

## SURVEILLANCE FOR RUFFE IN THE GREAT LAKES, 2014

Anjanette Bowen  
U.S. Fish and Wildlife Service  
Alpena Fish and Wildlife Conservation Office  
480 W. Fletcher Street  
Alpena, MI 49707  
989-356-5102 Ext. 1014  
[Anjanette\\_Bowen@fws.gov](mailto:Anjanette_Bowen@fws.gov)

Sandra Keppner  
U.S. Fish and Wildlife Service  
Lower Great Lakes Fish and Wildlife  
Conservation Office  
1101 Casey Road  
Basom, NY 14013  
585-948-5445 Ext. 2226  
[Sandra\\_Keppner@fws.gov](mailto:Sandra_Keppner@fws.gov)

### BACKGROUND

The Eurasian ruffe *Gymnocephalus cernuus* (ruffe) is an Eurasian percid that was likely introduced to the Great Lakes during the mid-1980s with ballast water that was discharged from an ocean-going ship (Pratt et al. 1992). Ruffe were first discovered in Lake Superior at the St. Louis River Estuary (SLRE), Minnesota/Wisconsin, where their population increased rapidly and by 1990 ruffe became the most abundant fish captured from the SLRE in bottom trawls. According to U.S. Geological Survey (USGS) sampling records, the SLRE ruffe population peaked in 1995 at about eight million ruffe captured in trawls, then subsequently declined to about two million in trawls by 2004; however, ruffe remained the most abundant species captured in trawls through 2004 (the USGS terminated SLRE trawl assessments after 2004 – USGS unpublished information). By 1991, ruffe were detected in Thunder Bay Harbour, Ontario, (Busiahn 1997); and by 1992 ruffe had spread to tributaries along the southern shore of Lake Superior (Slade and Kindt 1992).

Due to potential competition for food and space, ruffe pose a threat to native fish populations (Ruffe Task Force 1992); however the impacts of ruffe in the Great Lakes are not fully known. Experimental research conducted by the University of Minnesota Duluth revealed that ruffe consume a significant amount of benthic macro invertebrate energy (Schuldt et al. 1999). In a presentation of this research, co-author Carl Richards, University of Minnesota Natural Resources Research Institute, stated: “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.” The experiment also demonstrated significant declines in the growth of yellow perch *Perca flavescens*, when exposed to any ruffe densities (Henson 1999).

Similarly, trawl data from 1995-2002 in three Wisconsin tributaries east of the St. Louis River suggest that yellow perch abundance declined in years that ruffe abundance increased (Evrard et al. 1998; Czypinski et al. 2002). This trend was analyzed and found to be weakly significant for all three tributaries combined (D.H. Ogle, Northland College unpublished data). In contrast, a statistical analysis of bottom trawl data conducted by USGS showed no significant relationship between the increasing ruffe population and declining native fish populations in the St. Louis River (Bronte et al. 1998).

The Aquatic Nuisance Species Task Force declared the ruffe to be a “nuisance species” in the spring of 1992 due to increasing abundance, expansion outside the SLRE, and speculation about potential impacts on native fish

populations. 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 early 1995, and revised following the fall 1995 discovery of ruffe in Lake Huron (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).

Dedicated ruffe surveillance efforts, designed and implemented specifically to find and collect ruffe, 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) and the Ontario Ministry of Natural Resources and Forestry-Upper Great Lakes Management Unit (OMNRF-UGLMU). Since 1992, the range of ruffe has expanded with discoveries in Lake Huron (Thunder Bay River) in 1995, Lake Michigan (northern Green Bay) in 2002, and across the south shore of Lake Superior (to Whitefish Bay) in 2006 (Figure 1). A chronology of ruffe detection for the Great Lakes Basin is available in the Appendix. Currently, dedicated ruffe surveillance efforts are conducted in Lake Huron by the USFWS-Alpena Fish and Wildlife Conservation Office (USFWS-Alpena) and in Lakes Erie and Ontario by the USFWS-Lower Great Lakes Fish and Wildlife Conservation Office (USFWS-Lower Great Lakes).

Other management agencies report sampling that may capture ruffe incidentally using fishing gear to which ruffe are vulnerable, even though ruffe are not the target of their efforts. Fishery assessment methods and results were provided to us from fishery management and/or research agencies per our request. Content within this report is not a complete inventory of fishery assessment gear capable of capturing ruffe by all the agencies working in the Great Lakes, only that which was known or reported to us.

The following information summarizes dedicated ruffe surveillance conducted in 2014, and documents fish sampling that was reported by other organizations that were capable of capturing ruffe over the same time period.

## **OBJECTIVES**

The primary objective of ruffe surveillance was early detection and description of age and/or size composition. The secondary objectives were to describe the fish community at each location surveyed, and to monitor locations on the periphery of their range or where ruffe have been reported but populations are unknown. Lake Superior peripheral locations included areas around the established population at Thunder Bay Harbour, Ontario and the Tahquamenon River in Whitefish Bay, Michigan. Lake Michigan peripheral locations included areas around the established population at Little Bay de Noc (LBDN) of northern Green Bay and its tributaries and nearshore areas. Lake Huron peripheral locations included Thunder Bay in Alpena, Michigan; the Trout River and nearshore areas of Rogers City, Michigan; and the Cheboygan River and nearshore areas of Cheboygan, Michigan.

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

## **METHODS**

Ruffe surveillance was focused on areas that ruffe could potentially colonize via ballast water from inter- and intra-lake shipping as well as areas with habitat known to be attractive to ruffe (i.e. deep channels and pools, low

water clarity, soft substrate). Surveillance was conducted in natural channels, estuaries, embayments, pools, tributary mouths, canals, dredged shipping channels, and in or near shipping ports. Ruffe surveillance was usually conducted in water depths from 3 to 8 meters (m) and often sampled the deepest habitat at the site as determined by electronic depth sounder. However, shallow areas and areas with vegetation were also surveyed.

The primary gear used was a nylon bottom trawl (4.9 m head rope), commercially manufactured with a 3.8 cm stretch mesh body, 31.8 mm stretch mesh cod end, and a 6.25 to 12.5 mm stretch mesh inner liner. Bottom trawls were pulled with a variety of vessels and were deployed and retrieved either by hand or with a winch (hydraulic and electric) run by generator. 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).

Surface and bottom water temperature was recorded prior to each established trawl tow (transect), except when consecutive tows were conducted in close proximity to each other. Dissolved oxygen levels and water transparency were also recorded at each location sampled in Lakes Erie and Ontario. Depth was recorded at the start and finish of individual tows (and at several additional intervals on Lakes Erie and Ontario), 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 sampling location. Tows were directed along and across contours, but the majority was along contour.

In addition to bottom trawls, other gear employed included mini-fyke nets, boat electrofishing, and backpack electrofishing. Mini-fyke nets consisted of seven 0.7 m x 0.7 m rectangles interconnected with 25.4 mm stretch mesh netting and a 7.6 m lead. Mini-fyke nets were set overnight. Electrofishing used pulsed DC current and boat electrofishing was conducted during the night and backpack electrofishing was conducted during the day. Sampling location, water depth, and water temperature were recorded during each sampling effort.

Catches of fish were sorted by species and counted, and the individual 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 *Neogobius melanostomus*, white perch *Morone americana*, sea lamprey *Petromyzon marinus*, 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 either frozen or in 95% EtOH for later identification.

Efforts to increase public awareness of ruffe were conducted. *Ruffe Watch* identification cards and other information were distributed to harbor masters, marinas, and bait vendors, as well as individual private citizens near sampling locations on the Great Lakes. Information summaries, newsletter articles, and presentations were also conducted or provided.

Agency partners reported all sampling to which ruffe were vulnerable in addition to dedicated surveillance efforts to help provide coverage for ruffe detection across the Great Lakes. Agency partners also expanded awareness and helped promote reporting ruffe sightings.

## **RESULTS**

### **RUFFE SURVEILLANCE**

Dedicated ruffe surveillance was conducted by the USFWS in Lakes Huron, Erie, and Ontario in 2014; no ruffe were captured (Figures 2 and 3, and Tables 1, 2, and 3). No dedicated ruffe surveillance was conducted in Lake Michigan or Lake Superior.

### **LAKE HURON**

The USFWS-Alpena conducted ruffe surveillance bottom trawling (4.9 m head rope) during the fall at four previously established locations in U.S. waters on Lake Huron at the Au Gres River mouth in Au Gres, Michigan; Port of Calcite in Rogers City, Michigan; Port Dolomite in Cedarville, Michigan; and the Thunder Bay River mouth/shipping channel in Alpena, Michigan (Figure 2 and Table 1). No ruffe were captured. Staffing issues prevented fall sampling at three other dedicated locations. A total of 28 tows were completed in September and November, comprising 2.3 hours of effort. Seventeen taxa were collected. The majority of the catch consisted of round gobies (44%). The greatest catch (74 fish/minute) was experienced at the Au Gres River mouth. Round gobies were the most ubiquitous species and were captured at all but one of the sampling locations. A complete listing of all fish species captured is available upon request from the USFWS-Alpena.

Additional sampling was conducted by the USFWS-Alpena in historic ruffe capture locations during the spring and fall 2014 using backpack electrofishing, boat electrofishing, and mini-fyke nets. No ruffe were captured. Sampling locations included the Thunder Bay River and Lafarge port in Alpena, Michigan; Trout River in Rogers City, Michigan; and Cheboygan River in Cheboygan, Michigan (Figure 2 and Table 1). Sampling in the Alpena area consisted of nighttime boat electrofishing for 1.0 hour in the Thunder Bay River during May, nighttime boat electrofishing for 1.1 hours at the Lafarge port during May, 15 net lifts with mini-fyke nets in the Thunder Bay River during May, and 12 net lifts with mini-fyke nets in the Thunder Bay River during September. Sampling in the Rogers City area consisted of daytime backpack electrofishing in the Trout River for 0.5 hour during November. Sampling in the Cheboygan area consisted of nighttime boat electrofishing in the Cheboygan River for 1.2 hours during May and 16 net lifts with mini-fyke nets during September.

### **ST. MARYS RIVER**

The USFWS-Alpena incorporated ruffe surveillance in the St. Marys River into a new nonindigenous species early detection and monitoring program that is conducted in the St. Marys River and across the Great Lakes by the USFWS. Findings from this program are summarized under Reported Fish Sampling Capable of Incidentally Capturing Ruffe.

### **LAKE ERIE**

The USFWS-Lower Great Lakes conducted ruffe surveillance bottom trawling (4.9 m head rope) at seven previously established harbor locations in U.S. waters on Lake Erie including Ashtabula, Ohio; Buffalo, New York; Cleveland, Ohio; Conneaut, Ohio; Erie, Pennsylvania; Sandusky, Ohio; and the Maumee River in

Toledo, Ohio (Figure 3 and Table 2). No ruffe were captured. All sites were sampled once in spring 2014 (May), and at all locations except Sandusky and Toledo during fall 2014 (October) because of equipment breakdown.

The majority of the catch consisted of emerald shiners *Notropis atherinoides* (94%). The remainder of the catch was composed of common shiner *Luxilus cornutus*, channel catfish *Ictalurus punctatus*, freshwater drum *Aplodinotus grunniens*, gizzard shad *Dorosoma cepedianum*, round goby, trout-perch *Percopsis omiscomaycus*, white bass *Morone chrysops*, white perch, and yellow bullhead *Ameiurus natalis*. One trawl in Buffalo with a catch of 880 emerald shiners was the main source of the high percentage of that species. The fall catch was composed of 14 species. The majority of the fall catch also consisted of emerald shiners (96%). The remainder of the catch was composed of bluegill *Lepomis macrochirus*, common shiner, gizzard shad, golden shiner *Notemigonus crysoleucas*, pumpkinseed *Lepomis gibbosus*, round goby, rock bass *Ambloplites rupestris*, rainbow smelt *Osmerus mordax*, spottail shiner *Notropis hudsonius*, white perch, white sucker *Catostomus commersonii*, yellow perch, and an unknown Centrarchidae species. Similar to the spring catch, a single trawl in Ashtabula that contained 3,206 emerald shiners accounted for the high percentage of that species in the overall catch. A more detailed summary of all fish species captured at these locations is available upon request from the USFWS-Lower Great Lakes.

## **LAKE ONTARIO**

The USFWS-Lower Great Lakes conducted ruffe surveillance bottom trawling (4.9 m head rope) during the spring (May) and fall (October) 2014 along the southern shore of Lake Ontario at Rochester Harbor, New York in the Genesee River near its mouth at Lake Ontario (Figure 3 and Table 3). No ruffe were captured. The spring catch was composed of three species with one individual each: channel catfish, golden redhorse *Moxostoma erythrurum*, and spottail shiner. The fall catch was composed of 10 species. The majority of the catch consisted of emerald shiners (44%) and spottail shiners (16%). Alewife *Alosa pseudoharengus*, channel catfish, freshwater drum, round goby, rainbow smelt, trout-perch, walleye *Sander vitreus*, and white perch were a minority of the catch (each accounted for less than 10%). A more detailed summary of all fish species captured at these locations is available upon request from the USFWS-Lower Great Lakes.

## **LAKE MICHIGAN RAPID RESPONSE**

The Illinois Department of Natural Resources (ILDNR) led an invasive fish surveillance exercise on May 27-29, 2014 in Calumet Harbor and nearshore waters of Indiana and Illinois on Lake Michigan that targeted ruffe (ILDNR News Release 5/2014). The effort was initiated by ruffe environmental DNA (eDNA) discovered in water samples collected from Calumet Harbor by The Nature Conservancy in 2013. The goal of the exercise was to strengthen invasive species response coordination among Great Lakes states. Netting and electrofishing efforts were conducted by ILDNR and Indiana Department of Natural Resources (INDNR), and other partners including Michigan Department of Natural Resources (MIDNR), Minnesota Department of Natural Resources, USFWS, USGS, U.S. Coast Guard, U.S. Army Corps of Engineers, and Illinois Natural History Survey among others. No ruffe were captured.

Personnel from the USFWS-Green Bay Fish and Wildlife Conservation Office (USFWS-Green Bay) provided assistance with this exercise (Figure 23 and Table 5), and their sampling effort consisted of eight trawl tows, five minnow trap array lifts, five Windermere trap lifts, and five electrofishing transects (1.0 hour electrofishing effort).

## **REPORTED FISH SAMPLING CAPABLE OF INCIDENTALLY CAPTURING RUFFE**

Several agencies and organizations reported other fish sampling that was capable of capturing ruffe incidentally during 2014. Information was provided for each of the Great Lakes, the St. Marys River, and the St. Clair/Detroit River Waterway.

### **LAKE SUPERIOR**

The USGS-Lake Superior Biological Station (USGS-LSBS), Wisconsin Department of Natural Resources-Lake Superior Field Unit (WIDNR-Superior), Department of Fisheries and Oceans Canada-Great Lakes Laboratory for Fisheries and Aquatic Sciences (DFO-GLLFAS), Lake Superior State University (LSSU), Bay Mills Indian Community (BMIC), USFWS-Marquette Biological Station (USFWS-MBS), USFWS-Ashland, and OMNRF-UGLMU reported other fish sampling that was capable of capturing ruffe in Lake Superior (Figures 4, 5, and 6; and Table 4). These activities captured a total of 562 ruffe across Lake Superior at the Thunder Bay Harbour, Kaministiquia River, St. Louis River, Apostle Islands, Chequamegon Bay, Misery River, and Whitefish Bay (Naomikong Creek, Tahquamenon Bay-shallows, and Pendills Creek). Ruffe findings in eastern Lake Superior at Naomikong Creek (5 ruffe) and Pendills Creek (1 ruffe) were new sightings at tributaries within the existing ruffe range on Whitefish Bay.

Thunder Bay Harbour, Ontario Personnel from the USFWS-Ashland and OMNRF-UGLMU conducted sampling at Thunder Bay Harbour from August-September 2014 as part of an early detection and monitoring program to locate the presence and relative abundance of new nonindigenous fish (Figure 4 and Table 4). A total of 32 ruffe were captured (20 in trawls and 12 in fyke nets), all within the existing ruffe range. Sampling consisted of 20 paired fyke net lifts (paired fyke nets consist of one lead with a fyke net at each end), 0.8 hour bottom trawling (4.9 m head rope), and 3.3 hours electrofishing.

Kaministiquia River and Goulais River, Ontario Personnel from the DFO-GLLFAS conducted sampling at the Kaministiquia River and Goulais River in Ontario, Canada during August-September 2014 (Figure 5 and Table 4). Eight ruffe were captured (6 electrofishing, 1 in fyke nets, and 1 in trawls), all from the Kaministiquia River and within the existing ruffe range. Beach seines (15 m beach seine), trawls, trammel nets, fyke nets (1.3 m box fyke net), and boat electrofishing gear were used to sample the fish community. A total effort of 8 seine hauls, 0.8 hour trawling effort, 0.3 hour trammel netting effort, 9 fyke net lifts, and more than 3.1 hours electrofishing were conducted.

St. Louis River, Wisconsin Personnel from the USFWS-Ashland conducted sampling at the St. Louis River during August 2014 as part of an early detection and monitoring program to locate the presence and relative abundance of new nonindigenous fish (Figure 4 and Table 4). A total of 139 ruffe were captured (8 in fyke nets, 130 in trawls, and 1 electrofishing), all within the existing ruffe range. Sampling consisted of 20 paired fyke net lifts (paired fyke nets consist of one lead with a fyke net at each end), 0.8 hour bottom trawling (4.9 m head rope), and 7.0 hours electrofishing.

Apostle Islands and Chequamegon Bay, Wisconsin Personnel from the WIDNR-Superior conducted annual sampling to index the fish community in western waters of Lake Superior at management unit W-2, which includes the waters of the Apostle Islands and Chequamegon Bay in Wisconsin (Figure 4 and Table 4). A total of 170 ruffe were captured, all within the existing ruffe range. Sampling took place during July-August 2014 and consisted of 39 net lifts of a 1,097 m graded mesh gill net that included two panels (38.1 mm and 50.8 mm mesh) to which ruffe were vulnerable.

Chequamegon Bay, Wisconsin Personnel from the USFWS-Ashland conducted sampling at Chequamegon Bay during August 2014 as part of an early detection and monitoring program to locate the presence and relative abundance of new nonindigenous fish (Figure 4 and Table 4). A total of 72 ruffe were captured (23 in fyke nets, 38 in trawls, and 11 electrofishing), all within the existing ruffe range. Sampling consisted of 15 paired fyke net lifts (paired fyke nets consist of one lead with a fyke net at each end), 1.3 hours bottom trawling (4.9 m head rope), and 2.5 hours electrofishing.

