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SALINITY AND FISH EFFECTS ON SALTON SEA INVERTEBRATES: A MICROCOSM EXPERIMENT

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INTRODUCTION

Salinity has long been considered an important influence on the composition and dynamics of an ecosystem. Understanding the effects of salinity will increase our knowledge of the community, and the interactions that occur. It is surprising that most conclusions on this subject are based either on salinity tolerances of individual organisms or speculations drawn from descriptive studies (Greenwald and Hurlbert, 1993). Studies of tolerance levels of an individual species provide information on physiology but do not necessarily increase our knowledge on ecological effects. Therefore, if one wishes to investigate ecological effects of increasing salinity, it is necessary to study the problem at the community level.

Descriptive studies of saline lakes are one means to investigate the biotic community and how it interacts with the environment. These studies allow for a comparison of biota at different salinities or ionic compositions, as these vary from lake to lake or over time. However, these are uncontrolled studies and it is difficult to determine cause and effect.

There are a number of such descriptive studies that generally describe the present fauna, and draw the conclusion that changes in salinity will effect the species richness and composition (Aladin, Plotnikov, and Filippov 1992, Drabkova, Letanskaya, and Makartseva 1978, Hammer 1986, Jakhor, Bhargava, and Sinha 1990, Vareschi, and Jacobs 1984, Vareschi, and Vareschi 1984, Williams, Boulton, and Taaffe 1990). Wurtsbaugh (1990, 1991) carried out a descriptive study of the Great Salt Lake and a microcosm experiment that investigated interactions between microzooplankton, *Artemia*, and *Trichocorixa* in a saline (50 to 100 g/L) environment. It was found that changes in the salinity of the Great Salt Lake modified the zooplankton composition. The invertebrate predator, *Trichocorixa sp.,* was especially important in structuring the plankton community of both Great Salt Lake and the experimental microcosms.

Microcosm experiments provide the control lacking in descriptive studies and provide realism to an experiment not possible in the laboratory (Beyers and Odum 1993). They allow for the study of both populations and ecosystems simultaneously. However, there has been a paucity of experiments using microcosms to study salinity affects at the community level (Greenwald and Hurlbert, 1993). Although the few studies that have been carried out looked at salinity effects over very different ranges, the general trend found was that zooplankton diversity and density decreased with increasing salinity (Galat and Robinson 1983, Greenwald and Hurlbert 1993).

A common feature of the methodology of these experiments is that they manipulated salinity through dilution and evaporative concentration. This indeed changes the salinity, but also changes the concentrations of nutrients and all other substances present. Additionally, this may cause changes not only in concentrations but also in proportions of ions, nutrients, organisms present, or any other substance present. Thus, they have used salinity in loose terms to mean a large suite of variables. This makes it impossible to determine what effects were due to salinity itself. Therefore, there is ample opportunity for further experimental studies to contribute to our understanding of salinity effects.

At present one of the world's most dynamic salt lakes is the Salton Sea. This is the largest lake in California. It is approximately 58 km long and ranges from 14 to 22 km wide for a total surface area of 932 km^2 (Black 1981). It is important both biologically and economically. The Salton Sea boasts a renowned sport fishery, is an important habitat for over 2 million migratory birds, and is a breeding ground for several endangered species. It is also one of California's largest repositories for agricultural wastewaters. Salinity increase at the Salton Sea is not just of theoretical or academic interest but of real importance as the salinity is increasing at a rate of 0.8 g/L per year (California Regional Water Quality Control Board, Colorado River Basin•Region 7, 1991).

The Salton Sea was formed over a period of 16 months between 1905 and 1907. Heavy rains and the breaking of a dike caused the entire flow of the Colorado River water to rush into the Salton Sink, at that time a dry salt bed, 85 m below sea level. Since then the tendency of the lake has been toward increasing salinity, from the 3.55 g/L in 1907 to the 47 g/L in 1992. The increasing salinity is due mainly to high evaporation and low rainfall and the discharge of saline agricultural wastewaters into the closed lake (Fig. 1).

It is probable that during the breakthrough of the Colorado River all species in the river were introduced into the new lake it formed. However, with the increase in salinity there have been major changes in the biotic community. Currently, there are 5 phyla of invertebrates represented: Protozoa, Rotifera, Nematoda, Annelida, and Arthropoda. The dominant invertebrates include: ciliate protozoans, *Brachionus plicatilis* (rotifer), *Apocyclops dengizicus* (copepod), *Balanus amphitrite* (barnacle), *Neanthes*

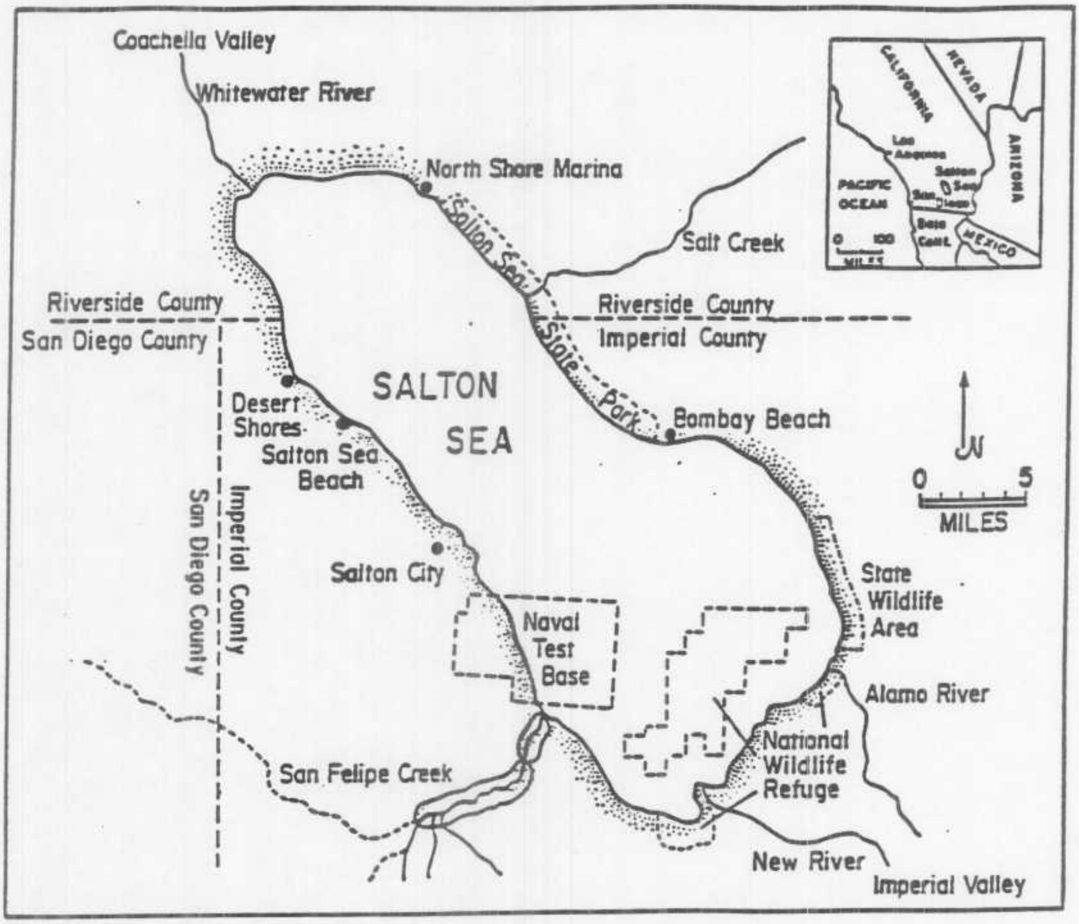

Fig. 1. Location of the Salton Sea.

succinea (pileworm), *Gammarus mucronatus* (amphipod), and *Trichocorixa reticulata* (corixid or water boatman).

The major fish present are: *Anisotremus davidsoni* (sargo), *Bairdiella icistius* (croaker), *Cynoscion xanthulus* (corvina), and *Oreochromis mossambicus* (tilapia). *O. mossambicus* in the Salton Sea are a robust fish reaching up to 1.6 kg in weight and 40 cm in length. They are a warm water fish that are one of the dominant fishes in the lake (Black 1981). Tilapia are able to withstand high salinities. They are sensitive to low winter water temperatures in the Salton Sea which can cause large dieoffs (Black 1981).

O. mossambicus are omnivores, reported to feed opportunistically (Niel, 1966 and Pullin et al. 1982). Whitfield and Blaber (1978) found that the diets of fingerlings, up to 5 cm TL (total length), consisted of 70% animal matter, 5-8 cm fish diets consisted of 40% animal matter, and in larger fish their diets consisted mostly of filamentous algae and epiphytic diatoms. Their salinity range is thought not to exceed 70 g/L and their reproductive capabilities may be lost at 60 g/L (Pullin et al. 1982). Popper and Lichatowich (1975) reported reproduction at salinities as high as 49 ppt. In other habitats they have been found to feed on insect larvae, crustaceans, and desmids, diatoms, epiphytic filamentous algae and other minute organisms associated with detritus (Trewavas 1983). In the Salton Sea they are the dominant planktivore. The presence or absence of such a planktivore should have dramatic effects on the plankton community. They are also currently the major item in the diet of corvina, sargo and croaker, and are an important sportfish (Black 1981).

Biologically, the lake is a rather simple system (Walker 1961). The biota has changed over time, but the food web has remained simple. As the salinity of the Salton Sea gradually increases, physiological and ecological principles, as well as existing information on the species present in the lake, make it clear that large changes in the structure and functioning of the aquatic community, including the waterbird assemblage, are to be expected. The nature of these changes is impossible to predict, however, because 1) our information on the salinity tolerances and population interactions among Salton Sea organisms is scant; and 2) there have been almost no prior experimental microcosm studies on the effects of salinity on communities in any aquatic system.

The objectives of this study were two fold. The first was to investigate the effects of increasing salinity on the Salton Sea algal and invertebrate assemblages in fish-free microcosms containing Salton Sea water experimentally adjusted to different salinity levels (30, 39, 48, 57, and 65 g/L). The second was to determine the effects of the presence of tilapia (*Oreochromis mossambicus*) on this biota at two of these salinities (39 and 57 g/L). The upper salinity was the point which we believed reproduction of this fish in the Salton Sea would be affected and the population would decrease in the Salton Sea. This paper reports only results for invertebrates (zooplankton and nekton) found in the upper part of the water column. Findings on the effects of salinity on the algae and benthic invertebrates will be reported by Gonzalez (in prep.) and Simpson (in prep.) respectively.

METHODS

Experimental Design

The experiment was carried out using a randomized block 2 x 5 incomplete factorial design with 4 replicate microcosms per treatment combination (Fig. 2). The 7 treatments per block consisted of the five salinity levels (30, 39, 48, 57, 65 g/L) without fish and two (39 and 57 g/L) with fish present.

Establishment Of Microcosms And Salinity Levels

Salton Sea water with a salinity of 47 g/L was transported by a tanker truck from the lake to San Diego State University and pumped into 28 380-L fiberglass tanks on the roof the San Diego State University Life Sciences building on November 19, 1991. Each tank was diluted to a salinity of 30 g/L and brought to a volume of 312 L.

The next objective was to create the experimental salinity levels in such a way that 1) the major ion composition at each salinity was approximately the same as that which would be obtained by evaporating Salton Sea water to the given salinity; and 2) the treatments initially did not differ with respect to nutrient levels, organism densities, or any variables other than salinity defined as the sum of major ions.

The relative proportions of ions at the Salton Sea in 1991 when the

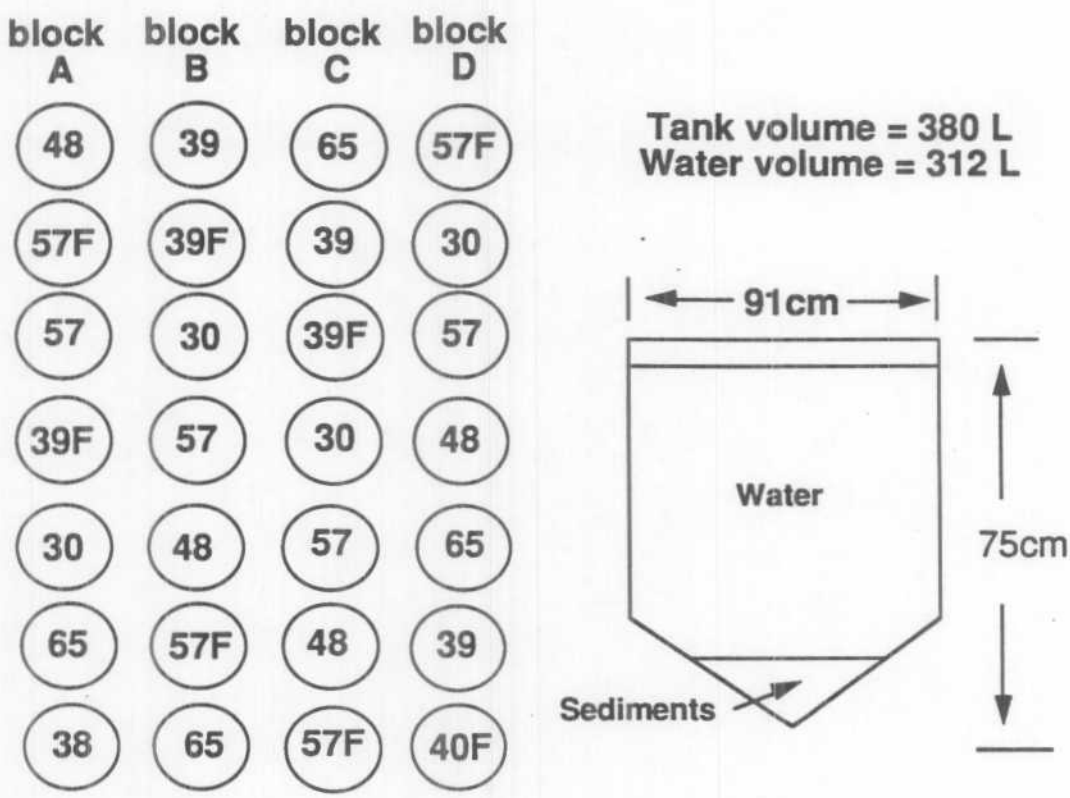

Fig. 2. Layout of experimental units and tank dimensions. Numbers represent the salilnity within each tank in g/L. F designates the placement of one tilapia within that tank.

salinity was 47 g/L were assumed to be the same as those reported by Parsons (1986) for when salinity of the lake was approximately 38 g/L. The amount of each ion needed to increase the salinity by 8.8 g/L while maintaining ionic proportions relatively constant was calculated (Table 1). The ions were added in the form of four salts (NaCl, Na_2SO_4, $MgSO_4$, and KCl) (Table 1). The estimated final salinities were 30.0, 38.8, 47.7, 56.6, 65.3 g/L, based on the assumption that Ca^{2+} and HCO_3^{-1} concentrations would remain as in the 30 g/L water. For convenience, the salinity levels will be referred to as 30, 39, 48, 57, and 65 g/L.

Neither Ca^{2+} nor HCO_3^{-1} were considered when determining the amounts of each ion needed to increase the salinity, because they were present in the Salton Sea in relatively small amounts. Additionally, the sediments added to each tank contained some barnacle shells, fish bones and other carbonate sediments. Thus $CaCO_3$ was available for Ca^{2+} and HCO_3^{-1} to adjust to saturation levels.

The salts needed to raise the salinity of one 312 L tank by 8.8 g/L were weighed out, mixed thoroughly, and placed in a bag. Enough of these bags (56) were made to create the target salinity levels for all tanks. Starting on January 4, 1990, one bag of salts was transferred into a nylon stocking which was hung over the side of each tank in the 39 - 65 g/L treatments and the salts allowed to dissolve. Two days later another bag was added to tanks in the 48 - 65 g/L treatments. The cycle was repeated two days later for the 57 and 65 g/L tanks, and two days later once again for the 65 g/L tanks. This increased the salinity 8.8 g/L every 2 days. Daily records of salinity were made using a hand refractometer and a correction factor (see below).

Table 1. The Amounts Of Each Ion Added To The Diluted Salton Sea Water And The Total Salts Added In Order To Achieve An Increase Of 8.84 g/L.

	Concentration g/L				
Ion	Salton Sea, 1986 (Parsons 1986)[a]	Predicted concentration after dilution of 47 g/L water to 30 g/L[b]	Amount (g) of each ion added per L to achieve increase of 8.8 g/L	Salt	Amount (g) of each salt added per liter to achieve increase of 8.84 g/L
Na	9.22	7.15	2.95	NaCl	6.09
K	0.42	0.32	0.11	KCl	0.20
Mg	1.31	1.02	0.17	Na_2SO_4	1.72
Ca	1.33	0.88	-	$MgSO_4.7H_2O$	1.67
Cl	16.60	12.86	3.79	Total salts	9.69
SO_4	9.66	7.49	1.82	Total ions	8.84
HCO_3	0.18	0.17	-		
Total	38.72	29.89	8.84		

[a]Average of values for 2 stations where surface, mid-depth, and bottom samples were taken.

[b]Predicted concentration of ions based on estimated tapwater concentrations (in g/L) of 0.0745 Na, 0.0042 K, 0.0262 Mg, 0.0520 Ca, 0.0940 Cl, 0.1470 SO_4., 0.1476 HCO_3. (mean values for November effluent from Alvarado Filtration Plant, City of San Diego).

Before addition of salts, 3 L of Salton Sea sediments were placed over the bottom of each tank on January 3, 1991. This provided a substrate for the benthos and a nutrient source corresponding to that represented by Salton Sea Sediments. The dry sediments were obtained from a portion of the southwestern shoreline of the lake that a few years earlier had been lake bottom. These sediments were a mixture of organic material, sand, silt, barnacle shells, and fish bones. They were homogenized thoroughly by mechanical mixing, sifted through 6 mm mesh sieve to remove coarse materials such as gravel, rocks, and larger barnacle shells and fish bones. The sediments were divided into 31 coequal aliquots of 3 L each and one was added to each of the 28 tanks. Three samples were set aside for later analysis of the nutrient (N, P) content of these sediments.

Water level was kept at approximately 10 cm below the lip of each tank by the addition of water from a holding tank that had been allowed to dechlorinate by sitting 2-4 days. Clear fiberglass covers were placed on each tank at the beginning of rainfall events and removed immediately thereafter. A PVC pipe (1.9 cm diameter, 25 cm long) with a Styrofoam floatation collar and an airstone just inside its lower end was installed vertically in each tank and served to gently mix the water column and inhibit stratification. The microcosms possessed a much greater ratio of hard surface area (tank walls) to water volume than does the Salton Sea. The vertical portion of the walls therefore were scrubbed twice a month with plastic pot scrubbers to prevent buildup of attached organism assemblages on the tanks' vertical walls which could tie up nutrients and negatively effect plankton development. The material removed from the walls was left in the tanks.

Inoculation Of Tanks

Though all tanks started off with abundant plankton that came with the initial Salton Sea water, the tanks were also inoculated identically with algae and invertebrates on 5 occasions between January 1991 and August 1991. These were collected both from the Salton Sea and from several other waterbodies in the region with salinities ranging from 2 to 220 g/L. The wide range of inocula was intended to permit rapid colonization of the tanks at each salinity level by many organisms in the region that might be capable of establishing populations at that salinity level. Appendix A gives details concerning inoculation dates and location and salinities of sources of the inocula.

Additionally, separate introductions of certain individual invertebrate species were made identically to each tank. These included: a polychaete (*Neanthes succinea*), a brine shrimp (*Artemia franciscana*), an amphipod (*Gammarus mucronatus*), a harpacticoid copepod (*Cletocamptus dietersi*), and brine flies (*Ephydra sp.*). All occur either in the lake or in ponds along its margin. On February 8, 1991, 2 *Neanthes* approximately 4 - 7 cm long were added to each tank and 7 more to each tank on March 1. These were placed in vials containing a 50:50 mixture of Salton Sea water and water from the receiving tank for 6 hours to allow acclimation. On February 8, April 10, and August 16, *Ephydra* pupae were collected from a hypersaline pond near the northwestern edge of the lake and placed in buckets, at 5 locations among the array of tanks. This was to allow adult brine flies access to tanks as potential oviposition sites.

Artemia franciscana from a hypersaline pond near the Salton Sea (120 g/L), were introduced on February 7, but did not survive, perhaps because the salinity difference was too great. Thus, *Artemia franciscana* was introduced at various times as eggs (approximately 3,800 on March 12, and approximately 1,000 on May 7) and as nauplii (approximately 1,500 on March 22 and approximately 750 on May 24). These larger numbers reflected our expectation that egg viability and acclimation of nauplii would be low. To assist acclimation prior to addition to the tanks, the nauplii were placed in vials for 8 hours containing a 50:50 mixture of the water in which they were hatched (70g/L) and the water of tank to which they were to be introduced.

Gammarus mucronatus was added to each tank on April 8 in a similar manner. For acclimation, ten amphipods were placed for 8 h in a vial containing a 50:50 mixture of Salton Sea water and the water from the intended tank. Though abundant at certain times in the Salton Sea, *Gammarus* apparently was not present in the lake water originally introduced into the tanks. From a *Cletocamptus dietersi* lab culture developed from Salton Sea collected individuals, approximately 172-200 individuals were added on May 29 to each tank. Further details on inocula are given in Appendix B.

Fish Introductions

Into each of the 39 and 57 g/L tanks designated to receive one, a single individual of *Oreochromis mossambicus*, 4-8 cm long, was introduced on July 3, 1991. The fish were to be introduced after enough time had passed to allow for prior development of invertebrate populations. Fish were collected from the Salton Sea at Red Hill Marina and transported to SDSU. The fish were randomly divided into two groups of 10 fish each and slowly acclimated in the laboratory to either 39 g/L or 57 g/L. On July 7, 1991, four similarly-sized fish from each group were chosen. The fish were weighed and length was measured and then randomly assigned to a tank. The remaining fish were kept in reserve at the two salinities in case an experimental fish died and needed to be replaced.

After the length and weight measurements were taken the fish were put in Ziplock bags with the water they came from and floated in the tank they were assigned, in order to acclimate to the temperature. Three hours later they were released. On the morning of July 8 in tanks 39F-A, 39F-B, and 39F-C the fish were found dead, floating at the surface. It could not be determined whether the fish in the other tanks were dead or alive because of high turbidity owing to phytoplankton. It was decided to remove all fish in order to restock and be certain that each tank would have a fish. On July 16, a net was passed through the water column of each tank in order to retrieve the fish. The net was also passed through the tanks where the dead fish had already been retrieved in order that they receive the same mild stirring. All of the fish in the 39F tanks fish had died, while all of those in the 57F tanks were recovered alive. The fish had been in the tanks for two weeks.

On August 9, of the remaining fish, 4 fish were again randomly assigned to the four tanks in each treatment (39F and 57F). They measured 5 to 7 cm in total length and 5 to 12 g in weight. For each tank a 3 L bucket was filled with its water, was covered with 1.0 cm mesh netting, and was suspended in the tank. This allowed us to assess the success of initial acclimation to the tank's water. By two days later the fish had died in tanks 39F-A and 57F-D. Both were replaced with another fish acclimated to that salinity. On September 28 all fish appeared healthy and active. The buckets were removed and the fish were released into the tanks. On October 2, the fish in 39F-A was found dead. It was removed and replaced with another fish in a bucket/net setup and released on October 10. The fish was again found dead on December 12, but was not replaced. Appendix C gives additional detail on establishment and maintenance of these fish treatments

Sampling Methods And Regimes

Selected physical-chemical variables were monitored on a regular basis. Salinity, temperature, dissolved oxygen, pH, and visibility were measured twice monthly between 12:00 and 12:30 PM. Temperature, pH, and dissolved oxygen was measured at intervals of 3 months once every 4 h over a 24 h period.

Salinity was measured using a Reichert-Jung hand refractometer (0-160 g/kg). The refractometer is calibrated for NaCl solutions. By diluting and evaporating Salton Sea water (between 10 and 95 g/L) and using gravimetric determinations we determined that multiplying the refractometer reading by 1.13 would yield salinity or total dissolved solids in g/L. Temperature was measured using YSI Tele-Thermometer (model 44TD) and pH with a Beckman Chem-mate pH meter. Maximum and minimum temperatures were determined with a Taylor maximum-minimum thermometer read weekly. Dissolved oxygen was measured using a YSI (model 57) dissolved oxygen meter and visibility with a Secchi disk. Nutrient (N, P, Si) concentrations were measured every 2 months for each tank, and major ions were measured on 4 dates. Only salinity and maximum-minimum temperature data are reported in this paper. Other physical-chemical variables will be reported and discussed by Gonzalez (in prep.), with her analysis of the effects of salinity on the phytoplankton and attached algae.

