STOMACH CONTENTS OF PACIFIC WHITING, *MERLUCCIUS PRODUCTUS*, OFF WASHINGTON AND OREGON, APRIL - JULY 1967

by

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ABSTRACT

A total of 1,430 Pacific whiting, Merluccius productus, stomachs was collected off Washington and Oregon in 1967. The stomach analysis results were summarized to provide a comparison with other Pacific whiting food habit studies. Euphausiids were the main item in the diet both in terms of occurrence and weight in the stomachs. Approximately 90% of the whiting stomach content weight consisted of euphausiids in the samples collected off the Washington coast compared with 72% euphausiids by weight for the Oregon samples. The remainder of the whiting diet off Oregon was mostly fish, predominantly northern anchovy, Engraulis mordax. The dominance of euphausiids in the diet is greater than in other studies and could possibly be related to whiting size.

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CONTENTS

INTRODUCTION

The Pacific whiting, Merluccius productus, constitutes a major groundfish resource off the west coast of North America. The whiting stock must be carefully managed because it forms the basis of a large domestic joint venture and foreign fishery. Management decisions should include a consideration of the effect that whiting abundance may have on other commercial stocks. Food habit studies are necessary in this respect because they help identify species interactions through predation.

Previous food habit studies of the species have reported that euphausiids are a major prey item of Pacific whiting, although fish or shrimp at times predominate in the diet (Alton and Nelson 1970; Gotshall 1969; Outram and Haegele 1972). Since these studies have not clearly defined the causes of the observed diet differences, it seems that further data are needed to explain the variety of prey items that may dominate the whiting's food. Factors such as whiting size or die1 differences in prey availability could possibly influence the whiting's selection of food items.

This paper presents the methods used and basic data collected from examining the contents of 1,430 Pacific whiting stomachs taken in April through July of 1967 off the coasts of Oregon and Washington. Since this is one of the largest collections of whiting stomach contents data, it is important that the data be synthesized and made available for comparison with previous whiting food habit studies. This should enable a further refinement of the definition of the whiting's diet.

METHODS

Stomachs were collected from subsamples of adult Pacific whiting taken from pelagic trawls over bottom depths generally less than 100 m off the

coasts of Oregon and Washington (Figure 1). Samples were obtained at different times of day and at different depths depending on the location of the fish in the water column (Table 1). On board the vessel, the length and sex of the fish were recorded and the stomachs excised. The degrees of fullness and digestion of the stomach contents were noted, and each stomach was labeled and preserved individually in a dilute solution of formaldehyde.. Empty or everted stomachs were noted but not preserved. Stomach contents were identified to the lowest possible taxon in the laboratory, and the damp weight of each taxon was measured and recorded for each stomach. Counts were made of the number of organisms in each taxon in a stomach with the exception of unidentified euphausiids and unidentified remains.

DATA SUMMARY

The basic information available from the stomach contents analysis is the weight and frequency of occurrence of food items. This is summarized by cruise for Washington (Table 2) and Oregon (Table 3). The greatest number of stomachs, 1,228, were collected from off the Washington coast. The major prey items of whiting from this area were identified as euphausiids which comprised almost 90% by weight of the total food eaten. Fish, mostly unidentified, were the next important food item with a total of 8.6% by weight of the stomach contents.

A total of 202 stomachs containing food were taken off the Oregon coast. Again, euphausiids predominated in the contents, totalling 71.9% by weight of the contents. Almost 26% of the stomach content weight was fish, most of which were anchovies.

For both areas, euphausiids occurred in around 99% of the stomachs; Thysanoessa spinifera was the main species of euphausiid in these samples. The

