Benthic Invertebrates, Sediment Structure, and Demersal Fishes off Tillamook Bay, Oregon, September-October 1988

by
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Final Report of Research

Funded by

U.S. Army Corps of Engineers
Portland District
P.O. Box 2946
Portland, Oregon 97208
(Contract DACW57-85-H-0001)

and

Coastal Zone and Estuarine Studies Division
Northwest Fisheries Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
2725 Montlake Boulevard East
Seattle, Washington 98112

November 1990

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INTRODUCTION

Biological surveys done by the National Marine Fisheries Service (NMFS) in 1984 and 1985 at the Interim Ocean Dredge Material Disposal Site (ODMDS) offshore from Tillamook Bay, Oregon, revealed extremely high densities of benthic invertebrates (Emmett et al. 1987, 1988). As a result, the U.S. Army Corps of Engineers (COE), Portland District, entered into a cooperative agreement with NMFS to sample deeper areas outside of the present disposal site in hopes of finding a replacement site that is biologically less productive. The main objective of this study was to sample benthic invertebrates and fishes along a transect originating in the present disposal area (35-m depth contour) and ending at the 73-m depth contour, in September and October 1988.

METHODS

Box-Coring (Benthic Invertebrates and Sediments)

Benthic invertebrates and sediments were collected at eight stations along a transect that ran perpendicular to shore, starting at the 35-m depth contour and ending at the 73-m contour. Four nontransect sites were also sampled, two north of the transect at the 61-m and 73-m contours and two south of the transect at similar depths (Fig. 1). Loran-C navigational readings for each station were taken and are provided in Appendix Table 1. A 0.1-m^2 Gray-O'Hara box corer (Pequegnat et al. 1981) was used to collect six samples at each station. Five of these samples were individually sieved through a 0.5-mm mesh screen, and the residue containing the macroinvertebrates placed in jars with a buffered 5% formaldehyde solution containing rose bengal (a protein stain). The sixth sample was used for sediment analysis. Sediment grain size was determined by sieving and organic content (total organic carbon) by burning for 1 hour at 600°C. Sediment analysis was done by the COE sediment laboratory at Troutdale, Oregon. Benthic organisms were sorted from the preserved samples, identified to the lowest possible taxonomic level (usually species), and counted. All specimens were placed in vials containing 70% ethyl alcohol and stored at the NMFS Point Adams Biological Field Station, Hammond, Oregon.

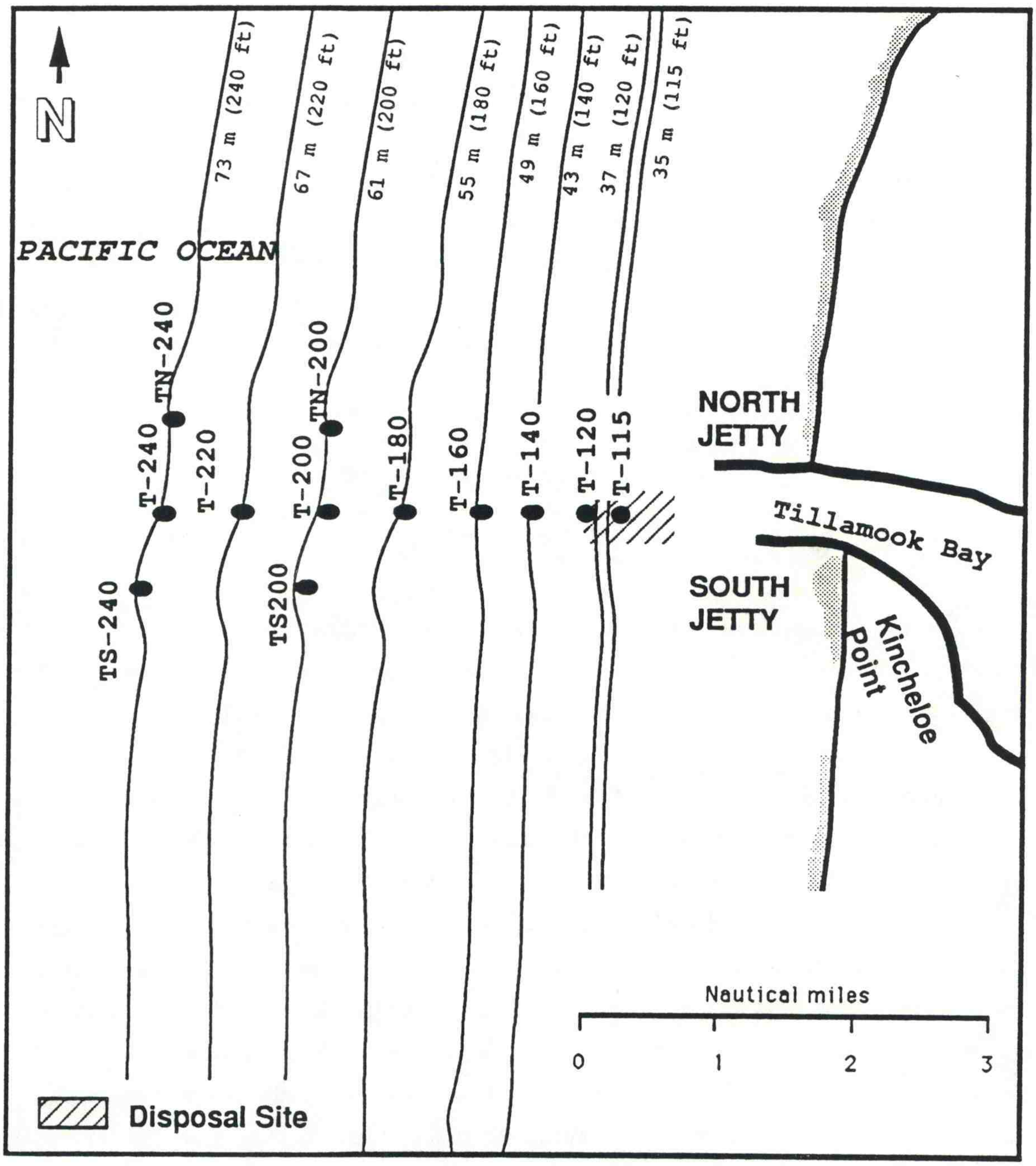

Figure 1.--Locations of benthic invertebrate and sediment stations off Tillamook Bay, Oregon, which were sampled on 3 October 1988. Depth contours are shown in meters and feet.

Trawling (Fishes and Large Epibenthic Invertebrates)

There were eight bottom trawling efforts: four along the previously defined transect at depth contours of 34, 55, 61, and 67 m; two north of the transect along the 61- and 67-m depth contours; and two south of the transect at similar depths (Fig. 2). Bottom trawling was done with an 8-m semiballoon shrimp trawl that had overall mesh size of 38.1 mm (stretched); a 12.7-mm mesh liner was inserted in the cod end to ensure retention of small fishes and invertebrates. Fishing width of the trawl was estimated to be 5 m. Each trawling effort was 10 minutes in duration. Position fixes were determined using Loran-C navigational equipment (see Appendix Table 1 for Loran-C readings for each station).

All captured fishes, crabs, and shrimp were placed in labeled 19-l (5-gal) buckets containing a buffered solution of 5% formaldehyde and seawater. In the laboratory, fishes and crabs were rinsed in fresh water, measured (total and standard lengths, mm), and weighed (g). Crabs were measured across the carapace just anterior to the tenth anterolateral spines. Shrimp were identified, counted, and weighed. For each trawling effort, a subsample of up to 50 fish and crabs for each species was measured and weighed. When more than 50 of a species were captured, the remainder was counted and weighed as a group.

Data Analysis

Benthic Invertebrates

The five benthic invertebrate samples from each station were treated as replicates, allowing calculation of a mean number/m^2 and a standard deviation for each species. Four community structure indices were also calculated for each station.

1) Shannon-Weaver Diversity Index (H') (Shannon and Weaver 1963):

$$H' = -\sum_{i=1}^{s} Pi \log_2 Pi$$

where Pi = Xa/N (Xa is the number of individuals of a particular species in the sample, N is the total number of individuals in the sample) and s = number of species.

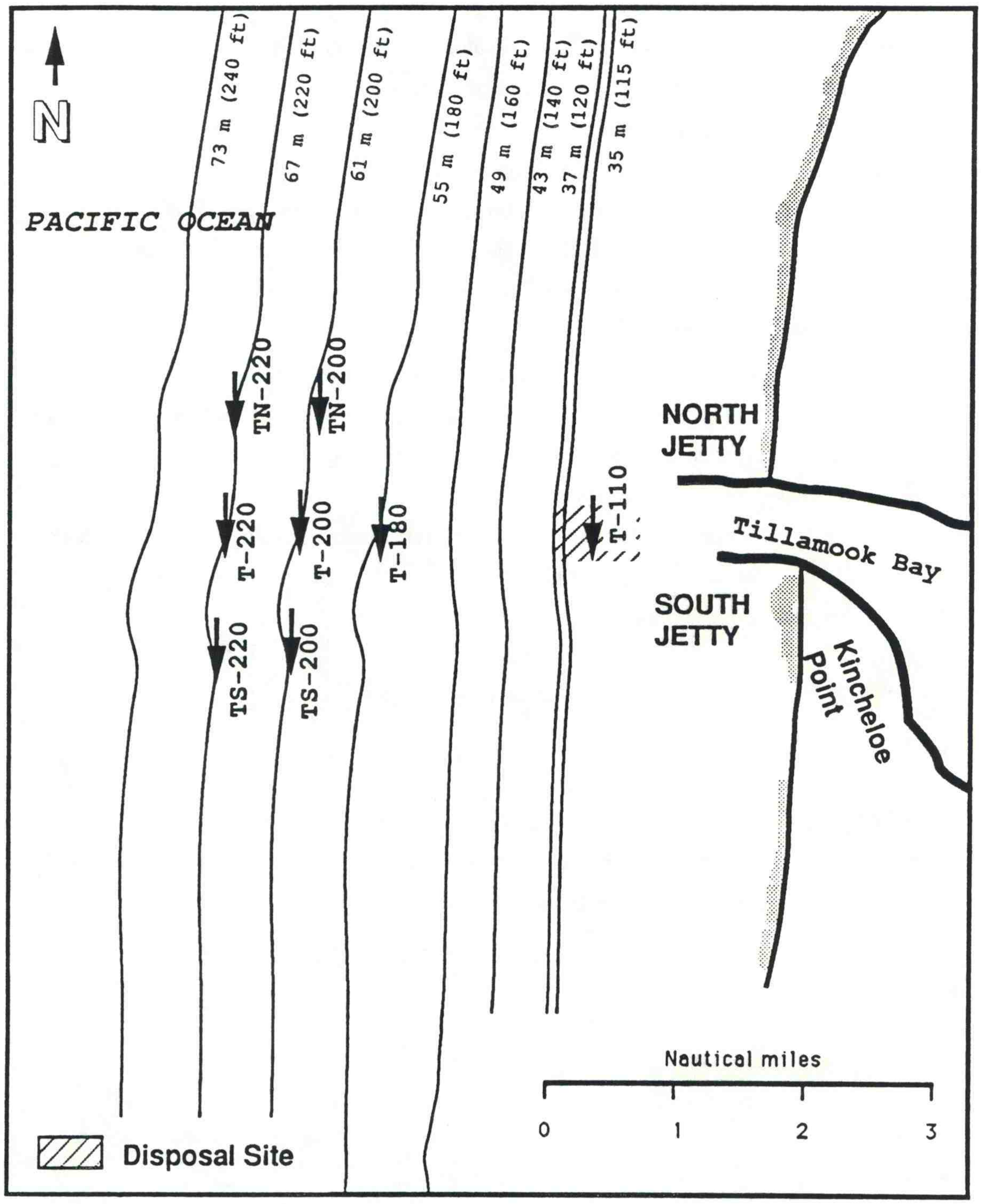

Figure 2.--Locations of trawl stations off Tillamook Bay, Oregon, which were sampled from 28 September to 3 October 1988. Depth contours are shown in meters and feet.

2) Simpson Diversity Value (SDV) (Simpson 1949):

$$SDV = 1 - \sum_{i=1}^{s} Pi^2$$

where Pi = Xa/N (Xa is the number of individuals of a particular species in the sample, N is the total number of individuals in the sample) and s = number of species.

3) Species Richness (SR) was estimated using Margalef's formula (Margalef 1958):

$$SR = (s - 1) / Ln(N)$$

where s = number of species and N = total number of individuals at the station.

4) Species Evenness (J') was calculated using Pielou's formula (Pielou 1966):

$$J' = H'/\log_2 s$$

where H' = Shannon-Weaver Diversity Index and s = number of species.

Sediments

Mean grain size (phi), percent silt-clay, and percent organic matter were calculated for each station.

Trawling (Fishes and Large Epibenthic Invertebrates)

The computer program LORAN/AND/DISTANCE on the Alaska Fisheries Center's Burroughs (B7800)[1] computer was used to calculate the distance fished. By using distance fished, fishing width of the trawl (5 m), and catch data, we estimated densities of fishes and crabs [number/hectare (ha)]. The computer program FISH/STAT/OFFSHORE on the B7800 computer was used to produce a descriptive summary of each trawling effort . Output from the program included a species list for each effort, the number and weight (g) of fishes and crabs captured (total and by species), number/ha (total and by species), weight/ha (total and by species), and the previously described four community structure indices.

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[1]Reference to trade names does not imply endorsement by National Marine Fisheries Service, NOAA.

Length-frequency distributions of eight common fishes and Dungeness crab carapace-width frequency distributions were used to define the size-class structures of these species in the study area. Histograms were made by grouping individual total lengths for each species into 5-mm increments; fish >300 mm were included in the 300-mm interval.

RESULTS

Benthic Invertebrates

A total of 211 benthic invertebrate taxa with a mean density of 1,009/m^2 were identified during this survey (Table 1, Appendix Table 2). Highest benthic invertebrate densities were found at Station TS-200, a southern station located at the 61-m (200 ft) depth contour. Lowest densities were at the nearby Station TS-240 located at the 73-m (240 ft) depth contour. The number of invertebrate taxa/station ranged from a low of 44 (Station T-160) to a high of 92 (Station TN- 240). All community structure indices were high; H' > 4.0, SDV > 8.0, SR > 6, and J' > 0.65 (Table 1). This reflected the large number of taxa occurring at each station and indicated that no species numerically dominated the benthic infauna community. Appendix Table 3 contains individual station data; all species are listed in Appendix Table 4.

Molluscs and polychaetes were the most abundant taxa collected, but amphipods were also numerous (Table 2). Abundant species included the molluscs *Acila catrensis*, *Olivella pycna*, and *O. baetica*; the polychaete *Nephtys caecoides*; and the amphipod *Rhepoxynius daboius*.

Sediments

Sediments consisted of fine-grain sands with low percentages of silt-clay and organic matter and were very similar among stations (Table 3, and Appendix Table 5). There were only minor differences in median grain size among stations, except for Station TN-200 which had a lower median grain size (2.1 phi) than other stations. Percent silt-clay at Station T-240 (3.1%) was much higher than at the other stations.

Trawling (Fishes and Large Epibenthic Invertebrates)

A total of 1,017 demersal organisms were captured, representing 20 different species of fish (Table 4). Pacific sanddab, *Citharichthys sordidus*, and speckled sanddab, *Citharichthys stigmaeus*, were the most abundant fish species (97 and 96/ha, respectively). Other numerically important species included rex sole, *Glyptocephalus zachirus*, and English sole, *Parophrys*

Table 1.--Description of the benthic invertebrate community off Tillamook Bay, Oregon, 3 October 1988. Values for each station were calculated by combining replicates.

Station	Depth (m)	Number of taxa	Number per m^2 Mean	Standard deviation	H'[a]	SDV[b]	SR[c]	J'[d]
T-115	35	55	1,263	185	4.57	0.93	8.43	0.79
T-120	37	46	1,309	379	4.39	0.93	6.98	0.80
T-140	43	63	1,265	394	4.61	0.92	9.67	0.77
T-160	49	44	531	102	4.45	0.93	7.90	0.82
T-180	55	61	719	200	4.86	0.95	10.27	0.82
T-200	61	67	1,050	222	4.44	0.90	10.61	0.73
T-220	67	68	1,180	214	4.41	0.90	10.57	0.72
T-240	73	58	550	153	4.87	0.94	10.22	0.83
TN-200	61	77	1,144	524	4.97	0.94	12.05	0.79
TN-240	73	92	1,125	305	5.40	0.96	14.46	0.83
TS-200	61	70	1,436	462	4.21	0.87	10.56	0.69
TS-240	73	58	446	253	4.82	0.94	10.44	0.83
Mean		63	1,009	431	4.67	0.93	10.18	0.79

[a] Shannon-Weaver Diversity Index (H')
[b] Simpson Diversity Value (SDV)
[c] Species Richness (SR)
[d] Species Evenness (J')

Table 2.--Benthic invertebrates collected off Tillamook Bay, Oregon, 3 October 1988. Only the most numerous taxa from each category are shown.

Taxa	Total number	Mean number/m^2
Polychaeta		
Nephtys caecoides	349	61.6
Magelona sacculata	136	24.0
Glycinde armigera	118	20.7
Spiochaetopterus costarum	112	19.8
Spiophanes berkeleyorum	99	17.5
Miscellaneous	1,050	185.8
Total	1,864	329.4
Molluscs		
Acila castrensis	604	106.7
Olivella pycna	385	68.0
Olivella baetica	382	67.5
Mitrella gouldi	196	34.6
Dentalium spp.	157	27.7
Miscellaneous	230	40.6
Total	1,954	345.1
Cumacea/Mysidacea		
Diastylopsis dawsoni	32	5.7
Diastylis bidentata	15	2.7
Miscellaneous	12	2.1
Total	39	10.5
Amphipoda		
Rhepoxynius daboius	548	96.8
Rhepoxynius cf. *menziesi*	164	29.0
Eohaustorius cf. *brevicuspis*	105	18.5
Foxiphalus obtusidens	59	10.4
Ampelisca cf. *caryi*	55	9.7
Miscellaneous	377	6.6
Total	1,308	231.0
Decapoda		
Pagurus cf. *setosus*	28	4.9
Miscellaneous	28	5.0
Total	5	9.9
Echinodermata		
Amphiuridae	52	9.1
Amphiodia urtica	38	6.7
Miscellaneous	21	3.7
Total	111	19.5
Other taxa	360	63.6
Grand Total	5,712	1,009.0

Table 3.--Sediment characteristics of 12 benthic sites off Tillamook Bay, Oregon, 3 October 1988.

