

February 28, 2002

F/AKC2:FRS

## **CRUISE RESULTS**

**F/V SEA STORM 2001-02**

**F/V FROSTI 2001-01**

**2001 WEST COAST TRIENNIAL GROUND FISH ASSESSMENT SURVEY**

**JUNE 1 - AUGUST 27, 2001**

The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) recently completed the ninth in a series of triennial comprehensive bottom trawl surveys of West Coast continental shelf groundfish resources. This report summarizes the preliminary results of the survey.

### **ITINERARY**

The survey was conducted aboard the chartered commercial trawlers *Sea Storm* and *Frosti* starting June 1, 2001. The *Sea Storm* fished continuously finishing on August 5, while the *Frosti* was off charter between June 23 and July 15 and finished on August 27. The vessels worked northward from Pt. Conception, California, to central Vancouver Island (Esowista Peninsula), British Columbia, Canada (lat. 34°30'-49°06'N), sampling predetermined stations at depths between 55 and 500 meters (Figure 1).

### **OBJECTIVES**

The triennial groundfish surveys are designed to describe and monitor the distribution, abundance, and population biology parameters of a variety of groundfish stocks off the U.S. Pacific coast and a small portion of the southernmost Canadian coast. Previous surveys in this series were conducted in 1977, 1980, 1983, 1986, 1989, 1992, 1995, and 1998. The objectives of the triennial survey series are:

1. to describe and assess the demersal component of the Pacific hake (*Merluccius productus*, also known as Pacific whiting) resource;
2. to describe and assess the shallow component of the sablefish (*Anoplopoma fimbria*) resource, specifically fish less than two years of age;
3. to monitor the abundance, distribution, and biological characteristics of principal rockfish (*Sebastes* spp.) species, including those inhabiting the upper continental slope;
4. to monitor the status of other important groundfish stocks;
5. to determine the biological population characteristics of key groundfish species (e.g., size composition, age composition, size at maturity, length-weight relationships, and trophic interrelationships);
6. to collect samples from a variety of species for biological studies performed by scientists at various fishery agencies and academic institutions; and
7. to collect sea temperature profiles and other oceanographic data.

#### **VESSELS AND GEAR**

The *Sea Storm* is 38 m long and powered by a single main engine which generates 1,710 continuous horsepower. The *Frosti* is 39 m long and powered by a single main engine which generates 1,000 continuous horsepower. Each vessel was staffed by an experienced skipper, a four- or five-member fishing crew, and six scientists.

Both vessels used RACE standardized Poly Nor'Eastern high opening bottom trawls, equipped with bobbin roller gear. This trawl is built with a 27.2 m headrope with twenty one 30 cm floats and a 24.7 m long chain fishing line attached to a 24.9 m footrope. The roller gear is 24.2 m long, constructed of 2-cm diameter galvanized wire rope strung with 36-cm diameter rubber bobbins spaced 1.5 m apart and separated by a solid string of 10-cm diameter rubber disks. At each end of the roller gear, a 5.9 m wire rope extension strung with 10-cm and 20-cm diameter rubber disks spans the lower flying-wing section. Trawls are made of 12.7-cm stretched-mesh polyethylene web with a 3.2-cm stretched-mesh nylon liner in the codend. Nets are 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 are used with this trawl. For most of the tows, the fishing dimensions of the trawl were measured using a Scanmar<sup>1</sup> acoustic net measurement system. Preliminary analysis revealed that the trawl nets fished by the *Sea Storm* had a 13.71 m mean path width and a 7.67 m mean net height, while those fished aboard the *Frosti* had a 14.05 m mean path width and a 7.47 m mean net height.

Sea surface temperatures and temperature-depth profiles were obtained from most hauls with a net mounted data logger. Surface temperatures were also measured at most stations with a conventional bucket thermometer.

### **SURVEY DESIGN AND METHODS**

The triennial west coast bottom trawl survey was designed primarily as a method for assessing the abundance and distribution of a broad range of economically important groundfish species. We have modified the design of the survey periodically to collect more detailed information on specific species groups, while maintaining the primary multispecies objectives. Since 1995 we have sampled stations in deeper water (367-500 m) to meet the current needs of resource managers for more complete data on slope-dwelling rockfish species such as darkblotched (*Sebastes crameri*), splitnose (*S. diploproa*), sharpchin (*S. zacentrus*), and redstriped rockfish (*S. proriger*).

