# Population Dynamics of the St. Marys River Fish Community 1975-2002

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*Abstract*- This survey was a continuation of a series of investigations all using similar methodologies since 1975. The Survey used gillnets to determine trends in abundance based on their catch-per-unit-of-effort (CPUE) as well as to collect specimens for analysis of various biological parameters. The report focuses on the status of five resident species of particular interest to anglers. Abundance has been remarkably stable across the survey series for most species. Two important species exhibited declines in 2002; northern pike and lake herring. Walleye, smallmouth bass, and yellow perch were all largely unchanged in mean CPUE. Within the St. Marys River, Lake George and the St. Joseph Channel exhibited relatively high abundances for many species while Lake Nicolet, Lake Munuscong, and Potagannissing Bay trended lower. Total annual mortality was mostly unchanged except for yellow perch which increased. Growth rate improved for walleye and yellow perch. It is not fully clear what accounts for lake herring decline as their mortality rate was low. Also noted during this survey was the first record of white perch, an invasive species from the eastern Atlantic Ocean. The infrequency of the survey as well as under representation of juveniles by the gillnet gear made analysis of recruitment trends difficult. Suggestions are offered for the future frequency and type of sampling to more fully assess the dynamics of the fish community.

## Introduction

A substantial sport fishery exists in the St. Marys River. Sport fishing pressure during the open water season averaged over 444,000 angler hours per year for 1999 – 2001 (Fielder et al. 2002). In 1999, the open water fishing pressure (556,000 hours) in the St. Marys River amounted to 36% as much as all the sport fishing pressure in the Michigan waters of Lake Huron that year. We estimate that over $11 million (US) in economic activity in Michigan and Ontario was generated from the 1999 open water fishery and 2000 ice fishery as a result of angler expenditure [based on a total of 150,858 angler trips (Fielder et al. 2002) and $73.50/trip (U.S. Department of Interior et al. 2001)]. Besides the sport fishery, a tribal substance fishery operates in the river and several commercial fisheries operate in adjacent waters (Fielder et al. 2002).

Fisheries management of the St. Marys River is complicated by the multijurisdictional nature of this international border water (Fielder 2002). The Great Lakes Fishery Commission's St. Marys River Fisheries Task Group developed a plan for the regular assessment of the river's aquatic resources (Gebhardt et al. 2002). Included was a standardized assessment of the fish community. That protocol forms the basis of this study. Such regular assessment is necessary to monitor trends in the fish populations and assess their status relative to changing ecological conditions and management initiatives.

Several issues currently face fisheries management on the St. Marys River. Walleyes have been stocked in the river for years by various agencies. Recently the need for stocking, the contribution of stocked fish, and the appropriate number to stock has been questioned. Similarly, length limits, which are used on a variety of species by two agencies has also been questioned (Greenwood et al. 2002). The regulations are not uniform between Michigan and Ontario making for angler confusion and may be undermining their effectiveness. Information is needed to develop new regulations. In addition, there has been a long standing concern over the sustainability of the relatively intense fisheries in the river (Westerman and Van Oosten 1937; Schorfhaar 1975; Greenwood et al. 2002). While this study was not intended to explicitly answer these questions, the fundamental trend information summarized will assist in providing an up to date assessment of the status of these fish populations and help define further information needed.

Specifically the objective of this study was to provide information on abundance, growth, mortality and size structure of the important fish populations in 2002 and to make comparisons to similar previous surveys (Schorfhaar 1975; Miller 1981; Grimm 1989; Fielder and Waybrant 1998). It is also the objective of this report to comment on the overall current status of certain notable species. Lastly, it is the objective to archive certain information to facilitate future work.

## Study Site

The St. Marys River is a connecting channel between Lakes Superior and Huron (Figure 1). The river flows southeasterly about 112 km and empties into Lake Huron at De Tour, Michigan but also drains into Ontario's North Channel through the St. Joseph Channel and Potagannissing Bay. The river is bordered on the northeast by Ontario and by Michigan on the other side. The river includes a variety of lacustrine reaches; specifically Lake Nicolet, Lake George, Lake Munuscong, and Raber Bay. For practical purposes and for this study, Potagannissing Bay is also considered part of the St. Marys River. The rapids at Sault Ste. Marie is perhaps one of the most well know features of this river, although today 93% of the river flow is diverted for hydroelectric generation (Edsall and Gannon 1993). Three large Islands divide the river flow into various channels. The St. Marys River aquatic habitat includes an expanse of coastal wetlands that provide spawning and nursery habitat for fish. Duffy et al. (1987) describes in detail the ecological and physical characteristics of the St. Marys River.

## Methods

This study followed the fish community assessment procedure recommended by Gebhardt et al. (2002) which in turn was based on the methods used by past surveys (Schorfhaar 1975; Miller 1981; Grimm 1989; Fielder and Waybrant 1998) so as to allow comparability. Multifilament nylon gillnets were used to collect fish in this study. The nets measured 1.8 m deep by 304.8 m long and were comprised of six different mesh sizes. Each mesh was in a 30.5 m long panel. Mesh sizes were; 38.1mm, 50.8 mm, 63.5 mm, 76.2 mm, 88.9 mm, 101.6 mm, 114.3 mm, 127.0 mm, 139.7 mm, and 152.4 mm stretch measure. Nets were fished overnight on the bottom.

Field work was jointly conducted by the member agencies of the St. Marys River Fisheries Task Group. They were the Bay Mills Indian Community (BMIC), Chippewa Ottawa Resource Authority (CORA), Michigan Department of Natural Resources (MDNR), Ontario Ministry of Natural Resources (OMNR), and the United States Fish & Wildlife Service (USFWS). Net set locations were divided throughout the St. Marys River (Figure 1). For the purpose of some analyses, data was organized by seven different distinct areas (Table 1).

The catch from each lift was identified, weighed (round weight) and measured for total length. Scales or dorsal spines were collected for aging from walleye (See appendix 1 for a complete listing of all the common and scientific names of fishes mentioned in this report), yellow perch, smallmouth bass, northern pike, all salmonines, and lake herring. These same species were internally inspected for sex, maturity (according to the methods of Fielder 1998), stomach contents, and for salmonids; visceral fat index scoring (according to the methods of Goede 1989). Stomach contents were identified when possible and enumerated. Age in years was determined from the scales or spines and recorded for each individual fish.

Stomach contents of certain species of interest are reported as incidence (percent void and percent with contents) and as percent occurrence. Percent occurrence is the percent of nonvoid stomachs containing at least one of a particular prey item. Also included is the percent each prey type comprised of all items eaten.

Catch per unit of effort (CPUE) was expressed two ways; first was the total number of each species per net lift or number per 304.8 m of net across all mesh sizes used. The second was to express CPUE based only on the catch collected from the same mesh sizes used in past surveys. Those survey nets in 1975, 1979, 1987, and 1995 only included 50.8 mm, 63.5 mm, 76.2 mm, and 114.3 mm stretch measure mesh. This second method of expressing CPUE allowed a more direct comparison for trend purposes and was standardized (extrapolated when necessary) to 304.8 m of net length. The CPUE values of the two different methods are also contrasted to explore comparability.

Total annual mortality was derived using the Robson-Chapman method (Van Den Avyle and Hayward 1999) on certain species of interest. Age information was also organized by CPUE so as to compare year class strength. Growth rate was expressed as mean length-at-capture-at-age and compared to Michigan averages according to Schneider et al. (2000) and to Lake Huron averages for those species. The Lake Huron data were means of total length from the North Channel of Lake Huron for collections made in similar times of the year (OMNR unpublished data). Survey growth rate averages were also compared to similar data from past surveys. In this report, however, when 1995 mean length-at-age is presented, it is calculated based on the catch from all mesh sizes used which may differ some from those values reported by Fielder and Waybrant (1998) which omitted the effect of the 38.1 mm mesh size. Condition was expressed as relative weight (Wr; Ney 1999). Growth parameters were further explored via length / weight relationships and Von Bertalanffy growth equations (Van Den Avyle and Hayward 1999) for some species.

Statistical analysis included comparison of means via the nonparametric Kruskal-Wallis (K-W) test. Testing for differences of means between two independent samples used the t-test for normally distributed data and the Mann-Whitney U (M-WU) test. Nonparametric procedures were used because gillnet CPUE data were rarely normally distributed. Comparison of the mean CPUE values between the expanded mesh nets (full compliment of mesh sizes fished) and the traditional mesh panels alone (used by past surveys) were standardized to a uniform total net length of 304.8 m to ensure comparability. Some data and means from past surveys were recalculated for reporting and comparison purposes in this report and may differ slightly from those reported by past authors. Length / weight regression analysis used log transformed data and was linear regression. All statistical tests were performed at the significance level of P=0.05 and followed the methods of Sokal and Rohlf (1981). Analysis was performed with the aid of SPSS computer software (SPSS 2001).

## Results

A total of 3,318 specimens were collected in the survey, representing 35 different species. The mean CPUE of walleye in 2002 was the lowest measured since 1975 (Table 2) but there was no statistically significant differences among the survey years (K-W test; P=0.084). Yellow perch mean CPUE declined slightly in 2002 and the various survey year means were significantly different (K-W test; P=0.004). The difference almost certainly stems from the higher mean CPUE exhibited in 1987 compared to the other years which were very similar. Northern pike mean CPUE declined to its lowest level measured in 2002, and there was a significant difference among surveyed years (K-W test; P<0.001). Similarly, there was a significant difference in mean CPUE of smallmouth bass among surveyed years (K-W test; P=0.001) but the 2002 mean CPUE value was still well above the means from the 1970s (Table 2). Lake herring mean CPUE in 2002 was very low compared to past surveys but did not test significantly different (K-W test; P=0.113). Increases in mean CPUE for 2002 was also noted for longnose gar, white bass, and rock bass. Notable declines occurred in brown bullheads. The exotic white perch were collected for the first time in this survey series in 2002 (Table 2).

The gillnet specifications used in the 2002 survey differed from past survey years in that additional meshes were added. The CPUEs summarized in Table 2 were standardized to only include the catch from those mesh sizes in common with past years to allow comparison. It remains possible that some of the available catch was spread over more mesh sizes in 2002 whereby lowering the CPUE value of the traditional meshes alone. If so, the Mean CPUE of the full mesh complement fished in 2002 would be greater than that of the traditional meshes alone. This was explored by the comparison of the mean CPUE of each species between the expanded mesh net (full complement of mesh sizes fished) and the traditional mesh sizes (panels) (Table 3). Under this comparison, the mean CPUE of lake herring was significantly lower (M-WU test; P=0.031) when all mesh sizes were included than that indicated by the traditional mesh sizes alone, but did not trigger a significant difference when compared among years. There was also a significant difference in catch from the two mesh compliments for northern pike (M-WU test; P=0.024), but in this case, the catch was even greater in the traditional mesh, thus not likely accounting for the significant difference observed in the among year comparison. The CPUE from the expanded mesh catch was also slightly lower for walleye and smallmouth bass but not significantly different. The yellow perch catch was essentially the same in the comparison (Table 3).

The St. Marys River encompasses a large variety of habitats. Some indication can be derived of where changes in abundance have occurred by examining trends in CPUE by reach of river. Northern pike declined in CPUE from past years in all areas but increased in Lake George and Potagannissing Bay (Table 4). Lake herring were absent from the catch in all areas except the upper river and Potagannissing Bay. Walleyes appeared to increase in Lake George and Raber Bay but declined in Lake Nicolet and Potagannissing Bay. Smallmouth bass declined in all reaches except Lake George. Yellow perch remained largely unchanged except for indications of possible decline in the lower two reaches of the river (Table 4).

Trends in total annual mortality varied by species. Mortality was much greater in 2002 compared to the 1995 survey for yellow perch in all reaches of the river except Potagannissing Bay (Table 5). Mortality was lower for other notable species or largely unchanged from 1995. Lake herring mortality was somewhat greater in 2002 but low overall for that species.

Walleye growth rate as indicted by mean length at age, improved in 2002 compared to past survey years (Table 6). Improvements were most pronounced for fish younger than age-6. The overall growth rate now slightly exceeds the state of Michigan average rate for walleye (Schneider et al 2000), the first time ever in this survey series. Compared to the Ontario Lake Huron average, growth rate was slower for ages 1-4. Growth rate of lake herring was also above average but improved only slightly over 1995 (Table 7). Lake herring growth rate was at or slightly below the Ontario Lake Huron average. Improvements in lake herring mean length at age were evident for fish age-5 and older when compared to the 1995 survey means. Growth rate improved slightly for northern pike (Table 8) and smallmouth bass (Table 9) but both still averaged below the state of Michigan average rate and the Ontario Lake Huron rate.

