Northern Alberta Non-Game Fish Status Assessment

Interim Report of Project Activities

February 2009

Prepared by

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for

The Royal Alberta Museum
&
The Alberta Conservation Association

Acknowledgements

The success of this project is due in large part to the effort and dedication of many field and lab personnel. In particular, Brian Meagher, Shaun Potvin and Ian Kriston served as crew leaders from 2002 to 2008. Their able assistants included Steven Baryluk, Callee Soltys, Paul Knaga, Scott Keast, Patrick Harrigan, Anne-Sophie Bergeron, Melanie Matilla, Trisha Boorman, Jamie Smithson, Ryan Cox, Kim Ives, Sean McFadden, and Marsha VanDenEnden. Collecting permits and sampling information were obtained from Fisheries Management staff of Alberta Sustainable Resource Development including Ken Bodden, Dick Brown, Kayedon Wilcox, Chris Davis, Denyse McDonagh, George Walker, Wes English, Travis Ripley, Melissa England, David DeRosa, Martin Brilling, Don Hildebrandt and Daryl Watters.

This project has been possible with the generous financial support provided by the Alberta Conservation Association through the Grant Eligible Conservation Fund.

Introduction

The Preliminary Status Evaluation of Alberta Fish (Mackay 2000) and The General Status of Alberta Wild Species 2005 (Anon. 2006) highlight the paucity of population trend information for provincial non-game fishes. A handful of species identified as potential candidates for listing under Endangered Species legislation like the pygmy whitefish (Mackay 2000), shortjaw cisco (Steinhilber 2002), bull trout (Post and Johnston 2002), lake sturgeon (SRD 2002), western silvery minnow (Pollard 2003), St. Mary shorthead sculpin (Pollard 2004), Arctic grayling (SRD 2005) and westslope cutthroat trout (SRD 2006) have been studied recently to gather enough information to assess their status based on a precautionary approach to data quality. However, robust population data are still needed. For the majority of non-game fishes, especially those not identified as "at risk," even less is known about their populations, trends and status. Yet these common species form the ecological base upon which our commercially valuable game fishes depend. This study focuses on helping to provide the data needed to determine trends in size and distribution of forage fish populations as an indicator of ecosystem health and as a status assessment tool to aid fisheries managers in coping with increasing demands on our sport and commercial fish resources.

Determining population trends requires many years of sampling before long-term patterns of population increase or decline can be distinguished from the background "noise" caused by natural short-term variation and sampling bias. Monitoring projects may require 20 years or more of sampling to yield robust, defensible conclusions. The Royal Alberta Museum is committed to acquiring data and associated specimens over the long term to aid in achieving the goal of non-game fish trend and status assessments. As the Museum is not encumbered by the task of managing provincial game fishes, resources can be devoted to documenting non-game fish populations and preserving voucher specimens for future research.

Monitoring and analysis of the status of species, with the ultimate objective of responsible and informed biodiversity conservation, is a long-term endeavor. A far-sighted perspective is also important when considering the value of preserving museum specimens encountered in inventory and monitoring projects. Acquiring physical documentation of species in time and space through the collection and preservation of voucher specimens is a primary and unique function of museums. The value of these collections to the scientific community and society in general are manifold, but they are often under-appreciated (Suarez and Tsutsui 2004). Traditionally, museum specimens have been used in taxonomic research, a discipline that has seen a recent resurgence with increased concern over the loss of biodiversity – and the need to know what is being lost. Physical specimens, whether entire organisms, parts thereof, or tissue samples for genetic analysis, are essential in taxonomic studies. Museums typically hold a large series of readily available specimens that otherwise would be expensive, time-consuming, and perhaps difficult, dangerous, or even impossible to obtain from the field for every new taxonomic project. Specimens also provide verifiable documentation of chemical contamination, structural abnormalities, and the physical responses of species to such

things as global warming, biological invasions, and habitat loss or fragmentation (Suarez and Tsutsui 2004). This project capitalizes on the wide variety of species and localities sampled to acquire and preserve voucher fish specimens for current and future research. Approximately 60,000 specimens have been archived in the Ichthyology collection at the Royal Alberta Museum as a result of this study. These specimens, most preserved in 70% ethanol, are available for use by any interested users. Specimen data are available upon request and selected information is also accessible on the Museum's *Creature Collection* website (www.royalalbertamuseum.ca/vcollects/index.asp).

Methods

The sampling protocols used in this study were deliberately chosen to be simple, cost-effective, and widely employed and accepted. The procedures result in catch-per-unit-effort data that are directly compatible with the Fisheries Management Information System (FMIS) database. This standard methodology is repeatable over time and space, and by different data collectors. An effective monitoring protocol acknowledges that many different researchers, from government biologists to students must be able to contribute to the population database and that these data must be comparable. Techniques that are expensive or difficult to implement will not be attractive for a wide range of data collectors. Newly developed protocols, while perhaps more effective at capturing specific species at specific times, have the additional disadvantage of being incompatible with historical data collected by traditional techniques. Comparability of data, temporally and spatially, is more important for the purpose of trend assessment than absolute capture efficiency of a given technique.

Sampling Techniques and Data and Specimen Archiving
The sampling methods used in this project include standard non-lethal collecting gear, primarily beach seines and minnow traps. Sampling effort, habitat characteristics, and specimen data are recorded as per FMIS guidelines. Captured specimens are enumerated and specimen data is recorded from a sub-sample of the collection. All data are forwarded to Alberta Sustainable Resource Development staff for uploading to the FMIS database and are also retained in the Royal Alberta Museum's collections database. Selected information from the Museum database is accessible to the public on-line via the *Creature Collection* website at www.royalalbertamuseum.ca/vcollects/index.asp or by contacting the Curator of Ichthyology directly. Voucher specimens from each site are retained for preservation in the research collection at the Royal Alberta Museum. Specimens are catalogued and preserved in 70% ethanol and are available for examination by any interested users.

For lake surveys, a 60 m seine pull is conducted at each of five sampling sites on the lake using a 5 m X 2 m beach seine. The total distance sampled per lake is, therefore, 300 m (60 m X 5 sites). Although the nets are five metres in length, they are never stretched to their maximum when in use. Field crews endeavour to stay three metres apart during seine pulls. This value (3m) is used to calculate the area of the swath surveyed (e.g., 60 m

X 3 m = 180 m^2 per sampling site or 900 m^2 per lake). Nets are pulled by hand and no seining is done in water deeper than about 1 m.

Standard minnow (Gee) traps are the primary means of sampling small creeks and streams. Traps are unbaited to avoid biases that may result from differential attraction of species to certain baits. Typically, four to six traps are deployed at each site and an effort is made to sample a variety of microhabitats. Traps are checked every 24 hours.

Site Selection

The selection of survey sites is quasi-random and based, in part, on accessibility. In an effort to maximize randomness, prior knowledge of species assemblages or environmental parameters is not used as a guide to site selection. In 2002 and 2003, the study area was restricted to water bodies in the St. Paul and Cold Lake regions. In 2004, many of these sites were re-visited ("index sites"), and an additional 15 localities were surveyed in the Lac La Biche region. In 2005, the study area was expanded to include the Grande Prairie, Swan Hills, and Stony Plain regions. In 2006, the Peerless Lake area was added to the geographic coverage and in 2007 the Calling Lake area was the focus of reconnaissance surveys. In 2008, the Peace River and tributaries in the area between Manning and Ft. Vermilion were the primary new study sites. Discussions have been held with fisheries managers from each of these areas to determine potential survey sites that would maximize the value of data and specimens to these stakeholders.

Although the survey area is being expanded continually, a sub-sample of "index" sites have been selected for on-going monitoring. Selection of index localities for repeated monitoring is based in part on the species richness (diversity of species) of the site. This pragmatic approach will produce trend data for the greatest number of species while maximizing the efficiency of resource investment. The widespread reconnaissance or inventory surveys will provide species distribution data, including range extensions and contractions, and will suggest relative abundances of species outside of the index sites. These will be useful for rough comparison and corroboration of population trend data.

Within each lake, the five beach seining sites are chosen quasi-randomly to maximize the variety of habitats surveyed while considering site characteristics that permit seining. Soft substrates, thick vegetation, or obstructions like snags or large rocks can preclude the use of a seine in some areas. Nevertheless, efforts are made to sample a variety of habitat types within the constraints imposed by this collecting technique.

Accessibility is a major factor in the selection of minnow trap placement sites. Many of the sites sampled are near road crossings or where creeks enter or leave lakes. A mixture of disturbed (e.g., bridge pilings or culvert scour pools) and undisturbed microhabitats are surveyed when possible.

Data Analysis

At each lake, catch-per-unit-effort (CUE) values for seining data are calculated as:

Total area seined (all sampling sites combined) / number of individuals of each species captured (all sampling sites combined)

CUE values for the trapping data at each site are calculated as:

Total trap-hours (all traps at a site combined) / number of individuals of each species captured (all traps combined)

Mean catch values, standard deviations and coefficients of variation were calculated for each species at index sites sampled for five years or more. The statistical power of these data was analyzed with the MONITOR program (Gibbs 1995) to assess if the current monitoring protocols are sufficient to detect population trends at various rates of increase or decline. Manipulation of the sampling effort parameters in the MONITOR simulations, assuming the inter-annual data variances calculated above, was used to identify sampling protocol adjustments (e.g., number of survey sites or survey events) that would increase the statistical power of the data.