Station	Date	Depth (m)	Median grain size (phi)	Percent silt-clay	Percent organics
T-115	3 Oct 88	35	3.1	0.6	1.1
T-120	3 Oct 88	37	3.1	0.5	0.9
T-140	3 Oct 88	43	3.2	0.8	1.1
T-160	3 Oct 88	49	3.1	0.4	0.5
T-180	3 Oct 88	55	3.1	0.9	0.7
T-200	3 Oct 88	61	3.1	0.9	1.2
T-220	3 Oct 88	67	3.1	1.1	1.1
T-240	3 Oct 88	73	3.1	3.1	1.6
TN-200	3 Oct 88	61	2.1	0.3	1.2
TN-240	3 Oct 88	73	3.1	1.7	1.2
TS-200	3 Oct 88	61	3.1	0.9	1.1
TS-240	3 Oct 88	73	3.2	1.9	1.4
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Mean			3.0	1.1	1.1
Standard deviation			0.3	0.8	0.9

Table 4.--Catch summary for eight trawl sites off Tillamook Bay, Oregon, 28-29 September 1988.

Taxa	Number captured	Total wt. (g)	Number per hectare	Wt. (g) per hectare
Sandpaper skate	2	1,701	1	858
Spotted ratfish	8	3,881	2	1,221
Pacific tomcod	4	17	1	7
Shiner perch	3	52	1	23
Unidentified goby	2	2	0	0
Lingcod	3	228	1	126
Pacific staghorn sculpin	3	81	1	43
Unidentified poacher	4	12	2	5
Sturgeon poacher	7	63	3	33
Gray starsnout poacher	11	23	6	12
Showy snailfish	5	14	3	8
Unidentified snailfish	1	1	0	0
Pacific sanddab	206	3,433	97	1,612
Speckled sanddab	186	8,878	96	4,152
Petrale sole	15	1,160	7	610
Rex sole	78	4,930	40	2,255
Slender sole	37	485	19	273
Arrowtooth flounder	20	438	9	211
Dover sole	22	1635	11	794
English sole	60	4,470	29	2,147
Dungeness crab	16	3376	8	2,071
Red rock crab	1	1	0	0
Northern crangon shimp	323	347	155	166
Total	1,017	35,228	492	16,627

vetulus. The most abundant invertebrate captured in the trawl was the shrimp *Crangon alaskensis*. Large differences in trawl catches occurred among stations (Table 5, and Appendix Table 6). The lowest trawl catches were along the transect line; these four stations had a mean density of only 91 organisms/ha. Northern and southern trawls averaged 909/ha. Community structure indices showed a similar trend (Table 5), with highest diversity for the trawls north and south of the transect line, except for J' (evenness), which was higher for the transect trawls. Size distributions indicated that the most dominant fish and Dungeness crab, *Cancer magister*, populations were composed primarily of juveniles (Figs. 3, 4, and 5). Only the speckled sanddab population was composed primarily of adults (Fig. 3).

Large amounts of algae (both green and brown) along with eelgrass blades, *Zostera* spp., were collected along with fish and crab in some of the trawl samples. In general, large amounts of plant material were collected at the transect stations but not at the nontransect stations (Fig. 6). Since the transect stations also had the lowest fish and crab densities, it seems likely that the large amounts of plant material at these stations interfered with sampling efficiency.

DISCUSSION

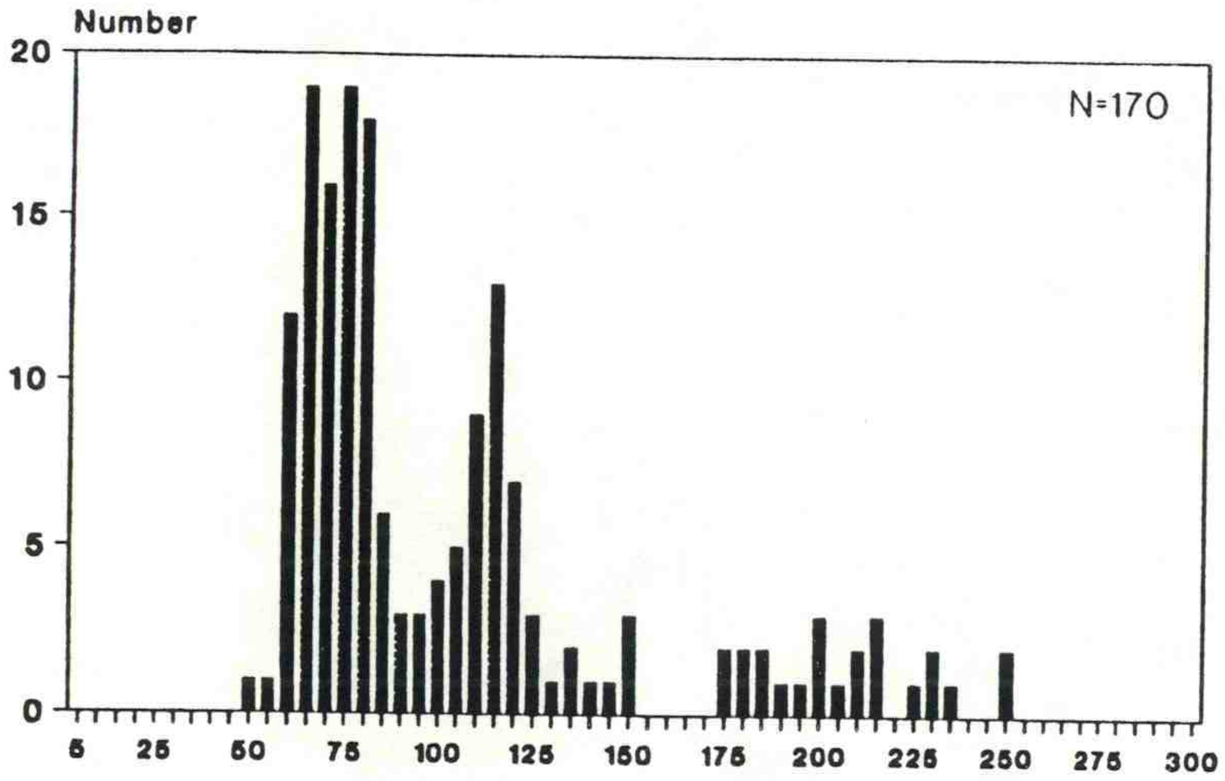
The results of this survey indicate substantially lower standing crops of benthic invertebrates and fishes at the present study area compared to those at the shallower, previously-surveyed Tillamook Bay Offshore Dredged Material Disposal Site (ODMDS). The overall mean density of benthic invertebrates in the present survey area was 1,009/m^2 in October 1988; whereas, densities at the Tillamook Bay ODMDS were 12,841/m^2 in September 1984, 1,473/m^2 in January 1985, and 6,053/m^2 in July 1985 (Emmett et al. 1987, 1988). Analyses of samples from T-115, which was the only benthic station sampled in both the present and previous studies, highlights this trend. The mean density of benthic invertebrates at T-115 in October 1988 was 1,263/m^2; in contrast, densities were 14,140/m^2 in September 1984, 4,027/m^2 in January 1985, and 4,625/m^2 in July 1985 (Emmett et al. 1987, 1988). Overall mean density of fish and epibenthic invertebrates was 429/ha at the present survey area; mean densities at Tillamook Bay ODMDS were 1,696/ha in September 1984, 1,505/ha in January 1985, and 1,231/ha in July 1985. Finally, physical characteristic of sediment at both the present survey area and the Tillamook Bay ODMDS were similar.

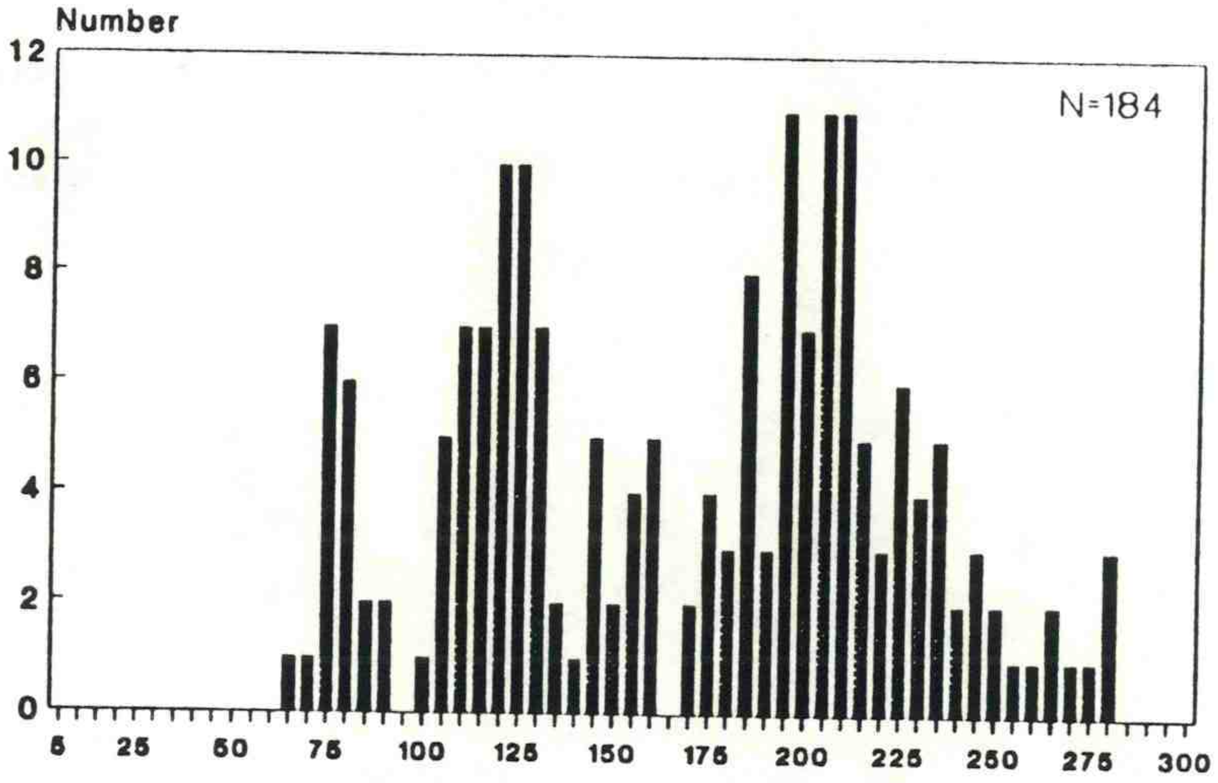
Despite the reduced density of benthic invertebrates indicated by the present data, the number of taxa and overall community structure indices were higher in the present compared to earlier studies. In previous surveys (Emmett et al. 1987, 1988) the polychaete *Owenia fusiformis*, was found to be a dominant member of the benthic community at the Tillamook Bay ODMDS. This species was not particularly abundant in the present area. Instead, over 200 taxa were found

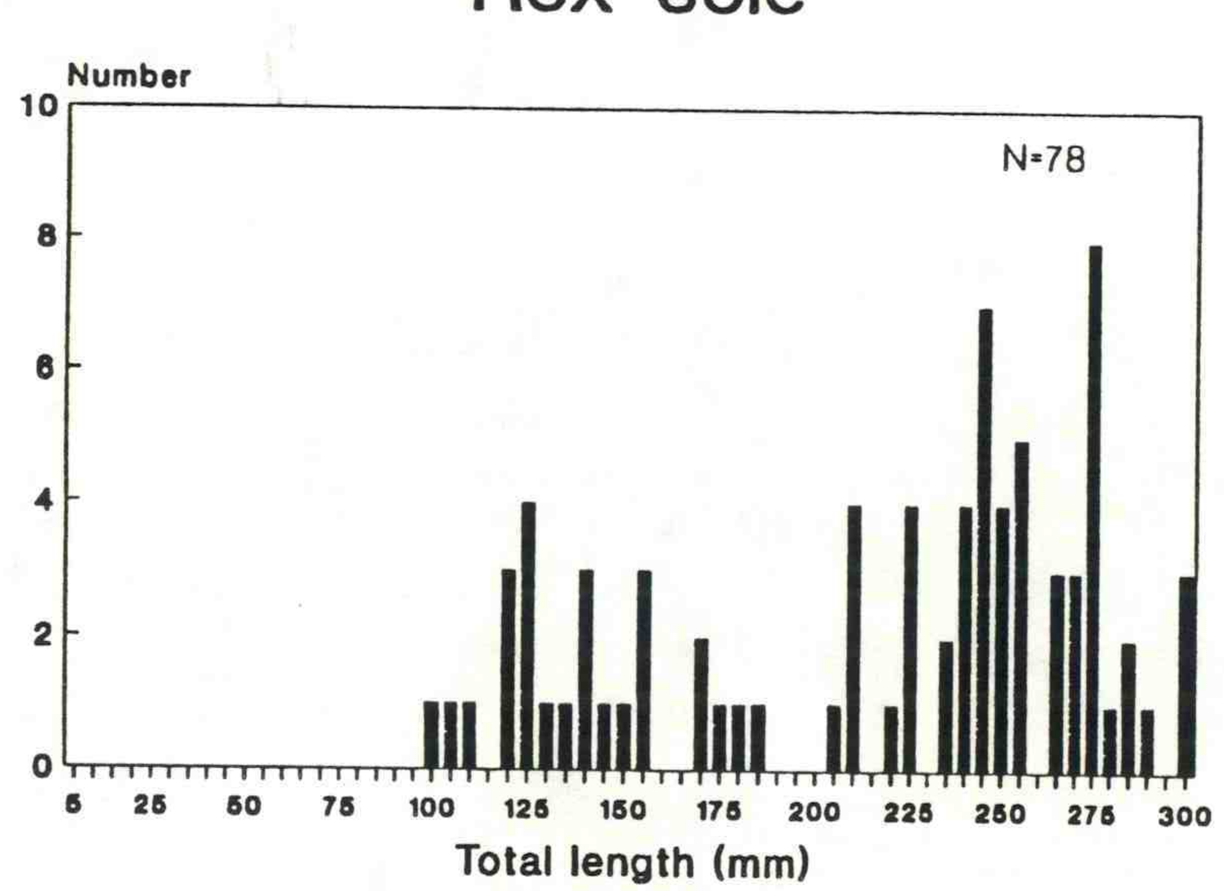
Table 5.--Summary for eight trawling sites (by station) off Tillamook Bay, Oregon, 28-29 September 1988.

Station	Depth (m)	No.of taxa	No./ha	Wt. (g)/ha	H'[a]	SDV[b]	SR[c]	J'[d]
T-110	34	4	29	9,037	1.57	0.60	1.17	0.79
T-180	55	4	18	167	1.79	0.67	1.67	0.90
T-200	61	9	310	13,141	2.49	0.78	1.80	0.79
T-220	67	2	6	6	1.00	0.50	1.44	1.00
TN-200	61	15	1,133	32,212	2.70	0.79	2.42	0.69
TN-220	67	16	760	28,005	2.73	0.79	2.90	0.68
TS-200	61	12	930	27,392	2.25	0.71	1.99	0.63
TS-220	67	15	813	23,146	3.00	0.83	2.77	0.77
Mean		10	492	16,627	2.19	0.71	2.02	0.78

[a] Shannon-Weaver Diversity Index (H')
[b] Simpson Diversity Value (SDV)
[c] Species Richness (SR)
[d] Species Evenness (J')