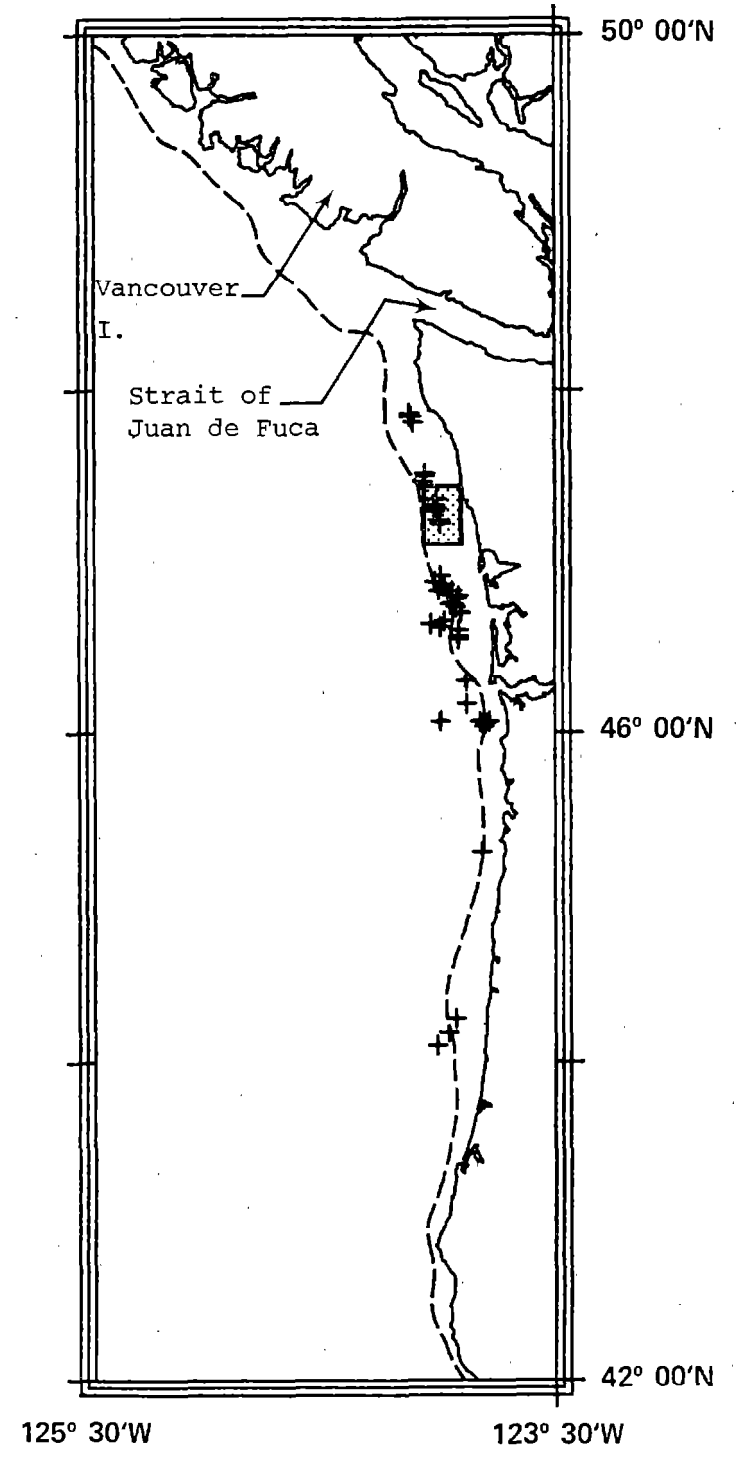

Figure 1. --Sampling locations for the study of Pacific whiting food habits off Washington and Oregon in relation to the 100 m depth contour. (Die1 sampling area enclosed by box.)

Table 1.--Vessel station information related to the sampling of Pacific whiting for food habit studies.

Haul[1] No.	Locale	Position Lat(N)	Position Long(W)	Date	Time[2] (PST)	Gear depth (m)	Bottom depth (m)	Fishing duration (h)	Whiting catch[3] (t/h)	No. whiting examined for food contents (no. of empty stomachs in parentheses)
			NOAA Ship JOHN N. COBB, Cruise No. 86 (Research operation)							
2	Oregon waters	44°06'	124°32'	4/27/67	1500	119	126	1.0	2.4	35 (26)
			NOAA Ship JOHN N. COBB, Cruise No. 87 (Research operation)							
3	Oregon waters	45°17'	124°08'	5/22/67	0700	97	106	1.5	1.6	33 (8)
4	" "	44°11'	124°26'	5/23/67	1500	99	99	1.0	2.0	36 (6)
5	" "	44°16'	124°22'	5/24/67	0800	82	84	1.0	0.1	14 (2)
6	Wash. waters	46°38'	124°35'	5/25/67	1500	154	156	0.8	Tr	10 (2)
			NOAA Ship JOHN N. COBB, Cruise No. 88 (Research operation)							
1	Wash. waters	47°22'	124°32'	7/11/67	1100	49	53	0.5	1.8	36 (1)
2	" "	46°55'	124°30'	7/11/67	2000	64	80	0.5	6.7	41 (21)
3	" "	46°39'	124°28'	7/12/67	1400	95	97	0.5	1.3	39 (9)
4	" "	46°37'	124°30'	7/12/67	1800	117	121	0.5	0.4	37 (17)
5	" "	46°53'	124°33'	7/13/67	0900	92	93	0.5	1.8	41 (21)
6	" "	47°13'	124°30'	7/14/67	1800	55	58	0.5	5.8	35 (5)
7	" "	47°18'	124°33'	7/14/67	2100	38	62	0.8	0.3	36 (2)
8	" "	47°19'	124°32'	7/14/67	2300	27	62	0.2	0.1	36 (0)
9	" "	47°20'	124°33'	7/15/67	0100	18	60	0.2	0.1	28 (0)
10	" "	47°19'	124°33'	7/15/67	0100	37	66	0.6	0.1	36 (1)
11	" "	47°19'	124°33'	7/15/67	0300	27	64	0.5	Tr	36 (1)
12	" "	47°19'	124°33'	7/15/67	0400	16	60	0.2	Tr	5 (1)
13	" "	47°19'	124°33'	7/15/67	0400	37	62	0.5	Tr	15 (1)
16	" "	47°14'	124°30'	7/15/67	0900	57	57	0.2	31.2	38 (0)
17	" "	47°30'	124°38'	7/17/67	1900	62	71	0.5	5.4	36 (1)
18	" "	47°31'	124°38'	7/17/67	2000	53	70	0.5	3.1	36 (1)
19	" "	47°31'	124°38'	7/17/67	2200	18	71	0.5	Tr	19 (0)
20	" "	47°30'	124°38'	7/18/67	0200	18	71	0.5	Tr	5 (0)
21	" "	47°30'	124°38'	7/18/67	0300	55	70	0.5	0.4	36 (1)
22	" "	47°30'	124°38'	7/18/67	0500	53	68	0.5	0.3	36 (1)
23	" "	47°28'	124°39'	7/19/67	1100	77	77	0.2	7.8	36 (7)
24	" "	46°50'	124°31'	7/26/67	1000	93	93	0.5	3.6	36 (10)
25	Oregon waters	46°10'	124°16'	7/27/67	1500	88	90	0.5	2.2	36 (16)
26	" "	46°10'	124°16'	7/27/67	1800	75	92	1.0	0.1	38 (28)
27	Wash. waters	47°52'	124°14'	7/29/67	1200	57	58	0.5	8.9	36 (2)
28	" "	47°51'	124°45'	7/29/67	2200	38	57	0.5	Tr	4 (1)
29	" "	47°51'	124°46'	7/29/67	2300	49	57	0.5	1.8	36 (3)
30	" "	47°51'	124°46'	7/29/67	0000	22	58	0.5	0.1	36 (0)
31	" "	47°51'	124°45'	7/30/67	0200	53	58	0.5	0.1	36 (0)
32	" "	47°52'	124°46'	7/30/67	0300	37	58	0.5	Tr	22 (0)
34	" "	47°49'	124°44'	7/30/67	0800	53	57	0.2	28.6	36 (1)

