



**Alaska
Fisheries Science
Center**

National Marine
Fisheries Service

U.S. DEPARTMENT OF COMMERCE

AFSC PROCESSED REPORT 2003-12

Echo Integration-trawl Survey of
Pacific Hake, *Merluccius productus*,
off the Pacific Coast of the United States
and Canada During June-August 2001

December 2003

Notice to Users of this Document

In the process of converting the original printed document into Adobe Acrobat .PDF format, slight differences in formatting can occur; page numbers in the .PDF may not match the original printed document; and some characters or symbols may not translate.

This document is being made available in .PDF format for the convenience of users; however, the accuracy and correctness of the document can only be certified as was presented in the original hard copy format.

**Echo Integration-Trawl Survey of
Pacific Hake, *Merluccius productus*,
off the Pacific Coast of the United States
and Canada during June-August 2001**

by

M.A. Guttormsen¹, C.D. Wilson¹, K. Cooke²,
M.W. Saunders², D.R. McKelvey¹, and R. Kieser²

¹Alaska Fisheries Science Center
7600 Sand Point Way N.E.
Seattle, WA 98115

²Biological Sciences Branch
Department of Fisheries and Oceans
Pacific Biological Station
Nanaimo, British Columbia V9T 6N7

December 2003

ABSTRACT

Results are presented for the ninth triennial echo integration-trawl (EIT) survey of Pacific hake, *Merluccius productus*, along the west coasts of the United States and Canada during the summer 2001. Scientists from the United States and Canada conducted the joint survey aboard two research vessels. Results are also reported for an inter-ship calibration of the acoustic systems aboard each vessel.

The total area surveyed, based on the efforts of both countries was greater than any previous EIT survey with the exception of the 1998 survey which extended to Cape Spencer, Alaska (58°N), because of the northward displacement of the Pacific hake during the strong 1997-98 El Niño conditions. The U.S. survey was conducted from 15 June to 29 July 2001, and extended along the Pacific coast from Monterey, California (36°N), to northern Vancouver Island, British Columbia (50°N). The Canadian survey was conducted from 6 to 18 August 2001, and covered the area beginning at the northern limit of the U.S. survey and progressed northward to Cape Muzon (55°N), then through Dixon Entrance, Hecate Strait, and Queen Charlotte Sound.

Most Pacific hake was detected between central California and central Oregon (37-44°N). The only substantial Pacific hake aggregation found outside that area was off La Perouse Bank off Vancouver Island, British Columbia (48°30'N). The coastwide Pacific hake abundance estimate was 2.1 billion fish weighing 0.74 million metric tons (t), which represents a decrease of about 38% from the 1998 estimate of 1.19 million t, and is the lowest biomass estimate in the time series. Overall, the 1999 year class contributed 50% of the biomass.

CONTENTS

INTRODUCTION.....	1
METHODS.....	2
Acoustic Data Acquisition.....	2
Survey Design.....	2
Trawling Operations.....	3
Physical Oceanographic Data Collection.....	4
Biological Sampling.....	5
Data Analysis.....	6
Acoustic System Calibration.....	6
U.S.-Canadian Acoustic Systems Comparison.....	7
Target Strength Data Collection.....	7
RESULTS.....	8
Biological and Oceanographic Sampling.....	8
Pacific Hake Distribution and Abundance.....	9
Target Strength Data.....	10
Acoustic Systems Calibration.....	10
U.S.-Canadian Acoustic Systems Comparison.....	10
DISCUSSION.....	11
ACKNOWLEDGMENTS.....	12
CITATIONS.....	13
TABLES and FIGURES.....	15
APPENDIX.....	57

INTRODUCTION

Pacific hake (*Merluccius productus*), also called Pacific whiting, 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 (Helser et al. 2002). Echo integration-trawl (EIT) surveys to assess the distribution, biology, and abundance of Pacific hake have been conducted triennially along the U.S. and Canadian Pacific coast since 1977 by Alaska Fisheries Science Center (AFSC), National Marine Fisheries Service (NMFS) scientists (Wilson et al. 2000), and annually along the Canadian west coast since 1990 by Pacific Biological Station (PBS), Department of Fisheries and Oceans (DFO) researchers (Cooke et al. 1996). The triennial surveys in 1995, 1998, and 2001 were carried out jointly by AFSC and DFO researchers and included inter-ship calibrations of the acoustic systems. All surveys were conducted during the summer months (June-September) when Pacific hake are in feeding aggregations along the continental shelf break from northern California to Queen Charlotte Sound. Movement is believed to be minimal and the stock is fully available to the survey during this time of year (Nelson and Dark 1985).

The surveys are an important data source for the joint Canada-U.S. Pacific hake stock assessment (Helser et al. 2002). The time series of survey estimates of abundance and age composition is used in an age-structured assessment model to estimate Pacific hake abundance. The most recent estimates of stock size from the model are used in forward projections to provide advice on future harvests.

Bottom trawl surveys conducted by the AFSC in the summer during the same years as the AFSC EIT surveys assess the near-bottom component of the stock (Nelson and Dark 1985). Stock assessments before 1993 added abundance estimates derived from the U.S. 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 EIT surveys since 1992 as the best estimates of total population biomass (Dorn 1996).

This document summarizes the results of the ninth triennial survey, conducted jointly by U.S. and Canadian scientists aboard the National Ocean and Atmospheric Administration (NOAA) ship *Miller Freeman* and the Canadian Coast Guard (CCGS) ship *W.E. Ricker* during the summer of 2001.

METHODS

The U.S. survey (cruise number MF2001-08) was conducted aboard the NOAA ship *Miller Freeman*, a 66 m stern trawler equipped for fisheries and oceanographic research. The Canadian survey (cruise number 2001-18) was conducted aboard the CCGS *W.E. Ricker*, a 58 m stern trawler, similarly equipped.

Acoustic Data Acquisition

Both vessels collected acoustic data with a Simrad EK500¹ quantitative echosounding system (Simrad 1993a, Bodholt 1990, Bodholt and Solli 1995). Simrad 38 kHz and 120 kHz split-beam transducers were located on retractable mounts on each vessel. Transducers remained lowered during all scientific operations. The NOAA ship *Miller Freeman*'s centerboard positioned the transducers 9 m below the ocean surface; the CCGS *W.E. Ricker*'s ram extended the transducers to 5.7 m below the surface. Results presented here are based on data collected with the 38 kHz transducers. Acoustic backscatter data from the Simrad EK500 echosounders were logged with Simrad BI500 software to SUN workstations (Foote et al. 1991, Simrad 1993b). Echo integration data were collected aboard the CCGS *W.E. Ricker* at greater than 1 to 0.5 Hz ping rate with a vertical resolution of 1 m and a horizontal resolution of about 5-10 m at a typical vessel speed of 4.6 m/sec (9 knots). Echo integration data were sampled aboard both vessels with a horizontal resolution of about 9 m and vertical resolution of 1-2 m.

Echograms were scrutinized using Simrad BI500 echo editing/integration software to partition the acoustic information into major species groups and to remove noise. Color echograms were recorded on printers to aid researchers in assigning echo sign and to compare fish distributions and species assignments from both vessels. Additional data processing and mapping methods unique to each agency are described later in this report.

Survey Design

The survey effort was split between the two vessels. The NOAA ship *Miller Freeman* covered the area from Monterey, California (36°N), to northern Vancouver Island, British Columbia (50°N; Fig. 1a). The CCGS *W.E. Ricker* continued the survey off Vancouver Island to southeast Alaska, near Cape Muzon (55°N; Fig. 1b), which was the northern limit of the Pacific hake distribution, then through Dixon Entrance, Hecate Strait, and Queen Charlotte Sound. Parallel transect spacing was 18.5 km between Monterey and Queen Charlotte Sound, 37.0 km west of the Queen Charlotte Islands and in Dixon Entrance, and 74.1 km in Hecate Strait.

¹ Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

Bottom depths at the nearshore ends of transects covered by the NOAA ship *Miller Freeman* ranged between about 30 and 100 m (mean 60 m), and the offshore ends were often in waters deeper than 1,500 m. Transects were extended if fish echo sign was found at or near the predetermined transect endpoints.

Typical vessel speed was about 6.0 m/sec (11.5 knots) for the NOAA ship *Miller Freeman* and 4.6 m/sec (9 knots) for the CCGS *W.E. Ricker* when running transects. Transects were only run during daylight hours (about 15 hours per day) by both vessels. Nighttime hours on the NOAA ship *Miller Freeman* were used on an opportunistic basis to collect Pacific hake target strength (TS) data, conduct trawl hauls on Pacific hake echo sign not sampled during the day, investigate aggregations of other midwater fishes and macrozooplankton, and conduct other ancillary projects. Night operations on the CCGS *W.E. Ricker* were used to conduct conductivity-temperature-depth (CTD) sampling.

Trawling Operations

Trawling operations were conducted from both vessels to aid in the interpretation of the acoustic data. U.S. researchers aboard the NOAA ship *Miller Freeman* sampled midwater and near-bottom echosign using an Aleutian Wing 30/26 trawl (AWT), except on four occasions when echosign was sampled with a Marinovich trawl. The AWT is a full-mesh wing trawl constructed of nylon except for polyethylene toward 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 except on 11 occasions, when a 1.2 cm mesh liner was used. The AWT was fished with 82.4 m of 1.9 cm diameter 8 by 19 non-rotational dandyline, 227 kg or 341 kg tom weights on each side. Meshes in the Marinovich trawl measured 7.6 cm forward, 3.2 cm in the codend, and 0.32 cm in the codend liner. Headrope and footrope lengths were 9.1 m. The Marinovich trawl was fished with 18.3 m of 1.27 cm diameter dandyline, and 227 kg tom weights on each side. Both nets were fished using 5 m² "Fishbuster" doors (1,247 kg each).

Scientists aboard the NOAA ship *Miller Freeman* sampled fish on and near the bottom with a polyethylene Nor'eastern (PNE) high-opening bottom trawl equipped with roller gear. The trawl was constructed with stretch mesh mesh sizes that ranged from 13 cm in the forward portion of the net to 8.9 cm in the codend. The codend was fitted with a 3.2 cm mesh liner. The 27.2 m headrope held 21 floats (30 cm diameter). A 24.7 m chain fishing line was attached to the 24.9 m footrope which was constructed of 1 cm 6 by 19 wire rope wrapped with polypropylene rope. The 24.2 m roller gear was constructed with 36 cm rubber bobbins spaced 1.5-2.1 m apart. A solid string of 10 cm rubber disks separated some of the bobbins in the center section of the roller gear. Two 5.9 m wire rope extensions with 10 cm and 20 cm rubber disks were used to span the two lower flying wing sections and were attached to the roller gear. The roller gear was attached to the fishing line using chain toggles (2.9 kg each) which were comprised of five links

and one ring. The trawl was rigged with triple 54.9 m galvanized wire rope dandylines, and was fished with the “Fishbuster” doors.

Midwater and near-surface macrozooplankton were sampled from the NOAA ship *Miller Freeman* using a Methot trawl (Methot 1986) or a bongo net. The Methot trawl had a rigid square frame with 2.3 m sides. Mesh sizes were 2 by 3 mm in the main part of the net and 1 mm in the codend. A 1.8 m dihedral depressor modified from an Isaacs-Kidd midwater trawl was suspended below the frame to generate an additional downward force. The Methot trawl was attached to a single cable that was fed through the ship’s stern-mounted A-frame. The bongo net system was deployed from the ship’s starboard winch and consisted of a 60 cm bongo frame with paired 333 μm mesh nets, and a 46 kg lead weight used as a depressor. The Methot trawl and bongo net had calibrated General Oceanics flow meters attached to the mouth of the nets to measure volume filtered.

Trawl gears aboard the NOAA ship *Miller Freeman* were monitored during sampling for depth, net opening, and other parameters. A WesMar TCS700E third-wire trawl sonar or a Furuno CN-10B netsounder system was attached to the headrope of the AWT, PNE, and Marinovich trawls. A Scanmar depth sensor was attached to the Methot trawl frame, and a Sea-Bird CTD system was attached to the bongo frame. Vertical net openings averaged 24 m for the AWT, 3 m for the Marinovich, and 8 m for the PNE.

Canadian trawling operations were carried out with a midwater Polish rope trawl with a 20 m vertical opening and 1 cm codend mesh with a pair of 5 m² ‘USA JET’ combination trawl doors (1,100 kg), and 80 m sweep wires with 300 kg chain weights. A Simrad FS3300 third wire headrope trawl sonar and a Simrad ITI net mensuration system were used to monitor and guide the fishing process. Trawling operations included surface and midwater tows. Surface tows targeted Pacific salmon (*Oncorhynchus* spp.) from about 1 m to 15 m depth for another study described elsewhere.

Canadian researchers collected zooplankton samples at discrete depths using a Tucker trawl with a 1 m² mouth opening and 335 micron black Nitex® mesh. Each of the three nets on the Tucker trawl was equipped with a calibrated General Oceanics flow meter.

Physical Oceanographic Data Collection

Physical oceanographic data were collected by U.S. and Canadian researchers to contribute to ongoing studies of the bio-physical factors influencing the distribution of Pacific hake. Information was collected to describe ocean temperature, salinity, and current velocity.

U.S. researchers collected vertical profiles of salinity and temperature data with a Seabird CTD system at acoustic calibration sites and other locations during the survey. Expendable bathythermograph (XBT) data were collected to generate vertical temperature profiles at 0.5

degree latitude intervals along transects at the offshore endpoints, and over bottom depths of about 150 and 400 m. Occasionally, XBTs were deployed at other locations. Temperature/depth profile data were collected during most trawl hauls by attaching a Seabird SBE39 micro bathythermograph (SBE) to the trawl headrope or the Methot frame. Sea surface temperature, salinity, meteorological, and sea state data were collected using the NOAA ship *Miller Freeman's* Scientific Collection System. Ocean current velocity profile data were obtained using a 150 kHz narrow band acoustic Doppler current profiler (ADCP) system (RD Instruments, 9855 Businesspark Ave., San Diego, CA 92131) with the transducer mounted in the centerboard. The ADCP was slaved to the EK500 to avoid interference and was operated continuously throughout the cruise.

Canadian scientists collected CTD data at pre-selected stations using a Guildline CTD (8770 series). CTD stations, separated by approximately 1 km, were located on selected transects near the shelf break. Sea surface temperature and salinity measurements were recorded every 15 seconds from a Seabird thermosalinograph (SBE21). Ocean current velocity profile data were collected continuously using a 150 kHz narrow band ADCP with a ram-mounted transducer. The ADCP was not slaved to the EK500 and may have interfered to some degree with 120 kHz data collection.

Biological Sampling

Trawl hauls were made at selected locations to identify echo sign, to provide information on Pacific hake, and to identify the biological composition of associated fish and other organisms. The U.S. researchers used standard catch sorting and enumeration procedures to process the catches (Hughes 1976). Catches less than 900 kg were sorted completely, while larger catches were subsampled. Total numbers and weights were determined for all species. Weights were determined to the nearest 0.1 kg for the sorted portions of the catch using an electronic, motion-compensating scale (Marel M60). Pacific hake were subsampled to determine fork length (FL) composition by sex, collect otoliths for subsequent age determination, and collect maturity and length-weight measurements. A Marel M60 scale was used to determine all weights taken from individual hake specimens and lengths to the nearest centimeter were determined using a polycorder measuring device (Sigler 1994). Sexual maturity was determined by visual inspection using an 8-stage scale (ADP Code Book, 1999, RACE Division, AFSC, Seattle WA 98115). Otoliths were preserved in 50% ethanol.

Trawl catches on board the CCGS *W.E. Ricker* were emptied from the codend into a below-deck hopper and sorted by species off a conveyor belt into tubs. All tubs of fish were weighed to the nearest 0.5 kg on a Marel M60 motion compensated scale. Subsamples of Pacific hake were selected by retaining at least 3 tubs of fish from the start, middle and end of the hopper load for routine biological sampling. For small hauls, the entire catch was sampled. Sex, maturity (Weir et al. 1978), fork length to the nearest millimeter, and weight to the nearest gram were recorded for all Pacific hake sampled. Individual fish weights were determined using the

Marel M60 scale. Otoliths were collected and stored in a 1/1 glycerine/freshwater solution with thymol at 0.3% for subsequent age determination. Stomach contents of Pacific hake from 1 or 2 tubs from each haul were examined, and prey items were identified to the lowest possible taxon. The volume of each prey item was estimated visually to the nearest 1 cc. The state of digestion was recorded for each prey item, and any identifiable Pacific herring (*Clupea pallasii*) remains were counted and measured.

Data Analysis

Echo integration data were examined for Pacific hake echo sign from 5 m below the transducer to within 0.5 m of the bottom echo, or to a depth of 500 m when depths exceeded 500 m. Relatively high levels of backscattering attributed to unidentified smaller organisms other than hake were encountered throughout much of the water column in the Monterey, Eureka, and Columbia International North Pacific Fisheries Commission (INPFC) statistical areas. An acoustic volume backscattering (S_V) threshold value of -58.5 dB was used for these regions, whereas -69 dB was used for all other areas, where small scatterers were less abundant. The higher threshold was used in the south to avoid including significant quantities of non-hake scatterers in biomass estimates. This same procedure was applied to the 1992, 1995, and 1998 U.S. West Coast Pacific hake EIT survey data (Wilson and Guttormsen 1997, Wilson et al. 2000).

Pacific hake length data were aggregated into analytical strata based on echosign type, geographic proximity of hauls, and similarity in size composition. The average s_A value for each stratum was then scaled to age- and length-specific fish numbers and biomass using Pacific hake length distributions, a length-weight relationship and age-length keys derived from trawl catches, and a standard TS and fish length relationship ($TS = 20 \log L - 68$; Traynor 1996). Estimates of age- and length-specific numbers and biomass were then summed across geographic strata to provide estimates for each area and a total coastwide estimate.

Acoustic System Calibration

The U.S. and Canadian acoustic systems were calibrated in the field before and after the survey (Table 1). The calibration procedure involves suspending copper spheres with known backscattering cross sections below the transducers and measuring the acoustic returns following standard procedures (Foote et al. 1987, MacLennan and Simmonds 1992). Vessels were anchored during calibration; the NOAA ship *Miller Freeman* from the bow and stern and the CCGS *W.E. Ricker* from the bow only. Sphere diameters were 60 and 23 mm for the 38 and 120 kHz transducers, respectively. Split-beam target strength and echo integration data were collected to calculate echosounder gain parameters and transducer beam pattern characteristics and thus evaluate system performance.

U.S.-Canadian Acoustic Systems Comparison

An intercalibration of the Simrad EK500 acoustic systems aboard the NOAA ship *Miller Freeman* and the CCGS *W.E. Ricker* was conducted 26-27 July. Acoustic data at 38 kHz were collected along 14 southwest-northeast oriented transects about 40 km south of Nootka Sound, off Vancouver Island (Fig. 1a). Transects were run over bottom depths of about 60 to 140 m and varied in length from 9 to 20 km. For each transect, one vessel followed about 1.9 km (1.0 nmi) directly astern of the other. Vessels alternated for lead position at the beginning of transect pairs, with a few exceptions. Vessel speeds were about 3-4 m/sec (8-9 knots).

Target Strength Data Collection

When conditions were suitable for collection of *in situ* TS data (e.g., low fish density, single-species aggregations, unimodal size distribution, and calm seas), the NOAA ship *Miller Freeman* would repeat passes at speeds of less than 2 m/sec (4 knots) over aggregations of Pacific hake. Trawl hauls were conducted in conjunction with the acoustic TS data collection to gather biological data of the targeted aggregation.

RESULTS

The area of operations for the joint U.S.-Canada survey extended along the west coast of North America from Monterey, California, to Cape Muzon, Alaska (Fig. 1). The survey area was divided into geographical subareas, which were used for the analysis of the survey data (Table 2). The U.S. survey (Fig. 1a) was conducted from 15 June to 29 July 2001, and extended from Monterey, California (36°N), to northern Vancouver Island, British Columbia (50°N). About 4,870 km of parallel acoustic transect lines were run by the NOAA ship *Miller Freeman*. The Canadian survey was conducted between 6 and 18 August 2001; the survey started off Vancouver Island (50°N) and progressed northward along Queen Charlotte Islands to Cape Muzon (55°N), and then through Dixon Entrance, Hecate Strait, and Queen Charlotte Sound (Fig. 1b). About 640 km of parallel transects were run by the CCGS *W.E. Ricker*. Location, date, and time of each transect of the CCGS *W.E. Ricker* survey are listed in Appendix Tables 1a-c and shown in Appendix Figures 1a-b.

Biological and Oceanographic Sampling

Researchers aboard both ships conducted trawl hauls to identify echo sign and collect biological data. Aboard the NOAA ship *Miller Freeman*, 76 midwater trawls (i.e., 72 AWT and 4 Marinovich), 14 bottom trawls (Fig. 1a; Table 3), 59 Methot trawls, and 20 bongo tows (Fig. 2; Table 4 and 5) were conducted. Scientists aboard the CCGS *W.E. Ricker* conducted 41 midwater trawls (trawl data begin at set 68; sets 1 through 67 were conducted prior to this survey and form part of separate study that will be reported in a Canadian manuscript report) (Fig. 1b; Table 6; Appendix Table 2).

Pacific hake was the dominant fish species by both weight and numbers from midwater trawls aboard the NOAA ship *Miller Freeman* (Table 7). The most common bycatch species were Pacific herring (10.7% of the midwater catch by weight), walleye pollock (*Theragra chalcogramma*, 9.0%), and yellowtail rockfish (*Sebastes flavidus*, 6.3%). Pacific herring were caught mostly in the North and South Vancouver INPFC areas. Walleye pollock were caught mostly in the U.S. Vancouver INPFC areas. Most of the yellowtail rockfish (54%) were caught in Haul 39 (North Columbia INPFC area).

Pacific hake was the dominant fish species by weight in midwater trawls conducted aboard the CCGS *W.E. Ricker* (Table 8). The most common bycatch species by weight were pink salmon (*Oncorhynchus gorbuscha*, 15.6%), Pacific ocean perch (*Sebastes alutus*, 10.7%) and chum salmon (*O. keta*, 5.9%). Salmon were caught in surface trawls in the Southeast Alaska region and Queen Charlotte Sound (Appendix Table 3), and all of the Pacific ocean perch were caught just south of the Queen Charlotte Islands (Haul 99).

Pacific hake was the dominant fish species by weight and number in bottom trawls conducted aboard the NOAA ship *Miller Freeman* (Table 9). The most common bycatch species

by weight were splitnose rockfish (*Sebastes diploproa*, 15.1%) and Pacific ocean perch (10.8%); most of these species were caught in the South Vancouver INPFC area (Haul 58).

Physical oceanographic data consisted of 88 SBE, 11 CTD, and 89 XBT casts from the NOAA ship *Miller Freeman* (Fig. 3; Tables 3,10,11) and 46 CTD casts from the CCGS *W.E. Ricker* (Fig. 4; Table 12).

Pacific Hake Distribution and Abundance

Most of the Pacific hake echo sign was distributed between Point Reyes and Heceta Head (38-44°N, Fig. 5a). Pacific hake echo sign was observed over all bottom depths surveyed, including over bottom depths exceeding 1,500 m. Smaller fish (<40 cm FL) dominated trawl catches conducted on Pacific hake over bottom depths deeper than 100 m, while adult fish (≥40 cm FL) dominated catches conducted over bottom depths shallower than 100 m. Little Pacific hake echosign was detected north of Heceta Head with the exception of La Perouse Bank off Vancouver Island (Fig. 5b). No Pacific hake were found in Dixon Entrance, Hecate Strait, or Queen Charlotte Sound. Between Heceta Head and La Perouse Bank, most echosign was detected over bottom depths shallower than 200 m. North of La Perouse Bank, most echosign was detected over bottom depths greater than 300 m. Trawl hauls conducted north of Heceta Head contained mostly adult fish.

The coastwide estimates of Pacific hake abundance were 2.073 billion fish weighing 738,000 t. The abundance estimates in the area surveyed by the NOAA ship *Miller Freeman* were 2.025 billion fish weighing 704,000 t, while estimates from the area surveyed by the CCGS *W.E. Ricker* were 48 million fish weighing 34,000 t.

Pacific hake size composition differed over the survey area (Fig. 6; Tables 13 and 14). Smaller fish dominated abundance estimates in the southern area (Monterey, Eureka, and South Columbia INPFC areas), whereas adult fish were more abundant in the north (North Columbia, Vancouver, Charlotte, and Southeast Alaska INPFC areas). Size composition data for Pacific hake by trawl haul are presented in Appendix Figures 2-3.

Age-specific distributions for Pacific hake exhibited similar patterns to those based on length data (Fig. 7; Tables 15-16). Two-year-old fish (1999 year class) were the dominant age group in the Monterey, Eureka, and South Columbia INPFC areas, whereas 7-year-old fish (1994 year class) were dominant in the North Columbia INPFC area, and 4-year-olds (1997 year class) were dominant in the Vancouver, Charlotte, and Southeast Alaska INPFC areas. Overall, 50% of the biomass and 70% of the total numbers were composed of the 1999 year class.

Target Strength Data Collection

In situ target strength data were collected on 9 occasions from the NOAA ship *Miller Freeman* using the centerboard-mounted transducer (25 June, and 12, 15-17, 20, 22-24 July), and 18 hauls were conducted to identify the acoustic targets (Table 3). Catch data from seven hauls (Hauls 10, 12, 37-38, 49, 52, and 83), where Pacific hake made up 92-99% of the catch in numbers, indicated unimodal Pacific hake size distributions (Appendix Fig. 2).

Acoustic System Calibration

The NOAA ship *Miller Freeman* acoustic system calibrations were completed at the beginning and end of the survey. Beam pattern measurements were not completed during the 15 June calibration because of fish interference. The 38 kHz acoustic system exhibited a slight negative trend in TS and s_v gains with time, while the 120 kHz system showed a positive trend (Table 1). No adjustments were made to either system for this survey.

Calibration of the acoustic system on the CCGS *W.E. Ricker* was carried out before the survey. Target strength and integration values of the calibration spheres showed high variability owing to fish interference in the acoustic beam. For short periods when fish were not in the beam, however, the observed mean values suggested system gain parameters did not show significant change from the previous calibration. Values were therefore not adjusted from the most recent successful calibration conducted in January 2001 (Table 1).

U.S.-Canadian Acoustic Systems Comparison

Results from the inter-ship comparison indicated that the s_A estimates averaged by transect were generally greater for the Canadian system than those for the U.S. system (Fig. 8). The zero-intercept functional regression (Ricker 1973) of transect-averaged U.S. versus Canadian s_A estimates was

$$s_A(\text{Can}) = 1.23 \times s_A(\text{US}).$$

DISCUSSION

Comparison of abundance trends based on EIT survey results is difficult because of different areal coverage northward and offshore among surveys. 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. Before 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 extrapolated biomass estimates for the entire survey history by scaling the 1977-89 survey results to account for differences in areal coverage (Fig. 9). Results show that EIT abundance estimates steadily decreased from a high of 2.4 million t in 1986 even after re-scaling. The 2001 biomass estimate of 0.74 million t is the lowest estimate in the history of the surveys at 38% less than the 1998 estimate of 1.19 million t and 69% lower than the 1986 estimate. Moreover, 50% of the 2001 estimate is comprised of fish from the 1999 year class.