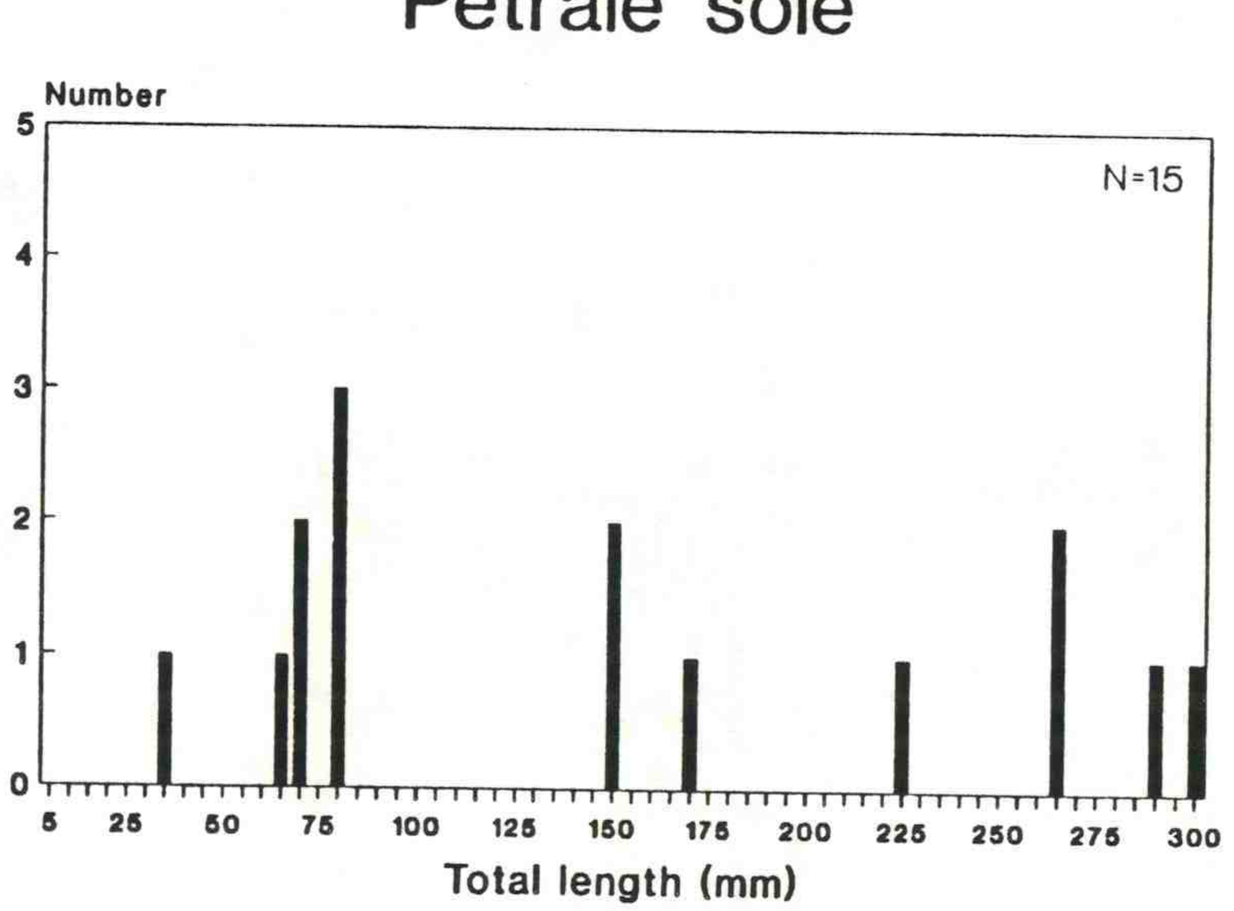
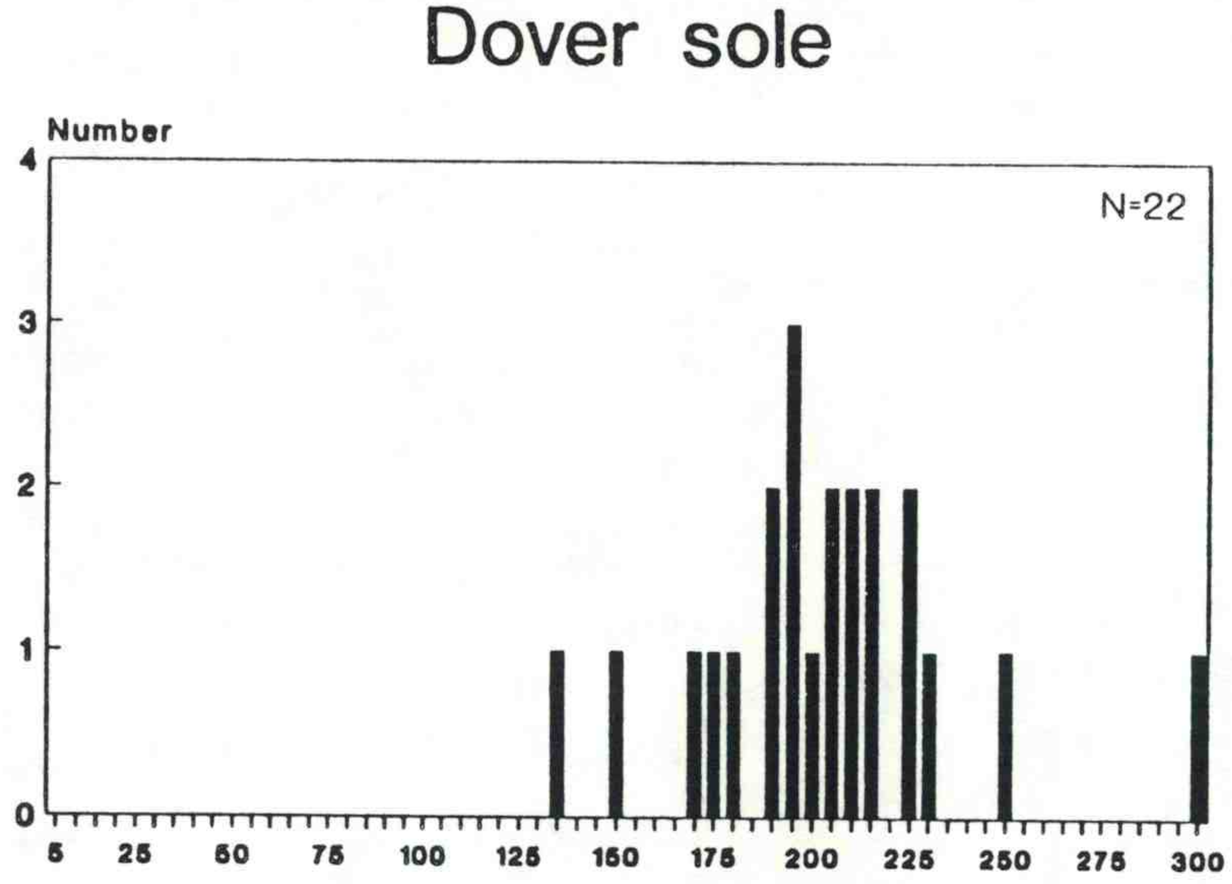
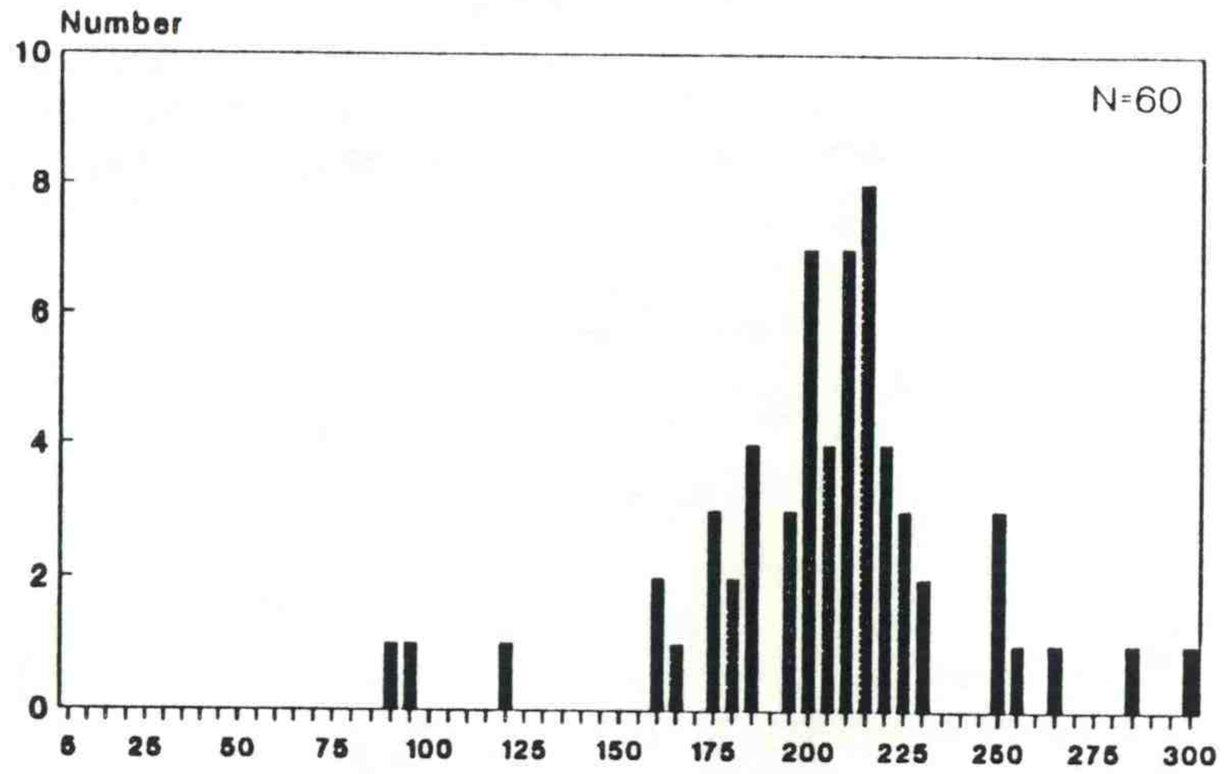
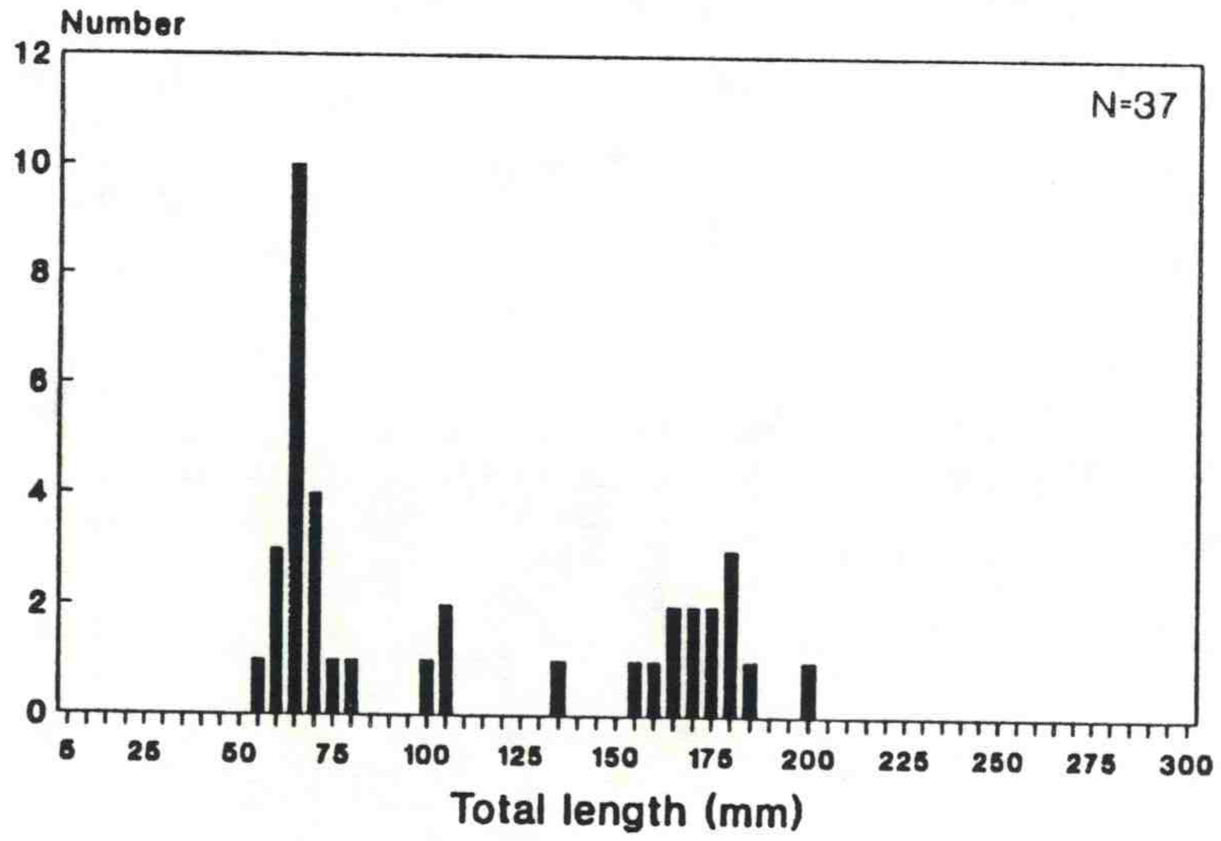


Figure 3.--Length frequency distributions of Pacific sanddab, *Citharichthys sordidus*; speckled sanddab, *Citharichthys stigmaeus*; rex sole, *Glyptocephalus zachirus*; and petrale sole, *Eopsetta jordani*; captured at eight trawling sites off Tillamook Bay, Oregon, 28-29 September 1988. Fish >300 mm are included in the 300-mm interval.







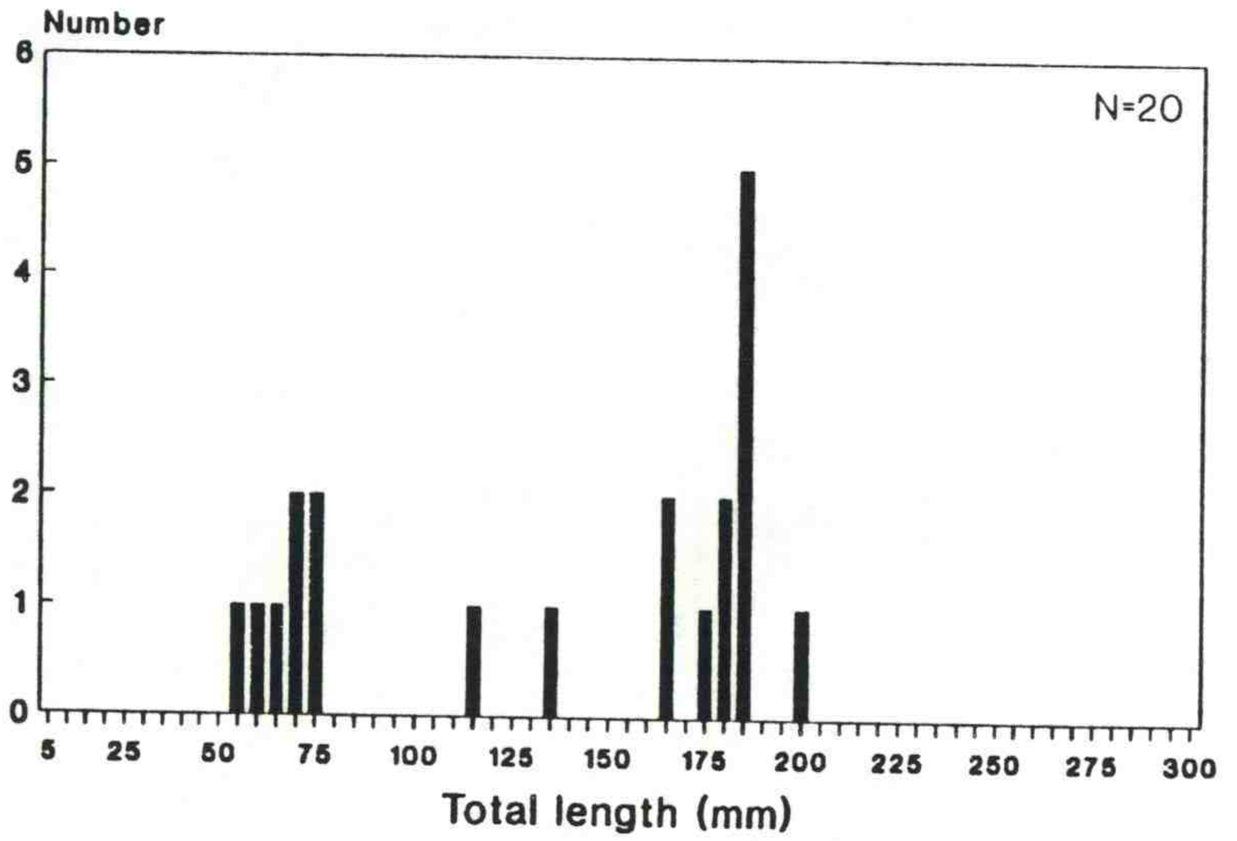


Figure 4.--Length frequency distributions dover sole, *Microstomus pacificus*; English sole, *Parophrys vetulus*; slender sole, *Lyopsetta exilis*; and arrowtooth flounder, *Atheresthes stomias*; captured at eight trawling sites off Tillamook Bay, Oregon, 28-29 September 1988. Fish >300 mm are included in the 300-mm interval.

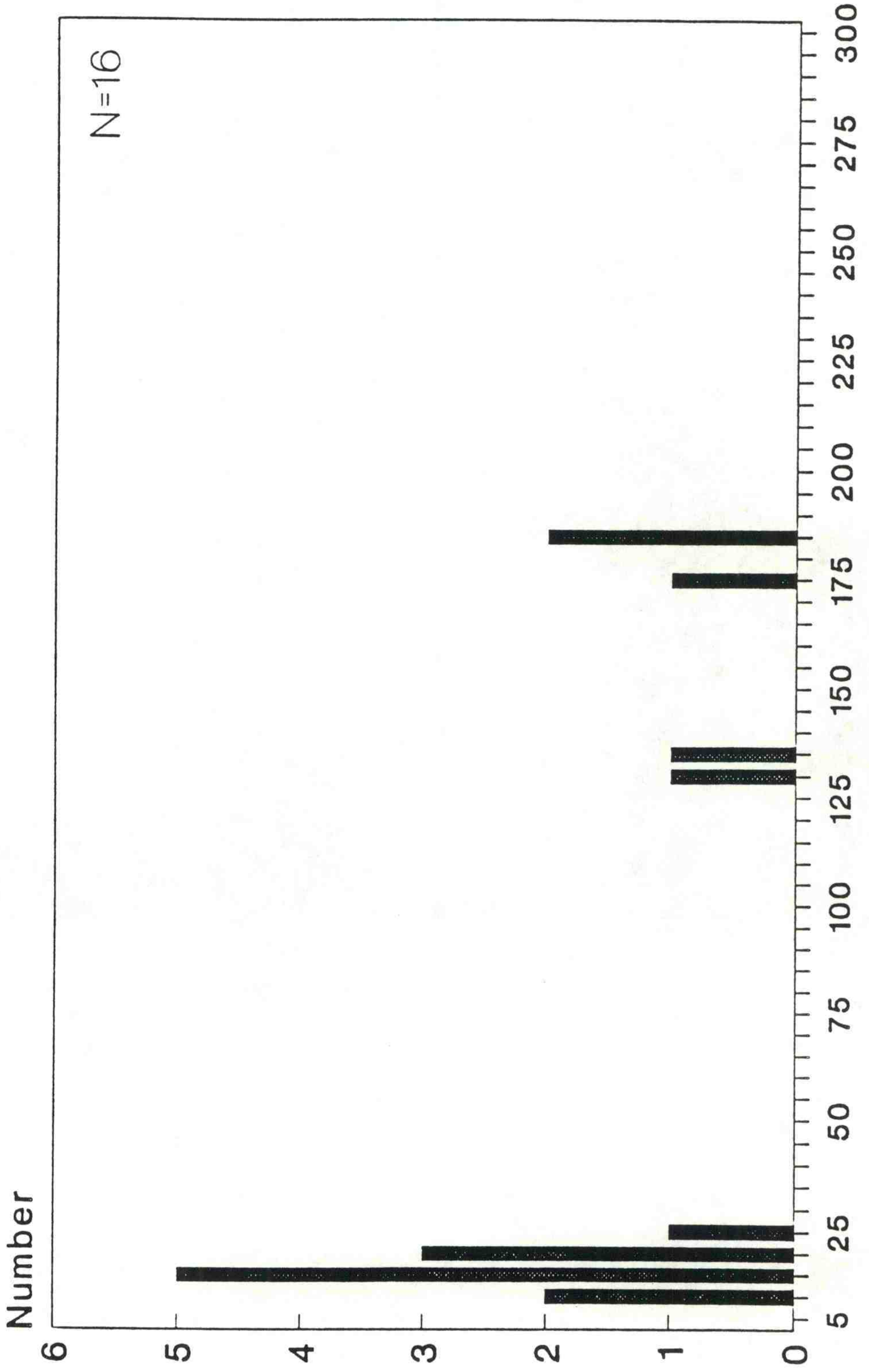


Figure 5.--Carapace-width frequency distributions of Dungeness crabs captured at eight trawling sites off Tillamook Bay, Oregon, 28-29 September 1988.