The survey area, which extends from Point Conception (lat. 34°30'N) to southwest Vancouver Island (lat. 49°30'N), was stratified by depth (55-183, 184-366, and 367-500 m) based on general distribution patterns of the major target species. Beginning at lat. 34°34.5'N, 119 tracklines spaced every 10 minutes of latitude were drawn across the three depth strata. Over 600 stations were randomly located along these tracklines at the rate of one station per linear 7.4 km in the shallow stratum, and one station per linear 9.3 km in the middle and deep strata. At least one trawl station was assigned to each depth stratum along each trackline. The two vessels, when working simultaneously, fished alternate tracklines.

Fishing operations for both vessels were standardized. Captains were instructed to try to maintain a constant fishing depth, maintain a constant fishing speed of three knots, and to set the gear so that, upon first bottom contact, the trawl was as close to its fishing configuration as possible. Tows lasted 30 minutes

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<sup>1</sup>Reference to trade names or commercial firms does not constitute U.S. government endorsement.

between the time the net achieved a stable fishing configuration on bottom and the beginning of net retrieval. Electronic bottom contact sensors were hung from the center of the roller gear to verify that the trawl was on bottom and to monitor the actual duration that the trawl remained in contact with the seabed. Catches were sorted, each species weighed and counted, and a variety of biological data (length, weight, and maturity of individual specimens) collected. Samples were also collected from several species for more detailed studies of their biology (age structures, tissue samples, stomach contents, etc.).

## RESULTS

Successful trawl hauls were achieved at 506 of the 527 stations sampled (Figure 1). Fifty-one stations were abandoned due to untrawlable bottom (Table 2) and 32 stations at the northern end of the survey area weren't sampled due to lack of time. Surface-to-bottom temperature profiles were collected by Richard Brancker Model XL200<sup>2</sup> microbathythermograph data loggers at 463 stations. Figure 2 presents sea surface and bottom temperatures by latitude.

We identified 199 fish species, representing 59 families, and numerous orders of invertebrates in catches throughout the survey. The types and counts of biological data collected as part of the RACE mission are summarized in Table 3. Age structures were collected from 17 groundfish species (7,314 specimens in all). The structures will be examined and ages will be assigned for these specimens at several west coast ageing laboratories.

Table 4 lists the dominant fish species and selected invertebrates caught by International North Pacific Fishery Commission (INPFC) area and depth stratum, ranked in order of catch per unit of effort (CPUE, kg/ha). Figure 1 shows the INPFC area boundaries (defined in Table 2). Pacific hake was the dominant component of the catch in all INPFC areas except the Vancouver area where walleye pollock (*Theragra chalcogramma*) was most predominant. Other dominant catch components were chilipepper (*Sebastes goodei*), shortbelly rockfish (*S. jordani*), and Dover sole (*Microstomus pacificus*) in the two southern areas; sablefish and Dover sole in the Eureka and Columbia areas; and yellowtail rockfish (*S. flavidus*), arrowtooth flounder (*Atheresthes stomias*), and Dover sole in the Vancouver area. Catches varied by depth stratum. Catches in the shallow depth

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stratum were dominated by chilipepper in the Conception area, hake in the three middle areas, and pollock in the Vancouver area. Catches in the middle depth stratum were dominated by hake and shortbelly rockfish in the three southern areas and by hake, Dover sole, sablefish, arrowtooth flounder, yellowtail rockfish and Pacific ocean perch (*S. alutus*) in the Columbia and Vancouver areas. The dominant catch components of the survey's deepest stratum included Dover sole and hake in all areas, as well as sablefish in the Eureka and Columbia areas; and rougheye rockfish (*S. aleutianus*) and shortspine thornyhead (*Sebastolobus alascanus*) in the Vancouver area.

Figure 3 shows the unweighted size compositions for several commercially important groundfish species. These distributions suggest that recent year classes of sablefish, Pacific ocean perch, bocaccio, and chilipepper may be stronger than average.

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Table 1.--Vessel itineraries and scientists participating during the 2001 NMFS triennial bottom trawl survey.

