MONITORING AND EVALUATION OF POTENTIAL SITES FOR THE LOWER SNAKE RIVER DREDGED MATERIAL MANAGEMENT PLAN AND THE WOODY RIPARIAN DEVELOPMENT PROGRAM

Completion Report

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EXECUTIVE SUMMARY

Sediment deposition near the confluence of the Snake and Clearwater rivers in Lower Granite Reservoir has aroused concern to maintain statutory uses. A number of studies were conducted in the late 1980s and early 1990s following two Adaptive Management workshops. These studies assessed the impact of dredging and in-water disposal on reservoir biota, including ESA listed migratory salmonid fishes. Three in-water disposal options were evaluated in the previous studies: submerged island, above-water island, and deep water disposal. Results of these studies showed that predator fishes were not concentrated and juvenile salmonid fishes were not residualizing at the disposal stations relative to reference stations. Later, community analysis of the fishes revealed that species richness was enhanced and that trophic structure and trends in feeding-guild abundance were not significantly different between reference and disposal stations. Construction of shallow-water habitat with dredged material appears to be one management approach that could increase habitat complexity. However, one aspect of the sediment management program that could not be evaluated was the long-term effects of in-water disposal on the Lower Granite Reservoir ecosystem. Therefore, this study was conducted after more than 10 years following in-water disposal with three objectives: to monitor abundance of predator fishes with special emphasis on northern pikeminnow and smallmouth bass at selected sites in Lower Granite Reservoir, to monitor juvenile fall chinook salmon abundance and habitat utilization at selected sites in Lower Granite and Little Goose reservoirs, and to characterize

habitat, including macrophyte development and substrates at previously constructed disposal sites and at additional potential disposal sites.

METHODS

We sampled 13 stations in Lower Granite Reservoir and three stations in Little Goose Reservoir, Snake River, Washington. Two stations were associated with the Centennial Island (nos. 1,2), the island constructed from dredged material, four were reference stations (3, 10, 11, 13) in Lower Granite Reservoir, four were potential dredging sites at boat launches in both Lower Granite and Little Goose reservoirs (4, 5, 14, 15), five were potential disposal sites (6, 7, 8, 9, 12), and one was a reference site in Little Goose Reservoir.

We used standardized day-time beach seining and nighttime boat electrofishing to sample fishes. Beach seining was conducted at biweekly intervals from late May through July, and monthly from August through November. Electrofishing also was conducted biweekly late May through July and monthly August and September. Boat launch sites were not electrofished. All fishes sampled were identified, measured and released. We calculated catch per unit effort (CPUE) as 5 minutes of electrofishing and one beach seine haul.

Habitat characterization also was conducted at each of the 16 stations. We sampled benthic macroinvertebrates (BMI), substrate composition, aquatic macrophyte composition, density, and biomass and mapped each of the areas.

RESULTS

A total of 33,471 fishes representing 25 species was collected at the 16 sampling stations in Lower Granite Reservoir and Little Goose Reservoir during 2002. These species represented 9 families and 7 orders. Juvenile anadromous salmonids accounted for 15.78 % of the total catch and two species commonly considered predatory, northern pikeminnow (*Ptychocheilus oregonensis*) and smallmouth bass (*Micropterus dolomieu*; hereafter referred to as predators) in the Columbia Basin, comprised 15.6 % of the catch. Total fish catches at most stations were generally highly correlated suggesting a similarity in the fish community at reference, potential and actual disposal and boat launch stations.

Fishes collected at stations 4,7, 11, and 15 accounted for 63.0 % of the total catch while fishes collected at Centennial Island comprised 3.8% of the total catch. The proportion of predator fishes collected was highest in August (27.9%) followed by July (25%).

Smallmouth bass and northern pikeminnow ranged in relative abundance from a high of 40.4% at station 11 to a low of 2.0% at station 15. Relative predator abundance at the disposal stations was highest at station 1 (18.1%), followed by station 2 (14.5%). However, the proportion of the total catch of smallmouth bass and northern pikeminnow was lower at stations 1 and 2 than the mean percentage of predator fishes (21.2%) at all stations.

Mean CPUE of potential predator fishes at disposal stations 1 and 2 was generally similar or lower than at other stations. Mean CPUE for smallmouth bass

was the highest of all predator fishes at all stations except at station 8 where largemouth bass (*M. salmoides*) was the highest. Differences in mean CPUE for smallmouth bass between disposal and reference stations were not statistically different.

Mean CPUE for northern pikeminnow was considerably lower than that for smallmouth bass at all stations in Lower Granite Reservoir (stations 1-13). Highest mean CPUE for northern pikeminnow was at station 6 and consistently low CPUEs were found at stations 2, 10, and 12. Mean CPUE for northern pikeminnow was significantly lower at one of the disposal stations. Abundance of other potential predator fishes was comparatively low at all stations. Although CPUEs for predators were relatively high at some stations, length analysis of captured fishes showed the majority of these were smaller.

We captured a total of 5282 juvenile anadromous salmonids using both gear types. Over 95% of the total juvenile anadromous salmonids were chinook salmon (*Oncorhynchus tshawytscha*). Chinook salmon were collected at each of the 16 stations, although proportional abundance was highest at stations 6, 7 and 11.

Fall chinook salmon were captured at all 16 stations but were caught in highest abundance at stations 6, 7, 9, and 11. Mean CPUE for fall chinook salmon at disposal stations 1 and 2 were similar to those at stations 4, 10, and 12, although in general, mean CPUE was lower in down-reservoir stations in Lower Granite Reservoir. Juvenile anadromous salmonids at disposal stations 1 and 2 accounted for 5.8% of all juvenile salmonids collected. Few significant differences in mean CPUE of chinook salmon were found between disposal and reference stations.

We identified >30 taxa in the benthic macroinvertebrate samples from Lower Granite and Little Goose reservoirs although representatives of Diptera, Oligochaeta, Ephemeroptera, Tricoptera, and Mollusca comprised the majority of the samples. Highest mean biomass of benthic macroinvertebrates was found at station 16 (>244 g/m^2) followed by station 15 (59.8 g/m^2). Biomass of benthic macroinvertebrates at stations 1 (17.29 g/m^2) and 2 (5.47g/m^2) were similar and ranked 7^{th} and 13^{th} from the most abundant, respectively. At these stations, pelecypods and oligochaetes comprised the majority of the macroinvertebrate biomass. Highest density of benthic macroinvertebrates (19,564/$m^{2)}$ was found at station 4 followed by station 15 (14,782/m^2. Densities of benthic macroinvertebrates at stations 1 (6,199/m^2) and 2 (6,846/m^2) were similar and ranked 11^{th} and 10^{th} from the most abundant, respectively.

We collected six species of submerged aquatic macrophytes at the 16 stations. Macrophyte distribution was clumped and generally low. Estimated submerged vegetation coverage at the 16 stations ranged from >80% at stations 11 and 15 to 0% at eight of the stations. Total dry-weight biomass (g/m^2) was highest at station 15 (6.01 g/m^2) followed distantly by station 11 (1.97 g/m^2). Aquatic macrophyte beds at disposal stations 1 and 2 were <15% of the total area. The species composition of aquatic macrophytes at stations 1 and 2 was similar to other stations. Biomass of macrophytes at disposal stations was low (0.024-0.161 g/m^2).

The predominant substrate particle size collected at all 16 stations was < 2 mm. Substrate at station 1 was predominately <2 mm. However, at station 2 we

collected a wide range of substrate sizes from 25-50 mm that accounted for about 40% of the substrate. Organic matter was generally <5%.

Depth mapping at various stations demonstrated that some shorelines had precipitous banks while others were generally flat with little shoreline gradient.

DISCUSSION

We believe sampling in 2002 was highly effective at describing the fish community and habitat characteristics at selected stations in Lower Granite and Little Goose reservoirs. We sampled over 33,000 fish at the 16 stations during 2002. Spatial distributions of fall chinook salmon were generally similar to those in previous surveys. Numbers collected downstream at stations 10 and 13 were higher than station 1 but lower than station 2. Chinook salmon were second in abundance of all fishes and highest numbers were collected at stations 6 and 7 on the south shoreline of Lower Granite Reservoir, upstream from Silcott Island.

The fish community in Lower Granite Reservoir has changed little from the early 1990s. Similar numbers of species have been collected since the late 1980s although two new species, the banded killifish (*Fundulus diaphanus*) and warmouth (*Lepomis gulosus*), were collected in Lower Granite Reservoir in 2002. Our collections suggest that feeding-guild abundance has not changed in a decade. Also, numbers of tolerant species were low in previous surveys and during 2002.

Fish community composition at the disposal stations was generally similar to each other. Overall, total fish sampled at disposal stations 1 and 2, ranked 13th and 14th. Fewer fish were collected at stations 10 and 12 than at disposal stations. The

most abundant species collected at station 1 was peamouth and they accounted for nearly 25% of the catch. At station 2, chinook salmon were most abundant and they accounted for 39.5% of the total catch.

The predator abundance at the disposal stations suggested that smallmouth bass and northern pikeminnow were the 5th and 8th in rank order of abundance, respectively. Although we collected over 3,500 smallmouth bass and 1,600 northern pikeminnow, the majority of these two predators were less than 100 mm.

We observed several changes in the BMI community from earlier surveys. Surveys in the 1980s and 1990s reported that the BMI biomass at shallow-water stations was largely oligochaetes followed by chironomids. We found taxa richness, biomass and density increased from the earlier surveys, possibly related to reservoir aging.

We found slight changes in the species composition of aquatic macrophytes from previous surveys. In 1992, *P. crispus* was generally the dominant aquatic macrophyte and in 2002, three species of *Potamogeton* and *Myriophyllum brasiliense* were abundant. In general, biomass of aquatic macrophytes has decreased since 1992.

Substrate characteristics at stations 1 and 2 were generally similar to those of previous surveys. At station 1, particles < 2 mm accounted for the majority of the substrate while at station 2, < 2mm particles accounted for about 60% of the samples and larger materials accounted for about 40% of the substrate.

Summary

Fish species richness has increased with the addition of two new species to the fish community in Lower Granite Reservoir. Juvenile anadromous salmonid use was observed at all stations although highest abundance was along the south shoreline, immediately upstream of Silcott Island. Substrate is generally similar, aquatic macrophytes have decreased in abundance, while benthic macroinvertebrates have increased in richness, density and biomass. Habitat changes have been slight throughout the reservoir.

Construction of Centennial Island occurred over 10 years ago. Findings in 2002 suggest that habitat and biotic community changes at the disposal stations were slight since construction. Changes in the fish community were few and our results suggest that dredged material can be used to increase shallow water habitat. One of the more significant habitat changes was increased erosion on the shore-side of Centennial Island.

Recommendations

1) Continue fish and invertebrate community monitoring and habitat characterization at proposed disposal sites in Lower Granite Reservoir.
2) Our data show that stations on the south shore, potential dredged material disposal locations upstream of Silcott Island, supported high numbers of juvenile anadromous fishes. Results from a second year of sampling would probably show the relative importance of these sites to juvenile anadromous fishes.
3) Because of the limited availability of shallow water habitat in Lower Granite Reservoir, managers are encouraged to creatively examine potential sites for beneficial uses of dredged material with high gradient slopes, especially in the lower (downstream of RM 119.5) reservoir.
4) BMI foraging sites in shallow water continue to be limited for juvenile anadromous salmonids in the downstream portion of Lower Granite Reservoir. One possible beneficial use of dredged material may be in increasing shallow water habitat, thereby increasing food availability to juvenile anadromous salmonid fishes.

INTRODUCTION

The Lower Granite Project, Snake River, Idaho-Washington, provides electrical power generation, flood control, navigation, and recreational benefits (Bennett et al. 1990). However, sediment deposition has become a primary concern for flood control and navigational uses in Lower Granite Reservoir. Accumulation of sediment has raised concern over the ability of the levee system on the Snake and Clearwater rivers to protect the cities of Lewiston, Idaho and Clarkston, Washington. Sediment inflows vary annually and seem positively linked to discharge. U.S. Army Corps of Engineer personnel have indicated that sediment inflows of nearly 3×10^6 yds^3 of sediment can enter the confluence of the Snake and Clearwater rivers, which form the upper end of Lower Granite Reservoir.

To alleviate the sediment accumulation and maintain statutory uses of the reservoir, sediment dredging was initiated in 1986 with land disposal (Bennett and Shrier 1987). Initial dredging was conducted using a hydraulic dredge; dredged material and water were pumped into a series of three settling ponds with over-flow return to the reservoir. Monitoring suggested increases in turbidity associated with the dredging and inflow from the settling ponds. In 1987, two adaptive environmental assessment management workshops were held to design an ecological monitoring program (Webb et al. 1987). The first workshop focused on developing a conceptual model of the biological system in Lower Granite Reservoir. From the conceptual model, four hypotheses were developed. The four hypotheses examined effects of dredging and in-water disposal of dredged material on salmonid habitat, salmonid predator habitat, resident game fishes, and recreational fishing

effort (Webb et al. 1987). The second workshop designed a monitoring program to identify the biological linkages within the four hypotheses. A mechanical dredge was used to remove sediment near the confluence of the Snake and Clearwater rivers in 1988, 1989, and 1992 with in-water disposal approximately 20 miles downstream [ca. river mile (RM) 120] in Lower Granite Reservoir. Three in-water disposal options followed those recommended by Webb et al. (1987): an underwater island, an above-water island and deep-water disposal. Both islands were constructed at mid-depth (20-60 ft) at RM 119.5. The resulting above-water island was named Centennial Island.

Monitoring of fish and benthic invertebrate communities was conducted from 1988 through 1993 (Bennett et al. 1990, 1991, 1993a, 1993b, 1995,1997a) and followed the general monitoring plan developed by interagency consensus through the interagency work group of the Lower Granite Sediment Study as detailed in Webb et al. (1987). A maximum of 26 fish species were collected during the monitoring studies. Catches of juvenile salmonid fishes generally dominated samples in the spring and young-of-year resident fishes dominated summer and fall samples. In 1992, catch rates of juvenile chinook salmon (*Oncorhynchus tshawytscha*) by surface trawling were significantly higher at reference stations at RM 127 and 111, two reference stations, than at the disposal stations (stations 2-channel side Centennial Island and 4-submerged island). Catch rates of juvenile steelhead (*O. mykiss*) were not significantly different between reference and disposal stations (Bennett et al. 1995). These results supported the hypothesis that construction of Centennial Island did not concentrate and promote residualism of

juvenile salmonid fishes. Catch rates of larval, juvenile and adult predator fishes also were not elevated relative to those at reference sites. Bennett et al. (1995) reported that few significant differences in catch per efforts were found for smallmouth bass (*Micropterus dolomieu*) from 1989 - 1992. Smallmouth bass and northern pikeminnow (*Ptychocheilus oregonensis*) were the two principal predator fishes along with fewer numbers of yellow perch (*Perca flavescens*), black (*Pomoxis nigromaculatus*) and white crappies (*P. annularis*). Channel catfish (*Ictalurus punctatus*), also identified as a potential juvenile salmonid fish predator (Poe et al. 1991), were more abundant than other fish predators in deep water. Thus, the hypothesis that habitat for salmonid predator fishes would be enhanced and/or concentrate predators was rejected.

Previous research also addressed the concept of beneficial uses of dredged material. The biological significance of shallow water habitat for foraging, resting, and feeding for juvenile anadromous salmonid fishes, such as chinook salmon, steelhead trout and resident gamefish was reported by Bennett and Shier (1986) and Bennett et al. (1983). These studies demonstrated that foraging for benthic macroinvertebrates by downstream migrating juvenile salmonids occurred in shallow water habitat. In contrast, Muir and Coley (1996) examined food abundance of juvenile salmonid stomachs collected at Lower Granite Dam and reported a high frequency of empty stomachs suggesting a paucity of food items in the lower reservoir. Since about 10% of the surface area in Lower Granite Reservoir is shallow water habitat, there is low foraging potential. Limited foraging opportunities in the lower reservoir, as a result of little shallow water habitat suggests a potential

beneficial use of dredged material. Thus, construction of foraging sites for juvenile salmonids may be beneficial especially in areas immediately upstream from Lower Granite Dam where more canyon-like shorelines occur.

Rapid fish and benthic macroinvertebrate colonization at in-water disposal sites in Lower Granite Reservoir has been reported with similar community structure and abundance as reference sites (Bennett et al. 1990, 1995). More recently, Chipps et al. (1997) conducted a fish community analysis of stations at Centennial Island in Lower Granite Reservoir. They showed that species richness was enhanced and that trophic structure and trends in feeding-guild abundance were not significantly different between reference and disposal stations. Chipps et al. (1997) concluded that construction of shallow-water habitat with dredged material could increase habitat complexity. These findings however, were based on short-term assessments, although their longer-term benefits have not been evaluated. One important item of managers that could not be answered by previous studies was longer-term biotic community responses.

This project provided monitoring and evaluation of the responses of the aquatic macroinvertebrate and fish communities 10 years following the end of the previous monitoring. Specific objectives of this project were:

OBJECTIVES

1). To monitor abundance of predator fishes with special emphasis on northern pikeminnow and smallmouth bass at selected sites in Lower Granite Reservoir;

2). To monitor juvenile fall chinook salmon abundance and habitat utilization at selected sites in Lower Granite and Little Goose reservoirs;

3). To characterize habitat, including macrophyte development and substrates at previously constructed disposal sites and at additional potential disposal sites.

STUDY AREA

We characterized habitat and sampled fish and macroinvertebrates at 16 stations in Lower Granite and Little Goose reservoirs during 2002 (Figure 1). Two stations (1 and 2) were associated with the dredged-material island constructed in 1989. Stations 3, 10, 11, 13, and 16 were reference stations. Remaining stations were either boat landing sites (4, 5, 14, 15) or proposed disposal locations (6, 7, 8, 9, 12). The location and relevance of these stations to this and previous research is shown in Table 1. Not all stations were sampled to fulfill each of the stated objectives. For example, predator assessments were not conducted at the boat landing sites.

Figure 1. Map of study area in Lower Granite and Little Goose reservoirs, Snake River. Sampling stations locations are shown with corresponding river mile (Rm) and south (S) or north (N) side of the reservoirs.

Table 1. Specific locations of the sampling stations are given with the corresponding river mile and shoreline compass direction in the reservoir (S-South; N-North):

Station No.	River Mile	General Location
1	RM - 120.48-120.19S	South shoreline of Centennial Island created with dredged materials
2	RM - 120.48-120.19S	North open water shoreline adjacent to Centennial Island created with dredged material
3	RM - 120.48-120.19S	Reference station and unaltered natural reservoir shoreline adjacent to and south of Centennial Island
4	RM - 142.5S	Swallows Nest Recreational Site
5	RM - 139.3S–	Greenbelt Boat Basin;
6	RM - 133.25S	Possible dredged material disposal station
7	RM 132.4S	Possible dredged material disposal station
8	RM – 131.9S	Possible dredged material disposal station
9	RM - 131.5S	Possible dredged material disposal station
10	RM - 110.0S	Reference station (Bennett et al. 1991,1992, 1993)
11	RM - 135.0N	Port of Whitman, a reference station for previous studies (Bennett et al. 1990, 1991, 1993, 1998a)
12	RM – 130.8	Immediately south of Chief Timothy
13	RM – 115.9S	Knoxway Bay
14	RM 104.5S	Illia Landing
15	RM 88.5S	Willow Landing
16	RM 100N	Schultz Bar, a reference station also sampled in 1979-1980 (Bennett et al. 1983)

Objective 1: *To monitor abundance of predator fishes with special emphasis on northern pikeminnow and smallmouth bass at selected sites in Lower Granite Reservoir*

One of the major concerns with in-water disposal of dredged material has been in developing habitat that either enhances recruitment of predator fishes or concentrates predators (Webb et al. 1987). We conducted intensive sampling to quantify predator abundance at potential and previous dredged material disposal stations.

METHODS

To monitor the abundance of predator fishes in Lower Granite Reservoir during 2002, we used beach seining and nighttime electrofishing. To sample daytime fish use of the shoreline, we used a 100 ft x 8 ft (30.5 m x 2.4 m) seine with an 8 x 8 x 8 ft (14.8 m^3) bag constructed of 0.25 inch (0.64 cm) mesh. At each station, effort consisted of three seine hauls during each sampling time. Sample locations at sampling stations were random and varied within and between sampling times. In May, we sampled only seven stations (4-9, 11, 12) due to lateness of contract award whereas all 16 stations were sampled at biweekly intervals during June through July and monthly from August-November, 2002. We standardized beach seine hauls by extending one of the 50 ft (15.2 m) lines attached to the brails of the seine perpendicular to the shoreline from a boat, at the end of the line, the seine was deployed parallel to the shoreline and then the other remaining attachment

line (50 ft /15.2 m) was run back to the shoreline. The seine was then drawn in perpendicular to the shoreline, keeping the seine extended until the brails reached the shoreline that resulted in sampling a consistent area of 5,000 ft^2 (464 m^2). This process was standardized from station to station, independent of water depth. This was the recommended size beach seine from Webb et al. (1987) and deployment used in previous Lower Granite Reservoir assessments (Bennett et al. 1988a, 1988b, 1990, 1991, 1993a, 1993b, 1995,1997a, 1998b). Following each seine haul, fish were consolidated in the bag and immediately transferred to live-wells. Fish were then removed from the live-well, and identified and measured for total length (mm). Juvenile salmonid fishes and some larger individuals were anaesthetized with MS222 to facilitate handling. Adipose clips also were noted. Fish not anaesthetized were immediately released following measuring whereas anaesthetized fish were placed in fresh water for recovery prior to release. On occasion, large collections required volumetric sub-sampling. Water temperature was recorded following each sample collection (Appendix Table 1).

Electrofishing was conducted only at study sites in Lower Granite Reservoir. We sampled these 11 stations at biweekly intervals during June through September. In May, stations 1, 2, 3, 10, and 13 were sampled. Electrofishing was conducted between 0.5 hours after sunset and 0.5 hours before sunrise using a Smith-Root electrofishing boat at 11 stations (1, 2, 3, 6, 7, 8, 9, 10, 11, 12, and 13). No electrofishing was conducted at the Little Goose (14, 15, & 16), Greenbelt (5), and Swallows Nest (4) stations. Electrofishing effort generally consisted of three-5-minute “current-on” intervals at each station. A constant output of 50-500 volts

Appendix Table 1. Mean water temperatures collected at the times of the field collections during 2002 in Lower Granite and Little Goose reservoirs, Snake River.

Date	Mean Water Temperature ©
May 15 - 31	15.5
June 1 - 15	14.7
June 16 - 30	17.9
July 1 - 15	20.8
July 16 - 31	23.3
August 1 - 15	21.5
September 1 - 15	20.7
September 16 - 30	19.3
October 1 - 15	18.0
November 1 - 15	10.0

direct current, 1-4.5 amperes, and 60 cycles/second was used. Generally, currents at 3-5 amps were found to adequately stun fish without causing mortality or visual evidence of injury. Exact settings varied among sites and sampling periods due to changes in water conductivity, temperature, and fish response. At some stations (e.g. 1 and 2), effort had to be reduced because of shoreline length; at these stations current-on effort was quantified and catch per effort (CPUE) adjusted for the standardized 5-minutes of effort. Each site was sampled by slowly motoring adjacent and parallel to the shoreline. Two netters in the bow collected fish and placed them in an aerated live-well. After each 5-minute electrofishing sample, collected fish were processed similarly to beach seining although sub-sampling was never required.

We made statistical comparisons of mean CPUE and correlated the total number of fishes collected at the appropriate stations. We used the Spearman Rank correlation to associate the relative abundance among species. Mean CPUE was transformed into ranks, analysis of variance using the GLM procedure of ranked CPUE (SAS 2002) that was followed by orthogonal contrasts (Ott 1977) of mean CPUE between the disposal (1 and 2) and reference stations (3, 10, 11, 13). Comparisons were made for both mean CPUE for electrofishing and beach seining.

RESULTS

Total Catch

A total of 33,471 fishes representing 25 species was collected at the 16 sampling stations in Lower Granite Reservoir and Little Goose Reservoir during 2002 (Table 2). These species represented 9 families and 7 orders; scientific and common names and species codes used throughout this report are presented in Table 3. Juvenile anadromous salmonids accounted for 15.78 % of the total catch and two species commonly considered predatory, northern pikeminnow and smallmouth bass (hereafter referred to as predators) in the Columbia Basin, comprised 15.6 % of the catch. Beach seining accounted for 87.5 % of the total catch and 90.3 % of the total juvenile salmonid catch (Table 4) while electrofishing accounted for the remaining 12.5% of the total catch (Table 5).

Total fish catches at most stations were generally highly correlated suggesting a similarity in the fish community. Also, total fish catches at stations 1 and 2 were highly correlated (r=0.95), as were correlations between stations 1 (r=0.90) and 2 (r=0.88) and the adjacent reference station 3. Catches among stations in closer proximity to one another generally had higher correlations than those more distant (Appendix Table 2).

Monthly Relative Abundance

Total Catch

Catches in September accounted for 38.3 % of the total number of fishes collected whereas catches in June (27.69 %) and July (14.53 %) were next in

Table 2. Fishes collected at 16 sampling stations in Lower Granite and Little Goose reservoirs, Snake River during 2002. Species codes are as follows: ASA - American shad, AAL - chiselmouth, CCA - common carp, MCA - peamouth, POR - northern pikeminnow, RBA - redside shiner, CCO - bridgelip sucker, CMA - largescale sucker, INE - brown bullhead, IPU - channel catfish, OKI - coho salmon, OMY - rainbow trout, ONE - sockeye salmon, OTSF – fall chinnok salmon ,OTSS – spring/summer chinook salmon, PWI - mountain whitefish, FDI - banded killifish, COT - sculpin spp., LGI - pumkinseed, LGU - warmouth, LMA - bluegill, MDO - smallmouth bass, MSA - largemouth bass, PAN - white crappie, PNI - black crappie, PFL - yellow perch. Station codes are as follows: 1 - RM 119.9 S, 2 - RM 119.9 S, 3 - RM 119.9 S, 4 - RM 142.5 S, 5 - RM 139.7 S, 6 - RM 133.25 S, 7 - RM 132.4 S, 8 - RM 131.9 S, 9 - RM 131.5 S, 10 - RM 110.0 S, 11 - RM 135.0 N, 12 - RM 130.8 S, 13 - RM 115.9 S, 14 - RM 104.5 S, 15 - RM 88.5 S, 16 - RM 100.0 N.

	Sampling Stations																
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**Total**
ASA	0	0	0	0	0	0	0	0	0	0	0	0	0	14	6377	0	6391
AAL	36	8	16	40	14	2	66	29	8	8	102	6	41	2	1	20	399
CCA	8	1	5	24	7	7	1	2	5	2	3	8	6	1	6	0	86
MCA	166	41	58	28	159	7	147	95	7	7	447	7	24	596	1761	419	3969
POR	12	1	22	49	147	24	96	104	15	1	429	2	20	415	181	131	1649
RBA	0	0	0	0	0	0	7	6	0	0	11	0	0	0	0	0	24
CCO	54	24	38	27	11	18	153	116	15	54	186	26	124	18	313	5	1182
CMA	85	155	110	110	51	81	99	68	92	169	216	150	137	159	293	33	2008
INE	2	0	5	87	624	0	10	5	0	0	0	0	1	0	7	0	741
IPU	0	0	0	1	0	0	0	0	0	0	0	0	0	0	111	0	112
OKI	0	0	3	0	45	18	18	3	3	5	22	3	5	0	2	5	132
OMY	0	0	0	9	2	3	0	0	2	1	0	3	0	4	0	2	26
ONE	0	0	0	0	10	22	7	22	0	0	1	2	1	14	1	14	94
OTSS	5	119	52	49	259	520	709	142	58	38	283	22	58	11	111	59	2495
OTSF	63	123	167	45	110	479	429	118	234	92	291	21	93	112	135	23	2535
PWI	46	35	95	30	0	111	730	444	98	0	370	39	19	2	0	5	2024
FDI	0	0	1	0	0	0	1	50	0	0	278	1	0	0	0	0	331
COT	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	1	5
LGI	51	14	49	2616	66	15	367	271	36	13	22	62	150	0	585	1	4318
LGU	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
LMA	2	1	0	100	19	0	1	14	1	4	1	4	26	0	18	0	191
MDO	109	88	152	119	232	261	446	222	116	212	1158	209	224	6	18	1	3573
MSA	0	0	0	1	0	0	34	298	1	0	0	2	3	0	8	0	347
PAN	7	2	10	372	3	2	39	57	4	1	108	0	12	0	119	3	739
PNI	22	1	2	2	3	0	0	1	0	3	0	0	1	0	53	0	88
PFL	0	0	2	1	1	0	0	2	0	0	1	4	0	0	0	0	11
TOTAL	668	613	788	3710	1763	1570	3360	2070	696	612	3929	571	945	1354	10100	722	33471

Table 3. Fishes collected with beach seine and electrofishing gear from Lower Granite and Little Goose reserviors, Snake River from May through November, 2002.

				Lower Granite	Little Goose
Family	Scientific Name	Common Name	Species Code	Stations 1 - 13	Stations 14 - 16
Clupeidae	*Alosa sapidissima*	American shad	ASA	0	6391
Cyprinidae	*Acrocheilus alutaceus*	chiselmouth	AAL	376	23
	Cyprinus carpio	common carp	CCA	79	7
	Mylocheilus caurinus	peamouth	MCA	1193	2776
	Ptychocheilus oregonensis	northern pikeminnow	POR	922	727
	Richardsonius balteatus	redside shiner	RBA	24	0
Catostomidae	*Catostomus columbianus*	bridgelip sucker	CCO	846	336
	Catostomus macrocheilus	largescale sucker	CMA	1523	485
Ictaluridae	*Ameiurus nebulosus*	brown bullhead	INE	734	7
	Ictalurus punctatus	channel catfish	IPU	1	111
Salmonidae	*Oncorhynchus kisutch*	coho salmon	OKI	125	7
	Oncorhynchus mykiss	rainbow trout	OMY	20	6
	Oncorhynchus nerka	sockeye salmon	ONE	65	29
	Oncorhynchus tshawytscha	chinook salmon	OTS	4579	451
	Prosopium williamsoni	mountain whitefish	PWI	2017	7
Cyprinodontidae	*Fundulus diaphanus*	banded killifish	FDI	331	0
Cottidae	*Cottus spp.* [a]	sculpin	COT	4	1
Centrarchidae	*Lepomis gibbosus*	pumpkinseed	LGI	3732	586
	Lepomis gulosus	warmouth	LGU	1	0
	Lepomis macrochirus	bluegill	LMA	173	18
	Micropterus dolomieu	smallmouth bass	MDO	3548	25
	Micropterus salmoides	largemouth bass	MSA	339	8
	Pomoxis annularis	white crappie	PAN	617	122
	Pomoxis nigromaculatus	black crappie	PNI	35	53
Percidae	*Perca flavescens*	yellow perch	PFL	11	0

[a] Includes prickly sculpin (Cottus asper), Piute sculpin (Cottus beldingi), and mottled sculpin (Cottus bairdi)

Table 4. total catch of fishes by beach seining from 16 stations in Lower Granite and Little Goose reservoirs, Snake River, from May through November, 2002. See Table 2 for species codes and station locations.

	Sampling Station																
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**Total**
ASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AAL	11	8	15	0	0	2	4	3	6	8	10	6	40	0	0	0	113
CCA	2	0	1	0	0	0	0	1	2	0	3	0	5	0	0	0	14
MCA	92	35	54	0	0	5	5	10	6	7	14	3	20	0	0	0	251
POR	5	1	19	0	0	21	8	8	9	1	11	1	13	0	0	0	97
RBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CCO	11	24	35	0	0	17	11	13	13	53	19	26	119	0	0	0	341
CMA	79	154	105	0	0	79	44	26	85	161	47	146	137	0	0	0	1063
INE	2	0	5	0	0	0	6	4	0	0	0	0	1	0	0	0	18
IPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OKI	0	0	1	0	0	6	1	1	0	4	9	1	2	0	0	0	25
OMY	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	2
ONE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTSS	3	2	5	0	0	125	82	24	19	7	127	6	1	0	0	0	401
OTSF	3	0	5	0	0	61	24	8	19	14	14	2	5	0	0	0	155
PWI	5	1	12	0	0	21	46	10	12	0	14	3	3	0	0	0	127
FDI	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	4
COT	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	3
LGI	36	13	41	0	0	15	26	35	30	13	8	50	148	0	0	0	415
LGU	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
LMA	1	1	0	0	0	0	0	0	1	4	0	4	21	0	0	0	32
MDO	43	75	119	0	0	123	32	17	76	184	41	173	183	0	0	0	1066
MSA	0	0	0	0	0	0	7	8	1	0	0	2	2	0	0	0	20
PAN	2	2	4	0	0	1	2	9	1	1	0	0	3	0	0	0	25
PNI	1	1	2	0	0	0	0	1	0	3	0	0	1	0	0	0	9
PFL	0	0	2	0	0	0	0	0	0	0	1	4	0	0	0	0	7
TOTAL	296	317	425	0	0	477	298	181	281	462	320	428	704	0	0	0	4189

Table 5. Total catch of fishes by electrofishing from 16 stations in Lower Granite and Little Goose reservoirs, Snake River, from May through November, 2002. See Table 2 for species codes and station locations.

	Sampling Stations																
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**Total**
ASA	0	0	0	0	0	0	0	0	0	0	0	0	0	14	6377	0	6391
AAL	25	0	1	40	14	0	62	26	2	0	92	0	1	2	1	20	286
CCA	6	1	4	24	7	7	1	1	3	2	0	8	1	1	6	0	72
MCA	74	6	4	28	159	2	142	85	1	0	433	4	4	596	1761	419	3718
POR	7	0	3	49	147	3	88	96	6	0	418	1	7	415	181	131	1552
RBA	0	0	0	0	0	0	7	6	0	0	11	0	0	0	0	0	24
CCO	43	0	3	27	11	1	142	103	2	1	167	0	5	18	313	5	841
CMA	6	1	5	110	51	2	55	42	7	8	169	4	0	159	293	33	945
INE	0	0	0	87	624	0	4	1	0	0	0	0	0	0	7	0	723
IPU	0	0	0	1	0	0	0	0	0	0	0	0	0	0	111	0	112
OKI	0	0	2	0	45	12	17	2	3	1	13	2	3	0	2	5	107
OMY	0	0	0	9	2	2	0	0	2	1	0	2	0	4	0	2	24
ONE	0	0	0	0	10	22	7	22	0	0	1	2	1	14	1	14	94
OTSS	2	117	47	49	259	395	627	118	39	31	156	16	57	11	111	59	2094
OTSF	60	123	162	45	110	418	405	110	215	78	277	19	88	112	135	23	2380
PWI	41	34	83	30	0	90	684	434	86	0	356	36	16	2	0	5	1897
FDI	0	0	1	0	0	0	1	48	0	0	276	1	0	0	0	0	327
COT	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
LGI	15	1	8	2616	66	0	341	236	6	0	14	12	2	0	585	1	3903
LGU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LMA	1	0	0	100	19	0	1	14	0	0	1	0	5	0	18	0	159
MDO	66	13	33	119	232	138	414	205	40	28	1117	36	41	6	18	1	2507
MSA	0	0	0	1	0	0	27	290	0	0	0	0	1	0	8	0	327
PAN	5	0	6	372	3	1	37	48	3	0	108	0	9	0	119	3	714
PNI	21	0	0	2	3	0	0	0	0	0	0	0	0	0	53	0	79
PFL	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0	4
TOTAL	372	296	363	3710	1763	1093	3062	1889	415	150	3609	143	241	1354	10100	722	29282

Appendix Table 2. Spearman correlation coefficients for total fish numbers collected at 16 stations in Lower Granite (stations 1-13) and Little Goose (stations 14-16) reservoirs, Snake River, during 2002.

	Sampling Stations															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1		0.96	0.90	0.82	0.72	0.70	0.80	0.68	0.83	0.78	0.74	0.88	0.61	0.62	0.62	0.70
2	-		0.88	0.80	0.63	0.74	0.82	0.71	0.88	0.79	0.79	0.90	0.62	0.59	0.66	0.68
3	0.88	-		0.75	0.71	0.78	0.85	0.69	0.87	0.71	0.83	0.83	0.55	0.48	0.68	0.69
4	0.80	0.75	-		0.72	0.55	0.70	0.63	0.74	0.64	0.57	0.83	**0.36**	0.55	0.45	0.64
5	0.63	0.71	0.72	-		0.64	0.65	0.48	0.61	0.72	0.56	0.77	0.51	0.54	0.59	0.57
6	0.74	0.78	0.55	0.64	-		0.80	0.65	0.86	0.62	0.78	0.76	0.74	0.38	0.81	0.58
7	0.82	0.85	0.70	0.65	0.80	-		0.92	0.86	0.60	0.84	0.88	0.54	0.47	0.71	0.77
8	0.71	0.69	0.63	0.48	0.65	0.92	-		0.73	0.42	0.77	0.79	0.42	0.38	0.55	0.69
9	0.83	0.88	0.87	0.61	0.86	0.86	0.73	-		0.77	0.79	0.89	0.61	0.45	0.74	0.66
10	0.79	0.71	0.64	0.72	0.62	0.60	0.42	0.77	-		0.58	0.82	0.47	0.54	0.58	0.47
11	0.79	0.83	0.57	0.56	0.78	0.84	0.88	0.79	0.58	-		0.75	0.59	0.36	0.71	0.71
12	0.90	0.83	0.83	0.77	0.76	0.88	0.79	0.89	0.82	0.75	-		0.53	0.59	0.64	0.71
13	0.62	0.55	0.36	0.51	0.74	0.54	0.42	0.61	0.47	0.60	0.53	-		0.53	0.76	0.58
14	0.59	0.48	0.55	0.38	0.47	0.38	0.45	0.54	0.36	0.59	0.59	0.53	-		0.40	0.75
15	0.66	0.68	0.45	0.59	0.81	0.74	0.55	0.74	0.58	0.71	0.64	0.76	0.40	-		0.51
16	0.68	0.69	0.64	0.57	0.58	0.77	0.69	0.66	0.47	0.64	0.71	0.58	0.75	0.51	-	

abundance. Lowest total number of fishes collected was 0.67% in November (Table 6).