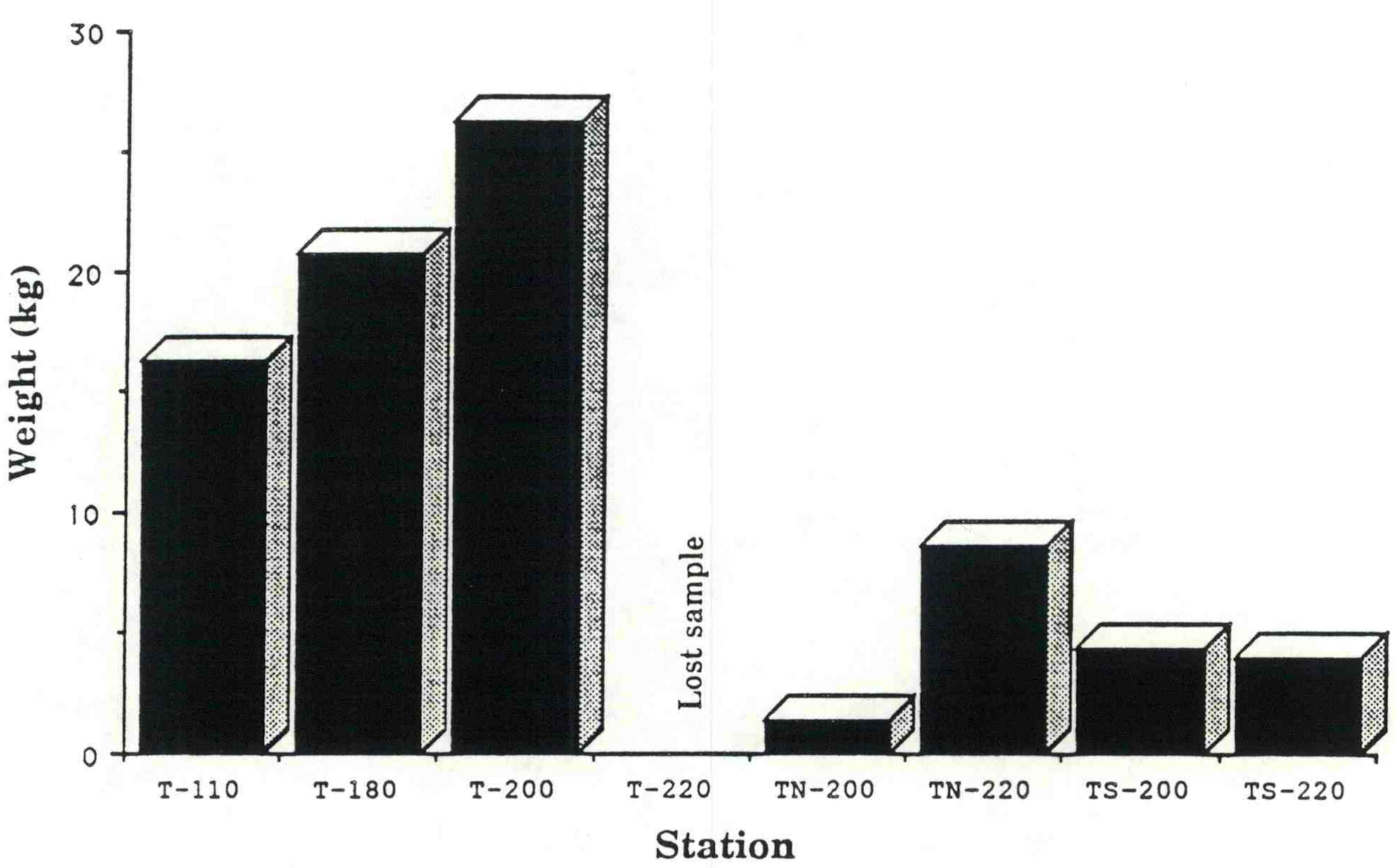


Figure 6.--The total wet weights of macroalgae and *Zostera* spp. blades collected in trawls off Tillamook Bay, Oregon, 28-29 September 1988.

and no taxon dominated the communities. Of particular note, several benthic invertebrate species collected in this survey had not previously been reported from adjacent areas or perhaps are even undescribed. However, because much of the Oregon coast has never been sampled this is not surprising.

As was the case at the Tillamook Bay ODMDS, most of the fishes captured by trawl were juveniles; however, the species composition of the demersal fish community differed between areas. Dominant fishes and epibenthic fauna at the ODMDS were Pacific tomcod *Microgadus proximus*, speckled sanddab, and Dungeness crab. Although speckled sanddab were also abundant in the October 1988 study area, Pacific tomcod and Dungeness crab were not.

Despite the findings of lower fish and invertebrate densities at the deeper area sampled in this most recent survey, there are additional factors that need to be considered before reaching any firm conclusions. With regard to the benthic invertebrate results, considerable difficulty was encountered during the collection of samples which may have compromised the results. The most critical of these problems was malfunction of the Gray-O'Hara box corer. After collection of the first few samples, it was discovered that the box corer was not closing completely and sediment was washing out during retrieval. A second box corer (provided by the COE) was used to complete the sampling, but it also was not functioning properly. Many cores were retrieved only partially full and it was not possible to distinguish between loss of sample due to failure of the corer to completely penetrate the substrate or sample washout. These problems were exacerbated by a large ground swell that would have made sampling difficult even without equipment problems.

Given these circumstances, numerous samples were collected at each station, saving for analyses only those that appeared to be minimally washed out. Thus, although the sediment samples were as uniform as possible, there is some question as to their ability to yield accurate data on benthic invertebrate density. Although the low variability between samples collected at the same stations and the high overall taxonomic diversity would suggest the samples were indeed representative, and that the area surveyed in October 1988 did have reduced densities of invertebrates, sampling problems cannot be ruled out as contributing to the finding. Additional surveys will be required to sort out these possibilities as well as provide data on the seasonal and annual variation in standing crop.

Further supporting the need for additional surveys at the deeper area off Tillamook Bay was the uncertainty surrounding the collections of fishes and epibenthic invertebrates. While areas rich in algae are often productive marine habitats, this study found reduced densities of fishes and shellfish compared to densities observed in earlier surveys at the Tillamook Bay ODMDS where much less algae were found. It cannot be ruled out that the algae interfered with net efficiency and contributed to the reduced catches. Indeed, the results suggest there was an inverse relationship between the volume of algae collected and the numbers of fish obtained by trawl at the

stations sampled. An accurate assessment of the demersal fish and shellfish community in this area may require a visual survey by remote camera.

CONCLUSIONS

Although sediment characteristics at the present study area were similar to those of the Tillamook Bay ODMDS, benthic invertebrate, fish, shrimp, and crab densities were lower than densities at the disposal site. However, benthic invertebrate densities in the present study may have been underestimated because of problems with the box corers related to washout or bottom substrate structure. Demersal fishes, shrimp, and crab densities may also have been underestimated due to large amounts of plant material plugging the trawl. Accordingly, in September 1990, NMFS again sampled at all previously sampled benthic invertebrate and trawl stations. These samples are presently being analyzed and the results will be available in July 1991.

This report does not constitute NMFS's formal comments under the Fish and Wildlife Coordination Act or the National Environmental Policy Act.

ACKNOWLEDGMENTS

This research was supported in part by COE, Portland District and Environmental Protection Agency, Region 10. We thank the COE, Portland District, for the sediment analysis. Special thanks go to Howard Jones and John Chapman for benthic invertebrate identifications.

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APPENDIX

Data Tables

Appendix Table 1.--Loran-C navigational readings of benthic and trawling stations off Tillamook Bay, Oregon, September and October 1988.

Benthic Station Locations

Station	Depth (m)	Loran Readings	
T-115	35	12381.3	28004.4
T-120	37	12381.4	28004.3
T-140	43	12382.3	28003.3
T-160	49	12383.0	28002.4
T-180	55	12383.8	28001.1
T-200	61	12384.9	27999.9
T-220	67	12386.1	27998.5
T-240	73	12387.3	27996.5
TN-200	61	12372.4	28001.8
TN-240	73	12375.2	27998.5
TS-200	61	12397.2	27997.5
TS-240	73	12392.0	27995.6

Trawl Locations

Station	Depth (m)	Loran Readings			
		Beginning		Ending	
T-110	34	12380.8	28004.7	12376.9	28005.3
T-180	55	12383.3	28001.5	12380.2	28002.1
T-200	61	12383.5	28000.0	12381.0	28000.4
T-220	67	12385.1	27998.7	12382.4	27999.4
TN-200	61	12374.4	28001.5	12371.9	28002.1
TN-220	67	12380.0	27999.5	12378.0	28000.0
TS-200	61	12395.5	27997.9	12393.4	27998.0
TS-220	67	12396.3	27996.6	12394.6	27996.8

Appendix Table 2.--Summary of benthic invertebrates (all stations combined, N = 59) Tillamook Bay, Oregon, 3 October 1988.

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Pachycerianthus fimbriatus	1	1.7	0.2	1.4
Polycladida	1	1.7	0.2	1.4
Nemertea	44	44.1	7.8	11.5
Paleonemertea	5	3.4	0.9	4.9
Nematoda	1	1.7	0.2	1.4
Polychaeta	4	6.8	0.7	2.6
Polynoidae	2	3.4	0.4	1.9
Harmathoe spp.	1	1.7	0.2	1.4
Harmothoe lunulata	6	8.5	1.1	3.7
Lepidasthenia longicirrata	3	5.1	0.5	2.3
Tenonia kitsapensis	1	1.7	0.2	1.4
Tenonia priops	2	3.4	0.4	1.9
Pholoe minuta	12	11.9	2.1	6.4
Sthenelais tertiaglabra	1	1.7	0.2	1.4
Sigalion spp.	15	20.3	2.6	5.7
Thalenessa spinosa	1	1.7	0.2	1.4
Anaitides groenlandica	27	32.2	4.8	8.1
Eteone spp.	4	6.8	0.7	2.6
Eteone longa	47	49.2	8.3	11.4
Eteone fauchaldi	4	6.8	0.7	2.6
Paranaitis polynoides	4	6.8	0.7	2.6
Phyllodoce spp.	10	10.2	1.8	5.9
Phyllodoce hartmanae	2	3.4	0.4	1.9
Micropodarke dubia	1	1.7	0.2	1.4
Heteropodarke heteromorpha	1	1.7	0.2	1.4
Podarkeopsis brevipalpa	1	1.7	0.2	1.4
Parandalia fauveli	3	3.4	0.5	3.0
Syllidae	4	3.4	0.7	4.3
Syllis gracilis	1	1.7	0.2	1.4
Syllis elongata	3	3.4	0.5	3.0
Nereidae	1	1.7	0.2	1.4
Nephtys spp.	1	1.7	0.2	1.4
Nephtys ferruginea	11	3.4	1.9	13.6
Nephtys caecoides	349	96.6	61.6	47.2
Nephtys assignis	3	5.1	0.5	2.3
Glycera spp.	1	1.7	0.2	1.4
Glycinde armigera	118	74.6	20.8	20.6
Goniada brunnea	38	42.4	6.7	9.4
Onuphis spp.	11	8.5	1.9	6.8
Onuphis iridescens	51	49.2	9.0	11.0
Lumbrineris spp.	23	32.2	4.1	6.7

Appendix Table 2.--Continued.

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Lumbrineris bicirrata	6	10.2	1.1	3.2
Arabellidae	1	1.7	0.2	1.4
Notocirrus californiensis	2	3.4	0.4	1.9
Ophryotrocha	5	1.7	0.9	6.8
Haploscoloplos panamensis	7	8.5	1.2	4.4
Naineris uncinata	1	1.7	0.2	1.4
Scoloplos spp.	51	8.5	9.0	32.9
Scoloplos armiger	32	16.9	5.7	18.7
Scoloplos pugettensis	66	50.8	11.7	17.5
Paraonidae	3	3.4	0.5	3.0
Aricidea suecica	4	6.8	0.7	2.6
Aricidea pacifica	24	27.1	4.2	8.5
Spionidae	1	1.7	0.2	1.4
Laonice cirrata	19	16.9	3.4	10.7
Polydora brachycephala	4	5.1	0.7	3.3
Prionospio steenstrupi	1	1.7	0.2	1.4
Spio butleri	5	8.5	0.9	2.9
Spiophanes spp.	20	5.1	3.5	17.3
Spiophanes bombyx	28	18.6	4.9	19.7
Spiophanes berkeleyorum	99	32.2	17.5	43.3
Paraprionospio pinnata	20	25.4	3.5	6.6
Scolelepsis foliosa	1	1.7	0.2	1.4
Prionospio lighti	61	33.9	10.8	18.1
Magelona longicornis	21	23.7	3.7	8.6
Magelona sacculata	136	55.9	24.0	37.2
Spiochaetopterus costarum	112	42.4	19.8	41.0
Cirratulidae	2	1.7	0.4	2.7
Tharyx multifilis	2	3.4	0.4	1.9
Chaetozone spinosa	91	50.8	16.1	27.0
Armandia brevis	1	1.7	0.2	1.4
Ophelia spp.	2	3.4	0.4	1.9
Travisia spp.	1	1.7	0.2	1.4
Capitella capitata	1	1.7	0.2	1.4
Notomastus lineatus	60	22.0	10.6	30.0
Mediomastus spp.	5	8.5	0.9	2.9
Decamastus gracilis	13	13.6	2.3	6.7
Barantolla americana	4	3.4	0.7	4.3
Maldanidae	2	3.4	0.4	1.9
Euclymene spp.	79	42.4	14.0	26.8
Euclymene zonalis	12	5.1	2.1	11.6
Owenia fusiformis	6	6.8	1.1	4.2
Myriochele oculata	29	15.3	5.1	17.7
Pectinaria californiensis	1	1.7	0.2	1.4
Ampharetidae	1	1.7	0.2	1.4

Appendix Table 2.--Continued.

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Ampharete acutifrons	5	6.8	0.9	3.5
Terebellidae	2	3.4	0.4	1.9
Pista cristata	8	13.6	1.4	3.6
Polycirrus spp.	15	16.9	2.6	6.6
Sabellidae	1	1.7	0.2	1.4
Chone duneri	23	28.8	4.1	7.0
Gastropoda	4	6.8	0.7	2.6
Lacuna carininata	3	3.4	0.5	3.0
Lacuna variegata	49	6.8	8.7	62.4
Epitonium indianorum	1	1.7	0.2	1.4
Naticidae	1	1.7	0.2	1.4
Ocenebra spp.	11	11.9	1.9	6.0
Mitrella gouldi	196	64.4	34.6	42.5
Nassarius mendicus	1	1.7	0.2	1.4
Olivella spp.	8	10.2	1.4	4.5
Olivella baetica	382	94.9	67.5	65.1
Olivella pycna	385	47.5	68.0	119.9
Kurtziella plumbea	5	6.8	0.9	3.5
Turbonilla spp.	2	3.4	0.4	1.9
Cylichna attanosa	10	13.6	1.8	4.8
Bivalvia	3	5.1	0.5	2.3
Acila castrensis	604	61.0	106.7	167.3
Nucula tenuis	3	3.4	0.5	3.0
Yoldia scissurata	14	18.6	2.5	5.6
Mytilidae	5	6.8	0.9	3.5
Axinopsida serricata	19	20.3	3.4	7.6
Siliqua spp.	1	1.7	0.2	1.4
Siliqua patula	2	3.4	0.4	1.9
Macoma modesta	8	13.6	1.4	3.6
Tellina carpenteri	49	23.7	8.7	21.4
Psephidia lordi	4	5.1	0.7	3.3
Pandora grandis	3	5.1	0.5	2.3
Lyonsia californica	1	1.7	0.2	1.4
Scaphopoda	2	3.4	0.4	1.9
Dentalium spp.	157	57.6	27.7	40.2
Dentalium laqueatum	8	3.4	1.4	9.6
Cadulus spp.	9	6.8	1.6	8.4
Ostracoda	33	20.3	5.8	14.1
Cylindroleberididae	12	16.9	2.1	5.4
Bathyleberis grossmani	9	10.2	1.6	5.4
Philomedidae	188	45.8	33.2	55.5
Euphilomedes carcharodonta	17	5.1	3.0	15.4
Calanoida	7	11.9	1.2	3.4
Cirripedia	1	1.7	0.2	1.4

Appendix Table 2.--Continued.

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Balanus spp.	1	1.7	0.2	1.4
Nebalia pugettensis	10	10.2	1.8	6.5
Mysidacea	2	3.4	0.4	1.9
Archaeomysis grebnitzkii	2	1.7	0.4	2.7
Lamprops cf. *californica*	4	5.1	0.7	3.3
Hemilamprops californica	1	1.7	0.2	1.4
Diastylis bidentata	15	18.6	2.6	6.3
Diastylopsis dawsoni	32	23.7	5.7	15.3
Colurostylis occidentalis	3	3.4	0.5	3.0
Tanaidacea	15	8.5	2.6	10.5
Leptognathia spp.	3	5.1	0.5	2.3
Haliophasma geminata	3	5.1	0.5	2.3
Tecticeps pugettensis	5	6.8	0.9	3.5
Synidotea angulata	2	1.7	0.4	2.7
Gammaridea	2	1.7	0.4	2.7
Ampelisca spp.	3	3.4	0.5	3.0
Ampelisca macrocephala	6	3.4	1.1	5.7
Ampelisca agassizi	46	25.4	8.1	22.2
Ampelisca careyi	55	47.5	9.7	13.0
Aoroides spp.	4	6.8	0.7	2.6
Aorides seconda	11	3.4	1.9	13.6
Atylus tridens	6	6.8	1.1	4.6
Corophium spinicorne	1	1.7	0.2	1.4
Melita spp.	1	1.7	0.2	1.4
Melita desdichada	21	3.4	3.7	23.6
Eohaustorius estuarius	3	3.4	0.5	3.0
Eohaustorius cf. *brevicuspis*	105	22.0	18.5	45.6
Eohaustorius sencillus	32	20.3	5.7	15.8
Isaeidae	2	3.4	0.4	1.9
Photis spp.	4	3.4	0.7	4.3
Photis californica	37	35.6	6.5	11.6
Photis macinerneyi	10	6.8	1.8	8.7
Photis parvidons	16	1.7	2.8	21.7
Protomedeia spp.	4	3.4	0.7	4.3
Protomedeia articulata	1	1.7	0.2	1.4
Cheirimedia cf. *zotea*	7	5.1	1.2	5.5
Cheirimedia cf. *semilcarpa*	2	3.4	0.4	1.9
Ischyrocerus spp.	1	1.7	0.2	1.4
Lysianassidae	1	1.7	0.2	1.4
Anonyx spp.	2	3.4	0.4	1.9
Anonyx liljeborgi	8	6.8	1.4	7.1
Anonyx adoxus	1	1.7	0.2	1.4
Hippomedon spp.	4	5.1	0.7	3.3

Appendix Table 2.--Continued.