<b>F/V Sea Storm</b>			<b>F/V Frosti</b>		
<b>Leg 1: 6/5 - 6/25</b>			<b>Leg 1: 6/5 - 6/25</b>		
<u>MONTEREY - EUREKA</u>			<u>MONTEREY - ASTORIA</u>		
Frank Shaw	Field Party Chief	AFSC	Mark Wilkins	Field Party Chief	AFSC
Bob Lauth	Fishery Biologist	AFSC	Harold Zenger	Fishery Biologist	AFSC
Gary Mundell	Computer Specialist	AFSC	Ron Payne	Fishery Tech.	AFSC
Scott McKillip	Gear Specialist	AFSC	Ron Erickson	Admin. Support	AFSC
Doug Limpinsel	Fishery Biologist	AFSC	Hunter Lenihan	Fishery Biologist	NWFSC
Annette Henry	Fishery Biologist	CDFG	Jerry Berger	Fishery Biologist	AFSC
<b>Leg 2: 6/25 - 7/16</b>					
<u>EUREKA - ASTORIA</u>					
Mark Zimmermann	Field Party Chief	AFSC			
Bill Floering	Fishery Tech.	AFSC			
Elaina Jorgenson	Fishery Biologist	AFSC			
Chris Johnston	Fishery Biologist	AFSC			
Paul Olson	Oceanographer	NWFSC			
John Field	Student	UW			
<b>Leg 3: 7/16 - 8/4</b>			<b>Leg 2: 7/16 - 8/6</b>		
<u>ASTORIA - SEATTLE</u>			<u>ASTORIA - ABERDEEN</u>		
Ken Weinberg	Field Party Chief	AFSC	Mark Wilkins	Field Party Chief	AFSC
Bill Floering	Fishery Tech.	AFSC	Lyle Britt	Fishery Biologist	AFSC
Steve Syrjala	Statistician	AFSC	Barney Baker	Gear Specialist	AFSC
Elaina Jorgenson	Fishery Biologist	AFSC	Sheryl Corey	Fishery Biologist	AFSC
Janet Mason	Fishery Biologist	SWFSC	Danny Badger	Student	UW
Alan Byrne	Fishery Biologist	IDFG	Ted Hart	Student	OSU
			<b>Leg 2: 8/6 - 8/27</b>		
			<u>ABERDEEN - SEATTLE</u>		
			Frank Shaw	Field Party Chief	AFSC
			Lyle Britt	Fishery Biologist	AFSC
			Dan Kamikawa	Fishery Biologist	NWFSC
			Dennis Benjamin	Fishery Biologist	AFSC
			Chris Gburski	Fishery Biologist	AFSC
			Jon Short	Fishery Biologist	AFSC

Affiliations of the Scientists:

AFSC - Alaska Fisheries Science Center  
 CDFG - California Department of Fish and Game  
 IDFG - Idaho Department of Fish and Game  
 NWFSC - Northwest Fisheries Science Center  
 OSU - Oregon State University  
 SWFSC - Southwest Fisheries Science Center  
 UW - University of Washington

Table 2.--Summary of sampling success at bottom trawl stations in each International North Pacific Fisheries Commission (INPFC) area and depth stratum during the 2001 NMFS triennial bottom trawl survey.

INPFC Area	Shallow (55-183 m)	Middle (184-366 m)	Deep (367-500 m)	Total (55-500 m)
<b>Conception</b> (south of 36°N lat)				
Successful	16	12	19	47
Unsuccessful	0	0	0	0
Abandoned	0	0	0	0
<b>Monterey</b> (36°-40°30'N lat)				
Successful	80	22	23	125
Unsuccessful	1	4	2	7
Abandoned	1	5	3	9
<b>Eureka</b> (40°30'-43°N lat)				
Successful	38	16	12	66
Unsuccessful	1	0	1	2
Abandoned	0	0	3	3
<b>Columbia</b> (43°-47°30'N lat)				
Successful	118	41	30	189
Unsuccessful	2	0	1	3
Abandoned	5	3	7	15
<b>U.S. Vancouver</b> (47°30'-Canada/U.S. border)				
Successful	25	12	2	39
Unsuccessful	4	0	1	5
Abandoned	3	2	4	9
<b>Canadian Vancouver</b> (north of Canada/U.S. border)				
Successful	33	3	4	40
Unsuccessful	1	3	0	4
Abandoned	11	1	3	15

Table 3.--A summary of biological data and specimens collected during the 2001 West Coast triennial bottom trawl survey. Finrays were collected from lingcod for ageing and otoliths were collected from all other species. Abbreviations: length frequency (LF), age structure (AGE), individual specimen weight (WGT), and maturity (MAT).

