SURVEILLANCE FOR RUFFE IN THE GREAT LAKES, 2008 to 2010

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BACKGROUND

The ruffe *Gymnocephalus cernuus*, an Eurasian percid, was likely introduced to the St. Louis River Estuary (SLRE), Minnesota/Wisconsin, during the mid 1980s in the ballast water of an ocean-going ship (Pratt et al., 1992). Ruffe increased rapidly and became the most abundant fish in the SLRE by 1990, based on bottom trawl assessment. The population peaked at about eight million in trawls by 1995 and subsequently declined to about two million in trawls by 2004; however, ruffe remained the most abundant species in trawls through 2004; the U.S. Geological Survey (USGS) terminated bottom trawl assessments in the SLRE after 2004 (unpublished, USGS, Great Lakes Science Center, Lake Superior Biological Station, Ashland, Wisconsin). In 1991, ruffe were detected in Thunder Bay Harbour, Ontario, (Busiahn, 1997). Due to potential competition for food and space, ruffe pose a threat to native fish populations (Ruffe Task Force, 1992).

Experimental research conducted by the University of Minnesota-Duluth revealed that ruffe consume a significant amount of benthic macroinvertebrate energy (Schuldt et al., 1999). In a presentation of this experiment, co-author Carl Richards, University of Minnesota Natural Resources Research Institute, stated in conclusion: "With the significant amount of benthic macroinvertebrate energy that ruffe are consuming in the St. Louis River Estuary, something has got to be happening in that ecosystem. We are just not seeing it yet." In the same experiment, research also demonstrated significant declines in the growth of yellow perch *Perca flavescens*, at ruffe densities less than, equal to, and greater than the densities of yellow perch (Henson, 1999). However, a statistical analysis of bottom trawl data conducted by USGS showed no significant relationship between an increasing ruffe population and declining native fish populations in the St. Louis River, Minnesota/Wisconsin (Bronte et al., 1998).

In three Wisconsin tributaries just east of the St. Louis River, 1995-2002 trawl data suggest that yellow perch abundance declines in years that ruffe abundance increases (Evrard et al., 1998), (Czypinski et al., 2002). This trend was analyzed and found to be weakly significant for all three tributaries combined (unpublished, D. H. Ogle, Department of Mathematics, Northland College, Ashland, Wisconsin).

As a result of increasing abundance and expansion outside the SLRE and speculation about potential impacts on native fish populations, the Aquatic Nuisance Species Task Force declared the ruffe to be a "nuisance species" in the spring of 1992. By authority of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, this designation authorized the formation of a control committee charged with the

responsibility of designing and implementing a control plan. The *Ruffe Control Plan* was drafted in 1995 with a revision in 1996 after ruffe were discovered in Lake Huron in 1995 (Kindt et al., 1996). The goal of the *Ruffe Control Plan* is "to prevent or delay the spread of ruffe in the Great Lakes and inland waters" (Ruffe Control Committee, 1996). Surveillance was one of eight objectives designed into the plan to achieve this goal.

Formal ruffe surveillance efforts began in 1992 to detect pioneering populations of ruffe in the Great Lakes (Slade and Kindt, 1992). These efforts were initiated by the U.S. Fish and Wildlife Service - Ashland Fish and Wildlife Conservation Office (USFWS-Ashland FWCO) and the Ontario Ministry of Natural Resources – Upper Great Lakes Management Unit (OMNR-UGLMU).

The term *ruffe surveillance*, as used herein, is defined as efforts designed and implemented specifically to find and collect ruffe.

The term *other fish sampling*, as used herein, is defined as efforts implemented to assess a fishery (including sea lamprey *Petromyzon marinus* assessments), in which ruffe are not specifically the target species, but the gear used is capable of capturing ruffe. In reporting other fish sampling, we describe results of fish sampling using gear that is capable of capturing ruffe, but the sampling was not dedicated to that purpose. Fishery assessment methods and results were provided to us per our request to fishery management and/or research agencies working in the Great Lakes. This is not a complete list of fishery sampling using gear that is capable of capturing ruffe, only that which was reported or known to us.

Following is a chronology of ruffe detection for the Great Lakes Basin (Figure 1):

1986 – Lake Superior: Ruffe were discovered in the SLRE (Duluth-Superior Harbor), Minnesota/Wisconsin, by the Wisconsin Department of Natural Resources (WIDNR). This was the initial sighting of ruffe in North America.

1991 – Lake Superior: Major ruffe range expansion was detected. A crew from USFWS-Ashland FWCO discovered ruffe in Thunder Bay Harbour, Ontario, 293 km northeast of the SLRE along the north shore of Lake Superior. This introduction was likely a ballast water transfer from shipping operating between the Duluth/Superior Harbor, Minnesota/Wisconsin and Thunder Bay Harbour.

1992 – Lake Superior: Major ruffe range expansion was detected. USFWS-Ashland FWCO initiated formal ruffe surveillance, and located several new populations along the south shore of Lake Superior, thus extending the known range of ruffe to the Sand River, Wisconsin, 60 km east of the SLRE.

1993 – Lake Superior: Major ruffe range expansion was detected. USFWS-Ashland FWCO discovered eight new locations colonized by ruffe in Lake Superior. Ruffe unexpectedly passed by Chequamegon Bay, Wisconsin, to the Bad River, Wisconsin, 156 km east of the SLRE (Busiahn, 1997). At the Bad River, ruffe were poised to enter Michigan waters of Lake Superior. **Lower Great Lakes:** The U.S. Fish and Wildlife Service - Lower Great Lakes Fish and Wildlife Conservation Office (USFWS-LGLFWCO) initiated ruffe surveillance in U.S. waters of Lakes Erie and Ontario (Slade et al., 1994). No ruffe were detected.

1994 – Lake Superior: Major ruffe range expansion was detected. The USFWS-Ashland FWCO discovered ruffe at five new locations in Lake Superior, the farthest of which was the Ontonagon River, Michigan, 276 km east of the SLRE. The OMNR-UGLMU also captured ruffe in the Thunder Bay

Harbour, Ontario, Lake Superior, where they had not been caught since 1991 (Slade et al., 1995). **Lower Great Lakes:** No ruffe were detected.

1995 – Lake Superior: No major ruffe expansion was detected. **Lake Huron**: Major ruffe range expansion was detected. The USFWS-Ashland FWCO discovered ruffe in Lake Huron near the mouth of the Thunder Bay River, Alpena, Michigan; this discovery was 480 km east of the Ontonagon River, Michigan (Busiahn, 1997). The Thunder Bay River, Michigan, was the only confirmed location where ruffe have been captured outside of Lake Superior, and it became the periphery of the ruffe range in the Great Lakes. This introduction into Lake Huron was likely an assisted range expansion from ballast water release. **Lower Great Lakes:** No ruffe were detected.

1996 – Lake Superior: No ruffe range expansion was detected, however the OMNR-UGLMU captured eight ruffe, the largest single-year catch since trawling began in Thunder Bay Harbour, Ontario in 1991 (Czypinski et al., 1997). Five of these specimens were young-of-the-year (YOY) indicating that successful reproduction was occurring in tributaries flowing into Thunder Bay. **Lake Huron:** The U.S. Fish and Wildlife Service - Alpena Fish and Wildlife Conservation Office (USFWS-Alpena FWCO) assumed ruffe surveillance for U.S. waters of Lake Huron. **Lower Great Lakes:** No ruffe were detected.

1997 – Lake Superior: Some interior ruffe range expansion was detected. Ruffe were discovered in three new locations within their known range in Lake Superior. The OMNR conducted ruffe surveillance in Canadian waters of Lake Huron. No ruffe were collected during those efforts. Ruffe catch rates at peripheral locations in Lake Superior were approximately less than or equal to previous years. **Lake Huron:** Ruffe catch rates at peripheral locations in U.S. waters of Lake Huron were approximately less than or equal to previous years. **Lower Great Lakes:** No ruffe were detected.

1998 – Lake Superior: No ruffe range expansion was detected. **Lake Huron:** Ruffe became the most abundant species captured during fall bottom trawling ruffe surveillance in the Thunder Bay River, Michigan, a peripheral range location in Lake Huron. **Lower Great Lakes:** The OMNR expanded ruffe surveillance into Canadian waters of Lake Erie, and USFWS-LGLFWCO added fall surveys to their ruffe surveillance locations. No ruffe were detected.

1999 – Lake Superior: Only minor ruffe range expansion was detected. The USFWS-Ashland FWCO detected ruffe in one new location in Lake Superior, the Firesteel River, Michigan, representing a range expansion of 12 km eastward along the south shore of Lake Superior. **Lake Huron:** The catch per unit effort (CPE) of ruffe in the Thunder Bay River Estuary, Lake Huron, increased from 1 per minute bottom trawling in 1998 to 11 per minute bottom trawling. The majority of the Thunder Bay River ruffe catch was YOY, and ruffe remained the most abundant species captured in trawls from this location. Round goby *Apollonia* (*Neogobius*) *melanostomus* were first captured from the Thunder Bay River, Lake Huron. **Lower Great Lakes:** No ruffe were detected.

2000 – Lake Superior: No ruffe range expansion was detected. Ruffe catch rates at peripheral locations in Thunder Bay, Harbour, Ontario were less than or equal to previous years. The exception was the Ontonagon River, Michigan, Lake Superior, where the mean ruffe CPE (No./Hr. bottom trawling) more than doubled from 5 in 1999 to 11. **Lake Huron**: Ruffe catch rates at peripheral locations in the Thunder Bay River, Michigan were less than or equal to previous years. The CPE of ruffe in the Thunder Bay River Estuary declined from 11 to 0.3 per minute bottom trawling. Round goby were the most abundant species captured from the Thunder Bay River during ruffe surveillance. The Alpena FWCO expanded ruffe surveillance into the St. Marys River. **Lower Great Lakes:** No ruffe were detected.

2001 – Lake Superior: Minor ruffe range expansion was detected. The OMNR detected ruffe near the mouth of the Current River, Lake Superior, which is located within Thunder Bay Harbour, Ontario. This discovery represents a range expansion of 8 km eastward along the north shore of Lake Superior. A large catch of YOY ruffe from one bottom trawl tow in the Ontonagon River, Michigan, increased the mean CPE (No./Hr. bottom trawling) of that colony more than 7 fold to 78. However, no ruffe were captured east of the Ontonagon River along the south shore of Lake Superior. Using a 38 mm stretch mesh gill net (15 m panel), the Red Cliff Tribal Fisheries Department in cooperation with USFWS-Ashland FWCO attempted to capture ruffe during a lake whitefish *Coregonus clupeaformis* spawning assessment near the Apostle Islands, Lake Superior. The objective of this effort was to investigate potential ruffe predation on lake whitefish eggs; no ruffe were captured in this one-night effort. **Lake Huron:** No ruffe were captured from the Thunder Bay River colony or any other ruffe surveillance location in Lake Huron. **Lower Great Lakes:** No ruffe were detected.

2002 – Lake Superior: Major ruffe range expansion was detected. The USFWS-Ashland FWCO discovered ruffe in the Keweenaw Waterway, 101 km east of the Ontonagon, River, Michigan, the previous eastern boundary of the ruffe range along the south shore of Lake Superior. In the Ontonagon River, although trawling indicated a decline in ruffe abundance from 2001, the overall trend in ruffe abundance continued to increase. The Red Cliff Tribal Fisheries Department in cooperation with USFWS-Ashland FWCO continued a ruffe capture effort during lake whitefish spawning near the Apostle Islands, Lake Superior; no ruffe were captured in this one-night gill net effort. Due to unseasonably cold weather, no ruffe surveillance was conducted in Thunder Bay Harbour, Ontario, the eastern boundary of the ruffe range along the north shore of Lake Superior. **Lake Huron:** No ruffe expansion was detected in Lake Huron, and no ruffe were captured in trawls within the ruffe range in Lake Huron. The USFWS-Alpena FWCO initiated reduction of the spawning ruffe population in the Thunder Bay River, Lake Huron, with a 38 mm stretch mesh gill net (30.5 m panel); a total of 96 ruffe were captured in 52 nights effort. **Lake Michigan:** Major ruffe range expansion was detected. The USFWS-Ashland FWCO discovered ruffe in Lake Michigan at Little Bay de Noc (LBDN) near Escanaba, Michigan. **Lower Great Lakes:** No ruffe were detected.

2003- Lake Superior: Minor ruffe range expansion was detected in Thunder Bay Harbour, Ontario, Lake Superior, and in LBDN, Lake Michigan. However, ruffe CPE in trawls increased significantly in Thunder Bay Harbour from 78/hour in 2000 to 569/hour in 2003. In addition, round goby and white perch *Morone americana* were discovered in Thunder Bay Harbour, the second confirmed location for round goby in Lake Superior. Ruffe surveillance was expanded in Lake Michigan by Ashland and Green Bay FWCOs to include a total of nine major ports, but no ruffe were captured outside of LBDN. The Red Cliff Tribal Fisheries Department in cooperation with UFWS-Ashland FWCO continued a ruffe capture effort during lake trout *Salvelinus namaycush* and lake whitefish spawning near the Apostle Islands, Lake Superior. A total of nine adult ruffe were captured in 19 net-nights; no eggs of any species were found in the ruffe diet analysis. In Lake Superior, a combination of bottom trawling, gill netting, and trapping conducted by the USFWS-Ashland FWCO failed to effectively (achieve a minimum reduction of 90% of the ruffe population) reduce the ruffe spawning population in the Ontonagon River Estuary, Michigan. Totals of 65, 16, and 4 ruffe were removed in 5.2 hours of trawling effort, 23 nights of trapping effort, and 2.9 hours of gill netting (30.5 m panel) effort respectively. A bycatch of 62 stocked juvenile lake sturgeon *Acipenser fulvescens* were also captured, standard data was recorded, and all sturgeon were released alive. **Lake Huron:** Ruffe were not captured from new locations in Lake Huron; however, they continued to persist in the Thunder Bay River, Michigan. The USFWS-Alpena FWCO continued reduction of spawning ruffe in the Thunder Bay River, removing a total of ten ruffe in 74 nights of gill net effort. **Lake Michigan:** Minor ruffe range expansion was detected in LBDN, Lake Michigan. **Lower Great Lakes:** No ruffe were detected.

2004 – Lake Superior: Major ruffe range expansion was detected. The USFWS-Ashland FWCO discovered ruffe in Marquette Harbor, Michigan, Lake Superior, 110 km east of the Sturgeon River Sloughs, Keweenaw Waterway, the previous detected eastern boundary of the ruffe range along the south

shore of Lake Superior. **Lake Huron:** Ruffe were not captured from new locations in Lake Huron, nor were they captured from the Thunder Bay River, Michigan. **Lake Michigan:** The Michigan Department of Natural Resources (MIDNR) discovered ruffe in Big Bay de Noc (BBDN), Lake Michigan, 15 km east of LBDN. LBDN was the location of initial discovery of ruffe in Lake Michigan in 2002. **Lower Great Lakes:** No ruffe were detected.

2005 – Lake Superior: Minor range expansion was detected. The USGS-Lake Superior Biological Station (USGS-LSBS) captured one sub-adult ruffe incidentally from Thunder Bay, Ontario, 5 km northeast of Thunder Bay Harbour, Ontario, the previous eastern boundary of the ruffe range along the north shore of Lake Superior. The MIDNR captured one mature ruffe incidentally from Torch Lake, a new location within the Keweenaw Waterway; ruffe were first detected in the Keweenaw Waterway in 2002. The USFWS-Ashland FWCO captured one mature ruffe from lower Marquette Harbor, Michigan, where ruffe were first detected in 2004. Marquette Harbor continued to be the eastern boundary of the ruffe range along the south shore of Lake Superior. **Lake Huron:** In Lake Huron, no ruffe were captured from new or previously detected locations, including the Thunder Bay River and Thunder Bay shipping lanes, where they were first detected in 1995. **Lake Michigan:** The MIDNR captured no ruffe in other fish sampling from BBDN, where they were first detected in 2004. However, MIDNR captured a total of 22 ruffe in other fish sampling from LBDN, where ruffe were first detected in 2002. The Bays de Noc of northern Green Bay continued to comprise the ruffe range in Lake Michigan. **Lower Great Lakes:** No ruffe were detected.

2006 – Lake Superior: Major ruffe range expansion was detected. Surveillance activity along the south shore of Lake Superior confirmed ruffe expansion 226 km east of Marquette Harbor, Michigan, the previous eastern boundary of the ruffe range. A USFWS crew captured one adult ruffe near Grand Marais, Michigan, 120 km east of Marquette Harbor. The MIDNR confirmed one adult ruffe captured by an angler in Little Lake Harbor, Michigan, 167 km east of Marquette Harbor. The USFWS confirmed two adult ruffe captured by an angler in the Tahquamenon River estuary, a tributary on the west shore of Whitefish Bay, 226 km east of Marquette Harbor and 55 km west of the Soo Locks. In Thunder Bay, Ontario, the OMNR confirmed that ruffe span the entire length (13 km) of the Thunder Bay Harbour, the eastern boundary of the ruffe range along the north shore. The OMNR also reported that a commercial fisherman captured three adult ruffe in a 120 mm (4.75 inches) stretch mesh gill net near the Welcome Islands in Thunder Bay, 3.5 km east of the Mission River estuary. The OMNR captured one adult ruffe 42 km upriver from the mouth of the Kaministiquia River, a tributary of Thunder Bay Harbour. **Lake Huron:** No ruffe were captured in Lake Huron from the Thunder Bay River or other areas sampled. Ruffe have not been captured from Lake Huron since 2003. **Lake Michigan:** No ruffe were reported from new locations or BBDN, where they were first detected in 2004. However, MIDNR captured a total of 40 ruffe from LBDN, 18 more than were captured there in 2005. LBDN and BBDN of Green Bay continue to comprise the ruffe range in Lake Michigan. **Lower Great Lakes:** No ruffe were detected.

2007 – Lake Superior: The ruffe range spanned the entire south shore from the Duluth-Superior Harbor, Minnesota/Wisconsin to Whitefish Bay, Michigan; and along the north shore from the Duluth-Superior Harbor to Thunder Bay, Ontario. Within this range, the MIDNR captured ruffe in the Portage Canal of the Keweenaw Waterway. **Lake Huron:** No ruffe were captured from new or previously detected locations of Lake Huron, including the Thunder Bay River and Thunder Bay shipping lanes, where they were first detected in 1995. No ruffe have been captured from Lake Huron since 2003. **Lake Michigan:** Minor ruffe range expansion was detected in Green Bay. The WIDNR reported one ruffe captured in southern Green Bay, 1.5 miles southeast of Marinette, Wisconsin, by commercial fisherman, Jim Benson. This was a range expansion of 88 kilometers (55 miles) south from LBDN of northern Green Bay. The MIDNR captured a total of 13 ruffe from LBDN, where they were first detected in 2002. No ruffe were reported from BBDN of northern Green Bay, where they were first detected in 2004. No ruffe were reported

outside of Green Bay. In Lake Michigan, the ruffe range consisted of Green Bay. **Lower Great Lakes:** No ruffe were detected.

2008 – Lake Superior: No range expansion was detected in Lake Superior. The range of ruffe spanned the entire south shore of the lake from the Duluth-Superior Harbor on the border of Minnesota and Wisconsin, to Whitefish Bay, Michigan; and along the north shore from the Duluth Superior Harbor to Thunder Bay, Ontario Canada. Dedicated ruffe surveillance efforts by the USFWS-Ashland FWCO were halted in Lake Superior because the range extends the extent of U.S. waters of the lake. The USGS continued to capture ruffe (110 ruffe) within the known range in western Lake Superior from near the Duluth Harbor, west of and within the Apostle Islands, and Chequamegon Bay. **Lake Huron:** Ruffe range expansion was detected. The U.S. Fish and Wildlife Service – Marquette Biological Station (USFWS-MBS) reported two ruffe captured incidentally from the Trout River in Rogers City, Michigan (80 km north of the Thunder Bay River in Alpena, Michigan - the previous peripheral boundary of the ruffe range in Lake Huron**)**. Both ruffe were captured in the same lift from a semi-permanent trap maintained upstream in the Trout River to assess sea lamprey. No ruffe were captured from other areas of Lake Huron, including the Thunder Bay River and Thunder Bay shipping lanes, where they were first detected in 1995. No ruffe have been captured from these areas of Lake Huron since 2003. Ruffe remained undetected in the St. Marys River, since surveillance was initiated in 2000. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR continued to capture ruffe (5 ruffe) incidentally during sampling efforts in LBDN. **Lower Great Lakes:** No ruffe were detected.