Calculation of population trends requires a minimum of three data points through time. This is a statistical minimum. Given the wide variance inherent in most monitoring data, additional sample points are necessary to produce meaningful results. In this study, trend analyses were initiated after five years of surveys were completed. Catch-per-unit-effort data were visualized graphically and least squares regressions calculated to determine if significant trends are apparent. MONITOR simulations will forecast how much survey effort should be required to produce statistically significant ($P < 0.1$) trends at a given magnitude of change (e.g., 5%, 10% increase or decline per year). The target level for this project will be determined after preliminary data analyses are conducted. The annual percent population change detectability targets will take into consideration time and financial constraints.

Mapping
Site and species distribution maps were produced using ArcGIS. The GPS coordinates used to plot site maps for seining locations were chosen from the 5 sampling site coordinates on each lake to best approximate the centre of waterbody. The only exception was Lesser Slave Lake where the size of this locality allowed individual sampling sites to be identifiable on a map scaled to show the northern Alberta study area overall (see Fig. 1).

Results

Figure 1 shows the locations of the 288 sites sampled in northern Alberta between 2002 and 2008. Appendix 1 lists the names of all localities and their geographic coordinates.

Appendix 2 lists catch-per-unit-effort by species for each water body sampled. Only minnow trapping and beach seining summaries are reported here as these were the most commonly employed techniques in the study. Up to seven years of data have been acquired from some sites while other localities have been sampled between one and six

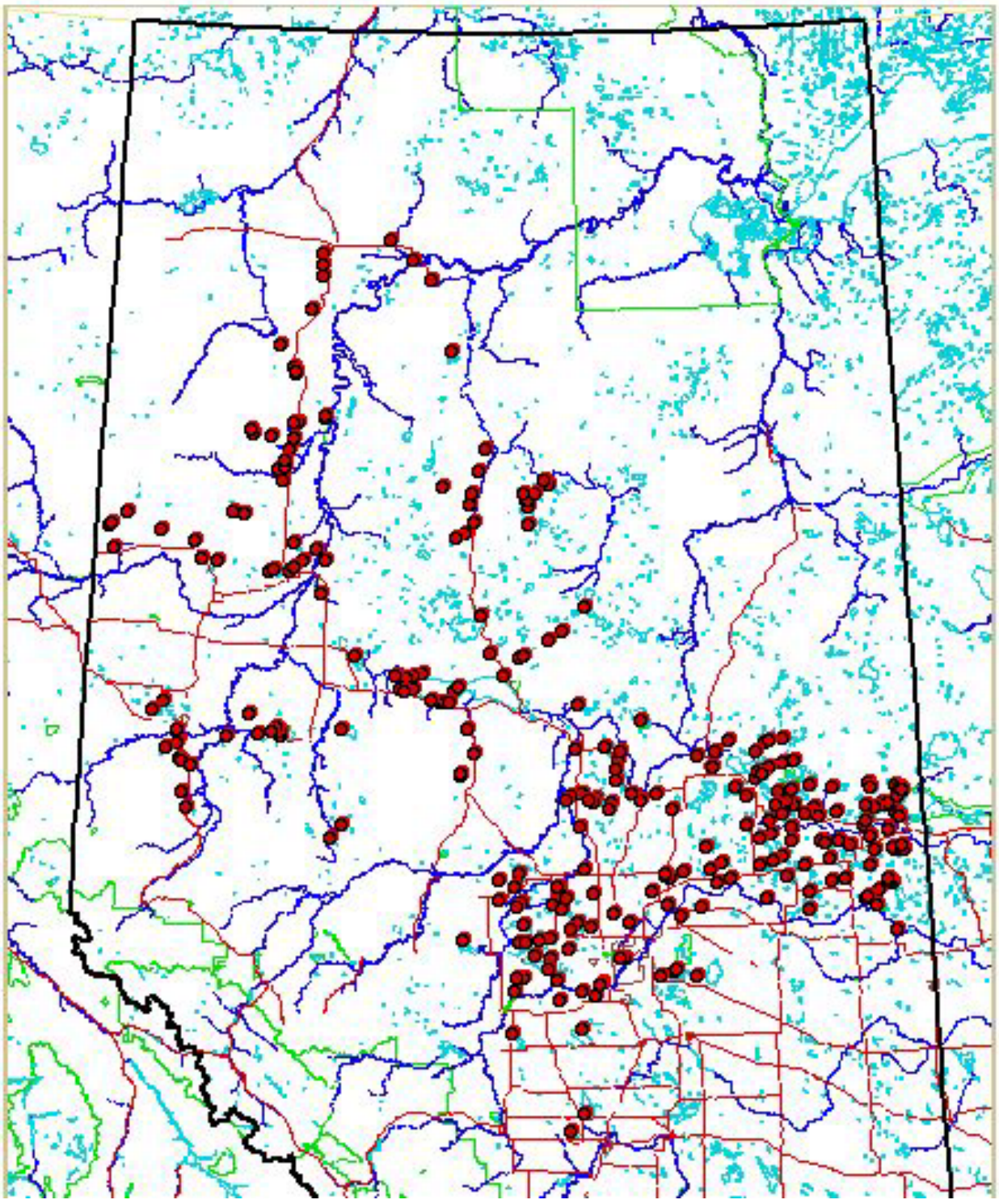

Figure 1. Survey sites in northern Alberta 2002-2008.

times. Several sites were surveyed twice within a given year. These sites are indicated by a 1 or 2 in parenthesis after the date.

Some distribution and abundance patterns are beginning to emerge from these data. The species encountered most frequently throughout the study area is the brook stickleback which was found in about 50% of all sites sampled (standing or flowing water - Fig. 2). In the 168 streams and rivers surveyed by minnow trapping, the most common species captured were brook sticklebacks (56% of the sites sampled), fathead minnows (36% of sites), lake chub (23% of sites) and white suckers (19% of sites). Both species of *Phoxinus* - the northern redbelly dace and finescale dace - were also encountered in 12–14% of flowing water sites surveyed. The most common species captured by beach seining in lakes were brook sticklebacks (43% of sites), spottail shiners (40% of sites) and Iowa darters (34% of sites). Immature yellow perch were prevalent in many lake samples but the relative abundance of game species encountered in these surveys should be interpreted with caution as body size has a major effect on the ability of an individual to escape capture by beach seining or trapping.

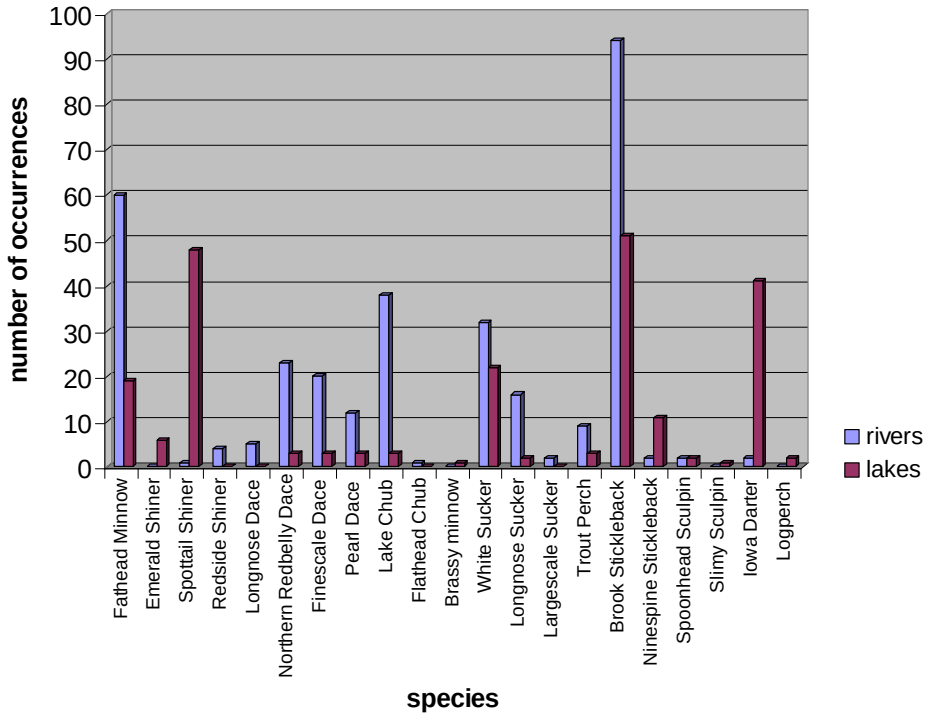

Figure 2. Frequency of occurrence of non-game fish species in samples collected from 288 lakes and rivers in northern Alberta (2002-2008).

Figure 3 shows those non-game species that were most often encountered in large numbers. In streams and rivers, fathead minnows, northern redbelly dace, lake chub and brook sticklebacks were regularly found to be abundant at survey sites. Based on figure 3, large numbers of ninespine sticklebacks appear to be common in streams in the study

area. However, this species was found at only three flowing water sites, one of which yielded 56 trapped specimens (i.e., large numbers encountered at 33% of sites).

In lakes, spottail shiners, brassy minnows and pearl dace were most often found in large numbers. Spottail shiners are commonly encountered and abundant at many sites (see also Fig. 2). However, the brassy minnow, and to a large extent the pearl dace, numbers are based on sampling conducted at Musreau Lake where these species are typically seined in very large numbers (occasionally over 1000 individuals in a single 20 m seine pull). Note that although Iowa Darters are one of the most commonly encountered species in lakes (Fig 2.), they are rarely captured in large numbers.

