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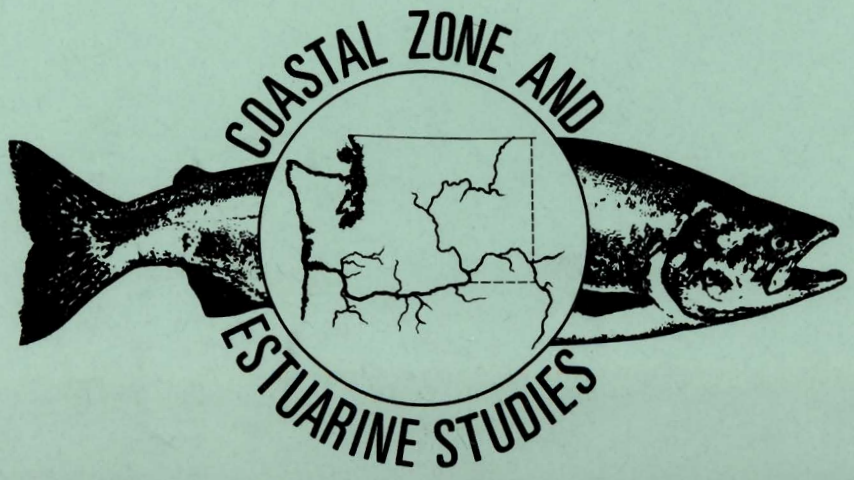

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Final Report of Research
financed by
Portland District
U.S. Army Corps of Engineers
Contract DACW57-85-F-0210

and

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

March 1987

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INTRODUCTION

In July 1984, the Habitat Investigations Task of the National Marine Fisheries Service (NMFS) entered into a cooperative agreement with the Planning Division of the U.S. Army Corps of Engineers (COE) Portland District to study the fish and benthic invertebrate communities of four offshore (Oregon) interim dredge disposal sites. This information was needed by the COE to obtain final designation of the interim disposal sites by the Environmental Protection Agency (EPA).

Benthic invertebrate communities are commonly monitored during environmental assessment surveys. Benthic invertebrates are useful indicators of environmental conditions because: (1) they are in contact with dredge materials; (2) being relatively immobile, they are either transported or buried by materials; and (3) they provide a critical link in the food chain (Morton 1977).

Bottom trawl surveys (fishes and crabs) at dredge sites can be important in identifying what species use an area and determining if the areas are migration routes or spawning, rearing, or feeding sites. However, dredging effects on fishes and crabs are difficult to quantify because of the animals' mobility, contagious distribution, and ability to avoid disturbed habitats.

Combined benthic invertebrate, fish, and crab surveys are useful in identifying both the community structure and diversity of the benthic community and in distinguishing possible food web linkages between the infauna and the vagile epifauna (fishes and crabs).

The four ocean interim disposal areas surveyed off the Oregon coast were in coastal areas near Tillamook and Depoe Bays and the Siuslaw and Umpqua Rivers (Fig. 1). Two benthic invertebrate and bottom trawl surveys were done; Survey 1 (September-October 1984) and Survey 2 (January 1985).

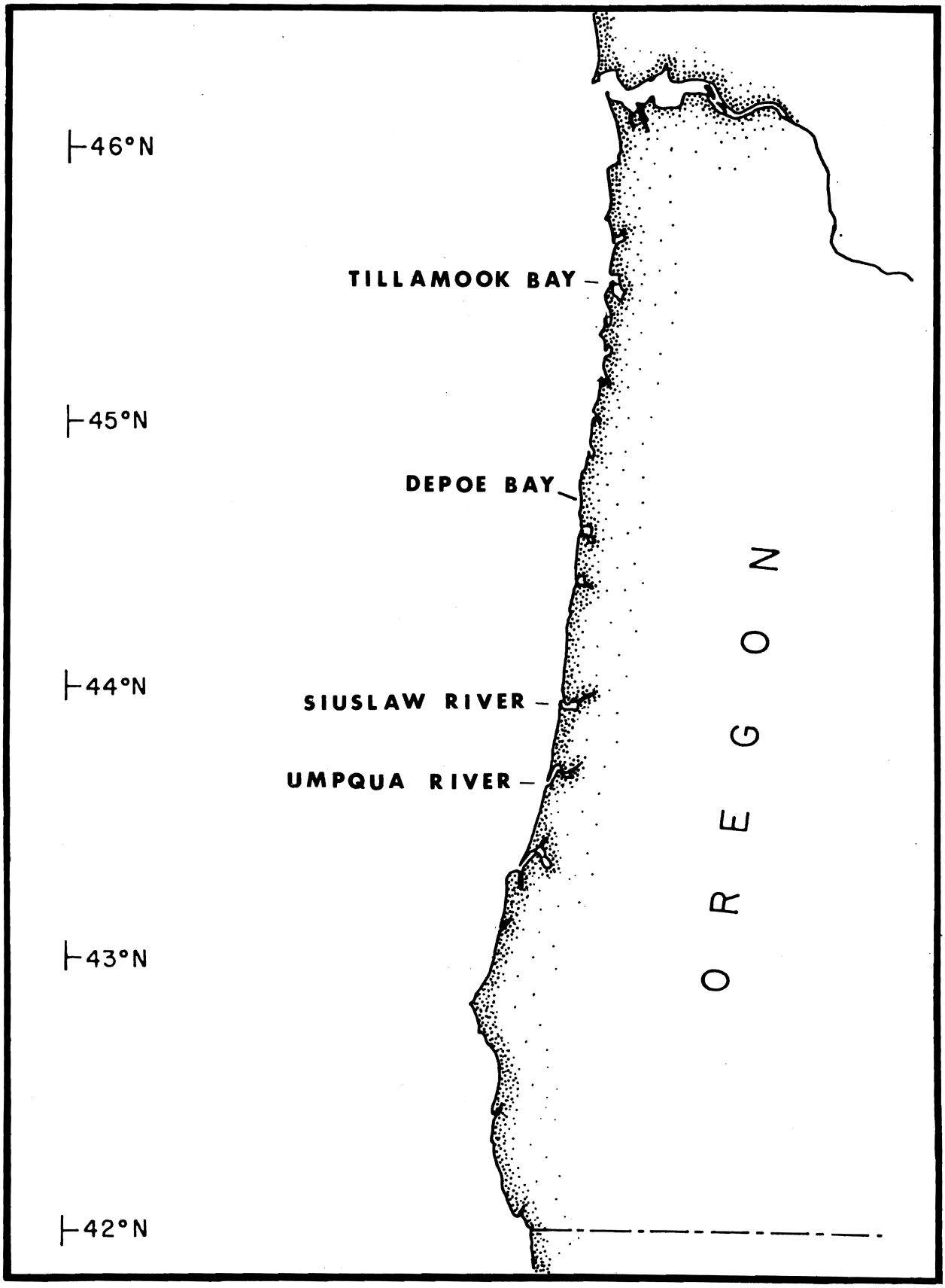

Figure 1.--Locations of the four interim dredge disposal areas along the Oregon Coast.

METHODS

Trawling (Fishes and Crabs)

Bottom trawling was done with an 8-m semiballoon shrimp trawl that had an 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 generally 10 min in duration and was made along the appropriate depth contour. Position fixes were determined using Loran-C navigational equipment (see Appendix A for Loran-C values for each station).

Seventeen trawls were done during Survey 1 and 18 during Survey 2. Only one trawl was done at Depoe Bay during Survey 1 because of inclement weather and equipment malfunction; however, two trawls were done during Survey 2. We sampled six sites near Tillamook Bay (Fig. 2), two near Depoe Bay (Fig. 3), four near the Siuslaw River (Fig. 4), and six near the Umpqua River (Fig. 5).

All fishes and crabs captured were placed in labeled 5-gallon buckets containing a buffered solution of seawater and 5% formaldehyde. If a fish was too large to fit in a bucket, the fish was measured, weighed, and its stomach removed and placed in a labeled plastic bag containing a 5% formaldehyde solution. At the lab, fishes and crabs were rinsed in fresh water, measured (total and standard lengths, mm), and weighed (g). Dungeness crab widths were measured just anterior to the tenth anterolateral spines. For each trawl, a subsample of 20 fishes and crabs for each size class (for each species) was measured and weighed. When more than 20 of a size class were captured, the remainder was counted and weighed as a group.

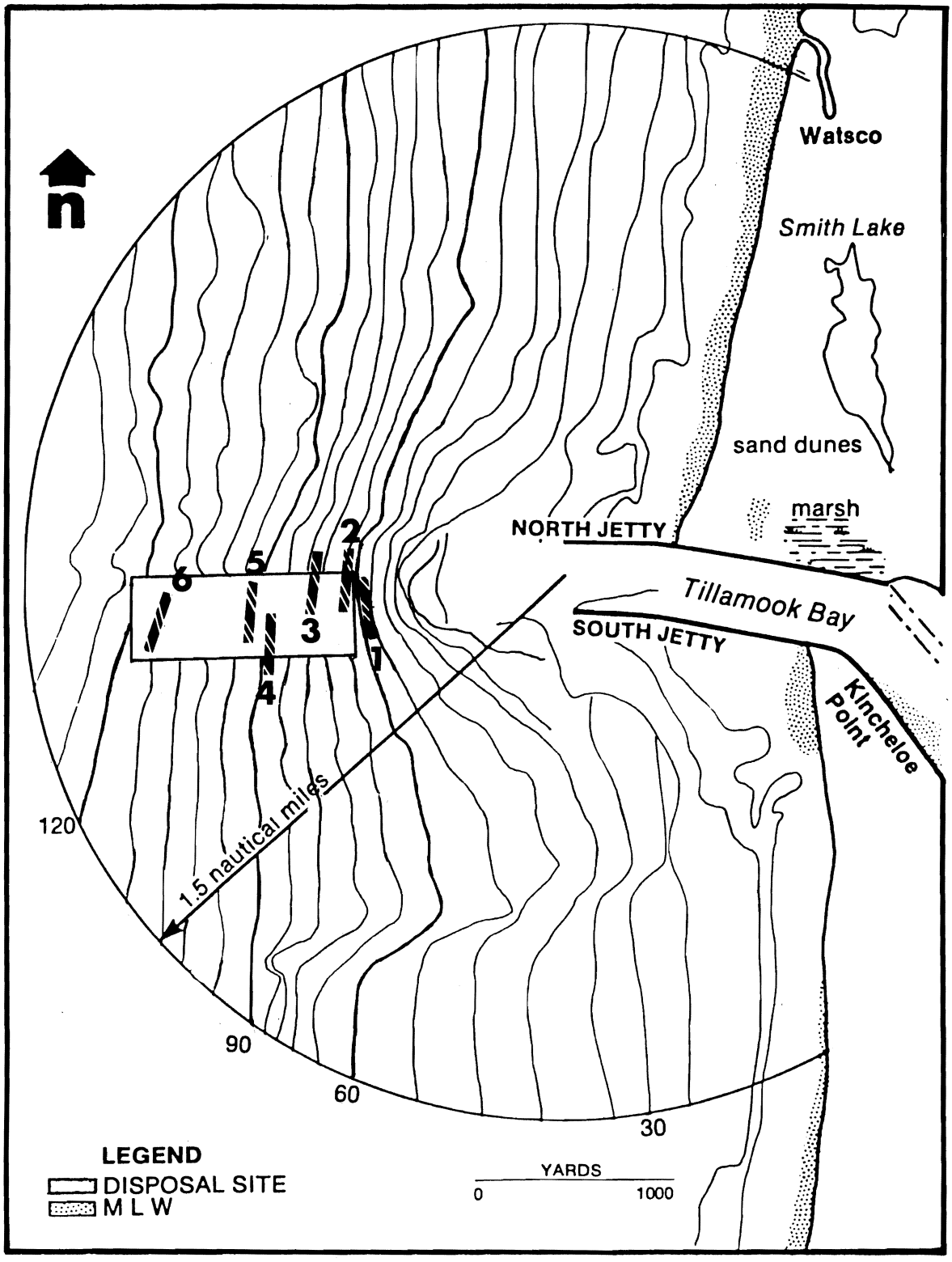

Figure 2.--Locations of the six trawl sites and the dredge disposal site off Tillamook Bay, Oregon; depth contours are shown in feet.

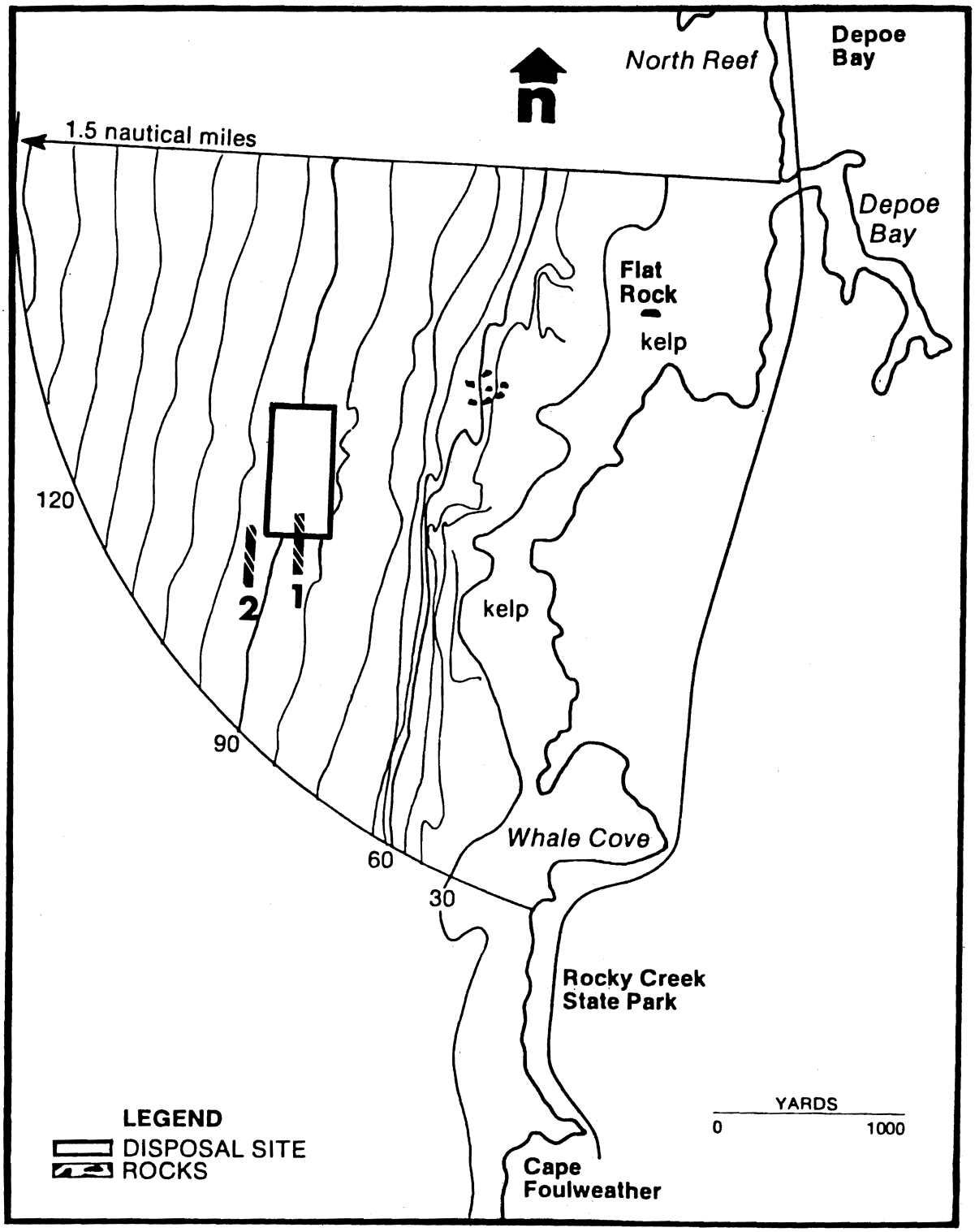

Figure 3.--Locations of the two trawl sites and the dredge disposal site off Depoe Bay, Oregon; depth contours are shown in feet.

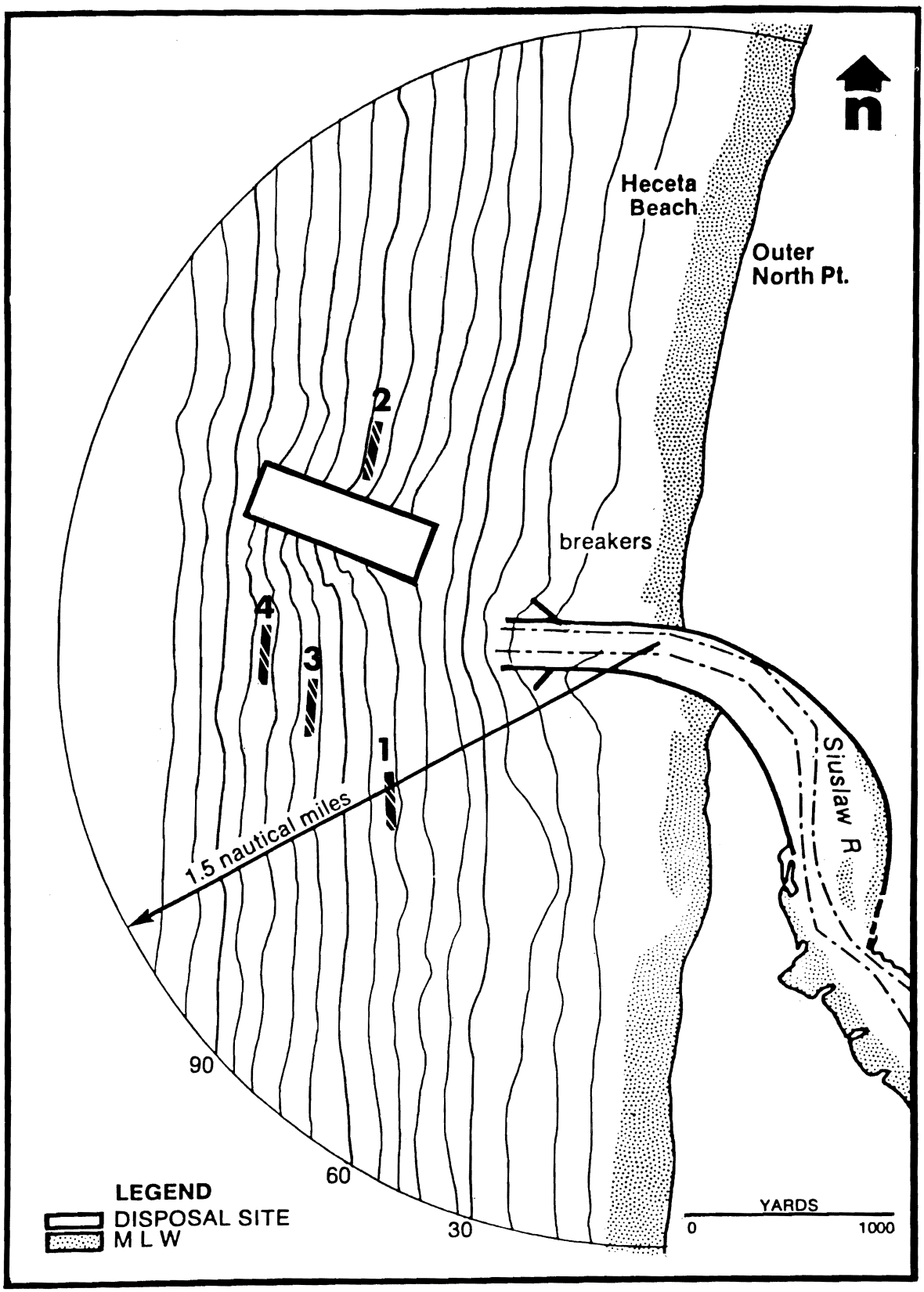

Figure 4.--Locations of the four trawl sites and the dredge disposal site off the Siuslaw River, Oregon; depth contours are shown in feet.

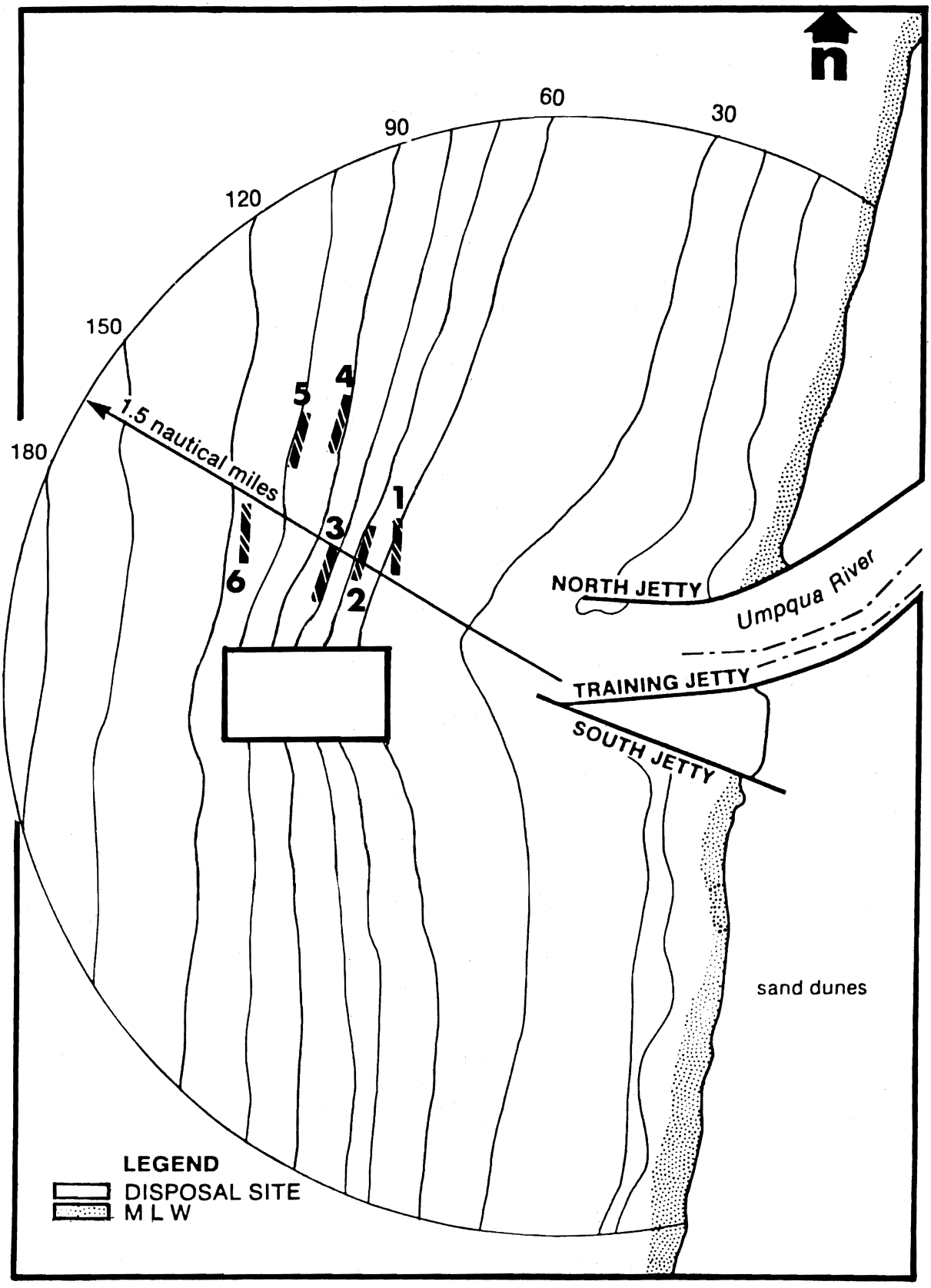

Figure 5.--Locations of the six trawl sites and the dredge disposal site off the Umpqua River, Oregon; depth contours are shown in feet.

Benthic Invertebrates

Benthic infaunal samples were collected with a 0.096-m^2 Gray-O'Hara[1/] box corer. Six box core samples were collected at each station. Five of these samples were individually sieved through a 0.5-mm diameter mesh screen; and the residue, containing the macroinvertebrates, was placed in jars and preserved in a buffered 5% formaldehyde solution containing rose bengal (a protein stain). One of the six grab samples was subsampled for sediment analysis. Sediment analysis was done by the COE (Portland, Oregon). Sediment grain size was determined by sieving and organic content was determined by burning for 1 hour at 600°C.

At the lab, preserved benthic invertebrate samples were washed in fresh water, and the organisms were picked from the samples. Organisms were identified to the lowest possible taxonomic level (usually species) and counted. All specimens were placed in 70% ethyl alcohol and stored in vials at the Hammond, Oregon, Field Station (NMFS).

During each survey, 63 stations were sampled: 22 stations near Tillamook Bay (Fig. 6), 3 stations near Depoe Bay (Fig. 7), 14 stations near the Siuslaw River (Fig. 8), and 24 stations near the Umpqua River (Fig. 9). Except for Depoe Bay, each study area had stations located along three transects, one in the dredge disposal site and the others north and south of the disposal site. A few reference stations were located farther away from the disposal site to provide information that would be unaffected by dredge disposal. Loran-C navigational readings were recorded at each station enabling replication and reoccupation of the stations at later dates (Appendix A).

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

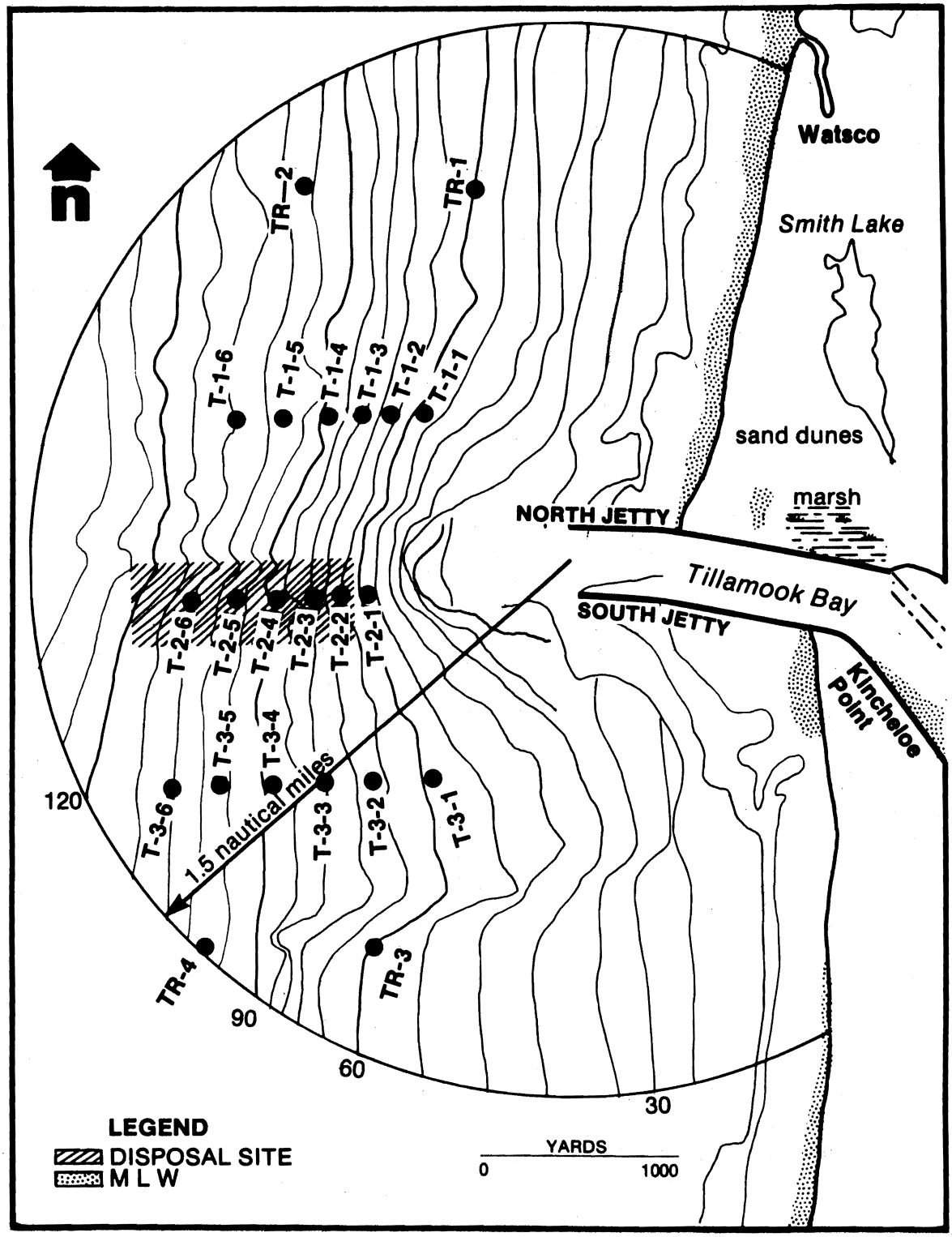

Figure 6.-- Locations of the 22 benthic invertebrate stations and the dredge disposal site near Tillamook Bay, Oregon; depth contours are shown in feet.

