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Echo Integration-Trawl Survey of Pacific Whiting, *Merluccius productus*, off the West Coasts of the United States and Canada During July-September 1995

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U.S. DEPARTMENT OF COMMERCE
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ABSTRACT

Results are presented from the seventh triennial echo integration-trawl survey of Pacific whiting, *Merluccius productus,* along the west coasts of the United States and Canada. Areal coverage during the survey was more extensive than for earlier surveys both in increased effort offshore and to the north. The survey was conducted from 1 July to 1 September 1995, and extended along the Pacific coast from Point Conception, California, to Dixon Entrance, Alaska. Aggregations of Pacific whiting were detected throughout the study area, with the heaviest Pacific whiting echo sign observed off California near Point Arena and Cape Mendocino, off central Oregon, over Juan de Fuca Canyon near Cape Flattery, and off northern Vancouver Island. Trends in size composition for Pacific whiting exhibited a latitudinal cline over the study area, with larger fish generally more abundant in the northern areas. Over 75% of the population numbers and biomass was composed of the 1984, 1987, 1990, and 1993 year classes. The coastwide biomass for Pacific whiting was estimated at 1.39 million t, which was similar to earlier triennial acoustic survey biomass estimates. Acoustic backscattering was converted into abundance estimates using a target strength (TS) to length (L) model of TS = 20 Log L - 68 rather than the historically used model of TS = -35 dB/kg of fish. Justification for the use of the 20 Log L - 68 model is discussed, and estimates based on both models are compared.

CONTENTS

INTRODUCTION

Pacific whiting *(Merluccius productus)* is an important commercial marine fish off the west coast of North America, with annual harvests in excess of 200,000 metric tons (t) by U.S. and Canadian fishermen (Dorn 1996). To assess the distribution, numbers, and biomass of Pacific whiting along the-West Coast, echo integration-trawl (EIT) surveys have been conducted triennially since 1977 by the Alaska Fisheries Science Center (AFSC), National Marine Fisheries Service (NMFS), Seattle. The surveys are conducted during July-September when Pacific whiting movements are believed to be relatively localized since they are between a springtime northward feeding migration and an autumn southward migration to their spawning areas off southern California and Mexico (Nelson and Dark 1985). During the northward migration, the largest fish make the longest migrations; adults migrate as far as Vancouver Island, while juveniles generally remain off California (Dark et al. 1980, Bailey et al. 1982). Female Pacific whiting mature at an age of 3-4 years and a length of about 40 cm (Best 1963).

Estimates produced from the EIT survey results are used with other survey and catch data to assess the current population level (Methot 1989, Dorn 1996). An AFSC bottom trawl survey, conducted in the summer during the same years as the EIT survey, assesses the bottom component of the stock (Nelson and Dark 1985). Stock assessments before 1993 added abundance estimates derived from the bottom trawl and the EIT surveys. Subsequent modeling efforts have treated each survey time series separately in evaluating trends in the population and have considered estimates from the 1992 and 1995 EIT surveys as representing the best estimates of population

levels (Dorn 1996). This document summarizes the results of the seventh triennial west coast Pacific whiting EIT survey conducted during 1995.

METHODS

Sampling Equipment

The survey was conducted using the NOAA ship *Miller Freeman,* a 66 m stern trawler equipped for fisheries and oceanographic research. Acoustic data were collected with a Simrad EK500 quantitative echosounding system (Bodholt et al. 1989). Simrad 38 kHz and 120 kHz split-beam transducers were mounted on the bottom of the vessel's retractable centerboard, which was fully extended during all scientific operations. This positioned the transducers 9 m below the ocean surface. All results presented here are based on data collected with the 38 kHz transducer. System electronics were housed in a portable laboratory mounted on the vessel's weather deck. Data from the Simrad EK500 echosounder/receiver were processed using Simrad BI500 echo integration and target strength data analysis software (Foote et al. 1991) on a SUN workstation.

Midwater echo-sign was sampled using an Aleutian Wing 30/26 trawl (AWT), a full-mesh wing trawl constructed of nylon except for polyethylene towards the aft section of the body and the codend. The headrope and footrope both measured 81.7 m. Mesh sizes tapered from 3.25 m in the forward section of the net to 8.9 cm in the codend. The codend was fitted with a 3.2 cm mesh liner. The codend was also fitted with a 4.8 mm mesh liner during the first nine midwater

hauls of the survey. The AWT was fished with 82.4 m of 1.9 cm diameter 8 by 19 non-rotational dandylines, 455 kg tom weights on each side, and 5 m^2 "Fishbuster" doors (1,250 kg), except on three occasions (Hauls 80, 81, and 85) when 1.8 by 2.7 m steel V-doors (1,000 kg) were used.

A Methot trawl was used for sampling smaller organisms. The mouth of the Methot trawl is a rigid square frame with 2.3 m sides. A 1.83 m dihedral depressor modified from an Isaacs-Kidd midwater trawl was suspended below the frame. Mesh sizes were 2 by 3 mm in the main part of the net and 1 mm in the codend. The Methot trawl was attached to a single cable fed through a stern-mounted A-frame. The volume of water filtered was measured with a calibrated General Oceanics flow meter attached to the mouth of the net. A Marinovich trawl was used for one haul. Mesh sizes for this net measured 7.6 cm forward, 3.2 cm in the codend, and 3.2 mm in the codend liner. Headrope and footrope lengths were each 9.1 m, and the trawl was fished with the 1.8 m by 2.7 m steel-V doors.

Near-bottom echo-sign was primarily sampled with a nylon Nor'eastern (NNE) trawl except on three occasions when a modified poly Nor'eastern trawl (PNE) was used. Mesh sizes in the NNE and PNE ranged from 12.7 cm in the body to 8.9 cm in the intermediate section and codend. The codends were fitted with a 3.2 cm mesh liner. Headrope and footrope lengths for the NNE were 27.4 m and 32.0 m, respectively, and the footrope was equipped with 36 cm diameter roller gear. The NNE was fished with the "Fishbuster" doors. The PNE was used once. with the 1.8 m by 2.7 m steel V-doors (Haul 72) and twice with the "Fishbuster" doors (Hauls 77 and 79). The PNE headrope and footrope lengths were 27.2 m and 24.9 m, respectively, and the

footrope was equipped with 50.8 cm split tires in the bosom of the trawl and fitted with 45.7 cm rockhopper discs and steel bobbins along the wings.

All trawl hauls except for Methot tows were monitored with a WesMar "third wire" trawl sonar or a Furuno-wireless net sounder system attached to the headrope of the trawl. Vertical net opening, depth, and temperature at depth were measured. The AWT and NNE vertical mouth openings averaged 27 m and 6 m, respectively.

Water temperature and salinity profile data were collected with a Seabird conductivity/ temperature/depth (CTD) system. Temperature and depth profile data were collected during trawl hauls by attaching a micro-bathythermograph (MBT) to the trawl headropes or frame. Expendable bathythermograph (XBT) data were collected at several sites. An acoustic Doppler current profiler (RD Instruments) was slaved to the EK500 to avoid interference, and it operated continuously throughout the cruise. To avoid interference, the transmissions of the two systems were synchronized.

Sampling Techniques

The area of operations during the EIT survey extended along the west coast of North America from Point Conception, California, to Dixon Entrance, Alaska (Fig. 1). An exploratory survey effort on young-of-the-year Pacific whiting off Southern California also occurred during the survey but will be reported elsewhere (A. Hollowed, NMFS, NOM, 7600 Sand Point Way

NE, Seattle, WA 98115, pers. commun.). Areal coverage during the EIT survey was more extensive than for earlier surveys. There was increased effort offshore and to the north, particularly when compared to EIT surveys conducted prior to 1992. Echo integration data were collected along parallel transects with the exception of the first three transects, where a zig zag pattern was followed. Transects were spaced 18.5 km apart except in inshore waters near the U.S./Canada border where spacing was reduced to 9.3 km to more closely correspond to the survey pattern used by Canadian scientists, and off the Queen Charlotte Islands where spacing was increased to 27.8 km (Fig. 1). Depths at the near-shore end of transects were usually between 40 and 75 m, while the offshore extent often ended in waters deeper than 1,500 m. Transects were extended into deeper water when fish sign was found at or near the predetermined transect outer endpoints. Typical vessel speed was about 20-22 km/hour when running transects. Echo integration data were collected with a horizontal resolution of about 9 m and a vertical resolution of l-2 m.

Scientific operations were conducted 24 hours a day. Transects were run during daylight hours (about 15 hours per day). Nighttime hours were used on an opportunistic basis to collect Pacific whiting target strength data, to conduct trawl hauls on echo-sign observed during the day, to investigate aggregations of other midwater fishes and macrozooplankton, and to conduct other ancillary projects.

Trawl hauls were made on selected echo-sign to provide information on Pacific whiting and to identify the biological composition of associated fish and other organisms. Standard catch

sorting and enumeration procedures were used to process the catches (sensu Hughes 1976). Catches less than 900 kg were completely sorted, while larger catches were subsampled. Total weights and numbers were determined for all species. Pacific whiting were further subsampled to determine length composition by sex, as well as to collect stomachs, otoliths, and length-weight measurements of individual fish. Sexual maturity was determined by visual inspection using a 5-stage scale. Stomach samples were preserved in 10% formalin. Individual fish were weighed to the nearest 2 g on an electronic scale. Fork lengths of fish greater than 8 cm were measured to the nearest centimeter. Standard lengths of young-of-the-year Pacific whiting (<8 cm) were measured to the nearest millimeter.

CTD casts were made at selected trawl haul locations, and also at two or three stations on every second or third transect (0.2°-0.5° lat) during most of the survey. One station was located at the offshore end of the transect and the second was located over a nominal bottom depth of 400 m along the same transect. A third CTD cast was sometimes made between these two CTD stations.

Data Analysis

The echo integration data were examined for Pacific whiting sign between the transducer and within 0.5 m of the bottom, or within the upper 500-1,000 m when in deep water. Considerable quantities of small, non-whiting scatterers were typically encountered throughout much of the water column in the Monterey, Eureka, and Columbia International North Pacific

Fisheries Commission (INPFC) statistical areas. To avoid including significant quantities of non-whiting scatterers in biomass estimates, the acoustic volume backscattering (S_v) threshold value used for these regions was -58.5 dB. An S_v value of -69 dB was used for the more northerly areas, where small scatterers were less abundant. This was the same procedure that was applied to the 1992 west coast EIT Pacific whiting survey data (Dorn et al. 1994).

Absolute estimates of pollock abundance were derived from the echo-integration and trawl data in the following manner. All of the echo-integration data were initially partitioned into ten geographical-length sample strata based on the distributional patterns in the echo-integration data and size composition catch data. These strata segregated aggregations of Pacific whiting with similar size distributions. The mean area backscattering estimate attributed to Pacific whiting within each stratum was extrapolated to each sample stratum area. These estimates were scaled to age- and length-specific biomass and numbers using Pacific whiting size compositions, a length-weight relationship, age-length keys derived from trawl catches, and a previously derived relationship between target strength (TS) and fish length. (See following discussion on the selection of the most appropriate TS to fish length model.) Estimates of age- and length-specific biomass and numbers were then summed across sample strata to provide estimates for each INPFC area and a total coastwide estimate. Because few hauls were conducted inside of the 200 m depth contour off Vancouver Island (Fig. l), length data from that area were supplemented

with length data collected by Canadian scientists at or near the same time as our survey of that region'.

Target Strength

Target strength is a measure of acoustic reflectivity and is used to scale relative acoustic-based estimates of abundance to absolute abundance estimates. For previous Pacific whiting EIT surveys, a target strength value of -35 dB/kg was used to scale the echo-integration data. This value is based on a literature review of target strength measurements for gadoid species of similar size and shape to Pacific whiting (Dark et al. 1980). The analysis of *in situ* target strength data by Traynor (1996) however, suggests a target strength to length (L; in cm) relationship of TS = 20 log L - 68 (Fig. 2). Although more data are needed to confirm that the "best" relationship is 20 log L -68, this model is believed to be an improvement over the -35 dB/kg model. The slope term of the equation has a theoretical foundation and is generally accepted as appropriate (Foote 1987, MacClennan and Simmonds 1992). There is more uncertainty in the intercept value of -68 dB, which is based on nighttime measurements of dispersed fish and may not be appropriate for daytime aggregations of Pacific whiting with possibly different behavior and depth adaptations. There are also no measurements for Pacific whiting less than 40 cm. Unfortunately, attempts to collect additional target strength measurements during the 1995 survey were unsuccessful (see Target Strength Data Collection Section). Nevertheless, acoustic estimates for

'Data were supplied by M. Saunders, Pacific Biological Station, Department of Fisheries and Oceans, Nanaimo, British Columbia, Canada.

the 1995 survey were scaled to absolute estimates of abundance using the 20 log L - 68 relationship. Estimates based on both TS models for the 1992 and 1995 triennial EIT survey are presented in the Appendix for comparative purposes.

Acoustic System Calibration

The acoustic system was calibrated by suspending copper spheres with known backscattering characteristics below the transducer and measuring the acoustic returns following the procedure outlined by Foote et al. (1987). Sphere diameters were 60 and 23 mm for the 38 kHz and 120 kHz transducers, respectively. Split-beam target strength and echo-integration data were collected to describe acoustic gain parameters and transducer beam pattern characteristics. System gain parameters were adjusted to produce the echo-integration and target strength measurement values equivalent to the corresponding theoretical values for each sphere. Three system calibrations were completed (Table 1). The vessel was anchored fore and aft during the calibrations in Port Susan, Washington, and Kendrick Inlet, B.C., but was not anchored during the calibration near Santa Cruz Island, California. During the Santa Cruz Island calibration, only on-axis target strength measurements at 120 kHz were collected. The 120 kHz acoustic system exhibited a negative trend in target strength and volume backscattering (S,) gains with time, while the 38 kHz system remained stable (Table 1).

U.S./Canadian Acoustic Systems Comparison

An inter-ship comparison study of the scientific echosounding systems aboard the NOAA ship *Miller Freeman* and the Canadian research *vessel W.E. Ricker* was conducted during 19-22 August. Both a Biosonics 101 and a Simrad EK500 scientific acoustic system operated at 38 kHz aboard the Canadian vessel. Descriptions of these acoustic systems are available elsewhere (Cooke et al. in press; R. Kieser, Pacific Biological Station, Department Fisheries and Oceans, Nanaimo, pers. commun.). Acoustic data were collected along 24 east-west oriented transects in an area about 28 km northwest of Cape Flattery, Washington, (48°27.3'N, 125°09.3'W) and an area near Nootka Sound, B.C., (48°38.6'N, 125°58.7'W). Data from three transects were discarded because of equipment problems. Transects were 5.6 to 14.8 km in length and were conducted over bottom depths between 100 and 800 m. One vessel followed about 0.9 km directly astern of the other along each transect. The vessel taking the lead position changed after each pair of transects. Vessel speeds were about 1 l-l 5 km/hour.

Target Strength Data Collection

In situ target strength data were collected and nine hauls were made to verify the echo-sign on five different nights off the coast of northern Washington and Vancouver Island (Table 2).

RESULTS

Biological and Oceanographic Results

Data to describe the abundance and distribution of Pacific whiting were collected during 1 July to 1 September 1995, along the west coasts of the U.S. and Canada. About 7,000 km of acoustic transect lines were run during the survey (Fig. 1). A total of 78 midwater trawls and 17 bottom trawls (Fig. 1, Table 2) were conducted to identify echo-sign and collect biological data. Geographical boundaries of the areas used for the analysis of survey data are listed in Table 3.

Pacific whiting was the dominant fish species by weight and by number in the midwater and bottom trawls (Tables 4 and 5). Yellowtail rockfish *(Sebastes flavidus,* 2.4% of the total midwater catch by weight) and redstripe rockfish *(S. proriger,* 2.4%) were the most common bycatch species in the midwater trawls. Yellowtail rockfish were only caught in the Vancouver INPFC area, with 91.6% of the catch occurring in Haul 83. Virtually all the redstripe rockfish were caught in Hauls 44 (Oregon) and 92 (Dixon Entrance, AK), which contained 64.1% and 35.8%, respectively, of the total catch for that species. The most common bycatch species in the bottom trawl hauls were shortbelly rockfish (S. jordani, 5.7%), stripetail rockfish (S. saxicola, 4.6%) sablefish (Anoplopoma finzbria, 4.6%) redstripe rockfish (3.4%) and splitnose rocktish (S. diploproa, 2.0%). As with the midwater trawls, the major bycatch species caught in bottom trawls occurred mostly in 1 or 2 hauls. These hauls were located off California and Oregon. For shortbelly rockfish, 85.3% of the catch occurred in Haul 7. Stripetail rockfish were mostly caught

in Hauls 7 (42.2%) and 16 (39.7%), sablefish in Haul 35 (88.0%) redstripe rockfish in Haul 39 (97.6%), and splitnose rockfish in Hauls 7 (42.2%) and 42 (39.7%). Twenty-six Methot trawls were conducted on echo-sign believed to be primarily macrozooplankton (Fig. 3).

The physical oceanographic data consisted of 78 CTD, 4 XBT, and 141 MBT casts. Details pertaining to the CTD and XBT casts (e.g., time, location, associated trawl hauls) are listed in Tables 6-7 and Figure 4.

Pacific Whiting Distribution and Abundance

Aggregations of Pacific whiting were generally detected throughout the study area except in the extreme northern and southern areas. The heaviest Pacific whiting echo-sign was observed off California near Point Arena and Cape Mendocino, off central Oregon from 43º to 45ºN, in Juan de Fuca Canyon near Cape Flattery, and off northern Vancouver Island (Fig. 5). No echo-sign was attributed to Pacific whiting north of 5 1 °N or south of about 38°N. Although Pacific whiting were sometimes caught south of 38°N, the dominance of small scatterers in this area prevented identification of Pacific whiting echo-sign. The coastwide estimates of Pacific whiting abundance were 3.026×10^9 fish weighing 1.388×10^9 t.

Pacific whiting were observed over bottom depths of 50-1,500 m, although the density by bottom depth varied throughout the survey area. In the southernmost INPFC areas (Monterey, Eureka, and South Columbia), as well as in the Charlotte area, significant amounts of echo-sign

extended over bottom depths exceeding 1,000 m. In contrast, echo-sign in the North Columbia, U.S. Vancouver, and South Vancouver INPFC areas was primarily restricted to bottom depths less than 500 m.

Trends in size composition for Pacific whiting differed over the study area (Tables 8 and 9; Fig. 6). Smaller fish (≤ 40 cm) were generally more abundant in the southern areas, whereas larger, adult fish (>40 cm) were generally more abundant in the northern areas. The modal length for adult fish, for example, was 44 cm in the Monterey INPFC area, 46 cm in the Eureka INPFC area, 45 cm in the South and North Columbia INPFC areas, and 48 cm in the Vancouver and Charlotte INPFC areas, A similar latitudinal trend in length was not observed for l-year-old fish. Modal lengths were largest (28 cm) for 1-year-olds captured in the North Columbia and U.S. Vancouver INPFC areas, and smaller (25-26 cm) in other INPFC areas to the north and south.

Age-specific distributions for Pacific whiting exhibited similar patterns to those based on length data (Fig. 7; Tables 10 and 11). Age-l fish (1994 year class) were found in all areas except the Charlotte INPFC area. Age-l fish were also caught in several hauls conducted south of 38°N. Nearly 71% of the total estimated number of age-l fish were found in the Eureka and South Columbia INPFC areas. The distribution of 2-year-olds (1993 year class) was more localized. About two-thirds of the age-2 fish were located in the Monterey INPFC area, with most of the remainder found in the Eureka INPFC area (30%). Adult fish (age 3+) were present throughout the survey area. In terms of biomass, 2-year-old fish formed the dominant age class in the Monterey and Eureka INPFC areas, whereas 5-year-old fish (1990 year class) were dominant in

the Columbia INPFC areas and 11 -year-olds (1984 year class) were dominant in the areas north of the Columbia INPFC area. Eight-year-olds (1987 year class) were the second most abundant age class in all INPFC areas except Monterey and Eureka. Overall, over 75% of the population and biomass was composed of the 1984, 1987, 1990, and 1993 year classes.

Young-of-the-year Pacific whiting were caught in low numbers in five trawl hauls (Hauls 1-3, 5, 6) in the southern California region. Young-of-the-year Pacific whiting were also caught prior to the EIT survey during the exploratory survey for juvenile Pacific whiting. However, it was not possible to distinguish acoustic backscattering attributed to young-of-the-year Pacific whiting.

Target Strength Data

Catch data from hauls made during nights of *in situ* TS collections suggested that suitable target strength measurements could be collected for Pacific whiting. For example, Pacific whiting catches exhibited unimodal size distributions (not shown) for most of the TS hauls (i.e., hauls 71, 76-77, 80-8 1, 84-85). In addition, Pacific whiting made up 93-99% of the catch in numbers from all TS hauls. Post-cruise analysis of the *in situ* target strength data, however, indicated that targets from smaller scatterers other than Pacific whiting likely contaminated the TS data and invalidated the results. Unfortunately, no hauls were made with small mesh nets to verify the presence of “contaminant” scatterers (e.g., euphausiids) during these nights.

Canadian Acoustic Systems Comparison

Results from the inter-ship comparison indicated that area acoustic backscattering estimates (S,) averaged over each transect based on the Canadian Biosonics system were generally greater than those based on the U.S. Simrad system (Fig. 8). Because only a few comparisons occurred at large mean S_A values (i.e., mean S_A>2,500), transect data were reanalyzed to isolate areas along each transect that were characterized by high-density scattering. Mean $S_A$values were determined using only these "high-density" portions of the transects. This increased the number of comparisons for large S_A values (Fig. 9). The zero-intercept regression equation that was fitted using least squares to the reanalyzed S_A estimates between the U.S. Simrad (US) and Canadian Biosonics (CanBS) systems was CanBS=l.46*US (r^2=0.58), whereas for the U.S. and Canadian Simrad (CanEK) systems, the fitted equation was CanEK=O,89*US (r^2=0.63). The fitted zero-intercept regression for the two Canadian systems was CanEK=0.59*CanBS (not shown, r^2=0.94). (Abundance estimates from the Canadian survey conducted during July-September were based on the Biosonics sounder because the newly acquired Simrad sounder was undergoing field trials by the Canadian scientists at the time [R. Kieser, Pacific Biological Station, Department Fisheries and Oceans, Nanaimo, pers. commun.])