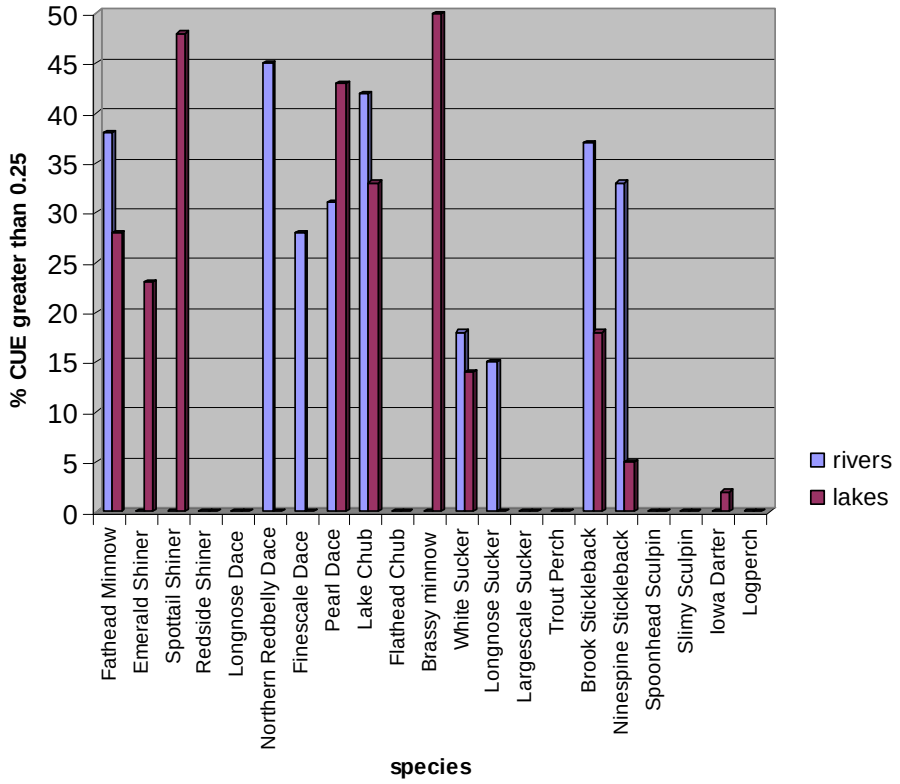

Figure 3. Percent of samples in which species were captured in large numbers. For lakes, a catch-per-unit-effort (CUE) greater than 0.25 indicates more than about 200 individuals seined per lake. For rivers, a CUE greater than 0.25 generally translates to more than 30 individuals encountered at each minnow-trapping site.

Plots of annual catch-per-unit-effort by species for selected waterbodies show much inter-year variation. For example, figure 4 shows catch-per-unit-effort trends for white suckers, ninespine sticklebacks and Iowa darters in Cold Lake. The population spikes shown in each of these graphs are typical of most of the index sites sampled. This annual variation means that many years of sampling is required before long-term trends can be discerned with confidence. Lines of best fit to these data were not significant for the white sucker (P=.99) or Iowa darter (P=.96) although the ninespine stickleback does show a significant decline (P=.02) in the trend line.

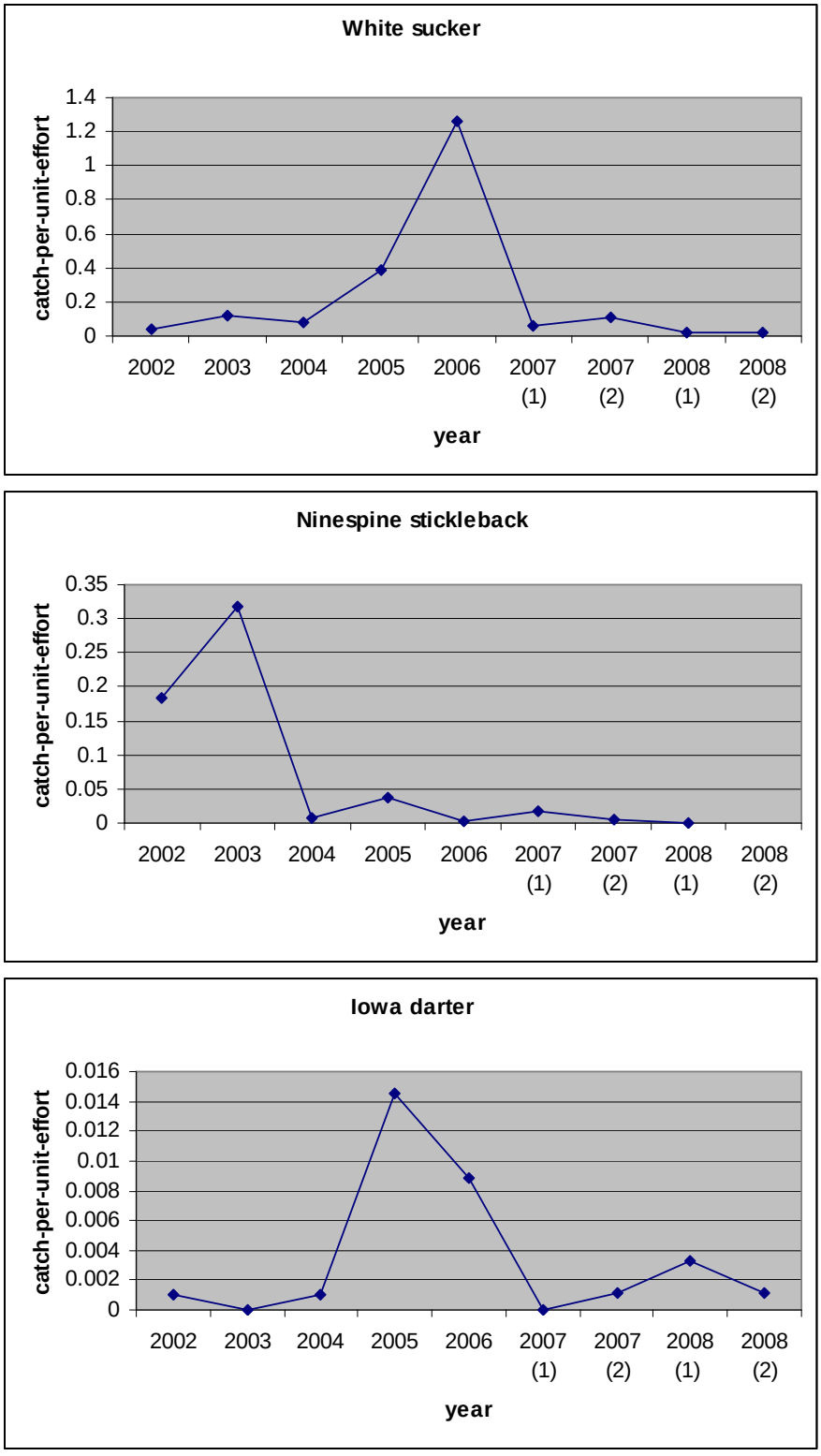

Figure 4. Catch-per-unit-effort plots for three non-game species from Cold Lake.

Discussion

The ability to detect long-term population trends over the "noise" of annual variation and sampling bias is a function of data variance and sampling effort. Population spikes, as seen in the example data presented here, may represent real population increases in response to such things as reduced predation and/or competition or favourable environmental conditions that enhance survival and reproduction in the short term. Alternatively, increased catch rates in a given sampling period may reflect random fortuitous encounters with large numbers of schooling individuals or sampling during conditions that are most favourable for capturing species with the gear used in this study. Shallow inshore areas - the habitats sampled by beach seining - are susceptible to temperature fluctuations and wave action that may be unsuitable for some species during certain weather events. Except in extreme situations, weather was not a criterion used to maximize the consistency of sampling effort at each survey site. The time of year (with a maximum of one week variation among years), sampling location and capture method were held constant but the weather was a variable that was not taken into consideration.

Beginning in 2007, selected index sites were monitored twice per year within a one-week time period. This revised protocol was initiated to quantify intra-year variation that may be due, in part, to factors such as weather, and to bolster the statistical robustness of the data. Simulations using the MONITOR software suggested that multiple intra-year sampling, even as infrequently as twice per year, substantially increases the power of the survey data to detect population trends. Simulations also showed that increasing the number of localities sampled had much less impact on the statistical power of the data. After several years of this increased survey effort the data will be re-analyzed and further adjustments made as necessary. The within-year variation (sampling bias) derived from these data will also provide a more appropriate assessment of overall variance for the purposes of on-going power analysis (Gibbs 1995). It is this sampling bias, which excludes any real population changes over time (i.e., variability that would be included in inter-annual data) that is the best indicator of how much effort is required to detect trends over the "noise" in the sample data.

The survey methods employed in this study were chosen because they are non-lethal and result in no by-catch of game species. This was an important consideration especially in those water bodies that have experienced a recent decline or collapse of game fish populations. However, seining and trapping alone may inadequately sample some species. While this is particularly true of game species, adults of which are rarely encountered using these protocols, it also applies to several non-game species that spend much of their life in offshore habitats that are not conducive to seining or minnow-trapping. This sampling limitation has implications for species inventories and distribution mapping but does not negate monitoring data for those species that are regularly encountered, as long as the sampling protocols are applied consistently. The objective of this project is to detect population trends in some of the province's non-game fishes. The species that are detectable by the protocols used here can be tracked specifically and can serve as indicators of ecosystem health and stability.

Additional study might involve the use of small mesh, multi-panel gill-netting or deployment of more elaborate traps to corroborate or augment the seine and minnow trap data. Gill-netting would be used sparingly as it tends to result in significant mortality of captured game fishes even when small mesh sizes are used. Short set durations ranging from a few minutes to an hour or two are an option that would significantly reduce mortality of hardier species like northern pike, walleye, and lake trout. Lake whitefish will likely still succumb to this protocol, but this species is currently of somewhat less concern to fisheries managers than the predatory species listed above.