2009- Lake Superior: No range expansion was detected. The range of ruffe spanned the entire south shore of Lake Superior from the Duluth-Superior Harbor on the border of Minnesota and Wisconsin, to Whitefish Bay, Michigan; and along the north shore from the Duluth Superior Harbor to Thunder Bay, Ontario Canada. The USGS did not capture ruffe during their sampling efforts in Lake Superior. **Lake Huron:** No ruffe were captured from new or previously detected locations, including the Thunder Bay River and Thunder Bay shipping lanes, where they were first detected in 1995 or the Trout River in Rogers City, Michigan where they were first identified in a trap in 2008. Ruffe remained undetected in the St. Marys River, since surveillance was initiated in 2000. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR continued to capture ruffe (2 ruffe) incidentally from LBDN, within the known range. **Lower Great Lakes:** No ruffe were detected.

2010 – Lake Superior: No range expansion was detected. The range of ruffe spanned the entire south shore of the lake from the Duluth-Superior Harbor on the border of Minnesota and Wisconsin, to Whitefish Bay, Michigan; and along the north shore from the Duluth Superior Harbor to Thunder Bay, Ontario Canada. The USGS captured ruffe (60 ruffe) within the known range in western Lake Superior from near the Duluth Harbor and Chequamegon Bay. **Lake Huron:** No ruffe were captured from new or previously detected locations, including the Thunder Bay River and Thunder Bay shipping lanes, where they were first detected in 1995 or the Trout River in Rogers City, Michigan where they were first identified in a trap in 2008. Ruffe remained undetected in the St. Marys River, since surveillance was initiated in 2000. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR continued to capture ruffe (10 ruffe) incidentally from LBDN, within the known range. **Lower Great Lakes:** No ruffe were detected.

The following report summarizes dedicated ruffe surveillance from 2008 through 2010. It also documents other fish sampling reported by several organizations that were capable of capturing ruffe incidentally over the same time period.

OBJECTIVES

The primary objective of ruffe surveillance activities is early detection and description of age and/or size composition. The secondary objectives are to describe the fish community at each location surveyed, and to monitor peripheral range locations where ruffe had been previously detected. In Lake Superior, the peripheral locations include Thunder Bay Harbour and Whitefish Bay. In Lake Michigan the peripheral locations include LBDN and BBDN of Green Bay. In Lake Huron the peripheral locations include the Thunder Bay River and shipping lanes, and the Trout River in Rogers City, Michigan.

These objectives address the needs of the Ruffe Control Program (Ruffe Control Committee, 1996) by defining the range of ruffe and detecting reproducing populations on the periphery of the range. Early detection of range expansion minimizes rate of spread by public awareness and voluntary ballast water management by the Great Lakes maritime industry.

METHODS

Ruffe surveillance was concentrated in habitat defined as cloudy, turbid, or stained water with little light penetration and soft substrate. These areas included estuaries, embayments, tributary mouths, canals, and in or near shipping ports. We focused on areas that ruffe could potentially colonize through ballast water from inter- and intra-lake shipping. Ruffe surveillance was usually concentrated in the deepest habitat at the site as determined by electronic depth sounders, but depths from 3-8 meters (m) were targeted when available, which compares to the depth range in the SLRE. This included natural channels, dredged shipping channels, and pools. However, ruffe surveillance was not limited to these areas; shallow areas in rivers and embayments and areas with vegetation were also surveyed.

The primary gear used was a nylon bottom trawl (4.9-m headrope), commercially manufactured with a 3.8 cm stretch-mesh body, a 31.8 mm stretch-mesh cod end, and a 6.25-12.5 mm stretch-mesh inner liner to hold small specimens.

Bottom trawls were pulled with a variety of vessels and were deployed and retrieved either by hand or with a winch powered hydraulically, electrically, or by gasoline engine. The target time for trawl tows was 5 to 10 minutes per tow, but varied in duration depending on the size of the area trawled, the presence of submerged obstacles, and numbers of fish captured. Tow speed was maintained at approximately 4 km/hour, and was monitored by commercially manufactured global position systems (GPS) or engine tachometer readings.

The term *established location*, as used herein, refers to a geographic body of water that was selected for ruffe surveillance based on the risk of invasion by ruffe. The risk was assessed by the amount of habitat known to be attractive to ruffe (i.e. deep channels and pools, low water clarity, soft substrate).

Bottom water temperature was recorded prior to each established trawl tow (transect), except when consecutive tows were conducted in close proximity to each other. Depth was recorded at the start and finish of individual tows and then averaged to determine the mean depth for each tow. The mean depths of all tows at an established location were averaged to calculate the mean depth at that established location. Tows were directed along and across contours, but the majority was along contour.

The USFWS-LGLFWCO recorded depths at several additional intervals (e.g. 2, 5, and 7 minutes) to determine the mean depth for each tow. Surface temperature, surface and bottom dissolved oxygen levels, and water transparency were also recorded at each location sampled in Lakes Erie and Ontario.

Catches of fish were sorted by species and counted, and the total length of up to 50 specimens of each species were measured to the nearest millimeter. All captured species were released, except aquatic invasive species (AIS) (i.e. ruffe, round goby, white perch, sea lamprey, tubenose goby *Proterorhinus marmoratus*, threespine stickleback *Gasterosteus aculeatus*, fourspine stickleback *Apeltes quadracus*, common carp *Cyprinus carpio*, rudd *Scardinius erythrophthalmus*, rusty crayfish *Orconectes rusticus***,** zebra mussel *Dreissena polymorpha*, quagga mussel *Dreissena bugensis*, and Eurasian watermilfoil *Myriophyllum spicatum*). Captured AIS were either destroyed, or preserved in 95% ethyl alcohol (EtOH). Specimens of unidentified species were retained frozen for later identification.

Public awareness of ruffe continued to be emphasized. Ruffe Watch identification cards and other information were distributed to harbor-masters, marinas, bait vendors, and motel managers, as well as cooperators and individual private citizens near sampling locations in the Great Lakes. Accomplishment reports, information for newsletter articles, and presentations were also conducted or provided.

Cooperation from agency partners and the public continued to expand the coverage and frequency of ruffe observations. Private anglers were encouraged to report ruffe catches and many agencies and organizations reported fish sampling that was capable of incidental ruffe capture.

RESULTS

RUFFE SURVEILLANCE

Dedicated ruffe surveillance was conducted by the USFWS in Lakes Huron (including connecting waters of the St. Marys River), Erie and Ontario in 2008, 2009, and 2010 (Figures 2 and 3, and Tables 1, 2, 3 and 4). Ruffe surveillance was not conducted in Lake Michigan and efforts conducted by the USFWS-Ashland FWCO were halted in Lake Superior following 2007 because the range extends the extent of U.S. waters of the lake. No ruffe were captured during surveillance efforts in Lakes Huron, Erie, and Ontario from 2008 to 2010.

LAKE HURON

Dedicated ruffe surveillance was conducted at eight locations in U.S. waters of Lake Huron.

The USFWS-Alpena FWCO used a 4.9-m bottom trawl to collect fish at eight locations in U.S. waters of Lake Huron during September and October (Figure 2 and Table 1). Efforts targeted deep water areas within shipping channels and river mouths. Established sampling locations included the following: Au Gres River mouth, Cheboygan River mouth, Harbor Beach DTE port, National Gypsum port, Port Dolomite, Saginaw River mouth, Thunder Bay River mouth, and Thunder Bay shipping channel. No ruffe were captured. A general catch summary is provided below. A complete listing of all fish species captured is available upon request from the USFWS-Alpena FWCO.

2008 A total of 47 tows were completed in September and October, comprising 3.9 hours of effort. Twenty-five taxa were collected. The majority of the catch consisted of mimic shiners *Notropis volucellus*

captured from the Harbor Beach DTE port. The greatest catch (234 fish/minute) was also experienced at the Harbor Beach DTE port. The greatest diversity of species (13 species) was represented at the Au Gres River mouth and the Harbor Beach DTE port. Round goby was the most ubiquitous species and was captured at seven of the eight sampling locations.

2009 A total of 34 tows were completed in September, comprising 2.8 hours of effort. Gear failure prevented sampling at National Gypsum and the mouth of the Saginaw River. Twenty-five taxa were collected. The majority of the catch consisted of yellow perch captured from the Au Gres River mouth. The greatest catch (63 fish/minute) and the greatest diversity of species (20 species) was also represented at the Au Gres River mouth. Round goby was the most ubiquitous species and was captured at all six sampling locations.

2010 A total of 42 tows were completed in September, comprising 3.5 hours of effort. Gear failure prevented sampling at the Thunder Bay River mouth. Twenty-three taxa were collected. The majority of the catch consisted of mimic shiners captured from the Cheboygan River mouth. The greatest catch (67 fish/minute) was also experienced at the Cheboygan River mouth. The greatest diversity of species (15 species) was represented at the Au Gres River mouth. Round goby and yellow perch were the most ubiquitous species and were captured at five of the six sampling locations.

ST. MARYS RIVER

Dedicated ruffe surveillance was conducted at six locations in U.S. waters of the St. Marys River.

The USFWS-Alpena FWCO used a 4.9-m bottom trawl to collect fish at six locations downriver from the Soo Locks during September and October (Figure 2 and Table 2). Established sampling locations included the Municipal Marina of Sault Ste. Marie, Michigan, Munuscong Channel, and two areas near De Tour. New sampling locations, Lake Nicolet and Raber Bay, were included in 2009 to expand coverage within the river. No ruffe were captured. A general catch summary is provided below. A complete listing of all fish species captured is available upon request from the USFWS-Alpena FWCO.

2008 A total of 11 tows comprising 0.91 hours effort was conducted in October. Sixteen taxa were collected. The majority of the catch consisted of rainbow smelt *Osmerus mordax* and mimic shiners captured from the Sault Ste. Marie Municipal Marina. The greatest catch (25 fish/minute) and the greatest diversity of species (14 species) was experienced at the Sault Ste. Marie Municipal Marina. Johnny darter *Etheostoma nigrum*, mimic shiner and trout-perch *Percopsis omiscomaycus* were the most ubiquitous species and were captured at all four of the sampling locations.

2009 A total of 31 tows comprising 2.58 hours effort was conducted in September. Two new locations were added in Lake Nicolet and Raber Bay to increase sampling coverage of the river. Fifteen taxa were collected. The majority of the catch consisted of trout-perch captured from De Tour and Raber Bay. The greatest catch (29 fish/minute) and the greatest diversity of species (12 species) was experienced at Raber Bay. Johnny darter, logperch *Percina caprodes*, mimic shiner and rainbow smelt were among the most ubiquitous species and were captured at five of the six sampling locations.

2010 A total of 16 tows comprising 1.33 hours effort was conducted in September. Gear failure prevented sampling at two De Tour locations and Raber Bay. Eighteen taxa were collected. The majority of the catch consisted of mimic shiners captured from the Sault Ste. Marie Municipal Marina. The greatest catch (31 fish/minute) was also experienced at the Sault Ste. Marie Municipal Marina. The greatest

diversity of species (13 species) was represented at the Sault Ste. Marie Municipal Marina and the Munuscong Channel. Bluntnose minnow *Pimephales notatus*, logperch, mimic shiner, rainbow smelt, spottail shiner *Notropis hudsonius*, trout-perch and yellow perch were among the most ubiquitous species and were captured at all three of the sampling locations.

LAKE ERIE

Dedicated ruffe surveillance was conducted in U.S. waters of Lake Erie at seven locations.

The USFWS-LGLFWCO used a 4.9-m bottom trawl to collect fish from each of seven sites on Lake Erie, including Ashtabula, Buffalo, Cleveland, Conneaut, Erie, Sandusky, and Toledo (Figure 3 and Table 3). All sites were sampled once in spring (May) and again in the fall (September/October) with one exception; there was no sampling done at the Erie Harbor in the fall 2010 due to weather conditions. No ruffe were captured at any of these sites. A general catch summary is provided below. A complete listing of all fish species captured is available upon request from the USFWS-LGLFWCO.

2008 The spring catch was comprised of nine species. Emerald shiner *Notropis atherinoides* and white perch comprised over half of the spring catch at 26.5% and 24.1%, respectively. Channel catfish *Ictalurus punctatus*, freshwater drum *Aplodinotus grunniens*, spottail shiner, rainbow smelt, trout-perch, bluegill *Lepomis macrochirus* and walleye *Sander vitreus* made up the remainder of the catch. The fall survey included 19 species, comprised mostly of rainbow smelt (30.9%) and white perch (20.1%). Round goby (14.6%) and freshwater drum (8.3%) were the next most abundant.

2009 The spring catch was comprised of six species. Emerald shiner dominated the spring catch (60.1%) with rainbow smelt being the second most abundant (20.9%). Channel catfish, bluegill, freshwater drum, and white perch made up the remainder of the catch. The fall survey included 14 species, comprised mostly of gizzard shad *Dorosoma cepedianum* (50.8%). White perch (25.8%) was the next most abundant.

2010 The spring catch was composed of 16 species. The species composition was predominately emerald shiners (23.4%) with round gobies (12.1%) and freshwater drum (11.7%) being the next most dominant species. The fall survey was comprised of 12 species, the most abundant being emerald shiners (80.6%) followed by white perch (7.1%).

LAKE ONTARIO

Dedicated ruffe surveillance was conducted at one location in U.S. waters of Lake Ontario.

The USFWS-LGLFWCO conducted dedicated surveillance efforts (bottom trawling) at Rochester, New York in the Genesee River near the mouth at Lake Ontario in the Rochester Harbor (Figure 3 and Table 4). Transects were located in areas where there was a dredged shipping channel, no more than 3 km upstream from the lake. Sampling was conducted during both spring (May) and fall (September/October). No ruffe were captured. A general catch summary is provided below. A complete listing of all fish species captured is available upon request from the USFWS-LGLFWCO.

2008 During May 2008, alewife *Alosa pseudoharengus*, emerald shiner, spottail shiner, and white perch were collected. Alewife made up 42% of the total catch, with emerald shiner and spottail shiner each

making up 25% of the total catch. In September, seven species made up the catch with gizzard shad (36%), spottail shiner (21%) and freshwater drum (14%) being the three most abundant. Few round goby were collected during these bottom trawling efforts.

2009 During May 2009, five species including alewife, rainbow smelt, slimy sculpin *Cottus cognatus*, emerald shiner, and yellow perch were collected. Rainbow smelt (29%), alewife (25%), and slimy sculpin (21%) made up 75% of the total catch, with emerald shiner and yellow perch each making up 13% of the total catch. In September, only two species (emerald shiner and alewife) made up the catch with emerald shiner (98%) dominating the collection. In 2009, no round goby were collected during these ruffe bottom trawling efforts.

2010 No fish were captured during the sampling in May 2010. During the fall survey, eight species were captured. Channel catfish, spottail shiner, and trout-perch had the three highest abundances (24% each).

REPORTED FISH SAMPLING THAT WAS CAPABLE OF INCIDENTALLY CAPTURING RUFFE

Several organizations reported fish sampling that was capable of capturing ruffe incidentally from 2008 to 2010. Information was provided for each of the Great Lakes, including the connecting waters of the St. Marys River.

LAKE SUPERIOR

Several organizations including the USFWS-MBS, USGS-LSBS, Department of Fisheries and Oceans-Great Lakes Laboratory of Fisheries and Aquatic Sciences (DFO-GLLFAS), OMNR-UGLMU, USFWS-Ashland FWCO, and Ontario Federation of Anglers and Hunters (OFAH) reported other fish sampling that was capable of incidentally capturing or documenting ruffe within, on the periphery and at new locations within Lake Superior (Figures 4 and 5 and Table 5). These activities captured a total of 192 ruffe (Thunder Bay Harbour, Duluth Harbor, Misery River, west of and within the Apostle Islands and Chequamegon Bay) in 2008, one ruffe (Misery River) in 2009, and 101 ruffe (Thunder Bay Harbour, Duluth Harbor, Middle River, Misery River and Chequamegon Bay) in 2010 – all within the current ruffe range. No ruffe were reportedly captured outside of the ruffe range.

Black Bay and the Black Sturgeon River The OMNR-UGLMU conducted a riverine fish community assessment in the Black Sturgeon River in 2008. A total of 25 locations were sampled overnight with graded mesh gill nets (12 to 127 mm stretch mesh) in August and September (Figure 4 and Table 5). No ruffe were captured following 29 overnight sets.

The OMNR-UGLMU also conducted a fall walleye population assessment in Black Bay during September 2008 using graded mesh gill nets. No ruffe were captured following 69 overnight sets (Figure 4 and Table 5).

Thunder Bay Harbour In 2008, the DFO-GLLFAS conducted surveys in Lake Superior to collect fishes for VHS (Viral Hemorrhagic Septicaemia) screening. Water temperatures during this sampling were required to be less than 10°C, thus all sampling was late fall. Sampling was conducted within the ruffe range in Thunder Bay Harbour from September 29 through October 2, 2008. Nordic gill nets (four 30-m nets comprised of twelve 2.5-m panels of 5 to 55 mm mesh) were fished for three nights (360 m effort) and

8 hours of boat electrofishing were used to collect samples at three locations in the Thunder Bay Harbour area (McKellar Pond, Neebing River, and Thunder Bay Harbour) (Figure 4 and Table 5). Approximately 75 ruffe were collected during this period (50 in gill nets and 25 via electrofishing). One hundred and fifty fish were needed to meet the quota, and ruffe were the largest catch.

In September 2010, the OMNR-UGLMU and USFWS-Ashland FWCO conducted sampling in Thunder Bay Harbour to detect presence and relative abundance of new nonindigenous invasive fish. Sampling consisted of 15 paired fyke net trapnights (paired fyke nets consist of one lead with a fyke net at each end) and 1.07 hours bottom trawling (4.9-m headrope) (Figure 4 and Table 5). A total of 33 ruffe were captured in fyke nets at the Kaministiquia, Mission, and McKellar Rivers and off McKellar and Mission Islands. Four ruffe were captured trawling off Mission and McKellar Islands.

The OFAH reported one confirmed sighting of ruffe captured from the Kaministiquia River in March, 2010. This was the only confirmed ruffe sighting reported to the OFAH from 2008 to 2010.

Nearshore The USGS-LSBS conducted bottom trawling (11.9-m headrope) across-contour to assess spring forage fish community abundance in U.S. and Canadian waters around the lake. Transects included nearshore sampling at 152 locations (86 locations in 2008, 90 locations in 2009, and 136 locations in 2010) for a total of 134.75 hours of effort (Figure 5 and Table 5). Transects were within, near the periphery and outside of the detected ruffe range. A total of 170 ruffe were captured within the detected ruffe range in western Lake Superior (110 ruffe in 2008 and 60 ruffe in 2010) from near the Duluth Harbor, west of and within the Apostle Islands, and Chequamegon Bay. No ruffe were captured on the periphery or outside of the detected range.

Isle Royale During June to August (primarily June), 2008 to 2010, the USFWS-Ashland FWCO in cooperation with the National Park Service (NPS) and MIDNR, conducted coaster brook trout assessments at four locations around Isle Royale (Malone Bay, Washington Harbor, Tobin Harbor, and Washington Creek) that included a total of 41.45 hours electrofishing (Figure 4 and Table 5). No ruffe were captured or observed.

South Shore Tributaries The USFWS-MBS worked with the Great Lakes Indian Fish & Wildlife Commission (GLIFWC), NPS, Red Cliff Band of Lake Superior Chippewa (RCBLSC), and private contractors to conduct sampling in 17 southern Lake Superior tributaries from 2008 to 2010 to assess sea lamprey abundance (Figure 4 and Table 5). Sampling was conducted annually within the detected ruffe range from April or May to July using fyke nets (FN), permanent traps (PT) and portable assessment traps (PAT). Twelve ruffe were captured (seven ruffe in 2008, one ruffe in 2009, and four ruffe in 2010) following a total of 1,618 trapnights in 2008, 1,325 trapnights in 2009 and 1,506 trapnights in 2010. All ruffe were captured from the Misery and Middle Rivers within the known ruffe range. A summary of fish species captured at these locations is available upon request from the USFWS-MBS.

Unconfirmed Sightings None reported.

LAKE MICHIGAN

The USGS-Great Lakes Science Center (USGS-GLSC), Michigan Department of Natural Resources – Marquette Fisheries Research Station (MIDNR-Marquette), USFWS-MBS and Ludington Biological Station (USFWS-MBS/LBS) and Inland Seas Education Association (ISEA) reported other fish sampling capable of capturing ruffe incidentally (Figures 4, 6, and 7, and Table 6). All sources sampled areas that

were within or near the periphery of the current ruffe range (Green Bay). The MIDNR-Marquette was the only agency to report capturing ruffe, all from LBDN in northern Green Bay where they were first detected in 2002. A total of five ruffe were captured in 2008, three ruffe in 2009 and nine ruffe in 2010. Ruffe were not reported from outside of the known range.

