# Fall Littoral Index Netting Report for Trout Lake (Burpee Township) 1998

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January, 1999

**Executive Summary:** Lake trout population status on Trout Lake was assessed during the fall of 1998. Thirty, short duration, fine mesh, gill net sets were made according to the Ministry's "Spring Littoral Index Netting" (SLIN) protocol. The 'timing deviation' from the prescribed protocol is discussed in the report. A total of 146 lake trout were caught for a Catch-Per-Unit-Effort (CUE) of 4.87 ± 1.55 lake trout per net set ($P > 0.05$). Relative to other lake trout lakes in the Parry Sound Area and the Province of Ontario, this CUE is among the highest yet recorded and is certainly indicative of a remarkably high abundance of lake trout. Lake trout were widely distributed throughout the lake with a *probability of capture* (nets containing at least one lake trout) of 93%. Mean size of lake trout sampled was: 48.3 ± 1.58 cm ($P > .05$) total length; 43.7 ± 1.49 cm. fork length; and round weight 1002 ± 110 grams. CUE and size class structure of the lake trout catch indicate excellent levels of reproduction and recruitment to the population. The *condition* (length-weight relationship) of lake trout sampled was slightly below the provincial average. This is probably attributable to heavy planktiverous feeding by this population and / or considerable intraspecific (between lake trout) competition. Although inconclusive, sexual maturation appears to be considerably delayed in this population.

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# 1.0 Introduction

Trout Lake is a medium size (290 hectares or 716 acres) lake situated approximately 35 kilometers north of Parry Sound in Burpee Township. The lake has a maximum depth of 40 m., a mean depth of 12 m. (BAR, 1987) and a littoral zone (light penetration to bottom) of 41% of lake bottom (OMNR, 1972). Total catchment area is approximately 1900 hectares (BAR, 1987). The water has high transparency with a secchi reading of 5.5 meters (1998).

From 1982 to '86, the lake was part of an Experimental Lake Neutralization Study (BAR, 1987). This involved intensive monitoring of the chemical, physical and biological aspects of the aquatic ecosystem before and after the neutralization treatment of 147 tonnes of calcite applied in May of 1984 (BAR, 1987). After treatment, the pH rose from 5.8 to 6.6 and alkalinity increased fourfold from 1 to 4 mg/L. The fish community was intensively monitored for two years following treatment. Only minor changes in abundance or community composition were apparent and all changes could be attributed to normal annual variation.

The native fish community is comprised of 16 species including: lake trout (Salvelinus namaycush), cisco (*Coregonus artedii*), common white sucker (*Catostomus commersoni*), smallmouth bass (*Micropterus dolomieui*), yellow perch (*Perca Flavescens*), central mudminnow (*Umbra limi*), northern red-belly dace (*Phosinus eos*), golden shiner (*Notemigonus crysoleucas*), common shiner (*Notropis cornutus*), blacknose shiner (*Notropis hetserolepis*), bluntnose minnow (*Pimephales notatus*), creek chub (*Semotilus atromaculatus*), brown bullhead (Ictalurus nebulosus), brook stickleback (*Culaea inconstans*), pumpkinseed (*Leponis gibbosus*) and Iowa darter (*Etheostoma exile*) (BAR, 1987). The lake was stocked with a total of approximately 22,000 yearling lake trout from 1970 to 1974. No further stockings have occurred since.

There are eight recreation camps / cottages on the lake. These are accessed by float plane or by a crude system of ATV / snowmobile trails that originate along the Hydro corridor to the east of the lake. There is also a portage route from the Shawanaga River at the south end of the lake.

In 1972 an Aquatic Habitat Inventory (Lake) Survey was conducted by the Ministry of Natural Resources. In 1982 the lake was closed to winter fishing in an effort to "reduce the harvest of lake trout during (this ) vulnerable seasons and re-build the native population …" (Thurston; no date).

# 2.0 Methods

With one key exception, sampling design was according to the "Field Manual For Spring Littoral Index Netting (SLIN) Surveys" (McKay, 1995), FAU update 94-2 (OMNR, 1994) and subsequent revisions (Lester, 1995). The key deviation from the above methodology was that our survey was conducted during the fall period (Oct. 26-29$^{th}$) as opposed to the prescribed spring period - immediately after ice out and prior to surface temperatures warming to 13 °Celsius. This deviation was due to accommodation and manpower considerations as well as a pressing need to assess the status of lake trout populations in many Parry Sound Area lakes. Unfortunately, the short *window of opportunity* for conducting SLIN surveys in the spring has severely limited the number of lakes (usually two) that can be surveyed in any particular year.



