



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE  
Alaska Fisheries Science Center  
Resource Assessment and Conservation Engineering Division  
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April 22, 1993

## **CRUISE RESULTS**

**CHARTERED VESSELS R/V ALASKA (CRUISE 92-2)  
AND F/V GREEN HOPE (CRUISE 92-1)  
1992 WEST COAST TRIENNIAL GROUND FISH ASSESSMENT SURVEY  
JULY 6-OCTOBER 10, 1992**

The sixth triennial comprehensive bottom trawl survey of west coast continental shelf groundfish resources was recently completed by the Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC). This report summarizes the preliminary results of the survey.

## **ITINERARY**

The survey was conducted aboard the chartered University of Washington research vessel Alaska between August 20 and October 13, 1992, and the commercial trawler Green Hope between July 12 and October 5, 1992. The vessels worked northward from Pt. Conception, California, to central Vancouver Island (Nootka Sound), British Columbia, Canada (34°30' to 49°30' N lat.), sampling predetermined stations between 55 and 366 m in depth (30 to 200 fm) (Figure 1).

## **OBJECTIVES**

The triennial groundfish surveys are designed to describe and monitor the distribution, abundance, and population biology parameters of various groundfish stocks off the U.S. Pacific coast. Previous surveys in this series were conducted in 1977, 1980, 1983, 1986, and 1989. The objectives of the 1992 survey were unchanged from those in 1989. Specifically, they were:





1. to describe and assess the demersal component of the Pacific whiting (Merluccius productus) resource;
2. to describe and assess the abundance of the prerecruit component of sablefish (Anoplopoma fimbria), specifically those 1.5 years old, because the abundance of these prerecruits estimated from trawl survey data has been shown to be consistent with that inferred from commercial catch levels;
3. to monitor the status of other important groundfish stocks;
4. to determine the biological population characteristics of key groundfish species (e.g., size composition, age composition, size at maturity, length-weight relationships, and feeding habits);
5. to continue to study the movement of juvenile sablefish through tagging;
6. to collect samples requested for special studies conducted by scientists at various fishery agencies and academic institutions; and
7. to collect oceanographic data describing habitat, including sea temperature and salinity profiles.

#### **VESSELS AND GEAR**

Two commercial bottom trawlers performed the trawl operations. The research trawler Alaska is 30.5 m long overall and powered by a single main engine with 855 continuous horsepower. The Green Hope is 30.7 m long overall and also powered by a single main engine with 565 continuous horsepower.

Both vessels used standardized polyethylene Nor'eastern high opening bottom trawls equipped with bobbin roller gear. Gear specifications include: a 27.2-m headrope with twenty-one 30-cm floats and a 24.3-m long link chain fishing line attached to a 24.9-m footrope. The roller gear was 24.2 m long, constructed of 2-cm diameter galvanized wire rope, 36-cm rubber bobbins spaced 1.5 m apart, and separated by a solid string of 10-cm rubber disks. Additionally, 5.9-m wire rope extensions with 10-cm and 20-cm rubber disks were used to span each lower flying wing section. Trawls were made of 12.7-cm stretched-mesh polyethylene web with a 0.6-cm mesh nylon liner in the codend. Nets were rigged with triple 54.9-m, 1.6-cm diameter galvanized wire rope

dandylines. Steel V-doors (2.1 x 1.5 m) weighing approximately 567 kg each were used. The fishing dimensions of the trawl were measured aboard each vessel using a Scanmar<sup>1</sup> net measurement system. Preliminary inspection of the data revealed that the net used on the Green Hope had a 12.55-m mean path width while that used aboard the Alaska had a 12.76-m mean path width.

Oceanographic data were collected throughout the cruise. Temperature-depth profiles were obtained from most hauls with a net-mounted data logger. Temperature and salinity profiles of the water column were gathered at selected stations using a self-contained Seabird CTD probe and sea surface temperatures were taken using bucket thermometers.

### SURVEY DESIGN AND METHODS

Until 1989, west coast triennial groundfish surveys had the primary objective of providing distribution and abundance estimates of Pacific whiting and shelf rockfish resources, particularly canary (Sebastes pinniger) and yellowtail (S. flavidus) rockfish. Despite a number of attempts to improve the precision of rockfish biomass estimates, variances remained high. Consequently, the 1989 and 1992 surveys have shifted away from high density rockfish sampling and placed greater emphasis on abundance assessment of Pacific whiting and juvenile (age 1+) sablefish. The present survey focused on these two species while maintaining the broader, multi-species assessment objective of previous surveys. Accordingly, a background sampling intensity comparable to the low density sampling in prior surveys was used for the entire survey area, with heavier sampling concentrated in four latitudinal ranges identified as high density strata for juvenile sablefish. These areas were delineated using catch rate information from previous surveys and commercial catch records. The latitudinal ranges of the high density strata are:

47°50' -48°20' Juan de Fuca Canyon  
 44°40' -46°30' Astoria Canyon  
 36°50' -38°00' Half Moon Bay  
 34°30' -35°40' Morro Bay

The typical reduction in whiting and juvenile sablefish catch rates at depths from 165 m to 183 m served as the rationale for stratification at 183 m. Thus, the shallow stratum ranged from 55 to 183 m and the deep stratum from 184 to 366 m.

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<sup>1</sup> Reference to trade names or commercial firms does not constitute endorsement by the National Marine Fisheries Service, NOAA.

Tracklines were drawn across both depth strata at 18.5-km intervals. In the four high density juvenile sablefish strata, additional tracklines were drawn midway between the 18.5-km tracklines, crossing only the 55- to 183-m depth stratum. Stations were randomly located along tracklines at the rate of one station per 7.4 km in the shallow stratum, and one station per 9.3 km in the deep stratum. At least one trawl station was assigned to each depth stratum along each trackline. The two vessels fished alternate tracklines (alternate pairs in the high density areas) to minimize and to assess the effects of between-vessel differences in fishing power.

A total of 601 predetermined stations were established for this survey. Tows were 30 minutes in duration, allowing 3 to 10 minutes between setting the winch brakes and beginning the tow to allow the net to settle to the bottom. Efforts were made to maintain towing at a constant depth. Catches were sorted, weighed, and counted by species and a variety of biological data (age, length, weight, and maturity of individual specimens) was taken. Special requests were also fulfilled for meristic, stomach, fin ray, tissue, and whole fish samples.