Personnel from the USGS-LSBS conducted bottom trawling (5.5 m head rope) in Chequamegon Bay during July 2014 (Figure 6 and Table 4). A total of 126 ruffe were captured, all within the existing ruffe range. Effort consisted of one ten minute tow conducted at each of 32 locations within the bay for 5.3 hours of effort.

Lake Superior Nearshore/Offshore Personnel from the USGS-LSBS conducted spring and summer bottom trawling (11.9 m head rope) in U.S. and Canadian waters of Lake Superior (Figure 6 and Table 4). One ruffe was captured near the Apostle Islands, at a nearshore location within the existing ruffe range. Nearshore sampling was conducted during spring 2014 (May-June) at 72 locations for a total of 29.1 hours of effort. Offshore sampling was conducted during summer 2014 (July) at 30 locations for a total of 10.0 hours of effort.

Whitefish Bay, Michigan Personnel from LSSU and BMIC conducted summer 2014 (June-August) sampling in nearshore areas of Whitefish Bay near Naomikong Creek, Pendills Creek, Big Pine River, Tahquamenon Bay (Shallows), and Pendills Bay (Narrows) (Figure 4 and Table 4). Sampling was conducted with a beach seine (46 m seine) and 21.3 m graded mesh gill net (9.5 mm to 38.1 mm stretch mesh) for a total of 57 seine hauls and 60 net lifts. A total of eleven ruffe were captured from Naomikong Creek (5 ruffe in gill nets), Tahquamenon Bay (Shallows) (5 ruffe in gill nets), and Pendills Creek (1 ruffe in a seine).

Captures of ruffe from Naomikong Creek and Pendills Creek were new sightings from tributaries to the existing ruffe range on Whitefish Bay. Ruffe were first captured from the Tahquamenon River in the spring of 2006 and then in Tahquamenon Bay in 2011. There have been other recent undocumented reports of ruffe in Whitefish Bay.

Lake Superior South Shore Tributaries in Wisconsin and Michigan Personnel from the USFWS-MBS worked with staff from the Great Lakes Indian Fish and Wildlife Commission (GLIFWC), National Park Service (NPS), Red Cliff Band of Lake Superior Chippewa (RCBLS), and private contractors to assess sea lamprey abundance in 17 southern Lake Superior tributaries (Wisconsin and Michigan) (Figure 4 and Table 4). Three ruffe were captured from the Misery River, a known location where ruffe were last captured in 2012. Sampling was conducted from May-July 2014 with fyke nets, permanent traps, and portable assessment traps for a total of 903 net/trap lifts of effort. A summary of fish species captured at these locations is available upon request from the USFWS-MBS.

Unconfirmed Sightings No unconfirmed sightings were reported for Lake Superior.

## **LAKE MICHIGAN**

The USGS-Great Lakes Science Center (USGS-GLSC), MIDNR-Marquette Fisheries Research Station (MIDNR-Marquette), USFWS-MBS and USFWS-Ludington Biological Station (USFWS-LBS), USFWS-Green Bay, WIDNR-Peshtigo Service Center (WIDNR-Peshtigo), and Inland Seas Education Association (ISEA) reported other fish sampling capable of capturing ruffe in Lake Michigan (Figures 4, 7, and 8; and Table 5). 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. Ruffe were not reported from outside of the known range.

Little Bay de Noc, Michigan Since 1988, personnel from the MIDNR-Marquette office have conducted annual summer fishery assessments in Green Bay at LBDN using bottom trawls (3.7 m head rope) (Figure 7 and Table 5). A total of 10 trawl tows for 1.7 hours effort were conducted from June-October 2014. No ruffe were captured.

Since 2009, personnel from the MIDNR-Marquette office have also conducted annual fall fishery surveys to assess the fish community of northern Lake Michigan at LBDN (Figure 7 and Table 5). Sampling gear consisted of 97.5 m graded mesh gill nets that included a 25 mm stretch mesh panel to which ruffe were vulnerable. A total of 32 net lifts were conducted from August-September 2014. Five ruffe were captured, all within the existing range.

Big Bay de Noc, Michigan Personnel from the MIDNR-Marquette office conducted summer 2014 assessments in Green Bay at BBDN that were similar to those conducted in LBDN (described above) using bottom trawls (Figure 7 and Table 5). A total of 10 trawl tows for 1.7 hours effort were conducted from June-October 2014. No ruffe were captured.

Personnel from the MIDNR-Marquette office also conducted an annual fall fishery survey at BBDN that was similar to that conducted in LBDN (described above) to assess the fish community of northern Lake Michigan (Figure 7 and Table 5). A total of 48 net lifts were conducted from August-September 2014. No ruffe were captured.

Personnel from ISEA, a nonprofit environmental education organization, conducted bottom trawling (4.9 m head rope) in BBDN during June 2014 as part of their educational efforts targeting school groups (mainly grades 5-7) (Figure 4 and Table 5). No ruffe were captured following 0.7 hours of effort.

Manistique and Naubinway, Michigan Personnel from the MIDNR-Marquette office conducted summer 2014 bottom trawling in northern Lake Michigan near Manistique, Michigan and fall 2014 gill netting near Manistique and Naubinway, Michigan (described above for LBDN and BBDN) (Figure 7 and Table 5). No ruffe were captured following a total of 10 trawl tows for 1.7 hours trawling effort in Manistique and 21 net lifts in Manistique (10 net lifts) and Naubinway (11 net lifts).

Green Bay, Wisconsin Personnel from the WIDNR-Peshtigo office conducted fish sampling in Green Bay with a beach seine and trawl from June-August 2014 (Figure 4 and Table 5). No ruffe were captured following seine hauls (15.2 m beach seine) at 15 locations for a total of 52 seine hauls and 793 m seining effort, and trawling at 12 locations for a total of 75 trawl tows and 6.3 hours trawling effort.

Personnel from the WIDNR-Peshtigo office also conducted fish sampling with paired fyke nets at Little Tail Point in southern Green Bay during May 2014 (Figure 4 and Table 5). No ruffe were captured following sampling at three locations for a total of 36 net lifts of effort.

Green Bay, Wisconsin; Burns Harbor, Indiana; and Milwaukee, Wisconsin Personnel from the USFWS-Green Bay conducted sampling in Green Bay, Burns Harbor, and Milwaukee from August-November 2014 as part of an early detection and monitoring program to locate the presence and relative abundance of new nonindigenous fish (Figure 4 and Table 5). No ruffe were captured. Sample gear consisted of fyke nets (0.9 m x 1.5 m box, 12.7 mm #126 mesh), mini-fyke nets (0.7 m x 1.0 m box, 3.175 mm #35 mesh), baited minnow trap arrays (five minnow traps tethered to one line, spaced 7.6 m apart), and electrofishing. A variety of

habitats were sampled, but in general fyke and mini-fyke nets were located in 1-2 m of water, minnow trap arrays were deployed in 3-10 m of water, and electrofishing occurred in 1-3 m of water.

Green Bay sampling consisted of six fyke net lifts, six mini-fyke net lifts, 25 minnow trap array lifts, and 39 electrofishing runs for a total of 7.1 hours electrofishing effort. Burns Harbor sampling consisted of nine fyke net lifts, 10 mini-fyke net lifts, 10 minnow trap array lifts, 21 micromesh gill net lifts for a total of 28.4 hours netting effort, and 22 electrofishing runs for a total of 4.1 hours electrofishing effort. Milwaukee sampling consisted of 6 fyke net lifts, 6 mini-fyke net lifts, 25 minnow trap array lifts, eight micromesh gill net lifts for a total of 20.4 hours netting effort, and 21 electrofishing runs for 4.0 hours electrofishing effort.

Grand Traverse Bay, Petoskey, Leland, Frankfort, and Lake Charlevoix in Michigan Personnel from ISEA completed 158 trawl tows of 10 minute duration for a total of 26.5 hours bottom trawling effort in Grand Traverse Bay (including Suttons Bay, West Grand Traverse Bay, and Elk Rapids), Petoskey, Leland, Frankfort, and Lake Charlevoix (Figure 4 and Table 5). No ruffe were captured.

Lake Michigan Tributaries in Wisconsin and Michigan Personnel from the USFWS-MBS/LBS worked with staff from the Grand Traverse Band of Ottawa and Chippewa Indians (GTBOCI) and private contractors to conduct sampling in 17 Lake Michigan tributaries to assess sea lamprey abundance (Figure 4 and Table 5). No ruffe were captured. Sampling was conducted from April-June 2014 using fyke nets, permanent traps, portable assessment traps, and semi-permanent traps for a total of 991 net/trap lifts effort. Four tributaries were located within or on the periphery of the detected ruffe range in Green Bay. A summary of fish species captured at these locations is available upon request from the USFWS-MBS.

Lake Michigan Nearshore/Offshore Personnel from the USGS-GLSC conducted annual fall bottom trawling (12 m head rope) at seven locations in Lake Michigan including Manistique, Michigan; Frankfort, Michigan; Ludington, Michigan; Saugatuck, Michigan; Waukegan, Illinois; Port Washington, Wisconsin; and Sturgeon Bay, Wisconsin to assess prey fish community abundance during September 2014 (Figure 8 and Table 5). No ruffe were captured. Ten minute trawl tows were conducted at 5-135 m depths for a total of 68 tows and 9.9 hours of effort.

Unconfirmed Sightings No unconfirmed sightings were reported for Lake Michigan.

## **ST. MARYS RIVER**

The USFWS-Ashland, OMNRF-UGLMU, DFO-GLLFAS, St. Marys River Fisheries Task Group (SMRFTG), USFWS-MBS, and USFWS-Alpena reported other fish sampling that was capable of capturing ruffe in the St. Marys River (Figures 4 and 5, and Tables 4 and 6). No ruffe were captured.

St. Marys River-Upstream of Locks Personnel from the USFWS-Ashland and OMNRF-UGLMU conducted sampling in U.S. and Canadian waters of the St. Marys River upstream of the Soo Locks from August-September 2014 as part of an early detection and monitoring program to locate the presence and relative abundance of new nonindigenous fish (Figure 4 and Table 4). No ruffe were captured. Sampling consisted of 20 paired fyke net lifts (paired fyke nets consist of one lead with a fyke net at each end), 0.8 hours bottom trawling (4.9 m head rope), and 2.0 hours electrofishing.

St. Marys River-Locks Downstream Personnel from the USFWS-Alpena and OMNRF-UGLMU conducted sampling in U.S. and Canadian waters of the St. Marys River downstream of the Soo Locks to De Tour Village, Michigan during August and October 2014 as part of an early detection and monitoring program to

locate the presence and relative abundance of new nonindigenous fish (Figure 4 and Table 6). No ruffe were captured. Sampling was similar to sampling conducted in the upper St. Marys River by the USFWS-Ashland (see above). Effort consisted of 15 paired fyke net lifts (paired fyke nets consist of one lead with a fyke net at each end), 1.3 hours bottom trawling (4.9 m head rope), and 1.7 hours nighttime electrofishing.

River wide The SMRFTG is an international multiagency group that was established in 1997 by the Great Lake Fishery Commission's Lake Huron Committee (LHC). Member agencies include the MIDNR, OMNRF, DFO, Inter-Tribal Fisheries and Assessment Program (ITFAP), USGS, USFWS, and others. The SMRFTG conducted annual fall nighttime boat electrofishing in September 2014 to assess juvenile walleye at seven locations for a total of 20 transects across U.S. and Canadian waters of the St. Marys River (Figure 4 and Table 6). No ruffe were captured. Sampling locations included the Sault area, Lake Nicolet, Lake George, Lake Munuscong, Raber Bay, Potagannissing Bay, and St. Joseph Channel. A total of 23.2 hours of effort was conducted.

Personnel from the DFO-GLLFAS conducted nighttime boat electrofishing in the St. Marys River during June 2014 (Figure 5 and Table 6). No ruffe were captured following 7.8 hours of effort.

Personnel from the USFWS-MBS conducted sampling in the St. Marys River to assess sea lamprey abundance (Figure 4 and Table 6). No ruffe were captured. Sampling was conducted from June-August 2014 using portable assessment traps. A total of 262 trap lifts were conducted. A summary of fish species captured at these locations is available upon request from USFWS-MBS.

Unconfirmed Sightings No unconfirmed sightings were reported for the St. Marys River.

## **LAKE HURON**

The Michigan Department of Natural Resources-Alpena Fisheries Research Station (MIDNR-Alpena), Michigan Department of Natural Resources-Lake St. Clair Fisheries Research Station (MIDNR-Lake St. Clair), DFO-GLLFAS, USFWS-MBS/LBS, and USFWS-Alpena reported other fish sampling that was capable of capturing ruffe in Lake Huron (Figures 4 and 5, and Table 6). No ruffe were captured.

Les Cheneaux Islands, Michigan Since 1969, personnel from the MIDNR-Alpena office have conducted an annual fall survey in the Les Cheneaux Islands to gauge trends and assess the current status of the fisheries resources (Figure 4 and Table 6). No ruffe were captured following six gill net lifts from September-October 2014. Each gill net included a 30.5 m panel of 38 mm stretch mesh to which ruffe would be vulnerable.

Thunder Bay, Michigan Personnel from the MIDNR-Alpena office conducted bottom trawling from July-August 2014 at locations off North Point and off Black River in Thunder Bay to assess young-of-the-year lake trout and juvenile lake whitefish (Figure 4 and Table 6). No ruffe were captured. A total of 6.3 hours of sampling effort was conducted with an 11 m trawl (11 m head rope, semi-balloon otter trawl with 23 m bridle, and 13 mm stretch mesh cod end).

Saginaw Bay, Michigan Personnel from the MIDNR-Lake St. Clair office conducted fall 2014 (September) bottom trawling (10 m head rope) at eight locations in Saginaw Bay as part of an annual survey to assess the fish community (Figure 4 and Table 6). No ruffe were captured following a total of 24 tows for 3.8 hours of effort.

Personnel from the MIDNR-Alpena office conducted graded mesh gill netting at the inner and outer portions of Saginaw Bay during September 2014 to assess the fish community (Figure 4 and Table 6). No ruffe were captured. Each net included a 30.5 m panel of 38 mm stretch mesh to which ruffe were vulnerable. A total of 40 net lifts were conducted.

Lake Huron Tributaries in Michigan Personnel from the USFWS-MBS/LBS and private contractors conducted sampling in 11 Lake Huron tributaries to assess sea lamprey abundance (Figure 4 and Table 6). No ruffe were captured. Sampling was conducted from April-August 2014 using fyke nets, permanent traps, portable assessment traps, and semi-permanent traps. A total of 709 net/trap lifts were conducted. A summary of fish species captured at trap locations is available upon request from the USFWS-MBS.

Lake Huron Tributaries in Ontario Personnel from the DFO-GLLFAS conducted sampling at 9 Lake Huron tributaries in Ontario, Canada from June-August 2014 (Figure 5 and Table 6). No ruffe were captured. Sampling locations included Coldwater Creek, Hog Creek, Magnetawan River, Mississagi River, Naiscoot River, Nottawasaga River, Shebeshekong River, Spanish River, and Sturgeon River. Boat electrofishing, seining (15 m beach seine), trawling, trammel netting, fyke netting (1.3 m box fyke net), and trap netting (1.2 m trap net) gear was used to sample the fish community. A total effort of 15.7 hours electrofishing, 4 seine hauls, 2.3 hours trawling effort, 0.6 hour trammel netting, 57 fyke net lifts, and 10 trap lifts were conducted.

Unconfirmed Sightings No unconfirmed sightings were reported for Lake Huron.

## **ST. CLAIR/DETROIT RIVER WATERWAY**

The MIDNR-Lake St. Clair and USFWS-Alpena reported other fish sampling capable of capturing ruffe in the St. Clair/Detroit River Waterway which includes the St. Clair River, Lake St. Clair, and Detroit River (Figure 9 and Table 7). No ruffe were captured.

St. Clair River, Michigan Personnel from the USFWS-Alpena used baited Gee minnow traps in an effort to collect a variety of benthic species and 91 m small mesh gill nets (15 m panels of 25 mm and 38 mm stretch mesh to which ruffe would be vulnerable) to capture young-of-year and juvenile lake sturgeon in U.S. waters of the St. Clair River (Figure 9 and Table 7). No ruffe were captured following 143 trap lifts and 69 gill net lifts at 13 locations during April-June and November 2014.

Lake St. Clair, Michigan Personnel from the MIDNR-Lake St. Clair office conducted bottom trawling (10 m head rope) at one location in Lake St. Clair as part of an annual survey to assess the fish community (Figure 9 and Table 7). No ruffe were captured following a total of 9 tows for 1.3 hours of effort during May and September 2014.

Personnel from the MIDNR-Lake St. Clair office also conducted small mesh trap netting at four locations in Lake St. Clair during April and May 2014 (Figure 9 and Table 7). No ruffe were captured following a total of 40 net lifts.

Detroit River, Michigan and Ontario Personnel from the USFWS-Alpena conducted small mesh gill netting (91 m nets with 15 m panels of 25 mm and 38 mm stretch mesh to which ruffe were vulnerable) in U.S. and Canadian waters of the Detroit River to capture young-of-year and juvenile lake sturgeon (Figure 9 and Table 7). No ruffe were captured following 14 gill net lifts at 9 locations during April-May and November 2014.

Personnel from the USFWS-Alpena also conducted sampling in U.S. and Canadian waters of the Detroit

River during July 2014 as part of an early detection and monitoring program to locate the presence and relative abundance of new nonindigenous fish (Figure 9 and Table 7). No ruffe were captured. Sampling consisted of 15 paired fyke net lifts (paired fyke nets consist of one lead with a fyke net at each end), 0.7 hours bottom trawling (4.9 m head rope), 1.5 hours electrofishing, and 15 baited minnow trap arrays.

Unconfirmed Sightings No unconfirmed sightings were reported for the Huron Erie waterway

## **LAKE ERIE**

The Ohio Department of Natural Resources-Sandusky Fish Research Unit (ODNR-Sandusky), ODNR-Fairport Fish Research Unit (ODNR-Fairport), MIDNR-Lake St. Clair, USGS-Lake Erie Biological Station (USGS-LEBS), USFWS-MBS/LBS, USFWS-Lower Great Lakes, and USFWS-Alpena reported other fish sampling that was capable of capturing ruffe in Lake Erie (Figures 9, 10, and 11; and Table 7). No ruffe were captured.

Western Basin of Lake Erie in Michigan Personnel from the MIDNR-Lake St. Clair office conducted bottom trawling (10 m head rope) at six locations in Michigan waters of Lake Erie during August 2014 to assess the fish community (Figure 9 and Table 7). No ruffe were captured following 6 tows for 0.8 hours of effort.

