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EXPERIMENTAL CROPPING OF LAKES: 4. BENTHIC COMMUNITIES

by M. C. Healey

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ABSTRACT

Healey, M. C. 1977. Experimental cropping of lakes: 4. Benthic communities. Fish. Mar. Serv. Res. Dev. Tech. Rep. 711: 47 p.

This is the fourth in a series of limnological reports on Alexie, Baptiste, Chitty, and Drygeese lakes north of Yellowknife, NWT, and deals with the composition of the benthic community in the lakes.

Benthic animals were identified to various taxonomic levels depending on difficulty of identification and importance in the fauna. Seventy-nine taxa were identified from the lakes, 43% of which were common to all lakes. Percent similarity calculations indicated greatest similarity between the pairs Alexie/Chitty and Baptiste/Drygeese.

Chironomids, especially chironomini and tanytarsini, dominated in Alexie and Chitty, followed by sphaeriid molluscs and *Hyalella azteca*. Baptiste and Drygeese were dominated by *Pontoporeia affinis* followed by chironomidae and *H. azteca*. There were few consistent seasonal trends in composition of benthos.

Overall, benthos was slightly more abundant in 1972 than 1971. Benthic organisms were generally more abundant in these lakes than in other shield and shield margin lakes.

Alexie and Drygeese had two clear peaks of abundance with depth, the first in shallow samples and the second at 20-25 m. Chitty had a single peak in abundance at mid depth. In Baptiste, benthos were most abundant in the shallowest and deepest samples and least abundant at intermediate depth. Dominant taxa generally had similar depth distributions, while the minor taxa were mainly in the shallow samples.

The size composition of organisms was similar between lakes and years. Biomass distribution with depth was similar to numerical distribution. Organisms tended to be slightly larger in Alexie and Chitty.

The data on benthic communities further confirm the similarity among the four lakes that was reported in previous reports, and that the greatest similarity was between Alexie and Chitty as a pair and Baptiste and Drygeese as a pair.

RÉSUMÉ

Healey, M. C. 1977. Experimental cropping of lakes: 4. Benthic communities. Fish. Mar. Serv. Res. Dev. Tech. Rep. 711: 47 p.

Le présent rapport limnologique, quatrième d'une série portant sur les lacs Alexie, Baptiste, Chitty et Drygeese, au nord de Yellowknife (T.N.-O.), traite de la composition de leur communauté benthique.

Ce benthos a été classé à divers niveaux taxonomiques selon la difficulté de l'identification et son importance dans la faune. On a identifié 79 taxas dont 43% étaient communs à tous les lacs. Les calculs du pourcentage de similitude ont montré une plus grande similitude entre les lacs Alexie et Chitty et entre les lacs Baptiste et Drygeese.

Les chironomides, en particulier chironomini et tanytarsini, dominaient dans les lacs Alexie et Chitty, suivis des mollusques sphaeriides et de *Hyalella azteca*, tandis que dans les lacs Baptiste et Drygeese, *Pontoporeia affinis* dominait, suivi des chironomidae et de *H. azteca*. La composition du benthos montrait peu de tendances saisonniéres uniformes.

Dans l'ensemble, les organismes benthiques étaient légèrement plus abondants en 1972 qu'en 1971 et généralement plus abondants dans ces lacs que dans d'autres lacs du Bouclier et de sa périphérie.

Les lacs Alexie et Drygeese avaient deux sommets d'abondance en fonction de la profondeur, le premier dans les eaux peu profondes et le deuxième entre 20 et 25 m. Le lac Chitty avait un seul sommet d'abondance à une profondeur moyenne. Dans le lac Baptiste, les espèces benthiques étaient plus abondantes dans les échantillons prélevés en eau profonde et peu profonde et moins abondante à une profondeur intermédiaire. Les taxas dominants avaient généralement une distribution semblable en fonction de la profondeur, alors que les taxas mineurs se trouvaient principalement en eau peu profonde.

La composition des organismes en fonction de leur taille était semblable entre les lacs et d'une année à l'autre. La distribution de la biomasse selon la profrondeur était semblable à la distribution numérique. Les organismes avaient tendance à être légèrement plus gros dans les lacs Alexie et Chitty.

Les données sur les communautés benthiques confirment la similitude entre les quatre lacs, mentionnée dans les rapports précédents, et le fait que la similitude était plus forte entre les lacs Alexie et Chitty et entre les lacs Baptiste et Drygeese.

This is the fourth in a series of reports on four lakes north of Yellowknife, Northwest Territories. I used these lakes in an experiment to examine the response of lake whitefish (Coregonus clupeaformis) and the lake community in general to exploitation. Previous reports dealt with the background and design of the experiment (Healey 1973), physical and chemical features of the lakes (Healey and Woodall 1973) and phytoplankton and zooplankton (Healey and Kling 1975). The purpose of this report is to describe the benthic communities (the food of the whitefish) of the four lakes from sampling in 1971 and 1972 (prior to the start of exploitation), and to discuss further the differences and similarities among the lakes. As with previous reports on the limnology of the lakes, the approach in this report is descriptive. A more analytical description of the dynamics of the benthic community and its responses (if any) to exploitation of the lake fishes, will appear in later reports.

METHODS

I took all samples with a standard Wildco tall Ekman dredge with a mouth opening 6 in (15.24 cm) square. I discarded dredge contents and resampled when the surface of the sediment was within 5 cm of the top of the dredge, when the top doors did not close, or when the jaws were not completely closed. I washed the samples at the time of sampling through a 600 micron mesh sieve and preserved the remaining debris and organisms in 10% formalin for later sorting and examination.

In 1971, I sampled the four lakes twice: during the periods 3-15 July and 18-25 August. During each period I collected 10 dredge samples from each lake, usually five from depths above the thermocline and five from depths below the thermocline. I sampled 2-4 stations in each lake and not all stations were the same in each period (Fig. 1, Table 1). In 1972, I established two sampling transects in each lake. Each transect ran from shore to maximum depth in a different part of the lake. I sampled 5 or 6 fixed depths and locations (marked by buoys) on one of these transects (Transect 1) and 3 or 4 locations on the other (Transect 2) (Fig. 1, Table 2). I took three samples at each sampling depth on Transect 1 and two on Transect 2. I sampled the transects three times in 1972: during the periods 29 May - 3 June, 24 -31 July, and 28 September - 5 October. The more intensive sampling on Transect 1 was intended to provide data on abundance of benthos in relation to depth and season in a particular location while the sampling at Transect 2 was intended to indicate the representativeness of events at Transect 1. At the time of sampling I made notes of the type of substrate encountered at each sampling location.

I picked all the samples by hand, although I occasionally used sucrose flotation as an aid to separating the organisms from the debris. I identified the different organisms to various taxonomic levels depending on their difficulty and their relative importance in the samples. I obtained more complete identification of insect larvae from the Entomology Research Institute, Agriculture Canada, Ottawa, and of bivalve molluscs from Dr. L. Kalas, Canada Centre for Inland Waters, Burlington, Ontario. I divided the dominant taxa into several length categories and recorded the number in each category (Table 3). In general the length I measured was the maximum length along the main axis of the body.

I measured the wet weight of all the samples and dried half the samples to constant weight at 60 C. I converted all weights to dry weight from the ratio of dry to wet weight of the samples which were dried. I converted counts and weights to geometric mean number of organisms per m^2 or grams of dry matter per m^2.

I sorted the samples, which were not dried, into insect larvae and bivalves and sent the specimens to the authorities noted above for more complete identification.

RESULTS

SUBSTRATE TYPES:

The types of substrate I encountered when sampling ranged from mixtures of sand, clay and pebbles to soft easily sieved silt (Table 4). Most sand, algae (chiefly *Nostoc* sp.) and waterlogged woody debris occurred in shallow areas. Some of the shallow locations sampled had very soft substrate, however. (I classified substrates as firm if the Ekman dredge did not bite deeper than 15 cm, and soft if the bite was deeper). Sand and gravel gave way to clay and silt at deeper stations and at the deepest stations only soft easily sieved brown silt occurred. Each of the lakes had a band of moss growing in water depths between about 6 and 16 m. The moss was usually most dense at about 12 m.

TAXONOMIC COMPOSITION OF THE BENTHOS:

A total of 79 taxa occurred in the samples from the four lakes (Table 5). Alexie had the most taxa (62) and Drygeese the fewest (52). Some taxa identified in the samples are not normal components of the bottom fauna (eg. *Gordius*, *Dasyhelia*) and some were not properly sampled because of their small size (eg. *Cladocera*, *Ostracoda*, *Nematoda*).

Thirty-four of the taxa were common to all the lakes, 13 to three of the four, 12 to two of the four, and 17 were identified from only one lake. Percent similarity calculated for all possible pairings of the lakes indicated that Alexie was most like Chitty and least like Drygeese, Baptiste was most like Alexie and least like Chitty, Chitty was most like Alexie and least like Drygeese, Drygeese was most like Baptiste and least like Alexie (Table 6). These results suggest that Alexie and Chitty form a pair with much in common, and Drygeese and Baptiste form a pair with much in common. This grouping conforms to the physical situation of the lakes, Alexie and Chitty being on one subdrainage and Baptiste and Drygeese on another (Healey and Woodall 1973).

This pairing of the lakes was evident in calculations of percent similarity among the genera of chironomidae identified in the lakes, but not in similar calculations among the 11 species of Sphaeriidae. Among the Sphaeriidae there was a high degree of similarity among Alexie, Baptiste and Chitty, all of which differed from Drygeese (Table 6). Drygeese tended to have a low percent similarity with the other lakes in all the groupings, suggesting that it was the most different overall, in spite of the tendency to group with Baptiste.

Despite the differences noted above, the similarity among all the lakes was high.

