

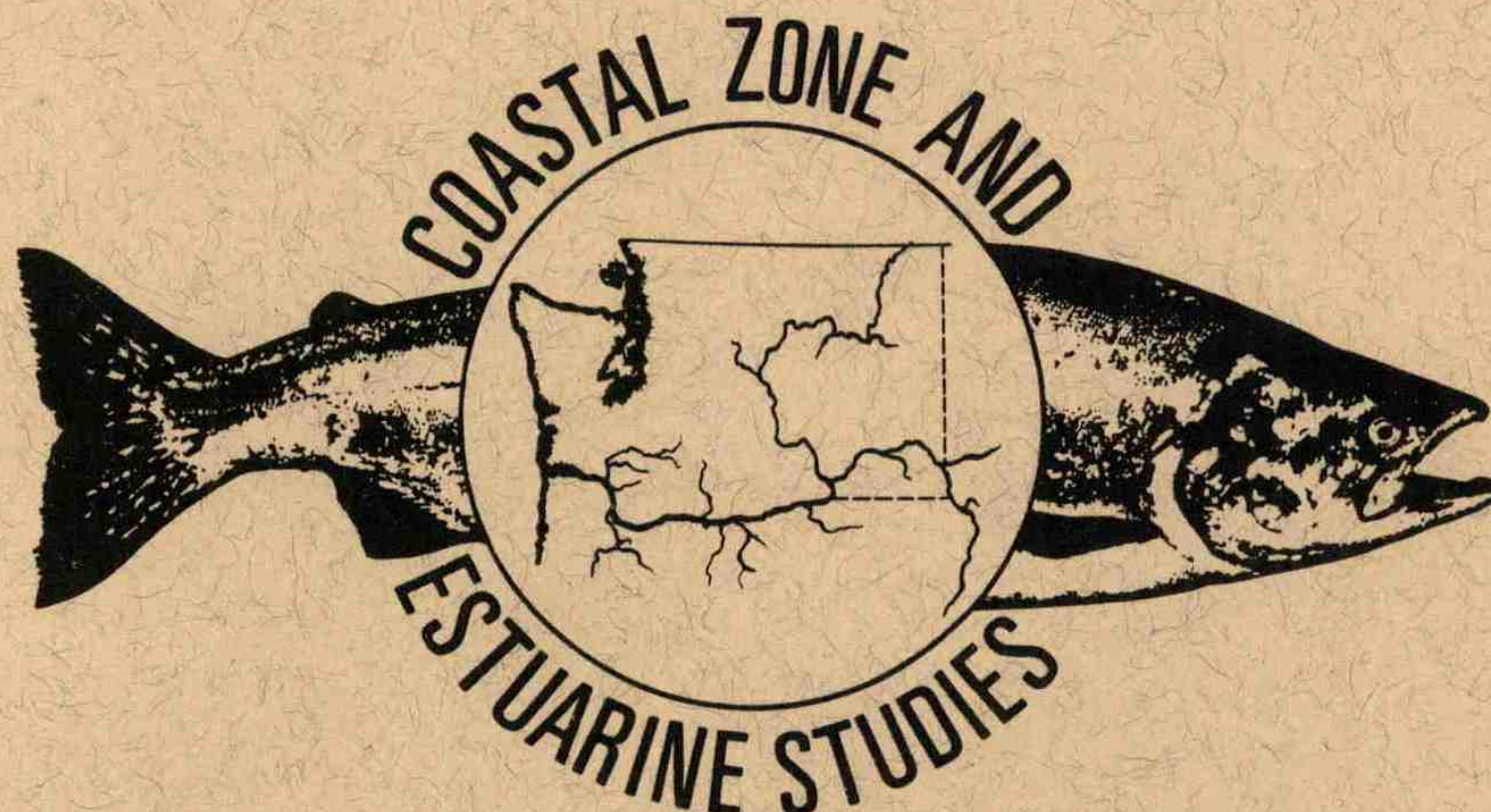
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# Benthic Invertebrates at a Test Dredged-Materials Disposal Site in the Umpqua River, Oregon

by  
David R. Miller, Robert L. Emmett  
and Robert J. McConnell

May 1989



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IN THE UMPQUA RIVER, OREGON**

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## INTRODUCTION

In June 1987, the National Marine Fisheries Service (NMFS) entered into a cooperative agreement with the U.S. Army Corps of Engineers (COE), Portland District, to assess the impact of the disposal of dredged materials from the entrance of Winchester Bay, Umpqua River, Oregon, on benthic infauna at a proposed in-bay disposal site (Fig. 1). Dredging began 15 September and was completed on 16 October. Collection of biological and sediment samples was done on 18 August and 26 October 1987.

## METHODS

### Benthic Invertebrates and Sediments

Benthic invertebrates and sediments were collected at 10 stations in and adjacent to the proposed disposal site at approximately River Mile (RM) 0.65 -1.0 (Fig. 1). Latitude and longitude of each station are given in Appendix Table A. A 0.1-m<sup>2</sup> Gray-O'Hara box corer (Pequegnat et al. 1981) was used to collect six samples at each station. Five of these samples were sieved through a 0.5-mm diameter mesh screen, and the residue containing the macroinvertebrates placed in jars with a buffered 5% formaldehyde solution containing rose bengal (a protein stain). The sixth sample was used for sediment analysis. Sediment grain size was determined by sieving and organic content by burning for 1 hour at 600°C. Sediment analysis was done by the COE sediment laboratory at Troutdale, Oregon. Benthic organisms were sorted from the preserved samples, identified to the lowest possible taxonomic level (usually species), and counted. All specimens were placed in vials containing 70% ethyl alcohol and stored at the NMFS Point Adams Biological Field Station, Hammond, Oregon.

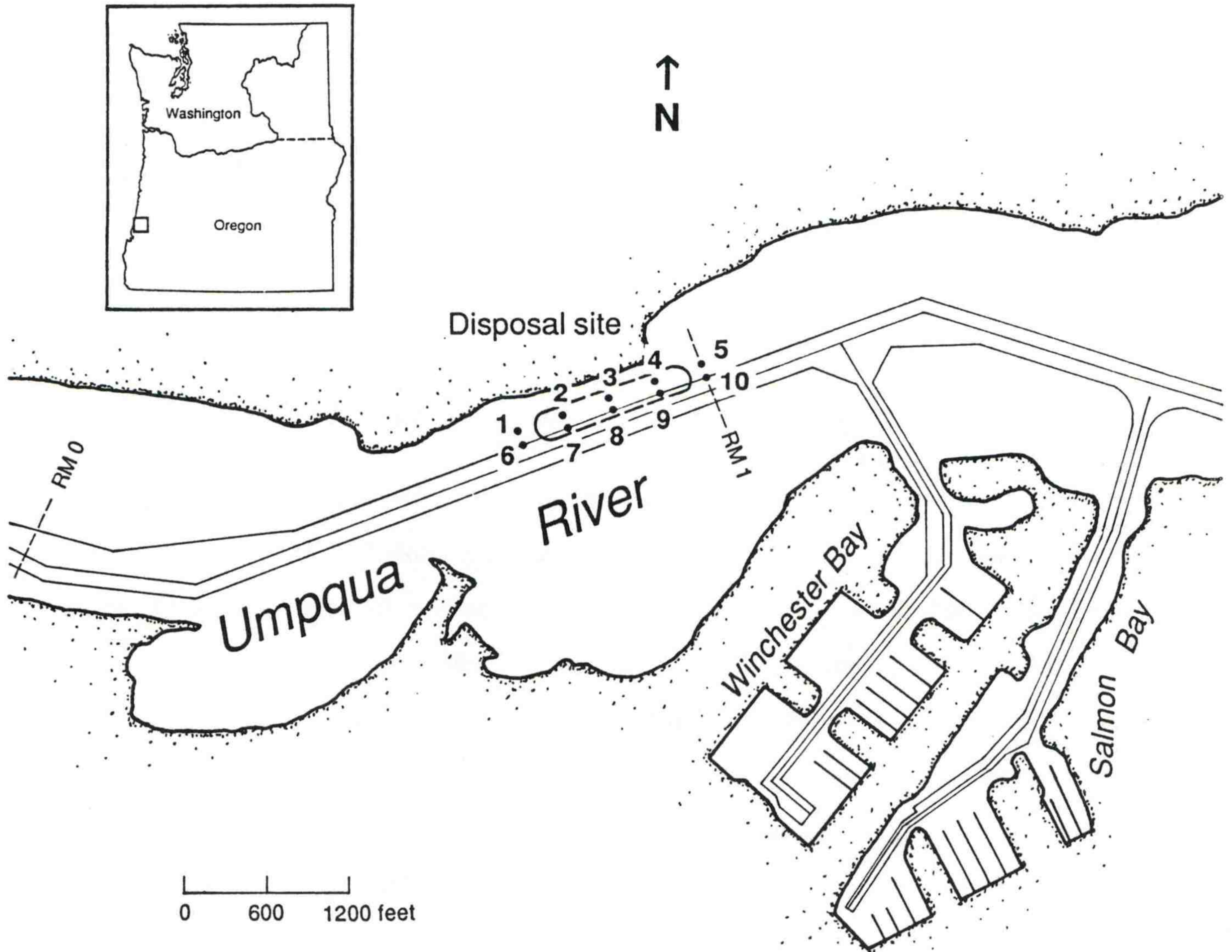


Figure 1.--Location of stations at a test dredged-material disposal site in the Umpqua River, Oregon which were sampled for benthic invertebrates on 18 August and 26 October 1987.

## Data Analysis

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

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

$$H' = - \sum_{i=1}^S P_i \log_2 P_i$$

where  $P_i = X_a/n$  ( $X_a$  is the number of individuals of a particular species in the sample, and  $n$  is the total number of all individuals in the sample), and  $S$  = number of species.

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

$$SDV = 1 - \sum_{i=1}^S P_i^2$$

Diversity values are sensitive to two components, the number of species in a sample (species richness) and the distribution of individuals among species (evenness) (Lloyd and Ghelardi 1964).

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

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

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

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

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

where  $H'$  = Shannon-Weaver Diversity Index, and  $S$  = number of species.

A two-sample t-test, using log transformations of the mean number of benthic invertebrates per  $m^2$  for each station, was done to identify any significant differences in the benthic invertebrate community between the pre-and post-disposal surveys.

## RESULTS

A total of 122 invertebrate taxa with a mean density of 976/ $m^2$  were identified from the Umpqua River in-bay disposal site survey on 18 August (Table 1, Appendix Table C). Highest invertebrate densities were found in the northern portion of the disposal site at Stations 3, 4, 8, 9, and 10. These five stations had a mean invertebrate density of 1,779/ $m^2$  with an individual high density of 3,755/ $m^2$  at Station 3. Number of taxa ranged from 14 to 52 per station with a mean of 30 for all 10 stations. Dominant species included the polychaetes Magelona sacculata and Phyllodoce williamsi and the amphipod Eogammarus confervicolus (Table 2). Indices of species diversity reflected the dominance of the amphipod E. confervicolus at Station 8, and the polychaete M. sacculata and the amphipod Grandifoxus grandis at Station 4.

A total of 144 taxa with a mean density of 1,516/ $m^2$  were found at the test site on 26 October after disposal had been completed (Table 3, Appendix Table D). Highest invertebrate densities were again found in the northern portion of the site with Station 5 replacing Station 8 in the earlier sequence. These five stations had a mean invertebrate density of 2,704/ $m^2$  with an individual high density of 4,545/ $m^2$  (Station 10). Number of taxa ranged from 19 to 69 per station with a mean of 43. Dominant organisms were the polychaetes Spiophanes bombyx, Opheliidae (juvenile

Table 1.--Benthic invertebrates at the dredge-disposal site in the Umpqua River near Winchester Bay, Oregon, 18 August 1987.