Spatial Relative Abundance

Fishes collected at stations 4,7, 11, and 15 accounted for 63.0 % of the total catch (Table 2). In comparison, fishes collected at Centennial Island comprised 3.8% of the total catch. Throughout the entire 7-month sampling period, the lowest number of fishes was collected at stations 10 and 12.

Temporal Predator Abundance

The proportion of predator fishes collected was highest in August (27.9%) followed by July (25%; Table 2). The lowest number of predator fishes was collected in October (0.56%), followed by November (1.3%).

Spatial Predator Abundance

Smallmouth bass and northern pikeminnow ranged in relative abundance from a high of 40.4% at station 11 to a low of 2.0% at station 15 (Table 2). Relative predator abundance at the disposal stations was highest at station 1 (18.1%), followed by station 2 (14.5%). However, the proportion of the total catch of smallmouth bass and northern pikeminnow was lower at stations 1 and 2 than the mean percentage of predator fishes (21.2%) at all stations.

Catch Per Unit Effort

Mean CPUE of potential predator fishes at disposal stations 1 and 2 was generally similar or lower than at other stations (Figure 2). Catches of predator fishes at station 2 were mostly smallmouth bass. Catches at station 1 also contained black crappie and northern pikeminnow, although both were low in abundance.

Table 6. Total monthly catch of fishes in Lower Granite and Little Goose reservoirs, Snake River, from May through November, 2002. See Table 3 for species codes.

Species	Month							
	May	June	July	August	September	October	November	TOTAL
ASA	0	0	0	0	6377	14	0	6391
AAL	49	47	119	27	150	6	1	399
CCA	6	32	34	10	2	2	0	86
MCA	51	1568	477	113	1290	467	3	3969
POR	48	791	312	46	444	8	0	1649
RBA	0	0	11	1	12	0	0	24
CCO	89	454	173	26	425	13	2	1182
CMA	24	550	600	397	415	13	9	2008
INE	0	8	101	7	625	0	0	741
IPU	0	5	106	1	0	0	0	112
OKI	80	48	3	0	1	0	0	132
OMY	10	4	2	2	1	6	1	26
ONE	42	51	0	0	1	0	0	94
OTSS	581	1625	215	1	21	12	80	2535
OTSF	690	1782	23	0	0	0	0	2495
PWI	244	1348	231	56	37	6	102	2024
FDI	0	6	27	7	278	0	13	331
COT	0	3	2	0	0	0	0	5
LGI	170	554	1140	408	196	1850	0	4318
LGU	0	0	0	1	0	0	0	1
LMA	0	14	61	41	39	36	0	191
MDO	59	212	902	413	1978	6	3	3573
MSA	0	6	251	50	39	0	1	347
PAN	3	87	51	36	498	54	10	739
PNI	3	68	16	1	0	0	0	88
PFL	0	5	5	1	0	0	0	11
TOTAL	2149	9268	4862	1645	12829	2493	225	33471

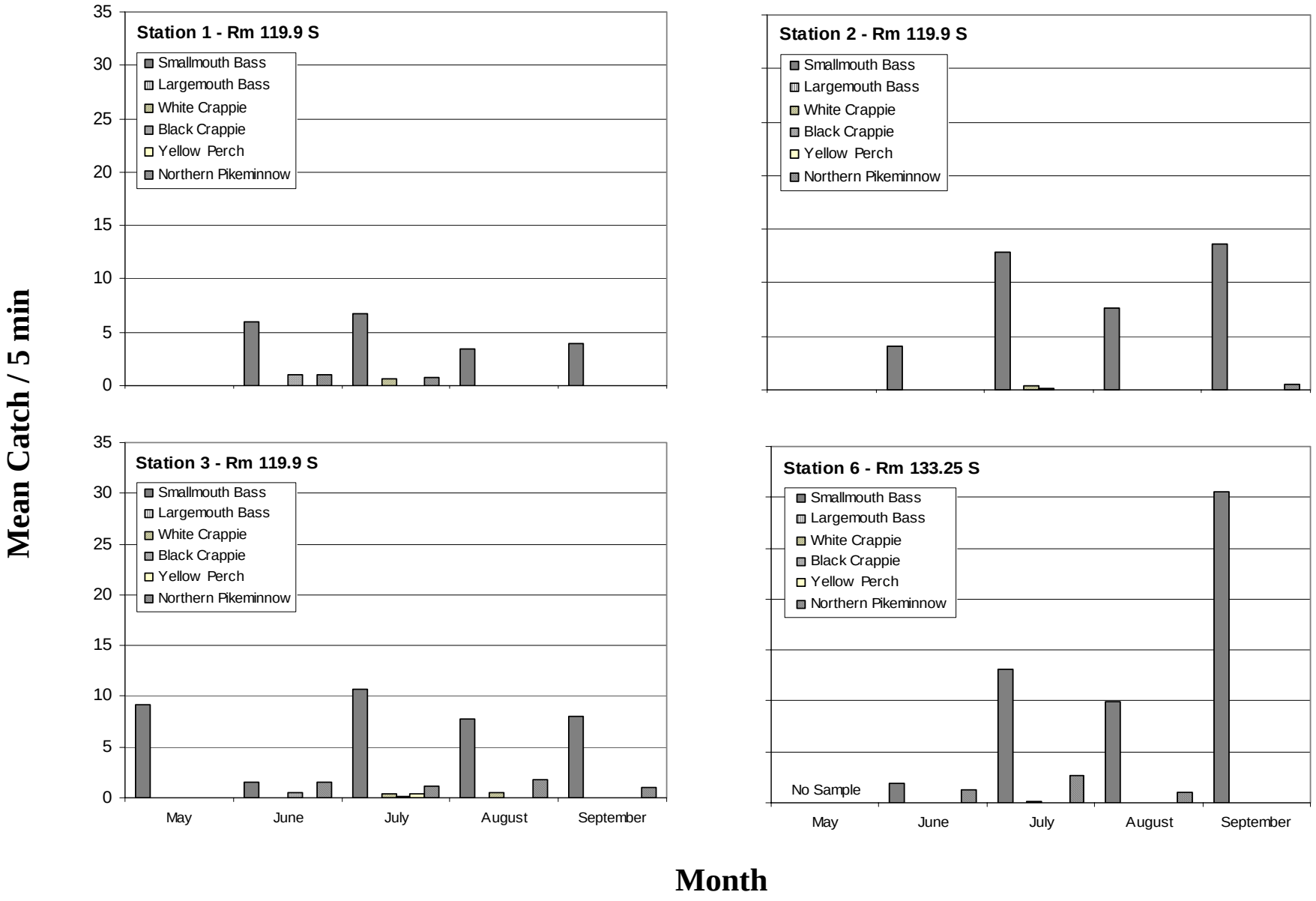

Figure 2. Mean monthly catch-per-unit-effort for salmonid predator fishes collected by electrofishing at various stations in Lower Granite reservoir, Snake River.

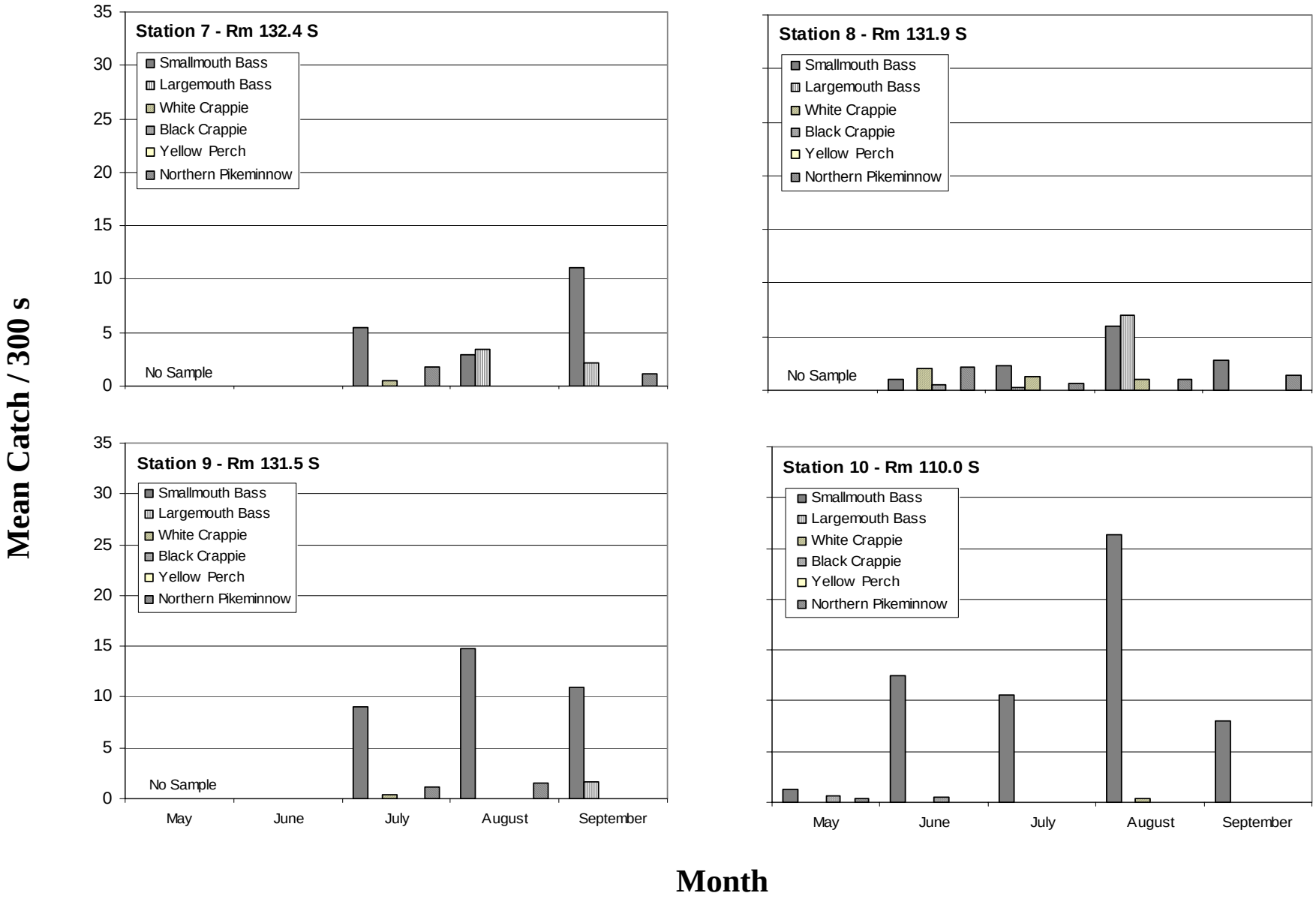

Figure 2. Cont.

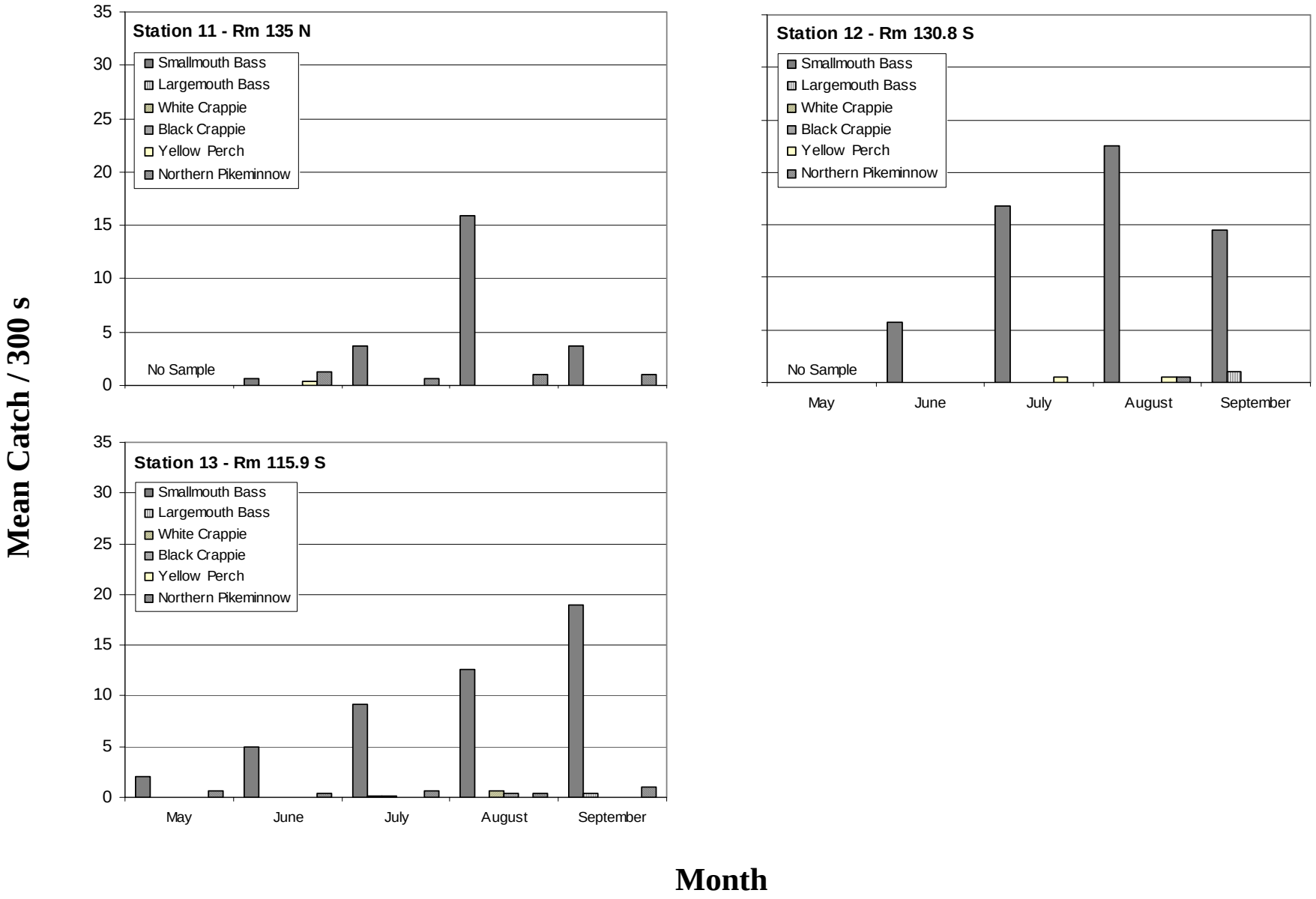

Figure 2. Cont.

Smallmouth bass

Relative abundance of predator fishes based on catch per effort (CPUE) generally increased from May through September (Figure 2). Mean CPUE for smallmouth bass was the highest of all predator fishes at all stations except at station 8 where largemouth bass (*M. salmoides*) was the highest. Mean CPUE of smallmouth bass at stations 1 and 2 were generally similar to those from other stations. August and September were months when the highest CPUEs were recorded for smallmouth bass.

Differences in mean CPUE for smallmouth bass between disposal stations and reference stations were not statistically different (Tables 7 and 8). We found no significant differences in mean CPUE between disposal and reference stations for either electrofishing or beach seining.

Northern Pikeminnow

Mean CPUE for northern pikeminnow was considerably lower than that for smallmouth bass at all stations in Lower Granite Reservoir (stations 1-13). Highest mean CPUE for northern pikeminnow was at station 6 and consistently low CPUEs were found at stations 2, 10, and 12 (Figure 2). Highest mean CPUEs were found in July and August.

Differences in mean CPUE for northern pikeminnow between disposal station 1 and reference stations were statistically different for beach seining but not electrofishing (Tables 7 and 8). Differences in mean CPUE between station 2 and reference stations were significant for both electrofishing and beach seining. Mean CPUE was lower at the disposal stations for both electrofishing and beach seining.

Table 7. Results of orthogonal contrasts of disposal station 1 versus reference stations 3.10.11. and 13 in Lower Granite Reservoir, May – November, 2002. * indicates significance at P<0.05.

		Electrofishing			Beach Seining		
	Species	**F value**	**P value**		**F value**	**P value**	
AAL	chiselmouth	0.35	0.55		2.41	0.12	
ASA	American shad	0.00	0.00		0.00	1.00	
CCA	common carp	0.03	0.86		0.42	0.52	
CCO	bridgelip sucker	0.62	0.43		0.73	0.39	
CMA	largescale sucker	0.59	0.45		0.50	0.48	
COT	sculpin	0.39	0.54		0.40	0.53	
FDI	banded killifish	0.29	0.59		27.97	0.000	****
INE	brown bullhead	1.03	0.31		0.05	0.83	
IPU	channel catfish	0.00	0.00		0.00	1.00	
LGI	pumpkinseed	2.25	0.14		0.56	0.45	
LGU	warmouth	0.00	1.00		0.00	0.00	
LMA	bluegill	0.57	0.45		0.06	0.81	
MCA	peamouth	9.06	0.003	****	0.06	0.81	
MDO	smallmouth bass	1.27	0.26		0.01	0.92	
MSA	largemouth bass	0.08	0.78		3.78	0.05	
OKI	coho salmon	1.56	0.21		2.56	0.11	
OMY	rainbow trout	0.00	1.00		0.19	0.66	
ONE	sockeye salmon	0.00	0.00		0.32	0.57	
OTSF	Fall chinook salmon	0.27	0.60		3.32	0.07	
OTSS	Spring chinook salmon	0.69	0.41		5.95	0.02	*
PAN	white crappie	0.86	0.35		3.58	0.06	
PFL	yellow perch	0.69	0.41		0.29	0.59	
PNI	black crappie	0.00	0.98		10.80	0.001	****
POR	northern pikeminnow	0.85	0.36		7.43	0.01	****
PWI	mountain whitefish	0.19	0.67		8.45	0.003	****
RBA	redside shiner	0.00	0.00		2.25	0.13	

Table 8. Results of orthogonal contrasts of disposal station 2 versus reference stations 3.10.11. and 13 in Lower Granite Reservoir, May – November, 2002. * indicates significance at P<0.05.

		Electrofishing			Beach Seining		
	Species	**F value**	**P value**		**F value**	**P value**	
AAL	chiselmouth	0.83	0.36		7.53	0.01	*
ASA	American shad	0.00	0.00		0.00	1.00	
CCA	common carp	2.10	0.15		0.00	0.98	
CCO	bridgelip sucker	0.05	0.83		11.16	0.001	*
CMA	largescale sucker	0.32	0.57		5.43	0.02	*
COT	sculpin	0.44	0.51		0.40	0.53	
FDI	banded killifish	0.33	0.57		27.97	0.000	*
INE	brown bullhead	1.35	0.25		0.05	0.83	
IPU	channel catfish	0.00	0.00		0.00	1.00	
LGI	pumpkinseed	2.46	0.12		9.43	0.002	*
LGU	warmouth	0.00	1.00		0.00	0.00	
LMA	bluegill	0.90	0.35		0.93	0.33	
MCA	peamouth	0.13	0.72		0.24	0.62	
MDO	smallmouth bass	0.31	0.58		0.40	0.53	
MSA	largemouth bass	0.09	0.76		3.78	0.05	
OKI	coho salmon	1.80	0.18		2.56	0.11	
OMY	rainbow trout	0.00	1.00		0.19	0.66	
ONE	sockeye salmon	0.00	0.00		0.32	0.57	
OTSF	Fall chinook salmon	2.11	0.15		0.18	0.67	
OTSS	Spring chinook salmon	1.02	0.31		0.16	0.69	
PAN	white crappie	0.01	0.94		6.46	0.01	*
PFL	yellow perch	0.80	0.37		0.29	0.59	
PNI	black crappie	0.03	0.86		0.00	1.000	
POR	northern pikeminnow	5.93	0.02	*	12.90	0.000	*
PWI	mountain whitefish	1.13	0.29		8.61	0.004	*
RBA	redside shiner	0.00	0.00		2.25	0.13	

Other Potential Predator Fishes

Abundance of other potential predator fishes was comparatively low at all stations (Figure 2). Mean CPUEs for largemouth bass at stations 7 and 8 were the highest of all stations but lower than those for smallmouth bass, except at station 7. Largemouth bass were collected in low abundance at all other stations (Table 2). Mean CPUEs for yellow perch, and white and black crappies were consistently lower than those for smallmouth bass and northern pikeminnow. White crappie was more abundant than black crappie; highest abundance of white crappie was at stations 4, 11, and 15 (Table 2). Overall, low numbers of yellow perch were collected and the maximum number collected at any one station was four (station 12). Mean CPUE and other statistics for all fishes sampled by electrofishing and beach seining are shown in Appendix Tables 3 and 4, respectively. Comparison of mean CPUE between disposal and reference stations revealed few significant differences (Tables 7 and 8).

Size Comparisons

Length analysis of captured fishes showed high abundance of smaller fishes (Table 9). Fishes <200 mm accounted for 96% of all collected. Mean lengths varied spatially and temporally. A generalization of fish sizes was that smaller fish were collected in May, larger in June, and then smaller lengths later in the year (Appendix Table 5).

Smallmouth Bass

We collected over 3500 smallmouth bass in both Lower Granite and Little Goose reservoirs and nearly 2500 were measured. Smallmouth bass < 100 mm

Appendix Table 3. Basic statistics of CPUE for various species from Lower Granite Reservoir (stations 1 – 13) and Little Goose Reservoir (stations 14 – 16) collected by electrofishing during 2002.

Species	Station	Month	n	CPUE	SD	MIN	MAX
AAL	1	5	1				
	1	6	1				
	1	7	5	0.59	0.89	0.00	1.99
	1	8	2	0.36	0.92	3.00	4.31
	1	9	2	1.42	0.60	0.99	1.85
	2	5	2				
	2	6	1				
	2	7	6	1.79	2.71	0.00	6.82
	2	8	2	1.00	1.41	0.00	2.00
	2	9	2				
	3	5	1				
	3	6	2	0.52	0.74	0.00	1.05
	3	7	6	0.66	1.21	0.00	3.01
	3	8	4	2.50	2.64	0.00	6.00
	3	9	2				
	6	6	3	0.31	0.54	0.00	0.95
	6	7	6	0.32	0.79	0.00	1.95
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4	0.99	1.40	0.00	2.99
	7	8	2				
	7	9	1				
	8	6	2	0.56	0.79	0.00	1.12
	8	7	3	0.63	1.09	0.00	1.89
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6	0.80	1.53	0.00	3.82
	9	8	2	1.49	2.11	0.00	2.99
	9	9	2				
	10	5	3	1.00	1.00	0.00	2.00
	10	6	2	2.00	1.41	1.00	3.00
	10	7	7	0.14	0.37	0.00	0.98
	10	8	3				
	10	9	2				
	11	6	3	0.66	1.15	0.00	2.00
	11	7	5	0.78	0.81	0.00	1.95
	11	8	2	0.50	0.70	0.00	1.00
	11	9	2	1.47	2.07	0.00	2.94

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
AAL	12	6	3	0.66	0.57	0.00	1.00
	12	7	6	0.16	0.40	0.00	1.00
	12	8	2	0.96	1.35	0.00	1.92
	12	9	2	0.86	1.21	0.00	1.72
	13	5	3	1.66	0.57	1.00	2.00
	13	6	3	6.64	10.65	0.00	18.94
	13	7	9	1.50	1.78	0.00	5.00
	13	8	3	0.32	0.56	0.00	0.97
	13	9	3	0.66	0.57	0.00	1.00
ASA	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
ASA	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				
CCA	1	5	1				
	1	6	1				
	1	7	5	0.40	0.89	0.00	2.00
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2	0.49	0.70	0.00	0.99
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3	0.31	0.54	0.00	0.94
	8	8	1				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CCA	8	9	1				
	9	6	2				
	9	7	6	0.33	0.80	0.00	1.98
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5	0.19	0.43	0.00	0.98
	11	8	2	0.50	0.70	0.00	1.00
	11	9	2	0.49	0.69	0.00	0.98
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3	0.33	0.57	0.00	0.99
	13	6	3				
	13	7	9	0.33	0.99	0.00	2.99
	13	8	3	0.32	0.56	0.00	0.97
	13	9	3				
CCO	1	5	1	3.35	0.00	3.35	3.35
	1	6	1	4.00	0.00	4.00	4.00
	1	7	5	0.79	0.83	0.00	1.99
	1	8	2				
	1	9	2				
	2	5	2	2.84	2.61	0.99	4.69
	2	6	1	6.02	0.00	6.02	6.02
	2	7	6	2.59	3.36	0.00	8.85
	2	8	2				
	2	9	2	0.50	0.70	0.00	1.00
	3	5	1	5.49	0.00	5.49	5.49
	3	6	2	10.43	11.94	1.99	18.88
	3	7	6	1.83	1.46	0.00	3.99
	3	8	4				
	3	9	2	0.50	0.70	0.00	1.00
	6	6	3	1.26	2.19	0.00	3.80
	6	7	6	1.16	1.47	0.00	4.00
	6	8	1	0.00	0.00	0.00	0.00
	6	9	1	5.92	0.00	5.92	5.92

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CCO	7	6	2				
	7	7	4	1.99	3.99	0.00	7.97
	7	8	2	1.00	1.41	0.00	2.00
	7	9	1	1.11	0.00	1.11	1.11
	8	6	2	1.00	1.41	0.00	2.00
	8	7	3	3.64	4.69	0.00	8.94
	8	8	1				
	8	9	1				
	9	6	2	3.70	5.23	0.00	7.41
	9	7	6	1.80	1.79	0.00	4.00
	9	8	2				
	9	9	2				
	10	5	3	5.65	3.20	2.00	7.97
	10	6	2	11.99	9.91	4.98	19.00
	10	7	7	1.70	1.48	0.00	4.00
	10	8	3				
	10	9	2				
	11	6	3	1.33	1.52	0.00	3.00
	11	7	5	2.90	3.78	0.00	8.65
	11	8	2				
	11	9	2				
	12	6	3	4.53	4.73	1.61	10.00
	12	7	6	2.33	1.63	0.00	5.00
	12	8	2				
	12	9	2				
	13	5	3	18.95	11.52	7.00	30.00
	13	6	3	10.63	17.55	0.00	30.90
	13	7	9	2.95	3.03	0.00	7.08
	13	8	3	0.33	0.57	0.00	1.00
	13	9	3	2.75	3.19	0.00	6.25
CMA	1	5	1				
	1	6	1	8.00	0.00	8.00	8.00
	1	7	5	10.01	8.60	1.99	23.00
	1	8	2	10.02	0.03	10.00	10.05
	1	9	2	6.74	1.66	5.56	7.92
	2	5	2	2.98	4.21	0.00	5.96
	2	6	1	7.02	0.00	7.02	7.02
	2	7	6	22.20	15.05	0.00	41.94
	2	8	2	23.03	7.02	18.07	28.00
	2	9	2	9.90	2.96	8.00	11.81
	3	5	1	3.66	0.00	3.66	3.66
	3	6	2	8.22	3.20	5.96	10.49

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CMA	3	7	6	4.00	3.56	0.00	9.00
	3	8	4	7.99	3.56	4.96	12.00
	3	9	2	17.00	5.65	13.00	21.00
	6	6	3	0.66	1.14	0.00	1.99
	6	7	6	1.66	3.14	0.00	8.00
	6	8	1	37.87	0.00	37.87	37.87
	6	9	1	28.62	0.00	28.62	28.62
	7	6	2				
	7	7	4	2.18	2.12	0.00	4.80
	7	8	2	20.04	4.17	17.09	23.00
	7	9	1	6.67	0.00	6.67	6.67
	8	6	2	1.12	1.58	0.00	2.24
	8	7	3	3.95	5.17	0.94	9.93
	8	8	1	5.98	0.00	5.98	5.98
	8	9	1	8.41	0.00	8.41	8.41
	9	6	2	0.48	0.67	0.00	0.96
	9	7	6	5.21	3.91	0.00	11.00
	9	8	2	26.86	19.79	12.86	40.86
	9	9	2	8.63	7.59	3.26	14.00
	10	5	3	1.33	1.15	0.00	2.00
	10	6	2	0.50	0.70	0.00	1.00
	10	7	7	10.05	10.95	0.00	26.79
	10	8	3	22.94	11.64	12.00	35.18
	10	9	2	25.81	12.77	16.78	34.85
	11	6	3	3.33	3.05	0.00	6.00
	11	7	5	3.33	2.67	0.00	6.93
	11	8	2	2.50	3.53	0.00	5.00
	11	9	2	8.36	3.42	5.94	10.78
	12	6	3	3.99	4.58	0.00	9.00
	12	7	6	6.17	10.29	0.00	25.91
	12	8	2	28.60	18.75	15.34	41.86
	12	9	2	24.93	1.31	24.00	25.86
	13	5	3	1.66	1.52	0.00	3.00
	13	6	3	0.66	1.15	0.00	2.00
	13	7	9	7.40	9.47	0.00	27.62
	13	8	3	10.93	9.88	3.00	22.00
	13	9	3	18.80	14.80	7.00	35.42
COT	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
COT	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6	0.16	0.40	0.00	1.00
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2	0.50	0.70	0.00	1.00
	10	7	7	0.13	0.36	0.00	0.97
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
COT	13	8	3				
	13	9	3				
FDI	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1				
	8	9	1	2.80	0.00	2.80	2.80
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5	0.39	0.87	0.00	1.96
	11	8	2				
	11	9	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
FDI	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				
INE	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2	0.72	1.01	0.00	1.44
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2	1.02	0.04	0.99	1.05
	3	7	6	0.33	0.52	0.00	1.02
	3	8	4	0.25	0.50	0.00	1.00
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4	1.82	2.34	0.00	4.90
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3	0.94	1.63	0.00	2.83
	8	8	1	1.00	0.00	1.00	1.00
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
INE	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				
	13	8	3	0.33	0.57	0.00	1.00
	13	9	3				
IPU	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
IPU	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				
LGI	1	5	1				
	1	6	1	3.00	0.00	3.00	3.00
	1	7	5	5.38	3.73	3.00	11.92
	1	8	2	4.22	3.93	1.44	7.00
	1	9	2	1.48	2.10	0.00	2.97
	2	5	2				
	2	6	1				
	2	7	6	1.15	1.79	0.00	3.70
	2	8	2	1.50	2.12	0.00	3.00
	2	9	2	6.22	4.56	3.00	9.45
	3	5	1				
	3	6	2				
	3	7	6	4.00	2.18	2.01	8.00
	3	8	4	2.25	2.06	0.00	4.01
	3	9	2	4.00	2.82	2.00	6.00
	6	6	3				
	6	7	6	2.15	3.89	0.00	9.93
	6	8	1	1.99	0.00	1.99	1.99
	6	9	1				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LGI	7	6	2				
	7	7	4	6.96	7.10	0.00	16.67
	7	8	2	0.50	0.70	0.00	1.00
	7	9	1	1.11	0.00	1.11	1.11
	8	6	2	2.18	1.66	1.00	3.36
	8	7	3	7.30	9.25	0.99	17.92
	8	8	1	4.98	0.00	4.98	4.98
	8	9	1	4.21	0.00	4.21	4.21
	9	6	2	0.92	1.30	0.00	1.85
	9	7	6	3.36	4.00	0.00	11.00
	9	8	2	4.98	7.04	0.00	9.97
	9	9	2	2.13	1.59	1.00	3.26
	10	5	3	0.33	0.57	0.00	1.00
	10	6	2	0.50	0.70	0.00	1.00
	10	7	7	1.04	2.03	0.00	5.36
	10	8	3	2.33	2.06	0.00	3.91
	10	9	2	1.24	1.76	0.00	2.49
	11	6	3	0.66	0.57	0.00	1.00
	11	7	5	0.78	1.27	0.00	2.94
	11	8	2	0.50	0.70	0.00	1.00
	11	9	2	0.74	1.05	0.00	1.49
	12	6	3	0.66	0.57	0.00	1.00
	12	7	6	3.39	2.08	0.00	6.10
	12	8	2	7.89	5.74	3.83	11.96
	12	9	2	8.45	2.19	6.90	10.00
	13	5	3	1.32	1.51	0.00	2.98
	13	6	3	0.33	0.57	0.00	1.00
	13	7	9	7.88	5.77	0.00	15.05
	13	8	3	19.90	7.97	10.71	25.00
	13	9	3	6.02	6.90	2.00	14.00
LGU	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LGU	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1	1.00	0.00	1.00	1.00
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				
LMA	1	5	1				
	1	6	1				
	1	7	5	0.20	0.44	0.00	1.00
	1	8	2				
	1	9	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LMA	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2	0.50	0.70	0.00	1.00
	3	5	1				
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2	0.50	0.50	0.00	1.00
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7	0.28	0.49	0.00	1.04
	10	8	3	0.85	0.78	0.00	1.55
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6	0.16	0.40	0.00	1.00
	12	8	2	0.50	0.70	0.00	1.00
	12	9	2	1.36	0.50	1.00	1.72
	13	5	3				
	13	6	3				
	13	7	9	1.37	1.92	0.00	5.98

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LMA	13	8	3	1.97	0.96	1.00	2.92
	13	9	3	1.00	1.73	0.00	3.00
MCA	1	5	1	32.34	0.00	32.34	32.34
	1	6	1	11.00	0.00	11.00	11.00
	1	7	5	8.89	6.68	0.00	16.54
	1	8	2	9.02	1.44	8.00	10.05
	1	9	2	1.85	2.61	0.00	3.70
	2	5	2				
	2	6	1	1.00	0.00	1.00	1.00
	2	7	6	6.19	7.81	0.00	18.69
	2	8	2	0.50	0.70	0.00	1.00
	2	9	2				
	3	5	1	1.83	0.00	1.83	1.83
	3	6	2	12.33	4.80	8.94	15.73
	3	7	6	3.18	2.49	1.00	6.02
	3	8	4	3.61	3.66	0.00	7.44
	3	9	2				
	6	6	3	1.32	1.14	0.00	1.99
	6	7	6				
	6	8	1	1.00	0.00	1.00	1.00
	6	9	1				
	7	6	2				
	7	7	4	0.99	1.40	0.00	2.99
	7	8	2	0.50	0.70	0.00	1.00
	7	9	1				
	8	6	2	3.50	4.94	0.00	7.00
	8	7	3	0.99	0.99	0.00	1.99
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6	0.83	1.32	0.00	3.00
	9	8	2	2.14	3.03	0.00	4.29
	9	9	2				
	10	5	3	0.66	1.14	0.00	1.99
	10	6	2	2.50	3.53	0.00	5.00
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3	1.99	1.73	0.99	4.00
	11	7	5	1.18	2.65	0.00	5.94
	11	8	2	0.50	0.70	0.00	1.00
	11	9	2	0.49	0.69	0.00	0.98

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MCA	12	6	3	0.33	0.57	0.00	0.99
	12	7	6	0.33	0.52	0.00	1.02
	12	8	2				
	12	9	2				
	13	5	3	3.32	2.87	0.00	5.00
	13	6	3	1.33	1.52	0.00	2.99
	13	7	9	0.77	1.05	0.00	2.92
	13	8	3				
	13	9	3				
MDO	1	5	1				
	1	6	1	6.00	0.00	6.00	6.00
	1	7	5	6.70	6.70	0.00	16.54
	1	8	2	3.43	0.79	2.87	4.00
	1	9	2	3.89	2.89	1.85	5.94
	2	5	2				
	2	6	1	4.01	0.00	4.01	4.01
	2	7	6	12.87	13.38	1.00	38.71
	2	8	2	7.61	0.54	7.23	8.00
	2	9	2	13.58	0.82	13.00	14.17
	3	5	1	9.15	0.00	9.15	9.15
	3	6	2	1.49	2.10	0.00	2.98
	3	7	6	10.65	9.13	2.04	27.91
	3	8	4	7.76	7.20	0.00	17.06
	3	9	2	8.00	0.00	8.00	8.00
	6	6	3	1.94	0.92	1.00	2.85
	6	7	6	13.11	6.62	5.84	24.83
	6	8	1	9.97	0.00	9.97	9.97
	6	9	1	30.59	0.00	30.59	30.59
	7	6	2				
	7	7	4	5.48	5.11	0.00	11.76
	7	8	2	2.90	1.27	2.00	3.80
	7	9	1	11.11	0.00	11.11	11.11
	8	6	2	1.06	0.08	1.00	1.12
	8	7	3	2.25	1.99	0.00	3.77
	8	8	1	5.98	0.00	5.98	5.98
	8	9	1	2.80	0.00	2.80	2.80
	9	6	2				
	9	7	6	9.00	2.52	5.00	12.00
	9	8	2	14.75	8.73	8.57	20.93
	9	9	2	10.89	1.56	9.78	12.00
	10	5	3	1.33	0.57	1.00	2.00
	10	6	2	12.48	3.55	9.97	15.00

