BIOLOGICAL STUDIES ON ROCKFISH AND ASSOCIATED SPECIES FROM HECETA BANK OFF OREGON, 1980-81

COMPLETION REPORT

October 1, 1980 to March 1, 1982

William H. Barss
Steven L. Johnson
Robert L. Demory

Oregon Department of Fish and Wildlife

National Marine Fisheries Service
National Oceanic and Atmospheric Administration
United States Department of Commerce
Commercial Fisheries and Development Act
Project 1-151-R2
Contract 81-ABD-ORAC

July 1982

CONTENTS

TABLES

Number

FIGURES

Number

ABSTRACT

The Oregon Department of Fish and Wildlife conducted a rockfish stock assessment study on Heceta Bank off central Oergon in 1980-81. Biological data taken from trawl catches are summarized in this report. Sampling was conducted at sea on a near monthly basis throughtout a 13 month period. Special emphasis was placed on Canary rockfish 1/ which was the dominant species in the study area. Data collected included: species composition by area and terrain type, food habits, maturity, time of spawning, size composition, age composition and incidence of controversial species.

1/See Appendix 1 for scientific names.

INTRODUCTION

In January 1980 the Oregon Department of Fish and Wildlife initiated a study to improve the methodology for assessing rockfish stocks (Johnson, et al., 1982). During the project considerable time was spent at sea aboard commercial trawlers. On chartered commercial trawlers, trawl hauls were made to identify species composition of fish schools indicated on the electronic fish locating equipment. Trawl hauls were also observed during commercial fishing trips.

This study provided a unique opportunity to collect biological information from a discrete area on a monthly basis throughout the year.

The objective of this report was to summarize biological data collected during the Heceta Bank study. This information provided a useful addition to our data base on rockfish and associated species and improved the biological basis for the conservation and management of those species.

METHODS

The study area was located on the outer edge of Heceta Bank approximately twenty miles south of Newport, Oregon and 45 miles offshore (Figure 1). The boundaries of the areas were 44° 20' to 44° 02' north latitude and 70 to 130 fathoms. After the species composition was compiled, the study area was divided into three geographic sub areas (subarea 1, the north area; subarea 2, the middle area and subarea 3, the southern area) and into two bottom terrain types (smooth and rough) for ease of reporting and discussion. Type of bottom terrain was determined by the vessel echo-sounder and the skipper's expertise. While determination of bottom type was somewhat subjective, rough bottom was usually hard and uneven and could not be fished with a bottom trawl. Smooth bottom was usually trawlable and generally lacked pinnacles. Rough bottom terrain was usually encountered at depths inside of 90 fathoms.

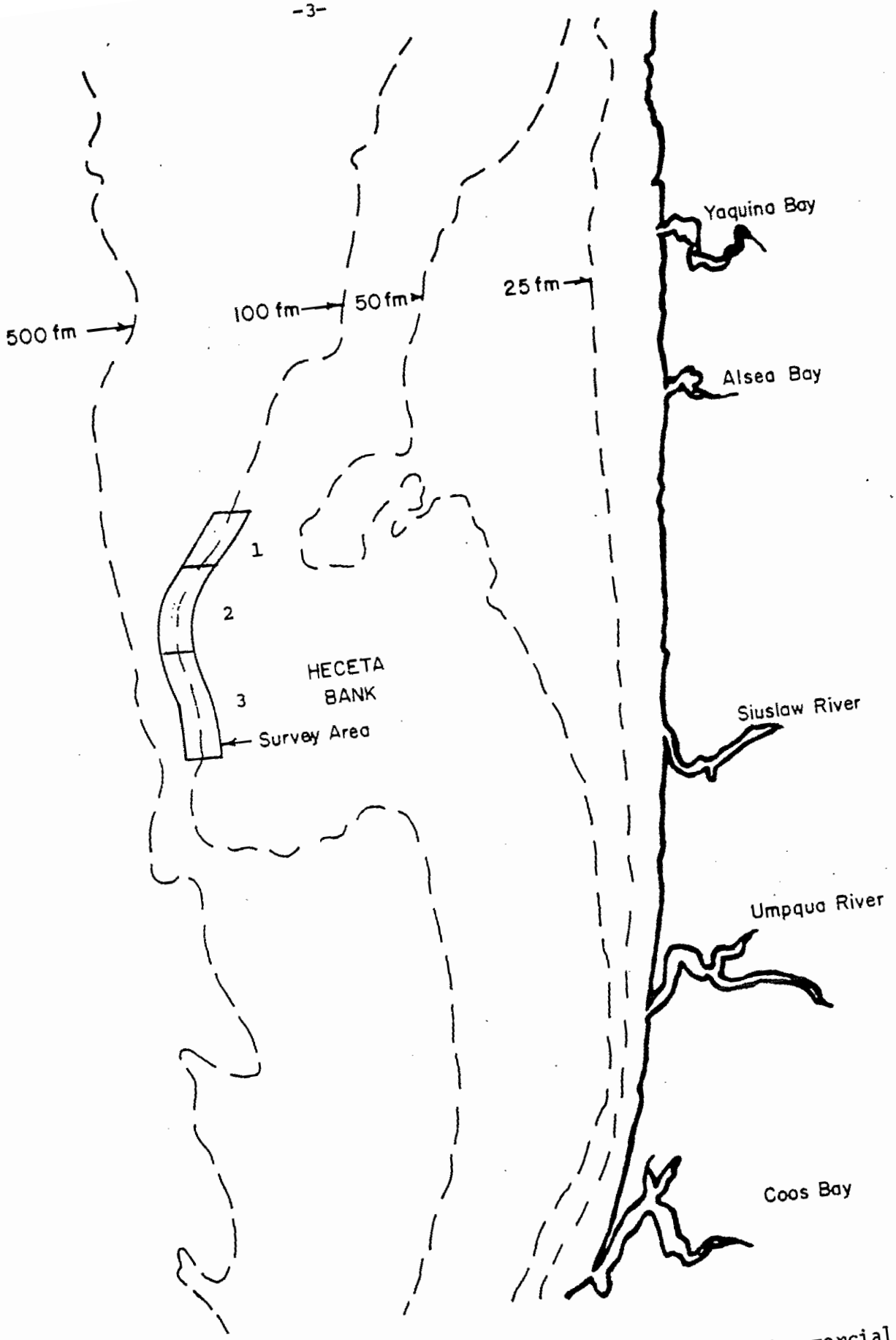

FIGURE 1. Map of the Heceta Bank rockfish survey area and numercial designation of subareas.