Western Basin of Lake Erie in Ohio Personnel from the ODNR-Sandusky office conducted bottom trawling (10.7 m head rope) in the western basin of Lake Erie from May-September 2014 to assess the relative abundance and growth of predator and forage fish species (Figure 9 and Table 7). No ruffe were captured. Ten minute trawl tows were conducted at water depths ranging from 1.7-12.6 m. A total of 130 tows were conducted for a total of 21.7 hours of effort.

ODNR-Sandusky staff also conducted a nearshore electrofishing survey at 12 sites in the western basin of Lake Erie during June 2014 (Figure 9 and Table 7). No ruffe were captured following 3.5 hours of effort.

Maumee Bay and Sandusky Bay in Ohio Personnel from the USFWS-Alpena conducted sampling in Maumee and Sandusky bays from August-October 2014 as part of an early detection and monitoring program to locate the presence and relative abundance of new nonindigenous fish (Figure 9 and Table 7). No ruffe were captured. Maumee Bay effort consisted of 15 paired fyke net lifts (paired fyke nets consist of one lead with a fyke net at each end), 1.3 hours bottom trawling (4.9 m head rope with a 3.8 cm stretch mesh body), and 1.5 hours nighttime electrofishing. Sandusky Bay effort consisted of 15 paired fyke net lifts, 1.3 hours bottom trawling, and 2.5 hours nighttime electrofishing.

Cuyahoga River and Grand River in Ohio Personnel from the ODNR-Fairport office conducted electrofishing and larval trawl tows (5 minute tows) in the lower Cuyahoga River and the lower Grand River during spring 2014 (and also fall 2014 at Cuyahoga River) as part of a Great Lakes Restoration Initiative (GLRI) project (Figure 9 and Table 7). No ruffe were captured. Six locations were sampled in the Cuyahoga River resulting in six electrofishing transects for 2.4 hours electrofishing effort and 22 larval tows for 1.8 hours larval trawl effort. Four locations were sampled in the Grand River resulting in four electrofishing transects for 0.7 hour electrofishing effort and nine larval tows for 0.8 hour larval trawl effort.

Central Basin of Lake Erie in Ohio Personnel from the ODNR-Fairport office conducted bottom trawling (10.4 m head rope, Yankee two seam) in the central basin of Lake Erie from August-October 2014 to assess the relative abundance and growth of predator and forage fish species (Figure 10 and Table 7). No ruffe were captured. Five minute tows (5-10 m depths) and ten minute tows were conducted at water depth strata ranging

from 10-15 m, 15-20 m, and > 20 m. A total of 40 trawl tows were conducted at five locations for 5.8 hours of effort.

Personnel from the ODNR-Fairport office also conducted gill netting (bottom set) in the central basin of Lake Erie from September-November 2014 to assess the adult abundance of walleye and smallmouth bass (Figure 10 and Table 7). No ruffe were captured. Sampling gear consisted of 182 m monofilament gill nets that included one panel of 32 mm stretch mesh to which ruffe were vulnerable. Two locations were sampled and a total of 9 net lift were completed.

Lake Erie Nearshore/Offshore in Ohio Personnel from the USGS-LEBS conducted annual bottom trawling (7.9 m head rope) in nearshore and offshore areas to assess the status of fish stocks in Lake Erie (Figure 11 and Table 7). No ruffe were captured. Ten minute trawl tows were conducted from May-July and September-October 2014 at 49 locations for a total of 32.6 hours of sampling effort.

Lake Erie South Shore Tributaries in Ohio and New York Personnel from the USFWS-MBS/LBS worked with private contractors to conduct sampling in three Lake Erie tributaries to assess sea lamprey abundance (Figure 9 and Table 7). No ruffe were captured. Sampling was conducted from April-June 2014 using portable assessment traps and semi-permanent traps. A total of 292 trap lifts were conducted. A summary of fish species captured at these locations is available upon request from the USFWS-MBS.

Buffalo, New York and the Upper Niagara River Personnel from the USFWS-Lower Great Lakes conducted sampling in Buffalo and the Upper Niagara River from June-October 2014 as part of an early detection and monitoring program to locate the presence and relative abundance of new nonindigenous fish (Figure 9 and Table 7). No ruffe were captured. Multiple gears were used including bottom trawl, benthic sled, electrofishing, and paired fyke nets for a total of 133.5 hours of effort.

Unconfirmed Sightings No unconfirmed sightings were reported for Lake Erie.

## **LAKE ONTARIO**

The USFWS-Lower Great Lakes, 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 9 and 12, and Table 8). No ruffe were captured.

Lower Niagara River, Genessee River, and Irondequoit Bay in New York Personnel from the USFWS-Lower Great Lakes conducted sampling along the shore of Lake Ontario in and near the Lower Niagara River, Genessee River, and Irondequoit Bay from June-November 2014 as part of an early detection and monitoring program to locate the presence and relative abundance of new nonindigenous fish (Figure 9 and Table 8). No ruffe were captured. Multiple gears were used including bottom trawl, benthic sled, electrofishing, and paired fyke nets for a total of 301.9 hours of effort.

Lake Ontario South Shore Tributaries in New York Personnel from the USFWS-MBS/LBS worked with private contractors to conduct sampling in six Lake Ontario tributaries to assess sea lamprey abundance (Figure 9 and Table 8). No ruffe were captured. Sampling was conducted from April-June 2014 using portable assessment traps and permanent traps for a total of 168 trap lifts. A summary of fish species captured at these locations is available upon request from USFWS-MBS.

Lake Ontario Nearshore/Offshore in New York Personnel from the USGS-LOBS and New York State Department of Environmental Conservation (NYSDEC) conducted annual bottom trawling (18.0 m head rope) in U.S. waters of Lake Ontario to assess the status of major prey fish stocks and juvenile lake trout (Figure 12 and Table 8). No ruffe were captured. Twelve to fourteen transects (25 km intervals) spanning the U.S. shoreline were sampled from March-July 2014, and six sites were sampled from August-September 2014. Bottom trawls depths ranged from 8-225 m at each transect. A total of 415 bottom trawls were conducted which resulted in 58.5 hours of sampling.

Unconfirmed Sightings No unconfirmed sightings were reported for Lake Ontario

## DISCUSSION

The summary of information gathered in 2014 indicates that ruffe continue to persist in areas where they have become established. A synopsis by water body follows.

### LAKE SUPERIOR

Although dedicated ruffe surveillance was not conducted within Lake Superior, reports from other sampling conducted during 2014 indicated that ruffe continue to persist in Lake Superior. No major range expansion was detected- even so, ruffe continue to expand within their existing range on Whitefish Bay.

Western and South Shore Areas Sampling conducted by USGS-LSBS, USFWS-MBS and GLIFWC, OMNRF-UGLMU, USFWS-Ashland, DFO-GLLFAS and WIDNR-Superior indicated that ruffe continued to persist in areas of western Lake Superior and along the south shore where they were previously established. Ruffe were reported from the Kaministiquia River and Thunder Bay Harbour (Ontario), St. Louis River (Minnesota/Wisconsin), Apostle Islands (Wisconsin), Chequamegon Bay (Wisconsin), and the Misery River (Michigan). No range expansion was detected in these areas based on incidental reports.

Whitefish Bay Ruffe were also reported from Whitefish Bay (Michigan) in eastern Lake Superior according to sampling conducted by LSSU and BMIC. A total of 11 ruffe were captured at Naomikong Creek (5 ruffe), Pendills Creek (1 ruffe), and shallows in Tahquamenon Bay (5 ruffe). Two locations, Naomikong Creek and Pendills Creek, were new sightings at tributaries within the existing ruffe range on Whitefish Bay. A higher number of ruffe was captured from Whitefish Bay and its tributaries during 2014 than in past years.

Ruffe were first captured from the Whitefish Bay area in 2006 when two ruffe were reported from the Tahquamenon River. Ruffe were also captured in 2011 at two areas within Whitefish Bay by the USGS-LSBS. Although fish sampling was not conducted in the Tahquamenon River in 2014, ruffe eDNA was detected in 2013 in water samples collected by The Nature Conservancy from the river during the spring. Ruffe continue to persist in the Whitefish Bay area and are increasingly inhabiting/using bay tributaries.

### ST. MARYS RIVER

No dedicated ruffe surveillance activities were conducted in the St. Marys River during 2014. Dedicated ruffe surveillance was initiated in the St. Marys River by the USFWS-Alpena in 2000 and these efforts were morphed into a comprehensive USFWS early detection and monitoring program in 2013-2014 to locate the presence and relative abundance of new nonindigenous fish. Ruffe were not detected as a result of this

sampling or other fish sampling in the St. Marys River that was conducted by the SMRFTG, DFO-GLLFAS, USFWS-Ashland, OMNRF-UGLMU, or USFWS-MBS.

An increase in ruffe detections within Whitefish Bay, Lake Superior during 2014 (see Lake Superior narrative above) raises concerns that ruffe may move into the St. Marys River from the nearby bay. In 2014 ruffe were captured at Pendills Creek and Naomikong Creek by LSSU and BMIC. These locations are closer to the St. Marys River than past sightings.

The warmer habitats, tributaries, and estuary areas adjacent to deeper dredged channels found in the St. Marys River may provide ideal habitat that allow ruffe to thrive. The St. Marys River is a major connecting channel within the Great Lakes and if ruffe reproduce and spread within the river, the river could serve as a vector to allow their migration into northern Lake Huron via connections at DeTour, Michigan, and into Ontario waters of the North Channel.

## **LAKE MICHIGAN**

Although dedicated ruffe surveillance was not conducted on Lake Michigan, 2014 reports from other fish surveys conducted by MIDNR-Marquette indicated that ruffe continued to persist in northern Green Bay at LBDN (Michigan). Ruffe were not captured outside of LBDN in 2014, and no expansion out of Green Bay was detected based on reports from other agencies including the WIDNR, USGS, ISEA, and USFWS – or as a result of rapid response activities led by the ILDNR and INDNR in southern Lake Michigan at the Calumet Harbor (Illinois).

Green Bay, Little Bay de Noc and Big Bay de Noc Ruffe were first discovered in Green Bay at LBDN in Escanaba, Michigan, during 2002 and then detected at BBDN in 2004. In 2007 ruffe were captured in southern Green Bay near Marinette, Wisconsin. Annual sampling by the MIDNR-Marquette to assess the fish communities of LBDN and BBDN continued to capture ruffe in LBDN through 2014. The ruffe were captured with gill nets in low numbers (5 ruffe) that were comparable to catches of ruffe at the same location in recent years. Personnel from the MIDNR-Marquette have captured ruffe each year since 2002, and catches have ranged from a high of 40 ruffe in 2006 to a low of two ruffe in 2009 and 2011. Catches of ruffe in recent years (2011-2014) have ranged between two ruffe captured in 2011 to nine captured in 2013. Ruffe continued to be absent from the MIDNR-Marquette catch in BBDN during 2014. Their personnel have not captured ruffe from BBDN since their initial discovery there in the fall of 2004.

## **LAKE HURON**

No ruffe were captured during dedicated ruffe surveillance conducted by the USFWS-Alpena or other fish sampling reported by the MIDNR-Alpena, MIDNR-Lake St. Clair, DFO-GLLFAS, or USFWS-MBS on Lake Huron during 2014. Ruffe were not captured from the Cheboygan River (Michigan) where sightings were reported in 2011 and 2012 or the Trout River (Michigan) where a sighting was reported in 2008. They also remain absent from the Thunder Bay area (Michigan) where they were captured from 1995 through 2003.

Cheboygan River, Michigan Ruffe were detected in the Cheboygan River by the USFWS-MBS at a sea lamprey trap on the first upstream dam in 2011 (1 ruffe) and 2012 (1 ruffe). Ruffe have not been captured as a result of targeted sampling conducted by USFWS-Alpena in the area using electrofishing and trap nets during 2013 and 2014. The status of ruffe in the Cheboygan River is unknown. It is not known whether the ruffe captured in 2011 and 2012 were random individuals, or part of a colony populating the river. If ruffe are present in the river, they are likely low in number because they have not been reported by local recreational

anglers, who are often first to detect new species. One may speculate that ruffe found in the Cheboygan River may have been transferred via ship ballast water from other infested areas of the Great Lakes or migrated north from historically infested areas of Thunder Bay.

Trout River, Michigan Ruffe were detected in the Trout River by the USFWS-MBS at a sea lamprey trap on the first upstream barrier in 2008 (2 ruffe). Ruffe have not been captured as a result of targeted sampling conducted by USFWS-Alpena in the area using backpack electrofishing in the Trout River in 2013 and 2014 and boom electrofishing at the nearby Port of Calcite and Rogers City marina. Like the Cheboygan River, the status of ruffe in the Trout River is unknown. The captured from the Trout River in 2008 may have resulted from ballast water transfer to the nearby Port of Calcite in Rogers City, Michigan from other infested locations around the Great Lakes or from migration originating at the historically infested area of Thunder Bay.

Thunder Bay River, Michigan Ruffe were first captured from the Thunder Bay River in 1995 during dedicated ruffe surveillance efforts conducted by the USFWS-Ashland. Abundance of ruffe peaked in the river during 1999 when they were the most abundant species captured during bottom trawls. By 2003, the abundance of ruffe had declined, possibly as the result of round goby invasion or targeted efforts to remove spawning adults during the spring. Ruffe have not been captured from the Thunder Bay River or the Alpena area since 2003 despite annual dedicated surveillance.

## **LOWER GREAT LAKES**

Ruffe have not been detected in the lower Great Lakes (Lakes Erie and Ontario) or the St.Clair/Detroit River Waterway despite dedicated ruffe surveillance efforts in Lakes Erie and Ontario by the USFWS and other fish sampling that was reported by the ODNR, MIDNR, USGS, NYDEC, and the USFWS.

## **KNOWN RANGE OF RUFFE IN THE GREAT LAKES**

The 2014 range of ruffe in the Great Lakes is as follows (Figure 13):

Lake Superior North Shore: U.S. waters of the Duluth/Superior Harbor, Minnesota/Wisconsin, north to Canadian waters of the Current River, Ontario in Thunder Bay.

South Shore: U.S. waters of the Duluth/Superior Harbor, Minnesota/Wisconsin, east to Pendills Creek, Michigan on Whitefish Bay.

Lake Michigan Green Bay.

Lake Huron Cheboygan River (Cheboygan, Michigan): At the first upstream barrier (dam) on the Cheboygan River.

Trout River (Rogers City, Michigan): At the first upstream barrier on the Trout River.

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

St. Clair/Detroit River Waterway Undetected.

Lake Erie and Lake Ontario Undetected.

Great Lakes Basin Inland Lakes and Streams Undetected.

## ACKNOWLEDGMENTS

We are grateful to the National Aquatic Nuisance Species Task Force for financially supporting this work and to the Great Lakes Sport Fishing Council for endorsing this work.

We also thank the many agencies across the Great Lakes that reported other fish sampling information, permitted ruffe surveillance within their jurisdictions, and to those who assisted with ruffe surveillance or data analysis.

### **Reported Information From Other Fish Sampling Capable of Capturing Ruffe**

Thank you to personnel from other agencies and offices who provided information on their sampling that was capable of capturing ruffe incidentally and/or assisted with review of this document.

Jessica Barber, U.S. Fish and Wildlife Service- Marquette Biological Station  
Andrew Briggs, U.S. Fish and Wildlife Service- Alpena Fish and Wildlife Conservation Office  
Stephen Chong, Ontario Ministry of Natural Resources and Forestry- Upper Great Lakes Management Unit  
John Deller, Ohio Department of Natural Resources- Fairport Fish Research Unit  
Lori Evrard, U.S. Geological Survey- Lake Superior Biological Station  
David Fielder, Michigan Department of Natural Resources- Alpena Fisheries Research Station  
Neal Godby, Michigan Department of Natural Resources- Gaylord Field Station  
Stephen Hensler, U.S. Fish and Wildlife Service- Alpena Fish and Wildlife Conservation Office  
Kevin Kayle, Ohio Department of Natural Resources- Fairport Fish Research Unit  
Patrick Kocovsky, U.S. Geological Survey- Lake Erie Biological Station  
Charles Madenjian, U.S. Geological Survey- Great Lakes Science Center  
Jared Myers, Wisconsin Department of Natural Resources- Lake Superior Field Unit  
Lisa O'Connor, Fisheries and Oceans Canada- Great Lakes Laboratory for Fisheries and Aquatic Sciences  
Chris Olds, U.S. Fish and Wildlife Service- Alpena Fish and Wildlife Conservation Office  
Tammie Paoli, Wisconsin Department of Natural Resources- Peshtigo Service Center  
Henry Quinlan, U.S. Fish and Wildlife Service- Ashland Fish and Wildlife Conservation Office  
Paul Ripple, Bay Mills Indian Community  
Timothy Strakosh, U.S. Fish and Wildlife Service- Green Bay Fish and Wildlife Conservation Office  
Mike Thomas, Michigan Department of Natural Resources- Lake St. Clair Fisheries Research Station  
Andrew Tucker, The Nature Conservancy  
Eric Weimer, Ohio Department of Natural Resources- Sandusky Fish Research Unit  
Jake Van Effen, U.S. Fish and Wildlife Service- Marquette Biological Station  
Brian Weidel, U.S. Geological Survey- Lake Ontario Biological Station  
William Wellenkamp, Michigan Department of Natural Resources- Alpena Fisheries Research Station  
Jeanie Williams, Inland Seas Educational Association  
Frank Zomer, Bay Mills Indian Community  
Troy Zorn, Michigan Department of Natural Resources- Marquette Fisheries Research Station

### Assisted with Ruffe Surveillance or Data Analysis

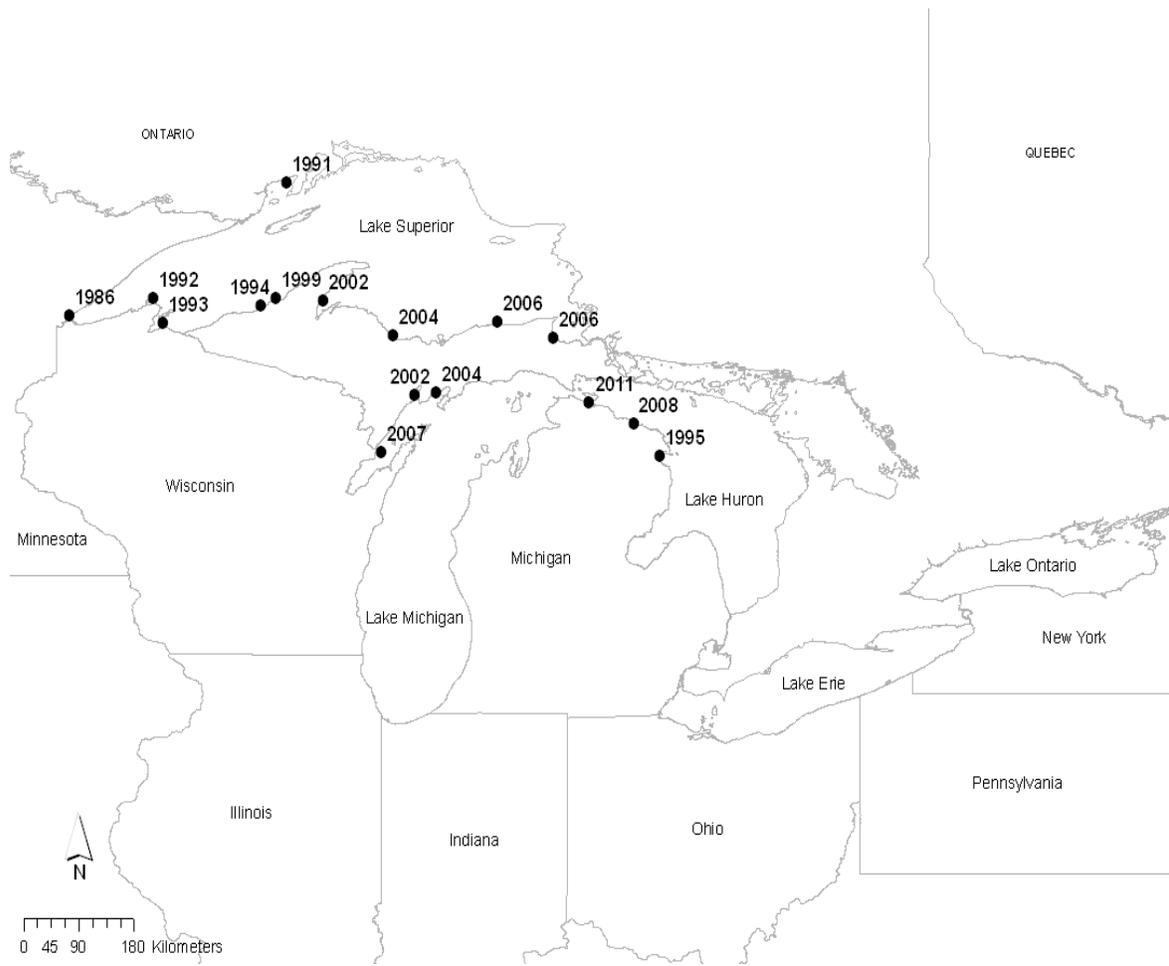
Thank you to the volunteers, staff members and others who assisted with ruffe sampling activities.

