Population Dynamics of the St. Marys River Fish Community 1975-2006

David G. Fielder[1]
Michigan Department of Natural Resources
Alpena Fisheries Research Station
160 E. Fletcher
Alpena, MI 49707

Neal Godby
Michigan Department of Natural Resources
Northern Lake Huron Management Unit
1732 W. M-32
Gaylord, MI 49735

Anjanette Bowen
U. S. Fish and Wildlife Service
Alpena Fisheries Resource Office
145 Water St.
Alpena, MI 49707

Lisa O'Connor
Fisheries and Oceans Canada
Great Lakes Laboratory for Fisheries and Aquatic Sciences
1 Canal Drive
Sault Ste. Marie, ON P6A 6W4

Josh Parish
Bay Mills Indian Community
12140 W. Lakeshore Dr.
Brimley, MI 49715

Susan Greenwood and Stephen Chong
Ontario Ministry of Natural Resources
1235 Queen St.
Sault Ste. Marie, ON P6A 2E5

Greg Wright
Chippewa / Ottawa Resource Authority
179 W. Three-Mile Rd.
Sault Ste. Marie, MI 49783

[1]Corresponding author; fielderd@michigan.gov

Abstract- Several important fish populations within the fish community of the St. Marys River exhibited increases in abundance in 2006. Improved recruitment since 2003 seemed to drive increases for walleye, yellow perch, and smallmouth bass. Northern pike have declined and there is concern that this species may be impacted by continuing low water levels. Cisco abundance remained low relative to past surveys. Total annual mortality rates remained unchanged for most species but increased for smallmouth bass and was high for yellow perch in some reaches of the river. Walleye diet showed a shift away from alewives which is consistent with the decline of alewife abundance in most of Lake Huron. Special concerns for the fish community in the river include the continuing trends of lower cisco abundance, the status of specific spawning stocks of walleye within the river, the presence of the exotic white perch and what impact it may have in the future, the potential for the exotics Eurasian ruffe, round goby, and rusty crayfish to reach and invade the fish community. Information needs for the future are: a) more frequent fish community assessments; b) better indices of recruitment for most species; c) contribution of hatchery walleye to the river population. Other needs for the river include the development of fish community objectives to better facilitate management and to allow a context with which to better interpret the findings of the fish community survey.

Introduction

The St. Marys River hosts a diverse fish community, many species of which provide for valuable sport, commercial, and tribal subsistence fisheries. The sport fishery alone is substantial and has been estimated to have consisted of as much as one third of the total open water sport fishing pressure for all US waters of Lake Huron in 1999 (Fielder et al. 2002), and was estimated to have generated up to $11 million US dollars in Michigan and Ontario from 1999 to 2000 for the open water and ice fishery combined (Fielder et al. 2002).

Despite the strong sport fishery, the river fish community is challenged by a number of threatening issues including the effects of sea lamprey and potential for establishment of other invasive species, predation effects of large numbers of cormorants (*Phalacrocorax auritus*), and diminishing habitat due to low water levels in the upper Great Lakes and water resource issues. There are also management issues including concern about the sustainability of these fisheries in the river, the need for common sport fishing regulations for Ontario and Michigan waters, and questions about the impact stocked walleye may have on the sustainability of wild walleye in the river. These issues highlight the need for a comprehensive fishery management plan or establishment of fish community objectives for the St. Marys River to permit issue resolution and coordinated efforts to benefit the fishery. At minimum, these issues highlight the value of assessment information to document and possibly track the effects of stressors and fish community changes.

Fishery issues are complicated by the diversity of fishery interests on the river (Fielder 2002). Local, state, federal, international, and tribal resource managers have fishery management interests in the river and a number of stakeholders groups value the fishery for their livelihood and enjoyment. In 1997 the St. Marys River Fishery Task Group (SMRFTG) was formed by the Great Lakes Fishery Commission's Lake Huron Committee. It included representatives from all major resource agencies with the goal of designing a fishery assessment and review program for the St. Marys River that would address the needs of all agencies (Fielder 2002). A river fishery assessment plan was developed in 2002 that included the need for and outlined a protocol for a fish community assessment for the St. Marys River (Gebhardt et al. 2002). The protocol followed a Michigan DNR (MDNR) assessment program that was initiated in 1975 and was repeated every four to eight years.

The objectives of this survey are to assess and provide information on the abundance, growth, mortality and size structure of important fish populations found in the St. Marys River; to make comparisons to previous surveys; and to comment on the overall current status of certain notable species.

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. Three large islands divide the river flow into these various channels and the river is bordered on the northeast by Ontario and 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 known features of this river, although today 93% of the river flow is diverted for hydroelectric generation (Edsall and Gannon 1993). 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; Fielder et al. 2003) so as to allow comparability. Multifilament nylon gillnets were used to collect fish in this study. In this survey and in 2002 the nets measured 1.8 m deep by 304.8 m long and were comprised of ten 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. The survey nets in 1975, 1979, 1987, and 1995 only 4 mesh sizes were utilized: 50.8 mm, 63.5 mm, 76.2 mm and 114.3 mm stretch measure mesh and panels were 30.5 m in length Nets were fished overnight on the bottom for all surveys.

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), Fisheries and Oceans Canada (DFO), and the United States Fish and Wildlife Service (USFWS). Net set locations were divided throughout the St. Marys River (Figure 1). Sites number 6 and 17 were not sampled in 2006 due to local conditions. 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 cisco. 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. Stomach contents of certain species of interest are reported as incidence (percent void and percent with contents) and proportion of occurrence which is the percent of that prey item in the total of all prey items consumed by that species.

Catch-per-unit-of-effort (CPUE) was expressed two ways; first, the total number of each species per net lift or number per 304.8 m of net across all mesh sizes was determined while the second was to express CPUE based only on the catch collected from the same mesh sizes used in past surveys (prior to 2002). 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. In 2006, 8 net sets from Potagannissing Bay were excluded from this expression of CPUE due to a lack of separation in the data by mesh size. 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 data from past surveys. 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 analyses 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 where possible and the Mann-Whitney U (M-WU) test when the assumption of normality could not be met. 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 analysis used log transformed data for linear regressions. 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 3,841 specimens were collected in the survey, representing 31 different species. The mean CPUE of walleye in 2006 was the greatest measured since 1975 (Table 2) and the mean CPUE was significantly different among the survey years (K-W test; $P=0.001$). Yellow perch mean CPUE increased in 2006 and the various survey year means were also significantly different (K-W test; $P=0.006$). The difference, however, appears to stem from the higher mean CPUE exhibited in 1987 compared to the other years which were otherwise similar. Northern pike mean CPUE continued to decline to its lowest measured level in 2006, 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 which showed an increase among surveyed years (K-W test; $P<0.001$), and the 2006 mean CPUE value was significantly greater than the 2002 value and represented a new high for the survey series (M-WU test; $P=0.011$) (Table 2). Cisco mean CPUE in 2006 was very low compared to past surveys, but mean CPUE among years was not significantly different (K-W test; $P=0.066$). A record high mean CPUE for rock bass was also observed in 2006. The exotic white perch, first collected in 2002, was again collected in 2006 but at a lower abundance (Table 2).

As stated in the methods the gillnet specifications used in the 2002 and 2006 surveys 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 all survey years to allow comparison. It remains possible that some of the available catch was spread over more mesh sizes in the two recent surveys, thereby lowering the CPUE value of the traditional meshes alone. If so, the mean CPUE of the full mesh complement fished in 2002 and 2006 would be greater than that of the traditional meshes alone. This was again explored in 2006 by comparing the mean CPUE of each species between the expanded mesh net (full complement of mesh sizes fished; 10) and the traditional mesh sizes (4 panels) (Table 3). Under this comparison, the mean CPUE of cisco was not significantly different (M-WU test; $P=0.457$) in 2006, though it was in 2002. Mean CPUE was again significantly greater for northern pike in the traditional mesh (M-WU test; $P=0.026$), consistent with the findings in 2002. The CPUE from the expanded mesh catch was also slightly lower for walleye and smallmouth bass but not significantly different in either 2006 or 2002. The yellow perch catch was essentially the same in the comparison for 2006 (M-WU test; $P=0.612$) as it had been in 2002 (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 river reach. Northern pike exhibited a substantial decline in CPUE within Lake George in 2006 compared to past survey years, although the CPUE was not significantly different from 2002 (M-WU test; P=0.301). Northern pike CPUE also dropped in Potagannissing Bay (Table 4). Cisco became abundant again in Raber Bay in 2006, a location where they were abundant early in the survey series. Cisco have continued to decline in Potagannissing Bay but their absence in 2006 may stem partly from the omission of most of those net sets in 2006 from the traditional CPUE expressions (as catches were not separated by mesh size). Increases in smallmouth bass were driven mainly by gains in Lake Munuscong and the St. Joseph Channel reaches of the St. Marys River. The record river-wide mean CPUE of walleye was driven by gains in all reaches of the river, though the most substantial increases were observed in the Upper River, Lake George, and Potagannissing Bay reaches. Yellow perch mean CPUE also increased in all reaches except the St. Joseph Channel and Potagannissing Bay.

