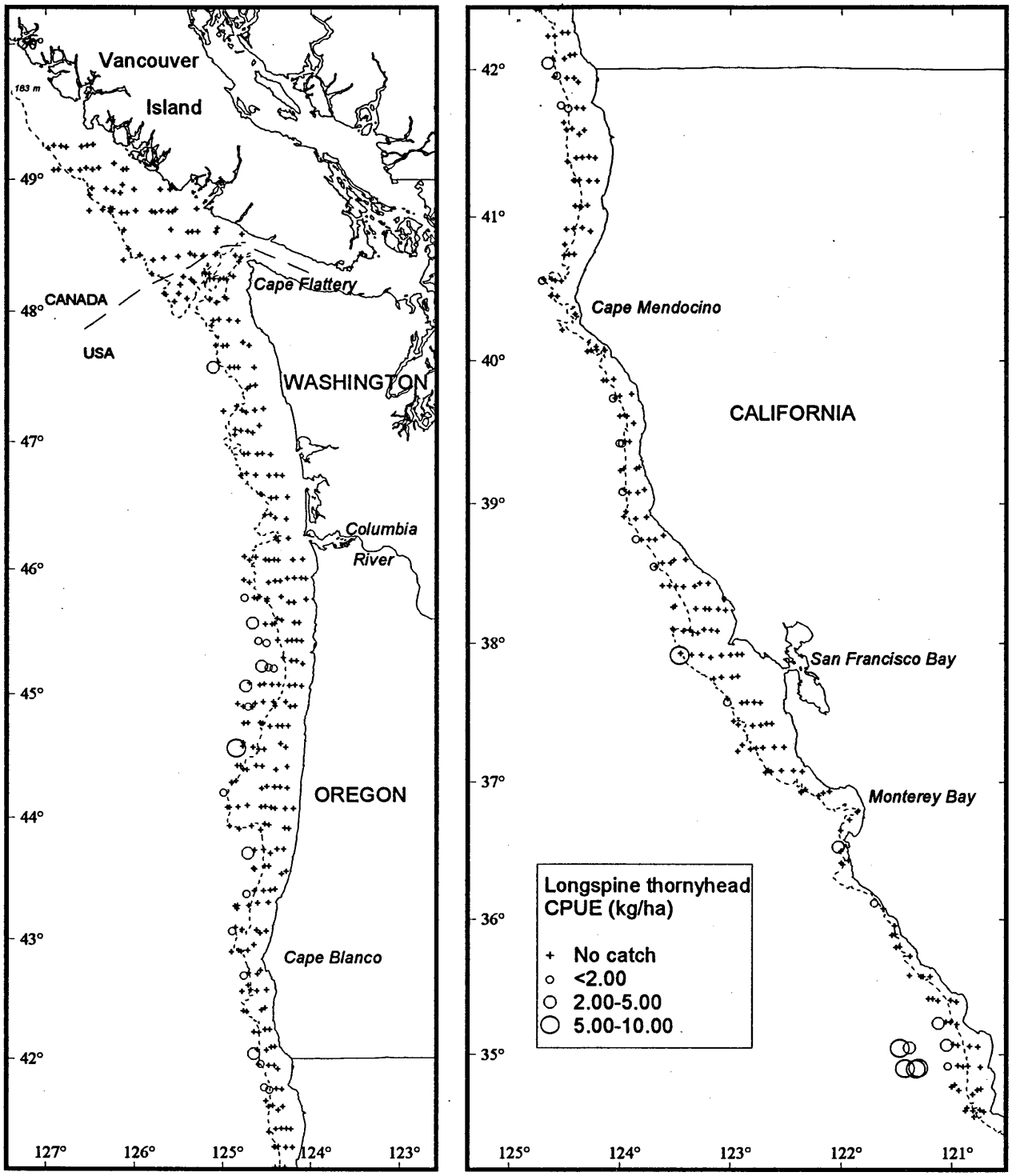

Figure 16.--Longspine thornyhead distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

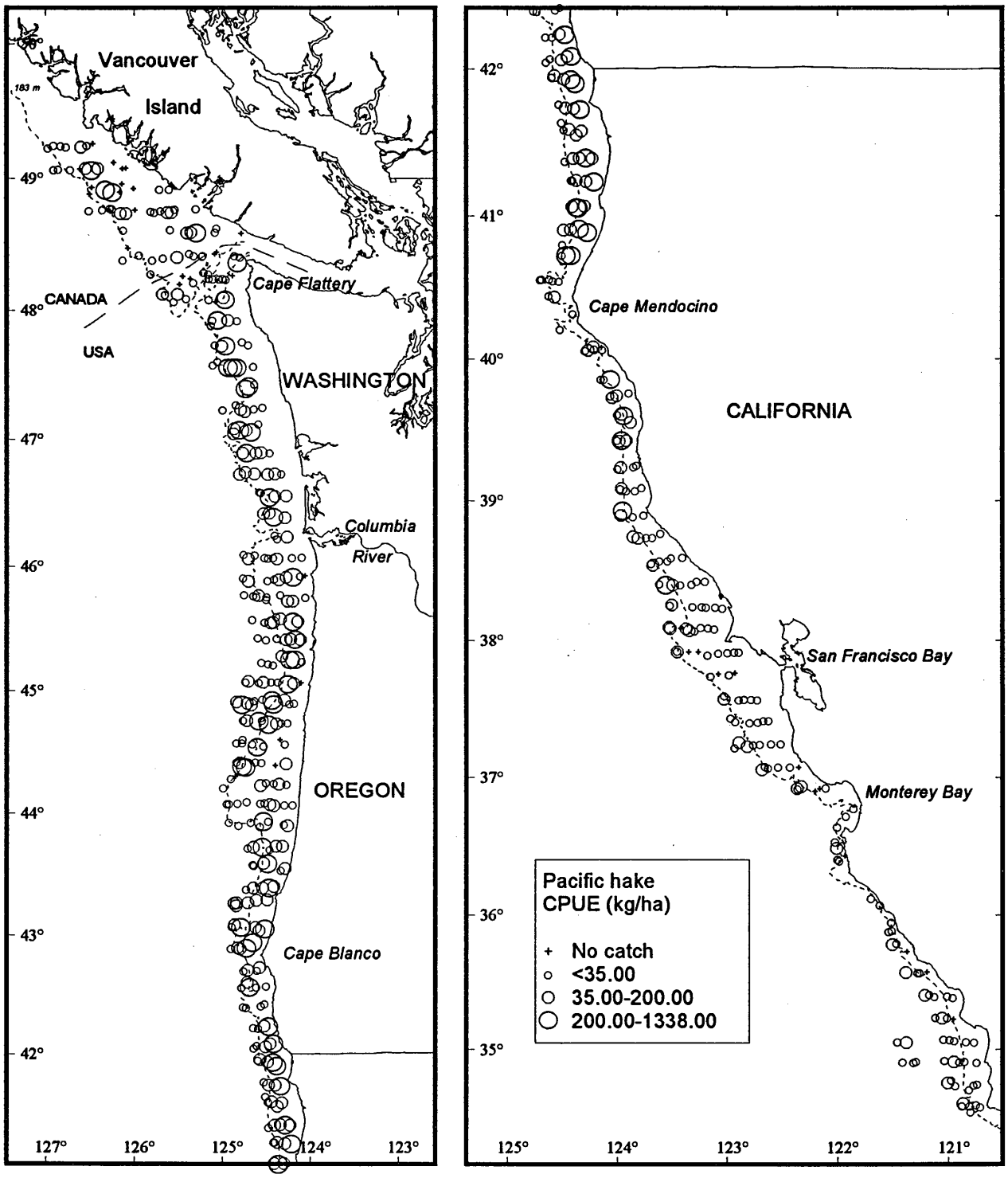

Figure 17.--Pacific hake distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

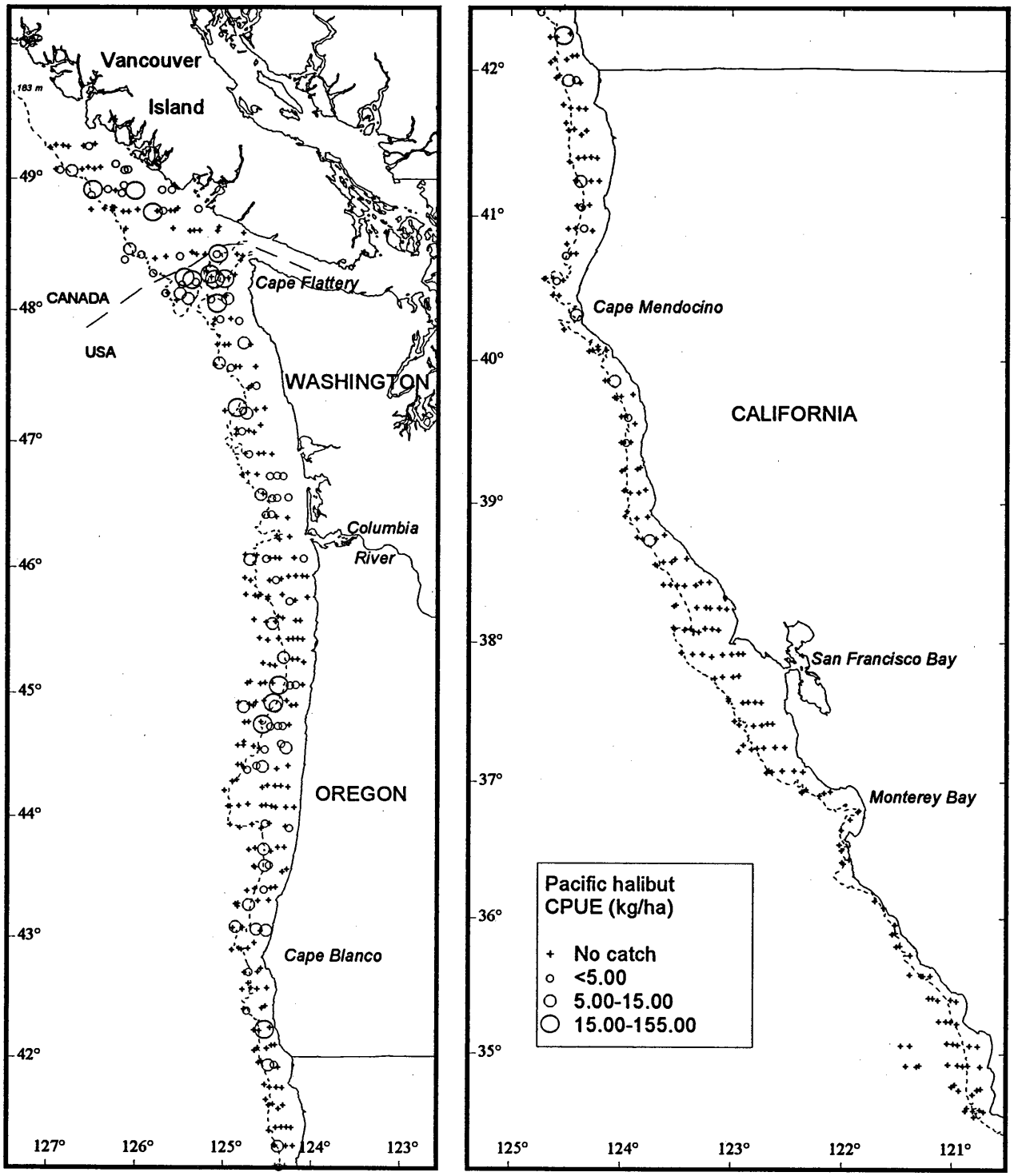

Figure 18.--Pacific halibut distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

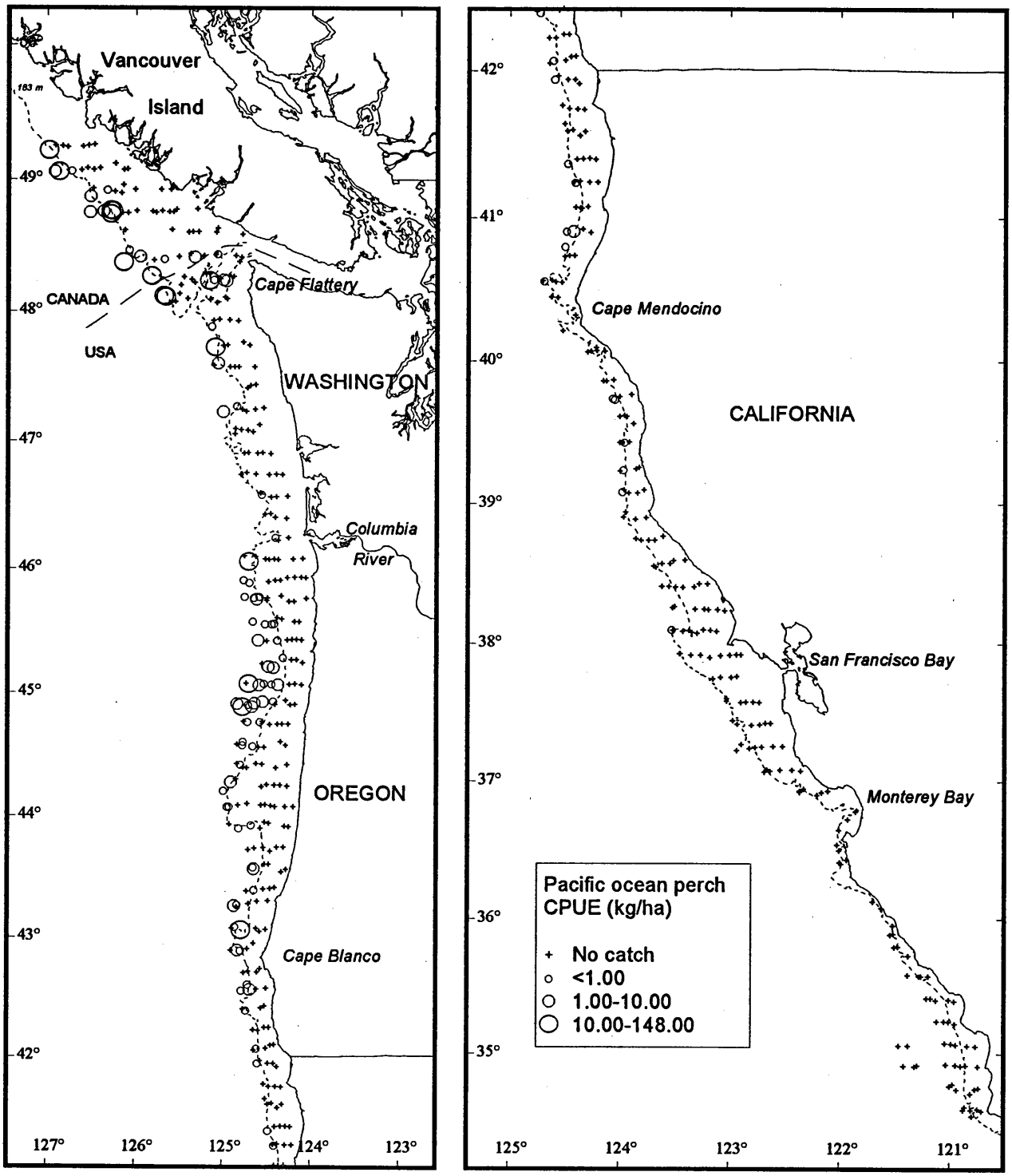

Figure 19.--Pacific ocean perch distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

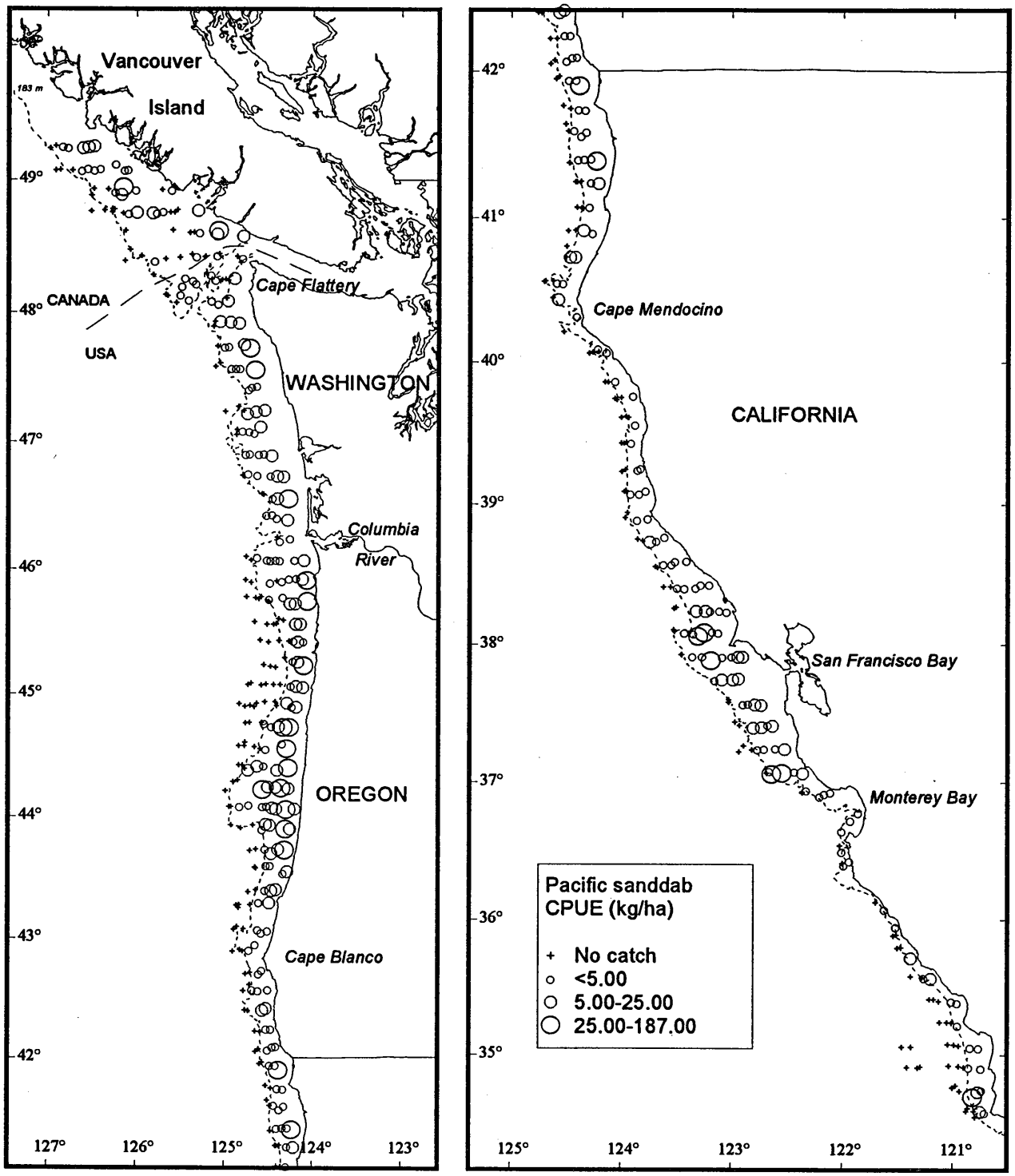

Figure 20.--Pacific sanddab distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

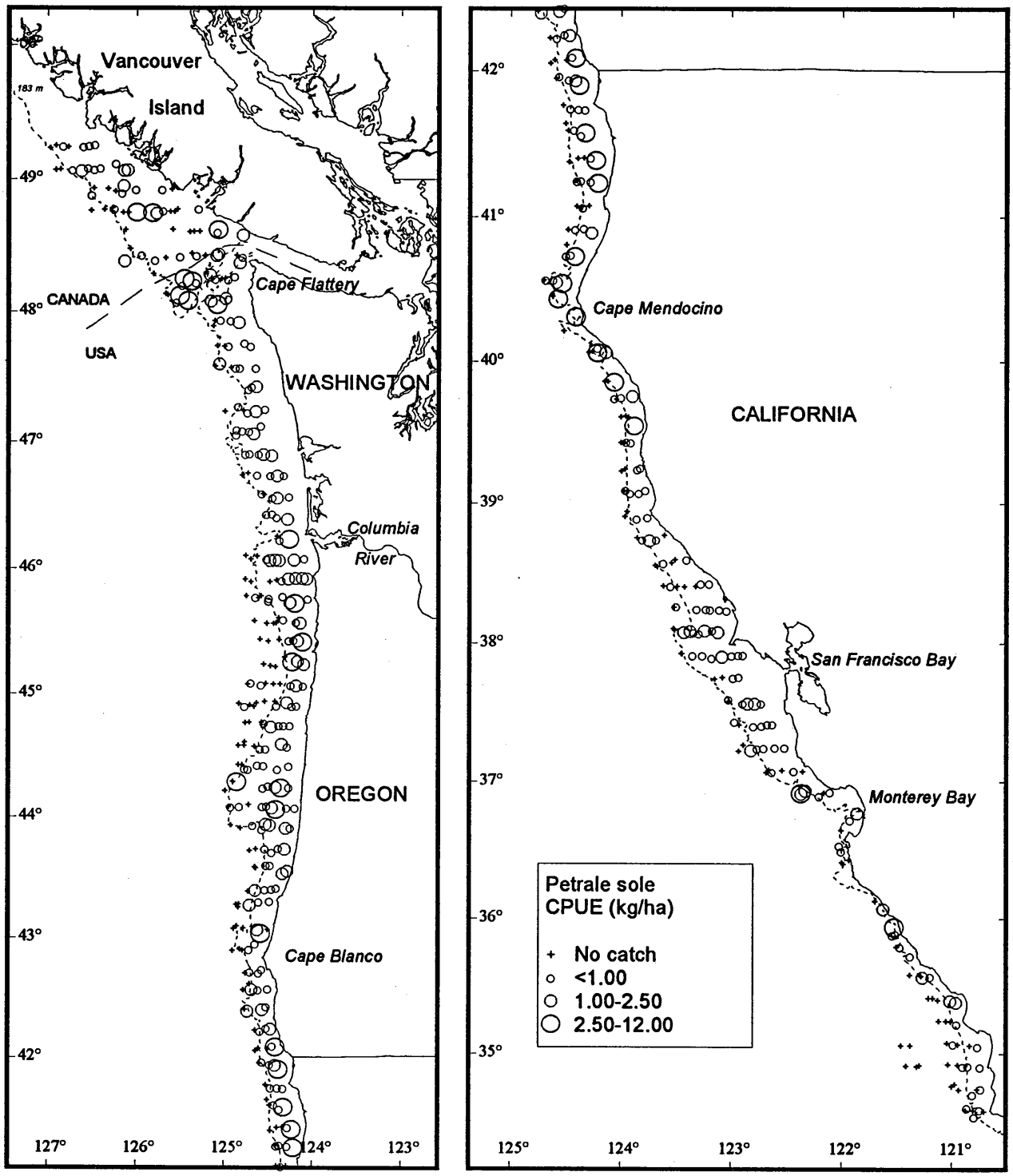

Figure 21.--Petrale sole distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