Growth rate of yellow perch improved in 2002, exceeding the state of Michigan average rate for the first time since 1975 (Table 10). Yellow perch growth rate was only faster for ages 5 and older when compared to the Ontario Lake Huron average. Growth improvements (when compared to past surveys) were most evident in the upper river, Lake George, and Potagannissing Bay. Growth rate improvements stemmed from fish age-3 and older (Table 10).

About 64% of female yellow perch were sexually maturity by 18 cm in total length. This corresponds to the minimum length limit imposed by Michigan for the sport fishery (Table 11). Female smallmouth bass are achieving 100% maturity by 25 cm, well in advance of the 36 cm Michigan minimum length limit. Maturity of female northern pike did not follow a consistent threshold (Table 11) and may have been a result of low sample size. The 61 cm Michigan minimum length limit appears to be within the range of maturity for pike. Ontario presently maintains no length limits in the St. Marys River except on walleye in the Lake George vicinity where a 46 cm maximum length limit is in place. Michigan maintains a 38 cm minimum length limit on the same species. It appears that female walleye in the St. Marys River consistently achieve 100% maturity around 51 cm.

Walleye in the St. Marys River at the time of the survey were consuming a diet mixed between prey fish and large invertebrates (Table 12). Rainbow smelt and alewife were the most common prey fish eaten while mayflies and crayfish were also consumed. Lake herring diet was entirely comprised of invertebrates with mayflies the most common item. Like walleye, northern pike split their diet between fish and invertebrates with alewife, yellow perch, and lake herring the most common prey fish species (Table 12). Crayfish were the dominant prey item consumed by smallmouth bass with lake herring and slimy sculpin were the prey fish eaten. Yellow perch diet was the most diverse with crayfish the most common item (Table 12). Condition as indicated by mean relative weight declined some from 1995 for walleye but remained largely unchanged for most other species (Table 13).

Incidence of sea lamprey wounding was greatest for chinook salmon and lake whitefish (Table 14). Small wound size exhibited by many species suggested attacks came from transforming sea lamprey. Most common wound class exhibited was A3 and B1 (see King and Edsall 1979 for classification explanation). Yellow perch exhibited the largest range of wound classification but this may have been an artifact of their large sample size.

Length / weight regression equations and Von Bertalanffy growth equations for five notable species is presented in Appendix 2. Length frequency distributions for these species from the survey catch is presented in Appendix 3.

## Discussion

The fish community of the St. Marys River remains remarkably stable despite the presence of considerable fishing pressure. Of the five game species of principal interest, three (walleye, yellow perch, and smallmouth bass) show no appreciable change in mean CPUE over the survey series. Only lake herring and northern pike exhibited a decline although only northern pike tested as statistically significant. Only the 1987 survey reported a significantly higher CPUE values for most species with all other years being stable. The greater 1987 values probably account for the significant differences when detected among years. The sport fishery that year also exhibited much higher harvest levels suggesting that the higher abundance was genuine that year (Fielder et al. 2002).

Trends by river reach may not be as static as river-wide means may suggest. Lake George appeared to sustain greater abundance of some species like walleye, northern pike, and smallmouth bass than in years past. The St. Joseph Channel, added to the survey in 2002, also exhibited high CPUE values relative to the other areas for several species. Other areas trended downward in CPUE such as Potagannissing Bay for all five notable species of interest. Also declining in CPUE was Lake Nicolet for northern pike, walleye, and smallmouth bass. Lake Munuscong was lower in mean CPUE as well for walleye and smallmouth bass. In the sport fishery, Lakes Nicolet, Munuscong, and Potagannissing Bay are among some of the most heavily fished areas. (Fielder et al. 2002). Total annual mortality was largely unchanged for most species except yellow perch. Diet has not changed appreciably from 1995 for most species and growth has improved for the Percids (walleye and yellow perch). Growth remained poor for smallmouth bass and northern pike based on Michigan averages. Growth was unchanged but very good for lake herring.

Only lake herring mean CPUE values were statistically significant in the comparison of the mesh compliments used in the expanded net specifications versus that of the traditional mesh sizes. For all other species tested, its concluded that the inclusion of the additional mesh sizes did not account for any declines reported in CPUE of the traditional mesh among years. Even for lake herring, the difference would not create a significant difference when tested among years. Therefore, on the whole, the expanded mesh nets are believed to have yielded a better representation of the overall size and age structure of the various fish populations and offer more validity in the analysis of various biological parameters with negligible effect on CPUE comparisons.

What follows is a detailed species by species accounting of the five species of principal interest.

*Walleye*

Walleye CPUE has been relatively stable over the history of this survey series (1975 – 2002). Although the 2002 value was the lowest measured, there does not seem to be an immediate trend. Like other species, the 1987 value was the greatest but appears to have been an anomalous year. Similarly, there appears to be no obvious indication as to how walleye abundance may be trending by river reach. The increase in the upper river may trace back to walleye stocking in the Waiska Bay area by CORA (Table 15), but there is insufficient information to determine the exact origin of those fish. Some increase in walleye CPUE is also noted for the 2002 survey in Lake George. Two management differences exist in that area that may account for this increase. Both MDNR and OMNR maintain walleye length limits in Lake George where as only the MDNR does in other river reaches. Although incongruent in combination (OMNR is a maximum length limit and MDNR is a minimum length limit), the two acting in concert may be limiting the harvest and building the population. The other management action has been the addition of Lake George in 1998 as a walleye stocking site by CORA (Table 15). Although adult walleye are believed to mix considerably throughout the river system, the combination of additional harvest regulation and the added stocking may have some role in accounting for the apparent localized increase in survey CPUE. While abundance of walleye has been stable overall in the St. Marys River, it is not clear to what degree that abundance and stability is owed to walleye stocking. Walleye fingerlings stocking has been occurring in most years at least back to 1985 (Fielder and Waybrant 1998).

Recruitment patterns in walleye for the St. Marys River are not readily discernable from these survey data. Catch-per-unit-of-effort for walleye by age does indicate a higher relative abundance of age-4 walleye. These fish would correspond to the 1998 year class which is noted to be unusually strong for percids throughout the Great Lakes region, possibly owing to favorable climatic conditions that spring (Michigan DNR, unpublished data) which favored both natural reproduction as well as good survival of stocked fish. Examinations of walleye from the 1998 year class in 1998 as age-0 for the presence of oxytetracycline marks that were applied to hatchery fish that year did indicate that river-wide, 60% of that cohort could be attributed to stocking that year (St. Marys River Fisheries Task Group, GLFC, Unpublished data). From this single year of data, it is apparent that stocked spring fingerlings can contribute to the population but it is also apparent that there is at least some natural reproduction present. Several additional years of such data, perhaps in combination with alternate year stocking, and supplemented with annual measures of recruitment strength would be necessary to fully assess the role of and need for walleye stocking. Little data exist with which to compare the modern walleye population and fishery to what was sustained there historically, however, walleye spawning runs in two tributaries to Lake George on the Ontario side (the Echo and Bar Rivers) is believed to be greatly depressed (OMNR, unpublished data).

The mean CPUE of walleyes in the St. Marys River in 2002 was 3.58 and ranged from 3.58 to 7.47 over the history of this survey series (Table 2). By contrast, the mean CPUE of walleye from very similar gear in Saginaw Bay was 10.67 for 1996 – 2002 (MDNR Unpublished data). Saginaw Bay's walleye population is considered depressed but still produces a well regarded sport fishery at those densities (Fielder and Baker In Press). Similar sampling in Lake Erie produced a mean CPUE of 105.37 walleyes for 1996 – 2001 (M. Thomas, MDNR, personal communication). Saginaw Bay and especially Lake Erie are unusually large and productive environments that are noted for their walleye populations and may not necessarily represent what might be expected from the St. Marys River. They do, however, provide some benchmark for referencing the current overall relative abundance of walleye in the St. Marys River. Estimates of walleye density in the St. Marys River would be necessary to try and relate the walleye population size to the overall production levels in the river. Such estimates are not possible from gillnet data but if generated, may allow comparison to other similar systems and better assess the degree to which the walleye population may be depressed (if any).

Losses or extractions of walleye in the St. Marys River are principally attributed to the various fisheries that operate in the vicinity. Although no specific estimates for natural mortality are available, there is no foundation to believe that it would be inordinately high, especially given the relatively intensive fishing activity in the area. Walleye are the second most sought after species in the sport fishery (Fielder et al. 2002). River wide, walleye total annual mortality rate is largely unchanged in the St. Marys River between 2002 and 1995 (Table 5) and is within the range commonly observed for exploited walleye populations (Colby et al. 1979). Walleye are the target of sport, subsistence, and commercial fisheries in the St. Marys River and Potagannissing Bay (Fielder et al. 2002). Estimates of sport walleye harvest between Michigan and Ontario ranged from 9,890 walleyes in 1999 to 23,847 walleyes in 2001. The Ontario commercial fishery in the eastern edge of Potagannissing Bay harvested another estimated 3,170 walleyes in 1999 (Fielder et al. 2002). Likely, fishing mortality (through these extractions) accounts for the majority of the total annual mortality rate.

Other losses can include predation. Double-crested cormorants (DCCO) do nest and feed in the St. Marys River (D. Trexel, University of Minnesota, personal communication) mainly in Potagannissing Bay and southern Lake George. It is not known to what degree these predacious birds may be impacting the walleye population. Cormorant predation can be great enough in some systems as to depress the local population (VanDeValk et al. 2002). Walleyes are attacked by parasitic sea lamprey in the St. Marys River but the overall rate appears relatively low and sea lamprey mortality is probably not a significant portion of the overall total annual mortality rate.

Walleye growth rate increased in 2002 compared to past surveys (Table 6). The increase was especially evident in the younger age groups. Although walleye abundance has been relatively stable over the study series, CPUE was the lowest measured in 2002. If decreases in abundance are genuine, then this may partly account for the improved growth.

Diet of walleyes at the time of the survey changed from 1995 when smelt were the most common prey item eaten. In 2002, alewife were the most commonly eaten prey fish followed by gizzard shad (Table 12; Fielder et al. 1998). The increase in consumption of gizzard shad was likely due to increases in their abundance in 2002 as indicated by the gillnet CPUE (Table 2).

Walleye condition as indicated by relative weight was lower in 2002 than 1995. Highest relative weight values were observed in the upper river and lower reaches. These areas may also include more access to main basin prey resources. At these growth rates and condition levels, female walleyes are not consistently achieving sexual maturity until 51 cm in total length (Table 11). Length limits are not always solely intended to protect mature fish, however, these data may help in evaluating how best to align future harvest regulations.

*Northern Pike*

Northern pike were significantly less abundant in 2002 compared to some past years (principally 1987) and exhibited the lowest gillnet CPUE of the survey series. The down turn appears to be driven by declines in all areas except Lake George. Declines were most abrupt in Lake Munuscong. Sport harvest of northern pike has also trended lower since the early 1990s (Fielder et al. 2002) but may be driven partly by an increase in minimum length limit imposed by Michigan on its sport fishery in the late 1990s. Northern pike depend on flooded vegetation for spawning and recent low Great Lakes water levels may be impacting pike reproduction. Trends in recruitment are not readily discernable from these data. Declines in abundance do not appear to be driven by total mortality as it has not changed appreciably from 1995 (Table 5).

Growth rates of northern pike in 2002 were again slightly below the Michigan state average and Ontario Lake Huron average but generally the same as past years (Table 8). Rainbow smelt were absent from northern pike diet in 2002 compared to 1995. Lake herring were observed in their diet for the first time, otherwise yellow perch and crayfish remained common prey items eaten (Table 12). Commensurate with the static growth, northern pike condition did not change appreciably in 2002. Thresholds of maturity by length were not clearly evident for female northern pike probably due to the small sample size (Table 11). Despite their large size, no sea lamprey wounding was observed for northern pike in 2002.