Specialized fish traps may be another alternative for corroborating or augmenting seining and minnow-trapping results. These traps can be costly, unwieldy at sites that are difficult to access, and require more time to deploy than a seine pull, minnow trap or gill net. It may be worthwhile to devote extra resources to this survey technique at selected index sites, but it will be difficult to implement over a wide range of localities within the time and financial constraints of this project. If a single trap design were intended to capture a wide range of species, further investigation would be required to determine mortality rates of non-game species trapped in a confined space with predatory species and capture myopathy.

In general, the net benefit of this project is positive – data is maximized with next to no impact on sensitive game fish populations. The same may not be true of other sampling protocols involving techniques like gill-netting. As detailed analyses of trend data continues, adjustments will be made to improve the efficacy and value of the project for resource managers and the residents of Alberta.

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Appendix 1. Survey sites (as of February 2009) and geographic coordinates.

Locality	Latitude	Longitude
Amisk River	54.4627800	-111.7727000
Angling Lake	54.2015500	-110.3103900
Arcadia Creek	55.4010700	-116.1295800
Babette Creek	54.6745000	-113.0852778
Bald Mountain Creek	54.8776100	-118.7422800
Baptiste Lake	54.7642222	-113.5520833
Bear Creek	58.2542300	-115.8173100
Bear Creek near Jarvie	54.4476667	-113.9874167
Bear Lake	55.2691900	-118.9744600
Bear Trap Lake	54.2111100	-110.5444000
Beaver Lake	54.7597200	-111.8977000
Beaver River south of Lessard	54.3894400	-110.6580000
Beaver River, Under HWY 867	54.3983300	-111.5025000
Beaverhill Creek	53.8152800	-112.8272000
Bede Creek	58.3349300	-117.2323100
Bent Pipe Creek	54.9856200	-118.7765300
Big Mountain Creek	54.8598100	-118.7088800
Bonnie Lake	54.1455600	-111.8788000
Bourque Lake	54.6744400	-110.5605000
Bourque Lake Creek	54.6469400	-110.5525000
Boyer River 1	58.0207900	-117.3635500
Buchanan Creek	56.8266389	-117.6433056
Calling Lake	55.1822500	-113.2479722
Campbell Creek	54.9379000	-118.9146300
Cardinal Creek	56.1893300	-117.7593000
Cardinal Lake	56.2064100	-117.7104300
Chalmers Creek	54.9651667	-115.2320556
Chip Lake	53.6671900	-115.3517400
Christy Creek	54.6311100	-112.0219000
Chuckegg Creek	58.2533300	-117.2319400
Clear River	56.3000000	-119.7000000
Cold Lake	54.6041700	-110.1858000
Cold Lake Creek	54.5725000	-110.2294000
Cold Lake, English Bay Camp Ground Creek	54.5719400	-110.2291000
Colinton Creek	54.6224722	-113.2536111
Columbine Creek	54.2970278	-111.1634444
Conjuring Creek	53.2796944	-113.8218889
Crooked Lake	54.9008889	-113.5319444
Cross Lake	54.6518611	-113.7947500
Cutbank River	54.6350500	-118.6870800
Dog Rump Creek	54.0243100	-111.0692200
Duck Creek	54.6746667	-113.9468333
Economy Creek	55.0465000	-118.2018100
Edith Creek	54.8083333	-115.3969444
Elinor Lake	54.6572200	-111.6400000
Ethel Lake	54.5266700	-110.3697000
Ethel Creek	54.4715200	-110.2843300

Eureka River	56.4518333	-119.1351110
Fawcett Lake	55.3011389	-113.9823889
Flat Creek	54.5579722	-112.8914444
Flatbush Creek	54.6643056	-114.1028056
Floatingstone Lake	54.2119400	-111.6344000
Fork Lake	54.4983300	-111.6022000
French Creek	54.6094167	-113.8367500
French Creek 2	54.6308611	-113.8888056
Frenchman Lake	54.5480600	-111.4486000
Frog Lake	53.9781700	-110.3574400
Garner Lake	54.1816700	-111.7300000
Ghost Lake	54.6087222	-113.6096389
Gods Lake	56.8271400	-114.3185500
Gold River	55.0253400	-112.1967400
Graham Lake	56.5545100	-114.5766100
Gravina Creek	57.2357222	-117.4871944
Gull Creek	54.8580600	-111.5680000
Gull Lake	52.4592400	-113.9736300
Hanmore Lake	54.2833300	-112.5166000
Harper Creek	55.2050300	-117.9388600
Hastings Lake	53.4237700	-112.9278000
Heart Lake	55.0263900	-111.5425000
Hilda Lake	54.5361100	-110.4180000
Hilda Lake, Unnamed creek	54.5150000	-110.4002000
Hines Creek	56.2644167	-118.3960000
Hotchkiss River 1	57.1444700	-118.0436200
Hotchkiss River 3	57.0529900	-117.5751900
Hotchkiss River 2007	57.0484440	-117.5695280
Hotchkiss River tributary 1	57.1362600	-117.8017800
Hotchkiss River tributary 2	57.1777500	-118.0761600
Iosegun Lake	54.4600600	-116.8087500
Ironwood Lake	54.5922200	-111.5425000
Island Creek	55.1388889	-115.3288333
Island Lake	54.8403889	-113.5511100
Isle Lake	53.6439400	-114.7093800
Isle Lake Creek Bayside Bridge	53.6521000	-114.6405300
Jack Creek	56.2595278	-118.6069444
Jackfish Creek	54.4175556	-110.6378889
Jackpine Creek	58.2542600	-115.8173100
Jim Cook's Creek	55.3152100	-115.6517800
Island Creek	55.1389000	-115.3288400
Katchemut Creek	53.3954200	-112.6767400
Keg River	57.7676800	-117.7486000
Kehewin Lake	54.0352800	-110.9125000
Kemp River 1	57.5781500	-117.5187400
Kemp River 2	57.6248900	-117.5501300
Kemp River Tributary	57.5915100	-117.5187800
Kennedy Creek	54.0780600	-112.9588000
Kennedy Creek 2	54.0960833	-113.0009444
Kilini Creek	53.6074300	-114.1491800

Kilsyth Creek	54.6299167	-114.1531389
La Biche River	54.9525300	-112.3733000
Lac Bellevue	53.8236100	-111.3355000
Lac La Biche	54.8025000	-111.8588000
Lac La Nonne	53.9186700	-114.2813900
Lac La Nonne Creek	53.9163900	-114.3230800
Lac Sante	54.8469400	-111.5647000
Lac St. Anne	53.6779300	-114.3565800
Lac St. Anne Creek	53.6620000	-114.4684000
Lafond Creek	57.0723200	-115.0967800
Lathrop Creek	56.5665833	-119.5427222
Lawrence Lake	55.0006667	-113.6895000
Leddy Lake	56.4090700	-117.4619700
Lessard Lake	53.7774200	-114.6555800
Lesser Slave Lake	55.3869400	-115.4847800
Lesser Slave Lake	55.4169700	-115.4434600
Lesser Slave Lake	55.4008700	-115.9628600
Lesser Slave Lake	55.5044300	-115.9783700
Lesser Slave Lake	55.5194400	-115.8694500
Lesser Slave Lake	55.5044800	-115.9783800
Lesser Slave Lake	55.4822200	-116.0446500
Limestone Creek	53.8736100	-112.5788000
Little Egg Creek	53.8410833	-113.6201111
Long Lake	56.7211200	-114.6015300
Long Lake	54.5673611	-113.6482222
Lottie Lake	54.0572200	-111.5722000
Lower Chain Lake	54.9653056	-113.5059167
Lower Therien Lake	53.9497200	-111.3319000
Lubicon River	56.4654720	-115.4699720
Marie Creek	54.5200000	-110.3205000
Marie Creek 2 (north of Ethel Lake)	54.5351389	-110.3593333
Marie Lake	54.6525000	-110.2650000
Marten Creek	55.5024900	-114.8853300
McLean Creek	56.4626944	-119.7637222
McMullen Lake Creek	55.8141700	-114.1770300
Medley River (off 897)	54.6341700	-110.2080000
Medley River mouth	54.5725000	-110.2294000
Medley River near mouth	54.6185830	-110.1726390
Melito Creek	58.4097900	-117.2321100
Middle Creek	53.9364167	-110.5249167
Miekle River	57.1333100	-117.5332100
Mill Creek (Edmonton)	53.5303056	-113.4821944
Mill Creek (Duffield)	53.5381670	-114.3455560
Mink Creek	53.5354000	-114.3455700
Minnie Lake	54.2786100	-111.1033000
Missawawi Lake	54.7019400	-112.1500000
Mons Lake	54.1839170	-112.3463890
Montagneuse River	56.3835278	-118.7125000
Moore Lake	54.5061100	-110.5191000
Moose Lake	54.2588900	-110.8261000