## RESULTS

Successful trawl hauls were achieved at 526 of the 569 survey stations attempted, while 34 stations were abandoned because they were considered untrawlable (Figure 1, Table 1) and 7 stations were not attempted due to time constraints. Surface temperatures were collected at 536 stations (Figure 2), while temperature and salinity profiles were taken at 89 of the innermost and outermost stations of the tracklines assigned to the Green Hope. Bottom temperatures from 502 stations were extracted from either the data logger or CTD temperature-depth profiles (Figure 2).

A total of 135 fish species belonging to 54 families were identified in catches throughout the survey. In addition to the groundfish species, samples contained representatives from numerous orders of invertebrates. The types and numbers of biological data collected from fish are summarized in Table 2. The International Pacific Halibut Commission (IPHC) participated in the survey and collected 222 specimens for analysis of age, length, gender, and parasites for comparisons with commercial fishing data. Age structures collected from other fish species will be read by the age determination unit of the AFSC.

Table 3 shows the dominant fish species caught by International North Pacific Fisheries Commission (INPFC) area and depth stratum, ranked in order of catch per unit effort (CPUE) expressed as kg/km trawled. Shortbelly rockfish (S. jordani) dominated the catches in both the Conception and Monterey INPFC areas and jack mackerel (Trachurus symmetricus) dominated in the Eureka INPFC area. Pacific hake had the highest mean CPUE in the Columbia INPFC area and in the U.S. and Canadian portions of the Vancouver area and was second in abundance in the Conception area, third in the Eureka area, and fourth in the Monterey area. Other dominant catch components included chilipepper (S. goodei) and white croaker (Genyonemus lineatus) in the Monterey area, Pacific herring (Clupea pallasii) in the Eureka area, sablefish and jack mackerel in the Columbia area, and spiny dogfish (Squalus acanthias) in the U.S. and Canadian portions of the Vancouver area. In the three northernmost INPFC areas, the shallow stratum was dominated by Pacific hake and the deep stratum was dominated by either sablefish, Pacific ocean perch (S. alutus), or Pacific hake. The shallow stratum in the Conception, Monterey, and Eureka areas was dominated by bocaccio (S. paucispinis), chilipepper, and jack mackerel, whereas the deep stratum was dominated by shortbelly rockfish and Pacific hake.

Estimates of the population size composition of several commercially-important groundfish species are provided in Figures 3 through 6, showing their size composition in U.S. waters only.

A total of 1,666 juvenile sablefish were captured, tagged, and released. This information will be incorporated into the sablefish tag release/recapture database maintained at the AFSC.

## SCIENTIFIC PERSONNEL

GREEN HOPE (90 DAYS)**Leg 1: 7/12-31****Morro Bay, CA - San Francisco, CA**

Mark Wilkins, AFSC	Chief Scientist
Bob Lauth, AFSC	Fishery Biol.
Robin Harrison, AFSC	Fishery Biol.
Dave Roetcisoender, AFSC	Fishery Biol.
Debra McFee, AFSC	Biological Tech.

**Leg 2: 8/1-21****San Francisco, CA - Eureka, CA**

Ken Weinberg, AFSC	Chief Scientist
Michael Martin, AFSC	Fishery Biol.
Debra McFee, AFSC	Biological Tech.
Peter Munro, AFSC	Fishery Biol.
Melissa Grader, AFSC	Fishery Biol.

**(Vessel Break 8/22-23)****Leg 3: 8/24-9/13****Eureka, CA - Astoria, OR**

Frank Shaw, AFSC	Chief Scientist
Brian Jarvis, SWFSC	Fishery Biol.
Joan Forsberg, IPHC	Fishery Biol.
Ron Kimball, AFSC	Biological Tech.
Lynn Faughnan, AFSC	Fishery Biol.

**Leg 4: 9/14-10/4****Astoria, OR - Seattle, WA**

Ken Weinberg, AFSC	Chief Scientist
Sand Borrego, AFSC	Gear Specialist
Michelle Sabo, AFSC	Fishery Biol.
Lori Sadorus, IPHC	Fishery Biol.
Brian Jarvis, SWFSC (1st half)	Fishery Biol.
Martha Rickey, WDF (2nd half)	Fishery Biol.

ALASKA (50 DAYS)**Leg 1: 8/20-9/13****Seattle, WA - Astoria, OR**

Norm Parks, AFSC	Chief Scientist
Bill Flerx, AFSC	Fishery Biol.
Chad Jay, OSU	Fishery Biol.
Calvin Blood, IPHC	Fishery Biol.
Mei Sun Yang, AFSC	Fishery Biol.

**Leg 2: 9/14-10/7****Astoria, OR - Seattle, WA**

Bob Lauth, AFSC	Chief Scientist
Steve de Blois, AFSC	Fishery Biol.
Mark Zimmermann, AFSC	Fishery Biol.
Bernard Vienneau, IPHC	Fishery Biol.
Terry Sample, AFSC (1st half)	Fishery Biol.
Russel Svec, MTC (2nd half)	Fishery Biol.

AFSC - Alaska Fisheries Science Center, Seattle, Washington

IPHC - International Pacific Halibut Commission, Seattle, Washington

MTC - Makah Tribal Council, Neah Bay, Washington

OSU - Oregon State University, Corvallis, Oregon

SWFSC - Southwest Fisheries Science Center, La Jolla, California

WDF - Washington Department of Fisheries, Seattle, Washington

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Table 1.--Summary of sampling success at bottom trawl stations in each International North Pacific Fisheries Commission (INPFC) area and depth stratum during the 1992 NMFS triennial bottom trawl survey.

INPFC AREA		Shallow (55-183 m)	Deep (184-366 m)	Total (55-366 m)
Conception	Successful	21	9	30
	Unsuccessful	4	0	4
	Abandoned	0	0	0
Monterey	Successful	108	21	129
	Unsuccessful	10	5	15
	Abandoned	9	7	16
Eureka	Successful	37	16	53
	Unsuccessful	2	0	2
	Abandoned	1	0	1
Columbia	Successful	167	36	203
	Unsuccessful	4	2	6
	Abandoned	5	3	8
U.S. Vancouver	Successful	38	12	50
	Unsuccessful	9	0	9
	Abandoned	4	1	5
Canadian Vancouver	Successful	54	7	61
	Unsuccessful	5	0	5
	Abandoned	8	4	12

Table 2.--Biological data collected during the 1992 west coast triennial survey. Abbreviations: length frequency (LF), age structure<sup>1</sup> (Age), specimen weight (Wgt), maturity (Mat), pathology samples (Path).