Invertebrates were sampled monthly with a 76 cm long, 15 cm diameter tube sampler, that collected zooplankton as well as nektonic and benthic organisms when present in the upper part of the water column. Sampling was carried out at night, starting 2 h after sunset. The tube sampler was quickly lowered to a depth of 45 cm and collected a 3.5 L sample. Simultaneously another person used a 9 L bucket to scoop an 8.5 sample from the upper 20 - 25 cm of the water column. The 12 L composite water sample was filtered through a 50 µm mesh plankton net, and preserved in 8% formaldehyde.

Sample Analysis And Data Analysis

Zooplankton samples were analyzed using a 40 x 50 mm Sedgwick-Rafter chamber and compound microscope. A sample was concentrated to 3 ml and then placed in the chamber. For a given sample, species that appeared to be present in numbers greater than about 25 individuals per counting transect (4 mm x 40 mm strip) were counted over 40 percent of the chamber. All other species were enumerated over the entire chamber.

Organisms were identified to the lowest taxonomic level possible, and numerical and biovolume densities were calculated.

Counts were made separately for different life stages or size classes for the crustaceans and corixids. This allowed for better estimates of the true biovolume and added insight on effects on reproduction. For the copepods, counts were made for nauplii, copepodites, and adults. The *Artemia* categories were: nauplii, post-nauplii <2 mm, post-nauplii 2-7 mm, adults (>7 mm) with and without eggs. The amphipod categories were : juveniles <2 mm, juveniles 2-4 mm and adults >4 mm. Corixids were separated into two categories based on size, <1.0 and >1.0 mm. Additionally, separate counts were made for *Brachionus* with and without eggs. For each age or size group, mean biovolume per individual was estimated, and both numerical and biovolume densities were calculated for each taxon.

For each taxon or group, a 1-way ANOVA was used to test for differences among treatment means on each sampling date. The count data (numbers/12 L) were converted to number per L and log transformed. Prior to taking the logarithm, we added the lowest possible non-zero value (0.08/L) for numerical density to each datum. Biovolume densities were also converted to a per L basis and log transformed. Prior to taking the logarithms we added the lowest possible non-zero value for that taxon (equal to 0.08 x the biovolume of the smallest individual) to each biovolume datum.

Fish treatments were first initiated in July. Therefore, the effect of salinity was tested for with 1-way ANOVAs for unequal replication from January 1991 to July 1991, utilizing data for 8 tanks at 39 and 57 g/L and for 4 tanks at the other salinities. After July, 1-way ANOVAs for equal replication were used. Two-way ANOVA's were carried out to assess the effects of fish at 39 and 57 g/L starting in October 1991, after the tilapia were finally established.

RESULTS

Salinity And Temperature

The trajectory of the salinities recorded for the treatments are shown in Fig. 3. The measured salinities were generally 2 g/L above the nominal salinities. This reflected the fact that salinity measurements were usually made before tap water was added to compensate for evaporation.

The lowest recorded temperature was 6^{o} C (November 25 - December 2), and the highest was 31.5^{o} C (August 13 - 26) (Fig. 3). The sharp drop in temperature recorded between October 21 and 28 corresponded to a sharp drop in air temperature (SDSU Weather Station, Geography Department).

Effects Of Salinity

The dominant invertebrates present were, crustaceans, insects, rotifers, protozoans, and nematodes. Strong effects were observed on numerical densities of individual taxa (Figs. 4 and 5), on biovolume densities of major taxa (Fig. 6), and on percent taxonomic composition (Fig. 7).

Crustaceans

On a biovolume basis, crustaceans were the most abundant group in the tanks (Fig. 6). Five species were present; an amphipod (*Gammarus*

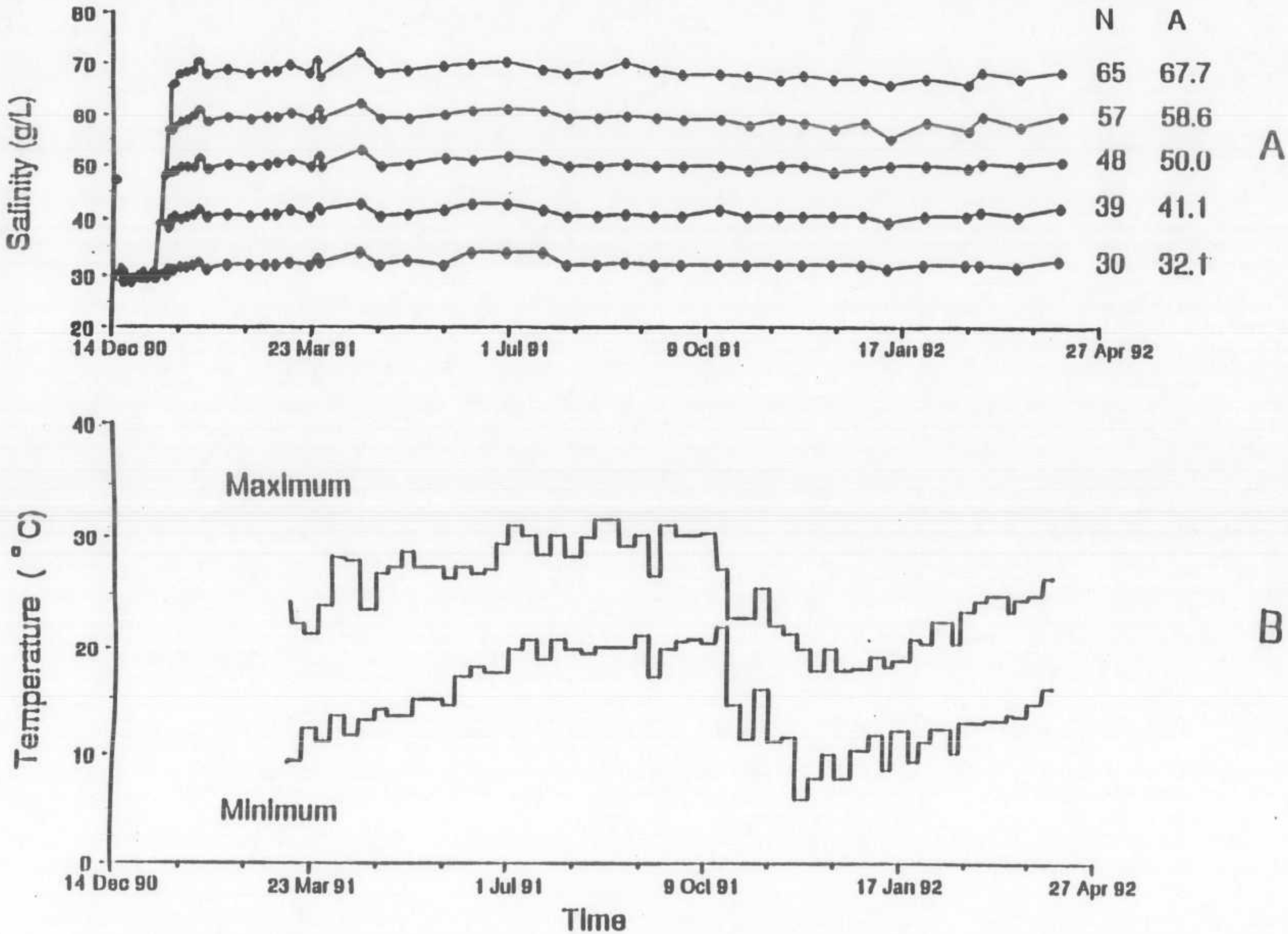

Fig. 3. Salinity (A) and maxiummu and minimum water temperatures (B) during the course of the experiment. Each salinity value ploted represents mean of 4 tanks. Temperature data represents averaged values for thermometer maintained in tanks (48A, 48C, 48D) over time.

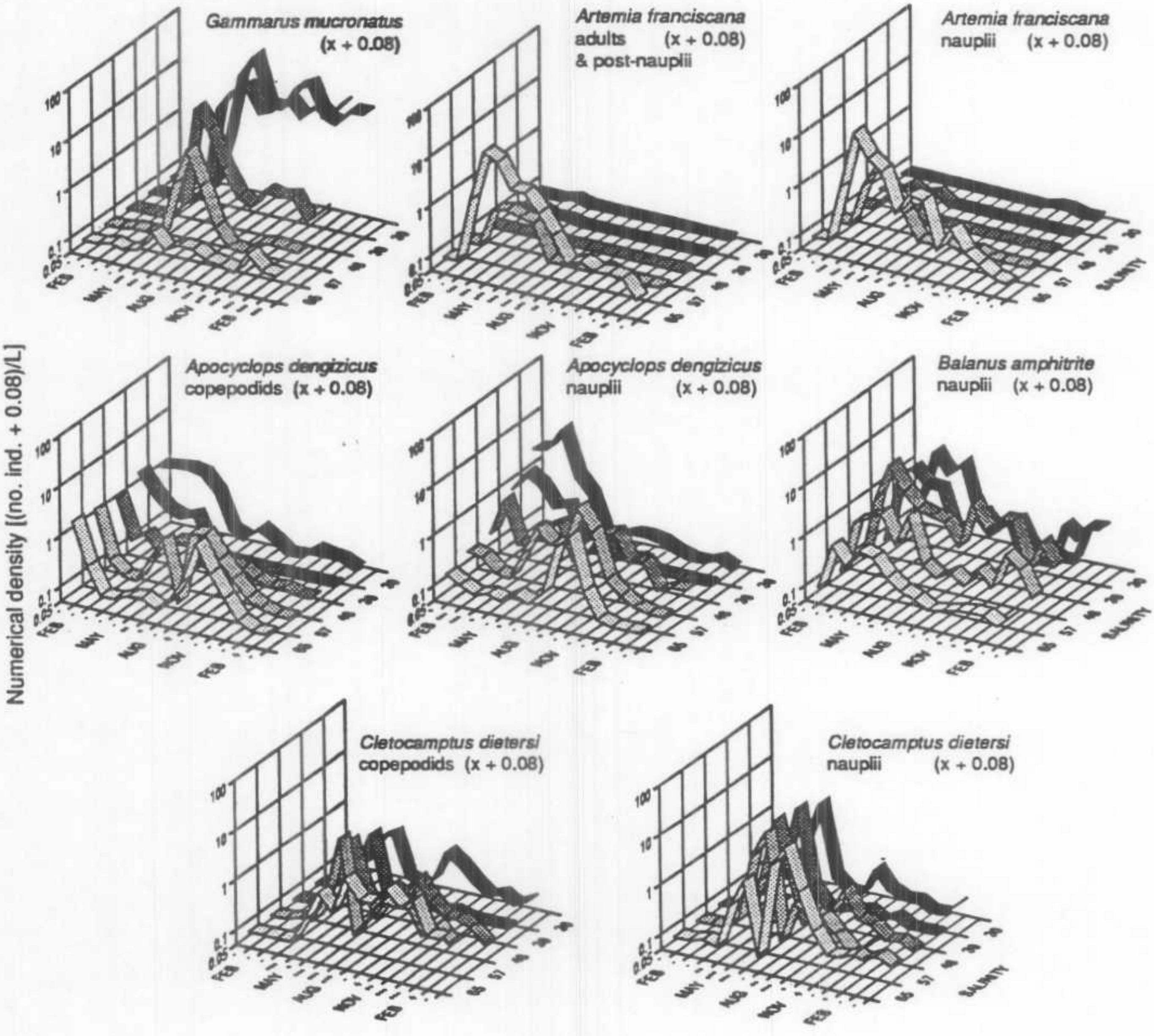

Fig. 4. Effects of salinity on geometric mean numerical densities of crustacean taxa. P values for date-by date ANOVAs are indicated by symbols as follows: -, $P > .1$; +, $.05 < P \leq .1$; •, $.01 < P \leq .05$; ••, $.001 < P \leq .01$; •••, $P < .001$. See text for explanation of the constant, 0.08.

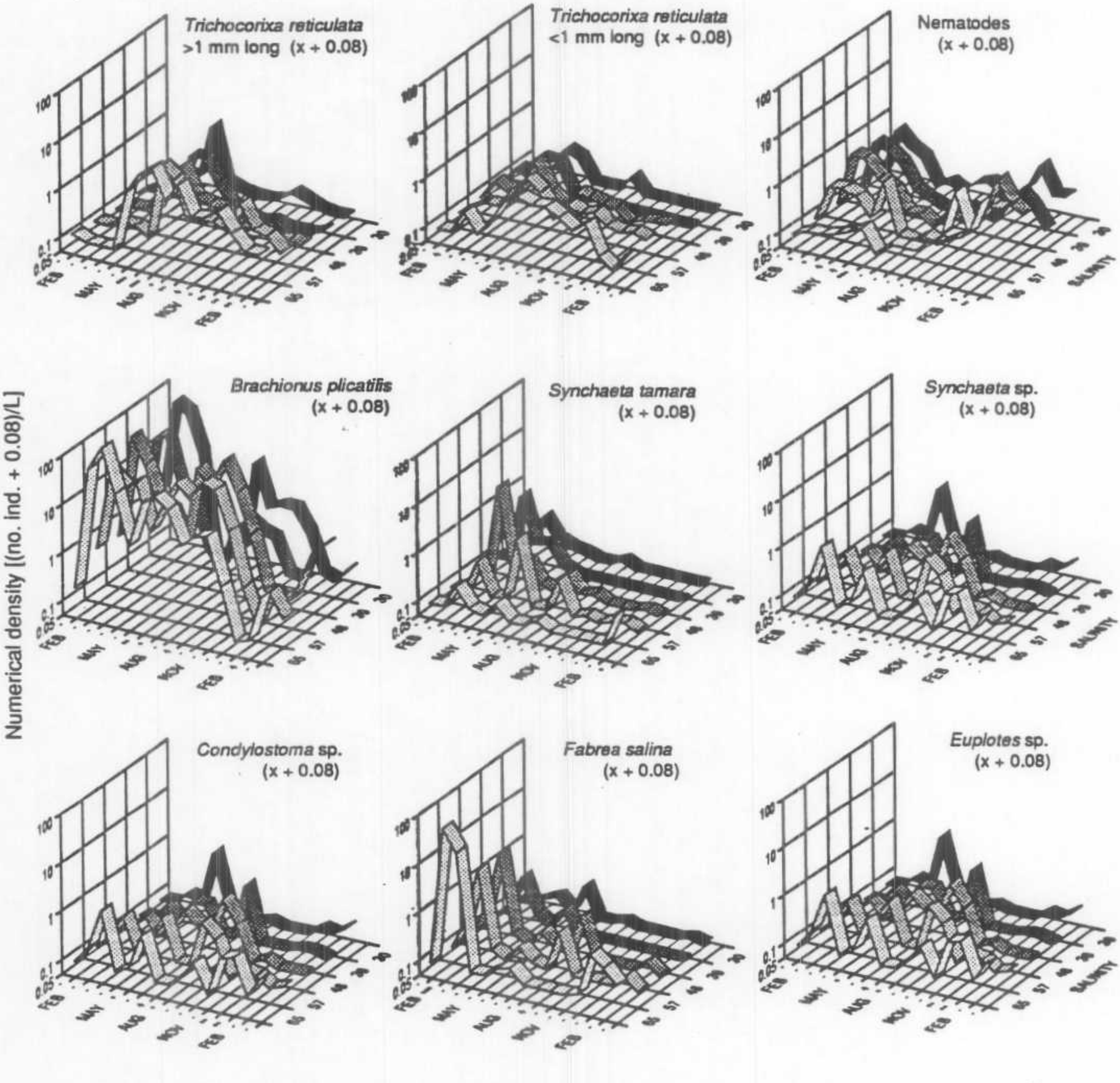

Fig. 5. Effects of salinity on geometric mean numerical densities of the principal non-crustacean taxa. Significance levels of date-by-date ANOVAs denoted as in Fig. 4. See text for explanation of the constant, 0.08.

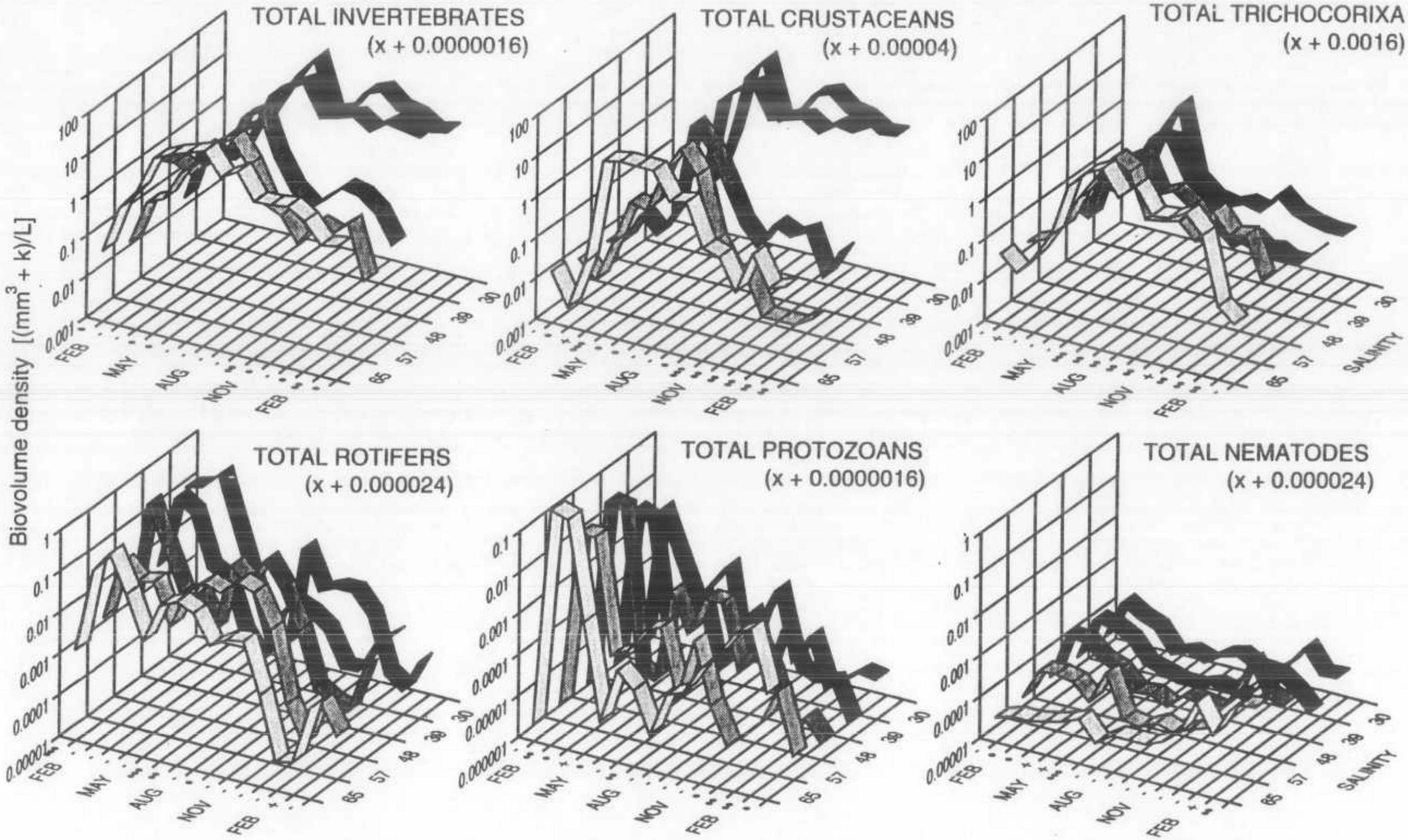

Fig. 6. Effects of salinity on geometric mean biovolume densities for major groups of invertebrates. Significance levels of date-by-date ANOVAs are denoted as in Fig. 4. Explanations of constants (k) added to data is given in the text.

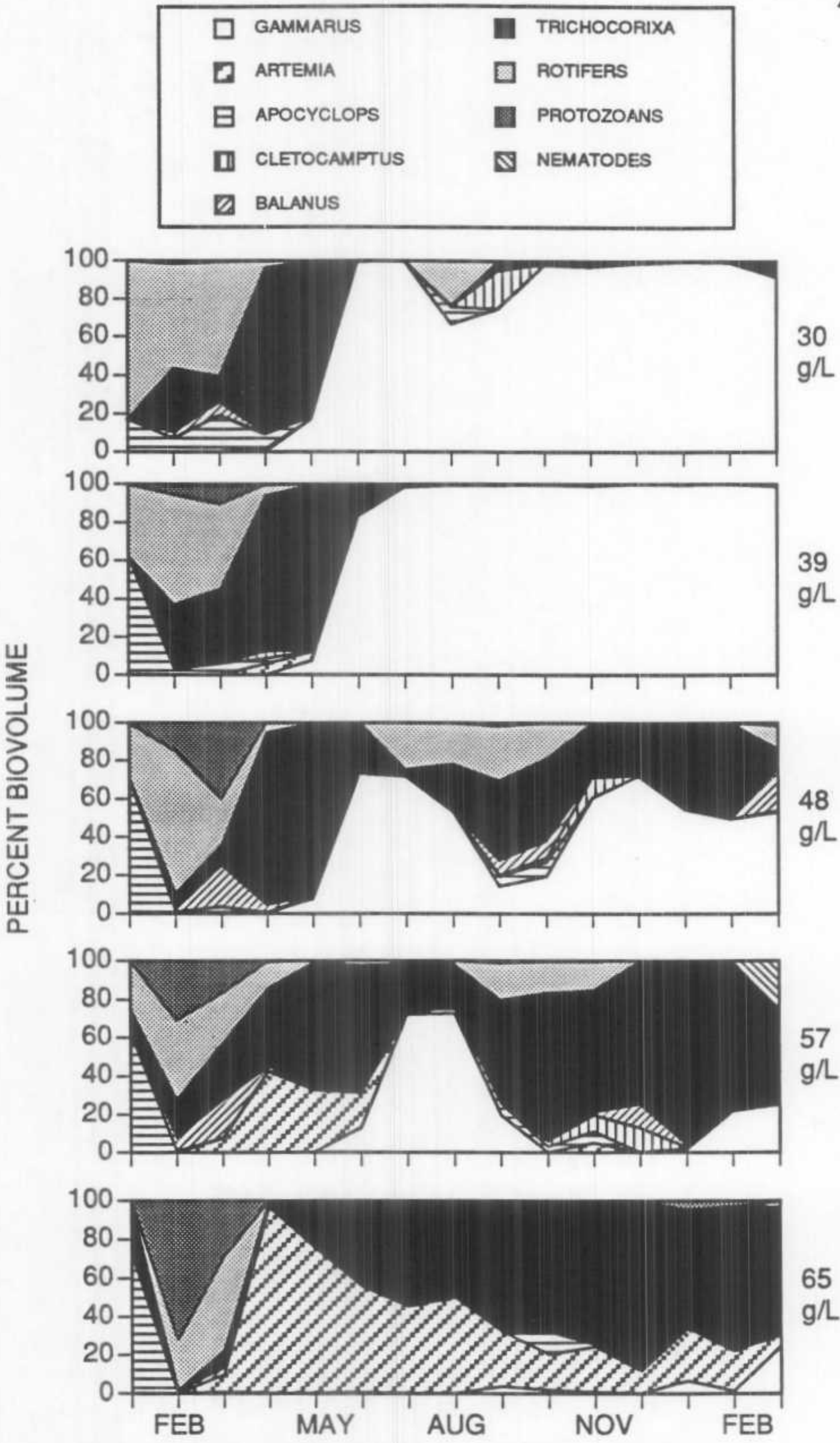

Fig. 7. Effects of salinity on the taxonomic composition of the invertebrate assemblages at five salinities (30, 39, 48, 57, and 65 g/L).

mucronatus), a brine shrimp (*Artemia franciscana*), one cyclopoid copepod (*Apocyclops dengizicus*), one harpacticoid copepod (*Cletocamptus dietersi*), and a barnacle (*Balanus amphitrite*).

