U.S. Fish & Wildlife Service

White Perch (*Morone americana*)
Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, July 2014
Revised, March 2019
Web Version, 8/26/2019

Image: Duane Raver/U.S. Fish & Wildlife Service. Public Domain.

1 Native Range and Status in the United States

Native Range

From Fuller et al. (2019a):

"Atlantic Slope drainages from St. Lawrence-Lake Ontario drainage, Quebec, south to Pee Dee River, South Carolina (Page and Burr 1991)."

Status in the United States

From CABI (2019):

"In some states of the USA it is both native to some parts and exotic to other areas."

From Fuller et al. (2019a):

"Established in all five Great Lakes and their surrounding states, as well as in Kentucky, Massachusetts, Missouri, Nebraska, New Hampshire, North Carolina, and Vermont. Current status in Colorado and Kansas is unknown."

"Although the White Perch was found in the Missouri River in Missouri almost to the Missouri/Iowa state border (Pflieger 1997), as of March 1998, there are no known collections in the state of Iowa (M. Konrad, personal communication)."

From Fuller et al. (2019b):

"This species has been recorded for Colorado (Everhart and Seaman 1971); Lake Michigan (Savitz et al. 1989; Mills et al. 1993), the Illinois River (Cochran and Hesse 1994; Burr et al. 1996; Irons 2002; Blodgett 1993), and the Mississippi River (Cochran and Hesse 1994; Rasmussen 1998), Illinois (Burr et al. 1996; Irons et al. 2002); Lake Michigan and several inland lakes, Indiana (Mills et al. 1993; R. Horner, personal communication; R. Robertson and D. Keller, personal communication); the Missouri River, Iowa (Hergenrader 1980; Bernstein 2001; Larson, personal communication); Hoover Pond in Kingman City Riverside Park, Cheney and Wilson reservoirs, and Browning Oxbow on the Missouri River, Kansas (Whitmore 1997; Rasmussen 1998; T. Mosher, personal communication; Goeckler, pers. comm.); inland lakes and ponds statewide except Aroostook County, Maine (Halliwell 2003); nonnative, inland waters of Massachusetts (Hartel 1992; Hartel et al. 1996; USFWS 2005); the Great Lakes, Michigan (Johnson and Evans 1990; Mills et al. 1993; Bowen, pers. comm.); Duluth Harbor, Lake Superior, Minnesota (Johnson and Evans 1990; Mills et al. 1993); Lake Contray in Buchanan County, Big Lake in Holt County, and the Missouri River in Carroll and Howard counties, in Missouri (Pflieger 1997); the Missouri River and the Platte River drainage in Nebraska (Hergenrader and Bliss 1971; Morris et al. 1974; Hergenrader 1980; Cross et al. 1986; Whitmore 1997; Rasmussen 1998) and Branched Oak Reservoir (Nebraska Parks and Game Commission); inland lakes in New Hampshire (Scarola 1973); Lake Champlain (Plosila and Nashett 1990; Good, personal communication) and the Great Lakes drainage, New York (Scott and Christie 1963; Lee et al. 1980 et seq.; Emery 1985; Smith 1985; Johnson and Evans 1990; Mills et al. 1993), including lakes Ontario and Erie, Oneida Lake, Cross Lake, and the Seneca River (Dence 1952); James, Norman, and Jordan reservoirs, North Carolina (Feiner et al. 2012); Lake Erie drainage and inland streams of Ohio (Busch et al. 1977; Trautman 1981; Smith 1985; Rasmussen 1998; Johnson and Evans 1990; Mills et al. 1993; Czypinski et al. 2001) and Cedar Point National Wildlife Refuge (USFWS 2005); Kaw and Keystone reservoirs, Oklahoma (J. Boxrucker, pers. comm.); Lake Erie, Pennsylvania (Larsen 1954; Busch et al. 1977; Johnson and Evans 1990; Page and Burr 1991; Mills et al. 1993); Lake Champlain, Vermont (Plosila and Nashett 1990; Good, personal communication). Smith Mountain Lake and Kerr Reservoir, Virginia (Jenkins and Burkhead 1994); the upper Potomac drainage, West Virginia (Cincotta, personal communication); and Lake Michigan at Green Bay, the St. Louis River estuary, Horicon National Wildlife Refuge, and Chequamegon Bay, Wisconsin (Savitz et al. 1989; Johnson and Evans 1990; Mills et al. 1993; Cochran and Hesse 1994; Czypinski et al. 2001; Associated Press 2003; Scheidegger, personal communication; USFWS 2005)."

From Froese and Pauly (2019a):

"A popular fish sold in live fish markets. Found in 1 out of 6 live fish markets near the Lakes Erie and Ontario [Rixon et al. 2005]."

Means of Introductions in the United States

From Fuller et al. (2019a):

"Populations in Lake Ontario drainage probably became established following construction of the Erie Canal."

"The first report of White Perch in the Great Lakes drainage was from Cross Lake, central New York, in 1950 (Dence 1952). The species apparently gained access to the lake via movement through the Erie Barge Canal in the 1930s and 1950s (Lee et al. 1980 et seq.; Johnson and Evans 1990; Mills et al. 1993). Scott and Christie (1963) stated that the White Perch most likely gained access to Lake Ontario via the Oswego River, as a result of spread of Hudson River populations northward and westward through the Mohawk River Valley and Erie Barge Canal. Once in Lake Ontario, it gained access to Lake Erie through the Welland Canal in 1953 and continued to spread to the upper Great Lakes (Johnson and Evans 1990; Mills et al. 1993). The first reports of westward movement through the Great Lakes are as follows: Lake Erie in 1953 (Larsen 1954), Lake St. Clair in 1977, Lake Huron in 1987 (Johnson and Evans 1990), Lake Michigan at Green Bay-Fox River, Wisconsin in May 1988 (Cochran and Hesse 1994), and Illinois waters of Lake Michigan off Chicago in September 1988 (Savitz et al. 1989). One oddity is that the first record from Lake Superior was in 1986 from Duluth Harbor-one year before the fish was found in Lake Huron, and two years before it was seen in Lake Michigan. The Duluth Harbor population may be restricted to that location because it is the warmest part of the lake. This population likely represents a separate introduction because it does not fit the pattern of western dispersal (Johnson and Evans 1990). In this case it is possible that the introduction occurred via ships' ballast water.

White Perch was brought from New Jersey to Nebraska in 1964, and fry produced that year in a hatchery were accidentally introduced into a reservoir that provided access to the Missouri River (Hergenrader and Bliss 1971). White Perch has been stocked intentionally in other areas for sportfishing. In Kansas, fish found at Browning Oxbow on the Missouri River are believed to have come from Nebraska. The species was not recorded from Missouri River in Missouri until the 1990s (Pflieger 1997). The source of the fish in the two Kansas reservoirs is a result of stock contamination from a striped bass stocking (Mosher, personal communication). White Perch were stocked in West Virginia in the early 1900s (Cincotta, personal communication) and are being illegally stocked by individuals in inland lakes in Indiana (R. Robertson and D. Keller, personal communication)."

Remarks

A previous version of this ERSS was published in July 2014. Revisions were done to incorporate new information and to bring the document in line with current standards.

Some populations of *Morone americana* have a marine life-stage. This ERSS is only valid for landlocked populations and the fresh and estuarine water life stages of coastal populations.

From GISD (2017):

"Hybrids of *Morone americana* and *M. mississippiensis* were first found in 2000 in the middle Illinois River (Irons et al. 2002)."