Station & depth (ft)	Number of taxa	Number per m <sup>2</sup>		H' <sup>a/</sup>	SDV <sup>b/</sup>	SR <sup>c/</sup>	J' <sup>d/</sup>	
		Mean	St. dev.					
1 <sup>e/</sup>	15	18	250	143	2.96	0.81	3.55	0.71
2	30	19	133	68	3.02	0.76	4.33	0.71
3	70	42	3,755	602	3.58	0.88	5.47	0.66
4	25	31	1,453	359	2.20	0.62	4.58	0.44
5 <sup>e/</sup>	55	25	156	21	4.05	0.92	5.56	0.87
6 <sup>e/</sup>	30	19	131	70	3.54	0.88	4.34	0.83
7	35	14	198	72	2.71	0.77	2.85	0.71
8	45	36	1,515	1,814	1.52	0.36	5.31	0.29
9	20	42	952	569	4.07	0.90	6.69	0.75
10 <sup>e/</sup>	20	<u>52</u>	<u>1,219</u>	252	3.78	0.85	8.00	0.66
Mean		30	976					

a/ Shannon-Weaver Diversity Index (H').

b/ Simpson Diversity Value (SDV).

c/ Species Richness (SR).

d/ Species Evenness (J').

e/ Proposed Umpqua River disposal-site reference station.



Table 2.--Benthic invertebrates collected at the dredge-disposal site in the Umpqua River near Winchester Bay, Oregon, 18 August 1987. Only dominant taxa from each category are shown.

Taxon	Total number	Mean no./m <sup>2</sup>
<b>POLYCHAETA</b>		
<u>Magelona sacculata</u>	563	117
<u>Phyllodoce williamsi</u>	430	90
<u>Syllis elongata</u>	217	45
<u>Spiophanes bombyx</u>	205	43
Miscellaneous	684	142
Total	2,099	437
<b>AMPHIPODA</b>		
<u>Eogammarus confervicolus</u>	598	125
<u>Grandifoxus grandis</u>	275	57
Miscellaneous	92	19
Total	965	201
<b>MOLLUSCA</b>		
Pholadidae	326	68
Mytilidae (Juvenile)	115	24
<u>Modiolus spp.</u>	103	22
Miscellaneous	544	114
Total	813	169
<b>MYSIDACEA/CUMACEA</b>		
<u>Archeomysis grebnitzkii</u>	70	15
Miscellaneous	4	<1
Total	74	15
<b>ECHINODERMATA</b>		
<u>Dendraster excentricus</u>	36	8
Miscellaneous	1	<1
Total	37	8
<b>OTHER</b>		
Nemertinea	386	80
Anthozoa	214	45
Miscellaneous	97	20
Total	697	145

Table 3.--Benthic invertebrates at the dredge-disposal site in the Umpqua River near Winchester Bay, Oregon, 26 October 1987.

Station & depth (ft)	No. of taxa	Number per m <sup>2</sup>		H' <sup>a/</sup>	SDV <sup>b/</sup>	SR <sup>c/</sup>	J' <sup>d/</sup>	
		Mean	St. dev.					
1 <sup>e/</sup>	17	34	454	673	3.79	0.88	6.13	0.75
2	30	27	336	339	3.17	0.80	5.12	0.67
3	70	40	1,317	251	3.16	0.81	6.05	0.59
4	25	61	1,984	1,122	3.61	0.79	8.75	0.61
5 <sup>e/</sup>	52	54	2,092	2,139	3.70	0.86	7.67	0.64
6 <sup>e/</sup>	30	19	156	44	3.13	0.81	4.17	0.74
7	38	30	261	127	4.25	0.93	6.01	0.87
8	47	28	459	185	2.78	0.72	5.01	0.58
9	19	69	3,582	896	3.97	0.89	9.13	0.65
10 <sup>e/</sup>	20	69	4,545	933	3.29	0.79	8.85	0.54
Mean		43	1,516					

a/ Shannon-Weaver Diversity Index (H').

b/ Simpson Diversity Value (SDV).

c/ Species Richness (SR).

d/ Species Evenness (J').

e/ Proposed Umpqua River disposal site reference stations.

species indeterminate), and Magelona sacculata (Table 4). Diversity values were similar between stations and slightly higher than in the 18 August survey (Table 3).

Statistical analysis showed no significant differences ( $P > 0.05$ ) in the numbers of species or densities of benthic invertebrates between the pre- and post-disposal surveys. The disposal site sediments were primarily poorly-graded sand (Appendix Table B). Organic content was low overall with mean levels of 1.7 and 1.8%, respectively, for the two surveys. There were, however, two stations with medium levels. Station 1 ranged from 0.5 to 4.0% and Station 3 from 6.0 to 3.7% organic content between surveys.

## DISCUSSION

The number of benthic invertebrate taxa present at the Umpqua River test site was high, but invertebrate densities were low in relation to those typically found in riverflats. For example, the Columbia River estuary has benthic invertebrate densities ranging from approximately 1,000 to 60,000/m<sup>2</sup> (Durkin and Emmett 1980). Moreover, in an area just upstream (RM 1.6) from our test site, Bottom et al. (1985) rarely found invertebrate densities of less than 1,000/m<sup>2</sup>, and frequently observed densities greater than 50,000/m<sup>2</sup>. Maximum densities were recorded in August (Bottom et al. 1985). Dominant taxa in both the present study and in Bottom et al. (1985) were polychaetes, amphipods, and molluscs.

The increase in numbers of benthic invertebrates observed between Survey 1 (18 August) and Survey 2 (26 October) was unexpected. Typically there is a reduction in invertebrate numbers immediately after dredge disposal (Allen and Hardy 1980). Among the possible explanations for this apparent increase are rapid recolonization of benthic invertebrates via recruitment, and transfer of the benthic community from the dredged site via the dredged material.

The higher invertebrate densities observed after disposal were primarily due to polychaete enhancement, with several different species showing increases. Other taxa

Table 4.--Benthic invertebrates collected at the dredge-disposal site in the Umpqua River near Winchester Bay, Oregon, 26 October 1987. Only dominant taxa from each category are shown.

Taxon	Total number	Mean no./m <sup>2</sup>
<b>POLYCHAETA</b>		
<u>Spiophanes bombyx</u>	783	163
<u>Opheliidae juvenile</u>	706	147
<u>Magelona sacculata</u>	616	128
<u>Syllis elongata</u>	433	90
<u>Mediomastus californiensis</u>	397	83
<u>Glycinde picta</u>	284	59
<u>Phyllodoce williamsi</u>	173	36
<u>Armandia brevis</u>	105	22
Miscellaneous	701	147
Total	4,198	875
<b>AMPHIPODA</b>		
<u>Parapleustes pugettensis</u>	421	88
<u>Grandifoxus grandis</u>	114	24
Miscellaneous	290	60
Total	825	172
<b>MOLLUSCA</b>		
<u>Bivalvia spp. juvenile</u>	289	60
Miscellaneous	369	77
Total	658	137
<b>MYSIDACEA/CUMACEA</b>		
<u>Archeomysis grebnitzkii</u>	14	3
<u>Lamprops sp.</u>	10	2
Total	24	5
<b>ECHINODERMATA</b>		
<u>Dendraster excentricus</u>	53	11
Miscellaneous	2	<1
Total	55	11
<b>OTHER</b>		
Nemertinea	609	127
Isopoda	429	89
Anthozoa	306	64
Miscellaneous	171	36
Total	1,515	316

such as nemertines and molluscs also increased. Although detailed analysis of the size structure of these invertebrates would have provided the data needed to help determine if increases were due to recruitment, this was not part of the study plan. However, in support of the recruitment possibility, one of the polychaetes (an indeterminate species of Opheliidae) found at the test site only after disposal was indeed a juvenile stage. Moreover, previous studies have shown that recolonization at dredge and disposal sites can sometimes occur quite rapidly, with original invertebrate biomass restored in 2 weeks to 4 months (Flemer et al. 1968; Morton 1977; Allen and Hardy 1980).

With regard to the potential for benthic invertebrate transfer, no determination can be made since no benthic invertebrate data are available for the dredge site. This inability to rule out species transfer emphasizes the need in future studies to identify the benthic community of both the dredge and the disposal sites. In addition, the natural annual variation at the test site was not documented before dredge disposal. It is possible that changes in numbers and composition of benthic invertebrate communities similar to those detected in this study are annual events. Before firm conclusions on the effect of dredge disposal can be drawn, the natural annual variation in the benthic community needs to be documented.

In any event, small-scale disposal of dredged materials is unlikely to have any long-term detrimental effect at this site; however, we believe a more comprehensive knowledge of baseline conditions is needed for the Umpqua River estuary. Adequate baseline knowledge should also be required for other northwest estuaries prior to in-bay disposal.

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

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**APPENDIX**

TABLES A-D

## APPENDIX TABLE A

Depth, latitude, and longitude at the Umpqua River test  
dredge-disposal site sampling stations, 18 August and 26 October  
1987.



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Station	Depth (feet)	Coordinates (N and W)
1	17	43° 40' 69" 124° 11' 61"
2	30	43° 40' 80" 124° 11' 44"
3	70	43° 40' 90" 124° 11' 31"
4	25	43° 41' 01" 124° 11' 22"
5	55	43° 41' 11" 124° 11' 06"
6	30	43° 40' 65" 124° 11' 60"
7	35	43° 40' 76" 124° 11' 43"
8	45	43° 40' 85" 124° 11' 31"
9	20	43° 40' 97" 124° 11' 23"
10	20	43° 41' 07" 124° 11' 06"

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APPENDIX TABLE B

Sediment structure analysis, Umpqua River  
test dredge-disposal site, 1987.

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
PROJECT: (87-SH-347) DEPTH: 15 feet  
STATION: 1 METHOD: Gray-O'Hara  
(reference)

Table with 7 columns: Size mm, U.S. Sieve Pan #, Phi, Percent Finer, Percent Retained, Percent by Size Classification. Rows include sieve sizes from 64 mm to <0.0625 mm with corresponding classification percentages.

% Gravel = 2.2 60% (0.371) mm  
% Sand = 97.7 30% (0.291) mm  
% Fines = 0.1 10% (0.230) mm

0.5% Organic content SP: Poorly-graded sand

SYSTEM :Umpqua In-bay DATE: 26 Oct 87  
PROJECT :(87-SH-347) DEPTH: 15 feet  
STATION : 1 METHOD: Gray-O'Hara  
(reference)

Table with 7 columns: Size mm, U.S. Sieve Pan #, Phi, Percent Finer, Percent Retained, Percent by Size Classification. Rows include sieve sizes from 64 mm to <0.0625 mm with corresponding classification percentages.

% Gravel = 12.4 60% < 0.631 mm Comment #10 & 18 fraction  
% Sand = 87.2 30% < 0.344 mm mainly shell  
% Fines = 0.4 10% < 0.228 mm fragments.

4.0% Organic content SP: Poorly-graded sand

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
PROJECT: (87-SH-347) DEPTH: 30 feet  
STATION: 2 METHOD: Gray-O'Hara

Table with 7 columns: Size mm, U.S. Sieve Pan #, Phi, Percent Finer, Percent Retained, Percent by Size Classification. Rows include sieve sizes from 64 mm to <0.0625 mm with corresponding classification percentages.

% Gravel = 6.4 60% < 0.422 mm  
% Sand = 93.5 30% < 0.320 mm  
% Fines = 0.1 10% < 0.259 mm

1.3% Organic content SP: Poorly-graded sand

SYSTEM :Umpqua In-bay DATE: 26 Oct 87  
PROJECT :(87-SH-347) DEPTH: 30 feet  
STATION : 2 METHOD: Gray-O'Hara

Table with 7 columns: Size mm, U.S. Sieve Pan #, Phi, Percent Finer, Percent Retained, Percent by Size Classification. Rows include sieve sizes from 64 mm to <0.0625 mm with corresponding classification percentages.

% Gravel = 2.3 60% < 0.345 mm Comment #10 & 18 fraction  
% Sand = 97.5 30% < 0.242 mm mainly shell  
% Fines = 0.2 10% < 0.169 mm fragments.