In 2001, 90% of the biomass was observed in U.S. waters. In contrast, 51% of the biomass was observed in U.S. waters in 1998, including fish observed off Alaska (5%), when the strong El Niño conditions of 1997-98 likely affected the summer distribution of Pacific hake. In 1995, 85% of the total biomass was observed in U.S. waters, and in 1992, when weak El Niño conditions existed, 62% of the total biomass was observed in U.S. waters (Wilson and Guttormsen 1997).

No echo sign was assigned to Pacific hake south of 37°N. However, hake were caught in relatively low numbers south of about 37°N during the AFSC summer 2001 triennial bottom trawl survey (Helser et al. 2002), and during a spring 2001 midwater trawl survey conducted by the Pacific Whiting Conservation Cooperative (PWCC) aboard the F/V *Predator* (V. Wespestad, PWCC, 1200 Westlake N. Suite 900, Seattle, WA 98109, unpubl MS). The inability to detect Pacific hake in this area based on acoustic methods is likely caused by the increased scattering from other species, relatively low densities of hake, and hake distributed closer to the bottom than in more northern areas of the survey area.

Because the inter-ship calibration was conducted under marginal conditions, EIT survey results were not adjusted based on the s_A ratios. Because of the low abundance of Pacific hake in the northern portion of the survey area, it was not possible to locate a study area that contained suitable field conditions (e.g., adequate ranges of Pacific hake backscattering densities). Instead, the inter-ship calibration was conducted over low or patchy aggregations of hake and other scatterers, which often resulted in high-density schools being detected by one vessel but missed by the other. Additionally, the wake of the leading vessel was often detected by the trailing vessel, suggesting that the 1 nmi distance between vessels should be increased during future inter-ship calibrations.

ACKNOWLEDGMENTS

Thanks to the captains and crews of the NOAA ship *Miller Freeman* and CCGS *W.E. Ricker* as well to all the others who participated in the survey. Capt. Gary Sigmund of the Canadian Groundfish Trawl Conservation Society is thanked for his participation and insight on board the CCGS *W.E. Ricker*.

CITATIONS

- Bodholt, H. 1990. Fish density derived from echo-integration and in situ target strength measurements. ICES CM doc. 1990/B:11, 10 p.
- Bodholt, H., and H. Solli. 1995. Split-beam techniques used in Simrad EK500 to measure target strength, p. 16-31. *In* G.T. Sakagawa (editor), Assessment methodologies and management: Proceedings of the World Fisheries Congress, Theme 5 (World Fisheries Congress 1992, Athens, Greece).
- Cooke, K., M. Saunders, W.T. Andrews, and R. Kieser. 1996. A hydroacoustic survey of Pacific hake on the continental shelf off British Columbia from the Canada/U.S. boundary to Queen Charlotte Sound: August 15-31, 1994. *Can. Manuscript Rep. Fish. Aquat. Sci.* 2363, 51 p.
- Dorn, M.W. 1996. Status of the coastal Pacific whiting resource in 1996. *In* Pacific Fishery Management Council, Appendix Volume I: Status of the Pacific Coast groundfish fishery through 1996 and recommended acceptable biological catches in 1997, p. A1-A77. Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.
- Foote, K.G., H.P. Knudsen, G. Vestnes, D.N. MacLennan, and E.J. Simmonds. 1987. Calibration of acoustic instruments for fish density estimation: a practical guide. ICES, Palaegade 2-4, 1261 Copenhagen, Denmark. *Coop. Res. Rep.* 144, 70 p.
- Foote, K.G., H.P. Knudsen, R.J. Korneliussen, P.E. Nordbo, and K. Roang. 1991. Postprocessing system for echo sounder data. *J. Acoust. Soc. Am.* 90: 37-47.
- Helser, T.E., M.W. Dorn, M.W. Saunders, C.D., Wilson, M.A., Guttormsen, K. Cooke, and M.E. Wilkins. 2002. Stock Assessment of Pacific Whiting in U.S. and Canadian Waters in 2001. *In* Pacific Fishery Management Council, Appendix: Status of the Pacific Coast groundfish fishery through 2001 and recommended acceptable biological catches in 2001: Stock assessment and fishery evaluation. Pacific Fishery Management Council, 2130 SW Fifth Avenue, Suite 224, Portland, OR 97201.
- Hughes, S.E. 1976. System for sampling large trawl catches of research vessels. *J. Fish. Res. Board. Can.* 33: 833-839.
- Kieser, R., K. Cooke, W.T. Andrews, S. McFarlane, and M. Smith. 1998. A hydroacoustic survey of Pacific hake in the Strait of Georgia. February 20 - March 5, 1996. *Can. Manuscr. Rep. Fish. Aquat. Sci.* 2456, 55 p.

- MacLennan, D.N., and E.J. Simmonds. 1992. Fisheries Acoustics. Chapman and Hall, London. 325 p.
- Method, R.D. 1986. Frame trawl for sampling pelagic juvenile fish. Calif. Coop. Oceanic Fish. Invest. Rep. 27:267-278.
- Nelson, M.O., and T.A. Dark. 1985. Results of the coastal Pacific hake, *Merluccius productus*, survey. Mar. Fish. Rev. 47(2):82-94.
- Ricker, W.E. 1973. Linear regressions in fishery research. J. Fish. Res. Board Can. 30: 409-434.
- Sigler, M. 1994. An electronic measuring board with bar codes. Trans. Am. Fish. Soc. 123: 115-117.
- Simrad. 1993a. Simrad EK500 scientific echo sounder reference manuals V4.01. Simrad Subsea A/S, Strandpromenaden 50, Box 111, N-3191 Horten, Norway.
- Simrad. 1993b. Simrad BI500 post-processing system reference manuals V5.20. Simrad Subsea A/S, Strandpromenaden 50, Box 111, N-3191 Horten, Norway.
- Traynor, J.J. 1996. Target strength measurements of walleye pollock (*Theragra chalcogramma*) and Pacific whiting (*Merluccius productus*). ICES J. Mar. Sci. 53: 253-258.
- Weir, K.R., R.J. Beamish, M.S. Smith, and J.R. Scarsbrook. 1978. Hake and pollock study, Strait of Georgia bottom trawl cruise, *G.B. Reed* February 25 – March 13, 1975. Fish. Mar. Ser. Data Rep. 71: 153 p.
- Wilson, C.D. and M.A. Guttormsen. 1997. Echo integration-trawl survey of Pacific whiting, *Merluccius productus*, off the west coasts of the United States and Canada during July-September 1995. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-74, 70 p.
- Wilson, C.D., M.A. Guttormsen, K. Cooke, M.W. Saunders, and R. Kieser. 2000. Echo integration-trawl survey of Pacific hake, *Merluccius productus*, off the Pacific coast of the United States and Canada during July-August 1998. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-118, 103 p.

Table 1.--Sphere calibrations conducted before, during, and after the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey along the U.S. and Canadian west coasts. TS represents target strength and s_v represents volume backscattering.

Date	Location	Freq (kHz)	Water temp (deg. C)		Sphere range		Gain (dB)		3dB beam width (deg.)	Angle offset	
			at transducer*	at sphere	from transducer (m)	TS	s_v	along		athwart	
<i>Miller Freeman</i>											
15 Jun	Port Susan, WA	38	10.7	9.4	26.2	25.6	25.4	--	--	--	
		120	10.7	9.4	20.5	25.4	25.5	--	--	--	
28 Jul	Port Susan, WA	38	11.7	10.0	28.7	25.5	25.3	6.92	-0.09	0.01	
		120	11.7	10.3	23.4	26.2	26.1	7.18	0.09	0.25	
Jun-Jul	System settings during survey	38	--	--	--	25.8	25.5	6.90	-0.08	0.03	
		120	--	--	--	25.6	25.6	7.30	-0.12	-0.21	
<i>W.E. Ricker</i>											
11 Jan	Deepwater Bay, B.C.	38	11.7	10.3	23.4	27.0	26.6	6.70	0.00	0.00	
		120	11.7	10.3	23.4	25.4	25.2	7.00	0.00	0.00	
Jul-Aug	System settings	38	11.7	10.3	23.4	27.0	26.6	6.70	0.00	0.00	
		120	11.7	10.3	23.4	25.4	25.2	7.00	0.00	0.00	

*The NOAA ship *Miller Freeman* 's 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-3191

Table 2.--Geographical areas used during the analysis of the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

INPFC area	Subarea ^a	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'	U.S.-Canada border
	South Vancouver	U.S.-Canada border	49°00'
	North Vancouver	49°00'	50°30'
Charlotte		50°30'	54°30'
Southeast Alaska		54°30'	West to 137°00'

^aSubareas used in analyses by Dorn (1996).

Table 3.--Trawl station and catch data summary for the NOAA ship *Miller Freeman* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Haul no.	INPFC area ^a	Gear type ^b	Date (2001)	Time (GMT)	Duration (min.)	Start position			Depth (m)		Temp. (°C)		Temp. profiler no.	Catch			
						Latitude	Longitude		Gear ^c	Surface	P. hake kg	Number		Other kg			
1	mont	P	19 Jun	19:26	10	36	18.11	122	1.51	109	109	9.3	11.8	302	0.0	0	55.0
2	mont	A	20 Jun	19:37	30	37	8.10	122	45.19	183	451	8.5	12.5	306	17.9	69	2.6
3	mont	P	21 Jun	4:02	20	37	18.94	122	53.69	272	272	7.4	13.6	307	433.5	1,650	1,146.5
4	mont	A	21 Jun	17:59	30	37	38.24	123	5.64	157	565	8.5	11.1	309	7.4	28	0.8
5	mont	A	22 Jun	14:49	3	38	8.23	123	28.02	166	334	8.1	9.8	314	683.5	1,698	2.9
6	mont	A	23 Jun	1:47	6	38	28.28	123	36.50	162	242	7.9	9.0	315	745.9	2,970	5.7
7	mont	A	23 Jun	14:25	22	38	37.79	123	26.94	70	83	8.5	9.4	318	368.8	546	14.2
8	mont	A	24 Jun	1:57	5	39	6.26	124	11.19	62	1,489	10.1	11.5	319	0.0	0	0.0
9	mont	A	24 Jun	14:48	3	39	8.11	123	55.78	122	140	8.3	9.9	323	2,260.0	8,595	0.0
10 ^d	mont	A	25 Jun	4:23	15	39	48.16	124	1.04	139	152	7.8	10.4	324	241.0	946	0.2
11 ^d	mont	P	25 Jun	5:59	4	39	48.17	124	0.85	152	152	7.7	10.7	325	700.5	2,163	172.4
12 ^d	mont	A	25 Jun	8:34	15	39	48.19	124	1.04	142	151	7.7	10.3	326	222.3	782	17.1
13	mont	A	25 Jun	15:35	4	39	58.03	124	33.04	84	1,091	8.6	9.6	327	1,279.1	4,378	6.9
14	mont	A	26 Jun	0:12	12	40	18.12	124	37.95	99	904	8.1	13.3	328	1,229.2	3,837	5.3
15	eur	A	27 Jun	13:40	12	41	7.65	124	17.00	93	96	8.0	13.0	335	774.6	1,270	14.2
16	eur	A	27 Jun	21:27	3	41	18.08	124	24.23	149	161	7.5	12.1	336	2,732.4	11,021	17.6
17	eur	P	28 Jun	8:46	5	41	23.05	124	9.43	49	49	8.5	11.7	339	0.0	0	15.8
18	eur	P	28 Jun	9:39	15	41	22.49	124	9.43	47	47	8.4	11.1	340	3.1	2	329.9
19	eur	P	28 Jun	14:15	4	41	38.14	124	12.69	36	45	8.1	11.2	341	0.0	0	5.9
20	eur	A	28 Jun	17:17	9	41	38.05	124	22.54	91	98	7.9	14.5	342	2,452.1	8,751	27.9
21	eur	A	29 Jun	2:11	2	41	47.97	124	25.13	72	115	7.8	12.6	343	5,295.9	13,728	4.1
22	eur	A	29 Jun	16:30	23	41	57.72	124	52.37	310	794	6.4	12.4	346	139.8	383	0.6
23	eur	P	30 Jun	0:49	5	42	17.67	124	29.54	98	98	7.6	11.4	347	3,209.7	5,816	4.3
24	eur	M	30 Jun	8:21	15	42	17.88	124	40.99	31	400	9.8	12.6	350	0.0	0	2.2
25	eur	A	30 Jun	15:06	15	42	27.90	124	49.22	277	334	7.0	12.4	352	1,677.9	5,047	2.1

Table 3.--Continued.

Haul no.	INPFC area ^a	Gear type ^b	Date (2001)	Time (GMT)	Duration (min.)	Start position			Depth (m)		Temp. (°C)		Temp. profiler no.	Catch			
						Latitude	Longitude		Gear	Bottom	Gear ^c	Surface		P. hake (kg)	Number	Other (kg)	
26	eur	P	1 Jul	5:05	13	42	47.96	124	42.84	61	144	8.4	12.2	353	1.0	2	3.8
27	eur	P	1 Jul	6:33	16	42	48.03	124	42.79	60	142	8.0	12.1	354	7.6	19	3.8
28	scol	A	1 Jul	19:04	9	43	7.30	124	50.82	170	289	7.2	13.7	355	3,220.0	8,539	0.0
29	scol	M	2 Jul	6:12	10	43	28.16	124	20.63	18	85	10.9	12.1	--	1.6	2	2.2
30	scol	M	2 Jul	7:31	15	43	28.12	124	20.91	19	86	9.7	12.1	356	0.0	0	2.4
31	scol	M	2 Jul	8:33	20	43	28.11	124	19.65	15	74	10.2	11.9	357	0.0	0	0.5
32	scol	A	2 Jul	17:14	3	43	37.68	124	25.53	118	123	7.2	13.3	360	1,240.0	3,569	2.1
33	scol	A	3 Jul	0:55	2	43	47.85	124	34.07	194	198	6.9	14.2	361	546.4	1,093	0.0
34	scol	A	6 Jul	16:11	42	43	57.21	124	26.79	115	124	7.4	12.0	366	224.4	456	120.9
35	scol	A	7 Jul	16:19	5	44	18.13	124	50.70	189	224	7.0	12.6	369	1,250.7	1,972	9.3
36	scol	A	11 Jul	5:05	30	45	18.05	124	46.54	478	568	5.5	15.0	373	23.1	35	9.4
37 ^d	ncol	A	12 Jul	4:02	41	45	48.12	124	11.96	96	102	7.0	13.1	376	362.7	478	0.1
38 ^d	ncol	A	12 Jul	10:08	25	45	48.11	124	10.82	92	99	7.1	12.6	377	259.7	332	0.1
39	ncol	A	13 Jul	1:06	23	46	8.17	124	36.94	128	158	7.1	13.2	379	0.0	0	2,340.0
40	ncol	A	13 Jul	13:05	1	46	17.49	124	15.82	67	72	7.4	13.2	380	0.0	0	9.1
41	ncol	A	13 Jul	15:20	5	46	17.42	124	15.91	66	73	7.4	13.2	381	0.0	0	24.7
42	ncol	A	14 Jul	14:36	27	46	38.17	124	19.46	63	67	7.8	12.2	384	0.0	0	109.3
43	ncol	P	14 Jul	16:13	20	46	38.26	124	17.97	68	68	7.2	11.9	385	1.2	1	223.1
44	ncol	A	15 Jul	0:42	28	46	48.21	124	53.68	305	352	6.1	14.0	386	170.2	249	5.0
45 ^d	ncol	A	15 Jul	5:29	30	46	48.08	124	22.74	66	74	7.7	12.0	387	221.8	262	16.6
46 ^d	ncol	A	15 Jul	10:49	26	46	48.07	124	23.15	63	74	7.6	12.1	388	694.5	828	11.7
47	ncol	A	15 Jul	17:35	19	46	58.13	125	5.90	152	1,000	7.5	14.1	389	3.3	4	0.6
48	ncol	A	15 Jul	23:54	40	47	8.09	124	37.23	70	80	7.5	11.9	390	1,134.7	1,469	28.8
49 ^d	ncol	A	16 Jul	6:14	30	47	16.72	124	33.37	59	68	7.7	12.2	391	1,544.9	1,814	39.1
50 ^d	ncol	A	16 Jul	10:23	16	47	17.38	124	33.46	56	67	7.9	11.4	392	1,222.6	1,475	39.3
51	ncol	A	16 Jul	23:01	30	47	28.14	124	56.18	302	401	--	12.9	394	100.4	141	3.8

Table 3.--Continued.

Haul no.	INPFC area ^a	Gear type ^b	Date (2001)	Time (GMT)	Duration (min.)	Start position			Depth (m)		Temp. (°C)		Temp. profiler no.	Catch			
						Latitude	Longitude		Gear	Bottom	Gear ^c	Surface		P. hake (kg)	Number	Other (kg)	
52 ^d	ncol	A	17 Jul	2:51	43	47	28.14	124	38.82	71	84	7.6	12.2	395	163.3	201	29.5
53 ^d	ncol	A	17 Jul	7:38	32	47	28.03	124	38.80	71	82	7.6	12.5	396	266.7	317	8.9
54	usvan	A	17 Jul	16:13	32	47	38.11	125	1.37	156	171	7.0	13.9	398	2.3	3	191.6
55	usvan	P	18 Jul	1:01	16	47	48.12	124	51.34	97	97	6.8	13.1	399	3,742.3	4,628	247.7
56	usvan	A	18 Jul	17:41	37	47	56.52	125	16.66	308	362	5.9	14.5	403	359.9	456	21.6
57	usvan	A	19 Jul	14:55	16	48	18.20	125	3.37	82	193	6.9	12.5	408	353.1	343	2,379.5
58	svan	P	19 Jul	21:41	10	48	17.98	125	54.34	234	234	6.0	13.2	410	14.0	20	3,156.0
59 ^d	svan	A	20 Jul	6:42	29	48	28.11	125	55.07	104	141	7.5	13.8	411	20.7	20	276.5
60	svan	A	20 Jul	17:01	25	48	28.02	125	42.62	94	104	6.9	11.6	414	0.0	0	98.8
61	svan	A	20 Jul	20:12	27	48	28.06	125	30.25	100	118	6.6	11.6	415	398.9	391	2,831.1
62	usvan	A	20 Jul	23:06	32	48	28.13	125	2.27	70	145	6.7	11.8	416	196.8	208	2,743.2
63	usvan	A	21 Jul	1:32	6	48	28.16	125	4.53	124	152	6.5	12.2	417	2,337.3	2,492	40.7
64	usvan	A	21 Jul	4:21	1	48	28.25	124	44.56	64	260	7.9	11.3	418	52.8	61	123.8
65	svan	A	21 Jul	8:22	2	48	34.66	124	52.29	51	72	9.6	11.7	419	0.0	0	71.9
66	svan	A	21 Jul	9:59	8	48	33.44	124	52.61	68	83	8.2	11.5	420	2.4	2	2,531.1
67	svan	A	21 Jul	16:30	12	48	38.09	125	20.49	102	112	7.0	11.9	421	462.0	474	828.0
68	svan	A	21 Jul	21:17	17	48	38.13	125	59.89	102	110	7.6	14.3	422	0.0	0	180.6
69	svan	A	22 Jul	5:07	20	48	48.15	126	24.97	211	235	6.3	12.5	423	158.3	188	20.0
70	svan	A	22 Jul	7:06	30	48	48.13	126	24.42	124	228	7.4	12.7	424	353.6	465	4.9
71 ^d	svan	A	22 Jul	10:40	25	48	43.86	126	12.87	140	157	7.1	13.0	425	0.0	0	71.3
72	svan	A	22 Jul	15:15	17	48	48.18	126	5.39	94	103	7.5	14.0	427	0.0	0	22.9
73	svan	A	22 Jul	17:38	15	48	48.18	126	17.40	151	162	6.9	12.4	428	0.0	0	342.1
74	svan	A	22 Jul	22:16	15	48	48.13	125	28.15	97	105	8.2	14.2	429	2.9	2	23.3
75	svan	A	23 Jul	5:58	30	48	58.10	126	20.10	107	141	7.3	14.1	430	134.2	144	19.7
76 ^d	svan	A	23 Jul	7:50	15	48	58.06	126	20.05	46	139	8.2	13.7	431	0.0	0	4.1
77 ^d	svan	A	23 Jul	9:47	25	48	58.08	126	13.19	102	116	7.3	14.1	432	237.9	268	7.3

Table 3.--Continued.

Haul no.	INPFC area ^a	Gear type ^b	Date (2001)	Time (GMT)	Duration (min.)	Start position		Depth (m)		Temp. (°C)		Temp. profiler no.	Catch				
						Latitude	Longitude	Gear	Bottom	Gear ^c	Surface		P. hake (kg)	Number	Other (kg)		
78 ^d	svan	A	23 Jul	12:38	11	48	58.09	126	12.99	95	110	7.4	13.9	433	4.0	5	82.6
79	svan	P	23 Jul	16:03	20	48	58.12	126	39.49	483	483	5.3	14.1	434	138.4	179	1.3
80	nvan	A	23 Jul	23:13	58	49	8.12	126	45.32	137	153	6.8	14.2	435	0.0	0	221.6
81	nvan	A	24 Jul	2:53	27	49	8.12	126	31.51	116	125	7.1	12.7	436	22.8	19	549.3
82 ^d	nvan	A	24 Jul	8:32	30	49	3.18	126	25.92	95	134	7.4	13.4	437	105.3	113	5.8
83 ^d	nvan	A	24 Jul	12:01	10	49	2.93	126	25.54	102	136	7.3	13.1	438	909.0	953	8.5
84	nvan	A	24 Jul	19:16	34	49	17.23	126	56.11	127	151	6.9	12.1	439	3.1	3	50.4
85	nvan	P	25 Jul	4:51	44	49	27.41	126	51.98	101	101	7.6	10.9	440	0.2	1	121.2
86	nvan	A	25 Jul	11:02	27	49	21.51	126	50.45	112	124	7.0	10.8	441	0.0	0	88.7
87	nvan	A	25 Jul	14:56	21	49	38.14	127	3.36	94	227	7.3	10.8	442	0.0	0	42.2
88	nvan	A	25 Jul	21:55	32	49	48.12	127	39.64	183	393	6.8	10.3	443	0.0	0	1,446.9
89	nvan	A	27 Jul	15:58	14	49	8.01	126	24.68	95	109	7.3	11.5	448	5,237.3	5,585	14.8
90	nvan	A	27 Jul	19:22	21	49	6.35	126	20.00	85	93	7.4	11.1	449	0.0	0	2,784.0

^a mont = Monterey, eur = Eureka, scol = South Columbia, ncol = North Columbia, usvan = U.S. Vancouver, svan = South Vancouver, and nvan = North Vancouver.

^b gear type A = Aleutian wing trawl, P = poly nor'eastern bottom trawl, M = Marinovich trawl

^c Gear temperatures were measured at the headrope.

^d Target strength data collection haul.

Table 4.--Methot trawl station and catch data summary for the NOAA ship *Miller Freeman* for the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Haul no.	Date (2001)	Time (GMT)	Duration (min.)	Start position		Depth (m)		Temp. (°C)		Temp. profiler no.	Catch (kg)		
				Latitude	Longitude	Gear ^a	Bottom	Gear ^b	Surface				
201	20 Jun	3:12	15	36	48.12	122	0.35	98	483	9.1	11.7	303	3.0
202	20 Jun	9:19	37	36	57.74	122	31.98	116	400	8.7	11.5	304	6.3
203	20 Jun	10:20	27	36	57.71	122	32.11	69	414	8.9	11.5	305	8.5
204	21 Jun	10:08	15	37	27.87	122	55.51	44	150	10.2	12	308	6.3
205	22 Jun	4:17	16	37	57.73	123	22.34	53	107	9.1	9.5	310	18.2
206	22 Jun	9:57	22	38	7.73	123	28.13	97	368	8.4	9.1	311	2.0
207	22 Jun	10:48	9	38	7.94	123	28.34	22	365	9.3	9.5	312	0.5
208	22 Jun	12:21	8	38	8.02	123	38.20	20	1,000	9.3	9.4	313	0.0
209	23 Jun	6:44	25	38	28.13	123	36.18	179	253	7.7	9.1	316	3.0
210	23 Jun	9:19	8	38	27.82	123	47.61	19	1,492	11.1	11.1	317	0.1
211	24 Jun	2:58	12	39	5.97	124	11.17	46	1,472	10	11.5	320	0.1
212	24 Jun	4:26	12	39	8.26	124	10.00	18	998	11	11.5	321	0.0
213	24 Jun	10:45	17	39	17.84	124	4.71	82	647	9.2	10.4	322	2.4
214	26 Jun	3:25	34	40	18.13	125	8.05	215	1,231	7.1	10.4	329	3.6
215	27 Jun	3:53	10	40	58.54	124	15.34	42	71	8.4	9.7	330	1.0
216	27 Jun	4:22	9	40	58.74	124	15.32	19	71	8.8	9.7	331	2.4
217	27 Jun	5:33	11	40	58.41	124	24.93	34	258	11.8	13.7	332	1.3
218	27 Jun	7:22	13	40	58.58	124	23.37	30	193	9	13.7	333	2.5
219	27 Jun	10:39	16	41	8.28	124	23.75	46	371	9.1	13.6	334	4.0
220	28 Jun	3:56	21	41	28.20	124	42.41	102	1,010	8.8	12.9	337	3.0
221	28 Jun	4:43	16	41	28.32	124	42.43	64	1,004	9	12.9	338	9.4
222	29 Jun	7:38	8	41	57.87	125	5.40	32	1,300	10.9	11.6	344	0.5
223	29 Jun	10:24	13	41	57.91	124	37.47	35	464	10.1	12.4	345	19.3
224	30 Jun	4:23	15	42	17.46	125	4.24	45	1,000	10.3	12.6	348	3.3
225	30 Jun	7:00	12	42	18.05	124	41.06	46	402	9.1	12.8	349	2.2
226	30 Jun	10:07	11	42	18.00	124	34.92	29	155	9.1	11	351	6.4
227	2 Jul	10:54	8	43	28.31	124	41.85	22	436	10.8	14.4	358	1.9
228	2 Jul	12:15	9	43	28.38	124	51.00	24	538	11.1	14	359	1.8
229	3 Jul	4:26	23	43	47.47	124	30.97	78	155	7.5	13	362	2.0
230	3 Jul	6:19	14	43	47.44	124	40.28	45	399	8.1	14.2	363	0.4
231	3 Jul	8:24	13	43	47.68	124	56.11	41	829	9.3	14.7	364	0.2
232	6 Jul	8:52	19	43	57.74	124	54.42	30	86	8.8	12.1	365	0.0
233	7 Jul	9:20	38	44	7.33	124	55.08	122	164	7.2	11.1	367	2.1
234	7 Jul	10:19	13	44	7.50	124	55.04	27	165	9.6	11.3	368	0.6
235	10 Jul	5:02	22	44	48.14	124	34.09	85	253	8.1	15	370	0.5

Table 4.--Continued.