Nearshore/Offshore The USGS-GLSC conducted annual fall bottom trawling (12-m headrope) on-contour to assess prey-fish community abundance at seven locations around Lake Michigan that were outside or near the periphery of the detected ruffe range (Green Bay) (Figure 6 and Table 6). Ten minute trawl tows were conducted at 5 to 110 m depths for a total of approximately 70 tows lakewide each year. No ruffe were captured following over 11 hours of sampling annually from 2008 to 2010.

Grand Traverse Bay and Little/Big Bays de Noc The ISEA is a non-profit environmental education organization. Scientific sampling aboard their vessel is conducted by ISEA staff, volunteer instructors, and students (mostly grades 5-7). The ISEA completed 68.89 hours (24.67 hours in 2008, 24.01 hours in 2009 and 20.21 hours in 2010) bottom trawling (4.9-m headrope) in Grand Traverse Bay and Little/Big Bays de Noc from 2008 to 2010 (Figure 4 and Table 6). Little and Big Bays de Noc are within or on the periphery of the current ruffe range in Lake Michigan (Green Bay). No ruffe were captured.

Little Bay de Noc (LBDN) of Northern Green Bay The MIDNR-Marquette conducted fall fishery assessments to determine the relative contribution of hatchery-reared walleye to year classes of walleye stocks in LBDN from 2004 to 2009. A random subset of four transects were sampled each year from a larger set of established transects. Sampling gear consisted of 182.9-m small mesh gill nets (25, 38, and 50 mm stretch mesh) for a total effort of 2,195 m in 2008 and 1,829 m in 2009 (Figures 4 and 7, and Table 6). Three ruffe were captured in 2008, all within the detected ruffe range. No ruffe were captured in 2009.

The MIDNR-Marquette conducted summer fishery assessments in LBDN from 1988 to 2010 using bottom trawls (3.7-m headrope) and experimental gill nets (18.3-m experimental gillnets with 25 mm to 102 mm stretch mesh). A total of 3.83 hours trawling effort was conducted each year from 2008 to 2010 (Figure 4 and Table 6). One ruffe was captured in 2008 and in 2010, no ruffe were captured in 2009. A total of 293 m of gill net effort was completed each year from 2008 to 2010. One ruffe was captured in 2008, no ruffe were captured in 2009, and one was caught in 2010. All ruffe were collected within the detected range.

In 2009, the MIDNR-Marquette initiated an annual fall fishery survey to assess the fish community of northern Lake Michigan at LBDN, BBDN, Menominee River, Cedar River, Manistique, and Naubinway. Sampling was conducted in 2009 and 2010. Sampling gear consisted of 97.5-m experimental gillnets (25 mm to 127 mm stretch mesh). A total of 3,218 m effort was conducted at LBDN in 2009 and 4,680 m effort was conducted at LBDN in 2010 (Figure 4 and Table 6). Two ruffe were captured at LBDN in 2009 and nine ruffe were captured there in 2010. All ruffe were captured within the detected range.

Big Bay de Noc (BBDN) of Northern Green Bay The MIDNR-Marquette conducted the same fall walleye assessment in BBDN as in LBDN (described in LBDN) from 2004 to 2009. A total of 12 transects for 6,584 m gill net effort was fished in 2008 and 1,646 m in 2009 (Figures 4 and 7, Table 6). No ruffe were captured. Ruffe were first detected in BBDN in 2004.

The MIDNR-Marquette conducted summer assessments in BBDN that were similar to those conducted in LBDN (described in LBDN) using bottom trawls and gill nets from 1988 to 2010. A total of 3.83 hours trawling effort and a total of 293 m of gill net effort was completed each year from 2008 to 2010 (Figure 4 and Table 6). No ruffe were captured in 2008, 2009 or 2010.

In 2009, the MIDNR-Marquette initiated an annual fall fishery survey to assess the fish community of northern Lake Michigan (see LBDN). A total of 2,925 m effort was conducted at BBDN in 2009 and 4,682 m effort was conducted at BBDN in 2010 (Figure 4 and Table 6). No ruffe were captured.

Tributaries The USFWS-MBS/LBS worked with the Grand Traverse Band of Ottawa and Chippewa Indians (GTBOCI) and private contractors to conduct sampling in up to 17 Lake Michigan tributaries from 2008 to 2010 to assess sea lamprey abundance (Figure 4 and Table 6). Sampling was mainly conducted annually from April to June using fyke nets (FN), permanent traps (PT), portable assessment traps (PAT) and semipermanent traps (SPT). Four tributaries were located within or on the periphery of the current ruffe range in Green Bay. No ruffe were captured following a total of 1,087 trapnights in 2008, 1,876 trapnights in 2009, and 1,266 trapnights in 2010. A summary of fish species captured at these locations is available upon request from the USFWS-MBS.

Unconfirmed Sightings None reported.

ST. MARYS RIVER

Incidental sampling capable of capturing ruffe in the St. Marys River was reported by the USFWS-Ashland FWCO, OMNR-UGLMU, MIDNR, St. Marys River Fishery Task Group (SMRFTG), DFO-GLLFAS, USFWS-Alpena FWCO and USFWS-MBS (Figures 4, 8, and 9, and Table 7). Locations across the river were sampled. No ruffe were captured.

Waiska Bay to Soo Locks During late August, 2010, the USFWS-Ashland FWCO and the OMNR-UGLMU in cooperation with MIDNR conducted sampling to detect presence and relative abundance of new nonindigenous invasive fish in U.S. and Canadian waters of the St. Marys River from Waiska Bay to the Soo Locks. Sampling consisted of 30 fyke net trapnights, 2.50 hours electrofishing, and 1.17 hours bottom trawling (4.9-m headrope) (Figure 4 and Table 7). No ruffe or other nonindigenous fish were captured.

River-wide The SMRFTG is an international multi-agency group that was established in 1997 by the Great Lake Fishery Commission's Lake Huron Committee (LHC) to design and recommend a St. Marys River fishery assessment and review program. Member agencies include the MIDNR, OMNR, Chippewa Ottawa Resource Authority, DFO, USGS, USFWS and others. In August, 2009, SMRFTG member agencies conducted a coordinated river-wide gill net survey to assess and provide information on the abundance, growth, mortality and size structure of important fish populations found in the St. Marys River. Multifilament gill nets (1.8 m deep by 304.8 m long with ten 30.5 m panels of 38.1 mm, 50.8 mm, 63.5 mm, 76.2 mm, 88.9 mm, 101.6 mm, 114.3 mm, 127.0 mm, 139.7mm and 152.4 mm stretch mesh) were fished overnight on the bottom at 44 locations (Figure 8 and Table 7). No ruffe were captured.

The SMRFTG also conducted annual fall nighttime electrofishing in September 2009 and 2010 to assess juvenile walleye at eight locations (six locations for 12 transects in 2009 and six locations for 22 transects in 2010) across the St. Marys River. Sampling locations included the upper river, Sault area, Lake Nicolet, Lake George, Lake Munuscong, Raber Bay, Potagannissing Bay and St. Joseph Channel. No ruffe were captured following 18.11 hours of effort in 2009 and 22.12 hours of effort in 2010 (Figure 4 and Table 7).

The DFO-GLLFAS conducted fish sampling on the St. Marys River in 2008 and 2009 as the last two years of a four year study (2006-2009) funded by the Great Lakes Action Plan to examine fish community structure and health. Sampling was conducted using boat electrofishing at night and consisted of 100 m

transects which were fished for 300 seconds in the spring (May to early June) and fall (September). Locations sampled included the upper river beginning in the Mark's Bay area and continued on the main river from the rapids through to Bell's Point. Lake George was sampled from a launch in the Barr River and St. Joseph's Island work was conducted from the Richard's Landing marina. Eighty sites were sampled in 2008 comprising 6.67 hours of effort and 72 sites were sampled in 2009 comprising 6.00 hours (Figure 4 and Table 7). No ruffe were captured.

In August, 2010, the USFWS-Alpena FWCO conducted bottom trawling (4.9-m headrope) at 18 locations across the St. Marys River to document juvenile and prey fishes in partnership with the SMRFTG. This was the first of a two year study (2010-2011). Five minute tows were conducted on-contour at water depths of 1.5-3.0 m, 3.0-4.6 m, 4.6-6.1 m and 6.1-7.6 m at each location, where depths were available. No ruffe were captured following 58 tows for 4.8 hours of sampling effort (Figure 9 and Table 7).

The USFWS-MBS conducted sampling in the St. Marys River from 2008 to 2010 to assess sea lamprey abundance (Figure 4 and Table 7). Sampling was conducted annually from May or June to July using portable assessment traps (PAT). No ruffe were captured following a total of 225 trapnights in 2008, 147 trapnights in 2009, and 225 trapnights in 2010. A summary of fish species captured at these locations is available upon request from USFWS-MBS.

Unconfirmed Sightings None reported.

LAKE HURON

Incidental sampling capable of capturing ruffe in Lake Huron was reported by the USGS-GLSC, Michigan Department of Natural Resources – Alpena Fisheries Research Station (MIDNR-Alpena), Michigan Department of Natural Resources – Lake St. Clair Fisheries Research Station (MIDNR-Lk. St. Clair) and USFWS-MBS/LBS (Figures 4 and 10, and Table 7). All agencies, except MDNR-Lk. St. Clair, conducted efforts near Thunder Bay and Rogers City, the periphery of the ruffe range in Lake Huron.

The USFWS-MBS reported that two ruffe were incidentally captured during sea lamprey trapping in the Trout River in Rogers City, Michigan during 2008. The trap was located approximately 1.4 km upstream in the river. Both ruffe were captured in the same lift on May 25, 2008. This is a range expansion of 80 km from the last known sighting on the periphery of the range in Lake Huron (Thunder Bay River). No other ruffe were reportedly captured from Lake Huron or the Lake Huron watershed.

Nearshore/Offshore The USGS-GLSC conducted annual fall (October/November) bottom trawling (21-m wing trawl) on-contour to assess the status and trends of the Lake Huron deepwater prey-fish community at five locations in U.S. waters and one location in Canadian waters. Ten minute trawl tows were conducted at 9 to 110 m depths each year. Three locations were surveyed in 2008 due to mechanical problems and bad weather, all six locations were surveyed in 2009, and all five U.S. locations were surveyed in 2010. No ruffe were captured following 25 tows comprising 4.17 hours of sampling in 2008, 44 tows comprising 7.33 hours of sampling in 2009, and 36 tows comprising 6.00 hours of sampling in 2010 (Figure 10 and Table 7).

Thunder Bay and Black River The MIDNR-Alpena conducted summer bottom trawling (11-m headrope, semi-balloon otter trawl with 23-m bridle, and 13 mm stretch mesh cod end) off North Point of Thunder Bay and off Black River to assess young of the year lake trout and juvenile lake whitefish. The survey is also used to index the prey/juvenile fish community of Thunder Bay as cormorant control progresses. Both

areas are periphery to locations where ruffe have been collected within the lake (Thunder Bay). No ruffe were captured following a total of 58 tows comprising 9.67 hours of effort in 2008, 38 tows comprising 6.28 hours of effort in 2009, and 38 tows comprising 6.33 hours of effort in 2010 (Figure 4 and Table 7).

Saginaw Bay The MIDNR-Lk. St. Clair conducted fall (September) bottom trawling (10-m headrope) in Saginaw Bay as part of an annual survey to assess the fish community. No ruffe were captured following a total of 37 tows comprising 5.23 hours of effort in 2008, 25 tows comprising 3.52 hours of effort in 2009, and 24 tows comprising 3.33 hours of effort in 2010 (Figure 4 and Table 7).

U.S. Tributaries The USFWS-MBS/LBS worked with CORA and private contractors to conduct sampling in 11 to 13 Lake Huron tributaries from 2008 to 2010 to assess sea lamprey abundance (Figure 4 and Table 7). Sampling was conducted annually from April to June at the majority of sampling locations using fyke nets (FN), permanent traps (PT), portable assessment traps (PAT) and semipermanent traps (SPT). Two ruffe were captured following a total of 1,214 trapnights in 2008, 948 trapnights in 2009, and 1,014 trapnights in 2010.

The two ruffe reported in 2008 were captured incidentally during trapping upstream in the Trout River in Rogers City, Michigan during May. This is a new location where ruffe have not previously been captured and is 80 km (50 miles) north of the Thunder Bay River, the only location where ruffe have been captured in Lake Huron in the past. The ruffe were captured with a semi-permanent trap set at an index location 1.4 km upstream from the mouth of the Trout River. The trap is fished annually from April to June. Both ruffe were captured on May 25, 2008 in a single catch from the trap. The water depth at the trap location was 0.3 m and the water temperature was 16 °C on the day of the catch. No other ruffe have been reported from this trap or other areas of Lake Huron or its tributaries since then. A summary of fish species captured at these locations is available upon request from the USFWS-MBS.

Unconfirmed Sightings None reported.

LAKE ERIE

The USFWS-MBS/LBS, USGS-Lake Erie Biological Station (USGS-LEBS), Ohio Department of Natural Resources-Sandusky Fisheries Research Unit (ODNR-Sandusky) and Ohio Department of Natural Resources- Fairport Harbor Fisheries Research Unit (ODNR-Fairport Harbor) reported other fish sampling that was capable of capturing ruffe incidentally (Figures 11, 12 and 13, and Table 8). No ruffe were captured.

South Shore Tributaries The USFWS-MBS/LBS worked with private contractors to conduct sampling in three Lake Erie tributaries from 2008 to 2010 to assess sea lamprey abundance (Figure 11 and Table 8). Sampling was conducted annually from April to June using portable assessment traps (PAT). No ruffe were captured following a total of 364 trapnights in 2008, 382 trapnights in 2009, and 397 trapnights in 2010. A summary of fish species captured at these locations is available upon request from the USFWS-MBS.

Western Basin The ODNR-Sandusky conducted bottom trawling (10.7-m headrope) in the western basin of Lake Erie from May to September during 2008 to 2010 to assess the relative abundance and growth of predator and forage fish species (Figure 12 and Table 8). Ten minute tows were conducted at water depths ranging from 1.8 to 12.8 m. A total of 118 trawl tows for 19.67 hours of effort were conducted in 2008, 121 trawl tows for 20.17 hours of effort in 2009, and 118 trawl tows for 19.67 hours of effort in 2010. No ruffe were captured.

The USGS-LEBS conducted annual summer and fall (June, September, and October) bottom trawling (7.9-m headrope) in nearshore and offshore areas to assess the status of fish stocks in western Lake Erie (Figure 13 and Table 8). Ten minute trawl tows were conducted at 3 to 13 m depths at a total of 28 locations in Michigan, Ohio, and Ontario waters of Lake Erie. No ruffe were captured following 16.00 hours of sampling in 2008, 16.00 hours of sampling in 2009 and 12.25 hours of sampling in 2010.

Central Basin The ODNR-Fairport Harbor conducted bottom trawling (10.4-m headrope) in the central basin of Lake Erie from May to October during 2008 and 2009, and during September in 2010 to assess to assess the relative abundance and growth of predator and forage fish species (Figure 12 and Table 8). Five minute tows (at < 5 m depths) and ten minute tows were conducted at water depth strata ranging from 5-10 m, 10-15 m, 15-20 m, and > 20 m. No ruffe were captured.

In the spring of 2009, the USGS-LEBS and the ODNR conducted bottom trawling at nearshore and offshore locations in central Lake Erie to examine stock structure of yellow perch. Thirty five trawl tows were conducted at depths ranging from 6 to 25 m in Ohio and Ontario. No ruffe were captured following 5.83 hours of sampling (Figure 13 and Table 8).

Unconfirmed Sightings None reported.

LAKE ONTARIO

The USFWS-MBS/LBS and USGS-Lake Ontario Biological Station (USGS-LOBS) reported other fish sampling that was capable of capturing ruffe incidentally in Lake Ontario (Figures 11 and 14 and Table 9). No ruffe were captured.

South Shore Tributaries The USFWS-MBS/LBS worked with private contractors to conduct sampling in five Lake Ontario tributaries from 2008 to 2010 to assess sea lamprey abundance (Figure 11 and Table 9). Sampling was conducted annually from April to June using portable assessment traps (PAT). No ruffe were captured following a total of 490 trapnights in 2008, 453 trapnights in 2009, and 391 trapnights in 2010. A summary of fish species captured at these locations is available upon request from USFWS-MBS.

U.S. Waters Nearshore/Offshore The USGS-LOBS and the New York State Department of Environmental Conservation (NYSDEC) conducted annual bottom trawling (18.0-m headrope) in U.S. waters to assess the status of major prey-fish stocks and juvenile lake trout (Figure 14 and Table 9). Twelve to fourteen locations spanning the U.S. shoreline (25-km intervals) were sampled during the spring and summer (April to July) and six sites were sampled in the fall (October). Ten minute trawl tows were completed at 10 m intervals for depths ranging from 8 to 150 m at each location. No ruffe were captured following a minimum of 37.50 hours of effort in 2008, 43.00 hours in 2009, and a similar effort in 2010.

Unconfirmed Sightings None reported.

DISCUSSION

Ruffe surveillance activities in Lakes Huron, Erie and Ontario, and connecting waters of the St. Marys River did not capture ruffe during 2008, 2009, or 2010.

Reporting provided on other fish sampling that was capable of incidentally capturing ruffe indicated that

ruffe continue to persist within their range in Lake Superior and within Green Bay, Lake Michigan. No range expansion was apparent on the periphery of the range within Lakes Superior and Michigan based on reports. However, ruffe were captured from a new location on the periphery of the range within Lake Huron in 2008 – expanding the range of ruffe with Lake Huron. A synopsis by water body follows.

LAKE SUPERIOR

Ruffe surveillance activities conducted by the USFWS-Ashland FWCO were ceased following 2007 because the range of ruffe had expanded to encompass all U.S. waters of Lake Superior, and continued surveillance to detect new populations of ruffe within U.S. waters of the lake were no longer warranted. Ruffe surveillance had been conducted by the USFWS-Ashland FWCO within Lake Superior since 1992, following the initial discovery of ruffe within the Great Lakes in 1986 by the WIDNR on the western boundary of the lake at the Duluth-Superior Harbor, Minnesota/Wisconsin, and continued through the 2006 confirmation of ruffe captured on the eastern boundary of the lake at the mouth of the Tahquamenon River in Whitefish Bay, Michigan. Surveillance efforts, coordination and reporting initiated and led by the USFWS-Ashland FWCO had sustained the Great Lakes ruffe surveillance program through the years.

Fish sampling reported by other agencies/offices that was capable of incidentally capturing ruffe indicated that ruffe continue to persist within the known range. Ruffe were reported from western Lake Superior from Thunder Bay Harbour, Ontario to Chequamegnon Bay, Wisconsin by the USGS-LSBS and USFWS-MBS. Ruffe currently span U.S. waters of the lake. No range expansion in Canadian waters of Ontario was apparent based on incidental reports.

LAKE MICHIGAN

Dedicated ruffe surveillance was not conducted within Lake Michigan, however reports from the MIDNR-Marquette from 2008 to 2010 indicated that ruffe continued to persist in LBDN of northern Green Bay where they were first discovered in 2002. Ruffe were also detected in BBDN in 2004 and southern Green Bay near Marinette, Wisconsin in 2007, however ruffe were not reportedly captured from these areas during sampling efforts by other agencies/offices from 2008 to 2010. No expansion out of Green Bay was detected based on reports from other agencies/offices.

Little and Big Bays de Noc of Northern Green Bay The MIDNR-Marquette conducted sampling with gill nets and trawls that was capable of incidentally capturing ruffe in northern Green Bay from 2008 to 2010. Ruffe continued to be captured from LBDN with both gear types, however no ruffe were captured from BBDN using similar gear over the same time period. The MIDNR has not captured ruffe from BBDN since the initial discovery of one ruffe in the fall of 2004. MIDNR incidental catch numbers for ruffe from LBDN for the time period 2002 thru 2010 have totaled 3, 4, 3, 22, 40, 13, 5, 2, and 10 respectively. The 2006 catch of 40 ruffe did not seem to recruit or transfer into a strong year class in 2007. Although ruffe catches were low in LBDN in 2008 and 2009, a fall assessment initiated by the MIDNR in 2009 using experimental gill nets (25 – 127 mm stretch mesh) showed an increase in catch from 2009 to 2010. Green Bay ruffe catches seem to follow the history of ruffe range expansion, which suggests that captures can vary with regard to total number and location in early years of invasion.

ST. MARYS RIVER

Ruffe surveillance activities were initiated in the St. Marys River in 2000 by the USFWS-Alpena FWCO.

