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Abstract approved: _____
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The 36 samples collected with a 22-foot semi-balloon shrimp trawl at depths from 40 to 1,829 meters off the central coast of Oregon between July 1961 and June 1962 provided preliminary data on the distribution, species composition, and associations of benthic fishes with respect to depth and sediment type.

Sixty-seven species of bottom fishes representing 21 families were collected; 86 percent of the total number of fishes was composed of specimens from the families Pleuronectidae, Scorpaenidae, and Bothidae.

Four communities of benthic fishes were found off the central Oregon coast within the depth interval from 40 to 1,829 meters. They were characterized by two or three dominant species, depth, and average sediment type. Ninety-seven percent of the species

occurring in the communities showed high abundance in only one community. Some species also demonstrated size segregation by communities.

The total number of species collected in progressively deeper communities was 26 (42 to 73 meters), 31 (119 to 199 meters), 20 (594 to 1,143 meters), and 9 (1,383 to 1,829 meters). Therefore the highest number of species occurred in the community on the outer continental shelf and upper slope, while the lowest number of species occurred at the extreme depths on the continental slope. The number of species found on the continental shelf and slope were similar. Species inhabiting the continental slope, however, usually occurred over greater depth ranges.

A comparison of the catches of the 22-foot shrimp trawl and a 94-foot fish trawl indicated that the small trawl used in this study retained comparatively few large fishes or semi-pelagic species. Fishes of the genus Sebastodes were grossly undersampled and probably comprised a major portion of the fish population, especially between the depths of 183 to 547 meters.

DISTRIBUTION OF BENTHIC FISHES ON THE CONTINENTAL SHELF AND SLOPE OF THE OREGON COAST

by

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DISTRIBUTION OF BENTHIC FISHES ON THE CONTINENTAL SHELF AND SLOPE OF THE OREGON COAST

I. INTRODUCTION

Until recently, little was known about the depth distribution and species composition of benthic fishes inhabiting the continental shelf and slope in the northeastern Pacific Ocean. Grey (1956) stated that no conclusions could be reached on the composition of the fishes of the deep-abyssal eastern Pacific region, since little bottom fishing has been conducted in these waters since the Albatross cruises of the late nineteenth and early twentieth centuries. Nor could conclusions be reached about the slope fishes or the fishes of the continental shelf.

Bottom trawl collections taken from the Albatross off Oregon between 1888 and 1890 were not extensive. During this time period 43 samples were taken, but only four were from depths greater than 183 meters.

Recently the Exploratory Fishing and Gear Research Division of the U.S. Bureau of Commercial Fisheries conducted bottom trawling on the continental shelf and slope from Oregon to the Bering Sea to depths of 549 meters. Information was obtained on the distribution, relative abundance, and sizes of commercially important demersal fishes in this region (Alverson, Pruter, and Ronholt, 1964).

Surveys of benthic fishes were conducted off Oregon in 1952 from Cape Foulweather to Cape Lookout at depths from 183 to 732 meters (Alverson, 1953) and in 1961 from Yaquina Head to the Siuslaw River at depths of 64 to 549 meters (Hitz and Alverson, 1963). In 1961, a line of stations was established extending from the Columbia River southwesterly for the study of the bathymetric distribution of benthic fishes and invertebrates (Hitz and Alverson, 1963). Samples have been obtained from depths of 91 to 1,920 meters (Pereyra, 1966).

Catch data from commercial trawlers have also been used in studying the demersal fishes of this region. Alverson (1960) found seasonal variations in the bathymetric catch patterns for nine commercially important ground fishes off the coast of Washington and British Columbia. Harry (1956) analyzed the catch composition of the Oregon otter trawl fishery using samples taken with commercial otter trawls from chartered fishing vessels. These studies were based on commercial catches where suitable trawling grounds existed on the shelf and upper slope and neglected less desirable trawling areas, therefore, they provide little systematic data on depth distributions of fishes.

This paper presents data on the distribution, species composition, and associations of benthic fishes with respect to depth and bottom types. It is based on an organized survey of benthic fishes at depths from 40 to 1,829 meters on the continental shelf and slope

off the central coast of Oregon.

Since the continental terrace off Oregon is narrow, extending 106-109 kilometers from shore, it was possible to sample a wide range of depths and sediment types within a short distance from shore. The continental shelf is narrower, steeper, and deeper than the average for the world (Byrne, 1962; Shepard, 1948). The shelf break occurs in the depth interval from 128 to 155 meters. The shelf will be arbitrarily considered to extend from 0 to 146 meters and the slope from 146 to 1,829 meters in this paper.

II. MATERIAL AND METHODS

Benthic fishes were sampled with a semi-balloon shrimp trawl.[1] Greenwood (1959) illustrates the general construction plan for this type of trawl. The headrope of the trawl was 22-feet long and the footrope 27-feet long. The net was constructed from 1 1/4-inch (stretch measured) cotton netting of number 18 thread. Either wood or metal otter doors were used to spread the trawl.

All tows were made with the single warp method in which a bridle composed of two legs of braided nylon rope, 100-feet in length connected the otter doors and net to the 3/8-inch cable tow line.

The trawl was set and retrieved while the ship was underway at low speeds. Cable was played out and retrieved at 35 to 40 meters per minute while the ship maintained a speed of approximately 3 knots. The duration of each tow, estimated from the moment the maximum amount of cable was in the water to beginning of the retrieve, was 20 minutes where the depth was 274 meters or less and 30-60 minutes where the bottom was deeper. The amount of cable required to trawl on the bottom was established by trial and error.

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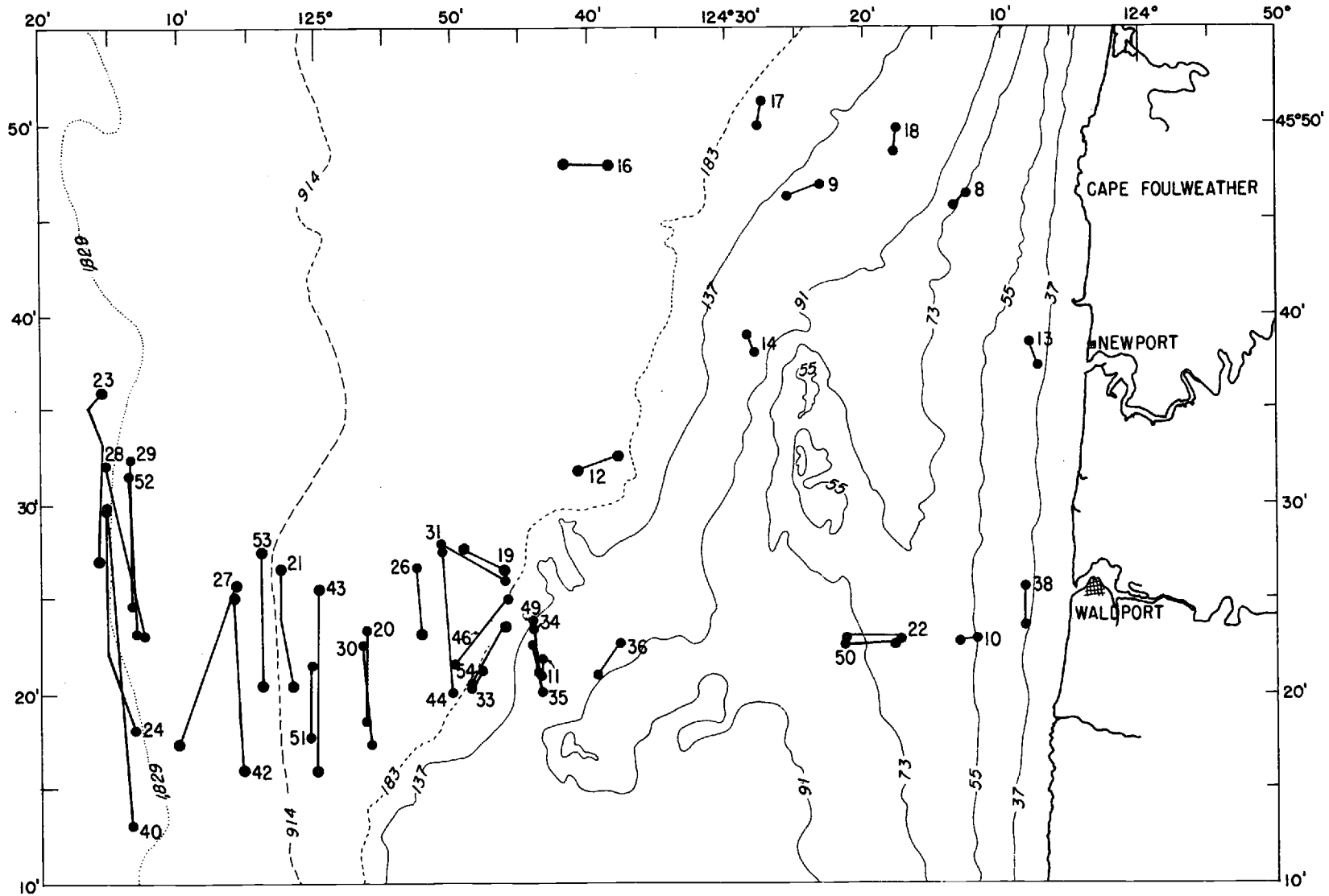
[1] Manufactured by Marinovich Trawl Company: Biloxi, Mississippi.

A 4:1 - 6:1 ratio of wire length to water depth was used for the stations inshore of the 366-meter contour and 2.5:1 or 3:1 for deeper stations. These ratios are similar to those given by Pereyra (1963) for a 43-foot flat shrimp trawl.

In all, 36 samples were collected off the central Oregon coast from Cape Foulweather to Waldport at depths from 40 to 1,829 meters (Figure 1) between July 1961 and June 1962. Fourteen samples were obtained over the shelf (146 meters or less) and 22 samples on the slope (146 to 1,829 meters). Samples were taken at least twice at the stations over the shelf and upper slope. Farther offshore at depths greater than 366 meters, only one sample was obtained because of the difficulty in relocating the exact position of the stations. Sampling depths were selected prior to each cruise to obtain the best possible coverage of the shelf and slope.

Station positions were determined primarily by Loran with radar and echo-sounding equipment as supplementary navigational aids. A Precision Depth Recorder in conjunction with an Edo Echo Sounder was used to determine depth and suitable bottom topography. Tows were made over comparatively flat terrain parallel to the contour lines. Nevertheless, the trawl was torn or lost during 6 of 12 unsuccessful tows indicating the roughness of the bottom in this area. The main obstruction to bottom trawling on the shelf was a region of rock out-cropping known as Stonewall Bank (Figure 1). Sampling

Figure 1. Location of the trawling stations off the central coast of Oregon.


20'
10'
125°
50'
40'
124°30'
20'
10'
124°
50°
50'
40'
30'
20'
10'
45°50'
CAPE FOULWEATHER
NEWPORT
WALDPORT
1828
914
183
137
91
73
55
37
1829
16
17
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locations on the shelf were usually on the periphery of this rock formation.

Benthic fishes in the samples were sorted into taxonomic groups and the common species identified and measured (total length) at sea. The remaining fish were preserved in 10 percent formalin at sea and identified and measured ashore.

A Dietz-LaFond sampler was used to collect sediment from the continental shelf and a Phleger corer with a 12-inch sample tube was used on the slope. Sediment samples were collected at each biological station for particle-size analyses. Hydrometric and settling tube methods were used to determine the distribution of particle sizes in each sediment sample. The percent composition of sand, silt, and clay at each trawl station is included in Appendix I. The Wentworth scale (Kuenen, 1960) for size classification of sediment particles was used to differentiate the particles of sand (2-0.0625 mm diameter), silt (0.0625-0.004 mm diameter), and clay (< 0.004 mm diameter). Rock, the only other major bottom material present, consisted of particles larger than 2.5 cm in diameter (Appendix I).

III. RESULTS

Species Composition

A total of 7,689 fishes representing 21 families and 67 identified species were collected during this study (Table 1). Most of these fishes are considered to be benthic, although some are pelagic and swim above the bottom.