*Yellow Perch*

Yellow perch abundance has been remarkably stable over the survey series (Table 2) despite the significant difference in mean CPUE among years. Like northern pike, this difference is probably driven primarily by the higher 1987 value as opposed to any difference between the other survey years. The expanded mesh CPUE value for 2002 is comparable to similar gear used to survey Saginaw Bay which is noted for its yellow perch population. There, mean CPUE for the period 1994 through 2002 was 57.5 compared to 23.4 for the St. Marys River in 2002 (Table 3). Saginaw Bay may not be a comparable environment given its size and productive capacity but the mean CPUE does provide a benchmark for comparison. Closer inspection of yellow perch mean CPUE by area (Table 4) indicates some decline in the lower reaches of the river for 2002. These declines, however, appear to be off set by the inclusion in 2002 of the St. Joseph Channel area in the calculation of the survey mean. This reach of river exhibited the greatest abundance of yellow perch. Similarly, yellow perch sport harvest has been very steady from 1999 to 2001 (Fielder et al. 2002).

The stability of yellow perch in the St. Marys River is curious given the sharp declines in the neighboring Les Cheneaux Islands. Declines there are partly attributed to high cormorant predation induced mortality (Fielder In Press). Total annual mortality is also high in the St. Marys River in 2002 demonstrating a substantial increase from 1995 (Table 5). There are also cormorant rookeries in the St. Marys River but it is not clear to what extent, if any, they account for this rise in total annual mortality. The substantial fisheries in the St. Marys River are likely are a major portion of the total annual mortality rate. Regardless, production and recruitment of yellow perch appear to have kept pace and sustained this population.

Trends in yellow perch recruitment are not readily discernable from the age structure (Table 10) but do indicate representation in some abundance out to age 6 and some beyond. The 1998 year class (age-4), which is strong for many Percids across the Great Lakes, does not appear to be unusually strong except perhaps in the upper river area.

Growth rate, as indicated by mean length-at-age, improved for yellow perch in 2002 compared to past survey years. Improvement was most noted in the upper river, Lake George, and Potagannissing Bay. The faster growth was most evident in perch age 4 and older (Table 10). Yellow perch are consuming a variety of prey items including both fish and invertebrates in the St. Marys River (Table 12). Slimy sculpins were the most common prey item followed by alewives. On the whole, it appears that crayfish are among the most important dietary items in terms of percent occurrence. Terrestrial insects were commonly consumed as well. This dietary pattern was very similar to that documented in the 1995 survey. This diet has also provided for good condition levels with perch in the Raber Bay area exhibiting the highest relative weight (Table 13). About

64% of female yellow perch achieved sexual maturity by the time they reach the 18 cm minimum length limit imposed by Michigan for its sport anglers (Table 11). Yellow perch exhibited a variety of sea lamprey wounding levels amounting to a total of 1.6% of the population (Table 14).

*Smallmouth Bass*

The significant differences in mean CPUE for this species over the survey series probably stems from the lower levels during the 1970s versus the higher levels since. Although mean CPUE has been declining some since the high in 1987, it still represents an increased population from the early survey years (Table 2). Smallmouth bass abundance continued to be greatest in the central portions of the river (Table 4).

Smallmouth bass total annual mortality rate is low and virtually unchanged from 1995 (Table 5). Smallmouth bass are generally not targeted by anglers in the St. Marys River (Fielder et al. 2002). Several year classes were evident in the 2002 survey catch (Table 9). Smallmouth bass begin recruiting to the sport fishery at about age 3. Michigan anglers are limited to fish 36 cm in total length. All female smallmouth bass are sexually mature by that age (Table 11).

Smallmouth bass diet is mixed between fish and crayfish. Of the fish, slimy sculpin and lake herring were the only species observed (Table 12). This is similar to that observed in 1995. Smallmouth bass growth is largely unchanged but still below the Michigan state average amd Ontario Lake Huron average (Table 9). Condition as indicated by relative weight, however, is very high for this species (Table 13). No lamprey wounding was observed on smallmouth bass in 2002.

*Lake Herring*

Mean CPUE of lake herring dropped 12 fold from the mean 1995 value (Table 2) although did not test significantly different. This is probably due to the inherent variability of this species in the gillnet catch data during the time of year the survey is conducted (August). Lake herring were the only notable species that may have had their CPUE in the traditional meshes affected by the expanded mesh compliment (Table 3). Even the higher CPUE in the expanded mesh was still over a 3 fold decrease from the 1995 CPUE value. Thus, there may be some genuine decline in lake herring abundance. No lake herring were sampled in Lake Nicolet or Raber Bay, two areas that always produced lake herring catch in past survey years often in abundance. Only Potagannissing Bay and the upper river held any lake herring in 2002 (Table 4).

Lake herring function as both a prey species (Table 12) as well as a targeted sport fish in the St. Marys River. Harvest has increased greatly in recent years to nearly 123,000 in 2001 (Fielder et al. 2002). Despite this increase, lake herring total annual mortality remained very low in 2002 suggesting that abundance may have increased (Table 5). This mortality estimate, however, is derived almost entirely from fish collected in one location (Potagannissing Bay). Localized mortality rates may have been higher in other reaches of the river. Lake herring age structure reached out to age 8 in 2002 and the 1998 year class showed prominently (Table 7). On the whole, the low lake herring total annual mortality rate suggests that declines in survey CPUE are not driven by predation or harvest. Still, this species warrants close monitoring.

There are no length limits on lake herring in the St. Marys River and females begin achieving sexual maturity at 28 cm. Lake herring diet was heavily comprised of mayflies which was different from that observed in 1995 when plankton dominated. Spiny water flea (BC) was also commonly eaten (Table 12). Lake herring growth rate continued to be well above the Michigan average in 2002 which may evidence a population level below historic levels although little is known about how herring grew before the survey series. Lake herring Growth rate was not as great as that reported for the Ontario Lake Huron average. Relative weight was modest for these fish (Table 13). Sea lamprey wounding was much lower in 2002 (0.8%; Table 14) compared to over 6% in 1995 (Fielder and Waybrant 1998).

*Special Concerns*

The apparent decline in lake herring abundance may be cause for concern. Generally the data is conflicting about the status of lake herring in the river and the actual trend in abundance needs further study. Lake herring are depressed from historic levels throughout most of Lake Huron and the St. Marys River has remained one of the few strongholds for this species. Any lake-wide recovery will require source stocks of which the St. Marys River may be one. Presently, there is conflicting information concerning the status of lake herring. Lake herring sport harvest is up but they are absent from the gillnet collections in most areas. Concurrent to this is a low total annual mortality rate based on the age structure of those fish that do remain. Lake herring distribution can be patchy depending on thermal preferences and availability of prey resources. This species bears close watching to better determine if they are actually less abundant of if the low survey catch in 2002 was merely an artifact of distribution differences.

Concern has been expressed for some spawning runs of walleye within the St. Marys River. This species has long been supplemented with substantial plantings of hatchery fish. Better information is needed on where the present day abundance of walleye sits with regard to historic levels and more importantly the capacity of the river to either sustain or increase the walleye population. Unlike some other notable Great Lake walleye populations, the St. Marys River harbors a diverse predator community and the abundance of walleye may be partially determined by the abundance of other potential competitors such as northern pike and smallmouth bass. More information is needed to better determine the full status of walleye within the fish community and the degree to which special management efforts are required.

It is noteworthy that white perch were documented for the first time in this survey in the St. Marys River (Raber and Munuscong Bays). An exotic invader from the Atlantic Ocean, white perch have been prevalent in Saginaw Bay since 1984. This species has been documented to consume walleye eggs (Schaeffer and Margraf 1987). Saginaw Bay continued to sustain an abundant yellow perch population in the face of this invasion but the implications of the addition of this exotic to the St. Marys River fish community is not yet known and will warrant close monitoring. Other likely invaders include the Eurasian ruffe and round goby. Although not yet documented in the St. Mary River (this study and USFWS, unpublished data), both are present in Lake Huron and will likely reach the St. Marys River eventually. These species will also have the potential to further perturb the ecosystem.

*Information Needs*

Patterns in recruitment are difficult to discern from these data. Needed are regular (annual) assessments of abundance of some indicator juvenile life stage such as age-0 or age-1 for the species of most interest. This survey series so far has averaged a frequency of once every 7 years. The St. Marys River Assessment Plan (Gebhardt et al. 2002) recommends conducting this survey annually if possible, or at least once every three years. That plan also calls for the addition of bottom trawling and electrofishing to better index recruitment. In the absence of recruitment indices, it is very difficult to determine what forces are shaping the overall abundances of important species (mortality or recruitment?). The age structure does provide some clues and it appears that the 1998 year class was stronger for some species as it was for many populations around the Great Lakes that year. Similarly, better information is needed on the contribution of stocked fish. This is most critical for walleye which are managed within the river system as opposed to the stocked salmonids which typically out migrate to Lake Huron for the majority of their lives.

The lack of regular harvest estimates is also hampering the ability to more fully piece together an accounting of the full status of the fish community and its trends. Harvest estimates from 1999 through 2001 helped greatly but ideally what is needed are annual estimates to more fully indicate trends and document the full range of extractions and fishing pressure river-wide. Better information is needed on the prey fish community which is either underrepresented by gillnet data or missed entirely. This substantial portion of the fish community is missing from the overall assessment and is needed to help discern factors affecting growth and production. These data could also be obtained in the process of indexing recruitment via trawling or electrofishing (Gebhardt et al. 2002).

Lastly, walleye management would benefit from information on exploitation rate, movement, and improved mortality estimation. All this could be accomplished through a comprehensive amrk-recapture type tagging study. Exploitation rate would help to determine the extent to which walleye abundance is shaped by harvest patterns as well as how that mortality is apportioned across the various fisheries. Information on movement would help to determine the extent of protective regulations needed to safe guard depressed spawning runs. If performed annually, tagging studies can permit improved mortality estimation using recruitment-independent models.

## Literature Cited


Colby, P. J, R. E. McNicol, and R.A. Ryder. 1979. Synopsis of biological data on walleye, *Stizostedion v. vitreum* (Mitchill 1818). Food and Agriculture Organization, Fish Synopsis No. 119. 139 p.

Duffy, W. G., T. R. Batterson, and C.D. McNabb. 1987. The ecology of the St. Mary's River, Michigan: an estuarine profile. U. S. Fish Wildlife Service Biol. Rep. 85(7.10). 138 pp.

Edsall, T. A., and J. E. Gannon 1993. A Profile of St. Marys River. MICHU-SG-93-700 Michigan Sea Grant College Program. Ann Arbor, Michigan.

Fielder, D. G. 1998. Lake herring spawning grounds of the St. Marys River with potential effects of early spring navigation. Michigan Department of Natural Resources, Fisheries Research Report 2049. Ann Arbor.

Fielder, D. 2002. St. Marys River Task Group: The St. Marys River and challenges of multijurisdictional fisheries. Fisheries, 27(9):32-34.

Fielder, D. G. 2004. Collapse of the yellow perch fishery in the Les Cheneaux Islands, Lake Huron and possible causes. Pages 129-130 in T. P. Barry and J. A. Malison, editors. Proceedings of Percis III. University of Wisconsin Sea Grant Institute, Madison.

Fielder, D. G., A. K. Bowen, K. J. Gebhardt, and S. J. Greenwood. 2002. Harvest of fishes in the St. Marys River, May, 1999 through March 2000. Great Lakes Fishery Commission, http://glfc.org/pubs/lake_committees/huron/St Marys River Harvest Report 1999-2000.pdf . Ann Arbor.

Fielder, D. G., and J. R. Waybrant. 1998. Fish population surveys of St. Marys River, 1975-95, and recommendations for management. Michigan Department of Natural Resources, Fisheries Research Report 2048. Ann Arbor.

Gebhardt, K., D. Fielder, S. Greenwood, H. Robbins, and T. Sutton [Editors]. 2002. St. Marys River Fisheries Assessment Plan. Great Lakes Fisheries Commission, http://www.glfc.org/pubs/lake_committees/huron/smrfinal.pdf. Ann Arbor.

Goede, R. W. 1989. Fish health/condition assessment procedures, part 1. Utah Division of Wildlife Resources, Fisheries Experiment Station, Logan.

Greenwood, S., K. Gebhardt, D. Fielder, H. Robbins, T. Sutton [Editors]. 2002. Towards a fisheries assessment plan – background information, stakeholder and agency consultation. Great Lakes Fishery Commission, http://www.glfc.org/lakecom/lhc/stkfinal.pdf . Ann Arbor.

Grimm, K. S. 1989. A fisheries survey of the St. Marys River, Chippewa County, August-October, 1987. Mich. Dept. Nat. Res. Tech. Rep. No. 89-7.

