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DUWAMISH RIVER COASTAL AMERICA RESTORATION AND REFERENCE SITES: RESULTS AND RECOMMENDATIONS FROM YEAR ONE PILOT AND MONITORING STUDIES

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Approved

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KEY WORDS

Duwamish River estuary, restoration, reference sites, benthic and epibenthic fauna, insects, emergent vegetation, sediment microalgae, monitoring recommendations.

OBJECTIVES

This report contains the results of first-year monitoring and pilot studies at Coastal America and reference sites located in the Duwamish River estuary, Seattle, Washington. The overall objectives of these studies were as follows:

1. Set up long-term reference sites and collect initial baseline data.
2. Identify attribute species, as defined by the Estuarine Habitat Assessment Protocol (Simenstad et al. 1991; henceforth referred to as the "Protocol") and important non-attribute species in the Duwamish River estuary.
3. Perform pilot studies to compare different sampling times, methodologies, tidal levels, and sites in the estuary for a variety of physical and biological attributes.
4. Recommend sampling protocols and designs based on the results of (2) and (3).

Results of these studies will be used in recommending a monitoring plan for Duwamish reference and restoration sites. The monitoring plan is presented in a separate report (Simenstad et al. in prep.).

SPECIFIC TASKS AND METHODS

REFERENCE SITES

Two reference sites were established for comparison of infaunal invertebrates with future Duwamish River estuary restoration sites (Fig. 1). As a reference to lower estuary restoration sites (e.g., GSA and T-105) a site was established on the mudflat on the northwestern shore of Kellogg Island between two large pilings. This site was chosen because it is close to proposed restoration sites and previous Kellogg Island study sites (Meyer et al. 1980; H. Leon, Pacific Rim Planners, Inc., Seattle, Washington, unpubl. data; G.T. Williams, Parametrix, Inc., Bellevue, Washington, unpubl. data). The second reference site was established on the mudflat just upstream of the entry of a small creek at the Turning Basin site as a reference to future Turning Basin restoration, again because of its proximity to the proposed restoration project. Both sites were also chosen because they represent some of the only remaining low-gradient mudflat habitat in the Duwamish River estuary. Low-gradient flats are the dominant unvegetated habitats in relatively unimpacted estuaries in the Pacific Northwest.

At each site, we established one 50-m transect. We placed 15 PVC stakes at random intervals along each transect as sample replicate locations. At Kellogg Island the 15 replicate stakes were placed at a tidal elevation between 0.0 and 0.4 ft relative to mean lower low water (MLLW); at the Turning Basin site the replicate stakes were between 0.2 and 0.6 ft (see Appendix 1 for survey data).

The 1993 summer pilot study included sampling emergent vegetation at several potential reference sites. Because species composition changes along a salinity gradient, emergent vegetation reference sites were selected at intervals between the Turning Basin and Kellogg Island as existing vegetation permitted.

Three *Carex lyngbyei* patches (Site 1, Site 2, and Site 3; Fig. 1) were selected as potential reference sites in the upper waterway. In the lower waterway, one site was chosen on the north end of Kellogg Island as a reference to more saline restoration sites in this area. At this high marsh site, one monotypic *Scirpus* patch and three multispecies patches were sampled (Fig. 1). *Carex* sites 1, 2, and 3 had mean elevations of 8.8, 7.2, and 5.6 ft, respectively; the three Kellogg Island sampling transects had mean elevations of 11.8, 12.1, and 11.3 ft; and the *Scirpus* sp. bench had a mean elevation of 11.0 ft (Appendix 1).

DATA ANALYSES AND PRESENTATION

With the exception of comparisons of data from two sizes of benthic core samplers, we chose to present data in simple graphical terms and not to conduct hypothesis tests of differences between sites and through time. Data are presented in graphs with their associated means and confidence intervals to allow visual assessment of the magnitude of variability of the different attributes sampled. In future studies it will be appropriate to conduct hypothesis testing, such as testing the performance of a restored site against that of a reference site (see Discussion and Recommendations).

BENTHIC AND EPIBENTHIC STUDIES

Year 1 sampling of benthic and epibenthic invertebrates at the reference sites is summarized in Table 1 and described in detail, as follows.

Sampling and Laboratory Methods

We used recommended sampling methods from the Protocol (Simenstad et al. 1991, pp. 40-115). Benthic macrofauna were sampled with PVC cores of 0.0024 m^2 and 0.0004 m^2. Benthic meiofauna were also sampled with the 0.0004-m^2 core. Cores were taken to depths of 10 cm. Epibenthic samples were collected with a 0.018-m^2 pump sampler on a 0.153-mm screen. All faunal samples were fixed in the field in a 5% buffered formaldehyde solution.

In the laboratory, faunal samples were transferred to 50% isopropanol after ~1 wk of fixation in the formaldehyde solution. Benthic macrofauna were screened at 0.5 mm to remove sediment. Benthic and epibenthic meiofauna were screened at 0.153 mm. If subsampling was necessary, samples were first separated with sieves into >2 mm and <2 mm fractions. The small fraction was then split in a Folsom plankton splitter (Wickstead 1976) until at least 100 organisms were obtained. The large fraction was examined in its entirety. All organisms were identified using dissection, and when necessary, compound microscopes. Taxa occurring as attributes in the Protocol were identified to species. Non-protocol taxa were not identified to species unless they were particularly abundant or have been identified or hypothesized as being prey for fishes or birds.

Sample Design

In addition to the objective of noting presence and abundance of Protocol species, we designed four separate benthic and epibenthic studies to address our other objectives:

1. On 27 April 1993, we sampled and analyzed 15 replicates of benthic macrofauna from both core sizes at both reference sites. Our goal was to compare the two cores for differences in sampling efficiency of Protocol and other species. If we determined that there was no difference in how the two cores sampled, then we could recommend that the smaller core be used for future monitoring because its samples are smaller, easier to process, and do not usually require splitting. The large core could then be used only for very large fauna such as clams.
2. We sampled and analyzed 15 replicates of benthic macrofauna monthly from April through July 1993 at both sites. The purpose of this sampling was threefold: First, it allowed us to monitor benthic species throughout a spring-early summer period for temporal trends, variation, and peaks. Second, it formed the basis of comparison of an upper waterway site (Turning Basin) with a lower waterway site (Kellogg Island). And third, it established first-year (pre-restoration) baseline data at two reference sites.
3. On 2 August 1993, we sampled meiofauna at the Kellogg Island reference site, taking 15 replicates using each of three methods: the epibenthic suction pump, the 0.0004-m^2 core with ~0.25 m of water over the transect (wet core), and the 0.0004-m^2 core with no water over the transect (dry core). Analysis of these samples enabled us to make a three-way comparison of these methods. Our hypothesis was that the wet core would sample epibenthic meiofauna at densities higher or equal to that of the pump and the dry core, and as such could be recommended for future monitoring.
4. On 2 August 1993, we also sampled meiofauna at three tidal elevations at the Kellogg Island reference site. In addition to the 15 replicates made with the wet core at the 0.0-ft transect, we also sampled using this method at -2.0 ft and +2.0 ft. Fifteen replicates were analyzed at the 0.0-ft elevation. Six replicates each (every other replicate along the 50-m transect) were analyzed at the -2.0 ft and +2.0 ft elevations. Our goal was to obtain preliminary information on differences in abundance of Protocol species at these different elevations.

INSECTS

Insects were sampled in May, June, and August at two locations: in the mixed species, *Juncus*-dominated high marsh on the north end of Kellogg Island and in the *Carex* bench near the Turning Basin (Site 1) (Table 1). Because the first year of monitoring was in part a pilot study for determining cost-effective sampling methods and acquiring baseline data, we chose a simple sweep-net method of sampling (Southwood 1978) that required little labor and had promise for providing useful results. Sweep netting was also chosen because it is biased toward adult insects, which are frequently found on emergent vegetation. These insects are often found in the stomach contents of surface-feeding juvenile salmon in Pacific Northwest estuaries (Congleton 1978, Northcote et al. 1979, Levy and Northcote 1981, Tschaplinski 1988, Miller

1993), including the Duwamish River estuary (Meyer et al. 1981; G.T. Williams, Parametrix, Inc., Bellevue, Washington, unpubl. data). The sweep-net sampling was designed to provide semi-quantitative data on insect assemblages associated with vegetation. Our goal was to gain enough information on the taxa that comprise the insect assemblages at the reference sites to be able to recommend sampling protocols appropriate for those taxa .

We collected insects with a 32-cm dia sweep net. Five samples were collected at each site. Each sample consisted of five 2-m wide sweeps, one sweep per pace for five paces. Sweeps were made within 0.25 m of the top of the vegetation. Insects were preserved in 50% isopropanol. In the laboratory, they were identified (usually to family level) and enumerated.

We also sampled insects monthly, May through June, using the 0.0024-m^2 core sampler at the locations mentioned above. Five replicate core samples were taken at each site. We attempted to analyze these samples, but abandoned analysis because (1) the sediment was very compacted and bound up by root material, causing inordinate processing time extracting invertebrates; (2) qualitative examination of several samples showed very low insect larvae abundances; and (3) we expected that benthic insect larvae would be at least partially assayed by the benthic infauna cores.

SEDIMENT MICROALGAE

We collected and processed sediment microalgae samples using methods recommended by the Protocol. Sediment samples for microalgae were taken at the Turning Basin and at Kellogg Island sites with a 0.0004 m^2 syringe to a depth of 1 cm. Fifteen replicate samples were taken at each site on each sampling date (see Benthic and Epibenthic Studies, pg. 2). Each sample was taken next to an invertebrate infauna core. Samples were placed on ice in opaque jars in the field and frozen immediately upon return to the laboratory. Laboratory processing consisted of thawing the samples, grinding them to disrupt the cells, and extracting the chlorophyll in acetone. Microalgal biomass was determined as chlorophyll *a* fluorescence measured with a fluorometer.

EMERGENT VEGETATION

Sampling Design

We sampled *Carex lyngbyei* on 7-14 July, 2-4 August, and 14-15 September. At each *Carex* bench (Sites 1, 2, and 3), 30-m transects were established along the visual center of the *Carex* stand. Random numbers for sample location were selected along the center line of the transect being sampled. Random numbers were also used to establish distances off the transect, with a coin toss to determine upland or river side for placement of the sampling quadrat (Fig. 2).

Sampling quadrats were constructed from 1/2-in PVC pipe and corner connectors to finished outside dimensions of 25 x 25 cm. Plastic coated tying wire was attached midpoint at a sawed slot to demarcate a smaller 12.5-x 12.5-cm corner quadrat (Fig. 3). Shoot density was counted in the large quadrat at all odd-numbered replicates. Shoot density, aboveground biomass, and belowground biomass were sampled within the smaller quadrat at all replicates.

Shoot density was measured at the *Scirpus* sp. patch on Kellogg Island on 1 August. Shoots were counted within ten 25- x 25-cm quadrats, which were randomly located within the *Scirpus* patch.

In the multispecies high marsh on Kellogg Island, we took random samples on 2 August in three patches, each of which was dominated by different plant species. Patch 1 consisted primarily of *Distichlis spicata* and *Salicornia virginica*; patch 2 consisted of *Juncus balticus*; patch 3 was a pond area with primarily *Juncus balticus*. Five 25- x 25-cm quadrats were placed randomly within each patch. Aboveground biomass samples were taken at each quadrat.

Sampling and Laboratory Methods

At the *Carex lyngbyei* bench sites, all living shoots were counted within the quadrats and then clipped at ground level with hand pruners and individually rubber-banded. Soil cores were taken to a depth of 19.5 cm with a 5-cm dia PVC core. All clipping and core samples were placed in labeled plastic bags. In the laboratory they were refrigerated until processed.

Individual shoots from each quadrat were counted in the laboratory to compare with the field counts. Shoots were then placed in aluminum foil in drying ovens at 60°C for 3 d and were then weighed to the nearest 0.01 g. Plant roots from each soil core were separated from sediment by rinsing the cores over a 2-mm sieve. Roots were then separated into live and dead categories based on color and turgidity. Separated samples were placed in drying ovens at 60°C for 5 d and then weighed to the nearest 0.01 g. At the *Scirpus* sp. patch, 10 randomly located measurements of live shoot density were made with the 25- x 25-cm quadrat.

At the multispecies high marsh on Kellogg Island, five random samples in each of the three vegetation assemblages were taken. For each sample, shoots of all vegetation lying within the 25- x 25-cm quadrat were clipped and handled as for *Carex* samples. In the laboratory, each sample was separated into separate species, which were oven-dried on labeled aluminum foil at 60°C for 3 d and weighed to the nearest 0.01 g.

SEDIMENT GRAIN SIZE

Sediment grain-size samples were collected at every third sample replicate station along the mudflat transects with the 0.0024-m2 core to a depth of 10 cm, placed in plastic bags, iced, and frozen upon return to the laboratory. Cores were processed in the laboratory according to the methods of Folk (1968). They were washed in freshwater to solubilize salts and then oven dried at 60°C. Sediment samples were then mechanically shaken through nested #10, #18, #35, #60, #120, and #230 sieves. The residual fines were added to the original liquid fraction and analyzed by pipet analysis.

RESULTS

BENTHIC INVERTEBRATE STUDIES

Protocol Species

We found 14 taxa that occur in the Protocol as prey attributes for higher trophic level organisms (Table 2). We identified seven additional taxa that were relatively large and abundant (the spionid polychaete worms *Pseudopolydora kempi japonica*, *Polydora ligni,* and *Pygospio elegans* and the cumacean *Leucon* sp.) or have been identified as prey for juvenile flatfish subsequent to publication of the Protocol (the harpacticoid copepods *Leimia vaga*, *Microarthridion littorale*, and *Tachidius triangularis*) (McCall 1992; J. Cordell, unpubl. data; R. Buckley, Washington State Department of Fish and Wildlife, unpubl. data) (Table 2).

Comparison of Large and Small Core Samplers

Densities of benthic infauna sampled by the two core sizes were usually similar (Fig. 4). In a comparison of the mean densities of the taxa that we selected for analysis, the large and small core samplers were significantly different only twice: for all organisms combined and for Nematoda at the Turning Basin site (Table 3). There was no significant difference between the two core sizes for any of the selected taxa at Kellogg Island.(Table 4). There were two other notable differences in the two core samplers: first, the bivalves *Macoma* spp. appeared only in large core samples and, second, the large core sampler usually showed a higher power to detect differences between means of the selected taxa (Tables 3, 4). Taxa richness was higher for the large core than for the small core: number of taxa was 44 for the large core and 35 for the small core at Kellogg Island and 28 for the large core and 24 for the small core at the Turning Basin (Appendix 2).

Temporal Sampling of Benthic Infauna at Turning Basin and Kellogg Island

<u>Comparison of Turning Basin and Kellogg Island</u>. For 11 selected taxa and all organisms combined, mean densities were either similar between the two sites or were lower at the Turning Basin site (Figs. 5-7). The single exception to this was for the gammarid amphipods *Corophium* spp., for which mean densities were always higher at the Turning Basin site (Fig. 7e).

<u>Temporal Trends</u>. In our four monthly samplings between April and July, for the 11 selected taxa and all organisms combined, there were usually no apparent temporal trends or peaks in mean densities, except as follows:

1. all infaunal organisms combined peaked during May and June at the Turning Basin site (Fig. 5c, Appendix 3);
2. spionid polychaetes increased every month from April through July at the Kellogg Island site (Fig. 6d, Appendix 3);

3. the gammarid amphipod *Eogammarus confervicolus* and the cumacean *Cumella vulgaris* increased steadily from April through June at the Kellogg Island site (Fig. 7a, b; Appendix 3);
4. the harpacticoid copepod *Leimia vaga* peaked during April at the Kellogg Island site (Fig. 7d, Appendix 3);
5. the gammarid amphipods *Corophium* spp. increased each month until they peaked in June and July at both the Kellogg Island and Turning Basin sites (Fig. 7c, Appendix 3); and
6. the harpacticoid copepods *Harpacticus* spp. peaked in June at the Kellogg Island site (Fig. 7e, Appendix 3).

Comparison of Dry Core, Wet Core, and Epibenthic Pump Meiofauna

The epibenthic pump and small dry and wet cores sampled similar assemblages of meiofauna (Appendix 4). Taxa richness was also very similar between the three sample types (Appendix 4). However, densities of organisms sampled with the pump were usually orders of magnitude lower than those sampled with the cores (Fig. 8a). In some cases (e.g., the harpacticoids *Harpacticus* spp. and *Microarthridion littorale*) taxa appeared only in core samples. For taxa that were compared, densities were slightly lower in wet cores as compared with dry cores, with the exception of *Microarthridion littorale*, which occurred only in wet cores.

Comparison of Meiofauna from Three Tide Elevations

There were differences between the three tide levels sampled for several benthic meiofaunal Protocol taxa (Fig. 8b): (1) the harpacticoid copepods *Harpacticus* spp., which occurred only at the 0.0-m tide level, (2) the harpacticoids *Tisbe* spp., which were absent from the higher elevation, and (3) the gammarid amphipod *Eogammarus confervicolus*, which was not present at the lower elevation. The 0.0-m level exhibited the highest taxa richness, with 40 taxa as compared with 20 and 36 taxa for the lower and higher elevation, respectively (Appendix 5).

INSECTS

The predominant insects in the sweep net samples were two families of Homoptera, Aphididae (aphids) and Cicadellidae (leaf hoppers), and dipteran flies in the families Chironomidae, Dolichopodidae, and Chloropidae. In the sedges at the Turning Basin site, chironomids were dominant in May and aphids were dominant in June and August. Aphids increased at this site from zero in May to a peak of 300.2 individuals per sample in August. In the mixed species high marsh at Kellogg Island, no single taxon was dominant. The predominant insects by month at this site were as follows: May—Cicadellidae, miscellaneous dipteran flies, and Order Thysanoptera, family Thripidae (thrips); June—Aphididae and Cicadellidae; July—Chloropidae and other dipterans; and August—miscellaneous dipterans, the Order Hemiptera, and the Order Coleoptera (beetles) (Fig. 9).

Sediment Microalgae

Mean sediment chlorophyll *a* concentrations were higher at the Kellogg Island mudflat (~0.8–1.0 $\mu g\ l^{-1}$) than at the Turning Basin mudflat (~0.4–0.6 $\mu g\ l^{-1}$) and were highest at both sites in May and June (Fig. 10).

Emergent Vegetation Studies

Carex lyngbyei *Patches*

Comparisons of *Carex lyngbyei* mean shoot density between data taken with the large and small quadrat sizes indicated that measurements of temporal trends and relative density were similar among the three sites for each date (Fig. 11, Appendix 6). While the shoot densities measured with the two quadrat sizes did not appear to be significantly different, they were consistently higher when the small quadrat was used. At site 1, shoot densities were similar and do not appear to be significantly different between the three sampling periods. Mean shoot density peaked at site 2 in July (small quadrat) and August (large quadrat) and had declined by September. Similarly, mean shoot density at site 3 peaked in August and had declined by September.

The relative means of aboveground biomass of *Carex* among the three sites for each date were similar to that for shoot density. Temporal trends were also similar, with small differences across time at site 1, peak biomass at sites 2 and 3 in July and August, and significant decreases in September (Fig. 12, bottom panel).

Both live and dead belowground biomass showed little difference among the three sampling periods, with two exceptions. First, mean live belowground biomass significantly declined at sites 2 and 3 in September (Fig. 12, middle panel). Second, mean dead belowground biomass was lower at site 1 in July than in August or September (Fig. 12, top panel).

Scirpus *sp. Bench*

The mean shoot density of the *Scirpus sp.* patch on Kellogg Island was 364.8 ± 68 (95% CI) shoots m^{-2} (Appendix 7).

Multispecies High Marsh (Kellogg Island)

Data from our stratified sampling at the vegetation patches at the north end of Kellogg Island confirmed our initial observations that each patch was dominated by one or two species. Patch 1 was dominated by *Distichlis spicata* and *Salicornia virginica*. Patch 2 had the highest species richness of the three patches, but was dominated by *Juncus balticus*. Patch 3 was a monotypic stand of *Juncus balticus* (Fig. 13, Appendix 8)

Sediment Grain Size

Sediment grain size distribution differed between the three sites examined (Table 5, Appendix 9). Both the Kellogg Island and Turning basin mudflats had a high proportion of fines, almost 35% of the sediment in each case. In contrast, the sediment from the sedge bench near the Turning Basin site consisted of only 21% fines. Mean grain size of sediments at the Turning Basin mudflat was ~30% lower than at the Kellogg Island mudflat. The differences in the mudflats occurred primarily in the 0.25- and 0.063-mm ϕ classes.

DISCUSSION AND RECOMMENDATIONS

BENTHIC INFAUNA

Taxa

The benthic assemblages we sampled at Kellogg Island and the Turning Basin apparently are very similar to those sampled by Leon (Pacific Rim Planners, Inc., Seattle, Washington, unpubl. data) at various stations in the Duwamish River estuary. These assemblages are dominated by several taxa, including the gammarid amphipods *Corophium* spp., the cumacean *Leucon* sp., and the polychaetes *Manayunkia aesturina*, *Hobsonia florida*, and several species in the family Spionidae. Most, but not all of these abundant species are listed in the Protocol as important prey attributes for fishes and birds.

At a minimum, we recommend future monitoring of the invertebrates listed in Table 2, including those which do not occur as prey attributes in the Protocol because they co-occur with Protocol taxa at high densities or have been found in fish diets after publication of the Protocol. It may be useful in the future to sample both juvenile salmon and non-salmonid fish in the Duwamish estuary to determine if some of the abundant non-protocol benthic invertebrates (e.g., spionid polychaetes and the cumacean *Leucon* sp.) are being consumed by predators. Another reason for monitoring non-Protocol species is that some taxa (e.g., certain species of tubificid oligochaete worms, dipteran larvae, and Nematoda) can form assemblages indicative of polluted conditions (Hynes 1970, Pennak 1989). Therefore, some other non-protocol taxa, such as nematodes, that are particularly abundant should also be considered for future monitoring as possible future indicators of habitat fitness.

Sampling Method

We recommend the larger core over the smaller core for sampling benthic infauna (≥0.5-mm sieve). Despite the fact that the two core sizes were not significantly different in estimating abundances of most organisms, and that larger samples are logistically more difficult to handle because of their larger volume and necessity for more splitting, large cores are superior to small cores in several aspects. First, the large core samples the largest of the taxa, *Macoma* clams and large polychaetes, which are not sampled by the small core. Thus, if the small core were used, large cores would have to be taken and sieved at a large mesh size specifically for these large taxa. This would add another level of sampling and processing. Second, despite error added by the necessity of more splitting of the large core samples, the large samples still usually exhibit more power to predict differences for most taxa tested. This is probably because variability in the density of benthic organisms at these sites occurs more at the scale of the small core, and the large core encompasses and therefore averages some of this variability. Finally, the large core sampled 11 more taxa than the small core did.

Replication and Sampling Frequency

We suggest that 15 replicates be used as a minimum in future benthic monitoring studies. Even with this replication, predictive power is relatively low for some taxa (Tables 3 and 4).

Most of the taxa analyzed for temporal change exhibited peak densities in June or July or both. Therefore, at least this period should be sampled. However, because of the possibility of interannual variation, we recommend that at least three time points be sampled in future monitoring, encompassing late-spring through mid-summer.

Comparison of Kellogg Island and Turning Basin as Reference Sites

The higher diversity and higher densities of most taxa at Kellogg Island is probably the result of the respective positions of the two sites relative to the salinity gradient in the estuary. Because the Turning Basin site is much further upstream than Kellogg Island, it experiences lower mean salinity. We infer this from pore water salinity measurements taken at the *Carex* bench sites in June, July, and August 1994 (S. Wenger, unpubl, data). These data show that salinities at Site 1, near the Turning Basin, ranged from 0% to 8‰ with a mean of 5.3‰, whereas those at Site 3, about half-way between Kellogg Island and the Turning Basin, ranged from 3% to 19‰ with a mean of 10.8‰. Therefore, only freshwater-tolerant species such as the polychaete *Hobsonia florida* and the gammarid amphipod *Corophium salmonis* are abundant at the Turning Basin site. The faunal differences between the two sites may also be due in part to their differing grain size spectra: the sediments at the Turning Basin were about 30% finer than those at Kellogg Island. Because of these differences, we recommend that both sites be retained as references. Each site will act as a reference for restoration in its proximity. Further, we recommend that future development and restoration at these sites be designed to avoid impact on the reference mudflats.

Tidal Elevation

On the basis of our limited comparison of meiofauna from three elevations at Kellogg Island, the 0.0-m elevation is an adequate and perhaps preferred level for monitoring and restoration of benthic infauna. We make this recommendation because the 0.0-m level was comparable to other elevations in density of Protocol and other important species. It also had the highest taxa richness and had Protocol species that were absent from the other elevations, but this may have been because fewer replicates were analyzed from these elevations.

INSECTS

The most abundant insects in our samples were dipterans (especially chironomids, dolichopodids, and chloropids) and homopterans (aphids and cicadellids). Aphids and chironomids were particularly abundant in the sedge vegetation at the Turning Basin site. In contrast, the mixed high marsh vegetation at Kellogg Island had a more diverse insect assemblage, which was not dominated by one or two taxa. Chironomids and dolichopodids are common estuarine aquatic flies with short-lived adult stages. Their larvae are usually found associated with sediments or detritus. Alternatively, chloropid larvae and aphids and cicadellids spend most of their life feeding on the culms of vegetation and can be associated with both aquatic and terrestrial vegetation. Therefore, both sites appear to have insect assemblages that depend on a variety of microhabitats depending on their species and life history stage.

For our initial surveys of Duwamish estuary insects, we chose sweep-netting, a simple, semi-quantitative method that samples insects primarily in their adult stage, when they occupy the vegetation. Two other devices that can be used to measure other aspects of insect production should be considered in future Duwamish restoration site monitoring: fall-out traps and emergence traps.