SPECIES	LF	AGE	WGT	MAT	SPECIES	LF	AGE	WGT	MAT
American shad	850				Pacific halibut	150			
Arrowtooth flounder	11,077				Pacific herring	2,570			
Aurora rockfish	3,342	714	714	666	Pacific ocean perch	1,271	556	556	503
Bank rockfish	44				Pacific sanddab	20,229			
Bering skate	432				Pacific sardine	308			
Big skate	84				Pacific tomcod	1,324			
Black rockfish	2				Petrale sole	3,209			
Blackjil rockfish	437	376	376	372	Pink rockfish	2			
Bocaccio	127	106	106	102	Puget Sound rockfish	3			
Brown cat shark	1,383				Pygmy rockfish	260			
Butter sole	95				Quillback rockfish	47			
California halibut	15				Redbanded rockfish	248			
Canary rockfish	439	378	378	229	Redstripe rockfish	694	215	215	214
Chilipepper	3,193	486	486	486	Rex sole	39,916			
Chinook salmon	164				Rosy rockfish	12			
Chub mackerel	521				Rosethorn rockfish	620			
Coho salmon	4				Rougheye rockfish	430			
Copper rockfish	22				Sablefish	13,659	1,394	1,394	1,125
Cowcod	15				Sand sole	40			
Curfin sole	644				Sharpchin rockfish	1,511	330	330	326
Darkblotched rockfish	2,990	1,058	1,058	975	Shortbelly rockfish	1,186			
Deepsea sole	1				Shortraker rockfish	32			
Dover sole	34,916				Shortspine thornyhead	10,628			
English sole	17,005		124		Silvergray rockfish	52	55	55	54
Filetail cat shark	208				Slender sole	14,871			
Flathead sole	3,986				Southern rock sole	388			
Greenblotched rockfish	7				Spiny dogfish	2,646			
Greenspotted rockfish	124				Splitnose rockfish	10,849	1,209	1,208	960
Greenstriped rockfish	5,477				Spotted turbot	7			
Halfbanded rockfish	1,061				Squarespot rockfish	48			
Hornyhead turbot	1				Starry flounder	54			
Jack mackerel	293				Stripetail rockfish	6,636			
Kelp greenling	1				Vermilion rockfish	102			
Lingcod	1,544	1,231	1,240	1,060	Walleye pollock	1,484			
Longnose skate	885				White croaker	593			
Longspine thornyhead	1,564				Widow rockfish	147			
Northern anchovy	24				Yelloweye rockfish	42	45	45	28
Pacific cod	221				Yellowmouth rockfish	3	4	4	4
Pacific hake	44,486	851	851	733	Yellowtail rockfish	1,167	781	781	726

Table 4.--Mean CPUE (kg/ha) for the 15 most abundant groundfish species by International North Pacific Fisheries Commission (INPFC) area and depth stratum during the 1998 triennial groundfish survey.

CONCEPTION AREA 55 - 183 m		CONCEPTION AREA 184 - 366 m		CONCEPTION AREA 367 - 500 m		CONCEPTION AREA 55 - 500 m	
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE
Shortbelly rockfish	53.1	Splitnose rockfish	20.4	Pacific hake	32.7	Shortbelly rockfish	18.6
Jack mackerel	15.4	Stripetail rockfish	17.1	Splitnose rockfish	23.0	Pacific hake	17.4
Pacific sanddab	8.6	Pacific hake	16.1	Dover sole	22.6	Splitnose rockfish	14.4
Chilipepper	5.4	Rex sole	5.5	Rex sole	7.9	Dover sole	9.5
White croaker	4.1	Dover sole	2.4	Aurora rockfish	4.8	Jack mackerel	5.4
Pacific herring	2.0	Chilipepper	1.2	Sablefish	2.7	Stripetail rockfish	4.9
Spiny dogfish	1.3	Slender sole	0.9	Longspine thornyhead	2.3	Rex sole	4.6
Stripetail rockfish	1.1	Shortbelly rockfish	0.3	Blackgill rockfish	2.0	Pacific sanddab	3.0
Pacific hake	1.0	Spiny dogfish	0.2	Longnose skate	1.5	Chilipepper	2.2
Pacific argentine	1.0	Big skate	0.2	Bigfin eelpout	1.1	Aurora rockfish	1.9
English sole	0.8	Sablefish	0.2	Shortfin eelpout	0.9	White croaker	1.4
Pacific angel shark	0.8	Longnose skate	0.2	Shortspine thornyhead	0.7	Sablefish	1.1
Halfbanded rockfish	0.8	Bigfin eelpout	0.2	Filetail cat shark	0.5	Longspine thornyhead	0.9
Petrale sole	0.6	Spotted ratfish	0.2	Spotted ratfish	0.4	Blackgill rockfish	0.8
Pacific pompano	0.5	Bering skate	0.2	Pacific electric ray	0.3	Pacific herring	0.7
Number of Hauls	16	Number of Hauls	12	Number of Hauls	18	Number of Hauls	46