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MDO	10	7	7	10.57	9.22	0.00	27.10
	10	8	3	26.36	11.45	16.00	38.66
	10	9	2	8.06	4.43	4.93	11.20
	11	6	3	0.66	1.15	0.00	2.00
	11	7	5	3.73	2.64	1.94	7.84
	11	8	2	15.86	9.70	9.00	22.73
	11	9	2	3.70	1.07	2.94	4.46
	12	6	3	5.73	2.95	3.23	9.00
	12	7	6	16.81	4.41	11.96	23.00
	12	8	2	22.56	6.15	18.21	26.91
	12	9	2	14.53	3.48	12.07	17.00
	13	5	3	1.99	1.71	1.00	3.97
	13	6	3	4.99	4.00	1.00	9.00
	13	7	9	9.19	4.30	4.00	18.94
	13	8	3	12.58	2.65	9.74	15.00
	13	9	3	18.91	5.00	14.00	24.00
MSA	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2	3.40	0.56	3.00	3.80
	7	9	1	2.22	0.00	2.22	2.22
	8	6	2				
	8	7	3	0.31	0.54	0.00	0.94
	8	8	1	6.98	0.00	6.98	6.98

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MSA	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2	1.63	2.30	0.00	3.26
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2	1.00	1.41	0.00	2.00
	13	5	3				
	13	6	3				
	13	7	9	0.10	0.31	0.00	0.95
	13	8	3				
	13	9	3	0.33	0.57	0.00	1.00
OKI	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1	1.83	0.00	1.83	1.83
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3	1.99	3.45	0.00	5.98
	6	7	6				
	6	8	1				
	6	9	1				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OKI	7	6	2				
	7	7	4	0.25	0.50	0.00	1.00
	7	8	2				
	7	9	1				
	8	6	2	0.50	0.70	0.00	1.00
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3	1.33	1.52	0.00	3.00
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3	2.66	4.61	0.00	8.00
	11	7	5	0.19	0.44	0.00	0.99
	11	8	2				
	11	9	2				
	12	6	3	0.33	0.57	0.00	1.00
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3	0.66	0.57	0.00	1.00
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				
OMY	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OMY	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1	0.99	0.00	0.99	0.99
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3	0.33	0.57	0.00	1.00
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				
ONE	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
ONE	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
ONE	13	8	3				
	13	9	3				
OTSF	1	5	1	1.12	0.00	1.12	1.12
	1	6	1	1.00	0.00	1.00	1.00
	1	7	5	0.19	0.44	0.00	0.99
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1	9.15	0.00	9.15	9.15
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3	6.53	3.49	2.99	9.97
	6	7	6	8.88	13.39	0.00	27.00
	6	8	1				
	6	9	1				
	7	6	2	7.00	1.41	6.00	8.00
	7	7	4	2.49	4.98	0.00	9.97
	7	8	2				
	7	9	1				
	8	6	2	4.06	4.15	1.12	7.00
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2	8.81	11.10	0.96	16.67
	9	7	6	1.82	3.22	0.00	7.92
	9	8	2				
	9	9	2				
	10	5	3	4.66	2.50	2.00	6.98
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3	3.65	2.30	1.00	5.00
	11	7	5	0.59	1.32	0.00	2.97
	11	8	2				
	11	9	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OTSF	12	6	3	0.33	0.57	0.00	0.99
	12	7	6	0.27	0.66	0.00	1.63
	12	8	2				
	12	9	2				
	13	5	3	1.66	1.15	0.99	3.00
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				
OTSS	1	5	1				
	1	6	1	3.00	0.00	3.00	3.00
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1	2.01	0.00	2.01	2.01
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1	1.83	0.00	1.83	1.83
	3	6	2	2.07	1.52	0.99	3.15
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3	38.96	29.69	11.96	70.76
	6	7	6	1.63	3.12	0.00	7.79
	6	8	1				
	6	9	1				
	7	6	2	38.00	7.07	33.00	43.00
	7	7	4	1.49	2.99	0.00	5.98
	7	8	2				
	7	9	1				
	8	6	2	12.18	12.47	3.36	21.00
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2	14.45	10.98	6.69	22.22
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3	1.66	1.15	1.00	3.00
	10	6	2	1.00	1.41	0.00	2.00

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OTSS	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3	41.88	8.97	34.00	51.66
	11	7	5	0.19	0.44	0.00	0.99
	11	8	2				
	11	9	2				
	12	6	3	2.07	1.79	0.00	3.23
	12	7	6	0.16	0.40	0.00	1.00
	12	8	2				
	12	9	2				
	13	5	3	0.33	0.57	0.00	1.00
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				
PAN	1	5	1				
	1	6	1				
	1	7	5	0.67	1.03	0.00	2.36
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6	0.33	0.81	0.00	2.00
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				
	3	7	6	0.33	0.51	0.00	1.00
	3	8	4	0.50	1.00	0.00	2.01
	3	9	2				
	6	6	3				
	6	7	6	0.16	0.40	0.00	0.99
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4	0.49	0.98	0.00	1.96
	7	8	2				
	7	9	1				
	8	6	2	2.00	2.82	0.00	4.00
	8	7	3	1.29	1.12	0.00	1.99
	8	8	1	1.00	0.00	1.00	1.00

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PAN	8	9	1				
	9	6	2				
	9	7	6	0.31	0.77	0.00	1.91
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3	0.32	0.56	0.00	0.98
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9	0.11	0.33	0.00	1.00
	13	8	3	0.66	1.15	0.00	2.00
	13	9	3				
PFL	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				
	3	7	6	0.33	0.52	0.00	1.02
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PFL	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3	0.33	0.57	0.00	0.99
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6	0.50	0.83	0.00	1.99
	12	8	2	0.50	0.70	0.00	1.00
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				
PNI	1	5	1				
	1	6	1	1.00	0.00	1.00	1.00
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6	0.16	0.40	0.00	1.00
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2	0.49	0.70	0.00	0.99

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PNI	3	7	6	0.17	0.41	0.00	1.02
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2	0.50	0.70	0.00	1.00
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3	0.66	0.57	0.00	1.00
	10	6	2	0.50	0.70	0.00	1.00
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				
	13	8	3	0.33	0.57	0.00	1.00
	13	9	3				
POR	1	5	1				
	1	6	1	1.00	0.00	1.00	1.00
	1	7	5	0.79	1.30	0.00	3.00
	1	8	2				
	1	9	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
POR	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2	0.50	0.70	0.00	1.00
	3	5	1				
	3	6	2	1.52	0.66	1.05	1.99
	3	7	6	1.16	1.16	0.00	3.00
	3	8	4	1.75	2.21	0.00	5.00
	3	9	2	1.00	1.41	0.00	2.00
	6	6	3	1.31	0.58	0.95	1.99
	6	7	6	2.66	5.12	0.00	13.00
	6	8	1	1.00	0.00	1.00	1.00
	6	9	1				
	7	6	2				
	7	7	4	1.74	2.05	0.00	3.99
	7	8	2				
	7	9	1	1.11	0.00	1.11	1.11
	8	6	2	2.12	0.16	2.00	2.24
	8	7	3	0.66	1.14	0.00	1.99
	8	8	1	1.00	0.00	1.00	1.00
	8	9	1	1.40	0.00	1.40	1.40
	9	6	2				
	9	7	6	1.14	0.96	0.00	2.00
	9	8	2	1.49	2.11	0.00	2.99
	9	9	2				
	10	5	3	0.33	0.57	0.00	1.00
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3	1.33	1.52	0.00	3.00
	11	7	5	0.58	0.88	0.00	1.98
	11	8	2	1.00	1.41	0.00	2.00
	11	9	2	0.98	1.38	0.00	1.96
	12	6	3				
	12	7	6				
	12	8	2	0.48	0.67	0.00	0.96
	12	9	2				
	13	5	3	0.66	1.14	0.00	1.99
	13	6	3	0.33	0.57	0.00	1.00
	13	7	9	0.65	0.99	0.00	3.00

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
POR	13	8	3	0.32	0.56	0.00	0.97
	13	9	3	1.00	1.73	0.00	3.00
PWI	1	5	1				
	1	6	1	3.00	0.00	3.00	3.00
	1	7	5	0.19	0.44	0.00	0.99
	1	8	2				
	1	9	2	0.92	1.30	0.00	1.85
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2	0.50	0.70	0.00	1.00
	3	5	1				
	3	6	2	3.64	3.74	0.99	6.29
	3	7	6				
	3	8	4				
	3	9	2	2.50	0.70	2.00	3.00
	6	6	3	3.19	3.93	0.00	7.59
	6	7	6	2.28	3.83	0.00	9.74
	6	8	1	1.00	0.00	1.00	1.00
	6	9	1	0.99	0.00	0.99	0.99
	7	6	2	17.50	16.26	6.00	29.00
	7	7	4	0.74	1.49	0.00	2.99
	7	8	2	0.95	1.34	0.00	1.90
	7	9	1	7.78	0.00	7.78	7.78
	8	6	2	4.00	5.65	0.00	8.00
	8	7	3	0.33	0.57	0.00	0.99
	8	8	1				
	8	9	1	1.40	0.00	1.40	1.40
	9	6	2	8.33	11.78	0.00	16.67
	9	7	6	0.68	0.85	0.00	2.13
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				
	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3	3.66	2.08	1.99	6.00
	11	7	5	0.39	0.88	0.00	1.98
	11	8	2				
	11	9	2	0.74	1.05	0.00	1.49

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PWI	12	6	3	0.99	1.00	0.00	2.00
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3	0.33	0.57	0.00	1.00
	13	6	3				
	13	7	9	0.26	0.53	0.00	1.42
	13	8	3				
	13	9	3				
RBA	1	5	1				
	1	6	1				
	1	7	5				
	1	8	2				
	1	9	2				
	2	5	2				
	2	6	1				
	2	7	6				
	2	8	2				
	2	9	2				
	3	5	1				
	3	6	2				
	3	7	6				
	3	8	4				
	3	9	2				
	6	6	3				
	6	7	6				
	6	8	1				
	6	9	1				
	7	6	2				
	7	7	4				
	7	8	2				
	7	9	1				
	8	6	2				
	8	7	3				
	8	8	1				
	8	9	1				
	9	6	2				
	9	7	6				
	9	8	2				
	9	9	2				
	10	5	3				
	10	6	2				

Appendix Table 3. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
RBA	10	7	7				
	10	8	3				
	10	9	2				
	11	6	3				
	11	7	5				
	11	8	2				
	11	9	2				
	12	6	3				
	12	7	6				
	12	8	2				
	12	9	2				
	13	5	3				
	13	6	3				
	13	7	9				
	13	8	3				
	13	9	3				

Appendix Table 4. Basic statistics of CPUE for various species from lower granite reservoir (station 1 – 13) and little goose reservoir (station 14 – 16) collected by beach seining during 2002.

Species	Station	Month	n	CPUE	SD	MIN	MAX
AAL	1	6	9	0.11	0.33	0.00	1.00
	1	7	6				
	1	8	3				
	1	9	3	8.00	13.80	0.00	24.00
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9	0.11	0.33	0.00	1.00
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3	8.66	15.00	0.00	26.00
	4	6	6				
	4	7	6	2.33	3.14	0.00	8.00
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3	3.66	4.04	0.00	8.00
	5	6	6	0.50	1.22	0.00	3.00
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
AAL	7	7	6	5.16	8.03	0.00	19.00
	7	8	3	0.33	0.57	0.00	1.00
	7	9	6	5.00	9.44	0.00	24.00
	7	10	3				
	8	5	3	0.33	0.57	0.00	1.00
	8	6	6				
	8	7	6	2.16	2.78	0.00	7.00
	8	8	3	0.33	0.57	0.00	1.00
	8	9	6	1.83	3.12	0.00	8.00
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6	0.33	0.51	0.00	1.00
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3	1.00	1.00	0.00	2.00
	11	6	6				
	11	7	6	2.16	3.71	0.00	9.00
	11	8	3				
	11	9	6	12.66	22.11	0.00	56.00
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9	0.11	0.33	0.00	1.00
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9	0.11	0.33	0.00	1.00
	14	7	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
AAL	14	8	3				
	14	9	3				
	14	10	3	0.33	0.57	0.00	1.00
	14	11	3				
	15	6	9				
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3	0.33	0.57	0.00	1.00
	16	6	9	1.00	1.73	0.00	5.00
	16	7	6	0.83	2.04	0.00	5.00
	16	8	3				
	16	9	3	0.33	0.57	0.00	1.00
	16	10	3	1.66	2.08	0.00	4.00
	16	11	3				
ASA	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
ASA	5	6	6				
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
ASA	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3	4.66	8.08	0.00	14.00
	14	11	3				
	15	6	9				
	15	7	6				
	15	8	3				
	15	9	3	2125.50	3512.56	4.00	6180.00
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
CCA	1	6	9	0.11	0.33	0.00	1.00
	1	7	6	0.83	2.04	0.00	5.00
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6	0.16	0.40	0.00	1.00
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CCA	3	6	9	0.11	0.33	0.00	1.00
	3	7	6	0.50	1.22	0.00	3.00
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3	1.33	1.52	0.00	3.00
	4	6	6	1.16	2.04	0.00	5.00
	4	7	6	1.33	1.96	0.00	5.00
	4	8	3	1.33	2.30	0.00	4.00
	4	9	3	0.33	0.57	0.00	1.00
	4	10	3				
	4	11	3				
	5	5	3				
	5	6	6	0.33	0.81	0.00	2.00
	5	7	6	0.50	1.22	0.00	3.00
	5	8	3	0.66	1.15	0.00	2.00
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3	0.33	0.57	0.00	1.00
	6	6	6	0.66	1.03	0.00	2.00
	6	7	6	0.33	0.51	0.00	1.00
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6	0.16	0.40	0.00	1.00
	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6				
	8	8	3	0.33	0.57	0.00	1.00
	8	9	6				
	8	11	3				
	9	5	3				
	9	6	6	0.50	1.22	0.00	3.00
	9	7	6				
	9	8	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CCA	9	9	6				
	9	11	3				
	10	6	9	0.11	0.33	0.00	1.00
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3	0.33	0.57	0.00	1.00
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				
	12	5	3				
	12	6	6	1.16	1.60	0.00	4.00
	12	7	6	0.16	0.40	0.00	1.00
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6	0.16	0.40	0.00	1.00
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3	0.33	0.57	0.00	1.00
	14	11	3				
	15	6	9	0.44	0.52	0.00	1.00
	15	7	6	0.16	0.40	0.00	1.00
	15	8	3	0.33	0.57	0.00	1.00
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CCA	16	10	3				
	16	11	3				
CCO	1	6	9	0.33	0.50	0.00	1.00
	1	7	6				
	1	8	3				
	1	9	3	13.33	22.23	0.00	39.00
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9	0.22	0.44	0.00	1.00
	3	7	6				
	3	8	3				
	3	9	3	0.33	0.57	0.00	1.00
	3	10	3				
	3	11	3				
	4	5	3	0.33	0.57	0.00	1.00
	4	6	6	0.16	0.40	0.00	1.00
	4	7	6	4.16	6.08	0.00	12.00
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3	0.66	1.15	0.00	2.00
	5	6	6	1.16	1.47	0.00	3.00
	5	7	6				
	5	8	3				
	5	9	3	0.66	0.57	0.00	1.00
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6	0.16	0.40	0.00	1.00
	6	11	3				
	7	5	3				
	7	6	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CCO	7	7	6	0.16	0.40	0.00	1.00
	7	8	3	4.00	6.92	0.00	12.00
	7	9	6	21.50	29.60	0.00	66.00
	7	11	3				
	8	5	3	0.33	0.57	0.00	1.00
	8	6	6	1.00	2.00	0.00	5.00
	8	7	6	0.16	0.40	0.00	1.00
	8	8	3	2.66	1.52	1.00	4.00
	8	9	6	14.10	22.78	0.00	58.00
	8	11	3	0.66	0.57	0.00	1.00
	9	5	3	0.66	0.57	0.00	1.00
	9	6	6				
	9	7	6				
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9	0.11	0.33	0.00	1.00
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6	2.66	5.57	0.00	14.00
	11	8	3	1.00	1.73	0.00	3.00
	11	9	6	24.66	25.97	0.00	52.00
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3	1.66	2.08	0.00	4.00
	13	10	3				
	13	11	3				
	14	6	9	0.66	2.00	0.00	6.00
	14	7	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CCO	14	8	3				
	14	9	3				
	14	10	3	4.00	3.00	1.00	7.00
	14	11	3				
	15	6	9	34.77	103.95	0.00	312.00
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9	0.22	0.44	0.00	1.00
	16	7	6	0.33	0.51	0.00	1.00
	16	8	3				
	16	9	3				
	16	10	3	0.33	0.57	0.00	1.00
	16	11	3				
CMA	1	6	9	0.44	0.72	0.00	2.00
	1	7	6	0.16	0.40	0.00	1.00
	1	8	3				
	1	9	3	0.33	0.57	0.00	1.00
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6	0.16	0.40	0.00	1.00
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9	0.44	1.01	0.00	3.00
	3	7	6	0.16	0.40	0.00	1.00
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3	0.33	0.57	0.00	1.00
	4	6	6	0.33	0.81	0.00	2.00
	4	7	6	16.16	25.58	0.00	66.00
	4	8	3	1.00	1.73	0.00	3.00
	4	9	3				
	4	10	3	2.33	3.21	0.00	6.00
	4	11	3				
	5	5	3	2.00	1.73	0.00	3.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CMA	5	6	6	5.83	9.66	0.00	25.00
	5	7	6	0.83	1.16	0.00	3.00
	5	8	3				
	5	9	3	0.66	0.57	0.00	1.00
	5	10	3				
	5	11	3	1.00	1.73	0.00	3.00
	6	5	3				
	6	6	6				
	6	7	6	0.33	0.81	0.00	2.00
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6	0.33	0.51	0.00	1.00
	7	7	6	8.16	18.10	0.00	45.00
	7	8	3	0.33	0.57	0.00	1.00
	7	9	6	0.50	0.83	0.00	2.00
	7	11	3				
	8	5	3				
	8	6	6	0.16	0.40	0.00	1.00
	8	7	6	2.50	4.23	0.00	11.00
	8	8	3				
	8	9	6	4.33	6.47	0.00	16.00
	8	11	3				
	9	5	3				
	9	6	6	0.16	0.40	0.00	1.00
	9	7	6				
	9	8	3	0.66	1.15	0.00	2.00
	9	9	6	0.66	1.03	0.00	2.00
	9	11	3				
	10	6	9	0.55	1.33	0.00	4.00
	10	7	6	0.16	0.40	0.00	1.00
	10	8	3				
	10	9	3				
	10	10	3	0.66	1.15	0.00	2.00
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6	7.16	7.96	0.00	18.00
	11	8	3	0.33	0.57	0.00	1.00
	11	9	6	20.66	25.85	0.00	64.00
	11	11	3	0.33	0.57	0.00	1.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
CMA	12	5	3				
	12	6	6	0.33	0.81	0.00	2.00
	12	7	6	0.16	0.40	0.00	1.00
	12	8	3	0.33	0.57	0.00	1.00
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9	17.44	41.72	0.00	128.00
	14	7	6	0.16	0.40	0.00	1.00
	14	8	3				
	14	9	3	0.33	0.57	0.00	1.00
	14	10	3				
	14	11	3				
	15	6	9	29.77	87.83	0.00	264.00
	15	7	6	0.66	0.81	0.00	2.00
	15	8	3	5.33	4.93	2.00	11.00
	15	9	3				
	15	10	3	0.33	0.57	0.00	1.00
	15	11	3	1.33	1.52	0.00	3.00
	16	6	9	0.88	1.69	0.00	5.00
	16	7	6	1.16	1.60	0.00	4.00
	16	8	3	3.66	0.57	3.00	4.00
	16	9	3	1.00	1.00	0.00	2.00
	16	10	3	1.00	1.73	0.00	3.00
	16	11	3	0.33	0.57	0.00	1.00
COT	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
COT	3	6	9	0.11	0.33	0.00	1.00
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				
	5	6	6				
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
COT	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9				
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9	0.11	0.33	0.00	1.00
	16	7	6				
	16	8	3				
	16	9	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
COT	16	10	3				
	16	11	3				
FDI	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9	0.11	0.33	0.00	1.00
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				
	5	6	6				
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
FDI	7	7	6	0.16	0.40	0.00	1.00
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6	0.33	0.51	0.00	1.00
	8	7	6	2.50	6.12	0.00	15.00
	8	8	3	0.66	0.57	0.00	1.00
	8	9	6	4.16	4.66	0.00	10.00
	8	11	3	1.13	0.57	1.00	2.00
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6	0.50	1.22	0.00	3.00
	11	7	6	1.33	3.26	0.00	8.00
	11	8	3	1.66	0.57	1.00	2.00
	11	9	6	41.83	93.28	0.00	232.00
	11	11	3	3.00	2.64	1.00	6.00
	12	5	3				
	12	6	6				
	12	7	6	0.16	0.40	0.00	1.00
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
FDI	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9				
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
INE	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6	0.50	1.22	0.00	3.00
	4	7	6	13.50	17.67	0.00	42.00
	4	8	3	0.66	1.15	0.00	2.00
	4	9	3	0.33	0.57	0.00	1.00
	4	10	3				
	4	11	3				
	5	5	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
INE	5	6	6				
	5	7	6				
	5	8	3				
	5	9	3	208.00	360.26	0.00	624.00
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6	0.16	0.40	0.00	1.00
	7	7	6	0.33	0.51	0.00	1.00
	7	8	3	0.33	0.57	0.00	1.00
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6	0.16	0.40	0.00	1.00
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
INE	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	0.11	0.33	0.00	1.00
	15	7	6	1.00	1.54	0.00	4.00
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
IPU	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
IPU	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				
	5	6	6				
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
IPU	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	0.44	.1.01	0.00	3.00
	15	7	6	17.66	29.73	0.00	76.00
	15	8	3	0.33	0.57	0.00	1.00
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
IPU	16	10	3				
	16	11	3				
LGI	1	6	9	1.00	1.73	0.00	4.00
	1	7	6	0.66	1.21	0.00	3.00
	1	8	3				
	1	9	3				
	1	10	3	0.66	1.15	0.00	2.00
	1	11	3				
	2	6	9				
	2	7	6	0.16	0.40	0.00	1.00
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9	0.11	0.33	0.00	1.00
	3	7	6	1.16	2.40	0.00	6.00
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3	53.00	86.65	0.00	153.00
	4	6	6	3.66	6.21	0.00	15.00
	4	7	6	76.83	118.85	0.00	303.00
	4	8	3	39.66	65.24	2.00	115.00
	4	9	3	4.00	6.92	0.00	12.00
	4	10	3	614.33	1063.19	0.00	1842.00
	4	11	3				
	5	5	3				
	5	6	6	1.83	3.60	0.00	9.00
	5	7	6	3.83	4.35	0.00	12.00
	5	8	3	0.66	0.57	0.00	1.00
	5	9	3	9.00	13.00	1.00	24.00
	5	10	3	1.00	1.73	0.00	3.00
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3	1.00	0.00	1.00	1.00
	7	6	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LGI	7	7	6	46.66	72.26	0.00	174.00
	7	8	3	17.00	27.73	0.00	49.00
	7	9	6	1.16	2.40	0.00	6.00
	7	11	3				
	8	5	3				
	8	6	6	1.00	1.67	0.00	4.00
	8	7	6	10.33	10.91	1.00	26.00
	8	8	3	26.66	38.47	2.00	71.00
	8	9	6	14.66	18.92	0.00	40.00
	8	11	3				
	9	5	3				
	9	6	6	0.16	0.40	0.00	1.00
	9	7	6	0.83	1.60	0.00	4.00
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3	1.00	1.73	0.00	3.00
	11	6	6	0.33	0.51	0.00	1.00
	11	7	6	0.50	0.83	0.00	2.00
	11	8	3	0.66	0.57	0.00	1.00
	11	9	6	0.66	1.63	0.00	4.00
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6	2.00	3.16	0.00	8.00
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6	0.33	0.51	0.00	1.00
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LGI	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	54.11	150.79	0.00	456.00
	15	7	6	10.50	8.14	1.00	21.00
	15	8	3	11.00	12.12	0.00	24.00
	15	9	3				
	15	10	3	0.66	1.15	0.00	2.00
	15	11	3				
	16	6	9	0.11	0.33	0.00	1.00
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
LGU	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LGU	5	6	6				
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LGU	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9				
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
LMA	1	6	9	0.11	0.33	0.00	1.00
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LMA	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6	0.16	0.40	0.00	1.00
	4	7	6	4.50	5.43	0.00	12.00
	4	8	3	10.00	17.32	0.00	30.00
	4	9	3	2.00	3.46	0.00	6.00
	4	10	3	12.00	20.78	0.00	36.00
	4	11	3				
	5	5	3				
	5	6	6				
	5	7	6	0.16	0.40	0.00	1.00
	5	8	3				
	5	9	3	6.00	7.93	0.00	15.00
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6	0.16	0.40	0.00	1.00
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6	1.66	3.61	0.00	9.00
	8	8	3				
	8	9	6	0.66	1.21	0.00	3.00
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LMA	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6	0.16	0.40	0.00	1.00
	11	8	3				
	11	9	6				
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3	1.66	2.88	0.00	5.00
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	1.33	4.00	0.00	12.00
	15	7	6	0.83	1.16	0.00	3.00
	15	8	3	0.33	0.57	0.00	1.00
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
LMA	16	10	3				
	16	11	3				
MCA	1	6	9	3.77	10.25	0.00	31.00
	1	7	6				
	1	8	3				
	1	9	3	7.66	13.27	0.00	23.00
	1	10	3	5.66	9.81	0.00	17.00
	1	11	3				
	2	6	9	0.66	0.86	0.00	2.00
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9	0.11	0.33	0.00	1.00
	3	7	6				
	3	8	3				
	3	9	3	1.00	1.73	0.00	3.00
	3	10	3				
	3	11	3				
	4	5	3	1.66	1.52	0.00	3.00
	4	6	6	1.00	1.54	0.00	4.00
	4	7	6	2.33	3.50	0.00	9.00
	4	8	3	1.00	1.73	0.00	3.00
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3	0.33	0.57	0.00	1.00
	5	6	6	22.00	29.91	1.00	76.00
	5	7	6				
	5	8	3				
	5	9	3	8.00	13.00	0.00	23.00
	5	10	3				
	5	11	3	0.66	1.15	0.00	2.00
	6	5	3				
	6	6	6	0.16	0.40	0.00	1.00
	6	7	6				
	6	8	3				
	6	9	6	0.16	0.40	0.00	1.00
	6	11	3				
	7	5	3	0.66	0.57	0.00	1.00
	7	6	6	1.50	3.20	0.00	8.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MCA	7	7	6	1.00	1.54	0.00	4.00
	7	8	3	17.66	25.57	0.00	47.00
	7	9	6	12.00	28.41	0.00	70.00
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6	2.66	5.60	0.00	14.00
	8	8	3	8.66	6.50	2.00	15.00
	8	9	6	7.00	12.37	0.00	32.00
	8	11	3	0.33	0.57	0.00	1.00
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3	0.33	0.57	0.00	1.00
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3	0.33	0.57	0.00	1.00
	11	6	6				
	11	7	6	9.33	22.86	0.00	56.00
	11	8	3				
	11	9	6	62.66	99.07	0.00	260.00
	11	11	3				
	12	5	3				
	12	6	6	0.16	0.40	0.00	1.00
	12	7	6				
	12	8	3				
	12	9	6	0.50	1.22	0.00	3.00
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3	1.33	2.30	0.00	4.00
	13	10	3				
	13	11	3				
	14	6	9	26.88	33.43	0.00	85.00
	14	7	6	4.83	8.06	0.00	20.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MCA	14	8	3				
	14	9	3				
	14	10	3	108.33	99.91	40.00	223.00
	14	11	3				
	15	6	9	109.33	325.75	0.00	978.00
	15	7	6	6.50	15.92	0.00	39.00
	15	8	3				
	15	9	3	245.66	196.79	115.00	472.00
	15	10	3	0.33	0.57	0.00	1.00
	15	11	3				
	16	6	9	9.88	10.40	0.00	30.00
	16	7	6	34.00	53.58	0.00	141.00
	16	8	3				
	16	9	3	0.66	1.15	0.00	2.00
	16	10	3	41.33	57.36	1.00	107.00
	16	11	3				
MDO	1	6	9	0.88	1.05	0.00	2.00
	1	7	6	4.16	7.30	0.00	19.00
	1	8	3	2.00	3.46	0.00	6.00
	1	9	3	9.00	7.00	2.00	16.00
	1	10	3				
	1	11	3				
	2	6	9	0.55	0.72	0.00	2.00
	2	7	6	0.83	0.40	0.00	1.00
	2	8	3				
	2	9	3	0.66	0.57	0.00	1.00
	2	10	3				
	2	11	3	0.33	0.57	0.00	1.00
	3	6	9	0.66	1.32	0.00	4.00
	3	7	6	3.00	3.52	0.00	9.00
	3	8	3	2.33	4.04	0.00	7.00
	3	9	3	0.66	1.15	0.00	2.00
	3	10	3				
	3	11	3				
	4	5	3	6.66	4.16	2.00	10.00
	4	6	6	0.50	0.54	0.00	1.00
	4	7	6	14.16	27.07	0.00	69.00
	4	8	3	1.66	2.08	0.00	4.00
	4	9	3	2.00	3.46	0.00	6.00
	4	10	3				
	4	11	3				
	5	5	3	4.66	5.03	0.00	10.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MDO	5	6	6	11.33	16.18	1.00	44.00
	5	7	6	6.16	4.44	2.00	13.00
	5	8	3	1.33	1.52	0.00	3.00
	5	9	3	35.00	24.02	8.00	54.00
	5	10	3	1.33	2.30	0.00	4.00
	5	11	3				
	6	5	3	2.00	1.73	0.00	3.00
	6	6	6	0.83	0.98	0.00	2.00
	6	7	6	5.16	5.77	0.00	15.00
	6	8	3	0.66	0.57	0.00	1.00
	6	9	6	15.66	30.70	0.00	77.00
	6	11	3				
	7	5	3				
	7	6	6	0.16	0.40	0.00	1.00
	7	7	6	2.66	1.96	1.00	6.00
	7	8	3	22.00	21.70	8.00	47.00
	7	9	6	55.16	117.26	0.00	294.00
	7	11	3				
	8	5	3				
	8	6	6	0.16	0.40	0.00	1.00
	8	7	6	1.66	1.50	0.00	3.00
	8	8	3	2.00	1.00	1.00	3.00
	8	9	6	31.16	40.06	1.00	108.00
	8	11	3	0.33	0.57	0.00	1.00
	9	5	3	0.33	0.57	0.00	1.00
	9	6	6	0.16	0.40	0.00	1.00
	9	7	6	5.33	7.47	0.00	20.00
	9	8	3	1.66	2.08	0.00	4.00
	9	9	6	0.16	0.40	0.00	1.00
	9	11	3				
	10	6	9	0.88	1.26	0.00	3.00
	10	7	6	3.33	3.01	0.00	7.00
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3	0.33	0.57	0.00	1.00
	11	6	6	1.83	3.25	0.00	8.00
	11	7	6	7.50	6.80	0.00	18.00
	11	8	3	15.66	9.29	5.00	22.00
	11	9	6	168.66	196.45	0.00	520.00
	11	11	3	0.33	0.57	0.00	1.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MDO	12	5	3	0.66	1.15	0.00	2.00
	12	6	6	0.16	0.40	0.00	1.00
	12	7	6	4.00	3.94	0.00	10.00
	12	8	3	3.00	5.19	0.00	9.00
	12	9	6				
	12	11	3				
	13	6	9	0.66	1.11	0.00	3.00
	13	7	6	2.83	5.98	0.00	15.00
	13	8	3				
	13	9	3	5.33	5.50	0.00	11.00
	13	10	3	0.66	1.15	0.00	2.00
	13	11	3				
	14	6	9	0.11	0.33	0.00	1.00
	14	7	6	0.50	0.54	0.00	1.00
	14	8	3				
	14	9	3	0.66	0.57	0.00	1.00
	14	10	3				
	14	11	3				
	15	6	9	0.77	1.39	0.00	4.00
	15	7	6	1.50	3.67	0.00	9.00
	15	8	3				
	15	9	3	0.66	1.15	0.00	2.00
	15	10	3				
	15	11	3				
	16	6	9	0.11	0.33	0.00	1.00
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
MSA	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MSA	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3	0.33	0.57	0.00	1.00
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				
	5	6	6				
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6	1.00	1.54	0.00	3.00
	7	8	3	3.33	5.77	0.00	10.00
	7	9	6	1.83	2.85	0.00	6.00
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6	40.33	87.46	0.00	218.00
	8	8	3	9.00	7.00	4.00	17.00
	8	9	6	3.50	6.80	0.00	17.00
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MSA	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3	0.33	0.57	0.00	1.00
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	0.66	2.00	0.00	6.00
	15	7	6	0.16	0.40	0.00	1.00
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3	0.33	0.57	0.00	1.00
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
MSA	16	10	3				
	16	11	3				
OKI	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9	0.22	0.44	0.00	1.00
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3	12.33	12.50	0.00	25.00
	5	6	6	1.33	1.96	0.00	5.00
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3	3.00	5.19	0.00	9.00
	6	6	6	0.50	0.83	0.00	2.00
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3	5.00	1.00	4.00	6.00
	7	6	6	0.33	0.51	0.00	1.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OKI	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6	0.33	0.51	0.00	1.00
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3	0.33	0.57	0.00	1.00
	9	6	6	0.33	0.51	0.00	1.00
	9	7	6				
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9	0.11	0.33	0.00	1.00
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3	3.66	3.21	0.00	6.00
	11	6	6	0.33	0.81	0.00	2.00
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				
	12	5	3				
	12	6	6	0.16	0.40	0.00	1.00
	12	7	6				
	12	8	3				
	12	9	6	0.16	0.40	0.00	1.00
	12	11	3				
	13	6	9	0.22	0.44	0.00	1.00
	13	7	6	0.16	0.40	0.00	1.00
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OKI	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	0.22	0.66	0.00	2.00
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9	0.55	1.01	0.00	3.00
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
OMY	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3	2.66	0.57	2.00	3.00
	4	6	6	0.16	0.40	0.00	1.00
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3	0.33	0.57	0.00	1.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OMY	5	6	6	0.16	0.40	0.00	1.00
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3	0.66	0.57	0.00	1.00
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3	0.33	0.57	0.00	1.00
	9	6	6				
	9	7	6	0.16	0.40	0.00	1.00
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3	0.33	0.57	0.00	1.00
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OMY	12	5	3				
	12	6	6	0.16	0.40	0.00	1.00
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3	0.33	0.57	0.00	1.00
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3	1.33	1.15	0.00	2.00
	14	11	3				
	15	6	9				
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6	0.16	0.40	0.00	1.00
	16	8	3				
	16	9	3				
	16	10	3	0.33	0.57	0.00	1.00
	16	11	3				
ONE	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
ONE	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				
	5	6	6	1.66	3.20	0.00	8.00
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3	6.00	4.35	1.00	9.00
	6	6	6	0.66	1.03	0.00	2.00
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3	2.00	0.00	2.00	2.00
	7	6	6	0.16	0.40	0.00	1.00
	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3	6.00	10.39	0.00	18.00
	8	6	6	0.66	1.63	0.00	4.00
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
ONE	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6	0.16	0.40	0.00	1.00
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				
	12	5	3				
	12	6	6	0.16	0.40	0.00	1.00
	12	7	6				
	12	8	3				
	12	9	6	0.16	0.40	0.00	1.00
	12	11	3				
	13	6	9	0.11	0.33	0.00	1.00
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9	1.55	1.74	0.00	4.00
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	0.11	0.33	0.00	1.00
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9	1.55	2.45	0.00	7.00
	16	7	6				
	16	8	3				
	16	9	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
ONE	16	10	3				
	16	11	3				
OTSF	1	6	9	6.33	7.98	0.00	19.00
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3	1.00	1.00	0.00	2.00
	2	6	9	13.11	14.04	0.00	37.00
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3	0.33	0.57	0.00	1.00
	2	11	3	1.33	1.52	0.00	3.00
	3	6	9	17.33	21.45	0.00	59.00
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3	2.00	1.73	1.00	4.00
	4	5	3	13.00	11.13	3.00	25.00
	4	6	6	1.00	1.26	0.00	3.00
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3	13.66	10.40	2.00	22.00
	5	6	6	7.66	8.16	0.00	19.00
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3	2.00	3.46	0.00	6.00
	5	11	3	5.66	3.05	3.00	9.00
	6	5	3	57.66	30.55	31.00	91.00
	6	6	6	24.16	13.04	11.00	44.00
	6	7	6	14.66	19.59	0.00	48.00
	6	8	3	0.33	0.57	0.00	1.00
	6	9	6	0.83	1.32	0.00	3.00
	6	11	3	2.00	1.00	1.00	3.00
	7	5	3	72.66	20.59	57.00	96.00
	7	6	6	27.00	25.15	9.00	76.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OTSF	7	7	6	0.83	1.32	0.00	3.00
	7	8	3				
	7	9	6				
	7	11	3	6.66	5.03	2.00	12.00
	8	5	3	15.33	10.21	8.00	27.00
	8	6	6	9.50	9.85	3.00	29.00
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3	2.33	3.21	0.00	6.00
	9	5	3	4.33	3.78	0.00	7.00
	9	6	6	27.16	26.52	2.00	71.00
	9	7	6	5.66	8.14	0.00	18.00
	9	8	3				
	9	9	6	0.50	0.54	0.00	1.00
	9	11	3	0.66	0.57	0.00	1.00
	10	6	9	8.00	14.77	0.00	39.00
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3	0.33	0.57	0.00	1.00
	10	11	3	1.66	2.08	0.00	4.00
	11	5	3	8.33	2.30	7.00	11.00
	11	6	6	39.00	37.48	0.00	77.00
	11	7	6	3.00	6.38	0.00	16.00
	11	8	3				
	11	9	6				
	11	11	3				
	12	5	3	0.33	0.57	0.00	1.00
	12	6	6	0.50	0.83	0.00	2.00
	12	7	6				
	12	8	3				
	12	9	6	2.16	3.48	0.00	8.00
	12	11	3	0.66	0.57	0.00	1.00
	13	6	9	9.33	9.20	0.00	24.00
	13	7	6	0.33	0.81	0.00	2.00
	13	8	3				
	13	9	3				
	13	10	3	0.66	1.15	0.00	2.00
	13	11	3				
	14	6	9	11.80	11.75	3.00	40.00
	14	7	6	0.16	0.40	0.00	1.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OTSF	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3	1.33	0.57	1.00	2.00
	15	6	9	14.77	18.34	0.00	60.00
	15	7	6	0.16	0.40	0.00	1.00
	15	8	3				
	15	9	3				
	15	10	3	0.33	0.57	0.00	1.00
	15	11	3				
	16	6	9	1.88	2.93	0.00	7.00
	16	7	6	0.16	0.40	0.00	1.00
	16	8	3				
	16	9	3				
	16	10	3	0.33	0.57	0.00	1.00
	16	11	3	1.33	2.30	0.00	4.00
OTSS	1	6	9	0.22	0.44	0.00	1.00
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9	13.00	11.98	1.00	35.00
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9	5.22	5.44	1.00	19.00
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3	10.33	7.63	2.00	17.00
	4	6	6	3.00	4.64	0.00	12.00
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3	23.66	15.01	15.00	41.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OTSS	5	6	6	31.33	29.79	0.00	80.00
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3	71.66	34.07	39.00	107.00
	6	6	6	29.16	10.32	12.00	42.00
	6	7	6	0.83	0.98	0.00	2.00
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3	111.00	35.00	86.00	151.00
	7	6	6	48.50	42.66	16.00	120.00
	7	7	6	0.50	0.83	0.00	2.00
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3	1.00	1.00	0.00	2.00
	8	6	6	19.16	25.49	0.00	65.00
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3	5.00	1.73	3.00	6.00
	9	6	6	3.83	6.49	0.00	17.00
	9	7	6	0.16	0.40	0.00	1.00
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9	3.44	5.72	0.00	16.00
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3	4.33	2.08	2.00	6.00
	11	6	6	23.83	32.13	0.00	84.00
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
OTSS	12	5	3	0.66	1.15	0.00	2.00
	12	6	6	2.33	1.03	1.00	4.00
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9	6.33	4.21	0.00	14.00
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9	1.22	1.48	0.00	4.00
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	12.33	12.57	0.00	35.00
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9	6.55	9.09	0.00	22.00
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
PAN	1	6	9	0.55	1.66	0.00	5.00
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PAN	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3	2.00	3.46	0.00	6.00
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3				
	4	9	3	106.00	183.59	0.00	318.00
	4	10	3	18.00	31.17	0.00	54.00
	4	11	3				
	5	5	3				
	5	6	6				
	5	7	6	0.33	0.51	0.00	1.00
	5	8	3				
	5	9	3	0.33	0.57	0.00	1.00
	5	10	3				
	5	11	3				
	6	5	3	0.33	0.57	0.00	1.00
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6	3.16	4.21	0.00	9.00
	7	8	3	3.00	5.19	0.00	9.00
	7	9	6	1.50	1.97	0.00	4.00
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6	2.00	2.44	0.00	6.00
	8	8	3	6.33	9.29	0.00	17.00
	8	9	6	2.66	2.33	0.00	5.00
	8	11	3	0.33	0.57	0.00	1.00
	9	5	3	0.66	1.15	0.00	2.00
	9	6	6				
	9	7	6	0.16	0.40	0.00	1.00
	9	8	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PAN	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6	18.00	40.21	0.00	100.00
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3	3.00	5.19	0.00	9.00
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	8.66	26.00	0.00	78.00
	15	7	6	0.33	0.51	0.00	1.00
	15	8	3	0.66	1.15	0.00	2.00
	15	9	3	10.33	17.89	0.00	31.00
	15	10	3				
	15	11	3	2.00	2.00	0.00	4.00
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PAN	16	10	3				
	16	11	3	1.00	1.73	0.00	3.00
PFL	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6	0.16	0.40	0.00	1.00
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				
	5	6	6	0.16	0.40	0.00	1.00
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PFL	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6	0.33	0.81	0.00	2.00
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PFL	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9				
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
PNI	1	6	9	2.33	4.35	0.00	10.00
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3	0.33	0.57	0.00	1.00
	4	6	6				
	4	7	6	0.16	0.40	0.00	1.00
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PNI	5	6	6	0.50	0.83	0.00	2.00
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6				
	7	8	3				
	7	9	6				
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6				
	8	8	3				
	8	9	6				
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6				
	11	8	3				
	11	9	6				
	11	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PNI	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9	4.44	11.86	0.00	36.00
	15	7	6	2.16	3.92	0.00	10.00
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				
POR	1	6	9	0.11	0.33	0.00	1.00
	1	7	6				
	1	8	3				
	1	9	3	2.00	3.46	0.00	6.00
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
POR	3	6	9	0.11	0.33	0.00	1.00
	3	7	6				
	3	8	3				
	3	9	3	0.66	1.15	0.00	2.00
	3	10	3				
	3	11	3				
	4	5	3	13.33	22.23	0.00	39.00
	4	6	6				
	4	7	6	1.00	1.26	0.00	3.00
	4	8	3	0.66	1.15	0.00	2.00
	4	9	3	0.33	0.57	0.00	1.00
	4	10	3				
	4	11	3				
	5	5	3	1.33	2.30	0.00	4.00
	5	6	6	16.83	26.91	0.00	64.00
	5	7	6	4.00	7.61	0.00	19.00
	5	8	3				
	5	9	3	6.00	10.39	0.00	18.00
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6	0.16	0.40	0.00	1.00
	6	8	3	0.33	0.57	0.00	1.00
	6	9	6	0.16	0.40	0.00	1.00
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6	7.83	10.10	0.00	24.00
	7	8	3	3.66	5.50	0.00	10.00
	7	9	6	5.00	9.25	0.00	23.00
	7	11	3				
	8	5	3				
	8	6	6	1.33	2.33	0.00	6.00
	8	7	6	10.16	13.89	0.00	38.00
	8	8	3	2.00	2.64	0.00	5.00
	8	9	6	3.50	5.04	0.00	13.00
	8	11	3				
	9	5	3	0.33	0.57	0.00	1.00
	9	6	6	0.50	0.83	0.00	2.00
	9	7	6	0.33	0.51	0.00	1.00
	9	8	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
POR	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6	0.83	2.04	0.00	5.00
	11	7	6	10.16	10.45	1.00	23.00
	11	8	3	1.33	2.30	0.00	4.00
	11	9	6	58.00	73.35	0.00	168.00
	11	11	3				
	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6	0.16	0.40	0.00	1.00
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3	0.33	0.57	0.00	1.00
	13	9	3	2.00	3.46	0.00	6.00
	13	10	3				
	13	11	3				
	14	6	9	45.11	71.87	0.00	212.00
	14	7	6	0.83	1.60	0.00	4.00
	14	8	3				
	14	9	3				
	14	10	3	1.33	2.30	0.00	4.00
	14	11	3				
	15	6	9	17.44	51.95	0.00	156.00
	15	7	6	3.83	7.02	0.00	18.00
	15	8	3	0.33	0.57	0.00	1.00
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9	10.22	11.44	0.00	32.00
	16	7	6	5.16	5.63	0.00	13.00
	16	8	3	1.33	2.30	0.00	4.00
	16	9	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
POR	16	10	3	1.33	2.30	0.00	4.00
	16	11	3				
PWI	1	6	9	4.44	7.84	0.00	22.00
	1	7	6				
	1	8	3	0.33	0.57	0.00	1.00
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9	3.77	6.39	0.00	15.00
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9	9.22	14.88	0.00	42.00
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6	5.00	7.53	0.00	17.00
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				
	5	6	6				
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3	3.66	3.05	1.00	7.00
	6	6	6	10.66	9.39	0.00	23.00
	6	7	6	0.66	0.81	0.00	2.00
	6	8	3	2.00	3.46	0.00	6.00
	6	9	6	0.16	0.40	0.00	1.00
	6	11	3	1.33	1.52	0.00	3.00
	7	5	3	22.66	9.01	14.00	32.00
	7	6	6	59.66	28.93	6.00	87.00

