

**The 1998
Northwest Fisheries Science Center
Pacific West Coast
Upper Continental Slop Trawl Survey
of Groundfish Resources
off Washington, Oregon, and California:
Estimates of Distribution, Abundance,
and Length Composition**

September 2001

**U.S. DEPARTMENT OF COMMERCE
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EXECUTIVE SUMMARY

In 1998 the Northwest Fisheries Science Center (NWFSC), initiated a new bottom trawl survey of the commercial groundfish resources in the slope zone (100–700 fathoms [fm]; 183–1,280 meters [m]) of the continental U.S. West Coast (Washington, Oregon, and California) chartering local West Coast trawlers. The survey was conducted from Cape Flattery, Washington (48° 10' N), to Morro Bay, California (35°N), between August 20, 1998 and October 16, 1998.

An Aberdeen-style net with a small-mesh (2" stretched measure or less) liner in the codend (to retain pre-recruits) was used to sample fish biomass. The tow duration of each haul was targeted for 15 minutes. Tow duration was measured as the simple difference between the times marking touchdown and lift-off of the trawl net from the seafloor.

Survey-sampling locations were arranged along east-west transects of latitude. Transects were designated to be separated by 10 minutes of latitude. There were 80 such transects in total, covering the coast between the survey endpoints. Five stations in each transect were selected from two categories: shallow (100–300 fm), and deep (300–700 fm). The category with the greatest linear distance was assigned three randomly-selected depth ranges to sample, while the category with the lesser linear distance was assigned two randomly-selected depth ranges to sample. Out of a total of 400 possible sampling locations, attempts at sampling were made in 347 of these. Of the stations in which sampling was attempted, 302 tows were successful. Simrad ITI or Scanmar net-mensuration data, as well as GPS course and position data, were obtained from 296 of the successful tows. Bottom-contact sensor data was obtained from 291 of the successful tows.

Catches were sorted to species level or to other appropriate taxon levels and then weighed using an electronic, motion-compensated scale. Sampling efforts were concentrated on the four Dover-sablefish-thornyhead (DTS) complex species: 1) Dover sole, 2) sablefish, 3) shortspine thornyhead (SST), and 4) longspine thornyhead (LST). Dover sole and sablefish were separated by sex and a total of up to 125-length measurements per haul were collected from each species for both sexes combined. A total of 48 species or families were identified over the entire survey area.

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We would like to thank the FV *Sea Eagle*, the FV *Pacific Sun IV*, the FV *Blue Horizon*, the FV *Amy Lynn*, and the scientific crew for their hard work during the 1998 NWFSC West Coast groundfish slope survey. The scientific crew included (in alphabetical order) Jon Brodziak, Tonya Builder, Dan Erickson, Dan Kamikawa, Nick Lowry, Marion Mann, Bruce McCain, Jennifer Menkel, Bruce Pedersen, Jean Rogers, Teresa Turk, John Wallace, and Bill West. We are also grateful to many people at the Resource Assessment and Conservation Engineering (RACE) and Resource Ecology and Fisheries Management (REFM) Divisions of the Alaska Fisheries Science Center (AFSC). They include Bob Lauth, Robin Harrison, Peter Munro, Michael Martin, and Sarah Gaichas who assisted us on details of the survey operations and planning; and Scott McEntire for creating the bottom contact sensor (BCS) and assisting us in our use of this very valuable instrument. Also, thanks to the net loft crew at the AFSC for refurbishing our nets, making the splitting nets, and supplying the net accessories used for this survey. We would also like to express our appreciation Mary Breaker and Mary Craig for their logistical shore-side support.

INTRODUCTION

Scientists from the Fishery Resource Analysis and Monitoring (FRAM) Division, of the Northwest Fisheries Science Center (NWFSC), of the National Marine Fisheries Service (NMFS), initiated a new bottom trawl survey of the commercial groundfish resources in the slope zone (100–700 fm; 183–1,280 m) of the continental U.S. West Coast (Washington, Oregon, and California) in 1998. One of the objectives of the new NWFSC bottom trawl slope survey (hereafter referred to as the NWFSC slope survey) was to provide information that would complement and extend two pre-existing U.S. West Coast groundfish resource surveys that have historically been conducted by the NMFS Alaska Fisheries Science Center (AFSC), Resource Assessment and Conservation Engineering (RACE) Division. Prior to 1998, the two surveys conducted by the AFSC were the principal sources of fishery-independent data used in stock assessments of the commercial groundfish resources in the slope zone (Methot et al. 2000).

The initiation of the NWFSC slope survey was prompted by the determination in the mid-1990s that stock assessments of the slope groundfish species did not have sufficient data to provide precise results. The need for greater precision in stock assessments was a concern because, at the time, five groundfish species had declined to the point where they were in a depleted state (Methot et al. 2000). The 1998 NWFSC slope survey was the first in a yearly time-series of indices of abundance for the commercial deep-water species, and it involved changes from the previous sampling locations and designs. The NWFSC slope survey is a cooperative survey, employing fishing vessels from the West Coast commercial fishing industry. The cooperative aspect of this survey utilizes the skills of the captains who are most familiar with the unique challenges of fishing in the deep waters off the West Coast, and it fulfills the cooperative-research provisions of the Magnuson–Stevens Sustainable Fisheries Act¹. By conducting yearly surveys, the information that is gathered would provide a measure of changes in relative abundances, distributions, and the conditions of these stocks. These yearly surveys also provide information to fisheries managers, fishers and concerned citizens.

The NWFSC slope survey covers habitats in depths ranging from 100–700 fathoms (fm) (183–1,280 m), from Cape Flattery, Washington (48° 10' N latitude), to Morro Bay, California (35° N latitude). The results are summarized by 2–depth strata (100–300 fm and 301–700 fm) within this area, and are further divided into the five International North Pacific Fisheries Commission (INPFC) statistical areas, which are U.S.–Vancouver, Columbia, Eureka, Monterey, and Conception (Fig. 1).

¹Management authority over fisheries along the West Coast of the United States, including specifically, the States of California, Oregon, and Washington, principally with the Pacific Fishery Management Council (PFMC). This organization was created by Congress in 1976 as part of the Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), the legislation that originally established a 200–mile extended economic zone (EEZ) surrounding the nation's coastline.

The purpose of this report is to document the survey design and field procedures, summarize the survey data, identify and record analyses of survey data, and present the results of the 1998 NWFSC slope survey. Included are summaries of catches, distribution, abundance, and size composition of species.

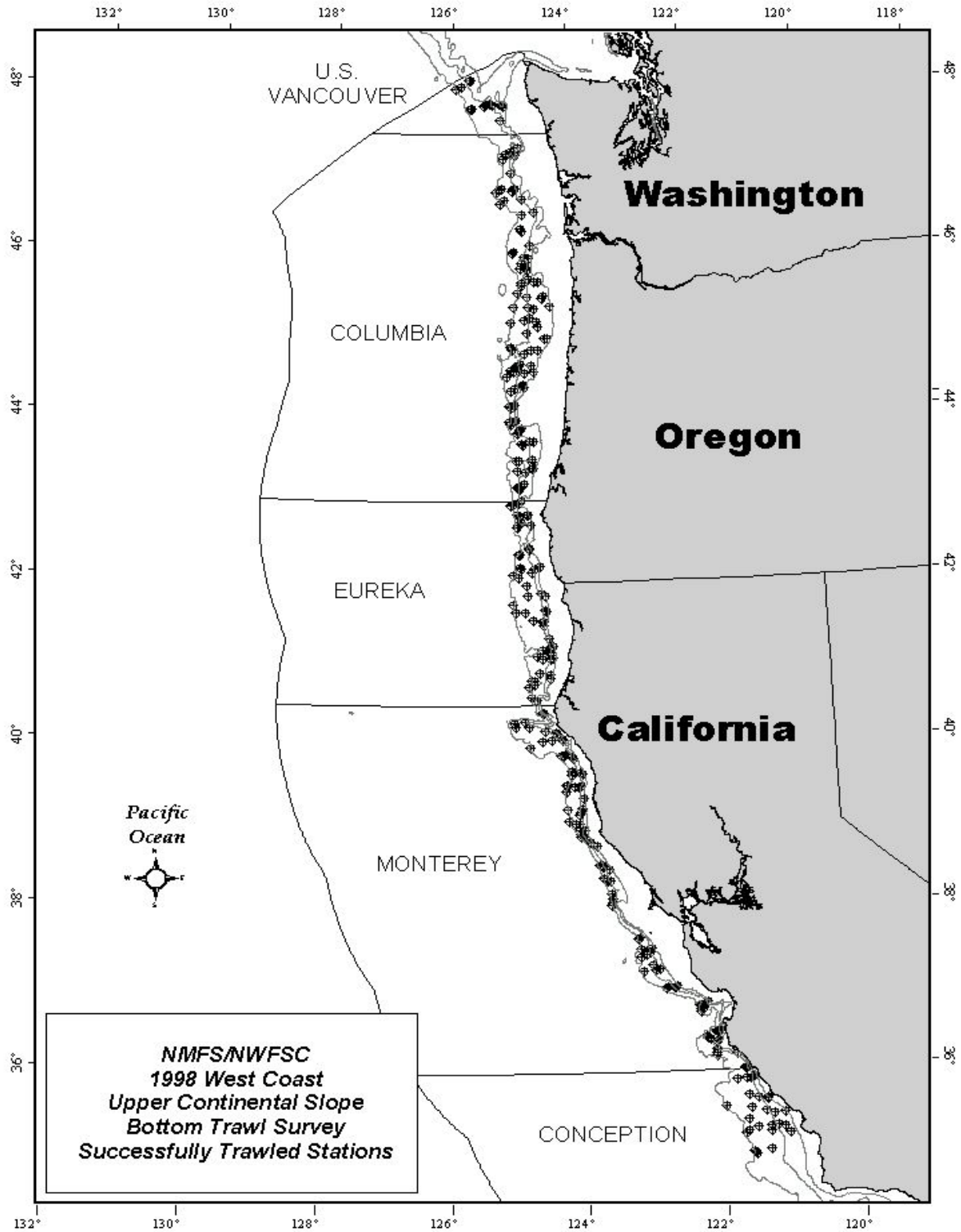


Figure 1. Map showing the extent of the NWFSC slope survey and the location of 302 successful bottom trawl samples.

SURVEY METHODS

Survey Period and Sampling Area

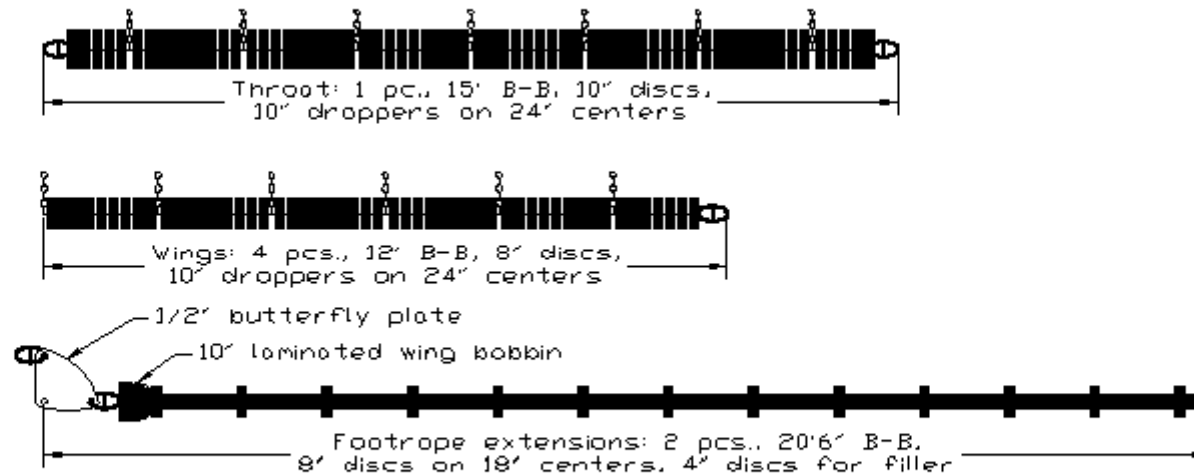
The 1998 NWFSC slope survey was conducted from Cape Flattery, Washington (48°10' N), to Morro Bay, California (35°N), between August 20, 1998 and October 16, 1998. Two trawling vessels, the FV (for fishing vessel) *Pacific Sun IV* and the FV *Sea Eagle*, were used during the first survey period, from August 20, 1998 to September 11, 1998. A second set of vessels, the FV *Amy Lynn* and the FV *Blue Horizon*, was used during the second survey period, from September 18, 1998 to October 16, 1998. These vessels started the survey off of Cape Flattery and then progressed south along the coast, finishing the survey in Morro Bay.

Vessels and Sampling Gear

An Aberdeen-style net with a small-mesh (2" stretched measure or less) liner in the codend (to retain pre-recruits) was used to sample fish biomass (Figs. 2 and 3). The Aberdeen trawl was chosen as the standard sampling gear for this survey because it has demonstrated relatively stable performance over the range of conditions that were expected to be encountered. The tow duration of each haul was targeted for 15 minutes. Acoustic and bottom contact instruments attached to the nets recorded various aspects of their mechanical performance, while other data on the operational conditions (e.g., depth, amount of towing cable deployed, towing speed, tow duration, and weather conditions) were recorded from instruments on the vessels.

Trawl Station Allocation

The 1998 NWFSC slope survey was a combination of both systematic and random sampling strategies. The survey-sampling locations were arranged along east-west transects of latitude. Fishing operations were carried out in depths ranging from 100–700 fm, on a variety of bottom types. Transects were designated to be separated by 10 minutes of latitude. There were 80 such transects in total, covering the coast between the survey endpoints. Five stations in each transect were selected from two categories: shallow (100–300 fm), and deep (300–700 fm). The category with the greatest linear distance was assigned three randomly-selected depth ranges to sample, while the category with the lesser linear distance was assigned two randomly-selected depth ranges to sample. Each of the four vessels occupied a different subset of 20 transects separated by 40 minutes of latitude, such that by the end of the survey, all 80 transects were sampled.



NOTES:

Footrope: 1/2" long-link alloy (grade7) chain
 Connectors: Campbell 1/2" hammerlocks with stainless pins & spacers
 Dropper connectors: 1/2" black shackles
 All section lengths are bearing point, including connectors

Figure 3. Footrope for NMFS 85'/104' Aberdeen Sampling Trawl 7 sections, 104' L.O.A.

Trawling Protocol

The goal of trawling operations was to maintain constant sampling (fishing) efficiency both across all of the conditions encountered during the survey and through time. The first tow of the day could not begin (net on seafloor) before sunrise, and the last tow of the day had to be completed (net off seafloor) before sunset. Once the vessel was in the area of a station, the captain was instructed to follow these search rules: 1) Stay within the boundary depth ranges, 2) stay within 5 minutes north or south of the transect latitude, 3) allow no more than 2 hours to search for trawlable ground, after which time the station was to be abandoned and noted in the log as untrawlable, and, 4) the vessel was to proceed to the next station. The only exception to the 2-hour rule would be in instances where the station was the last one scheduled for the day/transect, and there remained sufficient daylight hours to continue the search and complete a tow before sunset. Once a station was abandoned, the decision would be final, and no attempt was made to go back and complete it.

If the gear was damaged severely enough during a tow (that it might affect the composition of the catch), or if the gear performance was deemed to be unacceptable (because of large quantities of mud or jellyfish, or if lost or abandoned fishing gear was ensnared in the net), the haul was to be considered unsatisfactory. Unsuccessful hauls were not used in the analyses that follow, but they are included in Appendix A.

The chief scientist, or Field Party Chief (FPC), was responsible for monitoring the fishing operations, including vessel operations and gear performance, as reported by the trawl instrumentation systems. The target towing speed for each survey haul was 2.2 knots (kn) (speed over ground) as determined by the NMFS-supplied differential Global Positioning System (GPS) navigation unit.

The experience and judgment of each Captain was used to choose the initial scope for each depth and sampling station. Trawl performance was monitored using the Simrad Integrated Trawl Instrumentation (ITI)² and Scanmar systems³ and scope was adjusted when necessary. Sensors from the ITI trawl system were placed on the net prior to setting of the gear. Two instruments were placed in the middle of the net headrope. The first was the trawl eye, which gives an image of the vertical opening of the trawl, and its height above the bottom. The second was a temperature and depth recorder. A pair of wing units (one master and one slave) was placed on the port and starboard wings of the net to measure the wing spread. A bottom-contact sensor (BCS) was placed in the middle of the fishing line on the footrope portion of the net. The BCS recorded the angle of incline of the net, indicating when the net landed on the bottom and when it lifted off.

²Kongsberg Simrad Mesotech Ltd., 1598 Kebet Way, V3C 5M5 Port Coquitlam, BC, Canada.

³Scanmar, P.O. Box 44, N-3167 Asgardstrand, Norway.

Tow duration was targeted at 15 minutes in length. While the gear was being set, the vessel speeds varied from 5 kn to the targeted 2.2. kn when the net made contact with the bottom. The haul officially began when the net was in proper fishing configuration and was maintaining steady contact with the bottom. The haul ended when the net lifted off of the bottom after the start of haulback. The Simrad ITI trawl eye was used to monitor ground-gear contact during a haul, but the actual bottom time was determined using data from the BCS. Position data was collected at 2-second intervals for each haul using a GPS. These data, in addition to the real-time net mensuration information, were automatically stored in an onboard data-logging system, known as Flipper (Scientific Fisheries Systems, Inc.⁴). In addition to storing the GPS and ITI trawl information, Flipper also provided a means to download and save information from the BCS and the Fish Meter (FM) board that was used to collect data from the catch (described as follows in more detail).

Sampling Procedures and Biological Data Collection

Catches were sorted to species level or to other appropriate taxon levels and then weighed using an electronic, motion-compensated scale (Ryco, Inc.⁵). Sampling efforts were concentrated on the four Dover-sablefish-thornyhead (DTS) complex species: 1) Dover sole, 2) sablefish, 3) shortspine thornyhead (SST), and 4) longspine thornyhead (LST). Dover sole and sablefish were separated by sex and a total of up to 125-length measurements per haul were collected from each species for both sexes combined. Up to 125-length measurements were also collected for both LST and SST, but individual sexes were not determined. For species other than the DTS complex, only total counts and weights were recorded, except when additional information was needed for special projects.

Otoliths were collected from the DTS complex. Fifteen otoliths were collected from a random subset taken from each of the length samples of sablefish and Dover sole. Similarly, five otoliths were collected from a subset of both SST and LST length samples. When other important commercial species were encountered, such as bocaccio and shortbelly rockfish, length measurements and otoliths were collected from these as well. Any unidentified species were labeled, frozen and retained for later identification. After all of the scientific data was collected, marketable fish were placed in the hold of the vessel, iced and then delivered to a shoreside processing facility within 5 days. All other species which had no commercial value or which were prohibited from being landed were returned to the sea as soon as possible.

⁴Scientific Fisheries Systems, Inc., P.O. Box 242065, Anchorage, AK 99524.

⁵Ryco, Inc., 2100 Avenue B, Riviera Beach, FL 33404.

SURVEY ANALYSIS

Dimensions of the Tow

Tow duration was measured as the simple difference between the times marking touchdown and lift-off of the trawl net from the seafloor. Wherever possible, these times were determined from BCS traces of tow progression from net deployment to retrieval. Gaps left by unrecorded or otherwise suspect BCS information were filled using either patterns in records of headrope height from the trawl-eye sensor taken over the entire tow, or FPC observations of net touchdown and lift-off times.

Wherever possible, net width and height were estimated from trawl-sensor readings of wingspread and headrope height. For these cases, mean- and standard-error estimates were calculated for each, using a sample set limited to the center 80% of the tow duration to ensure that only on-bottom readings were included. Gaps left by absent or otherwise suspect data records were filled by prediction from separate robust linear regressions of the above width and height estimates (S-Plus 2000). Each was regressed against tow depth, with vessel identification as an indicator variable. All estimates were tagged with qualifying information indicating estimation method.

To estimate the distance fished, the time the net was on the seafloor was split into two distinct periods. The first period was from the time that the net reached the seafloor and began fishing (begin tow), until the time the vessel started the winches to haul the net back up to the surface (start of haulback). This time period is referred to as normal towing. The second period was from start of haulback to the time the net lifted off the seafloor (net off-bottom), which has been labeled as the lift-off lag. The normal towing distance is assumed to equal the geographical great circle distance from the vessel location at the begin tow point to the vessel location at the start of haulback. This estimate is conservative because any lateral curvature of the trackline during this time period is unaccounted. The distance that the vessel travels cannot be used for the lift-off lag distance because during this period the vessel is often stationary, or in some cases moving backwards. Therefore, a trigonometric (trig) method has been developed to find the distance covered by the net during the lift-off lag period. The hypotenuse of one of the right triangles, used in this method, involves a prediction of the amount of wire (towing warps) out at the time when the net off-bottom point occurs. This prediction was calculated for each vessel, using a tight fitting linear regression at a given duration between the net off-bottom point and when the doors reach the surface of the water (West and Wallace 2001).

Tows for which the trig method could not be applied, due to missing or incorrect information, were estimated using linear regression. The predictor variables for this regression are vessel identification, duration of the trawl on the seafloor, and average (or estimated) depth of the net during towing. All estimates were tagged with qualifying information indicating the estimation method and prediction error was determined for all predicted values.

Depth (Gear and Bottom)

Wherever possible, gear depth and bottom depth were estimated from records of trawl-sensor readings of headrope depth and headrope distance from bottom. Gear depth was taken as the headrope-depth sensor reading and bottom depth was taken as the sum of headrope depth and headrope distance from bottom. For cases where data of sufficient quality were available, mean- and standard-error estimates were calculated for each, using a sample set limited to the center 80% of the tow duration to ensure that only on-bottom readings were included. In cases where the previously mentioned data format was not met by gear-depth records, estimation was made from observations of gear depth outside the center 80% of the tow duration, if any were available that could reasonably be assumed within observed limits of net touchdown and lift-off. For some tows, no coincident records of headrope depth and headrope distance from bottom existed. In these cases, if gear depth and net height were estimable for a tow, bottom depth was estimated as the sum of these two endpoints. In cases where no reasonable observation of gear depth was recorded, but depth from the vessel navigational equipment was, bottom depth was estimated from these vessel records. All estimates were tagged with qualifying information indicating estimation method.

Area Estimates

Area estimates were calculated using digital-bathymetry points acquired from Naval Oceanographic Office DBDB-V Version 2.0 (Digital Bathymetric Data Base – Variable resolution⁶). The input data had variable resolutions of 5.0 minute, 1.0 minute, and 0.5 minute. The data points were gridded at 1 minute pixel resolution and contour lines for the survey depth zones were created from this grid. The contour lines were created at 100, 140, 180, 220, 260, 300, 380, 460, 540, 620, and 700 fms. Then contour lines were combined with INPFC area boundaries and with the maximum latitudinal extent of the survey (Point Conception in the South, and 48.25 decimal degrees or the extended economic zone (EEZ) in the North) to make polygons of each depth zone. Bathymetry data was projected to Albers Equal Area projection, and the total area of the seafloor in 2–depth zones (100–300 fm and 300–700 fm) and the five INPFC areas were calculated. Note, any areas that were westward of the primary 700 fm contour or eastward of the primary 100 fm contour were not included in the area calculations, even if they were at between a 100 fm and 700 fm depth.

⁶The Naval Oceanographic Office, 1002 Balch Blvd. Stennis Space Center, MS 39522-5001 US.

RESULTS

Haul, Catch, and Biological Data

The 1998 NWFSC slope survey consisted of a total of 400 possible sampling locations, and attempts at sampling were made in 347 of these. Of the stations in which sampling was attempted, 302 tows were successful (Fig. 1). Simrad ITI or Scanmar net-mensuration data, as well as GPS course and position data, were obtained from 296 of the successful tows. Bottom-contact sensor data was obtained from 291 of the successful tows. Table 1 shows the latitude boundaries, depth-stratum areas (km), and sampling densities by INPFC statistical area based on successful tows.

The mean-net widths and distances fished were calculated for each haul. When net-mensuration instrumentation gave estimates of net width, the mean-net width for each tow was calculated using a sample set limited to the center 80% of the tow duration. Distances fished were calculated by estimating the linear length that the net traveled on the seafloor from the point where it touched down to the point where it lifted off. An overall mean width of 14.46 m was calculated using data from the 296 hauls that both exhibited good trawl performance and had available net-mensuration estimates. The mean-net widths for the 296 tows ranged from 9.02 m to 17.79 m and had a standard deviation of 0.91 m. When the net-mensuration instrumentation was not performing correctly, the mean-net width was calculated using linear regressions in which trawl depth was factored for the individual chartered vessel (Fig. 4).

The relationship between wire length (i.e., scope) and gear depth for each haul is shown in Figure 5. The number of lengths and age structures that were collected from the nine main groundfish species are summarized in Table 2.

A total of 48 species or families were identified over the entire survey area. The frequency of occurrence, depth range, mean depth, and the latitudinal range for all of the identified organisms are listed in Table 3⁷. Appendix A provides detailed station information for each haul, as well as the associated catch weights of the major fish species and the total weights of invertebrates. Tables 4–9 list the number of individual fish lengths collected by species and by depth strata for the individual INPFC areas.

⁷Species unidentified are referred to as “unident.” in tables and figures following text.

Table 1. Latitude boundaries, depth stratum areas (km²), and sampling densities by INPFC statistical area based on successful tows during the NWFSC slope survey.

INPFC Area/ Latitude bounds	<u>Stratum 1 (183–549 m)</u>			<u>Stratum 2 (550–1,280 m)</u>			<u>All Strata (183–1,280 m)</u>		
	Area (km ²)	No. hauls	Hauls/ 1,000 km ²	Area (km ²)	No. hauls	Hauls/ 1,000 km ²	Area (km ²)	No. hauls	Hauls/ 1,000 km ²
U.S.–Vancouver 47°30' – Border	2,123	4	1.9	2,245	6	2.7	4,368	10	2.3
Columbia 43°00' – 47°30'	8,345	54	6.5	9,724	42	4.3	18,069	96	5.3
Eureka 40°30' – 43°00'	2,043	23	11.5	6,344	25	3.9	8,387	48	5.7
Monterey 36°00' – 40°30'	3,665	30	8.1	8,608	43	5	12,273	73	6.1
Conception 34°30' – 36°00'	2,889	8	2.8	7,659	14	1.8	10,548	22	2.1
Entire Survey Area 34°30' – Border	19,065	119	6.2	34,580	130	3.8	53,645	249	4.6

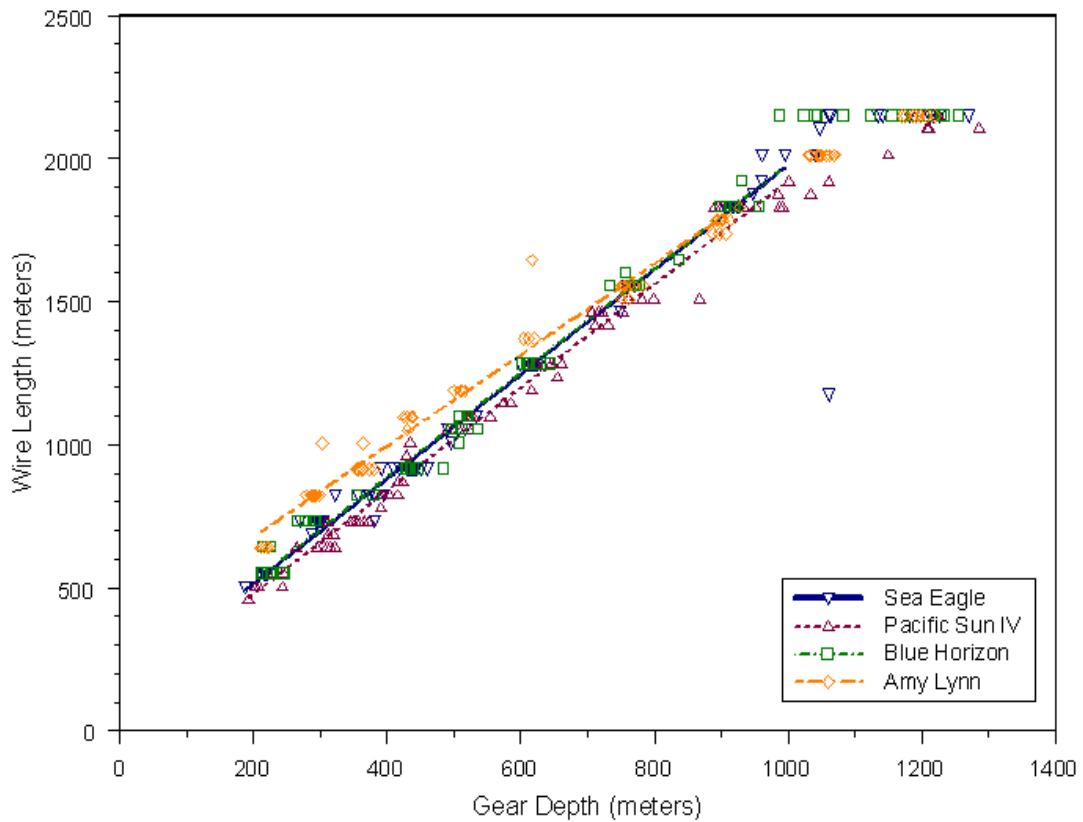


Figure 4. Estimates of mean-net width for trawls conducted as part of the NW FSC slope survey. Estimates are grouped by charter vessel and plotted relative to trawl depth. Prediction from robust linear regression of width against trawl depth, and factored by vessel identification was used to estimate net widths for tows lacking direct width observations. (Net Width = $13.9398 + 0.0011 * \text{Depth} + \text{VesselCoef}$, where VesselCoef is zero for the FV *Amy Lynn*, -0.6374 for the FV *Blue Horizon*, 0.1850 for the FV *Pacific Sun IV*, and 0.1743 for the FV *Sea Eagle*.)

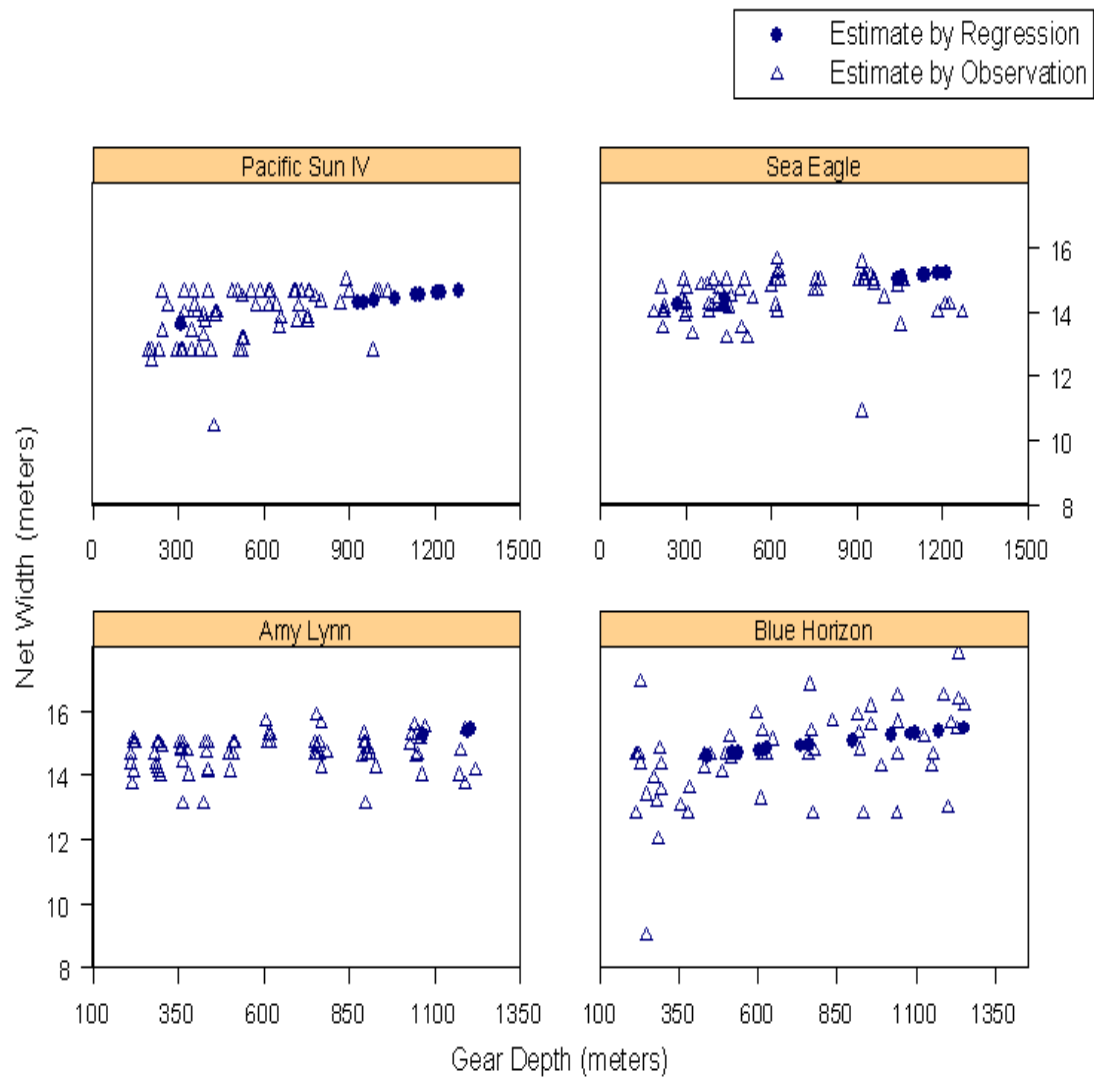


Figure 5. Wire length (scope) employed for each tow conducted as part of the NW FSC slope survey. Linear fits relative to net depth are limited to depths $\leq 1,000$ m.

Table 2. Biological data collected during the NWFSC slope survey.

Common Name	Lengths	Age Structures
Longspine thornyhead	28,858	472
Shortspine thornyhead	8,946	602
Bocaccio rockfish	95	87
Shortbelly rockfish	10	10
Lingcod	18	9
Dover sole	18,855	1,299
Pacific halibut	11	0
Petrale sole	104	49
Sablefish	1,991	686

Table 3. Frequency of occurrence, depth, and latitudinal ranges for fish species caught during the NWFSC slope survey.

Species Code	Scientific Name	Common Name	Frequency of Occurrence	Depth (m)			Latitudinal Range (ddmm)	
				Min.	Max.	Mean	South	North
3	Osteichthyes (class)	Fish unident.	58	204	1,225	576	37.24	48.15
150	Elasmobranch (subclass)	Shark unident.	185	204	1,233	702	34.94	48.15
310	<i>Squalus acanthias</i>	Spiny dogfish	49	188	605	316	35.46	48.15
400	Rajidae unident.	Skate unident.	241	188	1,270	594	34.94	48.15
710	<i>Hydrolagus colliei</i>	Spotted ratfish	89	188	1,235	369	35.19	47.85
10001	Pleuronectiformes	Flatfish unident.	80	188	512	318	35.19	48.15
10110	<i>Atheresthes stomias</i>	Arrowtooth flounder	70	188	1,172	397	37.24	48.15
10120	<i>Hippoglossus stenolepis</i>	Pacific halibut	10	220	439	358	42.40	48.15
10150	<i>Lyopsetta exilis</i>	Slender sole	1	322	322	322	41.82	41.82
10160	<i>Eopsetta jordani</i>	Petrale sole	20	188	439	264	35.62	47.85
10170	<i>Parophrys vetulus</i>	English sole	1	512	512	512	40.55	40.55
10180	<i>Microstomus pacificus</i>	Dover sole	273	188	1,255	598	34.94	48.15
10190	<i>Embassichthys bathybius</i>	Deepsea sole	136	416	1,270	919	34.94	48.07
10200	<i>Glyptocephalus zachirus</i>	Rex sole	155	188	1,233	396	35.00	48.15
20100	Alepocephalidae	Slickhead unident.	128	522	1,270	909	34.94	48.04
20510	<i>Anoplopoma fimbria</i>	Sablefish	253	188	1,270	685	34.94	48.15
20801	<i>Porichthys notatus</i>	Plainfin midshipman	2	211	212	212	35.62	36.35
21110	<i>Clupea pallasii</i>	Pacific herring	1	213	213	213	44.66	44.66
21200	Macrouridae	Grenadier unident.	150	284	1,270	907	34.94	48.07
21300	Cottidae	Sculpin unident.	24	188	1,255	448	35.91	48.15
21731	<i>Antimora microlepis</i>	Pacific flatnose	142	295	1,270	898	34.94	48.07
21910	<i>Ophiodon elongatus</i>	Lingcod	13	193	356	246	35.46	45.67
22500	<i>Merluccius productus</i>	Pacific hake	159	188	1,182	419	35.00	48.15
23000	Osmeridae	Smelt unident.	2	212	215	214	35.62	37.04
24100	Zoarcidae	Eelpout unident.	1	193	193	193	36.47	36.47
29999	Osteichthyes (class)	Roundfish unident.	233	188	1,286	653	34.94	48.15
30020	<i>Sebastolobus alascanus</i>	Shortspine thornyhead	269	188	1,270	657	34.94	48.15
30030	<i>Sebastolobus altivelis</i>	Longspine thornyhead	190	284	1,270	822	34.94	48.07
30040	<i>Sebastes</i> spp.	Rockfish unident.	145	188	1,049	375	35.00	48.15
30290	<i>Sebastes jordani</i>	Shortbelly rockfish	3	193	295	234	36.47	37.04
30400	<i>Sebastes paucispinis</i>	Bocaccio	2	245	295	270	36.47	40.56
30475	<i>Sebastes babcocki</i>	Redbanded rockfish	1	245	245	245	40.56	40.56
40500	Scyphozoa (class)	Jellyfish unident.	1	410	410	410	41.51	41.51
66000	Malacostraca (class)	Shrimp unident.	41	212	1,286	722	34.94	47.85
66020	<i>Pandalus</i> spp.		1	208	208	208	35.91	35.91
66040	<i>Pandalus platyceros</i>	Spot shrimp	10	188	291	239	35.91	48.15
68000	Malacostraca (class)	Crab unident.	35	213	1,270	892	34.98	48.07
68020	<i>Cancer magister</i>	Dungeness crab	16	204	512	292	37.50	46.12
68050	<i>Cancer productus</i>	Red rock crab	4	193	212	206	35.62	36.47
68550	<i>Chionoecetes tanneri</i>	Grooved Tanner crab	169	212	1,286	839	34.94	48.07
69270	<i>Lopholithodes foraminatus</i>	Box crab	11	220	380	289	37.25	48.15
69300	<i>Lithodes couesi</i>	Scarlet king crab	1	891	891	891	46.50	46.50
69321	<i>Paralithodes</i> spp.		1	1,209	1,209	1,209	45.17	45.17
69520	<i>Hyas</i> spp.		5	555	1,042	848	34.94	36.37
69556	<i>Munida quadrispina</i>	Pinchbug	2	286	605	445	35.63	36.34
78010	Octopodidae	Octopus unident.	60	280	1,255	666	34.98	48.15
78030	<i>Opisthoteuthis californiana</i>	Flapjack devilfish	5	389	1,049	771	35.19	37.00
79000	Cephalopoda (class)	Squid unident.	101	212	1,235	641	34.98	47.65
99999		Unsorted shab	295	188	1,286	644	34.94	48.15

Table 4. Number of length-frequency measurements collected by stratum during the NWFSC slope survey for all of the INPFC areas combined.