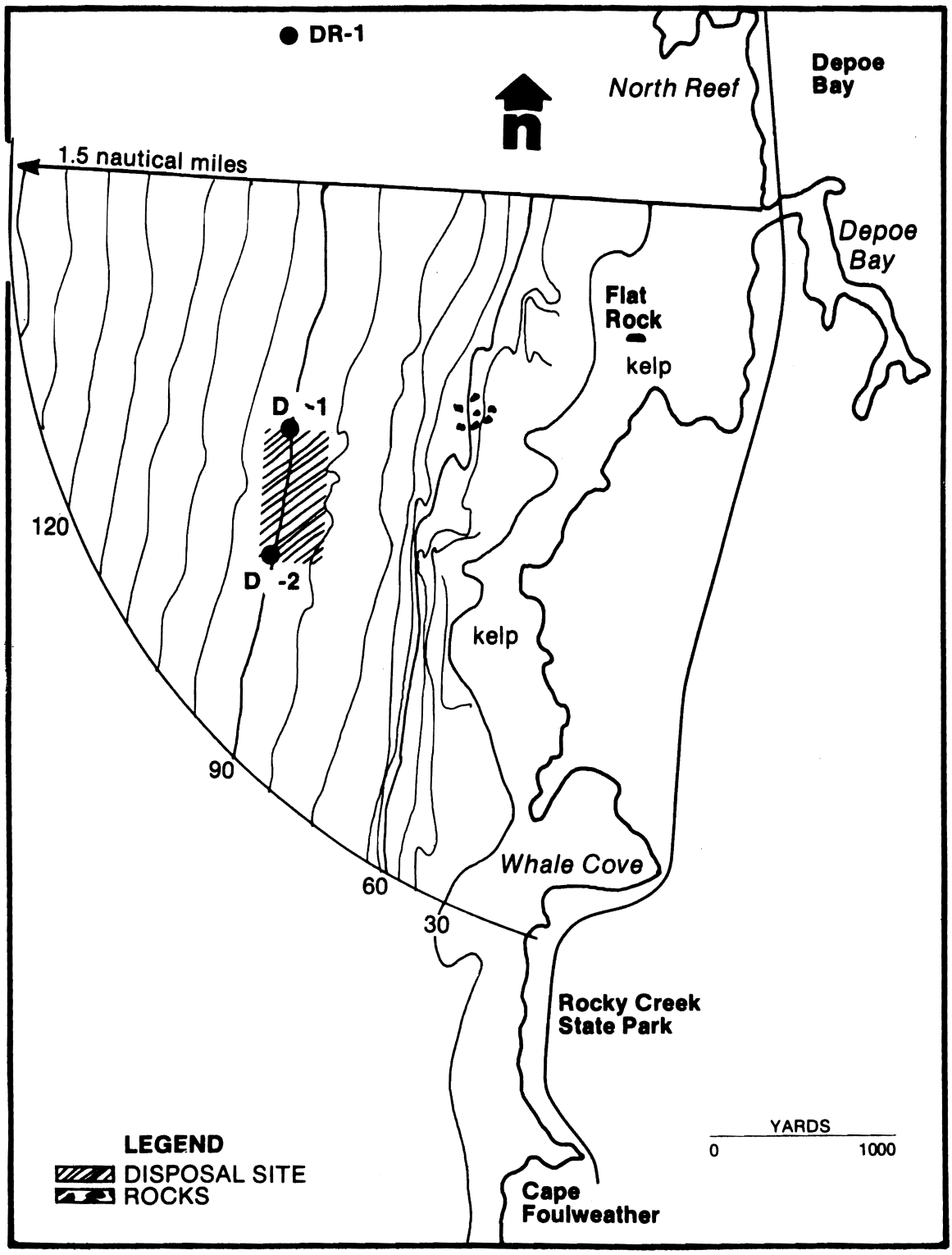

Figure 7.--Locations of the three benthic invertebrate stations and the dredge disposal site near Depoe Bay, Oregon; depth contours are shown in feet.

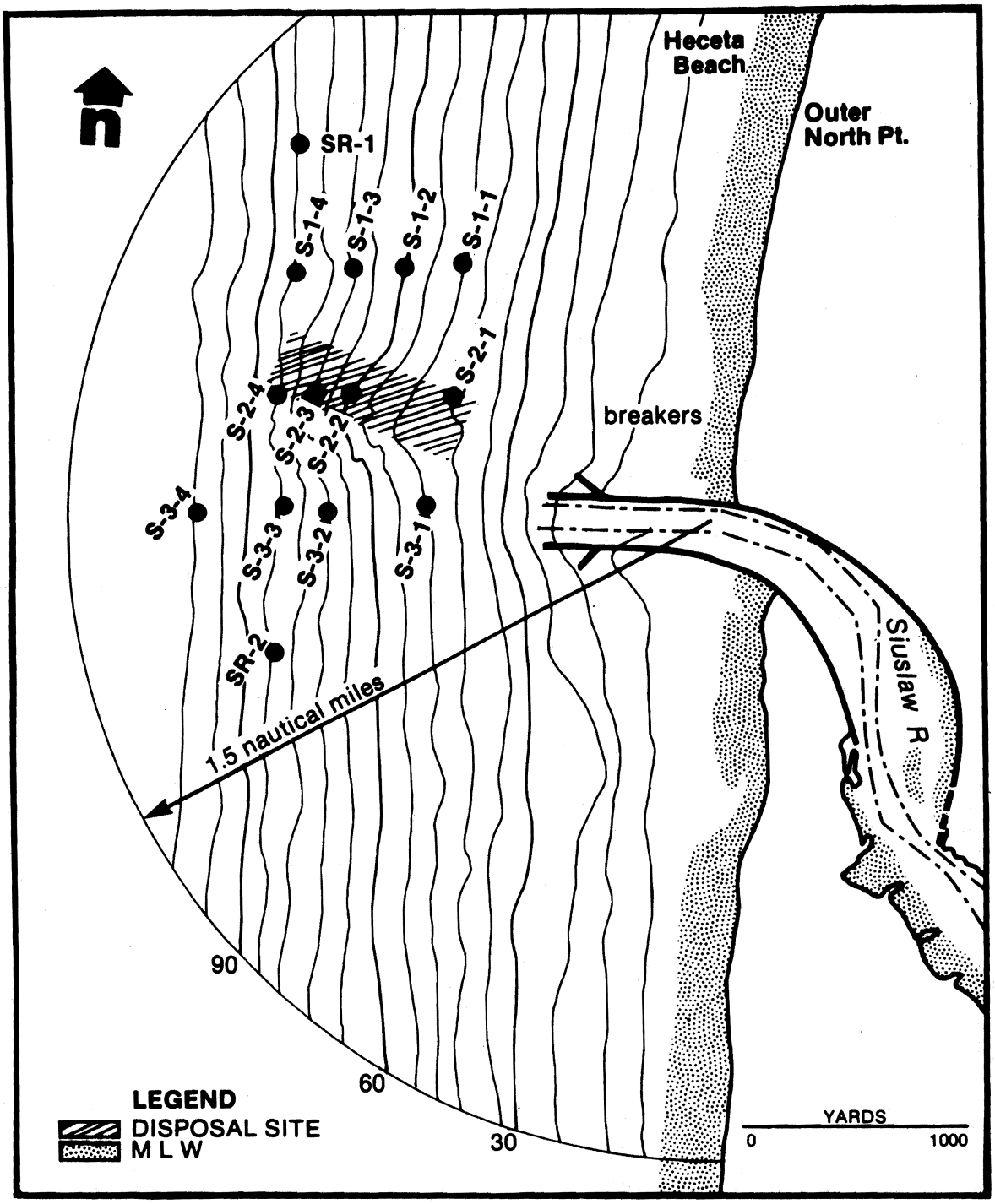

Figure 8.-- Locations of the 14 benthic invertebrate stations and the dredge disposal site near the Siuslaw River, Oregon; depth contours are shown in feet.

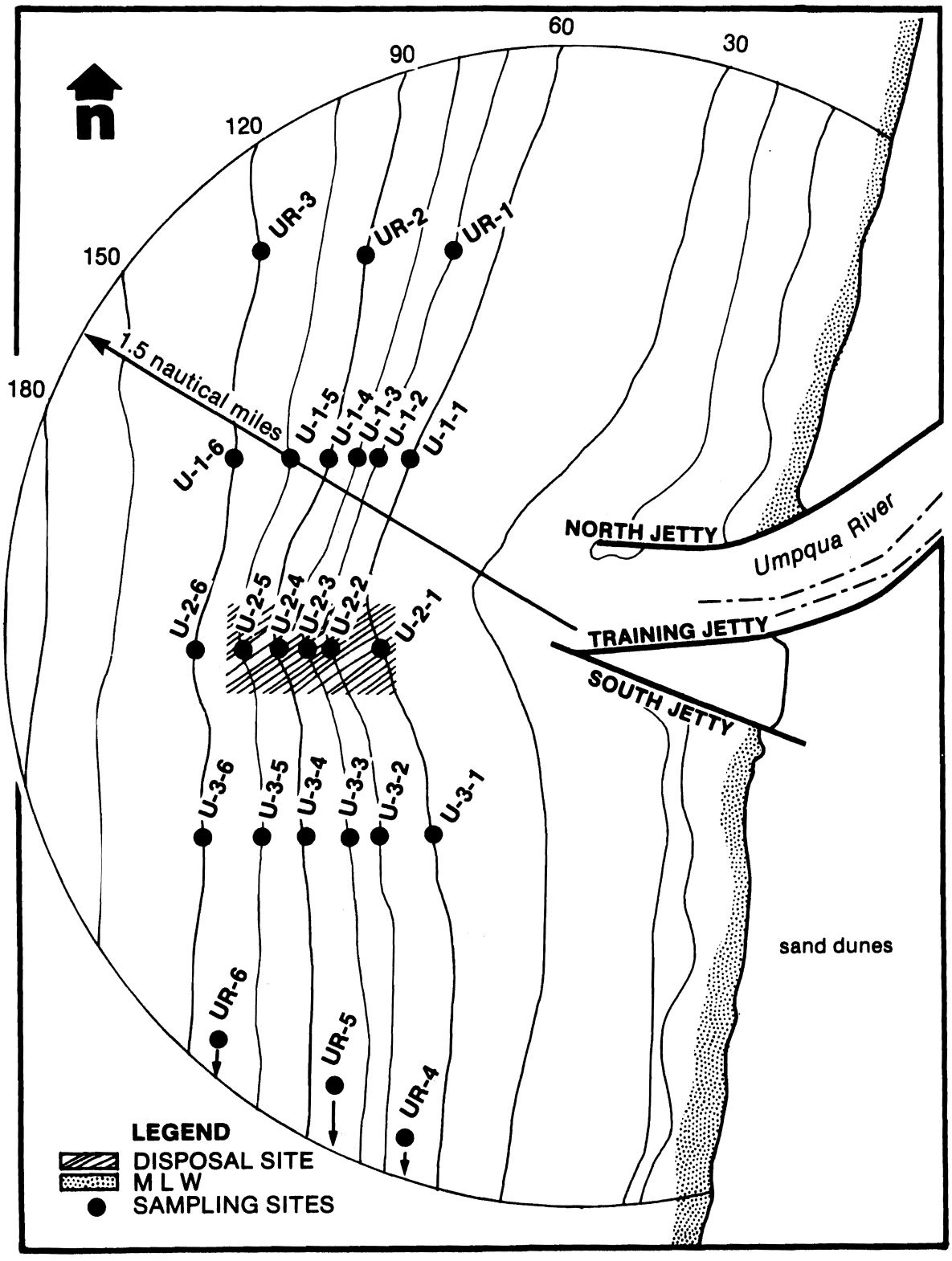

Figure 9.-- Locations of the 24 benthic invertebrate stations and the dredge disposal site near the Umpqua River, Oregon; depth contours are shown in feet.

Data Analyses

Trawling (Fishes and Crabs)

The computer program LORAN/AND/DISTANCE on the Northwest and Alaska Fisheries Center's (NWAFC) Burroughs (B7800) computer was used to calculate the distance fished. By using distance fished, fishing width of the trawl, and catch data, we estimated densities of fishes and crabs (number/hectare). Another computer program on the B7800 computer was used to produce descriptive summaries of each trawling effort (Appendix B). Output from the program included: a species list for each trawl, the number and weight (g) of fishes and crabs captured (total and by species), number per ha (total and by species), weight per ha (g) (total and by species), and four community structure indices. The four indices are the Shannon-Wiener Diversity Index (H') (Krebs 1978), Simpson Diversity Value (SD) (Simpson 1949), Species Richness (SR) (Margalef 1958), and Evenness (J) (Pielou 1966):

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

Pi = Xa/n (Xa equals the number of individuals of a particular species in a sample and n equals the total number of individuals in a sample)

S = number of species

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

$$SR = (S-1)/\ln (n)$$

$$J = H'/\log_2 S.$$

The non-parametric Mann-Whitney U-test and Kruskal-Wallis test (Elliott 1977) were used to determine if there were significant differences in mean densities of fishes and crabs between areas and surveys.

Benthic Invertebrates

Benthic invertebrate data were analyzed with the aid of a computer program on the NWAFC B7800 computer. The five benthic invertebrate samples collected at each station were treated as replicates, enabling us to calculate a mean number/m^2 and a standard deviation for each species. Also, the program calculated the number of species, mean number of invertebrates/sample (box core) and standard deviation, and total mean number of invertebrates/m^2 and standard deviation (Appendix C). The community structure indices used in the trawling analyses were also calculated for the benthic invertebrate data. Analysis of Variance (ANOVA) was done to determine if there were significant differences in the mean number of invertebrates/m^2 between areas and surveys. Data were first transformed [log(X+1)] to meet the requirements for a parametric test (Elliott 1977). Cluster analysis, using the Bray-Curtis dissimilarity index with a group averaging fusion strategy (Clifford and Stephenson 1975), was used to identify station groupings that had similar species and densities. A 0.5 dissimilarity value was considered a significant difference between groups. The mean number/m^2 (untransformed) for each species per station was used in this analysis. Species which had densities $<10/m^2$ were excluded from the analysis to reduce the effect of rare species.

Sediments

Mean grain size (phi), percent silt-clay, and percent organics were calculated for each station (Appendix D). Within area variability tended to be low, so no statistical analysis was performed within an area during a survey. To identify differences between areas and seasons, Analysis of Variance (ANOVA) was performed on transformed data [log(X+1)].

RESULTS

Tillamook Bay

Fishes and Crabs

The Tillamook Bay area had a mean number of 1,693 fishes and crabs/ha during Survey 1 and 912/ha for Survey 2 (Table 1). Diversity values (H' and SD) were surprisingly stable in spite of large variations in catch. Highest diversity values occurred at the sites with low catches. This occurred because the catch was composed of similar numbers of different species (J, Evenness, was high). Diversity values were lower at the other stations because the high catches were dominated by a few species.

Dominant fishes and crabs at Tillamook Bay included: Pacific tomcod, Microgadus proximus; Dungeness crab, Cancer magister; and speckled sanddab, Citharichthys stigmaeus, during Survey 1 and Dungeness crab; Pacific tomcod; sand sole, Psettichthys melanostictus; and night smelt, Spirinchus starksi, during Survey 2 (Table 2). Many fishes and crabs captured during both surveys were juveniles (Figs. 10 and 11); however, adults of some species like poachers, snailfishes, smelts, and speckled sanddab were captured. Almost all the Dungeness crabs were young-of-the-year.

Densities of fishes and crabs were lower during Survey 2 than during Survey 1 for each depth category except for the deepest (110 ft) (Fig. 12). Although there was a drop of 781 organisms/ha (mean) between surveys, there was no significant difference in catches (Mann-Whitney, $P > 0.05$) between surveys. This was probably due to the limited sample size and the wide range in catches.

A large number of shrimp, Crangon spp., were captured during Survey 1, but because of their small size and the large amounts of macroalgae, Ulva spp. and

Table 1.--Summaries of trawl data collected at the Tillamook Bay interim disposal site during Survey 1 (Sep.-Oct. 1984) and Survey 2 (Jan. 1985).

Survey 1

Station and depth (ft)	Number of species	Number per ha	Weight per ha (g)	H'	J	SD	SR
T-1 (60)	13	924	6,459	2.26	0.61	0.67	2.09
T-2 (70)	13	1,035	28,334	2.59	0.70	0.77	2.13
T-3 (80)	14	1,747	19,973	1.82	0.48	0.54	2.06
T-4 (90)	15	1,475	15,041	2.76	0.71	0.79	2.33
T-5 (100)	16	3,596	41,606	2.66	0.66	0.78	2.27
T-6 (110)	16	1,380	48,658	2.23	0.56	0.70	2.51
Mean	15	1,693	26,679	2.39	0.62	0.71	2.23

Survey 2

Station and depth (ft)	Number of species	Number per ha	Weight per ha (g)	H'	J	SD	SR
T-1 (60)	15	257	5,614	3.05	0.78	0.84	3.05
T-2 (70)	13	124	12,827	3.38	0.91	0.89	3.23
T-3 (80)	17	426	11,109	2.68	0.65	0.74	3.16
T-4 (90)	18	924	20,195	2.94	0.70	0.82	3.04
T-5 (100)	13	853	18,241	2.47	0.67	0.73	2.10
T-6 (110)	17	2,887	45,284	2.11	0.52	0.60	2.48
Mean	16	912	18,878	2.77	0.71	0.77	2.84

Table 2.--Catch summaries for fishes and crabs captured near Tillamook Bay during Survey 1 (Sep. 1984) and Survey 2 (Jan. 1985).

Species	Survey 1		Survey 2	
	Total number captured	Mean number per ha	Total number captured	Mean number per ha
Big skate	12	7	6	4
Spotted ratfish	20	12	0	0
Northern anchovy	2	1	0	0
American shad	0	0	29	13
Pacific herring	0	0	1	1
Whitebait smelt	36	21	0	0
Night smelt	15	9	117	64
Longfin smelt	0	0	6	4
Unid. juvenile smelt	53	33	2	1
Pacific tomcod	925	548	410	229
Tube-snout	0	0	4	2
Bay pipefish	0	0	24	13
Shiner perch	0	0	3	2
Striped seaperch	0	0	1	1
Spotfin surfperch	5	3	17	8
Wolf-eel	1	1	0	0
Pacific sand lance	21	11	3	2
Black rockfish	2	1	0	0
Unidentified rockfish	0	0	9	5
Kelp greenling	0	0	1	1
Red Irish lord	0	0	1	1
Pac. staghorn sculpin	28	17	20	12
Warty poacher	52	37	22	13
Tubenose poacher	1	1	21	12
Pricklebreast poacher	161	124	37	24
Showy snailfish	126	95	5	4
Unidentified snailfish	5	4	0	0
Speckled sanddab	289	176	53	34
Butter sole	29	21	15	10
Slender sole	1	1	0	0
Dover sole	2	1	0	0
English sole	82	49	6	4
Starry flounder	0	0	2	2
Sand sole	40	25	114	66
Larval flatfish	0	0	5	3
Dungeness crab	765	495	567	382
Cancer gracilis	0	0	4	2
Cancer sp. (unid.)	1	1	0	0
Cancer oregonensis	1	1	0	0
Purple shore crab	1	1	0	0
TOTAL	2,676	1,696	1,505	919

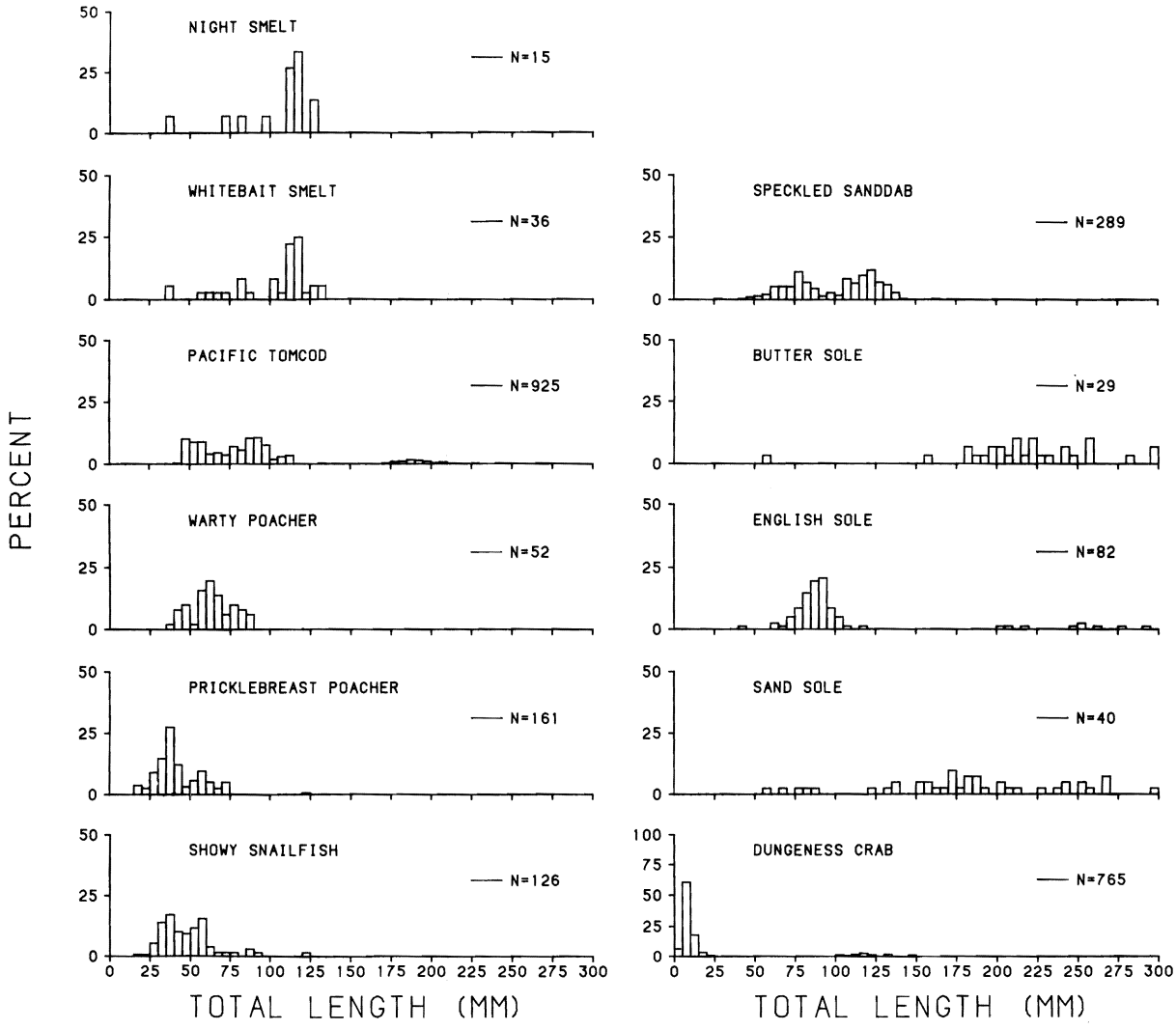

Figure 10.--Length frequency distributions of common fish species and Dungeness crabs captured near Tillamook Bay during Survey 1 (Sep. 84); carapace widths are shown for Dungeness crabs. Fishes > 300 mm are included in the 295-300 mm size interval.

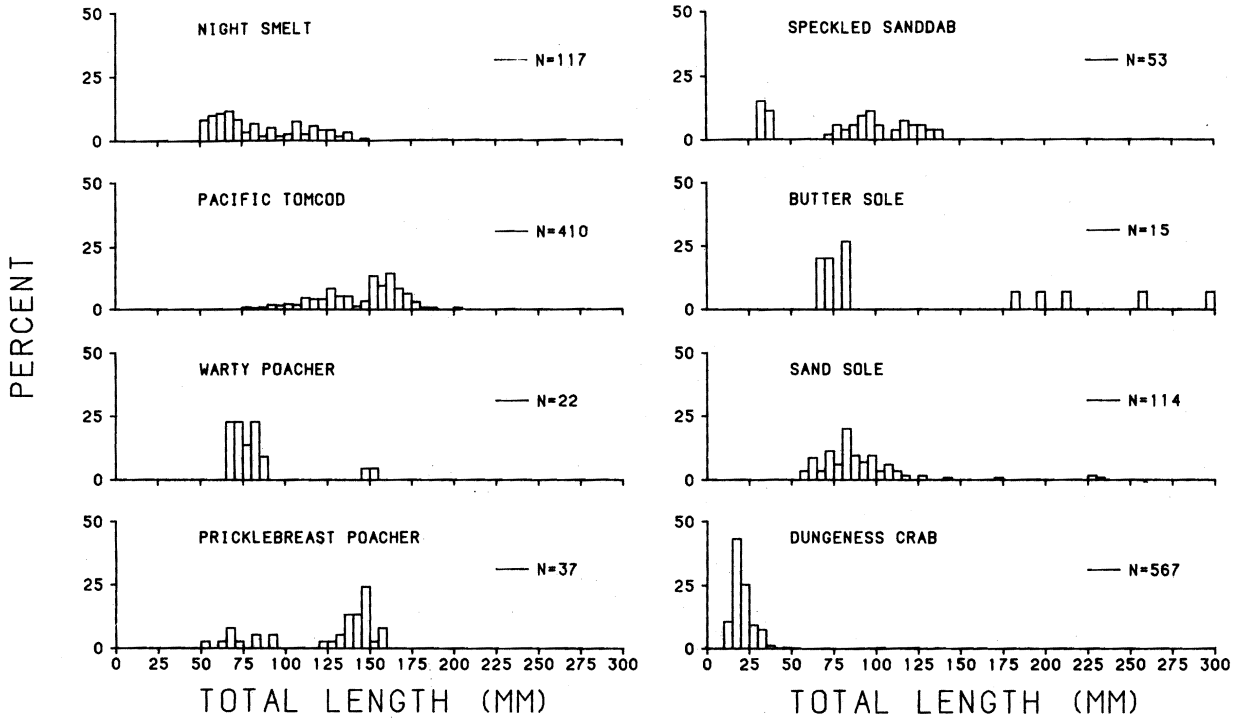

Figure 11.--Length frequency distributions of common fish species and Dungeness crabs captured near Tillamook Bay during Survey 2 (Jan. 85); carapace widths are shown for Dungeness crabs. Fishes > 300 mm are included in the 295-300 mm size interval.

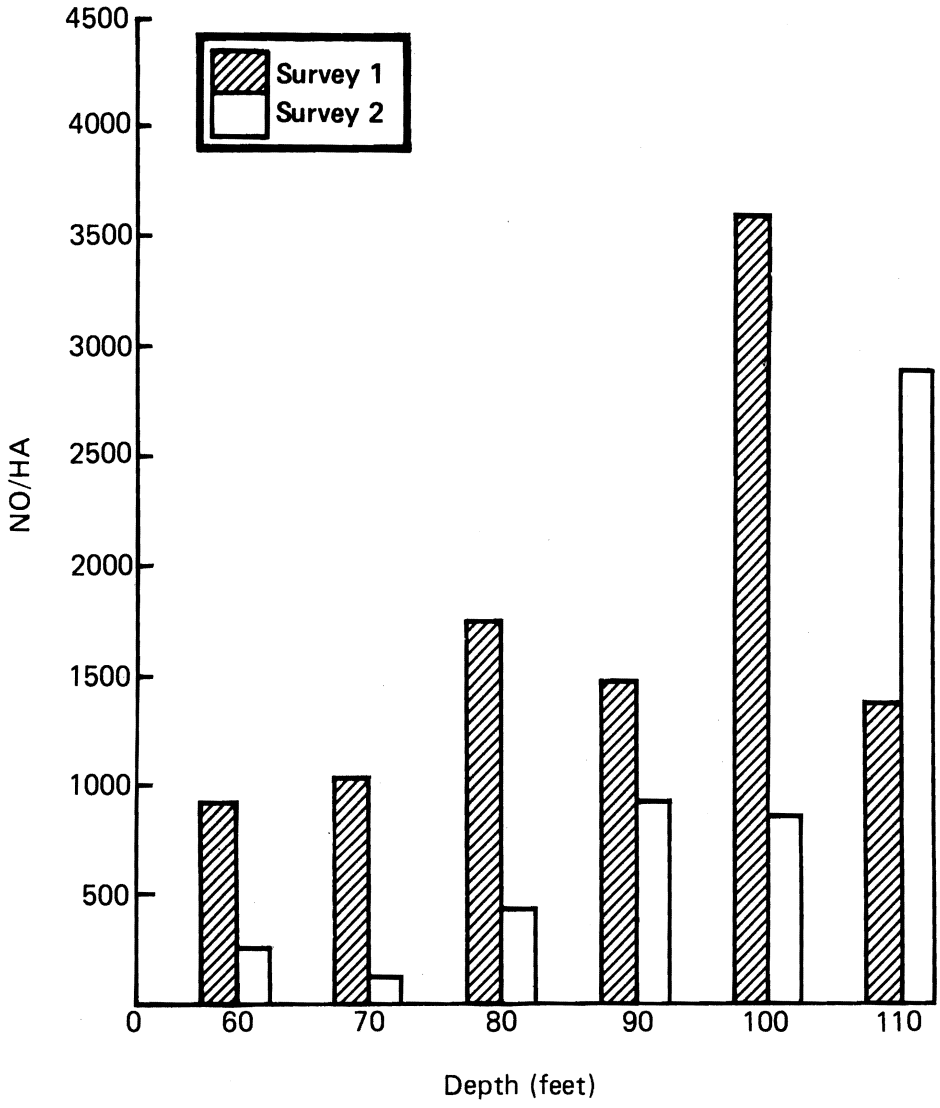

Figure 12.--Numbers of fishes and crabs (per hectare) captured at different depths during Survey 1 (Sep. 84) and Survey 2 (Jan. 85) near Tillamook Bay, Oregon.

others, also collected in the trawls, counting them was not feasible. We estimated that thousands of shrimp were captured in each trawling effort. Because the shrimp were not counted, they were not included in the data analysis.