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Hippomedon propinquus	3	5.1	0.5	2.3
Hippomedon cf. *weyes*	1	1.7	0.2	1.4
Wecomedon wecomus	2	3.4	0.4	1.9
Orchomene spp.	2	3.4	0.4	1.9
Pachynus cf. *barnardi*	24	22.0	4.2	10.1
Monoculodes spinipes	11	18.6	1.9	4.1
Synchelidium shoemakeri	1	1.7	0.2	1.4
Westwoodilla caecula	4	6.8	0.7	2.6
Paraphoxus obtusidens	59	27.1	10.4	23.9
Mandibulophoxus uncirostratus	1	1.7	0.2	1.4
Rhepoxynius daboius	548	98.3	96.8	62.4
Rhepoxynius menziesi	178	55.9	31.4	50.7
Rhepoxynius vigitegus	66	23.7	11.7	23.9
Grandifoxus grandis	13	3.4	2.3	12.7
Sympleustes sp.	1	1.7	0.2	1.4
Dulichia spp.	1	1.7	0.2	1.4
Stenothoidae	2	3.4	0.4	1.9
Tiron biocellata	1	1.7	0.2	1.4
Hyperoche spp.	1	1.7	0.2	1.4
Caprella incisa	1	1.7	0.2	1.4
Decapoda spp.	1	1.7	0.2	1.4
Paguridae	8	6.8	1.4	7.1
Pagurus spp.	7	10.2	1.2	3.9
Pagurus setosus	28	20.3	4.9	13.0
Upogebia spp.	2	3.4	0.4	1.9
Cancer spp.	1	1.7	0.2	1.4
Cancer magister	1	1.7	0.2	1.4
Pinnixa eburna	7	8.5	1.2	4.4
Scleroplax cf. *granulatus*	1	1.7	0.2	1.4
Sipunculidae	1	1.7	0.2	1.4
Echiurus spp.	1	1.7	0.2	1.4
Phoronis spp.	1	1.7	0.2	1.4
Ophiuroidea	6	6.8	1.1	4.2
Ophiura lutkeni	5	5.1	0.9	4.4
Amphiuridae	52	32.2	9.2	18.3
Amphiodia spp.	5	8.5	0.9	2.9
Amphiodia urtica	38	39.0	6.7	9.6
Holothuroidea	4	6.8	0.7	2.6
Cyclopteridae	1	1.7	0.2	1.4

Appendix Table 2.--Continued.

Number of taxa = 211.

Mean number/sample: 96.9 Standard deviation (SD): 41.5
Mean number/m^2: 1009.5 SD/m^2: 432.8

H' = 5.61 SDV = 0.96 SR = 24.27 J' = 0.73

Appendix Table 3.--Summary of benthic invertebrates (by individual station) off Tillamook Bay, Oregon, 3 October 1988.

Station: T-115	3 October 1988		Sample size: 5	
Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Pachycerianthus fimbriatus	1	20.0	2.1	4.7
Polycladida	1	20.0	2.1	4.7
Nemertea	11	80.0	22.9	20.0
Paleonemertea	5	40.0	10.4	14.7
Sigalion spp.	5	80.0	10.4	7.4
Eteone longa	4	60.0	8.3	8.7
Syllis gracilis	1	20.0	2.1	4.7
Nephtys ferruginea	10	20.0	20.8	46.6
Nephtys caecoides	47	80.0	97.9	79.6
Glycinde armigera	13	100.0	27.1	11.9
Onuphis spp.	11	100.0	22.9	8.7
Lumbrineris spp.	2	40.0	4.2	5.7
Lumbrineris bicirrata	1	20.0	2.1	4.7
Ophryotrocha	5	20.0	10.4	23.3
Scoloplos spp.	51	100.0	106.3	52.8
Scoloplos pugettensis	1	20.0	2.1	4.7
Paraonidae	2	20.0	4.2	9.3
Spiophanes spp.	20	60.0	41.7	48.3
Spiophanes bombyx	2	40.0	4.2	5.7
Magelona longicornis	1	20.0	2.1	4.7
Magelona sacculata	42	100.0	87.5	57.8
Chaetozone spinosa	18	80.0	37.5	34.2
Armandia brevis	1	20.0	2.1	4.7
Ophelia spp.	2	40.0	4.2	5.7
Notomastus lineatus	9	40.0	18.8	25.9
Maldanidae	1	20.0	2.1	4.7
Euclymene spp.	4	40.0	8.3	13.6
Lacuna variegata	2	40.0	4.2	5.7
Mitrella gouldi	5	40.0	10.4	14.7
Olivella baetica	32	100.0	66.7	39.4
Olivella pycna	100	100.0	208.4	170.9
Mytilidae	2	20.0	4.2	9.3
Siliqua spp.	1	20.0	2.1	4.7
Cylindroleberididae	1	20.0	2.1	4.7
Balanus spp.	1	20.0	2.1	4.7
Archaeomysis grebnitzkii	2	20.0	4.2	9.3
Colurostylis occidentalis	2	20.0	4.2	9.3
Tecticeps pugettensis	1	20.0	2.1	4.7
Ampelisca agassizi	15	40.0	31.3	64.2
Ampelisca careyi	4	60.0	8.3	8.7
Atylus tridens	3	20.0	6.3	14.0
Eohaustorius estuarius	2	20.0	4.2	9.3

Appendix Table 3.--Continued.

Station: T-115 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Eohaustorius cf. *brevicuspis*	26	100.0	54.2	28.9
Isaeidae	2	40.0	4.2	5.7
Photis californica	9	80.0	18.8	20.0
Hippomedon cf. *weyes*	1	20.0	2.1	4.7
Monoculodes spinipes	2	40.0	4.2	5.7
Paraphoxus obtusidens	27	80.0	56.3	50.3
Mandibulophoxus uncirostratus	1	20.0	2.1	4.7
Rhepoxynius daboius	47	100.0	97.9	49.8
Rhepoxynius vigitegus	24	100.0	50.0	11.4
Pagurus setosus	3	40.0	6.3	9.3
Phoronis spp.	1	20.0	2.1	4.7
Amphiuridae	17	80.0	35.4	25.1
Amphiodia urtica	2	20.0	4.2	9.3

Number of taxa= 55.

Mean number/sample: 121.2 Standard deviation (SD): 17.7
Mean number/m^2: 1262.9 SD/m^2: 184.7

H' = 4.57 SDV = 0.93 SR = 8.43 J' = 0.79

Appendix Table 3.--Continued.

Station: T-120	3 October 1988		Sample size: 5	
Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Nemertea	1	20.0	2.1	4.7
Eteone longa	4	60.0	8.3	8.7
Eteone fauchaldi	2	40.0	4.2	5.7
Paranaitis polynoides	1	20.0	2.1	4.7
Heteropodarke heteromorpha	1	20.0	2.1	4.7
Nephtys caecoides	49	80.0	102.1	87.9
Glycinde armigera	14	80.0	29.2	27.0
Goniada brunnea	1	20.0	2.1	4.7
Onuphis iridescens	8	80.0	16.7	15.8
Scoloplos armiger	24	80.0	50.0	45.1
Scoloplos pugettensis	3	40.0	6.3	9.3
Spiophanes bombyx	18	60.0	37.5	61.9
Spiophanes berkeleyorum	8	40.0	16.7	27.2
Prionospio lighti	1	20.0	2.1	4.7
Magelona sacculata	37	80.0	77.1	49.8
Chaetozone spinosa	7	60.0	14.6	15.8
Notomastus lineatus	12	40.0	25.0	37.3
Euclymene spp.	6	40.0	12.5	22.6
Owenia fusiformis	1	20.0	2.1	4.7
Ocenebra spp.	1	20.0	2.1	4.7
Mitrella gouldi	6	20.0	12.5	28.0
Olivella spp.	1	20.0	2.1	4.7
Olivella baetica	60	100.0	125.0	109.0
Olivella pycna	92	100.0	191.7	140.7
Macoma modesta	3	60.0	6.3	5.7
Tellina carpenteri	26	100.0	54.2	45.7
Ostracoda	1	20.0	2.1	4.7
Cylindroleberididae	2	40.0	4.2	5.7
Bathyleberis grossmani	3	20.0	6.3	14.0
Cirripedia	1	20.0	2.1	4.7
Mysidacea	1	20.0	2.1	4.7
Diastylopsis dawsoni	11	40.0	22.9	31.6
Tecticeps pugettensis	3	40.0	6.3	9.3
Ampelisca agassizi	5	40.0	10.4	18.0
Ampelisca careyi	7	60.0	14.6	17.4
Eohaustorius estuarius	1	20.0	2.1	4.7
Eohaustorius cf. *brevicuspis*	41	60.0	85.4	93.9
Photis californica	9	60.0	18.8	21.4
Monoculodes spinipes	3	60.0	6.3	5.7
Paraphoxus obtusidens	21	100.0	43.8	20.0
Rhepoxynius daboius	74	100.0	154.2	61.4
Rhepoxynius vigitegus	34	100.0	70.9	13.6

Appendix Table 3.--Continued.

Station: T-120 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Paguridae	6	40.0	12.5	22.6
Pagurus setosus	1	20.0	2.1	4.7
Amphiuridae	15	80.0	31.3	36.8
Amphiodia urtica	2	20.0	4.2	9.3

Number of taxa= 46.

Mean number/sample: 125.6 Standard deviation (SD): 36.4
Mean number/m^2: 1308.8 SD/m^2: 379.3

H' = 4.39 SDV = 0.93 SR = 6.98 J' = 0.80

Appendix Table 3.--Continued.

Station: T-140	3 October 1988		Sample size: 5	
Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Nemertea	6	80.0	12.5	11.4
Polychaeta	1	20.0	2.1	4.7
Harmothoe lunulata	1	20.0	2.1	4.7
Sigalion spp.	1	20.0	2.1	4.7
Anaitides groenlandica	3	60.0	6.3	5.7
Eteone spp.	1	20.0	2.1	4.7
Eteone longa	9	60.0	18.8	25.9
Eteone fauchaldi	1	20.0	2.1	4.7
Paranaitis polynoides	2	40.0	4.2	5.7
Podarkeopsis brevipalpa	1	20.0	2.1	4.7
Syllidae	3	20.0	6.3	14.0
Nephtys caecoides	20	100.0	41.7	12.8
Glycinde armigera	15	100.0	31.3	12.8
Goniada brunnea	4	60.0	8.3	8.7
Onuphis iridescens	5	40.0	10.4	14.7
Lumbrineris spp.	1	20.0	2.1	4.7
Notocirrus californiensis	1	20.0	2.1	4.7
Scoloplos armiger	5	60.0	10.4	12.8
Scoloplos pugettensis	9	20.0	18.8	41.9
Aricidea pacifica	1	20.0	2.1	4.7
Spionidae	1	20.0	2.1	4.7
Spiophanes bombyx	3	40.0	6.3	9.3
Spiophanes berkeleyorum	23	80.0	47.9	56.4
Magelona longicornis	1	20.0	2.1	4.7
Magelona sacculata	26	100.0	54.2	18.6
Spiochaetopterus costarum	5	60.0	10.4	12.8
Chaetozone spinosa	8	60.0	16.7	21.6
Notomastus lineatus	34	100.0	70.9	70.4
Euclymene spp.	5	60.0	10.4	12.8
Ampharete acutifrons	3	40.0	6.3	9.3
Polycirrus spp.	1	20.0	2.1	4.7
Gastropoda	2	40.0	4.2	5.7
Lacuna variegata	1	20.0	2.1	4.7
Ocenebra spp.	2	40.0	4.2	5.7
Mitrella gouldi	10	80.0	20.8	20.8
Olivella spp.	3	40.0	6.3	9.3
Olivella baetica	11	100.0	22.9	18.6
Olivella pycna	135	100.0	281.3	129.1
Kurtziella plumbea	1	20.0	2.1	4.7
Cylichna attanosa	1	20.0	2.1	4.7
Macoma modesta	3	60.0	6.3	5.7
Tellina carpenteri	14	80.0	29.2	20.0

Appendix Table 3.--Continued.

Station: T-140 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Pandora grandis	2	40.0	4.2	5.7
Ostracoda	3	40.0	6.3	9.3
Cylindroleberididae	3	20.0	6.3	14.0
Diastylopsis dawsoni	10	40.0	20.8	36.1
Ampelisca agassizi	4	40.0	8.3	13.6
Ampelisca careyi	13	80.0	27.1	17.4
Corophium spinicorne	1	20.0	2.1	4.7
Eohaustorius cf. *brevicuspis*	29	40.0	60.4	82.8
Eohaustorius sencillus	19	100.0	39.6	34.9
Photis californica	2	20.0	4.2	9.3
Pachynus cf. *barnardi*	5	20.0	10.4	23.3
Monoculodes spinipes	1	20.0	2.1	4.7
Paraphoxus obtusidens	6	80.0	12.5	11.4
Rhepoxynius daboius	19	80.0	39.6	37.1
Rhepoxynius menziesi	79	100.0	164.6	60.5
Rhepoxynius vigitegus	8	80.0	16.7	14.0
Tiron biocellata	1	20.0	2.1	4.7
Pagurus setosus	8	40.0	16.7	31.8
Amphiuridae	8	60.0	16.7	18.9
Amphiodia urtica	1	20.0	2.1	4.7
Holothuroidea	2	40.0	4.2	5.7

Number of taxa= 63.

Mean number/sample: 121.4 Standard deviation (SD): 37.8
Mean number/m^2: 1265.0 SD/m^2: 393.9

H' = 4.61 SDV = 0.92 SR = 9.67 J' = 0.77

Appendix Table 3.--Continued.

Station: T-160	3 October 1988		Sample size: 4	
Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Nemertea	3	25.0	7.8	15.6
Eteone spp.	1	25.0	2.6	5.2
Eteone longa	1	25.0	2.6	5.2
Syllidae	1	25.0	2.6	5.2
Nephtys caecoides	14	100.0	36.5	30.1
Glycinde armigera	7	75.0	18.2	15.6
Onuphis iridescens	3	50.0	7.8	10.0
Lumbrineris bicirrata	2	50.0	5.2	6.0
Scoloplos armiger	1	25.0	2.6	5.2
Spiophanes bombyx	1	25.0	2.6	5.2
Spiophanes berkeleyorum	1	25.0	2.6	5.2
Magelona sacculata	4	50.0	10.4	12.0
Spiochaetopterus costarum	1	25.0	2.6	5.2
Chaetozone spinosa	4	25.0	10.4	20.8
Chone duneri	2	50.0	5.2	6.0
Gastropoda	1	25.0	2.6	5.2
Mitrella gouldi	13	75.0	33.9	26.1
Olivella baetica	37	100.0	96.4	115.5
Olivella pycna	16	75.0	41.7	38.0
Acila castrensis	1	25.0	2.6	5.2
Tellina carpenteri	5	50.0	13.0	15.6
Dentalium laqueatum	1	25.0	2.6	5.2
Cylindroleberididae	1	25.0	2.6	5.2
Bathyleberis grossmani	1	25.0	2.6	5.2
Philomedidae	3	75.0	7.8	5.2
Calanoida	1	25.0	2.6	5.2
Diastylopsis dawsoni	1	25.0	2.6	5.2
Tecticeps pugettensis	1	25.0	2.6	5.2
Ampelisca agassizi	2	25.0	5.2	10.4
Ampelisca careyi	2	50.0	5.2	6.0
Eohaustorius cf. brevicuspis	8	50.0	20.8	35.1
Eohaustorius sencillus	8	75.0	20.8	19.0
Photis californica	1	25.0	2.6	5.2
Anonyx adoxus	1	25.0	2.6	5.2
Wecomedon wecomus	2	50.0	5.2	6.0
Pachynus cf. barnardi	3	25.0	7.8	15.6
Monoculodes spinipes	1	25.0	2.6	5.2
Paraphoxus obtusidens	3	50.0	7.8	10.0
Rhepoxynius daboius	8	100.0	20.8	8.5
Rhepoxynius menziesi	26	75.0	67.7	49.2
Pagurus setosus	5	50.0	13.0	15.6
Amphiuridae	5	50.0	13.0	15.6

Appendix Table 3.--Continued.

Station: T-160	3 October 1988		Sample size: 4	
Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Amphiodia urtica	1	25.0	2.6	5.2

Number of taxa= 43.
Mean number/sample: 51.0 Standard deviation (SD): 9.8
Mean number/m^2: 531.4 SD/m^2: 102.4

H' = 4.45 SDV = 0.93 SR = 7.90 J' = 0.82

Appendix Table 3.--Continued.