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PWI	7	7	6	19.83	19.90	2.00	54.00
	7	8	3	14.33	23.09	1.00	41.00
	7	9	6	2.16	2.31	0.00	6.00
	7	11	3	27.66	26.50	9.00	58.00
	8	5	3	49.33	45.88	18.00	102.00
	8	6	6	39.33	17.77	10.00	57.00
	8	7	6	6.33	8.86	0.00	20.00
	8	8	3				
	8	9	6				
	8	11	3	4.00	5.29	0.00	10.00
	9	5	3	0.33	0.57	0.00	1.00
	9	6	6	11.16	15.48	0.00	36.00
	9	7	6	2.66	4.13	0.00	8.00
	9	8	3				
	9	9	6	0.16	0.40	0.00	1.00
	9	11	3	0.33	0.57	0.00	1.00
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3	5.00	4.58	1.00	10.00
	11	6	6	50.50	67.09	3.00	180.00
	11	7	6	5.33	9.68	0.00	24.00
	11	8	3				
	11	9	6	0.83	1.60	0.00	4.00
	11	11	3	0.33	0.57	0.00	1.00
	12	5	3				
	12	6	6	5.83	12.43	0.00	31.00
	12	7	6	0.16	0.40	0.00	1.00
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9	1.33	2.34	0.00	7.00
	13	7	6				
	13	8	3	1.00	1.73	0.00	3.00
	13	9	3				
	13	10	3	0.33	0.57	0.00	1.00
	13	11	3				
	14	6	9				
	14	7	6				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
PWI	14	8	3				
	14	9	3				
	14	10	3	0.66	0.57	0.00	1.00
	14	11	3				
	15	6	9				
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3	0.33	0.57	0.00	1.00
	16	9	3				
	16	10	3	1.00	1.73	0.00	3.00
	16	11	3	0.33	0.57	0.00	1.00
RBA	1	6	9				
	1	7	6				
	1	8	3				
	1	9	3				
	1	10	3				
	1	11	3				
	2	6	9				
	2	7	6				
	2	8	3				
	2	9	3				
	2	10	3				
	2	11	3				
	3	6	9				
	3	7	6				
	3	8	3				
	3	9	3				
	3	10	3				
	3	11	3				
	4	5	3				
	4	6	6				
	4	7	6				
	4	8	3				
	4	9	3				
	4	10	3				
	4	11	3				
	5	5	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
RBA	5	6	6				
	5	7	6				
	5	8	3				
	5	9	3				
	5	10	3				
	5	11	3				
	6	5	3				
	6	6	6				
	6	7	6				
	6	8	3				
	6	9	6				
	6	11	3				
	7	5	3				
	7	6	6				
	7	7	6				
	7	8	3	0.33	0.57	0.00	1.00
	7	9	6	1.00	2.44	0.00	6.00
	7	11	3				
	8	5	3				
	8	6	6				
	8	7	6				
	8	8	3				
	8	9	6	1.00	1.26	0.00	3.00
	8	11	3				
	9	5	3				
	9	6	6				
	9	7	6				
	9	8	3				
	9	9	6				
	9	11	3				
	10	6	9				
	10	7	6				
	10	8	3				
	10	9	3				
	10	10	3				
	10	11	3				
	11	5	3				
	11	6	6				
	11	7	6	1.83	4.49	0.00	11.00
	11	8	3				
	11	9	6				
	11	11	3				

Appendix Table 4. Cont.

Species	Station	Month	n	CPUE	SD	MIN	MAX
RBA	12	5	3				
	12	6	6				
	12	7	6				
	12	8	3				
	12	9	6				
	12	11	3				
	13	6	9				
	13	7	6				
	13	8	3				
	13	9	3				
	13	10	3				
	13	11	3				
	14	6	9				
	14	7	6				
	14	8	3				
	14	9	3				
	14	10	3				
	14	11	3				
	15	6	9				
	15	7	6				
	15	8	3				
	15	9	3				
	15	10	3				
	15	11	3				
	16	6	9				
	16	7	6				
	16	8	3				
	16	9	3				
	16	10	3				
	16	11	3				

Table 9. Total catch of length classes (total-mm) of fishes collected from 16 stations in Lower Granite and Little Goose reservoirs from May through November, 2002. See Table 3 for species codes.

	Length Class (mm)								
Species	**≤100**	**101-200**	**201-300**	**301-400**	**401-500**	**501-600**	**601-700**	**>700**	**TOTAL**
AAL	250	144	5	0	0	0	0	0	399
ASA	6391	0	0	0	0	0	0	0	6391
CCA	2	2	5	24	13	25	8	7	86
CCO	821	308	45	8	0	0	0	0	1182
CMA	417	1266	123	57	112	33	0	0	2008
COT	5	0	0	0	0	0	0	0	5
FDI	305	26	0	0	0	0	0	0	331
INE	436	226	75	4	0	0	0	0	741
IPU	2	19	6	1	79	3	1	1	112
LGI	3740	576	2	0	0	0	0	0	4318
LGU	0	1	0	0	0	0	0	0	1
LMA	169	22	0	0	0	0	0	0	191
MCA	2966	904	86	13	0	0	0	0	3969
MDO	1988	1107	392	74	12	0	0	0	3573
MSA	319	26	2	0	0	0	0	0	347
OKI	15	117	0	0	0	0	0	0	132
OMY	3	14	6	1	0	0	0	2	26
ONE	68	26	0	0	0	0	0	0	94
OTS	4553	429	47	0	0	0	0	1	5030
PAN	674	43	22	0	0	0	0	0	739
PFL	1	6	4	0	0	0	0	0	11
PNI	6	63	19	0	0	0	0	0	88
POR	1225	400	23	1	0	0	0	0	1649
PWI	1870	152	2	0	0	0	0	0	2024
RBA	24	0	0	0	0	0	0	0	24
TOTAL	26250	5877	864	183	216	61	9	11	33471

Appendix Table 5. Total length statistics for all potential predator fishes collected from Lower Granite and Little Goose reservoirs, Snake River.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
May	3	MDO	5	114	79	222	27.0
	4	MDO	20	148	52	342	27.0
	5	MDO	14	159	57	380	36.5
	6	MDO	6	90	55	258	33.6
	9	MDO	1	90	90	90	0.0
	10	MDO	4	171	80	311	171.3
	11	MDO	1	65	65	65	0.0
	12	MDO	2	281	264	297	16.5
	13	MDO	6	205	138	305	23.6
June	1	MDO	14	212	115	310	15.4
	2	MDO	9	263	82	414	38.1
	3	MDO	9	178	105	284	178.4
	4	MDO	3	134	58	250	59.0
	5	MDO	68	195	56	384	9.3
	6	MDO	11	102	53	268	23.6
	7	MDO	1	55	55	55	0.0
	8	MDO	3	192	72	252	60.0
	9	MDO	1	350	350	350	0.0
	10	MDO	33	175	71	368	14.5
	11	MDO	13	179	63	224	11.5
	12	MDO	17	156	59	390	25.2
	13	MDO	21	216	53	410	23.3
	14	MDO	1	255	255	255	0.0
	15	MDO	7	287	260	320	8.5
	16	MDO	1	82	82	82	0.0
July	1	MDO	49	142	21	255	6.6
	2	MDO	45	145	55	370	9.7
	3	MDO	82	142	72	325	5.9
	4	MDO	85	101	29	256	6.9
	5	MDO	37	176	72	289	11.0
	6	MDO	107	107	52	258	5.3
	7	MDO	34	116	40	281	9.0
	8	MDO	17	99	63	182	8.5
	9	MDO	70	131	42	308	9.8
	10	MDO	95	145	25	455	7.1
	11	MDO	64	132	65	297	6.8
	12	MDO	111	116	52	456	6.6
	13	MDO	94	154	82	425	7.8
	14	MDO	3	304	278	338	17.9
	15	MDO	9	125	102	235	13.9
	16	MDO					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Max	Standard Error
August	1	MDO	12	132	109	201	6.8
	2	MDO	12	153	102	229	10.7
	3	MDO	38	143	31	310	10.6
	4	MDO	5	109	89	126	6.1
	5	MDO	4	104	90	118	7.4
	6	MDO	12	175	25	272	22.8
	7	MDO	70	46	25	212	3.1
	8	MDO	12	131	42	238	23.3
	9	MDO	28	145	71	230	9.1
	10	MDO	66	129	92	284	3.9
	11	MDO	61	114	27	259	6.3
	12	MDO	55	144	75	338	8.6
	13	MDO	38	153	42	420	10.5
	14	MDO					
	15	MDO					
	16	MDO					
September	1	MDO	34	65	45	153	5.3
	2	MDO	21	70	43	156	7.7
	3	MDO	18	71	45	256	12.4
	4	MDO	6	54	52	55	1.5
	5	MDO	105	71	41	156	3.4
	6	MDO	125	59	32	400	4.9
	7	MDO	341	63	35	319	5.3
	8	MDO	189	53	31	309	2.7
	9	MDO	16	94	31	332	23.0
	10	MDO	14	102	44	209	12.5
	11	MDO	1018	47	30	285	1.5
	12	MDO	24	124	36	345	13.4
	13	MDO	63	78	36	211	5.6
	14	MDO	2	41	38	44	3.0
	15	MDO	2	140	99	180	40.5
	16	MDO					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
October	1	MDO					
	2	MDO					
	3	MDO					
	4	MDO					
	5	MDO	4	48	41	56	3.3
	6	MDO					
	7	MDO					
	8	MDO					
	9	MDO					
	10	MDO					
	11	MDO					
	12	MDO					
	13	MDO	2	41	29	53	12.0
	14	MDO					
	15	MDO					
	16	MDO					
November	1	MDO					
	2	MDO	1	61	61	61	0.0
	3	MDO					
	4	MDO					
	5	MDO					
	6	MDO					
	7	MDO					
	8	MDO	1	136	136	136	0.0
	9	MDO					
	10	MDO					
	11	MDO	1	33	33	33	0.0
	12	MDO					
	13	MDO					
	14	MDO					
	15	MDO					
	16	MDO					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
May	3	MSA					
	4	MSA					
	5	MSA					
	6	MSA					
	9	MSA					
	10	MSA					
	11	MSA					
	12	MSA					
	13	MSA					
June	1	MSA					
	2	MSA					
	3	MSA					
	4	MSA					
	5	MSA					
	6	MSA					
	7	MSA					
	8	MSA					
	9	MSA					
	10	MSA					
	11	MSA					
	12	MSA					
	13	MSA					
	14	MSA					
	15	MSA	6	255	255	255	0.0
	16	MSA					
July	1	MSA					
	2	MSA					
	3	MSA					
	4	MSA					
	5	MSA					
	6	MSA					
	7	MSA	6	44	39	50	1.9
	8	MSA	243	60	38	137	0.6
	9	MSA					
	10	MSA					
	11	MSA					
	12	MSA					
	13	MSA	1	147	147	147	0.0
	14	MSA					
	15	MSA	1	176	176	176	0.0
	16	MSA					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
August	1	MSA					
	2	MSA					
	3	MSA					
	4	MSA	1	80	80	80	0.0
	5	MSA					
	6	MSA					
	7	MSA	15	78	63	96	3.0
	8	MSA	34	79	43	105	2.1
	9	MSA					
	10	MSA					
	11	MSA					
	12	MSA					
	13	MSA					
	14	MSA					
	15	MSA					
	16	MSA					
September	1	MSA					
	2	MSA					
	3	MSA					
	4	MSA					
	5	MSA					
	6	MSA					
	7	MSA	13	101	75	136	6.9
	8	MSA	21	114	66	187	7.0
	9	MSA	1	105	105	105	0.0
	10	MSA					
	11	MSA					
	12	MSA	2	116	101	130	14.5
	13	MSA	2	112	57	166	54.5
	14	MSA					
	15	MSA					
	16	MSA					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
October	1	MSA					
	2	MSA					
	3	MSA					
	4	MSA					
	5	MSA					
	6	MSA					
	7	MSA					
	8	MSA					
	9	MSA					
	10	MSA					
	11	MSA					
	12	MSA					
	13	MSA					
	14	MSA					
	15	MSA					
	16	MSA					
November	1	MSA					
	2	MSA					
	3	MSA					
	4	MSA					
	5	MSA					
	6	MSA					
	7	MSA					
	8	MSA					
	9	MSA					
	10	MSA					
	11	MSA					
	12	MSA					
	13	MSA					
	14	MSA					
	15	MSA	1	260	260	260	0.0
	16	MSA					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
May	3	POR					
	4	POR	40	62	33	200	4.3
	5	POR	4	60	50	74	5.3
	6	POR					
	9	POR	1	270	270	270	0.0
	10	POR	1	91	91	91	0.0
	11	POR					
	12	POR					
	13	POR	2	55	45	65	10.0
June	1	POR	2	93	80	106	13.0
	2	POR					
	3	POR	4	132	79	197	29.7
	4	POR					
	5	POR	101	67	38	100	2.5
	6	POR	4	223	194	237	9.9
	7	POR					
	8	POR	12	84	45	123	5.2
	9	POR	3	180	47	260	66.8
	10	POR					
	11	POR	9	59	34	85	7.8
	12	POR					
	13	POR	1	181	181	181	0.0
	14	POR	406	68	46	140	0.9
	15	POR	157	95	65	225	5.8
	16	POR	92	126	65	210	3.2
July	1	POR	4	124	111	144	7.9
	2	POR					
	3	POR	7	94	61	112	8.2
	4	POR	6	103	82	134	11.1
	5	POR	24	62	48	75	1.2
	6	POR	17	117	97	135	2.5
	7	POR	54	105	73	128	1.6
	8	POR	63	85	28	135	2.4
	9	POR	8	122	100	161	7.4
	10	POR					
	11	POR	64	85	52	165	2.2
	12	POR					
	13	POR	6	97	60	112	8.5
	14	POR	5	168	102	281	35.4
	15	POR	23	100	72	150	3.4
	16	POR	31	133	82	261	7.1

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
August	1	POR					
	2	POR					
	3	POR	7	135	125	148	3.0
	4	POR	2	99	94	103	4.5
	5	POR					
	6	POR	2	123	121	125	2.0
	7	POR	11	87	71	101	4.3
	8	POR	7	78	23	128	14.1
	9	POR	3	116	91	137	13.4
	10	POR					
	11	POR	6	86	68	121	8.5
	12	POR	1	49	49	49	0.0
	13	POR	2	139	79	199	60.0
	14	POR					
	15	POR	1	128	128	128	0.0
	16	POR	4	107	79	140	12.6
September	1	POR	6	57	44	64	3.2
	2	POR	1	150	150	150	0.0
	3	POR	4	104	53	158	28.5
	4	POR	1	55	55	55	0.0
	5	POR	18	74	48	362	17.0
	6	POR	1	54	54	54	0.0
	7	POR	31	67	40	221	6.3
	8	POR	22	57	42	105	3.0
	9	POR					
	10	POR					
	11	POR	350	52	38	126	1.3
	12	POR	1	137	137	137	0.0
	13	POR	9	85	54	152	13.2
	14	POR					
	15	POR					
	16	POR					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
October	1	POR					
	2	POR					
	3	POR					
	4	POR					
	5	POR					
	6	POR					
	7	POR					
	8	POR					
	9	POR					
	10	POR					
	11	POR					
	12	POR					
	13	POR					
	14	POR	4	80	52	161	27.0
	15	POR					
	16	POR	4	56	46	70	5.4
November	1	POR					
	2	POR					
	3	POR					
	4	POR					
	5	POR					
	6	POR					
	7	POR					
	8	POR					
	9	POR					
	10	POR					
	11	POR					
	12	POR					
	13	POR					
	14	POR					
	15	POR					
	16	POR					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
May	3	PAN					
	4	PAN					
	5	PAN					
	6	PAN	1	82	82	82	0.0
	9	PAN	2	84	80	87	3.5
	10	PAN					
	11	PAN					
	12	PAN					
	13	PAN					
June	1	PAN	5	201	193	205	2.7
	2	PAN					
	3	PAN					
	4	PAN					
	5	PAN					
	6	PAN					
	7	PAN					
	8	PAN	4	138	63	208	39.1
	9	PAN					
	10	PAN					
	11	PAN					
	12	PAN					
	13	PAN					
	14	PAN					
	15	PAN	78	91	70	108	3.1
	16	PAN					
July	1	PAN	2	190	106	274	84.0
	2	PAN	2	77	42	112	35.0
	3	PAN	2	100	92	107	7.5
	4	PAN					
	5	PAN	2	207	190	224	17.0
	6	PAN	1	105	105	105	0.0
	7	PAN	21	84	55	100	2.9
	8	PAN	16	85	66	140	4.5
	9	PAN	2	85	60	109	24.5
	10	PAN					
	11	PAN					
	12	PAN					
	13	PAN	1	61	61	61	0.0
	14	PAN					
	15	PAN	2	183	150	215	32.5
	16	PAN					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
August	1	PAN					
	2	PAN					
	3	PAN	2	121	108	134	13.0
	4	PAN					
	5	PAN					
	6	PAN					
	7	PAN	9	90	79	102	2.3
	8	PAN	20	90	70	100	1.7
	9	PAN					
	10	PAN	1	115	115	115	0.0
	11	PAN					
	12	PAN					
	13	PAN	2	185	127	243	58.0
	14	PAN					
	15	PAN	2	82	64	100	18.0
	16	PAN					
September	1	PAN					
	2	PAN					
	3	PAN	6	32	26	37	1.9
	4	PAN	318	34	17	55	0.8
	5	PAN	1	68	68	68	0.0
	6	PAN					
	7	PAN	9	35	27	47	2.6
	8	PAN	16	39	28	78	3.2
	9	PAN					
	10	PAN					
	11	PAN	108	51	32	67	1.5
	12	PAN					
	13	PAN	9	28	25	30	0.5
	14	PAN					
	15	PAN	31	135	22	247	112.5
	16	PAN					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
October	1	PAN					
	2	PAN					
	3	PAN					
	4	PAN	54	44	30	71	4.9
	5	PAN					
	6	PAN					
	7	PAN					
	8	PAN					
	9	PAN					
	10	PAN					
	11	PAN					
	12	PAN					
	13	PAN					
	14	PAN					
	15	PAN					
	16	PAN					
November	1	PAN					
	2	PAN					
	3	PAN					
	4	PAN					
	5	PAN					
	6	PAN					
	7	PAN					
	8	PAN	1	26	26	26	0.0
	9	PAN					
	10	PAN					
	11	PAN					
	12	PAN					
	13	PAN					
	14	PAN					
	15	PAN	6	29	24	33	1.4
	16	PAN	3	38	25	56	9.3

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
May	3	PNI					
	4	PNI	1	257	257	257	0.0
	5	PNI					
	6	PNI					
	9	PNI					
	10	PNI	2	140	130	150	10.0
	11	PNI					
	12	PNI					
	13	PNI					
June	1	PNI	22	158	110	242	5.9
	2	PNI					
	3	PNI	1	202	202	202	0.0
	4	PNI					
	5	PNI	3	191	181	210	9.5
	6	PNI					
	7	PNI					
	8	PNI	1	0	0	0	0.0
	9	PNI					
	10	PNI	1	205	205	205	0.0
	11	PNI					
	12	PNI					
	13	PNI					
	14	PNI					
	15	PNI	40	152	92	225	16.5
	16	PNI					
July	1	PNI					
	2	PNI	1	229	229	229	0.0
	3	PNI	1	170	170	170	0.0
	4	PNI	1	60	60	60	0.0
	5	PNI					
	6	PNI					
	7	PNI					
	8	PNI					
	9	PNI					
	10	PNI					
	11	PNI					
	12	PNI					
	13	PNI					
	14	PNI					
	15	PNI	13	171	97	228	8.8
	16	PNI					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
August	1	PNI					
	2	PNI					
	3	PNI					
	4	PNI					
	5	PNI					
	6	PNI					
	7	PNI					
	8	PNI					
	9	PNI					
	10	PNI					
	11	PNI					
	12	PNI					
	13	PNI	1	122	122	122	0.0
	14	PNI					
	15	PNI					
	16	PNI					
September	1	PNI					
	2	PNI					
	3	PNI					
	4	PNI					
	5	PNI					
	6	PNI					
	7	PNI					
	8	PNI					
	9	PNI					
	10	PNI					
	11	PNI					
	12	PNI					
	13	PNI					
	14	PNI					
	15	PNI					
	16	PNI					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
October	1	PNI					
	2	PNI					
	3	PNI					
	4	PNI					
	5	PNI					
	6	PNI					
	7	PNI					
	8	PNI					
	9	PNI					
	10	PNI					
	11	PNI					
	12	PNI					
	13	PNI					
	14	PNI					
	15	PNI					
	16	PNI					
November	1	PNI					
	2	PNI					
	3	PNI					
	4	PNI					
	5	PNI					
	6	PNI					
	7	PNI					
	8	PNI					
	9	PNI					
	10	PNI					
	11	PNI					
	12	PNI					
	13	PNI					
	14	PNI					
	15	PNI					
	16	PNI					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
May	3	PFL					
	4	PFL					
	5	PFL					
	6	PFL					
	9	PFL					
	10	PFL					
	11	PFL					
	12	PFL					
	13	PFL					
June	1	PFL					
	2	PFL					
	3	PFL					
	4	PFL	1	90	90	90	0.0
	5	PFL	1	162	162	162	0.0
	6	PFL					
	7	PFL					
	8	PFL	2	129	128	130	1.0
	9	PFL					
	10	PFL					
	11	PFL	1	155	155	155	0.0
	12	PFL					
	13	PFL					
	14	PFL					
	15	PFL					
	16	PFL					
July	1	PFL					
	2	PFL					
	3	PFL	2	186	132	240	54.0
	4	PFL					
	5	PFL					
	6	PFL					
	7	PFL					
	8	PFL					
	9	PFL					
	10	PFL					
	11	PFL					
	12	PFL	3	211	102	276	54.7
	13	PFL					
	14	PFL					
	15	PFL					
	16	PFL					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
August	1	PFL					
	2	PFL					
	3	PFL					
	4	PFL					
	5	PFL					
	6	PFL					
	7	PFL					
	8	PFL					
	9	PFL					
	10	PFL					
	11	PFL					
	12	PFL	1	215	215	215	0.0
	13	PFL					
	14	PFL					
	15	PFL					
	16	PFL					
September	1	PFL					
	2	PFL					
	3	PFL					
	4	PFL					
	5	PFL					
	6	PFL					
	7	PFL					
	8	PFL					
	9	PFL					
	10	PFL					
	11	PFL					
	12	PFL					
	13	PFL					
	14	PFL					
	15	PFL					
	16	PFL					

Appendix Table 5. Cont.

Month	Station	Species	Number	Mean (mm)	Range (mm) Min	Range (mm) Max	Standard Error
October	1	PFL					
	2	PFL					
	3	PFL					
	4	PFL					
	5	PFL					
	6	PFL					
	7	PFL					
	8	PFL					
	9	PFL					
	10	PFL					
	11	PFL					
	12	PFL					
	13	PFL					
	14	PFL					
	15	PFL					
	16	PFL					
November	1	PFL					
	2	PFL					
	3	PFL					
	4	PFL					
	5	PFL					
	6	PFL					
	7	PFL					
	8	PFL					
	9	PFL					
	10	PFL					
	11	PFL					
	12	PFL					
	13	PFL					
	14	PFL					
	15	PFL					
	16	PFL					

(55.6%) accounted for the highest numbers collected (Table 9). Larger smallmouth bass were low in abundance, as only 0.59% (n=21) were larger than 300 mm.

Size distributions of smallmouth bass at stations 1 and 2, the disposal stations, were similar to those sampled at other stations (Figure 3). Peaks in the size distributions at approximately 50 mm and 120 mm were similar to peaks in lengths of smallmouth bass collected from other stations.

Northern Pikeminnow

Although over 1600 northern pikeminnow were collected at all stations in Lower Granite and Little Goose reservoirs, mean lengths indicated most individuals were generally less than 150 mm (Table 9; Appendix Table 5). The modal size class of northern pikeminnow was <100 mm and it accounted for 74.3% of all collected. Northern pikeminnow > 200 mm accounted for 1.3 % of all those sampled. Ten of the 21 northern pikeminnow >200 mm were collected at stations 14-16 in Little Goose Reservoir.

The size distribution for northern pikeminnow at stations 1 and 2 was similar to that from other stations (Figure 4). Numbers were low for all sizes; peaks in size classes were similar between disposal and other stations. Larger northern pikeminnow, although sampled in low numbers throughout the reservoir, were never caught at disposal stations.

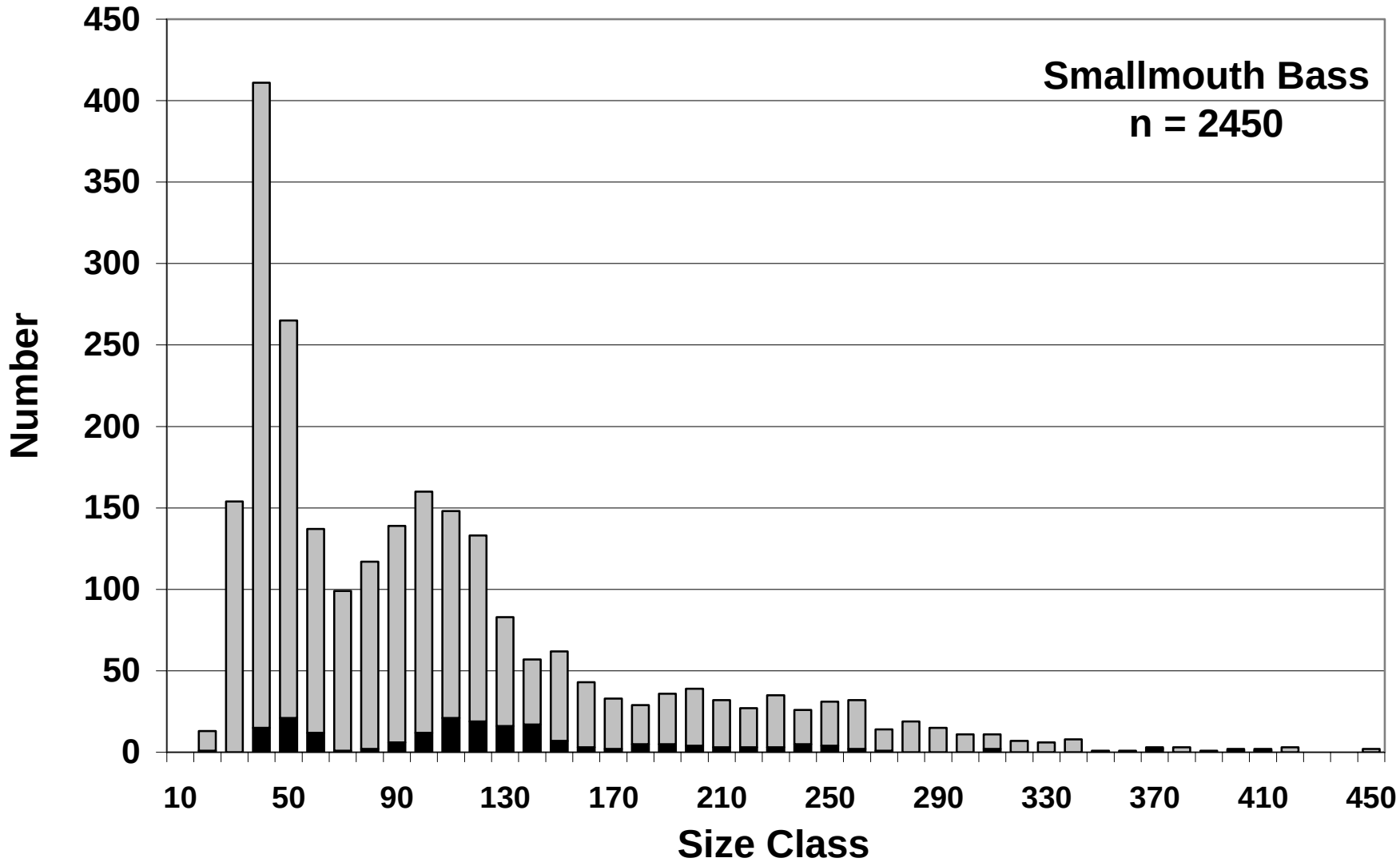

Figure 3. Length frequencies of smallmouth bass collected from Lower Granite and Little Goose reservoirs, Snake River, May – November, 2002. Shaded bars represent all fish and black bars represent fish collected from disposal stations 1 and 2.