PERCENT COMPOSITION OF THE BENTHOS BETWEEN LAKES, YEARS AND SEASONS:

Considerable year-to-year and lake-to-lake variation in percent composition of the benthic communities was evident in the data (Table 7). Chironomidae, Sphaeriidae and Amphipods dominated the fauna in all the lakes, but in different proportions. Chironomid larvae comprised 31-40% of the fauna in Alexie and most were of the tribes Chironomini and Tanytarsini. Chironomids were 23-27% of the fauna in Baptiste and the four subgroupings (Chironomini, Tanytarsini, Tanypodinae, Orthocladinae/ Diamesinae) were more evenly represented although Tanytarsini were most abundant. In Chitty, Chironomids were only 9% of the fauna in 1971 samples but were 43% of the 1972 samples. Chironomini clearly dominated in Chitty. Chironomids were 16-25% of the fauna in Drygeese, and, like Baptiste, the subgroupings were more evenly represented than in Alexie and Chitty, although Tanytarsini dominated strongly in 1971 samples. Sphaeriids were relatively much more abundant in Alexie and Chitty (16-30%) than in Baptiste and Drygeese (7-13%). Pisidium conventus dominated in all the lakes in 1972 but was much less important in 1971 except in Drygeese. P. nitidum contortum and P. ventricosum rotundatum replaced P. conventus in importance in 1971 in Alexie, Chitty and Baptiste. Nepionic (Postembryonic) stages were common in the samples from all four lakes. Of the Amphipods, Gammarus lacustris was only a small fraction of the fauna in any of the sample series. Hyalella azteca was slightly more common in Chitty than in Alexie, Baptiste and Drygeese, and Pontoporeia affinis was decidedly more common in Baptiste and Drygeese (42-57%) than in Alexie and Chitty (0-17%). None of the other taxa comprised more than 4% of the fauna and most were less than 1% (Table 7).

Alexie and Chitty had similar faunal compositions and were dominated by chironomid larvae, mostly of the tribes Chironomini and Tanytarsini, followed by Sphaeriid molluscs and H. azteca. Baptiste and Drygeese were also similar and were dominated by P. affinis followed by chironomid larvae of all types and H. azteca. Correlation coefficients between percentage composition of major taxa were greater than 0.98 for the pairings Alexie/Chitty and Baptiste/Drygeese but were less than 0.6 for other pairings.

Seasonal variations in most taxa were evident in 1972 (Table 8). Chironomidae generally declined in importance in all the lakes from spring through autumn. Sphaeriidae also showed a slight decline. H. azteca decreased in importance in summer but increased again in autumn, while P. affinis was most important in summer.

Among the Chironomidae, Chironomini were low in importance in the summer in all lakes as were Tanypodinae in Alexie, Baptiste and Chitty. Tanytarsini were of greatest importance in Alexie and Chitty in summer but showed no particular trend in Baptiste and Drygeese. Orthocladinae/Diamesinae were high in importance in Baptiste and Drygeese in summer but not in Alexie and Chitty (Table 8).

Few obvious seasonal trends were evident among the species of Sphaeriidae. P. conventus was lower in importance in Alexie and Baptiste in summer but was higher in summer in Chitty and Drygeese. Seasonal variations in the other species were either small and unrelated to the groupings Alexie/Chitty and Drygeese/Baptiste, or were unique to the individual lakes. Nepionic forms were most common in summer and autumn (Table 8).

Pulmonata and Valvatidae both tended to decrease in importance in the lakes from spring through autumn (Table 8).

NUMERICAL COMPOSITION OF THE BENTHOS BETWEEN LAKES, YEARS AND SEASONS:

The total abundance of benthos ranged from a low of 797 organisms/m^2 in Chitty in 1971 to 4218 organisms/m^2 in Drygeese in 1972 (Table 9). Estimated numbers per m^2 were consistently lower in the 1971 samples (797-3768/m^2) than in the 1972 samples (3979-4218/m^2). The very low value for Chitty in 1971 may be an artifact of the small number of samples and few sampling locations. Variations in total abundance between lakes in 1972 were relatively small.

Although some of the difference in abundance between 1971 and 1972 may be due to the different sampling designs and times of sampling in the two years, some features of the data suggest that part of the difference may be real. Differences between 1971 and 1972 were more marked in Alexie and Chitty than in Baptiste and Drygeese, which is in keeping with the general trend of differences and similarities in other features of the lakes. Although benthos was generally less abundant in 1971 samples, not all taxa were less abundant. P. nitidum was most abundant in 1971 in all lakes, P. nitidum contortum was most abundant in 1971 in Alexie, P. subtruncatum in Alexie and Chitty, and P. ventricosum rotundatum in all lakes. Pulmonata and Valvatidae were also most abundant in 1971 in some of the lakes.

The two transects sampled in 1972 provide an indication of the differences to expect between different areas of the same lake. The average abundance on one transect in 1972 was never less than 66% of the average abundance on the other, and ranged up to 87%. Average abundance in Alexie, Baptiste and Chitty in 1971 was less than 60% of the 1972 abundance (19-53%) while the abundance in Drygeese in 1971 was 91% of the 1972 abundance. The percent composition of the major taxa was comparable between the two transects on each lake (Table 10), although there were a few obvious differences between transects. For example, Tanytarsini were more important on Transect 1 in Chitty than on Transect 2, P. conventus was more important on Transect 1 in Alexie, Baptiste and Chitty, and P. nitidum contortum on Transect 2. The abundance of different organisms between transects was somewhat more variable, however (Table 11). Transect 2 in each lake was based on fewer samples and suggested consistently fewer organisms/m^2, similar to the result observed between years although the magnitude of difference was less. Most of the differences in total numbers between transects was due to differences in the abundance of H. azteca and P. affinis and not to any consistent differences in the other taxa. This was not true of the comparison between 1971 and 1972 (Table 9).

Finally, it seems unlikely that we would have consistently selected poor sampling locations in 1971. I feel, therefore, that in spite of the differences in sampling design in the 2 years, benthic organisms really were less abundant in 1971. Unfortunately, uncertainties in the data make it impossible to say how much less.

The abundance of the different taxa in each lake of course, reflects the percentage composition described above (Table 7 and 9), so little detailed comment is needed. Among the genera of Chironomidae, Alexie was dominated by Micropsectra, Dicrotendipes, Procladius, Stictochironomus and Chironomus; Baptiste by Micropsectra, Procladius, Heterotrissocladius, Paratanytarsus and Tanytarsus; Chitty by Micropsectra, Stictochironomus, Microtendipes and Procladius; and Drygeese by Micropsectra, Stictochironomus, Procladius, Heterotrissocladius, Cricotopus and Tanytarsus. Micropsectra and Procladius were common dominants in all lakes while the other genera were dominant in three or less (Table 12). Greatest similarity was between Alexie and Chitty as a pair and Baptiste and Drygeese as a pair.

Among the speices of Sphaeriidae, P. conventus was generally the most abundant, although numbers of this species varied considerably between years and lakes ($3\text{-}503/m^2$, Table 9). P. nitidum contortum and P. ventricosum rotundatum were both slightly less abundant than P. conventus, but tended to be less variable in abundance between years ($20\text{-}114/m^2$, $16\text{-}134/m^2$, respectively, Table 9).

Benthic organisms were most abundant in summer in Alexie and Baptiste but increased in abundance from spring through autumn in Chitty and Drygeese (Table 13). Individual taxa showed little consistent seasonal variation from lake to lake. Comparing between lakes Chironomidae were least abundant at all seasons in Drygeese ($612\text{-}757/m^2$) and about equally abundant in Alexie and Chitty ($1135\text{-}2195/m^2$) with Baptiste intermediate. Chironomini were least abundant in all lakes in summer. Tanytarsini were most abundant and Tanypodinae least abundant in summer in all lakes except Drygeese where Tanytarsini and Tanypodinae both were least abundant in summer.

The dominant genera of Chironomidae showed seasonal changes. Micropsectra became less important from spring through autumn, and Procladius increased in importance in the autumn. Heterotrissocladius was only of major importance in the fauna of Baptiste and Drygeese in the summer, although it was moderately important in Baptiste in spring and Drygeese in autumn.

Sphaeriidae declined in abundance from spring to autumn in Alexie and Drygeese, increased in abundance in Chitty, and were least abundant in summer in Baptiste. Comparing between lakes, Sphaeriidae were always less abundant in Baptiste and Drygeese ($224\text{-}415/m^2$) than in Alexie and Chitty ($559\text{-}936/m^2$). Individual species of sphaeriid showed various seasonal patterns of abundance but none was consistent from lake to lake. H. azteca was least abundant in summer in Baptiste and Chitty, and increased from spring to autumn in Alexie and Drygeese. P. affinis was most abundant in summer in Alexie and Baptiste, and increased from spring to autumn in Chitty and Drygeese. P. affinis was least abundant in all lakes in early spring. P. affinis was the dominant organism in Baptiste and Drygeese, and it was considerably more abundant in these two lakes ($1520\text{-}2831/m^2$) than in Alexie and Chitty ($284\text{-}980/m^2$)

Pulmonata and Valvatidae were generally most abundant in spring and summer samples although Valvatidae were also common in autumn samples from Chitty (Table 13). There was very little agreement in seasonal changes in abundance between the two transects on each lake (Table 14). It is difficult to decide how much similarity to expect because different depths were sampled on the two transects. The extent of the disagreement does, however, emphasize the difficulty of determining seasonal variations in the abundance of benthos and the very tenuous nature of any relationships identified above.

DEPTH DISTRIBUTION OF BENTHIC ANIMALS IN 1972:

Chironomidae in Alexie were abundant in shallow water, became least abundant at 7.5 and 12.5 m, increased to peak abundance at 22.5 m and declined in abundance again at the deepest stations (Table 15). Baptiste and Drygeese had similar, double peaked, patterns of abundance with depth, but the overall abundance of chironomids was less and variations in abundance with depth were also less than in Alexie. Chitty lake showed only a single peak in abundance with depth, at 10 m (Table 15). Chironomidae were, thus, most abundant in Chitty at the depths at which they were least abundant in the other lakes.

Chironomini were most abundant in the shallow samples in Alexie, Baptiste and Drygeese, but were most abundant in the middle depths in Chitty, suggesting that different species dominated in Chitty. More Chironomini occurred in the middle and deep samples in Alexie than in Baptiste and Drygeese, possibly reflecting the closer kinship between Alexie and Chitty.

Tanytarsini were most abundant in the deepest samples from Alexie, Baptiste and Chitty, but not in Drygeese where maximum abundance was in the shallow samples. Orthocladinae/Diamesinae were most abundant from shallow water down to middle depths in each lake and least abundant in the deep profundal particularly in Alexie and Chitty. In Baptiste and Drygeese these subfamilies also occurred in moderate abundance in the deep samples. Tanypodinae were most abundant in the middle depths in Alexie and Chitty but dominated in the shallow samples from Baptiste and Drygeese (Table 15).

Sphaeriidae showed a double peak in abundance with depth in Alexie and Drygeese, being most abundant at the 2-3 m and 17-25 m depths, and least abundant at 10-12 m and below 25 m. Sphaeriidae declined steadily in abundance with depth in Baptiste but reached their greatest density at 10 m in Chitty (Table 15).