The families Pleuronectidae, Scorpaenidae, and Bothidae contributed approximately 86 percent of the total number of specimens in the catch. Numerically dominant species for each of these families were:

Pleuronectidae	Percent of catch within family
Lyopsetta exilis	68
Glyptocephalus zachirus	14
Parophrys vetulus	9
Microstomus pacificus	5
Total	96
Scorpaenidae	
Sebastolobus altivelis	54
Sebastolobus alascanus	34
Total	88
Bothidae	
Citharichthys sordidus	97

Of the identified species, 72 percent were members of six

Table 1. List of benthic fishes collected off the central coast of Oregon during this study.

Families and Species	Total Number Collected	Shrimp Trawl Number
Myxinidae		
Polistotrema deani Evermann and Goldsborough 1906	3	42
Polistotrema stoutii (Lockington) 1878	62	8, 9, 20, 27, 42, 51
Polistotrema spp.	110	16, 21, 28, 30, 42, 43, 44, 53
Squalidae		
Squalus suckleyi (Girard) 1854	1	22
Rajidae		
Psammobatis spinosissimus Beebe and Tee-Van 1941	1	24
Raja binoculata Girard 1854	4	13, 22, 35
Raja kincaidii Garman 1908	11	17, 44, 46, 52
Raja rhina Jordan and Gilbert 1880	2	9, 44
Raja trachura Gilbert 1891	2	29, 44
Chimaeridae		
Hydrolagus colliei (Lay and Bennett) 1839	14	17, 38, 46, 49
Alepocephalidae		
Alepocephalus convexifrons Garman 1899	3	27, 42
Moridae		
Antimora rostrata Gunther 1878	24	24, 27, 28, 29, 40, 52, 53
Gadidae		
Microgadus proximus (Girard) 1854	99	13, 38, 50
Macrouridae		
Coryphaenoides acrolepis (Bean) 1883	144	20, 21, 24, 27, 28, 29, 40, 42, 43, 51, 52, 53
Coryphaenoides pectoralis (Gilbert) 1891	16	27, 29, 43
Embiotocidae		
Cymatogaster aggregata Gibbons 1854	1	38
Bathymasteridae		
Ronquilus jordani (Gilbert) 1888	9	14, 36
Stichaeidae		
Plectobranchus evides Gilbert 1890	2	17

Table 1. continued

Families and Species	Total Number Collected	Shrimp Trawl Number
Zoarcidae		
Aprodon cortezianus Gilbert 1890	5	16, 44
Bothrocara brunneum (Bean) 1890	1	28
Bothrocara remigera Gilbert 1915	1	40
Embryx crotalina (Gilbert) 1890	24	21, 42, 53
Lycodes diapterus Gilbert 1891	6	26, 30
Lycodopsis pacifica Collett 1879	157	9, 11, 17
Brotulidae		
Cataetyx rubrirostris Gilbert 1890	2	20, 43
Scorpaenidae		
Sebastolobus alascanus Bean 1890	785	16, 20, 21, 27, 28, 30, 31, 40, 42, 44, 46, 51, 53
Sebastolobus altivelis Gilbert 1893	1, 231	16, 20, 21, 26, 27, 29, 30, 40, 42, 43, 51, 52, 53
Sebastolobus spp.	35	43
Sebastodes alutus (Gilbert) 1890	33	17, 36, 46
Sebastodes crameri Jordan 1896	5	9, 16, 17, 18
Sebastodes diploproa (Gilbert) 1890	2	12, 44
Sebastodes elongatus (Ayres) 1859	94	9, 11, 14, 17, 34, 35, 36, 46, 49
Sebastodes entomelas (Jordan and Gilbert) 1880	1	54
Sebastodes helvomaculatus (Ayres) 1859	2	11, 16
Sebastodes melanops (Girard) 1856	2	38
Sebastodes proriger (Jordan and Gilbert) 1880	7	36
Sebastodes saxicola (Gilbert) 1890	33	17, 33, 46, 54
Sebastodes wilsoni Gilbert 1915	23	14, 36, 46
Sebastodes zacentrus (Gilbert) 1890	15	11, 14, 33, 36, 44, 46
Hexagrammidae		
Ophiodon elongatus Girard 1854	8	38

Table 1. continued

Families and Species	Total Number Collected	Shrimp Trawl Number
Anoplopomatidae		
Anoplopoma fimbria (Pallas) 1811	148	9, 12, 17, 18, 20, 21, 27, 28, 29, 30, 35, 42, 43, 44, 46, 51, 53
Cottidae		
Chitonotus pugetensis (Steindachner) 1877	3	10, 50
Hemilepidotus spinosus (Ayres) 1855	3	38
Icelinus filamentosus Gilbert 1890	13	11, 14, 36
Icelinus tenuis Gilbert 1890	9	11, 36
Paricelinus hopliticus Eigenmann and Eigenmann 1889	2	36
Radulinus asprellus Gilbert 1890	112	8, 9, 11, 14, 17, 18, 22, 35, 46
Bothidae		
Citharichthys sordidus (Girard) 1854	1,037	8, 10, 13, 22, 35, 36, 38, 49, 50
Citharichthys stigmaeus Jordan and Gilbert 1882	12	10, 14, 50
Pleuronectidae		
Atheresthes stomias (Jordan and Gilbert) 1880	21	8, 9, 10, 17, 18, 33, 34, 35, 49, 54
Embassichthys bathybius (Gilbert) 1890	19	21, 29, 40, 42
Eopsetta jordani (Lockington) 1879	51	8, 10, 13, 22, 33, 35, 36, 38, 46, 50
Glyptocephalus zachirus Lockington 1879	457	9, 10, 11, 16, 17, 18, 22, 30, 33, 34, 35, 36, 44, 46, 49, 50, 54
Isopsetta isolepis (Lockington) 1880	9	38
Lepidopsetta bilineata (Ayres) 1855	3	13, 36
Lyopsetta exilis (Jordan and Gilbert) 1880	2,168	9, 10, 11, 17, 18, 22, 33, 34, 35, 36, 44, 46, 49, 54
Microstomus pacificus (Lockington) 1879	160	9, 10, 11, 16, 17, 18, 20, 21, 22, 30, 34, 35, 36, 42, 43, 44, 46, 49 51, 54
Parophrys vetulus Girard 1854	281	10, 13, 22, 34, 35, 38, 46, 49, 50, 54
Platichthys stellatus (Pallas) 1811	1	38
Pleuronichthys decurrens Jordan and Gilbert 1880	1	13

Table 1. continued

Families and Species	Total Number Collected	Shrimp Trawl Number
Agonidae		
Agonopsis emmelane (Jordan and Starks) 1895	2	10, 11
Asterotheca infraspinata (Gilbert) 1904	1	22
Asterotheca pentacantha (Gilbert) 1890	4	16
Bathyagonus nigripinnis Gilbert 1890	3	30, 43
Occa verrucosa (Lockington) 1880	1	38
Xeneretmus latifrons (Gilbert) 1890	175	9, 17, 33, 35, 36, 46, 54
Xeneretmus triacanthus (Gilbert) 1890	9	11, 14, 18, 34
Liparidae		
Careproctus melanurus Gilbert 1891	3	51, 52, 53
Rhinoliparis attenuatus Burke 1912	1	20

families: Scorpaenidae - 13 species; Pleuronectidae - 11; Agonidae-7; Cottidae - 6; Zoarcidae - 6; and Rajidae - 5. The species composition for each trawl sample is shown in Appendix I.

Species Associations

A community is defined in this paper as an assemblage or group of species which are commonly found living together (Fager, 1963). The existence of communities can be recognized by the recurrence of species groups. One method of illustrating the similarity of species composition among samples is with a "trellis diagram".

A trellis diagram is constructed in the following way: (1) The percent composition is computed for all species in each sample. (2) All possible sample pairs are compared. For each species common to both samples, the lower of the two percent composition values is taken as a measure of species association between the two samples. (3) The sum of these low values then provides a quantitative index of species association for the two samples. For example, species X, Y, and Z occurred in samples I and II at the following percentages:

	Sample I	Sample II
Species X	10%	50%
Species Y	75%	20%
Species Z	15%	30%

The lowest percent composition values for species X, Y, and Z are 10, 20, and 15 respectively. Thus, the index of species association is 45 percent for these two samples. Finally, (4) the values obtained from all possible combinations of samples are arranged in a trellis diagram to show the relationships among samples. For further details on this method, see Wieser (1960) and MacFadyen (1963).

The trellis diagram in Figure 2 shows the degree of similarity of samples of benthic fishes collected with increasing depth across the continental shelf and slope. Three benthic fish communities are present with indications of a fourth community occurring in the region of deepest sampling. These communities or species groups are designated as Groups I, II, III, and IV. The species compositions of these groups are given in Appendix II. The four communities are characterized by dominant species, depth, and type of sediment in Table 2. In each community, only two or three fish species contributed from 77 to 93 percent (by number) of the fish fauna.

Based on changes in species composition, the community represented by Group IV is distinct. Deep-water species, Coryphaenoides acrolepis and Antimora rostrata, were dominant in these catches, while Sebastolobus altivelis and S. alascanus decreased relative to Group III.

Many species of benthic fishes were restricted to one community. Others were found in two or more associations. However,

Figure 2. "Trellis Diagram" illustrating the degree of similarity of the benthic fish fauna at the stations on the shelf and slope off the central coast of Oregon.

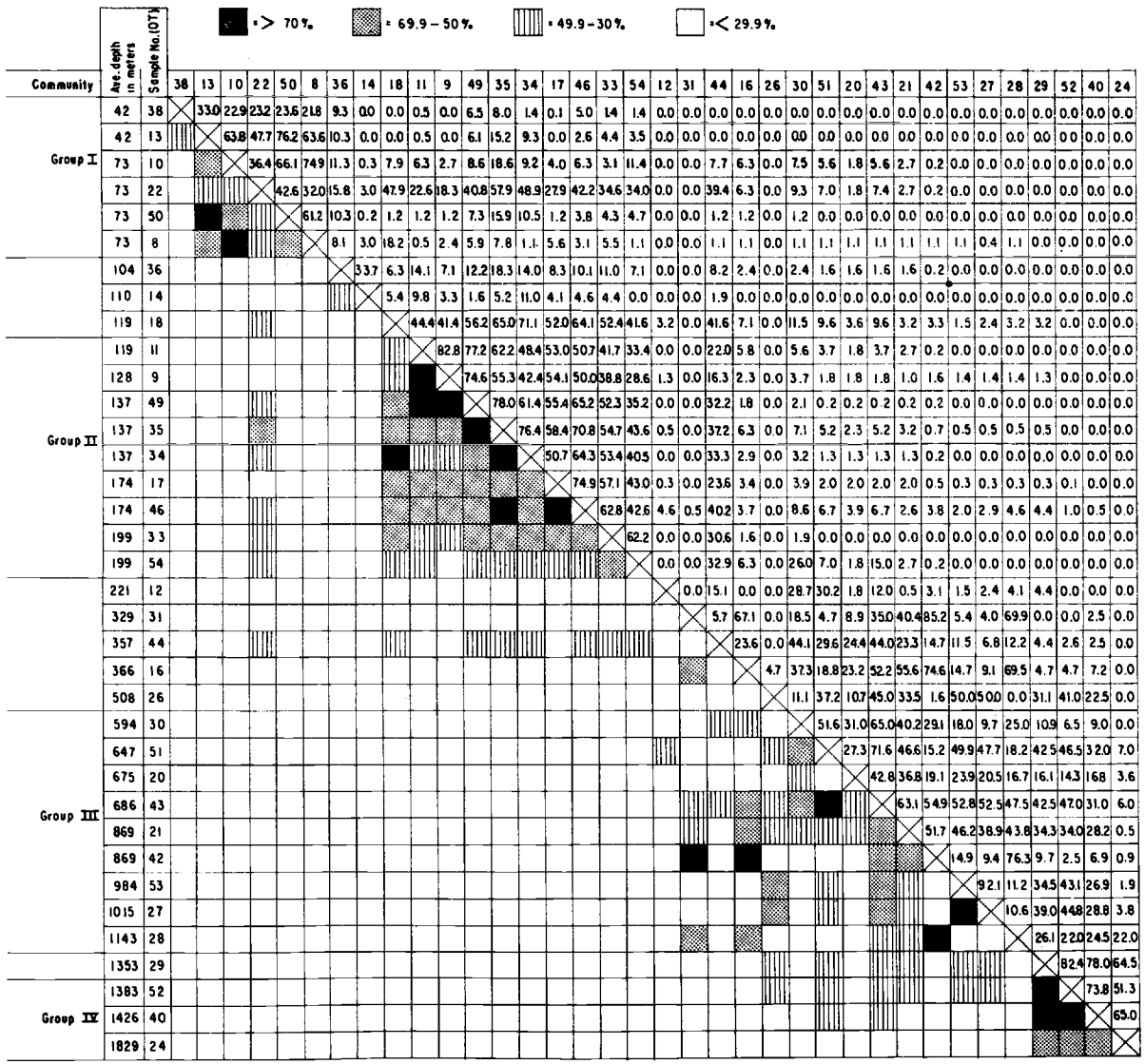

■ = > 70%.
▨ = 69.9 – 50%.
▥ = 49.9 – 30%.
□ = < 29.9%.
Community
Ave. depth in meters
Sample No. (OTU)
Group I
Group II
Group III
Group IV

Table 2. Depth interval, average sediment type, and dominant species for each community or species group.