Haul no.	Date (2001)	Time (GMT)	Duration (min.)	Start position		Depth (m)		Temp. (°C)		Temp. profiler no.	Catch (kg)
				Latitude	Longitude	Gear ^a	Bottom	Gear ^b	Surface		
236	10 Jul	5:46	18	44 48.21	124 34.23	27	258	10.5	15	371	311.5
237	10 Jul	6:56	19	44 47.69	124 31.02	19	185	13.7	15.2	372	7.5
238	11 Jul	7:04	62	45 17.99	124 46.51	463	581	5.4	14.8	374	1.2
239	11 Jul	8:33	16	45 18.11	124 46.56	28	583	12.9	14.8	375	1.9
240 ^c	12 Jul	11:44	24	45 47.93	124 10.01	91	105	6.8	12.5	378	2.0
241	13 Jul	20:27	26	46 16.38	124 25.56	71	427	7.5	12.5	381	27.2
242	14 Jul	10:25	58	46 30.65	124 32.60	397	582	5.8	12.2	383	1.8
243 ^c	16 Jul	12:10	14	47 17.28	124 33.37	45	68	7.4	11	393	2.7
244 ^c	17 Jul	9:04	22	47 28.03	124 40.12	75	84	7.2	12.2	397	0.5
245	18 Jul	7:35	19	47 58.31	125 30.23	57	171	7.6	13.1	400	3.5
246	18 Jul	8:11	13	47 58.34	125 29.01	20	173	11.4	13.1	401	1.8
247	18 Jul	10:58	35	47 57.46	125 14.01	101	171	7.5	13.2	402	6.0
248	19 Jul	7:40	25	48 7.69	125 1.52	71	269	7.7	14.2	404	7.9
249	19 Jul	8:42	18	48 7.88	125 1.49	24	263	9	14	405	6.8
250	19 Jul	9:51	26	48 7.85	124 58.68	149	169	7.1	14	406	4.1
251	19 Jul	10:43	20	48 7.78	124 58.65	26	165	9.1	13.6	407	2.9
252	19 Jul	16:38	20	48 18.08	125 4.68	139	164	6.5	12.2	409	3.6
253	20 Jul	10:47	15	48 19.87	125 52.64	24	411	9.5	13.3	412	2.3
254	20 Jul	12:25	19	48 23.98	125 59.02	85	193	7.4	13.4	413	7.9
255 ^c	22 Jul	12:12	12	48 43.22	126 16.72	21	496	11.4	13.2	426	2.0
256	27 Jul	9:53	47	48 54.08	126 31.34	252	509	5.8	11.3	444	6.1
257	27 Jul	11:20	15	48 54.34	126 32.41	28	531	8.6	11	445	3.1
258	27 Jul	12:06	19	48 54.09	126 30.14	122	175	7.3	11.3	446	4.9
259	27 Jul	12:44	17	48 54.22	126 30.53	27	181	9.3	11.2	447	9.1

^a Maximum depth^b Temperature at maximum gear depth^c Target strength data collection haul

Table 5.--Bongo station summary for the NOAA ship *Miller Freeman* for the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Bongo no.	Date (2001)	Time (GMT)	Start position		Depth (m)		Temp. (°C)	
			Latitude	Longitude	Gear ^a	Bottom	Gear ^b	Surface
1	24 Jun	9:30	39 18.06	123 59.53	41	400	9.5	9.6
2	25 Jun	11:27	40 3.19	124 8.72	61	119	8.2	10.0
3	25 Jun	12:02	40 0.69	124 9.99	60	160	8.2	9.4
4	26 Jun	10:35	40 21.35	124 30.76	60	547	7.8	8.8
5	26 Jun	11:50	40 21.24	124 36.59	60	1,270	7.8	8.9
6	27 Jun	11:19	41 8.28	124 23.71	60	380	8.5	13.4
7	29 Jun	8:02	41 58.71	125 6.00	61	1,352	10.1	11.5
8	30 Jun	4:59	42 17.36	125 4.29	66	306	8.8	12.6
9	30 Jun	7:33	42 18.87	124 41.78	62	413	8.6	12.9
10	30 Jun	10:40	42 18.73	124 35.47	61	156	8.4	11.0
11	2 Jul	9:20	43 28.02	124 22.31	60	90	7.4	12.2
12	2 Jul	11:24	43 28.92	124 42.79	60	473	8.2	14.5
13	3 Jul	5:16	43 47.76	124 31.24	62	155	7.7	13.2
14	3 Jul	6:52	43 48.48	124 40.55	85	395	7.7	14.3
15	3 Jul	8:58	43 48.44	124 56.32	62	876	8.3	14.2
16	10 Jul	12:21	44 47.96	124 34.17	75	241	8.1	15.2
17	13 Jul	10:43	46 13.94	124 26.26	62	335	7.8	12.1
18	13 Jul	11:26	46 16.28	124 25.63	63	412	7.6	12.1
19	17 Jul	11:23	47 22.90	124 48.82	60	541	7.6	12.5
20	18 Jul	10:15	47 58.07	125 13.96	60	171	7.8	13.0

^a Maximum gear depth

^b Temperature at maximum gear depth

Table 6.--Mid-water trawl station and catch data summary for the CCGS *W.E. Ricker* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Haul no.	INPFC area*	Date (2001)	Time (PDT)	Duration (min.)	Start position			Depth (m)		Surface temp (°C)	Catch (kg)		
					Latitude	Longitude		Gear Bottom	P. hake		Other		
68	van	7 Aug	7:32	42	50	17.81	128	17.78	301	472	13.5	301.9	21.9
69	van	7 Aug	11:50	112	50	27.94	128	8.84	8	53	13.2	-	42.0
70	van	7 Aug	13:06	44	50	28.25	128	19.05	15	160	14	-	33.7
71	van	7 Aug	14:05	51	50	28.22	128	27.57	-	198	13.8	-	49.0
72	van	7 Aug	15:25	49	50	28.17	128	33.29	-	760	12.6	-	15.0
73	van	7 Aug	16:45	55	50	28.21	128	34.75	176	325	12.8	-	4.0
74	char	9 Aug	14:58	45	50	58.15	129	48.35	-	-	-	-	16.0
75	char	9 Aug	16:13	32	50	58.10	129	40.43	-	-	-	-	6.2
76	char	9 Aug	17:43	34	50	57.87	129	25.46	-	-	-	-	53.4
77	char	9 Aug	19:04	45	50	58.12	129	11.48	-	-	-	-	0.1
78	char	9 Aug	17:10	35	51	31.25	130	7.30	100	-	-	-	1.0
79	char	11 Aug	10:15	58	52	15.16	131	32.40	-	-	-	8.7	3.3
80	char	11 Aug	16:00	60	52	47.24	132	15.31	-	-	-	12.3	7.4
81	char	12 Aug	7:30	25	53	26.77	133	3.31	-	-	-	287.1	1.2
82	char	12 Aug	10:03	43	53	32.63	133	14.99	-	-	-	3.7	-
83	char	12 Aug	13:39	43	53	48.02	133	24.76	-	-	-	-	2.4
84	char	12 Aug	16:10	20	53	54.30	133	39.06	-	-	-	-	6.0
85	se	13 Aug	7:12	38	54	48.23	133	1.04	-	80	-	-	29.9
86	se	13 Aug	8:45	40	54	46.12	133	12.55	-	70	-	-	105.0
87	se	13 Aug	9:59	24	54	45.57	133	20.48	-	70	-	-	2.3
88	se	13 Aug	11:07	33	54	44.36	133	28.05	-	80	-	-	33.8
89	se	13 Aug	12:35	20	54	44.05	133	37.99	-	100	-	-	34.0
90	se	13 Aug	14:22	13	54	42.92	133	52.08	-	120	-	-	15.1
91	se	13 Aug	15:33	19	54	42.18	133	59.99	-	115	-	-	53.7
92	se	13 Aug	16:42	23	54	41.30	134	6.44	-	270	-	-	34.3
93	se	13 Aug	17:35	46	54	39.45	134	6.95	460	-	-	5.4	69.6
94	se	13 Aug	19:10	28	54	37.95	134	8.95	10	-	-	-	6.0
95	char	15 Aug	16:34	37	52	38.38	130	19.21	-	-	-	-	36.3
96	char	15 Aug	17:30	38	52	38.17	130	10.35	-	-	-	-	3.8
97	char	15 Aug	18:25	20	52	38.27	130	3.24	-	-	-	-	27.5
98	char	15 Aug	19:05	23	52	38.13	129	58.74	70	-	-	-	3.5
99	char	16 Aug	8:30	30	51	48.20	130	45.48	280	-	-	-	191.0
100	char	18 Aug	7:06	39	51	8.43	129	16.18	-	-	-	-	5.2
101	char	18 Aug	8:11	40	51	7.99	129	6.61	-	-	-	-	4.5
102	char	18 Aug	9:06	47	51	7.55	128	56.67	-	-	-	-	3.5
103	char	18 Aug	10:06	45	51	7.45	128	47.21	-	-	-	-	8.8
104	char	18 Aug	10:59	46	51	8.12	128	38.34	-	-	-	-	1.6
105	char	18 Aug	12:20	46	51	8.19	128	25.97	-	-	-	-	80.8
106	char	18 Aug	12:26	87	51	8.11	128	16.03	-	-	-	-	8.2
107	char	18 Aug	14:25	25	51	8.27	128	9.50	-	-	-	-	36.0
108	char	18 Aug	15:08	27	51	8.59	128	3.61	-	-	-	-	35.4

* van = Vancouver, char = Charlotte, and se = southeast Alaska

Table 7.--Catch by species from 72 Aleutian wing trawl hauls conducted by the NOAA ship *Miller Freeman* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Common name	Scientific name	Weight		Numbers
		(kg)	(%)	
Pacific hake	<i>Merluccius productus</i>	44,131.8	67.7	99,478
Pacific herring	<i>Clupea pallasii</i>	7,099.7	10.7	83,341
Walleye pollock	<i>Theragra chalcogramma</i>	5,891.2	9.0	25,243
Yellowtail rockfish	<i>Sebastes flavidus</i>	4,076.2	6.3	2,863
Spiny dogfish	<i>Squalus acanthias</i>	2,624.4	4.0	3,118
Redstripe rockfish	<i>Sebastes proriger</i>	191.4	0.3	362
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	175.8	0.3	74
Jellyfish unidentified	Scyphozoa (Class)	149.2	0.2	-
Jack mackerel	<i>Trachurus symmetricus</i>	121.7	0.2	111
Pacific ocean perch	<i>Sebastes alutus</i>	118.4	0.2	84
Widow rockfish	<i>Sebastes entomelas</i>	113.7	0.2	65
Chub mackerel	<i>Scomber japonicus</i>	75.6	0.1	124
Pacific sardine	<i>Sardinops sagax</i>	57.5	0.1	330
Canary rockfish	<i>Sebastes pinniger</i>	54.6	0.1	24
English sole	<i>Parophrys vetulus</i>	46.2	0.1	271
Bocaccio	<i>Sebastes paucispinis</i>	35.9	0.1	8
Pacific sanddab	<i>Citharichthys sordidus</i>	23.3	< 0.1	135
Lingcod	<i>Ophiodon elongatus</i>	22.5	< 0.1	4
Chilipepper	<i>Sebastes goodei</i>	15.7	< 0.1	16
Pink salmon	<i>Oncorhynchus gorbuscha</i>	15.2	< 0.1	9
Squid unidentified	Teuthoidea (Order)	14.5	< 0.1	1,330
Myctophids	Myctophidae	14.2	< 0.1	14,754
Sanddab unidentified	<i>Citharichthys</i> species	14.1	< 0.1	66
Coho salmon	<i>Oncorhynchus kisutch</i>	13.3	< 0.1	7
Eulachon	<i>Thaleichthys pacificus</i>	11.9	< 0.1	1,045
Gonatus unidentified	Gonatidae	10.4	< 0.1	34
Mackerel unidentified	Scombridae	10.3	< 0.1	6
Salps unidentified	Thaliacea (Class)	8.5	< 0.1	57
Chum salmon	<i>Oncorhynchus keta</i>	8.1	< 0.1	2
Longnose skate	<i>Raja rhina</i>	5.7	< 0.1	1
Whitebait smelt	<i>Allosmerus elongatus</i>	5.7	< 0.1	698
Shrimp unidentified	Natantia (Suborder)	5.1	< 0.1	120
Silvergray rockfish	<i>Sebastes brevispinis</i>	4.9	< 0.1	2
Bigfin eelpout	<i>Lycodes cortezianus</i>	3.9	< 0.1	481
American shad	<i>Alosa sapidissima</i>	3.1	< 0.1	14
Flathead sole	<i>Hippoglossoides elassodon</i>	3.1	< 0.1	38
Magistrate armhook squid	<i>Berryteuthis magister</i>	2.9	< 0.1	5
Sablefish	<i>Anoplopoma fimbria</i>	2.1	< 0.1	3
Starry flounder	<i>Platichthys stellatus</i>	1.8	< 0.1	2
Black rockfish	<i>Sebastes melanops</i>	1.8	< 0.1	1

Table 7--Continued.

Common name	Scientific name	Weight		Numbers
		(kg)	(%)	
Brown cat shark	<i>Apristurus brunneus</i>	1.0	< 0.1	1
Slender sole	<i>Lyopsetta exilis</i>	1.0	< 0.1	14
Smelt unidentified	Osmeridae	0.8	< 0.1	82
Pacific viperfish	<i>Chauliodus macouni</i>	0.5	< 0.1	47
Euphausiids unidentified	Euphausiacea (Order)	0.5	< 0.1	287
Northern lampfish	<i>Stenobranchius leucopsarus</i>	0.4	< 0.1	9
Arrowtooth flounder	<i>Atheresthes stomias</i>	0.3	< 0.1	2
Lamprey unidentified	Petromyzontidae	0.3	< 0.1	13
Pacific lamprey	<i>Lampetra tridentata</i>	0.2	< 0.1	11
Octopus unidentified	Octopoda (Order)	0.2	< 0.1	1
Shortspine thornyhead	<i>Sebastolobus alascanus</i>	0.1	< 0.1	2
Ribbon barracudina	<i>Notolepsis risso</i>	0.1	< 0.1	6
Longfin dragonfish	<i>Tactostoma macropus</i>	0.1	< 0.1	3
Northern anchovy	<i>Engraulis mordax</i>	< 0.1	< 0.1	1
Warty poacher	<i>Occella verrucosa</i>	< 0.1	< 0.1	1
Fish larvae unidentified	Osteichthyes (Class)	< 0.1	< 0.1	8
Flatfish larvae	<i>Pleuronectiformes</i> (Order)	< 0.1	< 0.1	4
Poacher unidentified	Agonidae	< 0.1	< 0.1	1
Totals		65,190.8		234,932

Table 8.--Catch by species from 41 mid-water trawl hauls conducted by the CCGS *W.E. Ricker* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Common name	Scientific name	Weight (kg)	Percent
Pacific hake	<i>Merluccius productus</i>	619.1	36.2
Pink salmon	<i>Oncorhynchus gorbuscha</i>	266.4	15.6
Pacific ocean perch	<i>Sebastes alutus</i>	183.8	10.7
Chum salmon	<i>Oncorhynchus keta</i>	100.5	5.9
Jack mackerel	<i>Trachurus symmetricus</i>	89.4	5.2
Sablefish	<i>Anoplopoma fimbria</i>	85.6	5.0
Yellowmouth rockfish	<i>Sebastes reedi</i>	68.7	4.0
Jellyfish	Scyphozoa (Class)	60.6	3.5
Sauries	Scomberesocidae	57.3	3.3
Coho salmon	<i>Oncorhynchus kisutch</i>	53.5	3.1
Sockeye salmon	<i>Oncorhynchus nerka</i>	36.0	2.1
Rougheye rockfish	<i>Sebastes aleutianus</i>	22.7	1.3
California headlightfish	<i>Diaphus theta</i>	20.0	1.2
Squid	Teuthoidea (Order)	11.6	0.7
Blue shark	<i>Prionace glauca</i>	7.2	0.4
Yellowtail rockfish	<i>Sebastes flavidus</i>	4.8	0.3
Euphausiids		4.5	0.3
Bocaccio	<i>Sebastes paucispinis</i>	4.0	0.2
Silvergray rockfish	<i>Sebastes brevispinis</i>	3.4	0.2
Northern lampfish	<i>Stenobrachius leucopsarus</i>	3.3	0.2
Rockfishes	<i>Sebastes</i> species	3.2	0.2
Black rockfish	<i>Sebastes melanops</i>	2.1	0.1
Redstripe rockfish	<i>Sebastes proriger</i>	1.5	0.1
Shrimp	Nantantia (Suborder)	0.7	<0.1
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	0.7	<0.1
Prowfish	<i>Zaprora silenus</i>	0.3	<0.1
Blue lanternfish	<i>Tarletonbeania crenularis</i>	0.3	<0.1
Pacific herring	<i>Clupea pallasii</i>	0.2	<0.1
Flatfishes	Pleuronectiformes (Order)	<0.1	<0.1
Sculpins	Cottidae	<0.1	<0.1
Lowcrest hatchetfish	<i>Argyropelecus sladeni</i>	<0.1	<0.1
Walleye pollock	<i>Theragra chalcogramma</i>	<0.1	<0.1
Wolf eel	<i>Anarrhichthys ocellatus</i>	<0.1	<0.1
Ragfish	<i>Icosteus aenigmaticus</i>	<0.1	<0.1
Pacific viperfish	<i>Chauliodus macouni</i>	<0.1	<0.1
Unidentified Larvae		<0.1	<0.1
Total		1,711.4	

Table 9.--Catch by species from 14 poly Nor' eastern hauls conducted by the NOAA ship *Miller Freeman* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Common name	Scientific name	Weight		Numbers
		(kg)	(%)	
Pacific hake	<i>Merluccius productus</i>	8,251.5	60.1	14,481
Splitnose rockfish	<i>Sebastes diploproa</i>	2,075.4	15.1	4,664
Pacific ocean perch	<i>Sebastes alutus</i>	1,485.9	10.8	1,600
Sharpchin rockfish	<i>Sebastes zacentrus</i>	364.6	2.7	1,950
Pacific sanddab	<i>Citharichthys sordidus</i>	247.4	1.8	2,961
Jellyfish unidentified	Scyphozoa (Class)	172.9	1.3	-
Dover sole	<i>Microstomus pacificus</i>	169.9	1.2	638
Redstripe rockfish	<i>Sebastes proriger</i>	162.2	1.2	90
Spiny dogfish	<i>Squalus acanthias</i>	117.1	0.9	168
Walleye pollock	<i>Theragra chalcogramma</i>	98.3	0.7	498
Pacific tomcod	<i>Microgadus proximus</i>	97.7	0.7	2,435
Darkblotched rockfish	<i>Sebastes crameri</i>	77.2	0.6	114
English sole	<i>Parophrys vetulus</i>	71.9	0.5	532
Rex sole	<i>Glyptocephalus zachirus</i>	57.2	0.4	445
Yellowtail rockfish	<i>Sebastes flavidus</i>	55.1	0.4	42
Sablefish	<i>Anoplopoma fimbria</i>	26.7	0.2	29
Rosethorn rockfish	<i>Sebastes helvomaculatus</i>	24.4	0.2	75
Pacific sardine	<i>Sardinops sagax</i>	16.4	0.1	181
Blue shark	<i>Prionace glauca</i>	15.1	0.1	1
Bigfin eelpout	<i>Lycodes corteziianus</i>	12.2	0.1	135
Shortspine thornyhead	<i>Sebastolobus alascanus</i>	11.5	0.1	79
Pacific cod	<i>Gadus macrocephalus</i>	10.7	0.1	7
Spotted ratfish	<i>Hydrolagus colliei</i>	10.4	0.1	20
Pacific herring	<i>Clupea pallasii</i>	9.1	0.1	238
Silvergray rockfish	<i>Sebastes brevispinis</i>	8.1	0.1	4
Longnose skate	<i>Raja rhina</i>	7.9	0.1	3
Lingcod	<i>Ophiodon elongatus</i>	6.5	< 0.1	3
Arrowtooth flounder	<i>Atheresthes stomias</i>	5.9	< 0.1	29
Chub mackerel	<i>Scomber japonicus</i>	5.0	< 0.1	8
Smelt unidentified	Osmeridae	4.9	< 0.1	415
Canary rockfish	<i>Sebastes pinniger</i>	4.7	< 0.1	3
Petrale sole	<i>Eopsetta jordani</i>	4.7	< 0.1	5
Slender sole	<i>Lyopsetta exilis</i>	4.3	< 0.1	77
Lamp shells	Brachiopoda (Phylum)	4.3	< 0.1	260
Sponge unidentified	Porifera (Phylum)	3.7	< 0.1	1
Squid unidentified	Teuthoidea (Order)	3.7	< 0.1	176
Widow rockfish	<i>Sebastes entomelas</i>	3.7	< 0.1	3
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	2.7	< 0.1	3
Rougheye rockfish	<i>Sebastes aleutianus</i>	2.4	< 0.1	1
Bocaccio	<i>Sebastes paucispinis</i>	2.1	< 0.1	2

Table 9.--Continued.

Species name	Scientific name	Weight		Numbers
		(kg)	(%)	
Sea anemone unidentified	Actiniaria (Order)	2.1	< 0.1	13
Salps unidentified	Thaliacea (Class)	2.0	< 0.1	80
Northern anchovy	<i>Engraulis mordax</i>	1.8	< 0.1	199
Octopus unidentified	Octopoda (Order)	1.7	< 0.1	3
Shrimp unidentified	Natantia (Suborder)	1.7	< 0.1	135
Brown rockfish	<i>Sebastes auriculatus</i>	1.6	< 0.1	1
Black rockfish	<i>Sebastes melanops</i>	1.6	< 0.1	1
American shad	<i>Alosa sapidissima</i>	1.6	< 0.1	3
Sanddab unidentified	<i>Citharichthys</i> species	1.3	< 0.1	14
Flathead sole	<i>Hippoglossoides elassodon</i>	1.3	< 0.1	18
Shortbelly rockfish	<i>Sebastes jordani</i>	1.0	< 0.1	35
Redbanded rockfish	<i>Sebastes babcocki</i>	0.9	< 0.1	3
Starfish unidentified	Asteroidea (Class)	0.8	< 0.1	5
Pacific staghorn sculpin	<i>Leptocottus armatus</i>	0.5	< 0.1	4
Dungeness crab	<i>Cancer magister</i>	0.5	< 0.1	1
Sea cucumber unidentified	Holothuroidea (Class)	0.4	< 0.1	3
Big skate	<i>Raja binoculata</i>	0.3	< 0.1	2
Butter sole	<i>Isopsetta isolepis</i>	0.3	< 0.1	2
California skate	<i>Raja inornata</i>	0.3	< 0.1	1
Eelpout unidentified	Zoarcidae	0.2	< 0.1	3
Chiton unidentified	Polyplacophora (Class)	0.2	< 0.1	1
Kelp crab	<i>Pugettia</i> species	0.2	< 0.1	1
Sea pen unidentified	Pennatulacea (Order)	0.2	< 0.1	3
Hybrid sole	<i>Inopsetta ischyra</i>	0.1	< 0.1	1
Spot shrimp	<i>Pandalus platyceros</i>	0.1	< 0.1	3
White croaker	<i>Genyonemus lineatus</i>	0.1	< 0.1	1
Basketstarfish	<i>Gorgonocephalus caryi</i>	0.1	< 0.1	2
Sculpin unidentified	Cottidae	0.1	< 0.1	1
Whitebait smelt	<i>Allosmerus elongatus</i>	0.1	< 0.1	18
Pacific saury	<i>Cololabis saira</i>	0.1	< 0.1	3
Plainfin midshipman	<i>Porichthys notatus</i>	< 0.1	< 0.1	1
Myctophids	Myctophidae	< 0.1	< 0.1	4
Fish unidentified	Osteichthyes (Class)	< 0.1	< 0.1	1
Viperfish unidentified	Chauliodontidae	< 0.1	< 0.1	1
Totals		13,738.4		32,948

Table 10.--Conductivity-temperature-depth casts made by the NOAA ship *Miller Freeman* before, during, and after the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Number	Date (2001)	Time (GMT)	Position				Depth (m)	
			latitude	longitude	cast	bottom		
501	16 Jun	3:13	48 8.64	122 24.85	101	105		
502	16 Jun	4:49	48 8.66	122 24.81	100	105		
503	20 Jun	8:40	36 58.03	122 32.04	407	411		
504	20 Jun	12:30	36 58.55	122 17.11	86	88		
505	21 Jun	10:55	37 28.13	122 55.46	142	144		
506	23 Jun	7:57	38 28.06	123 39.94	573	580		
507	24 Jun	9:01	39 18.15	123 59.57	396	404		
508	6 Jul	9:41	43 57.94	124 54.28	92	99		
509	6 Jul	10:25	43 58.17	124 55.91	135	141		
510	11 Jul	9:35	45 19.23	124 46.40		551		
511	28 Jul	21:35	48 3.74	122 23.07	117	120		

Table 11.--Expendable bathythermograph casts made by the NOAA ship *Miller Freeman* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Cast	Date (2001)	Time (GMT)	Position		Bottom depth (m)
			latitude	longitude	
1	16 Jun	23:11	47 23.5	124 56.6	1196
2	19 Jun	13:13	36 38.2	122 24.8	870
3	19 Jun	14:58	36 38.1	122 24.8	>1000
4	20 Jun	0:59	36 48.1	122 8.7	359
5	20 Jun	1:58	36 48.1	121 54.8	168
6	20 Jun	16:59	37 8.1	122 59.0	660
7	20 Jun	18:05	37 8.2	122 44.8	399
8	20 Jun	21:02	37 8.1	122 42.0	151
9	21 Jun	16:44	37 38.1	123 5.8	394
10	21 Jun	16:51	37 38.1	123 3.2	173
11	21 Jun	20:28	37 38.1	123 21.3	>1000
12	22 Jun	13:14	38 8.1	123 34.3	773
13	22 Jun	16:03	38 8.1	123 29.9	405
14	22 Jun	16:17	38 8.1	123 26.0	221
15	23 Jun	16:41	38 36.5	123 29.9	172
16	23 Jun	18:06	38 38.1	123 46.0	>1000
17	24 Jun	3:58	39 8.0	124 9.0	906
18	24 Jun	5:56	39 8.1	123 56.4	148
19	24 Jun	22:49	39 38.2	123 56.6	153
20	24 Jun	23:05	39 38.2	124 0.5	406
21	25 Jun	0:15	39 38.1	124 17.1	>1000
22	25 Jun	18:32	40 8.1	124 55.0	1072
23	25 Jun	20:36	40 8.2	124 21.9	403
24	25 Jun	20:52	40 8.2	124 18.7	152
25	26 Jun	16:25	40 38.1	125 1.5	>1000
26	26 Jun	18:46	40 38.2	124 29.6	390
27	26 Jun	18:50	40 38.1	124 28.5	151
28	27 Jun	15:10	41 8.1	124 20.3	154
29	27 Jun	15:27	41 8.1	124 23.8	395
30	27 Jun	17:42	41 8.1	124 53.5	>1500
31	28 Jun	15:56	41 38.1	124 54.1	154
32	28 Jun	19:14	41 38.1	124 31.0	402
33	28 Jun	20:55	41 38.1	124 55.3	956
34	29 Jun	20:00	42 8.1	125 11.0	821
35	29 Jun	22:05	42 8.1	124 38.6	400
36	29 Jun	22:21	42 8.1	124 33.8	151
37	30 Jun	19:06	42 38.1	125 22.7	1057
38	30 Jun	21:24	42 38.1	124 43.6	442
39	30 Jun	21:35	42 38.1	124 40.2	154
40	1 Jul	16:32	43 8.1	125 13.5	>1800
41	1 Jul	17:52	43 8.2	124 52.7	438
42	1 Jul	20:53	43 8.1	124 39.6	152
43	2 Jul	18:08	43 38.1	124 29.8	151
44	2 Jul	18:47	43 38.3	124 40.4	392

Table 11.--Continued.