MONTEREY AREA 55 - 183 m		MONTEREY AREA 184 - 366 m		MONTEREY AREA 367 - 500 m		MONTEREY AREA 55 - 500 m	
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE
Pacific hake	21.5	Pacific hake	102.3	Dover sole	45.8	Pacific hake	36.6
Pacific herring	14.4	Splitnose rockfish	46.7	Pacific hake	22.9	Dover sole	12.9
Chilipepper	12.3	Chilipepper	28.5	Rex sole	17.9	Chilipepper	12.8
Pacific sanddab	8.0	Dover sole	18.5	Sablefish	10.0	Splitnose rockfish	10.1
White croaker	7.6	Spiny dogfish	16.8	Splitnose rockfish	7.4	Pacific herring	8.9
Jack mackerel	7.3	Shortbelly rockfish	16.6	Aurora rockfish	4.2	Spiny dogfish	6.8
Pacific sardine	5.8	Stripetail rockfish	15.4	Spiny dogfish	3.5	Rex sole	6.0
Spiny dogfish	4.9	Rex sole	9.2	Shortspine thornyhead	2.8	Pacific sanddab	5.0
Yellowtail rockfish	4.4	Widow rockfish	4.6	Bigfin eelpout	2.7	White croaker	4.7
Chub mackerel	3.8	Sablefish	4.0	Spotted ratfish	2.6	Jack mackerel	4.6
Northern anchovy	2.8	English sole	2.0	Longnose skate	1.5	Stripetail rockfish	4.4
Stripetail rockfish	2.6	Spotted ratfish	1.6	Brown cat shark	1.4	Pacific sardine	3.6
English sole	2.1	Longnose skate	1.1	Blackgill rockfish	1.3	Shortbelly rockfish	3.3
Chinook salmon	1.8	Sharpchin rockfish	0.8	Longspine thornyhead	0.6	Sablefish	2.8
Rex sole	1.1	Bigfin eelpout	0.7	Filetail cat shark	0.4	Yellowtail rockfish	2.7
Number of Hauls	77	Number of Hauls	23	Number of Hauls	25	Number of Hauls	125

EUREKA AREA 55 - 183 m		EUREKA AREA 184 - 366 m		EUREKA AREA 367 - 500 m		EUREKA AREA 55 - 500 m	
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE
Pacific hake	228.0	Pacific hake	58.6	Dover sole	33.1	Pacific hake	144.8
English sole	5.0	Dover sole	25.2	Sablefish	28.4	Dover sole	15.4
Pacific sanddab	4.8	Sablefish	14.2	Pacific hake	17.1	Sablefish	9.2
Dover sole	4.7	Rex sole	12.5	Rex sole	13.5	Rex sole	7.9
Rex sole	3.9	Spiny dogfish	10.0	Shortfin eelpout	4.4	Spiny dogfish	5.1
Spiny dogfish	3.8	Splitnose rockfish	5.4	Brown cat shark	4.3	English sole	3.2
Pacific herring	1.9	Stripetail rockfish	4.3	Shortspine thornyhead	4.0	Pacific sanddab	2.7
Petrale sole	1.3	Longnose skate	2.2	Aurora rockfish	2.7	Stripetail rockfish	1.6
Stripetail rockfish	1.1	Chilipepper	2.2	Spiny dogfish	2.7	Splitnose rockfish	1.4
Pacific halibut	1.1	Darkblotched rockfish	2.0	Bigfin eelpout	1.4	Longnose skate	1.1
Big skate	1.1	English sole	1.9	Arrowtooth flounder	1.4	Shortspine thornyhead	1.1
Yellowtail rockfish	0.9	Bigfin eelpout	1.3	Longnose skate	0.7	Pacific herring	1.0
Longnose skate	0.8	Spotted ratfish	1.2	Longspine thornyhead	0.3	Shortfin eelpout	1.0
Slender sole	0.5	Arrowtooth flounder	1.0	Spotted ratfish	0.2	Brown cat shark	1.0
Blackbelly eelpout	0.5	Shortspine thornyhead	1.0	Bering skate	0.2	Pacific halibut	0.8
Number of Hauls	38	Number of Hauls	16	Number of Hauls	14	Number of Hauls	68

Table 4 (cont.)