SLIN surveys are intended to be conducted when the lake trout populations is most randomly distributed thought the lake. Fall surveys - especially those conducted during the spawning period, may severely

compromise this precondition by artificially increasing catches of lake trout for nets set in the vicinity of spawning sites. Consequently, an inflated *Index of Relative Abundance* (i.e. the Catch-Per-Unit-Effort) would lead to the impression of a greater abundance of lake trout than is actually the case. This bias did not appear evident in our data and is further discussed in the report (Section 4.1).

Where possible, nets were set perpendicular to shore and with an orientation as depicted in Figure 1. The 'near-shore' end of the net was generally set in approximately 2.4 metres (8') of water and extending offshore into waters less than 30 metres of depth (Appendix A).

Netting sites were randomly selected. The shoreline of Trout Lake was sectioned into 100 meter lengths and numbered ( 1 - 251). (Shoreline which comprised weedy back bays, river mouths and that which was in close proximity to other numbered shoreline was deleted from prospective shoreline to be netted. See Appendix E for these areas.) Thirty prospective netting sites and 10 alternate sites were then selected from a table of random numbers.

For logistical convenience, netting sites were clustered such that the netting crew worked in a general vicinity of the lake on any particular day (Appendix A). A minimum distance of 400 metres was always maintained between nets which were actively fishing to eliminate competition between nets.

Complete catch enumeration was conducted for all sets (Appendix B). Standard biosampling (total and fork lengths, weight, sex and condition) was conducted for all fish caught, with the exception of common white suckers for which only round weights were recorded (Appendix C & D).

Access to the lake was via float plane.

# 3.0 Results

## 3.1 Catch and Relative Abundance Indices:

A total of 146 lake trout, 5 smallmouth bass, 5 common white suckers and 1 cisco were caught in 30 gill net sets during the survey (Appendix B). Biomass of lake trout caught was 137.4 kg.; smallmouth bass - 5.0 kg.; common white sucker - 5.8 kg. and cisco - 50 grams, for a total catch biomass of 148.2 kilograms (Appendix C & D).

The catch-per-unit-effort (CUE) by number for lake trout was a remarkable $4.87 \pm 1.55$ ($P > 0.05$) trout caught per net set. Lake trout dominated the catch, accounting for 93% of all fish caught by number, and likewise 93% of the catch by weight.

The 'probability of capture' (percentage of nets that caught any number of lake trout) was a remarkable 93% (28 of 30 sets - Appendix B).



## 3.2 Biosampling Data:

Mean size of lake trout was: 1002 grams ± 110 (P > .05) round weight; 48.3 cm. ± 1.58 (P > .05) total length and 43.7 cm. ± 1.47 (P > .05) fork length (N = 137) (Appendix C). All lake trout were of natural origin.

Sampling mortality was 10.9% (16 lake trout). Most of these fish were relatively small in size - averaging 490 grams. Consequently, they were more susceptible to being 'gilled' as opposed to the intended 'being caught by the teeth' in the fine mesh gill nets. For those fish with discernible contents in their stomach, 7 contained aquatic invertebrates and/or plankton; 3 contained fish remains of which cisco and yellow perch could be identified.

Biosampling data for other species caught is provided in Appendix D.

# 4.0 Discussion

## 4.1 Abundance Index (CUE) for Lake Trout:

Reference values to indicate lake trout population status have not yet been defined for Ontario lake trout lakes (Lester, pers. comm.). Nonetheless, sufficient data is available within Parry Sound District and elsewhere in the Province to give a good indication of the relative abundance of lake trout in Trout Lake (Figure 2).