Species	Stratum 1 (183–549 m)	Stratum 2 (550–1,280 m)	Total
Longspine thornyhead	1,581	27,277	28,858
Shortspine thornyhead	7,033	1,913	8,946
Bocaccio rockfish	95	0	95
Shortbelly rockfish	10	0	10
Lingcod	18	0	18
Dover sole	13,209	5,646	18,855
Pacific halibut	11	0	11
Petrale sole	104	0	104
Sablefish	675	1,316	1,991

Table 5. Number of length-frequency measurements collected by stratum during the NWFSC slope survey for the INPFC Conception area.

Species	Stratum 1 (183–549 m)	Stratum 2 (550–1,280 m)	Total
Longspine thornyhead	219	2,212	2,431
Shortspine thornyhead	36	378	414
Bocaccio rockfish	0	0	0
Shortbelly rockfish	0	0	0
Lingcod	0	0	0
Dover sole	289	886	1,175
Pacific halibut	0	0	0
Petrale sole	5	0	5
Sablefish	26	249	275

Table 6. Number of length-frequency measurements collected by stratum during the NWFSC slope survey for the INPFC Monterey area.

Species	Stratum 1 (183–549 m)	Stratum 2 (550–1,280 m)	Total
Longspine thornyhead	129	9,997	10,126
Shortspine thornyhead	558	690	1,248
Bocaccio rockfish	7	0	7
Shortbelly rockfish	10	0	10
Lingcod	3	0	3
Dover sole	3,850	3,028	6,878
Pacific halibut	0	0	0
Petrale sole	99	0	99
Sablefish	133	447	580

Table 7. Number of length-frequency measurements collected by stratum during NWFSC slope survey for the INPFC Eureka area.

Species	Stratum 1 (183–549 m)	Stratum 2 (550–1,280 m)	Total
Longspine thornyhead	181	4,670	4,851
Shortspine thornyhead	912	253	1,165
Bocaccio rockfish	88	0	88
Shortbelly rockfish	0	0	0
Lingcod	9	0	9
Dover sole	2,818	746	3,564
Pacific halibut	1	0	1
Petrale sole	0	0	0
Sablefish	184	170	354

Table 8. Number of length-frequency measurements collected by stratum during the NWFSC slope survey for the INPFC Columbia area.

Species	Stratum 1 (183–549 m)	Stratum 2 (550–1,280 m)	Total
Longspine thornyhead	1,032	8,732	9,764
Shortspine thornyhead	4,543	419	4,962
Bocaccio rockfish	0	0	0
Shortbelly rockfish	0	0	0
Lingcod	6	0	6
Dover sole	5,453	944	6,397
Pacific halibut	8	0	8
Petrale sole	0	0	0
Sablefish	316	408	724

Table 9. Number of length-frequency measurements collected by stratum during the NWFSC slope survey for the INPFC U.S.-Vancouver area.

Species	Stratum 1 (183–549 m)	Stratum 2 (550–1,280 m)	Total
Longspine thornyhead	20	42	62
Shortspine thornyhead	984	173	1,157
Bocaccio rockfish	0	0	0
Shortbelly rockfish	0	0	0
Lingcod	0	0	0
Dover sole	799	42	841
Pacific halibut	2	0	2
Petrale sole	0	0	0
Sablefish	16	42	58

Temperature Data

Sea surface temperatures ranged from 10.9°C to 18.1°C during the August–September 1998 portion of the survey, and from 11.1°C to 16.1°C during the September–October 1998 portion of the survey (Fig. 6). The mean sea-surface temperature was 14.7°C. Estimates of the mean-bottom temperatures were not available for the 1998 NWFSC West Coast slope survey.

Relative Density and Distribution of Species

Information on the relative density and distribution of the 20 most abundant groundfish and select crab species are broken down in several ways: 1) for all depth strata and INPFC areas combined (Table 10), 2) by depth strata for all INPFC areas combined (Table 11), and 3) by depth stratum within each individual INPFC area (Tables 12–16). Dover sole (*Microstomus pacificus*) had the highest catch rates in the U.S.–Vancouver, Columbia, Eureka, and Monterey INPFC areas for all depth strata combined, and also when all INPFC areas and depth strata were combined (e.g., survey-wide). Rockfish unidentified (*Sebastes* spp.) had the highest catch rates in the Conception INPFC area for all depth strata combined (Table 10). When all of the INPFC areas combined were parsed by depth stratum, Dover sole had the highest catch rates in the shallowest stratum, and longspine thornyhead (*Sebastolobus altivelis*) had the highest catch rates in the deepest stratum (Table 11).

Catch rates varied with depth stratum for the individual INPFC areas (Tables 12–16). Generally, rockfish unidentified were the predominant species in the shallow stratum in the U.S.–Vancouver, Monterey, and Conception INPFC areas, while Dover sole were the predominant species in the shallow stratum for the Columbia and Eureka INPFC areas. For the deepest stratum, longspine thornyhead were the dominant species in the U.S.–Vancouver, Columbia, and Eureka INPFC areas, while Dover sole were the dominant species in the Monterey and Conception INPFC areas.

Figures 7–15 are maps showing the geographical distributions and relative abundance of both select groundfish species and the grooved Tanner crab (*Chionoecetes tanneri*). These maps show the location points of the hauls where the species were caught. Catch rates were categorized as: 1) no catch, 2) greater than zero and less than, or equal to, the mean catch-per-unit effort (CPUE), 3) greater than the mean CPUE and less than, or equal to, one standard deviation from the mean, 4) between one and two standard deviations greater than the mean CPUE, and 5) over two standard deviations greater than the mean CPUE.

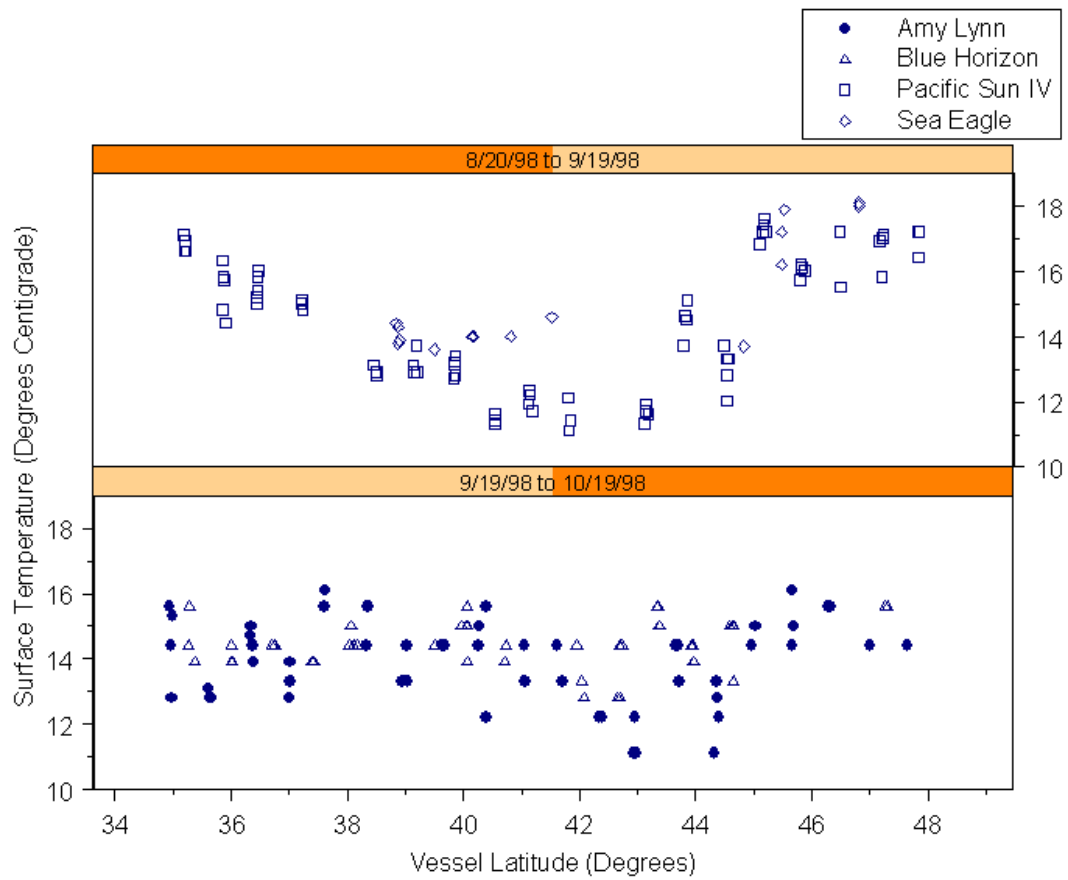


Figure 6. Sea Surface Temperature observed for each tow conducted as part of the NWFSC slope survey. Observations are grouped by the time of year (August/September, September/October) they were taken and plotted relative to latitude.

Table 10. Mean CPUE (kg/ha) of the 20 most abundant groundfish and selected crab species caught in each of the INPFC areas for all strata (183–1,280 m) combined during the NWFSC slope survey.

All Areas		U.S.-Vancouver Area		Columbia Area	
Dover sole	23.58	Rockfish unident.	31.64	Dover sole	20.50
Longspine thornyhead	13.66	Dover sole	23.76	Longspine thornyhead	9.48
Rockfish unident.	11.55	Longspine thornyhead	11.35	Grenadier unident.	8.44
Grenadier unident.	10.80	Arrowtooth flounder	10.14	Pacific Whiting	7.85
Sablefish	6.58	Shortspine thornyhead	9.22	Sablefish	7.43
Pacific Whiting	5.56	Spiny dogfish	7.09	Rockfish unident.	5.78
Shortspine thornyhead	5.39	Sablefish	4.31	Skate unident.	5.16
Skate unident.	4.40	Grooved tanner crab	3.95	Grooved tanner crab	4.92
Grooved tanner crab	3.95	Skate unident.	3.21	Shortspine thornyhead	4.63
Rex sole	2.76	Grenadier unident.	2.75	Spiny dogfish	3.60
Spiny dogfish	2.49	Rex sole	2.37	Rex sole	3.40
Shark unident.	1.57	Roundfish unident.	2.17	Arrowtooth flounder	1.24
Roundfish unident.	1.42	Pacific halibut	1.39	Roundfish unident.	1.17
Slickhead unident.	1.40	Flatfish unident.	1.25	Deepsea sole	0.81
Deepsea sole	1.38	Deepsea sole	1.19	Shark unident.	0.78
Arrowtooth flounder	1.31	Pacific whiting	0.82	Flatfish unident.	0.65
Spotted ratfish	0.70	Fish unident.	0.67	Pacific halibut	0.53
Flatfish unident.	0.62	Octopus unident.	0.24	Spotted ratfish	0.51
Squid unident.	0.58	Spotted ratfish	0.21	Fish unident.	0.48
Pacific flatnose	0.55	Pacific flatnose	0.19	Pacific flatnose	0.47
Number of hauls	249	Number of hauls	10	Number of hauls	96

Table 10. (Cont.). Mean CPUE (kg/ha) of the 20 most abundant groundfish and selected crab species caught in each of the INPFC areas for all strata (183–1,280 m) combined during the NWFSC slope survey.

Eureka Area		Monterey Area		Conception Area	
Dover sole	21.71	Dover sole	34.37	Dover sole	17.72
Longspine thornyhead	18.84	Grenadier unident.	19.04	Rockfish unident.	16.02
Grenadier unident.	15.02	Longspine thornyhead	16.64	Longspine thornyhead	14.22
Pacific whiting	7.14	Rockfish unident.	14.91	Sablefish	7.58
Grooved tanner crab	5.84	Pacific whiting	6.12	Shortspine thornyhead	5.74
Sablefish	5.81	Sablefish	5.81	Grenadier unident.	5.25
Shortspine thornyhead	4.68	Shortspine thornyhead	5.32	Shark unident.	4.16
Rex sole	4.00	Skate unident.	5.09	Skate unident.	3.49
Skate unident.	3.50	Grooved tanner crab	4.36	Slickhead unident.	2.96
Bocaccio	3.36	Rex sole	3.08	Pacific whiting	1.72
Rockfish unident.	2.98	Slickhead unident.	2.35	Spotted ratfish	1.37
Deepsea sole	2.20	Deepsea sole	2.23	Roundfish unident.	1.20
Roundfish unident.	1.28	Spiny dogfish	1.96	Deepsea sole	0.77
Pacific flatnose	0.96	Squid unident.	1.84	Flatfish unident.	0.64
Slickhead unident.	0.96	Roundfish unident.	1.80	Spiny dogfish	0.61
Spiny dogfish	0.80	Shark unident.	1.67	Rex sole	0.46
Squid unident.	0.68	Spotted ratfish	0.93	Grooved tanner crab	0.31
Shark unident.	0.62	Pacific flatnose	0.79	Petrals sole	0.25
Fish unident.	0.49	Flatfish unident.	0.62	Pacific flatnose	0.20
Arrowtooth flounder	0.40	Fish unident.	0.46	Spot shrimp	0.18
Number of hauls	48	Number of hauls	73	Number of hauls	22

Table 11. Mean CPUE (kg/ha) of the 20 most abundant groundfish and selected crab species caught in all of the INPFC areas combined during the NW FSC slope survey.

Stratum 1 (183–549 m)		Stratum 2 (550–1,280 m)	
Dover sole	33.79	Longspine thornyhead	20.85
Rockfish unident.	32.41	Dover sole	17.95
Pacific whiting	15.39	Grenadier unident.	16.73
Skate unident.	9.55	Sablefish	8.05
Rex sole	7.24	Grooved tanner crab	6.11
Spiny dogfish	6.98	Shortspine thornyhead	5.58
Shortspine thornyhead	5.03	Slickhead unident.	2.16
Sablefish	3.93	Deepsea sole	2.12
Arrowtooth flounder	3.58	Shark unident.	1.56
Spotted ratfish	1.95	Skate unident.	1.56
Flatfish unident.	1.74	Roundfish unident.	1.45
Shark unident	1.60	Pacific flatnose	0.84
Bocaccio	1.50	Squid unident.	0.30
Roundfish unident.	1.45	Rex sole	0.29
Squid unident.	1.08	Fish unident.	0.29
Pacific halibut	0.87	Pacific whiting	0.15
Longspine thornyhead	0.63	Octopus unident.	0.13
Fish unident.	0.60	Crab unident.	0.12
Petrale sole	0.46	Arrowtooth flounder	0.05
Lingcod	0.28	Sculpin unident.	0.05
Number of hauls	119	Number of hauls	130

Table 12. Mean CPUE (kg/ha) of the 20 most abundant groundfish and selected crab species caught in the INPFC Conception area during the NWFSC slope survey.

Stratum 1 (183–549 m)		Stratum 2 (550–1,280 m)	
Rockfish unident.	58.39	Dover sole	22.06
Skate unident.	7.18	Longspine thornyhead	19.15
Shark unident.	6.27	Sablefish	9.71
Dover sole	6.22	Shortspine thornyhead	7.57
Pacific whiting	5.98	Grenadier unident.	7.23
Spotted ratfish	4.97	Slickhead unident.	4.08
Flatfish unident.	2.35	Shark unident.	3.37
Spiny dogfish	2.13	Skate unident.	1.66
Roundfish unident.	1.96	Deepsea sole	1.06
Sablefish	1.93	Roundfish unident.	0.91
Rex sole	1.64	Grooved tanner crab	0.43
Longspine thornyhead	1.16	Pacific flatnose	0.28
Petrale sole	0.90	Pacific whiting	0.11
Shortspine thornyhead	0.87	Squid unident.	0.06
Spot shrimp	0.65	Rockfish unident.	0.05
Sculpin unident.	0.34	Spiny dogfish	0.04
Red rock crab	0.24	Crab unident.	0.04
Pandalus spp.	0.18	Shrimp unident.	0.03
Lingcod	0.15	Octopus unident.	0.02
Crab unident.	0.14	Spotted ratfish	0.02
Number of hauls	8	Number of hauls	14

Table 13. Mean CPUE (kg/ha) of the 20 most abundant groundfish and selected crab species caught in the INPFC Monterey area during the NWFSC slope survey.

Stratum 1 (183–549 m)		Stratum 2 (550–1,280 m)	
Rockfish unident.	49.70	Dover sole	32.62
Dover sole	38.49	Grenadier unident.	27.12
Pacific whiting	20.07	Longspine thornyhead	23.58
Skate unident.	13.39	Sablefish	7.23
Rex sole	9.79	Shortspine thornyhead	6.92
Spiny dogfish	6.58	Grooved tanner crab	6.19
Squid unident.	4.60	Slickhead unident.	3.34
Spotted ratfish	3.07	Deepsea sole	3.18
Sablefish	2.49	Shark unident.	2.09
Flatfish unident.	2.07	Roundfish unident.	1.88
Roundfish unident.	1.61	Skate unident.	1.55
Shortspine thornyhead	1.56	Pacific flatnose	1.12
Petrale sole	1.45	Squid unident.	0.67
Fish unident.	0.72	Fish unident.	0.35
Shark unident.	0.69	Rex sole	0.23
Longspine thornyhead	0.33	Pacific whiting	0.18
Shortbelly rockfish	0.17	Octopus unident.	0.12
Lingcod	0.16	Crab unident.	0.12
Bocaccio	0.12	Rockfish unident.	0.09
Dungeness crab	0.11	Flapjack devilfish	0.05
Number of hauls	30	Number of hauls	43

Table 14. Mean CPUE (kg/ha) of the 20 most abundant groundfish and selected crab species caught in the INPFC Eureka area during the NWFSC slope survey.

Stratum 1 (183–549 m)		Stratum 2 (550–1,280 m)	
Dover sole	54.40	Longspine thornyhead	24.77
Pacific whiting	28.96	Grenadier unident.	19.83
Bocaccio	13.80	Dover sole	11.19
Rex sole	13.02	Grooved tanner crab	7.65
Rockfish unident.	12.11	Sablefish	6.36
Skate unident.	9.98	Shortspine thornyhead	5.19
Sablefish	4.09	Deepsea sole	2.91
Spiny dogfish	3.30	Skate unident.	1.41
Shortspine thornyhead	3.11	Slickhead unident.	1.27
Arrowtooth flounder	1.53	Pacific flatnose.	1.26
Roundfish unident.	1.42	Roundfish unident.	1.23
Squid unident.	1.41	Rex sole	1.10
Fish unident.	1.25	Shark unident.	0.65
Flatfish unident.	0.81	Squid unident.	0.44
Lingcod	0.75	Fish unident.	0.24
Dungeness crab	0.74	Crab unident.	0.24
Spotted ratfish	0.72	Octopus unident.	0.20
Redbanded rockfish	0.65	Sculpin unident.	0.16
Shark unident.	0.52	Pacific whiting	0.11
Pacific halibut	0.52	Rockfish unident.	0.04
Number of hauls	23	Number of hauls	25

Table 15. Mean CPUE (kg/ha) of the 20 most abundant groundfish and selected crab species caught in the INPFC Columbia area during the NWFSC slope survey.

Stratum 1 (183–549 m)		Stratum 2 (550–1,280 m)	
Dover sole	33.10	Longspine thornyhead	16.94
Pacific whiting	16.86	Grenadier unident.	15.62
Rockfish unident.	12.48	Dover sole	9.68
Skate unident.	9.03	Grooved tanner crab	9.14
Spiny dogfish	7.80	Sablefish	9.12
Rex sole	7.25	Shortspine thornyhead	3.13
Shortspine thornyhead	6.37	Skate unident.	1.84
Sablefish	5.46	Deepsea sole	1.45
Arrowtooth flounder	2.49	Roundfish un ident.	1.09
Flatfish unident.	1.41	Pacific flatnose.	0.87
Roundfish un ident.	1.26	Slickhead unident.	0.66
Pacific halibut	1.14	Shark unident.	0.58
Spotted ratfish	1.10	Fish un ident.	0.46
Shark unident.	1.02	Octopus unident.	0.17
Longspine thornyhead	0.78	Arrowtooth flounder	0.16
Fish un ident.	0.51	Pacific whiting	0.12
Lingcod	0.34	Squid unident.	0.11
Box crab	0.24	Rex sole	0.10
Red rock crab	0.19	Crab unident.	0.10
Octopus unident.	0.12	Sculpin unident.	0.07
Number of hauls	54	Number of hauls	42

Table 16. Mean CPUE (kg/ha) of the 20 (17 species total were caught in Stratum 2) most abundant groundfish and selected crab species caught in the INPFC U.S.-Vancouver area during the NWFSC slope survey.

Stratum 1 (183-549 m)		Stratum 2 (550-1,280 m)	
Rockfish unident.	65.10	Longspine thornyhead	22.09
Dover sole	46.10	Grooved tanner crab	7.68
Arrowtooth flounder	20.86	Sablefish	5.60
Spiny dogfish	14.59	Shortspine thornyhead	5.38
Shortspine thornyhead	13.28	Grenadier unident.	5.36
Skate unident.	6.19	Roundfish unident.	3.00
Rex sole	4.88	Dover sole	2.62
Sablefish	2.95	Deepsea sole	2.32
Pacific halibut	2.85	Skate unident.	0.40
Flatfish unident.	2.57	Fish unident.	0.38
Pacific whiting	1.31	Pacific flatnose	0.36
Roundfish unident.	1.30	Pacific whiting	0.35
Fish unident.	0.97	Crab unident.	0.21
Spotted ratfish	0.43	Shark unident.	0.17
Octopus unident.	0.41	Slickhead unident.	0.17
Spot shrimp	0.33	Octopus unident.	0.09
Petrale sole	0.31	Squid unident.	0.08
Box crab	0.22		
Shark unident.	0.13		
Sculpin unident.	0.05		
Number of hauls	4	Number of hauls	6

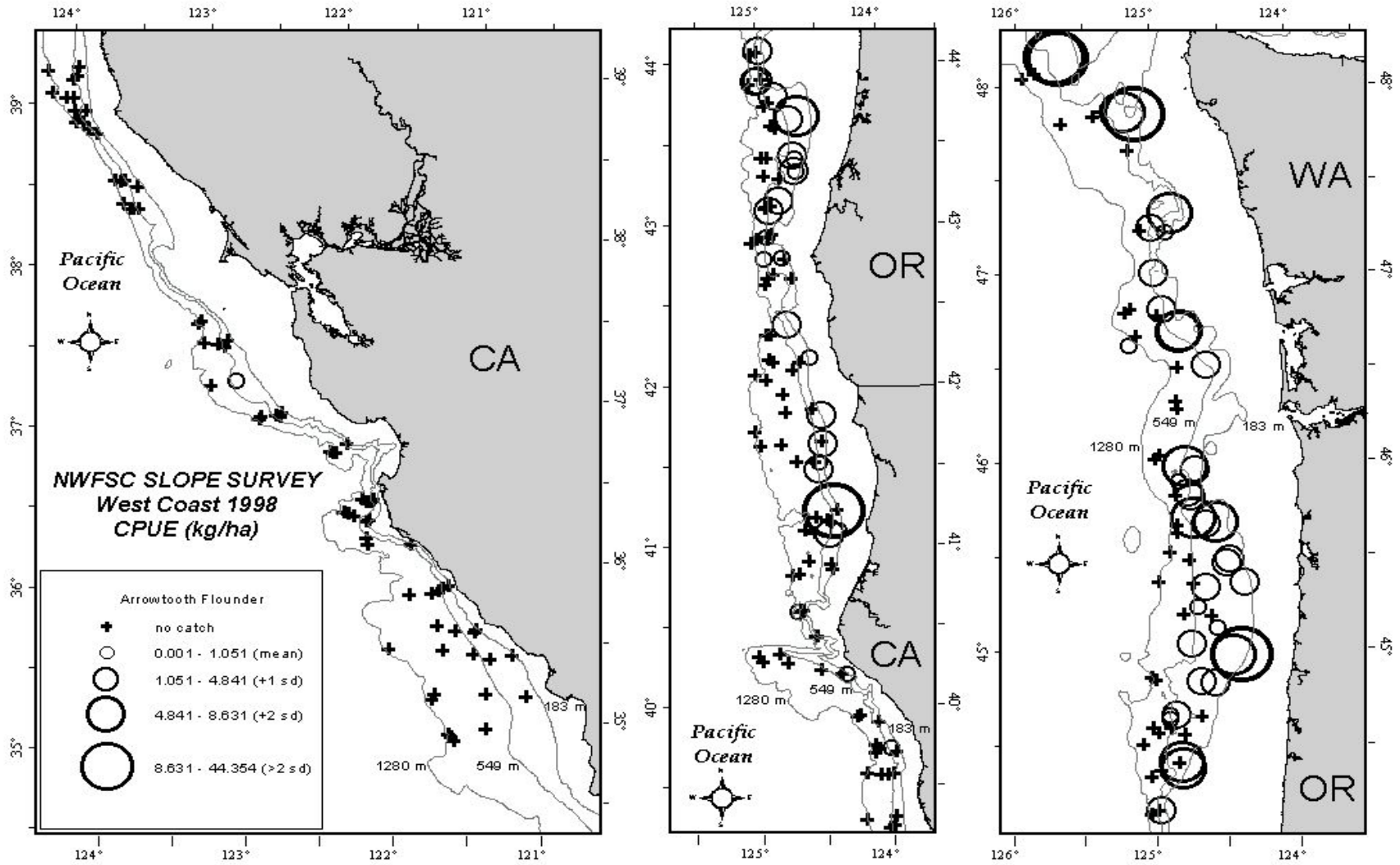


Figure 7. Arrowtooth flounder distribution and relative abundance (kg/ha) from the NWFSC slope survey.

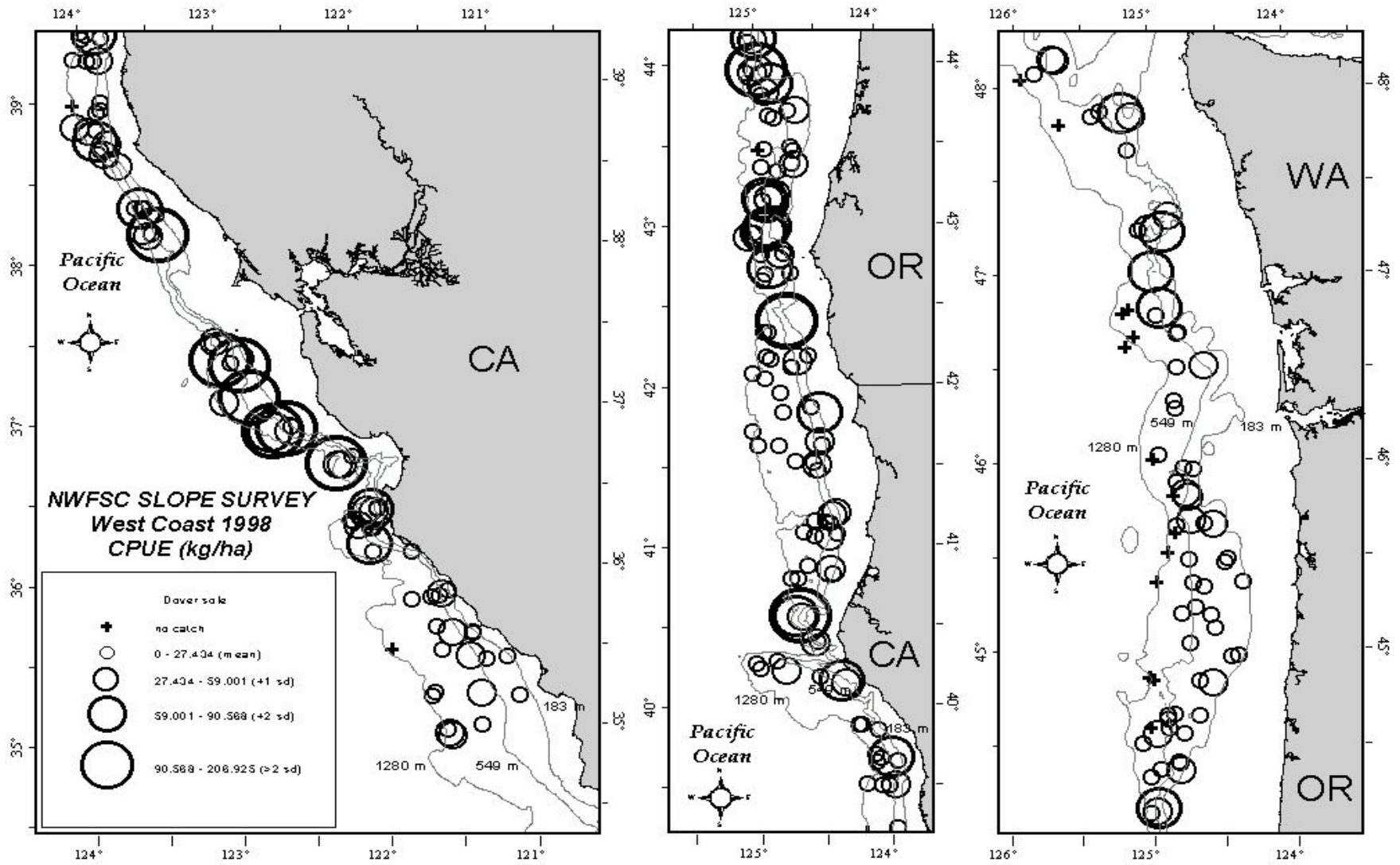


Figure 8. Dover sole distribution and relative abundance (kg/ha) from the NWFSC slope survey.

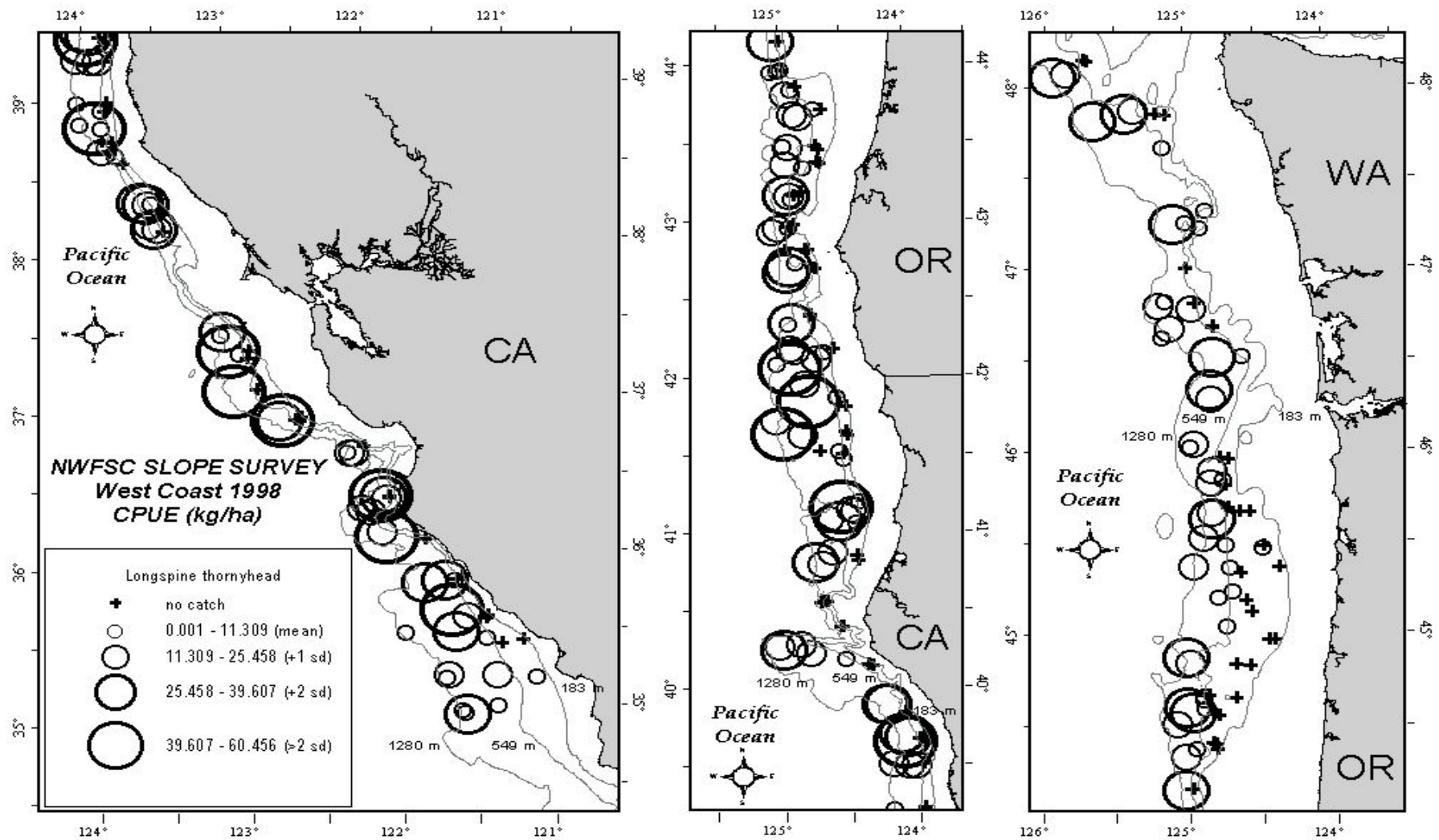


Figure 9. Longspine thornyhead distribution and relative abundance (kg/ha) from the NWFSC slope survey.

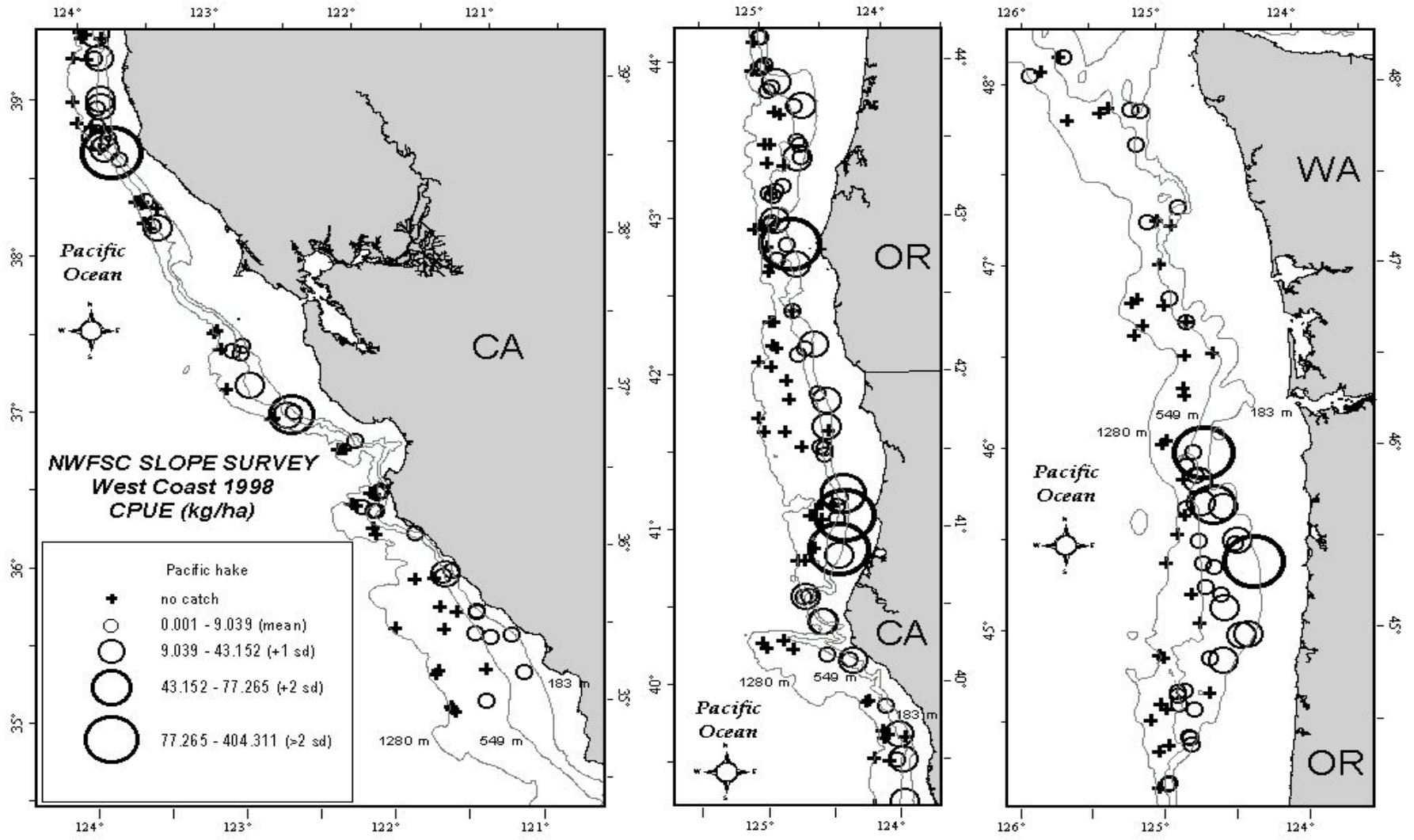


Figure 10. Pacific hake distribution and relative abundance (kg/ha) from the NWFSC slope survey.