Species	LF	Age	Wgt	Mat	Path	Species	LF	Age	Wgt	Mat	Path
Pacific hake	48,832	1088	958	790	154	Brown rockfish	5	—	—	—	—
Sablefish	7,621	730	588	313	101	Canary rockfish	680	280	214	106	—
American shad	19	---	---	---	---	Chilipepper	4,195	246	187	141	1
Chinook salmon	29	---	---	---	---	Darkblotched rockfish	1,661	---	---	---	---
Chub mackerel	575	---	---	---	---	Flag rockfish	1	---	---	---	---
Jack mackerel	371	---	---	---	---	Greenspotted rockfish	16	---	---	---	---
Lingcod	892	343	268	105	---	Greenstriped rockfish	2,917	---	---	---	---
Pacific cod	199	---	---	---	---	Halfbanded rockfish	762	---	---	---	---
Pacific herring	216	---	---	---	---	Olive rockfish	121	---	---	---	---
Pacific lamprey	---	---	---	---	1	Pacific ocean perch	2,347	702	617	160	1
Pacific sardine	91	---	---	---	---	Pygmy rockfish	1,323	---	---	---	---
Pacific tomcod	109	---	---	---	---	Quillback rockfish	17	---	---	---	---
Walleye pollock	606	---	---	---	---	Redbanded rockfish	93	---	---	---	---
Arrowtooth flounder	5,176	---	256	197	53	Redstripe rockfish	3,648	---	---	---	---
Butter sole	34	---	---	---	---	Rosethorn rockfish	654	---	---	---	---
Curlinfin sole	12	---	---	---	---	Rougheye rockfish	351	---	---	---	---
Dover sole	11,612	---	367	321	116	Sharpchin rockfish	2,676	---	---	---	---
English sole	10,479	---	---	---	2	Shortbelly rockfish	5,310	---	---	---	---
Flathead sole	1,055	---	---	---	---	Shortspine thornyhead	1,414	---	---	---	61
Pacific halibut	220	177	---	---	43	Silvergray rockfish	221	52	52	52	---
Pacific sanddab	14,254	---	---	---	---	Speckled rockfish	78	---	---	---	---
Petrals sole	1,105	---	159	---	---	Splitnose rockfish	3,877	---	---	---	---
Rex sole	18,293	---	---	---	1	Squarespot rockfish	12	---	---	---	---
Rock sole	565	---	---	---	---	Stripetail rockfish	5,770	---	---	---	---
Sand sole	106	---	---	---	---	Vermilion rockfish	142	---	---	---	---
Slender sole	876	---	---	---	---	Widow rockfish	724	34	55	40	---
Bank rockfish	126	---	---	---	---	Yelloweye rockfish	24	---	---	---	2
Blue rockfish	273	---	---	---	---	Yellowmouth rockfish	34	---	---	---	---
Bocaccio	538	125	101	46	---	Yellowtail rockfish	2,835	933	882	380	---

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<sup>1</sup>Finrays were collected from lingcod. Otoliths were collected from all other species.

Table 3.--Mean CPUE (kg/km) for the 20 most abundant groundfish species by International North Pacific Fisheries Commission (INPFC) area and depth stratum during the 1992 triennial groundfish survey.

CONCEPTION AREA 55-183 m		CONCEPTION AREA 184-366 m		CONCEPTION AREA 55-366 m	
Species	CPUE	Species	CPUE	Species	CPUE
Bocaccio	4.8	Shortbelly rockfish	150.0	Shortbelly rockfish	67.8
White croaker	4.4	Pacific hake	13.2	Pacific hake	7.0
Chilipepper	3.5	Stripetail rockfish	6.9	Stripetail rockfish	3.2
Widow rockfish	3.3	Splitnose rockfish	4.0	Bocaccio	2.8
Pacific sanddab	3.0	Spiny dogfish	3.4	Chilipepper	2.5
Pacific hake	2.0	Dover sole	2.0	White croaker	2.4
Pacific pompano	1.9	Chilipepper	1.2	Splitnose rockfish	1.8
Northern anchovy	1.9	Spotted ratfish	0.8	Spiny dogfish	1.8
Halfbanded rockfish	1.4	Rex sole	0.7	Widow rockfish	1.8
Vermilion rockfish	1.3	Sablefish	0.6	Pacific sanddab	1.6
Yellowtail rockfish	0.9	Pacific electric ray	0.5	Pacific pompano	1.0
Speckled rockfish	0.6	Longnose skate	0.4	Northern anchovy	1.0
Shortbelly rockfish	0.5	Bocaccio	0.4	Dover sole	0.9
Spiny dogfish	0.5	Sixgill shark	0.3	Halfbanded rockfish	0.8
Plainfin midshipman	0.3	Bigfin eelpout	0.2	Vermilion rockfish	0.7
Pacific electric ray	0.3	Slender sole	0.2	Yellowtail rockfish	0.5
Pink seaperch	0.2	Lingcod	0.1	Spotted ratfish	0.4
Pacific argentine	0.2	Shortspine thornyhead	0.1	Pacific electric ray	0.4
English sole	0.1	Cat shark unid.	0.1	Rex sole	0.3
Lingcod	0.1	Brown cat shark	T	Speckled rockfish	0.3
Number of hauls	21	Number of hauls	9	Number of hauls	30

MONTEREY AREA 55-183 m		MONTEREY AREA 184-366 m		MONTEREY AREA 55-366 m	
Species	CPUE	Species	CPUE	Species	CPUE
Chilipepper	23.3	Shortbelly rockfish	47.1	Shortbelly rockfish	19.9
Shortbelly rockfish	14.0	Pacific hake	25.1	Chilipepper	19.7
White croaker	13.2	Splitnose rockfish	9.8	White croaker	10.8
Widow rockfish	11.9	Stripetail rockfish	7.8	Widow rockfish	9.8
Pacific herring	7.9	Spiny dogfish	6.6	Pacific hake	9.7
Pacific hake	6.4	Dover sole	6.0	Pacific herring	6.5
Stripetail rockfish	3.9	Chilipepper	3.4	Stripetail rockfish	4.6
Pacific sanddab	3.4	Sablefish	1.8	Pacific sanddab	2.8
Spiny dogfish	1.8	English sole	1.4	Spiny dogfish	2.7
English sole	1.5	Rex sole	1.2	Splitnose rockfish	1.7
Sharpchin rockfish	1.1	Darkblotched rockfish	1.2	English sole	1.5
Rex sole	0.9	Shortspine thornyhead	0.7	Dover sole	1.2
Sablefish	0.7	Bank rockfish	0.5	Sharpchin rockfish	1.0
Yellowtail rockfish	0.7	Sharpchin rockfish	0.5	Rex sole	1.0
Big skate	0.6	Pacific electric ray	0.3	Sablefish	0.9
Plainfin midshipman	0.5	Shortraker rockfish	0.2	Yellowtail rockfish	0.6
Lingcod	0.5	Bocaccio	0.2	Big skate	0.5
Pacific pompano	0.5	Widow rockfish	0.2	Plainfin midshipman	0.4
Bocaccio	0.5	Bigfin eelpout	0.1	Lingcod	0.4
Greenstriped rockfish	0.3	Petrals sole	0.1	Bocaccio	0.4
Number of hauls	108	Number of hauls	21	Number of hauls	129