Station: T-180	3 October 1988		Sample size: 5	
Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Nemertea	3	40.0	6.3	9.3
Polychaeta	1	20.0	2.1	4.7
Harmathoe spp.	1	20.0	2.1	4.7
Sigalion spp.	1	20.0	2.1	4.7
Anaitides groenlandica	1	20.0	2.1	4.7
Eteone spp.	1	20.0	2.1	4.7
Phyllodoce spp.	2	20.0	4.2	9.3
Syllis elongata	3	40.0	6.3	9.3
Nephtys caecoides	26	100.0	54.2	29.8
Glycinde armigera	10	80.0	20.8	14.7
Goniada brunnea	2	40.0	4.2	5.7
Onuphis iridescens	8	80.0	16.7	11.9
Scoloplos armiger	2	40.0	4.2	5.7
Scoloplos pugettensis	10	80.0	20.8	24.4
Laonice cirrata	1	20.0	2.1	4.7
Spio butleri	1	20.0	2.1	4.7
Spiophanes bombyx	4	60.0	8.3	8.7
Spiophanes berkeleyorum	17	40.0	35.4	54.9
Paraprionospio pinnata	2	40.0	4.2	5.7
Magelona longicornis	2	20.0	4.2	9.3
Magelona sacculata	1	20.0	2.1	4.7
Spiochaetopterus costarum	14	60.0	29.2	43.8
Chaetozone spinosa	8	60.0	16.7	18.9
Notomastus lineatus	1	20.0	2.1	4.7
Euclymene spp.	5	40.0	10.4	14.7
Owenia fusiformis	2	20.0	4.2	9.3
Chone duneri	1	20.0	2.1	4.7
Mitrella gouldi	33	100.0	68.8	44.0
Olivella baetica	39	100.0	81.3	25.9
Olivella pycna	30	100.0	62.5	56.1
Acila castrensis	7	60.0	14.6	14.0
Tellina carpenteri	3	40.0	6.3	9.3
Dentalium spp.	2	40.0	4.2	5.7
Ostracoda	2	20.0	4.2	9.3
Cylindroleberididae	1	20.0	2.1	4.7
Bathyleberis grossmani	2	40.0	4.2	5.7
Philomedidae	5	40.0	10.4	18.0
Nebalia pugettensis	1	20.0	2.1	4.7
Diastylis bidentata	2	40.0	4.2	5.7
Diastylopsis dawsoni	1	20.0	2.1	4.7
Colurostylis occidentalis	1	20.0	2.1	4.7
Ampelisca spp.	1	20.0	2.1	4.7

Appendix Table 3.--Continued.

Station: T-180 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Ampelisca agassizi	5	20.0	10.4	23.3
Ampelisca careyi	3	40.0	6.3	9.3
Aoroides spp.	1	20.0	2.1	4.7
Melita desdichada	4	20.0	8.3	18.6
Eohaustorius sencillus	5	80.0	10.4	7.4
Photis californica	3	40.0	6.3	9.3
Protomedeia spp.	1	20.0	2.1	4.7
Cheirimedia cf. *zotea*	3	20.0	6.3	14.0
Pachynus cf. *barnardi*	3	20.0	6.3	14.0
Paraphoxus obtusidens	2	20.0	4.2	9.3
Rhepoxynius daboius	33	120.0	68.8	9.3
Rhepoxynius menziesi	12	60.0	25.0	31.8
Caprella incisa	1	20.0	2.1	4.7
Decapoda spp.	1	20.0	2.1	4.7
Pagurus spp.	3	60.0	6.3	5.7
Cancer spp.	1	20.0	2.1	4.7
Ophiura lutkeni	1	20.0	2.1	4.7
Amphiodia urtica	3	40.0	6.3	9.3

Number of taxa= 60.

Mean number/sample: 69.0 Standard deviation (SD): 19.2
Mean number/m^2: 719.0 SD/m^2: 200.4

H' = 4.85 SDV = 0.94 SR = 10.10 J' = 0.82

Appendix Table 3.--Continued.

Station: T-200 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Nemertea	3	60.0	6.3	5.7
Polychaeta	2	40.0	4.2	5.7
Anaitides groenlandica	1	20.0	2.1	4.7
Eteone longa	3	40.0	6.3	9.3
Phyllodoce spp.	2	20.0	4.2	9.3
Nephtys caecoides	18	100.0	37.5	21.6
Glycinde armigera	9	80.0	18.8	15.5
Goniada brunnea	6	80.0	12.5	8.7
Onuphis iridescens	6	80.0	12.5	8.7
Lumbrineris spp.	2	40.0	4.2	5.7
Scoloplos pugettensis	11	80.0	22.9	18.6
Laonice cirrata	3	40.0	6.3	9.3
Spiophanes berkeleyorum	2	20.0	4.2	9.3
Paraprionospio pinnata	5	60.0	10.4	10.4
Prionospio lighti	2	20.0	4.2	9.3
Magelona longicornis	1	20.0	2.1	4.7
Magelona sacculata	6	80.0	12.5	8.7
Spiochaetopterus costarum	4	40.0	8.3	13.6
Chaetozone spinosa	2	20.0	4.2	9.3
Mediomastus spp.	1	20.0	2.1	4.7
Euclymene spp.	11	60.0	22.9	34.9
Myriochele oculata	3	40.0	6.3	9.3
Ampharete acutifrons	1	20.0	2.1	4.7
Pista cristata	1	20.0	2.1	4.7
Chone duneri	2	40.0	4.2	5.7
Mitrella gouldi	25	100.0	52.1	38.3
Olivella spp.	2	40.0	4.2	5.7
Olivella baetica	30	80.0	62.5	38.3
Olivella pycna	1	20.0	2.1	4.7
Kurtziella plumbea	1	20.0	2.1	4.7
Cylichna attanosa	1	20.0	2.1	4.7
Acila castrensis	133	100.0	277.2	136.2
Yoldia scissurata	4	60.0	8.3	8.7
Axinopsida serricata	1	20.0	2.1	4.7
Tellina carpenteri	1	20.0	2.1	4.7
Dentalium spp.	28	100.0	58.4	34.2
Ostracoda	3	20.0	6.3	14.0
Cylindroleberididae	1	20.0	2.1	4.7
Philomedidae	46	80.0	95.9	81.2
Calanoida	2	40.0	4.2	5.7
Nebalia pugettensis	3	40.0	6.3	9.3
Mysidacea	1	20.0	2.1	4.7

Appendix Table 3.--Continued.

Station: T-200 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Lamprops cf. *californica*	2	20.0	4.2	9.3
Diastylis bidentata	6	80.0	12.5	11.4
Diastylopsis dawsoni	1	20.0	2.1	4.7
Haliophasma geminata	1	20.0	2.1	4.7
Ampelisca agassizi	5	20.0	10.4	23.3
Ampelisca careyi	4	60.0	8.3	8.7
Aoroides spp.	1	20.0	2.1	4.7
Atylus tridens	1	20.0	2.1	4.7
Photis spp.	1	20.0	2.1	4.7
Photis californica	5	60.0	10.4	12.8
Anonyx liljeborgi	1	20.0	2.1	4.7
Orchomene spp.	2	40.0	4.2	5.7
Pachynus cf. *barnardi*	4	40.0	8.3	13.6
Westwoodilla caecula	1	20.0	2.1	4.7
Rhepoxynius daboius	49	100.0	102.1	52.8
Rhepoxynius menziesi	15	100.0	31.3	12.8
Hyperoche spp.	1	20.0	2.1	4.7
Pagurus setosus	3	40.0	6.3	9.3
Echiurus spp.	1	20.0	2.1	4.7
Ophiuroidea	1	20.0	2.1	4.7
Amphiuridae	2	40.0	4.2	5.7
Amphiodia spp.	2	40.0	4.2	5.7
Amphiodia urtica	4	60.0	8.3	8.7
Cyclopteridae	1	20.0	2.1	4.7

Number of taxa= 66.

Mean number/sample: 100.8 Standard deviation (SD): 21.3
Mean number/m^2: 1050.3 SD/m^2: 222.3

H' = 4.41 SDV = 0.90 SR = 10.45 J' = 0.73

Appendix Table 3.--Continued.

Station: T-220 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Nemertea	2	20.0	4.2	9.3
Harmothoe lunulata	2	20.0	4.2	9.3
Tenonia kitsapensis	1	20.0	2.1	4.7
Sigalion spp.	1	20.0	2.1	4.7
Anaitides groenlandica	4	60.0	8.3	8.7
Eteone longa	5	60.0	10.4	12.8
Phyllodoce spp.	1	20.0	2.1	4.7
Nereidae	1	20.0	2.1	4.7
Nephtys spp.	1	20.0	2.1	4.7
Nephtys caecoides	22	100.0	45.8	20.3
Nephtys assignis	1	20.0	2.1	4.7
Glycinde armigera	7	80.0	14.6	9.3
Goniada brunnea	8	100.0	16.7	9.3
Onuphis iridescens	1	20.0	2.1	4.7
Lumbrineris spp.	4	60.0	8.3	8.7
Lumbrineris bicirrata	1	20.0	2.1	4.7
Notocirrus californiensis	1	20.0	2.1	4.7
Scoloplos pugettensis	10	100.0	20.8	12.8
Laonice cirrata	4	60.0	8.3	8.7
Polydora brachycephala	3	40.0	6.3	9.3
Spiophanes berkeleyorum	2	20.0	4.2	9.3
Paraprionospio pinnata	4	60.0	8.3	8.7
Prionospio lighti	11	60.0	22.9	27.0
Magelona sacculata	1	20.0	2.1	4.7
Spiochaetopterus costarum	9	40.0	18.8	36.4
Chaetozone spinosa	1	20.0	2.1	4.7
Notomastus lineatus	3	40.0	6.3	9.3
Euclymene spp.	6	40.0	12.5	22.6
Euclymene zonalis	1	20.0	2.1	4.7
Myriochele oculata	2	20.0	4.2	9.3
Pista cristata	1	20.0	2.1	4.7
Polycirrus spp.	4	40.0	8.3	11.4
Chone duneri	5	60.0	10.4	10.4
Gastropoda	1	20.0	2.1	4.7
Lacuna variegata	46	20.0	95.9	214.4
Naticidae	1	20.0	2.1	4.7
Ocenebra spp.	4	40.0	8.3	11.4
Mitrella gouldi	15	40.0	31.3	64.2
Olivella baetica	25	80.0	52.1	42.3
Kurtziella plumbea	3	40.0	6.3	9.3
Acila castrensis	150	100.0	312.6	142.3
Yoldia scissurata	2	20.0	4.2	9.3

Appendix Table 3.--Continued.

Station: T-220 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Siliqua patula	1	20.0	2.1	4.7
Scaphopoda	1	20.0	2.1	4.7
Dentalium spp.	27	80.0	56.3	38.7
Cadulus spp.	6	20.0	12.5	28.0
Ostracoda	3	20.0	6.3	14.0
Philomedidae	38	80.0	79.2	59.2
Calanoida	2	40.0	4.2	5.7
Diastylis bidentata	2	20.0	4.2	9.3
Diastylopsis dawsoni	2	20.0	4.2	9.3
Synidotea angulata	2	20.0	4.2	9.3
Gammaridea	2	20.0	4.2	9.3
Ampelisca agassizi	2	40.0	4.2	5.7
Ampelisca careyi	5	40.0	10.4	14.7
Atylus tridens	1	20.0	2.1	4.7
Photis californica	1	20.0	2.1	4.7
Cheirimedia cf. *zotea*	2	20.0	4.2	9.3
Pachynus cf. *barnardi*	1	20.0	2.1	4.7
Westwoodilla caecula	1	20.0	2.1	4.7
Rhepoxynius daboius	62	100.0	129.2	44.0
Rhepoxynius menziesi	17	80.0	35.4	25.1
Pagurus setosus	2	20.0	4.2	9.3
Upogebia spp.	1	20.0	2.1	4.7
Pinnixa eburna	2	20.0	4.2	9.3
Ophiuroidea	2	20.0	4.2	9.3
Amphiodia urtica	4	60.0	8.3	8.7

Number of taxa= 67.

Mean number/sample: 113.2 Standard deviation (SD): 20.5
Mean number/m^2: 1179.5 SD/m^2: 213.7

H' = 4.39 SDV = 0.90 SR = 10.41 J' = 0.72

Appendix Table 3.--Continued.

Station: T-240	3 October 1988		Sample size: 5	
Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Nemertea	1	20.0	2.1	4.7
Lepidasthenia longicirrata	1	20.0	2.1	4.7
Pholoe minuta	4	40.0	8.3	11.4
Sigalion spp.	2	20.0	4.2	9.3
Anaitides groenlandica	4	60.0	8.3	8.7
Eteone longa	4	60.0	8.3	8.7
Nephtys caecoides	27	100.0	56.3	30.9
Glycinde armigera	5	60.0	10.4	10.4
Onuphis iridescens	1	20.0	2.1	4.7
Lumbrineris spp.	2	40.0	4.2	5.7
Lumbrineris bicirrata	1	20.0	2.1	4.7
Scoloplos pugettensis	5	60.0	10.4	10.4
Aricidea suecica	3	60.0	6.3	5.7
Aricidea pacifica	3	60.0	6.3	5.7
Polydora brachycephala	1	20.0	2.1	4.7
Spio butleri	1	20.0	2.1	4.7
Spiophanes berkeleyorum	1	20.0	2.1	4.7
Prionospio lighti	14	80.0	29.2	23.8
Magelona longicornis	3	40.0	6.3	9.3
Magelona sacculata	3	40.0	6.3	9.3
Spiochaetopterus costarum	9	60.0	18.8	22.6
Cirratulidae	2	20.0	4.2	9.3
Chaetozone spinosa	7	100.0	14.6	9.3
Travisia spp.	1	20.0	2.1	4.7
Mediomastus spp.	2	40.0	4.2	5.7
Decamastus gracilis	3	20.0	6.3	14.0
Barantolla americana	3	20.0	6.3	14.0
Euclymene spp.	4	40.0	8.3	11.4
Myriochele oculata	3	20.0	6.3	14.0
Pista cristata	1	20.0	2.1	4.7
Polycirrus spp.	3	40.0	6.3	9.3
Mitrella gouldi	1	20.0	2.1	4.7
Olivella baetica	12	100.0	25.0	17.4
Cylichna attanosa	3	40.0	6.3	9.3
Bivalvia	1	20.0	2.1	4.7
Acila castrensis	8	100.0	16.7	5.7
Nucula tenuis	2	20.0	4.2	9.3
Axinopsida serricata	4	60.0	8.3	8.7
Dentalium spp.	37	100.0	77.1	73.9
Ostracoda	2	20.0	4.2	9.3
Philomedidae	11	60.0	22.9	28.0
Nebalia pugettensis	1	20.0	2.1	4.7

Appendix Table 3.--Continued.

Station: T-240 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Lamprops cf. *californica*	1	20.0	2.1	4.7
Ampelisca macrocephala	3	20.0	6.3	14.0
Ampelisca careyi	1	20.0	2.1	4.7
Photis macinerneyi	1	20.0	2.1	4.7
Cheirimedia cf. *semilcarpa*	1	20.0	2.1	4.7
Anonyx spp.	1	20.0	2.1	4.7
Anonyx liljeborgi	1	20.0	2.1	4.7
Hippomedon spp.	2	20.0	4.2	9.3
Hippomedon propinquus	1	20.0	2.1	4.7
Pachynus cf. *barnardi*	1	20.0	2.1	4.7
Westwoodilla caecula	1	20.0	2.1	4.7
Rhepoxynius daboius	33	100.0	68.8	34.2
Rhepoxynius menziesi	6	80.0	12.5	8.7
Amphiodia spp.	1	20.0	2.1	4.7
Amphiodia urtica	3	40.0	6.3	9.3
Holothuroidea	1	20.0	2.1	4.7

Number of taxa= 58.

Mean number/sample: 52.8 Standard deviation (SD): 14.7
Mean number/m^2: 550.2 SD/m^2: 152.7

H' = 4.87 SDV = 0.94 SR = 10.22 J' = 0.83

Appendix Table 3.--Continued.

Station: TN-200 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Nemertea	4	60.0	8.3	8.7
Harmothoe lunulata	1	20.0	2.1	4.7
Lepidasthenia longicirrata	1	20.0	2.1	4.7
Pholoe minuta	1	20.0	2.1	4.7
Eteone spp.	1	20.0	2.1	4.7
Eteone longa	6	80.0	12.5	8.7
Phyllodoce spp.	4	40.0	8.3	13.6
Phyllodoce hartmanae	2	40.0	4.2	5.7
Micropodarke dubia	1	20.0	2.1	4.7
Nephtys caecoides	31	100.0	64.6	27.0
Glycinde armigera	20	80.0	41.7	43.6
Goniada brunnea	6	80.0	12.5	8.7
Onuphis iridescens	9	80.0	18.8	13.6
Lumbrineris spp.	5	60.0	10.4	12.8
Scoloplos pugettensis	11	80.0	22.9	13.6
Aricidea pacifica	2	20.0	4.2	9.3
Spio butleri	1	20.0	2.1	4.7
Spiophanes berkeleyorum	29	60.0	60.4	102.5
Paraprionospio pinnata	3	40.0	6.3	9.3
Scolelepsis foliosa	1	20.0	2.1	4.7
Prionospio lighti	10	60.0	20.8	24.4
Magelona longicornis	2	40.0	4.2	5.7
Magelona sacculata	6	60.0	12.5	13.6
Spiochaetopterus costarum	18	60.0	37.5	48.1
Tharyx multifilis	1	20.0	2.1	4.7
Chaetozone spinosa	4	40.0	8.3	11.4
Capitella capitata	1	20.0	2.1	4.7
Notomastus lineatus	1	20.0	2.1	4.7
Decamastus gracilis	1	20.0	2.1	4.7
Barantolla americana	1	20.0	2.1	4.7
Euclymene spp.	7	60.0	14.6	21.6
Euclymene zonalis	11	40.0	22.9	36.4
Owenia fusiformis	2	20.0	4.2	9.3
Myriochele oculata	1	20.0	2.1	4.7
Ampharete acutifrons	1	20.0	2.1	4.7
Pista cristata	1	20.0	2.1	4.7
Polycirrus spp.	1	20.0	2.1	4.7
Chone duneri	6	80.0	12.5	8.7
Lacuna carininata	3	40.0	6.3	9.3
Mitrella gouldi	11	100.0	22.9	11.4
Olivella spp.	2	20.0	4.2	9.3
Olivella baetica	22	80.0	45.8	42.1

Appendix Table 3.--Continued.