Fallout traps consist of shallow plastic boxes filled with a preservative that can float on the water, and which catch any insects that fall from the air or overhanging vegetation. These traps have several advantages over sweep-net sampling. First, they are quantitative because they sample the fallout of insects into a known unit area. Second, they directly sample that portion of insect production being made available to surface feeding fish. Sweep nets sample insects that are found in vegetation, and their abundance is only an indirect measurement of availability to fish. Finally, fallout traps can measure insect input in relation to different physical and biological variables. For instance, they can be deployed at different distances from vegetation, under different wind conditions, or adjacent to different plant assemblages to test the effect of those variables. Fallout traps can also be combined with sweep netting to more precisely determine the source of insects being put into the system.

Emergence traps are a well-developed and tested device for collecting newly hatched adult insects emerging from sediment or vegetation (Macan 1964, Morgan 1971, LeSage and Harrison 1979, Welch et al. 1988). They can sample insect production from the sediment or portions of plants (e.g., lower stems), which may not be adequately sampled by sweep netting or fallout traps. Emergence traps may be particularly useful in the habitats we sampled in the Duwamish estuary because the structure of the sediment did not allow us to effectively use benthic core samples for insect larvae.

Many of the insect taxa we collected in the Duwamish estuary occur in the diet of juvenile salmon (Simenstad et al. 1991). Therefore, we recommend a more rigorous linkage of insect production to insect prey availability. Using a combination of the sampling methods mentioned above would be one approach to making this linkage. An examination of salmon stomach contents would complete the linkage to fish. A truly thorough study of restoration performance would require not only measurement of standing stock at reference and treatment sites, but also turnover rates and flux rates of insects between restored and existing systems. In this case, sampling frequency would have to be increased, probably from monthly to weekly.

SEDIMENT MICROALGAE

Sediment microalgae samples were relatively easy to collect and process. Furthermore, 15 samples per site appear to be sufficient to statistically detect the effects of location and sampling date. Therefore, we do not recommend changes in our sampling protocol. While peak chlorophyll *a* concentrations occurred in May and June, we do not recommend that sediment microalgae samples be confined to those months, because of the likelihood of interannual variation in peak production. Because of the strong differences between sites, any restoration area should be closely matched to reference sites. The differences in chlorophyll *a* concentration between the Turning Basin and Kellogg Island sites could be due to their differences in location along the estuarine gradient of salinity or tidal range or to physicochemical differences such as turbidity, water quality, or sediment grain size.

EMERGENT VEGETATION

Sites

Because vegetation assemblage structure and productivity varies along salinity gradients, we recommend that our sedge sites (sites 1, 2, and 3), the Kellogg Island mixed species assemblage, and the *Scirpus* sp. patch at the north end of Kellogg Island be retained as reference sites. These areas are among the only estuarine wetland vegetation complexes remaining in the lower Duwamish River. As such, they may be the only within-estuary sites available for continuing use as references to restored habitats in the Duwamish River estuary.

Sampling and Processing

Peak aboveground standing crop of sedges occurred in July and August in our samples. By September, biomass and shoot density had declined and we noted that *Carex lyngbyei* plants were matted down and decaying. Therefore, we recommend that aboveground biomass sampling take place at least once during mid-summer peak production. Because we do not know exactly when peak sedge biomass is reached in the Duwamish estuary, multiple samplings between the time of first new growth and decline may also be desirable. Grazing by Canada geese (*Branta canadensis leucopareia*) was noted at the sedge sites, and is suspected to be important at the Kellogg Island sites where geese are common. Goose exclosures may therefore be required in future comparisons of aboveground production between restored and reference sites in order to test the variable of grazing. High within-site variability in shoot density and aboveground biomass at sites 1, 2, and 3 was visually noted and was apparent in data analysis. Utilizing stratified sampling techniques and the larger quadrat size may help to reduce within-site variability.

Live belowground biomass of sedges also appeared to decrease significantly at two of the three sites in September. Therefore, several samplings per year may be required to adequately monitor this parameter. As with aboveground biomass, high within-site variability may be decreased with the use of larger core samplers and stratified sampling techniques. We experienced difficulty in separating live from dead belowground biomass. Therefore, we recommend the use of the following categories for distinguishing between categories of belowground plant matter:

- obviously live
- not obviously live or dead
- obviously dead, and
- other material (wood chips, leaves).

Elevation

In order to reduce variability between restoration sites and reference sites, we recommend that samples to be compared should be taken at equivalent elevations. For instance, if our reference sites are retained in future monitoring studies, sampling elevations at restored sites can be determined using our site elevations from Appendix 1.

Replication

If a detectable difference equal to one standard error is desired, our data indicate that a sample size of 19 is required. If a detectable difference equal to one-half the mean is desired, depending upon the parameter being measured, a sample size between 4 and 7 is required. Our replication of 10 samples falls within the latter range and would be appropriate for future monitoring at this resolution level.

Related Variables

A number of physicochemical factors we did not sample can affect emergent vegetation in estuaries. These factors should be considered in future monitoring plans and include grazing, pore water salinity, nutrients, sedimentation and erosion, sediment grain size, redox potential in rooting zone, current velocity, boat wakes, and presence of large woody debris.

Areal Change over Time

We recommend that the change in size and shape of vegetation patches in the Duwamish River estuary be monitored over time via annual aerial photography and ground surveys or by staking edges and recording changes when productivity data are collected.

SEDIMENT GRAIN SIZE

Our sediment grain size data from the mudflat sites were similar to that found by G.T. Williams (Parametrix, Inc., Bellevue, Washington, unpubl. data) in consisting of predominantly fine sediments. Sediment grain size can be an important determining factor in structuring benthic and emergent vegetation assemblages. In particular, the temporal changes in grain size and deposition rate of new sediments at restoration sites will be important in the succession and establishment of biota at these sites. Therefore, we recommend at least yearly sampling of sediment grain size at restoration and reference sites. More frequent sampling may be necessary if rapid changes (e.g., deposition) in sediments are noticed after restoration.

GENERAL RECOMMENDATIONS FOR LONG TERM MONITORING OF RESTORATION AND REFERENCE SITES

Sampling Designs and Locations

Most wetland attributes have heterogeneous spatial distributions; thus, when attempting to detect change over time, it is important to return to the same sampling locations at each sampling date. Permanent markers can be used to help relocate sampling locations, but if they are used, they should be checked periodically to ensure that they are not lost and not affecting sediment deposition or species presence in the area. We recommend that these markers be located and surveyed to at least 1" x 1" of latitude and longitude, as described by Merrill (1986). When possible, one permanent marker should be used to locate the general sampling area and individual sampling locations can then be mapped and relocated by specifying distances and directions from the primary marker or other samples. Global Positioning System (GPS) technology can also be used to relocate sampling spots. When destructive or removal sampling methods are used, such as taking cores or clipping vegetation for biomass, the exact same location should not be sampled again. Instead, samples should be taken 5- to 10-cm from the previous locations. For example, one could sample to the north, south, east, and west sides of permanent markers on consecutive sampling dates.

Sampling designs and location of sampling units should fit the question of interest. That is, to choose an appropriate design, one must carefully consider the situation, formulate the question, and choose effective sampling techniques. For example, when sampling *Carex*, we noticed that the patches were generally small, and that edge shoot densities were very irregular. Because we were interested in estimating shoot density in "mature" stands of *Carex*, we chose to limit our sampling to central portions and to exclude samples from the edges. This was accomplished by placing a transect along the centerline through the middle of the patch to enable us to locate sampling units within the established areas of each patch. Had our interest been in describing the range of variability within *Carex* patches, we would have included sampling units that fell within edge areas. This example illustrates the types of design questions that are common in monitoring. While all objectives can not be met with one sampling design, use of stratified sampling designs and labeling samples as to their locations, or both, can sometimes help to accomplish more than one objective. For example, to establish shoot densities within "mature" areas and to also know the range of variability within the entire patch, we could have increased the sample size and labeled samples as to whether they came from central or edge areas. Then, when analyzing the data, we could have developed separate estimates for the mean and variance within the smaller "mature" areas and the larger areas that included edges.

Although initially most monitoring programs will be focused on describing as many aspects of a site as possible, the more focused the questions being asked, the better the ability to determine appropriate sampling designs. Even in a "general" monitoring program, it may become necessary to limit the number of species that will be described quantitatively. It may be helpful to ask the following questions when deciding on a monitoring design and use the answers to optimize that design:

- What variables will be used as indicators of system functions? Which of these variables are the most important?
- Are these variables heterogeneously distributed (e.g., do different areas exhibit different abundance, morphologies or life history stages)?
- What sampling methods are appropriate for measuring the variables of interest? What biases may be introduced by these methods?
- Are there any ecologically significant criteria that the sampling program should be designed to detect?
- Can any data provide information about how the populations of interest are distributed and what sample sizes are required to detect differences?

The following basic principles can be used to help guide sample design:

- Stratify when possible to reduce variance and improve understanding of the area.
- Avoid systematic sampling unless no spatial periodicities exist in the data or use it as a first stage of sampling to comprehensively cover an area of interest, with the second stage involving random selection of units.
- Use transects to help locate primary random samples (e.g., using a central transect as a reference to place samples randomly throughout a patch) or as sampling units themselves (e.g., number of shoots along randomly placed transects of a given length).

Destructive Sampling

We recommend non-destructive over destructive sampling methods when comparable quality is possible. For example, shoot density and biomass estimates may be directly related, and both can describe abundance and distribution of *Carex.* Because biomass tends to be variable and requires relatively large sample sizes, which can be destructive, we therefore recommend sampling biomass every 2 to 5 years, especially for small or newly restored sites. It is possible that the relationship between shoot density and biomass that is established for those years can be used to estimate biomass in years in which only non-destructive shoot density data are taken.

Scales and Methods

Often, sampling at several scales and frequencies and with several methods is required to evaluate biotic functions. For example, to measure how *Carex* abundance changes over time, changes in both the size of benches and the within-bench shoot density should be tracked. Similarly, both aboveground shoot density and biomass and belowground biomass are important indicators of *Carex* productivity. In establishing trophic links between fish and their invertebrate prey, it is important to quantify both the production of prey species from a given site and the occurrence of the invertebrates in fish diets. We recommend monitoring at multiple scales and frequencies and with different methods. Which scales, frequencies, and methods are used will depend on the processes and/or attributes being measured.

EXPLORATORY DATA ANALYSIS AND HYPOTHESIS TESTING

As monitoring at Duwamish River estuary reference and restoration sites continues, the following methods of exploratory data analysis may be useful for understanding and presenting data.

Frequency distributions	Histograms can be plotted to determine if transformations of the data are required to conduct parametric statistical analyses and if distributions change over time.
Variance-to-mean ratios and coefficients of variation	These methods give information about species distribution. High variance-to-mean ratios indicate patchy species distribution. In such cases, large sample sizes will be required to detect statistical differences, and the size of the sampling unit will affect estimates of mean and variance. A variance-to-mean ratio of ~1 indicates a random distribution; a variance to mean ratio <1 indicates a more regular distribution.
Mapping	Mapping locations of data values or plotting data values against a spatial variable (e.g., latitude and longitude; sample number if samples were taken along a transect or x,y if samples were taken within a plot) can be used to look for gradients in the data.

In this study, our main goal was to document species assemblages and abundances of important species within those assemblages at two reference sites in the Duwamish River estuary. We did not make statistical comparisons between sites or times. However, after multiple years of data have been gathered it will be desirable to test whether the abundances of certain species are the same at adjacent restoration and reference sites on a sampling date. Similarly, whether species abundances change in the same ways over time at each site will be of interest. Statistical hypothesis testing could also be useful in indicating what information would be lost by eliminating sampling times or locations.

Results from hypothesis testing must always be interpreted within the context of the sampling design used and what is known about the system being studied. We strongly recommend continued monitoring at both Duwamish reference sites for as many time periods per anum as possible in order to improve our understanding of the kinds of variability that occur at each site. This will facilitate the design of appropriate monitoring studies in the future. Without this "context," interpreting results from hypothesis testing will be extremely difficult. For instance, the population increase of a species sampled at a reference and a restored site may be of similar magnitude but of different timing. In this case, if only one or a few periods were sampled, and they did not encompass the increase at both sites, meaningful comparison would be impossible.

Statistical testing for changes over time is complex. The data series from monitoring programs should be, but have historically not been, long enough to employ time-series analysis methods. For example, the assumptions of most analysis of variance (ANOVA) tests are not well met by data sampled for 3 to 25 time units. Depending on the hypothesis being tested, it may be possible to create meaningful summary statistics for short time series that can be used in ANOVA tests. An example of such a statistic is the "day weighted variable" described in Conquest and Taub (1989), which was developed for testing differences in time-related treatment effects. However, our ability to predict or test for functional equivalency of created or restored wetlands to reference levels will likely depend on longer time-series information (Simenstad and Thom, unpubl. data).

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FIGURES

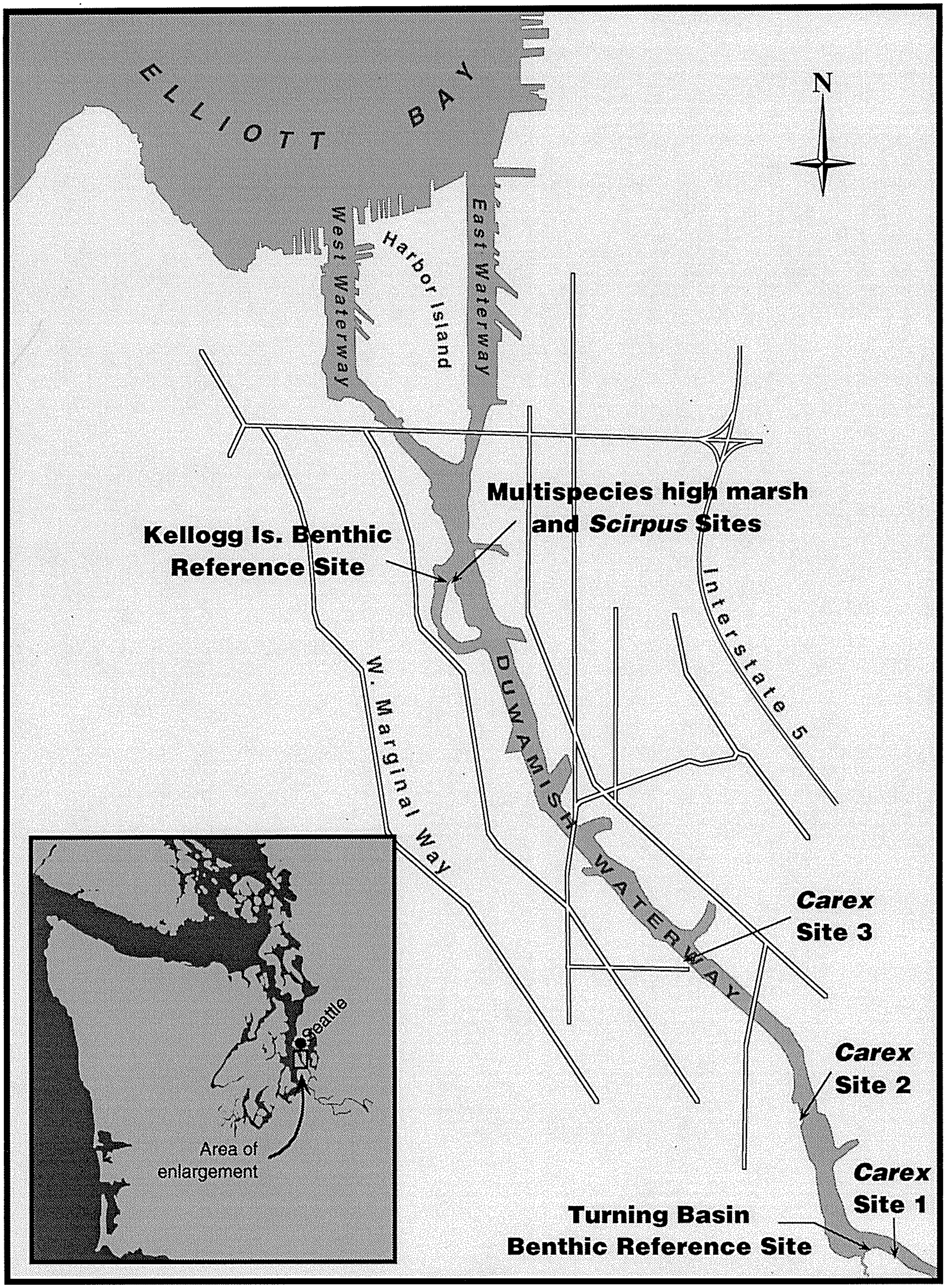

Figure 1. Location of sampling sites in the Duwamish River estuary.

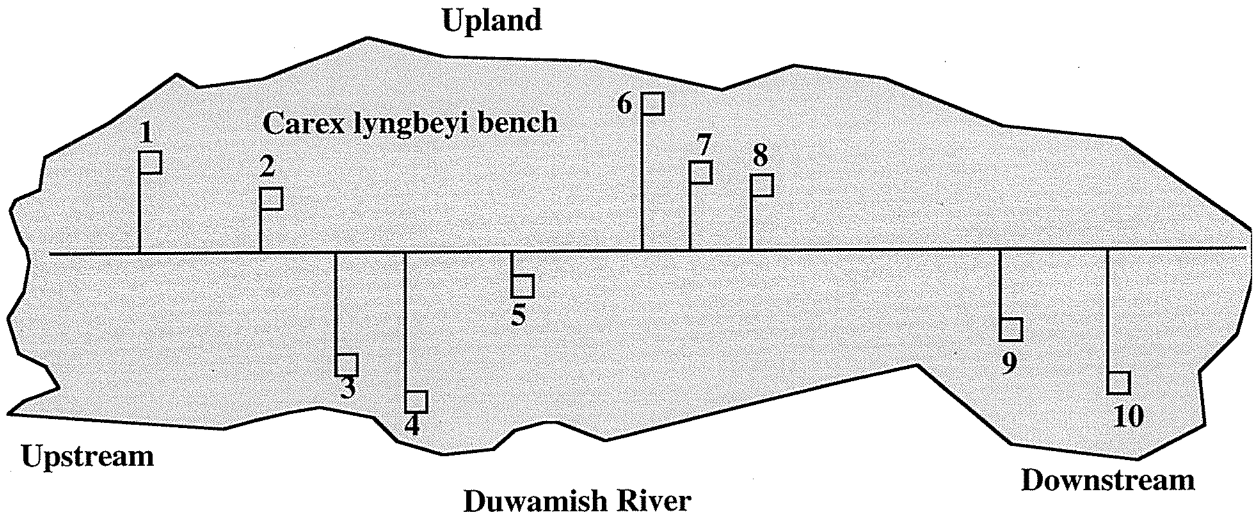

Figure 2. Schematic representation of design used to sample *Carex lyngbyei* patches in the Duwamish River estuary. Numbers denote individual sample replicates.

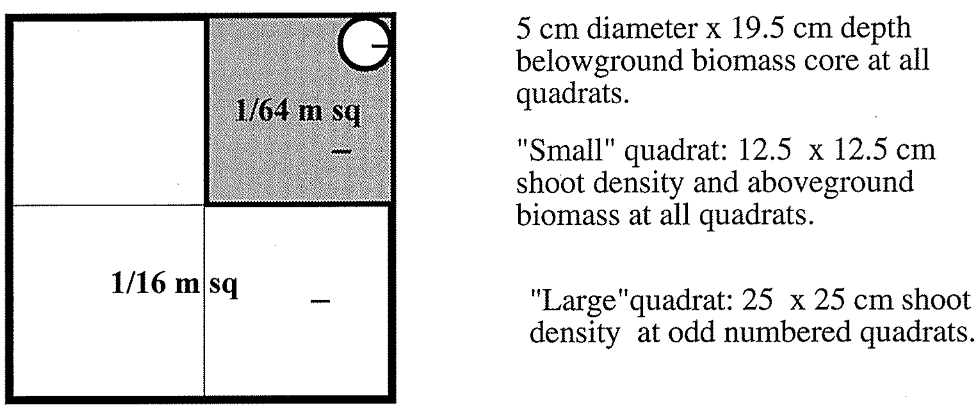

Figure 3. Schematic representation of quadrats and core used for sampling plant biomass and shoot density in the Duwamish River estuary.

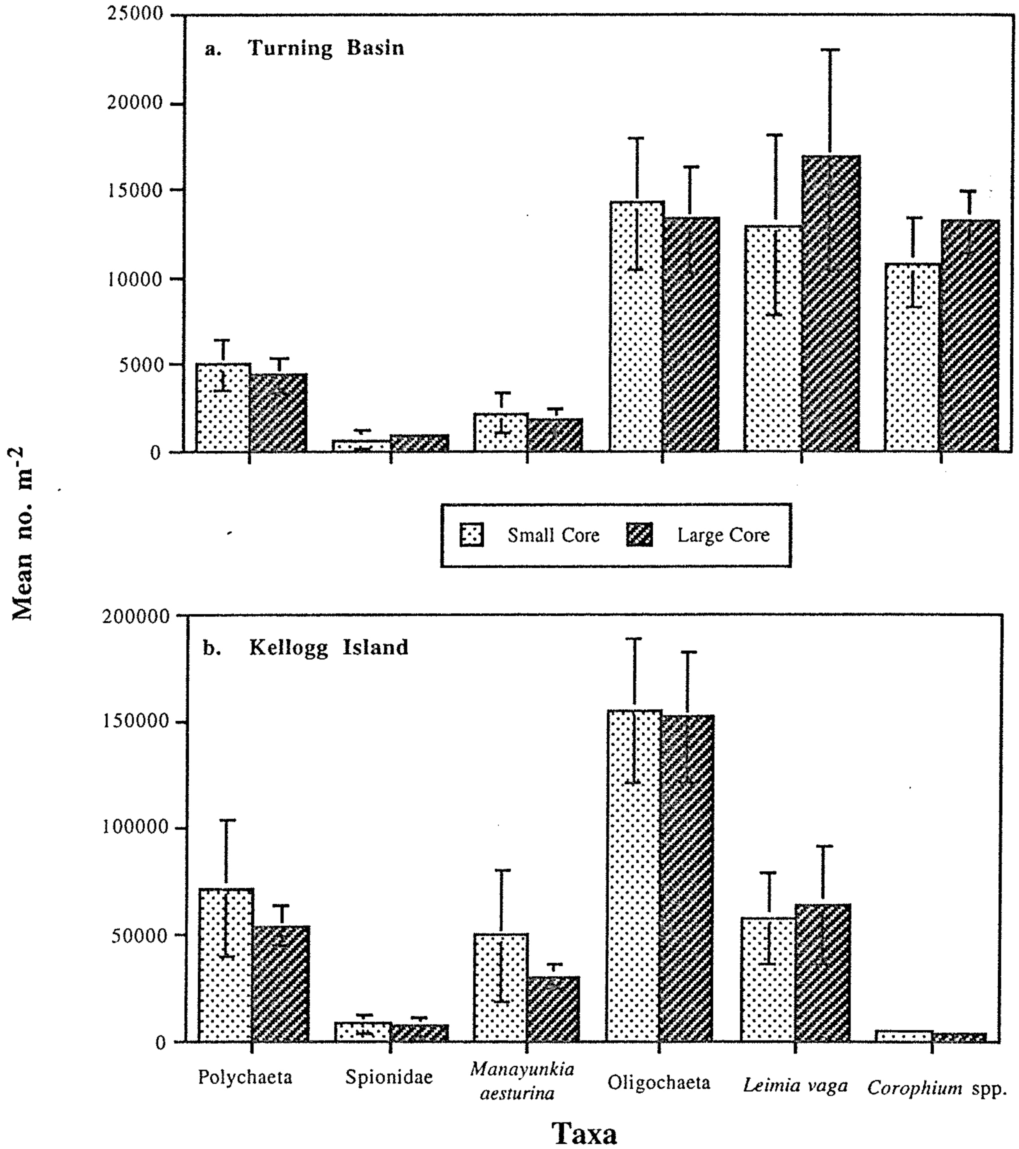

Figure 4. Comparison of two sizes of benthic core samplers for selected taxa at two reference sites in the Duwamish River estuary, 3 April, 1993.

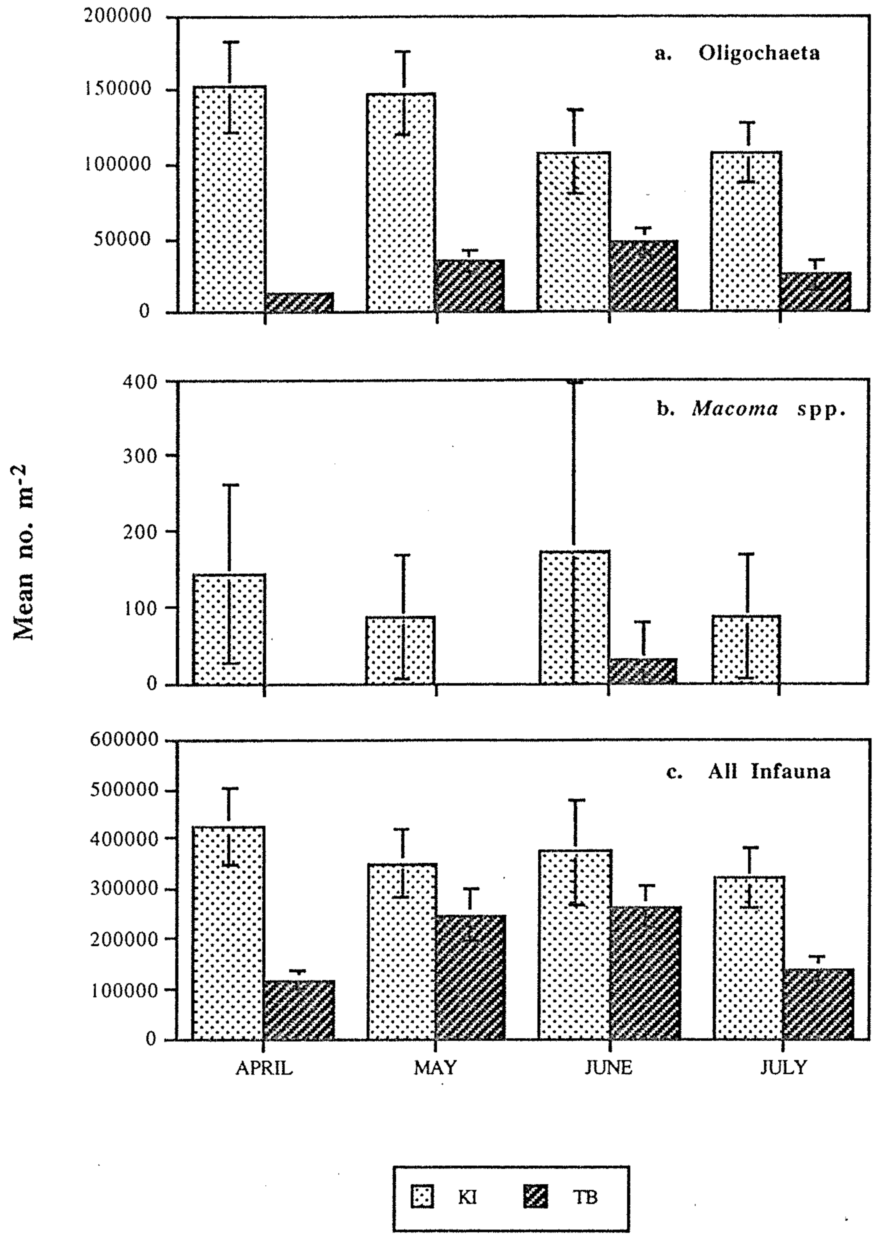

Figure 5. Mean density of a. Oligochaeta, b. *Macoma* spp., and c. total infaunal invertebrates from reference mudflats in the Duwamish River estuary, April-July, 1993.