Table 1 (Cont'd).--Vessel station information related to the sampling of Pacific whiting for food habit studies.

Haul[1] No.	Locale	Position Lat(N)	Position Long(W)	Date	Time[2] (PST)	Gear depth (m)	Bottom depth (m)	Fishing duration (h)	Whiting catch[3] (t/h)	No. whiting examined for food contents (no. of empty stomachs in parentheses)
			NOAA Ship JOHN N. COBB, Cruise No. 93 (Research operation)							
4	Calif. waters	33°01'	117°22'	3/2/68	1400	312	324	1.0	Tr	29 (24)
			COMMANDO, Cruise No. 14 (Research operation)							
4	Oregon waters	46°04'	124°30'	6/19/67	1200	123	144	1.0	0.9	15 (8)
			BARON (Commercial fishing operation)							
1	Oregon waters	46°04'	124°09'	6/2/67	1400	77	77	0.8	7.0	28 (2)
2	" "	46°02'	124°07'	6/2/67	1600	73	73	1.0	0.9	25 (1)
3	" "	46°03'	124°06'	6/2/67	1800	64	64	1.0	6.2	25 (2)
4	" "	46°04'	124°04'	6/2/67	2000	49	49	1.0	3.6	18 (0)
5	Wash. waters	46°18'	124°16'	6/3/67	1000	64	75	0.8	3.0	29 (1)
6	" "	46°33'	124°20'	6/3/67	1500	73	73	1.0	7.1	35 (1)
7	" "	46°34'	124°20'	6/3/67	1700	73	73	1.0	5.4	35 (7)
8	" "	46°33'	124°20'	6/3/67	1900	73	73	1.8	2.5	35 (14)
9	" "	46°36'	124°20'	6/4/67	0700	71	71	1.0	6.2	35 (8)
10	" "	46°36'	124°20'	6/4/67	1900	73	73	1.0	15.2	19 (4)
11	" "	46°36'	124°20'	6/4/67	1200	73	73	1.8	0.4	35 (8)
12	" "	46°42'	124°19'	6/4/67	1500	62	62	1.5	4.9	30 (9)
			RECRUIT (Commercial fishing operation)							
2	Wash. waters	46°45'	124°23'	6/21/67	1100	64	75	1.2	4.5	11 (2)
			ST. MICHAEL (Commercial fishing operation)							
1	Wash. waters	46°45'	124°25'	6/30/67	1100	77	79	1.2	4.6	30 (7)
2	" "	46°48'	124°20'	6/30/67	1600	55	55	1.3	2.7	35 (1)
3	" "	46°48'	124°26'	7/1/67	0800	79	80	1.3	1.3	35 (6)
4	" "	46°45'	124°24'	7/1/67	1000	77	77	1.0	0.4	25 (9)
5	" "	46°44'	124°22'	7/1/67	1300	70	70	1.2	11.6	35 (11)
6	" "	46°47'	124°21'	7/1/67	1600	58	60	1.2	1.8	35 (5)
7	" "	46°52'	124°28'	7/2/67	0800	77	82	1.2	6.2	35 (2)
8	" "	46°52'	124°29'	7/2/67	1100	82	84	1.3	1.7	35 (4)
9	" "	46°50'	124°24'	7/2/67	1300	73	73	2.7	3.3	35 (9)

1/ Cobb pelagic trawl = gear type.
2/ Nearest hour.
3/ Metric ton = t.

Table 2.--Summary of Pacific whiting diet information by cruise off the Washington coast in terms of total weight in grams (W) and frequency of occurrence (FO) of food items in the stomachs.

