DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 16

RIN 1018–AY69

[Docket No. FWS–HQ–FAC–2013–0095; FXFR13360900000–156–FF09F14000]

Injurious Wildlife Species; Listing 10 Freshwater Fish and 1 Crayfish

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: The U.S. Fish and Wildlife Service (Service) proposes to amend its regulations to add to the list of injurious fish the following freshwater fish species: Crucian carp (*Carassius carassius*), Eurasian minnow (*Phoxinus phoxinus*), Prussian carp (*Carassius gibelio*), roach (*Rutilus rutilus*), stone moroko (*Pseudorasbora parva*), Nile perch (*Lates niloticus*), Amur sleeper (*Perccottus glenii*), European perch (*Perca fluviatilis*), zander (*Sander lucioperca*), and wels catfish (*Silurus glanis*). In addition, the Service also proposes to amend its regulations to add the freshwater crayfish species common yabby (*Cherax destructor*) to the list of injurious crustaceans. These listings would prohibit the importation of any live animal, gamete, viable egg, or hybrid of these 10 fish and 1 crayfish into the United States, except as specifically authorized. These listings would also prohibit the interstate transportation of any live animal, gamete, viable egg, or hybrid of these 10 fish and 1 crayfish between the States, the District of Columbia, the Commonwealth of Puerto Rico, or any territory or possession of the United States, except as specifically authorized. As proposed, these species are injurious to human beings, to the interests of agriculture, or to wildlife or the wildlife resources of the United States, and the listing will prevent the purposeful or accidental introduction and subsequent establishment of these 10 fish and 1 crayfish into ecosystems of the United States. We are also making available for public review and comment the associated draft environmental assessment and draft economic analysis for this action.

DATES: Comments will be considered if received on or before December 29, 2015.

ADDRESSES: You may submit comments by one of the following methods:

- *Federal eRulemaking Portal: http://www.regulations.gov*. In the Search box, enter the docket number for the proposed rule, which is FWS–HQ–FAC–2013–0095. Click on ''Comment Now!'' to submit a comment. Please ensure that you have found the correct rulemaking before submitting your comment.
- *U.S. mail or hand delivery:* Public Comments Processing, Attn: FWS–HQ–FAC–2013–0095; U.S. Fish and Wildlife Service Headquarters, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

Comments will not be accepted by email or faxes. All comments will be posted on *http://www.regulations.gov*. This generally means that any personal information provided will be posted (see Public Comments, below, for more information).

FOR FURTHER INFORMATION CONTACT: Susan Jewell, U.S. Fish and Wildlife Service, MS–FAC, 5275 Leesburg Pike, Falls Church, VA 22041–3803; 703–358–2416. If a telecommunications device for the deaf (TDD) is required, please call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

The U.S. Fish and Wildlife Service (Service) proposes to amend its regulations to add to the list of injurious fish the following nonnative freshwater fish species: Crucian carp, Eurasian minnow, Prussian carp, roach, stone moroko, Nile perch, Amur sleeper, European perch, zander, and wels catfish. In addition, the Service proposes to amend its regulations to add the common yabby, a nonnative freshwater crayfish species, to the list of injurious crustaceans. These listings would prohibit the importation of any live animal, gamete, viable egg, or hybrid of these 10 fish and 1 crayfish (11 species) into the United States, except as specifically authorized. These listings would also prohibit the interstate transportation of any live animal, gamete, viable egg, or hybrid of these 10 fish and 1 crayfish, except as specifically authorized. If the proposed rule is made final, importation and interstate transportation of any live animal, gamete, viable egg, or hybrid of these 10 fish and 1 crayfish could be authorized only by permit for scientific, medical, educational, or zoological purposes, or without a permit by Federal agencies solely for their own use. This action is necessary to protect human beings and the interests of agriculture, wildlife, or wildlife resources from the purposeful or accidental introduction and subsequent establishment of these 11 species into ecosystems of the United States.

The need for the proposed action to add 11 nonnative species to the list of injurious wildlife under the Lacey Act developed from the Service's concern that, through our rapid screen process, these 11 species were categorized as ''high risk'' for invasiveness. All 11 species have a high climate match in parts of the United States, a history of invasiveness outside their native ranges, and, except for one fish species in one lake, are not currently found in U.S. ecosystems. Nine of the freshwater fish species (Amur sleeper, crucian carp, Eurasian minnow, European perch, Prussian carp, roach, stone moroko, wels catfish, and zander) have been introduced to and established populations within Europe and Asia, where they have spread and are causing harm. The Nile perch has been introduced to and become invasive in central Africa. The freshwater crayfish, the common yabby, has been introduced to western Australia and to Europe where it has established invasive populations. Most of these species were originally introduced for aquaculture, recreational fishing, or ornamental purposes. Two of these fish species (the Eurasian minnow and stone moroko) were accidently introduced when they were unintentionally transported in shipments with desirable fish species stocked for aquaculture or fisheries management.

A species does not have to be currently imported or present in the United States for the Service to list it as injurious. The objective of this listing is to utilize the Lacey Act's major strength by prohibiting importation and interstate transportation and thus preventing the species' likely introduction and establishment in the wild and likely injuriousness to human beings, the interests of agriculture, or to wildlife or wildlife resources. Based on our evaluation of the injurious nature of all 11 species, the Service seeks to prevent these introductions and establishment within the United States, consistent with the Lacey Act.

We evaluated the 10 fish and 1 crayfish species using the Service's Injurious Wildlife Evaluation Criteria. The criteria include the likelihood and magnitude of release or escape, of survival and establishment upon release or escape, and of spread from origin of release or escape. The criteria also examine the effect on wildlife resources and ecosystems (such as through hybridizing, competition for food or habitat, predation on native species, and pathogen transfer), on endangered and threatened species and their respective habitats, and on human beings, forestry, horticulture, and agriculture. Additionally, criteria evaluate the likelihood and magnitude of wildlife or habitat damages resulting from control measures. The analysis using these criteria serves as a basis for the Service's regulatory decision regarding injurious wildlife species listings. The objective of such a listing would be to prohibit importation and interstate transportation and thus prevent each of the species' likely introduction and establishment in the wild, thereby preventing injurious effects consistent with the Lacey Act.

Each of these 11 species has a well-documented history of invasiveness outside of its native range, but not in the United States. When released into the environment, these species have survived and established, expanded their nonnative range, preyed on native wildlife species, and competed with native species for food and habitat. Since it would be difficult to eradicate, manage, or control the spread of these 11 species; it would be difficult to rehabilitate or recover habitats disturbed by these species; and because introduction of these 11 species would negatively affect agriculture, human beings, and native wildlife or wildlife resources, the Service is proposing to amend its regulations to add these 11 species as injurious under the Lacey Act. This listing would prohibit the importation and interstate transportation of any live animal, gamete, viable egg, or hybrid in the United States, except as specifically authorized.

This proposed rule is not significant under Executive Order (E.O.) 12866. E.O. 12866 Regulatory Planning and Review (Panetta 1993) and the subsequent document, Economic Analysis of Federal Regulations under E.O. 12866 (U.S. Office of Management and Budget 1996) require the Service to ensure that proper consideration is given to the effect of this proposed action on the business community and economy. With respect to the regulations under consideration, analysis that comports with the Circular A–4 would include a full description and estimation of the economic benefits and cost associated with the implementation of the regulations. The economic effects to three groups would be addressed: (1) Producers; (2) consumers; and (3) society. Of the 11 species, only one population of one species (zander) is found in the wild in the United States. Of the 11 species, 1 species (yabby) is in the aquarium trade in the United States; 3 species (crucian carp, Nile perch, and wels catfish) have been imported in small numbers since 2011; and 7 species are not in U.S. trade. Therefore, the economic effect in the United States is negligible or nil. The draft economic analysis that the Service prepared supports this conclusion (USFWS Draft Economic Analysis 2015).

Background

The regulations contained in 50 CFR part 16 implement the Lacey Act (the Act; 18 U.S.C. 42, as amended). Under the terms of the Act, the Secretary of the Interior is authorized to prescribe by regulation those wild mammals, wild birds, fish, mollusks, crustaceans, amphibians, reptiles, and the offspring or eggs of any of the foregoing that are injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States. The lists of injurious wildlife species are found in title 50 of the Code of Federal Regulations (CFR) at §§ 16.11 through 16.15.

The purpose of listing the crucian carp, Eurasian minnow, Prussian carp, roach, stone moroko, Nile perch, Amur sleeper, European perch, zander, and wels catfish and the common yabby (hereafter ''11 species'') as injurious wildlife is to prevent the harm that these species could cause to the interests of agriculture, human beings, wildlife, and wildlife resources through their accidental or intentional introduction and establishment into the wild in the United States.

The Service evaluated each of the 11 species individually and determined them to be injurious. Therefore, for these 11 species, their importation into, or transportation between, the States, the District of Columbia, the Commonwealth of Puerto Rico, or any territory or possession of the United States of live animals, gametes, viable eggs, or hybrids, except by permit for zoological, educational, medical, or scientific purposes (in accordance with permit regulations 50 CFR 16.22), or by Federal agencies without a permit solely for their own use, upon filing a written declaration with the District Director of Customs and the U.S. Fish and Wildlife Service Inspector at the port of entry. The rule would not prohibit intrastate transport of the listed fish or crayfish species. Any regulations pertaining to the transport or use of these species within a particular State would continue to be the responsibility of that State.

How the 11 Species Were Selected for Consideration as Injurious Species

While the Service recognizes that not all nonnative species become invasive, it is important to have some understanding of the risk that nonnative species pose to the United States. Therefore, the Service utilizes a rapid screening process to provide a prediction of the invasive potential of nonnative species. Rapid screens categorize risk as either high, low, or uncertain and have been produced for hundreds of foreign aquatic fish and invertebrates for use by the Service and other entities. Each rapid screen is summarized in an Ecological Risk Screening Summary (ERSS; see ''Rapid Screening'' for explanation regarding how these summaries were done). The Service selected 11 species with a rapid screen result of ''high risk'' to consider for listing as injurious. These 11 species have a high climate match (see Rapid Screening) in parts of the United States, a history of invasiveness outside of their native range (see *Need for the Proposed Rule*), are not yet found in U.S. ecosystems (except for one), and have a high degree of certainty regarding these results. Other species meet these criteria and will be considered in subsequent rules. The ERSS reports for each of the 11 species are available on the Service's Web site (*http://www.fws.gov/injuriouswildlife*).