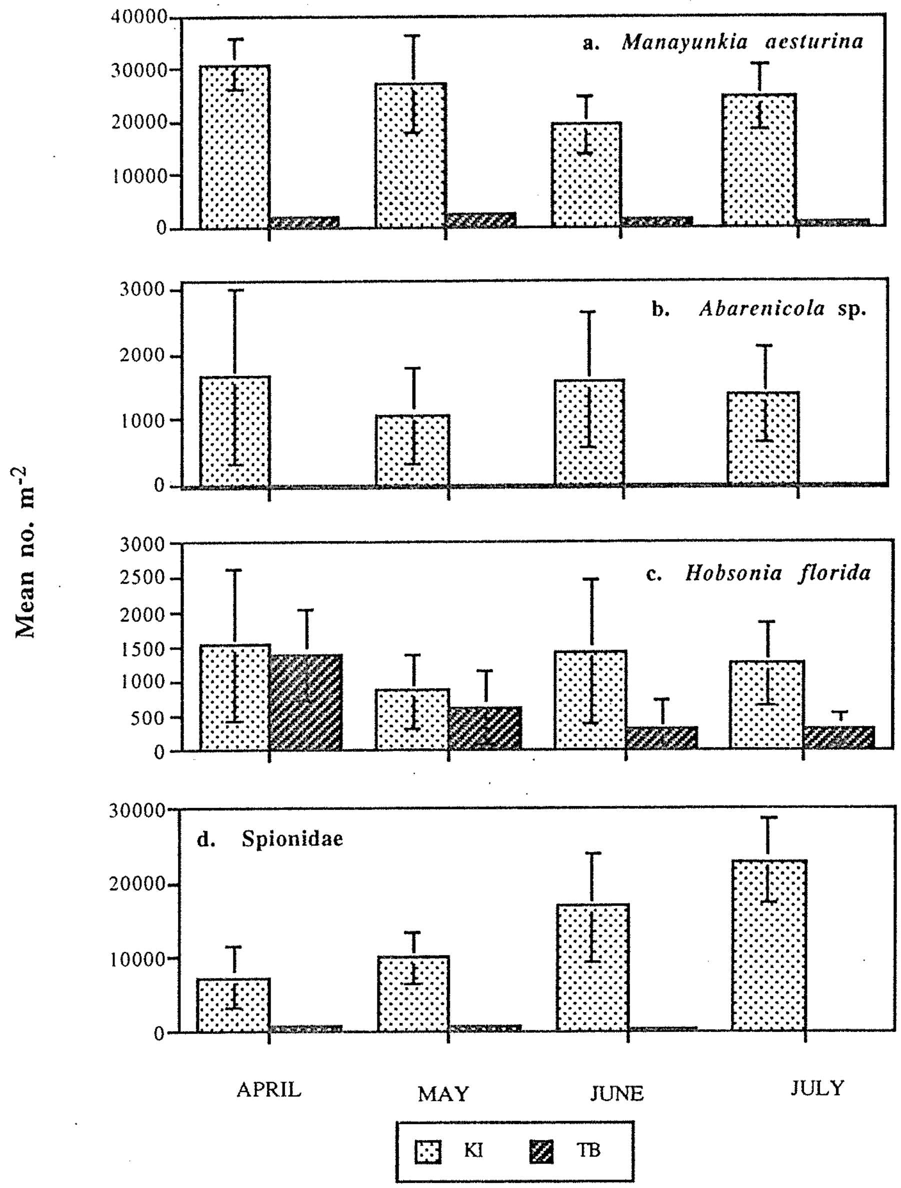

Figure 6. Mean density of selected polychaete worms from reference mudflats in the Duwamish River estuary, April-June, 1993.

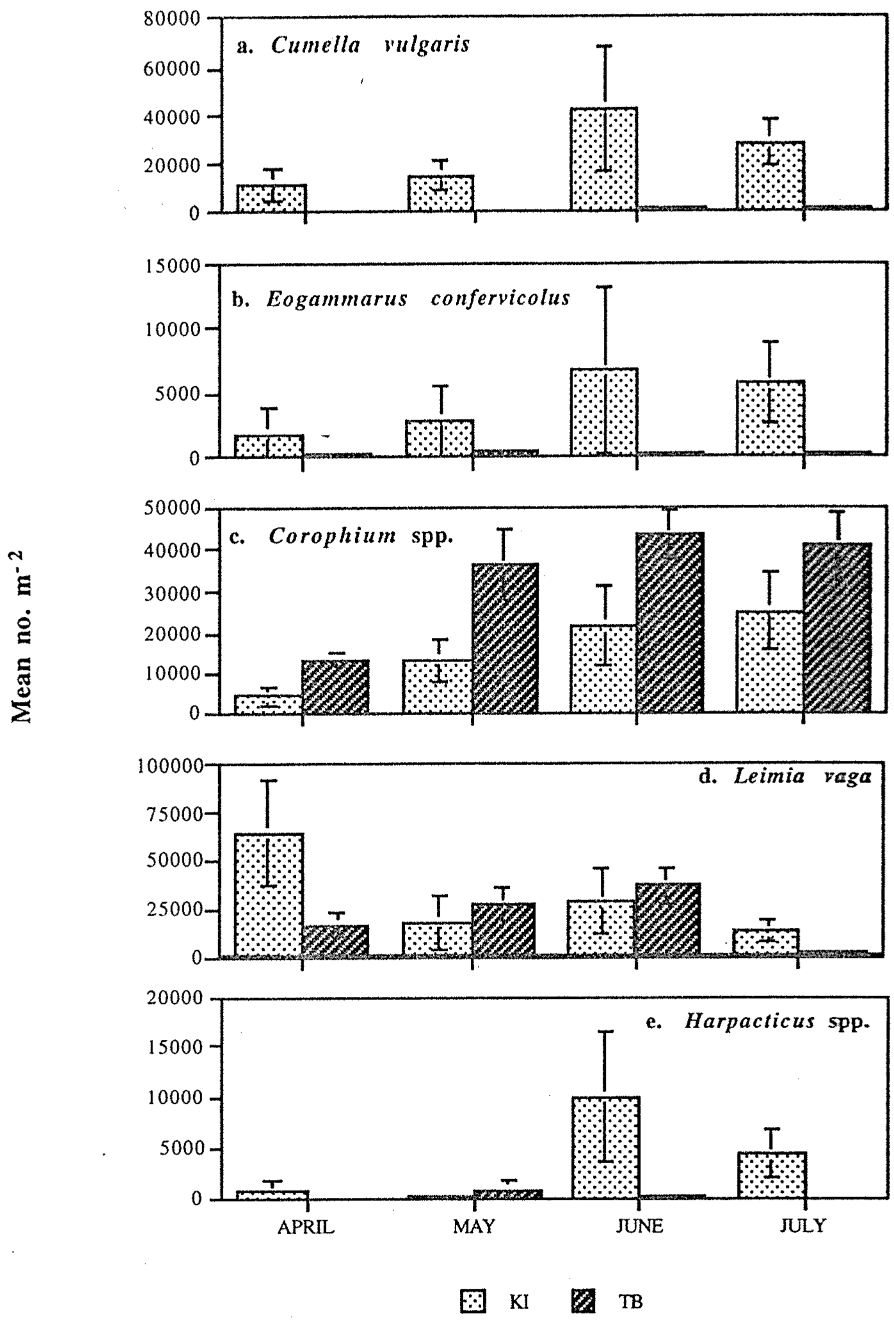

Figure 7. Mean density of selected crustaceans from reference mudflats in the Duwamish River estuary, April-July, 1993.

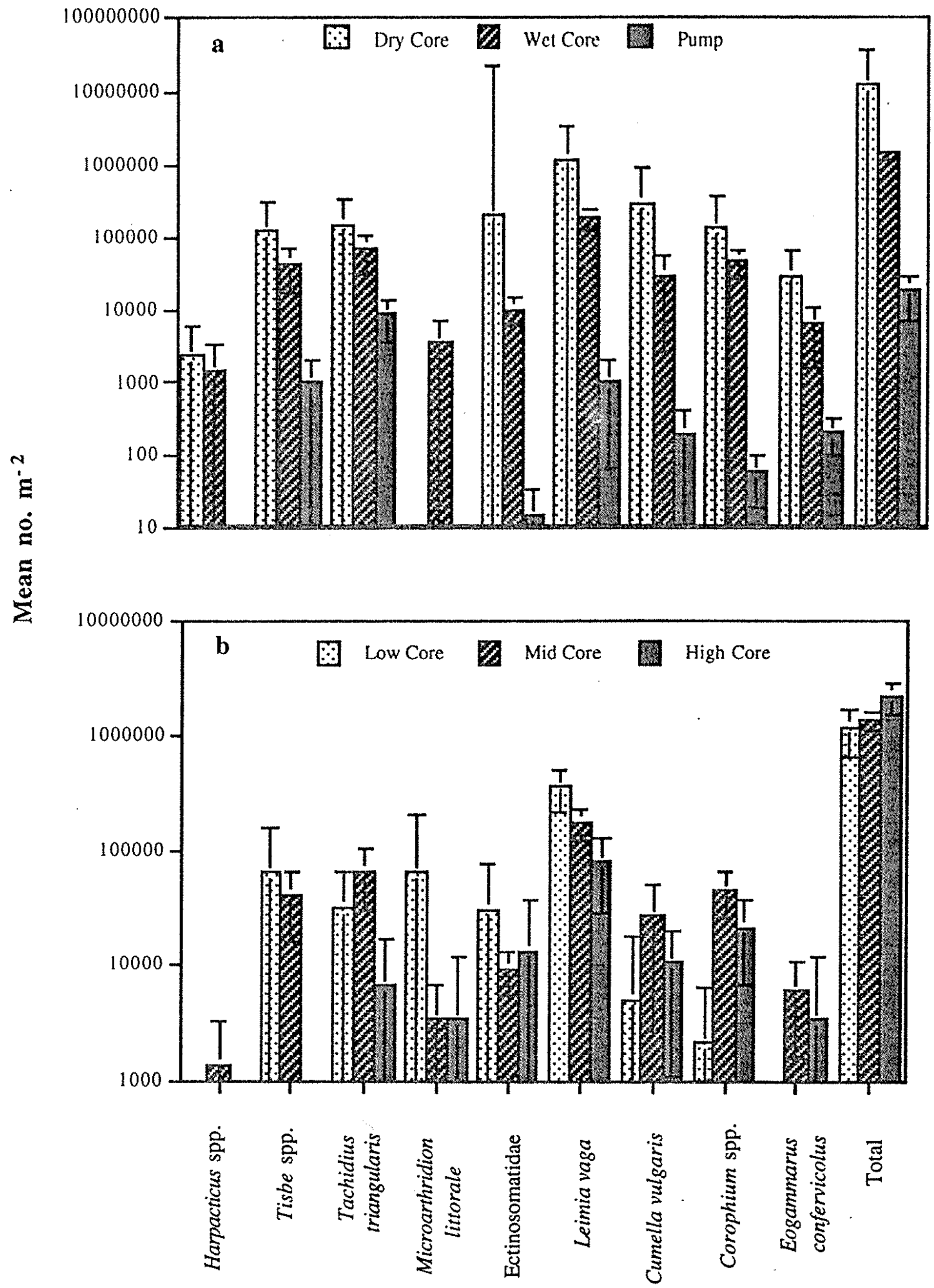

Figure 8. Mean density of selected meiofaunal invertebrates from Kellogg Island, Duwamish River estuary, August, 1993. a. Comparison of three sampling methods. b. Comparison of three tidal elevations.

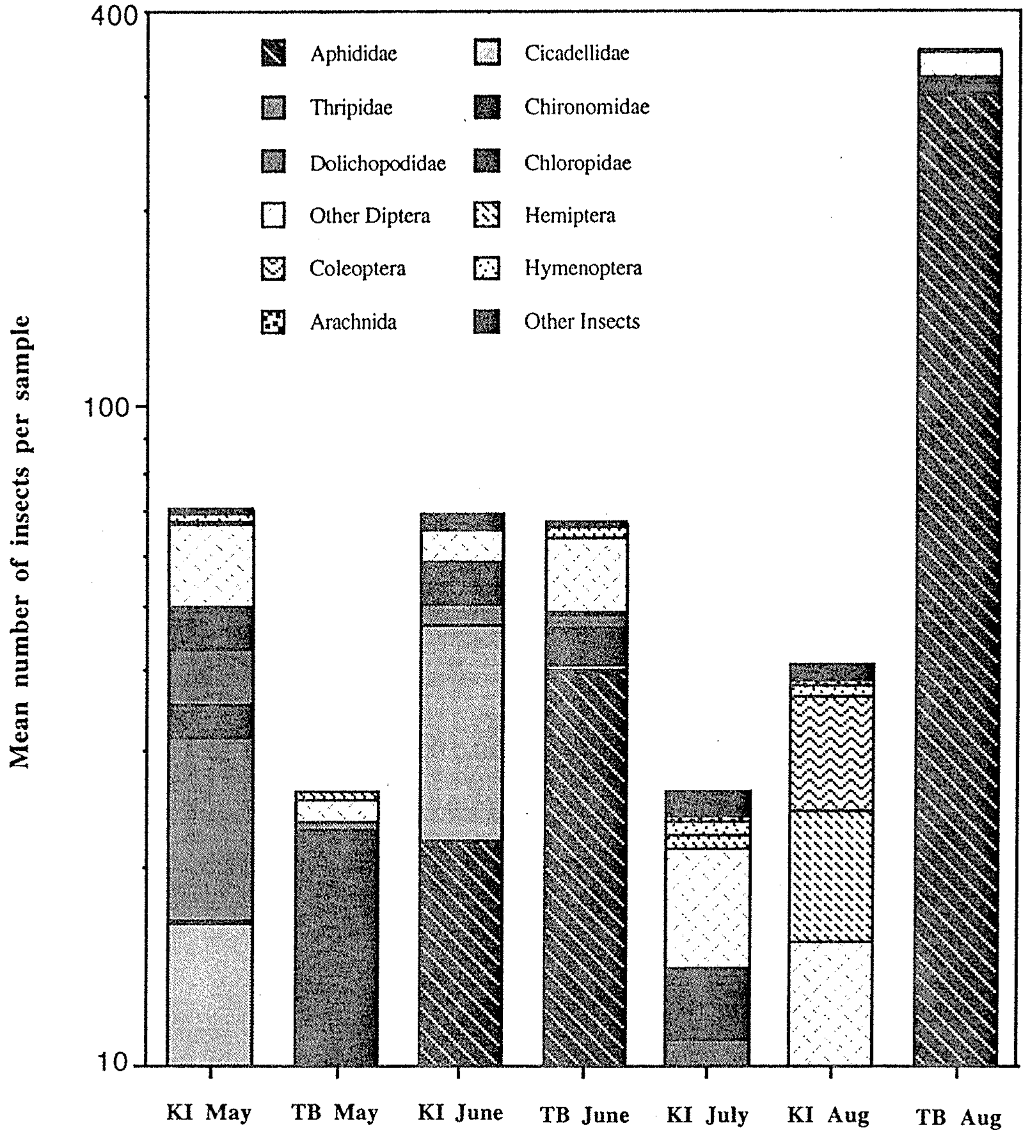

Figure 9. Mean number (n = 5) of insect taxa from vegetation sweep net samples at two sites in the Duwamish River estuary, May-August, 1993.

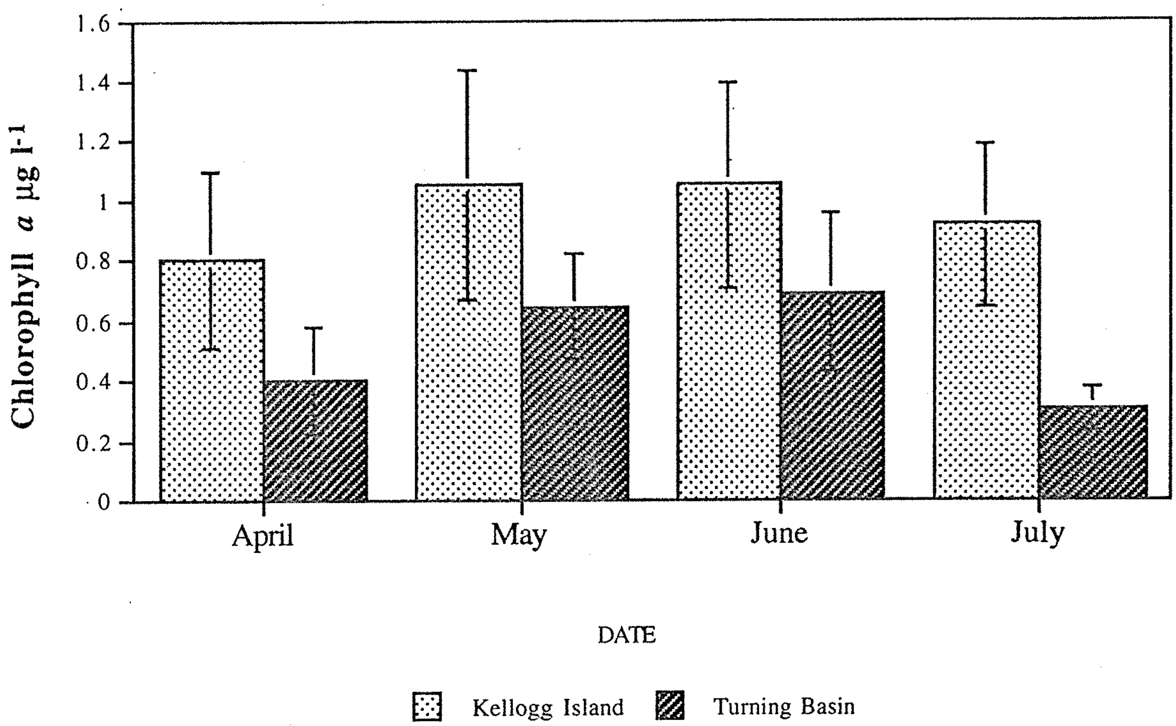

Figure 10. Chlorophyll a concentration at two sites and four dates in the Duwamish River estuary, April-July, 1993.

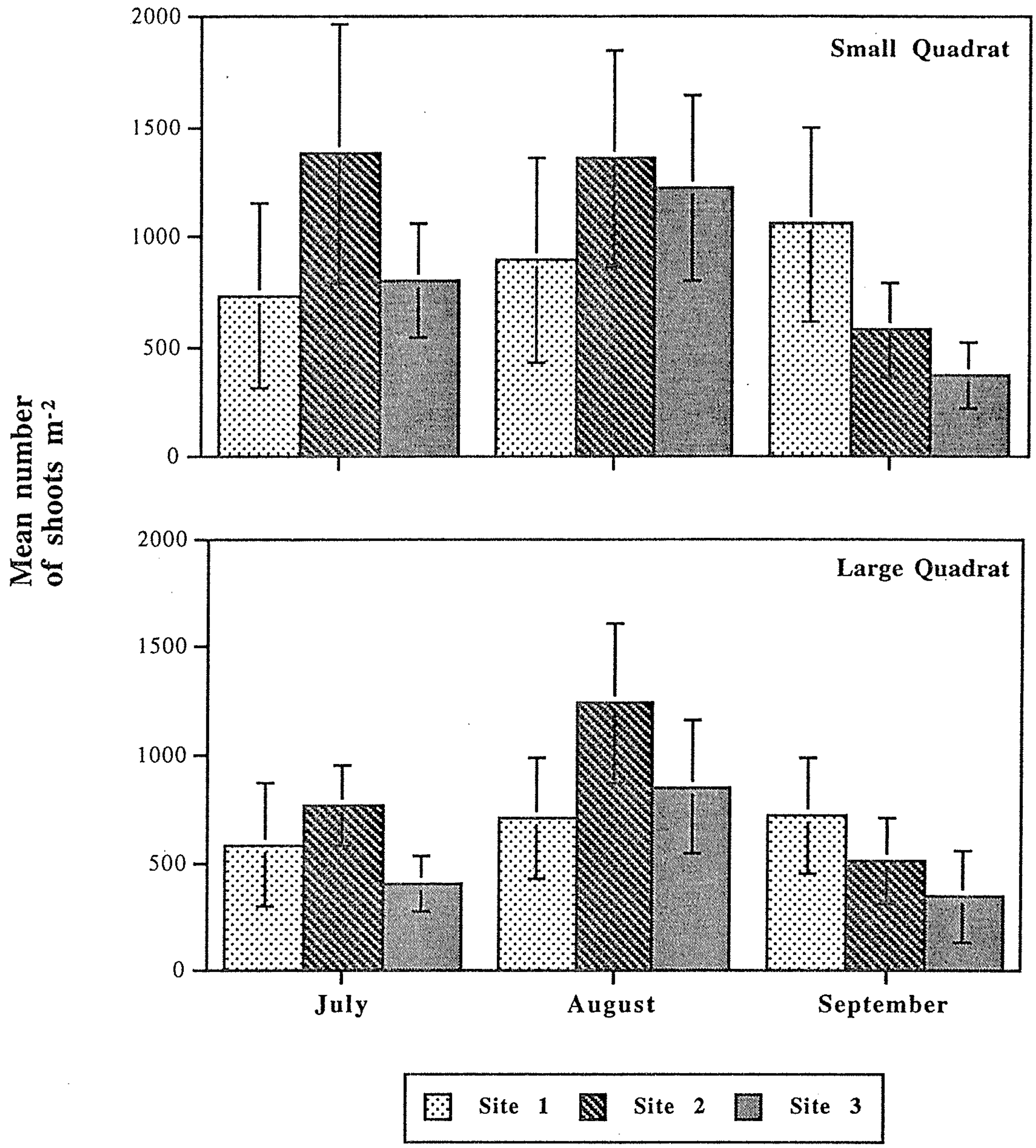

Figure 11. Comparison of shoot density of *Carex lyngbyei* from two quadrat sizes at three sites in the Duwamish River estuary, July-September, 1993.

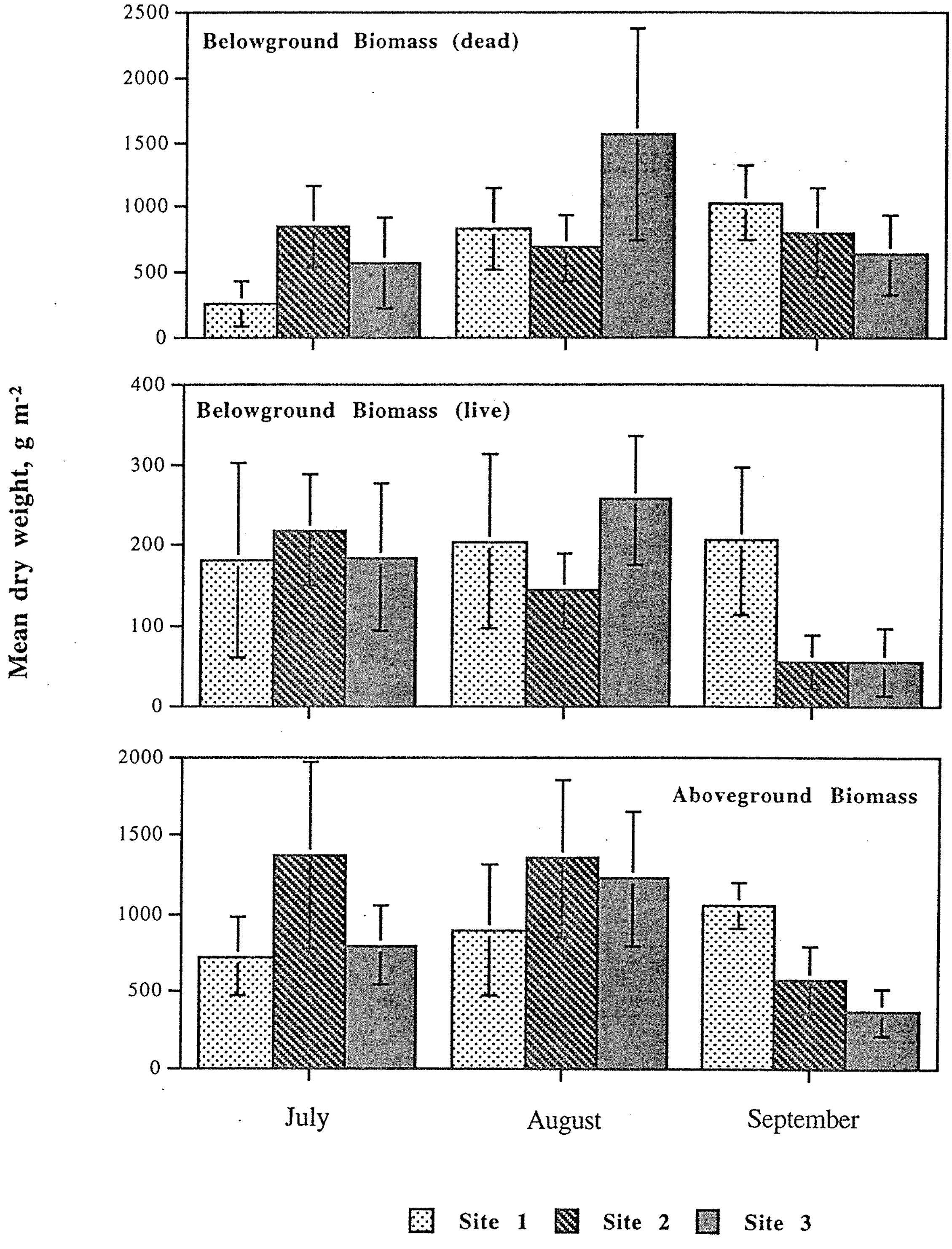

Figure 12. Measures of standing crop of *Carex lyngbyei* at three sites and dates in the Duwamish River estuary, July-September, 1993.