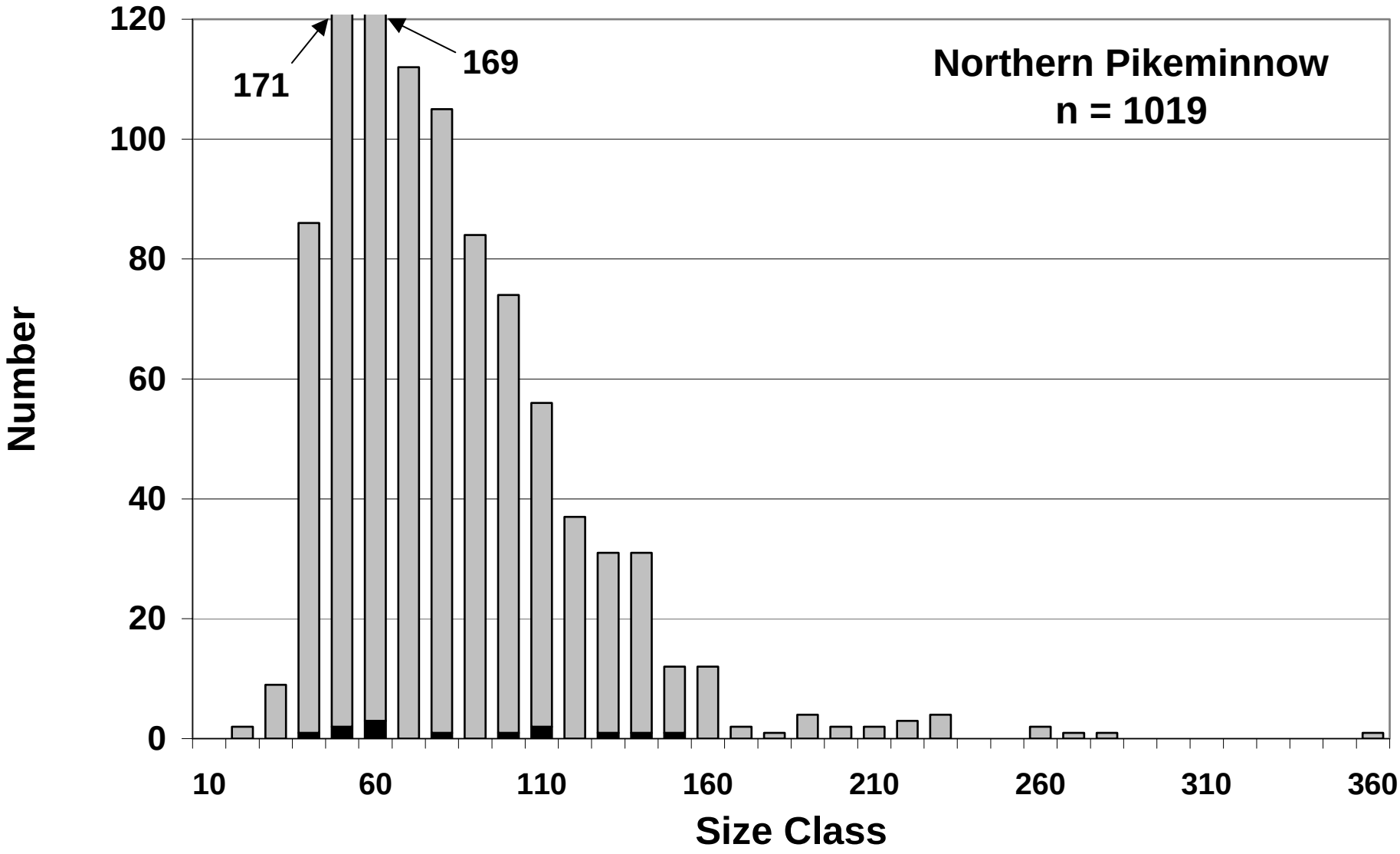

Figure 4. Length frequencies of northern pikeminnow collected from Lower Granite and Little Goose reservoirs, Snake River, May – November, 2002. Shaded bars represent all fish and black bars represent fish collected from disposal stations 1 and 2.

Objective 2: *To monitor juvenile fall chinook salmon abundance and habitat utilization at selected sites in Lower Granite and Little Goose reservoirs;*

Previous surveys have indicated that fall chinook salmon attain highest abundance in up-reservoir locations (Bennett et al. 1998a). Fall chinook salmon exhibit a strong preference for sandy shorelines with more gentle slopes (Curet 1994). Previous surveys reported low numbers of fall chinook salmon downstream of RM 120 in Lower Granite Reservoir (Bennett et al. 1998a).

METHODS

Sampling of juvenile salmonids, and specifically fall chinook salmon, was conducted using daytime beach seining and nighttime electrofishing. Procedures were identical to those employed under Objective 1 for predator sampling. Beach seining commenced on 28 May, 2002 and stations 4-9, 11, and 12 were sampled. Salmonids were anaesthetized, total lengths (mm) measured, and fish were allowed to recover prior to release. For stock separation, juvenile chinook salmon were separated by size; fish smaller than 75 mm in May, June and 100 mm in July were considered fall chinook salmon, while those larger than or equal to these lengths were considered spring/summer chinook salmon (Curet 1994). All juvenile chinook salmon captured during August – November were classified as fall chinook salmon.

Catch per haul was calculated for CPUE. Statistical comparisons of mean CPUE were conducted on ranked values by ANOVA and compared between disposal and reference stations (Objective 1).

RESULTS

We captured a total of 5282 juvenile anadromous salmonids using both gear types (Tables 4 and 5). Over 95% of the total juvenile anadromous salmonids were chinook salmon (Table 2). Chinook salmon were collected at each of the 16 stations, although their proportional abundance was highest at stations 6, 7 and 11. Lower numbers of chinook salmon were collected at stations 1, 4, 12, and 16.

Mean CPUE for all salmonids was highest for chinook salmon (Figure 5). Mean CPUEs for coho (*O. kisutch*) and sockeye salmon (*O. nerka*) and steelhead were consistently low. Temporally, the highest catches of all salmonids were made in May and June. Thereafter, mean CPUE was low at all stations.

Fall chinook salmon were captured at all 16 stations but were caught in highest abundance at stations 6, 7, 9, and 11. Mean CPUE for fall chinook salmon at disposal stations 1 and 2 were similar to those at stations 4, 10, and 12, although in general, mean CPUE was lower in down-reservoir stations in Lower Granite Reservoir. CPUE for fall chinook salmon was highest of all stocks of juvenile salmonids in Little Goose Reservoir.

Juvenile anadromous salmonids at disposal stations 1 and 2 accounted for 5.8% of all juvenile salmonids collected (Table 2). When salmonid numbers were standardized for effort among stations (not all stations could be sampled in May), that proportion collected at disposal stations increased to 7.99%. Total number of chinook salmon collected at station 2 was higher than at reference stations 3, 10, 12, 13, and 16 and higher than boat access sites 4, 5, 14 and 15 (Table 2).

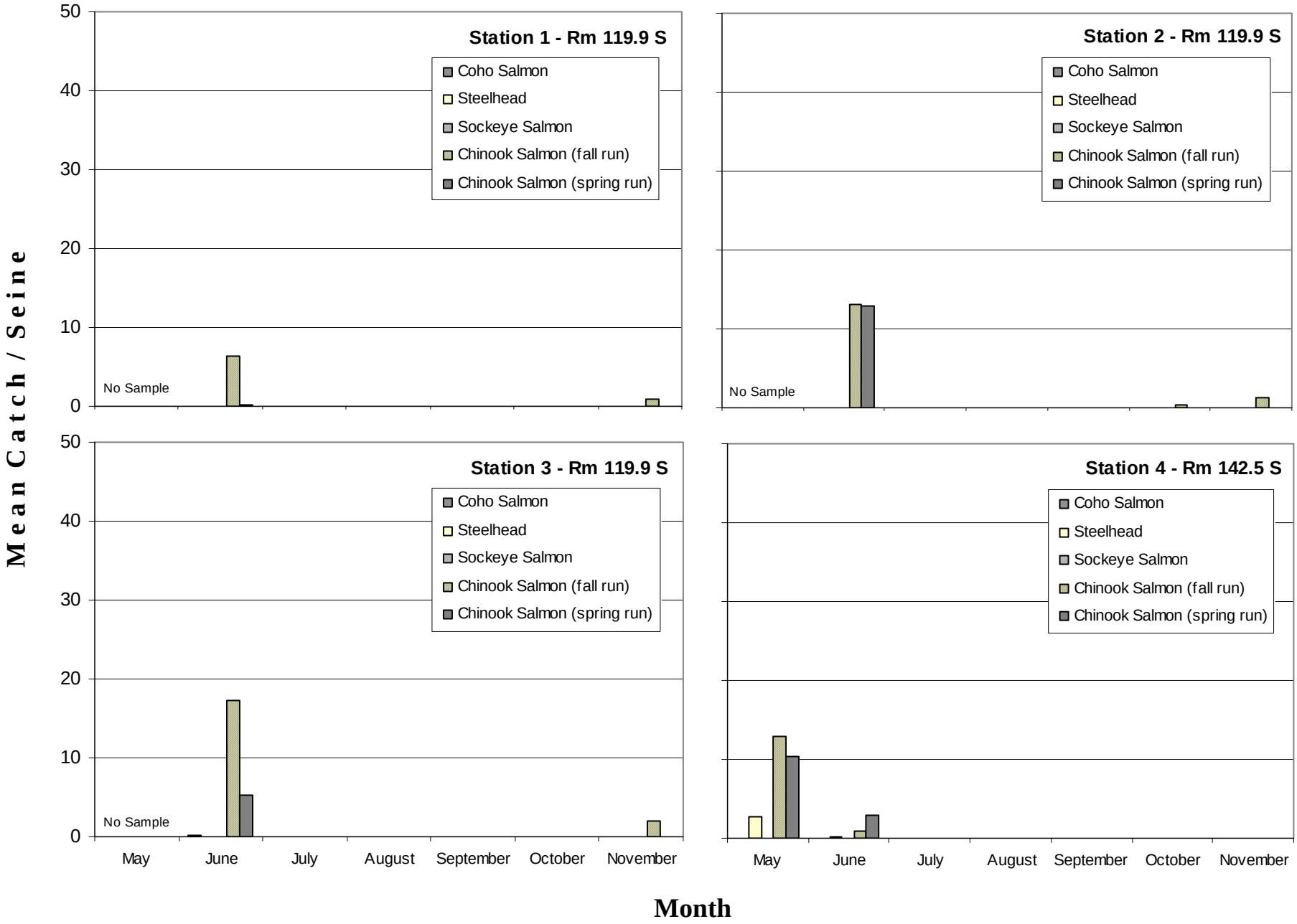

Figure 5. Mean monthly catch-per-unit-effort for juvenile anadromous fishes collected by beach seining Lower Granite (stations 1-13) and Little Goose (stations 14-16) reservoirs, Snake River from May through November 2002.

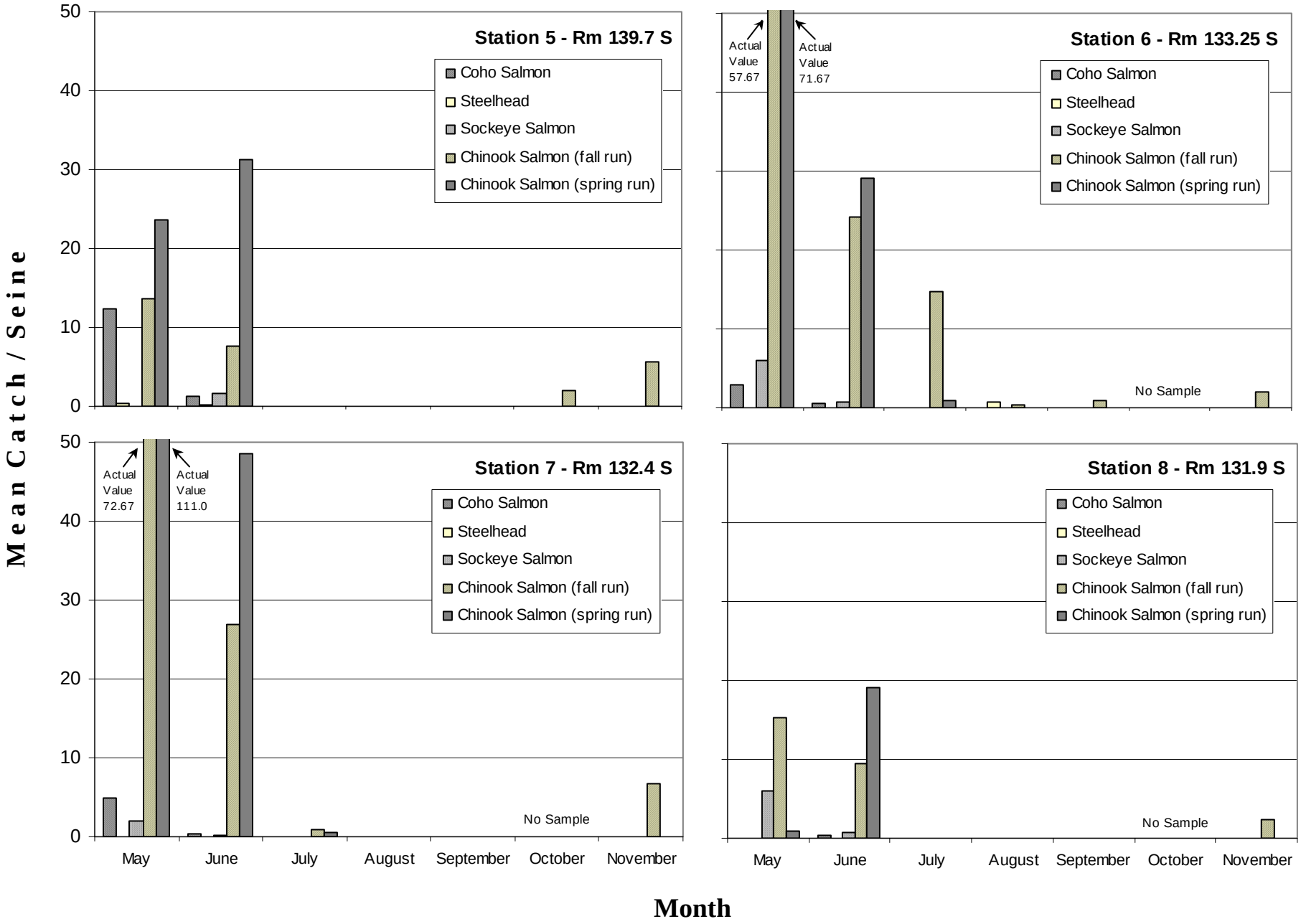

Figure 5 Cont.

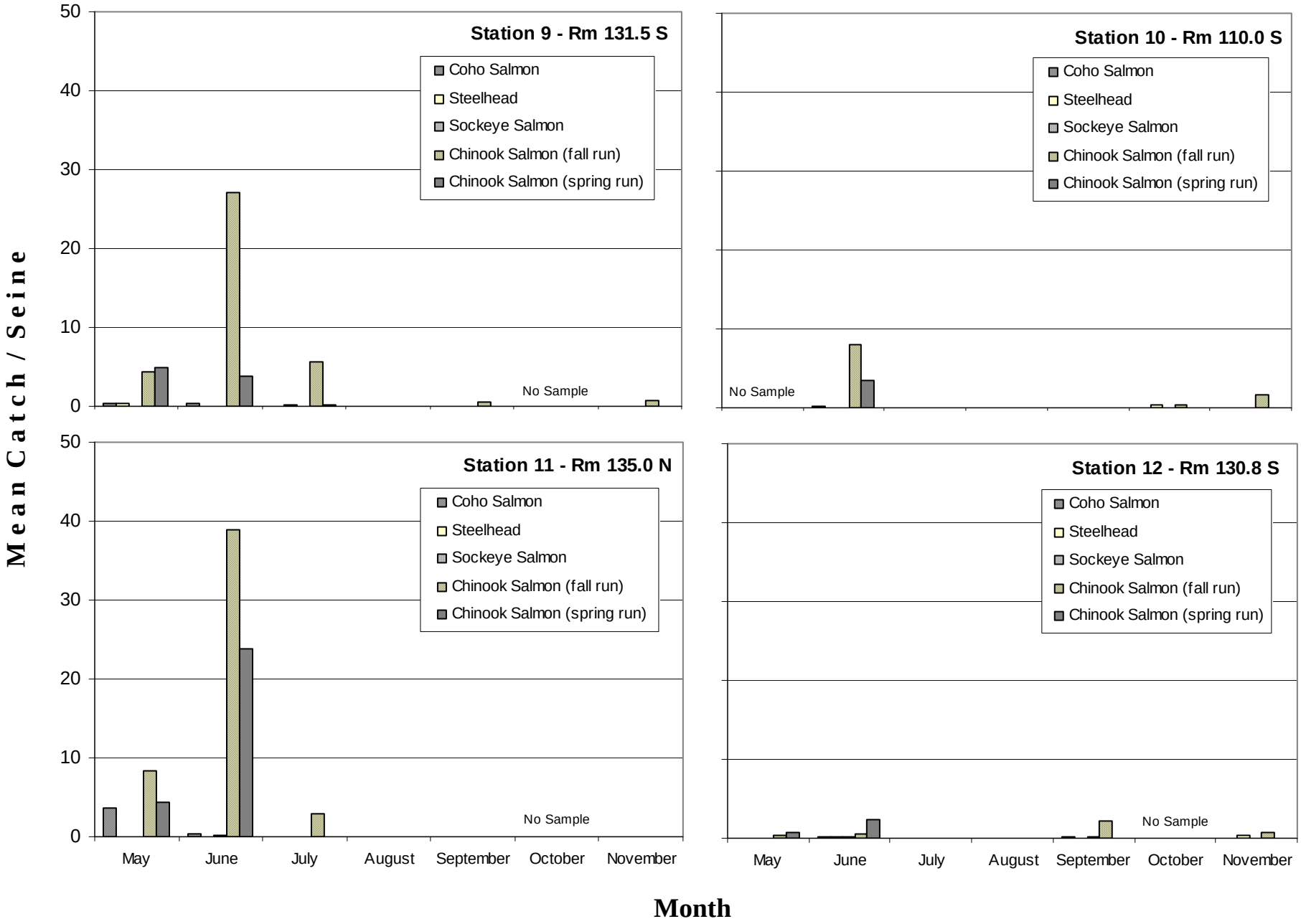

Figure 5 Cont.

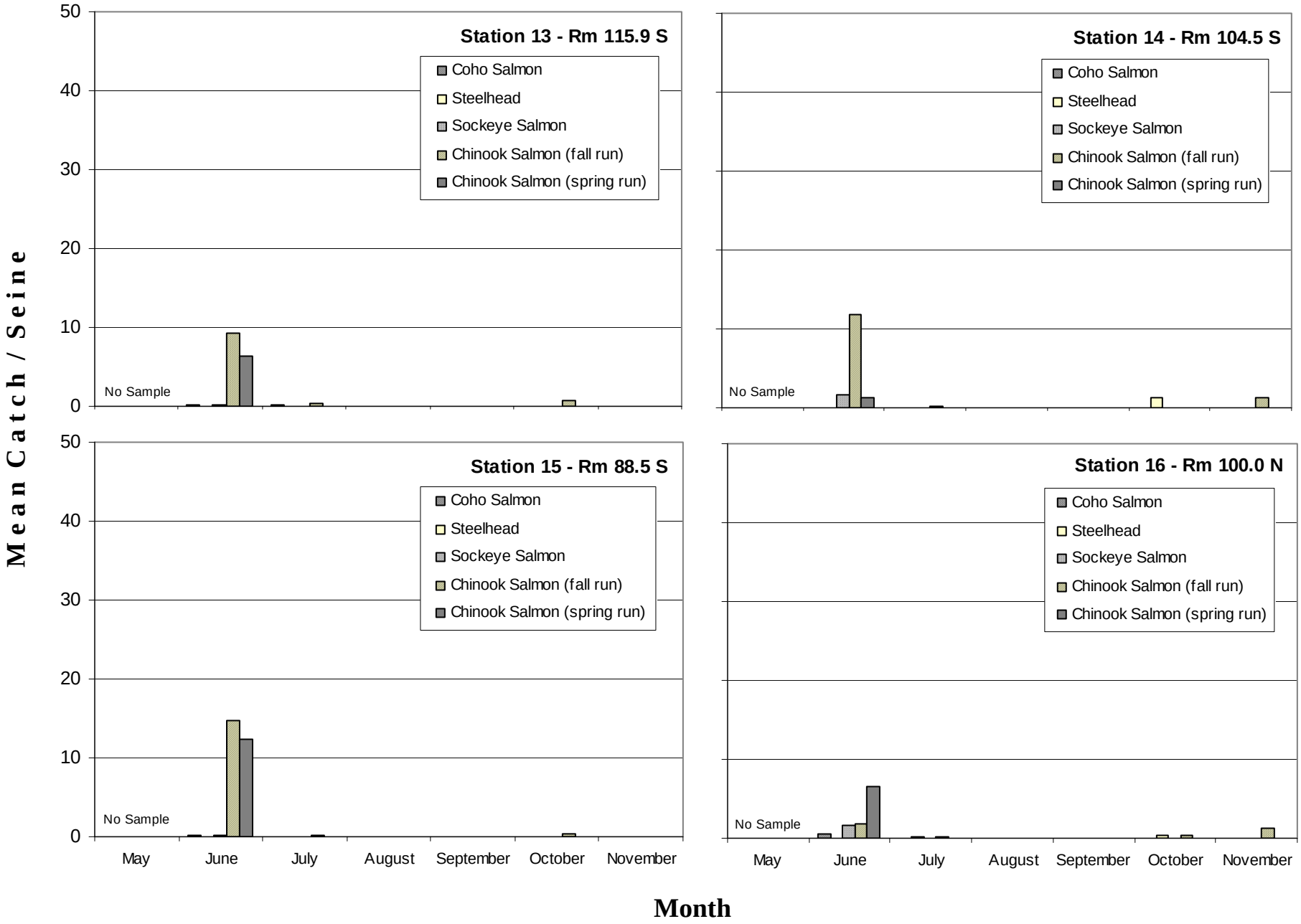

Figure 5 Cont.

Statistical comparisons of mean CPUE among stations revealed a number of differences in juvenile salmonid fish abundance. Abundance of coho salmon based on mean CPUE was not significantly different at stations 1 and 2 and reference stations by either beach seining or electrofishing (Tables 7 and 8).

Abundance of juvenile steelhead and sockeye salmon also was not significantly different at stations 1 and 2 than reference stations for both electrofishing and beach seining (Tables 7 and 8).

Few significant differences in mean CPUE of chinook salmon were found between disposal and reference stations (Tables 7 and 8). Mean CPUE for fall chinook salmon was not significantly different at stations 1 and 2 than at reference stations. The lack of significance was found for fall chinook salmon for both beach seining and electrofishing. No significant difference was found in CPUE for juvenile spring/summer chinook salmon at disposal station 2 and reference stations for either beach seining or electrofishing. Mean CPUE for juvenile spring/summer chinook salmon collected by beach seining at station 1 was significantly lower than at the reference stations. No such difference was found with electrofishing.

Mean lengths of chinook salmon showed an increase from month to month until November. The modal size class was 70 mm and 80 mm in May, June/July, respectively (Table 10). In September and October, modal size classes were 200 and 210 mm, respectively whereas in November, the modal size class was 100 mm.

Lengths of chinook salmon collected from the disposal stations demonstrated a higher incidence of smaller salmon, likely fall chinook salmon, than the lengths of

Table 10. Length frequencies of juvenile anadromous salmonids collected from Lower Granite and Little Goose reservoirs from May through November, 2002.

		Size Class																														
Month	Species	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	Total
May	Chinook	0	0	5	89	98	231	338	245	82	36	47	24	11	30	23	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1271
	Sockeye	0	0	0	2	1	11	15	8	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
	Steelhead	0	0	0	0	0	0	0	0	0	0	1	1	0	0	4	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10
	Coho	0	0	0	0	0	2	1	0	1	1	3	5	9	27	23	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	80
June	Chinook	0	0	5	226	540	522	672	792	446	130	43	17	3	1	6	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	3406
	Sockeye	0	0	0	0	1	1	8	7	8	10	8	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51
	Steelhead	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	4
	Coho	0	0	0	0	1	0	1	1	5	6	7	5	0	9	5	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	48
July	Chinook	0	0	0	0	7	18	47	76	67	18	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	238
	Sockeye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Steelhead	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Coho	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Aug.	Chinook	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Sockeye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Steelhead	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Coho	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sept.	Chinook	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	9	5	1	0	0	0	0	0	0	0	0	21
	Sockeye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	Steelhead	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Coho	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Oct.	Chinook	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2	3	4	0	0	0	0	0	0	0	0	0	12
	Sockeye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Steelhead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	4
	Coho	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov.	Chinook	0	0	0	0	0	0	0	2	7	11	8	6	8	3	4	3	1	2	1	3	3	3	6	7	1	1	0	0	0	0	80
	Sockeye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Steelhead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
	Coho	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

those collected from other stations (Figure 6). Peak length was 50 mm at the disposal stations while that at other stations was at 80 mm.

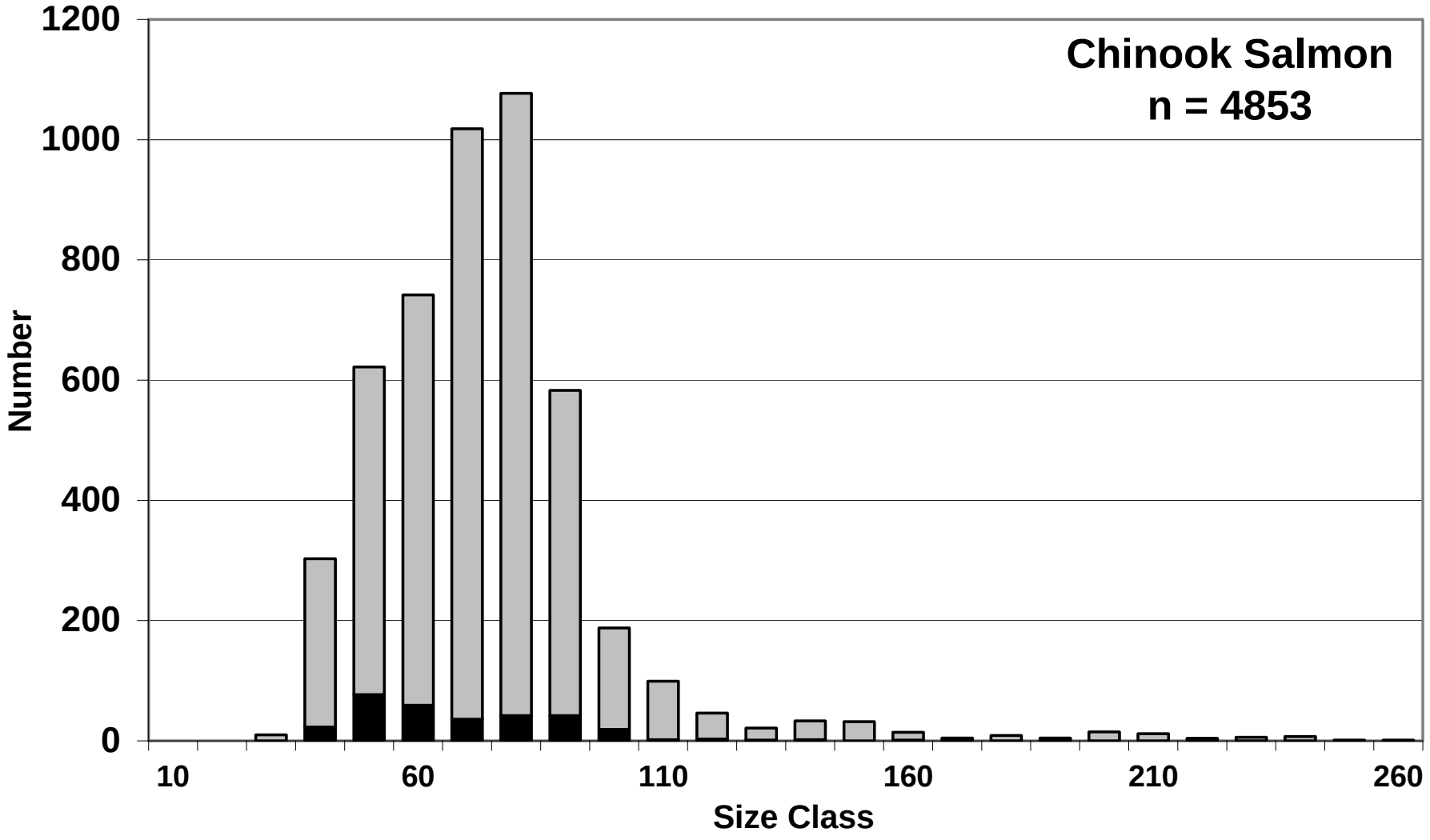

Figure 6. Length frequencies of chinook salmon collected from Lower Granite and Little Goose reservoirs, Snake River, May – November, 2002. Shaded bars represent all fish and black bars represent fish collected from disposal stations 1 and 2.

Objective 3. *To characterize habitat at previously constructed disposal sites and at additional potential disposal sites, including macrophyte development and substrate.*

Changes in reservoir habitats associated with ageing and operations have been well documented in the literature. Differences in fish community structure between Lower Granite Reservoir and Little Goose Reservoir in 1979 and 1980 prompted Bennett et al. (1983) to state that reservoir aging was probably responsible for observed differences between reservoirs. This objective examines those changes and compares some of the important habitat attributes that can affect fish and fish food abundances.

METHODS

Benthic Macroinvertebrates

Benthic macroinvertebrates (BMI) were collected at all 13 stations in Lower Granite Reservoir and at all three stations in Little Goose Reservoir during June - July, 2002. Fourteen samples were collected from each station using a Peterson dredge (300 mm x 330 mm). Depth and water temperature were recorded with each sample. Stations were generally divided into four transects and three samples were taken from each transect. The two remaining samples were taken at random locations within the station boundaries. Initial samples were taken approximately 10’ (3m) from the estimated low water point and at each point at approximately10 ft (3 m) intervals into the reservoir. At bay and launch stations, samples were taken from the mouth of each bay or launch site and then randomly throughout the site.

Each Peterson dredge sample was washed through a 0.595 mm sieve bucket (#30). Large rocks and woody debris were scrubbed with a course brush and rinsed into the sieve. Pressurized hand sprayers were used to rinse sampled material into containers for storage. Samples were preserved in 10% formalin with rosebengal dye.

In the laboratory, sample processing depended upon the size of the sample. Small samples or those containing large rocks were examined in total. Larger samples required sub-sampling. To sub-sample, we diluted the sample by one to four times, thoroughly mixed the sample, and then took a 5 cm core from the center of the sample. Benthic macroinvertebrates were sorted from other materials in samples and sub-samples using illuminated magnifiers and then later enumerated and identified to the lowest practical taxonomic groups. Groups were blotted dry and weighed to the nearest 0.001 g. Invertebrate biomass and density were expanded relative to the proportion of the sub-sample, when necessary, and then to a 1 m^2 area.

Vegetation Sampling

Each station was sampled to identify and map vegetation between 19 August and 16 September, 2002. Dominant shoreline vegetation was identified and recorded. Emergent vegetation beds were identified to genus in the field and mapped using GPS. Submerged aquatic macrophytes were mapped and sampled at all sites for later identification and biomass determination.

Submerged aquatic macrophytes were located by snorkeling along parallel transects throughout the entire site at each of the 16 stations. Snorkelers worked in pairs and were generally separated to maintain appropriate spacing by a 4-m pole and adherence to transect lines. Transect numbers and spacing of snorkelers varied, depending on water clarity and depth. Divers deployed buoys to delineate the boundaries of macrophyte beds. Macrophyte beds were considered separate if spaced $\geq$2 m apart, otherwise they were considered a single bed. After snorkeling an entire site, each macrophyte bed was mapped using of a Trimble GeoExplorer 3 Global Positioning System (GPS). Following mapping, a 1-m^2 sinking sampling frame (with attached buoy) was randomly thrown into each bed. All vegetation within the sampling frame was clipped at the point of emergence from the substrate. Generally, 15-21 samples were collected at each site. Sparsely vegetated stations were sampled in entirety. Each random sampling point was recorded with GPS and all collected plants were bagged, tagged, and frozen for later identification, and laboratory analysis.

In the laboratory, aquatic macrophytes were thawed, washed, and separated by species. Excess moisture was removed by spinning the samples in a kitchen salad spinner. Wet weights were recorded and the samples were dried at 105 C for 24 hours to remove all moisture. Oven dry weights were recorded and total biomass was estimated at each site.

Substrate Sampling

We collected at least six substrate samples at each of the 16 stations using a Peterson dredge (300 mm x 330 mm) during September, 2002. Random locations

were sampled and the presence of solid substrate was noted when the dredge was empty upon retrieval. In the laboratory, samples were dried at 105 C until no weight change was detectable (3-12 days). Samples were then poured into a series of sieves (50 mm, 25 mm, 12.5 mm, 9.5 mm, 6.3 mm, 4.75 mm, 2 mm, <2 mm) and mechanically shaken for 5 minutes. The material remaining in each sieve was weighed and percentages of each particle size calculated. When possible, a 50-100 g sub-sample of material <2 mm was taken for proportion of organic matter. Percent organic matter <2 mm was estimated by drying the sub-sample for 12 hours at 105 C, weighing it, and then incinerating it for 8 hours at 500 C. The sub-sample was then completely rehydrated, dried for an additional 12 hours at 105 C, and weighed a second time. Percent organic matter was calculated from the change in pre- and post-incineration weights.

Site and Depth Mapping

The shoreline boundary of each study site was mapped on foot using a Trimble GeoExplorer 3 GPS. The open water boundary of each site, defined as a line approximately 15 m from shore, parallel to the shoreline, was mapped from a boat with a GPS unit. GPS data were differentially corrected.

Depth mapping occurred at each of the 16 stations in November, 2002. Three to 12 transects, perpendicular to shore, were mapped using an Eagle Mach I bathometer with graph recorder and GPS unit. Depth and geographic coordinates were recorded along each transect.

Depth maps of each site were created by estimating the distance between in-shore and off-shore points and dividing that distance into 10 equal segments. Geographic coordinates of the nine new points were calculated trigonometrically. Water depths at those points were read from the recorded depth. Overall slope, mean slope, and the slope of each transect were calculated. All data were then transferred to a geographic information system for mapping and overlay with other data layers.

RESULTS

Benthic Macroinvertebrates

Taxa Composition

We identified >30 taxa in the benthic macroinvertebrate samples from Lower Granite and Little Goose reservoirs (Tables 11 and 12). Four major taxa comprised a highly significant portion of the organisms: Diptera, Oligochaeta, Ephemeroptera, Tricoptera, and Mollusca. Five families represented Ephemeroptera and four represented most Tricoptera.

Biomass

Highest mean biomass of benthic macroinvertebrates was found at station 16 (>244 g/m^2) followed by station 15 (59.8 g/m^2)(Table 11). Lowest biomass was at station 7 (3.15 g/m^2). At station 16, pelecypods accounted for 99.9% of the biomass whereas at station 15, pelecypods, dipterans, and oligochaetes accounted for most of the biomass (Figure 7). Oligochaetes accounted for a range of 0.01% (station 16) to 82% (station 6) of the total biomass at the various stations.

Table 11. Mean benthic macroinvertebrate densities (no./m^2) and coefficients of variation (CV) at study sites in Lower Granite (Stations
Little Goose (Stations 14-16) reservoirs, Snake River, June-July, 2002.

	Station Number													
	1		2		3		4		5		6		7	
TAXA	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Arthropoda														
Mandibulata														
Insecta														
Coleoptera	0	0	0	0	0	0	14.43	1.26	0	0	0	0	0	0
Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diptera														
Chironomidae														
Adult	6.36	3.61	0	0	0	0	0.72	3.61	0	0	0	0	0	0
Pupae	6.22	3.61	83.50	1.10	7.66	2.91	7.94	1.75	10.55	2.25	0.72	3.61	6.36	3.61
Larvae	446.68	1.40	712.14	0.75	1032.21	0.88	876.43	1.11	597.21	0.60	368.01	0.86	83.13	1.32
Simuliidae	0	0	0	0	0	0	168.67	1.60	0	0	0	0	19.06	1.92
Ephemeroptera														
Baetidae	0	0	0	0	0	0	0.72	3.61	0	0	0	0	0	0
Caenidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeridae	0	0	6.94	3.22	36.42	1.41	7.08	3.23	0	0	0	0	0	0
Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leptophlebiidae	0	0	0	0	6.22	3.61	0	0	0	0	0	0	0	0
Hemiptera	0	0	0	0	0	0	1.44	2.45	0	0	0	0	0	0
Homoptera	6.22	3.61	0	0	0	0	0	0	0	0	0	0	0	0
Hymenoptera	0	0	0	0	0	0	6.36	3.61	0	0	0	0	0	0
Odonata														
Anisoptera	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plecoptera														
Perlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera														
Brachycentridae	6.22	3.61	0	0	7.66	2.91	1.44	3.61	6.63	3.61	0	0	6.36	3.61
Hydroptilidae	0	0	0	0	0	0	8.66	3.02	0	0	0	0	0	0
Polycentropodidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Psychomyiidae	0	0	0	0	0	0	0.72	3.61	0	0	0	0	0	0
Other/Unknown	0	0	6.22	3.61	0	0	0	0	0	0	0	0	0	0
Chelicerata														
Arachnida														
Acari														
Hydracarina	0	0	0	0	0	0	1.44	2.45	0	0	0	0	0	0
Other	0	0	6.22	3.61	0	0	0	0	0	0	0	0	0	0

Table 11. Continued.