Station: TN-200 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Olivella pycna	10	60.0	20.8	20.8
Cylichna attanosa	1	20.0	2.1	4.7
Acila castrensis	83	100.0	173.0	40.8
Yoldia scissurata	1	20.0	2.1	4.7
Axinopsida serricata	2	20.0	4.2	9.3
Psephidia lordi	4	60.0	8.3	8.7
Pandora grandis	1	20.0	2.1	4.7
Dentalium spp.	10	80.0	20.8	16.5
Dentalium laqueatum	7	20.0	14.6	32.6
Cadulus spp.	1	20.0	2.1	4.7
Ostracoda	3	20.0	6.3	14.0
Cylindroleberididae	2	40.0	4.2	5.7
Bathyleberis grossmani	2	20.0	4.2	9.3
Philomedidae	39	80.0	81.3	101.4
Calanoida	1	20.0	2.1	4.7
Nebalia pugettensis	4	20.0	8.3	18.6
Diastylis bidentata	3	40.0	6.3	9.3
Diastylopsis dawsoni	2	40.0	4.2	5.7
Ampelisca agassizi	3	20.0	6.3	14.0
Ampelisca careyi	6	60.0	12.5	13.6
Aoroides spp.	1	20.0	2.1	4.7
Aorides seconda	10	20.0	20.8	46.6
Photis californica	2	40.0	4.2	5.7
Photis macinerneyi	1	20.0	2.1	4.7
Protomedeia spp.	3	20.0	6.3	14.0
Lysianassidae	1	20.0	2.1	4.7
Anonyx liljeborgi	1	20.0	2.1	4.7
Pachynus cf. *barnardi*	2	20.0	4.2	9.3
Monoculodes spinipes	1	20.0	2.1	4.7
Rhepoxynius daboius	69	100.0	143.8	57.7
Grandifoxus grandis	13	40.0	27.1	38.7
Scleroplax cf. *granulatus*	1	20.0	2.1	4.7
Amphiuridae	1	20.0	2.1	4.7
Amphiodia spp.	1	20.0	2.1	4.7
Amphiodia urtica	5	60.0	10.4	10.4

Appendix Table 3.--Continued.

Station: TN-200	3 October 1988	Sample size: 5

Number of taxa= 77.

Mean number/sample: 109.8 Standard deviation (SD): 49.8
Mean number/m^2: 1144.1 SD/m^2: 519.2

H' = 4.97 SDV = 0.94 SR = 12.05 J' = 0.79

Appendix Table 3.--Continued.

Station: TN-240 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Nemertea	2	40.0	4.2	5.7
Nematoda	1	20.0	2.1	4.7
Polynoidae	2	40.0	4.2	5.7
Harmothoe lunulata	1	20.0	2.1	4.7
Tenonia priops	2	40.0	4.2	5.7
Pholoe minuta	6	60.0	12.5	13.6
Sthenelais tertiaglabra	1	20.0	2.1	4.7
Sigalion spp.	3	40.0	6.3	9.3
Thalenessa spinosa	1	20.0	2.1	4.7
Anaitides groenlandica	7	60.0	14.6	15.8
Eteone longa	4	60.0	8.3	8.7
Paranaitis polynoides	1	20.0	2.1	4.7
Nephtys ferruginea	1	20.0	2.1	4.7
Nephtys caecoides	48	100.0	100.0	56.9
Nephtys assignis	1	20.0	2.1	4.7
Glycera spp.	1	20.0	2.1	4.7
Glycinde armigera	10	80.0	20.8	19.5
Onuphis iridescens	2	40.0	4.2	5.7
Lumbrineris spp.	2	40.0	4.2	5.7
Arabellidae	1	20.0	2.1	4.7
Haploscoloplos panamensis	7	100.0	14.6	5.7
Naineris uncinata	1	20.0	2.1	4.7
Paraonidae	1	20.0	2.1	4.7
Aricidea pacifica	15	160.0	31.3	14.7
Prionospio steenstrupi	1	20.0	2.1	4.7
Spio butleri	2	40.0	4.2	5.7
Spiophanes berkeleyorum	3	60.0	6.3	5.7
Paraprionospio pinnata	1	20.0	2.1	4.7
Prionospio lighti	15	80.0	31.3	19.5
Magelona longicornis	7	40.0	14.6	22.8
Magelona sacculata	2	40.0	4.2	5.7
Spiochaetopterus costarum	35	60.0	72.9	99.4
Tharyx multifilis	1	20.0	2.1	4.7
Chaetozone spinosa	27	80.0	56.3	63.6
Mediomastus spp.	2	40.0	4.2	5.7
Decamastus gracilis	7	80.0	14.6	11.9
Euclymene spp.	12	60.0	25.0	39.4
Myriochele oculata	17	40.0	35.4	51.9
Pectinaria californiensis	1	20.0	2.1	4.7
Ampharetidae	1	20.0	2.1	4.7
Terebellidae	2	40.0	4.2	5.7
Pista cristata	3	60.0	6.3	5.7

Appendix Table 3.--Continued.

Station: TN-240 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Polycirrus spp.	6	80.0	12.5	11.4
Sabellidae	1	20.0	2.1	4.7
Chone duneri	2	20.0	4.2	9.3
Mitrella gouldi	3	20.0	6.3	14.0
Olivella baetica	32	100.0	66.7	74.6
Olivella pycna	1	20.0	2.1	4.7
Cylichna attanosa	1	20.0	2.1	4.7
Acila castrensis	10	100.0	20.8	10.4
Yoldia scissurata	3	60.0	6.3	5.7
Mytilidae	1	20.0	2.1	4.7
Axinopsida serricata	6	60.0	12.5	13.6
Siliqua patula	1	20.0	2.1	4.7
Macoma modesta	2	40.0	4.2	5.7
Lyonsia californica	1	20.0	2.1	4.7
Scaphopoda	1	20.0	2.1	4.7
Dentalium spp.	31	100.0	64.6	51.8
Cadulus spp.	1	20.0	2.1	4.7
Ostracoda	8	40.0	16.7	24.0
Cylindroleberididae	1	20.0	2.1	4.7
Philomedidae	17	60.0	35.4	44.0
Nebalia pugettensis	1	20.0	2.1	4.7
Diastylopsis dawsoni	1	20.0	2.1	4.7
Tanaidacea	13	60.0	27.1	27.2
Leptognathia spp.	2	40.0	4.2	5.7
Ampelisca macrocephala	3	20.0	6.3	14.0
Ampelisca agassizi	1	20.0	2.1	4.7
Ampelisca careyi	5	40.0	10.4	18.0
Aoroides spp.	1	20.0	2.1	4.7
Aorides seconda	1	20.0	2.1	4.7
Atylus tridens	1	20.0	2.1	4.7
Melita spp.	1	20.0	2.1	4.7
Melita desdichada	17	20.0	35.4	79.2
Photis spp.	3	20.0	6.3	14.0
Photis macinerneyi	6	20.0	12.5	28.0
Photis parvidons	16	20.0	33.3	74.6
Protomedeia articulata	1	20.0	2.1	4.7
Anonyx spp.	1	20.0	2.1	4.7
Pachynus cf. *barnardi*	1	20.0	2.1	4.7
Monoculodes spinipes	2	40.0	4.2	5.7
Rhepoxynius daboius	43	100.0	89.6	18.9
Rhepoxynius menziesi	1	20.0	2.1	4.7
Stenothoidae	2	40.0	4.2	5.7

Appendix Table 3.--Continued.

Station: TN-240 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Pagurus spp.	1	20.0	2.1	4.7
Pagurus setosus	6	40.0	12.5	22.6
Cancer magister	1	20.0	2.1	4.7
Sipunculidae	1	20.0	2.1	4.7
Ophiura lutkeni	3	20.0	6.3	14.0
Amphiuridae	2	20.0	4.2	9.3
Amphiodia spp.	1	20.0	2.1	4.7
Amphiodia urtica	12	100.0	25.0	9.3
Holothuroidea	1	20.0	2.1	4.7

Number of taxa= 93.

Mean number/sample: 108.0 Standard deviation (SD): 29.3
Mean number/m^2: 1125.4 SD/m^2: 305.3

H' = 5.41 SDV = 0.96 SR = 14.62 J' = 0.83

Appendix Table 3.--Continued.

Station: TS-200 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Nemertea	5	40.0	10.4	18.0
Anaitides groenlandica	2	20.0	4.2	9.3
Eteone longa	5	40.0	10.4	14.7
Eteone fauchaldi	1	20.0	2.1	4.7
Phyllodoce spp.	1	20.0	2.1	4.7
Nephtys caecoides	27	100.0	56.3	38.0
Nephtys assignis	1	20.0	2.1	4.7
Glycinde armigera	6	40.0	12.5	22.6
Goniada brunnea	10	100.0	20.8	12.8
Onuphis iridescens	6	80.0	12.5	8.7
Lumbrineris spp.	4	60.0	8.3	8.7
Scoloplos pugettensis	3	60.0	6.3	5.7
Aricidea suecica	1	20.0	2.1	4.7
Laonice cirrata	11	80.0	22.9	28.9
Spiophanes berkeleyorum	13	20.0	27.1	60.6
Paraprionospio pinnata	4	60.0	8.3	8.7
Prionospio lighti	7	60.0	14.6	17.4
Magelona longicornis	1	20.0	2.1	4.7
Magelona sacculata	8	80.0	16.7	15.8
Spiochaetopterus costarum	12	60.0	25.0	44.6
Chaetozone spinosa	3	20.0	6.3	14.0
Decamastus gracilis	1	20.0	2.1	4.7
Maldanidae	1	20.0	2.1	4.7
Euclymene spp.	19	60.0	39.6	61.8
Myriochele oculata	2	20.0	4.2	9.3
Chone duneri	5	80.0	10.4	7.4
Epitonium indianorum	1	20.0	2.1	4.7
Ocenebra spp.	4	40.0	8.3	13.6
Mitrella gouldi	47	100.0	97.9	40.1
Nassarius mendicus	1	20.0	2.1	4.7
Olivella baetica	60	100.0	125.0	98.0
Turbonilla spp.	2	40.0	4.2	5.7
Cylichna attanosa	1	20.0	2.1	4.7
Bivalvia	1	20.0	2.1	4.7
Acila castrensis	207	100.0	431.4	207.4
Nucula tenuis	1	20.0	2.1	4.7
Yoldia scissurata	4	60.0	8.3	8.7
Mytilidae	2	40.0	4.2	5.7
Axinopsida serricata	1	20.0	2.1	4.7
Dentalium spp.	6	80.0	12.5	8.7
Ostracoda	7	20.0	14.6	32.6

Appendix Table 3.--Continued.

Station: TS-200 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Bathyleberis grossmani	1	20.0	2.1	4.7
Philomedidae	21	40.0	43.8	62.7
Euphilomedes carcharodonta	16	40.0	33.3	46.2
Calanoida	1	20.0	2.1	4.7
Lamprops cf. *californica*	1	20.0	2.1	4.7
Hemilamprops californica	1	20.0	2.1	4.7
Diastylis bidentata	2	40.0	4.2	5.7
Diastylopsis dawsoni	2	40.0	4.2	5.7
Haliophasma geminata	1	20.0	2.1	4.7
Ampelisca spp.	2	20.0	4.2	9.3
Ampelisca agassizi	4	40.0	8.3	11.4
Ampelisca careyi	2	40.0	4.2	5.7
Photis californica	3	40.0	6.3	9.3
Photis macinerneyi	2	20.0	4.2	9.3
Cheirimedia cf. *zotea*	2	20.0	4.2	9.3
Cheirimedia cf. *semilcarpa*	1	20.0	2.1	4.7
Ischyrocerus spp.	1	20.0	2.1	4.7
Anonyx liljeborgi	5	20.0	10.4	23.3
Pachynus cf. *barnardi*	2	40.0	4.2	5.7
Monoculodes spinipes	1	20.0	2.1	4.7
Rhepoxynius daboius	88	100.0	183.4	50.3
Rhepoxynius menziesi	16	100.0	33.3	20.0
Dulichia spp.	1	20.0	2.1	4.7
Paguridae	1	20.0	2.1	4.7
Pagurus spp.	2	20.0	4.2	9.3
Pinnixa eburna	2	40.0	4.2	5.7
Ophiuroidea	3	40.0	6.3	9.3
Ophiura lutkeni	1	20.0	2.1	4.7

Number of taxa= 69.

Mean number/sample: 137.8 Standard deviation (SD): 44.3
Mean number/m^2: 1435.9 SD/m^2: 461.9

H' = 4.19 SDV = 0.87 SR = 10.41 J' = 0.69

Appendix Table 3.--Continued.

Station: TS-240 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m²	Standard deviation /m²
Nemertea	3	40.0	6.3	9.3
Harmothoe lunulata	1	20.0	2.1	4.7
Lepidasthenia longicirrata	1	20.0	2.1	4.7
Pholoe minuta	1	20.0	2.1	4.7
Sigalion spp.	2	40.0	4.2	5.7
Anaitides groenlandica	5	80.0	10.4	7.4
Eteone longa	2	40.0	4.2	5.7
Parandalia fauveli	3	40.0	6.3	9.3
Nephtys caecoides	20	100.0	41.7	29.5
Glycinde armigera	2	40.0	4.2	5.7
Goniada brunnea	1	20.0	2.1	4.7
Onuphis iridescens	2	20.0	4.2	9.3
Lumbrineris spp.	1	20.0	2.1	4.7
Lumbrineris bicirrata	1	20.0	2.1	4.7
Scoloplos pugettensis	3	60.0	6.3	5.7
Aricidea pacifica	3	60.0	6.3	5.7
Paraprionospio pinnata	1	20.0	2.1	4.7
Prionospio lighti	1	20.0	2.1	4.7
Magelona longicornis	3	60.0	6.3	5.7
Spiochaetopterus costarum	5	40.0	10.4	18.0
Chaetozone spinosa	2	40.0	4.2	5.7
Decamastus gracilis	1	20.0	2.1	4.7
Owenia fusiformis	1	20.0	2.1	4.7
Myriochele oculata	1	20.0	2.1	4.7
Pista cristata	1	20.0	2.1	4.7
Mitrella gouldi	27	80.0	56.3	56.9
Olivella baetica	22	100.0	45.8	28.2
Cylichna attanosa	2	20.0	4.2	9.3
Bivalvia	1	20.0	2.1	4.7
Acila castrensis	5	40.0	10.4	18.0
Axinopsida serricata	5	60.0	10.4	12.8
Dentalium spp.	16	100.0	33.3	22.6
Cadulus spp.	1	20.0	2.1	4.7
Ostracoda	1	20.0	2.1	4.7
Philomedidae	8	40.0	16.7	27.2
Euphilomedes carcharodonta	1	20.0	2.1	4.7
Diastylopsis dawsoni	1	20.0	2.1	4.7
Tanaidacea	2	40.0	4.2	5.7
Leptognathia spp.	1	20.0	2.1	4.7
Haliophasma geminata	1	20.0	2.1	4.7
Ampelisca careyi	3	20.0	6.3	14.0
Eohaustorius cf. *brevicuspis*	1	20.0	2.1	4.7

Appendix Table 3.--Continued.

Station: TS-240 3 October 1988 Sample size: 5

Taxa	Total number	Frequency occurrence (%)	Mean number /m^2	Standard deviation /m^2
Photis californica	2	40.0	4.2	5.7
Hippomedon spp.	2	40.0	4.2	5.7
Hippomedon propinquus	2	40.0	4.2	5.7
Pachynus cf. *barnardi*	2	40.0	4.2	5.7
Synchelidium shoemakeri	1	20.0	2.1	4.7
Westwoodilla caecula	1	20.0	2.1	4.7
Rhepoxynius daboius	23	80.0	47.9	63.6
Rhepoxynius menziesi	6	60.0	12.5	13.6
Sympleustes sp.	1	20.0	2.1	4.7
Paguridae	1	20.0	2.1	4.7
Pagurus spp.	1	20.0	2.1	4.7
Upogebia spp.	1	20.0	2.1	4.7
Pinnixa eburna	3	40.0	6.3	9.3
Amphiuridae	2	40.0	4.2	5.7
Amphiodia urtica	1	20.0	2.1	4.7

Number of taxa= 57.

Mean number/sample: 42.8 Standard deviation (SD): 24.7
Mean number/m^2: 446.0 SD/m^2: 257.8

H' = 4.82 SDV = 0.94 SR = 10.44 J' = 0.83

Appendix Table 4.--Invertebrate and fish taxa captured off Tillamook Bay, Oregon, 28 September to 3 October 1988.

Taxa Captured in Box Corer

Cnidaria
Anthozoa
Cerianthidae
Pachycerianthus fimbriatus

Platyhelmenthes
Polycladida

Nemertea
Paleonemertea

Nematoda

Annelida
Polychaeta
Polynoidae
Harmothoe spp.
Harmothoe lunulata
Lepidasthenia longicirrata
Tenonia kitsapensis
Tenonia priops
Sigalionidae
Pholoe minuta
Sthenelais tertiaglabra
Sigalion spp.
Thalenessa spinosa
Phyllodocidae
Phyllodoce groenlandica
Eteone spp.
Eteone longa
Eteone fauchaldi
Paranaitis polynoides
Phyllodoce spp.
Phyllodoce hartmanae
Hesionidae
Gyptis brevipalpa
Micropodarke dubia
Heteropodarke heteromorpha
Parandalia fauveli
Syllidae
Syllis gracilis
Syllis elongata
Nereidae
Nephtyidea

Appendix Table 4.--Continued.

Nephtys spp.
Nephtys ferruginea
Nephtys caecoides
Nephtys assignis
Glyceridae
Glycera spp.
Glycinde armigera
Goniada brunnea
Onuphidae
Onuphis spp.
Onuphis iridescens
Lumbrineridae
Lumbrineris spp.
Lumbrineris bicirrata
Arabellidae
Notocirrus californiensis
Dorvilleidae
Ophryotrocha spp.
Orbiniidae
Leitoscoloplos panamensis
Leitoscoloplos pugettensis
Naineris uncinata
Scoloplos spp.
Scoloplos armiger
Paraonidae
Aricidea suecica
Aricidea pacifica
Spionidae
Laonice cirrata
Polydora brachycephala
Prionospio steenstrupi
Prionospio lighti
Spio butleri
Spiophanes spp.
Spiophanes bombyx
Spiophanes berkeleyeorum
Paraprionospio pinnata
Scolelepis foliosa
Magelonidae
Magelona longicornis
Magelona sacculata
Chaetopteridae
Spiochaetopterus costarum
Cirratulidae
Tharyx multifilis
Chaetozone spinosa
Opheliidae
Armandia brevis
Ophelia spp.
Travisia spp.
Capitellidae
Capitella capitata

Appendix Table 4.--Continued.