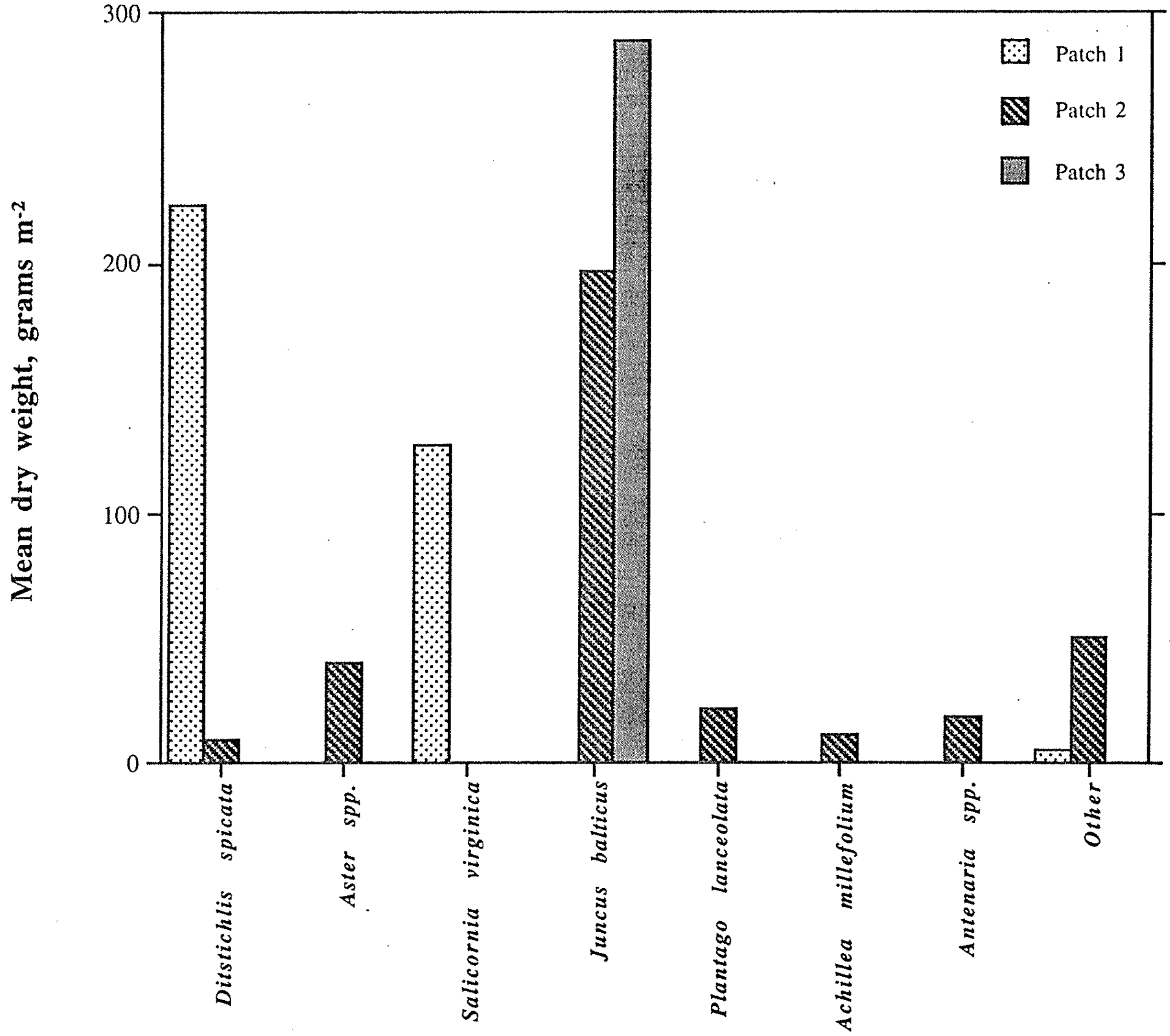

Figure 13. Distribution of plant species by dry weight in three patches at Kellogg Island, Duwamish River estuary.

TABLES

Table 1. Methods used for Duwamish River invertebrate monitoring, 1993. * indicates samples collected but not analyzed. TB = Turning Basin, KI = Kellogg Island.

Sampling	April	May	June	July	August
Comparison of large and small infauna cores (0.5 mm) (TB, KI)	X				
Infauna samples (0.5mm) (TB, KI)	X	X	X	X	X*
Meiofauna (0.130 mm): comparison of wet core, dry core, epi-pump (KI)					X
Comparison of meiofauna cores at three tide levels (KI)					X
Insect sweeps, *Juncus*		X	X	X	X
Insect sweeps, *Carex* (TB)		X	X		X
Insect cores, high intertidal (KI, TB)		X	X*	X*	X*
Benthic microalgae	X	X	X	X	X
Sediment grain size		X			X

Table 2. Prominent invertebrate species from 1993 sampling of Duwamish restoration sites at Turning Basin and Kellogg Island, Duwamish River estuary, Washington.

Taxa which occur in Estuarine Habitat Assessment Protocol as prey attributes

Polychaete Worms

Abarenicola sp., *Capitella* sp., *Hobsonia florida, Manayunkia aesturina*

Oligochaete Worms

Unidentified Oligochaeta

Bivalves

Macoma spp.

Cumaceans

Cumella vulgaris

Gammarid Amphipods

Corophium (*salmonis, spincorne, insidiosum*)

Eogammarus confervicolus

Harpacticoid Copepods

Harpacticus spp.

Tisbe spp.

Insects

Chironomidae, larvae

Taxa not in the Estuarine Habitat Assessment Protocol, but subsequently hypothesized or shown to be prey attributes

Polychaete Worms

Pseudopolydora kempi japonica, Polydora cornuta, Pygospio elegans

Cumaceans

Leucon sp.

Harpacticoid Copepods

Leimia vaga, Microarthridion littorale, Tachidius triangularis

Table 3. Comparison of small core (0.0004 m^2) and large core (0.0024 m^2) for selected taxa at Turning Basin, Duwamish River, Washington, 27 April 1993. * indicates significant difference at $\alpha = 0.05$. n = refers to number of samples required to detect a 50% difference in mean at $\alpha = 0.1$.

Taxon/Group	Mean	SD	p-value	1-ß	n =
All organisms					
Small Core	73333	18278	0.0007*	0.999	6
Large Core	113222	33787		0.998	8
Polychaeta					
Small Core	4000	2138	0.353	0.804	21
Large Core	4444	2169		0.863	18
Spionidae					
Small Core	533	915	0.259	0.201	203
Large Core	833	610		0.572	38
Manayunkia aesturina					
Small Core	1733	1668	0.930	0.400	65
Large Core	1694	1073		0.679	29
Oligochaeta					
Small Core	11333	5273	0.427	0.999	16
Large Core	12778	5237		0.947	13
Nematoda					
Small Core	24267	10222	0.00009*	0.936	14
Large Core	50083	20162		0.953	13
Leimia vaga					
Small Core	10400	7529	0.145	0.580	37
Large Core	15105	11629		0.536	42
Corophium spp.					
Small Core	8857	3739	0.022*	0.936	14
Large Core	12639	3057		0.999	6

Table 4. Comparison of small core (0.0004 m^2) and large core (0.0024 m^2) for selected taxa at Kellogg Island, Duwamish River, Washington, 27 April 1993. * indicates significant difference at $\alpha = 0.05$. n = refers to number of samples required to detect a 50% difference in mean at $\alpha = 0.1$.

Taxon/Group	Mean	SD	p-value	1-ß	n =
All organisms					
Small Core	321571	102204	0.119	0.992	8
Large Core	395639	137986		0.980	10
Polychaeta					
Small Core	57571	44022	0.513	0.516	42
Large Core	51388	16246		0.992	8
Spionidae					
Small Core	6857	5855	0.797	0.447	51
Large Core	7359	7706		0.341	77
Manayunkia aesturina					
Small Core	39857	42168	0.362	0.337	78
Large Core	29622	8734		0.997	8
Oligochaeta					
Small Core	123714	47060	0.450	0.959	11
Large Core	140065	51041		0.971	11
Nematoda					
Small Core	57714	36735	0.0023*	0.648	29
Large Core	107207	60626		0.737	23
Leima vaga					
Small Core	46143	30336	0.517	0.624	31
Large Core	54919	46535		0.451	51
Corophium spp.					
Small Core	4615	3776	0.825	0.473	47
Large Core	3956	4141		0.342	77

Table 5. Summary of grain size analysis from three sites in the Duwamish River estuary. KI = Kellogg Island site; TB = Turning Basin site.

Grain size by site	Percent by size class					
	TB mudflat		TB sedges		KI mudflat	
Phi	Mean	SDev	MEAN	SDev	Mean	SDev 0.
2 mm	0.02	0.04	0.44	0.34	0.51	0.29
1 mm	0.13	0.09	1.86	0.46	2.09	0.71
.5 mm	0.84	0.18	5.81	1.43	3.16	0.67
.25 mm	7.99	3.63	19.30	5.35	13.82	4.61
.125 mm	25.19	10.85	29.50	3.39	23.29	6.90
.063 mm	31.03	6.81	21.89	2.62	22.39	3.33
fines	34.81	13.03	21.21	6.97	34.75	6.97

Mean grain size						
	TB mudflat		TB sedges		KI mudflat	
	MEAN	SDEV	MEAN	SDEV	MEAN	SDEV
	0.21	0.04	0.35	0.05	0.29	0.02

APPENDICES

APPENDIX 1: SURVEY DATA

The following survey data were supplied by Mr. George Blomberg, Port of Seattle. All measurements are +/- 0.1 foot.

Mudflat Benthic Replicates

Kellogg Island		Turning Basin	
Replicate	Elevation (ft)	Replicate	Elevation
North end marker	+0.1	North end marker	+0.6
1	+0.1	1	+0.5
2	0.0	2	+0.6
3	+0.1	3	+0.5
4	0.0	4	+0.6
5	+0.1	5	+0.5
6	+0.3	6	+0.6
7	+0.3	7	+0.3
8	+0.3	8	+0.3
9	+0.3	9	+0.2
10	+0.3	10	+0.2
11	+0.3	11	+0.3
12	+0.3	12	+0.3
13	+0.2	13	+0.3
14	+0.4	14	+0.3
15	+0.2	14	+0.2

Emergent Vegetation Sampling Sites

Site	**Elevation range** (ft)	**Mean elevation**
Site1	8.0 to 9.7	8.8
Site2	6.7 to 7.6	7.15
Site 3	5.2 to 5.9	5.6
Kellogg Island patch 1	11.7 to 11.9	11.8
Kellogg Island patch 2	12.1 to 12.2	12.1
Kellogg Island patch 3	10.6 to 11.7	11.3
Scirpus bench north of KI		Approximately 12.0

APPENDIX 2: SUMMARY DATA FROM TWO BENTHIC INFAUNA CORE SAMPLERS AT TWO SITES IN THE DUWAMISH RIVER ESTUARY, 27 APRIL 1993

Summary of replicates I1 - I15 from 0.0024 m^2 core

Summary of replicates M1 - M15 from 0.0004 m^2 core

Station # 10070 = Kellogg Island Mudflat

Station # 10075 = Turning Basin Mudflat

BENTHIC PLANKTON ANALYSIS
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SUMMARY TABLE, PAGE 1

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* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AP27	10070	I 1
93AP27	10070	I 2
93AP27	10070	I 3
93AP27	10070	I 4
93AP27	10070	I 5
93AP27	10070	I 6
93AP27	10070	I 7
93AP27	10070	I 8
93AP27	10070	I 9
93AP27	10070	I10
93AP27	10070	I11
93AP27	10070	I12
93AP27	10070	I13
93AP27	10070	I14
93AP27	10070	I15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	405981.40	99999.00- 737083.30	138868.50	.34
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Rhizopodea-foraminiferida	C	8223.1	548.2	2222.2 - 3333.3	1154.4	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Cnidaria	C	6666.7	444.4	6666.7 - 6666.7	1721.3	.000	.000	.000 - .000	.00	.0000	.0000	.11	.00
Hydrozoa	C	13778.6	918.6	2667.5 - 6666.7	2046.9	.000	.000	.000 - .000	.00	.0000	.0000	.23	.00

BENTHIC PLANKTON ANALYSIS
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SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Hydroida	C	8750.0	583.3	416.7 - 6666.7	1738.1	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Anthozoa	C	2667.5	177.8	2667.5 - 2667.5	688.8	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Turbellaria	C	30306.4	2020.4	416.7 - 6666.7	1959.8	.000	.000	.000 - .000	.00	.0000	.0000	.50	.00
Nemertea	C	833.3	55.6	833.3 - 833.3	215.2	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Nematoda	C	********	103465.3	30416.7 - 260000.0	57545.1	.000	.000	.000 - .000	.00	.0000	.0000	25.49	.00
Polychaeta	7	1666.7	111.1	1666.7 - 1666.7	430.3	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Eteone sp.	C	2665.8	177.7	2665.8 - 2665.8	688.3	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Gyptis sp.	C	416.7	27.8	416.7 - 416.7	107.6	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Glycera sp.	C	416.7	27.8	416.7 - 416.7	107.6	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Glycera sp.	C	416.7	27.8	416.7 - 416.7	107.6	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Spionidae	7	23333.3	1555.6	5000.0 - 18333.3	4816.7	.000	.000	.000 - .000	.00	.0000	.0000	.38	.00
Polydora cornuta	C8	15280.7	1018.7	416.4 - 3055.6	1032.2	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00
Pseudopolydora kempi japonica	C	8499.1	566.6	416.7 - 2665.8	926.3	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Pygospio elegans	C	57307.6	3820.5	1666.7 - 20833.3	6088.8	.000	.000	.000 - .000	.00	.0000	.0000	.94	.00
Capitella sp.	C	184749.1	12316.6	3333.3 - 30000.0	8704.9	.000	.000	.000 - .000	.00	.0000	.0000	3.03	.00
Abarenicola sp.	C7	23806.2	1587.1	416.7 - 10000.0	2809.2	.000	.000	.000 - .000	.00	.0000	.0000	.39	.00
Hobsonia florida	C8	22007.7	1467.2	416.4 - 7500.0	1886.1	.000	.000	.000 - .000	.00	.0000	.0000	.36	.00
Manayunkia aestuarina	8C	441366.2	29424.4	16666.7 - 46666.7	8451.2	.000	.000	.000 - .000	.00	.0000	.0000	7.25	.00
Oligochaeta	C	********	145301.8	86800.0 - 241666.7	53206.8	.000	.000	.000 - .000	.00	.0000	.0000	35.79	.00
Macoma sp.	7	416.7	27.8	416.7 - 416.7	107.6	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Macoma nasuta	C	416.4	27.8	416.4 - 416.4	107.5	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Macoma inquinata	C	1245.5	83.0	412.2 - 416.7	171.9	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Podocopida	C	4332.5	288.8	1666.7 - 2665.8	785.3	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Harpacticus sp.-uniremis group	AF	8333.3	555.6	1666.7 - 6666.7	1744.2	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Microarthridion littorale		6666.7	444.4	6666.7 -	1721.3	.000	.000	.000 -	.00	.0000	.0000	.11	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 3

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	ABUN-DANCE	BIO-MASS
Heterolaophonte discophora	AC	165622.5	11041.5	2083.3 - 46666.7	12564.6	.000	.000	.000 - .000	.00	.0000	.0000	2.72	.00
Cletodidae	8	2222.2	148.1	2222.2 - 2222.2	573.8	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Huntemannia jadensis	A8	13295.6	886.4	416.7 - 6666.7	1855.3	.000	.000	.000 - .000	.00	.0000	.0000	.22	.00
Leimia vaga	A	924850.6	61656.7	10000.0 - 156666.7	47116.2	.000	.000	.000 - .000	.00	.0000	.0000	15.19	.00
Schizopera knabeni	8	3333.3	222.2	3333.3 - 3333.3	860.7	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Stenhelia sp.	8	3333.3	222.2	3333.3 - 3333.3	860.7	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Leucon sp.	78LF	122668.7	8177.9	416.7 - 20000.0	6068.8	.000	.000	.000 - .000	.00	.0000	.0000	2.01	.00
Cumella sp.	8	1666.7	111.1	1666.7 - 1666.7	430.3	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Cumella vulgaris	87L	161282.0	10752.1	1250.0 - 40000.0	11104.1	.000	.000	.000 - .000	.00	.0000	.0000	2.65	.00
Gnorimosphaeroma oregonensis	8	2222.2	148.1	2222.2 - 2222.2	573.8	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Corophium sp.	7	35194.4	2346.3	416.7 - 11666.7	3320.4	.000	.000	.000 - .000	.00	.0000	.0000	.58	.00
Corophium salmonis	8L	17112.0	1140.8	416.7 - 6111.1	1702.2	.000	.000	.000 - .000	.00	.0000	.0000	.28	.00
Corophium insidiosum	8	3500.6	233.4	833.1 - 2667.5	706.7	.000	.000	.000 - .000	.00	.0000	.0000	.06	.00
Corophium spinicorne	8	3350.0	223.3	433.3 - 1250.0	413.3	.000	.000	.000 - .000	.00	.0000	.0000	.06	.00
Anisogammaridae	7	8665.0	577.7	3333.3 - 5331.6	1570.5	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Eogammarus confervicolus	78L	15327.8	1021.9	416.7 - 9495.6	2576.0	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 44

SHANNON-WEINER DIVERSITY INDEX NUMBERS 2.76
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.76

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AP27	10070	M 1
93AP27	10070	M 2
93AP27	10070	M 3
93AP27	10070	M 4
93AP27	10070	M 5
93AP27	10070	M 6
93AP27	10070	M 7
93AP27	10070	M 8
93AP27	10070	M 9
93AP27	10070	M10
93AP27	10070	M11
93AP27	10070	M13
93AP27	10070	M14
93AP27	10070	M15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.000	.000- .000	.000	.001
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	401964.30	99999.00- 667500.00	127754.90	.32
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Rhizopodea-foraminiferida	C	17500.0	1250.0	2500.0 - 7500.0	2729.8	.000	.000	.000 - .000	.00	.0000	.0000	.31	.00
Hydroida	C	37500.0	2678.6	2500.0 - 15000.0	4097.9	.000	.000	.000 - .000	.00	.0000	.0000	.67	.00
Anthozoa	C	7500.0	535.7	2500.0 - 5000.0	1447.3	.000	.000	.000 - .000	.00	.0000	.0000	.13	.00
Turbellaria	C	52500.0	3750.0	2500.0 - 15000.0	5071.6	.000	.000	.000 - .000	.00	.0000	.0000	.93	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Nematoda	C	********	72142.9	17500.0 - 177500.0	45918.6	.000	.000	.000 - .000	.00	.0000	.0000	17.95	.00
Polychaeta	C	7500.0	535.7	7500.0 - 7500.0	2004.5	.000	.000	.000 - .000	.00	.0000	.0000	.13	.00
Spionidae	7	2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Polydora cornuta	C	22500.0	1607.1	2500.0 - 5000.0	1862.4	.000	.000	.000 - .000	.00	.0000	.0000	.40	.00
Pseudopolydora kempi japonica	C	22500.0	1607.1	2500.0 - 7500.0	2520.5	.000	.000	.000 - .000	.00	.0000	.0000	.40	.00
Pygospio elegans	C	70000.0	5000.0	2500.0 - 17500.0	5188.7	.000	.000	.000 - .000	.00	.0000	.0000	1.24	.00
Spionidae	C	2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Capitella sp.	C	137500.0	9821.4	2500.0 - 27500.0	8347.3	.000	.000	.000 - .000	.00	.0000	.0000	2.44	.00
Abarenicola sp.	C	30000.0	2142.9	2500.0 - 12500.0	3650.2	.000	.000	.000 - .000	.00	.0000	.0000	.53	.00
Hobsonia florida	C	12500.0	892.9	2500.0 - 5000.0	1862.4	.000	.000	.000 - .000	.00	.0000	.0000	.22	.00
Manayunkia aestuarina	CA	697500.0	49821.4	15000.0 - 205000.0	52709.9	.000	.000	.000 - .000	.00	.0000	.0000	12.39	.00
Polychaeta	7	2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Oligochaeta	C	********	154642.9	87500.0 - 290000.0	58825.5	.000	.000	.000 - .000	.00	.0000	.0000	38.47	.00
Halacaridae	C	10000.0	714.3	2500.0 - 5000.0	1528.1	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Podocopida	C	2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Scottolana canadensis	L	2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Ectinosomatidae	LA8	10000.0	714.3	2500.0 - 5000.0	1528.1	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Harpacticus sp.-uniremis group	F	2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Microarthridion littorale	8	2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Heterolaophonte discophora	A	77500.0	5535.7	2500.0 - 17500.0	5386.8	.000	.000	.000 - .000	.00	.0000	.0000	1.38	.00
Huntemannia jadensis	A8	45000.0	3214.3	2500.0 - 12500.0	3724.7	.000	.000	.000 - .000	.00	.0000	.0000	.80	.00
Leimia vaga	A	807500.0	57678.6	17500.0 - 140000.0	37920.3	.000	.000	.000 - .000	.00	.0000	.0000	14.35	.00
Schizopera knabeni	8	2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Stenhelia sp.	L	2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Leucon sp.	87L	137500.0	9821.4	2500.0 - 17500.0	5044.4	.000	.000	.000 - .000	.00	.0000	.0000	2.44	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Cumella vulgaris 87L		150000.0	10714.3	2500.0 - 42500.0	12146.1	.000	.000	.000 - .000	.00	.0000	.0000	2.67	.00
Corophium sp. 7		47500.0	3392.9	2500.0 - 17500.0	5058.0	.000	.000	.000 - .000	.00	.0000	.0000	.84	.00
Corophium salmonis 8		17500.0	1250.0	2500.0 - 5000.0	1626.1	.000	.000	.000 - .000	.00	.0000	.0000	.31	.00
Corophium insidiosum 8		2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Corophium spinicorne 8		7500.0	535.7	2500.0 - 2500.0	1064.5	.000	.000	.000 - .000	.00	.0000	.0000	.13	.00
Anisogammaridae 7		2500.0	178.6	2500.0 - 2500.0	668.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 35

SHANNON-WEINER DIVERSITY INDEX NUMBERS 2.84
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.84

BENTHIC PLANKTON ANALYSIS

SUMMARY TABLE, PAGE 1

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****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AP27	10075	I 1
93AP27	10075	I 2
93AP27	10075	I 3
93AP27	10075	I 4
93AP27	10075	I 5
93AP27	10075	I 6
93AP27	10075	I 7
93AP27	10075	I 8
93AP27	10075	I 9
93AP27	10075	I10
93AP27	10075	I11
93AP27	10075	I12
93AP27	10075	I13
93AP27	10075	I14
93AP27	10075	I15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	118144.90	73043.47- 205652.20	35256.27	.30
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
												ABUN-	BIO-
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	DANCE	MASS
Turbellaria	C	37826.1	2521.7	434.8 - 7826.1	2248.4	.000	.000	.000 - .000	.00	.0000	.0000	2.13	.00
Nematoda	C	783912.9	52260.9	29130.4 - 101739.1	21038.5	.000	.000	.000 - .000	.00	.0000	.0000	44.23	.00
Nereis sp.	C	5217.4	347.8	434.8 - 1739.1	498.4	.000	.000	.000 - .000	.00	.0000	.0000	.29	.00

BENTHIC PLANKTON ANALYSIS
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SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Pseudopolydora kempi japonica	C	13043.5	869.6	434.8 - 2173.9	636.5	.000	.000	.000 - .000	.00	.0000	.0000	.74	.00
Hobsonia florida	C	20869.6	1391.3	434.8 - 3913.0	1175.9	.000	.000	.000 - .000	.00	.0000	.0000	1.18	.00
Manayunkia aestuarina	C	26521.7	1768.1	434.8 - 3913.0	1120.2	.000	.000	.000 - .000	.00	.0000	.0000	1.50	.00
Oligochaeta	CA	200000.0	13333.3	7826.1 - 26087.0	5464.3	.000	.000	.000 - .000	.00	.0000	.0000	11.29	.00
Acarina	C	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Podocopida	C	11739.1	782.6	434.8 - 1739.1	524.8	.000	.000	.000 - .000	.00	.0000	.0000	.66	.00
Scottolana canadensis	8A	53913.0	3594.2	2173.9 - 6087.0	1245.8	.000	.000	.000 - .000	.00	.0000	.0000	3.04	.00
Pseudobradya sp.	A	1304.3	87.0	434.8 - 869.6	243.7	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Microarthridion littorale	8	1304.3	87.0	434.8 - 434.8	180.0	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Nitocra sp.	8A	32608.7	2173.9	869.6 - 4782.6	1746.9	.000	.000	.000 - .000	.00	.0000	.0000	1.84	.00
Huntemannia jadensis	A	118695.6	7913.0	2608.7 - 13913.0	3574.7	.000	.000	.000 - .000	.00	.0000	.0000	6.70	.00
Leimia vaga	A	251304.3	16753.6	6087.0 - 47826.1	11490.2	.000	.000	.000 - .000	.00	.0000	.0000	14.18	.00
Leucon sp.	87	8695.7	579.7	434.8 - 2173.9	607.5	.000	.000	.000 - .000	.00	.0000	.0000	.49	.00
Cumella vulgaris	78	2173.9	144.9	434.8 - 1304.3	355.0	.000	.000	.000 - .000	.00	.0000	.0000	.12	.00
Tanais sp.	8	869.6	58.0	434.8 - 434.8	153.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Corophium sp.	7	9565.2	637.7	434.8 - 2608.7	867.5	.000	.000	.000 - .000	.00	.0000	.0000	.54	.00
Corophium sp.	8	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Corophium salmonis	87	183913.0	12260.9	7826.1 - 19130.4	2958.9	.000	.000	.000 - .000	.00	.0000	.0000	10.38	.00
Corophium spinicorne	8	3913.0	260.9	434.8 - 1304.3	395.8	.000	.000	.000 - .000	.00	.0000	.0000	.22	.00
Gammaridae	7	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Anisogammarus sp.	7	869.6	58.0	434.8 - 434.8	153.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Eogammarus confervicolus	7	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Diptera	G	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Ceratopogonidae	6	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Diptera-chironomidae	6	1304.3	87.0	434.8 - 434.8	180.0	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 28

