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**LAKE VARIABILITY AND CLIMATE CHANGE STUDY:  
FISHERIES INVESTIGATIONS FROM THE NORTHWESTERN  
ONTARIO LAKE SIZE SERIES (NOLSS) LAKES, 1987-1989**

by

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Surveys were conducted on the six Northwestern Ontario Lake Size Series (NOLSS) lakes to assess their fish population communities over the period 1987-89. Larger lakes, Trout, Sydney and Musclow, were commercially gillnetted over the past 40 years. Harvests had declined during the last decade and all licences were cancelled by 1988. Sport fishing lodges operate on Trout and Sydney Lakes while Musclow and Linge Lakes were used as fly-in outpost camps. Green and Orange Lakes had likely never been fished, due to their small size and remote location. Length and age frequency distributions of predators in most lakes indicated very old slow growing populations. However, Sydney Lake walleye (Stizostedion vitreum) showed evidence of over exploitation. Fish from exploited lakes had slightly higher growth rates compared to the non-exploited lakes in this series.

Northern pike (Esox lucius), cisco (Coregonus artedii), white sucker (Catostomus commersoni) and yellow perch (Perca flavescens) were the only large fish species common to all lakes. Walleye was the most abundant predator in five lakes but was absent from Green Lake (smallest). Large fish species diversity increased with lake surface area. Spottail shiner (Notropis hudsonius) was the only cyprinid common to all lakes.

Data are presented on catch per unit of effort, condition, stomach contents, muscle mercury concentration and stable isotope composition (carbon, nitrogen).

Key words: walleye; northern pike; Stizostedion vitreum; mercury; stable isotopes.

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Entre 1987 et 1989, on a mené des études sur six lacs de taille différente du nord-ouest de l'Ontario (Northwestern Ontario Lake Size Series, NOLSS) afin d'évaluer la population des peuplements ichthyologiques. Depuis 40 ans, on pratique dans les plus grands de ces lacs, soit les lacs Trout, Sydney et Musclow, la pêche commerciale au filet maillant. Les prises ont baissé au cours des dix dernières années et dès 1988, tous les permis ont été annulés. Alors que les camps de pêche sportive des lacs Trout et Sydney continuent d'être exploités, ceux des lacs Musclow et Linge servent de postes avancés de tourisme aérien. Il est fort probable qu'on n'avait jamais pêché dans les lacs Green et Orange, étant donné leur petite taille et le fait qu'ils soient situés dans une région éloignée. Dans la plupart des lacs, les distributions de fréquence des âges et des longueurs des prédateurs indiquent la présence de très vieilles populations à croissance lente. Les données sur le lac Sydney semblent cependant indiquer une surexploitation du doré (Stizostedion vitreum). Les poissons des lacs exploités avaient un taux de croissance légèrement supérieur à celui des poissons des lacs non exploités de cette série.

Les seules espèces de poissons de grande taille communes à tous les lacs étaient le brochet (Esox lucius), le cisco (Coregonus artedii), le meunier noir (Catostomus commersoni) et la perche (Perca flavescens). Le doré était le prédateur le plus abondant dans cinq lacs mais était absent du lac Green (le plus petit). La diversité des espèces de grande taille augmentait en fonction de la superficie des lacs. La queue à tache noire (Notropis hudsonius) était le seul cyprinidé commun à tous les lacs.

Des données sont présentées sur les prises par unité d'effort, l'état des poissons, le contenu de leur estomac, la teneur en mercure de leur tissu musculaire et leur teneur relative en isotopes stables (carbone, azote).

Mots-clés: doré; Stizostedion vitreum; mercure; isotopes stables.

## INTRODUCTION

The fisheries investigations described in this report were undertaken as part of a broader multidisciplinary study. Fee et al. (1989, 1992) describe the rationale, design, and core methodology for the six lakes of the Northwestern Ontario Lake Size Series (NOLSS) study, which was initiated in 1986. The NOLSS study is primarily a long term physical and chemical investigation to determine how limnological variability in natural (unperturbed) lakes is related to information that can be derived from maps (geologic, topographic and bathymetric) and standard observational climate data (meteorological and hydrological). The study is focused on the effect of lake size (surface area), which varies several orders of magnitude among the study lakes although their water turnover times are similar. While the physical/chemical methods used in this study will remain constant over time, other investigations are designed to augment the core limnological studies to answer specific questions.

The purpose of the fish surveys, carried out from 1987 to 1989, was to assess and categorize the fish population community structure in the six lakes. The impact of top-down control of lake productivity is well known (Carpenter et al. 1985) and those studying lower trophic levels must have an understanding of the fish fauna. It is also possible that introductions of new fish species may occur into one or more of the six lakes. The rainbow smelt (*Osmerus mordax*) is an example of a species whose distribution is expanding into this region. This species can alter fish community structure quickly and drastically (Ritchie 1989) and this may have effects on lower trophic levels.

This purpose of this report is to summarize the fish population data collected during these surveys, to present data on the commercial harvest of fish and to archive baseline data on present fish mercury levels and stable isotope composition of various fish species from the NOLSS lakes.

## STUDY AREA

The six NOLSS lakes are located within 90 km of the town of Red Lake, northwestern Ontario (51°N, 94°W) (Fig. 1). The area is underlain by

Canadian Shield Precambrian bedrock. The climate is classified as severe continental and is characterized by long cold winters and short hot summers. The six lakes are similar in estimated water turnover time, ranging from 7.5 to 22.3 yr. However, they vary considerably in surface area, ranging from 89 to 34,690 ha (0.88 to 347 km<sup>2</sup>) (Table 1). Four of the six lakes, Green, Orange, Linge and Musclow are located within the Woodland Caribou Wilderness Provincial Park, an extensive pristine wilderness preserve, in which future development will be strictly controlled by the Ontario Ministry of Natural Resources (OMNR). The three largest lakes, Musclow, Sydney and Trout have in the past supported commercial gill net fisheries and together with Linge Lake still support recreational fisheries. Sydney Lake has one sport fishing lodge while Trout Lake supports four fishing lodges (Marshall Macklin Monaghan 1979). Musclow and Linge Lakes are used as fly-in outpost fishing camps. The smallest lakes (Orange and Green) have never been commercially fished, and likely have never been sport fished due to their small size and remote location.

## METHODS AND MATERIALS

### EXPERIMENTAL GILL NETTING

In 1987, experimental gill netting was carried out in early June and again in early October when the lakes were unstratified and cold. The 1987 sampling was carried out from a float plane and gill net sets were placed offshore. Two nets were set during each sampling period in each lake, one shallow (<10 m) and one deep (>20 m). In 1988 and 1989 sampling was done in August when the lakes were warm and fully stratified. During 1988 and 1989 sampling was carried out using a small boat, thus permitting sampling of nearshore habitats. The experimental gill nets used during the three years of survey work were bottom nets that were 90 m long by 2 m high and were composed of six 15 m stretched mesh nylon panels (sewn in linear series): 38 mm (1.5 in), 51 mm (2 in), 70 mm (2.75 in), 89 mm (3.5 in), 107 mm (4.25 in) and 132 mm (5.25 in). The net set locations (Figs. 2-7) were chosen using bathymetric maps found in Fee et al. (1989). The catch was recorded by species per 90 m net (all

caught per 90 m net, adjusted to a 16 h overnight set. Fishing effort was variable from lake to lake but low with no more than four net nights per year in small lakes. This minimized the impact on fish populations.

In addition to the large mesh CPUE gill net fishing, beach seines and small mesh gill nets (8 and 10 mm bar) were used occasionally to sample the small fish fauna in these lakes.

## BIOLOGICAL SAMPLING

Fish were sampled for fork length ( $\pm 1$  mm), round weight ( $\pm 25$  g), sex, and stomach contents. Stomach contents were identified to species where possible. Fish aging structures were collected as follows: operculum from walleye (*Stizostedion vitreum*); cleithrum from northern pike (*Esox lucius*); pectoral fin from lake whitefish (*Coregonus clupeaformis*), white sucker (*Catostomus commersoni*), longnose sucker (*Catostomus catostomus*), cisco (*Coregonus artedii*), and shorthead redhorse (*Moxostoma macrolepidotum*); otoliths from lake trout (*Salvelinus namaycush*) and burbot (*Lota lota*) and dorsal spine from yellow perch (*Perca flavescens*). Opercula and cleithra were cleaned and dried, and ages were determined using a transmitted light dissecting microscope. Pectoral fins and dorsal spines were cut to size, dried, embedded in epoxy, thin-sectioned using an Isomet low-speed saw, and mounted on glass slides with Diatex (Tm) medium. These sections were aged using a projected image attachment on a transmitted light compound microscope.

White muscle (>25 g) was removed, from the mid-body above the lateral line on the left side, from up to 30 fish per species per lake each year. These tissues were individually analyzed for total mercury concentration using the methodology of Hendzel and Jamieson (1976). A subsample of this tissue was removed, from size selected individuals, for analysis of stable carbon ( $^{13}\text{C}/^{12}\text{C}$ ) and nitrogen ( $^{15}\text{N}/^{14}\text{N}$ ) isotope composition, using the methodology of Hesslein et al. (1989).

## DATA ANALYSIS

Length-weight relationships were described as follows (Bagenal and Tesch 1978):

$$\text{Log}_{10}W = a + b(\text{Log}_{10}L)$$

where: W = weight in grams  
L = fork length in millimetres  
a = Y intercept  
b = slope of the regression line

Relative condition factor (K) was calculated using the following formula (Bagenal and Tesch 1978):

$$K = \frac{W * 10^5}{L^3}$$

where: W = weight in grams  
L = fork length in millimetres

The morphoedaphic index (MEI) is a first order predictor of potential fish production based on total dissolved solids (TDS) and mean depth (Ryder 1965). The Ryder equation is expressed as follows:

$$Y = 1.38 * (\text{MEI}^{0.445})$$

where: Y = potential yield in  $\text{kg} \cdot \text{ha}^{-1}$   
MEI = TDS/Mean depth (m)

## RESULTS AND DISCUSSION

### COMMERCIAL AND SPORT FISHING

Data for the commercial fisheries on Musclow, Sydney and Trout Lakes, which dates from the early 1950's, is summarized in Tables 2-4 (data supplied by OMNR, Red Lake District). In general, these lakes were more heavily exploited during the 1950's and 1960's, and the harvest has declined over time.

Musclow Lake sustained a mean annual harvest (MAH) of  $3137 \text{ kg} \cdot \text{yr}^{-1}$  (57% lake whitefish, 32% walleye, 10% pike, and 0.01% lake trout) for the 35 year period from 1959 to 1984 (Table 2). Harvesting was lower over the period 1950-65 with a MAH of 2004 kg and was higher from 1966 to 1984 with a MAH of 4091 kg. Musclow Lake had a peak rate of commercial gill net harvest of  $4.77 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$  in 1966 and averaged  $1.41 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$  from 1950 to 1984. The potential yield of fish from Musclow Lake, as derived from the MEI is  $1.64 \text{ kg} \cdot \text{ha}^{-1}$  (Table 1).

The commercial gill net fishery was taking on average about 86% of the annual sustainable harvest. The average rate of exploitation over this period was intermediate between Sydney and Trout Lakes. Gill net exploitation, although generally high in Musclow Lake, was not compounded by high sport fishing pressure on predator species. The commercial gill net fishery was cancelled in 1985.

Sydney Lake has undergone the most intense rate of exploitation of any of the commercially fished lakes. The MAH was 9821 kg (36% lake whitefish, 33% walleye, 18% pike, 10% lake trout and 3% other species) for the 27 year record of commercial fishing from 1951 to 1977 (Table 3). Harvesting was higher during the period 1951-65 with a MAH of 14353 kg and was lower from 1966 to 1977 with a MAH of 4592 kg. Harvests peaked at  $3.93 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$  in 1952 and averaged  $1.71 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$  from 1951 to 1977. Adams and Olver (1977) determined that lakes in northern Ontario had a sustainable yield of  $1.00\text{-}1.25 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$  for moderately to intensively fished lakes. The pressure was lower ( $0.80 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$ ) during the ten years prior to the cancellation of a commercial licence in 1978. The potential fish yield for Sydney Lake as derived from the MEI is  $1.59 \text{ kg} \cdot \text{ha}^{-1}$  (Table 1). Although, the gill net fishery was over-harvesting Sydney Lake during the 1950's and early 1960's it took on average only 50% of the annual sustainable harvest during the 1970's. However, there is a sport fishing lodge which has further harvested predator species and for which harvest data are unavailable. It is possible that the combined harvest of sport and gill net fishing for walleye from Sydney Lake was above a sustainable level prior to cancellation of the commercial gill net licence.

Trout Lake had a MAH of 23210 kg (48% lake whitefish, 21% walleye, 4% pike, 5% lake trout and 22% other species) for the 38-year period from 1950 to 1988 (Table 20). Harvesting was substantially higher during the 23 years from 1950 to 1972 when the MAH was 35309 kg. During the subsequent period 1973-87, the MAH dropped to 4366 kg. Trout Lake has undergone the lowest amount of commercial gill net harvesting of these three lakes, with a peak rate of  $1.42 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$  in 1963 and averaging  $0.67 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$  from 1950 to 1987. Although this is a lower rate of exploitation, there are also four sport fishing

lodges operating on the lake which exploit the predator populations and for which limited harvest data is available. The potential fish yield for Trout Lake as derived from the MEI is  $3.51 \text{ kg} \cdot \text{ha}^{-1}$  (Table 1). According to a creel survey conducted on Trout Lake during 1989 walleye were being harvested at 98% of the maximum sustainable yield during a year in which angler effort was slightly lower than normal (DeAngelis 1990). Considering this sport fishery data it is likely that while the gill net fishery was ongoing the total harvest may have exceeded the sustainable yield for this lake for certain species such as walleye. Trout Lake was closed to commercial gill net fishing in 1988.

Although gill net fishing has been discontinued on these lakes, some impact of this fishing remains in the fish populations of Musclow, Sydney and Trout Lakes. Recent changes to the recreational fishing regulations (reduced catch limits, minimum size restrictions and use of barbless hooks) implemented by OMNR should lead to reduced sport fishing pressure on mature fish in these lakes and help to minimize future impact to the NOLSS fish populations.

## EXPERIMENTAL FISHING

NOLSS lakes fish surveys resulted in the sampling of 571 fish in 1987, 792 fish in 1988 and 954 fish in 1989. These numbers refer to both gill net and seine net catches from all lakes combined for each year. Raw data for weight, length, age, sex, stomach contents, stable isotope ratios and mercury concentration data, for the 1987-89 fish surveys, are summarized in Appendices 1-3. See Appendix 4 for the key to stomach contents code. A sample of fish from each lake was frozen and archived in the first year of study, in order to allow for potential future study (e.g. contaminants) (Appendix 5).

Summaries of gill net set information (time, date, and depth), number, and CPUE of individual species for the years 1987 to 1989 are presented in Tables 5-7. The catch composition among years was more stable in the small lakes, which contained fewer species and simpler fish species assemblages (Fig. 8). The most abundant species were easily determined in smaller lakes in the first few net sets. Orange and Linge Lakes were characterized by consistently large walleye

catches, indicative of a large standing stock and care was taken to limit the time that nets were set. Catches were less predictable in the larger lakes, which contained more varied habitats and a more complex trophic structure. Walleye was the most abundant large piscivore in all lakes with the exception of Green Lake, in which it was absent. Northern pike was the only large piscivore common to all lakes, however, it was generally found in lower abundance. The other large fish species common to all lakes were the white sucker, yellow perch and cisco. Fishing in 1988 and 1989 revealed only one additional large species in the NOLSS lakes not found in 1987, that was the shorthead redhorse sucker from Sydney Lake (Table 8).

The fish species composition differs among the six study lakes (identification follows Scott and Crossman 1973; taxonomy follows Robins et al. 1991) (Table 8). Lake trout Salvelinus namaycush were reported from Musclow Lake commercial fishing records. However, it was not captured during these surveys nor was it captured by OMNR during the last few years (Lee Gerrish, OMNR, Red Lake District, pers. comm.). Lake trout was captured during a 1990 survey conducted by Dr. W. Franzin (unpubl. data). This low capture rate may be related to fishing technique or time of year, but is more likely related to low abundance. Comparison of our catch records for a few lakes with those of OMNR for the same lakes indicates that our sampling failed to detect a number of small fish species (Table 8). For instance, there were 19 species reported from Sydney Lake (10 small and nine large) while only 14 species have been reported from Trout Lake (five small and nine large). Trout Lake is a much larger lake with a complex shoreline structure (Fig. 7), and therefore may require increased effort to more fully define its small fish fauna.

In general, the diversity of large fish species increased and trophic structure became more complex as lake surface area increased (Fig. 9). Green Lake (88 ha) has a fish fauna typical of smaller Experimental Lakes Area (ELA) lakes such as Lake 240 (44 ha), Lake 255 (32 ha), and Lake 164 (15 ha) (Beamish et al. 1976; R. Fudge, unpubl. data). These small lakes each have one large piscivore (northern pike), a zooplanktivore/benthivore (cisco or lake whitefish), and a detritivore (white sucker). The largest increase in fish species diversity was evident as the surface

area of the NOLSS lakes increased by an order of magnitude from 80 to 2000 ha. There was no further change over the next order of magnitude (2000 to 35,000 ha). It is possible that when the small fish fauna are completely described for each lake, a similar trend of increased diversity with increasing surface area will also be evident and that it will occur over a larger range of surface area. Small fish species diversity does appear to increase with surface area and was largest in Sydney Lake.

## LENGTH AND AGE FREQUENCY DISTRIBUTIONS

Sample sizes of fish captured for each species were generally too small to determine annual change among lakes. Therefore, length and age data were combined for all years to increase the sample size for analysis.

Walleye from the NOLSS lakes ranged in length from 100 to 650 mm (Fig. 10). Walleye from Linge, Musclow, and Sydney Lakes were on average slightly smaller than those from Orange or Trout Lakes. Although, the largest walleye caught was from Sydney Lake. Length frequency distributions for walleye from all lakes except Sydney were multimodal. The Sydney Lake walleye length frequency distribution was unimodal at 350 mm. Walleye caught in the NOLSS lakes ranged in age from 2 to 24 years (Table 9) and the oldest walleye were found in Orange Lake. The age of some walleye from Orange Lake exceeds the maximum published age for walleye of about 20 years (Scott and Crossman 1973). Walleye age frequency distributions were also multimodal with the exception of Sydney Lake fish, which had one dominant mode at 4 years (Fig. 10). The walleye population in Sydney Lake appears to have undergone significant exploitation, which has cropped the older and larger individuals from the population.

Northern pike from the six study lakes ranged in length from 225 to 875 mm with the Green Lake population showing the greatest range (Fig. 11). Northern pike from Green and Orange Lakes had the greatest range in age (2-19 yr) (Table 10). These data should be viewed with caution because the sample sizes are small. However, it appears that while northern pike populations were

generally small in most NOLSS lakes, they represented very minor components in Orange and Linge Lakes. In Linge Lake, only six pike were captured over three years, despite fishing effort in nearshore habitats. Only in Green Lake was northern pike the dominant predator.

Cisco from the six study lakes ranged from 100 to 425 mm in length (Fig. 12). Larger cisco were found in Orange, Sydney, and Musclow Lakes. Cisco from all the lakes had length frequency distributions that were unimodal at 175 mm. Cisco ranged in age from 2 to 14 years (Table 11). The cisco age frequency distributions of most lakes were unimodal (range 2-4 yr) although Orange, Musclow and Sydney Lakes all had much older components in the population (Fig. 12).

White sucker from five lakes ranged in length from 100 to 525 mm (Fig. 13). The white sucker populations in these lakes appeared multimodal in length and age frequency distributions (Fig. 13). They ranged in age from 2 to 19 years (Table 12). Data are not presented for Orange Lake because only two large suckers were caught during the three years of fishing.

Lake whitefish were found only in the four larger NOLSS lakes where they ranged in length from 75 to 575 mm (Fig. 14). The ages ranged from 1-20 years for these lakes with the oldest fish found in Trout Lake (Table 13). Lake whitefish from Musclow Lake were slightly larger than those in Linge, Sydney, and Trout Lakes.

Burbot were found only in Musclow, Sydney, and Trout Lakes. This species ranged in total length from 250 to 725 mm (Fig. 15). Length frequency distributions for burbot were unimodal at approximately 500 mm. The ages ranged from 4 to 20 years for these lakes with the oldest fish found in Trout Lake (Table 14).

Length and age frequency data show that most lakes had populations of fish species which contained several dominant age groups as well as a wide range of age and size classes. This would indicate that the fish populations of most lakes were not being over-harvested. The exception to this observation was the walleye population in Sydney Lake, which had few fish older than 10 years and was dominated by young small fish. The age of 10 years is significant in that it

coincides with the closure of the commercial gill net fishery and could indicate that the population was starting to rebound after closure. The Sydney Lake length frequency data do show large year classes of smaller, younger fish, which if not over exploited by the ongoing sport fishery, could help the population to recover.

## LENGTH-WEIGHT RELATIONSHIPS AND GROWTH

The three years of fishing data were combined to provide adequate sample sizes for analyses. Plots of log length versus log weight data for large fish species are presented in Figs. 16-21.

Length-weight regressions for walleye from the five lakes in which it was found showed significant differences in their slopes ( $F_{4,723} = 4.18$ ,  $P < 0.002$ ) (Fig. 16). Data on mean length, weight and condition indicated that walleye from Linge and Sydney Lakes (mean relative K values 0.95-0.99) were in slightly poorer condition compared to walleye from Trout, Orange, and Musclow Lakes (range 1.05-1.06) (Table 15). Carlander (1944) stated that fish with condition factors greater than 1.02 are in excellent condition. Growth of walleye (mean length-at-age) was compared among the NOLSS series as well as to that from two other geographic locations (Fig. 22). It appeared that the growth rate of walleye in all NOLSS lakes was higher than in Kakisa Lake, NWT (Roberge et al. 1986), but less than in Lake Ontario (Payne 1963). The low growth rate of walleye from the NOLSS lakes compared to Lake Ontario is almost certainly related to their geographic location on the Canadian Shield, an area noted for low aquatic productivity (Colby et al. 1979; Carlander 1948). Growth was not directly related to lake size, this is similar to the findings of Cooley (1992). Although, walleye from Trout and Sydney Lakes appeared to have slightly higher growth rates than those from Musclow, Orange and Linge Lakes. These apparently elevated growth rates may have been caused by the higher commercial and recreational exploitation on these lakes and may not be directly related to lake size. There is a direct relationship between higher growth rates and elevated exploitation in walleye populations (Forney 1965; Spangler 1977; Colby et al. 1979; Colby and Nepszy 1981). Orange Lake showed the greatest range in age among the study lakes, as

well as relatively slower growth. It had a large standing stock of walleye which Alm (1946) indicated can result in reduced growth through increased competition for resources. Orange Lake is vulnerable to exploitation because of its small size and low productivity. If, for instance, fishing lodges were to use Orange Lake as a fishing outpost, the walleye population could be severely altered very quickly (Mosindy and Momot 1987). Scientific surveys have been the only known source of fish harvesting on Orange Lake. These surveys were highest in 1987 when  $0.52 \text{ kg} \cdot \text{ha}^{-1}$  of walleye were harvested from Orange Lake, compared with walleye harvests on the three larger lakes of much less than  $0.01 \text{ kg} \cdot \text{ha}^{-1}$ . The Orange Lake harvest was reduced to  $0.27 \text{ kg} \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$  during 1988 and 1989. These harvests alone could start to influence the population dynamics if continued. It should be noted that walleye from NOLSS lakes were aged using opercula while walleye from other sites were aged using scales. There is the potential for scales to underage walleye compared to opercula (Campbell and Babaluk 1979). Therefore, care must be taken when comparing growth.

There were significant differences in the slope of the length-weight regressions among the six NOLSS Lakes cisco populations ( $F_{5,393} = 11.53$ ,  $P < 0.001$ ). However, cisco length-weight relationships were not significantly different among Green, Linge and Trout Lakes ( $F_{2,105} = 1.18$ ,  $P > 0.10$ ) and similarly among Orange, Sydney and Musclow Lakes ( $F_{2,288} = 2.00$ ,  $P > 0.10$ ) (Fig. 17). Cisco from Orange, Sydney and Musclow Lakes grew larger and were characterized by higher mean condition factor (range 1.25-1.37) compared to those from Green, Linge and Trout Lakes (range 1.04-1.15) (Table 16). It is not currently known whether these differences might be due to different species of cisco being present or simply due to different within lake growth potential. All cisco were assumed to be C. artedii, however future studies may indicate the presence of other species such as C. zenithicus.

The length-weight regression lines for white sucker from the five NOLSS lakes in which it was found to be abundant showed significant differences in slope ( $F_{4,324} = 6.54$ ,  $P < 0.001$ ) (Fig. 18). Although sample sizes from Linge, Green and Musclow Lakes were smaller, the length-weight relationships were adequately described due to a good size range in the catch. Average

condition factors were similar among most NOLSS lakes (range mean K values 1.31-1.40) (Table 17). Orange Lake sucker appeared to be in better condition (mean K value 1.57), however, this value was based on only two large fish. Growth rates for white sucker were compared among the study lakes as well as to Lake 468 of the Experimental Lakes Area (Fig. 23) (unpubl. data, Mills and Chalanchuk, Freshwater Institute, 501 University Cres., Winnipeg). For fish younger than 10 years, growth was similar among all lakes with the exception of Green Lake where growth was slower. After 11 years of age fish grew larger at any given age in NOLSS lakes than in Lake 468.

The length-weight regressions for northern pike from all six lakes showed great variation (Fig. 19). The resulting relationships should be viewed with caution because the sample sizes were extremely low from all lakes and in most the size distributions were skewed towards large fish. Linge Lake, with a sample of only six fish, had the most skewed relationship (Fig. 19). Average condition factors for pike ranged from 0.58 to 0.78 and did not appear to show any trend with lake size (Table 18).

The length-weight regressions for lake whitefish from four lakes showed significant statistical differences ( $F_{3,166} = 7.14$ ,  $P < 0.001$ ) (Fig. 20). Musclow Lake appeared to produce slightly heavier fish at any given length (Table 19). During the period of commercial exploitation, this lake had a reputation for producing very large "jumbo" whitefish (J. Fahlgren, Sydney Lake Lodge, pers. comm.). In most lakes the population of lake whitefish was quite small and was always associated with cisco.

The length-weight regressions for burbot from Sydney, Musclow and Trout Lakes were not significantly different ( $F_{2,145} = 0.47$ ,  $P > 0.10$ ) (Fig. 21). The numbers of fish captured and the size distributions were sufficient to adequately describe these populations. Sydney Lake appeared to produce slightly heavier fish at length than Musclow. Similarly, Musclow fish were larger than Trout Lake burbot (Table 20).

The NOLSS lakes can be viewed as being in different stages of development with respect to their fish population structures. These differences are most evident among lakes which have been

exploited and thus differ in age composition from unexploited lakes. Fish generally grow rapidly in length during early stages of development but at maturity this somatic growth is directed into reproduction, resulting in much reduced adult growth (Moyle and Cech 1988). For example, Orange Lake has likely never been exploited prior to this study and has an old, slow growing walleye population. In Orange Lake almost all of the energy was directed towards maintenance and reproduction. This large population of older walleye likely suppressed development and growth of early cohorts. Alternatively, Sydney Lake, which has undergone significant fish exploitation, has a walleye population which has been cropped of older large individuals and was dominated by young fast growing fish. It follows, that since these walleye populations are partitioning energy in fundamentally different ways, the same linear regression model would be inadequate for describing both these populations (Cooley 1992). Exploitation has tended to increase with lake size in NOLSS lakes and this has led to population age structure differences in some NOLSS lakes fish populations. This obscures the determination of relationships which may be related directly to lake size.

## FISH STOMACH ANALYSIS

Differences in the feeding patterns of selected species among years were evident although small. In some cases, differences may have been related to time of sampling (1987 - Spring, 1988 and 1989 - late summer). The yearly data was combined to aid inter-lake comparisons for several species. The results are presented as percent occurrence and are summarized in Table 21.

The number of empty northern pike stomachs ranged from 35% in Green Lake to 73% in Trout Lake. Excluding empty stomachs, fish were found in between 46% (Linge) and 100% (Musclow and Trout) of pike stomachs. Green Lake northern pike fed on five fish species, the most for any of the lakes. Invertebrates, mainly crayfish and mayflies, were found in 54% of the non-empty stomachs of Orange Lake pike. However, no invertebrates were found in stomachs of pike caught in Trout and Musclow Lakes.

The number of empty walleye stomachs ranged from 53% in Sydney Lake to 70% in Linge Lake. Excluding empty stomachs, fish occurred in between 52% (Orange) to 94% (Sydney) of walleye stomachs. Sydney Lake walleye were found to feed upon five species of fish, the most in the NOLSS lakes. Invertebrates were not found in walleye stomachs from Trout Lake but formed as much as 34% of the stomach contents of non-empty walleye from Orange Lake.

The number of empty lake whitefish stomachs varied only slightly among the NOLSS lakes, ranging from 31% in Musclow to 37% in Sydney. A lake whitefish with stickleback remains in the gut was found in Trout Lake. This was the only incidence of whitefish piscivory encountered in the NOLSS lakes.

The feeding data collected to date is preliminary but does indicate a trend for increased piscivory in walleye with increasing lake size. This trend is somewhat obscured because Green Lake does not support walleye and Orange Lake has a very large walleye population. The large walleye population in Orange Lake could be depressing small fish abundance so that the walleye must feed more heavily on invertebrates. There was no evidence of walleye cannibalism in any of the NOLSS lakes.

Stomach analyses also proved useful in an indirect manner by identifying small fish species that were not encountered in regular gill net sampling. Those species include log perch (Percina caprodes) from Sydney and Green Lakes, nine-spine stickleback (Pungitius pungitius) from Green, Sydney and Trout Lakes, slimy sculpin (Cottus cognatus) from Orange Lake, and brook stickleback (Culaea inconstans) from Sydney Lake.

## CONCLUSION

The NOLSS lakes have undergone varying degrees of fish resource exploitation over five decades. Larger lakes have been fished commercially while smaller lakes have to date only been fished for scientific purposes since 1987. Previous fishing in most NOLSS lakes does not appear to have had a major impact on fish populations. Sydney Lake does appear to have been fished more intensively and shows predator length

and age frequency distributions which are skewed towards smaller and younger fish. Strong year classes are moving through this population and if exploitation does not increase, the Sydney Lake walleye population may recover. Because commercial gill net fisheries have been closed and sport fishery restrictions introduced for all NOLSS lakes, it is very likely that exploitation will not increase markedly in NOLSS lakes during the 10-year period of the study. The small lakes are vulnerable to exploitation, particularly Orange Lake, which has a large standing stock of walleye. It is unlikely that further large mesh gill net surveys will be required on small NOLSS lakes (Green, Orange and Linge) in the near future, as additional information gained would be limited and the potential for impact great. Toward the end of the study period, gill net surveys could once again be employed for purposes of comparison. Interim work should involve non-destructive sampling techniques for large fish species.

The large fish species population structure of the NOLSS lakes have likely been adequately described by these surveys. However, the small fish populations have not been satisfactorily investigated. More work is required in terms of quantifying habitat diversity in the larger lakes and fully identifying small fish species present. There is a positive relationship between large fish species diversity and lake size in the NOLSS lakes. This relationship may also become evident when the small fish fauna has been fully identified.

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**Table 1. Limnological characteristics of the six NOLSS Lakes (Adapted from Fee et al. 1989).**

<i>Lakes</i>	1 A <i>ha</i>	2 Ad <i>ha</i>	3 r <i>yr</i>	4 zm <i>m</i>	5 z <i>m</i>	6 SLD	7 Ve/Ae <i>m</i>	8 0e <i>C</i>	9 K25 <i>uS/cm</i>	10 TDS	11 MEI	12 Y <i>kg/ha</i>
Green	89	323	13.0	18.0	7.7	2.02	12.5	18.3	28.0	18.65	2.42	2.05
Orange	167	1270	11.6	28.0	14.4	2.31	20.0	18.9	48.0	31.97	2.22	1.97
Linge	706	3687	9.8	22.0	8.4	2.84	9.1	17.6	30.0	19.98	2.38	2.03
Musclow	2219	35067	7.5	43.0	19.3	3.64	33.3	16.9	43.0	28.64	1.48	1.64
Sydney	5748	55297	9.5	71.0	20.0	7.40	20.0	17.3	41.0	27.31	1.37	1.59
Trout	34690	106533	22.3	47.0	13.7	10.48	14.3	15.5	62.0	41.29	3.01	2.25

1. A - Lake surface area (net water area).
2. Ad - Area of the drainage basin, including the lake area.
3. r - Nominal water renewal time, calculated from lake volume, basin area, and maps of mean annual runoff.
4. zm - Maximum depth.
5. z - Mean depth.
6. SLD - Shoreline development, including islands.
7. Ve/Ae - Ratio of epilimnion volume to epilimnion sediment area.
8. 0e - June-August 1986 average epilimnion temperature.
9. K25 - Specific conductance (25 C).
10. TDS - Total dissolved solids. \* (Estimated from Specific conductance data)
11. MEI - Morphoedaphic index. \* (Calculated as follows - TDS/Mean depth)
12. Y - Potential fish production (Ryder 1965).

\* - These parameters allow for a crude estimation of potential fish production (Y) for NOLSS lakes.