Gammarus mucronatus was the most abundant crustacean. *Gammarus* was introduced into the tanks on April 8, first appeared in the May samples, and by June dominated the two lower salinities. *Gammarus* increased rapidly in May and June at the 4 lower salinities, but then decreased rapidly in the summer at 48 and 57 g/L (Fig. 4). Densities remained high throughout the experiment at 30 and 39 g/L. *Gammarus* was continuously present, but in very low numbers, at 65 g/L. Densities greatly decreased with increasing salinity.

Artemia franciscana was absent or rare at 30, 39, and 48 g/L. Densities were moderate at 57 g/L and high at 65 g/L in the spring, but declined to low levels in the summer (Fig. 4). The general trends for the *Artemia* adults/post-nauplii and nauplii are the same, and the presence of nauplii throughout the experiment indicate some reproduction at 65 g/L was taking place. The presence of a few nauplii at 30 g/L in December and January may have been due to contamination from the 65 g/L tanks.

Apocyclops dengizicus copepodids initially had the same densities at all 5 salinity treatments, perhaps a reflection of initial stocking rates. However, after January 1991, densities decreased in all salinities, most dramatically in the higher salinities (Fig. 4). Initially, nauplii decreased very sharply with increasing salinity (Fig. 4). In the summer the salinity effect reversed itself, and by September both copepodids and nauplii were more abundant at 57 and 65 g/L than at the lower salinities.

Cletocamptus dietersi was essentially absent the first few months of the experiment. Densities began to increase in all salinities in the spring (Fig. 4), but by April and May densities were highest at the lower salinities, 30 and 39 g/L, for both the copepodids and nauplii. However, this tendency was reversed in the summer (June, July, and August), and in the winter (November, December, and January) for the copepodids, and in June, August, September, October, and January for the nauplii, when highest densities were recorded at 65 g/L.

Salinity effects on *Balanus amphitrite* nauplii densities were notable on 4 dates. In June the highest densities occurred at 57 and 48 g/L and in the winter (November, December, and January) the highest densities were at 48 g/L (Fig. 4).

Total crustacean abundance initially increased at all salinities (Fig. 6). In April and May densities were greatest at the 65 and 57 g/L treatments. By June densities had increased at the lower salinities and there were high densities at all 5 salinities throughout August. For the remainder of the experiment densities were highest at 30 and 38 g/L and abundance in all three of the higher salinities decreased after August. Densities at the 65 g/L treatment remained greater than densities at 57 and 48 g/L. These patterns are primarily a reflection of the respective responses of *Gammarus* and *Artemia*.

Trichocorixa

Trichocorixa was the only insect collected by the water column samples. Total *Trichocorixa* abundance increased with increasing salinity (Fig. 6). Initially they increased rapidly and to about the same extent in all treatments. Then, from June through February of the experiment, *Trichocorixa* >1 mm were markedly more abundant at 57 and 65 g/L than at the lower salinities. However, in February *Trichocorixa* <1 mm highest densities were at 48, 39, and 30 g/L. Then from summer to early winter (June, July, and September to December) densities of *Trichocorixa* <1 mm were also markedly greater at the higher salinities.

Rotifers

Initially there were 6 taxa of rotifers present in high densities. These were *Brachionus plicatilis*, *Synchaeta tamara*, *Synchaeta sp.*, *Colurella sp.* and two unidentified species. However, after March only 3, *Brachionus* and the two *Synchaeta spp.* were abundant.

Brachionus plicatilis (Fig. 5) was the most abundant rotifer. It was present throughout the experiment, and found at all salinities. In June and July densities were notably higher at the higher salinities.

Synchaeta tamara (Fig. 4) densities were highest at 57 and 65 g/L on June and April 1992. *Synchaeta sp.* densities greatly decreased with increasing salinity for the first four months and had disappeared by June.

In February 1991, two unidentified rotifers were abundant at 48 and 39 g/L treatments. They were scarce or absent at higher salinities and by March they had completely disappeared from all treatments. *Colurella* was present from March - May. The highest densities also occurred at 39 and 48 g/L.

Total rotifer abundance initially reflected the higher densities of *Synchaeta sp.* at the lower salinities and later in June, July, and September, *Brachionus* densities at the higher salinities (Fig. 5).

Protozoans

Due to the mesh size of the net (55 μm), smaller species of protozoans were not collected in the samples. Some information on these species was obtained for phytoplankton samples and will be given in Gonzalez (in prep.). Three larger protozoans that were common in the invertebrate samples were *Condylostoma sp.*, *Fabrea salina*, and *Euplotes sp.*

Initially, *Condylostoma* increased rapidly at the beginning of the experiment (Fig. 5). By February they were more abundant at the three higher salinities. In April the populations greatly declined. However, the highest densities still occurred at the higher salinities in both April and July. During winter, (December, January, and February) densities were notably higher at 65 g/L.

Fabrea's highest density occurred at 65 g/L (Fig. 5). In February, *Fabrea* demonstrated a clear salinity effect. Numerical densities increased with increasing salinity. Densities declined rapidly in March and April and remained low for the remainder of the experiment, with the exception of a slight increase in September at 48 and 57 g/L treatments.

Euplotes was present at all salinities throughout the experiment. Notable differences among salinities were observed in May (highest densities at 30 g/L), in August (highest densities at 48 g/L), and in December - January (highest densities at 65 g/L).

Total protozoan abundance reflected the densities summed for *Condylostoma*, *Fabrea*, and *Euplotes* (Fig 3). Highest densities occurred at the higher salinities (58 and 65 g/L) in the spring (February - April 1991) and at the lowest salinities (30 and 39 g/L) in May. Then in July and for the rest of the winter (December, - April 1992) the highest densities occurred at the highest salinities.

Nematodes

Nematodes composed only a small portion of the total biovolume. From February through June 1991 the highest densities occurred at the lowest salinities (Figs. 5 and 6). However, this trend reversed and the highest densities were at the two highest salinities in June 1991, February, and April 1992.

Polychaetes

Neanthes succiena was not able to establish itself. One adult was collected in May at 39 g/L. *Neanthes* larvae were found in the April sample at two salinities 30 and 39 g/L, but at very low densities.

Total Invertebrates

Initially, (January) total invertebrate abundance was greatest at 30 g/L and lowest at 48 g/L (Fig. 6). In the spring, densities were greatest at 65 g/L. Then in the fall through the winter (October - February) the greatest densities occurred at the 30 g/L. The maxima at 30 and 39 g/L was a reflection of the density of *Gammarus* at the two lowest salinities, while the slight increase at 65 g/L was the result of the density of *Artemia* and *Trichocorixa* at the highest salinity.

Taxonomic Composition

The relative abundances of the different major taxa differed markedly among the different salinities (Fig 7). Initially, all treatments were dominated by rotifers and *Apocyclops*, with the rotifer:*Apocyclops* ratio decreasing with increasing salinity. Protozoans briefly reached their maximum in February, their relative abundance increasing with increasing salinity (Fig. 7). By April, *Trichocorixa* dominated the four lower salinities in terms of relative abundance and *Trichocorixa* and *Artemia* dominated the highest. For the latter two thirds of the experiment, there was complete dominance by *Gammarus* at the two lower salinities, *Artemia* and *Trichocorixa* dominated the highest salinity, and *Trichocorixa* and *Gammarus* along with a somewhat more diverse mixture of the remaining taxa dominated the intermediate salinities.

Effects Of Tilapia

Effects of tilapia on the abundance of individual taxa (Fig. 8) and on the taxonomic composition (Fig. 9) were very strong at both 39 and 57 g/L. Strong interactive effects of salinity and fish existed for many taxa on many dates. In most cases these reflected simply a marked fish effect at one salinity and the absence or rarity of the taxon in both fish and no-fish tanks at the other salinity.

At 39 g/L the most notable effects of tilapia were an approximate 99% reduction of *Gammarus* densities, with a consequent large reduction in total crustacean and total invertebrates, an approximately 90% increase in

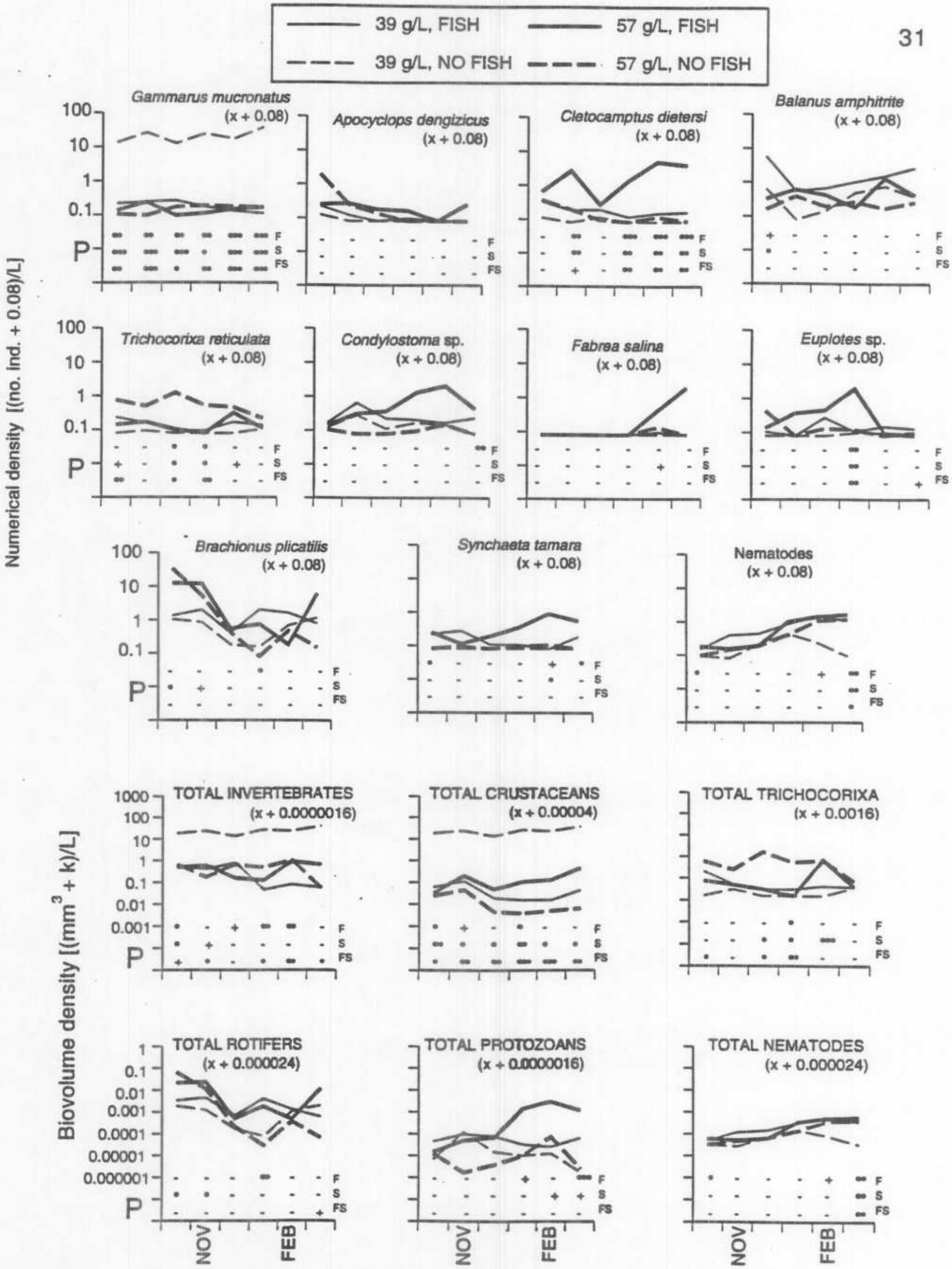

Fig. 8. Effects of fish (F) on abundance of invertebrates at two salinities (S). Results of date-by-date 2-way ANOVAs testing for main (F, S) and interaction (FS) effects are shown at bottom of each graph, with P values indicated as in Fig. 4.

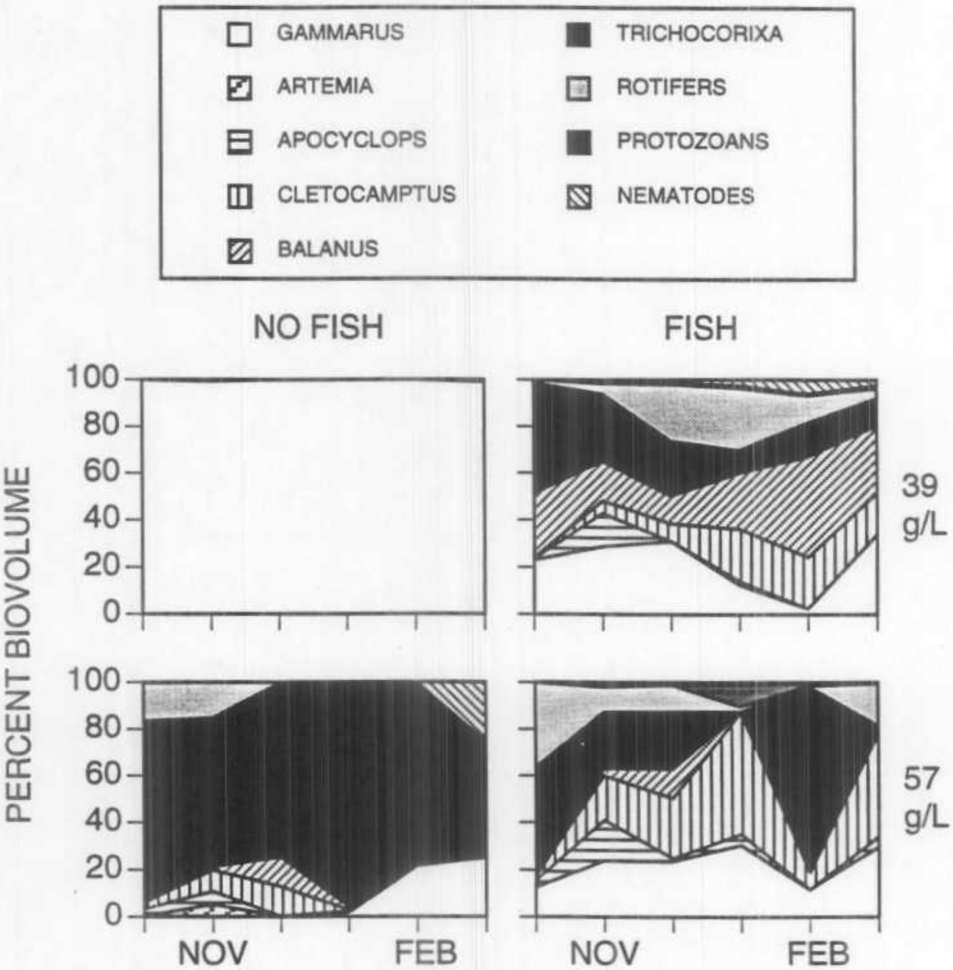

Fig. 9. Effects of tilapia (*Oreochromis mossambicus*) on the taxonomic composition of the invertebrate assemblages at two salinities (39 and 57 g/L).

Brachionus in January, and on the final sampling date an approximate 90% increase in nematodes and total protozoans.

At 57 g/L the presence of tilapia reduced *Trichocorixa* by 90 and 70% in December and January, respectively. The presence of fish caused a 90-99% increase in *Cletocamptus* in November, January, February and April. *Euplotes* and *Brachionus* densities increased by approximately 90% in January, *Condylostoma* densities increased by approximately 67% in April, and *Synchaeta* densities increased approximately 90% in February and April.

The relative abundances of the different major taxa at 39 and 57 g/L, were markedly affected by the presence of fish (Fig. 9). In the absence of fish there was strong dominance by *Gammarus* at 39 g/L and by *Trichocorixa* at 57 g/L from October - April. However, the presence of fish decreased the densities of *Gammarus* and *Trichocorixa* and was accompanied by increases in the relative abundances of the protozoans, rotifers, copepods, *Balanus*, and nematodes (Fig. 9).

Correlations Among Taxa

Numerical densities of *Gammarus*, *Artemia* and *Trichocorixa* on four sampling dates were graphed (Fig. 10) to more clearly display correlations. There were negative correlations between *Gammarus* and *Artemia*, and *Gammarus* and *Trichocorixa*. *Gammarus* densities were highest at the lower salinities and *Artemia* and *Trichocorixa* densities were greatest at the higher salinities (Fig. 10). There was frequently an inverse relationship between *Artemia* and *Trichocorixa* (Figs. 4, 5, & 10). Even though both had low densities at low salinities, at the two highest salinities *Artemia's* densities

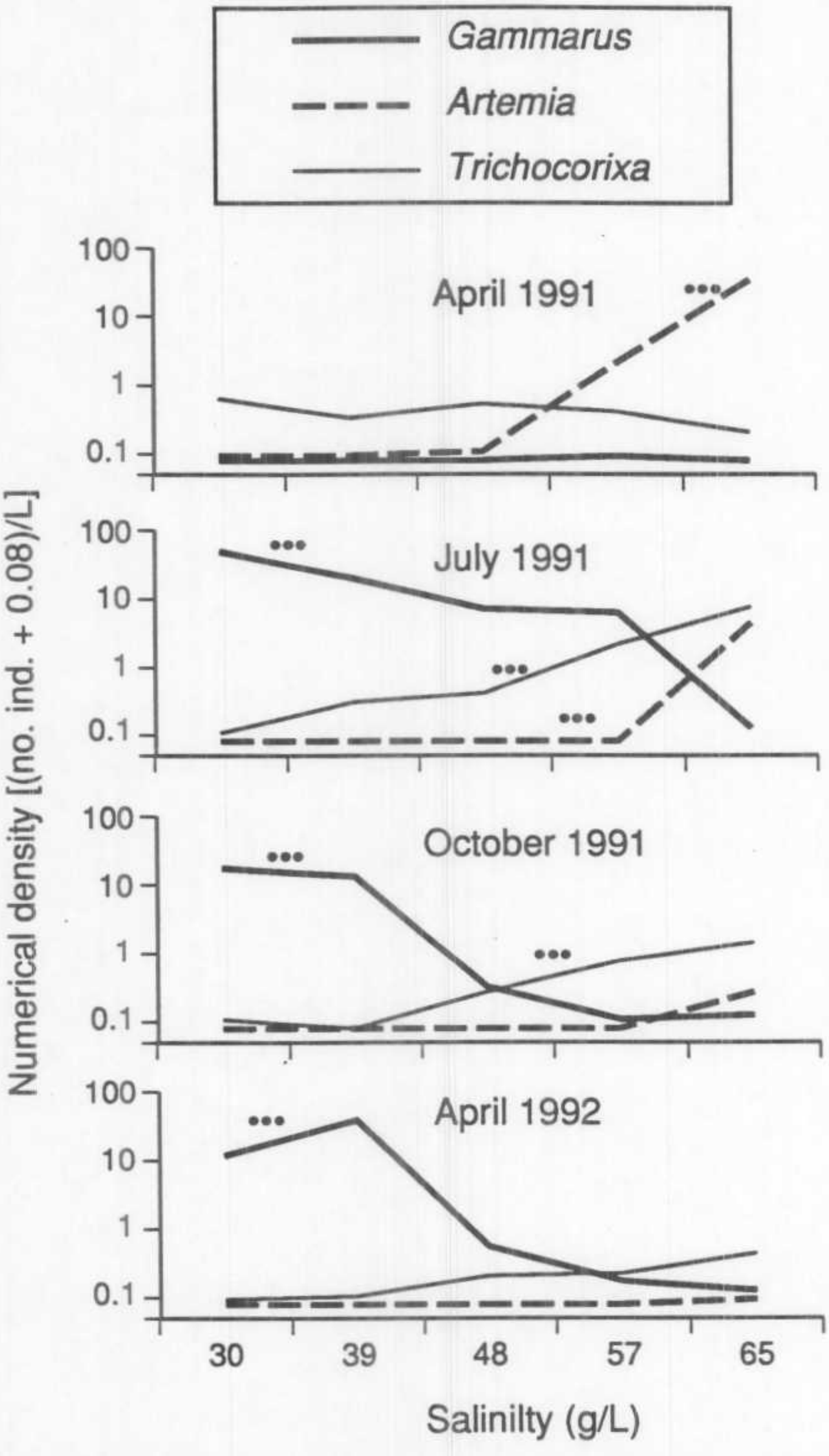

Fig. 10. Effect of salinity on three major invertebrates on four sampling dates; Significance levels of date-by-date ANOVAs denoted as in Fig. 4.

increased until April 1991 and then decreased until the end of the experiment, April 1992. *Trichocorixa's* numbers began to increase in April 1991, peaked in July, and then decreased, remaining greater than *Artemia* (Fig. 10).

An inverse relationship sometimes existed between *Gammarus* and *Apocyclops* densities. At 30 g/L *Apocyclops* decreased and remained low in April as *Gammarus* densities increased and remained high for the duration of the experiment (Fig. 4). At 57 and 65 g/L, *Apocyclops* and *Artemia* exhibited an inverse relationship. In March, *Apocyclops* decreased and *Artemia* increased. Then *Artemia* decreased throughout the spring and summer (April - September) as *Apocyclops* increased in the summer and fall (August - October). Artemia densities increase slightly in October - January at 65 g/L, while *Apocyclops* densities decrease (Fig. 4).

There was a negative correlation between *Fabrea* and *Artemia* at 65 g/L (Figs. 4 & 5). *Fabrea* densities increased in February and March and fall quickly in April, as *Artemia* densities increase. *Fabrea* densities remain low until December when there is a slight increase following a decline in *Artemia* densities.

The presence of fish greatly reduced the densities of *Gammarus* at 39 g/L and *Trichocorixa* at 57 g/L (Fig. 8). These reductions were associated with increases in the other invertebrates. At 39 g/L the decrease in *Gammarus* is correlated with a dramatic increase in rotifers, *Balanus*, and *Cletocamptus* and some increase in *Trichocorixa* and nematode densities (Fig. 8). At 57 g/L the decrease in *Trichocorixa* is associated with an increase in *Cletocamptus*, rotifers, *Apocyclops*, and protozoan densities (Fig. 8).

DISCUSSION

The Microcosm Foodweb

A schematic of the microcosm foodweb given in Fig. 11 is helpful for interpreting results. All of the taxa present are dependent on the phytoplankton and periphyton, if not as adults, than as nauplii or juveniles (Fig. 11).

Amphipods are thought to play an important role as herbivores and as food for predators in the littoral of saline lake ecosystems at lower salinities (Hammer 1986). *Gammarus* is generally thought to be a voracious grazer feeding on bacteria, photosynthetic microeukaryotes and macroalgae (La France and Ruber 1985, Smith et al. 1982, Zimmerman et al. 1979) and primarily a benthic organism. Although many amphipods supplement their diet by catching small animals, strictly predace ous feeding is thought to be uncommon (Barnes 1987). However, Hunte and Myers (1984) reported that *Gammarus mucronatus, Gammarus tigrinus and Gammarus lawrencianus* adults cannibalized juvenile gammarideans in plastic containers in the laboratory, and *Gammarus pulex* preys upon an isopod *Asellus aquaticus* (Bengtsson 1982). Savage (1980) found *Gammarus tigrinus* would feed upon both Corixidae (up to 3rd instar nympths) and Gammaridae (up to 2.5 mm) in a lake, and in our laboratory unstarved *Gammarus mucronatus* has been observed to prey upon all sizes of *Artemia*.