Patterns of abundance across age and year classes indicate some among-species trends. Percids (walleye and yellow perch) exhibited strong year classes since 2003 (ages 1-3), and yellow perch had a good year class in 2002, as well (age 4) (Tables 5 and 6 respectively). Such patterns of increased recruitment were not evident for cisco (Table 7) and northern pike (Table 8). Smallmouth bass, like the Percids, also appeared to exhibit stable recruitment since 2003 (Table 9).

Trends in total annual mortality varied by species. Yellow perch total annual mortality rate increased in three reaches of the St. Marys River, but was largely unchanged from 2002 on a river wide basis (Table 10). The increase in recruitment in recent years violates the assumption of equal annual recruitment for this method of mortality estimation and may account for some of these increases, including in Potagannissing Bay. Total annual mortality rate for other species was largely unchanged except for smallmouth bass, where the total annual mortality rate appears to be increasing (Table 10). Generally, all the total annual mortality rates were largely within sustainable levels; however, the yellow perch river-wide rate, as well as some reach-specific rates, are high and consistent with heavy exploitation.

Walleye growth rate, as indicted by mean length at age, remained largely unchanged since 2002 (Table 5) but still reflects a general trend of improved growth rate since the survey series began in the mid-1970s. The mean length is a reflection of the younger mean age, which in turn likely stems from the increased recruitment in recent years. Growth rate of yellow perch increased in all reaches of the river in 2006 except for the St. Joseph Channel (Table 6). Like walleye, there has been a trend towards improved growth over the survey series. Cisco growth rate has remained largely unchanged and cisco generally grow faster than the Michigan state average, but not as fast as the average for cisco in the Ontario waters of the rest of Lake Huron (Table 7). Northern pike exhibited an improved growth rate in 2006 across all ages (Table 8). Smallmouth bass continue to grow slower than the Michigan state average rate for length at age, but better than the Ontario Lake Huron average rate (Table 9). The 2006 rate, however, is an improvement over past years of the survey series.

Approximately half of female yellow perch were sexually mature by the time they were 18 cm in total length. This corresponds to the minimum length limit imposed by Michigan for the sport fishery (Table 11). Females were fully mature at about 21 cm total length. Female smallmouth bass are achieving 100% maturity by 30 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), possibly 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 total length.

The diet of walleye, at the time of the survey, has exhibited a shift away from alewife in 2002 to one dominated by rainbow smelt in 2006 (Table 12). Walleye were the only species, of those examined, still showing any utilization of alewives in the St. Marys River, and this phenomena is likely a reflection of the lake-wide decline of alewives in the rest of Lake Huron. Crayfish figured prominently in the diet of all other species examined, but not walleye (Table 12). The most varied diet was that of northern pike which made similar usage of a number of fish species as prey. Condition, as indicated by relative weight, was largely unchanged for most species, but there may be some indication of a declining trend in walleye (Table 13). Walleye condition was lowest in the upper river reach of the St. Marys. Smallmouth bass continue to exhibit a high condition level in the St. Marys River.

Incidence of sea lamprey wounding was greatest for chinook salmon (Table 14). No sea lamprey wounds were observed on lake whitefish in 2006, but 5.9% of the lake whitefish captured in 2002 exhibited wounds. Generally, proportions of fish showing sea lamprey wounds declined in 2006 except for cisco and Chinook salmon. The most common wound class exhibited was A3 (should this be A1?) and B1 (see King and Edsall 1979 for classification explanation). White sucker exhibited the largest range of wound classification, but this may have been an artifact of their relatively large sample size.

Walleye stocking in the St. Marys River has continued by CORA and the Michigan DNR since the last survey (Table 15). The greatest plants are in the upper river reach and Potagannissing Bay. Length/weight regression equations and Von Bertalanffy growth equations for five notable species are presented in Appendix 2. Length frequency distributions for these species from the survey catch are presented in Appendix 3.

Discussion

Walleye

Walleye were the fourth most abundant species (as measured by CPUE) in the St. Marys River during the 2006 survey, behind yellow perch, white suckers, and rock bass (Table 2). Walleye CPUE (11.18) in 2006 was the highest measured over the survey series (1975-2006). Catch for this species had been remarkably stable over previous surveys, with CPUE values ranging from 3.58 in 2002 to the previous high of 7.47 in 1987 (Table 2). Angler reports of exceptional walleye fishing confirm the increased abundance observed during this survey.

Although CPUE increased throughout the river, the increase was especially pronounced in the Upper River, Lake George and Potagannissing Bay. Fielder et al. (2002) hypothesized that increased abundance in the Upper River may be due to stocking efforts in Waishkey Bay, while increases in abundance in Lake George may be due to walleye length limits in both Ontario and Michigan waters, the only reach in the survey to have dual regulations. 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. These regulations may also protect walleye which undertake seasonal migrations into Lake George following spawning in Lake Munuscong (Liston et al 1986).

Hatchery composition of walleye year classes in the Upper River also indicate that stocking may have contributed to the higher CPUE. Since all walleye stocked in the St. Marys are marked with oxytetracycline (OTC), the ratio of OTC- marked fish to unmarked fish shows the relative contribution of stocked fish. Analysis shows that 85.6% of the age-0 walleye captured in the Upper River during annual fall walleye surveys (1998-2006, N=90) were of hatchery origin (SMRFTG, unpublished data).

In addition to the dual regulations, increases in walleye abundance in Lake George may also be the result of walleye stocking on the south side of that reach. A total of 68,951 spring fingerling walleye were stocked in Lake George in 2004-2006. A limited dataset (2004 and 2006, N=52) show 28.8% of the age-0 walleye captured during fall electrofishing surveys in Lake George were of hatchery origin (SMRFTG, unpublished data).

Walleye CPUE in Munuscong Bay (4.2) was the highest observed in the survey series, despite elevated water temperatures in this shallow bay. Angler reports during the survey indicated that more walleye were in the deeper, colder waters of the shipping channel. Catch rates may have been higher if nets had been set in the shipping channel, but shipping traffic precluded that option. Munuscong River and Bay provide important walleye spawning and nursery habitat, so have not been stocked in recent years. There is concern that stocking walleye on top of healthy wild populations may be detrimental.

Age-1 to Age-3 walleye had the highest CPUE during this survey, corresponding to the 2003-2005 year classes with walleye up to age-14 captured. The 2003 year class was especially strong for percid natural reproduction in other parts of the Great Lakes as well (Fielder et al. In Press, Fielder and Thomas 2006, Thomas and Haas 2007). Walleye were not stocked in the St. Marys River in 2005, indicating that natural reproduction likely plays a strong role in year class strength. Relative contributions of natural reproduction and stocking to the St. Marys River walleye population should become evident as data on recruitment trends are collected through annual fall walleye evaluations.

The St. Marys River Fisheries Task Group has initiated an annual fall walleye electrofishing survey to evaluate year class strength throughout the St. Marys River and complement data collected during the periodic fish community surveys. While some member agencies had been doing similar work since 1992, the coordinated, river-wide fall surveys began in 2004. The 2004 year-class had the highest CPUE in the fall electrofishing surveys since 2002, which also corresponded as the strongest year class in the 2006 gill net survey. The mean CPUE for age-0 walleye in 2003 and 2005, however, was lower than the average since 1992 (SMRFTG, unpublished data). The walleye recruitment study is described in the St. Marys River Walleye Stocking and Evaluation Plan.

Mean CPUE of walleyes in the St. Marys River fish community survey in 2006 was 11.18, after reaching a low for the survey series in 2002 at 3.58. Walleye CPUE in Saginaw Bay using similar gear averaged 6.6 to 13.0 from 1998-2004 (Fielder and Thomas 2006). Saginaw Bay is a shallow, productive bay of Lake Huron that is well known for its walleye fishery, and has seen strong year classes of wild walleye since 2003. Although the St. Marys River is much less productive, the 2006 walleye catch rate in the St. Marys River put it well in the range of CPUE values seen in Saginaw Bay.

Total annual mortality (38%) for walleye was slightly lower in 2006 compared to the 2002 (49%) and 1995 (51%) values (Table 10). Losses and extractions of walleye from the St. Marys River are primarily due to angling and predation. Angler harvest in the walleye fishery can be as much as

25,000 (Fielder et al. 2002). Based on a creel survey done from 1999-2000, walleye are the second most sought after species in the St. Marys River sport fishery (Fielder et al. 2002).

Mean length-at-age for walleye in the 2006 survey was slightly above the state of Michigan average. The growth index, which compares length-at-age to state average, was +9 mm. The 2002 survey was the only other in the survey series that showed an above average growth index for this species in the St. Marys River. The above average growth indicates that walleye are growing very well, considering that the river originates from cold Lake Superior outflow. Compared to mean- lengths-at-age for walleye from the North Channel in 2006 (OMNR, unpublished data), however, St. Marys River walleye had a growth index of -35 mm (Table 5).

Rainbow smelt were the most common prey item (46% occurrence) for walleye based on the examination of stomach contents of fish captured during the survey. This is a shift from the walleye diet found in 2002, in which alewife were more abundant in the diet, with rainbow smelt occurring much less frequently. The switch in walleye diet from alewife to smelt may be reflective of a lake-wide decline in alewife abundance in Lake Huron (Bence and Mohr In Press). Smelt were also more prominent than alewife in walleye diet during the 1995 survey (Fielder and Waybrant 1998), although they were not as prevalent as in the present survey. Other identifiable items in walleye stomachs in 2006 were mayflies, cisco, ninespine stickleback, and white sucker. Gizzard shad, which were a component of walleye diets in previous surveys, were also absent from walleye stomachs in 2006.