Table 3 (continued)

EUREKA AREA 55-183 m		EUREKA AREA 184-366 m		EUREKA AREA 55-366 m	
Species	CPUE	Species	CPUE	Species	CPUE
Jack mackerel	21.8	Pacific hake	28.5	Jack mackerel	17.3
Pacific herring	16.0	Dover sole	13.0	Pacific herring	13.0
Pacific sanddab	5.7	Sablefish	10.5	Pacific hake	9.6
Pacific hake	4.7	Stripetail rockfish	9.3	Pacific sanddab	4.5
Rex sole	1.7	Splitnose rockfish	5.2	Dover sole	3.5
Chinook salmon	1.4	Darkblotched rockfish	2.9	Sablefish	2.3
Whitebait smelt	1.0	Rex sole	2.1	Stripetail rockfish	2.2
Dover sole	1.0	Arrowtooth flounder	1.8	Rex sole	1.8
English sole	0.7	Pacific herring	1.5	Chinook salmon	1.2
Arrowtooth flounder	0.5	Shortspine thornyhead	1.3	Splitnose rockfish	1.1
Petrale sole	0.4	Spiny dogfish	1.2	Darkblotched rockfish	0.8
Big skate	0.4	Sharpchin rockfish	1.1	Whitebait smelt	0.8
Pacific halibut	0.3	Shortbelly rockfish	1.0	Arrowtooth flounder	0.8
Spotted ratfish	0.3	Lingcod	0.8	English sole	0.7
Darkblotched rockfish	0.3	Pacific halibut	0.6	Spiny dogfish	0.4
Stripetail rockfish	0.3	English sole	0.6	Petrale sole	0.4
Eulachon	0.2	Pacific ocean perch	0.6	Pacific halibut	0.4
Pacific tomcod	0.2	Longnose skate	0.4	Big skate	0.3
Yellowtail rockfish	0.2	Greenstriped rockfish	0.4	Lingcod	0.3
Spiny dogfish	0.2	Chinook salmon	0.4	Spotted ratfish	0.3
Number of hauls	37	Number of hauls	16	Number of hauls	53
COLUMBIA AREA 55-183 m		COLUMBIA AREA 184-366 m		COLUMBIA AREA 55-366 m	
Species	CPUE	Species	CPUE	Species	CPUE
Pacific hake	138.4	Sablefish	80.8	Pacific hake	123.8
Jack mackerel	22.0	Pacific hake	67.3	Sablefish	22.1
Chub mackerel	12.8	Sharpchin rockfish	34.8	Jack mackerel	17.6
Pacific sanddab	7.3	Darkblotched rockfish	11.6	Chub mackerel	10.6
Sablefish	7.0	Dover sole	9.5	Sharpchin rockfish	7.7
Spiny dogfish	5.9	Spiny dogfish	9.3	Spiny dogfish	6.6
Rex sole	4.9	Redstripe rockfish	8.8	Pacific sanddab	5.8
English sole	4.3	Splitnose rockfish	6.9	Rex sole	4.7
Dover sole	2.7	Pacific ocean perch	6.0	Dover sole	4.1
Lingcod	2.2	Yellowtail rockfish	4.4	English sole	3.6
Redstripe rockfish	2.2	Rex sole	4.1	Redstripe rockfish	3.5
Yellowtail rockfish	1.9	Shortspine thornyhead	3.2	Darkblotched rockfish	2.8
Pygmy rockfish	1.8	Arrowtooth flounder	2.9	Yellowtail rockfish	2.4
Greenstriped rockfish	1.5	Pacific halibut	2.9	Lingcod	1.9
Pacific halibut	1.4	Chub mackerel	2.5	Pacific halibut	1.7
American shad	1.2	Greenstriped rockfish	2.2	Greenstriped rockfish	1.7
Pacific herring	1.1	Spotted ratfish	1.5	Pygmy rockfish	1.4
Arrowtooth flounder	0.9	Longnose skate	1.4	Splitnose rockfish	1.4
Big skate	0.8	Rosethorn rockfish	0.9	Arrowtooth flounder	1.4
Canary rockfish	0.7	Stripetail rockfish	0.9	Pacific ocean perch	1.3
Number of hauls	167	Number of hauls	36	Number of hauls	203

Table 3 (continued)

US VANCOUVER AREA 55-183 m		US VANCOUVER AREA 184-366 m		US VANCOUVER AREA 55-366 m	
Species	CPUE	Species	CPUE	Species	CPUE
Pacific hake	72.4	Pacific hake	16.5	Pacific hake	58.3
Spiny dogfish	51.1	Dover sole	14.8	Spiny dogfish	40.6
Sablefish	17.7	Spiny dogfish	9.4	Sablefish	14.9
Redstripe rockfish	14.6	Pacific halibut	8.1	Redstripe rockfish	11.9
Yellowtail rockfish	14.5	Arrowtooth flounder	7.4	Yellowtail rockfish	11.1
Pacific herring	12.1	Sablefish	6.4	Pacific herring	9.0
Pygmy rockfish	7.8	Pacific ocean perch	4.9	Pygmy rockfish	5.9
Pacific sanddab	3.0	Redstripe rockfish	4.0	Dover sole	5.1
Sharpchin rockfish	2.6	Spotted ratfish	3.3	Arrowtooth flounder	3.7
Arrowtooth flounder	2.4	Rex sole	3.1	Pacific halibut	3.3
English sole	2.1	Shortspine thornyhead	2.8	Sharpchin rockfish	2.6
Dover sole	1.8	Sharpchin rockfish	2.5	Pacific sanddab	2.3
Pacific halibut	1.7	Longnose skate	2.3	Rex sole	1.9
Rex sole	1.5	Greenstriped rockfish	1.8	English sole	1.8
Greenstriped rockfish	1.5	Pacific cod	1.7	Greenstriped rockfish	1.5
Pacific cod	1.4	Walleye pollock	1.7	Pacific cod	1.5
Big skate	1.2	Rougheye rockfish	1.1	Pacific ocean perch	1.3
American shad	1.1	Yellowtail rockfish	1.0	Big skate	1.0
Darkblotched rockfish	0.8	English sole	0.9	Spotted ratfish	1.0
Widow rockfish	0.6	Flathead sole	0.6	American shad	0.9
Number of hauls	38	Number of hauls	12	Number of hauls	50