Chuck Beal (Volunteer USFWS-Alpena)	Heidi Himes (USFWS-Lower Great Lakes)
Denise Clay (USFWS-Lower Great Lakes)	Gerry Kraft (Volunteer USFWS-Alpena)
Rebecca Collins (USFWS-Alpena)	Joseph Luttrell (USFWS-Alpena)
Joseph Curtis (Volunteer USFWS-Alpena)	Kelly McDonald (USFWS-Lower Great Lakes)
Edward Czarnecki (Volunteer USFWS-Alpena)	Kwamina Osteidu (USFWS-Lower Great Lakes)
Daniel Drake (USFWS-Lower Great Lakes )	Scott Sanders (USFWS-Lower Great Lakes)
Steven Gambicki (USFWS-Alpena)	Roger Witherbee (Volunteer USFWS-Alpena)
Joseph Gerbyshak (USFWS-Alpena)	Ron Young (Volunteer USFWS-Alpena)

### **BIBLIOGRAPHY**

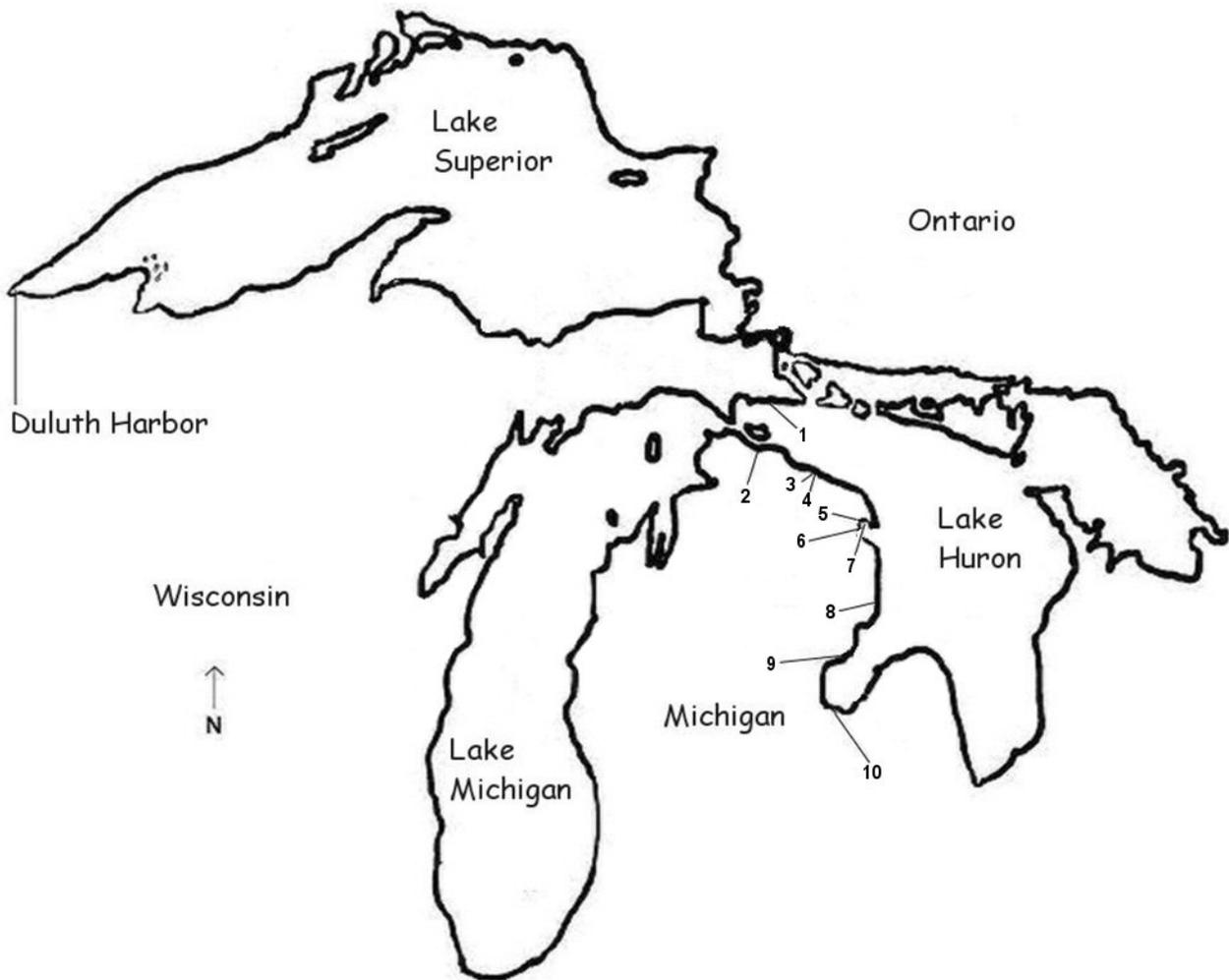
- Bronte, C.R., L.M. Evrard, W.P. Brown, K.R. Mayo and A.J. Edwards. 1998. Fish community changes in the St. Louis River estuary, Lake Superior, 1989-1996: is it ruffe or population dynamics? *Journal of Great Lakes Research* 24 (2): 309-318.
- Bunnell, D.B., C.P. Madenjian, T.J. Desorcie, M.J. Kostich, K.R. Smith and J.V. Adams. 2013. Status and trends of prey fish populations in Lake Michigan, 2012. Report to the Great Lakes Fishery Commission, Lake Michigan Committee, Duluth, MN, 19 March 2013.
- Busiahn, T.R. 1997. Ruffe control: a case study of an aquatic nuisance species control program. F. M. D'Itri, ed. *Zebra mussels and aquatic nuisance species*. Ann Arbor Press Inc., Chelsea, MI. Pages 69-86.
- Czypinski, G.D., A.K. Bowen and M.A. Goehle. 2008. Surveillance for ruffe in the Great Lakes, 2007. Fishery Resources Office, Ashland, WI. U.S. Fish and Wildlife Service station report. 35 p.
- Czypinski, G.D., A.K. Bowen, M.T. Weimer and A. Dextrase. 2002. Surveillance for ruffe in the Great Lakes, 2001. Fishery Resources Office, Ashland, WI. U.S. Fish and Wildlife Service station report. 36 p.
- Czypinski, G.D., G. Johnson, A.K. Hintz and S.M. Keppner. 1997. Surveillance for ruffe in the Great Lakes, 1996. Fishery Resources Office, Ashland, WI. U.S. Fish and Wildlife Service station report. 23 p.
- Evrard, L.M., A.J. Edwards, M.H. Hoff and C.R. Bronte. 1998. Ruffe population investigations in Lake Superior tributaries. U.S. Geological Survey, Great Lakes Science Center, Lake Superior Biological Station, Ashland, WI. U.S. Geological Survey lake report. 44 p.
- Gorman, O.T., L.M. Evrard, G.A. Cholwek and M.R. Vinson. 2013. Status and trends in the fish community of Lake Superior, 2012. Report to the Great Lakes Fishery Commission, Lake Superior Committee, Duluth, MN, 20 March 2013.

- Henson, F.G. 1999. Competition between ruffe (*Gymnocephalus cernuus*) and yellow perch (*Perca flavescens*) and the influence of temperature on growth and gastric evacuation of ruffe. MS Thesis, University of Minnesota, St. Paul, MN.
- Kindt, K.J., S.M. Keppner and G. Johnson, 1996. Surveillance for ruffe in the Great Lakes, 1995. Fishery Resources Office, Ashland, WI. U.S. Fish and Wildlife Service station report. 23 p.
- Kraus, R., M. Rogers, P.M. Kocovsky, W.H. Edwards, B. Bodamer-Scarbro, K. Keretz and R. Wirick. 2013. Fisheries research and monitoring activities of the Lake Erie Biological Station, 2012. Report to the Great Lakes Fishery Commission, Lake Erie Committee, Niagara Falls, NY, 26-28 March 2013.
- Pratt, D.M., W.H. Blust and J.H. Selgeby. 1992. Ruffe, *Gymnocephalus cernuus*: newly introduced in North America. Canadian Journal of Fisheries and Aquatic Sciences 49: 1616-1618.
- Roseman, E.F., S.C. Riley, S.A. Farha, B.M. Maitland, T.R. Tucker, S.A. Provo and M.W. McLean. 2013. Status and trends of the Lake Huron offshore demersal fish community, 1976-2012. Report to the Great Lakes Fishery Commission, Lake Huron Committee, Duluth, MN, 21 March 2013.
- Ruffe Control Committee. 1996. Revised ruffe control program. Submitted to the Aquatic Nuisance Species Task Force by the Ruffe Control Committee, Thomas R. Busiahn, Chairman, October, 1996. U.S. Fish and Wildlife Service, Fishery Resources Office, Ashland, WI. 30 p.
- Ruffe Task Force. 1992. Ruffe in the Great Lakes: a threat to North American fisheries. Great Lakes Fishery Commission, Ann Arbor, MI. 144 p.
- Schuldt, J.A., C. Richards and R.M. Newman. 1999. Effects of Eurasian ruffe on food resources and native yellow perch in experimental mesocosms. Bulletin of the North American Benthological Society 16(1): 163.
- Slade, J.W. and K.J. Kindt. 1992. Surveillance for ruffe in the upper Great Lakes, 1992. U.S. Fish and Wildlife Service, Fishery Resources Office, Ashland, WI. U.S. Fish and Wildlife Service station report. 8 p.
- Slade, J.W., S.M. Keppner and W.R. MacCallum. 1994. Surveillance for ruffe in the Great Lakes, 1993. U.S. Fish and Wildlife Service, Fishery Resources Office, Ashland, WI. U.S. Fish and Wildlife Service station report. 14 p.
- Slade, J.W., S.M. Keppner and W.R. MacCallum. 1995. Surveillance for ruffe in the Great Lakes, 1994. U.S. Fish and Wildlife Service, Fishery Resources Office, Ashland, WI. U.S. Fish and Wildlife Service station report. 27 p.



**Progression of Ruffe Across the Great Lakes**

**Figure 1.** Progression of ruffe across the Great Lakes. Note: Not all ruffe sightings are represented, only first sightings are referenced in the progression of their spread across the Great Lakes.



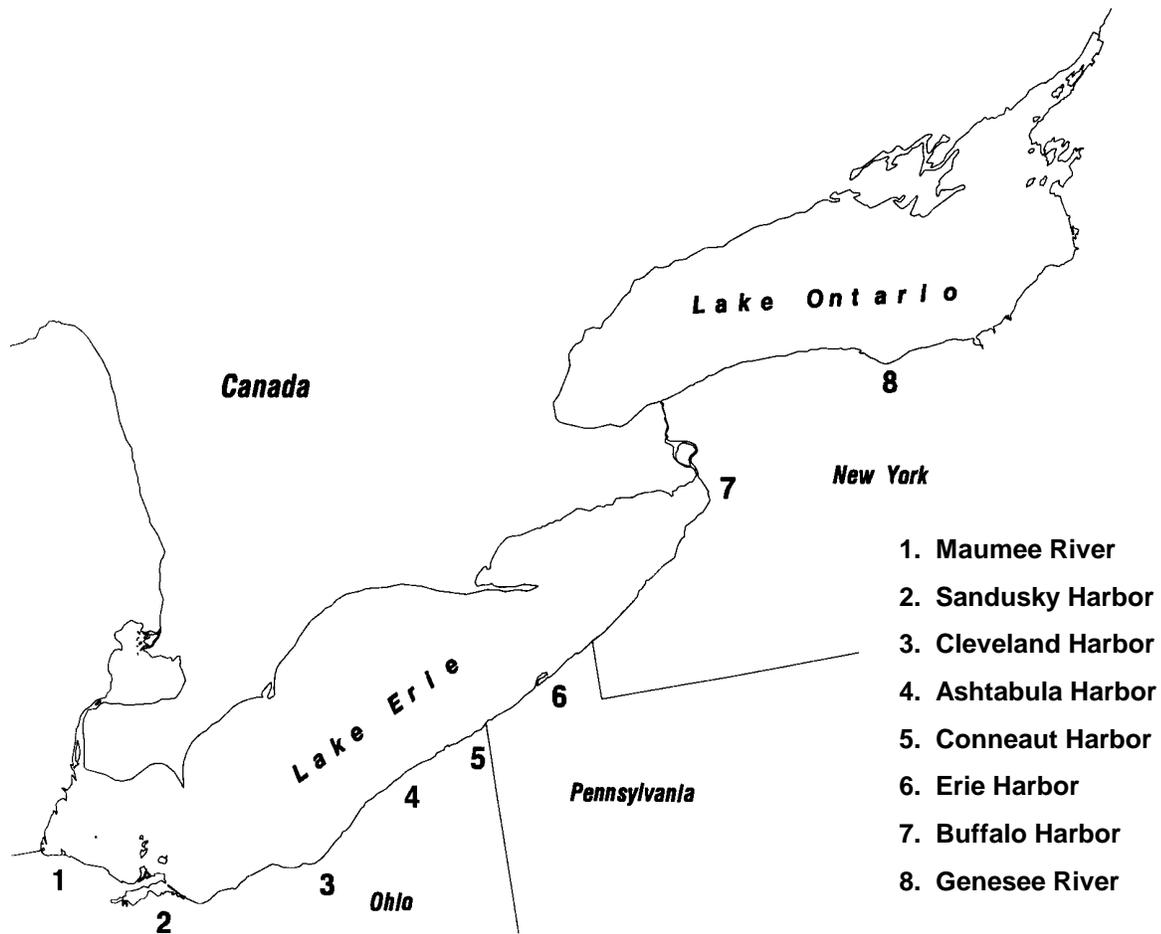
**Ruffe Surveillance, Lake Huron, 2014**



**U. S. Fish and Wildlife Service**

- |                      |                                     |
|----------------------|-------------------------------------|
| 1. Port Dolomite     | 6. Thunder Bay -Shipping Channel    |
| 2. Cheboygan River   | 7. Thunder Bay -Lafarge Corporation |
| 3. Trout River       | 8. Au Sable River                   |
| 4. Port of Calcite   | 9. Au Gres River                    |
| 5. Thunder Bay River | 10. Saginaw River                   |