Moose Lake River	54.2854700	-110.9523900
Moosehills Creek	53.8858611	-110.6771667
Mooswa Creek	53.8895278	-110.6407222
Muriel Lake	54.1050000	-110.6163000
Muriel Creek east of Ardmore	54.3555560	-110.3618890
Muriel Creek west of Ardmore	54.3128600	-110.5808600
Muskeg Creek	54.6688056	-113.3589167
Musreau Lake	54.5322400	-118.6280100
Nakamun Lake	53.8815700	-114.2158000
Namepi Creek	54.1179444	-113.0009167
Newt Creek	53.9486000	-114.1482500
Newton Creek	54.0278800	-114.2256200
Newton Creek 2	54.0273611	-114.2504167
Nipisi Creek	55.6547600	-115.0535700
Normandeau Lake	54.5676670	-111.6839170
North Heart River	56.0564800	-117.1290100
North Saskatchewan River	53.5333300	-113.5500000
North Saskatchewan River, near Devon	53.3611100	-113.7561000
North Saskatchewan River, Near Duvernay	53.9186100	-111.8350000
North Saskatchewan River, near Genessee	53.3772800	-114.2813900
North Saskatchewan River, near Tomahawk	53.3159700	-114.7565300
North Saskatchewan River, Waskateneau Bridge	0.0000000	0.0000000
North Saskatchewan River, West of Devon	53.3566700	-113.7686000
North Wabasca Lake	55.9789000	-113.8972900
Notikewin River (2007)	56.9011667	-117.7102778
Notikewin River 1	56.9245700	-117.6321300
Notikewin River 2	57.2760700	-117.1360300
Notikewin River at Peace River	57.2842220	-117.1326110
Oldman Creek	55.3087100	-115.6009100
Osborne Creek	54.5000000	-110.9500000
Owl River	54.9975000	-111.7748610
Paddle River	53.9471500	-114.9430200
Parma Creek	58.3350200	-117.2323800
Pastecho River	55.6212500	-114.7008000
Peace River	56.3611100	-117.1900500
Peace River (hoop net site 2007)	56.3568060	-117.1869170
Peace River 1	57.2933300	-117.1375000
Peace River 2	57.2842220	-117.1326110
Peace River at Fort Vermilion	58.3833330	-116.0500000
Peace River tributary 1	56.2911300	-117.0837100
Peace River tributary 2	56.2765400	-117.3474100
Peace River tributary 3	56.2038300	-117.5228300
Peerless Lake	56.6764500	-114.5847200
Pelican Creek	55.0655100	-117.5582400
Pembina River	53.9284600	-114.6701900
Piche River	55.0097500	-111.7127500
Pigeon Lake	53.0505000	-113.9977200
Pine Creek	54.9222200	-112.5781400
Pinehurst Lake	54.6580600	-111.4805000
Plamondon Creek	54.8346600	-112.3988100

Ponton River	58.5149600	-116.3560300
Price Creek	54.6705556	-113.3575000
Punk Creek	54.5380556	-111.2244440
Qui Barre River	53.7453200	-113.8713800
Redwater River	53.9782778	-113.8339722
Redwater River (hwy 38 bridge)	53.8915000	-112.9734170
Redwater River east of Opal	53.9878610	-113.1493330
Reita Creek	54.2288900	-110.3302000
Riel Beach Creek	53.9945400	-110.3672400
Romeo Creek	54.0817500	-114.9518600
Round Lake	56.7597400	-114.5680500
Rourke Creek	54.9918611	-114.0402778
Sand River	54.4688900	-111.1869000
Sandy Lake	53.7802600	-114.0408700
Saskatoon Lake	55.2076700	-119.0961100
Shoal Lake Creek	53.3958800	-114.6528000
Siebert Lake	54.6900600	-111.2669200
Silver Creek	56.5957778	-118.2560000
Slims Creek	57.2288889	-117.5438611
Smoke Lake	54.3638890	-116.9150000
Smoky Creek	54.0347200	-112.3883000
Smoky River	54.8357900	-118.5965900
Snipe Lake	55.1138300	-116.8218200
South Buck Lake	53.0201000	-114.7962900
South Cooking Lake	53.4053900	-113.0927100
Square Creek	54.9331110	-111.8718330
St. Lina Creek	54.3132500	-111.5034722
Stove Creek	56.9681944	-117.6248056
Strawberry Creek	55.3167600	-115.5399200
Strong Creek	56.2330800	-117.4548900
Sturgeon Lake	55.0887000	-117.5651900
Sturgeon River	53.691410	-114.5904290
Sturgeon River near New Lunnon	53.7812500	-113.4213330
Sunnybrook Creek	53.2456667	-114.2458056
Swan Hills 2	54.8268600	-115.3969400
Swan Lake	55.0628000	-117.8148000
Swan River	54.8268611	-115.3969444
Sweeney Creek	56.4726389	-119.7506111
Sylvan Lake	52.3318300	-114.1323300
Thin Lake River	54.1732200	-111.0615200
Thunder Lake	54.1203300	-114.7152000
Toad Creek	53.7446600	-114.1098300
Tomahawk Creek	53.3958200	-114.7244200
Touchwood Lake	54.8588900	-111.4305000
Tucker Lake	54.5333300	-110.6166000
Unnamed Creek by Sturgeon Lake	55.1202000	-117.6226900
Unnamed Creek by Angling Lake	54.2094400	-110.1861000
Unnamed Creek near Grand Centre	54.4423600	-110.2136400
Unnamed Creek from Pembina River	53.9014400	-114.7457300
Unnamed Creek from Paddle River	54.0351900	-114.7610900

Unnamed Creek 1 near Lesser Slave Lake	56.7233600	-114.5772300
Unnamed Creek 2 near Lesser Slave Lake	56.7660700	-114.4922800
Unnamed Creek 3 near Lesser Slave Lake	56.8606600	-114.3787200
Unnamed Creek 4 near Lesser Slave Lake	56.7646100	-114.6225500
Unnamed Creek 5 near Lesser Slave Lake	56.4837900	-115.3708300
Unnamed Creek 6 near Lesser Slave Lake	56.4654800	-115.4699900
Unnamed Creek 7 near Lesser Slave Lake	56.5697700	-115.2384600
Unnamed Creek 8 near Lesser Slave Lake	56.6846800	-115.3035600
Unnamed Creek 9 near Lesser Slave Lake	56.6933300	-115.3012200
Unnamed Creek 10 near Lesser Slave Lake	56.8135100	-115.6515700
Unnamed Creek 11 near Lesser Slave Lake	56.7628700	-115.2886900
Unnamed Creek 12 near Lesser Slave Lake	56.9299200	-115.2015500
Unnamed Creek near Arcadia	55.3961900	-116.0727500
Unnamed Creek near Barnegat (Lac La Biche)	54.8245560	-111.7295560
Unnamed Creek near Driftpile	55.3354900	-115.7556500
Unnamed Creek near Fork Lake	54.4860000	-111.3347500
Unnamed Creek near Grouard	55.5035300	-116.1820100
Unnamed Creek near Hilda Lake	54.0348333	-112.3884722
Unnamed Creek near McRae	54.3578056	-111.7511111
Unnamed Creek near Reita Creek	54.2387500	-110.2273300
Unnamed Creek near Riel Beach	53.9945278	-110.3672500
Unnamed Creek near Slave Lake	54.8268600	-115.3969300
Unnamed Creek near Square Lake	54.0136700	-110.4126400
Unnamed Creek near Sturgeon Heights	55.0874100	-117.6735500
Unnamed creek on 881 A near Lac La Biche	54.7750000	-111.8219000
Utikuma Lake	55.9141500	-115.1709000
Vermilion River	53.6527778	-110.3333330
Vincent Lake	54.1294400	-111.3563000
Wabamun Lake	53.5520500	-114.5175900
Wabamun Creek	53.4616800	-114.3672900
Wabash Creek	54.1521111	-113.9453611
Wadlin Lake	57.7547200	-115.5536100
Wagon Creek	56.5954722	-118.0988889
Wapiti River	55.0712900	-118.8030700
Wakinagin Creek	53.4397400	-112.8896200
Waskatenau Creek	54.1216700	-112.7836000
West Creek	53.2998889	-113.9802500
Winagami Lake	55.6245000	-116.6826700
White Earth Creek north of Smoky Lake	54.1311100	-112.4755000
White Earth Creek south of highway 28	54.0720000	-112.2435560
Whitefish Creek	54.4305700	-112.0269000
Whitefish Lake	54.3416700	-111.8775000
Whitney Lake	53.8314900	-110.5479000
Willow River site 1	55.6449000	-114.6494100
Willow River site 2	55.7509700	-114.3503000
Wolf Lake	54.6708300	-111.0008000
Yelling Creek	54.1735833	-111.1528056

Appendix 2. Catch per unit effort by species at all northern Alberta localities

Locality	Technique	Year	Fathead Minnow	Emerald Shiner	Spottail Shiner	Redside Shiner	Longnose Dace	Northern Redbelly Dace	Finescale Dace	Pearl Dace	Lake Chub	Flathead Chub	Brassy minnow	White Sucker	Longnose Sucker	Largescale Sucker	Lake Whitefish	Northern Pike	Burbot	Trout Perch	Brook Stickleback	Ninespine Stickleback	Spoonhead Sculpin	Slimy Sculpin	Iowa Darter	Logperch	Yellow Perch	Walleye
Minnow Trapping - number of fish caught per trap per hour																												
Amisk River	trap	2003	0.14					0.14			0.01			0.04							0.09							
		2004																			0.114							
Arcadia Creek	trap	2005																										
Babette Creek	trap	2007	0.015															0.059			0.119							
Bald Mountain Creek		2005							0.01		0.03				0.01	0.02				0.01								
		2006							0.01		0.36				0.03	0.01				0.01								
Bear Creek	trap	2007													0.02													
Bear River	trap	2008									0.018									0.037								
Beaverhill Creek	trap	2004																			0.313							
Beaver River (hwy 867)	trap	2003	0.68					0.02			0.05			0.76							1.26				0.002			
Beaver River (Rg. Rd. 452)	trap	2004									0.07			0.07														
Beaver River (hwy 881)	trap	2004	0.017						0.133												0.694							
Beaverlodge River	trap	2006																			0.1129							
Bede Creek	trap	2008	0.12																		0.065							
Bent Pipe Creek	trap	2005							0.08						0.01						0.09							
Big Mountain Creek		2005				0.01			0.04		2.78			0.01	0.15	0.04				0.01								
		2006				0.005					0.625				0.016						0.005							
Bourque Lake Creek	trap	2004	0.031						0.063									0.031										
Boyer River 1	trap	2008	4.021					0.16	1.702																			
Buchanan Creek	trap	2007	0.7					0.4			0.167			0.133														
Campbell Creek	trap	2006																			0.007							
Cardinal Creek	trap	2005	0.04																		10.88							
Chalmers Creek	trap	2005																										
Christy Creek	trap	2004	0.041																		0.593							
		2005																			0.125							
Chuckegg Creek	trap	2008	6.213					0.053	3.34												0.043							
Clear River	trap	2007										0.038								0.013								