2.0% Organic content SP: Poorly-graded sand

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
PROJECT: (87-SH-347) DEPTH: 70 feet  
STATION: 3 METHOD: Gray-O'Hara

SYSTEM :Umpqua In-bay DATE: 26 Oct 87  
PROJECT :(87-SH-347) DEPTH: 70 feet  
STATION : 3 METHOD: Gray-O'Hara

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in.	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in.	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in.	-4	81.3	18.7	
8 mm	5/16in.	-3	79.2	2.1	20.8 % Medium gravel
4 mm	No. 5	-2	78.4	0.8	
2 mm	10.00	-1	78.3	0.1	0.9 % Fine gravel
1 mm	18.00	0	78.0	0.3	
0.5 mm	35.00	1	77.7	0.3	0.6 % Coarse sand
0.25 mm	60.00	2	77.2	0.5	0.5 % Medium sand
0.125 mm	120.00	3	77.0	0.2	
0.0625 mm	230.00	4.00	61.3	15.7	15.9 % Fine sand
<.0625 mm	<230			61.3	61.3 % Silt/clay

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in.	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in.	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in.	-4	94.9	5.1	
8 mm	5/16in.	-3	92.8	2.1	7.2 % Medium gravel
4 mm	No. 5	-2	92.6	0.2	
2 mm	10.00	-1	79.50	13.1	13.3 % Fine gravel
1 mm	18.00	0	70.10	9.4	
0.5 mm	35.00	1	59.80	10.3	19.7 % Coarse sand
0.25 mm	60.00	2	40.60	19.2	19.2 % Medium sand
0.125 mm	120.00	3	24.70	15.9	
0.0625 mm	230.00	4.00	20.60	4.1	20.0 % Fine sand
<.0625 mm	<230			20.6	20.6 % Silt/clay

% Gravel = 21.7 60% < 0.059 mm  
% Sand = 17.0 30% < 0.018 mm  
% Fines = 61.3 10% < ??

% Gravel = 20.5 60% < 0.504 mm Comment #10 & 18 fraction  
% Sand = 58.9 30% < 0.169 mm mainly shell  
% Fines = 20.6 10% < 0.012 mm fragments.

6.0% Organic content ML: gravelly silt with sand

3.7% Organic content Atterberg limits req. for classification

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
PROJECT: (87-SH-347) DEPTH: 25 feet  
STATION: 4 METHOD: Gray-O'Hara

SYSTEM :Umpqua In-bay DATE: 26 Oct 87  
PROJECT :(87-SH-347) DEPTH: 25 feet  
STATION : 4 METHOD: Gray-O'Hara

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in.	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in.	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in.	-4	100.0	0.0	
8 mm	5/16in.	-3	100.0	0.0	0.0 % Medium gravel
4 mm	No. 5	-2	99.3	0.7	
2 mm	10.00	-1	98.1	1.2	1.9 % Fine gravel
1 mm	18.00	0	96.7	1.4	
0.5 mm	35.00	1	83.5	13.2	14.6 % Coarse sand
0.25 mm	60.00	2	26.1	57.4	57.4 % Medium sand
0.125 mm	120.00	3	1.8	24.3	
0.0625 mm	230.00	4.00	0.2	1.6	25.9 % Fine sand
<.0625 mm	<230			0.2	0.2 % Silt/clay

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in.	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in.	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in.	-4	100.0	0.0	
8 mm	5/16in.	-3	100.0	0.0	0.0 % Medium gravel
4 mm	No. 5	-2	99.8	0.2	
2 mm	10.00	-1	99.10	0.7	0.9 % Fine gravel
1 mm	18.00	0	97.80	1.3	
0.5 mm	35.00	1	90.90	6.9	8.2 % Coarse sand
0.25 mm	60.00	2	39.60	51.3	51.3 % Medium sand
0.125 mm	120.00	3	1.10	38.5	
0.0625 mm	230.00	4.00	0.10	1.0	39.5 % Fine sand
<.0625 mm	<230			0.1	0.1 % Silt/clay

% Gravel = 1.9 60% < 0.368 mm  
% Sand = 97.9 30% < 0.264 mm  
% Fines = 0.2 10% < 0.176 mm

% Gravel = 0.9 60% < 0.319 mm Comment #10 & 18 fraction  
% Sand = 99.0 30% < 0.216 mm mainly shell  
% Fines = 0.1 10% < 0.158 mm fragments.

1.2% Organic content SP: Poorly-graded sand

0.8% Organic content SP: Poorly-graded sand

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
 PROJECT: (87-SH-347) DEPTH: 55 feet  
 STATION: 5 METHOD: Gray-O'Hara  
 (reference)

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16 in	-3	100.0	0.0	0.0 % Medium gravel
4 mm	No. 5	-2	100.0	0.0	
2 mm	10.00	-1	98.5	1.5	1.5 % Fine gravel
1 mm	18.00	0	96.0	2.5	
0.5 mm	35.00	1	88.2	7.8	10.3 % Coarse sand
0.25 mm	60.00	2	40.2	48.0	48.0 % Medium sand
0.125 mm	120.00	3	9.0	31.2	
0.0625 mm	230.00	4.00	4.5	4.5	35.7 % Fine sand
<.0625 mm	<230			4.5	4.5 % Silt/clay

% Gravel = 1.5      60% < 0.326 mm  
 % Sand = 94.0      30% < 0.208 mm  
 % Fines = 4.5      10% < 0.133 mm

SYSTEM :Umpqua In-bay DATE: 26 Oct 87  
 PROJECT :(87-SH-347) DEPTH: 55 feet  
 STATION : 5 METHOD: Gray-O'Hara  
 (reference)

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16 in	-3	99.5	0.5	0.5 % Medium gravel
4 mm	No. 5	-2	99.4	0.1	
2 mm	10.00	-1	98.30	1.1	1.2 % Fine gravel
1 mm	18.00	0	97.60	0.7	
0.5 mm	35.00	1	93.70	3.9	4.6 % Coarse sand
0.25 mm	60.00	2	53.80	39.9	39.9 % Medium sand
0.125 mm	120.00	3	3.10	50.7	
0.0625 mm	230.00	4.00	0.10	3.0	53.7 % Fine sand
<.0625 mm	<230			0.1	0.1 % Silt/clay

% Gravel = 1.7      60% < 0.272 mm      Comment #10 fraction  
 % Sand = 98.2      30% < 0.186 mm      mainly shell  
 % Fines = 0.1      10% < 0.147 mm      fragments.

1.8% Organic content      SP: Poorly-graded sand

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
 PROJECT: (87-SH-347) DEPTH: 30 feet  
 STATION: 6 METHOD: Gray-O'Hara  
 (reference)

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16 in	-3	100.0	0.0	0.0 % Medium gravel
4 mm	No. 5	-2	100.0	0.0	
2 mm	10.00	-1	99.3	0.7	0.7 % Fine gravel
1 mm	18.00	0	98.2	1.1	
0.5 mm	35.00	1	90.2	8.0	9.1 % Coarse sand
0.25 mm	60.00	2	15.8	74.4	74.4 % Medium sand
0.125 mm	120.00	3	1.1	14.7	
0.0625 mm	230.00	4.00	0.2	0.9	15.6 % Fine sand
<.0625 mm	<230			0.2	0.2 % Silt/clay

% Gravel = 0.7      60% < 0.365 mm  
 % Sand = 99.1      30% < 0.291 mm  
 % Fines = 0.2      10% < 0.222 mm

1.1% Organic content      SP: Poorly-graded sand

1.3% Organic content      SP: Poorly-graded sand

SYSTEM :Umpqua In-bay DATE: 26 Oct 87  
 PROJECT :(87-SH-347) DEPTH: 30 feet  
 STATION : 6 METHOD: Gray-O'Hara  
 (reference)

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16 in	-3	100.0	0.0	0.0 % Medium gravel
4 mm	No. 5	-2	99.9	0.1	
2 mm	10.00	-1	99.40	0.5	0.6 % Fine gravel
1 mm	18.00	0	97.70	1.7	
0.5 mm	35.00	1	82.20	15.5	17.2 % Coarse sand
0.25 mm	60.00	2	9.70	72.5	72.5 % Medium sand
0.125 mm	120.00	3	0.30	9.4	
0.0625 mm	230.00	4.00	0.10	0.2	9.6 % Fine sand
<.0625 mm	<230			0.1	0.1 % Silt/clay

% Gravel = 0.6      60% < 0.392 mm      Comment #10 fraction  
 % Sand = 99.3      30% < 0.308 mm      mainly shell  
 % Fines = 0.1      10% < 0.248 mm      fragments.

1.1% Organic content      SP: Poorly-graded sand

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
 PROJECT: (87-SH-347) DEPTH: 35 feet  
 STATION: 7 METHOD: Gray-O'Hara

SYSTEM :Umpqua In-bay DATE: 26 Oct 87  
 PROJECT :(87-SH-347) DEPTH: 35 feet  
 STATION : 7 METHOD: Gray-O'Hara

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4 mm	No. 5	-2	100.0	0.0	
2 mm	10.00	-1	99.8	0.2	0.2 % Fine gravel
1 mm	18.00	0	98.7	1.1	
0.5 mm	35.00	1	87.9	10.8	11.9 % Coarse sand
0.25 mm	60.00	2	11.6	76.3	76.3 % Medium sand
0.125 mm	120.00	3	0.2	11.4	
0.0625 mm	230.00	4.00	0.1	0.1	11.5 % Fine sand
<.0625 mm	<230			0.1	0.1 % Silt/clay

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16in	-3	100.0	0.0	0.0 % Medium gravel
4 mm	No. 5	-2	100.0	0.0	
2 mm	10.00	-1	99.80	0.2	0.2 % Fine gravel
1 mm	18.00	0	99.20	0.6	
0.5 mm	35.00	1	93.90	5.3	5.9 % Coarse sand
0.25 mm	60.00	2	17.10	76.8	76.8 % Medium sand
0.125 mm	120.00	3	0.20	16.9	
0.0625 mm	230.00	4.00	0.10	0.1	17.0 % Fine sand
<.0625 mm	<230			0.1	0.1 % Silt/clay

% Gravel = 0.2      60% < 0.375 mm  
 % Sand = 99.7      30% < 0.301 mm  
 % Fines = 0.1      10% < 0.239

% Gravel = 0.2      60% < 0.357 mm      Comment #10 fraction  
 % Sand = 99.7      30% < 0.286 mm      mainly shell  
 % Fines = 0.1      10% < 0.220 mm      fragments.

0.7% Organic content      SP: Poorly-graded sand

0.8% Organic content      SP: Poorly-graded sand

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
 PROJECT: (87-SH-347) DEPTH: 45 feet  
 STATION: 8 METHOD: Gray-O'Hara

SYSTEM :Umpqua In-bay DATE: 26 Oct 87  
 PROJECT :(87-SH-347) DEPTH: 45 feet  
 STATION : 8 METHOD: Gray-O'Hara

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16in	-3	99.8	0.2	0.2 % Medium gravel
4 mm	No. 5	-2	99.6	0.2	
2 mm	10.00	-1	92.4	7.2	7.4 % Fine gravel
1 mm	18.00	0	85.1	7.3	
0.5 mm	35.00	1	63.3	21.8	29.1 % Coarse sand
0.25 mm	60.00	2	16.4	46.9	46.9 % Medium sand
0.125 mm	120.00	3	0.3	16.1	
0.0625 mm	230.00	4.00	0.1	0.2	16.3 % Fine sand
<.0625 mm	<230			0.1	0.1 % Silt/clay

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16in	-3	99.9	0.1	0.1 % Medium gravel
4 mm	No. 5	-2	99.8	0.1	
2 mm	10.00	-1	90.10	9.7	9.8 % Fine gravel
1 mm	18.00	0	80.90	9.2	
0.5 mm	35.00	1	55.60	25.3	34.5 % Coarse sand
0.25 mm	60.00	2	6.40	49.2	49.2 % Medium sand
0.125 mm	120.00	3	0.50	5.9	
0.0625 mm	230.00	4.00	0.20	0.3	6.2 % Fine sand
<.0625 mm	<230			0.2	0.2 % Silt/clay

% Gravel = 7.6      60% < 0.468 mm  
 % Sand = 92.3      30% < 0.307 mm  
 % Fines = 0.1      10% < 0.211 mm

% Gravel = 9.9      60% < 0.535 mm      Comment: # 10 & 18  
 % Sand = 89.9      30% < 0.352 mm      fraction mainly  
 % Fines = 0.2      10% < 0.268 mm      shell fragments

1.3% Organic content      SP: Poorly-graded sand

1.6% Organic content      SP: Poorly-graded sand

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
PROJECT: (87-SH-347) DEPTH: 20 feet  
STATION: 9 METHOD: Gray-O'Hara

SYSTEM: Umpqua In-bay DATE: 26 Oct 87  
PROJECT: (87-SH-347) DEPTH: 20 feet  
STATION: 9 METHOD: Gray-O'Hara

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16 in	-3	100.0	0.0	0.0 % Medium gravel
4 mm	No. 5	-2	99.2	0.8	
2 mm	10.00	-1	96.7	2.5	3.3 % Fine gravel
1 mm	18.00	0	94.5	2.2	
0.5 mm	35.00	1	89.6	4.9	7.1 % Coarse sand
0.25 mm	60.00	2	63.3	26.3	26.3 % Medium sand
0.125 mm	120.00	3	7.3	56.0	
0.0625 mm	230.00	4.00	0.8	6.5	62.5 % Fine sand
<.0625 mm	<230			0.8	0.8 % Silt/clay