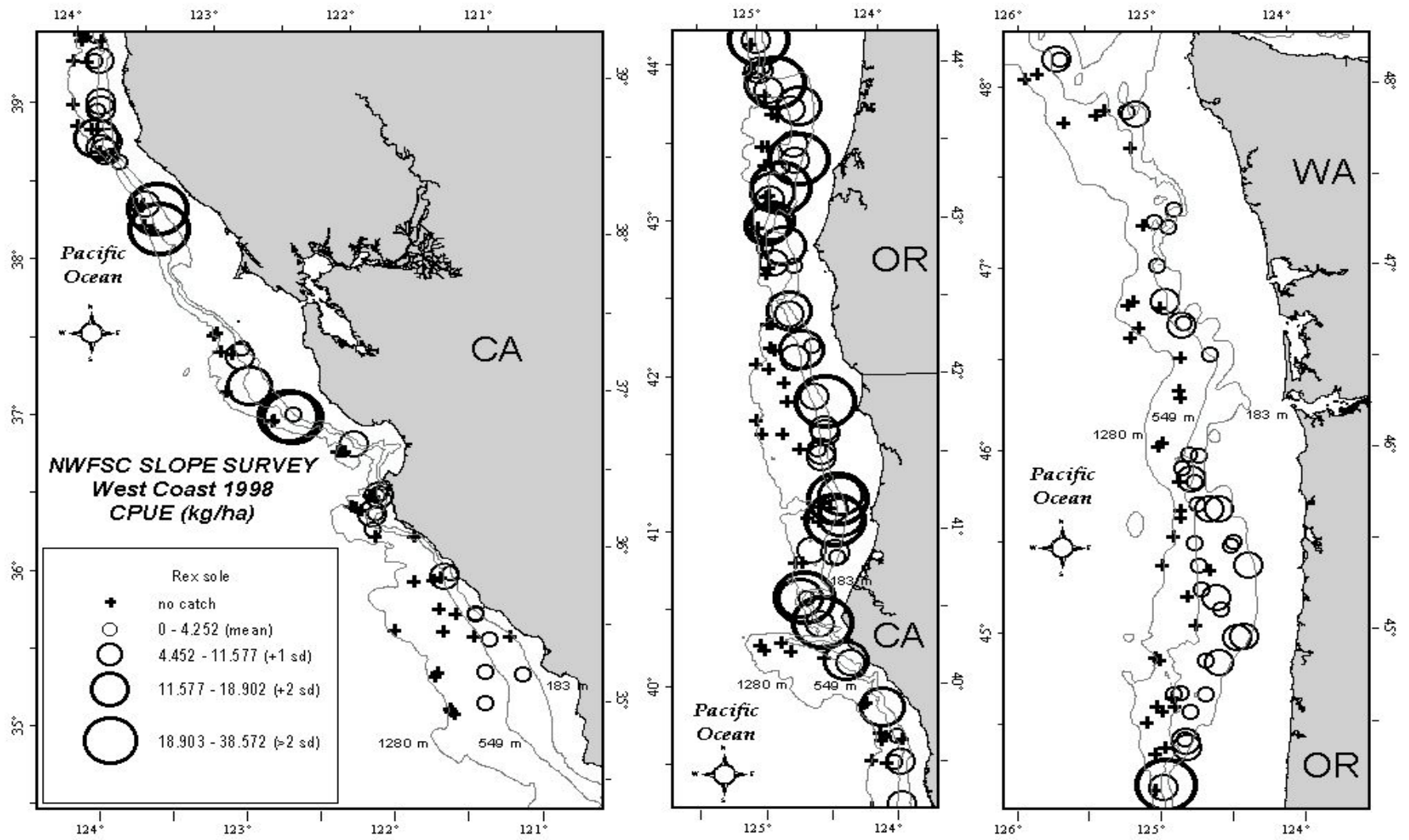


Figure 11. Rex sole distribution and relative abundance (kg/ha) from the NWFSC slope survey.

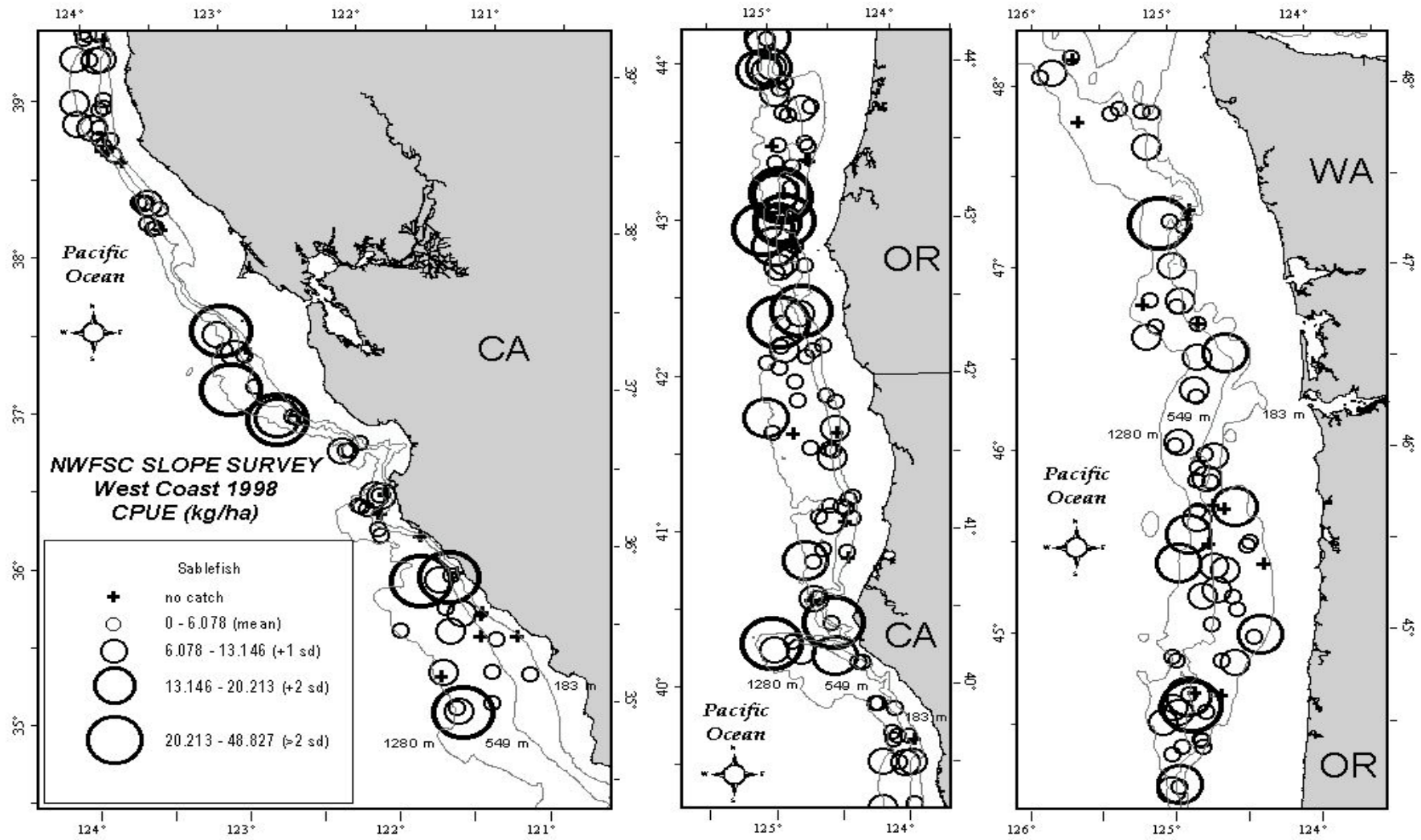


Figure 12. Sablefish distribution and relative abundance (kg/ha) from the NWFSC slope survey.

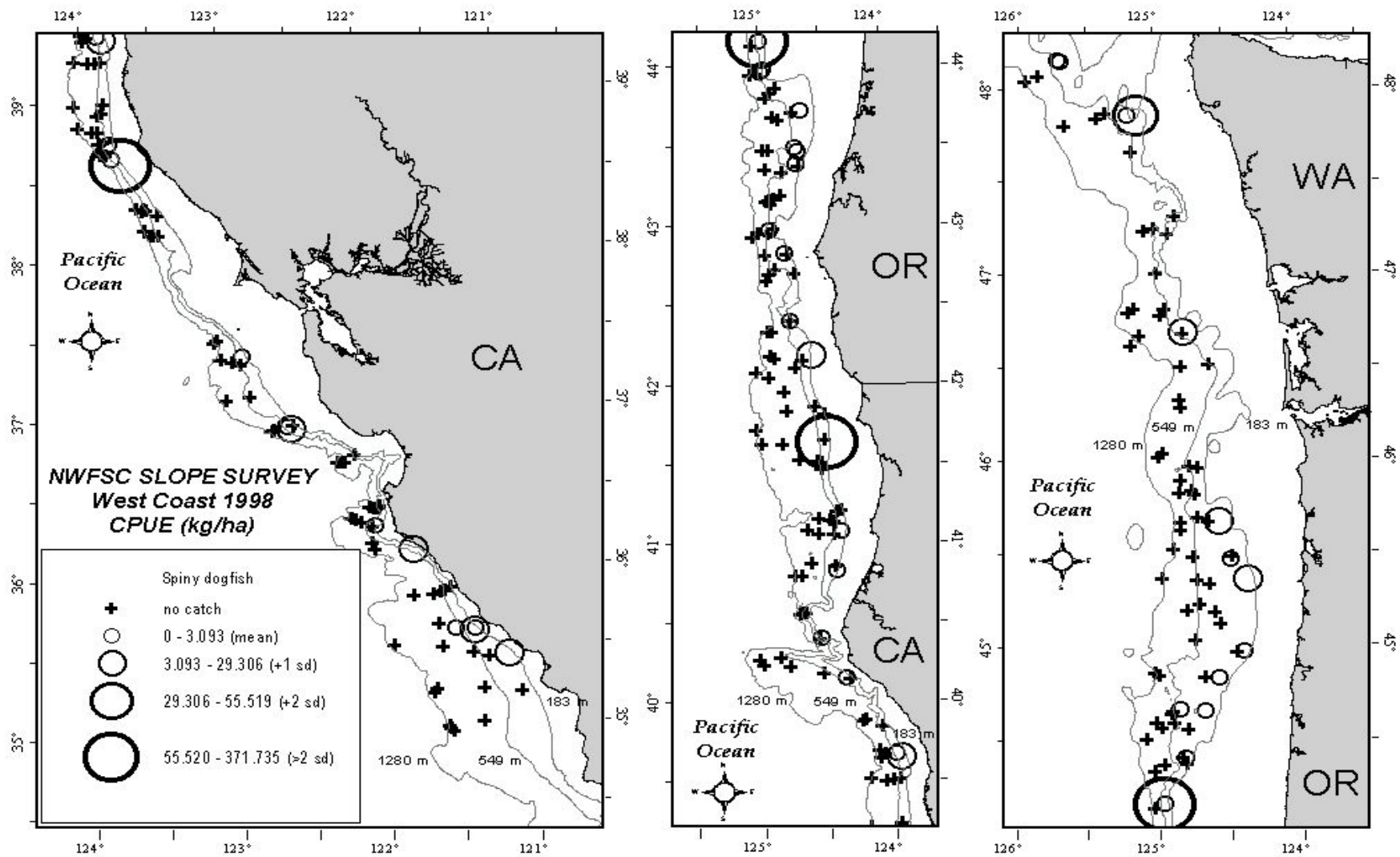


Figure 13. Shortspine thornyhead distribution and relative abundance (kg/ha) from the NWFSC slope survey.

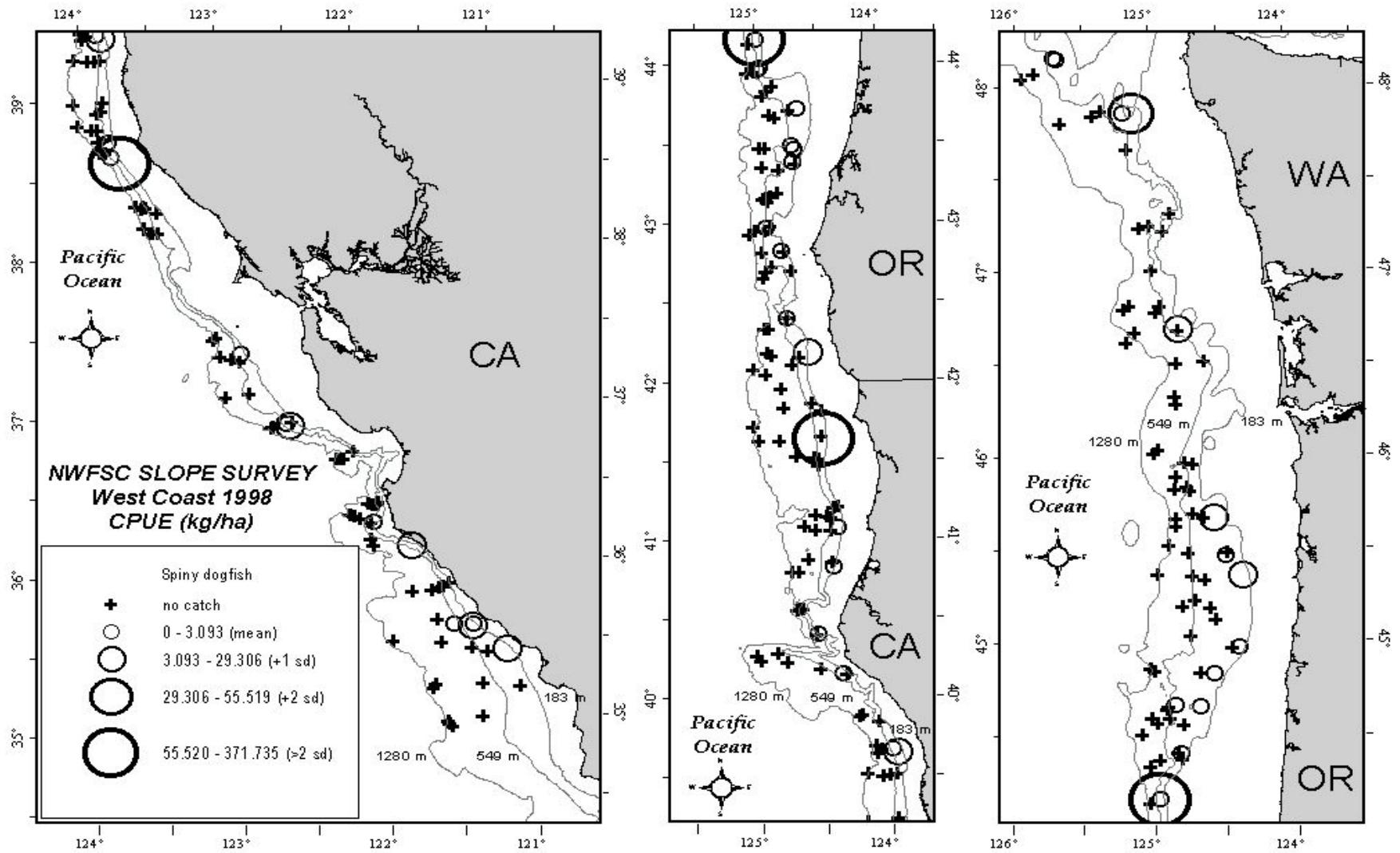


Figure 14. Spiny dogfish distribution and relative abundance (kg/ha) from the NWFSC slope survey.

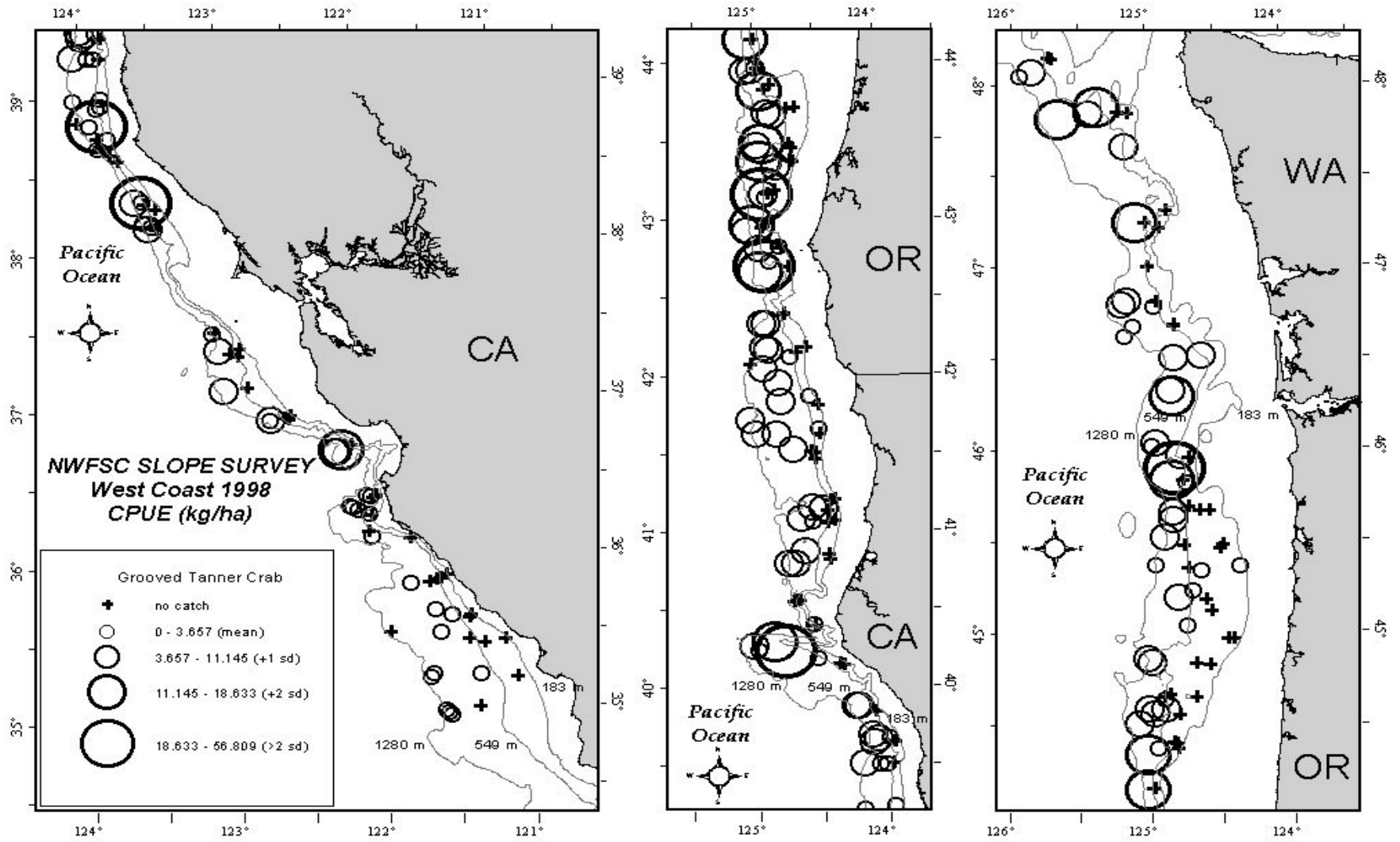


Figure 15. Grooved Tanner crab distribution and relative abundance (kg/ha) from the NWFSC slope survey.

Biomass and Population Estimates

Abundance estimates of biomass in metric tons (t) along with associated coefficients of variation (CV) are presented for selected taxa by depth strata and INPFC areas in Tables 17–22. Note that the CV's presented are calculated using the standard error (or standard deviation/number sampled) divided by the mean CPUE. The total number of hauls, haul-catch weights and numbers, and length data are shown in Tables 23–28 by stratum and INPFC area for each fish species.

The calculated biomass estimates are not absolute estimates. Herding caused by doors and bridles, as well as escapement from underneath the trawl footrope, around the net opening, and through the net mesh, may affect the trawl catches (Gunderson 1993). Abundance calculations are based on the assumption that all of the fish that are in front of the trawl and between the wingtips have an equal chance of being caught. The ability of a fish to avoid the net will depend on: the species of fish, fish shape, size, and speed, and its reaction to which part of the net it encounters (Lauth 1999). Furthermore, this survey only covers limited portions of the total depth and geographic range of many of the species that are caught.

Table 17. Estimates of fish biomass (metric tons) and coefficients of variation (CV) by stratum for the INPFC U.S.-Vancouver, Columbia, Eureka, Monterey, and Conception areas combined from the NWFSC slope survey.

Species	Stratum 1		Stratum 2		All strata	
	183-549 m		550-1,280 m		183-1,280 m	
	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %
Redbanded rockfish	133	4	-	-	133	4
Bocaccio	2,863	4	-	-	2,863	4
Rockfish unident.	61,791	14	161	3	61,952	14
Longspine thornyhead	1,193	5	72,110	15	73,303	15
Shortspine thornyhead	9,594	19	19,299	18	28,893	14
Roundfish unident.	2,774	9	4,829	13	7,603	9
Pacific whiting	29,348	4	504	4	29,852	4
Grenadier unident.	86	2	57,855	6	57,941	5
Sablefish	7,488	9	27,821	11	35,309	9
Rex sole	13,808	10	1,001	6	14,809	10
Deepsea sole	62	3	7,326	8	7,388	8
Dover sole	64,427	22	62,076	15	126,503	13
Slender sole	6	4	-	-	6	4
Arrowtooth flounder	6,833	40	175	4	7,007	39
Flatfish unident.	3,325	10	-	-	3,325	10
Skate unident	18,208	9	5,379	7	23,587	7
Spiny dogfish	13,308	7	30	7	13,338	7
Shark unident	3,049	10	5,395	10	8,444	7
Fish unident.	1,151	6	986	4	2,137	4

Table 18. Estimates of fish biomass (metric tons) and coefficients of variation (CV) by stratum for the INPFC Conception area from NWFSC slope survey.

Species	Stratum 1		Stratum 2		All strata	
	183-549 m		550-1,280 m		183-1,280 m	
	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %
Redbanded rockfish	-	-	-	-	-	-
Bocaccio	-	-	-	-	-	-
Rockfish unident.	16,867	39	35	11	16,902	39
Longspine thornyhead	335	14	14,667	38	15,002	37
Shortspine thornyhead	251	19	5,798	54	6,049	52
Roundfish unident.	566	31	697	30	1,263	22
Pacific whiting	1,727	27	84	8	1,811	26
Grenadier unident.	2	13	5,537	21	5,539	21
Sablefish	558	27	7,437	30	7,995	28
Rex sole	474	32	12	7	482	31
Deepsea sole	-	-	812	24	812	24
Dover sole	1,797	19	16,896	45	18,693	40
Slender sole	-	-	-	-	-	-
Arrowtooth flounder	-	-	-	-	-	-
Flatfish unident.	679	18	-	-	679	18
Skate unident	2,412	31	1,271	20	3,683	21
Spiny dogfish	615	19	30	7	645	18
Shark unident	1,811	17	2,581	19	4,392	13
Fish unident.	-	-	-	-	-	-

Table 19. Estimates of fish biomass (metric tons) and coefficients of variation (CV) by stratum for the INPFC Monterey area from the NWFSC slope survey.

Species	Stratum 1		Stratum 2		All strata	
	183–549 m		550–1,280 m		183–1,280 m	
	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %
Redbanded rockfish	-	-	-	-	-	-
Bocaccio	44	3	-	-	-	-
Rockfish unident.	18,215	13	80	4	18,295	13
Longspine thornyhead	121	5	20,298	25	20,419	24
Shortspine thornyhead	572	14	5,957	17	6,529	16
Roundfish unident.	590	16	1,618	16	2,208	13
Pacific whiting	7,355	9	155	5	7,510	9
Grenadier unident.	19	3	23,345	8	23,364	8
Sablefish	912	10	6,224	13	7,136	11
Rex sole	3,588	19	198	3	3,786	18
Deepsea sole	-	-	2,737	13	2,737	13
Dover sole	14,106	19	28,080	17	42,186	13
Slender sole	-	-	-	-	-	-
Arrowtooth flounder	14	6	-	-	14	6
Flatfish unident.	759	8	-	-	759	8
Skate unident	4,907	19	1,334	13	6,241	15
Spiny dogfish	2,411	4	-	-	2,411	4
Shark unident	253	9	1,799	9	2,052	8
Fish un ident.	264	8	301	5	565	5

Table 20. Estimates of fish biomass (metric tons) and coefficients of variation (CV) by stratum for the INPFC Eureka area from the NWFSC slope survey.

Species	Stratum 1		Stratum 2		All strata	
	183–549 m		550–1,280 m		183–1,280 m	
	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %
Redbanded rockfish	133	4	–	–	133	4
Bocaccio	2,819	4	–	–	2,819	4
Rockfish unident.	2,474	13	25	4	2,499	12
Longspine thornyhead	86	10	15,715	32	15,801	32
Shortspine thornyhead	635	21	3,293	17	3,928	15
Roundfish unident.	290	20	780	20	1,070	15
Pacific whiting	5,916	13	70	6	5,986	13
Grenadier unident.	12	4	12,581	13	12,593	13
Sablefish	835	16	4,035	21	4,870	18
Rex sole	2,660	27	698	8	3,358	21
Deepsea sole	–	–	1,846	16	1,846	16
Dover sole	11,112	21	7,099	31	18,211	18
Slender sole	6	4	–	–	6	4
Arrowtooth flounder	313	7	19	4	332	7
Flatfish unident.	165	11	–	–	165	11
Skate unident	2,039	15	895	11	2,934	11
Spiny dogfish	674	5	–	–	674	5
Shark unident	106	18	412	23	518	19
Fish unident.	255	12	152	7	407	8

Table 21. Estimates of fish biomass (metric tons) and coefficients of variation (CV) by stratum for the INPFC Columbia area from the NWFSC slope survey.

Species	Stratum 1		Stratum 2		All strata	
	183–549 m		550–1,280 m		183–1,280 m	
	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %
Redbanded rockfish	-	-	-	-	-	-
Bocaccio	-	-	-	-	-	-
Rockfish unident.	10,415	4	21	3	10,436	4
Longspine thornyhead	651	5	16,472	27	17,123	26
Shortspine thornyhead	5,316	19	3,044	13	8,360	13
Roundfish unident.	1,052	9	1,060	12	2,112	8
Pacific whiting	14,071	4	117	4	14,188	4
Grenadier unident.	53	2	15,189	10	15,242	10
Sablefish	4,557	12	8,868	17	13,425	12
Rex sole	6,051	13	97	3	6,148	13
Deepsea sole	62	3	1,410	14	1,472	13
Dover sole	27,624	16	9,413	10	37,037	12
Slender sole	-	-	-	-	-	-
Arrowtooth flounder	2,078	13	156	4	2,234	12
Flatfish unident.	1,177	5	-	-	1,177	5
Skate unident	7,536	14	1,789	9	9,325	11
Spiny dogfish	6,510	2	-	-	6,510	2
Shark unident	851	3	564	14	1,415	6
Fish unident.	426	7	447	6	873	5

Table 22. Estimates of fish biomass (metric tons) and coefficients of variation (CV) by stratum for the INPFC U.S.-Vancouver area from the NWFSC slope survey.

Species	Stratum 1		Stratum 2		All strata	
	183-549 m		550-1,280 m		183-1,280 m	
	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %	Biomass (m.t.)	C.V. %
Redbanded rockfish	-	-	-	-	-	-
Bocaccio	-	-	-	-	-	-
Rockfish unident.	13,820	40	-	-	13,820	40
Longspine thornyhead	-	-	4,958	77	4,958	77
Shortspine thornyhead	2,819	54	1,208	87	4,027	46
Roundfish unident.	276	37	673	71	949	52
Pacific whiting	278	62	79	18	357	49
Grenadier unident.	-	-	1,203	55	1,203	55
Sablefish	626	60	1,257	54	1,883	41
Rex sole	1,036	60	-	-	1,036	60
Deepsea sole	-	-	521	57	521	57
Dover sole	9,787	134	588	34	10,375	127
Slender sole	-	-	-	-	-	-
Arrowtooth flounder	4,428	62	-	-	4,428	62
Flatfish unident.	546	52	-	-	546	52
Skate unident	1,314	44	90	25	1,404	41
Spiny dogfish	3,097	28	-	-	3,097	28
Shark unident	28	25	38	42	66	27
Fish unident.	206	27	85	18	291	20

Table 23. Total number of hauls and hauls with weight, number and length data by stratum for the INPFC U.S.-Vancouver, Columbia, Eureka, Monterey, and Conception areas from the NWFSC slope survey.

Species	Shallow Stratum <550 m			Deep Stratum >550 m		
	Total hauls =145			Total hauls = 157		
	<u>Hauls with:</u>			<u>Hauls with:</u>		
	Wt.	No.	Len.	Wt.	No.	Len.
Spiny dogfish	46	47	47	1	1	1
Skate unident.	139	139	139	101	101	101
Spotted ratfish	82	82	82	7	7	7
Flatfish unident.	79	79	79	0	0	0
Arrowtooth flounder	64	64	64	6	6	6
Pacific halibut	10	10	10	0	0	0
Petrale sole	19	20	20	0	0	0
Dover sole	144	144	144	128	129	129
Deepsea sole	5	5	5	130	131	131
Rex sole	138	138	138	16	16	16
Slickhead unident.	1	1	1	127	127	127
Sablefish	104	104	104	149	149	149
Grenadier unident.	7	8	8	142	141	142
Sculpin unident.	19	19	19	5	5	5
Pacific flatnose	12	12	12	130	130	130
Lingcod	13	13	13	0	0	0
Pacific hake	131	131	131	26	26	27
Roundfish unident.	108	108	108	123	124	124
Shortspine thornyhead	124	124	124	143	145	145
Longspine thornyhead	35	35	36	154	154	154
Rockfish unident.	134	135	135	9	9	9
Shrimp unident.	17	17	17	20	21	23
Spot shrimp	9	9	10	0	0	0
Crab unident.	9	9	9	25	26	26
Dungeness crab	16	16	16	0	0	0
Red rock crab	4	4	4	0	0	0
Grooved Tanner crab	26	26	26	142	142	142
Box crab	11	11	11	0	0	0
Octopus unident.	29	29	29	31	31	31
Squid unident.	42	42	42	56	58	58

Table 24. Total number of hauls and hauls with weight, number and length data by stratum for the INPFC U.S.-Vancouver area from the NWFSC slope survey.

Species	Shallow Stratum <550 m			Deep Stratum >550 m		
	Total hauls = 6			Total hauls = 8		
	<u>Hauls with:</u>			<u>Hauls with:</u>		
	Wt.	No.	Len.	Wt.	No.	Len.
Spiny dogfish	3	3	3	0	0	0
Skate unident.	4	4	4	2	2	2
Spotted ratfish	1	1	1	0	0	0
Flatfish unident.	3	3	3	0	0	0
Arrowtooth flounder	3	3	3	0	0	0
Pacific halibut	2	2	2	0	0	0
Petrals Sole	0	0	0	0	0	0
Dover sole	4	4	4	4	4	4
Deepsea sole	1	1	1	4	4	4
Rex sole	4	4	4	0	0	0
Slickhead unident.	0	0	0	2	2	2
Sablefish	3	3	3	5	5	5
Grenadier unident.	1	1	1	5	5	5
Sculpin unident.	2	2	2	0	0	0
Pacific flatnose	1	1	1	4	4	4
Lingcod	0	0	0	0	0	0
Pacific hake	3	3	3	2	2	2
Roundfish unident.	2	2	2	4	4	4
Shortspine thornyhead	4	4	4	5	5	5
Longspine thornyhead	1	1	1	5	5	5
Rockfish unident.	4	4	4	0	0	0
Shrimp unident.	2	2	2	0	0	0
Spot shrimp	1	1	1	0	0	0
Crab unident.	0	0	0	3	3	3
Dungeness crab	0	0	0	0	0	0
Red rock crab	0	0	0	0	0	0
Grooved Tanner crab	0	0	0	5	5	5
Box crab	1	1	1	0	0	0
Octopus unident.	3	3	3	2	2	2
Squid unident.	0	0	0	1	1	1

Table 25. Total number of hauls and hauls with weight, number and length data by stratum for the INPFC Columbia area from the NWFSC slope survey.

Species	Shallow Stratum <550 m			Deep Stratum >550 m		
	Total hauls = 61			Total hauls = 48		
	<u>Hauls with:</u>			<u>Hauls with:</u>		
	Wt.	No.	Len.	Wt.	No.	Len.
Spiny dogfish	18	18	18	0	0	0
Skate unident.	59	59	59	33	33	33
Spotted ratfish	30	30	30	2	2	2
Flatfish unident.	32	32	32	0	0	0
Arrowtooth flounder	44	44	44	5	5	5
Pacific halibut	7	7	7	0	0	0
Petrale sole	2	2	2	0	0	0
Dover sole	61	61	61	30	31	31
Deepsea sole	4	4	4	42	42	42
Rex sole	59	59	59	5	5	5
Slickhead unident.	0	0	0	33	33	33
Sablefish	50	50	50	45	45	45
Grenadier unident.	2	2	2	47	46	47
Sculpin unident.	7	7	7	2	2	2
Pacific flatnose	6	6	6	41	41	41
Lingcod	4	4	4	0	0	0
Pacific hake	55	55	55	8	8	8
Roundfish unident.	42	42	42	30	31	31
Shortspine thornyhead	61	61	61	39	41	41
Longspine thornyhead	18	18	18	47	47	47
Rockfish unident.	53	54	54	2	2	2
Shrimp unident.	7	7	7	5	5	5
Spot shrimp	3	3	3	0	0	0
Crab unident.	4	4	4	8	9	9
Dungeness crab	4	4	4	0	0	0
Red rock crab	0	0	0	0	0	0
Grooved Tanner crab	14	14	14	47	47	47
Box crab	7	7	7	0	0	0
Octopus unident.	12	12	12	8	8	8
Squid unident.	10	10	10	12	13	13

Table 26. Total number of hauls and hauls with weight, number and length data by stratum for the INPFC Eureka area from the NWFSC slope survey.

Species	Shallow Stratum <550 m			Deep Stratum >550 m		
	Total hauls = 26			Total hauls = 27		
	<u>Hauls with:</u>			<u>Hauls with:</u>		
	Wt.	No.	Len.	Wt.	No.	Len.
Spiny dogfish	7	8	8	0	0	0
Skate unident.	23	23	23	13	13	13
Spotted ratfish	13	13	13	1	1	1
Flatfish unident.	15	15	15	0	0	0
Arrowtooth flounder	12	12	12	1	1	1
Pacific halibut	1	1	1	0	0	0
Petrale sole	1	2	2	0	0	0
Dover sole	26	26	26	26	26	26
Deepsea sole	0	0	0	22	22	22
Rex sole	25	25	25	5	5	5
Slickhead unident.	0	0	0	22	22	22
Sablefish	20	20	20	26	26	26
Grenadier unident.	1	1	1	23	23	23
Sculpin unident.	2	2	2	3	3	3
Pacific flatnose	2	2	2	24	24	24
Lingcod	5	5	5	0	0	0
Pacific hake	23	23	23	3	3	3
Roundfish unident.	19	19	19	21	21	21
Shortspine thornyhead	25	25	25	24	24	24
Longspine thornyhead	7	7	7	25	25	25
Rockfish unident.	24	24	24	1	1	1
Shrimp unident.	4	4	4	0	1	1
Spot shrimp	1	1	1	0	0	0
Crab unident.	1	1	1	5	5	5
Dungeness crab	9	9	9	0	0	0
Red rock crab	0	0	0	0	0	0
Grooved Tanner crab	5	5	5	24	24	24
Box crab	0	0	0	0	0	0
Octopus unident.	6	6	6	5	5	5
Squid unident.	15	15	15	13	14	14

Table 27. Total number of hauls and hauls with weight, number and length data by stratum for the INPFC Monterey area from the NWFSC slope survey.

Species	Shallow Stratum <550 m			Deep Stratum >550 m		
	Total hauls = 42			Total hauls = 57		
	<u>Hauls with:</u>			<u>Hauls with:</u>		
	Wt.	No.	Len.	Wt.	No.	Len.
Spiny dogfish	13	13	13	0	0	0
Skate unident.	41	41	41	39	39	39
Spotted ratfish	28	28	28	3	3	3
Flatfish unident.	23	23	23	0	0	0
Arrowtooth flounder	3	3	3	0	0	0
Pacific halibut	0	0	0	0	0	0
Petrale sole	12	12	12	0	0	0
Dover sole	41	41	41	52	52	52
Deepsea sole	0	0	0	48	49	49
Rex sole	39	39	39	5	5	5
Slickhead unident.	1	1	1	52	52	52
Sablefish	24	24	24	56	56	56
Grenadier unident.	2	2	2	53	53	53
Sculpin unident.	6	6	6	0	0	0
Pacific flatnose	3	3	3	49	49	49
Lingcod	3	3	3	0	0	0
Pacific hake	38	38	38	9	9	10
Roundfish unident.	33	33	33	48	48	48
Shortspine thornyhead	27	27	27	55	55	55
Longspine thornyhead	6	6	7	57	57	57
Rockfish unident.	41	41	41	3	3	3
Shrimp unident.	3	3	3	9	9	10
Spot shrimp	3	3	3	0	0	0
Crab unident.	1	1	1	7	7	7
Dungeness crab	3	3	3	0	0	0
Red rock crab	2	2	2	0	0	0
Grooved Tanner crab	7	7	7	50	50	50
Box crab	3	3	3	1	1	1
Octopus unident.	4	4	4	13	13	13
Squid unident.	16	16	16	20	20	20

Table 28. Total number of hauls and hauls with weight, number and length data by stratum for the INPFC Conception area from the NWFSC slope survey.