The species of Spheriidae had rather obvious depth distributions. P. casertanum was recorded only in shallow to middle depths, but numbers were small. P. conventus occurred at all depths but was most abundant at 15-20 m in all but Baptiste where it was abundant at both 2.5 and 12.5 m. The remaining species tended to be restricted to the shallower stations except in Chitty where P. ferrugineum, P. lilljeborgi, and P. subtruncatum occurred deeper than in other lakes.

Pulmonate molluscs occurred to 12 m but were most common in shallow samples. Valvatid molluscs also occurred only to 12.5 m. Mysids occurred only in the deep samples from Alexie and Chitty but were recorded over all depths in Baptiste and Drygeese. Gammarus lacustris and H. azteca were found only to 12.5 m and G. lacustris tended to be most abundant in the moss zone while H. azteca was most abundant in the shallow littoral. P. affinis occurred at all depths but was most abundant in the deeper samples (Table 15).

Oligochaeta were found at all depths and showed no clear pattern of depth distribution. Most of the minor organisms were found in the shallow samples (Table 15).

If we consider total benthos, Alexie, Baptiste and Drygeese still show two peaks in abundance, the first in the shallow littoral and the second in the 20-25 m depth zone. Minimum abundance in these lakes was at 10-15 m and in the deepest stations (Table 15). Chitty, however, showed only a single maximum, at 10-15 m with low numbers in the shallow littoral and at the deepest stations (Table 15).

The depth distributions of the various taxa in different seasons were reasonably consistent. Chironomidae in Alexie always were least abundant at 7.5 m or 12.5 m and a second minimum occurred at 27.5 m in summer and autumn, but not in spring. Chironomidae in Baptiste in spring fluctuated in abundance with depth but were at maximum abundance at 2.5 and 22.5 m depth. In summer they were at low abundance at all depths, and numbers were similar at all depths. In autumn, numbers declined from 2.5 to 17.5 m then increased again. In Drygeese in spring, Chironomidae were most abundant at 3 and 21 m but did not decline markedly in abundance below 21 m. This pattern was repeated in summer and autumn but the decline in abundance below 21 m was more pronounced. Chironomidae in Chitty showed a single peak in abundance with depth at all seasons, the peak being at 14 m in spring and summer, and 10 m in autumn (Table 16).

The double peak in abundance with depth observed for Sphaeriidae in Alexie and Drygeese in the overall data was repeated each season (Table 16). The individual seasons in Baptiste suggested a double peak in abundance of sphaeriids with depth (Table 16), although the total data indicated a continuous decline in abundance with depth (Table 15). Spring and summer depth distributions of Sphaeriidae in Chitty also showed a double peak in abundance, while the autumn samples showed a single peak in abundance at mid depth. Seasonal depth distributions of the remaining taxa generally were simply reflections of the pattern described for the seasons combined (Table 16).

Seasonal comparison of the depth distribution of total benthos showed some departures from the average picture for each lake (Table 16). In Alexie benthos was always abundant at 2.5 m and declined to a minimum at some intermediate depth (12.5 m in spring and autumn and 7.5 m in summer). A second maximum occurred at 21.5 m in summer and autumn and 27.5 m in spring. In Baptiste, spring and summer samples suggested a weak bimodal distribution with maxima in shallow and deep water. Autumn samples showed clear maxima at 2.5 and 27.5 m and a minimum at 12.5 m. Drygeese showed a double peak in abundance with depth in all seasons. A minimum always occurred at 15 and 33 m. Maxima occurred at 3 or 9 m and 21 or 27 m depending on the season. In Chitty a single peak in abundance was evident at mid depth in summer and autumn. Spring samples, however, showed a double peak in abundance similar to the common pattern in the other lakes (Table 16).

WEIGHT OF BENTHOS BETWEEN LAKES, YEARS, AND SEASONS:

The average dry weight of benthos ranged from 0.42 g/m^2 in Chitty in 1971 to 2.17 g/m^2 in Alexie in 1971. In spite of the lower numerical abundance of benthos in all the lakes in 1971, the average weight of benthos was higher in 1971 in all but Chitty (Table 17). None of the lakes had obviously more or less biomass than the others, and differences in biomass between years appear to be at least as great as differences between lakes.

There was no clear trend in biomass with depth in the lakes, although biomass tended to be relatively high in the shallow stations and low in the deep stations (Table 17).

The depth distribution of biomass varied with the seasons (Fig. 2). In Alexie, Baptiste and Drygeese biomass was high in the shallow stations in spring and autumn and decreased with depth. In Alexie and Drygeese there was indication of a second maximum in biomass below 15 m. During summer biomass was relatively low and constant with depth. In Chitty spring and autumn samples showed a peak in biomass at mid depth, as was shown by abundance. In summer biomass increased with depth in Chitty (Fig. 2).

SIZE COMPOSITION OF BENTHOS BETWEEN YEARS, LAKES AND SEASONS:

The average size of chironomid larvae was smaller in all lakes in 1972 except for Drygeese where the sizes were equal in 1971 and 1972 (Table 18). P. affinis were smaller in Alexie, larger in Baptiste, and of similar size in Drygeese in 1972 as compared with 1971. H. azteca were smaller in Alexie and Baptiste, but larger in Chitty and Drygeese in 1972. G. lacustris were smaller in Alexie and Baptiste, but larger in Drygeese in 1972. Sphaeriidae were larger in Alexie, Baptiste and Chitty, but of similar size in Drygeese in 1972. Valvatidae were smaller in Alexie and Baptiste but larger in Chitty and Drygeese in 1972 (Table 18). Overall instances of decreases in average size in 1972 samples equalled increases in size. Alexie and Baptiste showed more decreases and Chitty and Drygeese more increases in size, however (Table 18).

Changes in average size are a reflection of changes in size composition of the organisms in the samples from year to year (Table 19). Relatively more Chironomidae fell into the <5 mm class in 1972 than in 1971 in all the lakes, and relatively fewer were in the >15 mm class, except in Drygeese where both large and small chironomids were more abundant in 1972. Although P. affinis showed no consistent changes in mean size, relatively more were recorded in both the largest and smallest size classes in all lakes in 1972. A similar, though weaker, trend was evident in H. azteca. Sample sizes for G. lacustris were generally small, especially in 1971, so that size-frequency distributions should not be treated too seriously. However, the relatively large sample from Alexie in 1971 consisted mainly of larger individuals. Sphaeriids were smaller in Alexie, Baptiste and Chitty in 1971 while valvatids were larger in Alexie and Baptiste and smaller in Chitty and Drygeese in 1971, as noted above.

Although no lake contained overwhelmingly larger organisms, in relative terms the organisms in Alexie and Chitty were slightly larger than those in Baptiste and Drygeese (Table 18).

There were no consistent seasonal changes in the size composition of the major taxa, except for H. azteca which were larger in all lakes in summer. Nor were there any consistent changes in the average size of organisms with depth, although organisms found in the deepest samples from Drygeese Lake (deeper than any of the other lakes) were of above average size.

DISCUSSION

Previous reports (Healey and Woodall 1973; Healey and Kling 1975) emphasized the similarity among the lakes in morphometry, physical and chemical features, and phytoplankton and zooplankton communities. Examination of the benthic communities further emphasizes the basic similarity among the lakes, a feature of considerable importance to the exploitation experiment. Previous reports also showed that the greatest similarity was between Alexie and Chitty as a pair and Baptiste and Drygeese as a pair. This pairing of the lakes was also apparent in the benthic communities, and is probably due to Alexie and Chitty lying on a different sub-drainage than Baptiste and Drygeese (Fig. 1).

The composition of the benthos in the lakes was very similar to that described for other oligotrophic lakes near the margin of the Precambrian Shield (Rawson 1953, 1960; Oliver 1960; Slack 1967; Hamilton 1971), and was also similar to that described for oligotrophic lake Konnevesi in Finland (Särkkä 1972). Baptiste and Drygeese conformed to lakes of type E as described by Hamilton (1971) (relatively large, deep, and dominated by P. affinis and sphaeriids). Alexie and Chitty, although of similar morphometry and chemistry to Baptiste and Drygeese, were dominated by Chironomidae. Other examples of relatively deep, large, oligotrophic shield lakes which are dominated by Chironomidae exist, however (Slack 1967; Rawson 1960; Oliver 1960). Oligochaetes, which were rare in the lakes, are abundant in nearby Great Slave Lake (Rawson 1953), and in some other shield lakes. Chaoborus, which was absent from the lakes, is also common in some other shield lakes, but generally those further south.

Benthic organisms were on average more abundant in my lakes than in other shield and shield margin lakes. Maximum abundance of profundal benthos ranged up to $2921/m^2$ in ELA lakes of a similar character (Hamilton 1971) and $2844/m^2$ in Amisk Lake, Saskatchewan (Rawson 1960) compared with $4391/m^2$ in my lakes, but was as low as $274/m^2$ in Cree Lake and below $1000/m^2$ in several other Saskatchewan lakes (Rawson 1960). Biomass was also high in the lakes ranging up to 2.17 g/m^2 (dry weight). Other shield and shield margin lakes had benthic biomass generally less than 1 g/m^2 (Rawson 1953, 1960; Oliver 1960; Slack 1967). Some of the difference may result from the fact that most published reports cited above refer only to profundal benthos, while I also sampled the littoral where benthic organisms are generally more abundant, and that sieving meshes used by some authors were larger than 600 μ. In spite of these differences, however, benthic organisms appear more abundant in my lakes than one would expect to find in oligotrophic lakes.

Seasonal variations in abundance of benthos in the lakes did not agree with that described for Lac la Ronge by Oliver (1960). In Lac la Ronge the tendency was for abundance to be low in mid-summer and high in spring and autumn, while in my lakes the tendency was for abundance to be lowest in spring and to increase in summer and autumn. Chironomidae showed strong seasonal variation in abundance in Lac la Ronge mainly due to variations in the dominant form C. anthracinus. Seasonal variation in the abundance of Chironomidae was weak and inconsistent in my lakes.

The strong bimodal depth distribution of total benthos observed in Alexie, Baptiste and Drygeese was not apparent over the same depth range in either Great Slave (Rawson 1953) or Lac la Ronge (Oliver 1960). In Great Slave the abundance of benthos declined steadily from shallow water to the greatest depths. Although there were some minor peaks in abundance at intermediate depths, none were as obvious as in my lakes. Numbers of benthic organisms tended to decline continuously with depth in Lac la Ronge too, except that in 1952 peak numbers occurred between 5 and 10 m (Oliver 1960). Chironomid larvae in Great Slave did show a second small peak in abundance at 15-20 m similar to Alexie, Baptiste and Drygeese, while in Lac la Ronge they were most abundant at 5-10 m, more similar to Chitty Lake. Sphaeriidae declined steadily in abundance with depth in Great Slave and Lac la Ronge, as they did in Baptiste. The other three lakes in the series demonstrated that other patterns of depth distribution are possible, and that such differences are not necessarily due to major differences in species composition.