DISCUSSION

Comparison of abundance trends based on the triennial EIT survey results for Pacific whiting is difficult because of different areal coverage northward and offshore. For example, the

1983, 1986, and 1989 surveys only sampled seaward to about the 366 m depth contour, while the 1977 and 1980 surveys generally remained inside of the 458 m depth contour. Previous to 1992, the northern limit of the surveys ranged from 48° 15'N (in 1983) to 50°N (in 1977, 1980, and 1989). Dorn (1996) however, provides a time series of adjusted biomass estimates for the entire survey history by scaling the 1977-89 survey results to account for differences in areal coverage, as well as adjusting these results to reflect the use of a 20 log L - 68 target strength relationship. These adjusted coastwide biomass estimates based on the triennial EIT survey results do not exhibit any dramatic trends between 1977 and 1995 (Fig. 10). The largest change in biomass during the time series occurred between 1983 and 1986.

The distribution of l-year-old fish extended farther to the north during the present survey than that reported in previous surveys (Fig. 11). In the past, no 1-year-olds were detected in the Vancouver areas and only minimal amounts were reported in the Columbia areas. The previous EIT surveys were not conducted during years when strong year classes of Pacific whiting (i.e., the 1977, 1980, 1984, and 1987 year classes) were present as 1-year-olds. However, there is not enough evidence at this time to assess the relative magnitude of the 1994 year class, and whether the distribution pattern of these 1-year-olds is a result of year-class strength or the result of other biological and physical factors acting upon the population.

A significantly higher proportion of the biomass was observed off the U.S. coast than off Canada in 1995 compared to 1992. In 1995, 85% of the biomass was observed in U.S. waters, whereas 62% was observed in 1992. It is unlikely that large quantities of Pacific whiting were

missed by the survey in Canadian waters. Concurrent with the U.S. survey, Canadian scientists conducted survey operations in two additional areas not covered by the United States (R. Kieser, Pacific Biological Station, Department Fisheries and Oceans, Nanaimo, pers. commun.). Approximately 30-40,000 t of Pacific whiting were found by the Canadians in Goose Island Gully in Queen Charlotte Sound, and no Pacific whiting were reported from their transects in Hecate Strait.

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Table 1 .--Summary of sphere calibrations associated with the 1995 Pacific whiting echo integration-trawl survey of the U.S. and Canadian west coasts. TS represents target strength and Sv represents volume backscattering.

Date	Location	Freq (kHz)	Water temp (deg. C) At transducer*	Water temp (deg. C) At sphere	Sphere range from transducer (m)	Gain (dB) TS	Gain (dB) S_V	3dB beam width (deg.)	Angle offset Along	Angle offset Athwart
2 Jul	Port Susan, WA	38	11.6	9.4	26.9	27.4	27.2	7.11	-0.14	-0.06
		120	11.6	9.9	22.2	25.9	25.8	9.12	-0.75	-0.20
8 Jul	Santa Cruz Is., CA	120	16.4	11.7	21.3	25.6				
22 Aug	Kendrick Inlet, BC	38	14.0	10.6	27.5	27.3	27.3	7.15	-0.12	-0.05
		120	14.0	11.1	22.8	25.4	25.4	9.24	-0.83	-0.39

*The transducer was located approximately 9 m below the surface.

Note: Gain and beam pattern terms are defined in the "Operator Manual for Simrad EK500 Scientific Echo Sounder (1993)" available from Simrad Subsea A/S , Standpromenaden 50, P.O. Box 111 N-3 191 Hot-ten, Norway.

Table 2.--Summary of trawl stations and catch data from the 1995 Pacific whiting echo integration-trawl survey of the U.S. and Canadian west coasts.

Haul	INPFC	Gear	Date	Time	Start Position		Depth (m)		Temp. (deg. C)		P. whiting (>80 mm)		
No.	area'	type2	(1995)	(GM-0	Latitude (N)	Longitude (W)	Gear	Bottom	Gear	Surface	(kg)	Numbers	Other (kg)
1	CON	A	11 Jul	1653-1726	35 17.35	121 01.50	198	234	8.8	13.6	1.2	13	4.0
2	MON	A	12 Jul	0516-0546	35 47.76	121 31.22	369	477	7.2	12.1	34.1	181	13.6
3	MON	B	12 Jul	0856-0905	35 46.75	121 27.57	111	111	9.5	12.1	41.7	386	21.4
4	MON	A	12 Jul	1020-1026	35 47.48	121 28.36	107	140	9.3	11.3	3,039.0	32,434	--
5	MON	A	13 Jul	0029-0048	36 16.92	122 06.64	118	574	9.4	13.2	--	--	1.2
6	MON	A	14 Jul	0646-0711	37 07.61	122 42.81	77	165	9.4	15.1	2.7	16	4.6
7	MON	B	14 Jul	0953-1008	37 07.78	122 42.72	220	220	8.1	15.1	20.6	49	1,040.4
8	MON	A	14 Jul	2040-2100	37 38.02	123 06.24	186	659	8.2	13.3	--	--	0.7
9	MON	A	15 Jul	1034-1150	37 48.19	123 31.75	334	2,250	6.9	14.6	221.9	775	27.1
10	MON	A	16 Jul	0243-0255	38 08.17	123 30.48	157	571	8.4	12.9	138.7	544	65.5
11	MON	A	16 Jul	0531-0551	38 07.88	123 27.66	224	336	8.2	12.9	9,758.4	35,162	218.6
12	MON	A	16 Jul	1317-1327	38 08.47	123 31.29	396	582	6.7	12.9	664.4	2,213	2.6
13	MON	A	16 Jul	1927-1929	38 28.15	123 35.82	199	210	8.3	13.2	7,985.5	31,266	177.5
14	MON	A	17 Jul	0612-0632	38 48.12	123 59.86	366	1,474	6.8	14.8	493.4	1,623	9.3
15	MON	A	17 Jul	1958-2002	39 18.20	123 59.08	297	380	7.4	11.8	905.6	3,380	1.4
16	MON	B	22 Jul	0208-0223	39 47.67	124 04.56	248	247	8.0	14.9	96.6	233	274.9
17	MON	A	22 Jul	0422-0442	39 47.55	124 05.23	256	413	8.0	14.9	3,408.5	12,909	128.5
18	MON	A	22 Jul	0830-0905	39 47.83	123 56.76	124	139	8.3	13.4	3.6	7	43.1
19	MON	A	23 Jul	0249-0319	40 17.11	125 03.82	300	1,187	6.3	16.6	89.1	166	55.7
20	MON	A	23 Jul	0812-0842	40 18.88	124 36.02	309	1,371	7.1	12.4	1,748.1	6,169	16.0
21	EUR	A	23 Jul	1811-1812	40 38.42	124 34.35	281	948	7.7	15.3	5,436.2	17,975	5.8
22	EUR	B	24 Jul	0310-0317	40 48.15	124 28.47	295	295	7.4	14.2	63.0	113	231.7
23	EUR	B	25 Jul	0747-0802	41 27.53	124 28.26	170	170	7.8	14.4	185.0	527	14.0
24	EUR	B	25 Jul	1126-1141	41 38.16	124 27.95	189	189	7.9	14.0	125.3	289	11.5
25	EUR	A	25 Jul	2103-2111	41 47.39	125 03.83	239	1,344	6.9	14.2	1,469.4	3,288	27.6
26	EUR	A	27 Jul	0214-0229	42 07.85	124 35.54	205	212	7.7	14.2	982.0	6,485	16.0
27	EUR	A	27 Jul	0405-0420	42 09.90	124 42.08	106	554	7.9	14.3	--	--	28.1
28	EUR	A	27 Jul	1133-1217	42 30.74	125 15.46	87	3,129	8.9	17.6	--	--	20.2
29	EUR	A	27 Jul	1847-1855	42 37.78	124 42.64	207	244	7.6	12.7	2,494.0	4,986	<0.1
30	COL	A	28 Jul	1952-2001	43 07.26	124 51.87	272	330	6.9	17.2	1,234.1	2,395	12.9
31	COL	A	29 Jul	1825-1840	43 27.76	124 53.97	240	700	7.4	15.4	2,883.5	5,323	14.5
32	COL	A	30 Jul	0034-0045	43 37.53	124 30.06	142	156	7.7	14.2	3,213.6	5,969	6.4
33	COL	A	30 Jul	1531-1550	43 48.09	125 08.47	263	1,461	6.8	15.6	1,156.0	2,148	--

Table 2.--Continued.

Haul	INPFC	Gear	Date	Time	Start Position		Depth (m)		Temp. (deg. C)		P. whiting (>80 mm)		
No.	area[1]	type[2]	(1995)	(GMT)	Latitude (N)	Longitude (W)	Gear	Bottom	Gear	Surface	(kg)	Numbers	Other (kg)
34	COL	A	30 Jul	2359-0001	43 56.66	124 36.76	178	184	7.4	13.3	4,525.8	8,878	9.2
35	COL	B	31 Jul	1036-1051	43 58.33	124 57.50	283	283	6.6	13.3	34.0	60	544.3
36	COL	A	1 Aug	0717-0802	44 16.71	124 55.58	129	470	7.3	12.4	3,438.9	6,365	2.1
37	COL	A	1 Aug	1045-1115	44 16.37	124 47.33	113	131	7.3	13.2	2,740.0	4,732	19.0
38	COL	A	2 Aug	0411-0441	44 37.13	124 46.95	190	325	7.4	13.0	202.2	350	0.8
39	COL	B	2 Aug	0648-0703	44 39.19	124 43.63	145	145	7.5	12.3	8.0	18	545.7
40	COL	B	2 Aug	1633-1638	44 46.83	124 32.19	187	187	7.2	11.3	130.5	1,080	0.2
41	COL	A	3 Aug	0551-0621	45 07.45	124 16.55	120	174	7.2	11.7	346.8	1,943	<0.1
42	COL	B	3 Aug	0913-0048	45 07.31	124 29.31	365	365	5.7	14.3	29.7	53	321.6
43	COL	A	3 Aug	1457-1516	45 18.56	124 15.94	149	174	7.1	13.3	3,225.8	27,828	1.2
44	COL	A	3 Aug	2353-2359	45 27.65	124 23.56	192	196	7.0	14.9	530.2	1,451	1737.3
45	COL	A	4 Aug	0404-0435	45 27.26	124 16.08	63	164	8.1	15.3	91.6	470	2.4
46	COL	A	4 Aug	0729-0814	45 28.05	124 39.30	218	477	6.8	15.7	144.1	243	6.6
47	COL	B	4 Aug	2335-2341	45 47.41	124 11.06	109	109	7.3	13.3	485.7	789	11.2
48	COL	A	5 Aug	0240-0300	45 38.35	124 12.63	108	121	7.1	12.9	3,378.1	5,766	249.9
49	COL	A	5 Aug	0759-0829	45 08.01	124 30.19	168	362	7.2	14.5	56.7	96	1.1
50	COL	A	5 Aug	1104-1134	44 57.99	124 33.90	208	438	6.9	15.1	116.8	196	1.0
51	COL	A	5 Aug	1502-1523	44 51.40	124 21.90	141	149	7.4	11.3	1,664.6	2,764	104.4
52	COL	B	5 Aug	1811-1824	44 57.30	124 18.20	155	155	6.9	11.4	61.2	568	1.1
53	COL	A	5 Aug	2105-2114	45 09.76	124 15.51	139	149	7.2	12.0	946.0	10,712	11.0
54	COL	A	6 Aug	0054-0124	45 25.07	124 28.83	247	422	6.5	16.7	603.8	1,045	86.8
55	COL	A	6 Aug	1008-1038	45 56.87	124 33.78	74	148	8.2	14.4	427.0	722	1.6
56	COL	A	7 Aug	1556-1600	46 28.00	124 31.74	243	389	6.4	13.9	556.6	1,001	19.8
57	COL	A	7 Aug	2145-2208	46 37.74	124 26.30	93	103	7.3	12.7	453.4	761	120.1
58	COL	A	8 Aug	0405-0426	46 49.38	124 47.18	89	156	7.5	12.7	377.2	639	1.3
59	COL	B	8 Aug	0540-0555	46 50.20	124 49.85	168	168	6.7	12.6	14.3	24	64.4
60	COL	B	8 Aug	2127-2133	46 58.14	124 35.75	95	95	7.1	13.0	1,065.1	1,774	4.9
61	COL	A	9 Aug	0052-0122	46 58.37	125 02.06	178	805	6.9	14.1	339.4	595	240.5
62	COL	A	13 Aug	2046-2054	47 18.09	124 43.68	118	133	7.4	15.1	2828.2	10,477	255.8
63	VAN	A	14 Aug	1513-1519	47 38.98	124 48.32	89	92	7.2	12.3	2443.5	4,497	23.5
64	VAN	A	14 Aug	2041-2110	47 37.84	125 25.10	234	1,099	6.6	15.0	298.3	468	2.3
65[T]	VAN	A	15 Aug	0517-0547	47 47.42	124 57.40	96	113	7.2	13.1	2,206.4	3,606	13.5
66[T]	VAN	A	15 Aug	1050-1120	47 47.80	124 57.45	93	121	7.2	13.1	827.9	1,471	45.1
67	VAN	A	15 Aug	1659-1710	47 59.18	125 06.87	130	140	7.0	14.4	1,607.2	2,362	393.8

Table 2.--Continued.

Haul No.	INPFC area[1]	Gear type[2]	Date (1995)	Time (GMT)	Start Position		Depth (m)		Temp. (deg. C)		P. whiting (>80 mm)		
					Latitude (N)	Longitude (W)	Gear	Bottom	Gear	Surface	(kg)	Numbers	Other (kg)
68	VAN	A	16 Aug	1105-1140	48 08.96	125 35.56	123	160	7.8	15.6	373.7	322	10.9
69	VAN	A	16 Aug	1558-1600	48 08.20	125 08.48	165	253	6.8	14.9	690.4	1,402	<0.1
70	VAN	A	17 Aug	0206-0209	48 23.75	125 01.55	119	179	6.8	11.9	2,584.7	3,528	30.3
71[T]	VAN	A	18 Aug	0947-1007	48 31.10	124 42.53	91	218	7.9	10.5	591.3	782	27.2
72	VAN	P	19 Aug	0301-0311	48 44.18	125 35.56	188	188	7.2	11.6	810.6	984	137.1
73	VAN	A	20 Aug	1626-1641	48 38.26	126 00.81	100	112	7.7	14.7	0.9	1	51.1
74	VAN	A	20 Aug	1828-1903	48 39.25	125 55.88	96	103	7.7	14.5	--	--	750.0
75	VAN	A	21 Aug	0412-0429	48 48.09	126 35.39	273	450	5.9	16.2	718.1	994	0.9
76[T]	VAN	A	22 Aug	0750-0820	49 19.77	127 04.33	95	168	7.4	14.5	379.8	538	54.3
77[T]	VAN	P	22 Aug	1029-1044	49 19.76	127 08.79	189	189	6.4	14.3	80.2	110	168.4
78	VAN	A	23 Aug	1556-1608	49 08.26	126 56.53	233	329	6.3	14.3	1,805.5	2,665	4.5
79	VAN	P	23 Aug	2005-2014	49 08.22	126 28.05	119	119	6.8	14.8	3,465.6	9,594	14.5
80[T]	VAN	A	24 Aug	0722-0747	49 17.83	127 02.95	109	172	7.1	14.3	609.6	842	83.4
81[T]	VAN	A	24 Aug	1136-1206	49 17.75	127 02.49	119	166	7.3	14.7	238.2	312	13.3
82	VAN	A	24 Aug	2046-2056	49 38.06	127 27.34	271	660	6.1	15.2	2,217.1	3,053	12.9
83	VAN	A	25 Aug	1505-1515	49 58.02	127 50.23	127	577	7.0	14.8	8,219.6	11,048	3,570.4
84[T]	VAN	A	26 Aug	0249-0250	50 16.06	128 15.15	161	902	6.8	14.7	902.6	1,145	112.4
85[T]	VAN	A	26 Aug	0814-0842	50 15.72	128 15.13	118	495	7.7	14.7	412.0	513	6.2
86	CHAR	A	27 Aug	0200-0217	50 38.04	128 48.38	194	241	6.4	15.2	43.6	58	796.4
87	CHAR	A	27 Aug	0359-0424	50 38.10	128 51.66	433	821	5.4	15.3	24.7	30	37.9
88	CHAR	A	27 Aug	1820-1830	50 48.12	129 29.26	256	1,096	5.9	14.6	276.1	345	17.1
89	CHAR	A	28 Aug	0057-0127	50 58.08	129 45.49	261	974	6.0	15.4	890.2	1,103	155.8
90	CHAR	A	29 Aug	1822-1837	53 10.28	132 56.75	83	734	8.3	14.9	--	--	--
91	CHAR	A	30 Aug	0139-0209	53 40.31	133 09.88	154	181	6.9	15.0	--	--	1.6
92	SE	A	30 Aug	2153-2206	54 34.61	133 58.63	209	221	5.5	14.1	--	--	1,065.8
93	SE	A	31 Aug	0042-0055	54 45.66	133 58.70	132	207	6.5	13.9	--	--	4.7
94	SE	A	31 Aug	1744-1749	54 49.90	133 20.30	137	158	6.7	11.6	--	--	0.7
95	SE	M	1 Sep	0258-0313	54 49.16	133 20.02	131	152	6.5	11.7	--	--	1.5

[1] CON=Conception, MON=Monterey, EUR=Eureka, COL=Columbia, VAN = Vancouver, CHAR = Charlotte, SE = Southeastern

[2] A = Aleutian wing trawl, B = nylon Nor'eastern bottom trawl, P = polyethylene Nor'eastern bottom trawl, M = Marinovich trawl

[T]Target strength data collection haul.

Table 3.--Geographical areas used during the analysis of the 1995 West Coast Pacific whiting survey.

INPFC area	Subarea*	Boundaries	
		Southern	Northern
Conception		32°30'	35°30'
Monterey		35°30'	40°30'
Eureka		40°30'	43°00'
Columbia		43°00'	47°30'
	South Columbia	43°00'	45°46'
	North Columbia	45°46'	47°30'
Vancouver		47°30'	50°30'
	U.S. Vancouver	47°30'	US/Canada border
	South Vancouver	US/Canada border	49°00'
	North Vancouver	49°00'	50°30'
Charlotte		50°30'	54°30'

*Subareas used in analyses by Dorn et al. (1994).

Table 4.--Summary of catch by species from 77 Aleutian Wing and 1 Marinovich mid-water trawl hauls conducted during the 1995 Pacific whiting echo integration-trawl survey of the U.S. and Canada west coasts.

Common Name	Scientific Name	Weight (kg)	Percent	Numbers
Pacific whiting	*Merluccius productus*	102,987.7	90.3	303,874
Yellowtail rockfish	*Sebastes flavidus*	2,734.6	2.4	2,125
Redstripe rockfish	*Sebastes proriger*	2,710.6	2.4	5,383
Jack mackerel	*Trachurus symmetricus*	1,313.2	1.2	1,456
Chum mackerel	*Scomber japonicus*	1,247.6	1.1	2,241
Widow rockfish	*Sebastes entomelas*	1,162.2	1.0	761
Yellowmouth rockfish	*Sebastes reedi*	560.5	0.5	391
Spiny dogfish	*Squalus acanthias*	275.7	0.2	574
Shortbelly rockfish	*Sebastes jordani*	177.9	0.2	896
Chilipepper	*Sebastes goodei*	169.8	0.1	184
Chinook salmon	*Oncorhynchus tshawytscha*	124.1	0.1	46
Pacific herring	*Clupea pallasi*	93.6	0.1	1,884
King-of-the-salmon	*Trachipterus altivelis*	79.3	0.1	26
Jellyfish unidentified	Scyphozoa	52.7	<0.1	33
Pacific ocean perch	*Sebastes alutus*	52.1	<0.1	54
Silvergray rockfish	*Sebastes brevispinis*	43.7	<0.1	15
Lanternfish unidentified	Myctophidae	36.8	<0.1	7,866
Bocaccio	*Sebastes paucispinis*	34.2	<0.1	8
Pink salmon	*Oncorhynchus gorbuscha*	21.4	<0.1	13
Longnose skate	*Raja rhina*	21.0	<0.1	2
Soupfin shark	*Galeorhinus zyopterus*	17.5	<0.1	1
Rougheye rockfish	*Sebastes aleutianus*	15.6	<0.1	11
Squid unidentified	Teuthoida	15.4	<0.1	330
California market squid	*Loligo opalescens*	14.8	<0.1	714
Arrowtooth flounder	*Atheresthes stomias*	13.4	<0.1	4
Brown cat shark	*Apristurus brunneus*	10.6	<0.1	17
Lingcod	*Ophiodon elongatus*	9.0	<0.1	2
Robust blacksmelt	*Bathylagus milleri*	6.4	<0.1	144
Salps unidentified	Thaliacea	5.4	<0.1	31
Medusa fish	*Icichthys lockingtoni*	5.3	<0.1	6
Pacific sardine	*Sardinops sagox*	4.8	<0.1	25
Coho salmon	*Oncorhynchus kisutch*	3.9	<0.1	2
American shad	*Alosa sapidissima*	3.1	<0.1	5
Stripetail rockfish	*Sebastes saxicola*	3.0	<0.1	10
Euphausiid unidentified	Euphausiacea	2.5	<0.1	0
English sole	*Pleuronectes vetulus*	2.2	<0.1	8
Skate unidentified	Rajidae	2.2	<0.1	1
Pacific pomfret	*Brama japonica*	1.9	<0.1	2
Sablefish	*Anoplopoma fimbria*	1.2	<0.1	5
Shrimp unidentified	Natantia	1.1	<0.1	556

Table 4.--Continued.