Except for one species in one lake, these 11 species are not currently present in U.S. ecosystems. All 11 species are documented to be highly invasive internationally (see Species Information for each species). Nine of the freshwater fish species (Amur sleeper, crucian carp, Eurasian minnow, European perch, Prussian carp, roach, stone moroko, wels catfish, and zander) have been introduced and established populations within Europe and Asia. The Prussian carp was recently found to be established in waterways in southern Alberta, Canada (Elgin *et al.* 2014), near the U.S. border. Another freshwater fish species, the Nile perch, has been introduced to and become invasive in central Africa. The freshwater crayfish, the common yabby, has been introduced to and established populations within Australia and Europe. Most of the 11 species were originally intentionally introduced for aquaculture, recreational fishing, or ornamental purposes. The Eurasian minnow and the stone moroko were accidently mixed with and introduced with shipments of fish stocked for other intended purposes. Consistent with 18 U.S.C. 42, the Service aims to prevent the introduction and establishment of all 11 species within the United States due to concerns regarding the potential injurious effects of the 11 species on human beings, the interests of agriculture, or to wildlife or wildlife resources of the United States.

Need for the Proposed Rule

The threat posed by these 11 species is evident in their history of invasiveness in other countries and have a high risk of establishment as demonstrated by a high climate match within the United States. Invasive species means ''an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health'' (Executive Order 13112 on Invasive Species, 1999). A history of invasiveness means that a species has been introduced (either intentionally or unintentionally) to an area or areas where it is not native and has subsequently been scientifically documented to have caused harm to the environment.

Based on the results of rapid screening assessments and our injurious wildlife evaluation, we anticipate that these 11 species would become invasive if they are introduced and become established in waters of the United States. All of these species have wide distribution ranges (where they are native and where they are invasive), suggesting they are highly adaptable and tolerant of new environments and opportunistic when expanding from their native range. Under the Act, the Service has the ability to prevent the introduction of injurious wildlife that poses a threat to the United States. Preventing injurious wildlife from entering the United States is widely considered the most economically effective and efficient management approach for avoiding the adverse ecological effects and economic costs often caused by invasive species.

Listing Process

The Service promulgates regulations under the Act in accordance with the Administrative Procedure Act (APA; 5 U.S.C. 551 *et seq.*). We are publishing a proposed rule for public notice and comment. We also solicit peer review under Office of Management and Budget (OMB) guidelines ''Final Information Quality Bulletin for Peer Review'' (OMB 2004). We also make available to the public an economic analysis (including analysis of potential effects on small businesses) if appropriate. We also follow National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*) requirements, which may include preparing an environmental assessment or environmental impact statement, also available to the public. For this proposed rule, we prepared a draft economic analysis and a draft environmental assessment.

This proposed rule is based on an evaluation using the Service's Injurious Wildlife Evaluation Criteria (see Injurious Wildlife Evaluation Criteria, below, for more information). We use these criteria to evaluate whether a species does or does not qualify as injurious under the Act. These criteria include the likelihood and magnitude of release or escape, of survival and establishment upon release or escape, and of spread from origin of release or escape. These criteria also examine the impact on wildlife resources and ecosystems (such as through hybridizing, competition for food or habitat, predation on native species, and pathogen transfer), on endangered and threatened species and their respective habitats, and on human beings, forestry, horticulture, and agriculture. Additionally, criteria evaluate the likelihood and magnitude of wildlife or habitat damages resulting from measures to control the proposed species. The analysis using these criteria serves as a basis for the Service's regulatory decision regarding injurious wildlife species listings. The objective of such a listing would be to prohibit importation and interstate transportation and thus prevent the species' likely introduction and establishment in the wild, thereby preventing injurious effects consistent with 18 U.S.C. 42.

We are evaluating each of the 11 species individually and will list only those species that we determine to be injurious. If a determination is made to not finalize a listing, the Service will publish notice in the **Federal Register** announcing that it is withdrawing the proposed rule with respect to any such species. If a determination is made to finalize the listing of a species as injurious after evaluating the comments we receive during this proposed rule's comment period, a final rule would be published. The final rule would contain responses to comments we receive on the proposed rule, state the final decision, and provide the justification for that decision. If listed, species determined to be injurious will be identified in the Code of Federal Regulations.

Introduction Pathways for the 11 Species

The primary potential pathways for the 11 species into the United States are through commercial trade in the live animal industry, including aquaculture, recreational fishing, bait, and ornamental display. Some could arrive unintentionally in water used to carry other aquatic species. Aquatic species may be imported into many designated ports of entry, including Miami, Los Angeles, Baltimore, Dallas-Fort Worth, Detroit, Chicago, and San Francisco. Once imported, these species may be transported throughout the country for aquaculture, recreational and commercial fishing, aquaculture, bait, display, and other possible uses.

Aquaculture is the farming of aquatic organisms, such as fish, crustaceans, mollusks, and plants for food, pets, stocking for fishing, and other purposes. Aquaculture usually occurs in a controlled setting where the water is contained, as a pond or in a tank, and is separate from lakes, ponds, rivers, and other natural waters. The controlled setting allows the aquaculturist to maintain proper conditions for each species being raised, which promotes optimal feeding and provides protection from predation and disease. However, Bartley (2011) states that aquaculture is the primary reason for the deliberate movement of aquatic species outside of their range, and Casal (2006) states that many countries are turning to aquaculture for human consumption, and that has led to the introduction and establishment of these species in local ecosystems. Although the farmed species are normally safely contained, outdoor aquaculture ponds have often flooded from major rainfall events and merged with neighboring natural waters, allowing the farmed species to escape by swimming or floating to nearby watersheds. Once a species enters a watershed, it has the potential to establish and spread throughout the watershed, which then increases the risk of spread to neighboring watersheds through further flooding. Other pathways for aquaculture species to enter natural waters include intentional stocking programs, and through unintentional stocking when the species is inadvertently included in a shipment with an intended species for stocking (Bartley 2011), release of unwanted ornamental fish, and release of live bait by fishermen.

Stocking for recreational fishing is a common pathway for invasive species when an aquatic species is released into a water body where it is not native. Often it takes repeated releases before the fish (or other animal) becomes established. The type of species that are typically selected and released for recreational fishing are predatory, grow quickly and to large sizes, reproduce abundantly, and are adaptable to many habitat conditions (Fuller *et al.* 1999). These are often the traits that also contribute to the species becoming invasive (Copp *et al.* 2005c; Kolar and Lodge 2001, 2002). Live aquatic species, such as fish and crayfish, are frequently used as bait for recreational and commercial fishing. Generally, bait animals are kept alive until they are needed, and leftover individuals may be released into convenient waterbodies (Litvak and Mandrak, 1993; Ludwig and Leitch, 1996). For example, Kilian *et al.* (2012) reported that 65 and 69 percent of Maryland anglers using fishes and crayfishes, respectively, released their unused bait, and that a nonnative, potentially invasive species imported into the State as bait is likely to be released into the wild. Often, these individuals survive, establish, and cause harm to that waterbody (Fuller *et al.* 1999; Kilian *et al.* 2012). Litvak and Mandrak (1993) found that 41 percent of anglers released live bait after use. Their survey found nearly all the anglers who released their bait thought they were doing a good thing for the environment. When the authors examined the purchase location and the angling destination, they concluded that 18 of the 28 species found in the dealers' bait tanks may have been used outside their native range. Therefore, it is not surprising that so many species are introduced in this manner; Ontario, Canada alone has more than 65 legal baitfish species, many of which are not native to some or all of Ontario (Cudmore and Mandrak 2005). Ludwig and Leitch (1996) concluded that the probability of at least 1,000 bait release events from the Mississippi Basin to the Hudson Bay Basin in one year is close to 1 (a certainty).

Ornamental aquatic species are species kept in aquaria and aquatic gardens for display for entertainment or public education. The most sought-after species frequently are not native to the display area. Ornamental species may accidentally escape from outdoor ponds into neighboring waterbodies (Andrews 1990; Fuller *et al.* 1999; Gherardi 2011b). They may also be released outdoors intentionally when owners no longer wish to maintain them, despite laws in most States prohibiting release into the wild. The first tropical freshwater fish became available in trade in the United States in the early 1900s (Duggan 2011), and there is currently a large variety of freshwater and saltwater fish in the ornamental trade. The trade in ornamental crayfish species is more recent but is growing rapidly (Gherardi 2011b).

The invasive range of many of the species in this proposed rule has expanded through intentional release for commercial and recreational fishing (European perch, Nile perch, Prussian carp, roach, wels catfish, zander, and common yabby), as bait (Eurasian minnow, roach, common yabby), and as ornamental fish (Amur sleeper, stone moroko), and unintentionally (Amur sleeper, crucian carp, Eurasian minnow, and stone moroko) with shipments of other aquatic species. All 11 species have proven that they are capable of naturally dispersing through waterways.

More importantly, the main factors influencing the chances of these 11 species establishing in the wild would be the propagule pressure, defined as the frequency of release events (propagule number) and numbers of individuals released (propagule size) (Williamson 1996; Colautti and MacIsaac 2004; Duncan 2011). This increases the odds of both genders being released and finding mates and of those individuals being healthy and vigorous. After a sufficient number of unintentional or intentional releases, a species may establish in those regions suitable for its survival and reproduction. Thus, allowing the importation and unregulated interstate transport of these 11 species subsequently increases the risk of any of these species becoming established within the United States.