From CABI (2019):

"*M. americana* hybridizes with *Moronechrysops* [*sic*] (native white bass) (Todd, 1986) and with *Morone mississippiensis* (Irons et al., 2002) in the USA. These hybrids are capable of back-crossing with parent species as well as crossing among themselves; therefore *M. americana* will dilute the gene pool of both parent species (Natureserve, 2008)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From Fricke et al. (2019):

"**Current status:** Valid as *Morone americana* (Gmelin 1789)."

From ITIS (2019):

"Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Acanthopterygii
Order Perciformes
Suborder Percoidei
Family Moronidae
Genus *Morone*
Species *Morone americana* (Gmelin, 1789)"

Size, Weight, and Age Range

From CABI (2019):

"*M. americana* is a demersal and semi-anadromous species, usually reaching a length of 12.7-17.8 cm and weighing from an average of 250 g up to 650 g (Riede, 2004). However, a maximum length of 49.5 cm has been recorded (IGFA, 2001), and a maximum weight of 2200 g (Robins and Ray, 1986). The recorded maximum age is 16 years (Froese and Pauly, 2008)."

Environment

From CABI (2019):

"*M. americana* occurs in fresh, brackish and coastal waters (Robins and Ray, 1986). It is found predominantly in brackish water and close to the shore in saltwater (Natureserve, 2008), but is also common in pools and other quiet water areas of medium to large rivers, usually over mud (Froese and Pauly, 2008), far up medium to large rivers in fresh water and in lakes and ponds having no sea connection (Natureserve, 2008). *M. americana* is very common in shallow portions of inland lakes and rivers in its native range […]. It has been observed to move offshore during the day and onshore at night."

Climate/Range

From Froese and Pauly (2019a):

"Temperate; 50°N - 32°N, 96°W - 59°W"

Distribution Outside the United States

Native

Part of the native range of *Morone americana* is in the United States. See Section 1 for a full description of native range.

From Fuller et al. (2019a):

"Atlantic Slope drainages from St. Lawrence-Lake Ontario drainage, Quebec, south […]."

Introduced

From Froese and Pauly (2019a):

"[…] introduced into Ontario [Canada] [Coker et al. 2001]. Known from St. Lawrence drainage, Quebec southward to Lake Superior; introduced to Great Lakes (except Superior) [Page and Burr 2011]."

According to FAO (2019), *Morone americana* has been introduced to China but information on that status of that introduction was not available. No other information about this introduction could be found.

Means of Introduction Outside the United States

No information on means of introduction outside the United States was found.

Short Description

From CABI (2019):

"*M. americana* has a deep and laterally compressed body. The colour varies from dark greyish-green, dark silvery-green, or dark brown to almost black on the back, pale-olive or silvery-green on the sides and silvery-white on the belly. The white perch has a terminal mouth and a tongue with two narrow tooth patches on the anterolateral margin for grasping prey items (Jenkins and Burkhead, 1994). It does not have barbels. *M. americana* has two dorsal fins, slightly connected by a membrane, the anterior with six to ten spines, the posterior with one spine and 10-13 rays, no adipose fin, anal fin with […] and eight to ten rays and lateral line with 44-52 ctenoid scales. The juveniles are similar to the adults, but may have faint lateral stripes.

Other identifying characteristics include the following. The body is deepest just ahead of, or at the beginning of, the dorsal fin; there are no lines or stripes on the back or sides; when the spiny dorsal fin is pulled erect, the soft dorsal fin also becomes erect; the second and third bony anal spines are almost exactly the same length; and the anal fin usually has eight or nine soft rays behind the three bony spines (National Sea Grant, 1998; Wisconsin Sea Grant, 2002b; Chesapeake Bay Program, 2006)."

Biology

From Froese and Pauly (2019a):

"Inhabits pools and other quiet-water areas of medium to large rivers, usually over mud [Page and Burr 2011]. Neither anterolateral glandular groove nor venom gland is present [Smith and Wheeler 2006]."

From CABI (2019):

"In its native estuarine environment, *M. americana* is semi-anadromous and spawns in the spring when water temperatures are between 10 and 16°C (Mansueti, 1961; Jenkins and Burkhead, 1994). It migrates from the saltier bays and coastal areas into tidal, but more freshwater portions of streams and rivers to spawn in spring. In landlocked waters, it spawns in both rivers and reservoirs, and migrates from deep to shallow waters to spawn when [water] temperatures are between 15 and 20°C, but may show no preference for habitat types during spawning and egg deposition (Zuerlein, 1981).

M. americana maturation is size-specific with males maturing at smaller sizes than females (Mansueti, 1961). Males may spawn for the first time at 2 years, and females usually by 3 years, usually in late spring in brackish to nearly fresh water rivers over sandy bottoms. Spawning occurs over a period of 10 to 21 days with individual females expelling eggs on more than one occasion (Mansueti, 1961). Female *M. americana* are oviparous, broadcasting demersal, adhesive eggs to be fertilized externally (Mansueti, 1961). The eggs sink to the bottom and stick (Thomson et al., 1978). Its fecundity ranges between 20,000 and 150,000 eggs per individual female (Jenkins and Burkhead, 1994). Hatching takes place from 1 to 6 days following fertilization; 4 days at the usual spawning temperature of 15°C (Natureserve, 2008)."

"Larval *M. americana* feed on zooplankton such as rotifers, copepods and cladocerns (Setzler-Hamilton et al., 1982). One-year-old *M. americana* first feed on zooplankton early in life, but then changes their diet to benthic invertebrates (Gopalan et al., 1998), and as they grow larger, aquatic insect larvae (chironomids, trichopterans, and ephemeropterans) become an important part of the diet. Large individuals consume a high percentage of fishes (Scott and Crossman, 1973). Fish eggs are an important component of the *M. americana* diet especially in spring months. It may consume its own eggs (McGovern and Olney, 1988), or *Stizostedion vitreum* (walleye) or *Morone chrysops* (white bass) eggs can make up to 100% of the *M. americana* diet depending on which fish is spawning. *M. americana* also feed heavily on minnows of *Notropis* spp. and zooplankton."

From Fuller et al. (2019a):

"Feiner et al. (2012) found life history differences (e.g., growth rate, reproductive investment) across introduced populations within three large reservoirs in North Carolina representing different stages of invasion, and suggest that this plasticity allows for increased success during establishment. Feiner et al. (2013a) found that populations in the North Carolina reservoirs occupied a wide trophic niche, and suggested that niche breadth likely also aides [*sic*] establishment success. Pothoven and Höök (2015) found overlap in standard diet assemblages of age-0 White Perch and White Bass in Saginaw Bay, Lake Huron, indicating that complete trophic separation was not a requirement for long-term stable coexistence."

From GISD (2017):

"Young *M. americana* use near shore areas downstream from their hatching areas to feed on the larvae of insects and crustaceans during their first summer and fall seasons. Mature *M. americana* may remain in quiet tributaries throughout spring and summer, or venture into open waters; in winter; however, adults swim downstream to the deeper channels. *M. americana* may live up to around 10 years, feeding on small fish and shellfish, and other bottom-dwelling aquatic species (Chesapeake Bay Program, 2006)."

Human Uses

From Froese and Pauly (2019a):

"A popular fish sold in live fish markets. Found in 1 out of 6 live fish markets near the Lakes Erie and Ontario [Rixon et al. 2005]."