CANADIAN VANCOUVER AREA 55-183 m		CANADIAN VANCOUVER AREA 184-366 m		CANADIAN VANCOUVER AREA 55-366 m	
Species	CPUE	Species	CPUE	Species	CPUE
Pacific hake	51.8	Pacific ocean perch	82.2	Pacific hake	47.9
Spiny dogfish	43.6	Redstripe rockfish	33.2	Spiny dogfish	41.4
Yellowtail rockfish	9.0	Spiny dogfish	22.6	Redstripe rockfish	10.5
Arrowtooth flounder	8.6	Silvergray rockfish	19.2	Pacific ocean perch	9.4
Pacific herring	8.1	Pacific hake	14.6	Arrowtooth flounder	9.2
Redstripe rockfish	7.8	Arrowtooth flounder	14.4	Yellowtail rockfish	8.1
Dover sole	6.5	Dover sole	13.8	Dover sole	7.3
Walleye pollock	4.0	Sharpchin rockfish	13.2	Pacific herring	7.3
Rex sole	3.6	Sablefish	8.8	Sablefish	3.7
Lingcod	3.5	Bocaccio	7.0	Rex sole	3.7
Eulachon	3.2	Pacific cod	5.1	Walleye pollock	3.6
Sablefish	3.2	Splitnose rockfish	4.5	Lingcod	3.3
English sole	2.1	Rex sole	4.1	Sharpchin rockfish	3.2
Sharpchin rockfish	2.1	Greenstriped rockfish	3.9	Eulachon	2.9
Pacific cod	1.9	Canary rockfish	3.0	Silvergray rockfish	2.2
Flathead sole	1.7	Rosethorn rockfish	2.6	Pacific cod	2.2
Longnose skate	1.6	Redbanded rockfish	2.5	English sole	1.9
Canary rockfish	1.3	Spotted ratfish	2.3	Flathead sole	1.5
Pacific halibut	1.2	Pacific halibut	1.9	Longnose skate	1.5
Greenstriped rockfish	1.2	Lingcod	1.6	Greenstriped rockfish	1.5
Number of hauls	54	Number of hauls	7	Number of hauls	61

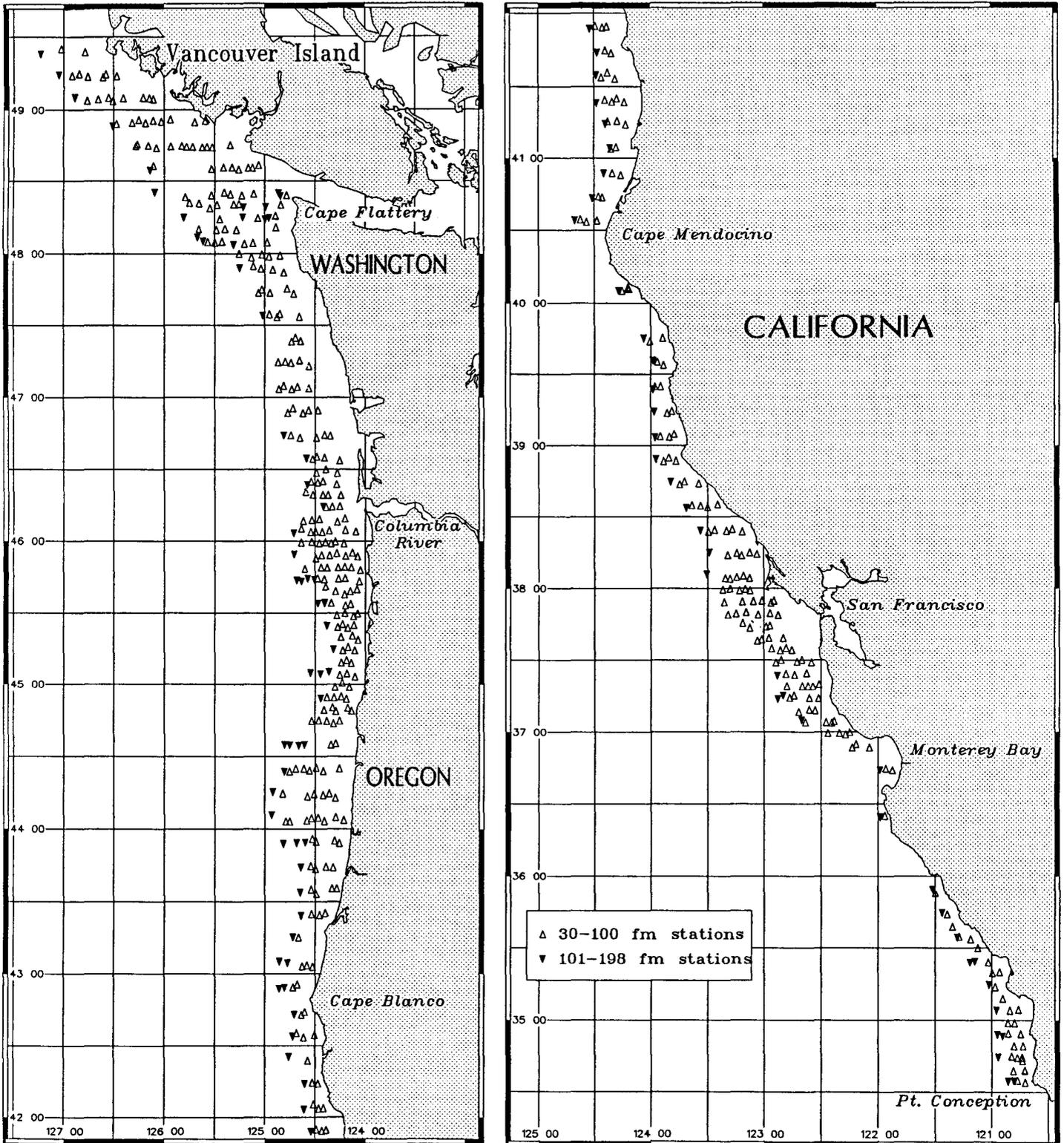


Figure 1.--Stations sampled successfully with bottom trawl hauls during the 1992 NMFS triennial bottom trawl survey.