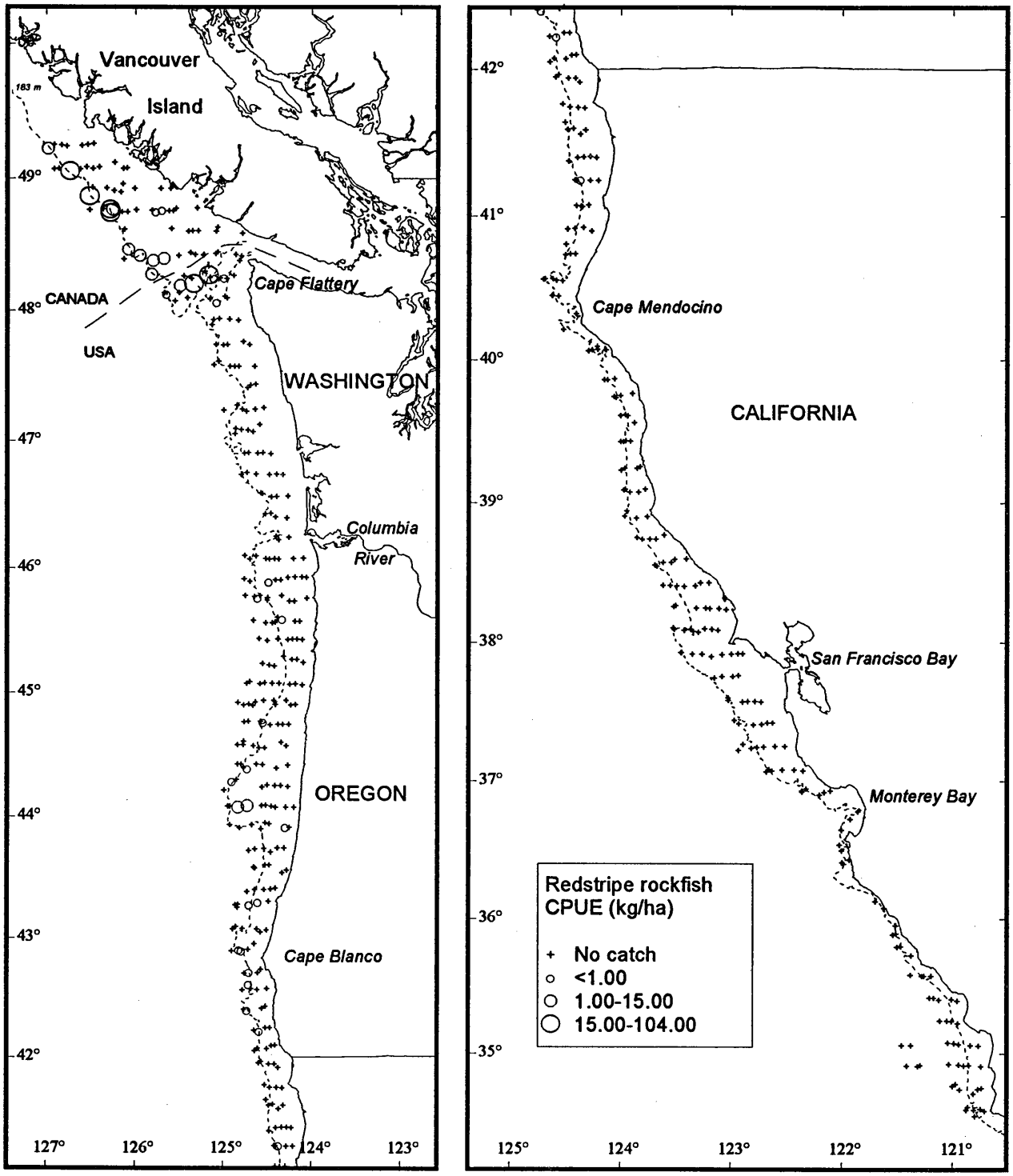

Figure 22.--Redstripe rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

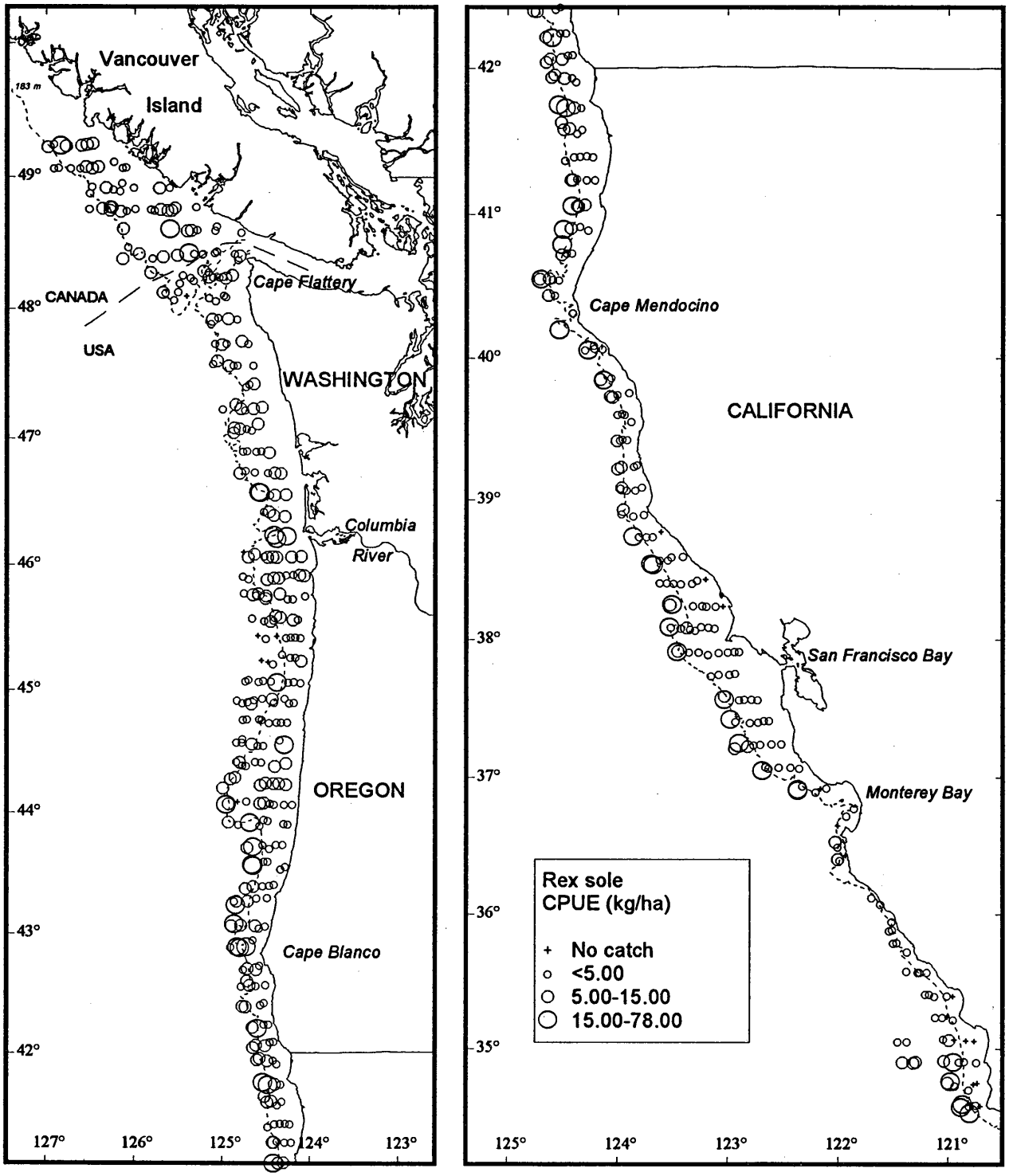

Figure 23.--Rex sole distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

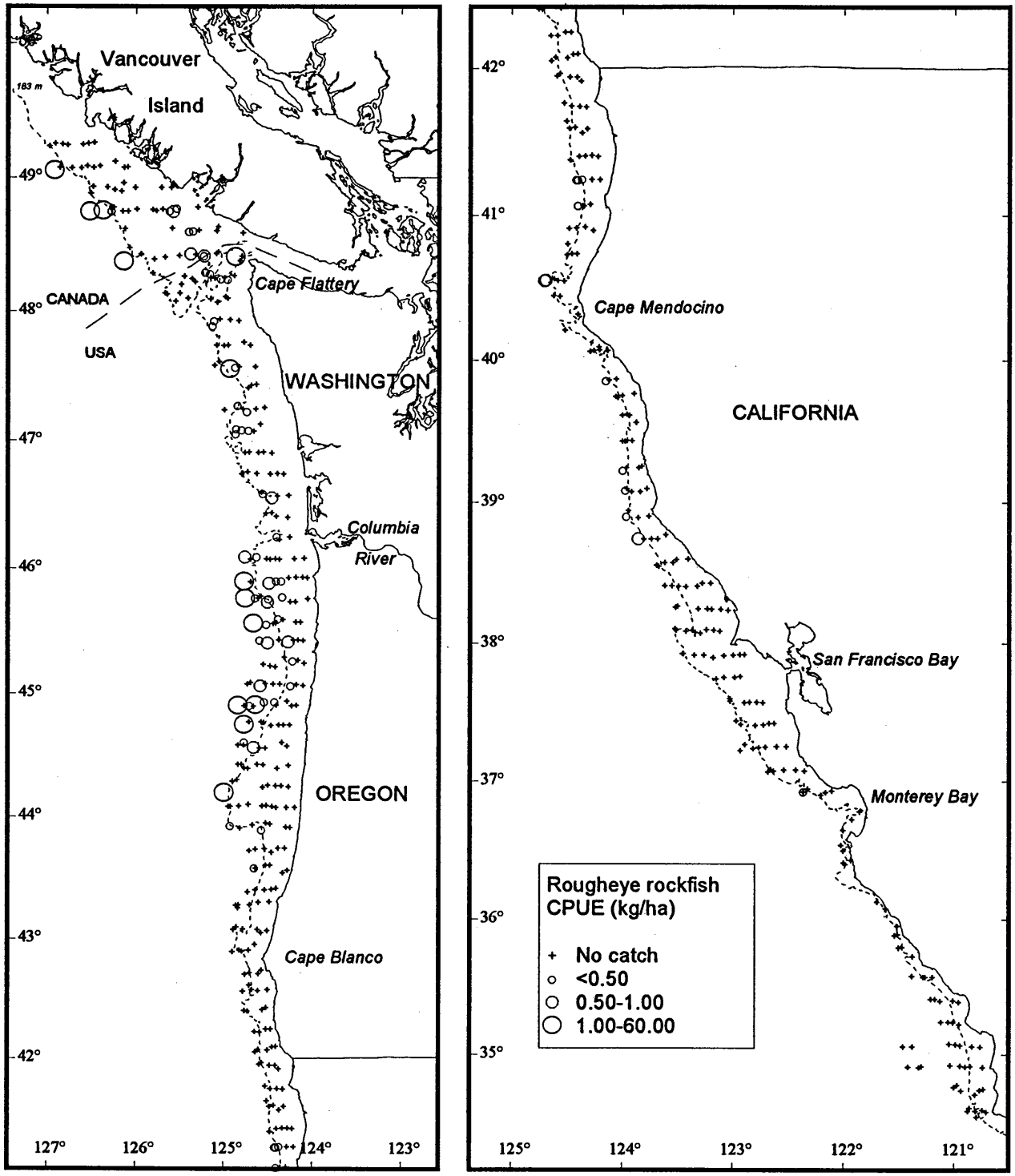

Figure 24.--Rougheye rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

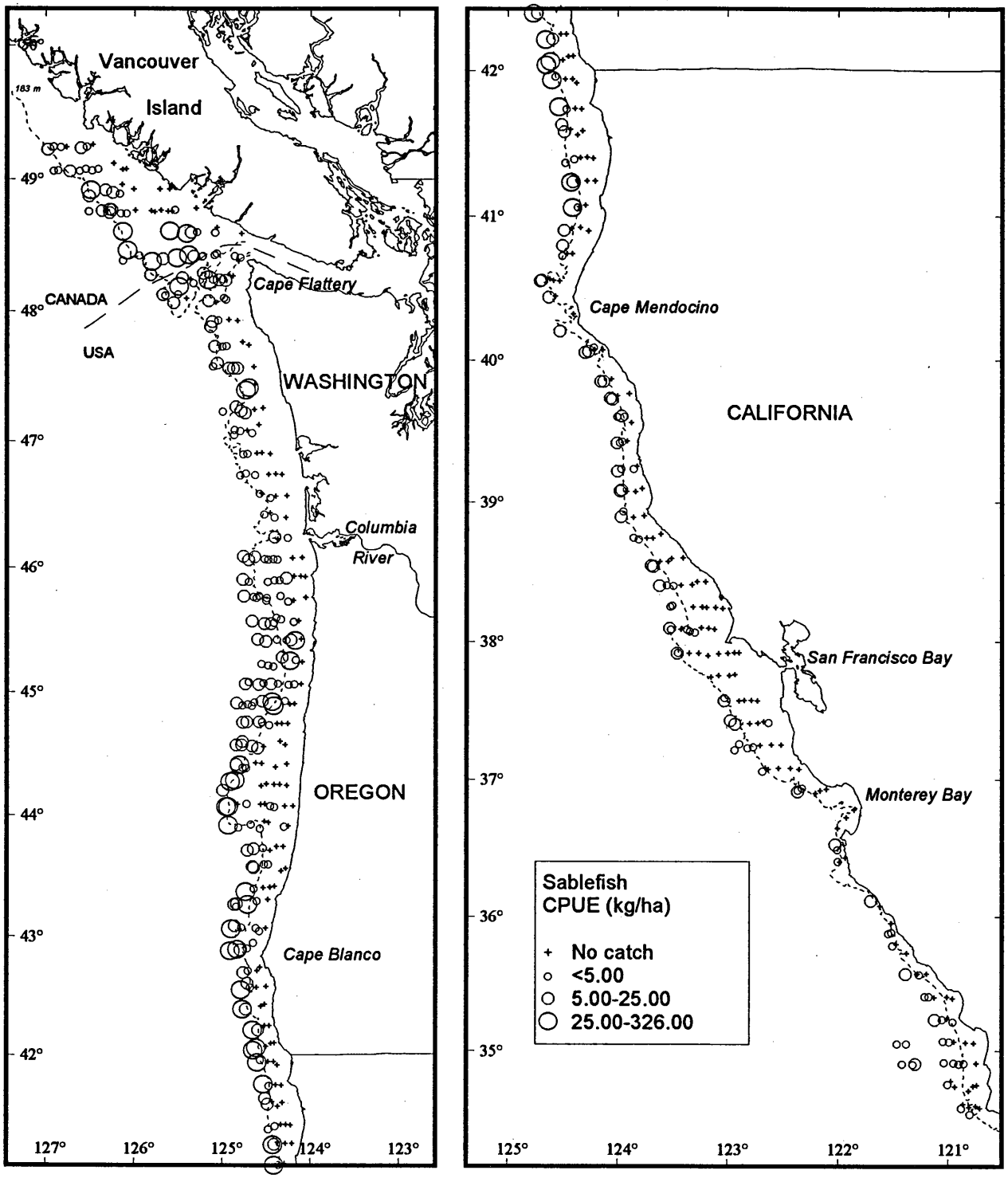

Figure 25.--Sablefish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

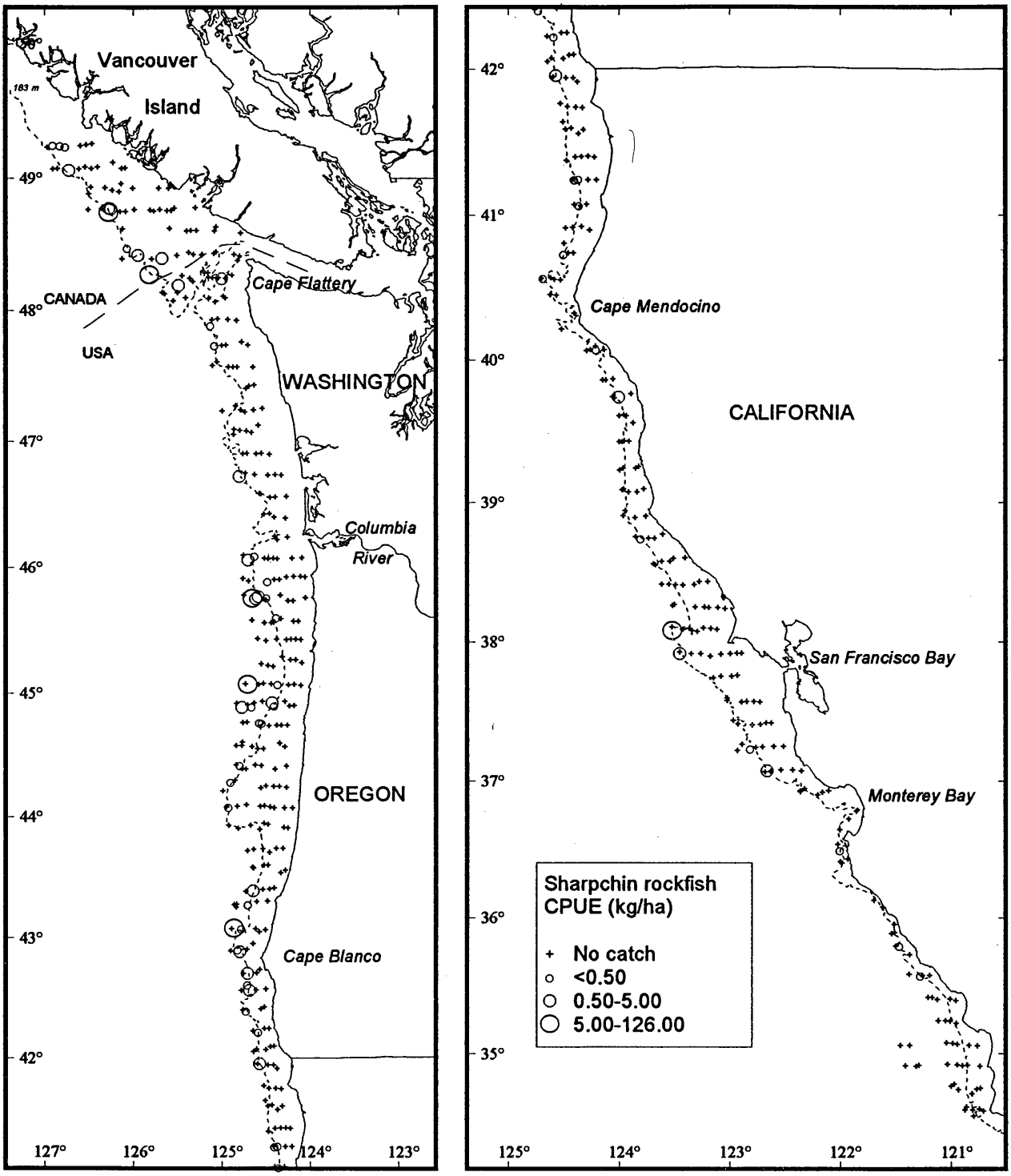

Figure 26.--Sharpchin rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

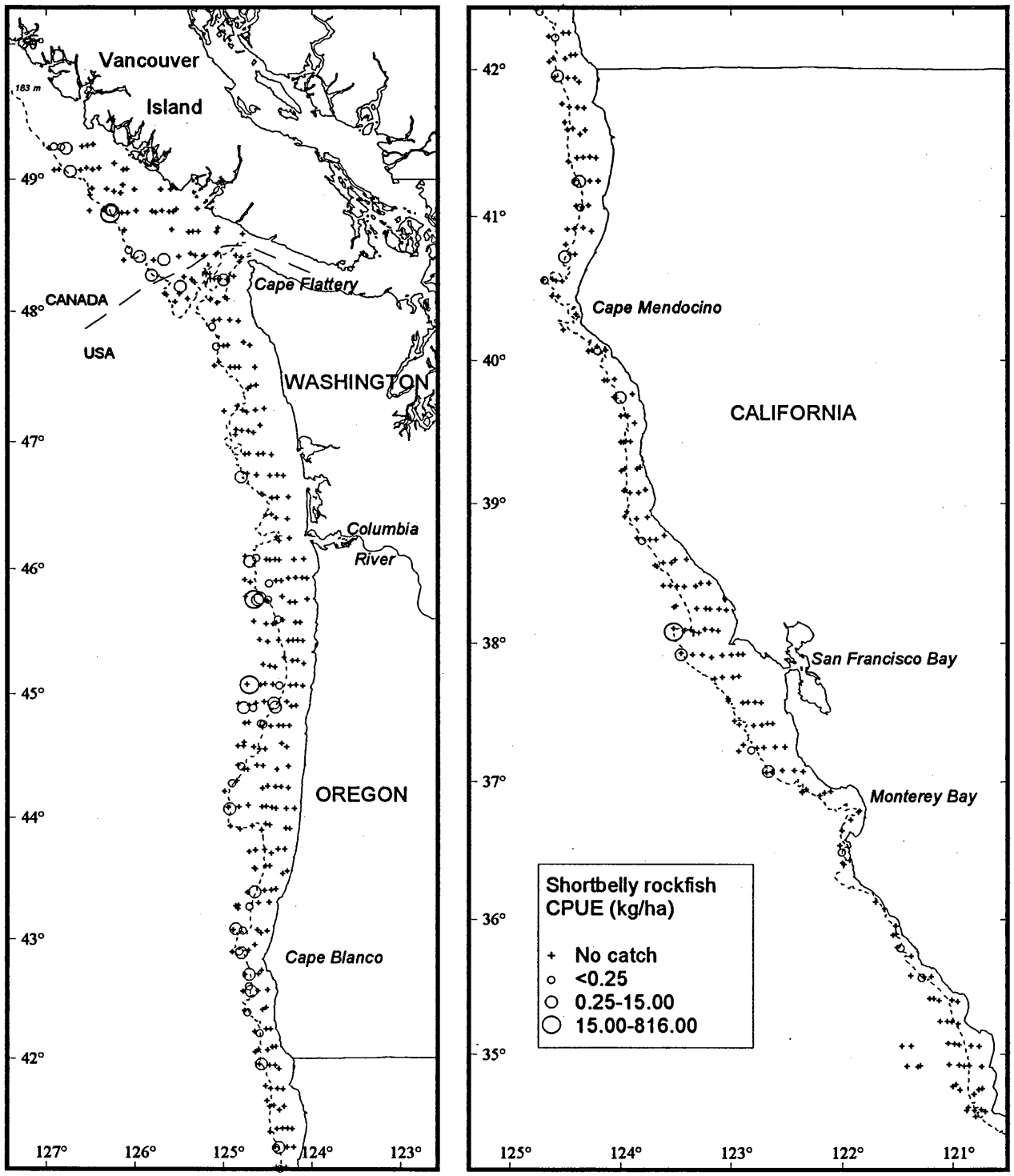

Figure 27.--Shortbelly rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

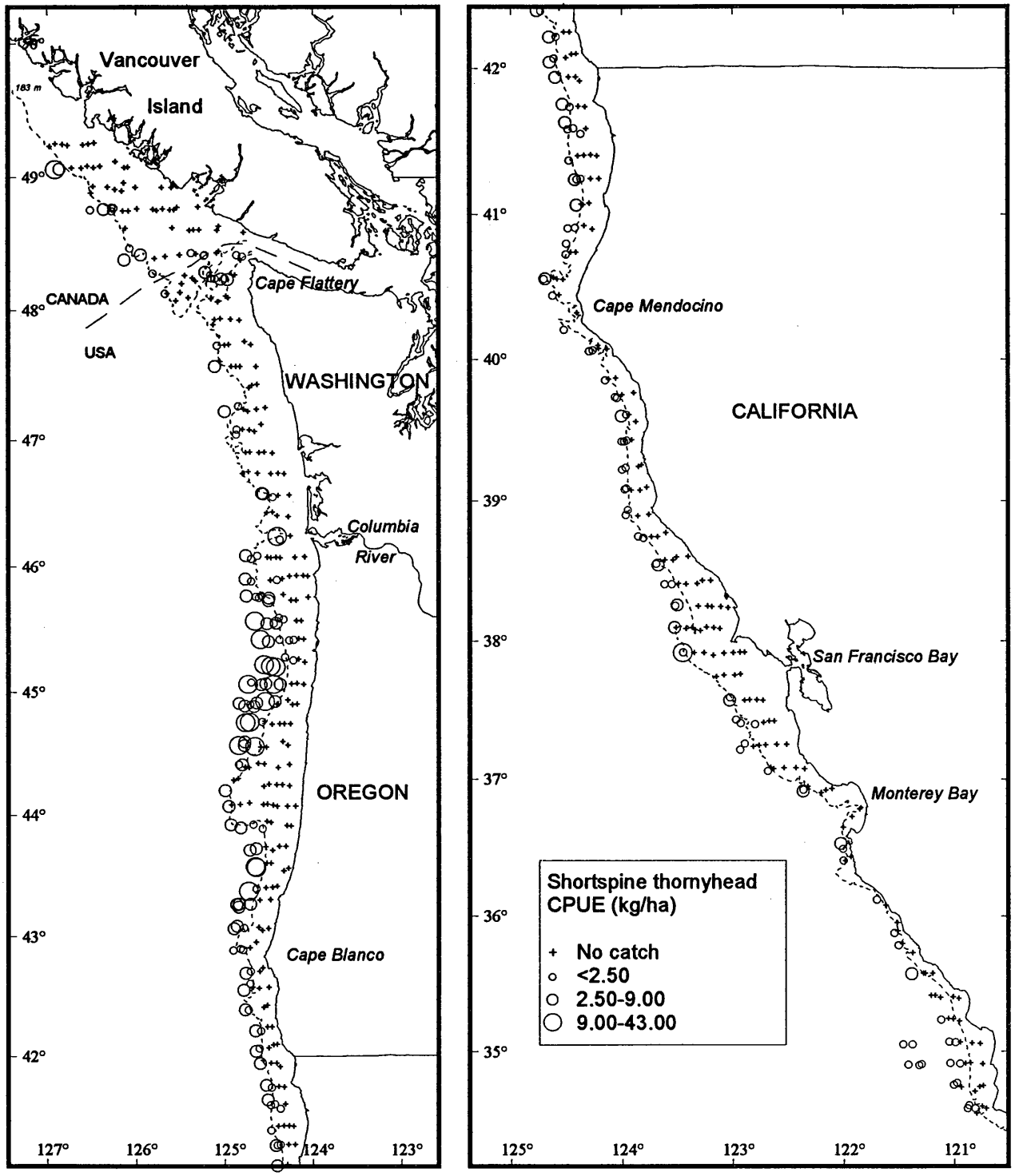

Figure 28.--Shortspine thornyhead distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