	Vessel and cruise													
	Cobb 87		Cobb 88		Baron		Recruit		St. Michael		T		T (%)	
Prey item	W	FO	W	FO	W	FO	W	FO	W	FO	W	FO	W	FO
Crustacea	26.3	8	7012.7	771	1426.88	188	92.24	9	1034.6	243	9592.72	1219	90.6	99.3
Euphausiids	26.3	8	6937.6	766	1412.98	188	89.82	9	1011.5	243	9478.2	1214	89.6	98.9
T. spinifera	1.0	3	2713.5	677	445.26	173	43.24	7	511.1	216	3714.1	1076	35.1	87.6
E. pacifica	5.5	5	1.6	13	8.6	35			11.3	43	27.0	96	0.3	7.8
Unid.	19.8	7	4222.5	679	959.12	181	46.58	8	489.1	225	5737.1	1100	54.2	89.6
Pandalid shrimp			6.3	5	2.0	2	2.42	1	18.8	6	29.52	14	0.3	1.1
Crangonid shrimp			17.4	24	4.0	8			3.4	3	24.8	35	0.2	2.8
Sergestes similis					0.1	1					0.1	1	T	-
Mysids					0.5	5					0.5	5	T	-
Amphipods			0.1	1					0.1	1	0.2	2	T	-
Crab			5.4	1							5.4	1	T	-
Crab megalopa			0.5	6	7.2	31			0.8	4	8.5	41	0.1	3.3
Unid.			45.4	9	0.1	1					45.5	10	0.4	0.8
Cumaceans			2.1	1							2.1	1	T	-
Fish			620.3	79	273.41	33			12.2	10	905.91	122	8.6	9.9
Anchovy			7.0	1							7.0	1	0.1	-
Smelt			68.6	16	14.1	3			0.2	1	82.9	20	0.8	1.6
Ammodytes			4.3	1							4.3	1	T	-
Sebastes sp.									4.8	2	4.8	2	T	-
Pacific whiting			20.5	1							20.5	1	0.2	-
Cottidae			3.2	1							3.2	1	T	-
Zoarcidae			58.4	3							58.4	3	0.5	-
Pleuronectidae			1.1	1							1.1	1	T	-
Sciaenidae			2.1	1							2.1	1	T	-
Gadidae			134.4	3							134.4	3	1.3	-
Unid.			320.7	56	259.31	30			7.2	8	587.21	94	5.5	7.6
Fish eggs			1.2	1							1.2	1	T	-
Plant material			1.6	3							1.6	3	T	-
Unid. remains			67.5	14	10.2	2	0.74	1			78.44	17	0.7	1.4
Total	26.3	8	7705.4	777	1710.49	191	92.98	9	1046.8	243	10581.97	1228		

Table 3.--Summary of Pacific whiting diet information by cruise off the Washington coast in terms total weight in grams (W) and frequency of occurrence (FO) of food items in the stomachs.

	Vessel and cruise													
	Cobb 86		Cobb 87		Cobb 88		Commando 14		Baron		T		T (%)	
Prey item	W	FO	W	FO	W	FO	W	FO	W	FO	W	FO	W	FO
Crustacea	5.8	8	482.4	67	25.0	27	13.5	7	1242.8	90	1769.5	199	73.6	98.5
Euphausiids	5.8	8	467.3	67	12.6	24	13.5	7	1227.8	89	1727.0	195	71.9	96.5
T. spinifera	4.7	6	239.0	59	1.0	5	3.3	6	257.5	79	505.5	155	21.0	76.7
E. pacifica			8.0	11			0.3	2	32.0	49	40.3	62	1.7	30.7
Unid.	1.1	1	220.3	67	11.6	21	9.9	7	938.8	89	1181.7	185	49.2	91.6
Pandalid shrimp			2.7	1	5.6	2					8.3	3	0.3	1.5
Crangonid shrimp					3.1	1			0.9	2	4.0	3	0.2	1.5
Mysids									0.4	4	0.4	4	T	2.0
Crab megalopa			12.4	16	0.1	1			13.1	44	25.6	61	1.1	30.2
Unid.					3.6	3			0.1	1	3.7	4	0.1	2.0
Fish	18.4	2	5.2	2	7.7	3			590.2	23	621.5	30	25.6	14.8
Anchovy	17.1	1							374.1	9	391.2	10	16.3	4.9
Smelt	1.3	1	5.1	1					11.3	2	17.7	4	0.7	2.0
Unid.			0.1	1	7.7	3			204.8	13	212.6	17	8.8	8.4
Unid. remains					1.2	2			10.7	2	11.9	4	0.5	2.0
Total	24.2	8	487.6	67	33.9	29	13.5	7	1843.7	91	2402.9	202		

other identified species was Euphausia pacifica which occurred infrequently in the contents.

The only other notable occurrence was the presence of crab larvae in the megalopa stage in the Oregon samples. Although they comprised only 1.1% by weight of the contents, crab megalopa occurred in almost one-third of the stomachs.

Thus, euphausiids were the major prey item of Pacific whiting in this study. Fish played a relatively minor role in the diet, especially in the Washington samples. The predominance of euphausiids is greater than in other reported studies and could be due to availability, season, depth, or whiting size.

Table 4 is a compilation of the basic data by haul along with the mean length of Pacific whiting in the haul. In these spring and summer samples for the Washington and Oregon coasts, the mean whiting size is only around 500 mm. Whiting size in a particular area, which changes with season, may be important in determining the array of food items in the diet of Pacific whiting.