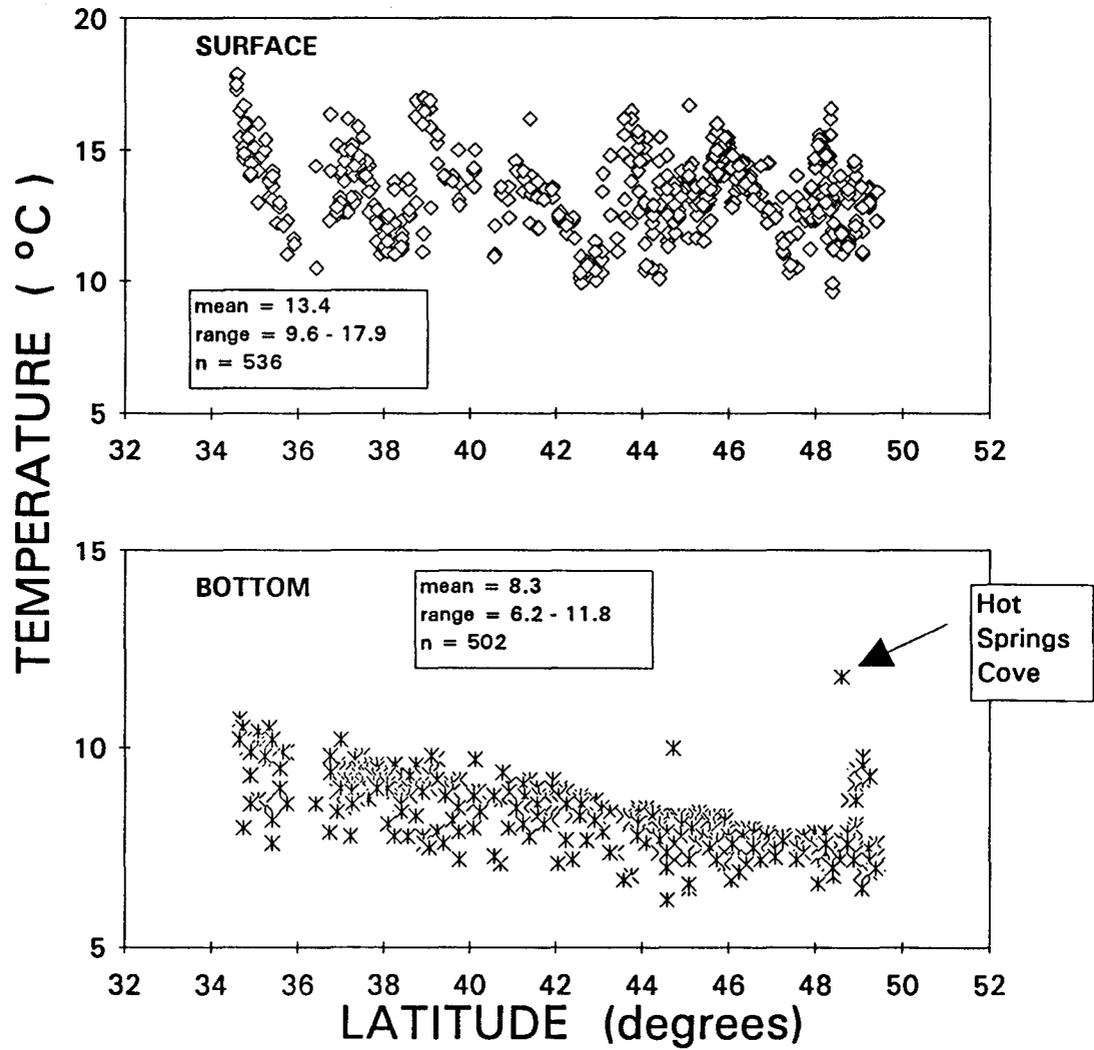
**West Coast Triennial 1992**

Figure 2.-- Surface and bottom temperatures by latitude taken during the 1992 triennial survey.