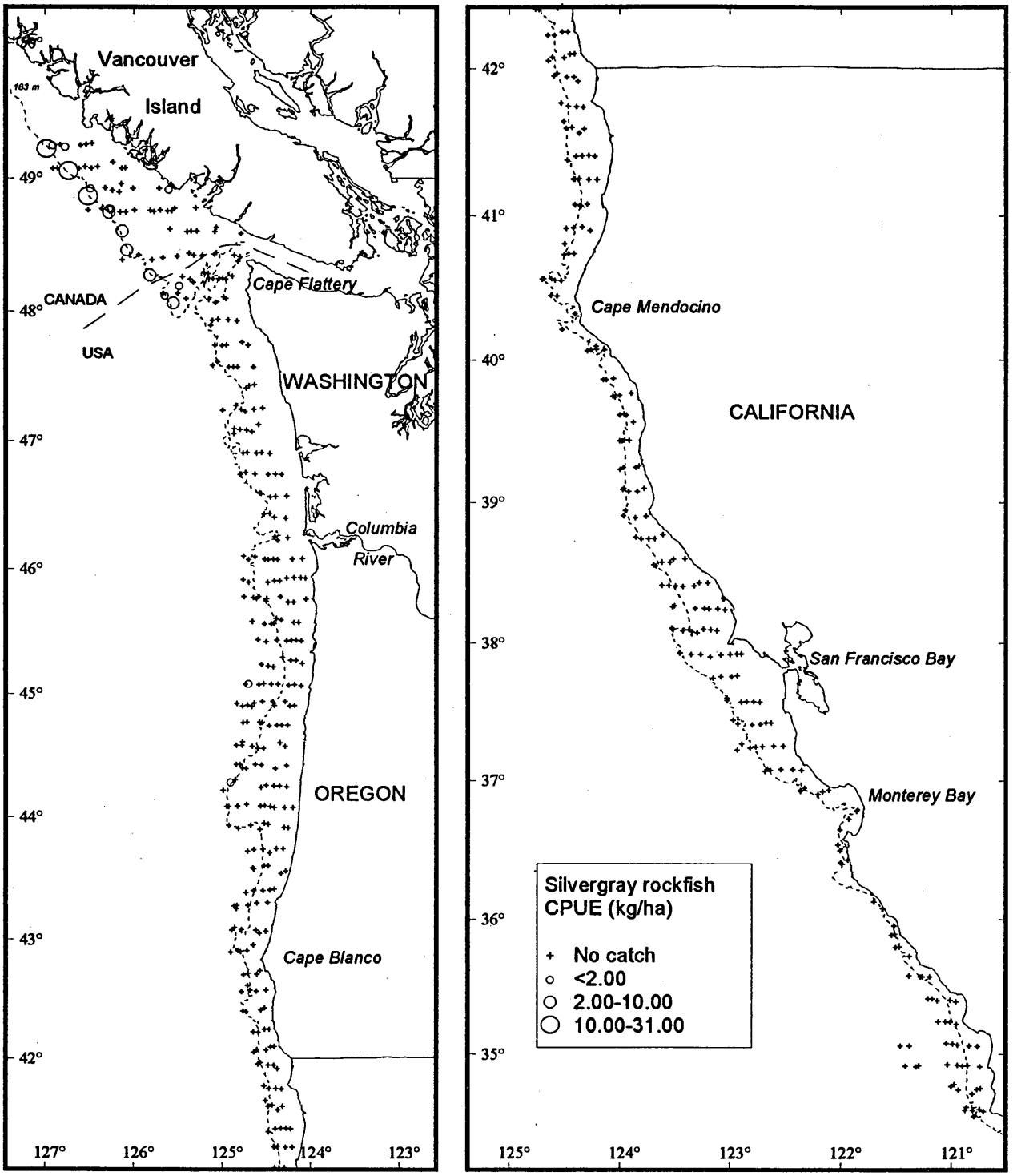

Figure 29.--Silvergray rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

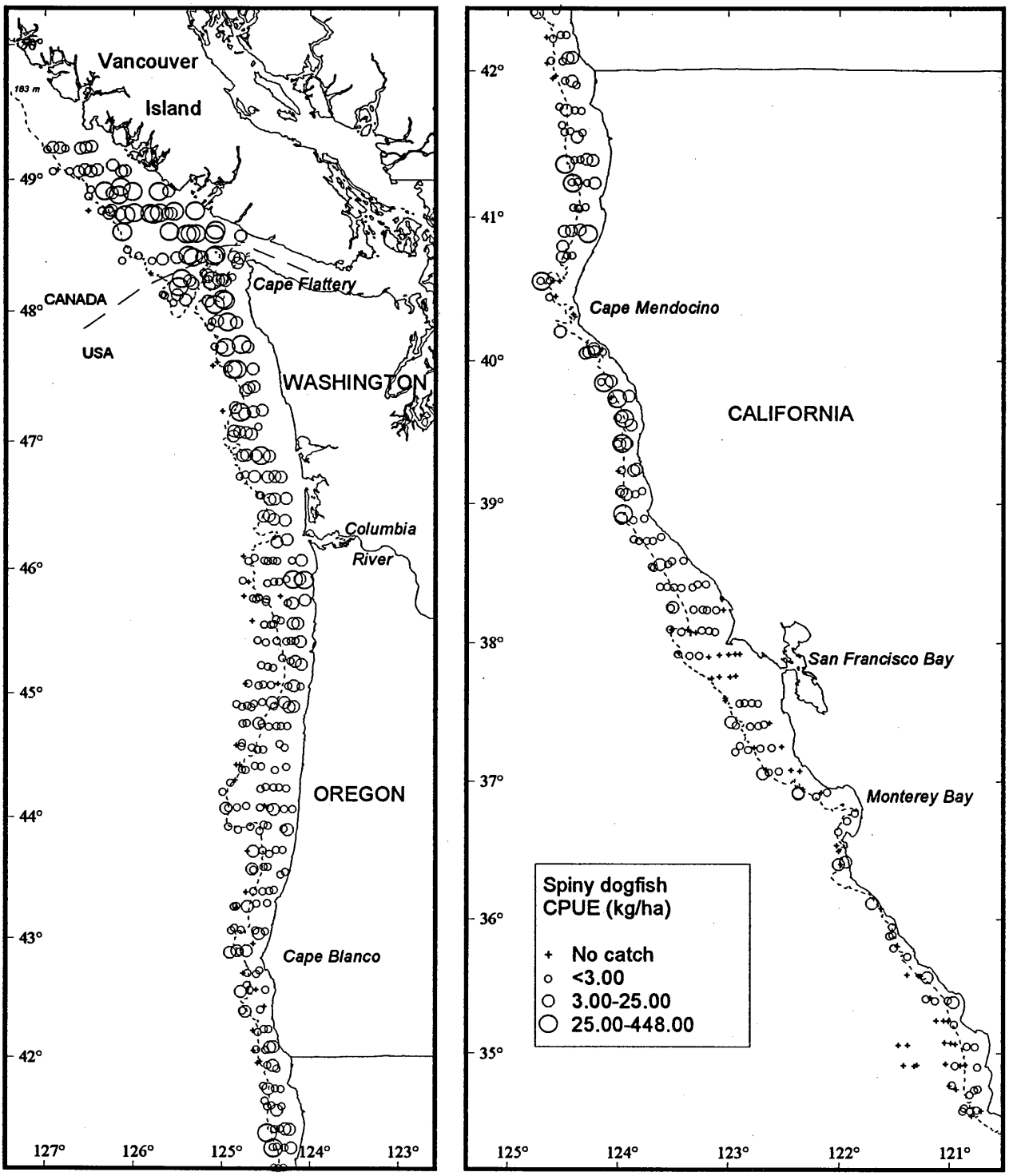

Figure 30.--Spiny dogfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

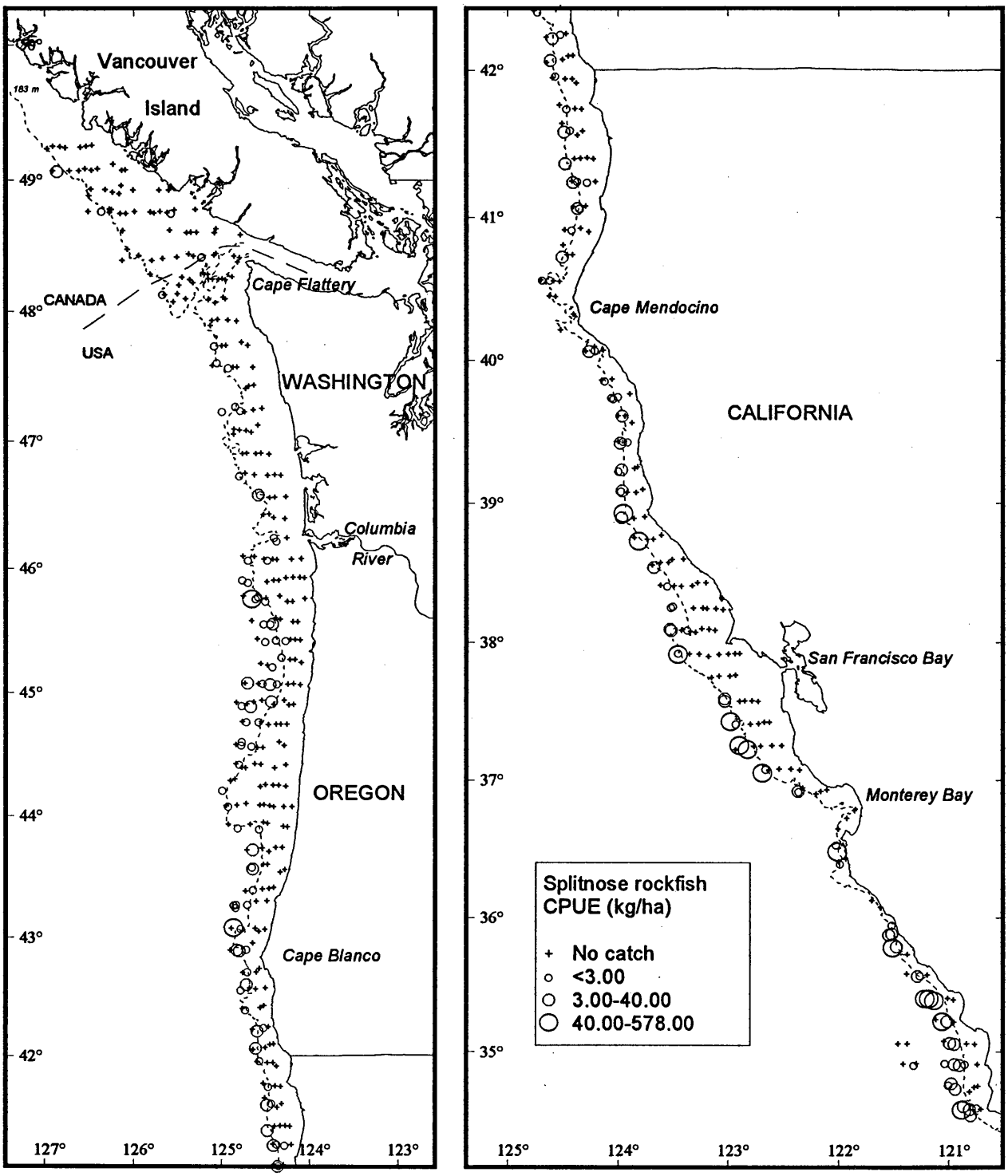

Figure 31.--Splitnose rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

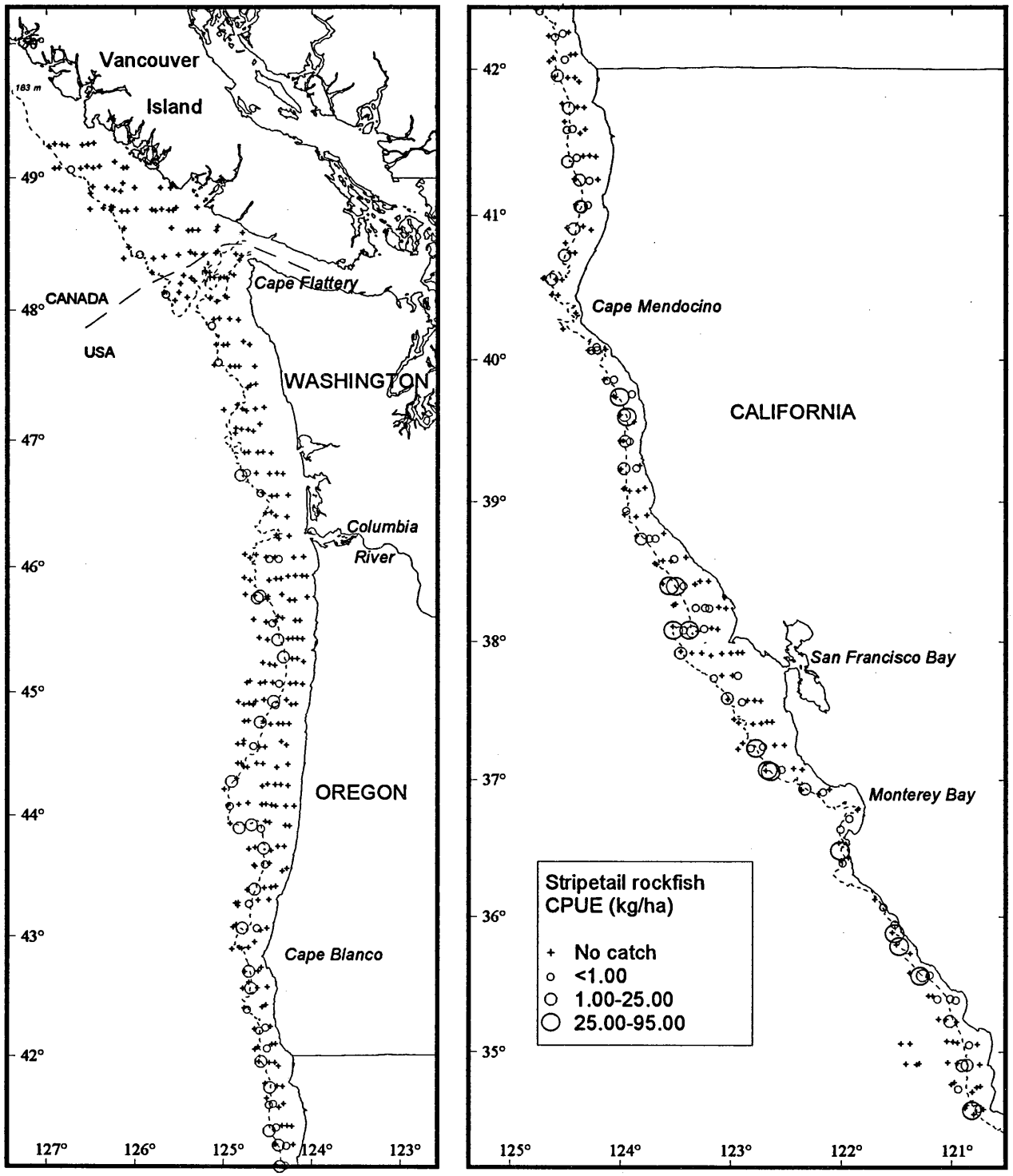

Figure 32.--Stripetail rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

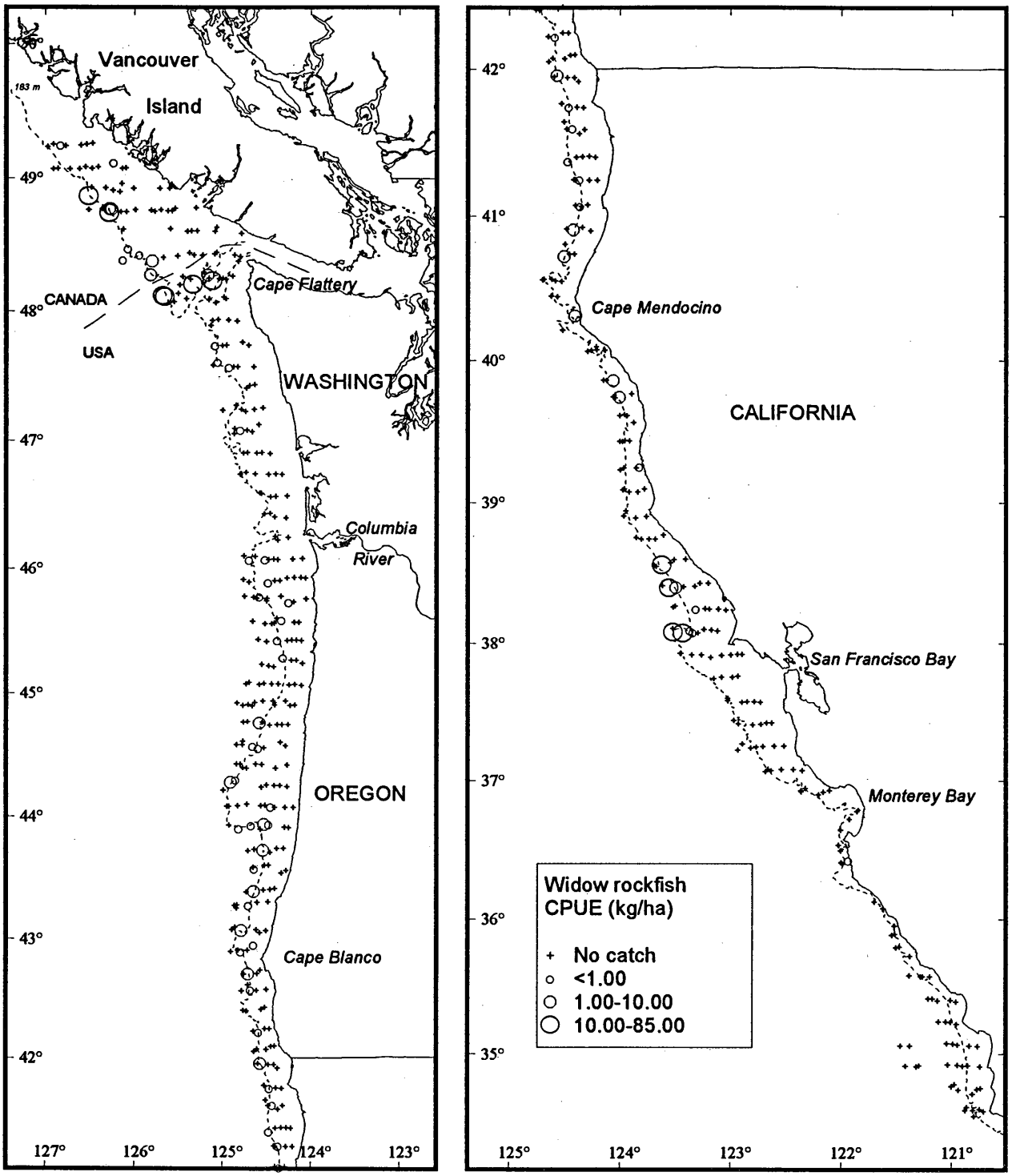

Figure 33.--Widow rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

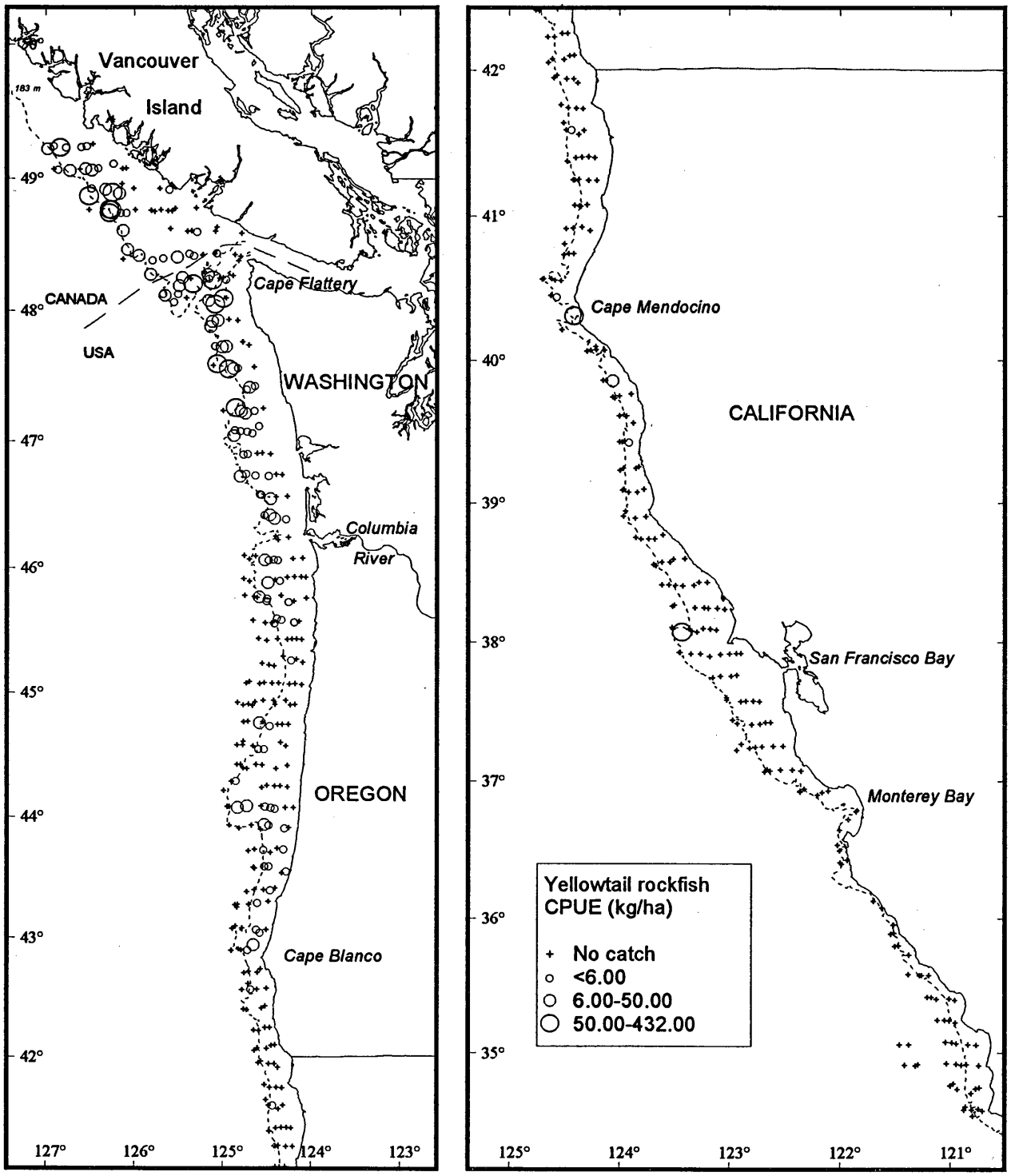

Figure 34.--Yellowtail rockfish distribution and relative abundance measured in catch rates (kg/ha) from the 1998 West Coast triennial bottom trawl survey.

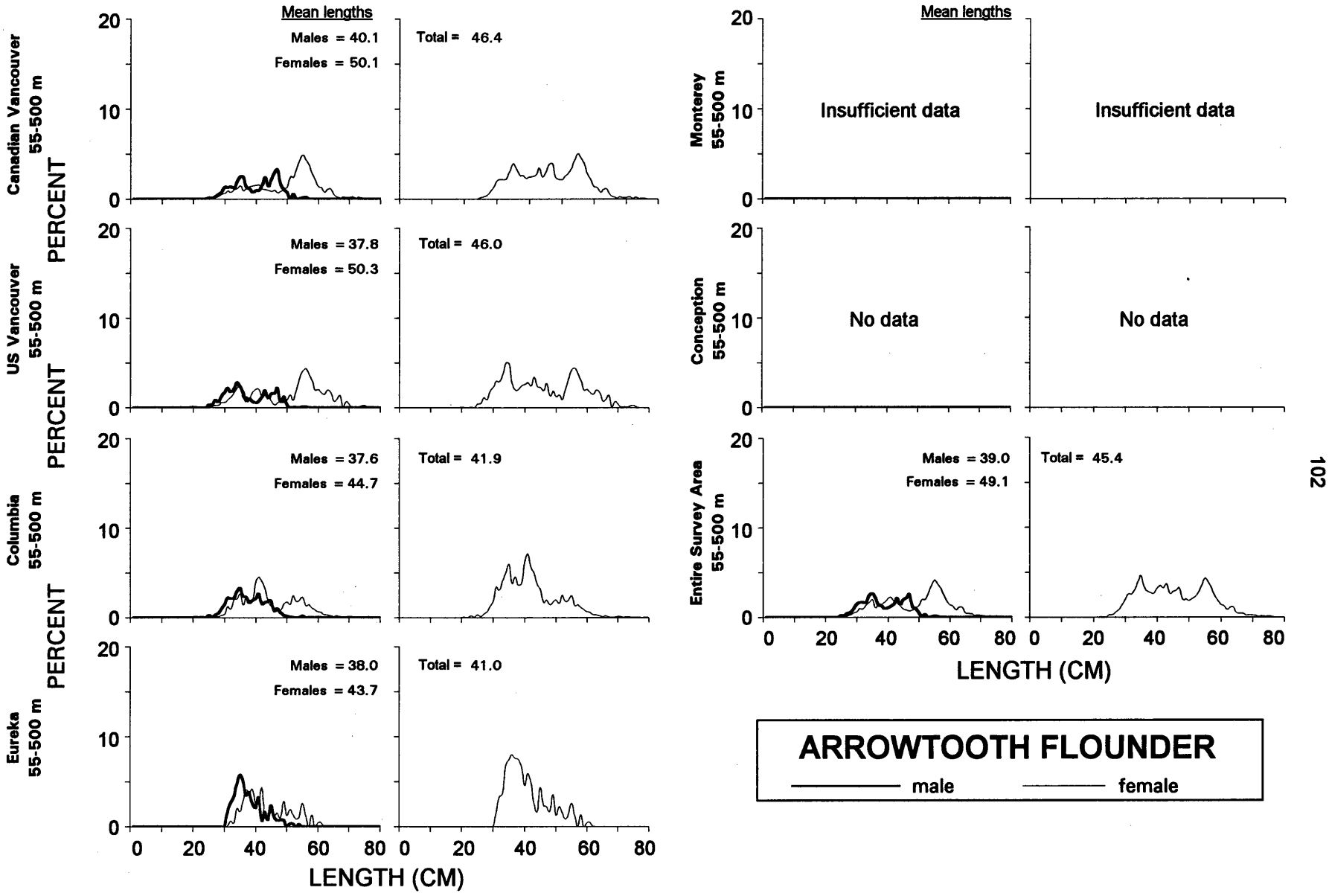

Figure 35.-- Estimated population size composition and mean lengths of arrowtooth flounder by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

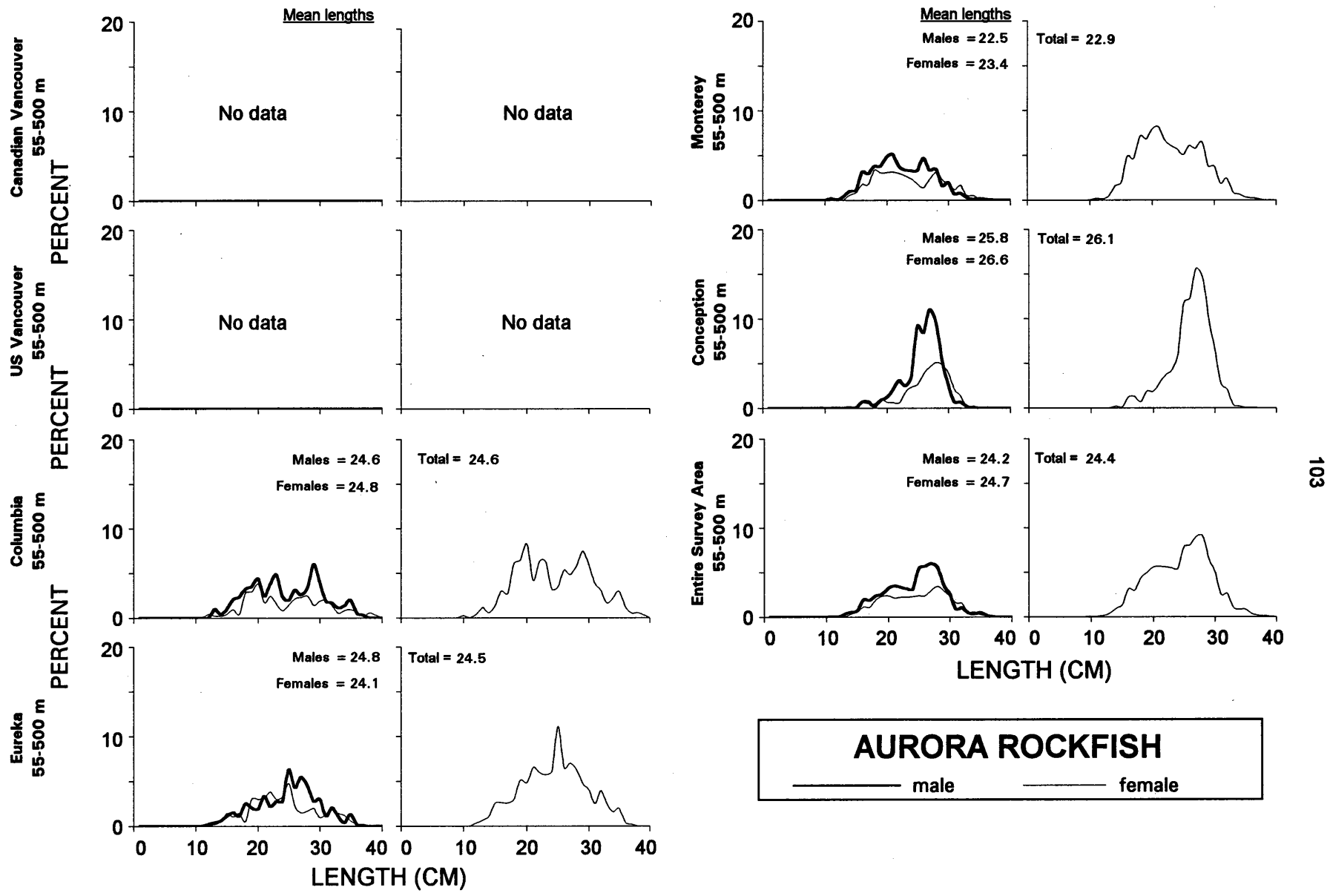

Figure 36.-- Estimated population size composition and mean lengths of aurora rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