Sampling locations within the river have expanded since that time to provide for better coverage of the river. Efforts were expanded in 2009 to include Raber Bay and Lake Nicolet, two previously unsampled areas that are known to support other percids including walleye and yellow perch. No ruffe have been captured from the river since surveillance was initiated. The St. Marys River is within proximity to Whitefish Bay, Lake Superior, where ruffe were captured in 2006 at the mouth of the Tahquamenon River, 55 km (34.1 miles) east of the Soo Locks. Ruffe have not reportedly been captured as a result of other fish sampling that was capable of incidentally capturing ruffe within the St. Marys River.

LAKE HURON

Dedicated ruffe surveillance did not capture ruffe from sampled areas within Lake Huron from 2008 to 2010. Ruffe remain absent from the Thunder Bay area (Thunder Bay River and Thunder Bay shipping channel) where they had previously been captured. However, the range of ruffe has expanded north on the periphery of the range to the Trout River in Rogers City, Michigan based on incidental catch information provided by the USFWS-MBS. The sighting is 80 km (50 miles) north of the Thunder Bay River. No other ruffe were reportedly captured from Lake Huron from 2008 to 2010 based on other fish sampling that was capable of incidentally capturing ruffe.

Trout River, Michigan The USFWS-MBS reported a new sighting of two ruffe captured during one lift in May 2008 from a sea lamprey assessment trap fished upstream on the Trout River in Rogers City, Michigan. The trap was operated in the spring each year (April or May to June) from 2008 to 2010. No other ruffe were captured following the sighting, despite continued trap operation. The origin of the ruffe is unknown, however they may have migrated into the area from Thunder Bay, the only location where ruffe were known to exist in Lake Huron, or they may have been introduced via ship ballast water from the Calcite port located in Rogers City. Lake currents flow north from the Thunder Bay River, where ruffe were known to exist from 1995 to 2003. Migration is possible over the 80 km (50 mile) distance from the Thunder Bay River to the Trout River, and ruffe are thought to have moved across portions of the south shore of Lake Superior via migration. Ship ballast water transfer is suspected to have transferred ruffe into the Great Lakes. A large limestone/dolomite quarry and shipping port (Calcite) is located in Rogers City, and ruffe may have originated from ship ballast water exchanged in the area or nearby. The status of ruffe in the Rogers City area is unknown. The USFWS-Alpena FWCO only recently learned about the sighting and has planned expanded ruffe surveillance activities for the Rogers City area in 2011.

Thunder Bay River, Michigan Ruffe surveillance efforts from 2008 to 2010 did not capture ruffe from the Thunder Bay River or Thunder Bay shipping channel where they were initially captured in 1995. Ruffe abundance in bottom trawls (mainly young-of-the-year) from the Thunder Bay River peaked in 1999 then declined. Ruffe have not been captured during trawling efforts since 2001. The USFWS-Alpena FWCO initiated an adult spawning phase ruffe removal effort from 2002 to 2008 to remove ruffe prior to spawning. A total of 96 ruffe were removed in 2002, 10 ruffe were removed in 2003 and no ruffe were captured from 2004 to 2008. The absence of young-of-the-year following 2001, decline in adult spawning phase ruffe captured from 2002 to 2003 and the absence of ruffe from ongoing trawling and gill netting efforts through 2008 indicated a decline in the Thunder Bay area ruffe population. The lack of young-of-the-year was an initial sign that recruitment may not be taking place and was insufficient to foster the population.

It is not known why the large abundance of ruffe captured in 1999 did not transfer into a substantial catch of adult or subsequent young-of-the-year production in 2000. One observation that coincided with the decline in ruffe in the Thunder Bay area was the colonization and subsequent flourishing of the round goby. The round goby was first captured from the Thunder Bay River in 1999, and although their

abundance was low that year (14% of total catch), they became the most abundant species captured from the river in 2000, a status which has continued. Round gobies are aggressive, egg predators that may spawn repeatedly during a season and guard their nests to ensure the development of their young – allowing them to become abundant. Although direct interactions between round goby and ruffe are unknown, we surmise that round goby may have fed on ruffe eggs and/or young that were deposited and/or hatched in the river in the spring and early summer, or that round goby may have had some other negative effect on ruffe. Potential predation effects of round goby and the removal of spawning adults in 2002 and 2003 may have contributed to the decline in ruffe abundance. Ruffe have not been captured from the Thunder Bay area since 2003, however round gobies continued to be the most abundant species captured in the Thunder Bay area during ruffe surveillance trawling from 2008 to 2010.

LOWER GREAT LAKES

Ruffe surveillance activities have not detected ruffe in the lower Great Lakes (Lakes Erie and Ontario) and ruffe have not been reported by other agencies/offices that were capable of incidentally capturing ruffe during their sampling efforts.

RANGE OF RUFFE IN THE GREAT LAKES

The current range of ruffe in the Great Lakes is as follows:

Lake Superior
North Shore: From the Duluth/Superior Harbor, Minnesota/Wisconsin, U.S.A., to near the mouth of the Current River, Thunder Bay Harbour, Ontario, Canada.

South Shore: From the Duluth/Superior Harbor, Minnesota/Wisconsin, to the Tahquamenon River, Michigan, a tributary in western Whitefish Bay 55 km west of the Soo Locks.

Lake Michigan
Green Bay.

Lake Huron
Trout River (Rogers City, Michigan): Ruffe were captured once in 2008 and have not been captured from this location since then.

Thunder Bay River/Thunder Bay Shipping Channel (Alpena, Michigan): No ruffe have been captured or reported from this area of Lake Huron since 2003.

Lake Erie	Lake Ontario	Great Lakes Basin Inland Lakes & Streams
Unconfirmed.	Undetected.	Undetected.

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Bryan Young (USFWS-LGLFWCO)

Reported Information From Other Fish Sampling Capable of Capturing Ruffe Incidentally

Thank you to other agencies and offices who provided information on their sampling that was capable of capturing ruffe incidentally.

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Edward Roseman (USGS-GLSC)
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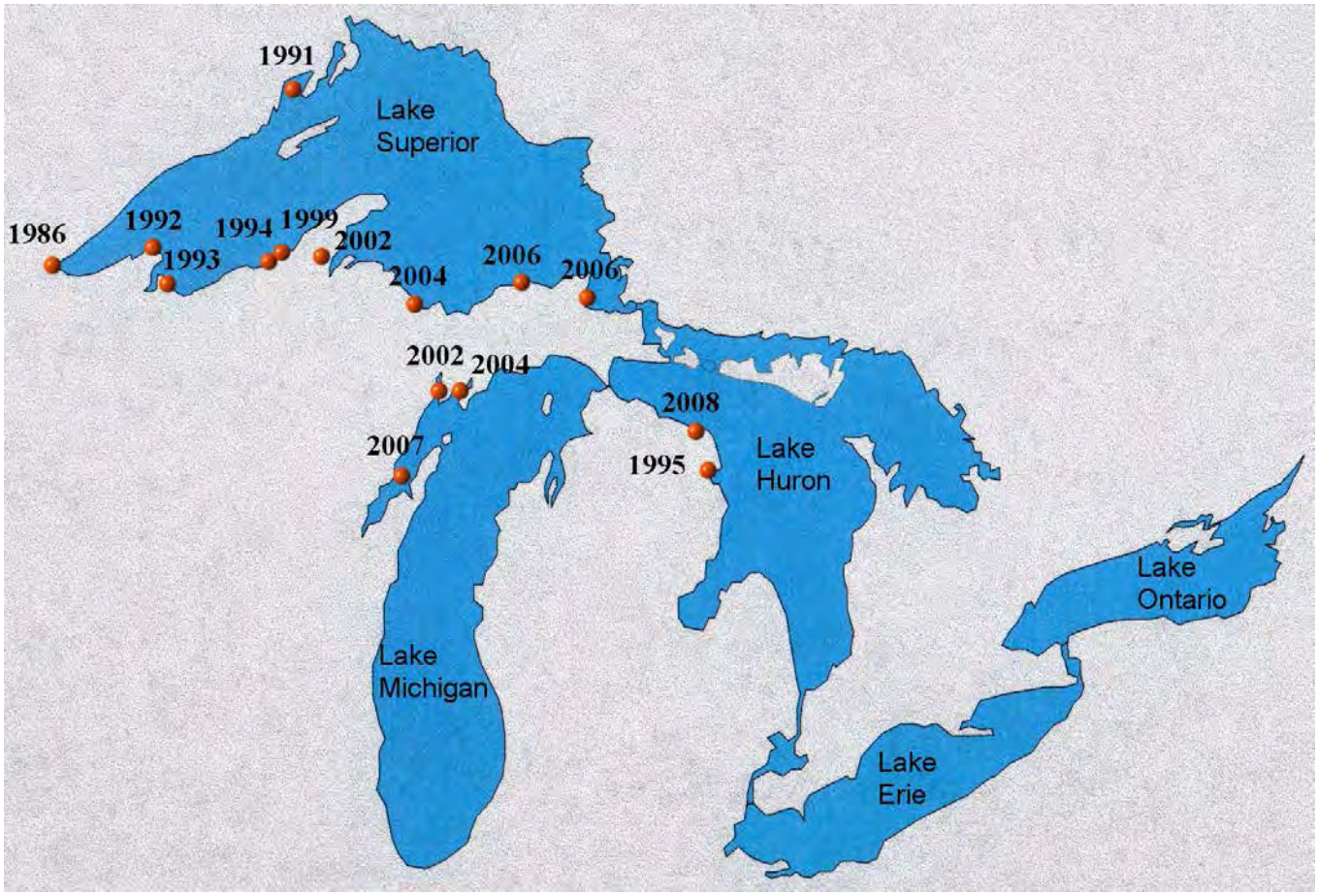
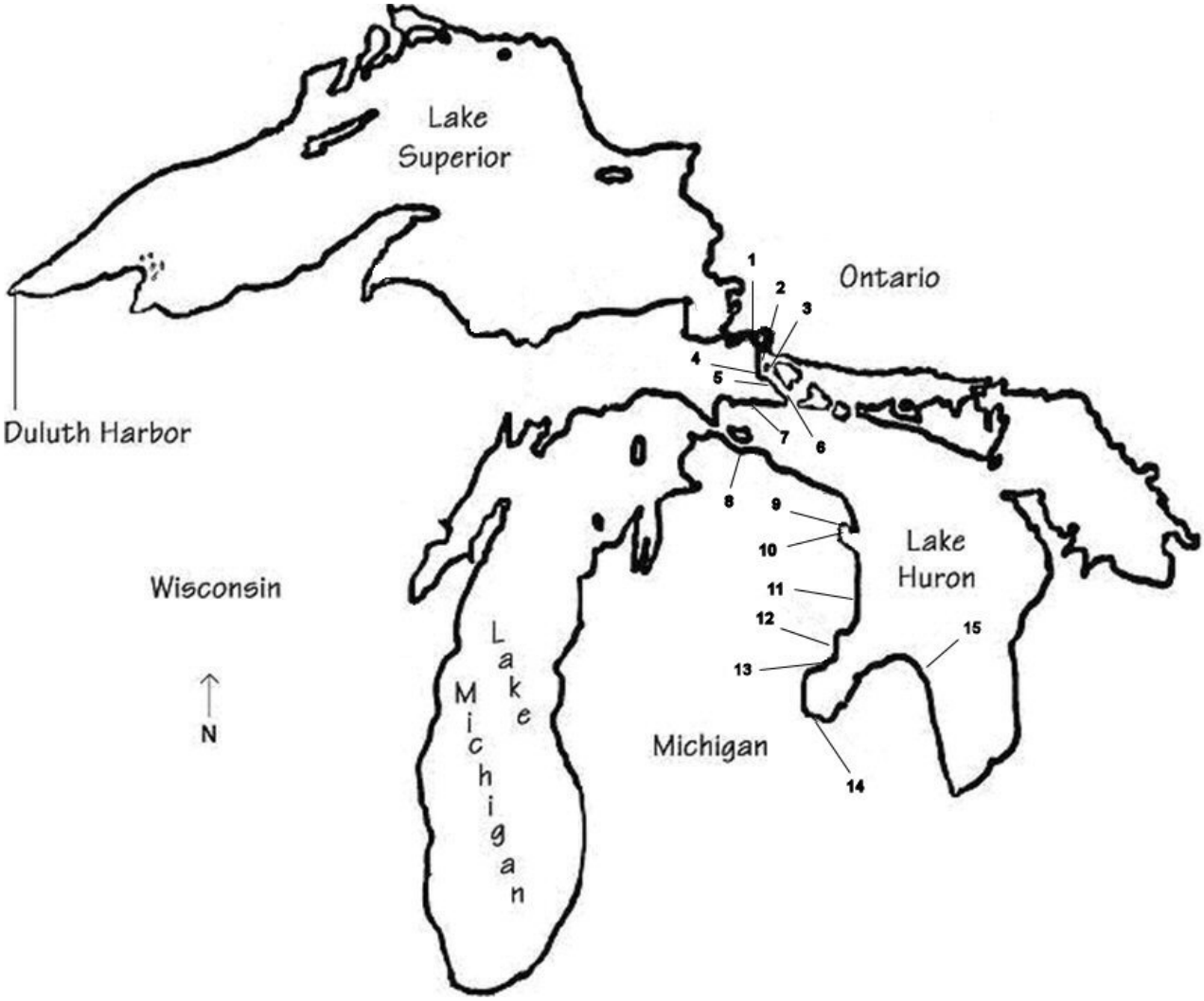


Progression of Ruffe Across the Great Lakes

Figure 1. Progression of ruffe across the Great Lakes. Note: Map does not show all ruffe sightings, only new sightings in the progression of their spread across the Great Lakes over time.

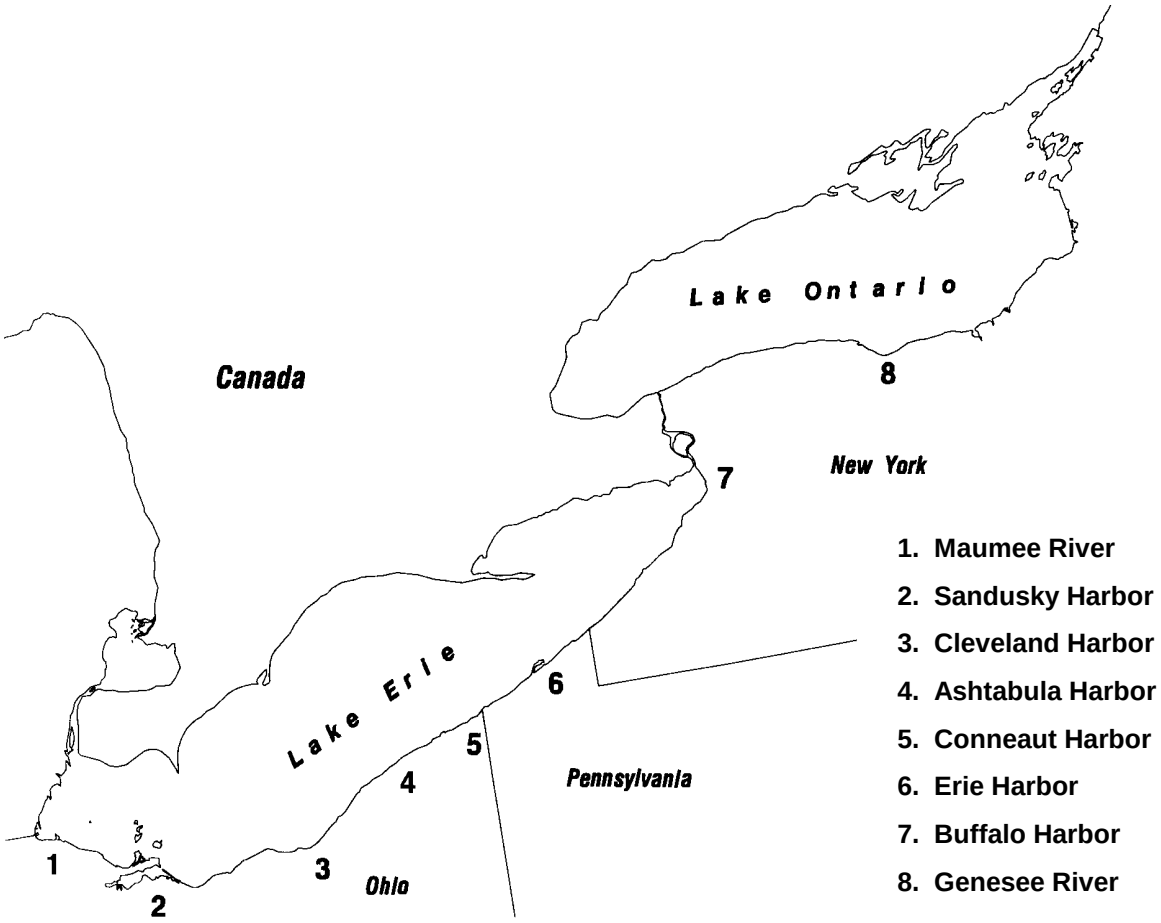


Ruffe Surveillance, St. Marys River/Lake Huron, 2008-2010

U.S. Fish & Wildlife Service

1. St. Marys River (SSM Municipal Marina)
2. St. Marys River (Lake Nicolet)
3. St. Marys River (Munuscong Channel)
4. St. Marys River (Raber Bay)
5. St. Marys River (De Tour – Maud Bay)
6. St. Marys River (De Tour Dock Co.)
7. Port Dolomite
8. Cheboygan River
9. Thunder Bay River
10. Thunder Bay (Shipping Channel)
11. Au Sable River
12. National Gypsum
13. Au Gres River
14. Saginaw River
15. Harbor Beach.

Figure 2. Locations surveyed for ruffe in the upper Great Lakes from 2008 to 2010.



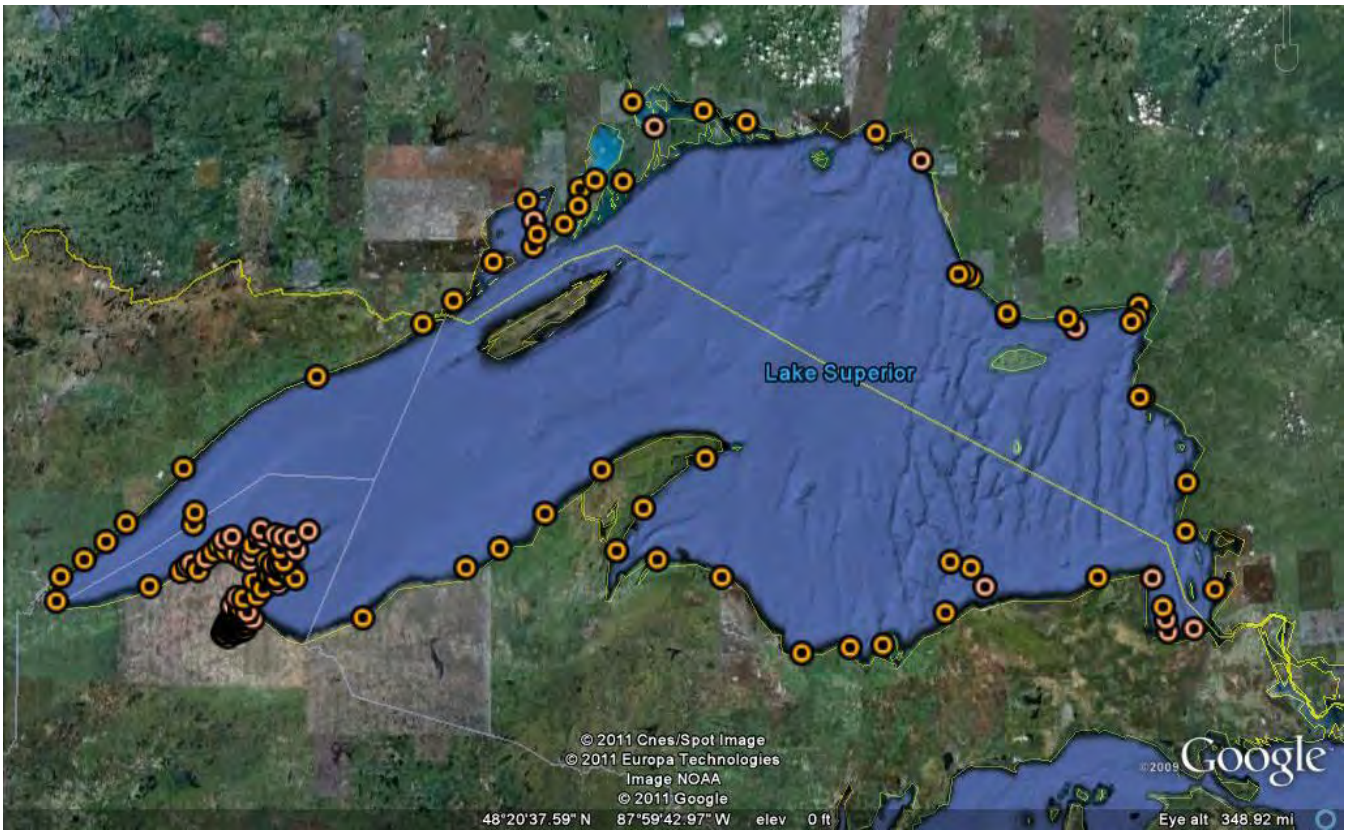
Ruffe Surveillance, Lake Erie/Lake Ontario, 2008-2010

U.S. Fish & Wildlife Service

Figure 3. Locations surveyed for ruffe in the lower Great Lakes from 2008 to 2010.