Table 4.--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	86		87		87	
Haul number	2		3		4	
Total number of fish examined (with food)	8		25		30	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	5.8	8	93.9	25	272.7	30
Euphausiids	5.8	8	80.1	25	272.6	30
Thysanoessa spinifera	4.7	6	36.4	23	126.1	24
Euphausia pacifica	--	--	8.0	11	--	--
Unidentified	1.1	1	35.7	25	146.5	30
Pandalid shrimp	--	--	2.7	1	--	--
Crangonid shrimp						
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae	--	--	11.1	13	0.1	1
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	18.4	2	5.2	2	--	--
Anchovy	17.1	1	--	--	--	--
Herring						
Smelt	1.3	1	5.1	1	--	--
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	--	--	0.1	1	--	--
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains						
Total contents	24.2	8	99.1	25	272.7	30
Mean predator length (mm)	502		503		494	
Number empty stomachs	8		1		0	
Number regurgitated stomachs	11		7		6	
Total number stomachs	27		33		36	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	87		87		88	
Haul number	5		6		1	
Total number of fish examined (with food)	12		8		35	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	115.8	12	26.3	8	594.7	35
Euphausiids	114.6	12	26.3	8	594.6	35
Thysanoessa spinifera	76.5	12	1.0	3	236.1	32
Euphausia pacifica	--	--	5.5	5	--	--
Unidentified	38.1	12	19.8	7	358.5	31
Pandalid shrimp						
Crangonid shrimp						
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae	1.2	2	--	--	0.1	1
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	--	--	--	--	37.6	4
Anchovy						
Herring						
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	--	--	--	--	37.6	4
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains	--	--	--	--	21.5	2
Total contents	115.8	12	26.3	8	653.8	35
Mean predator length (mm)	489		492		470	
Number empty stomachs	1		0		0	
Number regurgitated stomachs	1		2		1	
Total number stomachs	14		10		36	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	2		3		4	
Total number of fish examined (with food)	20		28		16	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	92.3	20	53.8	27	47.3	15
Euphausiids	85.7	19	49.8	26	38.4	14
Thysanoessa spinifera	7.8	10	23.7	22	5.5	8
Euphausia pacifica	0.3	2	0.8	8	0.3	1
Unidentified	77.6	16	25.3	17	32.6	12
Pandalid shrimp	1.8	1	1.2	1	1.7	1
Crangonid shrimp						
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae						
Unidentified	4.8	2	2.8	1	7.2	1
Squid						
Sea urchin						
Cumaceans						
Fish	--	-	13.6	4	14.5	4
Anchovy						
Herring						
Smelt	--	-	13.6	4	11.6	2
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	--	-	--	-	2.9	2
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains						
Total contents	92.3	20	67.4	28	61.8	6
Mean predator length (mm)	468		477		477	
Number empty stomachs	13		3		6	
Number regurgitated stomachs	8		8		13	
Total number stomachs	41		39		35	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	5		6		7	
Total number of fish examined (with food)	16		30		34	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	26.2	16	553.2	30	461.4	34
Euphausiids	26.2	16	553.2	30	461.4	34
Thysanoessa spinifera	13.9	14	160.5	26	60.5	27
Euphausia pacifica	0.1	1	--	-	--	-
Unidentified	12.2	16	392.7	30	400.9	33
Pandalid shrimp						
Crangonid shrimp						
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae						
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	--	-	4.4	2	13.4	2
Anchovy	--	-	--	-	7.0	1
Herring						
Smelt	--	-	3.5	1	--	-
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	--	-	0.9	1	6.4	2
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material	--	-	0.3	1	--	-
Fish eggs						
Unidentified remains						
Total contents	26.2	16	557.9	30	474.8	34
Mean predator length (mm)	482		486		429	
Number empty stomachs	2		1		2	
Number regurgitated stomachs	23		4		0	
Total number stomachs	41		35		36	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	8		9		10	
Total number of fish examined (with food)	36		28		33	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	201.0	35	142.7	28	179.4	32
Euphausiids	198.2	34	142.6	28	179.4	32
Thysanoessa spinifera	57.0	31	50.1	27	57.7	32
Euphausia pacifica						
Unidentified	141.2	31	92.5	27	121.7	23
Pandalid shrimp						
Crangonid shrimp						
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae	--	-	0.1	1	--	-
Unidentified	2.8	1	--	-	--	-
Squid						
Sea urchin						
Cumaceans						
Fish	13.0	4	21.3	2	4.8	1
Anchovy						
Herring						
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting	--	-	20.5	1	--	-
Cottidae						
Unidentified	13.0	4	0.8	1	4.8	1
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains	1.6	1	--	-	--	-
Total contents	215.6	36	164.0	28	184.2	33
Mean predator length (mm)	509		511		536	
Number empty stomachs	0		0		1	
Number regurgitated stomachs	0		0		2	
Total number stomachs	36		28		36	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	11		12		13	
Total number of fish examined (with food)	35		3		14	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	356.8	35	22.7	3	61.2	14
Euphausiids	328.2	34	22.7	3	59.3	14
Thysanoessa spinifera	143.5	33	3.5	3	28.6	14
Euphausia pacifica						
Unidentified	184.7	28	19.2	3	30.7	6
Pandalid shrimp						
Crangonid shrimp	1.2	1	--	-	1.8	2
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae						
Unidentified	27.4	2	--	-	0.1	2
Squid						
Sea urchin						
Cumaceans						
Fish	12.5	5	--	-	--	-
Anchovy						
Herring						
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	12.5	5	--	-	--	-
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains	4.5	2	--	-	--	-
Total contents	373.8	35	22.7	3	61.2	14
Mean predator length (mm)	500		517		536	
Number empty stomachs	1		1		1	
Number regurgitated stomachs	0		1		0	
Total number stomachs	36		5		15	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	16		17		18	
Total number of fish examined (with food)	38		35		35	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	386.6	38	342.2	35	233.4	35
Euphausiids	386.6	38	342.2	35	233.4	35
Thysanoessa spinifera	81.5	31	132.7	32	68.0	30
Euphausia pacifica	— —	—	0.1	1	— —	—
Unidentified	305.1	38	209.4	35	165.4	35
Pandalid shrimp						
Crangonid shrimp						
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae						
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	16.7	6	— —	—	— —	—
Anchovy						
Herring						
Smelt	14.9	4	— —	—	— —	—
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	1.8	2	— —	—	— —	—
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material	— —	—	— —	—	1.3	2
Fish eggs						
Unidentified remains						
Total contents	403.3	38	342.2	35	234.7	35
Mean predator length (mm)	484		474		483	
Number empty stomachs	0		0		1	
Number regurgitated stomachs	0		1		0	
Total number stomachs	38		36		36	