**Table 2. Musclow Lake commercial fishing harvest (kg dressed weight), 1950-84.**  
**Commercial fishing ceased after 1984. (Data from the Ontario Ministry of Natural Resources, Red Lake District).**

Year	Lake trout	Northern pike	Lake whitefish	Walleye	White sucker	Cisco	Total
1950	0	134	100	2,137	0	0	2,371
1951	3	289	250	887	0	0	1,429
1952	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0
1955	153	401	8,352	1,159	0	0	10,065
1956	7	38	1,033	35	0	0	1,113
1957	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0
1959	184	0	3,921	1,385	0	0	5,490
1960	4	80	989	55	0	0	1,128
1961	0	0	660	694	0	0	1,354
1962	0	0	964	403	0	0	1,367
1963	7	731	2,689	3,308	0	0	6,735
1964	0	353	66	586	0	0	1,005
1965	0	0	0	0	0	0	0
1966	142	1,437	7,081	1,915	0	0	10,575
1967	18	362	4,389	1,198	0	0	5,967
1968	10	1,277	3,639	257	0	0	5,183
1969	6	33	2,362	893	0	0	3,294
1970	25	22	183	6	0	0	236
1971	0	464	200	659	0	0	1,323
1972	0	173	45	482	0	0	700
1973	0	259	2,380	1,268	0	0	3,907
1974	0	511	2,466	1,052	0	0	4,029
1975	0	237	2,689	2,785	0	0	5,711
1976	0	32	80	684	0	0	796
1977	0	75	3,263	1,924	0	0	5,262
1978	24	0	2,816	1,886	0	0	4,726
1979	80	1,037	2,903	2,084	0	0	6,104
1980	35	1,305	2,845	2,001	0	10	6,196
1981	14	260	139	605	144	0	1,162
1982	23	1,094	3,208	937	0	0	5,262
1983	0	152	125	1,792	75	0	2,144
1984	111	715	2,665	1,661	0	0	5,152
<b>Total:</b>	<b>846</b>	<b>11,471</b>	<b>62,502</b>	<b>34,738</b>	<b>219</b>	<b>10</b>	<b>109,786</b>

**Table 3. Sydney Lake commercial fishing harvest (kg dressed weight), 1951-77. Commercial fishing ceased after 1977. (Data from the Ontario Ministry of Natural Resources, Red Lake District).**

Year	Lake trout	Northern pike	Lake whitefish	Walleye	White sucker	Cisco	Total
1951	2,609	1,579	8,977	7,880	0	583	21,628
1952	2,324	2,896	9,967	6,569	0	855	22,611
1953	2,104	1,985	5,077	4,971	0	348	14,485
1954	1,939	2,579	7,153	5,070	0	0	16,741
1955	1,605	1,839	5,299	4,149	0	51	12,943
1956	648	1,860	1,820	2,453	0	66	6,847
1957	213	315	120	510	0	41	1,199
1958	1,560	3,230	4,849	5,555	0	25	15,219
1959	2,324	3,584	9,840	3,881	0	2,045	21,674
1960	2,385	3,015	6,545	4,944	1,818	0	18,707
1961	2,377	4,985	5,871	7,237	0	0	20,470
1962	899	2,863	5,153	3,328	0	0	12,243
1963	214	362	2,139	5,975	0	0	8,690
1964	880	4,009	4,235	5,119	0	0	14,243
1965	523	2,122	2,793	2,155	0	0	7,593
1966	0	0	0	0	0	0	0
1967	188	3,646	1,666	4,208	0	0	9,708
1968	1,523	2,570	2,850	2,927	0	0	9,870
1969	1,176	1,184	2,286	2,307	0	570	7,523
1970	783	1,690	3,332	4,196	0	259	10,260
1971	325	1,361	1,557	3,845	1,818	0	8,906
1972	0	0	0	0	0	0	0
1973	282	227	3,841	2,577	0	0	6,927
1974	241	0	1,936	677	0	61	2,915
1975	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0
1977	0	1,323	1,374	884	0	0	3,581
<b>Total:</b>	<b>27,122</b>	<b>49,224</b>	<b>98,680</b>	<b>91,417</b>	<b>3,636</b>	<b>4,904</b>	<b>274,983</b>

**Table 4. Trout Lake commercial fishing harvest (kg dressed weight), 1950-87. Commercial fishing ceased after 1987. (Data from the Ontario Ministry of Natural Resources, Red Lake District).**

Year	Lake trout	Northern pike	Lake whitefish	Walleye	White sucker	Cisco	Total
1950	5,888	3,144	27,326	8,210	0	0	44,568
1951	2,234	2,937	25,835	6,528	0	0	37,534
1952	4,891	2,216	28,287	8,269	0	0	43,663
1953	3,028	1,370	19,066	11,153	0	0	34,617
1954	3,651	2,350	34,002	6,836	0	0	46,839
1955	2,520	1,131	15,959	6,066	0	0	25,676
1956	2,237	1,800	20,719	8,982	0	0	33,738
1957	2,859	3,398	17,045	7,962	0	0	31,264
1958	1,472	794	14,176	4,601	0	0	21,043
1959	1,850	773	19,405	11,153	0	0	33,181
1960	581	1,347	12,013	6,677	14,159	752	35,529
1961	751	250	5,486	8,683	11,195	2,248	28,613
1962	608	616	12,126	6,098	8,970	3,582	32,000
1963	1,231	382	10,841	10,062	21,752	4,918	49,186
1964	0	1,615	10,742	1,838	0	0	14,195
1965	753	275	16,435	5,764	22,664	0	45,891
1966	499	713	10,630	8,945	19,236	0	40,023
1967	1,598	444	17,771	6,080	5,739	0	31,632
1968	1,205	0	15,250	6,662	0	0	23,117
1969	853	1,232	13,444	5,333	16,441	0	37,303
1970	1,131	726	18,351	4,430	19,837	0	44,475
1971	1,297	904	16,268	5,890	25,632	0	49,991
1972	936	298	8,620	4,965	13,223	0	28,042
1973	0	183	2,103	519	0	0	2,805
1974	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0
1976	650	891	8,820	520	0	0	10,881
1977	45	2	5,726	120	0	0	5,893
1978	216	0	3,736	525	0	0	4,477
1979	41	18	4,409	672	0	0	5,140
1980	316	601	6,673	1,194	0	0	8,784
1981	66	470	777	5,091	1,182	0	7,586
1982	401	203	432	2,719	0	0	3,755
1983	91	591	682	4,227	0	0	5,591
1984	125	215	384	2,816	0	0	3,540
1985	146	230	424	3,372	0	0	4,172
1986	110	125	422	2,606	0	0	3,263
1987	195	102	231	3,436	0	0	3,964
<b>Total:</b>	<b>44,475</b>	<b>32,346</b>	<b>424,616</b>	<b>189,004</b>	<b>180,030</b>	<b>11,500</b>	<b>881,971</b>

Table 5. Number and catch per unit of effort (in parentheses) for fish caught in gill nets in 1987. CPUE values are standardized to a 16 h set.

Lake	Date	Gill net set			Northern pike	Walleye	Lake trout	Lake whitefish	White sucker	Longnose sucker	Burbot	Cisco	Yellow perch	Trout-perch	Shorthead redhorse
		Set number	Depth (m)	Duration (h)											
Green L.	03-Jun	1	9	19.3	4 (3.3)	0	0	0	5 (4.1)	0	0	0	0	0	0
	03-Jun	2	15	19.5	2 (1.6)	0	0	0	7 (5.7)	0	0	2 (1.6)	0	0	0
Orange L.	02-Jun	1	15	22.0	5 (3.6)	22 (16.0)	0	0	0	0	0	15 (10.9)	1 (0.7)	0	0
	02-Jun	2	20	21.9	0	34 (24.1)	0	0	0	0	0	29 (21.2)	0	0	0
	13-Oct	3	14	22.0	5 (3.6)	48 (34.9)	0	0	1 (0.7)	0	0	1 (0.7)	0	0	0
	13-Oct	4	20	21.1	2 (1.5)	17 (12.9)	0	0	0	0	0	2 (1.5)	0	0	0
Linge L.	02-Jun	1	9	18.5	2 (1.7)	17 (14.5)	0	0	9 (7.8)	0	0	10 (8.7)	0	0	0
	02-Jun	2	21	18.9	0	10 (8.5)	1 (0.9)	23 (19.5)	2 (1.7)	0	0	2 (1.7)	0	3 (2.5)	0
Musclow L.	03-Jun	1	15	20.5	3 (2.3)	21 (16.4)	0	2 (1.6)	5 (3.9)	0	0	0	0	8 (6.2)	0
	03-Jun	2	20	20.6	3 (2.3)	8 (6.2)	0	0	2 (1.6)	0	0	7 (5.4)	0	4 (3.1)	1 (0.8)
Sydney L.	01-Jun	1	11	23.5	0	1 (0.7)	2 (1.4)	13 (8.9)	3 (2.1)	0	0	1 (0.7)	0	0	0
	01-Jun	2	25	23.6	0	3 (2.0)	2 (1.4)	12 (8.1)	1 (0.7)	0	3 (2.0)	6 (4.1)	0	0	0
	13-Oct	3	15	31.1	0	6 (3.1)	5 (2.6)	11 (5.7)	18 (9.3)	0	2 (1.0)	35 (18.0)	10 (5.2)	0	0
	13-Oct	4	15	30.4	1 (0.5)	7 (3.7)	6 (3.2)	8 (4.2)	9 (4.8)	0	0	54 (28.4)	0	0	0
Trout L.	01-Jun	1	10	24.2	2 (1.3)	2 (1.3)	1 (0.7)	8 (5.3)	15 (9.9)	0	0	3 (2.0)	0	5 (3.3)	0
	01-Jun	2	20	24.3	1 (0.7)	0	1 (0.7)	13 (8.6)	2 (1.3)	3 (2.0)	7 (4.6)	0	0	0	0

**Table 6. Number and catch per unit of effort (in parentheses) for fish caught in gill nets in 1988. CPUE values are standardized to a 16 h set**

Lake	Date	Gill net set			Northern pike	Walleye	Lake trout	Lake whitefish	White sucker	Longnose sucker	Burbot	Cisco	Yellow perch	Trout-perch	Shorthead redhorse
		Set number	Depth (m)	Duration (h)											
Green L.	22-Aug	1	18	14.0	0	0	0	0	5 (5.3)	0	0	0	0	0	
	22-Aug	2	7	12.3	4 (5.2)	0	0	0	0	0	0	0	8 (10.4)	0	
Orange L.	23-Aug	1	7	10.6	1 (1.5)	44 (66.4)	0	0	0	0	0	0	0	0	
	23-Aug	2	20	10.0	0	5 (8.0)	0	0	0	0	0	4 (6.4)	0	0	
	24-Aug	3	4	11.5	3 (4.2)	14 (19.5)	0	0	0	0	0	0	0	0	
Linge L.	20-Aug	1	21	18.5	0	6 (5.2)	0	3 (2.6)	0	0	0	15 (13.0)	0	0	
	20-Aug	2	10	16.0	1 (1.0)	41 (41.0)	0	0	5 (5.0)	0	0	0	0	0	
	20-Aug	3	3	14.5	1 (1.1)	19 (21.0)	0	0	26 (28.7)	0	0	0	2 (2.2)	0	
Musclow L.	26-Aug	1	26	18.5	0	0	0	6 (5.2)	0	0	19 (16.4)	32 (27.7)	0	0	
	26-Aug	2	10	14.3	2 (2.2)	6 (6.7)	0	0	31 (34.7)	0	0	8 (9.0)	0	0	
	26-Aug	3	20	14.2	0	5 (5.6)	0	3 (3.4)	0	0	15 (16.9)	21 (23.7)	0	0	
Sydney L.	27-Aug	1	35	14.7	0	0	0	7 (7.6)	0	0	9 (9.8)	5 (5.1)	0	0	
	27-Aug	2	7	14.0	4 (4.6)	30 (34.3)	1 (1.1)	7 (8.0)	6 (6.9)	0	0	0	3 (3.4)	0	
	27-Aug	3	14	14.1	0	38 (43.1)	0	0	24 (27.2)	0	0	1 (1.1)	0	2 (2.3)	
Trout L.	17-Aug	1	12	25.0	4 (2.6)	10 (6.4)	0	7 (4.5)	20 (12.8)	0	0	0	7 (4.5)	0	
	17-Aug	2	15	20.5	0	4 (3.1)	0	1 (0.8)	3 (2.3)	5 (3.9)	2 (1.6)	12 (9.4)	0	0	
	17-Aug	3	5	20.0	2 (1.6)	14 (10.9)	0	1 (0.8)	4 (3.2)	0	0	1 (0.8)	2 (1.6)	0	
	17-Aug	4	47	11.5	0	0	3 (4.7)	11 (15.3)	0	0	28 (39.0)	2 (2.8)	0	0	
	18-Aug	5	47	11.5	0	0	3 (4.2)	8 (11.1)	0	0	30 (41.7)	7 (9.7)	0	0	

**Table 7. Number and catch per unit of effort (in parentheses) for fish caught in gill nets in 1989. CPUE values are standardized to a 16 h set.**

Lake	Date	Gill net set			Northern pike	Walleye	Lake trout	Lake whitefish	White sucker	Longnose sucker	Burbot	Cisco	Yellow perch	Trout-perch	Shorthead redhorse
		Set number	Depth (m)	Duration (h)											
Green L.	07-Aug	1	10	15.4	2 (2.1)	0	0	0	5 (5.3)	0	0	11 (11.7)	0	0	0
	07-Aug	2	14	15.1	1 (1.1)	0	0	0	0	0	0	9 (9.5)	0	0	0
	08-Aug	3	10	22.3	1 (0.7)	0	0	0	3 (2.2)	0	0	7 (5.0)	0	0	0
	08-Aug	4	15	22.0	4 (2.9)	0	0	0	6 (4.4)	0	0	5 (3.6)	0	0	0
Orange L.	03-Aug	1	10	12.8	2 (2.5)	11 (13.8)	0	0	0	0	0	7 (8.8)	0	0	0
	03-Aug	2	30	12.5	0	0	0	0	0	0	0	38 (48.6)	0	0	0
	04-Aug	3	9	13.9	4 (4.6)	49 (56.4)	0	0	0	0	0	0	0	0	0
	04-Aug	4	14	14.0	0	6 (6.9)	0	0	0	0	0	7 (8.0)	0	0	0
Linge L.	08-Aug	1	10	13.8	1 (1.2)	59 (68.7)	0	0	8 (9.3)	0	0	0	0	0	0
	08-Aug	2	16	14.2	0	18 (20.3)	2 (2.3)	22 (24.8)	1 (1.1)	0	0	20 (22.5)	0	0	0
Musclow L.	01-Aug	1	10	12.0	4 (5.3)	42 (56.0)	0	0	16 (21.3)	0	0	1 (1.0)	0	0	0
	01-Aug	2	20	12.8	2 (2.5)	0	0	4 (5.0)	0	0	7 (8.8)	20 (25.1)	0	0	0
Sydney L.	17-Aug	1	35	16.5	2 (1.9)	0	0	1 (1.0)	10 (9.7)	0	0	7 (6.8)	0	0	0
	17-Aug	2	13	16.6	5 (4.8)	34 (32.8)	2 (1.9)	0	16 (15.4)	0	2 (1.9)	1 (1.0)	6 (5.8)	0	0
	18-Aug	3	9	13.0	0	83 (102.2)	0	0	10 (12.3)	0	0	0	0	0	0
	18-Aug	4	25	11.9	0	0	0	3 (4.0)	1 (1.4)	0	4 (5.4)	0	0	0	0
Trout L.	22-Aug	1	14	18.5	1 (0.9)	32 (27.7)	0	0	17 (14.7)	0	0	2 (1.7)	0	0	0
	22-Aug	2	10	16.0	0	10 (10.0)	0	1 (1.0)	40 (40.0)	1 (1.0)	1 (1.0)	3 (3.0)	0	0	0
	23-Aug	3	25	12.4	0	1 (1.3)	0	4 (5.2)	0	18 (23.2)	17 (21.9)	0	0	0	0
	23-Aug	4	25	11.1	0	0	0	2 (2.9)	0	3 (4.3)	1 (15.9)	0	0	0	0

Table 8. Summary of fish species caught in each of the six NOLSS lakes.

	Common name	Scientific name	Green	Orange	Linge	Musclow	Sydney	Trout
1	Northern pike	<i>Esox lucius</i>	S	S	S	S	S	S
2	Walleye	<i>Stizostedion vitreum</i>		S	S	S	S	S
3	Lake trout	<i>Salvelinus namaycush</i>			S	O	S	S
4	Lake whitefish	<i>Coregonus clupeaformis</i>			S	S	S	S
5	White sucker	<i>Catostomus commersoni</i>	S	S	S	S	S	S
6	Longnose sucker	<i>Catostomus catostomus</i>						S
7	Burbot	<i>Lota lota</i>				S	S	S
8	Cisco	<i>Coregonus artedii</i>	S	S	S	S	S	S
9	Yellow perch	<i>Perca flavescens</i>	S	S	S	S	S	S
10	Trout-perch	<i>Percopsis omiscomaycus</i>		S	S	S	O	S
11	Shorthead redhorse	<i>Moxostoma macrolepidotum</i>				S	S	
12	Spottail shiner	<i>Notropis hudsonius</i>	S	S	O	O	S	S
13	Lake chub	<i>Couesius plumbeus</i>				S		S
14	Log perch	<i>Percina caprodes</i>	S			O	S	S
15	Blacknose shiner	<i>Notropis heterolepis</i>			O		O	
16	Bluntnose minnow	<i>Pimephales notatus</i>					O	
17	Fathead minnow	<i>Pimephales promelas</i>			O		O	
18	Ninespine stickleback	<i>Pungitius pungitius</i>	S				S	S
19	Iowa darter	<i>Etheostoma exile</i>		X	O		O	
20	Johnny darter	<i>Etheostoma nigrum</i>			O	O		
21	Slimy sculpin	<i>Cottus cognatus</i>		S	O	X		
22	River darter	<i>Percina shumardi</i>				O		
23	Brook stickleback	<i>Culaea inconstans</i>					O	
24	Mimic shiner	<i>Notropis volucellus</i>		X				
Total number of species found in each lake:			7	10	14	16	18	14

"S" - indicates species caught during this study.

"O" - indicates species reported by OMNR (Red Lake District, lake survey data).

"X" - indicates species reported by Dr. B. Franzin, FWI, 501 Univ. Cres., Winnipeg.







**Table 15. Mean length, weight and condition factor (K) by length class for walleye. NOLSS, 1987-89.**

Len	Green				Orange				Linge				Musclow				Sydney				Trout									
	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K					
80						0					0					0					0									
120	Species not Present.					0					3	92	7	0.82	0.89	15	103	10	2.42	0.92	0									
160						0					0					2	140	26	7.50	0.93	0									
200						5	187	74	18.78	1.13	1	193	45		0.83	3	178	57	4.71	1.01	3	188	87	11.79	1.04					
240						2	223	118	12.50	1.07	13	224	107	31.23	0.95	6	220	141	72.19	1.33	12	227	129	26.55	1.10					
280						10	259	179	25.48	1.03	15	256	170	98.14	1.01	15	259	185	30.22	1.06	18	262	176	26.59	0.98					
320						11	315	314	26.98	1.01	14	298	253	46.81	0.95	10	305	292	20.78	1.03	31	301	284	33.48	1.04					
360						18	340	406	64.63	1.04	28	338	368	47.59	0.95	18	343	429	56.11	1.07	43	338	385	47.65	0.99					
400						18	385	574	65.36	1.01	22	382	555	65.29	1.00	12	380	587	65.11	1.03	37	381	584	54.80	1.02					
440						36	423	789	98.57	1.06	33	422	740	77.51	0.99	10	418	750	104.50	1.03	24	421	770	74.82	1.03					
480						59	459	1013	103.75	1.04	27	459	940	100.51	0.97	5	454	997	37.78	1.07	8	455	1111	113.86	1.18					
520						25	499	1285	129.01	1.04	16	497	1237	180.24	1.01	2	489	1108	82.50	0.95	5	502	1195	298.56	0.94					
560						13	541	1718	305.78	1.09	1	533	1700		1.12	0					1	528	850		0.44					
600						5	582	2240	210.12	1.14	0					0				2	568	2018	7.50	1.10						
640						0					0					4	627	2588	250.31	1.05	1	619	2550		1.08					
Total						202					173					96					190				74					
Mean							383	793	96.27	1.06		336	557	58.92	0.95		315	454	47.63	1.05		380	786	73.33	0.99		423	1032	80.51	1.06

**Table 16. Mean length, weight and condition factor (K) by length class for cisco. NOLSS, 1987-89.**

Len	Green				Orange				Linge				Musclow				Sydney				Trout									
	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K					
70	0					0					0					0					0									
100	0					0					0					1	100	9		0.90	0									
130	0					0					0					0					0									
160	14	156	40	7.67	1.06	13	154	44	7.56	1.21	20	153	44	6.80	1.24	2	153	45	5.00	1.26	28	155	41	5.00	1.10					
190	20	167	48	4.02	1.02	35	174	60	12.82	1.15	15	175	54	7.47	1.00	38	174	57	8.24	1.09	71	167	51	8.33	1.08					
220	0					30	204	98	14.93	1.16	10	204	81	16.80	0.95	19	204	89	15.38	1.05	9	203	91	16.49	1.08					
250	0					10	232	152	35.28	1.22	2	227	120	20.00	1.03	5	231	125	33.47	1.01	0									
280	0					6	262	220	33.17	1.22	0					3	273	323	18.86	1.59	1	251	225		1.42					
310	0					6	296	333	30.79	1.29	0					2	294	370	30.00	1.48	1	298	375		1.45					
340	0					8	326	454	39.72	1.31	0					1	325	625		1.82	0									
370	0					3	357	672	133.31	1.48	0					1	369	700		1.82	1	366	750		1.53					
400	0					0					0					0					1	377	850		1.59					
430	0					0					0					1	424	1350		1.77	0									
Total	34					111					47					73					112				30					
Mean		162	44	5.85	1.04		251	254	38.45	1.25		190	75	12.77	1.06		255	369	11.09	1.38		259	340	4.26	1.32		192	85	16.66	1.15

Table 17. Mean length, weight and condition factor (K) by length class for white sucker. NOLSS, 1987-89.

Length Class	Green					Orange					Linge					Musclow					Sydney					Trout				
	Length		Weight			Length		Weight			Length		Weight			Length		Weight			Length		Weight			Length		Weight		
	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K
80	0					0					0					1	80	6		1.17	0					0				
110	0					0					0					0					0					0				
140	0					0					0					0					0					0				
170	2	166	68	7.50	1.48	0					5	158	43	2.45	1.09	1	170	50		1.02	7	161	50	12.29	1.20	1	158	50		1.27
200	2	178	75	0.00	1.33	0					3	187	67	23.57	1.02	2	177	50	0.00	0.91	7	188	83	16.64	1.25	5	189	99	5.83	1.47
230	4	221	134	15.16	1.24	0					4	220	130	40.62	1.22	1	228	160		1.35	15	217	127	11.36	1.25	5	220	136	11.58	1.27
260	1	238	150		1.11	0					1	259	210		1.21	0					6	245	188	26.14	1.27	8	244	192	20.76	1.33
290	1	287	350		1.48	0					1	268	260		1.35	2	279	528	227.50	2.44	6	269	251	31.55	1.29	15	274	280	38.99	1.36
320	3	301	333	23.57	1.22	0					2	304	413	37.50	1.47	5	309	433	53.44	1.46	3	309	433	84.98	1.47	20	304	365	47.42	1.29
350	2	339	575	25.00	1.48	0					4	340	539	81.96	1.37	3	346	613	8.50	1.48	3	344	572	55.73	1.40	10	334	515	39.75	1.39
380	5	362	656	40.17	1.38	0					9	370	664	51.95	1.31	12	365	683	64.79	1.40	9	361	667	48.83	1.41	7	365	724	95.30	1.49
410	4	402	881	92.49	1.35	0					12	396	880	106.51	1.41	12	398	934	93.02	1.48	13	399	953	84.73	1.51	8	395	946	65.88	1.53
440	5	422	1010	121.04	1.35	0					3	429	1242	100.69	1.58	10	421	1096	102.11	1.47	16	423	1120	88.20	1.48	7	422	1071	97.09	1.43
470	2	449	1138	87.50	1.26	2	444	1370	27.50	1.57	7	455	1324	144.21	1.41	5	456	1390	56.83	1.46	6	454	1347	139.75	1.44	12	454	1384	115.95	1.48
500	0					0					0					1	485	655		0.57	4	485	1581	81.73	1.39	2	484	1638	37.50	1.45
530	0					0					0					0					1	514	1675		1.23	1	503	1700		1.38
Total	31					2					51					54					97					101				
Mean		306	488	37.49	1.33		444	1370	27.50	1.57		308	525	53.59	1.31		330	599	55.11	1.37		318	647	48.71	1.34		334	705	44.31	1.40

Table 18. Mean length, weight and condition factor (K) by length class for northern pike. NOLSS, 1987-89.

Length Class	Green					Orange					Linge					Musclow					Sydney					Trout				
	Length		Weight			Length		Weight			Length		Weight			Length		Weight			Length		Weight			Length		Weight		
	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K	n	(mm)	(g)	SD	K
220	1	216	95		0.94	0					0					0					0					0				
260	0					0					0					0					0					0				
300	0					0					0					0					1	275	140		0.67	0				
340	1	321	225		0.68	1	328	210		0.60	0					1	321	225		0.68	0					0				
380	1	378	400		0.75	0					0					0					0					0				
420	0					0					0					2	398	388	37.50	0.62	0					0				
460	1	425	460		0.60	3	443	585	24.83	0.67	0					1	444	575		0.66	1	460	875		0.90	0				
500	1	498	925		0.75	2	476	888	37.50	0.64	3	486	723	73.07	0.62	4	480	756	116.42	0.68	1	469	700		0.68	0				
540	0					2	531	908	82.50	0.61	1	532	950		0.63	3	521	1042	196.14	0.74	0					0				
580	1	551	1250		0.75	5	555	1192	187.10	0.70	1	561	825		0.47	4	547	1156	56.94	0.71	1	569	1725		0.94	1	556	1200		0.70
620	3	605	1763	44.97	0.80	3	600	1400	127.48	0.85	1	599	1325		0.62	1	608	2050		0.91	0					2	610	1723	177.50	0.76
660	2	633	1750	100.00	0.69	5	636	1875	192.35	0.73	0					2	650	1828	227.50	0.67	4	637	1896	187.36	0.73	1	621	1900		0.79
700	6	678	2135	194.14	0.69	2	680	2175	50.00	0.69	0					4	671	1888	207.29	0.63	4	690	2451	219.95	0.75	3	673	2300	108.01	0.76
740	3	716	2367	201.38	0.64	0					0					2	713	2500	25.00	0.69	2	729	2955	295.00	0.76	2	713	3095	95.00	0.86
780	3	761	3270	86.83	0.74	1	749	2950		0.70	0					0					0				1	772	3500		0.76	
820	2	804	3550	800.00	0.68	0					0					0					0				1	806	4200		0.80	
860	0					0					0					0					0				0					
900	1	866	4400		0.68	0					0					0					0				0					
Total	26					24					6					24					14					11				
Mean		573	1738	92.87	0.72		555	1331	77.97	0.67		545	956	18.27	0.58		535	1241	86.68	0.70		547	1535	100.33	0.78		679	2560	54.36	0.78

Table 19. Mean length, weight and condition factor (K) by length class for lake whitefish. NOLSS, 1987-89.

Length Class	Green				Orange				Linge				Musclow				Sydney				Trout						
	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K		
60											0					0					0						
100	Species not Present				Species not Present							0					0					0					
140											0						0					0					
180							179	75		1.31							0					3	173	48	13.12	0.93	
220											0					1	210	125		1.35		2	198	77	1.50	1.02	
260							236	109	40.98	1.29						0						7	233	126	27.31	1.00	
300							283	313	37.50	1.39						0						2	263	313	17.50	1.72	
340							323	417	62.38	1.23						0						4	304	286	44.91	1.02	
380							360	600	41.46	1.29					1.30	1	343	525		1.30		4	361	539	65.90	1.15	
420							399	859	91.47	1.35						0						7	400	739	231.06	1.16	
460							432	1077	153.63	1.34					1.76	1	446	1560		1.76		18	441	1153	111.77	1.34	
500							464	1150		1.15					1.72	2	485	1963	387.50	1.72		14	476	1510	111.09	1.40	
540							0								1.60	7	530	2381	247.44	1.60		0				1.19	
580							0								1.52	3	557	2823	140.97	1.52		0				1.31	
Total							48								15							58				54	
Mean							334	582	53.43	1.29					1.54		429	1529	129.32	1.54			334	593	76.38	1.22	

Table 20. Mean length, weight and condition factor (K) by length class for burbot. NOLSS, 1987-89.

Length Class	Green				Orange				Linge				Musclow				Sydney				Trout							
	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K	n	Length (mm)	Weight (g)	SD	K			
240																0						1	240	100		0.72		
270	Species not Present				Species not Present				Species not Present								0						1	282	150		0.83	
300																1	290	150		0.83			0					
330																0							0					
360																2	348	328	37.50	0.78			2	352	380	20.00	0.87	
390																0							1	381	415		0.75	
420																0							1	393	360		0.59	
450																2	442	505	72.50	0.58			2	436	568	107.50	0.68	
480																4	465	649	40.21	0.65			2	462	650	50.00	0.66	
510																12	498	699	56.01	0.57			2	485	800	100.00	0.70	
540																8	525	942	76.20	0.65			3	530	918	197.33	0.62	
570																4	556	1068	71.89	0.62			2	550	1248	2.50	0.75	
600																3	592	1408	42.49	0.68			1	575	1115		0.59	
630																2	610	1350	90.00	0.60			0				0.53	
660																2	638	1855	355.00	0.71			0				0.44	
690																0							1	662	1725		0.59	
720																1	716	2015		0.55			1	703	2360		0.68	
Total															41								20				90	
Mean															0.64		516	897	76.53	0.64				464	830	36.72	0.70	

Table 21. Percentage occurrence of food items in stomachs of fish caught in NOLSS study lakes, 1987-89.

Lake	Species	n	Empty	Fish								Invertebrates								Other ***				
				Lake whitefish	Cisco	White sucker	Stickleback	Yellow perch	Log perch	Trout-perch	Sculpin	Unident remain	Ephemeroptera	Diptera	Trichoptera	Amphipoda	Mysidacea	Gastropoda	Pelecypoda		Decapoda	Unident remain		
Green	Cisco	29	75.9	0	0	0	0	0	0	0	0	0	0	17.2	0	0	0	0	0	0	0	0	7.0	
	Northern pike	26	34.6	0	7.6	3.9	7.7	23.1	3.9	0	0	11.5	0	0	0	0	0	0	3.9	0	0	0	3.9	
Orange	Cisco	29	65.5	0	0	0	0	0	0	0	0	0	3.5	13.8	3.5	0	0	0	13.8	0	0	0	0	
	Walleye	203	58.6	0	2.0	0	0	6.9	0	0.5	2.0	10.4	10.4	0.5	0	0	3.5	0	0	1.5	1.0	0	2.5	
	Northern pike	25	48.0	0	0	0	0	16.0	0	0	0	8.0	16.0	0	0	0	0	0	12.0	0	0	0	0	
Linge	Lake whitefish	50	36.0	0	0	0	0	0	0	0	0	0	0	12.0	0	0	0	4.0	20.0	0	0	0	28.0	
	Walleye	163	69.9	0	3.7	0	0	1.2	0	0	0.6	11.0	3.7	1.8	0	0	0	0	0	8.0	0	0	0	
	Northern pike	6	66.7	0	0	0	0	0	0	0	0	16.7	0	0	0	0	0	0	16.7	0	0	0	0	
Musclow	Lake whitefish	13	30.8	0	0	0	0	0	0	0	0	0	0	15.4	0	23.1	0	15.4	15.4	0	0	0	0	
	Burbot	41	70.7	0	14.6	0	0	0	0	2.4	0	4.9	7.3	0	0	0	0	0	0	0	0	0	0	
	Walleye	55	63.6	0	1.8	0	0	5.5	0	0	0	20.0	3.6	0	0	0	0	0	0	1.8	0	0	3.6	
	Northern pike	23	69.9	0	8.7	0	0	8.7	0	0	0	13.0	0	0	0	0	0	0	0	0	0	0	0	
Sydney	Cisco	8	100.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Lake whitefish	35	37.1	0	0	0	0	0	0	0	0	0	0	14.3	0	0	0	14.3	2.9	0	0	0	31.4	
	Lake trout	18	38.9	5.6	22.2	5.6	5.6	11.1	0	0	0	11.1	0	0	0	0	0	0	0	0	0	0	0	0
	Burbot	18	66.7	0	5.3	0	0	5.3	0	0	0	0	0	0	0	0	0	0	0	22.2	0	0	0	
	Walleye	184	53.3	0	10.3	0.5	2.1	13.0	0.5	0	0	17.9	0.5	0	0	0	0	0	0	0	0	0	1.6	
	Northern pike	15	46.7	0	6.7	0	6.7	6.7	0	0	0	26.7	0	0	0	0	0	0	0	6.7	0	0	0	
Trout	Lake whitefish	40	35.0	0	0	0	2.5	0	0	0	2.5	2.5	5.0	20.0	0	2.5	0	5.0	17.5	0	0	0	10.0	
	Trout	6	50.0	0	16.7	0	0	0	0	16.7	0	16.7	0	0	0	0	0	0	0	0	0	0	0	
	Burbot	26	57.7	0	11.5	0	0	0	0	0	0	11.5	0	0	0	0	0	0	0	11.5	0	0	7.7	
	Walleye	68	57.4	0	8.8	0	5.8	1.5	0	0	0	23.5	0	0	0	0	0	0	0	0	0	0	2.9	
	Northern pike	11	72.7	9.1	0	0	0	0	0	0	0	18.2	0	0	0	0	0	0	0	0	0	0	0	

\*\*\* "Other" - Includes detritus, stones, conifer needles, macrophytes, fish eggs and a frog.

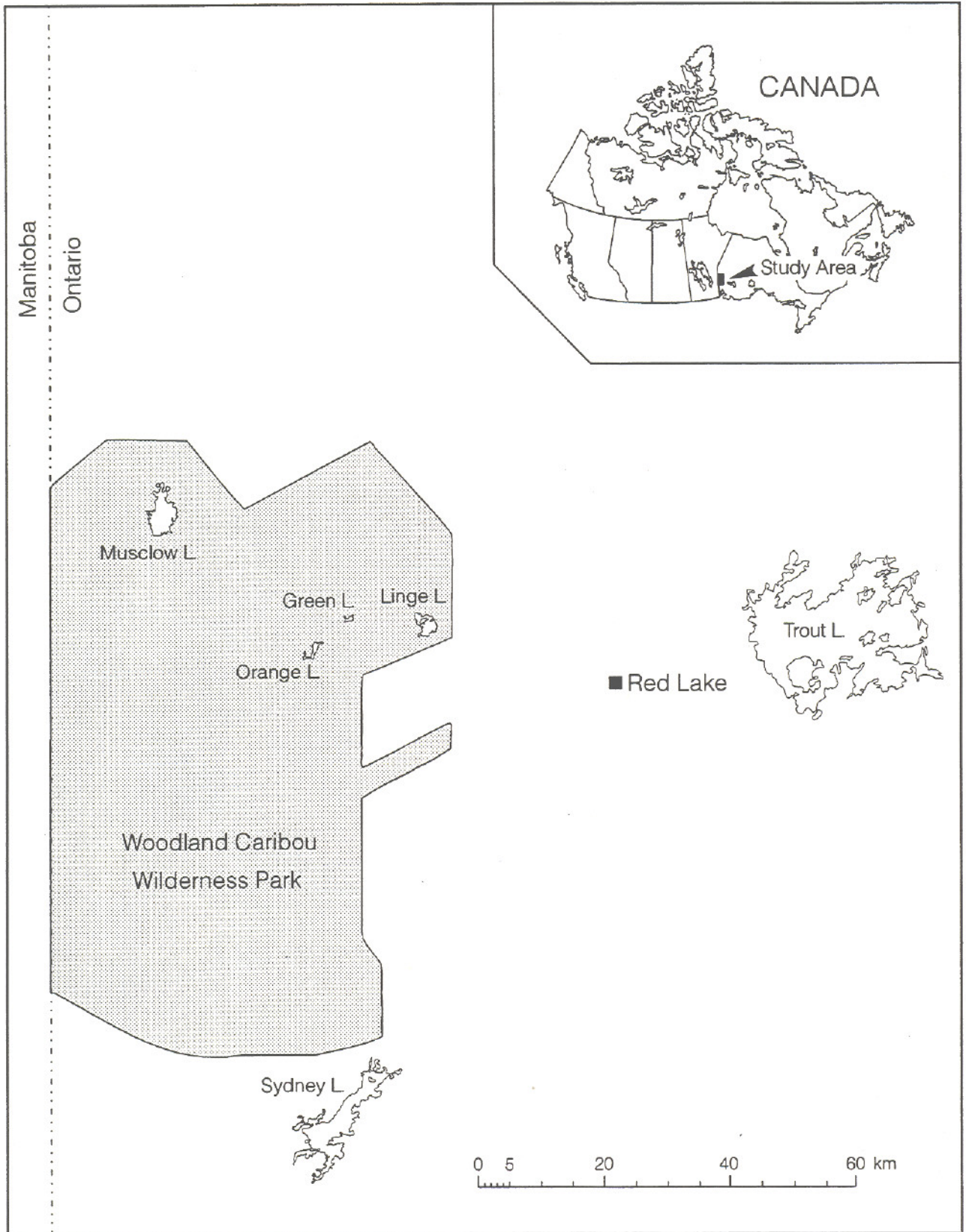


Fig. 1. Map of the Red Lake District of northwestern Ontario showing the location of the six NOLSS lakes.

