

Status of Reintroduction of Great Lakes Muskellunge to Wisconsin waters of Green Bay, Lake Michigan

Background

The Wisconsin Department of Natural Resources (WDNR) in cooperation with several local musky clubs and the Musky Clubs Alliance of Wisconsin initiated a Great Lakes strain muskellunge reintroduction program in 1989 in the Green Bay waters of Lake Michigan. Muskellunge in southern Green Bay were decimated during the early to mid 1900s by habitat destruction, pollution, and over-exploitation (Kapuscinski 2007). The need to reestablish a native inshore predator fish species has been identified in several planning efforts including the Lake Michigan Integrated Fisheries Management Plan and the Lower Green Bay Remedial Action Plan (Lake Michigan Fisheries Team 2004, WDNR 1986).

A three-phase plan was drafted by WDNR biologists to re-establish a self-sustaining population of muskellunge in Green Bay: (1) identify and appropriate egg source, obtain eggs, and successfully hatch, rear and stock fish, (2) establish an inland lake broodstock population, and (3) develop a self sustaining population in Green Bay. Phase 1 included the collection of gametes from the Indian Spread Chain in the lower peninsula of Michigan, a tributary system to Lake Huron. In cooperation with the Michigan DNR, gametes were collected and brought to the Wild Rose Fish Hatchery from 1989-1993. In 1997, additional spawn was collected from Lake St. Clair to increase the genetic diversity of the population.

Phase 2 was initiated with the stocking of muskellunge fingerlings into Long Lake in Waushara County, Wisconsin from 1989-1992. From 1995-2001, Long Lake was the main brood source for the reintroduction effort. However in 2002 the WDNR discontinued the use of Long Lake as a broodstock lake. In April of 2009, three new inland lakes were stocked with muskellunge from Georgian Bay, Lake Huron, in order to establish brood populations.

There has been no significant amount recruitment from natural reproduction of muskellunge documented in Green Bay or the Lower Fox River as of the fall of 2008. However in 2008, two young of the year muskellunge were collected from the Lower Menominee River. Tissue samples have confirmed these two individuals are the progeny of Great Lakes spotted muskellunge, the first evidence of natural reproduction.

Current Status

Current assessment of the Green Bay muskellunge population includes spring fyke netting and fall electrofishing. Spring netting was conducted in 2009 from April 24th through May 14th. A total of 94 net nights were fished and 197 muskellunge were captured ranging in size from 914mm (36in) to 1289mm (50.75in, Figures 1 and 2). The average daily catch rate was 2.5 fish per net night. The mean size of fish has continued to increase as this re-established population continues to mature (Figure 1). The average fish length was 1105mm (43.5in); in 2008 the average was 1085mm (42.7in). Twelve fish were larger than 1270mm (50in) and 30 fish were larger than 1219mm (48in). Male fish appear to recruit to the population sooner, but female fish grow faster and attain larger ultimate size (Figure 2).