**Figure 2.** Locations surveyed for ruffe in the upper Great Lakes during 2014.



**Ruffe Surveillance, Lake Erie/Lake Ontario, 2014**



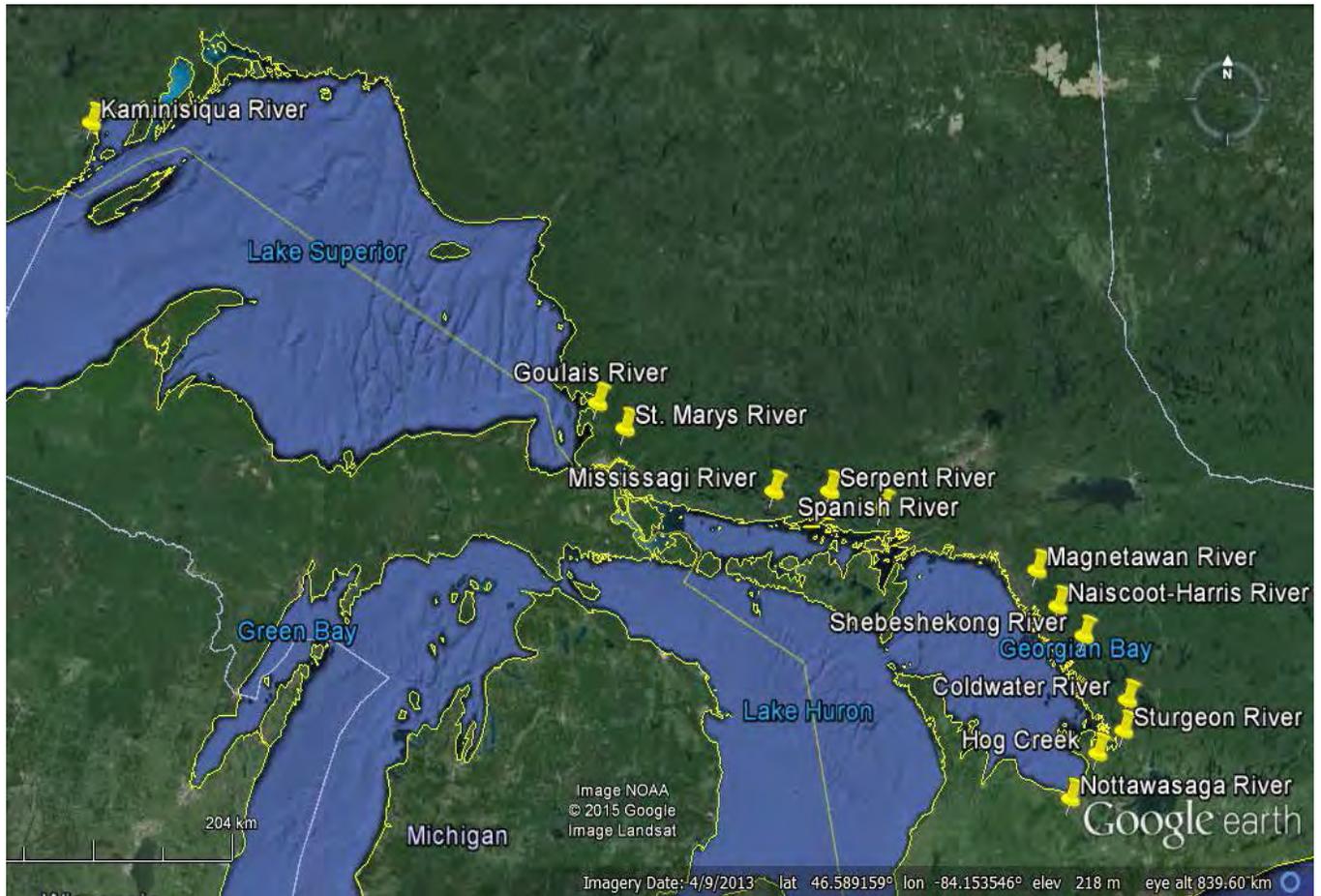
**U. S. Fish and Wildlife Service**

**Figure 3.** Locations surveyed for ruffe in the lower Great Lakes during 2014.



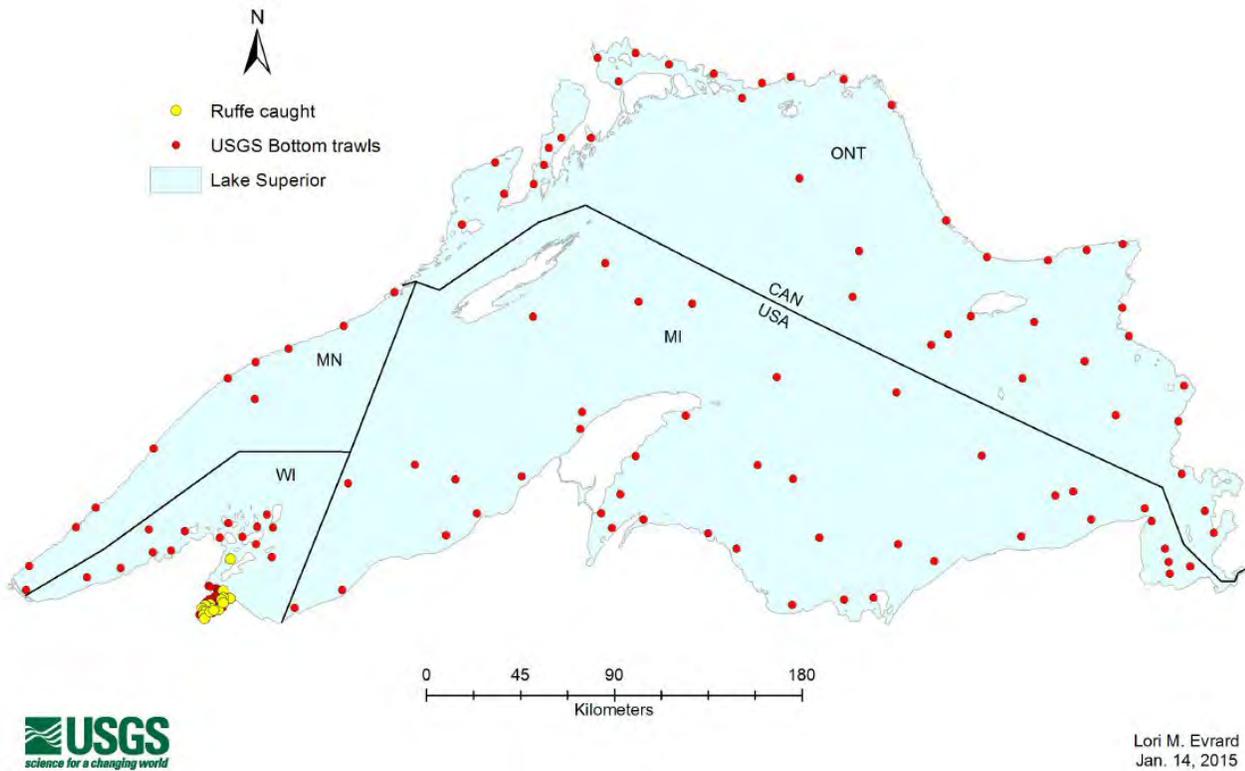
- |                              |                                    |                                 |                          |
|------------------------------|------------------------------------|---------------------------------|--------------------------|
| 1. Thunder Bay Harbour *     | 18. Furnace Creek                  | 35. Green Bay                   | 52. Carp Lake River      |
| 2. St. Louis River *         | 19. Miners River                   | 36. East Twin River             | 53. Carp River           |
| 3. Amnicon River             | 20. Betsy River                    | 37. Milwaukee                   | 54. Les Cheneaux Islands |
| 4. Middle River              | 21. Tahquamenon River              | 38. Calumet Harbor              | 55. Albany Creek         |
| 5. Poplar River              | 22. Tahquamenon Bay *              | 39. Burns Harbor                | 56. Trout Creek          |
| 6. Brule River               | 23. Naomikong Creek *              | 40. Trail Creek                 | 57. Cheboygan River      |
| 7. Red Cliff Creek           | 24. Pendills Bay, Pendills Creek * | 41. St. Joseph River            | 58. Greene Creek         |
| 8. Apostle Islands *         | 25. Big Pine Picnic Area           | 42. Muskegon River              | 59. Ocqueoc River        |
| 9. Chequamegon Bay *         | 26. St. Marys River                | 43. Big Manistee River          | 60. Trout River          |
| 10. Bad River                | 27. Hog Island Creek               | 44. Little Manistee River       | 61. Thunder Bay          |
| 11. Firesteel River          | 28. Manistique River               | 45. Frankfort, Betsie River     | 62. Devils River         |
| 12. Misery River *           | 29. Ogontz River                   | 46. Leland                      | 63. Au Sable River       |
| 13. Silver River             | 30. Big Bay de Noc                 | 47. Grand Traverse Bay          | 64. East Au Gres River   |
| 14. Big Garlic River         | 31. Little Bay de Noc *            | 48. Boardman River              | 65. Saginaw Bay          |
| 15. Chocoday River           | 32. Menominee River                | 49. Elk Lake Outlet             | 66. Tittabawassee River  |
| 16. Laughing Whitefish River | 33. Peshigo River                  | 50. Lake Charlevoix, Deer Creek |                          |
| 17. Rock River               | 34. Oconto River                   | 51. Petoskey                    |                          |

**Figure 4.** Upper Great Lakes fish sampling conducted in 2014 and reported by agency and university personnel. Ruffe would have been vulnerable to gear used during sampling. The \* denotes locations where ruffe were captured.



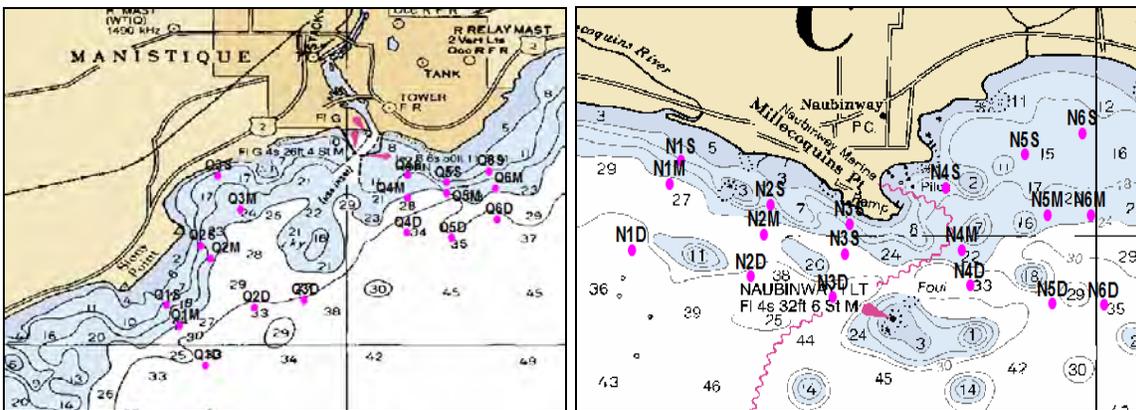
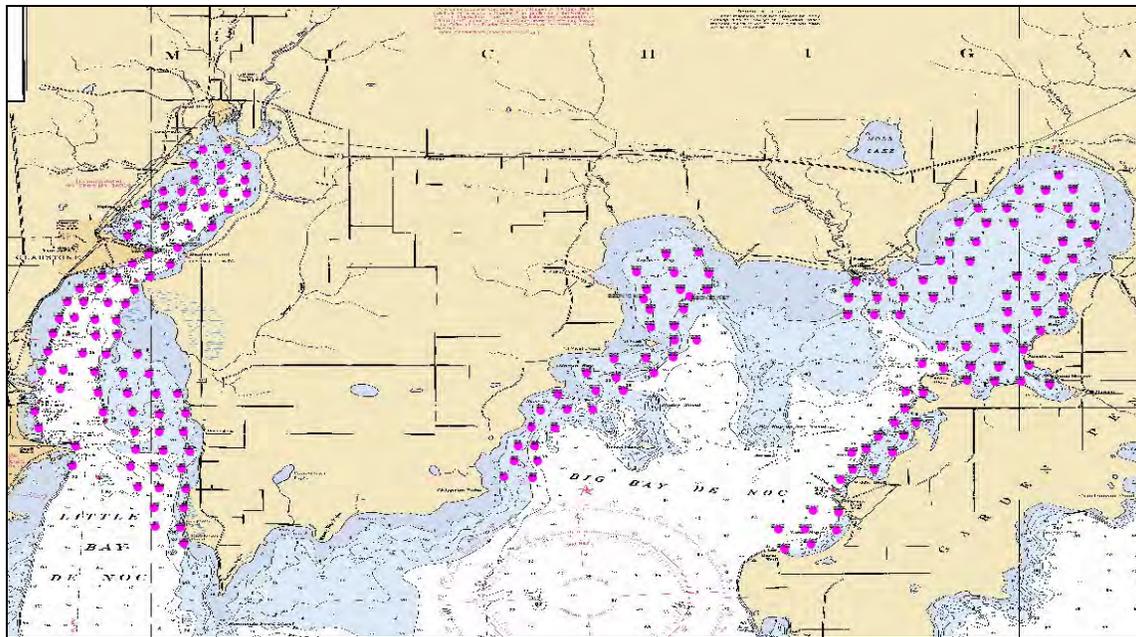
**Fisheries and Oceans Canada**

**Figure 5.** The Fisheries and Oceans Canada-Great Lakes Laboratory for Fisheries and Aquatic Sciences reported boat electrofishing, seining, trawling, trammel netting, and fyke netting at the Kaminisiquia and Goulais Rivers in Lake Superior, the St. Marys River, and tributaries along the eastern shore of Lake Huron during 2014. Ruffe would have been vulnerable to gears used during sampling.



U. S. Geological Survey

**Figure 6.** The USGS-Lake Superior Biological Station reported annual bottom trawling at locations in Lake Superior during 2014. Ruffe would have been vulnerable to gear used during sampling.

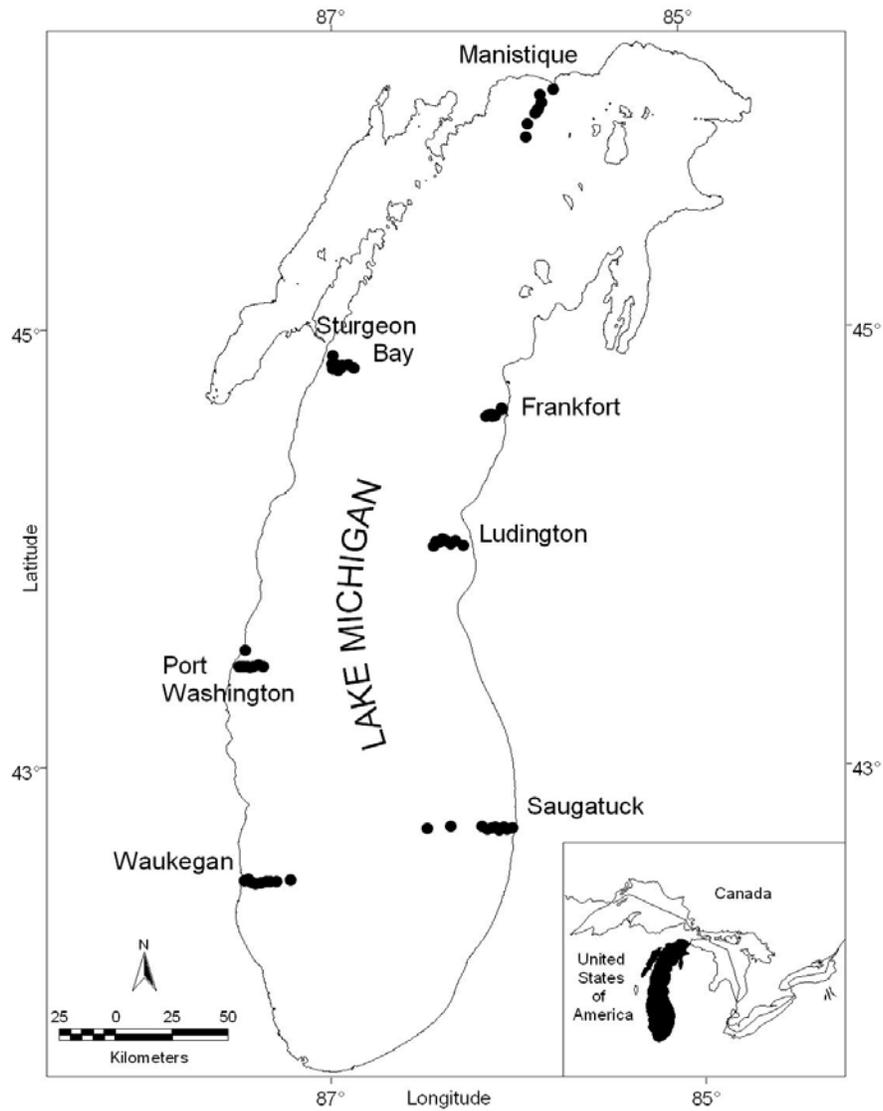


Potential Netting Locations, Fall Assessment Survey, 2009-2014



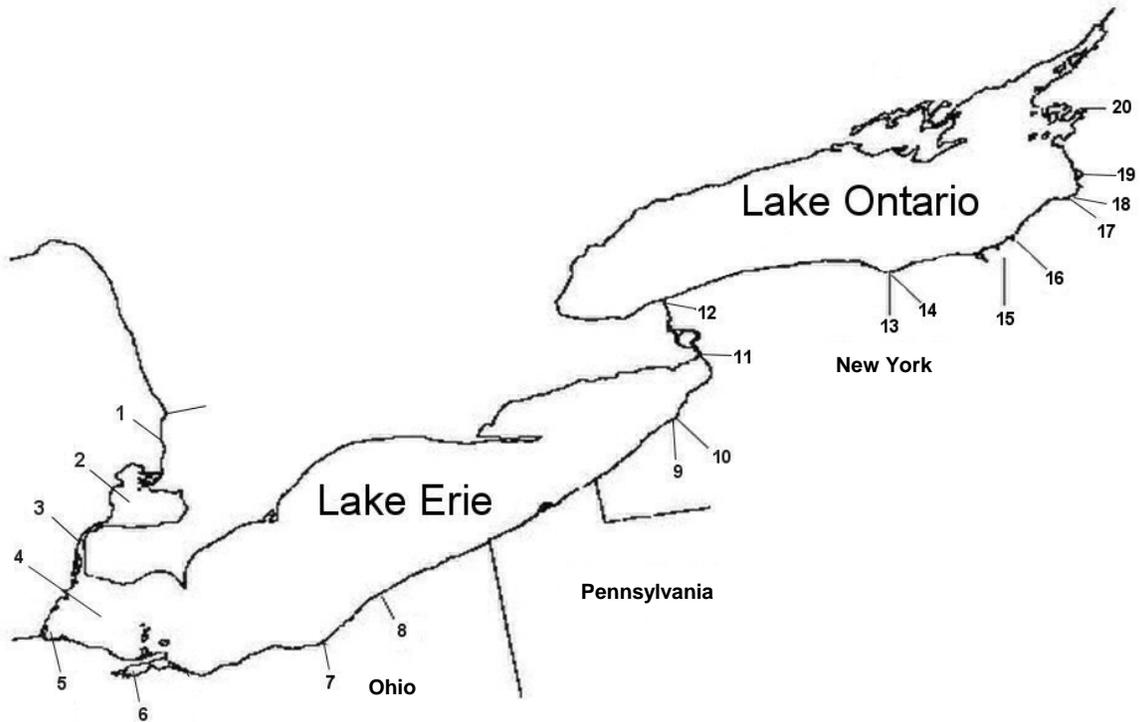
Michigan Department of Natural Resources

**Figure 7.** The Michigan DNR-Marquette Fisheries Research Station reported gill netting and bottom trawling at locations in northern Green Bay (top), Manistique (bottom left) and Naubinway (bottom right) in Lake Michigan. Each year a stratified random sample is obtained for each Bay de Noc from this grid of potential sites. Other nearshore sampling areas (Manistique and Naubinway) cycle from year to year. Ruffe would have been vulnerable to gears used during sampling.