Depth distribution of biomass generally reflected the distribution of numbers of organisms except that the indication of bimodality was less. The distribution of biomass with depth in the lakes was, therefore, more similar to that described for Great Slave and Lac la Ronge (Rawson 1953; Oliver 1960) than was the distribution of abundance. Considerable seasonal variation on depth distribution of biomass was evident in the lakes, however, and this variation is masked when values from various seasons are averaged.

Because of the obvious variation in my data between years, lakes, seasons and transects, few unequivocal generalizations about the benthic communities I sampled are possible. My observations appear typical by comparison with what is known about oligotrophic lakes on the Precambrian Shield and elsewhere. If anything, benthic organisms are above average in abundance and biomass in the lakes, and this suggests good feeding conditions for benthic feeding fishes, the lake whitefish in particular.

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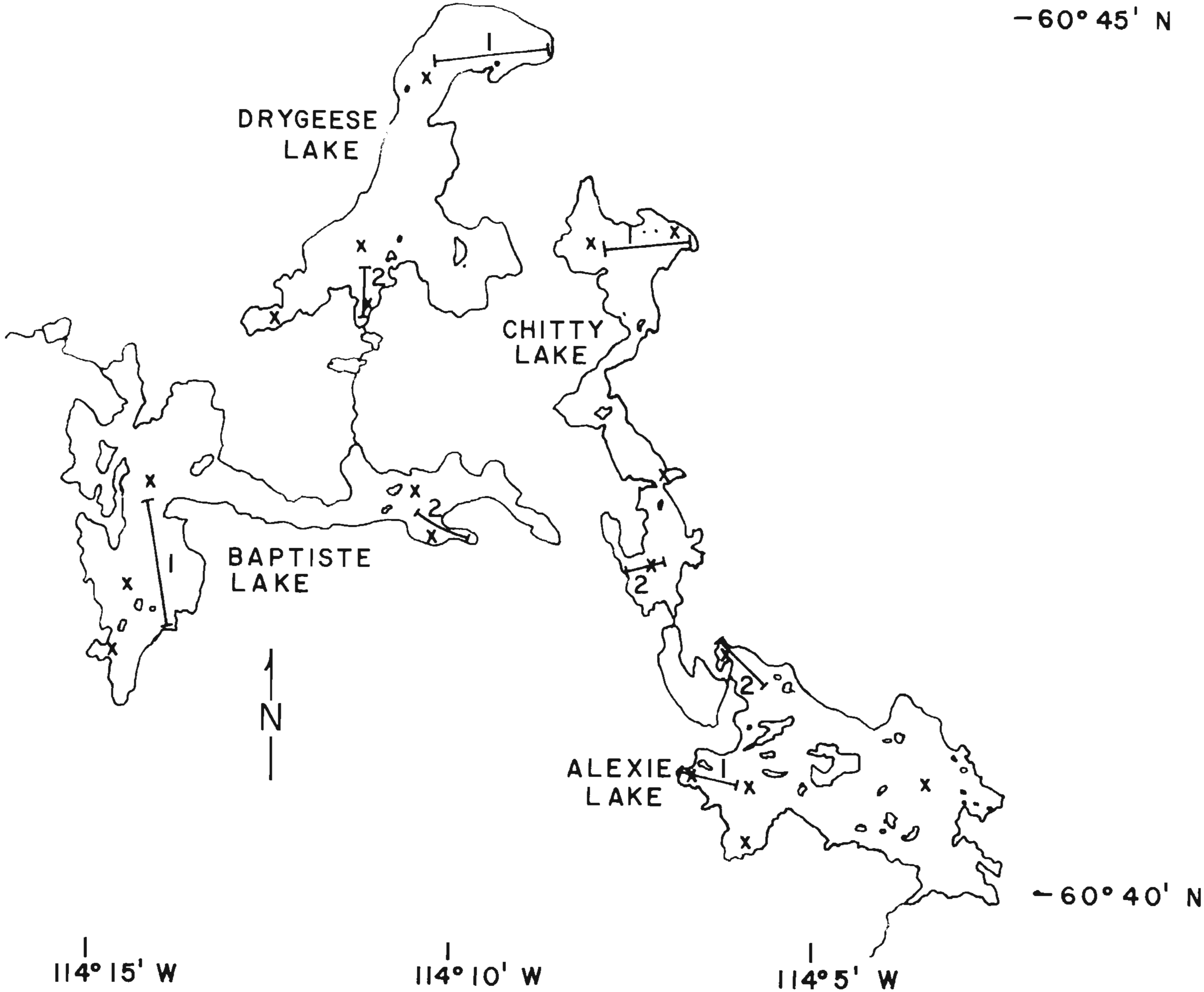

Fig. 1. Map of the experimental lakes. 1971 sampling locations marked (X). 1972 sampling transects marked ├───┤ (1) or (2).

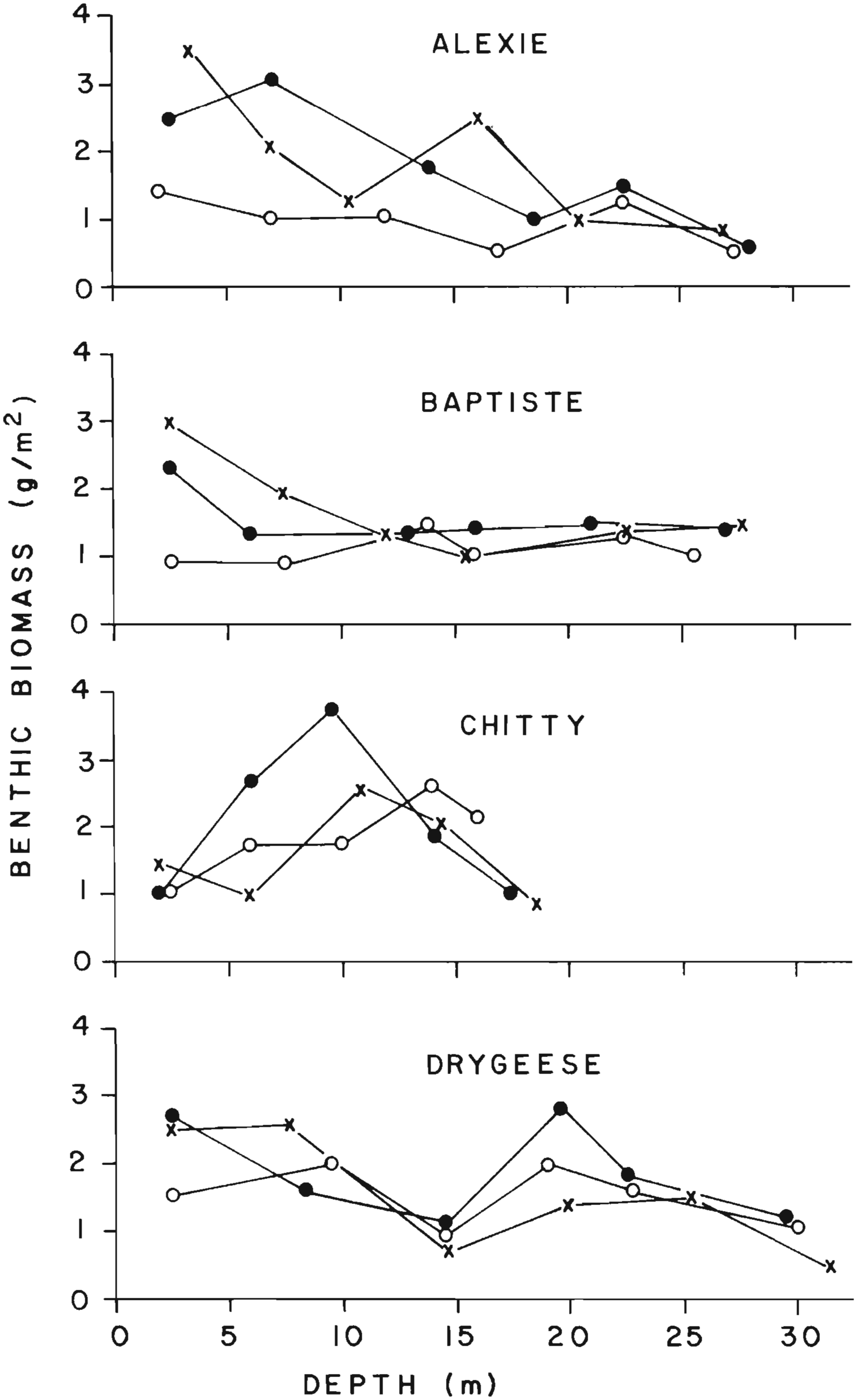

Fig. 2. Depth distribution of biomass in the 4 lakes. X = Spring
O = Summer ● = Autumn.

Table 1. Sampling dates and depths sampled in 1971. The number in the table body is the number of samples taken and the bracketed number the number of different locations sampled at that depth.

Lake	Sampling date	Sample depth range						
		<5 m	5-10	10-15	15-20	20-25	25-30	>30
Alexie	6/7/71	5(2)	-	-	-	-	5(1)	-
	25/8/71	2(1)	3(1)	-	2(1)	-	3(1)	-
Baptiste	3/7/71	4(1)	-	3(1)	2(1)	-	-	1(1)
	18/8/71	5(2)	-	-	-	2(1)	3(1)	-
Chitty	7/7/71	5(2)	-	3(1)	2(1)	-	-	-
	23/8/71	5(2)	-	3(1)	2(1)	-	-	-
Drygeese	15/7/71	-	5(1)	-	-	5(1)	-	-
	21/8/71	3(1)	2(1)	-	-	2(1)	-	3(1)

Table 2. Depths sampled on each transect in the four lakes in 1972.

Lake	Transect	Sample depths (m)	Samples per depth
Alexie	1	2.5, 7.5, 12.5, 17.5, 22.5, 27.5	3
	2	4, 8, 16	2
Baptiste	1	2.5, 7.5, 12.5, 17.5, 22.5, 27.5	3
	2	3, 9, 16	2
Chitty	1	2, 6, 10, 14, 18	3
	2	2, 6, 10, 14	2
Drygeese	1	3, 9, 15, 21, 27, 33	3
	2	3, 9, 18	2

Table 3. Length measurements made on each taxonomic group.