Benthic Invertebrates

The study area off Tillamook Bay had a diverse benthic invertebrate community (Appendix C). A total of 168 different taxa were identified in this area; the highest density of benthic invertebrates (65,919/m^2) was found at Station T-1-3 during Survey 1 (Table 3). Highest invertebrate density from Survey 2 was 23,090/m^2 at Station TR-2 (Table 4). In general, the shallow stations (60 ft) had the lowest densities; especially during Survey 2. Generally there was a direct relationship between densities and numbers of species, with large number of species associated with high invertebrate densities. Diversity values (H' and SD) showed an inverse relationship to invertebrate densities; high diversity values were associated with low invertebrate densities. This occurred because stations with high invertebrate densities were numerically dominated by Owenia fusiformis, a tube-dwelling Owenidae polychaete. Other important species were Spiophanes bombyx (Spionidae polychaete) and Siliqua sloati (Bivalvia) (Table 5). The highest density of O. fusiformis was 50,246/m^2 during Survey 1. Stations that did not have large numbers of this species did not have high invertebrate densities.

Cluster analysis of Survey 1 data revealed four cluster groups which were easily identified by density (Fig. 13). The high density group was composed of stations located primarily north of the disposal site, and the moderate density group (6,000-15,000/m^2) consisted mainly of deepwater sites. The cluster group

Table 3.--Description of the benthic invertebrate community near Tillamook Bay during Survey 1 (Sep. 1984). Total were calculated by combining replicates from all stations.

Station and depth (ft)	Number of species	No./m^2	St. dev.	H'	J	SD	SR
TR-1 (60)	59	2,102	443	4.51	0.77	0.92	8.39
TR-2 (100)	65	44,871	15,678	0.89	0.15	0.21	6.41
T-1-1 (60)	52	4,250	1,242	3.68	0.64	0.84	6.69
T-1-2 (70)	62	33,933	9,397	1.51	0.25	0.39	6.29
T-1-3 (80)	74	65,919	31,346	1.41	0.23	0.40	7.04
T-1-4 (90)	62	50,858	16,071	1.16	0.20	0.33	6.04
T-1-5 (100)	67	27,369	8,082	0.83	0.14	0.16	6.96
T-1-6 (115)	69	10,473	2,320	1.53	0.25	0.32	7.98
T-2-1 (60)	63	1,529	179	4.49	0.75	0.92	9.40
T-2-2 (70)	61	1,906	435	4.61	0.78	0.93	8.80
T-2-3 (80)	86	9,919	7,605	2.71	0.42	0.66	10.04
T-2-4 (90)	66	10,498	3,113	2.11	0.35	0.53	7.62
T-2-5 (100)	65	39,054	27,504	0.74	0.12	0.16	6.50
T-2-6 (115)	65	14,140	9,583	1.58	0.26	0.39	7.25
T-3-1 (60)	47	935	390	4.28	0.77	0.89	7.53
T-3-2 (70)	52	1,083	368	4.66	0.82	0.94	8.16
T-3-3 (80)	39	458	250	4.45	0.84	0.92	7.05
T-3-4 (90)	38	473	268	4.30	0.82	0.91	6.82
T-3-5 (100)	41	1,245	827	3.86	0.72	0.87	6.48
T-3-6 (115)	66	6,254	5,554	2.08	0.34	0.50	8.12
TR-3 (60)	49	1,290	295	4.72	0.84	0.95	7.47
TR-4 (100)	50	15,806	10,803	0.71	0.13	0.15	5.48
TOTAL	168	15,790	21,461	1.68	0.23	0.38	13.90

Table 4.--Description of the benthic invertebrate community at Tillamook Bay, Survey 2 (Jan.1985). Totals were calculated by combining replicates from all stations.

Station and depth (ft)	Number of species	No./m^2	St. dev.	H'	J	SD	SR
TR-1 (60)	47	7,750	7,914	1.49	0.27	0.34	5.60
TR-2 (100)	55	23,090	7,513	0.83	0.14	0.18	5.80
T-1-1 (60)	39	550	160	4.50	0.85	0.94	6.81
T-1-3 (80)	46	981	329	4.32	0.78	0.92	7.31
T-1-4 (90)	38	1,206	218	4.12	0.78	0.91	5.82
T-1-5 (100)	46	10,310	2,572	1.24	0.23	0.29	5.29
T-1-6 (115)	45	5,867	3,403	2.00	0.36	0.50	5.54
T-2-1 (60)	28	410	189	3.19	0.66	0.82	5.11
T-2-2 (70)	28	421	50	3.66	0.76	0.86	5.09
T-2-3 (80)	42	460	298	4.58	0.85	0.94	7.60
T-2-4 (90)	42	2,529	2,035	2.43	0.45	0.56	5.77
T-2-5 (100)	45	996	529	4.33	0.79	0.92	7.13
T-2-6 (115)	44	4,027	2,554	2.30	0.42	0.57	5.68
T-3-1 (60)	37	760	109	4.10	0.79	0.91	6.10
T-3-2 (70)	43	942	205	4.26	0.79	0.92	6.87
T-3-3 (80)	49	1,123	129	4.09	0.73	0.91	7.63
T-3-4 (90)	47	1,837	331	3.56	0.64	0.82	6.78
T-3-5 (100)	49	2,713	674	3.04	0.54	0.70	6.69
T-3-6 (115)	52	2,535	311	4.06	0.71	0.90	7.18
TR-3 (60)	38	617	129	4.34	0.83	0.93	6.50
TR-4 (100)	52	20,344	6,374	0.77	0.13	0.16	5.55
TOTAL	124	4,122	6,687	0.77	0.32	0.50	11.52

Table 5.--Summary of benthic invertebrate collections near Tillamook Bay during Survey 1 (Sep. 1984) and Survey 2 (Jan. 1985). Only dominant taxa from each major category are shown.

Taxon	Survey 1		Survey 2	
	Total number	Mean number/m^2	Total number	Mean number/m^2
POLYCHAETA				
Spiophanes bombyx	5,951	570	154	15
Megelona sacculata	1,335	127	390	37
Owenia fusiformis	131,082	12,352	30,563	2,894
Myriochele heeri	94	9	693	66
Scoloplos armiger	517	49	982	93
Miscellaneous	684	240	1,582	149
TOTAL	139,663	13,347	34,364	3,254
MOLLUSCA				
Olivella pycna	715	68	722	68
Mactra/Spisula spp.	922	88	20	2
Siliqua sloati	10,831	1,035	16	2
Tellina modesta	307	29	158	15
Tellina nuculoides	339	32	104	10
Miscellaneous	942	91	338	32
TOTAL	14,056	1,343	1,358	129
MYSIDACEA/CUMACEA				
Neomysis kadiakensis	878	83	39	4
Anchicolurus occidentalis	335	32	116	11
Diastylopsis spp.	599	57	0	0
Diastylopsis tenuis	0	0	56	5
Miscellaneous	439	43	47	4
TOTAL	2,251	215	258	24
AMPHIPODA				
Atylus tridens	2,405	230	26	2
Eohaustorius sencillus	1,067	102	2,830	268
Foxiphalus major	769	74	98	9
Mandibulophoxus gelesi	842	80	1,271	120
Rhepoxynius vigitegus	494	47	645	61
Miscellaneous	2,121	203	1,638	156
TOTAL	7,698	736	6,508	616
ECHINODERMATA				
Amphiodia spp.	187	18	351	33
Dendraster excentricus	66	6	97	9
Miscellaneous	1	0	3	1
TOTAL	254	24	451	43
OTHER				
Lissocrangon stylirostris	227	22	7	1
Nemertea	319	31	226	21
Pagurus spp.	173	17	168	16
Miscellaneous	365	34	117	11
TOTAL	1,084	104	518	49
GRAND TOTAL	165,006	15,769	43,457	4,115

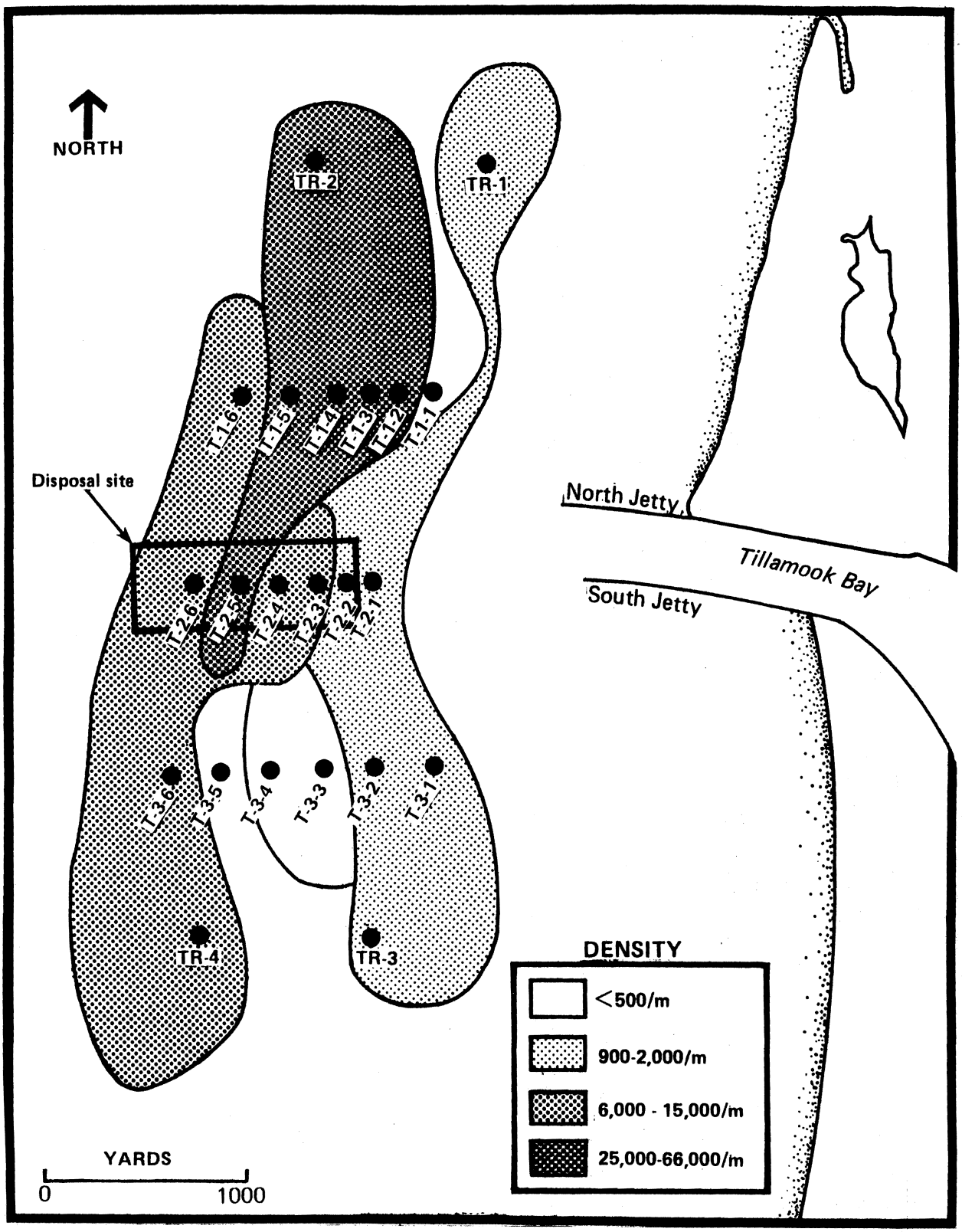

Figure 13.--Locations of the benthic invertebrate cluster groups identified from Survey 1 (Sep. 84) near Tillamook Bay, Oregon.

with densities from 900-2,000/m^2 was composed of shallow-water stations; the lowest density group consisted of two stations located south of the disposal area. Two stations did not fit into any cluster group.

Five cluster groups were identified from Survey 2 (Fig. 14). The groups appeared to follow a pattern, with the lowest density group located directly off the mouth of the bay, and the higher density groups located farther offshore and/or north and south of the mouth.

There was a significant drop (ANOVA, $P < 0.05$) in the numbers of invertebrates/m^2 from Survey 1 to Survey 2. Most of this decline was due to the reduced numbers of polychaetes (primarily O. fusiformis), mollusks, and mysids/cumaceans (Table 5). Amphipod numbers did not show a large drop between surveys. Although densities of the dominant amphipod in Survey 1 (Atylus tridens) dropped between surveys, another species (Eohaustorius sencillus) increased in abundance.

Sediments

Sediments at Tillamook Bay were fine sand; mean grain size was 3.02 phi during Survey 1 and 2.97 phi during Survey 2. Sediments were low in silt-clay (mean values of 0.77 and 0.60% during Surveys 1 and 2, respectively) and organics (mean values of 1.32 and 1.41% during Surveys 1 and 2, respectively). However, there were no significant differences (ANOVA, $P > 0.05$) between surveys for any of the sediment characteristics.

Depoe Bay

Fishes and Crabs

Densities of fishes and crabs at Depoe Bay were much higher during Survey 2 (3,548/ha) than during Survey 1 (1,013/ha) (Table 6), due to the large

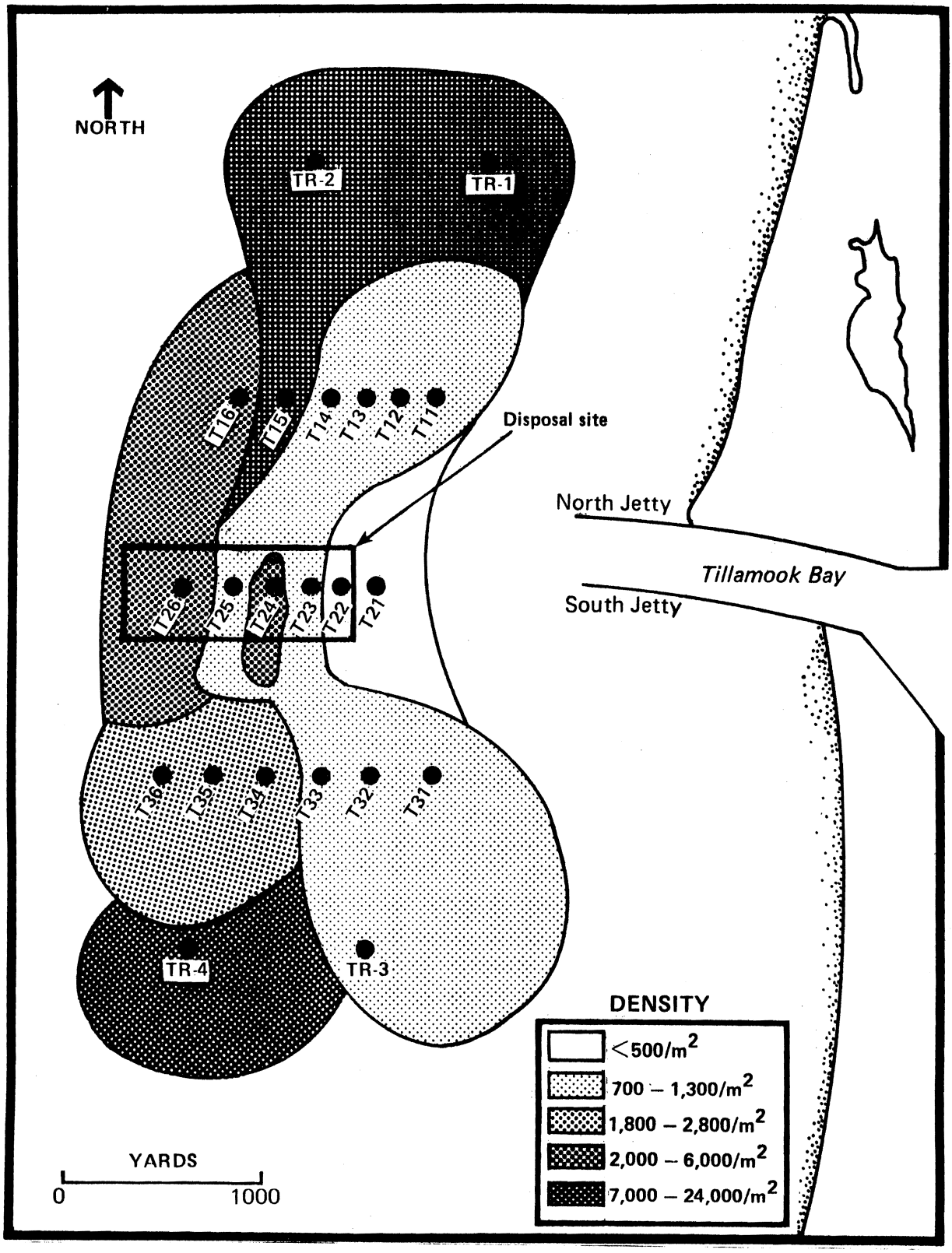

Figure 14.--Locations of the benthic invertebrate cluster groups identified from Survey 2 (Jan. 85) near Tillamook Bay, Oregon.

Table 6.--Summaries of trawl data collected at the Depoe Bay interim disposal site during Survey 1 (Oct. 1984) and Survey 2 (Jan. 1985).

Survey 1

Station and depth (ft)	Number of species	Number per ha	Weight per ha (g)	H'	J	SD	SR
D-1 (80)	11	1,013	14,582	1.69	0.49	0.52	1.68

Survey 2

Station and depth (ft)	Number of species	Number per ha	Weight per ha (g)	H'	J	SD	SR
D-1 (80)	11	3,866	18,006	1.07	0.31	0.30	1.43
D-2 (90)	11	3,230	23,518	0.83	0.24	0.27	1.41
Mean	11	3,548	20,762	0.95	0.28	0.29	1.42

catches of night smelt during Survey 2 (Table 7). Pacific tomcod, speckled sanddab, and sand sole were also numerically important. Diversity indices (H' and SD) were lower in Survey 2 (Table 6), a result of the large catch of night smelt. Many of the fishes and crabs captured were juveniles (Figs. 15 and 16). Dungeness crabs were primarily young-of-the-year.

Benthic Invertebrates

Benthic invertebrate densities at Depoe Bay were not significantly different (ANOVA, $P > 0.05$) between Survey 1 (mean value of $1,891/m^2$) and Survey 2 (mean value of $2,384/m^2$) (Table 8). Diversity indices (H' and SD) were relatively high and similar between surveys, indicating the area had many species with similar densities.

Depoe Bay did not have any dominant taxa. Polychaetes, mollusks, and amphipods had similar densities in both surveys (Table 9). The most abundant species were: Megelona sacculata and Scoloplos armiger (polychaetes), Olivella pycna (mollusk), and Eohaustorius sencillus (amphipod).

Cluster analysis revealed that during Survey 1 all stations had similar species and densities (Fig. 17). In Survey 2, Station D-1 had species and densities dissimilar to the other stations (Fig. 18).

Sediments

Sediments at Depoe Bay were mainly clean fine sands; mean grain size was 3.10 phi for Survey 1 and 3.27 phi for Survey 2. Percent silt-clay was low (0.37 and 1.67% for Surveys 1 and 2, respectively), as was percent organics (1.03 and 1.47% for Surveys 1 and 2, respectively). However, there were no significant differences in mean grain size or percent organics between the two surveys (ANOVA, $P > 0.05$). Percent silt-clay was significantly higher (ANOVA, $P < 0.05$) during Survey 1.

Table 7.-- Catch summaries for fishes and crabs captured near Depoe Bay during Survey 1 (Oct. 1984) and Survey 2 (Jan. 1985).

Species	Survey 1		Survey 2	
	Total number captured	Mean number per ha	Total number captured	Mean number per ha
Big skate	0	0	2	3
American shad	0	0	11	17
Northern anchovy	10	26	0	0
Whitebait smelt	2	5	2	3
Night smelt	0	0	1,939	2,980
Pacific tomcod	257	677	204	301
Pacific sand lance	0	0	2	3
Pac. staghorn sculpin	0	0	17	30
Warty poacher	1	3	0	0
Pricklebreast poacher	3	8	1	2
Speckled sanddab	51	134	31	54
Petrale sole	1	3	0	0
Butter sole	9	24	19	28
English sole	34	90	6	10
Sand sole	15	40	59	98
Dungeness crab	1	3	13	22
Cancer gracilis	0	0	1	2
TOTAL	384	1,013	2,307	3,553

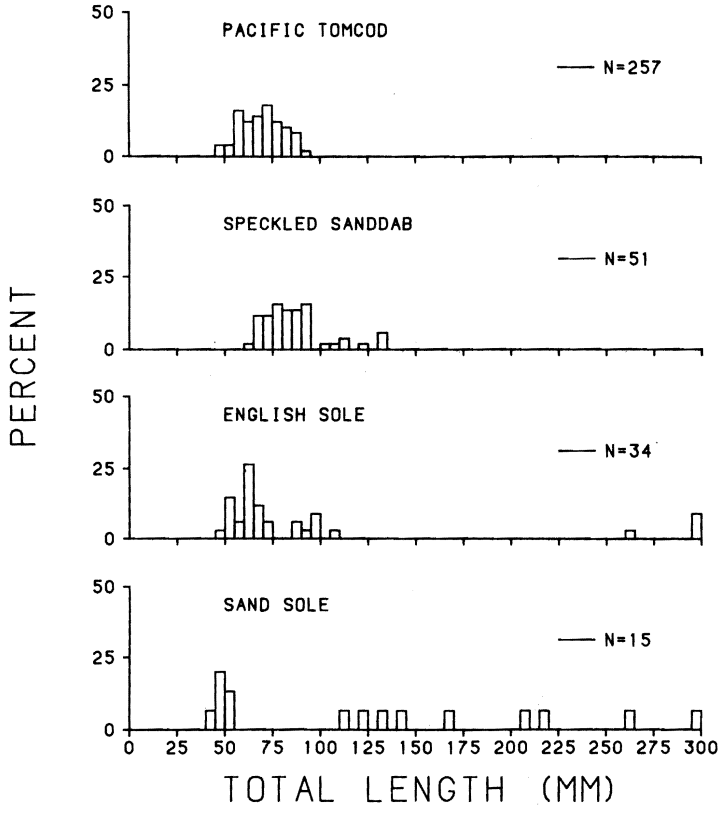

Figure 15.--Length frequency distributions of common fish species and Dungeness crabs captured near Depoe Bay during Survey 1 (Oct. 84). Fishes > 300 mm are included in the 295-300 mm size interval.

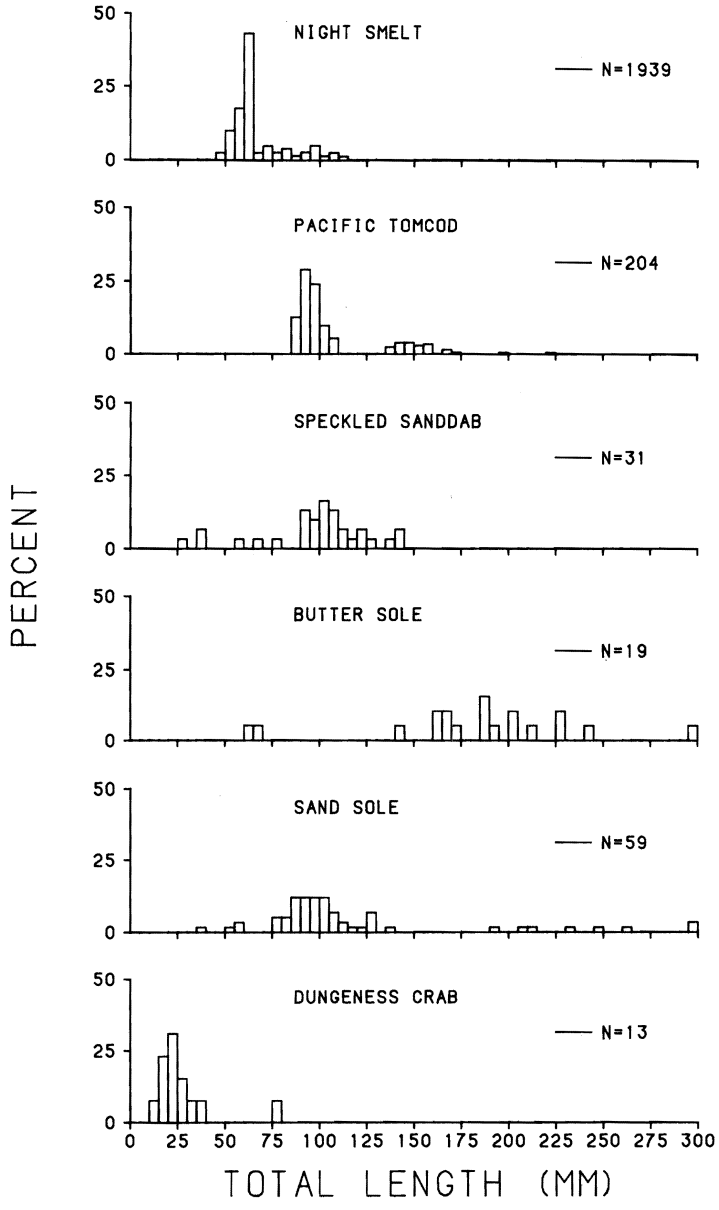

Figure 16.--Length frequency distributions of common fish species and Dungeness crabs captured near Depoe Bay during Survey 2 (Jan. 85); carapace widths are shown for Dungeness crabs. Fishes > 300 mm are included in the 295-300 mm size interval.

Table 8.--Description of the benthic invertebrate community near Depoe Bay during Survey 1 (Oct. 1984) and Survey 2 (Jan. 1985). Totals were calculated by combining replicates from all stations.

SURVEY 1

Station and depth (ft)	Number of species	No./m^2	St. dev.	H'	J	SD	SR
DR-1 (90)	50	1,621	222	3.99	0.71	0.88	7.36
D-1 (80)	53	1,973	307	4.21	0.74	0.90	7.59
D-2 (85)	48	2,042	220	3.70	0.66	0.84	6.82
TOTAL	73	1,891	306	4.12	0.66	0.88	8.98

SURVEY 2

Station and depth (ft)	Number of species	No./m^2	St. dev.	H'	J	SD	SR
DR-1 (90)	44	2,068	661	3.69	0.68	0.86	6.44
D-1 (80)	52	2,879	1,730	4.00	0.70	0.89	7.05
D-2 (85)	48	2,142	948	3.82	0.68	0.84	6.78
TOTAL	68	2,384	1,203	4.25	0.70	0.91	8.30

Table 9.-- Summary of benthic invertebrate collections near Depoe Bay during Survey 1 (Oct. 1984) and Survey 2 (Jan. 1985). Only dominant taxa from each major category are shown.