	Station Number													
	9		10		11		12		13		14		15	
TAXA	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Arthropoda														
Mandibulata														
Insecta														
Coleoptera	0	0	0	0	0	0	0.72	3.61	0	0	0	0	0	0
Collembola	0	0	0	0	0	0	0.72	3.61	0	0	0	0	0	0
Diptera														
Chironomidae														
Adult	43.54	3.61	12.71	3.61	149.28	3.61	6.22	3.61	0.72	3.61	0	0	12.44	3.61
Pupae	6.22	3.61	34.67	1.55	19.21	1.74	28.00	1.06	56.18	1.34	13.43	2.02	40.48	1.31
Larvae	306.14	0.78	958.23	0.96	1689.85	1.21	577.65	0.45	1322.69	1.15	314.28	2.24	2333.52	2.07
Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera														
Baetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caenidae	0	0	0	0	0	0	0	0	0.72	3.61	0	0	0	0
Ephemeridae	0	0	19.66	1.83	0.72	3.61	16.18	1.86	6.36	3.61	0	0	13.88	3.22
Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	6.22	3.61
Leptophlebiidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemiptera	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Homoptera	6.22	3.61	0	0	0	0	1.44	2.45	0.72	3.61	0	0	0	0
Hymenoptera	0	0	0	0	0	0	0.72	3.61	0	0	0	0	0	0
Odonata														
Anisoptera	0	0	0	0	0	0	0	0	0	0	0.72	3.61	0	0
Plecoptera														
Perlidae	0	0	6.48	3.61	0	0	0	0	0	0	0	0	0	0
Trichoptera														
Brachycentridae	0	0	0	0	0.72	3.61	0	0	0	0	0	0	0	0
Hydroptilidae	0	0	0	0	0	0	0	0	0	0	6.22	3.61	0	0
Polycentropodidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Psychomyiidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other/Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chelicerata														
Arachnida														
Acari														
Hydracarina	0	0	0.72	3.61	1.44	2.45	8.38	2.69	0	0	0	0	6.36	3.61
Other	0	0	0	0	0	0	0	0	0.72	3.61	0	0	0	0

Table 11. Continued.

TAXA	Station Number 1 Mean	1 CV	2 Mean	2 CV	3 Mean	3 CV	4 Mean	4 CV	5 Mean	5 CV	6 Mean	6 CV	7 Mean	7 CV	8 Mean	8 CV
Arthropoda																
Crustacea																
Malacostraca																
Amphipoda																
Corophiidae																
Corophium sp.	473.06	1.20	183.18	2.02	1849.38	3.41	0	0	0	0	0	0	0	0	0	0
Gammaridae																
Gammarus sp.	62.88	2.09	77.38	2.50	100.92	1.64	0	0	0	0	0	0	0	0	0	0
Isopoda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mysidacea																
Mysidae																
Mysis sp.	0	0	0	0	0	0	2.16	2.60	0	0	0.72	3.61	0	0	0	0
Annelida																
Hirudinea	297.26	1.41	192.02	2.06	267.65	1.95	1296.79	0.42	694.69	0.95	607.65	0.93	460.22	0.81	656.89	1.26
Oligochaeta	4610.24	1.37	5231.02	1.56	5119.92	0.92	17056.43	0.70	12066.02	0.58	10056.75	0.57	5310.53	0.71	6218.48	0.58
Polychaeta	176.48	1.29	138.41	1.29	20.82	2.31	0	0	0	0	0	0	0	0	0	0
Nematoda	37.46	2.10	170.40	1.58	31.96	2.21	51.66	0.69	8.08	2.98	6.36	3.61	37.99	1.44	31.65	1.71
Mollusca																
Gastropoda	0	0	0	0	0	0	7.22	1.23	6.63	3.61	0	0	0	0	0	0
Pelecypoda	69.51	1.54	39.04	1.61	67.25	1.19	53.38	1.31	43.06	0.95	6.36	3.61	0	0	0	0
TOTAL	6198.60		6846.46		8548.09		19563.68		13432.87		11046.57		5923.65		7066.93	

Table 11. Continued.

	Station Number													
	9		10		11		12		13		14		15	
TAXA	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Arthropoda														
Crustacea														
Malacostraca														
Amphipoda														
Corophiidae														
Corophium sp.	0	0	126.99	1.67	0	0	0	0	244.57	1.37	307.86	1.13	0	0
Gammaridae														
Gammarus sp.	0	0	4.33	3.61	0	0	0	0	13.16	3.40	90.98	1.76	6.36	3.61
Isopoda	6.22	3.61	0	0	0	0	0	0	0	0	0	0	0	0
Mysidacea														
Mysidae														
Mysis sp.	0	0	0	0	9.24	2.64	0	0	0	0	0	0	0	0
Annelida														
Hirudinea	741.26	1.24	138.41	1.48	479.54	1.36	521.30	0.93	421.30	1.21	11.27	1.97	676.99	1.37
Oligochaeta	7792.33	0.65	3669.72	0.76	5203.44	0.62	7930.37	0.57	5366.73	1.19	607.35	1.03	11130.75	1.23
Polychaeta	6.22	3.61	60.67	1.01	25.97	2.77	48.59	2.75	13.30	2.30	2.16	2.60	200.68	2.09
Nematoda	18.66	2.60	102.02	1.46	2.16	2.60	48.38	1.39	161.28	2.25	1.44	2.45	289.97	2.11
Mollusca														
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0	6.22	3.61
Pelecypoda	18.66	1.91	114.94	0.74	6.94	3.22	18.21	1.76	64.01	0.77	42.92	1.52	58.42	1.54
TOTAL	8945.46		5249.54		7588.52		9206.90		7672.45		1398.64		14782.28	

Table 12. Mean benthic macroinvertebrate biomass (g/m^2) and coefficients of variation (CV) at study sites in Lower Granite (Stations 1
Goose (Stations 14-16) reservoirs, Snake River, June-July, 2002. Biomass values of 0.0000 indicate that weights were <0.1 mg.

	Station Number													
	1		2		3		4		5		6		7	
TAXA	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Arthropoda														
Mandibulata														
Insecta														
Coleoptera	0	0	0	0	0	0	0.0029	1.26	0	0	0	0	0	0
Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diptera														
Chironomidae														
Adult	0.0196	3.61	0	0	0	0	0.0022	3.61	0	0	0	0	0	0
Pupae	0.0124	3.61	0.4388	1.43	0.0584	3.05	0.0620	1.57	0.1198	1.68	0.0029	3.61	0.0508	3.61
Larvae	1.3513	1.82	0.8538	1.36	1.3698	1.14	1.7486	0.43	3.5662	1.08	1.3307	1.32	0.3468	2.27
Simuliidae	0	0	0	0	0	0	0.0967	1.62	0	0	0	0	0.0150	1.92
Ephemeroptera														
Baetidae	0	0	0	0	0	0	0.0000	0.00	0	0	0	0	0	0
Caenidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeridae	0	0	0.5111	3.12	2.7616	1.44	1.6651	3.49	0	0	0	0	0	0
Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leptophlebiidae	0	0	0	0	0.0000	0.00	0	0	0	0	0	0	0	0
Hemiptera	0	0	0	0	0	0	0.0000	0.00	0	0	0	0	0	0
Homoptera	0.0000	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Hymenoptera	0	0	0	0	0	0	0.0000	0.00	0	0	0	0	0	0
Odonata														
Anisoptera	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plecoptera														
Perlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera														
Brachycentridae	0.0187	3.61	0	0	0.0136	2.87	0.0014	3.61	0.0116	3.61	0	0	0.0111	3.61
Hydroptilidae	0	0	0	0	0	0	0.0095	3.02	0	0	0	0	0	0
Polycentropodidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Psychomyiidae	0	0	0	0	0	0	0.0000	0.00	0	0	0	0	0	0
Other/Unknown	0	0	0.0000	0.00	0	0	0	0	0	0	0	0	0	0
Chelicerata														
Arachnida														
Acari														
Hydracarina	0	0	0	0	0	0	0.0000	0.00	0	0	0	0	0	0
Other	0	0	0.0000	0.00	0	0	0	0	0	0	0	0	0	0

Table 12. Continued.

	Station Number															
	9		10		11		12		13		14		15		16	
TAXA	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Arthropoda																
Mandibulata																
Insecta																
Coleoptera	0	0	0	0	0	0	0.0001	3.61	0	0	0	0	0	0	0	0
Collembola	0	0	0	0	0	0	0.0000	0.00	0	0	0	0	0	0	0	0
Diptera																
Chironomidae																
Adult	0.2986	3.61	0.0393	3.61	0.0560	3.61	0.0192	3.61	0.0152	3.61	0	0	0.1679	3.61	0.0022	3.61
Pupae	0.0124	3.61	0.1299	1.89	0.1016	1.94	0.3199	1.37	0.6579	1.67	0.0692	2.56	0.2819	1.18	0.3023	1.90
Larvae	0.9299	1.36	1.2846	1.33	2.7197	1.84	3.2939	1.10	5.5470	1.48	0.1762	1.29	6.8235	2.70	0.1016	1.35
Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephemeroptera																
Baetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caenidae	0	0	0	0	0	0	0	0	0.0014	3.61	0	0	0	0	0	0
Ephemeridae	0	0	1.8075	2.26	0.0231	3.61	2.4982	2.68	0.0445	3.61	0	0	2.0156	3.02	0	0
Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0.00	0.0000	0.00
Leptophlebiidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemiptera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Homoptera	0.0000	0.00	0	0	0	0	0.0000	0.00	0.0000	0.00	0	0	0	0	0	0
Hymenoptera	0	0	0	0	0	0	0.0000	0.00	0	0	0	0	0	0	0	0
Odonata																
Anisoptera	0	0	0	0	0	0	0	0	0	0	0.2251	3.61	0	0	0.0133	3.61
Plecoptera																
Perlidae	0	0	0.5444	3.61	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera																
Brachycentridae	0	0	0	0	0.0013	3.61	0	0	0	0	0	0	0	0	0	0
Hydroptilidae	0	0	0	0	0	0	0	0	0	0	0.0068	3.61	0	0	0.0008	3.61
Polycentropodidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0029	3.61
Psychomyiidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0.00
Other/Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chelicerata																
Arachnida																
Acari																
Hydracarina	0	0	0.0000	0.00	0.0000	0.00	0.0000	0.00	0	0	0	0	0.0000	0.00	0.0000	0.00
Other	0	0	0	0	0	0	0	0	0.0000	0.00	0	0	0	0	0	0

Table 12. Continued.

	Station Number															
	1		2		3		4		5		6		7		8	
TAXA	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Arthropoda																
Crustacea																
Malacostraca																
Amphipoda																
Corophiidae																
Corophium sp.	0.4157	1.44	0.1804	2.05	1.2255	3.33	0	0	0	0	0	0	0	0	0	0
Gammaridae																
Gammarus sp.	0.0505	2.09	0.0485	2.29	0.0698	1.69	0	0	0	0	0	0	0	0	0	0
Isopoda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mysidacea																
Mysidae																
Mysis sp.	0	0	0	0	0	0	0.0000	0.00	0	0	0.0000	0.00	0	0	0	0
Annelida																
Hirudinea	0.0533	1.42	0.0396	2.28	0.0652	2.38	0.1345	0.57	0.1199	0.89	0.3105	2.18	0.1289	1.21	0.1549	1.29
Oligochaeta	1.5982	1.32	2.0191	2.51	3.0567	1.01	5.2945	0.57	15.8080	1.22	9.2633	1.82	2.5933	0.65	2.4067	0.46
Polychaeta	0.3740	1.09	0.3082	0.98	0.1057	2.31	0	0	0	0	0	0	0	0	0	0
Nematoda	0.0010	2.10	0.0047	1.58	0.0009	2.21	0.0014	0.69	0.0002	2.98	0.0002	3.61	0.0011	1.44	0.0009	1.71
Mollusca																
Gastropoda	0	0	0	0	0	0	0.2136	1.48	0.0133	3.61	0	0	0	0	0	0
Pelecypoda	13.3968	2.13	1.0646	2.42	13.5250	1.41	3.0945	1.20	5.3425	1.18	0.3433	3.61	0	0	0	0
TOTAL	17.2916		5.4688		22.2522		12.3270		24.9815		11.2509		3.1469		3.3580	

Table 12. Continued.

	Station Number															
	9		10		11		12		13		14		15		16	
TAXA	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Arthropoda																
Crustacea																
Malacostraca																
Amphipoda																
Corophiidae																
Corophium sp.	0	0	0.1121	1.71	0	0	0	0	0.2656	1.57	0.3199	0.96	0	0	0.4048	1.40
Gammaridae																
Gammarus sp.	0	0	0.0022	3.61	0	0	0	0	0.0106	3.40	0.0843	1.93	0.0051	3.61	0.0194	1.65
Isopoda	0.0000	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mysidacea																
Mysidae																
Mysis sp.	0	0	0	0	0.0000	0.00	0	0	0	0	0	0	0	0	0.0000	0.00
Annelida																
Hirudinea	0.1859	1.22	0.0205	1.20	0.0946	1.37	0.1296	1.48	0.1310	1.58	0.0020	1.97	0.1229	0.81	0.0003	2.45
Oligochaeta	3.9403	0.79	1.0101	0.84	2.7703	0.66	6.6725	0.71	8.0304	1.22	0.2227	0.67	10.1767	1.18	0.0326	1.61
Polychaeta	1.5861	3.61	0.2741	1.15	0.0372	1.44	0.9816	3.20	0.0422	2.76	0.0110	2.60	0.5056	1.82	0.0339	3.61
Nematoda	0.0005	2.60	0.0028	1.46	0.0001	2.60	0.0016	1.66	0.0042	2.20	0.0000	2.45	0.0081	2.11	0.0008	2.48
Mollusca																
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0	0.1685	3.61	0	0
Pelecypoda	3.3643	2.68	47.9950	2.30	2.5048	3.60	0.6556	2.17	11.4673	1.58	31.3908	2.84	39.6164	3.05	243.8446	1.73
TOTAL	10.3180		53.2224		8.3087		14.5723		26.2171		32.5079		59.8921		244.7593	

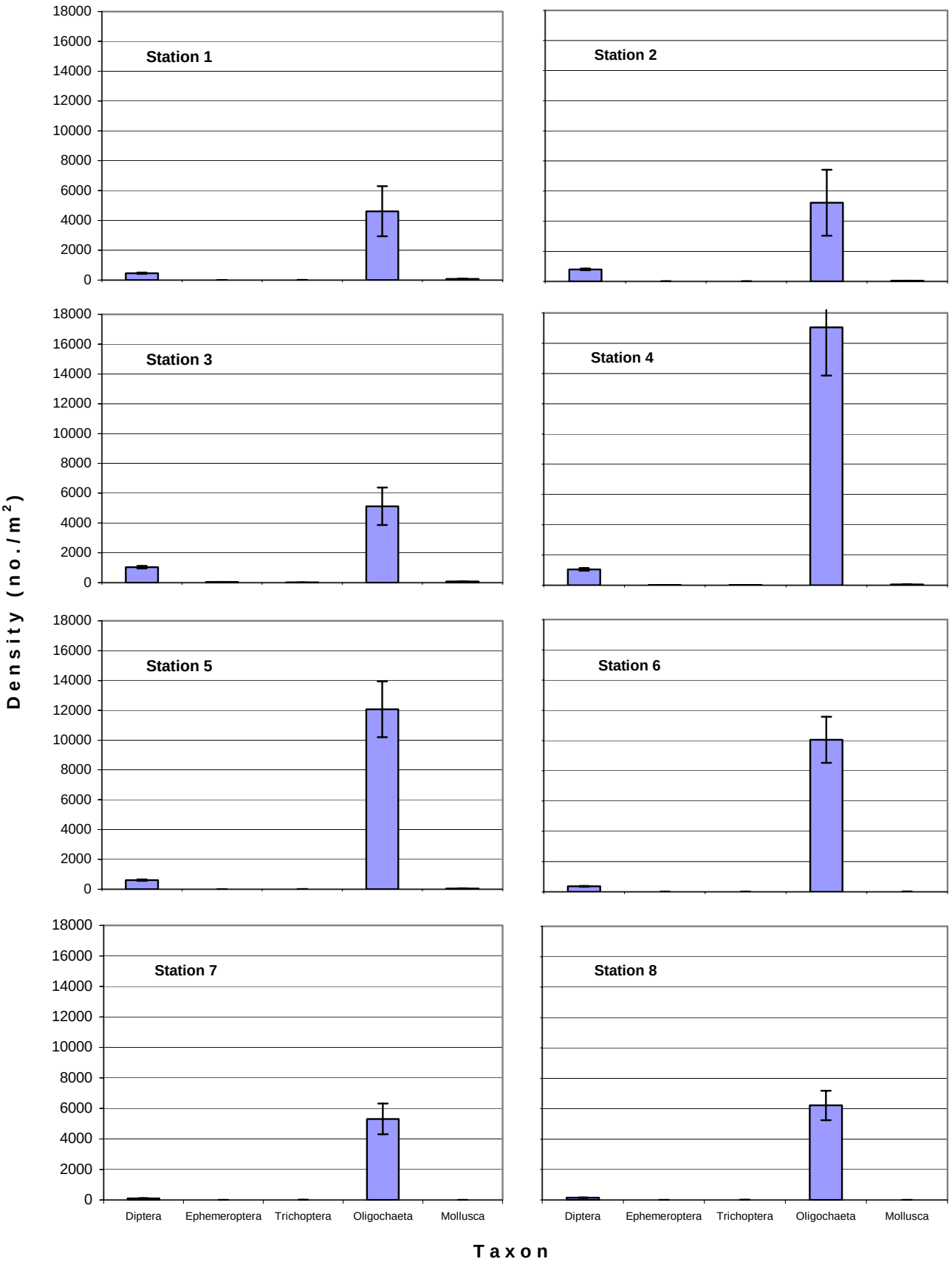

Figure 7. Mean benthic macroinvertebrate densities (no./m^2) and 1 standard error of selected taxa at study sites in Lower Granite (Stations 1-13) and Little Goose (Stations 14-16) reservoirs, Snake River, June-July, 2002.

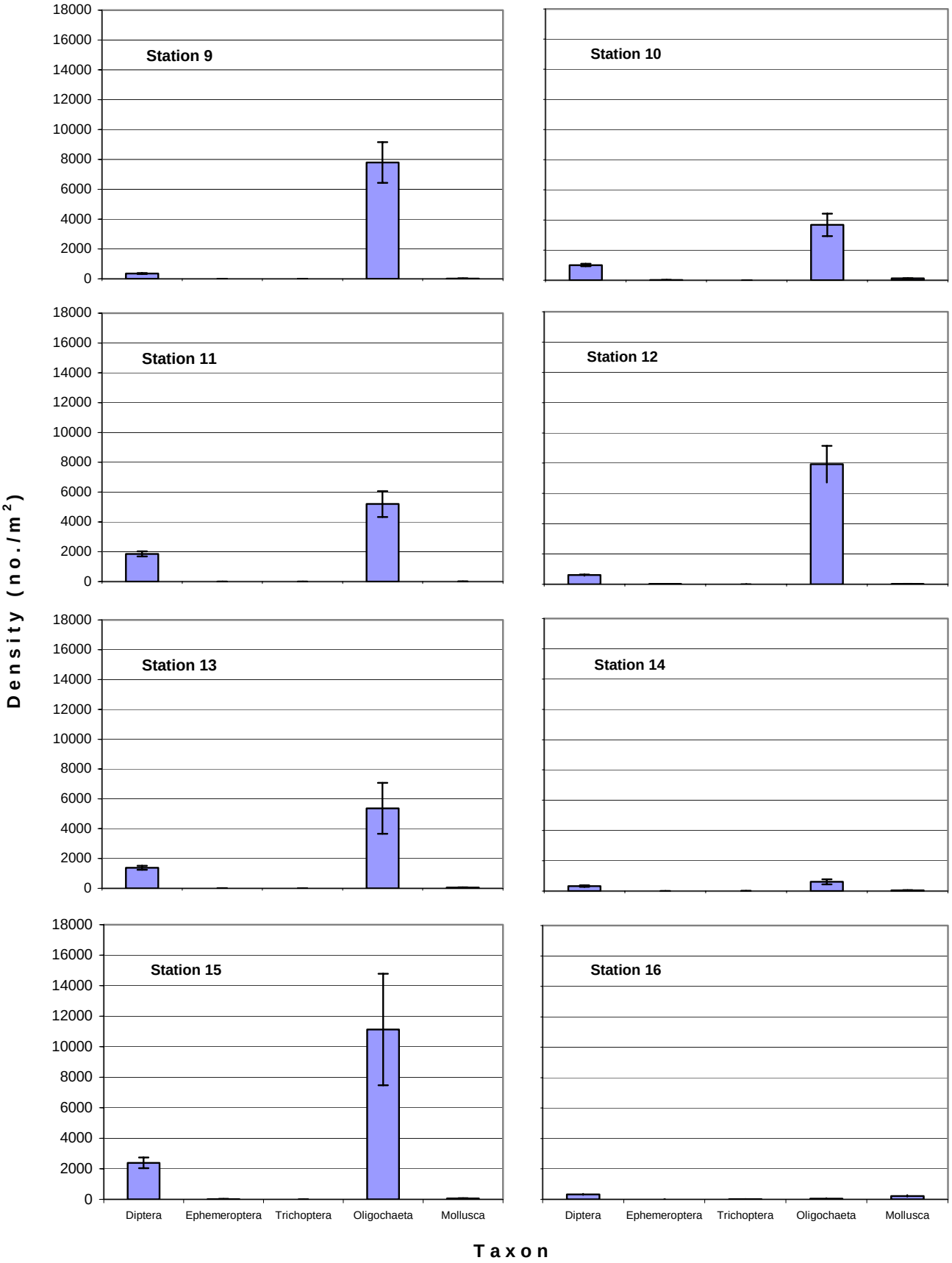

Figure 7. Continued.

Biomass of benthic macroinvertebrates at stations 1 (17.29 g/m^2) and 2 (5.47g/m^2) were similar and ranked 7^{th} and 13^{th} from the most abundant, respectively. At these stations, pelecypods and oligochaetes comprised the majority of the macroinvertebrate biomass (Figure 7).

Density

Mean benthic macroinvertebrate density among stations did not follow that of biomass (Table 10). Highest density of benthic macroinvertebrates of 19,564/m^2 was found at station 4 followed by station 15 (14,782/m^2)(Figure 8). Lowest density of benthic macroinvertebrates was collected at station 16 (1.073/m^2).

Densities of benthic macroinvertebrates at stations 1 (6,199/m^2) and 2 (6,846/m^2) were similar and ranked 11^{th} and 10^{th} from the most abundant, respectively. Oligochaetes comprised the bulk of the organisms followed by pelecypods at the disposal stations.

Macrophyte Sampling

We collected six species of submerged aquatic macrophytes at the 16 stations. Macrophyte distribution was clumped and generally low (Figures 9-22). Estimated submerged vegetation coverage at the 16 stations ranged from >80% at stations 11 and 15 to 0% at eight of the stations (Figure 23). Total dry-weight biomass (g/m^2) was highest at station 15 (6.01 g/m^2) followed distantly by station 11 (1.97 g/m^2; Table 13). *Myriophyllum brasiliense* attained the highest biomass of the six species followed by *Potamogeton pectinatus*. Both *Potamogeton pectinatus* and *P. crispus* were the most commonly encountered macrophytes. No macrophytes

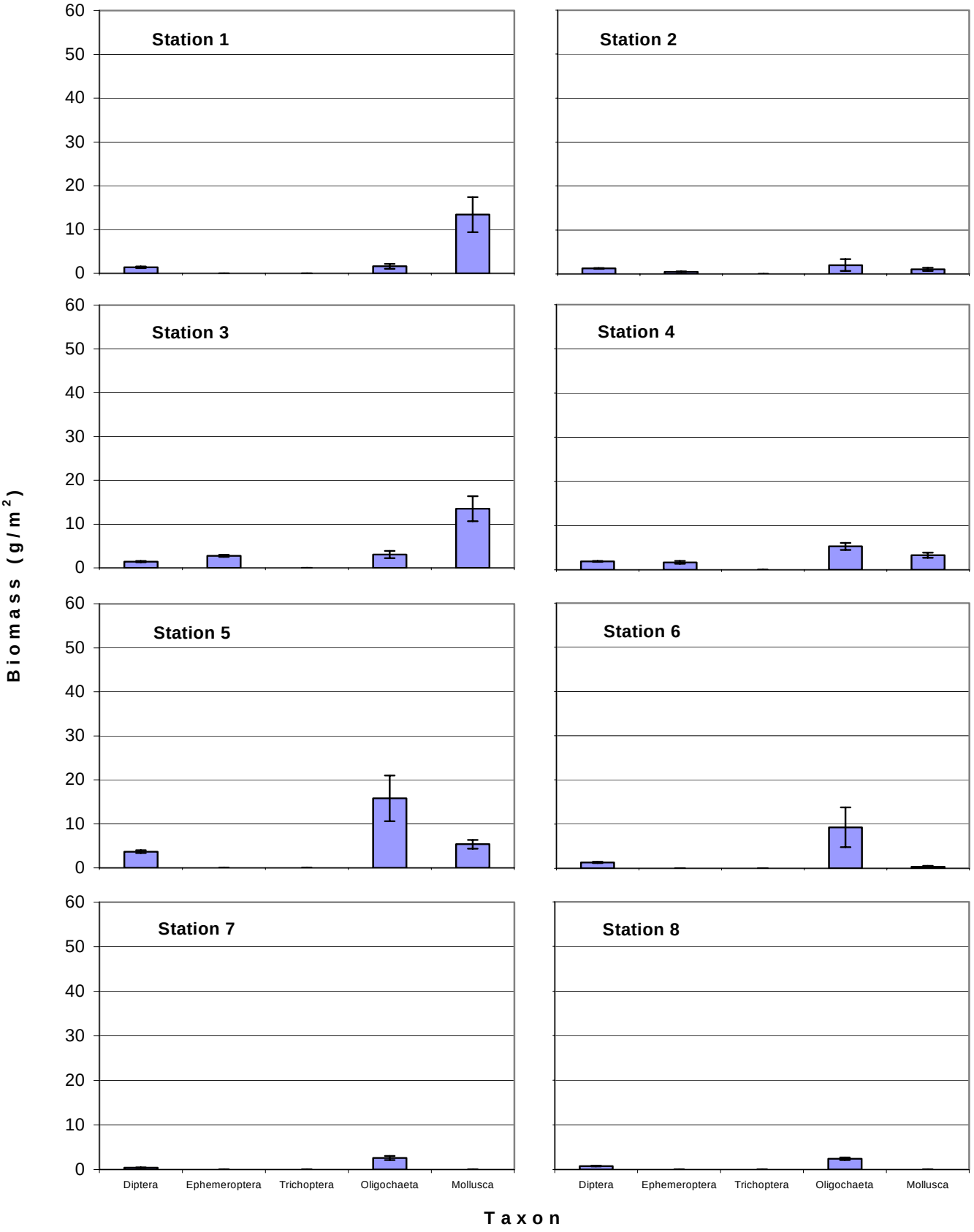

Figure 8. Mean benthic macroinvertebrate biomass (g/m^2) and 1 standard error of selected taxa at study sites in Lower Granite (Stations 1-13) and Little Goose (Stations 14-16) reservoirs, Snake River, June-July, 2002.

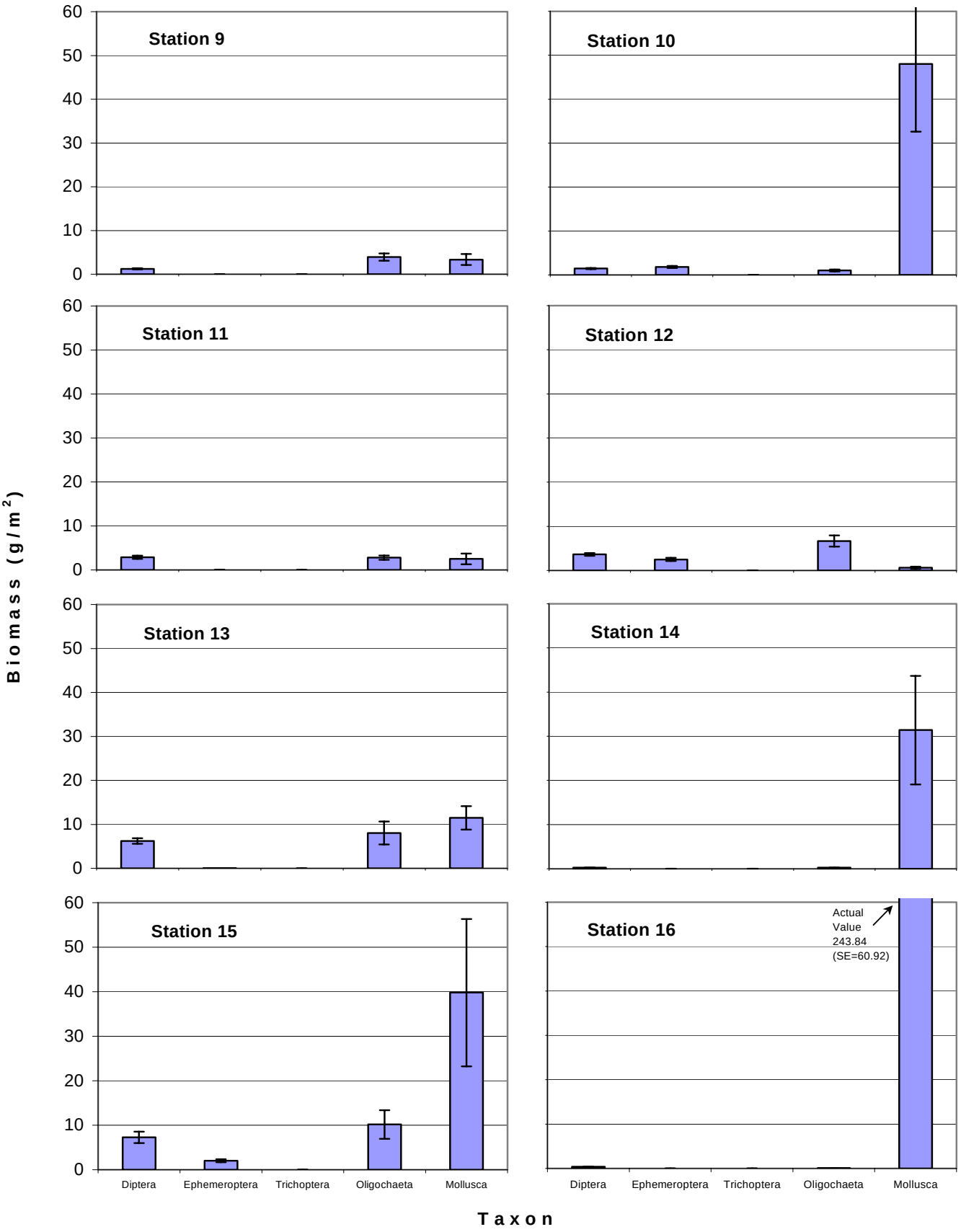

Figure 8. Continued.

were located in waters deeper than 4 m at any stations. Emergent vegetation was highest at station 15.

Aquatic macrophyte beds at disposal stations 1 and 2 were <15% of the total area. The species composition of aquatic macrophytes at stations 1 and 2 was similar to other stations. Biomass of macrophytes at disposal stations was low (0.024-0.161 g/m^2).

Substrate Sampling

The predominant substrate particle size collected at all 16 stations was < 2 mm (Figure 24). Substrate >2 mm was more common at stations 4-6, 9, and 10. Station 16 contained the highest percentage of substrate > 50 mm and, overall, the lowest proportion of particles < 2 mm. Substrate at station 1 was predominately <2 mm. However, at station 2 we collected a wide range of substrate sizes from 25-50 mm that accounted for about 40% of the substrate. Organic matter was generally <5% and was higher at stations 4, 5, and 6. Organic content at both disposal stations was low (Figure 24).

Depth mapping at various stations demonstrated that some shorelines had precipitous banks while others were generally flat with little shoreline gradient (Figures 9-22). Water depth on the south shoreline of Centennial Island showed some “spreading” of the dredged material although little spreading was found on the north shoreline. Water depth at stations 6-9 was generally shallow with little gradient.

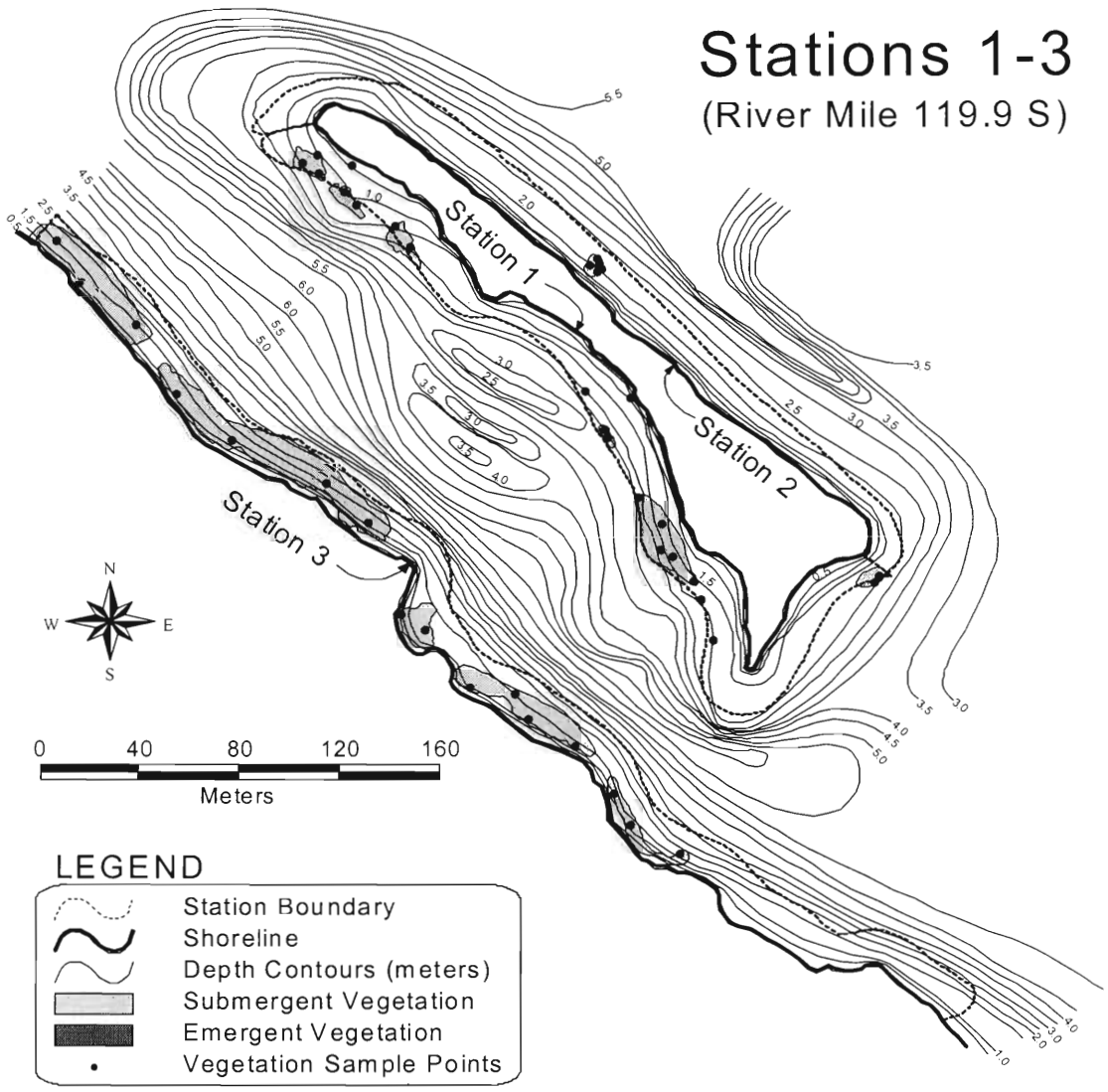

Figure 9. Bathymetric map of sampling stations 1, 2, and 3 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals.