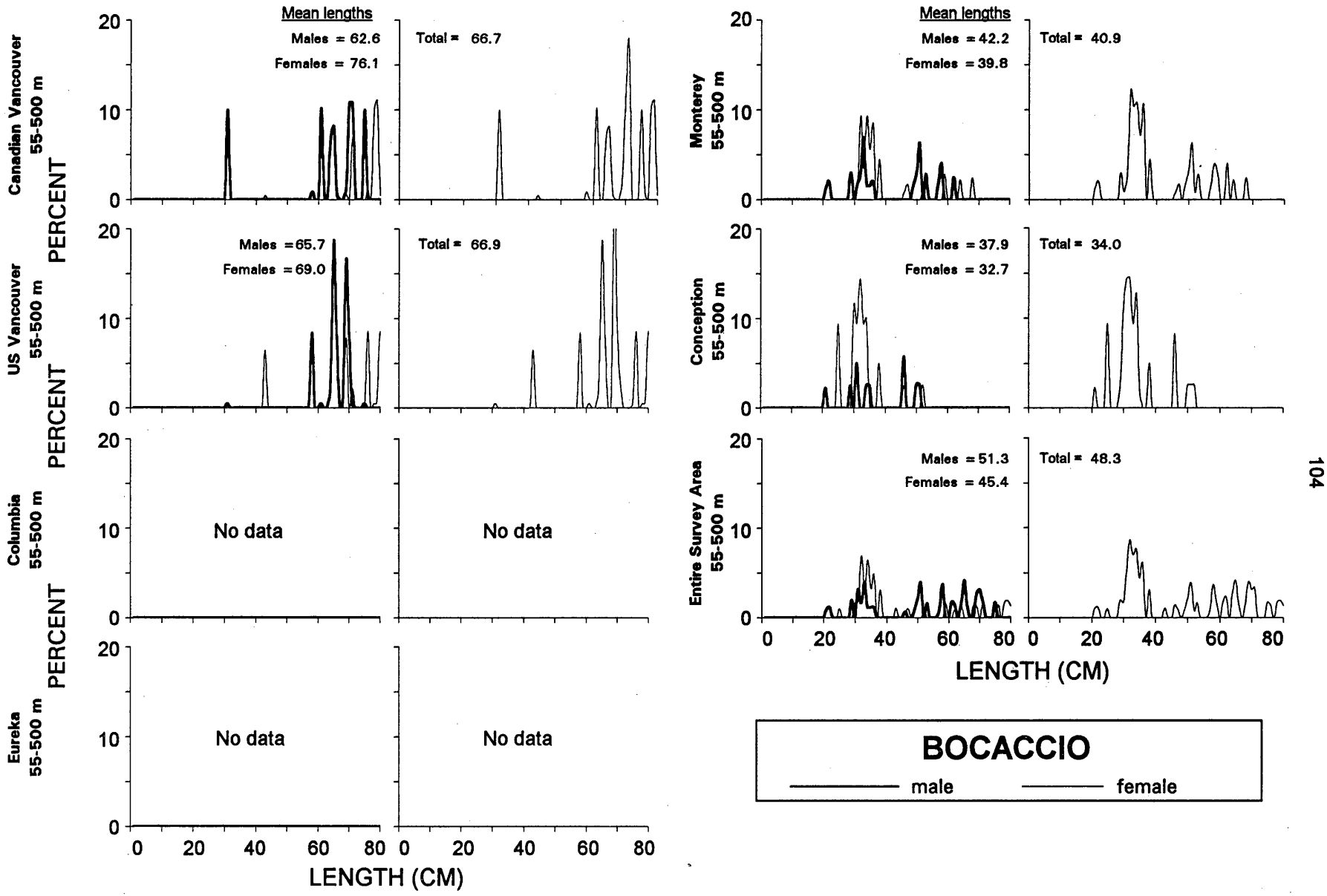

Figure 37.-- Estimated population size composition and mean lengths of bocaccio by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

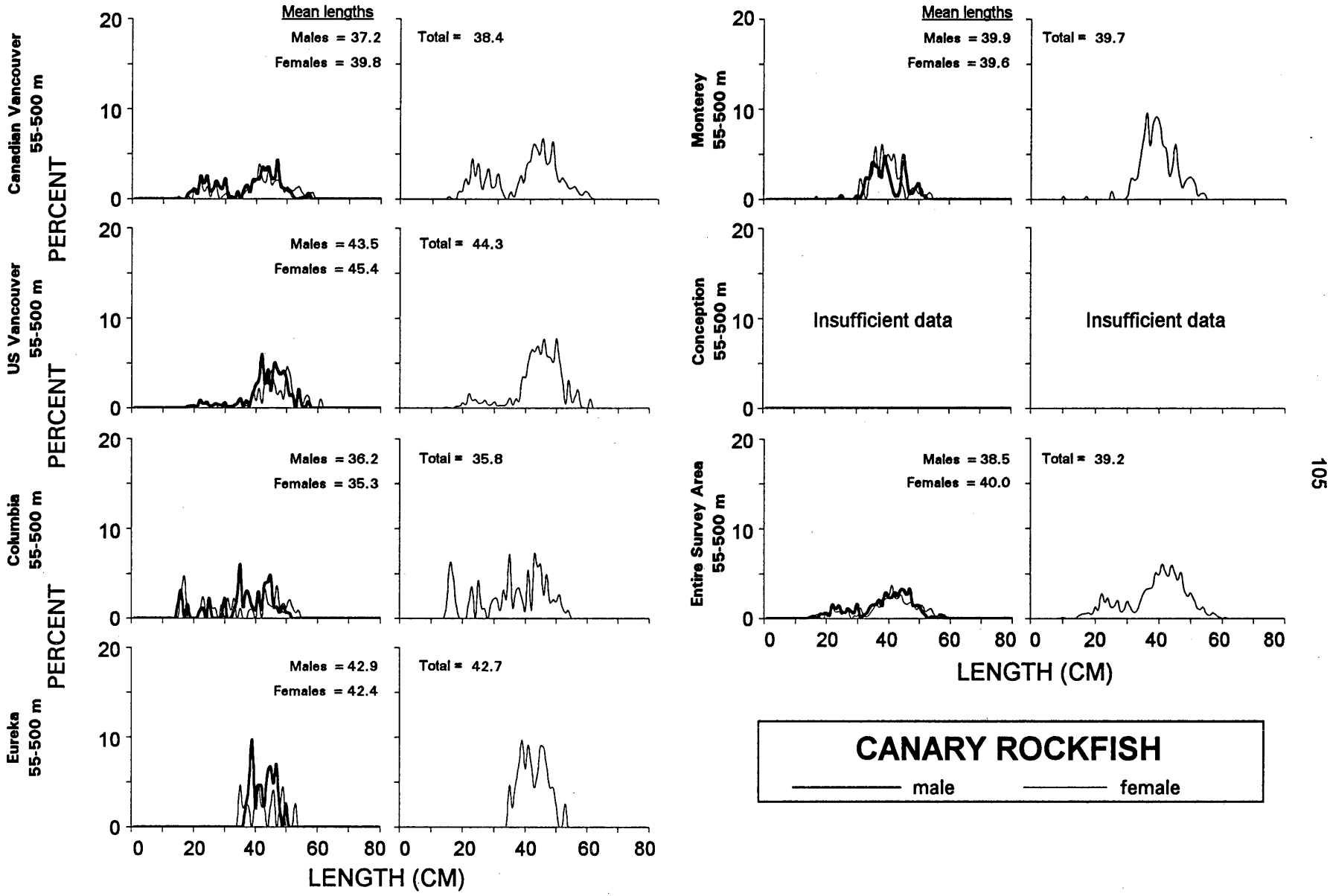

Figure 38.-- Estimated population size composition and mean lengths of canary rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

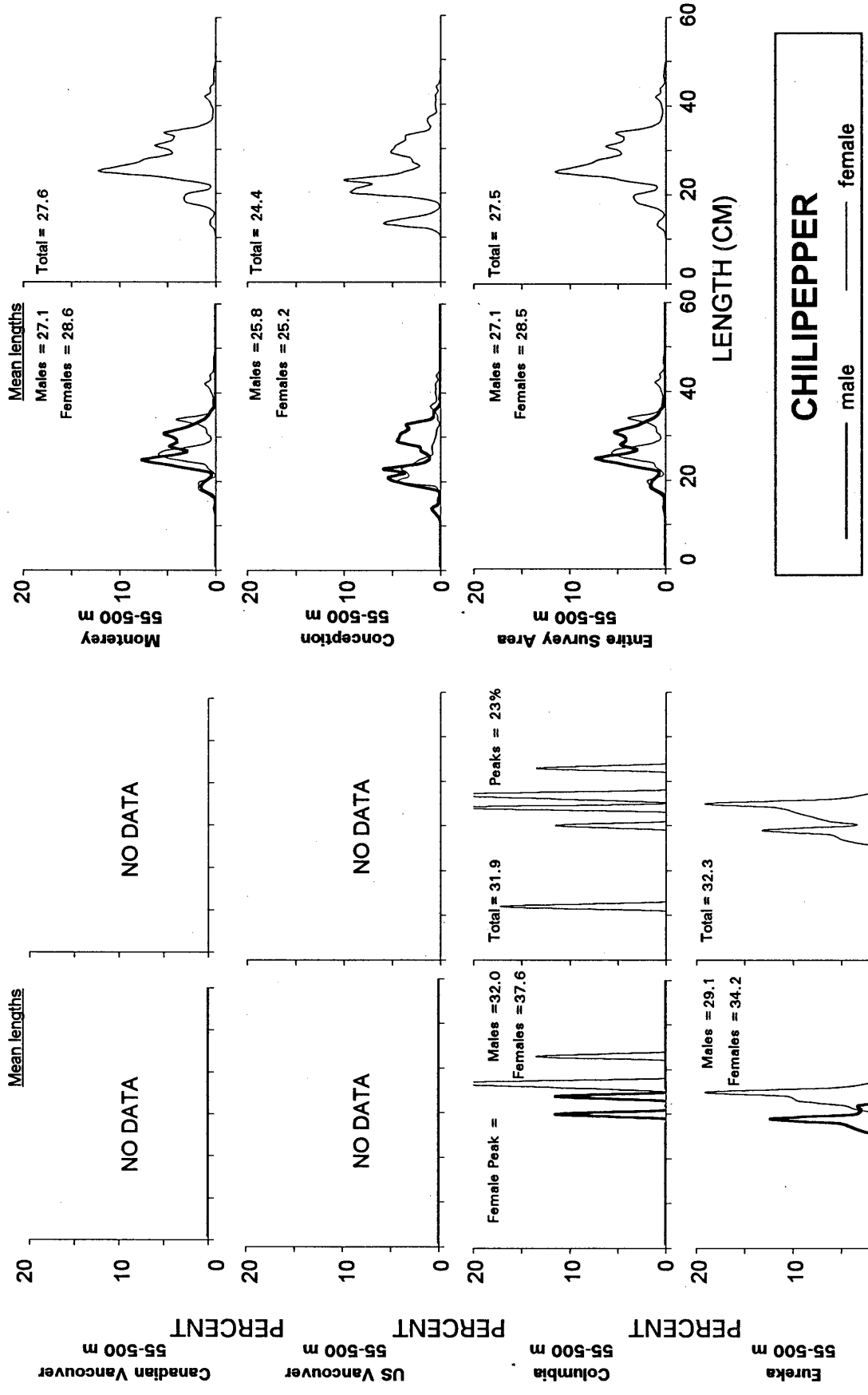

Figure 39.-- Estimated population size composition and mean lengths of chilipepper by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

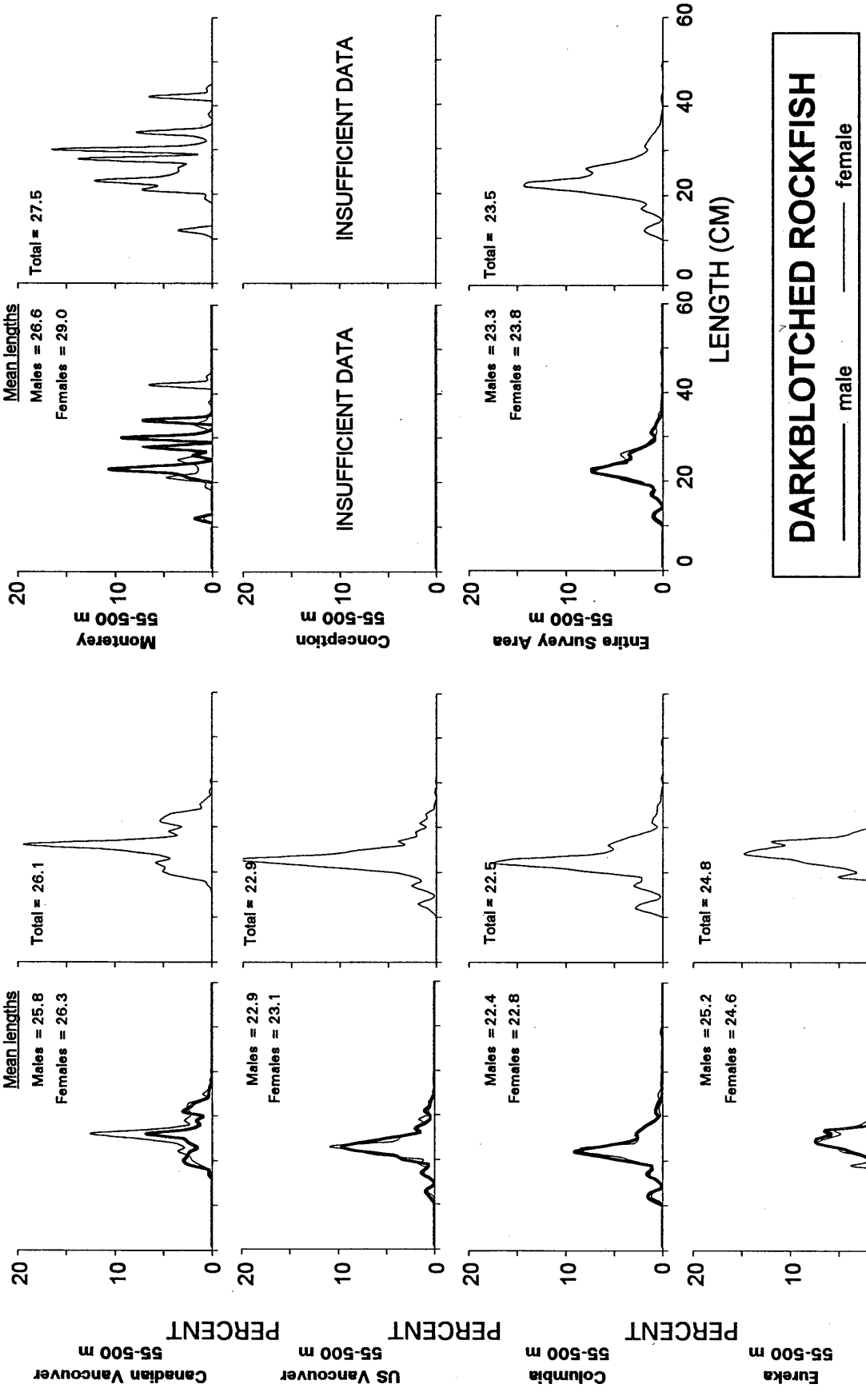

Figure 40.-- Estimated population size composition and mean lengths of darkblotched rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

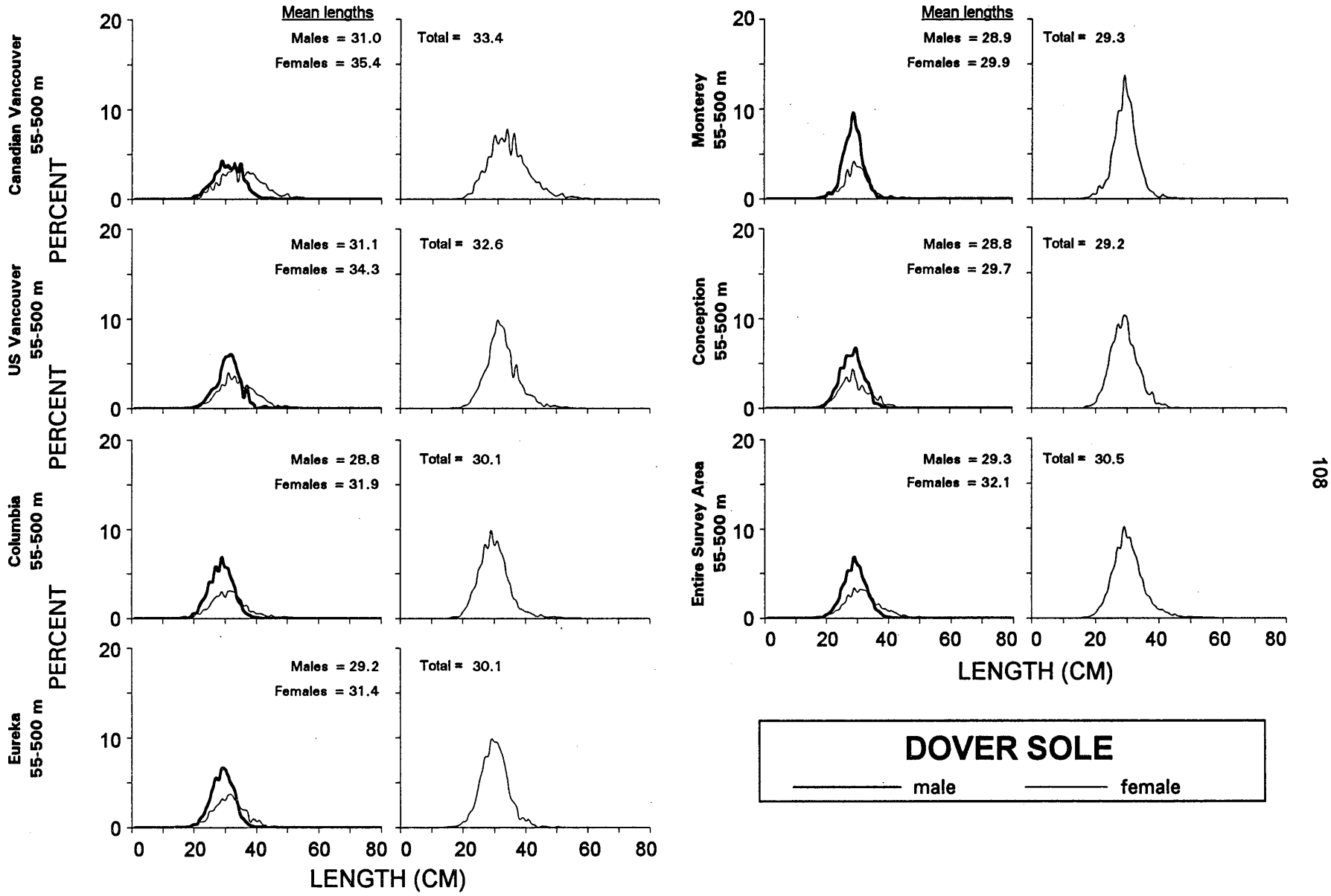

Figure 41.-- Estimated population size composition and mean lengths of Dover sole by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

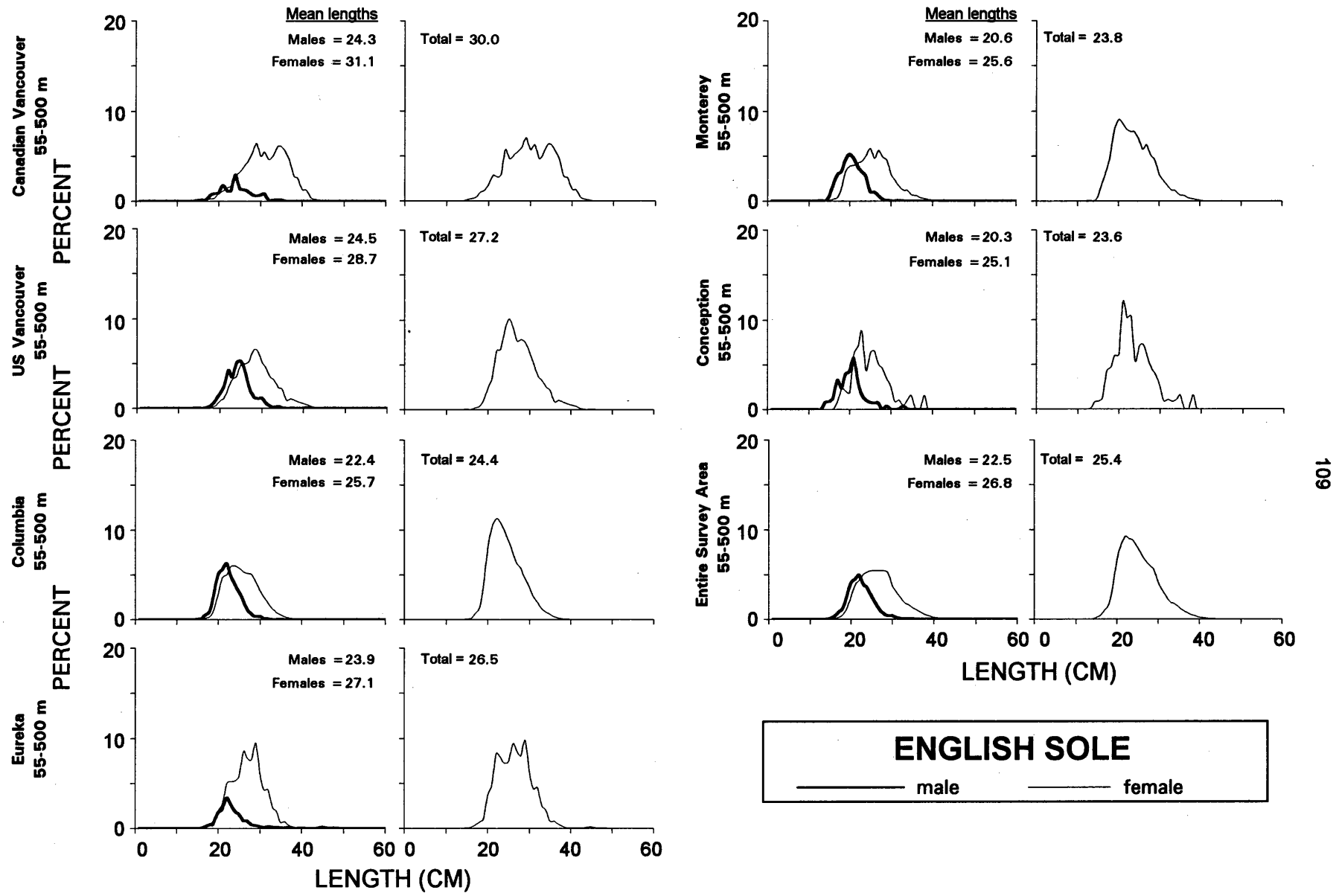

Figure 42.-- Estimated population size composition and mean lengths of English sole by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

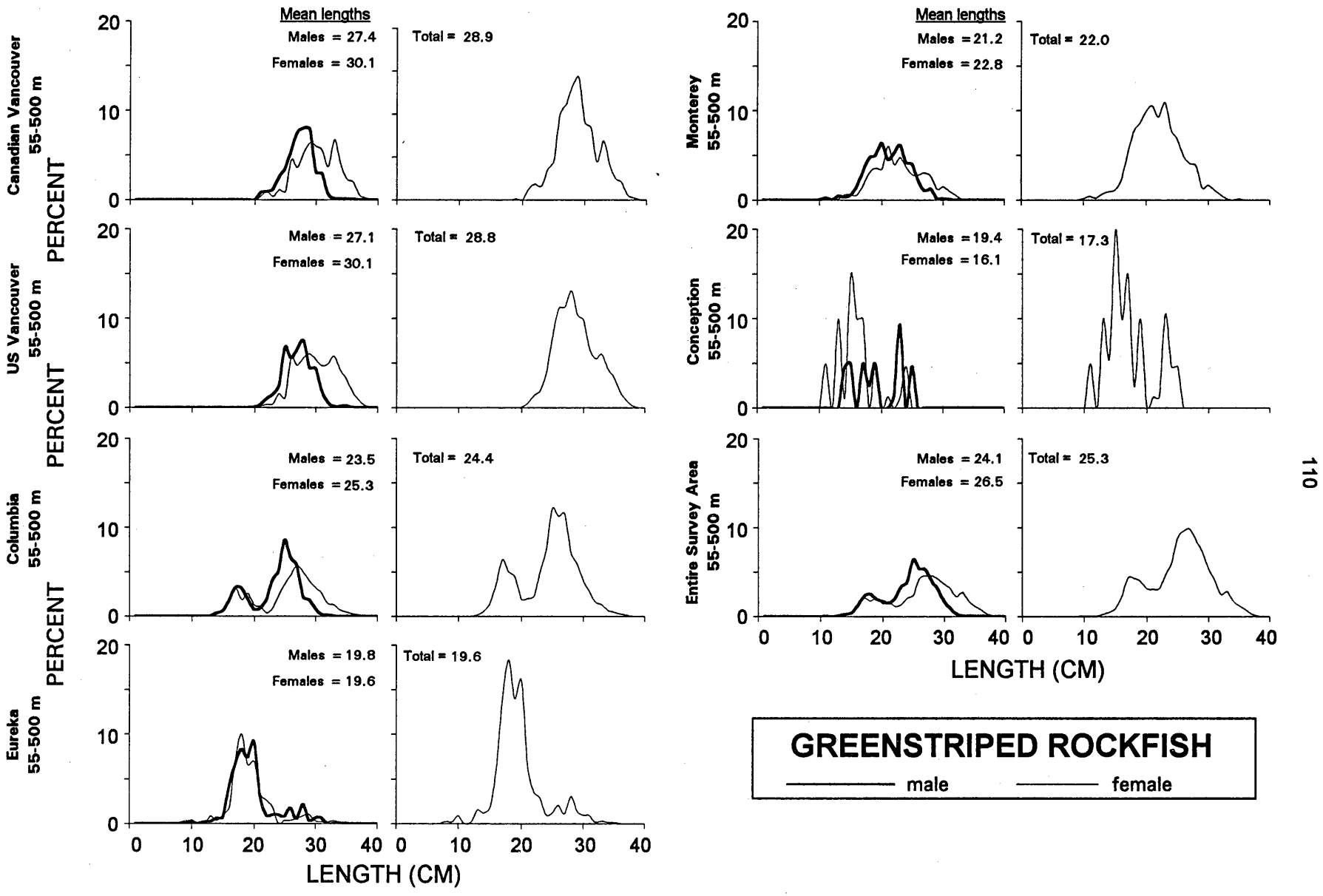

Figure 43.-- Estimated population size composition and mean lengths of greenstriped rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