COLUMBIA AREA 55 - 183 m		COLUMBIA AREA 184 - 366 m		COLUMBIA AREA 367 - 500 m		COLUMBIA AREA 55 - 500 m		
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	
Pacific hake	131.3	Pacific hake	84.1	Pacific hake	20.0	Pacific hake	104.4	
Pacific sanddab	9.2	Sablefish	17.4	Sablefish	15.4	Sablefish	10.5	
Sablefish	7.2	Dover sole	11.5	Sablefish	14.8	Dover sole	8.3	
English sole	5.9	Splitnose rockfish	10.1	Shortspine thornyhead	7.9	Rex sole	6.3	
Rex sole	5.6	Rex sole	9.7	Rex sole	4.3	Pacific sanddab	5.8	
Dover sole	5.5	Sharpchin rockfish	7.1	Arrowtooth flounder	1.1	English sole	3.9	
Spiny dogfish	5.0	Pacific ocean perch	6.3	Brown cat shark	0.9	Spiny dogfish	3.5	
Pacific herring	4.9	Shortspine thornyhead	4.5	Aurora rockfish	0.8	Pacific herring	3.1	
Yellowtail rockfish	2.6	Arrowtooth flounder	3.7	Longspine thornyhead	0.8	Shortspine thornyhead	2.2	
American shad	2.4	Pacific halibut	3.6	Pacific ocean perch	0.8	Splitnose rockfish	2.2	
Pacific halibut	2.0	Lingcod	3.3	Longnose skate	0.8	Yellowtail rockfish	2.2	
Arrowtooth flounder	1.7	Yellowtail rockfish	2.4	Bigfin eelpout	0.7	Arrowtooth flounder	2.1	
Greenstriped rockfish	1.5	Darkblotched rockfish	2.3	Spiny dogfish	0.7	Pacific halibut	2.0	
Chub mackerel	1.5	Stripetail rockfish	2.2	Rougheye rockfish	0.5	American shad	1.6	
Big skate	1.0	Spiny dogfish	1.2	Shortfin eelpout	0.4	Sharpchin rockfish	1.5	
Number of Hauls		118	Number of Hauls		40	Number of Hauls		186

U.S. VANCOUVER AREA 55 - 183 m		U.S. VANCOUVER AREA 184 - 366 m		U.S. VANCOUVER AREA 367 - 500 m		U.S. VANCOUVER AREA 55 - 500 m		
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	
Pacific hake	166.8	Pacific hake	20.6	Pacific hake	4.6	Pacific hake	125.6	
Spiny dogfish	44.1	Pacific ocean perch	20.1	Dover sole	4.6	Spiny dogfish	33.5	
Yellowtail rockfish	42.4	Dover sole	17.9	Longspine thornyhead	3.0	Yellowtail rockfish	32.7	
Arrowtooth flounder	21.6	Arrowtooth flounder	12.2	Shortspine thornyhead	2.7	Arrowtooth flounder	18.7	
Pacific sanddab	8.4	Sablefish	12.1	Sablefish	1.2	Dover sole	7.9	
Pacific halibut	7.1	Widow rockfish	8.9	Pacific flatnose	0.6	Sablefish	6.8	
English sole	5.1	Spotted ratfish	8.8	Rex sole	0.4	Pacific sanddab	6.1	
Sablefish	5.0	Yellowtail rockfish	8.4	Spotted ratfish	0.3	Pacific halibut	5.5	
Dover sole	4.5	Spiny dogfish	6.6	Shortfin eelpout	0.2	Spotted ratfish	5.4	
Spotted ratfish	4.4	Rex sole	6.1	Brown cat shark	0.2	Pacific ocean perch	5.2	
Redstripe rockfish	3.8	Longnose skate	2.5	Deepsea sole	0.2	Widow rockfish	4.1	
Widow rockfish	2.5	Shortspine thornyhead	2.0	Aleutian skate	0.2	English sole	3.9	
Longnose skate	2.4	Darkblotched rockfish	1.5	Myctophids	Trace	Rex sole	3.2	
Greenstriped rockfish	2.4	Pacific halibut	1.4	Pacific viperfish	Trace	Redstripe rockfish	2.8	
Rex sole	2.3	Pacific cod	1.4	Longfin dragonfish	Trace	Longnose skate	2.4	
Number of Hauls		31	Number of Hauls		11	Number of Hauls		43