King, E. L. Jr., and T. A. Edsall. 1979. Illustrated field guide for the classification of sea lamprey attack marks on Great Lakes lake trout. Great Lakes Fishery Commission, Special Publication 79-1. Ann Arbor.

Miller, B. R. 1981. A 1979 fisheries survey of the St. Mary's River system in Chippewa County, and comparisons with 1975 results. Mich. Dept. Nat. Res. Tech. Rep. No. 81-1.

Ney, J. J. 1999. Practical use of biological statistics. Pages 167-191 in C. C. Kohler and W. A. Hubert, editors. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Schaeffer, J. S., and F. J. Margraf. 1987. Predation on fish eggs by white perch, *Morone Americana*, in western Lake Erie. Environmental Biology of Fishes 18:77-80.

Schneider, J. C., P. W. Laarman, and H. Gowing. 2000. Age and growth methods and state averages. Chapter 9 in J. Schneider, editor. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.

Schorfhaar, R. 1975. A Fisheries Survey of the St. Mary's River, 1975. Michigan Department of Natural Resources, Fisheries Division, Marquette. (Unpublished).

Sokal, R. R., and F. J. Rohlf. 1981. Biometry. Second Edition. W. H. Freeman and Company, San Francisco, California.

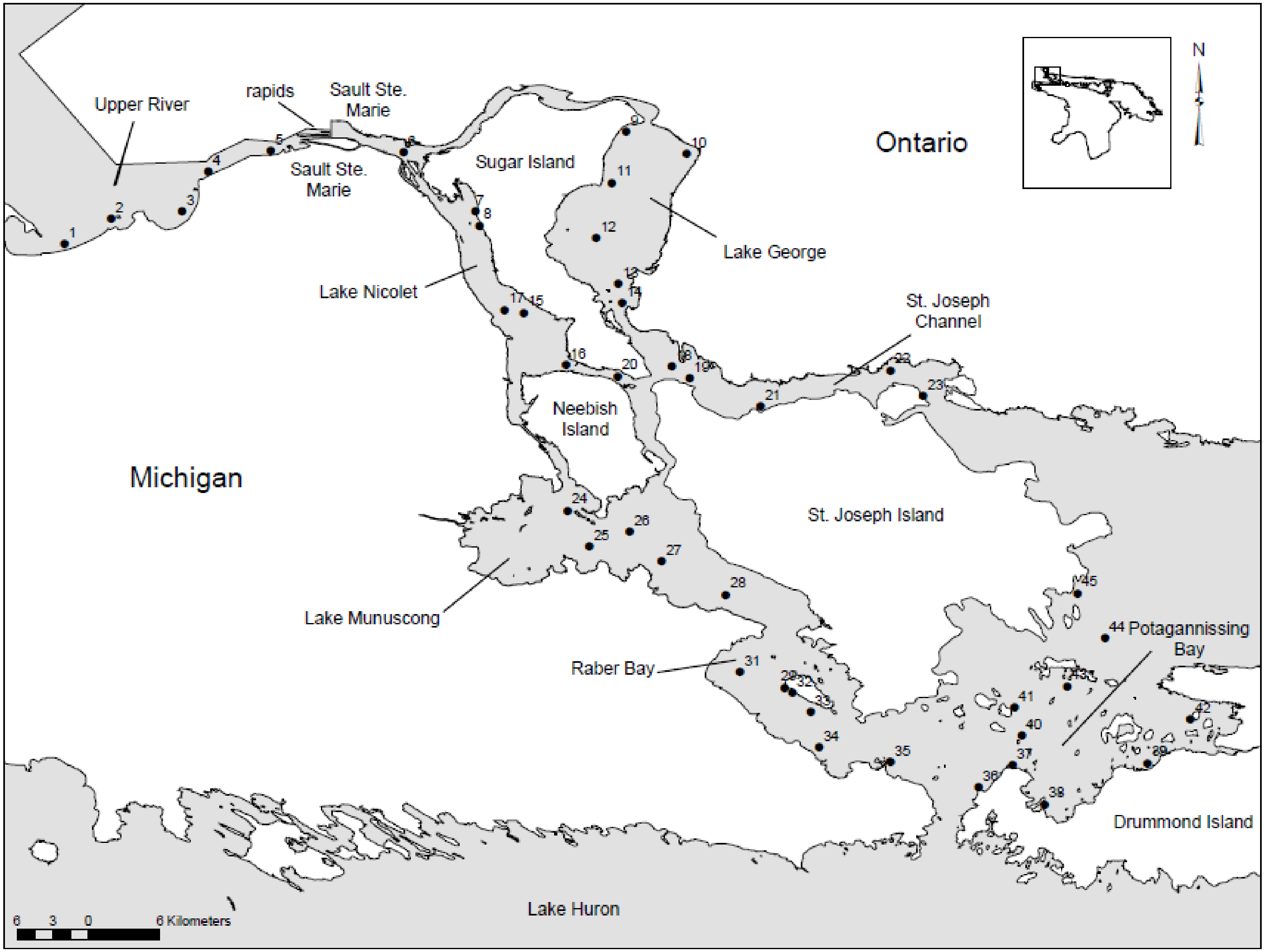
SPSS. 2001. SPSS for windows. Release 11.0.1. SPSS Inc., Chicago, Illinois.

U.S. Department of Interior, U.S. Fish and Wildlife Service, U.S. Department of Commerce, and U.S. Census Bureau. 2001. 2001 National survey of fishing, hunting, and wildlife-associated recreation. U.S. Fish and Wildlife Service. Washington DC.

Van Den Avyle, M. V., and R. S. Hayward. 1999. Dynamics of exploited fish populations. Pages 127-166 in C. C. Kohler and W. A. Hubert, editors. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.

VanDeValk, A. J., C. M. Adams, L. G. Rudstam, J. L. Forney, T. E. Brooking, M. A. Gerken, B. P. Young, and J. T. Hooper. 2002: Comparison of Angler and Cormorant Harvest of Walleye and Yellow Perch in Oneida Lake, New York**.** Transactions of the American Fisheries Society, 131:27–39.

Westerman, F. A., and J. Van Oosten. 1937. Fisheries of Potagannissing Bay, Michigan. Michigan Department of Conservation, Report to the Michigan State Senate, pursuant to Senate Resolution No. 35. Lansing.




•Net set locations

Figure 1. St. Marys River and location of gillnet sets made in August 2002.

Table 1. Net set locations used to define areas within the St. Marys River for the purpose of certain data analyses and the agency that performed the field work. See Figure 1 for location of each net number.

| Area | Net set numbers | Agency |
|---|---|---|
| Upper River | 1, 2, 3, 4, 5 | BMIC |
| Lake Nicolet | 6, 7, 8, 15, 16, 17, 20 | USFWS & CORA |
| Lake George | 9, 10, 11, 12, 13, 14 | BMIC & OMNR |
| Lake Munuscong | 24, 25, 26, 27, 28 | CORA |
| St. Joseph Channel | 18, 19, 21, 22, 23 | OMNR |
| Raber Bay | 29, 31, 32, 33, 34, 35 | MDNR |
| Potagannissing Bay | 36, 37, 38, 39, 40, 41, 42, 43, 44, 45 | MDNR & OMNR |

Table 2.–Mean Catch-Per-Unit-of-Effort (CPUE) of all species collected from the St. Marys River 1975 through 2002. Means are based on 304.8 m (1000 ft) of gillnet with standard error in parentheses. Total nets set were 32 each in 1975 and 1979, 27[b] in 1987, 51 in 1995, and 44 in 2002.

| Species[a] | 1975 | | 1979 | | 1987[b] | | 1995[c] | | 2002 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Alewife | 1.64 | (0.57) | 0.23 | (0.12) | 0.19 | (0.11) | 15.11 | (12.22) | 0.11 | (0.11) |
| Atlantic salmon | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.09 | (0.07) | 0.00 | (0.00) |
| Black crappie | 0.03 | (0.03) | 0.00 | (0.00) | 0.25 | (0.22) | 0.00 | (0.00) | 0.00 | (0.00) |
| Bloater | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.28 | (0.21) |
| Bowfin | 0.03 | (0.03) | 0.03 | (0.03) | 0.40 | (0.40) | 0.00 | (0.00) | 0.00 | (0.00) |
| Brook trout | 0.03 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) |
| Brown bullhead | 6.41 | (3.16) | 0.76 | (0.50) | 6.67 | (3.51) | 2.56 | (1.36) | 0.06 | (0.06) |
| Brown trout | 0.03 | (0.03) | 0.00 | (0.00) | 0.03 | (0.03) | 0.09 | (0.07) | 0.00 | (0.00) |
| Burbot | 0.05 | (0.04) | 0.00 | (0.00) | 0.00 | (0.00) | 0.05 | (0.05) | 0.34 | (0.17) |
| Carp | 0.16 | (0.08) | 0.00 | (0.00) | 0.03 | (0.03) | 0.00 | (0.00) | 0.00 | (0.00) |
| Channel catfish | 0.00 | (0.00) | 0.00 | (0.00) | 0.09 | (0.05) | 0.00 | (0.00) | 0.06 | (0.06) |
| Chinook salmon | 0.00 | (0.00) | 0.03 | (0.03) | 0.46 | (0.29) | 0.08 | (0.05) | 0.00 | (0.00) |
| Coho salmon | 0.03 | (0.03) | 0.00 | (0.00) | 0.00 | (0.00) | 0.05 | (0.05) | 0.00 | (0.00) |
| Freshwater drum | 0.00 | (0.00) | 0.00 | (0.00) | 0.03 | (0.03) | 0.00 | (0.00) | 0.06 | (0.06) |
| Gizzard shad | 0.00 | (0.00) | 0.00 | (0.00) | 0.12 | (0.12) | 0.05 | (0.05) | 0.40 | (0.21) |
| Lake herring | 14.12 | (5.13) | 22.40 | (11.28) | 18.98 | (8.34) | 9.80 | (3.40) | 0.80 | (0.34) |
| Lake trout | 0.00 | (0.00) | 0.31 | (0.31) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) |
| Lake whitefish | 1.15 | (0.41) | 0.55 | (0.25) | 2.10 | (0.99) | 0.73 | (0.37) | 0.06 | (0.06) |
| Longnose gar | 0.00 | (0.00) | 0.03 | (0.03) | 0.06 | (0.04) | 0.00 | (0.00) | 3.92 | (3.52) |
| Longnose sucker | 0.94 | (0.51) | 1.07 | (0.49) | 4.26 | (2.46) | 2.85 | (1.33) | 2.10 | (1.01) |
| Menominee | 0.83 | (0.44) | 0.52 | (0.30) | 0.00 | (0.00) | 1.49 | (0.55) | 0.06 | (0.06) |
| Northern hogsucker | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.05 | (0.05) | 0.00 | (0.00) |
| Northern pike | 9.04 | (1.77) | 8.07 | (1.31) | 12.69 | (2.11) | 9.26 | (1.64) | 4.43 | (2.28) |
| Pink salmon | 0.00 | (0.00) | 0.00 | (0.00) | 2.78 | (1.38) | 0.55 | (0.20) | 0.00 | (0.00) |
| Rainbow smelt | 4.97 | (2.45) | 1.64 | (0.69) | 1.02 | (0.47) | 0.86 | (0.50) | 2.61 | (0.61) |
| Rainbow trout | 0.03 | (0.03) | 0.13 | (0.07) | 0.22 | (0.22) | 0.00 | (0.00) | 0.00 | (0.00) |
| Redhorse spp. | 0.65 | (0.29) | 0.55 | (0.20) | 0.62 | (0.17) | 1.69 | (0.53) | 0.40 | (0.29) |
| Rock bass | 6.20 | (2.25) | 2.29 | (0.67) | 11.67 | (2.42) | 5.57 | (1.35) | 11.42 | (2.77) |
| Sculpin | 0.05 | (0.04) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) |
| Sea lamprey | 0.00 | (0.00) | 0.03 | (0.03) | 0.00 | (0.00) | 0.12 | (0.09) | 0.00 | (0.00) |
| Smallmouth bass | 0.89 | (0.45) | 0.26 | (0.14) | 4.66 | (2.23) | 3.77 | (0.95) | 2.27 | (0.59) |
| Splake | 0.34 | (0.19) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) |
| Sturgeon spp. | 0.99 | (0.96) | 0.03 | (0.03) | 0.09 | (0.05) | 0.00 | (0.00) | 0.00 | (0.00) |
| Sunfish spp. | 0.13 | (0.08) | 0.13 | (0.11) | 1.54 | (0.89) | 0.65 | (0.47) | 0.97 | (0.56) |

Table 2.–Continued.

| Species[a] | 1975 | | 1979 | | 1987[b] | | 1995[c] | | 2002 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Tiger musky | 0.00 | (0.00) | 0.68 | (0.43) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) |
| Trout-perch | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.34 | (0.17) |
| Walleye | 4.27 | (1.56) | 4.14 | (1.73) | 7.47 | (1.92) | 3.92 | (0.83) | 3.58 | (1.04) |
| White bass | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.85 | (0.41) |
| White sucker | 21.48 | (3.94) | 13.85 | (2.20) | 25.68 | (5.46) | 20.00 | (2.47) | 24.7 | (3.93) |
| White perch | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 0.00 | (0.00) | 4.38 | (2.51) |
| Yellow perch | 23.02 | (6.28) | 25.68 | (4.93) | 49.48 | (7.16) | 29.97 | (5.85) | 25.3 | (4.50) |

[a] See Table 1 for a complete list of common and scientific names of fishes mentioned in this report.