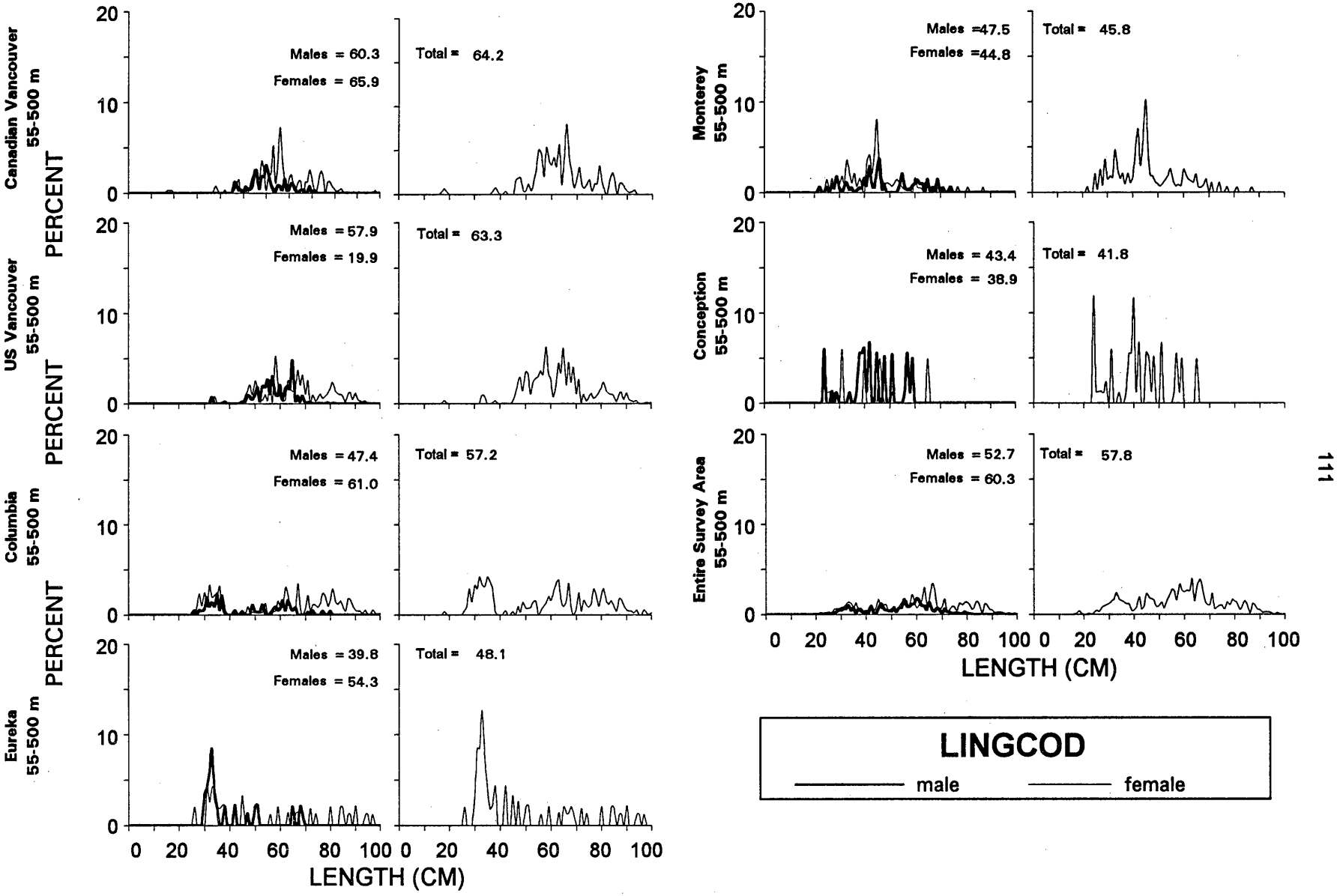

Figure 44.-- Estimated population size composition and mean lengths of lingcod by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

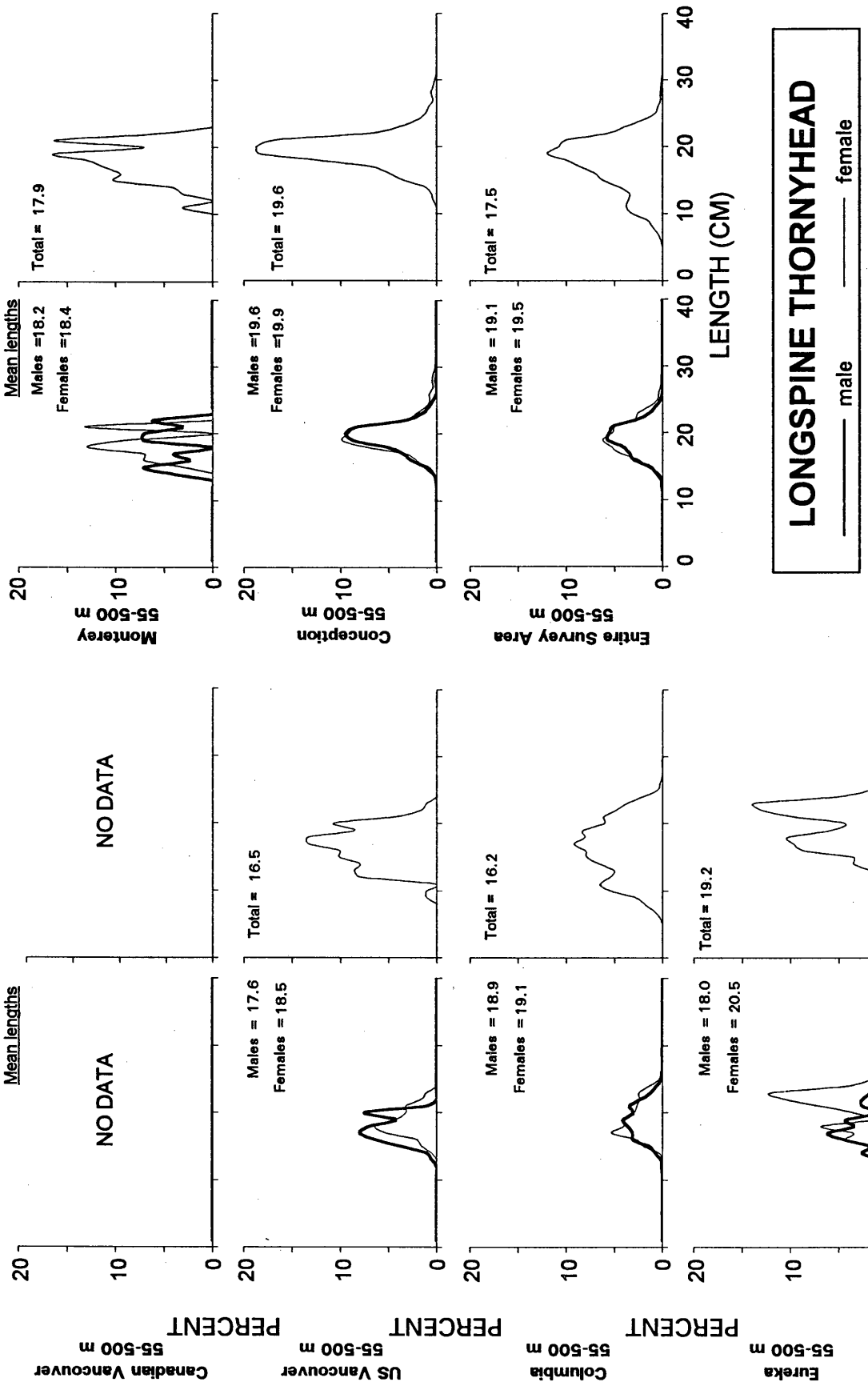

Figure 45.-- Estimated population size composition and mean lengths of longspine thornyhead by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

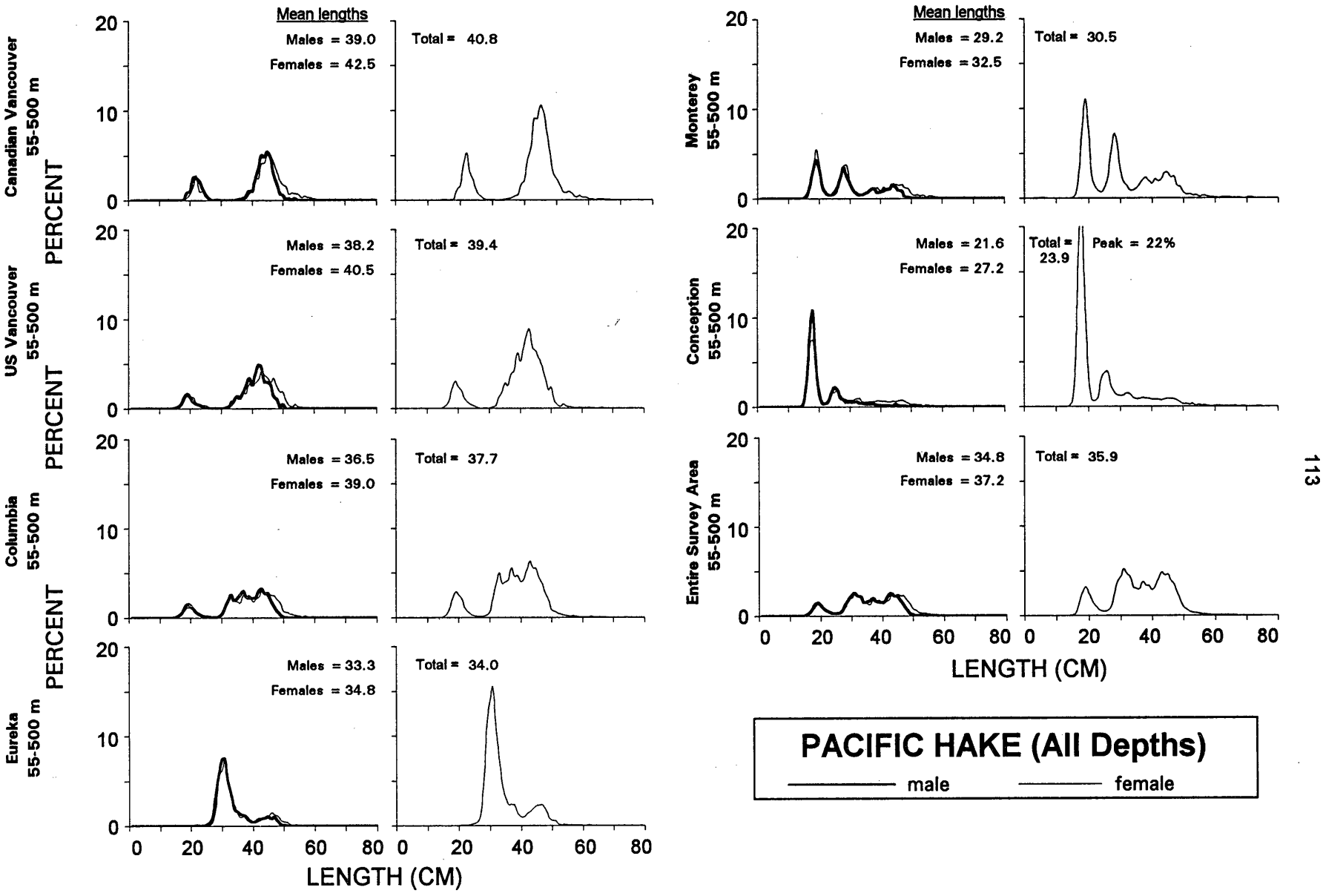

Figure 46.-- Estimated population size composition and mean lengths of Pacific hake by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

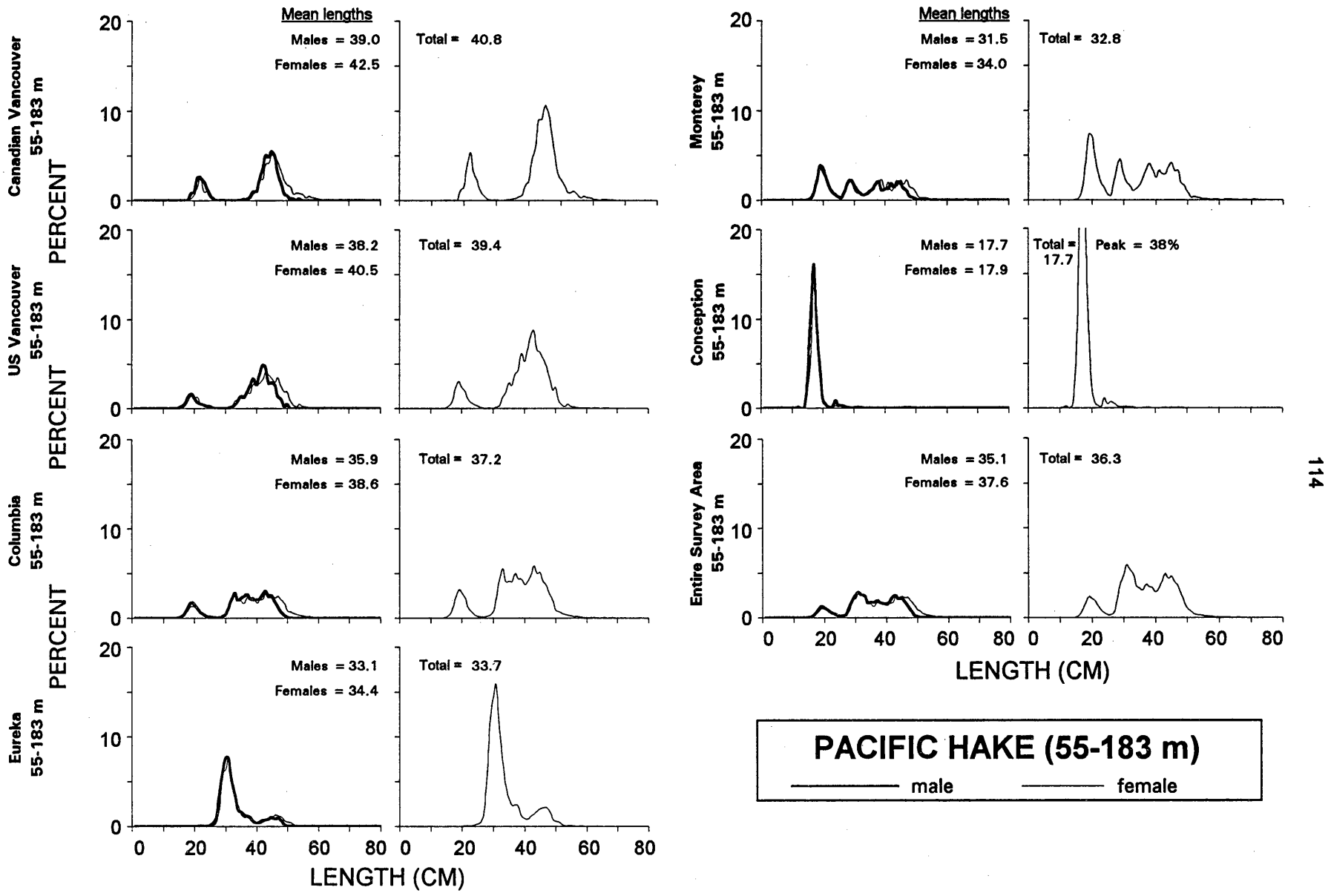

Figure 47.-- Estimated population size composition and mean lengths of Pacific hake by sex and International North Pacific Fisheries Commission area for the shallow depth stratum (55-183 m) from the 1998 triennial bottom trawl survey.

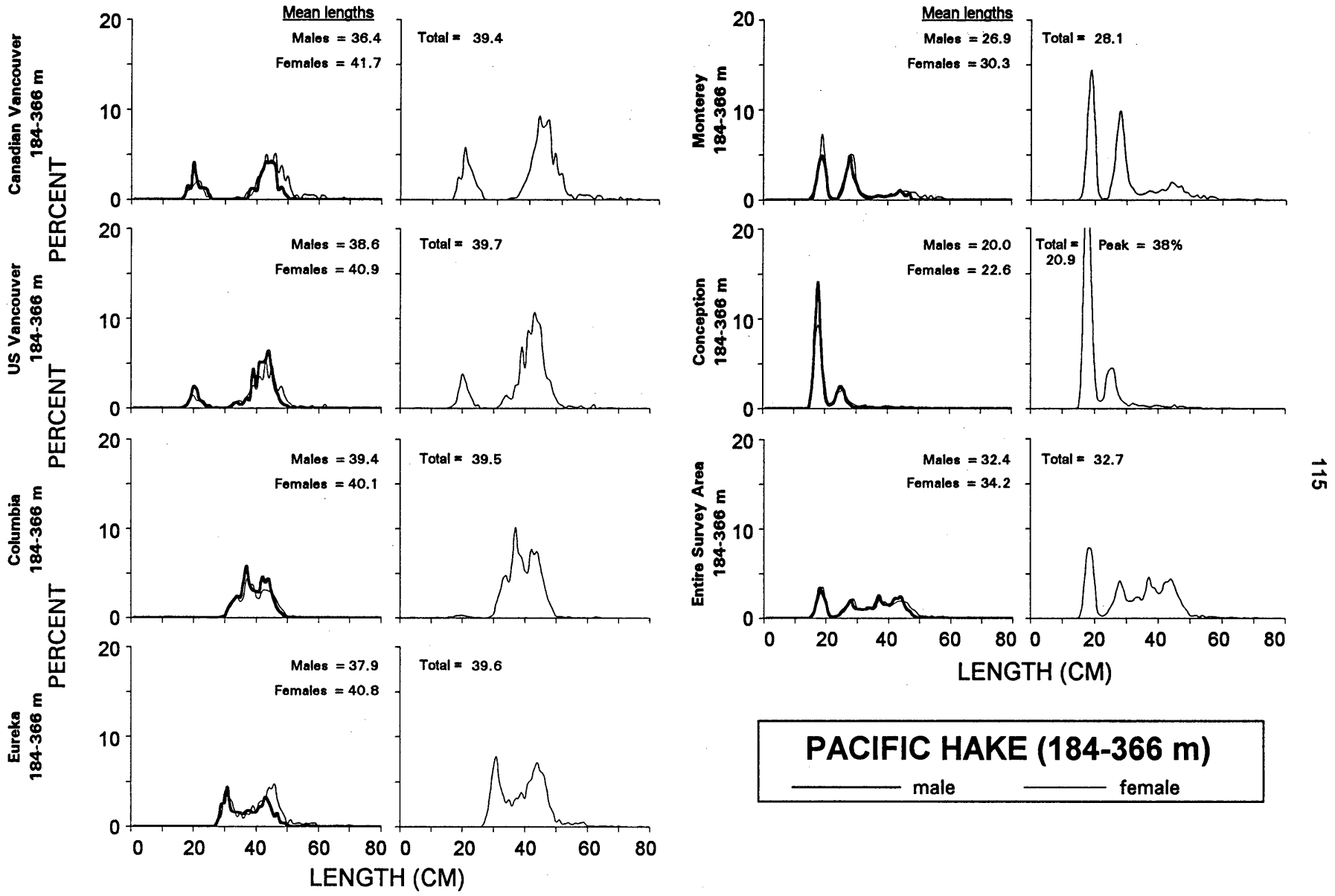

Figure 48.-- Estimated population size composition and mean lengths of Pacific hake by sex and International North Pacific Fisheries Commission area for the middle depth stratum (184-366 m) from the 1998 triennial bottom trawl survey.

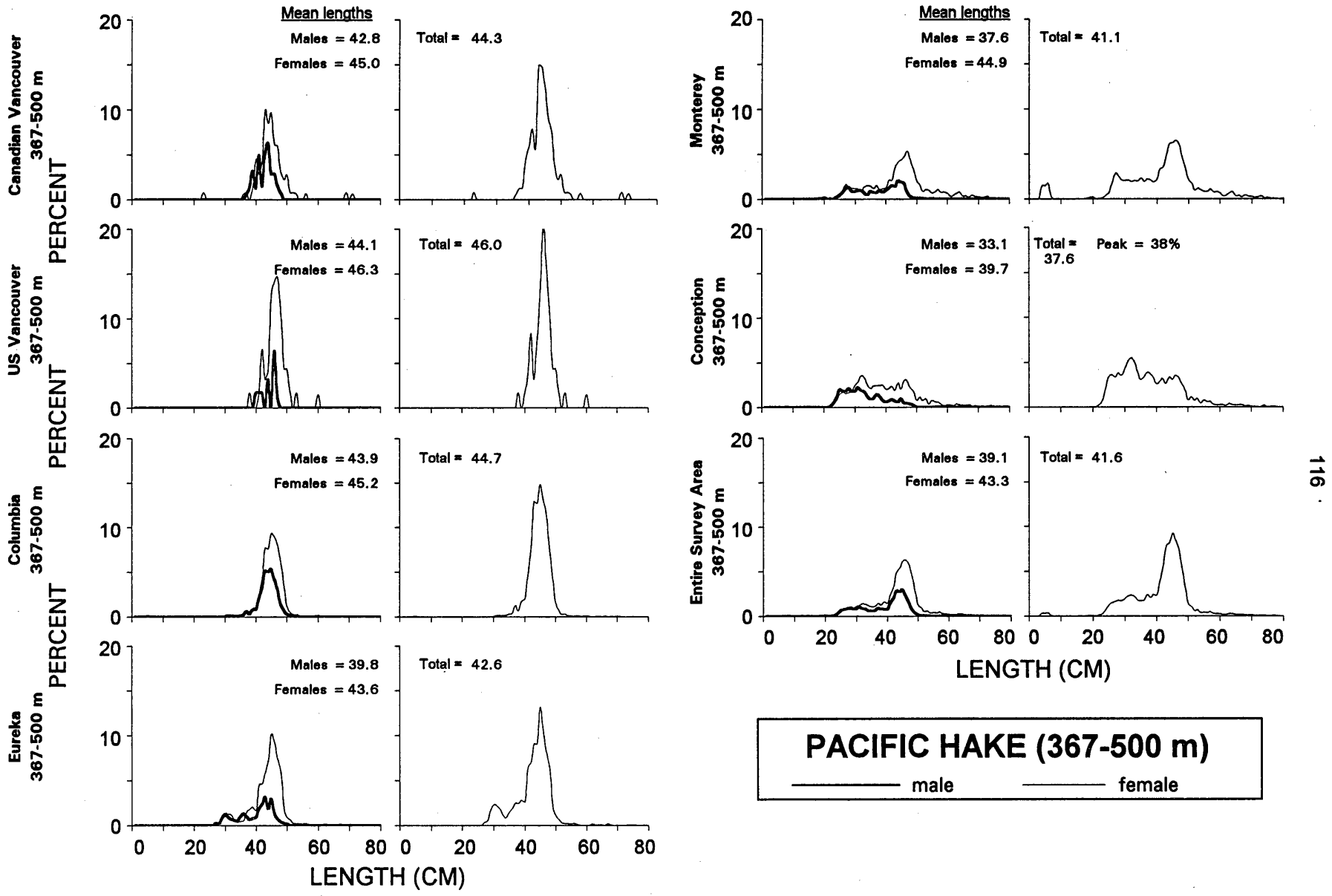

Figure 49.-- Estimated population size composition and mean lengths of Pacific hake by sex and International North Pacific Fisheries Commission area for the deep depth stratum (367-500 m) from the 1998 triennial bottom trawl survey.

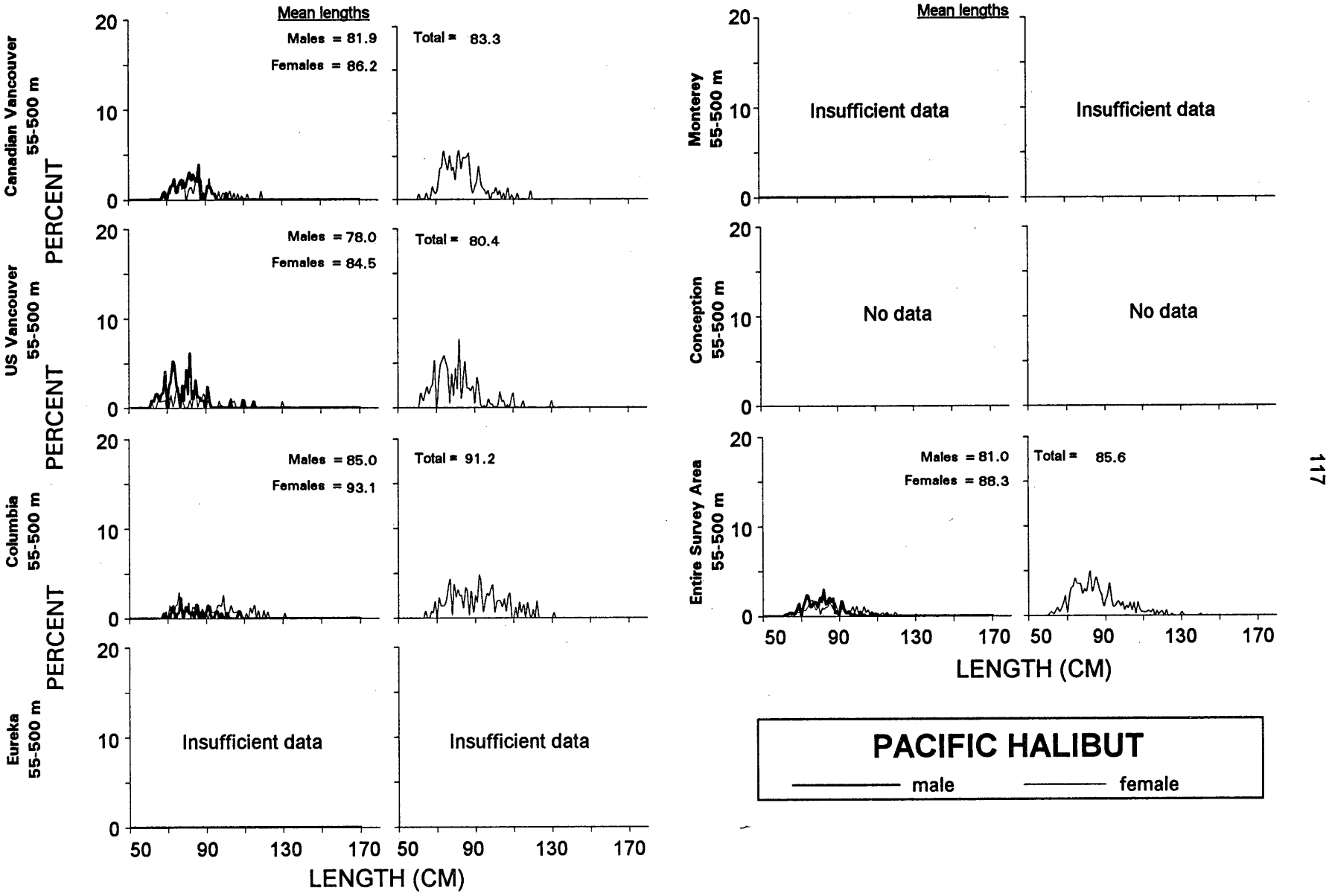

Figure 50.-- Estimated population size composition and mean length of Pacific halibut by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