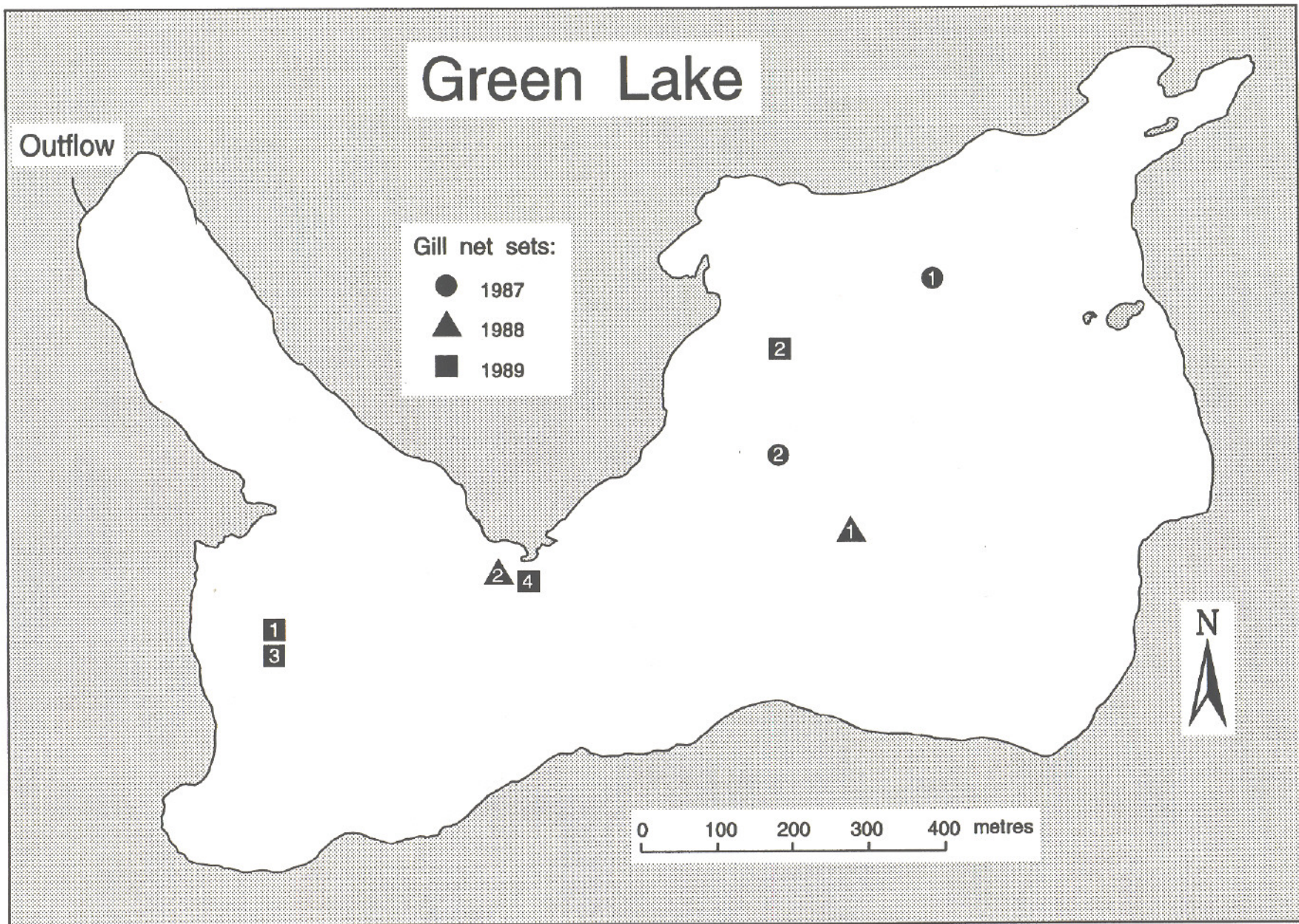


Fig. 2. Map of Green Lake showing gill net set locations in 1987-89.

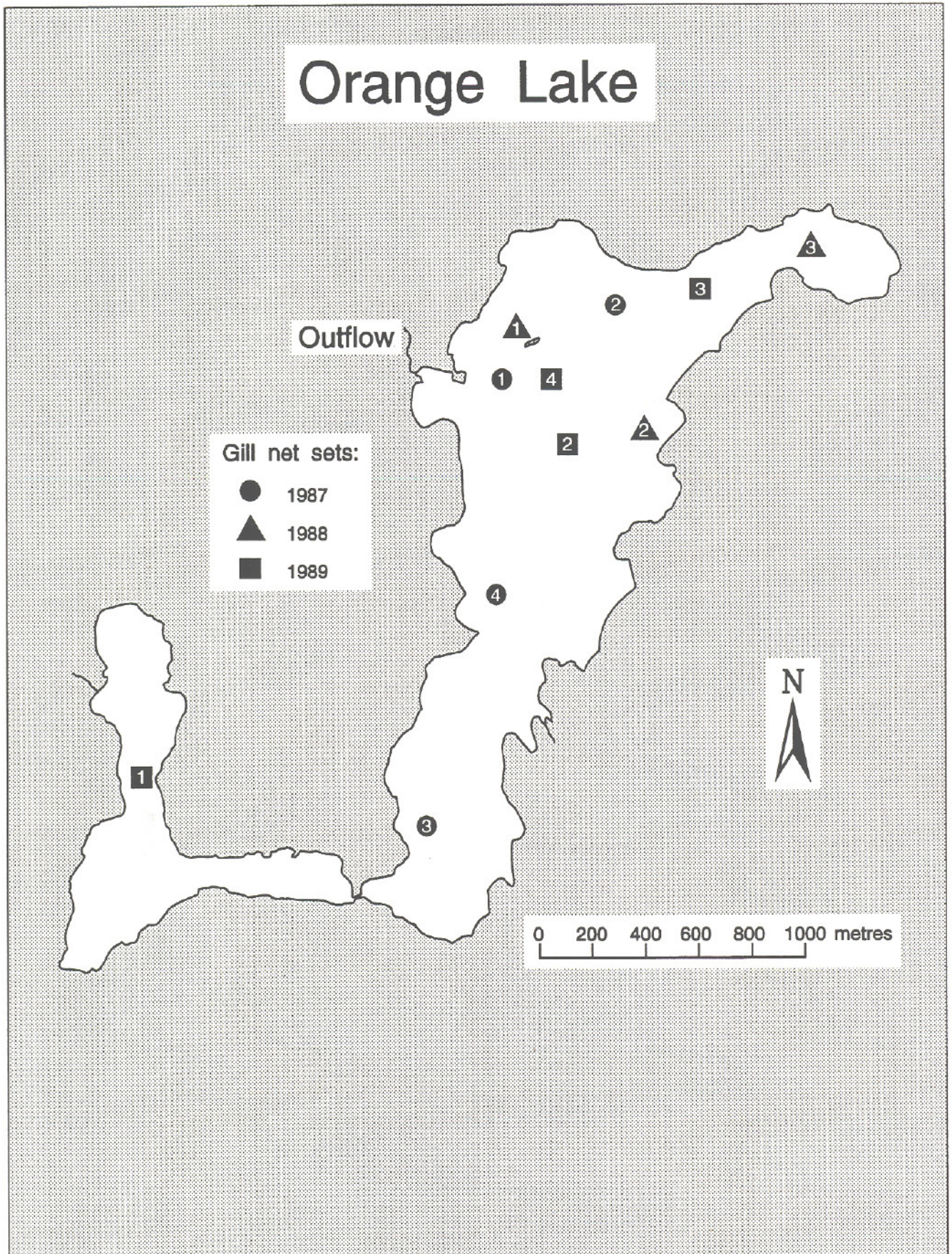


Fig. 3. Map of Orange Lake showing gill net set locations, 1987-89.

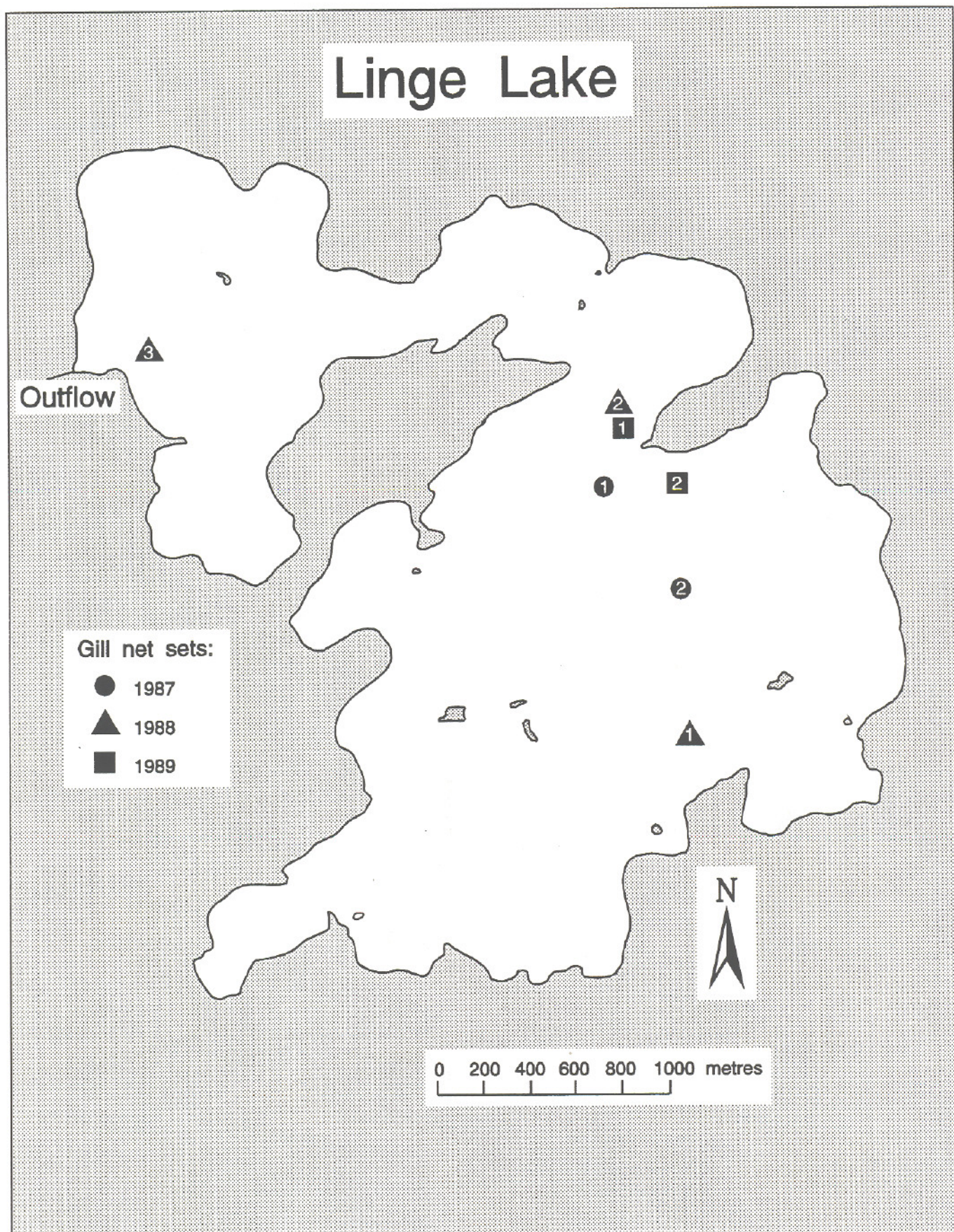


Fig. 4. Map of Linge Lake showing gill net set locations, 1987-89.

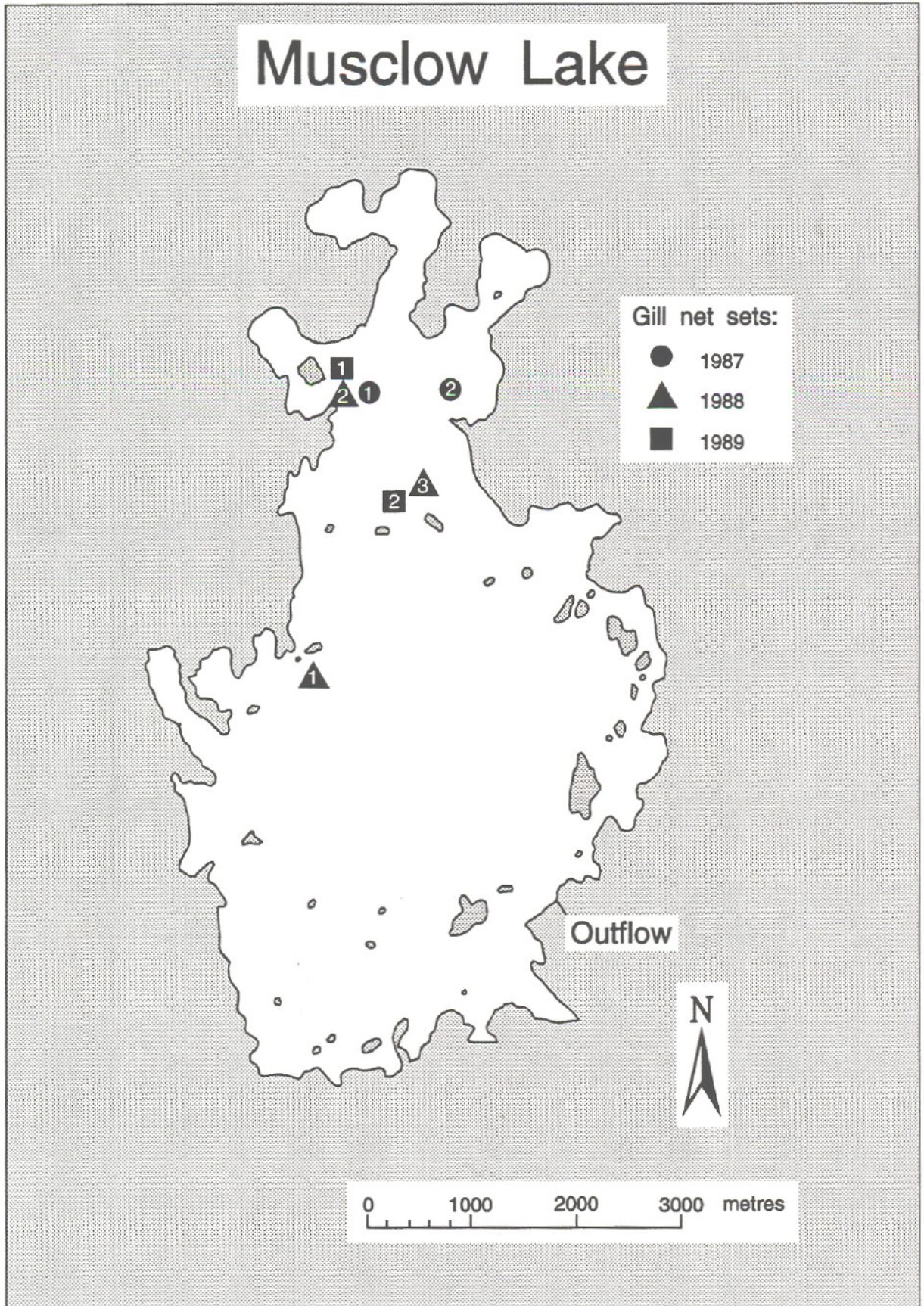


Fig. 5. Map of Musclow Lake showing gill net set locations, 1987-89.

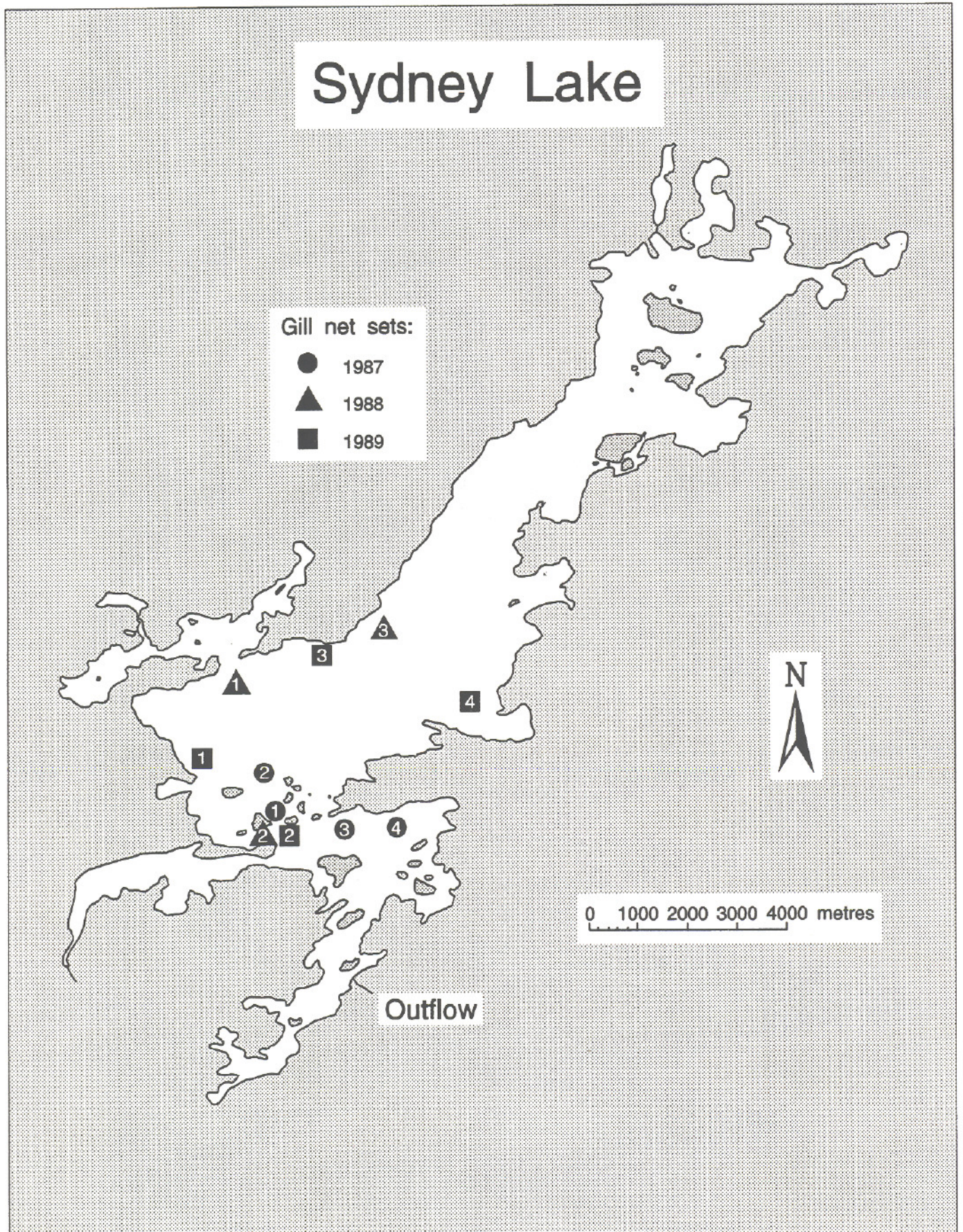


Fig. 6. Map of Sydney Lake showing gill net set locations, 1987-89.

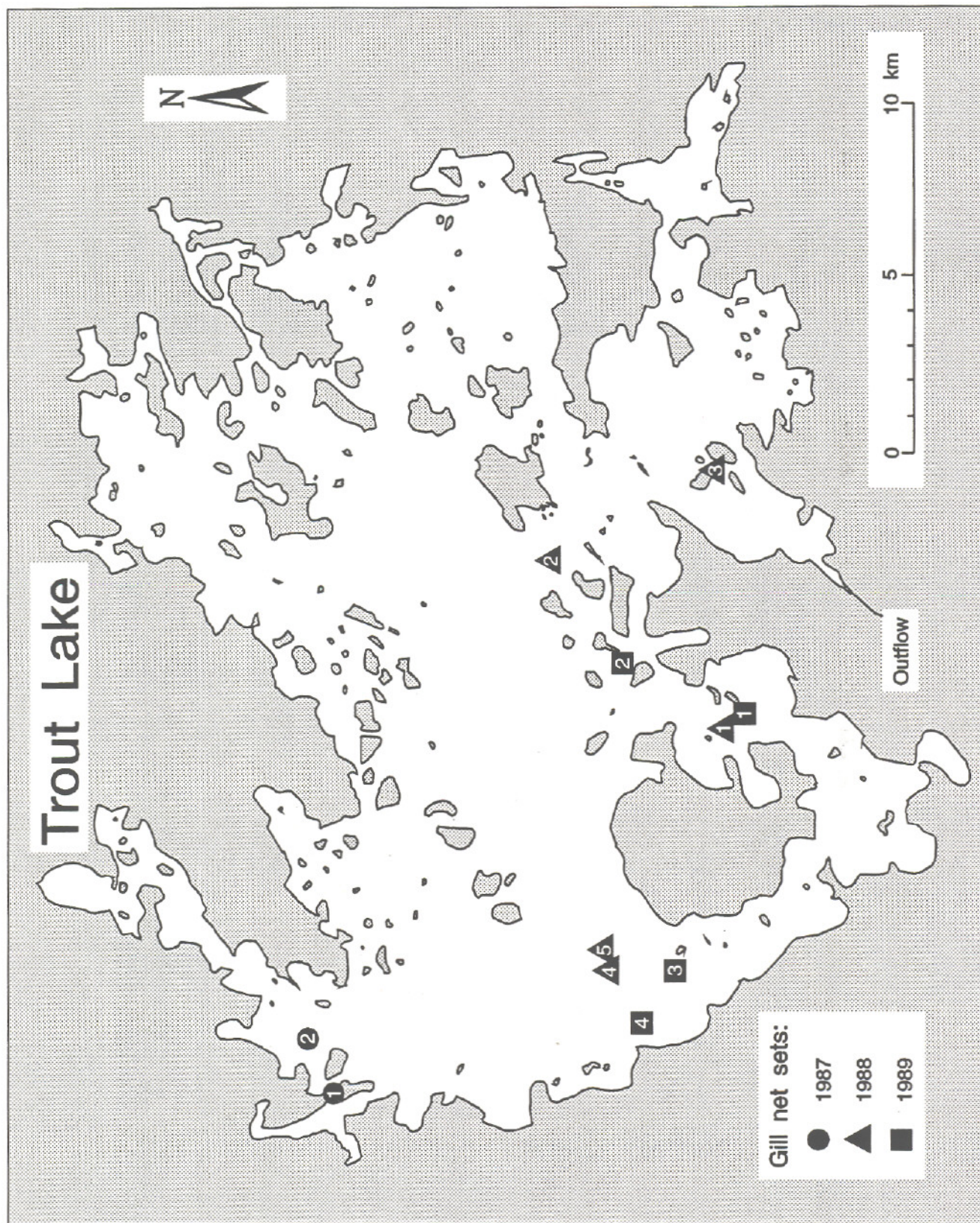


Fig. 7. Map of Trout Lake showing gill net set locations, 1987-89.

Species Composition (%)

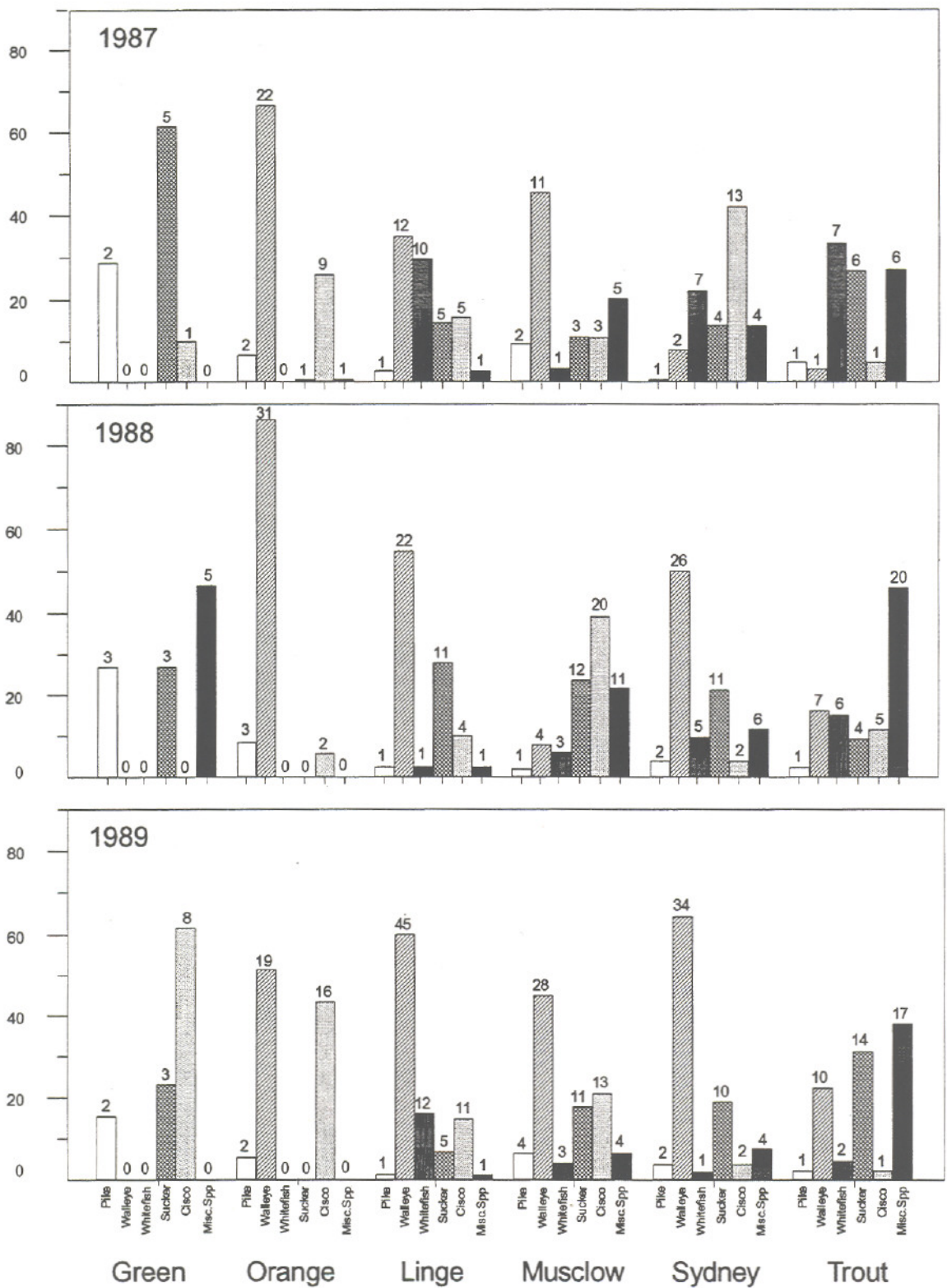


Fig. 8. Mean percent species composition and mean number of fish caught per net (over bar) for the CPUE adjusted gill net catch by year and lake, NOLSS lakes, 1987-89 (CPUE adjusted a 16 h set).

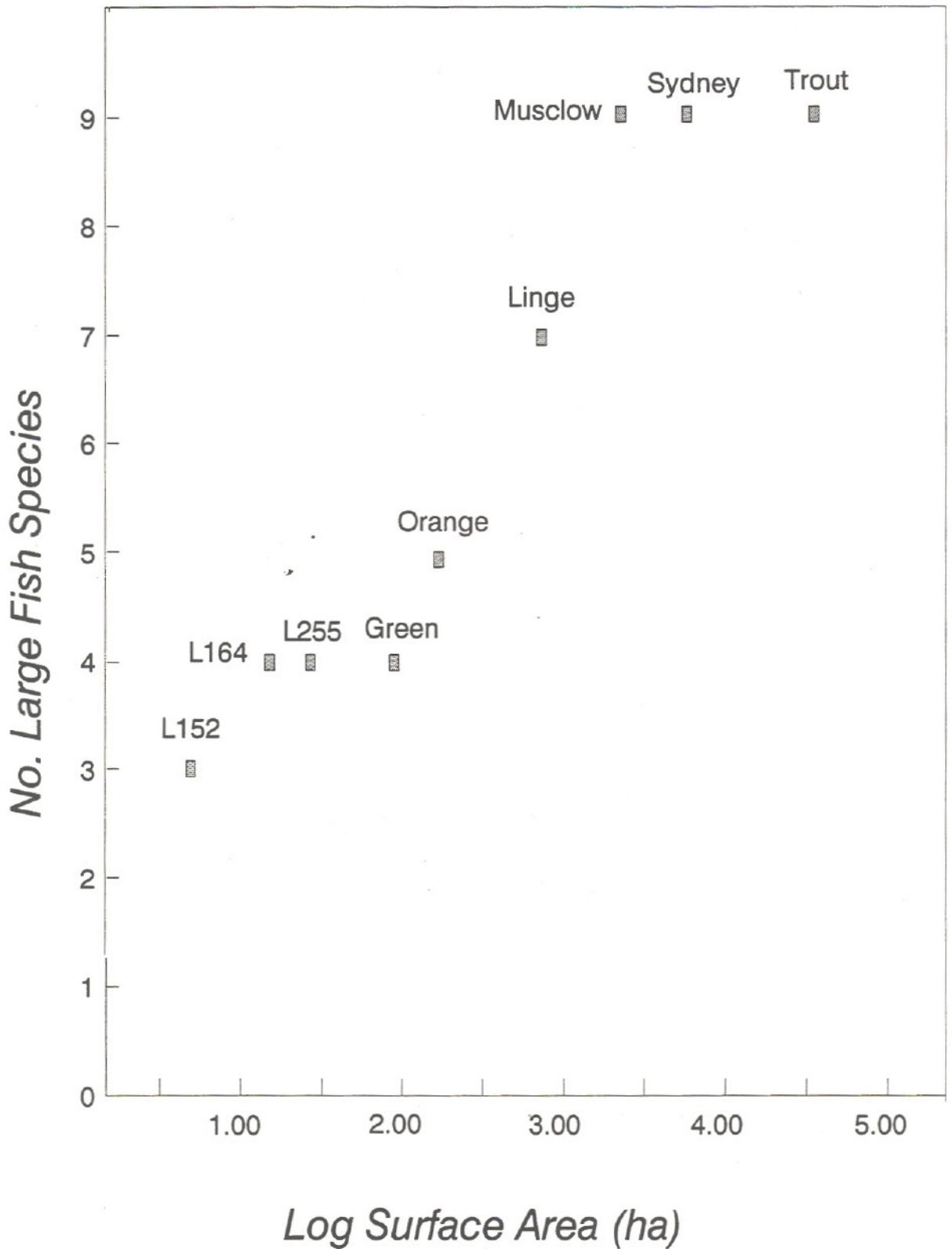


Fig. 9. Lake surface area versus the number of large fish species found in each of the NOLSS lakes, 1987-89. (See text for definition of large fish species).

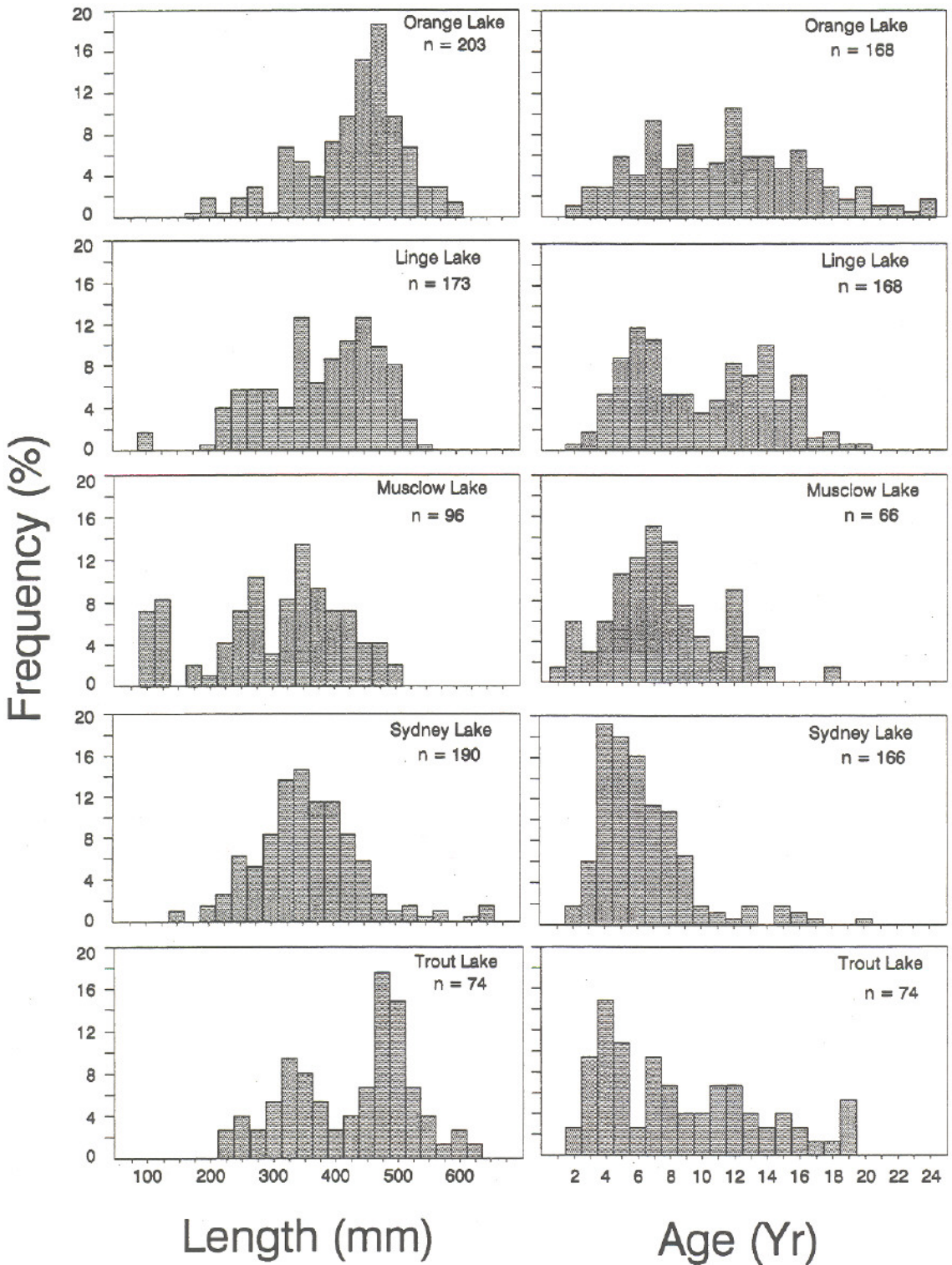


Fig. 10. Length and age frequency distributions for walleye from the NOLSS lakes, 1987-89.