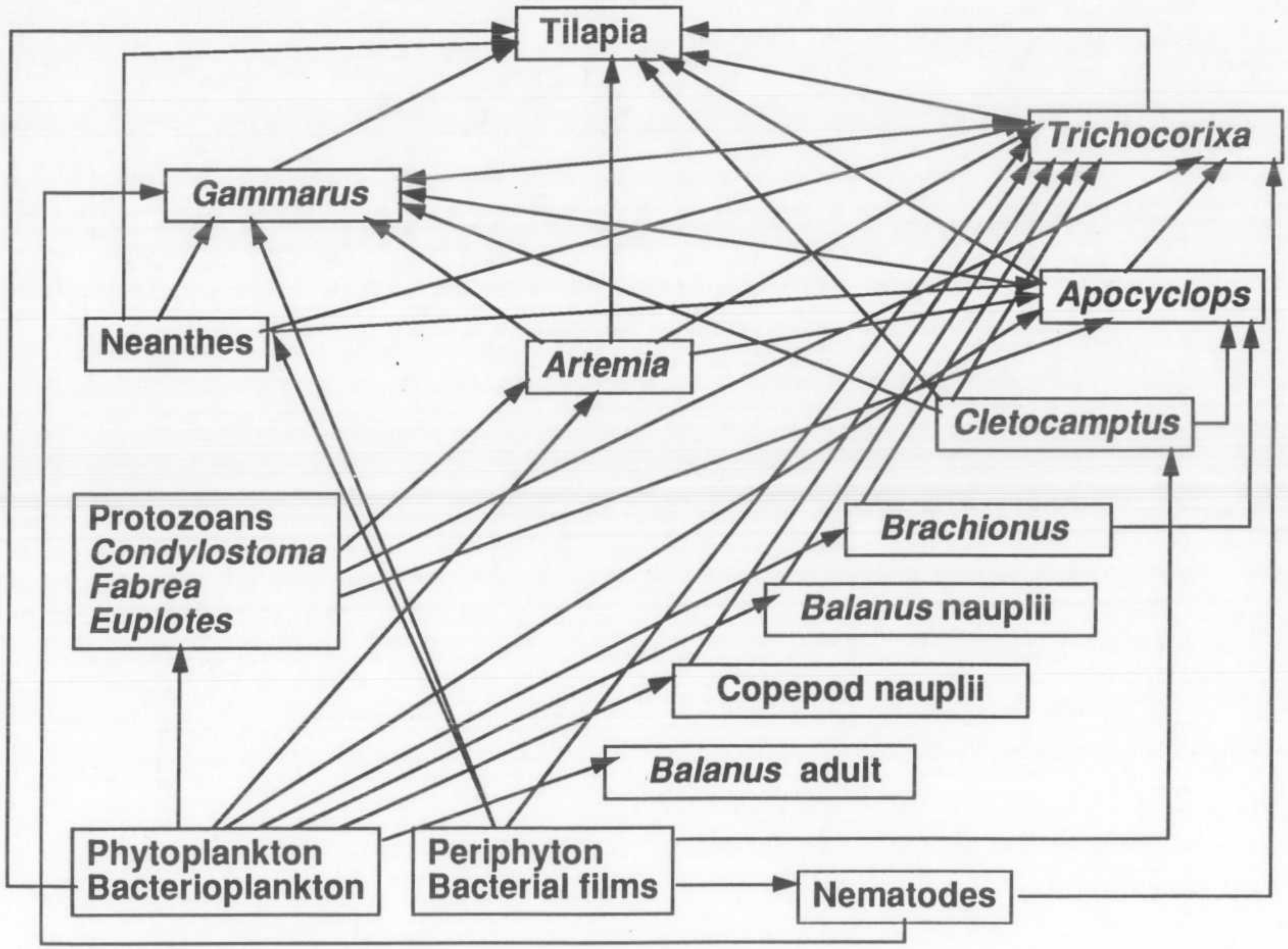

Fig. 11. A proposed foodweb for the microcosm ecosystem.

Artemia are efficient filter-feeders that feed upon bacteria, algae and protozoans that most often inhabit hypersaline (>80 g/L) waters (Hammer 1986) (Fig. 11). *Artemia* are well suited for this type of ecosystem because of their ability to osmoregulate, utilize oxygen at low concentrations, and tolerate broad temperature changes (Hammer 1986). *Artemia* is also known to be capable of tolerating extreme salinity ranges, though they are most often found in salinities 100 g/l or greater. It has been suggested that *Artemia* is capable of inhabiting lower salinities, but predaceous vertebrates and invertebrates probably prevent them from doing so (Edmondson 1966; Kristensen and Hulscher-Emeis 1972; Persoone and Sorgeloos 1980; Bhargava et al. 1987; Hammer and Hurlbert 1990; Wurtsbaugh 1991).

Corixids are considered omnivores, eating algae as well as scavenging and preying upon chironomid larvae, mosquito larvae, copepods and cladocerans (Tones 1976), as well as *Artemia* (Wurtsbaugh 1990, 1991). *Trichocorixa* in the microcosms were most likely feeding upon *Artemia*, copepods, protozoans, and periphyton (Fig. 11). *Trichocorixa verticalis* are euryhaline having been reported in salinities up to 90 g/L. *Trichocorixa reticulata* was acclimated to water ranging from fresh to 300 ppt in a laboratory setting (Jang and Tullis, 1980). Investigations of evaporation basins in the southern San Joaquin Valley found *Trichocorixa reticulata* at salinities from 7 - 70 g/L (Parker and Knight 1992).

Apocyclops is a predaceous copepod that has been shown to feed on protozoans, rotifers, and other copepods, as well as on *Artemia* (Hammer and Hurlbert 1990). *Apocyclops dengizicus* is peculiar to arid regions. It has been found in salinities from 4 - 69 g/L (Hammer 1986, Timms 1993). In the laboratory Dexter (1993) found that *Apocyclops dengizicus* could survive in salinities as high as 107 /L for 60 days, however reproduction greatly decreased at salinities above 68 g/L. *Cletocamptus* is a benthic harpacticoid that feeds essentially on bacteria, algae and protozoans attached to sand grains, algae, or sea grasses (Hammer 1986, Barnes 1987) (Fig. 11).

Oreochromis mossambicus is found at the top of the foodweb in the microcosms. Tilapia are both planktivores and opportunists (Pullin 1982), feeding on the larger invertebrates present in the microcosm (Fig. 11).

Gammarus And Salinity

Gammarus appeared to be sensitive to the higher salinities. There was a steady decline in numbers as the salinity increased. *Gammarus mucronatus* has been reported in estuaries and coastal areas with salinities as low as 4 g/L (Barnard and Gray 1968) as well as in hypersaline lagoons of up to 50 g/L (Hedgepeth 1967). LaFrance and Ruber (1985) found *Gammarus mucronatus* to be strongly associated with the presence of floating algal mats in salt marshes. They hypothesized that the relationship was nutritional as well as providing refuge from fish and other predators. In a laboratory setting *Gammarus mucronatus* survived in salinities up to 79 g/L with no observable salinity effects on survival (D. Dexter, Dept. of Biology, SDSU, pers. comm.). However, this was without the added stress from competition and other interactions with other species. It is likely that the added pressure from interactions with other species and environmental stresses, decreased its tolerance to salinity in the microcosms.

Invertebrate Predator-Prey Interactions

This study has shown that *Gammarus* was the most abundant invertebrate collected in the samples at the two lowest salinities. The best explanation for the scarcity of the other invertebrates at the lower salinities is that in addition to being a voracious grazer, *Gammarus* is an opportunistic predator feeding perhaps on slow moving large ciliates, nematodes, rotifers, crustacean nauplii, *Trichocorixa* and their eggs, or *Artemia.*

If the diet of *Gammarus* is restricted to attached algae, macroalgae and photosynthetic microeukaryotes, it would seem unlikely to competitively exclude filter feeders such as rotifers, *Artemia*, *Balanus*, and large ciliates or predators such as *Trichocorixa* and *Apocyclops*. However, at the two lowest salinities, *Gammarus* completely dominated the community. The negative interactions observed between *Gammarus* and *Trichocorixa*, *Artemia*, *Apocyclops*, *Balanus*, and nematodes in this experiment lends support for this hypothesis, and suggests that more research is needed to determine their feeding habits under varying conditions and whether its diet is perhaps more diverse than previously thought.

Additional support was found when unstarved *Gammarus* were placed in vials with *Artemia* to observe if any interaction occurred. Both juvenile and adult *Gammarus* would immediately attack and ingest large and small *Artemia*. It is therefore, likely that *Gammarus* preyed upon *Artemia* and possibly the eggs of *Artemia* in the microcosms.

Savage (1980) describes a similar negative interaction between the densities of *Gammarus tigrinus* and a corixid, *Sigara lateralis* at a like in

England. Increases in temperature and salinities (1-5 g/L) and the loss of sub-aquatic vegetation, correlated with the increase of *Gammarus tigrinus* and extirpation of *Sigara lateralis* and *Gammarus dubeni*. Savage (1980) postulated the exclusion of *Sigara lateralis* and *Gammarus dubeni* was due to the demand for similar food sources and also by direct predation. Savage noted the virtual absence of *Sigara lateralis* juveniles, which prevented breeding a year later.

Predation by *Trichocorixa* on *Artemia* seems the most likely explanation for the observed negative correlations between these two species. *Trichocorixa* is a predator that has been found to prey upon *Artemia* and greatly affect their densities. Wurtsbaugh's (1989, 1991) investigation of the Great Salt Lake found an inverse relationship between *Artemia* and *Trichocorixa verticalis*. Additionally Wurtsbaugh (1991) observed strong predation by *Trichocorixa* on *Artemia* in a microcosm experiment. *Trichocorixa verticalis* limited *Artemia* abundance by preying on nauplii or other juvenile stages. Protozoans benefited by the predation of *Trichocorixa verticalis* on *Artemia*. Densities of protozoans increased with the increase of *Trichocorixa verticalis*.

The negative correlation between *Artemia* and *Apocyclops* is most likely explained by a predator-prey relationship. Kristensen (1965) found *Artemia* in salinities from 10 to 200 g/L if there was no predation or competition with other macro species. Apocyclops sp. has been found to be an effective predator of *Artemia* nauplii and adults (Hammer and Hurlbert 1990, Kristensen 1965) and to survive in salinities up to 89 g/L. *Apocyclops dengizicus* has been found to survive and reproduce in salinities up to 68 g/L in the laboratory (Dexter 1993). Though our results do not confirm this predator-prey relationship, they do show a negative interaction between the two. This suggests that *Apocyclops* could have preyed upon *Artemia*, helping to cause *Artemia* densities to decrease in the summer and fall.

Competitive Interactions

Artemia most likely affected the protozoan densities through competition, both feeding on phytoplankton. *Artemia* is an indiscriminate filter-feeder (Persoone and Sorgeloos 1980), size of particle being the major determinant of food intake. Dobbeleir, Adams, Bossuyt, Bruggeman, and Sorgeloos (1980) determined that particle size should be less than 50 μm for food used in *Artemia* culturing methods. Therefore the larger protozoans collected in our net were probably not preyed on by the *Artemia*.

Grazing by *Artemia* on phytoplankton has been implicated in the negative correlations between *Artemia* densities and phytoplankton densities (Anderson 1958, Mason 1967, Wirick 1972). In laboratory experiments peak filtering rates were measured between 150 and 250 ml/adult/day (Reeve 1963, Lenz 1982), and at this feeding rate, 4-7 adult *Artemia*/L would clear the water column once per day (Lenz 1987). The protozoans collected by the tube sampler and net were generally greater than 50 μm, which makes it probable that any negative correlation was due to competition rather than predation. Though it should be noted that is possible that *Artemia* filter smaller forms and may prey directly on smaller protozoans or rotifer eggs. However, their ability to digest these forms is unclear, more research in this area is needed.

Wurtsbaugh (1991) noted that the densities of protozoans increased with the decrease in *Artemia* and an increase in *Trichocorixa*. Wurtsbaugh (1991) additionally, found an inverse relationship between *Artemia* and rotifers and copepods. He gave three possible explanations, predation from *Artemia* adults, exploitative competition for bacteria, or interference competition had caused the decline of zooplankton in the microcosms. This is supported by other studies that show large grazers may decrease microzooplankton populations either through competition or predation (Porter et al. 1979; Gilbert 1989). *Artemia's* increase in March is correlated with a decrease in *Fabrea*, *Condylostoma*, and *Brachionus* at the higher salinities and a low density of nematodes at the higher salinities initially (Figs. 4, & 5). It is also correlated with a 99% reduction of attached algae in the microcosms and a large decrease in phytoplankton (Gonzalez in prep.). Furthermore, in Fig. 8, it is apparent that at the two higher salinities, the densities of protozoans and rotifers is lowest if *Artemia* densities are greater than *Trichocorixa* densities.

Fish and Community Structure

There is extensive literature on the effects of fish predation on freshwater zooplankton assemblages. However there are relatively few studies that have looked at the effects of fish predation on zooplankton assemblages in saline systems, where invertebrate predators are often the top predator. Top predators play an important role in structuring the lower trophic levels.

Invertebrate eating fish have been shown to directly influence densities of large invertebrate predators or grazers (Hall et al. 1976, Hurlbert and Mulla1981, Salki et. al. 1984, Hanazato and Yasuno 1989, Blois-Heulin et al. 1990). Fish selectively eat the larger zooplankters altering the structure of the zooplankton community (O'Brien et al. 1976, O'Brien 1979, Zaret 1980, and Lazzaro 1987). In the microcosms, predation by tilapia on *Gammarus* at the lower salinities caused the marked decrease in *Gammarus* densities. The loss of this predator is the most likely explanation for the increase in densities of *Balanus*, *Brachionus*, and nematodes. At the higher salinity, tilapia preyed upon *Trichocorixa*, causing the decline in their densities. This in turn caused an increase in the smaller zooplankters, *Cletocamptus*, *Condylostoma*, *Fabrea*, *Euplotes*, and *Synchaeta*.

Ecological Change At The Salton Sea

During this study (1991-1992), the Salton Sea was at 47 g/L. The Salton Sea's littoral zone supports a variety of invertebrate species including: *Gammarus*, *Trichocorixa*, *Balanus*, *Apocyclops*, *Cletocamptus*, as well as rotifers, protozoans, and nematodes. Fish and birds play an important role as top predators in this ecosystem. As the salinity in the Salton Sea continues to increase a large change in the community can be expected. It is unlikely that fish will be present in the Salton Sea when the salinity reaches 60 g/L. The decline of fish will lead to a change in the bird population from fish and invertebrate eating birds to only invertebrate eating birds. This will also effect the overall structure of the invertebrate community.

Various invertebrate species are likely to be intolerant to the higher salinities and so fewer competitors will be present.

Our results suggest that as the salinity increases to 50 g/L one can expect that *Gammarus* densities will decrease substantially, and the *Trichocorixa* densities will increase due to the loss of this predator. *Trichocorixa* will dominate the invertebrates present in the Salton Sea in the 50 to 65 g/L range. The remaining invertebrate population will be reduced perhaps consisting of *Brachionus*, a few protozoans, and *Cletocamptus*. One can also expect that between 55 and 60 g/L the fish population will decline and there will be a change to only invertebrate eating birds and a marked increase in *Trichocorixa* densities. The increase in Trichcorixa will be accompanied by a decrease in the remaining microzooplankters densities. An additional effect of the loss of fish in the lake will be the appearance of *Artemia*. However at this salinity range, densities of *Artemia* would be low due to predation by *Trichocorixa*. If the salinity was allowed to increase to 100 g/L or more, the invertebrate composition would likely consist of *Artemia*, a few protozoans, the brinefly *Ephydra sp.*, and birds preying on the *Artemia* and the brinefly pupae. This scenario is very similar to Wurtsbaugh's description of the Great Salt Lake (1991), an invertebrate assemblage of one rotifer, two copepods, *Artemia* and *Trichocorixa* at 50-100 g/L and only *Artemia* at high salinities (<100 g/L). It is certain however, that as the salinity continues to increase, an overall change in the taxonomic composition of the Salton Sea biota can be expected due to salinity intolerance and the biotic interactions.

CONCLUSIONS

In an investigation of the effects of increasing salinity on an ecosystem, there is a need to examine the entire community. The results of this study have made it apparent that in addition to the physiological stresses imposed by an increase in salinity, biotic interactions will determine the structure of a community. Therefore, physiological studies are not sufficient to predict changes to the community. Microcosm experiments investigating salinity effects are an excellent tool for this investigation. They allow for control of the manipulated factor(s) while mimicking natural conditions as close as possible.

As the salinity in the Salton Sea continues to increase, large changes in the invertebrate community are inevitable. This investigation has allowed us to predict some of those changes to the invertebrate community and to speculate on effects to the entire ecosystem.

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APPENDICES

APPENDIX A

INOCULATION OF TANKS

Appendix A

Inoculation Of Tanks

Table A-1. Dates and salinitites (g/L) of plankton inoculation (NS designates no sample was taken).

Date Eight Inoculation Sites	1/16/91 g/L	2/7/91 g/L	2/28/91 g/L	5/2/91 g/L	8/21/91 g/L
Johnson St. (North-West End)	39	28	14	22	6
86th St. (North-West End)	4	3	2	8	2
White Water River (North End)	2	1	1	4	2
84th St. Hypersaline Pond (East Side)	115	90	50	82	142
84th St. Isolated Part of Lake (East Side)	40	46	NS	60	NS
Niver's Dock (East Side)	41	43	36	42	41
Unocal Hypersaline Pond (South End)	182	180	NS	204	270
Obsidean Bute (South End)	47	48	NS	48	52
Pond Near Alamo River (South End)	32	30	30	35	70
Salton Sea (South End)	NS	NS	NS	38	NS

Table A-2. Numbers and dates of neuston, benthos, and larger plankters inoculated into each tank.

Date	Inoculation	No. of organisms per tank
01/17/91	*Neanthes*	2
02/08/91	*Ephydra* pupae - 5 buckets set out for access to tanks	-
03/01/91	*Neanthes*	7
03/12/91	*Artemia* eggs	3750
03/22/91	*Artemia* nauplii	1500
04/08/91	*Gammarus*	10
04/10/91	*Ephydra* pupae buckets refilled	-
05/07/91	*Artemia* eggs	1000
05/24/91	*Artemia* nauplii	750
05/29/91	*Cletocamptus*	172-200

APPENDIX B

FISH WEIGHTS/LENGTHS AND DATES OF PLACEMENT INTO THE TANKS

Appendix B
Fish Weights/Lengths And Dates Of Placement Into The Tanks

	39F-A	39F-B	39F-C	39F-C	58F-A	58F-B	58F-C	58F-D
7/7/91	Placed directly into tank	Placed directly into tank	Placed directly into tank	Placed directly into tank	Placed directly into tank	Placed directly into tank	Placed directly into tank	Placed directly into tank
7/8/91	Dead/removed fish	Dead/removed fish	Dead/removed fish					
7/16/91				Missing	Removed	Removed	Removed	Removed
9/13/91	Placed bucket with fish into tank 8.2 g 6.5 cm	Placed bucket with fish into tank 8.8 g 6.5 cm	Placed bucket with fish into tank 6.0 g 6.1 cm	Placed bucket with fish into tank 12.4 g 7.3 cm	Placed bucket with fish into tank 6.2 g 5.9 cm	Placed bucket with fish into tank 5.8 g 5.7 cm	Placed bucket with fish into tank 12.2 g 7.4 cm	Placed bucket with fish into tank 6.9 g 6.1 cm
9/15/91	Dead/replaced fish 12.6 g 7.3 cm							Dead/replaced fish 8.1 g 4.4cm
9/25/91								Unhealthy, replaced fish with another fish 4.4 g 5.1 cm
9/28/91	Released fish from bucket	Released fish from bucket	Released fish from bucket	Released fish from bucket	Released fish from bucket	Released fish from bucket	Released fish from bucket	Released fish from bucket
10/2/91	Dead/removed fish							
10/8/91	Placed bucket with fish into tank 9.5 g 6.8 cm							
10/10/91	Released fish from bucket							
12/6/92	Dead/removed fish and did not replace							
4/6/92	Died 12/6/92	24.18g 9.0cm Female	Missing	27.83 g 9.9 cm Male	34.99 g 10.0 cm Male	36.72 g 10.02 cm Male	13.98 g 7.99 cm Female	Missing

APPENDIX C

COUNT DATA FOR INDIVIDUAL TAXA
AT FIVE SALINITIES

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Gammarus mucronatus total (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	0	0	0.25	17.34	30-A	53.88	0.83	9.92	39.84	73.34	12.09	8.17	4.17	6.5
30-B	0	0	0	0	0.5	48.66	30-B	41.75	0.25	0.08	3.09	4.25	0.59	0.58	1.41	0.83
30-C	0	0	0	0	2.91	3.59	30-C	54.21	75.59	13.67	25.16	23.58	33.08	4.91	54.67	25.66
30-D	0	0	0	0	0.58	29.75	30-D	45.13	58.41	57.83	30.16	49.58	6.84	28.59	47.68	116.86
39-A	0	0	0	0	0.17	15.09	39-A	7.92	16.17	15.34	41.41	35.42	7.75	10.42	14.42	46.08
39-B	0	0	0	0	0	2.66	39-B	21.17	9.41	1.16	7.42	13.08	19	8.84	46.26	32.5
39-C	0	0	0	0	0.17	0.75	39-C	9.25	45.29	31.76	4.67	5.16	5.83	85.49	5.83	22.91
39-D	0	0	0	0	0.08	26.67	39-D	101.92	129.46	18.59	20.58	187.87	29.75	49.5	25	62.75
39F-A	0	0	0	0	0.25	12.75	48-A	13.75	4.66	0.17	0.33	4.17	3.5	1.92	1.09	0.17
39F-B	0	0	0	0	0.17	11.25	48-B	6.92	1.5	0.33	1.17	4.91	1.34	4.16	0.42	0.49
39F-C	0	0	0	0	0.25	18.75	48-C	22.8	1.08	0.74	0.17	0.17	0.5	0.58	0.08	4.25
39F-D	0	0	0	0	0.08	9.16	48-D	1.16	0.33	0.5	0	0	0	0	0	0.08
48-A	0	0	0	0	0.08	10.51	57-A	8.17	1	0	0	0	0	0.34	0.08	0
48-B	0	0	0	0	0.08	23.09	57-B	9	4.33	1.25	0	0	0	0	0	0
48-C	0	0	0	0	0.08	37.76	57-C	6.5	1.92	0.08	0.17	0	0.5	0.42	1	1.66
48-D	0	0	0	0	0.08	8.17	57-D	3.08	0.24	0.08	0	0.08	0.16	0	0	0
57-A	0	0	0	0	0	1.75	65-A	0.08	0.08	0.34	0.08	0	0	0.17	0.08	0.08
57-B	0	0	0	0	0	0.58	65-B	0	0.08	0.25	0	0.08	0	0.08	0.25	0
57-C	0	0	0	0	0	0.25	65-C	0	0.17	0	0	0.08	0.08	0.25	0	0
57-D	0	0	0	0	0.08	0.92	65-D	0.16	0.08	0	0.16	0	0	0.25	0	0.17
57F-A	0	0	0	0	0	0.25										
57F-B	0	0	0	0	0	1.42										
57F-C	0	0	0.17	0	0	3.58										
57F-D	0	0	0	0.17	0	3.17										
65-A	0	0	0.08	0	0.08	0.34										
65-B	0	0	0	0	0	0.16										
65-C	0	0	0	0	0	0.08										
65-D	0	0	0	0	0	0.16										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Artemia franciscana nauplii (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	0	0	0	0	30-A	0	0	0	0	0	0.08	0	0	0
30-B	0	0	0	0	0	0	30-B	0	0	0	0	0	0	0	0	0
30-C	0	0	0	0	0	0	30-C	0	0	0	0	0	0	0.08	0	0
30-D	0	0	0	0	0	0	30-D	0	0	0	0	0	0	0	0	0
39-A	0	0	0	0.17	0	0	39-A	0	0	0	0	0	0	0	0	0
39-B	0	0	0	0	0.17	0	39-B	0	0	0	0	0	0	0	0	0
39-C	0	0	0	0	0	0	39-C	0	0	0	0	0	0	0	0	0
39-D	0	0	0.08	0	0	0	39-D	0	0	0	0	0	0	0	0	0
39F-A	0	0	0	0	0	0	48-A	0	0	0	0	0	0	0	0	0
39F-B	0	0	0	0	0	0	48-B	0	0	0	0	0	0	0	0	0
39F-C	0	0	0.25	0	0	0	48-C	0	0	0	0	0	0	0	0	0
39F-D	0	0	0.42	0	0.67	0	48-D	0	0	0	0	0	0	0	0	0
48-A	0	0	0	0.17	0.08	0	57-A	0	0	0	0	0	0	0	0	0
48-B	0	0	0.08	0	0	0	57-B	0	0	0	0	0	0	0	0	0
48-C	0	0	0.25	0	0	0	57-C	0	0	0.17	0	0	0	0	0	0
48-D	0	0	0.08	0	0	0	57-D	0	0	0	0	0.08	0	0	0	0
57-A	0	0	0.25	4.17	9.5	0.25	65-A	2.29	0	0	0	0.17	0	0	0.08	0
57-B	0	0	0.17	0.08	0	0	65-B	0.67	3	0.33	0	0	0	0	0	0
57-C	0	0	0.67	0.33	0	0	65-C	0.75	17	40	0	0.17	0.25	0.17	0	0
57-D	0	0	0.67	2.25	0	0.25	65-D	0	1.67	3.33	1.5	18.67	0.75	0.17	0	0
57F-A	0	0	0.42	1.92	1.58	0										
57F-B	0	0	0.42	12.33	4.75	1.42										
57F-C	0	0	1	0.75	0.17	0.08										
57F-D	0	0	0.5	5.08	1.08	0.83										
65-A	0	0	0.75	11	1.42	2.92										
65-B	0	0	1	30.21	1.33	13.5										
65-C	0	0	1.25	13.17	52.17	3.58										
65-D	0	0	1	13.08	8.58	1										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Artemia franciscana postnauplii (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	0	0	0	0	30-A	0	0	0	0	0	0	0	0	0
30-B	0	0	0	0.08	0	0	30-B	0	0	0	0	0	0	0	0	0
30-C	0	0	0	0	0	0	30-C	0	0	0	0	0	0	0	0	0
30-D	0	0	0	0	0	0	30-D	0	0	0	0	0	0	0	0	0
39-A	0	0	0	0.08	0	0	39-A	0	0	0	0	0	0	0	0	0
39-B	0	0	0	0	0.16	0	39-B	0	0	0	0	0	0	0	0	0
39-C	0	0	0.17	0	0	0	39-C	0	0	0	0	0	0	0	0	0
39-D	0	0	0	0	0	0	39-D	0	0	0	0	0	0	0	0	0
39F-A	0	0	0	0	0	0	48-A	0	0	0	0	0	0	0	0	0
39F-B	0	0	0	0	0	0	48-B	0	0	0	0	0	0	0	0	0
39F-C	0	0	0.17	0	0	0	48-C	0	0	0	0	0	0	0	0	0
39F-D	0	0	0.08	0	0	0	48-D	0	0	0	0	0	0	0	0	0
48-A	0	0	0	0	0	0	57-A	0	0	0	0	0	0	0	0	0
48-B	0	0	0	0	0	0	57-B	0	0	0	0	0	0	0	0	0
48-C	0	0	0	0	0	0	57-C	0	0	0	0	0.16	0	0	0	0
48-D	0	0	0	0	0	0	57-D	0	0	0	0	0	0	0	0	0
57-A	0	0	0.42	2.99	2.42	2.41	65-A	17.12	0.58	0	0	0.08	0	0	0.17	0
57-B	0	0	0.08	0	0	0.25	65-B	5.91	2	0.16	0	0	0	0	0	0
57-C	0	0	0	0.08	0	0	65-C	2.24	4.91	4.42	0.17	0.33	0.08	0.17	0.42	0.08
57-D	0	0	2.42	1.08	2	1.09	65-D	0.91	1.33	2.91	1.59	1.66	2.42	1.74	0.16	0
57F-A	0	0	0.33	0.33	0.25	0.08										
57F-B	0	0	1.08	3.09	1.5	1										
57F-C	0	0	0.17	0	0	0.08										
57F-D	0	0	1.08	1.34	1.09	0.25										
65-A	0	0	1.25	32.09	28.75	5.83										
65-B	0	0	1	33.36	28.36	7.84										
65-C	0	0	1.42	5.5	2.16	2.58										
65-D	0	0	2.42	12.75	12.5	1.91										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Apocyclops dengizicus nauplii (number/liter)

Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91
30-A	3.43	11.33	6	0	0.83	0
30-B	1.29	3.26	6.83	0.25	0	0.08
30-C	0.43	1.25	5.75	0.5	0	0
30-D	16.29	1.33	16.5	90.89	12.83	0
39-A	0	1.91	4	0.25	1.17	0.08
39-B	0.43	0.5	0.08	0.08	0	0
39-C	2.43	1.74	4.75	1.17	0.08	0
39-D	2.29	2.83	1.33	1.25	1.83	0
39F-A	5.86	10.41	7.58	0.17	3.08	0.75
39F-B	0	1.09	0.33	0.5	0.5	0
39F-C	1.86	2.51	1	3.58	2.42	0.08
39F-D	0.71	0.99	0.5	0.08	0.25	0
48-A	0.14	2.75	0.08	0.42	0	0
48-B	0.29	0.5	0.17	0	0.42	3.67
48-C	0	1.33	0.08	0.42	10	0.75
48-D	0.29	0.67	0.08	0	0.08	1.08
57-A	1.14	0.17	0	0	0	0.25
57-B	0.71	0.08	0	0	0	0.83
57-C	0	0.08	0	0	0.17	0
57-D	0	0.17	0	0	2.08	50.78
57F-A	0.14	0.25	0	0	0.08	0
57F-B	0	0.08	0.08	0	2	14
57F-C	0	0.08	0.17	0	0	0.5
57F-D	0.29	0	0	0.17	1.25	8.92
65-A	0	0	0	0	0	0
65-B	0.29	0	0	0	0	0.17
65-C	0	0	0	0.08	0	0.08
65-D	0.14	0.17	0	0	0	0

Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	0.17	0	0	0	0	0	0
30-B	0.16	0.67	0	0.17	0.08	0	0	0	0
30-C	0	0	0	0	0	0	0	0.17	0
30-D	0	0	0.17	0.08	0	0	0	0	0
39-A	1.83	0	0	0	0	0	0	0	0
39-B	0.08	0	0	0.17	0	0	0	0	0
39-C	0	0	0	0.08	0	0	0	0	0
39-D	0.08	0.08	0.17	0	0	0	0	0	0
48-A	0	0.17	0.75	0.25	0	0.5	0.08	0	0.5
48-B	1.08	2.33	11.25	15.75	7.33	2.5	0	0.5	0
48-C	0	0	0	0.17	0	0	0	0	0
48-D	0	0	0.25	0.33	0	0	0	0	0
57-A	1.17	0	16.25	4	0	0.25	0.08	0	0
57-B	0.08	0.58	0.5	0.08	0	0	0	0	0
57-C	0	0	0.42	0.17	0.08	0	0	0	0
57-D	14.42	81	140.1	79.58	3.17	0.08	0	0	0
65-A	0	0	0.58	0.08	0	0	0	0	0
65-B	0	0	0.08	0.17	0	0	0	0	0
65-C	0	1.67	8.75	26.42	0.17	0	0	0	0
65-D	0.08	0	7.67	99.67	5.17	0.08	0	0	0

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Apocyclops dengizicus copepodids (number/liter)

Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91
30-A	1.57	1.16	2.41	0	0.83	0
30-B	0.43	1.42	0.75	1.08	0	0.5
30-C	1.43	2	0.99	1.49	0	0
30-D	1.43	0.67	1.66	15.84	22.83	0
39-A	3	1.33	0.74	0	0.08	0
39-B	2.21	0.25	0	0	0	0
39-C	0.86	1.83	0.41	0.16	0.49	0
39-D	1.71	1.83	1.33	0.57	1.75	0.08
39F-A	4.42	1.59	0.91	0	0.75	0.17
39F-B	0.57	0.08	0	0.41	0.33	0.17
39F-C	1.57	0.57	1.34	3.42	5.17	0
39F-D	2.43	0.34	0.17	1.42	0	0.08
48-A	0.57	0.08	1.49	0.33	0	0
48-B	1	0.08	0.08	0	0.08	1.33
48-C	1	0.08	0.33	0.16	7.67	0.25
48-D	2.57	0.25	0	0	0	0.16
57-A	1.71	0.08	0	0	0	0
57-B	0.86	0	0	0.08	0.08	0.25
57-C	2.14	0	0.08	0	0	0.08
57-D	1	0.17	0	0	1.75	31.01
57F-A	2	0.08	0.08	0	0	0
57F-B	1.14	0	0	0	0.59	10.41
57F-C	1	0.25	0	0	0.25	0.75
57F-D	1.57	0.34	0	0	1.58	1.58
65-A	1.29	0.08	0	0	0	0.08
65-B	0.71	0.17	0	0	0	0
65-C	2.14	0.17	0	0	0	0.08
65-D	3.43	0.34	0	0	0.17	0

Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0.08	0	0	0	0	0.08	0	0
30-B	0.08	1	0.08	0	0	0.17	0	0	0
30-C	0	0	0	0	0	0	0	0.17	0
30-D	0	0	0.17	0	0	0.08	0.08	0	0
39-A	0	0	0	0	0	0	0	0	0
39-B	0	0	0	0	0	0	0	0	0
39-C	0	0	0	0	0	0	0	0	0
39-D	0	0	0	0	0	0	0	0	0
48-A	0	0.08	0.33	0	0.17	0	0.08	0	0.08
48-B	0.16	0.08	0.42	1.74	0	0.17	0.08	0.08	0
48-C	0	0	0	0	0	0	0	0	0
48-D	0.16	0	0	0	0.08	0	0	0	0
57-A	1.33	0	1.08	0.25	0.08	0	0	0	0
57-B	0	1.5	0.08	0	0	0	0.08	0	0
57-C	0.08	0.16	0.5	0.17	0	0	0	0	0
57-D	16.5	126.34	47.5	14.92	4.84	0.5	0	0	0
65-A	0	0	0	0	0	0.08	0	0	0
65-B	0	0	0.08	0.58	0	0	0	0	0
65-C	0	0.16	1.24	23.67	6.5	0.59	0.08	0	0
65-D	0	0.17	1	27.17	6.08	0.5	0.08	0	0

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Cletocamptus dietersi nauplii (number/liter)

Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91
30-A	0	0	0	1.33	4.5	0.08
30-B	0	0	0	0.5	3.17	0
30-C	0	0	0	2.08	1.83	0.08
30-D	0	0	0	0	4.92	0.08
39-A	0	0	0	0.5	14	0.08
39-B	0	0	0	0	3.75	0.75
39-C	0	0	0	1	3.67	0
39-D	0	0	0	0.33	8.23	0
39F-A	0	0	0	0.58	5.17	0.33
39F-B	0	0	0	0.25	4.25	0.17
39F-C	0	0	0	0.67	6.17	0.08
39F-D	0	0	0	0.25	5.75	0
48-A	0	0	0	1.25	14.08	0.42
48-B	0	0	0	0.17	10	0.75
48-C	0	0	0	0.17	8.25	0.08
48-D	0	0	0	0.33	1.92	2.83
57-A	0	0	0	0	7.08	10.42
57-B	0	0	0	0.08	2.17	12.83
57-C	0	0	0	0	1.08	11.17
57-D	0	0	0	0	4.67	1.25
57F-A	0	0	0	0.17	4.17	53.13
57F-B	0	0	0	0	2.5	6.83
57F-C	0	0	0	0	5.25	11.92
57F-D	0	0	0	0.33	0.83	10.25
65-A	0	0	0.08	0	0.25	4.67
65-B	0	0	0	0	1.75	7
65-C	0	0	0	0	0.25	2.17
65-D	0	0	0	0	0.58	0.25

Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	2.42	0	0	0.08	0	0	0
30-B	0	0	0.42	0.67	0.17	0	0	0	0.83
30-C	0	0	0	0	0	0	0	0	0
30-D	0	0	0	0	0	0.08	0	0	0
39-A	0	0	0	0	0	0	0	0	0
39-B	0	0	0.08	0.25	0	0.08	0	0	0
39-C	0	0	0	0	0	0	0	0	0
39-D	0	0	0	0	0	0.08	0	0	0
48-A	0	0	0.67	0.33	0.17	0.58	0.08	0	0
48-B	0	0	0	4.92	0.67	0.08	0	0	0
48-C	0	0	0	0.83	0	0	0	0.17	0
48-D	0	0.78	0.08	0	0	0	0	0	0
57-A	0	18.25	0.75	0.75	0.33	0.08	0	0	0
57-B	0	0.08	0.75	0.33	0	0	0	0.08	0
57-C	0	0.17	0.17	0.08	0.42	0	0	0.08	0
57-D	0	0	0	0.25	0	0	0	0	0
65-A	0	0.92	3.33	0.67	0.08	0.08	0.17	0	0
65-B	0	24.67	8.25	2.83	0.17	0	0.33	0.33	0.67
65-C	0	19.08	120.83	11.5	1.17	0.92	0	1.58	13.17
65-D	0	2.5	17.58	1.17	0.75	0	0.08	0	0

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Cletocamptus dietersi copepodids (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	0.08	0.17	1.33	0.17	30-A	0	0.33	0.5	0	0	0	0	0	0
30-B	0	0	0	0.5	1.58	0	30-B	0	0	17.59	22.16	1.75	0.17	0.25	0	0.5
30-C	0	0	0.17	0.42	0	0	30-C	0	0	0	0	0	0	0	0	0
30-D	0	0	0	0.5	1.08	0	30-D	0	0	0	0	0	0	0.08	0.08	0
39-A	0	0	0	0.17	1	0	39-A	0	0	0	0	0	0	0	0	0
39-B	0	0	0	0	1.08	0	39-B	0	0	0	0	0.08	0	0	0	0
39-C	0	0	0.08	0.5	0.91	0	39-C	0	0	0.08	0	0	0	0	0	0
39-D	0	0	0.17	0.25	2.91	0	39-D	0	0	0	0	0	0	0	0	0
39F-A	0	0	0	0.58	1.59	0	48-A	0	0.16	0.25	0.83	0.17	0.08	0	0.17	0
39F-B	0	0	0	0.08	1.41	0	48-B	0	0.33	0.08	0.74	0.08	0.08	0.33	0.08	0
39F-C	0	0	0	0	1.25	0	48-C	0	0.25	0.08	1	1.75	0.5	0.42	0.08	0
39F-D	0	0	0	0.34	0.83	0	48-D	0	0.59	0.5	0.33	0.08	0	0	0	0
48-A	0	0	0	0.58	4.42	0.17	57-A	0	0.25	1.08	0.33	0.42	0.25	0.75	0.08	2.84
48-B	0	0	0	0.08	1.92	0.08	57-B	0	0.08	0.25	0.83	0.5	0.08	0.08	0	0.25
48-C	0	0	0.5	0	3.34	0	57-C	0	0.17	1.84	0.33	0.66	0.08	0.66	0.17	0
48-D	0	0	0	0.25	0.42	1.17	57-D	0	0	0	0.17	0.16	0	0	0.08	0
57-A	0	0	0	0	0.67	4.83	65-A	0.16	1.92	1.08	1.83	1.84	1	1.24	0	0
57-B	0	0	0	0.08	0.66	4.67	65-B	0.16	3.09	0.25	0.67	2.17	1.09	1.5	0.17	0.17
57-C	0	0	0	0	0.16	8.42	65-C	1	3.58	1.75	1.83	6.76	1.75	2.41	4.99	12.34
57-D	0	0	0.08	0	0.41	5.75	65-D	0.66	1.76	1.84	0.5	1.17	1	2.75	0.33	0.08
57F-A	0	0	0.08	0	0.16	14.42										
57F-B	0	0	0	0	0.17	6.92										
57F-C	0	0	0	0	1.74	4.91										
57F-D	0	0	0	0.08	0.08	1.83										
65-A	0	0	0	0	0.33	0.67										
65-B	0	0	0	0	0.08	1.09										
65-C	0	0	0	0	0.08	1.66										
65-D	0	0	0	0	0.25	0.58										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Balanus amphitrite nauplii (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	23	2.67	0.25	4.17	0.08	30-A	0	11.5	18.83	0.08	0	0	0	0.67	2.58
30-B	0	0	10.33	0	0.08	0.08	30-B	0	0	0	0	0.25	0	0	0.08	0.08
30-C	0	0	14.42	7.17	2.5	1.33	30-C	0	0.58	0.17	0	0	0	0.17	0.33	0.17
30-D	0	0	0.08	8.5	16.17	0	30-D	0	0	0.08	0	0	0	0	0	0
39-A	0	0.92	0.5	5.67	1.67	0.08	39-A	0.83	4.83	1.75	0.17	0	0	0.17	4.75	11.67
39-B	0	3	22.75	15.33	1.08	7.5	39-B	0	2.42	2.17	13.08	0	0	6.08	1	0.17
39-C	0	0.34	0.58	15.17	4	0.08	39-C	0	0.25	0.08	0.25	0	0.83	0.17	0.33	0
39-D	0	0	0	0	0.42	0	39-D	0	0.25	0.17	0.08	0	0	0.08	0.08	0
39F-A	0	8.09	36.72	2.58	0.17	0	48-A	0.08	10.58	5.08	0.08	25.58	32.92	3.08	0.17	14.92
39F-B	0	128.83	32.08	0.25	0.08	0.17	48-B	2.08	8.08	0.08	30.83	6.67	5	2.08	8.33	41.41
39F-C	0	0.67	0.17	0.08	7	0	48-C	0	0.08	0	0.17	0.08	1.25	0.25	0	0.83
39F-D	0	0.58	19.67	2.17	16.75	0.17	48-D	0.08	0	0.25	0.67	0.42	0	0.25	0	0.08
48-A	0	0.58	9.42	0.08	19.25	2.08	57-A	0.67	0.33	1.42	0.33	0.25	0.17	1.17	0	0
48-B	0	7.67	47.66	15.42	10.33	0.58	57-B	4.08	11.5	0.08	0	0.17	0.08	0.25	0	0.17
48-C	0	0.17	0.08	1.33	0.08	0	57-C	5.25	0.33	0	0.17	3.67	0.17	0	1.58	2.5
48-D	0	2.66	35.42	10.17	0	11	57-D	0	0	0	0	0	0.08	0.08	0	0
57-A	0	11.01	14.08	2.25	6.33	9.5	65-A	0	0	0.75	0.17	0	0	0	0	0
57-B	0	0.34	5.25	0.17	0	2	65-B	0.25	0.08	0	0	0.17	0.08	0.17	0.25	0
57-C	0	0	25.42	40.25	1.17	5.25	65-C	0.08	0	0	0	0.08	0.08	0.42	0.08	0.08
57-D	0	1.67	0	2.08	0.08	0	65-D	0	0	0.08	0	0	0.08	0	0	0
57F-A	0	18.83	25.78	16.25	5.33	0.75										
57F-B	0	0.25	0.17	0.75	0.08	0.42										
57F-C	0	0.34	0	0.25	0.58	6.17										
57F-D	0	0.17	0	0.58	0	30.21										
65-A	0	2.25	6.92	0.5	0.25	0.17										
65-B	0	0.34	0	3.58	24.67	0.17										
65-C	0	0.17	0.08	0.17	0.08	0.92										
65-D	0	0.58	0	0.33	0	0										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Trichocorixa reticulata <1mm long (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	0	0.08	0	0	30-A	0	0	0.25	0	0	0	0	0	0
30-B	0	0.34	0.08	0	0.08	0	30-B	0	0	0.08	0	0	0	0	0	0
30-C	0	0	0	0.17	0.08	0	30-C	0	0	0.08	0	0	0	0	0	0
30-D	0	0.08	0.25	1.92	1	0	30-D	0	0	0	0	0	0	0	0	0
39-A	0	0.08	0.08	0.08	0.33	0	39-A	0	0	0	0	0	0	0	0	0
39-B	0	0	0	0	0	0.08	39-B	0	0.08	0	0	0	0	0	0	0
39-C	0	0.08	0	0	0.58	0	39-C	0	0	0	0	0	0	0	0	0
39-D	0	0.41	0.17	0.33	1.17	0.08	39-D	0	0	0	0	0	0	0	0	0
39F-A	0	0.17	0	0	0.33	0	48-A	0	0	0	0.08	0.33	0	0.08	0	0
39F-B	0	0.08	0	0	0	0	48-B	0	0	0.17	0.08	0.08	0	0	0.08	0.25
39F-C	0	0.08	0	0.33	1.33	0	48-C	0	0.58	0.67	0.25	0	0	0.17	0.17	0.5
39F-D	0	0.08	0.33	0.33	0.33	0	48-D	0.75	1.83	0.33	0.25	0.42	0.42	0.17	0.25	0
48-A	0	0.17	0.33	0	0.67	0	57-A	0.33	0	0.17	0	0	0.42	0.67	5.67	1.08
48-B	0	0.08	0	0.08	0.33	0.25	57-B	0.08	0.08	0.08	0.08	0.08	0	0.08	0	0.08
48-C	0	0.08	0	0.08	3.5	0.17	57-C	0.16	0.08	0.25	1.33	1.67	0.83	0.08	0	0
48-D	0	0.17	0.08	0.25	0.42	0.25	57-D	4.83	0.33	2.08	0.42	0.92	0	0	0	0
57-A	0	0	0	0	0.08	0.83	65-A	1.88	0.08	0.92	1.58	0.67	0.75	0.5	0	0.5
57-B	0	0.17	0.08	0.08	0.33	0.08	65-B	3.08	0.83	1.25	0.5	0.5	0.25	0	0	0.08
57-C	0	0	0.25	0	0.25	0.33	65-C	0	0.08	0.17	0.25	0.25	0.33	0	0	0
57-D	0	0	0	0.5	0.83	3.33	65-D	1.25	10.75	0.92	0.17	0	0.67	0	0	0.08
57F-A	0	0	0.33	0.17	0.25	0.67										
57F-B	0	0.08	0.17	0	0.33	3										
57F-C	0	0	0.08	0	0.58	0.42										
57F-D	0	0.25	0.08	0.83	1.17	1.92										
65-A	0	0	0.25	0	0.08	0.33										
65-B	0	0	0	0	0	0.42										
65-C	0	0	0.25	0	0.25	0.33										
65-D	0	0	0.25	0.08	0.33	1.5										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Trichocorixa reticulata >1 mm long (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0.08	0	0.33	0.75	0	30-A	0	0	0.08	0.17	0.5	0.67	0	0.08	0
30-B	0	0	0	0.08	1.08	0.08	30-B	0.17	0	0	0	0.17	0	0	0	0.08
30-C	0	0.08	0.08	0.58	1.42	0	30-C	0	0	0	0	0	0	0	0	0
30-D	0	0	0.17	0.5	4.08	0.25	30-D	0	0.08	0	0	0	0	0.17	0	0
39-A	0	0	0	0.17	0.25	0.17	39-A	0.17	0	0	0	0	0	0	0	0.17
39-B	0	0.17	0	0.17	0.58	0.92	39-B	0.17	0.17	0	0	0.08	0	0	0	0
39-C	0	0	0.17	0.08	0.67	1	39-C	0	0	0	0	0	0	0	0	0
39-D	0	0.17	0.08	1.58	1.92	4	39-D	1.67	0.08	0.08	0	0	0	0	0	0
39F-A	0	0.08	0	0	0.33	1.33	48-A	0	0.17	0	0	0.08	0	0	0	0
39F-B	0	0	0	0.17	0.33	0.08	48-B	0.75	0.17	0.25	0	0	0.08	0	0	0
39F-C	0	0	0.08	0.17	4.83	2.58	48-C	0.25	0.08	0.17	0	0	0	0.08	0.17	0.25
39F-D	0	0	0	0.08	0.83	0.75	48-D	0.42	0.58	0.58	0.25	0.33	0.5	0.08	0.08	0
48-A	0	0.17	0.17	0.5	0.67	0.08	57-A	1.17	0.08	0.17	0.5	0	2.17	1.08	1.58	1.25
48-B	0	0	0	0.08	0.33	3.42	57-B	0.67	0.17	0	0	0	0	0	0.08	0
48-C	0	0	0	0.92	2.75	3.25	57-C	1	0	0.08	0.08	0.58	5.17	0.08	0.08	0
48-D	0	0	0	0.17	0.17	1.42	57-D	8.08	2.42	3.33	1.92	1.08	1.75	1.08	0.17	0
57-A	0	0	0	0.08	0.42	6.25	65-A	5.21	1	3.92	1.92	4	2	1	0.42	0.67
57-B	0	0	0	0	0.75	1.5	65-B	3.58	0.67	6.75	1.67	0.17	2.58	0.25	0.17	0.08
57-C	0	0	0	0.17	0.25	2.42	65-C	8.33	0.42	0.42	0.17	1.83	0.58	0.33	0.25	0.42
57-D	0	0.08	0	0.33	1.42	3.42	65-D	7	13.17	11.92	0.75	0.5	1.67	1	0.17	0.08
57F-A	0.14	0	0.17	0.5	0.58	3.92										
57F-B	0	0	0.17	0.33	0.92	0.5										
57F-C	0	0	0.08	0.25	0.83	4.83										
57F-D	0	0	0	0.42	1	3.25										
65-A	0.14	0	0	0	1.25	4.17										
65-B	0	0	0	0.08	1.42	3.92										
65-C	0	0	0	0.5	1.67	1.83										
65-D	0	0	0	0.08	1.08	5.58										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Brachionus plicatilis (number/liter)

Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91
30-A	0.85	13.16	7.92	3.33	0.25	0
30-B	0.71	27.58	1	3	0.08	0
30-C	1.14	1057.9	134.13	3.33	0.08	0
30-D	0.71	62.99	4363.5	110.42	32.88	0.08
39-A	0	215.75	13.83	7.09	3.86	0.5
39-B	0.14	4.97	1.75	1.17	0.42	0
39-C	0	45.1	163.75	45.17	1.75	0.33
39-D	0.86	0	126.14	188.27	36.75	7
39F-A	2.28	125.83	144.53	0.5	4	0
39F-B	1.86	48.6	4.75	0.25	0.25	0.08
39F-C	1	28.42	20.83	10.08	2.75	0.08
39F-D	0	47.34	323.7	0.25	0.41	0
48-A	0.29	1143.5	786.9	1.08	0.42	2.5
48-B	0.57	22.25	6.75	0	2.83	0
48-C	0.43	34.01	10.58	331.48	114.22	11.58
48-D	0.28	14.49	1.83	7	0.25	0
57-A	0.43	22.09	0.25	16.84	0.5	1.25
57-B	0.29	2.83	0.33	1.92	0.08	6.34
57-C	0	3.92	2.91	0	0	2.67
57-D	0.71	7.58	29.42	2034.7	16.33	1178.9
57F-A	0.29	1.59	0.5	2.83	0.83	1.33
57F-B	0.86	169	659.28	62.4	22.5	137.24
57F-C	2	16.84	62.71	422.41	0.92	0.33
57F-D	0.58	6745.4	2028.9	54.01	152.87	18.5
65-A	0.43	13.83	1.66	8.25	1.25	1.08
65-B	0	37.76	5.91	15.25	0.75	5.08
65-C	0.14	61.49	17827	77.34	5.83	437.67
65-D	0	294.84	4921.3	30.7	3.67	63.75

Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	319.79	70	0.17	0.25	0.67	0	0	0.16
30-B	0.42	7.09	0.25	187.85	56.33	0.58	0	0	0.16
30-C	0	6.16	0.08	0.08	1.25	0.58	0	0	0.08
30-D	0	0.42	0.75	1.17	0.25	0.33	0.17	0	0
39-A	0.08	2.75	0.34	0.08	0.17	0.25	0	3.66	3
39-B	0	0.58	0.83	0.33	0.58	0.17	1.08	0.17	0.08
39-C	0.08	0.16	28.75	4.33	20.75	0.08	0	0.17	7.17
39-D	0	0.75	0.5	4.17	0.08	0	0	0.83	0.42
48-A	40.25	16.17	4.59	278.13	34.41	0	0.33	0.92	2
48-B	0.24	0	160.42	0.75	11.34	0.42	0	0	0.08
48-C	1.08	1079.4	914.79	6.58	0	0.08	0	0	0.5
48-D	41568	32.75	11.25	23.5	0.67	0.08	0.08	0	0.83
57-A	11	17.75	19.75	62.83	0.34	0	0	0	0
57-B	19.58	8	5.59	4	2.84	0	0	2	0.92
57-C	2.75	3.42	252.66	102.34	16.92	0	0	0	0
57-D	1256.8	239.09	94.29	45.75	39.41	60.05	0	3.67	0
65-A	0.25	1.75	16.5	69.17	193.23	23.25	0	0	0.08
65-B	44.75	36.5	4.92	1.75	0.25	0	0	0	0.33
65-C	151.04	186.98	1.75	9.25	68.75	2.33	0	0.08	105.42
65-D	489.59	13.42	2	2.34	1.41	0.08	0	0	0

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Synchaeta tamara (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	0	0.08	0.17	0	30-A	0	0	0.17	0	0	0	0	0	0
30-B	0	0	0.42	0	0	0.08	30-B	0	0	0	0	0	0	0	0	0
30-C	0	0	1.83	0.08	0	0	30-C	0	0	0	0	0	0	0	0	0
30-D	0	0	0.08	0.08	0	0	30-D	0	0	0	0	0	0	0	0	0
39-A	0	0	0	1.83	1	0.17	39-A	0	0	0	0	0	0	0	0	0
39-B	0	0	2.82	0	1.83	0	39-B	0	0	0	0	0	0	0	0	0
39-C	0	0	0.58	0.17	0	0	39-C	0	0	0	0	0	0	0	0	0
39-D	0	0	0.17	0.08	1.58	0	39-D	0	0	0	0	0	0	0	0	0
39F-A	0	0	0	0	0	0.17	48-A	0	3.33	0	0	0	0	0	0.08	0
39F-B	0	0	1.17	0	0.08	0	48-B	0	0	0	0	0	0	0	0	0
39F-C	0	0	997.77	2.25	0	0	48-C	0	0	0.08	0	0	0	0	0	0
39F-D	0	0	36.1	0	0	0	48-D	0	0	0	0.17	0	0	0	0	0
48-A	0	0	1.75	0.08	1.67	0	57-A	0	0	0	0	0	0	0.08	0	0
48-B	0	0	44.79	0	0	0	57-B	0	0	36.33	0	0	0	0	0	0
48-C	0	0	23.34	0.08	0.25	0	57-C	0	0	0	0	0.08	0	0	0	0
48-D	0	0	0.68	0	0	0.08	57-D	0	0	0	0	0	0	0	0.17	0
57-A	0	0	0.17	0	0	0.67	65-A	0	0	0	0	0	0	0	0	0
57-B	0	0	0.25	0	0.08	3.25	65-B	0	0	0	0	0	0	0	0	1.75
57-C	0	0	0	0	0	3.58	65-C	0	0	0.25	0	0	0	0	0	1.58
57-D	0	0	4.42	0	0	0	65-D	0	0	0	0	0	0	0	0	0
57F-A	0	0	0.58	0	0	105.47										
57F-B	0	0	0	0	0	0.33										
57F-C	0	0	1.17	0	0	2.92										
57F-D	0	0	0.08	0	0	0.58										
65-A	0	0	2.58	0	0	0.08										
65-B	0	0	0.08	0	0	0.25										
65-C	0	0	0	0	0	0.08										
65-D	0	0	0	0.08	0	0										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Synchaeta sp. (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	378.7	0.08	351.65	0.08	0	0	30-A	0	0	0	0	0	0	0	0	0
30-B	427	3.33	106.25	0.75	0	0	30-B	0	0	0	0	0	0	0	0	0
30-C	659	1.74	303.58	0	0	0	30-C	0	0	0	0	0	0	0	0	0
30-D	202.57	0.41	4.5	399.72	0	0	30-D	0	0	0	0	0	0	0	0	0
39-A	88.71	306.75	455.37	0	0	0	39-A	0	0	0	0	0	0	0	0	0
39-B	1.57	5.24	1.25	0	0	0	39-B	0	0	0	0	0	0	0	0	0
39-C	57.57	1.25	28.83	19.08	0.08	0	39-C	0	0	0	0	0	0	0	0	0
39-D	105.29	250.83	31.83	0	0	0	39-D	0	0	0	0	0	0	0	0	0
39F-A	7.29	7.67	0	0.17	0	0	48-A	0	0	0	0	0	0	0	0	0
39F-B	1.71	20.74	0.08	0.17	0	0	48-B	0	0	0	0	0	0	0	0	0
39F-C	32	0.17	0.5	0	0	0.92	48-C	0	0	0	0	0	0	0	0	0
39F-D	0.14	0	0.25	0	0	0	48-D	0	0	0	0	0	0	0	0	0
48-A	0.71	0.75	0	0	0	0	57-A	0	0	0	0	0	0	0	0	0
48-B	11	1.74	0.08	0	0	0	57-B	0	0	0	0	0	0	0	0	0
48-C	4.83	0.41	0	0	0	0	57-C	0	0	0	0	0	0	0	0	0
48-D	15	9.42	0	0	0	0	57-D	0	0	0	0	0	0	0	0	0
57-A	24.71	0.08	0.08	0	0	0	65-A	0	0	0	0	0	0	0	0	0
57-B	59.14	0.17	0	0	0	0	65-B	0	0	0	0	0	0	0	0	0
57-C	0.57	0	0	0	0	0	65-C	0	0	0	0	0	0	0	0	0
57-D	0	0	0	0	0	0	65-D	0	0	0	0	0	0	0	0	0
57F-A	2	0.17	0	0	0	0										
57F-B	2.29	0	0	0	0	0										
57F-C	0.57	0.25	0	0	0	0										
57F-D	0.43	0	0	0	0	0										
65-A	1.71	0.08	0	0	0	0										
65-B	0.86	0	0.08	0	0	0										
65-C	1.43	0	0	0	0	0										
65-D	1.14	0	0	0	0	0										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Condylostoma sp. (number/liter)						
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91
30-A	0	0.5	0	0.17	0	0.42
30-B	0	1.5	1.08	0	0	0
30-C	0	18.5	0	0.08	0.25	0.42
30-D	0	4.25	18.75	0	0.25	0
39-A	0	10.26	0.25	0	0	0.08
39-B	0	1.5	4.83	0.08	0.25	0.25
39-C	0	82.5	821.27	0	0	0.17
39-D	0	5	6	0	0	0
39F-A	0	38.08	0.33	0.25	0.08	0
39F-B	0	2.75	1.42	0	0	0.08
39F-C	0	14.25	42.09	0	0	0.08
39F-D	0	1.25	2.17	0	0	0.25
48-A	0	100.83	19.83	0.08	0	0
48-B	0	154.5	685.59	0	0	1.5
48-C	0	23.92	58.58	0.33	0	0
48-D	0	7.41	0.92	0.08	0	0
57-A	0	4.17	4.75	0	0	0
57-B	0	4	5.42	1.75	0	0.33
57-C	0	33.75	4.5	3.17	0.08	0.33
57-D	0	7.92	16.91	0.08	0.17	0.17
57F-A	0	71.92	4	0.17	0.08	0
57F-B	0	28.75	0.67	0.17	0	0.08
57F-C	0	48.92	1.83	0.33	0.33	0.08
57F-D	0	65.84	2.83	0.08	0.17	0
65-A	0	45.41	27.84	0.67	0	0
65-B	0	55.09	46.67	0.58	0	0.17
65-C	0	87.16	2	0.67	0	0.08
65-D	0	5.67	14.83	0.25	0	0

Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	2.67	42.29	0	0	0	0	0	0
30-B	0	0.08	0.25	0	0	0	0	0	0
30-C	0	0	0	0	67.08	0	0	0	0
30-D	0	0	0	0.08	0	0	0	0	0
39-A	0	1.08	0.17	0	0	0.08	0	0.91	0
39-B	0	0.16	0.5	0.33	0.92	0.08	1.5	0	0
39-C	0	0	0	0	0.42	0	0	0	0
39-D	0	0	0.08	0	0.08	0	0	0	0
48-A	0.08	0	0	0.16	3.92	0	0	0	0
48-B	0.66	0.5	0	0	0.75	0.08	0	0	0
48-C	0.25	3.67	2.17	0	0	0	0	0.16	0
48-D	0	0.58	0	0	0.08	0.25	0	0	0
57-A	0.24	0	0	0	0	0	0	0.17	0
57-B	0.24	0	0	0	0	0	0	0.08	0
57-C	1.08	0	2	0.17	0	0	0	0.08	0
57-D	0.58	0.59	0.17	0	0	0	0.08	0	0
65-A	0	0.08	1	0	0.75	1.09	0.25	1.75	0
65-B	0.08	0	0	0	0	2.42	6	30.75	0.08
65-C	0.16	0	0.33	18.66	56.68	17.58	46.25	1.75	18.83
65-D	0	0	0	0	0.08	0	0.08	0.25	0

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Fabrea salinia (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	0	0.08	0	0.08	30-A	0	0	0	0	0	0	0	0.08	0
30-B	0	0	0	0.08	0	0.17	30-B	0	0	0	0	0	0	0	0	0
30-C	0	0	0.08	0.17	0	0.33	30-C	0	0	0.08	0	0	0	0	0	0
30-D	0	0	0.08	0	0	0.58	30-D	0	0	0	0	0	0	0	0	0
39-A	0	0	0.5	0	0	0	39-A	0	0	0	0	0	0	0	0	0
39-B	0	0.5	0.08	0.08	0	0.67	39-B	0.08	0	0	0	0	0	0	0	0
39-C	0	0	12	1.42	0	0.33	39-C	0	0	0	0	0	0	0	0	0
39-D	0	0	6.75	0.08	0	0.17	39-D	0	0	0	0	0	0	0	0	0
39F-A	0	0.34	0.08	0	0	0.08	48-A	0	0	1	0	0	0	0	0	0
39F-B	0	0	0.08	0	0	0.17	48-B	0.16	0	0.08	0	0	0	0	0	0
39F-C	0	0	2.42	0	0	0.25	48-C	0.08	0	177.6	0	0	0	0	0	0
39F-D	0	0.34	0	0	0	0	48-D	0	0	0.42	0	0	0	0	0	0
48-A	0	0.84	1	0	0	0.17	57-A	0.08	0	0.17	0	0	0	0	0	0
48-B	0	0	1.67	0	0	0	57-B	0	0	0	0	0	0	0	0.08	0
48-C	0	0	27.83	0	0	0	57-C	0	0	27.25	0	0	0	0	0.25	0
48-D	0	0	1.08	0	0	0.08	57-D	0	0	0.08	0	0	0	0	0	0
57-A	0	0.08	0.08	0	0	0.33	65-A	0	0	0	0	0	0	0	0	0
57-B	0	0	0	0	0	0.42	65-B	0	0	0	0	0	0	0	0	0
57-C	0	0.34	40.21	0	0	0.08	65-C	0.42	0	0	0	0	0.08	508.5	73.42	4.83
57-D	0	0	0	0	0	0	65-D	0.08	0	0	0	0	0	0	0	0
57F-A	0	0.5	0.92	0.17	0	0.17										
57F-B	0	0.08	2165.4	0	0	0										
57F-C	0	0.84	2.25	0	0	0.08										
57F-D	0	1.91	748.84	0.25	0	0										
65-A	0	3.05	0.08	0	0	0										
65-B	0	0.5	0.17	0	0	0.17										
65-C	0	610.58	1323.1	0	0	0.08										
65-D	0	7644.3	2854.3	0	0	0										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Euplotes sp. (number/liter)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0	0.08	0.08	2	0	30-A	0	0	0	0	0	0	0	0	0.25
30-B	0	0	0.25	0	0	0	30-B	0	0	0	0	0	0	0.33	0.17	0.25
30-C	0	0	0	0.08	1.42	0	30-C	0	0	0.08	0	0	0	0	0	0
30-D	0	0	0	0	12	0.5	30-D	0	0	0	0	0	0	0	0	0
39-A	0	0	0.08	0	0.17	0	39-A	0	0	0.17	0	0	0	0	0	0
39-B	0	0	0.08	0	0.5	0.25	39-B	0	0	1.75	0	0	0	0.08	0.08	0
39-C	0	0	1.25	0	0.67	1.33	39-C	0	0	0	0	0	0	0	0	0
39-D	0	0	0	0	0.08	0.17	39-D	0	0	33.75	0	0	0	0	0	0
39F-A	0	0	0	0.08	0.25	0.33	48-A	0.42	0.5	1.08	2.83	0	0.17	0	0	0
39F-B	0	0	0	0	0	0	48-B	0	0.08	0.08	0.08	0	0	0	0	0
39F-C	0	0	0.08	0	0.5	0.08	48-C	2.25	0	11.17	0.33	0	0	0	0	0
39F-D	0	0.08	0.25	0.08	0.08	0.83	48-D	0	0.5	0.92	0.08	0	0	0	0	0
48-A	0	0	0	0	0.08	0.25	57-A	0	0.08	0.08	0	0	0.5	0.33	0	0
48-B	0	0.17	0.17	0.08	0.42	0	57-B	0.08	0	0.17	0	0	0	0	0	0
48-C	0	0	0.67	0	0	1.42	57-C	0	0	143.75	66.49	0	0	0	0	0.08
48-D	0	0	0.08	0	0	0.92	57-D	0	0	0	0	0	0	0	0	0
57-A	0	0	1.67	0	0.25	0.08	65-A	0	0	0.25	0	0	1.25	0.42	0	0
57-B	0	0	0.08	0	0.25	0.25	65-B	0	0	0	0.33	0	0.67	2.33	0	0
57-C	0	0.25	0.08	0	0.17	46.46	65-C	0	0	0	0.42	0	0.33	0.25	0.25	0.08
57-D	0	0.34	38.8	0	0.5	0	65-D	0	0	0.08	0.42	0	0.08	0.25	0	6.83
57F-A	0	0	0.42	0	0.5	1.75										
57F-B	0	0.34	0	0	0.08	0										
57F-C	0	0	0	0	0	0.92										
57F-D	0	0	0.17	0	0	1.17										
65-A	0	1.91	0	0	0.08	0.42										
65-B	0	0	2.67	0	0.08	1										
65-C	0	0	35.83	0	0	1.25										
65-D	0	0	0.17	0	0	0.08										

Appendix C

Count Data For Individual Taxa At Five Salinities In Tanks Without Fish

Nematodes (number/liter)

Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91
30-A	0	0.17	0.08	0.33	0	0.08
30-B	0	0.17	0.42	0	0	0
30-C	0	4.42	0.08	0.5	0	0.08
30-D	0	0.75	1.58	0.17	0	0
39-A	0	0.08	0	0.25	0.08	0
39-B	0	0.25	0.33	0.17	0.08	0.08
39-C	0	2.51	0.58	1	0.17	0
39-D	0	2.17	1.5	0.33	0.08	0
39F-A	0	0.58	0.92	0.17	0	0
39F-B	0	1.67	2	0.08	0.08	0
39F-C	0	0.84	0.5	1.33	0.08	0.08
39F-D	0	0.58	1	0.33	0	0.08
48-A	0	1.16	3.33	0.25	0.17	0
48-B	0	1.42	0.08	0.33	0.67	0
48-C	0	1.83	1.25	0.25	0.08	0
48-D	0	0.17	1	0.58	0.17	0.25
57-A	0	0.08	0.33	0.25	0	0.42
57-B	0	0.5	0.17	0.33	0.17	1.75
57-C	0	0.5	0.08	0.33	0	5.83
57-D	0	0.41	0.58	1	0	0.08
57F-A	0	0.92	0.83	0.08	0.08	1.75
57F-B	0	0.25	0.33	0.33	0.08	0.42
57F-C	0	0.84	0.58	0.08	0.75	1.33
57F-D	0	0.08	0.75	0.58	0.08	0.92
65-A	0	0.17	0	0.08	0.25	0
65-B	0	0	0	0	0	0.5
65-C	0	0	0.17	0.17	0	0.75
65-D	0	0	0	0	0.25	0

Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0.83	0.67	0	0	0.08	13.58	0.08	0.17
30-B	0	0	0	0.25	0.17	0.58	0.67	0.83	0.67
30-C	0	0	0	0	0	0	0.08	0.08	0.08
30-D	0	0	0.17	0	0	0.17	0.08	0	0
39-A	0	0	0	0	0	0.33	5.5	0.92	0
39-B	0	0	0.08	0	0	0.17	1.08	0	0.08
39-C	0	0	0	0	0	0.17	0	0.08	0
39-D	0	0	0.08	0.08	0	0	0	0.17	0
48-A	0	0	0.25	0.17	0.5	0.17	0.25	0.33	0.17
48-B	0.16	0	0	0	0	1.08	155.47	0.92	0.33
48-C	0	0	0.08	0.25	0	0.25	0.17	0.58	0.25
48-D	0.08	0	0.17	0	0	0.17	0.5	0.33	0.83
57-A	0.08	0	0	0	0	0.17	0.42	1.17	1.5
57-B	0	0	0.08	0	0.17	0	0.08	0.92	1.25
57-C	0	0	0.17	0.08	0.17	0.33	0.83	2.5	3.67
57-D	0	0	0	0	0	0.08	0.33	0.33	0.17
65-A	0	0.17	0.08	0.42	0	0.5	6.25	0.67	4.5
65-B	0	0.08	0.17	0.08	0.5	0.17	3.33	1.33	0.42
65-C	0	0	0	0	0.25	0.42	8.42	0.17	35.42
65-D	0	0.08	0.08	0	0.08	0.5	1.25	0.5	1.58

APPENDIX D

BIOVOLUME DATA FOR INDIVIDUAL TAXA AT FIVE SALINITIES

Appendix D

Biovolume Data For Individual Taxa At Five Salinities in Tanks Without Fish

Total Invertebrates (cubic mm/L)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0.128	0.362	0.184	1.015	2.294	46.19	30-A	72.715	1.14	10.355	66.836	79.015	36.238	23.438	8.714	10.921
30-B	0.124	0.142	0.105	0.291	3.752	20.905	30-B	57.554	0.036	0.094	5.942	6.215	1.506	1.482	0.517	0.74
30-C	0.193	2.322	0.699	1.832	7.775	6.025	30-C	49.476	78.972	24.208	29.793	35.281	43.31	13.857	20.051	14.349
30-D	0.099	0.149	9.163	2.808	14.542	66.206	30-D	141.826	148.766	75.874	23.433	68.138	22.263	53.773	26.494	48.216
39-A	0.041	1.184	0.194	1.022	1.841	34.353	39-A	29.09	91.628	23.656	26.412	68.475	18.293	23.817	26.36	12.454
39-B	0.022	0.545	0.074	0.55	2.641	7.735	39-B	59.852	25.704	0.558	9.17	10.149	19.703	7.749	25.99	22.684
39-C	0.026	0.695	1.979	0.374	2.154	6.953	39-C	17.9	93.101	110.59	14.806	5.101	2.288	37.939	10.937	43.626
39-D	0.053	1.225	0.593	5.18	6.134	65.727	39-D	119.401	163.825	30.542	30.293	101.357	40.916	71.77	36.979	185.223
39F-A	0.051	0.681	0.401	0.01	1.107	54.469	48-A	28.487	7.072	0.033	1.034	3.062	3.634	4.093	1.034	0.042
39F-B	0.007	0.438	0.084	0.519	1.012	17.07	48-B	18.185	2.514	1.131	0.175	6.59	2.758	9.142	1.042	0.627
39F-C	0.025	0.187	0.668	0.66	15.395	76.494	48-C	51.908	2.472	3.04	0.071	0.012	0.512	0.339	0.547	2.514
39F-D	0.016	0.123	0.778	0.33	2.606	13.404	48-D	80.325	3.632	2.315	0.848	1.078	1.583	0.274	0.289	0.005
48-A	0.004	3.884	2.177	1.526	2.212	20.716	57-A	26.553	2.783	0.644	1.632	0.003	6.598	3.412	5.843	3.978
48-B	0.01	0.522	1.136	0.287	1.569	30.476	57-B	18.69	13.889	0.182	0.027	0.023	3.29E-04	0.017	0.245	0.019
48-C	0.008	0.477	0.146	3.426	9.444	33.52	57-C	22.392	6.951	0.82	0.719	2.996	15.711	0.274	1.74	1.992
48-D	0.024	0.229	0.094	0.598	0.598	10.105	57-D	37.318	9.582	12.245	6.513	3.651	5.388	3.243	0.518	5.64E-05
57-A	0.019	0.078	0.044	7.832	10.12	31.927	65-A	98.321	5.725	12.993	6.683	12.539	6.2	4.106	1.28	2.58
57-B	0.023	0.049	0.049	0.022	2.321	6.417	65-B	26.768	8.649	22.417	5.122	0.632	7.802	0.77	0.576	0.258
57-C	0.012	0.061	0.16	1.094	0.803	8.396	65-C	32.686	6.939	9.235	1.038	6.926	1.888	2.329	1.333	2.031
57-D	0.007	0.272	0.123	10.331	15.025	19.845	65-D	26.88	42.665	50.303	11.791	9.053	9.433	10.575	0.933	1.256
57F-A	0.433	0.15	0.649	1.642	2.71	12.43										
57F-B	0.01	0.381	3.288	11.785	5.663	5.976										
57F-C	0.01	0.119	0.397	1.564	2.63	23.491										
57F-D	0.01	13.175	4.799	3.055	4.476	18.159										
65-A	0.429	0.104	0.137	15.318	41.38	41.994										
65-B	0.005	0.156	0.099	11.361	30.481	49.539										
65-C	0.02	0.654	37.504	23.008	10.112	13.282										
65-D	0.032	5.687	11.928	7.045	13.796	23.181										