% Gravel = 3.3      60% < 0.235 mm  
% Sand = 95.9      30% < 0.173 mm  
% Fines = 0.8      10% < 0.135 mm

2.7% Organic content      SP: Poorly-graded sand

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	96.2	3.8	
8 mm	5/16 in	-3	90.2	6.0	9.8 % Medium gravel
4 mm	No. 5	-2	89.5	0.7	
2 mm	10.00	-1	82.5	7.0	7.7 % Fine gravel
1 mm	18.00	0	78.1	4.4	
0.5 mm	35.00	1	67.6	10.5	14.9 % Coarse sand
0.25 mm	60.00	2	21.2	46.4	46.4 % Medium sand
0.125 mm	120.00	3	2.2	19.0	
0.0625 mm	230.00	4.00	0.7	1.5	20.5 % Fine sand
<.0625 mm	<230			0.7	0.7 % Silt/clay

% Gravel = 17.5      60% < 0.430 mm      Comment: # 10 & 18  
% Sand = 81.8      30% < 0.288 mm      fraction mainly  
% Fines = 0.7      10% < 0.187 mm      shell fragments

1.4% Organic content      SP: Poorly-graded sand

SYSTEM: Umpqua In-bay DATE: 18 Aug 87  
PROJECT: (87-SH-347) DEPTH: 20 feet  
STATION: 10 METHOD: Gray-O'Hara  
(reference)

SYSTEM: Umpqua In-bay DATE: 26 Oct 87  
PROJECT: (87-SH-347) DEPTH: 20 feet  
STATION: 10 METHOD: Gray-O'Hara  
(reference)

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16 in	-3	99.9	0.1	0.1 % Medium gravel
4 mm	No. 5	-2	99.7	0.2	
2 mm	10.00	-1	98.5	1.2	1.4 % Fine gravel
1 mm	18.00	0	96.9	1.6	
0.5 mm	35.00	1	90.3	6.6	8.2 % Coarse sand
0.25 mm	60.00	2	45.5	44.8	44.8 % Medium sand
0.125 mm	120.00	3	1.3	44.2	
0.0625 mm	230.00	4.00	0.2	1.1	45.3 % Fine sand
<.0625 mm	<230			0.2	0.2 % Silt/clay

% Gravel = 1.5      60% < 0.302 mm  
% Sand = 98.3      30% < 0.202 mm  
% Fines = 0.2      10% < 0.154 mm

0.8% Organic content      SP: Poorly-graded sand

Size mm	U.S.Sieve Pan #	Phi	Percent Finer	Percent Retained	Percent by Size Classification
64 mm	2-1/2 in	-6	100.0	0.0	0.0 % Rubble
32 mm	1-1/4 in	-5	100.0	0.0	0.0 % Coarse gravel
16 mm	5/8 in	-4	100.0	0.0	
8 mm	5/16 in	-3	99.6	0.4	0.4 % Medium gravel
4 mm	No. 5	-2	99.4	0.2	
2 mm	10.00	-1	95.7	3.7	3.9 % Fine gravel
1 mm	18.00	0	93.1	2.6	
0.5 mm	35.00	1	83.8	9.3	11.9 % Coarse sand
0.25 mm	60.00	2	39.9	43.9	43.9 % Medium sand
0.125 mm	120.00	3	1.2	38.7	
0.0625 mm	230.00	4.00	0.2	1.0	39.7 % Fine sand
<.0625 mm	<230			0.2	0.2 % Silt/clay

% Gravel = 4.3      60% < 0.332 mm      Comment: # 10 & 18  
% Sand = 95.5      30% < 0.213 mm      fraction mainly  
% Fines = 0.2      10% < 0.158 mm      shell fragments

1.2% Organic content      SP: Poorly-graded sand

## APPENDIX TABLE C

Benthic invertebrates at 10 sampling stations at  
a test dredge-disposal site in the Umpqua River  
near Winchester Bay, Oregon, 18 August 1987.



Station 1	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Nemertinea	5	60.00	10.42	10.42
<u>Scoloplos acmeceps</u>	13	60.00	27.09	32.62
Spionidae	2	20.00	4.17	9.32
<u>Pygospio elegans</u>	1	20.00	2.08	4.66
<u>Spio butleri</u>	1	20.00	2.08	4.66
<u>Magelona sacculata</u>	8	80.00	16.67	11.88
<u>Capitella capitata</u> complex	2	20.00	4.17	9.32
<u>Glycera convoluta</u>	1	20.00	2.08	4.66
<u>Glycera tenuis</u>	1	20.00	2.08	4.66
<u>Nephtys caecoides</u>	36	100.00	75.02	30.73
Gastropoda	1	20.00	2.08	4.66
<u>Nucella</u> spp.	1	20.00	2.08	4.66
<u>Lamprops quadriplicata</u>	1	20.00	2.08	4.66
<u>Ianiropsis</u> sp.	1	20.00	2.08	4.66
<u>Eohaustorius sawyeri</u>	2	20.00	4.17	9.32
<u>Ischyrocerus pegalops</u>	1	20.00	2.08	4.66
<u>Grandifoxus grandis</u>	32	100.00	66.69	58.30
<u>Parapleustes den</u>	11	60.00	22.92	25.95

Number of taxa = 18

Mean number per sample: 24.00

Standard deviation (S.D.): 13.73

Mean number/m<sup>2</sup>: 250.08

S.D./m<sup>2</sup>: 143.06

H' = 2.96    SDV = 0.81    SR = 3.55    J' = 0.71

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Station 2	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Nemertinea	29	100.00	60.44	66.88
<u>Magelona sacculata</u>	1	20.00	2.08	4.66
Capitellidae	2	20.00	4.17	9.32
<u>Phyllodoce williamsi</u>	1	20.00	2.08	4.66
<u>Eteone fauchaldi</u>	1	20.00	2.08	4.66
Syllidae	1	20.00	2.08	4.66
Syllidae sp. indeterminate	2	20.00	4.17	9.32
<u>Syllis elongata</u>	5	60.00	10.42	10.42
<u>Nephtys caecoides</u>	1	20.00	2.08	4.66
<u>Lumbrineris zonata</u>	1	20.00	2.08	4.66
Bivalvia spp. juvenile	2	40.00	4.17	5.71
<u>Modiolus</u> spp.	2	40.00	4.17	5.71
<u>Gnorimosphaeroma oregonensis</u>	2	20.00	4.17	9.32
<u>Eogammarus confervicolus</u>	9	40.00	18.76	36.40
<u>Grandifoxus grandis</u>	1	20.00	2.08	4.66
<u>Fabia</u> sp.	1	20.00	2.08	4.66
<u>Cancer magister</u>	1	20.00	2.08	4.66
<u>Dendraster excentricus</u>	1	20.00	2.08	4.66
Insecta	1	20.00	2.08	4.66

Number of taxa = 19

Mean number per sample: 12.80

Standard deviation (S.D.): 6.53

Mean number/m<sup>2</sup>: 133.38

S.D./m<sup>2</sup>: 68.09

H' = 3.02

SDV = 0.76

SR = 4.33

J' = 0.71

Station 3	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	196	100.00	408.46	321.37
Platyhelminthes	29	100.00	60.44	15.46
Nemertinea	151	100.00	314.68	123.82
Polychaeta	1	20.00	2.08	4.66
Spionidae	1	20.00	2.08	4.66
<u>Polydora socialis</u>	13	80.00	27.09	28.15
<u>Capitella capitata</u> complex	13	60.00	27.09	32.62
<u>Armandia brevis</u>	1	20.00	2.08	4.66
<u>Phyllodoce williamsi</u>	423	100.00	881.53	349.16
<u>Eulalia viridis</u>	52	100.00	108.37	39.40
Polynoididae sp. indet.	1	20.00	2.08	4.66
Syllidae	26	100.00	54.18	34.87
<u>Syllis elongata</u>	174	100.00	362.62	196.52
Nereidae sp. juvenile	2	20.00	4.17	9.32
<u>Nereis</u> sp. indet.	1	20.00	2.08	4.66
<u>Glycinde picta</u>	3	40.00	6.25	9.32
<u>Lumbrineris</u> sp. juvenile	16	100.00	33.34	20.04
<u>Pholoides aspera</u>	17	80.00	35.43	25.09
<u>Owenia fusiformis</u>	1	20.00	2.08	4.66
Sabellidae	14	40.00	29.18	59.59
<u>Chone dunneri</u>	46	80.00	95.86	73.09
Gastropoda	6	20.00	12.50	27.96
Nudibranchia	2	20.00	4.17	9.32
Bivalvia spp. juvenile	36	100.00	75.02	66.07
Mytilidae	10	20.00	20.84	46.60
Mytilidae spp. juvenile	103	80.00	214.65	174.30
<u>Modiolus</u> spp.	85	100.00	177.14	58.48
<u>Clinocardium nuttallii</u>	2	40.00	4.17	5.71
<u>Mya arenaria</u>	1	20.00	2.08	4.66
<u>Macoma</u> sp.	2	20.00	4.17	9.32
Pholadidae spp.	325	100.00	677.30	283.36
Teredinidae	5	20.00	10.42	23.30
Mysidacea	1	20.00	2.08	4.66
<u>Idotea</u> spp.	4	20.00	8.34	18.64
<u>Gnorimosphaeroma oregonensis</u>	2	20.00	4.17	9.32
Gammaridea	1	20.00	2.08	4.66
<u>Jassa falcata</u>	7	80.00	14.59	11.88
Porcellanidae	1	20.00	2.08	4.66
<u>Pinnixa</u> sp.	1	20.00	2.08	4.66
<u>Cancer magister</u>	5	60.00	10.42	10.42
Pycnogonida	1	20.00	2.08	4.66

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Station 3  
(CONTINUED)

18 August 1987

Sample size - 5

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Number of taxa = 42

Mean number per sample: 360.40

Standard deviation (S.D.): 57.80

Mean number/m<sup>2</sup>: 3,755.37

S.D./m<sup>2</sup>: 602.23

H' = 3.58    SDV = 0.88    SR = 5.47    J' = 0.66

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Station 4	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
<u>Nemertinea</u>	2	20.00	4.17	5.71
<u>Orbiniidae</u>	5	40.00	10.42	14.74
<u>Scoloplos</u> sp. juvenile	2	20.00	4.17	9.32
<u>Scoloplos</u> <u>armiger</u>	5	40.00	10.42	18.05
<u>Scoloplos</u> <u>acmeceps</u>	24	80.00	50.02	37.13
<u>Scoelepsis</u> <u>squamata</u>	2	20.00	4.17	9.32
<u>Scoelepsis</u> <u>foliosa</u>	1	20.00	2.08	4.66
<u>Spiophanes</u> <u>bombyx</u>	20	80.00	41.68	38.99
<u>Magelona</u> <u>sacculata</u>	395	100.00	823.18	307.26
<u>Capitella</u> <u>capitata</u> complex	7	80.00	14.59	11.88
<u>Decamastus</u> <u>gracilis</u>	1	20.00	2.08	4.66
<u>Phyllodoce</u> <u>williamsi</u>	1	20.00	2.08	4.66
<u>Syllidae</u>	2	20.00	4.17	9.32
<u>Glycera</u> <u>convoluta</u>	1	20.00	2.08	4.66
<u>Glycera</u> <u>tenuis</u>	2	20.00	4.17	9.32
<u>Glycinde</u> <u>picta</u>	14	80.00	29.18	32.45
<u>Nephtys</u> <u>caecoides</u>	3	40.00	6.25	9.32
<u>Bivalvia</u> spp. juvenile	2	20.00	4.17	9.32
<u>Mytilidae</u> spp. juvenile	5	80.00	10.42	7.37
<u>Modiolus</u> spp.	1	20.00	2.08	4.66
<u>Mya</u> <u>arenaria</u>	1	20.00	2.08	4.66
<u>Siliqua</u> <u>patula</u>	4	40.00	8.34	13.59
<u>Pholadidae</u> spp.	1	20.00	2.08	4.66
<u>Archeomysis</u> <u>grebnitzkii</u>	18	100.00	37.51	11.88
<u>Ianiropsis</u> sp.	1	20.00	2.08	4.66
<u>Gammaridea</u>	1	20.00	2.08	4.66
<u>Eogammarus</u> <u>confervicolus</u>	1	20.00	2.08	4.66
<u>Eohaustorius</u> sp. juvenile	2	40.00	4.17	5.71
<u>Grandifoxus</u> <u>grandis</u>	165	100.00	343.86	139.60
<u>Porcellanidae</u>	1	20.00	2.08	4.66
<u>Dendraster</u> <u>excentricus</u>	7	60.00	14.59	21.61