From CABI (2019):

"*M. americana* is a food fish and provides angling opportunities, but tends to stunt and become undesirable when over-population occurs in freshwater lakes (Scott and Crossman, 1990). Due to this tendency towards over-population and stunting in fresh waters, it is not often exploited as a game fish and generally is regarded as undesirable. It is an excellent panfish, highly regarded as a food fish in the Eastern USA (Wisconsin Sea Grant, 2002b); however, in general, it is of minor commercial importance in fisheries and use in public aquariums (Froese and Pauly, 2008)."

From Fuller et al. (2019b):

"As of 2003, it was estimated that over 500,000 lbs. of white perch are caught commercially in the U.S. and Canada each year (188,000+ lbs. in the U.S. alone), particularly in lakes Erie and

Ontario (Dann and Schroeder 2003; Brown et al. 1999). This provides an estimated value of approximately $107,000 yr-1 in the U.S. and $260,000 yr-1 overall (Dann and Schroeder 2003)."

Diseases

Infection with viral haemorrhagic septicaemia is an OIE-reportable disease (OIE 2019).

According to Algers et al. (2008), *Morone americana* may be a host and susceptible to viral haemorrhagic septicaemia.

From Matsche et al. (2019):

"A variety of parasites was reported from white perch in the Chesapeake Bay region, including *Kudoa* sp. (myxosporea, multivalvulida) (Bunton and Poynton, 1991), nematodes (multiple species), trematodes (multiple species), an unidentified cestode and acanthocephalan, and the crustacean isopod, *Livoneca ovalis* (Beacham and Haley, 1976), […]. Two species of coccidia, *Eimeria glenorensis* and *Eimeria moronei*, were described from the intestine of white perch from the Bay of Quinte, Lake Ontario (Molnar and Fernando, 1974), […]"

Matsche et al. (2019) also list *Morone americana* as a host for *Goussia bayae*.

From Froese and Pauly (2019a):

"Epitheliocystis, Bacterial diseases."

Froese and Pauly (2019b) list *Brachyphallus crenatus*, *Lepocreadium areolatum*, *Ergasilus arthrosis*, *E. luciopercarum*, *E. labracis*, *Homalometron pallidum*, *Trilobovarium truncatum*, *Lepocreadium trullaforme*, *Lernaea cruciata*, *Lernanthropus leidyi*, *Podocotyle reflexa*, and *Stephanostomum tenue* as parasites of *Morone americana.*

Poelen et al. (2014) lists *Morone americana* as a host for *Acanthocephalus anguillae*, *Apophallus venustus, Azygia* sp.*, Bicotylophora* sp.*, Bothrimonus sturionis, Brachyphallus crenatus, Camallanus lacustris*, *Cestodaria* sp.*, Clinostomum marginatum*, *Crepidostomum cooperi, Cucullanellus cotylophora*, *Cucullanus* sp., *Dacnitoides cotylophora*, *Dactylocotyle denticulatum*, *Diplocotyle olrikii*, *Diplostomum huronense, D. scheuringi, D. spathaceum, Distomum areolatum, D. tenue, D. trachinoti*, *Dollfusentis chandleri*, *Echinorhynchus agilis, Eudistoma* sp., *Eustrongylides tubifex*, *Erpocotyle mavori*, *Fasciola* sp., *Globoporum moronic*, *Gnathostoma* sp., *Goezia sinamora*, *Homalometron pallidum*, *Lepocreadium areolatum, L. californianum*, *L. trullaforme*, *Leptorhynchoides thecatus, Metabronema* sp., *Microcotyle eueides*, *M. macroura*, *Monocelis lineata*, *Neochasmus sogandaresi*, *Neoechinorhynchus cylindratus*, *Neolebouria truncate*, *Onchocleidus nactus*, *O. mimius, Onchocotyle mavori, Paratenuisentis ambiguus*, *Pauciconfibula subsolana*, *Pedocotyle morone*, *Philometra rubra, Podocotyle morone*, *P. olssoni*, *Pomphorhynchus rocci*, *Posthodiplostomum minimum, Proteocephalus amboplitis*, *Spinitectus carolini*, *Stephanostomum tenue*, *Triaenophorus nodulosus, Tylodelphys scheuringi*, *Urocleidus nactus*, and *U. rogersi*.

Threat to Humans

From Froese and Pauly (2019):

"Harmless"

3 Impacts of Introductions

From Hergenrader and Bliss (1971):

"Concomitant with the increase in abundance of the white perch, the black bullhead in 1966 declined some 12% from the previous year in the gill net catch […] and some 27% in the fyke net catch […]. In 1967 bullheads suffered a drastic decline in numbers, being reduced by some 63% in the gill net catch and by 40% in the fyke net catch from the previous ear. At the same time the white perch increased by 61% in the gill net catch and by 19% in the fyke net catch."

From Hurley (1992):

"Consumption of amphipods, mainly *P.* [*Pontoporeia*] *hoyi* [a species native to Lake Ontario], exceeded the daily production in August-September 1972-77 (112%) [in Bay of Quinte, Lake Ontario]. Johnson and McNeil (1986) cited white perch predation as a factor in restricting *Pontoporeia* expansion in the lower bay. The data presented here support that hypothesis. In addition, *Pontoporeia* expanded in both numbers and area after 1977. The increased production of *Pontoporeia* in 1978-88 may be linked to the decline in white perch at that time when daily consumption by white perch was less than 1% of the daily net production."

From Wong (2002):

"Declines in catch rates of several species coincided with increases in the white perch population […]. Brown bullhead catches were variable through the first 7 years of the study, peaking at 1.3 fish per net night prior to establishment of white perch, but were rare or absent from gill-net samples following 1993. Catch rates for flat bullheads fluctuated after white perch appeared in gill-net surveys. From the period 1987–1990, an average of 1 flat bullhead and 0.6 white perch were captured per net night. From 1991–95, when white perch catch increased sharply from 0.9 to 18 fish per net night. Catch rates for flat bullheads declined thereafter, falling to 0.7, 0.2, and 0.1 fish per net night in 1996, 1997, and 1998 respectively. Annual variation in catch rates was significant for flat bullheads (P = 0.0368), but not for brown bullheads (P = 0.2199).

Other declines concurrent with the white perch invasion of Jordan Lake [North Carolina] were seen in catch rates of white crappie and bluegill. Average catch rates for 1987–1990 were 1.3 white crappie per night, and 2.2 bluegill per net night. After white perch catches increased in the early 1990s, catch rates for white crappie in 1995–1998 fell to 0.025 fish per net night. Catch rates in 1995–1998 also declined sharply for bluegill, 0.175 fish per net night. Significant annual variability occurred for both white crappie (P = 0.0355) and bluegill (P = 0.0012)."

From Fuller et al. (2019a):

“Fish eggs are an important component of the diet of White Perch especially in the spring months. White Perch generally preys on eggs of Walleye *Stizostedion vitreum vitreum*, White Bass *Morone chrysops*, other species, and can cannabilize its own eggs (Schaeffer and Margraf 1987). Walleye or White Bass eggs can make up 100% of White Perch diet depending on which fish is spawning. During a three-year study, this diet was found to be unique in that: 1) eggs were eaten for a comparatively long time, 2) they were the only significant food item eaten by adults during two of the three years, 3) large volumes were eaten per individual, and 4) most fish were feeding. White Perch also feeds heavily on minnows *Notropis* spp. (Schaeffer and Margraf 1987). The collapse of the Walleye fishery in the Bay of Quinte (on the north shore of Lake Ontario) coincided with the increase in the White Perch population and may have been a result of egg predation and lack of recruitment (Schaeffer and Margraf 1987).”