Species	Shallow Stratum <550 m			Deep Stratum >550 m		
	Total hauls =10			Total hauls = 17		
	<u>Hauls with:</u>			<u>Hauls with:</u>		
	Wt.	No.	Len.	Wt.	No.	Len.
Spiny dogfish	3	3	3	1	1	1
Skate unident.	10	10	10	12	12	12
Spotted ratfish	8	8	8	1	1	1
Flatfish unident.	4	4	4	0	0	0
Arrowtooth flounder	0	0	0	0	0	0
Pacific halibut	0	0	0	0	0	0
Petrale sole	3	3	3	0	0	0
Dover sole	10	10	10	16	16	16
Deepsea sole	0	0	0	11	11	11
Rex sole	9	9	9	1	1	1
Slickhead unident.	0	0	0	16	16	16
Sablefish	5	5	5	15	15	15
Grenadier unident.	1	2	2	11	11	11
Sculpin unident.	1	1	1	0	0	0
Pacific flatnose	0	0	0	11	11	11
Lingcod	1	1	1	0	0	0
Pacific hake	10	10	10	4	4	4
Roundfish unident.	10	10	10	17	17	17
Shortspine thornyhead	5	5	5	17	17	17
Longspine thornyhead	3	3	3	17	17	17
Rockfish unident.	10	10	10	3	3	3
Shrimp unident.	0	0	0	6	6	7
Spot shrimp	1	1	1	0	0	0
Crab unident.	3	3	3	2	2	2
Dungeness crab	0	0	0	0	0	0
Red rock crab	2	2	2	0	0	0
Grooved tanner crab	0	0	0	13	13	13
Box crab	0	0	0	0	0	0
Octopus unident.	4	4	4	3	3	3
Squid unident.	1	1	1	10	10	10

Size and Age Compositions

Figures 16-39 show the estimated-population length frequencies for the four DST complex species and are presented by depth stratum for all INPFC areas combined, and for individual INPFC areas. Note that the length frequencies are the sum of all measured fish, unadjusted for subsampling, area swept, or stratum size. There was no age data available for analysis at the time this report was prepared.

Analysis Approach and Data Requests

The estimation of population parameters presented in this document has followed statistical procedures similar to those used by Lauth (1999) for the comparable survey conducted on the RV *Miller Freeman*. This approach does not consider possible differences between vessels, treating each tow as both independent and random. A statistical analysis that explicitly considers vessel effects, the probability distribution of catch-per-tow, and alternative stratifications is under development⁸. The results from this more sophisticated analysis may lead to a better understanding of the slope survey data and may in the future replace the results and analysis presented within this document.

To conserve paper resources and avoid excessive detail and printing costs, this document only includes information for commercially important species. If you would like information on other species not present in this document, or more detailed information, please contact Teresa Turk by phone at (206) 860-3460 or by email at teresa.turk@noaa.gov.

⁸Helser, T. E., A. E. Punt, and R. D. Methot. In prep. A statistical approach to analyzing a multi-vessel fishery-resource survey on the West Coast continental slope.

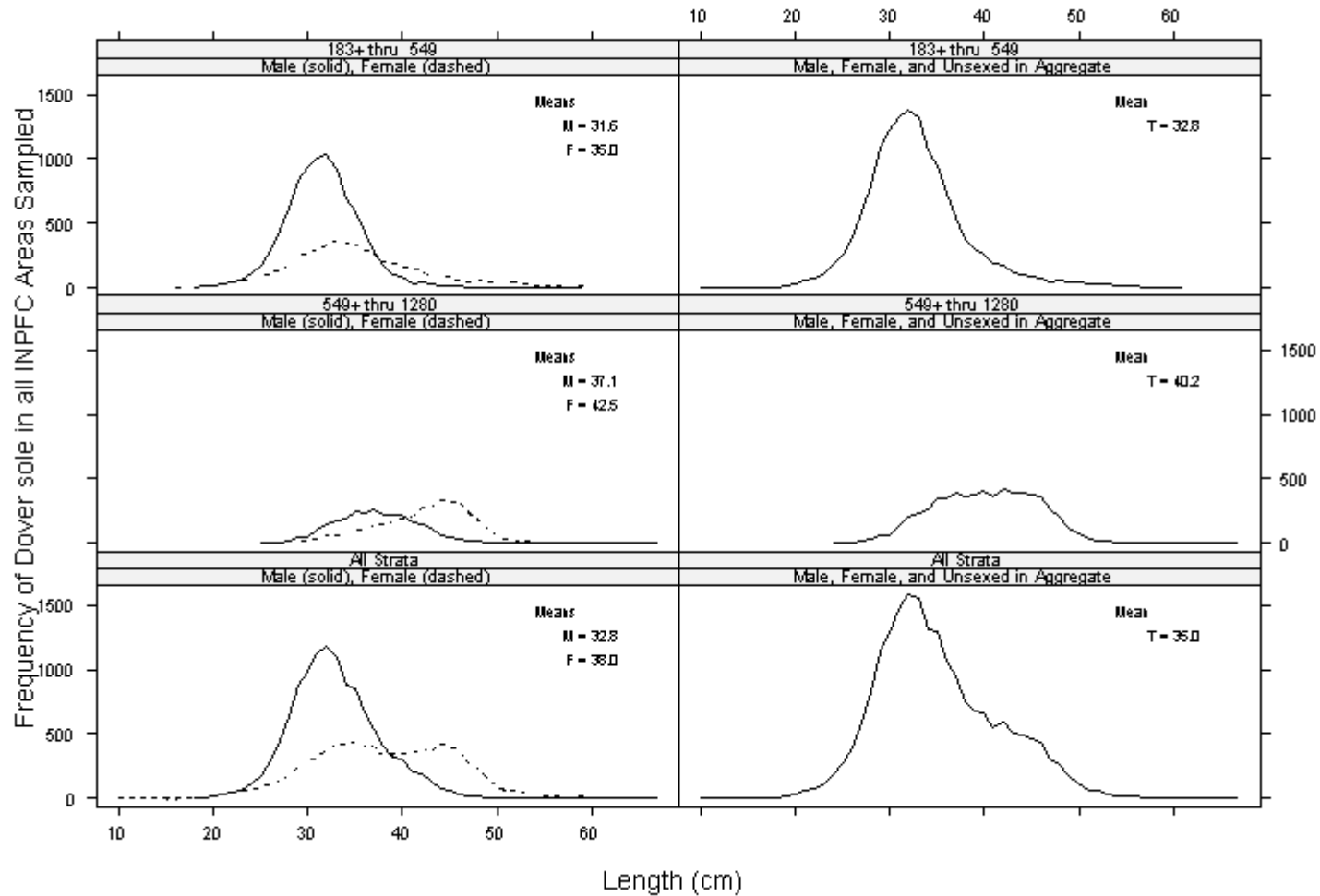


Figure 16. Dover sole. Unweighted length-frequency data and mean lengths (cm) of Dover sole by depth stratum and by sex (T=males, female, and unsexed in aggregate) for all the INPFC areas sampled from the NWFSC slope survey.

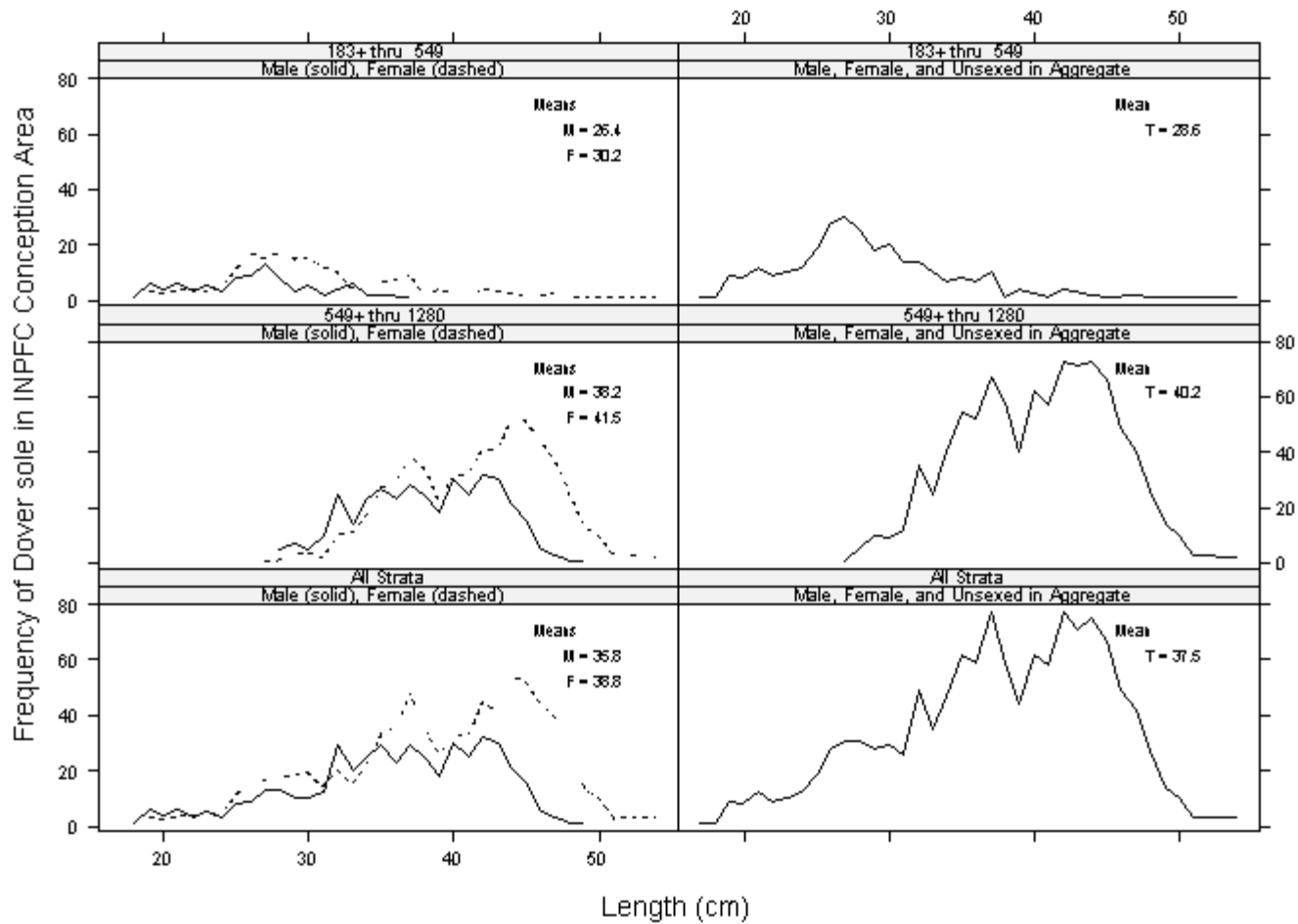


Figure 17. Dover sole. Unweighted length-frequency data and mean lengths (cm) of Dover sole by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC C conception area from the NWFS C slope survey.

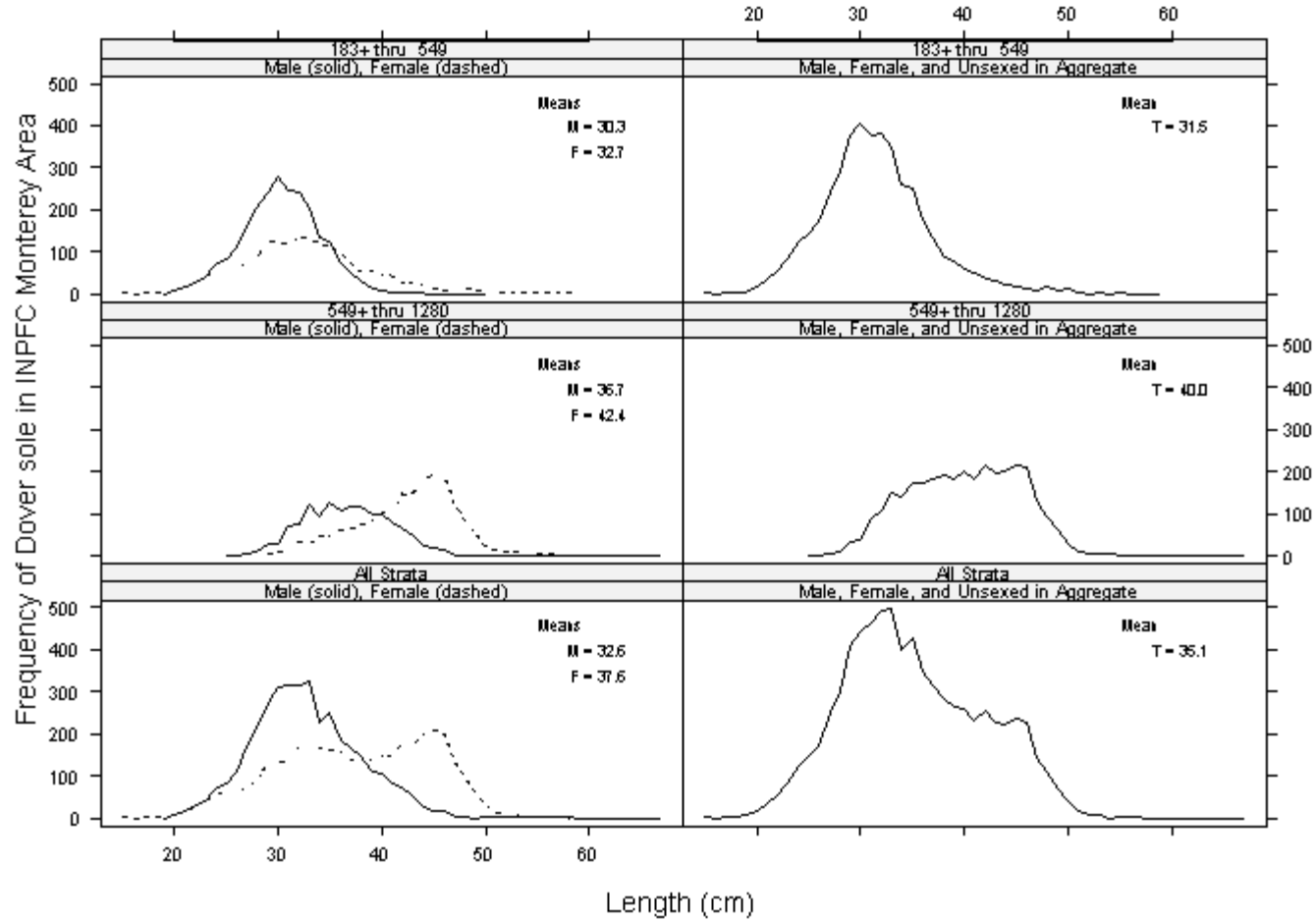


Figure 18. Dover sole. Unweighted length-frequency data and mean lengths (cm) of Dover sole by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Monterey area from the NWFSC slope survey.

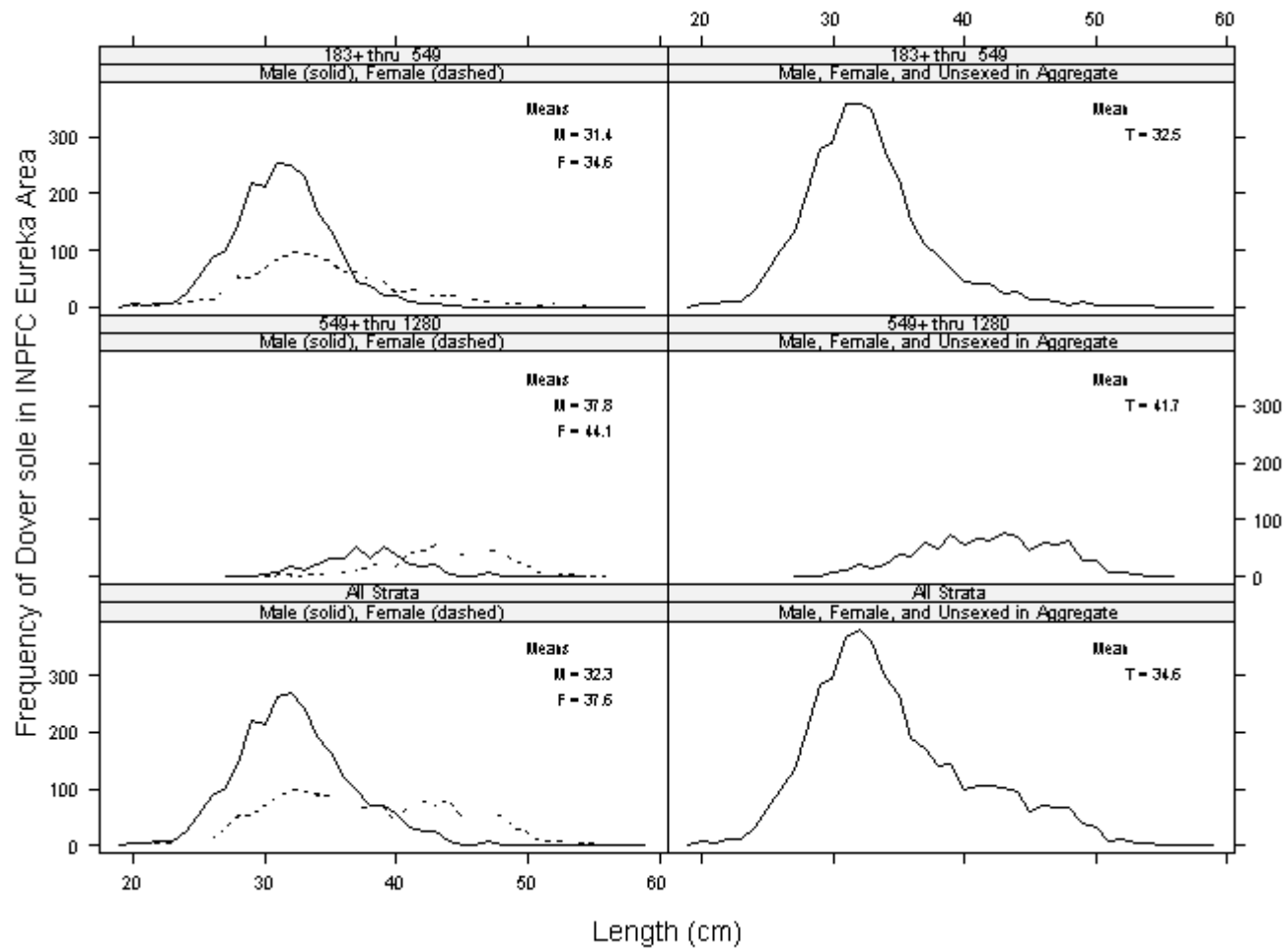


Figure 19. Dover sole. Unweighted length-frequency data and mean lengths (cm) of Dover sole by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Eureka area from the NWFSC slope survey.

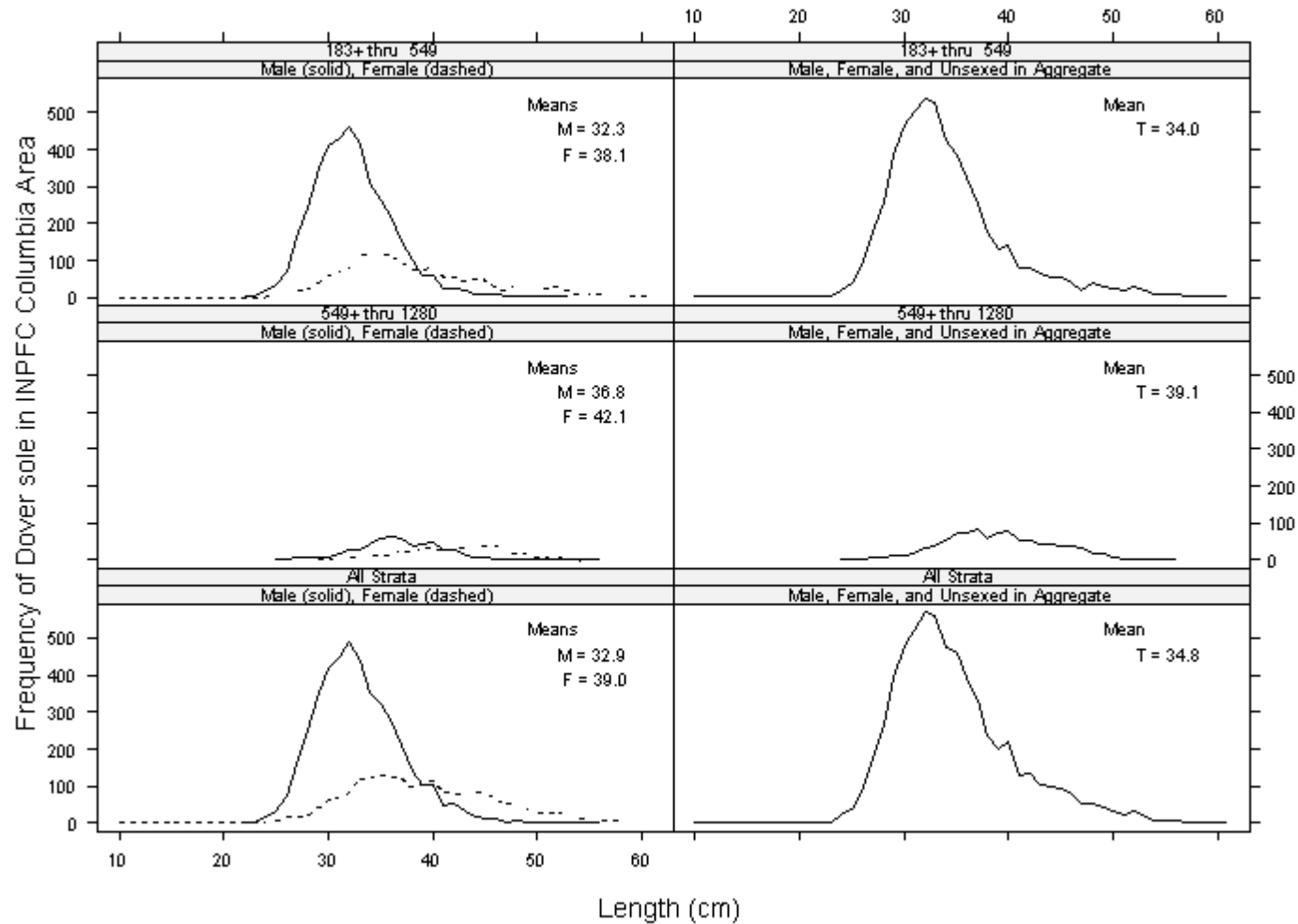


Figure 20. Dover sole. Unweighted length-frequency data and mean lengths (cm) of Dover sole by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Columbia area from the NWFS C slope survey.

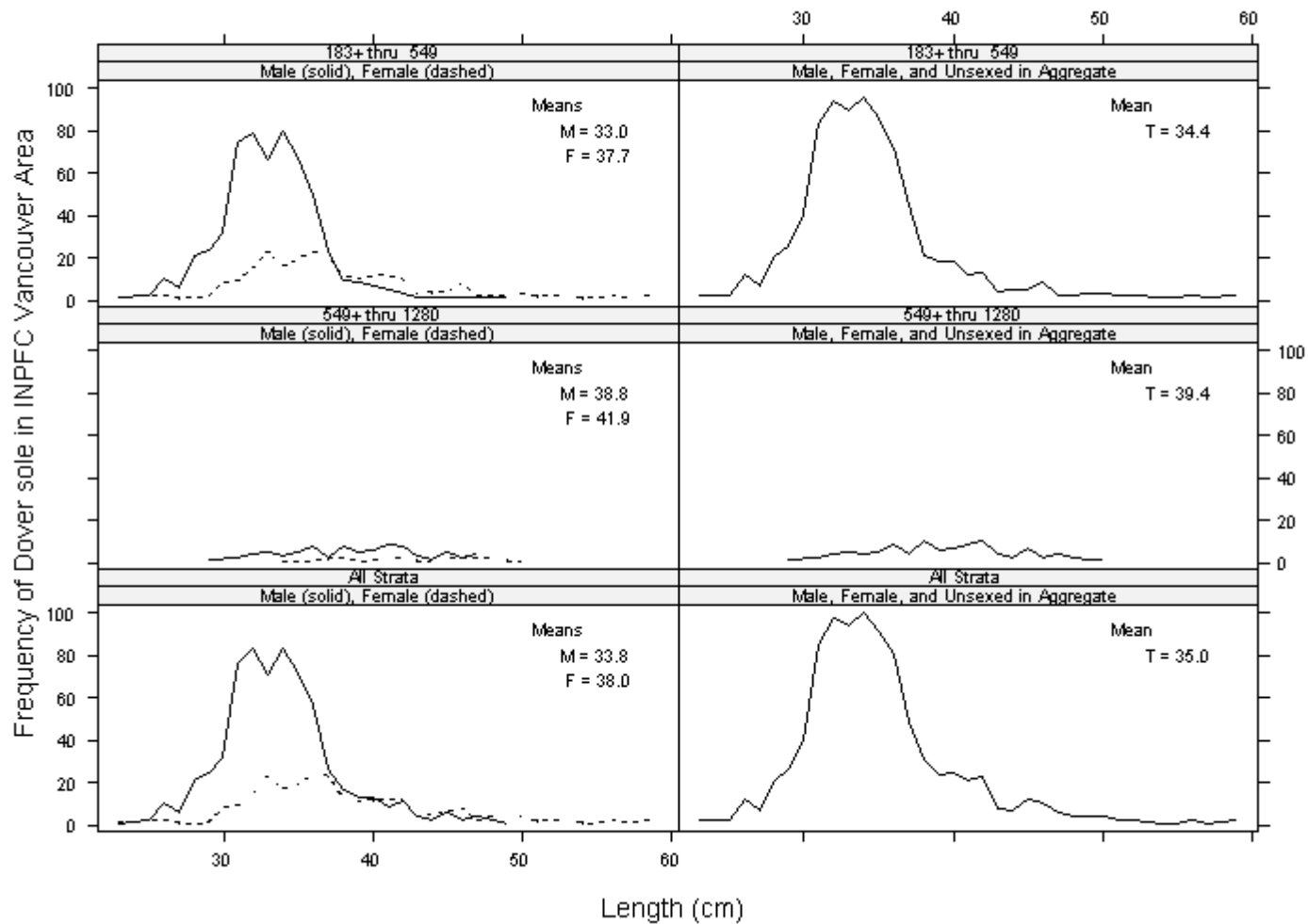


Figure 21. Dover sole. Unweighted length-frequency data and mean lengths (cm) of Dover sole by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC U.S.-Vancouver area from the NWFSC slope survey.

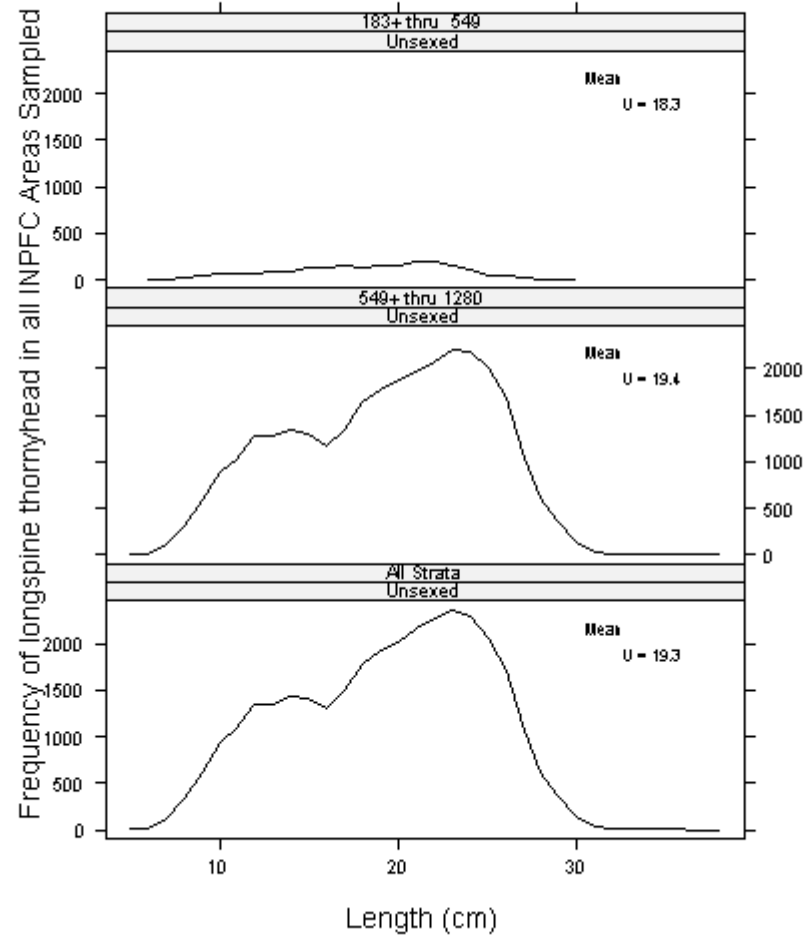


Figure 22. Longspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of longspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for all the INPFC areas sampled from the NWFSC slope survey.

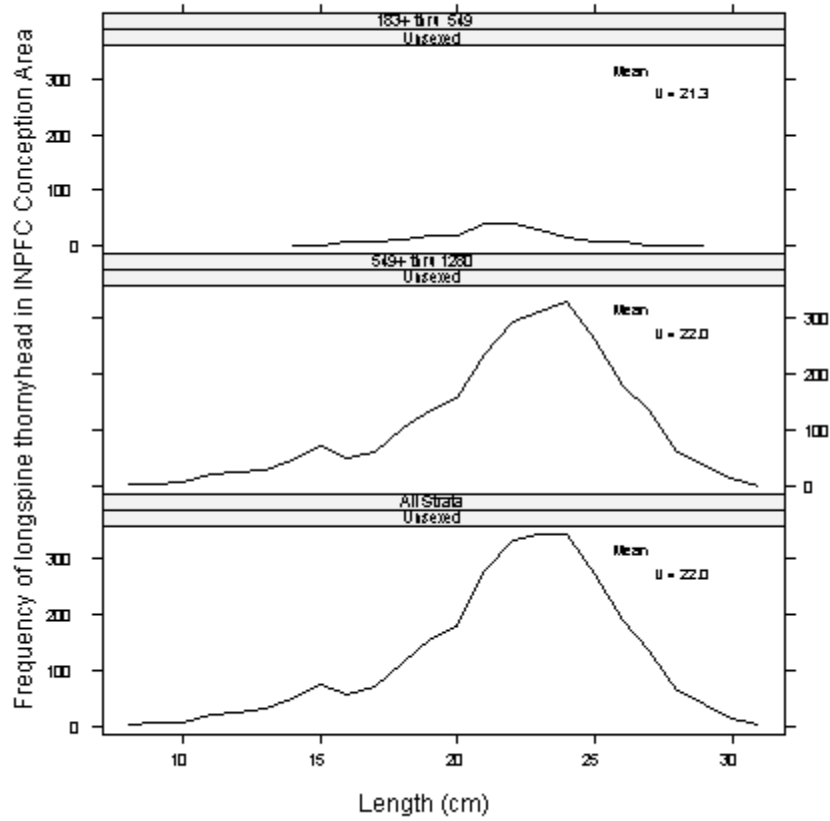


Figure 23. Longspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of longspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC C conception area from the NWFS C slope survey.

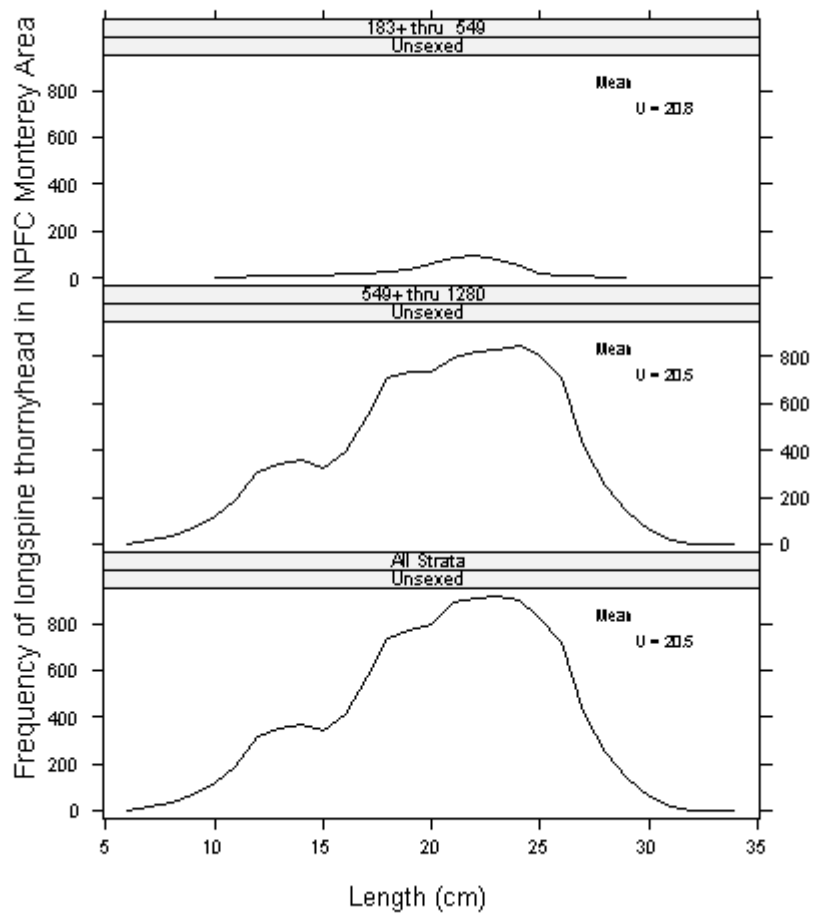


Figure 24. Longspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of longspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Monterey area from the NWFS slope survey.

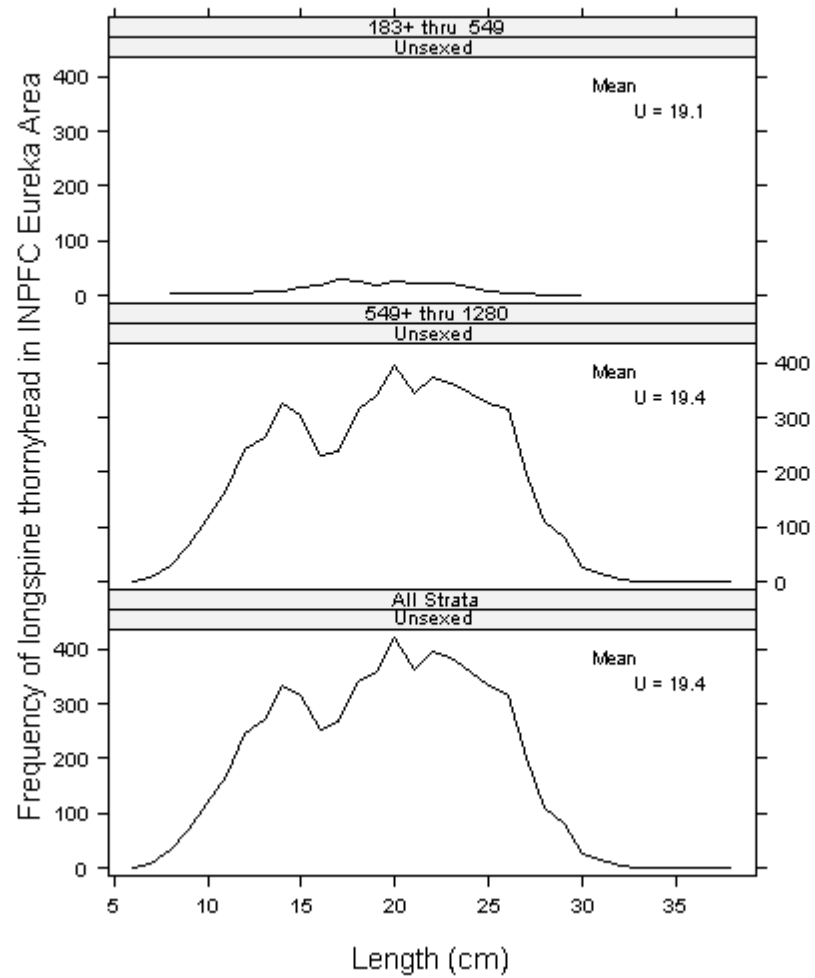


Figure 25. Longspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of longspine thomyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Eureka area from the NW FSC slope survey.

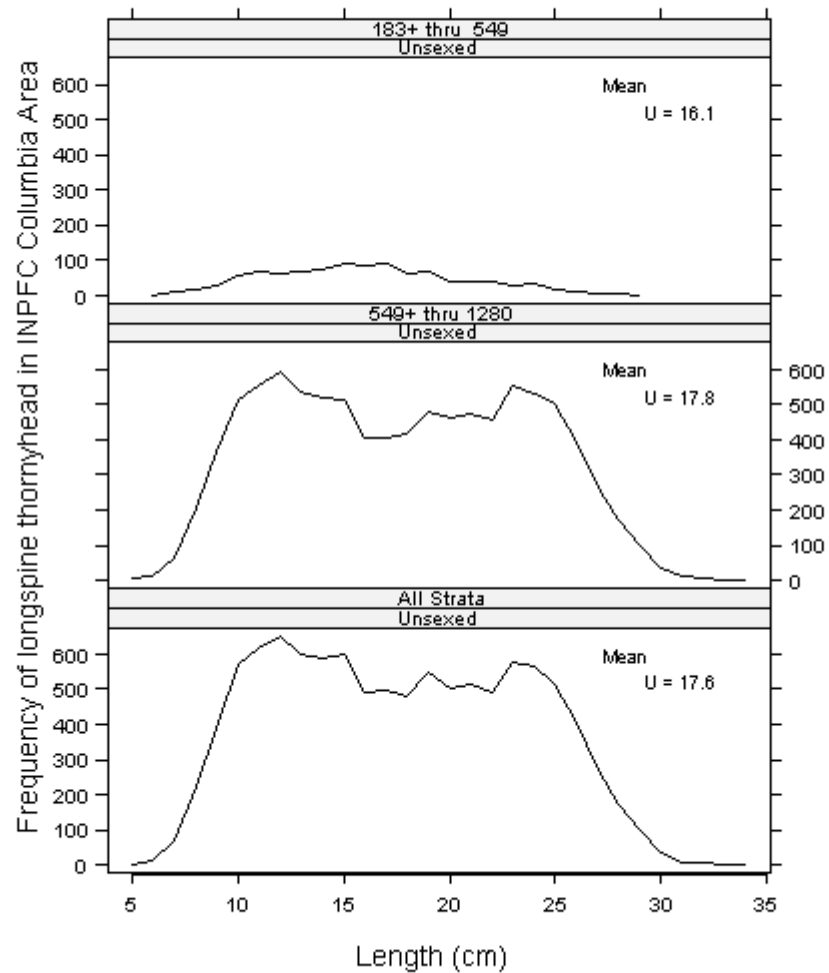


Figure 26. Longspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of longspine thomyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Columbia area from the NWFS C slope survey.