Number of taxa = 31

Mean number per sample: 139.40

Standard deviation (S.D.): 34.49

Mean number/m<sup>2</sup>: 1,452.55

S.D./m<sup>2</sup>: 359.35

H' = 2.20

SDV = 0.62

SR = 4.58

J' = 0.44

Station 5	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
<u>Nemertinea</u>	9	60.00	18.76	25.95
<u>Scoloplos sp. juvenile</u>	1	20.00	2.08	4.66
<u>Scoelepsis squamata</u>	1	20.00	2.08	4.66
<u>Magelona sacculata</u>	2	20.00	4.17	9.32
<u>Capitella capitata complex</u>	1	20.00	2.08	4.66
<u>Armandia bravis</u>	1	20.00	2.08	4.66
<u>Ophelia sp.</u>	5	60.00	10.42	12.76
<u>Phyllodoce williamsi</u>	1	20.00	2.08	4.66
<u>Glycera convoluta</u>	1	20.00	2.08	4.66
<u>Glycera tenuis</u>	5	100.00	10.42	0.00
<u>Glycinde picta</u>	9	80.00	18.76	20.04
<u>Nephtys caecoides</u>	6	60.00	12.50	13.59
<u>Nephtys californiensis</u>	4	60.00	8.34	8.72
<u>N.caecoides/californiensis</u>	3	20.00	6.25	13.98
<u>Lumbrineris zonata</u>	1	20.00	2.08	4.66
<u>Modiolus spp.</u>	1	20.00	2.08	4.66
<u>Clinocardium nuttallii juv.</u>	1	20.00	2.08	4.66
<u>Clinocardium nuttallii</u>	1	20.00	2.08	4.66
<u>Mya arenaria</u>	1	20.00	2.08	4.66
<u>Archeomysis grebnitzkii</u>	4	60.00	8.34	8.72
<u>Eohaustorius sp. juvenile</u>	1	20.00	2.08	4.66
<u>Synchelidium shoemakeri</u>	1	20.00	2.08	4.66
<u>Mandibulophoxus uncistrostratus</u>	1	20.00	2.08	4.66
<u>Grandifoxus grandis</u>	12	80.00	25.01	18.93
<u>Dendraster excentricus</u>	2	40.00	4.17	5.71

Number of taxa = 25

Mean number per sample: 15

Standard deviation (S.D.): 2.00

Mean number/m<sup>2</sup>: 156.30

S.D./m<sup>2</sup>: 20.84

H' = 4.05    SDV = 0.92    SR = 5.56    J' = 0.87

Station 6	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Nemertinea	1	20.00	2.08	4.66
Polychaeta	2	20.00	4.17	9.32
Paraonidae	1	20.00	2.08	4.66
<u>Pygospio elegans</u>	2	40.00	4.17	5.71
<u>Magelona sacculata</u>	10	80.00	20.84	16.48
<u>Ophelia</u> sp.	1	20.00	2.08	4.66
<u>Phyllodoce</u> sp. indeterminate	2	20.00	4.17	9.32
<u>Phyllodoce</u> sp. juvenile	1	20.00	2.08	4.66
<u>Syllidae</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Glycera tenuis</u>	7	80.00	14.59	11.88
<u>Glycinde picta</u>	1	20.00	2.08	4.66
<u>Nephtys caecoides</u>	6	80.00	12.50	8.72
<u>Nephtys californiensis</u>	1	20.00	2.08	4.66
<u>Mytilidae</u> sp. juvenile	1	20.00	2.08	4.66
<u>Clinocardium nuttallii</u>	1	20.00	2.08	4.66
<u>Archeomysis grebnitzkii</u>	8	60.00	16.67	21.61
<u>Lamprops quadriplicata</u>	1	20.00	2.08	4.66
<u>Eohaustorius</u> sp. juvenile	2	40.00	4.17	5.71
<u>Grandifoxus grandis</u>	14	80.00	29.18	28.91

Number of taxa = 19

Mean number per sample: 12.60

Standard deviation (S.D.): 6.69

Mean number/m<sup>2</sup>: 131.29

S.D./m<sup>2</sup>: 69.74

H' = 3.54    SDV = 0.88    SR = 4.34    J' = 0.83

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Station 7	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
<u>Pygospio elegans</u>	1	20.00	2.08	4.66
<u>Magelona sacculata</u>	17	60.00	35.43	33.44
Capitellidae	1	20.00	2.08	4.66
<u>Ophelia</u> sp. 1	1	20.00	2.08	4.66
<u>Glycera convoluta</u>	1	20.00	2.08	4.66
<u>Glycera tenuis</u>	5	80.00	10.42	7.37
<u>Nephtys</u> sp. juvenile	1	20.00	2.08	4.66
<u>Nephtys caecoides</u>	2	20.00	4.17	9.32
<u>Nephtys californiensis</u>	4	40.00	8.34	11.41
Bivalvia spp. juvenile	1	20.00	2.08	4.66
<u>Archeomysis grebnitzkii</u>	9	80.00	18.76	15.46
<u>Eohaustorius</u> sp. juvenile	1	20.00	2.08	4.66
<u>Grandifoxus grandis</u>	38	100.00	79.19	107.94
<u>Dendraster excentricus</u>	13	80.00	27.09	21.61

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Number of taxa = 14

Mean number per sample: 19.60                      Standard deviation (S.D.): 6.89

Mean number/m<sup>2</sup>: 197.98                      S.D./m<sup>2</sup>: 71.81

H' = 2.71      SDV = 0.77      SR = 2.85      J' = 0.71

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Station 8	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	1	20.00	2.08	4.66
Nemertinea	43	100.00	89.61	80.24
<u>Soloplos acmeceps</u>	2	20.00	4.17	9.32
Spionidae	1	20.00	2.08	4.66
<u>Capitella capitata</u> complex	3	40.00	6.25	9.32
<u>Ophelia</u> sp. 1	1	20.00	2.08	4.66
<u>Phyllodoce williamsi</u>	2	40.00	4.17	5.71
<u>Eteone</u> sp. indeterminate	1	20.00	2.08	4.66
Syllidae	2	20.00	4.17	9.32
Syllidae sp. indeterminate	1	20.00	2.08	4.66
<u>Syllis elongata</u>	10	40.00	20.84	41.02
Nereidae	1	20.00	2.08	4.66
<u>Glycinde picta</u>	3	60.00	6.25	5.71
<u>Nephtys caecoides</u>	2	20.00	4.17	9.32
Lumbrineridae	1	20.00	2.08	4.66
<u>Lumbrineris zonata</u>	4	40.00	8.34	13.59
<u>Drilonereis falcata</u>	1	20.00	2.08	4.66
<u>Diaphana</u> sp.	1	20.00	2.08	4.66
<u>Modiolus</u> spp.	1	20.00	2.08	4.66
<u>Mytilus edulis</u>	1	20.00	2.08	4.66
<u>Mya arenaria</u>	11	80.00	22.92	15.46
<u>Mya</u> spp. juvenile	1	20.00	2.08	4.66
<u>Archeomysis grebnitzkii</u>	5	60.00	10.42	10.42
<u>Idotea fewkesi</u>	2	20.00	4.17	9.32
<u>Ianiropsis</u> sp.	1	20.00	2.08	4.66
<u>Gnorimosphaeroma oregonensis</u>	6	40.00	12.50	18.64
Gammaridea	1	20.00	2.08	4.66
<u>Eogammarus confervicolus</u>	581	100.00	1210.80	1614.35
<u>Ischyrocerus pegalops</u>	21	40.00	43.76	86.68
<u>Grandifoxus grandis</u>	3	40.00	6.25	9.32
<u>Parapleustes pugettensis</u>	1	20.00	2.08	4.66
<u>Cancer magister</u>	2	20.00	4.17	9.32
<u>Cancer magister</u> juvenile	3	20.00	6.25	5.71
<u>Dendraster excentricus</u>	3	60.00	6.25	5.71
Holothuroidea	1	20.00	2.08	4.66

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Station 8  
(CONTINUED)

18 August 1987

Sample size - 5

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Number of taxa = 36

Mean number per sample: 145.40

Standard deviation (S.D.): 174.09

Mean number/m<sup>2</sup>: 1,515.07

S.D./m<sup>2</sup>: 1,814.05

H' = 1.52    SDV = 0.36    SR = 5.31    J' = 0.29

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Station 9	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	16	60.00	33.34	43.21
Nemertinea	103	60.00	214.65	349.70
<u>Scoloplos acmeceps</u>	1	20.00	2.08	4.66
<u>Spiophanes berkeleyorum</u>	1	20.00	2.08	4.66
<u>Spiophanes bombyx</u>	1	20.00	2.08	4.66
<u>Magelona sacculata</u>	36	40.00	75.02	150.89
<u>Capitella capitata</u> complex	4	60.00	8.34	8.72
Opheliidae	1	20.00	2.08	4.66
<u>Armandia brevis</u>	26	80.00	54.18	47.98
<u>Phyllodoce hartmanae</u>	15	40.00	31.26	42.96
<u>Phyllodoce williamsi</u>	1	20.00	2.08	4.66
<u>Eumida sanguinea</u>	3	40.00	6.25	9.32
Syllidae	3	20.00	6.25	13.98
<u>Syllis elongata</u>	28	60.00	58.35	65.32
<u>Platynereis bicanaliculata</u>	10	20.00	20.84	46.60
<u>Glycera convoluta</u>	1	20.00	2.08	4.66
<u>Glycera tenuis</u>	2	40.00	4.17	5.71
<u>Glycinde armigera</u>	1	20.00	2.08	4.66
<u>Glycinde picta</u>	50	100.00	104.20	54.64
<u>Lumbrineris</u> sp.indeterminate	1	20.00	2.08	4.66
<u>Lumbrineris zonata</u>	4	20.00	8.34	18.64
<u>Euchone</u> nr. <u>E. hancocki</u>	5	20.00	10.42	23.30
<u>Chone dunneri</u>	1	20.00	2.08	4.66
Nudibranchia	7	40.00	14.59	27.17
<u>Nucella</u> spp.	1	20.00	2.08	4.66
<u>Diaphana</u> sp.	3	20.00	6.25	13.98
<u>Lacuna carinata</u>	3	20.00	6.25	13.98
<u>Bivalvia</u> spp. juvenile	9	40.00	18.76	36.40
<u>Modiolus</u> spp.	11	20.00	22.92	51.26
<u>Clinocardium nuttallii</u>	3	20.00	6.25	13.98
<u>Mya arenaria</u>	54	80.00	112.54	68.88
<u>Mya</u> spp. juvenile	4	20.00	8.34	18.64
<u>Archeomysis grebnitzkii</u>	1	20.00	2.08	4.66
<u>Gnorimosphaeroma oregonensis</u>	2	40.00	4.17	5.71
<u>Melita desdichada</u>	2	20.00	4.17	9.32
<u>Eogammarus confervicolus</u>	6	40.00	12.50	18.64
Phoxocephalidae	1	20.00	2.08	4.66
<u>Parapleustes pugettensis</u>	17	40.00	35.43	58.76
<u>Pagurus</u> sp.	1	20.00	2.08	4.66
<u>Cancer magister</u>	15	40.00	31.26	42.96
<u>Cancer magister</u> (megalops)	2	40.00	4.17	5.71
Pycnogonida	1	20.00	2.08	4.66

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Station 9  
(CONTINUED)