Five Oregon vessels ranging in length from 68-90 feet were used during the study. The vessels were chosen because of their equipment and the skipper's experience in fishing for rockfish. Fish schools were located with fish scopes, echo-sounders and fishermen skill. Tows were made on observed fish schools whenever bottom terrain and vessel equipment permitted. All vessels used roller-gear type bottom trawls designed for rockfish fishing over rough terrain.

Biological Sampling

For each tow an estimate was made of total catch weight. If the catch was small the entire catch was sorted to species and weighed. For large catches we sampled for species composition by weighing out the minor species and subsampling the dominant species.

Statistics recorded for selected rockfish species included fork length, sex, maturity stage, gross description of stomach contents, age (from otoliths) and weight. Stomach samples were taken from canary and yellowtail rockfish. Individual length, weight and maturity were taken for incidentally caught lingcod, and length and weight only were taken on Pacific halibut and chinook salmon as time permitted.

Fork length was recorded to the nearest centimeter while weight was recorded to the nearest 1/4 pound (113.4 gms) at sea. Samples processed on shore were weighed to the nearest 10 grams. Stomach samples were labeled, wrapped in gauze and stored in 20% formalin-seawater solution for later analysis by Oregon State University graduate student Richard Brodeur. Otoliths were stored in a 30% ethanol solution. Otoliths were prepared for aging by using the break and burn technique described by T. Williams and B.C. Bedford (T.B. Bagenal, 1974).

Gonad stages used to describe maturity were as follows:

Sex	Code (Stage)	Condition	Description
Males	1	Immature	String-like, translucent, small
	2	Maturing	String-like, slight swelling, translucent, white, small
	3	Mature	Ribbon-like, swollen, brown to white
	4	Developing	Large, swollen, easily broken, milt in sperm duct
	5	Spawning	Swollen, flowing milt when pressure applied to testes
	6	Spent	Swollen, milt in sperm duct
	7	Resting	Ribbon-like, flat, tan or brown ribbon
Females	1	Immature	String-like, small, firm, translucent
	2	Maturing	Small, thin, translucent or opaque
	3	Mature	Large, opaque, granular, ova held in follicle
	4	Developing	Fertilized, large, translucent (cleared) eggs, ova usually not held in follicle
	5	Spawning	Eyed eggs and/or larvae, ova not held in follicle, large, contains much fluid
	6	Spent	Flaccid, purple to pink ovary, flattened elliptical in cross section
	7	Resting	Moderate size, firm, red-grey ovary

Table 1. Percent Species Composition by Survey Subarea and Terrain Type, Heceta Bank 1980-81.

Species	All area combined	Subarea 1 Rough	Subarea 1 Smooth	Subarea 2 Rough	Subarea 2 Smooth	Subarea 3 Rough	Subarea 3 Smooth	Total Pounds
Canary rockfish	80.0	5.1	46.3	92.7	85.2	12.0	12.1	140,883
Yellowtail rockfish	4.1	22.1	12.1	4.1	4.1	0.1	0.5	7,164
Sharpchin rockfish	2.7	12.4	0.9	0.4	1.4	21.6	15.6	4,730
Redstripe rockfish	2.1	11.3	0.4	0.1	0.1	32.0	7.2	3,688
Bocaccio	1.9	4.4	4.3	1.1	0.8	6.9	23.4	3,370
Silvergray rockfish	0.8	3.5	0.9	0.2	0.9	0.8	2.9	1,356
Yelloweye rockfish	0.8	0.7	0.6	0.2	0.7	3.1	3.0	1,358
Yellowmouth rockfish	0.7	14.6	0.0	0.0	0.0	1.1	18.4	1,275
Shortbelly rockfish	0.4	0.0	0.0	0.0	tr.	5.5	3.1	682
Widow rockfish	0.1	5.5	0.2	0.0	tr.	0.0	0.0	141
Lingcod	2.9	7.7	10.7	0.3	3.7	4.0	3.0	5,152
Dogfish	0.9	0.4	4.0	0.1	0.8	4.9	2.2	1,620
Pacific halibut	0.8	1.9	2.2	0.5	0.7	2.3	0.0	1,342
Other flatfish[2/]	0.2	3.7	5.2	tr.	0.1	0.4	0.8	365
Pacific whiting	0.4	0.0	3.8	tr.	0.5	0.0	1.4	706
Sablefish	0.3	0.3	1.3	tr.	0.3	0.2	1.6	448
Chinook salmon	0.1	1.9	0.3	0.1	0.1	1.2	0.0	250
Miscellaneous	0.9	4.3	6.8	0.1	0.7	3.8	4.8	1,651
Total pounds	176,181	1,868	2,486	48,283	109,274	9,376	4,894	176,181
Number of tows		3	7	10	33	6	4	

1/ See Appendix 1 for scientific names of all fish species observed.

2/ Trawls used were not efficient for catching flatfish.

RESULTS

Between January 1980 and January 1981, nine chartered surveys and seven trips as guests aboard trawlers were completed for a total of 29 sea days in the study area. Sixty-six bottom tows were satisfactorily completed of which 63 provided useable catches for analysis.