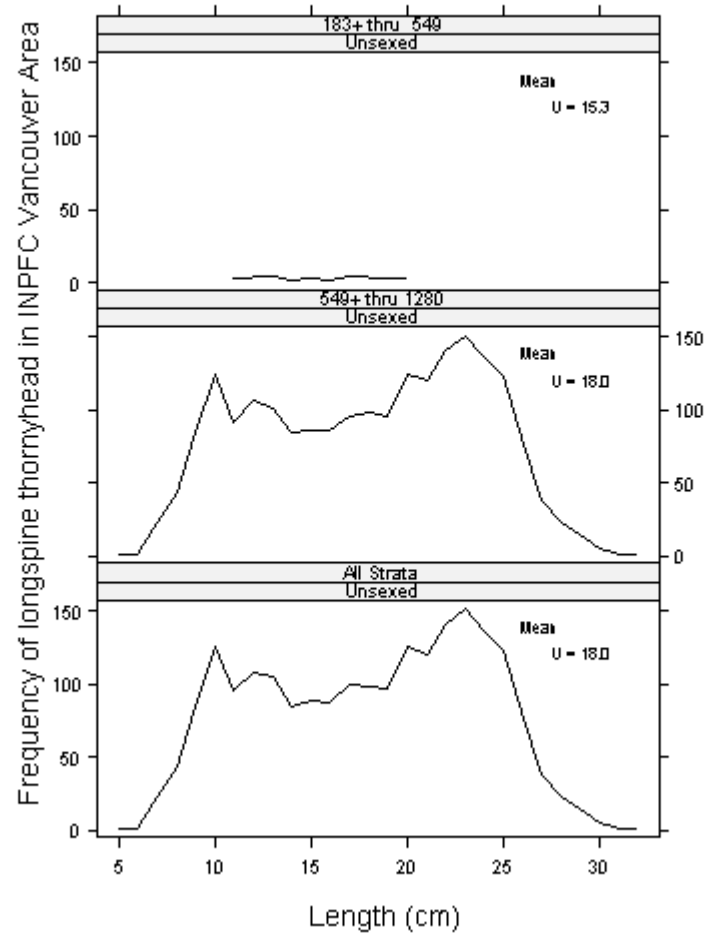


Figure 27. Longspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of longspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC U.S.-Vancouver area from the NWFS C slope survey.

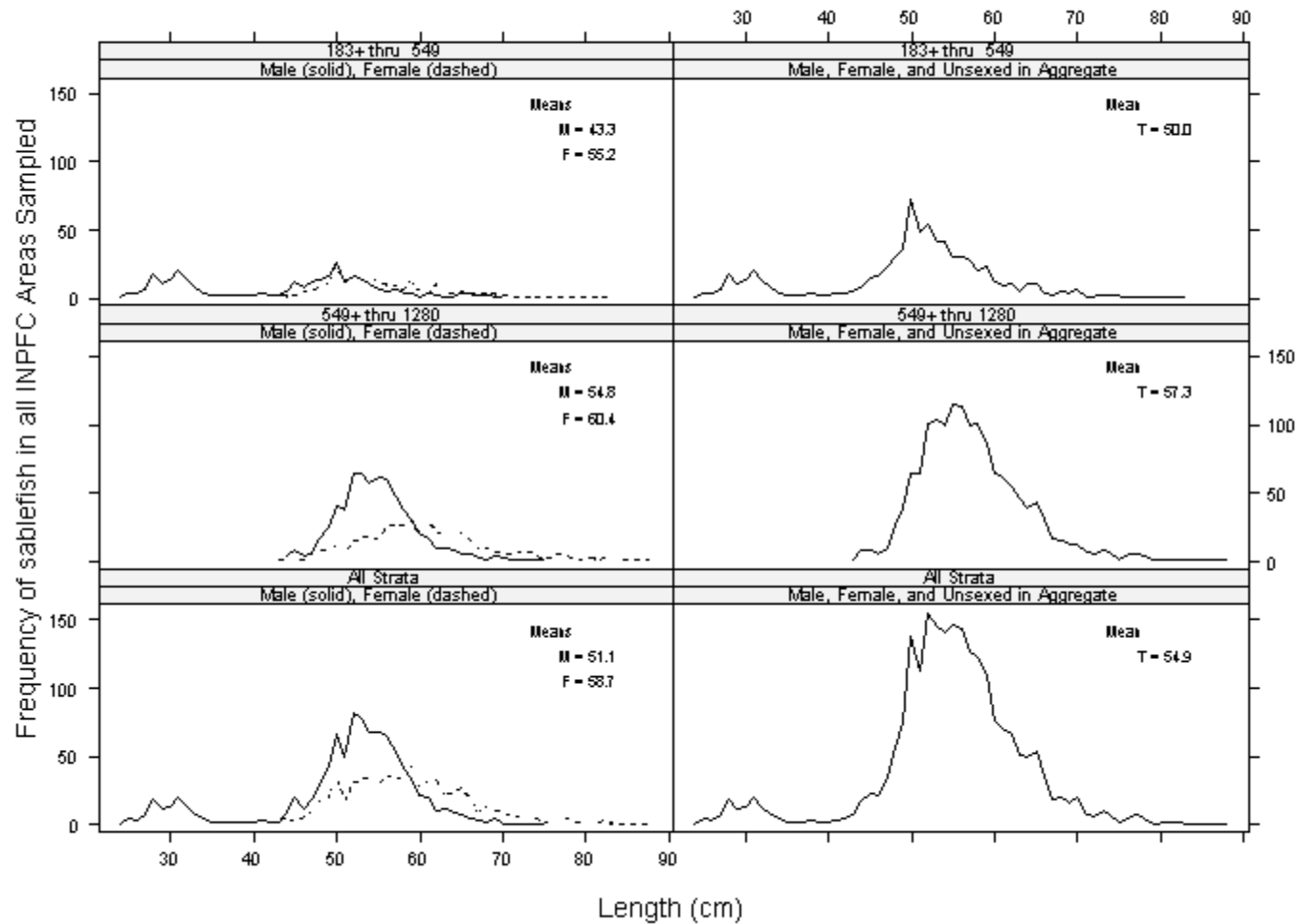


Figure 28. Sablefish. Unweighted length-frequency data and mean lengths (cm) of sablefish by depth stratum and by sex (T=males, female, and unsexed in aggregate) for all the INPFC areas sampled from the NWFS C slope survey.

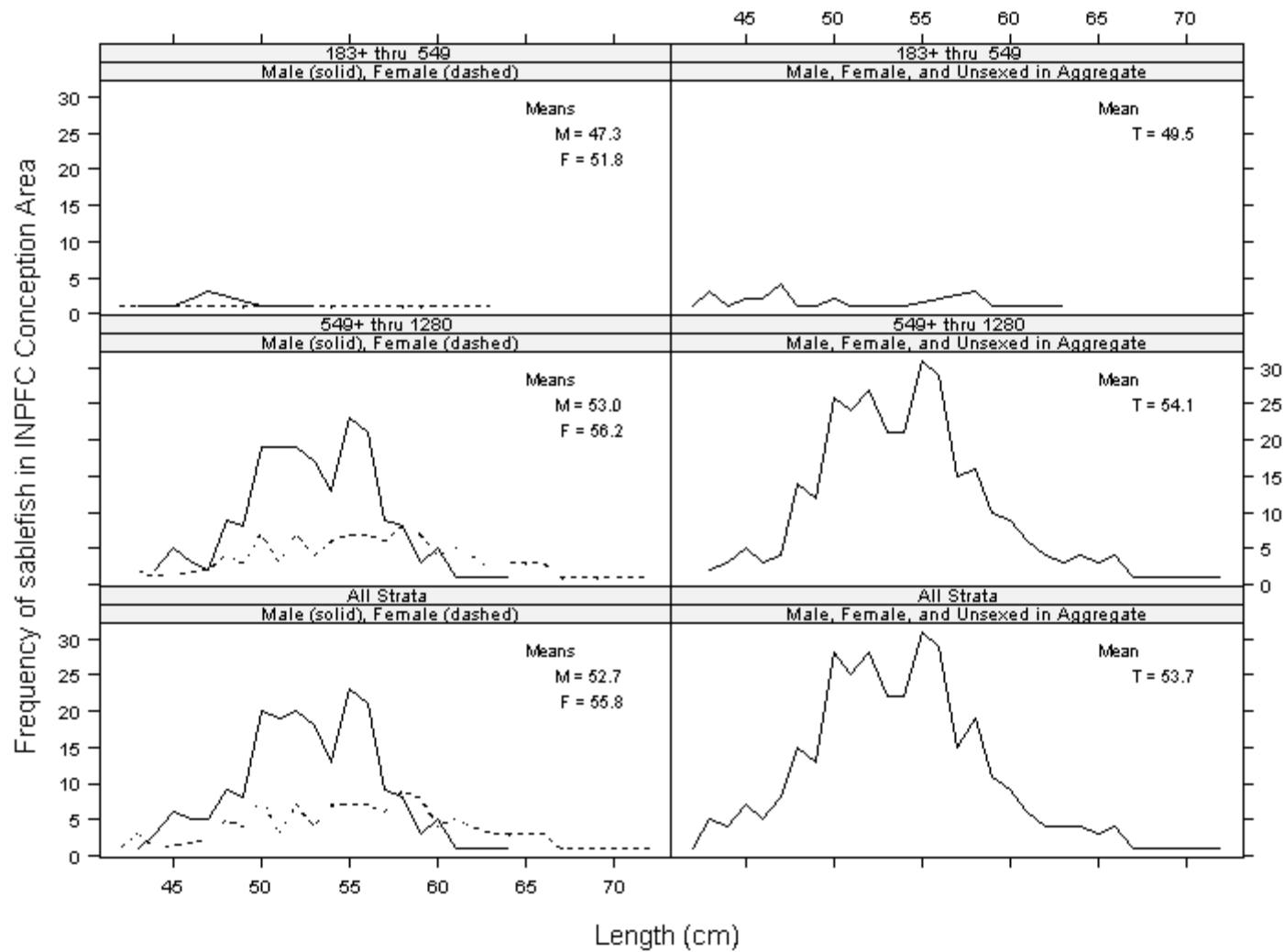


Figure 29. Sablefish. Unweighted length-frequency data and mean lengths (cm) of sablefish by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Conception area from the NWFS slope survey.

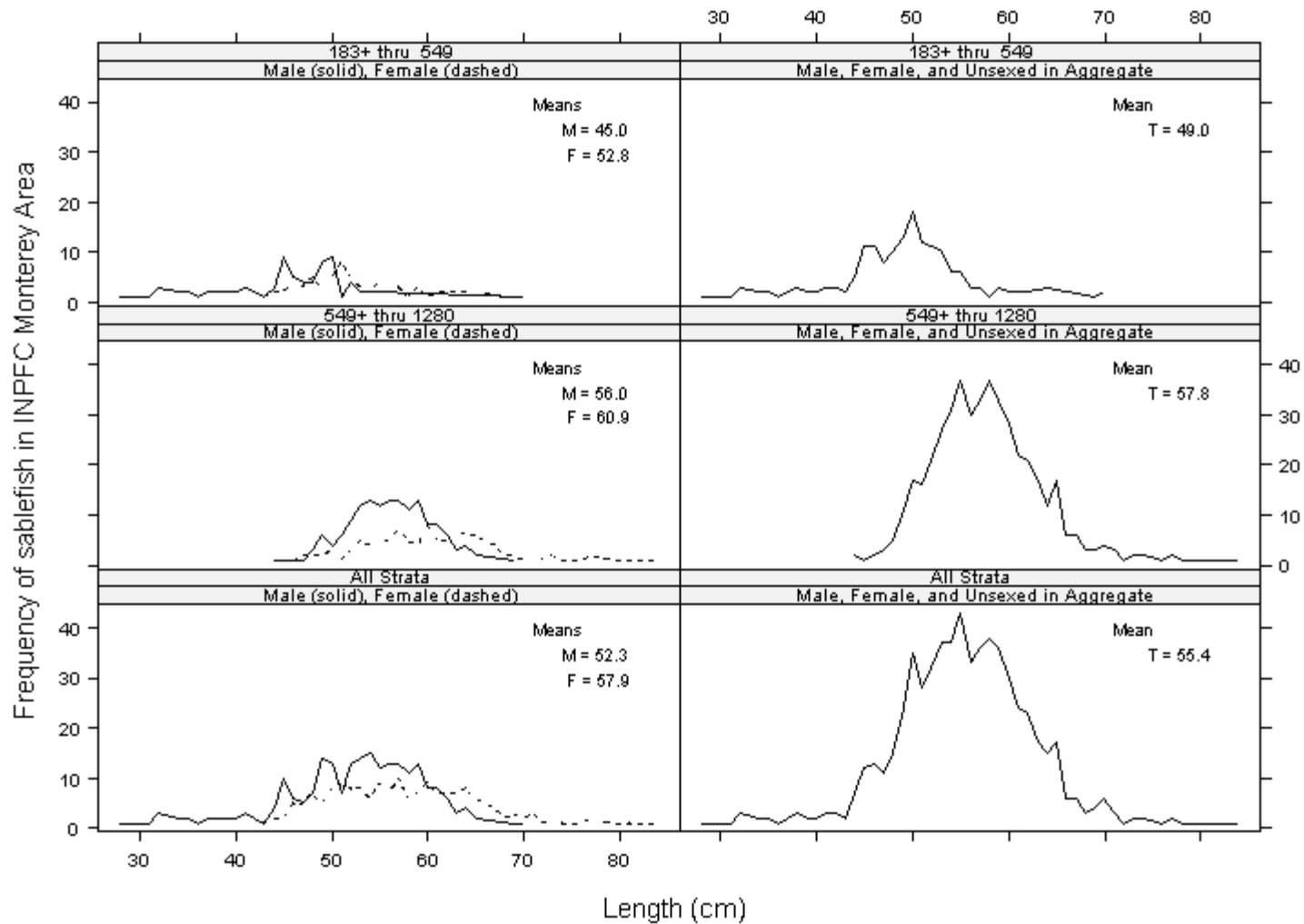


Figure 30. Sablefish. Unweighted length-frequency data and mean lengths (cm) of sablefish by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Monterey area from the NWFS slope survey.

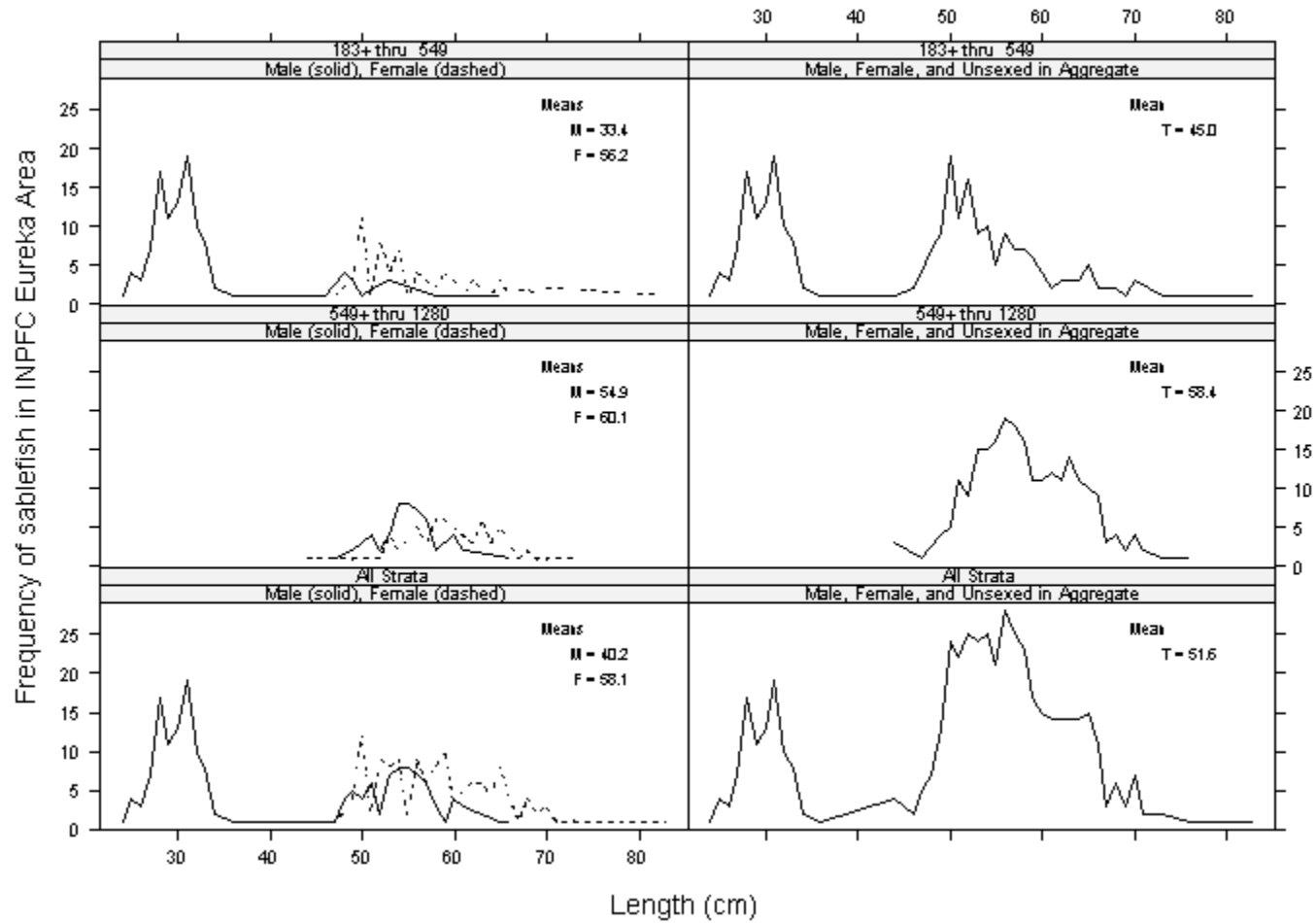


Figure 31. Sablefish. Unweighted length-frequency data and mean lengths (cm) of sablefish by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Eureka area from the NWFSC slope survey.

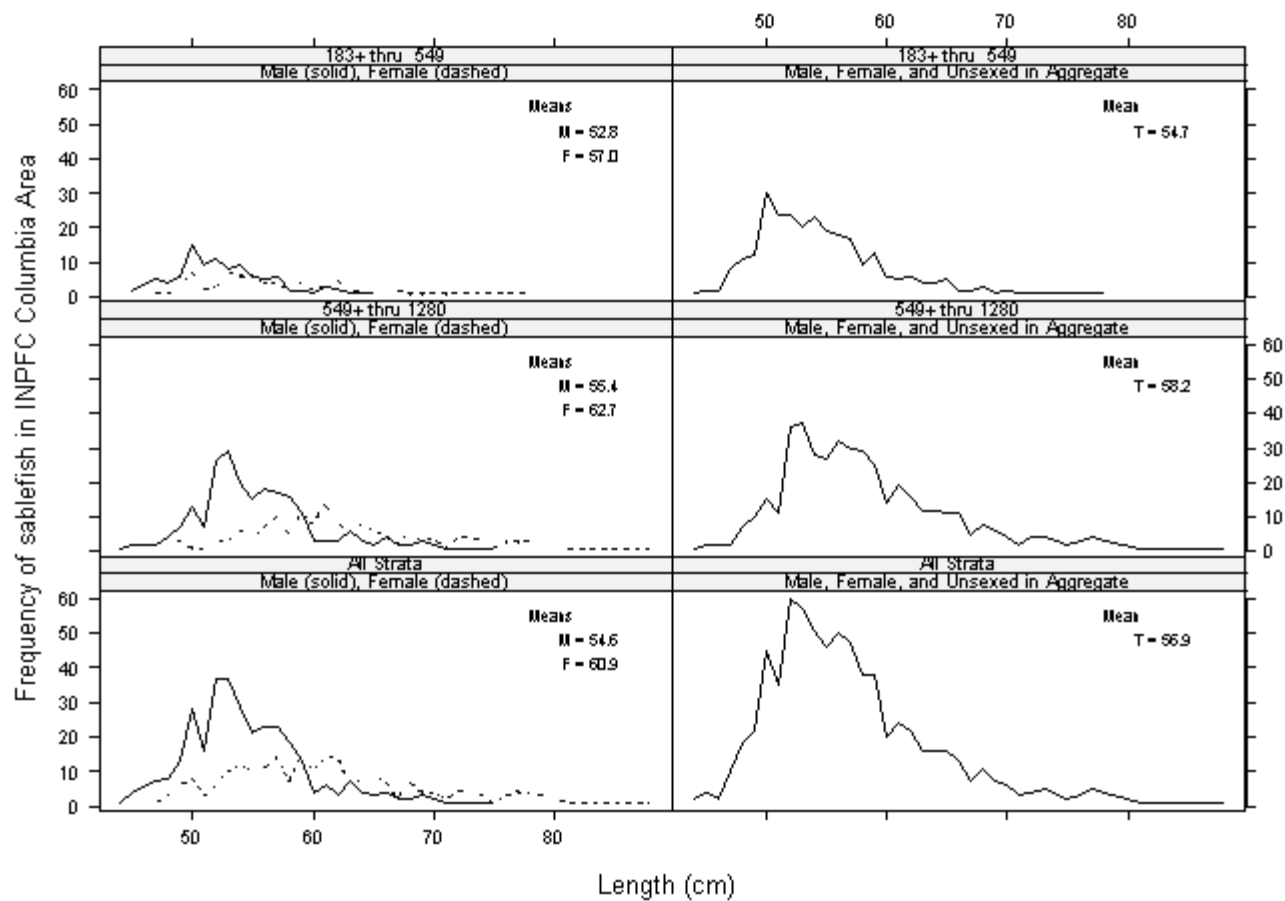


Figure 32. Sablefish. Unweighted length-frequency data and mean lengths (cm) of sablefish by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Columbia area from the NWFS C slope survey.

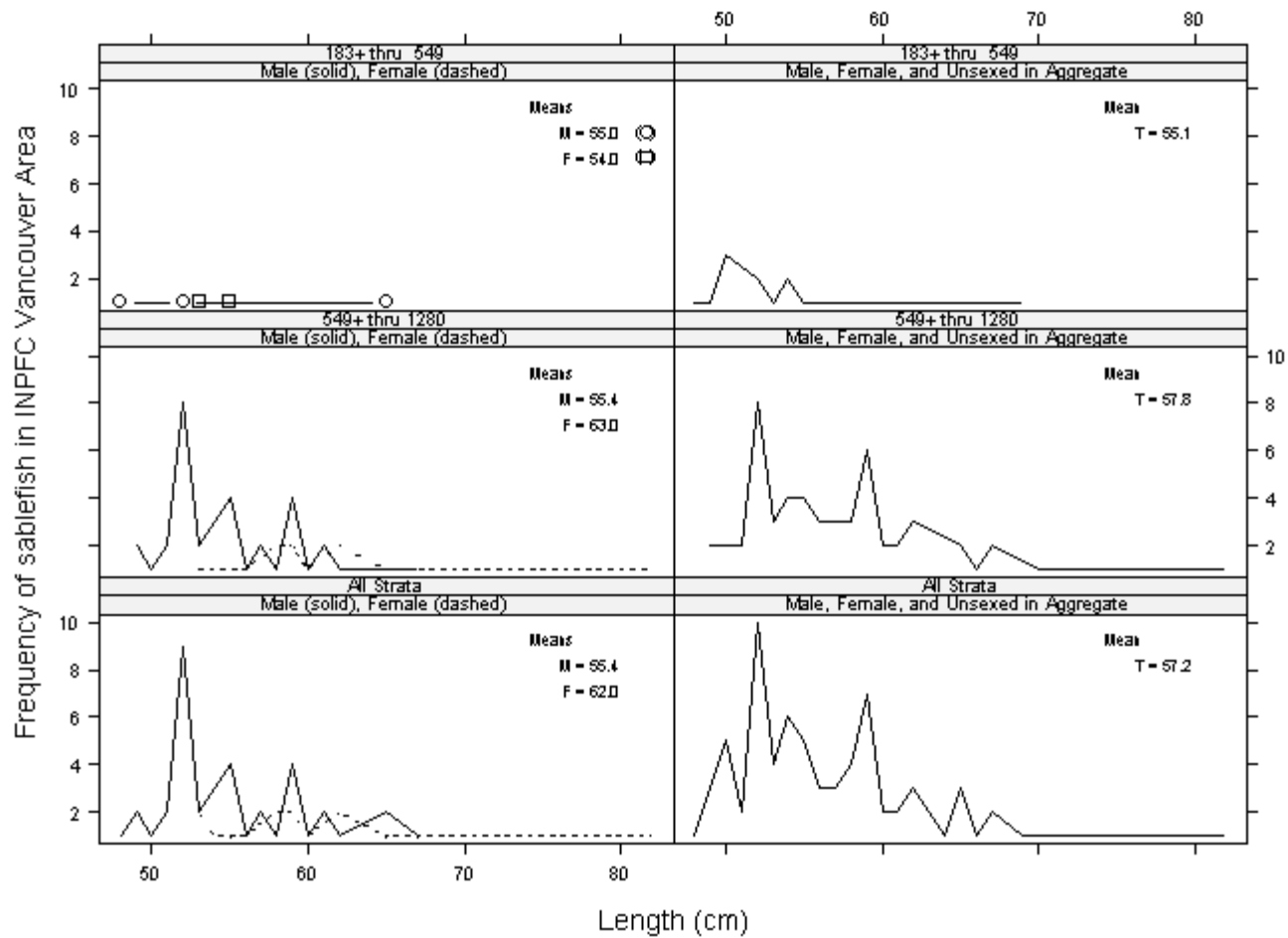


Figure 33. Sablefish. Unweighted length-frequency data and mean lengths (cm) of sablefish by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC U.S.-Vancouver area from the NWFS C slope survey.

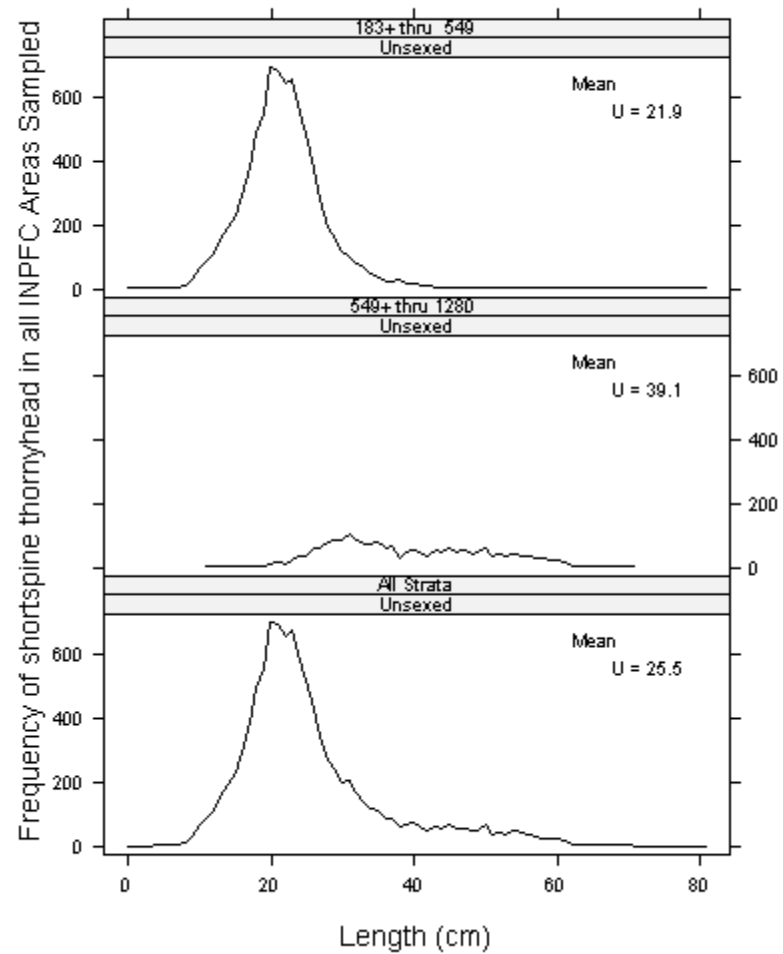


Figure 34. Shortspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of shortspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for all the INPFC areas sampled from the NWFS C slope survey.

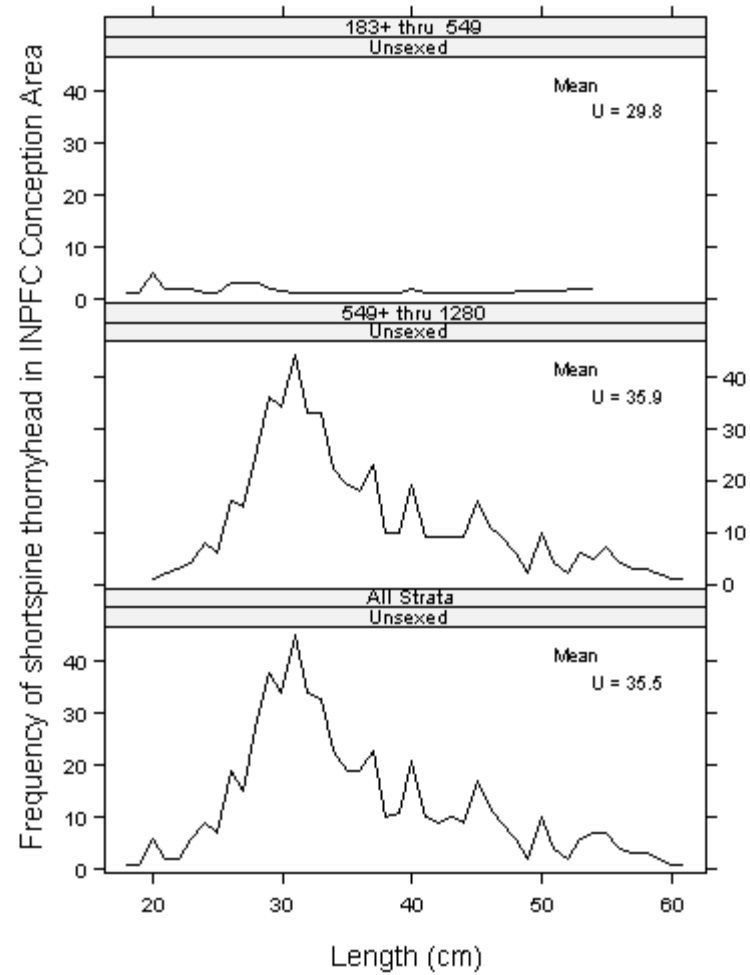


Figure 35. Shortspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of shortspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC C conception area from the NWFS C slope survey.

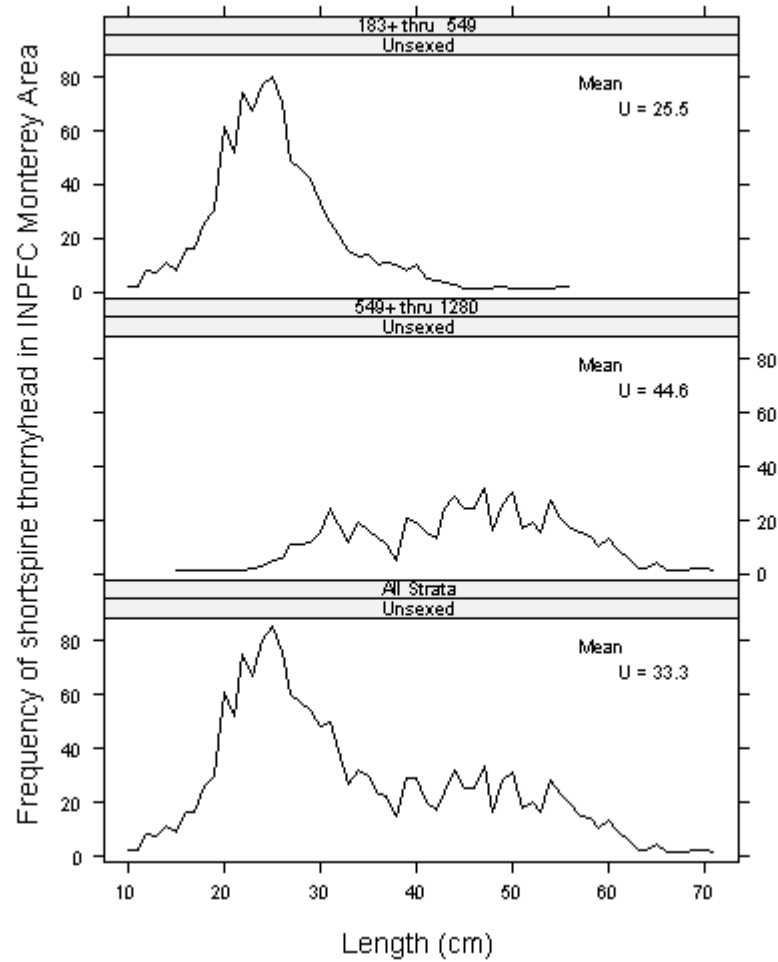


Figure 36. Shortspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of shortspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Monterey area from the NWFSC slope survey.

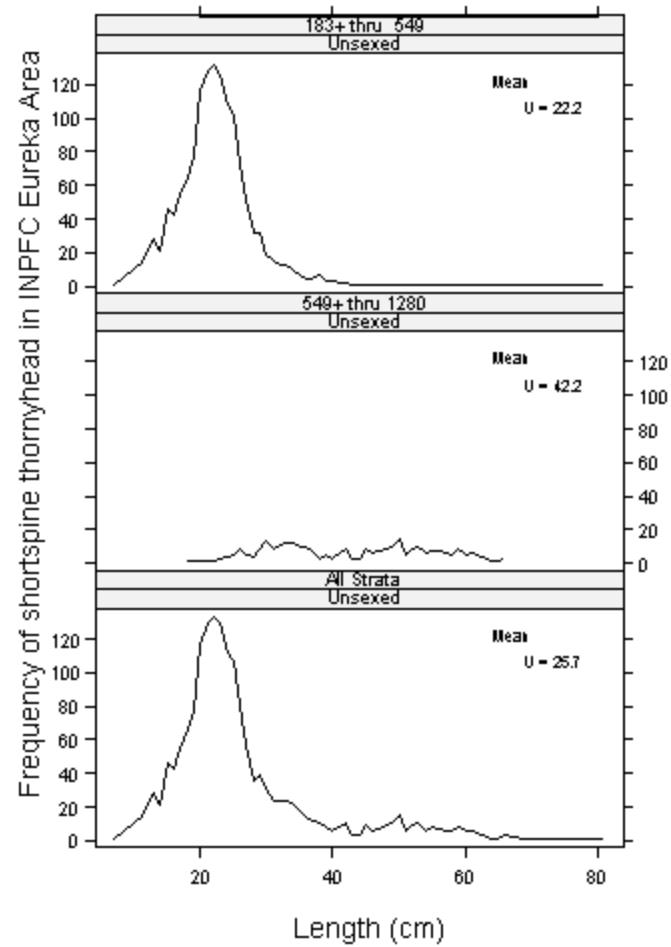


Figure 37. Shortspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of shortspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Eureka area from the NWFSC slope survey.

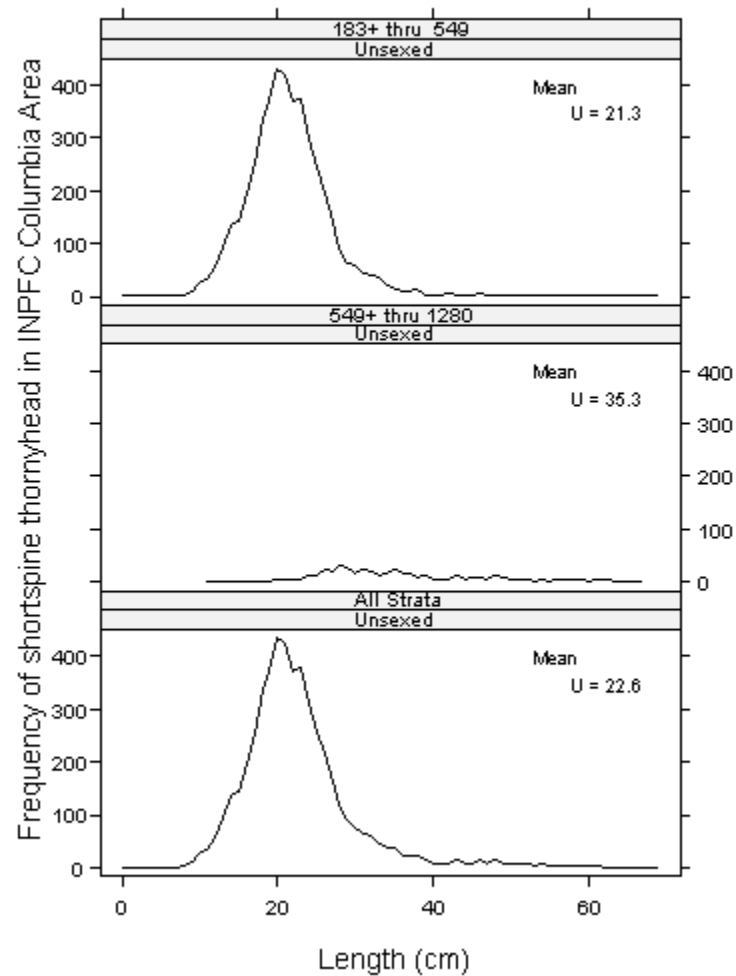


Figure 38. Shortspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of shortspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC Columbia area from the NWFSC slope survey.