“Parrish and Margraf (1994) speculated that competition between White Perch and forage fishes, such as Emerald Shiner *Notropis atherinoides* and Spottail Shiner *N. hudsonius*, may actually be more complex and may be responsible for the declines of the latter species. Decline of these species could also affect Walleye *Stizostedion vitreum*, the top predator in Lake Erie (Parrish and Margraf 1994).”

“Feiner et al. (2013a, b) found significant overlap in trophic niche and resource use between White Perch and Walleye *Sander vitreus*, Largemouth Bass *Micropterus salmoides*, Bluegill *Lepomis macrochirus*, Striped Bass *M. saxatilis*, and White Bass *M. chryops* in three lakes in North Carolina, suggesting the potential for resource competition.”

“Invasion of the Great Lakes brought White Perch into sympatric distribution with White Bass, a closely related but previously allopatric species, allowing hybridization to occur. White Perch x White Bass hybrids have been reported in western Lake Erie, in Ohio and Michigan, and from the Detroit and St. Clair Rivers in Michigan (Todd 1986). Hybrids were first noted in western Lake Erie in the early 1980s, as White Perch were increasing in this region (Todd 1986). These hybrids probably occur in other Great Lakes because the two species are sympatric throughout the chain of lakes. […] Because these hybrids are capable of backcrossing with the parental species, and possibly producing of F2 hybrids by crossing amongst themselves (Todd 1986), they dilute the gene pool of each parent species. The White Perch x White Bass hybrid is the first naturally occurring *Morone* hybrid known (Todd 1986). Hybrids of *M. americana* and *M. mississippiensis* were first found in 2000 in the middle Illinois River (Irons et al. 2002). Hybridization and competition may represent another threat to the already dwindling Yellow Bass of that region.”

From Fuller et al. (2019b):

“Madenjian et al. (2000) hypothesized that egg predation by white perch was the most significant contributor to the large decline in white bass recruitment in Lake Erie in the 1980s.”

“It has been speculated that a white perch diet of *Daphnia* in Lake Champlain contributed to the decline of the species in this locality since white perch became established (Couture and Watzin

2008). Parrish and Margraf (1990) hypothesized that white perch compete with native yellow perch (*Perca flavescens*) for zooplankton. They determined that growth rates of yellow perch had declined since the invasion of white perch in Lake Erie, especially in the western basin. They also determined that the two species had considerable diet overlap and found one sample in which white perch consumed 27 percent more food than yellow perch. It has been speculated that competition between white perch and forage fishes, such as emerald shiner (*Notropis atherinoides*) and spottail shiner (*N. hudsonius*), as well as freshwater drum (*Aplodinotus grunniens*), is complex and may be responsible for the declines of the latter species (Parrish and Margraf 1994, Stapanian et al. 2007)."

4 Global Distribution

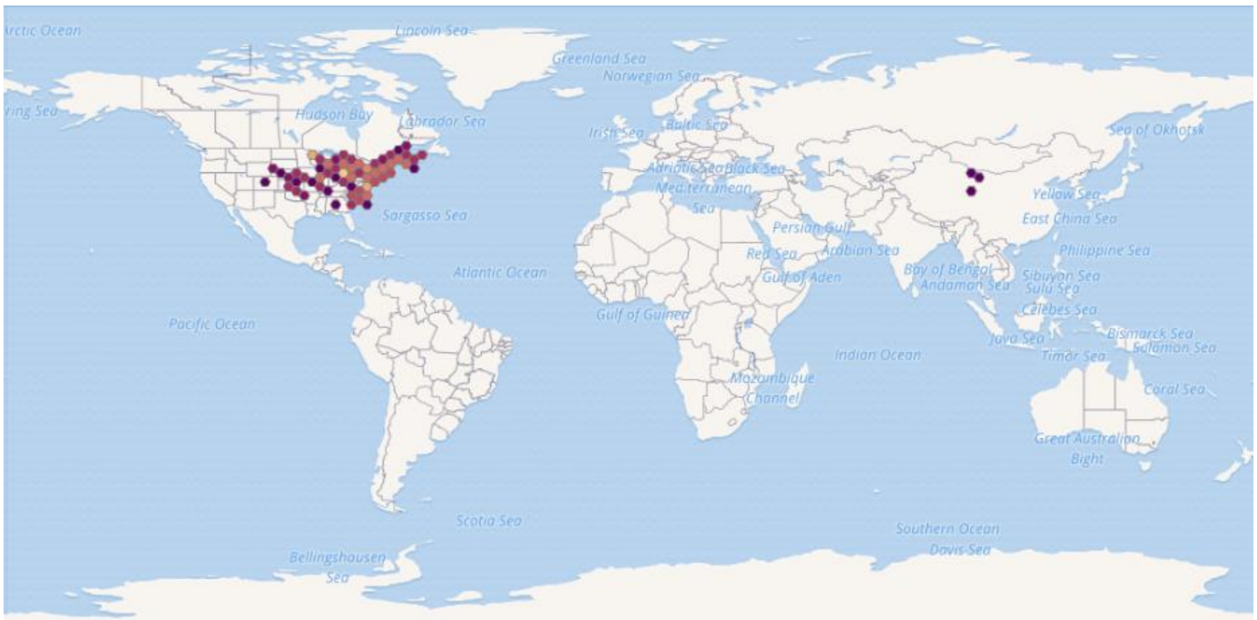

Figure 1. Known global distribution of *Morone americana*. Locations are in the United States, Canada, and China. Map from GBIF Secretariat (2019). The locations in China were not used to select source locations for the climate match; the coordinates listed do not match the recorded collection location.

5 Distribution Within the United States

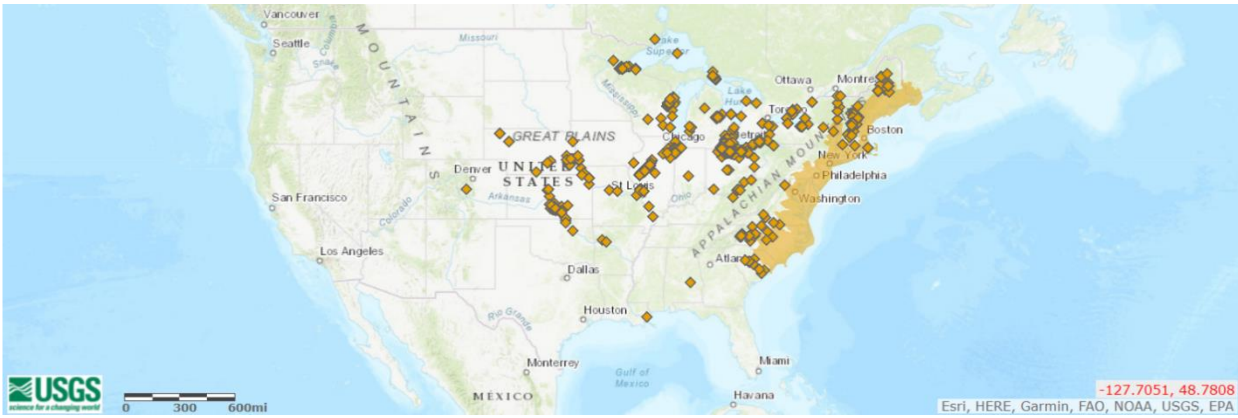

Figure 2. Known distribution of *Morone americana* in the contiguous United States. Yellow shading along east coast shows the native range of *M. americana* in the United States. Map from Fuller et al. (2019a). The location in eastern Louisiana was not used to select source points for the climate match; the record does not represent an established population.