An additional factor contributing to an invasive species' successful establishment is a documented history of these same species successfully establishing elsewhere outside of their native ranges. All 11 species have been introduced, become established, and been documented as causing harm in countries outside of their native ranges. For example, the stone moroko's native range includes southern and central Japan, Taiwan, Korea, China, and the Amur River basin (Copp *et al.* 2010). Since the stone moroko's original introduction to Romania in the early 1960s, this species has invaded nearly every European country and additional regions of Asia (Welcomme 1988; Copp *et al.* 2010; Froese and Pauly 2014). Thus, a high climate and habitat match between the species' native range and its introduced range has contributed significantly to its successful establishment.

As mentioned above, a species does not have to be currently imported or present in the United States for the Service to list it as injurious. The objective of this listing is to utilize the Act's major strength to prohibit importation and interstate transportation and thus prevent the species' likely introduction and establishment in the wild and likely harm to human beings, the interests of agriculture, or wildlife or wildlife resources, thereby preventing injurious effects consistent with the Lacey Act.

Public Comments

The Service is soliciting substantive public comments and supporting data on the draft environmental assessment, the draft economic analysis, and this proposed rule to add the 11 species to the list of injurious wildlife under the Act. This proposed rule and supporting materials will be available on *http://www.regulations.gov* under Docket No. FWS–HQ–FAC–2013–0095.

Comments and materials concerning this rule may be submitted by one of the methods listed in **ADDRESSES**. Comments sent by email or fax or to an address not listed in **ADDRESSES** will not be accepted.

We will post your entire comment—including your personal identifying information—on *http://www.regulations.gov*. If your written comments provide personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that this information will not be published.

Those comments and materials that we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public review at *http://www.regulations.gov* under Docket No. FWS–HQ–FAC–2013–0095, or by appointment, during normal business hours at U.S. Fish and Wildlife Service Headquarters (see **FOR FURTHER INFORMATION CONTACT**).

We are soliciting public comments and supporting data to gain additional information, and we specifically seek comment regarding the crucian carp, Eurasian minnow, Prussian carp, roach, stone moroko, Nile perch, Amur sleeper, European perch, zander, and wels catfish and the common yabby on the following questions:

(1) What regulations does your State or Territory have pertaining to the use, possession, sale, transport, or production of any of the 11 species in this proposed rule? What are relevant Federal, State, or local rules that may duplicate, overlap, or conflict with the proposed Federal regulation?

(2) Are any of the 11 species currently found in the wild in any of the States or Territories? If so, which species and where?

(3) Are any of the 11 species currently in production for wholesale or retail sale, and in which States?

(4) What would it cost to eradicate individuals or populations of any of the 11 species, or similar species, if found in the United States? What methods are effective?

(5) What State-protected species would be adversely affected by the introduction of any of the 11 species?

(6) What provisions in the proposed rule should the Service consider with

regard to: (a) The effect of the provision(s) (including any benefits and costs), if any, and (b) what alternatives, if any, the Service should consider, as well as the costs and benefits of those alternatives, paying specific attention to the effect the proposed rule would have on small entities?

(7) How could the proposed rule be modified to reduce any costs or burdens for small entities consistent with the Service's requirements?

(8) Should we include or not include hybrids of the species analyzed in this proposed rule, and would the hybrids be likely to possess the same biological characteristics as the parent species?

Species Information

We obtained our information on a species' biology, history of invasiveness, and climate matching from a variety of sources, including the U.S. Geological Survey Nonindigenous Aquatic Species (NAS) database, Centre for Agricultural Bioscience International's Invasive Species Compendium (CABI ISC), ERSS reports, and primary literature. We queried the NAS database (*http://nas.er.usgs.gov/*) to confirm that 10 of the 11 species are not currently established in U.S. ecosystems. The zander is established in a lake in North Dakota (Fuller 2009). The CABI ISC (*http://www.cabi.org/isc/*) is a constantly developing, encyclopedic resource containing datasheets on more than 1,500 invasive species and animal diseases. The Service contracted with CABI for many of the species-specific datasheets that we used in preparation of this proposed rule. The datasheets were prepared by world experts on the species, and each datasheet was reviewed by expert peer reviewers. The datasheets served as sources of compiled information that allowed us to prepare this proposed rule efficiently.

Crucian Carp (Carassius carassius)

The crucian carp was first described and cataloged by Linnaeus in 1758, and is part of the order Cypriniformes and family Cyprinidae. The family Cyprinidae, or the carp and minnow family, is a large and diverse group that includes 2,963 freshwater species (Froese and Pauly 2014).

Native Range and Habitat

The crucian carp inhabits a temperate climate (Riehl and Baensch 1991). The native range includes much of north and central Europe, extending from the North Sea and Baltic Sea basins across northern France and Germany to the Alps and through the Danube River basin and eastward to Siberia (Godard and Copp 2012). The species inhabits freshwater lakes, ponds, rivers, and ditches (Godard and Copp 2012). This species can survive in water with low dissolved oxygen levels, including aquatic environments with greatly reduced oxygen (hypoxic) or largely devoid of dissolved oxygen (anoxic) (Godard and Copp 2012).

Nonnative Range and Habitat

Crucian carp have been widely introduced to and established in Croatia, Greece, southern France (Holčík 1991; Godard and Copp 2012), Italy, and England (Kottelat and Freyhof 2007), Spain, Belgium, Israel, Switzerland, Chile, India, Sri Lanka, Philippines (Holčík 1991; Froese and Pauly 2014), and Turkey (Innal and Erk'akan 2006). In the United States, crucian carp may have been established within Chicago (Illinois) lakes and lagoons in the early 1900s (Meek and Hildebrand 1910; Schofield *et al.* 2005), but apparently died out because currently no such population exists (Welcomme 1988; Schofield *et al.* 2005; Schofield *et al.* 2013).

Several other fish species, including the Prussian carp, a brown variety of goldfish (*Carassius auratus*), and the common carp (*Cyprinus carpio*), have been misidentified as crucian carp (Godard and Copp 2012). Crucian carp may have been accidently introduced to some regions in misidentified shipments of ornamental fish (Wheeler 2000; Hickley and Chare 2004). However, no known populations of crucian carp currently exist in the United States.

Biology

Crucian carp generally range from 20 to 45 centimeters (cm) (8 to 18 inches (in)) long with a maximum of 50 cm (19.5 in) (Godard and Copp 2012). Specimens have been reported to weigh up to 3 kilograms (kg) (6.6 pounds (lb)) (Froese and Pauly 2014). These fish have an olive-gray back that transitions into brassy green along the sides and brown on the body (Godard and Copp 2012).

Crucian carp can live up to 10 years (Kottelat and Freyhof 2007) and reach sexual maturity at one and a half years but may not begin spawning until their third year (Godard and Copp 2012). Crucian carp are batch spawners (release multiple batches of eggs per season) and may spawn one to three times per year (Aho and Holopainen 2000, Godard and Copp 2012).

Crucian carp feed during the day and night on plankton, benthic (bottom-dwelling) invertebrates, plant materials, and detritus (organic material) (Kottelat and Freyhof 2007).

Crucian carp can harbor the fish disease spring viraemia of carp (SVC) (Ahne *et al.* 2002) and several parasitic infections (*Dactylogyrus* gill flukes disease, Trichodinosis, skin flukes, false fungal infection, and turbidity of the skin) (Froese and Pauly 2014). SVC is a disease that, when found, is required to be reported to the Office International des Epizooties (OIE) (World Organisation of Animal Health) (Ahne *et al.* 2002). The SVC virus infects carp species but may be transmitted to other fish species. The virus is shed with fecal matter and urine, and often infects through waterborne transmission (Ahne *et al.* 2002). Additionally, SVC may result in significant morbidity and mortality with an approximate 70 percent fatality among juvenile fish and 30 percent fatality in adult fish (Ahne *et al.* 2002). Thus, the spread of SVC may have serious effects on native fish stocks. OIE-notifiable diseases affect animal health internationally.

OIE-notifiable diseases meet certain criteria for consequences, spread, and diagnosis. For the consequences criteria, the disease must have either been documented as causing significant production losses on a national or multinational (zonal or regional) level, or have scientific evidence that indicates that the diseases will cause significant morbidity or mortality in wild aquatic animal populations, or be an agent of public health concern. For the spread criteria, the disease's infectious etiology (cause) must be known or an infectious agent is strongly associated with the disease (with etiology unknown). In addition for the spread criteria, there must be a likelihood of international spread (via live animals and animal products) and the disease must not be widespread (several countries or regions of countries without specific disease). For the diagnosis criteria, there must be a standardized, proven diagnostic test for disease detection (OIE 2012). These internationally-accepted standards, including those that document the consequences (harm) of certain diseases, offer supporting evidence of injuriousness.

Invasiveness

This species demonstrates many of the strongest traits for invasiveness. The crucian carp is capable of securing and ingesting a wide range of food, has a broad native range, and is highly adaptable to different environments (Godard and Copp 2012). Crucian carp can increase turbidity (cloudiness of water) in lakes, rivers, and streams with soft bottom sediments while scavenging along the substrate. Increased turbidity reduces light availability to submerged plants and can result in harmful ecosystem changes, such as to phytoplankton survival and nutrient cycling. Crucian carp can breed with other carp species, including the common carp (Wheeler 2000). Hybrids of crucian carp and common carp can affect fisheries, because such hybrids, along with the introduced crucian carp, may compete with native species for food and habitat resources (Godard and Copp 2012).

Eurasian Minnow (Phoxinus phoxinus)

The Eurasian minnow was first described and cataloged by Linnaeus in 1758, and belongs to the order Cypriniformes and family Cyprinidae (ITIS 2014). Although Eurasian minnow is the preferred common name, this fish species is also referred to as the European minnow.

Native Range and Habitat

The Eurasian minnow inhabits a temperate climate, and the native range includes much of Eurasia within the basins of the Atlantic, North and Baltic Seas, and the Arctic and the northern Pacific Oceans (Froese and Pauly 2014).