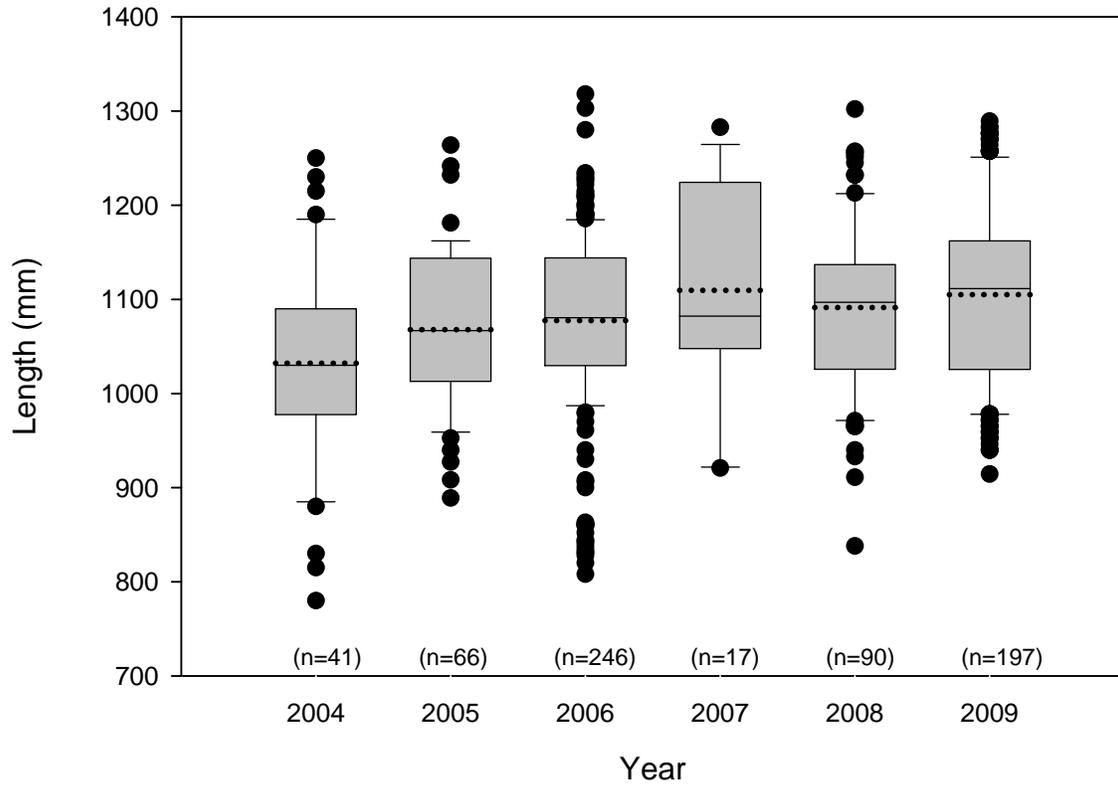


Figure 1. Length distributions of muskellunge captured during spring netting surveys of the lower Fox River from 2004-2009. The shaded box is defined as the upper and lower quartiles with the median described by the solid line in the box and the mean by the dotted line. The whiskers represent the 10th and 90th percentiles of the distribution.

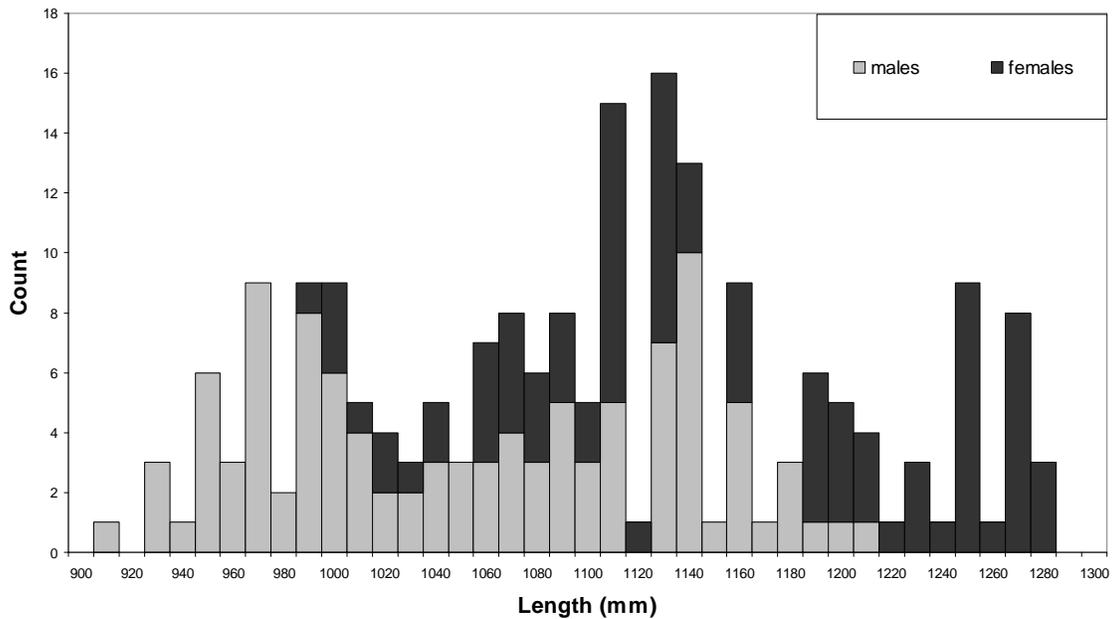


Figure 2. Length frequency distribution of Great Lakes Spotted muskellunge, by sex, from spring 2009 netting of the Lower Fox River and Green Bay.