Community Name	Depth Interval (meters)	Average Sediment Type for each Community	Dominant Species	Percent Composition
Group I	42 to 73	100% sand	1. Citharichthys sordidus	64.0
			2. Parophrys vetulus	16.3
				T=80.3
Group II	119 to 199	69% sand;	1. Lyopsetta exilis	66.4
		19% silt;	2. Glyptocephalus zachirus	11.4
		12% clay		T=77.8
Group III	594 to	17% sand;	1. Sebastolobus altivelis	49.7
	1,143	55% silt;	2. Sebastolobus alascanus	30.9
		28% clay		T=80.6
Group IV	1,383	1% sand;	1. Coryphaenoides acrolepis	51.6
	to	53% silt;	2. Sebastolobus altivelis	26.3
	1,829	46% clay	3. Antimora rostrata	14.7
				T=92.6

species found in more than one community were usually much more abundant in one community than in the others: 97 percent of the species exhibited high abundance (> 60 percent of total number) in only one particular community. Table 3 shows the species limited to a community and those common to other communities. Species limited to one community comprised 50 percent of the species in Group I, 48 percent in Group II, 52 percent in Group III, and 22 percent in Group IV. Thus the degree of fidelity, or restriction to one community, remained approximately constant with increasing depth through Group III but decreased rapidly with Group IV. Stated in another way, the number of species found in two or more communities remained at approximately 50 percent in Groups I, II, and III but increased to 78 percent in the deepest community, Group IV. Species common to two or three communities, but showing high abundance in only one community, are listed in Table 4.

Species found in more than one community usually showed a segregation by size. Parophrys vetulus is a good example. Small individuals (average length 21.3 cm) were common to Group I while large individuals (average length 33.8 cm) were found in Group II (Table 5). Microstomus pacificus was one of the species which did not show high abundance in a particular community. It occurred over one of the broadest depth ranges (Groups I, II, and III) for a species, and the average size of M. pacificus increased gradually

Table 3. List of species within each community that are limited to a community or common to more than one community. (Roman numerals designate the species group; numbers in parentheses the percentage for each group.)

Community Name	(A) Species Limited to a Community	(B) Species in Common with Other Communities
Group I	1. Microgadus proximus	1. Citharichthys sordidus I (96.3); II (3.7)
	2. Isopsetta isolepis	2. Parophrys vetulus I (89.7); II (10.3)
	3. Chitonotus pugetensis	3. Eopsetta jordani I (89.8); II (10.2)
	4. Citharichthys stigmaeus	4. Glyptocephalus zachirus I (10.4); II (89.1); III (0.5)
	5. Hemilepidotus spinosus	5. Microstomus pacificus I (29.8); II (33.3); III (36.9)
	6. Sebastodes melanops	6. Radulinus asprellus I (22.1); II (77.9)
	7. Asterotheca infraspinata	7. Lyopsetta exilis I (0.6); II (99.4)
	8. Cymatogaster aggregata	8. Ophiodon elongatus I (87.5); II (12.5)
	9. Lepidopsetta bilineata	9. Hydrolagus colliei I (35.7); II (64.3)
	10. Occa verrucosa	10. Raja binoculata I (75.0); II (25.0)
	11. Platichthys stellatus	11. Atheresthes stomias I (10.0); II (90.0)
	12. Pleuronichthys decurrens	12. Agonopsis emmelane I (50.0); II (50.0)
	13. Squalus suckleyi	13. Polistotrema stoutii I (1.6); II (1.6); III (96.8)
Group II	1. Xeneretmus latifrons	1. Lyopsetta exilis I (0.6); II (99.4)
	2. Lycodopsis pacifica	2. Glyptocephalus zachirus I (10.4); II (89.1); III (0.5)
	3. Sebastodes elongatus	3. Radulinus asprellus I (22.1); II (77.9)
	4. Sebastodes saxicola	4. Microstomus pacificus I (29.8); II (33.3); III (36.9)
	5. Icelinus filamentosus	5. Citharichthys sordidus I (96.3); II (3.7)
	6. Sebastodes zacentrus	6. Parophrys vetulus I (89.7); II (10.3)
	7. Xeneretmus triacanthus	7. Anoplopoma fimbria II (20.3); III (79.7)
	8. Icelinus tenuis	8. Atheresthes stomias I (10.0); II (90.0)
	9. Sebastodes crameri	9. Hydrolagus colliei I (35.7); II (64.3)
	10. Plectobranchus evides	10. Eopsetta jordani I (89.8); II (10.2)
	11. Raja rhina	11. Raja kincaidii II (75.0); IV (25.0)
	12. Sebastodes alutus	12. Agonopsis emmelane I (50.0); II (50.0)
	13. Sebastodes entomelas	13. Ophiodon elongatus I (87.5); II (12.5)
	14. Sebastodes helvomaculatus	14. Polistotrema stoutii I (1.6); II (1.6); III (96.8)
	15. Sebastodes wilsoni	15. Raja binoculata I (75.0); II (25.0)
		16. Sebastolobus alascanus II (0.1); III (99.7); IV (0.1)

Table 3. continued

Community Name	(A) Species Limited to a Community	(B) Species in Common with Other Communities
Group III	1. Polistotrema spp.	1. Sebastolobus altivelis III (98.0); IV (2.0)
	2. Embryx crotalina	2. Sebastolobus alascanus II (0.1); III (99.7); IV (0.1)
	3. Coryphaenoides pectoralis	3. Anoplopoma fimbria II (20.3); III (79.7)
	4. Lycodes diapterus	4. Coryphaenoides acrolepis III (60.5); IV (39.5)
	5. Alepocephalus convexifrons	5. Polistotrema stoutii I (1.6); II (1.6); III (96.8)
	6. Bathyagonus nigripinnis	6. Microstomus pacificus I (29.8); II (33.3); III (36.9)
	7. Cataetyx rubrirostris	7. Embassichthys bathybius III (88.9); IV (11.1)
	8. Polistotrema deani	8. Antimora rostrata III (30.0); IV (70.0)
	9. Bothrocara brunneum	9. Careproctus melanurus III (66.7); IV (33.3)
	10. Raja trachura	10. Glyptocephalus zachirus I (10.4); II (89.1); III (0.5)
	11. Rhinoliparis attenuatus	
Group IV	1. Bothrocara remigera	1. Coryphaenoides acrolepis III (60.5); IV (39.5)
	2. Psammobatis spinosissimus	2. Sebastolobus altivelis III (98.0); IV (2.0)
		3. Antimora rostrata III (30.0); IV (70.0)
		4. Embassichthys bathybius III (88.9); IV (11.1)
		5. Careproctus melanurus III (66.7); IV (33.3)
		6. Raja kincaidii II (75.0); IV (25.0)
		7. Sebastolobus alascanus II (0.1); III (99.7); IV (0.1)

Table 4. Species of benthic fishes common to two or more communities but showing high abundance, greater than 60 percent of total number, in only one community.

Species	Community of highest abundance			
	Group I	Group II	Group III	Group IV
1. Citharichthys sordidus	X			
2. Parophrys vetulus	X			
3. Eopsetta jordani	X			
4. Ophiodon elongatus	X			
5. Raja binoculata	X			
6. Lyopsetta exilis		X		
7. Glyptocephalus zachirus		X		
8. Radulinus asprellus		X		
9. Atheresthes stomias		X		
10. Hydrolagus colliei		X		
11. Raja kincaidii		X		
12. Sebastolobus altivelis			X	
13. Sebastolobus alascanus			X	
14. Anoplopoma fimbria			X	
15. Coryphaenoides acrolepis			X	
16. Polistotrema stoutii			X	
17. Embassichthys bathybius			X	
18. Careproctus melanurus			X	
19. Antimora rostrata				X

Table 5. Length distributions of selected species of benthic fishes in various communities.

Species	Community Number	Number of Organisms by Community	Mean by Community (cm)	± Standard Deviation by Community (cm)	Size Range in cm
1. Atheresthes stomias	I	2	--	--	4.5 & 59.6
	II	18	42.7	32.1-53.3	18.5-64.3
2. Citharichthys sordidus	I	989	13.2	8.5-17.9	6.2-29.7
	II	38	18.8	14.7-22.9	10.6-28.3
3. Eopsetta jordani	I	44	21.4	10.1-32.7	8.3-47.3
	II	5	37.1	30.1-44.1	30.0-46.6
4. Lyopsetta exilis	I	13	14.4	10.6-18.2	10.4-19.4
	II	2,101	16.0	11.3-20.7	6.0-29.1
5. Parophrys vetulus	I	124	21.3	13.6-29.0	7.5-39.5
	II	29	33.8	31.3-36.3	28.2-37.8
6. Glyptocephalus zachirus	I	42	25.4	19.2-31.6	6.9-32.1
	II	359	18.8	11.2-26.4	5.5-34.8
	III	2	--	--	6.6 & 35.5
7. Microstomus pacificus	I	42	23.1	15.8-30.4	9.2-42.3
	II	47	32.3	25.0-39.6	14.2-49.9
	III	52	41.7	37.9-45.5	27.6-50.0

Table 5. continued

Species	Community Number	Number of Organisms by Community	Mean by Community (cm)	± Standard Deviation by Community (cm)	Size Range in cm
8. Anoplopoma fimbria	II	27	44.0	34.9-53.1	29.7-56.2
	III	106	61.0	53.0-69.0	38.0-96.8
9. Coryphaenoides pectoralis	III	13	60.1	53.6-66.6	50.5-71.4
10. Sebastolobus alascanus	III	751	21.4	10.0-32.5	6.0-65.0
11. Antimora rostrata	III	6	34.3	31.9-36.7	31.9-38.8
	IV	14	43.3	35.2-51.4	27.2-53.3
12. Coryphaenoides acrolepis	III	75	37.7	22.6-52.8	9.0-61.5
	IV	49	39.7	22.3-57.1	9.1-77.6
13. Embassichthys bathybius	III	16	14.9	8.3-21.5	6.9-35.4
	IV	2	--	--	35.3 & 36.5
14. Sebastolobus altivelis	III	1,208	11.5	6.0-17.0	4.7-29.4
	IV	25	16.0	11.5-20.5	10.0-25.3

in progressively deeper communities.

Some species showed both high abundance in a single community as well as size distribution by communities (Citharichthys sordidus, Eopsetta jordani, Parophrys vetulus, Anoplopoma fimbria, and Antimora rostrata) (Table 5). For the first three species, the smallest sizes accompanied the highest abundance in one community, and larger average sizes were found in another community. Furthermore, the distribution of the mean lengths and length ranges for species such as P. vetulus and E. jordani indicates that large specimens occurred in both communities while small specimens were restricted to one community. This size distribution suggests that the small or young specimens are most limited in their depth distribution. The average size of most species included in Table 5 showed an increase in length in deeper communities. This distributional pattern may indicate a change in environmental preference or tolerance with length or age.