Common Name	Scientific Name	Weight (kg)	Percent	Numbers
Splitnose rockfish	*Sebastes diploproa*	1.1	<0.1	2
Sergestid shrimp unidentified	Sergestes sp.	1.0	<0.1	142
Flying squid	*Ommastrephes bartrami*	0.9	<0.1	18
Pandalid shrimp unidentified	Pandalidae	0.9	<0.1	138
Sharpchin rockfish	*Sebastes zacentrus*	0.7	<0.1	1
Squid unidentified	Gonatus sp.	0.6	<0.1	102
Filetail cat shark	*Parmaturus xaniurus*	0.6	<0.1	1
Blue lanternfish	*Tarletonbeania crenularis*	0.5	<0.1	271
Ocean shrimp	*Pandalus jordani*	0.4	<0.1	145
California smoothtongue	*Leuroglossus stilbius*	0.4	<0.1	79
Magistrate armhook squid	*Berryteuthis magister*	0.3	<0.1	20
Pallid eelpout	*Lycodapus mandibularis*	0.3	<0.1	14
California lanternfish	*Symbolophorus californiensis*	0.3	<0.1	7
Eulachon	*Thaleichthys pacificus*	0.3	<0.1	9
Viperfish unidentified	Chauliodontidae	0.2	<0.1	16
Walleye pollock	*Theragra chalcogramma*	0.2	<0.1	74
Slender barracudina	*Lestidiops ringens*	0.2	<0.1	9
Invertebrate unidentified		0.2	<0.1	4
White bait smelt	*Allosmerus elongatus*	0.2	<0.1	10
Prowfish	*Zaprora silenus*	0.2	<0.1	1
Slender sole	*Eopsetta exilis*	0.1	<0.1	5
Rex sole	*Errex zachirus*	0.1	<0.1	1
Shining loosejaw	*Aristostomias scintillans*	0.1	<0.1	2
Plainfin midshipman	*Porichthys notatus*	0.1	<0.1	1
Longfin dragonfish	*Tactostoma macropus*	0.1	<0.1	7
Spotted cusk-eel	*Chilara taylori*	0.1	<0.1	1
Pacific viperfish	*Chauliodus macouni*	0.1	<0.1	4
Chiroteuthid squid	*Chiroteuthis calyx*	<0.1	<0.1	1
Bigfin eelpout	*Lycodes cortezianus*	<0.1	<0.1	1
Highsnout bigscale	*Melamphaes lugubruis*	<0.1	<0.1	4
Comb jelly unidentified	Ctenophora	<0.1	<0.1	16
Fish larvae unidentified	Pisces	<0.1	<0.1	82
Longfin sanddab	*Citharichthys xanthostigma*	<0.1	<0.1	1
Blackbelly eelpout	*Lycodopsis pacifica*	<0.1	<0.1	1
Hatchetfish unidentified	Sternoptychidae	<0.1	<0.1	6
Flatfish larvae unidentified	Pleuronectiformes	<0.1	<0.1	31
Rockfish unidentified	Sebastes sp.	<0.1	<0.1	41
Eel larvae unidentified	Leptocephalus Unidentified	<0.1	<0.1	1
Amphipod unidentified	Amphipoda	<0.1	<0.1	2
Totals		114,048.0		321,847

Table 5.--Summary of catch by species from 17 bottom trawl hauls conducted during the 1995 Pacific whiting echo integration-trawl survey of the U.S. and Canadian west coasts.

Common Name	Scientific Name	Weight (kg)	Percent	Numbers
Pacific whiting	*Merluccius productus*	6,717.1	66.9	16,652
Shortbelly rockfish	*Sebastes jordani*	572.2	5.7	3,328
Stripetail rockfish	*Sebastes saxicola*	464.0	4.6	4,984
Sablefish	*Anoplopoma fimbria*	457.1	4.6	157
Redstripe rockfish	*Sebastes proriger*	338.8	3.4	1,488
Splitnose rockfish	*Sebastes diploproa*	204.3	2.0	700
Jellyfish unidentified	Scyphozoa	176.6	1.8	--
Dover sole	*Microstomus pacificus*	159.7	1.6	551
Sharpchin rockfish	*Sebastes zacentrus*	132.8	1.3	813
Stony coral unidentified	Madreporaria	106.0	1.1	--
Rex sole	*Errex zachirus*	91.6	0.9	628
Canary rockfish	*Sebastes pinniger*	69.7	0.7	34
Shortspine thornyhead	*Sebastolobus alascanus*	62.2	0.6	579
Bocaccio	*Sebastes paucispinis*	42.9	0.4	56
Arrowtooth flounder	*Atheresthes stomias*	39.5	0.4	35
Pacific halibut	*Hippoglossus stenolepis*	37.8	0.4	3
Longnose skate	*Raja rhina*	27.6	0.3	23
Spotted ratfish	*Hydrolagus colliei*	27.5	0.3	49
Pacific ocean perch	*Sebastes alutus*	26.4	0.3	43
Rougheye rockfish	*Sebastes aleutianus*	26.3	0.3	14
Yellowtail rockfish	*Sebastes flavidus*	21.5	0.2	17
Widow rockfish	*Sebastes entomelas*	19.6	0.2	13
Darkblotched rockfish	*Sebastes crameri*	18.6	0.2	21
Pacific sanddab	*Citharichthys sordidus*	15.7	0.2	251
Lingcod	*Ophiodon elongatus*	14.9	0.1	4
Jack mackerel	*Trachurus symmetricus*	13.8	0.1	15
Flathead sole	*Hippoglossoides elassodon*	13.0	0.1	46
Greenstriped rockfish	*Sebastes elongatus*	11.4	0.1	38
English sole	*Pleuronectes vetulus*	10.1	0.1	32
Pacific cod	*Gadus macrocephalus*	9.6	0.1	7
Brown cat shark	*Apristurus brunneus*	9.4	0.1	12
Redbanded rockfish	*Sebastes babcocki*	8.9	0.1	8
American shad	*Alosa sapidissima*	8.9	<0.1	17
Starfish unidentified	Echinodermata	8.5	0.1	12
Shortraker rockfish	*Sebastes borealis*	7.4	0.1	2
Heart urchin unidentified	Echinoidea	7.4	0.1	317
Slender sole	*Eopsetta exilis*	7.1	0.1	113
Silvergray rockfish	*Sebastes brevispinis*	6.2	0.1	4
Spiny dogfish	*Squalus acanthias*	5.8	0.1	40
Cowcod	*Sebastes levis*	5.8	0.1	4
Rosethorn rockfish	*Sebastes helvomaculatus*	4.3	<0.1	24
Ocean shrimp	*Pandalus jordani*	3.7	<0.1	517
Chilipepper	*Sebastes goodei*	3.5	<0.1	5
Yelloweye rockfish	*Sebastes ruberrimus*	2.8	<0.1	1
Sponge unidentified	Porifera	2.8	<0.1	3

Table 5 .--Continued.

Common Name	Scientific Name	Weight (kg)	Percent	Numbers
Eelpout unidentified	Zoarcidae	2.5	<0.1	54
Bigfin eelpout	*Lycodes cortezianus*	2.5	<0.1	26
Sea urchin unidentified	Echinoidea	2.0	<0.1	48
Pacific electric ray	*Torpedo californica*	1.9	<0.1	1
Squid unidentified	Teuthoida	1.9	<0.1	2
Chub mackerel	*Scomber japonicus*	1.5	<0.1	5
Big skate	*Raja binoculata*	1.5	<0.1	4
Petrale sole	*Eopsetta jordani*	1.5	<0.1	3
Sea cucumber unidentified	Holothuroidea	1.3	<0.1	14
Black eelpout	*Lycodes diapterus*	1.0	<0.1	18
Sea anemone unidentified	Actiniaria	1.0	<0.1	2
Blackbelly eelpout	*Lycodopsis pacifica*	0.8	<0.1	18
Spot shrimp	*Pandalus platyceros*	0.8	<0.1	15
Sidestripe shrimp	*Pandalopsis dispar*	0.7	<0.1	47
California market squid	*Loligo opalescens*	0.6	<0.1	14
Spotted cusk-eel	*Chilara taylori*	0.5	<0.1	4
Plainfin midshipman	*Porichthys notatus*	0.5	<0.1	4
Octopus unidentified	Octopoda	0.4	<0.1	2
Fuzzy crab	*Acantholithodes hispidus*	0.4	<0.1	2
Sea mouse unidentified	Aphroditidae	0.4	<0.1	7
Pacific staghorn sculpin	*Leptocottus armatus*	0.4	<0.1	2
Cushion starfish	*Pteraster tesselatus*	0.3	<0.1	1
Pandalid shrimp unidentified	Pandalidae	0.3	<0.1	38
Brown box crab	*Lopholithodes foraminatus*	0.3	<0.1	1
Pacific herring	*Clupea pallasi*	0.2	<0.1	1
Eulachon	*Thaleichthys pacificus*	0.2	<0.1	3
Tunicate unidentified	Ascidiacea	0.2	<0.1	6
Box crab unidentified	Lopholithodes sp.	0.2	<0.1	1
Pink seaperch	*Zalembius rosaceus*	0.2	<0.1	4
Walleye pollock	*Theragra chalcogramma*	0.2	<0.1	1
Oregon triton	*Fusitrition oregonensis*	0.2	<0.1	2
Snailfish unidentified	Cyclopteridae	0.1	<0.1	1
Red sea urchin	*Strongylocentrotus franciscanus*	0.1	<0.1	1
Salps unidentified	Thaliacea	0.1	<0.1	3
Polychaete worm unidentified	Polychaeta	0.1	<0.1	1
Brittlestarfish unidentified	Ophiuroidea	0.1	<0.1	30
Shortfin eelpout	*Lycodes brevipes*	0.1	<0.1	2
Thornback sculpin	*Paricelinus hopliticus*	<0.1	<0.1	2
Shrimp unidentified	Natantia	<0.1	<0.1	4
Invertebrate eggs unidentified		<0.1	<0.1	4
Crangonid shrimp unidentified	Crangonidae	<0.1	<0.1	4
Blacktip poacher	*Xeneretmus triacanthus*	<0.1	<0.1	1
Monster snailfish	*Careproctus phasma*	<0.1	<0.1	1
Spider crab	*Chorilla longipes*	<0.1	<0.1	1
Totals		10,047.5		32,065

Table 6.--Summary of conductivity-temperature-depth casts conducted during the 1995 Pacific whiting echo integration-trawl survey of the U.S. and Canadian west coasts.

Cast	Haul*	Date (1995)	Time (GMT)	Position		Depth (m)		Transect
				Latitude (N)	Longitude (W)	Cast	Bottom	
1	--	2 Jul	2250	48 09.08	122 25.37	84	94	Port Susan cal
2	--	5 Jul	0220	42 47.20	126 01.40	497	2,780	--
3				*** unit failed ***				
4	Expl-3	8 Jul	0445	34 02.79	121 21.46	331	3,310	Expl-4
5	--	9 Jul	0030	33 50.00	119 44.10	57	536	Channel Is. cal
6	Expl-6	9 Jul	0536	33 32.48	119 59.05	--	649	Expl-6
7				*** unit failed ***				
8	Expl-8	9 Jul	1521	33 07.57	119 44.84	473	1,143	Expl-8
9	Expl-10	10 Jul	1951	34 16.58	119 53.40	305	461	Expl-13
10	Methot-3	11 Jul	1134	34 49.45	120 54.82	220	245	Expl-18
11	1	11 Jul	1850	35 18.02	121 13.77	242	271	2
12				*** unit failed ***				
13	2	12 Jul	0703	35 49.10	121 33.09	426	496	5
14	4	12 Jul	1239	35 58.21	121 35.78	316	425	6
15	--	12 Jul	1546	35 58.20	122 01.45	306	1,619	6
16	--	12 Jul	1736	35 58.11	122 18.15	315	2,275	6
17	--	13 Jul	0936	36 27.91	122 04.54	518	877	9
18	--	13 Jul	1137	36 27.98	122 22.75	586	1,560	9
19	--	14 Jul	0126	37 08.05	122 59.41	511	650	12
20	6	14 Jul	0837	37 07.38	122 44.21	317	416	13
21	--	15 Jul	0455	37 48.05	123 35.22	519	2,730	17
22	--	15 Jul	0707	37 48.16	123 54.64	459	3,560	17
23	10-12	16 Jul	0254	38 08.35	123 33.53	511	820	19
24	14	17 Jul	0801	38 48.42	123 59.97	524	1,486	23
25	15	18 Jul	0135	39 17.94	123 59.00	359	362	26
26	16	22 Jul	0104	39 46.14	124 05.10	392	403	29
27	18	22 Jul	1008	39 47.36	123 59.01	136	152	29
28	--	22 Jul	1155	39 57.78	124 14.01	304	445	30
29	--	22 Jul	1545	39 58.56	124 43.44	553	1,129	30
30	--	22 Jul	1758	39 58.99	125 03.00	519	1,547	30
31	19	23 Jul	0506	40 19.12	125 05.06	552	1,246	32
32	20	23 Jul	1006	40 21.09	124 40.64	370	1,456	32
33	22	24 Jul	0412	40 48.67	124 28.80	354	368	35
34	Methot-7	24 Jul	1000	40 48.54	124 34.30	506	560	35
35				*** unit failed ***				
36	25	25 Jul	2250	41 47.73	125 04.40	497	1,341	41
37	--	26 Jul	0904	41 47.88	124 30.92	321	400	41
38	--	26 Jul	1037	41 48.21	124 44.18	506	778	41
39	--	27 Jul	0755	42 28.24	124 51.89	511	641	45
40	--	27 Jul	0958	42 28.15	125 12.31	518	3,072	45
41	--	28 Jul	0013	42 48.05	125 28.63	573	3,067	47
42	Methot-12	28 Jul	0524	42 48.27	124 56.01	520	589	47
43	--	28 Jul	0939	42 48.10	125 09.21	478	2,200	47
44	--	29 Jul	0749	43 18.14	124 53.33	490	522	50
45	--	29 Jul	0945	43 18.48	125 13.48	570	1,843	50
46	--	30 Jul	0436	43 38.12	125 11.78	502	1,600	52
47	--	31 Jul	0533	43 58.17	125 20.24	539	2,548	54

Table 6.--Continued.

Cast	Haul*	Date (1995)	Time (GMT)	Position		Depth (m)		Transect
				Latitude (N)	Longitude (W)	Cast	Bottom	
48	--	31 Jul	0755	43 58.28	124 59.51	531	685	54
49	--	2 Aug	1239	44 47.88	125 08.13	513	1,830	59
50	--	4 Aug	1016	45 38.48	124 45.43	350	457	61
51	--	4 Aug	1729	45 38.37	125 05.32	545	1,492	64
52	--	6 Aug	0800	45 57.90	124 44.73	337	423	66
53	--	7 Aug	0112	46 17.19	124 41.36	420	645	68
54	--	7 Aug	0403	46 17.90	125 01.73	515	1,258	68
55	--	7 Aug	0650	46 27.70	124 39.66	631	925	68
56	Methot-19	7 Aug	0900	46 27.99	125 01.98	561	1,819	69
57				*** unit failed ***				
58	59	8 Aug	0849	46 48.13	124 56.87	525	579	70
59	--	8 Aug	1204	46 47.78	125 18.19	486	1,268	70
60	--	9 Aug	0440	47 07.88	125 18.70	560	1,697	72
61				*** unit failed ***				
62	--	13 Aug	0922	47 08.03	125 01.73	519	1,005	--
63	65/66	15 Aug	0930	47 47.66	124 56.50	98	112	77
64	--	15 Aug	2310	47 57.99	125 39.64	542	671	78
65	--	16 Aug	0123	47 58.11	126 01.74	520	800	78
66	--	20 Aug	2343	48 47.98	127 00.23	530	1,274	95
67	75	21 Aug	0557	48 47.91	126 37.60	505	540	95
68	--	22 Aug	2146	49 42.69	126 38.12	51	53	Kendrick I. cal
69	--	23 Aug	1049	49 07.90	127 00.45	509	592	97
70	--	23 Aug	1252	49 07.81	127 24.24	522	1,800	97
71	--	26 Aug	0416	50 17.06	128 20.44	553	792	104
72	--	26 Aug	1743	50 18.55	128 41.68	516	1,500	104
73	--	28 Aug	0312	50 58.23	129 49.95	548	1,476	108
74	--	28 Aug	0516	50 58.03	130 13.78	528	2,230	108
75	--	29 Aug	0819	53 03.15	132 38.81	517	533	114
76	--	29 Aug	1014	55 52.54	132 56.08	522	1,800	114
77	--	30 Aug	0532	53 29.49	133 42.04	528	2,100	117
78	--	30 Aug	0749	53 37.12	133 20.30	534	619	117

Table 7.--Summary of expendable bathythermograph casts conducted during the 1995 Pacific whiting echo integration-trawl survey of the U.S. and Canadian west coasts.

Drop	Haul*	Date (1995)	Time (GMT)	Position		Bottom Depth (m)	Transect
				Latitude (N)	Longitude (W)		
1	--	4 Jul	1648	44 09.42	125 24.36	1,114	--
2	Expl-11	11 Jul	0049	34 08.64	120 09.52	437	Expl-14
3	3,4	12 Jul	1058	35 48.37	121 29.53	336	5
4	5	13 Jul	0129	36 17.55	122 09.20	716	8

*Expl refers to hauls conducted during the exploratory juvenile Pacific whiting.

Table 8.--Estimated biomass at length (in 1,000s of metric tons) of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey. Area boundaries are defined in Table 3.

			Columbia		Vancouver				
Length	Monterey	Eureka	South	North	U.S.	South	North	Charlotte	Total
20	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.05
21	0.00	0.10	0.13	0.01	0.00	0.01	0.00	0.00	0.26
22	0.00	0.32	0.39	0.01	0.00	0.05	0.01	0.00	0.78
23	0.00	0.93	1.13	0.04	0.02	0.21	0.10	0.00	2.43
24	0.01	1.82	2.19	0.11	0.04	0.44	0.32	0.00	4.91
25	0.06	2.36	2.72	0.26	0.11	0.64	0.55	0.00	6.69
26	0.11	2.11	2.40	0.54	0.22	0.68	0.65	0.00	6.71
27	0.11	1.21	1.07	0.60	0.24	0.44	0.47	0.00	4.14
28	0.09	0.48	0.45	0.69	0.28	0.21	0.23	0.00	2.43
29	0.23	0.13	0.07	0.43	0.18	0.05	0.06	0.00	1.15
30	0.63	0.21	0.00	0.19	0.08	0.04	0.05	0.00	1.19
31	1.39	0.46	0.00	0.06	0.03	0.00	0.00	0.00	1.93
32	6.40	2.22	0.06	0.01	0.00	0.00	0.00	0.00	8.70
33	20.29	6.87	0.08	0.00	0.00	0.00	0.00	0.00	27.24
34	43.39	15.63	0.46	0.01	0.00	0.00	0.00	0.00	59.48
35	48.72	18.85	0.88	0.03	0.00	0.00	0.00	0.00	68.48
36	34.25	17.35	2.25	0.08	0.00	0.00	0.00	0.00	53.93
37	15.67	10.09	2.58	0.10	0.01	0.01	0.00	0.00	28.46
38	4.60	5.86	2.62	0.12	0.00	0.00	0.00	0.00	13.20
39	1.40	2.48	2.04	0.23	0.00	0.00	0.00	0.00	6.16
40	1.28	1.79	2.83	0.43	0.05	0.00	0.01	0.00	6.39
41	1.40	4.51	8.29	1.55	0.12	0.01	0.05	0.01	15.95
42	1.62	7.79	22.96	4.55	0.78	0.09	0.44	0.09	38.32
43	2.55	12.49	45.10	10.61	1.88	0.34	1.09	0.20	74.25
44	3.29	15.82	68.21	18.04	5.37	0.94	3.35	0.66	115.68
45	2.36	16.34	81.89	23.63	9.50	1.83	6.56	1.31	143.41
46	1.36	18.42	78.01	23.13	17.33	3.96	13.62	2.69	158.51
47	2.36	18.17	63.90	19.40	21.40	5.63	18.09	3.52	152.47
48	1.50	14.93	42.43	13.44	25.54	7.99	23.63	4.37	133.83
49	0.82	6.66	23.82	8.15	20.82	6.64	19.55	3.64	90.09
50	0.38	4.10	12.04	3.73	17.16	5.76	16.05	3.06	62.28
51	0.02	2.54	4.72	1.91	9.41	3.70	9.08	1.66	33.03
52	0.29	1.05	2.58	0.96	7.02	3.10	7.11	1.26	23.36
53	0.00	0.67	1.20	0.41	3.37	1.40	3.20	0.61	10.85
54	0.33	0.21	0.27	0.12	3.00	1.09	2.82	0.55	8.38
55	0.19	0.31	0.35	0.12	1.22	0.74	1.39	0.22	4.54
56	0.00	0.29	0.40	0.20	0.99	0.44	0.93	0.17	3.42
57	0.00	0.48	0.11	0.03	0.72	0.30	0.68	0.13	2.46
58	0.00	0.46	0.07	0.07	0.56	0.30	0.55	0.10	2.11
59	0.00	0.53	0.12	0.03	0.40	0.18	0.39	0.07	1.73
60	0.11	0.65	0.07	0.12	0.25	0.12	0.18	0.04	1.53
61	0.24	0.15	0.10	0.00	0.15	0.05	0.13	0.03	0.84
62	0.00	0.00	0.00	0.00	0.13	0.05	0.15	0.02	0.36
63	0.13	0.04	0.00	0.00	0.04	0.02	0.04	0.01	0.29
64	0.00	0.00	0.00	0.00	0.01	0.07	0.09	0.00	0.17
65	0.00	0.00	0.00	0.05	0.03	0.04	0.01	0.00	0.14
66	0.00	0.37	0.10	0.00	0.02	0.02	0.02	0.00	0.54
67	0.00	0.91	0.29	0.00	0.09	0.02	0.08	0.02	1.41
68	0.00	0.83	0.23	0.06	0.01	0.00	0.01	0.00	1.15
69	0.00	0.00	0.00	0.00	0.11	0.02	0.10	0.02	0.26
70	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.03
71	0.16	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.21
72	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.02
73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
74	0.00	1.17	0.41	0.08	0.00	0.00	0.00	0.00	1.66
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	197.71	221.23	482.04	134.35	148.70	47.64	131.86	24.45	1,387.98

Table 9.--Estimated numbers at length (1,000,000s of fish) of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey. Area boundaries are defined in Table 3.