CANADIAN VANCOUVER AREA 55 - 183 m		CANADIAN VANCOUVER AREA 184 - 366 m		CANADIAN VANCOUVER AREA 367 - 500 m		CANADIAN VANCOUVER AREA 55 - 500 m		
SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	SPECIES	CPUE	
Pacific hake	48.3	Yellowtail rockfish	92.5	Rougheye rockfish	27.0	Pacific hake	40.1	
Spiny dogfish	46.3	Pacific ocean perch	46.4	Pacific ocean perch	16.1	Spiny dogfish	37.8	
Arrowtooth flounder	17.8	Arrowtooth flounder	37.6	Dover sole	13.8	Arrowtooth flounder	19.8	
Sablefish	13.2	Redstripe rockfish	21.8	Arrowtooth flounder	11.7	Yellowtail rockfish	19.1	
Pacific herring	12.4	Sharpchin rockfish	15.8	Shortspine thornyhead	5.8	Sablefish	12.8	
Yellowtail rockfish	9.9	Sablefish	15.3	Rex sole	5.0	Pacific herring	10.1	
Dover sole	9.1	Widow rockfish	12.7	Pacific hake	4.9	Dover sole	9.6	
Rex sole	5.9	Dover sole	10.8	Longnose skate	4.0	Pacific ocean perch	7.5	
Pacific halibut	4.8	Greenstriped rockfish	10.3	Sablefish	2.4	Rex sole	6.0	
Lingcod	4.0	Silvergray rockfish	8.0	Pacific halibut	0.6	Redstripe rockfish	4.4	
English sole	3.9	Rex sole	7.5	Bigfin eelpout	0.3	Pacific halibut	4.3	
Pacific sanddab	3.9	Canary rockfish	6.2	Petrals sole	0.3	Lingcod	3.4	
Redstripe rockfish	2.2	Pacific hake	4.1	Spotted ratfish	0.2	English sole	3.3	
Canary rockfish	1.7	Pacific halibut	3.1	Darkblotched rockfish	0.2	Pacific sanddab	3.2	
Flathead sole	1.4	Darkblotched rockfish	2.5	Spiny dogfish	0.2	Greenstriped rockfish	2.2	
Number of Hauls		48	Number of Hauls		7	Number of Hauls		59

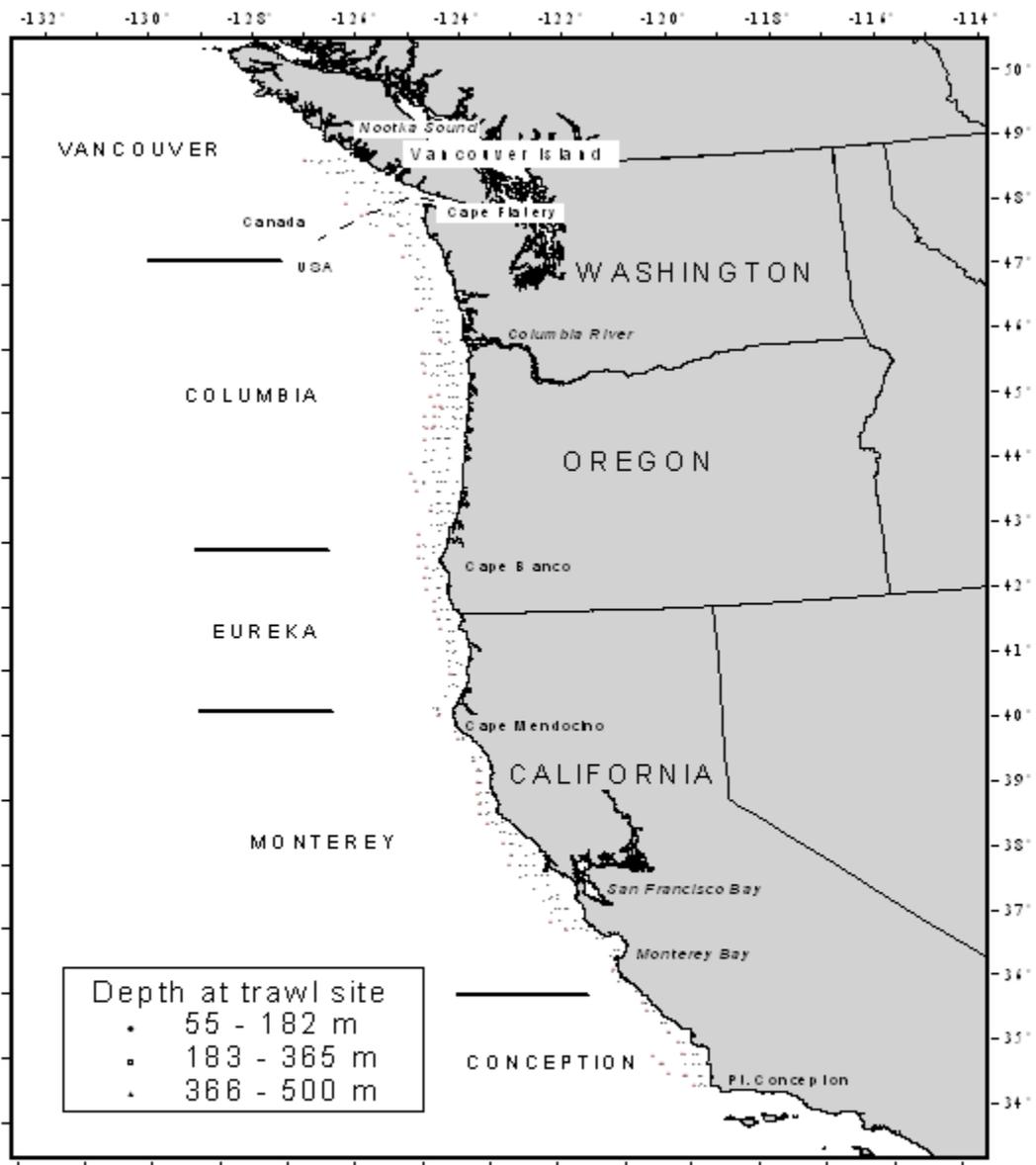


Figure 1. - Stations sampled successfully during the 2001 National Marine Fisheries Service triennial West Coast bottom trawl survey.