Taxon	Survey 1		Survey 2	
	Total number	Mean number/m^2	Total number	Mean number/m^2
POLYCHAETA				
Megelona sacculata	391	272	118	88
Scoloplos armiger	98	68	350	260
Nephtys caecoides	73	51	101	75
Spiophanes bombyx	23	47	263	196
Miscellaneous	282	164	209	156
TOTAL	867	602	1,041	775
MOLLUSCA				
Olivella pycna	772	536	726	540
Tellina modesta	81	56	70	52
Tellina nuculoides	50	35	36	27
Mactra/Spisula spp.	0	0	70	52
Miscellaneous	91	62	45	34
TOTAL	994	689	947	705
MYSIDACEA/CUMACEA				
Neomysis kadiakensis	48	33	5	4
Diastylopsis tenuis	13	9	26	19
Anchicolurus occidentalis	2	1	48	37
Miscellaneous	14	11	1	0
TOTAL	77	54	80	60
AMPHIPODA				
Eohaustorius sencillus	219	152	352	262
Rhepoxynius abronius	182	126	129	96
Ampelisca agassizi	65	45	103	76
Miscellaneous	192	134	409	305
TOTAL	658	457	993	739
ECHINODERMATA				
Amphiodia spp.	20	14	26	19
Dendraster excentricus	14	10	9	7
Miscellaneous	2	1	3	2
TOTAL	36	25	38	28
OTHER				
Nemertea	55	38	42	31
Pagurus spp.	30	21	12	9
Miscellaneous	6	4	41	31
TOTAL	91	63	95	71
GRAND TOTAL	2,723	1,890	3,194	2,378

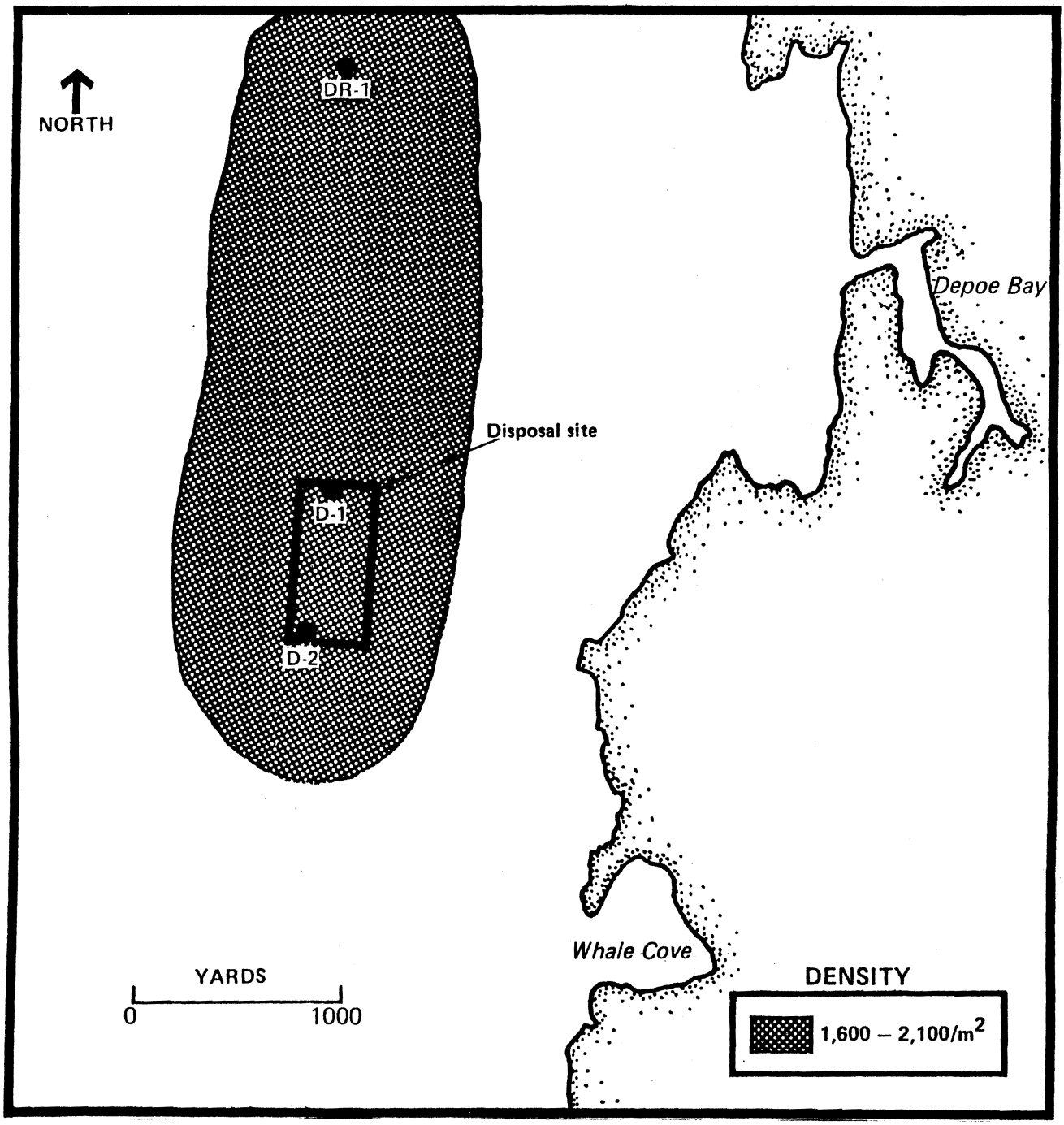

Figure 17.--Locations of the benthic invertebrate cluster groups identified from Survey 1 (Oct. 84) near Depoe Bay, Oregon.

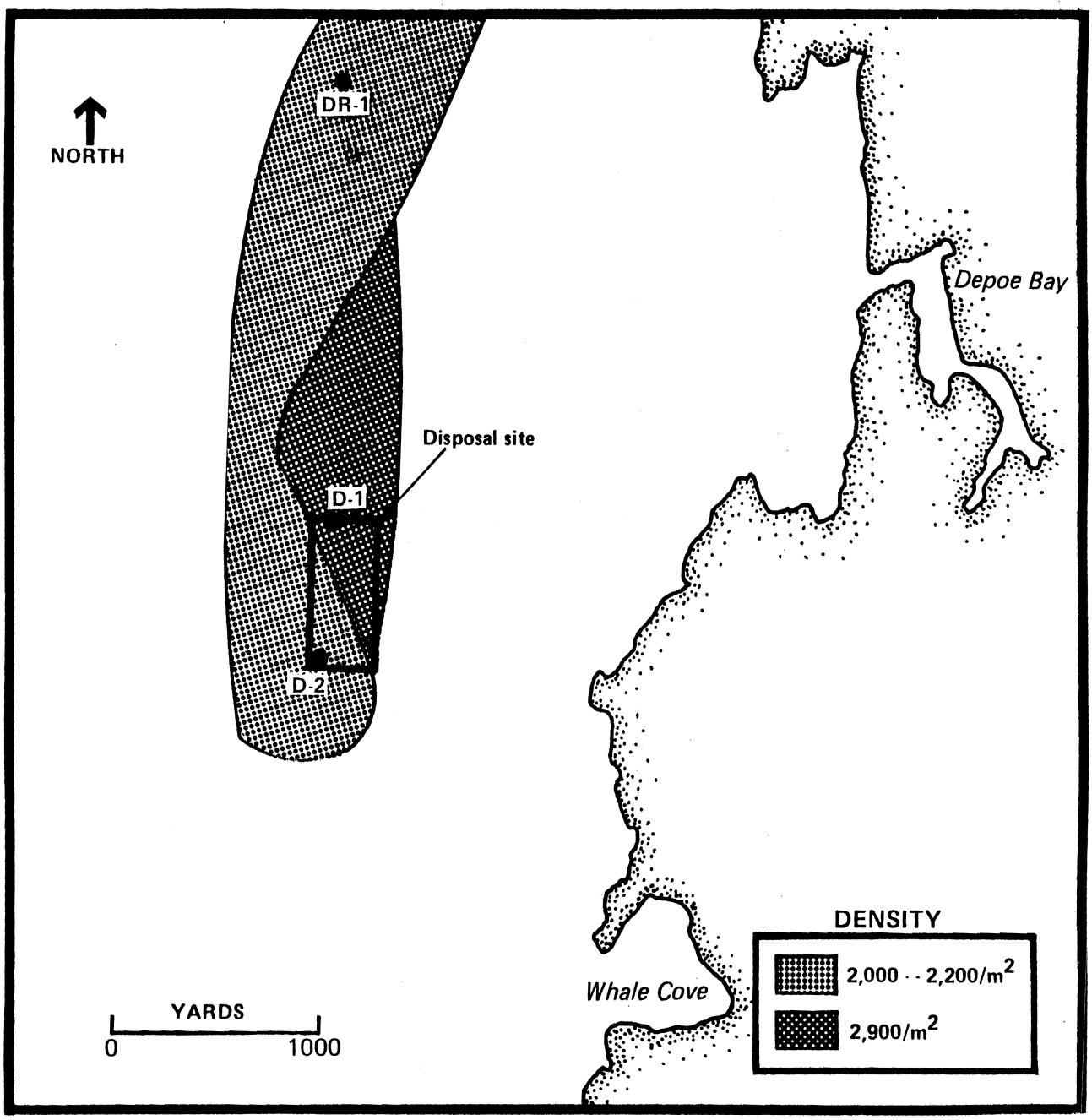

Figure 18.--Locations of the benthic invertebrate cluster groups identified from Survey 2 (Jan. 85) near Depoe Bay, Oregon.

Siuslaw River

Fishes and Crabs

The mean density of fishes and crabs at Siuslaw River in Survey 2 (3,023/ha) was greater than Survey 1 (1,151/ha) (Table 10), but it was not significantly different (Mann-Whitney, $P > 0.05$). In Survey 1 there was no relationship between catch and depth; however, during Survey 2 catches decreased as depth increased (Fig. 19). Diversity values (H', J, and SD) in Survey 2 increased with depth but showed no trend in Survey 1. During Survey 2, large catches of night smelt and unidentified juvenile smelt at the shallow stations strongly influenced diversity and the catch vs. depth relationship. Other numerically important species at Siuslaw River were Pacific tomcod, speckled sanddab, and sand sole (Table 11). Similar to the other disposal sites, many of the fishes and crabs captured were juveniles (Figs. 20 and 21).

Benthic Invertebrates

Benthic invertebrate densities at Siuslaw River ranged from 365/m^2 (Survey 2) to 3,904/m^2 (Survey 2). Total densities for Surveys 1 and 2 were very similar, 2,164/m^2 and 2,188/m^2, respectively (Table 12). Diversity values (H', J, SD, and SR) were generally higher during Survey 1; this difference was probably related to the larger evenness (J) values in Survey 1. Polychaetes, primarily Scoloplos armiger, Chaetozone setosa, and Megelona sacculata, were the dominant invertebrates at the Siuslaw River site (Table 13). Amphipods were also important, with Eohaustorius sencillus, Mandibulophoxus gelesi, and Eohaustorius sawyeri predominating. This area also had more sand dollars, Dendraster excentricus, than any other disposal area investigated.

Table 10.--Summaries of trawl data collected at the Siuslaw River interim disposal site during Survey 1 (Oct. 1984) and Survey 2 (Jan. 1985).

Survey 1

Station and depth (ft)	Number of species	Number per ha	Weight per ha (g)	H'	J	SD	SR
S-1 (50)	9	765	15,914	2.39	0.75	0.75	1.69
S-2 (60)	15	1,747	14,179	2.25	0.58	0.67	2.88
S-3 (70)	17	697	17,565	3.05	0.75	0.84	2.92
S-4 (80)	10	1,394	25,920	2.11	0.63	0.69	1.62
Mean	13	1,151	18,395	2.45	0.70	0.72	2.28

Survey 2

Station and depth (ft)	Number of species	Number per ha	Weight per ha (g)	H'	J	SD	SR
S-1 (50)	20	4,314	30,810	1.64	0.38	0.45	2.57
S-2 (60)	20	3,811	31,621	1.75	0.41	0.47	2.62
S-3 (70)	18	2,388	37,537	2.19	0.53	0.68	2.52
S-4 (80)	17	1,580	44,220	2.36	0.58	0.68	2.50
Mean	19	3,023	36,047	2.00	0.48	0.57	2.55

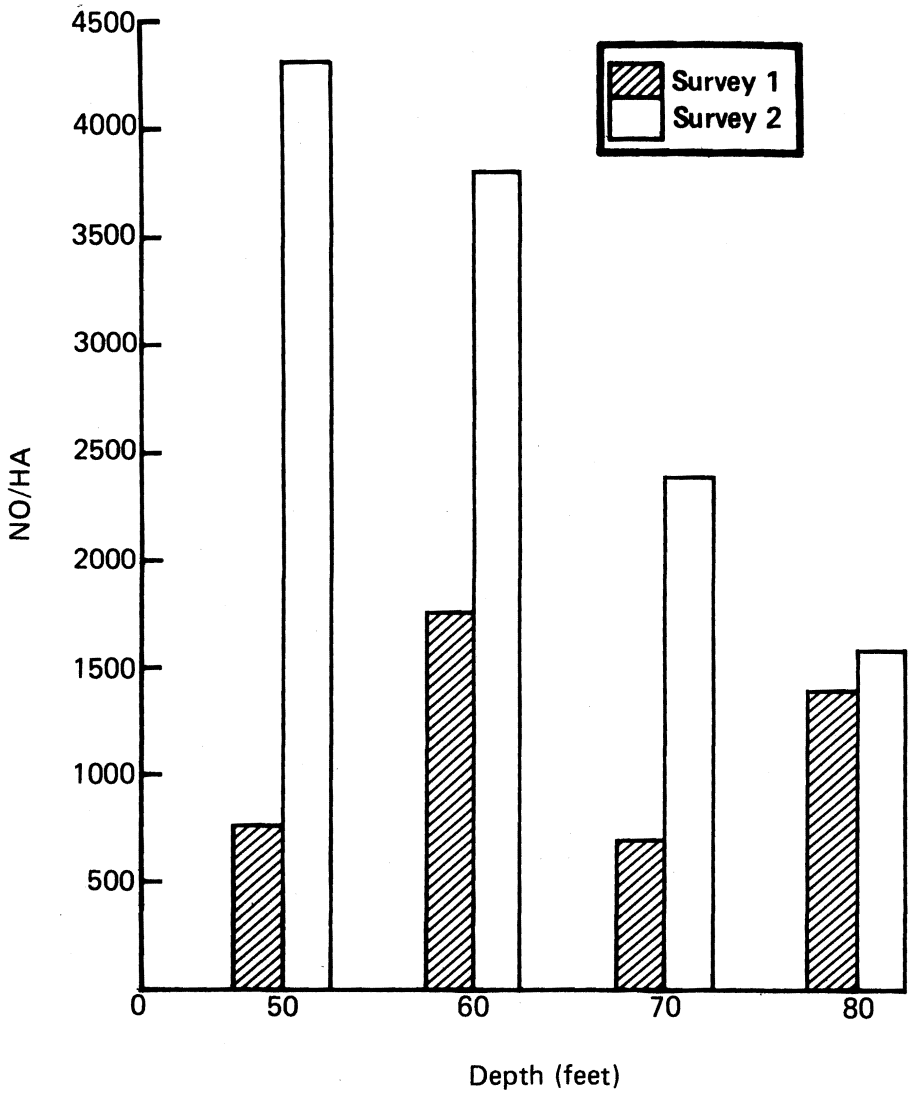

Figure 19.--Numbers of fishes and crabs (per hectare) captured at different depths during Survey 1 (Oct. 84) and Survey 2 (Jan. 85) near Siuslaw River, Oregon.

Table 11.--Catch summaries for fishes and crabs captured near Siuslaw River during Survey 1 (Oct. 1984) and Survey 2 (Jan. 1985).

Species	Survey 1		Survey 2	
	Total number captured	Mean number per ha	Total number captured	Mean number per ha
Big skate	2	2	7	5
American shad	3	2	25	17
Northern anchovy	86	240	1	1
Whitebait smelt	1	1	27	18
Night smelt	26	30	676	466
Unid. juvenile smelt	0	0	2,216	1,476
Pacific tomcod	194	269	722	490
Bay pipefish	0	0	8	6
Shiner perch	27	20	0	0
Spotfin surfperch	1	4	44	30
Saddleback gunnel	0	0	1	1
Pacific sand lance	7	13	3	2
Pac. staghorn sculpin	4	7	53	36
Warty poacher	1	4	18	12
Tubenose poacher	2	5	0	0
Pricklebreast poacher	14	24	40	27
Slipskin snailfish	0	0	1	1
Showy snailfish	1	4	9	6
Pacific sanddab	0	0	16	11
Speckled sanddab	223	331	81	55
Butter sole	10	12	55	37
English sole	50	61	42	29
Starry flounder	2	2	1	1
Sand sole	55	78	349	235
Larval flatfish	0	0	30	20
Dungeness crab	21	37	60	40
Cancer branneri	0	0	1	1
Cancer gracilis	0	0	1	1
Cancer oregonensis	7	8	0	0
Pugettia richii	1	1	0	0
TOTAL	738	1,155	4,487	3,024

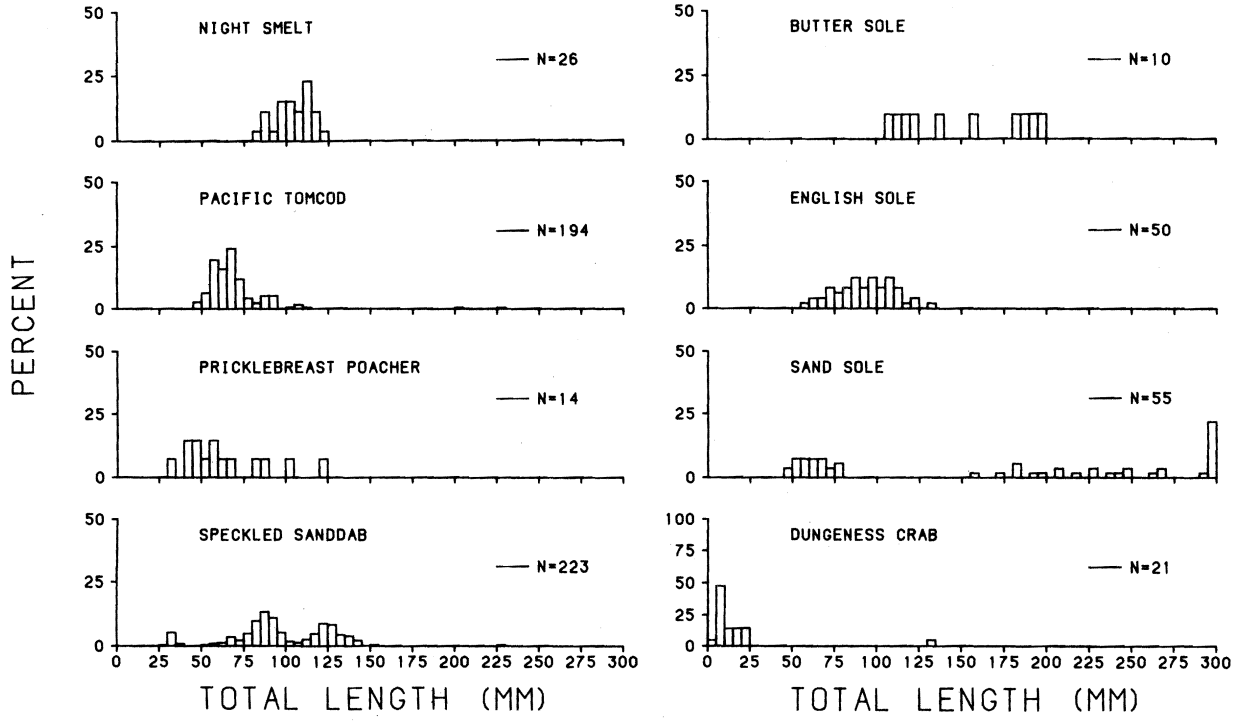

Figure 20.--Length frequency distributions of common fish species and Dungeness crabs captured near Siuslaw River during Survey 1 (Oct. 84); carapace widths are shown for Dungeness crabs. Fishes > 300 mm are included in the 295-300 mm size interval.

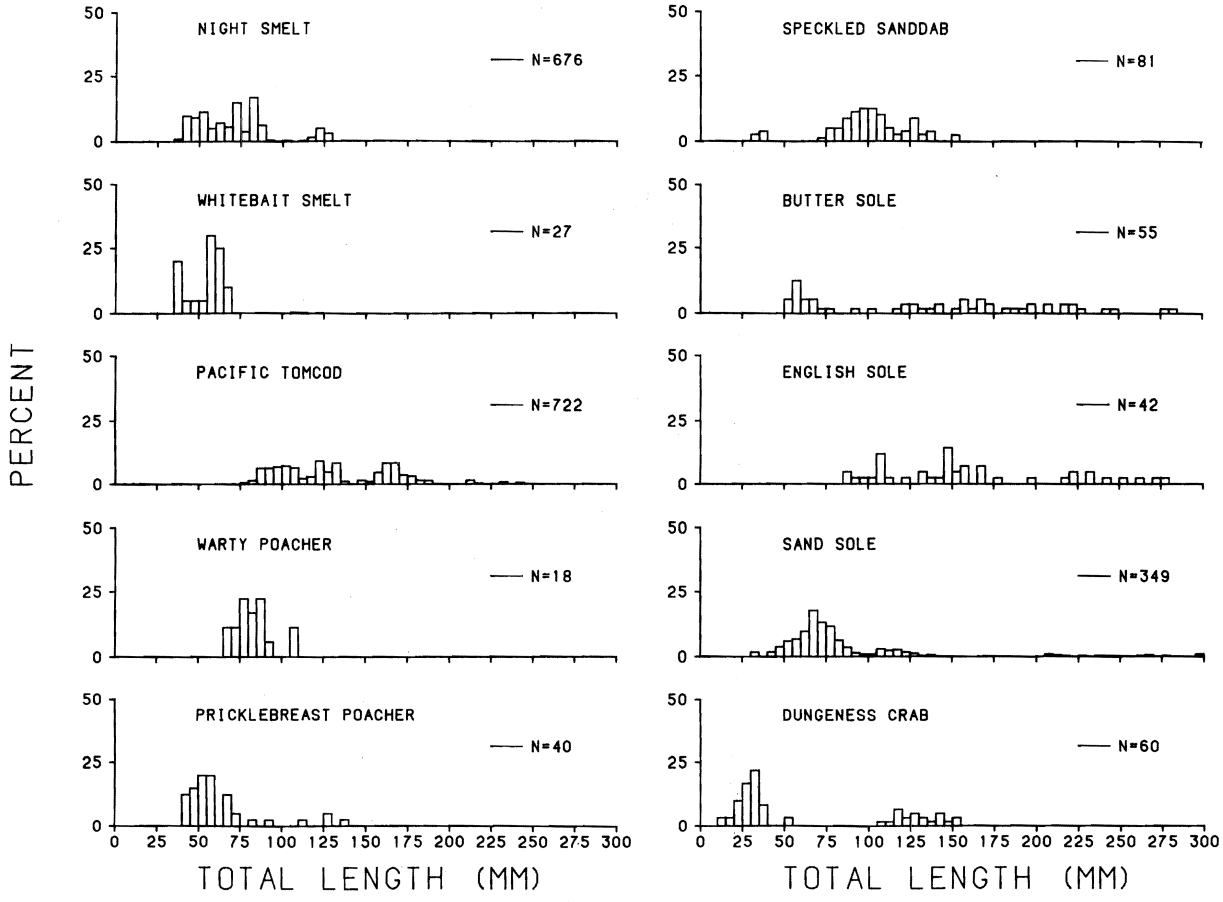

Figure 21.--Length frequency distributions of common fish species and Dungeness crabs captured near Siuslaw River during Survey 2 (Jan. 85); carapace widths are shown for Dungeness crabs. Fishes > 300 mm are included in the 295-300 mm size interval.

Table 12.--Description of the benthic inverterate community near Siuslaw River during Survey 1 (Oct. 1984) and Survey 2 (Jan. 1985). Totals were calculated by combining replicates from all stations.

Survey 1

Station and depth (ft)	Number of species	No./m^2	St. dev.	H'	J	SD	SR
SR-1 (80)	56	2,004	749	4.32	0.74	0.92	8.01
S-1-1 (50)	44	3,769	1,175	3.58	0.66	0.87	5.73
S-1-2 (60)	54	3,892	1,013	3.53	0.61	0.83	7.04
S-1-3 (70)	47	2,479	1,004	4.11	0.74	0.91	6.50
S-1-4 (80)	56	2,233	714	4.21	0.73	0.92	7.88
S-2-1 (40)	46	548	218	4.53	0.82	0.93	8.08
S-2-2 (60)	39	973	243	4.11	0.78	0.91	6.18
S-2-3 (70)	36	1,164	296	4.30	0.83	0.93	5.74
S-2-4 (80)	40	1,071	385	4.16	0.78	0.92	6.25
S-3-1 (50)	63	2,052	616	4.16	0.70	0.90	9.00
S-3-2 (70)	54	3,423	982	3.66	0.64	0.87	7.16
S-3-3 (80)	61	2,871	581	4.08	0.69	0.91	8.30
S-3-4 (100)	52	1,633	234	4.44	0.78	0.92	7.92
SR-2 (80)	57	1,838	232	4.23	0.73	0.92	8.26
TOTAL	135	2,164	1,207	4.60	00.65	140.92	14.02

Survey 2

Station and depth (ft)	Number of species	No./m^2	St. dev.	H'	J	SD	SR
SR-1 (80)	49	3,048	801	3.46	0.62	0.82	6.59
S-1-1 (50)	45	2,669	831	3.17	0.58	0.80	6.15
S-1-2 (80)	52	2,669	495	3.31	0.58	0.78	7.13
S-1-3 (70)	55	3,265	464	3.43	0.59	0.79	7.34
S-1-4 (80)	42	2,213	627	3.46	0.64	0.83	6.03
S-2-1 (40)	31	365	202	3.14	0.63	0.73	5.81
S-2-2 (60)	36	437	144	4.25	0.82	0.91	6.55
S-2-3 (70)	43	1,233	536	3.49	0.64	0.78	6.58
S-2-4 (80)	43	1,050	533	3.81	0.70	0.84	6.75
S-3-1 (50)	31	927	161	3.47	0.70	0.87	4.92
S-3-2 (70)	32	3,152	466	3.24	0.56	0.75	7.24
S-3-3 (80)	57	3,904	940	3.57	0.61	0.84	7.43
S-3-4 (100)	45	3,552	2,797	2.53	0.46	0.63	5.91
SR-2 (80)	46	2,148	1,030	3.86	0.70	0.88	6.49
TOTAL	106	2,188	1,438	3.91	0.58	0.86	10.94

Table 13.--Summary of benthic invertebrate collections near Siuslaw River during Survey 1 (Oct. 1984) and Survey 2 (Jan. 1985). Only dominant taxa from each major category are shown.

Taxon	Survey 1		Survey 2	
	Total number	Mean number/m^2	Total number	Mean number/m^2
POLYCHAETA				
Chaetozone setosa	2,552	391	1,941	289
Megelona sacculata	1,558	239	387	58
Scoloplos armiger	1,395	214	4,661	694
Nephtys caecoides	91	14	444	66
Miscellaneous	2,336	357	1,372	203
TOTAL	7,932	1,215	8,805	1,310
MOLLUSCA				
Tellina nuculoides	738	113	52	8
Olivella pycna	567	87	419	62
Olivella biplicata	413	63	314	47
Mactra/Spisula spp.	6	1	154	23
Miscellaneous	352	54	135	20
TOTAL	2,076	318	1,074	160
MYSIDACEA/CUMACEA				
Archaeomysis grebnitzkii	70	11	36	5
Neomysis kadiakensis	17	3	186	28
Diastylopsis tenuis	66	10	41	6
Diastylopsis dawsoni	21	3	7	1
Anchicolurus occidentalis	5	1	73	11
Miscellaneous	29	4	41	6
TOTAL	208	32	384	57
AMPHIPODA				
Eohaustorius sencillus	1,358	208	131	19
Mandibulophoxus gelesi	435	67	1,120	167
Rhepoxynius vigitegus	485	74	608	90
Eohaustorius sawyeri	4	1	1,583	236
Miscellaneous	584	89	541	81
TOTAL	2,866	439	3,983	593
ECHINODERMATA				
Dendraster excentricus	267	41	147	22
Miscellaneous	33	5	45	7
TOTAL	300	46	192	29
OTHER				
Pleurobranchia spp.	224	34	1	0
Nemertea	207	32	96	14
Pagurus spp.	149	23	90	13
Crab larvae (zoeae)	82	13	32	5
Miscellaneous	79	12	33	6
TOTAL	741	114	252	38
GRAND TOTAL	14,123	2,164	14,690	2,187

Cluster analysis showed Siuslaw River had assemblages of low benthic invertebrate densities (on and near the disposal site) surrounded by an assemblage of higher densities (Figs. 22 and 23). Since the COE was actively disposing of dredge material at the disposal site during Survey 1, low benthic invertebrate densities at stations within the disposal site were expected. Similar densities and cluster groups during Survey 2 indicated recolonization of the disposal site had not occurred.

Sediments

Sediments at Siuslaw River were clean fine sands with a mean grain size of 2.77 phi for Survey 1 and 2.88 phi for Survey 2. Percent silt-clay and organics were low. Mean percent silt-clay was 0.23%, and mean organic content was 0.74% during Survey 1. During Survey 2 mean percent silt-clay was 0.69%, and mean organic content was 0.87%. Only percent silt-clay was found to be significantly different (ANOVA, $P < 0.05$) between surveys and was higher during Survey 2.