			Columbia		Vancouver				
Length	Monterey	Eureka	South	North	U.S.	South	North	Charlotte	Total
20	0.00	0.42	0.55	0.00	0.00	0.05	0.00	0.00	1.02
21	0.00	1.81	2.49	0.25	0.04	0.24	0.08	0.00	4.91
22	0.00	5.19	6.42	0.07	0.04	0.77	0.15	0.00	12.65
23	0.00	13.28	16.03	0.58	0.27	2.93	1.46	0.00	34.54
24	0.06	22.54	27.20	1.31	0.51	5.42	3.93	0.00	60.96
25	0.65	25.72	29.72	2.78	1.15	6.98	6.04	0.00	73.04
26	1.02	20.38	23.18	5.19	2.10	6.60	6.26	0.00	64.72
27	0.90	10.35	9.15	5.16	2.08	3.77	4.03	0.00	35.44
28	0.70	3.68	3.43	5.26	2.13	1.61	1.74	0.00	18.55
29	1.55	0.90	0.51	2.96	1.20	0.34	0.39	0.00	7.85
30	3.89	1.28	0.00	1.15	0.47	0.23	0.28	0.00	7.31
31	7.68	2.54	0.00	0.34	0.14	0.00	0.00	0.00	10.70
32	32.04	11.11	0.28	0.05	0.02	0.01	0.00	0.00	43.51
33	92.13	31.20	0.36	0.00	0.00	0.00	0.00	0.00	123.69
34	179.26	64.57	1.89	0.03	0.00	0.00	0.00	0.00	245.75
35	183.69	71.06	3.32	0.13	0.00	0.00	0.00	0.00	258.20
36	118.15	59.85	7.75	0.27	0.00	0.00	0.00	0.00	186.02
37	49.57	31.91	8.17	0.33	0.02	0.03	0.00	0.00	90.02
38	13.36	17.04	7.63	0.35	0.00	0.00	0.00	0.00	38.38
39	3.76	6.65	5.46	0.63	0.00	0.00	0.00	0.00	16.50
40	3.16	4.43	7.00	1.05	0.13	0.01	0.03	0.01	15.80
41	3.21	10.32	18.97	3.55	0.28	0.03	0.10	0.02	36.49
42	3.43	16.52	48.66	9.65	1.65	0.19	0.93	0.19	81.23
43	5.01	24.58	88.74	20.88	3.69	0.67	2.13	0.39	146.09
44	6.02	28.94	124.82	33.01	9.83	1.72	6.13	1.21	211.68
45	4.02	27.84	139.58	40.28	16.19	3.12	11.17	2.22	244.42
46	2.16	29.29	124.04	36.77	27.55	6.30	21.65	4.27	252.05
47	3.50	27.00	94.93	28.82	31.80	8.37	26.87	5.23	226.51
48	2.08	20.75	58.98	18.68	35.50	11.10	32.85	6.08	186.03
49	1.06	8.68	31.03	10.61	27.11	8.65	25.46	4.74	117.34
50	0.47	5.01	14.71	4.56	20.96	7.04	19.61	3.74	76.10
51	0.02	2.91	5.41	2.19	10.80	4.25	10.43	1.90	37.92
52	0.32	1.13	2.78	1.03	7.58	3.35	7.67	1.36	25.22
53	0.00	0.68	1.22	0.42	3.42	1.42	3.25	0.62	11.03
54	0.32	0.20	0.25	0.11	2.87	1.04	2.70	0.52	8.03
55	0.17	0.28	0.31	0.11	1.11	0.67	1.26	0.20	4.11
56	0.00	0.25	0.34	0.17	0.85	0.38	0.80	0.15	2.92
57	0.00	0.38	0.09	0.03	0.58	0.24	0.55	0.11	1.98
58	0.00	0.35	0.05	0.05	0.43	0.23	0.42	0.08	1.61
59	0.00	0.38	0.09	0.02	0.29	0.13	0.28	0.05	1.25
60	0.08	0.45	0.05	0.08	0.17	0.08	0.12	0.02	1.05
61	0.16	0.10	0.06	0.00	0.10	0.03	0.09	0.02	0.55
62	0.00	0.00	0.00	0.00	0.08	0.03	0.09	0.01	0.22
63	0.08	0.03	0.00	0.00	0.02	0.01	0.02	0.00	0.17
64	0.00	0.00	0.00	0.00	0.00	0.04	0.05	0.00	0.10
65	0.00	0.00	0.00	0.03	0.02	0.02	0.01	0.00	0.07
66	0.00	0.19	0.05	0.00	0.01	0.01	0.01	0.00	0.28
67	0.00	0.44	0.14	0.00	0.04	0.01	0.04	0.01	0.68
68	0.00	0.38	0.10	0.03	0.01	0.00	0.01	0.00	0.53
69	0.00	0.00	0.00	0.00	0.05	0.01	0.04	0.01	0.11
70	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01
71	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.08
72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
74	0.00	0.42	0.14	0.03	0.00	0.00	0.00	0.00	0.59
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	723.73	613.41	916.10	239.03	213.32	88.12	199.15	33.16	3,026.01

Table lO.--Estimated biomass at age (in 1,000s of metric tons) of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey. Area boundaries are defined in Table 3.

			Columbia		Vancouver				
Age	Monterey	Eureka	South	North	U.S.	South	North	Charlotte	Total
1	0.4	9.7	10.6	2.9	1.2	2.8	2.4	0.0	30.0
2	150.5	69.5	7.1	0.2	0.0	0.0	0.0	0.0	227.4
3	22.9	8.4	4.5	0.0	0.0	0.0	0.0	0.0	35.8
4	0.5	6.0	4.9	2.1	0.7	0.0	0.4	0.1	14.6
5	9.7	27.3	184.4	48.2	22.6	4.8	17.4	3.3	317.7
6	0.0	3.0	7.7	1.4	1.1	1.3	1.5	0.3	16.3
7	0.4	8.0	19.2	9.0	5.4	0.9	9.2	1.7	53.9
8	4.1	26.2	111.5	30.2	38.2	13.9	37.5	7.1	268.7
9	0.0	1.4	0.0	0.8	0.3	0.2	0.7	0.1	3.6
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	5.9	38.8	95.9	30.2	63.2	19.3	49.0	9.2	311.4
12	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.6
13	0.2	4.7	3.1	0.7	1.1	0.3	3.3	0.6	13.9
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	1.8	10.1	30.3	7.3	13.7	4.2	9.6	1.8	78.9
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.7
18	1.2	6.9	3.0	0.7	0.5	0.0	0.8	0.1	13.2
19	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.6
Total	197.7	221.2	482.0	134.4	148.7	47.6	131.9	24.5	1,388.0

Table 1 l.--Estimated numbers at age (1,000,000s of fish) of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey. Area boundaries are defined in Table 3.

			Columbia		Vancouver				
Age	Monterey	Eureka	South	North	U.S.	South	North	Charlotte	Total
1	3.6	105.6	118.7	25.1	10.1	28.9	24.3	0.0	316.4
2	593.7	262.3	23.8	0.8	0.0	0.0	0.0	0.0	880.5
3	80.4	25.6	11.8	0.0	0.0	0.0	0.0	0.0	117.8
4	1.1	16.0	9.3	4.2	1.2	0.0	0.7	0.1	32.6
5	23.4	53.3	336.2	86.1	37.0	7.7	27.0	5.2	575.9
6	0.0	5.8	12.8	2.3	1.7	1.8	1.9	0.4	26.6
7	0.6	14.3	33.7	15.4	8.6	1.3	12.5	2.4	88.8
8	7.5	42.2	174.9	47.3	52.3	18.4	51.1	9.7	403.4
9	0.0	2.5	0.0	1.3	0.5	0.3	1.1	0.2	5.9
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	8.4	57.1	141.2	43.2	80.6	24.0	63.0	11.9	429.3
12	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	1.0
13	0.4	4.6	4.4	1.0	1.5	0.4	4.4	0.8	17.4
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	2.6	13.7	44.8	10.4	18.1	5.3	12.4	2.3	109.6
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	1.2
18	2.0	8.9	4.5	1.1	0.8	0.0	0.8	0.1	18.2
19	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	1.0
Total	723.7	613.4	916.1	239.0	213.3	88.1	199.2	33.2	3,026.0

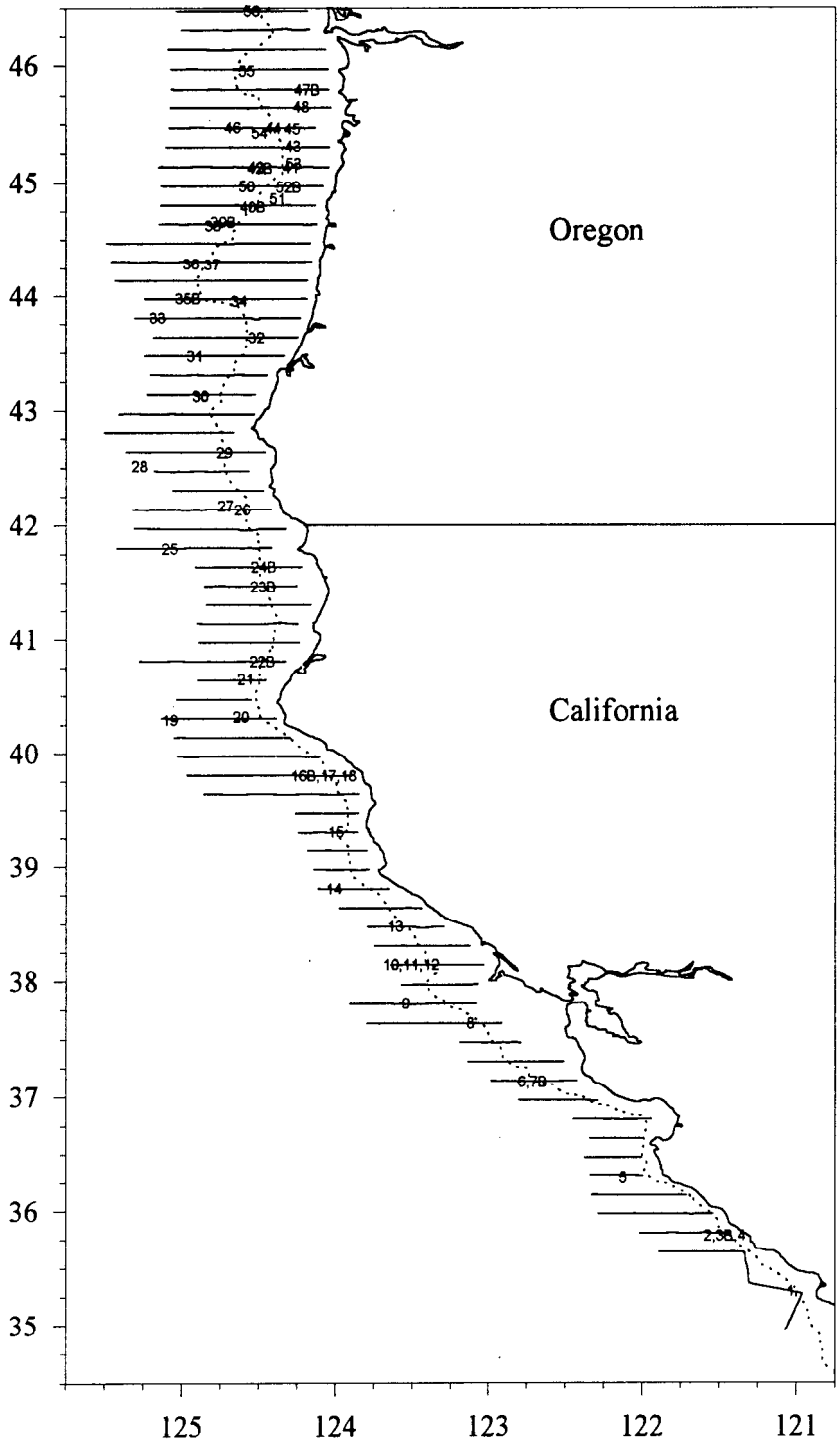


Figure 1 .--Survey trackline with haul locations for the Aleutian wing trawl, Nor'eastern bottom trawl (B), and Marinovich trawl (M) during the 1995 Pacific whiting echo integration-trawl survey of the U.S. and Canadian west coasts. The dotted line represents the 200 m bottom contour.

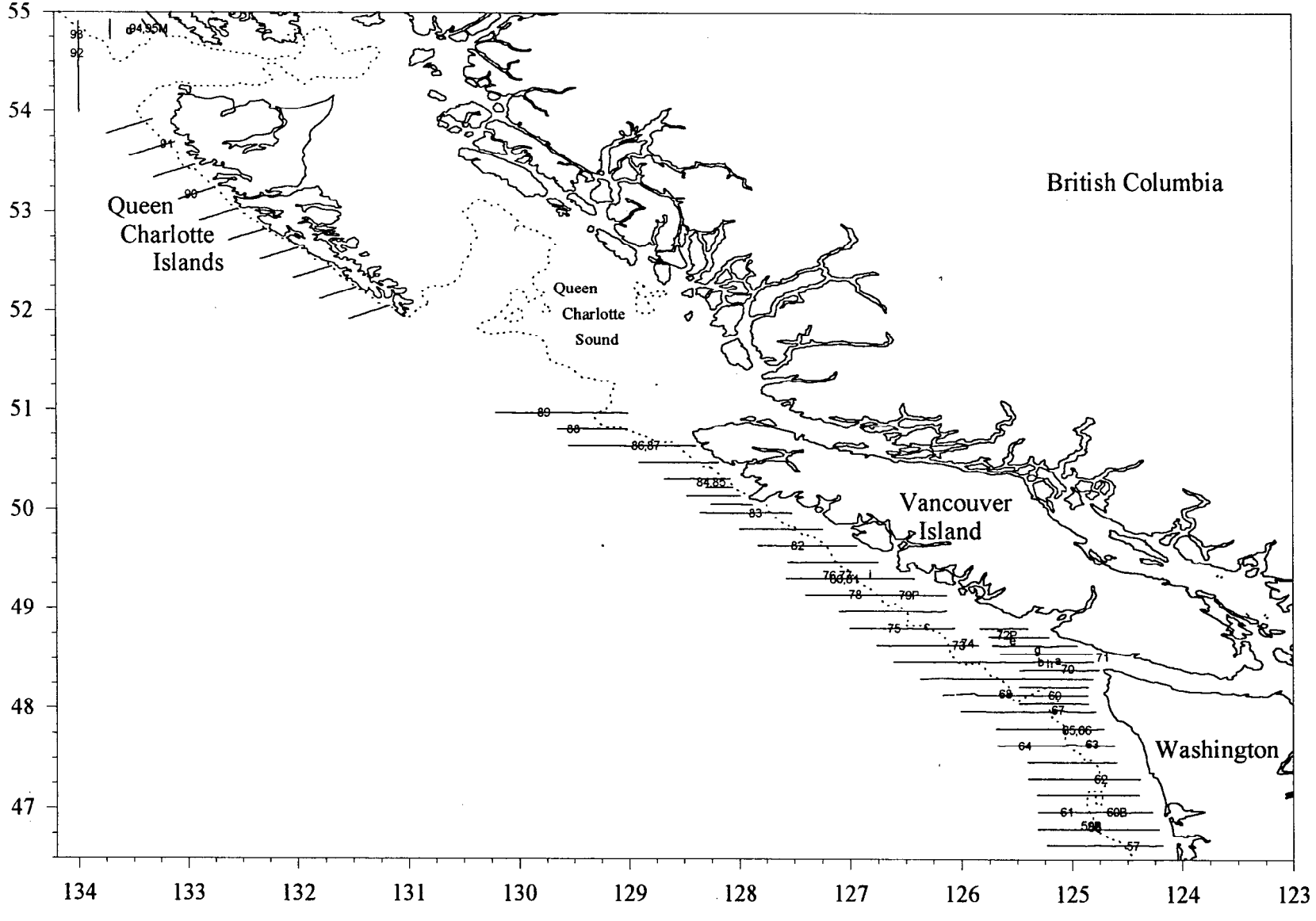


Figure 1.--Continued. Supplemental Canadian trawl locations designated by letters a-i.

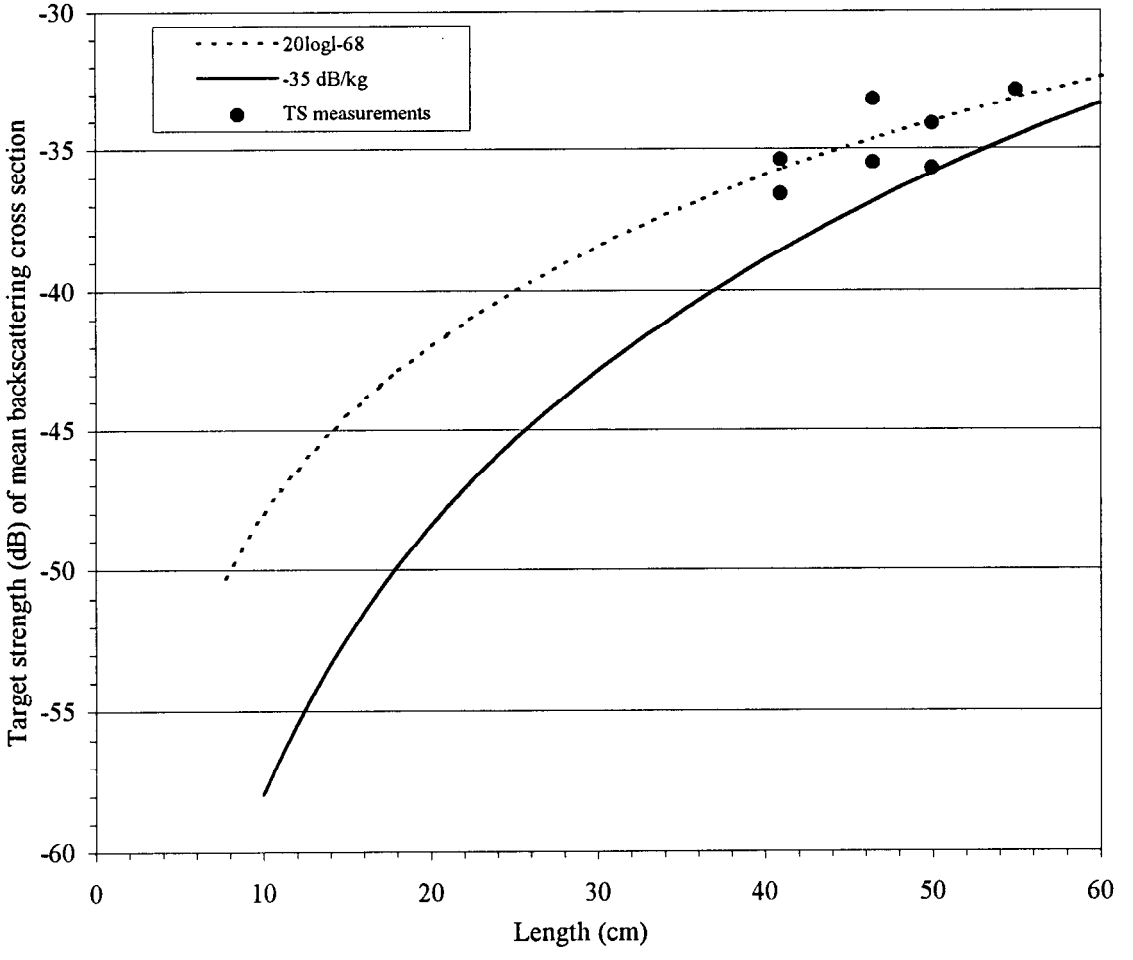


Figure 2.--Summary of *in situ* target-strength (TS) measurements for Pacific whiting (modified from Traynor 1996).

a

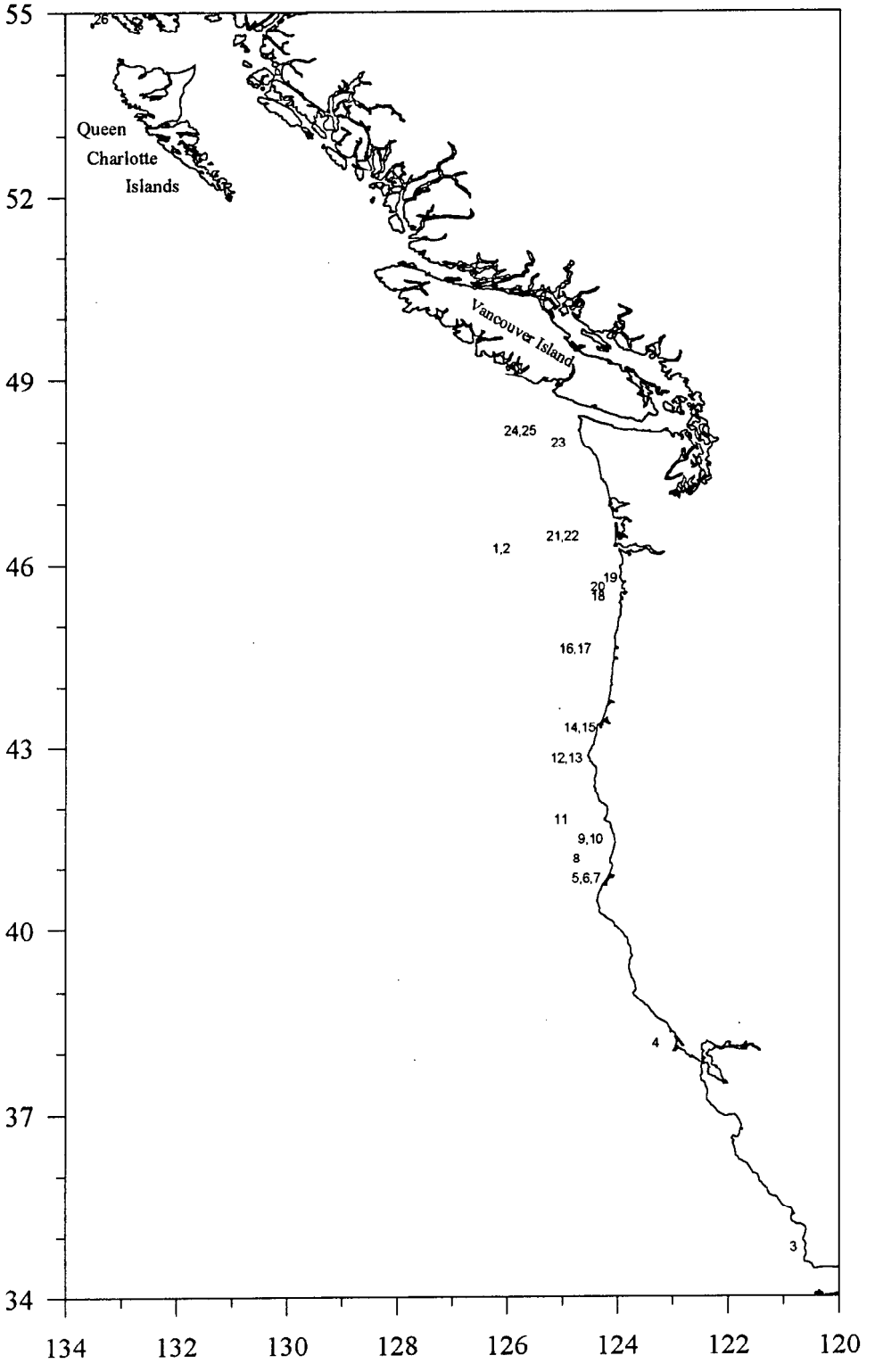


Figure 3.--Methot trawl locations for the 1995 Pacific whiting echo integration-trawl survey of the U.S. and Canadian west coasts.