Appendix D

Biovolume Data For Individual Taxa At Five Salinities in Tanks Without Fish

Total Crustaceans (cubic mm/L)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0.022	0.096	0.071	0.002	0.042	46.189	30-A	72.715	0.522	9.87	66.326	77.513	34.226	23.433	8.474	10.921
30-B	0.005	0.014	0.057	0.045	0.494	20.665	30-B	57.043	0.022	0.078	5.575	5.596	1.505	1.482	0.517	0.5
30-C	0.009	0.015	0.072	0.051	3.495	6.024	30-C	49.476	78.961	24.192	29.793	35.194	43.309	13.857	20.051	14.348
30-D	0.042	0.006	0.086	0.605	2.033	65.455	30-D	141.826	148.525	75.873	23.431	68.138	22.262	53.263	26.494	48.216
39-A	0.016	0.015	0.026	0.482	1.019	33.841	39-A	28.579	91.621	23.655	26.412	68.475	18.292	23.815	26.351	11.938
39-B	0.021	0.008	0.062	0.038	0.897	4.956	39-B	59.342	25.177	0.556	9.169	9.907	19.703	7.744	25.99	22.684
39-C	0.01	0.019	0.029	0.041	0.026	3.95	39-C	17.9	93.101	110.535	14.798	5.061	2.288	37.939	10.936	43.612
39-D	0.022	0.016	0.053	0.015	0.073	53.689	39-D	114.387	163.584	30.299	30.285	101.356	40.916	71.77	36.977	185.222
39F-A	0.044	0.06	0.12	0.009	0.043	50.476	48-A	28.41	6.53	0.024	0.482	2.685	3.634	4.076	1.032	0.038
39F-B	0.003	0.263	0.072	0.008	0.021	16.829	48-B	15.932	2.003	0.038	0.159	6.553	2.517	9.091	1.026	0.579
39F-C	0.014	0.014	0.052	0.066	0.632	68.748	48-C	51.155	0.039	0.504	0.01	0.012	0.512	0.066	0.003	1.666
39F-D	0.016	0.005	0.046	0.025	0.049	11.152	48-D	0.06	1.474	0.488	0.003	0.005	0	0.001	0	0.003
48-A	0.003	0.007	0.041	0.023	0.069	20.468	57-A	22.955	2.509	0.063	0.011	0.003	0.002	0.04	0.003	0.016
48-B	0.006	0.018	0.098	0.032	0.509	20.158	57-B	16.626	13.347	0.145	0.004	0.002	3.29E-04	0.001	3.96E-05	0.002
48-C	0.005	0.004	0.019	0.009	0.293	23.707	57-C	19.352	6.926	0.02	0.018	0.899	0.029	0.018	1.499	1.991
48-D	0.019	0.012	0.072	0.025	0.006	5.794	57-D	9.672	1.784	1.664	0.578	0.154	0.019	1.62E-04	3.74E-04	0
57-A	0.012	0.023	0.036	7.558	8.842	12.999	65-A	82.316	2.703	1.014	0.479	0.026	0.005	1.005	0.016	0.47
57-B	0.006	0.001	0.025	0.002	0.005	1.884	65-B	15.338	6.408	1.901	0.008	0.024	0.005	0.01	0.02	0.001
57-C	0.012	1.66E-04	0.073	0.58	0.004	1.055	65-C	7.387	5.306	7.937	0.435	1.171	0.056	0.928	0.531	0.52
57-D	0.005	0.005	0.038	5.342	10.57	6.623	65-D	4.683	1.023	14.336	9.502	7.549	4.29	7.572	0.423	0.999
57F-A	0.011	0.04	0.067	0.102	0.919	0.499										
57F-B	0.008	0.001	0.018	10.674	2.794	3.627										
57F-C	0.005	0.004	0.016	0.006	0.023	8.908										
57F-D	0.009	0.002	0.021	1.53	0.953	7.995										
65-A	0.007	0.005	0.045	15.301	37.61	29.409										
65-B	0.004	0.002	0.021	11.09	26.216	37.678										
65-C	0.02	0.001	0.028	21.351	5.039	6.877										
65-D	0.032	0.003	0.04	6.73	10.483	6.015										

Appendix D

Biovolume Data For Individual Taxa At Five Salinities in Tanks Without Fish

Total Trichocorixa (cubic mm/L)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0.24	0	1.006	2.252	0	30-A	0	0	0.289	0.51	1.501	2.011	0	0.24	0
30-B	0	0.066	0.015	0.24	3.258	0.24	30-B	0.51	0	0.015	0	0.51	0	0	0	0.24
30-C	0	0.24	0.24	1.774	4.279	0	30-C	0	0	0.015	0	0	0	0	0	0
30-D	0	0.015	0.559	1.872	12.442	0.751	30-D	0	0.24	0	0	0	0	0.51	0	0
39-A	0	0.015	0.015	0.526	0.814	0.51	39-A	0.51	0	0	0	0	0	0	0	0.51
39-B	0	0.51	0	0.51	1.741	2.777	39-B	0.51	0.526	0	0	0.24	0	0	0	0
39-C	0	0.015	0.51	0.24	2.124	3.002	39-C	0	0	0	0	0	0	0	0	0
39-D	0	0.59	0.273	4.807	5.99	12.024	39-D	5.014	0.24	0.24	0	0	0	0	0	0
39F-A	0	0.273	0	0	1.055	3.993	48-A	0	0.51	0	0.015	0.304	0	0.015	0	0
39F-B	0	0.015	0	0.51	0.991	0.24	48-B	2.252	0.51	0.783	0.015	0.015	0.24	0	0.015	0.048
39F-C	0	0.015	0.24	0.574	14.758	7.746	48-C	0.751	0.352	0.64	0.048	0	0	0.273	0.543	0.847
39F-D	0	0.015	0.064	0.304	2.556	2.252	48-D	1.406	2.095	1.805	0.799	1.072	1.582	0.273	0.289	0
48-A	0	0.543	0.574	1.501	2.141	0.24	57-A	3.576	0.24	0.543	1.501	0	6.596	3.372	5.839	3.962
48-B	0	0.015	0	0.256	1.055	10.316	57-B	2.027	0.526	0.015	0.015	0.015	0	0.015	0.24	0.015
48-C	0	0.015	0	2.777	8.933	9.79	57-C	3.033	0.015	0.289	0.497	2.064	15.682	0.256	0.24	0
48-D	0	0.033	0.015	0.559	0.592	4.311	57-D	25.191	7.329	10.399	5.845	3.42	5.254	3.242	0.51	0
57-A	0	0	0	0.24	1.276	18.924	65-A	16.005	3.018	11.946	6.07	12.138	6.149	3.099	1.261	2.108
57-B	0	0.033	0.015	0.015	2.315	4.519	65-B	11.343	2.172	20.506	5.11	0.607	7.794	0.751	0.51	0.256
57-C	0	0	0.048	0.51	0.799	7.329	65-C	25.008	1.276	1.294	0.559	5.542	1.805	0.991	0.751	1.261
57-D	0	0.24	0	1.087	4.424	10.911	65-D	21.257	41.617	35.964	2.285	1.501	5.143	3.002	0.51	0.256
57F-A	0.42	0	0.574	1.534	1.79	11.898										
57F-B	0	0.015	0.543	0.991	2.826	2.081										
57F-C	0	0	0.256	0.751	2.604	14.582										
57F-D	0	0.048	0.015	1.421	3.228	10.128										
65-A	0.42	0	0.048	0	3.768	12.583										
65-B	0	0	0	0.24	4.263	11.85										
65-C	0	0	0.048	1.501	5.062	5.558										
65-D	0	0	0.048	0.256	3.306	17.042										

Appendix D

Biovolume Data For Individual Taxa At Five Salinities in Tanks Without Fish

Total Rotifers (cubic mm/L)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0.106	0.025	0.114	0.006	0.001	0	30-A	0	0.614	0.135	3.22E-04	4.74E-04	0.001	0	0	3.20E-04
30-B	0.119	0.06	0.031	0.006	1.66E-04	2.19E-05	30-B	0.001	0.014	4.90E-04	0.366	0.109	0.001	0	0	3.20E-04
30-C	0.184	2.038	0.386	0.007	1.52E-04	0	30-C	0	0.012	1.52E-04	1.52E-04	0.002	0.001	0	0	1.52E-04
30-D	0.057	0.121	8.49	0.324	0.065	1.52E-04	30-D	0	0.001	0.001	0.002	4.74E-04	0.001	3.22E-04	0	0
39-A	0.025	1.139	0.153	0.014	0.008	0.001	39-A	1.68E-04	0.005	0.001	1.52E-04	3.22E-04	4.74E-04	0	0.007	0.006
39-B	0.001	0.023	0.005	0.002	0.002	0	39-B	0	0.001	0.002	0.001	0.001	3.22E-04	0.002	3.57E-04	1.52E-04
39-C	0.016	0.54	0.326	0.092	0.004	0.001	39-C	1.52E-04	3.20E-04	0.055	0.008	0.039	1.52E-04	0	3.22E-04	0.014
39-D	0.031	0.612	0.253	0.358	0.071	0.013	39-D	0	0.001	0.001	0.008	1.52E-04	0	0.001	0.002	0.001
39F-A	0.007	0.292	0.28	0.001	0.008	4.66E-05	48-A	0.076	0.032	0.009	0.536	0.067	0	0.001	0.002	0.004
39F-B	0.004	0.155	0.01	0.001	0.001	1.52E-04	48-B	4.71E-04	0	0.31	0.001	0.022	0.001	0	0	1.52E-04
39F-C	0.011	0.136	0.314	0.02	0.005	4.06E-04	48-C	0.002	2.076	1.774	0.013	0	1.66E-04	0	0	0.001
39F-D	3.87E-05	0.101	0.664	4.74E-04	0.001	0	48-D	78.859	0.062	0.022	0.046	0.001	1.52E-04	1.52E-04	0	0.002
48-A	0.001	3.186	1.531	0.002	0.002	0.005	57-A	0.021	0.034	0.038	0.12	0.001	0	2.19E-05	0	0
48-B	0.004	0.263	0.039	0	0.005	0	57-B	0.037	0.015	0.021	0.008	0.006	0	0	0.004	0.002
48-C	0.002	0.423	0.027	0.639	0.218	0.022	57-C	0.005	0.01	0.48	0.198	0.033	0	0	0	0
48-D	0.005	0.174	0.004	0.014	4.88E-04	2.19E-05	57-D	2.454	0.468	0.181	0.089	0.077	0.115	0	0.007	0
57-A	0.008	0.048	0.001	0.034	0.001	0.003	65-A	4.74E-04	0.003	0.032	0.133	0.374	0.044	5.92E-05	0	1.52E-04
57-B	0.017	0.009	0.001	0.004	1.74E-04	0.013	65-B	0.087	0.07	0.009	0.003	4.90E-04	0	0	0	0.001
57-C	1.58E-04	0.011	0.006	0	0	0.006	65-C	0.291	0.357	0.003	0.018	0.131	0.004	0	1.68E-04	0.207
57-D	0.001	0.015	0.059	3.901	0.032	2.31	65-D	0.94	0.026	0.004	0.004	0.003	2.02E-04	0	0	0
57F-A	0.001	0.005	0.001	0.005	0.002	0.031										
57F-B	0.002	0.323	1.281	0.12	0.043	0.267										
57F-C	0.004	0.043	0.121	0.807	0.002	0.001										
57F-D	0.001	13.028	4.258	0.103	0.294	0.036										
65-A	0.001	0.031	0.004	0.016	0.002	0.002										
65-B	2.38E-04	0.074	0.011	0.03	0.001	0.01										
65-C	0.001	0.118	36.539	0.155	0.011	0.846										
65-D	3.15E-04	0.575	9.914	0.058	0.007	0.124										

Appendix D

Biovolume Data For Individual Taxa At Five Salinities in Tanks Without Fish

Total Protozoans (cubic mm/L)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	0.001	6.22E-06	5.96E-05	1.56E-04	0.001	30	0	0.004	0.06	0	0	0	0	5.34E-05	1.94E-05
30-B	0	0.002	0.001	5.34E-05	0	1.13E-04	30	0	1.17E-04	3.64E-04	0	0	0	2.57E-05	1.32E-05	1.94E-05
30-C	0	0.027	5.34E-05	2.36E-04	4.74E-04	0.001	30	0	0	5.96E-05	0	0.084	0	0	0	0
30-D	0	0.006	0.027	0	0.001	4.26E-04	30	0	0	0	1.17E-04	0	0	0	0	0
39-A	0	0.015	0.001	0	1.32E-05	1.17E-04	39	0	0.002	2.61E-04	0	0	1.51E-04	0	0.001	0
39-B	0	0.003	0.007	5.34E-05	4.13E-04	0.001	39	5.34E-05	2.43E-04	0.001	4.81E-04	0.001	1.17E-04	0.002	6.22E-06	0
39-C	0	0.12	1.113	0.001	5.21E-05	0.001	39	0	0	0	0	0.001	0	0	0	0
39-D	0	0.007	0.013	5.34E-05	6.22E-06	1.27E-04	39	0	0	0.003	0	1.17E-04	0	0	0	0
39F-A	0	0.056	0.001	6.22E-06	1.36E-04	1.19E-04	48	1.49E-04	3.89E-05	0.001	3.75E-04	0.006	1.32E-05	0	0	0
39F-B	0	0.004	0.002	0	0	2.40E-04	48	0.001	0.001	5.96E-05	6.22E-06	0.001	1.17E-04	0	0	0
39F-C	0	0.021	0.062	0	1.16E-04	2.90E-04	48	0.001	0.005	0.123	2.57E-05	0	0	0	1.55E-04	0
39F-D	0	0.002	0.003	6.22E-06	2.53E-05	4.29E-04	48	0	0.001	3.52E-04	6.22E-06	1.17E-04	3.64E-04	0	0	0
48-A	0	0.147	0.03	0	6.22E-06	0.003	57	2.46E-04	6.22E-06	1.20E-04	0	0	3.89E-05	2.57E-05	2.48E-04	0
48-B	0	0.225	0.999	6.22E-06	3.27E-05	0.002	57	1.99E-04	0	1.32E-05	0	0	0	0	1.70E-04	0
48-C	0	0.035	0.099	1.17E-04	0	1.10E-04	57	0.001	0	0.032	0.005	0	0	0	2.83E-04	6.22E-06
48-D	0	0.011	0.002	0	0	1.55E-04	57	0.001	0.001	3.01E-04	0	0	0	1.17E-04	0	0
57-A	0	0.006	0.007	0	1.94E-05	2.26E-04	65	0	1.17E-04	0.001	0	0.001	0.002	3.97E-04	0.003	0
57-B	0	0.006	0.008	1.17E-04	1.94E-05	0.001	65	1.17E-04	0	0	2.57E-05	0	0.003	0.009	0.045	1.17E-04
57-C	0	0.049	0.033	0.004	1.30E-04	0.004	65	3.56E-04	0	4.81E-04	0.027	0.082	0.023	0.407	0.052	0.031
57-D	0	0.012	0.027	0	2.86E-04	2.48E-04	65	5.34E-05	0	6.22E-06	3.27E-05	1.17E-04	6.22E-06	1.36E-04	3.64E-04	0.001
57F-A	0	0.105	0.006	1.13E-04	1.55E-04	2.50E-04										
57F-B	0	0.042	1.446	0	6.22E-06	1.17E-04										
57F-C	0	0.072	0.004	4.81E-04	4.81E-04	2.41E-04										
57F-D	0	0.097	0.504	2.83E-04	2.48E-04	9.10E-05										
65-A	0	0.068	0.04	0.001	2.86E-05	9.07E-05										
65-B	0	0.081	0.067	0.001	6.22E-06	0.001										
65-C	0	0.534	0.889	0.001	0	2.67E-04										
65-D	0	5.109	1.926	3.64E-04	0	6.22E-06										

Appendix D

Biovolume Data For Individual Taxa At Five Salinities in Tanks Without Fish

Total Nematodes (cubic mm/L)																
Salinity	1/24/91	2/27/91	3/21/91	4/25/91	5/28/91	6/29/91	Salinity	7/29/91	8/28/91	9/26/91	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
30-A	0	5.64E-05	2.65E-05	1.09E-04	0	2.65E-05	30-A	0	2.75E-04	2.22E-04	0	0	2.65E-05	0.005	2.65E-05	5.64E-05
30-B	0	5.64E-05	1.39E-04	0	0	0	30-B	0	0	0	8.29E-05	5.64E-05	1.92E-04	2.22E-04	2.75E-04	2.22E-04
30-C	0	0.001	2.65E-05	1.66E-04	0	2.65E-05	30-C	0	0	0	0	0	0	2.65E-05	2.65E-05	2.65E-05
30-D	0	2.49E-04	0.001	5.64E-05	0	0	30-D	0	0	5.64E-05	0	0	5.64E-05	2.65E-05	0	0
39-A	0	2.65E-05	0	8.29E-05	2.65E-05	0	39-A	0	0	0	0	0	1.09E-04	0.002	3.05E-04	0
39-B	0	8.29E-05	1.09E-04	5.64E-05	2.65E-05	2.65E-05	39-B	0	0	2.65E-05	0	0	5.64E-05	3.58E-04	0	2.65E-05
39-C	0	0.001	1.92E-04	3.32E-04	5.64E-05	0	39-C	0	0	0	0	0	5.64E-05	0	2.65E-05	0
39-D	0	0.001	4.97E-04	1.09E-04	2.65E-05	0	39-D	0	0	2.65E-05	2.65E-05	0	0	0	5.64E-05	0
39F-A	0	1.92E-04	3.05E-04	5.64E-05	0	0	48-A	0	0	8.29E-05	5.64E-05	1.66E-04	5.64E-05	8.29E-05	1.09E-04	5.64E-05
39F-B	0	0.001	0.001	2.65E-05	2.65E-05	0	48-B	5.31E-05	0	0	0	0	3.58E-04	0.052	3.05E-04	1.09E-04
39F-C	0	2.79E-04	1.66E-04	4.41E-04	2.65E-05	2.65E-05	48-C	0	0	2.65E-05	8.29E-05	0	8.29E-05	5.64E-05	1.92E-04	8.29E-05
39F-D	0	1.92E-04	3.32E-04	1.09E-04	0	2.65E-05	48-D	2.65E-05	0	5.64E-05	0	0	5.64E-05	1.66E-04	1.09E-04	2.75E-04
48-A	0	3.85E-04	0.001	8.29E-05	5.64E-05	0	57-A	2.65E-05	0	0	0	0	5.64E-05	1.39E-04	3.88E-04	4.97E-04
48-B	0	4.71E-04	2.65E-05	1.09E-04	2.22E-04	0	57-B	0	0	2.65E-05	0	5.64E-05	0	2.65E-05	3.05E-04	4.15E-04
48-C	0	0.001	4.15E-04	8.29E-05	2.65E-05	0	57-C	0	0	5.64E-05	2.65E-05	5.64E-05	1.09E-04	2.75E-04	0.001	0.001
48-D	0	5.64E-05	3.32E-04	1.92E-04	5.64E-05	8.29E-05	57-D	0	0	0	0	0	2.65E-05	1.09E-04	1.09E-04	5.64E-05
57-A	0	2.65E-05	1.09E-04	8.29E-05	0	1.39E-04	65-A	0	5.64E-05	2.65E-05	1.39E-04	0	1.66E-04	0.002	2.22E-04	0.001
57-B	0	1.66E-04	5.64E-05	1.09E-04	5.64E-05	0.001	65-B	0	2.65E-05	5.64E-05	2.65E-05	1.66E-04	5.64E-05	0.001	4.41E-04	1.39E-04
57-C	0	1.66E-04	2.65E-05	1.09E-04	0	0.002	65-C	0	0	0	0	8.29E-05	1.39E-04	0.003	5.64E-05	0.012
57-D	0	1.36E-04	1.92E-04	3.32E-04	0	2.65E-05	65-D	0	2.65E-05	2.65E-05	0	2.65E-05	1.66E-04	4.15E-04	1.66E-04	0.001
57F-A	0	3.05E-04	2.75E-04	2.65E-05	2.65E-05	0.001										
57F-B	0	8.29E-05	1.09E-04	1.09E-04	2.65E-05	1.39E-04										
57F-C	0	2.79E-04	1.92E-04	2.65E-05	2.49E-04	4.41E-04										
57F-D	0	2.65E-05	2.49E-04	1.92E-04	2.65E-05	3.05E-04										
65-A	0	5.64E-05	0	2.65E-05	8.29E-05	0										
65-B	0	0	0	0	0	1.66E-04										
65-C	0	0	5.64E-05	5.64E-05	0	2.49E-04										
65-D	0	0	0	0	8.29E-05	0										

APPENDIX E

COUNT DATA AFTER FISH INTRODUCTIONS AT TWO SALINITIES

Appendix E

Count Data After Fish Introductions At Two Salinities

Total Invertebrates (number/liter)							Total Crustaceans (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	26.412	68.475	18.294	23.817	26.359	12.454	39-A	26.4123	68.475	18.293	23.8153	26.351	11.939
39-B	9.171	10.149	19.703	7.749	25.99	22.685	39-B	9.16948	9.90717	19.702	7.744	25.99	22.6843
39-C	14.807	5.101	2.288	37.939	10.937	43.626	39-C	14.7982	5.061	2.288	37.9393	10.937	43.612
39-D	30.293	101.357	40.916	71.77	36.977	185.223	39-D	30.2852	101.357	40.916	71.7702	36.9762	185.222
39F-A	1.787	1.056	0.002	0.613	1.733	1.178	39F-A	0.00233	0.01	0.00037	0.01937	0.00337	0.47508
39F-B	0.052	0.043	0.019	0.008	0.043	0.127	39F-B	0.05208	0.037	0.017	0.00717	0.04	0.126
39F-C	3.368	5.168	8.955	0.143	0.111	0.003	39F-C	3.094	4.90616	8.947	0.139	0.10437	0.00334
39F-D	0.279	0.1	0.243	0.006	0.005	0.022	39F-D	0.034	0.078	0.00216	0.003	0.004	0.018
57-A	1.631	0.003	6.598	3.412	5.843	3.978	57-A	0.011	0.00317	0.00234	0.03917	0.00337	0.015
57-B	0.027	0.024	0.00033	0.016	0.245	0.018	57-B	0.00417	0.88234	0.00033	0.00133	4E-05	0.00134
57-C	0.711	2.994	15.71	0.273	1.74	1.992	57-C	0.01034	0.01017	0.02934	0.018	1.499	1.991
57-D	6.543	3.645	5.386	3.242	0.518	5.6E-05	57-D	0.60948	0.148	0.01716	0.00016	0.00137	0
57F-A	0.357	0.381	0.071	0.06	1.323	0.489	57F-A	0.006	0.245	0.065	0.04716	0.048	0.445
57F-B	1.001	1.232	0.065	0.052	0.582	0.501	57F-B	0.538	1.181	0.038	0.05	0.071	0.5
57F-C	0.3	0.187	0.498	0.133	0.909	0.114	57F-C	0.038	0.168	0.497	0.102	0.154	0.113
57F-D	0.519	1.53	0.259	0.486	1.036	5.995	57F-D	0.008	0.03016	0.004	0.47012	0.47084	1.473