Cast	Date (2001)	Time (GMT)	Position		Bottom depth (m)
			latitude	longitude	
45	2 Jul	20:46	43 38.1	125 9.9	879
46	6 Jul	22:39	44 8.1	125 10.2	810
47	6 Jul	23:22	44 8.1	124 59.7	479
48	7 Jul	0:02	44 8.1	124 50.6	102
49	7 Jul	8:29	44 8.2	124 54.3	147
50	9 Jul	7:37	44 38.2	124 34.5	169
51	9 Jul	8:36	44 38.1	124 50.2	399
52	9 Jul	21:18	44 38.1	125 11.6	1459
53	9 Jul	23:54	44 38.2	124 32.2	137
54	10 Jul	3:56	44 48.2	124 31.3	187
55	10 Jul	21:52	45 8.1	124 13.1	151
56	10 Jul	23:56	45 8.1	124 45.6	458
57	11 Jul	1:20	45 8.1	125 8.1	>1000
58	11 Jul	21:39	45 38.1	125 3.9	>1500
59	11 Jul	22:50	45 38.1	124 45.3	394
60	12 Jul	0:33	45 38.1	124 16.9	145
61	12 Jul	23:39	46 8.1	124 34.6	151
62	13 Jul	0:00	46 8.1	124 40.7	403
63	13 Jul	4:17	46 8.1	125 4.7	1406
64	13 Jul	18:39	46 13.6	124 29.9	547
65	14 Jul	18:01	46 38.1	124 37.5	151
66	14 Jul	18:18	46 38.1	124 42.1	414
67	14 Jul	20:13	46 38.1	125 13.7	1440
68	15 Jul	20:04	47 8.1	125 16.9	1014
69	15 Jul	21:04	47 8.2	124 59.2	360
70	15 Jul	21:21	47 8.1	124 54.2	151
71	17 Jul	14:55	47 38.1	124 58.0	151
72	17 Jul	18:07	47 38.1	125 7.1	398
73	17 Jul	20:26	47 39.2	125 42.4	1196
74	18 Jul	22:39	48 8.1	126 9.2	801
75	18 Jul	23:57	48 8.1	125 44.9	390
76	19 Jul	0:29	48 8.1	125 35.1	146
77	19 Jul	2:08	48 8.1	125 18.7	157
78	19 Jul	3:14	48 8.1	124 58.5	150
79	20 Jul	11:49	48 22.1	125 56.1	315
80	21 Jul	22:53	48 38.1	126 7.4	271
81	21 Jul	23:15	48 38.1	126 13.4	421
82	21 Jul	1:10	48 38.1	126 38.1	1456
83	23 Jul	20:16	49 8.1	127 24.2	>1000
84	23 Jul	21:38	49 8.2	126 58.0	400
85	23 Jul	22:08	49 8.1	126 47.8	150
86	25 Jul	16:42	49 38.1	127 18.2	149
87	25 Jul	17:07	49 38.1	127 24.2	423
88	25 Jul	18:45	49 38.1	127 49.8	1360
89	27 Jul	13:12	48 54.7	126 31.8	315

Table 12.--Conductivity-temperature-depth casts made by the CCGS *W.E. Ricker* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Number	Date (2001)	Time (GMT)	Position			Depth (m)	
			latitude	longitude	cast	bottom	
3	27 Jul	13:04	48 32.78	126 24.39	1,102	1,127	
4	27 Jul	17:02	48 37.32	126 8.39	144	157	
5	28 Jul	2:30	48 55.95	125 39.03	82	93	
7	28 Jul	6:32	48 58.30	125 47.05	30	38	
8	28 Jul	14:14	49 16.61	126 15.57	25	28	
9	28 Jul	18:15	49 13.52	126 26.78	71	78	
10	28 Jul	22:35	49 8.89	126 39.97	121	129	
11	29 Jul	0:35	49 4.93	126 52.86	262	277	
12	29 Jul	2:35	49 2.48	127 1.06	1,021	1,036	
14	29 Jul	13:08	48 33.95	124 43.46	71	79	
15	29 Jul	16:07	48 30.38	124 54.86	70	78	
16	29 Jul	18:51	48 25.32	125 7.74	99	108	
17	29 Jul	23:17	48 18.83	125 23.84	109	118	
18	30 Jul	2:40	48 12.10	125 40.83	515	526	
20	30 Jul	5:07	48 23.41	125 20.77	108	119	
22	30 Jul	6:36	48 25.40	125 7.71	100	110	
24	30 Jul	7:48	48 28.98	125 15.41	140	148	
26	30 Jul	13:06	48 19.91	125 57.50	557	572	
27	30 Jul	17:21	48 25.59	125 48.09	121	134	
28	30 Jul	22:01	48 32.52	125 31.16	103	113	
29	31 Jul	0:51	48 37.35	125 18.49	91	103	
30	31 Jul	2:39	48 43.05	125 13.51	60	71	
31	1 Aug	5:07	48 34.53	125 30.03	110	114	
33	1 Aug	6:01	48 32.04	125 35.39	70	76	
35	1 Aug	7:47	48 36.45	125 54.08	85	89	
38	1 Aug	9:07	48 40.64	125 46.22	87	93	
39	2 Aug	3:43	48 29.36	126 7.10	192	198	
41	2 Aug	5:32	48 24.74	126 15.68	501	915	
43	2 Aug	7:17	48 22.63	126 3.83	371	375	
45	4 Aug	2:56	48 30.71	125 3.87	130	134	
47	4 Aug	4:58	48 29.47	124 42.93	251	257	
49	5 Aug	13:10	49 28.30	126 36.35	20	27	
50	5 Aug	18:46	49 29.60	126 51.55	71	80	
51	5 Aug	22:18	49 31.62	127 13.34	151	158	
52	5 Aug	23:30	49 34.31	127 17.91	417	433	
53	6 Aug	3:20	49 38.19	127 22.55	150	165	
54	6 Aug	14:14	49 53.52	127 14.57	38	43	
55	6 Aug	16:39	49 53.95	127 25.13	54	63	
56	6 Aug	19:06	49 53.11	127 38.60	93	100	
57	6 Aug	20:53	49 51.70	127 46.09	511	530	
59	7 Aug	18:27	50 28.13	128 9.82	33	38	
60	7 Aug	22:07	50 27.96	128 32.07	205	214	

Table 12.--Continued.

Number	Date (2001)	Time (GMT)	Position		Depth (m)	
			latitude	longitude	cast	bottom
61	8 Aug	1:52	50 27.99	128 44.16	497	1,831
63	9 Aug	19:47	50 58.08	130 5.05	505	2,200
64	9 Aug	21:27	50 58.13	129 48.94	500	1,418
65	10 Aug	2:56	50 57.38	129 7.60	95	107
66	10 Aug	23:11	51 38.29	130 2.12	343	352
67	11 Aug	2:12	51 38.12	130 24.67	371	387
68	11 Aug	4:25	51 38.14	130 49.91	502	1,150
69	11 Aug	13:06	52 8.12	131 20.03	91	113
70	11 Aug	14:35	52 8.18	131 38.59	500	1,868
71	12 Aug	0:11	52 44.84	132 11.03	498	608
72	12 Aug	4:41	53 8.14	132 56.12	502	949
73	12 Aug	6:05	53 8.20	132 40.42	314	327
75	12 Aug	13:07	53 28.08	132 56.90	103	111
76	12 Aug	15:20	53 28.15	133 6.08	560	595
77	13 Aug	2:41	54 8.10	133 44.28	501	557
78	13 Aug	4:57	54 8.07	133 17.47	95	109
79	13 Aug	12:56	54 47.64	133 3.04	116	123
80	13 Aug	15:29	54 46.41	133 11.09	183	196
81	13 Aug	16:33	54 45.20	133 17.66	100	114
82	13 Aug	17:50	54 45.01	133 26.90	135	147
83	13 Aug	19:00	54 44.39	133 34.72	180	195
84	13 Aug	20:15	54 43.57	133 42.60	205	212
85	13 Aug	20:57	54 42.87	133 50.30	215	226
86	13 Aug	22:12	54 42.24	133 58.19	190	205
87	13 Aug	23:22	54 41.51	134 5.96	210	223
88	14 Aug	3:28	54 40.01	134 21.70	501	2,115
89	14 Aug	4:58	54 38.34	134 37.96	501	2,370
90	14 Aug	13:11	54 36.59	132 41.57	115	124
91	14 Aug	15:33	54 14.10	132 41.22	160	172
92	14 Aug	18:43	54 26.18	132 6.98	321	330
93	14 Aug	20:06	54 36.43	132 6.83	132	137
94	14 Aug	21:21	54 36.46	131 49.92	325	337
95	14 Aug	22:45	54 36.46	131 32.90	135	143
96	15 Aug	1:03	54 15.50	131 32.52	37	46
97	15 Aug	2:50	54 15.04	131 2.35	111	117
98	16 Aug	3:08	52 38.24	129 47.41	150	161
99	16 Aug	4:30	52 38.18	130 6.33	240	252
100	16 Aug	5:38	52 38.19	130 20.71	172	179
101	16 Aug	12:50	51 48.11	131 1.62	500	1,851
102	16 Aug	13:58	51 48.09	130 53.50	150	193
103	16 Aug	19:29	51 48.08	129 43.47	290	305
104	16 Aug	22:45	51 48.08	128 51.28	46	56
105	17 Aug	0:04	51 47.97	128 32.68	126	136
106	17 Aug	1:10	51 48.15	128 16.87	136	145
107	17 Aug	13:13	51 28.15	128 49.96	85	98
108	17 Aug	18:54	51 18.15	128 22.04	73	82

Table 12.--Continued.

Number	Date (2001)	Time (GMT)	Position				Depth (m)	
			latitude	longitude	cast	bottom		
109	17 Aug	21:50	51 18.27	129 6.50	250	263		
110	18 Aug	4:23	51 8.18	128 29.02	170	173		
111	18 Aug	5:51	51 8.01	128 45.02	81	91		
112	18 Aug	7:10	51 8.07	129 1.06	121	127		
113	18 Aug	12:53	51 8.17	129 16.79	191	209		
114	18 Aug	22:45	51 6.92	128 0.85	110	112		

Table 13.--Estimated biomass at length (thousands of metric tons) of Pacific hake by area for the 2001 joint U.S.-Canada echo integration-trawl survey of the U.S. and Canadian west coasts. Area boundaries are defined in Table 2.

Length (cm)	Monterey	Eureka	Columbia		Vancouver			Charlotte	SE		Total
			South	North	U.S.	South	North		Alaska		
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
16	0.00	0.00	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	0.00	0.00	
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
20	0.00	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	0.00	
22	0.00	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	0.00	
24	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
27	0.12	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	
28	0.35	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	
29	0.46	0.32	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.81	
30	2.62	1.89	0.04	0.00	0.00	0.00	0.00	0.00	0.00	4.55	
31	9.02	6.28	0.10	0.00	0.00	0.00	0.00	0.00	0.00	15.40	
32	19.33	15.31	0.30	<0.01	0.00	0.00	0.00	0.00	0.00	34.93	
33	35.32	31.29	1.17	<0.01	0.00	0.00	0.00	0.00	0.00	67.78	
34	38.44	45.32	4.00	0.01	0.00	0.01	0.00	0.00	0.00	87.79	
35	30.33	43.06	7.69	0.01	0.00	0.01	0.00	0.00	0.00	81.10	
36	14.06	28.84	11.19	<0.01	0.00	0.00	0.00	0.00	0.00	54.10	
37	5.17	11.39	7.62	0.01	0.01	0.02	0.00	0.00	0.00	24.21	
38	2.29	5.24	4.83	0.02	0.01	0.01	0.00	0.08	<0.01	12.47	
39	3.14	4.57	3.72	0.02	0.02	0.03	0.00	0.18	<0.01	11.68	
40	3.26	5.09	4.52	0.03	0.02	0.04	0.00	0.36	0.01	13.33	
41	4.27	5.86	7.43	0.09	0.08	0.14	0.00	0.42	0.01	18.30	
42	3.60	8.16	6.05	0.19	0.12	0.21	0.00	1.05	0.02	19.40	
43	3.07	10.36	4.90	0.29	0.22	0.39	0.00	1.87	0.04	21.13	
44	2.91	9.58	5.24	0.56	0.42	0.76	0.28	1.81	0.04	21.59	
45	4.30	14.19	3.89	0.92	0.81	1.46	0.27	1.95	0.04	27.83	
46	2.87	13.65	3.50	1.41	1.40	2.51	0.28	2.36	0.05	28.02	
47	2.85	12.38	3.12	2.14	2.36	4.25	1.24	2.34	0.05	30.73	
48	2.55	12.27	2.77	2.60	2.88	5.17	0.94	3.25	0.07	32.51	
49	1.79	9.11	2.20	3.05	3.30	5.93	1.83	3.47	0.07	30.75	
50	0.69	4.62	1.41	2.55	2.87	5.15	1.15	1.52	0.03	19.98	
51	0.79	3.74	1.01	2.08	2.37	4.27	0.79	0.78	0.02	15.85	
52	0.64	2.97	0.40	1.53	1.76	3.17	0.60	1.01	0.02	12.09	
53	0.95	2.35	0.76	0.99	1.20	2.15	0.19	0.88	0.02	9.49	
54	0.29	1.36	0.38	0.81	0.99	1.78	0.44	0.46	0.01	6.52	
55	0.67	1.31	0.18	0.55	0.63	1.13	0.21	0.19	<0.01	4.87	
56	0.90	0.94	0.01	0.35	0.41	0.74	0.26	0.24	0.01	3.85	

Table 13.--Continued.

Length (cm)	Monterey	Eureka	Columbia		Vancouver			Charlotte	SE		Total
			South	North	U.S.	South	North		Alaska		
57	0.54	1.05	0.01	0.28	0.34	0.60	0.00	0.25	0.01	3.07	
58	0.33	0.22	0.09	0.21	0.26	0.46	0.00	0.00	0.00	1.57	
59	0.27	0.94	0.35	0.18	0.16	0.28	0.00	0.00	0.00	2.17	
60	0.00	0.00	0.00	0.13	0.16	0.29	0.00	0.00	0.00	0.58	
61	0.96	0.64	0.00	0.05	0.05	0.09	0.30	0.00	0.00	2.10	
62	0.73	0.49	0.01	0.06	0.04	0.08	0.00	0.00	0.00	1.41	
63	0.96	1.88	0.01	0.04	0.03	0.05	0.00	0.00	0.00	2.96	
64	1.30	0.86	0.00	0.04	0.05	0.09	0.00	0.00	0.00	2.33	
65	0.73	0.48	0.02	0.07	0.03	0.05	0.00	0.00	0.00	1.36	
66	0.36	0.24	0.36	0.01	0.01	0.02	0.00	0.00	0.00	1.00	
67	0.76	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26	
68	0.00	0.00	0.00	0.01	0.02	0.03	0.00	0.00	0.00	0.07	
69	0.83	0.55	0.14	0.06	0.08	0.14	0.00	0.00	0.00	1.79	
70	0.43	0.28	0.01	0.03	0.02	0.03	0.00	0.00	0.00	0.80	
71	0.92	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.52	
72	0.48	0.32	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.83	
73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
74	0.59	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total	207.23	321.27	89.46	21.39	23.10	41.53	8.78	24.47	0.52	737.74	

Table 14.--Estimated numbers at length (millions of fish) of Pacific hake by area for the 2001 joint U.S.-Canada echo integration-trawl survey of the U.S. and Canadian west coasts. Area boundaries are defined in Table 2.

Length (cm)	Monterey	Eureka	Columbia		Vancouver			Charlotte	SE		Total
			South	North	U.S.	South	North		Alaska		
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
16	0.00	0.00	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	0.00	0.00	
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
20	0.00	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	0.00	
22	0.00	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	0.00	
24	0.31	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
27	1.04	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.81	
28	2.76	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.59	
29	3.19	2.21	0.17	0.00	0.00	0.00	0.00	0.00	0.00	5.57	
30	16.28	11.56	0.21	0.00	0.00	0.00	0.00	0.00	0.00	28.05	
31	50.22	34.77	0.49	0.00	0.00	0.00	0.00	0.00	0.00	85.47	
32	96.84	75.35	1.29	0.01	0.00	0.00	0.00	0.00	0.00	173.49	
33	159.77	138.26	4.77	0.02	0.00	0.00	0.00	0.00	0.00	302.81	
34	157.48	179.44	15.05	0.05	0.02	0.03	0.00	0.00	0.00	352.07	
35	112.86	154.89	26.68	0.04	0.01	0.02	0.00	0.00	0.00	294.51	
36	47.64	94.50	35.91	0.01	0.01	0.01	0.00	0.00	0.00	178.09	
37	15.98	34.34	22.62	0.03	0.03	0.06	0.00	0.00	0.00	73.06	
38	6.47	14.59	13.30	0.04	0.02	0.03	0.00	0.22	<0.01	34.67	
39	8.15	11.78	9.48	0.04	0.05	0.09	0.00	0.44	0.01	30.04	
40	7.78	12.14	10.70	0.07	0.05	0.09	0.00	0.87	0.02	31.72	
41	9.40	12.95	16.44	0.21	0.17	0.30	0.00	0.87	0.02	40.36	
42	7.32	16.84	12.53	0.38	0.24	0.44	0.00	2.18	0.05	39.99	
43	5.79	20.06	9.54	0.55	0.42	0.75	0.00	3.50	0.07	40.67	
44	5.10	17.40	9.60	0.98	0.74	1.34	0.45	3.28	0.07	38.96	
45	7.03	24.24	6.71	1.51	1.34	2.41	0.45	3.28	0.07	47.03	
46	4.42	22.08	5.70	2.17	2.14	3.86	0.45	3.71	0.08	44.60	
47	4.10	18.89	4.80	3.07	3.39	6.09	1.79	3.50	0.07	45.71	
48	3.44	17.69	4.03	3.49	3.86	6.94	1.34	4.59	0.10	45.47	
49	2.28	12.45	3.00	3.82	4.14	7.45	2.46	4.59	0.10	40.29	
50	0.84	6.01	1.83	3.00	3.37	6.07	1.34	1.97	0.04	24.47	
51	0.91	4.63	1.25	2.30	2.62	4.71	0.89	0.87	0.02	18.21	
52	0.67	3.45	0.46	1.58	1.83	3.29	0.67	1.09	0.02	13.07	
53	0.92	2.54	0.85	0.97	1.17	2.10	0.22	1.09	0.02	9.89	
54	0.26	1.38	0.40	0.75	0.91	1.64	0.45	0.44	0.01	6.23	
55	0.56	1.25	0.18	0.48	0.54	0.98	0.22	0.22	<0.01	4.43	
56	0.71	0.81	0.01	0.29	0.34	0.61	0.22	0.22	<0.01	3.20	

Table 14.--Continued.

Length (cm)	Monterey	Eureka	Columbia		Vancouver			Charlotte	SE		Total
			South	North	U.S.	South	North		Alaska		
57	0.41	0.93	0.01	0.22	0.26	0.47	0.00	0.22	<0.01	2.50	
58	0.23	0.15	0.08	0.15	0.19	0.34	0.00	0.00	0.00	1.14	
59	0.18	0.75	0.28	0.12	0.11	0.19	0.00	0.00	0.00	1.64	
60	0.00	0.00	0.00	0.09	0.10	0.19	0.00	0.00	0.00	0.38	
61	0.57	0.38	0.00	0.03	0.03	0.06	0.22	0.00	0.00	1.29	
62	0.41	0.27	0.01	0.04	0.03	0.05	0.00	0.00	0.00	0.79	
63	0.51	1.17	0.00	0.02	0.02	0.03	0.00	0.00	0.00	1.74	
64	0.65	0.43	0.00	0.02	0.03	0.05	0.00	0.00	0.00	1.17	
65	0.35	0.23	0.01	0.03	0.01	0.02	0.00	0.00	0.00	0.65	
66	0.16	0.11	0.21	0.00	0.01	0.01	0.00	0.00	0.00	0.50	
67	0.33	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	
68	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.03	
69	0.33	0.22	0.08	0.02	0.03	0.06	0.00	0.00	0.00	0.73	
70	0.16	0.11	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.30	
71	0.33	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	
72	0.16	0.11	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.28	
73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
74	0.18	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total	745.46	954.86	218.69	26.64	28.25	50.79	11.16	37.14	0.79	2,073.77	

Table 15.--Estimated biomass at age (thousands of metric tons) of Pacific hake by area for the 2001 joint U.S.-Canada echo integration-trawl survey of the U.S. and Canadian west coasts. Area boundaries are defined in Table 2.

Age	Monterey	Eureka	Columbia		Vancouver			Charlotte	SE Alaska	Total
			South	North	U.S.	South	North			
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	144.19	186.51	36.86	0.07	0.04	0.06	0.00	0.00	0.00	367.73
3	23.71	26.27	25.56	0.99	0.50	0.66	0.13	0.00	0.00	77.82
4	8.39	9.33	6.13	2.00	5.45	10.26	2.16	16.88	0.36	60.96
5	6.87	38.40	8.79	3.88	4.61	6.45	1.18	2.60	0.06	72.83
6	3.31	18.13	3.92	3.09	3.09	5.77	0.50	0.77	0.02	38.59
7	5.87	15.46	3.70	5.25	3.61	7.07	1.53	0.92	0.02	43.42
8	4.41	6.04	2.04	2.46	2.32	4.36	1.80	1.26	0.03	24.72
9	2.41	8.39	0.68	0.57	0.91	1.48	0.40	0.46	0.01	15.31
10	3.43	5.18	0.89	0.98	0.83	1.58	0.20	1.03	0.02	14.14
11	1.37	0.55	0.37	0.59	0.52	1.37	0.41	0.00	0.00	5.18
12	1.29	1.85	0.19	0.35	0.24	1.00	0.00	0.00	0.00	4.90
13	1.64	5.15	0.09	0.48	0.30	0.55	0.00	0.00	0.00	8.22
14	0.36	0.00	0.05	0.14	0.08	0.11	0.00	0.00	0.00	0.73
15	0.00	0.00	0.10	0.20	0.24	0.44	0.00	0.00	0.00	0.98
16	0.00	0.00	0.00	0.00	0.10	0.14	0.00	0.00	0.00	0.24
17	0.00	0.00	0.06	0.22	0.19	0.04	0.46	0.00	0.00	0.97
18	0.00	0.00	0.05	0.12	0.03	0.04	0.00	0.00	0.00	0.25
19	0.00	0.00	0.00	0.00	0.05	0.06	0.00	0.54	0.01	0.66
20	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.10
Total	207.24	321.27	89.47	21.38	23.10	41.53	8.78	24.47	0.52	737.74

Table 16.--Estimated numbers at age (millions of fish) of Pacific hake by area for the 2001 joint U.S.-Canada echo integration-trawl survey of the U.S. and Canadian west coasts. Area boundaries are defined in Table 2.

Age	Monterey	Eureka	Columbia		Vancouver			Charlotte	SE	Total
			South	North	U.S.	South	North		Alaska	
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	621.58	730.03	119.23	0.22	0.11	0.19	0.00	0.00	0.00	1,471.36
3	66.89	58.43	56.28	1.82	0.78	1.13	0.22	0.00	0.00	185.56
4	20.74	22.86	11.48	2.84	7.54	13.95	3.13	26.56	0.56	109.65
5	12.05	64.37	15.02	5.34	6.20	8.67	1.56	4.17	0.09	117.47
6	4.41	27.02	6.08	3.99	3.78	7.24	0.67	1.04	0.02	54.26
7	7.26	21.80	5.08	5.81	3.82	7.41	1.79	1.04	0.02	54.02
8	4.30	8.06	2.75	2.88	2.51	5.10	2.23	1.56	0.03	29.41
9	1.98	10.24	0.74	0.59	1.01	1.58	0.45	0.52	0.01	17.11
10	2.17	4.11	0.91	1.03	0.87	1.63	0.22	1.04	0.02	12.01
11	1.32	0.22	0.50	0.68	0.51	1.39	0.45	0.00	0.00	5.07
12	1.05	1.60	0.22	0.36	0.23	1.02	0.00	0.00	0.00	4.48
13	1.25	6.13	0.10	0.39	0.29	0.58	0.00	0.00	0.00	8.73
14	0.46	0.00	0.06	0.15	0.06	0.10	0.00	0.00	0.00	0.83
15	0.00	0.00	0.12	0.22	0.19	0.40	0.00	0.00	0.00	0.95
16	0.00	0.00	0.00	0.00	0.09	0.15	0.00	0.00	0.00	0.24
17	0.00	0.00	0.06	0.22	0.18	0.03	0.45	0.00	0.00	0.93
18	0.00	0.00	0.06	0.11	0.03	0.04	0.00	0.00	0.00	0.23
19	0.00	0.00	0.00	0.00	0.04	0.06	0.00	0.52	0.01	0.64
20	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.11
Total	745.46	954.86	218.69	26.64	28.25	50.79	11.16	36.46	0.77	2,073.06

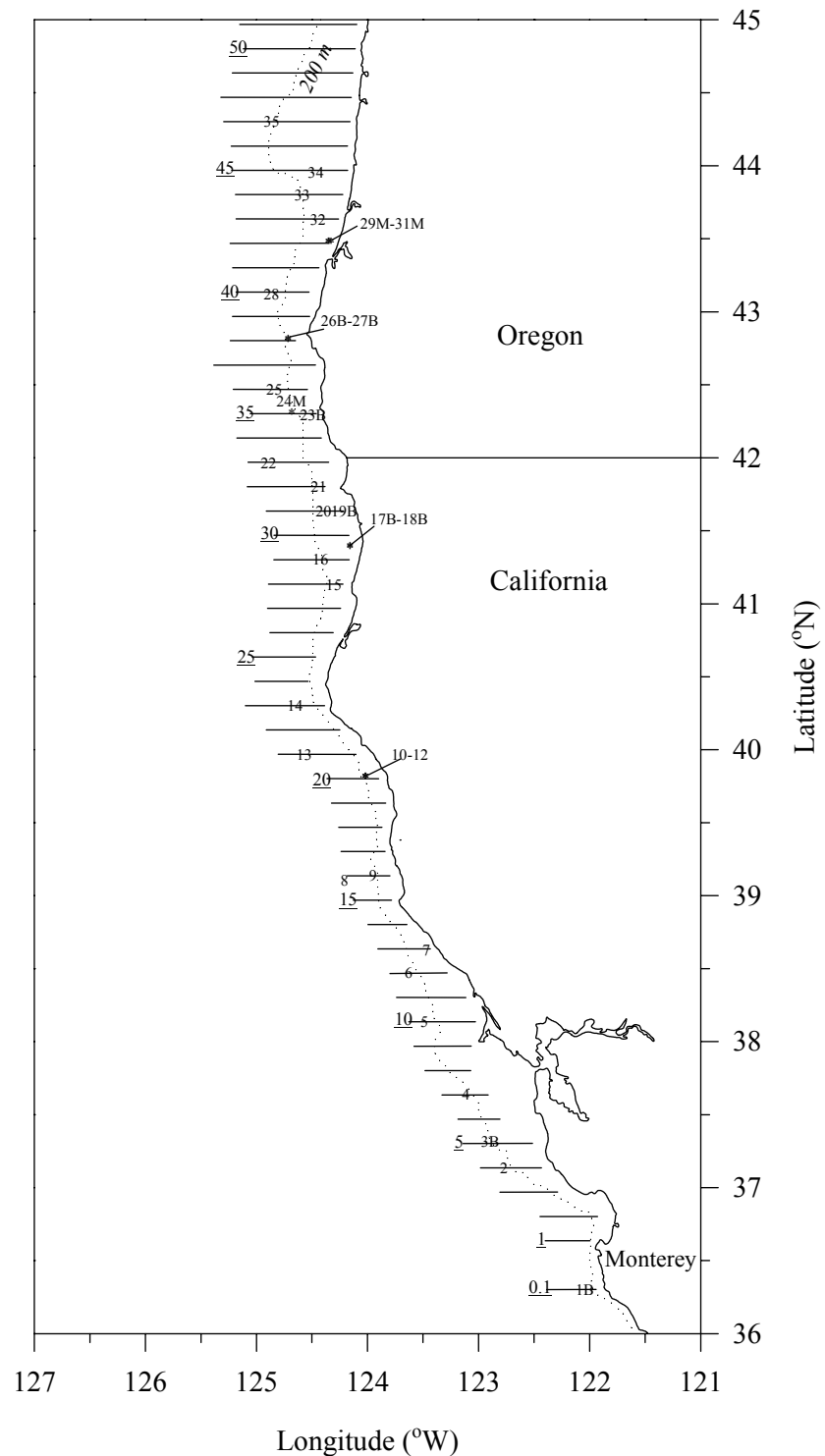


Figure 1a.--Survey trackline with haul locations for the Aleutian wing trawl, poly Nor' eastern bottom trawl (B), and Marinovich trawl (M) for the NOAA ship *Miller Freeman* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts. Transects are underlined.