Locality	Technique	Year	Fathead Minnow	Emerald Shiner	Spottail Shiner	Redside Shiner	Longnose Dace	Northern Redbelly Dace	Finescale Dace	Pearl Dace	Lake Chub	Flathead Chub	Brassy minnow	White Sucker	Longnose Sucker	Largescale Sucker	Lake Whitefish	Northern Pike	Burbot	Trout Perch	Brook Stickleback	Ninespine Stickleback	Spoonhead Sculpin	Slimy Sculpin	Iowa Darter	Logperch	Yellow Perch	Walleye
Colinton Creek	trap	2007									0.15			0.045	0.015						0.015							
Columbine Creek	trap	2006	0.399																		0.074							
Conjuring Creek	trap	2007	0.66					1.17													0.24							
Cutbank River	trap	2006				0.005					1.199				0.032													
Dog Rump Creek	trap	2008	1.015																		0.029							
Duck Creek	trap	2007	0.032																		1						0.032	
English Bay Creek at road	trap	2003	3.51					5.596	0.027					0.177								0.762					0.03	
		2004	2.9				0.208	2	1.53	0.017	0.158			0.325	1.05				0.008		0.775	0.017					0.042	
		2005	0.755				0.01		0.031		0.02			1.847							0.031						0.092	
		2007	1.871					1.742	0.226		0.043			7.172	0.312						0.054							
		2008						1.135	1.281	0.5	0.083			0.125	0.208				0.01		0.083							
English Bay Creek at lake	trap	2003	0.009		0.018			0.036	0.145					0.009							0.153	0.009	0.009				0.216	
Ethel Lake Creek	trap	2005							0.017												2.381							
Eureka River	trap	2007	0.012						0.012		0.012			0.012						0.012								
Flat Creek	trap	2007																			0.659							
Flatbush Creek	trap	2007																										
French Creek 1	trap	2007	0.193																		1.867							
French Creek 2	trap	2007	0.224																		4.043						0.914	
Gold River	trap	2006	0.062																		0.01							
Gravina Creek	trap	2007								0.174											0.188							
Gull Creek	trap	2004																			0.524							
		2005																			0.01							
Harper's Creek	trap	2005						0.02													0.05							
Hines Creek	trap	2007	0.405					1.622		2.5				0.054							0.014							
Hotchkiss River	trap	2007																										
Hotchkiss R. trib 1	trap	2008	0.224						1.878												0.204							
Hotchkiss R. trib 2	trap	2008																										
Island Creek	trap	2005									0.74			0.04														
Jack Creek	trap	2007								0.013											0.184							
Jackfish Creek	trap	2004												0.035							0.123							
Jackpine Creek	trap	2008	0.028					0.009			0.156			0.083							0.009							
Jim Cook's Creek	trap	2005	2.94																									

Locality	Technique	Year	Fathead Minnow	Emerald Shiner	Spottail Shiner	Redside Shiner	Longnose Dace	Northern Redbelly Dace	Finescale Dace	Pearl Dace	Lake Chub	Flathead Chub	Brassy minnow	White Sucker	Longnose Sucker	Largescale Sucker	Lake Whitefish	Northern Pike	Burbot	Trout Perch	Brook Stickleback	Ninespine Stickleback	Spoonhead Sculpin	Slimy Sculpin	Iowa Darter	Logperch	Yellow Perch	Walleye
Katchemut Creek	trap	2005	1.043																		0.529							
Keg River	trap	2008									0.043									0.033								
Kemp River 1	trap	2008									0.272				0.022													
Kemp River 2	trap	2008									0.012				0.012													
Kemp River trib	trap	2008	0.176					1.066													0.055							
Kennedy Creek	trap	2004	0.033												0.01						0.011							
Kennedy Creek 2	trap	2007	0.171																		0.872							
Kilini Creek	trap	2005																			5.19							
Kilsyth Creek	trap	2007	0.205					0.446	0.185												0.436							
Lathrop Creek	trap	2007								0.017	5.724			0.017														
Limestone Creek	trap	2004																			0.031							
Little Egg Creek	trap	2007	0.02																		0.16							
La Biche River	trap	2006																	0.005									
Lafond Creek	trap	2006									0.37			0.02							0.02							
Lubicon River	trap	2006	0.6124																		2.1685							
Marie Creek #1	trap	2004						0.038																				
Marie Creek #2	trap	2005																										
Marten Creek	trap	2005									0.63			0.33														
McLean Creek	trap	2007					0.013			0.013	2.513			0.138														
McMullen Creek	trap	2005																			1.22							
Medley River (off 897)	trap	2004	0.19					0.155	0.181	0.129	0.052			0.009							0.621							
		2005							0.015	0.026	0.567										0.18							
		2006	0.179					4.144	0.006		0.256			0.167							0.01							
		2007	0.489					13.217	2.174	0.228	1.283			0.174	0.076						0.033							
		2008					0.016	0.172	2.047	0.297	0.594			0.016							0.25							
Medley River (upstream of Cold Lake)	trap	2003	0.005						0.005	0.021	0.271			0.032							0.011		0.005					
Melito Creek	trap	2008	2.021					0.798													0.053							
Middle Creek	trap	2006																										
Mink Creek		2005																										
Montagneuse River	trap	2007	1.355							2.145											0.039							
Moose lake R. #1	trap	2004																										
Moose lake R. #2	trap	2005	0.005																									

Locality	Technique	Year	Fathead Minnow	Emerald Shiner	Spottail Shiner	Redside Shiner	Longnose Dace	Northern Redbelly Dace	Finescale Dace	Pearl Dace	Lake Chub	Flathead Chub	Brassy minnow	White Sucker	Longnose Sucker	Largescale Sucker	Lake Whitefish	Northern Pike	Burbot	Trout Perch	Brook Stickleback	Ninespine Stickleback	Spoonhead Sculpin	Slimy Sculpin	Iowa Darter	Logperch	Yellow Perch	Walleye
Moosehills Creek	trap	2006																			0.69							
Mooswa Creek	trap	2006	0.075																		0.188							
Muriel Creek #1	trap	2004																										
Muriel Creek #2	trap	2005																										
Muskeg Creek	trap	2007	2.374																		1.114							
Namepi Creek	trap	2007	4.987																		0.013							
Newt Creek	trap	2005																										
Newton Creek	trap	2006																										
Newton Creek 2	trap	2007													0.6						0.01							
North Heart River	trap	2005				0.07					0.29			0.17	0.01						0.19							
Notikewin River	trap	2007									0.012									0.06								
Notikewin R. @ Peace River	trap	2008																										
Old Man Creek	trap	2005																										
Osborne Creek	trap	2006							0.02												0.413							
Parma Creek	trap	2008	0.656					0.989							0.011						0.344							
Pastecho River	trap	2005																			0.44							
Peace River #1	trap	2005																										
Peace River drainage #1	trap	2005									0.01			0.08							0.22							
Peace River Drainage #2	trap	2005							0.37																			
Peace River Drainage #3	trap	2005																			0.06							
Peace River A	hoop net	2007																0.43										
Pelican Creek	trap	2005																	0.03									
Pembina River	trap	2005																										
Pine Creek trib	trap	2006																			0.309							
Plamondon Creek	trap	2006																										
Price Creek	trap	2007	0.176						0.015												0.293							
Punk Creek	trap	2006	0.162					1.046													0.046							
Qui Barre River	trap	2006																			0.36							
Redwater River	trap	2007																			0.025							
Reita Creek	trap	2004																0.046										
		2005																										
Romeo Creek	trap	2006	0.13																		1.06							

Locality	Technique	Year	Fathead Minnow	Emerald Shiner	Spottail Shiner	Redside Shiner	Longnose Dace	Northern Redbelly Dace	Finescale Dace	Pearl Dace	Lake Chub	Flathead Chub	Brassy minnow	White Sucker	Longnose Sucker	Largescale Sucker	Lake Whitefish	Northern Pike	Burbot	Trout Perch	Brook Stickleback	Ninespine Stickleback	Spoonhead Sculpin	Slimy Sculpin	Iowa Darter	Logperch	Yellow Perch	Walleye
Rourke Creek	trap	2007	0.026					0.01		0.016	0.323			0.063						0.021								
Sand River	trap	2003									0.26			0.03														
		2004									0.007			0.025													0.025	
		2005							0.005		0.02			0.02					0.005									
		2006																										
		2007																										
Shoal Lake Creek	trap	2005																										
Silver Creek	trap	2007	0.017								0.119										0.085							
Slims Creek	trap	2007																			0.133							
Smoky Creek	trap	2004	1.94																		0.236							
Smoky River	trap	2005									0.03																	
Stove Creek	trap	2007																			0.032							
Strawberry Creek	trap	2005																	0.01									
Strong Creek	trap	2005																			5.7							
Sturgeon River #2	trap	2005												0.02														
Sunnybrook Creek	trap	2007	0.03				0.01	0.01			0.14			1.32	0.02						0.07							
Swan Hills Creek #1	trap	2005									0.13			0.01					0.004									
Swan Hills Creek #2	trap	2005																										
Sweeney Creek	trap	2007				0.06	0.01				0.24			0.12														
Thin Lake River	trap	2005	0.011																		1.966							
Toad Creek	trap	2005																										
Tomahawk Creek	trap	2005	0.08											0.01							0.04							
Unnamed Creek (Grand Centre)	trap	2005	0.01						0.01																			
Unnamed Creek (Square Lake)	trap	2005						0.01													1.04							
Unnamed Creek (Isle Lake)	trap	2005																0.01									0.01	
Unnamed Creek (Riel Beach)	trap	2005	0.24																		0.41				0.04			
Unnamed Creek (Lac La Nonne)	trap	2005																										
Unnamed Creek (Lac Ste. Anne	trap	2005																			0.29							
Unnamed Creek (Arcadia)	trap	2005													0.01													
Unnamed Creek (Driftpile)	trap	2005																										
Unnamed Creek (Grouard)	trap	2005																										