Mean condition (87) as measured by relative weight was slightly lower in 2006 than 2002. Highest relative weights were found in Lake Nicolet and Lake George, while the lowest relative weights were found in Raber Bay. The lower condition value may be a result of the increased abundance of walleye observed in the 2006 survey; that is, more fish competing for food resources. The above average growth index, however, indicates that the fish are still growing well and that there is not a shortage of prey.

Northern Pike

Northern pike gillnet CPUE continued its overall decline since the 1987 survey (Table 2). However in an area by area comparison with the 2002 survey CPUE was very slightly improved or remained the same for all areas except Lake George and Potagannissing Bay which declined noticeably (Table 4). The coastal wetlands of this area of the river have been considerably affected by the low spring water levels of the past five years which may be having a negative effect on pike spawning success. Lake Munuscong CPUE (5) had improved from 2002 survey (0) but is still very low compared to past survey years. This area of the river is also shallow and ringed by a wetland fringe. Low water levels and the influence of lake effect seiches may impact spawning and nursery habitat in Lake Munuscong. Mortality has not changed appreciably since the 1995 survey (Table 10). Recruitment may be affected by the loss of habitat associated with current low water levels.

Age distribution has lessened since 2002 (Table 8) and age-1 made up 44% of the catch compared to 54% of the catch being composed of age-2 and 3 fish in 2002. The truncated age structure is consistent with continuing mortality in a declining recruitment situation. Growth for pike is up from 2002 and for the first time in the survey series consistent with the decline in abundance, the growth index was above the Michigan state average.

Northern pike diet continues to be predominantly fish (47%) with yellow perch being the most common in fish examined (Table 12). Other species included white sucker, ninespine stickleback and rainbow smelt. Crayfish (21.7%) were the only invertebrate noted. In this survey fewer fish were unidentifiable which may account for the higher presence of perch observed compared to 2002. Northern pike condition improved in all areas of the river from the values for 2002 but are not appreciably different than 1995 survey consistent with improved growth. Maturity thresholds were not discernable in the fish captured due to the small sample size. Females at 34, 42 and 47 cm were visibly mature while others over 34 cm were not. As in 2002 no sea lamprey wounding was observed for northern pike.

Yellow Perch

Perch abundance in the St. Marys River continues to be stable over the time series (Table 2) and perhaps trending upward since the last record high in 1987. Annual index gillnet surveys[1] in the adjacent North Channel of Lake Huron, (OMNR 2004, 2005, 2006), also showed a continued upward trend in abundance. Perch were most abundant in Lake George followed by Raber Bay and the Upper River. Potagannissing Bay had very low abundance which may be due in part to data deficiencies in the 2006 survey (Table 4). Alewives collapsed in Lake Huron in 2003 and improved reproductive success of percids has been credited to their absence (Fielder et al. In Press). Other phenomenon may have contributed to improved yellow perch recruitment including ideal climatic conditions in 2003 and the implementation of cormorant control in the Michigan waters of the area (BMIC, unpublished data). The age structure of the catch is consistent with stronger 2003 and 2004 year classes (Table 6). Abundance in the St. Joseph Channel area was much less than in the 2002 survey when it had the highest CPUE. However, with only two data points, four years apart, the significance of this abrupt change is not clear. The St. Joseph Channel supports a popular winter perch fishery and a short duration but significant early spring angling effort occurs when perch move into shallows to spawn (OMNR unpublished data). Over all, perch abundance in each area has improved from the 1995 and 2002 surveys (St. Joseph Channel and Potagannissing Bay areas excluded).

Total annual mortality for the entire river increased slightly from 2002 and continues to trend upward for the recent time series (1995-2006). Mortality was highest in Potagannissing Bay, Lake Munuscong and the Upper River. Potagannissing Bay and Lake Munuscong receive high annual harvests of perch (Fielder et al. 2002, SMRFTG unpublished data). Cormorant predation may also influence mortality due to the close proximity to rookeries.

Consistent with the stronger yellow perch year classes since 2003 in the St. Marys River, the areas of the North Channel and southern Georgian Bay reflect similar age structures suggesting a regional effect. This may reflect improved reproductive success again stemming from the collapse of alewives. In contrast, yellow perch populations in the Ontario waters of southern Lake Huron were more heavily dominated by older ages (OMNR 2006).

In 2006 most age-3 fish met Michigan’s angling minimum perch size limit of 178 mm. The upper river (only Michigan waters surveyed) was the only area where the mean length at age suggested that some age-2 fish were legal angling size. In 2002 most age-3 fish barely met the minimum size limit. Only about half the female yellow perch were achieving maturity by 178 mm (Table 11).

Growth rate (mean length at age) continued the increasing trend from 1995 for age-4 and younger fish river wide. When compared to the Michigan state average the yellow perch growth index was higher than reported in 2002 (Table 6) and generally better than the Michigan state average but

[1] OMNR index series gear uses monofilament nets which make direct comparison of CPUE between projects open to interpretation. Reporting of trends is still useful.

more in line with the Ontario average mean length-at-age for the North Channel. On the whole, yellow perch growth rate is improving over the time series since 1975.

Perch diet has not changed from the 2002 survey in items and relative occurrence. Crayfish continue to be an important prey item (60%) followed by fish (31%). Fish species included Johnny darter, slimy sculpin and ninespine stickleback, however, most of the fish items were unidentifiable (Table 12). Casual observations suggested fewer crayfish encountered in collection gear in 2006. Sea lamprey predation on yellow perch continues to be negligible with less than 0.5% wounding for 1,627 fish examined.

Smallmouth Bass

Overall the smallmouth bass population in the St. Marys River appears healthy. Although the data collected during this survey seem to conflict at times, the population seems to be increasing despite an increase in total annual mortality.

There was a significant increase in mean CPUE of smallmouth bass in 2006 (K-W test; $P<0.001$). The 2006 mean CPUE value represents a new high for the survey (Table 2). This increase was driven entirely by the Lake Munuscong and St. Joseph Channel reaches which had mean CPUE values 2 to 3 times greater than the remaining reaches. Bass abundance in both these reaches was significantly higher than those recorded in the 2002 survey (Table 4). The central portion of the river seems to remain good habitat for smallmouth bass. The increase in river-wide mean CPUE of smallmouth bass is interesting since the total annual mortality rate has increased from 0.36 and 0.37 in 1995 and 2002 respectively to 0.55 in 2006 (Table 10). In addition, with an increase in mean CPUE, growth rates have also increased, which like the increase in mortality rate, seems contrary to expected population dynamics which typically show as populations increase, mortality is low and growth decreases. The data collected indicates just the opposite. This could be a result of a population that is still far below carrying capacity or a result of small sample size. The condition factor for 2006 is high and although the mean length-at-age increased substantially from 2002 to 2006 the mean is still well below the state average but more in line with the Ontario average for North Channel populations. This supports the idea that the population is still below carrying capacity and that density dependent factors have not yet been expressed (Tables 9 & 13).

As the 2002 survey showed, smallmouth bass continue to rely on fish and crayfish as their primary prey items. Yellow perch was the top fish eaten followed by slimy sculpin, ninespine stickleback and white sucker (Table 12). In all, smallmouth bass diet in the St. Mary's River remains relatively simple depending heavily on crayfish and a few prey fish species.

Cisco

Overall cisco populations have trended lower in the river although their distribution makes quantitative assessment during the time of year the survey is conducted difficult to fully assess. Growth rates and mortality rates generally indicate the population is still relatively healthy.

Cisco mean CPUE in 2006 increased over the record low 2002 survey but still remains low compared to past surveys (Table 2). A significant increase was observed in the Raber Bay reach of the river which dominated the catch (Table 4). This is one location where they were abundant early in the survey series. Cisco have continued to decline in Potagannissing Bay but their lack in 2006 may stem partly from the omission of most of those net sets in 2006 from the traditional CPUE expressions (from a lack of mesh-specific data).

Cisco growth rate has trended slower over the time series but is generally in line with the Michigan state average and the Ontario average for the North Channel (Table 7).

Special Concerns

In 2002, questions arose as to whether cisco abundance was actually lower than previous surveys or if ciscoes were displaying patchy distribution due to thermal preferences and availability of prey resources. Given the depressed stock levels in Lake Huron and the potential for the St. Marys River to be a source of recovery stocks, this population should be monitored closely to determine if stocks have declined or if survey methods are not adequately sampling the population during this time period. A new recreational creel limit of 25 (12 fish conservation limit) cisco was implemented by Ontario in 2008 to address concerns of excessive possession.