Eurasian minnows can be found in a variety of habitats ranging from brackish (estuarine; slightly salty) to freshwater streams, rivers, ponds, and lakes located within the coastal zone to the mountains (Sandlund 2008). In Norway, they are found at elevations up to 2,000 m (6,562 ft). These minnows prefer shallow lakes or slow-flowing streams and rivers with stony substrate (Sandlund 2008).

Nonnative Range and Habitat

The Eurasian minnow's nonnative range includes parts of Sweden and Norway, United Kingdom, and Egypt (Sandlund 2008), as well as other drainages juxtaposed to native waterways. The Eurasian minnow was initially introduced as live bait, which was the main pathway of introduction throughout the 1900s (Sandlund 2008). The inadvertent inclusion of this minnow species in the transport water of brown trout (*Salmo trutta*) that were intentionally stocked into lakes for recreational angling has contributed to their spread (Sandlund 2008). From these initial stockings, minnows have swum downstream and established in new waterways, and have spread to new waterways through tunnels constructed for hydropower development. These minnows have also been purposely introduced as food for brown trout and to control the Tune fly (in Simuliidae) (Sandlund 2008).

The Eurasian minnow is expanding its nonnative range by establishing populations in additional waterways bordering the native range. Waterways near where the minnow is already established are most at risk (Sandlund 2008).

Biology

The Eurasian minnow has a torpedo-shaped body measuring 6 to 10 cm (2.3 to 4 in) with a maximum of 15 cm (6 in). Size and growth rate are both highly dependent on population density and environmental factors (Lien 1981; Mills 1987, 1988; Sandlund 2008). These minnows have variable coloration but are often brownish-green on the back with a whitish stomach and brown and black blotches along the side (Sandlund 2008).

The Eurasian minnow's life-history traits (age, size at sexual maturity, growth rate, and life span) may be highly variable (Mills 1988). Populations residing in lower latitudes often have smaller body size and younger age of maturity than those populations in higher altitudes and latitudes (Mills 1988). Maturity ranges from less than 1 year to 6 years of age, with a lifespan as long as 13 to 15 years (Sandlund 2008). The Eurasian minnow spawns annually with an average fecundity between 200 to 1,000 eggs (Sandlund 2008).

This minnow usually cohabitates with salmonid fishes (Kottelat and Freyhof 2007). The Eurasian minnow feeds mostly on invertebrates (crustaceans and insect larvae) as well as some algal and plant material (Lien 1981).

Invasiveness

The Eurasian minnow demonstrates many of the strongest traits for invasiveness. The species is highly adaptable to new environments and is difficult to control (Sandlund 2008). The species can become established within varying freshwater systems, including lowland and high alpine areas, as well as in brackish water (Sandlund 2008). Introductions of the Eurasian minnow can cause major changes to nonnative ecosystems by affecting the benthic community (decreased invertebrate diversity) and disrupting trophic level structure (Sandlund 2008). This affects the ability of native fish to find food as well as disrupts native spawning. The Eurasian minnow has been shown to reduce recruitment of brown trout by predation (Sandlund 2008). Although brown trout are not native to the United States, they are closely related to our native trout and salmon, and thus Eurasian minnows could be expected to reduce the recruitment of native trout.

In addition, Eurasian minnows are carriers of parasites and have increased the introduction of parasites to new areas. Such parasites affected native snails, mussels, and different insects within subalpine lakes in southern Norway following introduction of the Eurasian minnows (Sandlund 2008). Additionally, Zietara *et al.* (2008) used molecular methods to link the parasite *Gyrodactylus aphyae* from Eurasian minnows to the new hosts of Atlantic salmon (*Salmo salar*) and brown trout.

Prussian Carp (Carassius gibelio)

The Prussian carp was first described and catalogued by Bloch in 1782, and belongs to the order Cypriniformes and family Cyprinidae (ITIS 2014).

Native Range and Habitat

The Prussian carp inhabits a temperate climate (Baensch and Riehl 2004). The species is native to regions of central Europe and eastward to Siberia. It is also native to several Asian countries, including China, Georgia, Kyrgyzstan, Mongolia, Turkey, and Turkmenistan (Britton 2011). The Prussian carp resides in a variety of fresh stillwater bodies and rivers. This species also inhabits warm, shallow, eutrophic (high in nutrients) waters with submerged vegetation or regular flooding events (Kottelat and Freyhof 2007). This species can live in polluted waters with pollution and low oxygen concentrations (Britton 2011).

Nonnative Range and Habitat

The Prussian carp has been introduced to many countries within central and Western Europe. This species was first introduced to Belgium during the 1600s and is now prevalent in Belgian freshwater systems. The Prussian carp was also introduced to Belarus and Poland during 1940s for recreational fishing and aquaculture. This carp species has dispersed and expanded its range using the Vistula and Bug River basins (Britton 2011). During the mid to late 1970s, this carp species invaded the Czech Republic river system from the Danube River via the Morava River. Once in the river system, the fish expanded into tributary streams and connected watersheds. Throughout its nonnative range, this species has been stocked with common carp and misidentified as crucian carp (Britton 2011). From the original stocked site, the Prussian carp has dispersed both naturally (swimming) and with human involvement.

The Prussian carp's current nonnative range includes the Asian countries of

Armenia, Turkey, and Uzbekistan and the European countries of Belarus, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Poland, and Switzerland (Britton 2011). The species has recently invaded the Iberian Peninsula (Ribeiro *et al.* 2015). The species was recently found to be established in waterways in southern Alberta, Canada (Elgin *et al.* 2014).

Biology

The Prussian carp has a silvery-brown body with an average length of 20 cm (7.9 in) and reported maximum length of 35 cm (13.8 in) (Kottelat and Freyhof 2007, Froese and Pauly 2014). This species has a reported maximum weight of 3 kilograms (kg; 6.6 pounds (lb) (Froese and Pauly 201b).

The Prussian carp lives up to 10 years (Kottelat and Freyhof 2007). This species can reproduce in a way very rare among fish. Introduced populations often include, or are solely composed of, triploid females that can undergo natural gynogenesis, allowing them to reproduce from unfertilized eggs (Britton 2011). Thus, the eggs are viable without being fertilized by males.

The Prussian carp is a generalist omnivore and consumes a varied diet that includes plankton, benthic invertebrates, plant material, and detritus (Britton 2011).

The parasite *Thelohanellus wuhanensis* (Wang *et al.* 2001) and black spot disease (Posthodiplostomatosis) have been found to affect the Prussian carp (Markovíc *et al.* 2012).

Invasiveness

The Prussian carp is a highly invasive species in freshwater ecosystems throughout Europe and Asia. This fish species grows rapidly and can reproduce from unfertilized eggs (Vetemaa *et al.* 2005). Prussian carp have been implicated in the decline in both the biodiversity and population of native fish (Vetemaa *et al.* 2005, Lusk *et al.* 2010). The presence of this fish species has been linked with increased water turbidity (Crivelli 1995), which in turn alters both the ecosystem's trophic level structure and nutrient availability.

Roach (Rutilus rutilus)

The roach was first described and cataloged by Linnaeus in 1758, and belongs to the order Cypriniformes and family Cyprinidae (ITIS 2014).

Native Range and Habitat

The roach inhabits temperate climates (Riehl and Baensch 1991). The species' native range includes regions of Europe and Asia. Within Europe, it is found north of the Pyrenees and Alps and eastward to the Ural River and Eya drainages (Caspian Sea basin) and within the Aegean Sea basin and watershed (Kottelat and Freyhof 2007). In Asia, the roach's native range extends from the Sea of Marmara basin and lower Sakarya Province (Turkey) to the Aral Sea basin and Siberia (Kottelat and Freyhof 2007).

This species often resides in nutrient-rich lakes, medium to large rivers, and backwaters. Within rivers, the roach is limited to areas with slow currents.

Nonnative Range and Habitat

This species has been introduced to several countries for recreational fishing. Once introduced, the roach has moved into new water bodies within the same country (Rocabayera and Veiga 2012). In 1889, the roach was brought from England to Ireland for use as bait fish. Some of these fish accidently escaped into Cork Blackwater system. After this initial introduction, this fish species was deliberately stocked in nearby lakes. The roach has continued its expansion throughout Ireland watersheds, and by 2000, had invaded every major river system within Ireland (Rocabayera and Veiga 2012).

This species has been reported as invasive in north and central Italy, where it was introduced for recreational fishing (Rocabayera and Veiga 2012). The roach was also introduced to Madagascar, Morocco, Cyprus, Portugal, the Azores, Spain, and Australia (Rocabayera and Veiga 2012).

Biology

The roach has an average body length of 25 cm (9.8 in) and reported maximum length of 50 cm (19.7 in) (Rocabayera and Veiga 2012). The maximum published weight is 1.84 kg (4 lb) (Froese and Pauly 2014).

The roach can live up to 14 years (Froese and Pauly 2013). Male fish are sexually mature at 2 to 3 years and female fish at 3 to 4 years. A whole roach population typically spawns within 5 to 10 days, with each female producing 700 to 77,000 eggs (Rocabayera and Veiga 2012). Eggs hatch approximately 12 days later (Kottelat and Freyhoff 2007).

The roach has a general, omnivorous diet, including benthic invertebrates, zooplankton, plants, and detritus (Rocabayera and Veiga 2012). Of the European cyprinids (carps, minnows, and their relatives), the roach is one of the most efficient molluscivores (Winfield and Winfield 1994).

Parasitic infections, including worm cataracts (*Diplostomum spathaceum*), black spot disease (diplostomiasis), and tapeworm (*Ligula intestinalis*), have all been found associated with the roach (Rocabayera and Veiga 2012), as has the pathogen bacterium *Aeromonas salmonicida,* which causes furunculosis (skin ulcers) in several fish species (Wiklund and Dalsgaard 1998).