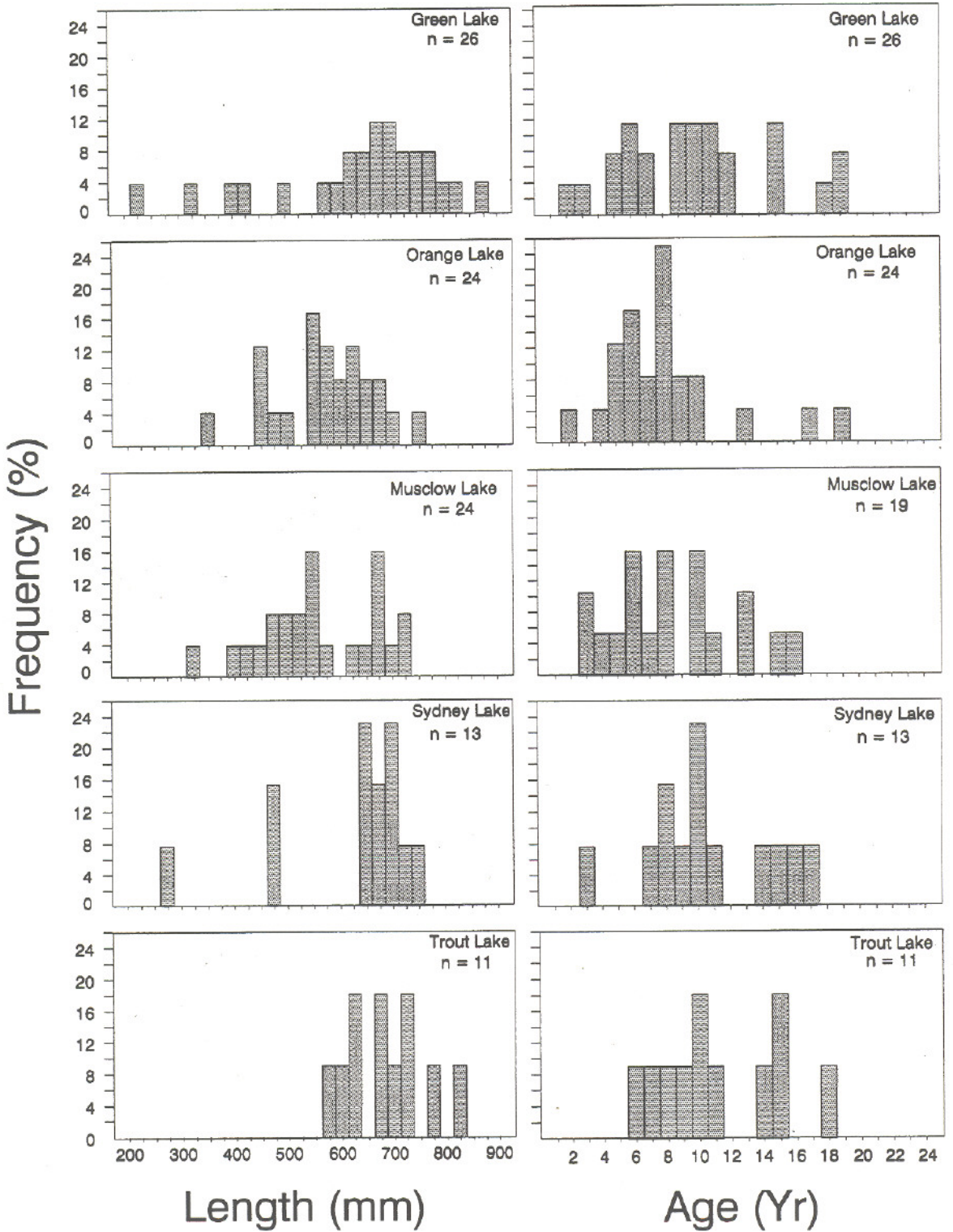


Fig. 11. Length and age frequency distributions for northern pike from the NOLSS lakes, 1987-89.

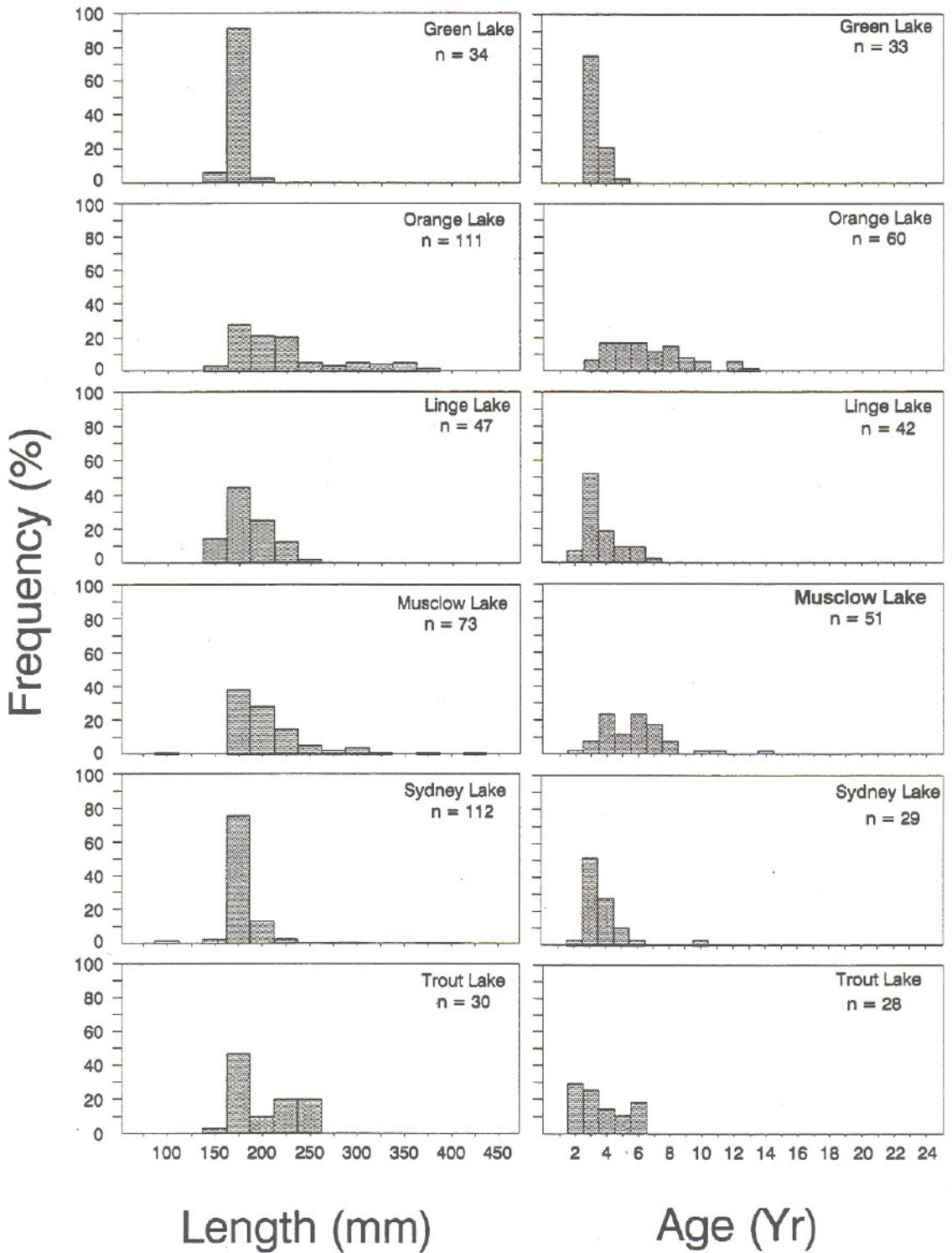


Fig. 12. Length and age frequency distributions for cisco from the NOLSS lakes, 1987-89.

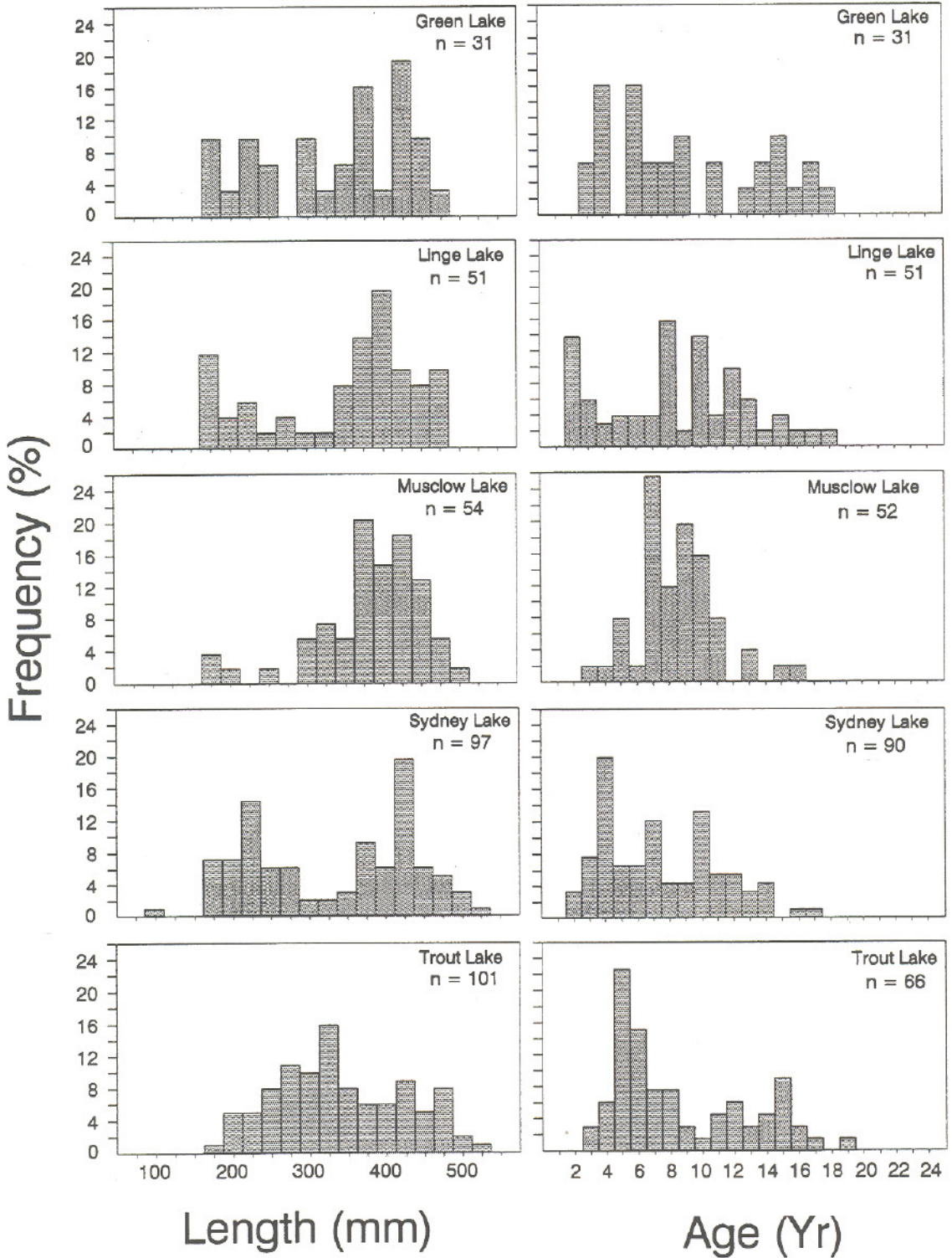


Fig. 13. Length and age frequency distributions for white sucker from the NOLSS lakes, 1987-89.

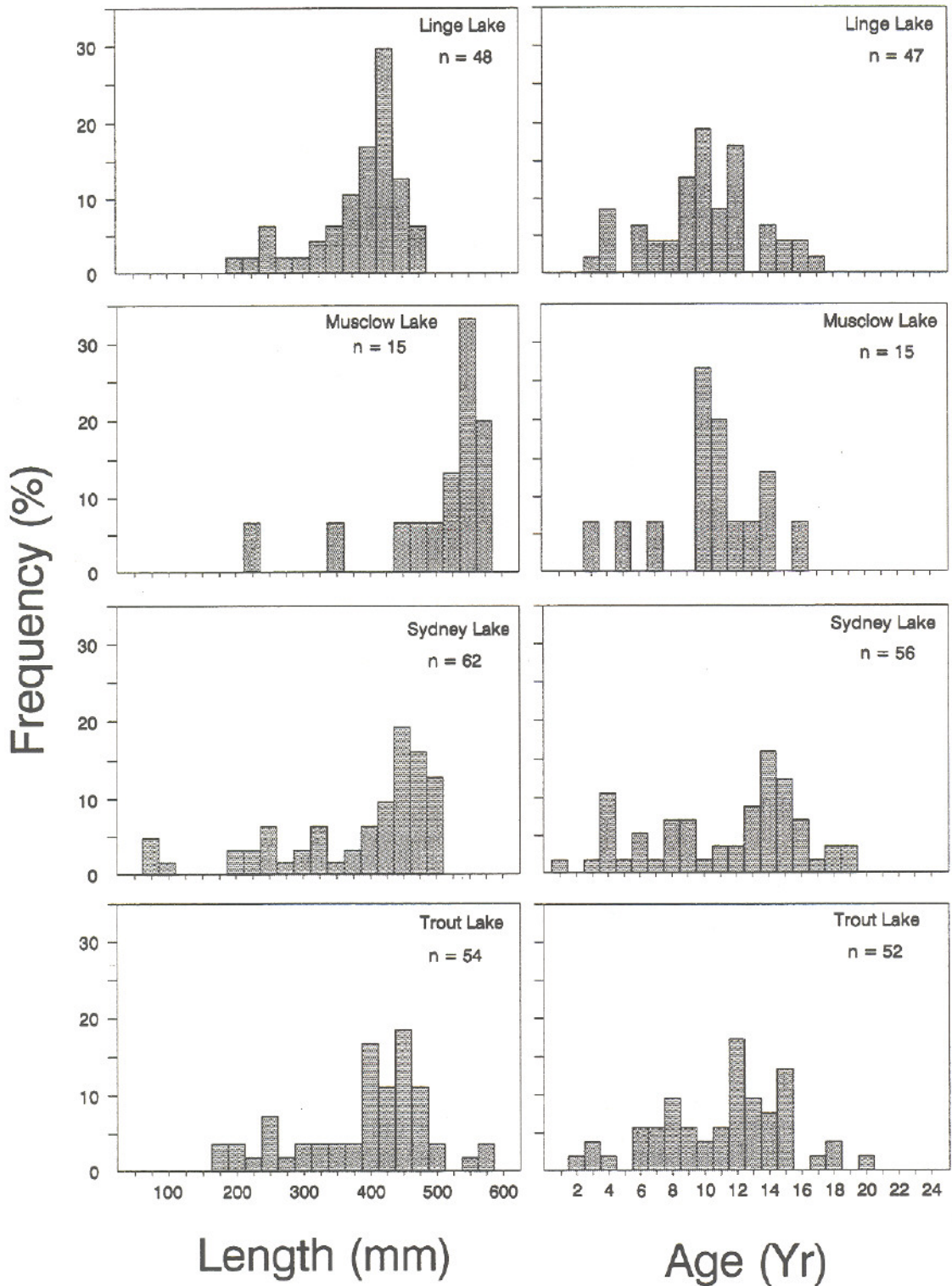


Fig. 14. Length and age frequency distributions for lake whitefish from the NOLSS lakes, 1987-89.

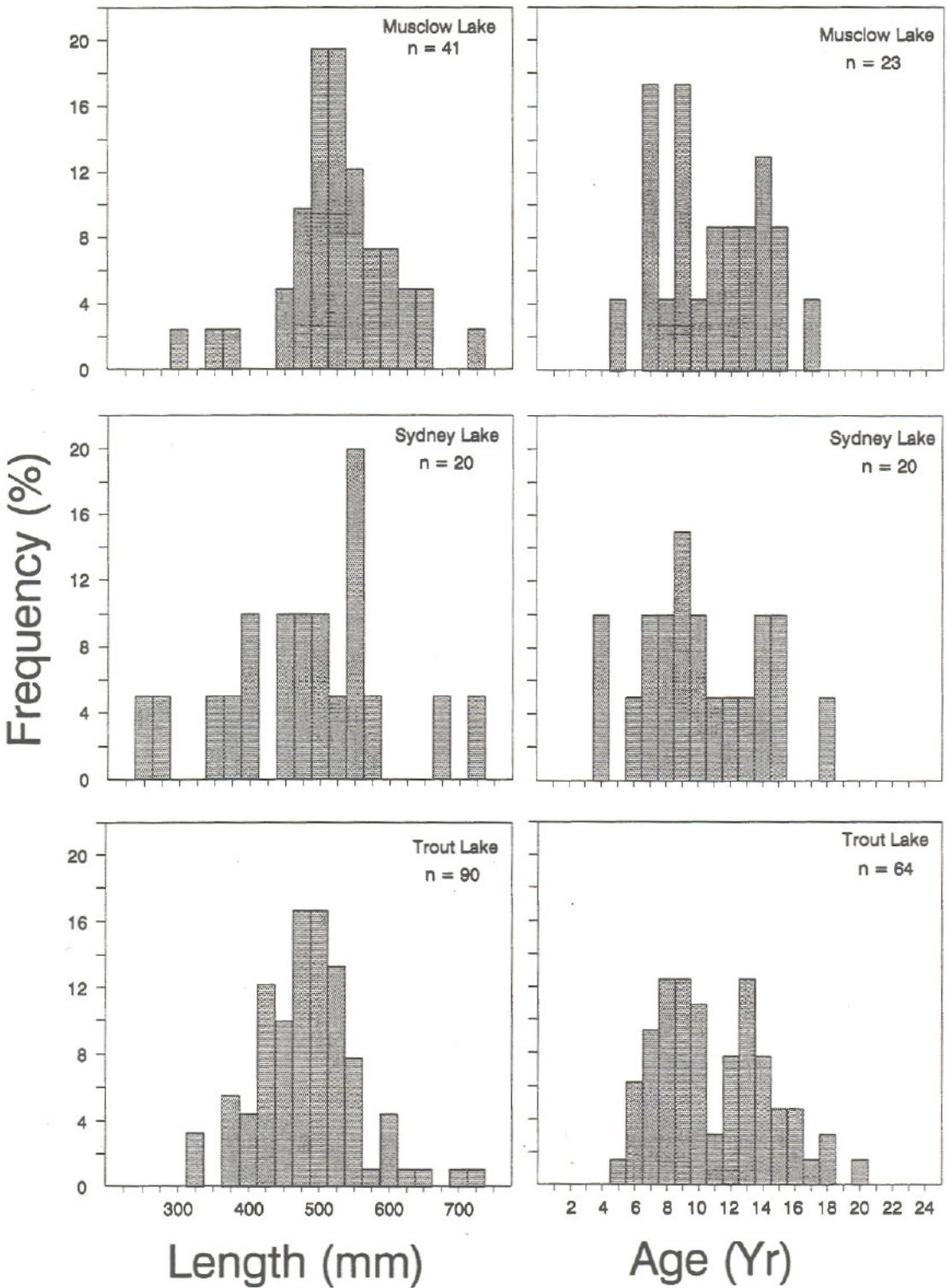


Fig. 15. Length and age frequency distributions for burbot from the NOLSS lakes, 1987-89.

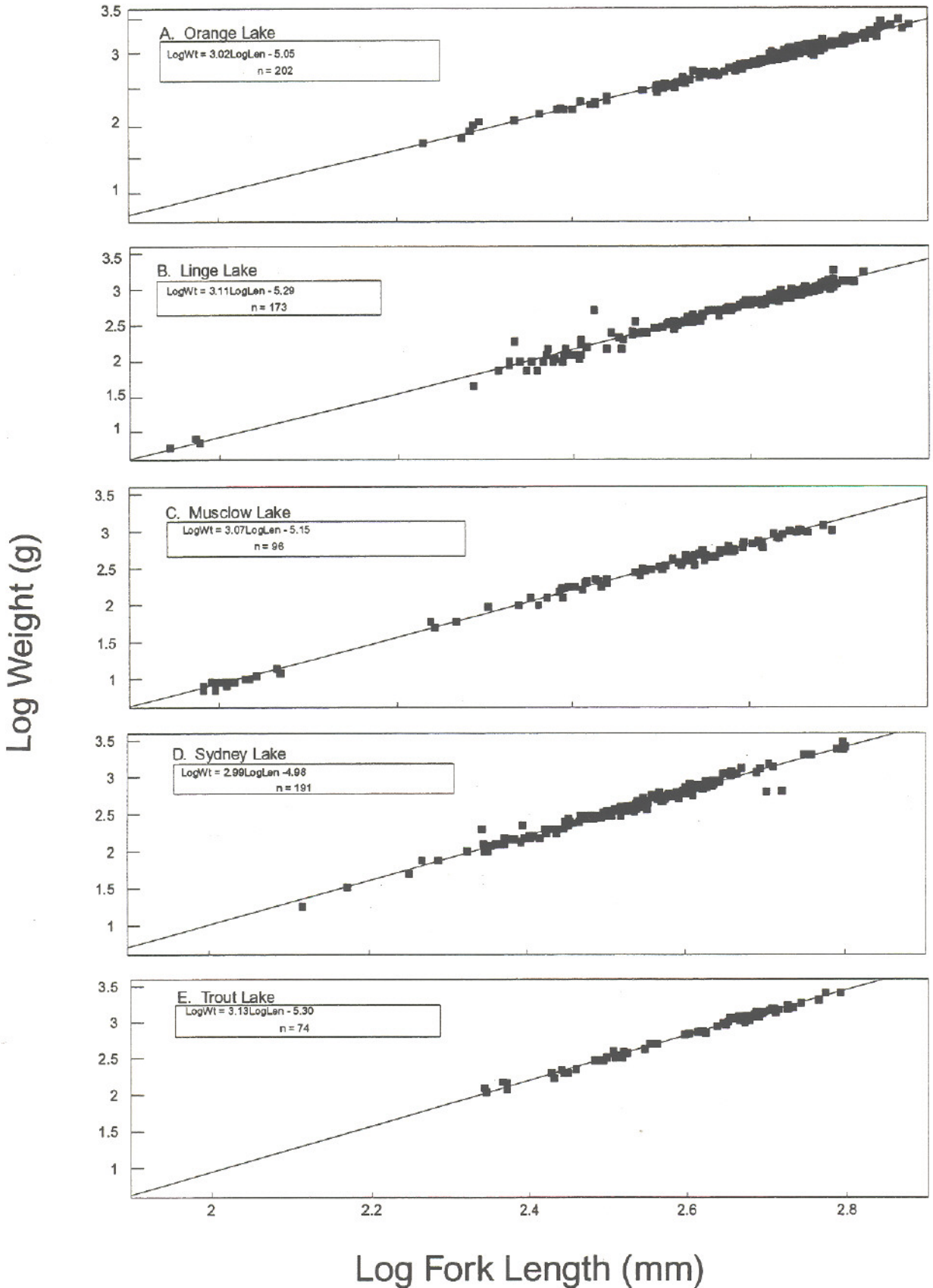


Fig. 16. Log Length-Log weight regression lines for walleye from the NOLSS lakes, 1987-89.

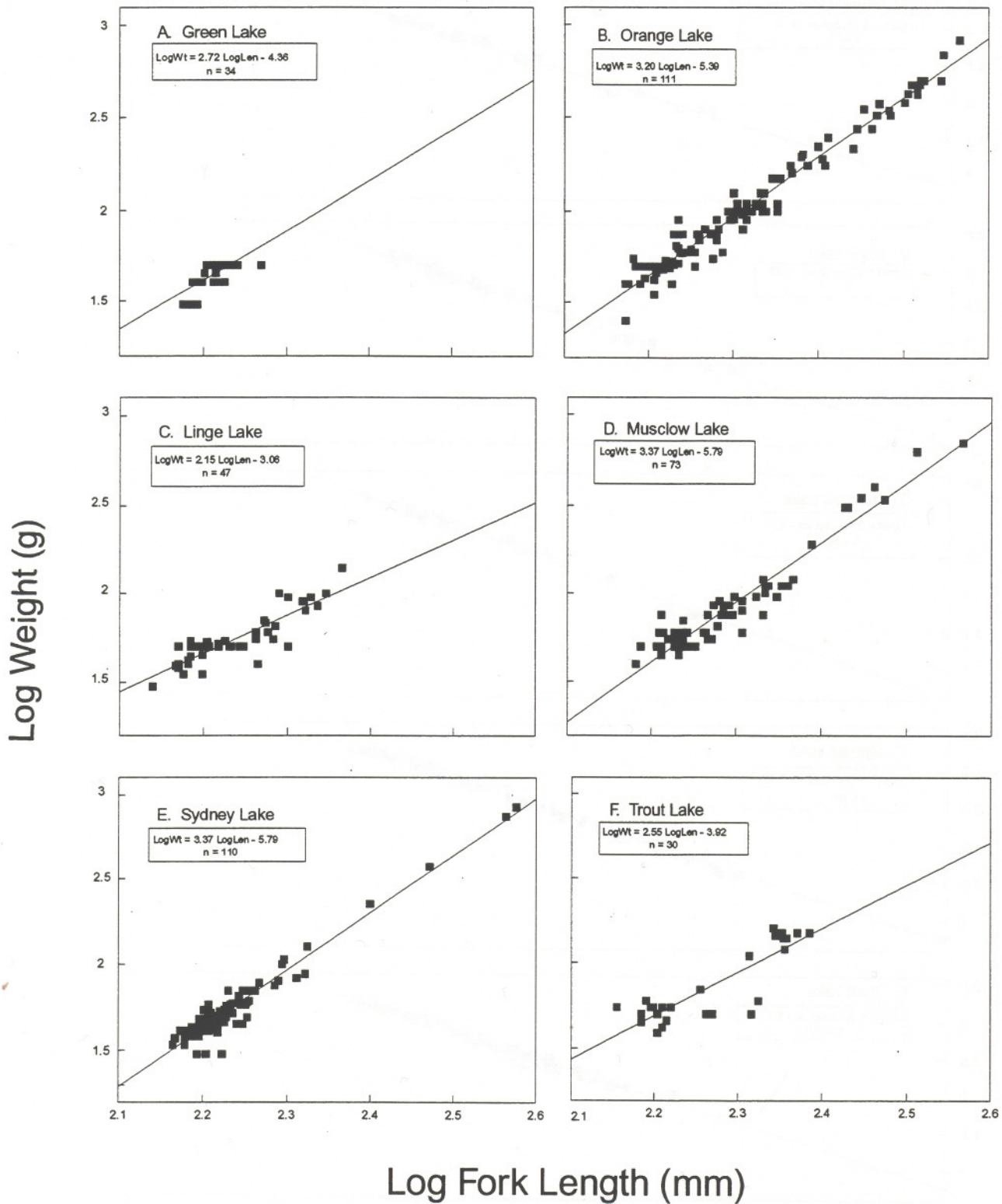


Fig. 17. Log Length-Log weight regression lines for cisco from the NOLSS lakes, 1987-89.

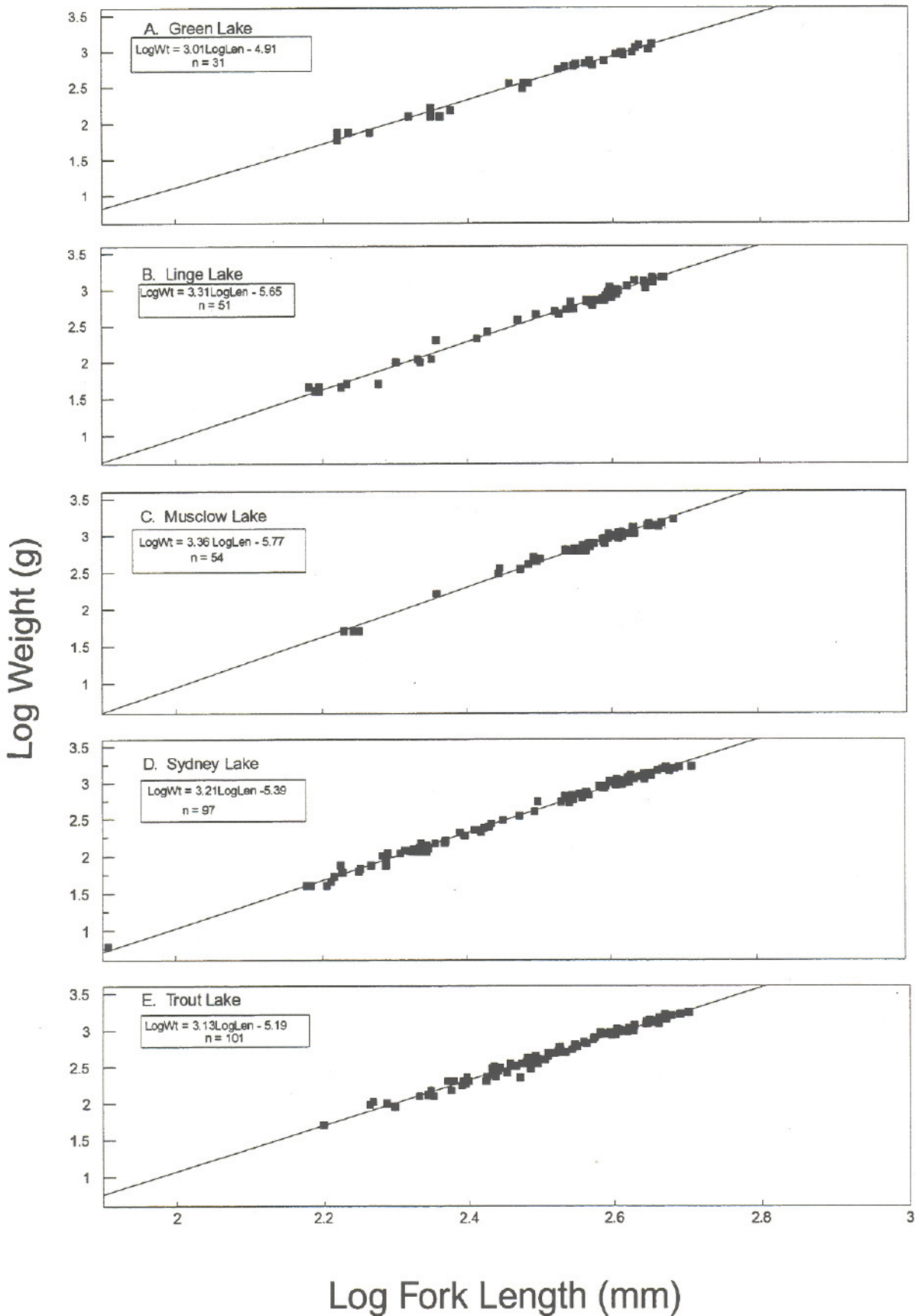


Fig. 18. Log Length-Log weight regression lines for white sucker from the NOLSS lakes, 1987-89.

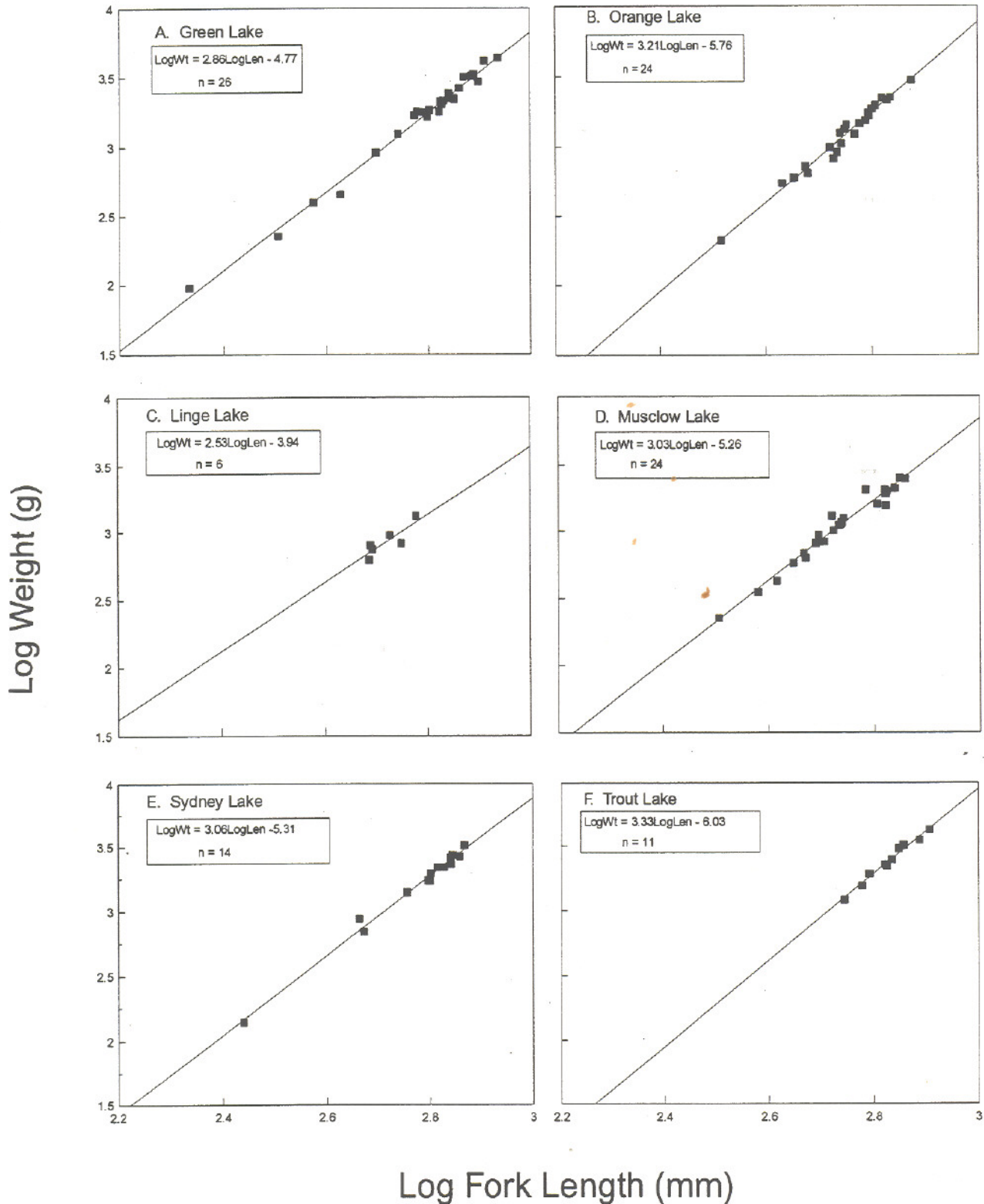


Fig. 19. Log Length-Log weight regression lines for northern pike from the NOLSS lakes, 1987-89.