The 2002 report expressed concerns regarding the spawning runs of walleye in the St. Marys River, which have long been supplemented with plantings of hatchery fish. In 2006, the CPUE for walleye was the greatest measured since 1975 (Table 2). Yellow perch and smallmouth bass also increased in 2006; however, northern pike were at their lowest CPUE since the beginning of the surveys. Better information is needed to determine the relationship between the abundance of walleye and the capacity of the river to either sustain or increase the walleye population. The relationship of walleye to other potential competitors, including smallmouth bass and northern pike, is also important in the management of the species. The completion of the St. Marys River Walleye Stocking and Evaluation Plan provides a study design to evaluate the walleye population in the river, both natural and stocked, and would provide a starting point for examining the relationship of walleye to other species in the river.

White perch, an aquatic invasive from the Atlantic Ocean, were again collected in 2006, though at abundance levels lower than in 2002. In 2002 and 2006, collections were made in Munuscong and Raber Bays, and in 2006 three white perch were also collected in Potagannissing Bay at stations 39 and 42 (Figure 1). Thus, while the abundance was lower in 2006, the distribution of white perch has expanded in the river. Given that this species has been documented to consume walleye eggs (Schaeffer and Margraf 1987), continued monitoring of their distribution is warranted. Other potential invaders include both the Eurasian ruffe and the round goby. In 2006 ruffe were documented in Tahquamenon River, 55 km west of the Sault Locks (Czypinski et al. 2006), and round goby have been collected in the North Channel on Manitoulin Island. It is expected that these species will eventually reach the St. Marys River given the close proximity of both species to the river. Rusty crayfish were first documented at the mouth of the Munuscong River in 2007 (D. Traynor, LSSU, Personal Communication). The potential impact of these or new species, either alone or in combination, on the river ecosystem is unknown and as such further monitoring both their spread and impact on arrival will be critical.

Although cormorant management has begun in the area (BMIC, unpublished data), the role of this species should continue to be considered and managed so as to benefit fish populations and strive for a sustainable level of cormorants. Cooperative efforts among management agencies should be coordinated and a river wide strategy developed.

Continuing trends of declining water levels in the river due to decreased outflows from Lake Superior and Lake Huron levels poses a potential issue for species dependent on coastal wetlands and seasonally flooded areas for spawning or nursery habitat. Management of water levels in the Great Lakes and connecting channels needs to consider environmental and fishery needs in addition to commercial interests.

Information Needs

Continued monitoring of the fish community in the St. Marys River remains essential. The frequency should be increased in accordance with the original St. Marys River Fishery Assessment Plan (Gebhardt et al. 2002). More information is needed on reproductive success and recruitment of all species. The addition of a trawling or electrofishing survey would be greatly beneficial to our understanding of the fish community within the river. The recently begun study of walleye recruitment will be a valuable element to this end. The current creel survey operated jointly between the MDNR and OMNR has been fragmented and is proving difficult to extract the needed information. Better funding and more complete coverage of the river is needed. The overall management of the St. Marys River fishery resources would greatly benefit from the development of river-wide joint fish community objectives. These objectives would allow the development of management strategies and a better context with which to interpret findings from the Fish Community Index Surveys. The development of common recreational fishing regulations between Ontario and Michigan remains a need. Development of fish community objectives will drive this effort in addition to the continued assessment of the dynamics of the fish community.

Literature Cited

Bence, J.R. and Mohr L.C. [Editors]. In Press. The state of Lake Huron in 2004. Great Lakes Fish. Comm. Special Publication.

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.

Czypinski, G. D, A. K. Bowen, M. A. Goehle, and B. Browson. 2006. Surveillance for ruffe in the Great Lakes, 2006. U. S. Fish and Wildlife Service station report. Fishery Resources Office, Ashland, WI. 44 pp.

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., D. J. Borgeson, A. K. Bowen, S. R, Koproski, S. J. Greenwood, and G. M. Wright. 2003. Population dynamics of the St. Marys River fish community 1975-2002. Great Lakes Fishery Commission, Miscellaneous publication. http://glfc.org/pubs/lake_committees/huron/St Marys River FCS Report 2002.pdf . Ann Arbor.

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., A. Liskauskas, L. Mohr, and J. Boase. In Press. Nearshore Fish Community. In The state of Lake Huron in 2004. *Edited* by J.R. Bence and L.C. Mohr. Great Lakes Fisheries Commission Special Publication.

Fielder, D.G., and M.V. Thomas. 2006. Fish Population Dynamics of Saginaw Bay, Lake Huron 1998-2004. Michigan Department of Natural Resources, Fisheries Division, Research Report 2083, 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://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.

Liston, C. R., and thirteen coauthors. 1986. Limnological and fisheries studies of the St. Marys River, Michigan in relation to proposed extension of the navigation season, 1982 and 1983. Department of Fisheries and Wildlife, Michigan State University. U.S. Fish and Wildlife Service contract no. 14-16-0009-79-013.

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.

Ontario Ministry of Natural Resources (OMNR) 2004 Offshore Index Assessment Program 2004 Summary Report Upper Great Lakes Management Unit Lake Huron Report: PS-LHA- IA04-Sum

Ontario Ministry of Natural Resources (OMNR) 2005 Offshore Index Assessment Program 2005 Summary Report Upper Great Lakes Management Unit Lake Huron Report: PS-LHA- IA05-Sum

Ontario Ministry of Natural Resources (OMNR) 2006 Offshore Index Assessment Program 2006 Summary Report Upper Great Lakes Management Unit Lake Huron Report: PS-LHA- IA06-Sum

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.

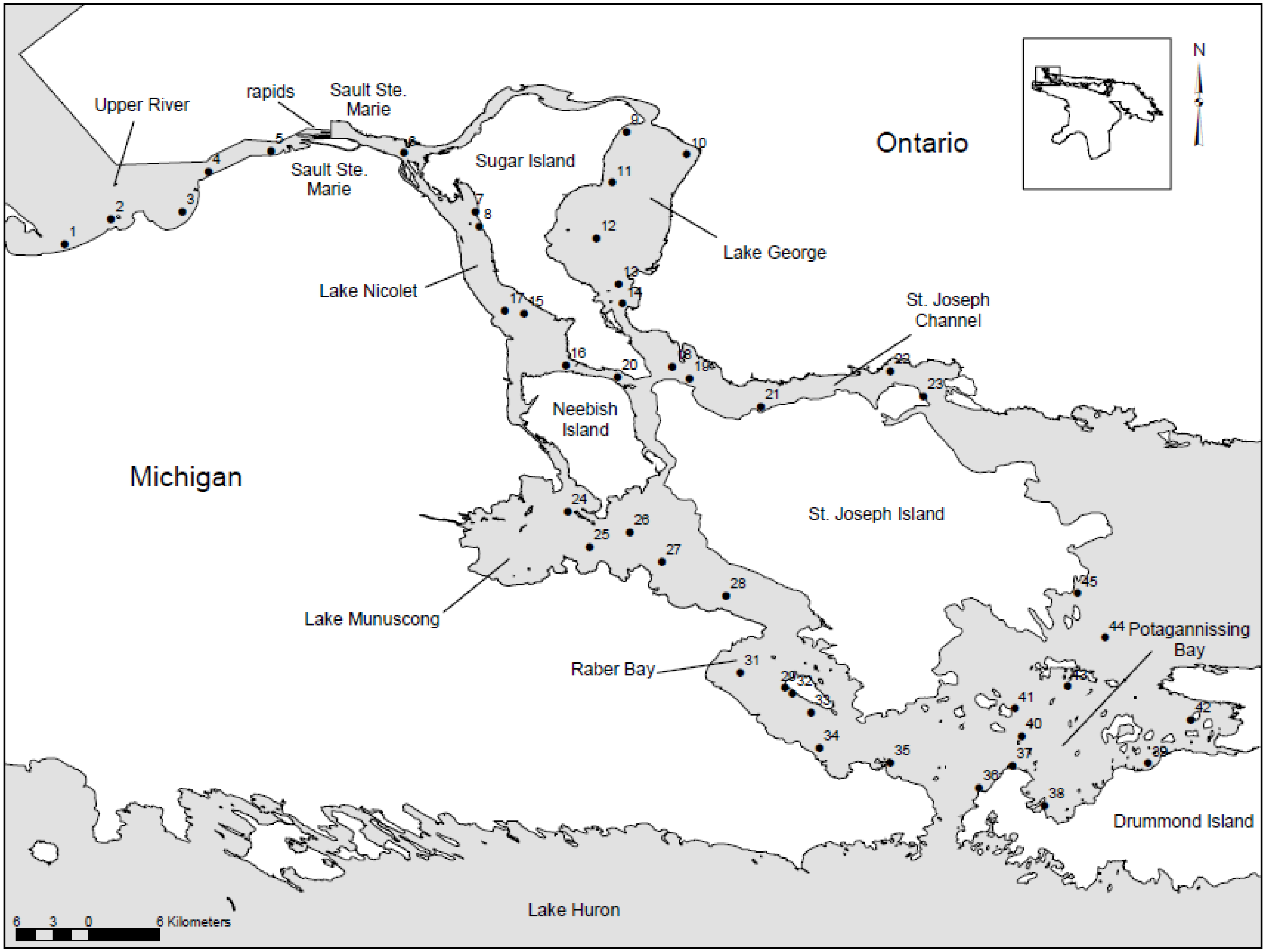
Thomas, M.V., and R. Haas. 2007. Status of the fisheries in Michigan Waters of Lake Erie and Lake St. Clair. Michigan Department of Natural Resources, Lake St. Clair Fisheries Research Station. Prepared for GLFC Lake Erie Committee Meeting, March 22, 2007.