Invasiveness

The main issues associated with invasive roach populations include competition with native fish species, hybridization with native fish species, and altered ecosystem nutrient cycling (Rocabayera and Veiga 2012). The roach is a highly adaptive species and adapts to a different habitat or diet to avoid predation or competition (Winfield and Winfield 1994).

The roach also has a high reproductive rate and spawns earlier than some other native fish (Volta and Jepsen 2008, Rocabayera and Veiga 2012). This allows larvae to have a competitive edge over native fish larvae (Volta and Jepsen 2008).

The roach can hybridize with other cyprinids, including rudd (*Scardinius erythrophthalmus*) and bream (*Abramis brama*), in places where it has invaded. The new species (roach-rudd cross and roach-bream cross) then compete for food and habitat resources with both the native fish (rudd, bream) and invasive fish (roach) (Rocabayera and Veiga 2012).

Within nutrient-rich lakes or ponds, large populations of roach create adverse nutrient cycling. High numbers of roach consume large amounts of zooplankton, which results in algal blooms, increased turbidity, and changes in nutrient availability and cycling (Rocabayera and Veiga 2012).

Stone Moroko (Pseudorasbora parva)

The stone moroko was first described and cataloged by Temminick and Schlegel in 1846 and belongs to the order Cypriniformes and family Cyprinidae (ITIS 2014). Although the preferred common name is the stone moroko, this fish species is also called the topmouth gudgeon (Froese and Pauly 2014).

Native Range and Habitat

The stone moroko inhabits a temperate climate (Baensch and Riehl 1993). Its native range is Asia, including southern and central Japan, Taiwan, Korea, China, and the Amur River basin. The stone moroko resides in freshwater lakes, ponds, rivers, streams, and irrigation canals (Copp 2007).

Nonnative Range and Habitat

The stone moroko was introduced to Romania in the early 1960s with a

Chinese carp shipment (Copp *et al.* 2010). By 2000, this fish species had invaded nearly every other European country and additional countries in Asia (Copp 2007). This species was primarily introduced unintentionally with fish shipped purposefully. Secondary natural dispersal also occurred in most countries (Copp 2007).

Within Asia, the stone moroko has been introduced to Afghanistan, Armenia, Iran, Kazakhstan, Laos, Taiwan, Turkey, and Uzbekistan (Copp 2007). In Europe, this fish species' nonnative range includes Albania, Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Lithuania, Moldova, Montenegro, Netherlands, Poland, Romania, Russia, Serbia, Slovakia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom (Copp 2007). The stone moroko has also been introduced to Algeria and Fiji (Copp 2007).

Biology

The stone moroko is a small fish with an average body length of 8 cm (3.1 in), maximum reported length of 11 cm (4.3 in) (Froese and Pauly 2014g), and average body mass of 17 to 19 grams (g; 0.04 lb) (Witkowski 2011). This fish species is grayish black with a lighter belly and sides. Juveniles have a dark stripe along the side that disappears with maturity (Witkowski 2011).

This fish species can live up to 5 years (Froese and Pauly 2014). The stone moroko becomes sexually mature and begins spawning at 1 year (Witkowski 2011). Females release several dozen eggs per spawning event and spawn several times per year. The total number of eggs spawned per female ranges from a few hundred to a few thousand eggs (Witkowski 2011). Male fish aggressively guard eggs until hatching (Witkowski 2011).

The stone moroko maintains an omnivorous diet of small insects, fish, mollusks, planktonic crustaceans, fish eggs, algae (Froese and Pauly 2014g), and plants (Kottelat and Freyhof 2007).

The stone moroko is an unaffected carrier of the pathogenic parasite *Sphaerothecum destruens* (Gozlan *et al.* 2005, Pinder *et al.* 2005). This parasite is transferred to water from healthy stone morokos. Once in the water, this parasite has infected Chinook salmon (*Oncorhynchus tshawytscha*), Atlantic salmon, sunbleak (*Leucaspius delineatus*), and fathead minnows (*Pimephales promelas*) (Gozlan *et al.* 2005). *Sphaerothecum destruens* infects the internal organs, resulting in spawning failure, organ failure, and death (Gozlan *et al.* 2005).

Invasiveness

The stone moroko has proven to be a highly invasive fish, establishing invasive populations in nearly every European country over a 40-year span (Copp 2007, Copp *et al.* 2010). This fish species has proven to be adaptive and tolerant of a variety of habitats, including those of poorer quality (Beyer *et al.* 2007). This species' invasiveness is further aided by multiple spawning events and the guarding of eggs by the male until hatching (Kottelat and Freyhof 2007).

In many areas of introduction and establishment (for example, United Kingdom, Italy, China, and Russia), the stone moroko has been linked to the decline of native freshwater fish populations (Copp 2007). The stone moroko has been found to dominate the fish community when it becomes established. Native fishes have exhibited decreased growth rate and reproduction, and they shifted their diet as a result of food competition (Britton *et al.* 2010b).

Additionally, this species is a vector of *Sphaerothecum destruens,* which is a documented pathogen of native salmonids (Gozlan *et al.* 2005, Gozlan *et al.* 2009, Andreou *et al.* 2011). *Sphaerothecum destruens* has caused mortalities in cultured North American salmon (Andreou *et al.* 2011)

Nile Perch (Lates niloticus)

The Nile perch was first described and cataloged by Linnaeus in 1758 and is in the order Perciformes and family Centropomidae (ITIS 2014). Although its preferred common name is the Nile perch, it is also referred to as the African snook and Victoria perch (Witte 2013).

Native Range and Habitat

The Nile perch inhabits a tropical climate with an optimal water temperature of 28 °C (82 °F) and an upper lethal temperature of 38 °C (100 °F) (Kitchell *et al.* 1997). The species' native distribution includes much of central, western, and eastern Africa. The species is common in the Nile, Chad, Senegal, Volta, and Zaire River basins and brackish Lake Mariout near Alexandria, Egypt (Witte 2013). Nile perch reside in brackish lakes and freshwater lakes, rivers, stream, reservoirs, and irrigation channels (Witte 2013).

Nonnative Range and Habitat

The Nile perch, which is not native to Lake Victoria in Africa, was first introduced to the lake in 1954 from nearby Lake Albert. This species was introduced on the Ugandan side and spread to the Kenyan side. A breeding population existed in the lake by 1962 (Witte 2013). Additional introductions of Nile perch occurred in 1962 and 1963, in Kenyan and Ugandan waters to promote a commercial fishery. The increase in Nile perch population was first noted in Kenyan waters in 1979, in Ugandan waters 2 to 3 years later, and in Tanzanian waters 4 to 5 years later (Witte 2013).

The Nile perch was also introduced to Lake Kyoga (1954 and 1955) to gauge the effects of Nile perch on fish populations similar to that of Lake Victoria. At the time of introduction, people were unaware that this species had already been introduced to Lake Victoria (Witte 2013). Since its initial introduction to Lakes Victoria and Kyoga, this fish species has been accidently and deliberately introduced to many of the neighboring lakes and waterways (Witte 2013). There are currently only a few lakes in the area without a Nile perch population (Witte 2013).

The Nile perch was also introduced into Cuba for aquaculture and sport in 1982 and 1983 (Welcomme 1988), but we have no information on the subsequent status.

Nile perch were stocked in Texas waters in 1978, 1979, and 1984 (88, 14, and 26 fish respectively in Victor Braunig Lake); in 1981 (68,119 in Coleto Creek Reservoir); and in 1983 (1,310 in Fairfield Lake) (Fuller *et al.* 1999, Texas Parks and Wildlife Department 2013a). These introductions were unsuccessful at establishing a self-sustaining population (Howells 1992, Howells 2001). The fish were unable to survive in the cold water temperatures (Howells 2001). Today, Nile perch are a prohibited exotic species in Texas (Texas Parks and Wildlife Department 2013b).

Biology

The Nile perch has a perch-like body with average body length of 100 cm (3.3 ft), maximum length of 200 cm (6.6 ft) (Ribbink 1987, Froese and Pauly 2013), and maximum weight of 200 kg (441 lb) (Ribbink 1987). The Nile perch is gray-blue on the dorsal side with gray-silver along the flank and ventral side (Witte 2013).

The age of sexual maturity varies with habitat location. Most male fish become sexually mature before females (1 to 2 years versus 1 to 4 years of age) (Witte 2013). This species spawns throughout the year with increased spawning during the rainy season (Witte 2013). The Nile perch produce 3 million to 15 million eggs per breeding cycle (Asila and Ogari 1988). This high fecundity allows the Nile perch to quickly establish in new regions with favorable habitats (Ogutu-Ohwayo 1988). Additionally, the Nile perch's reproductive rate in introduced habitats is much greater than that of its prey, haplochromine cichlids (fish from the family Cichlidae), which have a reproductive rate of 13 to 33 eggs per breeding cycle (Goldschmidt and Witte 1990).

Nile perch less than 5 cm eat zooplankton (cladocerans and copepods) (Witte 2013). Juvenile Nile perch (35 to 75 cm long) feed on invertebrates, primarily aquatic insects, crustaceans, and mollusks (Ribbink 1987). Adult Nile perch are piscivorous (fish eaters), they also consume large crustaceans (*Caridina* and *Macrobrachium* shrimp) and insects (Witte 2013).

The Nile perch is host to a number of parasites capable of causing infections and diseases in other species, including sporozoa infections (*Hennegya* sp.), *Dolops* infestation, *Ergasilus* disease, gonad nematodosis disease (*Philometra* sp.), and *Macrogyrodactylus* and *Diplectanum* infestation (Paperna 1996, Froese and Pauly 2014f).

Invasiveness

The Nile perch has been listed as one of the 100 ''World's Worst'' Invaders by the Global Invasive Species Database (*http://www.issg.org*) (Snoeks 2010, ISSG 2015). During the 1950s and 1960s, this fish was introduced to several East African lakes for commercial fishing. This fish is now prevalent in Lake Victoria and contributes to over 90 percent of demersal (bottom-dwelling) fish mass within this lake (Witte 2013). Since its introduction, native fish populations have declined or disappeared (Witte 2013). Approximately 200 native haplochromine cichlid species have become locally extinct due to predation and competition (Snoeks 2010, Witte 2013). Consequently, this has resulted in significant shifts to the trophic level structure and loss of biodiversity of this lake's ecosystem.