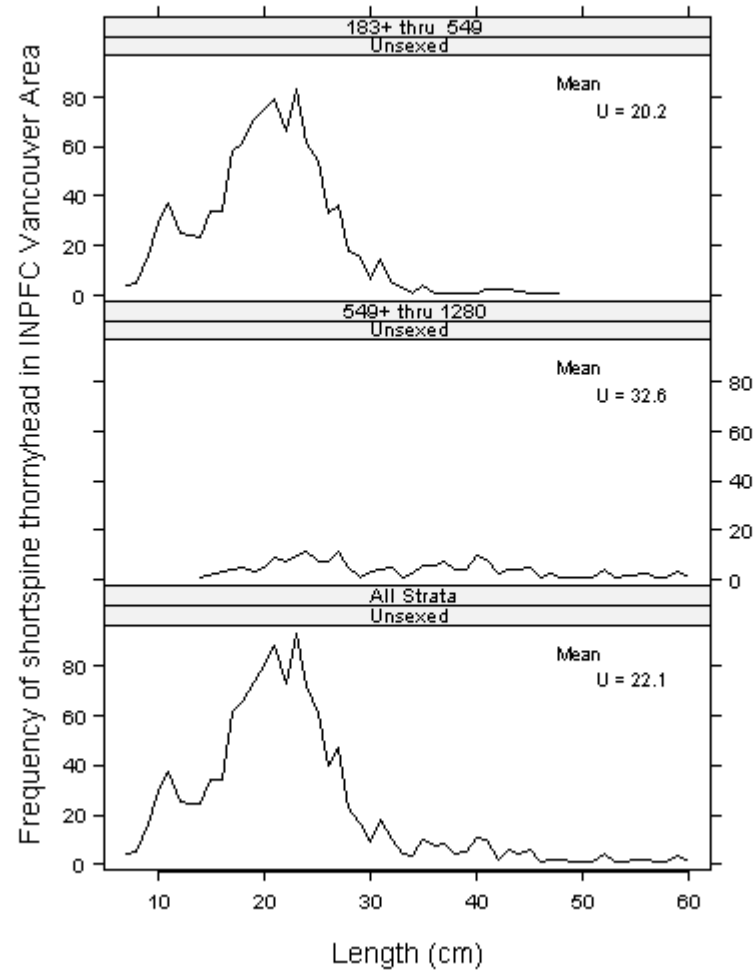


Figure 39. Shortspine thornyhead. Unweighted length-frequency data and mean lengths (cm) of shortspine thornyhead by depth stratum and by sex (T=males, female, and unsexed in aggregate) for the INPFC U.S.-Vancouver area from the NWFSC slope survey.

CITATIONS

- Gunderson, D. R. 1993. Surveys of fisheries resources. John Wiley and Sons, Inc., New York, NY, 248 p.
- Lauth, R. R. 1999. The 1997 Pacific West Coast upper continental slope trawl survey of groundfish resources off Washington, Oregon and California: Estimates of distribution, abundance, and length composition. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-98, 284 p.
- Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). 1976. U.S. Code, Title 16, amended as 16 U.S.C. Section 1801 et seq. (Available at http://www.cmc-ocean.org/2_bp/msfcm a.php3.)
- Methot, R. D., J. R. Wallace, and C. W. West. 2000. Introducing a new trawl survey for U.S. West Coast slope groundfish. Presented at ICES Annual Science Conference, Brugge, Belgium, September, 2000, 16 p.
- S-Plus. 1999. S-Plus 2000 User's Guide. Data analysis products division, Mathsoft, Inc., Seattle, WA.
- West, C. W., and J. W. Wallace. In press. Measurements of Distance Fished During the Trawl Retrieval Period. Fish. Res.

APPENDIX A:
HAUL AND CATCH INFORMATION

APPENDIX A

Haul and Catch Information

Appendix A consists of Table A-1, listing station data and catch data for all hauls from the 1998 NWFSC slope survey of the International North Pacific Fisheries Commission (INPFC) U.S.-Vancouver, Columbia, Eureka, Monterey, and Conception statistical areas. Depths are reported in meters (m), distances fished in meters (m), and catch weights are in kilograms (kg). Geodetic positions are displayed in the table as decimal degrees (e.g., 45.1495 corresponds to 45°14.95'N latitude). Only catches from hauls with a performance code greater than or equal to 0 were used for data analyses. The asterisk (*) indicates species appearance in tow, but no weights were recorded. Performance codes that appear in this appendix are as follows:

<u>Code</u>	<u>Explanation</u>
0	Good performance
1	Satisfactory performance, hung up
1.1	Satisfactory performance, minor hang(s)
1.11	Satisfactory performance, completed tow
3.12	Satisfactory performance, Dungeness crab pot
4.2	Satisfactory performance, caught large quantity of mud
4.5	Satisfactory performance, large invertebrate catch affected net performance
5	Satisfactory performance, unspecified gear performance problem
5.1	Satisfactory performance, net came off bottom
6.31	Satisfactory performance, haulback delayed due to mechanical problems
<hr/>	
-6	Unsatisfactory performance, unspecified problems
-5.7	Unsatisfactory performance, net unable to reach bottom due to strong currents
-5.4	Unsatisfactory performance, unspecified door problem
-5.3	Unsatisfactory performance, weather affected trawl performance
-5.1	Unsatisfactory performance, net came off bottom
-5	Unsatisfactory performance, unspecified gear performance problem
-4.5	Unsatisfactory performance, large invertebrate catch affected net performance
-4.2	Unsatisfactory performance, caught large quantity of mud
-4.1	Unsatisfactory performance, caught large rock
-2.4	Unsatisfactory performance, belly damaged
-1.2	Unsatisfactory performance, major hang, stopped forward progress of vessel
-1	Unsatisfactory performance, hung up

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey.

Haul number	199801001001	199801001002	199801001003	199801001004	199801001005	199801001006	199801001007	199801001008	199801001009	199801001010
Start date and time	8/20/98 16:29	8/20/98 20:08	8/21/98 8:14	8/21/98 10:12	8/21/98 13:13	8/21/98 17:14	8/21/98 20:24	8/22/98 7:22	8/22/98 9:50	8/22/98 12:22
Start latitude (dd)	48.1483	48.1522	47.8493	47.8272		47.8013		46.8162	46.8183	46.8180
Start longitude (dd)	-125.6867	-125.7050	-125.1333	-125.1212		-125.6488		-124.9290	-124.9468	-125.1503
End latitude (dd)	48.1400	48.1450	47.8448	47.8212	47.8230	47.7925	47.7913	46.8080	46.8100	46.8098
End longitude (dd)	-125.6883	-125.7118	-125.1235	-125.1128	-125.4502	-125.6507	-125.6730	-124.9255	-124.9445	-125.1523
Station	1A	1D	5A	5B	5H	5I	5J	9D	9E	9G
Avg. Bottom depth (m)	268.95	444.26	193.40	306.72	914.40	1044.71	1139.10	466.15	539.77	753.82
Duration (hr)	0.35	0.3	0.32	0.39	0.62	0.4	0.5	0.29	0.39	0.36
Distance fished (km)	1.17	0.96	1.06			1.65		1.09		1.45
Net width (m)		14.41	14.00	14.75		15.04	15.14	14.50	14.40	14.67
Performance	0	0	0	0	5	0	0	0	0	5.1
Spiny dogfish	2.0	1.9	81.1	1.5						
Other sharks		0.7				0.2		3.2	0.4	2.6
Skates	5.3	23.1	3.4	29.4		0.2	4.4	6.0	2.8	1.4
Other elasmobranchs			1.0	1.0						
Arrowtooth flounder	73.5	30.5	14.5	26.3				3.0		
Petrale sole			1.8							
Dover sole	50.1	80.4	48.4	35.3				102.1	113.7	*
Deepsea sole					12.4	10.1	15.3		1.3	1.0
Rex sole	2.3	13.7	9.7	4.6				8.5	7.0	
Other flatfish	16.5	9.6	5.9	8.4				0.5		
Sablefish		8.0	3.3	10.2	5.2		5.9	15.0	12.7	3.1
Other grenadier					5.4	30.9	154.9			1.4
Pacific flatnose							3.4		1.4	1.8
Slickheads						0.3	2.4			0.3
Pacific whiting	3.2		1.4	8.7				2.8	3.0	
Fish unidentified	6.2	5.1	2.5	2.3	7.4	6.8	6.6	5.4	7.6	2.6
Shortspine thornyhead	17.2	41.0	0.3	33.4	6.5	13.7	21.4	11.6	10.4	1.2
Longspine thornyhead					170.0	88.6	78.0		3.9	20.0
Other rockfish	301.7	22.3	91.1	26.4				3.7	2.3	
Grooved tanner crab					26.8	35.4	29.2		1.0	15.9
Other invertebrates	10.0	11.1	5.1 *	153.1	20.6	10.5	33.5	32.2	8.4	3.3
Total catch weight by species	488.1	247.4	269.5	340.8	254.1	196.8	355.0	194.0	176.2	54.6

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801001011	199801001012	199801001013	199801001014	199801001015	199801001016	199801001017	199801001018	199801001019	199801001020
Start date and time	8/22/98 14:40	8/22/98 17:18	8/23/98 18:25	8/23/98 19:33	8/24/98 8:06	8/24/98 10:47	8/24/98 13:16	8/24/98 15:33	8/24/98 17:33	8/27/98 6:55
Start latitude (dd)	46.8015		46.1620	46.1233	45.5188	45.4940	45.4850	45.4658	45.4907	44.8303
Start longitude (dd)	-125.1928		-124.6688	-124.6823	-124.8900	-124.8118	-124.7435	-124.4862	-124.4643	-124.5722
End latitude (dd)	46.7918	46.7707	46.1558	46.1148	45.5267	45.5020	45.4777	45.4572	45.4818	44.8218
End longitude (dd)	-125.1918	-125.2403	-124.6768	-124.6840	-124.8830	-124.8087	-124.7428	-124.4820	-124.4628	-124.5762
Station	9I	9J	13B	13D	17H	17G	17	17D	17C	21B
Avg. Bottom depth (m)	1046.35	1139.10	269.95	424.46	1231.06	824.99	522.54	397.42	292.56	298.35
Duration (hr)	0.48	0.65	0.3	0.33	0.42	0.35	0.27	0.34	0.33	0.31
Distance fished (km)	1.88				1.51		0.82	1.28	1.17	1.17
Net width (m)	14.80	15.14	10.75	14.71	14.25	13.43	13.20	14.17	14.40	15.00
Performance	5.1	1.11	-5.1	5.1	0	-4.2	1.11	0	0	0
Spiny dogfish								1.9		1.4
Other sharks	1.0	0.2		1.8						
Skates	1.3	10.5	11.8	0.4	16.8		1.0	4.0	5.4	14.3
Other elasmobranchs			1.0							0.7
Arrowtooth flounder			2.6	6.0				5.2	3.4	6.0
Petrale sole										
Dover sole			21.7	20.7		*	23.3	42.2	34.4	58.6
Deepsea sole	2.8	9.8			3.4	1.6				
Rex sole			0.4	2.1			0.4	5.3	3.3	16.0
Other flatfish			11.7					0.3	4.6	4.8
Sablefish		13.2		20.5	38.6	3.9		9.2	3.9	20.0
Other grenadier	49.8	80.6			63.9	4.8				
Pacific flatnose	1.2	5.1			4.3					
Slickheads	0.3				2.3	1.3				
Pacific whiting			6.9	1.1			5.1	3.1	36.6	18.5
Fish unidentified	6.6	1.6	1.3	0.5	3.0	0.5		4.6	0.8	2.2
Shortspine thornyhead	5.8	8.1	0.7	64.2	2.3	0.6	9.3	12.6	15.6	20.0
Longspine thornyhead	41.9	71.9			33.1	10.9	9.6	0.4		
Other rockfish			32.0	3.4			2.2	10.8	80.7	3.5
Grooved tanner crab	16.8	10.3		7.1	9.5	19.2				
Other invertebrates	4.2	46.8	34.5	10.5	52.0	5.1	12.2	17.1	26.2	3.3
Total catch weight by species	131.7	258.3	124.6	138.3	229.1	47.9	63.0	116.9		169.3

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801001021	199801001022	199801001023	199801001024	199801001025	199801001026	199801001027	199801001028	199801001029	199801001030
Start date and time	8/27/98 10:35	8/27/98 12:29	8/27/98 15:00	8/27/98 18:10		8/28/98 8:54	8/28/98 11:24	8/28/98 14:24	8/28/98 16:31	8/28/98 18:47
Start latitude (dd)	44.8422	44.7958	44.8377	44.8600		44.1427	44.1298	44.1490	44.1640	44.1483
Start longitude (dd)	-124.6720	-124.7818	-124.9875	-125.0108		-125.0563	-125.0385	-124.9932	-124.9848	-124.9702
End latitude (dd)	44.8328	44.7883	44.8452	44.8618	44.1253	44.1513	44.1367	44.1382	44.1397	44.1578
End longitude (dd)	-124.6752	-124.7877	-124.9960	-125.0262	-125.0555	-125.0547	-125.0272	-124.9928	-124.9835	-124.9720
Station	21C	21D	21H	21I	25J	25J	25H	25E	25C	25B
Avg. Bottom depth (m)	400.55	449.39	966.02	1069.57	1207.01	1275.70	999.69	469.07	385.99	301.05
Duration (hr)	0.32	0.32	0.48	0.46		0.29	0.41	0.3	0.28	0.3
Distance fished (km)	1.19		1.83	1.89			1.82	1.21	1.36	1.27
Net width (m)	15.00	15.00	15.00	15.00		14.00	14.44	14.00	14.00	14.29
Performance	0	0	0	0	-5.7	0	1.11	-5.1	0	0
Spiny dogfish									706.7	1.2
Other sharks		1.9	0.5							
Skates	3.2	2.4	1.4	3.1		9.3	3.1	7.5	14.9	43.5
Other elasmobranchs	1.8	0.9							4.8	5.4
Arrowtooth flounder	6.3	5.1						1.2		2.3
Petrale sole										
Dover sole	23.3	6.3					23.0	84.8	103.3	147.8
Deepsea sole			0.9	4.4		1.2	20.5			
Rex sole	0.1	1.4						18.8	10.0	59.6
Other flatfish	21.4							0.1	0.5	46.7
Sablefish	6.5	15.7	9.4	11.8		17.2	17.5	10.6	7.9	24.2
Other grenadier			12.7	46.9		180.9	28.9			
Pacific flatnose			2.4	2.4		7.1				
Slickheads			3.2	11.9		2.8	1.2			
Pacific whiting	14.7	11.5						3.5	3.1	5.2
Fish unidentified	3.0	4.1	13.4	10.4		2.2	5.2	1.9	2.3	8.0
Shortspine thornyhead	9.8	14.0	0.5	10.4		1.8	36.3	3.4	8.5	5.5
Longspine thornyhead			64.6	73.6		21.9	86.0	0.9		
Other rockfish	6.8	3.6						4.0	0.6	17.5
Grooved tanner crab		0.6	30.2	16.9		12.7	36.8	0.9		
Other invertebrates	23.6	8.6	8.3	19.9		24.7	8.0	4.3	5.2	49.4
Total catch weight by species	120.5	76.1	147.5	211.7		281.8	266.5	141.9	867.8	416.3

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801001031	199801001032	199801001033	199801001034	199801001035	199801001036	199801001037	199801001038	199801001039	199801001040
Start date and time	8/29/98 7:01	8/29/98 8:36	8/29/98 11:16	8/28/98 13:36	8/29/98 15:55	8/30/98 8:29	8/30/98 11:14	8/30/98 13:52	8/30/98 15:59	8/31/98 6:55
Start latitude (dd)	43.4552	43.4907	43.4788	43.4782		42.8107	42.7967	42.8147	42.8183	42.1767
Start longitude (dd)	-124.6808	-124.6965	-124.9112	-124.9552		-124.9397	-124.9010	-124.7955	-124.7705	-124.5933
End latitude (dd)	43.4638	43.4817	43.4697	43.4685		42.8183	42.8038	42.8233	42.8268	42.1858
End longitude (dd)	-124.6767	-124.6985	-124.9115	-124.9550		-124.9463	-124.9082	-124.7990	-124.7742	-124.5935
Station	29C	29D	29G	29H	29I	33F	33D	33B	33A	37A
Avg. Bottom depth (m)	378.78	456.18	776.98	965.04	1057.93	630.75	436.24	300.83	224.39	227.69
Duration (hr)	0.29	0.28	0.32	0.34	0.65	0.33	0.29	0.31	0.33	0.3
Distance fished (km)	1.17	1.13	1.26	1.41		1.3		1.19	1.28	1.12
Net width (m)	14.86	14.14	15.00	14.89	13.60	15.29	14.33	13.88	13.50	14.14
Performance	0	0	0	0	-1.1	0	0	0	0	0
Spiny dogfish	1.0	0.3						0.3		5.0
Other sharks			1.2	0.5		3.5	1.7			
Skates	10.7	2.3	0.7				18.7	5.7	19.5	7.7
Other elasmobranchs								2.6	2.9	2.4
Arrowtooth flounder	1.0	1.9				1.5		0.6		0.7
Petrale sole									0.5	
Dover sole	9.5	15.4	3.3		1.3	27.9	141.4	59.8	25.7	13.1
Deepsea sole			2.4	2.2	13.4					
Rex sole	7.7	17.3				1.3	12.7	30.7	7.4	4.5
Other flatfish							0.2	8.0	7.9	0.7
Sablefish	10.4	4.4	6.3			36.4	2.7	1.2		3.1
Other grenadier			14.0	20.1	94.7					
Pacific flatnose			0.6	0.9	2.1					
Slickheads			0.8	4.0	0.2					
Pacific whiting	4.2	2.3					1.0	13.3	166.0	35.4
Fish unidentified	0.9	1.8	1.2	2.5	4.4	0.4	0.8	3.1	0.6	0.7
Shortspine thornyhead	10.8	14.4	3.7	0.7		41.4	2.2	5.3	1.3	1.1
Longspine thornyhead			26.8	17.0	27.3		0.4			
Other rockfish	2.9	2.2					2.7		1.0	43.8
Grooved tanner crab			28.2	18.9	29.5	9.5	0.8	4.9		
Other invertebrates	21.3	85.8	6.8	4.7	8.1	4.0	6.7	6.9	9.6	8.0
Total catch weight by species	80.4	148.1	96.0	71.5	181.0	125.9	192.0	142.4	242.4	126.2

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801001041	199801001042	199801001043	199801001044	199801001045	199801001046	199801001047	199801001048	199801001049	199801001050
Start date and time	8/31/98 8:55	8/31/98 11:14	8/31/98 13:40	8/31/98 16:06	9/2/98 8:16	9/2/98 11:22	9/2/98 14:03	9/2/98 16:08	9/2/98 18:22	9/3/98 7:15
Start latitude (dd)	42.1492	42.1038	42.1583	42.1708	41.4806	41.5235	41.5173	41.4612	41.5118	40.8182
Start longitude (dd)	-124.6655	-124.7248	-124.8762	-124.9167	-124.9612	-124.7093	-124.5608	-124.5273	-124.5340	-124.4385
End latitude (dd)	42.1582	42.1127	42.1675	42.1808	41.4868	41.5208	41.5090	41.4718	41.5033	40.8262
End longitude (dd)	-124.6677	-124.7268	-124.8777	-124.9173	-124.9518	-124.6980	-124.5615	-124.5297	-124.5313	-124.4318
Station	37E	37F	37H	37I	41I	41H	41F	41E	41D	45A
Avg. Bottom depth (m)	513.05	633.86	923.71	1066.16	1060.70	953.16	618.44	496.16	415.92	220.51
Duration (hr)	0.31	0.29	0.36	0.54	0.37	0.35	0.31	0.35	0.28	0.29
Distance fished (km)	1.27	1.22	1.56	2.42	1.4	1.29	1.15	1.42	1.02	1.06
Net width (m)	15.00	15.00	15.56	15.00		15.17	15.00	14.67	14.40	14.75
Performance	0	0	0	0	-5.1	0	0	5.1	0	0
Spiny dogfish										1.6
Other sharks	0.7	0.7	0.5		0.5	2.2	1.5	1.8	1.0	
Skates	2.0			2.1				6.2		4.8
Other elasmobranchs										0.2
Arrowtooth flounder								5.7	0.6	
Petrale sole										
Dover sole	87.5	31.9	6.9	5.8	2.6	14.0	24.7	55.7	77.0	5.9
Deepsea sole			1.2	6.0	8.4	5.6				
Rex sole	27.3	20.2					3.5	13.2	6.9	2.1
Other flatfish	0.2									2.7
Sablefish	7.5	9.3	19.3	15.4	2.7	10.3	8.9	18.2	5.7	
Other grenadier			14.9	102.3	49.6	1.7				
Pacific flatnose		0.2	0.7	3.0	2.0	0.8	1.0			
Slickheads		0.1	0.3	23.8	0.2	0.8				
Pacific whiting	2.8	2.4					2.0	2.6	5.1	30.0
Fish unidentified	5.1	2.2	2.2	5.2	4.2	3.0	9.8	5.3	3.7	0.4
Shortspine thornyhead	5.3	3.5	0.5	5.9	1.5		4.3	15.2	11.3	0.0
Longspine thornyhead	4.8	26.6	61.8	75.3	10.1		3.9	2.3		
Other rockfish	0.6							8.7	12.4	149.4
Grooved tanner crab		2.3	17.2	28.8	8.4	11.7				
Other invertebrates	11.6	3.3	6.2	14.9	27.0	32.0	5.1	41.8	15.8	30.9
Total catch weight by species	155.4	102.7	131.7	288.5	117.2	82.1	64.7	176.7	139.5	228.0

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801001051	199801001052	199801001053	199801001054	199801001055	199801001056	199801001057	199801001058	199801001059	199801001060
Start date and time	9/3/98 9:00	9/3/98 11:06	9/3/98 13:41	9/3/98 16:00	9/4/98 7:32	9/4/98 10:27	9/4/98 12:56	9/4/98 14:47	9/4/98 16:27	9/5/98 7:08
Start latitude (dd)	40.8602	40.8692	40.7907	40.7852	40.2263	40.2252	40.1803	40.1497	40.1368	39.5073
Start longitude (dd)	-124.4413	-124.6177	-124.7043	-124.7492	-124.9893	-124.7997	-124.5445	-124.3815	-124.3427	-123.9958
End latitude (dd)	40.8515	40.8783	40.7970	40.7947	40.2365	40.2190	40.1757	40.1438	40.1448	39.4993
End longitude (dd)	-124.4418	-124.6195	-124.6965	-124.7477	-124.9958	-124.7910	-124.5355	-124.3733	-124.3475	-123.9958
Station	45B	45F	45H	45J	49I	49G	49F	49C	49B	53D
Avg. Bottom depth (m)	304.51	627.13	933.67	1217.09	1053.44	764.73	619.18	386.78	308.27	438.90
Duration (hr)	0.28	0.29	0.33	0.3	0.4	0.27	0.3	0.26	0.3	0.26
Distance fished (km)	1.03	1.26	1.27	0.98	1.98	1.12	1.04	0.95	1.11	0.98
Net width (m)	14.25	15.67	15.00	14.25	15.00	14.67	15.00	14.25	14.00	14.25
Performance	0	0	0	0	0	0	0	0	0	0
Spiny dogfish								0.6		
Other sharks	1.1	1.0	1.3	1.6	4.2	6.5	1.4	0.1	0.3	3.4
Skates	75.6	4.2		9.2	0.6		1.0	11.7	12.4	4.4
Other elasmobranchs	1.4							19.1	11.0	3.5
Arrowtooth flounder									0.3	
Petrale sole										
Dover sole	85.4	48.3	24.4	22.3	1.5	59.1	41.4	118.9	88.0	71.3
Deepsea sole			0.8	20.5	1.0					
Rex sole	16.2	14.2						24.5	12.0	9.3
Other flatfish										
Sablefish	6.0	9.1	7.4	20.7	31.2	10.9	22.0	1.6	3.4	13.7
Other grenadier			9.5	126.4	60.4	1.7	0.6			
Pacific flatnose		0.4	1.2	8.1	1.5					
Slickheads		0.2	6.1		5.1	6.6				
Pacific whiting	273.2						0.6	9.7	32.6	18.6
Fish unidentified	9.9	3.2	1.1		1.5	2.3	2.2	3.3	2.6	6.7
Shortspine thornyhead	1.0	4.3	7.6	21.3	11.0	2.1	6.0	6.3	6.9	4.7
Longspine thornyhead		25.0	45.5	46.9	88.5	38.3	14.4			
Other rockfish	28.4							0.5	8.1	24.7
Grooved tanner crab		12.8	12.2	5.9	8.5	36.2	0.2			
Other invertebrates	21.0	18.5	4.0	91.2	51.4	1.8	11.1	21.5	94.7	40.2
Total catch weight by species	519.2	141.2	121.1	374.1	266.4	165.5	100.9	217.8	272.3	200.

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801001061	199801001062	199801001063	199801001064	199801001065	199801001066	199801001067	199801001068	199801001069	199801001070
Start date and time	9/4/98 9:09	9/5/98 10:43	9/5/98 12:30	9/5/98 15:02	9/6/98 8:02	9/6/98 10:05	9/6/98 11:14	9/6/98 12:24	9/6/98 13:37	9/10/98 7:31
Start latitude (dd)	39.4570	39.4998	39.4877	39.5012	38.8828	38.9077	38.8807	38.8453	38.8077	37.5000
Start longitude (dd)	-124.0160	-124.0388	-124.0928	-124.2097	-124.0267	-124.0075	-123.9732	-123.9382	-123.8703	-122.9782
End latitude (dd)	39.4657	39.4913	39.4977	39.5105	38.8752	38.9043	38.8735	38.8387	38.8013	37.5067
End longitude (dd)	-124.0155	-124.0422	-124.0907	-124.2027	-124.0188	-123.9977	-123.9687	-123.9312	-123.8637	-122.9860
Station	53E	53F	53G	53J	57J	57F	57E	57D	57B	65A
Avg. Bottom depth (m)	519.49	618.07	776.87	1217.84	1145.98	624.11	501.84	446.94	302.44	226.37
Duration (hr)	0.25	0.27	0.32	0.36	0.35	0.26	0.26	0.27	0.28	0.29
Distance fished (km)		1.12	1.49	1.63	1.43	1.1	0.96	0.97	0.98	1.02
Net width (m)	12.00	14.20	15.00	15.23	15.15	14.00	13.50	13.20	13.86	14.00
Performance	-4.5	0	0	0	0	0	0	0	0	0
Spiny dogfish								3.9	217.6	1.5
Other sharks	0.4	2.4	3.1			2.5				
Skates	0.9	1.3		12.7	10.9	1.9	32.8	82.2	11.9	4.6
Other elasmobranchs										
Arrowtooth flounder										
Petrale sole										2.2
Dover sole	25.3	24.7	31.1	26.3	11.5	8.8	36.3	11.4	60.9	75.8
Deepsea sole		1.9	3.4	13.4	16.6	0.9				
Rex sole	7.6	0.9				12.6	14.8	2.8	5.1	2.4
Other flatfish							0.4		0.7	0.2
Sablefish	5.4	11.7	6.8	17.9		5.2		2.7		
Other grenadier		2.4	0.9		93.7					
Pacific flatnose		0.2	0.6	7.1	2.8	0.6				
Slickheads			3.8	4.1	3.0					
Pacific whiting	2.7	0.8				1.8	26.9	279.8	8.6	0.7
Fish unidentified	2.2	1.4	3.4	1.5	4.5	6.4	3.4	1.2	0.2	0.5
Shortspine thornyhead	4.8	5.3	3.6	34.0	6.1	1.4	0.4	0.4		
Longspine thornyhead	10.7	20.4	36.6	30.8	33.5	2.4	*	0.2		
Other rockfish	12.1	1.0					1.1	24.8	212.7	147.5
Grooved tanner crab		2.9	6.0	9.2	5.9					
Other invertebrates	9.3	7.8	6.0	21.7	39.5	2.4		78.2	18.7	11.3
Total catch weight by species	81.4	85.1	105.3	178.7	228.0	46.9	116.1	487.6	536.4	246.7

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801001071	199801001072	199801001073	199801001074	199801001075	199801001076	199801001077	199801001078	199801001079	199801001080
Start date and time	9/10/98 9:26	9/10/98 11:44	9/10/98 14:20	9/10/98 18:05	9/11/98 9:09	9/11/98 11:37	9/11/98 14:14	9/11/98 16:15	9/11/98 18:35	9/12/98 8:17
Start latitude (dd)	37.4552	37.4708	37.4860	37.4382	36.7765	36.7730	36.7735	36.8320	36.8700	36.1772
Start longitude (dd)	-123.0013	-123.0577	-123.1478	-123.2067	-122.3003	-122.2768	-122.2518	-122.1713	-122.2005	-121.7630
End latitude (dd)	37.4630	37.4790	37.4960	37.4480	36.7850	36.7830	36.7823	36.8233	36.8667	36.1797
End longitude (dd)	-123.0055	-123.0595	-123.1483	-123.2020	-122.2940	-122.2777	-122.2550	-122.1683	-122.1917	-121.7733
Station	65B	65F	65H	65I	69J	69H	69G	69C	69A	73C
Avg. Bottom depth (m)	442.89	619.62	923.38	1078.37	1186.47	928.36	762.35	328.35	217.13	361.32
Duration (hr)	0.29	0.3	0.44	0.47	0.36	0.36	0.33	0.32	0.28	0.3
Distance fished (km)	1.08	1.22	1.7	1.94	1.36	1.46	1.42	1.24	0.91	1.2
Net width (m)	14.20	15.00	10.89		14.00	15.00	15.00	13.33	13.00	14.83
Performance	0	0	5	-5.1	0	0	0	5.1	-5	0
Spiny dogfish										16.1
Other sharks	2.1	12.0	1.2	1.4	0.7	6.0	3.5			
Skates	8.5	1.5		32.0	16.2			20.7	0.1	40.4
Other elasmobranchs								3.1	0.2	7.0
Arrowtooth flounder										
Petrale sole								5.0		
Dover sole	192.3	44.3	246.6	80.9	209.0	126.2	93.7	36.9	2.3	1.3
Deepsea sole			13.6	21.2	15.8		1.1			
Rex sole	12.3							10.8		
Other flatfish									1.9	1.0
Sablefish	3.6	11.9	6.8	33.6	11.6	5.2	4.3	1.2		
Other grenadier		0.5	9.4	127.6	119.9	15.3	0.7			
Pacific flatnose		0.6	0.7	5.7	2.7	2.9	0.5			
Slickheads		0.2	3.8	4.9	12.1	2.7	3.1			
Pacific whiting	9.4	0.5			*			3.3		2.7
Fish unidentified	5.1	10.8	2.9	12.7	2.6	6.5	1.3	10.0	0.1	7.0
Shortspine thornyhead	3.1	4.9	18.9	36.8	23.8	10.9	7.1	2.3		
Longspine thornyhead		5.0	97.4	42.3	20.8	43.2	38.0			
Other rockfish	43.3							470.9	35.1	117.4
Grooved tanner crab			19.0	8.8	16.8	20.0	27.1			
Other invertebrates	18.7	2.2	12.3	9.2	27.4	6.6	2.5	5.0	1.3	1.9
Total catch weight by species	298.4	94.4	432.6	417.1	479.4	245.5	182.9	569.2	41.0	194.8

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801001081	199801001082	199801001083	199801001084	199801001085	199801001086	199801001087	199801001088	199801002001	199801002002
Start date and time	9/12/98 11:10	9/12/98 13:26	9/12/98 15:50	9/13/98 7:23	9/13/98 10:58	9/13/98 13:44	9/13/98 15:20	9/13/98 17:00	8/20/98 10:24	8/20/98 15:16
Start latitude (dd)	36.2375	36.1943	36.1693	35.5337	35.5158	35.4765	35.4448	35.4567	47.8535	47.8466
Start longitude (dd)	-122.0765	-122.0645	-122.0700	-121.9508	-121.5953	-121.3758	-121.2657	-121.1148	-125.1884	-125.2990
End latitude (dd)	36.2320	36.1888	36.1625	35.5400	35.5097	35.4680	35.4362	35.4502	47.8569	47.8490
End longitude (dd)	-122.0683	-122.0553	-122.0575	-121.9607	-121.5862	-121.3717	-121.2627	-121.1072	-125.2010	-125.3111
Station	73F	73H	73I	77J	77H	77F	77D	77A	3B	3E
Avg. Bottom depth (m)	605.81	909.38	1065.98	1186.78	930.29	624.56	440.60	227.01	316.48	512.06
Duration (hr)	0.32	0.35	0.52	0.37	0.31	0.29	0.27	0.29	0.35	0.35
Distance fished (km)	1.27	1.4		1.59	1.34	1.22	1.08	1.06	1.13	1.12
Net width (m)	14.80	15.00	15.07	15.19	15.17	15.20	14.25	14.00	13.63	
Performance	0	0	0	0	0	0	0	0	0	0
Spiny dogfish								16.1	2.1	
Other sharks	7.7	1.8	3.6	7.8	0.1	8.6	8.4			2.8
Skates		0.4			2.5	1.6	1.9	40.4	4.0	4.0
Other elasmobranchs	0.7							7.0	1.6	
Arrowtooth flounder									11.2	
Petrale sole										
Dover sole	122.5	35.3			45.0	51.6	0.3	1.3	98.1	102.9
Deepsea sole	0.5	6.5	7.3		3.5	0.8				1.0
Rex sole	0.2						0.7		2.7	0.7
Other flatfish								1.0	1.2	
Sablefish	1.7	3.7	53.5	2.7	12.8		8.2		5.9	4.6
Other grenadier		5.7	117.8	53.1	9.7					1.9
Pacific flatnose		0.3	0.6	3.7	0.1					1.0
Slickheads	1.1	7.6	15.2	21.8	28.7	0.3				
Pacific whiting						0.2	7.7	2.7	3.7	1.5
Fish unidentified	8.7	2.9	2.1	1.3	5.4	0.4	0.8	7.0	0.3	2.7
Shortspine thornyhead	28.8	5.0	41.1	3.9	20.6	13.1	1.6		19.8	8.8
Longspine thornyhead	31.1	86.7	78.6	7.6	73.9	16.2				1.0
Other rockfish	3.0					0.6	17.7	117.4	1.7	0.2
Grooved tanner crab		1.2	16.9		3.3					
Other invertebrates	3.2	49.7	20.3	12.2	8.7	19.5	6.6	1.9	42.5	19.0
Total catch weight by species	209.2	206.8	357.0	114.1	214.3	112.9	53.9	194.8	194.8	152.1

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801002003	199801002004	199801002005	199801002006	199801002007	199801002008	199801002009	199801002010	199801002011	199801002012
Start date and time	8/20/98 18:00	8/20/98 20:00	8/21/98 9:06	8/21/98 13:10	8/21/98 17:10	8/21/98 19:08	8/22/98 7:53	8/22/98 9:35	8/22/98 12:59	8/22/98 15:27
Start latitude (dd)	47.8660	47.8444	47.1837	47.2339	47.2484	47.2215	46.5036	46.4957	46.5208	46.4790
Start longitude (dd)	-125.3586	-125.4124	-125.1253	-125.0793	-125.0005	-124.8982	-124.5187	-124.5268	-124.6061	-124.7458
End latitude (dd)	47.8667	47.8401	47.1797	47.2290	47.2420	47.2166	46.4990	46.4874	46.5113	46.4741
End longitude (dd)	-125.3547	-125.4210	-125.1338	-125.0775	-124.9993	-124.9057	-124.5200	-124.5263	-124.6157	-124.8256
Station	3G	3H	7J	7G	7D	7C	11C	11F	11F	11G
Avg. Bottom depth (m)	768.10	992.85	1291.44	763.70	440.08	398.81	365.76	433.56	666.94	760.05
Duration (hr)	0.49	0.61	0.72	0.62	0.47	0.4	0.45	0.37	0.65	0.56
Distance fished (km)	1.06	1.55		1.41	1.37	1.03			2.15	
Net width (m)	15.00	14.35	14.67	14.60	14.00	13.67	13.00	13.86	13.80	13.83
Performance	1.11	1.11	1.11	4.2	1.11	0	-1	-1	0	-1
Spiny dogfish										
Other sharks	0.4			0.9	1.8			0.6	0.6	
Skates	1.2			0.4	1.7	16.8		5.0	1.0	
Other elasmobranchs										
Arrowtooth flounder						3.1	0.8	9.5	4.4	
Petrale sole										
Dover sole	13.1	5.9		7.6	66.8	102.1		69.9	131.0	26.9
Deepsea sole	2.6	5.2		5.3	4.9				1.2	3.3
Rex sole					2.1	3.3		16.7	0.7	
Other flatfish										
Sablefish	4.8	8.7		59.1	2.6	4.0		26.0	48.4	8.7
Other grenadier	4.3	9.9		12.5					2.6	1.3
Pacific flatnose	0.3			1.0					1.9	0.2
Slickheads	0.6			1.3						
Pacific whiting				0.3				0.8		
Fish unidentified	5.4	4.6	0.6	2.2	3.7	4.1		5.8	18.5	1.0
Shortspine thornyhead	8.7	7.8		15.1	11.5	35.3		116.2	16.1	4.9
Longspine thornyhead	18.3	61.4		69.3	8.4	0.0			9.9	16.7
Other rockfish					2.7	48.5		2.7	0.7	
Grooved tanner crab	17.7	24.1	*	22.9					13.6	9.9
Other invertebrates	4.3	11.3	0.1 *	14.8	8.4	31.6		271.3	25.7	13.6
Total catch weight by species	81.7	138.9	0.7	212.7	117.7	246.5		524.5	276.3	86.5

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801002013	199801002014	199801002015	199801002016	199801002017	199801002018	199801002019	199801002020	199801002021	199801002022
Start date and time	8/22/98 18:04	8/23/98 6:59	8/23/98 8:18	8/23/98 10:23	8/23/98 12:36	8/24/98 7:47	8/24/98 11:39	8/24/98 13:43	8/24/98 15:41	8/24/98 17:20
Start latitude (dd)	46.4975	45.8087	45.8322	45.8862	45.8288	45.1654	45.1915	45.2192	45.1864	45.1250
Start longitude (dd)	-124.8095	-124.7301	-124.7528	-124.8215	-124.8360	-125.0235	-124.7980	-124.6989	-124.5940	-124.5573
End latitude (dd)	46.5016	45.8176	45.8409	45.8950	45.8236	45.1689	45.1974	45.2278	45.1767	45.1126
End longitude (dd)	-124.8228	-124.7340	-124.7524	-124.8294	-124.8319	-125.0240	-124.7910	-124.7028	-124.5886	-124.5581
Station	11H	15C	15D	15G	15H	19J	19F	19E	19C	19B
Avg. Bottom depth (m)	895.87	363.38	434.75	787.04	937.93	1213.71	651.24	528.04	371.51	324.78
Duration (hr)	0.46	0.47	0.52	0.54	0.71	0.87	0.47	0.43	0.4	0.39
Distance fished (km)	1.22	1.3	1.45	1.81	1.67		1.51	1.41	1.3	1.43
Net width (m)	15.00	14.20	14.00	14.50	14.29	14.58	14.20	14.50	14.00	14.00
Performance	4.2	0	0	4.2	4.2	0	0	0	0	0
Spiny dogfish										
Other sharks	3.8	2.0	3.3	1.5	1.2		1.9	2.2		
Skates		5.5	7.1	9.1		12.5	1.4	2.0	1.2	66.3
Other elasmobranchs		10.9	6.6	0.5					0.7	
Arrowtooth flounder		4.3	8.8	1.1				1.5		0.8
Petrale sole										
Dover sole	1.3	53.2	69.7	40.6			4.1	1.6	9.4	22.2
Deepsea sole	10.0			4.0	5.6	1.3	0.5			
Rex sole		7.2	9.2	0.3				0.3	13.0	7.7
Other flatfish										
Sablefish	23.2	5.6	16.1	8.3	7.2	25.4	20.4	19.1	1.1	3.0
Other grenadier	27.8			9.3	16.4	98.5	7.5			
Pacific flatnose	0.7			0.8	0.7	10.7	1.4	0.8		
Slickheads	2.2			1.9	1.3					
Pacific whiting		18.4	11.7	1.9				2.5	7.1	20.4
Fish unidentified	4.1	4.1	3.8	2.7	6.5	2.8	0.7	3.5	2.3	0.6
Shortspine thornyhead	6.4	6.7	11.3	2.0	14.6	1.4	13.2	14.6	8.3	8.9
Longspine thornyhead	65.6		1.8	48.9	56.6	38.6	6.5	15.6		
Other rockfish		0.5	1.9	1.7					23.2	18.3
Grooved tanner crab	17.2	0.5		68.2	36.6	24.2	13.9	0.6		
Other invertebrates	7.5	22.0	97.4	9.0	3.1	62.7	24.3	29.7	32.8	20.8
Total catch weight by species	169.8	140.9	248.7	211.8	149.8	278.1	95.8	94.0	99.1	169.0