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 2006. Not sampled were site numbers 6 & 17.

Table 1. Net set locations used to define areas within the St. Marys River for the purpose of certain data analyses, along with a list of the agencies 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
Lake George	9, 10, 11, 12, 13, 14	CORA, OMNR & DFO
Lake Munuscong	24, 25, 26, 27, 28	MDNR
St. Joseph Channel	18, 19, 21, 22, 23	OMNR & DFO
Raber Bay	31, 32, 33, 34, 35	CORA & BMIC
Potagannissing Bay	36, 37, 38, 39, 40, 41, 42, 43, 44, 45	MDNR, OMNR & DFO

Table 2. Mean Catch-Per-Unit-of-Effort (CPUE) of all species collected from the St. Marys River 1975 through 2006. Means are based on number per 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 [c] in 1995, 44 in 2002, and 42 in 2006, although only 34 sets are represented here due to data recording limitations. The St. Joseph Channel portion of the St. Marys was added to the survey series beginning in 2002.

Species[a]	1975		1979		1987 [b]		1995 [c]		2002		2006	
Alewife	1.64	(0.57)	0.23	(0.12)	0.19	(0.11)	15.11	(12.22)	0.11	(0.11)	0.00	(0.00)
Atlantic salmon	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.09	(0.07)	0.00	(0.00)	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)	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)	0.00	(0.00)
Bowfin	0.03	(0.03)	0.03	(0.03)	0.40	(0.40)	0.00	(0.00)	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)	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)	3.38	(1.69)
Brown trout	0.03	(0.03)	0.00	(0.00)	0.03	(0.03)	0.09	(0.07)	0.00	(0.00)	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)	0.00	(0.00)
Carp	0.16	(0.08)	0.00	(0.00)	0.03	(0.03)	0.00	(0.00)	0.00	(0.00)	0.07	(0.07)
Channel catfish	0.00	(0.00)	0.00	(0.00)	0.09	(0.05)	0.00	(0.00)	0.06	(0.06)	0.15	(0.15)
Chinook salmon	0.00	(0.00)	0.03	(0.03)	0.46	(0.29)	0.08	(0.05)	0.00	(0.00)	0.10	(0.08)
Cisco	14.12	(5.13)	22.40	(11.28)	18.98	(8.34)	9.80	(3.40)	0.80	(0.34)	3.53	(1.84)
Coho salmon	0.03	(0.03)	0.00	(0.00)	0.00	(0.00)	0.05	(0.05)	0.00	(0.00)	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)	0.59	(0.24)
Gizzard shad	0.00	(0.00)	0.00	(0.00)	0.12	(0.12)	0.05	(0.05)	0.40	(0.21)	0.00	(0.00)
Lake trout	0.00	(0.00)	0.31	(0.31)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.07	(0.07)
Lake whitefish	1.15	(0.41)	0.55	(0.25)	2.10	(0.99)	0.73	(0.37)	0.06	(0.06)	0.29	(0.18)
Largemouth bass	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.07	(0.07)
Longnose gar	0.00	(0.00)	0.03	(0.03)	0.06	(0.04)	0.00	(0.00)	3.92	(3.52)	0.07	(0.07)
Longnose sucker	0.94	(0.51)	1.07	(0.49)	4.26	(2.46)	2.85	(1.33)	2.10	(1.01)	1.99	(1.26)
Menominee	0.83	(0.44)	0.52	(0.30)	0.00	(0.00)	1.49	(0.55)	0.06	(0.06)	0.18	(0.11)
Northern hogsucker	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.05	(0.05)	0.00	(0.00)	0.00	(0.00)

Table 2 continued.

Northern pike	9.04	(1.77)	8.07	(1.31)	12.69	(2.11)	9.26	(1.64)	4.43	(2.28)	3.82	(0.81)
Pink salmon	0.00	(0.00)	0.00	(0.00)	2.78	(1.38)	0.55	(0.20)	0.00	(0.00)	0.22	(0.12)
Rainbow smelt	4.97	(2.45)	1.64	(0.69)	1.02	(0.47)	0.86	(0.50)	2.61	(0.61)	0.44	(0.22)
Rainbow trout	0.03	(0.03)	0.13	(0.07)	0.22	(0.22)	0.00	(0.00)	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)	1.25	(0.41)
Rock bass	6.20	(2.25)	2.29	(0.67)	11.67	(2.42)	5.57	(1.35)	11.42	(2.77)	14.34	(3.66)
Sculpin	0.05	(0.04)	0.00	(0.00)	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)	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)	6.32	(1.76)
Splake	0.34	(0.19)	0.00	(0.00)	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)	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)	0.66	(0.66)
Tiger musky	0.00	(0.00)	0.68	(0.43)	0.00	(0.00)	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)	0.00	(0.00)
Walleye	4.27	(1.56)	4.14	(1.73)	7.47	(1.92)	3.92	(0.83)	3.58	(1.04)	11.18	(2.97)
White bass	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.85	(0.41)	0.07	(0.07)
White sucker	21.48	(3.94)	13.85	(2.20)	25.68	(5.46)	20.00	(2.47)	24.7	(3.93)	17.65	(2.52)
White perch	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	4.38	(2.51)	0.74	(0.42)
Yellow perch	23.02	(6.28)	25.68	(4.93)	49.48	(7.16)	29.97	(5.85)	25.3	(4.50)	37.21	(8.94)

[a] See Appendix 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 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 and 2006 with all ten mesh sizes included (Expanded mesh) and from the traditional mesh (4 mesh sizes). Means are based number per 304.8 m (1000 ft) of gillnet with standard error in parentheses. There were 44 total nets set in 2002 and 42 in 2006. The traditional mesh CPUE values in 2006 reflect a sample size of 34 net sets.

	2002		2006	
Species[a]	Expanded mesh	Traditional mesh	Expanded mesh	Traditional mesh
Alewife	10.61 (7.84)	0.11 (0.11)	1.12 (0.73)	0.00 (0.00)
Atlantic salmon	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Black crappie	0.00 (0.00)	0.00 (0.00)	0.02 (0.02)	0.00 (0.00)
Bloater	0.02 (0.02)	0.28 (0.21)	0.00 (0.00)	0.00 (0.00)
Bowfin	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Brook trout	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Brown bullhead	2.59 (1.21)	0.06 (0.06)	2.79 (1.13)	3.38 (1.69)
Brown trout	0.02 (0.02)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Burbot	0.09 (0.04)	0.34 (0.17)	0.07 (0.05)	0.00 (0.00)
Carp	0.05 (0.03)	0.00 (0.00)	0.19 (0.12)	0.07 (0.07)
Channel catfish	0.02 (0.02)	0.06 (0.06)	0.31 (0.20)	0.15 (0.15)
Chinook salmon	0.64 (0.21)	0.00 (0.00)	0.29 (0.16)	0.10 (0.08)
Cisco	2.84 (1.35)	0.80 (0.34)	3.62 (1.50)	3.53 (1.84)
Coho salmon	0.00 (0.00)	0.00 (0.00)	0.02 (0.02)	0.00 (0.00)
Freshwater drum	0.43 (0.18)	0.06 (0.06)	1.12 (0.35)	0.59 (0.24)
Gizzard shad	0.09 (0.09)	0.40 (0.21)	0.02 (0.02)	0.00 (0.00)
Lake trout	0.00 (0.00)	0.00 (0.00)	0.14 (0.09)	0.07 (0.07)
Lake whitefish	0.77 (0.35)	0.06 (0.06)	0.50 (0.20)	0.29 (0.18)
Largemouth bass	0.00 (0.00)	0.00 (0.00)	0.02 (0.02)	0.07 (0.07)
Longnose gar	0.02 (0.02)	3.92 (3.52)	0.07 (0.05)	0.07 (0.07)
Longnose sucker	1.20 (0.56)	2.10 (1.01)	1.29 (0.59)	1.99 (1.26)
Menominee	0.36 (0.15)	0.06 (0.06)	0.86 (0.54)	0.18 (0.11)
Northern hogsucker	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Northern pike	1.55 (0.33)	4.43 (2.28)	1.69 (0.40)	3.82 (0.81)
Pink salmon	0.39 (0.22)	0.00 (0.00)	0.14 (0.07)	0.22 (0.12)
Rainbow smelt	0.25 (0.11)	2.61 (0.61)	1.40 (0.51)	0.44 (0.22)
Rainbow trout	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Redhorse spp.	0.53 (0.27)	0.40 (0.29)	0.93 (0.28)	1.25 (0.41)
Rock bass	5.95 (1.45)	11.42 (2.77)	5.81 (1.32)	14.34 (3.66)
Sculpin	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Sea lamprey	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Smallmouth bass	1.48 (0.30)	2.27 (0.59)	4.36 (1.21)	6.32 (1.76)
Splake	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Sturgeon spp.	0.02 (0.02)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Sunfish spp.	0.41 (0.23)	0.97 (0.56)	0.26 (0.22)	0.66 (0.66)
Tiger musky	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Trout-perch	0.05 (0.03)	0.34 (0.17)	0.00 (0.00)	0.00 (0.00)
Walleye	2.55 (0.65)	3.58 (1.04)	6.07 (1.35)	11.18 (2.97)
White bass	0.02 (0.02)	0.85 (0.41)	0.02 (0.02)	0.07 (0.07)
White crappie	0.02 (0.02)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
White sucker	18.80 (2.09)	24.77 (3.93)	17.88 (2.47)	17.65 (2.52)

Table 3 continued.