Taxonomic group	Length measurements	Length classes (mm)
Chironomid larvae	Tip of head capsule to maximum posterior extension of straightened animal.	<5, 5-10, 10-15, >15
Pontoporeia *Hyalella* *Gammarus*	Tip of rostrum to tip of uropod of straightened animal.	<4, 4-6, 6-8, >8 <4, 4-8, 8-12, >12
Sphaeriidae	Anterior posterior breadth of shell.	<2, 2-4, 4-6, >6
Valvatidae	Maximum diameter of spiral.	<2, 2-4, 4-6, >6
Pulmonata	Maximum height of spiral.	<5, 5-10, 10-15, >15
Mysids	Tip of rostrum to tip of uropod of straightened animal.	<5, 5-10, 10-15, >15

Table 4. Summary of substrate types at different sampling depths in the four lakes.

	Depth stratum				
Lake	<5 m	5-10 m	10-15 m	15-20 m	>20 m
Alexie	Clay, Sand Small Sticks Algae Firm	Sand Clay Moss Firm	Silt Moss Soft	Sand Silt Moss Soft	Silt Soft
Baptiste	Clay, Sand Silt, Moss Soft and Firm	Clay, Sand Stones, Silt Moss, Soft and Firm	Clay Silt Moss Soft	Clay Silt Moss Soft	Silt Soft
Chitty	Silt, Sand Algae Soft and Firm	Silt Moss Soft	Silt, Sand Clay Moss Soft	Silt Soft	Silt Soft
Drygeese	Clay, Sand Silt Firm	Clay Silt Moss Firm	Silt Soft	Silt Firm	Silt, Sand and Clay Soft and Firm

Table 5. Taxa of benthic organisms identified in the four lakes.

	Alexie	Baptiste	Chitty	Drygeese
NEMATODA		+		
NEMATOMORPHA				
Gordiidae				
Gordius		+		
PLATYHEIMINTHES				
Turbellaria	+			
ANNELIDA				
Oligochaeta	+	+	+	+
Hirudinea	+	+	+	+
MOLLUSCA				
Pelecypoda				
Sphaeriidae				
Pisidium casertanum	+	+	+	
Pisidium conventus	+	+	+	+
Pisidium idahoense	+		+	
Pisidium ferrugineum	+	+	+	
Pisidium lilljeborgi	+	+	+	+
Pisidium nitidum	+	+	+	+
Pisidium nitidum contortum	+	+	+	+
Pisidium subtruncatum	+	+	+	+
Pisidium ventricosum rotundatum	+	+	+	+
Pisidium walkeri	+	+	+	
Sphaerium nitidum	+		+	+
Gastropoda				
Lymnaeidae				
Lymnae	+	+	+	+
Valvatidae				
Valvata sincera helicoidea (Dall)	+	+	+	+

Table 5 (cont'd)

	Alexie	Baptiste	Chitty	Drygeese
ARTHROPODA				
Crustacea				
Cladocera	+	+		
Ostracoda			+	
Copepoda	+	+	+	+
Malacostraca				
Amphipoda				
Gammarus lacustris	+	+	+	+
Hyallela azteca	+	+	+	+
Pontoporeia affinis	+	+	+	+
Mysidacea				
Mysis relica	+	+	+	+
Insecta				
Ephemeroptera				
Baetis	+		+	
Centroptilum	+		+	+
Caenis	+	+	+	
Ephemera				+
Odonata				
Enallagma	+	+		
Trichoptera				
Limnephilidae				+
Brachycentridae				+
Leptoceridae	+	+		+
Oecetis		+		
Molannidae	+	+		+
Phryganeidae				

Table 5 (cont'd)

	Alexie	Baptiste	Chitty	Drygeese
Phryganeidae				
Agrypnia	+	+	+	+
Psychomyiidae	+		+	
Polycentropus			+	
Hemiptera				
Corixinae				
Sigara		+		
Coleoptera				
Dytiscidae				
Hydroporus (*Oreodytes*)			+	
Diptera				
Ceratopogonidae				
Dasyhelea	+		+	
Bezzia	+	+	+	
Palpomyia/*Bezzia*	+	+	+	+
Chironomidae				
Chironomini				
Chironomus	+	+	+	+
Cryptochironomus	+	+	+	+
Cryptocladopelma	+	+	+	
Dicrotendipes	+	+	+	+
Einfeldia	+			
Endochironomus	+	+		
Glyptotendipes	+	+		
Microtendipes		+	+	+
Nilothauma	+			
Paracladopelma		+		+
Phaenopsectra	+	+	+	
Polypedilum	+	+	+	+
Pseudochironomus		+		
Stictochironomus	+	+	+	+

Table 5 (cont'd)

	Alexie	Baptiste	Chitty	Drygeese
Tanytarsini				
Cladotanytarsus	+	+	+	+
Micropsectra	+	+	+	+
Paratanytarsus	+	+	+	+
Tanytarsus	+	+	+	+
Stempellinella	+	+		+
Diamesinae				
Prodiamesa	+	+	+	+
Potthastia		+		+
Pagastiella	+	+	+	+
Orthocladinae				
Cricotopus	+	+	+	+
Heterotrissocladius	+	+	+	+
Microcricotopus				+
Orthocladius				+
Psectrocladius		+	+	+
Trissocladius	+		+	+
D. (unnamed genus)				+
H. (unnamed genus)		+		
Smittia	+			+
Tanypodinae				
Ablabesmyia	+	+	+	+
Procladius	+	+	+	+
Protanypus	+	+	+	+
Thienemannemyia	+			
Archnida				
Hydrocarina	+		+	
Totals	61	58	53	50

Table 6. Percentage similarity among the four lakes for all taxa, chironomids, and sphaeriids.

Lake	Alexie	Baptiste	Chitty	Drygeese
		<u>All taxa</u>		
Alexie	100	68	77	58
Baptiste		100	63	67
Chitty			100	62
Drygeese				100
		<u>Chironomids</u>		
Alexie	100	67	71	62
Baptiste		100	72	74
Chitty			100	69
Drygeese				100
		<u>Sphaeriids</u>		
Alexie	100	82	100	64
Baptiste		100	82	60
Chitty			100	64
Drygeese				100

Table 7. Percent composition of major taxa in the four lakes during 1971 and 1972. Subgroupings of Chironomidae and Sphaeriidae presented as percentages of the group rather than of all taxa.

Lake / Year	Alexie 1971	Alexie 1972	Baptiste 1971	Baptiste 1972	Chitty 1971	Chitty 1972	Drygeese 1971	Drygeese 1972
Chironomidae	31	40	27	23	9	43	25	16
Chironomini	40	23	41	11	52	53	15	19
Tanytarsini	43	57	21	47	26	26	69	29
Orthocladinae/Diamesinae	2	9	19	24	2	4	4	31
Tanypodinae	15	11	18	18	26	17	12	20
Sphaeriidae	26	16	13	8	30	19	7	8
Pisidium casertanum	0	1	4	4	16	4	0	0
Pisidium conventus	28	50	7	25	1	62	60	80
Pisidium idahoense	0	<1	0	0	0	<1	0	0
Pisidium ferrugineum	2	2	0	2	0	4	0	0
Pisidium lilljeborgi	0	17	3	2	0	8	4	3
Pisidium nitidum	11	2	29	0	0	0	10	3
Pisidium nitidum contortum	21	12	6	28	25	10	9	6
Pisidium subtruncatum	15	9	4	25	19	2	0	3
Pisidium ventricosum rotundatum	18	4	47	13	39	7	9	5
Pisidium walkeri	5	<1	0	1	0	2	0	0
Sphaerium nitidum	0	<1	0	0	0	4	8	1
Nepionic	33	31	40	46	27	19	4	38
Pulmonata	2	<1	<1	<1	0	<1	<1	<1
Valvatidae	4	1	<1	1	3	1	3	<1
Mysis relicta	<1	<1	<1	<1	0	<1	<1	1
Gammarus lacustris	<1	2	<1	3	0	<1	1	2
Hyalella azteca	6	19	16	12	55	18	19	12

Table 7 (cont'd)

Lake / Year	Alexie		Baptiste		Chitty		Drygeese	
	1971	1972	1971	1972	1971	1972	1971	1972
Pontoporeia affinis	3	16	42	49	0	17	42	57
Oligochaeta	3	2	<1	3	4	1	3	3
Miscellaneous	<1	4	<1	1	3	1	<1	1

Table 8. Percent composition by season in the four lakes in 1972. Percentages of subgroupings of Chironomidae and Sphaeriidae are percentages of the group rather than all taxa.

Lake	Alexie			Baptiste			Chitty			Drygeese		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	35	49	34	23	26	19	48	45	38	20	13	15
Chironomini	27	14	32	15	5	15	55	37	63	26	9	26
Tanytarsini	45	73	42	48	47	44	22	47	13	41	29	27
Orthocladinae/Diamesinae	12	7	10	18	37	12	4	3	5	18	46	20
Tanypodinae	16	6	15	20	11	28	19	13	19	15	16	26
Sphaeriidae	23	15	13	10	5	10	21	22	16	12	8	6
Pisidium casertanum	2	0	2	5	3	2	9	5	10	0	0	0
Pisidium conventus	65	35	47	33	13	22	49	72	63	72	90	78
Pisidium idahoense	0	1	0	0	0	0	0	0.5	1	0	0	0
Pisidium ferrugineum	2	3	3	2	0	4	10	0	3	0	0	0
Pisidium lilljeborgi	15	24	12	1	3	4	10	1	11	5	3	3
Pisidium nitidum	0.7	5	1	0	0	0	0	0	0	0	0	9
Pisidium nitidum cortortum	8	13	18	19	57	20	9	10	10	7	4	6
Pisidium subtruncatum	2	12	16	31	19	22	3	2	1	7	0	0
Pisidium ventricosum rotundatum	5	7	0.4	9	3	22	7	6	9	9	3	1
Pisidium walkeri	0	0	0.7	0	0	4	3	3	0	0	0	0
Sphaerium nitidum	0.3	0	0	0	0	0	0	0.6	0.6	0	0	3
Nepionic	8	54	33	19	65	45	23	10	23	11	59	49
Pulmonata	1	0.1	0	0.8	<0.1	0.1	0.1	<0.1	0	0.9	0	0
Valvatidae	3	<0.1	0	0.9	0.5	<0.1	0.5	0.7	0.5	0.6	0	0
Mysis relicta	0.3	<0.1	0.2	0.1	0.2	0.4		<0.1	<0.1	0.2	0.9	0.4
Gammarus lacustris	1	2	4	2	1	6	<0.1	<0.1	0.5	3	0.3	4
Hyalella azteca	18	15	25	20	2	15	18	4	26	10	10	15
Pontoporeia affinis	14	17	16	41	60	45	9	26	17	49	64	56
Oligochaeta	2	2	1	2	3	3	2	0.8	0.4	4	3	3
Miscellaneous	3	1	7	0.1	1	2	2	0.6	1	0.8	0.5	0.4

Table 9. Numbers of benthic organisms per m^2 in each lake in 1971 and 1972.