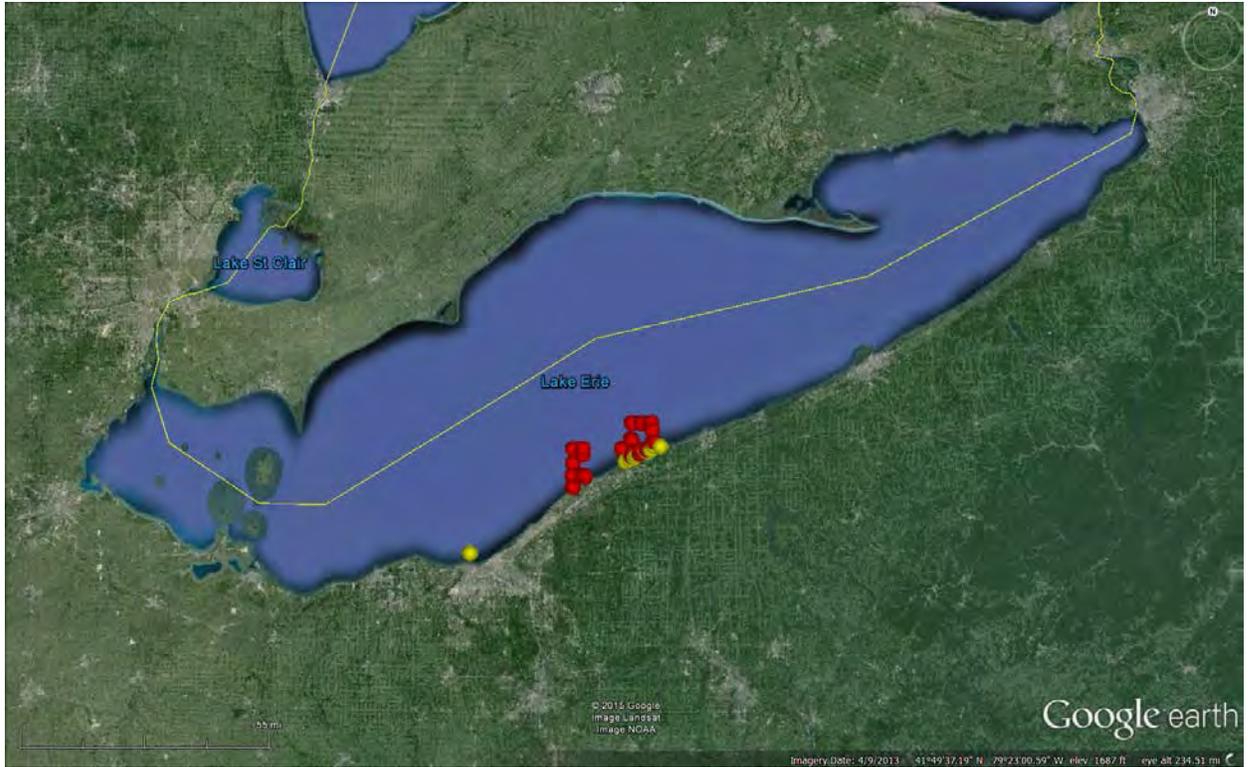
U. S. Geological Survey

**Figure 8.** The USGS-Great Lakes Science Center reported bottom trawling at locations in Lake Michigan during 2014. Ruffe would have been vulnerable to gear used during sampling.



- |                    |                         |                           |                      |
|--------------------|-------------------------|---------------------------|----------------------|
| 1. St. Clair River | 7. Cuyahoga River       | 13. Genessee River        | 19. Grindstone Creek |
| 2. Lake St. Clair  | 8. Grand River          | 14. Irondequoit Bay       | 20. Black River      |
| 3. Detroit River   | 9. Spooner Creek        | 15. Sterling Valley Creek |                      |
| 4. Western Basin   | 10. Cattaraugus Creek   | 16. Sterling Creek        |                      |
| 5. Maumee Bay      | 11. Upper Niagara River | 17. Little Salmon River   |                      |
| 6. Sandusky Bay    | 12. Lower Niagara River | 18. Salmon River          |                      |

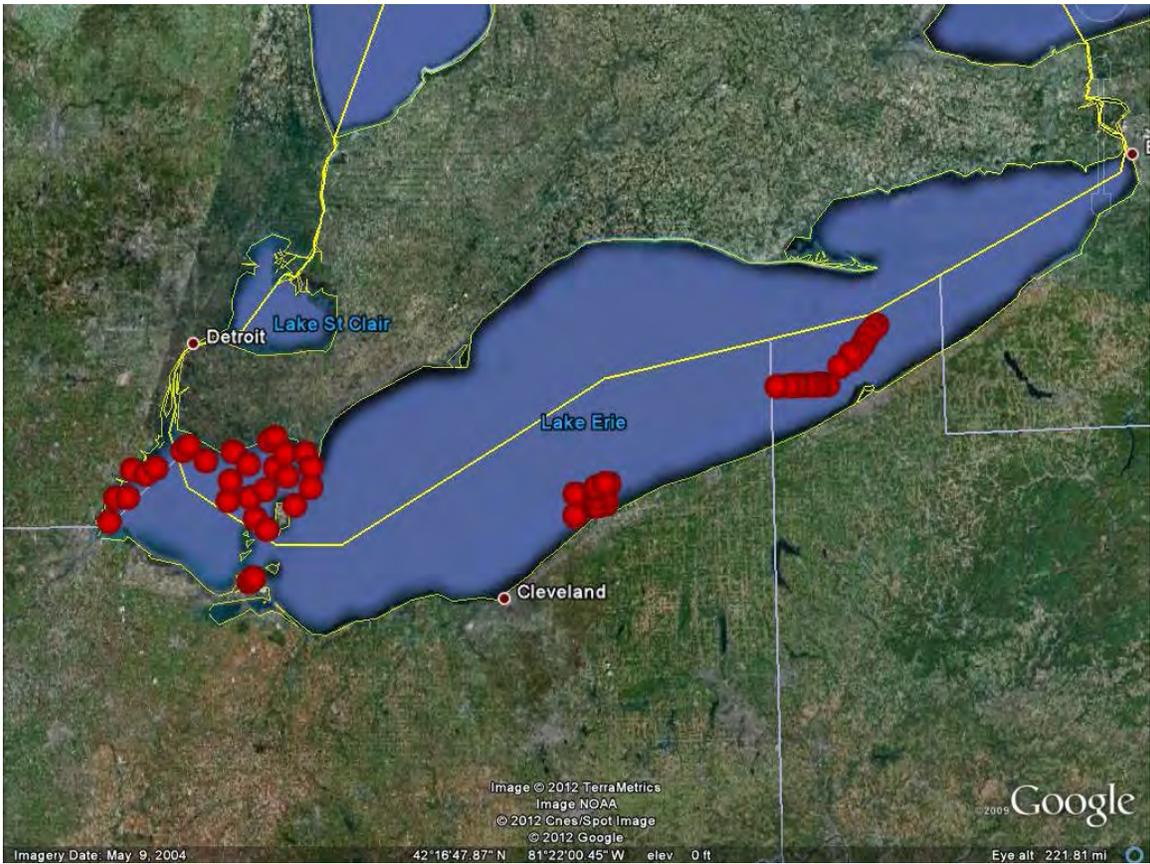
**Figure 9.** Lower Great Lakes fish sampling conducted in 2014 and reported by agency personnel. Ruffe would have been vulnerable to gears used during sampling.



## Central Basin Sampling Locations

### Ohio Department of Natural Resources

**Figure 10.** The Ohio DNR- Fairport Fish Research Unit reported annual bottom trawling (red) and nearshore gillnetting (yellow) at locations in Lake Erie's central basin during 2014. Ruffe would have been vulnerable to gear used during sampling.

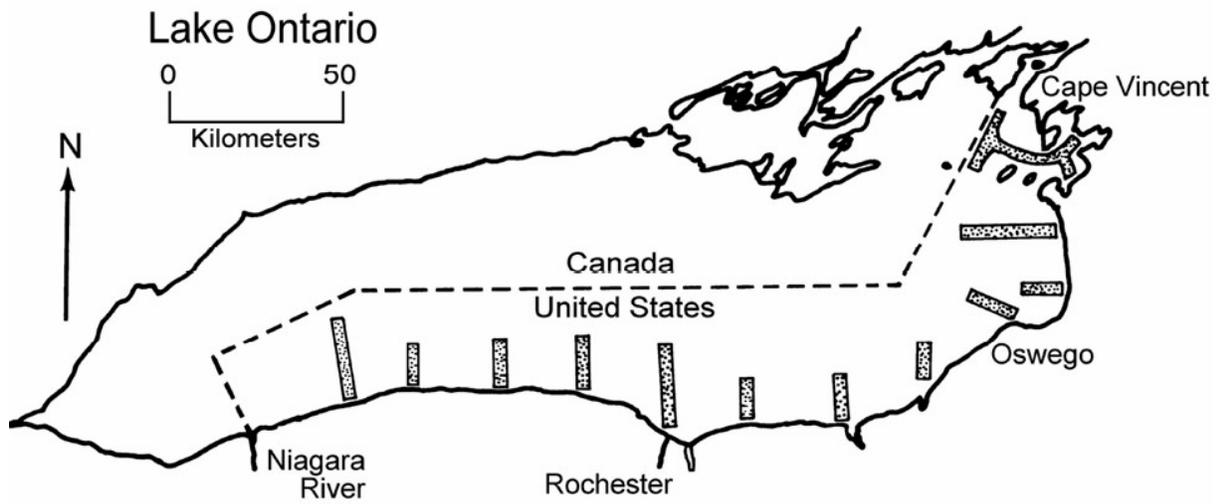


### Bottom Trawling Locations



U. S. Geological Survey

**Figure 11.** The USGS-Lake Erie Biological Station conducted annual bottom trawling at locations in Lake Erie during 2014. Ruffe would have been vulnerable to gear used during sampling.



U. S. Geological Survey

**Figure 12.** The USGS-Lake Ontario Biological Station conducted annual bottom trawling at locations in Lake Ontario during 2014. Ruffe would have been vulnerable to gear used during sampling.



**Table 1.** Summary of dedicated ruffe surveillance in U.S. waters of Lake Huron in 2014.

<u>Location</u>	<u>Agency</u>	<u>Effort</u>	<u>Gear</u>	<u>Date</u>	<u>Depth</u>	<u>S. Temp</u>	<u>B. Temp</u>	<u>Ruffe</u>
Au Gres River	FWS	0.25 hours	BT-4.9	9/4/2014	3.1	25.60	23.00	0
Au Sable River*	FWS	-----	-----	-----	-----	-----	-----	-----
Cheboygan River	FWS	0.50 hours	BT-4.9	9/8/2014	6.8	22.80	18.90	0
Cheboygan River	FWS	16 net lifts	FN	9/8/2014-9/12/2014	7.8	19.33	19.33	0
Cheboygan River	FWS	1.23 hours	EF	5/9/2014	2.7	15.90	15.90	0
Port of Calcite	FWS	0.08 hours	BT-4.9	11/10/2014	7.9	5.70	6.30	0
Port Dolomite	FWS	0.50 hours	BT-4.9	9/9/2014	6.9	15.80	14.20	0
Saginaw River*	FWS	-----	-----	-----	-----	-----	-----	-----
Thunder Bay-Lafarge Corporation	FWS	1.06 hours	EF	5/5/2014	-----	8.30	9.20	0
Thunder Bay-Shipping Channel	FWS	0.50 hours	BT-4.9	9/3/2014	6.5	25.30	15.60	0
Thunder Bay River	FWS	0.50 hours	BT-4.9	9/3/2014,11/5/2014	6.4	16.03	10.91	0
Thunder Bay River	FWS	0.97 hours	EF	5/5/2014-5/6/2014	-----	7.10	8.97	0
Thunder Bay River	FWS	15 net lifts	FN	5/5/2014-5/9/2014	2.0	10.67	10.20	0
Thunder Bay River	FWS	12 net lifts	FN	9/2/2014-9/5/2014	2.7	22.50	22.50	0
Trout River	FWS	0.50 hours	EF2	11/5/2014	0.9	6.00	6.00	0
Totals		2.33 hours	BT-4.9					0
		3.26 hours	EF					0
		0.50 hours	EF2					0
		43 net lifts	FN					0
		Total ruffe (ruffe surveillance)						0

\*Staffing limitations did not allow for sampling in Au Sable River and Saginaw River.

Key to headings:

Agency = U.S. Fish and Wildlife Service (FWS).

Gear = BT-4.9=Bottom trawl I (4.9 m head rope).

EF=Boat electrofishing.

EF2=Backpack electrofishing.

FN=Mini-fyke net (small mesh).

Depth = Average water depth (m).

S. Temp = Average surface water temperature (°C).

B. Temp = Average bottom water temperature (°C).

**Table 2.** Summary of dedicated ruffe surveillance in U.S. waters of Lake Erie in 2014.

<u>Location</u>	<u>Agency</u>	<u>Effort</u>	<u>Gear</u>	<u>Date</u>	<u>Depth</u>	<u>S. Temp</u>	<u>B. Temp</u>	<u>S. DO</u>	<u>B. DO</u>	<u>Secchi</u>	<u>Ruffe</u>
Ashtabula Harbor	FWS	0.66 hours	BT-4.9	5/23/2014	8.0	15.60	15.13	8.94	8.16	0.67	0
Ashtabula Harbor	FWS	0.68 hours	BT-4.9	10/15/2014	7.9	15.58	15.23	9.70	9.16	1.38	0
Buffalo Harbor	FWS	0.89 hours	BT-4.9	5/13/2014	8.0	11.66	9.58	11.77	13.06	3.05	0
Buffalo Harbor	FWS	0.67 hours	BT-4.9	10/1/2014	6.7	19.73	19.68	15.36	15.40	3.13	0
Cleveland Harbor	FWS	0.85 hours	BT-4.9	5/22/2014	8.5	15.20	14.00	9.56	9.38	0.37	0
Cleveland Harbor	FWS	0.87 hours	BT-4.9	10/15/2014	7.7	15.94	15.88	9.38	9.11	1.24	0
Conneaut Harbor	FWS	0.15 hours	BT-4.9	5/23/2014	6.8	15.00	-----	10.56	-----	1.00	0
Conneaut Harbor	FWS	0.50 hours	BT-4.9	10/16/2014	8.3	15.67	15.43	8.89	8.80	1.09	0
Erie Harbor	FWS	0.67 hours	BT-4.9	5/29/2014	8.0	18.13	18.03	9.56	9.48	1.25	0
Erie Harbor	FWS	0.75 hours	-----	10/16/2014	8.9	15.50	15.50	10.08	9.81	1.38	0
Maumee River	FWS	0.83 hours	BT-4.9	5/21/2014	7.5	16.96	16.34	7.52	7.31	0.25	0
Maumee River*	FWS	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sandusky Harbor	FWS	0.50 hours	BT-4.9	5/19/2014	6.5	17.33	15.80	12.98	10.08	0.43	0
Sandusky Harbor*	FWS	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Totals		8.02 hours	BT-4.9								0
		Total ruffe (ruffe surveillance)									0

\*Equipment limitations did not allow for fall sampling in Sandusky Harbor and Maumee River.

Key to headings:

Agency = U.S. Fish and Wildlife Service (FWS).

Gear = Bottom trawl (4.9 m head rope).

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 3.** Summary of dedicated ruffe surveillance in U.S. waters of Lake Ontario in 2014.

<u>Location</u>	<u>Agency</u>	<u>Effort</u>	<u>Gear</u>	<u>Date</u>	<u>Depth</u>	<u>S. Temp</u>	<u>B. Temp</u>	<u>S. DO</u>	<u>B. DO</u>	<u>Secchi</u>	<u>Ruffe</u>
Genesee River	FWS	0.50 hours	BT-4.9	5/28/2014	7.1	17.10	17.10	10.04	10.02	0.20	0
Genesee River	FWS	0.59 hours	BT-4.9	10/2/2014	6.9	19.28	18.85	9.21	8.24	0.81	0
Totals		1.09 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 head rope).

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 4.** Summary of other fish sampling conducted in Lake Superior that was reported as capable of capturing ruffe during 2014.