Locality	Technique	Year	Fathead Minnow	Emerald Shiner	Spottail Shiner	Redside Shiner	Longnose Dace	Northern Redbelly Dace	Finescale Dace	Pearl Dace	Lake Chub	Flathead Chub	Brassy minnow	White Sucker	Longnose Sucker	Largescale Sucker	Lake Whitefish	Northern Pike	Burbot	Trout Perch	Brook Stickleback	Ninespine Stickleback	Spoonhead Sculpin	Slimy Sculpin	Iowa Darter	Logperch	Yellow Perch	Walleye
Unnamed Creek (Young's Point)	trap	2005																	0.01									
Unnamed Creek (Sturgeon Heights)	trap	2005																0.02										
unnamed Creek (Hilda Lake)	trap	2004						0.06																				
unnamed Creek (Angling Lake)	trap	2004	5.22					0.077			0.048										0.452							
Unnamed Creek (Fork Lake)	trap	2004																										
Unnamed Creek (Long Lake)	trap	2006																	0.04									
Unnamed Creek (A2 - Kidney Lake)	trap	2006																										
Unnamed Creek (A3 - Goosegrass Lake	trap	2006																										
Unnamed Creek (A4 - Round Lake)	trap	2006																	0.0049									
Unnamed Creek (A5 - Loon Lake	trap	2006	2.4432																		0.5568							
Unnamed Creek (A7 - Red Earth)	trap	2006	0.0182								1.5758										0.0182							
Unnamed Creek (A8 - Loon River)	trap	2006																			0.175							
Unnamed Creek (A9 - Numasc Rd.)	trap	2006																			0.1481							
Unnamed Creek (A10 - Numasc 2)	trap	2006								0.3625	0.65			0.0125							0.025							
Unnamed Creek (A11)	trap	2006																			0.0123							
Unnamed Creek (A12)	trap	2006																										
Unnamed Creek (paddle river)	trap	2006	3.38																		3.13							
Unnamed Creek (Pembina River)	trap	2006																			0.72							
Vermilion River	trap	2003																			0.01							
Wabamun Creek	trap	2005									0.07																	
Wabash Creek	trap	2007																										
Wagon Creek	trap	2007	0.04																		0.04							
Wakinagan Creek	trap	2005																			0.467							
Wapiti River	trap	2005																										
Waskatenau Creek	trap	2003	3.24																		0.16							
		2004	0.25																		0.74							
		2005																			0.004							
		2006																										

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West Creek	trap	2007									0.0206			0.0619							0.0515							
White Earth Creek (855)	trap	2004																			0.076							
White Earth Creek (hwy 28)	trap	2004																		0.021								
Whitefish Creek	trap	2005	0.024																		1.417							
Willow River #1	trap	2005								0.03											0.02							
Willow River #2	trap	2005												0.12							0.2							
Yelling Creek	trap	2006																										
Seining - number of fish caught per m^2 seined																												
Angling Lake	seine	2005			0.0537									0.0019					0.0037		0.0148						0.1278	
		2006			0.0042																						0.0014	
		2007																										
Baptiste Lake	seine	2007	0.0011		0.5211									0.0189				0.0033									0.0344	
		2008			0.6833																							
Bear Lake	seine	2005			0.2744									0.3122							2.9878							
Beartrap Lake	seine	2003																									0.553	
		2004																			0.036						0.428	
Beaver Lake	seine	2004			0.097													0.001			0.102				1.262		0.001	
		2005																			0.0222				0.2244		0.0033	
		2006			0.4089													0.0011	0.0078		0.0233				0.3611		0.0044	
		2007 (1)			0.1022													0.0022			0.0078				0.0011			
		2007 (2)			0.0456													0.0022							0.0044			
		2008 (1)																0.0022										
		2008 (2)			0.4733																				0.0011			
Bonnie Lake	seine	2003																			0.353							
Bourque Lake	seine	2004			0.03													0.012			0.003				0.002		0.003	
Calling Lake	seine	2007		0.0033	0.0078										0.1967												0.0567	
		2008			0.0011																				0.0011			
Cardinal Lake	seine	2005	3.5278																		4.5486							
Chip Lake	seine	2005																0.0048			0.0036							
Cold Lake	seine	2002		0.023	0.044						0.711			0.042				0.003			0.037	0.184	0.001		0.001		0.019	0.001

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		2003	0.024	0.006	0.208									0.122							0.001	0.317				0.008	0.015	0.374
		2004	0.001		0.185			0.001	0.11					0.079							0.001	0.008			0.001	0.027		0.004
		2005	0.0029	0.0014	0.0058				0.0014					0.3841								0.0362	0.0014	0.0014	0.0145	0.0058		
		2006			0.0144						0.0078			1.2644								0.0022			0.0089	0.03		
		2007 (1)		0.0011										0.0578			0.0044					0.0167						
		2007 (2)		0.0022										0.1078			0.0011					0.0056			0.0011			
		2008 (1)												0.0189								0.0011			0.0033			
		2008 (2)												0.0178											0.0011			
Cooking Lake	seine	2005																										
Crooked Lake	seine	2007												0.0033				0.0189							0.0056		0.0022	
Cross Lake	seine	2007												0.0033				0.0011									0.5456	
Elinor Lake	seine	2004			1.798																0.006				0.028		0.003	
		2005			0.5644																0.0022				0.0322		0.0011	
		2006			0.75													0.0011			0.0011				0.0033			
		2007			1.2156																0.0011							
		2008 (1)			0.1667																0.0033				0.0011		0.0022	
		2008 (2)			0.2011																				0.0022			
Ethel Lake	seine	2002			0.395					0.003								0.004			0.128				0.074		0.705	
		2003			0.787																0.001				0.004		0.025	
		2004			5.88													0.014							0.06		0.409	0.002
		2005			2.882				0.0218					0.047				0.0026			0.0039				0.0103		0.0487	0.0026
		2006			0.252				0.004					0.57											0.002		0.111	
		2007 (1)			0.832									0.351													0.088	
		2007 (2)			0.172									0.958											0.001		0.011	
		2008			0.2456									0.26													0.0056	
Fawcett Lake	seine	2007			1.2267													0.0011									0.0011	
Floatingstone Lake	seine	2003			0.339													0.006			0.167	0.015			0.137		0.006	
		2004			0.114																0.272				0.016			
		2005			0.04													0.0067			0.0389	0.5711			0.0389			
		2006			0.0911																0.0867	0.0078			0.0111		0.0044	
		2007			2.8689													0.0044			0.0156	0.0022			0.0033		0.0011	
		2008 (1)			1.9578																0.0133	0.0011			0.0078			

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		2008 (2)			0.2356													0.0011	0.0011			0.0022			0.0044		0.0033	
Fork Lake	seine	2003			0.25									0.005				0.008			0.001				0.008		0.002	
		2004			0.447																				0.003		0.006	
		2005			1.1668																						0.0011	
		2006			0.0822																				0.0033			
		2007																0.0022										
		2008 (1)			0.86																				0.0011			
		2008 (2)			0.0144														0.0011						0.0011			
Frenchman Lake	seine	2004																			0.456							
Frog Lake	seine	2005	0.001		0.141																0.001				0.014			
		2006															0.006								0.017			
		2007	0.044														0.001				0.002				0.006			
		2008																							0.0044			
Garner Lake	seine	2002			0.278																0.042				0.006		0.011	
		2003	0.001		0.885																0.021				0.009		0.043	0.001
		2004			4.17																0.156				0.007		0.009	
		2005			0.0123																0.0901				0.0025		0.0025	
		2006			0.0933																0.9278				0.0267			
		2007			0.1744																0.1322				0.01			
		2008			0.0889																0.0589				0.0011		0.0022	
Ghost Lake	seine	2007 (1)																			0.0111							
		2007 (2)																0.0222										
Gods Lake	seine	2006			0.7833													0.0133									0.0022	
Graham Lake	seine	2006			0.2133									0.0056													0.0578	
Gull Lake	seine	2008		1.9244	0.28																							
Hastings Lake	seine	2005	3.9429																		0.3381							
Heart Lake	seine	2004			0.82																0.01	0.014			0.008		0.178	
		2005			7.5458									0.0083							0.0208				0.0028		0.0014	
		2006			0.5389																0.0522				0.0011		0.0067	
		2007			0.1311																0.2589	0.0044			0.0522		0.0033	
		2008			0.27													0.0011			0.1133	0.0011			0.0011		0.0011	
Hilda Lake	seine	2002			0.406																0.027				0.088		0.198	