Agonopsis emmelane was the only species for which a community trend by abundance or size could not be established, probably because of insufficient data (only two specimens collected). In addition, six uncommon species apparently were not associated with a particular community, but they occurred in the transition regions between Groups I and II or II and III (Table 6).

Overlap of the communities was thus minimal since 98 percent of the species associated with communities showed high abundance

Table 6. A list of species occurring between communities.

Species	Occurrence between Communities
1. Paricelinus hopliticus	I - II
2. Ronquilus jordani	I - II
3. Sebastodes proriger	I - II
4. Aprodon cortezianus	II - III
5. Asterotheca pentacantha	II - III
6. Sebastodes diploproa	II - III

in one particular community or size segregation by communities.

Sediment Types and Communities

The average sediment composition was grossly different for each community (Table 2). However, individual sediment samples within each community (Table 7) indicated that two distinct sediment types existed in the depth range occupied by both Groups II and III. The sediment character changed rapidly between 174 meters (OT 46) and 199 meters (OT 33) for Group II and between 984 and 1,015 meters (OT 27 and 28) for Group III. These regions of sediment transition occurred between the two deepest sampling stations in these two communities. Nevertheless, the faunal similarities of species Groups II and III appear to be maintained in these regions of rapidly changing sediment composition, but only over a limited depth interval.

The only communities separated by an abrupt change in sediment type were Groups I and II (Table 7). An extensive rocky area (Stonewall Bank, Figure 1) existed between these two communities. This area was predominantly inhabited by species of the genus Sebastodes (72 percent of the total catch) with low numbers of pleuronectids (8 percent). It is not known how this rocky area affected the distribution of fishes. Pleuronectid species were numerous (26 percent of the total catch) in Group I and dominant (81 percent) in

Table 7. Sediment composition at each biological sampling location, and average sediment composition with respect to depth and the benthic fish communities.

Community	Sample Number	Average Depth in meters	Sediment Composition Percent rock	sand	silt	clay	Average Sediment Composition
	OT-38	42		100			
	OT-13	42		100			
Group I	OT-10	73		100			100% sand
	OT-22	73		100			
	OT-50	73		100			
	OT-8	73		100			
	OT-36	104	100				Rock
	OT-14	110		65	19	16	
	OT-18	119		88	5	7	
	OT-11	119		89	5	6	
	OT-9	128		73	10	17	81% sand;
	OT-49	137		89	5	6	10% silt;
	OT-35	137		89	5	6	9% clay
Group II	OT-34	137		89	5	6	
	OT-17	174		56	25	19	
	OT-46	174		87	11	2	
	OT-33	199		23	53	24	
	OT-54	199		23	53	24	
	OT-12	221		47	28	25	
	OT-31	329		53	31	16	
	OT-44	357		23	53	24	
	OT-16	366		52	20	28	28% sand;
	OT-26	508		38	48	14	48% silt;
	OT-30	594		14	64	22	24% clay
	OT-51	647		28	58	14	
	OT-20	675		14	64	22	
	OT-43	686		28	58	14	
Group III	OT-21	887		20	42	38	
	OT-42	887		3	56	41	
	OT-53	984		35	45	20	
	OT-27	1,015		12	54	34	
	OT-28	1,143		1	51	48	
	OT-29	1,353		1	54	45	1% sand;
	OT-52	1,383		1	54	45	53% silt;
Group IV	OT-40	1,426		1	51	48	46% clay
	OT-24	1,829		2	53	45	

Group II. The dominant pleuronectid species were different in Groups I (Parophrys vetulus) and II (Lyopsetta exilis), however. In addition, the invertebrate species, collected along a station line positioned farther to the north off the Oregon coast, showed a change in species composition at depths similar to those found in the transition region between Groups I and II but where a rocky area did not exist (Carey, personal communication).

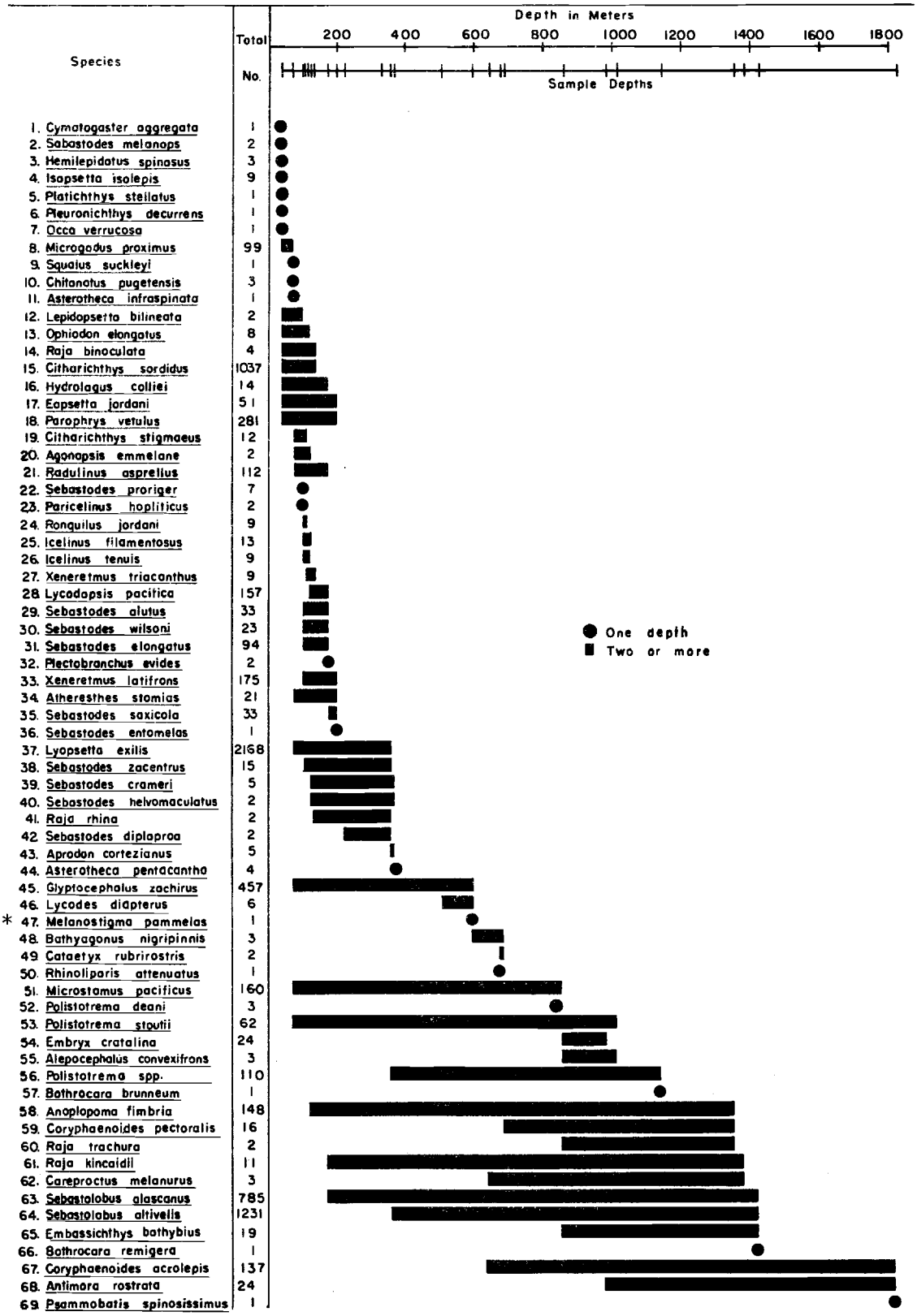
Depth Distributions

Forty-two species occurred on the continental shelf while 46 occurred on the continental slope (Figure 3). Thus, species diversity, as indicated by number of species (Appendix II), was about the same on the shelf as on the slope despite the larger number of collections on the slope (22 versus 14 on the shelf) and despite the broader depth range sampled on the slope. Of the species collected in the sampling area 63 percent were present over the limited depth interval (0 to 146 meters) of the continental shelf.

The highest number of species collected in the progressively deeper Groups of I to IV occurred in Group II with the lowest species number in Group IV. The total number of species collected in each community was 26 in Group I, 31 in Group II, 20 in Group III, and 9 in Group IV (Appendix II). The depth interval occupied by Group II (119 to 199 meters) included the outer region of the continental shelf

Figure 3. Depth ranges for species of benthic fishes collected off the central coast of Oregon.

* This species is primarily pelagic and thus has been exempted in the other figures and tables.


Species
Total No.
Depth in Meters
200 400 600 800 1000 1200 1400 1600 1800
Sample Depths
One depth
Two or more
1. Cymatogaster aggregata 1
2. Sebastodes melanops 2
3. Hemilepidotus spinosus 3
4. Isopsetta isolepis 9
5. Platichthys stellatus 1
6. Pleuronichthys decurrens 1
7. Occa verrucosa 1
8. Microgadus proximus 99
9. Squalus suckleyi 1
10. Chitonotus pugetensis 3
11. Asterotheca infraspinata 1
12. Lepidopsetta bilineata 2
13. Ophiodon elongatus 8
14. Raja binoculata 4
15. Citharichthys sordidus 1037
16. Hydrolagus colliei 14
17. Eopsetta jordani 51
18. Parophrys vetulus 281
19. Citharichthys stigmaeus 12
20. Agonopsis emmelane 2
21. Radulinus asprellus 112
22. Sebastodes proriger 7
23. Paricelinus hopliticus 2
24. Ronquilus jordani 9
25. Icelinus filamentosus 13
26. Icelinus tenuis 9
27. Xeneretmus triacanthus 9
28. Lycodopsis pacifica 157
29. Sebastodes alutus 33
30. Sebastodes wilsoni 23
31. Sebastodes elongatus 94
32. Plectobranchus evides 2
33. Xeneretmus latifrons 175
34. Atheresthes stomias 21
35. Sebastodes saxicola 33
36. Sebastodes entomelas 1
37. Lyopsetta exilis 2168
38. Sebastodes zacentrus 15
39. Sebastodes crameri 5
40. Sebastodes helvomaculatus 2
41. Raja rhina 2
42. Sebastodes diploproa 2
43. Aprodon cortezianus 5
44. Asterotheca pentacantha 4
45. Glyptocephalus zachirus 457
46. Lycodes diapterus 6
* 47. Melanostigma pammelas 1
48. Bathyagonus nigripinnis 3
49. Cataetyx rubrirostris 2
50. Rhinoliparis attenuatus 1
51. Microstomus pacificus 160
52. Polistotrema deani 3
53. Polistotrema stoutii 62
54. Embryx cratalina 24
55. Alepocephalus convexifrons 3
56. Polistotrema spp. 110
57. Bathrocara brunneum 1
58. Anoplopoma fimbria 148
59. Coryphaenoides pectoralis 16
60. Raja trachura 2
61. Raja kincaidii 11
62. Careproctus melanurus 3
63. Sebastolobus glascanus 785
64. Sebastolobus altivelis 1231
65. Embassichthys bathybius 19
66. Bathrocara remigera 1
67. Coryphaenoides acrolepis 137
68. Antimora rostrata 24
69. Psammobatis spinosissimus 1

and the start of the continental slope while Group IV occupied the extreme depths on the continental slope (1,372 to 1,829 meters).

Species of benthic fishes inhabiting the continental slope generally have greater depth ranges than those inhabiting the shelf (Figure 3). Coryphaenoides acrolepis is an example of such a wide ranging species. Specimens of C. acrolepis displayed large variations in some morphological characteristics (Appendix III) which cannot be explained at this time.

IV. DISCUSSION

Sampling bias is an inherent problem with all nets designed to sample a segment of the aquatic biomass such as the benthic fishes. Some portion of the benthic fishes along a given path will avoid or escape from any net. Thus only a partial estimate of the benthic fish populations can be obtained by the use of one type of sampling equipment.