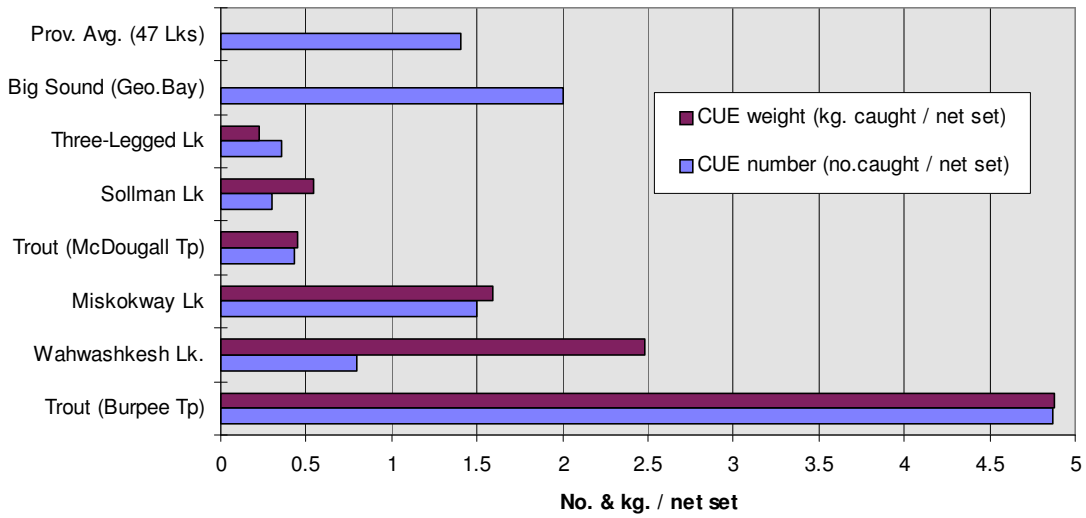
Provincial CUE (number) data from 47 lake trout lakes throughout the Province has a mean CUE of 1.4 (Powell, pers. comm.). CUE values range from a low of 0.28 (Twelve Mile Lake - Bancroft area) to a high of 3.85 (Louisa Lake - Algonquin Park). Such values can approximately be viewed as representing the "best" - 3.85; the "worst" - 0.28; and 1.4 - as "average" abundance of lake trout.

The "Big Sound" (a.k.a. Parry Sound) adjacent to the Town of parry Sound has a high quality, premier lake trout fishery with which most Parry Sound area fishermen are quite familiar. SLIN netting conducted on the Big Sound during the spring of 1997 resulted in a CUE of approximately 2.0 (Andersen, pers. comm.). Certainly, a CUE of this magnitude is indicative of a high quality lake trout fishery with high population abundance.

When compared with the lakes in the Provincial data set as well as those in the Parry Sound area for which similar SLIN projects have been conducted (Figure 2), Trout Lake remarkably exceeds all of them in CUE values for both number and weight. Even recognizing some inconsistencies with respect to methodology, undoubtedly the abundance of lake trout in Trout lake is quite remarkable - even on a Provincial scale.



**Figure 2. Comparison of Lake Trout Relative abundance Index (Catch-Per-Unit-Effort data for both number and weight / net set) for lakes surveyed by SLIN netting protocol in the Parry Sound Area and the Provincial average.**




Also remarkable, was the wide dispersion of lake trout throughout Trout Lake. All but two of our net sets caught lake trout for a *'probability of capture'* of 93%. The previously 'high' lake in the parry Sound area was Miskokway - with a *probability of capture* of 77% (McIntyre, 1998).

Understandably, we were quite concerned with possible biases being introduced into the catch data because we were conducting the survey during the lake trout spawning period. The bias being that adult spawning lake trout would be concentrated around spawning sites resulting in high catches in those sets which just happened to be set in the vicinity. This did not appear evident in the catch data however. Quite surprisingly, we could determine spawning condition (ripe, green or spent) for only 21 of the 137 lake trout sampled (Appendix C). Of these fish, only 12 (57%) were captured in the 15 net sets that were located within 500 metres of a known spawning site (Figure 1).

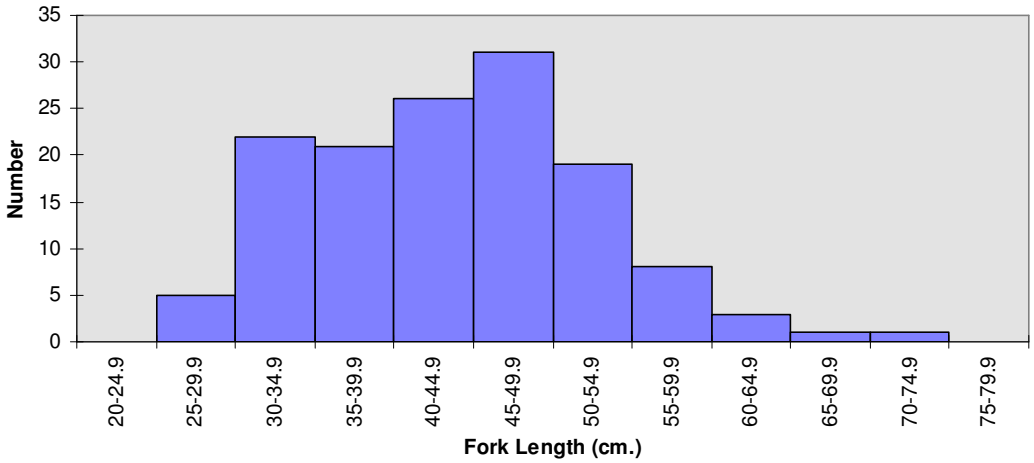
## 4.2 Lake trout Biosampling Implications:

### 4.2.1 Size Class Distribution:

We categorized sampled lake trout into 5 cm. size class bins and observed a relatively even distribution of size classes from 30 to 54.9 centimeters (Figure 3). We interpret the significance of this as representing strong and consistent year class recruitment. (Fish less than 30 cm. fork length are probably not fully vulnerable to the gear and are consequently under-represented in the catch.) Mortality appeared to increase greatly for lake trout in excess of 55 cm. fork length.

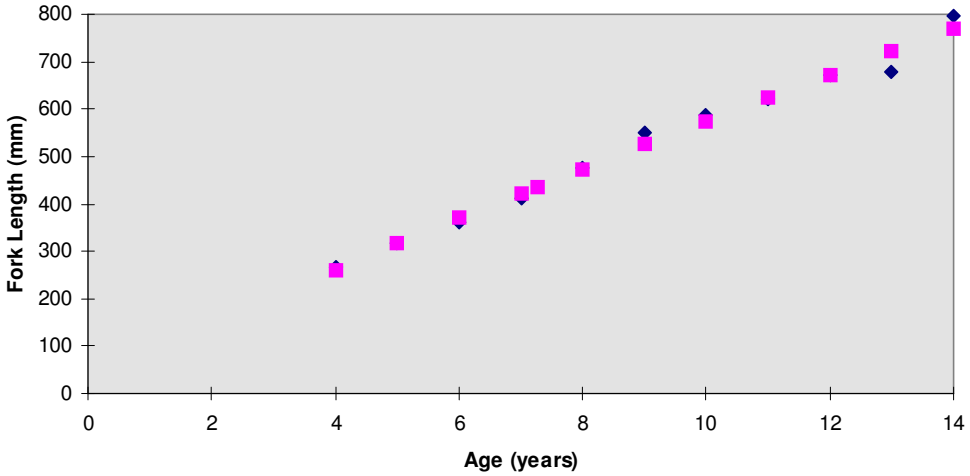


**Figure 3. Size class distribution for lake trout sampled from Trout Lake (Burpee Twp.) during the 1998, fall littoral index netting survey.**




We used seasonal (fall), age-specific fork length data from the lake neutralization study conducted on Trout Lake in the 1980s (BAR, 1987) to calculate a growth equation (Appendix F). A bivariate curve fitting program was used to generate a power curve defined by the equation: Fork Length = 79.36 $(age)^{0.86}$ (r = .996) (Figure 4).

**Figure 4. Lake trout growth curve.** (From BAR, 1987)




Boxes represent theoretical length at age from calculated growth equation based on 'age specific fork lengths' (indicated by triangles) presented by BAR, 1987. (Also see Appendix F.)



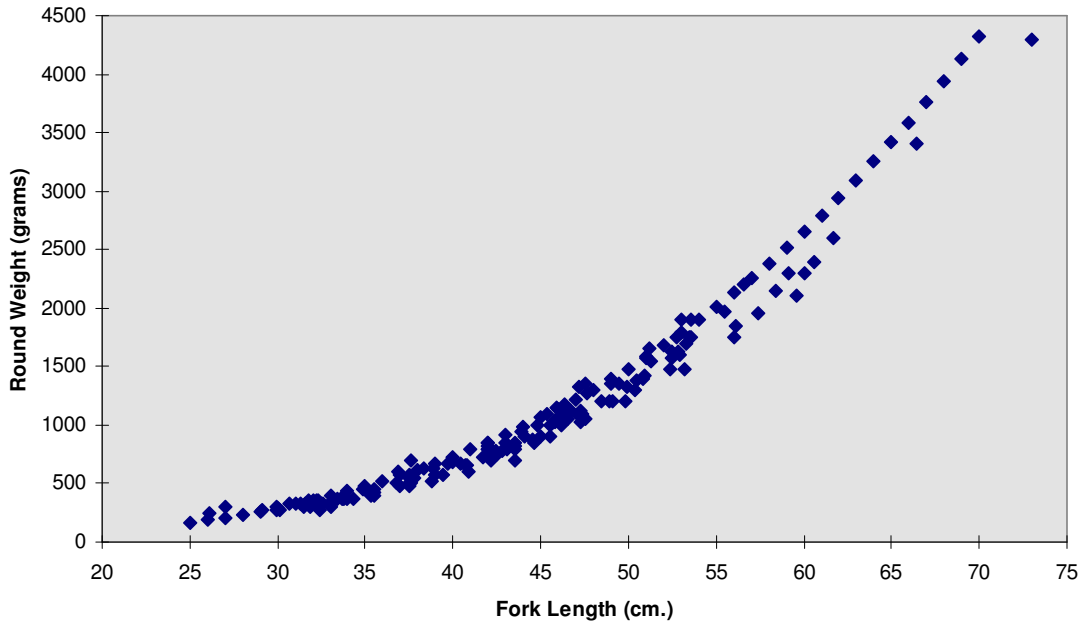
Assuming that the growth rate of lake trout has not changes substantially since the 1980s, the mean size of lake trout sampled in 1998 (mean fork length = 437 mm; from Appendix C) would have a calculated age 7.26 years.