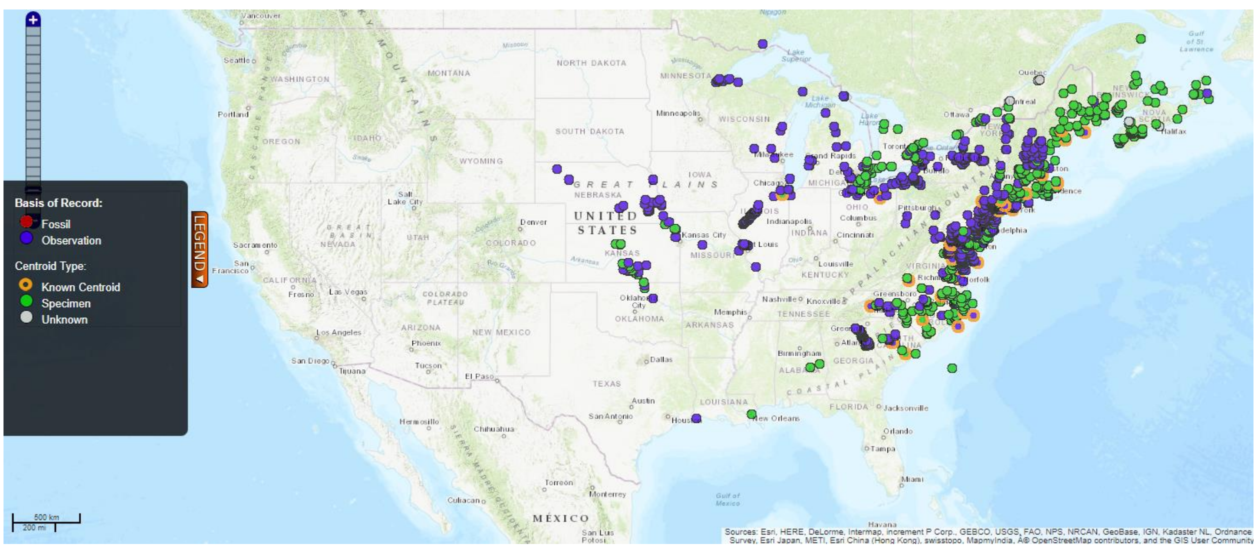

Figure 3. Additional known distribution of *Morone americana* in the contiguous United States. Map from BISON (2019). The locations in Louisiana were not used to select source points for the climate match; they do not represent established populations.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for the contiguous United States was mostly high. The Pacific Coast and Rocky Mountain areas had low climate matches. Southern Florida, southern and western Texas, and the western plains had medium matches. Everywhere else had a high climate match. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for contiguous United States was 0.727, high (scores 0.103 and greater are classified as high). All States had a high individual Climate 6 score except for Arizona, Idaho, and Nevada which had medium scores, and California, Oregon, and Washington which had low scores.

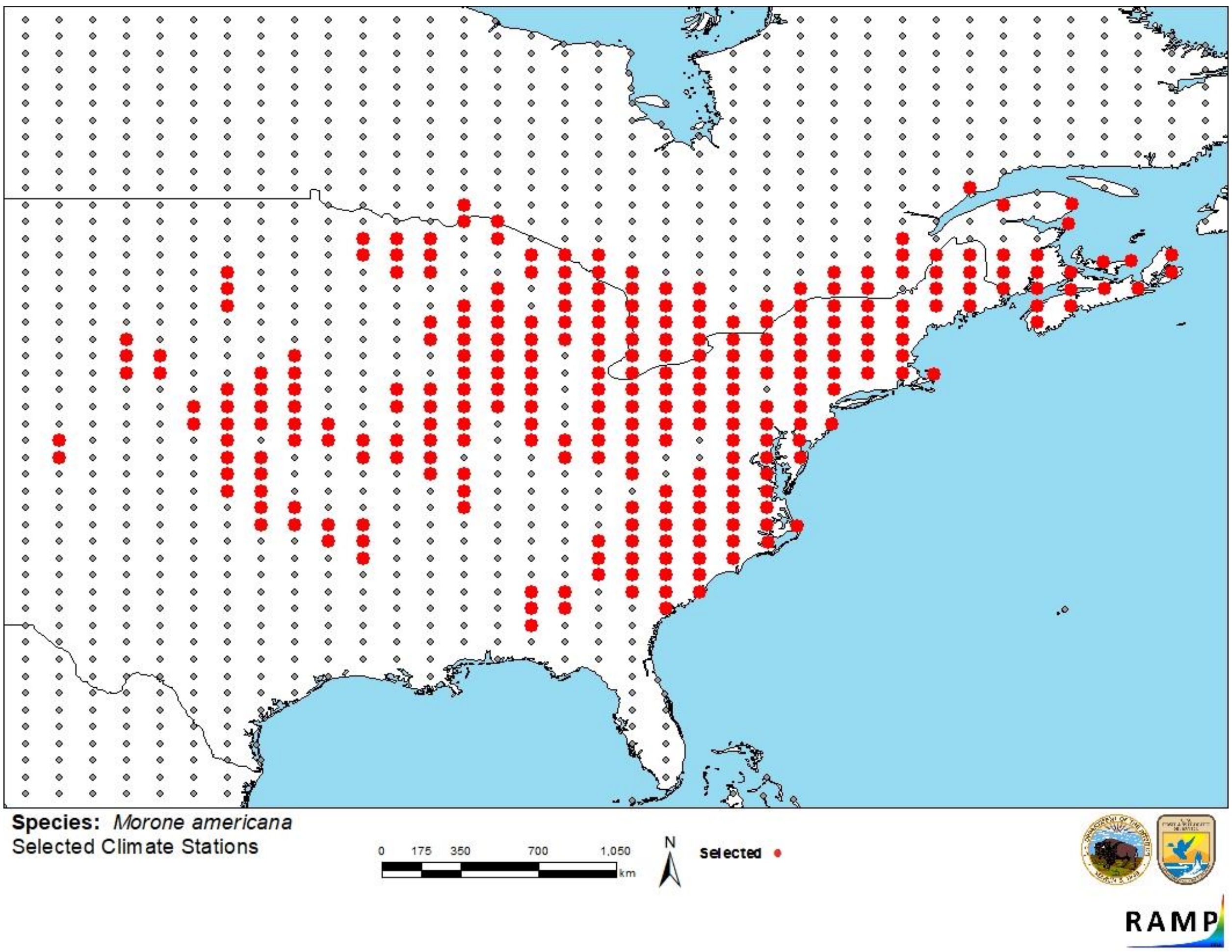

Figure 4. RAMP (Sanders et al. 2018) source map showing weather stations in North America selected as source locations (red; Canada, United States) and non-source locations (gray) for *Morone americana* climate matching. Source locations from BISON (2019), Fuller et al. (2019a), and GBIF Secretariat (2019). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