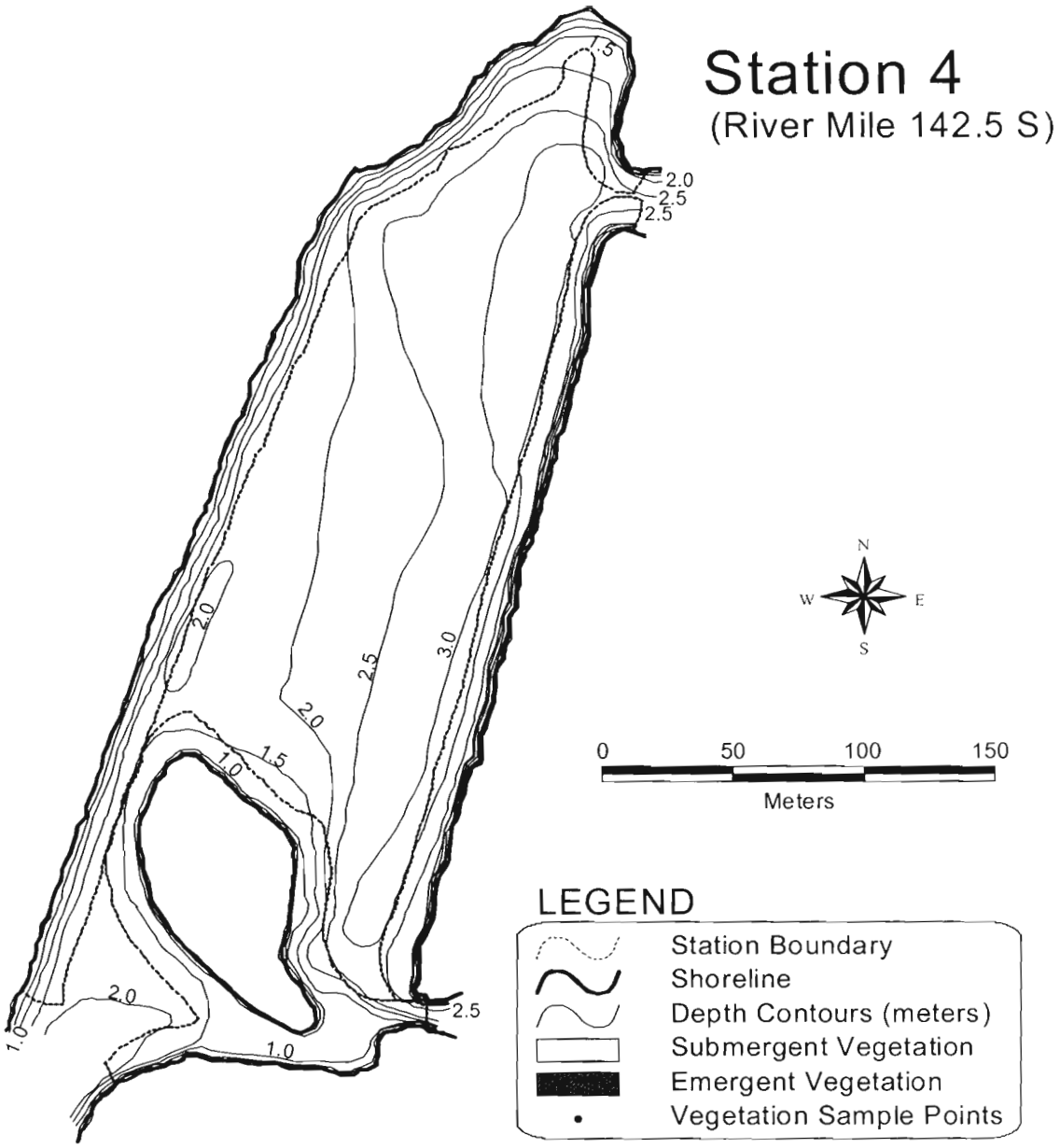

Figure 10. Bathymetric map of sampling station 4 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals. For clarity, not all depth contours are labeled.

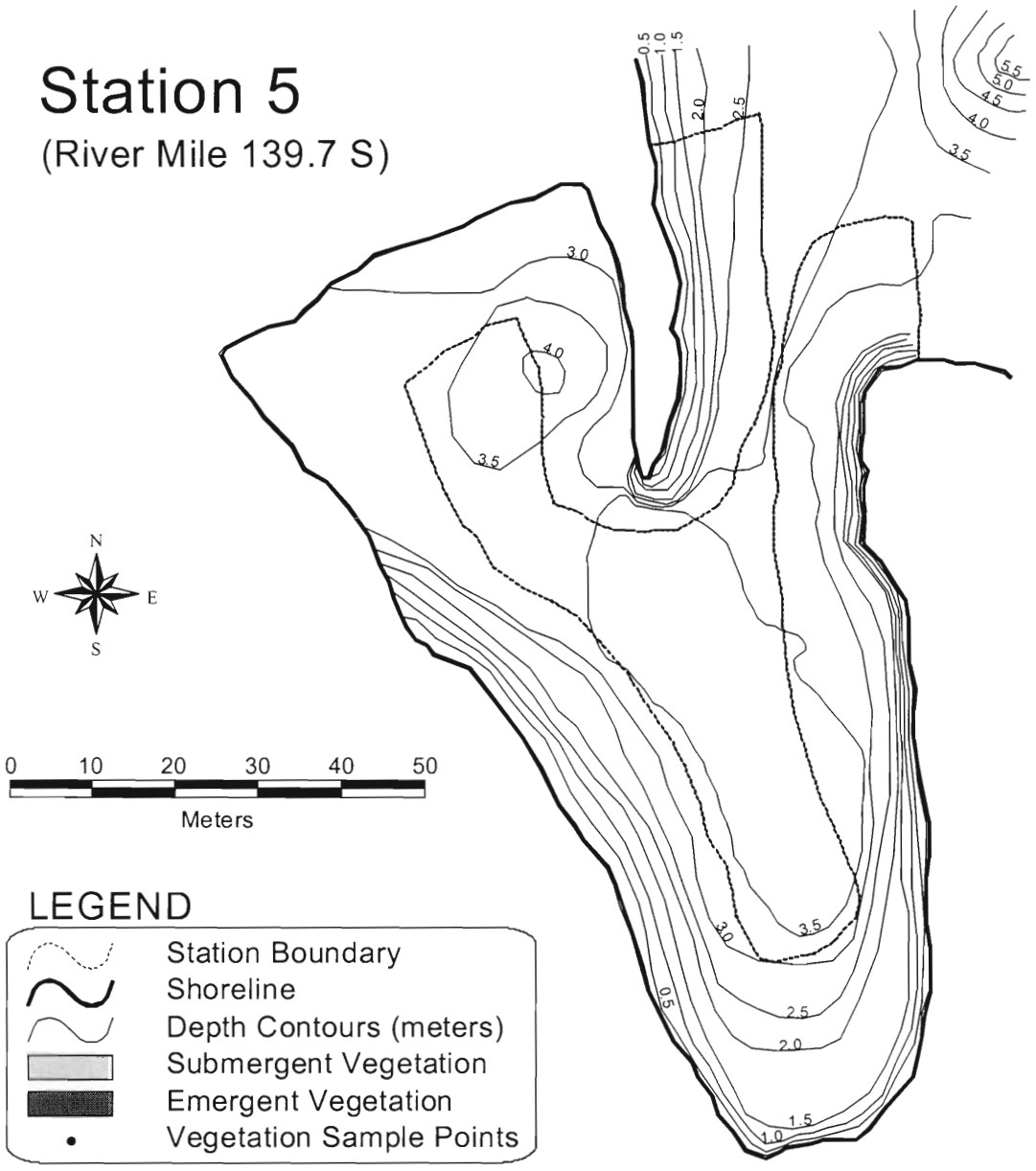

Figure 11. Bathymetric map of sampling station 5 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals.

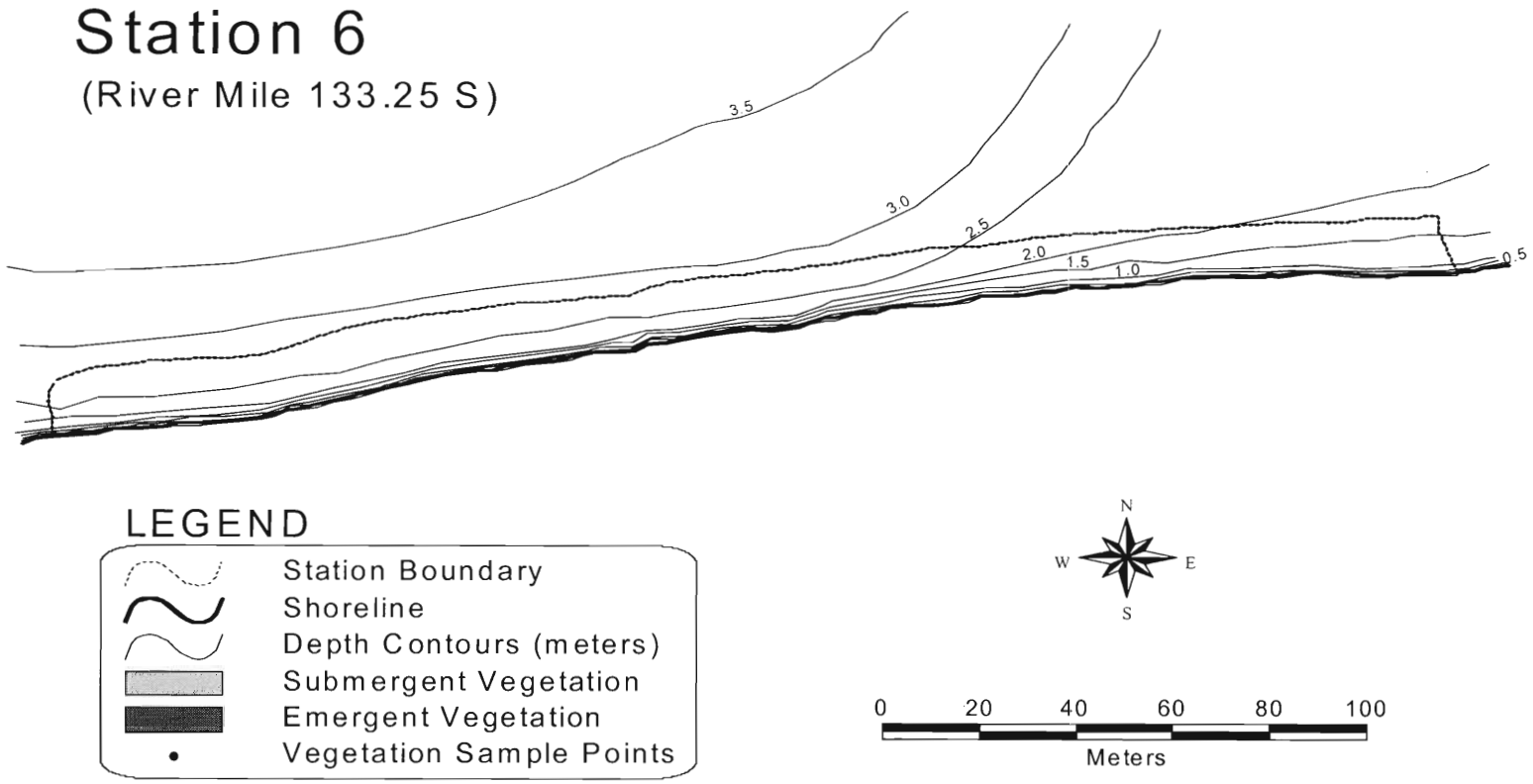

Figure 12. Bathymetric map of sampling station 6 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals.

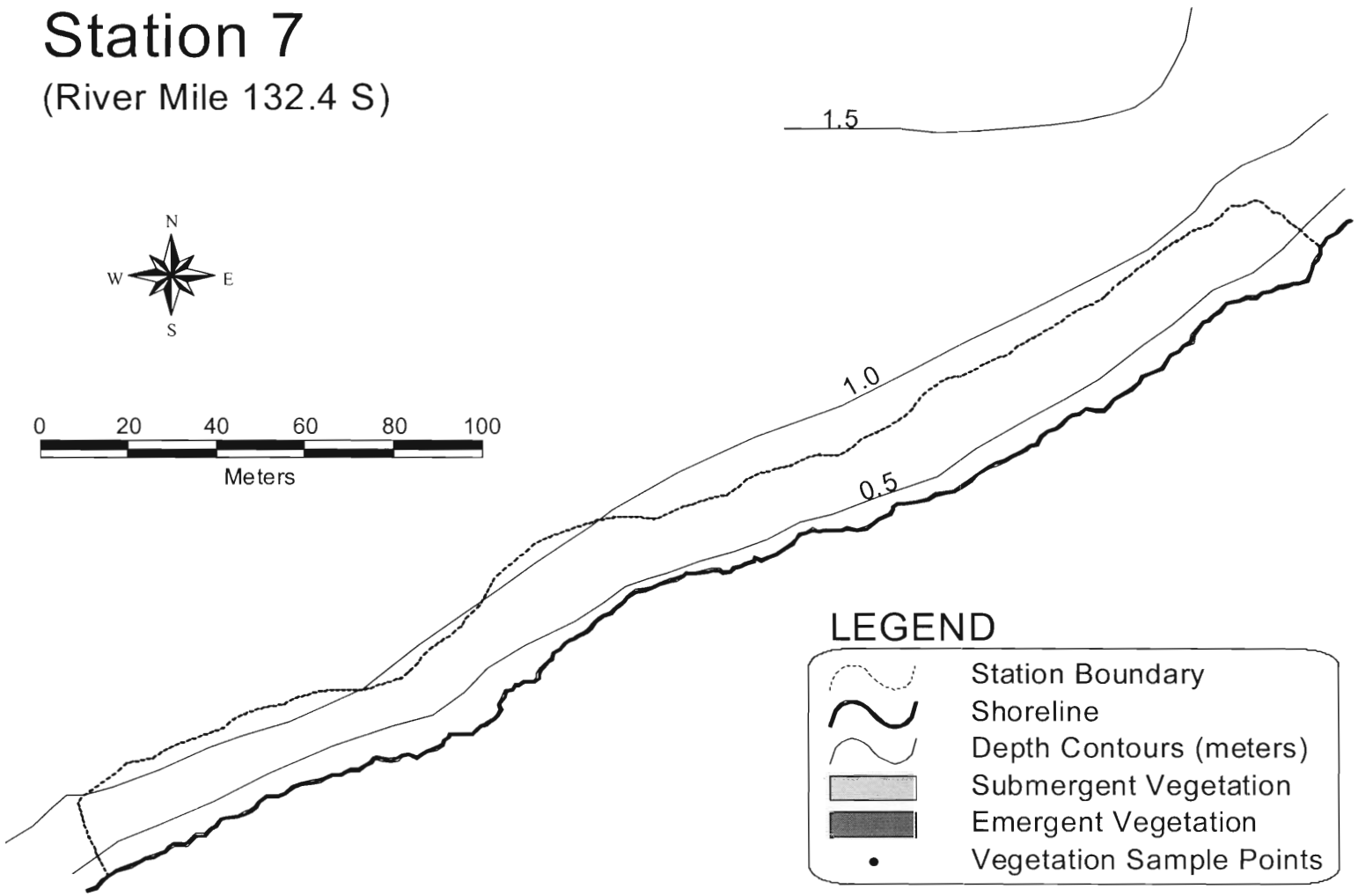

Figure 13. Bathymetric map of sampling station 7 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals.

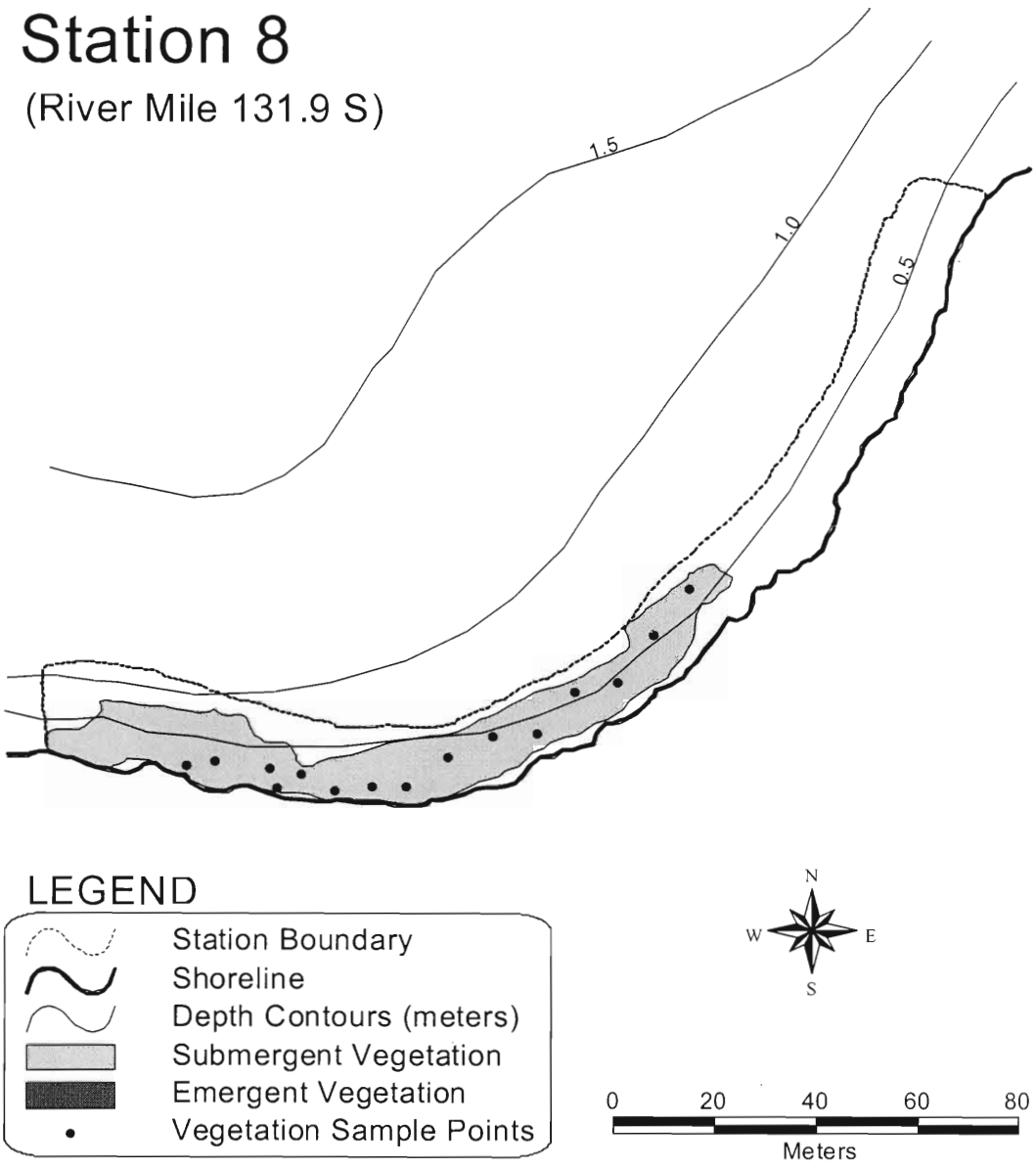

Figure 14. Bathymetric map of sampling station 8 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals.

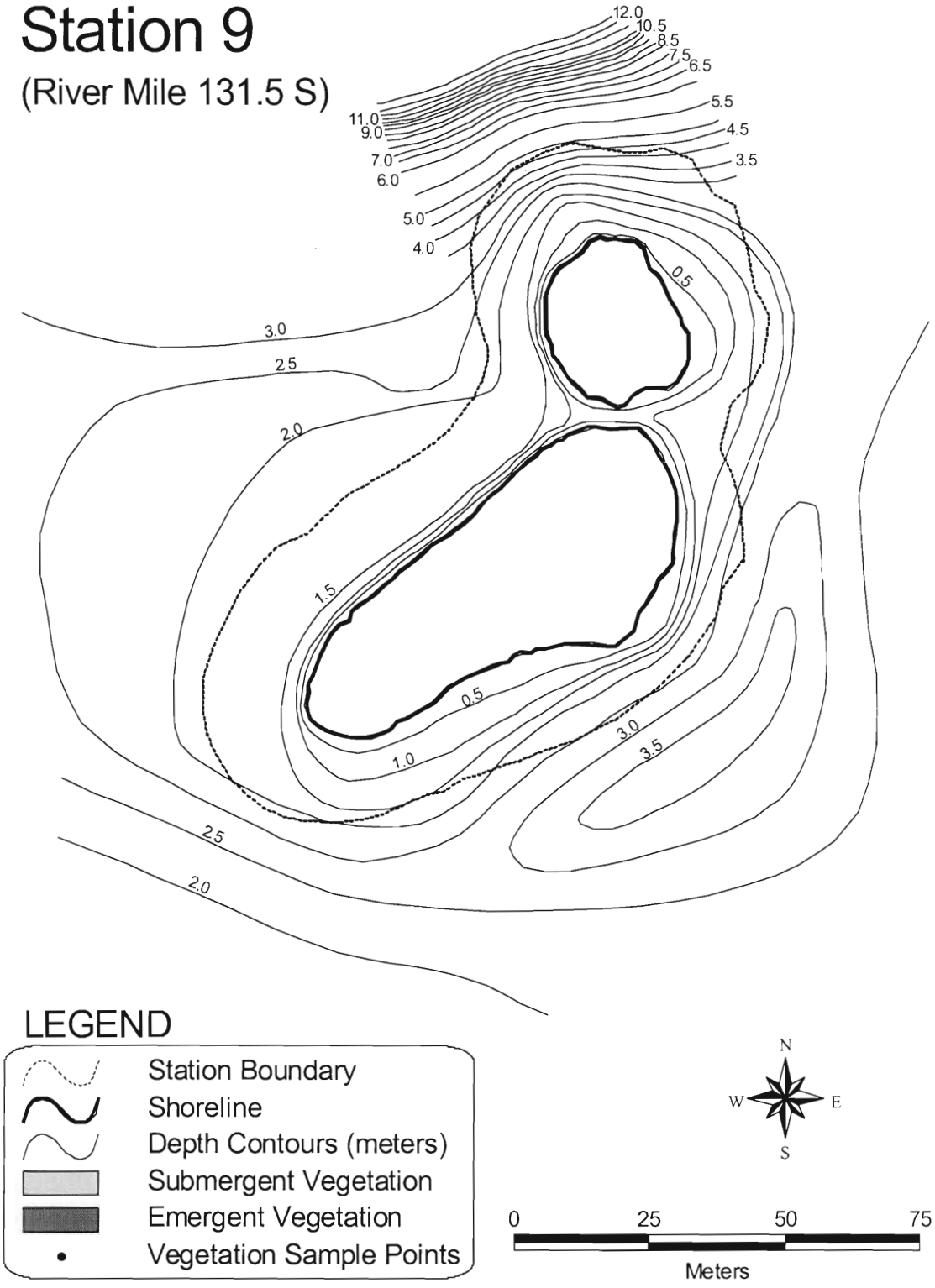

Figure 15. Bathymetric map of sampling station 9 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals. For clarity, not all depth contours are labeled.

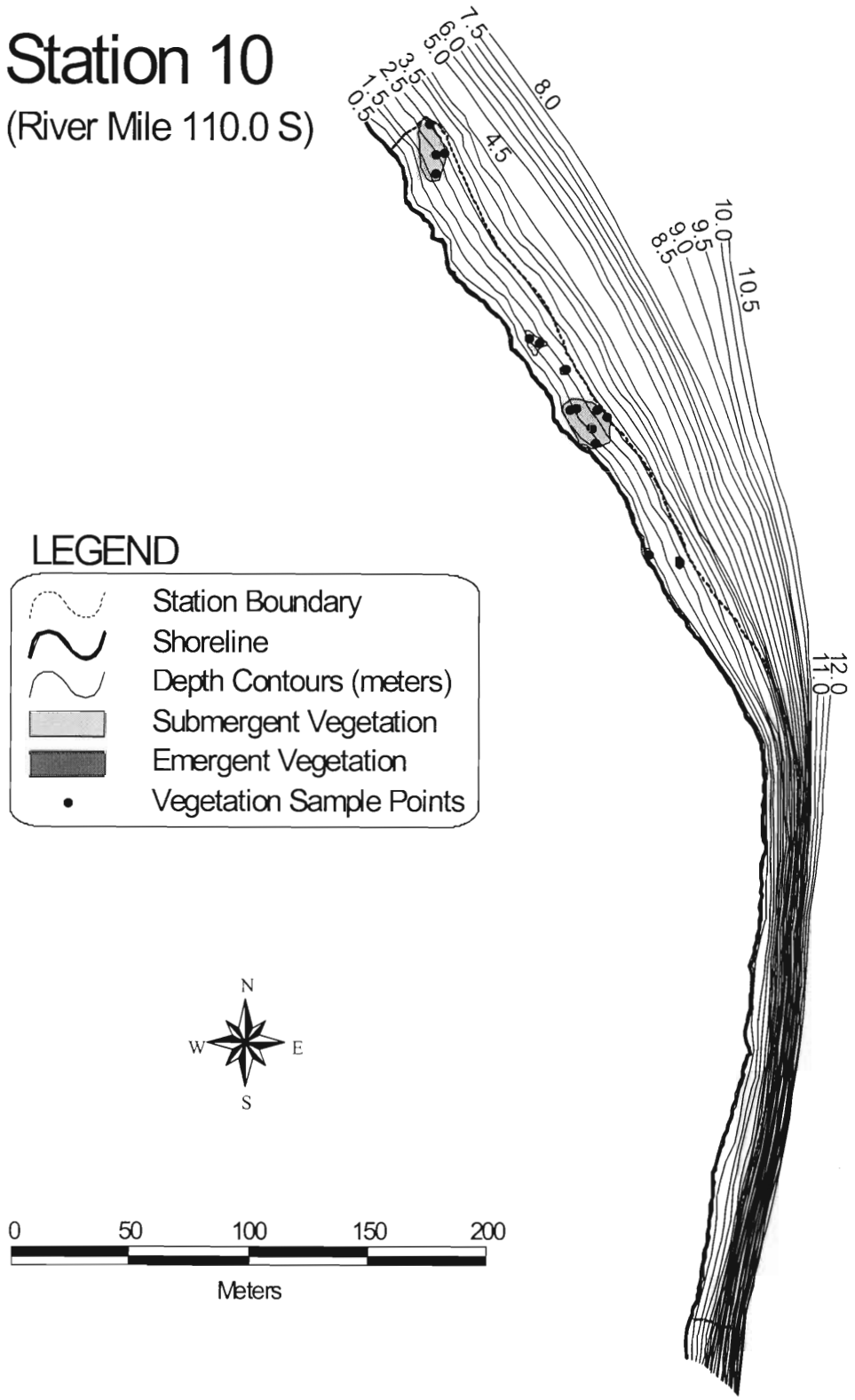

Figure 16. Bathymetric map of sampling station 10 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals. For clarity, not all depth contours are labeled.

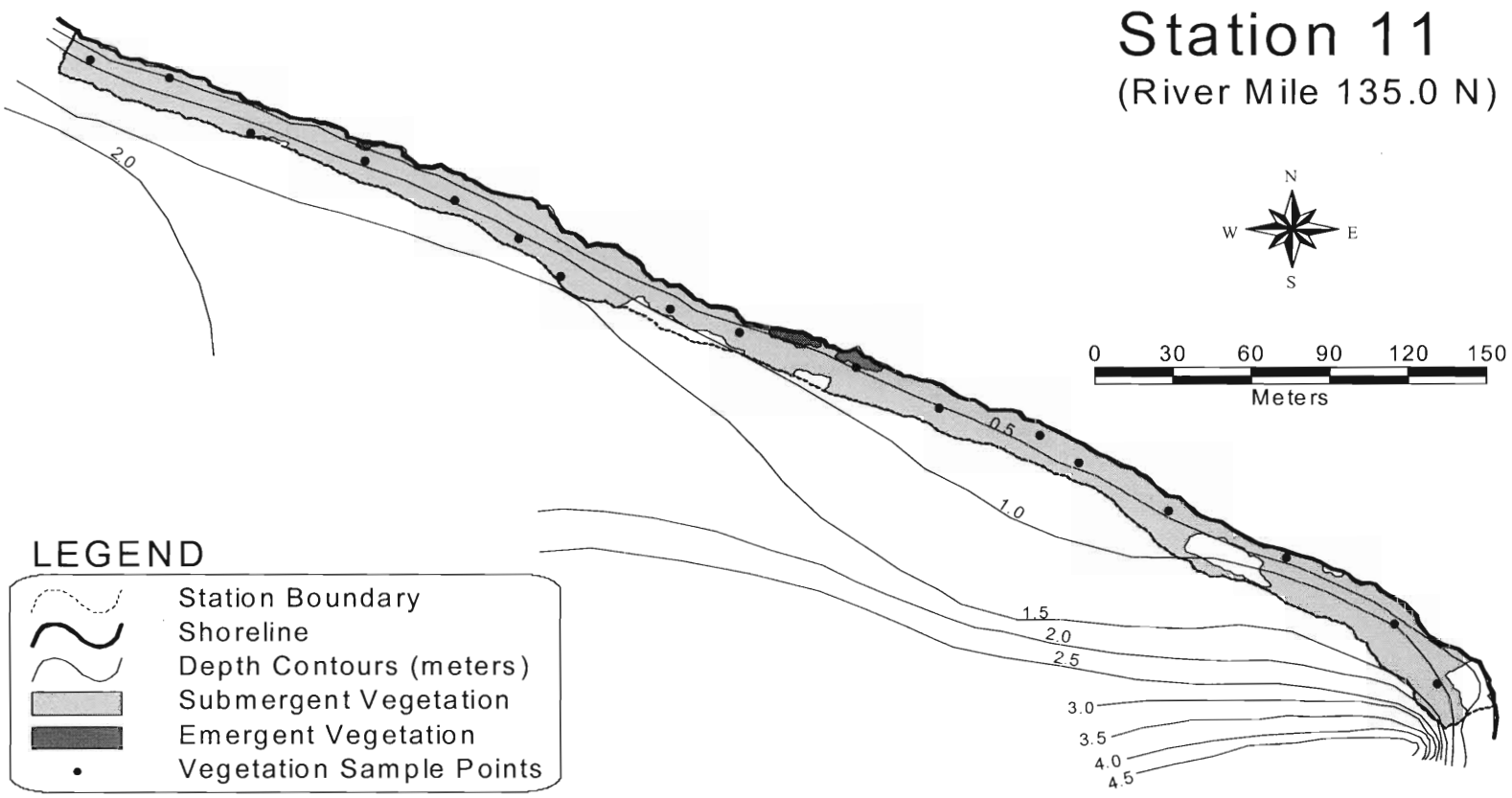

Figure 17. Bathymetric map of sampling station 11 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals.

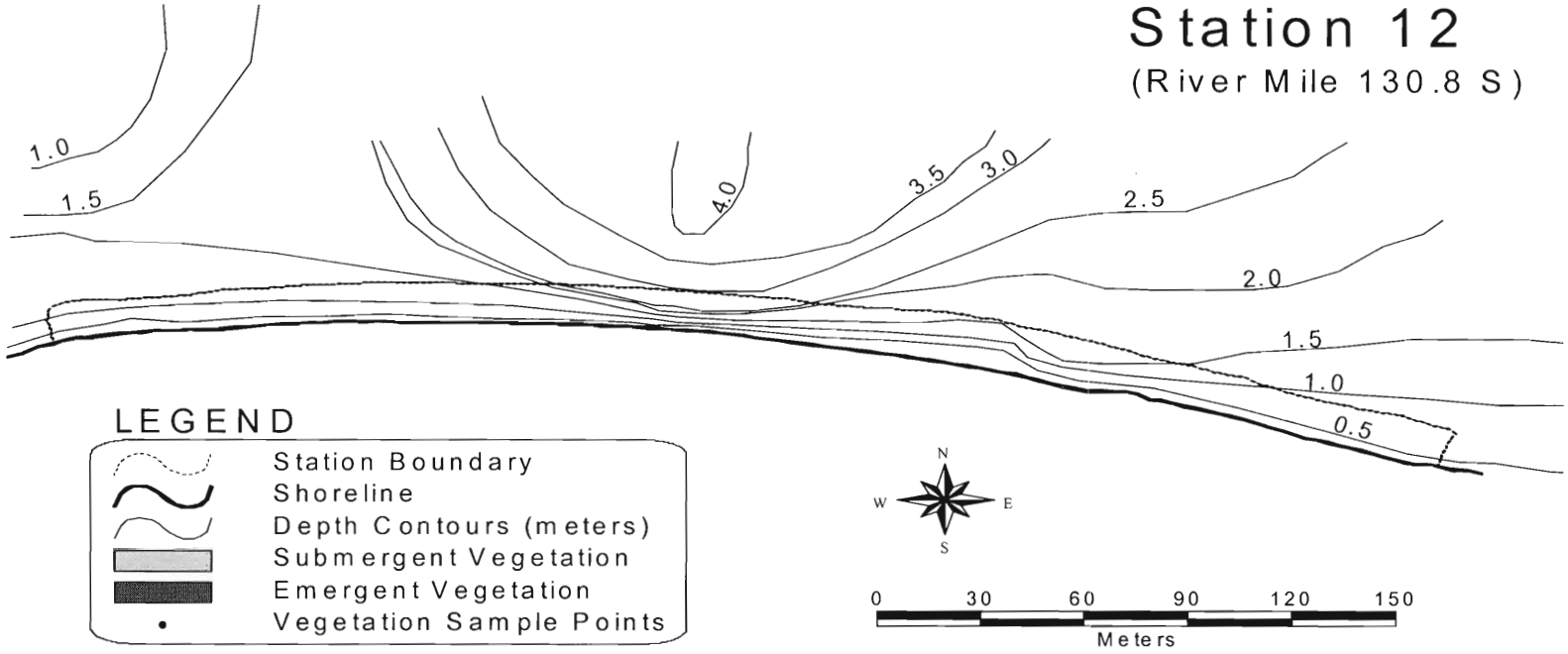

Figure 18. Bathymetric map of sampling station 12 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals.

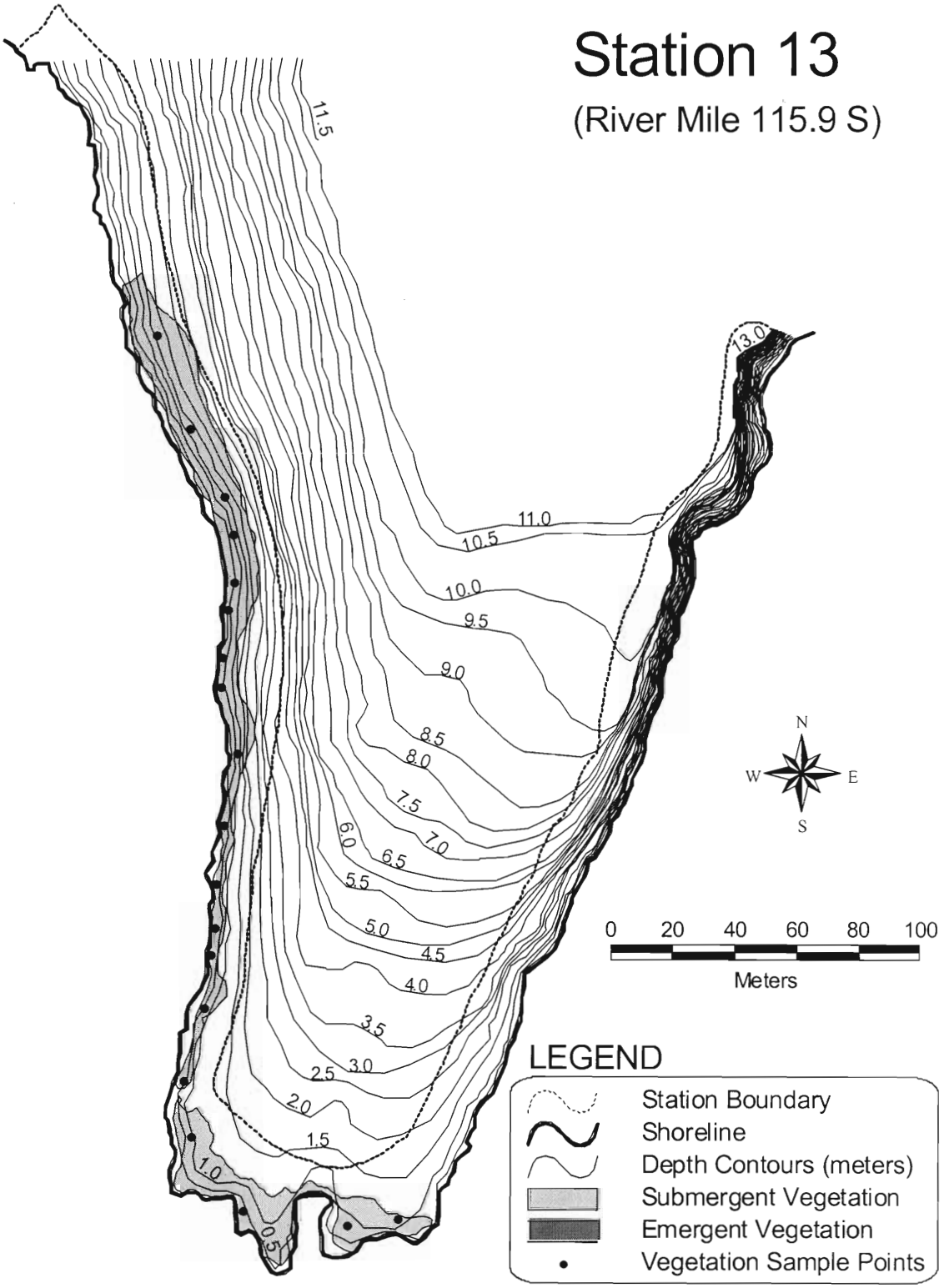

Figure 19. Bathymetric map of sampling station 13 in Lower Granite Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals. For clarity, not all depth contours are labeled.