Umpqua River

Fishes and Crabs

The mean density of fishes and crabs at Umpqua River was significantly greater (Mann-Whitney, $P < 0.05$) during Survey 2 (3,401/ha) than during Survey 1 (711/ha) (Table 14). For Survey 1 there were no consistent relationships between density and depth or diversity and depth. However, like Siuslaw River, Survey 2 catches decreased as depth increased (Fig. 24). Diversity values (H', J, SD) generally increased as depth increased during Survey 2 (Table 14).

High catches of night smelt during Survey 2 caused the large catch differences between surveys and the diversity-depth relationship.

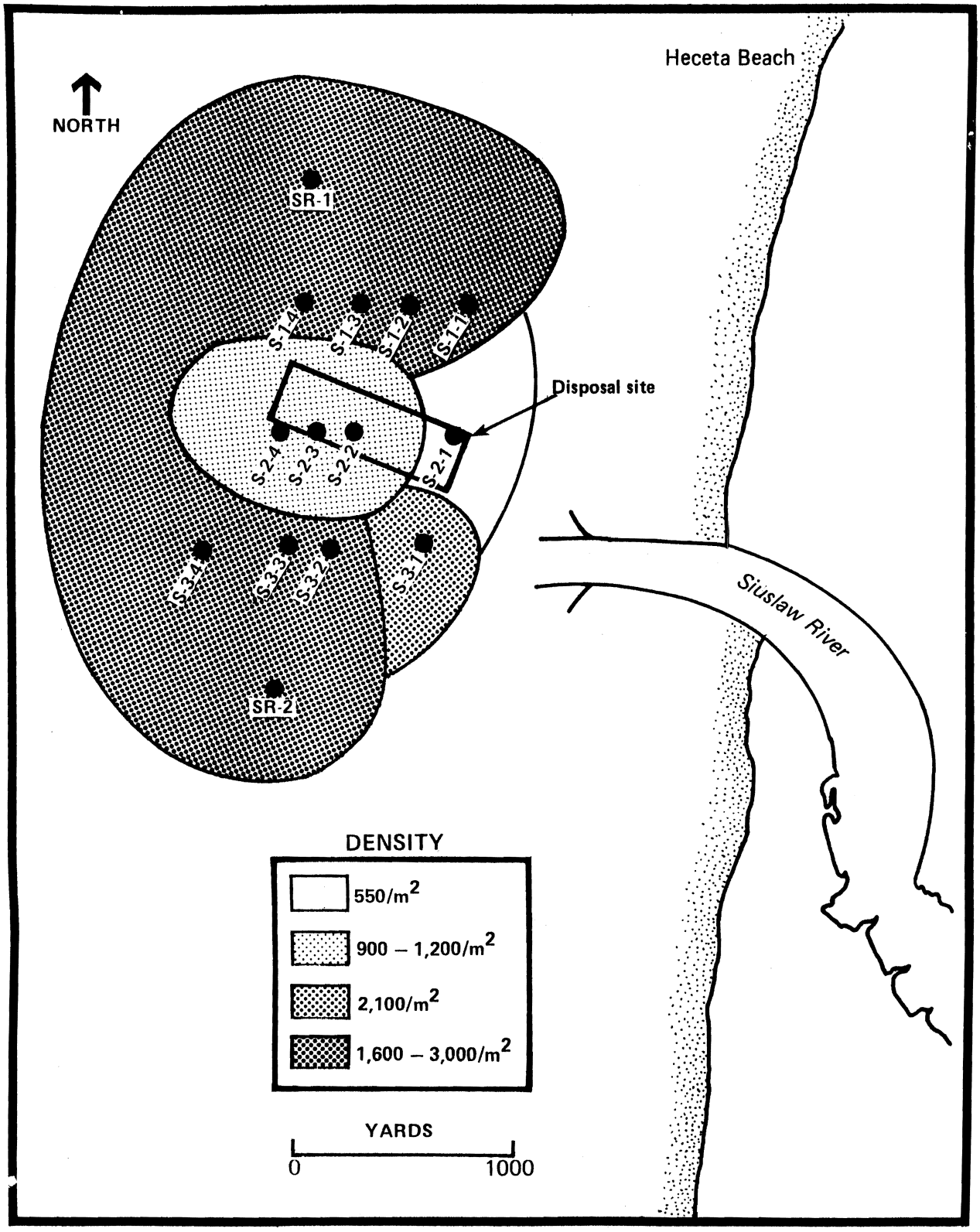

Figure 22.--Locations of the benthic invertebrate cluster groups identified from Survey 1 (Oct. 84) near Siuslaw River, Oregon.

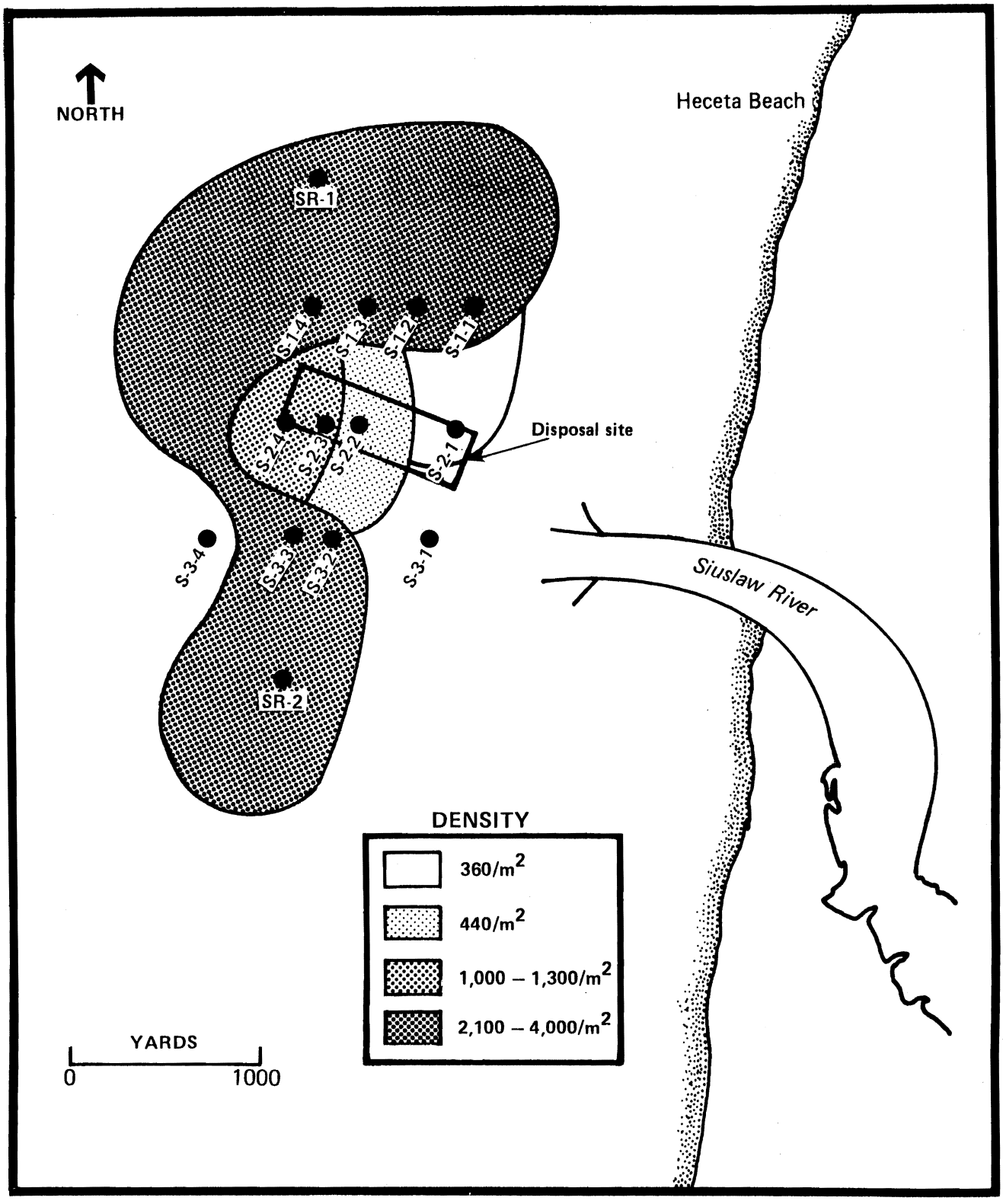

Figure 23.--Locations of the benthic invertebrate cluster groups identified from Survey 2 (Jan. 85) near Siuslaw River, Oregon.

Table 14.--Summaries of trawl data collected at the Umpqua River interim disposal site during Survey 1 (Sep. 1984) and Survey 2 (Jan. 1985).

Survey 1

Station and depth (ft)	Number of species	Number per ha	Weight per ha (g)	H'	J	SD	SR
U-1 (60)	14	911	24,268	2.39	0.63	0.73	2.36
U-2 (70)	13	2,235	49,239	2.25	0.61	0.70	1.88
U-3 (80)	10	302	17,043	1.67	0.50	0.47	1.94
U-4 (90)	13	704	28,356	2.53	0.68	0.71	2.32
U-5 (100)	9	103	5,310	2.44	0.77	0.72	2.49
U-6 (115)	3	13	1,248	1.50	0.95	0.63	1.44
Mean	10	711	20,911	2.13	0.69	0.66	2.07

Survey 2

Station and depth (ft)	Number of species	Number per ha	Weight per ha (g)	H'	J	SD	SR
U-1 (60)	14	6,201	21,102	0.58	0.15	0.14	1.69
U-2 (70)	12	6,634	18,868	0.44	0.12	0.10	1.40
U-3 (80)	17	2,900	22,571	1.52	0.37	0.42	2.30
U-4 (90)	20	2,853	29,681	1.65	0.38	0.44	2.76
U-5 (100)	17	1,472	27,982	2.85	0.70	0.81	2.54
U-6 (115)	12	345	12,393	2.51	0.70	0.72	2.36
Mean	15	3,401	22,100	1.59	0.40	0.44	2.18

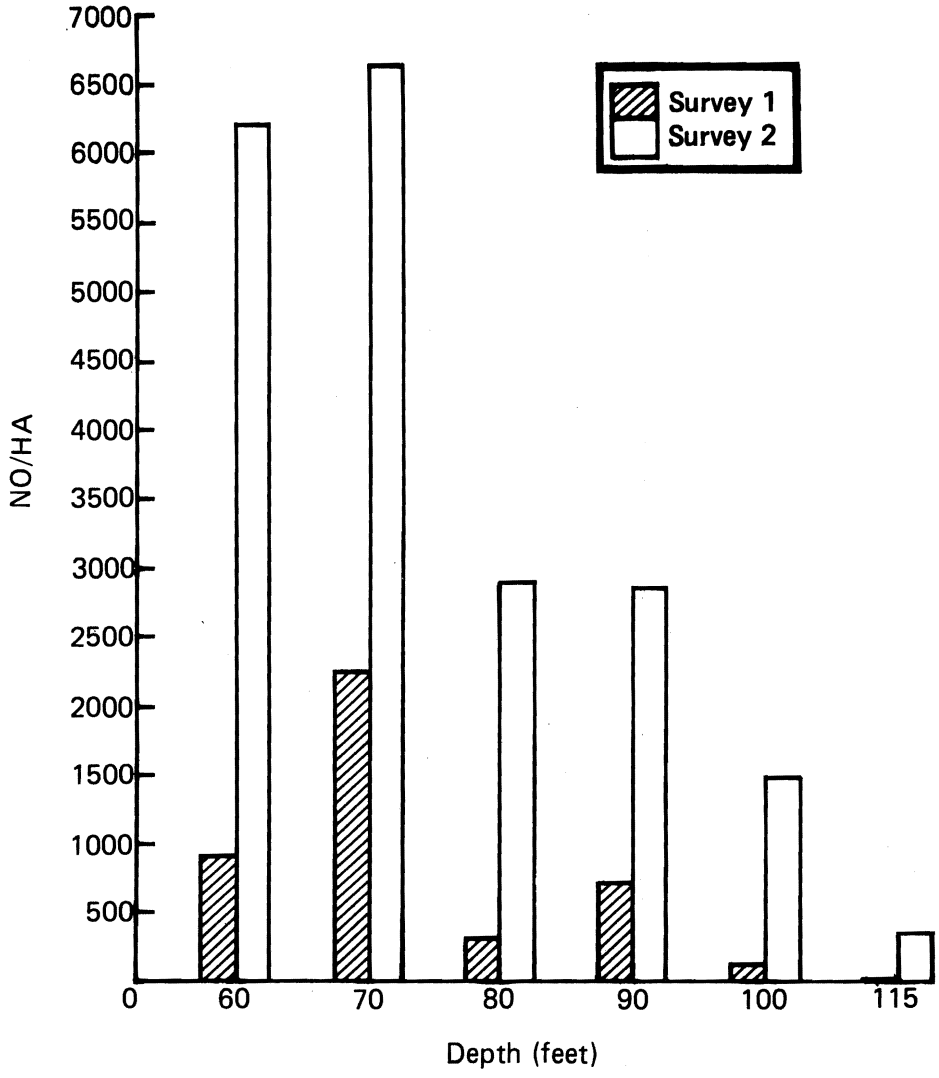

Figure 24.--Numbers of fishes and crabs (per hectare) captured at different depths during Survey 1 (Sep. 84) and Survey 2 (Jan. 85) near Umpqua River, Oregon.

Night smelt comprised 82% of the total catch during Survey 2 and only 1% of the Survey 1 catch (Table 15). Other important species were Pacific tomcod; pricklebreast poacher, Stellerina xyosterna; Pacific sand lance, Ammodytes hexapterus; speckled sanddab; sand sole; and English sole, Parophrys vetulus. Length frequency distributions of the common fish species and Dungeness crab for both surveys indicated many fishes and crabs were juveniles (Figs. 25 and 26). The size group of Dungeness crabs captured changed between surveys. During Survey 1 most Dungeness crabs were young-of-the-year (< 25mm wide), but during Survey 2, most Dungeness crabs were probably adults (≥ 100 mm wide).

Benthic Invertebrates

A total of 189 invertebrate taxa were identified from Survey 1 and 139 from Survey 2 (Tables 16 and 17). Mean invertebrate densities ranged from 365/m^2 at Station U-2-3 (Survey 2) to 5,483/m^2 at Station UR-2 (Survey 2). There was no significant difference (ANOVA, $P > 0.05$) between survey densities; total mean densities were 2,728/m^2 for Survey 1 and 2,949/m^2 for Survey 2. Diversity indices (H', J, SD, SR) tended to be higher during Survey 1.

Umpqua River benthos was dominated by polychaetes, primarily Scoloplos armiger, Megelona sacculata, and Chaetozone setosa (Table 18). During Survey 1, mollusks were secondary in importance, whereas during Survey 2 amphipods were secondary. Amphipods tripled in abundance between Surveys 1 and 2, primarily due to the increase in Eohaustorius sencillus (Table 18).

Cluster analysis showed two low density groups located on the disposal site during Survey 1 (Fig. 27). These low density groups were surrounded by a higher density group encompassing almost all the other

Table 15.-- Catch summaries for fishes and crabs captured near Umpqua River during Survey 1 (Sep. 1984) and Survey 2 (Jan. 1985).

Species	Survey 1		Survey 2	
	Total number captured	Mean number per ha	Total number captured	Mean number per ha
Spiny dogfish	0	0	1	1
Big skate	5	3	3	2
American shad	0	0	82	38
Northern anchovy	2	1	0	0
Whitebait smelt	0	0	7	3
Night smelt	9	6	6,131	2,766
Longfin smelt	0	0	1	1
Unid. juvenile smelt	1	1	1	1
Pacific tomcod	228	136	298	136
Larval groundfish	0	0	2	1
King-of-the-salmon	1	1	0	0
Bay pipefish	1	1	8	4
Shiner perch	4	3	37	18
Spotfin surfperch	0	0	35	16
Wolf-eel	3	2	0	0
Pacific sand lance	0	0	250	115
Lingcod	1	1	0	0
Pac. staghorn sculpin	3	2	56	27
Cabezon	0	0	1	1
Warty poacher	45	28	2	1
Tubenose poacher	21	13	5	2
Pricklebreast poacher	388	241	65	30
Pacific sanddab	0	0	24	12
Speckled sanddab	248	154	71	33
Butter sole	5	3	25	12
English sole	73	47	61	28
C-O sole	4	2	0	0
Sand sole	79	49	307	146
Larval flatfish	1	1	1	1
Dungeness crab	27	17	17	8
Red rock crab	1	1	0	0
Cancer gracilis	0	0	2	1
Kelp crab	1	1	0	0
Pugettia richii	1	1	0	0
TOTAL	1,152	715	7,493	3,404

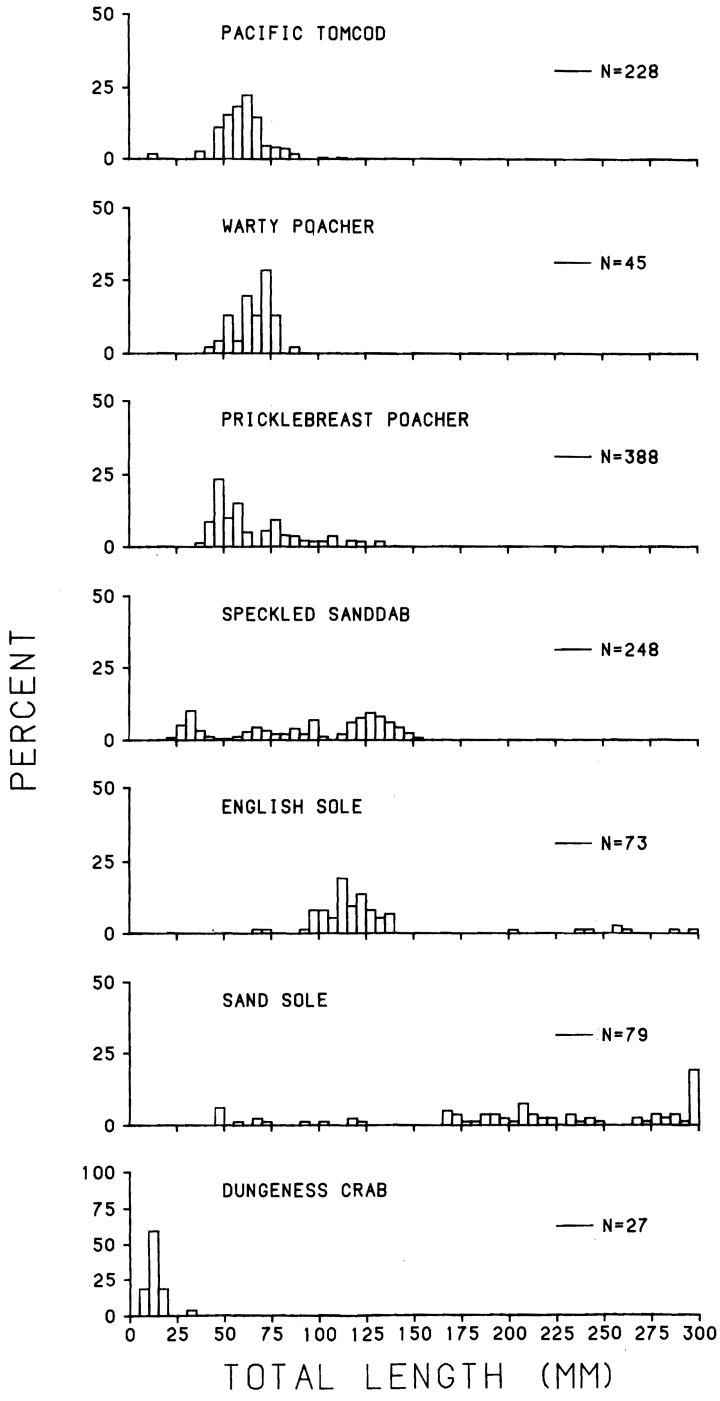

Figure 25.--Length frequency distributions of common fish species and Dungeness crabs captured near Umpqua River during Survey 1 (Sep. 84); carapace widths are shown for Dungeness crabs. Fishes > 300 mm are included in the 295-300 mm size interval.

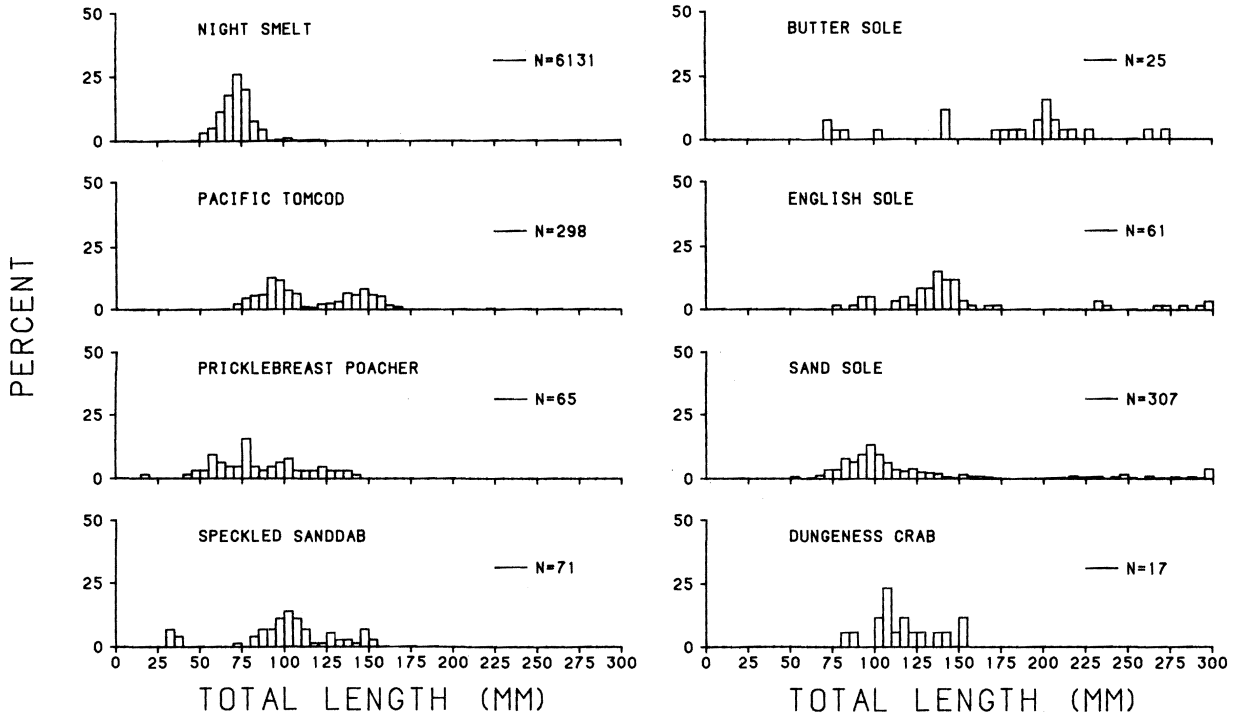

Figure 26.--Length frequency distributions of common fish species and Dungeness crabs captured near Umpqua River during Survey 2 (Jan. 85); carapace widths are shown for Dungeness crabs. Fishes > 300 mm are included in the 295-300 mm size interval.

Table 16.--Description of the invertebrate community near Umpqua River during Survey 1 (Sep. 1984). Totals were calculated by combining replicates from all stations.

Station and depth (ft)	Number of species	No./m^2	St. dev.	H'	J	SD	SR
UR-1 (70)	68	2,619	597	4.20	0.69	0.89	9.39
UR-2 (95)	84	4,442	240	4.23	0.66	0.90	10.83
UR-3 (115)	79	3,792	484	4.40	0.70	0.91	10.39
U-1-1 (60)	62	3,721	895	3.67	0.62	0.82	8.15
U-1-2 (70)	67	3,681	525	3.85	0.63	0.84	8.83
U-1-3 (80)	67	3,638	216	3.81	0.63	0.83	8.84
U-1-4 (90)	72	3,894	376	3.82	0.62	0.82	9.42
U-1-5 (100)	87	4,381	768	4.04	0.63	0.85	11.24
U-1-6 (120)	76	4,019	872	3.94	0.63	0.85	9.91
U-2-1 (65)	33	1,044	306	3.10	0.62	50.76	5.15
U-2-2 (70)	31	869	400	2.61	0.53	0.65	4.97
U-2-3 (80)	41	683	132	3.77	0.70	0.86	6.90
U-2-4 (90)	37	735	298	3.85	0.74	0.86	6.90
U-2-5 (100)	54	1,656	1,115	3.45	0.60	0.77	7.94
U-2-6 (115)	59	2,044	703	3.68	0.63	0.81	8.42
U-3-1 (60)	51	2,817	907	4.10	0.72	0.90	6.94
U-3-2 (70)	53	3,154	650	4.11	0.72	0.91	7.10
U-3-3 (80)	63	2,556	476	4.07	0.68	0.90	8.72
U-3-4 (90)	72	2,827	643	4.38	0.71	0.91	9.84
U-3-5 (00)	80	3,110	949	4.36	0.69	0.91	10.81
U-3-6 (120)	67	2,808	368	4.39	0.72	0.92	9.16
UR-4 (60)	47	1,933	250	4.15	0.75	0.91	6.73
UR-5 (95)	58	3,185	884	4.21	0.72	0.92	7.77
UR-6 (115)	59	2,108	320	4.40	0.75	0.93	8.38
TOTAL	189	2,728	1,157	4.63	0.61	0.90	18.15

Table 17.--Description of the benthic invertebrate community near Umpqua River, Survey 2 (Jan. 1985). Totals were calculated by combining replicates from all stations.

Station and depth (ft)	Number of species	No./m^2	St. dev.	H'	J	SD	SR
UR-1 (70)	59	3,923	765	3.79	0.64	0.86	7.69
UR-2 (95)	57	5,483	435	3.19	0.55	0.73	7.11
UR-3 (115)	65	3,167	617	3.70	0.61	0.82	8.74
U-1-1 (60)	45	2,650	512	3.23	0.59	0.79	6.16
U-1-2 (70)	49	2,846	489	3.32	0.59	0.77	6.86
U-1-3 (80)	50	2,681	687	3.49	0.62	0.82	6.84
U-1-4 (90)	57	5,450	2,191	3.03	0.52	0.73	7.12
U-1-5 (100)	51	3,506	1,371	3.00	0.53	0.72	6.73
U-1-6 (120)	55	2,567	816	3.74	0.65	0.85	7.59
U-2-1 (65)	19	496	236	1.72	0.41	0.44	3.29
U-2-2 (70)	19	494	587	2.29	0.54	0.68	3.29
U-2-3 (80)	21	365	125	3.30	0.75	0.85	3.87
U-2-4 (90)	32	540	245	3.46	0.69	0.83	5.58
U-2-5 (100)	34	392	161	3.76	0.74	0.86	6.30
U-2-6 (115)	34	460	226	3.90	0.77	0.90	6.11
U-3-1 (60)	51	4,777	1,118	2.63	0.46	0.71	6.46
U-3-2 (70)	53	4,569	589	2.97	0.52	0.76	6.76
U-3-3 (80)	57	4,565	575	3.12	0.53	0.79	7.28
U-3-4 (90)	48	4,108	886	3.33	0.60	0.79	6.19
U-3-5 (100)	58	4,415	645	2.52	0.43	0.60	7.44
U-3-6 (120)	63	3,031	229	3.93	0.66	0.89	8.51
UR-4 (60)	49	2,927	1,206	3.11	0.55	0.77	6.62
UR-5 (95)	54	4,396	1,939	3.21	0.56	0.74	6.92
UR-6 (115)	59	2,958	917	3.84	0.65	0.86	7.99
TOTAL	139	2,949	1,854	3.85	0.54	0.85	13.24

Table 18.--Summary of benthic invertebrate collections near the Umpqua River during Survey 1 (Sep. 1984) and Survey 2 (Jan. 1985). Only dominant taxa from each major category are shown.