Lake / Year	Alexie 1971	Alexie 1972	Baptiste 1971	Baptiste 1972	Chitty 1971	Chitty 1972	Drygeese 1971	Drygeese 1972
Chironomidae	709	1586	582	936	74	1797	912	642
Chironomini	283	360	239	103	38	948	133	134
Tanytarsini	305	903	124	438	19	470	633	207
Orthocladinae/Diamesinae	13	144	111	226	1	72	37	172
Tanypodinae	108	178	108	170	14	306	108	127
Sphaeriidae	528	648	283	334	242	812	261	344
Pisidium casertanum	0	9	12	12	38	36	0	0
Pisidium conventus	146	324	19	82	3	503	156	274
Pisidium idahoense	0	3	0	0	0	4	0	0
Pisidium ferrugineum	9	16	0	8	0	33	0	0
Pisidium lilljeborgi	0	111	9	8	0	62	12	12
Pisidium nitidum	58	15	81	0	0	0	27	10
Pisidium nitidum contortum	114	80	17	93	60	78	23	20
Pisidium subtruncatum	77	60	12	84	46	17	0	9
Pisidium ventricosum rotundatum	96	28	134	42	94	60	24	16
Pisidium walkeri	28	2	0	4	0	14	0	0
Sphaerium nitidum	0	1	0	0	0	4	20	3
Nepionic	175	201	114	154	67	152	11	132
Pulmonata	34	12	7	8	0	1	29	9
Valvatidae	88	32	9	22	27	22	127	6
Mysis relicta	1	8	14	9	0	2	4	22
Gammarus lacustris	2	95	2	116	0	9	52	98
Hyalella azteca	120	773	345	484	438	743	711	484
Pontoporeia affinis	517	624	895	2014	0	736	1569	2366
Oligochaeta	56	60	7	118	9	40	96	136
Miscellaneous	5	141	2	42	7	56	7	22
All organisms	2060	3979	2146	4083	797	4218	3768	4129

Table 10. Percent composition of the benthos from the two transects on each lake in 1972.

Lake / Transect	Alexie 1	Alexie 2	Baptiste 1	Baptiste 2	Chitty 1	Chitty 2	Drygeese 1	Drygeese 2
Chironomidae	36	45	18	28	42	43	13	19
Chironomini	20	26	14	9	45	63	18	24
Tanytarsini	64	48	40	52	36	13	35	29
Orthocladinae/Diamesinae	4	15	26	23	4	5	31	23
Tanypodinae	11	12	21	16	15	19	15	24
Sphaeriidae	15	18	7	9	21	17	6	12
Pisidium casertanum	1	2	3	4	0.1	12		
Pisidium conventus	69	27	42	8	73	42	78	81
Pisidium idahoense	1					2		
Pisidium ferrugineum	2	3	5		0.6	10		
Pisidium lilljeborgi	9	28	5		5	12	9	
Pisidium nitidum	1	4						5
Pisidium nitidum contortum	10	15	6	48	8	12	4	7
Pisidium subtruncatum	4	16	30	21	3	1		4
Pisidium ventricosum rotundatum	3	6	6	19	8	7	7	3
Pisidium walkeri	0.4		3		1	3		
Sphaerium nitidum	0.3				0.7	0	2	
Nepionic	23	41	38	53	9	32	26	47
Pulmonata	0.2	0.5	0.4	0.2	<0.1	<0.1	<0.1	0.5
Valvatidae	0.5	1	0.3	0.7	0.5	0.6	<0.1	0.3
Mysis relicta	0.2	0.2	0.2	0.2	<0.1	<0.1	0.3	1
Gammarus lacustris	2	3	0.3	6	0.3	<0.1	1	4
Hyalella azteca	21	17	13	11	12	26	19	2
Pontoporeia affinis	22	7	57	40	22	11	56	60
Oligochaeta	1	2	3	3	1	0.3	5	1
Miscellaneous	2	6	0.3	2	1	1	0.8	0.2

Table 11. Numbers of benthic organisms per m^2 on each transect sampled in 1972.

Lake / Transect	Alexie 1	Alexie 2	Baptiste 1	Baptiste 2	Chitty 1	Chitty 2	Drygeese 1	Drygeese 2
Chironomidae	1735	1437	801	1072	2089	1505	627	657
Chironomini	350	371	109	97	946	951	111	158
Tanytarsini	1119	687	320	555	747	193	222	192
Orthocladinae/Diamesinae	76	212	206	245	76	69	195	149
Tanypodinae	190	166	166	175	319	292	97	157
Sphaeriidae	716	580	323	346	1027	597	280	409
Pisidium casertanum	6	12	11	13	1	71		
Pisidium conventus	493	154	137	27	754	252	217	332
Pisidium idahoense	6					9		
Pisidium ferrugineum	15	16	16		6	60		
Pisidium lilljeborgi	62	160	17		53	71	25	
Pisidium nitidum	8	22						19
Pisidium nitidum contortum	70	89	19	167	84	71	12	28
Pisidium subtruncatum	28	93	96	72	26	8		18
Pisidium ventricosum rotundatum	23	34	18	66	81	39	20	12
Pisidium walkeri	3		9		13	16		
Sphaerium nitidum	2				7		6	
Nepionic	162	240	122	185	111	193	73	192
Pulmonata	10	15	19	7	2	0.6	1	17
Valvatidae	26	37	15	28	24	20	1	11
Mysis relicta	9	6	10	8	2	1	12	33
Gammarus lacustris	89	101	11	222	16	2	46	149
Hyalella azteca	1006	540	555	413	575	911	881	86
Pontoporeia affinis	1034	215	2513	1515	1080	391	2647	2085
Oligochaeta	49	70	123	114	69	11	226	46
Miscellaneous	103	179	12	72	64	49	37	7
All organisms	4777	3178	4383	3798	4948	3487	4759	3499

Table 12. Abundance (#/m^2) of the most abundant genera of Chironomidae in the lakes in 1972.

Genus	Lake: Alexie	Baptiste	Chitty	Drygeese
Micropsectra	586	187	395	128
Procladius	190	168	270	109
Stictochironomus	79	28	234	51
Heterotrissocladius	16	131	9	90
Tanytarsus	79	94	72	64
Dicrotendipes	285	9	36	6
Chironomus	48	2	108	7
Paratanytarsus	19	56	20	4
Microtendipes	3	9	413	2
Cricotopus	10	7	7	39

Table 13. Numbers of benthic organisms per m² during three seasons in the four lakes in 1972.

Lake / Season	Alexie			Baptiste			Chitty			Drygeese		
	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	1135	2152	1470	944	1166	699	1575	1622	2195	612	556	757
Chironomini	308	299	474	139	62	108	860	602	1384	158	48	196
Tanytarsini	512	1575	621	450	550	311	352	760	298	251	162	208
Orthocladinae/Diamesinae	138	140	154	166	427	84	58	51	108	108	258	152
Tanypodinae	177	137	220	188	125	198	303	209	404	94	87	200
Sphaeriidae	724	661	559	415	224	366	708	792	936	378	351	304
Pisidium casertanum	18		10	20	7	9	62	36	10			
Pisidium conventus	473	234	264	136	30	80	347	574	588	272	316	236
Pisidium idahoense		8						4	9			
Pisidium ferrugineum	12	20	16	10		14	68		32			
Pisidium lilljeborgi	108	158	68	5	7	14	70	11	106	19	9	10
Pisidium nitidum	5	32	7									28
Pisidium nitidum contortum	55	86	98	78	129	72	62	82	90	27	15	18
Pisidium subtruncatum	15	77	90	128	43	81	24	14	14	27		
Pisidium ventricosum rotundatum	36	48	2	38	7	82	52	46	81	34	11	3
Pisidium walkeri			4			14	24	20				
Sphaerium nitidum	2							5	6			9
Nepionic	59	360	184	79	146	164	163	78	215	42	208	148
Pulmonata	32	6		34	2	4	4	0.5		28		
Valvatidae	90	3		38	24	2	15	24	28	18		
Mysis relicta	10	2	10	5	10	14		2	0.5	6	39	22
Gammarus lacustris	31	76	178	68	64	218	1	0.5	26	86	13	195
Hyalella azteca	591	647	1081	808	74	568	591	159	1479	322	418	712
Pontoporeia affinis	446	748	679	1664	2692	1687	284	942	980	1520	2747	2831
Oligochaeta	58	74	44	100	144	113	67	30	24	118	146	142
Miscellaneous	100	40	284	6	53	68	70	20	82	25	20	20
All organisms	3217	4409	4305	4082	4453	3739	3315	3592	5750	3113	4290	4983

Table 14. Comparison of abundance of benthic organisms on the two transects in each lake during three seasons in 1972.