Species Composition. Rockfish comprised nearly 94% of the catch in the study area, and canary rockfish alone made up 80% of the total catch weight (Table 1). This may not be representative of all portions of Heceta Bank, because most tows (68%) came from subarea 2 which also produced 89% of the total catch weight and 85% of the canary rockfish weight. Canary rockfish were also the dominant species over smooth bottom in subarea 1.

Catches in rough subarea 1 and subarea 3 were mixed. Over rough bottom from subarea 1, catches were primarily a mixture of yellowtail rockfish, lingcod, juvenile yellowmouth rockfish and small rockfish species. Subarea 3 consisted primarily of small rockfish or juvenile yellowmouth rockfish with moderate catches of bocaccio and canary rockfish.

Food Habits. A cursory examination was performed at sea on stomach contents of canary rockfish, yellowtail rockfish, widow rockfish and shortbelly rockfish (Table 2). No attempt to do otherwise was intended because a detailed analysis of the food habits of canary and yellowtail rockfish will be forthcoming as a MS thesis from Oregon State University.

We examined 360 canary rockfish stomachs that contained recognizable prey. Many additional fish examined had everted or empty stomachs. The diet was almost exclusively euphausiids and they occurred in nearly 99% of the non-everted stomachs examined.

Table 2. Frequency of occurrence (number) of prey items in stomachs of selected rockfish species collected from Heceta Bank. Double counting occurs because some fish had more than one prey item.

Prey item	Number of stomachs examined			
	Canary rockfish	Yellowtail rockfish	Widow rockfish	Shortbelly rockfish[1/]
Euphasiids	355	165	12	17
Fish	11	36	0	0
Squid	1	23	0	0
Jellyfish(salp, etc.)	0	6	10	0
Shrimp	4	8	0	0
Copepod	1	0	0	0
Crab megalops	0	1	0	0
Unidentifiable	0	0	2	1
Empty	90	20	35	11
Number containing prey	360	170	18	18

1/ Collected from Nelson Island just north of the survey area.

Fish, primarily lantern fish and hatchet fish, and shrimp were of minor importance. Fishermen fishing Heceta Bank have stated that northern anchovy *(Engraulis mordax)* are an important food item for canary rockfish at certain times of the year, but they were not observed in 1980. These observations were consistent with the prey organisms listed by Phillips (1964).

There were 170 yellowtail rockfish that contained recognizable prey items. Eupahusiids occurred most frequently and were found in 97% of the stomachs examined. Small fish, primarily lantern fish, occurred in 21% of the fish while 14% contained squid. Everted stomachs were uncommon. Phillips (1964) also noted a large variety of prey items in yellowtail rockfish stomachs, but he indicated more importance for small fishes and included salps and pyrosomes.

There were 18 widow rockfish with recognizable food organisms. Of these 75% contained euphausiids and 63% contained jellyfish-like food species (salps, etc.). A majority of the fish had empty or everted stomachs. Supplemental data obtained from landings of widow rockfish showed that euphausiids and jelly-like organisms were the most common prey. Euphausiids were the most frequently found food item, and were present in stomachs throughout the year. Of secondary importance were jelly-like organisms (salps, etc.) and small fish, primarily lantern fish and tiny rockfish. Other macroplanktonic organisms primarily pteropods, heteropods and crab megalops (in April) only) were occasionally abundant in stomachs. Other food items infrequently found were octopus, shrimp and sea mouse.

Other observations on widow rockfish differ from Phillips (1964) who reported extensive feeding on macroplanktonic organisms, primarily hyperied amphipods and occasionally salps, pyrosomes, small squid and anchovies.

A 30-fish sample of shortbelly rockfish was examined for food items. The sample came from just north of the survey area, and stomach contents consisted of euphausiids and was consistent with results of Phillips (1964).

Maturity. Length-maturity observations were taken from 1,089 canary rockfish (Table 3) and age-maturity observations were taken from 283 fish (Table 4). Almost all males were mature and although the number of young males was inadequate, the data suggest that 50% maturity occurs at about age 7 years and 39 cm. Nearly all males were mature at 10 years of age and 45 cm. Females were 50% mature at about age 8 years and a length of about 47 cm, and all females were mature at age 20 years and 56 cm. Our observations on size at 50% maturity were consistent with results from Gunderson et al. (1980) findings for Canary rockfish from the 1977 rockfish survey off Oregon, Washington and California, with Harling et al., (1971) for fish off Queen Charlotte Sound and with Westrheim (1975) for fish off West Vancouver Island. Phillips (1964) who worked with California canary rockfish, found that 50% maturity occurred at a smaller size (14 in. TL) and younger age (5 to 6 years).

Length-maturity was recorded from 287 yellowtail rockfish. Length at 50% and 100% maturity for females was 43 cm and 50 cm respectively (Table 5). Length at maturity for males could not be determined since nearly all males observed were mature. Our results agreed with those of Westrheim (1975) for females from off Western Vancouver Island, but Gunderson et al., (1980) placed 50% maturity for female yellowtail rockfish at a somewhat larger size (45.0 cm FL) while Phillips (1964) indicated 50% maturity to be 13 inches (33 cm TL).

Table 3. Length at maturity of canary rockfish collected from Heceta Bank.

Length (cm)	Number				Percent Mature	
	Immature		Mature			
	M	F	M	F	M	F
36	0	-	1	-	100	-
37	1	-	0	--	0	-
38	0	2	1	0	100	0
39	5	4	4	2	44	33
40	4	4	9	0	69	0
41	1	6	9	2	90	25
42	7	5	15	1	68	17
43	6	6	19	1	76	14
44	2	8	24	1	92	11
45	1	5	25	5	96	50
46	1	8	27	6	96	43
47	0	6	41	13	100	68
48	0	6	57	11	100	65
49	1	9	76	13	99	59
50	0	5	68	32	100	86
51	0	7	53	46	100	87
52	0	5	54	37	100	88
53	0	4	26	38	100	90
54	0	0	17	25	100	100
55	0	1	15	37	100	97
56	0	0	2	61	100	100
57	0	0	1	36	100	100
58	0	0	2	30	100	100
59	0	0	1	19	100	100
60	-	0	-	6	-	100
Total	29	91	547	422		

Table 4. Age at maturity of canary rockfish collected from Heceta Bank.