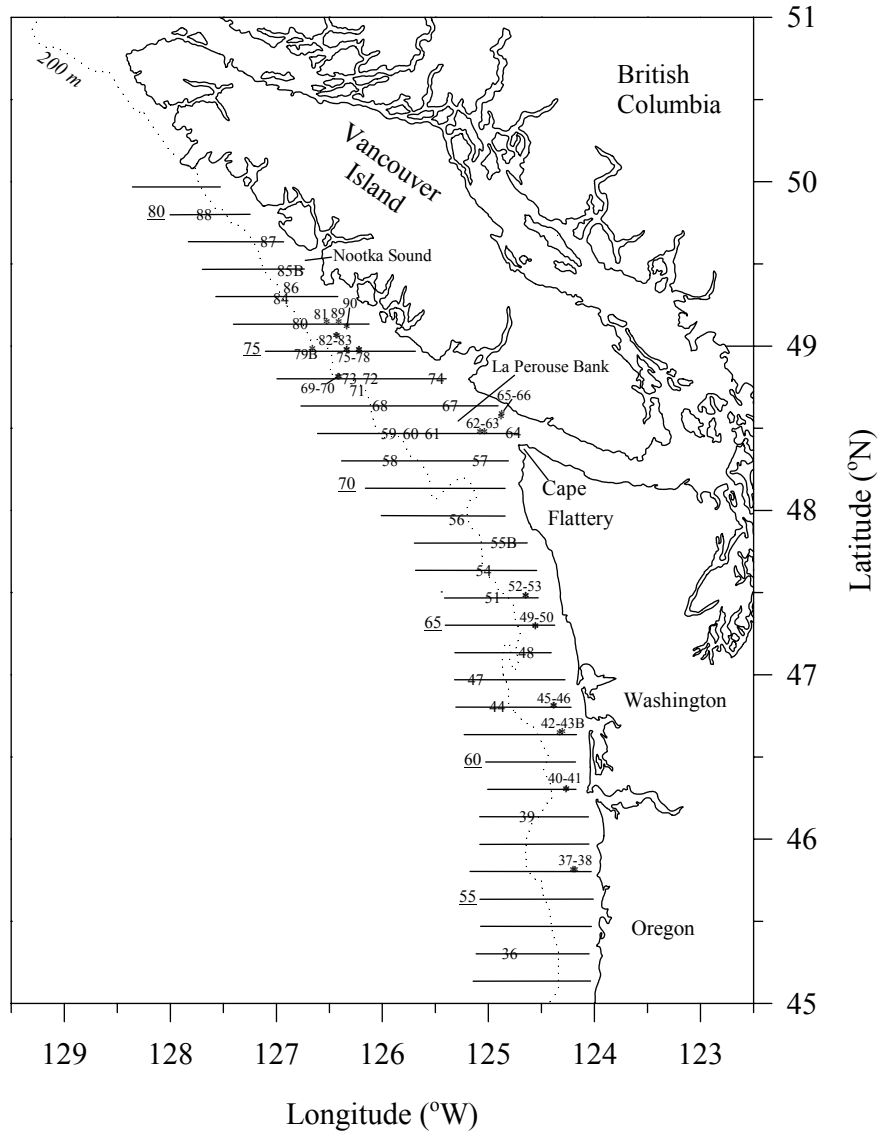


Figure 1a.--Continued.

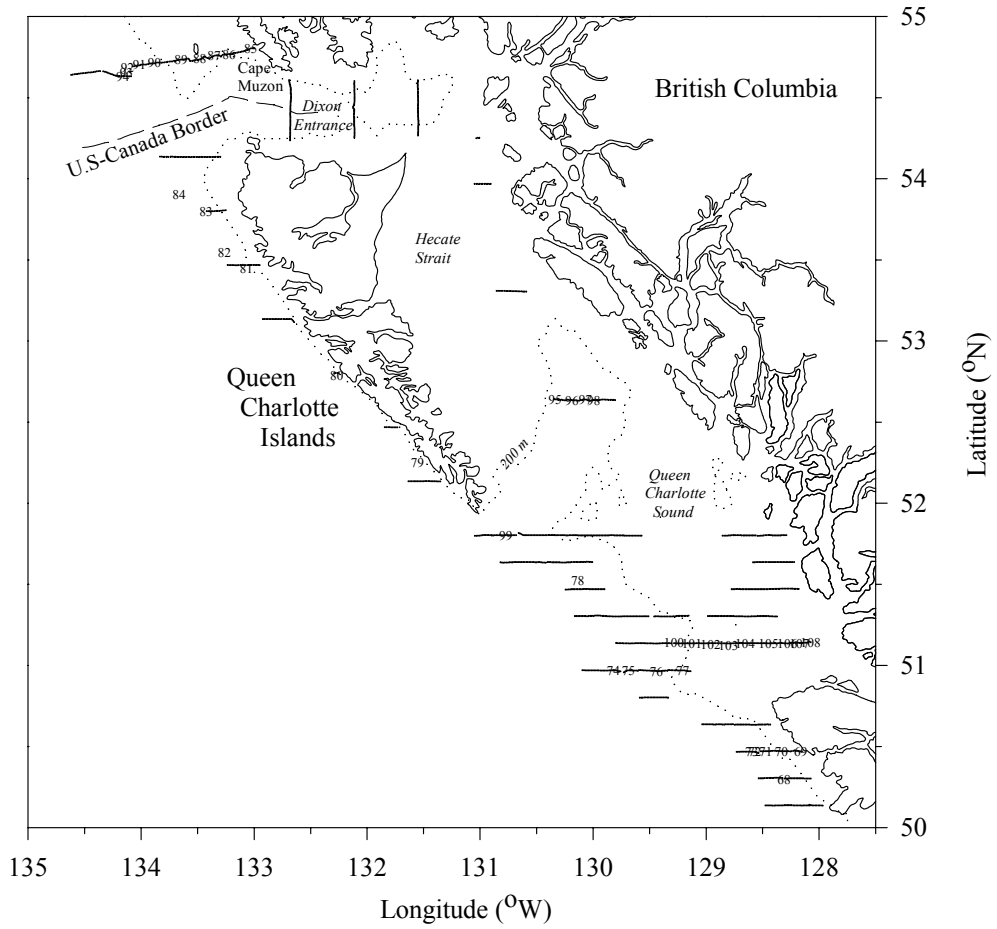


Figure 1b.--Survey trackline and haul locations for the CCGS *W.E. Ricker* for the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

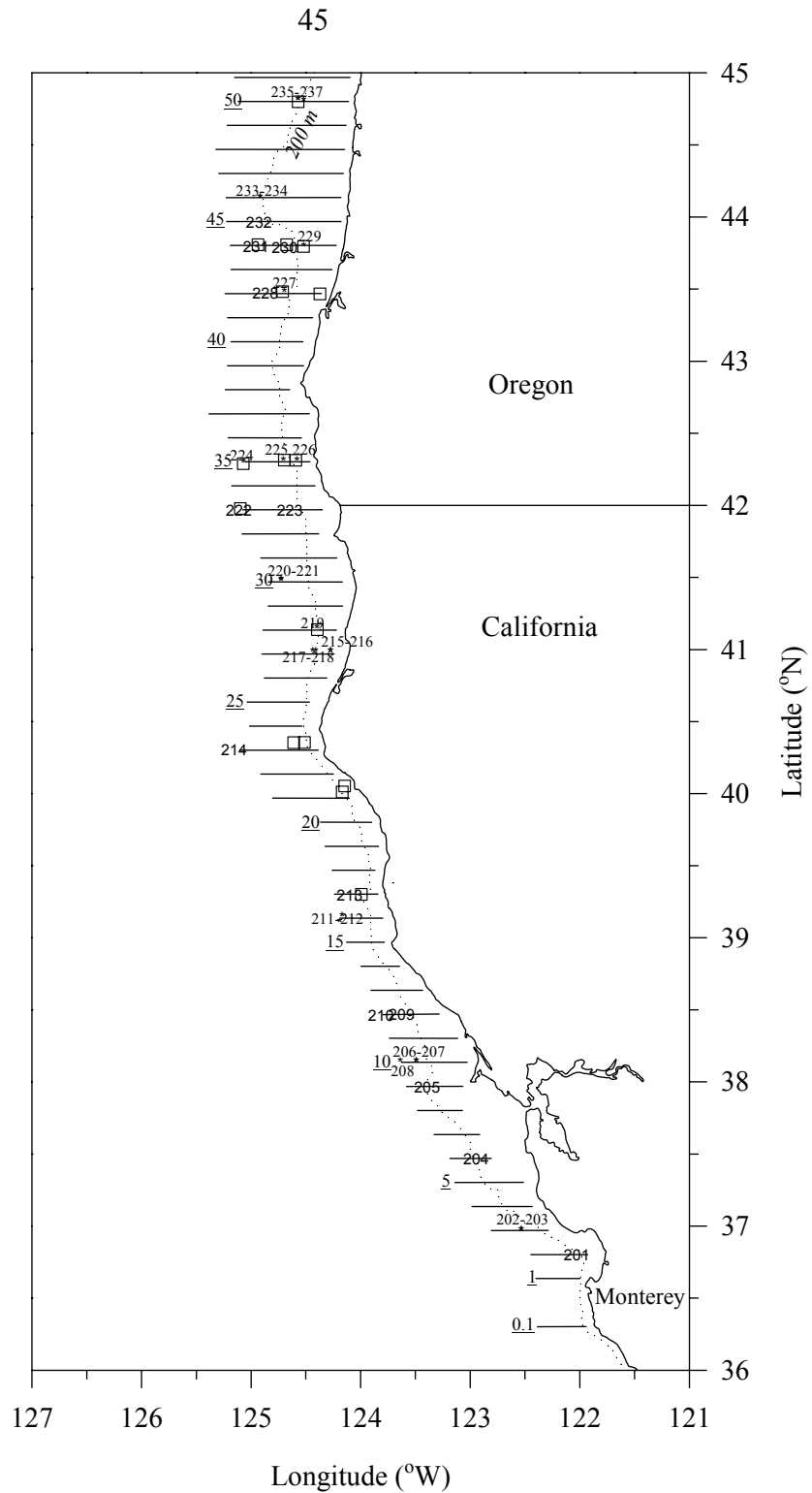


Figure 2.--Survey trackline with bongo (square symbols) and Methot trawl haul locations for the NOAA ship *Miller Freeman* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts. Transects are underlined.

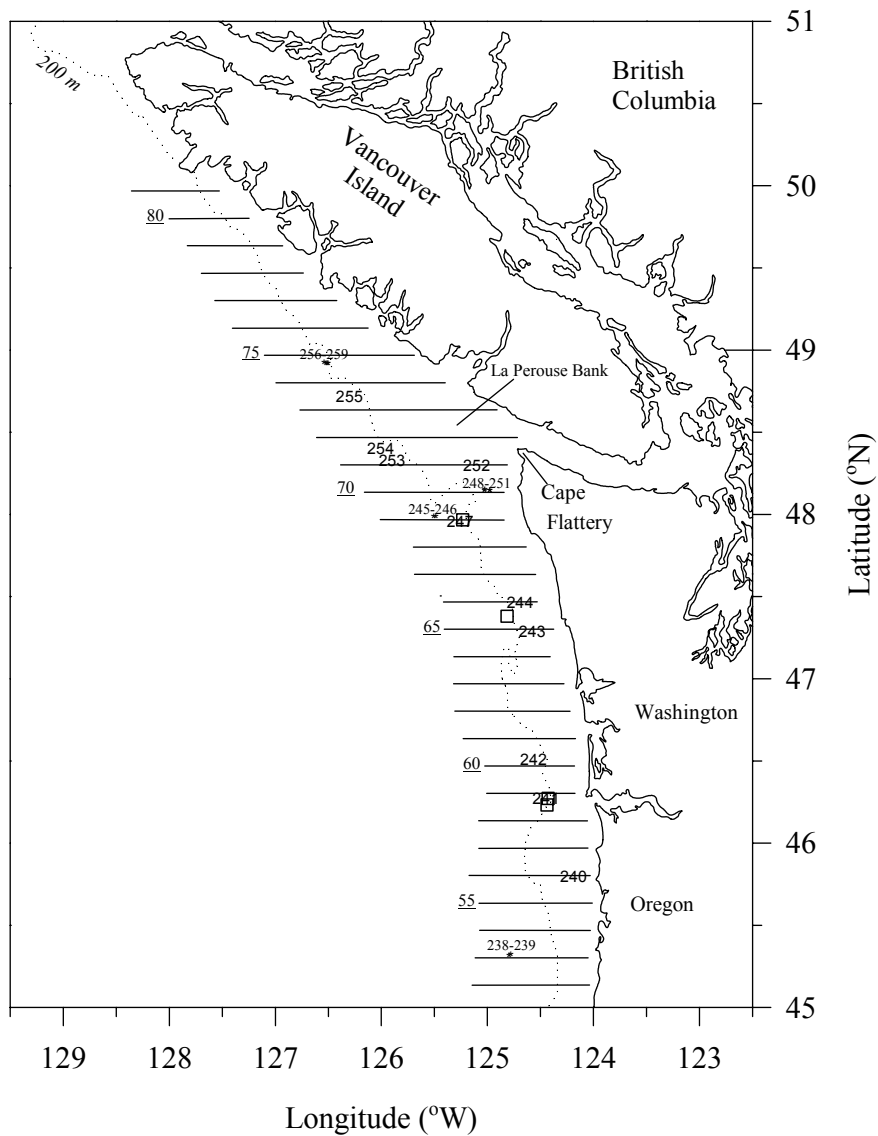


Figure 2.--Continued.

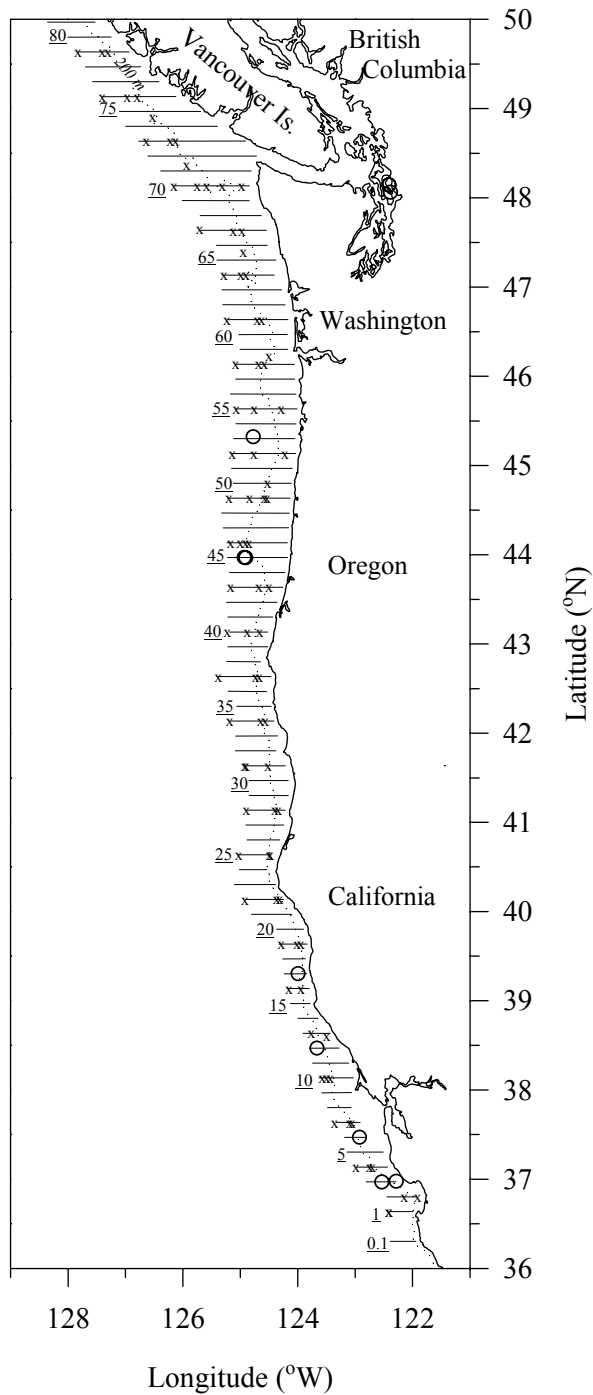


Figure 3.--Survey trackline with expendable bathythermograph (x) and conductivity-temperature-depth (O) cast locations for the NOAA ship *Miller Freeman* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey along the U.S.-Canadian west coasts. Transect numbers are underlined.

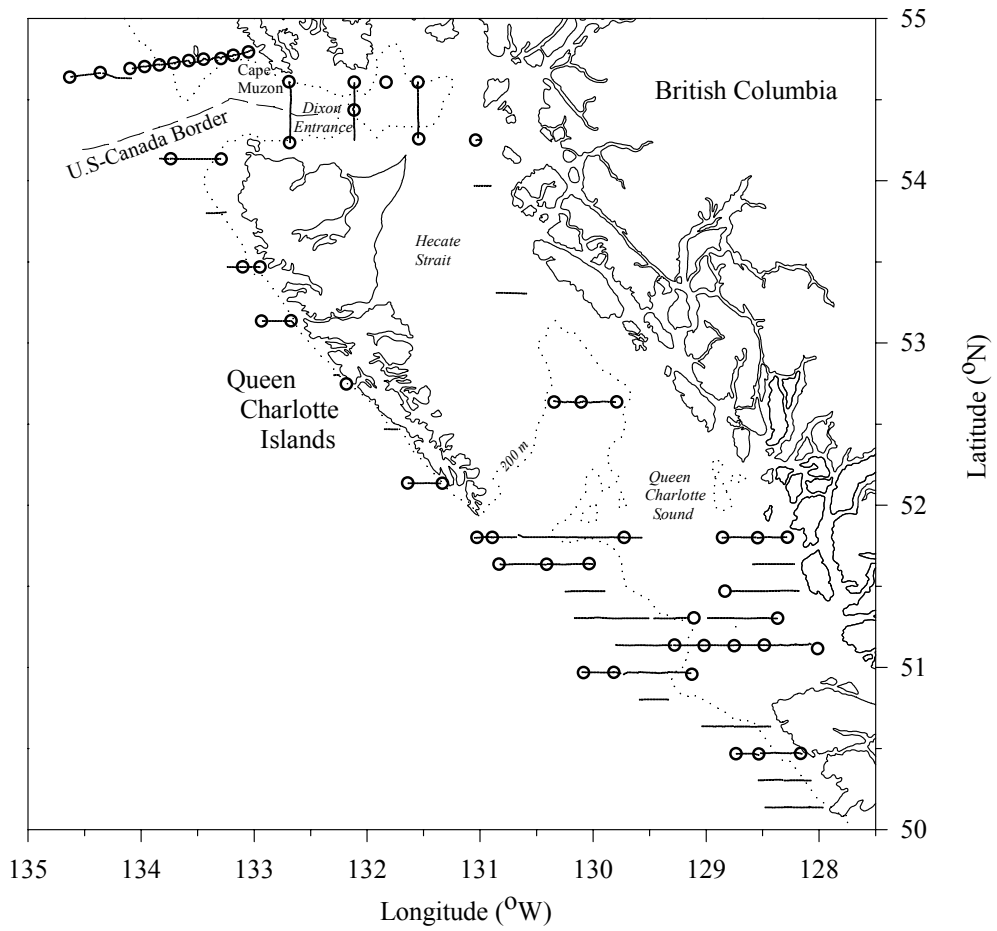


Figure 4.--Survey trackline with conductivity-temperature-depth (O) cast locations for the CCGS *W.E. Ricker* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

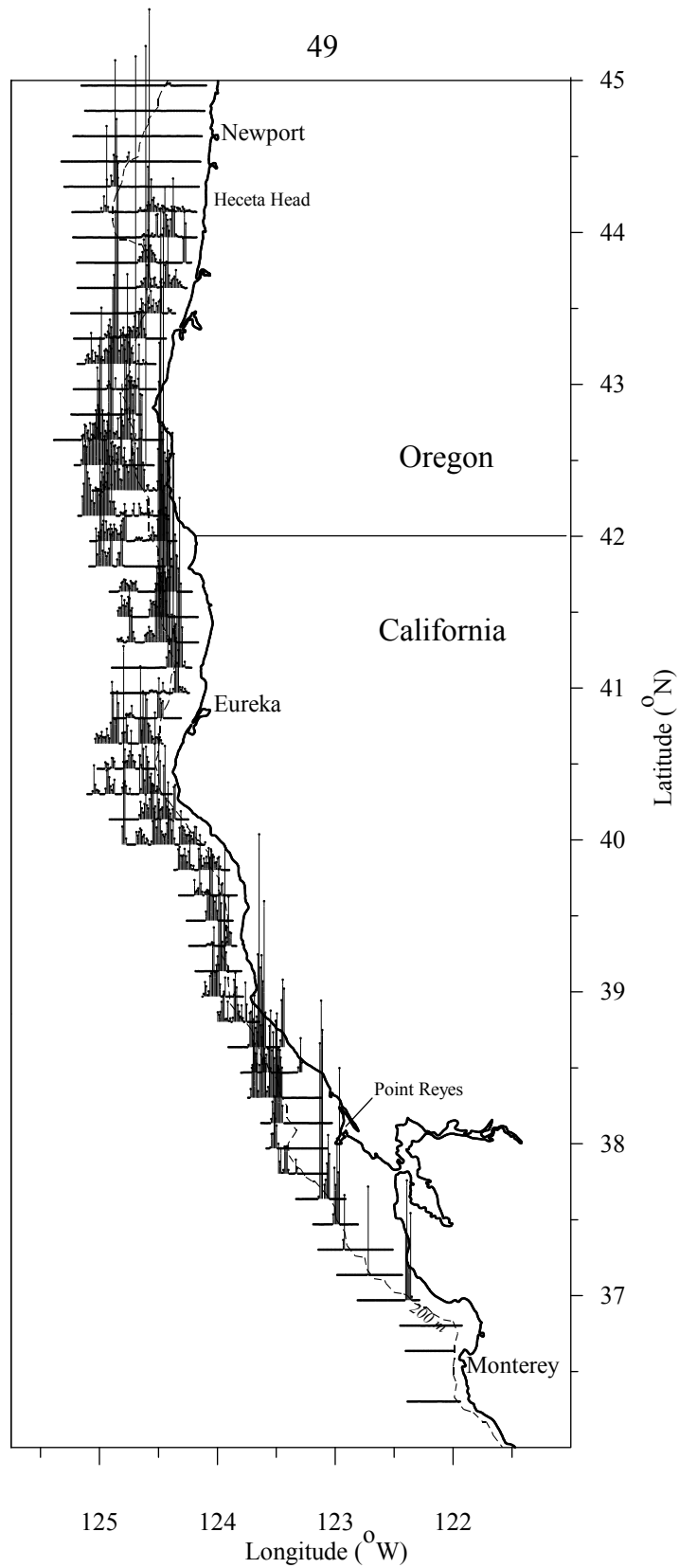


Figure 5a.--Acoustic backscattering attributed to Pacific hake along transects conducted by the NOAA ship *Miller Freeman* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey along the U.S. and Canadian west coasts.

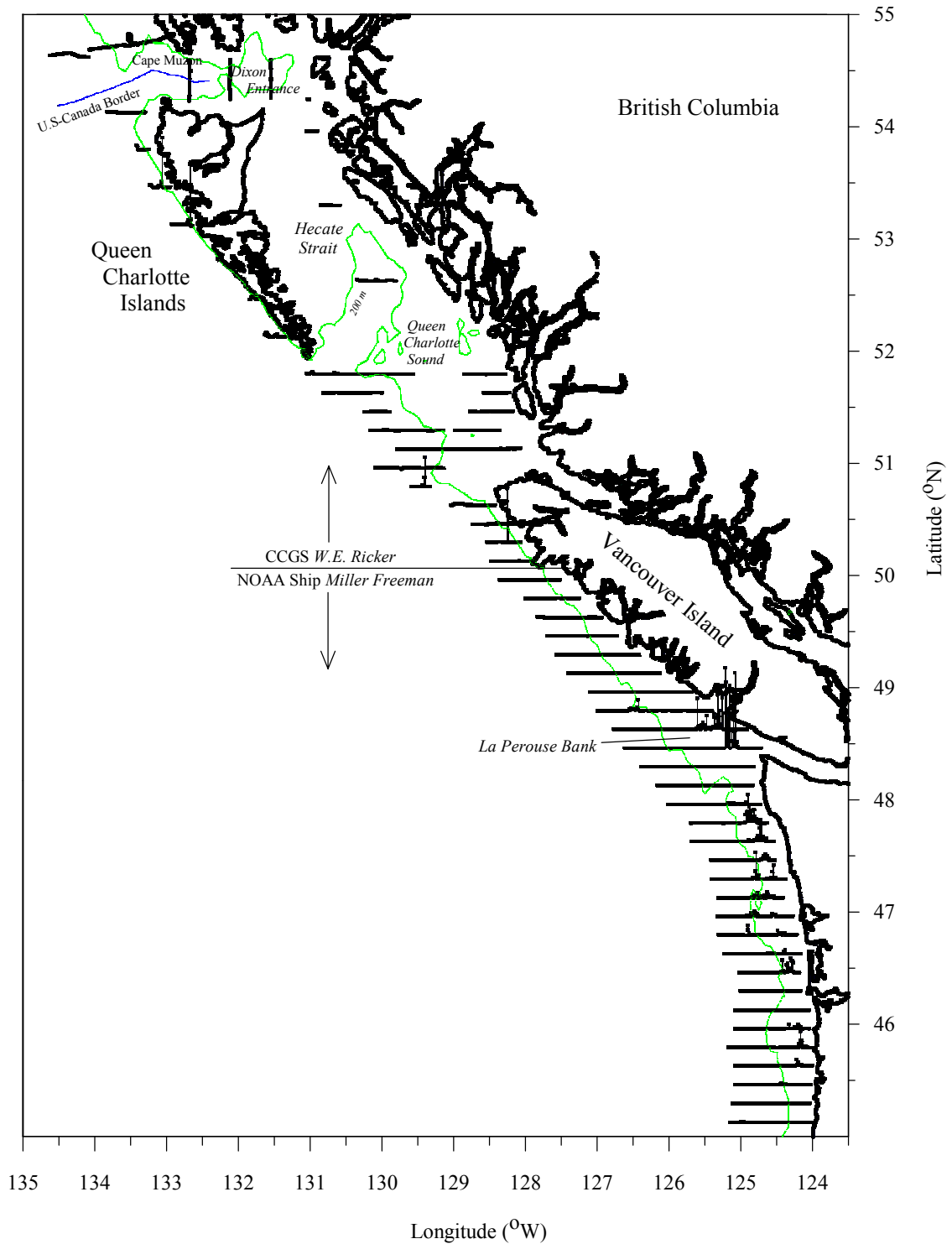


Figure 5b.--Acoustic backscatter attributed to Pacific hake along transects conducted by the NOAA ship *Miller Freeman* and CCGS *W.E. Ricker* during the 2001 joint U.S.-Canada echo integration-trawl survey of the U.S. and Canadian west coasts.