White perch	0.16 (0.09)	4.38 (2.51)	0.50 (0.22)	0.74 (0.42)
Yellow perch	23.43 (4.25)	25.34 (4.50)	39.92 (7.15)	37.21 (8.94)

Table 4. Mean catch-per-unit-of-effort is number per 304.8 m (1000 ft.) collected from St. Marys River 1975 through 2006 based on catch from traditional mesh sizes. 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	2006	40.0 (16.8)	29.5 (12.9)	66.2 (28.2)	25.0 (5.4)	16.5 (5.7)	57.0 (46.0)	1.2 (1.2)[b]
	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	2006	1.0 (0.6)	2.5 (1.4)	4.2 (1.4)	5.0 (2.2)	10.0 (2.8)	1.5 (0.6)	0.0 (0.0) [b]
	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	2006	15.5 (6.2)	4.0 (1.7)	26.7 (14.0)	4.2 (1.7)	3.5 (1.9)	8.5 (4.4)	18.8 (6.2) [b]
	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	2006	0.5 (0.5)	4.0 (2.0)	5.0 (1.7)	13.8 (4.6)	16.5 (5.7)	2.5 (1.6)	1.2 (1.2) [b]
	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)
Cisco	2006	0.0 (0.0)	0.5 (0.5)	0.8 (0.5)	0.0 (0.0)	0.5 (0.5)	22.0 (9.4)	0.0 (0.0) [b]
	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)

Table 4 continued.

	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.

[b] Potagannissing Bay mean CPUE values for 2006 reflect only two net sets via the traditional mesh sizes and was probably under-sampled for the purpose of this reach specific analysis.

Table 5. Catch-per-unit-of-effort (CPUE) of walleye by age and mean length-at-age at capture for the St. Marys River, August-September, 2006. 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 2006 North Channel (ON NC) average[2]. Unit of effort is one 304.8 m gillnet set. Growth index[1] compares length-at-age to state average and the 2006 year to the NC average. It 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 un-aged 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	58	65	53	27	22	10	3	7	3	1				1			
CPUE	1.38	1.55	1.26	0.64	0.52	0.24	0.07	0.16	0.07	0.05				0.02			
Frequency (%)	22.8	22.6	20.9	10.6	8.7	3.9	1.2	2.8	1.2	0.8				0.4			
Mean length																	
This survey (2006)	287	363	391	416	483	520		561							3.0	383	+9
2002 survey	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 NC 2006 average		381	410	471	511	538		635		658							-35

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

Table 6. Catch-per-unit-of-effort (CPUE) of yellow perch by age and mean length-at-age at capture for the St. Marys River, August-September, 2006. 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 2006 North Channel average[2] (ON NC). Unit of effort is one 304.8 m gillnet set. Growth index[1] compares length-at-age to Michigan state average and the 2006 year to the North Channel average. It excludes age groups represented by less than 5 specimens. All lengths and the growth indexes are in mm. CPUE values by age may omit some un-aged 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	14	39	50	17	1	1	2						
CPUE	2.80	7.80	10.00	3.40	0.20	0.20	0.40						
Frequency (%)	11.2	31.2	40.0	13.6	0.8	0.8	1.6						
Mean length													
This survey (2006)	159	186	241	251							2.7	219	+40
2002 survey	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
ON NC 2006	124	173	211	235	243	248	256	276		290			+24
Lake Nicolet													
Number	7	50	35	11	2		1						
CPUE	1.40	10.00	7.00	2.20	0.40		0.17						
Frequency (%)	6.6	47.2	29.9	9.4	1.7		0.9						
Mean length													
This survey (2006)	143	164	205	235							2.6	188	+17
2002 survey		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
ON NC 2006	124	173	211	235	243	248	256	276		290			+1
Lake George													
Number	135	94	56	43	26	7	2						
CPUE	22.50	15.67	9.33	7.17	4.33	1.17	0.33						
Frequency (%)	37.2	25.9	15.4	11.8	7.2	1.9	0.6						
Mean length													
This survey (2006)	156	172	207	246	246	272					2.3	188	+22
2002 survey	155	153	194	222	269	311	318	315			2.8	185	+12
1995 survey		148	169	206	233	247	242	263	256				-15

Table 6 continued.

1987 survey				198	216	256	264	302	323		-10
1979 survey			173	190	203	249	282	282		297	-12
ON NC 2006	124	173	211	235	243	248	256	276		290	+10

Table 6. Continued.

Parameter & Area	Age 1	2	3	4	5	6	7	8	9	10	Mean age	Mean length	Growth index
St. Joseph Channel													
Number	6	53	43	15	5	6	2						
CPUE	1.20	10.60	8.60	3.00	1.00	1.20	0.33						
Frequency (%)	4.6	40.8	33.1	11.5	3.8	4.6	1.5						
Mean length													
This survey (2006)	149	155	174	194	212	283					2.9	167	+0
2002 survey		147	167	217	259	293					3.2	183	+8
1995 survey													
1987 survey													
1979 survey													
ON NC 2006	124	173	211	235	243	248	256	276		290			-11
Lake Munuscong													
Number	19	31	45	4	2	1	1						
CPUE	3.17	5.17	7.50	0.67	0.33	0.17	0.17						
Frequency (%)	18.4	30.1	43.7	3.9	1.9	1.0	1.0						
Mean length													
This survey (2006)	155	182	227								2.5	205	+31
2002 survey	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
ON NC 2006	124	173	211	235	243	248	256	276		290			+19
Raber Bay													
Number	25	37	38	37	14	8	1	1	1				
CPUE	5.00	7.40	7.60	7.40	2.80	1.60	0.20	0.20	0.20				
Frequency (%)	15.4	22.8	23.5	22.8	8.6	4.9	0.6	0.6	0.6				
Mean length													
This survey (2006)	157	182	207	223	244	273					3.1	204	+20
2002 survey		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
ON NC 2006	124	173	211	235	243	248	256	276		290			+9

Table 6. Continued.

Parameter & Area	Age 1	2	3	4	5	6	7	8	9	10	Mean age	Mean length	Growth index
Potagannissing Bay													
Number	131	154	328	16									
CPUE	0.40	3.10	2.70	0.60									
Frequency (%)	20.8	24.5	52.1	2.5									
Mean length													
This survey (2006)	153	181	229	263							2.4	202	+37
2002 survey	157	172	196	247	297	175					2.6	189	+32
1995 survey	133	158	167	208	215	243	275	290					-6
1987 survey					231	262	272	307		330			-1
1979 survey			201	224	249	269	302	323	282				+20
ON NC 2006	124	173	211	235	243	248	256	276		290			+21
River-wide													
Number	337	458	595	143	50	23	9	1	1				
CPUE	8.02	10.90	14.16	3.40	1.19	0.55	0.21	0.02	0.02				
Frequency (%)	20.8	28.3	36.8	8.8	3.1	1.4	0.6	0.1	0.1				
Mean length													
This survey (2006)	155	175	221	236	246	280	290				2.5	196	+22
2002 survey	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 NC 2006	124	173	211	235	243	248	256	276		290			+16

[1]From Schneider et al. (2000)

[2]Ontario MNR, unpublished data

Table 7. Catch-per-unit-of-effort (CPUE) of cisco by age and mean length-at-age at capture for the St. Marys River, August - September, 2006. 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 2006 North Channel (ON NC) average[2]. Unit of effort is one 304.8 m gillnet set. Growth index[1] compares length-at-age to state average and the 2006 year to the NC average. It 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 un-aged 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		20	45	38	43	3	6	9	5	1							
CPUE		0.48	1.07	0.90	0.98	0.07	0.14	0.21	0.12	0.02							
Frequency (%)		13.7	30.8	26.0	13.0	2.1	4.1	6.2	3.4	0.7							
Mean length																	
This survey (2006)		213	232	281	326		378	386	377						3.2	280	+8
2002 survey		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 NC 2006 average			265	263	329	292	358	377	372	388	372	390	374	393			+29

[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 - September, 2006. 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 2002 North Channel (ON NC) average[2]. Unit of effort is one 304.8 m gillnet set. Growth index[1] compares length-at-age to state average and the 2006 year to the NC average. It 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 un-aged 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	30	18	8	9												
CPUE	0.07	0.71	0.43	0.19	0.21												
Frequency (%)	4.4	44.1	26.5	11.3	12.7												
Mean length																	
This survey (2006)	269	429	528	601	642										1.8	491	+13
2002 survey	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 NC 2002 average		377	483	580	657	749	706										+26

[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 - September, 2006. 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 2003 North Channel (ON NC) average[2]. Unit of effort is one 304.8 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 un-aged 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		26	39	59	35	9	1	4	1	1	1						
CPUE		0.62	0.93	1.40	0.83	0.21	0.02	0.10	0.02	0.02	0.02						
Frequency (%)		14.8	22.2	33.5	19.9	5.1	0.6	2.3	0.6	0.6	0.6						
<u>Mean length</u>																	
This survey (2006)		171	251	282	315	371		391							3.0	273	-18
2002 survey		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 NC 2003 average		128	161	175	256	291	240										+60

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

Table 10. Comparison of total annual mortality rates for select fish species in the St. Marys River, computed from fish collected in experimental mesh gillnets 2006; 2002 and 1995 total annual mortality rates are provided for comparison.