Age (Yrs)	Number				Percent Mature	
	Immature		Mature			
	M	F	M	F	M	F
6	-	1	-	0	-	0
7	0	2	1	0	100	0
8	3	1	6	4	67	80
9	1	1	3	1	75	50
10	0	1	10	3	100	75
11	0	1	10	8	100	89
12	1	2	19	4	95	85
13	0	7	12	14	100	67
14	0	1	9	8	100	89
15	0	1	2	7	100	88
16	0	1	10	11	100	92
17	0	1	8	11	100	92
18	0	1	7	5	100	83
19	0	1	8	3	100	75
20	0	0	3	4	100	100
21	0	0	6	8	100	100
22	0	0	4	5	100	100
23	0	0	3	4	100	100
24	0	0	5	1	100	100
25	-	0	0	1	-	100
26	0	0	1	3	100	100
27	0	0	3	1	100	100
28	-	-	-	-	-	-
29	-	0	-	2	-	100
30	0	-	4	-	100	-
31	0	-	1	-	100	-
32	0	-	2	-	100	-
33	-	-	-	-	-	-
34	0	-	1	-	100	-
35	-	-	-	-	-	-
36	0	-	3	-	100	-
Total	5	22	141	115		

Table 5. Length at maturity of yellowtail rockfish collected from Heceta Bank.

Length (cm)	Number				Percent Mature	
	Immature		Mature			
	M	F	M	F	M	F
39	0	-	3	-	100	-
40	0	-	2	-	100	-
41	0	1	7	0	100	0
42	0	1	2	0	100	0
43	0	1	6	2	100	67
44	1	1	20	3	95	75
45	0	4	13	3	100	43
46	1	2	27	9	96	82
47	0	2	26	8	100	80
48	0	2	20	9	100	82
49	0	1	12	17	100	94
50	0	0	8	13	100	100
51	0	0	4	15	100	100
52	-	0	-	9	-	100
53	-	0	-	5	-	100
54	-	0	-	9	-	100
55	-	0	-	3	-	100
56	-	0	-	1	-	100
TOTAL	2	15	157	113		

Time of Spawning. From samples of canary rockfish, gonad condition was recorded for 524 males and 430 females. Males were ripe (stage 5) in October-December. Parturition took place primarily in January and February (Table 6). Our findings are consistent with observations of Westrheim (1975) for Oregon-British Columbia waters.

Sampling of yellowtail rockfish was inadequate during the mating-spawning season, but it appears that copulation took place about December and parturition about March (Table 7). Westrheim (1975) also found that March was the principal month of parturition off Oregon-British Columbia. Further maturity sampling in January through June and in November would be necessary to more accurately define the mating and spawning periods.

Size and Age Composition. Lengths were taken on four rockfish species. Mean length and length range are summarized below. Our mean lengths are similar to those reported by Boehlert (1980) for canary rockfish and somewhat larger than those reported by Fraidenburg (1980) for yellowtail rockfish. Length frequency distributions are shown in Table 8.

Species/sex	Mean length(cm)	Length range(cm)
Canary rockfish		
Males	48.6	36-59
Females	52.5	38-60
Yellowtail rockfish		
Males	46.1	39-51
Females	49.1	41-56
Widow rockfish		
Males	41.9	37-47
Females	44.9	41-52
Yelloweye rockfish		
Males	57.7	45-70
Females	55.9	48-66

Table 6. Gonad condition (%), by month, of mature canary rockfish collected from Heceta Bank.

Month	Number Examined		Gonad Stage									
			Male[1/]					Female[1/]				
	M	F	3	4	5	6	7	3	4	5	6	7
Jan.	16	20	0	0	0	81	19	5	40	45	5	5
Feb.	90	37	0	0	0	3	97	3	0	5	46	46
Mar.	52	18	0	0	0	21	79	0	0	0	22	78
Apr.	79	40	76	0	0	0	24	13	0	0	15	73
May[2/]	21	27	95	0	0	0	5	0	0	0	0	100
June	17	11	47	0	0	0	1	0	0	0	0	100
July	102	128	95	4	0	0	0	97	0	0	1	2
Aug.	8	1	75	25	0	0	0	100	0	0	0	0
Sept.	98	141	0	100	0	0	0	100	0	0	0	0
Oct.	9	20	0	89	11	0	0	100	0	0	0	0
Nov.	-	-	-	-	-	-	-	-	-	-	-	-
Dec.	53	14	0	72	28	0	0	93	7	0	0	0

1/ Code for gonad condition from table on page _____.

2/ From a sample of a commercial landing from Heceta Bank

Table 7. Gonad condition (to nearest percent by month) of mature yellowtail rockfish from Heceta Bank survey samples, 1980-81.

Month	Number Examined		Gonad Stage									
			Male					Female				
	M	F	3	4	5	6	7	3	4	5	6	7
January	24	3	0	0	0	0	100	33			67	
February	-	-	-	-	-	-	-	-	-	-	-	-
March	47	14	0	0	0	0	100	0	0	7	57	36
April	-	-	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-	-	-	-	-
July	14	32	100	0	0	0	0	66	0	0	12	22
August	20	16	100	0	0	0	0	100	0	0	0	0
September	10	28	0	100	0	0	0	100	0	0	0	0
October	-	2	-	-	-	-	-	100	-	-	-	-
November	-	-	-	-	-	-	-	-	-	-	-	-
December	35	17	37	29	9	9	17	100	0	0	0	0

Table 8. Length frequency distribution of selected rockfish species collected from Heceta Bank.