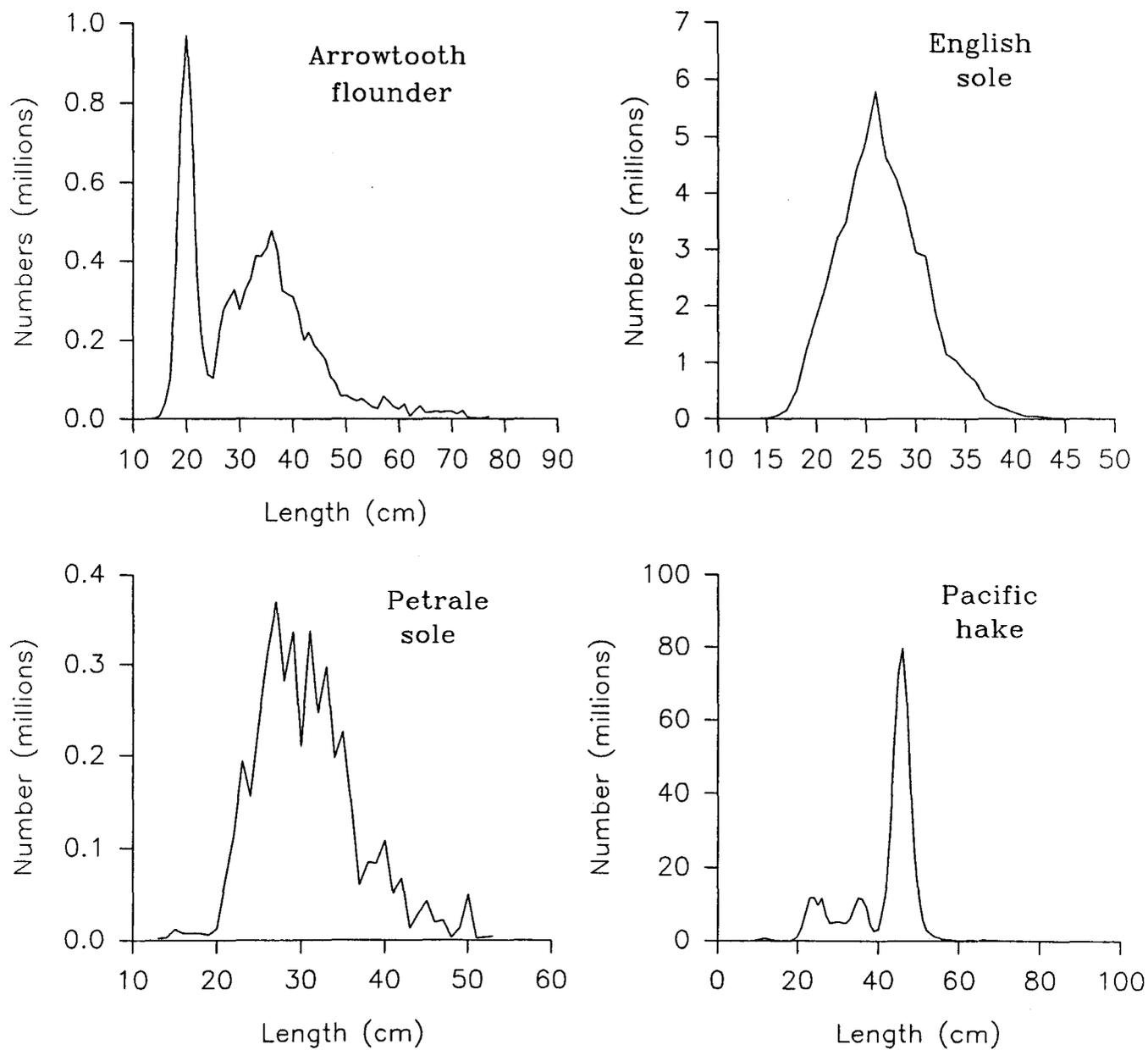


Figure 3.--Estimated size compositions for arrowtooth flounder, English sole, petrale sole, and Pacific hake for the portion of the survey area in U.S. waters.

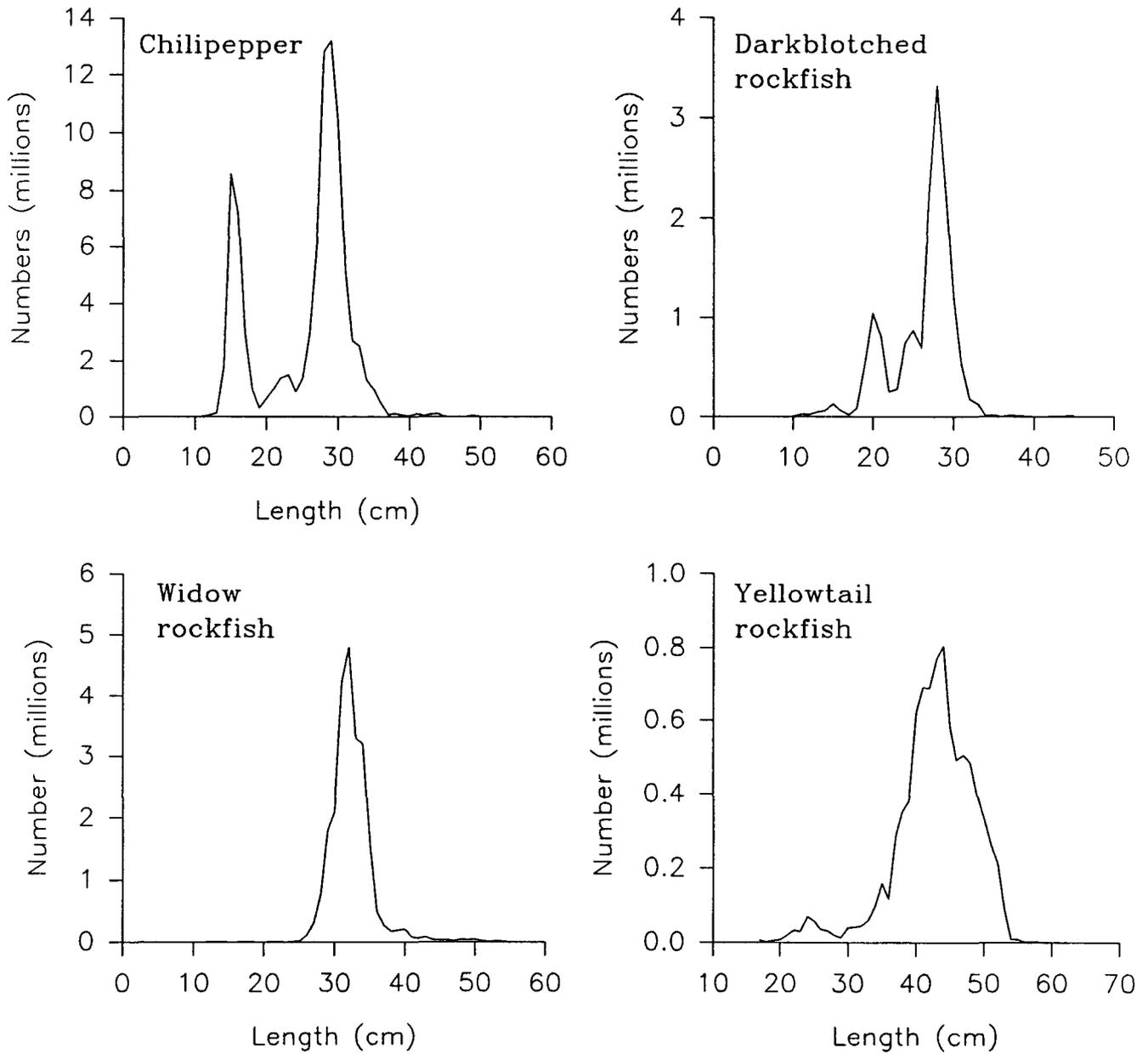


Figure 4.--Estimated size compositions for chilipepper, darkblotched rockfish, widow rockfish, and yellowtail rockfish for the portion of the survey area in U.S. waters.