Species	Area, if not total for the river	1995 total annual mortality	2002 total annual mortality	2006 total annual mortality
Yellow perch	Upper River	0.25	0.54	0.70
	Lake Nicolet	0.38	0.70	0.59
	Lake George	0.40	0.52	0.43
	St. Joseph Channel	Not sampled	0.64	0.50
	Lake Munuscong	0.41	0.61	0.78
	Raber Bay	0.44	0.63	0.49
	Potagannissing Bay	0.60	0.57	0.96
	River Total	0.38	0.68	0.70
Northern pike		0.58	0.52	0.61
Walleye		0.51	0.49	0.38
Cisco		0.31	0.39	0.40
Smallmouth bass		0.36	0.37	0.55

Table 11. Maturity schedule for five notable species expressed as percent maturity of females by length in the St. Marys River. Fish used in the analysis were collected by gillnets in August - September 2006.

	Species				
Length (cm)	Walleye	Smallmouth bass	Northern pike	Yellow perch	Cisco
13				0.0%	
14				8.0%	
15		0.0%		16.7%	
16		0.0%		29.2%	
17		100.0%		50.0%	
18		100.0%		48.6%	0.0%
19				85.7%	0.0%
20		0.0%		83.9%	20.0%
21				93.4%	0.0%
22		0.0%		95.9%	20.0%
23		0.0%		98.5%	50.0%
24	0.0%	50.0%		98.8%	66.7%
25	100.0%	0.0%		98.6%	0.0%
26	100.0%	66.7%		100.0%	33.3%
27	100.0%	40.0%	0.0%	100.0%	25.0%
28	0.0%	0.0%		94.7%	100.0%
29	20.0%	66.7%		100.0%	
30	0.0%	100.0%		100.0%	50.0%
31	0.0%	100.0%		100.0%	100.0%
32	0.0%	100.0%		100.0%	80.0%
33	25.0%	100.0%		100.0%	100.0%
34	0.0%	100.0%	100.0%		100.0%
35	50.0%			100.0%	100.0%
36	0.0%	100.0%			100.0%
37	0.0%	100.0%			100.0%
38	25.0%	100.0%			100.0%
39	33.3%	50.0%			100.0%
40	66.7%	100.0%			
41	50.0%	100.0%	0.0%		100.0%
42	66.7%		100.0%		100.0%
43	20.0%	0.0%			
44	0.0%	100.0%	0.0%		
45	0.0%	100.0%			100.0%
46	0.0%				100.0%
47	100.0%	0.0%	100.0%		
48	100.0%				
49			0.0%		100.0%
50	100.0%	0.0%			

Table 11. Continued.

	Species				
Length (cm)	Walleye	Smallmouth bass	Northern pike	Yellow perch	Cisco
51	75.0%		100.0%		
52	100.0%		100.0%		
53	100.0%				
54			100.0%		
55	100.0%				
56	100.0%				
57			50.0%		
58					
59	100.0%		50.0%		
60	100.0%				
61			100.0%		
62	0.0%		100.0%		
63					
64					
65					
66					
67					
68			100.0%		

Table 12. Incidence and proportion of occurrence of food items (based on stomach content identification) for select species from the St. Marys River, August – September 2006.

	Walleye	Northern pike	Smallmouth bass	Yellow perch
Incidence				
No. stomachs examined	225	65	155	1503
% void	68	72	52	57
Percent of Occurrence				
Unidentified fish remains	41.6	8.7	26.3	23.1
Crayfish		21.7	54.0	60.5
Alewife	2.9			
Rainbow smelt	46.0	8.7		0.8
Mayfly	0.7			3.8
Gizzard shad				
Unidentified zooplankton			1.0	1.1
Spiny water flea				
Dragon fly				
Yellow perch		26.0	7.1	
Cisco	1.4			0.1
Slimy sculpin	3.6		5.0	2.1
Johnny darter				3.4
Unidentified terrestrial insects				0.6
Ninespine stickleback	1.4	13.0	2.0	1.8
Threespine stickleback				
Snails				
White sucker	2.2	8.7	2.0	
Other		13.0	2.0	2.3

35

Table 13. Condition of select species, by area and river wide, for the St. Marys River, August - September 2006; data from 2002 and 1995 are presented for comparison. Values are mean relative weight.

Location	Walleye	Yellow perch	Smallmouth bass	Northern pike	Cisco
Upper River	79	94	115	106	---
Lake Nicolet	91	91	116	89	94
Lake George	91	90	117	96	92
Lake Munuscong	87	89	106	90	---
St. Joseph Channel	85	83	109	95	83
Raber Bay	84	91	100	98	81
Potagannissing Bay	87	93	110	97	89
River wide 2006 (this survey)	87	91	109	94	84
River wide 2002	90	94	106	87	89
River wide 1995	102	97	106	91	---

Table 14. Percent of sea lamprey wounds by species exhibiting wounding from the St. Marys River, August - September 2006. N denotes sample size of specimens examined for wounds.

Species	N	A1	A2	A3	A4	B1	B2	B3	B4	Total
Walleye	254					0.4%				0.4%
Yellow perch	1672	<0.1%	<0.1%			0.4%				0.5%
Cisco	152	1.3 %			0.6%	2.0%				3.9%
Lake whitefish	21									
Northern pike	71									
White sucker	739	0.1%		0.3%			0.1%	0.1%		0.7%
Longnose sucker	54					1.8%				1.8%
Rock bass	230									
Chinook salmon	12	8.3%							8.3%	16.7%

Table 15. Number of walleye stocked from 2002 to 2006 at various locations in St. Marys River by agency. All fish were spring fingerlings unless otherwise noted. “FF” denotes fall fingerlings. All fish were marked with oxytetracycline except for the CORA plants in 2004 when 24% were marked.

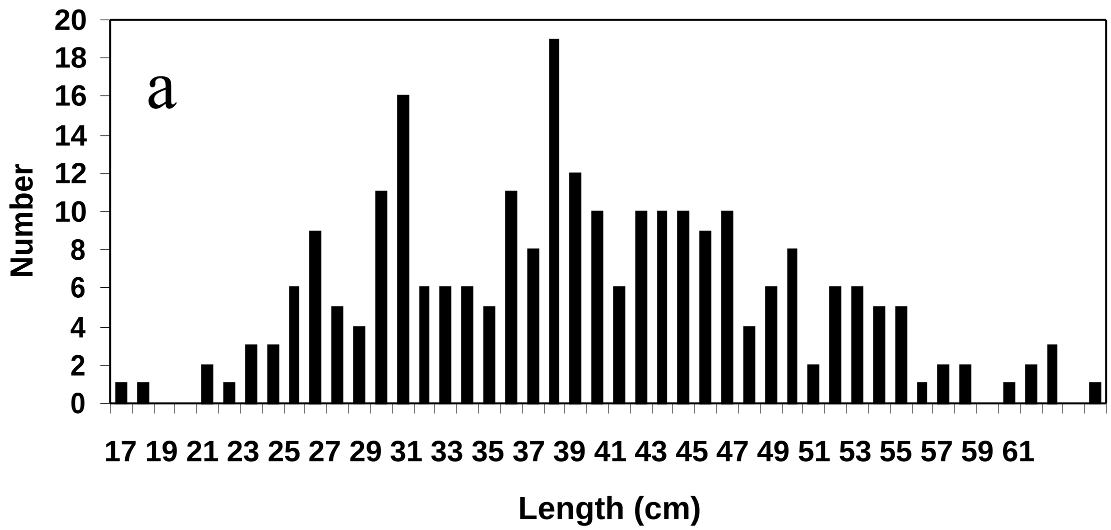
Location	2002	2003	2004	2005	2006
Waiska River or Bay	100,450 CORA	107,055 + 10,173FF CORA	100,400 CORA	107,113 CORA	99,963 CORA
Soo, below locks		101,115 + 25,235FF CORA	45,800 + 5,000FF CORA		44,096 CORA
Lake George		98,080 CORA	49,600 CORA		68,951 CORACORA
Lake Nicolet			40,000 CORA		5,000FF CORA
Lake Munuscong					
Raber Bay	5,970 FF,CORA	99,750 CORA	5,000FF CORA		68,160 + 1600FF CORA
Potagannissing Bay	101,648 MDNR	103,200 MDNR	103,400 MDNR		102,078 MDNR