Length (cm)	Canary rockfish		Yellowtail rockfish		Widow rockfish		Yelloweye rockfish	
	M	F	M	F	M	F	M	F
36	1							
37	1				1			
38	1	2			4			
39	9	6	3		5			
40	14	4	2		1			
41	10	9	10	1	14	4		
42	23	7	4	2	10	1		
43	26	8	10	3	4	4		
44	30	10	21	4	10	5		
45	37	14	19	8	5	4	2	
46	36	18	37	11	4	1		
47	55	24	34	11	1	1		
48	76	20	30	11		1		1
49	102	32	15	18				
50	89	47	8	15		2		2
51	77	67	4	16				
52	74	64		10		2	1	1
53	38	59		6				
54	26	52		9			1	
55	15	51		3				2
56	2	85		1			1	2
57	2	53					3	
58	3	44					1	1
59	1	27					1	
60		11						1
61							2	
62								
63							2	
64								
65							1	1
66								1
67								
68								
69								
70							1	
Total	748	714	197	129	66	25	16	12
Mean length (cm)	48.6	52.5	46.1	49.1	41.9	44.9	57.7	55.9

The age of canary rockfish males ranged from 7 to 36 years with a mean of 17 years. Age of females ranged from 6 to 34 years with a mean of 15 years. A histogram of the age composition for canary rockfish, sexes combined, is shown in Figure 2. Our age histogram is quite similar to that reported by Boehlert (1980) indicating a weak 1965 year class followed by a fairly strong 1967 year class. We both noted fairly strong 1963 year classes.

The age frequency distribution for canary rockfish had several prominent modes beginning with the 1970 year class and ending with 1944 year class. These modes corresponded, in part, with strong year classes observed in other species. The 1943-44 year classes were strong for Dover sole (ODFW data) and petrale sole (Ketchen and Forrester, 1966). Recent strong year classes observed were 1961 for English sole (Haymen, et al., 1979), Pacific whiting (Dark, 1975) and Pacific ocean perch (Gunderson, et al., 1977). The 1970 year class was strong for Pacific ocean perch and widow rockfish (ODFW data).

Longevity of both sexes of canary rockfish was similar, and age of recruitment to the fishing ground and/or trawl gear was essentially the same. Fish younger than age six were not observed enen though the gear did capture smaller sized rockfish of other species, such as redstripe and shortbelly rockfish.

Length-weight. Individual weights were taken on only 79 canary rockfish. The length-weight relationship is summarized in Figure 3. Mean weight was 1,978 grams (4.36 pounds) for males and 2,708 grams (5.97 pounds) for females.

Incidental species. We sampled three species because of special informational requirements. These were lingcod, Pacific halibut and chinook salmon. Lingcod, although a legal species for trawl gear, received special attention because incidence during directed trawl fishing for rockfish was not well