Appendix E

Count Data After Fish Introductions At Two Salinities

Total Trichocorixa (number/liter)							Total Rotifers (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0	0	0	0	0	0.51	39-A	0.00015	0.0003	0.00047	0	0.007	0.00536
39-B	0	0.24	0	0	0	0	39-B	0.001	0.00117	0.00032	0.00217	0.00036	0.00015
39-C	0	0	0	0	0	0	39-C	0.009	0.03917	0.00015	0	0.00032	0.014
39-D	0	0	0	0	0	0	39-D	0.008	0.00015	0	0	0.00117	0.001
39F-A	1.756	1.039	0	0.24	1.008	0.607	39F-A	0.029	0.00702	0.002	0.353	0.721	0.0953
39F-B	0	0	0	0	0	0	39F-B	0.00052	0.005	0.00137	0.00047	0	0
39F-C	0.273	0	0	0	0	0	39F-C	0.001	0.002	0.000474	0.000369	0.006	0
39F-D	0.24	0.015	0.24	0	0	0	39F-D	0.004047	0.005	0.000152	0.003	0	0.002
57-A	1.501	0	6.596	3.372	5.839	3.962	57-A	0.119	0.000679	0	2.19E-05	0	0
57-B	0.015	0.015	0	0.015	0.24	0.015	57-B	0.008	0.006	0	0	0.004	0.001357
57-C	0.497	2.064	15.681	0.255	0.24	0	57-C	0.198	0.032022	0	0	0	0
57-D	5.845	3.42	5.254	3.242	0.51	0	57-D	0.089	0.077	0.115	0	0.007097	0
57F-A	0	0	0	0	1.261	0	57F-A	0.351115	0.136022	0.003	0.002	0.00254	0.042
57F-B	0	0	0	0	0.51	0	57F-B	0.463137	0.051	0.027	0.001	0	0.000869
57F-C	0.255	0	0	0	0.751	0	57F-C	0.007022	0.003022	0	0.000267	0.001152	6.86E-05
57F-D	0.51	1.487	0.255	0	0.51	0.751	57F-D	0.000152	0.013	0	0.015401	0.000404	3.764

Appendix E

Count Data After Fish Introductions At Two Salinities

Total Protozoans (number/liter)							Total Nematodes (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0	0	0.000151	0	0.001115	0	39-A	0	0	0.000109	0.002	0.000305	0
39-B	0.00048	0.001	0.000117	0.002006	6.22E-06	0	39-B	0	0	5.64E-05	0.000358	0	2.65E-05
39-C	0	0.001	0	0	0	0	39-C	0	0	5.64E-05	0	2.65E-05	0
39-D	0	0.000117	0	0	0	0	39-D	2.65E-05	0	0	0	5.64E-05	0
39F-A	1.3E-05	0	4.98E-06	0	0	0	39F-A	2.65E-05	2.65E-05	5.64E-05	0.001	0.000166	0.000192
39F-B	0	0.000117	0.000428	0	0.001125	0.000487	39F-B	2.65E-05	0.000109	0.000415	0.000358	0.002	0.000415
39F-C	0.000364	0.26	0.007006	0.003	0.000117	1.32E-05	39F-C	0	0	0	5.64E-05	0.000109	0.000139
39F-D	0.000402	0	0	0.00013	0	0.001	39F-D	5.64E-05	0.001	0.000441	0.000305	0.001	0.001
57-A	0	0	3.89E-05	2.57E-05	0.000281	0	57-A	0	0	5.64E-05	0.000139	0.000388	0.000497
57-B	0	0	0	0	0.00017	0	57-B	0	5.64E-05	0	2.65E-05	0.000305	0.000415
57-C	0.005081	0	0	0	0.000283	6.22E-06	57-C	2.65E-05	5.64E-05	0.000109	0.000275	0.001	0.001
57-D	0	0	0	0.000117	0	0	57-D	0	0	2.65E-05	0.000109	0.000109	5.64E-05
57F-A	0	0.000117	0.003394	0.01	0.011006	0.00128	57F-A	8.29E-05	0	2.65E-05	2.65E-05	8.29E-05	0.001
57F-B	0.000163	0	0	2.57E-05	0.000117	0.000417	57F-B	2.65E-05	0	2.65E-05	0.001	0.001	0.000249
57F-C	9.66E-05	0.016119	0.001524	0.027103	0.000553	0.000486	57F-C	5.64E-05	0.000166	8.29E-05	0.003	0.002	0.001
57F-D	0	0	0	0.000416	0.054	0.007117	57F-D	0	2.65E-05	2.65E-05	5.64E-05	0.000305	0.000305

Appendix E

Count Data After Fish Introductions At Two Salinities

Gammarus mucronatus (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	41.41	35.42	7.75	10.42	14.42	46.08
39-B	7.42	13.08	19	8.84	46.26	32.5
39-C	4.67	5.16	5.83	85.49	5.83	22.91
39-D	20.58	187.87	29.75	49.5	25	62.75
39F-A	0	0	0	0.25	0.08	0.08
39F-B	0	0.08	0.17	0.08	0.08	0
39F-C	4.16	1.66	3.25	0.16	0.08	0.08
39F-D	0	0.08	0	0	0	0
57-A	0	0	0	0.34	0.08	0
57-B	0	0	0	0	0	0
57-C	0.17	0	0.5	0.42	1	1.66
57-D	0	0.08	0.16	0	0	0
57F-A	0	0	0	0	0.17	0.08
57F-B	0.24	0.92	0	0.08	0.08	0.08
57F-C	0.08	0.08	0.08	0	0	0
57F-D	0	0.17	0	0.08	0.08	0.33

Apocyclops dengizicus nauplii (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0	0	0	0	0	0
39-B	0.17	0	0	0	0	0
39-C	0.08	0	0	0	0	0
39-D	0	0	0	0	0	0
39F-A	0.08	0	0	0	0	0
39F-B	0.17	0.17	0	0.08	0	0
39F-C	0.33	0	0	0	0	0
39F-D	0.08	0	0	0	0	0
57-A	4	0	0.25	0.08	0	0
57-B	0.08	0	0	0	0	0
57-C	0.17	0.08	0	0	0	0
57-D	79.58	3.17	0.08	0	0	0
57F-A	0	0	0	0	0	0
57F-B	0	0	0	0	0	0
57F-C	6.58	9.5	1.75	1.25	0	8.08
57F-D	0	0	0	0	0	0

Appendix E

Count Data After Fish Introductions At Two Salinities

Apocyclops dengizicus copepodids (number/liter)							Cletocamptus dietersi nauplii (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0	0	0	0	0	0	39-A	0	0	0	0	0	0
39-B	0	0	0	0	0	0	39-B	0.25	0	0.08	0	0	0
39-C	0	0	0	0	0	0	39-C	0	0	0	0	0	0
39-D	0	0	0	0	0	0	39-D	0	0	0.08	0	0	0
39F-A	0.08	0.17	0	0.5	0	0	39F-A	0.08	0	0	0	0	0.17
39F-B	0.08	0.08	0	0	0	0	39F-B	0.17	0.42	1.17	0.08	0.17	0.08
39F-C	0.17	0	0	0.08	0	0	39F-C	0.75	0	0	0	0	0
39F-D	0.16	2.09	0	0	0	0	39F-D	0.33	0.25	0.08	0.08	0.17	0.08
57-A	0.25	0.08	0	0	0	0	57-A	0.75	0.33	0.08	0	0	0
57-B	0	0	0	0.08	0	0	57-B	0.33	0	0	0	0.08	0
57-C	0.17	0	0	0	0	0	57-C	0.08	0.42	0	0	0.08	0
57-D	14.92	4.84	0.5	0	0	0	57-D	0.25	0	0	0	0	0
57F-A	0	0	0	0	0	0	57F-A	0.25	8.25	1.17	0.92	16	17.42
57F-B	0	0.08	0	0	0	0	57F-B	8.17	3.17	0.42	9.08	8.67	10.58
57F-C	1.83	4.74	1.5	2.5	0	0.83	57F-C	0.33	4.5	0	0.92	11	3.75
57F-D	0.42	0	0.25	0	0	0	57F-D	0.08	0.33	0	0.25	0.25	0.17

Appendix E

Count Data After Fish Introductions At Two Salinities

Cletotocamptus dietersi copepodids (number/liter)							Balanus amphitrite (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0	0	0	0	0	0	39-A	0.17	0	0	0.17	4.75	11.67
39-B	0	0.08	0	0	0	0	39-B	13.08	0	0	6.08	1	0.17
39-C	0	0	0	0	0	0	39-C	0.25	0	0.83	0.17	0.33	0
39-D	0	0	0	0	0	0	39-D	0.08	0	0	0.08	0.08	0
39F-A	0.42	0.25	0.08	0.08	0.08	0	39F-A	0.33	0.5	0	0.33	0	2.67
39F-B	0	0.17	0.25	0.75	0.5	0.5	39F-B	25.33	14.5	4.42	0.5	16.92	61.2
39F-C	0.17	0.08	0	0.17	0.08	0	39F-C	7.33	0.08	3.58	58.59	50	0.17
39F-D	1.16	6	0.41	0.67	0.91	3	39F-D	13.92	0	0.08	0	0	1
57-A	0.33	0.42	0.25	0.75	0.08	2.84	57-A	0.33	0.25	0.17	1.17	0	0
57-B	0.83	0.5	0.08	0.08	0	0.25	57-B	0	0.17	0.08	0.25	0	0.17
57-C	0.33	0.66	0.08	0.66	0.17	0	57-C	0.17	3.67	0.17	0	1.58	2.5
57-D	0.17	0.16	0	0	0.08	0	57-D	0	0	0.08	0.08	0	0
57F-A	1.67	43	7.83	10.42	6.75	88.91	57F-A	0.33	23.08	17.33	0.08	1.08	4.42
57F-B	12.17	23.83	8.67	7.91	9	4.58	57F-B	0.5	0.42	0	0	9.33	0.83
57F-C	0.92	6.58	2.5	17.5	28.75	20.58	57F-C	0.5	0	0.25	1.08	1	0
57F-D	0.33	0.33	0	0	0.08	0.25	57F-D	0	0.08	0	0	0.17	0

Appendix E

Count Data After Fish Introductions At Two Salinities

Trichocorixa reticulata <1.0 cm (number/liter)							Trichocorixa reticulata >1.0 cm (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0	0	0	0	0	0	39-A	0	0	0	0	0	0.17
39-B	0	0	0	0	0	0	39-B	0	0.08	0	0	0	0
39-C	0	0	0	0	0	0	39-C	0	0	0	0	0	0
39-D	0	0	0	0	0	0	39-D	0	0	0	0	0	0
39F-A	0.08	0.25	0	0	1.33	0.5	39F-A	0.58	0.33	0	0.08	0.25	0.17
39F-B	0	0	0	0	0	0	39F-B	0	0	0	0	0	0
39F-C	0.17	0	0	0	0	0	39F-C	0.08	0	0	0	0	0
39F-D	0	0.08	0	0	0	0	39F-D	0.08	0	0.08	0	0	0
57-A	0	0	0.42	0.67	5.67	1.08	57-A	0.5	0	2.17	1.08	1.58	1.25
57-B	0.08	0.08	0	0.08	0	0.08	57-B	0	0	0	0	0.08	0
57-C	1.33	1.67	0.83	0.08	0	0	57-C	0.08	0.58	5.17	0.08	0.08	0
57-D	0.42	0.92	0	0	0	0	57-D	1.92	1.08	1.75	1.08	0.17	0
57F-A	0	0	0	0	0	0	57F-A	0	0	0	0	0.42	0
57F-B	0	0	0	0	0	0	57F-B	0	0	0	0	0.17	0
57F-C	0.08	0	0	0	0	0	57F-C	0.08	0	0	0	0.25	0
57F-D	0	1.17	0.08	0	0	0	57F-D	0.17	0.42	0.08	0	0.17	0.25

Appendix E

Count Data After Fish Introductions At Two Salinities

Brachionus plicatilis (number/liter)							Synchaeta tamara (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0.08	0.16	0.25	0	3.66	3	39-A	0	0	0	0	0	0
39-B	0.33	0.58	0.17	1.08	0.17	0.08	39-B	0	0	0	0	0	0
39-C	4.33	20.75	0.08	0	0.17	7.17	39-C	0	0	0	0	0	0
39-D	4.17	0.08	0	0	0.83	0.42	39-D	0	0	0	0	0	0
39F-A	14.66	3.67	1	182.82	366.31	48.5	39F-A	0	0.08	0	0	0	2.17
39F-B	0.08	1.75	0.41	0.25	0	0	39F-B	1.33	5.5	0.17	0	0	0
39F-C	0.42	0.83	0.25	0.17	3	0	39F-C	0	0	0	0.17	0	0
39F-D	2.42	2.42	0.08	1.08	0	1.17	39F-D	0.17	0	0	0	0	0
57-A	62.83	0.34	0	0	0	0	57-A	0	0	0	0.08	0	0
57-B	4	2.84	0	0	2	0.92	57-B	0	0	0	0	0	0
57-C	102.34	16.92	0	0	0	0	57-C	0	0.08	0	0	0	0
57-D	45.75	39.41	60.05	0	3.67	0	57-D	0	0	0	0	0.17	0
57F-A	182.03	71	0.83	0.33	0.25	20.83	57F-A	0.42	0.08	2.58	4.92	8.83	3.92
57F-B	240.1	26.33	14.25	0.5	0	0.33	57F-B	0.5	0	0	0	0	0.83
57F-C	3.25	1.5	0	0.08	0.08	0	57F-C	0.08	0.08	0	0.42	3.83	0.25
57F-D	0.08	6.92	0	7.83	0.17	1935.34	57F-D	0	0	0	0	0.17	0

Appendix E

Count Data After Fish Introductions At Two Salinities

Fabrea salinia (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0	0	0	0	0	0
39-B	0	0	0	0	0	0
39-C	0	0	0	0	0	0
39-D	0	0	0	0	0	0
39F-A	0	0	0	0	0	0
39F-B	0	0	0	0	0.08	0
39F-C	0	0	0	0	0	0
39F-D	0	0	0	0	0	0
57-A	0	0	0	0	0	0
57-B	0	0	0	0	0.08	0
57-C	0	0	0	0	0.25	0
57-D	0	0	0	0	0	0
57F-A	0	0	0	0	0.75	0.42
57F-B	0	0	0	0	0	0.08
57F-C	0	0	0	0	0	0
57F-D	0	0	0	0	5.08	11.17

Euplotes sp. (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0	0	0	0	0	0
39-B	0	0	0	0.08	0.08	0
39-C	0	0	0	0	0	0
39-D	0	0	0	0	0	0
39F-A	0.17	0	0	0	0	0
39F-B	0	0	5.5	0	0.92	0.08
39F-C	0	0	0.08	0	0	0.17
39F-D	0	0	0	0.17	0	0
57-A	0	0	0.5	0.33	0	0
57-B	0	0	0	0	0	0
57-C	68.49	0	0	0	0	0.08
57-D	0	0	0	0	0	0
57F-A	0	0	0.92	10.5	0.08	0
57F-B	0.08	0	0	0.33	0	0
57F-C	0.25	35.92	6.25	1.33	0	0
57F-D	0	0	0	2.17	0	0

Appendix E

Count Data After Fish Introductions At Two Salinities

Condylostoma sp. (number/liter)							Nematodes (number/liter)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0	0	0.08	0	0.91	0	39-A	0	0	0.33	5.5	0.92	0
39-B	0.33	0.92	0.08	1.5	0	0	39-B	0	0	0.17	1.08	0	0.08
39-C	0	0.42	0	0	0	0	39-C	0	0	0.17	0	0.08	0
39-D	0	0.08	0	0	0	0	39-D	0.08	0	0	0	0.17	0
39F-A	0	0	0	0	0	0	39F-A	0.08	0.08	0.17	1.75	0.5	0.58
39F-B	0	0.08	0	0	0.67	0.33	39F-B	0.08	0.33	1.25	1.08	5.17	1.25
39F-C	0.25	183.96	4.92	1.75	0.08	0	39F-C	0	0	0	0.17	0.33	0.42
39F-D	0.33	0	0	0.08	0	1.08	39F-D	0.17	4.42	1.33	0.92	3.5	3.58
57-A	0	0	0	0	0.17	0	57-A	0	0	0.17	0.42	1.17	1.5
57-B	0	0	0	0	0.08	0	57-B	0	0.17	0	0.08	0.92	1.25
57-C	0.17	0	0	0	0.08	0	57-C	0.08	0.17	0.33	0.83	2.5	3.67
57-D	0	0	0	0.08	0	0	57-D	0	0	0.08	0.33	0.33	0.17
57F-A	0	0.08	2.67	6.25	6.92	0.83	57F-A	0.25	0	0.08	0.08	0.25	3.67
57F-B	0.33	0	0	0	0.08	0.25	57F-B	0.08	0	0.08	2.5	2.08	0.75
57F-C	0.08	9.08	0.91	18.83	0.33	0.67	57F-C	0.17	0.5	0.25	9.83	5.67	2.42
57F-D	0	0	0	0.17	35.33	0.08	57F-D	0	0.08	0.08	0.17	0.92	0.92

APPENDIX F

BIOVOLUME DATA AFTER FISH INTRODUCTIONS AT TWO SALINITIES

Appendix F

Biovolume Data After Fish Introductions At Two Salinities

Total Invertebrates (cubic mm/L)							Total Crustaceans (cubic mm/L)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	26.4120	68.4750	18.2940	23.8170	26.3590	12.4540	39-A	26.4123	68.4750	18.2930	23.8153	26.3510	11.9390
39-B	9.1710	10.1490	19.7030	7.7490	25.9900	22.6850	39-B	9.1695	9.9072	19.7020	7.7440	25.9900	22.6843
39-C	14.8070	5.1010	2.2880	37.9390	10.9370	43.6260	39-C	14.7982	5.0610	2.2880	37.9393	10.9370	43.6120
39-D	30.2930	101.3570	40.9160	71.7700	36.9770	185.2230	39-D	30.2852	101.3570	40.9160	71.7702	36.9762	185.2220
39F-A	1.7870	1.0560	0.0020	0.6130	1.7330	1.1780	39F-A	0.0023	0.0100	0.0004	0.0194	0.0034	0.4751
39F-B	0.0520	0.0430	0.0190	0.0080	0.0430	0.1270	39F-B	0.0521	0.0370	0.0170	0.0072	0.0400	0.1260
39F-C	3.3680	5.1680	8.9550	0.1430	0.1110	0.0030	39F-C	3.0940	4.9062	8.9470	0.1390	0.1044	0.0033
39F-D	0.2790	0.1000	0.2430	0.0060	0.0050	0.0220	39F-D	0.0340	0.0780	0.0022	0.0030	0.0040	0.0180
57-A	1.6310	0.0030	6.5980	3.4120	5.8430	3.9780	57-A	0.0110	0.0032	0.0023	0.0392	0.0034	0.0150
57-B	0.0270	0.0240	0.0003	0.0160	0.2450	0.0180	57-B	0.0042	0.8823	0.0003	0.0013	0.0000	0.0013
57-C	0.7110	2.9940	15.7100	0.2730	1.7400	1.9920	57-C	0.0103	0.0102	0.0293	0.0180	1.4990	1.9910
57-D	6.5430	3.6450	5.3860	3.2420	0.5180	0.0001	57-D	0.6095	0.1480	0.0172	0.0002	0.0014	0.0000
57F-A	0.3570	0.3810	0.0710	0.0600	1.3230	0.4890	57F-A	0.0060	0.2450	0.0650	0.0472	0.0480	0.4450
57F-B	1.0010	1.2320	0.0650	0.0520	0.5820	0.5010	57F-B	0.5380	1.1810	0.0380	0.0500	0.0710	0.5000
57F-C	0.3000	0.1870	0.4980	0.1330	0.9090	0.1140	57F-C	0.0380	0.1680	0.4970	0.1020	0.1540	0.1130
57F-D	0.5190	1.5300	0.2590	0.4860	1.0360	5.9950	57F-D	0.0080	0.0302	0.0040	0.4701	0.4708	1.4730

Appendix F

Biovolume Data After Fish Introductions At Two Salinities

Total Trichocorixa (cubic mm/L)							Total Rotifers (cubic mm/L)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0.0000	0.0000	0.0000	0.0000	0.0000	0.5100	39-A	0.0002	0.0003	0.0005	0.0000	0.0070	0.0054
39-B	0.0000	0.2400	0.0000	0.0000	0.0000	0.0000	39-B	0.0010	0.0012	0.0003	0.0022	0.0004	0.0002
39-C	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	39-C	0.0090	0.0392	0.0002	0.0000	0.0003	0.0140
39-D	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	39-D	0.0080	0.0002	0.0000	0.0000	0.0012	0.0010
39F-A	1.7560	1.0390	0.0000	0.2400	1.0080	0.6070	39F-A	0.0290	0.0070	0.0020	0.3530	0.7210	0.0953
39F-B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	39F-B	0.0005	0.0050	0.0014	0.0005	0.0000	0.0000
39F-C	0.2730	0.0000	0.0000	0.0000	0.0000	0.0000	39F-C	0.0010	0.0020	0.0005	0.0004	0.0060	0.0000
39F-D	0.2400	0.0150	0.2400	0.0000	0.0000	0.0000	39F-D	0.0040	0.0050	0.0002	0.0030	0.0000	0.0020
57-A	1.5010	0.0000	6.5960	3.3720	5.8390	3.9620	57-A	0.1190	0.0007	0.0000	0.0000	0.0000	0.0000
57-B	0.0150	0.0150	0.0000	0.0150	0.2400	0.0150	57-B	0.0080	0.0060	0.0000	0.0000	0.0040	0.0014
57-C	0.4970	2.0640	15.6810	0.2550	0.2400	0.0000	57-C	0.1980	0.0320	0.0000	0.0000	0.0000	0.0000
57-D	5.8450	3.4200	5.2540	3.2420	0.5100	0.0000	57-D	0.0890	0.0770	0.1150	0.0000	0.0071	0.0000
57F-A	0.0000	0.0000	0.0000	0.0000	1.2610	0.0000	57F-A	0.3511	0.1360	0.0030	0.0020	0.0025	0.0420
57F-B	0.0000	0.0000	0.0000	0.0000	0.5100	0.0000	57F-B	0.4631	0.0510	0.0270	0.0010	0.0000	0.0009
57F-C	0.2550	0.0000	0.0000	0.0000	0.7510	0.0000	57F-C	0.0070	0.0030	0.0000	0.0003	0.0012	0.0001
57F-D	0.5100	1.4870	0.2550	0.0000	0.5100	0.7510	57F-D	0.0002	0.0130	0.0000	0.0154	0.0004	3.7640

Appendix F

Biovolume Data After Fish Introductions At Two Salinities

Total Protozoans (cubic mm/L)							Total Nematodes (cubic mm/L)						
Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92	Salinity	10/24/91	11/26/91	12/27/91	1/27/92	2/24/92	4/6/92
39-A	0.0000	0.0000	0.0002	0.0000	0.0011	0.0000	39-A	0.0000	0.0000	0.0001	0.0020	0.0003	0.0000
39-B	0.0005	0.0010	0.0001	0.0020	0.0000	0.0000	39-B	0.0000	0.0000	0.0001	0.0004	0.0000	0.0000
39-C	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	39-C	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
39-D	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	39-D	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
39F-A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	39F-A	0.0000	0.0000	0.0001	0.0010	0.0002	0.0002
39F-B	0.0000	0.0001	0.0004	0.0000	0.0011	0.0005	39F-B	0.0000	0.0001	0.0004	0.0004	0.0020	0.0004
39F-C	0.0004	0.2600	0.0070	0.0030	0.0001	0.0000	39F-C	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001
39F-D	0.0004	0.0000	0.0000	0.0001	0.0000	0.0010	39F-D	0.0001	0.0010	0.0004	0.0003	0.0010	0.0010
57-A	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	57-A	0.0000	0.0000	0.0001	0.0001	0.0004	0.0005
57-B	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	57-B	0.0000	0.0001	0.0000	0.0000	0.0003	0.0004
57-C	0.0051	0.0000	0.0000	0.0000	0.0003	0.0000	57-C	0.0000	0.0001	0.0001	0.0003	0.0010	0.0010
57-D	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	57-D	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001
57F-A	0.0000	0.0001	0.0034	0.0100	0.0110	0.0013	57F-A	0.0001	0.0000	0.0000	0.0000	0.0001	0.0010
57F-B	0.0002	0.0000	0.0000	0.0000	0.0001	0.0004	57F-B	0.0000	0.0000	0.0000	0.0010	0.0010	0.0002
57F-C	0.0001	0.0161	0.0015	0.0271	0.0006	0.0005	57F-C	0.0001	0.0002	0.0001	0.0030	0.0020	0.0010
57F-D	0.0000	0.0000	0.0000	0.0004	0.0540	0.0071	57F-D	0.0000	0.0000	0.0000	0.0001	0.0003	0.0003

ABSTRACT

study suggests that the principal change would be an increase in *Trichocorixa* densities, the loss of *Gammarus*, and the appearance of *Artemia* at about 60-70 g/L, when both fish and invertebrate predators are likely to be scarce or absent. Changes in populations will have large consequences for water birds at the Salton Sea in the near future.