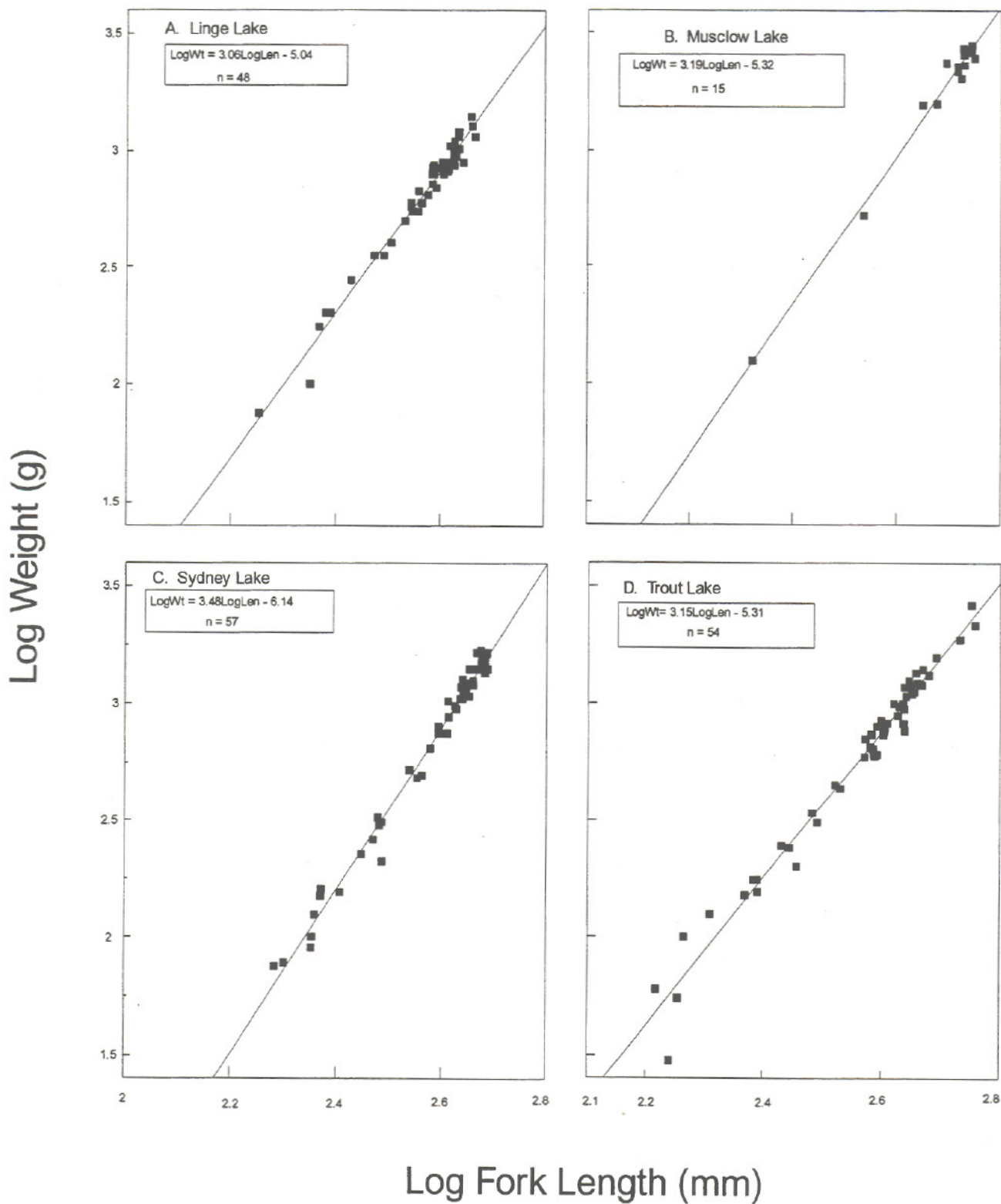


Fig. 20. Log Length-Log weight regression lines for lake whitefish from the NOLSS lakes, 1987-89.

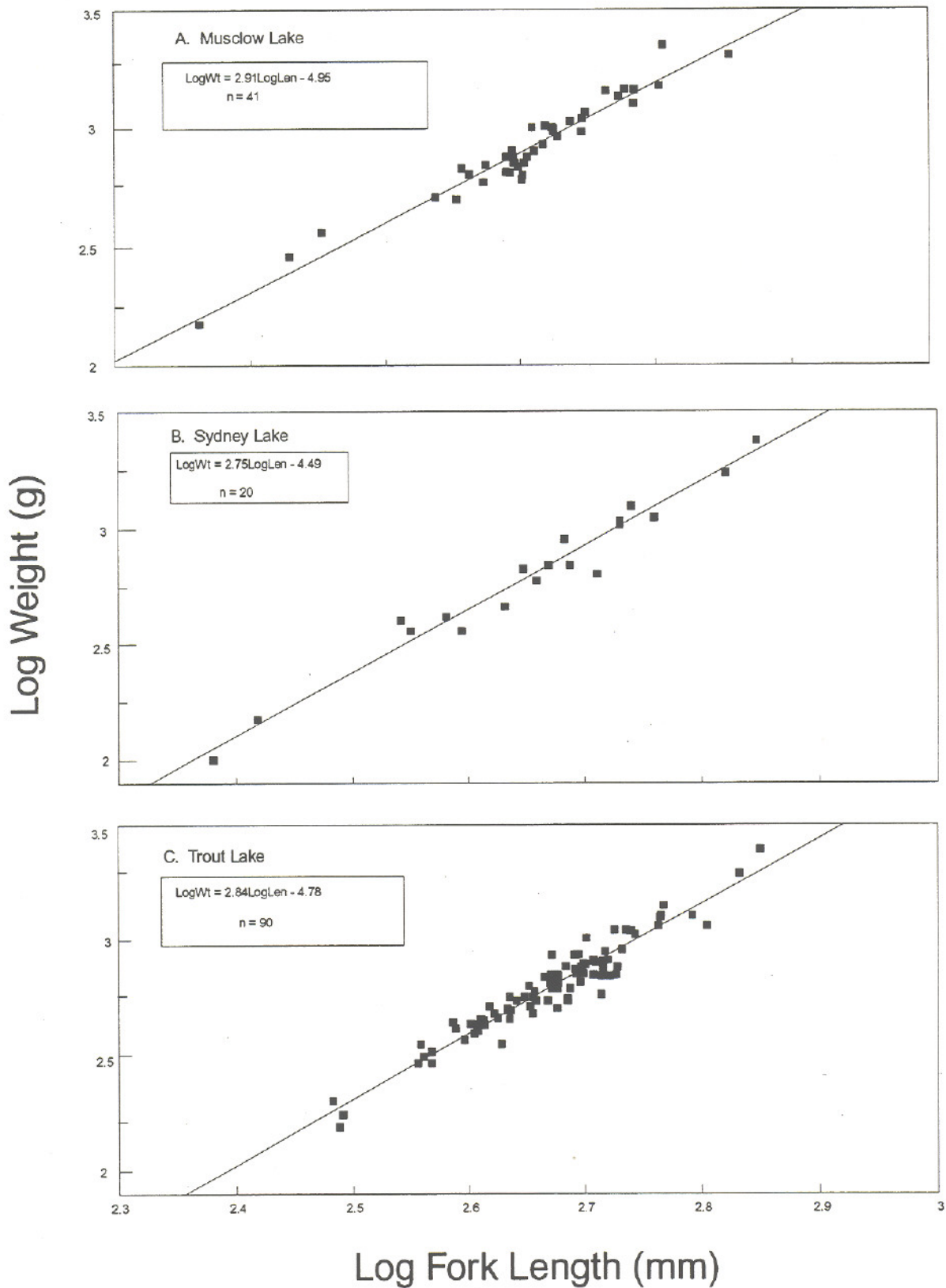


Fig. 21. Log Length-Log weight regression lines for burbot from the NOLSS lakes, 1987-89.

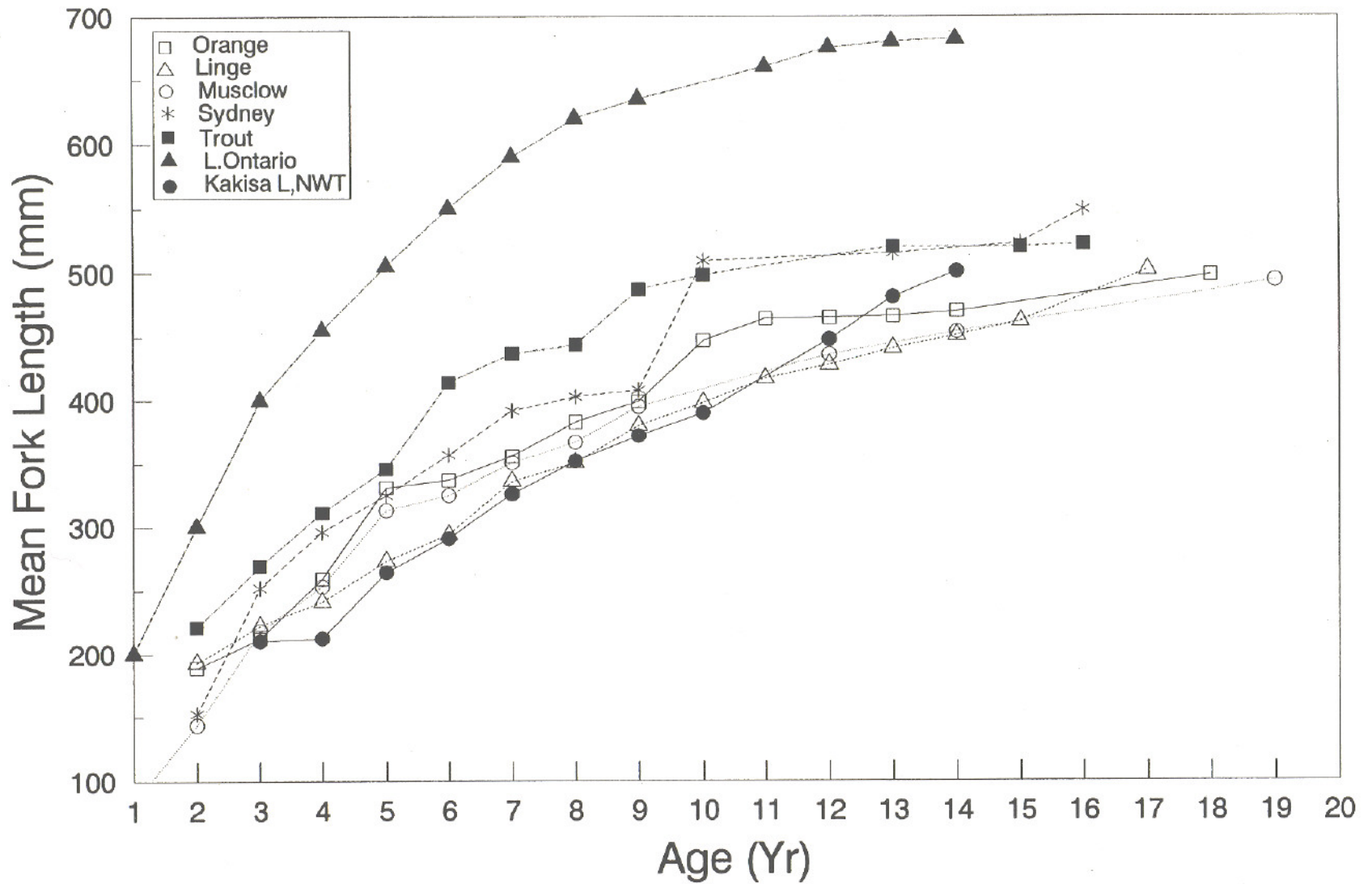


Fig. 22. Comparison of growth (mean fork length at age) for walleye among five NOLSS lakes, 1987-89, and two other locations (Roberge et al. 1986).

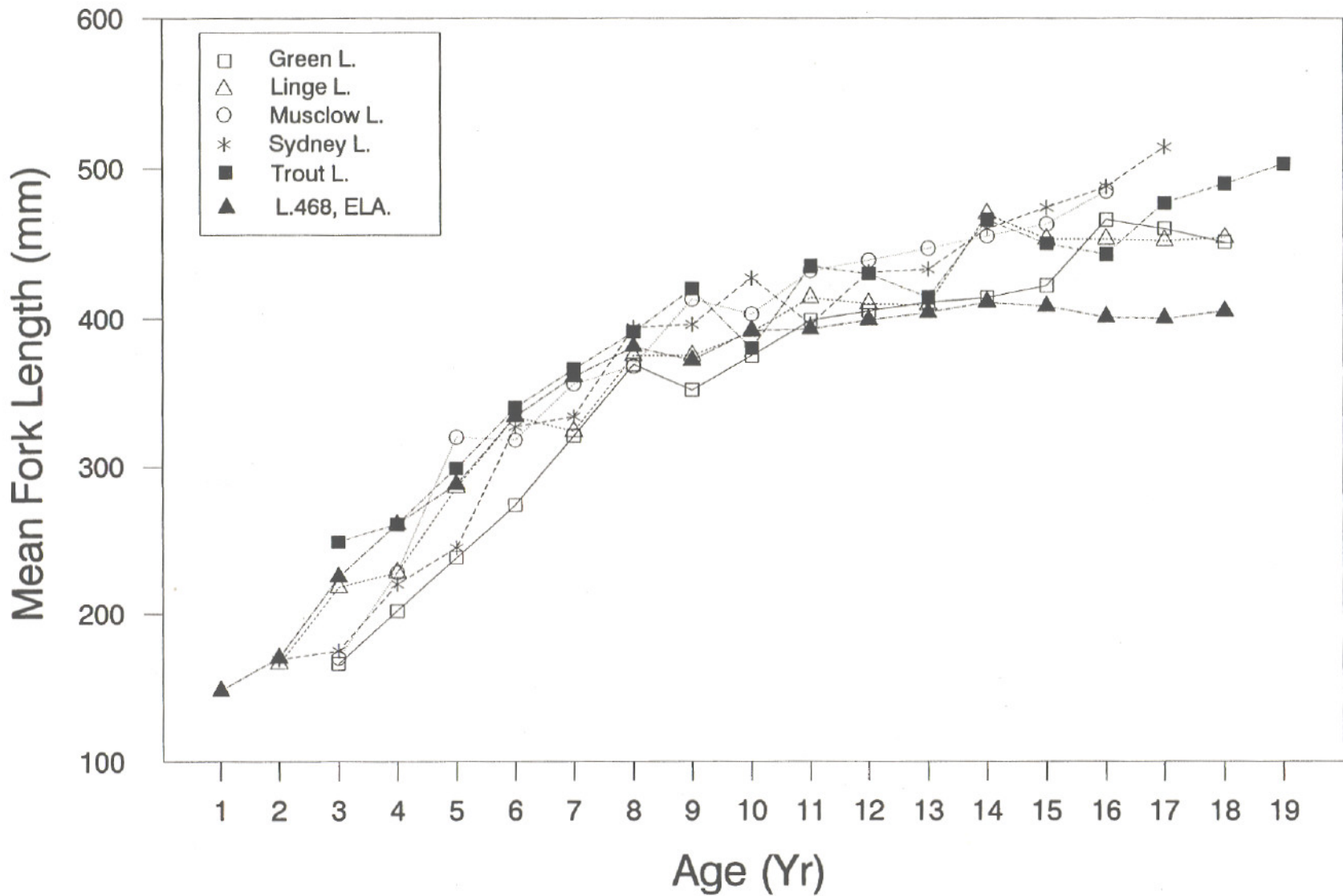


Fig. 23. Comparison of growth (mean fork length at age) for white sucker among five NOLSS lakes, 1987-89, and one ELA lake (S. Chalanchuk, FWI, unpublished data).

Appendix 1.1. Raw data from the 1987 NOLSS fish survey of Green Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Northern pike	Jun 4	866	4400	M	11	1	0.98	3772.1	-27.72	12.06	1
		672	2050	M	7	1	1.41	3773	-26.96	11.86	2
		602	1800	M	5	32	0.81	3774	-25.50	11.60	3
		693	2250	M	7	1	1.34	3775	-27.34	12.13	4
		635	1850	M	6	32	0.99	-	-	-	5
		712	2200	M	10	1	1.97	-	-	-	6
White sucker		354	650	-	7	-	0.05	3788	-27.69	8.98	7
		342	600	M	14	-	0.09	3789	-29.80	10.13	8
		403	900	-	14	-	0.06	3790	-30.87	9.58	9
		300	350	-	6	-	0.03	3791	-31.39	9.28	10
		208	125	-	4	-	0.05	-	-	-	11
		166	75	-	3	-	0.06	-	-	-	12
		223	160	-	4	-	0.01	-	-	-	13
		299	300	-	6	-	0.07	-	-	-	14
		305	350	-	6	-	0.02	-	-	-	15
		184	75	-	4	-	0.06	-	-	-	16
		172	75	-	4	-	0.07	-	-	-	17
		166	60	-	3	-	0.07	-	-	-	18
Cisco		165	50	-	3	-	-	3816	-34.21	11.23	19
		160	50	-	3	-	-	3817	-33.93	10.87	20

Appendix 1.2. Raw data from the 1987 NOLSS fish survey of Orange Lake (Note: There is no fish no. 377).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no	
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)		
Walleye	Jun 2	509	1550	F	14	20	-	-	-	-	427	
		488	1150	M	10	1	-	-	-	-	428	
		543	1825	M	11	1	-	-	-	-	429	
		509	1225	M	17	1	-	-	-	-	430	
		475	1175	M	22	1	-	-	-	-	431	
		545	1700	M	24	110	-	-	-	-	432	
		555	2000	M	22	210	-	-	-	-	433	
		488	1200	M	11	1	-	-	-	-	434	
		573	2200	F	19	20	-	-	-	-	435	
		467	1175	F	15	1	-	-	-	-	436	
		563	2125	F	19	1	-	-	-	-	437	
		533	1600	F	18	1	-	-	-	-	438	
		468	1050	M	-	111	-	-	-	-	439	
		517	1325	M	-	111	-	-	-	-	440	
		520	1500	M	-	1	-	-	-	-	441	
		497	1300	F	-	80	-	-	-	-	442	
		500	1225	M	-	1	-	-	-	-	443	
		473	1050	M	-	1	-	-	-	-	444	
		440	1050	M	-	20	-	-	-	-	445	
		446	850	M	-	1	-	-	-	-	446	
		460	950	F	-	1	-	-	-	-	447	
		506	1400	F	-	1	-	-	-	-	448	
		436	900	M	-	1	-	-	-	-	449	
		492	1300	M	-	1	-	-	-	-	450	
		451	975	M	-	1	-	-	-	-	451	
		Oct 13	471	1225	M	10	1	0.81	3837	-27.54	9.56	359
			442	1075	F	13	1	1.16	3838	-26.96	9.78	360
			483	1200	F	11	1	1.15	3839	-28.23	9.98	361
			478	1200	F	9	1	0.80	3840	-28.54	9.98	362
			463	1000	F	18	151	1.45	-	-	-	363
			444	975	M	14	1	1.32	-	-	-	364
			462	1200	M	16	1	1.06	-	-	-	365
			448	975	F	9	1	0.87	-	-	-	366
			459	1100	M	13	151	1.06	-	-	-	367
			460	1150	M	12	32	0.70	-	-	-	368
			427	775	M	20	1	1.46	-	-	-	369
			334	375	M	5	151	0.51	-	-	-	370
			350	500	M	7	61	0.42	-	-	-	371
			419	800	M	13	1	1.04	-	-	-	372
	475		1100	M	12	1	0.62	-	-	-	373	
	440		825	M	11	1	1.46	-	-	-	374	
	423		825	M	21	1	1.04	-	-	-	375	
	481		1400	F	-	20	1.54	-	-	-	376	
	419		875	M	12	1	1.29	-	-	-	378	
	191		74	M	2	1	-	-	-	-	379	
	187		58	M	2	1	-	-	-	-	380	
429	850		M	11	1	1.14	-	-	-	381		
313	325		M	4	151	0.86	-	-	-	382		
453	1050		F	8	1	0.69	-	-	-	383		
513	1475		F	13	1	0.96	-	-	-	384		
461	1050		M	14	1	1.43	-	-	-	385		
478	1250		M	16	20	-	-	-	-	386		
558	2500	F	12	20	-	-	-	-	393			
555	2100	F	17	32	-	-	-	-	394			
446	1050	F	16	1	-	-	-	-	395			



## Appendix 1.2 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no	
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)		
Cisco	Jun 2	178	62	-	-	-	-	-	-	-	480	
		172	52	-	-	-	-	-	-	-	481	
		213	107	-	-	-	-	-	-	-	482	
		191	70	-	-	-	-	-	-	-	483	
		182	72	-	-	-	-	-	-	-	484	
		200	94	-	-	-	-	-	-	-	485	
		200	91	-	-	-	-	-	-	-	486	
		172	63	-	-	-	-	-	-	-	487	
		155	40	-	-	-	-	-	-	-	488	
		168	49	-	-	-	-	-	-	-	489	
		177	60	-	-	-	-	-	-	-	490	
		169	53	-	-	-	-	-	-	-	491	
		166	54	-	-	-	-	-	-	-	492	
		161	42	-	-	-	-	-	-	-	493	
		165	48	-	-	-	-	-	-	-	494	
		170	51	-	-	-	-	-	-	-	495	
		Cisco	Oct 13	192	80	M	3	-	0.30	3808	-30.28	6.99
218	100			M	5	-	0.17	3809	-29.85	7.96	389	
212	110			F	5	-	0.26	3810	-29.63	7.54	390	
Northern pike	Jun 2	623	1725	M	7	110	1.07	-	-	-	422	
		641	1950	M	9	1	1.12	-	-	-	423	
		632	1850	F	8	1	1.07	-	-	-	424	
		562	1325	M	6	1	1.05	-	-	-	425	
		660	2200	M	9	20	1.15	-	-	-	426	
	Northern pike	Oct 13	566	1425	M	7	1	0.88	3776	-27.20	9.73	355
			614	1525	F	8	1	1.40	3777	-27.63	9.59	356
			599	1450	F	8	1	1.15	3778	-26.56	9.85	357
			473	725	M	5	1	0.54	3779	-25.86	9.42	358
			550	1250	F	6	20	0.74	-	-	-	387
			749	2950	F	13	1	1.59	-	-	-	391
684	2225	F	10	1	1.18	-	-	-	392			
Yellow perch	Jun 2	145	37	-	-	-	-	-	-	496		

Appendix 1.3. Raw data from the 1987 NOLSS fish survey of Linge Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Jun 2	401	700	M	12	1	0.78	3841	-24.27	11.57	534
		459	1050	M	11	32	0.75	3842	-28.07	11.11	535
		487	1325	M	14	20	0.97	3843	-28.03	10.93	536
		505	1275	F	15	1	1.06	3844	-26.80	11.13	537
		404	650	F	8	1	0.60	-	-	-	538
		373	500	M	9	1	0.63	-	-	-	539
		235	150	M	5	1	0.38	-	-	-	540
		352	450	M	9	1	0.62	-	-	-	541
		246	150	M	6	80	0.43	-	-	-	542
		321	325	M	8	1	0.54	-	-	-	543
		256	175	M	5	1	0.36	-	-	-	544
		410	600	M	11	1	1.08	-	-	-	545
		426	875	F	13	1	0.86	-	-	-	546
		440	850	F	16	1	1.30	-	-	-	547
		381	550	F	10	1	0.84	-	-	-	548
		212	100	M	5	1	-	-	-	-	549
		277	250	-	5	1	-	-	-	-	550
		396	600	M	11	1	0.66	-	-	-	551
		414	625	M	9	1	0.97	-	-	-	552
		256	200	M	6	1	0.36	-	-	-	553
		366	500	M	7	1	0.50	-	-	-	554
		428	800	M	12	1	0.81	-	-	-	555
		533	1700	F	18	20	1.20	-	-	-	556
		393	700	M	13	1	0.83	-	-	-	557
		387	600	M	-	1	0.82	-	-	-	558
		416	725	M	14	20	1.07	-	-	-	559
		376	550	M	11	1	0.55	-	-	-	560
		White sucker	Jun 2	452	1450	M	17	-	0.25	3792	-27.34
367	700			-	13	-	0.13	3793	-27.48	7.86	498
349	675			F	8	-	0.05	3794	-26.54	8.14	499
313	450			-	5	-	0.05	3795.1	-25.95	8.56	500
404	1000			M	12	-	0.18	-	-	-	501
390	825			M	8	-	0.12	-	-	-	502
227	200			-	4	-	0.04	-	-	-	503
418	1100			-	13	-	0.15	-	-	-	504
428	1325			-	12	-	0.10	-	-	-	505
454	1400			M	11	-	0.14	-	-	-	506
395	1075			-	12	-	0.12	-	-	-	507
Cisco	Jun 2			160	53	F	4	-	0.12	3812	-29.45
		153	54	F	3	-	0.09	3813	-29.20	8.35	562
		150	35	F	3	-	0.08	3814	-29.64	8.22	563
		188	68	M	5	-	0.11	3815	-29.84	8.22	564
		152	40	M	2	-	0.08	-	-	-	565
		165	52	F	3	-	0.12	-	-	-	566
		168	54	-	3	-	0.18	-	-	-	567
		152	42	F	3	-	0.07	-	-	-	568
		148	38	F	-	-	0.08	-	-	-	569
		153	44	M	3	-	0.08	-	-	-	570
		148	38	F	2	-	0.12	-	-	-	571
		147	39	M	3	-	0.07	-	-	-	572
Northern pike	Jun 2	488	800	M	4	1	0.54	3780	-24.79	10.10	531
		599	1325	M	5	181	1.30	3781	-25.92	10.92	532
Lake whitefish	Jun 2	431	1200	M	16	1	0.27	3828	-24.44	10.43	508
		349	600	M	10	121	0.14	3829	-28.78	9.31	509
		410	825	F	12	1	0.32	3830	-24.48	9.14	510
		351	550	F	9	1	0.11	3831	-29.65	9.19	511
		268	275	-	6	-	0.09	-	-	-	512
		340	500	M	7	121	0.16	-	-	-	513

## Appendix 1.3 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Lake whitefish	Jun 2	245	200	-	4	-	0.12	-	-	-	514
		233	175	-	4	-	0.10	-	-	-	515
		310	350	F	6	170	0.10	-	-	-	516
		297	350	F	6	170	0.10	-	-	-	517
		320	400	F	8	1	0.12	-	-	-	518
		240	200	-	4	-	0.13	-	-	-	519
		179	75	-	3	-	0.12	-	-	-	520
		384	850	F	10	1	0.18	-	-	-	521
		349	575	M	9	170	0.08	-	-	-	522
		401	900	M	12	5	0.19	-	-	-	523
		383	800	M	10	5,170	0.09	-	-	-	524
		391	850	M	12	5,170	0.10	-	-	-	525
		386	800	M	9	5,170	0.10	-	-	-	526
		415	1050	M	11	5,170	0.30	-	-	-	527
		361	675	M	9	1	0.10	-	-	-	528
403	800	F	12	1	0.22	-	-	-	529		
401	875	F	-	5,170	0.08	-	-	-	530		
Lake trout	Jun 2	547	2050	M	-	20	0.58	3832.1	-27.39	11.30	533

Appendix 1.4. Raw data from the 1987 NOLSS fish survey of Musclove Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Jun 4	443	1000	M	8	1	0.44	3833.1	-26.11	10.86	27
		429	825	M	10	1	0.54	3834	-27.14	11.00	28
		392	600	M	8	1	0.39	3835.1	-25.79	10.81	29
		338	470	M	5	1	0.28	3836	-26.59	10.49	30
		378	625	M	7	1	0.40	-	-	-	31
		327	425	M	5	1	0.25	-	-	-	32
		83	16	-	1	-	0.09	-	-	-	33
		348	475	M	6	110	0.24	-	-	-	34
		235	125	-	3	-	0.18	-	-	-	35
		346	475	-	6	-	0.26	-	-	-	36
		267	225	M	4	-	0.23	-	-	-	37
		249	175	M	4	-	0.16	-	-	-	38
		253	175	M	4	-	0.19	-	-	-	39
		244	170	-	4	-	0.16	-	-	-	40
		275	225	-	5	-	0.27	-	-	-	41
		173	60	-	2	-	-	-	-	-	42
		175	50	-	2	-	-	-	-	-	43
		382	525	M	7	1	0.28	-	-	-	44
		454	1050	M	14	1	0.65	-	-	-	45
		456	1025	F	13	20	0.57	-	-	-	46
		353	550	M	11	32	0.43	-	-	-	47
		370	550	M	5	1	0.25	-	-	-	48
		393	700	F	9	110	0.40	-	-	-	49
		321	340	-	6	1	0.22	-	-	-	50
		304	290	-	7	1	0.30	-	-	-	51
		302	310	-	5	1	0.19	-	-	-	52
269	210	F	7	1	0.25	-	-	-	53		
261	210	M	5	1	-	-	-	-	54		
260	200	M	6	1	-	-	-	-	55		
White sucker	Jun 4	228	160	-	4	-	-	3796	-27.49	8.86	56
		368	725	-	7	-	-	3797	-24.65	7.89	57
		408	1075	-	10	-	-	3798	-25.21	7.87	58
		402	975	-	9	-	-	3799	-22.89	7.61	59
		344	625	-	8	-	-	-	-	-	60
		318	475	-	6	-	-	-	-	-	61
		278	300	-	5	-	-	-	-	-	62
Cisco	Jun 4	268	310	-	6	-	-	-	-	-	66
		280	350	-	6	-	-	3818	-31.99	9.65	67
		290	400	-	8	-	-	-	-	-	68
		270	310	-	6	-	-	3819	-31.99	8.79	69
		245	190	-	6	-	-	3820	-31.48	9.43	70
		171	45	-	3	-	-	-	-	-	71
		100	9	-	2	-	-	3821	-30.79	7.87	72
Northern pike	Jun 4	444	575	M	4	1	0.25	3783.1	-25.43	9.92	21
		546	1125	M	5	1	0.31	3784	-26.02	10.36	22
		608	2050	M	10	32	0.82	3785	-26.71	10.50	23
		465	675	M	3	-	0.36	3786	-25.89	10.00	24
		525	1300	M	7	1	0.55	-	-	-	25
		552	1250	M	6	1	0.42	-	-	-	26
Lake whitefish	Jun 4	210	125	-	3	-	0.01	3822	-29.87	9.82	64
		495	2350	F	12	1	0.07	3823	-33.04	8.72	65
Shorthead redhorse	Jun 4	414	1310	F	12	1	-	-	-	-	63

Appendix 1.5. Raw data from the 1987 NOLSS fish survey of Sydney Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Jun 2	226	119	-	4	-	0.15	3845	-25.77	9.41	170
		281	250	M	6	-	0.16	3846	-25.25	9.29	171
		237	146	-	3	-	0.08	3847	-25.73	9.66	172
		229	127	M	3	-	0.12	3848	-25.15	8.87	173
	Oct 13	445	1100	M	8	20	0.34	-	-	-	181
		318	325	M	6	50	0.20	-	-	-	182
		404	800	M	9	1	0.56	-	-	-	183
		399	725	M	8	51,61	0.34	-	-	-	184
		364	550	M	9	1	0.28	-	-	-	185
		355	475	M	7	1	0.28	-	-	-	186
		353	525	M	9	52,61	0.26	-	-	-	187
		318	350	M	6	20	0.26	-	-	-	188
		362	575	M	7	20	0.26	-	-	-	189
		469	1325	M	16	20	0.55	-	-	-	244
		370	625	M	8	20	0.25	-	-	-	245
		508	1500	F	11	20	0.37	-	-	-	246
		284	275	M	4	41	0.11	-	-	-	350
White sucker	Jun 2	316	550	M	7	-	0.06	3800	-25.45	7.18	166
		195	111	M	3	-	0.24	3801	-33.00	6.73	167
		192	101	-	4	-	0.05	3802	-28.50	7.63	168
		151	40	-	3	-	-	3803	-24.26	6.00	169
	Oct 13	452	1350	F	14	-	0.15	-	-	-	205
		364	675	-	7	-	0.05	-	-	-	206
		216	114	-	4	-	-	-	-	-	207
		219	125	-	4	-	-	-	-	-	208
		221	114	-	4	-	-	-	-	-	209
		227	147	-	5	-	-	-	-	-	210
		165	53	-	2	-	-	-	-	-	211
		179	68	-	2	-	-	-	-	-	212
		353	575	-	6	-	0.04	-	-	-	247
		272	275	-	5	-	0.04	-	-	-	248
		368	750	M	6	160	0.05	-	-	-	249
		470	1550	F	14	1	0.28	-	-	-	250
		312	400	-	6	-	0.08	-	-	-	251
		194	89	-	4	-	0.03	-	-	-	336b
		221	139	-	4	-	0.05	-	-	-	337
		211	117	-	4	-	0.02	-	-	-	338
		222	128	-	4	-	0.05	-	-	-	339
		212	125	-	4	-	0.02	-	-	-	340
		206	119	-	4	-	0.02	-	-	-	341
		222	130	-	4	-	0.03	-	-	-	342
		217	124	-	4	-	0.04	-	-	-	343
		249	192	-	4	-	0.03	-	-	-	344
220	130	-	4	-	0.05	-	-	-	345		
178	62	-	3	-	0.03	-	-	-	346		
203	109	-	4	-	0.07	-	-	-	347		
216	129	-	-	-	-	-	-	-	348		
169	60	-	-	-	-	-	-	-	349		
Cisco	Jun 2	377	850	F	-	-	-	-	-	-	161
		366	750	M	-	-	-	3804	-30.30	7.68	162
		251	225	M	-	-	-	3805	-30.70	8.09	163
		210	88	-	-	-	-	3806	-31.58	8.54	164
		157	38	-	-	-	-	3807	-28.76	7.73	165
	Oct 13	165	46	-	3	-	0.14	-	-	-	213
		162	44	-	3	-	0.11	-	-	-	214
		165	48	-	3	-	0.16	-	-	-	215
		169	49	-	3	-	0.13	-	-	-	216
		165	43	-	3	-	0.12	-	-	-	217

## Appendix 1.5 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Cisco	Oct 13	162	45	-	3	-	0.11	-	-	-	218
		205	83	-	4	-	-	-	-	-	252
		211	127	-	4	-	-	-	-	-	253
		198	107	-	4	-	-	-	-	-	254
		161	48	-	3	-	-	-	-	-	255
		180	61	-	3	-	-	-	-	-	256
		168	47	-	3	-	-	-	-	-	257
		146	34	-	3	-	-	-	-	-	258
		156	42	-	3	-	-	-	-	-	259
		162	45	-	-	-	-	-	-	-	260
		175	65	-	3	-	-	-	-	-	261
		176	58	-	-	-	-	-	-	-	262
		159	54	-	-	-	-	-	-	-	263
		167	51	-	-	-	-	-	-	-	264
		161	43	-	-	-	-	-	-	-	265
		161	46	-	-	-	-	-	-	-	266
		166	48	-	-	-	-	-	-	-	267
		161	46	-	-	-	-	-	-	-	268
		157	45	-	-	-	-	-	-	-	269
		166	50	-	-	-	-	-	-	-	270
		162	46	-	-	-	-	-	-	-	271
		169	57	-	-	-	-	-	-	-	272
		162	52	-	-	-	-	-	-	-	273
		157	48	F	-	-	-	-	-	-	274
		151	41	M	-	-	-	-	-	-	275
		161	50	F	-	-	-	-	-	-	276
		161	50	F	-	-	-	-	-	-	277
		158	43	F	-	-	-	-	-	-	278
		162	47	M	-	-	-	-	-	-	279
		152	40	M	-	-	-	-	-	-	280
		159	41	F	-	-	-	-	-	-	281
		185	78	F	-	-	-	-	-	-	282
		168	53	F	-	-	-	-	-	-	283
		162	42	F	-	-	-	-	-	-	284
		163	43	M	-	-	0.09	-	-	-	285
		161	41	F	-	-	0.18	-	-	-	286
		162	49	F	-	-	0.11	-	-	-	287
		171	58	M	-	-	0.11	-	-	-	288
		162	49	M	-	-	0.12	-	-	-	289
		169	54	F	-	-	0.15	-	-	-	290
		151	41	F	-	-	0.10	-	-	-	291
		168	46	F	-	-	0.09	-	-	-	292
		162	45	F	-	-	0.11	-	-	-	293
		178	59	M	-	-	0.11	-	-	-	294
		154	42	M	-	-	0.13	-	-	-	295
		151	37	M	-	-	0.14	-	-	-	296
		166	53	M	-	-	-	-	-	-	297
		168	46	F	-	-	-	-	-	-	298
		179	60	F	-	-	-	-	-	-	299
		161	45	M	-	-	-	-	-	-	300
		179	49	F	-	-	-	-	-	-	301
		166	48	F	-	-	-	-	-	-	302
		155	39	M	-	-	-	-	-	-	303
		165	44	M	-	-	-	-	-	-	304
		155	41	F	-	-	-	-	-	-	305
		169	50	F	-	-	-	-	-	-	306
		149	41	F	-	-	-	-	-	-	307
		172	59	M	-	-	-	-	-	-	308