### 4.2.2 Condition (Length-Weight Relationship)

The relationship between weight and length reflects the state of well-being of individual fish in a population (Payne et al. 1990). The condition of a fish is dependent both on genetic factors and nutrition (Lester et al. 1991). If the amount (or quality) of food decreases, so will condition. This is reflected in a lower weight of fish relative to its length. Likewise, if food abundance increases so will condition. Therefor, changes in lake trout condition can be expected to change in direct response to population abundance which regulates intraspecific (between lake trout) competition for food.

Payne, et al (1990) used data from 23 Ontario lakes to develop the following weight-length standard for Ontario trout lakes: Wt (grams) = 3.88 x $10^{-6}$ Fork Length (mm.)$^{3.18}$. This relationship is shown as a solid line in Figure 3. Samples from Trout Lake predominantly cluster slightly below this line, indicating that these fish have a lower weight at length than the 'Ontario average', and hence are in slightly poorer condition. This slightly poorer condition may be a symptom of intense intraspecific (between lake trout) competition and / or planktiverous feeding habits which results in slower growth and less 'robust' fish. It is surprising and atypical that we only caught one cisco in this survey. This schooling and typically small forage fish species is often found in large abundance. Its scarcity may represent intense predation by lake trout.

**Figure 3. Trout Lake - lake trout fork length-weight relationship from 1998 FLIN project.**




The solid line represents the 'Provincial average' - length-weight relationship which is defined by the equation: $y = 3.88 \times 10^{-6} ( x^{3.18})$ (from Payne et al. 1990). Other data points represent individual lake trout sampled from Trout Lake in 1998.



Of the dead fish that were internally sampled, 10 contained aquatic invertebrates and/or zooplankton, 3 contained fish remains and three were empty (Appendix C). Trout lake has a rich and varied fauna of zooplankton (BAR, 1987). However, we believed that the freshwater shrimp - *Mysis relicta*, was the predominant zooplankton species found in the lake trout that we internally sampled. Planktiverous feeding

lake trout are known to be slower growing than pisciverous feeding lake trout. This may also contribute to the below average condition observed in this population.

### 4.2.3 Sexual Maturity:

Our netting activities took place from October 26th - 29th. We anticipated that we would be in the middle or near the end of the lake trout spawning run. We expected that a large majority of mature males would be in *'ripe'* (milt readily flowing with abdominal pressure) condition and that sexual condition amongst females would vary from '*green*' (distended with eggs but not flowing), to '*ripe*', to '*spent*' (abdomens flaccid; eggs have been extruded).

We were able to ascertain sexual condition for only six mature females - with five being *green* and one *spent* (Appendix C). We did not see any lake trout eggs during the course of the survey. Also, we only encountered 15 sexually mature males that were in spawning (*ripe*) conditions. We were perplexed that it appeared that the spawning run hadn't even started yet - at a time when we expected that it would be nearing completion. We wondered if the 'warmest year on record' (Environment Canada) may have delayed lake trout spawning activities in 1998. Certainly the surface water temperatures of 11 and 12 °C. that we recorded (Appendix A) were much warmer than is normal.

Very surprising, was the low frequency of reproductively active (mature) lake trout in the catch. Only 21 of 137 fish sampled (15%) were assessed as being sexually mature based on the extrusion of milt or eggs or obviously distended abdominal areas indicating *green* females. Those fish whose sexual condition was assessed as '*No gametes'* present, were presumed to be *immature* or possibly small *green* females carrying very few eggs. Many of these *"No gametes"* lake trout were quite large such that one would have expected them to be mature and in spawning condition. Although it is possible that the spawning run was over or nearing completion and we were looking at many spent fish, this is highly unlikely. Five 5 of the 6 conclusively mature females we sampled were green suggesting the run had yet occur.