An indication of sampling biases can be obtained by comparing the mean lengths of selected species and the species composition taken in the 22-foot shrimp trawl used for this study with those from the 94-foot eastern fish trawl used by Alverson et al. (1964). The shrimp trawl was constructed from 1 1/4-inch mesh (stretch measured) while the fish trawl had 4 1/2-inch mesh in the wings and body of the net and 3 1/2-inch mesh in the cod-end. The single warp method was used to tow the shrimp trawl while the fish trawl was towed by the double warp method. These two trawls, therefore, showed gross differences in rigging, mesh size, physical size, and shape.

The comparison of mean lengths listed in Table 8 indicates that the 22-foot shrimp trawl retained smaller sizes of fishes than the 94-foot fish trawl. Of the species common to both trawls Eopsetta jordani, Glyptocephalus zachirus, and Sebastodes spp.

Table 8. Length ranges and means for selected species of benthic fishes collected in the 22-foot shrimp trawl used in this study and the 94-foot eastern fish trawl used by Alverson et al. (1964).

Species	Mean (cm)		Length Range (cm)	
	Shrimp Trawl	Fish Trawl	Shrimp Trawl	Fish Trawl
1. Atheresthes stomias	42.4	39.5	4.5-64.3	28.8-59.0
2. Eopsetta jordani	23.0	41.4	8.3-40.6	23.0-59.0
3. Glyptocephalus zachirus	19.3	28.0	5.5-35.5	11.0-41.0
4. Microstomus pacificus	33.1	38.6	9.2-52.7	27.0-56.0
5. Parophrys vetulus	23.6	30.3	7.5-39.5	19.0-44.0
6. Sebastodes alutus	11.5	37.0	7.2-22.6	22.0-50.0
7. Sebastodes elongatus	12.6	27.2	5.3-34.5	11.0-36.0
8. Sebastodes saxicola	18.7	28.3	13.7-30.3	19.0-32.0
9. Anoplopoma fimbria	57.0	54.1	29.7-96.8	40.0-78.0
10. Citharichthys sordidus	14.4		6.2-29.7	
11. Microgadus proximus	10.3		5.7-21.0	
12. Sebastodes wilsoni	11.9		7.9-17.9	
13. Lyopsetts exilis	15.9		6.0-29.1	
14. Embassichthys bathybius	18.2		6.9-36.5	
15. Sebastolobus alascanus	20.6		6.0-65.0	
16. Coryphaenoides pectoralis	66.6		50.5-119.5	
17. Sebastolobus altivelis	11.7		4.7-29.4	
18. Coryphaenoides acrolepis	34.2		9.0-77.6	
19. Antimora rostrata	39.5		27.2-53.3	

showed the largest differences in size. For example, the mean length of S. alutus was only 11.5 cm in the shrimp trawl but 37 cm in the fish trawl.

Alverson et al. (1964) reported 22 rockfish and 14 flatfish off Oregon and Washington while only 12 rockfish and 13 flatfish were collected in this study. Species of the genus Sebastodes were not major contributors, by number, to my catches (Appendix II); Sebastodes elongatus was the most abundant species. This species was listed by Alverson et al. (1964) as one of the small rockfishes which did not contribute significantly to the rockfish catch off Oregon. Conversely, Sebastodes alutus, Merluccius productus, and Squalus acanthias were listed by Alverson et al. (1964) as important species, but these species were only minor contributors or absent from the catches of the shrimp trawl. Thus, the 22-foot shrimp trawl did not retain large demersal species or species which are more pelagic and may range off the bottom.

Two possible reasons for the differences in mean length and species catches shown by the two studies are: (1) actual differences in the species and size composition between the areas studied. My study was confined to a small area, whereas Alverson et al. (1964) sampled extensively off both Oregon and Washington. More species would be expected from their samples merely because of the greater area sampled; and (2) apparent differences caused by avoidance and

mesh selection that result in retention of different species and size classes by the two trawls.

I believe that the differences were primarily caused by the selectivity of the trawls. This conclusion is substantiated by Jurkovich (1954) and Pereyra, Heyamoto, and Simpson (in press). Jurkovich (1954) showed that large differences in size composition of a population of Parophrys vetulus could be obtained by changing the mesh size in the cod-end of an eastern fish trawl. The number of small P. vetulus (< 30 cm in length) retained in the cod-end constructed from 3-inch mesh (stretch measured) was six times that of the 4 1/2-inch mesh cod-end, showing that the small mesh definitely retained a smaller size of P. vetulus than the large mesh.

Pereyra et al. (in press) noted differences in species composition, relative abundance, and size of benthic fishes collected by a 70-foot semi-balloon shrimp trawl with 1 1/2-inch mesh and a 94-foot eastern fish trawl with variable mesh from 4 inches in the wings and body to 1 1/2-inch liner in the cod-end. The 70-foot shrimp trawl, with small mesh throughout, retained a higher percentage of small fishes (31 cm or less) than the 94-foot fish trawl. The largest size difference was noted in specimens of Sebastodes alutus. The 94-foot fish trawl also retained a larger number of fish species, particularly those of the flatfish group. Pereyra et al. (in press) concluded that the differences in rigging (single warp versus double

warp towing) and general configuration (mesh size, mouth opening, and placement of the otter doors) of the two trawls were the main reasons for the observed differences in species size and composition.

Large discrepancies in the ranking of major species with depth can be expected between this study and that of Alverson et al. (1964) because of differences in sampling characteristics of the two trawls. Moreover, Alverson et al. (1964) ranked their species by weight instead of numbers. Nevertheless, comparison of dominant species from the two studies (Table 9) may provide a more complete understanding of the species distributions and possible community structure of all benthic fishes at various depths.

Inadequate sampling prevented Alverson et al. (1964) from describing the major species in the 2- to 90-meter depth interval within which the community of Group I occurred (Table 9). They listed Citharichthys sordidus, the major species in my study, as an unimportant segment of the flounder population at these depths, but it occurred in 100 percent of their samples from the 2- to 90-meter interval off Oregon.

Lyopsetta exilis was the dominant species (Table 9) in Group II (119 to 199 meters) whereas Merluccius productus was the dominant species for these depths according to Alverson et al. (1964). Merluccius productus was not present in the samples from the shrimp trawl, and L. exilis occurred in only trace quantities in the

Table 9. A comparison of the major species of benthic fishes taken in the 22-foot shrimp trawl used in this study and the 94-foot eastern fish trawl used by Alverson et al. (1964). (Species are ranked in order of abundance by number or weight).

	22-foot Shrimp Trawl		94-foot Fish Trawl	
Community	Depth Interval (m)	Major Species off Central Oregon (by number)	Depth Interval (m)	Major Species off Oregon and Washington (by weight)
Group I	42 to 73	1. Citharichthys sordidus 2. Parophrys vetulus 3. Microgadus proximus 4. Eopsetta jordani 5. Glyptocephalus zachirus	2 to 90	Inadequate sampling - Not described
Group II	119 to 199	1. Lyopsetta exilis 2. Glyptocephalus zachirus 3. Xeneretmus latifrons 4. Lycodopsis pacifica 5. Radulinus asprellus	91 to 181	1. Merluccius productus 2. Atheresthes stomias 3. Microstomus pacificus 4. Glyptocephalus zachirus 5. Anoplopoma fimbria
Transition region between II and III	200 to 547	1. Sebastolobus alascanus 2. Polistotrema spp. 3. Glyptocephalus zachirus 4. Anoplopoma fimbria 5. Raja kincaidii	183 to 272	1. Sebastodes alutus 2. Microstomus pacificus 3. Atheresthes stomias 4. Anoplopoma fimbria 5. Squalus acanthias
			274 to 364	1. Sebastodes alutus 2. Microstomus pacificus 3. Anoplopoma fimbria 4. Merluccius productus 5. Atheresthes stomias
			366 to 547	1. Anoplopoma fimbria 2. Microstomus pacificus 3. Sebastodes alutus 4. Sebastolobus spp. 5. Atheresthes stomias

samples from the fish trawl. Therefore, M. productus, as well as other species such as Atheresthes stomias and Microstomus pacificus, is probably more important at these depths than indicated by catches of the shrimp trawl. Both studies, however, ranked Glyptocephalus zachirus among the major species in the 119- to 199-meter interval off Oregon.

The fish fauna of the transition region, 200 to 547 meters, located between Groups II (119 to 199 meters) and III (549 to 1,189 meters) (Figure 2), was largely Sebastodes alutus, Microstomus pacificus, Anoplopoma fimbria, and Atheresthes stomias (Alverson et al., 1964). In the shrimp trawl, Sebastolobus alascanus, Polistotrema spp., Glyptocephalus zachirus, and Anoplopoma fimbria were numerically dominant. The relative importance and sizes of Sebastodes alutus were strikingly different between the two trawls. Sebastodes alutus was a minor species in the samples from the shrimp trawl while it was a major species in the catches of the fish trawl. Furthermore, S. alutus occurred at quite dissimilar depths in the shrimp trawl (104 to 174 meters) and fish trawl (183 to 547 meters). Thus, it is apparent that the adult segment of the S. alutus population and other species of Sebastodes were not adequately sampled by the shrimp trawl. Sebastodes spp. (principally S. alutus) are undoubtedly a major component of the fish fauna from 183 to 547 meters.

Both studies report the maximum number of species over the outer continental shelf and upper slope as well as a significant decrease in species numbers with increasing depth.

V. SUMMARY

1. A systematic survey of benthic fishes was conducted with a 22-foot semi-balloon shrimp trawl at depths from 40 to 1,829 meters off the central coast of Oregon during the period from July 1961 through June 1962. Information was obtained on the distribution, species composition, and associations of benthic fishes with respect to depth and sediment types.
2. Sixty-seven species representing 21 families were collected off the central Oregon coast. Eighty-six percent of the total fish catch was composed of specimens from the families Pleuronectidae, Scorpaenidae, and Bothidae. Six families - Scorpaenidae, Pleuronectidae, Agonidae, Cottidae, Zoarcidae, and Rajidae - contributed 72 percent of the identified species.
3. Four benthic fish communities were defined on the continental shelf and slope off the central coast of Oregon by the use of a "trellis diagram". Each community was characterized by dominant species, depth, and average sediment type.
4. Most of the fishes (77 - 93 percent by number) in each community consisted of only two or three species.

5. The species associations of Groups II and III were maintained in regions of rapidly changing sediment character, but only over a limited depth interval at the extreme depths in each community.
6. Few species were common to more than one community; 98 percent of the species showed high abundance in only one community or size segregation by communities.
7. The number of species found on the continental shelf and slope were similar, but species inhabiting the continental slope usually occurred over greater depth ranges.
8. The largest number of species occurred over the outer region of the continental shelf and the upper part of the continental slope. The fewest species occurred at the lower depths of the continental slope.
9. The 22-foot semi-balloon shrimp trawl was selective for small fishes and retained few large fishes or semi-pelagic forms, such as species of the genus Sebastodes, compared to larger trawls.
10. Since this sampling bias did occur, it seems apparent that Sebastodes spp. (principally S. alutus) are a major component of the fish fauna in the interval from 183 to 547 meters.

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APPENDICES

Appendix I

Species composition of the samples from the 22-foot semi-balloon shrimp trawl.

Appendix I. Species composition of the samples from the 22-foot semi-balloon shrimp trawl.