[b] Mean CPUEs for 1987 are calculated from a restored data set that lacked five net sets compared to those summarized in Grimm 1987.

[c] Mean CPUEs for 1995 included the addition of nets from the St. Joseph Channel area of the St. Marys River. Mean CPUEs for 1995 also included the influence of 3.81 cm (1.5 inch) mesh net on some sets performed in the Raber and Potagannissing area of the river. This effort was incorporated in to the calculation of CPUE but may still have slightly inflated mean CPUE for certain species such as yellow perch and alewife.

Table 3.–Mean Catch-Per-Unit-of-Effort (CPUE) of all species collected from the St. Marys River in 2002 with all mesh sizes included (Expanded mesh) and from the traditional mesh. Means are based on 304.8 m (1000 ft) of gillnet with standard error in parentheses. There were 44 total nets set.

| Species[a] | Expanded mesh | Traditional mesh |
|---|---|---|
| Alewife | 10.61 (7.84) | 0.11 (0.11) |
| Atlantic salmon | 0.00 (0.00) | 0.00 (0.00) |
| Black crappie | 0.00 (0.00) | 0.00 (0.00) |
| Bloater | 0.02 (0.02) | 0.28 (0.21) |
| Bowfin | 0.00 (0.00) | 0.00 (0.00) |
| Brook trout | 0.00 (0.00) | 0.00 (0.00) |
| Brown bullhead | 2.59 (1.21) | 0.06 (0.06) |
| Brown trout | 0.02 (0.02) | 0.00 (0.00) |
| Burbot | 0.09 (0.04) | 0.34 (0.17) |
| Carp | 0.05 (0.03) | 0.00 (0.00) |
| Channel catfish | 0.02 (0.02) | 0.06 (0.06) |
| Chinook salmon | 0.64 (0.21) | 0.00 (0.00) |
| Coho salmon | 0.00 (0.00) | 0.00 (0.00) |
| Freshwater drum | 0.43 (0.18) | 0.06 (0.06) |
| Gizzard shad | 0.09 (0.09) | 0.40 (0.21) |
| Lake herring | 2.84 (1.35) | 0.80 (0.34) |
| Lake trout | 0.00 (0.00) | 0.00 (0.00) |
| Lake whitefish | 0.77 (0.35) | 0.06 (0.06) |
| Longnose gar | 0.02 (0.02) | 3.92 (3.52) |
| Longnose sucker | 1.20 (0.56) | 2.10 (1.01) |
| Menominee | 0.36 (0.15) | 0.06 (0.06) |
| Northern hogsucker | 0.00 (0.00) | 0.00 (0.00) |
| Northern pike | 1.55 (0.33) | 4.43 (2.28) |
| Pink salmon | 0.39 (0.22) | 0.00 (0.00) |
| Rainbow smelt | 0.25 (0.11) | 2.61 (0.61) |
| Rainbow trout | 0.00 (0.00) | 0.00 (0.00) |
| Redhorse spp. | 0.53 (0.27) | 0.40 (0.29) |
| Rock bass | 5.95 (1.45) | 11.42 (2.77) |
| Sculpin | 0.00 (0.00) | 0.00 (0.00) |
| Sea lamprey | 0.00 (0.00) | 0.00 (0.00) |
| Smallmouth bass | 1.48 (0.30) | 2.27 (0.59) |
| Splake | 0.00 (0.00) | 0.00 (0.00) |
| Sturgeon spp. | 0.02 (0.02) | 0.00 (0.00) |
| Sunfish spp. | 0.41 (0.23) | 0.97 (0.56) |
| Tiger musky | 0.00 (0.00) | 0.00 (0.00) |
| Trout-perch | 0.05 (0.03) | 0.34 (0.17) |
| Walleye | 2.55 (0.65) | 3.58 (1.04) |
| White bass | 0.02 (0.02) | 0.85 (0.41) |
| White crappie | 0.02 (0.02) | 0.00 (0.00) |
| White sucker | 18.80 (2.09) | 24.77 (3.93) |
| White perch | 0.16 (0.09) | 4.38 (2.51) |
| Yellow perch | 23.43 (4.25) | 25.34 (4.50) |

Table 4.–Mean catch-per-unit-of-effort in 304.8 m (1000 ft.) collected from St. Marys River 1975 through 2002. Standard error of the mean is in parentheses.

| Species | Year | Upper River | Lake Nicolet | Lake George | Lake Munuscong | St. Joseph Channel | Raber Bay | Potagannissing Bay |
|---|---|---|---|---|---|---|---|---|
| Yellow perch | 2002 | 26.5 (11.1) | 20.7 (7.8) | 42.5 (20.5) | 17.0 (4.6) | 54.5 (18.3) | 17.9 (7.3) | 11.8 (6.0) |
| | 1995 | 39.0 (17.2) | 21.6 (10.2) | 42.3 (22.6) | 20.3 ( 2.5) | --- | 27.0 ( 6.8)[a] | 29.6 (11.5) |
| | 1987 | 33.9 (15.9) | 30.4 (27.1) | 65.0 (19.0) | 30.0 ( 4.9) | --- | 41.4 ( 4.8) | 62.5 (16.3) |
| | 1979 | 43.1 ( 9.0) | 18.9 ( 9.5) | 26.2 (11.0) | 9.2 ( 2.1) | --- | 9.8 ( 5.0) | 37.3 (11.7) |
| | 1975 | 25.3 (16.6) | 13.9 (10.0) | 31.8 (10.0) | 11.2 ( 6.0) | --- | 6.0 ( 3.6) | 33.5 (16.4) |
| Northern pike | 2002 | 0.0 (0.0) | 0.4 (0.4) | 21.7 (14.7) | 0.0 (0.0) | 7.5 (6.3) | 0.4 (0.4) | 2.2 (1.8) |
| | 1995 | 2.5 ( 1.6) | 8.1 ( 3.4) | 16.3 ( 4.5) | 18.4 ( 5.5) | --- | 12.8 ( 3.4) | 1.6 ( 1.2) |
| | 1987 | 6.9 ( 5.0) | 2.9 ( 2.1) | 27.0 ( 5.2) | 15.6 ( 3.0) | --- | 11.7 ( 3.2) | 8.0 ( 3.0) |
| | 1979 | 1.9 ( 0.3) | 4.7 ( 3.5) | 14.3 ( 3.3) | 11.8 ( 4.6) | --- | 6.0 ( 2.6) | 6.5 ( 1.4) |
| | 1975 | 4.4 ( 4.0) | 11.7 ( 7.1) | 17.3 ( 7.8) | 9.3 ( 2.6) | --- | 5.0 ( 3.0) | 7.1 (2.4) |
| Walleye | 2002 | 2.5 (2.5) | 1.1 (0.5) | 8.8 (3.6) | 1.0 (1.0) | 3.0 (1.5) | 7.9 (5.6) | 1.8 (1.2) |
| | 1995 | 2.5 ( 0.8) | 5.6 ( 3.1) | 2.0 ( 6.9) | 2.8 ( 0.9) | --- | 3.6 ( 1.1) | 5.4 ( 2.1) |
| | 1987 | 1.1 ( 0.7) | 0.8 ( 0.0) | 8.0 ( 3.5) | 3.1 ( 1.4) | --- | 21.9 ( 8.0) | 6.3 ( 2.4) |
| | 1979 | 0.0 ( 0.0) | 1.1 ( 0.7) | 4.0 ( 2.8) | 2.9 ( 1.0) | --- | 5.6 ( 2.8) | 6.3 ( 4.8) |
| | 1975 | 0.0 ( 0.0) | 4.7 ( 2.0) | 5.0 ( 4.0) | 2.9 ( 1.8) | --- | 2.1 ( 1.4) | 6.5 ( 4.1) |
| Smallmouth bass | 2002 | 0.0 (0.0) | 1.1 (0.7) | 4.2 (2.9) | 4.5 (1.4) | 4.5 (1.8) | 2.5 (2.0) | 0.8 (0.4) |
| | 1995 | 0.0 ( 0.0) | 3.1 ( 3.1) | 3.5 ( 2.0) | 8.1 ( 2.8) | --- | 5.9 ( 4.5) | 2.5 ( 1.0) |
| | 1987 | 0.6 ( 0.3) | 2.1 ( 1.2) | 15.5 (10.6) | 7.9 ( 5.3) | --- | 2.3 ( 0.4) | 0.2 ( 0.1) |
| | 1979 | 0.0 ( 0.0) | 0.0 ( 0.0) | 0.0 ( 0.0) | 0.3 ( 0.3) | --- | 0.0 ( 0.0) | 0.6 ( 0.4) |
| | 1975 | 0.0 ( 0.0) | 0.0 ( 0.0) | 0.3 ( 0.2) | 1.8 ( 1.2) | --- | 0.0 ( 0.0) | 1.4 ( 1.1) |
| Lake herring | 2002 | 0.5 (0.0) | 0.0 (0.0) | 0.0 (0.0) | 0.0 (0.0) | 0.0 (0.0) | 0.0 (0.0) | 3.2 (1.2) |
| | 1995 | 0.0 ( 0.0) | 13.4 ( 5.9) | 3.5 (3.2) | 0.0 ( 0.0) | --- | 11.7 ( 9.3) | 19.2 ( 9.8) |
| | 1987 | 0.0 ( 0.0) | 0.8 ( 0.8) | 3.3 ( 2.9) | 0.8 ( 0.6) | --- | 1.2 ( 1.0) | 54.0 (21.1) |
| | 1979 | 0.0 ( 0.0) | 3.1 ( 3.1) | 0.0 ( 0.0) | 0.0 ( 0.0) | --- | 62.7 (62.4) | 39.8 (23.8) |
| | 1975 | 0.0 ( 0.0) | 9.2 ( 8.3) | 0.0 ( 0.0) | 0.1 ( 0.1) | --- | 42.5 (17.8) | 23.0 (11.7) |

[a] Means from these areas included some efforts of 3.51 c, (1.5 in.) mesh. While compensated for in the calculation of CPUE, the influence of the smaller mesh may have slightly inflated the mean for certain species such as yellow perch.