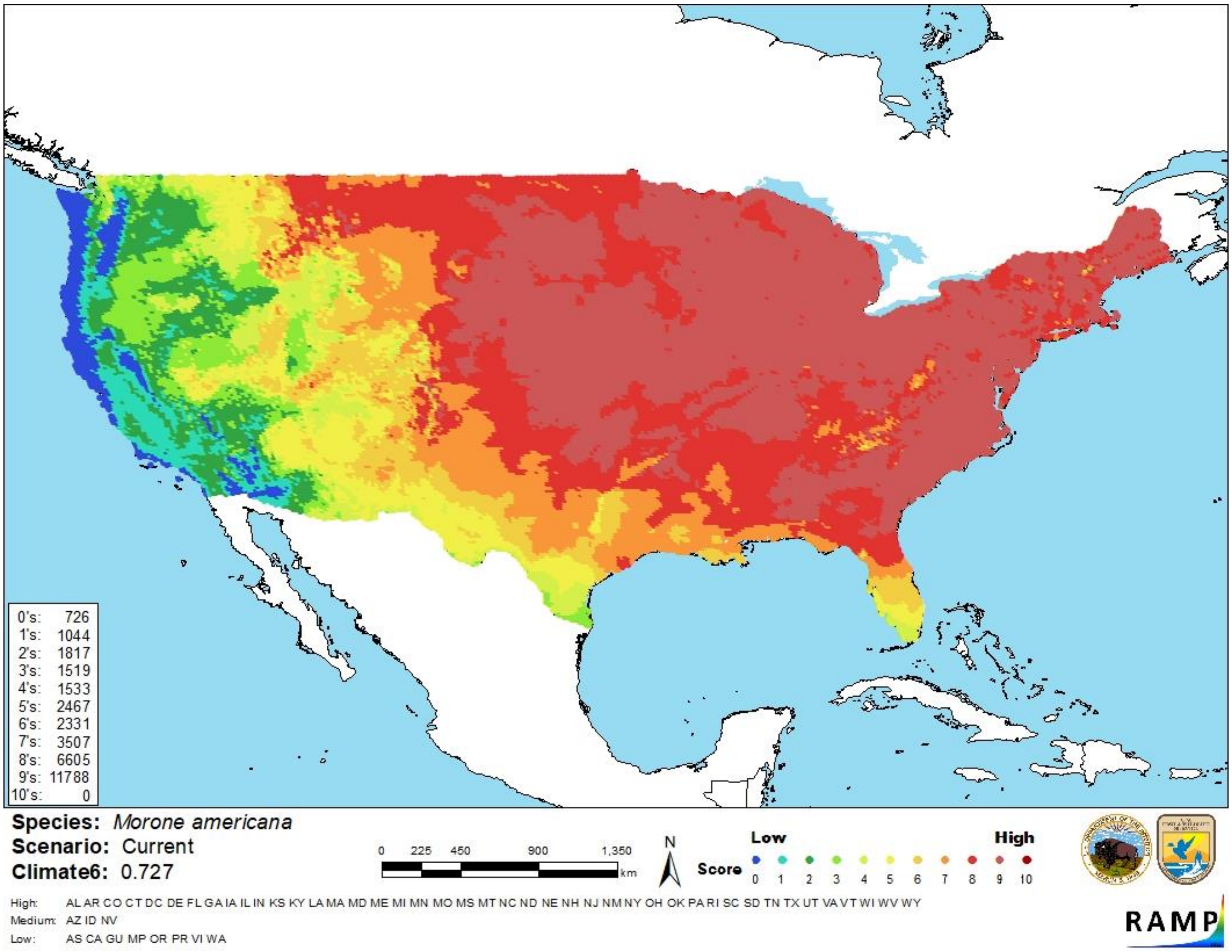

Figure 5. Map of RAMP (Sanders et al. 2018) climate matches for *Morone americana* in the contiguous United States based on source locations reported by BISON (2019), Fuller et al. (2019a), and GBIF Secretariat (2019). 0 = Lowest match, 10 = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores)	Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

7 Certainty of Assessment

Certainty of this assessment is high. The biology, ecology, and distribution of *Morone americana* are well-documented. Negative impacts from introductions of this species are adequately documented in the scientific literature. No further information is needed to evaluate the negative impacts the species is having where introduced.

8 Risk Assessment

Summary of Risk to the Contiguous United States

White perch (*Morone americana*) is a fish native to the East Coast of the United States and Canada; it can inhabit fresh, brackish and coastal waters. This assessment is applicable only to landlocked populations and the freshwater stages of other populations. This species can reproduce successfully in freshwater. *M. americana* is utilized in both commercial and sport fisheries. The life history is plastic; shifts have been documented corresponding to invasion stages and other environmental conditions. *M. americana* has been reported as a host for many diseases and parasites; of particular note is the probable host status and susceptibility of the species to viral haemorrhagic septicaemia (VHS). The history of invasiveness is high. *M. americana* has spread to other areas east of the Rocky Mountains by bait fish release, intentional stocking, and fish movement through man-made and natural hydrologic connections. Several types of impacts have been documented for this species. *M. americana* has impacted abundance of an amphipod in the Bay of Quinte, Lake Ontario. Significant declines in native fish abundance have also been documented after *M. americana* invasion. It has been implicated in the decline of at least one walleye fishery. Hybridization between *M. americana* and two other native *Morone* spp. have been documented with the hybrids being reproductively viable. Climate match with the contiguous United States is high. The only areas of low match were along the Pacific Coast. The certainty of assessment is high. The biology, distribution, and history of invasiveness is well-documented in the literature. The overall risk for this species is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): High**
- **Remarks/Important additional information:** Probable host for VHS.
- **Overall Risk Assessment Category: High**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

Algers, B., H. J. Blokhuis, D. M. Broom, P. Costa, M. Domingo, M. Greiner, D. Guemene, J. Hartung, F. Koenen, C. Müller-Graf, D. B. Morton, A. Osterhaus, D. U. Pfeiffer, R. Roberts, M. Sanaa, M. Salman, J. M. Sharp, P. Vannier, and M. Wierup. 2008. Scientific opinion of the panel on AHAW on a request from the European Commission on aquatic animal species susceptible to diseases listed in the council directive 2006/88/EC. The EFSA Journal 808:1–144.

BISON. 2019. Biodiversity Information Serving Our Nation (BISON). U.S. Geological Survey. Available: https://bison.usgs.gov. (February 2019).

CABI. 2019. *Morone americana* (white perch) [original text by S. Siriwardena]. In Invasive Species Compendium. CAB International, Wallingford, U.K. Available: https://www.cabi.org/ISC/datasheet/74160. (February 2019).

FAO (Fisheries and Agriculture Organization of the United Nations). 2019. Database on introductions of aquatic species. FAO, Rome. Available: http://www.fao.org/fishery/introsp/search/en. (February 2019).

Fricke, R., W. N. Eschmeyer, and R. van der Laan, editors. 2019. Eschmeyer's catalog of fishes: genera, species, references. Available: http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp. (February 2019).

Froese, R., and D. Pauly, editors. 2019a. *Morone americana* (Gmelin, 1789). FishBase. Available: http://www.fishbase.us/summary/Morone-americana.html. (February 2019).

Froese, R., and D. Pauly, editors. 2019b. *Morone americana*. *In* World Register of Marine Species. Available: http://www.marinespecies.org/aphia.php?p=taxdetails&id=151177. (February 2019).

Fuller, P., E. Maynard, D. Raikow, J. Larson, A. Fusaro, and M. Neilson. 2019a. *Morone americana* (Gmelin, 1789). U.S. Geological Survey, Nonindigenous Aquatic Species Database, Gainesville, Florida. Available: http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=777. (February 2019).

Fuller, P., E. Maynard, D. Raikow, J. Larson, A. Fusaro, and M. Neilson. 2019b. *Morone americana*. U.S. Geological Survey, Nonindigenous Aquatic Species Database, Gainesville, Florida, and NOAA Great Lakes Aquatic Nonindigenous Species Information System, Ann Arbor, Michigan. Available: https://nas.er.usgs.gov/queries/greatLakes/FactSheet.aspx?SpeciesID=777&Potential=N&Type=0&HUCNumber=DGreatLakes. (February 2019).