Lake	Alexie						Baptiste					
Transect	1			2			1			2		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	1457	1863	1885	813	2441	1056	1014	721	668	875	1611	730
Chironomini	223	263	564	392	335	385	155	57	116	123	68	99
Tanytarsini	960	1367	1029	64	1783	213	433	283	243	468	818	379
Orthocladinae/Diamesinae	112	64	51	165	216	256	226	266	126	106	588	41
Tanypodinae	162	168	240	192	106	201	199	115	183	178	135	213
Sphaeriidae	939	519	691	509	803	427	420	202	348	410	246	383
Pisidium casertanum			19	36				14	18	39		
Pisidium conventus	692	285	502	254	182	25	193	60	158	78		2
Pisidium idahoense		17										
Pisidium ferrugineum	15		31	10	39		21		27			
Pisidium lilljeborgi	42	84	60	173	233	75	11	14	27			
Pisidium nitidum	10		14		65							
Pisidium nitidum contortum	98	67	46	12	104	151	39	14	4	117	244	141
Pisidium subtruncatum	30	50	5		104	176	139	86	64	117		98
Pisidium ventricosum rotundatum	47	17	5	24	78		17	14	23	58		141
Pisidium walkeri			9						27			
Sphaerium nitidum	5											
Nepionic	118	215	153		505	214	102	111	152	56	182	316
Pulmonata	19	12		45			48	3	7	21		
Valvatidae	76	1		104	6		20	19	4	56	30	
Mysis relicta	18	3	6	2		15	6	20	6	4		21
Gammarus lacustris	11	2	253	51	151	102	28		4	107	128	432
Hyalella azteca	876	623	1520	306	671	642	514	131	1020	1103	18	117
Pontoporeia affinis	731	1111	1260	160	386	98	1923	3110	2508	1404	2274	866
Oligochaeta	65	31	50	52	118	39	157	46	167	42	241	59
Miscellaneous	199	44	65		35	503	9	8	19	2	98	117
All organisms	4391	4209	5730	2042	4611	2882	4139	4260	4751	4024	4646	2725

Table 14 (cont'd)

Lake	Chitty						Drygeese					
Transect	1			2			1			2		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	1497	1626	3145	1653	1617	1245	611	702	567	612	411	947
Chironomini	704	229	1906	1016	974	863	186	70	78	131	27	315
Tanytarsini	574	1111	557	131	408	39	312	186	169	191	139	247
Orthocladinae/Diamesinae	37	58	133	80	44	84	65	359	162	150	157	141
Tanypodinae	181	228	549	426	190	259	48	86	158	141	88	243
Sphaeriidae	687	1105	1288	730	478	584	247	352	240	509	350	368
Pisidium casertanum		4		123	69	21						
Pisidium conventus	503	802	958	191	347	218	178	312	162	366	321	310
Pisidium idahoense					8	18						
Pisidium ferrugineum	19			116		64						
Pisidium lilljeborgi	17	22	121	122		91	38	18	20			
Pisidium nitidum												57
Pisidium nitidum contortum	44	115	93	80	48	86			35	54	30	
Pisidium subtruncatum	24	27	27	24						54		
Pisidium ventricosum rotundatum	80	86	76	24	7	86	31	22	6	36		
Pisidium walkeri		39		49								
Sphaerium nitidum		10	12						18			
Nepionic	57	92	185	269	64	245	41	139	40	42	277	257
Pulmonata	4	1		3			4			51		
Valvatidae	28	45		2	2	55	4			32		
Mysis relicta		4	1				5	27	4	8	51	39
Gammarus lacustris		1	48	2	0	4	112	14	13	59	12	377
Hyalella azteca	516	233	975	666	85	1983	643	581	1420		254	4
Pontoporeia affinis	569	1531	1140		352	821	1413	3450	3079	1627	2045	2583
Oligochaeta	113	50	45	21	10	2	207	210	262	30	82	23
Miscellaneous	122	18	53	5	22	120	45	39	26	5	2	15
All organisms	3536	4614	6695	3082	2566	4814	3290	5375	5611	2933	3207	4356

Table 15. Abundance of various taxa at different depths on Transect 1 of each lake in 1972 (numbers of organisms per m^2).

Lake / Depth (m)	Alexie						Baptiste					
	2.5	7.5	12.5	17.5	22.5	27.5	2.5	7.5	12.5	17.5	22.5	27.5
Chironomidae	1928	855	848	1202	3934	1646	1060	852	825	468	915	681
Chironomini	1301	276	90	207	48	178	295	166	178	5	5	9
Tanytarsini	246	188	357	723	3764	1437	184	209	147	226	692	460
Orthocladinae/Diamesinae	150	105	132	61	0	6	188	248	403	159	120	116
Tanypodinae	229	285	269	210	122	25	394	229	99	78	98	96
Sphaeriidae	1130	842	281	1109	765	172	1012	411	301	158	57	2
Pisidium casertanum		38					66					
Pisidium conventus	447	357	117	1099	765	172	255	70	280	158	57	2
Pisidium idahoense		34										
Pisidium ferrugineum	94						22	54	20			
Pisidium lilljeborgi	33	209	129				49	55				
Pisidium nitidum	19	11	18									
Pisidium nitidum contortum	351	72					65	50				
Pisidium subtruncatum	148	20					447	130	1			
Pisidium ventricosum rotundatum	29	99		10			108					
Pisidium walkeri			18					54				
Sphaerium nitidum	10											
Nepionic	502	331	92	47			412	264	1	41	10	
Pulmonata	1	60					101	12	1			
Valvatidae	66	85	2				9	54	2			
Mysis relicta				5	40	6	2	7	36	1	5	8
Gammarus lacustris		506	25					8	57			
Hyalella azteca	4817	1219	3				3042	282	6			
Pontoporeia affinis		52	1089	1679	2337	1046	272	2091	1841	2692	3972	4212
Oligochaeta	179	8	3	34	9	58	191	33	83	134	111	188
Miscellaneous	563	12	7	11	11	13	40	24	2	5		1
All organisms	8684	3639	2258	4040	7096	2914	5729	3774	3154	3458	5060	5092

Table 15 (cont'd)

Lake / Depth (m)	Chitty					Drygeese					
	2.0	6.0	10.0	14.0	18.0	3.0	9.0	15.0	21.0	27.0	33.0
Chironomidae	510	1493	4225	2908	1310	1462	618	230	721	457	270
Chironomini	93	876	2895	380	488	373	227	23	5	4	37
Tanytarsini	209	226	298	2247	757	435	88	116	214	291	189
Orthocladinae/Diamesinae	73	106	144	28	27	380	225	21	407	129	9
Tanypodinae	135	284	887	253	38	273	78	70	96	33	33
Sphaeriidae	520	719	1283	1612	999	426	126	233	702	163	29
Pisidium casertanum			6								
Pisidium conventus	33	118	1060	1575	986	188	48	233	653	152	29
Pisidium idahoense											
Pisidium ferrugineum		11	15		5						
Pisidium lilljeborgi	20	92	124	21	8	131	21				
Pisidium nitidum											
Pisidium nitidum contortum	234	187				57	12				
Pisidium subtruncatum	12	51	51	16							
Pisidium ventricosum rotundatum	203	194	7			50	8		49	11	
Pisidium walkeri	18	48									
Sphaerium nitidum		16	21				36				
Nepionic	209	169	177		5	148	24	180	128	24	6
Pulmonata		8				8					
Valvatidae	16	106				6	2				
Mysis relicta				7	1	1	1	4	45	13	6
Gammarus lacustris	25	3	55			40	238				
Hyalella azteca	1470	1397	6			2937	2352				
Pontoporeia affinis		270	1775	2689	665	466	1978	1488	4997	5244	1709
Oligochaeta	40	31	45	57	173	109	54	253	463	58	421
Miscellaneous	242	77	1	1	1	145	19	8	9	2	36
All organisms	2823	4104	7390	7274	3149	5600	5388	2216	6937	5937	2471

Table 16. Depth distribution of benthic organisms during the three seasons of sampling on Transect 1 in each lake during 1972.

Lake	Alexie								
Depth (m)	2.5			7.5			12.5		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	1106	1379	3298	813	857	894	632	1600	313
Chironomini	396	1174	2334	406	88	336	27	187	56
Tanytarsini	336	86	316	29	428	104	55	960	56
Orthocladinae/Diamesinae	179	75	196	174	59	81	275	107	14
Tanypodinae	194	43	451	203	280	371	275	347	185
Sphaeriidae	1469	1064	858	847	517	1162	291	339	212
Pisidium casertanum						113			
Pisidium conventus	499	426	415	391		680	265	85	
Pisidium idahoense					103				
Pisidium ferrugineum	88		194						
Pisidium lilljeborgi	29	43	28	195	207	226	26	254	106
Pisidium nitidum	29		28	33					53
Pisidium nitidum contortum	588	298	166		103	113			
Pisidium subtruncatum	147	298		33		28			
Pisidium ventricosum rotundatum	58		28	195	103				
Pisidium walkeri									53
Sphaerium nitidum	29								
Nepionic	489	580	436	218	409	368		158	118
Pulmonata	3			110	71				
Valvatidae	199			251	5		5		
Mysis relicta									
Gammarus lacustris						1519.	64	12	
Hyalella azteca	5251	3708	5491		28	3628	3	3	3
Pontoporeia affinis				102	36	19	136	1387	1743
Oligochaeta	359	61	117	3	3	19	3	3	3
Miscellaneous	1167	240	281	12	5	19	3	3	15
All organisms	9554	6542	10045	2138	1931	7260	1137	3347	2289

Table 16 (cont'd)

Lake	Alexie								
Depth (m)	17.5			22.5			27.5		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	844	1561	1201	2211	4828	4764	3138	957	842
Chironomini	451	28	143	43	28	73	15	176	443
Tanytarsini	131	1238	801	2133	4629	4529	3081	862	369
Orthocladinae/Diamesinae	44	126	14					19	
Tanypodinae	218	168	243	35	170	161	44	0	30
Sphaeriidae	1889	593	847	674	570	1051	464	34	19
Pisidium casertanum									
Pisidium conventus	1859	593	847	674	570	1051	464	34	19
Pisidium idahoense									
Pisidium ferrugineum									
Pisidium lilljeborgi									
Pisidium nitidum									
Pisidium nitidum contortum									
Pisidium subtruncatum									
Pisidium ventricosum rotundatum	30								
Pisidium walkeri									
Sphaerium nitidum									
Nepionic		140							
Pulmonata									
Valvatidae									
Mysis relicta			15	102	15	3	3	3	15
Gammarus lacustris									
Hyalella azteca									
Pontoporeia affinis	1463	1386	2188	1381	2727	2902	1301	1129	708
Oligochaeta	3	44	56	19	3	4		71	102
Miscellaneous	12	3	19		15	19			38
All organisms	4211	3587	4326	4387	8158	8773	4906	2191	1724

Table 16 (cont'd)

Lake	Baptiste								
Depth (m)	2.5			7.5			12.5		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	1270	689	1222	743	737	1078	1260	689	528
Chironomini	649	53	182	138	42	319	117	220	196
Tanytarsini	113	199	239	220	181	228	147	234	60
Orthocladinae/Diamesinae	113	199	253	96	389	258	850	207	151
Tanypodinae	395	238	548	289	125	273	147	28	121
Sphaeriidae	1305	606	1127	260	251	723	562	338	3
Pisidium casertanum		87	110						
Pisidium conventus	134		632	130		80	502	338	
Pisidium idahoense									
Pisidium ferrugineum	67					161	60		
Pisidium lilljeborgi	67		82		84	80			
Pisidium nitidum									
Pisidium nitidum contortum	167		27	65	84				
Pisidium subtruncatum	770	433	137	65	84	241			3
Pisidium ventricosum rotundatum	100	87	137						
Pisidium walkeri						161			
Sphaerium nitidum									
Nepionic	557	477	203	52	175	564			3
Pulmonata	270	15	19	16		20	3		
Valvatidae	21	3	3	96	112	23	5		
Mysis relicta	3		3			20	3	102	13
Gammarus lacustris				23			147		25
Hyalella azteca	2251	778	6097	817	5	23	17		
Pontoporeia affinis	157	296	363	1346	3174	1754	1341	2715	1468
Oligochaeta	241	146	185	81	13	4	96	36	116
Miscellaneous	15	15	89	37	17	18	3		4
All organisms	5563	2548	9108	3419	4309	3663	3437	3880	2157