Nighttime electrofishing surveys have been conducted along the length of the Fox River from the mouth to the DePere dam during the last week of October to index walleye and muskellunge populations. In 2008, we captured 52 muskies ranging in size from 737mm (29in) to 1206mm (47.5in), during 7.9 hours of effort over three evenings (Figure 3). The average length of an adult fish was 1026mm (40.4 in).

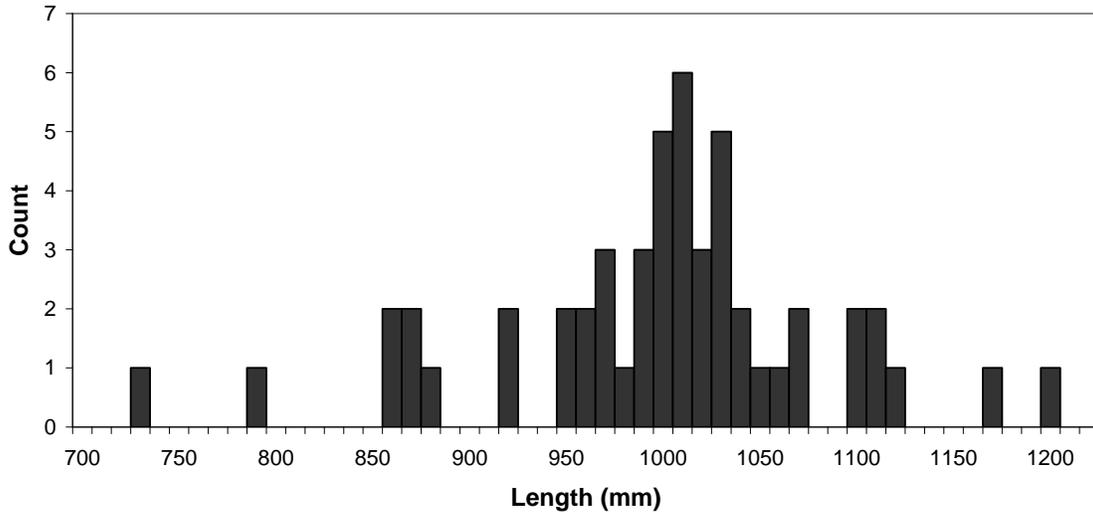


Figure 3. Length frequency distribution of Great Lakes Spotted muskellunge from fall 2008 electrofishing of the Lower Fox River.

Adult muskellunge catch per unit of effort (CPUE) was 6.61 fish per hour, the highest recorded since the index surveys began in 2000 (Figure 4). The CPUE in the fall index sampling has steadily increased over the past eight years, suggesting a growing population, likely as a result of the increases in stocking. The dramatic increase in the fall 2008 catch rate is attributable to the 2002 and 2003 year classes beginning to recruit. In those years the stocking rate increased from around 3000 a year to average of 20000 per year (Table 1).