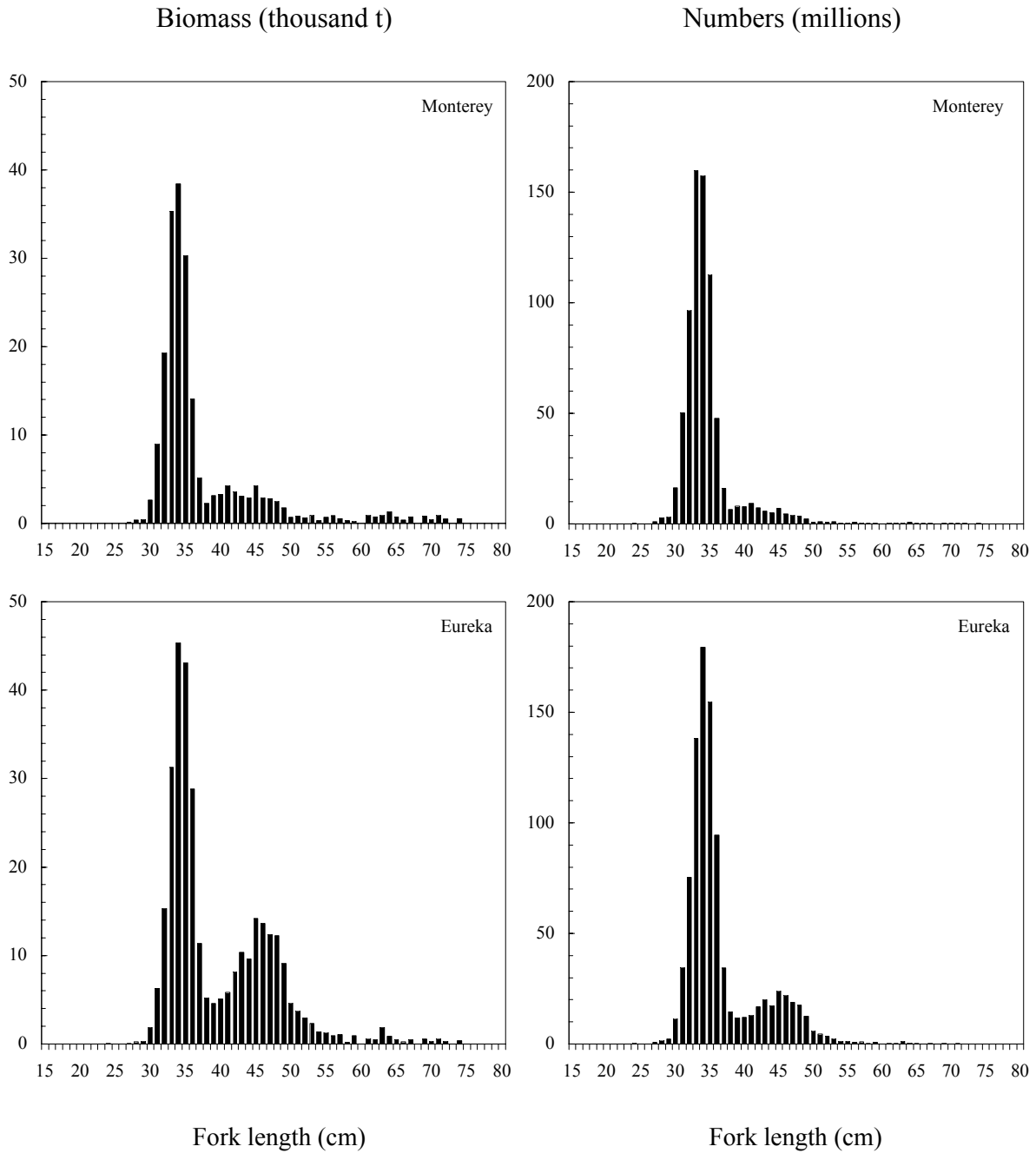


Figure 6.--Biomass (thousands of metric tons (t)) and numbers at length (millions) of Pacific hake by area for the 2001 joint U.S.-Canada echo integration-trawl survey of the U.S. and Canadian west coasts. Area boundaries are defined in Table 2.

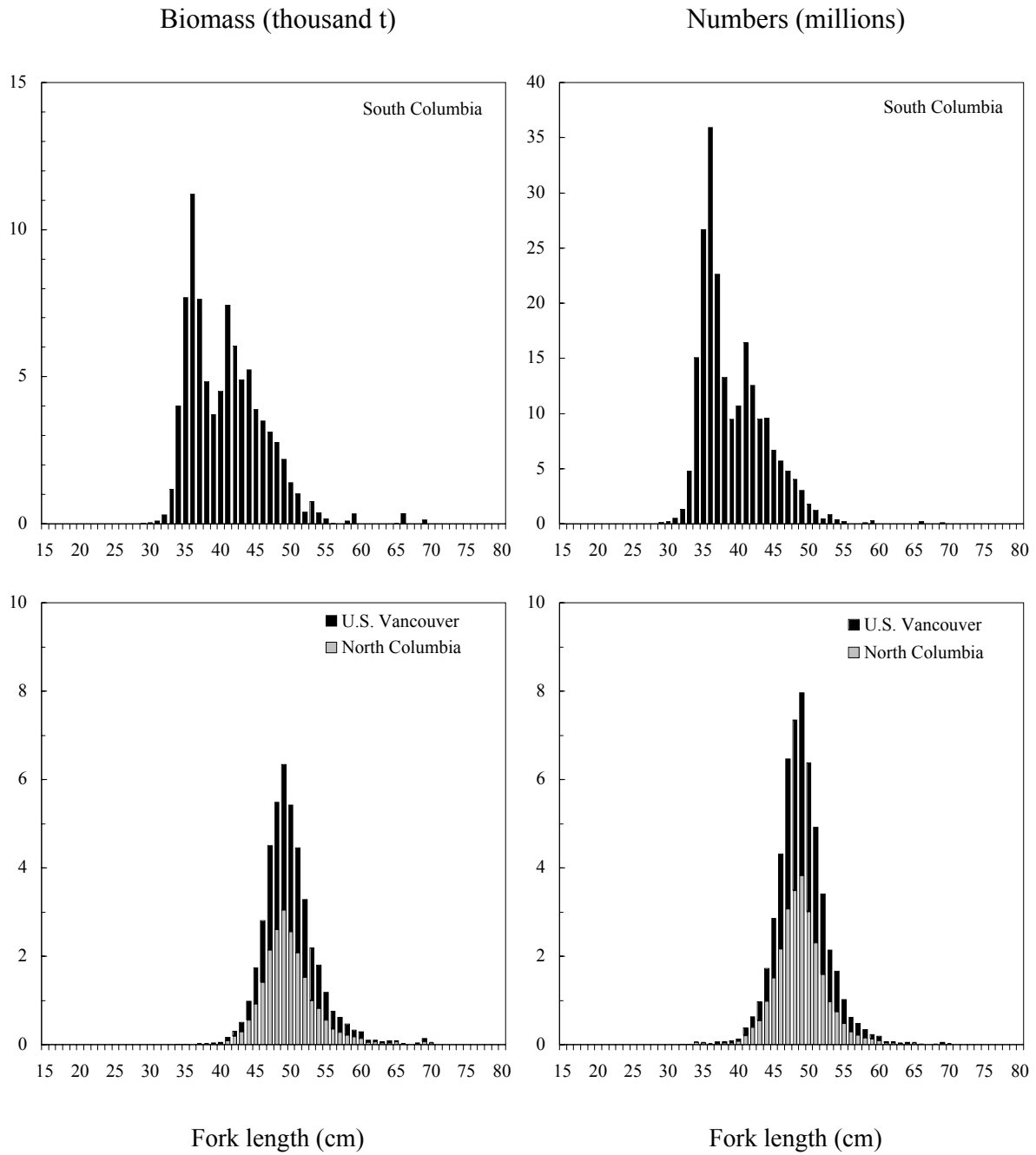


Figure 6.--Continued.

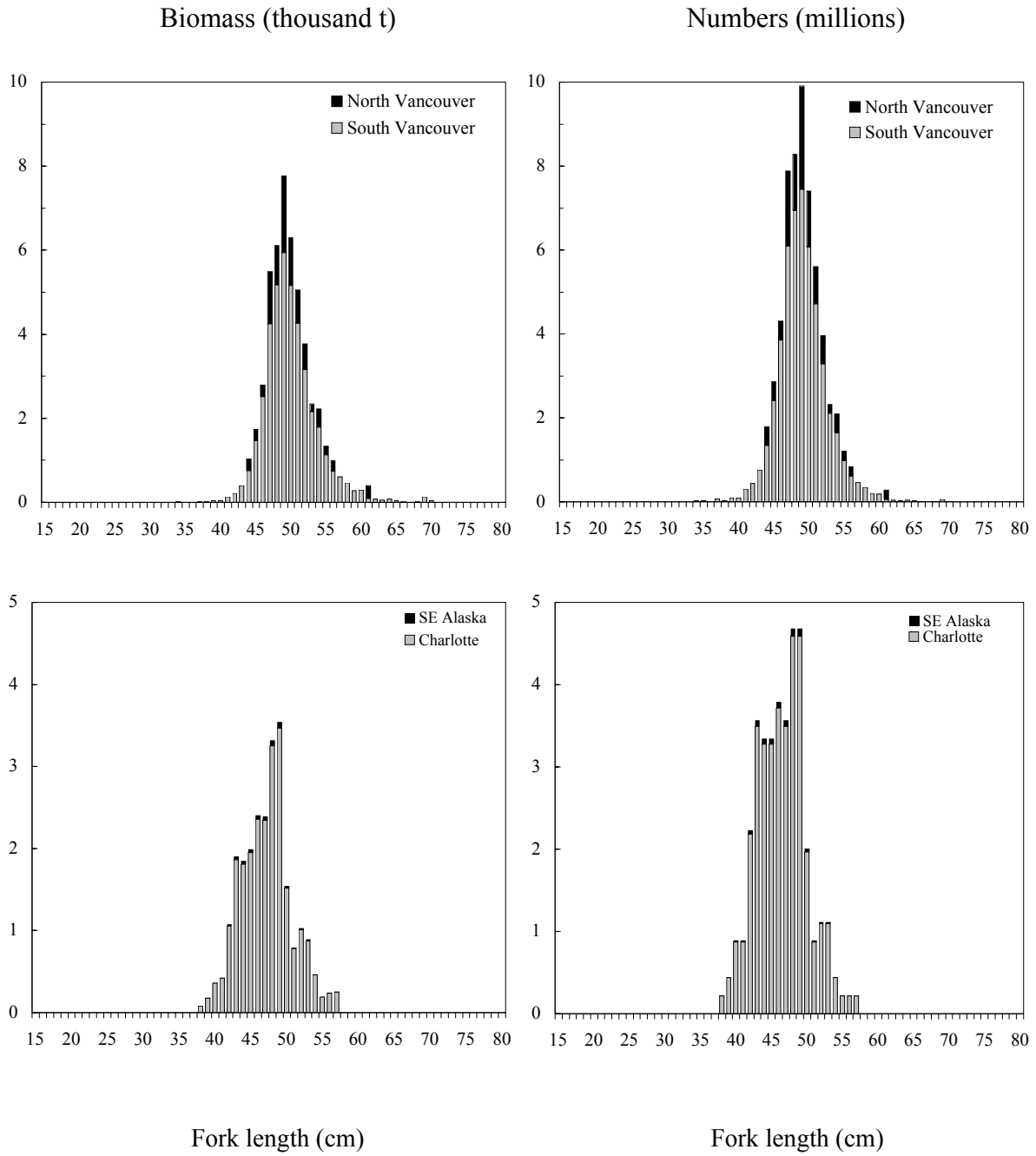


Figure 6.--Continued.

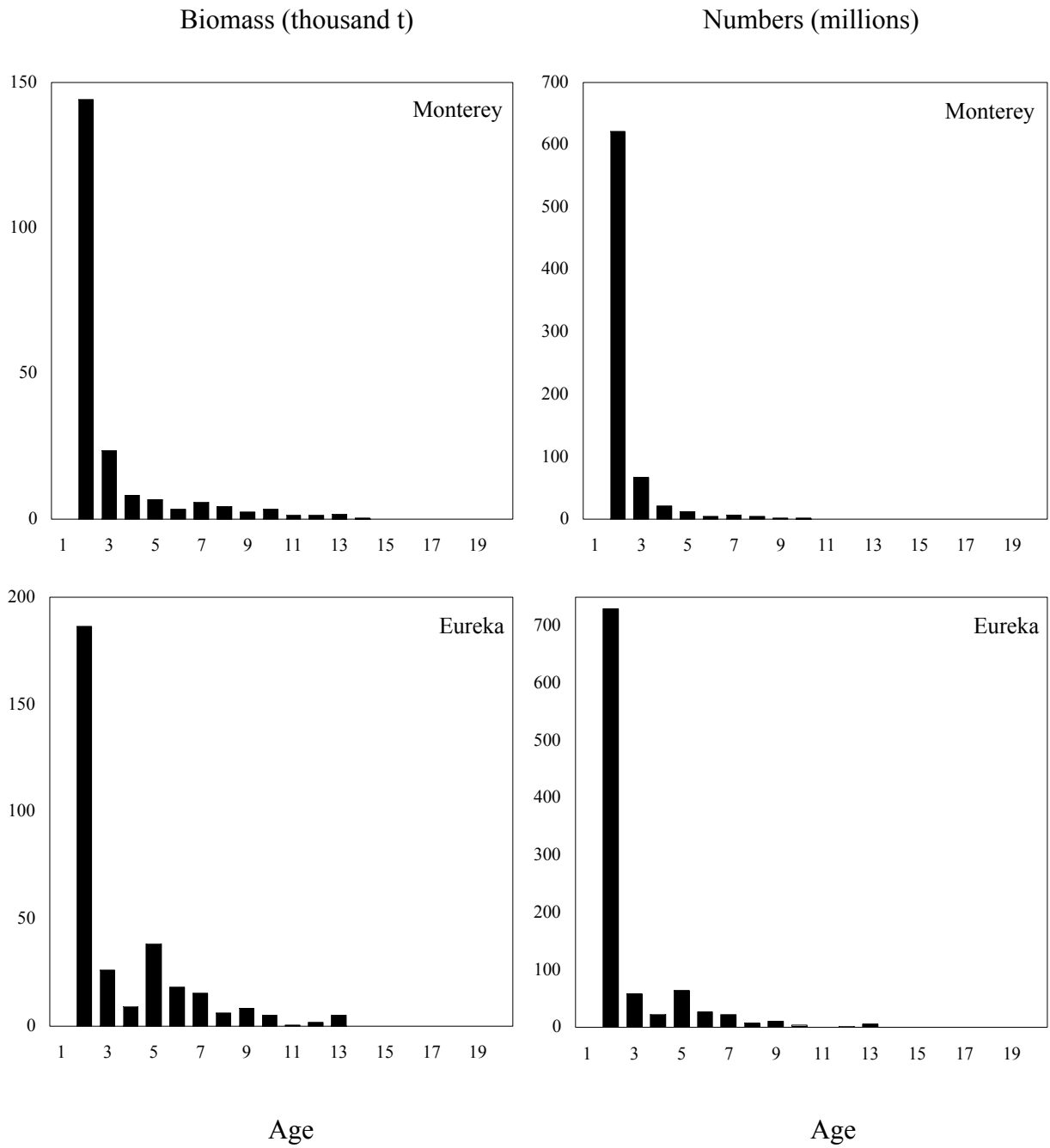


Figure 7.--Biomass (thousands of metric tons (t)) and numbers at age of Pacific hake by area for the 2001 joint U.S.-Canada echo integration-trawl survey of the U.S. and Canadian west coasts. Area boundaries are defined in Table 2.

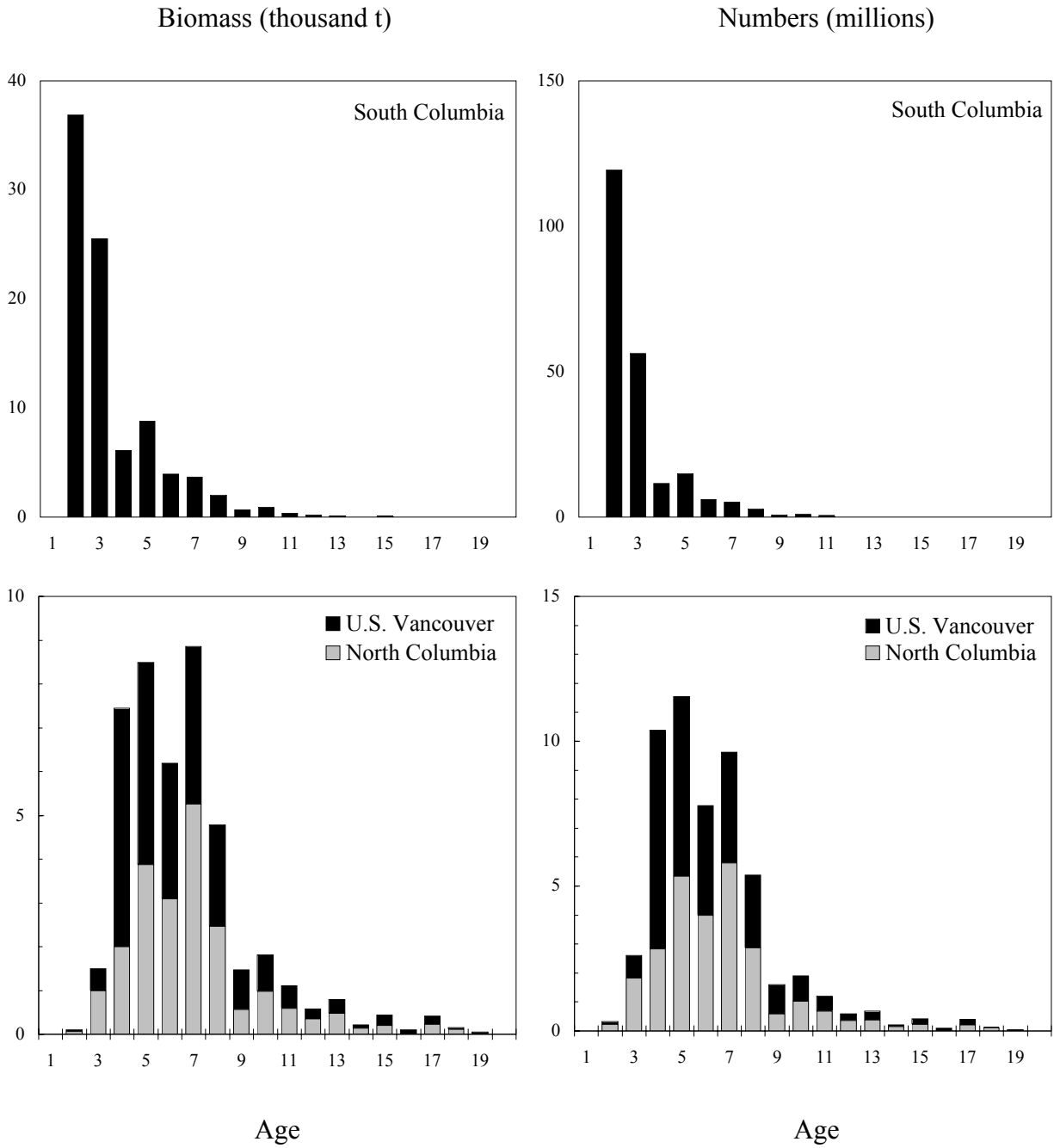


Figure 7.--Continued.

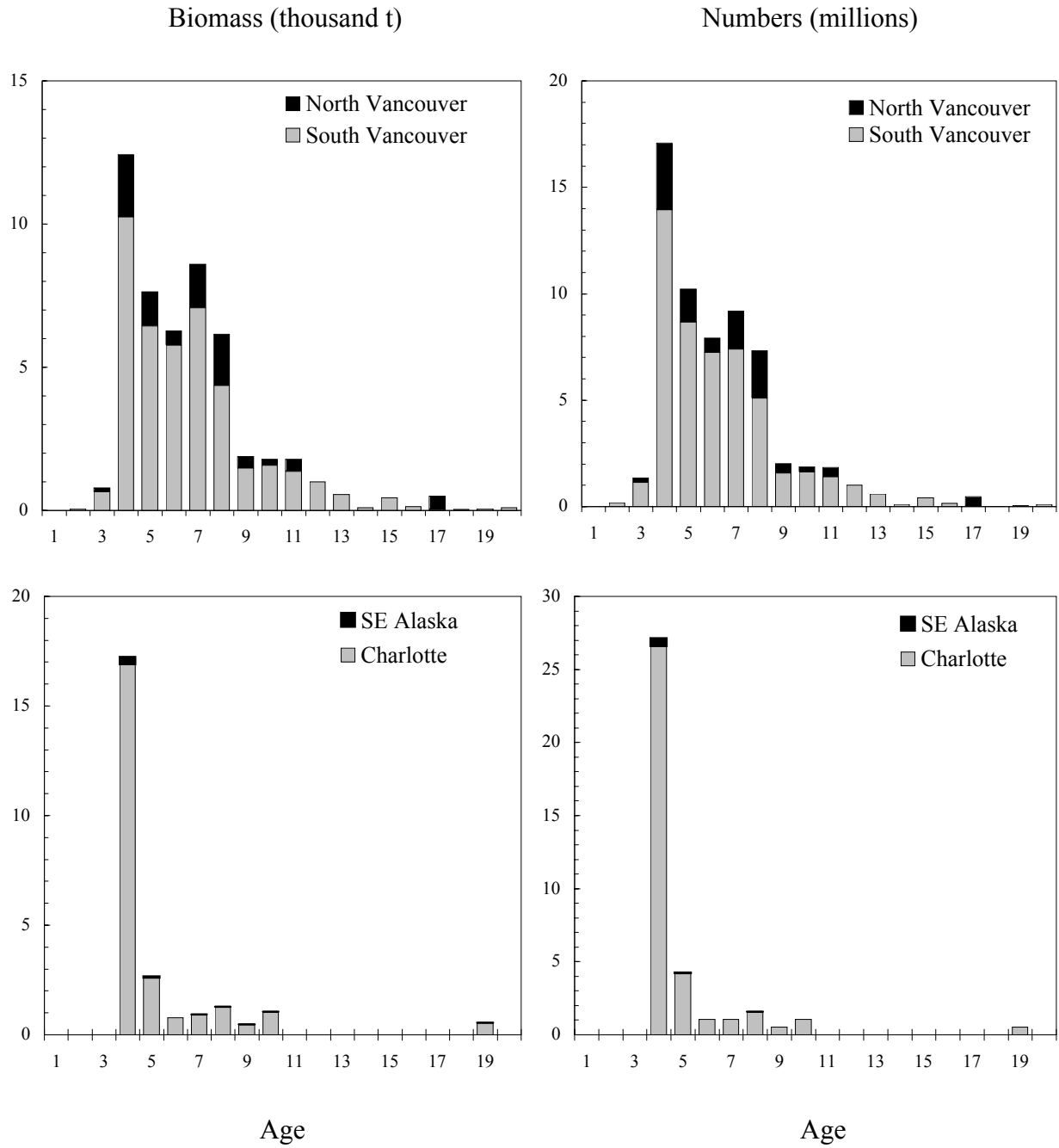


Figure 7.--Continued.

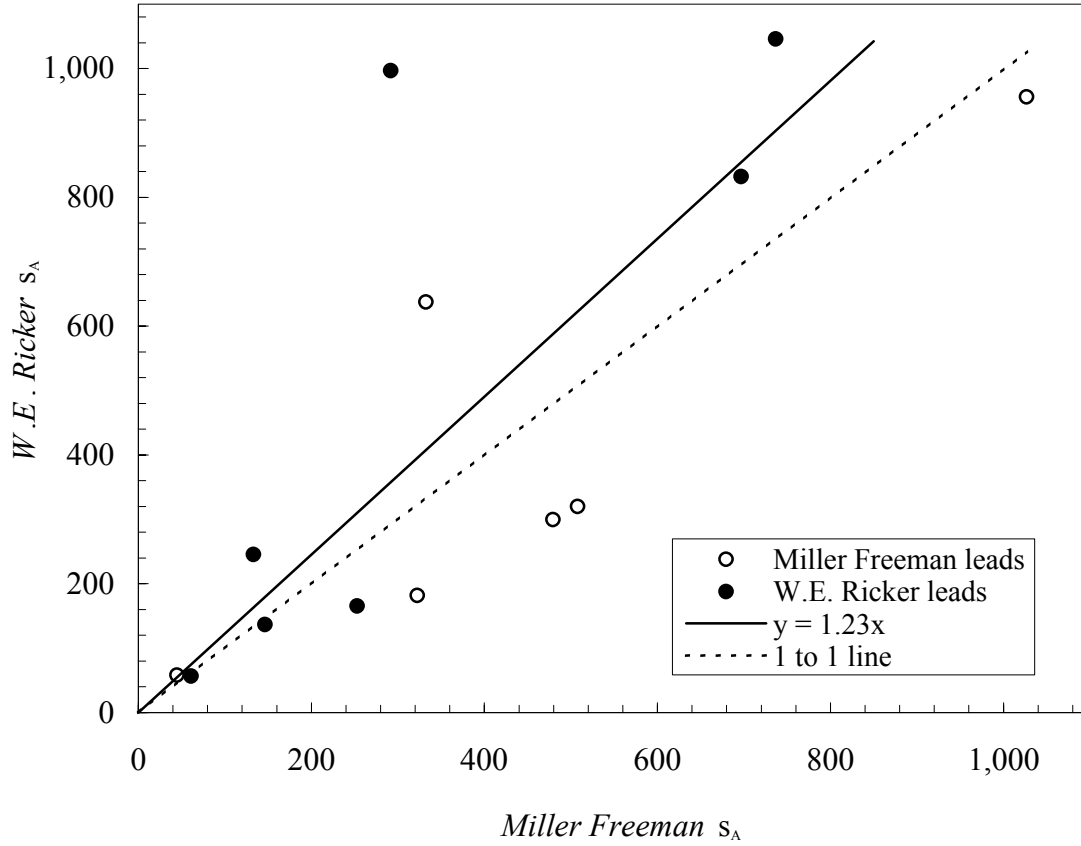


Figure 8.--Comparison of mean area backscattering coefficient (s_A) values by transect from the intership calibration of the NOAA ship *Miller Freeman* and CCGS *W.E. Ricker* Simrad EK500 acoustic systems. The solid line represents a zero-intercept functional regression fitted to the data.