18 August 1987

Sample size - 5

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Number of taxa = 42

Mean number per sample: 91.40

Standard deviation (S.D.): 54.62

Mean number/m<sup>2</sup>: 952.39

S.D./m<sup>2</sup>: 569.09

H' = 4.07    SDV = 0.90    SR = 6.69    J' = 0.75

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Station 10	18 August 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	1	20.00	2.08	4.66
Nemertinia	43	100.00	89.61	33.44
Polychaeta	1	20.00	2.08	4.66
Orbiniidae	1	20.00	2.08	4.66
<u>Scoloplos armiger</u>	2	40.00	4.17	5.71
<u>Scoloplos acmeceps</u>	3	20.00	6.25	13.98
<u>Scoelepsis squamata</u>	1	20.00	2.00	4.66
<u>Spiophanes berkeleyoru</u>	2	20.00	4.17	9.32
<u>Spiophanes bombyx</u>	184	100.00	383.46	218.00
<u>Magelona sacculata</u>	94	80.00	195.90	215.24
Capitellidae	1	20.00	2.08	4.66
<u>Capitella capitata</u> complex	3	20.00	6.25	13.98
<u>Mediomastus</u> sp. indeterminate	1	20.00	2.08	4.66
Opheliidae	3	60.00	6.25	5.71
<u>Ophelia</u> sp. 1	2	20.00	4.17	9.32
<u>Ophelia</u> sp. juvenile	2	20.00	4.17	9.32
<u>Phyllodoce</u> sp. juvenile	1	20.00	2.08	4.66
Phyllodoce	1	20.00	2.08	4.66
<u>Phyllodoce hartmanae</u>	1	20.00	2.08	4.66
<u>Phyllodoce williamsi</u>	1	20.00	2.08	4.66
<u>Paleonotus bellis</u>	1	20.00	2.08	4.66
<u>Glycera convoluta</u>	5	40.00	10.42	14.74
<u>Glycera tenuis</u>	28	100.00	58.35	15.80
<u>Glycinde picta</u>	40	100.00	83.36	48.32
<u>Nephtys caecoides</u>	6	60.00	12.50	13.59
Gastropoda sp. juvenile	6	60.00	12.50	17.12
<u>Diaphana</u> sp.	1	20.00	2.08	4.66
Bivalvia spp. juvenile	37	100.00	77.11	94.82
Mytilidae spp. juvenile	6	40.00	12.50	22.59
<u>Modiolus</u> spp.	2	20.00	4.17	9.32
<u>Clinocardium nuttallii</u>	3	60.00	6.25	5.71
<u>Mya arenaria</u>	9	60.00	18.76	30.73
<u>Mya</u> spp. juvenile	5	20.00	10.42	23.30
Tellinidae spp. juvenile	6	40.00	12.50	17.12
<u>Siliqua patula</u>	9	60.00	18.76	22.59
<u>Archeomysis grebnitzkii</u>	25	80.00	52.10	87.80
<u>Cumella vulgaris</u>	1	20.00	2.08	4.66
<u>Gnorimosphaeroma oregonensis</u>	4	40.00	8.34	13.59
Gammaridae	2	40.00	4.17	5.71
<u>Eogammarus confervicolus</u>	1	20.00	2.08	4.66
<u>Eohaustorius</u> spp.	1	20.00	2.08	4.66
<u>Corophium</u> sp. indeterminate	6	60.00	12.50	17.12
<u>Jassa falcata</u>	2	20.00	4.17	9.32

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Station 10  
(CONTINUED)

18 August 1987

Sample size - 5

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Number of taxa = 52

Mean number per sample: 117.00

Standard deviation (S.D.): 24.19

Mean number/m<sup>2</sup>: 1,219

S.D./m<sup>2</sup>: 569.09

H' = 3.78    SDV = 0.85    SR = 8.00    J' = 0.66

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## APPENDIX TABLE D

Benthic invertebrates at 10 sampling stations at  
a test dredge-disposal site in the Umpqua River  
near Winchester Bay, Oregon, 26 October 1987

Station 1	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	9	40.00	18.76	27.96
Platyhelminthes	1	20.00	2.08	4.66
Nemertinea	21	40.00	43.76	86.68
Polychaeta sp. indeterminate	1	20.00	2.08	4.66
<u>Scoloplos armiger</u>	2	40.00	4.17	5.71
<u>Paraonella platybranchia</u>	1	20.00	2.08	4.66
<u>Magelona sacculata</u>	2	40.00	4.17	5.71
<u>Capitella capitata</u> complex	3	60.00	6.25	5.71
<u>Mediomastus</u> sp. indeterminate	1	20.00	2.08	4.66
Opheliidae sp. juvenile	1	20.00	2.08	4.66
<u>Ophelia</u> sp. juvenile	1	20.00	2.08	4.66
Syllidae sp. indeterminate	4	20.00	8.34	18.64
<u>Syllis elongata</u>	47	100.00	97.95	161.02
<u>Glycera convoluta</u>	1	20.00	2.08	4.66
<u>Glycera tenuis</u>	3	40.00	6.25	9.32
<u>Nephtys californiensis</u>	5	60.00	10.42	10.42
<u>Sabellaria cementarium</u>	2	40.00	4.17	5.71
<u>Saccocirrus exoticus</u>	46	20.00	95.86	214.36
Oligochaeta	1	20.00	2.08	4.66
Gastropoda sp. juvenile	2	20.00	4.17	9.32
Bivalvia spp. juvenile	3	40.00	6.25	9.32
Mytilidae spp. juvenile	1	20.00	2.08	4.66
<u>Clinocardium nuttallii</u>	2	40.00	4.17	5.71
<u>Siliqua patula</u>	1	20.00	2.08	4.66
<u>Ianiropsis kincaidi kincaidi</u>	5	20.00	10.42	23.30
<u>Bathycopea daltonae</u>	1	20.00	2.08	4.66
<u>Gnorimosphaeroma oregonensis</u>	8	20.00	16.67	37.28
<u>Atylus tridens</u>	12	40.00	25.01	50.30
<u>Melita</u> sp. juvenile	1	20.00	2.08	4.66
<u>Allorchestes angustus</u>	21	20.00	43.76	97.86
<u>Cheriphotis megacheles</u>	6	20.00	12.50	27.96
<u>Grandifoxus grandis</u>	1	20.00	2.08	4.66
<u>Hyale frequens</u>	1	20.00	2.08	4.66
<u>Dendraster excentricus</u>	1	20.00	2.08	4.66



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Station 1  
(CONTINUED)

18 August 1987

Sample size - 5

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Number of taxa = 34

Mean number per sample: 43.60

Standard deviation (S.D.): 64.62

Mean number/m<sup>2</sup>: 454.31

S.D./m<sup>2</sup>: 673.30

H' = 3.79    SDV = 0.88    SR = 6.13    J' = 0.75

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Station 2	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	18	80.00	37.51	27.17
Nemertinea	15	40.00	31.26	54.14
Paraonidae	1	20.00	2.08	4.66
<u>Spiochaetopterus costarum</u>	1	20.00	2.08	4.66
<u>Capitella capitata</u> complex	8	60.00	16.67	21.61
<u>Mediomastus californiensis</u>	1	20.00	2.08	4.66
Opheliidae sp. juvenile	1	20.00	2.08	4.66
<u>Ophelia</u> sp. juvenile	1	20.00	2.08	4.66
<u>Syllis elongata</u>	9	100.00	18.76	13.59
<u>Glycera capitata</u>	1	20.00	2.08	4.66
<u>Glycera tenuis</u>	1	20.00	2.08	4.66
<u>Glycinde picta</u>	2	40.00	4.17	5.71
<u>Nephtys caecoides</u>	1	20.00	2.08	4.66
<u>Nephtys californiensis</u>	4	60.00	8.34	8.72
<u>Owenia fusiformis</u>	5	60.00	10.42	12.76
Sabellariidae	1	20.00	2.08	4.66
Bivalvia spp. juvenile	2	20.00	4.17	9.32
Mytilidae spp. juvenile	66	40.00	137.54	301.77
<u>Mytilus edulis</u>	1	20.00	2.08	4.66
<u>Mya arenaria</u>	1	20.00	2.08	4.66
<u>Idotea</u> spp.	1	20.00	2.08	4.66
<u>Atylus tridens</u>	1	20.00	2.08	4.66
<u>Grandifoxus grandis</u>	14	80.00	29.18	37.86
Caprellidae	1	20.00	2.08	4.66
Pinnotheridae	1	20.00	2.08	4.66
<u>Dendraster excentricus</u>	1	20.00	2.08	4.66
Asteroidea	1	20.00	2.08	4.66

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Number of taxa = 27

Mean number per sample: 32.20

Standard deviation (S.D.): 32.52

Mean number/m<sup>2</sup>: 335.52

S.D./m<sup>2</sup>: 338.88

H' = 3.17    SDV = 0.80    SR = 5.12    J' = 0.67

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Station 3	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	3	40.00	6.25	9.32
Nemertinea	173	100.00	360.53	324.24
<u>Scoloplos armiger</u>	1	20.00	2.08	4.66
<u>Barantolla americana</u>	3	20.00	6.25	13.98
<u>Capitella capitata</u> complex	6	40.00	12.50	17.12
<u>Mediomastus californiensis</u>	121	100.00	252.16	132.30
<u>Armandia brevis</u>	10	80.00	20.84	19.49
<u>Phyllodoce williamsi</u>	1	20.00	2.08	4.66
<u>Eulalia viridis</u>	1	20.00	2.08	4.66
<u>Syllidae</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Syllis elongata</u>	172	100.00	358.45	417.16
<u>Nereis vexillosa</u>	2	20.00	4.17	9.32
<u>Glycinde armigera</u>	2	20.00	4.17	9.32
<u>Glycinde picta</u>	25	60.00	52.10	66.72
<u>Lumbrineris zonata</u>	11	80.00	22.92	23.76
<u>Oligochaeta</u>	15	60.00	31.26	29.47
<u>Oligochaete</u>	8	20.00	16.67	37.28
<u>Phidiana</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Spisula</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Clinocardium nuttallii</u>	1	20.00	2.08	4.66
<u>Mya arenaria</u>	4	40.00	8.34	13.59
<u>Macoma nasuta</u>	1	20.00	2.08	4.66
<u>Pholadidae</u> spp.	8	40.00	16.67	31.78
<u>Lamprops</u> sp.	1	20.00	2.08	4.66
<u>Ianiropsis kincaidi kincaidi</u>	2	20.00	4.17	9.32
<u>Gnorimosphaeroma oregonensis</u>	13	40.00	27.09	49.75
<u>Melita desdichada</u>	1	20.00	2.08	4.66
<u>Eogammarus confervicolus</u>	4	40.00	8.34	13.59
<u>Corophium</u> sp. juvenile	2	20.00	4.17	9.32
<u>Pontogeneia rostrata</u>	1	20.00	2.08	4.66
<u>Jassa falcata</u>	1	20.00	2.08	4.66
<u>Cheriphotis megacheles</u>	3	40.00	6.25	9.32
<u>Parapleustes pugettensis</u>	16	60.00	33.34	37.86
<u>Hyale frequens</u>	4	20.00	8.34	18.64
<u>Heptacarpus brevirostris</u>	2	40.00	4.17	5.71
<u>Pinnotheridae</u>	7	40.00	14.59	20.31
<u>Cancer magister</u> juvenile	1	20.00	2.08	4.66
<u>Cancer productus</u>	2	40.00	4.17	5.71
Insecta	1	20.00	2.08	4.66

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Station 3  
(CONTINUED)