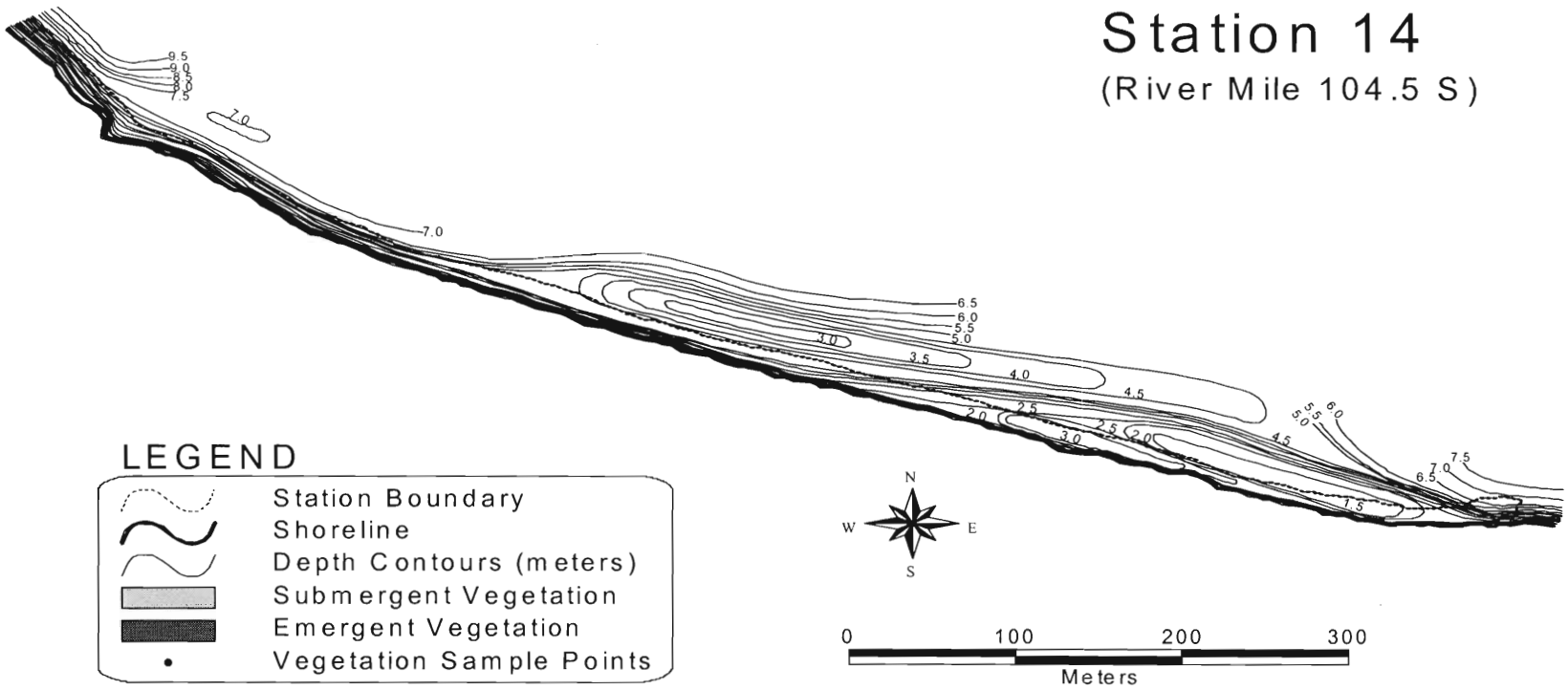

Figure 20. Bathymetric map of sampling station 14 in Little Goose Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals. For clarity, not all depth contours are labeled.

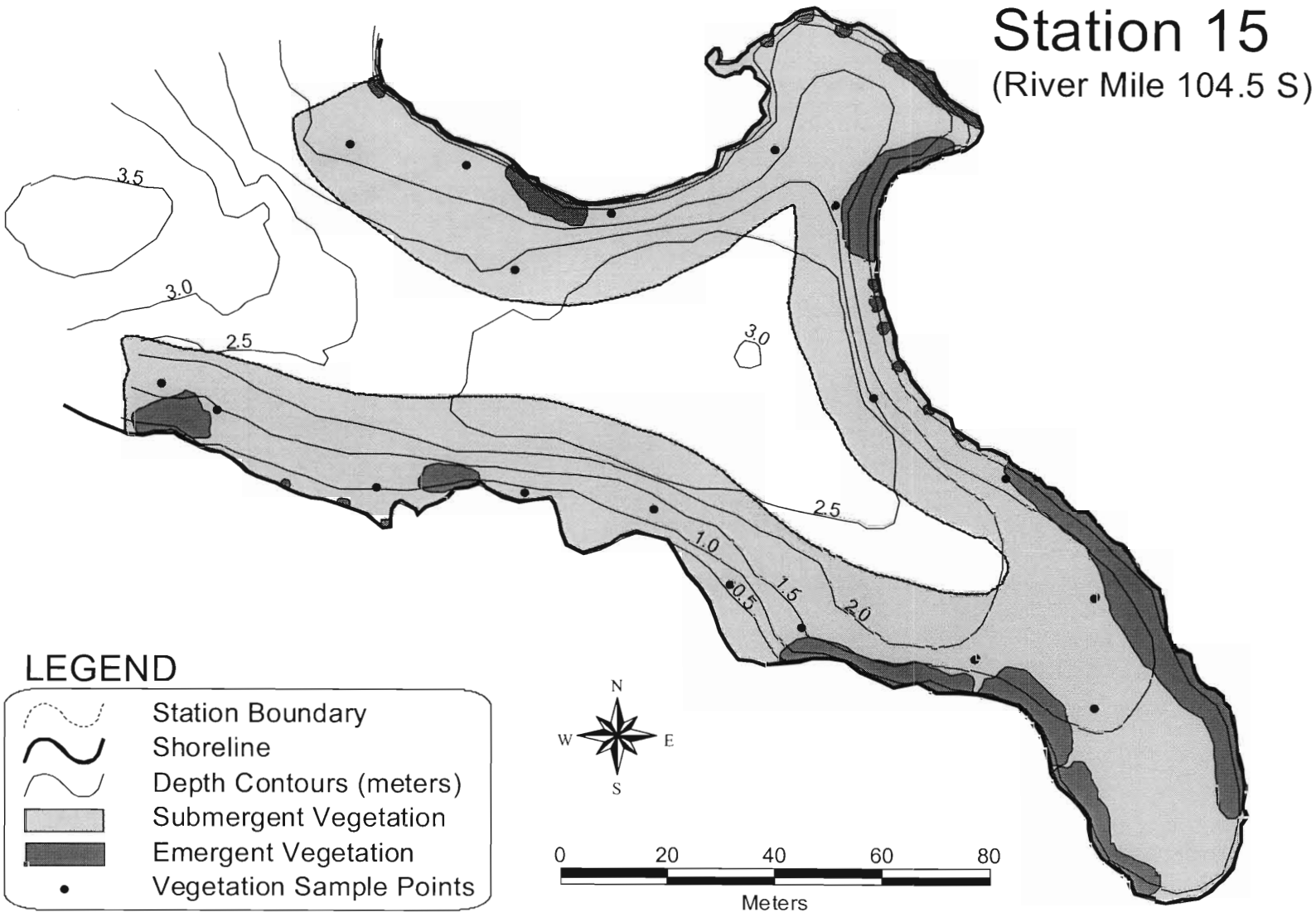

Figure 21. Bathymetric map of sampling station 15 in Little Goose Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals.

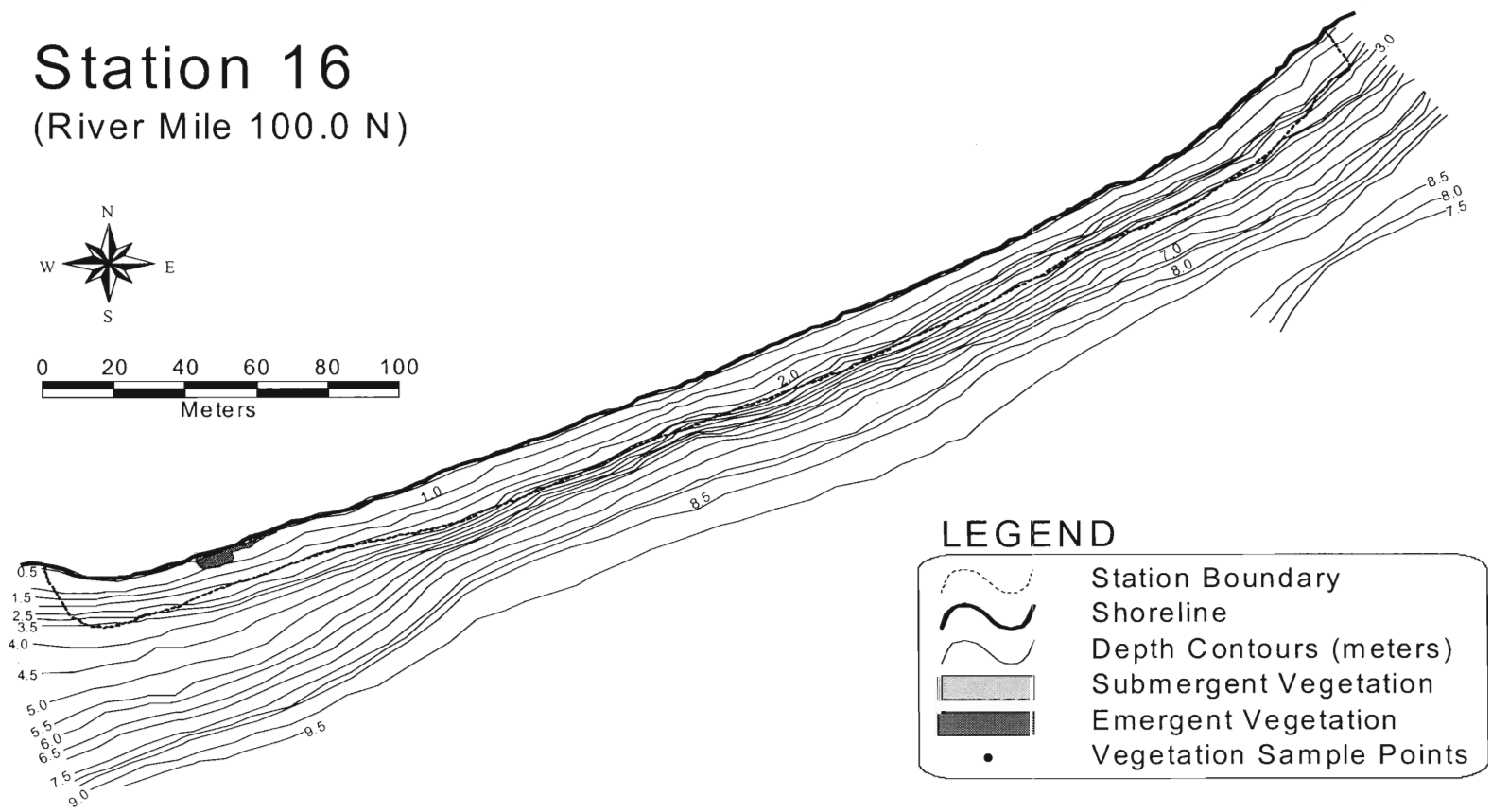

Figure 22. Bathymetric map of sampling station 16 in Little Goose Reservoir, Snake River. Aquatic macrophyte coverage and sampling points are shown. Depth contours are at 0.5 m intervals.

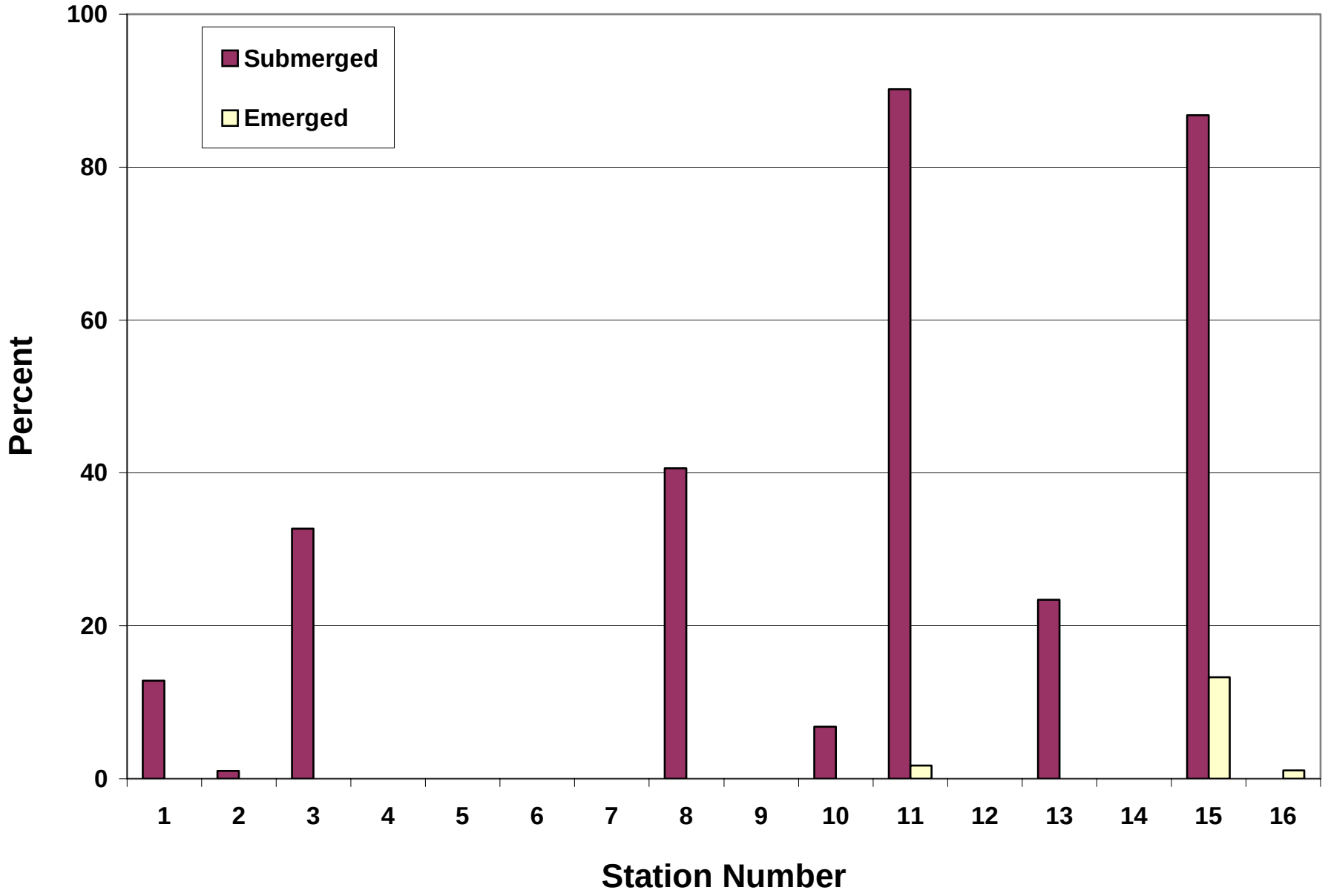

Figure 23. Vegetation coverage at 16 stations in Lower Granite (station 1-13) and Little Goose (station 14-16) reservoirs, Snake River, August – September 2002.

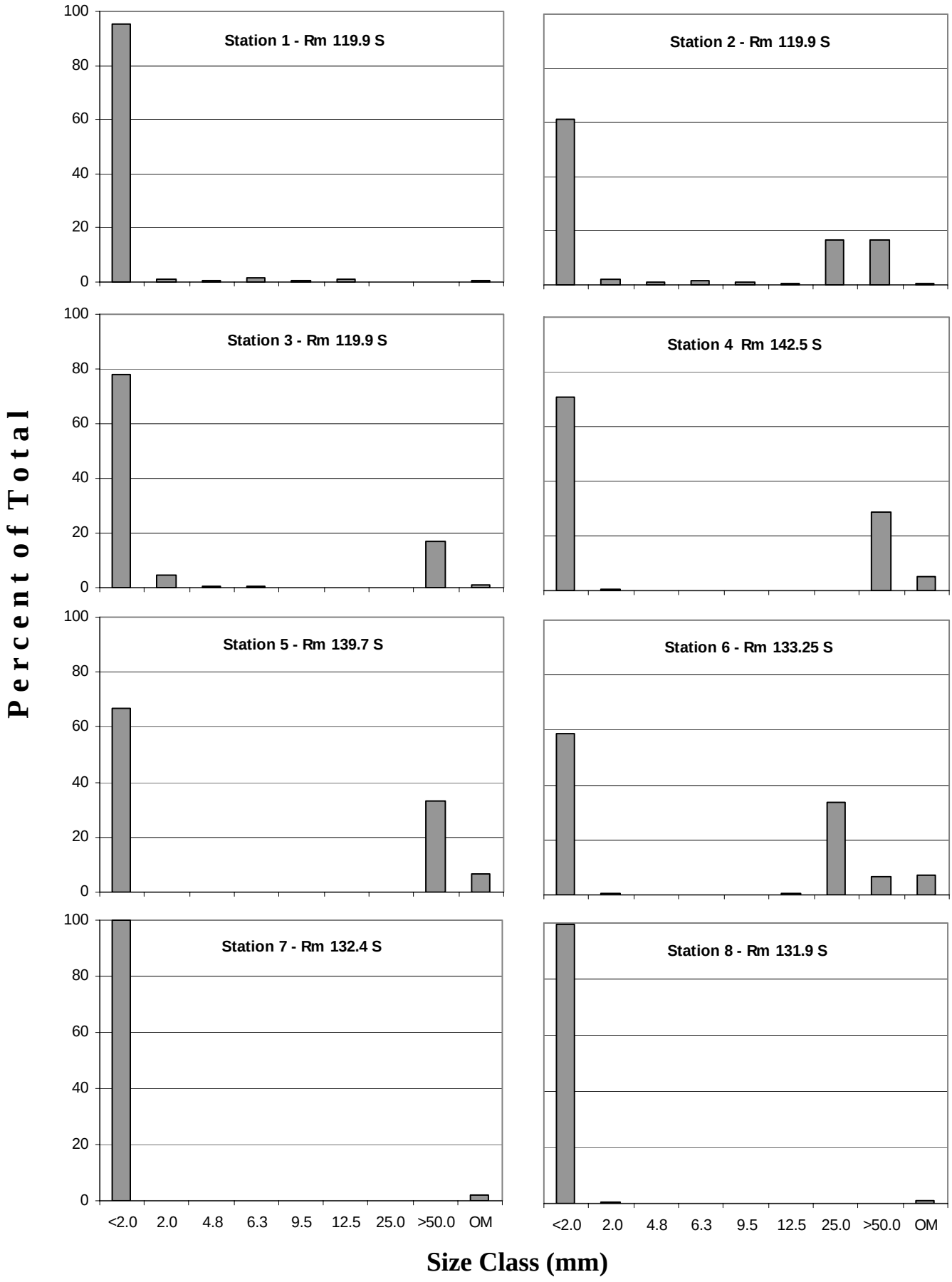

Figure 24. Mean sizes and organic matter (OM) from samples collected from Lower Granite Reservoir, Snake River, September 2002. Percent organic matter is relative to the <2 mm size class

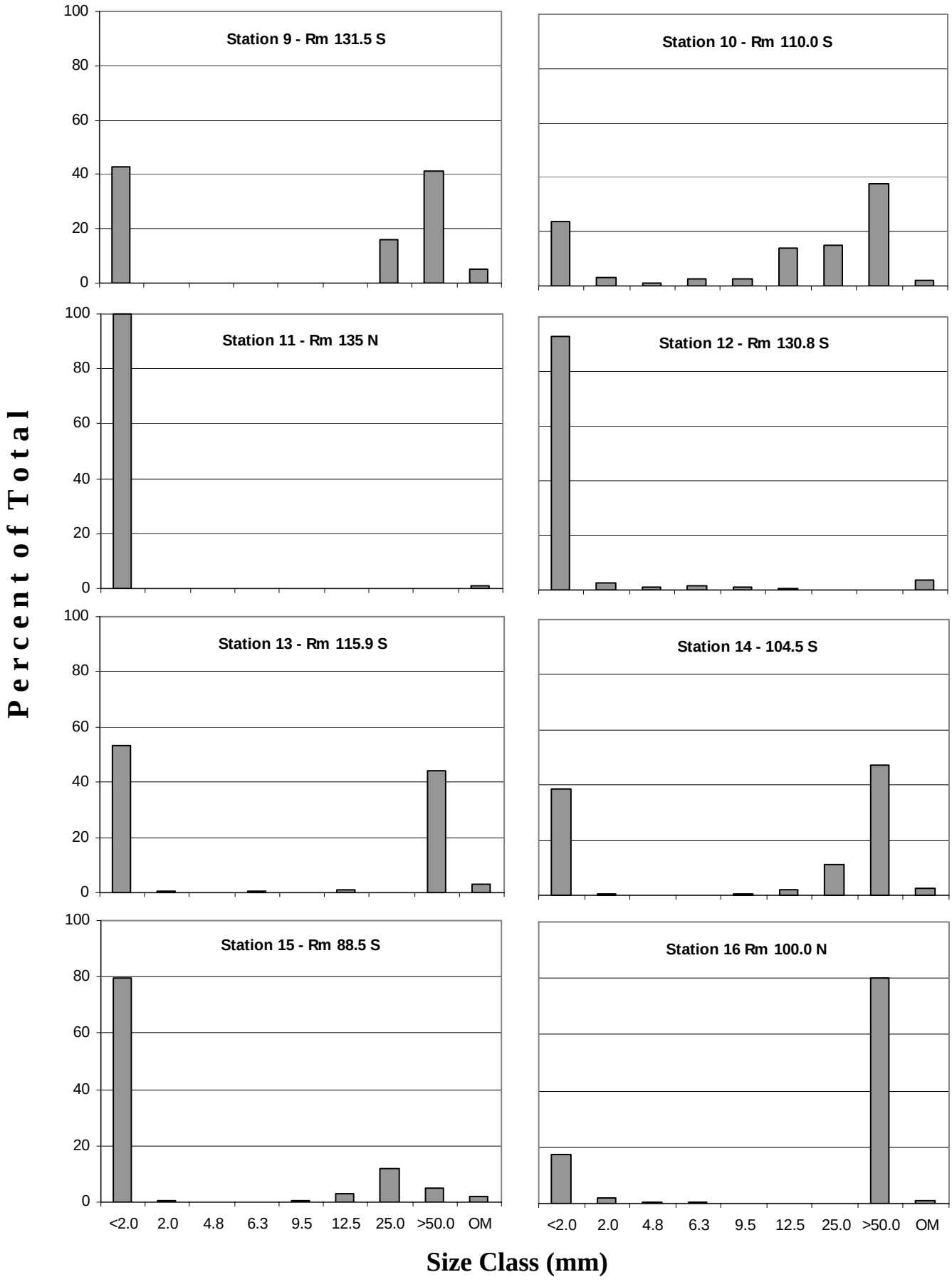

Figure 24 Cont.

Table 13. Submerged aquatic macrophyte biomass (dry weight) from study sites in Lower Granite (Stations 1-13) and Little Goose (Stations 14-16) reservoirs, Snake River, August-September 2002.

Station Number	Species	N	Mean Biomass Density within Macrophyte Beds (g/m^2)	Total Submerged Macrophyte Bed Area (m^2)	Total Biomass (g)	Total Station Area (m^2)	Total Biomass Density within Station (g/m^2)
1	*Myriophyllum brasiliense*	1	0.262	904	11.278	7041	0.002
	Potamogeton berchtoldii	1	0.145		6.242		0.001
	Potamogeton crispus	17	1.359		994.615		0.141
	Potamogeton pectinatus	6	0.458		118.338		0.017
2	*Potamogeton pectinatus*	5	2.329	57	132.753	5457	0.024
3	*Potamogeton berchtoldii*	4	1.367	3287	1122.921	10039	0.112
	Potamogeton crispus	10	1.400		2876.947		0.287
	Potamogeton pectinatus	9	1.161		2146.000		0.214
4			0	0	0	18029	0
5			0	0	0	4490	0
6			0	0	0	4155	0
7			0	0	0	6390	0
8	*Potamogeton berchtoldii*	5	0.872	1569	455.847	3864	0.118
	Potamogeton crispus	4	3.558		1488.667		0.385
	Potamogeton pectinatus	10	1.101		1152.064		0.298
9			0	0	0	4882	0
10	*Myriophyllum brasiliense*	15	5.528	530	2929.769	7742	0.378
11	*Potamogeton berchtoldii*	5	0.477	11223	1574.521	12447	0.126
	Potamogeton pectinatus	13	2.480		21281.449		1.710
12			0	0	0	6614	0
13	*Myriophyllum brasiliense*	3	4.647	3120	2289.259	13316	0.172
	Polygonum amphibium	1	0.381		62.564		0.005
	Potamogeton berchtoldii	9	7.111		10508.981		0.789
	Potamogeton crispus	4	2.219		1457.697		0.109
	Potamogeton pectinatus	10	3.372		5536.522		0.416
14			0	0	0	15166	0
15	*Elodea canadensis*	6	0.184	8867	542.857	10220	0.053
	Myriophyllum brasiliense	16	7.321		57702.988		5.646
	Polygonum amphibium	1	0.136		66.995		0.007
	Potamogeton berchtoldii	3	0.076		112.315		0.011
	Potamogeton crispus	8	0.731		2879.312		0.282
	Potamogeton pectinatus	1	0.164		80.788		0.008
16			0	0	0	6248	0

DISCUSSION

Fish Community

We believe sampling in 2002 was highly effective at describing the fish community and habitat characteristics at selected stations in Lower Granite and Little Goose reservoirs. We sampled over 33,000 fish at the 16 stations during 2002. Interestingly, American shad was the species collected in highest abundance although they were only collected on 2 days at two stations (stations 14 and 15), both in Little Goose Reservoir. None were collected in Lower Granite Reservoir.

Chinook salmon were second in abundance of all fishes and highest numbers were collected at stations 6 and 7 on the south shoreline of Lower Granite Reservoir, upstream from Silcott Island. The abundance of chinook salmon at these two stations is interesting. Fall and spring/summer chinook salmon abundance was high at these stations during May and June. In July, mainly fall chinook salmon were sampled at station 6 while numbers of both spring/summer and fall chinook salmon were low at other stations. Highest mean CPUE in May was for spring/summer chinook salmon at station 7, whereas in June CPUEs also were highest for spring/summer chinook salmon. Generally by the time both biweekly samples were taken in July, most chinook salmon had migrated either to deeper waters or away from the various stations in both Lower Granite and Little Goose reservoirs.

Numbers of juvenile chinook salmon collected at some of the stations reflected the late May sampling effort at some of the stations. Some stations downstream of station 12 were not sampled in May as a result of the lateness in timing of authorization to initiate collecting. Although some stations were initially

sampled near the end of May, the total reservoir could not be completely sampled. We collected over 1400 juvenile anadromous salmonids in May and when these were removed from the totals, the percent collected from the disposal stations increased from 5.8% to 7.99%. Based on the lengths of most of these chinook salmon, they were predominately fall chinook salmon.

Spatial distributions of fall chinook salmon were generally similar to those in previous surveys (Bennett et al. 1998b). Numbers collected downstream at stations 10 and 13 were higher than station 1 but lower than station 2. In 1990, 28 fall chinook salmon were sampled at stations 1 and 2 that accounted for about 11% of all sampled during that year (Bennett et al. 1993a). Surveys to assess spatial and temporal distribution of fall chinook salmon in Lower Granite Reservoir in both 1992 and 1993 indicated that peaks in shoreline abundance coincided with 10 May and 2 June, respectively (Bennett et al. 1998a). Thus, the later timing associated with the inception of sampling in 2002 may have influenced the numbers of fall chinook salmon collected.

The reason for the unusually high abundance of chinook salmon at stations 6 and 7 is not known. However, analysis of the habitat at these stations may provide some insight. First of all, fish predator abundance was low at both of these stations during May and June and generally remained low throughout the summer and fall. Mean CPUEs for both smallmouth bass and northern pikeminnow were low during May and June. Overall predator abundance at these stations was lower than the mean proportion of predators collected at all stations (21.2%). Substrate size at station 6 was different in that the proportion of larger particles was higher than at most

stations while substrate size at station 7 was similar among other stations. Particles < 2 mm was the modal substrate size at both stations although organic matter at station 6 was highest of all stations. Also interesting is that later in the summer, when aquatic macrophytes were sampled, they were absent at both stations. Benthic macroinvertebrates at station 6 were relatively low in density (15th highest) at station 6 while biomass was 10th in overall ranking. Benthic macroinvertebrate biomass and density were similarly low at station 7. Thus, the characteristics that we sampled likely do not identify any uniqueness to the habitat characteristic beyond that from other stations. Based on visual observations, higher water velocities occurred at stations 6 and 7. It was especially interesting that chinook salmon abundance at station 6 was so high considering the proportion of the larger substrate. Earlier surveys suggested fall chinook salmon exhibit a strong preference for finer substrate (Curet 1994).

The fish community in Lower Granite Reservoir has changed little from the early 1990s. We sampled 25 species in 2002, whereas 24, 20, 26, and 22 species were collected in 1988, 1989, 1990, 1992, respectively (Bennett et al. 1990, 1991, 1993, 1995). One difference among surveys was that deep waters were not sampled during 2002 as they were in some of the earlier studies. Another difference was that two species, banded killifish (*Fundulus diaphanus*)and warmouth (*Lepomis gulosus*), were collected in Lower Granite Reservoir in 2002, but not in the 1990s. Banded killifish were never sampled in any of the previous surveys (Bennett et al. 1990, 1991, 1993a, 1993b, 1995, 1997a) and warmouth were only reported for Little Goose Reservoir (Bennett et al. 1983). Chipps et al. (1997) indicated that trophic

structure and trends in feeding-guild abundance were not significantly different between disposal and reference stations from 1989 to 1993. Our collections suggest that feeding-guild abundance has not changed in a decade. Also, numbers of tolerant species were low in previous surveys and during 2002.

Fish community composition at the disposal stations was generally similar to each other. Overall, total fish sampled at disposal stations 1 and 2 ranked 13th and 14 th. Fewer fish were collected at stations 10 and 12 than at disposal stations. The most abundant species collected at station 1 was peamouth and they accounted for nearly 25% of the catch. At station 2, chinook salmon were most abundant and they accounted for 39.5% of the total catch. Peamouth, smallmouth bass, largescale sucker (*Catostomus macrocheilus*), chinook salmon and bridgelip suckers (*C. columbianus*) were the top five species in abundance at station 1 while chinook salmon, largescale sucker, smallmouth bass, peamouth and mountain whitefish (*Prosopium williamsoni*) were the top five in abundance at station 2.

The predator abundance at the disposal stations suggested that smallmouth bass and northern pikeminnow were the 5th and 8th in rank order of abundance, respectively. Pumpkinseed (*L. gibbosus*) and peamouth (*Mylocheilus caurinus*), both insectivores (Chipps et al. 1997), were more abundant than either smallmouth bass or northern pikeminnow.

Although we collected over 3,500 smallmouth bass and 1,600 northern pikeminnow, the majority of these two predators were less than 100 mm. For example, 55.6% of the smallmouth bass and 74.3% of the northern pikeminnow were <100 mm. Although smallmouth bass as small as 70 mm consume juvenile

salmonids, the majority of juvenile salmonid predation occurs from smallmouth bass > 250 mm (Anglea 1998; Naughton 1998; Bennett and Naughton 1999). In our samples < 2.5% of the total smallmouth bass collected were >300 mm. For northern pikeminnow < 200 mm, little predatory activity has been reported (Poe et al. 1991). The proportion collected > 200 mm was 1.5 % at all stations; most northern pikeminnow collected at the disposal stations were generally <160 mm. These data suggest that fish predator population abundance at all of the stations sampled was largely composed of individuals, too small to prey on juvenile salmonids.

Benthic Macroinvertebrates

We observed several changes in the benthic macroinvertebrate (BMI) community from earlier surveys. For example in 1987, the maximum number of taxa collected ranged from 2 to 8 and mean biomass ranged from 5 g/m^2 to 20 g/m^2 (Bennett et al. 1988a). The majority of the BMI biomass at shallow-water stations was largely oligochaetes followed by chironomids. In 1989, benthic macroinvertebrate biomass ranged from 1.5 g/m^2 to 13 g/m^2 (Bennett et al. 1991). Biomass was approximately 75% chironomids and 25% oligochaetes. In 1992, BMI biomass ranged from 0.65 g/m^2 to 8.73 g/m^2 (Bennett et al. 1995). In comparison, in 2002, BMI biomass ranged from 3.15 g/m^2 to 244.8 g/m^2 and >30 taxa were collected. Much of the difference between biomass in 2002 and earlier years was in different locations sampled and the resulting contribution of pelecypods. BMI biomass at disposal stations 1 and 2 both exhibited an increase from 1.5 g/m^2 to 17.3 g/m^2 and 1.91 g/m^2 to 5.5 g/m^2, respectively.

One possible explanation for the overall higher estimates of BMI is related to reservoir aging and the accumulation of more organic/detrital food materials for invertebrates. In 1993 and 1994, substrate samples were collected throughout Lower Granite Reservoir (Bennett et al. 1998b) and organic content of the substrate was variable among locations and depths. Although samples were collected and analyzed similarly in 1993 and 1994 as in 2002, organic content was generally higher in 1993 and 1994. However, lower organic content in 2002 could be related to higher benthic macroinvertebrates assimilating the organic material or lesser amounts of organic matter in inflows from upstream sources.

BMI community structure has increased in taxa richness in the last 10+ years. In 2002, we found the number of major taxa increased to > 30. Earlier surveys and the 1980s and 1990s revealed that oligochaetes and chironomids comprised over 90% of the BMI community (Bennett et al. 1997b). However in 2002, oligochaetes and chironomids were the major BMI community components but molluscs, specifically pelecypods, increased substantially in abundance. Burrowing mayflies and Trichoptera also were more common in 2002 although their contribution to the overall density and biomass was low.

Aquatic Macrophytes

In 1992, Bennett et al. (1995) sampled aquatic macrophytes at disposal stations 1 and 2 and several reference stations. Aquatic macrophytes were observed at depths of 0.76 m to 3.5 m in 1992, and similarly distributed within the water column in 2002.

We found slight changes in the species composition of aquatic macrophytes from previous surveys. In 1992, *P. crispus* was generally the dominant aquatic macrophyte although *P. filiformis* was dominant at station 11. Disposal stations 1 and 2 and reference station 3 only had growths of *P. crispus* in 1992. In 2002, four species were collected at station 1; three species of *Potamogeton* and *Myriophyllum brasiliense*. At station 2, *P. pectinatus* has seemed to replace *P. crispus* since 1992. *P. crispus* was still present in 2002 at reference station 3, although two other species of *Potamogeton* also were collected there. At reference station 10, a similar change in species was found; in 1992, *P. crispus* was the only species present, whereas in 2002 *M. brasiliense* was the only species of aquatic macrophyte present.

In general, biomass of aquatic macrophytes has decreased since 1992. For example, in August 1992, estimated mean biomass within the macrophyte bed at station 1 was 20.3 g/m^2 compared to 2.224 g/m^2 in 2002. Although macrophyte total biomass was higher at station 2, it was generally lower than at other stations with macrophytes. At reference station 10, August biomass was 36.5 g/m^2 in 1992 compared to our estimates in 2002 at 5.5 g/m^2. Thus, we have seen within 10 years a species change and surprisingly, a decrease in biomass.

Substrates

Substrate characteristics at stations 1 and 2 were generally similar to those of previous surveys. At station 1, particles < 2 mm accounted for the majority of the substrate while at station 2, < 2mm particles accounted for about 60% of the samples and larger materials accounted for about 40% of the substrate.

Summary

Based on 1 year of sampling in 2002 at the 16 stations in Lower Granite and Little Goose reservoirs, we observed several changes in the fish community and habitat. Fish species richness has increased with the addition of two new species to Lower Granite Reservoir. Juvenile anadromous salmonid use was observed at all stations although highest abundance was along the south shoreline, immediately upstream of Silcott Island. Substrate is generally similar, aquatic macrophytes have decreased in abundance, while benthic macroinvertebrates have increased in density and biomass. Habitat changes have been slight throughout the reservoir. Signs of eutrophication are most apparent in backwaters with accumulations of sediment. Macrophyte biomass was generally lower than in previous surveys in the early 1990s throughout the reservoir although species richness was higher. These changes were most obvious at station 11 although biotic communities generally were similar to those in the 1990s from previous surveys. In spite of these habitat changes, juvenile anadromous fish use continued to be high at station 11.

Construction of Centennial Island occurred over 10 years ago. Findings in 2002 suggest that habitat and biotic community changes at the disposal stations were slight since construction. One of the more significant habitat changes was increased erosion on the shore-side of Centennial Island. Changes in the fish community were few and our results suggest that dredged material can be used to increase shallow water habitat. Benefits to the fish community as identified by Chipps et al. (1997) appear consistent with previous findings. Juvenile salmonid use is higher or similar to that at reference sites at similar locations in Lower Granite Reservoir. Benthic

macroinvertebrate density and biomass have increased along with the BMI community taxa richness. Results from the 2002 survey should further allay two concerns identified in the Adaptive Management Workshops (Webb et al. 1987): 1) juvenile salmonid fishes are not residualizing at constructed habitat and 2) predator abundance and predator foraging sites have not increased as a result of in-water disposal of dredged materials.

Recommendations

1) Continue fish and invertebrate community monitoring and habitat characterization at proposed disposal sites in Lower Granite Reservoir.
2) Our data show that stations on the south shore, potential dredged material disposal locations upstream of Silcott Island, supported high numbers of juvenile anadromous fishes. Results from a second year of sampling would probably show the relative importance of these sites to juvenile anadromous fishes.
3) Because of the limited availability of shallow water habitat in Lower Granite Reservoir, managers are encouraged to creatively examine potential sites for beneficial uses of dredged material with high gradient slopes, especially in the lower (downstream of RM 119.5) reservoir.
4) BMI foraging sites in shallow water continue to be limited for juvenile anadromous salmonids in the downstream portion of Lower Granite Reservoir. One possible beneficial use of dredged material may be in increasing shallow water habitat, thereby increasing food availability to juvenile anadromous salmonid fishes.

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