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
7	11 July 1961	Cape Foulweather	73	100% sand	No Sample - Net Collapsed			
8	11 July 1961	Cape Foulweather	68 to 82	100% sand	Citharichthys sordidus	68	73.9	6.4 to 18.2
					Radulinus asprellus	16	17.4	4.0 to 10.1
					Eopsetta jordani	6	6.5	26.7 to 40.6
					Atheresthes stomias	1	1.1	4.5
					Polistotrema stoutii	1	1.1	54.3
					T = 5	T=92	T=100.0	
9	11 July 1961	Cape Foulweather	128	73% sand; 10% silt; 17% clay	Lyopsetta exilis	1,047	88.0	6.2 to 22.5
					Glyptocephalus zachirus	37	3.1	6.6 to 27.5
					Lycodopsis pacifica	30	2.5	5.4 to 18.9
					Radulinus asprellus	24	2.0	8.3 to 11.1
					Sebastodes elongatus	16	1.3	6.4 to 8.2
					Anoplopoma fimbria	15	1.3	39.8 to 56.2
					Xeneretmus latifrons	8	0.7	13.3 to 16.3
					Microstomus pacificus	5	0.4	26.9 to 49.9
					Atheresthes stomias	4	0.3	35.4 to 64.3
					Sebastodes crameri	2	0.2	5.6 ; 6.1
					Polistotrema stoutii	1	0.1	54.0
					Raja rhina	1	0.1	61.5
					T = 12	T=1,190	T=100.0	
10	12 July 1961	Waldport	68	100% sand	Citharichthys sordidus	527	84.7	6.4 to 26.5
					Microstomus pacificus	35	5.6	9.2 to 42.3
					Parophrys vetulus	35	5.6	17.0 to 39.5
					Glyptocephalus zachirus	12	1.9	25.3 to 31.5
					Eopsetta jordani	5	0.8	16.7 to 47.3

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
Con't. 10					Citharichthys stigmaeus	2	0.3	10.3; 11.5
					Ophiodon elongatus	2	0.3	54.0; 70.0
					Agonopsis emmelane	1	0.2	11.0
					Atheresthes stomias	1	0.2	59.6
					Chitonotus pugetensis	1	0.2	8.8
					Lyopsetta exilis	1	0.2	17.6
					T = 11	T=622	T=100.0	
11	12 July 1961	Waldport	124 to 126	Rocky 89% sand; 5% silt; 6% clay	Lyopsetta exilis	164	77.0	7.4 to 25.0
					Glyptocephalus zachirus	12	5.6	19.5 to 30.4
					Icelinus filamentosus	8	3.7	12.5 to 18.5
					Microstomus pacificus	8	3.7	19.3 to 44.5
					Sebastodes elongatus	8	3.7	5.3 to 27.5
					Icelinus tenuis	4	1.9	9.7 to 12.6
					Sebastodes zacentrus	3	1.4	13.0 to 17.0
					Agonopsis emmelane	1	0.5	18.6
					Lycodopsis pacifica	1	0.5	18.3
					Ophiodon elongatus	1	0.5	60.3
					Radulinus asprellus	1	0.5	10.9
					Sebastodes helvomaculatus	1	0.5	21.2
					Xeneretmus triacanthus	1	0.5	11.1
					T = 13	T=213	T=100.0	
12	12 July 1961	Newport	221	47% sand; 28% silt; 25% clay	Anoplopoma fimbria	2	66.7	50.4; 66.8
					Sebastodes diploproa	1	33.3	32.0
					T = 2	T=3	T=100.0	

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
13	13 July 1961	Newport	46	100% sand	Citharichthys sordidus	44	57.1	7.1 to 23.3
					Parophrys vetulus	12	15.6	14.8 to 22.7
					Eopsetta jordani	7	9.1	21.0 to 38.9
					Microgadus proximus	7	9.1	5.7 to 7.6
					Ophiodon elongatus	4	5.2	10.0 to 76.9
					Lepidopsetta bilineata	1	1.3	20.5
					Pleuronichthys decurrens	1	1.3	31.1
					Raja binoculata	1	1.3	57.5
					T = 8	T=77	T=100.0	
14	13 July 1961	Newport	110	Rocky 65% sand; 19% silt; 16% clay	Citharichthys stigmaeus	9	27.3	9.7 to 20.3
					Sebastodes elongatus	9	27.3	6.0 to 12.6
					Icelinus filamentosus	4	12.1	18.3 to 19.3
					Ronquilus jordani	4	12.1	15.0 to 17.9
					Sebastodes zacentrus	4	12.1	6.4 to 8.5
					Radulinus asprellus	1	3.0	8.1
					Sebastodes wilsoni	1	3.0	11.5
					Xeneretmus triacanthus	1	3.0	13.0
					T = 8	T=33	T= 99.9	
15	13 July 1961	Newport	152	Rocky 72% sand; 14% silt; 14% clay	No Sample - Net Torn			
16	13 July 1961	Cape Foulweather	366	Between 92% sand; 2% silt; 6% clay	Sebastolobus alascanus	43	67.1	3.4 to 36.0
					Polistotrema spp.	5	7.8	33.0 to 40.0
					Asterotheca pentacantha	4	6.2	17.9 to 19.3
					Aprodon corteziana	3	4.7	29.0 to 38.9

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
Con't.				and	Microstomus pacificus	3	4.7	29.3 to 35.3
16				11% sand;	Sebastolobus altivelis	3	4.7	6.4 to 13.7
				39% silt;	Glyptocephalus zachirus	1	1.6	26.7
				50% clay	Sebastodes crameri	1	1.6	43.9
					Sebastodes helvomaculatus	1	1.6	16.8
					T = 9	T=64	T=100.0	
17	13 July 1961	Cape Foulweather	174	56% sand; 25% silt; 19% clay	Lyopsetta exilis	329	43.6	7.0 to 25.0
					Xeneretmus latifrons	130	17.2	8.0 to 18.0
					Lycodopsis pacifica	126	16.7	14.1 to 17.4
					Glyptocephalus zachirus	77	10.2	6.7 to 34.8
					Radulinus asprellus	36	4.8	5.0 to 11.0
					Sebastodes saxicola	20	2.7	13.7 to 30.3
					Microstomus pacificus	13	1.7	23.0 to 44.1
					Sebastodes elongatus	8	1.1	7.3 to 21.5
					Atheresthes stomias	6	0.8	40.3 to 51.0
					Anoplopoma fimbria	2	0.3	44.0; 48.5
					Plectobranchus evides	2	0.3	9.5; 9.6
					Hydrolagus colliei	1	0.1	16.2
					Raja kincaidii	1	0.1	57.0
					Sebastodes alutus	1	0.1	12.6
					Sebastodes crameri	1	0.1	6.2
					T = 15	T=753	T=99.8	
18	13 July 1961	Cape Foulweather	119	88% sand; 5% silt; 7% clay	Lyopsetta exilis	43	34.1	7.1 to 18.7
					Glyptocephalus zachirus	41	32.5	6.7 to 24.4
					Radulinus asprellus	25	19.8	4.0 to 10.7
					Microstomus pacificus	8	6.4	9.7 to 52.7
					Anoplopoma fimbria	4	3.2	44.4 to 47.3

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
Con't.					Xeneretmus triacanthus	3	2.4	6.8 to 11.6
18					Atheresthes stomias	1	0.8	59.1
					Sebastodes crameri	1	0.8	6.5
					T = 8	T=126	T=100.0	
19	8 Aug. 1961	Waldport	525 to 536	Between 67% sand; 14% silt; 19% clay and 38% sand; 48% silt; 14% clay	No Vertebrates in Sample			
20	8 Aug. 1961	Waldport	673 to 677	14% sand; 64% silt; 22% clay	Polistotrema stoutii	39	69.6	26.0 to 44.5
					Sebastolobus altivelis	6	10.7	6.2 to 25.1
					Sebastolobus alascanus	5	8.9	24.1 to 41.9
					Coryphaenoides acrolepis	2	3.6	18.5; 23.0
					Anoplopoma fimbria	1	1.8	55.5
					Cataetyx rubrirostris	1	1.8	9.0
					Microstomus pacificus	1	1.8	38.2
					Rhinoliparis attenuatus	1	1.8	6.6
					T = 8	T=56	T=100.0	
21	9 Aug. 1961	Waldport	854 to 869	North 4% sand; 40% silt; 56% clay	Sebastolobus alascanus	76	40.4	8.0 to 49.0
					Sebastolobus altivelis	63	33.5	6.1 to 25.3
					Polistotrema spp.	27	14.4	
					Embryx crotalina	10	5.3	14.9 to 38.6

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
Con't.				South	Embassichthys bathybius	5	2.7	6.9 to 35.4
21				35% sand;	Microstomus pacificus	5	2.7	27.6 to 43.2
				45% silt;	Anoplopoma fimbria	1	0.5	51.2
				20% clay	Coryphaenoides acrolepis	1	0.5	51.0
					T = 8	T=188	T=100.0	
22	10 Aug. 1961	Waldport	70 to 73	100% sand	Glyptocephalus zachirus	24	25.5	18.3 to 32.1
					Citharichthys sordidus	21	22.3	10.1 to 25.0
					Parophrys vetulus	15	16.0	19.3 to 35.5
					Lyopsetta exilis	12	12.8	10.4 to 19.4
					Eopsetta jordani	8	8.5	12.1 to 27.4
					Microstomus pacificus	7	7.4	17.3 to 37.7
					Radulinus asprellus	3	3.2	8.2 to 9.9
					Raja binoculata	2	2.1	86.3; 96.4
					Asterotheca infraspinata	1	1.1	10.9
					Squalus suckleyi	1	1.1	68.0
					T = 10	T=94	T=100.0	
23	14 Aug. 1961	Waldport	1,829	Rocky 1% sand; 51% silt; 48% clay	No Sample - Net Torn			
24	14 Aug. 1961	Waldport	1,829	North 1% sand; 51% silt; 48% clay	Coryphaenoides acrolepis	10	55.6	9.1 to 58.8
					Antimora rostrata	7	38.9	37.0 to 53.3
					Psammobatis spinosissimus	1	5.5	88.5
					T = 3	T=18	T=100.0	
				South 2% sand; 55% silt; 43% clay				

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
25	15 Aug. 1961	Waldport	1,372	Rocky 5% sand; 58% silt; 37% clay	No Sample - Net Torn			
26	16 Aug. 1961	Waldport	507 to 512	38% sand; 48% silt; 14% clay	Lycodes diapterus	1	50.0	22.3
					Sebastolobus altivelis	1	50.0	27.3
					T = 2	T=2	T=100.0	
27	19 Oct. 1961	Waldport	933 to 1,097	North 1% sand; 54% silt; 45% clay South 23% sand; 54% silt; 23% clay	Sebastolobus altivelis	621	87.6	6.7 to 25.6
					Sebastolobus alascanus	28	4.0	6.0 to 63.7
					Coryphaenoides acrolepis	26	3.7	26.7 to 59.2
					Anoplopoma fimbria	17	2.4	55.5 to 74.0
					Coryphaenoides pectoralis	12	1.7	50.5 to 71.4
					Polistotrema stoutii	3	0.4	39.5 to 46.1
					Alepocephalus convexifrons	1	0.1	24.6
					Antimora rostrata	1	0.1	34.5
					T = 8	T=709	T=100.0	
28	20 Oct. 1961	Waldport	1,097 to 1,189	1% sand; 51% silt; 48% clay	Sebastolobus alascanus	86	69.9	7.0 to 50.3
					Coryphaenoides acrolepis	23	18.7	9.0 to 61.5
					Anoplopoma fimbria	5	4.1	63.5 to 73.3
					Antimora rostrata	4	3.3	31.9 to 38.8
					Polistotrema spp.	3	2.4	
					Bothrocara brunneum	1	0.8	52.7
					Chauliodus macouni	1	0.8	19.4
					T = 7	T=123	T=100.0	