SHANNON-WEINER DIVERSITY INDEX	NUMBERS	2.71
	BIOMASS	.00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS		2.71

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AP27	10075	M1
93AP27	10075	M2
93AP27	10075	M3
93AP27	10075	M4
93AP27	10075	M5
93AP27	10075	M6
93AP27	10075	M7
93AP27	10075	M8
93AP27	10075	M9
93AP27	10075	M10
93AP27	10075	M11
93AP27	10075	M12
93AP27	10075	M13
93AP27	10075	M14
93AP27	10075	M15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.000	.000- .000	.000	.001
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	91666.66	50000.00- 125000.00	22847.88	.25
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Hydroida	C	2500.0	166.7	2500.0 - 2500.0	645.5	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Turbellaria	C	117500.0	7833.3	2500.0 - 30000.0	7371.9	.000	.000	.000 - .000	.00	.0000	.0000	8.55	.00
Nematoda	C	455000.0	30333.3	10000.0 - 55000.0	12777.9	.000	.000	.000 - .000	.00	.0000	.0000	33.09	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	ABUN-DANCE	BIO-MASS
Nereis sp.	C	10000.0	666.7	2500.0 - 5000.0	1484.0	.000	.000	.000 - .000	.00	.0000	.0000	.73	.00
Pseudopolydora kempi japonica	C	10000.0	666.7	2500.0 - 2500.0	1144.3	.000	.000	.000 - .000	.00	.0000	.0000	.73	.00
Hobsonia florida	C	22500.0	1500.0	2500.0 - 5000.0	1581.1	.000	.000	.000 - .000	.00	.0000	.0000	1.64	.00
Manayunkia aestuarina	C	32500.0	2166.7	2500.0 - 5000.0	2084.5	.000	.000	.000 - .000	.00	.0000	.0000	2.36	.00
Oligochaeta	C	212500.0	14166.7	2500.0 - 27500.0	6591.8	.000	.000	.000 - .000	.00	.0000	.0000	15.45	.00
Podocopida	C	7500.0	500.0	2500.0 - 2500.0	1035.1	.000	.000	.000 - .000	.00	.0000	.0000	.55	.00
Scottolana canadensis	8	30000.0	2000.0	2500.0 - 7500.0	2352.8	.000	.000	.000 - .000	.00	.0000	.0000	2.18	.00
Tisbidae	8	5000.0	333.3	2500.0 - 2500.0	879.7	.000	.000	.000 - .000	.00	.0000	.0000	.36	.00
Huntemannia jadensis	A	90000.0	6000.0	2500.0 - 22500.0	5158.2	.000	.000	.000 - .000	.00	.0000	.0000	6.55	.00
Leimia vaga	A	195000.0	13000.0	2500.0 - 32500.0	9411.2	.000	.000	.000 - .000	.00	.0000	.0000	14.18	.00
Schizopera knabeni	8	2500.0	166.7	2500.0 - 2500.0	645.5	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Leucon sp.	7	5000.0	333.3	2500.0 - 2500.0	879.7	.000	.000	.000 - .000	.00	.0000	.0000	.36	.00
Cumella vulgaris	7	2500.0	166.7	2500.0 - 2500.0	645.5	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Tanais sp.	7	2500.0	166.7	2500.0 - 2500.0	645.5	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Corophium sp.	7	7500.0	500.0	2500.0 - 2500.0	1035.1	.000	.000	.000 - .000	.00	.0000	.0000	.55	.00
Corophium salmonis	87	145000.0	9666.7	2500.0 - 15000.0	3994.0	.000	.000	.000 - .000	.00	.0000	.0000	10.55	.00
Corophium spinicorne	87	10000.0	666.7	2500.0 - 5000.0	1484.0	.000	.000	.000 - .000	.00	.0000	.0000	.73	.00
Eogammarus confervicolus	7	2500.0	166.7	2500.0 - 2500.0	645.5	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Collembola	C	2500.0	166.7	2500.0 - 2500.0	645.5	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Ceratopogonidae	6	2500.0	166.7	2500.0 - 2500.0	645.5	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Diptera-chironomidae	6	2500.0	166.7	2500.0 - 2500.0	645.5	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 24

SHANNON-WEINER DIVERSITY INDEX NUMBERS 3.02
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 3.02

APPENDIX 3: MONTHLY BENTHIC INFAUNA SUMMARY DATA FROM TWO SITES IN THE DUWAMISH RIVER ESTUARY, APRIL THROUGH JULY 1993

Station Number 10070 = Kellogg Island Mudflat Reference Site

Station Number 10075 = Turning Basin Mudflat Reference Site

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* GRAND SUMMARY *

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FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AP27	10070	I 1
93AP27	10070	I 2
93AP27	10070	I 3
93AP27	10070	I 4
93AP27	10070	I 5
93AP27	10070	I 6
93AP27	10070	I 7
93AP27	10070	I 8
93AP27	10070	I 9
93AP27	10070	I10
93AP27	10070	I11
93AP27	10070	I12
93AP27	10070	I13
93AP27	10070	I14
93AP27	10070	I15

SPECIES DEFINITION -
  TRUNCATED = NO
  LH-STAGE = EGGORNOT
  PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	405981.40	99999.00- 737083.30	138868.50	.34
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	ABUN-DANCE	BIO-MASS
Rhizopodea-foraminiferida	C	8223.1	548.2	2222.2 - 3333.3	1154.4	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Cnidaria	C	6666.7	444.4	6666.7 - 6666.7	1721.3	.000	.000	.000 - .000	.00	.0000	.0000	.11	.00
Hydrozoa	C	13778.6	918.6	2667.5 - 6666.7	2046.9	.000	.000	.000 - .000	.00	.0000	.0000	.23	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Hydroida	C	8750.0	583.3	416.7 - 6666.7	1738.1	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Anthozoa	C	2667.5	177.8	2667.5 - 2667.5	688.8	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Turbellaria	C	30306.4	2020.4	416.7 - 6666.7	1959.8	.000	.000	.000 - .000	.00	.0000	.0000	.50	.00
Nemertea	C	833.3	55.6	833.3 - 833.3	215.2	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Nematoda	C	********	103465.3	30416.7 - 260000.0	57545.1	.000	.000	.000 - .000	.00	.0000	.0000	25.49	.00
Polychaeta	7	1666.7	111.1	1666.7 - 1666.7	430.3	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Eteone sp.	C	2665.8	177.7	2665.8 - 2665.8	688.3	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Gyptis sp.	C	416.7	27.8	416.7 - 416.7	107.6	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Glycera sp.	C	416.7	27.8	416.7 - 416.7	107.6	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Glycera sp.	C	416.7	27.8	416.7 - 416.7	107.6	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Spionidae	7	23333.3	1555.6	5000.0 - 18333.3	4816.7	.000	.000	.000 - .000	.00	.0000	.0000	.38	.00
Polydora cornuta	C8	15280.7	1018.7	416.4 - 3055.6	1032.2	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00
Pseudopolydora kempi japonica	C	8499.1	566.6	416.7 - 2665.8	926.3	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Pygospio elegans	C	57307.6	3820.5	1666.7 - 20833.3	6088.8	.000	.000	.000 - .000	.00	.0000	.0000	.94	.00
Capitella sp.	C	184749.1	12316.6	3333.3 - 30000.0	8704.9	.000	.000	.000 - .000	.00	.0000	.0000	3.03	.00
Abarenicola sp.	C7	23806.2	1587.1	416.7 - 10000.0	2809.2	.000	.000	.000 - .000	.00	.0000	.0000	.39	.00
Hobsonia florida	C8	22007.7	1467.2	416.4 - 7500.0	1886.1	.000	.000	.000 - .000	.00	.0000	.0000	.36	.00
Manayunkia aestuarina	8C	441366.2	29424.4	16666.7 - 46666.7	8451.2	.000	.000	.000 - .000	.00	.0000	.0000	7.25	.00
Oligochaeta	C	********	145301.8	86800.0 - 241666.7	53206.8	.000	.000	.000 - .000	.00	.0000	.0000	35.79	.00
Macoma sp.	7	416.7	27.8	416.7 - 416.7	107.6	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Macoma nasuta	C	416.4	27.8	416.4 - 416.4	107.5	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Macoma inquinata	C	1245.5	83.0	412.2 - 416.7	171.9	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Podocopida	C	4332.5	288.8	1666.7 - 2665.8	785.3	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Harpacticus sp.-uniremis group	AF	8333.3	555.6	1666.7 - 6666.7	1744.2	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Microarthridion littorale	8	6666.7	444.4	6666.7 - 6666.7	1721.3	.000	.000	.000 - .000	.00	.0000	.0000	.11	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Heterolaophonte discophora	AC	165622.5	11041.5	2083.3 - 46666.7	12564.6	.000	.000	.000 - .000	.00	.0000	.0000	2.72	.00
Cletodidae	8	2222.2	148.1	2222.2 - 2222.2	573.8	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Huntemannia jadensis	A8	13295.6	886.4	416.7 - 6666.7	1855.3	.000	.000	.000 - .000	.00	.0000	.0000	.22	.00
Leimia vaga	A	924850.6	61656.7	10000.0 - 156666.7	47116.2	.000	.000	.000 - .000	.00	.0000	.0000	15.19	.00
Schizopera knabeni	8	3333.3	222.2	3333.3 - 3333.3	860.7	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Stenhelia sp.	8	3333.3	222.2	3333.3 - 3333.3	860.7	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Leucon sp.	78LF	122668.7	8177.9	416.7 - 20000.0	6068.8	.000	.000	.000 - .000	.00	.0000	.0000	2.01	.00
Cumella sp.	8	1666.7	111.1	1666.7 - 1666.7	430.3	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Cumella vulgaris	87L	161282.0	10752.1	1250.0 - 40000.0	11104.1	.000	.000	.000 - .000	.00	.0000	.0000	2.65	.00
Gnorimosphaeroma oregonensis	8	2222.2	148.1	2222.2 - 2222.2	573.8	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Corophium sp.	7	35194.4	2346.3	416.7 - 11666.7	3320.4	.000	.000	.000 - .000	.00	.0000	.0000	.58	.00
Corophium salmonis	8L	17112.0	1140.8	416.7 - 6111.1	1702.2	.000	.000	.000 - .000	.00	.0000	.0000	.28	.00
Corophium insidiosum	8	3500.6	233.4	833.1 - 2667.5	706.7	.000	.000	.000 - .000	.00	.0000	.0000	.06	.00
Corophium spinicorne	8	3350.0	223.3	433.3 - 1250.0	413.3	.000	.000	.000 - .000	.00	.0000	.0000	.06	.00
Anisogammaridae	7	8665.0	577.7	3333.3 - 5331.6	1570.5	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Eogammarus confervicolus	78L	15327.8	1021.9	416.7 - 9495.6	2576.0	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 44

SHANNON-WEINER DIVERSITY INDEX NUMBERS 2.76
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.76

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AP27	10075	I 1
93AP27	10075	I 2
93AP27	10075	I 3
93AP27	10075	I 4
93AP27	10075	I 5
93AP27	10075	I 6
93AP27	10075	I 7
93AP27	10075	I 8
93AP27	10075	I 9
93AP27	10075	I10
93AP27	10075	I11
93AP27	10075	I12
93AP27	10075	I13
93AP27	10075	I14
93AP27	10075	I15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	118144.90	73043.47- 205652.20	35256.27	.30
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Turbellaria	C	37826.1	2521.7	434.8 - 7826.1	2248.4	.000	.000	.000 - .000	.00	.0000	.0000	2.13	.00
Nematoda	C	783912.9	52260.9	29130.4 - 101739.1	21038.5	.000	.000	.000 - .000	.00	.0000	.0000	44.23	.00
Nereis sp.	C	5217.4	347.8	434.8 - 1739.1	498.4	.000	.000	.000 - .000	.00	.0000	.0000	.29	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	NUMBERS/M**2 MEAN	NUMBERS/M**2 RANGE	NUMBERS/M**2 S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	WET WEIGHT,GRAMS/M**2 MEAN	WET WEIGHT,GRAMS/M**2 RANGE	WET WEIGHT,GRAMS/M**2 S.D.	AVG. BIOMASS MEAN	AVG. BIOMASS S.D.	PERCENTAGES ABUN-DANCE	PERCENTAGES BIO-MASS
Pseudopolydora kempi japonica	C	13043.5	869.6	434.8 - 2173.9	636.5	.000	.000	.000 - .000	.00	.0000	.0000	.74	.00
Hobsonia florida	C	20869.6	1391.3	434.8 - 3913.0	1175.9	.000	.000	.000 - .000	.00	.0000	.0000	1.18	.00
Manayunkia aestuarina	C	26521.7	1768.1	434.8 - 3913.0	1120.2	.000	.000	.000 - .000	.00	.0000	.0000	1.50	.00
Oligochaeta	CA	200000.0	13333.3	7826.1 - 26087.0	5464.3	.000	.000	.000 - .000	.00	.0000	.0000	11.29	.00
Acarina	C	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Podocopida	C	11739.1	782.6	434.8 - 1739.1	524.8	.000	.000	.000 - .000	.00	.0000	.0000	.66	.00
Scottolana canadensis	8A	53913.0	3594.2	2173.9 - 6087.0	1245.8	.000	.000	.000 - .000	.00	.0000	.0000	3.04	.00
Pseudobradya sp.	A	1304.3	87.0	434.8 - 869.6	243.7	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Microarthridion littorale	8	1304.3	87.0	434.8 - 434.8	180.0	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Nitocra sp.	8A	32608.7	2173.9	869.6 - 4782.6	1746.9	.000	.000	.000 - .000	.00	.0000	.0000	1.84	.00
Huntemannia jadensis	A	118695.6	7913.0	2608.7 - 13913.0	3574.7	.000	.000	.000 - .000	.00	.0000	.0000	6.70	.00
Leimia vaga	A	251304.3	16753.6	6087.0 - 47826.1	11490.2	.000	.000	.000 - .000	.00	.0000	.0000	14.18	.00
Leucon sp.	87	8695.7	579.7	434.8 - 2173.9	607.5	.000	.000	.000 - .000	.00	.0000	.0000	.49	.00
Cumella vulgaris	78	2173.9	144.9	434.8 - 1304.3	355.0	.000	.000	.000 - .000	.00	.0000	.0000	.12	.00
Tanais sp.	8	869.6	58.0	434.8 - 434.8	153.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Corophium sp.	7	9565.2	637.7	434.8 - 2608.7	867.5	.000	.000	.000 - .000	.00	.0000	.0000	.54	.00
Corophium sp.	8	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Corophium salmonis	87	183913.0	12260.9	7826.1 - 19130.4	2958.9	.000	.000	.000 - .000	.00	.0000	.0000	10.38	.00
Corophium spinicorne	8	3913.0	260.9	434.8 - 1304.3	395.8	.000	.000	.000 - .000	.00	.0000	.0000	.22	.00
Gammaridae	7	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Anisogammarus sp.	7	869.6	58.0	434.8 - 434.8	153.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Eogammarus confervicolus	7	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Diptera	G	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Ceratopogonidae	6	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Diptera-chironomidae	6	1304.3	87.0	434.8 - 434.8	180.0	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 28

SHANNON-WEINER DIVERSITY INDEX	NUMBERS	2.71
	BIOMASS	.00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS		2.71

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:	FILEID	STATION	SAMPLE
	93MY19	10070	I01
	93MY19	10070	I02
	93MY19	10070	I03
	93MY19	10070	I04
	93MY19	10070	I05
	93MY19	10070	I06
	93MY19	10070	I07
	93MY19	10070	I08
	93MY19	10070	I09
	93MY19	10070	I10
	93MY19	10070	I11
	93MY19	10070	I12
	93MY19	10070	I13
	93MY19	10070	I14
	93MY19	10070	I15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	347493.90	99999.00- 598695.60	123282.20	.35
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	ABUN-DANCE	BIO-MASS
Hydrozoa	C	3478.3	231.9	3478.3 - 3478.3	898.1	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Hydroida	C	29565.2	1971.0	434.8 - 13913.0	3750.5	.000	.000	.000 - .000	.00	.0000	.0000	.57	.00
Anthozoa	C	6956.5	463.8	1739.1 - 3478.3	1032.4	.000	.000	.000 - .000	.00	.0000	.0000	.13	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Turbellaria	C	82463.8	5497.6	1739.1 - 17391.3	5347.6	.000	.000	.000 - .000	.00	.0000	.0000	1.58	.00
Nematoda	C	733768.2	48917.9	16521.7 - 115942.0	36854.6	.000	.000	.000 - .000	.00	.0000	.0000	14.08	.00
Polychaeta	7	869.6	58.0	869.6 - 869.6	224.5	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Nereis sp.	C	3913.0	260.9	434.8 - 1739.1	540.1	.000	.000	.000 - .000	.00	.0000	.0000	.08	.00
Spionidae	C7	6087.0	405.8	869.6 - 3478.3	978.7	.000	.000	.000 - .000	.00	.0000	.0000	.12	.00
Polydora cornuta	C	48117.1	3207.8	869.6 - 8695.7	2547.6	.000	.000	.000 - .000	.00	.0000	.0000	.92	.00
Pseudopolydora kempi japonica	C	11739.1	782.6	434.8 - 3043.5	917.9	.000	.000	.000 - .000	.00	.0000	.0000	.23	.00
Pygospio elegans	C	82173.9	5478.3	434.8 - 17391.3	5627.8	.000	.000	.000 - .000	.00	.0000	.0000	1.58	.00
Capitella capitata	C	184347.8	12289.9	3043.5 - 49565.2	12018.2	.000	.000	.000 - .000	.00	.0000	.0000	3.54	.00
Abarenicola sp.	7	16087.0	1072.5	434.8 - 5217.4	1566.5	.000	.000	.000 - .000	.00	.0000	.0000	.31	.00
Hobsonia florida	C	13043.5	869.6	434.8 - 3478.3	972.2	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00
Manayunkia aestuarina	C	401739.1	26782.6	6956.5 - 61739.1	16131.2	.000	.000	.000 - .000	.00	.0000	.0000	7.71	.00
Oligochaeta	C	********	146720.8	88695.6 - 259130.4	49466.7	.000	.000	.000 - .000	.00	.0000	.0000	42.22	.00
Macoma nasuta	C	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Macoma inquinata	C	869.6	58.0	434.8 - 434.8	153.0	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Halacaridae	C	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Podocopida	C	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Eurytemora americana	8	7826.1	521.7	1739.1 - 4347.8	1220.9	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00
Scottolana canadensis	8	6521.7	434.8	1739.1 - 3043.5	944.0	.000	.000	.000 - .000	.00	.0000	.0000	.13	.00
Harpacticus sp.	8	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Harpacticus sp.-uniremis group	FA	3478.3	231.9	1739.1 - 1739.1	611.9	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Laophontidae	8	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Heterolaophonte discophora	A	125217.4	8347.8	434.8 - 28695.7	9884.8	.000	.000	.000 - .000	.00	.0000	.0000	2.40	.00
Nitocra sp.	8	9275.4	618.4	2318.8 - 6956.5	1852.3	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Huntemannia jadensis	A	47971.0	3198.1	434.8 - 17391.3	4810.6	.000	.000	.000 - .000	.00	.0000	.0000	.92	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Leimia vaga	A	271014.5	18067.6	869.6 - 128695.6	31901.4	.000	.000	.000 - .000	.00	.0000	.0000	5.20	.00
Mysidacea-mysida	7	2608.7	173.9	869.6 - 1739.1	487.5	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Leucon sp.	78LA	401450.4	26763.4	2754.8 - 78260.9	21612.2	.000	.000	.000 - .000	.00	.0000	.0000	7.70	.00
Cumella vulgaris	87L	235652.2	15710.1	869.6 - 43913.0	10975.7	.000	.000	.000 - .000	.00	.0000	.0000	4.52	.00
Tanais sp.	7	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Corophiidae	L	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Corophium salmonis	87CL	189130.4	12608.7	2173.9 - 27391.3	7928.9	.000	.000	.000 - .000	.00	.0000	.0000	3.63	.00
Corophium spinicorne	87	3913.0	260.9	434.8 - 1739.1	610.5	.000	.000	.000 - .000	.00	.0000	.0000	.08	.00
Corophiidae	4	24347.8	1623.2	24347.8 - 24347.8	6286.6	.000	.000	.000 - .000	.00	.0000	.0000	.47	.00
Eogammarus confervicolus	87L	41305.5	2753.7	869.6 - 14349.0	4967.5	.000	.000	.000 - .000	.00	.0000	.0000	.79	.00
Plecoptera-setipalpia	6	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Diptera-chironomidae	6	4058.0	270.5	1739.1 - 2318.8	722.3	.000	.000	.000 - .000	.00	.0000	.0000	.08	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 40

SHANNON-WEINER DIVERSITY INDEX NUMBERS 3.05
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 3.05

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93MY19	10075	I01
93MY19	10075	I02
93MY19	10075	I03
93MY19	10075	I04
93MY19	10075	I05
93MY19	10075	I06
93MY19	10075	I07
93MY19	10075	I08
93MY19	10075	I09
93MY19	10075	I10
93MY19	10075	I11
93MY19	10075	I12
93MY19	10075	I13
93MY19	10075	I14
93MY19	10075	I15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	246579.70	99999.00- 455652.20	95561.55	.39
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Hydroida	C	101304.3	6753.6	434.8 - 31304.3	9507.0	.000	.000	.000 - .000	.00	.0000	.0000	2.74	.00
Anthozoa	C	13623.2	908.2	434.8 - 6956.5	1961.7	.000	.000	.000 - .000	.00	.0000	.0000	.37	.00
Turbellaria	C	136087.0	9072.5	1739.1 - 20869.6	5487.0	.000	.000	.000 - .000	.00	.0000	.0000	3.68	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	NUMBERS/M**2 MEAN	NUMBERS/M**2 RANGE	NUMBERS/M**2 S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	WET WEIGHT,GRAMS/M**2 MEAN	WET WEIGHT,GRAMS/M**2 RANGE	WET WEIGHT,GRAMS/M**2 S.D.	AVG. BIOMASS MEAN	AVG. BIOMASS S.D.	PERCENTAGES ABUN-DANCE	PERCENTAGES BIO-MASS
Nematoda	C	********	82579.7	17391.3 - 213913.0	46496.6	.000	.000	.000 - .000	.00	.0000	.0000	33.49	.00
Nereis sp.	C	4347.8	289.9	869.6 - 1739.1	536.7	.000	.000	.000 - .000	.00	.0000	.0000	.12	.00
Spionidae	C	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Pseudopolydora kempi japonica	C	3913.0	260.9	869.6 - 1739.1	564.5	.000	.000	.000 - .000	.00	.0000	.0000	.11	.00
Capitella sp.	C	2608.7	173.9	869.6 - 1739.1	487.5	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Hobsonia florida	C	9420.3	628.0	434.8 - 3478.3	977.8	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00
Manayunkia aestuarina	C	28985.5	1932.4	434.8 - 4347.8	1562.5	.000	.000	.000 - .000	.00	.0000	.0000	.78	.00
Oligochaeta	C	521594.2	34772.9	15217.4 - 54782.6	12062.2	.000	.000	.000 - .000	.00	.0000	.0000	14.10	.00
Halacaridae	C	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Podocopida	C	17101.4	1140.1	434.8 - 5217.4	1371.5	.000	.000	.000 - .000	.00	.0000	.0000	.46	.00
Harpacticoida	A	2608.7	173.9	2608.7 - 2608.7	673.6	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Scottolana canadensis	8	62608.7	4173.9	869.6 - 13913.0	3984.2	.000	.000	.000 - .000	.00	.0000	.0000	1.69	.00
Pseudobradya sp.	8A	17826.1	1188.4	869.6 - 5217.4	1758.2	.000	.000	.000 - .000	.00	.0000	.0000	.48	.00
Harpacticus sp.	F	3478.3	231.9	3478.3 - 3478.3	898.1	.000	.000	.000 - .000	.00	.0000	.0000	.09	.00
Harpacticus sp.-uniremis group	F	10434.8	695.7	1739.1 - 5217.4	1583.1	.000	.000	.000 - .000	.00	.0000	.0000	.28	.00
Heterolaophonte discophora	A	3478.3	231.9	869.6 - 1739.1	516.2	.000	.000	.000 - .000	.00	.0000	.0000	.09	.00
Nitocra sp.	8	39710.1	2647.3	869.6 - 11304.3	3212.5	.000	.000	.000 - .000	.00	.0000	.0000	1.07	.00
Huntemannia jadensis	AC	387246.4	25816.4	2608.7 - 59130.4	19405.6	.000	.000	.000 - .000	.00	.0000	.0000	10.47	.00
Leimia vaga	AF	413623.2	27574.9	869.6 - 61304.3	17953.7	.000	.000	.000 - .000	.00	.0000	.0000	11.18	.00
Leucon sp.	L87	97101.5	6473.4	3478.3 - 13913.0	3200.5	.000	.000	.000 - .000	.00	.0000	.0000	2.63	.00
Cumella vulgaris	8	1159.4	77.3	1159.4 - 1159.4	299.4	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Tanais sp.	8	3913.0	260.9	434.8 - 1739.1	514.4	.000	.000	.000 - .000	.00	.0000	.0000	.11	.00
Corophium sp.	78	19130.4	1275.4	869.6 - 6956.5	2201.5	.000	.000	.000 - .000	.00	.0000	.0000	.52	.00
Corophium salmonis	L87	515652.2	34376.8	12608.7 - 57391.3	13118.3	.000	.000	.000 - .000	.00	.0000	.0000	13.94	.00
Corophium spinicorne	87	10000.0	666.7	434.8 - 6956.5	1865.5	.000	.000	.000 - .000	.00	.0000	.0000	.27	.00