Table 5.– Comparison of total annual mortality rates for select fish species in the St. Marys River, computed from fish collected in experimental mesh gillnets 2002 with 1995 results for comparison.

| Species | Area, if not total for the river | 1995 total annual mortality | 2002 total annual mortality |
|---|---|---|---|
| Yellow perch | Upper River | 0.25 | 0.54 |
| | Lake Nicolet | 0.38 | 0.70 |
| | Lake George | 0.40 | 0.52 |
| | St. Joseph Channel | Not sampled | 0.64 |
| | Lake Munuscong | 0.41 | 0.61 |
| | Raber Bay | 0.44 | 0.63 |
| | Potagannissing Bay | 0.60 | 0.57 |
| | River Total | 0.38 | 0.68 |
| Northern pike | | 0.58 | 0.52 |
| Walleye | | 0.51 | 0.49 |
| Lake herring | | 0.31 | 0.39 |
| Smallmouth bass | | 0.36 | 0.37 |

Table 6. Catch-per-unit-of-effort (CPUE) of walleye by age and mean length-at-age at capture for the St. Marys River, August, 2002. For comparison, mean length-at-age is included from past surveys and the Michigan state average length-at-age[1] as well as the Ontario Lake Huron North Channel (ON LH) average[2]. Unit of effort is one 305 m gillnet set. Growth index[1] compares length-at-age to state average and excludes age groups represented by less than 5 specimens. All lengths and the growth index are in mm. CPUE values by age may omit some unaged fish and therefore may not total to the overall CPUE for this species as reported in Table 2.

| | Age | | | | | | | | | | | | | | Mean | Mean | Growth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | age | length | index |
| Number | 12 | 12 | 16 | 51 | 8 | 2 | 1 | 4 | | 1 | 1 | 1 | 1 | 2 | | | |
| CPUE | 0.27 | 0.27 | 0.36 | 1.16 | 0.18 | 0.04 | 0.02 | 0.09 | | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | | | |
| Frequency (%) | 10.7 | 10.7 | 14.3 | 45.5 | 7.1 | 1.8 | 0.9 | 3.6 | | 0.9 | 0.9 | 0.9 | 0.9 | 1.8 | | | |
| Mean length | | | | | | | | | | | | | | | | | |
| This survey (2002) | 253 | 312 | 393 | 472 | 530 | 421 | 563 | 552 | | 590 | 578 | 660 | 571 | 614 | 4.0 | 434 | +15 |
| 1995 survey | 209 | 271 | 278 | 363 | 489 | 502 | 560 | 611 | | 604 | | | | | | | -26 |
| 1987 survey | 240 | 288 | 347 | 407 | 464 | 505 | 549 | 585 | 607 | 660 | | | | | | | -17 |
| 1979 survey | | 307 | 378 | 447 | 472 | 528 | 513 | 538 | | | | | | | | | -27 |
| MI average | 250 | 338 | 386 | 437 | 472 | 516 | 541 | 561 | 582 | | | | | | | | |
| ON LH average | 313 | 376 | 438 | 490 | 499 | 504 | 517 | 533 | 540 | 560 | 570 | 615 | 626 | 643 | | | |

[1]From Schneider et al. (2000)

[2]Ontario MNR, unpublished data

Table 7. Catch-per-unit-of-effort (CPUE) of lake herring by age and mean length-at-age at capture for the St. Marys River, August, 2002. For comparison, mean length-at-age is included from past surveys and the Michigan state average length-at-age[1] as well as the Ontario Lake Huron North Channel (ON LH) average[2]. Unit of effort is one 305 m gillnet set. Growth index[1] compares length-at-age to state average and excludes age groups represented by less than 5 specimens. All lengths and the growth index are in mm. CPUE values by age may omit some unaged fish and therefore may not total to the overall CPUE for this species as reported in Table 2.

| | Age | | | | | | | | | | | | | | Mean | Mean | Growth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | age | length | index |
| Number | | 32 | 20 | 6 | 43 | 14 | 5 | 1 | 1 | | | | | | | | |
| CPUE | | 0.72 | 0.45 | 0.14 | 0.98 | 0.32 | 0.11 | 0.02 | 0.02 | | | | | | | | |
| Frequency (%) | | 26.2 | 16.4 | 4.9 | 35.2 | 11.5 | 4.1 | 0.8 | 0.8 | | | | | | | | |
| Mean length | | | | | | | | | | | | | | | | | |
| This survey (2002) | | 199 | 240 | 306 | 338 | 374 | 383 | 412 | 416 | | | | | | 3.1 | 292 | +26 |
| 1995 survey | | 200 | 265 | 330 | 289 | 327 | 379 | 399 | 401 | 412 | 446 | | | | | | +16 |
| MI average | | 214 | 241 | 267 | 294 | 321 | 347 | 374 | 400 | | | | | | | | |
| ON LH average | | | 303 | 338 | 374 | 394 | 407 | 413 | 438 | 451 | | | | | | | |

[1]From Schneider et al. (2000)
[2]Ontario MNR, unpublished data

Table 8. Catch-per-unit-of-effort (CPUE) of northern pike by age and mean length-at-age at capture for the St. Marys River, August, 2002. For comparison, mean length-at-age is included from past surveys and the Michigan state average length-at-age[1] as well as the Ontario Lake Huron North Channel (ON LH) average[2]. Unit of effort is one 305 m gillnet set. Growth index[1] compares length-at-age to state average and excludes age groups represented by less than 5 specimens. All lengths and the growth index are in mm. CPUE values by age may omit some unaged fish and therefore may not total to the overall CPUE for this species as reported in Table 2.

| | Age | | | | | | | | | | | | | | Mean | Mean | Growth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | age | length | index |
| Number | 3 | 12 | 19 | 14 | 9 | 3 | | | | | | | | | | | |
| CPUE | 0.07 | 0.27 | 0.43 | 0.32 | 0.20 | 0.07 | | | | | | | | | | | |
| Frequency (%) | 5.0 | 20.0 | 31.7 | 23.3 | 15.0 | 5.0 | | | | | | | | | | | |
| Mean length | | | | | | | | | | | | | | | | | |
| This survey (2002) | 250 | 371 | 455 | 564 | 620 | 669 | | | | | | | | | 2.4 | 477 | -34 |
| 1995 survey | | 399 | 465 | 538 | 605 | 621 | 722 | 918 | | 1033 | | | | | | | -39 |
| 1987 survey | | 407 | 468 | 515 | 575 | 672 | 726 | 752 | 754 | | | | | | | | -39 |
| MI average | | 422 | 511 | 579 | 635 | 683 | 732 | 780 | | | | | | | | | |
| ON LH average | | 466 | 521 | 619 | 662 | | | | | | | | | | | | |

[1]From Schneider et al. (2000)
[2]Ontario MNR, unpublished data

Table 9. Catch-per-unit-of-effort (CPUE) of smallmouth bass by age and mean length-at-age at capture for the St. Marys River, August, 2002. For comparison, mean length-at-age is included from past surveys and the Michigan state average length-at-age[1] as well as the Ontario Lake Huron North Channel (ON LH) average[2]. Unit of effort is one 305 m gillnet set. Growth index[1] compares length-at-age to state average and excludes age groups represented by less than 5 specimens. All lengths and the growth index are in mm. CPUE values by age may omit some unaged fish and therefore may not total to the overall CPUE for this species as reported in Table 2.

| | Age | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Mean age | Mean length | Growth index |
| Number | | 5 | 1 | 16 | 25 | 5 | 6 | 3 | 1 | | | 1 | | | | | |
| CPUE | | 0.11 | 0.02 | 0.36 | 0.57 | 0.11 | 0.14 | 0.07 | 0.02 | | | 0.02 | | | | | |
| Frequency (%) | | 7.9 | 1.6 | 25.4 | 39.7 | 7.9 | 9.5 | 4.8 | 1.6 | | | 1.6 | | | | | |
| <u>Mean length</u> | | | | | | | | | | | | | | | | | |
| This survey (2002) | | 146 | 187 | 222 | 291 | 325 | 376 | 398 | 457 | | | 457 | | | 4.1 | 281 | -61 |
| 1995 survey | | 145 | | 245 | 263 | 278 | 305 | 340 | 359 | | | | | | | | -99 |
| 1987 survey | | | | 234 | 268 | 330 | 347 | 371 | | | | | | | | | -72 |
| MI average | | 178 | 257 | 305 | 356 | 386 | 406 | 434 | 452 | 475 | | | | | | | |
| ON LH average | | | 200 | 270 | 310 | 355 | 412 | 409 | 428 | 449 | 450 | 467 | | | | | |

[1]From Schneider et al. (2000)
[2]Ontario MNR, unpublished data

Table 10. Catch-per-unit-of-effort (CPUE) of yellow perch by age and mean length-at-age at capture for the St. Marys River, August, 2002. For comparison, mean length-at-age is included from past surveys and the Michigan state average length-at-age[1] as well as the Ontario Lake Huron North Channel (ON LH) average[2]. Unit of effort is one 305 m gillnet set. Growth index[1] compares length-at-age to state average and excludes age groups represented by less than 5 specimens. All lengths and the growth index are in mm. CPUE values by age may omit some unaged fish and therefore may not total to the overall CPUE for this species as reported in Table 2.

| | Age | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameter & Area | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean age | Mean length | Growth index |
| **Upper River** | | | | | | | | | | | | | |
| Number | 18 | 20 | 19 | 33 | 1 | | 1 | | 1 | 1 | | | |
| CPUE | 3.60 | 4.00 | 3.80 | 6.60 | 0.20 | | 0.20 | | 0.20 | 0.20 | | | |
| Frequency (%) | 19.1 | 21.3 | 20.2 | 35.1 | 1.1 | | 1.1 | | 1.1 | 1.1 | | | |
| <u>Mean length</u> | | | | | | | | | | | | | |
| This survey (2002) | 146 | 170 | 222 | 251 | 343 | | 361 | | 373 | 372 | 3.0 | 212 | +28 |
| 1995 survey | | 157 | 184 | 200 | 225 | 244 | 269 | 280 | 298 | 354 | | | -7 |
| 1987 survey | | | | 201 | 216 | 224 | 254 | 264 | 305 | 312 | | | -20 |
| 1979 survey | | | 183 | 201 | 216 | 259 | 272 | 302 | 295 | | | | -6 |
| **Lake Nicolet** | | | | | | | | | | | | | |
| Number | | 12 | 82 | 24 | 6 | 3 | 1 | | | | | | |
| CPUE | | 1.71 | 11.71 | 3.48 | 0.88 | 0.48 | 0.11 | | | | | | |
| Frequency (%) | | 9.4 | 64.1 | 18.8 | 4.7 | 2.3 | 0.8 | | | | | | |
| <u>Mean length</u> | | | | | | | | | | | | | |
| This survey (2002) | | 148 | 162 | 197 | 238 | 239 | 328 | | | | 3.3 | 177 | -10 |
| 1995 survey | 170 | 147 | 172 | 209 | 227 | 250 | 275 | 284 | | | | | -7 |
| 1987 survey | | | | 196 | 221 | 231 | 287 | 295 | | | | | -7 |
| 1979 survey | | | 168 | 185 | 221 | 208 | 244 | | | | | | -18 |
| **Lake George** | | | | | | | | | | | | | |
| Number | 17 | 99 | 75 | 52 | 4 | 3 | 2 | 1 | | | | | |
| CPUE | 2.87 | 16.50 | 12.50 | 8.67 | 0.67 | 0.50 | 0.33 | 0.17 | | | | | |
| Frequency (%) | 6.7 | 39.1 | 29.6 | 20.6 | 1.6 | 1.2 | 0.8 | 0.4 | | | | | |
| <u>Mean length</u> | | | | | | | | | | | | | |
| This survey (2002) | 155 | 153 | 194 | 222 | 269 | 311 | 318 | 315 | | | 2.8 | 185 | +12 |
| 1995 survey | | 148 | 169 | 206 | 233 | 247 | 242 | 263 | 256 | | | | -15 |
| 1987 survey | | | | 198 | 216 | 256 | 264 | 302 | 323 | | | | -10 |
| 1979 survey | | | 173 | 190 | 203 | 249 | 282 | 282 | | 297 | | | -12 |

Table 10. Continued.