Table 4 (Cont'd) .--Composition of food organisms in stomachs of, Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	19		20		21	
Total number of fish examined (with food)	19		5		35	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	126.0	19	71.1	5	400.4	35
Euphausiids	126.0	19	71.0	5	399.5	35
Thysanoessa spinifera	58.0	18	30.8	5	186.5	34
Euphausia pacifica						
Unidentified	68.0	16	40.2	5	213.0	33
Pandalid shrimp	--	--	--	--	0.9	1
Crangonid shrimp						
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae	--	--	0.1	1	--	--
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	7.7	2	--	--	3.8	2
Anchovy						
Herring						
Smelt	--	--	--	--	3.6	1
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	7.7	2	--	--	0.2	1
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains						
Total contents	133.7	19	71.1	5	404.2	35
Mean predator length (mm)	485		508		496	
Number empty stomachs	0		0		0	
Number regurgitated stomachs	0		0		1	
Total number stomachs	19		5		36	

Table 4 (cont'd),--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	22		23		24	
Total number of fish examined (with food)	34		29		23	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	435.7	34	206.1	29	58.3	23
Euphausiids	435.0	34	206.0	29	58.3	23
Thysanoessa spinifera	245.4	34	44.2	25	9.4	10
Euphausia pacifica						
Unidentified	189.6	32	161.8	26	48.9	23
Pandalid shrimp	0.7	1	--	--	--	--
Crangonid shrimp						
Sergestes similis						
Mysids						
Amphipod	--	--	0.1	1	--	--
Crab						
Crab larvae						
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	2.9	3	0.2	2	--	--
Anchovy						
Herring						
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	1.8	2	0.2	2	--	--
Zoarcidae						
Pleuronectid	1.1	1	--	--	--	--
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains						
Total contents	438.6	34	206.3	29	58.3	23
Mean predator length (mm)	484		505		480	
Number empty stomachs	0		6		1	
Number regurgitated stomachs	2		0		11	
Total number stomachs	36		35		35	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	25		26		27	
Total number of fish examined (with food)	19		10		34	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	15.7	18	9.3	9	302.9	32
Euphausiids	9.4	17	3.2	7	301.6	32
Thysanoessa spinifera	0.5	2	0.5	3	141.4	27
Euphausia pacifica						
Unidentified	8.9	17	2.7	4	160.2	28
Pandalid shrimp	3.7	1	1.9	1	--	-
Crangonid shrimp	--	-	3.1	1	1.2	2
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae	0.1	1	--	-	--	-
Unidentified	2.5	2	1.1	1	0.1	1
Squid						
Sea urchin						
Cumaceans						
	7.1	2	0.6	1	102.6	9
Anchovy						
Herring						
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	7.1	2	0.6	1	69.6	7
Zoarcidae	--	-	--	-	30.9	1
Pleuronectid						
Sciaenidae	--	-	--	-	2.1	1
Gadidae						
Plant material						
Fish eggs						
Unidentified remains	0.7	1	0.5	1	1.6	2
Total contents	23.5	19	10.4	10	407.1	34
Mean predator length (mm)	467		492		540	
Number empty stomachs	14		18		2	
Number regurgitated stomachs	3		10		0	
Total number stomachs	36					

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	28		29		30	
Total number of fish examined (with food)	3		33		36	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	4.7	3	339.5	33	239.3	36
Euphausiids	4.7	3	332.6	33	238.6	36
Thysanoessa spinifera	4.2	3	69.9	27	130.7	36
Euphausia pacifica						
Unidentified	0.5	1	262.7	30	107.9	29
Pandalid shrimp						
Crangonid shrimp	--	--	1.2	1	0.7	3
Sergestes similis						
Mysids						
Amphipod						
Crab	--	--	5.4	1	--	--
Crab larvae						
Unidentified	--	--	0.3	1	--	--
Squid						
Sea urchin						
Cumaceans						
Fish	--	--	62.6	6	8.7	3
Anchovy						
Herring						
Smelt						
Ammodytes	--	--	--	--	8.6	2
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	--	--	31.8	6	0.1	1
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae	--	--	30.8	1	--	--
Plant material						
Fish eggs	--	--	1.2	1	--	--
Unidentified remains	--	--	25.5	1	--	--
Total contents	4.7	3	428.8	33	248.0	36
Mean predator length (mm)	520		548		553	
Number empty stomachs	1		3		0	
Number regurgitated stomachs	0		0		0	
Total number stomachs	4		36		36	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COBB		COBB	
Cruise number	88		88		88	
Haul number	31		32		34	
Total number of fish examined (with food)	34		21		35	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	325.6	34	269.7	21	478.5	35
Euphausiids	318.3	34	268.5	21	475.6	35
Thysanoessa spinifera	226.7	32	187.3	21	248.4	33
Euphausia pacifica						
Unidentified	91.6	26	81.2	16	227.2	33
Pandalid shrimp						
Crangonid shrimp	7.3	7	1.1	3	2.9	5
Sergestes similis						
Mysids						
Anphipod						
Crab						
Crab larvae	--	-	0.1	1	--	-
Unidentified						
Squid						
Sea urchin						
Cumaceans	--	-	--	-	2.1	1
	69.8	5	44.1	5	166.1	8
Anchovy						
Herring						
Smelt	7.5	1	5.3	1	--	-
Ammodytes	--	-	4.3	1	--	-
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae	--	-	3.2	1	--	-
Unidentified	11.7	3	28.1	3	88.8	7
Zoarcidae			3.2	1	24.3	1
Pleuronectid						
Sciaenidae						
Gadidae	--	-	--	-	53.0	1
Plant material						
Fish eggs						
Unidentified remains	7.8	3	1.2	1	3.8	2
Total contents	403.2	34	315.0	21	650.5	35
Mean predator length (mm)	541		557		538	
Number empty stomachs	0		0		0	
Number regurgitated stomachs	2		1		0	
Total number stomachs	36		22		35	