BENTHIC PLANKTON ANALYSIS   SUMMARY TABLE, PAGE 3
****

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT, GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Eogammarus confervicolus 87C		7536.2	502.4	434.8 - 2318.8	857.2	.000	.000	.000 - .000	.00	.0000	.0000	.20	.00
Tricoptera 6		869.6	58.0	869.6 - 869.6	224.5	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Diptera-chironomidae 6		21594.2	1439.6	434.8 - 5217.4	1540.1	.000	.000	.000 - .000	.00	.0000	.0000	.58	.00
Pleuronectidae 7		869.6	58.0	869.6 - 869.6	224.5	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 32

SHANNON-WEINER DIVERSITY INDEX NUMBERS 3.05
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 3.05

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93JN04	10070	I01
93JN04	10070	I02
93JN04	10070	I03
93JN04	10070	I04
93JN04	10070	I05
93JN04	10070	I06
93JN04	10070	I07
93JN04	10070	I08
93JN04	10070	I09
93JN04	10070	I10
93JN04	10070	I11
93JN04	10070	I12
93JN04	10070	I13
93JN04	10070	I14
93JN04	10070	I15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	374242.30	53043.48- 695686.90	188418.30	.50
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Rhizopodea-foraminiferida	C	9565.2	637.7	869.6 - 8695.7	2240.4	.000	.000	.000 - .000	.00	.0000	.0000	.17	.00
Hydroida	C	38260.9	2550.7	434.8 - 10869.6	3835.9	.000	.000	.000 - .000	.00	.0000	.0000	.68	.00
Anthozoa	C	6087.0	405.8	869.6 - 3478.3	978.7	.000	.000	.000 - .000	.00	.0000	.0000	.11	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	NUMBERS/M**2 MEAN	NUMBERS/M**2 RANGE	NUMBERS/M**2 S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	WET WEIGHT MEAN	WET WEIGHT RANGE	WET WEIGHT S.D.	AVG. BIOMASS MEAN	AVG. BIOMASS S.D.	PERCENTAGES ABUN-DANCE	PERCENTAGES BIO-MASS
Turbellaria	C	40869.6	2724.6	434.8 - 6956.5	3128.7	.000	.000	.000 - .000	.00	.0000	.0000	.73	.00
Nematoda	C	715686.9	47712.5	10434.8 - 102608.7	27854.8	.000	.000	.000 - .000	.00	.0000	.0000	12.75	.00
Polychaeta	7	7826.1	521.7	2608.7 - 5217.4	1462.5	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Polychaeta	C	41739.1	2782.6	41739.1 - 41739.1	10777.0	.000	.000	.000 - .000	.00	.0000	.0000	.74	.00
Polydora sp.	C	3913.0	260.9	3913.0 - 3913.0	1010.3	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Polydora cornuta	C	57391.3	3826.1	434.8 - 17826.1	4916.8	.000	.000	.000 - .000	.00	.0000	.0000	1.02	.00
Pseudopolydora kempi japonica	C	44782.6	2985.5	434.8 - 10434.8	3130.4	.000	.000	.000 - .000	.00	.0000	.0000	.80	.00
Pygospio elegans	C	143913.0	9594.2	1739.1 - 32608.7	9534.8	.000	.000	.000 - .000	.00	.0000	.0000	2.56	.00
Capitella capitata	C	188260.9	12550.7	3043.5 - 30869.6	8855.5	.000	.000	.000 - .000	.00	.0000	.0000	3.35	.00
Abarenicola sp.	C	23913.0	1594.2	434.8 - 6956.5	2310.4	.000	.000	.000 - .000	.00	.0000	.0000	.43	.00
Hobsonia florida	C	21304.4	1420.3	434.8 - 6956.5	1884.2	.000	.000	.000 - .000	.00	.0000	.0000	.38	.00
Manayunkia aestuarina	C	286973.9	19131.6	8695.7 - 38713.0	9419.9	.000	.000	.000 - .000	.00	.0000	.0000	5.11	.00
Oligochaeta	C	********	107278.8	20434.8 - 197391.3	49826.4	.000	.000	.000 - .000	.00	.0000	.0000	28.67	.00
Macoma nasuta	C	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Macoma inquinata	C	2173.9	144.9	434.8 - 1739.1	455.0	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Halacaridae	C	3478.3	231.9	3478.3 - 3478.3	898.1	.000	.000	.000 - .000	.00	.0000	.0000	.06	.00
Podocopida	C	3478.3	231.9	1739.1 - 1739.1	611.9	.000	.000	.000 - .000	.00	.0000	.0000	.06	.00
Eurytemora affinis	8	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Scottolana canadensis	8	5652.2	376.8	434.8 - 3478.3	970.3	.000	.000	.000 - .000	.00	.0000	.0000	.10	.00
Pseudobradya sp.	8	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Harpacticus arcticus	8	8695.7	579.7	1739.1 - 3478.3	1258.7	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00
Harpacticus sp. a-uniremis gro	8	103478.3	6898.6	4347.8 - 27826.1	8711.0	.000	.000	.000 - .000	.00	.0000	.0000	1.84	.00
Harpacticus sp.-uniremis group	F8	37391.3	2492.8	869.6 - 10434.8	3300.9	.000	.000	.000 - .000	.00	.0000	.0000	.67	.00
Tachidius triangularis	8	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Heterolaophonte discophora	A	160869.6	10724.6	869.6 - 34782.6	9592.9	.000	.000	.000 - .000	.00	.0000	.0000	2.87	.00

BENTHIC PLANKTON ANALYSIS

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SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Nitocra sp.	8,	8695.7	579.7	1739.1 - 3478.3	1258.7	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00
Huntemannia jadensis	A	56087.0	3739.1	869.6 - 13913.0	3710.4	.000	.000	.000 - .000	.00	.0000	.0000	1.00	.00
Leimia vaga	A	435669.6	29044.6	1304.3 - 149565.2	37354.0	.000	.000	.000 - .000	.00	.0000	.0000	7.76	.00
Leucon sp.	87L	479582.6	31972.2	869.6 - 66539.1	17992.7	.000	.000	.000 - .000	.00	.0000	.0000	8.54	.00
Cumella vulgaris	87	640452.3	42696.8	10434.8 - 143060.9	45752.2	.000	.000	.000 - .000	.00	.0000	.0000	11.41	.00
Corophium sp.	7	4347.8	289.9	869.6 - 3478.3	910.0	.000	.000	.000 - .000	.00	.0000	.0000	.08	.00
Corophium salmonis	87L	251739.1	16782.6	5217.4 - 44347.8	14123.8	.000	.000	.000 - .000	.00	.0000	.0000	4.48	.00
Corophium insidiosum	78L	53043.5	3536.2	1739.1 - 10869.6	3821.8	.000	.000	.000 - .000	.00	.0000	.0000	.94	.00
Corophium spinicorne	7	12173.9	811.6	1739.1 - 6956.5	1957.3	.000	.000	.000 - .000	.00	.0000	.0000	.22	.00
Eogammarus confervicolus	87	100434.8	6695.7	1304.3 - 43478.3	11678.9	.000	.000	.000 - .000	.00	.0000	.0000	1.79	.00
Diptera-chironomidae	6	869.6	58.0	869.6 - 869.6	224.5	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 39

SHANNON-WEINER DIVERSITY INDEX NUMBERS 3.58

BIOMASS .00

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 3.58

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93JN04	10075	I01
93JN04	10075	I02
93JN04	10075	I03
93JN04	10075	I04
93JN04	10075	I05
93JN04	10075	I06
93JN04	10075	I07
93JN04	10075	I08
93JN04	10075	I09
93JN04	10075	I10
93JN04	10075	I11
93JN04	10075	I12
93JN04	10075	I13
93JN04	10075	I14
93JN04	10075	I15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	263797.20	99999.00- 422608.70	77196.22	.29
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	ABUN-DANCE	BIO-MASS
Hydroida	C	27826.1	1855.1	869.6 - 12173.9	3553.0	.000	.000	.000 - .000	.00	.0000	.0000	.70	.00
Anthozoa	C	6956.5	463.8	1739.1 - 3478.3	1032.4	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Turbellaria	C	61739.1	4115.9	1739.1 - 8695.7	3020.6	.000	.000	.000 - .000	.00	.0000	.0000	1.56	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME			* NUMBERS/M**2				* WET WEIGHT,GRAMS/M**2				* AVG. BIOMASS		* PERCENTAGES	
													* ABUN-	BIO-
	PARTS CODE	LH-STAGE	* TOTAL	MEAN	RANGE	S.D.	* TOTAL	MEAN	RANGE	S.D.	* MEAN	S.D.	* DANCE	MASS
Nematoda	C		********	70550.7	17391.3 - 154782.6	36596.9	.000	.000	.000 - .000	.00	.0000	.0000	26.74	.00
Nereis sp.	C		26956.5	1797.1	869.6 - 19130.4	4902.1	.000	.000	.000 - .000	.00	.0000	.0000	.68	.00
Pseudopolydora kempi japonica	C		1739.1	115.9	869.6 - 869.6	306.0	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Capitella sp.	C		12173.9	811.6	869.6 - 6956.5	1929.5	.000	.000	.000 - .000	.00	.0000	.0000	.31	.00
Hobsonia florida	C		4347.8	289.9	1739.1 - 2608.7	782.4	.000	.000	.000 - .000	.00	.0000	.0000	.11	.00
Manayunkia aestuarina	C		18260.9	1217.4	869.6 - 3478.3	1028.9	.000	.000	.000 - .000	.00	.0000	.0000	.46	.00
Oligochaeta	C		720000.1	48000.0	22608.7 - 97391.3	17711.9	.000	.000	.000 - .000	.00	.0000	.0000	18.20	.00
Macoma nasuta	C		434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Podocopida	C		12173.9	811.6	869.6 - 3478.3	1063.3	.000	.000	.000 - .000	.00	.0000	.0000	.31	.00
Harpacticoida	8CF		8695.7	579.7	1739.1 - 3478.3	1073.4	.000	.000	.000 - .000	.00	.0000	.0000	.22	.00
Scottolana canadensis	8		73913.0	4927.5	869.6 - 13913.0	3654.9	.000	.000	.000 - .000	.00	.0000	.0000	1.87	.00
Harpacticus sp. a-uniremis gro	8		3478.3	231.9	3478.3 - 3478.3	898.1	.000	.000	.000 - .000	.00	.0000	.0000	.09	.00
Microarthridion littorale	8		5217.4	347.8	1739.1 - 3478.3	975.0	.000	.000	.000 - .000	.00	.0000	.0000	.13	.00
Heterolaophonte discophora	A		8695.7	579.7	1739.1 - 5217.4	1420.0	.000	.000	.000 - .000	.00	.0000	.0000	.22	.00
Nitocra sp.	8		21739.1	1449.3	869.6 - 5217.4	1728.7	.000	.000	.000 - .000	.00	.0000	.0000	.55	.00
Huntemannia jadensis	A		593043.4	39536.2	9565.2 - 85217.4	22003.0	.000	.000	.000 - .000	.00	.0000	.0000	14.99	.00
Leimia vaga	A		554782.6	36985.5	7826.1 - 73043.5	21594.2	.000	.000	.000 - .000	.00	.0000	.0000	14.02	.00
Leucon sp.	87L		67826.1	4521.7	869.6 - 10434.8	2734.0	.000	.000	.000 - .000	.00	.0000	.0000	1.71	.00
Cumella vulgaris	78		10434.8	695.7	869.6 - 3478.3	1238.5	.000	.000	.000 - .000	.00	.0000	.0000	.26	.00
Tanais sp.	7		3478.3	231.9	3478.3 - 3478.3	898.1	.000	.000	.000 - .000	.00	.0000	.0000	.09	.00
Corophium sp.	7		55652.2	3710.1	1739.1 - 8695.7	2638.9	.000	.000	.000 - .000	.00	.0000	.0000	1.41	.00
Corophium salmonis	L87		561739.1	37449.3	18260.9 - 50434.8	9646.6	.000	.000	.000 - .000	.00	.0000	.0000	14.20	.00
Corophium spinicorne	78		33043.5	2202.9	869.6 - 6956.5	2151.9	.000	.000	.000 - .000	.00	.0000	.0000	.84	.00
Eogammarus confervicolus	7		2608.7	173.9	869.6 - 1739.1	487.5	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Diptera-chironomidae	6		1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 28

SHANNON-WEINER DIVERSITY INDEX	NUMBERS	2.97
	BIOMASS	.00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS		2.97

BENTHIC PLANKTON ANALYSIS
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****
* GRAND SUMMARY *
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FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93JL02	10070	I 1
93JL02	10070	I 2
93JL02	10070	I 3
93JL02	10070	I 4
93JL02	10070	I 5
93JL02	10070	I 6
93JL02	10070	I 7
93JL02	10070	I 8
93JL02	10070	I 9
93JL02	10070	I10
93JL02	10070	I11
93JL02	10070	I12
93JL02	10070	I13
93JL02	10070	I14
93JL02	10070	I15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	319981.00	99999.00- 508278.20	104605.60	.33
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
												ABUN-	BIO-
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	DANCE	MASS
Rhizopodea-foraminiferida C		1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Hydroida C		3478.3	231.9	1739.1 - 1739.1	611.9	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Anthozoa C		20289.9	1352.7	1159.4 - 6956.5	1992.2	.000	.000	.000 - .000	.00	.0000	.0000	.42	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Turbellaria	C	18550.7	1236.7	1159.4 - 5217.4	1666.8	.000	.000	.000 - .000	.00	.0000	.0000	.39	.00
Nematoda	C	595675.4	39711.7	434.8 - 136104.3	30812.4	.000	.000	.000 - .000	.00	.0000	.0000	12.41	.00
Polychaeta	7	22608.7	1507.2	1739.1 - 17391.3	4500.0	.000	.000	.000 - .000	.00	.0000	.0000	.47	.00
Eteone sp.	C	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Nereis sp.	C	7681.2	512.1	434.8 - 3913.0	1043.5	.000	.000	.000 - .000	.00	.0000	.0000	.16	.00
Glycera sp.	C	869.6	58.0	869.6 - 869.6	224.5	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Spionidae	7	6956.5	463.8	3478.3 - 3478.3	1223.9	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Polydora cornuta	C	146521.7	9768.1	1739.1 - 15652.2	4515.3	.000	.000	.000 - .000	.00	.0000	.0000	3.05	.00
Pseudopolydora kempi japonica	C	65072.5	4338.2	869.6 - 12608.7	3697.6	.000	.000	.000 - .000	.00	.0000	.0000	1.36	.00
Pygospio elegans	C	127107.2	8473.8	1739.1 - 21739.1	6045.2	.000	.000	.000 - .000	.00	.0000	.0000	2.65	.00
Capitella sp.	C	192463.8	12830.9	4782.6 - 26521.7	7174.4	.000	.000	.000 - .000	.00	.0000	.0000	4.01	.00
Abarenicola sp.	C	20724.6	1381.6	434.8 - 5217.4	1581.8	.000	.000	.000 - .000	.00	.0000	.0000	.43	.00
Hobsonia florida	C	18840.6	1256.0	434.8 - 3478.3	1097.8	.000	.000	.000 - .000	.00	.0000	.0000	.39	.00
Manayunkia aestuarina	C	362759.4	24184.0	13623.2 - 49130.4	10982.5	.000	.000	.000 - .000	.00	.0000	.0000	7.56	.00
Oligochaeta	C	********	107562.9	53478.3 - 192695.7	35769.5	.000	.000	.000 - .000	.00	.0000	.0000	33.62	.00
Macoma nasuta	C	434.8	29.0	434.8 - 434.8	112.3	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Macoma inquinata	C	869.6	58.0	434.8 - 434.8	153.0	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Podocopida	C	5217.4	347.8	1739.1 - 3478.3	975.0	.000	.000	.000 - .000	.00	.0000	.0000	.11	.00
Harpacticus arcticus	8	24202.9	1613.5	1159.4 - 5652.2	2374.4	.000	.000	.000 - .000	.00	.0000	.0000	.50	.00
Harpacticus sp. a-uniremis gro	8	41159.4	2744.0	1159.4 - 15652.2	4313.0	.000	.000	.000 - .000	.00	.0000	.0000	.86	.00
Heterolaophonte discophora	A	90434.8	6029.0	1159.4 - 17391.3	5689.4	.000	.000	.000 - .000	.00	.0000	.0000	1.88	.00
Nitocra sp.	8	13913.0	927.5	1739.1 - 3478.3	1292.6	.000	.000	.000 - .000	.00	.0000	.0000	.29	.00
Huntemannia jadensis	A	82318.8	5487.9	1159.4 - 38260.9	10028.6	.000	.000	.000 - .000	.00	.0000	.0000	1.72	.00
Leimia vaga	AC	197681.2	13178.7	434.8 - 48695.7	13492.8	.000	.000	.000 - .000	.00	.0000	.0000	4.12	.00
Leucon sp.	87L	232029.0	15468.6	3478.3 - 38260.9	11181.5	.000	.000	.000 - .000	.00	.0000	.0000	4.83	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Cumella vulgaris 87L		427831.9	28522.1	5217.4 - 66087.0	17780.0	.000	.000	.000 - .000	.00	.0000	.0000	8.91	.00
Corophium sp. 7		6956.5	463.8	6956.5 - 6956.5	1796.2	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Corophium salmonis L87		302608.7	20173.9	3478.3 - 46087.0	13754.5	.000	.000	.000 - .000	.00	.0000	.0000	6.30	.00
Corophium insidiosum 8L		59855.1	3990.3	434.8 - 17826.1	4563.0	.000	.000	.000 - .000	.00	.0000	.0000	1.25	.00
Corophium spinicorne 8		3478.3	231.9	3478.3 - 3478.3	898.1	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Eogammarus confervicolus 8L7		85507.3	5700.5	434.8 - 16956.5	5651.3	.000	.000	.000 - .000	.00	.0000	.0000	1.78	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 34

SHANNON-WEINER DIVERSITY INDEX NUMBERS 3.47
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 3.47

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:	FILEID	STATION	SAMPLE
	93JL02	10075	I 1
	93JL02	10075	I 2
	93JL02	10075	I 3
	93JL02	10075	I 4
	93JL02	10075	I 5
	93JL02	10075	I 6
	93JL02	10075	I 7
	93JL02	10075	I 8
	93JL02	10075	I 9
	93JL02	10075	I10
	93JL02	10075	I11
	93JL02	10075	I12
	93JL02	10075	I13
	93JL02	10075	I14
	93JL02	10075	I15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.002	.002- .002	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	140666.70	64782.60- 208695.60	40100.91	.29
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	ABUN-DANCE	BIO-MASS
Hydroida	C	1449.3	96.6	579.7 - 869.6	260.8	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Anthozoa	C	6811.6	454.1	434.8 - 1739.1	522.2	.000	.000	.000 - .000	.00	.0000	.0000	.32	.00
Turbellaria	C	6376.8	425.1	1159.4 - 1739.1	742.0	.000	.000	.000 - .000	.00	.0000	.0000	.30	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Nematoda	C	599565.2	39971.0	15652.2 - 67826.1	18544.9	.000	.000	.000 - .000	.00	.0000	.0000	28.42	.00
Eteone sp.	C	1159.4	77.3	1159.4 - 1159.4	299.4	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Nereis sp.	C	14782.6	985.5	869.6 - 5217.4	1638.9	.000	.000	.000 - .000	.00	.0000	.0000	.70	.00
Hobsonia florida	C	4927.5	328.5	579.7 - 869.6	422.4	.000	.000	.000 - .000	.00	.0000	.0000	.23	.00
Manayunkia aestuarina	C	9565.2	637.7	579.7 - 1739.1	711.7	.000	.000	.000 - .000	.00	.0000	.0000	.45	.00
Oligochaeta	C	375797.0	25053.1	11594.2 - 93043.5	19984.5	.000	.000	.000 - .000	.00	.0000	.0000	17.81	.00
Podocopida	C	10144.9	676.3	869.6 - 3478.3	971.7	.000	.000	.000 - .000	.00	.0000	.0000	.48	.00
Scottolana canadensis	8	6521.7	434.8	434.8 - 1739.1	555.9	.000	.000	.000 - .000	.00	.0000	.0000	.31	.00
Microarthridion littorale	8	869.6	58.0	869.6 - 869.6	224.5	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Heterolaophonte discophora	A	1739.1	115.9	1739.1 - 1739.1	449.0	.000	.000	.000 - .000	.00	.0000	.0000	.08	.00
Nitocra sp.	8	5507.2	367.1	869.6 - 2608.7	738.7	.000	.000	.000 - .000	.00	.0000	.0000	.26	.00
Huntemannia jadensis	A	355362.3	23690.8	6087.0 - 52173.9	13955.5	.000	.000	.000 - .000	.00	.0000	.0000	16.84	.00
Leimia vaga	A	43333.3	2888.9	434.8 - 19130.4	4942.3	.000	.000	.000 - .000	.00	.0000	.0000	2.05	.00
Leucon sp.	87L	36231.9	2415.5	869.6 - 7826.1	2071.9	.000	.000	.000 - .000	.00	.0000	.0000	1.72	.00
Cumella vulgaris	87	15797.1	1053.1	434.8 - 4637.7	1252.1	.000	.000	.000 - .000	.00	.0000	.0000	.75	.00
Tanais sp.	7	2029.0	135.3	869.6 - 1159.4	361.1	.000	.000	.000 - .000	.00	.0000	.0000	.10	.00
Corophium sp.	7	55217.4	3681.2	1739.1 - 7826.1	2367.4	.000	.000	.000 - .000	.00	.0000	.0000	2.62	.00
Corophium salmonis	87L	547971.0	36531.4	12608.7 - 54492.8	13306.1	.000	.000	.000 - .000	.00	.0000	.0000	25.97	.00
Corophium insidiosum	7	579.7	38.6	579.7 - 579.7	149.7	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Corophium spinicorne	87	7246.4	483.1	869.6 - 1739.1	740.3	.000	.000	.000 - .000	.00	.0000	.0000	.34	.00
Eogammarus confervicolus	7	1014.5	67.6	434.8 - 579.7	180.6	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 24

SHANNON-WEINER DIVERSITY INDEX NUMBERS 2.62
BIOMASS .00

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.62

APPENDIX 4: SUMMARY DATA FROM THREE MEIOFAUNA SAMPLING TECHNIQUES, KELLOGG ISLAND REFERENCE MUDFLAT, DUWAMISH RIVER ESTUARY ,2 AUGUST 1993

A. Summary data from 0.018m^2 epibenthic pump

B. Summary data from 0.0004 m^2 dry core

C. Summary data from 0.0004 m^2 wet core

EPIBENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AU02	10070	E01
93AU02	10070	E02
93AU02	10070	E03
93AU02	10070	E04
93AU02	10070	E05
93AU02	10070	E06
93AU02	10070	E07
93AU02	10070	E08
93AU02	10070	E09
93AU02	10070	E10
93AU02	10070	E11
93AU02	10070	E12
93AU02	10070	E13
93AU02	10070	E14
93AU02	10070	E15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.018	.018- .018	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	17751.85	1666.67- 62000.00	19901.56	1.12
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Turbellaria	C	555.6	37.0	55.6 - 222.2	65.3	.000	.000	.000 - .000	.00	.0000	.0000	.21	.00
Nematoda	C	3666.7	244.4	55.6 - 1111.1	341.7	.000	.000	.000 - .000	.00	.0000	.0000	1.38	.00
Spionidae	67	500.0	33.3	55.6 - 444.4	114.6	.000	.000	.000 - .000	.00	.0000	.0000	.19	.00

EPIBENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	NUMBERS/M**2 MEAN	NUMBERS/M**2 RANGE	NUMBERS/M**2 S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	WET WEIGHT,GRAMS/M**2 MEAN	WET WEIGHT,GRAMS/M**2 RANGE	WET WEIGHT,GRAMS/M**2 S.D.	AVG. BIOMASS MEAN	AVG. BIOMASS S.D.	PERCENTAGES ABUN-DANCE	PERCENTAGES BIO-MASS
Hobsonia florida	7	777.8	51.9	55.6 - 444.4	119.6	.000	.000	.000 - .000	.00	.0000	.0000	.29	.00
Manayunkia aestuarina	C7	1500.0	100.0	55.6 - 888.9	229.3	.000	.000	.000 - .000	.00	.0000	.0000	.56	.00
Oligochaeta	AC	1833.3	122.2	55.6 - 1111.1	288.8	.000	.000	.000 - .000	.00	.0000	.0000	.69	.00
Bivalvia	7	55.6	3.7	55.6 - 55.6	14.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Halacaridae	C	333.3	22.2	55.6 - 222.2	58.6	.000	.000	.000 - .000	.00	.0000	.0000	.13	.00
Euphilomedes carcharodonta	C	55.6	3.7	55.6 - 55.6	14.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Podocopida	C	38888.9	2592.6	55.6 - 18888.9	4641.7	.000	.000	.000 - .000	.00	.0000	.0000	14.60	.00
Harpacticoida	F2	2722.2	181.5	55.6 - 1000.0	283.6	.000	.000	.000 - .000	.00	.0000	.0000	1.02	.00
Ectinosomatidae	8A	222.2	14.8	55.6 - 111.1	33.0	.000	.000	.000 - .000	.00	.0000	.0000	.08	.00
Tisbe sp.	8AF	14333.3	955.6	55.6 - 6000.0	1756.6	.000	.000	.000 - .000	.00	.0000	.0000	5.38	.00
Tachidius triangularis	A	124111.1	8274.1	777.8 - 26888.9	8629.4	.000	.000	.000 - .000	.00	.0000	.0000	46.61	.00
Laophontidae	F	277.8	18.5	55.6 - 222.2	58.1	.000	.000	.000 - .000	.00	.0000	.0000	.10	.00
Heterolaophonte discophora	8A	1222.2	81.5	55.6 - 666.7	174.3	.000	.000	.000 - .000	.00	.0000	.0000	.46	.00
Heterolaophonte longisetigera	8	388.9	25.9	55.6 - 222.2	62.5	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00
Nitocra sp.	8	111.1	7.4	55.6 - 55.6	19.5	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Huntemannia jadensis	8	111.1	7.4	55.6 - 55.6	19.5	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Leimia vaga	A	14833.3	988.9	55.6 - 6222.2	1672.8	.000	.000	.000 - .000	.00	.0000	.0000	5.57	.00
Limnocletodes behningi	8	55.6	3.7	55.6 - 55.6	14.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Schizopera knabeni	AF	2055.6	137.0	55.6 - 1333.3	341.1	.000	.000	.000 - .000	.00	.0000	.0000	.77	.00
Stenhelia sp.	8FA	4777.8	318.5	55.6 - 2444.4	615.6	.000	.000	.000 - .000	.00	.0000	.0000	1.79	.00
Stenhelia peniculata	A	55.6	3.7	55.6 - 55.6	14.3	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Mesochra sp.	8	222.2	14.8	55.6 - 111.1	33.0	.000	.000	.000 - .000	.00	.0000	.0000	.08	.00
Paradactylopodia sp.	8	111.1	7.4	111.1 - 111.1	28.7	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Halicyclops sp.	FA	6055.6	403.7	55.6 - 2222.2	604.8	.000	.000	.000 - .000	.00	.0000	.0000	2.27	.00
Cyclopina sp.	A	38888.9	2592.6	277.8 - 17777.8	4465.3	.000	.000	.000 - .000	.00	.0000	.0000	14.60	.00

EPIBENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Neomysis mercedis		55.6	3.7	55.6 -	14.3	.000	.000	.000 -	.00	.0000	.0000	.02	.00
7				55.6				.000					
Leucon sp.		611.1	40.7	55.6 -	115.9	.000	.000	.000 -	.00	.0000	.0000	.23	.00
C7				444.4				.000					
Cumella vulgaris		2833.3	188.9	55.6 -	355.6	.000	.000	.000 -	.00	.0000	.0000	1.06	.00
78				1333.3				.000					
Tanaidacea-dikonophora		55.6	3.7	55.6 -	14.3	.000	.000	.000 -	.00	.0000	.0000	.02	.00
7				55.6				.000					
Corophium sp.		888.9	59.3	55.6 -	71.1	.000	.000	.000 -	.00	.0000	.0000	.33	.00
7				222.2				.000					
Eogammarus confervicolus		3111.1	207.4	55.6 -	196.4	.000	.000	.000 -	.00	.0000	.0000	1.17	.00
78				666.7				.000					

TOTAL NUMBER OF PLANKTON CATEGORIES 34

SHANNON-WEINER DIVERSITY INDEX NUMBERS 2.68
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.68

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AU02	10070	M01
93AU02	10070	M02
93AU02	10070	M03
93AU02	10070	M04
93AU02	10070	M05
93AU02	10070	M06
93AU02	10070	M07
93AU02	10070	M08
93AU02	10070	M09
93AU02	10070	M10
93AU02	10070	M11
93AU02	10070	M12
93AU02	10070	M13
93AU02	10070	M14
93AU02	10070	M15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.000	.000- .000	.000	.001
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	*********	99999.00- *********	*********	3.29
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Rhizopodea-foraminiferida C		********	529503.7	40000.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	4.16	.00
Cnidaria C		200000.0	13333.3	20000.0 - 80000.0	27945.5	.000	.000	.000 - .000	.00	.0000	.0000	.10	.00
Turbellaria C		********	98159.2	2600.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	.77	.00

BENTHIC PLANKTON ANALYSIS
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SUMMARY TABLE, PAGE 2

ORGANISM NAME	PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Nematoda	C		********	********	.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	49.66	.00
Spionidae	76		110000.0	7333.3	10000.0 - 60000.0	17915.1	.000	.000	.000 - .000	.00	.0000	.0000	.06	.00
Polydora cornuta	7A		30217.5	2014.5	2600.0 - 10000.0	3314.7	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Pseudopolydora kempi japonica	A7		30100.0	2006.7	2500.0 - 22600.0	5865.2	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Pygospio elegans	C7		22600.0	1506.7	2600.0 - 20000.0	5159.7	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Capitella sp.	7AC		132801.5	8853.4	2501.5 - 42600.0	12581.3	.000	.000	.000 - .000	.00	.0000	.0000	.07	.00
Hobsonia florida	7		********	294615.6	7271.7 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	2.32	.00
Manayunkia aestuarina	A		********	********	20000.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	9.35	.00
Oligochaeta	AC		451330.0	30088.7	2600.0 - 105000.0	37469.4	.000	.000	.000 - .000	.00	.0000	.0000	.24	.00
Bivalvia	7		30000.0	2000.0	10000.0 - 20000.0	5606.1	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Halacaridae	C		50000.0	3333.3	10000.0 - 20000.0	7237.5	.000	.000	.000 - .000	.00	.0000	.0000	.03	.00
Podocopida	CA		********	700142.8	20000.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	5.50	.00
Harpacticoida	F2		********	395397.6	20000.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	3.11	.00
Ectinosomatidae	A8		********	199123.1	7271.7 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	1.56	.00
Harpacticus sp. a-uniremis gro	8L		34543.3	2302.9	14543.3 - 20000.0	6164.2	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Tisbe sp.	AF		********	118166.2	20000.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	.93	.00
Tachidius triangularis	A		********	151196.6	20000.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	1.19	.00
Laophontidae	F		94543.3	6302.9	14543.3 - 60000.0	16070.4	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Heterolaophonte discophora	F8A		226358.3	15090.6	20000.0 - 70000.0	20712.4	.000	.000	.000 - .000	.00	.0000	.0000	.12	.00
Heterolaophonte longisetigera	8A		103630.0	6908.7	20000.0 - 43630.0	15089.3	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Nitocra sp.	8		********	95985.8	10000.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	.75	.00
Huntemannia jadensis	8		74543.3	4969.6	7271.7 - 20000.0	7247.2	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Leimia vaga	A		********	********	21815.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	9.24	.00
Limnocletodes behningi	8		7271.7	484.8	7271.7 - 7271.7	1877.5	.000	.000	.000 - .000	.00	.0000	.0000	.00	.00
Schizopera knabeni	A8		********	508050.1	7271.7 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	3.99	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Stenhelia sp.	8A	********	354987.1	14543.3 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	2.79	.00
Mesochra sp.	8	150000.0	10000.0	10000.0 - 40000.0	12535.7	.000	.000	.000 - .000	.00	.0000	.0000	.08	.00
Paradactylopodia sp.	8	20000.0	1333.3	20000.0 - 20000.0	5164.0	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Halicyclops sp.	8	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.01	.00
Cyclopina sp.	8A	381803.4	25453.6	7271.7 - 94531.7	33242.5	.000	.000	.000 - .000	.00	.0000	.0000	.20	.00
Leucon sp.	8	5001.5	333.4	2500.0 - 2501.5	879.9	.000	.000	.000 - .000	.00	.0000	.0000	.00	.00
Cumella vulgaris	A78	********	290615.6	7271.7 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	2.28	.00
Corophium sp.	7	********	105319.2	20000.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	.83	.00
Corophium salmonis	A	310659.6	20710.6	2600.0 - 252659.6	64451.1	.000	.000	.000 - .000	.00	.0000	.0000	.16	.00
Corophium insidiosum	A	100200.0	6680.0	2500.0 - 25000.0	8283.7	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Anisogammarus pugettensis	7	2501.5	166.8	2501.5 - 2501.5	645.9	.000	.000	.000 - .000	.00	.0000	.0000	.00	.00
Eogammarus confervicolus	78	417631.3	27842.1	2600.0 - 252659.6	64620.2	.000	.000	.000 - .000	.00	.0000	.0000	.22	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 40

SHANNON-WEINER DIVERSITY INDEX NUMBERS 2.85
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.85

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:	FILEID	STATION	SAMPLE
	93AU02	10070	E01
	93AU02	10070	E02
	93AU02	10070	E03
	93AU02	10070	E04
	93AU02	10070	E05
	93AU02	10070	E06
	93AU02	10070	E07
	93AU02	10070	E08
	93AU02	10070	E09
	93AU02	10070	E10
	93AU02	10070	E11
	93AU02	10070	E12
	93AU02	10070	E13
	93AU02	10070	E14
	93AU02	10070	E15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.000	.000- .000	.000	.001
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	*********	99999.00- *********	483276.70	.35
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Rhizopodea-foraminiferida	C	946666.7	63111.1	10000.0 - 220000.0	50826.0	.000	.000	.000 - .000	.00	.0000	.0000	4.58	.00
Cnidaria	C	143333.3	9555.6	10000.0 - 50000.0	15829.8	.000	.000	.000 - .000	.00	.0000	.0000	.69	.00
Anthozoa	C	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00

BENTHIC PLANKTON ANALYSIS
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SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Turbellaria	CA	700000.0	46666.7	10000.0 - 120000.0	38110.1	.000	.000	.000 - .000	.00	.0000	.0000	3.39	.00
Nematoda	C	********	311555.6	.0 - 870000.0	*******	.000	.000	.000 - .000	.00	.0000	.0000	22.63	.00
Spionidae	7	90000.0	6000.0	10000.0 - 30000.0	9102.6	.000	.000	.000 - .000	.00	.0000	.0000	.44	.00
Polydora cornuta	7CA	52566.7	3504.4	5000.0 - 12500.0	4801.1	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00
Pseudopolydora kempi japonica	C7	7500.0	500.0	2500.0 - 2500.0	1035.1	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Pygospio elegans	7AC	70800.0	4720.0	10000.0 - 20800.0	8445.0	.000	.000	.000 - .000	.00	.0000	.0000	.34	.00
Capitella sp.	7AC	210000.0	14000.0	10000.0 - 32500.0	12914.6	.000	.000	.000 - .000	.00	.0000	.0000	1.02	.00
Hobsonia florida	7A	625000.0	41666.7	10000.0 - 182500.0	48196.6	.000	.000	.000 - .000	.00	.0000	.0000	3.03	.00
Manayunkia aestuarina	A	********	104000.0	20000.0 - 200000.0	62312.6	.000	.000	.000 - .000	.00	.0000	.0000	7.55	.00
Oligochaeta	CA	********	76060.0	10000.0 - 267500.0	63956.4	.000	.000	.000 - .000	.00	.0000	.0000	5.52	.00
Halacaridae	C	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Podocopida	CA	********	75777.8	10000.0 - 200000.0	56279.7	.000	.000	.000 - .000	.00	.0000	.0000	5.50	.00
Harpacticoida	F2	286666.7	19111.1	10000.0 - 80000.0	21435.3	.000	.000	.000 - .000	.00	.0000	.0000	1.39	.00
Scottolana canadensis	8	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Ectinosomatidae	8A	143333.3	9555.6	10000.0 - 20000.0	7112.1	.000	.000	.000 - .000	.00	.0000	.0000	.69	.00
Harpacticus sp.-uniremis group	8F	20000.0	1333.3	10000.0 - 10000.0	3518.7	.000	.000	.000 - .000	.00	.0000	.0000	.10	.00
Tisbe sp.	A	630000.0	42000.0	10000.0 - 130000.0	45387.2	.000	.000	.000 - .000	.00	.0000	.0000	3.05	.00
Microarthridion littorale	8A	50000.0	3333.3	10000.0 - 20000.0	6172.1	.000	.000	.000 - .000	.00	.0000	.0000	.24	.00
Tachidius triangularis	A	********	67777.8	20000.0 - 280000.0	66817.3	.000	.000	.000 - .000	.00	.0000	.0000	4.92	.00
Laophontidae	F	30000.0	2000.0	10000.0 - 10000.0	4140.4	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00
Paralaophonte pacifica	8	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Heterolaophonte discophora	8A	286666.7	19111.1	10000.0 - 50000.0	13712.8	.000	.000	.000 - .000	.00	.0000	.0000	1.39	.00
Heterolaophonte longisetigera	8	80000.0	5333.3	10000.0 - 30000.0	10601.0	.000	.000	.000 - .000	.00	.0000	.0000	.39	.00
Nitocra sp.	8	60000.0	4000.0	10000.0 - 30000.0	9102.6	.000	.000	.000 - .000	.00	.0000	.0000	.29	.00
Huntemannia jadensis	F8	40000.0	2666.7	10000.0 - 10000.0	4577.4	.000	.000	.000 - .000	.00	.0000	.0000	.19	.00

BENTHIC PLANKTON ANALYSIS
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SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Leimia vaga	A	********	180444.4	30000.0 - 370000.0	97994.7	.000	.000	.000 - .000	.00	.0000	.0000	13.11	.00
Limnocletodes behningi	8	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Schizopera knabeni	A8	********	70888.9	10000.0 - 170000.0	45065.5	.000	.000	.000 - .000	.00	.0000	.0000	5.15	.00
Stenhelia sp.	A	806666.6	53777.8	20000.0 - 140000.0	39698.6	.000	.000	.000 - .000	.00	.0000	.0000	3.91	.00
Mesochra sp.	8A	200000.0	13333.3	10000.0 - 90000.0	24103.0	.000	.000	.000 - .000	.00	.0000	.0000	.97	.00
Paradactylopodia sp.	8	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Halicyclops sp.	F8A	163333.3	10888.9	10000.0 - 30000.0	11017.1	.000	.000	.000 - .000	.00	.0000	.0000	.79	.00
Cyclopina sp.	A	420000.0	28000.0	10000.0 - 70000.0	26779.5	.000	.000	.000 - .000	.00	.0000	.0000	2.03	.00
Leucon sp.	78	52500.0	3500.0	10000.0 - 32500.0	8752.6	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00
Cumella vulgaris	78	410000.0	27333.3	10000.0 - 140000.0	44636.1	.000	.000	.000 - .000	.00	.0000	.0000	1.99	.00
Corophium sp.	7	430000.0	28666.7	10000.0 - 90000.0	27220.4	.000	.000	.000 - .000	.00	.0000	.0000	2.08	.00
Corophium salmonis	A8	62466.7	4164.4	2500.0 - 20000.0	6658.0	.000	.000	.000 - .000	.00	.0000	.0000	.30	.00
Corophium insidiosum	8A	185000.0	12333.3	2500.0 - 50000.0	16622.6	.000	.000	.000 - .000	.00	.0000	.0000	.90	.00
Eogammarus confervicolus	87A	90000.0	6000.0	5000.0 - 20000.0	8062.3	.000	.000	.000 - .000	.00	.0000	.0000	.44	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 42

SHANNON-WEINER DIVERSITY INDEX NUMBERS 4.09
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 4.09

APPENDIX 5: SUMMARY DATA FROM MEIOFAUNA SAMPLED WITH A 0.0004-M^2 WET CORE AT THREE TIDE ELEVATIONS, KELLOGG ISLAND REFERENCE MUDFLAT, DUWAMISH RIVER ESTUARY, 2 AUGUST 1993

A. Summary data from -0.6 m

B. Summary data from 0.0 m

C. Summary data from +0.6 m

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AU02	10070	M 1
93AU02	10070	M 3
93AU02	10070	M 6
93AU02	10070	M 9
93AU02	10070	M12
93AU02	10070	M15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.000	.000- .000	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	*********	99999.00- *********	494573.10	.41
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	ABUN-DANCE	BIO-MASS
Rhizopodea-foraminiferida	C	359691.7	59948.6	10000.0 - 220000.0	80544.0	.000	.000	.000 - .000	.00	.0000	.0000	4.99	.00
Turbellaria	C	13333.3	2222.2	13333.3 - 13333.3	5443.3	.000	.000	.000 - .000	.00	.0000	.0000	.18	.00
Nematoda	C	********	438377.0	.0 - 746666.7	*******	.000	.000	.000 - .000	.00	.0000	.0000	36.49	.00
Polychaeta	7	10000.0	1666.7	10000.0 - 10000.0	4082.5	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Spionidae	7	7271.7	1211.9	7271.7 - 7271.7	2968.6	.000	.000	.000 - .000	.00	.0000	.0000	.10	.00
Capitella sp.	7AC	52115.7	8686.0	2600.0 - 32500.0	13415.4	.000	.000	.000 - .000	.00	.0000	.0000	.72	.00
Podocopida	C	237271.7	39545.3	7271.7 - 80000.0	32155.6	.000	.000	.000 - .000	.00	.0000	.0000	3.29	.00
Ectinosomatidae	A	181815.0	30302.5	10000.0 - 120000.0	45533.4	.000	.000	.000 - .000	.00	.0000	.0000	2.52	.00

BENTHIC PLANKTON ANALYSIS
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SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Tisbe sp.	A	390000.0	65000.0	20000.0 - 220000.0	95864.5	.000	.000	.000 - .000	.00	.0000	.0000	5.41	.00
Microarthridion littorale	A	392420.0	65403.3	10000.0 - 333333.3	*******	.000	.000	.000 - .000	.00	.0000	.0000	5.44	.00
Tachidius triangularis	8A	190000.0	31666.7	10000.0 - 80000.0	33714.5	.000	.000	.000 - .000	.00	.0000	.0000	2.64	.00
Heterolaophonte discophora	A	20000.0	3333.3	20000.0 - 20000.0	8165.0	.000	.000	.000 - .000	.00	.0000	.0000	.28	.00
Leimia vaga	A	********	365854.2	.0 - 540000.0	*******	.000	.000	.000 - .000	.00	.0000	.0000	30.46	.00
Schizopera knabeni	F8	27271.7	4545.3	7271.7 - 10000.0	5077.8	.000	.000	.000 - .000	.00	.0000	.0000	.38	.00
Stenhelia sp.	A8	231506.7	38584.4	10000.0 - 58173.4	19473.2	.000	.000	.000 - .000	.00	.0000	.0000	3.21	.00
Cyclopina sp.	A	171815.0	28635.8	20000.0 - 70000.0	29852.4	.000	.000	.000 - .000	.00	.0000	.0000	2.38	.00
Leucon sp.	78	55148.3	9191.4	13333.3 - 21815.0	10457.4	.000	.000	.000 - .000	.00	.0000	.0000	.77	.00
Cumella vulgaris	78	30000.0	5000.0	30000.0 - 30000.0	12247.4	.000	.000	.000 - .000	.00	.0000	.0000	.42	.00
Corophium sp.	7	10000.0	1666.7	10000.0 - 10000.0	4082.5	.000	.000	.000 - .000	.00	.0000	.0000	.14	.00
Corophium insidiosum	A	2600.0	433.3	2600.0 - 2600.0	1061.4	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 20

SHANNON-WEINER DIVERSITY INDEX NUMBERS 2.70
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.70

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AU02	10070	E01
93AU02	10070	E02
93AU02	10070	E03
93AU02	10070	E04
93AU02	10070	E05
93AU02	10070	E06
93AU02	10070	E07
93AU02	10070	E08
93AU02	10070	E09
93AU02	10070	E10
93AU02	10070	E11
93AU02	10070	E12
93AU02	10070	E13
93AU02	10070	E14
93AU02	10070	E15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.000	.000- .000	.000	.001
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	*********	99999.00- *********	483276.70	.35
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME		NUMBERS/M**2				WET WEIGHT,GRAMS/M**2				AVG. BIOMASS		PERCENTAGES	
PARTS CODE	LH-STAGE	TOTAL	MEAN	RANGE	S.D.	TOTAL	MEAN	RANGE	S.D.	MEAN	S.D.	ABUN-DANCE	BIO-MASS
Rhizopodea-foraminiferida C		946666.7	63111.1	10000.0 - 220000.0	50826.0	.000	.000	.000 - .000	.00	.0000	.0000	4.58	.00
Cnidaria C		143333.3	9555.6	10000.0 - 50000.0	15829.8	.000	.000	.000 - .000	.00	.0000	.0000	.69	.00
Anthozoa C		10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 2

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	NUMBERS/M**2 MEAN	NUMBERS/M**2 RANGE	NUMBERS/M**2 S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	WET WEIGHT,GRAMS/M**2 MEAN	WET WEIGHT,GRAMS/M**2 RANGE	WET WEIGHT,GRAMS/M**2 S.D.	AVG. BIOMASS MEAN	AVG. BIOMASS S.D.	PERCENTAGES ABUN-DANCE	PERCENTAGES BIO-MASS
Turbellaria	CA	700000.0	46666.7	10000.0 - 120000.0	38110.1	.000	.000	.000 - .000	.00	.0000	.0000	3.39	.00
Nematoda	C	********	311555.6	.0 - 870000.0	*******	.000	.000	.000 - .000	.00	.0000	.0000	22.63	.00
Spionidae	7	90000.0	6000.0	10000.0 - 30000.0	9102.6	.000	.000	.000 - .000	.00	.0000	.0000	.44	.00
Polydora cornuta	7CA	52566.7	3504.4	5000.0 - 12500.0	4801.1	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00
Pseudopolydora kempi japonica	C7	7500.0	500.0	2500.0 - 2500.0	1035.1	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Pygospio elegans	7AC	70800.0	4720.0	10000.0 - 20800.0	8445.0	.000	.000	.000 - .000	.00	.0000	.0000	.34	.00
Capitella sp.	7AC	210000.0	14000.0	10000.0 - 32500.0	12914.6	.000	.000	.000 - .000	.00	.0000	.0000	1.02	.00
Hobsonia florida	7A	625000.0	41666.7	10000.0 - 182500.0	48196.6	.000	.000	.000 - .000	.00	.0000	.0000	3.03	.00
Manayunkia aestuarina	A	********	104000.0	20000.0 - 200000.0	62312.6	.000	.000	.000 - .000	.00	.0000	.0000	7.55	.00
Oligochaeta	CA	********	76060.0	10000.0 - 267500.0	63956.4	.000	.000	.000 - .000	.00	.0000	.0000	5.52	.00
Halacaridae	C	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Podocopida	CA	********	75777.8	10000.0 - 200000.0	56279.7	.000	.000	.000 - .000	.00	.0000	.0000	5.50	.00
Harpacticoida	F2	286666.7	19111.1	10000.0 - 80000.0	21435.3	.000	.000	.000 - .000	.00	.0000	.0000	1.39	.00
Scottolana canadensis	8	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Ectinosomatidae	8A	143333.3	9555.6	10000.0 - 20000.0	7112.1	.000	.000	.000 - .000	.00	.0000	.0000	.69	.00
Harpacticus sp.-uniremis group	8F	20000.0	1333.3	10000.0 - 10000.0	3518.7	.000	.000	.000 - .000	.00	.0000	.0000	.10	.00
Tisbe sp.	A	630000.0	42000.0	10000.0 - 130000.0	45387.2	.000	.000	.000 - .000	.00	.0000	.0000	3.05	.00
Microarthridion littorale	8A	50000.0	3333.3	10000.0 - 20000.0	6172.1	.000	.000	.000 - .000	.00	.0000	.0000	.24	.00
Tachidius triangularis	A	********	67777.8	20000.0 - 280000.0	66817.3	.000	.000	.000 - .000	.00	.0000	.0000	4.92	.00
Laophontidae	F	30000.0	2000.0	10000.0 - 10000.0	4140.4	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00
Paralaophonte pacifica	8	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Heterolaophonte discophora	8A	286666.7	19111.1	10000.0 - 50000.0	13712.8	.000	.000	.000 - .000	.00	.0000	.0000	1.39	.00
Heterolaophonte longisetigera	8	80000.0	5333.3	10000.0 - 30000.0	10601.0	.000	.000	.000 - .000	.00	.0000	.0000	.39	.00
Nitocra sp.	8	60000.0	4000.0	10000.0 - 30000.0	9102.6	.000	.000	.000 - .000	.00	.0000	.0000	.29	.00
Huntemannia jadensis	F8	40000.0	2666.7	10000.0 - 10000.0	4577.4	.000	.000	.000 - .000	.00	.0000	.0000	.19	.00

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Leimia vaga	A	********	180444.4	30000.0 - 370000.0	97994.7	.000	.000	.000 - .000	.00	.0000	.0000	13.11	.00
Limnocletodes behningi	8	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Schizopera knabeni	A8	********	70888.9	10000.0 - 170000.0	45065.5	.000	.000	.000 - .000	.00	.0000	.0000	5.15	.00
Stenhelia sp.	A	806666.6	53777.8	20000.0 - 140000.0	39698.6	.000	.000	.000 - .000	.00	.0000	.0000	3.91	.00
Mesochra sp.	8A	200000.0	13333.3	10000.0 - 90000.0	24103.0	.000	.000	.000 - .000	.00	.0000	.0000	.97	.00
Paradactylopodia sp.	8	10000.0	666.7	10000.0 - 10000.0	2582.0	.000	.000	.000 - .000	.00	.0000	.0000	.05	.00
Halicyclops sp.	F8A	163333.3	10888.9	10000.0 - 30000.0	11017.1	.000	.000	.000 - .000	.00	.0000	.0000	.79	.00
Cyclopina sp.	A	420000.0	28000.0	10000.0 - 70000.0	26779.5	.000	.000	.000 - .000	.00	.0000	.0000	2.03	.00
Leucon sp.	78	52500.0	3500.0	10000.0 - 32500.0	8752.6	.000	.000	.000 - .000	.00	.0000	.0000	.25	.00
Cumella vulgaris	78	410000.0	27333.3	10000.0 - 140000.0	44636.1	.000	.000	.000 - .000	.00	.0000	.0000	1.99	.00
Corophium sp.	7	430000.0	28666.7	10000.0 - 90000.0	27220.4	.000	.000	.000 - .000	.00	.0000	.0000	2.08	.00
Corophium salmonis	A8	62466.7	4164.4	2500.0 - 20000.0	6658.0	.000	.000	.000 - .000	.00	.0000	.0000	.30	.00
Corophium insidiosum	8A	185000.0	12333.3	2500.0 - 50000.0	16622.6	.000	.000	.000 - .000	.00	.0000	.0000	.90	.00
Eogammarus confervicolus	87A	90000.0	6000.0	5000.0 - 20000.0	8062.3	.000	.000	.000 - .000	.00	.0000	.0000	.44	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 42