| Parameter & Area | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean age | Mean length | Growth index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **St. Joseph Channel** | | | | | | | | | | | | | |
| Number | | 59 | 123 | 61 | 21 | 5 | | | | | | | |
| CPUE | | 11.80 | 24.60 | 12.2 | 4.20 | 1.00 | | | | | | | |
| Frequency (%) | | 21.9 | 45.7 | 22.7 | 7.8 | 1.9 | | | | | | | |
| Mean length | | | | | | | | | | | | | |
| This survey (2002) | | 147 | 167 | 217 | 259 | 293 | | | | | 3.2 | 183 | +8 |
| 1995 survey | | | | | | | | | | | | | |
| 1987 survey | | | | | | | | | | | | | |
| 1979 survey | | | | | | | | | | | | | |
| **Lake Munuscong** | | | | | | | | | | | | | |
| Number | 1 | 49 | 25 | 10 | 2 | | 1 | | | | | | |
| CPUE | 0.20 | 9.80 | 5.00 | 2.00 | 0.40 | | 0.20 | | | | | | |
| Frequency (%) | 1.1 | 55.7 | 28.4 | 11.4 | 2.3 | | 1.1 | | | | | | |
| Mean length | | | | | | | | | | | | | |
| This survey (2002) | 153 | 146 | 180 | 208 | 230 | | 275 | | | | 2.6 | 1.66 | -6 |
| 1995 survey | | 145 | 177 | 213 | 229 | 239 | 256 | 292 | 278 | | | | -11 |
| 1987 survey | | | | 196 | 226 | 279 | 292 | 325 | | | | | +10 |
| 1979 survey | | 203 | 193 | 216 | 239 | 284 | 254 | | | | | | +9 |
| **Raber Bay** | | | | | | | | | | | | | |
| Number | | 17 | 39 | 27 | 6 | 1 | | | | | | | |
| CPUE | | 2.83 | 6.50 | 4.50 | 1.00 | 0.18 | | | | | | | |
| Frequency (%) | | 18.9 | 43.3 | 30.0 | 6.7 | 1.1 | | | | | | | |
| Mean length | | | | | | | | | | | | | |
| This survey (2002) | | 152 | 175 | 203 | 246 | 268 | | | | | 3.3 | 185 | -2 |
| 1995 survey | 137 | 152 | 202 | 227 | 236 | 260 | 268 | 269 | | | | | +4 |
| 1987 survey | | | 165 | 188 | 231 | 251 | 277 | 297 | 307 | 315 | | | -9 |
| 1979 survey | | 185 | 196 | 221 | 272 | 262 | | | | | | | +17 |

Table 10. Continued.

| Parameter & Area | Age 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean age | Mean length | Growth index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Potagannissing Bay** | | | | | | | | | | | | | |
| Number | 4 | 31 | 27 | 6 | 2 | 1 | | | | | | | |
| CPUE | 0.40 | 3.10 | 2.70 | 0.60 | 0.20 | 0.10 | | | | | | | |
| Frequency (%) | 5.6 | 43.7 | 38.0 | 8.5 | 2.8 | 1.4 | | | | | | | |
| <u>Mean length</u> | | | | | | | | | | | | | |
| This survey (2002) | 157 | 172 | 196 | 247 | 297 | 175 | | | | | 2.6 | 189 | +32 |
| 1995 survey | 133 | 158 | 167 | 208 | 215 | 243 | 275 | 290 | | | | | |
| 1987 survey | | | | | 231 | 262 | 272 | 307 | | 330 | | | -1 |
| 1979 survey | | | 201 | 224 | 249 | 269 | 302 | 323 | 282 | | | | +20 |
| **River-wide** | | | | | | | | | | | | | |
| Number | 40 | 287 | 390 | 213 | 42 | 13 | 5 | 1 | 1 | 1 | | | |
| CPUE | 0.91 | 6.52 | 8.86 | 4.84 | 0.95 | 0.30 | 0.11 | 0.02 | 0.02 | 0.02 | | | |
| Frequency (%) | 4.0 | 28.9 | 39.3 | 21.5 | 4.2 | 1.3 | 0.5 | 0.1 | 0.1 | 0.1 | | | |
| <u>Mean length</u> | | | | | | | | | | | | | |
| This survey (2002) | 151 | 153 | 177 | 220 | 258 | 274 | 320 | 315 | 373 | 372 | 3.0 | 184 | +15 |
| 1995 survey | 140 | 152 | 171 | 211 | 227 | 246 | 260 | 278 | 294 | 354 | | | -7 |
| 1987 survey | | | 165 | 195 | 223 | 244 | 273 | 296 | 308 | 319 | | | -6 |
| 1979 survey | | 196 | 196 | 209 | 229 | 264 | 285 | 302 | 291 | 297 | | | +7 |
| MI average | 127 | 160 | 183 | 208 | 234 | 257 | 277 | 292 | 302 | | | | |
| ON LH average | 141 | 183 | 229 | 241 | 248 | 250 | 259 | 274 | 278 | | | | |

[1]From Schneider et al. (2000)

[2]Ontario MNR, unpublished data

Table 11.–Maturity schedule for five notable species expressed as percent maturity of females by length in the St. Marys River collected by gillnets in August 2002.

| | Species | | | | |
|---|---|---|---|---|---|
| Length (cm) | Walleye | Smallmouth bass | Northern pike | Yellow perch | Lake herring |
| 13 | | | | 33.3% | |
| 14 | | 0% | | 39.5% | |
| 15 | | | | 53.8% | |
| 16 | | | | 41.4% | |
| 17 | | | | 54.5% | |
| 18 | | | | 63.9% | 0% |
| 19 | | 0% | | 66.0% | 0% |
| 20 | | | | 61.5% | 0% |
| 21 | | | | 88.6% | 0% |
| 22 | | 50% | | 83.3% | 0% |
| 23 | | 0% | | 92.9% | |
| 24 | | 0% | | 80.0% | |
| 25 | | 100% | | 89.5% | |
| 26 | | | | 94.1% | |
| 27 | | 100% | | 88.9% | 0% |
| 28 | | 100% | | 100% | 100% |
| 29 | | 100% | | 100% | 66.7% |
| 30 | | 100% | 0% | 100% | 100% |
| 31 | | 100% | | 100% | |
| 32 | 100% | 100% | | 100% | 85.7% |
| 33 | | 100% | | 66.7% | 100% |
| 34 | | | | 100% | 100% |
| 35 | | | | 100% | 100% |
| 36 | 0% | | | 100% | 100% |
| 37 | | 100% | | 100% | 100% |
| 38 | 0% | 100% | 100% | | 100% |
| 39 | | | 50% | | 100% |
| 40 | | 100% | | | 100% |
| 41 | | | 0% | | 50% |
| 42 | | | 0% | | 50% |
| 43 | | | 0% | | |
| 44 | | | | | |
| 45 | | | 100% | | |
| 46 | | 100% | | | |
| 47 | 50% | | | | |
| 48 | 100% | | 0% | | |
| 49 | 66.7% | | 0% | | |
| 50 | 85.7% | | | | |

Table 11.–Continued.

| | Species | | | | |
|---|---|---|---|---|---|
| Length (cm) | Walleye | Smallmouth bass | Northern pike | Yellow perch | Lake herring |
| 51 | 100% | | 100% | | |
| 52 | | | | | |
| 53 | 100% | | 0% | | |
| 54 | 100% | | 0% | | |
| 55 | | | | | |
| 56 | 100% | | 100% | | |
| 57 | | | | | |
| 58 | | | 0% | | |
| 59 | | | 100% | | |
| 60 | 100% | | 0% | | |
| 61 | | | 100% | | |
| 62 | | | | | |
| 63 | | | | | |
| 64 | | | | | |
| 65 | | | 100% | | |
| 66 | | | 100% | | |

Table 12. –Incidence and percent occurrence of food items (based on stomach content identification) for select species from the St. Marys River, August 2002. Percent prey item is in parenthesis.

| | Walleye | Lake herring | Northern pike | Smallmouth bass | Yellow perch |
|---|---|---|---|---|---|
| **Incidence** | | | | | |
| No. stomachs examined | 95 | 60 | 58 | 54 | 588 |
| % void | 54 | 53 | 71 | 39 | 68 |
| **Percent of Occurrence** | | | | | |
| Unidentified fish remains | 72.7 (63.8) | | 64.7 (44.4) | 45.4 (28.2) | 23.9 (20.2) |
| Crayfish | 2.3 (1.7) | | 11.8 (14.8) | 69.7 (67.6) | 55.3 (50.6) |
| Alewife | 13.6 (8.7) | | 5.9 (7.4) | | 2.6 (2.9) |
| Rainbow smelt | 2.3 (15.5) | | | | 0.5 (0.4) |
| Mayfly | 2.3 (8.6) | 82.1 (76.6) | | | 3.2 (2.0) |
| Gizzard shad | 6.8 (0.9) | | | | |
| Unidentified zooplankton | | 3.6 (3.3) | | | 1.6 (1.2) |
| Spiny water flea | | 17.9 (16.7) | | | 2.1 (0.4) |
| Dragon fly | | 3.6 (3.3) | | | 0.5 (0.4) |
| Yellow perch | | | 17.6 (11.1) | | |
| Lake herring | | | 5.9 (3.7) | 3.0 (1.4) | |
| Slimy sculpin | | | | 6.1 (2.8) | 4.2 (4.1) |
| Johnny darter | | | | | 0.5 (0.4) |
| Unidentified terrestrial insects | | | | | 7.4 (7.0) |
| Ninespine stickleback | | | | | 0.5 (0.4) |
| Threespine stickleback | | | | | 0.5 (1.6) |
| Snails | | | | | 1.1 (4.1) |
| Other | | | 5.9 (3.7) | | 1.6 (4.1) |


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Table 13.-Condition of select species by area in the St. Marys River, August 2002 and river wide with 1995 values for comparison. Values are mean relative weight.

| Location | Walleye | Yellow perch | Smallmouth bass | Northern pike | Lake herring |
|---|---|---|---|---|---|
| Upper River | 94.7 | 89.4 | --- | --- | --- |
| Lake Nicolet | 86.8 | 96.8 | 112.4 | 78.0 | 85.0 |
| Lake George | 87.8 | 91.7 | 100.0 | 83.6 | --- |
| Lake Munuscong | --- | 95.3 | 95.9 | 86.3 | --- |
| St. Joseph Channel | 82.8 | 93.0 | 110.2 | 89.0 | --- |
| Raber bay | 93.4 | 107.2 | 113.0 | 88.6 | 92.7 |
| Potagannissing Bay | 92.2 | 88.7 | 109.0 | --- | 88.5 |
| | | | | | |
| River wide this survey | 89.7 | 94.0 | 105.6 | 87.4 | 89.1 |
| River wide 1995 | 102.2 | 97.1 | 106.1 | 91.4 | --- |

Table 14.- Percent of sea lamprey wounds by species exhibiting wounding from the St. Marys River, August 2002. N denotes sample size of specimens examined for wounds.

| Species | N | A1 | A2 | A3 | A4 | B1 | B2 | B3 | B4 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Walleye | 112 | | | 0.9% | | | | | | 0.9% |
| Yellow perch | 1031 | <0.1% | 0.3% | 0.2% | <0.1% | 0.7% | <0.1% | <0.1% | | 1.6% |
| Lake herring | 125 | | | | | 0.8% | | | | 0.8% |
| Lake whitefish | 34 | | | | 2.9% | 2.9% | | | | 5.9% |
| White sucker | 827 | 0.4% | | 0.1% | 0.4% | 0.4% | | | | 1.2% |
| Longnose sucker | 53 | | 1.9% | | | | | | | 1.9% |
| Rock bass | 262 | | 0.4% | 0.4% | | 0.4% | | 0.4% | | 1.5% |
| Brown bullhead | 114 | | 0.9% | | | | | | | 0.9% |
| Chinook salmon | 28 | | | 3.6% | | | | | | 3.6% |

Table 15.- Number of walleye stocked from 1996 to 2002 at various locations in St. Marys River by agency. All fish were spring fingerlings unless otherwise noted. “FF” denotes fall fingerlings and “OTC” denotes marking with oxytetracycline.