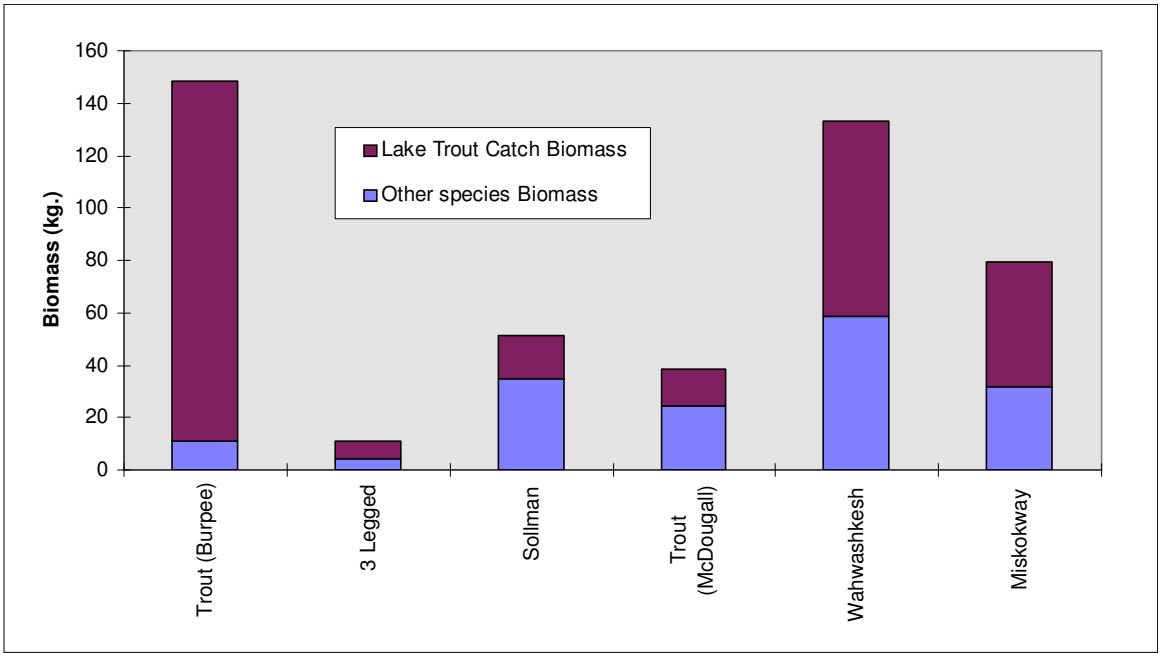
Sexual maturity is usually attained at about age 6 or 7 (Scott & Crossman, 1973); males maturing a year or two before females. According to growth analysis conducted on Trout Lake in the mid 1980s (BAR, 1987), seven year old lake trout in the fall average 41.3 cm. in fork length (Figure 4). One would expect most lake trout in excess of this length to be mature. We sampled 63 lake trout that had a fork length greater than 41.3 cm. and produced *'no gametes'*. The implication is that sexual maturity may be considerably delayed in this population. Early maturation is often considered a second order indicator of stress on a population. Such an indication is certainly not present in this population.

## 4.3 Fish Community Implications:

The cold-water fish community of Trout Lake is relatively simple, being comprised primarily of lake trout, cisco and common white sucker. Our data indicates that lake trout dominate this community, to the extend that cisco appear to be very rare. This dominance in Trout Lake is considerably greater than that observed in other Parry Sound Area lake trout lakes (Figure 4).



**Figure 4. Comparison of lake trout biomass and 'other species' biomass, from lakes for which Spring or Fall Littoral Index Netting surveys have been conducted in the Parry Sound Area.**




Relative to other lakes in the Parry Sound Area, lake trout productivity (biomass per hectare) is exceptionally high in Trout Lake.

## 5.0 Acknowledgments

Special thanks to Paul and Ina Schofield for the use of their cabin, boat and motor. (In my twenty-some-odd years with Natural Resources, this is the closest I've come to 'working in Paradise'!) Your generosity and many helpful comments were much appreciated.

Map preparation was by Rob Viejou, Parry Sound District GIS staff.

Jim Palmer and Eric McIntyre were the (lucky) field crew members.



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