26 October 1987

Sample size - 5

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Number of taxa = 40

Mean number per sample: 126.40

Standard deviation (S.D.): 24.06

Mean number/m<sup>2</sup>: 1,317.09

S.D./m<sup>2</sup>: 250.69

H' = 3.16

SDV = 0.81

SR = 6.05

J' = 0.59

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Station 4	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	10	40.00	20.84	41.02
Nemertinea	13	60.00	27.09	27.17
Orbiniidae	54	40.00	112.54	234.55
<u>Scoloplos armiger</u>	44	100.00	91.70	58.67
<u>Spiophanes bombyx</u>	67	100.00	139.63	139.53
<u>Magelona sacculata</u>	416	100.00	866.94	901.36
<u>Capitella capitata</u> complex	4	40.00	8.34	13.59
<u>Mediomastus californiensis</u>	4	40.00	8.34	11.41
<u>Armandia brevis</u>	18	60.00	37.51	39.40
<u>Opheliidae</u> sp. juvenile	3	40.00	6.25	9.32
<u>Phyllodoce williamsi</u>	7	80.00	14.59	11.88
<u>Eteone fauchaldi</u>	1	20.00	2.08	4.66
<u>Eteone</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Eulalia viridis</u>	4	20.00	8.34	18.64
<u>Eumida sanguinea</u>	3	20.00	6.25	13.98
<u>Polynoidae</u> sp. juvenile	1	20.00	2.08	4.66
<u>Halosydna brevisetosa</u>	1	20.00	2.08	4.66
<u>Paleonotus bellis</u>	14	20.00	29.18	65.24
<u>Syllidae</u> sp. indeterminate	2	40.00	4.17	5.71
<u>Autolytus</u> sp.	1	20.00	2.08	4.66
<u>Syllis elongata</u>	23	100.00	47.93	46.95
<u>Nereis vexillosa</u>	1	20.00	2.08	4.66
<u>Glycera convoluta</u>	9	60.00	18.76	21.35
<u>Glycinde picta</u>	21	100.00	43.76	27.96
<u>Nephtys caecoides</u>	2	20.00	4.17	9.32
<u>Nephtys californiensis</u>	1	20.00	2.08	4.66
<u>Onuphis</u> sp. indeterminate	10	40.00	20.84	29.47
<u>Sabellidae</u> sp. indeterminate	2	20.00	4.17	9.32
Oligochaeta	5	60.00	10.42	10.42
Gastropoda sp. juvenile	3	40.00	6.25	9.32
<u>Onchidoris</u> sp. indeterminate	2	20.00	4.17	9.32
<u>Polinices</u> sp.	1	20.00	2.08	4.66
<u>Nucella emarginata</u>	3	20.00	6.25	13.98
Bivalvia spp. juvenile	60	40.00	125.04	175.14
Mytilidae spp. juvenile	19	60.00	39.60	51.79
<u>Clinocardium nutallii</u>	2	40.00	4.17	5.71
<u>Mya arenaria</u>	2	40.00	4.17	5.71
<u>Hiatella</u> sp. indeterminate	2	20.00	4.17	9.32
<u>Macoma nasuta</u>	2	40.00	4.17	5.71
<u>Tellina</u> spp. juvenile	1	20.00	2.08	4.66
<u>Siliqua patula</u>	1	20.00	2.08	4.66
Pholadidae spp.	1	20.00	2.08	4.66
<u>Archeomysis grebnitzki</u>	1	20.00	2.08	4.66

Station 4  
(CONTINUED)

26 October 1987

Sample size - 5

Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
<u>Lamprops</u> sp.	2	20.00	4.17	9.32
<u>Idotea fewkesi</u>	2	20.00	4.17	9.32
<u>Synidotea</u> spp.	2	20.00	4.17	9.32
<u>Ianiropsis kincaidi kincaidi</u>	2	40.00	4.17	5.71
<u>Gnorimosphaeroma oregonensis</u>	1	20.00	2.08	4.66
<u>Atylus tridens</u>	6	40.00	12.50	18.64
<u>Eohaustorius sawyeri</u>	1	20.00	2.08	4.66
<u>Eohaustorius</u> sp. juvenile	1	20.00	2.08	4.66
<u>Allorchestes angustus</u>	6	40.00	12.50	17.12
<u>Jassa falcata</u>	43	40.00	89.61	194.61
<u>Cheriphotis megacheles</u>	1	20.00	2.08	4.66
<u>Mandibulophoxus uncirostratus</u>	5	40.00	10.42	14.74
<u>Eobrolgus spinosus</u>	4	20.00	8.34	18.64
<u>Grandifoxus grandis</u>	23	60.00	47.93	49.75
<u>Hyale frequens</u>	4	60.00	8.34	8.72
<u>Cancer productus</u>	1	20.00	2.08	4.66
<u>Dendraster excentricus</u>	4	40.00	8.34	13.59
Insecta	2	20.00	4.17	9.32

Number of taxa = 61

Mean number per sample: 190.40

Standard deviation (S.D.): 107.68

Mean number/m<sup>2</sup>: 1,983.97

S.D./m<sup>2</sup>: 1,122.07

H' = 3.61

SDV = 0.79

SR = 8.75

J' = 0.61

Station 5	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	49	80.00	102.12	124.91
Nemertinea	309	100.00	643.96	1,323.64
Polychaeta sp. indeterminate	1	20.00	2.08	4.66
Orbiniidae	3	20.00	6.25	13.98
<u>Scoloplos armiger</u>	10	40.00	20.84	28.54
Spionidae sp. indeterminate	2	20.00	4.17	9.33
<u>Scoelelepsis squamata</u>	1	20.00	2.08	4.66
<u>Spiophanes bombyx</u>	6	40.00	12.50	18.64
<u>Magelona sacculayta</u>	76	80.00	158.38	142.38
<u>Capitella capitata</u> complex	24	60.00	50.02	100.32
<u>Mediomastus californiensis</u>	124	100.00	258.42	177.66
<u>Armandia brevis</u>	30	100.00	62.52	60.31
<u>Ophelia</u> spp.	1	20.00	2.08	4.66
Ophelliidae sp. juvenile	9	40.00	18.76	25.95
<u>Phyllodoce</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Phyllodoce williamsi</u>	18	20.00	37.51	83.88
<u>Eulalia viridis</u>	4	40.00	8.34	11.41
Polynoidae sp. juvenile	2	40.00	4.17	5.71
<u>Paleonotus bellis</u>	4	20.00	8.34	18.64
<u>Syllis elongata</u>	139	40.00	289.68	607.78
<u>Nereis vexillosa</u>	2	20.00	4.17	9.32
<u>Glycera convoluta</u>	4	40.00	8.35	11.41
<u>Glycinde armigera</u>	1	20.00	2.08	4.66
<u>Glycinde picta</u>	36	100.00	75.02	40.62
<u>Nephtys caecoides</u>	3	40.00	6.25	9.32
<u>Lumbrineris zonata</u>	4	20.00	8.34	18.64
<u>Owenia fusiformis</u>	16	100.00	33.34	13.59
Sabellidae	1	20.00	2.08	4.66
<u>Chone dunneri</u>	5	40.00	10.42	14.74
Oligochaeta	48	100.00	100.03	57.83
<u>Onchidoris</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Polinices</u> sp.	1	20.00	2.08	4.66
<u>Diaphana</u> sp.	3	40.00	6.25	9.32
Bivalvia spp. juvenile	9	60.00	18.76	21.35
Mytilidae spp. juvenile	1	20.00	2.08	4.66
<u>Clinocardium nuttallii</u>	2	40.00	4.17	5.71
<u>Macoma nasuta</u>	1	20.00	2.08	4.66
<u>Macoma</u> spp.	1	20.00	2.08	4.66
<u>Tellina modesta</u>	13	80.00	27.09	38.00
<u>Lamprops</u> sp.	3	40.00	6.25	9.32
<u>Synidotea</u> spp.	2	40.00	4.17	5.71
<u>Ianiropsis kincaidi kincaidi</u>	1	20.00	2.08	4.66
<u>Limnoria</u> sp.	5	20.00	10.42	23.30

Station 5  
(CONTINUED)

26 October 1987

Sample size - 5

Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
<u>Gnorimosphaeroma oregonensis</u>	7	60.00	14.59	21.61
<u>Melita desdichada</u>	5	20.00	10.42	23.30
<u>Synchelidium shoemakeri</u>	3	40.00	6.25	9.32
<u>Corophium brevis</u>	1	20.00	2.08	4.66
<u>Pontogeneia rostrata</u>	3	20.00	6.25	13.98
<u>Cheriphotis megacheles</u>	1	20.00	2.08	4.66
Caprellidae	1	20.00	2.08	4.66
Pinnotheridae	1	20.00	2.08	4.66
<u>Cancer magister</u> juvenile	1	20.00	2.08	4.66
<u>Cancer productus</u>	1	20.00	2.08	4.66

Number of taxa = 54

Mean number per sample: 20.80

Standard deviation (S.D.): 205.25

Mean number/m<sup>2</sup>: 2,092.34

S.D./m<sup>2</sup>: 2,138.68

H' = 3.70

SDV = 0.86

SR = 7.67

J' = 0.64



Station 6	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	1	20.00	2.08	4.66
<u>Scoloplos armiger</u>	2	40.00	4.17	5.71
<u>Pygospio californica</u>	1	20.00	2.08	4.66
<u>Magelona sacullata</u>	8	80.00	16.67	15.80
<u>Mediomastus californiensis</u>	2	20.00	4.17	9.32
Ophelliidae sp. juvenile	1	20.00	2.08	4.66
<u>Eteone longa</u>	1	20.00	2.08	4.66
<u>Glycera capitata</u>	2	40.00	4.17	5.71
<u>Glycera sp. indeterminate</u>	1	20.00	2.08	4.66
<u>Glycera tenuis</u>	1	20.00	2.08	4.66
<u>Nephtys californiensis</u>	14	100.00	29.18	20.04
<u>Owenia fusiformis</u>	1	20.00	2.08	4.66
Bivalvia spp. juvenile	1	20.00	2.08	4.66
<u>Gnorimosphaeroma oregonensis</u>	1	20.00	2.08	4.66
<u>Eohaustorius washingtonianus</u>	1	20.00	2.08	4.66
<u>Mandibulophoxus uncistrostratus</u>	3	40.00	6.25	9.32
<u>Grandifoxus grandis</u>	28	80.00	58.35	39.40
<u>Dendraster excentricus</u>	4	40.00	8.34	11.41
Insecta	2	20.00	4.17	9.32

Number of taxa = 19

Mean number per sample: 15.00

Standard deviation (S.D.): 4.18

Mean number/m<sup>2</sup>: 156.30

S.D./m<sup>2</sup>: 43.59

H' = 3.13

SDV = 0.81

SR = 4.17

J' = 0.74

Station 7	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	2	40.00	4.17	5.71
Nemertinea	21	60.00	43.76	62.69
Orbiniidae sp. juvenile	1	20.00	2.08	4.66
<u>Magelona sacculata</u>	4	60.00	8.34	8.72
<u>Capitella capitata</u> complex	5	40.00	10.42	18.05
<u>Mediomastus californiensis</u>	4	40.00	8.34	11.41
Opheliidae	1	20.00	2.08	4.66
Syllidae sp. indeterminate	1	20.00	2.08	4.66
<u>Syllis elongata</u>	3	40.00	6.25	9.32
<u>Glycera tenuis</u>	1	20.00	2.08	4.66
<u>Glycinde picta</u>	2	40.00	4.17	5.71
<u>Nephtys californiensis</u>	2	20.00	4.17	9.32
Oligochaeta	1	20.00	2.08	4.66
Gastropoda sp. juvenile	2	40.00	4.17	5.71
Bivalvia spp. juvenile	11	40.00	22.92	45.66
Mytilidae	1	20.00	2.08	4.66
Mytilidae spp. juvenile	1	20.00	2.08	4.66
<u>Mya arenaria</u>	1	20.00	2.08	4.66
<u>Macoma nasuta</u>	1	20.00	2.08	4.66
<u>Archeomysis grebnitzkii</u>	7	80.00	14.59	11.88
<u>Synidotea</u> spp.	1	20.00	2.08	4.66
<u>Ianiropsis kincaidi kincaidi</u>	2	40.00	4.17	5.71
<u>Gnorimosphaeroma oregonensis</u>	2	20.00	4.17	9.32
<u>Atylus tridens</u>	5	40.00	10.42	18.05
<u>Eogammarus confervicolus</u>	2	40.00	4.17	5.71
<u>Allochestes angustus</u>	7	20.00	14.59	32.62
<u>Grandifoxus grandis</u>	13	80.00	27.09	32.62
<u>Hyale frequens</u>	3	20.00	6.25	13.98
<u>Dendraster excentricus</u>	6	80.00	12.50	11.41
Insecta	12	40.00	25.01	45.18