<u>Location</u>	<u>Agency</u>	<u>Effort</u>	<u>Gear</u>	<u>Date</u>	<u>Depth</u>	<u>Temp</u>	<u>Ruffe</u>
Amnicon River	GLIFWC/FWS	13 net lifts	FN	5/2014-6/2014	0.5-1.0	17.0	0
Apostle Islands/Chequamegon	WIDNR	39 net lifts	GN	7/2014-8/2014	15.8	9.4	170
Bad River	GLIFWC	93 trap lifts	PAT	5/2014-7/2014	0.5	17.8	0
Betsy River	PC	66 trap lifts	PAT	5/2014-7/2014	0.5	18.2	0
Big Garlic River	PC	41 net lifts	FN	5/2014-7/2014	0.5-1.0	17.5	0
Big Pine Picnic Area	BMIC/LSSU	1 haul	SEN	7/2014	0-2.0	-----	0
Brule River	GLIFWC/FWS	33 trap lifts	PT	5/2014-7/2014	0.8	16.2	0
Chequamegon Bay *	USGS	5.3 hours	BT-5.5	7/2014	6.0	-----	126
Chequamegon Bay *	FWS	1.3 hours	BT-4.9	8/2014	2.3-18.8	13.8-20.4	38
Chequamegon Bay *	FWS	2.5 hours	EF	8/2014	0.6-1.5	19.2-21.7	11
Chequamegon Bay *	FWS	15 net lifts	FN2	8/2014	0.6-1.6	17.6-21.6	23
Chocoday River	PC	36 net lifts	FN	5/2014-7/2014	0.5-1.0	15.0	0
Firesteel River	GLIFWC	18 net lifts	FN	5/2014-7/2014	0.5-1.0	19.3	0
Furnace Creek	PC	45 trap lifts	PAT	5/2014-7/2014	0.5	16.1	0
Goulais River	DFO	6 net lifts	FN1	8/2014	-----	-----	0
Goulais River	DFO	(not reported)	EF	8/2014	-----	-----	0
Goulais River	DFO	4 hauls	SEN1	8/2014	-----	-----	0
Goulais River	DFO	0.3 hours	TRM	8/2014	-----	-----	0
Kaministiquia River*	DFO	3.1 hours	EF	9/2014	-----	-----	6
Kaministiquia River*	DFO	3 net lifts	FN1	9/2014	-----	-----	1
Kaministiquia River	DFO	4 hauls	SEN1	9/2014	-----	-----	0
Kaministiquia River*	DFO	0.8 hours	TRL	9/2014	-----	-----	1
Laughing Whitefish River	PC	25 net lifts	FN	5/2014-7/2014	0.5	17.0	0
Middle River	GLIFWC/FWS	148 trap lifts	PAT	5/2014-6/2014	0.5	16.0	0
Miners River	NPS/FWS	78 trap lifts	PAT	5/2014-7/2014	0.5	14.4	0
Misery River *	GLIFWC	58 trap lifts	PAT	5/2014-7/2014	0.5	17.4	3
Naomikong Creek *	BMIC/LSSU	18 net lifts	GN1	7/2014-8/2014	2.0-3.0	12.6-20.6	5
Naomikong Creek	BMIC/LSSU	16 hauls	SEN	6/2014-8/2014	0-2.0	16.9-18.9	0
Nearshore*	USGS	29.1 hours	BT-11.9	5/2014-6/2014	40.0	3.6	1
Offshore	USGS	10.0 hours	BT-11.9	7/2014	189.0	3.5	0
Pendills Bay-Narrow s	BMIC/LSSU	12 net lifts	GN1	7/2014-8/2014	2.0-4.0	11.5-16.5	0
Pendills Bay-Narrow s	BMIC/LSSU	12 hauls	SEN	6/2014-8/2014	0-2.0	10.0-16.5	0
Pendills Creek	BMIC/LSSU	12 net lifts	GN1	7/2014-8/2014	2.0-4.0	12.1-16.1	0
Pendills Creek *	BMIC/LSSU	12 hauls	SEN	6/2014-8/2014	0-2.0	13.2-16.5	1
Poplar River	GLIFWC/FWS	17 net lifts	FN	5/2014-6/2014	0.5-1.0	16.1	0
Red Cliff Creek	RCBLSC	25 net lifts	FN	5/2014-6/2014	0.5-1.0	14.5	0
Rock River	FWS	84 trap lifts	PAT	5/2014-7/2014	0.5	14.7	0
Silver River	GLIFWC	24 net lifts	FN	5/2014-7/2014	0.5-1.0	14.5	0
St. Louis River *	FWS	0.8 hours	BT-4.9	8/2014	2.0-14.0	20.3-23.3	130
St. Louis River *	FWS	7.0 hours	EF	8/2014	0.9-4.0	19.1-21.7	1
St. Louis River *	FWS	20 net lifts	FN2	8/2014	0.8-2.2	19.0-21.6	8
St. Marys River-Upper	FWS/OMNRF	0.8 hours	BT-4.9	8/2014	1.7-11.0	13.4-17.4	0
St. Marys River-Upper	FWS/OMNRF	2.0 hours	EF	8/2014-9/2014	0.9-2.0	14.0-17.6	0
St. Marys River-Upper	FWS/OMNRF	20 net lifts	FN2	8/2014	0.5-1.1	15.5-20.4	0
Tahquamenon Bay-Shallow s *	BMIC/LSSU	18 net lifts	GN1	7/2014-8/2014	2.0-3.0	16.2-20.3	5
Tahquamenon Bay-Shallow s	BMIC/LSSU	16 hauls	SEN	6/2014-8/2014	0.0-2.0	17.5-20.9	0
Tahquamenon River	PC	99 trap lifts	PAT	5/2014-7/2014	0.5	18.4	0
Thunder Bay Harbour *	FWS/OMNRF	0.8 hours	BT-4.9	9/2014	3.5-10.2	16.5-18.8	20
Thunder Bay Harbour	FWS/OMNRF	3.3 hours	EF	8/2014	0.6-6.5	14.0-21.0	0
Thunder Bay Harbour *	FWS/OMNRF	20 trap lifts	FN2	8/2014	0.8-4.7	16.0-19.0	12
Totals		3.7 hours	BT-4.9				188
		5.3 hours	BT-5.5				126
		39.1 hours	BT-11.9				1
		17.9 hours	EF				18
		199 net lifts	FN				0
		9 net lifts	FN1				1
		75 net lifts	FN2				43
		39 net lifts	GN				170
		60 net lifts	GN1				10
		671 trap lifts	PAT				3
		33 trap lifts	PT				0
		57 hauls	SEN				1
		8 hauls	SEN1				0
		0.8 hours	TRL				1
		0.3 hours	TRM				0
		Total ruffe (captured incidentally)					562

Key to agency:

BMIC = Bay Mills Indian Community.  
DFO = Department of Fisheries and Oceans.  
FWS = U. S. Fish and Wildlife Service.  
GLIFWC = Great Lakes Indian Fish and Wildlife Commission.  
LSSU = Lake Superior State University.  
NPS = National Park Service.  
OMNRF = Ontario Ministry of Natural Resources and Forestry.  
PC = Private contractor.  
RCBLSC = Red Cliff Band of Lake Superior Chippewa.  
USGS = U.S. Geological Survey.  
WIDNR = Wisconsin Department of Natural Resources.

Key to symbols:

\* Locations where ruffe were captured.

Key to headings:

Depth = Average water depth (m) or depth range.  
Temp = Average water temperature (°C) or temperature range.

Key to gear:

BT-4.9 = Bottom trawl (4.9 m head rope).  
BT-5.5 = Bottom trawl (5.5 m head rope).  
BT-11.9 = Bottom trawl (11.9 m head rope).  
EF = Electrofishing.  
FN = Fyke net.  
FN1 = Fyke net (1.3 m box).  
FN2 = Paired fyke nets (4.7 mm mesh with 15 m lead).  
GN = Gill net (1097 m, 91 m panels of 38 to 178 mm stretch mesh).  
GN1 = Experimental gill net (12.2 m x 1.8 m, 8 panels of 6 to 32 mm mesh).  
PAT = Portable assessment trap.  
PT = Permanent trap.  
SEN = Beach seine (50 m x 2 m, 6 mm mesh).  
SEN1 = Beach seine (15 m length).  
TRM = Trammel net.  
TRL = Trawl.

**Table 5.** Summary of other fish sampling conducted in Lake Michigan that was reported as capable of capturing ruffe during 2014.

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Betsie River	GTBOCI	72 trap lifts	PAT	4/2014-6/2014	0.5-1.0	16.0	0
Big Bay de Noc	MIDNR	1.7 hours	BT-3.7	6/2014-10/2014	2.8-13.0	-----	0
Big Bay de Noc	MIDNR	48 net lifts	GN-EX	8/2014-9/2014	2.8-13.0	19.4-19.7	0
Big Bay de Noc	ISEA	0.7 hours	BT-4.9	6/2014	9.5	-----	0
Big Manistee River	FWS	44 trap lifts	PT	4/2014-6/2014	0.5-1.0	13.0	0
Boardman River	GTBOCI	86 trap lifts	PAT	4/2014-6/2014	0.5	16.1	0
Burns Harbor	FWS	10 net lifts	FN4	9/2014	0.0-15.0	-----	0
Burns Harbor	FWS	9 net lifts	FN3	9/2014	0.0-15.0	-----	0
Burns Harbor	FWS	4.1 hours	EF	9/2014	0.0-15.0	-----	0
Burns Harbor	FWS	21 net lifts	GN-M	9/2014	0.0-15.0	-----	0
Burns Harbor	FWS	10 array trap lifts	MT	9/2014	0.0-15.0	-----	0
Calumet Harbor	FWS	1.0 hours	EF	5/2014	2.5-6.5	-----	0
Calumet Harbor	FWS	5 array trap lifts	MT	5/2014	2.5-6.5	-----	0
Calumet Harbor	FWS	8 tows	TRL2	5/2014	2.5-6.5	-----	0
Calumet Harbor	FWS	5 trap lifts	MWT	5/2014	2.5-6.5	-----	0
Carp Lake River	FWS	63 trap lifts	PT	4/2014-6/2014	0.8	15.2	0
Deer Creek	PC	72 trap lifts	PAT	4/2014-6/2014	0.5	14.6	0
East Tw in River	PC	23 trap lifts	PAT	4/2014-6/2014	0.5	15.4	0
Elk Lake Outlet	PC	106 trap lifts	PAT	4/2014-6/2014	0.5-1.0	11.0	0
Elk Rapids	ISEA	0.7 hours	BT-4.9	7/2014-8/2014	9.2	-----	0
Frankfort	ISEA	0.5 hours	BT-4.9	8/2014	9.1	-----	0
Grand Traverse Bay-West	ISEA	7.2 hours	BT-4.9	5/2014-7/2014	9.2	-----	0
Green Bay	FWS	6 net lifts	FN4	8/2014-11/2014	0.0-6.0	-----	0
Green Bay	FWS	6 net lifts	FN3	8/2014-11/2014	0.0-6.0	-----	0
Green Bay	FWS	7.1 hours	EF	8/2014-11/2014	0.0-6.0	-----	0
Green Bay	FWS	25 array trap lifts	MT	8/2014-11/2014	0.0-6.0	-----	0
Green Bay	WIDNR	36 net lifts	FN2	5/2014	1.0-3.0	9.0	0
Green Bay	WIDNR	52 hauls	SEN	6/2014-7/2014	0.0-1.0	21.0	0
Green Bay	WIDNR	6.3 hours	TRL	8/2014	3.0-23.0	8.0-21.0	0
Hog Island Creek	PC	38 net lifts	FN	5/2014-6/2014	0.5-1.0	10.2	0
Inland-Lake Charlevoix	ISEA	1.2 hours	BT-4.9	7/2014-8/2014	13.0	-----	0
Leland	ISEA	0.2 hours	BT-4.9	8/2014	9.5	-----	0
Little Bay de Noc	MIDNR	1.7 hours	BT-3.7	6/2014-10/2014	2.1-20.8	-----	0
Little Bay de Noc *	MIDNR	32 net lifts	GN-EX	8/2014-9/2014	2.1-20.8	12.2-19.4	5
Little Manistee River	FWS	78 trap lifts	PAT	4/2014-6/2014	0.5-1.0	13.0	0
Manistique	MIDNR	1.7 hours	BT-3.7	6/2014-10/2014	-----	-----	0
Manistique	MIDNR	10 net lifts	GN-EX	8/2014-9/2014	3.1-11.1	17.3-17.8	0
Manistique River	FWS	20 trap lifts	SPT	5/2014-6/2014	0.5	18.2	0
Menominee River	FWS	21 trap lifts	PAT	5/2014-6/2014	0.5-1.0	18.5	0
Milw aukee	FWS	6 net lifts	FN4	9/2014	0.0-10.0	-----	0
Milw aukee	FWS	6 net lifts	FN3	9/2014	0.0-10.0	-----	0
Milw aukee	FWS	4.0 hours	EF	9/2014	0.0-10.0	-----	0
Milw aukee	FWS	8 net lifts	GN-M	9/2014	0.0-10.0	-----	0
Milw aukee	FWS	25 array trap lifts	MT	9/2014	0.0-10.0	-----	0
Muskegon River	FWS	82 trap lifts	PAT	4/2014-6/2014	1.0-5.0	13.7	0
Naubinway	MIDNR	11 net lifts	GN-EX	6/2014-10/2014	4.8-12.2	14.7-16.3	0
Nearshore/Offshore	USGS	9.9 hours	BT-12	9/2014	5.0-135.0	3.8-20.1	0
Oconto River	FWS	32 trap lifts	PAT	4/2014-6/2014	0.5-1.0	15.7	0
Ogontz River	PC	10 net lifts	FN	5/2014-6/2014	0.5-1.0	15.0	0
Peshigo River	FWS	68 trap lifts	PAT	4/2014-6/2014	0.5-1.0	16.2	0
Petoskey	ISEA	0.2 hours	BT-4.9	8/2014	8.5	-----	0
St. Joseph River	FWS	123 trap lifts	PAT	4/2014-6/2014	0.5	15.8	0
Suttons Bay	ISEA	16.5 hours	BT-4.9	5/2014-10/2014	11.0	-----	0
Trail Creek	PC	53 trap lifts	PT	4/2014-5/2014	0.5	14.2	0
Totals		5.1 hours	BT-3.7				0
		27.2 hours	BT-4.9				0
		9.9 hours	BT-12				0
		16.2 hours	EF				0
		48 net lifts	FN				0
		36 net lifts	FN2				0
		21 net lifts	FN3				0
		22 net lifts	FN4				0
		101 net lifts	GN-EX				5
		29 net lifts	GN-M				0
		65 array trap lifts	MT				0
		5 trap lifts	MWT				0
		763 trap lifts	PAT				0
		160 trap lifts	PT				0
		52 hauls	SEN				0
		20 trap lifts	SPT				0
		6.3 hours	TRL				0
		8 tows	TRL2				0
		Total ruffe (captured incidentally)					5

Key to agency:

FWS = U.S. Fish and 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.  
 WIDNR = Wisconsin Department of Natural Resources.

Key to symbols:

\* Location where ruffe were captured.

Key to headings:

Depth = Average water depth (m) or depth range.  
 Temp = Average water temperature (°C) or temperature range.

Key to gear:

BT-3.7 = Bottom trawl (3.7 m head rope).  
 BT-4.9 = Bottom trawl (4.9 m head rope).  
 BT-12 = Bottom trawl (12 m head rope).  
 EF = Electrofishing (boat).  
 FN = Fyke net.  
 FN2 = Fyke net (double ended nets).  
 FN3 = Paired fyke net (0.9 m x 1.5 m, 13 mm mesh).  
 FN4 = Paired mini-fyke net (0.7 m x 1.0 m, 3 mm mesh).  
 GN-EX = Gill net (97 m experimental with 25, 38, and 50 mm mesh panels).  
 GN-M = Gill net (12.2 m micromesh experimental with 12, 16, 20, and 25 mm mesh panels).  
 MT = Minnow trap array (5 traps - baited/unbaited).  
 MWT = Modified windermere trap.  
 PAT = Portable assessment trap.  
 PT = Permanent trap.  
 SEN = Beach seine (15.2 m seine).  
 SPT = Semipermanent trap.  
 TRL = Trawl.  
 TRL2 = Otter trawl.

**Table 6.** Summary of other fish sampling conducted in Lake Huron that was reported as capable of capturing ruffe during 2014.

Location	Agency	Effort	Gear	Date	Depth	Temp	Ruffe
Albany Creek	PC	32 trap lifts	PAT	5/2014-7/2014	0.5	13.9	0
Au Sable River	PC	92 trap lifts	PAT	4/2014-6/2014	0.5-1.0	11.3	0
Black River	MIDNR	1.0 hour	BT-11	7/2014	12.2-30.5	-----	0
Carp River	PC	183 net lifts	FN	5/2014-7/2014	0.5-1.0	15.6	0
Cheboygan River	FWS	134 trap lifts	PT	4/2014-6/2014	1.0	17.2	0
Coldwater	DFO	0.5 hour	TRL	6/2014	-----	-----	0
Coldwater	DFO	3.2 hours	EF	6/2014	-----	-----	0
Coldwater	DFO	10 net lifts	TN	6/2014	-----	-----	0
Coldwater	DFO	19 net lifts	FN1	6/2014	-----	-----	0
Coldwater	DFO	1 haul	SEN	6/2014	-----	-----	0
Devils River	PC	45 net lifts	FN	4/2014-6/2014	0.5-1.0	17.2	0
East Au Gres River	PC	37 trap lifts	PAT	4/2014-6/2014	0.5-1.0	15.3	0
Greene Creek	FWS	27 trap lifts	PAT	4/2014-6/2014	0.5	14.7	0
Hog Creek	DFO	1.6 hours	EF	7/2014	-----	-----	0
Hog Creek	DFO	5 net lifts	FN1	7/2014	-----	-----	0
Hog Creek	DFO	0.2 hour	TRM	7/2014	-----	-----	0
Hog Creek	DFO	0.2 hour	TRL	7/2014	-----	-----	0
Les Cheneaux Island area	MIDNR	6 net lifts	GN1	9/2014-10/2014	1.8-7.3	15.6-16.7	0
Magnetawan	DFO	0.3 hour	TRL	7/2014	-----	-----	0
Magnetawan	DFO	3 net lifts	FN1	7/2014	-----	-----	0
Magnetawan	DFO	1.0 hour	EF	7/2014	-----	-----	0
Mississagi River	DFO	1.2 hours	EF	7/2014	-----	-----	0
Mississagi River	DFO	6 net lifts	FN1	7/2014	-----	-----	0
Mississagi River	DFO	2 hauls	SEN	7/2014	-----	-----	0
Mississagi River	DFO	0.5 hour	TRL	7/2014	-----	-----	0
Mississagi River	DFO	3.3 hours	EF	7/2014	-----	-----	0
Naiscoot River	DFO	3 net lifts	FN1	7/2014	-----	-----	0
Naiscoot River	DFO	0.3 hour	TRL	7/2014	-----	-----	0
Naiscoot River	DFO	0.1 hour	TRM	7/2014	-----	-----	0
Nottawasaga River	DFO	0.2 hour	TRL	7/2014	-----	-----	0
Nottawasaga River	DFO	6 net lifts	FN1	7/2014	-----	-----	0
Nottawasaga River	DFO	1.7 hours	EF	7/2014	-----	-----	0
Nottawasaga River	DFO	0.1 hour	TRM	7/2014	-----	-----	0
Ocqueoc River	FWS	80 trap lifts	PT	5/2014-6/2014	0.4	18.7	0
Saginaw Bay	MIDNR	3.8 hours	BT-10	9/2014	4.2-12.2	16.6-18.3	0
Saginaw Bay	MIDNR	40 net lifts	GN1	9/2014	3.4-7.6	19.4-21.7	0
Shebeshkong River	DFO	0.1 hour	TRM	7/2014	-----	-----	0
Shebeshkong River	DFO	0.4 hour	TRL	7/2014	-----	-----	0
Shebeshkong River	DFO	0.9 hours	EF	7/2014	-----	-----	0
Shebeshkong River	DFO	6 net lifts	FN1	7/2014	-----	-----	0
Spanish River	DFO	6 net lifts	FN1	8/2014	-----	-----	0
Spanish River	DFO	1.8 hours	EF	8/2014	-----	-----	0
Spanish River	DFO	0.2 hour	TRM	8/2014	-----	-----	0
St. Marys River	FWS/OMNRF	15 net lifts	FN2	7/2014-8/2014,10/2014	1.2-4.8	16.2	0
St. Marys River	FWS/OMNRF	1.7 hours	EF	8/2014	0.6-1.9	18.1	0
St. Marys River	FWS/OMNRF	1.3 hours	BT-4.9	8/2014	2.0-8.0	17.7	0
St. Marys River	FWS	262 trap lifts	PAT	6/2014-8/2014	0.5-1.0	12.0	0
St. Marys River	SMRFTG	23.2 hours	EF	9/2014	0.6-2.0	15.1	0
St. Marys River	DFO	7.8 hours	EF	6/2014	-----	-----	0
Sturgeon River	DFO	0.1 hour	TRM	7/2014	-----	-----	0
Sturgeon River	DFO	1 haul	SEN	7/2014	-----	-----	0
Sturgeon River	DFO	3 net lifts	FN1	7/2014	-----	-----	0
Sturgeon River	DFO	1.0 hour	EF	7/2014	-----	-----	0
Thunder Bay	MIDNR	5.3 hours	BT-11	7/2014-8/2014	11-35.4	-----	0
Tittabawassee River	PC	31 trap lifts	SPT	4/2014-6/2014	1.0	18.3	0
Trout Creek	PC	34 net lifts	FN	5/2014-7/2014	0.5-1.0	15.9	0
Trout River	FWS	14 trap lifts	SPT	5/2014-6/2014	0.2	18.2	0
Totals		1.3 hours	BT-4.9				0
		3.8 hours	BT-10				0
		6.3 hours	BT-11				0
		48.4 hours	EF				0
		262 net lifts	FN				0
		57 net lifts	FN1				0
		15 net lifts	FN2				0
		46 net lifts	GN1				0
		450 trap lifts	PAT				0
		214 trap lifts	PT				0
		4 hauls	SEN				0
		45 trap lifts	SPT				0
		10 net lifts	TN				0
		2.4 hours	TRL				0
		0.8 hour	TRM				0
Total ruffe (captured incidentally)							0

**Key to agency:**

DFO = Department of Fisheries and Oceans.  
 FWS = U.S. Fish and Wildlife Service.  
 MIDNR = Michigan Department of Natural Resources.  
 OMNRF = Ontario Ministry of Natural Resources and Forestry  
 PC = Private contractor.  
 SMRFTG = St. Marys River Fisheries Task Group.