Amur Sleeper (Perccottus glenii)

The Amur sleeper was first described and cataloged by B.I. Dybowski in 1877, as part of the order Perciformes and family Odontobutidae (Bogutskaya and Naseka 2002, ITIS 2014). The Amur sleeper is the preferred common name of this freshwater fish, but this fish is also called the Chinese sleeper or rotan (Bogutskaya and Naseka 2002, Froese and Pauly 2014). In this proposed rule, we will refer to the species as the Amur sleeper.

Native Range and Habitat

The Amur sleeper inhabits a temperate climate (Baensch and Riehl 2004). The species' native distribution includes much of the freshwater regions of northeastern China and northern North Korea, the Far East of Russia (Reshetnikov 2004), and South Korea (Grabowska 2011). Within China, this species is predominately native to the lower to middle region of the Amur River watershed, including the Zeya, Sunguri, and Ussuri tributaries (Bogutskaya and Naseka 2002, Grabowska 2011) and Lake Khanka (Courtenay 2006). The Amur sleeper's range extends northward to the Tugur River (Siberia) (Grabowska 2011) and southward to the Sea of Japan (Bogutskaya and Naseka 2002, Grabowska 2011). To the west, the species does not occur in the Amur River upstream of Dzhalinda (Bogutskaya and Nasaka 2002).

The Amur sleeper inhabits freshwater lakes, ponds, canals, backwaters, flood plains, oxbow lakes, and marshes (Grabowska 2011). This fish is a poor swimmer, thriving in slow-moving waters with dense vegetation and muddy substrate and avoiding main river currents (Grabowska 2011). The Amur sleeper can live in poorly oxygenated water and can also survive in dried out or frozen water bodies by burrowing into and hibernating in the mud (Bogutskaya and Nasaka 2002, Grabowska 2011).

Although the Amur sleeper is a freshwater fish, there are limited reports of it appearing in saltwater environments (Bogutskaya and Naseka 2002). These reports seem to occur with flood events and are likely a consequence of these fish being carried downstream into these saltwater environments (Bogutskaya and Naseka 2002).

Nonnative Range and Habitat

This species' first known introduction was in western Russia. In 1912, Russian naturalist I.L. Zalivskii brought four Amur sleepers to the Lisiy Nos settlement (St. Petersburg, Russia) (Reshetnikov 2004, Grabowska 2011). These four fish were held in aquaria until 1916, when they were released into a pond, where they subsequently established a population before naturally dispersing into nearby water bodies (Reshetnikov 2004, Grabowska 2011). In 1948, additional Amur sleepers were introduced to Moscow for use in ornamental ponds by members of an expedition (Bogutskaya and Naseka 2002, Reshetnikov 2004). These fish escaped the ponds they were stocked into and spread to nearby waters in the city of Moscow and Moscow Province (Reshetnikov 2004).

Additionally, Amur sleepers were introduced to new areas when they were unintentionally shipped to fish farms in fish stocks such as silver carp (*Hypophthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*). From these initial introductions, the Amur sleepers were able to expand from their native range through escape, release, and transfer between fish farms (Reshetnikov 2004). Additionally, Amur sleepers tolerate being transported well, so anglers use them as bait and move them from one waterbody to another (Reshetnikov 2004).

The Amur sleeper is an invasive species in western Russia and 14 additional countries: Mongolia, Belarus, Ukraine, Lithuania, Latvia, Estonia, Poland, Hungary, Romania, Slovakia, Serbia, Bulgaria, Moldova, and Croatia (Froese and Pauly 2014, Grabowska 2011). The Amur sleeper is established within the Baikal, Baltic, and Volga water basins of Europe and Asia (Bogutskaya and Naseka 2002). The species' nonnative range extends northward to Lake Plestsy in Arkhangelsk province (Russia), southward to Bulgaria, and westward to the Kis-Balaton watershed in Hungary (Grabowska 2011).

Biology

The Amur sleeper is a small- to medium-sized fish with a maximum body length of 25 cm (9.8 in) (Grabowska 2011) and weight of 250 g (0.6 lb) (Reshetnikov 2003). As with other fish species, both body length and weight vary with food supply, and larger Amur sleeper specimens have been reported from the nonnative range (Bogutskaya and Naseka 2002).

Body shape is fusiform with two dorsal fins, short pelvic fins, and rounded caudal fin (Grabowska 2011). The Amur sleeper has dark coloration of greenish olive, brownish gray, or dark green with dark spots and pale yellow to blue-green flecks (Grabowska 2011). Males are not easily discerned from females except during breeding season. Breeding males are darker (almost black) with bright blue-green spots and also have inflated areas on the head (Grabowska 2011).

The Amur sleeper lifespan is from 7 to 10 years. Within native ranges, the fish rarely lives more than 4 years, whereas in nonnative ranges, the fish generally lives longer (Bogutskaya and Naseka 2002, Grabowska 2011). The fish reaches maturity between 2 and 3 years of age (Grabowska 2011) and has at least two spawning events per year.

The number of eggs per spawning event varies with female size. In the Wloclawski Reservoir, which is outside of the Amur sleeper's native range, the females produced an average of 7,766 eggs per female (range 1,963 to 23,479 eggs) (Grabowska *et al.* 2011). Male Amur sleepers are active in prenatal care by guarding eggs and aggressively defending the nest (Bogutskaya and Naseka 2002, Grabowska *et al.* 2011).

The Amur sleeper is a voracious, generalist predator that eats invertebrates (such as freshwater crayfish, shrimp, mollusks, and insects), amphibian tadpoles, and small fish (Bogutskaya and Naseka 2002). Reshetnikov (2003) found that the Amur sleeper significantly reduced species diversity of fishes and amphibians where it was introduced. In some small water bodies, Amur sleepers considerably decrease the number of species of aquatic macroinvertebrates, amphibian larvae, and fish species (Reshetnikov 2003, Pauly 2014, Kottelat and Freyhof 2007).

The predators of Amur sleepers include pike, perch, snakeheads (*Channa* spp.), and gulls (Laridae) (Bogutskaya and Naseka 2002). In their native range, it is believed that this species is primarily controlled by snakeheads. Eggs and juveniles are fed on by a variety of insects (Bogutskaya and Naseka 2002).

The Amur sleeper reportedly has high parasitic burdens of more than 40 parasite species (Grabowska 2011). The host-specific parasites, including *Nippotaenia mogurndae* and *Gyrodactylus perccotti,* have been transported to new areas along with the introduced Amur sleeper (Košuthová *et al.* 2004, Grabowska 2011). The cestode (tapeworm) *Nippotaenia mogurndae* was first reported in Europe in the River Latorica in east Slovakia in 1998, after this same river was invaded by the Amur sleeper (Košuthová *et al.* 2004). This parasite may be able to infect other fish species (Košuthová *et al.* 2008). Thus, the potential for the Amur sleeper to function as a parasitic host could aid in the transmission of parasites to new environments and potentially to new species (Košuthová *et al.* 2008, Košuthová *et al.* 2009).

Invasiveness

The Amur sleeper is considered one of the most widespread, invasive fish in European freshwater ecosystems within the last several decades (Copp *et al.* 2005a, Grabowska 2011, Reshetnikov and Ficetola 2011). Reshetnikov and Ficetola (2011) indicate that there are 13 expansion centers for this fish outside of its native range. Once this species has been introduced, it has proven to be capable of establishing sustainable populations (Reshetnikov 2004). Within the Vistula River (Poland), the Amur sleeper has averaged an annual expansion of its range by 88 kilometers (54.5 miles) per year (Grabowska 2011). A recent study (Reshetnikov and Ficetola 2011) suggests many other regions of Europe and Asia, as well as northeastern United States and southeastern Canada, have suitable climates for the Amur sleeper and are at risk for an invasion.

The Amur sleeper demonstrates many of the strongest traits for invasiveness: It consumes a highly varied diet, is fast growing with a high reproductive potential, easily adapts to different environments, and has an expansive native range and proven history of increasing its nonnative range by itself and through human-mediated activities (Grabowska 2011). Where it is invasive, the Amur sleeper competes with native species for similar habitat and diet resources (Reshetnikov 2003, Kottelat and Freyhof 2007). This fish has also been associated with the decline in populations of the European mudminnow (*Umbra krameri*), crucian carp, and belica (*Leucaspius delineates*) (Grabowska 2011). This species hosts parasites that may be transmitted to native fish species when introduced outside of its native range (Košuthová *et al.* 2008, Košuthová *et al.* 2009).

European Perch (Perca fluviatilis)

The European perch was first described and cataloged by Linnaeus in 1758, and is part of the order Perciformes and family Percidae (ITIS 2014). European perch is the preferred common name, but this species may also be referred to as the Eurasian perch or redfin perch (Allen 2004, Froese and Pauly 2014).

Native Range and Habitat

The European perch inhabits a temperate climate (Riehl and Baensch 1991, Froese and Pauly 2014). This species' native range extends throughout Europe and regions of Asia, including Afghanistan, Armenia, Azerbaijan, Georgia, Iran, Kazakhstan, Mongolia, Turkey, and Uzbekistan (Froese and Pauly 2014). The fish resides in a range of habitats that includes estuaries and freshwater lakes, ponds, rivers, and streams (Froese and Pauly 2014).