Number of taxa = 30

Mean number per sample: 25.00

Standard deviation (S.D.): 12.23

Mean number/m<sup>2</sup>: 260.5

S.D./m<sup>2</sup>: 127.41

H' = 4.25    SDV = 0.93    SR = 6.01    J' = 0.87

Station 8	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
<u>Anthozoa</u>	1	20.00	2.08	4.66
<u>Nemertinea</u>	1	20.00	2.08	4.66
<u>Polychaeta sp. indeterminate</u>	2	20.00	4.17	9.32
<u>Scoloplos armiger</u>	2	20.00	4.17	9.32
<u>Spiophanes bombyx</u>	1	20.00	2.08	4.66
<u>Magelona sacullata</u>	108	80.00	225.07	167.95
<u>Ophelia limacina</u>	1	20.00	2.08	4.66
<u>Ophiliidae sp. juvenile</u>	2	20.00	4.17	9.32
<u>Syllidae sp. indeterminate</u>	1	20.00	2.08	4.66
<u>Syllis elongata</u>	3	40.00	6.25	9.32
<u>Glycera tenuis</u>	2	40.00	4.17	5.71
<u>Nephtys caecoides</u>	1	20.00	2.08	4.66
<u>Owenia fusiformis</u>	2	40.00	4.17	5.71
<u>Gastropoda sp. juvenile</u>	1	20.00	2.08	4.66
<u>Bivalvia spp. juvenile</u>	1	20.00	2.08	4.66
<u>Siliqua patula</u>	1	20.00	2.08	4.66
<u>Archeomysis grebnitzkii</u>	6	40.00	12.50	17.12
<u>Gnorimosphaeroma oregonensis</u>	4	40.00	8.34	13.59
<u>Atylus tridens</u>	2	20.00	4.17	9.32
<u>Eohaustorius sawyeri</u>	2	20.00	4.17	9.32
<u>Allorchestes angustus</u>	9	40.00	18.76	25.95
<u>Monoculodes spinipes</u>	1	20.00	2.08	4.66
<u>Ischyrocerus sp.</u>	1	20.00	2.08	4.66
<u>Mandibulophoxus uncistrostratus</u>	3	60.00	6.25	5.71
<u>Grandifoxus grandis</u>	34	80.00	70.86	40.62
<u>Hyale frequens</u>	1	20.00	2.08	4.66
<u>Cancer magister</u>	1	20.00	2.08	4.66
<u>Dendraster excentricus</u>	26	80.00	54.18	54.84

Number of taxa = 28

Mean number per sample: 44.00

Standard deviation (S.D.): 17.72

Mean number/m<sup>2</sup>: 458.48

S.D./m<sup>2</sup>: 184.64

H' = 2.78    SDV = 0.72    SR = 5.01    J' = 0.58

Station 9	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Anthozoa	213	100.00	443.89	286.18
Platyhelminthes	2	20.00	4.17	9.32
Nemertinea	30	100.00	62.52	41.02
Polychaeta sp. indeterminate	12	40.00	25.01	35.03
<u>Scoloplos armiger</u>	4	60.00	8.34	8.72
<u>Polydora</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Spiophanes bombyx</u>	1	20.00	2.08	4.66
<u>Magelona sacculata</u>	1	20.00	2.08	4.66
Capitellidae sp. indeterminate	7	40.00	14.59	22.83
<u>Capitella capitata</u> complex	11	80.00	22.92	20.04
<u>Mediomastus</u> sp. indeterminate	4	40.00	8.34	11.41
<u>Mediomastus californiensis</u>	38	60.00	79.19	73.90
<u>Armandia bevis</u>	40	100.00	83.36	60.31
<u>Ophelia</u> spp.	22	20.00	45.85	102.52
<u>Ophelia</u> sp. 1	3	20.00	6.25	13.98
Ophiliidae sp. juvenile	9	40.00	18.76	27.96
Phyllodoce sp. juvenile	16	20.00	33.34	74.56
Phyllodoce sp. indeterminate	7	40.00	14.59	20.31
<u>Phyllodoce williamsi</u>	70	100.00	145.88	122.19
<u>Eulalia viridis</u>	1	20.00	2.08	4.66
<u>Eulalia</u> sp.	1	20.00	2.08	4.66
<u>Eumida sanguinea</u>	1	20.00	2.08	4.66
Polynoidae sp. juvenile	4	40.00	8.34	13.59
<u>Paleonotus bellis</u>	4	40.00	8.34	13.59
<u>Syllidae</u> sp. indeterminate	6	60.00	12.50	17.12
<u>Syllis elongata</u>	25	100.00	52.10	39.68
Nereidae sp. juvenile	8	60.00	16.67	17.44
<u>Platynereis bicanaliculata</u>	3	60.00	6.25	5.71
<u>Nereis</u> spp.	1	20.00	2.08	4.66
<u>Glycera capitata</u>	2	40.00	4.17	5.71
<u>Glycinde picta</u>	133	100.00	277.17	80.91
<u>Nephtys</u> sp. juvenile	1	20.00	2.08	4.66
<u>Lumbrineris zonata</u>	1	20.00	2.08	4.66
<u>Pholoides aspera</u>	20	40.00	41.68	57.55
<u>Owenia fusiformis</u>	1	20.00	2.08	4.66
Sabellidae	3	20.00	6.25	13.98
Oligochaeta	21	100.00	43.76	13.59
Gastropoda	2	20.00	4.17	9.32
Gastropoda sp. juvenile	6	60.00	12.50	13.59
<u>Archidoria</u> sp. indeterminate	10	80.00	20.84	16.48
Nudibranchia	1	20.00	2.08	4.66
<u>Onchidoris</u> sp. indeterminate	69	100.00	143.80	55.33
<u>Polinices</u> sp.	2	40.00	4.17	5.71

Station 9  
(CONTINUED)

26 October 1987

Sample size - 5

Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
<u>Polinices</u> sp.	2	40.00	4.17	5.71
<u>Nucella emarginata</u>	3	20.00	4.17	9.32
<u>Diaphana</u> sp.	3	40.00	6.25	9.32
<u>Bivalvia</u> spp. juvenile	127	100.00	264.67	280.72
<u>Mytilidae</u> spp. juvenile	5	40.00	10.42	14.74
<u>Clinocardium nuttallii</u>	14	100.00	29.18	13.59
<u>Mya arenaria</u>	3	60.00	6.25	5.71
<u>Macoma nasuta</u>	6	80.00	12.50	11.41
<u>Tellina modesta</u>	2	20.00	4.17	9.32
<u>Lamprops</u> sp.	1	20.00	2.08	4.66
<u>Idotea fewkesi</u>	1	20.00	2.08	4.66
<u>Ianiropsis kincaidi kincaidi</u>	22	100.00	45.85	28.15
<u>Gnorimosphaeroma oregonensis</u>	324	100.00	675.22	312.03
<u>Atylus tridens</u>	1	20.00	2.08	4.66
Gammaridae	3	20.00	6.25	13.98
<u>Corophium brevis</u>	4	40.00	8.34	13.59
<u>Ischyrocerus</u> sp.	1	20.00	2.08	4.66
<u>Cheriphotis megacheles</u>	3	20.00	6.25	13.98
<u>Parapleustes pugettensis</u>	362	100.00	754.41	217.78
Caprellidae	2	40.00	4.17	5.71
<u>Pagurus dalli</u>	1	20.00	2.08	4.66
Pinnotheridae	5	60.00	10.42	14.74
<u>Cancer magister</u>	1	20.00	2.08	4.66
<u>Cancer magister</u> juvenile	4	40.00	8.34	13.59
Asteroidea	1	20.00	2.08	4.66
Pycnogonida	3	40.00	6.25	9.32

Number of taxa = 69

Mean number per sample: 343.80

Standard deviation (S.D.): 85.95

Mean number/m<sup>2</sup>: 3,582.40

S.D./m<sup>2</sup>: 895.59

H' = 3.97    SDV = 0.89    SR = 9.13    J' = 0.65

Station 10	26 October 1987		Sample size - 5	
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
Nemertinea	26	100.00	54.18	63.98
Polychaeta sp. indeterminate	3	20.00	6.25	13.98
Orbiniidae	14	40.00	29.18	54.34
<u>Scoloplos armiger</u>	6	60.00	12.50	13.59
<u>Spiophanes bombyx</u>	708	100.00	1,475.47	762.53
<u>Magelona sacculata</u>	1	20.00	2.08	4.66
<u>Magelona hobsonae</u>	2	20.00	4.17	9.32
Capitellidae sp. indeterminate	1	20.00	2.08	4.66
<u>Capitella capitata</u> complex	22	40.00	45.85	96.80
<u>Mediomastus</u> sp. indeterminate	11	20.00	22.92	51.26
<u>Mediomastus californiensis</u>	103	80.00	214.65	153.60
<u>Armandia brevis</u>	7	40.00	14.59	20.31
<u>Ophelia</u> spp.	14	60.00	29.18	31.61
<u>Ophelia</u> sp. juvenile	3	20.00	6.25	13.98
Ophiliidae sp. juvenile	680	100.00	1,417.12	293.52
<u>Phyllodoce</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Phyllodoce hartmanae</u>	3	40.00	6.25	9.32
<u>Phyllodoce williamsi</u>	77	80.00	160.47	295.97
<u>Eteone</u> sp. indeterminate	5	40.00	10.42	14.74
<u>Eteone</u> sp. juvenile	3	20.00	6.25	13.98
<u>Eulalia viridis</u>	2	20.00	4.17	9.32
Polynoidae sp. juvenile	1	20.00	2.08	4.66
<u>Paleonotus bellis</u>	3	20.00	6.25	13.98
<u>Syllidae</u> sp. indeterminate	1	20.00	2.08	4.66
<u>Syllis elongata</u>	12	20.00	25.01	55.92
<u>Platynereis bicanaliculata</u>	7	40.00	14.59	20.31
<u>Glycera capitata</u>	1	20.00	2.08	4.66
<u>Glycera convoluta</u>	20	100.00	41.68	20.84
<u>Glycera tenuis</u>	5	20.00	10.42	23.30
<u>Glycinde picta</u>	77	100.00	160.47	63.21
<u>Nephtys</u> sp. indeterminate	3	20.00	6.25	13.98
<u>Nephtys caecoides</u>	3	20.00	6.25	13.98
<u>Nephtys californiensis</u>	1	20.00	2.08	4.66
<u>Owenia fusiformis</u>	6	60.00	12.50	13.59
Oligochaeta	14	80.00	29.18	22.59
Gastropoda sp. juvenile	7	40.00	14.59	20.31
<u>Archidoria</u> sp. indeterminate	2	20.00	4.17	9.32
Nudibranchia	1	20.00	2.08	4.66
<u>Onchidoris</u> sp. indeterminate	10	60.00	20.84	35.34
<u>Olivella</u> spp. juvenile	1	20.00	2.08	4.66
Bivalvia spp. juvenile	75	60.00	156.30	299.11
Mytilidae spp. juvenile	2	20.00	4.17	9.32
<u>Clinocardium nuttallii</u>	8	100.00	16.67	5.71

Station 10 (CONTINUED)	26 October 1987	Sample size - 5		
Taxa	Total number	Frequency of occurrence (%)	Mean number /m <sup>2</sup>	Standard deviation /m <sup>2</sup>
<u>Mya arenaria</u>	16	100.00	33.34	28.91
Tellinidae	2	20.00	4.17	9.32
Tellinidae spp. juvenile	2	20.00	4.17	9.32
<u>Macoma nasuta</u>	2	20.00	4.17	9.32
<u>Macoma sp.</u>	3	40.00	6.25	9.32
<u>Tellina modesta</u>	4	20.00	8.34	18.64
<u>Siliqua patula</u>	24	80.00	50.02	51.79
<u>Lamprops sp.</u>	3	40.00	6.25	9.32
<u>Gnorimosphaeroma oregonensis</u>	20	60.00	41.68	47.18
<u>Atylus tridens</u>	5	40.00	10.42	14.74
<u>Eogammarus confervicolus</u>	4	40.00	8.34	13.59
<u>Eohaustorius sp. juvenile</u>	1	20.00	2.08	4.66
<u>Synchelidium shoemakeri</u>	1	20.00	2.08	4.66
<u>Corophium brevis</u>	1	20.00	2.08	4.66
<u>Jassa falcata</u>	3	20.00	6.25	13.98
<u>Cheriphotis megacheles</u>	3	20.00	6.25	13.98
<u>Mandibulophoxus uncistrostratus</u>	2	40.00	4.17	5.71
<u>Grandifoxus grandis</u>	1	20.00	2.08	4.66
<u>Parapleustes pugettensis</u>	43	40.00	89.61	153.43
<u>Hyale frequens</u>	72	20.00	150.05	335.52
Caprellidae	2	40.00	4.17	5.71
Brachyura zoea	1	20.00	2.08	4.66
Pinnotheridae	2	20.00	4.17	9.32
<u>Cancer magister</u>	2	20.00	4.17	9.32
<u>Dendraster excentricus</u>	11	80.00	22.92	20.04
Insecta	1	20.00	2.08	4.66

Number of taxa = 69

Mean number per sample: 436.20

Standard deviation (S.D.): 89.54

Mean number/m<sup>2</sup>: 4,545.20

S.D./m<sup>2</sup>: 933.02

H' = 3.29

SDV = 0.79

SR = 8.85

J' = 0.54