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
29	20 Oct. 1961	Waldport	1,335 to 1,372	1% sand; 54% silt; 45% clay	Coryphaenoides acrolepis	20	44.4	15.6 to 65.5
					Sebastolobus altivelis	14	31.1	8.9 to 21.3
					Antimora rostrata	4	8.9	32.0 to 35.0
					Coryphaenoides pectoralis	3	6.7	58.5 to 119.5
					Anoplopoma fimbria	2	4.4	70.5; 72.1
					Embassichthys bathybius	1	2.2	35.1
					Raja trachura	1	2.2	64.5
					T = 7	T=45	T=99.9	
30	21 Oct. 1961	Waldport	549 to 640	14% sand; 64% silt; 22% clay	Anoplopoma fimbria	31	28.7	47.2 to 76.5
					Microstomus pacificus	27	25.0	38.0 to 48.0
					Sebastolobus alascanus	20	18.5	14.2 to 45.8
					Polistotrema spp.	13	12.0	
					Sebastolobus altivelis	7	6.5	4.7 to 13.0
					Lycodes diapterus	5	4.6	27.4 to 33.2
					Bathyagonus nigripinnis	2	1.9	19.6; 19.7
					Glyptocephalus zachirus	2	1.9	6.6; 35.5
					Melanostigma pammelas	1	0.9	9.5
					T = 9	T=108	T=100.0	
31	21 Oct. 1961	Waldport	311 to 348	Between 67% sand; 14% silt; 19% clay and 38% sand; 48% silt; 14% clay	Sebastolobus alascanus	1	100.0	4.9
					T = 1	T= 1	T=100.0	

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
32	21 Oct. 1961	Waldport	192 to 201	23% sand; 53% silt; 24% clay	No Sample - Net did not reach bottom			
33	21 Oct. 1961	Waldport	174 to 205	23% sand; 53% silt; 24% clay	Lyopsetta exilis	8	34.7	12.2 to 29.1
					Glyptocephalus zachirus	4	17.4	6.5 to 30.9
					Sebastodes saxicola	4	17.4	20.9 to 23.8
					Atheresthes stomias	3	13.0	40.3 to 48.0
					Xeneretmus latifrons	2	8.7	16.7; 16.9
					Eopsetta jordani	1	4.4	39.3
					Sebastodes zacentrus	1	4.4	22.6
					T = 7	T=23	T=100.0	
34	21 Oct. 1961	Waldport	132 to 146	Rocky 89% sand; 5% silt; 6% clay	Glyptocephalus zachirus	28	37.3	7.8 to 30.0
					Lyopsetta exilis	28	37.3	12.7 to 26.2
					Parophrys vetulus	7	9.3	30.5 to 37.3
					Sebastodes elongatus	6	8.0	11.5 to 34.5
					Xeneretmus triacanthus	4	5.3	11.4 to 13.8
					Atheresthes stomias	1	1.3	42.0
					Microstomus pacificus	1	1.3	28.0
					T = 7	T=75	T= 99.8	
35	21 Oct. 1961	Waldport	128 to 146	Rocky 89% sand; 5% silt; 6% clay	Lyopsetta exilis	93	48.7	7.7 to 25.0
					Glyptocephalus zachirus	47	24.7	6.7 to 34.2
					Parophrys vetulus	15	7.9	28.2 to 37.8
					Citharichthys sordidus	10	5.2	15.2 to 28.3
					Microstomus pacificus	9	4.7	25.2 to 41.0
					Sebastodes elongatus	9	4.7	11.7 to 18.3
					Eopsetta jordani	3	1.6	30.0 to 39.2

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
Con't.					Anoplopoma fimbria	1	0.5	44.7
35					Atheresthes stomias	1	0.5	21.3
					Radulinus asprellus	1	0.5	8.4
					Raja binoculata	1	0.5	27.5
					Xeneretmus latifrons	1	0.5	16.8
					T = 12	T=191	T=100.0	
36	21 Oct. 1961	Waldport	101 to 106	Rocky	Sebastodes alutus	31	24.4	7.2 to 9.3
					Sebastodes elongatus	28	22.1	6.4 to 33.4
					Sebastodes wilsoni	21	16.5	7.8 to 17.9
					Citharichthys sordidus	10	7.9	15.2 to 19.1
					Sebastodes proriger	7	5.5	14.1 to 17.2
					Icelinus tenuis	5	3.9	9.0 to 12.5
					Lyopsetta exilis	5	3.9	5.6 to 13.0
					Ronquilus jordani	5	3.9	11.8 to 16.1
					Sebastodes zacentrus	5	3.9	8.0 to 9.4
					Eopsetta jordani	2	1.6	21.7; 34.8
					Microstomus pacificus	2	1.6	10.7; 15.5
					Paricelinus hopliticus	2	1.6	11.8; 13.2
					Glyptocephalus zachirus	1	0.8	12.9
					Icelinus filamentosus	1	0.8	23.9
					Lepidopsetta bilineata	1	0.8	28.2
					Xeneretmus latifrons	1	0.8	16.1
					T = 16	T=127	T=100.0	
37	21 Oct. 1961	Waldport	70 to 73	100% sand	No Sample - Net did not reach bottom			

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
38	21 Oct. 1961	Waldport	40 to 42	100% sand	Microgadus proximus	90	61.2	7.0 to 21.0
					Citharichthys sordidus	30	20.4	8.4 to 29.7
					Isopsetta isolepis	9	6.1	17.4 to 28.1
					Hydrolagus colliei	5	3.4	43.7 to 58.8
					Hemilepidotus spinosus	3	2.0	7.0 to 8.8
					Eopsetta jordani	2	1.4	28.4; 37.5
					Parophrys vetulus	2	1.4	7.5; 8.3
					Sebastodes melanops	2	1.4	39.4; 44.0
					Cymatogaster aggregata	1	0.7	8.1
					Occa verrucosa	1	0.7	15.4
					Ophiodon elongatus	1	0.7	35.0
					Platichthys stellatus	1	0.7	49.7
					T = 12	T=147	T=100.0	
39	9 Dec. 1961	Waldport	1,902	1% sand; 52% silt; 47% clay	No Sample - Net Collapsed			
40	10 Dec. 1961	Waldport	1,426	1% sand; 51% silt; 48% clay	Coryphaenoides acrolepis	22	55.0	18.0 to 77.6
					Sebastolobus altivelis	9	22.5	10.3 to 24.6
					Antimora rostrata	4	10.0	36.9 to 49.0
					Embassichthys bathybius	2	5.0	35.3; 36.5
					Bothrocara remigera	1	2.5	47.6
					Sebastolobus alascanus	1	2.5	11.3
					Tarletonbeania crenularis	1	2.5	6.8
					T = 7	T=40	T=100.0	

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
41	10 Dec. 1961	Waldport	823 to 914	North 1% sand; 54% silt; 45% clay South 5% sand; 58% silt; 37% clay	No Sample - Net Collapsed			
42	10 Dec. 1961	Waldport	823 to 914	North 1% sand; 54% silt; 45% clay South 5% sand; 58% silt; 37% clay	Sebastolobus alascanus	490	85.2	8.0 to 65.0
					Anoplopoma fimbria	18	3.1	53.0 to 75.0
					Polistotrema stoutii	16	2.8	38.0 to 47.0
					Polistotrema spp.	14	2.4	
					Embassichthys bathybius	11	1.9	7.0 to 17.9
					Sebastolobus altivelis	9	1.6	7.7 to 13.2
					Coryphaenoides acrolepis	5	0.9	26.5 to 41.3
					Embryx crotalina	5	0.9	35.6 to 39.5
					Polistotrema deani	3	0.5	36.6 to 44.3
					Alepocephalus convexifrons	2	0.3	16.5; 24.0
					Microstomus pacificus	1	0.2	38.0
					Raja trachura	1	0.2	17.9
					T = 12	T=575	T=100.0	
43	11 Dec. 1961	Waldport	640 to 732	Between 46% sand; 39% silt; 15% clay and	Sebastolobus spp.	35	35.0	7.0 to 43.0
					Microstomus pacificus	15	15.0	37.0 to 50.0
					Polistotrema spp.	15	15.0	
					Anoplopoma fimbria	12	12.0	38.0 to 66.0
					Sebastolobus altivelis	10	10.0	7.2 to 10.2

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
Con't.				and	Coryphaenoides acrolepis	6	6.0	11.0 to 36.0
43				9% sand;	Bathyagonus nigripinnis	1	1.0	19.0
				77% silt;	Cataetyx rubrirostris	1	1.0	8.0
				14% clay	Chauliodus macouni	1	1.0	16.5
					Coryphaenoides pectoralis	1	1.0	51.5
					Lampanyctus ritteri	1	1.0	20.0
					Tactostoma macropus	1	1.0	28.0
					Tarletonbeania crenularis	1	1.0	8.3
					T = 13	T=100	T=100.0	
44	11 Dec. 1961	Waldport	348 to 366	23% sand; 53% silt; 24% clay	Glyptocephalus zachirus	11	20.7	26.3 to 37.4
					Polistotrema spp.	8	15.1	
					Anoplopoma fimbria	7	13.2	43.9 to 69.5
					Raja kincaidii	7	13.2	33.8 to 46.1
					Lyopsetta exilis	6	11.3	12.3 to 23.8
					Microstomus pacificus	6	11.3	35.7 to 43.6
					Sebastolobus alascanus	3	5.7	15.0 to 44.3
					Aprodon cortezianus	2	3.8	28.6; 36.6
					Raja rhina	1	1.9	97.0
					Sebastodes diploproa	1	1.9	27.2
					Sebastodes zacentrus	1	1.9	14.1
					T = 11	T= 53	T=100.0	
45	11 Dec. 1961	Waldport	183	87% sand; 11% silt; 2% clay	No Sample - Net Torn			
46	11 Dec. 1961	Waldport	165 to 183	87% sand; 11% silt; 2% clay	Lyopsetta exilis	81	41.5	7.2 to 24.0
					Glyptocephalus zachirus	44	22.6	5.5 to 32.0
					Xeneretmus latifrons	32	16.4	13.2 to 17.5

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
Con't. 46					Anoplopoma fimbria	9	4.6	29.7 to 42.0
					Hydrolagus colliei	6	3.1	24.5 to 44.4
					Radulinus asprellus	5	2.6	8.5 to 12.6
					Parophrys vetulus	4	2.1	28.5 to 36.9
					Microstomus pacificus	3	1.6	19.5 to 29.5
					Raja kincaidii	2	1.0	19.8; 27.5
					Sebastodes elongatus	2	1.0	13.1; 14.4
					Sebastodes saxicola	2	1.0	14.8; 16.3
					Eopsetta jordani	1	0.5	46.6
					Sebastolobus alascanus	1	0.5	35.0
					Sebastodes alutus	1	0.5	17.1
					Sebastodes wilsoni	1	0.5	12.5
					Sebastodes zacentrus	1	0.5	17.9
					T = 16	T=195	T=100.0	
47	11 Dec. 1961	Waldport	110 to 128	Rocky 89% sand; 5% silt; 6% clay	No Sample - Net Torn			
48	11 Dec. 1961	Waldport	119 to 128	Rocky 89% sand; 5% silt; 6% clay	No Sample - Lost Net			
49	25 Jan. 1962	Waldport	128 to 135	Rocky 89% sand; 5% silt; 6% clay	Lyopsetta exilis	344	69.8	6.0 to 24.0
					Glyptocephalus zachirus	107	21.7	6.5 to 28.3
					Citharichthys sordidus	28	5.7	10.6 to 27.8
					Sebastodes elongatus	8	1.6	11.0 to 19.0

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
Con't. 49					Hydrolagus colliei	2	0.4	18.5; 19.6
					Parophrys vetulus	2	0.4	34.0; 34.5
					Atheresthes stomias	1	0.2	18.5
					Microstomus pacificus	1	0.2	14.2
					T = 8	T=493	T=100.0	
50	25 Jan. 1962	Waldport	71 to 73	100% sand	Citharichthys sordidus	299	58.1	
					Parophrys vetulus	188	36.6	9.7 to 36.7
					Eopsetta jordani	16	3.1	8.3 to 40.0
					Glyptocephalus zachirus	6	1.2	6.9 to 17.8
					Chitonotus pugetensis	2	0.4	6.5; 6.8
					Microgadus proximus	2	0.4	10.5; 11.4
					Citharichthys stigmaeus	1	0.2	8.8
					T = 7	T=514	T=100.0	
51	19 Apr. 1962	Waldport	636 to 658	Between 46% sand; 39% silt; 15% clay and 9% sand; 77% silt; 14% clay	Sebastolobus altivelis	16	37.2	6.6 to 28.8
					Anoplopoma fimbria	13	30.2	
					Coryphaenoides acrolepis	3	7.0	19.2 to 29.9
					Microstomus pacificus	3	7.0	
					Polistotrema stoutii	2	4.7	41.5; 42.8
					Sebastolobus alascanus	2	4.7	40.0; 45.5
					Careproctus melanurus	1	2.3	17.2
					Chauliodus macouni	1	2.3	21.5
					Lampanyctus leucopsarus	1	2.3	8.0
					Tarletonbeania crenularis	1	2.3	6.5
					T = 10	T=43	T=100.0	