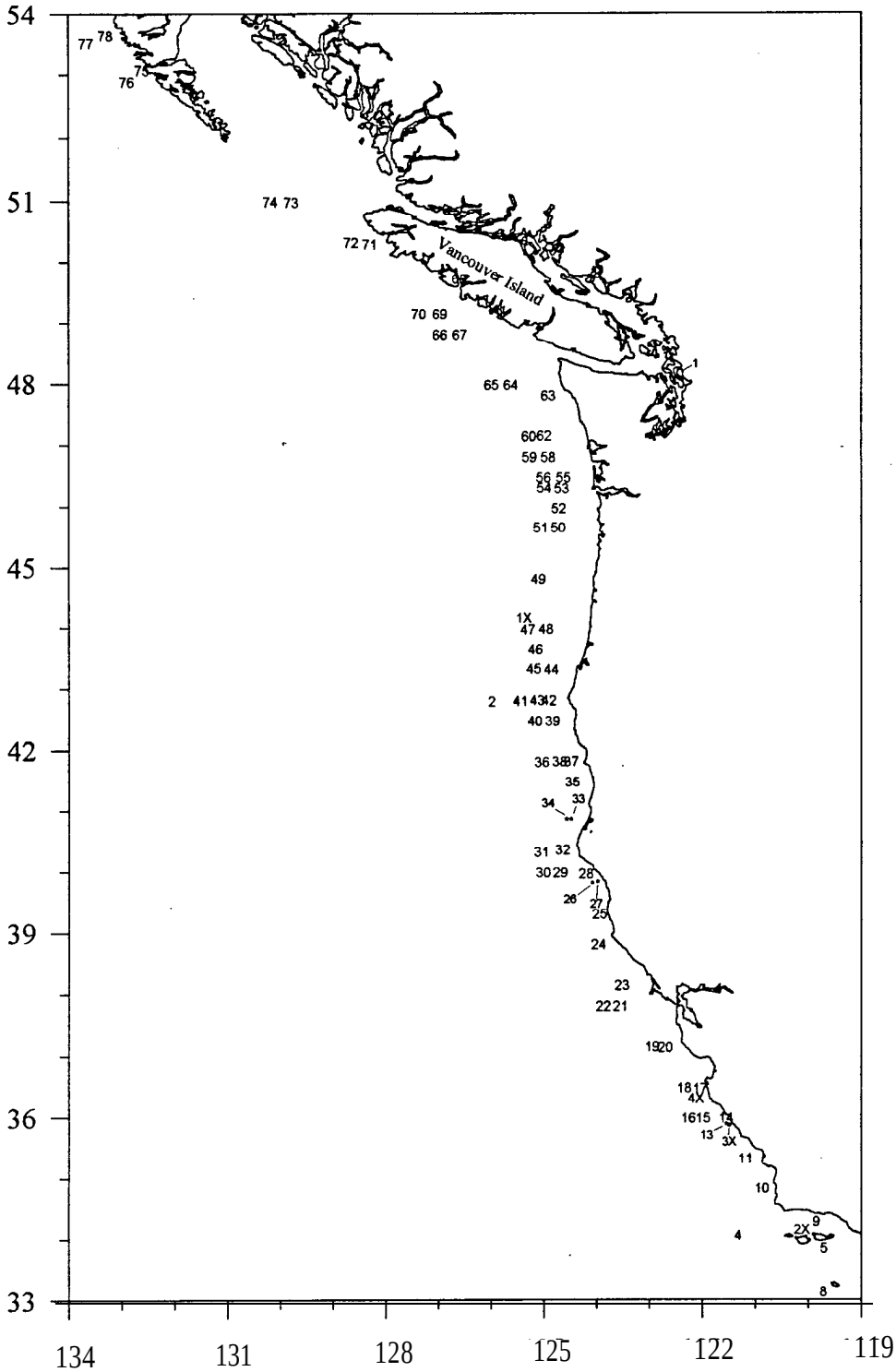


Figure 4.--Conductivity-temperature-depth and expendable bathythermograph (XBT) cast locations for the 1995 Pacific whiting echo integration-trawl survey of the U.S. and Canadian west coasts. XBT casts are labeled with an "X".

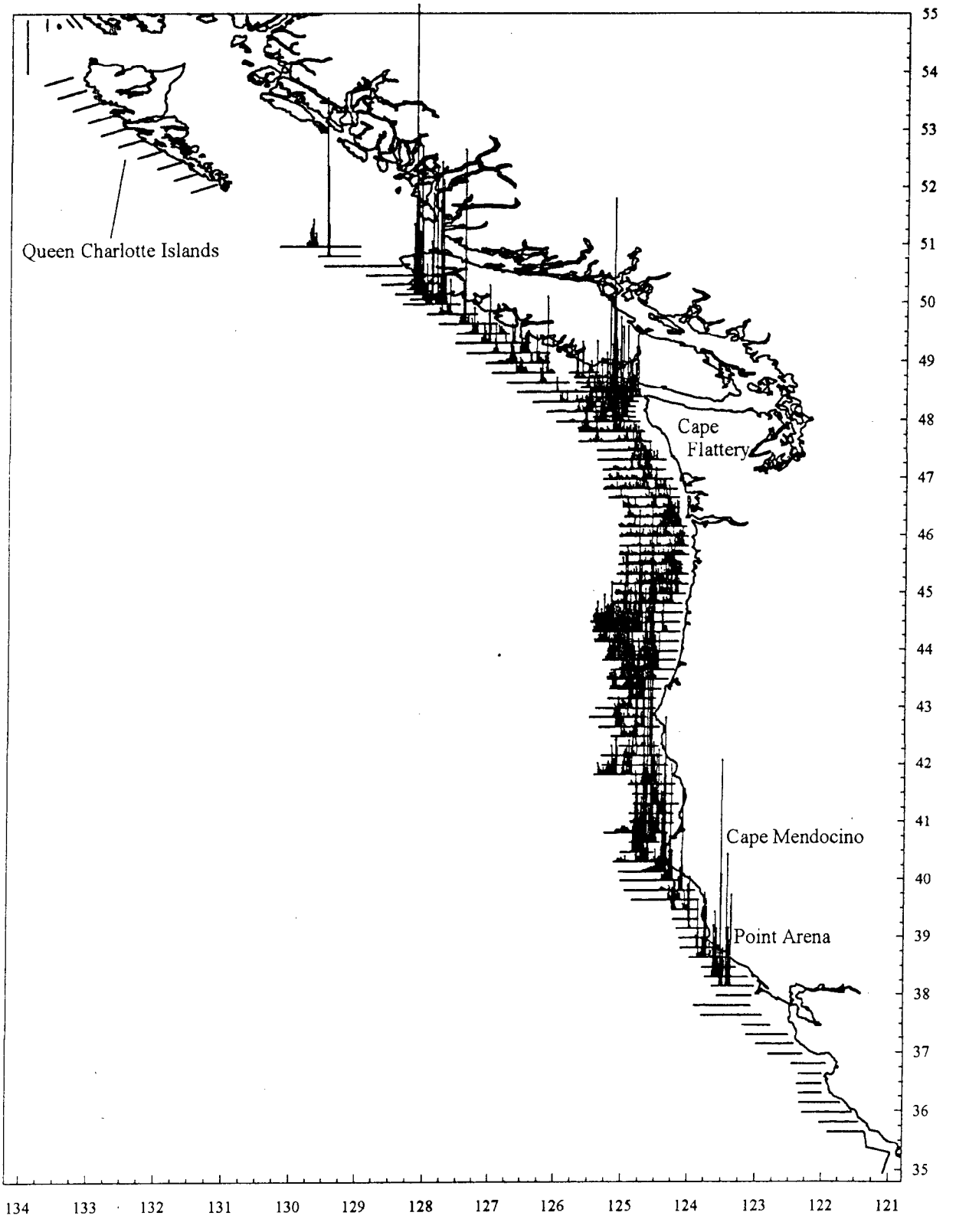


Figure 5 .--Acoustic backscattering attributed to Pacific whiting along transects off the U.S. and Canadian west coasts during the 1995 echo integration-trawl survey.

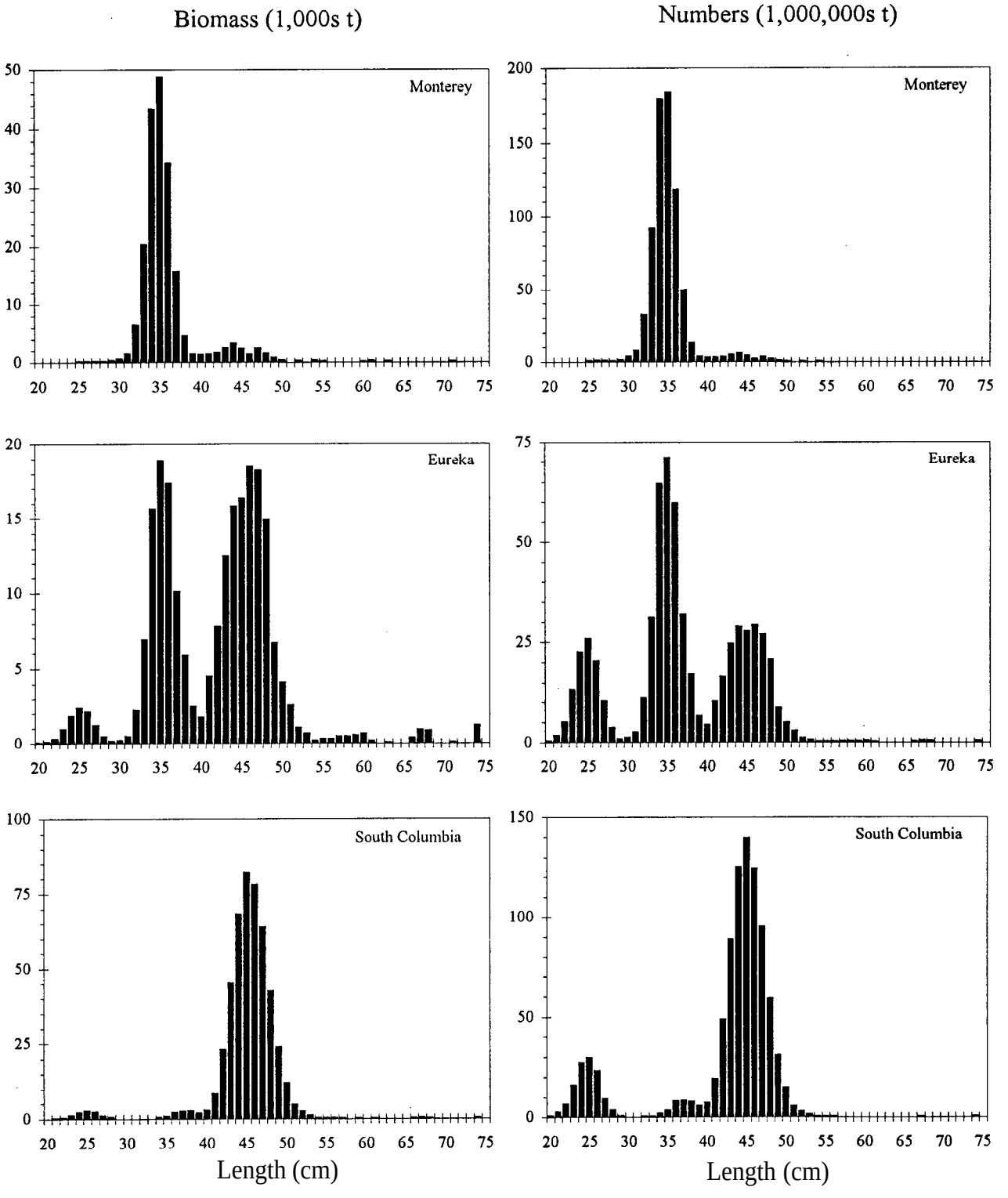


Figure 6.--Biomass and numbers at length of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey. Area boundaries are defined in Table 3. Note different axis scales for numbers and biomass.

a

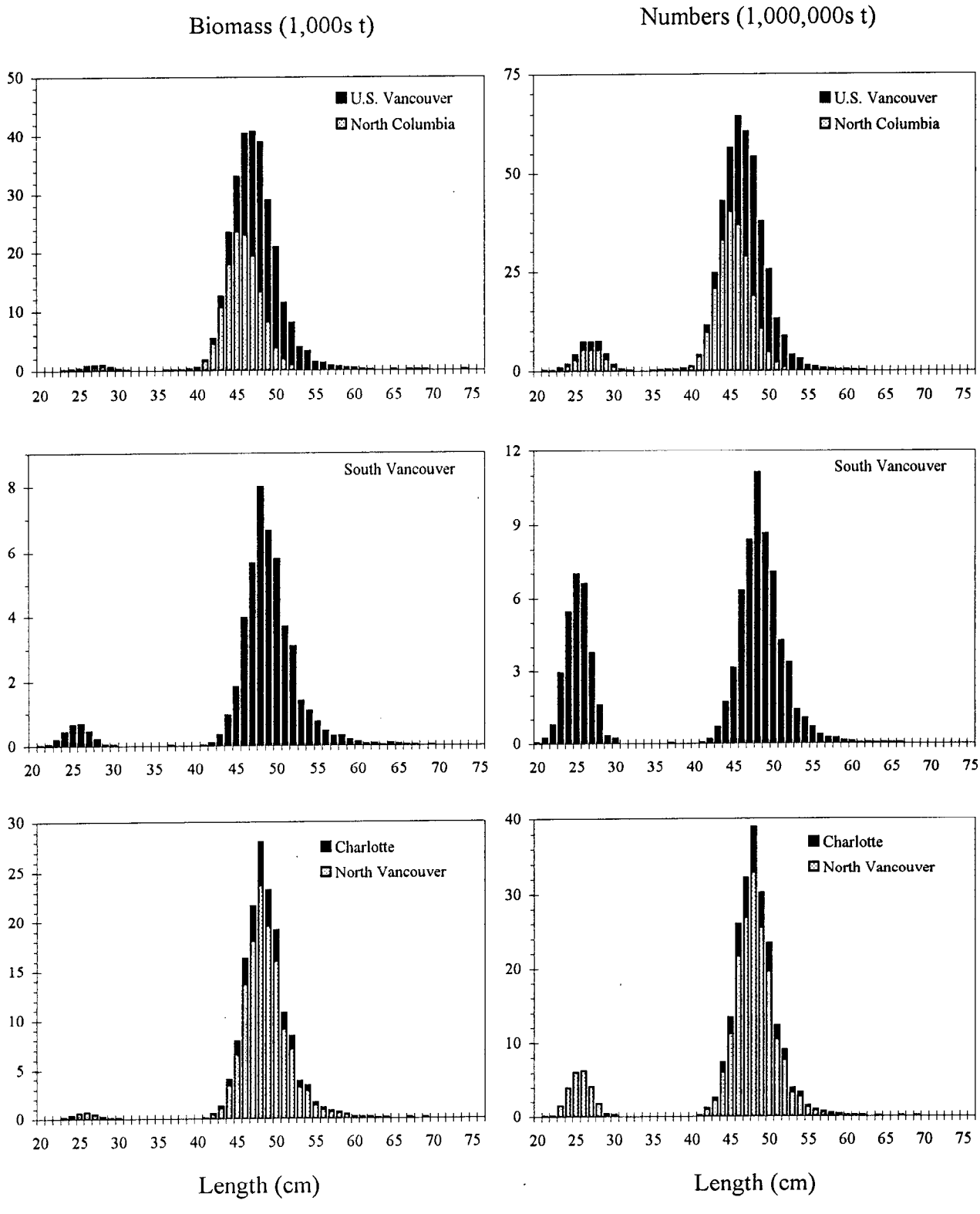


Figure 6.--Continued.

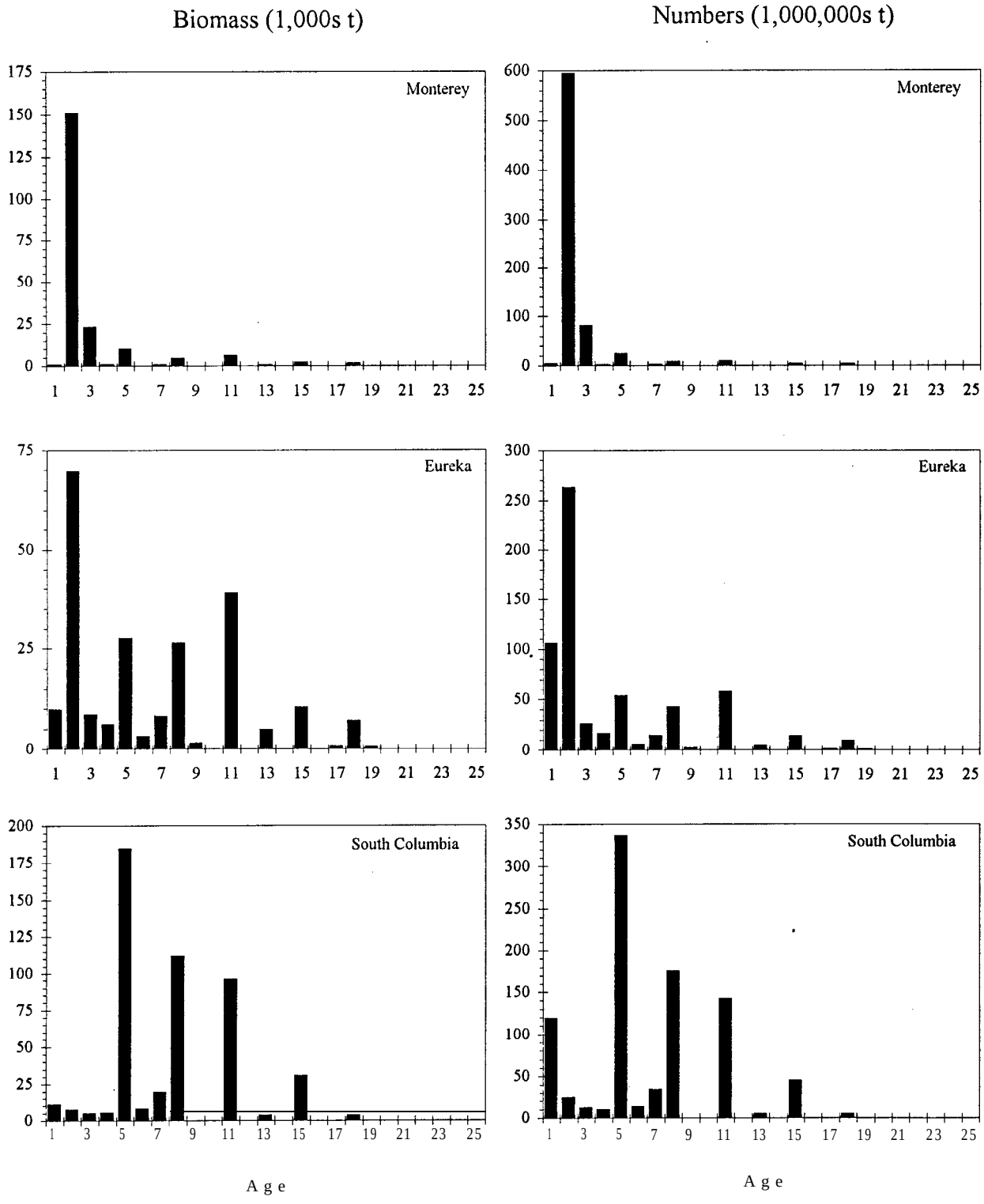


Figure 7.L-Biomass and numbers at age of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey. Area boundaries are defined in Table 3. Note different axis scales for numbers and biomass.

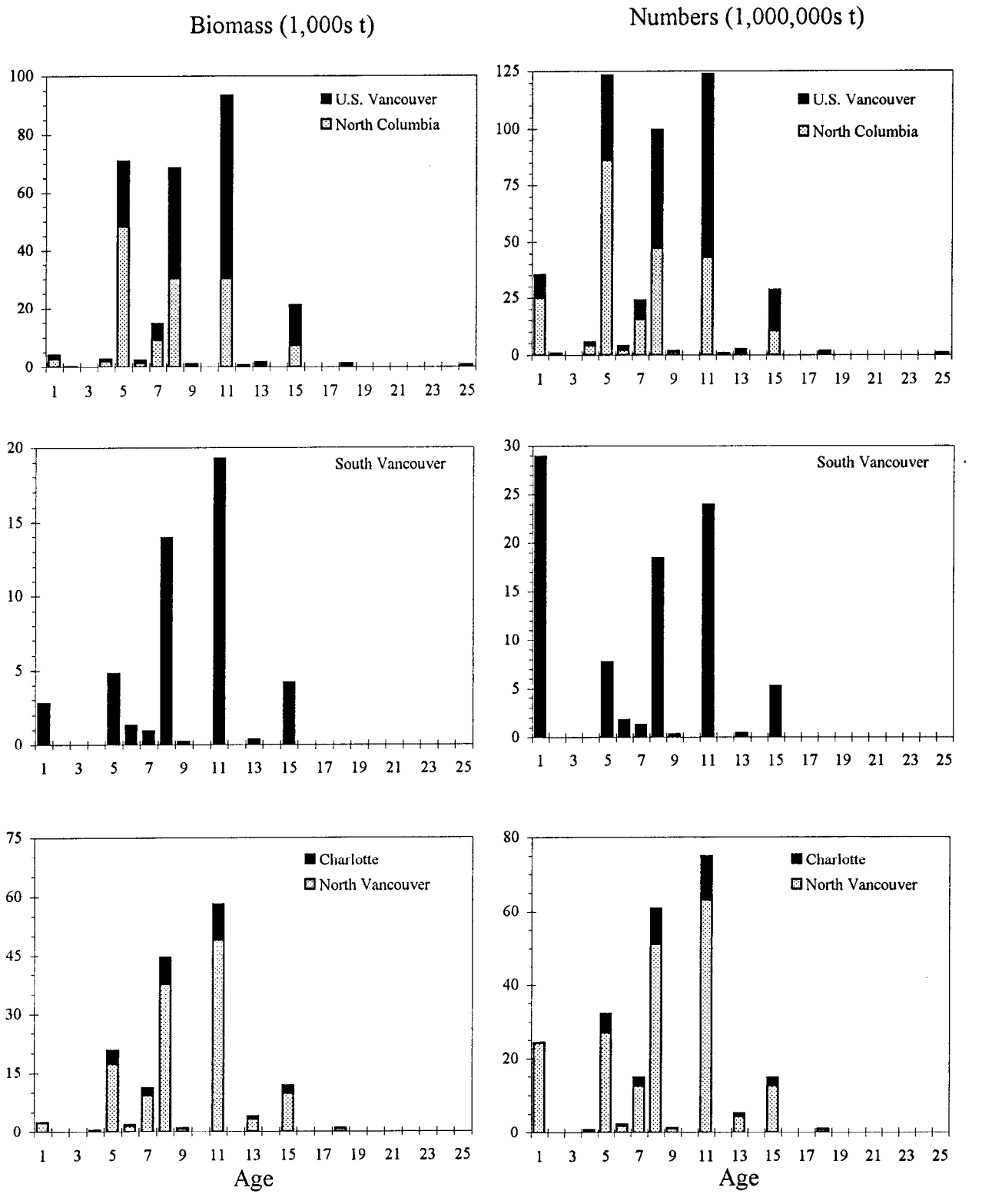


Figure 7.--Continued.