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801002023	199801002024	199801002025	199801002026	199801002027	199801002028	199801002029	199801002030	199801002031	199801002032
Start date and time	8/27/98 8:35	8/27/98 10:51	8/27/98 12:57	8/27/98 15:07	8/27/98 17:50	8/28/98 9:20	8/28/98 11:35	8/28/98 12:40	8/28/98 14:41	8/28/98 16:04
Start latitude (dd)	44.5614	44.5602	44.5842	44.5659	44.5088	43.8080	43.8181	43.8274	43.8540	43.8650
Start longitude (dd)	-124.6382	-124.7921	-124.8890	-124.9744	-125.0796	-124.9257	-124.8928	-124.8913	-124.8844	-124.8528
End latitude (dd)	44.5518	44.5503	44.5886	44.5580	44.5010	43.8005	43.8179	43.8333	43.8505	43.8719
End longitude (dd)	-124.6430	-124.7926	-124.8990	-124.9811	-125.0912	-124.9265	-124.8932	-124.8967	-124.8855	-124.8471
Station	23A	23C	23F	23H	23J	27G	27D	27D	27C	27B
Avg. Bottom depth (m)	249.02	359.72	590.23	872.12	1215.69	721.64	452.45	422.27	396.35	317.30
Duration (hr)	0.32	0.42	0.34	0.45	0.63	0.47	0.22	0.33	0.31	0.35
Distance fished (km)		1.17	1.05	1.22	1.72	1.48		1.03		1.07
Net width (m)	14.63	14.63	14.63	14.26	14.59	13.72	14.63	12.80	13.26	13.72
Performance	0	0	0	0	0	3.12	-1.2	5.1	1.11	0
Spiny dogfish										
Other sharks		0.8	2.3	1.3		1.1			20.7	56.5
Skates	1.7	22.4	3.2		10.7	5.6		5.2	53.1	44.3
Other elasmobranchs		0.3						7.4	4.1	0.9
Arrowtooth flounder										1.7
Petrale sole										
Dover sole	74.5	10.7	25.8	50.7	1.5	29.2		52.1	47.3	116.5
Deepsea sole				2.9		4.1		1.9		
Rex sole	17.9	4.7						11.1	10.8	35.9
Other flatfish	1.4							0.2	0.1	3.9
Sablefish	2.1	3.6	45.2	15.6	27.6	24.1		5.8	1.0	2.0
Other grenadier			6.4	8.6	285.1	3.6				
Pacific flatnose			1.7	0.2	3.1	1.0				
Slickheads			1.9	1.0		3.3				
Pacific whiting	6.2	5.8	0.2			0.7		4.6	2.7	28.4
Fish unidentified	3.3	3.5	3.6	0.5	0.8	2.9		1.9	0.6	5.8
Shortspine thornyhead	7.6	11.6	9.4		4.4	6.6		7.5	7.2	8.1
Longspine thornyhead			1.3	48.5	39.6	40.5		6.7	1.8	
Other rockfish	1.5	4.1						28.0	15.5	3.2
Grooved tanner crab			9.1	15.4	15.2	27.7				
Other invertebrates	4.5	7.6	7.4	7.2	49.5	10.7		2.7	2.4	10.5
Total catch weight by species	120.7	75.1	117.5	151.9	437.5	161.1		135.1	167.3	317.7

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801002033	199801002034	199801002035	199801002036	199801002037	199801002038	199801002039	199801002040	199801002041	199801002042
Start date and time	8/29/98 7:35	8/29/98 9:20	8/29/98 10:49	8/29/98 12:28	8/29/98 14:19	8/31/98 8:16	8/31/98 11:46	8/31/98 15:10	8/31/98 16:51	9/2/98 7:21
Start latitude (dd)	43.1944	43.1706	43.1359	43.1520	43.1514	41.7730	41.8356	41.8635	41.8200	41.2023
Start longitude (dd)	-124.8228	-124.8774	-124.8979	-124.9128	-124.9267	-124.9062	-124.7890	-124.5771	-124.5046	-124.3894
End latitude (dd)	43.1922	43.1612	43.1281	43.1638	43.1455	41.7633	41.8290	41.8572	41.8115	41.2111
End longitude (dd)	-124.8113	-124.8783	-124.8973	-124.9096	-124.9243	-124.9006	-124.7846	-124.5720	-124.5015	-124.3922
Station	31B	31C	31E	31F	31G	39H	39G	39E	39B	43A
Avg. Bottom depth (m)	314.46	351.62	534.31	629.35	725.85	914.40	766.18	495.73	328.15	270.25
Duration (hr)	0.36	0.37	0.41	0.44	0.51	0.52	0.51	0.4	0.36	0.35
Distance fished (km)	1.14	1.16	1.29	1.72	1.44	1.61	1.61	1.24	1.03	1.14
Net width (m)	12.80	12.80	13.17	14.63	14.17	14.63	14.63	14.63	14.63	14.17
Performance	0	0	0	0	0	-5.1	0	0	0	0
Spiny dogfish										
Other sharks		2.2		2.4	5.8	0.6	3.5		1.6	
Skates	18.3	29.3	11.3	7.3	3.1	8.0		0.7	66.4	14.5
Other elasmobranchs									0.4	
Arrowtooth flounder	3.5		5.1						3.3	
Petrale sole										
Dover sole	77.4	43.7	139.9	179.3	48.3	12.6	26.8	48.7	121.6	54.3
Deepsea sole					6.8	2.7	7.5			
Rex sole	44.7	22.1	19.4					11.8	55.1	20.9
Other flatfish	4.0	0.8							1.0	
Sablefish	8.7		36.3	63.7	33.2	41.3	12.6	1.3	7.1	2.2
Other grenadier				9.6	14.4	3.0	3.2			
Pacific flatnose			0.0	1.5						
Slickheads						0.7	2.0			
Pacific whiting	4.8	3.4	0.7		0.2			4.5	54.6	99.6
Fish unidentified		5.7	5.8	2.5	1.1	1.0	2.3	4.1	9.3	4.4
Shortspine thornyhead	6.7	6.9	15.6	24.3	33.4	49.5		6.4	5.9	4.0
Longspine thornyhead			2.4	32.7	71.7	120.2	112.7	6.2		
Other rockfish	10.3	24.2						0.7	12.1	19.7
Grooved tanner crab			3.4	17.1	101.7	0.3	18.8	0.2		
Other invertebrates	94.0	5.9	32.7	13.8	10.4	246.3	15.2	35.6	14.2	84.8
Total catch weight by species	272.4	144.2	272.6	354.2	330.1	486.2	204.6	120.2	352.6	304.4

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801002043	199801002044	199801002045	199801002046	199801002047	199801002048	199801002049	199801002050	199801002051	199801002052
Start date and time	9/2/98 9:11	9/2/98 11:33	9/2/98 14:06	9/2/98 16:50	9/3/98 7:32	9/3/98 12:22	9/3/98 13:40	9/3/98 15:22	9/3/98 17:12	9/4/98 21:49
Start latitude (dd)	41.1913	41.1409	41.1468	41.1520	40.5619	40.5422	40.5543	40.5539	40.5537	39.8599
Start longitude (dd)	-124.4234	-124.4447	-124.4737	-124.5607	-124.6668	-124.6938	-124.6945	-124.7098	-124.7164	-124.2898
End latitude (dd)	41.1991	41.1332	41.1381	41.1596	40.5552	40.5443	40.5614	40.5459	40.5622	39.8748
End longitude (dd)	-124.4271	-124.4449	-124.4729	-124.5554	-124.6710	-124.6952	-124.6940	-124.7074	-124.7166	-124.2874
Station	43E	43F	43G	43I	47A	47C	47C	47E	47F	51I
Avg. Bottom depth (m)	513.41	621.06	735.48	1039.09	251.22	376.12	354.88	517.76	614.05	1060.70
Duration (hr)	0.44	0.42	0.34	0.55	0.4	0.4	0.36	0.44	0.45	0.59
Distance fished (km)	1.21	1.3	1.2	1.87	1.07		1.05	1.17		2.34
Net width (m)	14.63	14.63	14.63	14.63	13.41	14.63	13.41	12.80	2.56	
Performance	0	0	0	0	1.1	-1	0	0	-5.4	0
Spiny dogfish										
Other sharks	1.3	0.7	2.0	3.6	1.2		2.1	1.7		1.4
Skates	1.1	3.4			11.5		13.2	25.2		17.2
Other elasmobranchs					2.3		8.8	2.6		
Arrowtooth flounder	39.0							1.4		
Petrale sole										
Dover sole	75.6	24.2	17.3	50.1	68.9		291.3	92.9		38.1
Deepsea sole			3.9	5.3						8.2
Rex sole	38.5	12.5			4.4		54.3	28.0		
Other flatfish								0.7		
Sablefish	4.2	3.0	5.5	9.2	1.3		14.8			13.7
Other grenadier		4.0	11.6	52.8				2.1		173.3
Pacific flatnose		0.1	0.4	1.9				0.7		4.4
Slickheads		0.6	1.4	6.8						8.5
Pacific whiting	5.2	0.6			2.5		42.3	3.0		
Fish unidentified	5.6	5.0	1.6	4.3	11.1		7.0	10.8		5.9
Shortspine thornyhead	9.2	22.2	33.7	27.8	3.2		17.7	0.7		61.4
Longspine thornyhead	1.9	35.3	42.1	131.1						143.4
Other rockfish	3.6					489.0	23.0	5.7		
Grooved tanner crab			17.0	12.2						31.2
Other invertebrates	38.1	18.0	8.2	6.7	55.5		12.6	32.1		104.8
Total catch weight by species	223.3	129.6	144.7	311.8	650.9		487.1	207.6		611.5

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801002053	199801002054	199801002055	199801002056	199801002057	199801002058	199801002059	199801002060	199801002061	199801002062
Start date and time	9/4/98 12:33	9/4/98 15:45	9/4/98 17:48	9/4/98 18:55	9/5/98 7:01	9/5/98 8:19	9/5/98 9:34	9/5/98 11:16	1/22/01 17:06	9/5/98 18:29
Start latitude (dd)	39.8698	39.8812	39.8599	39.8449	39.2266	39.1987	39.1702	39.1534		39.2096
Start longitude (dd)	-124.2649	-124.2399	-124.1374	-124.1149	-123.9894	-123.9990	-124.0005	-124.0296		-124.2153
End latitude (dd)	39.8768	39.8740	39.8549	39.8382	39.2194	39.1908	39.1632	39.1446	39.2125	39.2027
End longitude (dd)	-124.2631	-124.2420	-124.1328	-124.1084	-123.9912	-123.9988	-123.9993	-124.0315	-124.1703	-124.2131
Station	51H	51G	51B	51A	55C	55D	55D	55E	55I	55J
Avg. Bottom depth (m)	957.65	804.06	321.21	235.95	379.70	418.98	430.37	531.12	1060.70	1231.44
Duration (hr)	0.62	0.47	0.46	0.38	0.36	0.35	0.41	0.43	0	0.71
Distance fished (km)	1.93	1.62		1.02	1		0.99	1.28		1.49
Net width (m)	14.31	14.33	12.80	12.80	12.80	10.97	10.45	13.17		14.60
Performance	0	0	0	0	0	-4.5	4.5	0	-1	0
Spiny dogfish										
Other sharks	1.6	0.7	2.4	6.6	5.8			3.0		3.2
Skates	4.2		17.4	15.1	59.3		17.0	8.3		3.8
Other elasmobranchs			2.8	10.0	3.6		3.6			
Arrowtooth flounder										
Petrale sole										
Dover sole	6.0	23.6	129.5	28.1	7.5		8.1	35.4		
Deepsea sole	6.7	7.2								35.2
Rex sole			19.8	21.0	13.0		5.4	4.5		
Other flatfish										
Sablefish	12.2	3.2	0.8	3.6	2.7		3.8	1.5		14.5
Other grenadier	44.1	9.0					0.0			599.0
Pacific flatnose	3.0	0.7								21.2
Slickheads	14.1	2.3								9.0
Pacific whiting			14.8	4.9	35.3		40.0	4.5		
Fish unidentified	3.5	2.5	6.7	3.8	2.8		2.4	4.1		2.3
Shortspine thornyhead	11.7	8.0	3.0		3.6		1.7	5.6		20.9
Longspine thornyhead	89.5	69.2	0.1					10.5		22.3
Other rockfish			2.0	15.8	20.8		4.7	2.0		
Grooved tanner crab	22.6	8.6	0.4		0.5		0.5	0.0		0.9
Other invertebrates	20.6	4.7	14.0	23.5	38.0		59.3	44.1		117.4
Total catch weight by species	239.8	139.7	213.7	132.4	192.9		146.5	123.5		849.7

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801002063	199801002064	199801002065	199801002066	199801002067	199801002068	199801002069	199801002070	199801002071	199801002072
Start date and time	9/6/98 7:30	9/6/98 9:52	9/6/98 11:35	9/6/98 13:17	9/6/98 14:53	9/10/98 7:55	9/10/98 9:54	9/10/98 12:16	9/10/98 15:43	9/10/98 18:13
Start latitude (dd)	38.5210	38.5071	38.5124	38.5145	38.4708	37.2518	37.2350	37.2306	37.2246	37.1679
Start longitude (dd)	-123.7483	-123.7074	-123.6970	-123.6782	-123.5927	-122.8806	-122.9362	-122.9979	-123.1181	-123.1191
End latitude (dd)	38.5130	38.5010	38.5194	38.5090	38.4668	37.2438	37.2414	37.2207	37.2154	37.1576
End longitude (dd)	-123.7438	-123.7064	-123.6995	-123.6757	-123.5827	-122.8738	-122.9423	-122.9938	-123.1111	-123.1142
Station	59I	59G	59F	59E	59A	67B	67D	67F	67I	67J
Avg. Bottom depth (m)	1065.71	711.36	625.68	527.56	209.40	292.61	421.95	545.90	1002.27	1140.71
Duration (hr)	0.56	0.51	0.48	0.45	0.37	0.4	0.43	0.45	0.61	0.82
Distance fished (km)	1.85	1.5	1.51	1.26	1.11		1.28	1.41	2.06	
Net width (m)	14.43	14.63	14.17	12.80	12.80		12.80	13.26	14.63	14.51
Performance	0	0	0	0	0	0	0	-5.1	0	-4.1
Spiny dogfish										
Other sharks	1.3	4.7	11.9	3.4	2.8		1.3	4.2	9.1	
Skates	9.8	9.3	7.2	18.7	16.2	8.6	17.1	1.4	10.6	
Other elasmobranchs				10.9			0.3			
Arrowtooth flounder							0.9			
Petrale sole					3.0					
Dover sole	54.5	138.8	36.7	19.5	31.4	52.3	152.0	49.6	144.0	
Deepsea sole	38.0	9.5	2.5						3.6	
Rex sole				11.9	34.3	21.6	20.7	9.3		
Other flatfish						2.7	0.1			
Sablefish	2.0	5.3	8.9	14.3	3.6		0.6	11.5	67.9	
Other grenadier	94.2	1.1	0.7	2.5				0.1	440.2	
Pacific flatnose	3.4	1.1	1.0	0.9				0.1	1.6	
Slickheads	1.6	2.6	6.8	1.1					11.1	
Pacific whiting				10.5		9.2	28.8	3.3		
Fish unidentified	16.7	4.5	7.6	8.2	9.4	0.8	3.9	6.9	13.2	
Shortspine thornyhead	20.6		17.8	10.2			2.3	4.1	54.6	
Longspine thornyhead	71.6	68.2	35.2	5.3				17.5	178.9	
Other rockfish				5.5	41.3	48.5	32.8	2.4		
Grooved tanner crab	11.9	79.4	5.5					2.0	16.4	
Other invertebrates	73.4	8.2	24.4	36.0	13.1	2.4	10.6	10.5	10.6	
Total catch weight by species	399.0	332.7	166.2	158.9	155.1	146.1	271.4	122.9	961.8	

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801002073	199801002074	199801002075	199801002076	199801002077	199801002078	199801002079	199801002080	199801002081	199801002082
Start date and time	9/11/98 7:56	9/11/98 11:01	9/11/98 12:56	9/11/98 14:22	9/11/98 15:40	9/12/98 7:15	9/12/98 8:46	9/12/98 10:31	9/12/98 12:33	9/12/98 15:32
Start latitude (dd)	36.4765	36.4623	36.4567	36.4700	36.4717	35.9148	35.8974	35.8846	35.8749	35.8679
Start longitude (dd)	-122.0818	-122.0556	-122.0312	-122.0088	-122.0018	-121.5215	-121.5573	-121.5874	-121.6413	-121.7910
End latitude (dd)	36.4703	36.4575	36.4637	36.4627	36.4812	35.9071	35.8894	35.8773	35.8689	35.8596
End longitude (dd)	-122.0845	-122.0529	-122.0345	-122.0050	-122.0054	-121.5226	-121.5548	-121.5862	-121.6408	-121.7904
Station	71H	71G	71F	71B	71A	75A	75D	75F	75G	75I
Avg. Bottom depth (m)	903.50	756.39	578.82	300.56	198.28	212.90	409.01	560.06	716.82	990.57
Duration (hr)	0.68	0.51	0.4	0.35	0.33	0.34	0.39	0.43	0.54	0.59
Distance fished (km)	1.53	1.4	1.27	0.96	1.15	0.99	1.18	1.3	1.35	1.65
Net width (m)	14.63	13.72	14.17	12.80	12.80	12.50	14.63	14.63	14.63	12.80
Performance	0	1	0	0	0	4.5	0	0	0	0
Spiny dogfish										
Other sharks	1.8	2.2	37.3				65.5	32.9	12.0	0.9
Skates		1.5	1.8	19.0	1.0	8.8	6.3	15.8	5.7	7.7
Other elasmobranchs				7.1	13.9	0.4	35.9			
Arrowtooth flounder										
Petrale sole					1.0	6.5	1.5			
Dover sole	84.3	146.9	68.0	8.3	0.4	1.3	59.9	24.4	44.7	51.1
Deepsea sole	5.5	0.9	1.7						1.2	8.8
Rex sole			1.5	9.2	0.7	2.0	9.5			
Other flatfish				19.2	31.2	6.0				
Sablefish	22.9	6.7	17.0				3.6	46.5	17.9	45.6
Other grenadier	15.8	2.0	1.0							10.3
Pacific flatnose	0.2	0.1		0.1					0.1	0.1
Slickheads	15.8	2.1	0.1						2.6	22.4
Pacific whiting			6.7	7.7	2.1	1.0	42.8	2.8		
Fish unidentified	5.5	2.7	8.5	2.6	6.3	3.6	4.2	2.5	0.7	3.8
Shortspine thornyhead	6.8	8.6	8.9				2.1	22.1	12.1	24.0
Longspine thornyhead	99.7	54.2	31.0					14.0	60.6	72.3
Other rockfish				278.9	71.6	93.5	155.9	0.6		
Grooved tanner crab	3.6	2.0								0.8
Other invertebrates	*	148.2	38.7	6.0	6.6	30.4	1.7 *	50.1	68.6	33.0
Total catch weight by species	261.9	378.1	222.2	358.1	134.8	153.5	388.9	211.7	226.2	280.8

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801002083	199801002084	199801002085	199801002086	199801003001	199801003002	199801003003	199801003004	199801003005	199801003006
Start date and time	9/13/98 7:21	9/13/98 9:48	9/13/98 13:47	9/13/98 16:40	9/24/98 14:15	9/24/98 17:21	9/25/98 7:24	9/25/98 10:44	9/26/98 8:22	9/26/98 11:07
Start latitude (dd)	35.2114	35.2318	35.2230	35.1875	48.0410	48.0660	47.3140	47.2642	46.6165	46.6677
Start longitude (dd)	-121.6835	-121.6574	-121.3128	-121.0413	-125.9322	-125.8428	-124.8482	-124.9928	-125.1702	-125.1042
End latitude (dd)	35.2037	35.2428	35.2212	35.1932	48.0383	48.0740	47.3073	47.2697	46.6148	46.6738
End longitude (dd)	-121.6767	-121.6584	-121.3035	-121.0357	-125.9460	-125.8455	-124.8565	-124.9857	-125.1817	-125.1147
Station	79J	79I	79F	79D	2I	2G	6B	6D	10J	10H
Avg. Bottom depth (m)	1153.61	997.94	659.72	394.44	992.49	773.40	290.36	490.85	1176.10	903.98
Duration (hr)	0.71	0.62	0.43	0.4	0.4	0.35	0.3	0.28	0.24	0.38
Distance fished (km)	1.77	1.81	1.46	1.16	1.73	1.45	1.05		1.08	1.9
Net width (m)	14.52	14.63	13.53	13.90	14.26	15.36	12.02	14.11	15.37	15.08
Performance	0	0	0	0	0	0	5	6.31	0	0
Spiny dogfish										
Other sharks	4.4		0.7	9.6		0.7	1.8		0.6	1.2
Skates	1.8		1.3	30.4	3.9		8.7	6.5	1.0	0.8
Other elasmobranchs				7.6						
Arrowtooth flounder							6.7		0.9	
Petrale sole										
Dover sole	11.8	26.8	81.2	12.9		9.0	51.1	73.4		
Deepsea sole	4.0	3.0	6.0		10.8	3.3		5.3	3.9	5.7
Rex sole			0.3	4.9			1.9	5.5		
Other flatfish				0.1			1.5			
Sablefish			10.4	3.1	14.8	20.2		1.5	11.5	9.7
Other grenadier	41.3	55.6	0.5		15.7	2.1	0.2		20.1	4.8
Pacific flatnose	1.8	0.6			0.1	0.1		1.7	1.5	
Slickheads	6.6		5.8		1.3					1.3
Pacific whiting				7.0	0.4		3.7	0.9		
Fish unidentified	1.0	0.7	0.6	2.3	12.5	6.2	0.4	1.8	0.1	1.4
Shortspine thornyhead	17.4	18.9	16.4		25.1	7.3	28.4	12.3		3.7
Longspine thornyhead	27.1	42.3	43.2	1.0	81.9	38.0	0.3	3.0	11.3	43.8
Other rockfish				25.9			48.8	4.9		
Grooved tanner crab	4.2	0.5	1.1		2.5	10.0		0.8	2.8	6.9
Other invertebrates	51.0	0.1	11.1	20.6	25.3	0.2	9.0	16.7	2.3	11.2
Total catch weight by species	172.4	148.5	178.6	125.4	194.3	97.1	162.6	134.4	56.0	90.5

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801003007	199801003008	199801003009	199801003010	199801003011	199801003012	199801003013	199801003014	199801003015	199801003016
Start date and time	9/26/98 13:42	9/26/98 17:02	9/26/98 18:00	9/27/98 8:29	9/27/98 10:29	9/27/98 12:38	9/27/98 15:23	9/27/98 16:50	9/28/98 8:10	9/28/98 10:37
Start latitude (dd)	46.7773	46.6745	46.6908	46.0112		46.0338	45.9685	45.9573	45.3593	45.3853
Start longitude (dd)	-124.9523	-124.8045	-124.7992	-124.9805		-124.9522	-124.7612	-124.6988	-124.9605	-124.8808
End latitude (dd)	46.7850	46.6827	46.6835	46.0193	46.0590	46.0440	45.9625	45.9637	45.3672	45.3925
End longitude (dd)	-124.9598	-124.8047	-124.7995	-124.9852	-124.9733	-124.9493	-124.7727	-124.7060	-124.9597	-124.8798
Station	10F	10C	10B	14J	14I	14H	14D	14A	18J	18H
Avg. Bottom depth (m)	633.92	361.79	283.57	1260.53	1046.59	935.32	452.52	219.89	1161.04	914.40
Duration (hr)	0.27	0.28	0.3	0.38	0.52	0.45	0.27	0.34	0.49	0.57
Distance fished (km)	1.37	1.09	1	1.68		2.13	1.16	0.98	1.96	
Net width (m)	14.63	13.06	13.17	16.15	12.80	12.80	14.63	14.63	14.63	14.63
Performance	0	0	0	0	-6.4	0	0	0	0	-5
Spiny dogfish			32.1							
Other sharks								1.3	0.6	0.2
Skates		6.4	5.5	4.4	3.5		2.4	17.5	6.8	2.6
Other elasmobranchs							1.8	1.1		
Arrowtooth flounder		9.2	10.9				9.2	3.3		
Petrale sole										
Dover sole	29.5	37.7	13.3			2.4	22.0	6.2		
Deepsea sole	0.6				0.8	2.9			0.4	
Rex sole		9.7	3.5				2.2	3.2		
Other flatfish		0.8	9.5				0.2	9.6		
Sablefish	9.5	2.7		4.0	103.2	25.6	3.4	14.1	44.0	11.7
Other grenadier	5.7			62.1	123.3	10.4			118.9	6.9
Pacific flatnose	0.7			4.1	0.9	0.1			3.4	0.4
Slickheads					1.2				1.3	
Pacific whiting		10.8					6.2	576.8		
Fish unidentified	5.4	2.1	1.0			0.5	1.7	0.2	2.7	1.1
Shortspine thornyhead	7.6	11.1	4.5	3.5	11.8	2.0	4.4	2.9	5.5	0.4
Longspine thornyhead	39.4			20.0	86.5	40.4			34.1	26.5
Other rockfish		34.0	4.0				4.8	6.8		
Grooved tanner crab	2.6			7.6	12.1	10.7	7.8		9.5	4.0
Other invertebrates	4.1	43.3	5.6	26.0	31.1	39.6	12.2		55.7	3.0
Total catch weight by species	105.1	167.8	89.9	131.7	374.5	134.6	78.3	642.9	282.9	56.8

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801003017	199801003018	199801003019	199801003020	199801003021	199801003022	199801003023	199801003024	199801003025	199801003026
Start date and time	9/28/98 13:04	9/28/98 15:08	9/28/98 17:49	10/1/98 9:25	10/1/98 11:34	10/1/98 13:02	10/1/98 14:33	10/1/98 16:55	10/2/98 8:35	10/2/98 10:47
Start latitude (dd)	45.3547	45.3348	45.3573	44.6552	44.6671	44.6570	44.6406	44.5935	43.9694	43.9595
Start longitude (dd)	-124.7215	-124.6263	-124.3633	-124.6772	-124.8601	-124.9031	-124.9113	-125.0194	-124.9521	-124.9690
End latitude (dd)	45.3583	45.3393	45.3662	44.6463	44.6587	44.6491	44.6325	44.5830	43.9787	43.9686
End longitude (dd)	-124.7095	-124.6373	-124.3640	-124.6741	-124.8582	-124.8987	-124.9058	-125.0142	-124.9512	-124.9704
Station	18E	18D	18B	22A	22D	22E	22F	22I	26A	26E
Avg. Bottom depth (m)	526.61	433.01	217.60	217.93	441.47	514.58	615.76	1086.34	227.32	502.26
Duration (hr)	0.38	0.29	0.28	0.32	0.29	0.32	0.33	0.43	0.29	0.29
Distance fished (km)	1.47	1.13	1.02	1.13	1.1	1.29	1.36	1.82	1.06	1.13
Net width (m)	14.63	14.63	14.63	12.80	14.59	14.63	15.36	15.27	14.63	14.63
Performance	0	0	0	0	0	0	0	0	1	0
Spiny dogfish			15.3	1.0	1.0				0.8	1.2
Other sharks						3.8	2.0			2.0
Skates	12.1	2.5	0.3	28.1	17.9	25.7	4.5	12.1	6.4	4.2
Other elasmobranchs				17.9	1.5	0.7	0.5		0.6	
Arrowtooth flounder		4.5	3.7		5.5	0.5	1.0			3.5
Petrale sole									0.3	
Dover sole	16.4	26.7	27.6	0.7	25.9	32.8	2.7		44.8	218.6
Deepsea sole							1.0	5.7		
Rex sole	2.4		10.0	1.7	2.8	0.3			5.6	17.4
Other flatfish			2.8		3.8				3.3	0.7
Sablefish	17.1	11.1				7.1	34.5	28.2	13.5	21.8
Other grenadier							2.0	29.3		5.4
Pacific flatnose						0.3	0.6	1.7		
Slickheads							0.1	1.8		
Pacific whiting	4.5	7.4	130.6		1.9	0.7	0.6		4.6	3.0
Fish unidentified	0.6	2.7	1.3	20.9	4.7	0.1	2.5	3.9	19.7	4.6
Shortspine thornyhead	10.4	18.9	6.1	6.9	3.7	1.1	*	6.2	1.1	13.2
Longspine thornyhead	13.6					0.5	16.6	76.5		1.1
Other rockfish	4.2	6.6	8.8	422.2					54.3	
Grooved tanner crab		0.1	0.2				6.4	14.2		0.8
Other invertebrates	23.8	8.4	15.0	49.2	36.8	15.5	4.7	0.7	37.1	25.0
Total catch weight by species	105.1	88.9	221.7	548.5	105.4	89.3	79.5	180.4	192.2	322.5

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801003027	199801003028	199801003029	199801003030	199801003031	199801003032	199801003033	199801003034	199801003035	199801003036
Start date and time	10/2/98 13:08	10/2/98 15:42	10/2/98 17:59	10/3/98 8:10	10/3/98 11:17	10/3/98 13:11	10/3/98 15:07	10/3/98 16:20	10/4/98 7:29	10/4/98 9:50
Start latitude (dd)	43.9586	43.9330	43.9433	43.3446	43.3508	43.3382	43.3842	43.3806	42.6930	42.6598
Start longitude (dd)	-124.9904	-125.0348	-125.0528	-125.0642	-124.9386	-124.8102	-124.6887	-124.6694	-124.9607	-124.9304
End latitude (dd)	43.9510	43.9242	43.9524	43.3473	43.3599	43.3322	43.3760	43.3728	42.7035	42.6520
End longitude (dd)	-124.9916	-125.0283	-125.0513	-125.0514	-124.9370	-124.8016	-124.6900	-124.6749	-124.9659	-124.9367
Station	26F	26I	26J	30J	30G	30F	30B	30A	34I	34H
Avg. Bottom depth (m)	614.93	1043.39	1193.11	1153.46	762.46	618.87	296.39	219.22	1044.32	962.80
Duration (hr)	0.39	0.62	0.35	0.56	0.34	0.34	0.31	0.33	0.43	0.35
Distance fished (km)	1.45		1.47	2.46	1.42	1.42	1.1	1.1	1.86	1.44
Net width (m)	13.26	16.46	16.46	14.26	14.63	14.63	14.33	14.63	14.63	15.54
Performance	0	0	0	-5.1	0	0	0	0	-5.1	0
Spiny dogfish							1.0			
Other sharks	2.7			0.7	*	1.7	0.1			0.5
Skates	8.1		5.9	5.5	0.1	3.2	12.3	38.7	2.8	
Other elasmobranchs							3.0	2.5		
Arrowtooth flounder	7.0						5.3	0.7		
Petrale sole										
Dover sole	79.2	39.7	8.9	2.3	31.3	49.4	29.7	67.3	32.4	52.2
Deepsea sole	2.2	13.7	1.8	6.1	0.2	1.0			5.7	6.7
Rex sole	6.6	2.2				1.0	17.6	30.7		
Other flatfish							2.9	4.6		
Sablefish	19.8	27.8	39.1	11.3	5.3	5.8			29.5	7.3
Other grenadier	4.6	128.9	106.3	117.6	12.9	6.3			68.9	33.1
Pacific flatnose	3.3	2.3	7.8	7.9		0.6			1.5	1.6
Slickheads		2.6	1.2	1.0	2.3	1.0			3.4	2.4
Pacific whiting	5.3						15.2	6.7		
Fish unidentified	5.2	4.3	7.9	1.9	*	1.7	1.4	5.7	5.9	2.9
Shortspine thornyhead	14.3	18.9	3.9	3.1	6.2	1.7	8.4	4.5	4.0	2.7
Longspine thornyhead	12.1	22.2	23.2	37.6	34.0	11.2			109.2	70.1
Other rockfish							5.0	*		
Grooved tanner crab	8.0	43.3	10.0	22.8	38.6	20.0			19.8	28.7
Other invertebrates	19.7	15.1	18.3	16.1	6.6 *	20.2	22.5	12.7	17.8	8.2
Total catch weight by species	198.3	320.9	234.1	233.7	137.3	124.9	124.2	174.2	300.8	216.4

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801003037	199801003038	199801003039	199801003040	199801003041	199801003042	199801003043	199801003044	199801003045	199801003046
Start date and time	10/4/98 11:43	10/4/98 14:22	10/4/98 16:43	10/5/98 8:12	10/5/98 11:11	10/5/98 14:08		10/7/98 17:43	10/8/98 7:48	10/8/98 10:44
Start latitude (dd)	42.6919	42.7296	42.6934	42.0715	42.0426	41.9485			40.7105	40.7338
Start longitude (dd)	-124.9125	-124.8679	-124.7180	-125.0219	-124.9248	-124.8024			-124.7795	-124.6972
End latitude (dd)	42.7002	42.7256	42.7030	42.0805	42.0474	41.9531		41.3044	40.7055	40.7434
End longitude (dd)	-124.9180	-124.8779	-124.7176	-125.0251	-124.9371	-124.8129		-124.4492	-124.7896	-124.7008
Station	34G	34E	34A	38J	38I	38G	38E	42B	46J	46H
Avg. Bottom depth (m)	778.06	541.80	219.40	1260.84	1029.07	739.41	512.06	292.61	1239.64	961.93
Duration (hr)	0.35	0.29	0.32	0.47	0.39	0.33		0.37	0.45	0.46
Distance fished (km)	1.5	0.99	1.19	1.92	1.68	1.47				
Net width (m)	12.80	14.69	14.63	15.46	15.21	14.90			16.35	16.13
Performance	0	0	0	0	0	0	-1	0	0	0
Spiny dogfish										
Other sharks	0.1	1.0	1.0		1.9	2.7		*		
Skates		2.7		29.6	2.4	0.1		19.9	2.6	
Other elasmobranchs			0.3						1.3	
Arrowtooth flounder										
Petrale sole								*		
Dover sole	43.9	90.1	28.3	1.3	10.1	24.8		27.8		72.2
Deepsea sole	2.3			8.5	9.1	9.6			4.8	7.5
Rex sole		13.3	1.1					14.9		
Other flatfish			7.8					0.8		
Sablefish	14.4	13.8	1.1	16.3	3.0	1.8		0.8	5.7	11.6
Other grenadier	26.1			242.5	22.9	6.0			41.1	44.7
Pacific flatnose	0.1	0.7		32.9	3.5	0.1			1.6	1.6
Slickheads	1.6			0.8	2.5	0.7				1.0
Pacific whiting		1.9	61.6					22.9		
Fish unidentified	3.1	7.4	8.6	6.2	6.9	1.5		4.8	2.5	2.5
Shortspine thornyhead	1.7	4.7	0.6	4.7	11.0	4.2		0.8	30.1	9.3
Longspine thornyhead	73.1	1.3		19.1	107.6	47.9			19.4	89.8
Other rockfish			41.4					21.1		
Grooved tanner crab	109.2	2.1			20.3	9.3			11.2	18.7
Other invertebrates	5.1	14.2	7.3	13.0	52.4	6.2 *	*	22.4	81.1 *	20.6
Total catch weight by species	280.7	153.3	159.0	374.9	253.6	114.7		136.1	201.4	279.5

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801003047	199801003048	199801003049	199801003050	199801003051	199801003052	199801003053	199801003054	199801003055	199801003056
Start date and time	10/8/98 13:16	10/8/98 16:43	10/8/98 18:36	10/9/98 7:36	10/9/98 8:54	10/9/98 10:50	10/9/98 12:54	10/9/98 16:28	10/10/98 7:33	10/10/98 9:52
Start latitude (dd)		40.7378	40.5986	40.0599	40.0628	40.0609	40.0540	39.9688	39.4341	39.6031
Start longitude (dd)		-124.7894	-124.8372	-124.2599	-124.2767	-124.4355	-124.5793	-124.7626	-124.2393	-124.2733
End latitude (dd)	40.7701	40.5991	40.5808	40.0703	40.0716	40.0645	40.0544	39.9695	39.4385	39.4195
End longitude (dd)	-124.6850	-124.6652	-124.6702	-124.2669	-124.2808	-124.4463	-124.5940	-124.7751	-124.2307	-124.1580
Station	46G	46D	46A	50A	50B	50G	50H	50J	54J	54H
Avg. Bottom depth (m)	769.37	438.91	251.58	230.61	299.28	769.98	919.27	1213.96	1208.75	924.76
Duration (hr)	0.45	0.25	0.34	0.34	0.3	0.3	0.4	0.34	0.45	0.41
Distance fished (km)										
Net width (m)	16.82	14.72	9.02	14.36	13.53	14.94	15.87	15.61	12.98	15.33
Performance	-6.4	-5	0	0	0	0	0	5.1	0	0
Spiny dogfish		0.4	0.4							
Other sharks	0.5	*		1.3		2.9	3.4	0.3	1.2	1.7
Skates	1.1	14.4	38.3	1.5	10.6	2.9	0.1		9.7	0.1
Other elasmobranchs			2.8	1.1	6.8					
Arrowtooth flounder										
Petrale sole										
Dover sole	72.3	237.3	8.5	3.8	39.1	26.1				13.7
Deepsea sole	2.9					1.9	3.6	3.5	2.9	4.0
Rex sole		54.0		0.4	1.2					
Other flatfish		0.1	0.2	0.4	1.0					
Sablefish	9.3	13.4			6.1	7.6	1.6	7.4	24.3	4.5
Other grenadier	18.5					1.7	7.5	23.3	104.2	7.9
Pacific flatnose	0.3						0.4	6.4	18.8	1.1
Slickheads	0.4					2.8	4.2	0.9	4.0	8.8
Pacific whiting		71.5		1.5	2.6					
Fish unidentified	2.4	2.6	1.3	0.3	0.5	2.0	3.2	0.9	0.5	1.0
Shortspine thornyhead	2.5	58.2	1.8		4.7	7.2	1.6	3.4	12.7	1.6
Longspine thornyhead	78.0	1.3				53.6	62.9	11.2	32.3	47.0
Other rockfish		26.3	6.8	72.1	126.1					
Grooved tanner crab	78.5					4.8	6.5	0.9	7.1	15.6
Other invertebrates	3.0	85.3	105.8	3.3	4.8	2.9	13.8	28.8	66.2	13.1
Total catch weight by species	269.7	564.8	165.9	85.7	203.5	116.4	108.8	87.0	283.9	120.1