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		2003			0.184																0.105				0.03		0.059	
		2004			0.963									0.002							0.14	0.003			0.074		0.002	
		2005			1.0531																0.021				0.0926		0.0086	
		2006			0.9522																0.0044				0.0767		0.0067	
		2008 (1)	0.0236		2.5764			0.0028													0.0083						0.1	
		2008 (2)			0.3819			0.0097						0.0153							0.0083							
Iosegun Lake	seine	2008																0.0022							0.0044		0.0122	
Ironwood Lake	seine	2004			4.464													0.001			0.01				0.008		0.001	
		2005			0.79																0.0756						0.0467	
Island Lake	seine	2007																0.0056									0.5733	
		2008																0.0156										
Isle Lake	seine	2005			1.4051													0.0064			0.8577						0.0436	
		2006			0.0639													0.0028			1.9972						0.0111	
Kehiwin Lake	seine	2002			2.15																0.623	0.002			0.006		0.015	
		2003			3.469																1.302	0.01			0.002		0.024	
		2004			0.331																0.001	0.001			0.013		0.002	
		2005			2.5312																0.0355	0.014			0.0054		0.0419	
		2006	0.1178		0.7756																0.0444	0.0333			0.0022		0.3156	
		2007 (1)	0.3578		1.1856																0.0411							
		2007 (2)	0.9767		0.6656																0.0111	0.0189					0.0033	
		2008	0.1856		0.3122																0.02	0.0133						
Lac Bellevue	seine	2002	0.04																		0.238				0.05		0.186	
		2003																			0.037				0.021		0.257	
		2004	0.01																		0.274				0.007		0.056	
		2005	0.1344																		0.0589				0.0044		0.02	
		2007	0.03																		0.0611						0.0356	
		2008	0.0411																		0.0056						0.0011	
Lac la Biche	seine	2004			0.021									0.001					0.003		0.062				0.041		0.007	
		2005	0.0089		0.0378									0.0189							0.0033				0.0289		1.456	
		2006	0.0033		0.0044																0.0011				0.0433		0.02	
		2007	0.0033		0.0011									0.0011											0.0011			
		2008 (1)			0.0022									0.0011							0.0011	0.0011			0.0011			

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		2008 (2)			0.1311																0.0011	0.0011			0.0033			
Lac La Nonne	seine	2005			0.2083													0.0042	0.0014		0.0431				0.0014			
Lac Sante	seine	2002	0.187																0.157		0.031							
		2003	0.239																0.01									
		2004	21.21																		0.011							
		2006	3.703																		0.056							
Lawrence Lake	seine	2007																			0.0022							
Lac Ste. Anne	seine	2005			0.0011														0.0011								0.01	
Leddy Lake	seine	2005																			1.9833							
Lessard Lake	seine	2005																			2.7486							
Lesser Slave Lake	seine	2005		0.1209	0.0771									0.0092				0.0013	0.0039	0.0033							0.0575	
		2006		0.016	0.0931									0.009													0.0063	
		2007		0.6952	0.004									0.0016									0.0008					
		2008		0.034	0.0383									0.0019														
Long Lake	seine	2006			0.1822									0.0011				0.0022	0.0011						0.0122		0.0156	
Long Lake 2	seine	2007																							0.0011		0.0522	
Lottie Lake	seine	2003	0.447																		0.347							
Lower Chain Lake	seine	2007	0.1211																		0.0067							
Lower Therien	seine	2002																			0.033							
		2003	0.001																		0.04							
		2004																			0.617							
Marie Lake	seine	2002			1.769					0.001				0.326				0.001			0.005	0.111			0.013	0.004	0.099	0.002
		2003			0.001									0.008											0.002	0.007	0.143	0.022
		2004			0.013									0.311								0.001			0.001	0.002		0.001
		2005			0.5633									0.0167								0.0089			0.0044	0.0144	0.0011	0.0011
		2006			3.2444				0.01					1.3422							0.0011	0.0011			0.0022	0.0067	0.2867	0.0022
		2007 (1)			0.0011																	0.0044						
		2007 (2)	0.0156		0.0844																	0.0011			0.0011		0.0011	
		2008			0.05				0.0078	0.0133															0.0011			
Minnie Lake	seine	2004			0.175																							
Missawawi L.	seine	2004	0.49																		0.056							
Mons Lake	seine	2003																									0.006	

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Moore Lake	seine	2002			0.347																0.011				0.229		0.006	
		2003			0.147																0.001				0.006		0.56	
		2004			0.018																				0.002		0.055	0.015
		2005			0.1111																				0.0011		0.26	
		2006			0.0011																				0.0011		0.0433	
		2007			0.0011																				0.0011			
		2008			0.1111																						0.0022	
Moose Lake	seine	2002			1.549													0.001			0.064	0.059			0.007		0.255	
		2003			1.819																0.004				0.025		0.011	
		2004			6.312																	0.002			0.012		0.682	
		2005			2.3856																	0.0011			0.0078		0.0089	
		2006	0.0189		4.01												0.0011				0.0022	0.0222			0.0256		1.4233	
		2007 (1)	0.0122		2.0678																	0.0011					0.01	
		2007 (2)	0.3333		1.7378																0.0033						0.0067	
		2008			4.4178																						0.0656	
Muriel Lake	seine	2002			0.001						0.013									0.001	0.003				0.004		0.611	
		2003																									0.01	
		2005																										
Musreau Lake	seine	2005								0.3556			0.027	0.2016	0.0016				0.0095									
		2006								0.8344			0.0444	0.0878	0.0067				0.2144									
		2007								1.6422			3.4889	0.01	0.0033				0.0011									
		2008								0.0389			0.3956	0.0089					0.0778									
Nakamum Lake	seine	2005																			5.9909							
Normandeau L.	seine	2004																										
North Buck Lake	seine	2008			0.1167													0.0044			0.0011				0.0067		0.0222	
North Wabasca Lake	seine	2005			0.113																							
Peerless Lake	seine	2006		0.0022	0.0089																						0.0044	
Pigeon Lake	seine	2008			0.0044																							0.0011
Pinehurst Lake	seine	2004			1.626																				0.166		0.002	
		2005			0.0322									0.0011											0.0056			
Rock Island Lake	seine	2008			0.4433													0.0089	0.0011			0.0011			0.0011		0.0144	
Round Lake	seine	2006			0.0667									0.0011											0.0033		1.2856	0.0567

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Sandy Lake	seine	2005	0.2711																		0.4433							
Saskatoon Lake	seine	2005																			2.031							
Seibert Lake	seine	2006			0.1156														0.0011		0.0011				0.0233		0.0078	
Smoke Lake	seine	2008			0.1756													0.0122							0.0056		0.0078	
South Buck Lake	seine	2008			1.0644													0.0022	0.0011		0.0044				0.0011		0.0078	
Snipe Lake	seine	2005																0.0022							0.0011		0.0833	
Sturgeon Lake	seine	2005			2.0333									0.0444					0.0067						0.03		0.08	
		2006			3.0156									0.0022					0.0033	0.0011					0.0133		0.0067	
		2007			0.0967									0.04				0.0067	0.0122								0.0167	
		2008			0.42									0.0156				0.0022	0.0033						0.0011		0.0367	
Swan Lake	seine	2006						0.0156													0.2644							
Sylvan Lake	seine	2008		1.3578																								
Thunder Lake	seine	2006																0.0033									1.1389	
Touchwood Lake	seine	2004			4.424									0.007					0.001						0.014		0.006	
		2005			0.0397									0.0026							0.0013				0.0051		0.0641	
		2006			0.0767									0.0167							0.0218				0.0078		0.1833	
		2007			0.0611																						0.1022	
		2008			0.3056													0.0022	0.0011								0.0056	
Tucker Lake	seine	2004																0.099							0.018		0.463	
Utikuma Lake	seine	2005			0.0078																0.0022						0.0044	
Vincent	seine	2002																0.004			0.004				0.002		0.476	
		2003																0.003			0.012						0.002	0.001
		2004																0.001			0.612						0.001	
Wabamun Lake	seine	2005			0.8176									0.0176											0.0029		0.6343	
Wadlin Lake	seine	2008			0.0411																							
Whitefish Lake	seine	2003			0.161													0.002			0.02	0.014			0.039			
		2004			0.03																0.014	0.038			0.064		0.006	
		2005	0.003		2.756									0.0015							0.0446	0.0863			0.0417		0.0208	
		2006			5.2847													0.0014			0.0014	0.0764			0.0333		0.0042	
		2007			0.0736														0.0014		0.0125				0.0444			
		2008			2.7056																				0.0097		0.0042	
Whitney Lake	seine	2005																			0.0123				0.084		1.0049	

Locality	Technique	Year	Fathead Minnow	Emerald Shiner	Spottail Shiner	Redside Shiner	Longnose Dace	Northern Redbelly Dace	Finescale Dace	Pearl Dace	Lake Chub	Flathead Chub	Brassy minnow	White Sucker	Longnose Sucker	Largescale Sucker	Lake Whitefish	Northern Pike	Burbot	Trout Perch	Brook Stickleback	Ninespine Stickleback	Spoonhead Sculpin	Slimy Sculpin	Iowa Darter	Logperch	Yellow Perch	Walleye
Winagami Lake	seine	2005																0.0067										
Wolf Lake	seine	2003			0.333									0.025							0.004				0.008		0.008	
		2004			1.15									0.024				0.003	0.004			0.019			0.032		0.253	
		2005			0.4198									0.0046					0.0011		0.0284				0.0273		0.0068	
		2006			0.13																0.0067				0.0556			
		2007			0.0311									0.0011							0.0144				0.0644			
		2008			0.1056																0.0011				0.0056			