Appendix 1.5 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Cisco	Oct 13	159	43	M	-	-	-	-	-	-	309
		178	58	-	-	-	-	-	-	-	310
		162	51	M	-	-	-	-	-	-	311
		171	58	F	-	-	-	-	-	-	312
		161	46	M	-	-	-	-	-	-	313
		172	52	M	-	-	-	-	-	-	314
		168	54	M	-	-	-	-	-	-	315
		161	43	M	-	-	-	-	-	-	316
		161	50	F	-	-	-	-	-	-	317
		162	48	M	-	-	-	-	-	-	318
		161	43	F	-	-	-	-	-	-	319
		151	34	M	-	-	-	-	-	-	320
		162	42	F	-	-	-	-	-	-	321
		163	44	F	-	-	-	-	-	-	322
		160	48	F	-	-	-	-	-	-	323
		175	62	F	-	-	-	-	-	-	324
		153	40	M	-	-	-	-	-	-	325
		164	50	M	-	-	-	-	-	-	326
		162	45	F	-	-	-	-	-	-	327
		153	39	F	-	-	-	-	-	-	328
		164	48	F	-	-	-	-	-	-	329
		156	42	M	-	-	-	-	-	-	330
		161	58	F	-	-	-	-	-	-	331
163	50	M	-	-	-	-	-	-	332		
154	38	F	-	-	-	-	-	-	333		
157	44	M	-	-	-	-	-	-	334		
154	43	F	-	-	-	-	-	-	335		
147	37	M	-	-	-	-	-	-	336a		
Northern pike	Oct 13	569	1400	M	8	1	0.34	3782	-23.89	8.83	243
Lake whitefish	Jun 2	443	1125	F	14	121	0.23	3824.1	-27.33	7.89	136
		431	1050	F	16	1	0.18	3825	-27.83	8.07	137
		432	1175	M	18	170	0.11	3826	-28.04	8.22	138
		62	50	-	3	-	-	-	-	-	139
		78	56	-	-	-	-	-	-	-	140
		200	78	-	4	-	-	-	-	-	141
		421	975	F	13	121	0.16	3827	-27.12	8.00	142
		456	1225	M	14	121	0.06	-	-	-	143
		474	1500	M	19	-	0.12	-	-	-	144
		456	1250	F	13	121	0.13	-	-	-	145
		410	875	F	13	121	0.16	-	-	-	146
		72	53	-	-	-	-	-	-	-	147
		75	51	-	-	-	-	-	-	-	148
		228	125	M	7	-	0.11	-	-	-	149
		481	1375	F	15	-	0.15	-	-	-	150
		475	1575	M	14	-	0.11	-	-	-	151
		479	1525	M	15	-	0.13	-	-	-	152
446	1200	M	16	-	0.13	-	-	-	153		
484	1625	M	18	-	0.10	-	-	-	154		
462	1400	M	12	-	0.20	-	-	-	155		
Lake whitefish	Jun 2	409	1025	M	15	-	0.19	-	-	-	156
		485	1650	M	14	-	0.31	-	-	-	157
		441	1175	M	15	-	0.11	-	-	-	158
		486	1400	M	19	-	0.16	-	-	-	159
		481	1350	F	-	-	0.15	-	-	-	160
	Oct 13	449	1400	M	14	160,90	0.09	-	-	-	190
		436	1275	F	15	160,4	0.06	-	-	-	191
		423	950	F	16	160,90	0.16	-	-	-	192
		472	1675	M	16	160,4	0.10	-	-	-	193

## Appendix 1.5 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Lake whitefish	Oct 13	482	1575	F	-	1	0.17	-	-	-	194
		436	1050	M	14	90	0.15	-	-	-	195
		432	1050	F	17	90	0.21	-	-	-	196
		456	1250	M	15	1	0.12	-	-	-	197
		378	650	M	12	1	-	-	-	-	229
		301	325	F	8	1	-	-	-	-	230
		448	1075	M	14	1	-	-	-	-	231
		446	1225	F	13	160	0.20	-	-	-	232
		465	1400	F	15	90,4	-	-	-	-	233
		437	1100	F	13	90,4	0.14	-	-	-	234
		392	800	M	11	1	-	-	-	-	235
		463	1650	F	14	1	0.15	-	-	-	236
		192	75	M	3	-	-	-	-	-	351
		234	150	F	4	1	-	-	-	-	352
		280	225	F	4	1	-	-	-	-	353
Burbot	Jun 2	538	1075	M	14	-	0.80	3853	-27.28	9.90	178
		348	400	M	6	-	0.22	3854	-27.46	10.27	179
		444	675	M	10	-	0.34	3855	-27.53	10.32	180
	Oct 13	456	600	F	9	181	0.29	3856	-24.63	9.36	241
		550	1250	F	13	181	0.40	-	-	-	242
Lake trout	Jun 2	681	3850	M	22	-	0.63	3849	-27.53	11.15	174
		588	2150	M	17	-	0.49	3850	-26.85	10.01	175
		533	1550	M	15	-	0.36	3851	-26.96	9.97	176
		533	2075	F	17	-	0.30	3852	-27.10	10.26	177
		Oct 13	430	775	F	9	20	0.26	-	-	-
	421		950	M	8	1	0.23	-	-	-	199
	563		825	F	11	32	0.56	-	-	-	200
	621		2675	F	16	30	1.28	-	-	-	201
	472		1125	F	11	32	0.29	-	-	-	202
	599		2525	F	16	32	0.37	-	-	-	203
	658		3850	F	-	1	0.21	-	-	-	204
	474		1250	F	12	20	0.28	-	-	-	237
	377		625	M	8	51	0.22	-	-	-	238
	472		1200	F	10	1	0.23	-	-	-	239
	571	2150	F	19	61,41	0.66	-	-	-	240	
Yellow perch	Oct 13	154	48	M	-	-	-	3857	-24.95	8.00	219
		140	35	M	-	-	-	3858	-25.45	7.91	220
		185	83	F	-	-	-	3859	-25.68	8.76	221
		140	39	M	-	-	-	3860	-20.78	6.65	222
		185	82	-	-	-	-	-	-	-	223
		170	66	M	-	-	-	-	-	-	224
		152	39	M	-	-	-	-	-	-	225
		195	102	F	-	-	-	-	-	-	226
		151	45	M	-	-	-	-	-	-	227
		155	51	M	-	-	-	-	-	-	228

Appendix 1.6. Raw data from the 1987 NOLSS fish survey of Trout Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Jun 2	518	1500	F	18	1	0.53	3758.1	-25.34	9.63	109
		532	1500	M	15	1	0.83	3759	-24.12	10.25	110
White sucker	Jun 2	222	150	-	5	-	0.05	-	-	-	116
		158	50	-	4	-	0.04	-	-	-	117
		272	290	-	6	-	0.03	-	-	-	118
		272	320	-	5	-	0.03	3760	-25.25	7.12	119
		463	1500	F	14	-	0.20	3761	-21.60	6.74	120
		467	1650	F	14	-	0.26	3762	-23.13	6.21	121
		392	950	M	11	-	0.06	3763	-21.70	6.79	122
		442	1250	-	15	-	0.20	3764	-25.18	7.99	123
		441	1325	M	15	-	0.08	3765	-23.23	6.99	124
		424	1175	F	15	-	0.14	-	-	-	125
		381	950	F	7	-	0.10	-	-	-	126
		412	975	M	12	-	0.09	-	-	-	127
		422	1075	M	13	-	0.12	-	-	-	128
		351	650	M	7	-	0.05	-	-	-	129
		399	875	M	8	-	0.08	-	-	-	130
401	1060	M	12	-	0.10	-	-	-	131		
405	1025	M	13	-	0.16	-	-	-	132		
Cisco	Jun 2	162	42	-	-	-	-	3769	-28.11	7.09	82
		160	39	-	-	-	-	3770	-28.04	6.84	83
		164	46	-	-	-	-	3771	-27.72	6.32	84
Northern pike	Jun 2	556	1200	M	6	1	0.22	3755	-24.56	7.72	106
		621	1900	M	7	1	0.26	3756	-26.21	9.91	107
		619	1900	M	9	1	0.43	3757	-23.16	10.09	108
Lake whitefish	Jun 2	234	150	-	6	-	0.08	-	-	-	85
		242	175	M	6	-	0.06	-	-	-	86
		245	175	-	7	-	0.05	-	-	-	87
		184	100	-	4	-	0.04	-	-	-	88
		165	60	-	-	-	0.07	-	-	-	89
		455	1350	M	18	-	0.02	3749	-27.32	7.11	90
		457	1225	F	15	1	0.13	3750	-28.87	7.16	91
		434	950	F	12	121	0.19	3751	-28.87	7.27	92
		467	1400	M	17	3	0.14	3752	-22.51	7.13	93
		435	1175	M	14	121	0.11	3753	-29.36	8.61	94
		452	1125	F	12	121,140	0.19	3754	-27.50	8.43	95
		465	1200	F	-	121	0.18	-	-	-	96
		391	800	F	11	160	0.08	-	-	-	97
		432	1000	F	12	170	0.13	-	-	-	98
		403	800	F	14	170	0.11	-	-	-	99
		443	1250	M	14	170,160,121	0.13	-	-	-	100
		417	1000	M	12	-	0.09	-	-	-	101
406	825	M	14	170,3	0.05	-	-	-	102		
426	975	M	15	121,170	0.14	-	-	-	103		
403	775	F	13	170	0.08	-	-	-	104		
447	1100	M	15	170,3	0.08	-	-	-	105		
Burbot	Jun 2	582	1250	M	15	-	-	3743	-25.90	10.00	75
		518	575	M	10	-	-	3744	-25.85	10.14	76
		449	625	M	9	-	-	3745	-24.84	9.31	77
		620	1275	F	12	-	-	3746	-24.97	9.73	78
		583	1275	F	13	-	-	3747	-25.39	9.90	79
		580	1150	F	14	-	-	3748	-25.58	10.04	80
		708	2475	F	18	-	-	-	-	-	81
Lake trout	Jun 2	516	1700	F	8	-	0.31	3741	-26.53	10.41	73
		552	2100	M	-	-	0.39	3742	-26.64	10.07	74
Longnose sucker	Jun 2	485	1800	M	16	-	0.08	3766	-27.84	7.20	133
		371	875	M	10	-	0.04	3767	-31.00	7.75	134
		396	825	-	13	-	0.04	3768	-27.29	7.78	135



Appendix 2.1. Raw data from the 1988 NOLSS fish survey of Green Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no	
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)		
White sucker	Aug 23	335	550	M	9	-	0.06	4204	-28.77	10.34	313	
		287	350	-	7	-	0.04	4205	-26.37	8.77	314	
		364	670	M	8	-	0.05	4206.1	-28.56	8.78	315	
		424	950	F	15	-	0.14	4207	-29.77	10.41	316	
		351	610	M	9	1	0.09	-	-	-	317	
Northern pike	Aug 23	693	2440	F	11	20	0.89	-	-	-	309	
		669	2120	F	10	20	1.04	-	-	-	310	
		618	1790	M	9	1	0.76	-	-	-	311	
		216	95	F	2	61	0.09	-	-	-	312	
		425	460	F	3	1	0.25	-	-	-	326	
Yellow perch	Aug 22	93	8	-	-	-	-	-	-	-	742	
		89	7	-	-	-	-	-	-	-	743	
		84	6	-	-	-	-	-	-	-	744	
		87	7	-	-	-	-	-	-	-	745	
		87	7	-	-	-	-	-	-	-	746	
		89	7	-	-	-	-	-	-	-	747	
		71	5	-	-	-	-	-	-	-	748	
		85	6	-	-	-	-	0.11	-	-	-	749
		79	6	-	-	-	-	0.11	-	-	-	750
		80	5	-	-	-	-	0.10	-	-	-	751
		86	6	-	-	-	-	0.13	-	-	-	752
		92	8	-	-	-	-	0.10	-	-	-	753
		85	6	-	-	-	-	0.13	-	-	-	754
		83	7	-	-	-	-	-	-	-	-	755
		84	6	-	-	-	-	-	-	-	-	756
		85	7	-	-	-	-	-	-	-	-	757
		87	7	-	-	-	-	-	-	-	-	758
		87	7	-	-	-	-	-	-	-	-	759
		Aug 23	204	100	F	5	-	0.33	-	-	-	-
175	90		F	5	-	0.10	-	-	-	-	319	
155	60		F	4	-	0.20	-	-	-	-	320	
182	75		F	5	-	0.18	-	-	-	-	321	
164	50		F	5	-	0.14	-	-	-	-	322	
161	55		F	4	-	0.14	-	-	-	-	323	
163	55		F	-	-	0.10	-	-	-	-	324	
152	45	F	4	-	0.10	-	-	-	-	325		

Appendix 2.2. Raw data from the 1988 NOLSS fish survey of Orange Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 24	507	1440	M	19	70	2.06	4208	-27.39	10.30	332
		215	105	F	4	1	0.73	-	-	-	333
		193	90	F	3	20	0.42	-	-	-	334
		230	130	I	-	1	0.47	-	-	-	335
		256	195	F	6	1	0.50	-	-	-	336
		266	190	I	-	1	0.60	-	-	-	337
		388	560	F	8	121,110	0.58	-	-	-	338
		477	1185	F	12	1	1.47	4209	-27.34	9.63	339
		465	965	M	14	1	1.66	-	-	-	340
		441	860	F	12	100	1.64	-	-	-	341
		452	950	M	17	20	1.52	4210	-27.31	8.69	342
		399	700	F	6	1	0.66	-	-	-	343
		413	700	M	9	20,110	0.91	-	-	-	344
		435	995	M	17	110	1.70	-	-	-	345
		464	960	M	16	1	1.54	-	-	-	346
		408	650	F	9	1	0.75	-	-	-	347
		319	310	F	7	181	0.71	-	-	-	348
		453	1040	F	7	20	0.76	4211	-26.82	9.00	349
		335	360	F	7	1	0.62	-	-	-	350
		334	345	F	8	1	0.59	-	-	-	351
		320	310	F	7	61	0.79	-	-	-	352
		322	340	F	7	20	0.50	-	-	-	353
		385	555	M	5	1	0.81	-	-	-	354
		405	640	F	5	32	0.74	-	-	-	355
		318	300	F	9	1	0.59	-	-	-	356
		448	940	M	15	100	-	-	-	-	357
		425	745	F	14	1	-	-	-	-	358
		422	710	M	10	1	-	-	-	-	359
		438	805	M	11	1	-	-	-	-	360
		386	550	F	9	181	-	-	-	-	361
		445	885	M	17	1	-	-	-	-	362
		302	280	F	7	181	-	-	-	-	363
		323	335	F	5	1	-	-	-	-	364
		475	1060	F	12	1	-	-	-	-	365
		465	1100	M	13	1	-	-	-	-	366
		313	260	F	6	1	-	-	-	-	367
		466	1010	F	9	1	-	-	-	-	368
		519	1360	F	12	1	-	-	-	-	369
		363	500	F	6	61	-	-	-	-	370
		373	505	F	7	1	-	-	-	-	371
		243	155	F	4	1	-	-	-	-	372
		394	-	-	9	-	-	-	-	-	373
		395	655	F	17	61	-	-	-	-	374
		453	980	M	-	1	-	-	-	-	375
		337	350	F	8	6	-	-	-	-	376
		386	600	M	7	1	-	-	-	-	377
		360	450	F	5	181	-	-	-	-	378
315	340	F	7	61	-	-	-	-	379		
330	360	F	-	1	-	-	-	-	380		
	Aug 25	522	1410	F	20	1	-	-	-	393	
		536	1440	F	20	20	-	-	-	394	
		535	1680	F	18	1	-	-	-	395	
		461	960	M	20	1	-	-	-	396	
		482	1060	F	12	1	-	-	-	397	
		427	760	M	12	61,110	-	-	-	398	
		241	150	F	3	1	-	-	-	399	

## Appendix 2.2 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no	
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)		
White sucker	Aug 24	442	1190	F	9	-	0.12	4212.1	-21.70	5.86	389	
Cisco	Aug 24	352	690	F	12	-	0.42	-	-	-	327	
		350	500	M	9	-	0.21	4213	-29.64	7.70	328	
		304	345	F	8	-	0.33	4214	-29.96	8.32	329	
		254	190	F	6	-	0.24	-	-	-	330	
		258	245	F	7	-	0.26	-	-	-	381	
		189	55	M	4	-	0.23	-	-	-	382	
		161	35	F	3	-	0.08	-	-	-	383	
		152	55	-	3	-	0.11	4215	-30.70	6.88	384	
		172	90	F	4	-	0.17	4216	-30.20	6.87	385	
		240	195	F	5	-	0.20	-	-	-	386	
		276	215	F	7	-	0.32	-	-	-	387	
		317	380	F	9	-	0.31	-	-	-	388	
		Northern pike	Aug 24	450	605	F	5	1	0.49	-	-	-
543	910			M	8	61,110	0.70	-	-	-	390	
527	990			F	8	61,181,110	0.76	-	-	-	391	
328	210			F	2	110	0.37	-	-	-	392	
Yellow perch	Aug 17	81	6	-	-	-	0.10	4420	-26.64	7.08	797	
		83	6	-	-	-	0.18	4422	-26.59	7.26	799	
		90	9	-	-	-	0.06	4423	-24.79	6.71	800	
	Aug 24	83	6	-	-	-	-	-	-	-	728	
		81	6	-	-	-	-	-	-	-	729	
		93	8	-	-	-	-	-	-	-	730	
		83	6	-	-	-	-	-	-	-	731	
		90	9	-	-	-	-	-	-	-	732	
		92	8	-	-	-	-	-	-	-	733	
		88	7	-	-	-	-	0.14	-	-	-	734
		79	5	-	-	-	-	0.12	-	-	-	735
		76	5	-	-	-	-	0.17	-	-	-	736
		86	6	-	-	-	-	0.16	-	-	-	737
		88	7	-	-	-	-	0.17	-	-	-	738
		85	6	-	-	-	-	0.15	-	-	-	739
83	6	-	-	-	-	0.14	-	-	-	740		
85	6	-	-	-	-	0.11	-	-	-	741		

Appendix 2.3 Raw data from the 1988 NOLSS fish survey of Linge Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 21	312	290	F	6	-	0.37	-	-	-	241
		193	45	F	2	-	0.16	-	-	-	242
		293	235	F	5	-	0.43	-	-	-	243
		286	200	M	4	-	0.43	-	-	-	244
		350	365	F	7	-	0.38	-	-	-	245
		343	440	F	6	-	0.23	-	-	-	246
		397	600	F	8	-	0.50	4192	-26.47	9.92	247
		374	535	F	9	-	0.53	-	-	-	248
		327	280	F	6	1	0.29	-	-	-	249
		352	420	M	6	61	0.31	-	-	-	250
		487	1060	F	16	1	1.23	4193	-25.68	10.19	251
		471	1040	F	14	1	1.20	-	-	-	252
		399	605	F	9	1	0.65	-	-	-	253
		331	345	F	6	1	0.37	-	-	-	254
		265	510	F	8	1	0.44	-	-	-	255
		283	215	F	6	61	0.52	-	-	-	256
		328	310	F	7	1	0.40	-	-	-	257
		433	790	F	-	32	0.92	-	-	-	258
		417	690	F	10	1	0.73	-	-	-	259
		478	1205	F	13	20	0.97	4194	-26.63	10.03	260
		442	750	F	12	1	0.62	-	-	-	261
		381	540	M	8	1	0.52	-	-	-	262
		489	990	F	12	110	1.19	-	-	-	263
		493	1360	F	14	20	0.89	4195	-24.33	10.07	264
		483	1250	F	17	20	0.97	-	-	-	265
		443	1000	F	18	20	-	-	-	-	266
		317	300	F	7	1	-	-	-	-	267
		439	810	F	11	32	-	-	-	-	268
		447	835	F	13	1	-	-	-	-	269
		338	380	F	7	1	-	-	-	-	270
		463	890	F	12	1	-	-	-	-	271
		385	550	F	12	1	-	-	-	-	272
		322	345	F	7	1	-	-	-	-	273
		334	340	F	7	1	-	-	-	-	274
		428	800	M	15	1	-	-	-	-	275
		295	355	F	6	110	-	-	-	-	276
		425	740	M	14	121	-	-	-	-	277
		337	360	F	6	1	-	-	-	-	278
		425	740	M	12	1	-	-	-	-	279
		424	690	F	16	110	-	-	-	-	280
		328	310	F	7	1	-	-	-	-	281
		340	390	F	7	181	-	-	-	-	282
		456	850	F	13	1	-	-	-	-	283
		428	745	M	13	121	-	-	-	-	284
		377	500	M	13	121	-	-	-	-	285
		465	1010	-	14	1	-	-	-	-	286
		338	410	F	6	1	-	-	-	-	287
		293	260	F	6	110	-	-	-	-	288
		457	995	F	10	1	-	-	-	-	289
		391	645	M	12	1	-	-	-	-	290
		335	360	F	8	20	-	-	-	-	291
		402	660	M	14	1	-	-	-	-	292
		368	500	F	8	1	-	-	-	-	293
		341	350	F	7	1	-	-	-	-	294
		304	250	F	6	1	-	-	-	-	295
		343	350	F	9	1	-	-	-	-	296
		310	290	F	6	32	-	-	-	-	297
		403	645	-	14	181,110	-	-	-	-	298

## Appendix 2.3 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes		Fish no	
								Lab no	C13/C12 (o/oo)		N15/N14 (o/oo)
Walleye	Aug 21	330	315	M	6	1	-	-	-	299	
		297	245	F	7	1	-	-	-	300	
		335	355	M	10	1	-	-	-	301	
		348	405	F	5	1	-	-	-	302	
		327	355	F	5	1	-	-	-	303	
		239	110	F	4	20	-	-	-	304	
		302	255	F	7	1	-	-	-	305	
		413	650	M	11	1	-	-	-	306	
White sucker	Aug 21	374	610	F	11	-	0.13	4196.1	-24.22	7.54	210
		443	1050	F	13	-	0.28	4197.1	-20.77	6.51	211
		352	540	F	7	-	0.10	-	-	-	212
		216	100	F	3	-	0.02	-	-	-	213
		259	210	I	5	-	0.03	-	-	-	214
		268	260	I	4	-	0.05	-	-	-	215
		157	40	F	2	-	0.02	-	-	-	216
		155	40	I	2	-	0.01	-	-	-	217
		214	110	F	3	-	0.02	-	-	-	218
		168	45	I	2	-	0.01	-	-	-	219
		440	1300	F	15	-	0.15	4198	-26.06	7.26	220
		372	660	M	8	-	0.24	-	-	-	221
		392	810	M	10	-	0.25	-	-	-	222
		336	460	F	6	-	0.06	-	-	-	223
		377	700	M	10	-	0.18	-	-	-	224
		394	935	M	16	-	0.20	4199	-22.27	7.50	225
		454	1260	F	18	-	0.21	-	-	-	226
		375	700	F	9	-	0.10	-	-	-	227
		332	495	M	6	-	0.09	-	-	-	228
		393	910	F	10	-	0.10	-	-	-	229
		369	690	M	8	-	0.08	-	-	-	230
		224	110	-	3	-	0.01	-	-	-	231
		389	700	F	10	-	0.09	-	-	-	232
		200	100	-	2	-	0.02	-	-	-	233
		157	45	-	2	-	0.02	-	-	-	234
		152	45	-	2	-	-	-	-	-	235
		171	50	F	2	-	-	-	-	-	236
		403	950	F	10	-	-	-	-	-	237
406	960	F	8	-	-	-	-	-	238		
404	865	F	8	-	-	-	-	-	239		
442	1210	F	12	-	-	-	-	-	240		
Cisco	Aug 21	192	55	F	4	-	0.14	4200	-32.31	8.69	195
		232	140	F	6	-	0.21	4201	-30.53	9.45	196
		208	90	F	7	-	0.14	4202.1	-29.40	8.73	197
		213	95	F	6	-	0.17	-	-	-	198
		183	55	F	4	-	0.14	-	-	-	199
		184	40	F	5	-	0.14	4203	-29.68	9.02	200
		200	50	F	-	-	0.19	-	-	-	201
		195	100	F	5	-	0.10	-	-	-	202
		200	95	F	6	-	0.14	-	-	-	203
		222	100	F	6	-	0.16	-	-	-	204
		217	85	F	4	-	0.14	-	-	-	205
		193	65	F	5	-	0.10	-	-	-	206
		158	45	F	3	-	0.08	-	-	-	207
		158	35	F	2	-	0.08	-	-	-	208
		183	60	F	3	-	0.06	-	-	-	209



Appendix 2.4. Raw data from the 1988 NOLSS fish survey of Musclow Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 27	464	955	F	12	1	0.42	-	-	-	454
		451	955	F	12	1	0.40	4217	-26.37	10.17	455
		296	275	F	6	1	0.22	-	-	-	456
		483	1190	F	13	1	0.47	4218	-26.60	10.72	457
		350	500	F	8	61	0.25	-	-	-	458
		383	565	F	-	1	0.34	-	-	-	459
		408	740	M	11	1	0.72	-	-	-	460
		375	535	M	9	1	0.43	-	-	-	461
		408	710	M	12	1	0.81	4219	-26.97	10.79	462
		316	330	F	8	20	0.35	-	-	-	463
		201	95	F	3	1	0.09	4220	-22.90	9.50	464
		117	12	-	-	-	-	-	-	-	714
		102	9	-	-	-	-	-	-	-	715
		96	8	-	-	-	-	-	-	-	716
		108	10	-	-	-	-	-	-	-	717
		96	7	-	-	-	-	-	-	-	718
		98	9	-	-	-	-	-	-	-	719
		102	8	-	-	-	-	-	-	-	720
		110	11	-	2	-	-	-	-	-	721
		107	10	-	-	-	-	-	-	-	722
		116	14	-	2	-	-	-	-	-	723
		99	7	-	-	-	-	-	-	-	724
		100	9	-	-	-	-	-	-	-	725
104	9	-	-	-	-	-	-	-	726		
100	9	-	-	-	-	-	-	-	727		
White sucker	Aug 27	449	1445	M	11	-	0.12	4221	-23.04	7.71	467
		395	905	F	10	-	0.07	-	-	-	468
		412	1025	F	11	-	0.11	4222	-22.80	6.58	469
		410	1085	F	11	-	0.08	-	-	-	470
		429	1050	F	9	-	0.07	-	-	-	471
		413	1030	F	9	-	0.10	-	-	-	472
		485	655	F	16	-	0.19	-	-	-	473
		426	1245	F	10	-	0.08	-	-	-	474
		413	960	F	9	-	0.15	-	-	-	475
		427	1285	F	10	-	0.11	4223	-21.33	7.13	476
		387	890	M	5	-	0.06	4224	-24.32	7.20	477
		406	950	F	9	-	0.05	-	-	-	478
		455	1360	F	11	-	0.11	-	-	-	479
		467	1470	F	9	-	0.10	-	-	-	480
		447	1350	F	10	-	0.11	-	-	-	481
		314	440	M	5	-	0.06	-	-	-	482
		427	1200	F	9	-	0.10	-	-	-	483
		411	1060	F	8	-	0.07	-	-	-	484
		344	610	M	7	-	0.11	-	-	-	485
		306	400	F	7	-	0.04	-	-	-	486
		353	610	F	8	-	-	-	-	-	487
		370	760	F	8	-	-	-	-	-	488
		395	900	F	7	-	-	-	-	-	489
		372	695	M	8	-	-	-	-	-	490
		373	775	F	9	-	-	-	-	-	491
		354	645	M	7	-	-	-	-	-	492
		279	755	M	7	-	-	-	-	-	493
395	1045	F	7	-	-	-	-	-	494		
367	600	F	7	-	-	-	-	-	495		
349	605	F	10	-	-	-	-	-	496		
363	645	M	10	-	-	-	-	-	497		

Appendix 2.4 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Cisco	Aug 27	298	340	F	7	-	0.15	4225	-27.56	8.83	400
		223	95	M	6	-	0.17	-	-	-	401
		233	120	F	8	-	0.17	4226	-28.99	8.64	402
		190	65	F	7	-	0.22	-	-	-	403
		226	110	F	7	-	0.11	-	-	-	404
		230	110	F	-	-	0.14	-	-	-	405
		193	80	F	5	-	0.14	-	-	-	406
		198	75	F	5	-	0.19	4227	-28.58	9.07	407
		215	120	F	6	-	0.07	-	-	-	408
		216	110	F	8	-	0.22	-	-	-	409
		203	90	F	7	-	0.15	-	-	-	410
		211	95	F	7	-	0.18	-	-	-	411
		203	80	F	6	-	0.17	-	-	-	412
		193	85	F	7	-	0.26	-	-	-	413
		216	100	F	6	-	0.13	-	-	-	414
		166	55	I	4	-	0.04	-	-	-	415
		187	55	M	6	-	0.12	4228.1	-29.57	8.57	416
		152	40	I	3	-	0.09	-	-	-	417
		169	60	F	5	-	0.04	-	-	-	418
		218	110	F	7	-	0.30	-	-	-	419
		175	60	F	4	-	0.21	-	-	-	420
		170	55	F	4	-	0.14	-	-	-	421
		172	55	F	4	-	0.11	-	-	-	422
		218	110	F	6	-	0.05	-	-	-	423
		196	85	F	7	-	0.29	-	-	-	424
		203	60	F	-	-	-	-	-	-	425
		199	95	F	8	-	-	-	-	-	426
		173	70	F	4	-	-	-	-	-	427
		173	55	F	5	-	-	-	-	-	428
		163	50	F	4	-	-	-	-	-	429
		174	60	I	4	-	-	-	-	-	430
		171	60	F	4	-	-	-	-	-	431
		154	50	I	3	-	-	-	-	-	432
		163	45	F	4	-	-	-	-	-	433
		170	55	F	4	-	-	-	-	-	434
		185	75	F	-	-	-	-	-	-	435
		167	55	M	3	-	-	-	-	-	436
		174	60	F	5	-	-	-	-	-	437
		167	55	F	-	-	-	-	-	-	438
		188	85	F	7	-	-	-	-	-	439
163	75	F	6	-	-	-	-	-	440		
164	60	M	4	-	-	-	-	-	441		
162	60	F	4	-	-	-	-	-	442		
191	90	F	6	-	-	-	-	-	443		
172	55	F	5	-	-	-	-	-	444		
Northern pike	Aug 27	660	2055	F	13	20	0.45	-	-	-	465
		690	2100	F	16	1	0.77	-	-	-	466
Lake whitefish	Aug 27	561	2455	M	14	-	0.08	-	-	-	445
		529	2020	M	10	-	0.06	-	-	-	446
		536	2300	M	11	-	0.07	-	-	-	447
		535	2550	F	16	-	0.10	-	-	-	448
		536	2660	M	10	-	0.05	-	-	-	449
		554	2615	M	11	121,170,141	0.07	-	-	-	450
		521	2255	M	10	1	0.07	-	-	-	451
		521	2155	M	10	121,170,141	0.06	-	-	-	452
446	1560	F	11	141	0.04	-	-	-	453		

## Appendix 2.4 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Burbot	Aug 27	338	290	F	7	1	0.10	-	-	-	498
		434	510	-	8	1	0.19	-	-	-	499
		357	365	M	7	110	0.12	-	-	-	500
		497	710	F	11	1	0.27	-	-	-	501
		473	695	M	-	1	0.21	-	-	-	502
		716	2015	M	17	1	0.55	-	-	-	503
		610	1440	F	14	32	0.63	-	-	-	504
		547	1060	F	11	1	0.40	-	-	-	505
		561	1160	M	12	1	0.38	-	-	-	506
		514	795	M	-	1	0.41	-	-	-	507
		490	750	M	9	1	0.27	-	-	-	508
		636	1500	M	15	1	0.55	-	-	-	509
		495	800	F	7	1	0.18	-	-	-	510
		460	635	M	7	110	0.20	-	-	-	511
		557	960	F	14	1	0.47	-	-	-	512
		490	650	F	10	110	0.35	-	-	-	513
		508	750	F	9	1	0.35	-	-	-	514
		640	2210	F	15	20	0.59	-	-	-	515
		500	680	M	-	1	-	-	-	-	516
		503	605	F	-	1	-	-	-	-	517
		524	1020	M	-	1	-	-	-	-	518
		450	500	F	-	1	-	-	-	-	519
		504	630	F	-	1	-	-	-	-	520
		493	645	M	-	1	-	-	-	-	521
		505	710	M	-	32	-	-	-	-	522
		594	1350	F	-	1	-	-	-	-	523
		535	915	M	-	1	-	-	-	-	524
		558	1090	F	-	71	-	-	-	-	525
		496	710	M	-	1	-	-	-	-	526
		471	590	M	-	1	-	-	-	-	527
496	750	F	-	1	-	-	-	-	528		
531	965	F	-	32	-	-	-	-	529		
531	990	M	-	32	-	-	-	-	530		
609	1260	M	-	32	-	-	-	-	531		
Yellow perch	Aug 17	87	8	-	-	-	0.05	4416	-23.77	6.88	790
		92	9	-	-	-	0.05	4417	-21.41	6.46	791
		77	6	-	-	-	0.09	4418	-26.24	8.39	793
		89	8	-	-	-	0.04	4419	-23.43	7.30	795
	Aug 27	87	8	-	-	-	-	-	-	-	702
		92	9	-	-	-	-	-	-	-	703
		71	4	-	-	-	-	-	-	-	704
		77	6	-	-	-	-	-	-	-	705
		70	4	-	-	-	-	-	-	-	706
		89	8	-	-	-	-	-	-	-	707
		74	5	-	-	-	0.05	-	-	-	708
		83	6	-	-	-	0.05	-	-	-	709
		92	8	-	-	-	0.05	-	-	-	710
		72	4	-	-	-	0.06	-	-	-	711
		69	4	-	-	-	0.04	-	-	-	712
		71	4	-	-	-	0.04	-	-	-	713

Appendix 2.5. Raw data from the 1988 NOLSS fish survey of Sydney Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 28	400	655	M	8	1	0.31	-	-	-	557
		440	860	M	7	20	0.23	-	-	-	558
		357	370	M	5	1	0.18	-	-	-	559
		330	355	M	6	32	0.44	-	-	-	560
		450	1120	M	10	32	0.55	-	-	-	561
		428	800	M	6	32	0.25	-	-	-	562
		343	375	F	4	110	0.19	-	-	-	563
		392	610	F	6	1	0.31	-	-	-	564
		288	240	F	3	20	0.13	-	-	-	565
		321	340	F	5	1	0.16	-	-	-	566
		242	145	F	3	20	0.10	-	-	-	567
		235	150	F	3	32	0.13	-	-	-	568
		435	850	M	8	32	0.48	-	-	-	569
		628	3000	F	16	20	0.91	4230	-25.67	9.44	570
		384	550	M	9	1	0.33	-	-	-	571
		376	530	M	6	1	0.31	-	-	-	572
		413	780	F	7	20	0.35	-	-	-	573
		394	610	F	6	20	0.27	-	-	-	574
		393	610	F	6	1	0.27	-	-	-	575
		425	745	M	6	1	0.40	4231	-25.63	9.03	576
		322	320	F	5	1	0.23	-	-	-	577
		455	1040	M	9	32	0.55	-	-	-	578
		423	875	M	8	1	0.49	-	-	-	579
		432	900	M	13	1	0.74	4232	-25.28	9.03	580
		328	355	F	5	32	0.20	-	-	-	581
		504	640	F	15	1	-	-	-	-	582
		370	500	F	6	1	-	-	-	-	583
		410	745	F	7	32	-	-	-	-	584
		528	650	F	9	1	-	-	-	-	585
		562	2010	F	10	32	-	-	-	-	586
		495	1300	M	13	1	-	-	-	-	587
		490	1160	M	15	20	-	-	-	-	588
		408	640	M	7	1	-	-	-	-	589
		322	300	I	4	20	-	-	-	-	590
		373	515	M	6	1	-	-	-	-	591
		-	-	-	-	-	-	-	-	-	592
		412	710	-	6	1	-	-	-	-	593
		340	360	F	4	1	-	-	-	-	594
		431	760	M	6	1	-	-	-	-	595
		343	415	M	6	61	-	-	-	-	596
		377	540	F	8	1	-	-	-	-	597
		380	590	M	7	20	-	-	-	-	598
		376	510	M	6	1	-	-	-	-	599
		390	590	M	6	20	-	-	-	-	600
		320	340	I	5	61	-	-	-	-	601
		364	540	M	7	1	-	-	-	-	602
		344	340	M	6	61	-	-	-	-	603
		368	545	M	8	32	-	-	-	-	604
		345	410	F	5	20	-	-	-	-	605
		317	310	F	5	20	-	-	-	-	606
		355	420	I	5	1	-	-	-	-	607
		335	355	F	5	1	-	-	-	-	608
		390	605	M	6	1	-	-	-	-	609
		334	380	F	5	1	-	-	-	-	610
		375	505	M	5	1	-	-	-	-	611
		346	440	F	4	32	-	-	-	-	612
		332	360	M	5	1	-	-	-	-	613
		305	290	I	5	61	-	-	-	-	614
		312	285	F	4	1	-	-	-	-	615