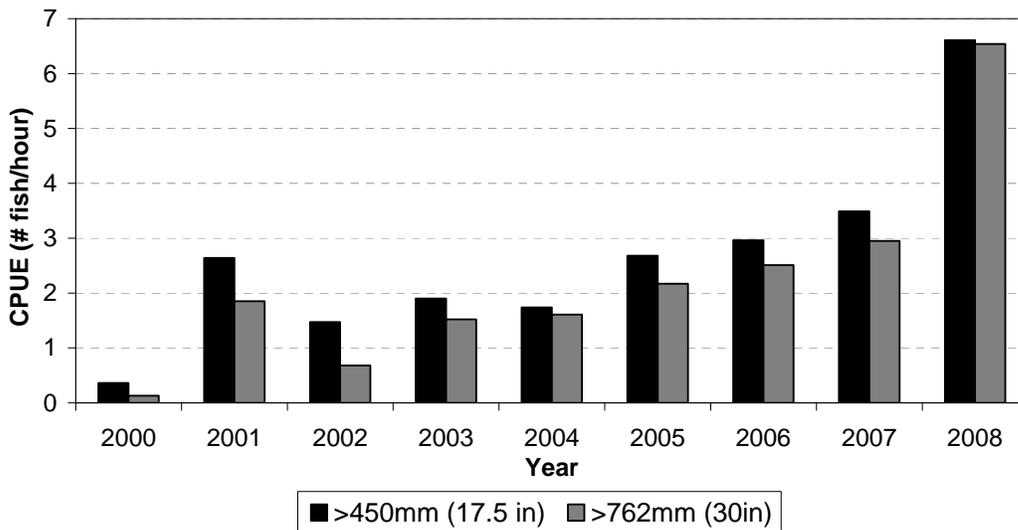


Figure 4. Catch per Unit Effort (CPUE) from night time electrofishing of Lower Fox River for muskellunge greater than 450mm (17.5in) and greater than 762mm (30in) from 2000- 2008.

Propagation and Stocking

The first six years of the program (1989-94), hatchery production averaged 2,200 fingerling and yearling muskies and was based upon spawn collected directly from the Indian Spread Chain in the State of Michigan. From 1995 to 2001, hatchery production averaged 2,875 muskies and was primarily from spawn collection from Long Lake, with the exception of 1997 when spawn was collected from Lake St. Clair, Michigan. From 2002 to 2006, spawn was collected from the Fox River and Long Lake and the annual hatchery production increased to an average of 20,324 muskellunge. Stocking has increased as hatchery production increased (Table 1). In 2005, the lower Fox River became the sole location for spawn collection for the reintroduction program. During 2007, discovery of other species of fish infected with Viral Hemorrhagic Septicemia virus in Lake Michigan, Green Bay and the Fox River prevented any collection of gametes from those waters and no spawn was collected. Additional stocking has been indefinitely postponed until egg disinfection protocols are approved or a disease free source of gametes becomes available. Since 2005, stockings have been distributed to a greater diversity of locations around Green Bay (Figure 5). There is evidence that muskellunge may exhibit spawning site fidelity (Crossman 1990) and more areas with appropriate habitat have been stocked to foster natural reproduction.

Table 1. Stockings of great lakes strain muskellunge into the waters and tributaries of Green Bay, Lake Michigan from 1989-2009.

Stocking	Fingerlings	Yearlings
1989	5261	0
1990	1274	9
1991	2624	0
1992	2107	152
1993	1394	215
1994	0	237
1995	1803	0
1996	3135	247
1997	1842	130
1998	4311	278
1999	3305	294
2000	2451	295
2001	1854	176
2002	9281	140
2003	33107	103
2004	20772	161
2005	18609	325
2006	18785	421
2007	0	640
2008	0	0
2009	0	0



Figure 5. Stocking locations of Great Lakes spotted muskellunge in Green Bay and tributaries before and after 2005.

Fishery

The reintroduction program has resulted in a muskellunge fishery that rapidly increased in popularity and participation in 2007. The Lake Michigan creel survey estimated a total of 35,638 hours of directed effort for muskellunge on Green Bay and the lower Fox River from March 15th through October 31st, 2008 (Figure 6). However, this value underestimates effort since a substantial amount of angling goes on in November after the creel census ends. This was down slightly from 2007 but still over twice the effort of 2005 and 2006. With the increase in effort the catch rate has decreased (Figure 6). An estimated 1,300 muskies were caught and released in 2008 compared to 1,945 in 2007. The catch rate in 2005 and 2006 was about 0.094 fish /hour (10.6 hours/fish). The rate slowed to 0.049 fish/hour (20.4hours/fish) in 2007 and in 2008 slowed even further to 0.036 fish/hour (27.8 hours/fish). In comparison, statewide directed muskellunge catch rates average 0.039 fish/hour (25.6 hours/fish) for naturally reproduced populations, and 0.020 fish/hour (50 hours/fish) for populations maintained by stocking (Simonson 2003). Figure 6 also shows the catch rates from a Muskies Inc. tournament that has been held annually on the lower part of the Bay and the Fox River since 2006. This tournament is only conducted over 2 days but during the most active period of muskellunge angling. The similarity in values of the tournament census data, and the creel estimates gives strong confidence in the survey estimates.