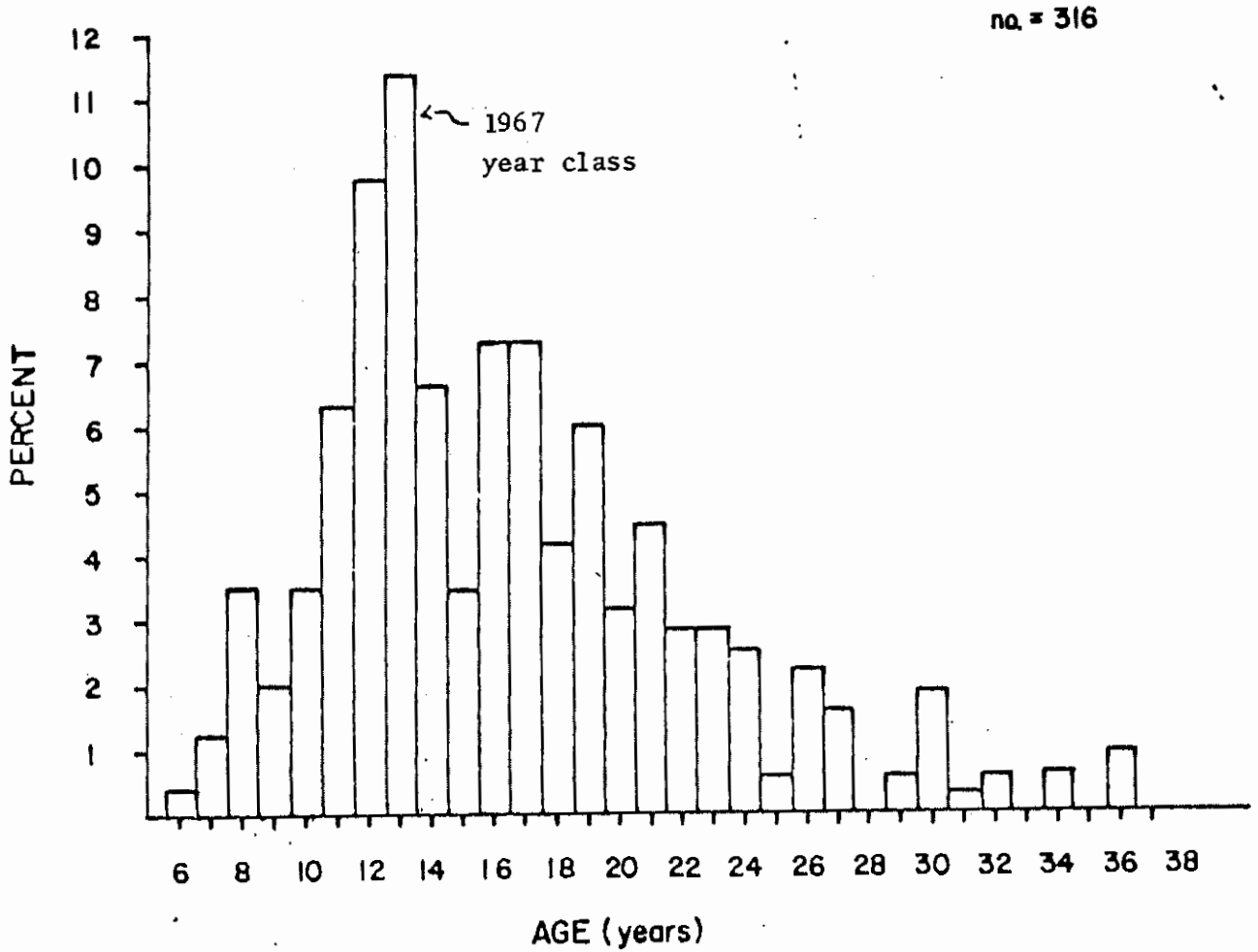

FIGURE 2. Age frequency of canary rockfish from Heceta Bank survey samples, 1980-81.

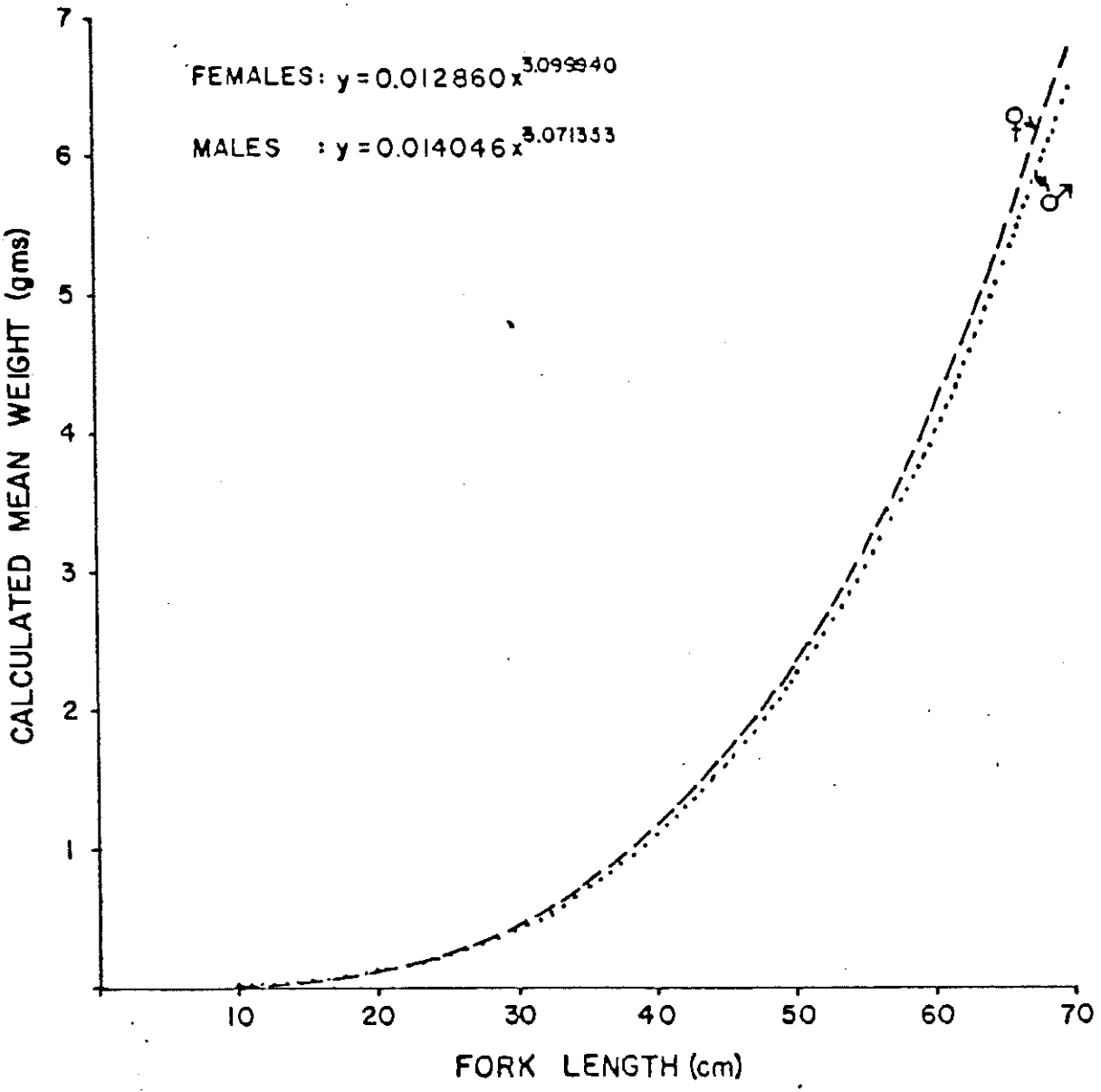

FIGURE 3. Length-weight relationship for canary rockfish from Heceta Bank survey samples, 1980-81.

documented and because lingcod have recently become a subject of user group conflict. Pacific halibut and chinook salmon cannot be retained when caught by trawl gear and both species are the subject of user group conflict.

Lingcod. There were 390 lingcod caught during the survey period. Females comprised 96% of the catch which is consistent with our observations during tagging studies on Stonewall Bank (Barss, 1978) and as reported by Miller, et al., (1973) for deep water areas. Males were all mature and ranged in length from 61 to 82 cm with mean length of 72 cm. Females ranged in length from 52 to 115 cm in length with a mean length at 85 cm (Table 9).

Of the females examined for maturity, 67% were mature and length at 50% maturity was about 70 cm (Table 10). Length at 50% maturity was considerably larger than that indicated by Miller et al., (1973). Spent females were observed in January and March indicating winter spawning. This agrees with the spawning period as reported by Miller et al. (1973) and other workers. A single female was observed in spawning condition in April.