## Appendix 2.5 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 28	338	405	F	4	1	-	-	-	-	616
		317	345	F	5	1	-	-	-	-	617
		336	345	F	5	1	-	-	-	-	618
		247	130	I	3	61	-	-	-	-	619
		283	220	F	4	61	-	-	-	-	620
		310	300	F	4	1	-	-	-	-	621
		288	240	F	4	61	-	-	-	-	622
		256	160	I	4	1	-	-	-	-	623
		253	160	F	3	61	-	-	-	-	624
		149	33	-	2	-	-	-	-	-	683
		131	18	-	2	-	-	-	-	-	684
White sucker	Aug 28	415	990	F	-	-	0.11	4233.1	-20.54	6.41	627
		422	1140	M	-	-	0.13	4234	-21.48	6.98	628
		413	935	M	9	-	0.19	-	-	-	629
		282	305	I	5	-	0.08	-	-	-	630
		352	640	M	8	-	0.06	-	-	-	631
		161	40	I	3	-	0.01	-	-	-	632
		250	190	I	4	-	0.02	-	-	-	633
		406	1105	F	7	-	0.05	-	-	-	634
		408	1080	F	8	-	0.15	4235	-16.27	6.54	635
		453	1260	M	10	-	0.16	-	-	-	636
		425	1270	F	10	-	0.11	4236	-19.84	6.13	637
		246	210	I	4	-	0.06	-	-	-	638
		369	705	I	6	-	0.05	-	-	-	639
		405	910	M	10	-	0.12	-	-	-	640
		363	615	F	11	-	0.10	-	-	-	641
		423	1140	F	10	-	0.18	-	-	-	642
		390	840	M	11	-	0.14	-	-	-	643
		475	1650	F	12	-	0.20	-	-	-	644
		194	75	F	5	-	0.02	-	-	-	645
		153	40	-	3	-	0.01	-	-	-	646
		383	905	F	7	-	0.09	-	-	-	647
		404	960	M	8	-	0.09	-	-	-	648
		352	675	M	7	-	0.07	-	-	-	649
		405	960	M	10	-	0.15	-	-	-	650
		397	1040	M	11	-	0.09	-	-	-	651
		443	1120	F	13	-	-	-	-	-	652
438	1210	M	14	-	-	-	-	-	653		
389	845	F	11	-	-	-	-	-	654		
263	210	-	6	-	-	-	-	-	655		
163	45	-	2	-	-	-	-	-	656		
80	6	-	-	-	-	-	-	-	685		
Cisco	Aug 28	156	30	F	4	-	0.13	4237	-27.37	8.02	532
		165	40	F	4	-	0.13	4238	-27.25	7.76	533
		177	45	F	3	-	0.20	4239	-28.78	7.30	534
		160	30	M	2	-	0.06	-	-	-	535
		167	30	F	3	-	0.16	-	-	-	536
		174	45	F	3	-	0.15	4240	-27.38	7.95	537
Northern pike	Aug 28	275	140	F	3	1	0.08	-	-	-	553
		721	2660	F	10	1	0.37	-	-	-	554
		672	2180	F	9	1	0.89	-	-	-	555
		634	1960	M	8	1	0.42	-	-	-	556
		460	875	M	-	-	-	-	-	-	669
Lake whitefish	Aug 28	226	100	I	4	-	0.08	-	-	-	538
		225	90	I	4	-	0.08	-	-	-	539
		255	155	I	5	-	0.07	-	-	-	540
		306	310	M	9	-	0.07	-	-	-	541
		408	750	F	10	-	0.08	-	-	-	542
		364	495	F	9	-	0.08	-	-	-	543



Appendix 2.6. Raw data from the 1988 NOLSS fish survey of Trout Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 18	540	1600	F	14	1	0.53	4181	-24.21	9.55	12
		508	1550	F	12	1	0.40	-	-	-	13
		473	1070	F	9	1	0.33	4182	-25.14	8.84	14
		450	1160	M	16	1	0.43	4183.1	-24.89	9.49	15
		420	710	F	8	1	0.24	-	-	-	16
		235	120	F	4	1	0.07	-	-	-	17
		278	200	-	5	20	0.11	-	-	-	18
		268	200	F	4	1	0.13	-	-	-	19
		495	1325	F	11	50	0.27	-	-	-	20
		483	1240	F	9	1	0.36	-	-	-	21
		619	2550	F	19	1	1.07	-	-	-	49
		484	1210	M	19	32	0.82	-	-	-	50
		483	1300	F	14	1	0.32	-	-	-	51
		462	1200	F	12	32,50	0.30	-	-	-	52
		400	700	M	8	1	0.27	-	-	-	76
		410	735	F	7	1	0.21	-	-	-	77
		357	500	F	6	1	0.18	-	-	-	78
		488	1310	M	19	20	0.72	-	-	-	79
		466	1100	F	11	20	0.28	-	-	-	80
		475	1200	M	17	20	0.58	-	-	-	81
		496	1380	M	13	-	0.45	4184	-24.91	9.18	82
		360	500	-	5	1	0.17	-	-	-	83
		220	125	-	2	-	0.09	-	-	-	84
		221	110	-	2	-	0.08	-	-	-	85
		235	145	F	3	-	0.06	-	-	-	86
		456	1145	M	11	-	0.30	-	-	-	87
		490	1200	M	19	-	0.67	-	-	-	88
276	220	-	3	-	0.14	-	-	-	89		
White sucker	Aug 18	477	1600	F	17	-	0.23	4185	-21.47	6.30	22
		444	1300	M	15	-	0.13	-	-	-	23
		440	1240	M	16	-	0.16	4186	-22.51	7.71	24
		270	255	-	5	-	0.02	-	-	-	25
		322	490	-	5	-	0.01	-	-	-	26
		312	410	F	5	-	0.03	-	-	-	27
		452	1300	F	12	-	0.16	4187	-20.73	6.48	28
		395	855	F	8	-	0.06	-	-	-	29
		453	1310	M	11	-	0.10	-	-	-	30
		373	800	M	8	-	0.05	-	-	-	31
		310	450	-	5	-	0.03	-	-	-	32
		415	960	F	7	-	0.06	4188	-20.34	6.12	33
		329	490	F	5	-	0.04	-	-	-	34
		340	500	-	6	-	0.05	-	-	-	35
		335	540	-	6	-	0.04	-	-	-	36
		353	600	M	6	-	0.03	-	-	-	37
		322	445	F	5	-	0.06	-	-	-	38
		283	260	-	4	-	0.04	-	-	-	39
		250	200	-	3	-	0.03	-	-	-	40
		248	185	-	3	-	0.02	-	-	-	41
		503	1760	F	19	-	0.35	-	-	-	70
		334	600	-	7	-	0.05	-	-	-	71
		385	900	M	8	-	0.07	-	-	-	72
460	1500	F	11	-	0.15	-	-	-	90		
185	105	-	-	-	-	-	-	-	91		
185	105	-	-	-	-	-	-	-	92		
183	95	-	-	-	-	-	-	-	93		
Cisco	Aug 18	143	55	-	2	-	0.04	4189	-26.13	5.37	58
		166	55	-	2	-	0.02	-	-	-	59
		160	50	M	2	-	0.02	4190	-26.06	5.36	60

## Appendix 2.6 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no	
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)		
Cisco	Aug 18	157	55	-	2	-	0.04	-	-	-	61	
		153	50	F	2	-	0.05	-	-	-	62	
		153	45	-	2	-	0.04	4191	-26.04	5.91	63	
		162	55	M	2	-	0.07	-	-	-	64	
		160	50	-	3	-	0.04	-	-	-	65	
		158	55	-	3	-	0.04	-	-	-	66	
		160	50	-	3	-	0.07	-	-	-	67	
		166	55	-	2	-	0.04	-	-	-	68	
		221	145	-	3	-	0.08	-	-	-	69	
	Aug 19	227	120	F	4	-	0.10	-	-	-	96	
		228	140	F	6	-	0.06	-	-	-	100	
		228	140	F	5	-	0.04	-	-	-	101	
		243	150	M	6	-	0.08	-	-	-	102	
		225	150	M	6	-	0.08	-	-	-	103	
		226	140	F	6	-	0.07	-	-	-	104	
		220	160	F	5	-	0.07	-	-	-	105	
		235	150	F	4	-	0.14	-	-	-	106	
		206	110	M	4	-	0.06	-	-	-	107	
155	60	F	3	-	0.28	-	-	-	108			
Northern pike	Aug 18	705	3000	M	15	31	0.71	-	-	-	8	
		806	4200	F	18	1	0.58	-	-	-	9	
		772	3500	F	15	1	0.35	-	-	-	10	
		670	2200	F	10	1	0.27	-	-	-	11	
		600	1545	M	8	20	0.33	-	-	-	97	
		720	3190	F	10	20	0.32	-	-	-	98	
Lake whitefish	Aug 18	540	1875	M	20	1	0.21	-	-	-	1	
		446	1200	F	10	110,50	0.10	-	-	-	2	
		463	1210	M	13	10	0.08	-	-	-	3	
		572	2160	F	15	1	0.15	-	-	-	4	
		390	610	F	9	20	0.20	-	-	-	5	
		478	1325	F	18	1	0.05	-	-	-	6	
		564	2630	M	15	1	0.17	-	-	-	7	
		339	435	F	8	-	0.06	-	-	-	75	
		400	740	-	8	-	0.09	-	-	-	99	
		Aug 19	402	760	F	11	-	0.13	-	-	-	115
			397	850	F	15	-	0.12	-	-	-	116
			304	340	F	9	-	0.05	-	-	-	117
			438	1075	M	10	-	0.10	-	-	-	118
	372		595	M	8	-	0.10	-	-	-	119	
	423		890	F	13	-	0.09	-	-	-	120	
	332		450	F	12	-	0.06	-	-	-	121	
	385		615	M	9	-	0.03	-	-	-	122	
	384		645	M	12	-	0.09	-	-	-	123	
	373		710	F	12	-	0.05	-	-	-	124	
	435		770	M	13	-	0.10	-	-	-	125	
	382		740	M	12	-	0.04	-	-	-	126	
	380		655	F	11	-	0.05	-	-	-	127	
	286	200	M	8	-	0.05	-	-	-	128		
	310	310	M	8	-	0.06	-	-	-	129		
	278	240	M	7	-	0.04	-	-	-	130		
	246	155	-	6	-	0.07	-	-	-	131		
270	245	F	7	-	0.02	-	-	-	132			
180	55	-	3	-	0.07	-	-	-	133			
Burbot	Aug 18	386	435	F	6	32	0.10	-	-	-	73	
		525	810	F	-	32	0.50	-	-	-	74	
	Aug 19	554	1050	F	14	-	0.32	-	-	-	134	
		500	710	M	10	-	0.56	-	-	-	135	
		510	810	M	10	-	0.39	-	-	-	136	

Appendix 2.6 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Burbot	Aug 19	535	755	M	11	-	0.45	-	-	-	137
		405	410	F	9	-	0.16	-	-	-	138
		500	780	M	9	-	0.29	-	-	-	139
		388	410	F	7	-	0.28	-	-	-	140
		520	740	M	20	-	0.48	-	-	-	141
		470	650	F	10	-	0.22	-	-	-	142
		445	560	F	13	-	0.43	-	-	-	143
		470	650	M	9	-	0.31	-	-	-	144
		510	700	M	14	-	0.32	-	-	-	145
		432	560	-	8	-	0.23	-	-	-	146
		470	610	M	13	-	0.50	-	-	-	147
		468	640	M	13	-	0.62	-	-	-	148
		498	755	M	13	-	0.39	-	-	-	149
		475	500	M	12	-	0.41	-	-	-	150
		466	540	M	14	-	0.48	-	-	-	151
		512	790	M	12	-	0.29	-	-	-	152
		415	510	M	7	-	0.21	-	-	-	153
		410	445	M	7	-	0.21	-	-	-	154
		430	490	F	9	-	-	-	-	-	155
		527	690	M	13	-	-	-	-	-	156
		493	710	F	-	-	-	-	-	-	157
		455	540	F	8	-	-	-	-	-	158
		308	155	F	5	-	-	-	-	-	159
		492	740	M	11	-	-	-	-	-	160
		491	850	M	13	-	-	-	-	-	161
		550	1090	M	18	-	-	-	-	-	162
		406	400	M	8	-	-	-	-	-	163
		370	325	F	8	-	-	-	-	-	164
		395	365	F	9	-	-	-	-	-	165
		475	700	M	-	-	-	-	-	-	166
		408	450	M	-	-	-	-	-	-	167
		503	1010	F	-	-	-	-	-	-	168
		485	540	M	-	-	-	-	-	-	169
		432	450	F	-	-	-	-	-	-	170
		476	690	M	-	-	-	-	-	-	171
		522	885	F	-	-	-	-	-	-	172
		495	860	F	-	-	-	-	-	-	173
		475	610	F	-	-	-	-	-	-	174
502	775	F	-	-	-	-	-	-	175		
453	560	M	-	-	-	-	-	-	176		
534	700	M	-	-	-	-	-	-	177		
476	640	M	-	-	-	-	-	-	178		
422	455	M	-	-	-	-	-	-	179		
463	680	M	-	-	-	-	-	-	180		
476	650	F	-	-	-	-	-	-	181		
497	650	M	-	-	-	-	-	-	182		
438	540	M	-	-	-	-	-	-	183		
487	610	M	-	-	-	-	-	-	184		
400	430	M	-	-	-	-	-	-	185		
518	690	F	-	-	-	-	-	-	186		
403	390	F	-	-	-	-	-	-	187		
450	510	F	-	-	-	-	-	-	188		
Lake trout	Aug 19	458	1200	F	-	32	0.57	-	-	-	109
		718	3800	F	10	1	1.13	-	-	-	110
		600	2940	F	10	71	0.62	-	-	-	111
		695	2940	M	9	1	0.66	-	-	-	112
		655	3600	M	15	1	0.77	-	-	-	113
		802	7200	M	-	20	1.32	-	-	-	114

## Appendix 2.6 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes		Fish no
								Lab no	C13/C12 (o/oo)	
Lake trout	Aug 19	652	3520	M	11	-	0.75	-	-	189
Longnose sucker	Aug 18	504	2050	M	17	-	0.24	-	-	53
		492	1890	F	15	-	0.08	-	-	54
		428	1130	M	10	-	0.06	-	-	55
		492	1890	M	15	-	0.14	-	-	56
		444	1350	M	13	-	0.10	-	-	57
Yellow perch	Aug 18	153	40	F	-	71	-	-	-	42
		156	45	-	-	-	-	-	-	43
		155	50	-	-	-	-	-	-	44
		160	50	-	-	-	-	-	-	45
		157	50	-	-	-	-	-	-	46
		145	45	-	-	-	-	-	-	47
		156	45	-	-	-	-	-	-	48
		147	60	-	-	-	-	-	-	94
		137	50	-	-	-	-	-	-	95

Appendix 3.1. Raw data from the 1989 NOLSS fish survey of Green Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
White sucker	Aug 7	413	875	M	15	-	0.09	1068	-	-	256
		411	925	F	13	-	0.12	1069	-	-	257
		451	1225	F	18	-	0.16	1070	-	-	258
		409	950	M	17	-	0.13	1071	-	-	259
	Aug 8	428	1100	M	15	-	0.08	1072	-	-	260
		446	1050	F	16	-	0.15	-	-	-	285
		370	725	F	9	-	0.05	-	-	-	286
		410	950	M	11	-	0.09	-	-	-	287
		387	725	M	11	-	0.06	-	-	-	288
		373	625	F	8	-	0.05	-	-	-	289
		433	1200	M	17	-	0.07	1076	-	-	290
		238	150	M	6	-	0.04	-	-	-	291
		230	125	M	6	-	0.04	-	-	-	292
		223	125	M	4	-	0.04	-	-	-	293
Cisco	Aug 7	186	50	F	3	121	0.25	1059	-	-	233
		172	50	F	3	121	0.33	1060	-	-	234
		168	40	M	3	1	0.23	1061	-	-	235
		174	50	F	4	1	0.12	-	-	-	236
		164	40	M	3	1	0.21	-	-	-	237
		164	45	F	-	121	0.37	-	-	-	238
		164	50	F	3	-	0.23	-	-	-	239
		163	40	F	3	121	0.31	-	-	-	240
		156	30	F	3	1	0.23	-	-	-	241
		168	50	F	5	-	0.19	-	-	-	242
		163	50	M	4	1	0.19	-	-	-	243
		164	40	F	4	-	0.18	-	-	-	244
		165	50	F	4	1	0.22	1062	-	-	245
		166	50	M	3	1	0.24	-	-	-	246
		155	40	F	3	1	0.20	-	-	-	247
		158	40	F	3	1	0.23	-	-	-	248
		150	30	M	3	1	0.16	1063	-	-	249
		160	50	M	3	1	0.24	-	-	-	250
		155	40	F	3	121	0.20	1064	-	-	251
		154	40	M	3	1	0.18	-	-	-	252
	Aug 8	166	50	M	3	2	0.08	-	-	-	273
		170	50	M	3	1	0.06	-	-	-	274
		168	50	M	4	1	0.12	-	-	-	275
		159	45	M	3	1	0.11	-	-	-	276
		163	50	M	3	1	0.15	-	-	-	277
		153	30	F	3	1	0.08	-	-	-	278
		154	40	F	3	1	0.10	-	-	-	279
		167	50	F	3	1	0.13	-	-	-	280
		150	30	M	3	1	0.10	-	-	-	281
		164	50	M	3	2	0.09	-	-	-	282
160	50	M	4	1	0.11	-	-	-	283		
160	50	M	4	1	0.21	-	-	-	284		
Northern pike	Aug 7	630	1650	M	15	61,62	1.80	1065	-	-	253
		768	3250	F	12	1	1.74	1066	-	-	254
		793	2950	F	18	61,51	1.83	1067	-	-	255
	Aug 8	775	3360	F	15	61	1.50	-	-	-	261
		664	1800	M	12	181	1.93	1073	-	-	262
		376	400	M	6	61	0.21	-	-	-	263
		321	225	M	5	1	0.27	1074	-	-	264
		728	2650	F	11	-	1.91	1075	-	-	265
		594	1700	-	9	-	0.53	-	-	-	266
		498	925	F	6	1	0.44	-	-	-	267
		677	2150	F	10	20	1.41	-	-	-	268
		741	3200	F	19	2	1.24	-	-	-	269

## Appendix 3.1 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes		Fish no
								Lab no	C13/C12 (o/oo)	
Northern pike	Aug 8	708	2250	F	15	41	2.26	-	-	270
		551	1250	M	9	51	0.80	-	-	271
		814	4150	F	19	61	1.83	-	-	272
Yellow perch	Aug 7	140	44	-	-	-	0.18	1203	-	811
		78	6	-	-	-	0.11	1204	-	812
		80	6	-	-	-	0.13	1205	-	813
		83	6	-	-	-	0.17	1206	-	814
		78	5	-	-	-	0.12	1207	-	815
		76	5	-	-	-	0.12	1208	-	816
		91	8	-	-	-	0.17	-	-	817
		168	60	-	-	-	0.14	-	-	818
		128	25	-	-	-	0.11	-	-	819
		113	19	-	-	-	0.12	-	-	820
		90	8	-	-	-	0.16	-	-	821
		86	8	-	-	-	0.16	-	-	822
		87	8	-	-	-	0.14	-	-	823
		84	8	-	-	-	0.17	-	-	824
		79	6	-	-	-	0.10	-	-	825
		81	6	-	-	-	0.14	-	-	826
		80	6	-	-	-	0.13	-	-	827
		79	6	-	-	-	0.11	-	-	828
		88	8	-	-	-	0.17	-	-	829
		89	8	-	-	-	0.22	-	-	830
		78	10	-	-	-	0.11	-	-	831
72	6	-	-	-	0.11	-	-	832		
83	7	-	-	-	0.17	-	-	833		
91	8	-	-	-	0.12	-	-	834		
Spottail shiner	Aug 7	78	7	-	-	-	-	1209	-	835
		74	7	-	-	-	-	1210	-	836
		81	9	-	-	-	-	1211	-	837
		72	6	-	-	-	-	1212	-	838
		82	8	-	-	-	-	1213	-	839
		79	7	-	-	-	-	1214	-	840
		81	7	-	-	-	-	-	-	841
		83	7	-	-	-	-	-	-	842
		76	6	-	-	-	-	-	-	843
		68	4	-	-	-	-	-	-	844
		70	5	-	-	-	-	-	-	845
		71	5	-	-	-	-	-	-	846
		74	6	-	-	-	-	-	-	847
		82	8	-	-	-	-	-	-	848
		71	6	-	-	-	-	-	-	849
		75	5	-	-	-	-	-	-	850
		85	8	-	-	-	-	-	-	851
		77	6	-	-	-	-	-	-	852
		76	6	-	-	-	-	-	-	853
		85	9	-	-	-	-	-	-	854
75	5	-	-	-	-	-	-	855		
72	5	-	-	-	-	-	-	856		
73	5	-	-	-	-	-	-	857		
75	5	-	-	-	-	-	-	858		

Appendix 3.2. Raw data from the 1989 NOLSS fish survey of Orange Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes		Fish no		
								Lab no	C13/C12 (o/oo)		N15/N14 (o/oo)	
Walleye	Aug 4	430	850	M	16	1	1.09	1047	-	-	154	
		430	775	M	11	20		1.08	-	-	155	
		439	925	M	10	61,6		0.70	1048	-	-	156
		368	475	M	8	1		0.98	-	-	-	157
		395	625	M	14	6		1.45	-	-	-	158
		378	575	M	16	1		1.36	-	-	-	159
		402	700	M	15	20		1.57	-	-	-	160
		322	325	M	9	1		0.63	-	-	-	161
		454	925	M	14	20		1.43	-	-	-	162
		196	100	-	3	1		0.36	1049	-	-	163
	328	350	M	9	1		1.03	-	-	-	164	
	Aug 5	600	2250	M	24	32,61,80		2.14	1054	-	-	178
		490	1175	M	10	1		0.81	-	-	-	179
		515	1425	M	18	1		1.75	-	-	-	180
		458	1125	M	13	20		1.18	-	-	-	181
		553	1525	M	13	20		1.57	-	-	-	182
		470	975	M	16	110		1.49	-	-	-	183
		481	1075	M	11	61		1.33	-	-	-	184
		485	1200	M	-	61		1.33	1055	-	-	185
		523	1425	M	16	61		1.77	-	-	-	186
		467	900	M	14	61		1.06	-	-	-	187
		492	1150	M	16	110		0.99	-	-	-	188
		432	825	M	15	1		1.26	-	-	-	189
		546	1625	F	16	1		0.41	1056	-	-	190
		251	150	M	4	1		0.44	1057	-	-	191
		367	450	M	7	6		0.58	-	-	-	192
		466	1000	F	12	20		1.05	-	-	-	193
		319	350	M	5	1		0.48	-	-	-	194
		478	975	M	20	1		1.79	-	-	-	195
		479	1050	M	23	110		2.06	-	-	-	196
		458	950	M	15	110		1.43	-	-	-	197
		410	675	M	7	110		0.67	-	-	-	198
		263	175	-	3	1		0.59	1058	-	-	199
		425	850	M	15	1		1.15	-	-	-	200
		491	1200	F	14	1		1.59	-	-	-	201
		451	900	F	17	110		1.51	-	-	-	202
		437	775	F	-	1		-	-	-	-	203
		453	900	F	12	110		-	-	-	-	204
		414	725	M	9	20		-	-	-	-	205
		320	350	-	7	1		-	-	-	-	206
		442	850	F	11	110		-	-	-	-	207
391	550	M	8	20		-	-	-	-	208		
341	400	F	8	1		-	-	-	-	209		
476	1100	F	21	20,110		-	-	-	-	210		
414	750	F	9	110		-	-	-	-	211		
475	1100	F	17	110		-	-	-	-	212		
453	925	M	12	110		-	-	-	-	213		
446	825	M	18	1		-	-	-	-	214		
445	900	F	16	110		-	-	-	-	215		
428	750	F	7	61		-	-	-	-	216		
349	425	M	6	1		-	-	-	-	217		
245	150	-	5	1		-	-	-	-	218		
276	200	M	6	1		-	-	-	-	219		
274	225	-	4	61		-	-	-	-	220		
506	1325	M	12	110		-	-	-	-	221		
415	725	M	-	1		-	-	-	-	222		
384	525	M	-	1		-	-	-	-	223		
411	700	F	-	110		-	-	-	-	224		

## Appendix 3.2 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 5	409	750	F	-	1	-	-	-	-	225
		385	600	F	-	1	-	-	-	-	226
		502	1225	F	-	110	-	-	-	-	227
		397	625	M	-	1	-	-	-	-	228
		435	825	F	-	110	-	-	-	-	229
		274	200	M	-	1	-	-	-	-	230
		410	725	M	-	1	-	-	-	-	231
		312	300	M	-	80	-	-	-	-	232
Cisco	Aug 4	334	500	F	8	1	0.35	1039	-	-	107
		284	350	F	6	1	0.25	1040	-	-	108
		323	475	F	8	1	0.33	1041	-	-	109
		368	825	M	9	1	0.29	1042	-	-	110
		330	475	F	8	1	0.25	-	-	-	111
		296	375	M	6	1	0.23	-	-	-	112
		165	50	F	3	1	0.18	1043	-	-	113
		225	100	M	6	170	0.19	1044	-	-	114
		225	100	F	5	1	0.26	-	-	-	115
		191	75	M	6	121	0.17	-	-	-	116
		216	100	F	7	1	0.34	-	-	-	117
		205	80	M	5	1	0.21	-	-	-	118
		210	100	M	5	1	0.14	-	-	-	119
		206	100	F	5	121	0.21	-	-	-	120
		174	75	M	4	1	0.18	-	-	-	121
		180	60	M	-	1	0.13	-	-	-	122
		204	100	F	5	121	0.15	-	-	-	123
		188	75	M	4	1	0.18	-	-	-	124
		208	100	F	6	1	0.30	-	-	-	125
		216	110	F	6	170	0.25	-	-	-	126
		159	50	M	-	1	0.19	-	-	-	127
		194	60	-	4	1	0.14	-	-	-	128
		189	75	F	5	1	0.28	-	-	-	129
		181	75	F	4	170	0.14	-	-	-	130
		198	90	F	-	170	0.34	-	-	-	131
		181	75	F	-	-	-	-	-	-	132
		173	60	M	-	-	-	-	-	-	133
		185	80	F	-	-	-	-	-	-	134
		161	50	M	-	-	-	-	-	-	135
		175	60	F	-	-	-	-	-	-	136
		149	25	-	-	-	-	-	-	-	137
		161	50	F	-	-	-	-	-	-	138
		191	90	M	-	-	-	-	-	-	139
150	40	-	-	-	-	-	-	-	140		
170	75	F	-	-	-	-	-	-	141		
169	40	M	-	-	-	-	-	-	142		
193	100	M	-	-	-	-	-	-	143		
156	50	M	-	-	-	-	-	-	144		
160	50	F	-	-	-	-	-	-	145		
149	40	M	-	-	-	-	-	-	146		
155	40	M	-	-	-	-	-	-	147		
149	40	M	-	-	-	-	-	-	148		
153	50	M	-	-	-	-	-	-	149		
158	50	F	-	-	-	-	-	-	150		
163	50	F	-	-	-	-	-	-	151		
Aug 5	328	460	M	10	121,130	0.49	-	-	-	165	
	328	420	F	10	1	0.47	-	-	-	166	
	251	220	M	8	110	0.28	-	-	-	167	
	227	150	M	6	20	0.22	-	-	-	168	
	225	110	F	-	-	-	-	-	-	169	



Appendix 3.3. Raw data from the 1989 NOLSS fish survey of Linge Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 9	461	925	F	15	1	1.34	1099	-	-	349
		476	975	F	16	1	1.34	-	-	-	350
		520	1225	F	17	1	1.73	1100	-	-	351
		483	1050	F	13	1	0.99	-	-	-	352
		520	1250	F	14	1	1.65	-	-	-	353
		454	825	F	16	1	1.61	-	-	-	354
		445	900	F	13	20	1.07	-	-	-	355
		474	950	F	19	20	1.91	-	-	-	356
		494	1150	F	13	1	1.00	-	-	-	357
		420	725	F	9	1	0.72	-	-	-	358
		412	675	F	15	20	1.36	-	-	-	359
		327	325	M	5	1	0.28	1101	-	-	360
		234	125	M	3	1	0.26	-	-	-	361
		274	150	M	5	1	0.30	-	-	-	362
		475	1075	F	15	20	1.13	-	-	-	363
		429	675	F	14	1	1.63	-	-	-	364
		446	825	F	12	1	1.21	-	-	-	365
		512	1275	F	15	32	1.51	1102	-	-	366
		351	425	M	8	1	0.46	-	-	-	367
		493	1050	F	20	1	1.70	-	-	-	368
		419	825	M	11	1	0.50	-	-	-	369
		468	925	F	16	1	0.97	-	-	-	370
		253	125	F	4	20	0.23	1103	-	-	371
		506	1275	F	14	1	1.52	1104	-	-	372
		400	675	M	12	181,32	0.92	-	-	-	373
		469	925	F	16	1	-	-	-	-	374
		428	775	M	14	1	-	-	-	-	375
		431	950	M	13	1	-	-	-	-	376
		375	500	M	10	1	-	-	-	-	377
		497	1175	F	16	1	-	-	-	-	378
		440	850	M	14	1	-	-	-	-	379
		448	950	M	15	1	-	-	-	-	380
		394	600	M	14	1	-	-	-	-	381
		433	775	F	12	1	-	-	-	-	382
		460	1025	F	14	1	-	-	-	-	383
		379	500	F	7	1	-	-	-	-	384
		493	1800	F	16	110	-	-	-	-	385
		461	925	F	18	1	-	-	-	-	386
		206	75	-	3	1	-	-	-	-	387
		376	525	M	9	1	-	-	-	-	388
		425	725	F	10	1	-	-	-	-	389
		341	375	M	7	1	-	-	-	-	390
		428	750	F	13	1	-	-	-	-	391
		457	850	F	16	1	-	-	-	-	392
		453	875	F	12	20	-	-	-	-	393
		453	825	M	15	20	-	-	-	-	394
		403	675	M	12	1	-	-	-	-	395
		427	775	M	11	1	-	-	-	-	396
		477	1100	M	14	1	-	-	-	-	397
		357	500	M	7	20	-	-	-	-	398
		285	150	M	5	1	-	-	-	-	399
		338	350	M	8	1	-	-	-	-	400
		365	500	M	9	1	-	-	-	-	401
		492	1275	F	14	20	-	-	-	-	402
		445	875	M	16	1	-	-	-	-	403
		435	750	F	12	1	-	-	-	-	404
		367	425	M	7	1	-	-	-	-	405
		346	375	M	7	1	-	-	-	-	406

Appendix 3.3 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes		Fish no	
								Lab no	C13/C12 (o/oo)		N15/N14 (o/oo)
Walleye	Aug 9	300	250	M	6	1	-	-	-	407	
		410	700	F	16	1	-	-	-	408	
		300	250	-	7	1	-	-	-	409	
		260	160	M	6	1	-	-	-	410	
		249	125	M	4	181	-	-	-	411	
		254	125	M	5	1	-	-	-	412	
		225	100	-	3	71	-	-	-	413	
		238	100	M	4	1	-	-	-	414	
		256	125	-	5	1	-	-	-	415	
		245	125	-	4	1	-	-	-	416	
		232	100	-	6	-	-	-	-	417	
		255	125	-	5	-	-	-	-	418	
		212	90	-	4	-	-	-	-	419	
		228	75	-	4	-	-	-	-	420	
		222	75	-	4	-	-	-	-	421	
		255	110	-	5	-	-	-	-	422	
		244	100	-	5	-	-	-	-	423	
		218	100	-	6	-	-	-	-	424	
		215	100	-	6	-	-	-	-	425	
		94	8	-	-	-	-	-	1223	-	870
		88	6	-	-	-	-	-	1224	-	871
		95	7	-	-	-	-	-	1225	-	872
		White sucker	Aug 9	470	1450	F	14	-	0.15	1079	-
398	775			F	10	-	0.09	1080	-	297	
367	675			F	8	-	0.06	1081	-	298	
344	525			F	8	-	0.06	-	-	299	
386	750			F	10	-	0.12	-	-	300	
295	375			M	7	-	0.05	-	-	301	
380	700			M	12	-	0.12	1082	-	302	
189	50			-	4	-	0.03	1083	-	303	
467	1450			F	15	-	0.36	1084	-	304	
Cisco	Aug 9			187	70	F	4	1	0.09	1087	-
		210	80	F	4	1	0.10	1088	-	308	
		171	50	F	3	1	0.09	1089	-	309	
		177	50	M	3	-	0.14	1090	-	310	
		209	90	M	4	-	0.23	-	-	311	
		161	50	F	3	-	0.10	-	-	312	
		158	50	F	3	-	0.06	-	-	313	
		155	50	F	3	-	0.07	-	-	314	
		170	50	F	3	-	0.08	-	-	315	
		138	30	F	-	-	0.06	-	-	316	
		165	50	F	3	-	0.09	-	-	317	
		175	50	-	3	-	0.12	-	-	318	
		165	50	F	3	-	0.09	-	-	319	
		154	50	F	3	-	0.09	-	-	320	
		160	50	F	-	-	0.08	-	-	321	
		157	50	F	3	-	0.10	-	-	322	
		148	40	F	3	-	0.07	-	-	323	
		189	60	F	4	-	0.18	1091	-	324	
		148	50	-	-	-	0.12	-	-	325	
		153	50	M	3	-	0.08	1092	-	326	
Northern pike	Aug 9	485	625	M	7	1	0.07	1085	-	305	
		561	825	F	11	1	0.20	1086	-	306	
Lake whitefish	Aug 9	425	950	M	15	160	0.13	1093	-	327	
		458	1275	M	14	1	0.12	1094	-	328	
		423	875	F	10	1	0.24	-	-	329	
		456	1400	F	16	1	0.11	1095	-	330	