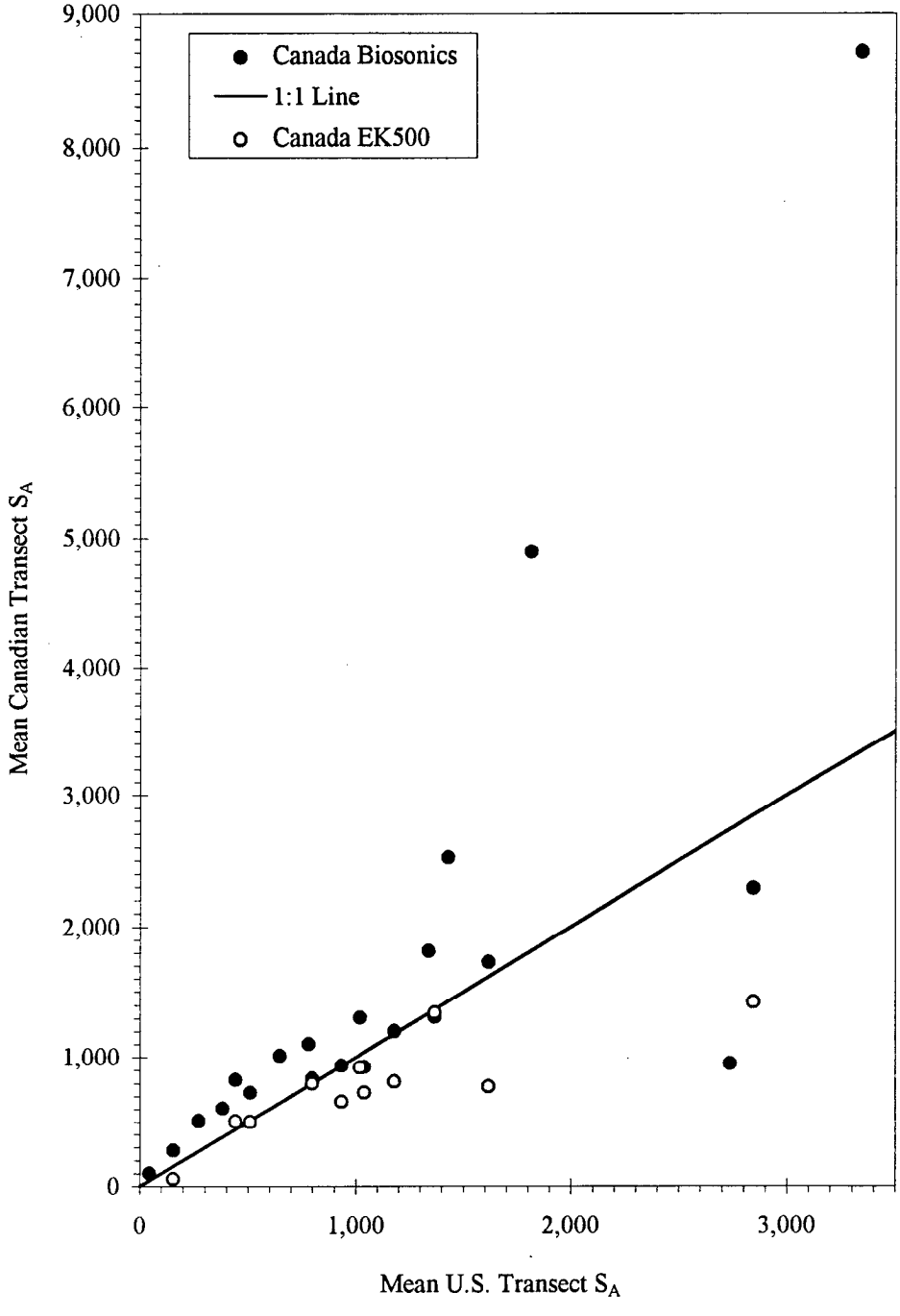


Figure 8.--Comparison of mean S_A values by transect for U.S. EK500, Canadian EK500, and Biosonic 101 acoustic systems. Canadian EK500 data for some transects were unavailable.

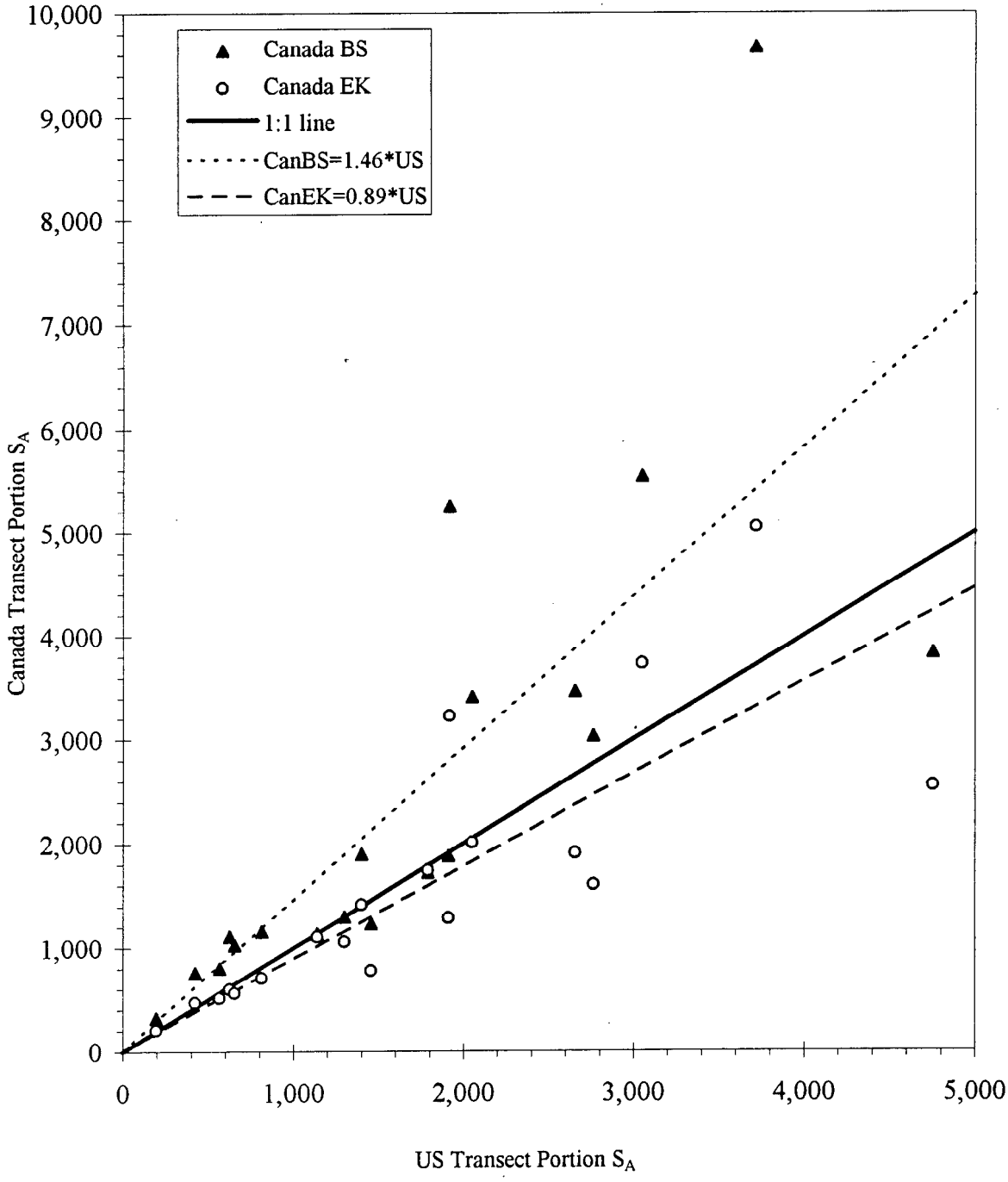


Figure 9.--Comparison of high-density S_A values of U. S. EK500 with Canadian EK500 and Biosonic 101 acoustic systems.

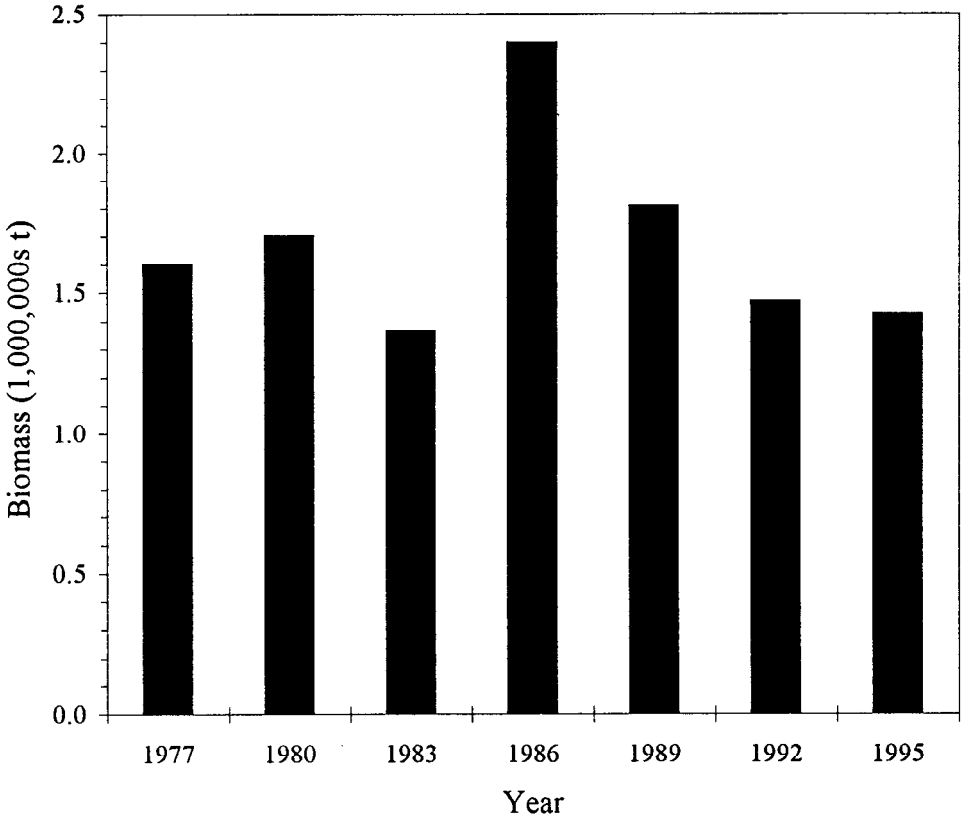


Figure IO.--Pacific whiting acoustic-trawl survey biomass estimates. Estimates for 1977- 1989 are adjusted for the increased offshore and northward coverage beginning in 1992 and the change of the target strength model from -35 dB/kg to TS=20 Log L - 68 (From Dorn 1996).

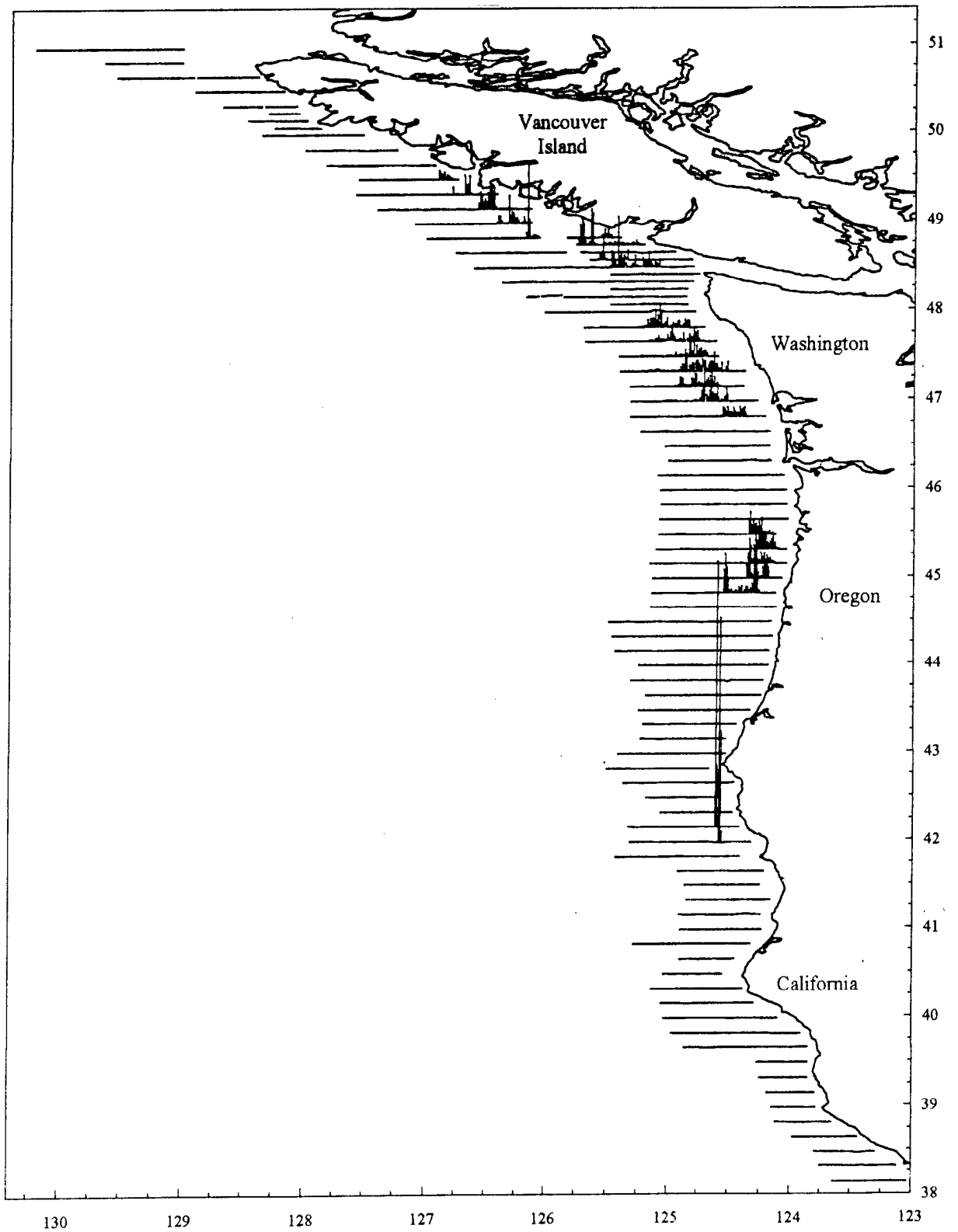


Figure 11 .--Acoustic backscattering attributed primarily to age- 1 Pacific whiting off the U.S. and Canadian west coasts during the 1995 echo integration-trawl survey. The areas north of 5 1 °N and south of 38°N are not shown because no Pacific whiting echo-sign was assigned in those areas (see Discussion).

APPENDIX

Comparison of the 1992 and 1995 EIT survey results based on two target strength models

Target strength (TS) is a measure of the acoustic reflectivity of fish and is necessary to scale relative estimates of fish abundance based on acoustics to absolute estimates of abundance. Historically (1977-92) a TS of -35 dB/kg of fish was used to scale the acoustic data for Pacific whiting from the triennial EIT surveys along the U.S. and Canadian west coasts. Recent evidence suggests that a more appropriate TS model for Pacific whiting is TS = 20 log L - 68, where L represents fish fork length in centimeters (see Methods). Results presented below compare estimates of fish abundance based on the two TS models for the 1992 and 1995 EIT Pacific whiting surveys.

Abundance estimates based on 20 Log L - 68 were less than those based on -35 dB/kg. The total estimated biomass for 1995 based on 20 log L - 68 was 1.39 x $l0^6$ t, which was 45 % less than the 2.53 x $l0^6$ t based on -35 dB/kg (Figs. Al, A2; Tables Al-A4). When the 1992 survey was reanalyzed using 20 log L - 68, the estimate was 1.47 x $l0^6$ t, which was 44% less than the estimate of 2.62 x $l0^6$ t using -35 dB/kg. (Figs. A3, A4; Tables A5-A12). The results of these comparisons were used to evaluate an approximate method for adjusting the earlier (1977-89) triennial EIT survey results (See Discussion; Dorn 1996).

Appendix Table 1.--Estimated biomass at age (in 1,000s of metric tons) of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey based on a target strength relationship of -35 dB/kg. Area boundaries are defined in Table 3.

			Columbia		Vancouver				
Age	Monterey	Eureka	South	North	U.S.	South	North	Charlotte	Total
1	0.95	20.77	23.15	5.23	2.12	5.07	4.64	0.00	61.93
2	342.68	150.24	12.56	0.38	0.01	0.00	0.00	0.00	505.87
3	52.15	16.94	7.86	0.00	0.00	0.00	0.00	0.00	76.95
4	1.21	11.77	8.47	3.20	1.15	0.00	0.57	0.10	26.47
5	21.89	50.56	320.69	83.49	36.07	7.75	27.46	5.21	553.12
6	0.00	5.58	13.41	2.44	1.69	2.14	2.50	0.46	28.22
7	0.78	14.78	33.42	15.58	8.70	1.48	14.91	2.77	92.42
8	9.25	48.74	194.50	52.19	61.30	23.17	60.39	11.28	460.82
9	0.00	2.68	0.00	1.29	0.49	0.35	1.17	0.22	6.20
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	12.96	72.55	168.15	52.22	101.56	32.12	79.20	14.63	533.39
12	0.00	0.00	0.00	0.53	0.53	0.00	0.00	0.00	1.06
13	0.52	8.59	5.41	1.14	1.72	0.56	5.22	0.98	24.14
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	4.07	19.10	53.00	12.54	22.13	6.98	15.56	2.87	136.25
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	1.23	0.00	0.00	0.00	0.00	0.00	0.00	1.23
18	2.68	12.95	5.28	1.18	0.78	0.00	1.22	0.22	24.31
19	0.00	1.01	0.00	0.00	0.00	0.00	0.00	0.00	1.01
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.53	0.53	0.00	0.00	0.00	1.06
Total	449.14	437.49	845.90	231.94	238.78	79.62	212.84	38.74	2,534.45

Appendix Table 2.--Estimated numbers at age (in 1,000,000s of fish) of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey based on a target strength relationship of -35 dB/kg. Area boundaries are defined in Table 3.

			Columbia		Vancouver				
Age	Monterey	Eureka	South	North	U.S.	South	North	Charlotte	Total
1	8.24	226.41	259.20	44.63	18.01	52.79	46.33	0.00	655.61
2	1,351.21	569.43	42.19	1.29	0.04	0.00	0.00	0.00	1,964.16
3	182.99	51.85	20.73	0.00	0.00	0.00	0.00	0.00	255.57
4	2.56	32.29	16.07	6.15	1.93	0.00	1.12	0.20	60.32
5	52.77	98.69	584.55	149.34	59.17	12.47	42.43	8.08	1,007.50
6	0.00	10.75	22.27	3.95	2.63	2.89	3.09	0.57	46.15
7	1.30	26.43	58.65	26.49	13.77	2.15	20.05	3.75	152.59
8	16.81	78.42	304.81	81.61	83.71	30.69	82.02	15.37	693.44
9	0.00	4.71	0.00	2.20	0.83	0.52	1.68	0.31	10.25
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	18.47	106.62	247.17	74.60	129.26	39.83	101.45	18.84	736.24
12	0.00	0.00	0.00	0.79	0.79	0.00	0.00	0.00	1.58
13	0.88	8.48	7.74	1.65	2.36	0.69	6.98	1.31	30.09
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	5.82	25.69	78.33	18.00	29.04	8.76	20.02	3.70	189.36
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	2.24	0.00	0.00	0.00	0.00	0.00	0.00	2.24
18	4.40	16.77	7.82	1.89	1.21	0.00	1.27	0.23	33.59
19	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.83
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.79	0.79	0.00	0.00	0.00	1.58
Total	1,645.45	1,259.61	1,649.53	413.38	343.54	150.79	326.44	52.36	5,841.10

Appendix Table 3.--Estimated biomass at length (in 1,000s of metric tons) of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey based on a target strength relationship of -35 dB/kg. Area boundaries are defined in Table 3.