Tows made in the survey area provided an opportunity to observe incidence of lingcod in directed rockfish fishing. Incidence was 4.89 fish per mt of total catch. The incidence of lingcod to rockfish only was 5.22 fish per mt of catch. The small difference in incidence results from the nature of the directed rockfish fishing; very little else is usually caught.

Chinook salmon. There were 26 chinook salmon caught which weighed about 250 pounds. Mean weight was about 4,400 gms (9.7 lbs). They comprised 0.14% of the total catch weight. Chinook salmon were primarily caught over rough terrain and usually with small catches of other species, predominantly rockfish and usually associated with yellowtail rockfish. Incidence of chinook salmon to rockfish was 0.35 fish per mt of rockfish.

Table 9. Length frequency distribution of selected incidental species collected from Heceta Bank.

Length interval (cm)	Lingcod		Pacific halibut	
	M	F	M	F
51-53		1		
54-56		1		
57-59				
60-62	2	9		
63-65		1		
66-68	2	11		
69-71		13		4
72-74	1	15		1
75-77	1	21		2
78-80	2	12		5
81-83	1	12		2
84-86		11		3
87-89		13		1
90-92		9		2
93-95		14		2
96-98		16		
99-101		15		2
102-104		8		
105-107		7		
108-110		6		
111-113		1		
114-116		1		1
117-119				
120-122				2
123-125				
126-128				1
129--131				1
132-134				2
135-137				2
138-140				1
141-143				
144-146				
147-149				
150-152				
153-155				1
Total	9	197		35
Mean length (cm)	71.7	84.8		97.8

Table 10. Length at maturity of lingcod collected from Heceta Bank.

Length interval (cm)	Number				Percent Mature	
	Immature		Mature			
	M	F	M	F	M	F
51-53	0	-	1	-	100	-
54-56	0	1	2	0	100	0
57-59	-	-	-	-	-	-
60-62	0	4	1	2	100	33
63-65	-	1	-	0	-	0
66-68	-	5	-	2	-	29
69-71	-	3	-	4	-	57
72-74	0	6	1	1	100	14
75-77	-	3	-	3	-	50
78-80	0	1	1	5	100	83
81-83	0	-	2	2	100	100
84-86	-	-	-	8	-	100
87-89	-	-	-	5	-	100
90-92	-	-	-	2	-	100
93-95	-	1	-	2	-	67
96-98	-	1	-	4	-	80
99-101	-	-	-	1	-	100
102-104	-	1	-	3	-	75
105-107	-	-	-	5	-	100
108-110	-	-	-	4	-	100
111-113	-	-	-	1	-	100
Total Number	0	27	8	54		

There was a definite seasonality associated with the occurrence of chinook salmon. They occurred most frequently during the winter and spring months and infrequently during the summer months.

Halibut. There were 37 halibut caught which weighed 1,342 lbs or 0.76 percent of the catch by weight. They ranged in size from about 11 to 125 lbs and 69 to 155 cm with a mean length of 98 cm. Mean weight was 16.5 kg (36.4 lbs). Two-thirds of the halibut caught were legal size (32 inches) as required by the International Pacific Halibut Commission (Anon., 1982). Halibut caught were much larger than trawl caught halibut from more northern waters (Bell and St. Pierre, 1970). Halibut were caught throughout most of the survey area on Heceta Bank and incidence was 0.48 fish per mt of rockfish.

SUMMARY

1. Canary rockfish comprised 80% of the total catch by weight.
2. Subarea 2 produced 89% of the catch by weight and 68% of the usable tows.
3. In subarea 1 over rough terrain, yellowtial, yellowmouth, sharpchin and redstripe rockfish dominated the catch. In subarea 1 over smooth terrain and throughout subarea 2, the dominant species was canary rockfish. In subarea 3 catches consisted primarily of sharpchin, redstripe, juvenile yellowmouth, bocaccio and canary rockfish.
4. Diet of canary rockfish was primarily euphausiids. Yellowtail rockfish consumed mostly euphausiids, small fish and squid. Widow rockfish stomachs contained euphausiids and jellyfish-like food species (salps, etc.). Shortbelly rockfish consumed euphausiids.
5. Canary rockfish were 50% mature at 7 years and 39 cm for males and 8 years and 47 cm for females. Length at 50% maturity for yellowtail rockfish females was 43 cm, and it was about 70 cm for female lingcod.

6. Parturition for canary rockfish was in January and February. Parturition was around March for yellowtail rockfish. Spent lingcod were observed in January and March.
7. Mean length by species was: canary rockfish, 48.6 cm for males and 52.5 cm for females; yellowtail rockfish, 46.1 cm for males and 49.1 cm for females; widow rockfish, 41.9 cm for males and 44.9 cm for females; yelloweye rockfish, 57.7 cm for males and 55.9 cm for females; and lingcod, 72 cm for males and 85 cm for females.
8. Mean age for canary rockfish was 17 years for males and 15 years for females. Maximum age was 36 years for males and 34 years for females.
9. Mean weight by species was: canary rockfish, 1,978 gms for males and 2,708 gms for females; chinook salmon, about 4,400 gms (9.6 pounds); and halibut about 16.5 kg (36.3 pounds).
10. The incidence of lingcod (390 fish) was 5 fish per mt of rockfish. Female lingcod comprised 96% of the lingcod catch. The incidence of salmon (26 fish) and halibut (37 fish) was 0.35 and 0.48 per mt of rockfish respectively.

ACKNOWLEDGMENTS

We express sincere thanks to the Oregon fishing industry and especially to the fishermen from the following vessels for their cooperation and support in this project: ANONA KAY, BAY ISLANDER, NEW LIFE, QUEEN VICTORIA and RONNIE C. We are also grateful for the assistance at sea provided by Oregon State University graduate student Richard Brodeur. Funding was granted through PL 88-309, Commercial Fisheries and Development Act of 1964, under contract 81-ABD-ORAC, project 1-151-R-2.