**Key to headings:**

Depth = Average water depth (m) or depth range.  
 Temp = Average water temperature (°C) or temperature range.

**Key to gear:**

BT-4.9 = Bottom trawl (4.9 m head rope).  
 BT-10 = Bottom trawl (10 m head rope).  
 BT-11 = Bottom trawl (11 m head rope).  
 EF = Electrofishing (boat).  
 FN = Fyke net.  
 FN1 = Fyke net (1.3 m box).  
 FN2 = Paired fyke net.  
 GN1 = Gill net (graded mesh included 30.48 m panel of 38.1 mm mesh).  
 PAT = Portable assessment trap.  
 PT = Permanent trap.  
 SEN = Beach seine (15 m length).  
 SPT = Semipermanent trap.  
 TN = Trap net.  
 TRL = Trawl.  
 TRM = Trammel net.

**Table 7.** Summary of other fish sampling conducted in Lake Erie that was reported as capable of capturing ruffe during 2014.

<u>Location</u>	<u>Agency</u>	<u>Effort</u>	<u>Gear</u>	<u>Date</u>	<u>Depth</u>	<u>Temp</u>	<u>Ruffe</u>
Cattaraugus Creek	FWS	106 trap lifts	SP	4/2014-6/2014	0.5	15.0	0
Central Basin-Ohio	ODNR	5.8 hours	BT-10.4	8/2014-10/2014	5.5-21.4	9.5-22.4	0
Central Basin-Ohio	ODNR	9 net lifts	GN1	9/2014-10/2014	4.9-14.4	13.5-19.6	0
Cuyahoga River-Low er	ODNR	2.4 hours	EF	4/2014,5/2014,9/2014	<1.0-9.0	9.0-25.0	0
Cuyahoga River-Low er	ODNR	1.8 hours	LTR	4/2014,5/2014,9/2014	<1.0-9.0	9.0-25.0	0
Grand River	PC	102 trap lifts	PAT	4/2014-6/2014	0.5	15.6	0
Grand River-Low er	ODNR	0.7 hours	EF	4/2014-5/2014	<1.0-9.0	9.0-14.0	0
Grand River-Low er	ODNR	0.8 hours	LTR	4/2014-5/2014	<1.0-9.0	9.0-14.0	0
HEW-Detroit River	FWS	14 net lifts	GN2	4/2014,5/2014,11/2014	2.9-12.2	6.8-12.7	0
HEW-Detroit River	FWS	15 net lifts	FN	7/2014	1.0-1.5	22.3-24.3	0
HEW-Detroit River	FWS	219 trap lifts	MT	4/2014,5/2014,7/2014,11/2014	1.1-12.1	6.0-23.5	0
HEW-Detroit River	FWS	1.5 hours	EF	8/2014,11/2014	3.0-6.3	7.5-21.7	0
HEW-Detroit River	FWS	0.7 hours	BT-4.9	7/2014	3.0-5.1	22.3-25.6	0
HEW-Lake St. Clair	MIDNR	1.3 hours	BT-10	5/2014,9/2014	2.7-3.9	12.5-22.1	0
HEW-Lake St. Clair	MIDNR	40 trap lifts	TN	4/2014,5/2014	2.7-3.4	7.0-15.0	0
HEW-St. Clair River	FWS	69 net lifts	GN2	4/2014-6/2014,11/2014	4.8-15.9	4.0-13.3	0
HEW-St. Clair River	FWS	143 trap lifts	MT	4/2014-6/2014,11/2014	4.8-17.1	4.0-13.3	0
Maumee Bay	FWS	1.5 hours	EF	9/2014	1.0-1.5	23.4-24.9	0
Maumee Bay	FWS	1.3 hours	BT-4.9	10/2014	2.1-5.2	11.8-12.4	0
Maumee Bay	FWS	15 net lifts	FN	8/2014	1.1-2.8	26.3	0
Nearshore/Offshore	USGS	32.6 hours	BT-7.9	5/2014-7/2014,9/2014-10/2014	3.0-30.0	9.0-22.0	0
Niagara River-Upper	FWS	133.6 hours	MULTI	6/2014-10/2014	-----	-----	0
Sandusky Bay	FWS	2.5 hours	EF	9/2014	1.1-2.9	17.7-19.2	0
Sandusky Bay	FWS	1.3 hours	BT-4.9	9/2014	2.4-3.5	17.9-19.2	0
Sandusky Bay	FWS	15 net lifts	FN	9/2014	1.2-2.4	18.2	0
Spooner Creek	PC	84 trap lifts	PAT	4/2014-6/2014	0.5	15.0	0
Western Basin-Michigan	MIDNR	0.8 hours	BT-10	8/2014	4.0-7.3	23.8-25.1	0
Western Basin-Ohio	ODNR	21.7 hours	BT-10.7	5/2014-9/2014	7.4	20.0	0
Western Basin-Ohio	ODNR	3.5 hours	EF	6/2014	1.0	23.8	0
Totals		3.3 hours	BT-4.9				0
		32.6 hours	BT-7.9				0
		2.1 hours	BT-10				0
		5.8 hours	BT-10.4				0
		21.7 hours	BT-10.7				0
		12.1 hours	EF				0
		45 net lifts	FN				0
		9 net lifts	GN1				0
		83 net lifts	GN2				0
		2.6 hours	LTR				0
		362 trap lifts	MT				0
		133.6 hours	MULTI				0
		186 trap lifts	PAT				0
		106 trap lifts	SP				0
		40 trap lifts	TN				0
Total ruffe (captured incidentally)							0

Key to location:

HEW = Huron Erie Waterway.

Key to agency:

FWS = U.S. Fish and Wildlife Service.

MIDNR = Michigan Department of Natural Resources.

ODNR = Ohio Department of Natural Resources.

PC = Private contractor.

USGS = U.S. Geological Survey.

Key to column headings:

Depth = Average water depth (m) or depth range.

Temp = Average surface temperature (°C) or temperature range.

Key to gear:

BT-4.9 = Bottom trawl (4.9 m head rope).

BT-7.9 = Bottom trawl (7.9 m head rope).

BT-10 = Bottom trawl (10.0 m head rope).

BT-10.4 = Bottom trawl (10.4 m head rope).

BT-10.7 = Bottom trawl (10.7 m head rope).

EF = Electrofishing.

FN = Paired fyke net.

GN1 = Gill net (182 m, included panel of 32 mm stretch mesh).

GN2 = Gill net (91 m, included panels of 25 and 38 mm stretch mesh).

LTR = Larval trawl.

MT = Gee minnow trap (baited).

MULTI = bottom trawl, benthic sled, electrofishing, and paired fyke net.

PAT = Portable assessment trap.

SP = Semi-permanent trap.

TN = Trap net.

**Table 8.** Summary of other fish sampling conducted in Lake Ontario that was reported as capable of capturing ruffe during 2014.

<u>Location</u>	<u>Agency</u>	<u>Effort</u>	<u>Gear</u>	<u>Date</u>	<u>Depth</u>	<u>Temp</u>	<u>Ruffe</u>	
Black River	PC	63 trap lifts	PAT	4/2014-6/2014	0.5	13.0	0	
Genessee River/Irondequoit Bay	FWS	301.9 hours	MULTI	6/2014-11/2014	-----	-----	0	
Grindstone Creek	PC	15 trap lifts	PAT	4/2014-5/2014	0.5	16.0	0	
Little Salmon River	PC	20 trap lifts	PAT	4/2014-5/2014	0.5	17.0	0	
Nearshore/Offshore	USGS/NY SDEC	58.5 hours	BT-18	3/2014-9/2014	8.0-225.0	0-17.6	0	
Niagara River-Low er	FWS	0.8 hours	EF	10/2014	0.3-2.7	18.1-19.4	0	
Salmon River	FWS	16 trap lifts	PT	5/2014	0.5	16.8	0	
Sterling Creek	PC	32 trap lifts	PAT	4/2014-5/2014	0.5-1.0	15.5	0	
Sterling Valley Creek	PC	22 trap lifts	PAT	4/2014-5/2014	0.5	15.5	0	
Totals		58.5 hours	BT-18				0	
		0.8 hours	EF				0	
		301.9 hours	MULTI				0	
		152 trap lifts	PAT				0	
		16 trap lifts	PT				0	
		Total ruffe (captured incidentally)						0

Key to agency:

FWS = U.S. Fish and Wildlife Service.  
 NY SDEC = 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 head rope).  
 EF = Electrofishing.  
 MULTI = bottom trawl, benthic sled, electrofishing, and paired fyke net.  
 PAT = Portable assessment trap.  
 PT = Permanent trap.

Key to column headings:

Depth = Average water depth (m) or depth range.  
 Temp = Average water temperature (°C) or temperature range.

## **APPENDIX: Chronology of ruffe detection for the Great Lakes Basin**

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

**1991 – Lake Superior:** Major ruffe range expansion was detected. A crew from U.S. Fish and Wildlife Service-Ashland Fish and Wildlife Conservation Office (USFWS-Ashland) 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 operations between the Duluth/Superior Harbor, Minnesota/Wisconsin, and Thunder Bay Harbour.

**1992 – Lake Superior:** Major ruffe range expansion was detected. USFWS-Ashland 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 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-Lower Great Lakes) 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 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 Ontario Ministry of Natural Resources and Forestry – Upper Great Lakes Management Unit (OMNRF-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 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 OMNRF-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) 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 OMNRF 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 OMNRF expanded ruffe surveillance into Canadian waters of Lake Erie and USFWS-Lower Great Lakes 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 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 effort (CPE) of ruffe in the Thunder Bay River estuary, Michigan, 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 (number per hour bottom trawling) more than doubled from 5 in 1999 to 11 in 2000. **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 USFWS-Alpena expanded ruffe surveillance into U.S. waters of the St. Marys River. **Lower Great Lakes:** No ruffe were detected.

**2001 – Lake Superior:** Minor ruffe range expansion was detected. The OMNRF detected ruffe near the mouth of the Current River, Lake Superior, which is located within Thunder Bay Harbour, Ontario. This discovery represented 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 (number per hour bottom trawling) of that colony more than seven 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 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, Michigan, colony or any other ruffe surveillance location in Lake Huron or the St. Marys River. **Lower Great Lakes:** No ruffe were detected.

**2002 – Lake Superior:** Major ruffe range expansion was detected. The USFWS-Ashland 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 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 or the St. Marys River, and no ruffe were captured in

trawls within the ruffe range in Lake Huron. The USFWS-Alpena initiated reduction of the spawning ruffe population in the Thunder Bay River, Michigan, 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 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. 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. Near the Apostle Islands, the Red Cliff Tribal Fisheries Department in cooperation with USFWS-Ashland continued a ruffe capture effort during lake trout *Salvelinus namaycush* and lake whitefish spawning. 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 the Ontonagon River Estuary in Michigan, a combination of bottom trawling, gill netting, and trapping conducted by the USFWS-Ashland failed to effectively (achieve a minimum reduction of 90% of the ruffe population) reduce the ruffe spawning population. 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 by-catch 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 or the St. Marys River; however, they continued to persist in the Thunder Bay River, Michigan. The USFWS-Alpena 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. Ruffe surveillance was expanded in Lake Michigan by USFWS-Ashland and USFWS-Green Bay to include a total of nine major ports, but no ruffe were captured outside of LBDN. **Lower Great Lakes:** No ruffe were detected.

**2004 – Lake Superior:** Major ruffe range expansion was detected. The USFWS-Ashland 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 or the St. Marys River, and they were not captured from the Thunder Bay River, Michigan. **Lake Michigan:** The Michigan Department of Natural Resources-Marquette Fisheries Research Station (MIDNR-Marquette) 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 U.S. Geological Survey-Lake Superior Biological Station (USGS-LSBS) captured one sub adult ruffe incidentally from Thunder Bay, Ontario, 5 km northeast of Thunder Bay Harbour, Ontario, and 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 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:** No ruffe were captured from new or previously detected locations in Lake Huron, including the Thunder Bay River, Michigan, and Thunder Bay shipping lanes, where they were first detected in 1995. No ruffe have been detected in the St. Marys River. **Lake Michigan:** The MIDNR-Marquette captured no ruffe in other fish sampling from BBDN, where they were first detected in 2004. However, MIDNR-Marquette 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, Michigan, 226 km east of Marquette Harbor and 55 km west of the Soo Locks. In Thunder Bay, Ontario, the OMNRF 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 OMNRF also reported that a commercial fisherman captured three adult ruffe in a 120 mm stretch mesh gill net near the Welcome Islands in Thunder Bay, 3.5 km east of the Mission River estuary. The OMNRF 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-Marquette 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 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, Michigan, 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 MIDNR 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-Marquette 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:** The range of ruffe spanned the south shore 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 were halted in Lake Superior because the range spans U.S. waters along the south shore of the lake. The USGS-LSBS 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, Michigan, 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. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR-Marquette continued to

capture ruffe (5 ruffe) incidentally during sampling efforts in LBDN. **Lower Great Lakes:** No ruffe were detected.

**2009 – Lake Superior:** The range of ruffe spanned the south shore 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-LSBS 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, Michigan, and Thunder Bay shipping lanes, where they were first detected in 1995 or the Trout River in Rogers City, Michigan, where they were first captured in a trap in 2008. Ruffe remained undetected in the St. Marys River. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR-Marquette continued to capture ruffe (2 ruffe) incidentally from LBDN, within the known range. **Lower Great Lakes:** No ruffe were detected.

**2010 – Lake Superior:** The range of ruffe spanned the south shore 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-LSBS 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 in Michigan, including the Thunder Bay River and Thunder Bay shipping lanes, where they were first detected in 1995 or the Trout River in Rogers City, where they were first identified in a trap in 2008. Ruffe remained undetected in the St. Marys River. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR-Marquette continued to capture ruffe (10 ruffe) incidentally from LBDN, within the known range. **Lower Great Lakes:** No ruffe were detected.

**2011 – Lake Superior:** The range of ruffe spanned the south shore 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-LSBS captured ruffe (48 ruffe) within the known range in Lake Superior from near the Duluth Harbor, Apostle Islands, Chequamegon Bay, Keewenaw Peninsula and Whitefish Point/Bay. **Lake Huron:** Ruffe range expansion was detected. The USFWS-MBS reported one ruffe captured incidentally from the Cheboygan River in Cheboygan, Michigan (60 km north of the Trout River in Rogers City, Michigan, where ruffe were captured in 2008 and 140 km north of the Thunder Bay River in Alpena, Michigan, where ruffe were first captured in 1995). The ruffe was captured in a permanent trap used to assess sea lamprey upstream in the Cheboygan River. No ruffe were captured from other areas of Lake Huron in Michigan, including the Trout River, Thunder Bay River, or Thunder Bay shipping lanes. Ruffe remained undetected in the St. Marys River. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR-Marquette continued to capture ruffe (2 ruffe) incidentally from LBDN, within the known range. **Lower Great Lakes:** No ruffe were detected.

**2012 – Lake Superior:** The range of ruffe spanned the south shore 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-LSBS, Wisconsin Department of Natural Resources-Lake Superior Field Unit (WIDNR-Superior), USFWS-Ashland, OMNRF-UGLMU and USFWS-MBS captured ruffe within the known range in Lake Superior at the Thunder Bay Harbour, Duluth Harbor, Apostle Islands, Chequamegon Bay and Keewenaw Peninsula. **Lake Huron:** The USFWS-MBS reported one ruffe captured incidentally from the Cheboygan River in Cheboygan, Michigan. One other ruffe was captured from the same location in 2011. No ruffe were captured from other areas of Lake Huron in Michigan, including the Trout River, Thunder Bay River, or Thunder Bay shipping lanes where they had been captured in the past. Ruffe remained undetected in the St. Marys River. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR-Marquette continued to capture ruffe (7 ruffe) incidentally from LBDN, within the

known range. **Lower Great Lakes:** No ruffe were detected.

**2013 – Lake Superior:** The range of ruffe spanned the south shore 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-LSBS, WIDNR-Superior, USFWS-Ashland and OMNRF-UGLMU captured ruffe within the known range in Lake Superior at Thunder Bay Harbour, St. Louis River and Chequamegon Bay. **Lake Huron:** No ruffe were captured from Lake Huron in Michigan, including the Cheboygan River, Trout River, Thunder Bay River, or Thunder Bay shipping lanes where they had been captured in the past. Ruffe remained undetected in the St. Marys River. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR-Marquette continued to capture ruffe (9 ruffe) incidentally from LBDN, within the known range. **Lower Great Lakes:** No ruffe were detected.

**2014 – Lake Superior:** The range of ruffe spanned the south shore 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-LSBS, USFWS-MBS and Great Lakes Indian Fish and Wildlife Commission (GLIFWC), OMNRF-UGLMU, USFWS-Ashland, Department of Fisheries and Oceans Canada – Great Lakes Laboratory for Fisheries and Aquatic Sciences (DFO-GLLFAS), and WIDNR-Superior captured ruffe within the known range in western Lake Superior at Kaministiquia River and Thunder Bay Harbour, St. Louis River, Apostle Islands, Chequamegon Bay, and Misery River. A larger number of ruffe were reported by Lake Superior State University (LSSU) and Bay Mills Indian Community (BMIC) from the known range in eastern Lake Superior at Whitefish Bay than past years. Eleven ruffe were captured there at Naomikong Creek, Pendills Creek, and the shallows in Tahquamenon Bay. Findings in Naomikong Creek (5 ruffe) and Pendills Creek (1 ruffe) were new sightings in tributaries within the known range. **Lake Huron:** No ruffe were captured from Lake Huron in Michigan, including the Cheboygan River, Trout River, Thunder Bay River, or Thunder Bay shipping lanes where they had been captured in the past. Ruffe remained undetected in the St. Marys River. **Lake Michigan:** The ruffe range consisted of Green Bay. The MIDNR-Marquette continued to capture ruffe (5 ruffe) incidentally from LBDN in northern Green Bay. **Lower Great Lakes:** No ruffe were detected.