Taxon	Survey 1		Survey 2	
	Total number	Mean number/m^2	Total number	Mean number/m^2
POLYCHAETA				
Scoloplos armiger	8,396	729	7,010	613
Megelona sacculata	2,143	186	566	50
Chaetozone setosa	816	71	3,162	277
Nephtys caecoides	441	38	777	68
Miscellaneous	4,648	403	2,783	244
TOTAL	16,444	1,427	14,298	1,252
MOLLUSCA				
Tellina modesta	2,538	220	1,168	102
Olivella pycna	1,979	172	1,545	135
Olivella biplicata	1,298	113	814	71
Miscellaneous	2,154	187	917	81
TOTAL	7,969	692	4,444	389
MYSIDACEA/CUMACEA				
Archaeomysis grebnitzkii	307	27	31	3
Neomysis kadiakensis	157	14	116	10
Diastylopsis tenuis	456	40	306	27
Anchicolurus occidentalis	6	1	47	4
Miscellaneous	256	21	36	3
TOTAL	1,182	103	536	47
AMPHIPODA				
Rhepoxynius abronius	1,770	154	1,251	110
Eohaustorius sencillus	808	57	10,032	878
Rhepoxynius vigitegus	434	38	418	37
Mandibulophoxus gelesi	158	14	601	53
Miscellaneous	1,682	158	1,105	96
TOTAL	4,852	421	13,407	1,174
ECHINODERMATA				
Amphiodia spp.	36	3	51	5
Dendraster excentricus	19	2	56	5
Miscellaneous	19	1	25	2
TOTAL	74	6	132	12
OTHER				
Nemertea	226	21	181	16
Pagurus spp.	168	35	388	34
Crab larvae (zoeae)	8	1	150	13
Miscellaneous	505	22	119	10
TOTAL	907	79	838	73
GRAND TOTAL	31,428	2,728	33,655	2,947

sampling stations. During Survey 2, two lower density groups still existed on the disposal site; these two groups had similar densities, but different species were important in each group (Fig. 28). Higher density cluster groups were located north and south of the disposal site.

Sediments

Like the other three disposal areas, the Umpqua River had clean fine sands that were low in silt-clay and organics. During Survey 1, mean grain size was 2.83 phi, and during Survey 2 it was 2.84 phi. Mean percent silt-clay was 1.41% during Survey 1 and 1.73% during Survey 2. Mean percent organics were 1.20% (Survey 1) and 1.15% (Survey 2). No significant differences (ANOVA, $P>0.05$) were found between the sediment structures of Surveys 1 and 2.

Area Comparisons

Fishes and Crabs

During Survey 1, no significant differences (Kruskal-Wallis, $P > 0.05$) occurred among densities of fishes and trawl caught crabs at the four areas. During Survey 2, densities were much lower at Tillamook Bay than the other three areas (Fig. 29), but the difference was not significant (Kruskal-Wallis, $P > 0.05$). The four areas contained similar fish and crab species (see Appendix E for a list of species identified during both surveys). One major difference between the areas was the occurrence of large numbers of smelt at Depoe Bay, Siuslaw River, and Umpqua River during Survey 2. Another major difference was in Dungeness crab densities. Dungeness crab was the second most abundant species at Tillamook Bay during Survey 1 and the most abundant species during Survey 2; however, it was not abundant at the other areas.

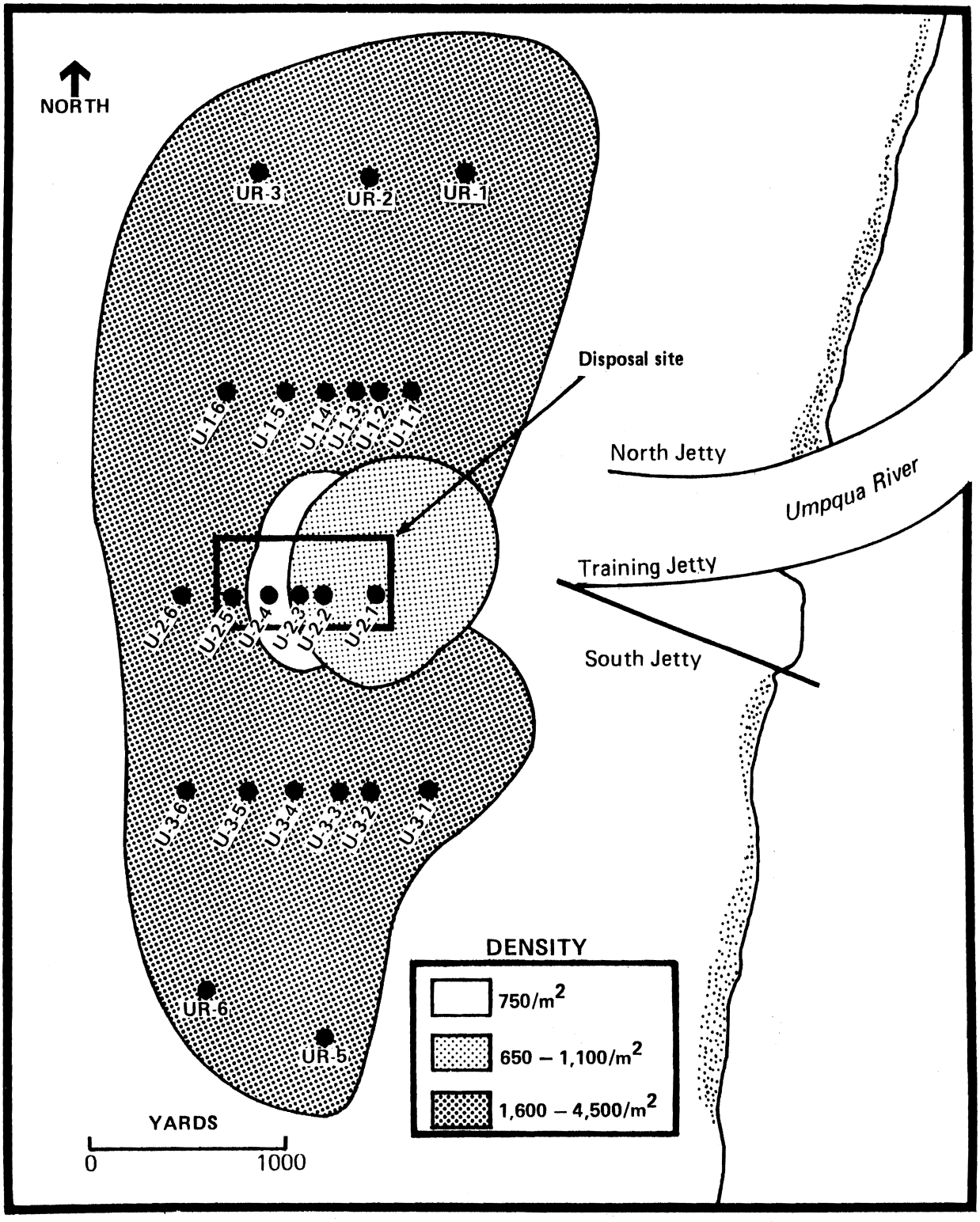

Figure 27.--Locations of the benthic invertebrate cluster groups identified from Survey 1 (Sep. 84) near Umpqua River, Oregon.

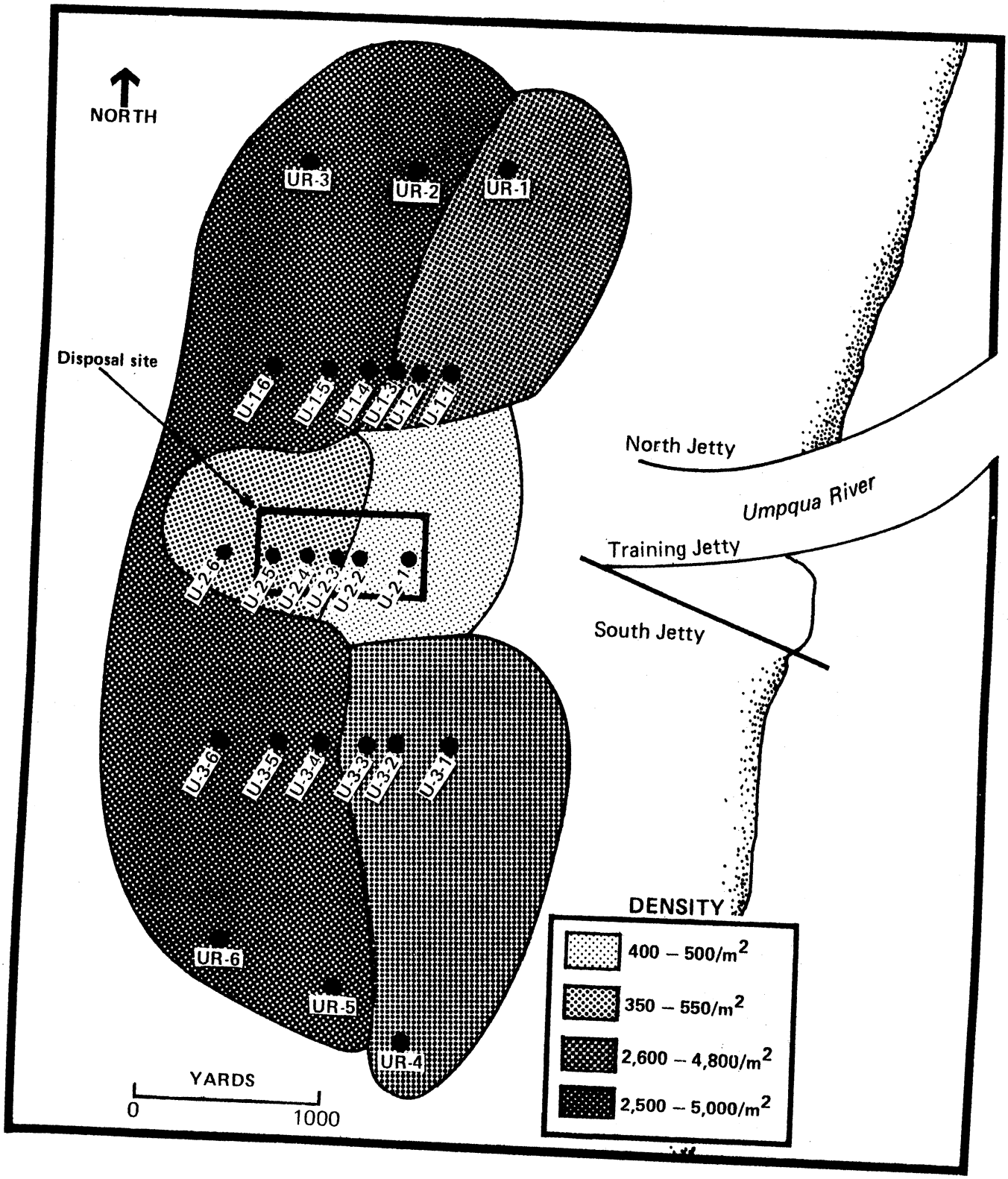

Figure 28.--Locations of the benthic invertebrate cluster groups identified from Survey 2 (Jan. 85) near Umpqua River, Oregon.

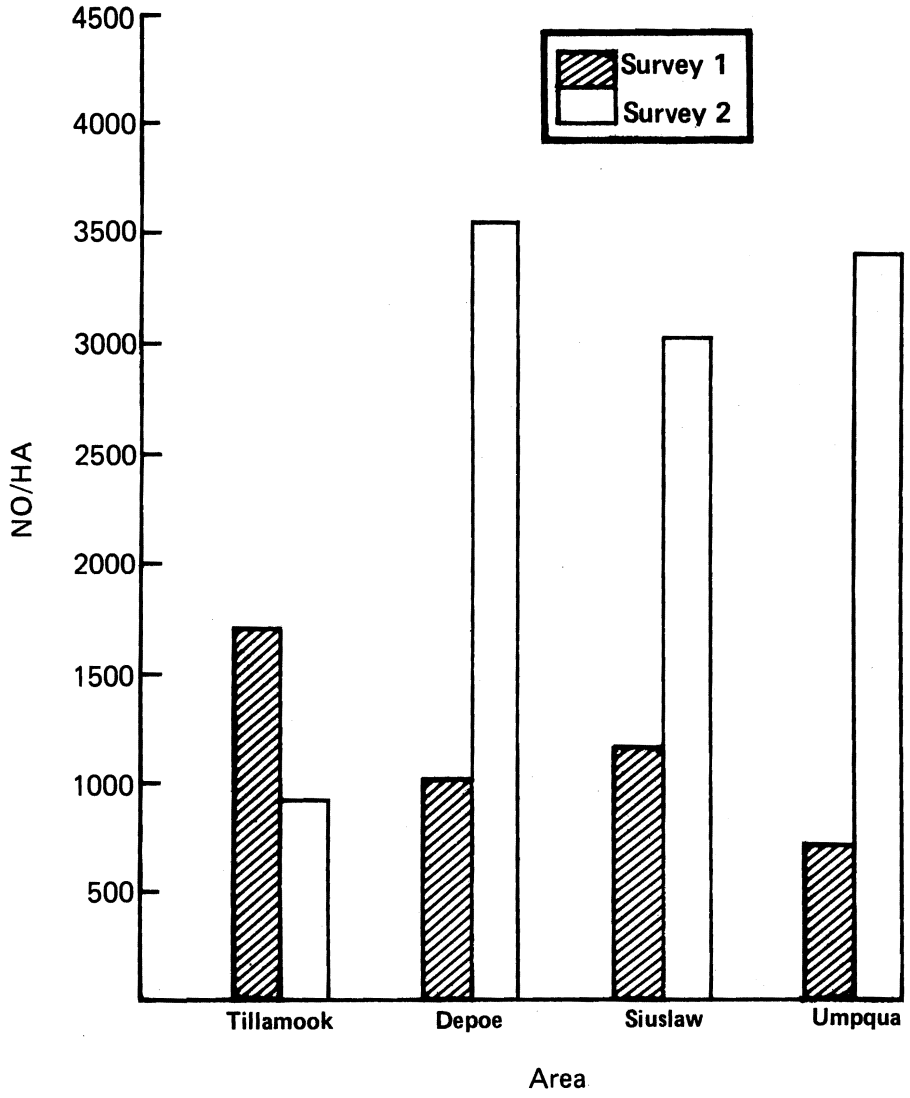

Figure 29.--Mean number (per hectare) of fishes and crabs captured at the four study locations during Survey 1 (Sep.-Oct. 84) and Survey 2 (Jan. 85).

Benthic Invertebrates

There was a significant difference (ANOVA, $P < 0.05$) in infaunal densities among the four areas during Survey 1, with Tillamook Bay having much higher densities than the other areas (Fig. 30). During Survey 2, no significant difference was found (ANOVA, $P > 0.05$). This was due to reduced densities at Tillamook Bay.

Although Umpqua River had more species than the other areas, all areas had similar species. The major difference between areas was in the abundance of those species. For example, Owenia fusiformis was very abundant at Tillamook Bay but was never abundant at the other areas. Atylus tridens and Siliqua sloati were also abundant at Tillamook Bay (Survey 1) but not at the other areas. Similar densities of Eohaustorius sencillus, Olivella pycna, and many other taxa were found at the four areas.

Sediments

There were significant differences in mean grain size (ANOVA, $P < 0.05$), percent silt-clay (ANOVA, $P < 0.05$), and percent organics (ANOVA, $P < 0.05$) among the four areas during Survey 1. During Survey 2, only percent silt-clay (ANOVA, $P < 0.05$) and percent organics (ANOVA, $P < 0.05$) were significantly different among the four areas.

Although there were differences in sediment characteristics between areas, all areas had clean fine sands that were low in silt-clay and organics. Tillamook Bay, which had much higher densities of infauna during Survey 1 than anywhere else, did not appear to have sediments greatly different from the other areas. Siuslaw River appeared to differ most from the other areas; percent silt-clay and percent organics were much lower at Siuslaw River than the other areas during Survey 1.

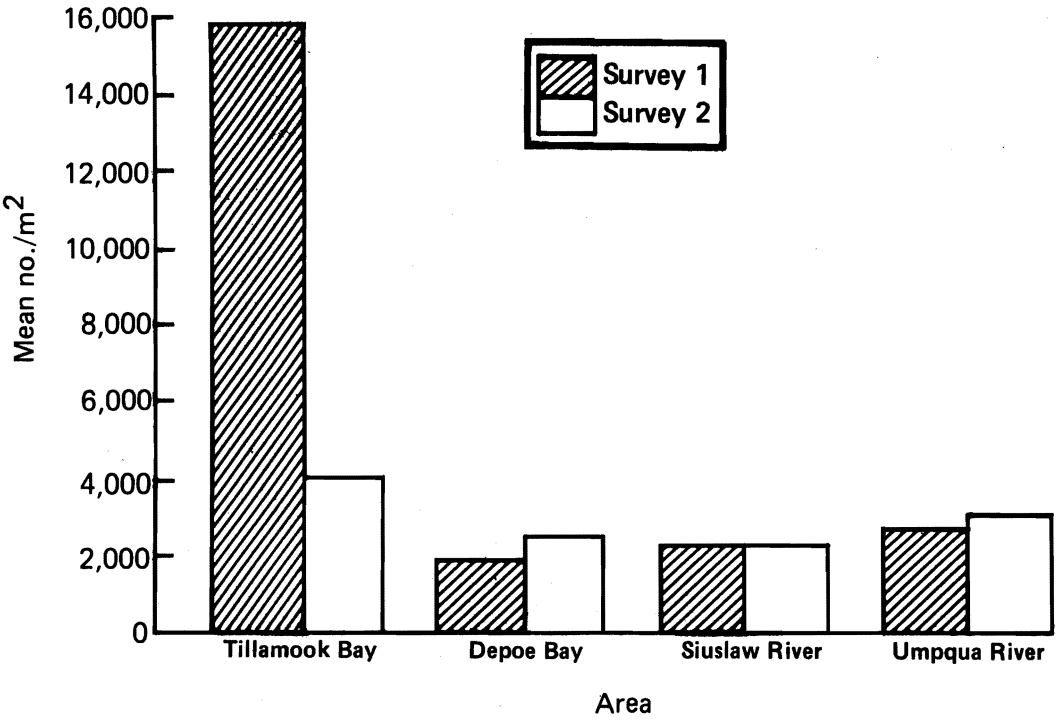

Figure 30.--Mean number of benthic invertebrates /m^2 at the four study sites during Survey 1 (Sep.-Oct. 84) and Survey 2 (Jan. 85).

DISCUSSION

Fishes and Crabs

Our fish and crab data agree closely with the findings of Hancock et al. (1984) off Coos Bay, Oregon, and Durkin and Lipovsky's (1977) data collected off the mouth of the Columbia River. They also reported that many of the fishes in the nearshore environment were juveniles. Commercially valuable species that significantly utilize the four disposal areas are: Dungeness crab, English sole, and sand sole. Probably only Dungeness crab and sand sole are fished commercially in the study areas (personal observation). The study areas may be utilized by some species as rearing areas and also as larval settlement areas. For example, transforming English sole larvae settle and rear in shallow coastal waters and estuaries, with the estuarine populations moving to offshore areas prior to adulthood (Krygier and Pearcy 1986). Pacific tomcod and Dungeness crab are also abundant in estuaries at times (NMFS 1981; Armstrong et al. 1982). Whether the areas off the mouths of estuaries are critical habitat for other species is unknown.

The Tillamook Bay area appears to be unique compared to the other areas. Large numbers of juvenile Dungeness crabs were present in this area during both surveys. This area also had massive amounts of macroalgae (Ulva spp., Enteromorpha spp., and others) on the bottom during Survey 1, as evidenced by the large amounts collected in the trawls. Large numbers of young-of-the-year Dungeness crabs and Crangon spp. shrimp appeared to be associated with this algae. The distribution, occurrence, origin, and abundance of the macroalgae are unknown, but the algal environment is probably responsible for the high numbers of crabs, shrimp, and benthic invertebrates in the Tillamook Bay area.

Benthic Invertebrates

All areas, except Tillamook Bay, appear to have species and densities comparable to those in similar areas off the Oregon coast (Hancock et al. 1984). The low densities at these areas are probably caused by regular disturbances, i.e., storms and high waves. Except for Tillamook Bay, invertebrate densities averaged about 2,384/m^2, which is similar to an area off Coos Bay (Hancock et al. 1984); a shallowwater sandy-bottom community off Washington (Lie and Kisker 1970); and a benthic community in water > 14 m in Monterey Bay, California (Oliver et al. 1980).

Tillamook Bay had much higher invertebrate densities than the other three areas, and the abundant species were different. At Tillamook Bay, Owenia fusiformis dominated the infaunal community. The distribution of this tube-dwelling species was probably strongly affected by sediment stability. Oliver et al. (1980) found tube-building polychaetes to be abundant only at greater depths (away from the beach), where sediment disruption was minimal. This probably explains why O. fusiformis was not abundant in the shallow areas (severe wave action) and the reduced numbers during Survey 2 (winter storms).

Cluster analysis showed that Siuslaw River and Umpqua River areas closely resembled each other. Each had low density cluster groups located at the dredge disposal site surrounded by a cluster group(s) of higher density. The sites at Siuslaw and Umpqua Rivers are actively used as dredge disposal areas, and the cluster data may reflect effects of this disposal. Also, local currents may regularly disrupt these sites, causing the low densities.

We do not know why the Tillamook Bay benthic invertebrate community is so different from the other areas. The benthic community's high standing crop may be linked to the export of primary production from the nearby estuary.

Supporting evidence for this comes from benthic invertebrate surveys off Willapa Bay and Grays Harbor, Washington. Pearson et al. (1985) found high densities of O. fusiformis off Grays Harbor, and Shapiro and Associates (1985) and the authors (unpublished observations) have noted extremely high densities of O. fusiformis off Willapa Bay. Both Willapa Bay and Grays Harbor have extensive mud flats where macroalgae can grow, as does Tillamook Bay. Since our trawling collected large amounts of algae that typically grow in estuaries, we speculate that the output of these materials enhances the benthic community in the adjacent nearshore environment.

Sediments

Sediments were typical of a nearshore environment that is exposed to waves and ocean swells (Fager 1968). Although sediments have a significant effect on the distribution and abundance of benthic invertebrates (Carey 1965), wave disturbance also plays an important role in determining the benthic invertebrate community in nearshore areas (Oliver et al. 1980). Since we found invertebrate densities at Tillamook Bay to be much greater than at the other disposal areas, sediment characteristics alone do not appear to present enough information to predict either the benthic invertebrate community or densities in the nearshore environment along the Oregon coast.

SUMMARY

Although there was a wide variation in densities of fishes and crabs between surveys, only at Umpqua River, where large catches of night smelt occurred in Survey 2, was there a significant difference in densities between surveys. The limited differences were probably a result of the

wide variation in catches at each area and the limited replication. Many of the fishes and crabs captured were juveniles, and only a few species dominated the catches. Dungeness crab densities were significantly higher at Tillamook Bay than at the other three disposal sites.

Sediments at the four study areas showed little seasonal variation and were composed of clean fine sands that were low in silt-clay and organics.

Benthic invertebrate species and densities at three of the areas (Umpqua River, Siuslaw River, and Depoe Bay) were similar to what has been found elsewhere off the Oregon coast; however, densities at Tillamook Bay were much higher than densities at the other areas. Cluster groupings of the invertebrate data from Umpqua River and Siuslaw River may reflect the effects of dredge disposal. What caused high invertebrate densities at the Tillamook Bay site is not known, but the contribution of primary production from the adjacent estuary is suspected. The overall size of the high invertebrate density region (Tillamook Bay) is not known and needs to be defined.

ACKNOWLEDGMENTS

We thank the Portland District of the COE for the use of some figures and the sediment analysis. Special thanks go to Danil Hancock, Howard Jones, Sandy Lipovsky, Susan Newhouse, and Thomas Moylan.

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APPENDIX A

Loran-C Navigational Values for Benthic and Trawl Stations

TILLAMOOK BAY BENTHIC STATIONS . SURVEY 1

Station	Depth (ft)	Loran Readings	
TR-1	60	12370.8	28008.1
TR-2	100	12369.8	28007.2
TR-3	60	12385.3	28005.7
TR-4	100	12386.7	28004.0
T-1-1	60	12370.0	28008.3
T-1-2	70	12370.5	28007.9
T-1-3	80	12371.0	28007.6
T-1-4	90	12371.2	28007.2
T-1-5	100	12371.4	28006.8
T-1-6	115	12373.3	28006.1
T-2-1	60	12377.9	28006.6
T-2-2	70	12377.6	28006.6
T-2-3	80	12377.8	28006.3
T-2-4	90	12378.0	28006.0
T-2-5	100	12378.0	28005.8
T-2-6	115	12379.2	28005.1
T-3-1	60	12383.2	28005.9
T-3-2	70	12383.5	28005.5
T-3-3	80	12383.5	28005.3
T-3-4	90	12384.0	28004.8
T-3-5	100	12384.2	28004.5
T-3-6	115	12384.4	28004.1

DEPOE BAY BENTHIC STATIONS SURVEY 1

Station	Depth (ft)	
		(No Loran C readings)
DR-1	90	0.5 mi N of "DB"*; 0.5 mi from shore
D-1	80	0.4 mi S of "DB"; 0.5 mi from shore
D-2	85	0.7 mi S of "DB"; 0.5 mi from shore

* "DB" is the navigational buoy near the mouth of Depoe Bay; distances are nautical miles.

SIUSLAW RIVER BENTHIC STATIONS SURVEY 1

Station	Depth (ft)	Loran Readings	
SR-1	80	13181.5	27873.5
SR-2	80	13192.4	27871.5
S-1-1	50	13183.6	27874.1
S-1-2	60	13183.7	27873.8
S-1-3	70	13183.6	27873.4
S-1-4	80	13184.3	27872.9
S-2-1	40	13186.6	27873.3
S-2-2	60	13186.1	27873.0
S-2-3	70	13186.5	27872.8
S-2-4	80	13186.5	27872.7
S-3-1	50	13189.3	27873.1
S-3-2	70	13188.8	27872.6
S-3-3	80	13189.1	27872.1
S-3-4	100	13188.3	27871.7

UMPQUA RIVER BENTHIC STATIONS SURVEY 1

Station	Depth (ft)	Loran Readings	
UR-1	70	13368.0	27831.4
UR-2	95	13367.8	27830.8
UR-3	115	13367.8	27830.1
UR-4	60	13383.4	27828.6
UR-5	95	13382.3	27827.7
UR-6	115	13382.3	27827.1
U-1-1	60	13371.3	27830.8
U-1-2	70	13370.7	27830.6
U-1-3	80	13370.8	27830.5
U-1-4	90	13370.6	27830.2
U-1-5	100	13371.1	27829.8
U-1-6	120	13371.8	27829.1
U-2-1	65	13376.3	27829.3
U-2-2	70	13376.3	27829.0
U-2-3	80	13376.4	27828.8
U-2-4	90	13376.5	27828.5
U-2-5	100	13376.6	27828.3
U-2-6	115	13376.6	27827.9
U-3-1	60	13380.7	27829.0
U-3-2	70	13380.5	27828.6
U-3-3	80	13380.5	27828.3
U-3-4	90	13380.5	27827.9
U-3-5	100	13380.4	27827.7
U-3-6	120	13380.2	27827.4

TILLAMOOK BAY TRAWL STATIONS SURVEY 1

Station	Depth (ft)	Loran Readings			
		Beginning		Ending	
T-1	60	12381.6	28006.0	12378.7	28006.3
T-2	70	12381.0	28005.8	12383.3	28005.6
T-3	80	12380.7	28005.7	12377.9	28006.1
T-4	90	12379.7	28005.5	12382.2	28005.1
T-5	100	12380.0	28005.3	12378.2	28005.7
T-6	110	12378.4	28005.2	12381.0	28004.7

DEPOE BAY TRAWL STATION SURVEY 1

Station	Depth (ft)	Loran Readings			
		Beginning		Ending	
D-1	80	12775.1	27934.4	12771.6	27934.9

SIUSLAW RIVER TRAWL STATIONS SURVEY 1

Station	Depth (ft)	Loran Readings			
		Beginning		Ending	
S-1	50	13186.5	27873.4	13185.1	27873.7
S-2	60	13191.1	27872.3	13190.4	27872.4
S-3	70	13188.0	27872.6	13191.3	27872.0
S-4	80	13187.7	27872.6	13186.1	27872.6

UMPQUA RIVER TRAWL STATIONS SURVEY 1

Station	Depth (ft)	Loran Readings			
		Beginning		Ending	
U-1	60	13373.5	27830.2	13371.0	27830.8
U-2	70	13372.1	27830.3	13370.2	27831.2
U-3	80	13372.2	27829.8	13375.4	27829.0
U-4	90	13373.6	27828.8	13376.0	27828.4
U-5	100	13370.6	27829.1	13368.3	27829.6
U-6	115	13371.8	27828.5	13374.1	27827.6

TILLAMOOK BAY BENTHIC STATIONS SURVEY 2

Station	Depth (ft)	Loran Readings	
TR-1	60	12370.3	28008.0
TR-2	100	12369.8	28007.2
TR-3	60	12385.3	28005.7
TR-4	100	12386.7	28004.0
T-1-1	60	12375.0	28007.4
T-1-2	70	12375.6	28007.0
T-1-3	80	12374.7	28007.0
T-1-4	90	12375.4	28006.6
T-1-5	100	12376.5	28006.3
T-1-6	115	12377.4	28005.6
T-2-1	60	12378.6	28006.5
T-2-2	70	12378.6	28006.4
T-2-3	80	12378.7	28006.3
T-2-4	90	12378.4	28006.0
T-2-5	100	12378.0	28005.8
T-2-6	115	12379.2	28005.1
T-3-1	60	12383.2	28005.9
T-3-2	70	12383.4	28005.6
T-3-3	80	12383.5	28005.2
T-3-4	90	12384.6	28004.7
T-3-5	100	12384.3	28004.4
T-3-6	115	12384.5	28004.1