1. Thunder Bay Harbour *
2. Amnicon River
3. Poplar River
4. Brule River
5. Red Cliff Creek
6. Bad River
7. Firesteel River
8. Misery River *
9. Silver River
10. Big Garlic River
11. Chocolay River
12. Laughing Whitefish River
13. Rock River
14. Furnace Creek
15. Miners River
16. Betsy River
17. Tahquamenon River
18. Isle Royale
19. Middle River *
20. Hog Island Creek
21. Manistique River
22. Ogontz River
23. Big Bay de Noc
24. Little Bay de Noc *
25. Menominee River
26. Peshtigo River
27. Oconto River
28. East Twin River
29. St. Joseph River
30. Muskegon River
31. Pere Marquette River
32. Big Manistee River
33. Little Manistee River
34. Betsy River
35. Gr. Traverse Bay (Northport)
36. Gr. Traverse Bay (Suttons Bay)
37. Gr. Traverse Bay (West Arm)
38. Boardman River
39. Gr. Traverse Bay (Bowers Harbor)
40. Elk Lake Outlet
41. Gr. Traverse Bay (Old Mission Harbor)
42. Gr. Traverse Bay (Omena Bay)
43. Deer Creek
44. Carp Lake Outlet
45. Carp River
44. Carp Lake Outlet
45. Carp River
46. Albany Creek
47. Trout Creek
48. Nunns Creek
49. Cheboygan River
50. Greene Creek
51. Ocqueoc River
52. Trout River *
53. Thunder Bay (North Point)
54. Devils River
55. Black River
56. Au Sable River
57. East Au Gres River
58. Saginaw Bay
59. Tittabawassee River
60. Black Bay
61. Black Sturgeon River

Figure 4. Reported sampling locations in the Upper Great Lakes, where ruffe were capable of incidental capture from 2008 to 2010. The * denotes locations where ruffe were captured.



USGS science for a changing world

U.S. Geological Survey

Figure 5. The USGS – Lake Superior Biological Station conducted annual bottom trawling at locations in Lake Superior where ruffe were capable of incidental capture from 2008 to 2010.

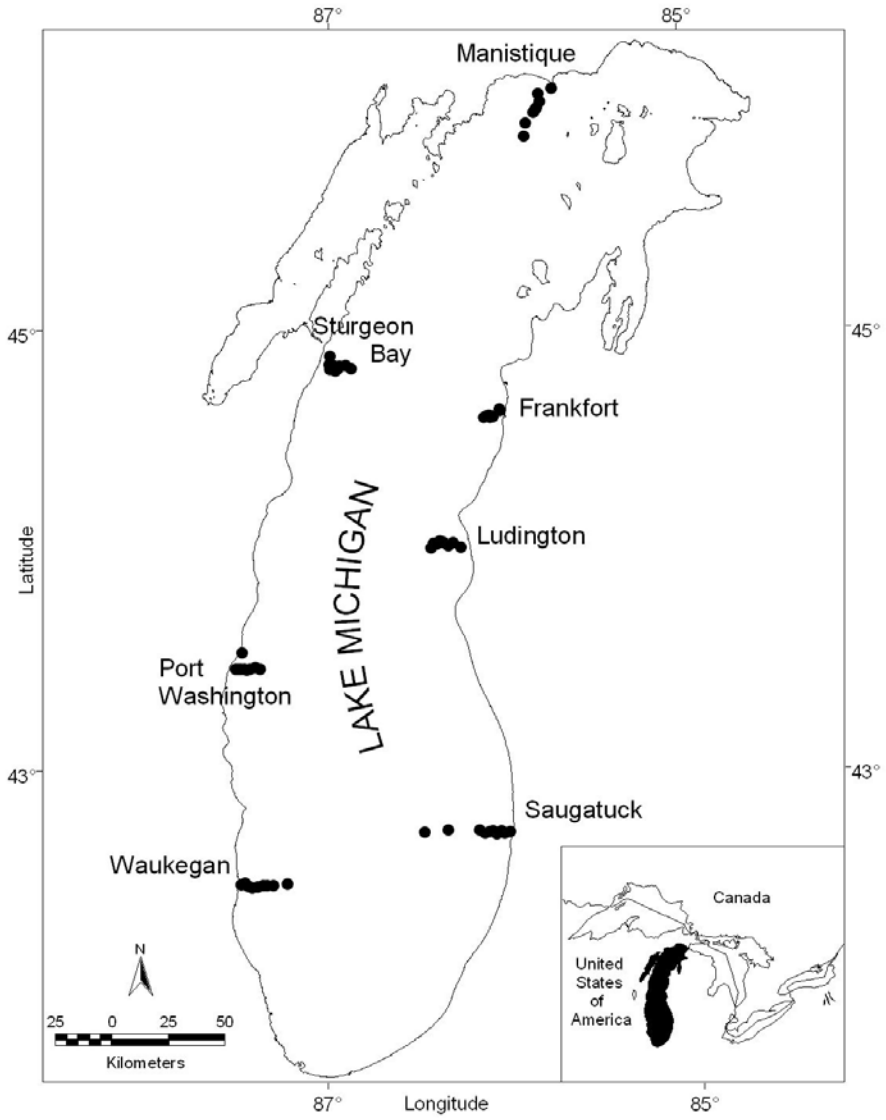


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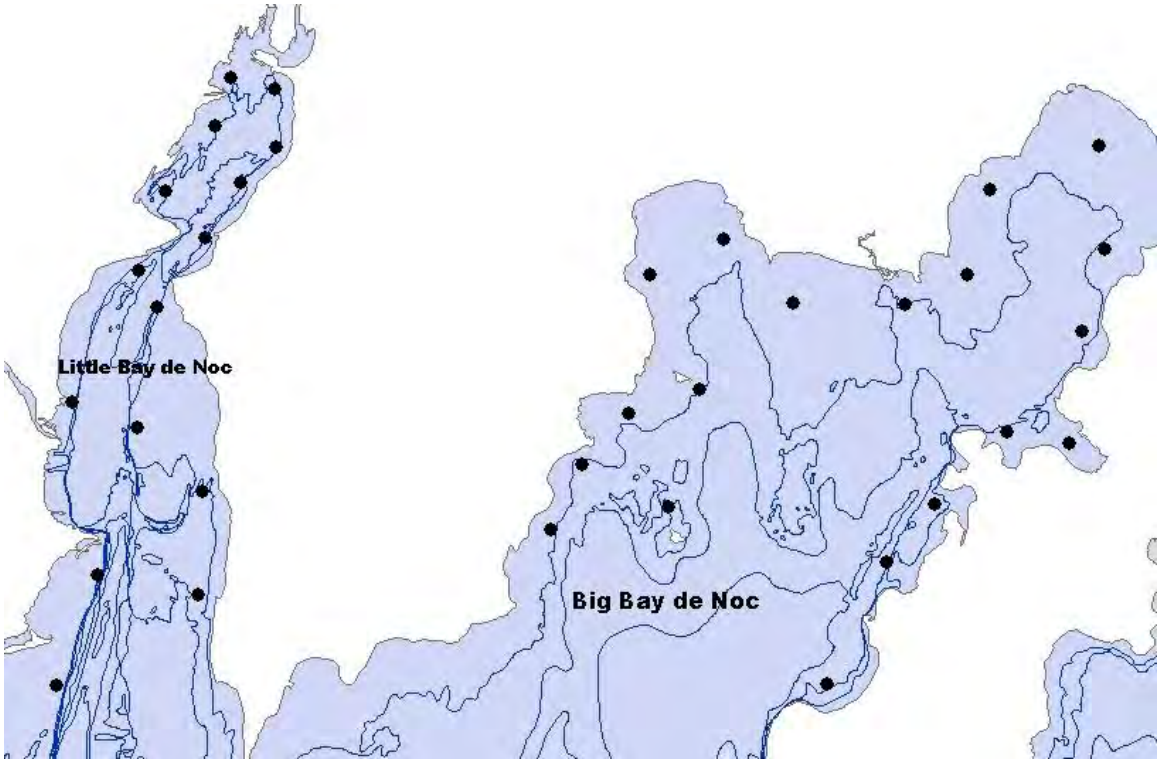
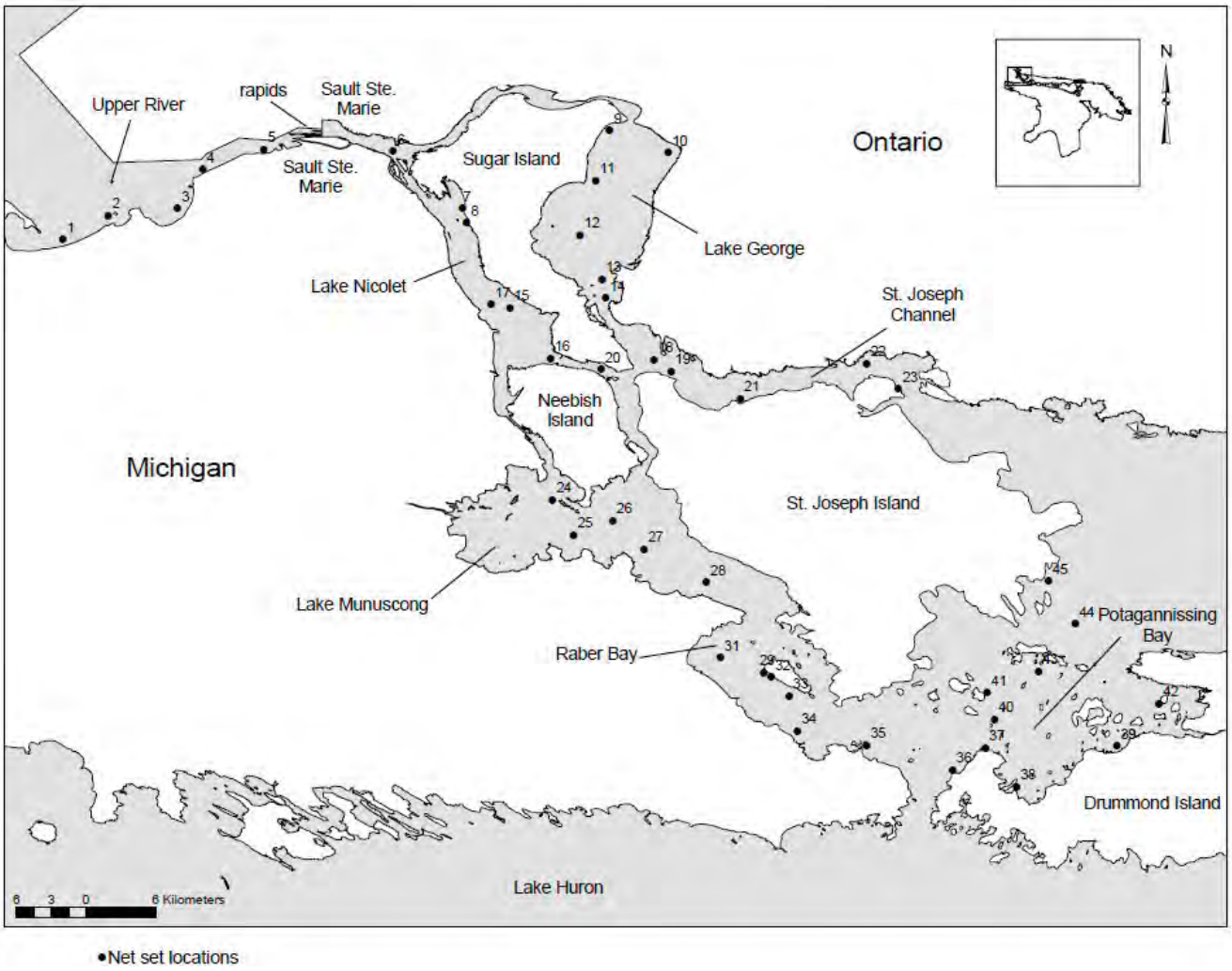
Figure 6. The USGS - Great Lakes Science Center conducted annual bottom trawl at locations in Lake Michigan where ruffe were capable of incidental capture from 2008 to 2010.



Gill Net Sites, Hatchery-reared Walleye Study, 2004-2010

Michigan Department of Natural Resources

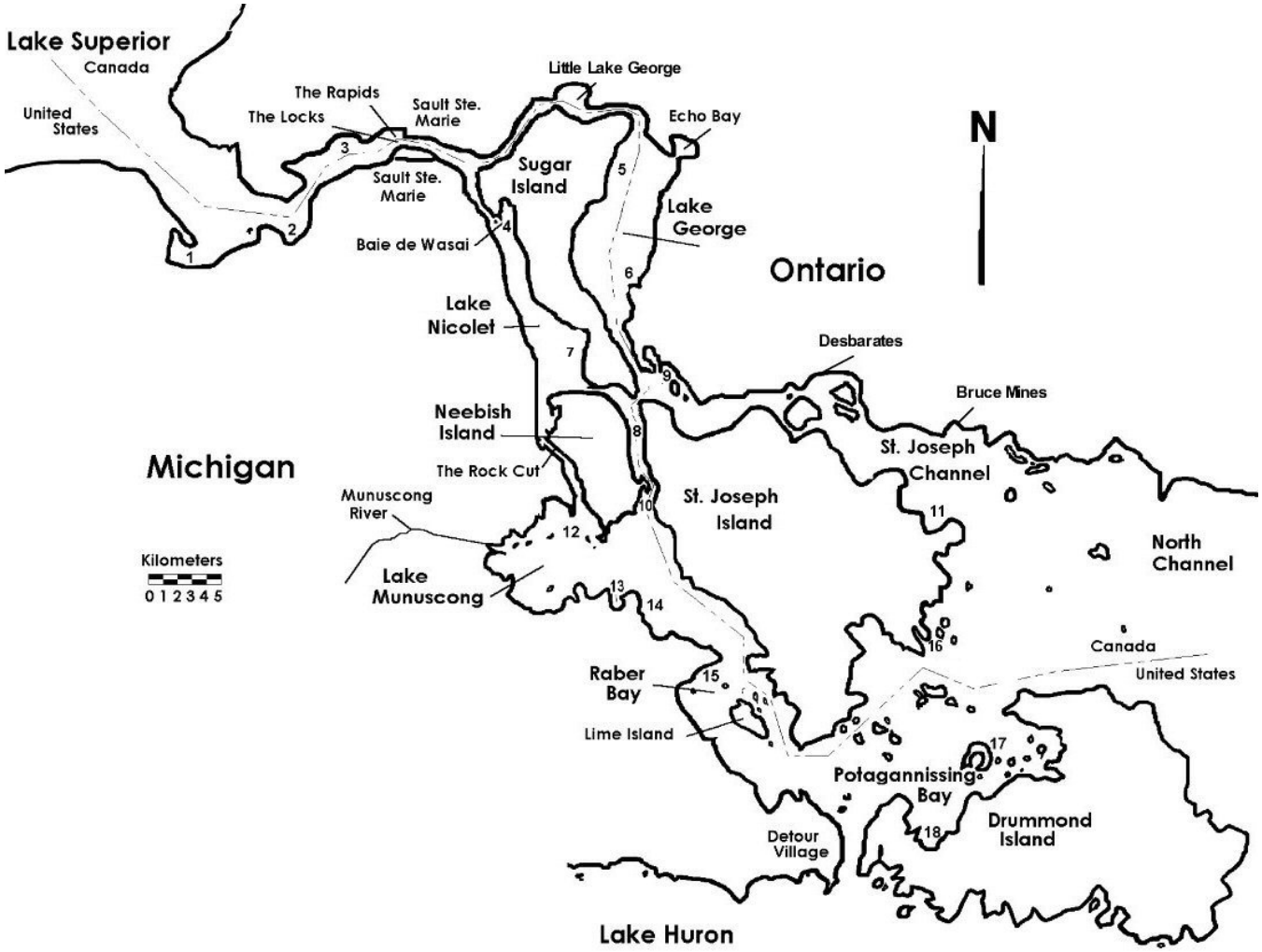
Figure 7. The Michigan DNR – Marquette Fisheries Research Station conducted gill netting at locations in northern Green Bay, Lake Michigan where ruffe were capable of capture incidentally. A subset of 12 sites from Big Bay de Noc and four sites from Little Bay de Noc were randomly selected and sampled each year.



Gill Net Locations, Fish Community Assessment, 2009

St. Marys River Fishery Task Group

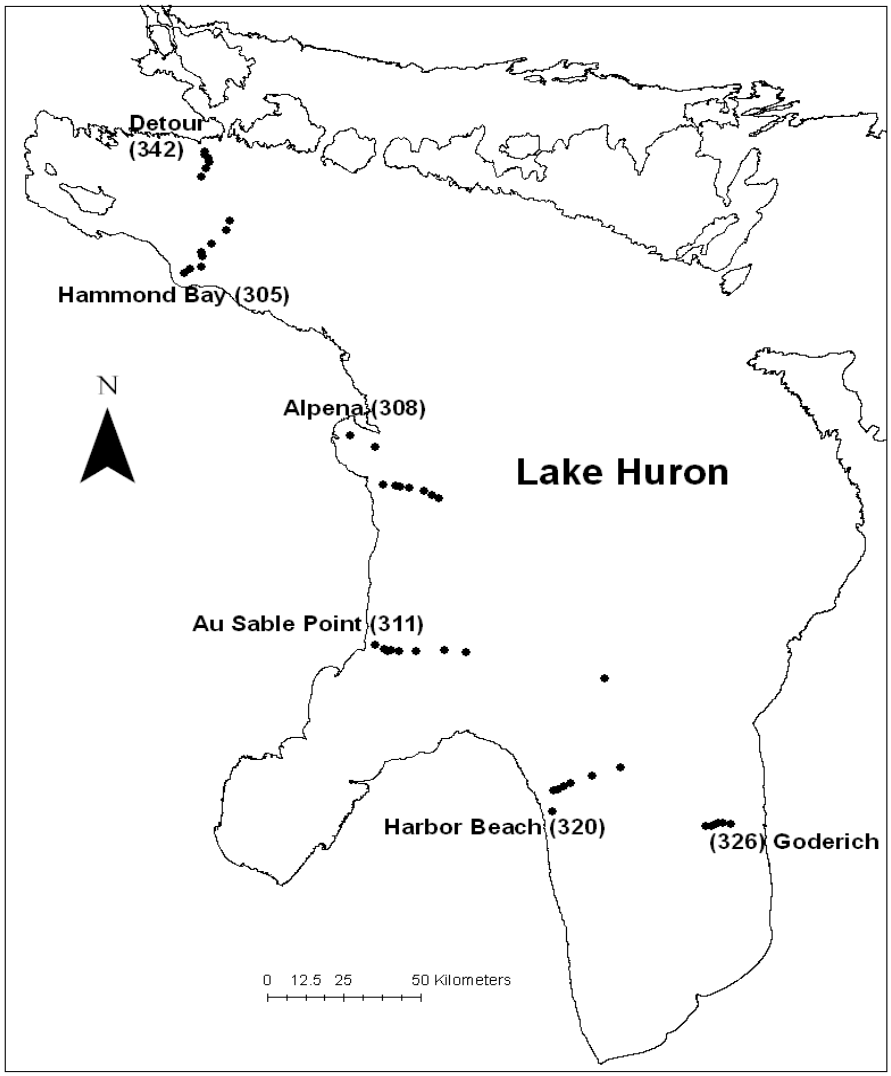
Figure 8. The St. Marys River Fishery Task Group conducted gill net sampling in 2009 at locations across the St. Marys where ruffe were capable of incidental capture.



Bottom Trawling Locations, Juvenile and Prey Fish Study, 2010-2011

U.S. Fish and Wildlife Service

Figure 9. The USFWS – Alpena Fish and Wildlife Conservation Office conducted bottom trawling in 2010 at locations in the St. Marys where ruffe were capable of incidental capture.