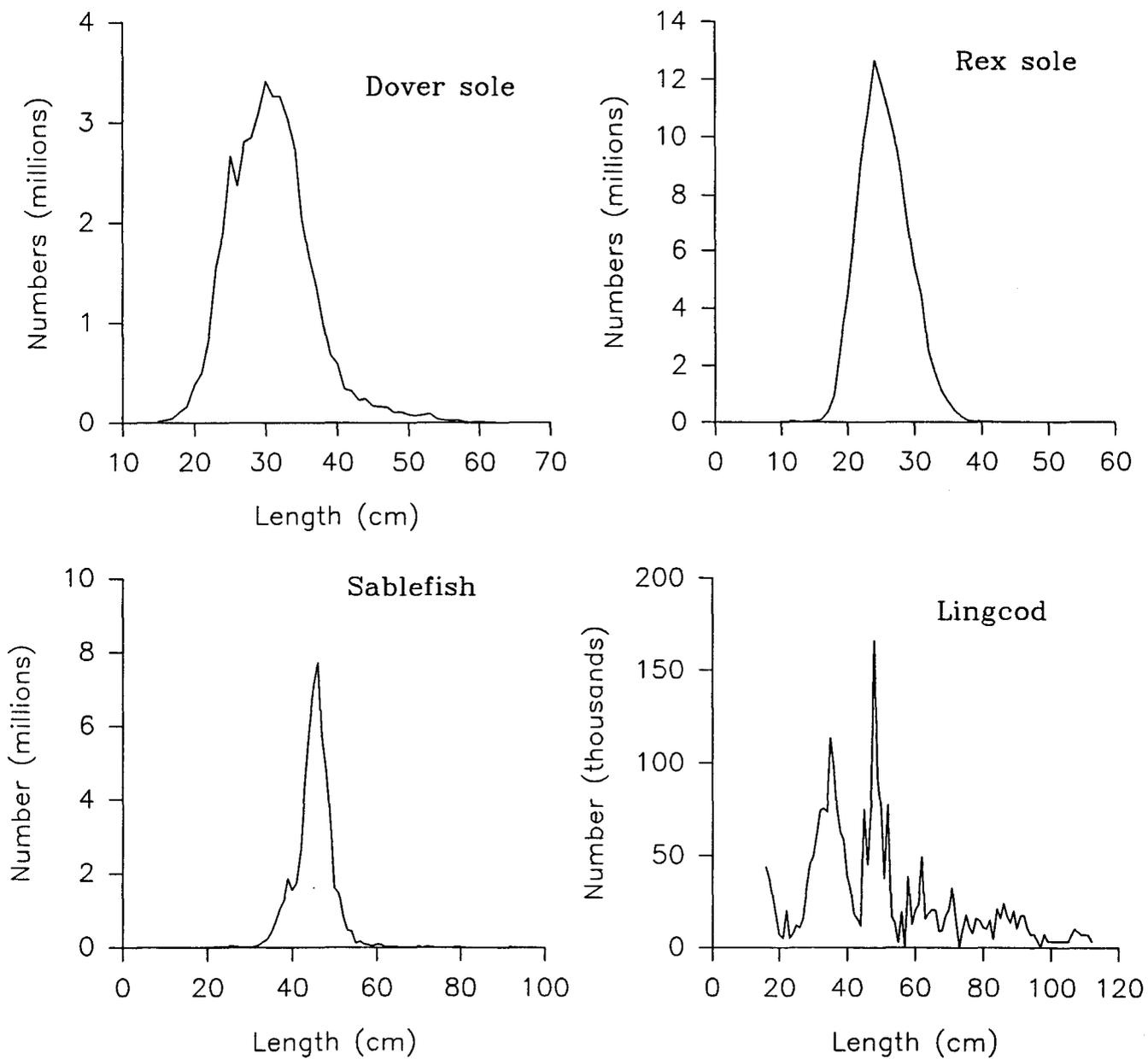


Figure 5.--Estimated size compositions for Dover sole, rex sole, sablefish, and lingcod for the portion of the survey area in U.S. waters.

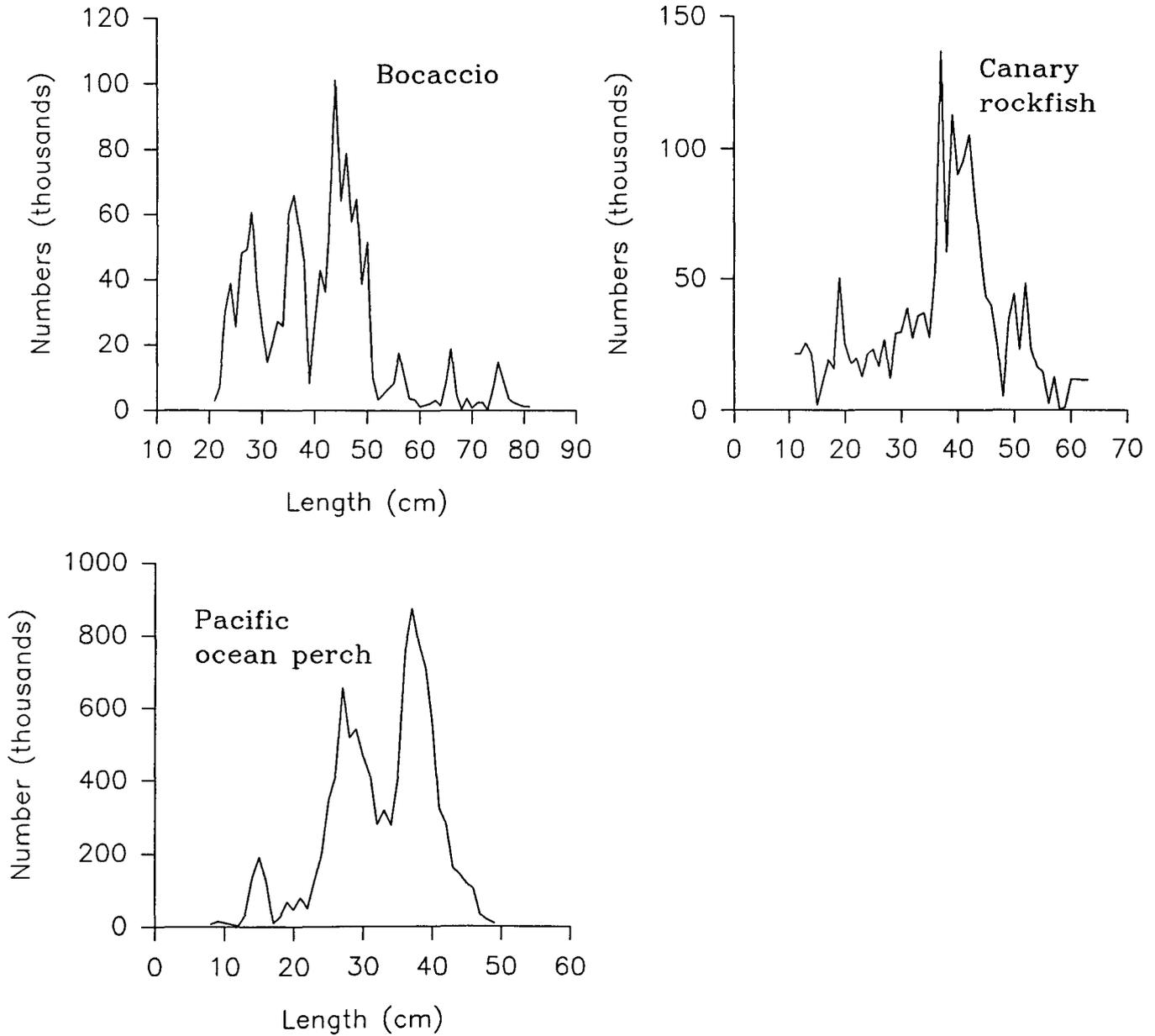


Figure 6.--Estimated size compositions for bocaccio, canary rockfish, and Pacific ocean perch for the portion of the survey area in U.S. waters.