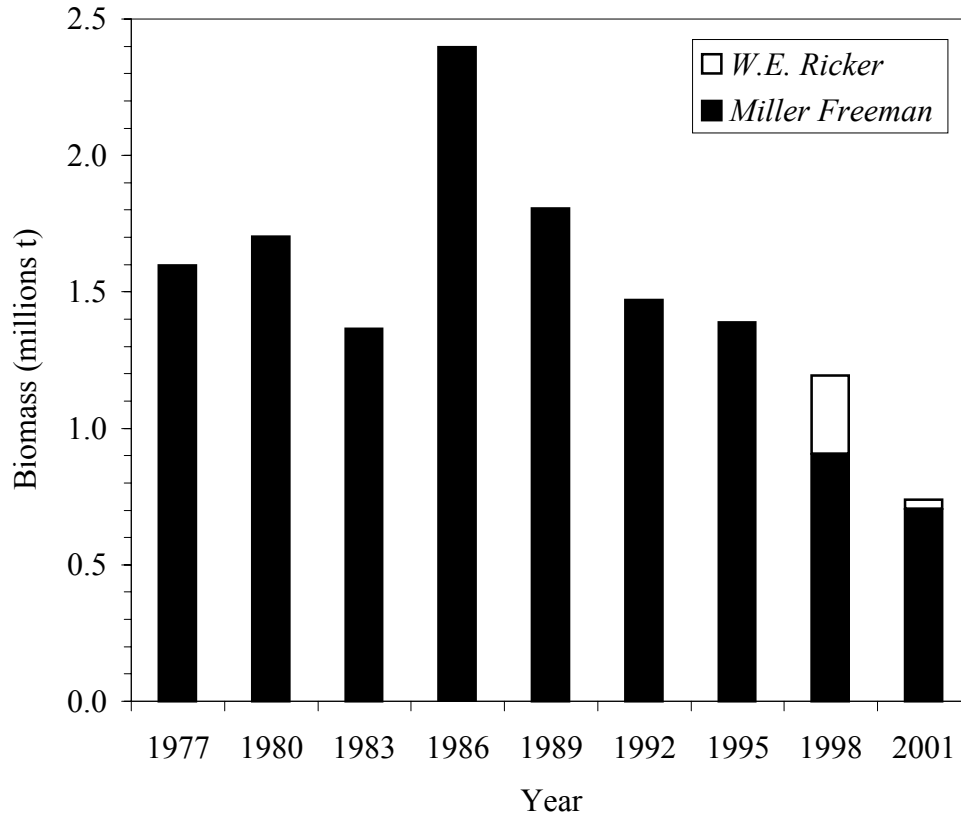


Figure 9.--Pacific hake acoustic-trawl survey biomass (millions metric tons (t)) estimates. Estimates for 1977-1989 are adjusted for the increased offshore and northward coverage beginning in 1992 and the change of the target strength (TS) model from -35 dB/kg to $TS=20 \text{ Log } L - 68$ (adapted from Dorn 1996).

APPENDIX

Appendix Table 1a.--Transect start and end times and locations off the west coast of Vancouver and Queen Charlotte Islands for the CCGS *W.E. Ricker* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Transect	Date	Time (PDT)		Log (nmi) ^a		Start position		End position	
		Start	End	Start	End	Latitude	Longitude	Latitude	Longitude
D82	6 Aug	15:10	15:37	1951.8	1956.4	50 8.15	127 58.12	50 8.25	128 5.23
D82.1	6 Aug	16:26	18:01	1964.1	1979.7	50 8.42	128 5.10	50 8.28	128 28.43
D83	7 Aug	4:51	5:48	2017.7	2027.2	50 18.13	128 4.40	50 18.33	128 18.88
D83.1	7 Aug	7:58	8:48	2038.7	2046.9	50 18.38	128 19.48	50 18.37	128 31.95
D83.3	7 Aug	11:00	13:44	2066.7	2081.0	50 28.02	128 9.20	50 28.22	128 31.27
D83.5	7 Aug	16:57	17:46	2092.8	2100.5	50 27.55	128 32.15	50 27.98	128 44.03
D85	7 Aug	19:18	20:38	2111.2	2123.6	50 38.00	128 44.78	50 38.03	128 25.32
T19.1	9 Aug	5:10	6:19	2269.2	2279.9	50 38.23	128 45.67	50 38.18	129 2.28
T20.0	9 Aug	7:57	9:05	2294.8	2304.5	50 48.05	129 20.08	50 48.03	129 35.43
T21.0	9 Aug	12:14	13:24	2326.3	2336.9	50 58.18	130 5.55	50 58.13	129 48.92
T21.1	9 Aug	13:52	14:39	2337.3	2340.2	50 58.22	129 49.22	50 57.65	129 44.88
T21.2	9 Aug	14:55	18:43	2341.3	2364.7	50 57.40	129 43.60	50 57.63	129 7.78
T23.1	10 Aug	5:40	7:30	2457.4	2476.0	51 8.28	129 47.62	51 8.15	129 18.22
T24.1	10 Aug	8:53	11:27	2488.6	2513.4	51 18.12	129 30.50	51 18.35	130 9.85
T25.0	10 Aug	12:31	13:49	2523.7	2537.2	51 27.98	130 14.53	51 28.33	129 53.42
T26.0	10 Aug	14:57	15:05	2548.0	2549.1	51 38.17	130 0.35	51 38.22	130 2.08
T26.1	10 Aug	15:33	15:57	2549.8	2553.6	51 38.33	130 2.63	51 38.18	130 8.73
T26.2	10 Aug	17:05	18:09	2559.6	2569.4	51 38.20	130 8.92	51 38.15	130 24.60
T26.3	10 Aug	18:33	20:23	2569.9	2585.3	51 37.97	130 25.08	51 38.13	130 49.75
T28.0	11 Aug	5:18	6:30	2639.6	2650.3	52 8.07	131 20.98	52 8.10	131 38.27
T29.0	11 Aug	11:31	11:58	2685.2	2689.5	52 28.08	131 43.98	52 28.15	131 51.02
T30.0	11 Aug	14:29	14:42	2714.2	2716.2	52 48.10	132 15.08	52 47.80	132 17.85
T31.0	11 Aug	19:31	20:35	2751.2	2762.0	53 7.07	132 38.85	53 8.13	132 55.83
T32.0	12 Aug	5:17	5:55	2809.6	2815.8	53 28.12	132 56.98	53 28.12	133 7.35
T32.1	12 Aug	7:50	8:18	2824.0	2828.5	53 28.05	133 7.37	53 28.12	133 14.90
T33.0	12 Aug	11:56	12:33	2858.2	2864.3	53 48.40	133 15.10	53 48.02	133 25.30
T34.0	12 Aug	17:04	17:20	2898.1	2900.9	54 8.17	133 49.95	54 8.10	133 45.23
T34.1	12 Aug	18:56	20:52	2913.5	2929.7	54 8.15	133 44.43	54 8.10	133 17.57

^a Log (nmi) is the cumulative distance in nautical miles traveled during the survey.

Appendix Table 1b.--Transect start and end times and locations for the Alaska and Dixon Entrance areas for the CCGS *W.E. Ricker* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Transect	Date	Time (PDT)		Log (nmi) ^a		Start position		End position	
		Start	End	Start	End	Latitude	Longitude	Latitude	Longitude
T35.0	13 Aug	6:13	15:13	2978.1	3021.1	54 48.20	133 0.13	54 41.50	134 5.27
T35.1	13 Aug	17:53	19:21	3030.6	3040.1	54 37.87	134 5.33	54 39.85	134 20.87
T35.2	13 Aug	19:52	20:54	3041.1	3050.6	54 39.88	134 21.87	54 38.35	134 37.93
T36.0*	14 Aug	5:24	7:29	3121.1	3143.7	54 36.48	132 41.42	54 14.10	132 40.97
T37.0*	14 Aug	9:37	10:40	3164.6	3175.4	54 15.13	132 6.77	54 26.03	132 6.88
T37.1*	14 Aug	10:56	12:01	3175.9	3186.2	54 26.18	132 7.43	54 36.42	132 6.75
T38.0*	14 Aug	14:56	17:00	3206.6	3227.5	54 36.38	131 32.92	54 15.63	131 32.80

^a Log (nmi) is the cumulative distance in nautical miles traveled during the survey.

Note: Transects with * are designated 'Disputed Zone' (see Tables 12-15; Figure 2).

Appendix Table 1c.--Transect start and end times and locations in the Hecate Strait and Queen Charlotte Sound areas for the CCGS *W.E. Ricker* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Transect	Date	Time (PDT)		Log (nmi) ^a		Start position		End position	
		Start	End	Start	End	Latitude	Longitude	Latitude	Longitude
T41.0	15 Aug	10:51	11:46	3317.1	3326.9	53 18.60	130 51.13	53 18.22	130 34.98
T44.0	15 Aug	15:28	19:04	3368.3	3389.3	52 38.50	130 20.67	52 38.15	129 47.47
T47.0	16 Aug	5:18	5:55	3470.1	3475.7	51 47.98	131 2.70	51 48.17	130 53.65
T47.1	16 Aug	6:10	6:58	3476.1	3484.4	51 48.12	130 53.70	51 48.18	130 40.28
T47.2	16 Aug	8:19	11:46	3491.1	3526.5	51 49.00	130 39.47	51 48.05	129 43.07
T47.3	16 Aug	11:46	12:18	3526.5	3532.2	51 48.05	129 43.07	51 48.02	129 33.82
T47.4	16 Aug	14:54	15:59	3559.2	3570.5	51 48.02	128 51.15	51 48.07	128 33.18
T47.5	16 Aug	16:14	17:11	3571	3580.9	51 47.95	128 32.62	51 48.12	128 16.77
T48.0	16 Aug	18:24	19:44	3591.4	3605.3	51 38.18	128 13.27	51 38.08	128 35.58
T49.0	17 Aug	7:24	9:38	3637.5	3660.5	51 28.18	128 46.35	51 28.13	128 10.05
T50.0	17 Aug	11:04	13:18	3673.5	3696.8	51 18.08	128 22.35	51 18.17	128 59.38
T50.1	17 Aug	14:17	15:31	3703.5	3715.5	51 18.33	129 9.18	51 18.10	129 28.32
T51.0	17 Aug	16:52	20:01	3728.3	3760.7	51 8.17	129 16.95	51 8.13	128 25.70
T51.1	18 Aug	11:31	14:09	3835.6	3850.4	51 8.22	128 25.25	51 8.45	128 3.90

^a Log (nmi) is the cumulative distance in nautical miles traveled during the survey.

Appendix Table 2.--Mid-water trawl station detailed summary for the CCGS *W.E. Ricker* for the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.

Set number	68	69	70	71	72	73	74
Date (MMDDYY)	08/07/01	08/07/01	08/07/01	08/07/01	08/07/01	08/07/01	08/09/01
Time Start (PDT)	7:32	11:50	13:06	14:05	15:25	16:45	14:58
Time End (PDT)	8:14	13:42	13:50	14:56	16:14	17:40	15:43
Duration of Set (Minutes)	42	112	44	51	49	55	45
Major Area	04	04	04	04	04	04	05
Minor Area	27	27	27	27	27	27	11
Locality	3	1	3	3	3	3	7
Start Latitude (Deg. N)	50	50	50	50	50	50	50
Start Latitude (Minutes)	17.81	27.94	28.25	28.22	28.17	28.21	58.15
Start Longitude (Deg. W)	128	128	128	128	128	128	129
Start Longitude (Minutes)	17.78	8.84	19.05	27.57	33.29	34.75	48.35
End Latitude (Deg. N)	50	50	50	50	50	50	50
End Latitude (Minutes)	18.58	28.38	28.37	28.22	28.17	27.77	57.69
End Longitude (Deg. W)	128	128	128	128	128	128	129
End Longitude (Minutes)	15.48	12.62	22.76	31.33	37.16	32.64	44.48
Direction of Set (Deg. T)	068	287	268	266	264	95	97
Start Bottom Depth (m)	471	33	144	191	250	300	695
Start Target Depth (m)	-	-	-	-	-	-	250
Start Capture Depth (m)	-	-	15	-	-	150	-
Start Gear Depth (m)	280	-	15	-	-	150	-
End Bottom Depth (m)	474	73	180	207	1125	359	426
End Target Depth (m)	-	-	-	-	-	-	-
End Capture Depth (m)	-	14	15	-	-	178	-
End Gear Depth (m)	305	14	15	-	-	178	-
Min. Bottom Depth (m)	471	33	144	191	250	300	160
Min. Target Depth (m)	200	5	-	-	-	150	-
Min. Capture Depth (m)	293	-	15	-	-	150	-
Min. Gear Depth (m)	293	-	15	-	-	150	-
Max. Bottom Depth (m)	474	73	180	207	1125	359	695
Max. Target Depth (m)	350	25	-	-	-	200	-
Max. Capture Depth (m)	317	17	15	-	-	199	-
Max. Gear Depth (m)	317	17	15	-	-	199	-
Modal Bottom Depth (m)	472	53	160	198	760	325	-
Modal Target Depth (m)	250	15	15	-	-	175	260
Modal Capture Depth (m)	308	8	15	-	-	176	260
Modal Gear Depth (m)	301	8	15	-	-	176	-
CTD Number	N/A	59	N/A	60	N/A	N/A	64
Surface Water Temp. (Deg C.)	13.5	13.2	14.0	13.8	12.6	12.8	-
Swell (m)	2	2	2	1	1	2	-
Air Temperature (Deg. C)	12.0	12.0	-	16.0	-	-	16.0

Appendix Table 2.--Continued.

Set number	75	76	77	78	79	80	81
Date (MMDDYY)	08/09/01	08/09/01	08/09/01	08/09/01	08/11/01	08/11/01	08/12/01
Time Start (PDT)	16:13	17:43	19:04	17:10	10:15	16:00	7:30
Time End (PDT)	16:45	18:17	19:49	17:45	11:13	17:00	7:55
Duration of Set (Minutes)	32	34	45	35	58	60	25
Major Area	05	05	05	06	09	09	09
Minor Area	11	11	11	08	34	31	31
Locality	7	7	1	14	5	13	1
Start Latitude (Deg. N)	50	50	50	51	52	52	53
Start Latitude (Minutes)	58.10	57.87	58.12	31.25	15.16	47.24	26.77
Start Longitude (Deg. W)	129	129	129	130	131	132	133
Start Longitude (Minutes)	40.43	25.46	11.48	7.30	32.40	15.31	3.31
End Latitude (Deg. N)	50	50	50	51	52	52	53
End Latitude (Minutes)	58.03	58.06	57.81	38.25	16.98	45.3	27.99
End Longitude (Deg. W)	129	129	129	130	131	132	133
End Longitude (Minutes)	36.58	21.12	8.01	5.38	34.87	12.23	4.62
Direction of Set (Deg. T)	91	91	91	90	332	326	320
Start Bottom Depth (m)	281	178	137	312	380	453	271
Start Target Depth (m)	148	-	-	171	-	-	-
Start Capture Depth (m)	-	-	-	-	-	-	-
Start Gear Depth (m)	-	-	-	-	-	-	-
End Bottom Depth (m)	253	94	113	167	420	389	433
End Target Depth (m)	135	-	-	80	-	-	-
End Capture Depth (m)	-	-	-	-	-	-	-
End Gear Depth (m)	-	-	-	-	-	-	-
Min. Bottom Depth (m)	253	94	60	167	380	389	271
Min. Target Depth (m)	135	-	-	60	-	-	-
Min. Capture Depth (m)	-	-	-	-	-	-	-
Min. Gear Depth (m)	-	-	-	-	-	-	-
Max. Bottom Depth (m)	253	102	72	312	420	453	495
Max. Target Depth (m)	148	-	-	177	-	-	-
Max. Capture Depth (m)	-	-	-	-	-	-	-
Max. Gear Depth (m)	-	-	-	-	-	-	-
Modal Bottom Depth (m)	-	-	-	-	-	-	-
Modal Target Depth (m)	-	-	-	100	350	375	325
Modal Capture Depth (m)	-	-	-	100	350	375	325
Modal Gear Depth (m)	-	-	-	100	-	-	-
CTD Number	N/A	N/A	65	66	N/A	71	76
Surface Water Temp. (Deg C.)	-	-	-	-	-	-	-
Swell (m)	-	-	-	-	-	-	-
Air Temperature (Deg. C)	-	15.0	14.5	18.0	13.0	15.0	-

Appendix Table 2.--Continued.

Set number	82	83	84	85	86	87	88
Date (MMDDYY)	08/12/01	08/12/01	08/12/01	08/13/01	08/13/01	08/13/01	08/13/01
Time Start (PDT)	10:03	13:39	16:10	7:12	8:45	9:59	11:07
Time End (PDT)	10:46	14:22	16:30	7:50	9:25	10:23	11:40
Duration of Set (Minutes)	43	43	20	38	40	24	33
Major Area							10
Minor Area	31	31	31	32	32	32	32
Locality	12	4	2	1	1	1	1
Start Latitude (Deg. N)	53	53	53	54	54	54	54
Start Latitude (Minutes)	32.63	48.02	54.30	48.23	46.12	45.57	44.36
Start Longitude (Deg. W)	133	133	133	133	133	133	133
Start Longitude (Minutes)	14.99	24.76	39.06	1.04	12.55	20.48	28.05
End Latitude (Deg. N)	53	53	53	54	54	54	54
End Latitude (Minutes)	30.47	48.16	55.48	47.62	45.79	44.98	43.66
End Longitude (Deg. W)	133	133	133	133	133	133	133
End Longitude (Minutes)	14.98	21.10	39.88	4.60	16.83	22.59	32.99
Direction of Set (Deg. T)	355	270	334	260	260	260	260
Start Bottom Depth (m)	358	186	525	66	66	60	72
Start Target Depth (m)	-	-	-	-	-	-	-
Start Capture Depth (m)	21	-	-	-	-	-	-
Start Gear Depth (m)	-	-	-	-	-	-	-
End Bottom Depth (m)	777	119	535	100	74	81	104
End Target Depth (m)	-	-	-	-	-	-	-
End Capture Depth (m)	3	-	-	-	-	-	-
End Gear Depth (m)	-	-	-	-	-	-	-
Min. Bottom Depth (m)	-	119	525	66	66	60	72
Min. Target Depth (m)	-	-	-	-	-	-	-
Min. Capture Depth (m)	-	-	-	-	-	-	-
Min. Gear Depth (m)	-	-	-	-	-	-	-
Max. Bottom Depth (m)	795	186	535	100	74	81	104
Max. Target Depth (m)	-	-	-	-	-	-	-
Max. Capture Depth (m)	-	-	-	-	-	-	-
Max. Gear Depth (m)	-	-	-	-	-	-	-
Modal Bottom Depth (m)	-	-	-	80	70	70	80
Modal Target Depth (m)	35	135	275	-	-	-	-
Modal Capture Depth (m)	35	135	275	-	-	-	-
Modal Gear Depth (m)	-	-	-	-	-	-	-
CTD Number	N/A	N/A	N/A	79	80	81	82
Surface Water Temp. (Deg C.)	-	-	-	-	-	-	-
Swell (m)	-	-	-	-	-	-	-
Air Temperature (Deg. C)	-	-	15.0	-	-	-	-

Appendix Table 2.--Continued.

Set number	96	97	98	99	100	101	102
Date (MMDDYY)	08/15/01	08/15/01	08/15/01	08/16/01	08/18/01	08/18/01	08/18/01
Time Start (PDT)	17:30	18:25	19:05	8:30	7:06	8:11	9:06
Time End (PDT)	18:08	18:45	19:28	9:00	7:45	8:51	9:53
Duration of Set (Minutes)	38	20	23	30	39	40	47
Major Area	07	07	07	06	05	05	05
Minor Area	06	07	07	08	11	11	11
Locality	5	0	0	6	1	1	1
Start Latitude (Deg. N)	52	52	52	51	51	51	51
Start Latitude (Minutes)	38.17	38.27	38.13	48.20	8.43	7.99	7.55
Start Longitude (Deg. W)	130	130	129	130	129	129	128
Start Longitude (Minutes)	10.35	3.24	58.74	45.48	16.18	6.61	56.67
End Latitude (Deg. N)	52	52	52	51	51	51	51
End Latitude (Minutes)	38.21	38	38.18	48.95	8.18	7.78	7.46
End Longitude (Deg. W)	130	130	129	130	129	129	128
End Longitude (Minutes)	6.05	1.26	56.48	39.70	12.30	2.58	52.46
Direction of Set (Deg. T)	90	90	90	100	90	90	90
Start Bottom Depth (m)	130	142	142	-	111	73	59
Start Target Depth (m)	-	-	60	250	-	-	-
Start Capture Depth (m)	-	-	60	280	-	-	-
Start Gear Depth (m)	-	-	60	250	-	-	-
End Bottom Depth (m)	135	138	139	-	91	74	50
End Target Depth (m)	-	-	60	300	-	-	-
End Capture Depth (m)	-	-	60	280	-	-	-
End Gear Depth (m)	-	-	60	300	-	-	-
Min. Bottom Depth (m)	130	138	139	-	91	73	50
Min. Target Depth (m)	-	-	60	250	-	-	-
Min. Capture Depth (m)	-	-	60	280	-	-	-
Min. Gear Depth (m)	-	-	60	250	-	-	-
Max. Bottom Depth (m)	135	142	142	-	111	74	59
Max. Target Depth (m)	-	-	80	300	-	-	-
Max. Capture Depth (m)	-	-	80	300	-	-	-
Max. Gear Depth (m)	-	-	80	300	-	-	-
Modal Bottom Depth (m)	-	-	-	-	-	-	-
Modal Target Depth (m)	-	-	70	280	-	-	-
Modal Capture Depth (m)	-	-	70	280	-	-	-
Modal Gear Depth (m)	-	-	70	280	-	-	-
CTD Number	99	99	99	102	113	112	112
Surface Water Temp. (Deg C.)	-	-	-	-	-	-	-
Swell (m)	-	-	-	-	-	-	-
Air Temperature (Deg. C)	-	-	17.0	14.0	13.5	-	-

Appendix Table 2.--Continued.

Set number	103	104	105	106	107	108
Date (MMDDYY)	08/18/01	08/18/01	08/18/01	08/18/01	08/18/01	08/18/01
Time Start (PDT)	10:06	10:59	12:20	12:26	14:25	15:08
Time End (PDT)	10:51	11:45	13:06	13:53	14:50	15:35
Duration of Set (Minutes)	45	46	46	87	25	27
Major Area	05	05	05	05	05	05
Minor Area	11	11	11	11	11	11
Locality	2	2	3	3	3	3
Start Latitude (Deg. N)	51	51	51	51	51	51
Start Latitude (Minutes)	7.45	8.12	8.19	8.11	8.27	8.59
Start Longitude (Deg. W)	128	128	128	128	128	128
Start Longitude (Minutes)	47.21	38.34	25.97	16.03	9.5	3.61
End Latitude (Deg. N)	51	51	51	51	51	51
End Latitude (Minutes)	7.73	8.32	8.23	8.27	8.37	7.35
End Longitude (Deg. W)	128	128	128	128	128	128
End Longitude (Minutes)	42.22	33.04	21.13	13.63	6.21	1.72
Direction of Set (Deg. T)	90	90	90	90	90	90
Start Bottom Depth (m)	44	70	90	81	73	55
Start Target Depth (m)	-	-	-	-	-	-
Start Capture Depth (m)	-	-	-	-	-	-
Start Gear Depth (m)	-	-	-	-	-	-
End Bottom Depth (m)	51	72	100	78	70	58
End Target Depth (m)	-	-	-	-	-	-
End Capture Depth (m)	-	-	-	-	-	-
End Gear Depth (m)	-	-	-	-	-	-
Min. Bottom Depth (m)	44	70	90	78	70	55
Min. Target Depth (m)	-	-	-	-	-	-
Min. Capture Depth (m)	-	-	-	-	-	-
Min. Gear Depth (m)	-	-	-	-	-	-
Max. Bottom Depth (m)	51	72	100	81	73	58
Max. Target Depth (m)	-	-	-	-	-	-
Max. Capture Depth (m)	-	-	-	-	-	-
Max. Gear Depth (m)	-	-	-	-	-	-
Modal Bottom Depth (m)	-	-	-	-	-	-
Modal Target Depth (m)	-	-	-	-	-	-
Modal Capture Depth (m)	-	-	-	-	-	-
Modal Gear Depth (m)	-	-	-	-	-	-
CTD Number	111	N/A	110	N/A	N/A	114
Surface Water Temp. (Deg C.)	-	-	-	-	-	-
Swell (m)	-	-	-	-	-	-
Air Temperature (Deg. C)	-	-	-	-	-	-

Appendix Table 3.--Continued.

Set No.	79	80	81	82	83	84	85	86	87	88	89
Total catch (kg)	12.0	19.7	288.3	3.7	2.4	6.0	29.9	105.0	2.3	33.8	34.0
Species											
Pacific hake	73	62	100	99	-	-	-	-	-	-	-
Walleye pollock	-	-	-	-	-	-	-	-	-	-	-
Pacific herring	-	-	-	-	-	-	-	<1	-	-	-
Sauries	-	-	-	-	-	-	-	-	-	-	-
Jack mackerel	-	-	-	-	-	-	-	-	-	-	-
Sablefish	-	-	-	-	-	-	-	-	-	-	-
Prowfish	-	-	-	-	-	-	<1	<1	-	-	-
Wolf eel	-	-	-	-	-	-	-	-	-	-	-
Ragfish	-	-	-	-	-	-	-	-	-	-	-
Pacific viperfish	-	-	-	-	-	-	-	-	-	-	-
Lowcrest hatchetfish	<1	-	-	-	-	-	-	-	-	-	-
Northern lampfish	5	10	-	-	-	5	-	-	-	-	-
California headlightfish	3	-	-	-	-	35	6	-	-	-	-
Blue lanternfish	-	-	-	-	-	-	-	-	-	-	-
Chinook salmon	-	-	-	-	-	-	-	-	-	-	-
Pink salmon	-	-	-	-	-	-	44	77	77	48	86
Coho salmon	-	-	-	-	14	-	31	6	10	42	1
Chum salmon	-	-	-	-	-	-	12	12	13	7	11
Sockeye salmon	-	-	-	-	-	-	<1	1	-	3	2
Sebastes species	<1	-	-	-	-	-	-	-	-	-	-
<i>S. brevispinis</i>	-	-	-	-	-	-	-	-	-	-	-
<i>S. flavidus</i>	-	-	-	-	-	-	-	-	-	-	-
<i>S. paucispinis</i>	-	-	-	-	-	-	-	-	-	-	-
<i>S. alutus</i>	-	-	-	-	-	-	-	-	-	-	-
<i>S. melanops</i>	-	-	-	-	-	-	7	-	-	-	-
<i>S. proriger</i>	-	-	-	-	-	-	-	-	-	-	-
<i>S. aleutianus</i>	-	-	-	-	-	-	-	-	-	-	-
<i>S. reedi</i>	-	23	<1	-	-	-	-	-	-	-	-
Flatfish	-	-	-	-	-	-	-	-	-	-	-
Sculpins	-	-	-	-	-	-	-	-	-	-	-
Blue shark	-	-	-	-	-	-	-	-	-	-	-
OTHER											
Squid	6	1	-	1	-	50	-	-	-	-	-
Shrimp	-	-	-	-	-	-	-	-	-	-	-
Jellyfish	4	-	-	-	-	10	1	3	-	-	-
Unidentified larvae	<1	-	-	-	-	-	-	-	-	-	-
Euphausiids	10	3	-	-	86	-	-	-	-	-	-

Appendix Table 4.--Summary by transect of area, mean nautical area scattering coefficient (s_A) and estimated numbers and weights of Pacific hake (in kg) from transects conducted by the CCGS *W.E. Ricker* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts. TSn is dB/fish derived from $TSn^a = 20\log L - 68$ (see text page 6). TSw is dB/kg, derived from $w = .0047(L)^{3.0855}$ (Kieser et al. 1998), using mean fish length from trawl catch data.