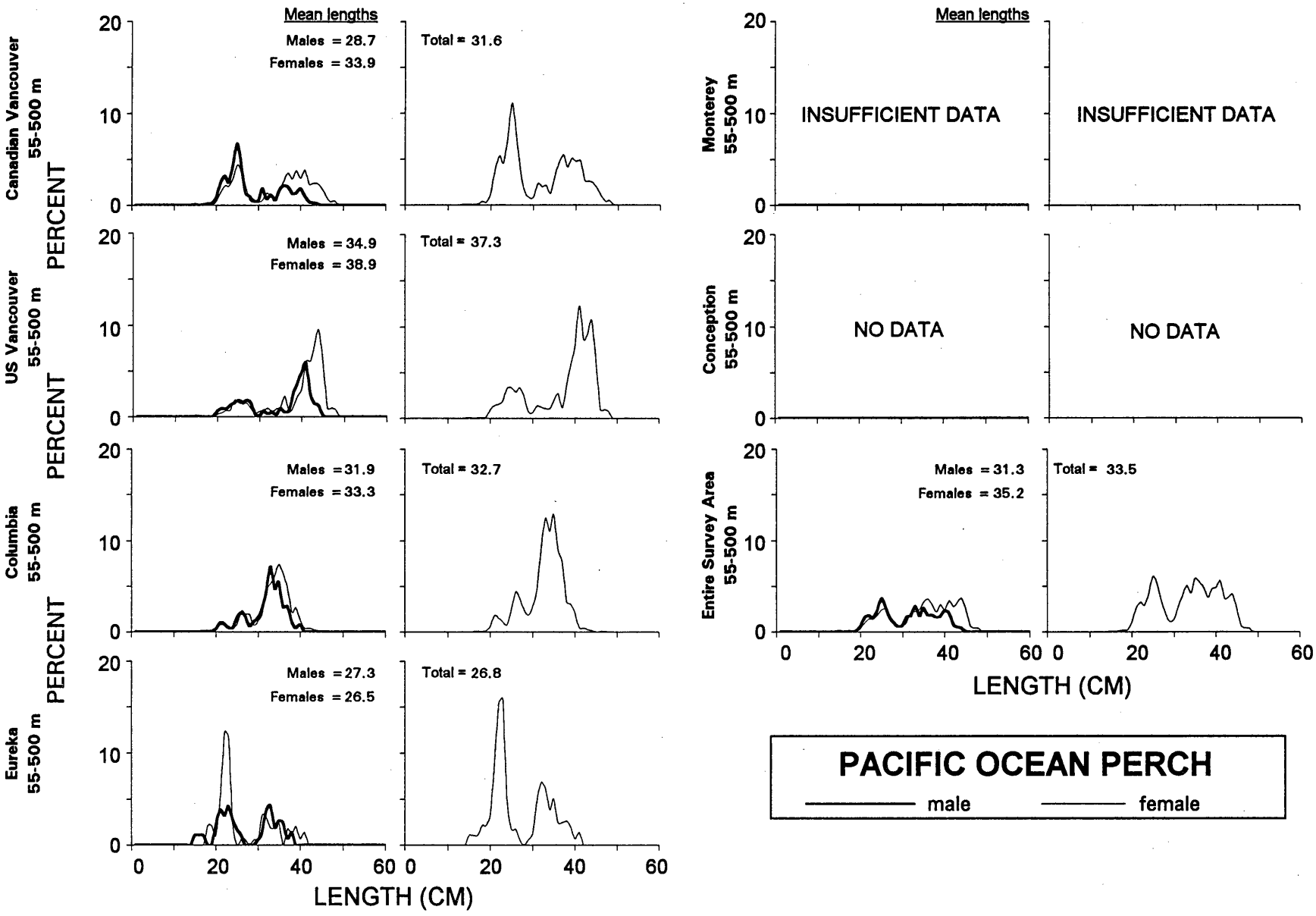

Figure 51.-- Estimated population size composition and mean lengths of Pacific ocean perch by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

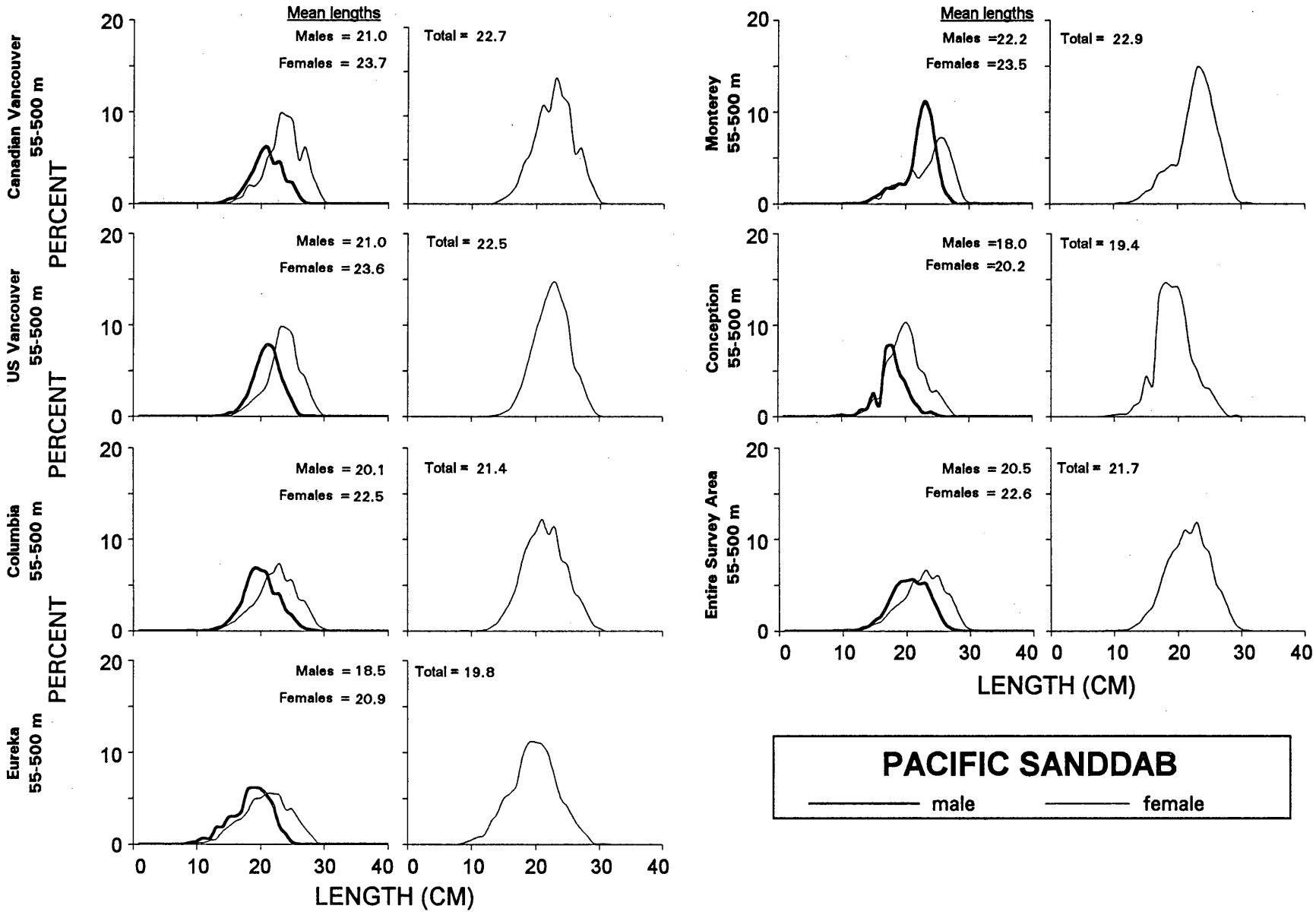

Figure 52.-- Estimated population size composition and mean lengths of Pacific sanddab by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

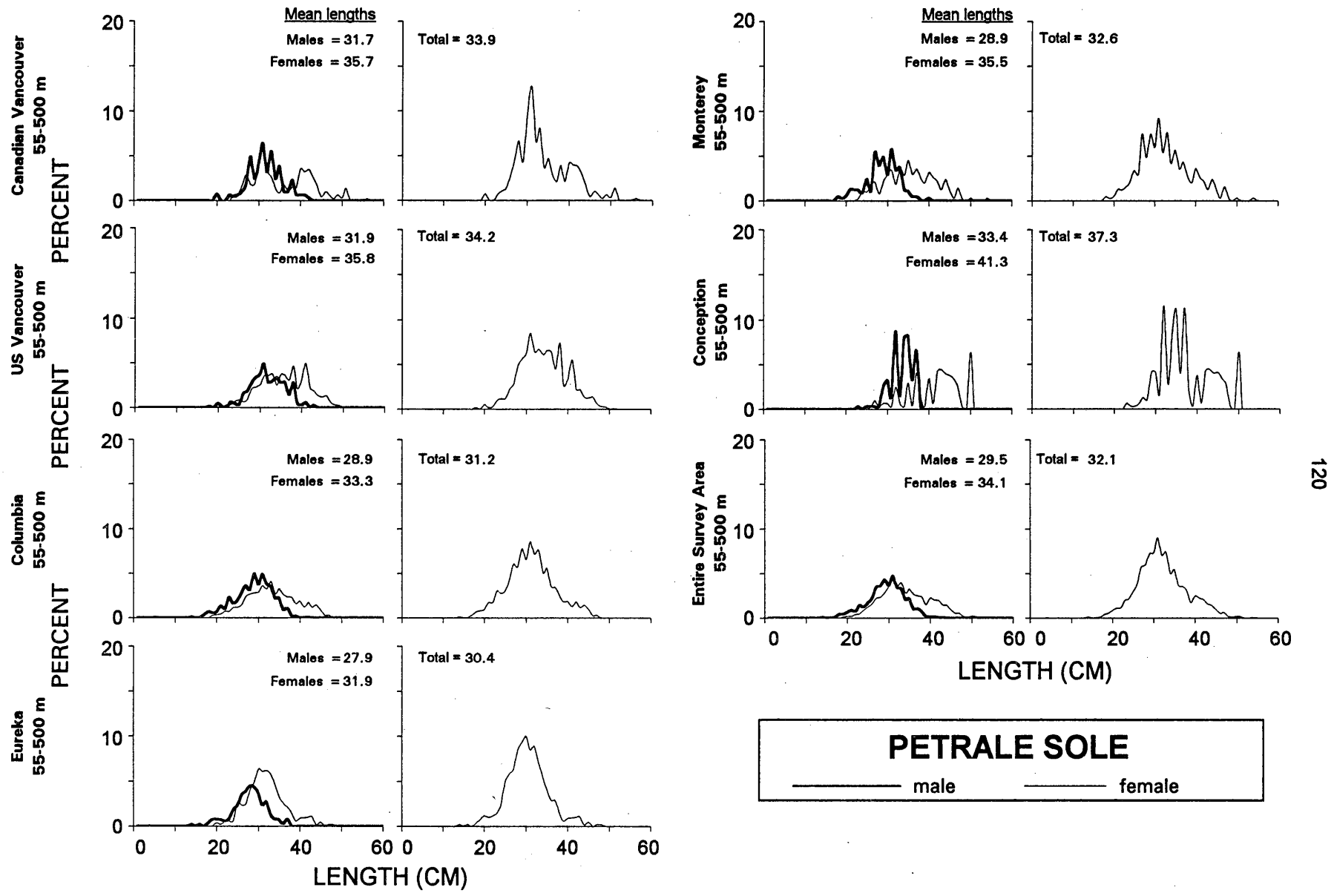

Figure 53.-- Estimated population size composition and mean lengths of petrale sole by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

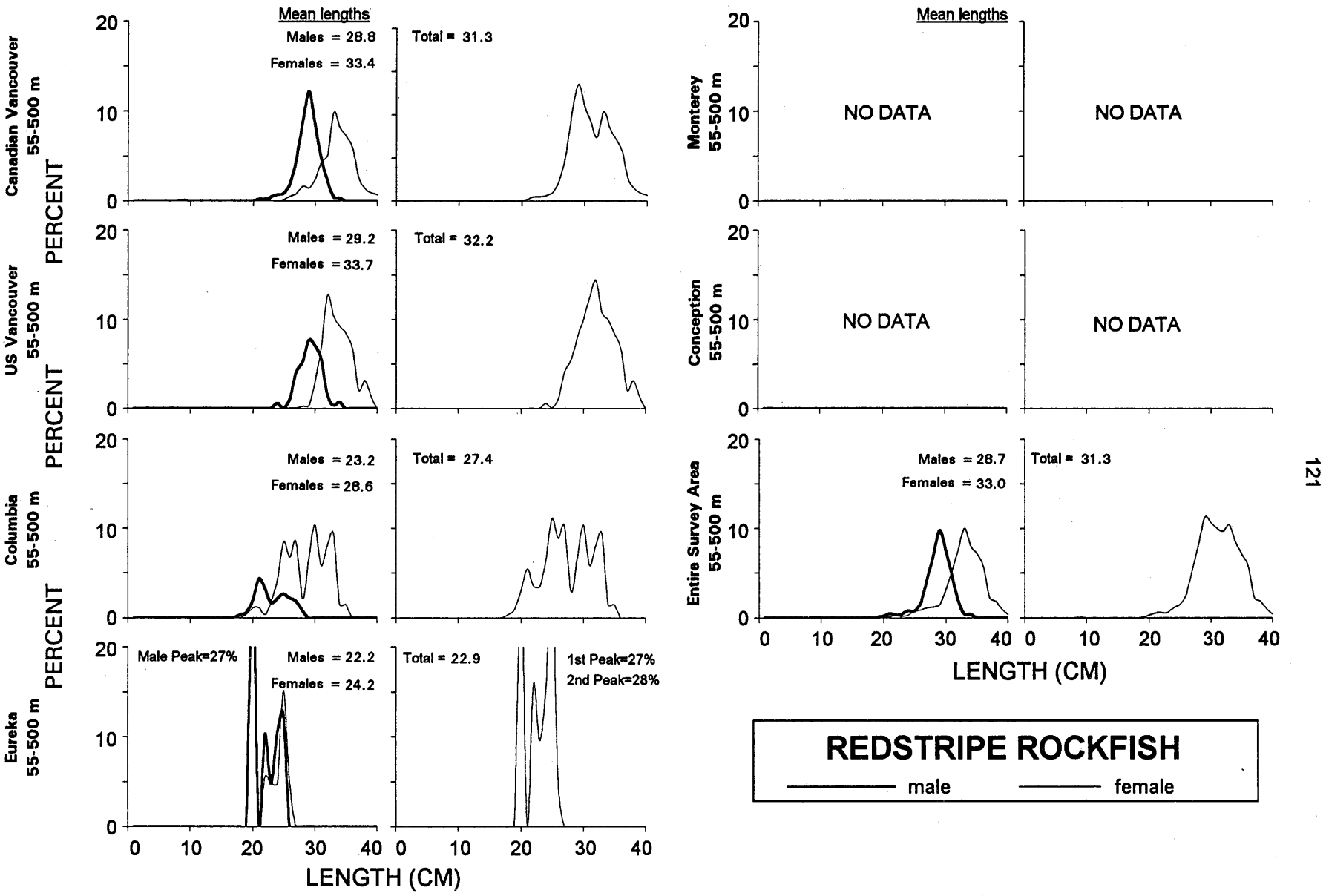

Figure 54.-- Estimated population size composition and mean lengths of redstripe rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

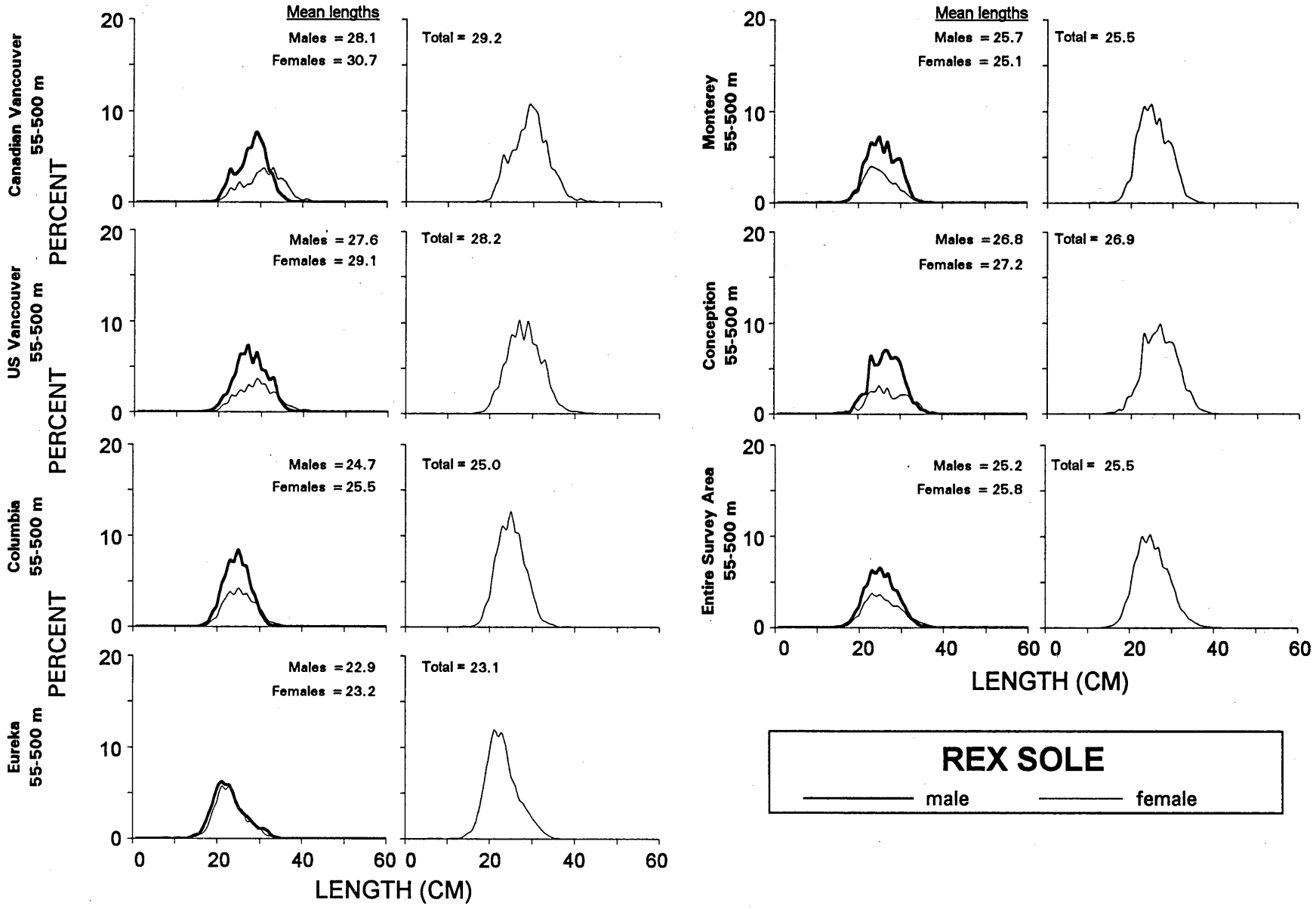

Figure 55.-- Estimated population size composition and mean lengths of rex sole by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

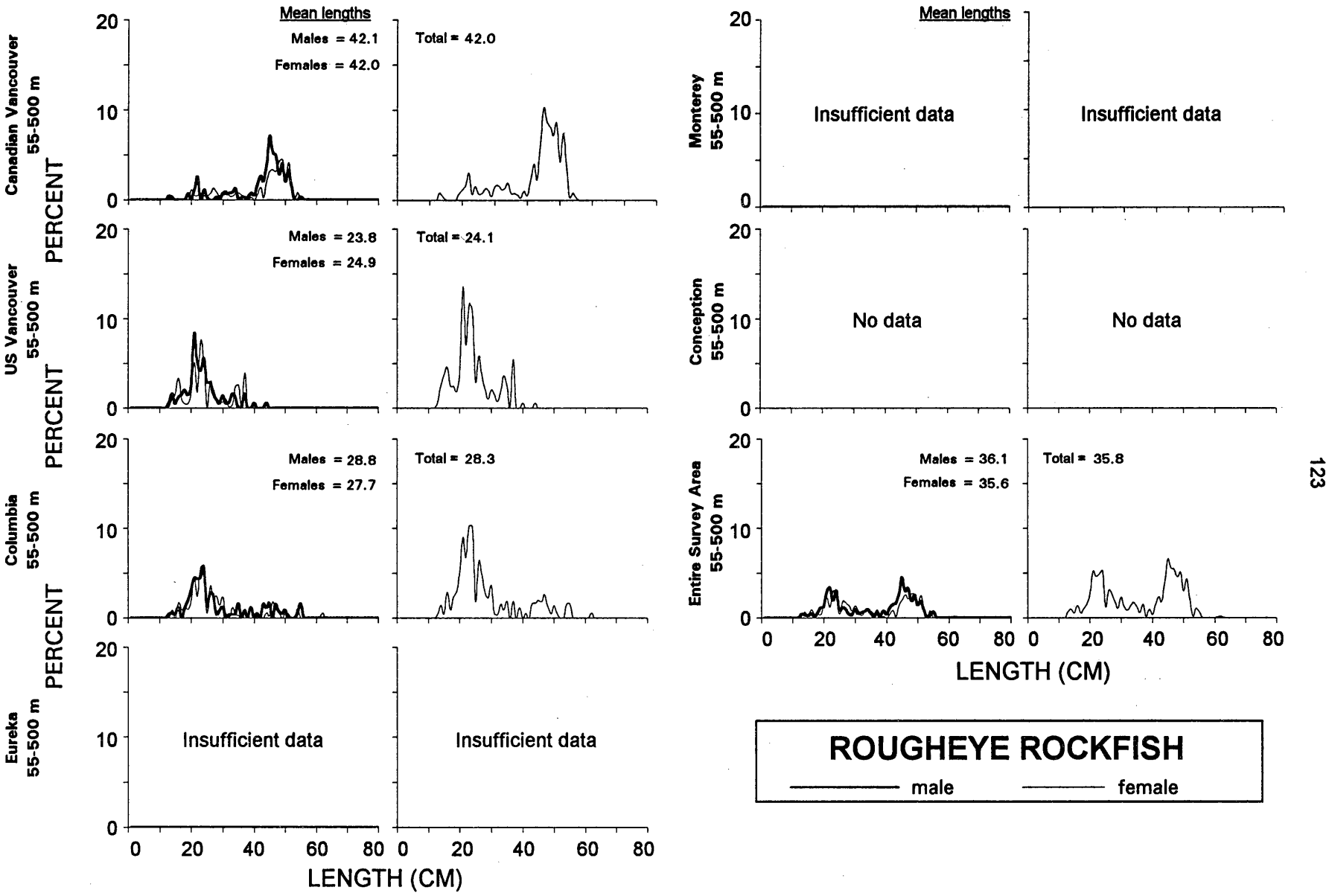

Figure 56.-- Estimated population size composition and mean lengths of rougheye rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

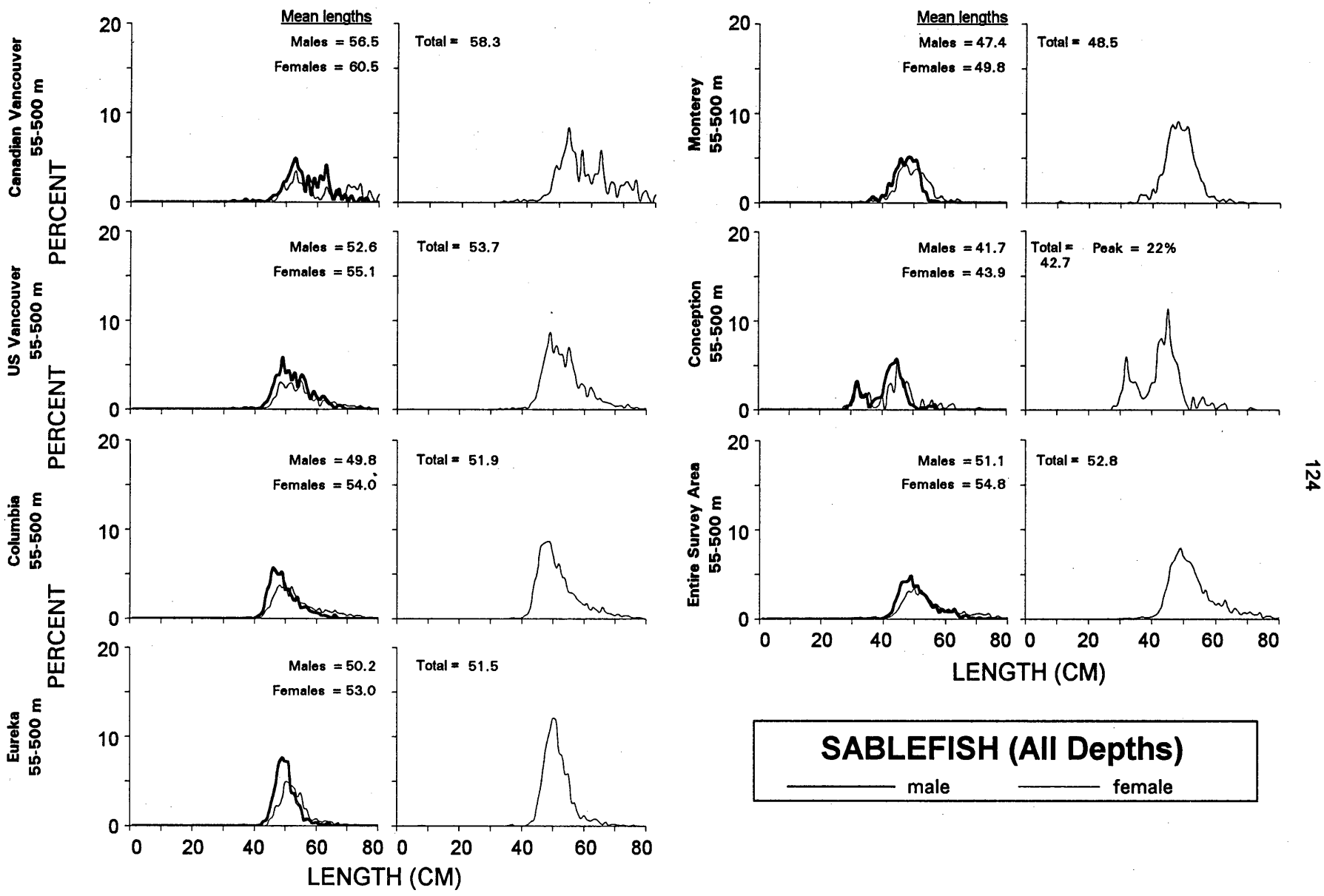

Figure 57.-- Estimated population size composition and mean lengths of sablefish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

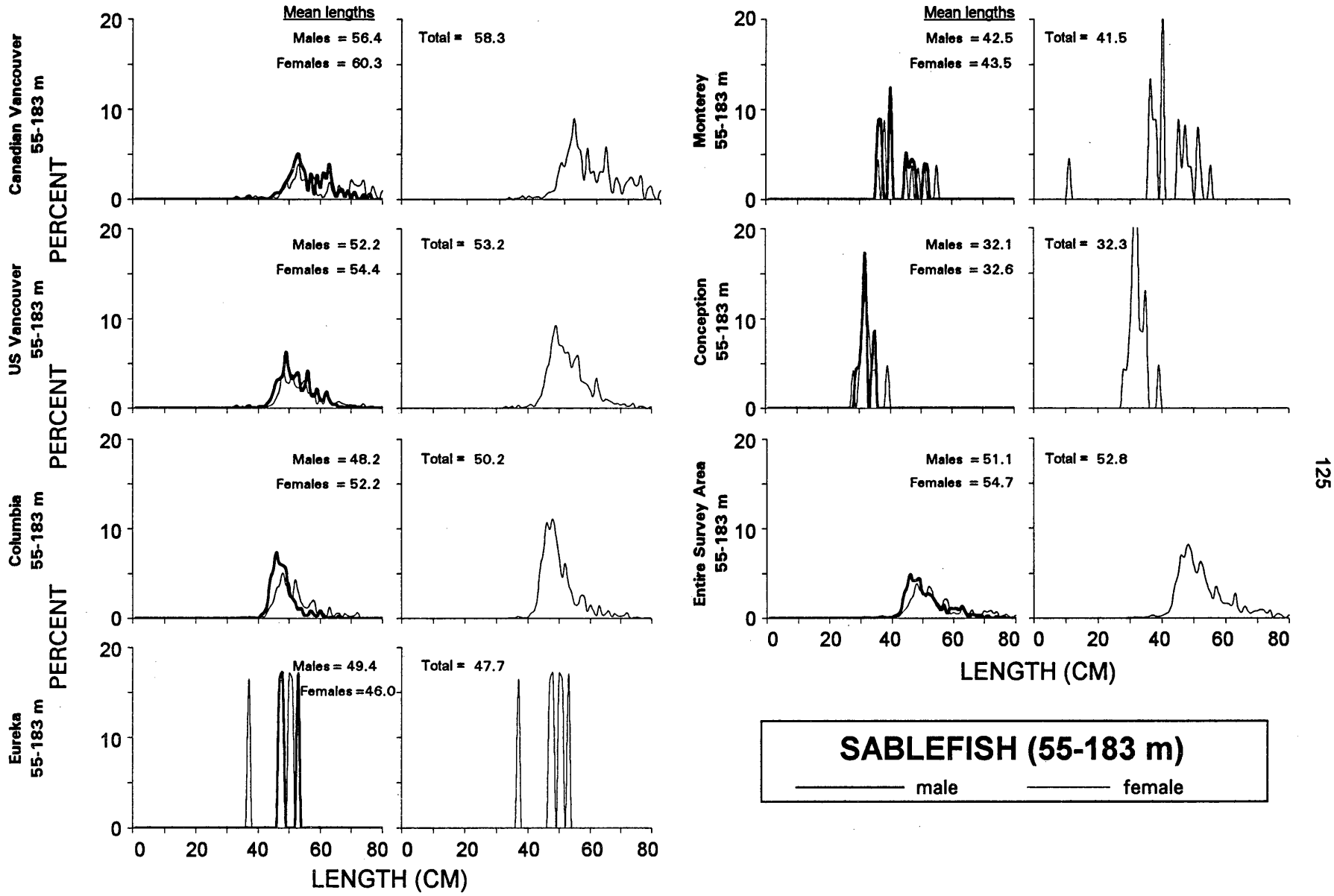

Figure 58.-- Estimated population size composition and mean lengths of sablefish by sex and International North Pacific Fisheries Commission area for the shallow depth stratum (55-183 m) from the 1998 triennial bottom trawl survey.