DEPOE BAY BENTHIC STATIONS SURVEY 2

Station	Depth (ft)	Loran Readings	
DR-1	90	12764.7	27945.6
D-1	80	12770.5	27945.2
D-2	85	12775.6	27933.9

SIUSLAW RIVER BENTHIC STATIONS SURVEY 2

Station	Depth (ft)	Loran Readings	
SR-1	80	13181.6	27873.6
SR-2	80	13192.5	27871.5
S-1-1	50	13183.5	27874.3
S-1-2	60	13183.7	27873.8
S-1-3	70	13183.7	27873.5
S-1-4	80	13184.3	27872.8
S-2-1	40	13186.7	27873.3
S-2-2	60	13186.2	27873.0
S-2-3	70	13186.5	27872.8
S-2-4	80	13186.5	27872.7
S-3-1	50	13189.3	27873.1
S-3-2	70	13188.8	27872.6
S-3-3	80	13189.0	27872.2
S-3-4	100	13188.3	27871.6

UMPQUA RIVER BENTHIC STATIONS SURVEY 2

Station	Depth (ft)	Loran Readings	
UR-1	70	13368.0	27831.4
UR-2	95	13367.8	27830.7
UR-3	115	13367.8	27830.0
UR-4	60	13383.5	27828.5
UR-5	95	13382.3	27827.7
UR-6	115	13382.2	27827.0
U-1-1	60	13371.2	27830.9
U-1-2	70	13371.0	27830.6
U-1-3	80	13370.9	27830.5
U-1-4	90	13370.6	27830.2
U-1-5	100	13371.2	27829.8
U-1-6	120	13371.8	27829.1
U-2-1	65	13376.5	27829.3
U-2-2	70	13376.4	27829.0
U-2-3	80	13376.5	27828.7
U-2-4	90	13376.4	27828.5
U-2-5	100	13376.6	27828.3
U-2-6	115	13376.6	27828.0
U-3-1	60	13380.8	27829.1
U-3-2	70	13380.5	27828.7
U-3-3	80	13380.6	27828.4
U-3-4	90	13380.5	27828.0
U-3-5	100	13380.3	27827.5
U-3-6	120	13380.3	27827.4

TILLAMOOK BAY TRAWL STATIONS SURVEY 2

Station	Depth (ft)	Loran Readings			
		Beginning		Ending	
T-1	60	12379.1	28006.0	12375.8	28006.9
T-2	70	12376.0	28006.7	12379.5	28006.1
T-3	80	12378.8	28005.9	12375.5	28006.6
T-4	90	12381.9	28005.2	12379.6	28005.9
T-5	100	12381.2	28005.2	12384.3	28004.5
T-6	110	12383.7	28004.5	12383.7	28005.0

DEPOE BAY TRAWL STATIONS SURVEY 2

Station	Depth (ft)	Loran Readings			
		Beginning		Ending	
D-1	80	12772.0	27945.0	12769.3	27945.5
D-2	90	12770.9	27944.7	12774.4	27944.1

SIUSLAW RIVER TRAWL STATIONS SURVEY 2

Station	Depth (ft)	Loran Readings			
		Beginning		Ending	
S-1	50	13187.6	27873.3	13184.0	27874.1
S-2	60	13184.4	27873.9	13188.0	27873.2
S-3	70	13187.4	27872.9	13184.0	27873.4
S-4	80	13184.8	27873.0	13188.5	27872.3

UMPQUA RIVER TRAWL STATIONS SURVEY 2

Station	Depth (ft)	Loran Readings			
		Beginning		Ending	
U-1	60	13372.7	27830.4	13375.9	27829.4
U-2	70	13376.7	27829.2	13373.0	27830.0
U-3	80	13372.0	27830.2	13375.2	27829.2
U-4	90	13376.6	27828.7	13373.3	27829.3
U-5	100	13374.2	27829.0	13377.7	27828.2
U-6	115	13376.3	27828.9	13373.5	27828.9

APPENDIX B

Summary of Each 8-m Trawl Effort

STATION: T-1
Gear: 8-m Trawl
Date: 8 Sep 1984
Depth: 60.0 ft
Distance traveled: 667 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	1	398	3	1193
Whitebait smelt	7	13	21	39
Pacific tomcod	45	195	135	585
Spotfin surfperch	3	80	9	240
Pacific sand lance	21	252	63	756
Pacific staghorn sculpin	1	23	3	69
Warty poacher	12	11	36	33
Pricklebreast poacher	1	1	3	3
Showy snailfish	2	2	6	6
Speckled sanddab	40	356	120	1067
English sole	7	39	21	117
Sand sole	5	111	15	333
Dungeness crab	163	673	489	2018
TOTALS	308	2154	924	6459

H=2.26 SD=0.67 SR=2.09 J=0.61

STATION: T-2
Gear: 8-m Trawl
Date: 8 Sep 1984
Depth: 70.0 ft
Distance traveled: 537 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	1	83	4	309
Night smelt	5	33	19	123
Whitebait smelt	18	162	67	603
Pacific tomcod	101	631	376	2350
Spotfin surfperch	2	35	7	130
Wolf-eel	1	3000	4	11173
Pacific staghorn sculpin	9	259	34	965
Warty poacher	2	2	7	7
Speckled sanddab	75	792	279	2950
Butter sole	1	336	4	1251
English sole	26	172	97	641
Sand sole	17	1887	63	7028
Dungeness crab	20	216	74	804
TOTALS	278	7608	1035	28334

H=2.59 SD=0.77 SR=2.13 J=0.70

STATION: T-3
Gear: 8-m Trawl
Date: 8 Sep 1984
Depth: 80.0 ft
Distance traveled: 630 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	6	653	19	2073
Northern anchovy	2	50	6	159
Night smelt	7	62	22	197
Whitebait smelt	8	56	25	178
Pacific tomcod	358	3121	1137	9908
Pacific staghorn sculpin	7	415	22	1317
Pricklebreast poacher	6	13	19	41
Showy snailfish	2	2	6	6
Speckled sanddab	42	581	133	1844
Butter sole	1	2	3	6
English sole	17	411	54	1305
Sand sole	6	403	19	1279
Dungeness crab	88	522	279	1657
Cancer sp. (unid.)	1	1	3	3
TOTALS	551	6292	1747	19973

H=1.82 SD=0.54 SR=2.06 J=0.48

STATION:T-4
Gear: 8-m Trawl
Date: 8 Sep 1984
Depth: 90.0 ft
Distance traveled: 556 m

Species	No. Captured	Total Wt.(s)	No. Per Hectare	Wt. Per Hectare
Night smelt	1	13	4	47
Unidentified juv. smelt	40	33	144	119
Pacific tomcod	151	916	543	3295
Pacific staghorn sculpin	9	764	32	2748
Warty poacher	3	6	11	22
Tubenose poacher	1	4	4	14
Pricklebreast poacher	24	24	86	86
Showy snailfish	29	32	104	115
Unidentified snailfish	3	1	11	4
Speckled sanddab	50	768	180	2763
Butter sole	7	887	25	3191
English sole	7	216	25	777
Sand sole	5	465	18	1673
Dungeness crab	79	46	284	165
Cancer oregonensis	1	6	4	22
TOTALS	410	4181	1475	15041

H=2.76 SD=0.79 SR=2.33 J=0.71

STATION: T-5
Gear: 8-m Trawl
Date: 8 Sep 1984
Depth: 100.0 ft
Distance traveled: 407 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	3	612	15	3007
Night smelt	2	15	10	74
Unidentified juv. smelt	8	6	39	29
Whitebait smelt	1	8	5	39
Pacific tomcod	109	1702	536	8364
Pacific staghorn sculpin	2	97	10	477
Warty poacher	34	63	167	310
Pricklebreast poacher	126	46	619	226
Showy snailfish	90	182	442	894
Unidentified snailfish	2	0	10	0
Speckled sanddab	42	775	206	3808
Butter sole	18	2054	88	10093
English sole	8	137	39	673
Sand sole	7	489	34	2403
Dover sole	1	97	5	477
Dungeness crab	279	2184	1371	10732
TOTALS	732	8467	3596	41606

H=2.66 SD=0.78 SR=2.27 J=0.66

STATION:T-6
Gear: 8-m Trawl
Date: 5 Sep 1984
Depth: 110.0 ft
Distance traveled: 574 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	1	157	3	547
Spotted ratfish	20	9670	70	33693
Unidentified juv. smelt	5	3	17	10
Whitebait smelt	2	15	7	52
Pacific tomcod	161	2124	561	7401
Black rockfish	2	340	7	1185
Warty poacher	1	1	3	3
Pricklebreast poacher	4	0	14	0
Showy snailfish	3	1	10	3
Speckled sanddab	40	474	139	1652
Butter sole	2	168	7	585
Slender sole	1	24	3	84
English sole	17	807	59	2812
Dover sole	1	130	3	453
Dungeness crab	136	49	474	171
Purple shore crab	1	2	3	7
TOTALS	397	13965	1380	48658

H=2.23 SD=0.70 SR=2.51 J=0.56

STATION:D-1
Gear: 8-m Trawl
Date: 22 Oct 1984
Depth: 81.0 ft
Distance traveled: 759 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Northern anchovy	10	11	26	29
Whitebait smelt	2	5	5	13
Pacific tomcod	257	1035	677	2727
Warty poacher	1	41	3	108
Pricklebreast poacher	3	22	8	58
Speckled sanddab	51	443	134	1167
Petrale sole	1	700	3	1845
Butter sole	9	1028	24	2709
English sole	34	1240	90	3267
Sand sole	15	978	40	2577
Dungeness crab	1	31	3	82
TOTALS	384	5534	1013	14582

H=1.69 SD=0.52 SR=1.68 J=0.49

STATION:S-1
Gear: 8-m Trawl
Date: 1 Oct 1984
Depth: 48.0 ft
Distance traveled: 296 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Night smelt	1	10	7	68
Pacific tomcod	13	38	88	257
Pacific sand lance	5	17	34	115
Pacific staghorn sculpin	1	38	7	257
Tubenose poacher	1	1	7	7
Pricklebreast poacher	8	7	54	47
Speckled sanddab	46	409	311	2764
Sand sole	24	1389	162	9385
Dungeness crab	14	446	95	3014
TOTALS	113	2355	765	15914

H=2.39 SD=0.75 SR=1.69 J=0.75

STATION:S-2
Gear: 8-m Trawl
Date: 1 Oct 1984
Depth: 61.0 ft
Distance traveled: 148 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Northern anchovy	67	86	905	1162
Night smelt	2	12	27	162
Pacific tomcod	20	50	270	676
Spotfin surfperch	1	43	14	581
Pacific sand lance	1	3	14	41
Pacific staghorn sculpin	1	23	14	311
Warty poacher	1	2	14	27
Tubenose poacher	1	1	14	14
Pricklebreast poacher	1	5	14	68
Showy snailfish	1	7	14	95
Speckled sanddab	23	305	311	4122
English sole	4	17	54	230
Sand sole	3	488	41	6595
Dungeness crab	2	6	27	81
Cancer oregonensis	1	1	14	14
TOTALS	129	1049	1747	14179

H=2.25 SD=0.67 SR=2.88 J=0.58

STATION:S-3
Gear: 8-m Trawl
Date: 1 Oct 1984
Depth: 69.0 ft
Distance traveled: 685 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	1	236	3	689
American shad	3	12	9	35
Northern anchovy	19	29	55	85
Night smelt	15	123	44	359
Whitebait smelt	1	1	3	3
Pacific tomcod	62	490	181	1431
Shiner perch	27	269	79	785
Pacific sand lance	1	10	3	29
Pacific staghorn sculpin	2	73	6	213
Speckled sanddab	53	708	155	2067
Butter sole	3	150	9	438
English sole	24	204	70	596
Starry flounder	1	646	3	1886
Sand sole	18	3025	53	8832
Dungeness crab	1	4	3	12
Cancer oregonensis	6	36	18	105
Pugettia richii	1	0	3	0
TOTALS	238	6016	697	17565

H=3.05 SD=0.84 SR=2.92 J=0.75

STATION:S-4
Gear: 8-m Trawl
Date: 1 Oct 1984
Depth: 76.0 ft
Distance traveled: 370 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	1	118	5	638
Night smelt	8	63	43	341
Pacific tomcod	99	289	535	1562
Pricklebreast poacher	5	18	27	97
Speckled sanddab	101	1193	546	6449
Butter sole	7	241	38	1303
English sole	22	199	119	1076
Starry flounder	1	197	5	1065
Sand sole	10	2469	54	13346
Dungeness crab	4	8	22	43
TOTALS	258	4795	1394	25920

H=2.11 SD=0.69 SR=1.62 J=0.63

STATION:U-1
Gear: 8-m Trawl
Date: 30 Sep 1984
Depth: 61.0 ft
Distance traveled: 537 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Unidentified juv. smelt	1	0	4	0
Pacific tomcod	22	49	82	182
Shiner perch	1	7	4	26
Wolf-eel	1	3200	4	11918
Pacific staghorn sculpin	1	34	4	127
Warty poacher	1	1	4	4
Tubenose poacher	6	5	22	19
Pricklebreast poacher	92	70	343	261
Speckled sanddab	80	444	298	1654
Butter sole	1	51	4	190
English sole	8	94	30	350
C-O sole	2	2	7	7
Sand sole	16	2549	60	9493
Dungeness crab	12	10	45	37
TOTALS	244	6516	911	24268

H=2.39 SD=0.73 SR=2.36 J=0.63

STATION:U-2
Gear: 8-m Trawl
Date: 30 Sep 1984
Depth: 60.0 ft
Distance traveled: 537 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Pacific tomcod	41	78	153	291
Bay pipefish	1	1	4	4
Wolf-eel	1	3100	4	11546
Warty poacher	38	91	142	339
Tubenose poacher	10	12	37	45
Pricklebreast poacher	290	299	1080	1114
Speckled sanddab	142	1433	529	5337
Butter sole	2	50	7	186
English sole	25	334	93	1244
C-O sole	2	4	7	15
Sand sole	39	7806	145	29073
Dungeness crab	8	11	30	41
Kelp crab	1	1	4	4
TOTALS	600	13220	2235	49239

H=2.25 SD=0.70 SR=1.88 J=0.61

STATION:U-3
Gear: 8-m Trawl
Date: 30 Sep 1984
Depth: 90.0 ft
Distance traveled: 685 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	2	755	6	2204
Night smelt	3	24	9	70
Pacific tomcod	74	200	216	584
Wolf-eel	1	2600	3	7591
Warty poacher	2	4	6	12
Speckled sanddab	5	54	15	158
English sole	3	39	9	114
Sand sole	8	2159	23	6304
Larval flatfish	1	0	3	0
Dungeness crab	4	2	12	6
TOTALS	103	5837	302	17043

H=1.67 SD=0.47 SR=1.94 J=0.50

STATION:U-4
Gear: 8-m Trawl
Date: 30 Sep 1984
Depth: 109.0 ft
Distance traveled: 500 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	3	1133	12	4532
Night smelt	6	69	24	276
Pacific tomcod	87	391	348	1564
Shiner perch	3	33	12	132
Pacific staghorn sculpin	2	59	8	236
Warty poacher	4	11	16	44
Tubenose poacher	4	5	16	20
Pricklebreast poacher	6	18	24	72
Speckled sanddab	19	420	76	1680
Butter sole	2	233	8	932
English sole	24	1187	96	4748
Sand sole	14	3527	56	14108
Dungeness crab	2	3	8	12
TOTALS	176	7089	704	28356

H=2.53 SD=0.71 SR=2.32 J=0.68

STATION:U-5
Gear: 8-m Trawl
Date: 30 Sep 1984
Depth: 110.0 ft
Distance traveled: 482 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Northern anchovy	2	2	8	8
Pacific tomcod	4	35	17	145
King-of-the-salmon	1	0	4	0
Tubenose poacher	1	1	4	4
Speckled sanddab	2	26	8	108
English sole	12	1207	50	5008
Dungeness crab	1	8	4	33
Red rock crab	1	0	4	0
Pugettia richii	1	1	4	4
TOTALS	25	1280	103	5310

H=2.44 SD=0.72 SR=2.49 J=0.77

STATION:U-6
Gear: 8-m Trawl
Date: 30 Sep 1984
Depth: 117.0 ft
Distance traveled: 574 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Lingcod	1	62	3	216
English sole	1	24	3	84
Sand sole	2	272	7	948
TOTALS	4	358	13	1248

H=1.50 SD=0.63 SR=1.44 J=0.95

STATION:T-1
Gear: 8-m Trawl
Date: 24 Jan 1985
Depth: 60.0 ft
Distance traveled: 778 m

Species	No. Captured	Total Wt.(s)	No. Per Hectare	Wt. Per Hectare
American shad	21	169	54	434
Night smelt	14	60	36	154
Pacific tomcod	23	782	59	2010
Tube-snout	1	5	3	13
Bay pipefish	3	10	8	26
Shiner perch	1	18	3	46
Spotfin surfperch	6	123	15	316
Pacific sand lance	1	4	3	10
Pacific staghorn sculpin	3	123	8	316
Warty poacher	1	1	3	3
Tubenose poacher	1	3	3	8
Speckled sanddab	4	26	10	67
Sand sole	2	6	5	15
Dungeness crab	17	853	44	2193
Cancer gracilis	1	1	3	3
TOTALS	99	2184	257	5614

H=3.05 SD=0.84 SR=3.05 J=0.78

STATION: T-2
Gear: 8-m Trawl
Date: 24 Jan 1985
Depth: 70.0 ft
Distance traveled: 648 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Pacific herring	1	13	3	40
American shad	2	11	6	34
Night smelt	4	24	12	74
Pacific tomcod	3	81	9	250
Tube-snout	3	11	9	34
Spotfin surfperch	5	151	15	466
Striped seaperch	1	379	3	1170
Unidentified rockfish	9	3430	28	10586
Warty poacher	1	2	3	6
Tubenose poacher	2	6	6	19
Pricklebreast poacher	1	4	3	12
Sand sole	4	23	12	71
Dungeness crab	5	21	15	65
TOTALS	41	4156	124	12827

H=3.38 SD=0.89 SR=3.23 J=0.91

STATION: T-3
Gear: 8-m Trawl
Date: 24 Jan 1985
Depth: 80.0 ft
Distance traveled: 741 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
American shad	5	38	13	103
Longfin smelt	1	4	3	11
Night smelt	7	33	19	89
Unidentified juv. smelt	2	2	5	5
Pacific tomcod	66	2267	178	6119
Bay pipefish	4	8	11	22
Spotfin surfperch	5	174	13	470
Pacific sand lance	1	5	3	13
Kelp greenling	1	1	3	3
Red Irish lord	1	5	3	13
Pacific staghorn sculpin	2	104	5	281
Warty poacher	4	9	11	24
Pricklebreast poacher	1	9	3	24
Speckled sanddab	3	42	8	113
Sand sole	10	43	27	116
Dungeness crab	42	1361	113	3673
Cancer gracilis	3	11	8	30
TOTALS	158	4116	426	11109

H=2.68 SD=0.74 SR=3.16 J=0.65

STATION: T-4
Gear: 8-m Trawl
Date: 29 Jan 1985
Depth: 90.0 ft
Distance traveled: 574 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	2	182	7	634
American shad	1	16	3	56
Night smelt	29	265	101	923
Pacific tomcod	72	2329	251	8115
Bay pipefish	8	10	28	35
Shiner perch	2	26	7	91
Spotfin surfperch	1	21	3	73
Pacific sand lance	1	4	3	14
Pacific staghorn sculpin	11	792	38	2760
Warty poacher	1	2	3	7
Tubenose poacher	8	27	28	94
Pricklebreast poacher	6	104	21	362
Speckled sanddab	11	104	38	362
Butter sole	1	3	3	10
English sole	2	26	7	91
Sand sole	45	487	157	1697
Larval flatfish	1	0	3	0
Dungeness crab	64	1398	223	4871
TOTALS	266	5796	924	20195

H=2.94 SD=0.82 SR=3.04 J=0.70

STATION:T-5
Gear: 8-m Trawl
Date: 29 Jan 1985
Depth: 100.0 ft
Distance traveled: 704 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Night smelt	41	135	116	384
Pacific tomcod	140	4990	398	14176
Bay pipefish	5	9	14	26
Warty poacher	7	36	20	102
Tubenose poacher	7	24	20	68
Pricklebreast poacher	9	119	26	338
Showy snailfish	1	4	3	11
Speckled sanddab	7	85	20	241
Butter sole	4	471	11	1338
English sole	2	24	6	68
Sand sole	25	296	71	841
Larval flatfish	2	0	6	0
Dungeness crab	50	228	142	648
TOTALS	300	6421	853	18241

H=2.47 SD=0.73 SR=2.10 J=0.67

STATION:T-6
Gear: 8-m Trawl
Date: 29 Jan 1985
Depth: 110.0 ft
Distance traveled: 444 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	4	404	18	1820
Longfin smelt	5	13	23	59
Night smelt	22	62	99	279
Pacific tomcod	106	3471	477	15635
Bay pipefish	4	12	18	54
Pacific staghorn sculpin	4	439	18	1977
Warty poacher	8	43	36	194
Tubenose poacher	3	12	14	54
Pricklebreast poacher	20	290	90	1306
Showy snailfish	4	260	18	1171
Speckled sanddab	28	220	126	991
Butter sole	10	251	45	1131
English sole	2	14	9	63
Starry flounder	2	3250	9	14640
Sand sole	28	285	126	1284
Larval flatfish	2	0	9	0
Dungeness crab	389	1027	1752	4626
TOTALS	641	10053	2887	45284

H=2.11 SD=0.60 SR=2.48 J=0.52

STATION:D-1
Gear: 8-m Trawl
Date: 29 Jan 1985
Depth: 80.0 ft
Distance traveled: 574 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
American shad	4	23	14	80
Night smelt	924	1335	3220	4652
Pacific tomcod	66	1382	230	4815
Pacific staghorn sculpin	17	906	59	3157
Pricklebreast poacher	1	3	3	10
Speckled sanddab	30	362	105	1261
Butter sole	5	181	17	631
English sole	5	265	17	923
Sand sole	46	562	160	1958
Dungeness crab	11	146	38	509
Cancer gracilis	1	3	3	10
TOTALS	1110	5168	3866	18006

H=1.07 SD=0.30 SR=1.43 J=0.31

STATION:D-2
Gear: 8-m Trawl
Date: 29 Jan 1985
Depth: 90.0 ft
Distance traveled: 741 m

Species	No. Captured	Total Wt.(s)	No. Per Hectare	Wt. Per Hectare
Big skate	2	1380	5	3725
American shad	7	64	19	173
Night smelt	1015	1684	2740	4545
Whitebait smelt	2	12	5	32
Pacific tomcod	138	2418	372	6526
Pacific sand lance	2	6	5	16
Speckled sanddab	1	19	3	51
Butter sole	14	1235	38	3333
English sole	1	63	3	170
Sand sole	13	1830	35	4939
Dungeness crab	2	3	5	8
TOTALS	1197	8714	3230	23518

H=0.83 SD=0.27 SR=1.41 J=0.24

STATION:S-1
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 50.0 ft
Distance traveled: 759 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
American shad	15	121	40	319
Northern anchovy	1	0	3	0
Night smelt	78	281	206	740
Unidentified juv. smelt	1200	1432	3162	3773
Whitebait smelt	2	15	5	40
Pacific tomcod	63	1695	166	4466
Bay pipefish	1	1	3	3
Spotfin surfperch	22	290	58	764
Saddleback gunnel	1	11	3	29
Pacific sand lance	2	11	5	29
Pacific staghorn sculpin	14	634	37	1671
Warty poacher	3	6	8	16
Pricklebreast poacher	1	1	3	3
Showy snailfish	1	27	3	71
Speckled sanddab	25	289	66	762
Butter sole	16	468	42	1233
English sole	9	560	24	1476
Sand sole	148	3789	390	9984
Larval flatfish	8	0	21	0
Dungeness crab	26	2061	69	5431
TOTALS	1636	11692	4314	30810

H=1.64 SD=0.45 SR=2.57 J=0.38

STATION:S-2
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 60.0 ft
Distance traveled: 741 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	3	1975	8	5331
American shad	9	70	24	189
Night smelt	52	180	140	486
Unidentified juv. smelt	1016	1270	2742	3428
Whitebait smelt	21	23	57	62
Pacific tomcod	109	3345	294	9028
Bay pipefish	4	6	11	16
Spotfin surfperch	18	248	49	669
Pacific sand lance	1	3	3	8
Pacific staghorn sculpin	6	360	16	972
Warty poacher	3	9	8	24
Pricklebreast poacher	6	8	16	22
Speckled sanddab	17	177	46	478
Butter sole	8	315	22	850
English sole	10	425	27	1147
Sand sole	92	1705	248	4602
Larval flatfish	15	0	40	0
Dungeness crab	20	1599	54	4316
Cancer gracilis	1	1	3	3
Cancer branneri	1	0	3	0
TOTALS	1412	11719	3811	31631

H=1.75 SD=0.47 SR=2.62 J=0.41

STATION: S-3
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 70.0 ft
Distance traveled: 704 m

Species	No. Captured	Total Wt.(s)	No. Per Hectare	Wt. Per Hectare
Big skate	3	910	9	2585
American shad	1	4	3	11
Night smelt	393	849	1116	2412
Pacific tomcod	255	6537	724	18571
Bay pipefish	2	1	6	3
Spotfin surfperch	4	68	11	193
Pacific staghorn sculpin	24	1165	68	3310
Warty poacher	6	24	17	68
Pricklebreast poacher	13	16	37	45
Showy snailfish	1	14	3	40
Pacific sanddab	2	128	6	364
Speckled sanddab	22	266	63	756
Butter sole	14	828	40	2352
English sole	13	444	37	1261
Starry flounder	1	589	3	1673
Sand sole	77	644	219	1830
Larval flatfish	6	0	17	0
Dungeness crab	3	726	9	2063
TOTALS	840	13213	2388	37537

H=2.19 SD=0.68 SR=2.52 J=0.53

STATION:S-4
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 80.0 ft
Distance traveled: 759 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	1	80	3	211
Night smelt	153	443	403	1167
Whitebait smelt	4	32	11	84
Pacific tomcod	295	8983	777	23671
Bay pipefish	1	1	3	3
Pacific staghorn sculpin	9	565	24	1489
Warty poacher	6	16	16	42
Pricklebreast poacher	20	66	53	174
Slipskin snailfish	1	0	3	0
Showy snailfish	7	114	18	300
Pacific sanddab	14	1135	37	2991
Speckled sanddab	17	134	45	353
Butter sole	17	552	45	1455
English sole	10	415	26	1094
Sand sole	32	327	84	862
Larval flatfish	1	0	3	0
Dungeness crab	11	3918	29	10324
TOTALS	599	16781	1580	44220

H=2.36 SD=0.68 SR=2.50 J=0.58

STATION:U-1
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 60.0 ft
Distance traveled: 722 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
American shad	41	192	114	532
Night smelt	2079	2964	5759	8211
Pacific tomcod	22	263	61	729
Bay pipefish	3	2	8	6
Shiner perch	2	15	6	42
Spotfin surfperch	5	101	14	280
Pacific sand lance	1	4	3	11
Pacific staghorn sculpin	7	216	19	598
Pricklebreast poacher	21	84	58	233
Speckled sanddab	15	232	42	643
Butter sole	2	76	6	211
Sand sole	31	1490	86	4127
Dungeness crab	7	1975	19	5471
Cancer gracilis	2	3	6	8
TOTALS	2238	7617	6201	21102

H=0.58 SD=0.14 SR=1.69 J=0.15

STATION:U-2
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 70.0 ft
Distance traveled: 778 m

Species	No. Captured	Total Wt.(s)	No. Per Hectare	Wt. Per Hectare
American shad	12	66	31	170
Night smelt	2447	2957	6290	7602
Pacific tomcod	31	495	80	1272
Bay pipefish	2	1	5	3
Shiner perch	4	27	10	69
Spotfin surfperch	10	217	26	558
Pacific sand lance	22	135	57	347
Pacific staghorn sculpin	1	29	3	75
Cabezon	1	0	3	0
Pricklebreast poacher	8	26	21	67
Speckled sanddab	4	64	10	165
Sand sole	38	3322	98	8540
TOTALS	2580	7339	6634	18868

H=0.44 SD=0.10 SR=1.40 J=0.12

STATION:U-3
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 80.0 ft
Distance traveled: 722 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	1	53	3	147
American shad	22	212	61	587
Night smelt	790	1787	2188	4950
Pacific tomcod	88	1498	244	4150
Bay pipefish	1	1	3	3
Shiner perch	4	31	11	86
Spotfin surfperch	1	21	3	58
Pacific sand lance	2	9	6	25
Pacific staghorn sculpin	6	202	17	560
Tubenose poacher	1	4	3	11
Pricklebreast poacher	33	121	91	335
Speckled sanddab	23	300	64	831
Butter sole	9	691	25	1914
English sole	15	477	42	1321
Sand sole	44	1408	122	3900
Larval flatfish	1	0	3	0
Dungeness crab	5	1333	14	3693
TOTALS	1046	8148	2900	22571

H=1.52 SD=0.42 SR=2.30 J=0.37

STATION:U-4
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 90.0 ft
Distance traveled: 685 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Spiny dogfish	1	744	3	2172
Big skate	1	32	3	93
American shad	6	51	18	149
Night smelt	724	1412	2114	4123
Whitebait smelt	7	31	20	91
Pacific tomcod	44	713	128	2082
Larval groundfish	2	0	6	0
Shiner perch	10	68	29	199
Spotfin surfperch	13	315	38	920
Pacific sand lance	52	338	152	987
Pacific staghorn sculpin	9	379	26	1107
Warty poacher	1	3	3	9
Tubenose poacher	2	6	6	18
Pricklebreast poacher	1	18	3	53
Pacific sanddab	5	718	15	2096
Speckled sanddab	13	159	38	464
Butter sole	4	363	12	1060
English sole	9	622	26	1816
Sand sole	70	2834	204	8274
Dungeness crab	3	1359	9	3968
TOTALS	977	10165	2853	29681

H=1.65 SD=0.44 SR=2.76 J=0.38

STATION:U-5
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 100.0 ft
Distance traveled: 741 m

Species	No. Captured	Total Wt.(g)	No. Per Hectare	Wt. Per Hectare
Big skate	1	243	3	656
Night smelt	91	544	246	1468
Pacific tomcod	112	1855	302	5007
Bay pipefish	2	2	5	5
Shiner perch	10	67	27	181
Spotfin surfperch	6	112	16	302
Pacific sand lance	165	945	445	2551
Pacific staghorn sculpin	15	483	40	1304
Warty poacher	1	4	3	11
Tubenose poacher	2	6	5	16
Pricklebreast poacher	2	25	5	67
Pacific sanddab	14	2137	38	5768
Speckled sanddab	11	134	30	362
Butter sole	6	190	16	513
English sole	33	1167	89	3150
Sand sole	73	1928	197	5204
Dungeness crab	2	525	5	1417
TOTALS	546	10367	1472	27982

H=2.85 SD=0.81 SR=2.54 J=0.70
#

STATION:U-6
Gear: 8-m Trawl
Date: 27 Jan 1985
Depth: 115.0 ft
Distance traveled: 611 m

Species	No. Captured	Total Wt.(s)	No. Per Hectare	Wt. Per Hectare
American shad	1	9	3	29
Longfin smelt	1	7	3	23
Unidentified juv. smelt	1	2	3	7
Pacific tomcod	1	5	3	16
Shiner perch	7	49	23	160
Pacific sand lance	8	55	26	180
Pacific staghorn sculpin	18	694	59	2272
Pacific sanddab	5	548	16	1794
Speckled sanddab	5	39	16	128
Butter sole	4	210	13	687
English sole	4	318	13	1041
Sand sole	51	1850	167	6056
TOTALS	106	3786	345	12393

H=2.51 SD=0.72 SR=2.36 J=0.70

APPENDIX C

Descriptive Summary of the Benthic Invertebrates at the 63 Sampling Stations

(Because of its length this Appendix was not included in this report but can be obtained by writing to the authors.)