GBIF Secretariat. 2019. GBIF backbone taxonomy: *Morone americana* (Gmelin, 1789). Global Biodiversity Information Facility, Copenhagen. Available: https://www.gbif.org/species/2394604. (February 2019).

GISD (Global Invasive Species Database). 2017. Species profile: *Morone americana*. Invasive Species Specialist Group, Gland, Switzerland. Available: http://www.iucngisd.org/gisd/speciesname/Morone+americana. (February 2019).

Hergenrader, G. L., and Q. P. Bliss. 1971. The White Perch in Nebraska. Transactions of the American Fisheries Society 100(4):734–738.

Hurley, D. A. 1992. Feeding and trophic interactions of White Perch (*Morone americana*) in the Bay of Quinte, Lake Ontario. Canadian Journal of Fisheries and Aquatic Sciences 49:2249–2259.

ITIS (Integrated Taxonomic Information System). 2019. *Morone americana* (Gmelin, 1789). Integrated Taxonomic Information System, Reston, Virginia. Available: https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=167678. (February 2019).

Matsche, M. A., C. R. Adams, and V. S. Blazer. 2019. Newly described coccidian *Goussia bayae* from White Perch *Morone americana*: morphology and phylogenetics support emerging taxonomy of *Goussia* with piscine hosts. Journal of Parasitology 105(1):1–10.

OIE (World Organisation for Animal Health). 2019. OIE-listed diseases, infections and infestations in force in 2019. Available: http://www.oie.int/animal-health-in-the-world/oie-listed-diseases-2019/. (February 2019).

Poelen, J. H., J. D. Simons, and C. J. Mungall. 2014. Global Biotic Interactions: an open infrastructure to share and analyze species-interaction datasets. Ecological Informatics 24:148–159.

Sanders, S., C. Castiglione, and M. Hoff. 2018. Risk assessment mapping program: RAMP, version 3.1. U.S. Fish and Wildlife Service.

Wong, R. K. 2002. White Perch expansion and life history within a southern reservoir. Master's thesis. North Carolina State University, Raleigh.

10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

Associated Press. 2003. The first White Perch on record shows up in Chequamegon Bay. Wisconsin State Journal July 25: B5.

Beacham, B., and A. Haley. 1976. Some parasites of White Perch, *Morone americana* (Gmelin), in Chesapeake Bay. Proceedings of the Helminthological Society of Washington 43:232–233.

Bernstein. 2001. [Source material did not give full citation for this reference.]

Blodgett. 1993. [Source material did not give full citation for this reference.]

Brown, R. W., M. Ebener, and T. Gorenflo. 1999. Great Lakes commercial fisheries: historical overview and prognosis for the future. Pages 307–354 *in* W. W. Taylor and C. P. Ferreri, editors. Great Lakes fisheries policy and management: a binational perspective. Michigan State University Press, East Lansing.

Bunton, T., and S. Poynton. 1991. *Kudoa* sp. (Myxosporea, Multivalvulida) infection in juvenile White Perch, *Morone americana* (Gmelin): histopathology and spore morphology. Journal of Fish Diseases 14:589–594.

Burr, B. M., D. J. Eisenhour, K. M. Cook, C. A. Taylor, G. L. Seegert, R.W. Sauer, and E. R. Atwood. 1996. Nonnative fishes in Illinois waters: What do the records reveal? Transactions of the Illinois State Academy of Science 89(1/2):73–91.

Busch, W. N., D. H. Davies, and S. J. Nepszy. 1977. Establishment of White Perch, *Morone americana*, in Lake Erie. Journal of the Fisheries Research Board of Canada 34:1039–1041.

Chesapeake Bay Program. 2006. White Perch in the bay and its rivers. Available: http://www.chesapeakebay.net/info/white_perch.cfm.

Cochran, P. A., and P. J. Hesse. 1994. Observations on the White Perch (*Morone americana*) early in its invasion of Wisconsin. Transactions of the Wisconsin Academy of Science Arts and Letters 82:23–58.

Coker, G. A., C. B. Portt, and C. K. Minns, 2001. Morphological and ecological characteristics of Canadian freshwater fishes. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2554.

Couture, S. C., and M. C. Watzin. 2008. Diet of invasive adult White Perch (*Morone americana*) and their effects on the zooplankton community in Missisquoi Bay, Lake Champlain. Journal of Great Lakes Research 34(3):485–494.

Cross, F. B., R. L. Mayden, and J. D. Stewart. 1986. Fishes in the western Mississippi drainage. Pages 363–412 *in* C. H. Hocutt and E. O. Wiley, editors. The zoogeography of North American freshwater fishes. John Wiley and Sons, New York.

Czypinski, G. D., A. K. Bowen, M. T. Weimer, and A. Dextrase. 2001. Surveillance for ruffe in the Great Lakes, 2001. U.S. Fish and Wildlife Service, Ashland, Wisconsin.

Dann, S. L., and B. C. Schroeder. 2003. The life of the lakes: A guide to the Great Lakes fishery. Michigan Sea Grant.

Dence, W. A. 1952. Establishment of White Perch, *Morone americana,* in central New York. Copeia 1952(3):200–201.

Emery, L. 1985. Review of fish introduced into the Great Lakes, 1819-1974. Great Lakes Fishery Commission Technical Report, volume 45.

Everhart, W. H., and W. R. Seaman. 1971. Fishes of Colorado. Colorado Game, Fish and Parks Division, Denver.

Feiner, Z. S., D. D. Aday, and J. A. Rice. 2012. Phenotypic shifts in White Perch life history strategy across stages of invasion. Biological Invasions 14(11):2315–2329.

Feiner, Z. S., J. A. Rice, and D. D. Aday. 2013a. Trophic niche of invasive White Perch and potential interactions with representative reservoir species. Transactions of the American Fisheries Society 142(3):628–641.

Feiner, Z. S., J. A. Rice, A. J. Bunch, and D. D. Aday. 2013b. Trophic niche and diet overlap between invasive White Perch and resident White Bass in a southeastern reservoir. Transactions of the American Fisheries Society 142(4):912–919.

Froese, R., and D. Pauly. 2008. FishBase. Available: http://www.fishbase.org.

Gmelin, J. F. 1789 Caroli a Linné. Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species; cum characteribus, differentiis, synonymis, locis. Editio decimo tertia, aucta, reformata.

Gopalan, G., D. A. Culver, L. Wu, and B. K. Trauben. 1998. Effects of recent ecosystem changes on the recruitment of young-of-the-year fish in western Lake Erie. Canadian Journal of Fisheries and Aquatic Sciences (55):2572–2579.

Halliwell, D. B. 2003. Introduced fish in Maine. MABP series: focus on freshwater biodiversity. [Source material did not provide full citation for this reference.]

Hartel, K. E. 1992. Non-native fishes known from Massachusetts freshwaters. Occasional Reports of the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Hartel, et al. 1996. [Source material did not provide full citation for this reference.]

Hergenrader. 1980. [Source material did not provide full citation for this reference.]

IGFA. 2001. Database of IGFA angling records until 2001. IGFA, Fort Lauderdale, Florida.

Irons. 2002. [Source material did not provide full citation for this reference.]