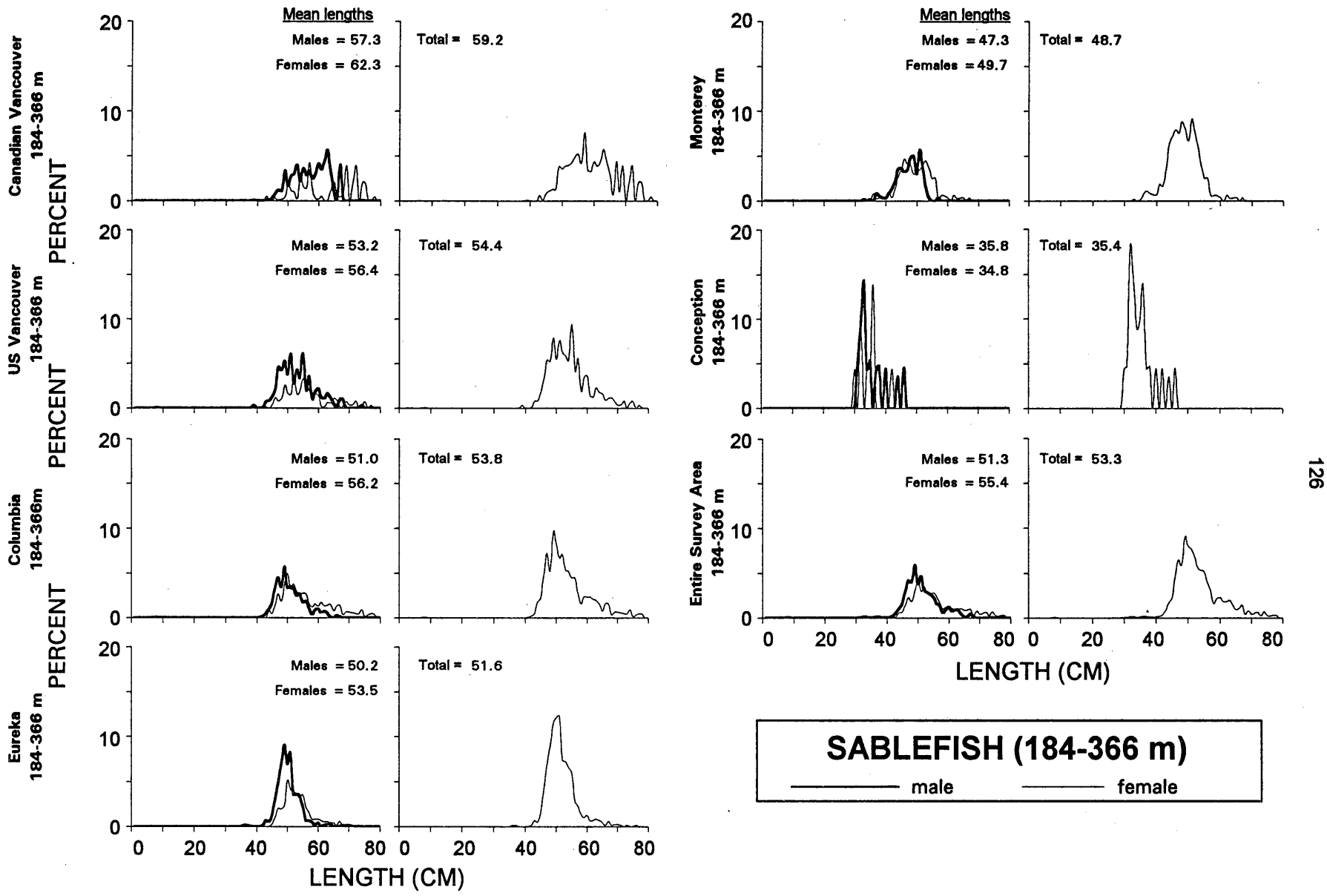

Figure 59.-- Estimated population size composition and mean lengths of sablefish by sex and International North Pacific Fisheries Commission area for the middle depth stratum (184-366 m) from the 1998 triennial bottom trawl survey.

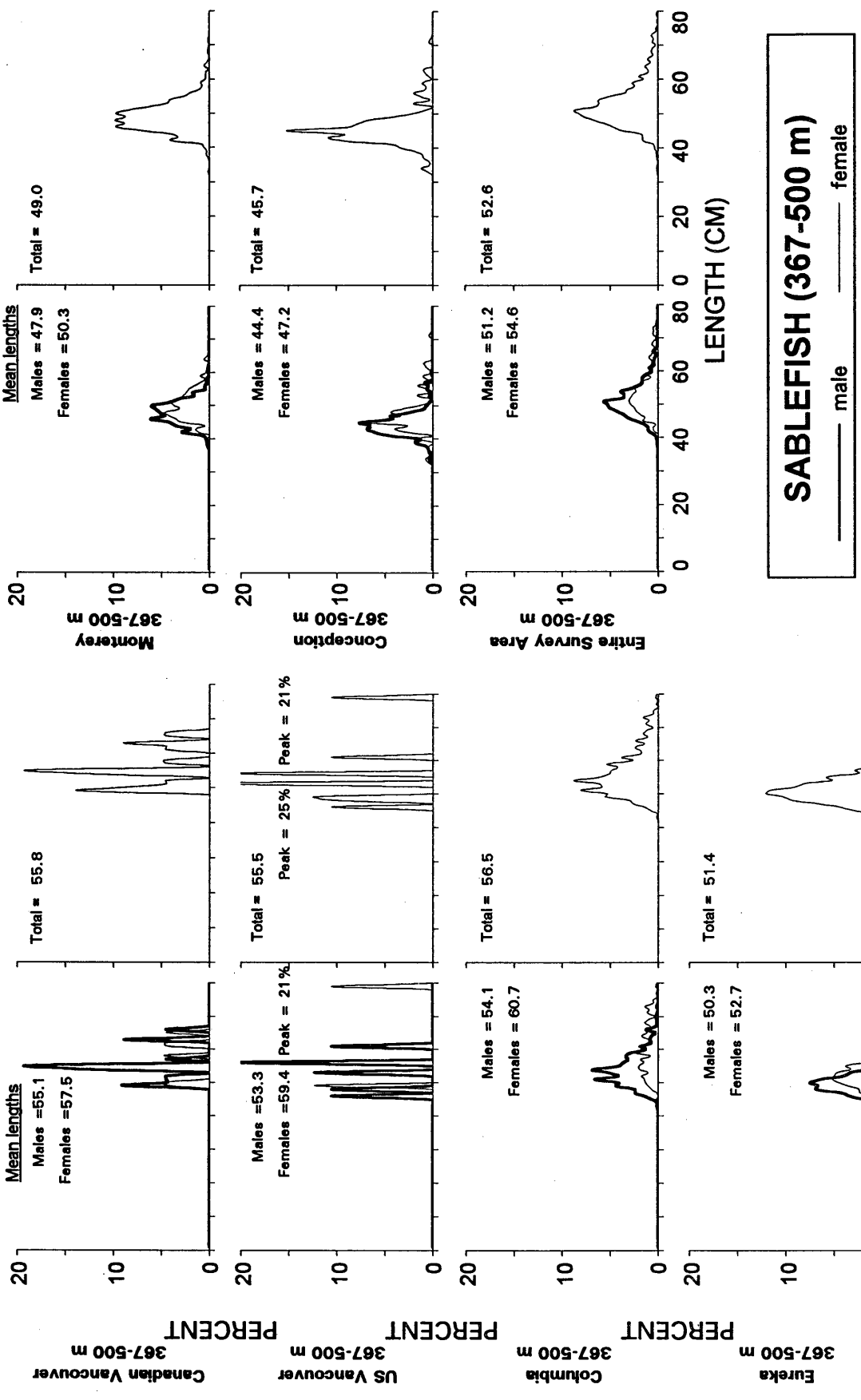

Figure 60.-- Estimated population size composition and mean lengths of sablefish by sex and International North Pacific Fisheries Commission area for the deep depth stratum (367-500 m) from the 1998 triennial bottom trawl survey.

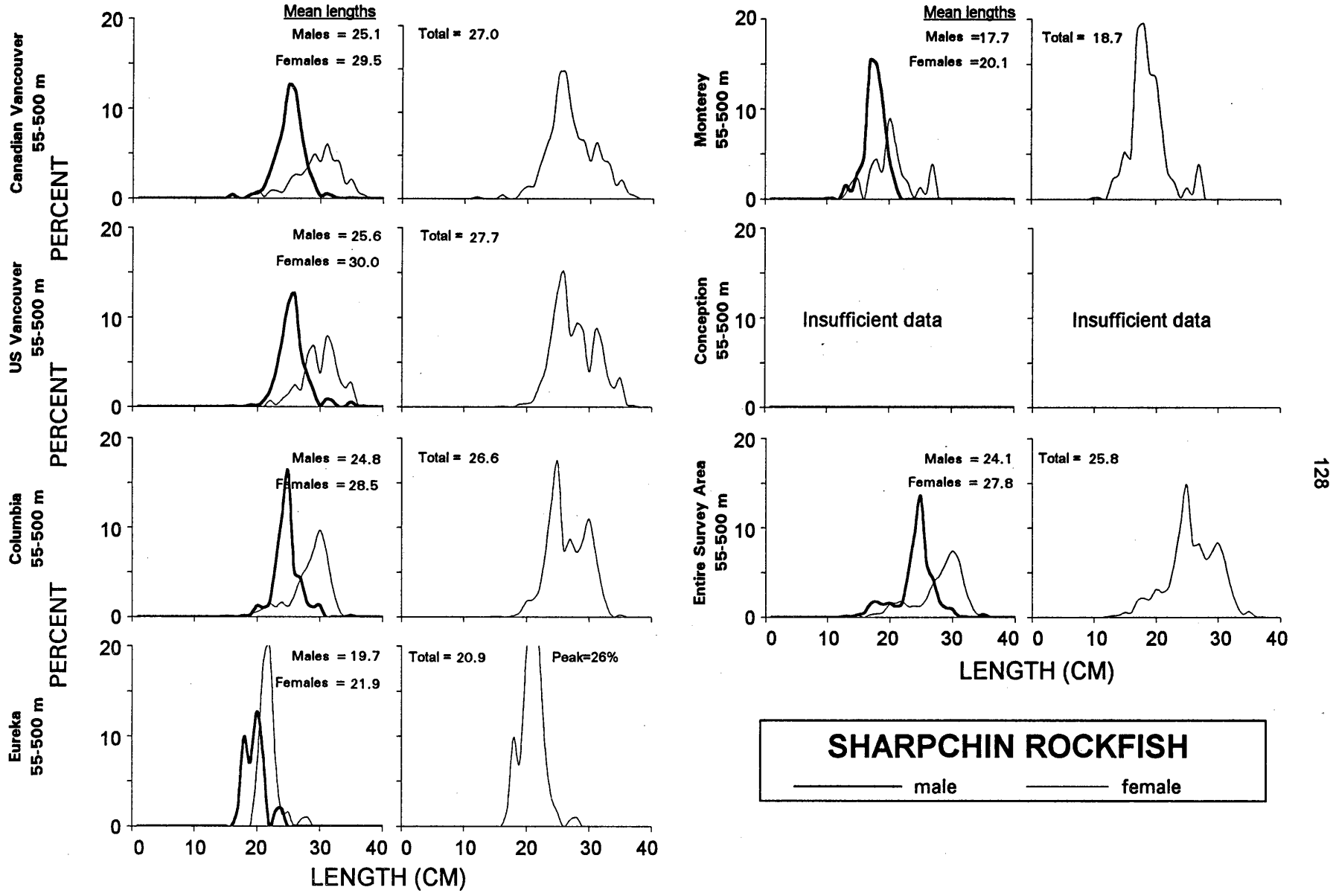

Figure 61.-- Estimated population size composition and mean lengths of sharpchin rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

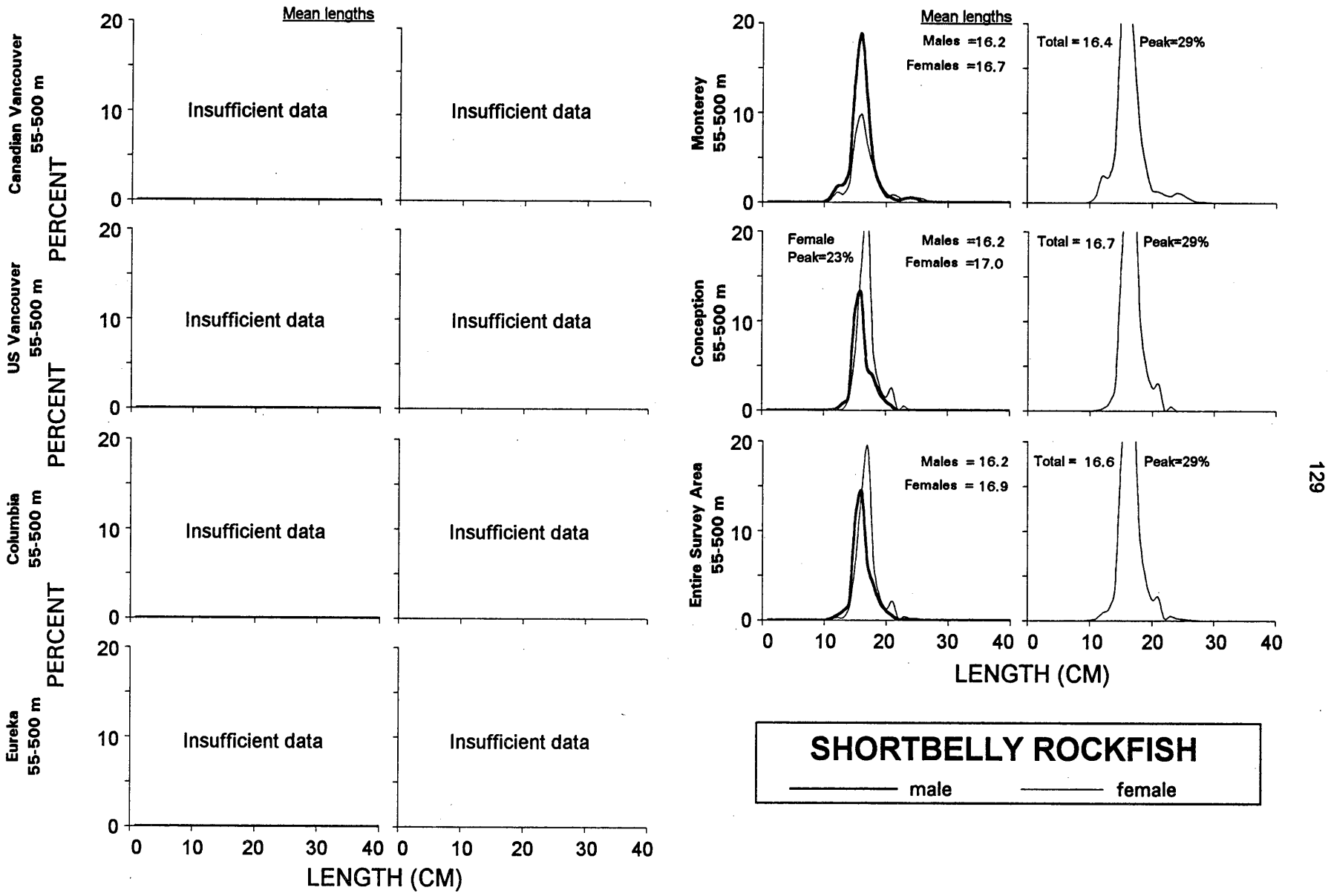

Figure 62.-- Estimated population size composition and mean lengths of shortbelly rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

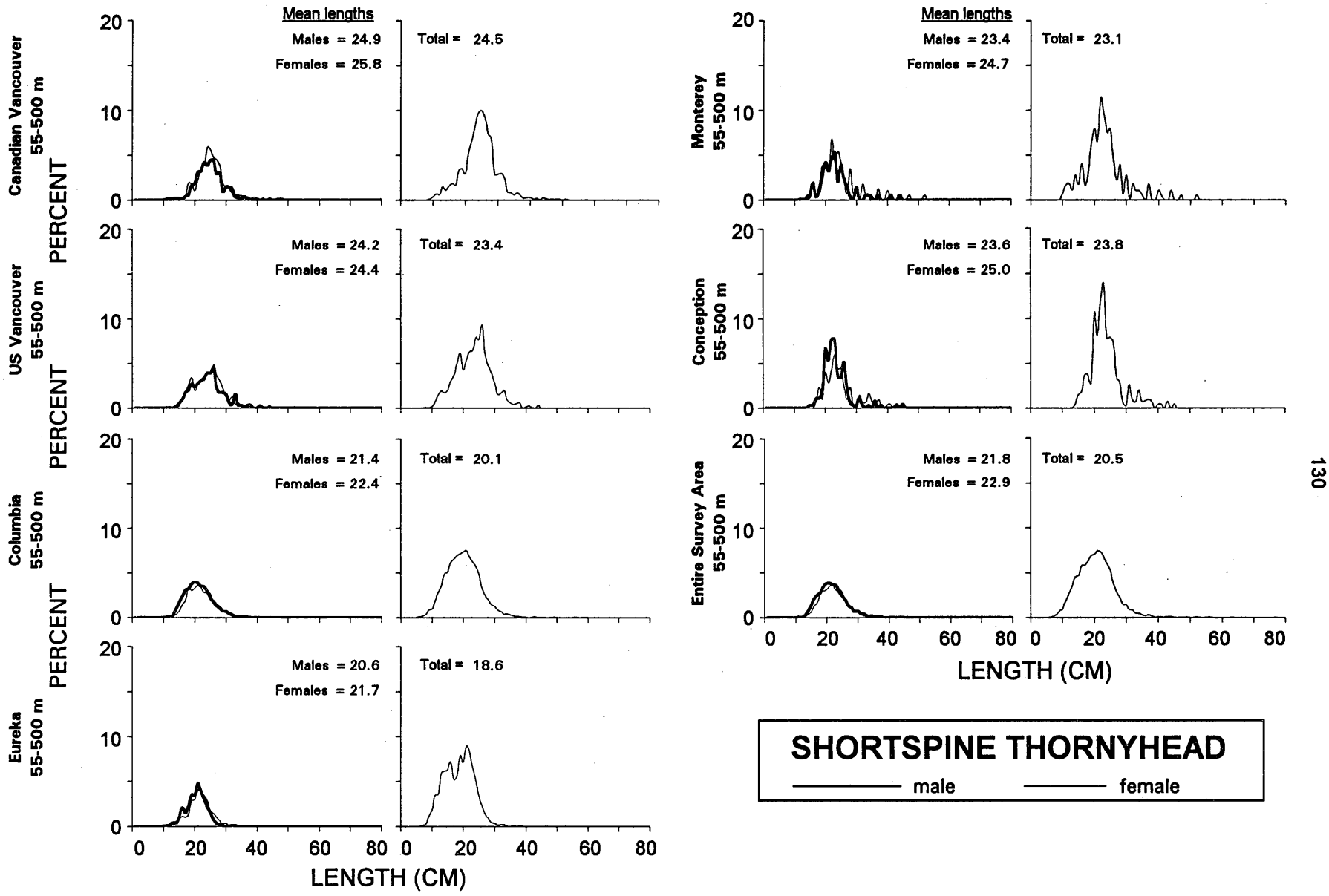

Figure 63.-- Estimated population size composition and mean lengths of shortspine thornyhead by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

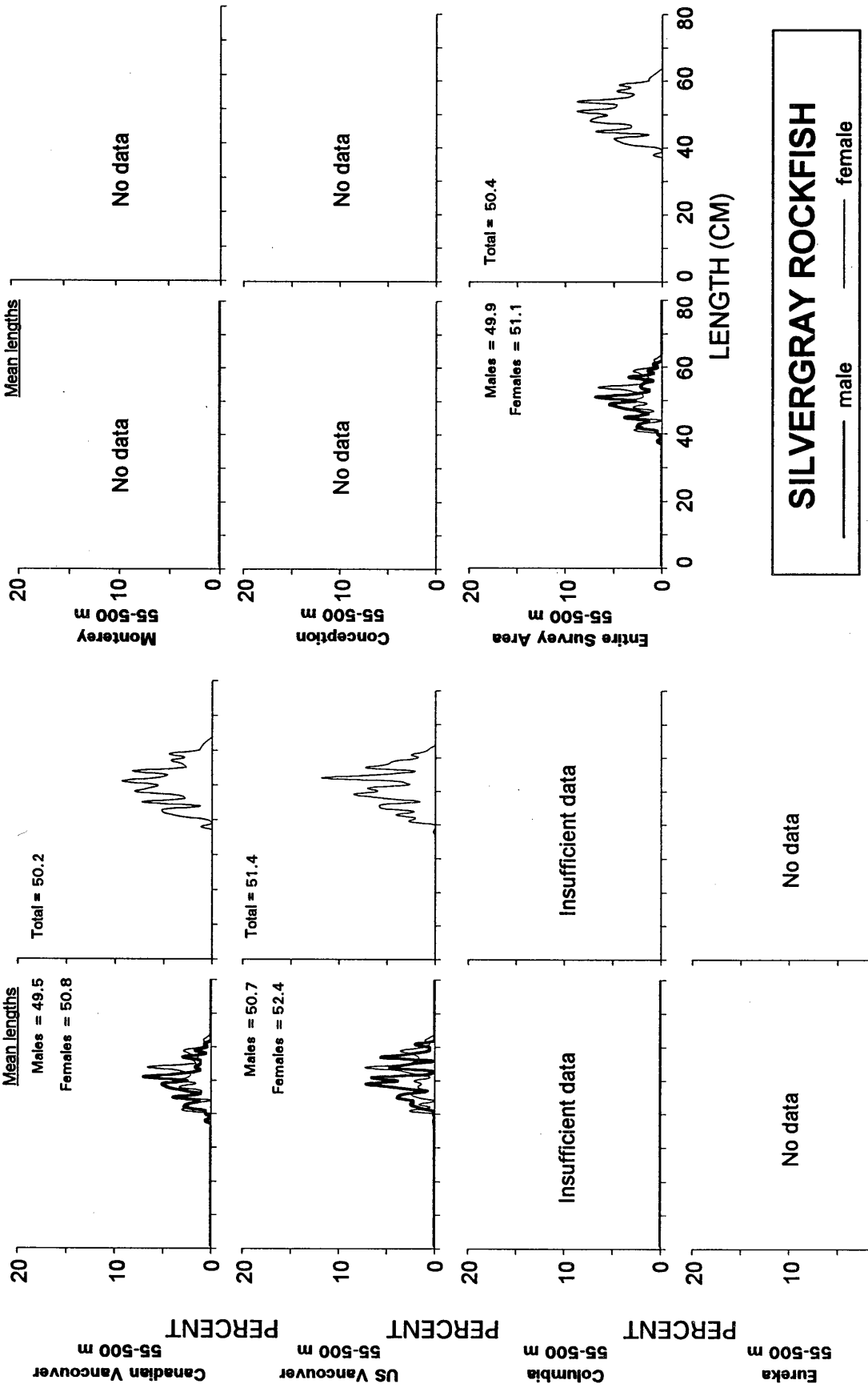

Figure 64.-- Estimated population size composition and mean lengths of silvergray rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