Nonnative Range and Habitat

The European perch has been intentionally introduced to several countries for recreational fishing, including Ireland (in the 1700s), Australia (in 1862), South Africa (in 1915), Morocco (in 1939), and Cyprus (in 1971) (FAO 2014, Froese and Pauly 2014). This species was introduced intentionally to Turkey for aquaculture (FAO 2004) and unintentionally to Algeria when it was included in the transport water with carp intentionally brought into the country (Kara 2012, Froese and Pauly 2014). European perch have also been introduced to China (in the 1970s), Italy (in 1860), New Zealand (in 1867), and Spain (no date) for unknown reasons (FAO 2014). In Australia, this species was first introduced as an effort to introduce wildlife familiar to European colonizers (Arthington and McKenzie 1997). The European perch was first introduced to Tasmania in 1862, Victoria in 1868, and to southwest Western Australia in 1892 and the early 1900s (Arthington and McKenzie 1997). This species has now invaded western Victoria, New South Wales, Tasmania, Western Australia, and South Australian Gulf Coast (NSW DPI 2013). In the 1980s, the European perch invaded the Murray River in southwestern Australia (Hutchison and Armstrong 1993).

Biology

The European perch has an average body length of 25 cm (10 in) with a maximum length of 60 cm (24 in) (Kottelat and Freyhof 2007, Froese and Pauly 2014j) and an average body weight of 1.2 kg (2.6 lb) with a maximum weight of 4.75 kg (10.5 lb) (Froese and Pauly 2014). European perch color varies with habitat. Fish in well-lit shallow habitats tend to be darker, whereas fish residing in poorly lit areas tend to be lighter. These fish may also absorb carotenoids (nutrients that cause color) from their diet (crustaceans), resulting in reddish-yellow color (Allen 2004). Male fish are not easily externally differentiated from female fish (Allen 2004).

The European perch lives up to 22 years (Froese and Pauly 2014), although the average is 6 years (Kottelat and Freyhof 2007). This fish may participate in short migrations prior to spawning in February through July, depending on latitude and altitude (Kottelat and Freyhof 2007). Female fish are sexually mature at 2 to 4 years and males at 1 to 2 years (Kottelat and Freyhof 2007).

The European perch is a generalist predator with a diet of zooplankton, macroinvertebrates (such as copepods and crustaceans), and small fish (Kottelat and Freyhof 2007, Froese and Pauly 2014).

The European perch can also carry the OIE-notifiable disease epizootic haematopoietic necrosis (EHN) virus

(NSW DPI 2013). Several native Australian fish (including the silver perch (*Bidyanus bidyanus*) and Murray cod (*Maccullochella peelii*)) are extremely susceptible to the virus and have had significant population declines over the past decades with the continued invasion of European perch (NSW DPI 2013).

Invasiveness

The European perch has been introduced to many new regions through fish stocking for recreational use. The nonnative range has also expanded as the fish has swum to new areas through connecting waterbodies (lakes, river, and streams within the same watershed). In New South Wales, Australia, these fish are a serious pest and are listed as Class 1 noxious species (NSW DPI 2013). These predatory fish have been blamed for the local extirpation of the mudminnow (*Galaxiella munda*) (Moore 2008, ISSG 2010) and depleted populations of native invertebrates and fish (Moore 2008). This species reportedly consumed 20,000 rainbow trout (*Oncorhynchus mykiss*) fry from an Australian reservoir in less than 3 days (NSW DPI 2013). The introduction of these fish in New Zealand and China has severely altered native freshwater communities (Closs *et al.* 2003). European perch form dense populations, forcing them to compete amongst each other for a reduced food supply. This results in stunted fish that are less appealing to the recreational fishery (NSW DPI 2013).

Zander (Sander lucioperca)

The zander was first described and catalogued by Linnaeus in 1758, and belongs to the order Perciformes and family Percidae (ITIS 2014). Although its preferred common name in the United States is the zander, this fish species is also called the pike-perch and European walleye (Godard and Copp 2011, Froese and Pauly 2014).

Native Range and Habitat

The zander's native range includes the Caspian Sea, Baltic Sea, Black Sea, Aral Sea, North Sea, and Aegean Sea basins. In Asia, this fish is native to Afghanistan, Armenia, Azerbaijan, Georgia, Iran, Kazakhstan, and Uzbekistan. In Europe, the zander is native to much of eastern Europe (Albania, Austria, Czech Republic, Estonia, Germany, Greece, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Russia, Serbia, Slovakia, Ukraine, and Serbia and Montenegro) and the Scandinavian Peninsula (Finland, Norway, and Sweden) (Godard and Copp 2011, Froese and Pauly 2014). The northernmost records of native populations are in Finland up to 64 °N (Larsen and Berg 2014).

The zander resides in brackish coastal estuaries and freshwater rivers, lakes, and reservoirs. The species prefers turbid, slightly eutrophic waters with high dissolved oxygen concentrations (Godard and Copp 2011). The zander can survive in salinities up to 20 parts per thousand (ppt), but prefers environments with salinities less than 12 ppt and requires less than 3 ppt for reproduction (Larsen and Berg 2014).

Nonnative Range and Habitat

The zander has been repeatedly introduced outside of its native range for recreational fishing and aquaculture and also to control cyprinids (Godard and Copp 2011, Larsen and Berg 2014). This species has been introduced to much of Europe, parts of Asia (China, Kyrgyzstan, and Turkey), and northern Africa (Algeria, Morocco, and Tunisia). Within Europe, the zander has been introduced to Belgium, Bulgaria, Croatia, Cyprus, Denmark, France, Italy, the Netherlands, Portugal, the Azores, Slovenia, Spain, Switzerland, and the United Kingdom (Godard and Copp 2011, Froese and Pauly 2014). In Denmark, although the zander is native, stocking is not permitted to prevent the species from being introduced into lakes and rivers where it is not presently found and where introduction is not desirable (Larsen and Berg 2014).

The zander has been previously introduced to the United States. Juvenile zanders were stocked into Spiritwood Lake (North Dakota) in 1989 for recreational fishing (Fuller *et al.* 1999, Fuller 2009, USGS NAS 2014). Although previous reports indicated that zanders did not become established in Spiritwood Lake, there have been documented reports of captured juvenile zanders from this lake (Fuller 2009). In 2009, the North Dakota Game and Fish Department reported a small, established population of zanders within Spiritwood Lake (Fuller 2009), and a zander caught in 2013 was considered the State record (North Dakota Game and Fish 2013).

Biology

The zander has an average body length of 50 cm (1.6 ft) and maximum body length of 100 cm (3.3 ft). The maximum published weight is 20 kg (44 lb) (Froese and Pauly 2013). The zander has a long slender body with yellow-gray fins and dark bands running from the back down each side (Godard and Copp 2011).

The zander's age expectancy is inversely correlated to its body growth rate. Slower-growing zanders may live up to 20 to 24 years, whereas faster-growing fish may live only 8 to 9 years (Godard and Copp 2011). Female zanders typically spawn in April and May and produce approximately 150 to 400 eggs per gram of body mass. After spawning, male zanders protect the nest and fan the eggs with the pectoral fins (Godard and Copp 2011).

The zander is piscivorous, and its diet includes smelt (*Osmerus eperlanus*), ruffe (*Gymnocephalus cernuus*), European perch, vendace (*Coregonus albula*), roach, and other zanders (Kangur and Kangur 1998).

Several studies have found that zanders can be hosts for multiple parasites (Godard and Copp 2011). The nematode *Anisakis,* which is known to infect humans through fish consumption, has been documented in the zander (Eslami and Mokhayer 1977, Eslami *et al.* 2011). A study in the Polish section of Vistula Lagoon found 26 species of parasites associated with the zander, which was more than any of the other 15 fish species studied (Rolbiecki 2002, 2006).

Invasiveness

The zander has been intentionally introduced numerous times for aquaculture, recreational fishing, and occasionally for biomanipulation to remove unwanted cyprinids (Godard and Copp 2011). Biomanipulation is the management of an ecosystem by adding or removing species. The zander also migrates for spawning, further expanding its invasive range. It is a predatory fish that is well-adapted to turbid water and low-light habitats (Sandström and Karås 2002). The zander competes with and preys on native fish populations. The zander is also a vector for the trematode *Bucephalus polymorphus,* which has been linked to a decrease in native French cyprinid populations (Kvach and Mierzejewska 2011).

Wels Catfish (Silurus glanis)

The wels catfish was first described and cataloged by Linnaeus in 1758, and belongs to the order Siluriformes and family Siluridae (ITIS 2014). The preferred common name is the wels catfish, but this fish is also called the Danube catfish, European catfish, and sheatfish (Rees 2012, Froese and Pauly 2014).

Native Range and Habitat

The wels catfish inhabits a temperate climate (Baensch and Riehl 2004). The species is native to eastern Europe and western Asia, including the North Sea, Baltic Sea, Black Sea, Caspian Sea, and Aral Sea basins (Rees 2012, Froese and Pauly 2014). The species resides in slow-moving rivers, backwaters, shallow floodplain channels, and heavily vegetated lakes (Kottelat and Freyhof 2007). The wels catfish has also been found in brackish water of the Baltic and Black Seas (Froese and Pauly 2014). The species is a demersal (bottom dwelling) species that prefers residing in crevices and root habitats (Rees 2012).

Nonnative Range and Habitat

The wels catfish was introduced to the United Kingdom and western Europe during the 19th century. The species was first introduced to England in 1880 for recreational fishing at the private Bedford manor estate of Woburn Abbey. Since then, wels catfish have been stocked both legally and illegally into many lakes and are now widely distributed throughout the United Kingdom (Rees 2012). This species was introduced to Spain, Italy, and France for recreational fishing and aquaculture (Rees 2012). Wels catfish were introduced to the Netherlands as a substitute predator to control cyprinid fish populations (De Groot 1985) after the native pike were overfished. The wels catfish has also been introduced to Algeria, Belgium, Bosnia-Hercegovina, China, Croatia, Cyprus, Denmark, Finland, Portugal, Syria, and Tunisia, although they are not known to be established in Algeria or Cyprus (Rees 2012).

Biology

The wels catfish commonly grows to 3 m (9.8 ft) in body length with a maximum length of 5 m (16.4 ft) and is Europe's largest freshwater fish (Rees 2012). The maximum published weight is 306 kg (675 lb) (Rees 2012).