Table 16 (cont'd)

Lake	Baptiste								
Depth (m)	17.5			22.5			27.5		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	658	644	102	1353	889	502	792	677	575
Chironomini		14			14		28		
Tanytarsini	411	229	38	1094	574	407	611	280	488
Orthocladinae/Diamesinae	82	343	51	130	191	40	83	264	
Tanypodinae	164	57	13	130	109	54	69	132	88
Sphaeriidae	251	5	219	139	12	19	3	3	
Pisidium casertanum									
Pisidium conventus	251	5	219	139	12	19	3	3	
Pisidium idahoense									
Pisidium ferrugineum									
Pisidium lilljeborgi									
Pisidium nitidum									
Pisidium nitidum contortum									
Pisidium subtruncatum									
Pisidium ventricosum rotundatum									
Pisidium walkeri									
Sphaerium nitidum									
Nepionic			122		12	19			
Pulmonata									
Valvatidae									
Mysis relicta	3			12	4		12	12	
Gammarus lacustris									
Hyalella azteca									
Pontoporeia affinis	1712	3162	3201	3122	4938	3857	3857	4375	4404
Oligochaeta	102		300	168	64	102	256	15	294
Miscellaneous		16							3
All organisms	2726	3827	3822	4794	5907	4480	4920	5082	5276

Table 16 (cont'd)

Lake	Chitty														
Depth (m)	2.0			6.0			10.0			14.0			18.0		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	584	321	626	552	446	3481	2236	1963	8476	2944	3317	2465	1168	2085	677
Chironomini	90	39	150	305	129	2195	1619	499	6567	340	305	496	1168	174	122
Tanytarsini	135	243	250	116	158	404	151	531	213	2470	2799	1472		1823	447
Orthocladinae/Diamesinae	157		63		29	289	27	193	213		66	17			81
Tanypodinae	202	39	163	131	129	592	439	740	1482	133	146	480		87	27
Sphaeriidae	476	604	480	241	1058	860	1084	510	2254	1618	1749	1469	15	1605	1378
Pisidium casertanum								19							
Pisidium conventus		26	74		240	115	923	434	1819	1592	1728	1405		1582	1378
Pisidium idahoense															
Pisidium ferrugineum				34			46						15		
Pisidium lilljeborgi	60				48	229	23	38	310			64		23	
Pisidium nitidum															
Pisidium nitidum contortum	119	289	295	103	288	172									
Pisidium subtruncatum			37		96	57	92	19	41	26	21				
Pisidium ventricosum rotundatum	298	236	74	103	192	287			21						
Pisidium walkeri		53			144										
Sphaerium nitidum					48				62						
Nepionic	200	295	133		163	344	85		447						15
Pulmonata				22	3										
Valvatidae	19	28		123	195										
Mysis relicta											19	3			3
Gammarus lacustris		3	71		3	5			164						
Hyalella azteca	2274	690	1445	304	477	3410			19						
Pontoporeia affinis				3	174	634	1290	2161	1873	1434	3930	2703	117	1389	488
Oligochaeta	117		3	3	71	19		64	71	147	22	3	296	93	129
Miscellaneous	605	85	35	3		227	3				3			4	
All organisms	4075	1731	2660	1251	2427	8636	4613	4698	12857	6143	9040	6643	1596	5176	2675

Table 16 (cont'd)

Lake	Drygeese								
Depth (m)	3.0			9.0			15.0		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	1940	1567	880	624	659	571	52	354	284
Chironomini	651	263	205	412	118	150	29	15	26
Tanytarsini	1042	132	132	40	165	60	6	162	180
Orthocladinae/Diamesinae	116	981	44	80	341	255	6	44	13
Tanypodinae	130	190	499	93	35	105	12	133	65
Sphaeriidae	496	439	344	134	25	219	321	221	159
Pisidium casertanum									
Pisidium conventus	258	219	86	107		36	321	221	159
Pisidium idahoense									
Pisidium ferrugineum									
Pisidium liljeborgi	198	110	86	27		36			
Pisidium nitidum									
Pisidium nitidum contortum			172			36			
Pisidium subtruncatum									
Pisidium ventricosum rotundatum	40	110			25				
Pisidium walkeri									
Sphaerium nitidum						109			
Nepionic		271	172		17	55	201	138	
Pulmonata	25								
Valvatidae	19			5					
Mysis relicta	3			3				12	
Gammarus lacustris	12	40	68	658	45	11			
Hyalella azteca	851	1399	6560	3008	2089	1960			
Pontoporeia affinis	984	203	212	711	3411	1811	495	2089	1880
Oligochaeta	132	56	139	89	17	56	316	174	268
Miscellaneous	121	186	129	19	22	17	3	18	3
All organisms	4583	3890	8332	5251	6268	4645	1187	2868	2594

Table 16 (cont'd)

Lake	Drygeese								
Depth (m)	21.0			27.0			33.0		
Season	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Chironomidae	380	879	906	328	503	541	341	249	219
Chironomini			15		12		26	15	73
Tanytarsini	236	202	204	271	294	307	275	161	131
Orthocladinae/Diamesinae	118	591	511	57	184	146	13	15	
Tanypodinae	26	86	175		12	88	26	58	15
Sphaeriidae	443	1208	455	76	219	195	12	5	71
Pisidium casertanum									
Pisidium conventus	295	1208	455	76	219	162	12	5	71
Pisidium idahoense									
Pisidium ferrugineum									
Pisidium lilljeborgi									
Pisidium nitidum									
Pisidium nitidum contortum									
Pisidium subtruncatum									
Pisidium ventricosum rotundatum	148					33			
Pisidium walkeri									
Sphaerium nitidum									
Nepionic	34	333	16		72		12	5	
Pulmonata									
Valvatidae									
Mysis relicta	19	117		3	15	22		15	3
Gammarus lacustris									
Hyalella azteca									
Pontoporeia affinis	2680	6444	5868	3577	6054	6102	28	2497	2603
Oligochaeta	155	390	844	19	152	3	532	472	259
Miscellaneous	26	3			3	4	102	3	4
All organisms	3703	9041	8073	4003	6946	6867	1015	3246	3159

Table 17. Dry weight (g/m^2) of benthos at various depths in each lake in 1971 and 1972.

Lake	Year	$\bar{x}$ all depths	0-5 m	5-10 m	10-15 m	15-20 m	20-25 m	25-30 m	>30 m
Alexie	1971	2.17	2.35	2.20	-	3.10	-	1.21	1.99
	1972	1.43	2.03	2.06	1.40	1.14	1.27	0.68	-
Baptiste	1971	1.65	1.56	1.36	1.46	2.76	1.74	1.55	1.12
	1972	1.44	1.76	1.61	1.41	1.19	1.36	1.31	-
Chitty	1971	0.42	0.71	-	0.10	0.41	0.46	-	-
	1972	1.73	1.22	2.17	2.24	1.27	-	-	-
Drygeese	1971	2.02	3.40	1.52	1.55	-	2.03	-	1.61
	1972	1.58	1.90	2.08	1.67	2.02	1.61	1.34	0.42

Table 18. Average length (mm) of benthic organisms in the four lakes in 1971 and 1972.

Lake / Year	Alexie		Baptiste		Chitty		Drygeese	
	1971	1972	1971	1972	1971	1972	1971	1972
Chironomids	8.73	6.08	9.09	6.00	10.26	6.90	6.70	6.74
P. affinis	3.44	3.76	3.91	3.64	-	3.86	3.65	3.62
H. azteca	3.80	3.45	3.86	3.03	2.72	2.89	2.99	3.41
G. lacustris	9.30	7.66	5.64	6.44	-	7.04	5.80	6.90
Sphaeriidae	2.05	2.15	1.78	2.34	1.90	2.25	1.98	1.92
Valvatidae	2.98	2.70	2.60	2.39	2.88	3.18	2.68	2.84

Table 19. Percent size composition of the major taxa in the four lakes in 1971 and 1972.

Taxon	Lake	Size composition							
		1971	1971	1971	1971	1972	1972	1972	1972
		<5 mm	5-10 mm	10-15 mm	>15 mm	<5 mm	5-10 mm	10-15 mm	>15 mm
Chironomids	Alexie	20	55	10	16	52	39	6	2
	Baptiste	13	58	12	17	50	47	4	0
	Chitty	11	40	29	20	39	49	12	1
	Drygeese	22	76	1	0	40	51	8	2
		<4 mm	4-6 mm	6-8 mm	>8 mm	<4 mm	4-6 mm	6-8 mm	>8 mm
P. affinis	Alexie	52	48	0	0	52	32	16	0
	Baptiste	37	62	1	0	54	33	13	0
	Chitty	0	0	0	0	48	37	15	0
	Drygeese	45	55	0	0	54	34	12	0
H. azteca	Alexie	40	60	0	0	55	40	5	0
	Baptiste	38	62	0	0	67	31	2	0
	Chitty	76	24	0	0	71	28	1	0
	Drygeese	67	33	0	0	55	42	3	0
		<4 mm	4-8 mm	8-12 mm	<12 mm	<4 mm	4-8 mm	8-12 mm	>12 mm
G. lacustris	Alexie	0	28	61	11	4	58	27	10
	Baptiste	27	61	6	6	19	60	12	9
	Chitty	0	0	0	0	37	21	21	21
	Drygeese	40	31	23	6	21	46	26	8
		<2 mm	2-4 mm	4-6 mm	>6 mm	<2 mm	2-4 mm	4-6 mm	>6 mm
Sphaeriidae	Alexie	63	37	0	0	58	41	1	0
	Baptiste	81	19	0	0	44	56	0	0
	Chitty	75	24	1	0	51	48	1	0
	Drygeese	71	27	2	0	72	28	0	0

Table 19 (cont'd)

Taxon	Lake	Size composition							
		1971	1971	1971	1971	1972	1972	1972	1972
		<2 mm	2-4 mm	4-6 mm	>6 mm	<2 mm	2-4 mm	4-6 mm	>6 mm
Valvatidae	Alexie	12	80	8	0	39	52	8	2
	Baptiste	27	73	0	0	41	59	0	0
	Chitty	8	92	0	0	24	56	18	3
	Drygeese	37	51	12	0	20	73	7	0