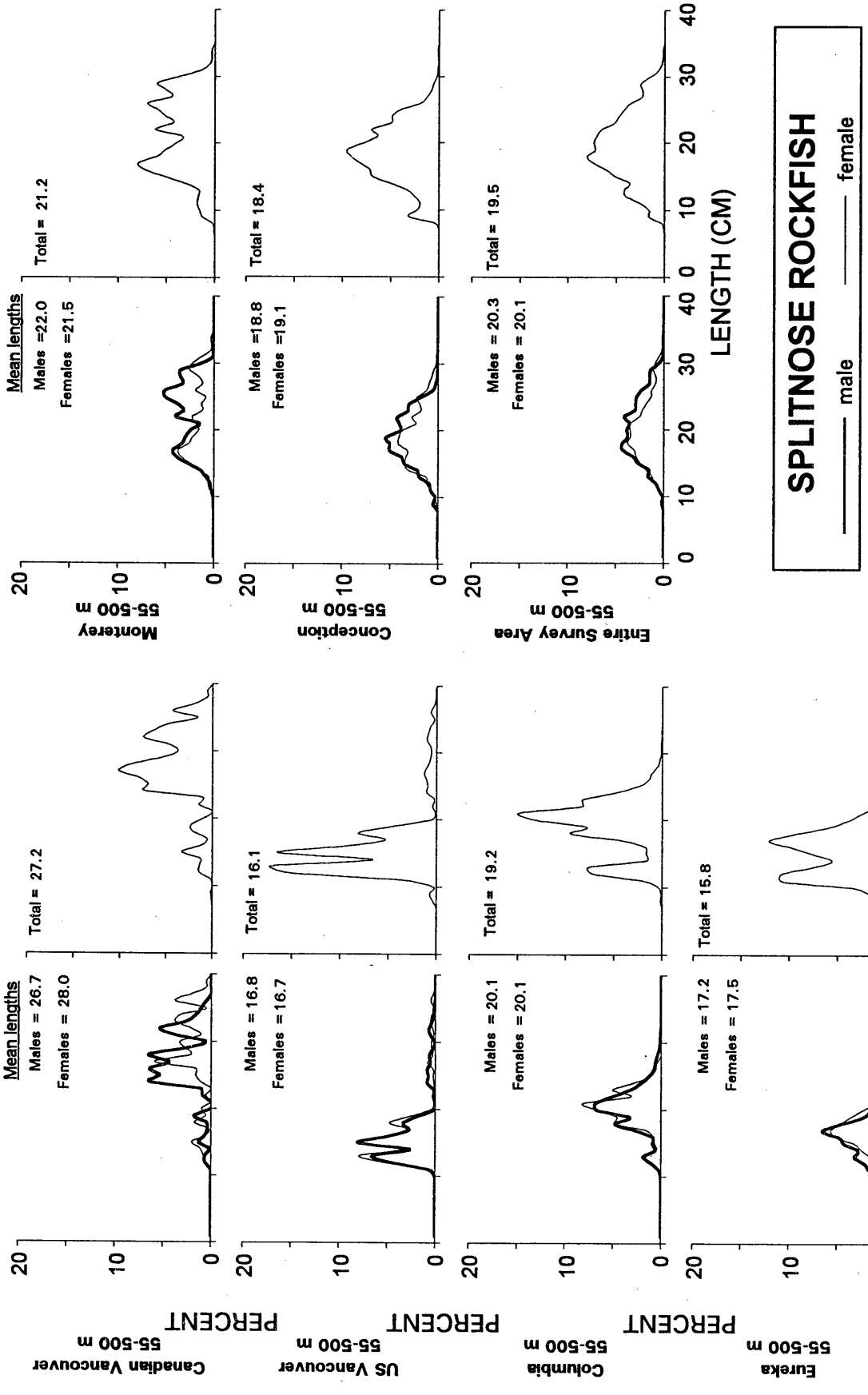

Figure 65.-- Estimated population size composition and mean lengths of splitnose rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

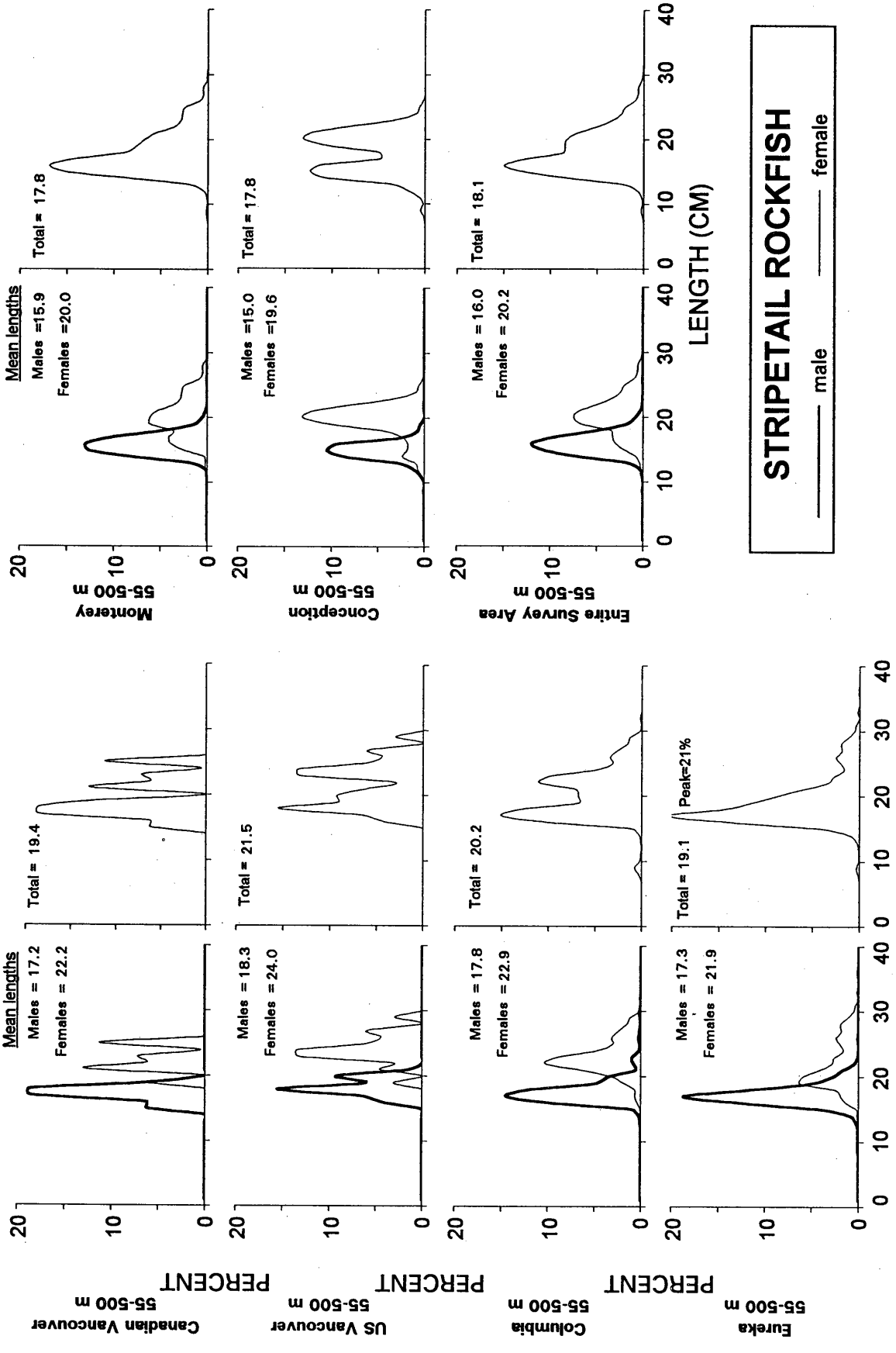

Figure 66.-- Estimated population size composition and mean lengths of stripetail rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

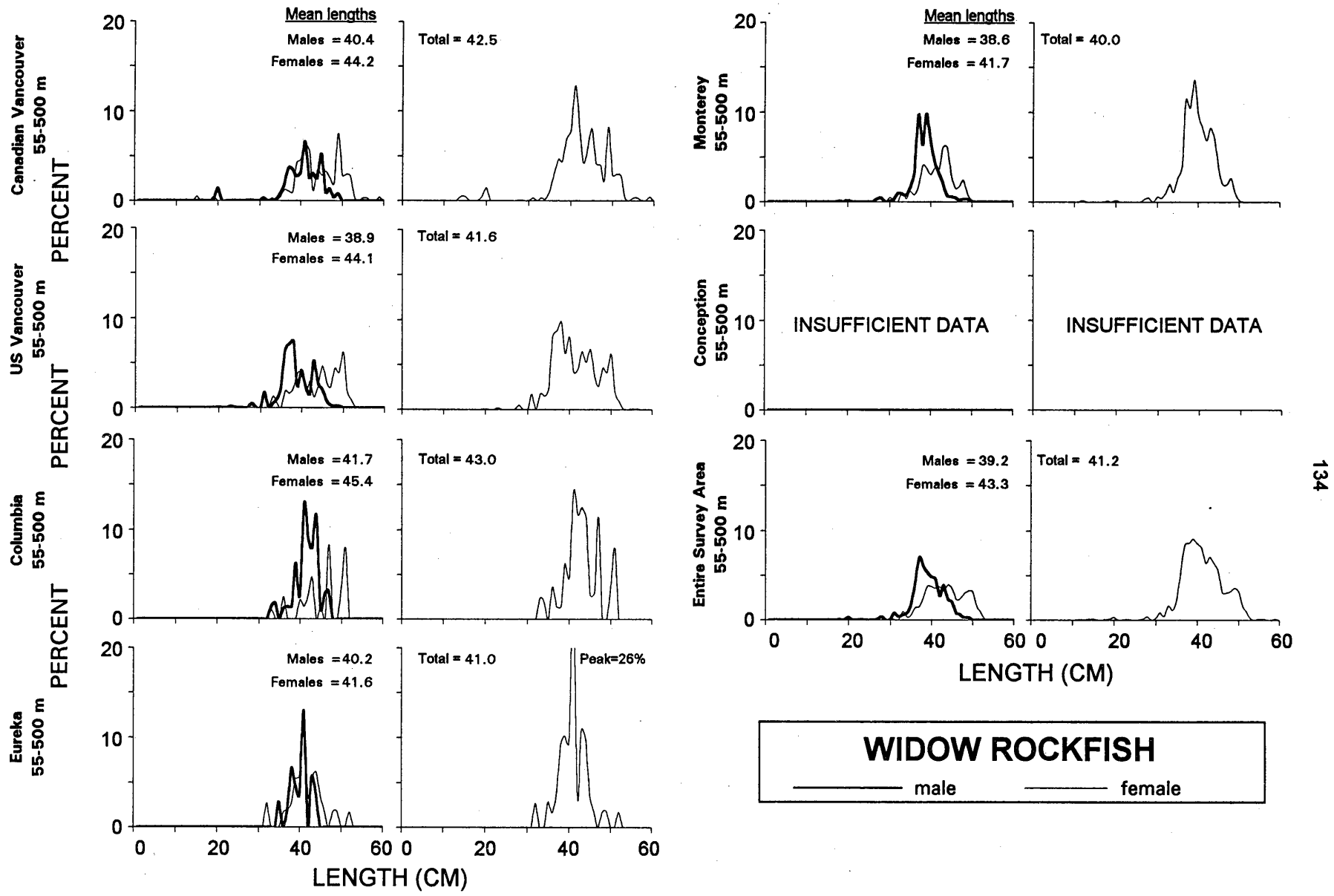

Figure 67.-- Estimated population size composition and mean lengths of widow rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

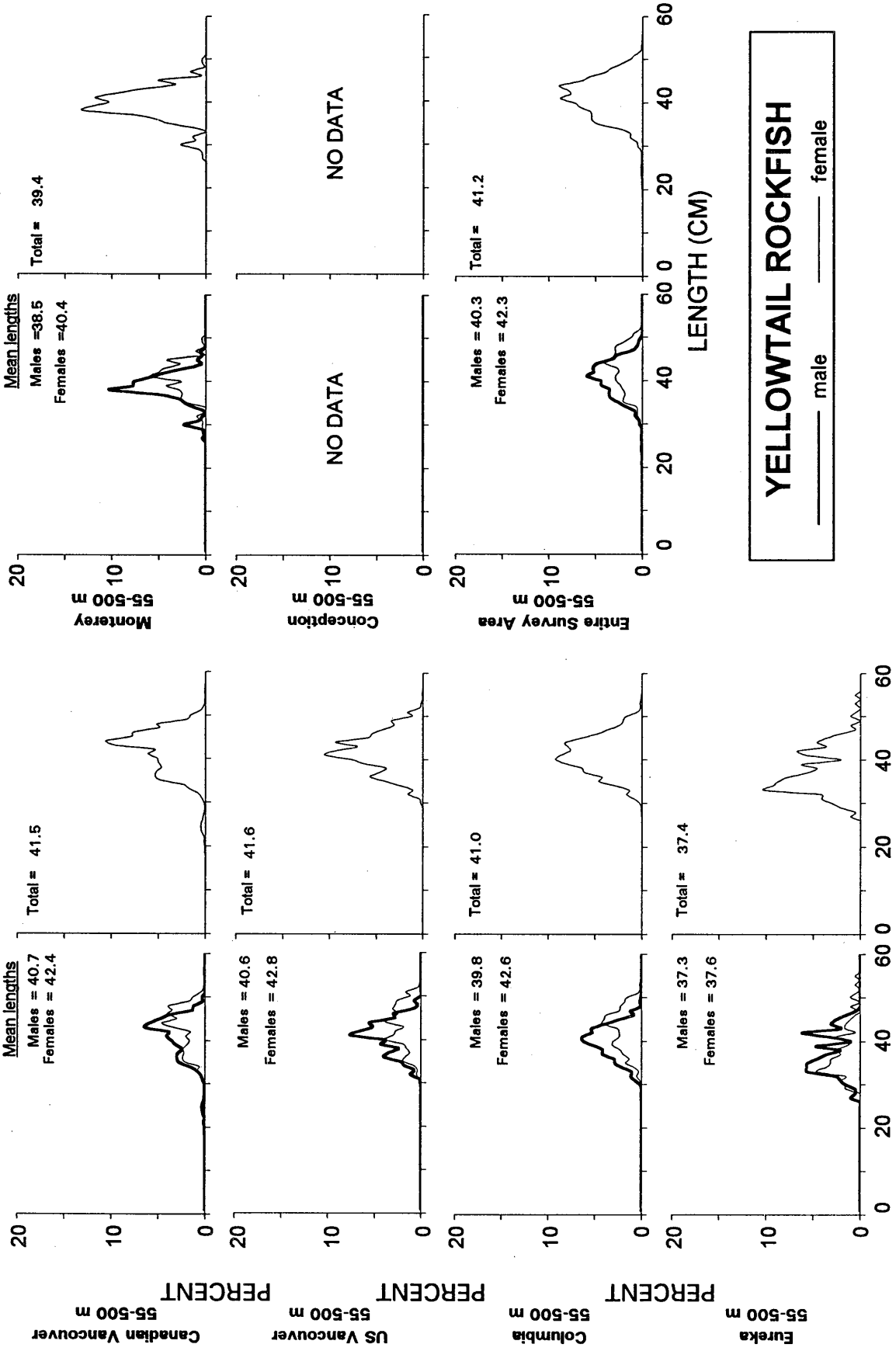

Figure 68.-- Estimated population size composition and mean lengths of yellowtail rockfish by sex and International North Pacific Fisheries Commission area for all depths (55-500 m) from the 1998 triennial bottom trawl survey.

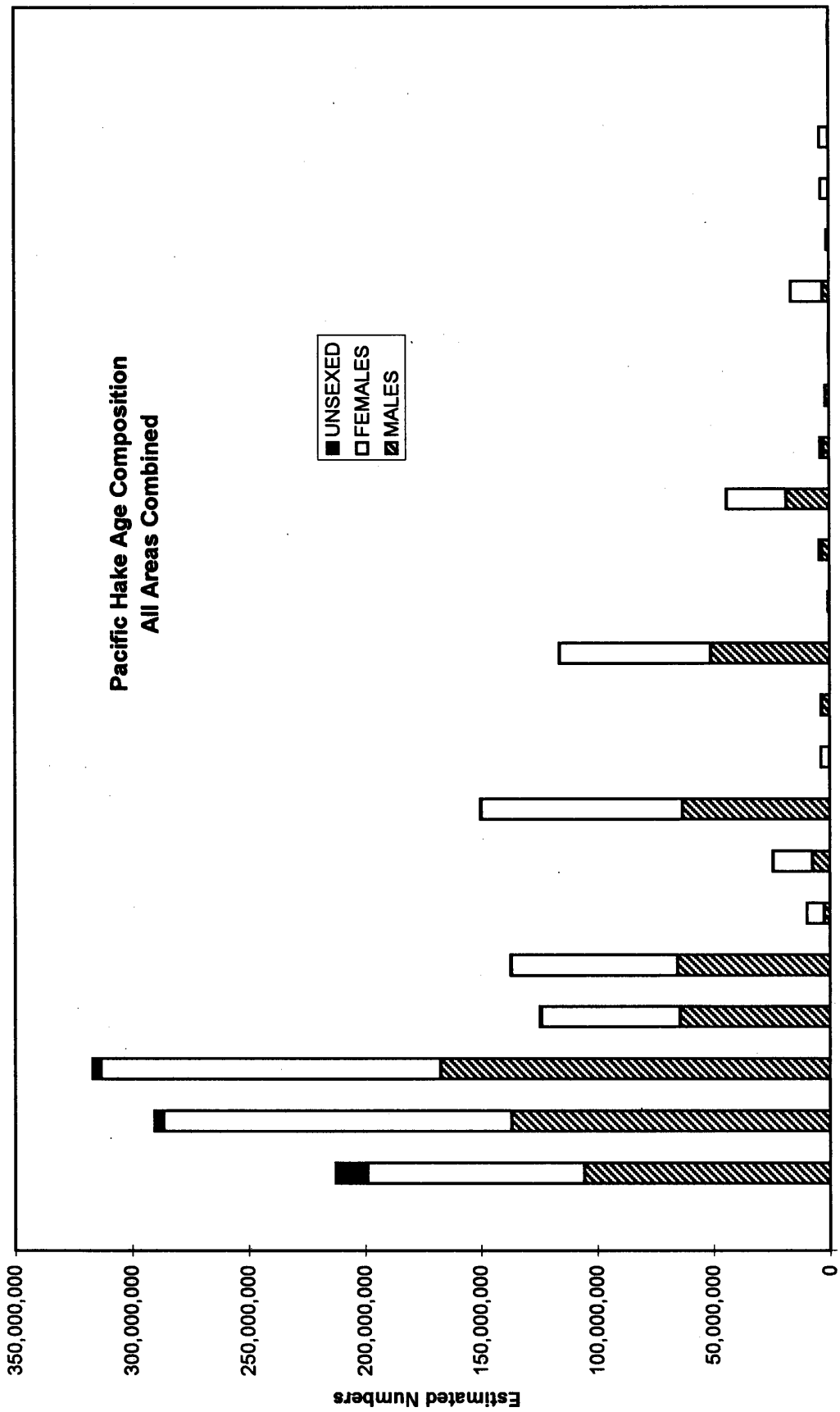

Figure 69.-- The age composition of the Pacific hake resource off California, Oregon, Washington, and British Columbia in 1998, based upon results of the National Marine Fisheries Service's triennial bottom trawl survey of groundfish resources.

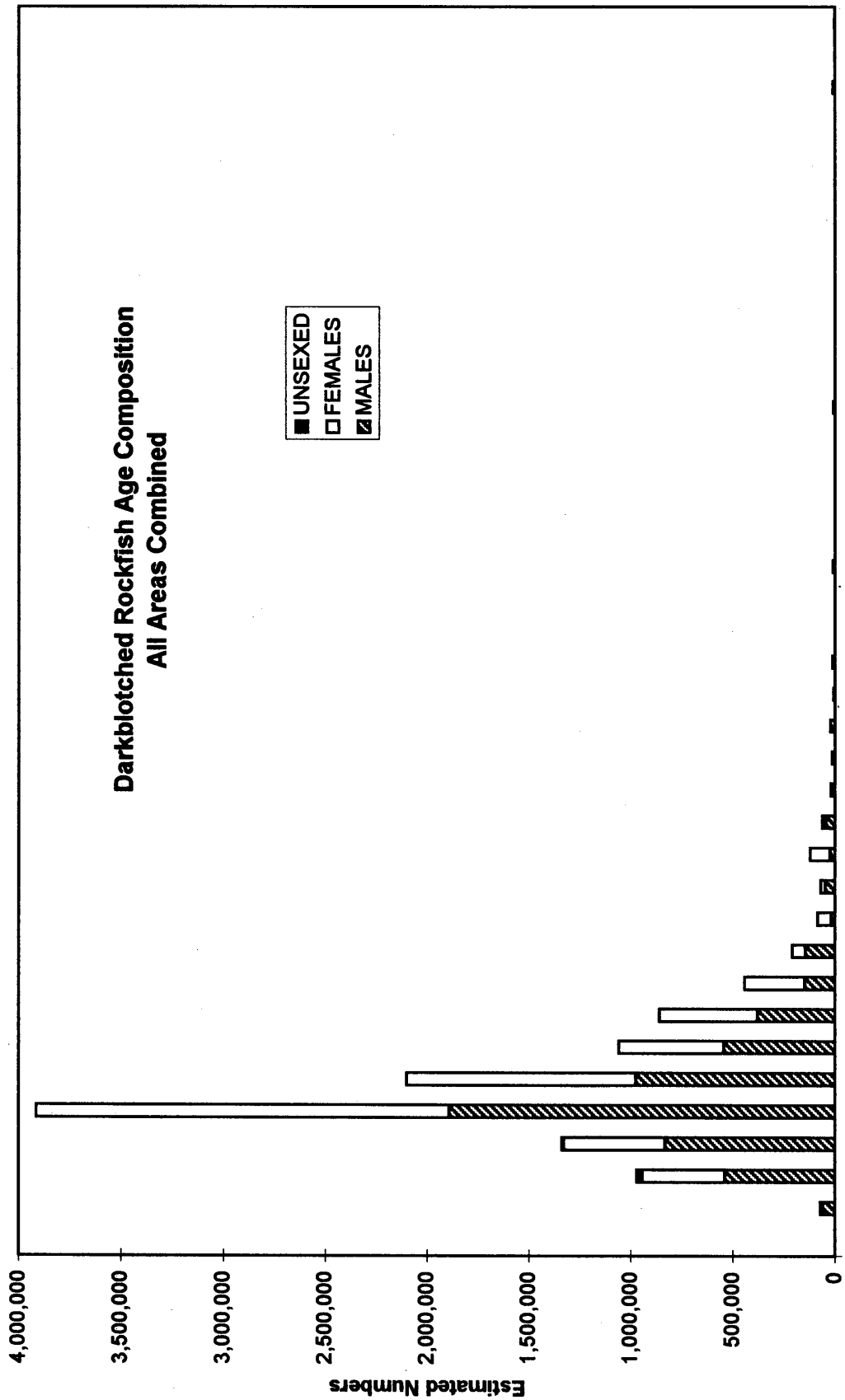

Figure 70.--The age composition of the darkblotched rockfish resource off California, Oregon, Washington, and British Columbia in 1998, based upon results of the National Marine Fisheries Service's triennial bottom trawl survey of groundfish resources.

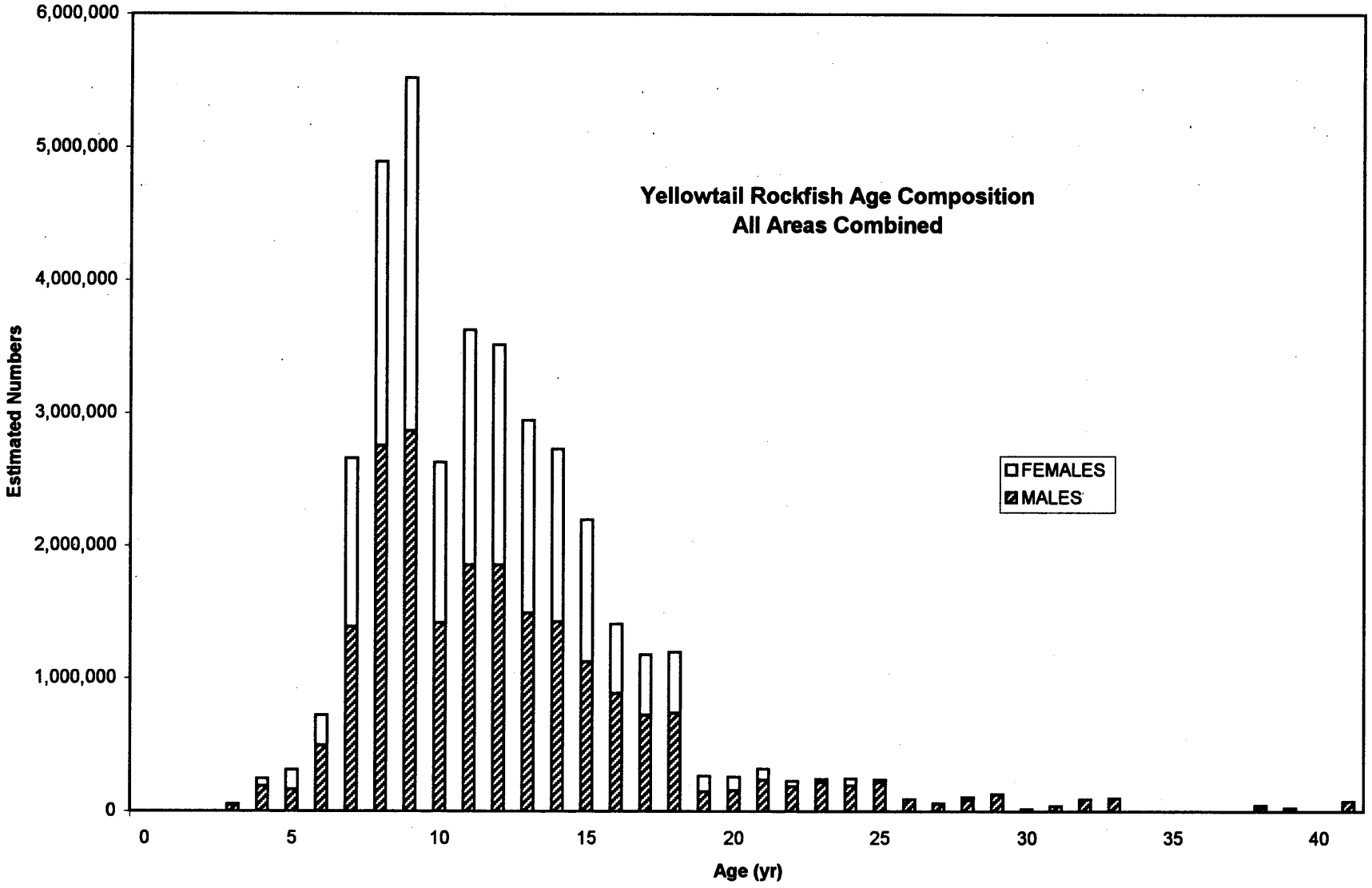

Figure 71.-- The age composition of the yellowtail rockfish resource off California, Oregon, Washington, and British Columbia in 1998, based upon results of the National Marine Fisheries Service's triennial bottom trawl survey of groundfish resources.

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