Table 4 (cont'd),--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	COBB		COMMANDO		RECRUIT	
Cruise number	93		14		10	
Haul number	4		4		2	
Total number of fish examined (with food)	5		7		9	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	1.7	3	13.5	7	92.24	9
Euphausiids	0.1	1	13.5	7	89.82	9
Thysanoessa spinifera	— —	—	3.3	6	43.24	7
Euphausia pacifica	— —	—	0.3	2	— —	—
Unidentified	0.1	1	9.9	7	46.58	8
Pandalid shrimp	— —	—	— —	—	2.42	1
Crangonid shrimp	1.2	1	— —	—	— —	—
Sergfistes similis						
Mysids						
Amhipod						
Crab						
Crab larvae						
Unidentified	0.4	2	— —	—	— —	—
Squid						
Sea urchin	2.6	1	— —	—	— —	—
Cumaceans						
Fish	2.8	2	— —	—	— —	—
Anchovy						
Herring						
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	2.8	2	— —	—	— —	—
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains	— —	—	— —	—	0.74	1
Total contents	7.1	5	13.5	7	92.98	9
Mean predator length (mm)	268		491		521	
Number empty stomachs	14		5		1	
Number regurgitated stomachs	10		3		1	
Total number stomachs	29		15		11	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	BARON		BARON		BARON	
Cruise number	5		5		5	
Haul number	1		2		3	
Total number of fish examined (with food)	26		24		23	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	374.4	26	345.9	24	327.0	23
Euphausiids	370.6	26	343.2	24	320.5	22
Thysanoessa spinifera	79.8	24	56.9	23	88.9	20
Euphausia pacifica	24.1	24	6.4	17	1.4	7
Unidentified	266.7	26	279.9	24	230.2	22
Pandalid shrimp						
Crangonid shrimp	--	--	--	--	0.9	2
Sergestes similis						
Mysids	0.1	1	--	--	0.3	3
Amphipod						
Crab						
Crab larvae	3.7	14	2.7	10	5.3	12
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	11.3	2	64.2	4	295.8	9
Anchovy	--	--	61.1	2	219.0	5
Herring						
Smelt	11.3	2	--	--	--	--
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	--	--	3.1	2	76.8	5
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains	--	--	--	--	6.7	1
Total contents	385.7	26	410.1	24	629.5	23
Mean predator length (mm)	494		481		503	
Number empty stomachs	1		1		2	
Number regurgitated stomachs	1		0		0	
Total number stomachs	28		25		25	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	BARON		BARON		BARON	
Cruise number	5		5		5	
Haul number	4		5		6	
Total number of fish examined (with food)	18		28		32	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	195.5	17	222.6	25	260.7	32
Euphausiids	194.0	17	217.1	25	260.0	32
Thysanoessa spinifera	31.9	12	64.2	23	50.6	28
Euphausia pacifica	0.1	1	1.9	6	0.6	4
Unidentified	162.0	17	151.0	25	208.8	31
Pandalid shrimp						
Crangonid shrimp	--	--	2.4	3	--	--
Sergestes similis	--	--	0.1	1	--	--
Mysids	--	--	0.4	4	--	--
Amphipod						
Crab						
Crab larvae	1.4	8	2.5	6	0.7	4
Unidentified	0.1	1	0.1	1	--	--
Squid						
Sea urchin						
Cumaceans						
Fish	218.9	8	159.3	11	24.4	6
Anchovy	94.0	2	--	--	--	--
Herring	--	--	0.9	1	--	--
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	124.9	6	158.4	10	24.4	6
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains	4.0	1	10.2	2	--	--
Total contents	418.4	18	392.1	28	285.1	32
Mean predator length (mm)	490		514		502	
Number empty stomachs	0		0		2	
Number regurgitated stomachs	0		1		1	
Total number stomachs	18		29		35	