Transect	Area (km ²)	s_A (m ² /nmi ²) ^b	Area s_A	TSn (dB/nos)	Fish numbers	Mean fish len (cm)	Mean fish wgt (kg)	TSw (dB/kg)	Total wgt (kg)
D82.0	197.7	0.0	0	-34.15	0	49.2	0.791	-33.1	-
D82.1	623.9	0.0	0	-34.15	0	49.2	0.791	-33.1	-
D83.0	355.6	298.0	30,896	-34.15	6,386,294	49.2	0.791	-33.1	5,048,489
D83.1	350.5	0.1	10	-34.15	2,112	49.2	0.791	-33.1	1,670
D83.3	452.2	0.0	0	-34.15	0	49.2	0.791	-33.1	-
D83.5	326.8	0.0	0	-34.15	0	49.2	0.791	-33.1	-
D85.0	800.2	0.0	0	-34.15	0	49.2	0.791	-33.1	-
T19.1	840.6	38.6	9,460	-34.15	1,955,454	49.2	0.791	-33.1	1,545,824
T20.0	534.1	85.8	13,361	-34.15	2,761,727	49.2	0.791	-33.1	2,183,199
T21.0	501.6	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T21.1	119.6	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T21.2	1,168.7	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T23.1	798.5	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T24.1	1,492.2	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T25.0	968.7	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T26.0	185.1	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T26.1	138.1	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T26.2	369.4	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T26.3	770.2	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T28.0	836.4	58.6	14,290	-34.35	3,097,785	48.0	0.737	-33.0	2,281,872
T29.0	416.9	33.3	4,048	-34.35	877,437	48.0	0.737	-33.0	646,332
T30.0	292.7	345.3	29,467	-34.35	6,387,911	48.0	0.737	-33.0	4,705,426
T31.0	791.2	102.7	23,691	-34.35	5,135,660	48.0	0.737	-33.0	3,783,000
T32.0	505.0	319.6	47,056	-34.35	10,200,882	48.0	0.737	-33.0	7,514,114
T32.1	318.7	87.1	8,093	-34.35	1,754,445	48.0	0.737	-33.0	1,292,349
T33.0	668.6	99.4	19,376	-34.35	4,200,416	48.0	0.737	-33.0	3,094,086
T34.0	548.8	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T34.1	2,287.4	0.1	67	-34.35	14,457	48.0	0.737	-33.0	10,649
T35.0	3,530.3	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T35.1	1,100.2	1.8	577	-34.35	125,165	48.0	0.737	-33.0	92,198
T35.2	645.5	14.2	2,672	-34.35	579,328	48.0	0.737	-33.0	426,741
T36.0*	2,128.3	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T37.0*	1,134.8	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T37.1*	968.4	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T38.0*	1,779.1	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T39.1	573.5	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T40.0	649.5	0.0	0	-34.35	0	48.0	0.737	-33.0	-

Appendix Table 4.--Continued.

Transect	Area (km ²)	s _A (m ² /nmi ²) ^b	Area s _A	TSn (dB/nos)	Fish numbers	Mean fish len (cm)	Mean fish wgt (kg)	TSw (dB/kg)	Total wgt (kg)
T41.0	1,633.0	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T44.0	4,407.8	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T47.0	472.0	51.8	7,128	-34.35	1,545,295	48.0	0.737	-33.0	1,138,286
T47.1	592.5	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T47.2	4,052.3	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T47.3	2,465.0	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T47.4	1,543.0	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T47.5	398.7	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T48.0	507.3	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T49.0	1,027.8	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T50.0	1,212.1	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T50.1	1,270.7	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T51.0	1,851.5	0.0	0	-34.35	0	48.0	0.737	-33.0	-
T51.1	916.7	0.0	0	-34.35	0	48.0	0.737	-33.0	-
Total					45,024,368				33,764,235

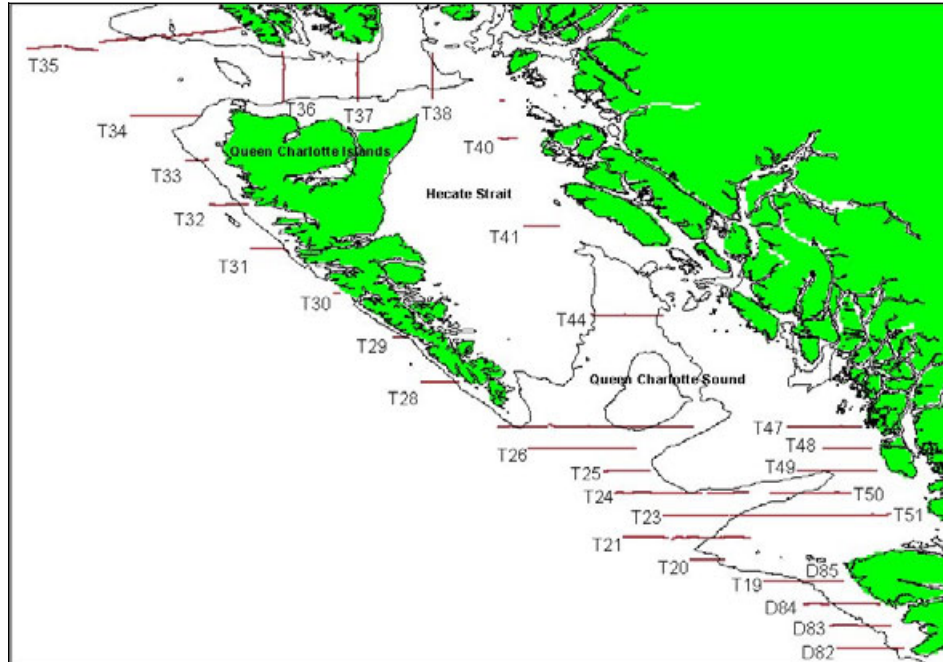
Note:

^aTS= Target Strength

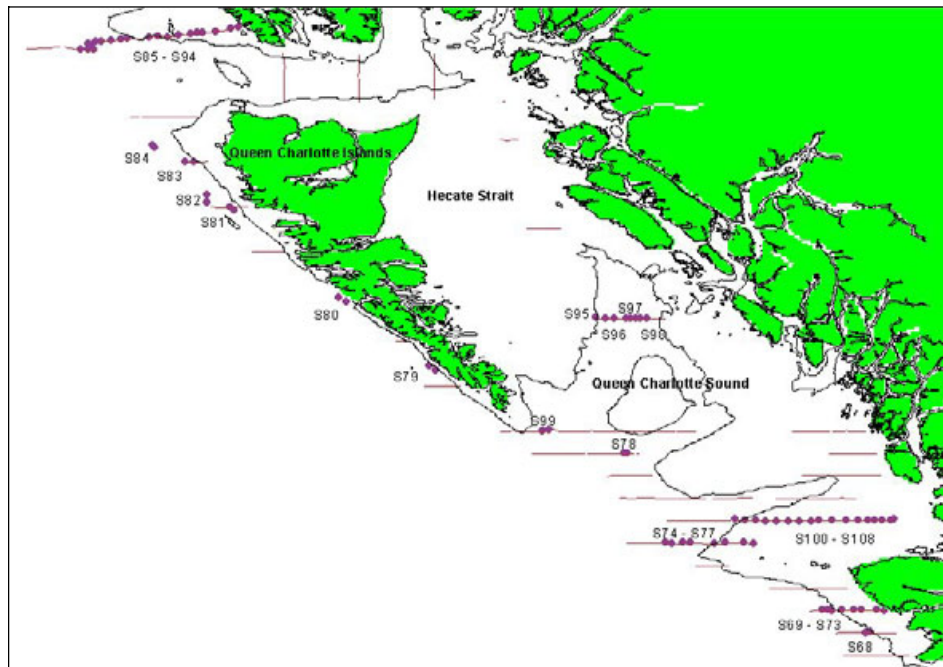
^bnmi = nautical miles

* = Transects designated 'Disputed Zone' in Dixon Entrance (see Tables 13-16; Fig. 2)

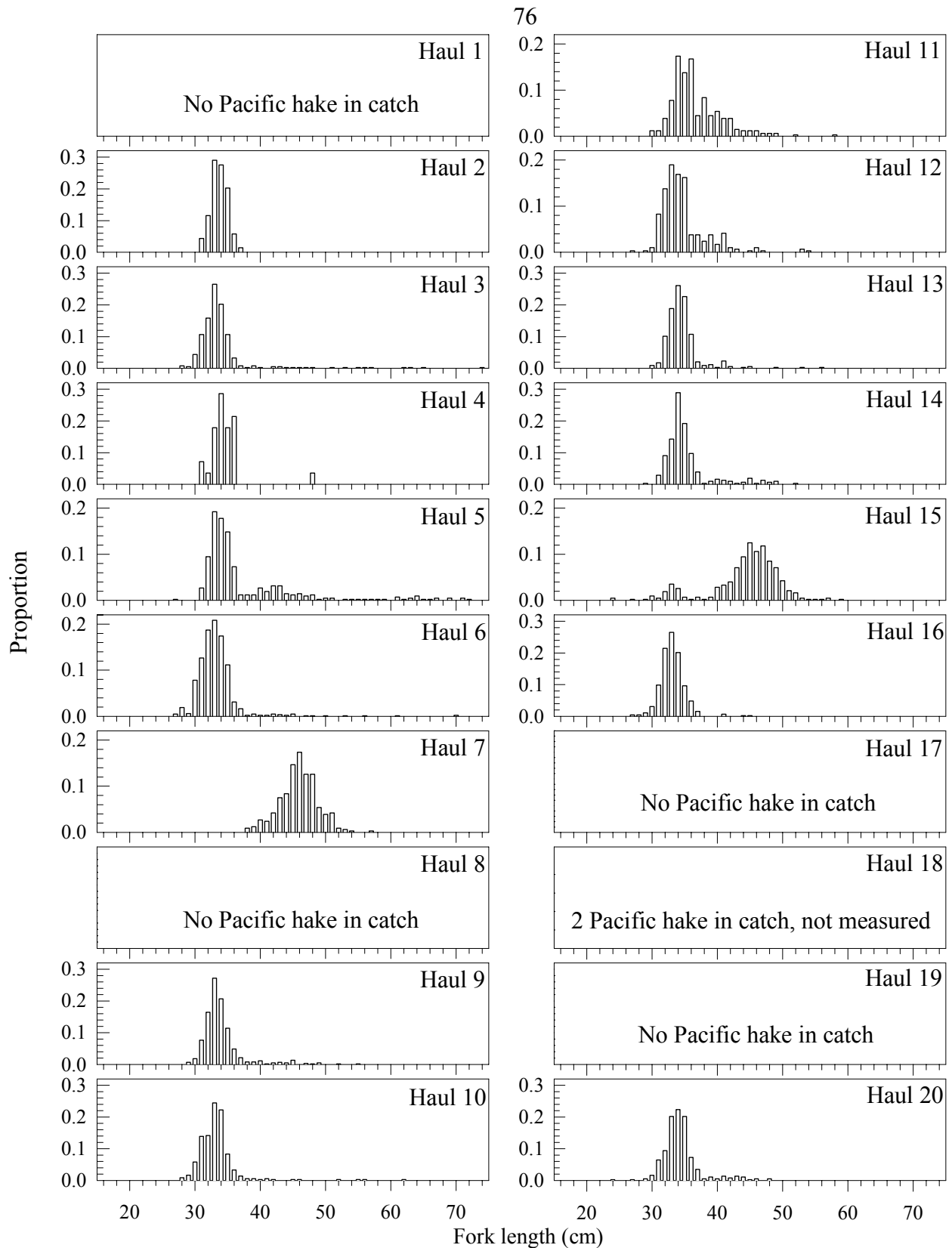
A



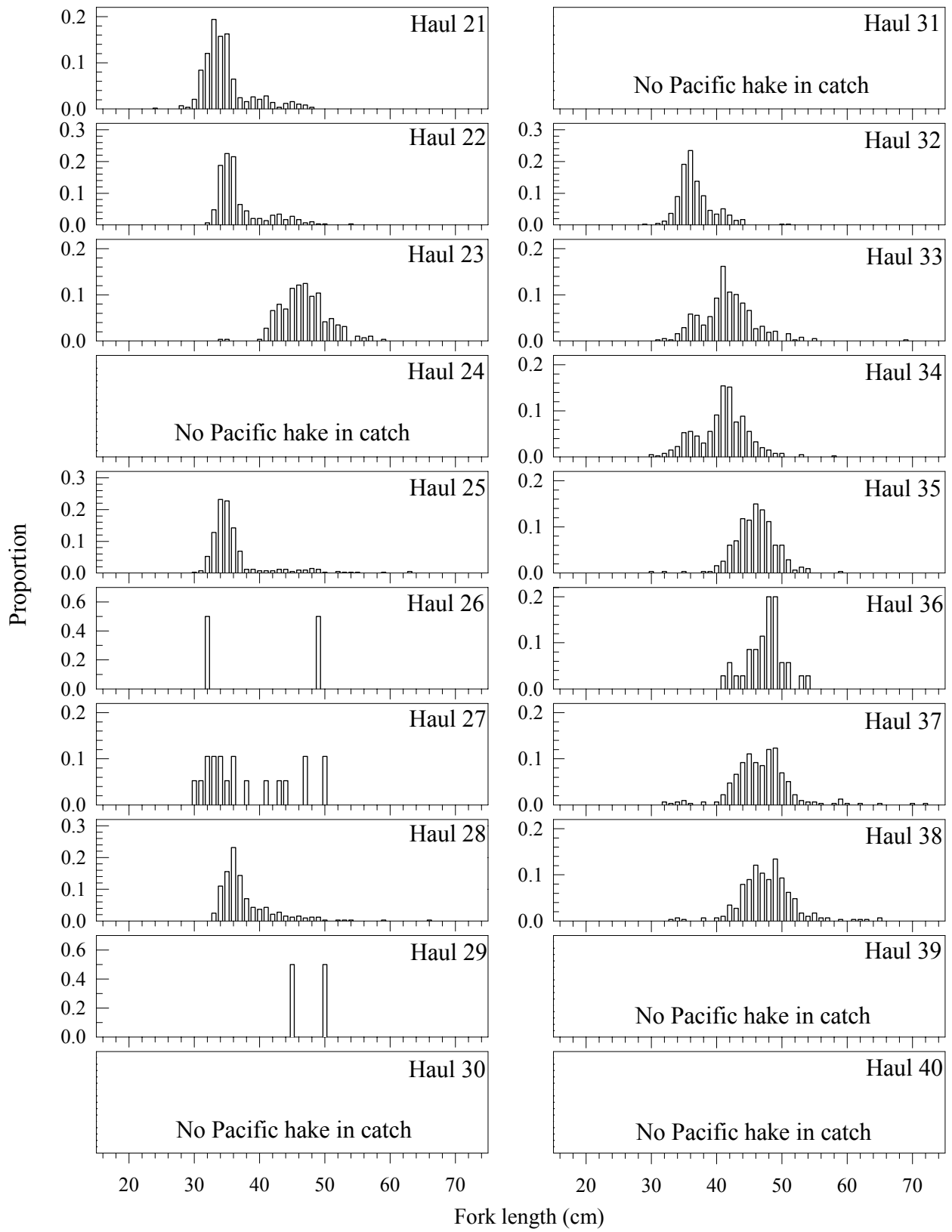
B



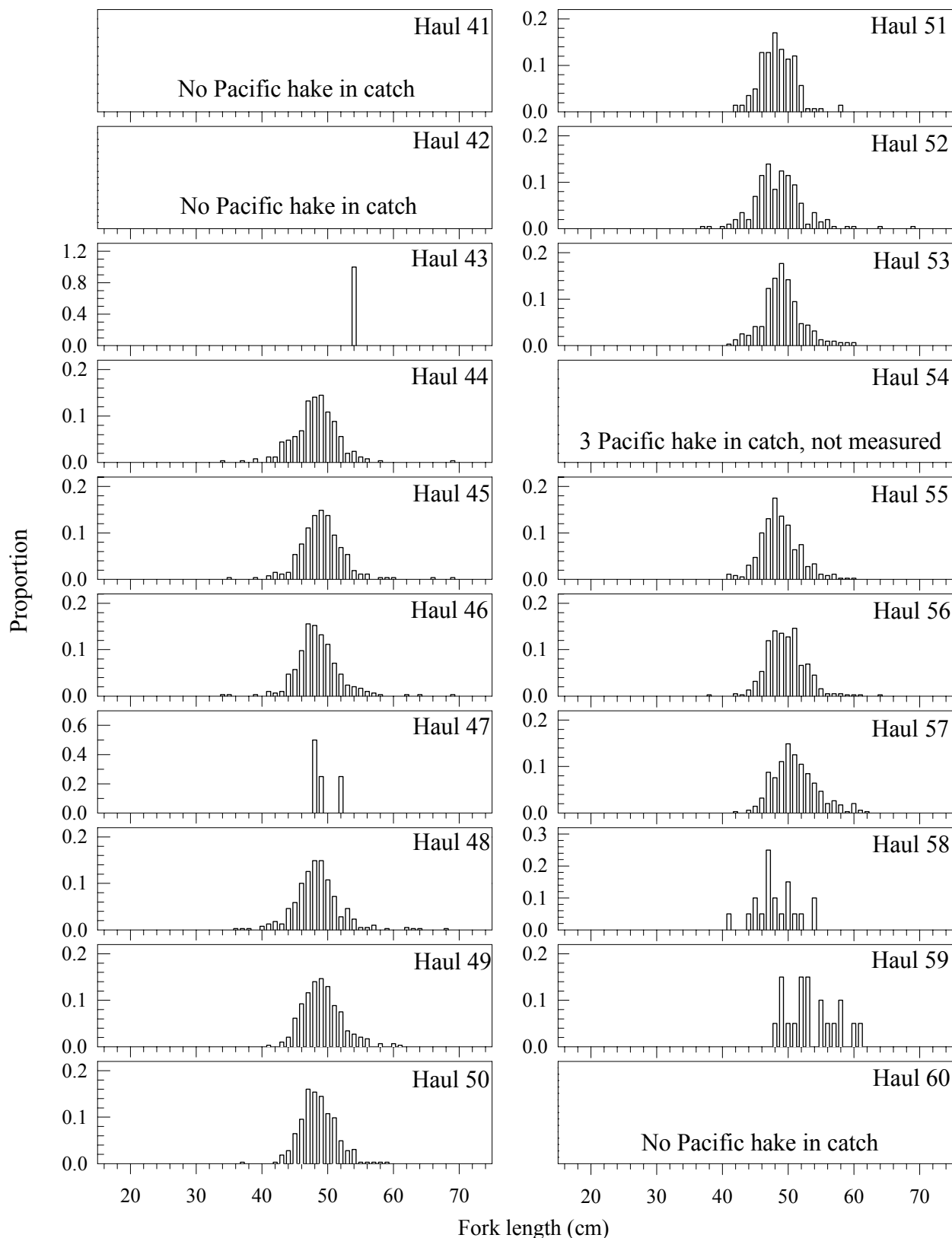
Appendix Figure 1.--Survey trackline (A), and trawl locations (B) for the west coast of Vancouver Island and Queen Charlotte Islands, Dixon Entrance, Hecate Strait, and Queen Charlotte Sound from the Pacific hake echo integration-trawl survey on the CCGS *W.E. Ricker*, 6–18 August 2001. The 200 m isobath is shown to indicate the continental shelf edge.



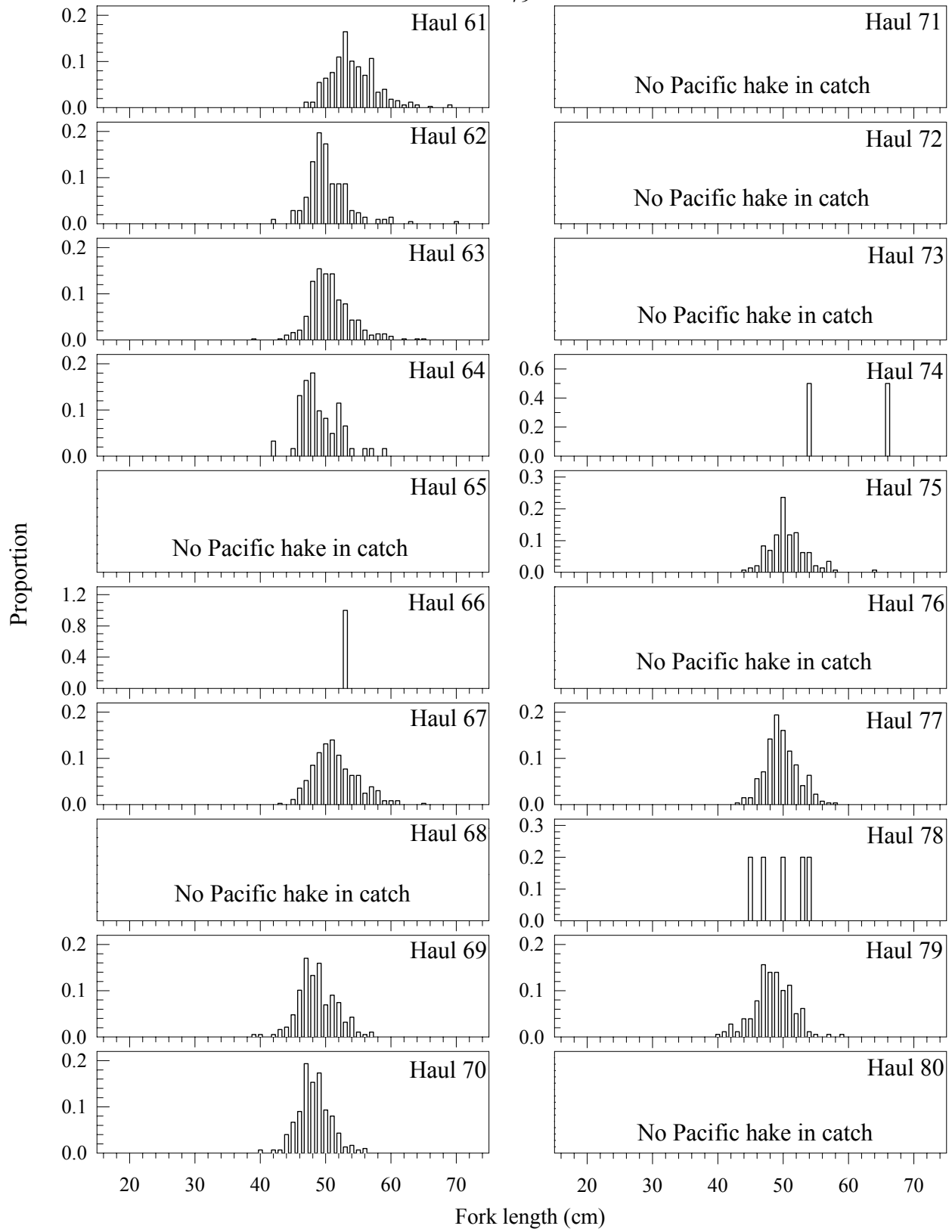
Appendix Figure 2.--Proportion at length of Pacific hake from hauls conducted by the NOAA ship *Miller Freeman* during the 2001 joint U.S.-Canada Pacific hake echo integration-trawl survey of the U.S. and Canadian west coasts.



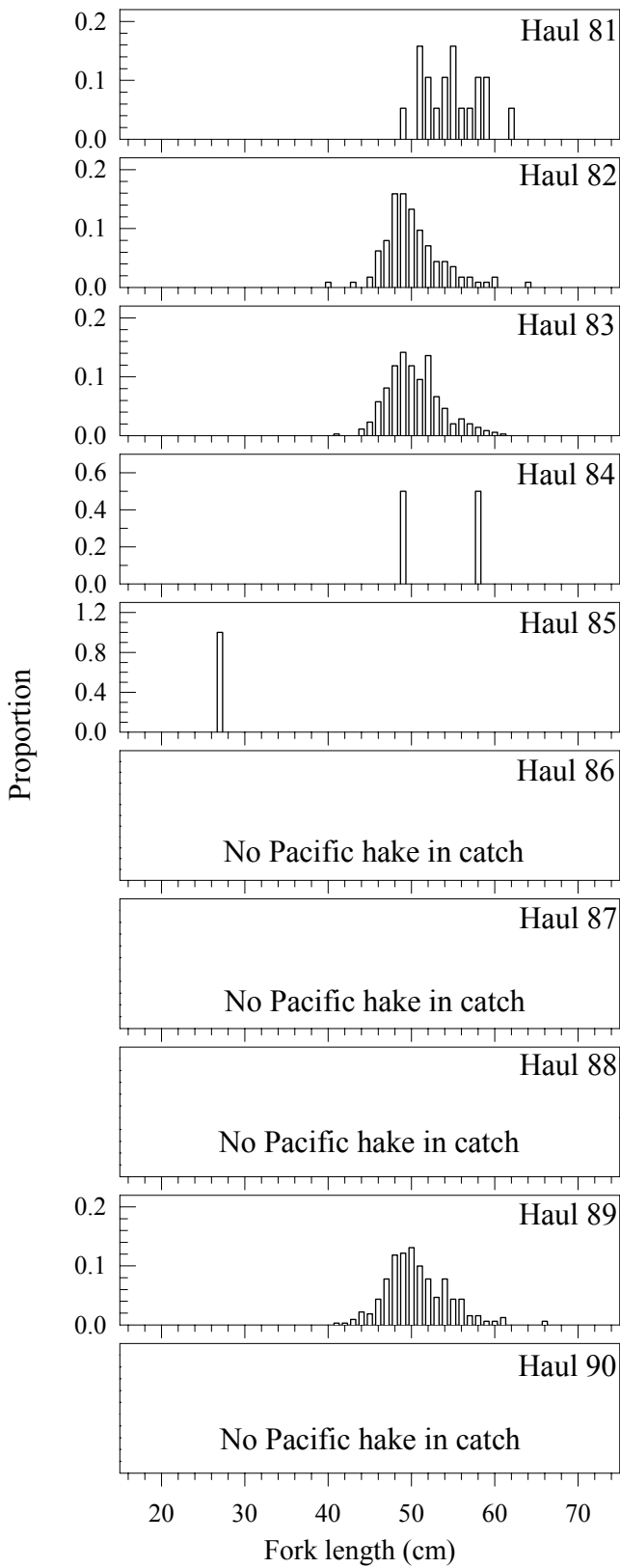
Appendix Figure 2.--Continued.



Appendix Figure 2.--Continued.



Appendix Figure 2.--Continued.



Appendix Figure 2.--Continued.