USGS science for a changing world

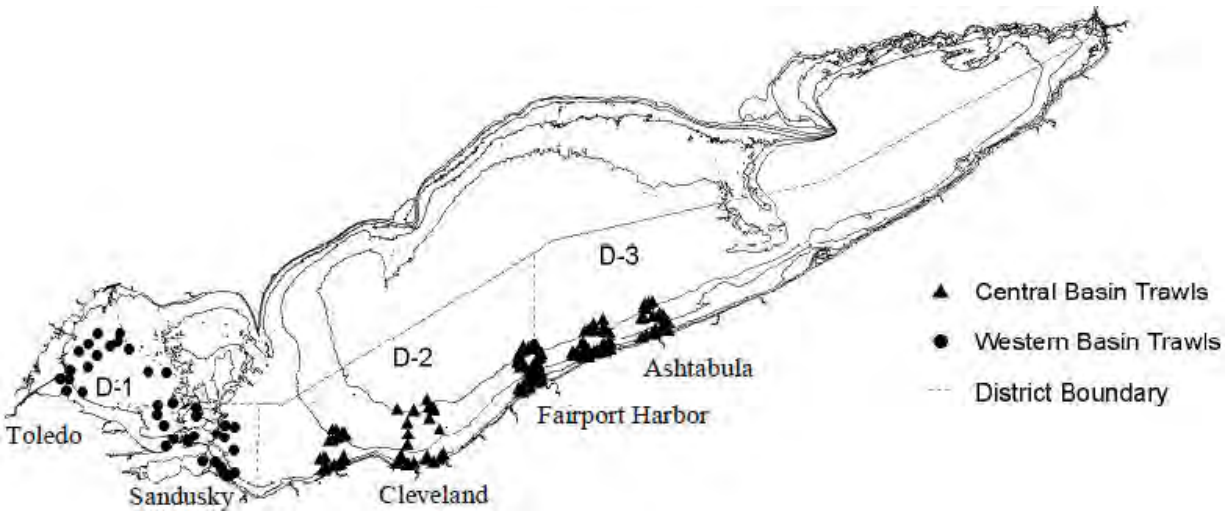
U.S. Geological Survey

Figure 10. The USGS - Great Lakes Science Center conducted annual bottom trawl at locations in Lake Huron where ruffe were capable of incidental capture from 2008 to 2010.

U.S. Fish and Wildlife Service

1. Black River
2. Grindstone Creek
3. Little Salmon River
4. Sterling Creek
5. Sterling Valley Creek
6. Cattaraugus Creek
7. Spooner Creek
8. Grand River

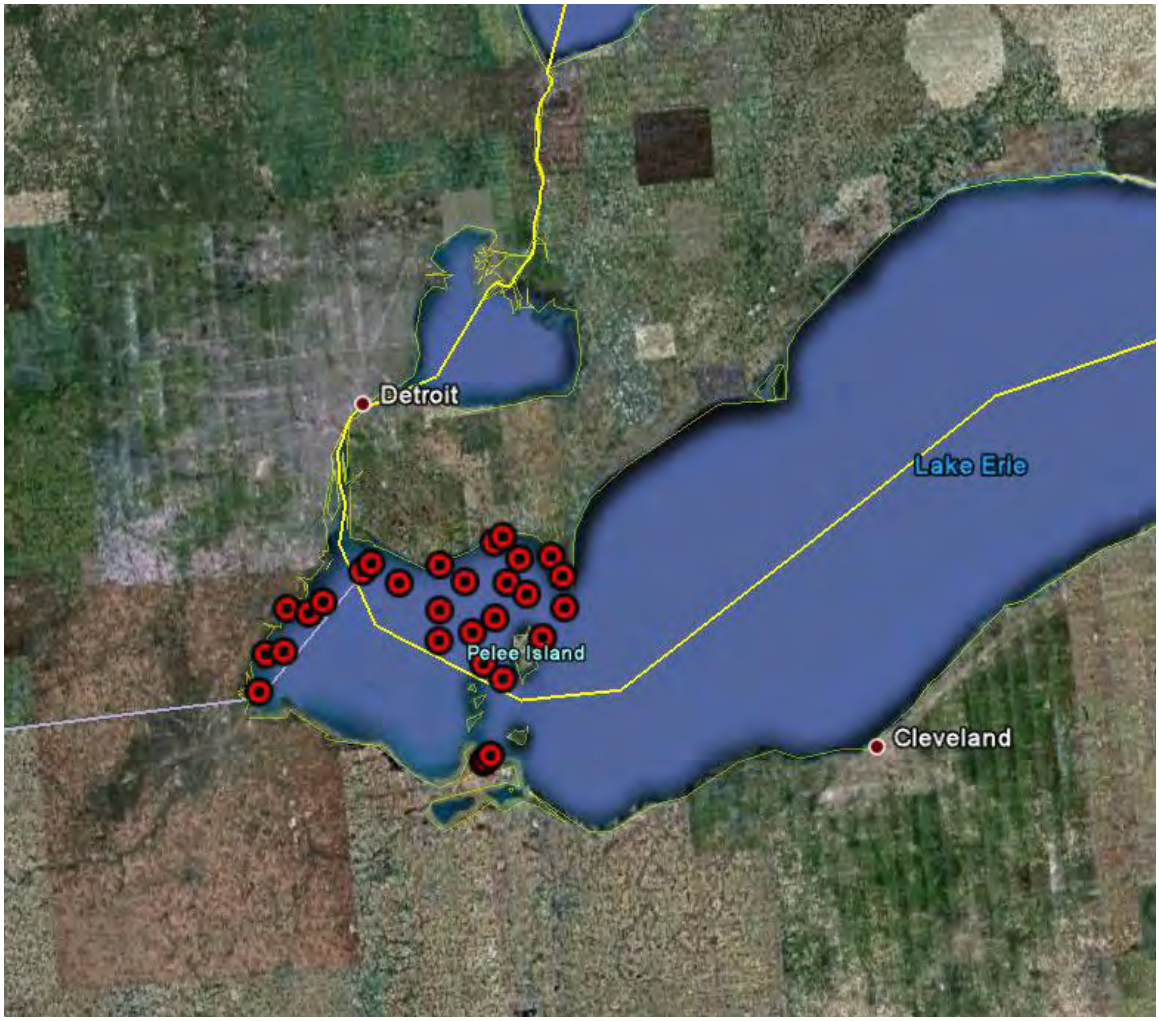
Figure 11. The USFWS – Marquette Biological Station conducted trapping for sea lampreys in U.S. waters of Lakes Erie and Ontario where ruffe were capable of incidental capture from 2008 to 2010.



Bottom Trawling Locations, 2008-2010

Ohio Department of Natural Resources

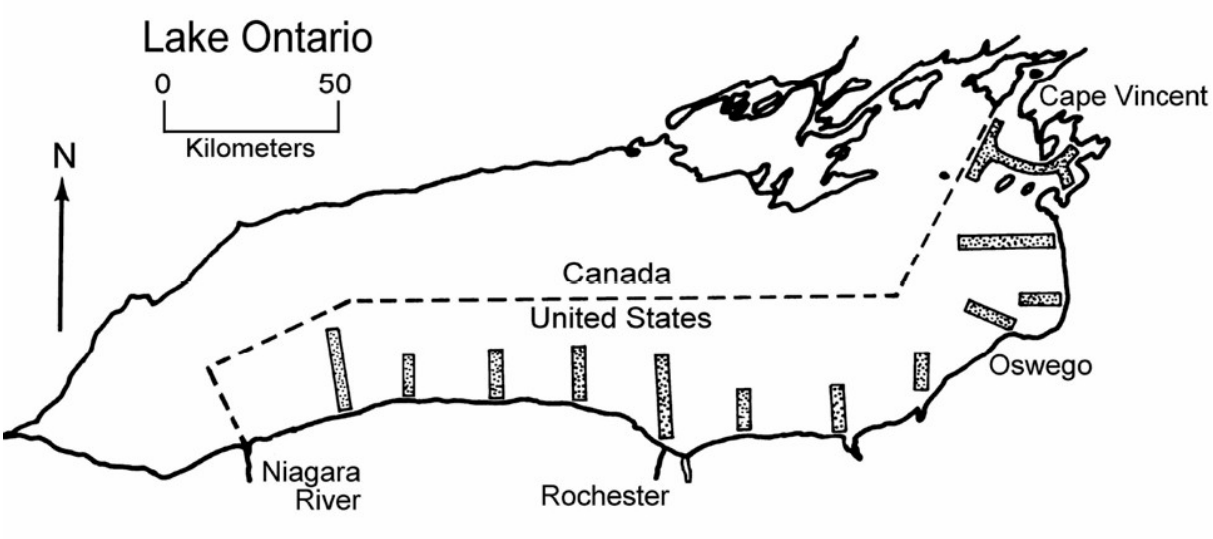
Figure 12. The Ohio DNR – Sandusky and Fairport Harbor Fisheries Research Units conducted annual bottom trawling at locations in Lake Erie where ruffe were capable of incidental capture from 2008 to 2010.



Bottom Trawling Locations, 2008-2010

USGS science for a changing world **U.S. Geological Survey**

Figure 13. The USGS – Lake Erie Biological Station conducted annual bottom trawling at locations in Lake Erie where ruffe were capable of incidental capture from 2008 to 2010.



Great Lakes Science Center – Lake Ontario Biological Stn.

New York State Department of Environmental Conservation

Figure 14. The USGS - Lake Ontario Biological Station and NYSDEC conducted annual bottom trawling at locations in Lake Ontario where ruffe were capable of incidental capture from 2008 to 2010.

Table 1. Summary of dedicated ruffe surveillance in U.S. waters of Lake Huron from 2008 to 2010.

2008

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	Ruffe
Au Gres River	FWS	0.50 hours	BT-4.9	10/6/2008	2.7	11.6	11.5	0
Cheboygan River	FWS	0.42 hours	BT-4.9	9/25/2008	7.1	17.8	15.4	0
Harbor Beach	FWS	0.50 hours	BT-4.9	10/7/2008	5.3	14.7	14.4	0
National Gypsum	FWS	0.50 hours	BT-4.9	10/3/2008	6.5	15.3	15.3	0
Port Dolomite	FWS	0.50 hours	BT-4.9	10/16/2008	7.4	10.0	-----	0
Sagianw River	FWS	0.50 hours	BT-4.9	10/8/2008	8.0	13.9	13.8	0
Thunder Bay River	FWS	0.08 hours	BT-4.9	9/29/2008	6.5	18.7	18.4	0
Thunder Bay River	FWS	0.42 hours	BT-4.9	10/28/2008	6.7	4.4	5.5	0
Thunder Bay (Shipping Channel)	FWS	0.17 hours	BT-4.9	9/29/2008	6.3	18.4	18.2	0
Thunder Bay (Shipping Channel)	FWS	0.33 hours	BT-4.9	10/27/2008	6.4	8.2	8.2	0
Totals		3.92 hours	BT-4.9					0
		Total ruffe (ruffe surveillance)						0

2009

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	Ruffe
Au Gres River	FWS	0.50 hours	BT-4.9	9/21/2009	2.6	21.0	21.0	0
Cheboygan River	FWS	0.50 hours	BT-4.9	9/10/2009	7.2	22.0	19.0	0
Harbor Beach	FWS	0.33 hours	BT-4.9	9/22/2009	4.9	21.7	18.0	0
National Gypsum*	FWS	-----	-----	-----	-----	-----	-----	-----
Port Dolomite	FWS	0.50 hours	BT-4.9	9/17/2009	7.5	18.7	17.2	0
Sagianw River*	FWS	-----	-----	-----	-----	-----	-----	-----
Thunder Bay River	FWS	0.50 hours	BT-4.9	9/9/2009	6.7	22.0	20.0	0
Thunder Bay (Shipping Channel)	FWS	0.50 hours	BT-4.9	9/9/2009	6.4	22.0	20.0	0
Totals		2.83 hours	BT-4.9					0
		Total ruffe (ruffe surveillance)						0

2010

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	Ruffe
Au Gres River	FWS	0.50 hours	BT-4.9	9/13/2010	2.7	19.0	14.1	0
Au Sable River	FWS	0.50 hours	BT-4.9	9/22/2010	4.0	17.7	18.0	0
Cheboygan River	FWS	0.50 hours	BT-4.9	9/20/2010	7.3	16.7	17.4	0
Harbor Beach	FWS	0.50 hours	BT-4.9	9/14/2010	6.1	18.7	17.0	0
National Gypsum	FWS	0.50 hours	BT-4.9	9/17/2010	6.6	16.5	13.4	0
Port Dolomite*	FWS	-----	-----	-----	-----	-----	-----	-----
Sagianw River	FWS	0.50 hours	BT-4.9	9/15/2010	8.2	19.8	16.1	0
Thunder Bay River*	FWS	-----	-----	-----	-----	-----	-----	-----
Thunder Bay (Shipping Channel)	FWS	0.50 hours	BT-4.9	9/23/2010	6.4	16.9	15.8	0
Totals		3.50 hours	BT-4.9					0
		Total ruffe (ruffe surveillance)						0

Key to headings:

Agency = U.S. Fish and Wildlife Service (FWS).
Gear = Bottom trawl (4.9-m headrope).
Depth = Average water depth (m).
S. Temp = Average surface water temperature (°C).
B. Temp = Average bottom water temperature (°C).

Key to symbols:

* Equipment failure prevented sampling.

Table 2. Summary of dedicated ruffe surveillance in U.S. waters of the St. Marys River from 2008 to 2010.

2008

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	Ruffe
De Tour - DeTour Dock Co.	FWS	0.25 hours	BT-4.9	10/17/2008	8.0	11.3	11.4	0
De Tour - Maud Bay	FWS	0.25 hours	BT-4.9	10/17/2008	7.7	11.3	11.4	0
Munuscong Channel	FWS	0.08 hours	BT-4.9	10/15/2008	3.0	11.3	11.4	0
Salut Ste. Marie Municipal Marina	FWS	0.33 hours	BT-4.9	10/15/2008	4.1	12.0	12.0	0
Totals		0.91 hours	BT-4.9					0
		Total ruffe (ruffe surveillance)						0

2009

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	Ruffe
De Tour - DeTour Dock Co.	FWS	0.50 hours	BT-4.9	9/16/2009	7.4	19.7	17.2	0
De Tour - Maud Bay	FWS	0.51 hours	BT-4.9	9/16/2009	7.2	19.9	17.4	0
Lake Nicolet	FWS	0.25 hours	BT-4.9	9/15/2009	9.3	19.5	19.4	0
Munuscong Channel	FWS	0.49 hours	BT-4.9	9/15/2009	7.0	21.4	19.8	0
Raber Bay	FWS	0.33 hours	BT-4.9	9/16/2009	7.4	20.0	17.5	0
Salut Ste. Marie Municipal Marina	FWS	0.50 hours	BT-4.9	9/15/2009	4.0	20.0	22.3	0
Totals		2.58 hours	BT-4.9					0
		Total ruffe (ruffe surveillance)						0

2010

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	Ruffe
De Tour - DeTour Dock Co.*	FWS	-----	-----	-----	-----	-----	-----	-----
De Tour - Maud Bay*	FWS	-----	-----	-----	-----	-----	-----	-----
Lake Nicolet	FWS	0.33 hours	BT-4.9	9/27/2010	8.3	16.2	18.2	0
Munuscong Channel	FWS	0.50 hours	BT-4.9	9/27/2010	9.3	15.9	17.0	0
Raber Bay*	FWS	-----	-----	-----	-----	-----	-----	-----
Salut Ste. Marie Municipal Marina	FWS	0.50 hours	BT-4.9	9/28/2010	4.5	15.6	15.7	0
Totals		1.33 hours	BT-4.9					0
		Total ruffe (ruffe surveillance)						0

Key to headings:

Agency = U.S. Fish and Wildlife Service (FWS).
Gear = Bottom trawl (4.9-m headrope).
Depth = Average water depth (m).
S. Temp = Average surface water temperature (°C).
B. Temp = Average bottom water temperature (°C).

Key to symbols:

* Equipment failure prevented sampling.

Table 3. Summary of dedicated ruffe surveillance in U.S. waters of Lake Erie from 2008 to 2010.

2008

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	S. DO	B. DO	Secchi	Ruffe
Ashtabula Harbor	FWS	0.59 hours	BT-4.9	5/21/2008	9.81	12.23	12.07	9.24	9.94	1.17	0
Ashtabula Harbor	FWS	0.78 hours	BT-4.9	9/25/2008	8.19	20.88	20.58	7.35	6.95	1.01	0
Buffalo Harbor	FWS	0.95 hours	BT-4.9	5/29/2008	7.64	12.78	12.38	10.08	10.74	3.24	0
Buffalo Harbor	FWS	0.97 hours	BT-4.9	9/18/2008	7.49	20.80	20.50	6.46	6.27	0.84	0
Cleveland Harbor	FWS	0.88 hours	BT-4.9	5/21/2008	8.21	14.08	14.00	10.03	9.48	0.90	0
Cleveland Harbor	FWS	1.13 hours	BT-4.9	9/25/2008	7.44	21.07	20.97	20.97	6.15	1.25	0
Conneaut Harbor	FWS	0.43 hours	BT-4.9	5/22/2008	8.43	11.87	11.87	9.80	9.85	0.90	0
Conneaut Harbor	FWS	0.58 hours	BT-4.9	9/26/2008	7.15	19.83	19.87	6.64	6.60	0.75	0
Erie Harbor	FWS	0.37 hours	BT-4.9	5/22/2008	9.07	12.25	12.25	10.34	10.36	2.25	0
Erie Harbor	FWS	0.58 hours	BT-4.9	6/24/2008	7.02	21.33	21.13	7.97	7.59	2.23	0
Erie Harbor	FWS	0.67 hours	BT-4.9	9/26/2008	7.63	19.68	19.60	7.35	7.02	1.26	0
Maumee River	FWS	0.75 hours	BT-4.9	5/20/2008	9.86	16.25	15.75	8.00	7.61	0.23	0
Maumee River	FWS	0.79 hours	BT-4.9	9/24/2008	8.33	20.83	20.78	6.61	6.35	0.28	0
Sandusky Harbor	FWS	0.55 hours	BT-4.9	5/19/2008	7.44	15.17	14.87	11.16	10.72	0.50	0
Sandusky Harbor	FWS	0.59 hours	BT-4.9	9/23/2008	6.89	21.03	20.63	8.45	7.98	0.47	0
Totals		10.61 hours	BT-4.9								0
		Total ruffe (ruffe surveillance)									0

2009

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	S. DO	B. DO	Secchi	Ruffe
Ashtabula Harbor	FWS	0.91 hours	BT-4.9	5/20/2009	7.57	17.06	13.03	10.07	9.62	0.79	0
Ashtabula Harbor	FWS	0.71 hours	BT-4.9	9/30/2009	9.06	-----	-----	-----	-----	0.45	0
Buffalo Harbor	FWS	0.74 hours	BT-4.9	5/15/2009	7.66	13.05	11.91	10.23	9.77	1.15	0
Buffalo Harbor	FWS	0.93 hours	BT-4.9	9/25/2009	7.27	20.28	20.28	8.21	8.06	-----	0
Cleveland Harbor	FWS	1.07 hours	BT-4.9	5/20/2009	8.53	14.66	13.14	10.11	8.98	0.93	0
Cleveland Harbor	FWS	0.87 hours	BT-4.9	10/1/2009	8.53	-----	-----	-----	-----	0.70	0
Conneaut Harbor	FWS	0.54 hours	BT-4.9	5/21/2009	7.84	14.09	12.73	10.30	10.17	1.75	0
Conneaut Harbor	FWS	0.50 hours	BT-4.9	9/30/2009	8.37	-----	-----	-----	-----	0.30	0
Erie Harbor	FWS	0.73 hours	BT-4.9	5/21/2009	8.28	17.85	14.21	10.22	9.48	3.00	0
Erie Harbor	FWS	0.78 hours	BT-4.9	10/27/2009	8.03	10.68	10.40	11.64	11.48	1.83	0
Maumee River	FWS	0.76 hours	BT-4.9	5/18/2009	9.18	17.59	16.95	8.08	7.57	0.25	0
Maumee River*	FWS	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sandusky Harbor	FWS	0.56 hours	BT-4.9	5/18/2009	7.21	16.89	15.37	12.50	9.16	0.32	0
Sandusky Harbor	FWS	0.50 hours	BT-4.9	9/29/2009	6.59	10.66	10.67	11.28	11.04	0.80	0
Totals		9.60 hours	BT-4.9								0
		Total ruffe (ruffe surveillance)									0

2010

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	S. DO	B. DO	Secchi	Ruffe
Ashtabula Harbor	FWS	0.67 hours	BT-4.9	5/19/2010	8.05	14.88	14.08	7.44	7.66	0.48	0
Ashtabula Harbor	FWS	0.57 hours	BT-4.9	9/24/2010	8.90	20.50	20.30	7.09	6.79	1.13	0
Buffalo Harbor	FWS	0.79 hours	BT-4.9	5/13/2010	5.46	7.58	7.50	8.47	8.31	0.56	0
Buffalo Harbor	FWS	0.93 hours	BT-4.9	10/12/2010	7.43	15.89	15.65	10.26	8.61	2.55	0
Cleveland Harbor	FWS	1.19 hours	BT-4.9	5/19/2010	8.70	14.40	14.23	8.49	8.09	1.01	0
Cleveland Harbor	FWS	0.72 hours	BT-4.9	9/24/2010	7.54	20.95	20.83	6.50	6.33	1.06	0
Conneaut Harbor	FWS	0.57 hours	BT-4.9	5/20/2010	7.92	14.60	13.67	8.37	8.35	1.13	0
Conneaut Harbor	FWS	0.20 hours	BT-4.9	9/25/2010	8.14	13.70	19.80	6.71	6.27	1.00	0
Erie Harbor	FWS	0.59 hours	BT-4.9	5/20/2010	8.68	15.20	15.07	9.18	9.24	1.77	0
Erie Harbor**	FWS	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Maumee River	FWS	0.40 hours	BT-4.9	5/18/2010	9.01	14.75	14.70	8.30	8.08	0.10	0
Maumee River	FWS	0.75 hours	BT-4.9	9/23/2010	9.09	20.50	20.20	5.57	5.40	0.45	0
Sandusky Harbor	FWS	0.53 hours	BT-4.9	5/17/2010	7.62	15.43	15.53	12.13	10.79	0.08	0
Sandusky Harbor	FWS	0.56 hours	BT-4.9	9/22/2010	6.58	20.87	19.80	7.79	6.96	0.62	0
Totals		8.50 hours	BT-4.9								0
		Total ruffe (ruffe surveillance)									0

Key to headings:

Agency = U.S. Fish and Wildlife Service (FWS).
Gear = Bottom trawl (4.9-m headrope).
Depth = Average water depth (m).
S. Temp = Average surface water temperature (°C).
B. Temp = Average bottom water temperature (°C).
S. DO = Surface dissolved oxygen (ppm).
B. DO = Bottom dissolved oxygen (ppm).
Secchi = Turbidity (m).