Table 4 (cont'd) .--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	BARON		BARON		BARON	
Cruise number	5		5		5	
Haul number	7		8		9	
Total number of fish examined (with food)	28		19		27	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	245.2	28	142.4	19	167.0	27
Euphausiids	244.4	28	141.6	19	165.6	27
Thysanoessa spinifera	82.1	27	45.8	17	70.9	27
Euphausia pacifica	0.8	6	0.1	1	4.7	14
Unidentified	161.5	24	95.7	18	90.0	26
Pandalid shrimp	0.8	1	--	--	--	--
Crangonid shrimp	--	--	0.5	2	0.5	1
Sergestes similis						
Mysids	--	--	--	--	0.1	1
Amphipod						
Crab						
Crab larvae	--	--	0.3	2	0.8	8
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	14.7	4	33.9	3	0.1	1
Anchovy						
Herring						
Smelt	13.2	2	--	--	--	--
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	1.5	2	33.9	3	0.1	1
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains						
Total contents	259.9	28	176.3	19	167.1	27
Mean predator length (mm)	512		522		537	
Number empty stomachs	0		15		1	
Number regurgitated stomachs	7		1		7	
Total number stomachs	35		35		35	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	BARON		BARON		BARON	
Cruise number	10		11		12	
Haul number						
Total number of fish examined (with food)	15		21		21	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	59.28	15	180.3	21	149.4	21
Euphausiids	59.28	15	176.4	21	148.6	21
Thysanoessa spinifera	26.06	15	41.1	18	64.5	18
Euphausia pacifica	— —	—	0.5	4	— —	—
Unidentified	33.22	15	134.8	21	84.1	21
Pandalid shrimp	— —	—	1.2	1	— —	—
Crangonid shrimp	— —	—	0.3	1	0.3	1
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae	— —	—	2.4	7	0.5	4
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	10.11	1	0.4	2	30.5	5
Anchovy						
Herring						
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	10.11	1	0.4	2	30.5	5
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains						
Total contents	69.39	15	180.7	21	179.9	21
Mean predator length (mm)	531		500		542	
Number empty stomachs	3		8		2	
Number regurgitated stomachs	0		6		7	
Total number stomachs	18		35		30	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	ST. MICHAEL		ST. MICHAEL		ST. MICHAEL	
Cruise number	14		14		14	
Haul number	1		2		3	
Total number of fish examined (with food)	23		34		29	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	83.2	23	166.5	34	74.8	29
Euphausiids	83.2	23	166.1	34	74.7	29
Thysanoessa spinifera	22.1	20	110.1	34	50.2	25
Euphausia pacifica	0.4	4	0.1	1	0.1	1
Unidentified	60.7	20	55.9	30	24.4	26
Pandalid shrimp	--	--	--	--	0.1	1
Crangonid shrimp	--	--	0.4	1	--	--
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae						
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	1.5	2	0.4	3	--	--
Anchovy						
Herring						
Smelt	0.2	1	--	--	--	--
Ammodytes						
Blackcod						
Sebastes sp.						
Pacific whiting						
Cottidae						
Unidentified	1.3	1	0.4	3	--	--
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains						
Total contents	84.7	23	166.9	34	74.8	29
Mean predator length (mm)	485		480		507	
Number empty stomachs	6		1		3	
Number regurgitated stomachs	1		0		3	
Total number stomachs	30		35		35	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number.

Vessel	ST. MICHAEL		ST. MICHAEL		ST. MICHAEL	
Cruise number	14		14		14	
Haul number	4		5		6	
Total number of fish examined (with food)	16		23		30	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	41.3	16	66.4	23	184.2	30
Euphausiids	41.3	16	64.0	23	181.2	30
Thysanoessa spinifera	18.7	12	18.4	17	101.2	30
Euphausia pacifica	--	—	0.3	3	0.3	3
Unidentified	22.6	16	45.3	22	79.7	24
Pandalid shrimp	--	—	2.2	1	--	—
Crangonid shrimp	--	—	--	—	3.0	2
Sergestes similis						
Mysids						
Amphipod						
Crab						
Crab larvae	--	—	0.2	1	--	—
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	2.8	1	--	—	3.2	1
Anchovy						
Herring						
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.	--	—	--	—	3.2	1
Pacific whiting						
Cottidae						
Unidentified	2.8	1	--	—	--	—
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains						
Total contents	44.1	16	66.4	23	187.4	30
Mean predator length (mm)	487		481		486	
Number empty stomachs	6		0		3	
Number regurgitated stomachs	3		12		2	
Total number stomachs	25		35		35	

Table 4 (cont'd).--Composition of food organisms in stomachs of Pacific whiting listed by vessel haul number,

Vessel	ST. MICHAEL		ST. MICHAEL		ST. MICHAEL	
Cruise number	14		14		14	
Haul number	7		8		9	
Total number of fish examined (with food)	32		30		26	
	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.	Total wt.(g)	Freq. occur.
Crustacea	155.9	32	151.7	30	110.6	26
Euphausiids	144.7	32	146.3	30	110.0	26
Thysanoessa spinifera	83.0	31	78.3	27	29.1	20
Euphausia pacifica	7.2	11	2.3	14	0.6	6
Unidentified	54.5	31	65.7	30	80.3	26
Pandalid shrimp	11.2	2	5.3	2	--	--
Crangonid shrimp						
Sergestes similis						
Mysids						
Amphipod	--	--	--	--	0.1	1
Crab						
Crab larvae	--	--	0.1	1	0.5	2
Unidentified						
Squid						
Sea urchin						
Cumaceans						
Fish	--	--	1.6	1	2.7	3
Anchovy						
Herring						
Smelt						
Ammodytes						
Blackcod						
Sebastes sp.	--	--	1.6	1	--	--
Pacific whiting						
Cottidae						
Unidentified	--	--	--	--	2.7	3
Zoarcidae						
Pleuronectid						
Sciaenidae						
Gadidae						
Plant material						
Fish eggs						
Unidentified remains						
Total contents	155.9	32	153.3	30	113.3	26
Mean predator length (mm)	487		542		477	
Number empty stomachs	2		2		3	
Number regurgitated stomachs	1		1		6	
Total number stomachs	35		33		35	

LITERATURE CITED

Alton, M., and M. Nelson. 1970. Food of Pacific hake, Merluccius productus, in Washington and northern Oregon coastal waters. In Pacific hake, p. 35-42. U.S. Fish Wildl. Serv., Circ. 332.

Gotshall, D. W. 1969. Stomach contents of Pacific hake and arrowtooth flounder from northern California. Calif. Fish Game 55:75-82.

Outram, D. N., and C. Haegele. 1972. Food of Pacific hake (Merluccius productus) on an offshore bank southwest of Vancouver Island, British Columbia. J. Fish. Res. Board Can. 29:1792-1795.