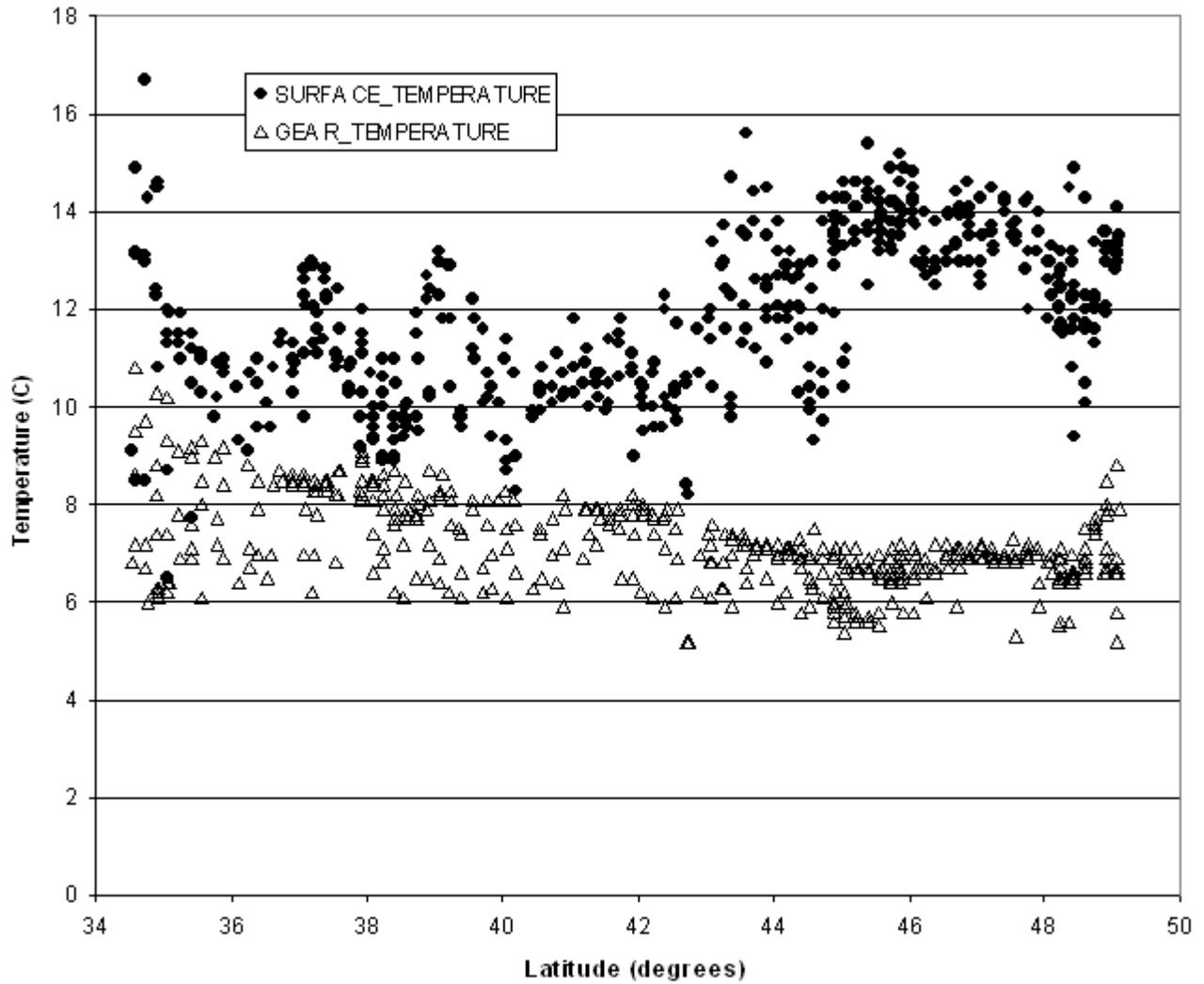


Figure 2.-- Trends in water temperatures by latitude measured during the 2001 National Marine Fisheries Service triennial West Coast bottom trawl survey.