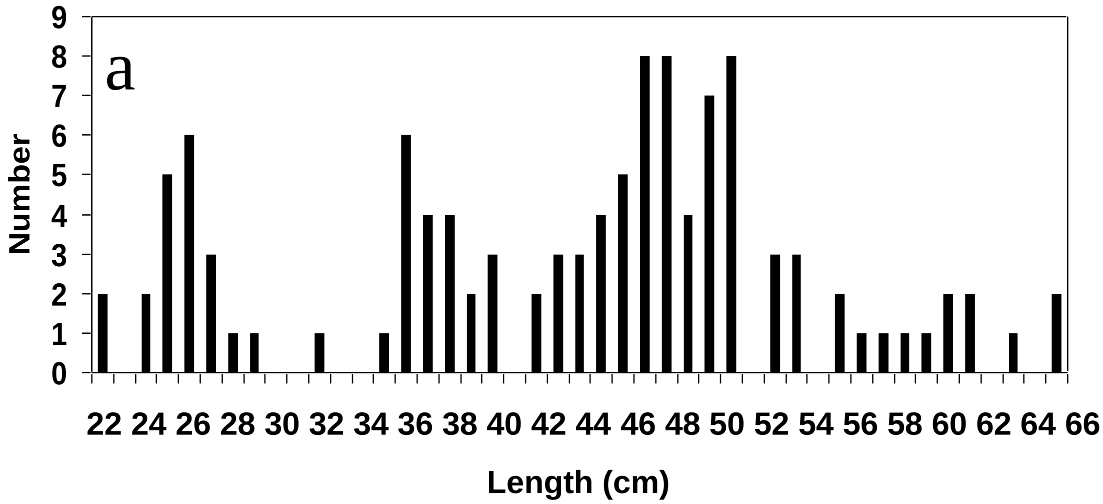
| Location | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Waiska River or Bay | 87,960 CORA | 43,795 CORA<br>3,450 FF CORA | 104,760 CORA | 4,000 FF CORA | 119,475 CORA | 30,909 OTC,CORA<br>56,579 CORA | 100,450 OTC,CORA |
| Soo, below locks | 194,655 MDNR | | 94,038 OTC,MDNR | | 40,000 MDNR | | |
| Lake George | | | 55,639 OTC,CORA | | 20,000 MDNR | 72,212 MDNR | |
| Lake Nicolet | | | | | 52,000 MDNR | 66,336 MDNR | |
| Lake Munuscong | 29,750 FF,MDNR | | 50,314 OTC,MDNR | | | | |
| Raber Bay | | | 50,220 OTC,MDNR | | | | 5,970 FF,CORA |
| Potagannissing Bay | 132,812 MDNR | | 50,220 OTC,MDNR | | 149,239 MDNR | 30,000 OTC,MDNR | 101,648 MDNR |

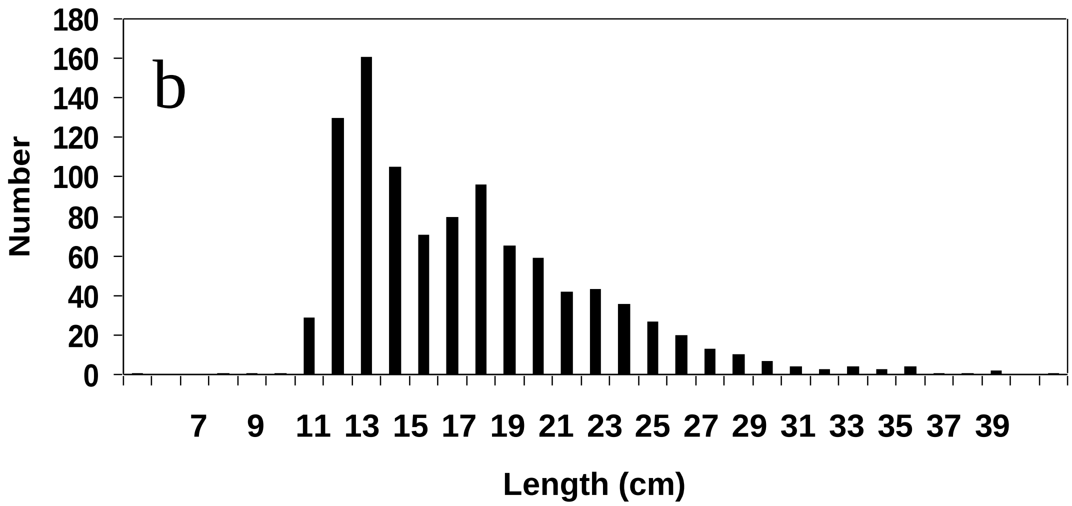
Appendix 1.–Common and scientific names of fishes and other aquatic organisms mentioned in this report.

| Common name | Scientific name |
|---|---|
| Alewife | *Alosa pseudoharengus* |
| Atlantic salmon | *Salmo salar* |
| Black crappie | *Pomoxis nigromaculatus* |
| Bloater | *Coregonus hoyi* |
| Bowfin | *Amia calva* |
| Brook trout | *Salvelinus fontinalis* |
| Brown bullhead | *Ictalurus nebulosus* |
| Brown trout | *Salmo trutta* |
| Burbot | *Lota lota* |
| Channel catfish | *Ictalurus punctatus* |
| Chinook salmon | *Oncorhynchus tshawytscha* |
| Coho salmon | *Oncorhynchus kisutch* |
| Common carp | *Cyprinus carpio* |
| Eurasian ruffe | *Gymnouphalus cernuus* |
| Freshwater drum | *Aplodinotus grunniens* |
| Gizzard shad | *Dorosoma cepedianum* |
| Johnny darter | *Etheostoma nigrum* |
| Lake herring | *Coregonus artedii* |
| Lake trout | *Salvelinus namaycusn* |
| Lake whitefish | *Coregonus clupeaformis* |
| Longnose gar | *Lepisosteus osseus* |
| Longnose sucker | *Catostomus catostomus* |
| Menominee | *Prosopium cylindraceum* |
| Northern hogsucker | *Hypentelium nigricans* |
| Northern pike | *Esox lucius* |
| Pink salmon | *Oncorhynchus gorbuscha* |
| Rainbow smelt | *Osmerus mordax* |
| Rainbow trout | *Oncorhyhus mykiss* |
| Rock bass | *Ambloplites rupestris* |
| Round goby | *Neogobius melanostomus* |
| Sculpin | *Cottus bairdi* |
| Sea lamprey | *Petromyzon marinus* |
| Smallmouth bass | *Micropterus dolomievi* |
| Splake | *S. fontinalis x S. namaycusn* |
| Tiger musky | *Esox masquinongy* |
| Trout-perch | *Percopsis omiscomaycus* |
| Walleye | *Sander vitreus* formally *Stizostedion vitreum* |
| White bass | *Morone chrysops* |
| White perch | *Morone americana* |
| White sucker | *Catostomus commersoni* |
| Yellow perch | *Perca flavescens* |

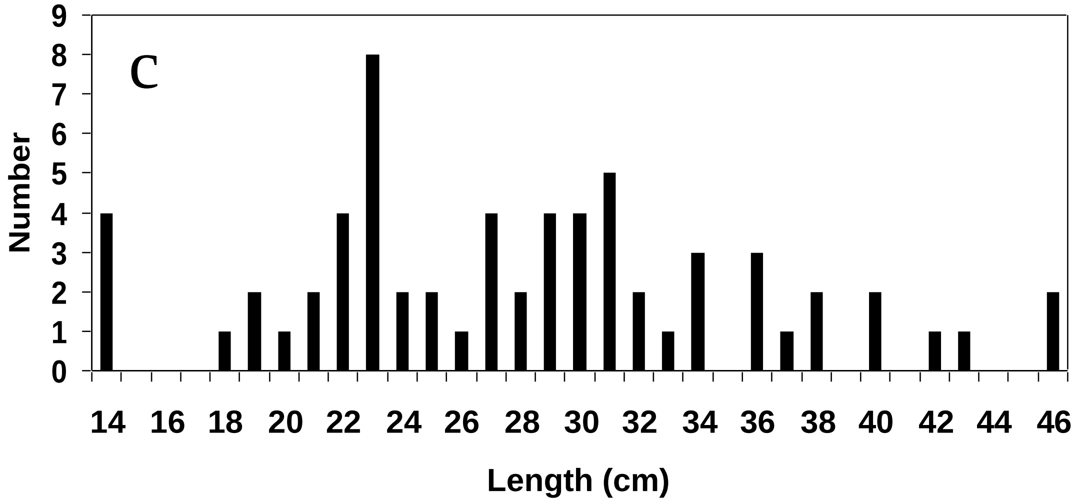
Appendix 2.–Length-weight regression equations and von Bertalanffy growth equations for select species from the St. Marys River August 2002. Length/weight equation Logs are base 10, weight (wt) is in grams, and 1ength (len) is in mm. Von Bertalanffy equations are based on mean length-at-age data where ‘t’ is age in years.

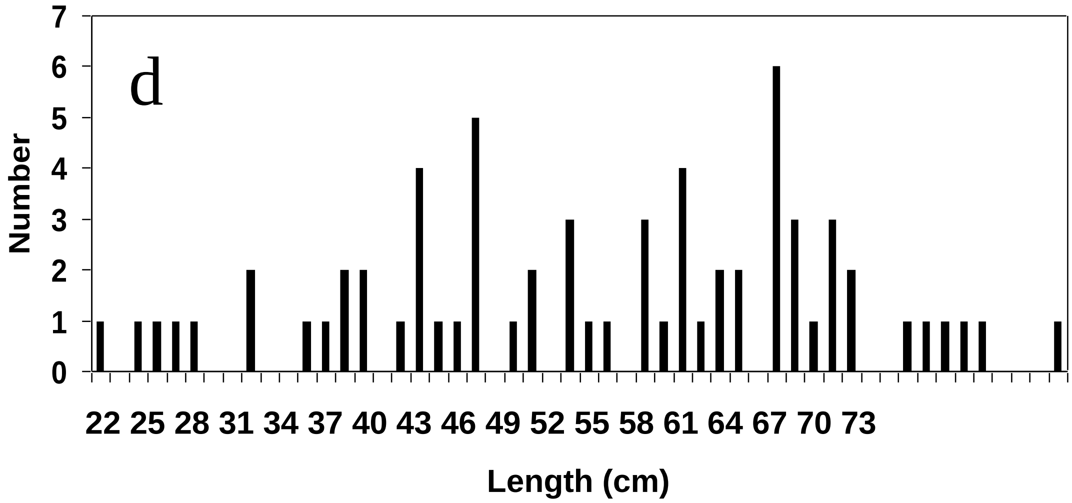
| Species | Length/Weight Equation | Len/Wt $r^2$ | Von Bertalanffy Equation | K | L∞ | $t_o$ |
|---|---|---|---|---|---|---|
| Walleye | log(wt)=3.055 log(len)-5.183 | 0.93 | $L_t=570[1-e^{-0.4263(t-2.06)}]$ | 0.4263 | 570 | 2.06 |
| Yellow perch | log(wt)=3.097 log(1en)-5.115 | 0.89 | $L_t=677[1-e^{-0.0528(t+2.87)}]$ | 0.0528 | 677 | -2.87 |
| Smallmouth bass | log(wt)=4.432 log(1en)-2.847 | 0.84 | $L_t=934[1-e^{-0.0641(t+1.43)}]$ | 0.0641 | 934 | -1.43 |
| Northern pike | log(wt)=4.428 log(1en)-2.690 | 0.79 | $L_t=897[1-e^{-0.2096(t+1.50)}]$ | 0.2096 | 897 | -1.50 |
| Lake herring | log(wt)=3.127 log(1en)-5.358 | 0.68 | $L_t=470[1-e^{-0.2352(t+1.26)}]$ | 0.2352 | 470 | -1.26 |



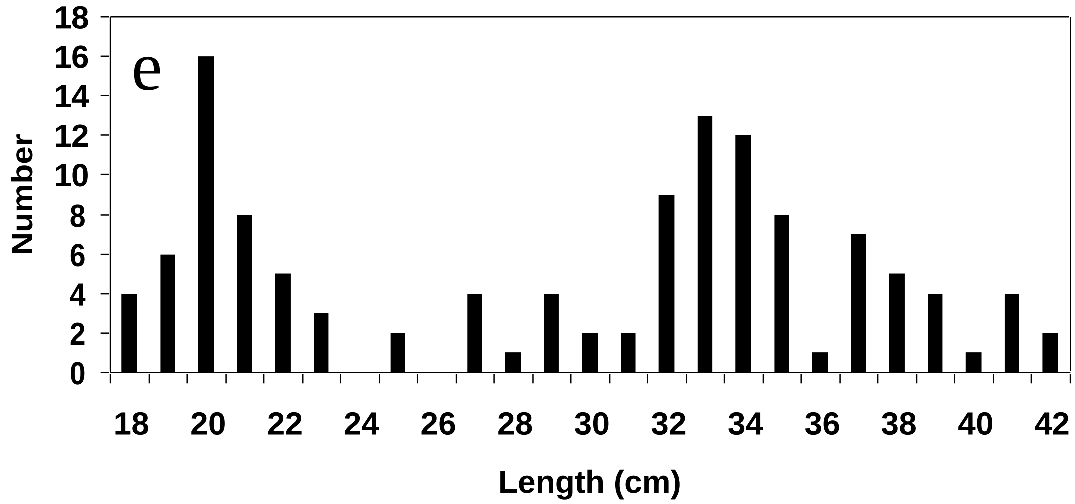




Appendix 3. Length frequencies from survey catch of; (a) walleye, (b) yellow perch, (c) smallmouth bass, (d) northern pike, and (e) lake herring from the St. Marys River, August 2002.




Appendix 3 continued.




Appendix 3 continued.