			Columbia		Vancouver				
Length	Monterey	Eureka	South	North	U.S.	South	North	Charlotte	Total
20	0.00	0.04	0.05	0.00	0.00	0.00	0.00	0.00	0.10
21	0.00	0.20	0.27	0.02	0.00	0.02	0.01	0.00	0.53
22	0.00	0.69	0.86	0.01	0.00	0.08	0.02	0.00	1.66
23	0.00	2.02	2.47	0.07	0.03	0.36	0.20	0.00	5.15
24	0.01	3.91	4.78	0.19	0.07	0.79	0.60	0.00	10.35
25	0.14	5.07	5.96	0.45	0.19	1.17	1.05	0.00	14.03
26	0.24	4.54	5.26	0.96	0.39	1.26	1.24	0.00	13.87
27	0.24	2.51	2.34	1.07	0.43	0.82	0.90	0.00	8.31
28	0.21	1.02	0.99	1.23	0.50	0.40	0.43	0.00	4.76
29	0.52	0.30	0.16	0.77	0.31	0.09	0.11	0.00	2.26
30	1.44	0.48	0.00	0.34	0.14	0.07	0.09	0.00	2.54
31	3.15	1.04	0.00	0.11	0.04	0.00	0.00	0.00	4.35
32	14.56	5.00	0.10	0.02	0.01	0.00	0.00	0.00	19.69
33	46.17	15.56	0.15	0.00	0.00	0.00	0.00	0.00	61.87
34	98.79	34.95	0.82	0.01	0.00	0.00	0.00	0.00	134.57
35	110.98	41.59	1.56	0.06	0.00	0.00	0.00	0.00	154.18
36	78.03	36.59	3.99	0.13	0.00	0.00	0.00	0.00	118.75
37	35.71	20.57	4.56	0.18	0.01	0.01	0.00	0.00	61.04
38	10.48	11.24	4.65	0.21	0.00	0.00	0.00	0.00	26.57
39	3.19	4.67	3.57	0.40	0.00	0.00	0.00	0.00	11.82
40	2.91	3.43	4.99	0.73	0.09	0.00	0.02	0.00	12.17
41	3.17	8.32	14.43	2.66	0.21	0.02	0.07	0.01	28.89
42	3.62	14.27	39.96	7.82	1.28	0.14	0.68	0.14	67.90
43	5.70	23.00	78.33	18.24	3.09	0.57	1.71	0.30	130.95
44	7.39	29.40	118.58	31.08	8.53	1.47	5.05	0.99	202.49
45	5.19	30.48	142.27	40.73	15.33	2.93	10.26	2.03	249.23
46	2.87	34.11	135.81	39.93	27.58	6.39	21.35	4.18	272.21
47	5.19	34.00	111.60	33.49	33.54	9.10	28.20	5.42	260.54
48	3.29	27.79	74.28	23.25	40.81	13.36	38.14	6.92	227.83
49	1.81	12.70	41.81	14.09	34.06	11.25	32.32	5.92	153.96
50	0.84	7.90	21.44	6.45	27.39	9.56	25.86	4.88	104.31
51	0.03	4.75	8.41	3.33	15.34	6.28	15.02	2.70	55.85
52	0.67	2.07	4.65	1.67	11.38	5.28	11.76	2.03	39.49
53	0.00	1.25	2.12	0.71	5.54	2.35	5.31	1.00	18.29
54	0.76	0.48	0.52	0.21	4.70	1.78	4.47	0.85	13.77
55	0.43	0.61	0.64	0.22	1.96	1.28	2.32	0.35	7.79
56	0.00	0.56	0.75	0.35	1.67	0.75	1.58	0.29	5.96
57	0.00	0.85	0.19	0.05	1.20	0.51	1.13	0.22	4.16
58	0.00	0.85	0.15	0.12	0.86	0.50	0.85	0.15	3.47
59	0.00	0.95	0.20	0.06	0.65	0.30	0.65	0.12	2.93
60	0.25	1.21	0.16	0.22	0.45	0.20	0.32	0.07	2.87
61	0.54	0.34	0.21	0.00	0.22	0.07	0.20	0.04	1.62
62	0.00	0.00	0.00	0.00	0.24	0.10	0.29	0.04	0.67
63	0.30	0.10	0.00	0.00	0.11	0.05	0.10	0.02	0.67
64	0.00	0.00	0.00	0.00	0.01	0.13	0.17	0.00	0.32
65	0.00	0.00	0.00	0.09	0.05	0.07	0.01	0.00	0.23
66	0.00	0.70	0.22	0.00	0.03	0.03	0.03	0.01	1.02
67	0.00	1.63	0.52	0.00	0.14	0.03	0.12	0.03	2.46
68	0.00	1.49	0.38	0.11	0.02	0.00	0.02	0.00	2.02
69	0.00	0.00	0.00	0.00	0.17	0.03	0.15	0.03	0.39
70	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.05
71	0.35	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.47
72	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.02
73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
74	0.00	2.14	0.75	0.14	0.00	0.00	0.00	0.00	3.02
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	449.12	437.46	845.89	231.95	238.76	79.64	212.83	38.76	2,534.42

Appendix Table 4.--Estimated numbers at length (in 1,000,000s of fish) of Pacific whiting by area for the 1995 West Coast echo integration-trawl survey based on a target strength relationship of -35 dB/kg. Area boundaries are defined in Table 3.

			Columbia		Vancouver				
Length	Monterey	Eureka	South	North	U.S.	South	North	Charlotte	Total
20	0.00	0.93	1.20	0.00	0.00	0.08	0.00	0.00	2.21
21	0.00	3.84	5.20	0.43	0.07	0.41	0.14	0.00	10.10
22	0.00	11.27	14.07	0.13	0.07	1.31	0.29	0.00	27.14
23	0.00	28.66	35.04	1.03	0.47	5.16	2.77	0.00	73.13
24	0.14	48.57	59.31	2.32	0.90	9.77	7.47	0.00	128.48
25	1.48	55.28	65.06	4.94	2.04	12.77	11.50	0.00	153.07
26	2.30	43.72	50.67	9.22	3.73	12.16	11.90	0.00	133.72
27	2.04	21.46	20.01	9.18	3.70	7.04	7.66	0.00	71.08
28	1.58	7.75	7.52	9.35	3.78	3.01	3.31	0.00	36.31
29	3.52	2.02	1.11	5.27	2.13	0.64	0.74	0.00	15.42
30	8.83	2.92	0.00	2.05	0.83	0.43	0.54	0.00	15.60
31	17.44	5.76	0.00	0.60	0.24	0.00	0.00	0.00	24.04
32	72.85	25.00	0.50	0.08	0.03	0.01	0.00	0.00	98.48
33	209.53	70.60	0.66	0.00	0.00	0.00	0.00	0.00	280.79
34	408.00	144.35	3.37	0.05	0.00	0.00	0.00	0.00	555.78
35	418.24	156.73	5.87	0.21	0.00	0.00	0.00	0.00	581.06
36	269.04	126.17	13.77	0.46	0.00	0.00	0.00	0.00	409.43
37	112.90	65.04	14.41	0.56	0.04	0.04	0.00	0.00	193.00
38	30.45	32.67	13.51	0.60	0.00	0.00	0.00	0.00	77.23
39	8.54	12.50	9.55	1.07	0.00	0.00	0.00	0.00	31.65
40	7.18	8.48	12.32	1.81	0.21	0.01	0.04	0.01	30.07
41	7.25	19.02	32.98	6.08	0.47	0.05	0.16	0.03	66.05
42	7.67	30.23	84.65	16.56	2.70	0.30	1.44	0.29	143.85
43	11.21	45.24	154.07	35.88	6.07	1.11	3.37	0.60	257.55
44	13.51	53.78	216.89	56.85	15.60	2.69	9.24	1.80	370.37
45	8.84	51.93	242.39	69.39	26.12	5.00	17.49	3.46	424.62
46	4.56	54.21	215.85	63.46	43.83	10.15	33.93	6.64	432.65
47	7.70	50.49	165.72	49.74	49.81	13.52	41.87	8.05	386.91
48	4.57	38.61	103.20	32.30	56.70	18.56	53.00	9.62	316.56
49	2.35	16.54	54.43	18.34	44.34	14.65	42.07	7.71	200.43
50	1.02	9.65	26.19	7.88	33.45	11.68	31.58	5.95	127.40
51	0.03	5.45	9.65	3.82	17.60	7.20	17.23	3.09	64.07
52	0.72	2.23	5.02	1.80	12.28	5.69	12.68	2.19	42.61
53	0.00	1.27	2.16	0.72	5.63	2.39	5.40	1.02	18.58
54	0.72	0.46	0.50	0.20	4.50	1.71	4.28	0.82	13.19
55	0.39	0.55	0.57	0.20	1.77	1.16	2.10	0.32	7.04
56	0.00	0.48	0.64	0.30	1.43	0.64	1.35	0.25	5.09
57	0.00	0.69	0.16	0.04	0.97	0.41	0.92	0.18	3.36
58	0.00	0.65	0.11	0.09	0.66	0.38	0.65	0.11	2.65
59	0.00	0.69	0.15	0.04	0.47	0.22	0.47	0.09	2.12
60	0.17	0.83	0.11	0.15	0.31	0.14	0.22	0.05	1.97
61	0.35	0.22	0.14	0.00	0.14	0.05	0.13	0.03	1.06
62	0.00	0.00	0.00	0.00	0.15	0.06	0.18	0.03	0.41
63	0.18	0.06	0.00	0.00	0.07	0.03	0.06	0.01	0.40
64	0.00	0.00	0.00	0.00	0.01	0.08	0.10	0.00	0.18
65	0.00	0.00	0.00	0.05	0.03	0.04	0.01	0.00	0.12
66	0.00	0.35	0.11	0.00	0.02	0.02	0.01	0.00	0.52
67	0.00	0.79	0.25	0.00	0.07	0.01	0.06	0.01	1.19
68	0.00	0.69	0.18	0.05	0.01	0.00	0.01	0.00	0.93
69	0.00	0.00	0.00	0.00	0.08	0.01	0.07	0.01	0.17
70	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.02
71	0.14	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.19
72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
74	0.00	0.76	0.26	0.05	0.00	0.00	0.00	0.00	1.07
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1,645.45	1,259.61	1,649.56	413.38	343.52	150.78	326.45	52.38	5,841.14

Appendix Table 5.--Estimated biomass at age (in 1,000s of metric tons) of Pacific whiting by area for the 1992 West Coast echo integration-trawl survey based on a target strength relationship of -35 dB/kg. Area boundaries are defined in Table 3.

			Columbia		Vancouver			
Age	Monterey	Eureka	south	North	U.S.	south	North	Total
1	46.06	29.64	0.13	0.03	0.00	0.00	0.00	75.87
2	28.99	48.62	74.60	0.56	0.00	0.00	0.00	152.77
3	2.87	8.68	12.51	6.43	1.74	0.00	2.56	34.79
4	0.23	31.07	62.88	38.65	21.45	15.01	37.90	207.18
5	0.41	22.09	132.10	96.19	87.96	69.93	73.49	482.16
6	0.12	0.02	10.56	11.94	12.08	15.48	7.31	57.50
7	0.00	0.00	2.80	0.65	1.80	3.76	12.85	21.87
8	1.81	34.90	264.35	146.56	238.24	157.79	264.65	1,108.29
9	0.35	0.00	2.26	1.09	0.75	10.03	18.79	33.26
10	0.00	1.10	6.62	1.44	2.18	2.23	5.81	19.38
11	0.00	0.27	2.69	0.00	0.00	2.05	2.97	7.97
12	2.02	34.60	55.07	31.84	62.78	74.47	120.92	381.70
13	0.00	2.14	1.77	0.54	2.19	3.30	10.07	20.01
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.09	0.76	0.00	0.74	1.46	4.97	6.73	14.76
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	1.07	2.98	0.00	0.00	4.04
Total	82.94	213.89	628.33	337.73	435.61	359.02	564.04	2,621.55

Appendix Table 6.--Estimated numbers at age (in 1,000,000s of fish) of Pacific whiting by area for the 1992 West Coast echo integration-trawl survey based on a target strength relationship of -35 dB/kg. Area boundaries are defined in Table 3.

			Columbia		Vancouver			
Age	Monterey	Eureka	south	North	U.S.	south	North	Total
1	510.10	199.34	0.82	0.20	0.00	0.00	0.00	710.46
2	197.57	229.78	281.94	2.11	0.00	0.00	0.00	711.40
3	1244	22.23	33.57	15.04	3.63	0.00	5.00	91.91
4	0.48	72.20	133.26	76.34	40.06	26.78	62.94	412.06
5	0.74	44.84	263.16	174.65	150.93	122.62	117.92	874.87
6	0.21	0.04	21.28	21.49	20.12	25.48	10.93	99.56
7	0.00	0.01	5.58	0.96	2.52	5.63	18.66	33.35
8	3.23	63.99	462.80	242.85	361.61	239.38	377.19	1,751.06
9	0.64	0.00	3.51	1.99	1.41	16.04	25.28	48.88
10	0.00	1.94	11.63	2.35	3.44	3.12	7.61	30.09
11	0.00	0.39	3.76	0.00	0.00	2.82	4.67	11.64
12	3.28	62.64	92.83	51.23	90.50	103.25	153.93	557.67
13	0.00	4.27	3.07	0.74	2.84	4.97	13.41	29.30
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.14	1.26	0.00	1.14	2.19	6.78	7.92	19.43
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	1.66	3.94	0.00	0.00	5.60
Total	728.83	702.95	1,3 17.24	592.75	683.20	556.88	805.45	5,387.29

Appendix Table 7.--Estimated biomass at length (in 1,000s of metric tons) of Pacific whiting by area for the 1992 West Coast echo integration-trawl survey based on a target strength relationship of -35 dB/kg. Area boundaries are defined in Table 3.

			Columbia		Vancouver			
Length	Monterey	Eureka	South	North	U.S.	South	North	Total
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.12
22	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.96
23	5.16	0.00	0.00	0.00	0.00	0.00	0.00	5.16
24	14.06	0.06	0.00	0.00	0.00	0.00	0.00	14.12
25	16.16	0.17	0.00	0.00	0.00	0.00	0.00	16.34
26	11.17	0.97	0.00	0.00	0.00	0.00	0.00	12.13
27	2.99	4.95	0.14	0.00	0.00	0.00	0.00	8.09
28	2.81	11.08	0.11	0.07	0.00	0.00	0.00	14.06
29	2.42	13.34	0.39	0.03	0.00	0.00	0.00	16.17
30	3.10	8.47	0.61	0.03	0.00	0.00	0.00	12.20
31	5.16	6.78	2.30	0.03	0.00	0.00	0.00	14.27
32	5.03	6.66	4.49	0.03	0.00	0.00	0.00	16.22
33	4.06	8.73	17.87	0.07	0.00	0.00	0.00	30.72
34	2.41	9.54	23.76	0.28	0.00	0.00	0.00	35.99
35	1.61	4.13	17.08	0.57	0.00	0.00	0.00	23.39
36	0.42	2.59	9.13	0.47	0.00	0.00	0.00	12.61
37	0.14	4.35	3.56	0.42	0.00	0.00	0.00	8.48
38	0.00	0.49	1.45	0.70	0.00	0.00	0.00	2.64
39	0.04	1.01	2.54	0.68	0.00	0.00	0.00	4.27
40	0.00	0.47	7.03	3.70	0.31	0.25	0.00	11.76
41	0.12	9.03	16.82	9.32	1.19	0.95	1.17	38.60
42	0.21	16.45	37.28	22.18	6.15	4.89	4.95	92.10
43	0.14	22.32	63.73	38.28	20.23	16.13	11.48	172.30
44	0.56	21.51	89.80	55.34	38.46	30.66	31.02	267.34
45	0.80	22.30	106.84	65.77	67.22	53.81	62.07	378.82
46	0.81	20.95	101.13	62.79	87.39	70.09	84.66	427.82
47	0.80	12.20	66.23	41.34	81.97	65.80	86.87	355.21
48	0.73	2.97	33.92	21.57	59.54	48.24	82.40	249.36
49	0.56	1.86	14.31	9.11	37.20	30.60	62.89	156.52
50	0.15	0.24	5.38	3.43	20.27	17.19	48.23	94.88
51	0.08	0.00	1.37	0.87	7.18	6.47	32.46	48.42
52	0.00	0.00	0.24	0.15	3.40	3.69	17.41	24.90
53	0.09	0.00	0.82	0.52	2.41	2.91	14.29	21.04
54	0.00	0.30	0.00	0.00	0.54	1.52	7.90	10.26
55	0.10	0.00	0.00	0.00	0.31	1.06	4.61	6.08
56	0.00	0.00	0.00	0.00	1.20	1.54	5.14	7.88
57	0.00	0.00	0.00	0.00	0.35	0.98	0.42	1.75
58	0.00	0.00	0.00	0.00	0.00	0.32	3.09	3.40
59	0.00	0.00	0.00	0.00	0.31	0.67	1.18	2.16
60	0.00	0.00	0.00	0.00	0.00	0.39	1.21	1.60
61	0.00	0.00	0.00	0.00	0.00	0.23	0.59	0.82
62	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.20
63	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.32
64	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.11
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	82.94	213.88	628.32	337.73	435.60	359.02	564.04	2,621.54

Appendix Table 8.--Estimated numbers at length (in 1,000,000s of fish) of Pacific whiting by area for the 1992 West Coast echo integration-trawl survey based on a target strength relationship of -35 dB/kg. Area boundaries are defined in Table 3.

			Columbia		Vancouver			
Length	Monterey	Eureka	South	North	U.S.	South	North	Total
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	2.11	0.00	0.00	0.00	0.00	0.00	0.00	2.11
22	15.14	0.00	0.00	0.00	0.00	0.00	0.00	15.14
23	71.30	0.00	0.00	0.00	0.00	0.00	0.00	71.30
24	171.31	0.66	0.00	0.00	0.00	0.00	0.00	171.97
25	174.58	1.64	0.00	0.00	0.00	0.00	0.00	176.23
26	107.44	8.22	0.00	0.00	0.00	0.00	0.00	115.66
27	25.72	38.04	0.97	0.00	0.00	0.00	0.00	64.73
28	21.69	76.94	0.67	0.40	0.00	0.00	0.00	99.70
29	16.86	84.04	2.17	0.13	0.00	0.00	0.00	103.20
30	19.53	48.58	3.14	0.13	0.00	0.00	0.00	71.39
31	29.52	35.54	10.91	0.13	0.00	0.00	0.00	76.11
32	26.22	31.99	19.66	0.13	0.00	0.00	0.00	78.00
33	19.30	38.48	72.35	0.27	0.00	0.00	0.00	130.40
34	10.50	38.72	89.13	1.01	0.00	0.00	0.00	139.35
35	6.45	15.46	59.50	1.89	0.00	0.00	0.00	83.29
36	1.55	8.97	29.60	1.44	0.00	0.00	0.00	41.56
37	0.49	13.97	10.77	1.21	0.00	0.00	0.00	26.44
38	0.00	1.46	4.10	1.87	0.00	0.00	0.00	7.43
39	0.10	2.82	6.72	1.70	0.00	0.00	0.00	11.34
40	0.00	1.21	17.42	8.69	0.81	0.65	0.00	28.79
41	0.30	21.85	39.10	20.53	2.83	2.28	2.57	89.45
42	0.49	37.24	81.48	45.93	13.51	10.75	10.11	199.51
43	0.30	47.36	131.18	74.56	41.05	32.75	21.89	349.09
44	1.13	42.83	174.30	101.57	72.16	57.52	55.39	504.90
45	1.53	41.72	195.81	113.89	116.82	93.52	103.88	667.16
46	1.44	36.89	175.22	102.71	140.89	113.01	133.00	703.16
47	1.34	20.24	108.61	63.94	122.80	98.58	128.29	543.80
48	1.15	4.65	52.71	31.60	83.01	67.26	114.52	354.89
49	0.83	2.75	21.09	12.65	48.34	39.76	82.37	207.79
50	0.21	0.34	7.53	4.51	24.58	20.85	59.60	117.62
51	0.10	0.00	1.82	1.09	8.14	7.33	37.89	56.37
52	0.00	0.00	0.30	0.18	3.61	3.92	19.22	27.23
53	0.10	0.00	0.98	0.59	2.39	2.89	14.93	21.90
54	0.00	0.34	0.00	0.00	0.50	1.42	7.82	10.09
55	0.10	0.00	0.00	0.00	0.27	0.93	4.33	5.64
56	0.00	0.00	0.00	0.00	0.99	1.27	4.58	6.84
57	0.00	0.00	0.00	0.00	0.27	0.76	0.35	1.39
58	0.00	0.00	0.00	0.00	0.00	0.23	2.49	2.72
59	0.00	0.00	0.00	0.00	0.21	0.46	0.91	1.58
60	0.00	0.00	0.00	0.00	0.00	0.26	0.88	1.14
61	0.00	0.00	0.00	0.00	0.00	0.14	0.41	0.55
62	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.12
63	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.17
64	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.06
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	728.83	702.95	1,317.24	592.75	683.20	556.88	805.45	5,387.29

Appendix Table 9.--Estimated biomass at age (in 1,000s of metric tons) of Pacific whiting by area for the 1992 West Coast echo integration-trawl survey based on a target strength relationship of TS=20 log L - 68. Area boundaries are defined in Table 3.

			Columbia		Vancouver			
Age	Monterey	Eureka	South	North	U.S.	South	North	Total
1	13.81	11.69	0.06	0.02	0.00	0.00	0.00	25.58
2	10.13	20.19	35.26	0.32	0.00	0.00	0.00	65.90
3	1.09	4.32	6.32	3.65	1.03	0.00	1.59	18.00
4	0.10	15.83	33.35	21.90	12.68	8.88	23.48	116.22
5	0.18	11.14	70.24	54.50	51.99	41.39	45.53	274.97
6	0.05	0.00	5.61	6.76	7.14	9.17	4.53	33.27
7	0.00	0.00	1.49	0.37	1.07	2.24	7.96	13.13
8	0.80	17.62	141.00	83.03	140.82	93.78	163.98	641.02
9	0.15	0.00	1.21	0.62	0.45	5.95	11.64	20.02
10	0.00	0.56	3.53	0.82	1.29	1.32	3.60	11.11
11	0.00	0.13	1.44	0.00	0.00	1.24	1.84	4.65
12	0.90	17.47	29.38	18.04	37.11	44.62	74.93	222.44
13	0.00	1.10	0.95	0.30	1.29	1.97	6.24	11.84
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.04	0.38	0.00	0.42	0.87	2.98	4.17	8.86
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.60	1.76	0.00	0.00	2.36
Total	27.25	100.42	329.85	191.33	257.48	213.53	349.49	1,469.35

Appendix Table lO.--Estimated numbers at age (in 1,000,000s of fish) of Pacific whiting by area for the 1992 West Coast echo integration-trawl survey based on a target strength relationship of TS=20 log L - 68. Area boundaries are defined in Table 3.