Appendix I. continued

Trawl Number	Date	Station Line	Depth in Meters	Bottom Sediments	Species	Number of Organisms	Percent Composition of Species	Length Range (cm)
52	20 June 1962	Waldport	1,372 to 1,394	1% sand; 54% silt; 45% clay	Coryphaenoides acrolepis	17	43.6	13.0 to 66.0
					Sebastolobus altivelis	16	41.0	10.0 to 25.3
					Antimora rostrata	3	7.7	27.2 to 37.5
					Careproctus melanurus	1	2.6	34.5
					Lampanyctus leucopsarus	1	2.6	10.1
					Raja kincaidii	1	2.6	83.0
					T = 6	T=39	T=100.1	
53	21 June 1962	Waldport	960 to 1,006	35% sand; 45% silt; 20% clay	Sebastolobus altivelis	456	84.4	5.1 to 29.4
					Sebastolobus alascanus	29	5.4	6.0 to 55.0
					Polistotrema spp.	25	4.6	
					Coryphaenoides acrolepis	9	1.7	11.0 to 54.6
					Embryx crotalina	9	1.7	13.7 to 42.5
					Anoplopoma fimbria	8	1.5	59.0 to 70.5
					Antimora rostrata	1	0.2	34.0
					Careproctus melanurus	1	0.2	12.8
					Chauliodus macouni	1	0.2	18.4
					Lampanyctus leucopsarus	1	0.2	10.2
					T = 10	T=540	T=100.1	
54	22 June 1962	Waldport	186 to 212	23% sand; 53% silt; 24% clay	Lyopsetta exilis	7	24.1	
					Microstomus pacificus	7	24.1	30.5 to 42.0
					Sebastodes saxicola	7	24.1	16.4 to 20.4
					Glyptocephalus zachirus	3	10.3	16.5 to 25.3
					Atheresthes stomias	2	6.9	42.0; 58.0
					Parophrys vetulus	1	3.5	32.2
					Sebastodes entomelas	1	3.5	7.5
					Xeneretmus latifrons	1	3.5	16.8
					T = 8	T=29	T=100.0	

Appendix II

Species composition and depth distributions of benthic fish communities.

Appendix II. Species composition and depth distribution of benthic fish communities.

Community Name	Depth Interval (meters)	Sample Number	Species	Percent of Total Catch for all Species by Community	Frequency of Occurrence by Community	Species Distribution and Percent of Total Catch of Species by Communities
Group I	42 to 73	38, 13, 10, 22, 50, 8	1. Citharichthys sordidus	64.0	100%	I (96.3); II (3.7)
			2. Parophrys vetulus	16.3	83%	I (89.7); II (10.3)
			3. Microgadus proximus	6.4	50%	I (100.0)
			4. Eopsetta jordani	2.8	100%	I (89.8); II (10.2)
			5. Glyptocephalus zachirus	2.7	50%	I (10.4); II (89.1); III (0.5)
			6. Microstomus pacificus	2.7	33%	I (29.8); II (33.3); III (36.9)
				T=94.9		
			7. Radulinus asprellus	1.2	33%	I (22.1); II (77.9)
			8. Lyopsetta exilis	0.8	33%	I (0.6); II (99.4)
			9. Isopsetta isolepis	0.6	17%	I (100.0)
			10. Ophiodon elongatus	0.4	50%	I (87.5); II (12.5)
			11. Hydrolagus colliei	0.3	17%	I (35.7); II (64.3)
			12. Chitonotus pugetensis	0.2	33%	I (100.0)
			13. Citharichthys stigmaeus	0.2	33%	I (100.0)
			14. Hemilepidotus spinosus	0.2	17%	I (100.0)
			15. Raja binoculata	0.2	33%	I (75.0); II (25.0)
			16. Atheresthes stomias	0.1	33%	I (10.0); II (90.0)
			17. Sebastodes melanops	0.1	17%	I (100.0)
			18. Agonopsis emmelane	Trace	17%	I (50.0); II (50.0)

Appendix II. continued

Community Name	Depth Interval (meters)	Sample Number	Species	Percent of Total Catch for all Species by Community	Frequency of Occurrence by Community	Species Distribution and Percent of Total Catch of Species by Communities
Con't. Group I			19. Asterotheca infraspinata	Trace	17%	I (100.0)
			20. Cymatogaster aggregata	Trace	17%	I (100.0)
			21. Lepidopsetta bilineata	Trace	17%	I (100.0)
			22. Occa verrucosa	Trace	17%	I (100.0)
			23. Platichthys stellatus	Trace	17%	I (100.0)
			24. Pleuronichthys decurrens	Trace	17%	I (100.0)
			25. Polistotrema stoutii	Trace	17%	I (1.6); II (1.6); III (96.8)
			26. Squalus suckleyi	Trace	17%	I (100.0)
Group II	119 to 199	11, 9, 49, 35, 34, 17, 46, 33, 54	1. Lyopsetta exilis	66.4	100%	I (0.6); II (99.4)
			2. Glyptocephalus zachirus	11.4	100%	I (10.4); II (89.1); III (0.5)
			3. Xeneretmus latifrons	5.5	66%	II (100.0)
			4. Lycodopsis pacifica	5.0	33%	II (100.0)
			5. Radulinus asprellus	2.1	55%	I (22.1); II (77.9)
			6. Sebastodes elongatus	1.8	77%	II (100.0)
			7. Microstomus pacificus	1.5	88%	I (29.8); II (33.3); III (36.9)
				T=93.7		
			8. Citharichthys sordidus	1.2	22%	I (96.3); II (3.7)
			9. Sebastodes saxicola	1.0	44%	II (100.0)

Appendix II. continued

Community Name	Depth Interval (meters)	Sample Number	Species	Percent of Total Catch for all Species by Community	Frequency of Occurrence by Community	Species Distribution and Percent of Total Catch of Species by Communities
Con't. Group II			10. Parophrys vetulus	0.9	55%	I (89.7); II (10.3)
			11. Anoplopoma fimbria	0.8	44%	II (20.3); III (79.7)
			12. Atheresthes stomias	0.6	77%	I (10.0); II (90.0)
			13. Hydrolagus colliei	0.3	33%	I (35.7); II (64.3)
			14. Icelinus filamentosus	0.2	11%	II (100.0)
			15. Eopsetta jordani	0.2	33%	I (89.8); II (10.2)
			16. Sebastodes zacentrus	0.2	33%	II (100.0)
			17. Xeneretmus triacanthus	0.2	22%	II (100.0)
			18. Icelinus tenuis	0.1	11%	II (100.0)
			19. Raja kincaidii	0.1	22%	II (75.0); IV (25.0)
			20. Sebastodes crameri	0.1	22%	II (100.0)
			21. Agonopsis emmelane	Trace	11%	I (50.0); II (50.0)
			22. Ophiodon elongatus	Trace	11%	I (87.5); II (12.5)
			23. Plectobranchus evides	Trace	11%	II (100.0)
			24. Polistotrema stoutii	Trace	11%	I (1.6); II (1.6); III (96.8)
			25. Raja binoculata	Trace	11%	I (75.0); II (25.0)
			26. Raja rhina	Trace	11%	II (100.0)
			27. Sebastolobus alascanus	Trace	11%	II (0.1); III (99.7); IV (0.1)
			28. Sebastodes alutus	Trace	22%	II (100.0)

Appendix II. continued

Community Name	Depth Interval (meters)	Sample Number		Species	Percent of Total Catch for all Species by Community	Frequency of Occurrence by Community	Species Distribution and Percent of Total Catch of Species by Communities
Con't. Group II			29.	Sebastodes entomelas	Trace	11%	II (100.0)
			30.	Sebastodes helvomaculatus	Trace	11%	II (100.0)
			31.	Sebastodes wilsoni	Trace	11%	II (100.0)
Group III	594 to 1,143	30, 51, 20, 43, 21, 42, 53, 27, 28	1.	Sebastolobus altivelis	49.7	88%	III (98.0); IV (2.0)
			2.	Sebastolobus alascanus	30.9	100%	II (0.1); III (99.7); IV (0.1)
			3.	Anoplopoma fimbria	4.4	100%	II (20.3); III (79.7)
			4.	Polistotrema spp.	4.0	66%	III (100.0)
			5.	Coryphaenoides acrolepis	3.1	88%	III (60.5); IV (39.5)
					T=92.1		
			6.	Polistotrema stoutii	2.5	44%	I (1.6); II (1.6); III (96.8)
			7.	Microstomus pacificus	2.1	66%	I (29.8); II (33.3); III (36.9)
			8.	Embryx crotalina	1.0	33%	III (100.0)
			9.	Embassichthys bathybius	0.7	22%	III (88.9); IV (11.1)
			10.	Coryphaenoides pectoralis	0.5	22%	III (100.0)
			11.	Antimora rostrata	0.2	33%	III (30.0); IV (70.0)
			12.	Lycodes diapterus	0.2	11%	III (100.0)
			13.	Alepocephalus convexifrons	0.1	22%	III (100.0)
			14.	Bathyagonus nigripinnis	0.1	22%	III (100.0)

Appendix II. continued

Community Name	Depth Interval (meters)	Sample Number	Species	Percent of Total Catch for all Species by Community	Frequency of Occurrence by Community	Species Distribution and Percent of Total Catch of Species by Communities
Con't. Group III			15. Careproctus melanurus	0.1	22%	III (66.7); IV (33.3)
			16. Cataetyx rubrirostris	0.1	22%	III (100.0)
			17. Glyptocephalus zachirus	0.1	11%	I (10.4); II (89.1); III (0.5)
			18. Polistotrema deani	0.1	11%	III (100.0)
			19. Bothrocara brunneum	Trace	11%	III (100.0)
			20. Raja trachura	Trace	11%	III (100.0)
			21. Rhinoliparis attenuatus	Trace	11%	III (100.0)
Group IV	1,383 to 1,829	52, 40 24	1. Coryphaenoides acrolepis	51.6	100%	III (60.5); IV (39.5)
			2. Sebastolobus altivelis	26.3	66%	III (98.0); IV (2.0)
			3. Antimora rostrata	14.7	100%	III (30.0); IV (70.0)
				T-92.6		
			4. Embassichthys bathybius	2.1	33%	III (88.9); IV (11.1)
			5. Bothrocara remigera	1.0	33%	IV (100.0)
			6. Careproctus melanurus	1.0	33%	III (66.7); IV (33.3)
			7. Psammobatis spinosissimus	1.0	33%	IV (100.0)
			8. Raja kincaidii	1.0	33%	II (75.0); IV (25.0)
			9. Sebastolobus alascanus	1.0	33%	II (0.1); III (99.7); IV (0.1)

Appendix III

The maximum variation shown by some morphological characteristics of Coryphaenoides acrolepis.

Appendix III. The maximum variation shown by some morphological characteristics of Coryphaenoides acrolepis.

Morphological Characteristics	Extremes Noted for Morphological Characteristics
1. Dorsal rays	9 to 15
2. Pectoral rays	17 to 21
3. Ventral rays	7 to 11
4. Maxillary reaches:	Middle of pupil to Rear of orbit
5. $\frac{\text{Head length}}{\text{Eye diameter}}$	3.18 to 4.53
6. $\frac{\text{Head length}}{\text{Maxillary}}$	2.38 to 3.44
7. $\frac{\text{Length of dorsal interspace}}{\text{Length of base of first dorsal}}$	0.28 to 1.00
8. $\frac{\text{Length of base of first dorsal}}{\text{Length of head}}$	0.22 to 0.67
9. $\frac{\text{Length of base of first dorsal}}{\text{Length of snout}}$	0.85 to 1.36