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801003057	199801003058	199801003059	199801003060	199801003061	199801003062	199801003063	199801003064	199801003065	199801003066
Start date and time	10/10/98 12:27	10/10/98 14:28	10/10/98 17:18	10/11/98 7:24	10/11/98 9:37	10/11/98 18:12	10/12/98 8:30	10/12/98 11:01	10/12/98 15:41	10/12/98 17:09
Start latitude (dd)			39.4061	38.8592	38.6430	38.7917	38.0368		38.0692	38.1592
Start longitude (dd)			-123.9656	-123.7703	-123.7708	-123.8878	-123.5691		-123.5414	-123.5481
End latitude (dd)	39.3999	39.3992	39.2818	38.6656	38.6503	38.7300	38.0292	38.0201	38.0591	38.0628
End longitude (dd)	-124.0392	-123.9744	-123.9594	-123.7785	-123.7786	-123.8563	-123.5652	-123.5508	-123.5372	-123.5337
Station	54F	54B	54A	58B	58C	58E	62J	62I	62E	62D
Avg. Bottom depth (m)	600.73	293.35	231.92	272.60	381.37	512.06	1237.09	1102.08	517.10	435.94
Duration (hr)	0.43	0.39	0.34	0.37	0.25	0.18	0.3	0.51	0.27	0.25
Distance fished (km)										
Net width (m)	15.91	14.81	16.92	13.90	12.80		17.79	15.29	14.51	14.23
Performance	-6.4	-6.4	0	0	-2.4	-6	0	-6.4	0	0
Spiny dogfish		292.9	7.7							
Other sharks	3.6					*	1.1	1.3		
Skates	5.3	3.5	6.0	4.5	1.7	2.4	22.5	2.3	5.0	15.0
Other elasmobranchs				2.0	3.1				4.8	
Arrowtooth flounder										
Petrale sole				8.8						
Dover sole	23.0	87.0		34.6	6.6	6.3	64.3	145.8	73.5	54.9
Deepsea sole	1.0					1.6	14.7	34.8		
Rex sole		21.3	0.6	17.5	7.8	9.5	0.1		10.4	1.2
Other flatfish		9.1	1.7	13.4						0.1
Sablefish	9.9					8.0	34.5	116.9	3.5	
Other grenadier	1.4						96.0	263.1		
Pacific flatnose	0.5						6.9	6.2	0.9	
Slickheads							1.0	5.2		
Pacific whiting	2.5	2.2	1.1	1.2		14.2			7.8	53.6
Fish unidentified	3.0			8.4	9.5	*	7.8	13.1	5.4	2.3
Shortspine thornyhead	3.8				*	6.6	1.5	23.5	4.5	1.1
Longspine thornyhead	*				2.6	3.4	6.4	141.2	2.5	
Other rockfish		69.5	18.5	95.2	151.8	8.0			2.5	62.1
Grooved tanner crab	33.0						0.9	2.7		
Other invertebrates	13.8	13.5	18.4	21.5	8.6	8.3	12.6	80.0	61.8	59.0
Total catch weight by species	100.8	499.0	54.0	207.1	191.7	68.3	270.3	836.1	182.6	249.3

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801003067	199801003068	199801003069	199801003070	199801003071	199801003072	199801003073	199801003074	199801003075	199801003076
Start date and time	10/12/98 18:24	10/16/98 10:00	10/16/98 14:36	10/16/98 17:37	10/17/98 9:18	10/17/98 11:34	10/17/98 14:18	10/17/98 18:10	10/18/98 8:22	10/18/98 10:37
Start latitude (dd)	38.2739	37.3900	37.4217	37.3000	36.7100	36.7400	36.7500	36.7417	36.0167	36.0033
Start longitude (dd)	-123.5961	-123.1567	-123.0550	-122.9681	-122.2867	-122.2767	-122.2400	-121.9833	-121.6183	-121.6283
End latitude (dd)	38.0706	37.4000	37.4233	37.3017	36.7033	36.7450	36.7533	36.7483	36.0167	36.0133
End longitude (dd)	-123.5244	-123.1583	-123.0650	-122.9733	-122.2833	-122.2850	-122.2500	-121.9800	-121.6233	-121.6350
Station	62A	66H	66F	66E	70J	70I	70G	70D	74C	74D
Avg. Bottom depth (m)	249.11	926.58	649.63	513.44	1234.99	1048.38	841.43	441.84	385.48	443.98
Duration (hr)	0.32	0.43	0.29	0.34	0.26	0.42	0.35	0.22	0.41	0.32
Distance fished (km)										
Net width (m)	13.39	14.80	15.10	15.18	15.42	15.65	15.70	14.68	13.61	14.59
Performance	0	0	0	0	0	0	0	-5.1	0	0
Spiny dogfish									67.6	
Other sharks		2.6	9.9	6.6	3.8	1.7	0.2	1.4	0.9	75.6
Skates	10.8	0.8		16.7	20.0	4.4		50.5	6.3	11.4
Other elasmobranchs				7.1					16.4	15.4
Arrowtooth flounder										
Petrale sole	4.6								7.9	3.3
Dover sole	20.2	205.6	92.8	19.1	35.8	70.4	82.5	90.7	27.3	88.8
Deepsea sole		8.8			9.6	9.1		1.0		
Rex sole	0.3			0.4				56.5	0.3	15.3
Other flatfish	7.9								0.2	
Sablefish		9.3	3.3	19.3	8.0	3.6	7.0	18.3		14.1
Other grenadier		33.8	1.2		95.9	85.1	4.5			
Pacific flatnose		1.2	0.4		5.4	5.2	1.1			
Slickheads		9.0	1.4		17.7	2.8	1.4			
Pacific whiting				16.1				20.6	9.2	42.8
Fish unidentified	0.9	3.6	1.7	9.0		2.2	1.2	3.0	0.5	5.9
Shortspine thornyhead		23.2	1.1	10.0		26.8	16.5	121.6	1.6	2.0
Longspine thornyhead		104.1	6.2	0.8	5.3	47.6	41.1	23.7		
Other rockfish	10.7			51.7				16.7	46.3	39.5
Grooved tanner crab		8.7	54.6		8.1	16.1	21.0	1.2		
Other invertebrates	4.8	3.5	6.5	36.1	8.0	13.5 *	7.0	141.0	107.2	21.5
Total catch weight by species	60.2	414.2	179.1	192.9	217.6	288.7	183.4	546.1	291.7	335.6

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801003077	199801003078	199801003079	199801003080	199801003081	199801003082	199801003083	199801004001	199801004002	199801004003
Start date and time	10/18/98 14:25	10/18/98 16:52	10/19/98 7:49	10/19/98 10:37	10/19/98 13:32	10/19/98 15:32	10/19/98 17:59	9/24/98 12:39	9/24/98 16:27	9/24/98 18:51
Start latitude (dd)	36.0000	35.9333	35.3783	35.2683		35.2900	35.2650	47.6378	47.6898	47.6538
Start longitude (dd)	-121.6667	-121.6800	-121.6317	-121.5067		-121.2050	-121.1200	-125.4123	-125.2427	-125.1642
End latitude (dd)	36.0117	35.9417	35.3767	35.2733	35.2817	35.2883	35.2717	47.6300	47.6968	47.6627
End longitude (dd)	-121.6700	-121.6817	-121.6417	-121.5167	-121.3100	-121.2167	-121.1267	-125.4083	-125.2357	-125.1572
Station	74F	74G	78I	78G	78F	78E	78D	4I	4H	4F
Avg. Bottom depth (m)	608.50	768.10	1129.47	782.36	630.44	524.41	443.98	1107.15	919.62	622.25
Duration (hr)	0.36	0.25	0.28	0.3	0.24	0.26	0.21	0.47	0.47	0.47
Distance fished (km)									1.59	1.77
Net width (m)	14.77		15.18	14.77	14.79	14.68	14.59	14.80	14.60	15.29
Performance	0	-2.4	0	0	5	0	0	-5.1	-5.1	0
Spiny dogfish										
Other sharks	10.7	7.3		0.2	6.5	8.3	1.1		0.7	1.1
Skates	9.6				4.9	0.8	8.4	10.3		
Other elasmobranchs	0.5					4.4	0.9			
Arrowtooth flounder										
Petrale sole										
Dover sole	11.4	44.1	5.2	16.0	44.3	9.6	2.5		52.0	2.1
Deepsea sole								2.7	6.0	
Rex sole						0.3	0.9			
Other flatfish										
Sablefish	64.9	8.9	36.6	34.8	8.7	6.8		21.0	14.8	31.3
Other grenadier			41.9	1.6		*		71.6	14.2	14.3
Pacific flatnose			1.0	0.4				1.3	0.7	5.1
Slickheads	0.5	0.8	9.2	5.8	0.4			1.3	1.9	
Pacific whiting	1.4			0.1	0.8	7.5	8.6			5.2
Fish unidentified	0.9	3.1	2.5	1.3	0.4	0.7	1.6	3.0	3.4	11.4
Shortspine thornyhead	56.6	19.9	7.4	10.4	8.1	1.0	0.4	2.5	5.0	11.7
Longspine thornyhead	23.0	42.8	6.4	57.9	25.7	3.4		94.9	64.7	20.3
Other rockfish					0.4	32.2	8.2			
Grooved tanner crab			2.5	5.9	0.3			15.0	24.4	11.5
Other invertebrates	113.0	38.8	4.9	1.6 *	16.0	22.1	7.3	23.7	9.1	14.7
Total catch weight by species	292.6	165.7	117.4	134.4	116.5	97.1	39.9	247.3	196.9	128.7

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801004004	199801004005	198801004006	199801004007	199801004008	199801004009	199801004010	199801004011	199801004012	199801004013
Start date and time	9/25/98 7:14	9/25/98 10:14		9/26/98 7:35	9/26/98 10:08	9/26/98 16:34	9/26/98 17:26	9/27/98 7:19	9/27/98 9:23	9/27/98 11:29
Start latitude (dd)	46.9942	47.0003		46.3252	46.2862	46.2583	46.2537	45.6700	45.6703	45.6923
Start longitude (dd)	-124.9813	-124.9872		-124.8308	-124.8192	-124.6055	-124.5748	-124.5532	-124.6222	-124.7097
End latitude (dd)	47.0035	47.0092		46.3240	46.2773	46.2582	46.2525	45.6740	45.6760	45.6957
End longitude (dd)	-124.9802	-124.9890		-124.8288	-124.8248	-124.6063	-124.5740	-124.5653	-124.6330	-124.7215
Station	8B	8C	8D	12H	12G	12D	12D	16A	16B	16C
Avg. Bottom depth (m)	308.22	362.22	438.91	912.67	766.23	445.01	438.91	225.58	298.48	367.30
Duration (hr)	0.36	0.33		0.3	0.3	0.03	0.05	0.3	0.32	0.33
Distance fished (km)		1.27		1.26	1.28			1.14	1.3	1.25
Net width (m)	14.88	14.86		14.83	14.62	14.00	19.00	15.00	15.00	14.38
Performance	0	0	-5.3	5.1	0	-1	-1	0	0	0
Spiny dogfish								6.8		
Other sharks				3.0	1.5					
Skates	2.0	1.5						34.7	2.5	21.4
Other elasmobranchs		2.4						5.4	0.6	1.4
Arrowtooth flounder	4.0	5.6						8.3	3.1	11.1
Petrale sole								1.8		
Dover sole	196.4	147.2		6.8	4.6			74.2	47.9	81.4
Deepsea sole				4.7	4.8					
Rex sole	13.2	3.9						9.7	12.5	6.4
Other flatfish	18.1							11.2	1.0	
Sablefish	5.2	14.9		15.7	5.9			24.6		
Other grenadier				5.0	5.3					
Pacific flatnose				0.1	0.1					
Slickheads				3.5	1.7					
Pacific whiting	2.1							60.7	112.8	48.0
Fish unidentified	1.6	2.0		5.6				1.9	1.7	1.4
Shortspine thornyhead	32.6	30.5		4.0	*			2.9	21.0	14.0
Longspine thornyhead				65.3	45.5					
Other rockfish	3.8	7.4						39.1	14.5	3.5
Grooved tanner crab	4.2			9.2	32.8					
Other invertebrates	16.8	17.7		12.8	7.5			88.3	7.4	7.3
Total catch weight by species	300.1	233.0		135.9	109.6			369.6	225.0	195.8

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801004014	199801004015	199801004016	199801004017	199801004018	199801004019	199801004020	199801004021	199801004022	199801004023
Start date and time	9/27/98 13:52	9/27/98 15:48	9/27/98 18:26		9/28/98 10:42	9/28/98 13:17	9/28/98 16:09	9/28/98 17:32	9/30/98 7:53	9/30/98 10:31
Start latitude (dd)	45.7113	45.6668	45.6178			45.0323	44.9610	44.9628	44.3254	44.3629
Start longitude (dd)	-124.8608	-124.8352	-124.8355			-124.7353	-124.4460	-124.4000	-125.0268	-124.9577
End latitude (dd)	45.7187	45.6582	45.6242			45.0403	44.9705	44.9722	44.3348	44.3700
End longitude (dd)	-124.8685	-124.8277	-124.8227			-124.7430	-124.4452	-124.3992	-125.0275	-124.9664
Station	16H	16H	16J	20I	20G	20E	20B	20A	24G	24F
Avg. Bottom depth (m)	913.65	932.49	1178.62	1060.70	768.10	520.95	297.04	229.13	788.52	625.73
Duration (hr)	0.38	0.32	0.47		0.48	0.33	0.33	0.31	0.33	0.33
Distance fished (km)		1.33	1.81			1.37	1.28	1.22	1.51	1.44
Net width (m)	13.14	14.25	14.00			15.00	15.00	15.00	14.71	15.25
Performance	-4.2	0	0	-5	0	0	0	0	0	0
Spiny dogfish								2.3		
Other sharks		2.1			4.2				0.9	2.0
Skates			15.1				5.3	48.0		4.1
Other elasmobranchs										
Arrowtooth flounder						3.2	14.4	21.3		
Petrale sole										
Dover sole		5.8				6.7	23.2	40.2	2.7	8.5
Deepsea sole		1.1	1.9		2.1				0.8	
Rex sole							16.6	20.5		
Other flatfish							50.1			
Sablefish		2.5	27.6		9.5	1.8	1.0	24.5	6.1	8.6
Other grenadier		5.7	119.7		13.9				3.0	4.2
Pacific flatnose			5.0		0.8				0.3	0.8
Slickheads		2.6	2.5		0.9				2.6	0.1
Pacific whiting		0.8					62.2	49.7		
Fish unidentified		1.8	7.0		0.5	0.3	1.1	0.3	0.6	1.2
Shortspine thornyhead		4.3	2.9		3.2	15.9	18.3	3.3		2.5
Longspine thornyhead		41.5	84.8		11.6	2.7			37.6	10.9
Other rockfish						2.1	6.5	13.1		
Grooved tanner crab		9.7	14.1		35.1	3.8			29.3	3.7
Other invertebrates		2.5	33.8		7.2	20.3	7.2	41.3	1.6	3.4
Total catch weight by species		80.6	314.4		89.1	56.8	206.0	264.4	85.4	49.9

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801004024	199801004025	199801004026	199801004027	199801004028	199801004029	199801004030	199801004031	199801004032	199801004033
Start date and time	9/30/98 12:53	9/30/98 14:46	9/30/98 16:51	10/1/98 7:19	10/1/98 9:45	10/1/98 12:17	10/1/98 15:06	10/1/98 18:37	10/2/98 7:52	10/2/98 10:55
Start latitude (dd)	44.4011	44.3956	44.3646	43.7148	43.7075	43.6653	43.6827	43.7046	42.9328	42.9539
Start longitude (dd)	-124.8328	-124.8181	-124.8118	-124.6510	-124.7182	-124.8348	-124.8742	-124.9354	-125.0428	-124.9972
End latitude (dd)	44.4103	44.4052	44.3732	43.7242	43.7171	43.6560	43.6760	43.7052	42.9238	42.9446
End longitude (dd)	-124.8355	-124.8173	-124.8063	-124.6517	-124.7199	-124.8314	-124.8646	-124.9232	-125.0432	-124.9994
Station	24D	24C	24A	28C	28E	28G	28H	28J	32J	32I
Avg. Bottom depth (m)	436.04	362.34	226.02	369.51	515.34	756.50	892.78	1173.63	1225.86	1075.16
Duration (hr)	0.32	0.34	0.32	0.32	0.32	0.34	0.39	0.3	0.36	0.36
Distance fished (km)	1.39	1.31	1.26	1.31	1.34	1.43	1.55		1.2	1.32
Net width (m)	14.71	14.75	14.12	15.00	14.62	15.00	14.57	14.75	14.14	15.50
Performance	0	0	0	0	0	0	0	-5.1	0	0
Spiny dogfish		0.7		3.0						
Other sharks	0.1	0.2			1.8	1.8				
Skates		30.6	7.0	36.0	4.3				31.6	1.9
Other elasmobranchs	0.9	11.0	0.1	0.3						
Arrowtooth flounder		10.3	13.9	13.4	2.7					
Petrale sole										
Dover sole	9.2	40.0	91.9	83.9	11.3	8.1	6.2		72.1	1.5
Deepsea sole						2.2	0.4		8.4	5.6
Rex sole	3.3	11.2	14.2	36.3	10.8					
Other flatfish		11.3	11.9	0.1						
Sablefish	3.0	9.7	7.9	4.4	14.5	5.2	2.2		49.4	15.0
Other grenadier						26.4	37.7		181.9	81.5
Pacific flatnose	0.3						1.1		16.6	2.7
Slickheads						0.4				2.5
Pacific whiting	0.9	8.1	6.4	59.0	5.2					
Fish unidentified	4.6	4.5	9.6	5.5			11.4		1.8	5.7
Shortspine thornyhead	1.3	9.3	0.9	15.6	12.6				7.5	
Longspine thornyhead					5.1	28.5	30.7		19.7	24.6
Other rockfish			3.2	2.7	0.2					
Grooved tanner crab						17.0	22.8		10.6	30.4
Other invertebrates	18.0	6.9	3.4	23.8	9.6	9.4	9.5		18.2	17.1
Total catch weight by species	41.5	153.9	170.3	284.0	78.2	98.9	122.1		417.9	188.5

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801004034	199801004035	199801004036	199801004037	199801004038	199801004039	199801004040	199801004041	199801004042	199801004043
Start date and time	10/2/98 13:09	10/2/98 15:42	10/2/98 17:50	10/3/98 7:24	10/3/98 9:56	10/3/98 12:38	10/3/98 15:20	10/3/98 17:54	10/4/98 7:27	10/4/98 10:36
Start latitude (dd)	42.9567	42.9684	42.9876	42.4060	42.4002	42.3916	42.3262	42.3367	41.7057	41.6231
Start longitude (dd)	-124.9230	-124.9072	-124.8758	-124.7606	-124.7634	-124.8156	-124.9017	-124.9249	-125.0259	-124.9835
End latitude (dd)	42.9482	42.9598	42.9801	42.3986	42.3930	42.3840	42.3355	42.3309	41.7161	41.6241
End longitude (dd)	-124.9184	-124.9064	-124.8810	-124.7544	-124.7577	-124.8160	-124.9010	-124.9328	-125.0247	-124.9956
Station	32D	32C	32B	36C	36D	36G	36I	36J	40J	40I
Avg. Bottom depth (m)	434.43	369.18	299.15	379.54	442.91	784.84	1062.11	1212.04	1180.33	1053.07
Duration (hr)	0.35	0.32	0.31	0.32	0.33	0.27	0.36	0.44	0.41	0.38
Distance fished (km)	1.4	1.16	1.15	1.26	1.24		1.4	1.42	1.67	1.49
Net width (m)	15.00	15.00	14.12	14.75	15.00	15.14	15.14	15.40	14.75	15.29
Performance	0	0	0	0	0	-5.1	0	1.11	0	0
Spiny dogfish		1.9			2.9					
Other sharks		2.2			0.2					
Skates	31.9	39.3	41.0	15.9	6.9		0.5	11.6	14.4	2.2
Other elasmobranchs		2.0		0.5	0.9					
Arrowtooth flounder	2.2			3.1	2.7					
Petrale sole										
Dover sole	127.5	139.3	98.9	308.1	304.1		2.9	15.6	48.2	6.4
Deepsea sole							5.2	31.0	2.9	9.4
Rex sole	30.1	29.9	26.3	28.1	21.1					
Other flatfish	26.9	2.6		0.4	22.6					
Sablefish	31.2	32.4	45.4	40.5	15.4		1.3	50.6	40.7	5.4
Other grenadier							38.5	260.6	107.6	12.6
Pacific flatnose							2.3	6.5	9.1	0.1
Slickheads							6.5	2.7	8.5	10.2
Pacific whiting	4.2	14.2	17.9		3.4					
Fish unidentified	5.9	4.1	5.5	4.1	7.7		2.0	4.8	7.4	2.9
Shortspine thornyhead	6.5	13.5	13.7	4.5	2.2		2.5	22.9	13.9	22.0
Longspine thornyhead	4.8						77.9	23.6	52.9	135.5
Other rockfish	3.5	4.2	7.3	3.3	7.0					
Grooved tanner crab							14.5	12.4	13.1	23.4
Other invertebrates	26.9	23.4	61.4	23.3	20.1		46.1	16.0	78.5	0.3
Total catch weight by species	301.6	309.1	317.4	431.9	417.1		200.1	458.2	397.1	230.3

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801004044	199801004045	199801004046	199801004047	199801004048	199801004049	199801004050	199801004051	199801004052	199801004053
Start date and time	10/4/98 13:28	10/4/98 16:41	10/4/98 17:54	10/7/98 7:24	10/7/98 9:24	10/7/98 14:08	10/7/98 16:41		10/8/98 7:35	10/8/98 10:32
Start latitude (dd)	41.6280	41.6518	41.6246	41.0631	41.0574	41.0617	41.0779		40.2692	40.2931
Start longitude (dd)	-124.8208	-124.5064	-124.4956	-124.3915	-124.4467	-124.5638	-124.6496		-125.0220	-124.9331
End latitude (dd)	41.6236	41.6428	41.6334	41.0726	41.0498	41.0562	41.0780		40.2615	
End longitude (dd)	-124.8304	-124.5035	-124.4926	-124.3906	-124.4488	-124.5722	-124.6379		-125.0307	
Station	40H	40C	40B	44B	44E	44G	44H		48I	48H
Avg. Bottom depth (m)	901.35	359.50	295.59	298.95	517.20	758.77	899.35		1072.93	
Duration (hr)	0.37	0.32	0.32	0.32	0.39	0.37	0.37		0.44	
Distance fished (km)	1.4	1.27	1.25	1.25	1.37	1.42	1.36		1.76	
Net width (m)	15.00	15.00	15.00	15.00	15.00	15.86	15.29		15.25	
Performance	0	0	0	5.1	0	0	0		0	-5.7
Spiny dogfish			129.8	1.3						
Other sharks	3.0			0.5	5.0	1.6	1.7		3.1	
Skates		61.1	5.2	26.3			1.6		4.7	
Other elasmobranchs										
Arrowtooth flounder			2.5	1.0	2.3					
Petrale sole										
Dover sole	5.6	54.8	21.6	33.5	76.9	23.4	22.8		18.2	
Deepsea sole	4.6					5.9	7.5		0.9	
Rex sole		20.2	16.0	31.2	52.6					
Other flatfish		2.9	0.3	0.3	0.1					
Sablefish		15.9		2.6		24.8	8.6		55.8	
Other grenadier	5.0					2.8	48.6		141.2	
Pacific flatnose	0.2						0.9		2.8	
Slickheads						2.1	0.8		4.1	
Pacific whiting		45.4		235.1	5.8					
Fish unidentified	4.4	3.1	7.7	3.8	6.2	1.4	6.2		2.8	
Shortspine thornyhead		14.7	4.8	0.9		5.9	1.6		19.0	
Longspine thornyhead	46.6					1.4	82.5	42.8	48.2	
Other rockfish		22.3	48.0	6.8	2.5	2.2				
Grooved tanner crab	17.2	1.5				6.7	8.2		12.5	
Other invertebrates	0.7	70.1	69.0	14.6	15.8	15.6	13.7		9.0	
Total catch weight by species	87.3	312.2	304.9	357.9	168.6	174.9	165.2		322.4	

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801004054	199801004055	199801004056	199801004057	199801004058	199801004059	199801004060	199801004061	199801004062	199801004063
Start date and time	10/8/98 12:40	10/8/98 16:08	10/8/98 17:45	10/9/98 7:24	10/9/98 8:45	10/9/98 11:06	10/9/98 13:26	10/9/98 16:42	10/10/98 7:34	10/10/98 10:31
Start latitude (dd)	40.2764	40.3917	40.3944	39.6389	39.6701	39.6604	39.6797	39.6442	39.0606	39.0287
Start longitude (dd)	-124.8604	-124.5686	-124.5568	-123.9765	-124.0232	-124.0979	-124.1374	-124.1375	-124.1902	-124.0802
End latitude (dd)	40.2864	40.3966	40.3992	39.6469	39.6618	39.6693	39.6893	39.6352	39.0703	39.0367
End longitude (dd)	-124.8635	-124.5772	-124.5666	-123.9808	-124.0204	-124.1014	-124.1408	-124.1348	-124.1890	-124.0847
Station	48G	48D	48B	52A	52C	52G	52H	52I	56J	56G
Avg. Bottom depth (m)	774.61	443.11	292.94	224.71	386.67	766.01	897.93	1051.62	1192.44	774.06
Duration (hr)	0.39	0.32	0.35	0.3	0.3	0.34	0.4	0.44	0.42	0.37
Distance fished (km)	1.71	1.25	1.28	1.11	1.05	1.35	1.6	1.66	1.63	1.51
Net width (m)	14.25	14.14	14.25	15.00	14.00	15.00	15.00	14.57	13.71	15.62
Performance	0	0	0	0	0	0	0	0	0	0
Spiny dogfish			1.0	20.4	3.9					
Other sharks	0.9					1.1	3.2	11.3	5.1	2.7
Skates	6.2	3.1	28.1	7.1	9.6				5.7	8.2
Other elasmobranchs		6.9	15.8	1.1	17.6	0.9				
Arrowtooth flounder					0.6					
Petrale sole										
Dover sole	40.2	60.8	39.7	1.6	104.1	37.3	6.9	38.5	89.1	65.6
Deepsea sole	1.3					3.1	5.2	14.0	*	5.6
Rex sole		14.6	64.5		4.0					
Other flatfish			2.3		1.8					
Sablefish	6.4	3.0	39.7		3.8	0.7	6.8	11.0	26.0	16.9
Other grenadier	2.2					2.1	14.5	23.5	178.8	3.7
Pacific flounder							2.3	4.1	13.6	0.1
Slickheads	0.7					2.5	4.5		6.3	12.2
Pacific whiting		27.6	69.8		43.2					
Fish unidentified	0.7	4.4	1.9		6.4	2.7	2.8	10.5	11.5	0.6
Shortspine thornyhead	2.8	2.4	12.7	0.1	3.4	8.6	4.6	25.3	8.7	28.1
Longspine thornyhead	38.3					62.8	66.8	98.9	17.3	142.5
Other rockfish		1.3	7.6	31.9	6.0					
Grooved tanner crab	34.8	1.1			0.3	7.6	13.4	18.1		0.4
Other invertebrates	2.9	76.7	30.7	2.4	33.0	19.4	15.9	118.9	17.5	8.4
Total catch weight by species	137.5	201.9	313.7	64.6	237.6	148.9	146.7	374.2	379.6	294.9

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801004064	199801004065	199801004066	199801004067	199801004068	199801004069	199801004070	199801004071	199801004072	199801004073
Start date and time	10/10/98 12:42	10/10/98 14:44	10/10/98 16:38	10/11/98 7:20	10/11/98 9:10	10/11/98 12:09	10/11/98 14:14	10/11/98 16:54	10/12/98 7:38	10/12/98 10:42
Start latitude (dd)	39.0336	38.9523	38.9464	38.3406	38.3387	38.3438	38.3422	38.3776	37.6096	37.6244
Start longitude (dd)	-124.0306	-124.0302	-123.9490	-123.4998	-123.5879	-123.6297	-123.6492	-123.6923	-123.1945	-123.1742
End latitude (dd)	39.0419	38.9614	38.9552	38.3423	38.3256	38.3356	38.3341	38.3688	37.6060	37.6202
End longitude (dd)	-124.0334	-124.0288	-123.9469	-123.5039	-123.5827	-123.6246	-123.6456	-123.6878	-123.1842	-123.1631
Station	56F	56E	56B	60A	60D	60F	60G	60I	64J	64I
Avg. Bottom depth (m)	616.53	506.13	303.76	225.71	441.61	624.80	758.24	1038.22	1205.45	1066.82
Duration (hr)	0.38	0.37	0.34	0.37	0.34	0.36	0.4	0.47	0.41	0.4
Distance fished (km)	1.49	1.46	1.31	0.96	1.88	1.45	1.5	1.68	1.38	1.39
Net width (m)	15.00	14.12	14.00	15.12	14.12	15.00	14.88	15.25	15.38	14.00
Performance	0	0	0	-1.2	0	0	0	0	0	0
Spiny dogfish			3.6	3.9						
Other sharks	2.0					0.7	3.7	0.4		
Skates	1.1	27.5	15.4		11.9	3.4	3.7	5.1	3.3	
Other elasmobranchs			0.4	8.9	2.6					
Arrowtooth flounder										
Petrale sole										
Dover sole	49.8	149.9	86.9	10.7	269.7	40.2	103.0	110.4	50.2	91.4
Deepsea sole	0.4						4.8	20.2	15.7	13.1
Rex sole		32.1	9.5	9.9	86.7					
Other flatfish			4.3	3.0	1.8					
Sablefish	10.5	11.6	0.6			3.2	3.3	10.8	20.3	90.9
Other grenadier						1.0	3.1	96.3	237.4	123.9
Pacific flatnose	0.1					0.2	0.9	2.4	19.9	1.4
Slickheads						0.8	1.6	5.5	55.3	58.0
Pacific whiting	0.3	27.4	10.2		92.6	2.9				
Fish unidentified	2.7	11.8	0.2	17.4	7.4	7.7	5.9	17.6	1.4	3.8
Shortspine thornyhead	8.2	6.1	1.8		1.1	54.2	4.6	14.9	14.4	55.3
Longspine thornyhead	9.6					33.6	65.8	45.3	22.4	60.8
Other rockfish		8.0	223.6	106.3	43.2					
Grooved tanner crab	126.6		0.2			5.2	24.5	7.0	0.5	
Other invertebrates	28.6	26.1	110.2	22.8	74.1	29.4	21.8	19.9	16.9	10.2
Total catch weight by species	239.9	300.5	467.0	182.8	591.1	182.3	246.7	355.6	457.7	508.8

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801004074	199801004075	199801004076	199801004077	199801004078	199801004079	199801004080	199801004081	199801004082	199801004083
Start date and time	10/16/98 7:34	10/16/98 10:39	10/16/98 12:35	10/16/98 15:24	10/16/98 17:43	10/17/98 7:19	10/17/98 9:27	10/17/98 11:42	10/17/98 14:03	10/17/98 17:17
Start latitude (dd)	37.0352	37.0117	37.0240	37.0106	37.0018	36.3934	36.3914	36.3675	36.3446	36.3472
Start longitude (dd)	-122.6206	-122.6277	-122.6573	-122.7632	-122.7748	-122.2179	-122.1897	-122.1554	-122.0640	-122.0412
End latitude (dd)	37.0404	37.0131	37.0196	37.0182	37.0085	36.4023	36.3966	36.3749	36.3377	36.3407
End longitude (dd)	-122.6302	-122.6379	-122.6664	-122.7689	-122.7846	-122.2104	-122.1800	-122.1476	-122.0716	-122.0493
Station	68A	68C	68D	68H	68I	72I	72H	72G	72B	72A
Avg. Bottom depth (m)	220.83	368.87	430.87	917.85	1054.70	1035.01	902.99	760.75	291.18	216.56
Duration (hr)	0.33	0.36	0.38	0.41	0.46	0.47	0.43	0.39	0.35	0.33
Distance fished (km)	1.2	1.22	1.41	1.68	1.71	1.93	1.53	1.52	1.32	1.21
Net width (m)	13.72	13.11	13.11	14.63	14.63	14.94	13.11	14.63	14.33	14.37
Performance	0	1.11	0	0	1.11	0	4.2	0	0	0
Spiny dogfish		6.5	2.9							0.7
Other sharks				0.1	15.7	1.6	1.4	8.3	0.6	
Skates	9.3	31.7	13.9	2.3		9.1	5.4		35.6	12.0
Other elasmobranchs		1.7							2.5	2.6
Arrowtooth flounder										
Petrale sole	4.5	0.4							61.0	1.8
Dover sole	12.6	78.1	196.8	228.0	171.9	10.5	3.1	63.9	13.4	1.9
Deepsea sole				11.3	2.3	14.1	4.6	2.3		
Rex sole	3.7	30.7	37.2						11.6	4.0
Other flatfish	10.3	1.1	0.3						8.9	11.0
Sablefish		1.2	7.7	45.7	69.9	8.1	2.7	2.3		
Other grenadier				68.9	224.1	97.8	1.4	1.8		
Pacific flatnose				0.5	4.4	2.2	1.1	0.8		
Slickheads				23.1	11.4	4.6	2.5	3.6		
Pacific whiting	0.2	90.1	35.2					0.4	7.5	0.9
Fish unidentified	1.9	1.9	4.5	7.5		2.2	3.7	2.1	1.1	2.4
Shortspine thornyhead		0.1	1.8	25.9	30.6	30.0	3.7	7.8		
Longspine thornyhead				126.9	65.8	54.9	19.4	40.9		
Other rockfish	184.8	199.6	70.1		4.5				19.1	2.5
Grooved tanner crab				15.0	4.2	10.4	5.6	4.8	0.7	
Other invertebrates	0.7	18.0	23.6	13.0	16.2	38.5	15.2	5.3	17.2	9.4
Total catch weight by species	228.0	461.1	394.0	568.2	621.0	284.0	69.8	144.3	179.2	49.2

Table A-1. Station and catch data from the 1998 West Coast upper continental slope bottom trawl survey. Continued.

Haul number	199801004084	199801004085	199801004086	199801004087	199801004088	199801004089	199801004090	199801004091
Start date and time	10/18/98 8:20	10/18/98 10:01	10/18/98 12:32	10/18/98 17:02	10/19/98 7:30	10/19/98 9:54	10/19/98 12:37	10/19/98 15:37
Start latitude (dd)	35.6243	35.6122	35.6340	35.6653	34.9816	34.9623	34.9413	34.9991
Start longitude (dd)	-121.3462	-121.3547	-121.4993	-121.6121	-121.5879	-121.5721	-121.5488	-121.3251
End latitude (dd)	35.6322	35.6194	35.6262	35.6733	34.9864	34.9685	34.9509	35.0056
End longitude (dd)	-121.3526	-121.3620	-121.4937	-121.6178	-121.5761	-121.5608	-121.5450	-121.3331
Station	76A	76B	76F	76G	80J	80I	80H	80E
Avg. Bottom depth (m)	217.42	284.81	609.54	754.56	1195.73	1046.96	906.96	504.53
Duration (hr)	0.32	0.34	0.39	0.39	0.45	0.47	0.44	0.37
Distance fished (km)	1.25	1.28	1.49	1.56	1.8	1.84	1.65	1.46
Net width (m)	14.63	14.63	15.68	14.63	15.41	15.54	14.63	14.63
Performance	0	1.11	0	0	0	0	0	0
Spiny dogfish	1.7	9.8	1.3					
Other sharks			19.7	5.2	1.4	3.5	2.1	1.9
Skates	1.8	11.7	5.2		1.6	0.6	4.7	3.2
Other elasmobranchs	14.3	2.7		0.5				
Arrowtooth flounder								
Petrale sole	2.0							
Dover sole	4.1	0.7	75.2	56.2	31.8	83.4	111.6	5.2
Deepsea sole				1.6	0.1	4.5	6.5	
Rex sole	2.9	0.3						1.7
Other flatfish	24.1							
Sablefish			19.4	13.4	14.9	25.3	65.6	13.0
Other grenadier					62.5	21.4	5.4	0.1
Pacific flatnose					3.1	0.4	0.1	
Slick heads			1.3	5.8	14.2	6.6	12.7	
Pacific whiting	0.7	7.5						14.5
Fish unidentified	0.9	1.5	0.6	0.9	3.2	2.3	5.4	14.3
Shortspine thornyhead			33.9	16.5	1.0	15.0	20.6	10.1
Longspine thornyhead			30.3	91.0	7.8	22.4	86.7	18.6
Other rockfish	26.6	299.6						42.8
Grooved tanner crab			0.3	1.1	1.0	0.5	1.1	
Other invertebrates	4.6	1.9	45.8	64.6	6.9	8.8	14.8	30.4
Total catch weight by species	83.7	335.7	233.0	256.8	149.5	194.0		