Key to symbols:

* Launch ramp at Maumee River was dry due to significant seiche event on 9/30/2009.
** Weather did not permit for safe sampling during the Fall of 2010 at Erie Harbor.

Table 4. Summary of dedicated ruffe surveillance in U.S. waters of Lake Ontario from 2008 to 2010.

2008

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	S. DO	B. DO	Secchi	Ruffe
Genesee River	FWS	0.70 hours	BT-4.9	5/28/2008	6.59	16.55	15.03	9.15	9.54	0.88	0
Genesee River	FWS	0.53 hours	BT-4.9	9/19/2008	6.14	19.40	18.93	7.38	7.34	0.42	0
Totals		1.23 hours	BT-4.9								0
		Total ruffe (ruffe surveillance)									0

2009

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	S. DO	B. DO	Secchi	Ruffe
Genesee River	FWS	0.55 hours	BT-4.9	5/22/2009	6.53	18.45	15.54	9.67	9.81	0.37	0
Genesee River	FWS	0.54 hours	BT-4.9	10/15/2009	3.26	10.40	11.64	11.48	1.83	1.83	0
Totals		1.09 hours	BT-4.9								0
		Total ruffe (ruffe surveillance)									0

2010

Location	Agency	Effort	Gear	Date	Depth	S. Temp	B. Temp	S. DO	B. DO	Secchi	Ruffe
Genesee River	FWS	0.37 hours	BT-4.9	5/14/2010	6.34	10.40	10.30	10.65	10.59	0.08	0
Genesee River	FWS	0.57 hours	BT-4.9	9/17/2010	6.50	17.17	17.23	6.82	6.68	0.75	0
Totals		0.94 hours	BT-4.9								0
		Total ruffe (ruffe surveillance)									0

Key to headings:

Agency = U.S. Fish and Wildlife Service (FWS).
Gear = Bottom trawl (4.9-m headrope).
Depth = Average water depth (m).
S. Temp = Average surface water temperature (°C).
B. Temp = Average bottom water temperature (°C).
S. DO = Surface dissolved oxygen (ppm).
B. DO = Bottom dissolved oxygen (ppm).
Secchi = Turbidity (m).

Table 5. Summary of reported fish sampling conducted in Lake Superior that was capable of incidentally capturing ruffe from 2008 to 2010.

2008

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Amnicon River	GLIFWC/FWS	37 trapnights	FN	5/19-6/25/2008	0.5-1.0	13.3	0
Bad River	GLIFWC	147 trapnights	PAT	5/1-6/18/2008	0.5	13.7	0
Betsy River	FWS	176 trapnights	PAT	5/6-6/30/2008	0.5	14.0	0
Big Garlic River	PC	59 trapnights	FN	5/4-7/2/2008	0.5-1.0	14.0	0
Black Bay	OMNR	69 nights	GN-GM	9/15-24/2008	3.0-25.0	13.0-15.0	0
Black Sturgeon River	OMNR	25 nights	GN-GM	8/25, 9/4/2008	-----	10.0-17.5	0
Brule River	GLIFWC/FWS	43 trapnights	PT	5/13-6/25/2008	0.8	14.0	0
Chocolay River	PC	59 trapnights	FN	5/4-7/2/2008	0.5-1.0	12.0	0
Firesteel River	GLIFWC	57 trapnights	FN	5/6-7/2/2008	0.5-1.0	15.0	0
Furnace Creek	PC	58 trapnights	PAT	5/5-7/2/2008	0.5	13.0	0
Isle Royale	FWS/NPS	10.33 hours	EF	6/3-9, 7/14/2008	0.6-1.0	8.5	0
Laughing Whitefish River	PC	59 trapnights	FN	5/4-7/2/2008	0.5	13.0	0
Middle River	GLIFWC/FWS	188 trapnights	PAT	5/8-6/24/2008	0.5	12.0	0
Miners River	NPS/FWS	104 trapnights	PAT	5/9-6/30/2008	0.5	13.0	0
Misery River *	GLIFWC	118 trapnights	PAT	5/5-7/2/2008	0.5	12.0	7
Nearshore *	USGS	46.73 hours	BT-11.9	5-9/2008	1.3 - 333.0	2.3-13.5	110
Poplar River	GLIFWC/FWS	36 trapnights	FN	5/6-6/11/2008	0.5-1.0	11.0	0
Red Cliff Creek	RCBLSC	142 trapnights	FN	5/5-7/15/2008	0.5-1.0	14.0	0
Rock River	FWS	108 trapnights	PAT	5/9-7/2/2008	0.5	13.0	0
Silver River	GLIFWC	62 trapnights	FN	5/7-7/8/2008	0.5-1.0	13.0	0
Tahquamenon River	FWS	165 trapnights	PAT	5/6-6/30/2008	0.5	15.0	0
Thunder Bay Harbour*	DFO	360 meters	GN-NOR	9/29-10/2/2008	1.0-2.0	<10.0	50**
Thunder Bay Harbour*	DFO	8.00 hours	EF	9/29-10/2/2008	0.5-1.5	<10.0	25**
Totals		46.73 hours	BT-11.9				110
		18.33 hours	EF				25**
		511 trapnights	FN				0
		94 nights	GN-GM				0
		360 meters	GN-NOR				50**
		1,064 trapnights	PAT				7
		43 trapnights	PT				0
		Total ruffe (captured incidentally)					192**

2009

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Amnicon River	GLIFWC/FWS	49 trapnights	FN	4/28-6/16/2009	0.5-1.0	13.3	0
Bad River	GLIFWC	129 trapnights	PAT	4/29-6/11/2009	0.5	14.5	0
Betsy River	FWS	114 trapnights	PAT	5/12-7/8/2009	0.5	16.8	0
Big Garlic River	PC	53 trapnights	FN	5/7-6/29/2009	0.5-1.0	17.3	0
Brule River	GLIFWC/FWS	31 trapnights	PT	4/28-6/29/2009	0.8	-----	0
Chocolay River	PC	55 trapnights	FN	5/7-7/1/2009	0.5	14.1	0
Firesteel River	GLIFWC	43 trapnights	FN	5/13-6/25/2009	0.5-1.0	15.0	0
Furnace Creek	PC	55 trapnights	PAT	5/6-6/30/2009	0.5	15.1	0
Isle Royale	FWS/NPS	19.60 hours	EF	6/2-9, 8/25-26/2009	0.6-1.0	12.4	0
Laughing Whitefish River	PC	55 trapnights	FN	5/6-6/30/2009	0.5	15.2	0
Middle River	GLIFWC/FWS	48 trapnights	PAT	4/28-6/16/2009	0.5	13.2	0
Miners River	NPS/FWS	116 trapnights	PAT	5/12-7/9/2009	0.5	13.3	0
Misery River *	GLIFWC	104 trapnights	PAT	5/5-6/26/2009	0.5	12.5	1
Nearshore	USGS	33.70 hours	BT-11.9	4-6/2009	3.0-333.0	1.7-9.9	0
Poplar River	GLIFWC/FWS	49 trapnights	FN	4/28-6/16/2009	0.5-1.0	12.7	0
Red Cliff Creek	RCBLSC	60 trapnights	FN	5/1-7/1/2009	0.5-1.0	14.0	0
Rock River	FWS	126 trapnights	PAT	5/7-7/9/2009	0.5	13.9	0
Silver River	GLIFWC	70 trapnights	FN	5/11-7/20/2009	0.5-1.0	13.3	0
Tahquamenon River	FWS	168 trapnights	PAT	5/13-7/8/2009	0.5	16.7	0
Totals		33.70 hours	BT-11.9				0
		19.60 hours	EF				0
		434 trapnights	FN				0
		860 trapnights	PAT				1
		31 trapnights	PT				0
		Total ruffe (captured incidentally)					1

Table 5. Continued.

2010

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Amnicon River	GLIFWC/FWS	62 trapnights	FN	4/14-6/14/2010	0.5-1.0	12.8	0
Bad River	GLIFWC	156 trapnights	PAT	4/13-6/3/2010	0.5	15.0	0
Betsy River	FWS	98 trapnights	PAT	4/30-6/17/2010	0.5	16.4	0
Big Garlic River	PC	59 trapnights	FN	4/29-6/26/2010	0.5-1.0	17.7	0
Brule River	GLIFWC/FWS	62 trapnights	PT	4/14-6/14/2010	0.8	13.0	0
Chocolay River	PC	59 trapnights	FN	4/29-6/26/2010	0.5-1.0	14.0	0
Firesteel River	GLIFWC	33 trapnights	FN	4/20-5/22/2010	0.5-1.0	13.1	0
Furnace Creek	PC	59 trapnights	PAT	4/29-6/26/2010	0.5	16.6	0
Isle Royale	FWS/NPS	11.52 hours	EF	6/15-18, 8/22-25/2010	0.6-1.0	13.3	0
Laughing Whitefish River	PC	59 trapnights	FN	4/29-6/26/2010	0.5	15.0	0
Middle River *	GLIFWC/FWS	248 trapnights	PAT	4/14-6/14/2010	0.5	12.8	3
Miners River	NPS/FWS	120 trapnights	PAT	4/26-6/24/2010	0.5	13.4	0
Misery River *	GLIFWC	132 trapnights	PAT	4/17-6/21/2010	0.5	14.2	1
Nearshore *	USGS	54.32 hours	BT-11.9	4-8, 9-10/2010	1.3-337.0	3.1-16.6	60
Poplar River	GLIFWC/FWS	62 trapnights	FN	4/14-6/14/2010	0.5-1.0	12.6	0
Red Cliff Creek	RCBLSC	60 trapnights	FN	4/12-6/10/2010	0.5-1.0	10.2	0
Silver River	GLIFWC	78 trapnights	FN	4/20-7/6/2010	0.5-1.0	14.4	0
Tahquamenon River	FWS	159 trapnights	PAT	4/30-6/21/2010	0.5	17.1	0
Thunder Bay Harbour *	OMNR/FWS	1.07 hours	BT-4.9	9/8-9/9/2010	2.2-10.1	12.0-15.0	4
Thunder Bay Harbour *	OMNR/FWS	15 trapnights	FN-2	9/8-9/10/2010	0.3-2.5	11.0-16.0	33
Totals		1.07 hours	BT-4.9				4
		54.32 hours	BT-11.9				60
		11.52 hours	EF				0
		472 trapnights	FN				0
		15 trapnights	FN-2				33
		972 trapnights	PAT				4
		62 trapnights	PT				0
		Total ruffe (captured incidentally)					101

Key to agency:
- DFO = Department of Fisheries and Oceans
- FWS = U.S. Fish & Wildlife Service
- GLIFWC = Great Lakes Indian Fish & Wildlife Commission
- NPS = National Park Service
- OMNR = Ontario Ministry of Natural Resources
- PC = Private contractor
- RCBLSC = Red Cliff Band of Lake Superior Chippewa
- USGS = U.S. Geological Survey

Key to gear:
- BT-4.9 = Bottom trawl (4.9-m headrope)
- BT-11.9 = Bottom trawl (11.9-m headrope)
- EF = Electrofishing
- FN = Fyke net
- FN-2 = Paired fyke nets (4.7 mm mesh with 15 m lead)
- GN-GM = Gill net (graded 12-127 mm mesh)
- GN-NOR = Gill net (nordic -12 panels at 2.5 m each 5-55 mm mesh)
- PAT = Portable assessment trap
- PT = Permanent trap

Key to symbols:
- * Locations where ruffe were captured.
- ** Approximate catch number.

Key to headings:
- Depth = Average water depth (m) or depth range.
- Temp = Average surface water temperature (°C) or temperature range.

Table 6. Summary of reported fish sampling conducted in Lake Michigan that was capable of incidentally capturing ruffe from 2008 to 2010.

2008

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Betsie River	GTBOCI	70 trapnights	PAT	4/14-6/19/2008	0.5-1.0	15.3	0
Big Bay de Noc	MIDNR	3.83 hours	BT-3.7	6-10/2008	-----	-----	0
Big Bay de Noc	MIDNR	293 meters	GN-EX1	6-10/2008	-----	-----	0
Big Bay de Noc	MIDNR	6,584 meters	GN-EX2	8-9/2008	-----	-----	0
Big Manistee River	FWS	72 trapnights	PAT	4/19-6/20/2008	0.5	14.2	0
Boardman River	GTBOCI	70 trapnights	PAT	4/14-6/19/2008	0.5	13.9	0
Carp Lake Outlet	FWS	34 trapnights	PT	4/21-6/25/2008	0.8	12.8	0
Deer Creek	PC	58 trapnights	PAT	4/21-6/20/2008	0.5	13.9	0
East Twin River	PC	28 trapnights	PAT	4/25-5/23/2008	0.5	12.7	0
Elk Lake Outlet	PC	32 trapnights	PAT	4/18-6/20/2008	0.5-1.0	12.2	0
Gr. Trav. Bay (Omena Bay)	ISEA	0.83 hours	BT-4.9	7/3-9/17/2008	8.8	-----	0
Gr. Trav. Bay (Suttons Bay)	ISEA	14.50 hours	BT-4.9	4/25-9/30/2008	9.4	-----	0
Gr. Trav. Bay (West Arm)	ISEA	8.17 hours	BT-4.9	5/5-8/12/2008	9.2	-----	0
Hog Island Creek	PC	61 trapnights	FN	5/1-7/1/2008	0.5-1.0	12.4	0
Little Bay de Noc	ISEA	1.17 hours	BT-4.9	7/8-7/12/2008	8.7	-----	0
Little Bay de Noc*	MIDNR	3.83 hours	BT-3.7	6-10/2008	-----	-----	1
Little Bay de Noc*	MIDNR	293 meters	GN-EX1	6-10/2008	-----	-----	1
Litlle Bay de Noc*	MIDNR	2,195 meters	GN-EX2	8-9/2008	-----	-----	3
Little Manistee River	FWS	168 trapnights	PAT	4/7-7/1/2008	0.5-1.0	14.2	0
Manistique River	FWS	35 trapnights	SPT	5/15-6/19/2008	0.5	15.4	0
Menominee River	FWS	39 trapnights	PAT	4/28-6/5/2008	0.5-1.0	13.0	0
Muskegon River	FWS	58 trapnights	PAT	4/19-6/18/2008	1.0-5.0	14.2	0
Nearshore/Offshore	USGS	11.35 hours**	BT-12	9-10/2008	5.0-100.0	-----	0
Oconto River	FWS	36 trapnights	PAT	4/29-6/4/2010	0.5-1.0	13.6	0
Ogontz River	PC	61 trapnights	FN	5/1-7/1/2008	0.5-1.0	13.9	0
Pere Marquette River	FWS	133 trapnights	PAT	3/20-8/1/2008	0.5-1.0	12.5	0
Peshtigo River	FWS	76 trapnights	PAT	4/29-6/5/2008	0.5-1.0	13.7	0
St. Joseph River	PC	56 trapnights	PAT	4/4-6/2/2008	0.5	15.3	0
Totals		7.66 hours	BT-3.7				1
		24.67 hours	BT-4.9				0
		11.35 hours**	BT-12				0
		122 trapnights	FN				0
		586 meters	GN-EX1				1
		8,779 meters	GN-EX2				3
		896 trapnights	PAT				0
		34 trapnights	PT				0
		35 trapnights	SPT				0
		Total ruffe (captured incidentally)					5

2009

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Betsie River	GTBOCI	150 trapnights	PAT	4/14-6/26/2009	0.5-1.0	14.6	0
Big Bay de Noc	ISEA	0.17 hours	BT-4.9	7/12/2009	6.8	-----	0
Big Bay de Noc	MIDNR	3.83 hours	BT-3.7	6-10/2009	-----	-----	0
Big Bay de Noc	MIDNR	293 meters	GN-EX1	6-10/2009	-----	-----	0
Big Bay de Noc	MIDNR	1,646 meters	GN-EX2	8-9/2009	-----	-----	0
Big Bay de Noc	MIDNR	3,219 meters	GN-EX3	8-9/2009	-----	-----	0
Big Manistee River	FWS	164 trapnights	PAT	4/4-6/25/2009	0.5	13.4	0
Boardman River	GTBOCI	148 trapnights	PAT	4/13-6/26/2009	0.5	13.5	0
Carp Lake Outlet	FWS	134 trapnights	PT	4/17-7/3/2009	0.8	12.6	0
Deer Creek	PC	118 trapnights	PAT	4/12-6/12/2009	0.5	12.0	0
East Twin River	PC	43 trapnights	PAT	4/27-6/10/2009	0.5	16.3	0
Elk Lake Outlet	PC	59 trapnights	PAT	4/12-6/12/2009	0.5-1.0	10.8	0
Gr. Trav. Bay (Bowers Harbor)	ISEA	0.17 hours	BT-4.9	7/16/2009	7.8	-----	0
Gr. Trav. Bay (Northport)	ISEA	0.17 hours	BT-4.9	6/17/2009	8.7	-----	0
Gr. Trav. Bay (Omena Bay)	ISEA	0.67 hours	BT-4.9	6/17-9/16/2009	11.2	-----	0
Gr. Trav. Bay (Suttons Bay)	ISEA	14.00 hours	BT-4.9	4/30-10/6/2009	9.0	-----	0
Gr. Trav. Bay (West Arm)	ISEA	7.50 hours	BT-4.9	5/11-9/14/2009	9.1	-----	0
Hog Island Creek	PC	64 trapnights	FN	4/21-6/24/2009	0.5-1.0	11.8	0
Little Bay de Noc	ISEA	1.33 hours	BT-4.9	7/8-7/11/2009	7.7	-----	0
Little Bay de Noc	MIDNR	3.83 hours	BT-3.7	6-10/2009	-----	-----	0
Little Bay de Noc	MIDNR	293 meters	GN-EX1	6-10/2009	-----	-----	0
Little Bay de Noc	MIDNR	1,829 meters	GN-EX2	8-9/2009	-----	-----	0
Little Bay de Noc*	MIDNR	3,218 meters	GN-EX3	8-9/2009	-----	-----	2
Little Manistee River	FWS	164 trapnights	PAT	4/4-6/25/2009	0.5-1.0	13.4	0
Manistique River	FWS	108 trapnights	SPT	5/13-7/6/2009	0.5	16.9	0
Menominee River	FWS	53 trapnights	PAT	4/24-6/17/2009	0.5	14.6	0
Muskegon River	FWS	160 trapnights	PAT	4/6-6/29/2009	1.0-5.0	13.7	0
Nearshore/Offshore	USGS	11.35 hours	BT-12	9-10/2009	5.0-110.0	4.2-16.7	0
Oconto River	FWS	43 trapnights	PAT	4/28-6/11/2009	0.5	15.5	0
Ogontz River	PC	56 trapnights	FN	5/5-6/30/2009	0.5-1.0	13.7	0
Pere Marquette River	FWS	178 trapnights	PAT	4/2-7/1/2009	0.5-1.0	12.9	0
Peshtigo River	FWS	98 trapnights	PAT	4/27-6/16/2009	0.5	14.5	0
St. Joseph River	PC	136 trapnights	PAT	4/9-6/6/2009	0.5	15.6	0
Totals		7.66 hours	BT-3.7				0
		24.01 hours	BT-4.9				0
		11.35 hours	BT-12				0
		120 trapnights	FN				0
		586 meters	GN-EX1				0
		3,475 meters	GN-EX2				0
		6,437 meters	GN-EX3				2
		1,514 trapnights	PAT				0
		134 trapnights	PT				0
		108 trapnights	SPT				0
		Total ruffe (captured incidentally)					2

Table 6. Continued.