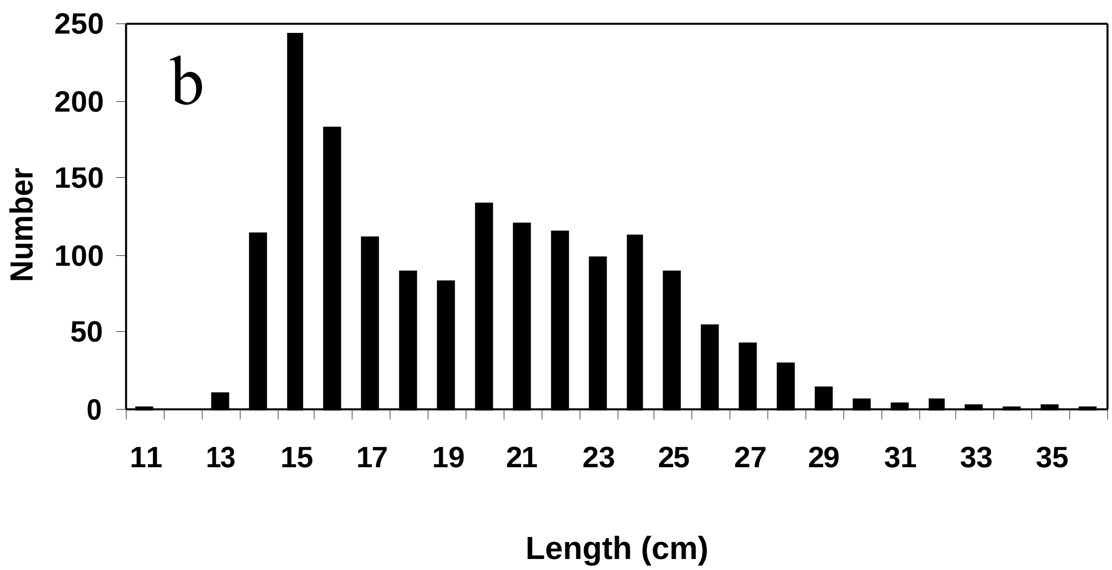
Appendix 1. Common and scientific names of fishes and other aquatic organisms mentioned in this report.

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*
Cisco (cisco)	*Coregonus artedii*
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 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*
White bass	*Morone chrysops*
White perch	*Morone americana*
White sucker	*Catostomus commersoni*
Yellow perch	*Perca flavescens*

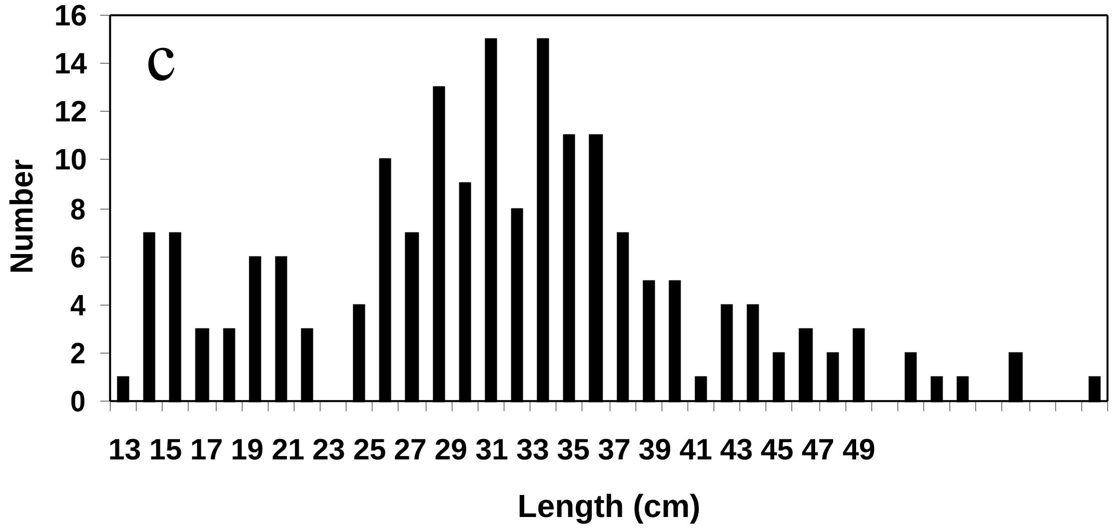
Appendix 2. Length-weight regression equations and von Bertalanffy growth equations for select species from the St. Marys River August – September 2006. Length/weight equation logs are base 10, weight (wt) is in grams, and 1ength (len) is in mm. Von Bertalanffy equations are based on mean length-at-age data where 't' is age in years.

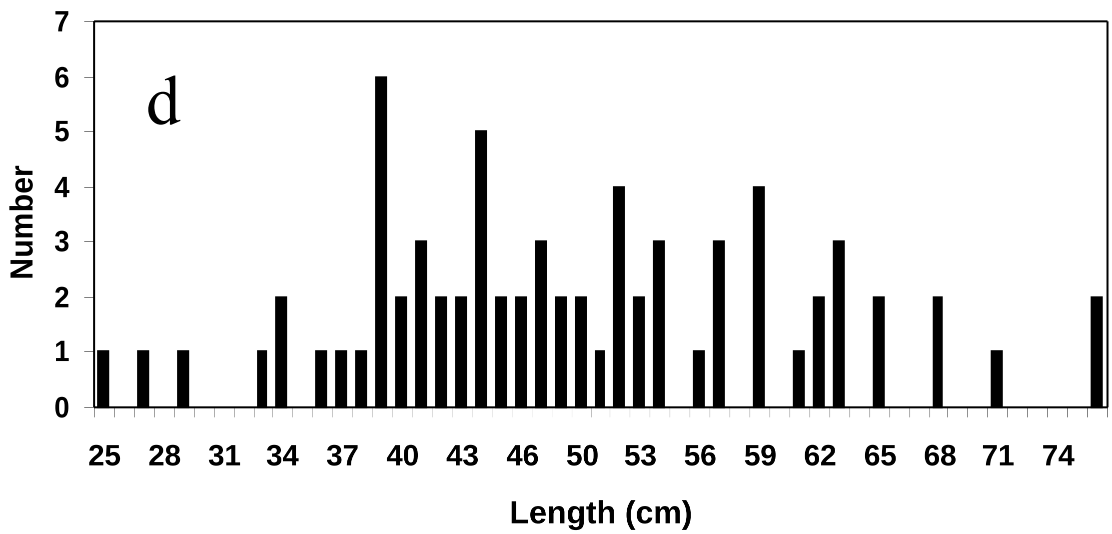
Species	Length/Weight Equation	Len/Wt r^2	Von Bertalanffy Equation	K	L∞	t_o
Walleye	log(wt)=3.230 log(len)-5.648	0.96	$L_t=547[1-e^{-0.3432(t-0.57)}]$	0.3432	547	0.57
Yellow perch	log(wt)=3.251 log(1en)-5.480	0.95	$L_t=311[1-e^{-0.2654(t+1.39)}]$	0.2654	311	-1.39
Smallmouth bass	log(wt)=3.077 log(1en)-5.004	0.96	$L_t=417[1-e^{-0.5038(t+1.31)}]$	0.5038	417	-1.31
Northern pike	log(wt)=2.941 log(1en)-5.091	0.85	$L_t=731[1-e^{-0.4089(t+1.15)}]$	0.4089	731	-1.15
Cisco	log(wt)=3.267 log(1en)-5.703	0.95	$L_t=451[1-e^{-0.2158(t+1.99)}]$	0.2158	451	-1.99



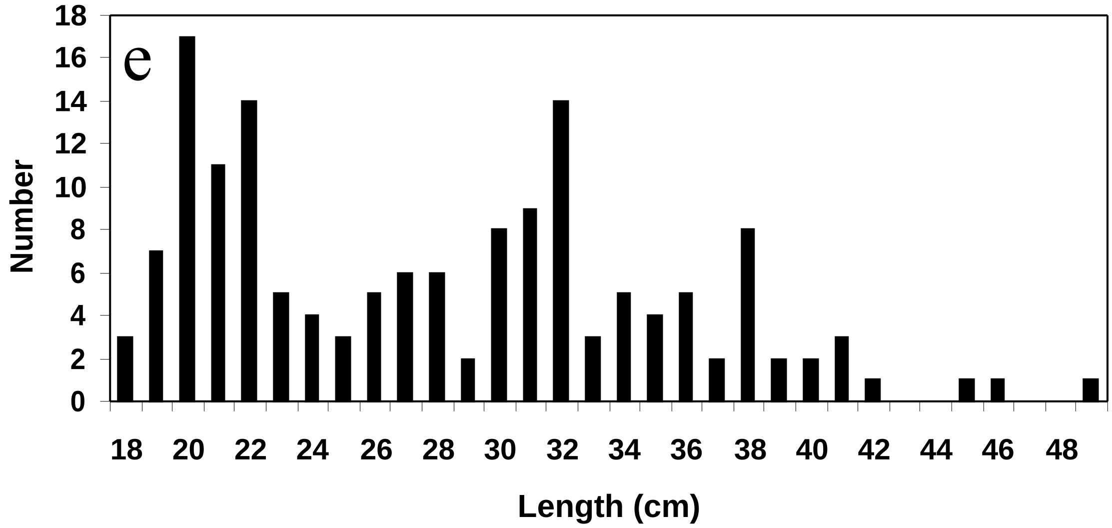


Appendix 3. Length frequencies from survey catch of; (a) walleye, (b) yellow perch, (c) smallmouth bass, (d) northern pike, and (e) cisco from the St. Marys River, August and September 2006 .





Appendix 3 continued.



Appendix 3 continued.