Notomastus lineatus
Mediomastus spp.
Decamastus gracilis
Barantolla americana
Maldanidae
Euclymenenae spp.
Euclymene zonalis
Oweniidae
Owenia fusiformis
Myriochele oculata
Pectinariidae
Pectinaria californiensis
Ampharetidae
Ampharete acutifrons
Terebellidae
Pista cristata
Polycirrus spp.
Sabellidae
Chone duneri

Mollusca
Gastropoda
Lacunidae
Lacuna carinata
Lacuna variegata
Epitoniidae
Epitonium indianorum
Naticidae
Muricidae
Ocenebra spp.
Mitrella gouldi
Nassaridae
Nassarius mendicus
Olividae
Olivella spp.
Olivella baetica
Olivella pycna
Turridae
Kurtziella pulmbae
Pyramidellidae
Turbonilla spp.
Scaphandridae
Cylichna attonsa
Chromodorididae
Cadulus sp.

Pelecypoda
Nuculidae
Acila castrensis
Nucula tenuis
Nuculanidae
Yoldia scissurata

Mytilidae
Thyasiridae
Axinopsida serricata
Solenidae
Siliqua spp.
Siliqua cf. *patula*
Tellinidae
Macoma spp.
Macoma moesta alaskana
Tellina carpenteri
Veneridae
Psephidia lordi
Pandoridae
Pandora grandis
Lyonsiidae
Lyonsia californica

Scaphopoda
Dentaliidae
Dentalium spp.
Dentalium rectius

Arthropoda
Ostracoda
Cylindroleberididae
Bathyleberis hancocki
Philomedidae
Euphilomedes carcharodonta

Copepoda
Calanoida

Cirripedia
Balanidae
Balanus spp.

Rhizocephala
Nebaliidae
Nebalia pugettensis

Mysidacea
Mysidae
Archaeomysis grebnitzkii

Cumacea
Lampropidae
Lamprops cf. *californica*
Hemilamprops cf. *californica*
Diastylidae
Diastylis bidentata
Diastylopsis dawsoni
Anchicolurus occidentalis

Appendix Table 4.--Continued.

Tanaidacea
Paratanaidae
Leptognathia spp.

Isopoda
Anthuridae
Haliophasma geminata
Spaeromatidae
Tecticeps pugettensis
Idoteidae
Synidotea cf. *angulata*

Amphipoda
Gammaridea
Ampeliscidae
Ampelisca spp.
Ampelisca macrocephala
Ampelisca agassizi
Ampelisca cf. *caryi*
Aoridae
Aoroides spp.
Aoroides cf. *seconda*
Atylidae
Atylus tridens
Corophiidae
Corophium spinicorne
Gammaridae
Melita spp.
Melita desdichada
Haustoridae
Eohaustorius estuarius
Eohaustorius cf. *brevicuspis*
Eohaustorius sencillus
Isaedae
Isaeidae sp.
Photis sp.
Photis cf. *californica*
Photis macinerneyi
Photis parvidons
Protomedeia spp.
Protomedeia articulata
Cheirimediea cf. *zotea*
Cheirimediea cf. *similicarpa*
Ischyroceridae
Ischyrocerus spp.
Lysianassidae
Anonyx spp.
Anonyx lilljeborgi
Anonyx adoxus
Hippomedon spp.
Hippomedon cf. *propinquus*

Hippomedon weyes
Orchomene spp.
Pachynus cf. *barnardi*
Wecomedon wecomus
Oedicerotidae
Monoculodes spinipes
Synchelidium shoemakeri
Westwoodilla caecula
Phoxocephalidae
Foxiphalus obtusidens
Mandibulophoxus unicirostratus
Rhepoxynius spp.
Rhepoxynius dabouis
Rhepoxynius vigitegus
Rhepoxynius cf. *menziesi*
Grandifoxus grandis
Pleustidae
Sympleustes sp.
Podoceridae
Dulichia spp.
Stenothoidae
Synopiidae
Tiron biocellata

Hyperiidea
Hyperiidae
Hyperoche sp.

Caprellidea
Caprellidae
Caprella incisa

Decapoda
Anomura
Callianassidae
Upogebia spp.
Paguridae
Pagurus spp.
Pagurus cf. *setosus*

Brachyura
Cancridae
Cancer spp.
Cancer magister
Pinnotheridae
Pinnixa cf. *eburna*
Grapsidae
Scleroplax cf. *granulata*

Onychophora
Sipuncula
Sipunculidae

Appendix Table 4.--Continued.

Echiura
Echiuridae
Echiurus spp.

Phoronida
Phoronidae
Phoronis spp.

Brachiopoda
Ophiuroidea
Ophiuridae
Ophiura lutkeni
Amphiuridae
Amphiodia spp.
Amphiodia urtica

Holothuroidea

Gnathostomata
Cyclopteridae (lumpfishes and snailfishes)

Taxa Captered by Trawl

Rajidae	
Raja kincaidii	Sandpaper skate
Chimaeridae	
Hydrolagus colliei	Spotted ratfish
Gadidae	
Microgadus proximus	Pacific tomcod
Embiotocidae	
Cymatogaster aggregata	Shiner perch
Gobiidae	
Unidentified goby	
Hexagrammidae	
Ophiodon elongatus	Lingcod
Cottidae	
Leptocottus armatus	Pacific staghorn sculpin
Agonidae	
Unidentified poacher	

Agonus acipenserinus	Sturgeon poacher
Bathyagonus alascanus	Gray starsnout poacher
Cyclopteridae	
Liparis pulchellus	Showy snailfish
Unidentified snailfish	
Bothidae	
Citharichthys sordidus	Pacific sanddab
Citharichthys stigmaeus	Speckled sanddab
Pleuronectidae	
Eopsetta jordani	Petrale sole
Glyptocephalus zachirus	Rex sole
Lyopsetta exilis	Slender sole
Atheresthes stomias	Arrowtooth flounder
Microstomus pacificus	Dover sole
Parophrys vetulus	English sole
Crustacea	
Decapoda Nantia	
Caridea	
Crangonidae	
Crangon alaskensis	Northern crangon shrimp
Decapoda Reptantia	
Brachyura	
Cancridae	
Cancer magister	Dungeness crab
Cancer productus	Red rock crab

Appendix Table 5.--Sediment characteristics at 12 benthic stations off Tillamook Bay, Oregon, 3 October 1988.

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: T-115

DATE : 3-Oct-88
DEPTH : 35 meters
METHOD : Gray-O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	100.0	0.0	
0.5	35	1	99.7	0.3	0.3 % Coarse sand
0.25	60	2	96.2	3.5	3.5 % Medium sand
0.125	120	3	14.8	81.4	
0.063	230	4	0.6	14.2	95.6 % Fine sand
<0.063	<230			0.6	0.6 % Silt/clay
					1.1 % Organics

0.0 % Gravel
99.4 % Sand
0.6 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: T-120

DATE : 3-Oct-88
DEPTH : 37 meters
METHOD : Gray O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	100.0	0.0	
0.5	35	1	99.7	0.3	0.3 % Coarse sand
0.25	60	2	95.7	4.0	4.0 % Medium sand
0.125	120	3	13.8	81.9	
0.063	230	4	0.5	13.3	95.2 % Fine sand
<0.063	<230			0.5	0.5 % Silt/clay
					0.9 % Organics

0.0 % Gravel
99.5 % Sand
0.5 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: T-140

DATE : 3-Oct-88
DEPTH : 43 meters
METHOD : Gray-O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	100.0	0.0	
0.5	35	1	99.7	0.3	0.3 % Coarse sand
0.25	60	2	97.3	2.4	2.4 % Medium sand
0.125	120	3	24.2	73.1	
0.063	230	4	0.8	23.4	96.5 % Fine sand
<0.063	<230			0.8	0.8 % Silt/clay
					1.1 % Organics

0.0 % Gravel
99.2 % Sand
0.8 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: T-160

DATE : 3-Oct-88
DEPTH : 49 meters
METHOD : Gray O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	100.0	0.0	
0.5	35	1	99.5	0.5	0.5 % Coarse sand
0.25	60	2	91.2	8.3	8.3 % Medium sand
0.125	120	3	21.3	69.9	
0.063	230	4	0.4	20.9	90.8 % Fine sand
<0.063	<230			0.4	0.4 % Silt/clay
					0.5 % Organics

0.0 % Gravel
99.6 % Sand
0.4 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: T-180

DATE : 3-Oct-88
DEPTH : 55 meters
METHOD : Gray-O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	100.0	0.0	
0.5	35	1	99.8	0.2	0.2 % Coarse sand
0.25	60	2	95.4	4.4	4.4 % Medium sand
0.125	120	3	17.1	78.3	
0.063	230	4	0.9	16.2	94.5 % Fine sand
<0.063	<230			0.9	0.9 % Silt/clay
					0.7 % Organics

0.0 % Gravel
99.1 % Sand
0.9 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: T-200

DATE : 3-Oct-88
DEPTH : 61 meters
METHOD : Gray O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	99.9	0.1	0.1 % Fine gravel
1	18	0	99.8	0.1	
0.5	35	1	98.8	1.0	1.1 % Coarse sand
0.25	60	2	93.9	4.9	4.9 % Medium sand
0.125	120	3	14.4	79.5	
0.063	230	4	0.9	13.5	93.0 % Fine sand
<0.063	<230			0.9	0.9 % Silt/clay
					1.2 % Organics

0.1 % Gravel
99.0 % Sand
0.9 % Fines

Appendix Table 5. Continued.

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: T-220

DATE : 3-Oct-88
DEPTH : 67 meters
METHOD : Gray-O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	99.9	0.1	
0.5	35	1	98.9	1.0	1.1 % Coarse sand
0.25	60	2	94.1	4.8	4.8 % Medium sand
0.125	120	3	18.6	75.5	
0.063	230	4	1.1	17.5	93.0 % Fine sand
<0.063	<230			1.1	1.1 % Silt/clay
					1.1 % Organics

0.0 % Gravel
98.9 % Sand
1.1 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: TN-200

DATE : 3-Oct-88
DEPTH : 61 meters
METHOD : Gray-O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	99.7	0.3	0.3 % Fine gravel
1	18	0	99.1	0.6	
0.5	35	1	92.3	6.8	7.4 % Coarse sand
0.25	60	2	18.3	74.0	74.0 % Medium sand
0.125	120	3	0.9	17.4	
0.063	230	4	0.3	0.6	18.0 % Fine sand
<0.063	<230			0.3	0.3 % Silt/clay
					1.2 % Organics

0.3 % Gravel
99.4 % Sand
0.3 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: TS-200

DATE : 3-Oct-88
DEPTH : 61 meters
METHOD : Gray-O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	100.0	0.0	
0.5	35	1	99.8	0.2	0.2 % Coarse sand
0.25	60	2	95.3	4.5	4.5 % Medium sand
0.125	120	3	13.8	81.5	
0.063	230	4	0.9	12.9	94.4 % Fine sand
<0.063	<230			0.9	0.9 % Silt/clay
					1.1 % Organics

0.0 % Gravel
99.1 % Sand
0.9 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: T-240

DATE : 3-Oct-88
DEPTH : 73 meters
METHOD : Gray O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	100.0	0.0	
0.5	35	1	98.3	1.7	1.7 % Coarse sand
0.25	60	2	90.4	7.9	7.9 % Medium sand
0.125	120	3	15.5	74.9	
0.063	230	4	3.1	12.4	87.3 % Fine sand
<0.063	<230			3.1	3.1 % Silt/clay
					1.6 % Organics

0.0 % Gravel
96.9 % Sand
3.1 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: TN-240

DATE : 3-Oct-88
DEPTH : 73 meters
METHOD : Gray O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	99.9	0.1	
0.5	35	1	99.1	0.8	0.9 % Coarse sand
0.25	60	2	92.4	6.7	6.7 % Medium sand
0.125	120	3	14.2	78.2	
0.063	230	4	1.7	12.5	90.7 % Fine sand
<0.063	<230			1.7	1.7 % Silt/clay
					1.2 % Organics

0.0 % Gravel
98.3 % Sand
1.7 % Fines

SYSTEM : Tillamook
PROJECT : HM-716
STATION #: TS-240

DATE : 3-Oct-88
DEPTH : 73 meters
METHOD : Gray O'Hara

Size mm	U.S. sieve pan #	Phi	Percent finer	Percent retained	Percent by size Classification
64	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16	5/8 in	-4	100.0	0.0	
8	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4	No. 5	-2	100.0	0.0	
2	10	-1	100.0	0.0	0.0 % Fine gravel
1	18	0	100.0	0.0	
0.5	35	1	99.7	0.3	0.3 % Coarse sand
0.25	60	2	96.5	3.2	3.2 % Medium sand
0.125	120	3	21.5	75.0	
0.063	230	4	1.9	19.6	94.6 % Fine sand
<0.063	<230			1.9	1.9 % Silt/clay
					1.4 % Organics

0.0 % Gravel
98.1 % Sand
1.9 % Fines

Appendix Table 6. --Summary of 8-m trawl effort at eight stations off Tillamook Bay, Oregon, 28-29 September 1988.

STATION:T110
Gear: 8-m Trawl
Date: 28 Sep 1988
Depth: 110.0 ft
Distance traveled: 870 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Spotted ratfish	7	3583	16	8237
Pacific tomcod	1	3	2	7
Speckled sanddab	1	100	2	230
English sole	4	245	9	563
TOTALS	13	3931	29	9037

H'=1.57 SDV=0.60 SR=1.17 J'=0.79

STATION:T180
Gear: 8-m Trawl
Date: 28 Sep 1988
Depth: 180.0 ft
Distance traveled: 685 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Unidentified goby	1	1	3	3
Speckled sanddab	3	54	9	158
Dungeness crab	1	1	3	3
Crangon alaskensis	1	1	3	3
TOTALS	6	57	18	167

H'=1.79 SDV=0.67 SR=1.67 J'=0.90

STATION:T200
Gear: 8-m Trawl
Date: 28 Sep 1988
Depth: 200.0 ft
Distance traveled: 556 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Pacific sanddab	9	102	32	367
Speckled sanddab	28	1918	101	6899
Petrale sole	3	336	11	1209
Rex sole	2	197	7	709
Arrowtooth flounder	1	29	4	104
English sole	9	931	32	3349
Dover sole	1	104	4	374
Dungeness crab	8	8	29	29
Crangon alaskensis	25	28	90	101
TOTALS	86	3653	310	13141

H'=2.49 SDV=0.78 SR=1.80 J'=0.79

STATION:T220
Gear: 8-m Trawl
Date: 28 Sep 1988
Depth: 220.0 ft
Distance traveled: 630 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Unidentified goby	1	1	3	3
Red rock crab	1	1	3	3
TOTALS	2	2	6	6

H'=1.00 SDV=0.50 SR=1.44 J'=1.00

STATION:TN220
Gear: 8-m Trawl
Date: 28 Sep 1988
Depth: 220.0 ft
Distance traveled: 463 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Sandpaper skate	1	900	4	3888
Pacific tomcod	1	4	4	17
Pacific staghorn sculpin	2	78	9	337
Unidentified poacher	2	7	9	30
Sturgeon poacher	4	51	17	220
Gray starsnout poacher	2	5	9	22
Showy snailfish	1	8	4	35
Pacific sanddab	35	181	151	782
Speckled sanddab	55	2649	238	11443
Petrale sole	4	527	17	2276
Rex sole	7	310	30	1339
Arrowtooth flounder	6	197	26	851
English sole	3	399	13	1724
Dover sole	5	199	22	860
Dungeness crab	1	930	4	4017
Crangon alaskensis	47	38	203	164
TOTALS	176	6483	760	28005

H'=2.73 SDV=0.79 SR=2.90 J'=0.68

STATION:TN200
Gear: 8-m Trawl
Date: 28 Sep 1988
Depth: 200.0 ft
Distance traveled: 574 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Shiner perch	1	23	3	80
Lingcod	1	98	3	341
Pacific staghorn sculpin	1	3	3	10
Unidentified poacher	2	5	7	17
Sturgeon poacher	2	9	7	31
Gray starsnout poacher	1	2	3	7
Pacific sanddab	76	478	265	1666
Speckled sanddab	52	4134	181	14404
Petrale sole	7	79	24	275
Rex sole	24	2421	84	8436
Slender sole	17	31	59	108
Arrowtooth flounder	13	212	45	739
English sole	13	1074	45	3742
Dover sole	4	555	14	1934
Crangon alaskensis	112	121	390	422
TOTALS	326	9245	1133	32212

H'=2.70 SDV=0.79 SR=2.42 J'=0.69

STATION:TS220
Gear: 8-m Trawl
Date: 29 Sep 1988
Depth: 220.0 ft
Distance traveled: 389 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Spotted ratfish	1	298	5	1532
Lingcod	2	130	10	668
Sturgeon poacher	1	3	5	15
Gray starsnout poacher	5	10	26	51
Showy snailfish	4	6	21	31
Unidentified snailfish	1	1	5	5
Pacific sanddab	7	92	36	473
Speckled sanddab	45	0	231	0
Petrale sole	1	218	5	1121
Rex sole	26	71	134	365
Slender sole	13	273	67	1404
English sole	13	721	67	3707
Dover sole	3	209	15	1075
Dungeness crab	4	2434	21	12514
Crangon alaskensis	32	36	165	185
TOTALS	158	4502	813	23146

H'=3.00 SDV=0.83 SR=2.77 J'=0.77

STATION:TS200
Gear: 8-m Trawl
Date: 29 Sep 1988
Depth: 200.0 ft
Distance traveled: 537 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Sandpaper skate	1	801	4	2983
Pacific tomcod	2	10	7	37
Shiner perch	2	29	7	108
Gray starsnout poacher	3	6	11	22
Pacific sanddab	79	2580	294	9609
Speckled sanddab	2	23	7	86
Rex sole	19	1931	71	7192
Slender sole	7	181	26	674
English sole	18	1100	67	4097
Dover sole	9	568	34	2115
Dungeness crab	2	3	7	11
Crangon alaskensis	106	123	395	458
TOTALS	250	7355	930	27392

H'=2.25 SDV=0.71 SR=1.99 J'=0.63