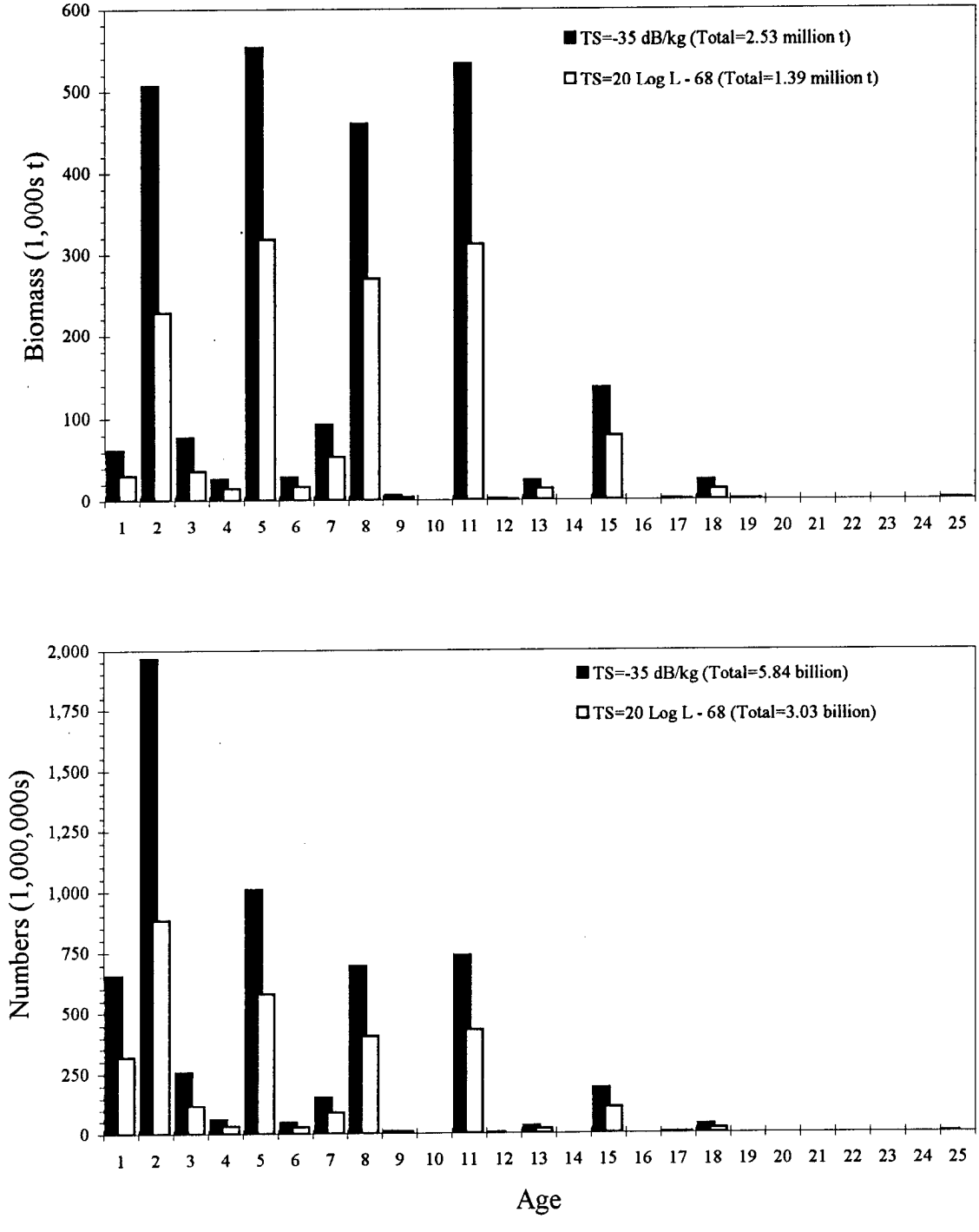
			Columbia		Vancouver			
Age	Monterey	Eureka	South	North	U.S.	South	North	Total
1	152.70	78.72	0.41	0.11	0.00	0.00	0.00	231.94
2	67.06	94.74	133.71	1.20	0.00	0.00	0.00	296.72
3	4.74	10.97	16.84	8.54	2.15	0.00	3.10	46.36
4	0.21	36.89	70.90	43.37	23.77	15.91	39.01	230.06
5	0.33	22.65	140.41	99.23	89.55	72.84	73.09	498.10
6	0.09	0.00	11.35	12.21	11.94	15.14	6.77	57.51
7	0.00	0.00	2.98	0.54	1.49	3.36	11.56	19.94
8	1.42	32.41	247.78	137.99	214.55	142.61	233.78	1,010.54
9	0.29	0.00	1.89	1.13	0.84	9.55	15.67	29.36
10	0.00	0.98	6.23	1.34	2.04	1.86	4.71	17.15
11	0.00	0.19	2.02	0.00	0.00	1.70	2.89	6.80
12	1.47	31.77	49.72	29.11	53.70	61.83	95.40	322.99
13	0.00	2.19	1.65	0.42	1.69	2.96	8.31	17.22
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.06	0.64	0.00	0.65	1.30	4.07	4.91	11.63
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.94	2.34	0.00	0.00	3.28
Total	228.37	312.15	685.88	336.80	405.35	331.83	499.20	2,799.59

Appendix Table 11 .--Estimated biomass at length (in 1,000s of metric tons) of Pacific whiting by area for the 1992 West Coast echo integration-trawl survey based on a target strength relationship of TS=20 log L - 68. Area boundaries are defined in Table 3.

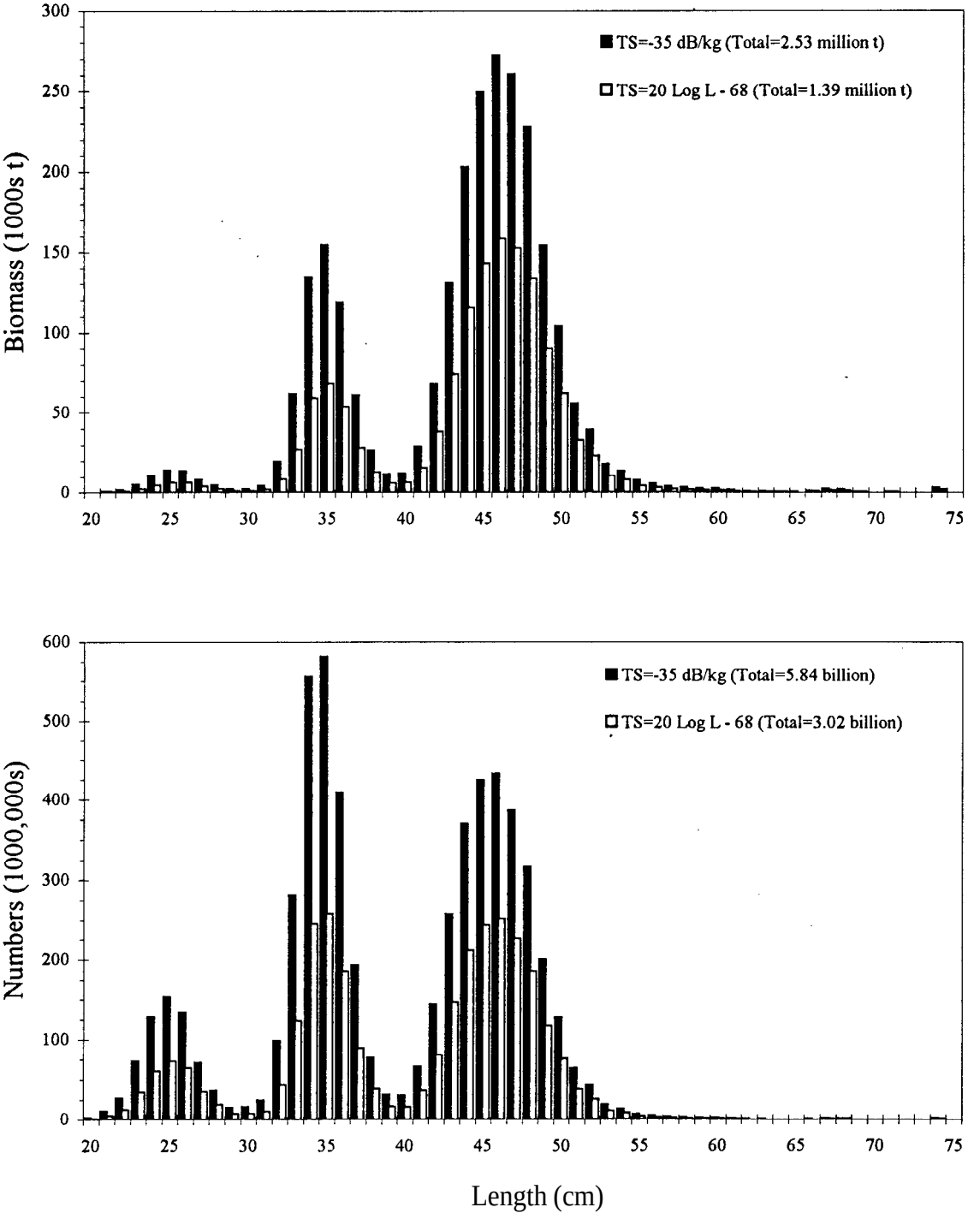
			Columbia		Vancouver			
Length	Monterey	Eureka	South	North	U.S.	South	North	Total
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03
22	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.28
23	1.52	0.00	0.00	0.00	0.00	0.00	0.00	1.52
24	4.14	0.02	0.00	0.00	0.00	0.00	0.00	4.17
25	4.78	0.07	0.00	0.00	0.00	0.00	0.00	4.85
26	3.33	0.38	0.00	0.00	0.00	0.00	0.00	3.71
27	0.97	1.95	0.07	0.00	0.00	0.00	0.00	2.98
28	0.94	4.35	0.06	0.04	0.00	0.00	0.00	5.39
29	0.85	5.24	0.18	0.01	0.00	0.00	0.00	6.29
30	1.10	3.37	0.29	0.02	0.00	0.00	0.00	4.77
31	1.87	2.69	1.08	0.02	0.00	0.00	0.00	5.66
32	1.88	2.67	2.12	0.02	0.00	0.00	0.00	6.69
33	1.52	3.59	8.42	0.04	0.00	0.00	0.00	13.56
34	0.92	4.11	11.21	0.16	0.00	0.00	0.00	16.39
35	0.62	1.77	8.09	0.32	0.00	0.00	0.00	10.80
36	0.17	1.20	4.34	0.26	0.00	0.00	0.00	5.97
37	0.06	2.20	1.72	0.24	0.00	0.00	0.00	4.21
38	0.00	0.23	0.75	0.40	0.00	0.00	0.00	1.37
39	0.02	0.51	1.27	0.38	0.00	0.00	0.00	2.17
40	0.00	0.22	3.69	2.10	0.19	0.15	0.00	6.34
41	0.05	4.59	8.86	5.28	0.70	0.56	0.73	20.77
42	0.08	8.37	19.79	12.57	3.63	2.89	3.07	50.40
43	0.06	11.32	33.87	21.69	11.96	9.54	7.11	95.54
44	0.25	10.96	47.86	31.35	22.73	18.13	19.22	150.50
45	0.35	11.31	56.94	37.26	39.73	31.85	38.46	215.90
46	0.36	10.57	53.94	35.57	51.65	41.49	52.46	246.04
47	0.35	6.15	35.34	23.42	48.45	38.96	53.83	206.49
48	0.33	1.50	18.14	12.22	35.19	28.61	51.05	147.04
49	0.26	0.89	7.65	5.16	21.98	18.19	38.97	93.10
50	0.07	0.10	2.88	1.94	11.98	10.27	29.89	57.11
51	0.04	0.00	0.73	0.49	4.25	3.90	20.11	29.52
52	0.00	0.00	0.13	0.09	2.01	2.29	10.79	15.30
53	0.04	0.00	0.44	0.30	1.42	1.83	8.86	12.88
54	0.00	0.12	0.00	0.00	0.32	1.02	4.90	6.35
55	0.05	0.00	0.00	0.00	0.18	0.71	2.86	3.80
56	0.00	0.00	0.00	0.00	0.71	0.97	3.18	4.86
57	0.00	0.00	0.00	0.00	0.21	0.65	0.26	1.12
58	0.00	0.00	0.00	0.00	0.00	0.22	1.91	2.13
59	0.00	0.00	0.00	0.00	0.18	0.44	0.73	1.35
60	0.00	0.00	0.00	0.00	0.00	0.28	0.75	1.03
61	0.00	0.00	0.00	0.00	0.00	0.16	0.37	0.53
62	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.14
63	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.22
64	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.08
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	27.26	100.42	329.84	191.33	257.48	213.53	349.49	1,469.34

Appendix Table 12.--Estimated numbers at length (in 1,000,000s of fish) of Pacific whiting by area for the 1992 West Coast echo integration-trawl survey based on a target strength relationship of TS=20 log L - 68. Area boundaries are defined in Table 3.

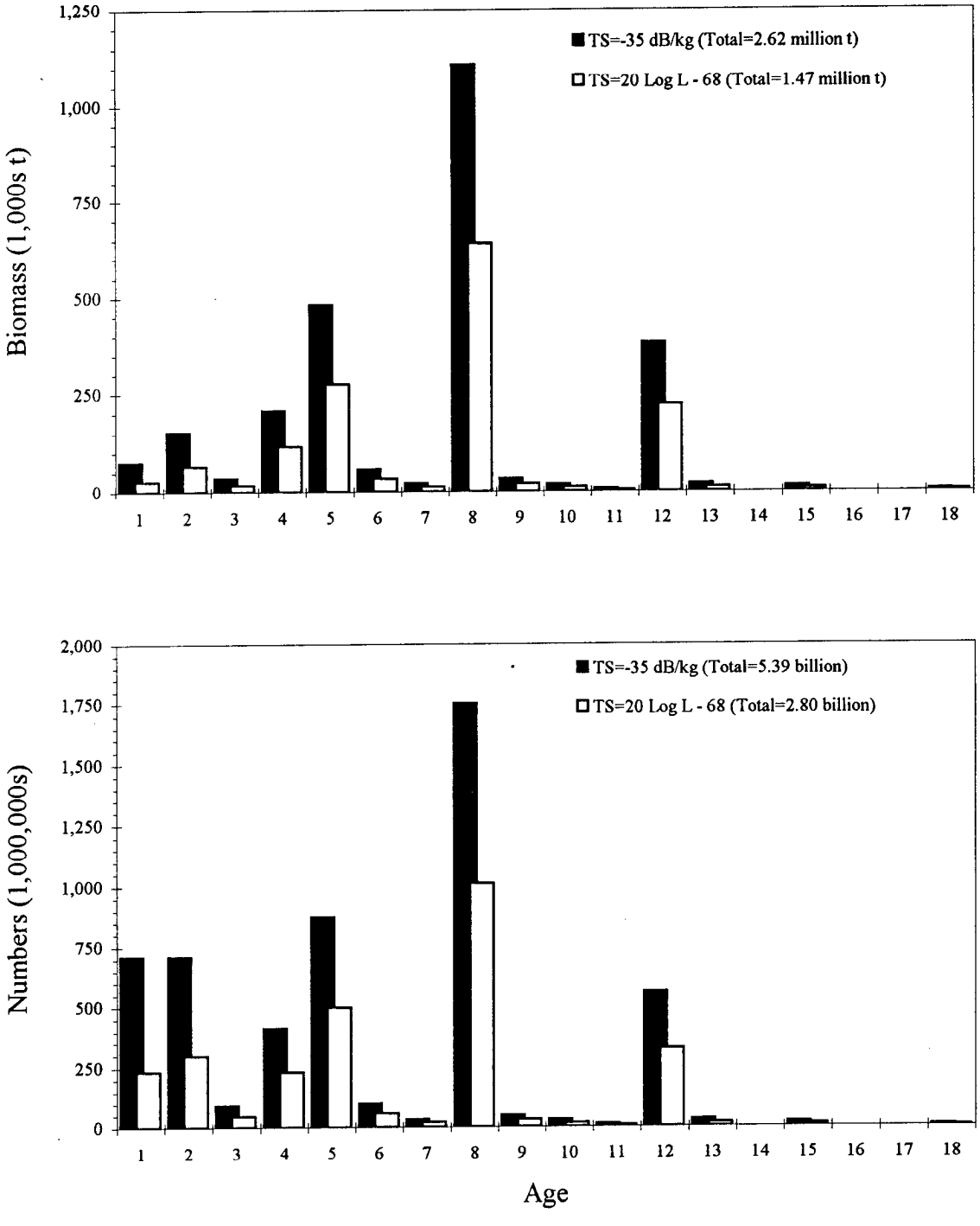
			Columbia		Vancouver			
Length	Monterey	Eureka	South	North	U.S.	South	North	Total
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.62
22	4.47	0.00	0.00	0.00	0.00	0.00	0.00	4.47
23	21.04	0.00	0.00	0.00	0.00	0.00	0.00	21.04
24	50.65	0.26	0.00	0.00	0.00	0.00	0.00	50.91
25	51.80	0.65	0.00	0.00	0.00	0.00	0.00	52.44
26	32.17	3.24	0.00	0.00	0.00	0.00	0.00	35.41
27	8.33	14.99	0.46	0.00	0.00	0.00	0.00	23.78
28	7.29	30.30	0.36	0.23	0.00	0.00	0.00	38.17
29	5.93	33.10	1.04	0.08	0.00	0.00	0.00	40.14
30	6.94	19.38	1.50	0.08	0.00	0.00	0.00	27.90
31	10.71	14.14	5.17	0.08	0.00	0.00	0.00	30.09
32	9.82	12.86	9.29	0.08	0.00	0.00	0.00	32.06
33	7.27	15.85	34.18	0.15	0.00	0.00	0.00	57.46
34	4.01	16.73	42.18	0.57	0.00	0.00	0.00	63.49
35	2.47	6.65	28.29	1.07	0.00	0.00	0.00	38.49
36	0.62	4.16	14.13	0.82	0.00	0.00	0.00	19.73
37	0.20	7.07	5.22	0.69	0.00	0.00	0.00	13.17
38	0.00	0.67	2.14	1.06	0.00	0.00	0.00	3.87
39	0.05	1.41	3.36	0.96	0.00	0.00	0.00	5.78
40	0.00	0.58	9.16	4.94	0.48	0.38	0.00	15.55
41	0.12	11.14	20.68	11.66	1.68	1.35	1.59	48.23
42	0.20	18.99	43.43	26.10	8.02	6.38	6.27	109.38
43	0.12	24.08	69.99	42.37	24.35	19.44	13.57	193.91
44	0.50	21.87	93.26	57.71	42.81	34.14	34.33	284.63
45	0.67	21.21	104.74	64.71	69.31	55.55	64.39	380.58
46	0.64	18.65	93.81	58.36	83.59	67.15	82.43	404.65
47	0.60	10.22	58.18	36.33	72.86	58.59	79.51	316.29
48	0.52	2.36	28.30	17.95	49.25	40.04	70.98	209.39
49	0.38	1.32	11.32	7.19	28.68	23.73	51.05	123.67
50	0.09	0.13	4.04	2.56	14.59	12.50	36.94	70.87
51	0.05	0.00	0.98	0.62	4.83	4.44	23.48	34.40
52	0.00	0.00	0.16	0.10	2.14	2.44	11.91	16.75
53	0.05	0.00	0.53	0.34	1.42	1.82	9.25	13.41
54	0.00	0.13	0.00	0.00	0.30	0.95	4.85	6.23
55	0.05	0.00	0.00	0.00	0.16	0.63	2.69	3.52
56	0.00	0.00	0.00	0.00	0.59	0.80	2.84	4.23
57	0.00	0.00	0.00	0.00	0.16	0.51	0.22	0.89
58	0.00	0.00	0.00	0.00	0.00	0.16	1.54	1.70
59	0.00	0.00	0.00	0.00	0.13	0.30	0.56	0.99
60	0.00	0.00	0.00	0.00	0.00	0.18	0.55	0.73
61	0.00	0.00	0.00	0.00	0.00	0.10	0.25	0.35
62	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.08
63	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.12
64	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.04
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	228.37	312.15	685.88	336.80	405.35	331.83	499.20	2,799.59



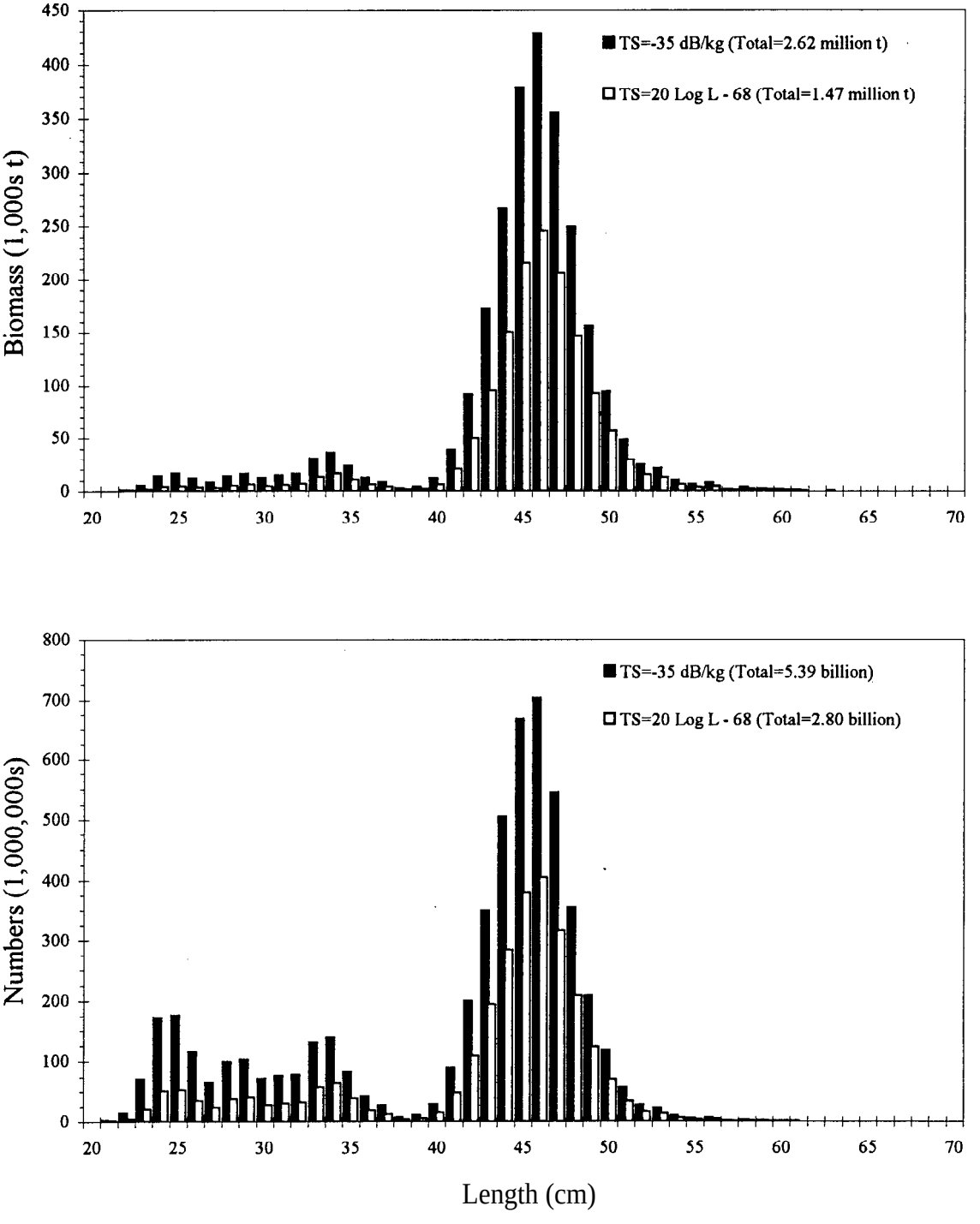
Appendix Figure 1. --Comparison of 1995 total coastwide estimates of Pacific whiting biomass and numbers at age based on target strength relationships of -35 dB/kg and TS=20 Log L - 68.



Appendix Figure 2.--Comparison of 1995 total coastwide estimates of Pacific whiting biomass and numbers at length based on target strength relationships of -35 dB/kg and TS=20 Log L - 68.



Appendix Figure 3 .--Comparison of 1992 total coastwide estimates of Pacific whiting biomass and numbers at age based on a target strength relationship of -35 dB/kg and TS=20 Log L - 68.



Appendix Figure 4.--Comparison of 1992 total coastwide estimates of Pacific whiting biomass and numbers at length based on a target strength relationship of -35 dB/kg and TS=20 Log L - 68.

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