SHANNON-WEINER DIVERSITY INDEX NUMBERS 4.09
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 4.09

BENTHIC PLANKTON ANALYSIS
****

SUMMARY TABLE, PAGE 1

****
* GRAND SUMMARY *
****

FROM COLLECTIONS:

FILEID	STATION	SAMPLE
93AU02	10070	M 1
93AU02	10070	M 3
93AU02	10070	M 6
93AU02	10070	M 9
93AU02	10070	M12
93AU02	10070	M15

SPECIES DEFINITION -
TRUNCATED = NO
LH-STAGE = EGGORNOT
PARTS CODE EXCLUDED

ABUNDANCES AND WEIGHTS ARE ADJUSTED TO AN AREA OF 1.0 SQUARE METERS

	MEAN	RANGE	S.D.	COEF.VAR
SAMPLE AREA (M**2)	.000	.000- .000	.000	.000
TOTAL WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
TOTAL ABUNDANCE (PER M**2)	*********	99999.00- *********	650354.40	.30
SAMPLE WET WEIGHT (PER M**2)	.000	.000- .000	.000	.000
SAMPLE DRY WEIGHT (PER M**2)	.000	.000- .000	.000	.000

ORGANISM NAME	PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Rhizopodea-foraminiferida	C		********	170998.3	40000.0 - 280000.0	92381.3	.000	.000	.000 - .000	.00	.0000	.0000	7.84	.00
Cnidaria	C		100000.0	16666.7	20000.0 - 40000.0	19663.8	.000	.000	.000 - .000	.00	.0000	.0000	.76	.00
Turbellaria	C		291996.6	48666.1	31996.6 - 120000.0	40033.6	.000	.000	.000 - .000	.00	.0000	.0000	2.23	.00
Nematoda	C		********	590992.6	.0 - ********	*******	.000	.000	.000 - .000	.00	.0000	.0000	27.08	.00
Spionidae	7		185262.1	30877.0	20000.0 - 62600.0	21993.1	.000	.000	.000 - .000	.00	.0000	.0000	1.41	.00
Polydora cornuta	C		2600.0	433.3	2600.0 - 2600.0	1061.4	.000	.000	.000 - .000	.00	.0000	.0000	.02	.00
Pseudopolydora kempi japonica	C		7800.0	1300.0	2600.0 - 2600.0	1424.1	.000	.000	.000 - .000	.00	.0000	.0000	.06	.00
Pygospio elegans	C		40000.0	6666.7	40000.0 - 40000.0	16329.9	.000	.000	.000 - .000	.00	.0000	.0000	.31	.00

BENTHIC PLANKTON ANALYSIS
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SUMMARY TABLE, PAGE 2

ORGANISM NAME	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
PARTS CODE													
Capitella sp.	7A	258784.1	43130.7	5000.0 - 115000.0	43770.2	.000	.000	.000 - .000	.00	.0000	.0000	1.98	.00
Hobsonia florida	7A	270665.5	45110.9	10000.0 - 100000.0	37158.5	.000	.000	.000 - .000	.00	.0000	.0000	2.07	.00
Manayunkia aestuarina	A	984936.0	164156.0	42500.0 - 280000.0	87302.4	.000	.000	.000 - .000	.00	.0000	.0000	7.52	.00
Oligochaeta	CA	********	175738.4	32500.0 - 315000.0	95753.8	.000	.000	.000 - .000	.00	.0000	.0000	8.05	.00
Halacaridae	C	30000.0	5000.0	10000.0 - 20000.0	8366.6	.000	.000	.000 - .000	.00	.0000	.0000	.23	.00
Podocopida	C	587320.8	97886.8	70000.0 - 120000.0	23550.9	.000	.000	.000 - .000	.00	.0000	.0000	4.49	.00
Harpacticoida	F	120000.0	20000.0	40000.0 - 80000.0	33466.4	.000	.000	.000 - .000	.00	.0000	.0000	.92	.00
Ectinosomatidae	A	80000.0	13333.3	20000.0 - 60000.0	24221.2	.000	.000	.000 - .000	.00	.0000	.0000	.61	.00
Microarthridion littorale	8	20000.0	3333.3	20000.0 - 20000.0	8165.0	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00
Tachidius triangularis	8A	40000.0	6666.7	20000.0 - 20000.0	10328.0	.000	.000	.000 - .000	.00	.0000	.0000	.31	.00
Tachidius discipes	8	20000.0	3333.3	20000.0 - 20000.0	8165.0	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00
Heterolaophonte discophora	8A	33931.1	5655.2	2600.0 - 21331.1	8601.0	.000	.000	.000 - .000	.00	.0000	.0000	.26	.00
Nitocra sp.	A	254658.7	42443.1	74658.7 - 180000.0	73709.4	.000	.000	.000 - .000	.00	.0000	.0000	1.94	.00
Huntemannia jadensis	A	294658.7	49109.8	20000.0 - 100000.0	31947.8	.000	.000	.000 - .000	.00	.0000	.0000	2.25	.00
Nannopus palustris	8	40000.0	6666.7	20000.0 - 20000.0	10328.0	.000	.000	.000 - .000	.00	.0000	.0000	.31	.00
Leimia vaga	A	475324.3	79220.7	30000.0 - 160000.0	47591.4	.000	.000	.000 - .000	.00	.0000	.0000	3.63	.00
Schizopera knabeni	A	864641.6	144106.9	40000.0 - 234641.6	76099.7	.000	.000	.000 - .000	.00	.0000	.0000	6.60	.00
Stenhelia sp.	A	********	333108.7	.0 - 700000.0	*******	.000	.000	.000 - .000	.00	.0000	.0000	15.26	.00
Mesochra sp.	A8	151331.1	25221.8	10000.0 - 60000.0	21624.8	.000	.000	.000 - .000	.00	.0000	.0000	1.16	.00
Thalestridae	F	20000.0	3333.3	20000.0 - 20000.0	8165.0	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00
Halicyclops sp.	8	10000.0	1666.7	10000.0 - 10000.0	4082.5	.000	.000	.000 - .000	.00	.0000	.0000	.08	.00
Leucon sp.	A	12500.0	2083.3	12500.0 - 12500.0	5103.1	.000	.000	.000 - .000	.00	.0000	.0000	.10	.00
Cumella vulgaris	78	63165.5	10527.6	10665.5 - 20000.0	9000.3	.000	.000	.000 - .000	.00	.0000	.0000	.48	.00
Tanais sp.	A	57500.0	9583.3	57500.0 - 57500.0	23474.3	.000	.000	.000 - .000	.00	.0000	.0000	.44	.00
Corophium sp.	7	71996.6	11999.4	20000.0 - 31996.6	13855.4	.000	.000	.000 - .000	.00	.0000	.0000	.55	.00

BENTHIC PLANKTON ANALYSIS
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SUMMARY TABLE, PAGE 3

ORGANISM NAME / PARTS CODE	LH-STAGE	NUMBERS/M**2 TOTAL	MEAN	RANGE	S.D.	WET WEIGHT,GRAMS/M**2 TOTAL	MEAN	RANGE	S.D.	AVG. BIOMASS MEAN	S.D.	PERCENTAGES ABUN-DANCE	BIO-MASS
Corophium salmonis 8A		55065.9	9177.6	5000.0 - 15000.0	4101.8	.000	.000	.000 - .000	.00	.0000	.0000	.42	.00
Corophium insidiosum 78		5200.0	866.7	2600.0 - 2600.0	1342.6	.000	.000	.000 - .000	.00	.0000	.0000	.04	.00
Eogammarus confervicolus 7		20000.0	3333.3	20000.0 - 20000.0	8165.0	.000	.000	.000 - .000	.00	.0000	.0000	.15	.00

TOTAL NUMBER OF PLANKTON CATEGORIES 36

SHANNON-WEINER DIVERSITY INDEX NUMBERS 3.68
BIOMASS .00
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 3.68

APPENDIX 6: DATA SUMMARIES FOR *CAREX LYNGBYEI* PATCHES; SITE 1, SITE 2, AND SITE 3

#Shts/16 = shoot density per 25 x 25 cm quadrat; # Shts/64 = shoot density per 12.5 x 12.5 cm quadrat; AGB = aboveground biomass, grams dry weight; BGBio (lv) = belowground live biomass in grams dry weight; BGBio (dd) = belowground dead biomass in grams dry weight.

DATE	SITE	S.E.	MEAN	^-C.I.	^+C.I.	MEDIAN
#Shts/16						
1	1	124.944	582.400	299.778	865.022	688.000
1	2	84.103	761.600	571.359	951.841	672.000
1	3	55.924	402.667	276.167	529.166	360.000
2	1	122.252	706.286	429.752	982.819	704.000
2	2	163.662	1241.600	871.396	1611.804	1184.000
2	3	137.358	848.000	537.296	1158.704	864.000
3	1	117.760	716.800	450.426	983.174	592.000
3	2	87.533	505.600	307.600	703.600	400.000
3	3	92.219	339.200	130.601	547.799	144.000
#Shts/64						
1	1	185.293	729.600	310.467	1148.733	672.000
1	2	260.275	1376.000	787.257	1964.743	1184.000
1	3	112.986	800.000	544.425	1055.575	896.000
2	1	203.283	896.000	436.173	1355.827	800.000
2	2	220.220	1356.800	858.663	1854.937	1504.000
2	3	187.309	1222.400	798.708	1646.092	1120.000
3	1	193.946	1056.000	617.295	1494.705	1056.000
3	2	93.964	576.000	363.454	788.546	480.000
3	3	65.267	371.200	223.565	518.835	384.000
AGB/64						
1	1	53.195	182.656	62.329	302.983	147.200
1	2	30.353	218.224	149.566	286.882	203.944
1	3	40.501	185.696	94.084	277.308	155.200
2	1	47.661	204.141	96.331	311.951	200.560
2	2	20.522	144.101	97.680	190.522	153.392
2	3	35.285	256.638	176.823	336.454	225.320
3	1	39.913	205.931	115.648	296.214	217.920
3	2	14.558	55.053	22.123	87.982	45.320
3	3	18.500	56.973	15.125	98.820	30.280
BGBio(lv)						
1	1	76.033	255.275	83.288	427.262	207.041
1	2	137.687	845.126	533.679	1156.573	872.477
1	3	153.851	564.946	216.934	912.957	361.622
2	1	140.828	835.755	517.202	1154.307	804.991
2	2	113.029	688.712	433.041	944.383	519.514
2	3	359.437	1558.439	745.392	2371.485	1205.577
3	1	125.991	1032.457	747.465	1317.449	1083.339
3	2	149.300	802.649	464.931	1140.366	787.420
3	3	133.216	637.983	336.647	939.319	567.390
BGBio(dd)						
1	1	169.028	510.295	127.954	892.636	362.386
1	2	76.921	698.593	524.598	872.588	656.523
1	3	75.254	441.026	270.802	611.251	506.526
2	1	130.836	561.941	265.991	857.891	408.735
2	2	53.099	278.958	158.849	399.067	248.297
2	3	115.690	495.292	233.601	756.983	547.527
3	1	118.035	580.429	313.434	847.424	471.892
3	2	212.907	479.531	-2.064	961.126	307.888
3	3	222.978	586.694	82.318	1091.070	240.402

APPENDIX 7: DATA SUMMARY FOR *SCIRPUS* SP. BENCH ON KELLOGG ISLAND

Quadrat #	Shoot Density/M
1	304
2	208
3	304
4	416
5	336
6	304
7	304
8	544
9	384
10	544

Shoot Density/ M sq.	
Mean	364.8
Standard Error	34.54748745
Median	320
Mode	304
Standard Deviation	109.2487478
Variance	11935.28889
Kurtosis	-0.157663142
Skewness	0.732029516
Range	336
Minimum	208
Maximum	544
Sum	3648
Count	10

APPENDIX 8: DATA SUMMARY FOR MULTISPECIES HIGH MARSH ON KELLOGG ISLAND

	Mean Weight (grams)		
Species	**Patch 1**	**Patch 2**	**Patch 3**
Distichlis spicata	223.69	9.28	0.00
Aster spp.	0.88	40.20	0.00
Spergularia marina	0.84	0.00	0.00
Salicornia virginica	127.07	0.00	0.00
Triglochin maritimum	3.92	1.81	0.00
Cotula coronopifolia	0.45	0.00	0.00
Juncus balticus	0.00	196.80	289.12
Atriplex patula	0.00	4.76	0.00
Plantago lanceolata	0.00	21.79	0.00
Achillea millefolium	0.00	11.56	0.00
Antenaria spp.	0.00	18.30	0.00
Other	0.00	43.71	0.00

APPENDIX 9: SEDIMENT GRAIN SIZE DATA

LOCATION: Duwamish River DATE: 8/2/93

Site 1=Turning Basin (TB) Site 2=Delightful Sedge Bench (DSB) Site 3=Kellog Island (KI)

SITE 1 TB Sample # 1

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0	0	0	3	0
1 mm	0.105	0.21613	0.21613	1.5	0.1575
.5 mm	0.402	0.82747	1.0436	0.75	0.3015
.25 mm	6.516	13.4124	14.456	0.625	4.0725
.125 mm	21.27	43.7816	58.2376	0.3125	6.64688
.063 mm	12.572	25.8779	84.1155	0.1575	1.98009
tot fines	7.717	15.8845	100	0.078	0.60193
TOTAL	48.582				13.7604

MEAN GRAINSIZE 0.28324

SITE 1 TB Sample # 2

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.028	0.08175	0.08175	3	0.084
1 mm	0.071	0.20731	0.28906	1.5	0.1065
.5 mm	0.254	0.74163	1.03069	0.75	0.1905
.25 mm	2.031	5.9301	6.96079	0.625	1.26938
.125 mm	5.925	17.2998	24.2606	0.3125	1.85156
.063 mm	10.696	31.2301	55.4907	0.1575	1.68462
tot fines	15.244	44.5093	100	0.078	1.18903
TOTAL	34.249				6.37559

MEAN GRAINSIZE 0.18615

SITE 1 TB Sample # 3

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.004	0.01228	0.01228	3	0.012
1 mm	0	0	0.01228	1.5	0
.5 mm	0.244	0.74911	0.76139	0.75	0.183
.25 mm	1.417	4.35036	5.11175	0.625	0.88563
.125 mm	8.37	25.6969	30.8087	0.3125	2.61563
.063 mm	13.898	42.6685	73.4772	0.1575	2.18894
tot fines	8.639	26.5228	100	0.078	0.67384
TOTAL	32.572				6.55903

MEAN GRAINSIZE 0.20137

SITE 1 TB Sample # 4

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0	0	0	3	0
1 mm	0.019	0.08439	0.08439	1.5	0.0285
.5 mm	0.257	1.14146	1.22585	0.75	0.19275
.25 mm	2.215	9.83789	11.0637	0.625	1.38438
.125 mm	4.521	20.0799	31.1437	0.3125	1.41281
.063 mm	6.073	26.9731	58.1168	0.1575	0.9565
tot fines	9.43	41.8832	100	0.078	0.73554
TOTAL	22.515				4.71048

MEAN GRAINSIZE 0.20921

SITE 1 TB Sample # 5

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0	0	0	3	0
1 mm	0.029	0.12521	0.12521	1.5	0.0435
.5 mm	0.166	0.71669	0.8419	0.75	0.1245
.25 mm	1.486	6.41568	7.25758	0.625	0.92875
.125 mm	4.426	19.1089	26.3665	0.3125	1.38313
.063 mm	6.578	28.4	54.7664	0.1575	1.03604
tot fines	10.477	45.2336	100	0.078	0.81721
TOTAL	23.162				4.33312

MEAN GRAINSIZE 0.18708

SUMMARY: SITE 1 Turning Basin

PERCENT by class

Phi	REP 1	REP 2	REP 3	REP 4	REP 5	MEAN	STDEV
2 mm	0	0.081754	0.01228	0	0	0.018807	0.035588
1 mm	0.216129	0.207305	0	0.084388	0.125205	0.126606	0.089917
.5 mm	0.827467	0.741627	0.74911	1.141461	0.716691	0.835271	0.176116
.25 mm	13.41237	5.9301	4.350362	9.837886	6.415681	7.989281	3.63268
.125 mm	43.78165	17.29978	25.69692	20.07995	19.10889	25.19343	10.8542
.063 mm	25.8779	31.23011	42.66855	26.97313	28.39997	31.02993	6.808365
fines	15.88448	44.50933	26.52278	41.88319	45.23357	34.80667	13.03467

MEAN GRAIN SIZE (mm)

REP 1	REP 2	REP 3	REP 4	REP 5	MEAN	STDEV
0.283241	0.186154	0.20137	0.209215	0.187079	0.213412	0.040234

SITE 2 DSB Sample # 1

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.27	0.98695	0.98695	3	0.81
1 mm	0.699	2.5551	3.54206	1.5	1.0485
.5 mm	2.102	7.68359	11.2256	0.75	1.5765
.25 mm	4.662	17.0413	28.267	0.625	2.91375
.125 mm	8.836	32.2989	60.5659	0.3125	2.76125
.063 mm	5.774	21.1061	81.672	0.1575	0.90941
tot fines	5.014	18.328	100	0.078	0.39109
TOTAL	27.357				10.4105

MEAN GRAINSIZE 0.38054

SITE 2 DSB Sample # 2

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.178	0.47038	0.47038	3	0.534
1 mm	0.764	2.01892	2.4893	1.5	1.146
.5 mm	2.415	6.3818	8.8711	0.75	1.81125
.25 mm	9.807	25.9156	34.7867	0.625	6.12938
.125 mm	12.138	32.0755	66.8622	0.3125	3.79313
.063 mm	7.294	19.2749	86.1371	0.1575	1.14881
tot fines	5.246	13.8629	100	0.078	0.40919
TOTAL	37.842				14.9717

MEAN GRAINSIZE 0.39564

SITE 2 DSB Sample # 3

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.153	0.39844	0.39844	3	0.459
1 mm	0.693	1.80469	2.20313	1.5	1.0395
.5 mm	2.393	6.23177	8.4349	0.75	1.79475
.25 mm	8.996	23.4271	31.862	0.625	5.6225
.125 mm	11.569	30.1276	61.9896	0.3125	3.61531
.063 mm	7.713	20.0859	82.0755	0.1575	1.2148
tot fines	6.883	17.9245	100	0.078	0.53687
TOTAL	38.4				14.2827

MEAN GRAINSIZE 0.37195

SITE 2 DSB Sample # 4

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.077	0.2334	0.2334	3	0.231
1 mm	0.504	1.52774	1.76114	1.5	0.756
.5 mm	1.411	4.27705	6.03819	0.75	1.05825
.25 mm	5.785	17.5356	23.5738	0.625	3.61563
.125 mm	9.584	29.0512	52.625	0.3125	2.995
.063 mm	7.666	23.2373	75.8624	0.1575	1.2074
tot fines	7.963	24.1376	100	0.078	0.62111
TOTAL	32.99				10.4844

MEAN GRAINSIZE 0.3178

SITE 2 DSB Sample # 5

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.025	0.08655	0.08655	3	0.075
1 mm	0.405	1.40211	1.48866	1.5	0.6075
.5 mm	1.287	4.4556	5.94426	0.75	0.96525
.25 mm	3.629	12.5636	18.5079	0.625	2.26813
.125 mm	6.913	23.9328	42.4407	0.3125	2.16031
.063 mm	7.437	25.7469	68.1876	0.1575	1.17133
tot fines	9.189	31.8124	100	0.078	0.71674
TOTAL	28.885				7.96426

MEAN GRAINSIZE 0.27572

SUMMARY: SITE 2 Delightful Sedge Bench

PERCENT by class

Phi	REP 1	REP 2	REP 3	REP 4	REP 5	MEAN	STDEV
2 mm	0.98695	0.470377	0.398438	0.233404	0.08655	0.435144	0.342526
1 mm	2.555105	2.018921	1.804688	1.527736	1.402112	1.861712	0.455942
.5 mm	7.683591	6.381798	6.231771	4.277054	4.4556	5.805963	1.431732
.25 mm	17.04134	25.91565	23.42708	17.53562	12.56361	19.29666	5.347734
.125 mm	32.29886	32.07547	30.1276	29.05123	23.93284	29.4972	3.3932
.063 mm	21.10612	19.27488	20.08594	23.23734	25.74693	21.89024	2.617212
fines	18.32803	13.8629	17.92448	24.13762	31.81236	21.21308	6.965291

MEAN GRAIN SIZE (mm)

REP 1	REP 2	REP 3	REP 4	REP 5	MEAN	STDEV
0.380542	0.395638	0.371946	0.317805	0.275723	0.348331	0.050092

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SITE 3 KI Sample # 1

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.16	0.80788	0.80788	3	0.48
1 mm	0.648	3.2719	4.07978	1.5	0.972
.5 mm	0.822	4.15047	8.23024	0.75	0.6165
.25 mm	1.44	7.27089	15.5011	0.625	0.9
.125 mm	3.268	16.5009	32.002	0.3125	1.02125
.063 mm	5.306	26.7912	58.7932	0.1575	0.8357
tot fines	8.161	41.2068	100	0.078	0.63656
TOTAL	19.805				5.462

MEAN GRAINSIZE 0.27579

SITE 3 KI Sample # 2

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.112	0.53823	0.53823	3	0.336
1 mm	0.414	1.98952	2.52775	1.5	0.621
.5 mm	0.569	2.73439	5.26215	0.75	0.42675
.25 mm	3.607	17.3338	22.596	0.625	2.25438
.125 mm	5.693	27.3584	49.9543	0.3125	1.77906
.063 mm	4.781	22.9756	72.93	0.1575	0.75301
tot fines	5.633	27.07	100	0.078	0.43937
TOTAL	20.809				6.60957

MEAN GRAINSIZE 0.31763

SITE 3 KI Sample # 3

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.115	0.60383	0.60383	3	0.345
1 mm	0.351	1.843	2.44684	1.5	0.5265
.5 mm	0.675	3.54424	5.99107	0.75	0.50625
.25 mm	3.624	19.0286	25.0197	0.625	2.265
.125 mm	3.112	16.3402	41.3599	0.3125	0.9725
.063 mm	3.461	18.1727	59.5327	0.1575	0.54511
tot fines	7.707	40.4673	100	0.078	0.60115
TOTAL	19.045				5.7615

MEAN GRAINSIZE 0.30252

SITE 3 KI Sample # 4

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.005	0.02158	0.02158	3	0.015
1 mm	0.318	1.37264	1.39422	1.5	0.477
.5 mm	0.638	2.75392	4.14814	0.75	0.4785
.25 mm	2.872	12.3969	16.5451	0.625	1.795
.125 mm	7.453	32.1708	48.7158	0.3125	2.32906
.063 mm	5.518	23.8184	72.5342	0.1575	0.86909
tot fines	6.363	27.4658	100	0.078	0.49631
TOTAL	23.167				6.45996

MEAN GRAINSIZE 0.27884

SITE 3 KI Sample # 5

Phi	Sam. wt	%	cum. %	midpoint	mid*wt
2 mm	0.123	0.5627	0.5627	3	0.369
1 mm	0.437	1.99918	2.56187	1.5	0.6555
.5 mm	0.571	2.6122	5.17407	0.75	0.42825
.25 mm	2.853	13.0518	18.2259	0.625	1.78313
.125 mm	5.262	24.0725	42.2984	0.3125	1.64438
.063 mm	4.411	20.1793	62.4777	0.1575	0.69473
tot fines	8.202	37.5223	100	0.078	0.63976
TOTAL	21.859				6.21474

MEAN GRAINSIZE 0.28431

SITE 3 Kellogg Island

PERCENT

REP 1	REP 2	REP 3	REP 4	REP 5	MEAN	STDEV
0.807877	0.538229	0.603833	0.021582	0.562697	0.506844	0.291381
3.271901	1.989524	1.843003	1.372642	1.999177	2.095249	0.705462
4.150467	2.734394	3.544237	2.753917	2.612196	3.159042	0.666106
7.270891	17.33385	19.02862	12.39694	13.05183	13.81643	4.609304
16.50088	27.35835	16.34025	32.17076	24.07246	23.28854	6.899689
26.79121	22.97564	18.17275	23.81836	20.17933	22.38746	3.332646
41.20677	27.07002	40.46731	27.46579	37.5223	34.74644	6.966077

MEAN GRAIN SIZE (mm)

REP 1	REP 2	REP 3	REP 4	REP 5	MEAN	STDEV
0.275789	0.31763	0.302521	0.278843	0.28431	0.291819	0.017766

AVERAGES BY SITE (OVER REPLICATES)

PERCENT by size class

	SITE 1		SITE 2		SITE 3	
Phi	MEAN	SDEV	MEAN	SDEV	MEAN	SDEV
2 mm	0.01881	0.03559	0.43514	0.34253	0.50684	0.29138
1 mm	0.12661	0.08992	1.86171	0.45594	2.09525	0.70546
.5 mm	0.83527	0.17612	5.80596	1.43173	3.15904	0.66611
.25 mm	7.98928	3.63268	19.2967	5.34773	13.8164	4.6093
.125 mm	25.1934	10.8542	29.4972	3.3932	23.2885	6.89969
.063 mm	31.0299	6.80836	21.8902	2.61721	22.3875	3.33265
fines	34.8067	13.0347	21.2131	6.96529	34.7464	6.96608

CUMULATIVE PERCENT

	SITE 1		SITE 2		SITE 3	
Phi	MEAN	SDEV	MEAN	SDEV	MEAN	SDEV
2 mm	0.01881	0.03559	0.43514	0.34253	0.50684	0.29138
1 mm	0.14541	0.08992	2.29686	0.45594	2.60209	0.70546
.5 mm	0.98068	0.17612	8.10282	1.43173	5.76114	0.66611
.25 mm	8.96996	3.63268	27.3995	5.34773	19.5776	4.6093
.125 mm	34.1634	10.8542	56.8967	3.3932	42.8661	6.89969
.063 mm	65.1933	6.80836	78.7869	2.61721	65.2536	3.33265
fines	100	13.0347	100	6.96529	100	6.96608

MEAN GRAIN SIZE (mm)

SITE 1		SITE 2		SITE 3	
MEAN	SDEV	MEAN	SDEV	MEAN	SDEV
0.21341	0.04023	0.34833	0.05009	0.29182	0.01777