APPENDIX D

Sediment Structure of the 63 Benthic Sampling Stations

Appendix Table D1.--Tillamook Bay benthic stations, Survey 1.

Station	Date	Mean grain size (phi)	Percent silt-clay	Percent organics
TR-1	4 Sep 84	3.0	0.6	1.1
TR-2	4 Sep 84	3.1	0.4	1.2
T-1-1	7 Sep 84	3.0	0.6	1.0
T-1-2	7 Sep 84	3.0	0.4	1.0
T-1-3	7 Sep 84	3.1	1.0	1.1
T-1-4	7 Sep 84	3.1	0.8	1.0
T-1-5	6 Sep 84	3.0	0.3	2.0
T-1-6	6 Sep 84	3.0	0.7	1.4
T-2-1	7 Sep 84	2.7	0.7	2.3
T-2-2	7 Sep 84	2.9	0.2	1.3
T-2-3	7 Sep 84	3.0	0.2	1.2
T-2-4	7 Sep 84	3.0	0.5	1.1
T-2-5	7 Sep 84	3.1	1.3	1.4
T-2-6	6 Sep 84	3.0	0.5	1.2
T-3-1	6 Sep 84	3.0	0.5	1.1
T-3-2	6 Sep 84	3.0	0.4	0.8
T-3-3	6 Sep 84	3.0	0.3	0.9
T-3-4	6 Sep 84	3.0	1.3	1.5
T-3-5	6 Sep 84	3.1	3.8	2.9
T-3-6	6 Sep 84	3.1	0.6	1.4
TR-3	8 Sep 84	3.1	0.8	0.9
TR-4	8 Sep 84	3.1	1.0	1.3
Mean		3.02	0.77	1.32
Standard deviation		0.09	0.74	0.49

Appendix Table D2.--Tillamook Bay benthic stations, Survey 2.

Station	Date	Mean grain size (phi)	Percent silt-clay	Percent organics
TR-1	22 Jan 85	3.1	1.0	1.1
TR-2	22 Jan 85	3.2	2.0	1.4
T-1-1	22 Jan 85	2.8	0.1	1.6
T-1-2	22 Jan 85	3.1	1.0	1.2
T-1-3	22 Jan 85	2.9	0.1	1.3
T-1-4	22 Jan 85	3.0	1.0	1.6
T-1-5	22 Jan 85	2.9	0.1	1.3
T-1-6	22 Jan 85	3.0	1.0	1.2
T-2-1	23 Jan 85	2.7	0.1	2.0
T-2-2	23 Jan 85	2.8	0.1	1.0
T-2-3	23 Jan 85	2.8	0.1	1.3
T-2-4	23 Jan 85	3.0	1.0	1.6
T-2-5	23 Jan 85	2.9	0.1	1.5
T-2-6	23 Jan 85	2.9	0.1	1.3
T-3-1	23 Jan 85	3.0	0.1	1.4
T-3-2	23 Jan 85	3.0	0.1	1.2
T-3-3	23 Jan 85	3.0	1.0	1.6
T-3-4	23 Jan 85	3.1	1.0	1.2
T-3-5	23 Jan 85	3.1	1.0	1.8
T-3-6	23 Jan 85	3.1	1.0	1.8
TR-3	23 Jan 85	2.9	0.1	1.1
TR-4	23 Jan 85	3.0	1.0	1.6
Mean		2.97	0.60	1.41
Standard deviation		0.13	0.55	0.26

Appendix Table D3.--Depoe Bay benthic stations, Survey 1.

Station	Date	Mean grain size (phi)	Percent silt-clay	Percent organics
DR-1	17 Oct 84	3.1	0.1	1.3
D-1	17 Oct 84	3.1	0.5	0.9
D-2	17 Oct 84	3.1	0.5	0.9
Mean		3.10	0.37	1.03
Standard deviation		0.00	0.23	0.23

Appendix Table D4.--Depoe Bay benthic stations, Survey 2.

Station	Date	Mean grain size (phi)	Percent silt-clay	Percent organics
DR-1	24 Jan 85	3.1	1.0	1.4
D-1	24 Jan 85	3.3	2.0	1.5
D-2	24 Jan 85	3.4	2.0	1.5
Mean		3.27	1.67	1.47
Standard deviation		0.15	0.58	0.06

Appendix Table D5.--Siuslaw River benthic stations, Survey 1.

Station	Date	Mean grain size (phi)	Percent silt-clay	Percent organics
SR-1	2 Oct 84	3.0	0.2	0.7
S-1-1	2 Oct 84	3.0	0.1	1.0
S-1-2	2 Oct 84	3.0	0.1	0.8
S-1-3	2 Oct 84	3.0	0.3	0.8
S-1-4	2 Oct 84	3.0	0.3	0.8
S-2-1	2 Oct 84	2.4	0.2	0.6
S-2-2	2 Oct 84	2.3	0.1	0.5
S-2-3	2 Oct 84	2.4	0.2	0.6
S-2-4	2 Oct 84	2.4	0.3	0.6
S-3-1	2 Oct 84	2.8	0.4	0.9
S-3-2	2 Oct 84	3.0	0.2	0.8
S-3-3	2 Oct 84	3.0	0.1	0.9
S-3-4	2 Oct 84	2.6	0.4	0.5
SR-2	2 Oct 84	2.9	0.3	0.8
Mean		2.77	0.23	0.74
Standard deviation		0.28	0.11	0.16

Appendix Table D6.--Siuslaw River benthic stations, Survey 2.

Station	Date	Mean grain size (phi)	Percent silt-clay	Percent organics
SR-1	28 Jan 85	3.1	1.0	0.9
S-1-1	28 Jan 85	3.2	1.0	1.1
S-1-2	28 Jan 85	3.0	1.0	0.8
S-1-3	28 Jan 85	3.1	2.0	0.9
S-1-4	28 Jan 85	2.9	1.0	0.8
S-2-1	28 Jan 85	2.5	0.1	0.6
S-2-2	28 Jan 85	2.7	0.1	0.7
S-2-3	28 Jan 85	2.8	0.1	0.9
S-2-4	28 Jan 85	2.7	0.1	0.5
S-3-1	25 Jan 85	2.9	0.1	1.7
S-3-2	28 Jan 85	3.0	1.0	0.9
S-3-3	28 Jan 85	3.1	1.0	0.8
S-3-4	28 Jan 85	2.7	1.0	0.9
SR-2	28 Jan 85	2.6	0.1	0.7
Mean		2.88	0.69	0.87
Standard deviation		0.22	0.59	0.28

Appendix Table D7.--Umpqua River benthic stations, Survey 1.

Station	Date	Mean grain size (phi)	Percent silt-clay	Percent organics
UR-1	30 Sep 84	3.1	1.4	1.0
UR-2	30 Sep 84	3.1	1.1	1.3
UR-3	30 Sep 84	3.1	0.9	1.2
U-1-1	26 Sep 84	3.0	0.7	1.3
U-1-2	26 Sep 84	3.0	0.7	1.5
U-1-3	26 Sep 84	3.1	1.4	1.3
U-1-4	26 Sep 84	3.4	6.3	1.5
U-1-5	26 Sep 84	3.0	1.3	1.6
U-1-6	26 Sep 84	3.1	2.9	1.9
U-2-1	28 Sep 84	2.1	0.2	0.7
U-2-2	28 Sep 84	2.2	0.1	0.8
U-2-3	28 Sep 84	2.1	0.5	1.1
U-2-4	28 Sep 84	2.0	0.4	1.5
U-2-5	28 Sep 84	2.2	0.8	1.3
U-2-6	28 Sep 84	2.3	0.7	1.0
U-3-1	27 Sep 84	3.0	0.6	0.9
U-3-2	27 Sep 84	3.0	1.1	1.3
U-3-3	27 Sep 84	3.0	0.3	1.2
U-3-4	28 Sep 84	3.4	8.7	1.4
U-3-5	28 Sep 84	3.0	0.8	1.1
U-3-6	28 Sep 84	3.0	1.3	1.2
UR-4	28 Sep 84	2.8	0.4	0.8
UR-5	28 Sep 84	3.0	0.4	0.9
UR-6	28 Sep 84	3.0	0.9	1.0
Mean		2.83	1.41	1.20
Standard deviation		0.42	1.99	0.29

Appendix Table D8.--Umpqua River benthic stations, Survey 2.

Station	Date	Mean grain size (phi)	Percent silt-clay	Percent organics
UR-1	25 Jan 85	3.1	2.0	1.1
UR-2	25 Jan 85	3.2	3.0	1.4
UR-3	25 Jan 85	3.1	3.0	1.5
U-1-1	25 Jan 85	2.9	1.0	1.5
U-1-2	25 Jan 85	3.1	3.0	1.4
U-1-3	25 Jan 85	3.0	1.0	1.2
U-1-4	25 Jan 85	3.2	4.0	1.3
U-1-5	25 Jan 85	3.3	7.0	2.2
U-1-6	25 Jan 85	2.9	1.0	1.4
U-2-1	25 Jan 85	2.2	0.1	0.6
U-2-2	25 Jan 85	2.4	0.1	0.7
U-2-3	25 Jan 85	2.3	0.1	0.4
U-2-4	26 Jan 85	2.0	0.1	0.7
U-2-5	26 Jan 85	2.0	0.1	0.8
U-2-6	26 Jan 85	2.0	0.1	0.7
U-3-1	26 Jan 85	3.0	1.0	1.1
U-3-2	26 Jan 85	3.1	2.0	1.0
U-3-3	26 Jan 85	3.1	2.0	1.3
U-3-4	26 Jan 85	3.1	2.0	1.2
U-3-5	26 Jan 85	3.1	2.0	1.3
U-3-6	26 Jan 85	3.0	2.0	1.4
UR-4	27 Jan 85	2.9	2.0	1.0
UR-5	27 Jan 85	3.1	1.0	1.3
UR-6	27 Jan 85	3.1	2.0	1.3
Mean		2.84	1.73	1.16
Standard deviation		0.43	1.57	0.38

APPENDIX E

Invertebrate and Fish Species Taken in Study

TAXA CAPTURED IN BOX CORES

Cnidaria
- Anthozoa
- Scyphozoa

Ctenophora
- *Pleurobranchia* spp.

Platyhelminthes
- Turbellaria

Nemertinea

Nematoda

Annelida
- Polychaeta
  - Orbiniidae
    - *Leitoscoloplos pugettensis* (Johnson 1910)
    - *Naineris uncinata* Hartman 1957
    - *Phylo felix* Kingberg 1866
    - *Scoloplos armiger* (Muller 1776)
  - Paraonidae
    - *Aricidea suecica* (Elaison 1920)
    - *Paraonella platybranchia* (Hartman 1961)
  - Spionidae
    - *Minuspio cirrifera* (Wiren 1883)
    - *Polydora* spp.
    - *Prionospio pinnata* Ehlers 1901
    - *Pygospio californica* Hartman 1936
    - *Scolelepis foliosa* (Audouin and Milne-Edwards 1883)
    - *Spio filicornis* Muller 1776
    - *Spiophanes berkeleyorum* Pettibone 1962
    - *Spiophanes bombyx* (Claparede 1870)
  - Megelonidae
    - *Megelona hartmanae* Jones 1978 (?)
    - *Megelona sacculata* Hartman 1961
    - *Megelona* spp.
  - Cirratulidae
    - *Chaetozone setosa* Malmgren 1867
    - Cirratulidae sp. A
  - Capitellidae
    - *Capitella capitata* (Fabricius 1780)
    - *Heteromastus filiformis* (Claparede 1864)
    - *Heteromastus* spp.
    - *Notomastus lineatus* Claparede 1870
    - *Notomastus* spp.
  - Maldanidae
    - *Axiothella rubrocincta* (Johnson 1901)
    - Maldanidae (unidentified)
  - Opheliidae
    - *Armandia brevis* Moore 1906
    - *Euzonus williamsi* (Hartman 1938)

Ophelia limacina (Rathke 1843)
Ophelia n. sp.
Ophelia spp.

Scalibregmidae

Scalibregma inflatum Rathke 1843

Phyllodocidae

Anaitides groenlandica (Oersted 1843)
Anaitides hartmanae (Blake and Walton 1977)
Anaitides multipapillata Kravitz and Jones 1979
Anaitides spp.
Eteone californica Hartman 1936
Eteone fauchaldi Kravitz and Jones 1979
Eteone longa (Fabricius 1780)
Eteone spp.
Eulalia viridis (Linnaeus 1767)
Paranaitides polynoides (Moore 1909)
Paranaitides spp.
Phyllodocidae (unidentified)

Polynoidae

Halosydna brevisetosa Kinberg 1855
Halosydna spp.
Lepidonotus spp.
Polynoidae spp. (juveniles)

Sigalionidae

Pholoe minuta (Fabricius 1780)
Sthenalais tertiaglabra Moore 1910
Thalenessa spinosa (Hartman 1939)

Chrysopetalidae

Paleanotus bellis (Johnson 1897)

Hesionidae

Hesionidae sp. A
Hesionidae sp. B
Podarkeopsis brevipalpa (Hartman-Schroeder 1959)

Syllidae

Brania spp.
Eusyllis spp.
Streptosyllis spp.
Syllis elongata (Johnson 1901)
Syllis fasciata Malmgren 1867 (?)
Syllis spp.
Trypanosyllis spp.

Nereidae

Cheilonereis cyclurus (Harrington 1897)
Nereis spp.
Platynereis bicanaliculata (Baird 1863)

Glyceridae

Glycera capitata Oersted 1843
Glycera convoluta Keferstein 1862
Glycera tenuis Hartman 1944
Glycera spp. (juveniles)

Goniadidae

Glycinde armigera Moore 1911
Glycinde picta Berkeley 1927
Goniada maculata Oersted 1843

Nephtyidae

Nephtys caeca (Fabricius 1780)
Nephtys caecoides Hartman 1938
Nephtys californiensis Hartman 1938
Nephtys longosetosa Oersted 1843
Nephtys spp.

Onuphidae
Diopatra ornata Moore 1911
Onuphis elegans (Johnson 1901)
Onuphis (Nothria)iridescens (Johnson 1901)

Lumbrineridae
Lumbrineris bicirrata Treadwell 1929
Lumbrineris californiensis Hartman 1944
Lumbrineris latreilli Audouin and Milne-Edwards 1843
Lumbrineris spp.

Oweniidae
Myriochele heeri Malmgren 1867
Owenia fusiformis delle Chiaje 1841

Ampharetidae
Ampharete acutifrons (Grube 1860)
Ampharete spp.

Terebellidae
Amaeana occidentalis Hartman 1944

Archiannelida

Mollusca

Gastropoda

Mesogastropoda

Lacunidae
Lacuna marmorata Dall 1919

Skeneopsidae
Skeneopsis sp.

Vitrinellidae
Leptogyra sp.

Epitoniidae
Epitonium indianorum (Carpenter 1864)

Neogastropoda

Thaididae
Nucella sp.

Columbellidae
Mitrella gouldii (Carpenter 1856)

Nassaridae
Nassarius fossatus (Gould 1850)
Nassarius mendicus (Gould 1850)

Olividae
Olivella baetica Marrat 1871
Olivella biplicata (Sowerby 1825)

Turridae
Mangelia spp.
Opistobranchia
Pyramidellidae
Odostomia spp.
Cephalaspidae
Aglajidae
Aglaja diomedea (Bergh 1894)
Scaphandridae
Cylichna attonsa (Carpenter 1864)
Thecosomata (Pteropoda)
Limacinidae
Limacina sp.
Nudibranchia
Pelecypoda
Nuculanidae
Yoldia scissurata (Dall 1887)
Mytilidae
Mytilus spp. (juveniles)
Modiolus spp.
Montacutidae
Orbitella sp.
Carditidae
Cyclocardia spp.
Cardiidae
Clinocardium nuttali (Conrad 1883)
Thyasiridae
Axinopsida serricata (Carpenter 1864)
Tellinidae
Macoma elimata Dunnill and Coan 1968
Macoma expansa Carpenter 1864
Macoma spp.
Tellina bodegensis Hinds 1845
Tellina modesta (Carpenter 1864)
Tellina nuculoides (Reeve 1854)
Solenidae
Siliqua patula (Dixon 1789)
Siliqua sloati Hertlein 1961
Solen sicarius Gould 1850
Pandoridae
Pandora punctata Conrad 1837
Pandora spp.
Scaphopoda
Polyplacophora

Arthropoda
Pycnogonidea
Achelia gracilipes (Cole 1904)
Pycnogonidea (unidentified)
Crustacea
Ostracoda
Ostracoda sp. A

Copepoda
  Harpacticoida
  Caligoida
Mysidacea
  Mysidae
    Acanthomysis davisi Banner 1948
    Acanthomysis macropsis (Tattersall 1932)
    Archaeomysis grebnitzkii Czerniavsky 1882
    Neomysis kadiakensis Ortmann 1908
Cumacea
  Colurostylidae
    Anchicolurus occidentalis (Calman 1912)
  Diastylidae
    Diastylis alaskensis Calman 1912
    Diastylis sp.
    Diastylopsis dawsoni Smith 1880
    Diastylopsis tenuis Zimmer 1936
    Diastylopsis sp. A
    Diastylopsis spp.
  Lampropidae
    Hemilamprops californica Zimmer 1936
  Leuconidae
    Leucon subnasica Given 1961
  Nannastacidae
    Camplyapsis sp.
    Cumella vulgaris Hart 1930
Isopoda
    Isopoda sp. A
    Isopoda sp. B
  Anthuridae
    Haliophasma geminata Menzies and Barnard 1959
  Idoteidae
    Edotea sublittoralis Menzies and Barnard 1959
    Idotea spp.
    Synidotea bicuspida Owen 1939
    Synidotea spp.
  Janiridae
    Ianiropsis kincaidi Richardson 1904
    Ianiropsis spp.
  Munnidae
    Munnogonium waldronense George and Stromberg 1966
  Spaeromatidae
    Bathycopea daltonae Menzies and Barnard 1959
    Gnorimosphaeroma lutea Menzies 1954
    Gnorimosphaeroma noblei Menzies 1954
    Gnorimosphaeroma oregonensis (Dana 1854-1855)
Amphipoda
  Ampeliscidae
    Ampelisca agassizi (Judd 1896)
    Ampelisca macrocephala Liljeborg 1851
    Ampelisca spp.
  Ampithoidae
    Ampithoe spp.
  Atylidae
    Atylus tridens (Alderman 1936)

Corophiidae
- Corophium salmonis Stimpson 1857
- Corophium spinicorne Stimpson 1857
- Corophium acherusicum Costa 1857
- Corophium spp.

Gammaridae
- Gammarid (unidentified)
- Anisogammarus pugettensis (Dana 1853)
- Eogammarus confervicolus (Stimpson 1857)
- Megaluropus longimerus Schellenberg 1925
- Melita desdichada Barnard 1962

Haustoriidae
- Eohaustorius estuarius Bosworth 1973
- Eohaustorius sawyeri Bosworth 1973
- Eohaustorius sencillus Barnard 1962
- Eohaustorius washingtonianus (Thorsteinson 1941)
- Eohaustorius spp.

Hyalidae
- Allorchestes angustus Dana 1854

Isaeidae
- Aoroides columbiae Walker 1898
- Cheriphotis sp.
- Photis macinerneyi Conlan 1983
- Photis parvidons Conlan 1983

Ischyroceridae
- Ischyrocerus spp.
- Jassa spp.

Lysianassidae
- Anonyx adoxus Hurley 1963
- Anonyx sp.
- Hippomedon denticulatus (Bate 1857)
- Psammonyx longimerus Jarret and Bousfield 1982

Oedicerotidae
- Monoculodes spinipes Mills 1962
- Synchelidium shoemakeri Mills 1962
- Westwoodilla caecula (Bate 1857)

Phoxocephalidae
- Foxiphalus major (Barnard 1960)
- Foxiphalus obtusidens (Barnard 1960)
- Foxiphalus spinosus (Barnard 1960)
- Foxiphalus spp. (juveniles)
- Mandibulophoxus gelesi (Giles 1890)
- Rhepoxynius abronius (Barnard 1960)
- Rhepoxynius dabouis (Barnard 1960)
- Rhepoxynius heterocuspidatus (Barnard 1960)
- Rhepoxynius tridentatus (Barnard 1954)
- Rhepoxynius vigitegus (Barnard 1971)
- Rhepoxynius spp.

Pleustidae
- Parapleustes den Barnard 1969

Tironidae
- Tiron biocellata Barnard 1962
- Tiron spp.

Talitridae
- Traskorchestia georgiana (Bousfield 1958)

- Hyperiidae
  - *Hyperoche medusarium* (Kroyer 1838)
- Caprellidae
- Natantia
  - Shrimp larvae
  - Shrimp (unidentified)
- Crangonidae
  - *Crangon alaskensis* Lockington 1887
  - *Crangon franciscorum* Stimpson 1856
  - *Lissocrangon stylirostris* (Holmes 1900)
- Reptantia
  - Crab larvae (zoeae)
  - Crab larvae (megalops)
- Callianassidae
  - *Callianassa californiensis* Dana 1854
- Paguridae
  - *Pagurus* spp.
- Pinnotheridae
  - *Pinnixa* spp.
- Porcellanidae
- Hippolytidae
  - *Eualos pusiolus* (Kroyer 1841)
- Majidae
  - *Pugettia gracilis* Dana 1854
- Cancridae
  - *Cancer gracilis* Dana 1852
  - *Cancer magister* Dana 1852
  - *Cancer oregonensis* (Dana 1852)
  - *Cancer* spp. (megalops)
- Grapsidae
  - *Hemigrapsus* sp.

Sipuncula

Phoronida

Echinodermata
- Ophiuroidea
  - *Amphiodia* spp.
- Echinoidea
  - *Dendraster excentricus* (Eschscholtz 1831)
- Holothuroidea
  - Unidentified sea cucumber
  - *Paracaudina chilensis* (J. Muller 1850)

Chaetognatha
- *Sagitta* spp.

Chordata
- Urochordata
  - Ascidiacea
- Vertebrata
  - Osteichthyes
    - Unidentified fish larvae
    - *Psettichthys melanostictus* (larvae)

TAXA CAPTURED BY TRAWL

Common Name	Scientific Name
Spiny dogfish	Squalus acanthias
Big skate	Raja binoculata
Spotted ratfish	Hydrolagus colliei
Pacific herring	Clupea harengus pallasi
American shad	Alosa sapidissima
Northern anchovy	Engraulis mordax
Whitebait smelt	Allosmerus elongatus
Night smelt	Spirinchus starksi
Longfin smelt	Spirinchus thaleichthys
Unid. juvenile smelt	Osmeridae
Pacific tomcod	Microgadus proximus
Larval groundfish	Gadidae
King-of-the-salmon	Trachipterus altivelis
Tube-snout	Aulorhynchus flavidus
Bay pipefish	Syngnathus leptorhynchus
Shiner perch	Cymatogaster aggregata
Striped seaperch	Embiotoca lateralis
Spotfin surfperch	Hyperprosopon anale
Saddleback gunnel	Pholis ornata
Wolf-eel	Anarrhichthys ocellatus
Pacific sand lance	Ammodytes hexapterus
Black rockfish	Sebastes melanops
Unidentified rockfish	Scorpaenidae
Kelp greenling	Hexagrammos decagrammus
Lingcod	Ophiodon elongatus
Red Irish lord	Hemilepidotus hemilepidotus
Pacific staghorn sculpin	Leptocottus armatus
Cabezon	Scorpaenichthys marmoratus
Warty poacher	Ocella verrucosa
Tubenose poacher	Pallasina barbata
Pricklebreast poacher	Stellerina xyosterna
Slipskin snailfish	Liparis fucensis
Showy snailfish	Liparis pulchellus
Unidentified snailfish	Cyclopteridae
Pacific sanddab	Citharichthys sordidus
Speckled sanddab	Citharichthys stigmaeus
Petrale sole	Eopsetta jordani
Butter sole	Isopsetta isolepis
Slender sole	Lyopsetta exilis
Dover sole	Microstomus pacificus
English sole	Parophrys vetulus
Starry flounder	Platichthys stellatus
C-O sole	Pleuronichthys coenosus
Sand sole	Psettichthys melanostictus
Larval flatfish	Pleuronectidae
Dungeness crab	Cancer magister
Oregon crab	Cancer oregonensis
Red rock crab	Cancer productus
Cancer gracilis	Cancer gracilis
Cancer branneri	Cancer branneri

Cancer sp. (unid.)	Cancridae
Purple shore crab	*Hemigrapsus nudus*
Pugettia richii	*Pugettia richii*
Kelp crab	*Pugettia producta*
Bay shrimp	*Crangon franciscorum*
Smooth shrimp	*Lissocrangon stylirostris*
Northern crangon	*Crangon alaskensis*
Unid. *Crangon* shrimp	Crangonidae
Ghost shrimp	*Callianassa californiensis*
Sand dollar	*Dendraster excentricus*
Ochre star	*Pisaster ochraceus*
Blood star	*Henricia leviuscula*
Purple sea urchin	*Strongylocentrotus purpuratus*
Nassarius fossatta	*Nassarius fossatta*
Olivella spp.	*Olivella* spp.
Scallop	*Chalmys* sp.
Sea anemone	*Metridium* sp.
Hermit crab	Paguridae
Squid	*Loligo* spp.
Octopus	*Octopus dofleine*
Unidentified fish	