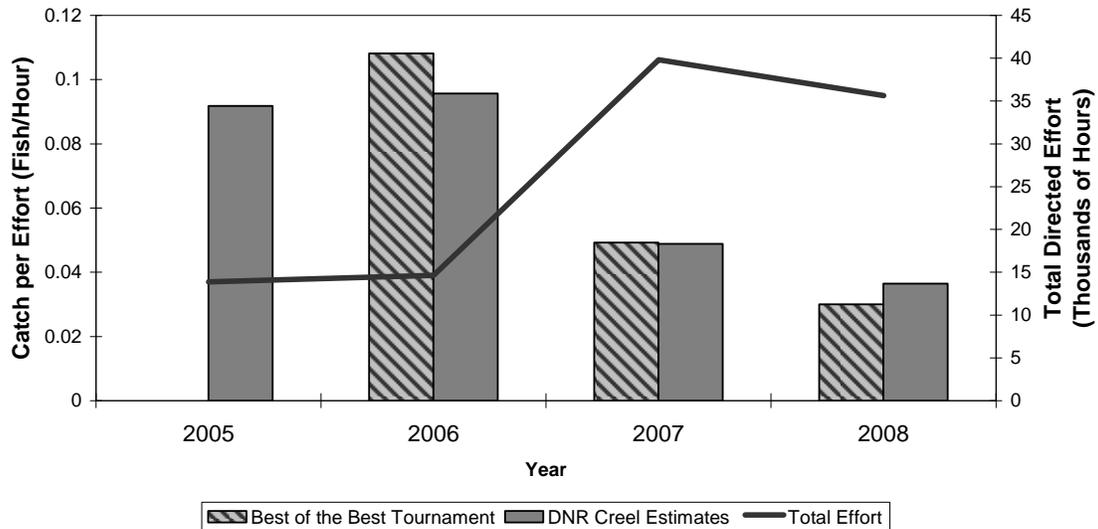


Figure 6. Total directed fishing effort for muskellunge on Green Bay waters of Lake Michigan from 2005-2008 is displayed by the solid black line and on the right axis. The left axis shows catch rate in number of muskellunge caught per hour of directed fishing, the estimated catch rate from creel surveys is displayed in gray, catch rate from the Muskies Inc. “Best of the Best Tournament” is shown with diagonal stripes

Future

The population of adult great lakes strain muskellunge in Green Bay waters is increasing as documented by the fall index CPUE steadily increasing since 2000. This is likely in response to the increases in stocking and hatchery production. A Jolly Seber population estimate of the Lower Fox River and Green Bay estimated a population size of 8469 individuals in the fall of 2008. This population appears to be separate from the populations in the Menominee River and Peshtigo River area, and the Sturgeon Bay and Little Sturgeon Bay area based on recaptures of tagged fish.

Hopefully the increase will push the population over a density threshold and there will begin to be significant recruitment from natural reproduction. As the population has increased the WDNR has received anecdotal reports of muskellunge spawning in Green Bay and tributary rivers. The WDNR in cooperation with the University of Michigan and supported by a Great Lakes Fish and Wildlife Restoration Act Grant has begun efforts to document if natural reproduction is occurring. In the spring of 2009, 20 gravid females were implanted with miniature radio transmitters during spring netting. Transmitters were inserted into oviducts, so during spawning the transmitter would be expressed and deposited with the eggs allowing identification of spawning sites. Identification of spawning locations and quantifying associated habitat will allow for prediction of additional locations for habitat protection, enhancement, and selection of more effective stocking locations.

Efforts are continuing to increase the genetic diversity of the present Green Bay muskellunge stock by establishing new inland brood lakes with fish from Canadian waters of the Great Lakes. Three new brood lakes were established in April 2009 when 1063 yearling muskies, of Georgian Bay, Lake Huron ancestry were imported and stocked into Northeast Wisconsin lakes. Hopefully these brood populations can begin contributing gametes by the year 2015. This project is a cooperative effort between the

WDNR, Ontario Ministry of Natural Resources, Sir Sanford Fleming College and supported financially by the Natural Resource Damage Assessment and Restoration settlements from the Fox River and Green Bay cleanup as well as local musky clubs, Muskies Inc., and the Musky Clubs Alliance of Wisconsin.

References

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