Irons, K. S., T. M. O'Hara, M. A. McClelland, and M. A. Pegg. 2002. White Perch occurrence, spread, and hybridization in the middle Illinois River, upper Mississippi River system. Transactions of the Illinois State Academy of Science 95(3):207–214.

Jenkins, R. E., and N. M. Burkhead. 1994. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland.

Johnson, M. G., and O. E. McNeil. 1986. Changes in abundance and species composition in benthic macroinvertebrate communities of the Bay of Quinte, 1966-84. Pages 177–189 *in* C. K. Minns, D. A. Hurley, and K. H. Nicholls, editors. Project Quinte: point-source phosphorus control and ecosystem response in the Bay of Quinte, Lake Ontario. Canadian Special Publication of Fisheries and Aquatic Sciences 86.

Johnson, T. B., and D. O. Evans. 1990. Size-dependent winter mortality of young-of-the-year White Perch: climate warming and invasion of the Laurentian Great Lakes. Transactions of the American Fisheries Society 119:301–313.

Larsen, L. 1954. First record of the White Perch (*Morone americana*) in Lake Erie. Copeia 1954(2):154.

Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980 et seq. Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh.

Madenjian, C. P., R. L. Knight, M. T. Bur, and J. L. Forney. 2000. Reduction in recruitment of White Bass in Lake Erie after invasion of White Perch. Transactions of the American Fisheries Society 129(6):1340–1353.

Mansueti, R. J. 1961. Movements, reproduction, and mortality of the White Perch, *Roccus americanus*, in the Patuxent Estuary, Maryland. Chesapeake Science (2):142–205.

McGovern, J. C., and J. E. Olney. 1988. Potential predation by fish and invertebrates on early life history stages of Striped Bass in Pamunkey River, Virginia. Transactions of the American Fisheries Society 117:152–161.

Mills, E. L., J. H. Leach, J. T. Carlton, and C. L. Secor. 1993. Exotic species in the Great Lakes: a history of biotic crisis and anthropogenic introductions. Journal of Great Lakes Research 19(1):1–54.

Molnár, K., and C. Fernando. 1974. Some new *Eimeria* (Protozoa, Coccidia) from freshwater fishes in Ontario, Canada. Canadian Journal of Zoology 52:413–419.

Morris, J., L. Morris, and L. Witt. 1974. The fishes of Nebraska. Nebraska Game and Parks Commission, Lincoln.

National Sea Grant. 1998. White Perch (*Morone americana*). Available: http://www.iisgcp.org/EXOTICSP/white_perch.htm.

Natureserve. 2008. *Morone americana*, White Perch. An online encyclopedia of life. Available: http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Morone+americana.

Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes of North America north of Mexico. The Peterson Field Guide Series, volume 42. Houghton Mifflin Company, Boston.

Page, L. M., and B. M. Burr. 2011. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Harcourt, Boston.

Parrish, D. L., and F. J. Margraf. 1990. Interactions between White Perch (*Morone americana*) and Yellow Perch (*Perca flavescens*) in Lake Erie as determined from feeding and growth. Canadian Journal of Fisheries and Aquatic Sciences 47(9):1779–1787.

Parrish, D. L., and F. J. Margraf. 1994. Spatial and temporal patterns of food use by White Perch and Yellow Perch in Lake Erie. Journal of Freshwater Ecology 9(1):29–35.

Pflieger, W. L. 1997. The fishes of Missouri. Missouri Department of Conservation, Jefferson City.

Plosila, D. S., and L. J. Nashett. 1990. First reported occurrence of White Perch in Lake Champlain. New York Department of Environmental Conservation, Bureau of Fisheries, Albany.

Pothoven, S. A., and T. O. Höök. 2015. Feeding ecology of invasive age-0 White Perch and native White Bass after two decades of co-existence in Saginaw Bay, Lake Huron. Aquatic Invasions 10(3):347–357.

Rasmussen, J. L. 1998. Aquatic nuisance species of the Mississippi River basin. 60th Midwest Fish and Wildlife Conference, Aquatic Nuisance Species Symposium, Cincinnati, Ohio.

Riede, K. 2004. Global register of migratory species - from global to regional scales. Federal Agency for Nature Conservation, Final Report, R&D-Projekt 808 05 081, Bonn.

Rixon, C. A. M., I. C. Duggan, N. M. N. Bergeron, A. Ricciardi, and H. J. Macisaac. 2005. Invasion risks posed by the aquarium trade and live fish markets on the Laurentian Great Lakes. Biodiversity Conservation 14:1365–1381.

Robins, C. R., and G. C. Ray. 1986. A field guide to Atlantic coast fishes of North America. Houghton Mifflin Company, Boston.

Savitz, J., C. Aiello, and L. G. Bardygula. 1989. The first record of the White Perch (*Morone americana*) in Illinois waters of Lake Michigan. Transactions of the Illinois Academy of Science 82(1&2):57–58.

Scarola, J. F. 1973. Freshwater fishes of New Hampshire. New Hampshire Fish and Game Department, Division of Inland and Marine Fisheries.

Schaeffer, J. S., and F. J. Margraf. 1987. Predation on fish eggs by White Perch, *Morone americana*, in western Lake Erie. Environmental Biology of Fishes 18(1):77–80.

Scott, W. B., and W. J. Christie. 1963. The invasion of the lower Great Lakes by White Perch, *Roccus americanus* (Gmelin). Journal of the Fisheries Research Board of Canada 20(5):1189–1195.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada, Bulletin 184.

Scott, W. B., and E. J. Crossman. 1990. Freshwater fishes of Canada. Bulletin of the Fisheries Research Board of Canada 184.

Setzler-Hamilton, E. M., P. W. Jones, F. D. Martin, K. Ripple, J. A. Mihursky, G. E. Drewry, and M. Beaven. 1982. [No title given.] Pages 139–157 *in* Proceedings of the Annual Meeting of the Potomac Chapter of the American Fisheries Society.

Smith, C. L. 1985. The inland fishes of New York State. New York State Department of Environmental Conservation, Albany.

Smith, W. L., and W. C. Wheeler. 2006. Venom evolution widespread in fishes: a phylogenetic road map for the bioprospecting of piscine venoms. Journal of Heredity 97(3):206–217.

Stapanian, M. A., M. T. Bur, and J. V. Adams. 2007. Temporal trends of young-of-year fishes in Lake Erie and comparison of diel sampling periods. Environmental Monitoring and Assessment 129(1-3):169–178.

Thomson, K. S., W. H. Weed, A. G. Taruski, and D. E. Simanek. 1978. Saltwater fishes of Connecticut, 2nd edition. Bulletin 105.

Todd, T. N. 1986. Occurrence of White Bass-White Perch hybrids in Lake Erie. Copeia 1986(1):196–199.

Trautman, M. B. 1981. The fishes of Ohio. Ohio State University Press, Columbus.

USFWS (U.S. Fish and Wildlife Service). 2005. National Wildlife Refuge System invasive species. Available: http://www.nwrinvasives.com/index.asp. (2006).

Whitmore, S. 1997. Aquatic nuisance species in Region 6 of the Fish and Wildlife Service. U.S. Fish and Wildlife Service, Great Plains Fish and Wildlife Management Assistance Office, Pierre, South Dakota.

Wisconsin Sea Grant. 2002b. White Perch *Morone americana*. University of Wisconsin Sea Grant Institute. Available: http://www.seagrant.wisc.edu/greatlakesfish/whiteperch.html.

Zuerlein, G. 1981. The White Perch, *Morone americana* (Gamelin) in Nebraska. Nebraska Technical Series 8, Lincoln.