## Appendix 3.3 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no	
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)		
Lake whitefish	Aug 9	430	1150	F	11	160	0.09	-	-	-	331	
		421	925	M	12	1	0.27	-	-	-	332	
		390	700	M	12	2	0.09	-	-	-	333	
		360	550	M	8	2	0.09	1096	-	-	-	334
		423	1100	M	10	1	0.07	-	-	-	-	335
		421	975	M	15	121	0.16	-	-	-	-	336
		431	1025	F	10	1	0.23	-	-	-	-	337
		385	875	M	9	2	0.08	-	-	-	-	338
		405	900	F	11	121,170	0.21	-	-	-	-	339
		430	1200	F	12	1	0.09	-	-	-	-	340
		376	650	F	10	1	0.12	1097	-	-	-	341
		428	1025	M	17	2	0.12	-	-	-	-	342
		420	1050	F	14	2	0.12	-	-	-	-	343
		410	900	M	12	2	0.33	-	-	-	-	344
		384	725	M	10	2	0.12	-	-	-	-	345
		440	900	F	14	1	0.18	-	-	-	-	346
		365	600	F	7	121	0.06	1098	-	-	-	347
		224	100	M	4	1	0.12	-	-	-	-	348
		Lake trout	Aug 9	540	1225	F	-	32	0.20	1077	-	-
548	1975			F	-	1	0.10	1078	-	-	295	
Yellow perch	Aug 9	72	5	-	-	-	0.07	1215	-	-	859	
		74	5	-	-	-	0.06	1216	-	-	860	
		79	6	-	-	-	0.07	1217	-	-	861	
		68	4	-	-	-	0.07	1218	-	-	862	
		76	6	-	-	-	0.07	1219	-	-	863	
		84	7	-	-	-	0.06	1220	-	-	864	
		73	4	-	-	-	0.04	-	-	-	865	
		75	5	-	-	-	0.07	-	-	-	866	
		74	5	-	-	-	0.08	-	-	-	867	
Trout-perch	Aug 9	66	4	-	-	-	-	1221	-	-	868	
		76	4	-	-	-	-	1222	-	-	869	

Appendix 3.4. Raw data from the 1989 NOLSS fish survey of Musclove Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 2	412	700	M	9	1	0.35	1030	-	-	55
		431	800	M	12	20	0.40	-	-	-	56
		435	900	F	12	1	0.35	1031	-	-	57
		402	675	M	9	1	0.42	-	-	-	58
		375	550	M	8	1	0.44	1032	-	-	59
		413	600	M	10	20	0.49	-	-	-	60
		425	925	F	12	1	0.72	1033	-	-	61
		392	650	M	9	61,6	0.36	-	-	-	62
		412	625	M	7	1	0.80	-	-	-	63
		342	450	F	7	20	0.22	-	-	-	64
		345	425	-	7	20	0.25	-	-	-	65
		384	550	F	8	1	0.30	-	-	-	66
		359	450	-	6	20	0.28	-	-	-	67
		494	1025	M	18	61	1.11	1034	-	-	68
		355	400	-	8	1	0.32	-	-	-	69
		365	450	M	7	20	0.20	-	-	-	70
		332	375	-	6	181	0.25	-	-	-	71
		356	475	M	13	1	0.21	-	-	-	72
		369	500	M	7	20	0.32	-	-	-	73
		343	440	M	8	20	0.24	-	-	-	74
		346	350	M	8	1	0.29	-	-	-	75
		334	350	M	6	20	0.31	-	-	-	76
		318	300	M	5	1	0.53	-	-	-	77
		341	400	-	7	6	0.16	-	-	-	78
		335	375	M	10	-	0.32	1035	-	-	79
		305	300	-	-	-	-	-	-	-	80
		309	300	M	-	-	-	-	-	-	81
		304	290	-	-	-	-	-	-	-	82
		300	250	-	-	-	-	-	-	-	83
		275	225	-	-	-	-	-	-	-	84
		271	175	-	-	-	-	-	-	-	85
		258	160	-	-	-	-	-	-	-	86
		245	125	-	-	-	-	-	-	-	87
243	150	-	-	-	-	-	-	-	88		
275	200	-	-	-	-	-	-	-	89		
208	300	-	-	-	-	-	-	-	90		
243	150	-	-	-	-	-	-	-	91		
225	125	-	-	-	-	-	-	-	92		
185	60	-	-	-	-	-	-	-	93		
300	275	-	-	-	-	-	-	-	94		
230	100	-	-	-	-	-	-	-	95		
218	100	-	-	-	-	-	-	-	96		
White sucker	Aug 2	388	810	M	13	-	0.09	1011	-	-	22
		463	1325	F	15	-	0.13	1012	-	-	23
		421	1050	M	9	-	0.08	1013	-	-	24
		390	775	M	7	-	0.07	-	-	-	25
		426	1050	M	13	-	0.11	1014	-	-	26
		376	775	F	9	-	0.07	-	-	-	27
		363	725	F	7	-	0.06	-	-	-	28
		389	900	F	7	-	0.05	-	-	-	29
		365	640	M	7	-	0.07	-	-	-	30
		298	350	-	5	-	0.04	-	-	-	31
		311	500	M	7	-	0.05	-	-	-	32
		408	900	F	10	-	0.08	-	-	-	33
		360	600	F	8	-	0.08	-	-	-	34
		178	50	-	-	-	0.02	1015	-	-	35
		175	50	-	-	-	0.03	1016	-	-	36
170	50	-	3	-	0.02	-	-	-	37		

Appendix 3.4 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no	
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)		
Cisco	Aug 2	215	75	F	-	-	0.23	1005	-	-	1	
		185	55	F	-	-	-	0.15	1006	-	-	2
		171	50	F	-	-	-	0.07	-	-	-	3
		192	75	F	-	-	-	0.09	-	-	-	4
		178	50	F	-	-	-	0.06	-	-	-	5
		171	50	F	-	-	-	0.05	-	-	-	6
		175	50	F	-	-	-	0.08	-	-	-	7
		174	50	M	-	-	-	0.10	-	-	-	8
		161	50	M	-	-	-	0.08	-	-	-	9
		176	50	F	-	-	-	0.04	-	-	-	10
		169	50	F	-	-	-	0.07	-	-	-	11
		183	60	F	-	-	-	0.08	-	-	-	12
		183	60	F	-	-	-	0.09	-	-	-	13
		184	60	M	-	-	-	0.05	-	-	-	14
		195	75	F	-	-	-	0.07	-	-	-	15
		424	1350	M	11	-	-	0.15	1007	-	-	16
		369	700	F	14	-	-	0.12	1008	-	-	17
		325	625	M	10	-	-	0.06	1009	-	-	18
		179	50	M	-	-	-	0.06	1010	-	-	19
		183	60	F	-	-	-	0.08	-	-	-	20
		193	75	F	-	-	-	0.03	-	-	-	21
Northern pike	Aug 2	667	2000	F	11	32	0.54	1017	-	-	38	
		662	1900	F	10	1	0.64	1018	-	-	39	
		542	1100	F	8	1	0.30	-	-	-	40	
		704	2525	F	8	1	0.42	-	-	-	41	
		548	1150	M	6	1	0.50	-	-	-	42	
	Aug 3	496	925	M	8	1	0.30	1019	-	-	43	
		529	1000	M	13	1	0.26	1036	-	-	97	
		321	225	M	3	20	0.11	-	-	-	98	
		414	425	M	6	61	0.16	-	-	-	99	
		468	625	M	10	1	0.27	-	-	-	100	
		639	1600	F	-	1	0.57	1037	-	-	101	
		663	1550	F	-	1	0.70	-	-	-	102	
		490	800	M	-	61	0.15	-	-	-	103	
		508	825	F	-	1	0.24	-	-	-	104	
		381	350	F	-	20	0.27	1038	-	-	105	
721	2475	F	15	1	0.87	-	-	-	106			
Lake whitefish	Aug 2	475	1575	F	7	160	0.04	1020	-	-	44	
		555	2800	F	13	160	0.09	1021	-	-	45	
		534	2725	F	14	1	0.08	1022	-	-	46	
		343	525	M	5	1	0.03	1023	-	-	47	
Burbot	Aug 2	581	1425	M	13	1	0.27	1024	-	-	48	
		522	850	M	12	1	0.38	1025	-	-	49	
		600	1450	M	13	1	0.39	1026	-	-	50	
		512	1000	-	9	20	0.20	-	-	-	51	
		454	675	M	9	32	0.25	1027	-	-	52	
		530	1000	F	14	1	0.23	1028	-	-	53	
		290	150	-	5	1	0.08	1029	-	-	54	
Yellow perch	Aug 3	67	5	-	-	-	0.05	1184	-	-	759	
		66	4	-	-	-	0.05	1185	-	-	760	
		70	5	-	-	-	0.04	1186	-	-	761	
		78	7	-	-	-	0.07	1187	-	-	762	
		51	2	-	-	-	0.05	1188	-	-	763	
		43	1	-	-	-	0.03	1189	-	-	764	
		44	1	-	-	-	0.04	-	-	-	765	
		43	1	-	-	-	0.03	-	-	-	766	
43	1	-	-	-	0.02	-	-	-	767			

## Appendix 3.4 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes		Fish no	
								Lab no	C13/C12 (o/oo)		N15/N14 (o/oo)
Yellow perch	Aug 3	43	1	-	-	-	0.02	-	-	-	768
		43	1	-	-	-	0.02	-	-	-	769
		43	1	-	-	-	0.04	-	-	-	770
		43	1	-	-	-	0.02	-	-	-	771
		40	1	-	-	-	0.03	-	-	-	772
Log perch	Aug 3	83	6	-	-	-	-	1190	-	-	773

Appendix 3.5. Raw data from the 1989 NOLSS fish survey of Sydney Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no		
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)			
Walleye	Aug 18	574	2025	F	15	32	1.44	1105	-	-	426		
		630	2375	F	20	1	1.82	1106	-	-	427		
		618	2400	F	13	1	0.99	1107	-	-	428		
		405	725	M	9	1	0.46	1108	-	-	429		
		415	775	F	7	1	0.44	-	-	-	430		
		368	525	M	8	20	0.18	-	-	-	431		
		358	450	M	5	1	0.23	-	-	-	432		
		350	425	M	7	1	0.26	-	-	-	433		
		374	475	M	6	32	0.25	-	-	-	434		
		355	450	M	5	20	0.20	-	-	-	435		
		348	425	M	4	32	0.28	-	-	-	436		
		370	500	M	5	1	0.20	-	-	-	437		
		303	275	M	4	20	0.19	-	-	-	438		
		337	375	M	4	20	0.20	-	-	-	439		
		309	300	M	4	1	0.12	1109	-	-	440		
		317	300	-	4	1	0.22	-	-	-	441		
		304	275	M	6	1	0.22	-	-	-	442		
		306	275	M	6	1	0.13	-	-	-	443		
		296	300	M	6	32	0.23	-	-	-	444		
		287	240	M	5	1	0.16	-	-	-	445		
		285	250	-	4	1	0.18	-	-	-	446		
		266	175	M	3	1	0.20	1110	-	-	447		
		274	175	M	4	1	0.13	-	-	-	448		
		273	200	-	5	1	0.18	-	-	-	449		
		178	50	M	2	1	0.10	-	-	-	450		
		261	150	-	4	1	-	-	-	-	451		
		276	200	-	4	1	-	-	-	-	452		
		275	200	M	5	-	-	-	-	-	453		
		254	150	M	4	61	-	-	-	-	454		
		249	150	M	5	20	-	-	-	-	455		
		211	100	-	3	1	-	-	-	-	456		
		224	100	-	4	61	-	-	-	-	457		
		233	125	M	4	20	-	-	-	-	458		
		235	125	M	4	1	-	-	-	-	459		
		Walleye	Aug 19	413	1050	F	10	-	0.11	-	-	-	479
				408	1000	M	10	-	0.14	-	-	-	480
				514	1675	F	17	-	0.30	1124	-	-	481
				423	1000	F	10	-	0.11	-	-	-	482
				429	1129	M	13	-	0.16	-	-	-	487
				408	1000	M	12	-	0.16	-	-	-	488
				392	900	M	10	-	0.09	-	-	-	489
				421	1150	-	12	-	0.12	1125	-	-	490
				235	160	-	4	-	0.05	-	-	-	494
387	850			F	9	-	0.09	1126	-	-	495		
261	225			-	5	-	0.04	-	-	-	500		
217	150			-	3	-	0.03	-	-	-	502		
425	725			M	8	1	0.34	-	-	-	512		
441	900			M	8	1	0.35	-	-	-	513		
632	2575			F	17	20	0.67	-	-	-	514		
423	750			M	8	1	0.34	-	-	-	515		
432	850			M	7	1	0.27	-	-	-	516		
514	1375			F	10	32	0.38	-	-	-	517		
456	1200			M	12	1	0.46	-	-	-	518		
460	1100			M	11	1	0.70	-	-	-	519		
414	750	M	9	20	0.33	-	-	-	520				
433	800	F	8	1	0.30	-	-	-	521				
463	1100	F	7	2	0.35	-	-	-	522				
396	600	M	7	1	0.31	-	-	-	523				

Appendix 3.5. Raw data from the 1989 NOLSS fish survey of Sydney Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes		Fish no	
								Lab no	C13/C12 (o/oo)		N15/N14 (o/oo)
Walleye	Aug 19	426	875	M	8	1	0.29	-	-	-	524
		420	700	M	9	1	0.27	-	-	-	525
		421	775	F	8	2	0.32	-	-	-	526
		386	575	M	6	1	-	-	-	-	527
		396	650	M	5	1	-	-	-	-	528
		389	625	-	5	-	-	-	-	-	529
		383	550	F	7	1	-	-	-	-	530
		384	575	M	7	20	-	-	-	-	531
		382	575	M	8	1	-	-	-	-	532
		398	600	F	8	1	-	-	-	-	533
		355	450	M	7	1	-	-	-	-	534
		337	400	-	4	62	-	-	-	-	535
		347	475	F	4	1	-	-	-	-	536
		325	350	-	5	2	-	-	-	-	537
		346	375	M	4	32	-	-	-	-	538
		333	375	-	6	61	-	-	-	-	539
		322	325	-	7	1	-	-	-	-	540
		368	500	M	9	1	-	-	-	-	541
		368	500	M	4	1	-	-	-	-	542
		421	725	M	5	1	-	-	-	-	543
		374	550	M	4	1	-	-	-	-	544
		399	600	M	7	1	-	-	-	-	545
		314	325	M	3	20	-	-	-	-	546
		325	375	M	6	1	-	-	-	-	547
		391	525	F	9	1	-	-	-	-	548
		328	350	F	8	1	-	-	-	-	549
		221	125	M	6	20	-	-	-	-	550
		270	200	M	5	61	-	-	-	-	551
		249	150	-	5	61	-	-	-	-	552
		408	575	M	7	1	-	-	-	-	553
		185	75	M	4	61	-	-	-	-	554
		222	100	-	4	1	-	-	-	-	555
		284	225	-	5	1	-	-	-	-	556
		350	400	M	-	1	-	-	-	-	557
280	200	F	-	61	-	-	-	-	558		
322	350	M	-	1	-	-	-	-	559		
300	275	M	-	61	-	-	-	-	560		
331	300	-	-	1	-	-	-	-	561		
372	475	M	-	1	-	-	-	-	562		
342	400	F	-	20	-	-	-	-	563		
284	275	M	-	51	-	-	-	-	564		
294	300	M	-	20	-	-	-	-	565		
346	375	M	-	1	-	-	-	-	567		
302	300	M	-	1	-	-	-	-	575		
304	300	M	-	61	-	-	-	-	576		
2/8	200	M	-	61	-	-	-	-	577		
White sucker	Aug 18	436	1200	F	12	-	0.08	1123	-	-	478
		413	1050	F	10	-	0.11	-	-	-	479
		423	1000	F	10	-	0.11	-	-	-	482
		360	700	F	9	-	0.10	-	-	-	483
		442	1325	F	11	-	0.13	-	-	-	484
		424	1200	M	9	-	0.07	-	-	-	485
		428	1150	M	13	-	0.17	-	-	-	486
		429	1129	M	13	-	0.16	-	-	-	487
		408	1000	M	12	-	0.16	-	-	-	488
		392	900	M	10	-	0.09	-	-	-	489
		270	250	-	7	-	0.08	-	-	-	491
417	1050	M	12	-	0.14	-	-	-	492		

## Appendix 3.5 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no		
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)			
White sucker	Aug 18	266	240	M	7	-	0.07	-	-	-	493		
		488	1575	F	16	-	0.19	-	-	-	496		
		480	1450	F	14	-	0.28	1127	-	-	497		
		343	650	M	7	-	0.08	-	-	-	498		
		258	225	-	7	-	0.06	-	-	-	499		
		261	225	-	5	-	0.04	-	-	-	500		
		234	150	-	5	-	0.05	1128	-	-	501		
		185	75	-	-	-	-	-	-	-	503		
		318	300	M	-	61	-	-	-	-	566		
		331	400	M	-	32	-	-	-	-	568		
		330	390	F	-	32	-	-	-	-	569		
		305	275	-	-	20	-	-	-	-	570		
		323	350	M	-	1	-	-	-	-	571		
		328	350	M	-	1	-	-	-	-	572		
	230	125	-	-	61	-	-	-	-	573			
	293	250	M	-	61	-	-	-	-	574			
	265	200	F	-	1	-	-	-	-	578			
	194	75	-	-	1	-	-	-	-	579			
	248	225	-	5	61	-	-	-	-	580			
	220	200	-	-	-	-	-	-	-	581			
	Aug 19	495	1650	F	10	2	-	-	-	-	585		
		420	1125	M	10	-	-	-	-	-	586		
		425	1175	F	8	-	-	-	-	-	587		
		340	540	M	-	-	-	-	-	-	588		
		371	670	F	7	-	-	-	-	-	589		
		462	1475	F	10	-	-	-	-	-	590		
		349	525	-	7	-	-	-	-	-	591		
298		350	M	6	-	-	-	-	-	592			
168		75	-	3	-	-	-	-	-	593			
Cisco		Aug 18	296	375	F	10	1	0.14	1118	-	-	469	
			195	80	F	6	1	0.17	-	-	-	470	
			197	100	F	5	1	0.19	1119	-	-	471	
			180	70	M	4	1	0.16	-	-	-	472	
	183		70	M	5	1	0.18	-	-	-	473		
	177		70	F	4	1	0.11	-	-	-	474		
	170		70	F	4	1	0.06	1120	-	-	475		
	Aug 20	193	75	M	5	1	0.17	1121	-	-	476		
		77	210	-	-	-	0.05	1144	-	-	598		
		78	210	-	-	-	0.06	1145	-	-	599		
		Northern pike	Aug 18	737	3250	F	14	61,51	1.01	1113	-	-	462
				633	1725	F	10	181,20	0.81	1114	-	-	463
				626	1725	M	16	20	1.17	1115	-	-	464
695	2300			F	10	20	0.71	1116	-	-	465		
693	2600			M	17	20	0.95	1117	-	-	466		
699	2725			M	15	1	1.30	-	-	-	467		
654	2175			M	11	32	0.39	-	-	-	468		
Aug 20	469	700	M	7	1	0.18	1146	-	-	600			
Lake whitefish	Aug 19	345	525	M	6	1	0.07	1122	-	-	477		
		235	160	F	6	1	0.06	1137	-	-	582		
		303	300	M	9	1	0.07	1138	-	-	583		
		295	260	F	6	2	0.06	1139	-	-	584		
Burbot	Aug 18	662	1725	M	15	181,32	0.70	1129	-	-	504		
		703	2360	M	18	1	0.50	1130	-	-	505		
	Aug 19	487	700	M	8	1	0.33	1140	-	-	594		
		469	700	M	9	181	0.27	1141	-	-	595		
		262	150	M	4	61	0.08	1142	-	-	596		
		240	100	-	4	1	0.10	1143	-	-	597		

## Appendix 3.5 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Lake trout	Aug 18	572	1925	M	-	61	0.49	1111	-	-	460
		521	1600	M	-	32	0.37	1112	-	-	461
Yellow perch	Aug 18	227	150	-	6	1	0.23	1131	-	-	506
		215	125	M	5	1	0.36	1132	-	-	507
		208	140	F	5	2	0.21	1133	-	-	508
		153	50	F	3	1	0.13	1134	-	-	509
		150	50	F	2	1	0.12	1135	-	-	510
		145	50	-	5	1	0.09	1136	-	-	511
		76	6	-	-	-	0.05	1226	-	-	873
		71	4	-	-	-	0.06	1227	-	-	874
		71	4	-	-	-	0.05	1228	-	-	875
		75	5	-	-	-	0.05	1229	-	-	876
		76	5	-	-	-	0.05	1230	-	-	877
		74	5	-	-	-	0.05	1231	-	-	878
		80	5	-	-	-	0.06	-	-	-	879
		86	9	-	-	-	0.04	-	-	-	880
		71	5	-	-	-	0.05	-	-	-	881
105	21	-	-	-	0.07	-	-	-	882		
143	42	-	-	-	0.13	-	-	-	883		
Spottail shiner	Aug 18	76	6	-	-	-	-	1232	-	-	884

Appendix 3.6. Raw data from the 1989 NOLSS fish survey of Trout Lake.

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Walleye	Aug 21	512	1550	M	13	1	0.73	-	-	-	601
	Aug 22	593	2550	F	16	1	0.64	1155	-	-	611
		581	2025	F	15	1	0.55	1156	-	-	612
	472	1225	F	7	20	0.23	1157	-	-	613	
	442	975	M	5	32	0.28	1158	-	-	614	
	463	1050	M	7	2	0.22	-	-	-	615	
	514	1350	F	11	2	0.44	-	-	-	616	
	553	1840	F	13	1	0.64	-	-	-	617	
	365	500	-	5	20	0.16	-	-	-	618	
	475	1125	M	10	1	0.32	-	-	-	619	
	448	1025	M	15	1	0.56	-	-	-	620	
	465	1175	M	11	20	0.66	-	-	-	621	
	488	1360	F	10	1	0.45	-	-	-	622	
	476	1060	M	8	20	0.53	-	-	-	623	
	505	1450	F	9	1	0.36	-	-	-	624	
	532	1725	F	10	32	0.36	-	-	-	625	
	312	300	M	5	20	0.17	1159	-	-	626	
	321	400	-	5	61	0.12	-	-	-	627	
	445	925	F	8	1	0.26	-	-	-	628	
	481	1200	F	8	1	0.22	-	-	-	629	
	334	375	M	5	20	0.17	1160	-	-	630	
	458	1125	M	12	1	0.39	-	-	-	631	
	470	1225	M	12	1	0.41	-	-	-	632	
	486	1400	M	12	32	0.49	-	-	-	633	
	416	750	M	7	20	0.21	-	-	-	634	
	434	875	M	7	1	0.20	-	-	-	635	
	395	675	-	7	1	0.19	1161	-	-	636	
	471	1200	F	7	1	0.30	-	-	-	637	
	352	425	M	5	1	0.19	-	-	-	638	
	330	325	-	4	20	0.15	-	-	-	639	
	331	390	-	4	1	0.16	-	-	-	640	
	326	325	M	4	32	-	-	-	-	641	
	328	350	-	4	20	-	-	-	-	642	
	315	325	-	4	1	-	-	-	-	643	
	311	300	M	4	1	-	-	-	-	644	
	323	325	-	4	1	-	-	-	-	645	
	288	225	-	3	20	-	-	-	-	646	
	281	200	-	3	51	-	-	-	-	647	
	323	350	M	4	20	-	-	-	-	648	
	327	325	M	4	51	-	-	-	-	649	
304	300	M	3	1	-	-	-	-	650		
270	170	-	3	20	-	-	-	-	651		
232	150	-	3	1	-	-	-	-	652		
Aug 23	470	1000	F	6	1	-	-	-	-	714	
White sucker	Aug 22	404	950	M	8	-	0.06	1162	-	-	653
		416	1075	M	9	-	0.07	1163	-	-	654
		304	375	M	4	-	0.03	1164	-	-	655
		459	1250	M	15	-	0.16	1165	-	-	656
		490	1675	M	15	-	0.17	1166	-	-	657
		312	350	M	5	-	0.03	-	-	-	658
		312	400	F	5	-	0.03	1167	-	-	659
		302	350	F	5	-	0.04	-	-	-	660
		469	1450	F	14	-	0.15	-	-	-	661
		456	1375	F	12	-	0.15	-	-	-	662
		423	1000	F	9	-	0.07	-	-	-	663
		445	1400	M	16	-	0.16	-	-	-	664
		372	760	M	6	-	0.05	-	-	-	665
		380	900	F	10	-	0.10	-	-	-	666

## Appendix 3.6 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no	
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)		
White sucker	Aug 22	361	700	M	6	-	0.04	-	-	-	667	
		348	550	-	7	-	-	0.06	-	-	-	668
		314	400	-	5	-	-	0.04	-	-	-	669
		333	525	-	6	-	-	0.04	-	-	-	670
		331	500	-	6	-	-	0.04	-	-	-	671
		341	510	F	6	-	-	0.05	-	-	-	672
		364	660	M	6	-	-	0.04	-	-	-	673
		306	350	M	5	-	-	0.03	-	-	-	674
		302	425	F	5	-	-	0.04	-	-	-	675
		299	350	M	4	-	-	0.03	-	-	-	676
		270	275	-	5	-	-	0.04	-	-	-	677
		300	350	-	-	-	-	-	-	-	-	678
		286	325	-	-	-	-	-	-	-	-	679
		270	300	-	-	-	-	-	-	-	-	680
		275	275	-	-	-	-	-	-	-	-	681
		305	400	-	-	-	-	-	-	-	-	682
		246	200	-	-	-	-	-	-	-	-	683
		286	350	-	-	-	-	-	-	-	-	684
		299	350	-	-	-	-	-	-	-	-	685
		304	360	-	-	-	-	-	-	-	-	686
		301	375	-	-	-	-	-	-	-	-	687
		291	325	-	-	-	-	-	-	-	-	688
		274	280	-	-	-	-	-	-	-	-	689
		266	230	-	-	-	-	-	-	-	-	690
		297	350	-	-	-	-	-	-	-	-	691
		222	150	-	-	-	-	-	-	-	-	692
		295	225	-	-	-	-	-	-	-	-	693
		273	230	-	-	-	-	-	-	-	-	694
		214	125	-	-	-	-	-	-	-	-	695
		193	100	-	-	-	-	-	-	-	-	696
		319	400	-	-	-	-	-	-	-	-	697
		198	90	-	-	-	-	-	-	-	-	698
		224	125	-	-	-	-	-	-	-	-	699
		275	300	-	-	-	-	-	-	-	-	700
		220	130	-	-	-	-	-	-	-	-	701
		277	310	-	-	-	-	-	-	-	-	702
		305	300	-	-	-	-	-	-	-	-	703
249	225	-	-	-	-	-	-	-	-	704		
245	175	-	-	-	-	-	-	-	-	705		
239	200	-	-	-	-	-	-	-	-	706		
234	200	-	-	-	-	-	-	-	-	707		
265	200	-	-	-	-	-	-	-	-	708		
237	150	-	-	-	-	-	-	-	-	709		
Cisco	Aug 22	207	50	F	5	2	0.16	1147	-	-	602	
		211	60	F	6	1	0.09	1148	-	-	603	
		186	50	F	4	-	-	0.06	1149	-	-	604
		180	70	M	3	-	-	0.04	1150	-	-	605
		183	50	F	3	1	1	0.08	1151	-	-	606
Northern pike	Aug 22	664	2250	M	11	1	0.41	1154	-	-	610	
	Aug 23	684	2450	F	14	1	0.46	1183	-	-	758	
Lake whitefish	Aug 22	204	125	-	3	110	0.03	1152	-	-	607	
	Aug 23	387	600	M	13	121	0.17	1168	-	-	710	
	433	825	M	12	1	1	0.17	1169	-	-	711	
	492	1575	F	15	1	1	0.11	1170	-	-	712	
	174	30	-	2	121	0.09	1171	-	-	713		
Burbot	Aug 23	638	1150	M	17	181	0.78	-	-	-	608	
		430	500	M	8	1	0.19	-	-	-	733	

## Appendix 3.6 (cont'd).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes			Fish no
								Lab no	C13/C12 (o/oo)	N15/N14 (o/oo)	
Burbot	Aug 23	532	1100	F	10	20	0.29	1177	-	-	734
		454	590	F	8	1	0.22	-	-	-	735
		411	425	F	9	1	0.21	-	-	-	736
		425	350	F	7	181	0.46	-	-	-	737
		433	490	F	9	20	0.28	1178	-	-	738
		370	290	M	7	2	0.14	1179	-	-	739
		364	310	-	6	1	0.17	-	-	-	740
		470	850	M	13	32	0.23	1180	-	-	741
		483	760	F	10	1	0.24	-	-	-	742
		469	700	M	10	1	0.24	-	-	-	743
		310	175	M	6	1	0.14	-	-	-	744
		362	350	F	7	20	0.15	-	-	-	745
		406	425	F	-	1	0.14	-	-	-	746
		544	1100	F	14	1	0.35	1181	-	-	747
		520	775	M	16	1	0.38	-	-	-	748
		419	475	M	8	32	0.23	-	-	-	749
		360	290	M	8	1	0.24	-	-	-	750
		485	550	M	16	1	0.41	-	-	-	751
		540	900	M	16	1	0.39	-	-	-	752
		452	475	M	12	181	0.39	-	-	-	753
		304	200	M	6	2	0.11	1182	-	-	754
		520	800	F	12	1	0.33	-	-	-	755
		586	1410	F	15	32	0.20	-	-	-	756
		680	1950	F	15	1	0.47	-	-	-	757
		Longnose sucker	Aug 22	174	50	-	3	2	0.02	1153	-
Aug 23	307		450	M	8	-	0.05	-	-	-	715
	360		750	M	11	-	0.11	-	-	-	716
	276		290	-	6	-	0.05	-	-	-	717
	348		575	M	9	-	0.07	-	-	-	718
	336		550	M	8	-	0.06	-	-	-	719
	357		660	M	8	-	0.07	-	-	-	720
	344		550	M	6	-	0.05	-	-	-	721
	310		425	M	7	-	0.05	-	-	-	722
	365		750	M	8	-	0.05	1172	-	-	723
	301		400	M	8	-	0.07	1173	-	-	724
	321		460	M	7	-	0.07	1174	-	-	725
	293		330	M	7	-	0.05	-	-	-	726
	321		425	M	7	-	0.05	-	-	-	727
	226		125	-	4	-	0.03	1175	-	-	728
	299		340	M	6	-	0.06	-	-	-	729
	265		260	-	7	-	0.06	1176	-	-	730
204	50	-	3	-	0.02	-	-	-	731		
272	300	M	7	-	0.06	-	-	-	732		
Yellow perch	Aug 22	84	6	-	-	-	0.02	1233	-	-	885
		82	6	-	-	-	0.03	1234	-	-	886
		81	6	-	-	-	0.03	1235	-	-	887
		81	5	-	-	-	0.03	1236	-	-	888
		80	6	-	-	-	0.07	1237	-	-	889
		79	5	-	-	-	0.03	1238	-	-	890
		78	5	-	-	-	0.03	-	-	-	891
		83	5	-	-	-	0.03	-	-	-	892
		87	7	-	-	-	0.04	-	-	-	893
		83	6	-	-	-	0.03	-	-	-	894
		74	6	-	-	-	0.04	-	-	-	895
		74	5	-	-	-	0.04	-	-	-	896
		82	6	-	-	-	0.02	-	-	-	897
		85	8	-	-	-	0.05	-	-	-	898
78	6	-	-	-	0.02	-	-	-	899		

## Appendix 3.6 (concluded).

Fish species	Date	Fork length (mm)	Round weight (g)	Sex	Age (yr)	Stomach contents (code)	Muscle [Hg] ( $\mu\text{g/g}$ )	Stable isotopes		Fish no
								Lab no	C13/C12 (o/oo)	
Yellow perch	Aug 22	78	5	-	-	-	0.03	-	-	900
		76	5	-	-	-	0.04	-	-	901
		77	6	-	-	-	0.03	-	-	902
		81	6	-	-	-	0.08	-	-	903
		86	6	-	-	-	0.07	-	-	904
		88	7	-	-	-	0.03	-	-	905
		85	7	-	-	-	0.03	-	-	906
		83	7	-	-	-	0.03	-	-	907
		99	10	-	-	-	0.05	-	-	908
Trout-perch	Aug 22	75	5	-	-	-	-	1245	-	915
		75	6	-	-	-	-	1246	-	916
		80	5	-	-	-	-	1247	-	917
		74	5	-	-	-	-	1248	-	918
		77	6	-	-	-	-	1249	-	919
		80	6	-	-	-	-	1250	-	920
		72	5	-	-	-	-	-	-	921
		79	7	-	-	-	-	-	-	922
		66	4	-	-	-	-	-	-	923
		78	6	-	-	-	-	-	-	924
		71	5	-	-	-	-	-	-	925
		71	5	-	-	-	-	-	-	926
		72	5	-	-	-	-	-	-	927
		Spottail shiner	Aug 22	76	5	-	-	-	-	1251
76	5			-	-	-	-	1252	-	929
86	7			-	-	-	-	1253	-	930
82	7			-	-	-	-	1254	-	931
86	8			-	-	-	-	1255	-	932
82	6			-	-	-	-	1256	-	933
84	7			-	-	-	-	-	-	934
85	9			-	-	-	-	-	-	935
84	8			-	-	-	-	-	-	936
75	5			-	-	-	-	-	-	937
75	5			-	-	-	-	-	-	938
82	6			-	-	-	-	-	-	939
79	6			-	-	-	-	-	-	940
77	6			-	-	-	-	-	-	941
77	7			-	-	-	-	-	-	942
84	7			-	-	-	-	-	-	943
75	6	-	-	-	-	-	-	944		
74	6	-	-	-	-	-	-	945		
Log perch	Aug 22	89	7	-	-	-	-	1239	-	909
		93	9	-	-	-	-	1240	-	910
		86	7	-	-	-	-	1241	-	911
		90	7	-	-	-	-	1242	-	912
		87	7	-	-	-	-	1243	-	913
94	7	-	-	-	-	1244	-	914		
Lake chub	Aug 22	86	7	-	-	-	-	1257	-	946
		87	8	-	-	-	-	1258	-	947
		81	6	-	-	-	-	1259	-	948

Appendix 4. Key to numerical codes for stomach contents of fish caught in NOLSS study.

Miscellaneous		Fish		Invertebrates	
Code	Stomach contents	Code	Stomach contents	Code	Stomach contents
1	Empty	20	Fish remains	100	Invertebrate remains
2	Unidentifiable remains	30	Coregonidae	110	Ephemeroptera
3	Spruce needles	31	Lake whitefish	111	<i>Hexagenia sp.</i>
4	Rock / gravel	32	Cisco	120	Diptera
5	Detritus	40	Catostomidae	121	Chironomidae
6	Macrophytes	41	White sucker	130	Trichoptera
10	Miscellaneous	50	Gasterosteidae	140	Amphipoda
200	Amphibia	51	Ninespine stickleback	141	<i>Pontoporeia sp.</i>
210	Frog	52	Brook stickleback	150	Mysidacea
		60	Percidae	151	<i>Mysis relicta</i>
		61	Yellow perch	160	Gastropoda
		62	Log perch	170	Pelecypoda
		70	Percopsidae	180	Decapoda
		71	Trout-perch	181	<i>Orconectes virilis</i>
		80	Cottidae		
		90	Fish eggs		

Appendix 5. Number of fish from each NOLSS lake that were frozen and archived over the period 1987-89.

Species	Green	Orange	Linge	Musclow	Sydney	Trout	Total
Northern pike	11	16	4	8	5	7	51
Walleye	-	91	27	43	32	30	223
Lake trout	-	-	1	-	19	7	27
Lake whitefish	-	-	26	7	44	24	101
White sucker	17	2	21	16	4	23	83
Longnose sucker	-	-	-	-	-	3	3
Burbot	-	-	-	5	5	9	19
Cisco	22	59	27	28	96	25	257
Total	50	168	106	107	205	128	764