LITERATURE CITED

Anon. 1982. Pacific Halibut Regulations, 1982. Internat. Pac. Halibut Comm.

Barss, W.H. 1978. Report of cruise 78-7, lingcod tagging. Ore. Dept. of Fish and Wildlife. Processed report.

Bell, F.H., and G. St. Pierre. 1970. The Pacific Halibut. Internat. Pacific Halibut Comm. Tech Report No. 6: 1-24.

Boehlert, G.W. 1980. Size composition, age composition and growth of canary rockfish, *Sebastes pinniger*, and splitnose rockfish, *S. diploproa*, from the 1977 rockfish survey. Marine Fisheries Reveiw. Vol. 42, No. 3-4: 57-63.

Dark, T.A. 1975. Age and growth of Pacific hake, (*Merluccius productus*). Fishery Bull. 73(2).

Fraidenburg, M.E. 1980. Yellowtail rockfish, *Sebastes flavidus*, length and age composition off California, Oregon, and Washington in 1977. Marine Fisheries Review. Vol. 42, No. 3-4: 54-56.

Gunderson, D.R., S.J. Westrheim, R.L. Demory, and M.E. Fraidenburg. 1974. The status of Pacific ocean perch (*Sebastes alutus)* stocks off British Columbia Washington and Oregon in 1974. Environment Canada, Fisheries and Marine Service, Tech. Report 690.

Gunderson, D.R., P. Callahan and B. Goiney. 1980. Maturation and fecundity of four species of *Sebastes*. Marine Fisheries Review. Vol. 42, No. 3-4: 74-79.

Harling, W.R., M.S. Smith and N.A. Webb. 1971. Preliminary report on maturity, spawning season and larvae identification of rockfishes (*Scorpaenidae)* collected during 1970. Fish. Res. Bd. Canada MS Report. 1137. 26 p.

Hayman, R.A., A.V. Tyler and R.L. Demory. 1980. A comparison of cohort analysis and catch per unit effort for Dover sole and English sole. Trans. Am. Fish. Soc. 109: 35-53.

Johnson, S.L., R.L. Demory, and W.H. Barss. 1982. Rockfish Assessment Studies on Heceta Bank, Oregon, 1980-81. Comm. Fish. Res. and Dev. Act. Completion Report, Ore. Dept. Fish and Wildlife. Processed Report.

Ketchen, K.S., and C.R. Forrester. 1966. Population dynamics of the petrale sole, (*Eopsetta jordani)*, in waters off Western Canada. Fish. Res. Bd. Canada. Bull. No. 153.

Miller, D.J., and J.J. Geibel. 1973. Summary of blue rockfish and lingcod life histories; a reef ecology study; and giant kelp, (*Macrocystis pyrifera)* experiments in Monterey Bay, California. Calif. Fish and Game, Fish. Bull. (158): 1-137.

Phillips, J.B. 1964. Life history studies on ten species of rockfish (genus Sebastodes). Calif. Dept. Fish and Game. Fish Bulletin 126.

Westrheim, S.J. 1975. Reproduction, maturation and identification of larvae of some Sebastes (Scorpaenidae) species in the northeast Pacific Ocean. J. Fish. Res. Board Canada 32: 2399-2411.

Williams, T., and B.C. Bedford. 1974. The use of otoliths for age determination. In: T.B. Bagenal (Ed), Aging of Fish, p. 114-123. The Proc. of an Inter. Symposium on the Aging of Fish held at Univ. of Reading, England on 19 and 20 July 1973.

Appendix 1. Common and scientific names of fish caught during the Heceta Bank study.

Spiny dogfish	*Squalus acanthias*
Sandpaper skate	*Raja kincaidii*
Longnose skate	*Raja rhina*
Ratfish	*Hydrolagus colliei*
Chinook salmon	*Onchorhynchus tshawytcha*
Pacific cod	*Gadus macrocephalus*
Pacific hake	*Merluccius productus*
Shortspine thornyhead	*Sebastolobus alascanus*
Pacific ocean perch	*Sebastes alutus*
Silvergray rockfish	*Sebastes brevispinis*
Greenspotted rockfish	*Sebastes chlorostictus*
Dark-blotched rockfish	*Sebastes crameri*
Splitnose rockfish	*Sebastes diploproa*
Greenstriped rockfish	*Sebastes elongatus*
Widow rockfish	*Sebastes entomelas*
Yellowtail rockfish	*Sebastes flavidus*
Chilipepper	*Sebastes goodei*
Rosethorn rockfish	*Sebastes helvomaculatus*
Shortbelly rockfish	*Sebastes jordani*
Speckled rockfish	*Sebastes ovalis*
Bocaccio	*Sebastes paucispinis*
Canary rockfish	*Sebastes pinniger*
Redstripe rockfish	*Sebastes proriger*
Yellowmouth rockfish	*Sebastes reedi*
Yelloweye rockfish	*Sebastes ruberrimus*
Stripetail rockfish	*Sebastes saxicola*
Pygmy rockfish	*Sebastes wilsoni*
Sharpchin rockfish	*Sebastes zacentrus*
Sablefish	*Anoplopoma fimbria*
Lingcod	*Ophiodon elongatus*
Jack mackerel	*Trachurus symmetricus*
Buffalo sculpin	*Enophrys bison*
Arrowtooth flounder	*Atheresthes stomias*
Petrale sole	*Eopsetta jordani*
Rex sole	*Glyptocephalus zachirus*
Flathead sole	*Hippoglossoides elassodon*
Pacific halibut	*Hippoglossus stenolepis*
Slender sole	*Lyopsetta exilis*
Dover sole	*Microstomus pacificus*
English sole	*Parophrys vetulus*