2010

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Betsie River	GTBOCI	128 trapnights	PAT	4/13-6/15/2010	0.5-1.0	15.0	0
Big Bay de Noc	MIDNR	3.83 hours	BT-3.7	6-10/2010	-----	-----	0
Big Bay de Noc	MIDNR	293 meters	GN-EX1	6-10/2010	-----	-----	0
Big Bay de Noc	MIDNR	4,682 meters	GN-EX3	8-9/2010	-----	-----	0
Big Manistee	FWS	124 trapnights	PAT	4/16-6/16/2010	0.5	14.7	0
Boardman River	GTBOCI	136 trapnights	PAT	4/12-6/18/2010	0.5	14.4	0
Carp Lake River	FWS	67 trapnights	PT	4/14-6/19/2010	0.8	13.1	0
East Twin River	PC	52 trapnights	PAT	4/12-6/2/2010	0.5	14.8	0
Elk Lake Outlet	PC	59 trapnights	PAT	4/15-6/12/2010	0.5-1.0	12.6	0
Gr. Trav. Bay (Bowers Harbor)	ISEA	0.50 hours	BT-4.9	6/21-9/19/2010	6.4-15.2	-----	0
Gr. Trav. Bay (Northport)	ISEA	0.17 hours	BT-4.9	9/17-18/2010	9.8-14.3	-----	0
Gr. Trav. Bay (Old Mission Harbor)	ISEA	0.33 hours	BT-4.9	9/20/2010	3.4-14.9	-----	0
Gr. Trav. Bay (Omena Bay)	ISEA	0.17 hours	BT-4.9	9/22/2010	7.6-9.5	-----	0
Gr. Trav. Bay (Power Island)	ISEA	0.52 hours	BT-4.9	6/22-9/19/2010	9.8-20.1	-----	0
Gr. Trav. Bay (Suttons Bay)	ISEA	11.88 hours	BT-4.9	4/30-10/5/2010	4.3-17.1	-----	0
Gr. Trav. Bay (West Arm)	ISEA	5.02 hours	BT-4.9	5/12-9/19/2010	4.6-21.3	-----	0
Gr. Trav. Bay (Traverse City)	ISEA	0.67 hours	BT-4.9	7/28-30/2010	7.0-8.8	-----	0
Hog Island Creek	PC	57 trapnights	FN	4/24-6/19/2010	0.5-1.0	14.3	0
Little Bay de Noc	ISEA	0.95 hours	BT-4.9	7/20-24/2010	6.1-17.1	-----	0
Little Bay de Noc*	MIDNR	3.83 hours	BT-3.7	6-10/2010	-----	-----	1
Little Bay de Noc	MIDNR	293 meters	GN-EX1	6-10/2010	-----	-----	0
Little Bay de Noc*	MIDNR	4,680 meters	GN-EX3	8-9/2010	-----	-----	9
Little Manistee	FWS	126 trapnights	PAT	4/15-6/16/2010	0.5-1.0	14.3	0
Manistique River	FWS	56 trapnights	SPT	4/16-6/10/2010	0.5	15.9	0
Menominee River	FWS	58 trapnights	PAT	4/8-6/4/2010	0.5-1.0	16.1	0
Muskegon River	FWS	60 trapnights	PAT	4/16-6/14/2010	1.0-5.0	14.5	0
Nearshore/Offshore	USGS	12.83 hours	BT-12	9-10/2010	5.0-110.0	4.2-16.8	0
Oconto River	FWS	55 trapnights	PAT	4/8-6/1/2010	0.5-1.0	15.4	0
Ogontz River	PC	64 trapnights	FN	4/19-6/21/2010	0.5-1.0	13.5	0
Peshtigo River	FWS	116 trapnights	PAT	4/8-6/4/2010	0.5-1.0	16.2	0
St. Joseph River	PC	108 trapnights	PAT	4/9-6/1/2010	0.5	16.2	0
Totals		7.66 hours	BT-3.7				1
		20.21 hours	BT-4.9				0
		12.83 hours	BT-12				0
		121 trapnights	FN				0
		586 meters	GN-EX1				0
		9,362 meters	GN-EX3				9
		1,022 trapnights	PAT				0
		67 trapnights	PT				0
		56 trapnights	SPT				0
		Total ruffe (captured incidentally)					10

Key to agency:
- FWS = U.S. Fish & Wildlife Service
- GTBOCI = Grand Traverse Band of Ottawa and Chippewa Indian
- ISEA = Inland Seas Education Association
- MIDNR = Michigan Department of Natural Resources
- PC = Private contractor
- USGS = U.S. Geological Survey

Key to symbols:
- * Locations where ruffe were captured.
- ** Approximate effort.

Key to gear:
- BT-3.7 = Bottom trawl (3.7-m headrope)
- BT-4.9 = Bottom trawl (4.9-m headrope)
- BT-12 = Bottom trawl (12-m headrope)
- FN = Fyke net
- GN-EX1 = Gill net (experimental 25 mm-102 mm stretch mesh panels)
- GN-EX2 = Gill net (experimental 25 mm, 38 mm, 50 mm stretch mesh panels
- GN-EX3 = Gill net (experimental 25 mm-127 mm stretch mesh panels)
- PAT = Portable assessment trap
- PT = Permanent trap
- SPT = Semipermanent trap

Key to headings:
- Depth = Average water depth (m) or depth range.
- Temp = Average bottom water temperature (°C) or temperature range.

Table 7. Summary of reported fish sampling conducted in Lake Huron that was capable of incidentally capturing ruffe from 2008 to 2010.

2008

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Albany Creek	CORA	56 trapnights	PAT	4/28-6/23/2008	0.5	11.2	0
Au Sable River	PC	122 trapnights	PAT	4/20-6/20/2008	0.5-1.0	14.6	0
Black River	MIDNR	1.67 hours	BT-11	7/2008	12.2-30.5	-----	0
Carp River	CORA	171 trapnights	FN	4/29-6/27/2008	0.5-1.0	12.5	0
Cheboygan River	FWS	325 trapnights	PT	4/21-6/25/2008	1.0	13.8	0
Devils River	PC	67 trapnights	FN	4/15-6/21/2008	0.5-1.0	13.9	0
East Au Gres River	PC	62 trapnights	PAT	4/19-6/20/2008	0.5-1.0	13.9	0
Greene Creek	FWS	64 trapnights	PAT	4/22-6/25/2008	0.5	13.4	0
Nearshore/Offshore	USGS	4.17 hours	BT-21	10-11/2008	9.0-110.0	-----	0
Nunns Creek	CORA	44 trapnights	PAT	5/12-6/25/2008	0.5	12.3	0
Ocqueoc River	FWS	130 trapnights	PT	4/22-6/26/2008	0.4	14.9	0
St. Marys River	FWS	225 trapnights	PAT	6/13-7/28/2008	0.5-1.0	14.1	0
St. Marys River	DFO	6.67 hours	EF	5-6, 9/2008	1.5	-----	0
Saginaw Bay	MIDNR	5.23 hours	BT-10	9/9-9/17/2008	7.9	19.9	0
Thunder Bay (North Point)	MIDNR	8.00 hours	BT-11	7-8/2008	12.2-30.5	-----	0
Tittabawassee River	PC	56 trapnights	SPT	4/10-6/5/2008	1.0	14.5	0
Trout Creek	CORA	56 trapnights	FN	4/28-6/23/2008	0.5-1.0	12.9	0
Trout River *	FWS	61 trapnights	SPT	4/23-6/23/2008	0.2	13.5	2
Totals		5.23 hours	BT-10				0
		9.67 hours	BT-11				0
		4.17 hours	BT-21				0
		6.67 hours	EF				0
		294 trapnights	FN				0
		573 trapnights	PAT				0
		455 trapnights	PT				0
		117 trapnights	SPT				2
		Total ruffe (captured incidentally)					2

2009

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Albany Creek	CORA	59 trapnights	PAT	4/28-6/26/2009	0.5	12.1	0
Au Sable River	PC	100 trapnights	PAT	4/20-6/9/2009	0.5-1.0	12.5	0
Black River	MIDNR	0.67 hours	BT-11	7/2009	12.2-30.5	-----	0
Carp River	CORA	177 trapnights	FN	4/28-6/26/2009	0.5-1.0	13.4	0
Cheboygan River	FWS	74 trapnights	PT	4/17-6/24/2009	1.0	13.8	0
Devils River	PC	68 trapnights	FN	4/13-6/20/2009	0.5-1.0	14.0	0
East Au Gres River	PC	44 trapnights	PAT	4/20-7/3/2009	1.0	13.4	0
Greene Creek	FWS	57 trapnights	PAT	4/18-6/24/2009	0.5	13.5	0
Nearshore/Offshore	USGS	7.33 hours	BT-21	10-11/2009	9.0-110.0	-----	0
Ocqueoc River	FWS	102 trapnights	PT	5/4-6/24/2009	0.4	15.1	0
St. Marys River	FWS	147 trapnights	PAT	6/10-7/29/2009	0.5-1.0	13.4	0
St. Marys River	SMRFTG	13,411 meters	GN-EX	8/2009	-----	-----	0
St. Marys River	SMRFTG	18.11 hours	EF	9/2009	-----	-----	0
St. Marys River	DFO	6.00 hours	EF	5-6, 9/2009	1.5	-----	0
Saginaw Bay	MIDNR	3.52 hours	BT-10	9/9-9/22/2009	7.9	21.2	0
Thunder Bay (North Point)	MIDNR	5.62 hours	BT-11	7/2009	12.2-30.5	-----	0
Trout Creek	CORA	59 trapnights	FN	4/28-6/26/2009	0.5-1.0	13.3	0
Trout River	FWS	100 trapnights	SPT	5/5-6/24/2009	0.2	12.5	0
Totals		3.52 hours	BT-10				0
		6.29 hours	BT-11				0
		7.33 hours	BT-21				0
		6.00 hours	EF				0
		304 trapnights	FN				0
		13,411 meters	GN-EX				0
		452 trapnights	PAT				0
		176 trapnights	PT				0
		163 trapnights	SPT				0
		Total ruffe (captured incidentally)					0

Table 7. Continued.

2010

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Albany Creek	FWS	46 trapnights	PAT	4/30-6/14/2010	0.5	13.4	0
Au Sable River	PC	124 trapnights	PAT	4/19-6/19/2010	0.5-1.0	16.0	0
Black River	MIDNR	1.33 hours	BT-11	7/2010	12.2-30.5	-----	0
Carp River	FWS	94 trapnights	FN	4/29-6/14/2010	0.5-1.0	15.3	0
Cheboygan River	FWS	136 trapnights	PT	4/14-6/20/2010	1.0	15.6	0
Devils River	PC	64 trapnights	FN	4/12-6/14/2010	0.5-1.0	15.0	0
East Au Gres River	PC	58 trapnights	PAT	4/19-6/15/2010	0.5-1.0	13.4	0
Greene Creek	FWS	120 trapnights	PAT	4/21-6/19/2010	0.5	15.8	0
Nearshore/Offshore	USGS	6.00 hours	BT-21	10-11/2010	9.0-110.0	-----	0
Ocqueoc River	FWS	120 trapnights	PT	4/23-6/21/2010	0.4	16.1	0
St. Marys River	FWS	225 trapnights	PAT	5/26-7/22/2010	0.5-1.0	15.7	0
St. Marys River	FWS	4.80 hours	BT-4.9	8/2010	1.5-7.6	-----	0
St. Marys River	FWS/OMNR	30 trapnights	FN	8/31-9/2/2010	1.2	21.4	0
St. Marys River	FWS/OMNR	2.50 hours	EF	8/30-9/1/2010	1.4	22.4	0
St. Marys River	FWS/OMNR	1.17 hours	BT-4.9	8/30-9/2/2010	4.8	20.2	0
St. Marys River	SMRFTG	22.12 hours	EF	9/2010	-----	-----	0
Saginaw Bay	MIDNR	3.33 hours	BT-10	9/14-9/22/2010	7.6	16.9	0
Thunder Bay (North Point)	MIDNR	5.00 hours	BT-11	7/2010	12.2-30.5	-----	0
Tittabawassee River	PC	66 trapnights	SPT	4/6-6/10/2010	1.0	15.0	0
Trout Creek	FWS	46 trapnights	FN	4/30-6/14/2010	0.5-1.0	12.9	0
Trout River	FWS	110 trapnights	SPT	4/26-6/19/2010	0.2	14.4	0
Totals		1.17 hours	BT-4.9				0
		3.33 hours	BT-10				0
		6.33 hours	BT-11				0
		6.00 hours	BT-21				0
		2.50 hours	EF				0
		234 trapnights	FN				0
		573 trapnights	PAT				0
		256 trapnights	PT				0
		176 trapnights	SPT				0
		Total ruffe (captured incidentally)					0

Key to agency:
- CORA = Chippewa Ottawa Resource Authority
- DFO = Department of Fisheries and Oceans
- FWS = U.S. Fish & Wildlife Service
- MIDNR = Michigan Department of Natural Resources
- OMNR = Ontario Ministry of Natural Resources
- PC = Private contractor
- SMRFTG = St. Marys River Fisheries Task Group
- USGS = U.S. Geological Survey

Key to headings:
- Depth = Average water depth (m) or depth range.
- Temp = Average bottom water temperature (°C).

Key to gear:
- BT-4.9 = Bottom trawl (4.9-m headrope)
- BT-10 = Bottom trawl (10-m headrope)
- BT-11 = Bottom trawl (11-m headrope)
- BT-21= Wing trawl (21-m headrope)
- EF = Electrofishing
- FN = Fyke net
- GN-EX = Gill net (experimental 38.1 to 152.4 mm stretch mesh panels)
- PAT = Portable assessment trap
- PT = Permanent trap
- SPT = Semipermanent trap

Key to symbols:
- * Locations where ruffe were captured.

Table 8. Summary of reported fish sampling conducted in Lake Erie that was capable of incidentally capturing ruffe from 2008 to 2010.

2008

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Cattaraugus Creek	PC	124 trapnights	PAT	4/8-6/9/2008	0.5	11.1	0
Central Basin	ODNR	hours	BT-10.4	5-10/2008	5.0-20.0	-----	0
Grand River	PC	116 trapnights	PAT	4/8-6/5/2008	0.5	14.6	0
Spooner Creek	PC	124 trapnights	PAT	4/8-6/9/2008	0.5	11.1	0
Western Basin	ODNR	19.67 hours	BT-10.7	5-9/2008	7.3	19.6 (B)	0
Western Basin	USGS	16.00 hours	BT-7.9	6, 9, 10/2008	3.0-13.0	7.0-23.0	0
Totals		16.00 hours	BT-7.9				0
		hours	BT-10.4				0
		19.67 hours	BT-10.7				0
		364 trapnights	PAT				0
		Total ruffe (captured incidentally)					0

2009

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Cattaraugus Creek	PC	120 trapnights	PAT	4/26-6/25/2009	0.5	14.3	0
Central Basin	USGS/ODNR	5.83 hours	BT-7.9	5/2009	6.0-25.0	5.8-10.0	0
Central Basin	ODNR	hours	BT-10.4	5-10/2009	5.0-20.0	-----	0
Grand River	PC	142 trapnights	PAT	4/15-6/5/2009	0.5	17.9	0
Spooner Creek	PC	120 trapnights	PAT	4/26-6/25/2009	0.5	14.3	0
Western Basin	ODNR	20.17 hours	BT-10.7	5-9/2009	7.4	19.7 (B)	0
Western Basin	USGS	16.00 hours	BT-7.9	6, 9, 10/2009	3.0-13.0	7.0-23.0	0
Totals		21.83 hours	BT-7.9				0
		hours	BT-10.4				0
		20.17 hours	BT-10.7				0
		382 trapnights	PAT				0
		Total ruffe (captured incidentally)					0

2010

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Cattaraugus Creek	PC	124 trapnights	PAT	4/18-6/18/2010	0.5	13.4	0
Central Basin	ODNR	hours	BT-10.4	9/2010	5.0-20.0	-----	0
Spooner Creek	PC	126 trapnights	PAT	4/17-6/18/2010	0.5	12.3	0
Grand River	PC	147 trapnights	PAT	4/13-5/31/2010	0.5	17.1	0
Western Basin	ODNR	19.67 hours	BT-10.7	5-9/2010	7.2	18.5 (B)	0
Western Basin	USGS	12.25 hours	BT-7.9	6, 9, 10/2010	3.0-11.0	17.0-26.0	0
Totals		12.25 hours	BT-7.9				0
		hours	BT-10.4				0
		19.67 hours	BT-10.7				0
		397 trapnights	PAT				0
		Total ruffe (captured incidentally)					0

Key to agency:
- ODNR = Ohio Department of Natural Resources
- PC = Private contractor
- USGS = U.S. Geological Survey

Key to gear:
- BT-7.9 = Bottom trawl (7.9-m headrope)
- BT-10.4 = Bottom trawl (10.4-m headrope)
- BT-10.7 = Bottom trawl (10.7-m headrope)
- PAT = Portable assessment trap

Key to column headings:
- Depth = Average water depth (m) or depth range.
- Temp = Average surface water temperature (°C) or temperature range. Bottom temperature is denoted with "B".

Table 9. Summary of reported fish sampling conducted in Lake Ontario that was capable of incidentally capturing ruffe from 2008 to 2010.

2008

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Black River	PC	222 trapnights	PAT	4/7-6/20/2008	0.5	16.1	0
Grindstone Creek	PC	67 trapnights	PAT	4/7-6/13/2008	0.5	16.1	0
Little Salmon River	PC	67 trapnights	PAT	4/7-6/13/2008	0.5	-----	0
Nearshore/Offshore	USGS/NYSDEC	37.50 hours*	BT-18	4-7/2008, 10/2008	8.0-150.0	-----	0
Sterling Creek	PC	67 trapnights	PAT	4/7-6/13/2008	0.5	16.3	0
Sterling Valley Creek	PC	67 trapnights	PAT	4/7-6/13/2008	0.5-1.0	-----	0
Totals		37.50 hours*	BT-18				0
		490 trapnights	PAT				0
		Total ruffe (captured incidentally)					0

2009

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Black River	PC	213 trapnights	PAT	4/17-6/27/2009	0.5	15.9	0
Grindstone Creek	PC	60 trapnights	PAT	4/13-6/12/2009	0.5	17.1	0
Little Salmon River	PC	60 trapnights	PAT	4/13-6/12/2009	0.5	17.0	0
Nearshore/Offshore	USGS/NYSDEC	43.00 hours*	BT-18	4-7/2009, 10/2009	8.0-150.0	-----	0
Sterling Creek	PC	60 trapnights	PAT	4/13-6/12/2009	0.5	16.8	0
Sterling Valley Creek	PC	60 trapnights	PAT	4/13-6/12/2009	0.5-1.0	16.8	0
Totals		43.00 hours*	BT-18				0
		453 trapnights	PAT				0
		Total ruffe (captured incidentally)					0

2010

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Black River	PC	171 trapnights	PAT	4/12 - 6/7/2010	0.5	15.0	0
Grindstone Creek	PC	55 trapnights	PAT	4/11 - 6/4/2010	0.5	17.5	0
Little Salmon River	PC	55 trapnights	PAT	4/11 - 6/4/2010	0.5	17.4	0
Nearshore/Offshore	USGS/NYSDEC	40.25 hours*	BT-18	4-7/2010, 10/2010	8.0-150.0	-----	0
Sterling Creek	PC	55 trapnights	PAT	4/11 - 6/4/2010	0.5-1.0	17.3	0
Sterling Valley Creek	PC	55 trapnights	PAT	4/11 - 6/4/2010	0.5	17.3	0
Totals		40.25 hours*	BT-18				0
		391 trapnights	PAT				0
		Total ruffe (captured incidentally)					0

Key to agency:
NYSDEC = New York State Department of Environmental Conservation
PC = Private contractor
USGS = U.S. Geological Survey

Key to gear:
BT-18 = Bottom trawl (18.0-m headrope)
PAT = Portable assessment trap

Key to column headings:
Depth = Average water depth (m) or depth range.
Temp = Average surface water temperature (°C).

Key to symbols:
* Approximate effort.