This species has a strong, elongated, scaleless, mucus-covered body with a flattened tail. The body color is variable but is generally mottled with dark greenish-black and creamy-yellow sides. Wels catfishes possess six barbels; two long ones on each side of the mouth, and four shorter ones under the jaw (Rees 2012).

Although the maximum reported age is 80 years (Kottelat and Freyhof 2007), the average lifespan of a wels catfish is 15 to 30 years. This species becomes sexually mature at 3 to 4 years of age. Nocturnal spawning occurs annually and aligns with optimal temperature and day length between April and August (Kottelat and Freyhof 2007, Rees 2012). The number of eggs produced per female, per year is highly variable, and depends on age, size, geographic location, and other factors. Studies in Asia have documented egg production of a range of approximately 8,000 to 467,000 eggs with the maximum reported being 700,000 eggs (Copp *et al.* 2009). Male fish will guard the nest, repeatedly fanning their tails to ensure proper ventilation until the eggs hatch 2 to 10 days later (Copp *et al.* 2009). Young catfish develop quickly and, on average, achieve a 38- to 48-cm (15- to 19-in) total length within their first year (Copp *et al.* 2009).

This species is primarily nocturnal and will exhibit territorial behavior (Copp *et al.* 2009). The wels catfish is a solitary ambush predator but is also an opportunistic scavenger of dead fish (Copp *et al.* 2009). Juvenile catfish typically eat invertebrates. Adult catfish are generalist predators with a diet that includes fish (at least 55 species), crayfish, small mammals (such as rodents), and waterfowl (Copp *et al.* 2009, Rees 2012). Wels catfish have been observed beaching themselves to prey on land birds located on river banks (Cucherousset 2012).

Juvenile wels catfish can carry the highly infectious SVC (Hickley and Chare 2004). This disease is recognized worldwide and is classified as a notifiable animal disease by the World Organisation for Animal Health (OIE 2014). The wels catfish is also a host to at least 52 parasites, including: *Trichodina siluri, Myxobolus miyarii, Leptorhynchoides plagicephalus* and *Pseudotracheliastes stellifer,* all of which may be detrimental to native fish survival (Copp *et al.* 2009).

Invasiveness

The wels catfish is a habitat-generalist that tolerates poorly oxygenated waters and has been repeatedly introduced to the United Kingdom and western Europe for aquaculture, research, pest control, and recreational fishing (Rees 2012). Although this species has been intentionally introduced for aquaculture and fishing, it has also expanded its nonnative range by escaping from breeding and stocking facilities (Rees 2012). This species is tolerant of a variety of warm-water habitats, including those with low dissolved oxygen levels. The invasive success of the wels catfish will likely be further enhanced with the predicted increase in water temperature with climate change (2 to 3 °C by 2050) (Rahel and Olden 2008, Britton *et al.* 2010a).

The major risks associated with invasive wels catfish to the native fish population include disease transmission (SVC) and competition for habitat and prey species (Rees 2012). This fish species also excretes large amounts of phosphorus and nitrogen (estimated 83- to 286-fold and 17- to 56-fold, respectively) (Boulêtreau *et al.* 2011) into the ecosystem and consequently greatly disrupts nutrient cycling and transport (Schaus *et al.* 1997, McIntyre *et al.* 2008, Boulêtreau *et al.* 2011). Because of their large size, multiple wels catfish in one location magnify these effects and can greatly increase algae and plant growth (Boulêtreau *et al.* 2011), which reduces water quality.

Common Yabby (Cherax destructor)

Unlike the 10 fish in this rule, the yabby is a crayfish. Crayfish are invertebrates with hard shells. They can live and breathe underwater, and they crawl along the substrate on four pairs of walking legs (Holdich and Reeve 1988); the pincers are considered another pair of walking legs. The common yabby was first described and cataloged by Clark in 1936 and belongs to the phylum Arthropoda, order Decapoda, and family Parastacidae (ITIS 2014). This freshwater crustacean may also be called the yabby or the common crayfish. The term ''yabby'' is also commonly used for crayfish in Australia.

Native Range and Habitat

The common yabby is native to eastern Australia and extends from South Australia, northward to southern parts of the Northern Territory, and eastward to the Great Dividing Range (Eastern Highlands) (Souty-Grosset *et al.* 2006, Gherardi 2011a).

The common yabby inhabits temperate and tropical climates. In aquaculture, the yabby tolerates the wide range of water temperatures from 1 to 35 °C (34 to 95 °F) and with an optimal water temperature range of 20 to 25 °C (68 to 77 °F) (Withnall 2000). Growth halts below 15 °C (59 °F) and above 34 °C (93 °F), partial hibernation (decreased metabolism and feeding) occurs below 16 °C (61 °F), and death occurs when temperatures rise above 36 °C (97 °F) (Gherardi 2011a). The yabby can also survive drought for several years by sealing itself in a deep burrow (burrows well over 5 meters (m; 16.4 feet (ft)) have been found) and aestivating (the crayfish's respiration, pulse, and digestion nearly cease) (NSW DPI 2015).

This species can tolerate a wide range of dissolved oxygen concentrations and salinities (Mills and Geddes 1980) but prefers salinities less than 8 ppt (Withnall 2000, Gherardi 2011a). Growth ceases at salinities above 8 ppt (Withnall 2000). This correlates with Beatty's (2005) study where all yabbies found in waters greater than 20 ppt were dead. Yabbies have been found in ponds where the dissolved oxygen was below 1 percent saturation (NSW DPI 2015).

The common yabby resides in a variety of habitats, including desert mound springs, alpine streams, subtropical creeks, rivers, billabongs (small lake, oxbow lake), temporary lakes, swamps, farm dams, and irrigation channels (Gherardi 2011a). The yabby is found in mildly turbid waters and muddy or silted bottoms. The common yabby digs burrows that connect to waterways (Withnall 2000). Burrowing can result in unstable and collapsed banks (Gherardi 2011a).

Nonnative Range and Habitat

The common yabby is commercially valuable and is frequently imported by countries for aquaculture, aquariums, and research (Gherardi 2011a); it is raised in aquaculture as food for humans (NSW DPI 2015). This species has spread throughout Australia, and its nonnative range extends to New South Wales east of the Great Dividing Range, Western Australia, and Tasmania. This crayfish species was introduced to Western Australia in 1932 for commercial aquaculture from where it escaped and established in rivers and irrigation dams (Souty-Grosset *et al.* 2006). Outside of Australia, this species has been introduced into Italy and Spain where it has become established (Gherardi 2011a). The common yabby has been introduced to China, South Africa, and Zambia for aquaculture (Gherardi 2011a) but has not become established in the wild in those countries. The first European introduction occurred in 1983, when common yabbies were transferred from a California farm to a pond in Girona, Catalonia, Spain (Souty-Grosset *et al.* 2006). This crayfish species became established in Zaragoza Province, Spain after being introduced in 1984 or 1985 (Souty-Grosset *et al.* 2006).

Biology

The common yabby has been described as a ''baby lobster'' because of its relatively large body size for a crayfish and because of its unusually large claws. Yabbies have a total body length up to 15 cm (6 in) with a smooth external carapace (exoskeleton) (Souty-Grosset *et al.* 2006, Gherardi 2011a). Body color can vary with geographic location, season, and water conditions (Withnall 2000). Most captive cultured yabbies are blue-gray, whereas wild yabbies may be green-beige to black (Souty-Grosset *et al.* 2006,Withnall 2000). Yabbies in the aquarium trade can be blue or white and go by the names blue knight and white ghost (LiveAquaria.com 2014a, b).

Most common yabbies live 3 years with some living up to 6 years (Souty-Grosset *et al.* 2006, Gherardi 2011a). Females can be distinguished from males by the presence of gonopores at the base of the third pair of walking legs; while males have papillae at the base of the fifth pair of walking legs (Gherardi 2011a). The female yabby becomes sexually mature before it is 1 year old (Gherardi 2011a). Spawning is dependent on day length and water temperatures. When water temperatures rise above 15 °C (59 °F), the common yabby will spawn from early spring to mid-summer. When the water temperature is consistently between 18 and 20 °C (64 to 68 °F) with daylight of more than 14 hours, the yabby will spawn up to five times a year (Gherardi 2011a). Young females produce 100 to 300 eggs per spawning event, while older (larger) females can produce up to 1,000 eggs (Withnall 2000). Incubation is also dependent on water temperature and typically lasts 19 to 40 days (Withnall 2000).

The common yabby grows through molting, which is shedding of the old carapace and then growing a new one (Withnall 2000). A juvenile yabby will molt every few days, whereas, an adult yabby may molt only annually or semiannually (Withnall 2000).

The common yabby is an opportunistic omnivore with a carnivorous summer diet and herbivorous winter diet (Beatty 2005). The diet includes fish (*Gambusia holbrooki*), plant material, detritus, and zooplankton. The yabby is also cannibalistic, especially where space and food are limited (Gherardi 2011a).

The common yabby is affected by at least ten parasites (Jones and Lawrence 2001), including the crayfish plague (caused by *Aphanomyces astaci*), burn spot disease, *Psorospermium* sp. (a parasite), and thelohaniasis (Jones and Lawrence 2001, Souty-Grosset *et al.* 2006, Gherardi 2011a). The crayfish plague is an OIE-reportable disease. Twenty-three bacteria species have been found in the yabby as well (Jones and Lawrence 2001).

Invasiveness

The common yabby has a quick growth and maturity rate, high reproductive rate, and generalist diet. These attributes, in addition to the species' tolerance for a wide range of freshwater habitats, make the common yabby an efficient invasive species. Additionally, the invasive range of the common yabby is expected to expand with climate change (Gherardi 2011a). Yabbies can also live on land and travel long distances by walking between water bodies (Gherardi 2011b:129).

The common yabby may reduce biodiversity through competition and predation with native species. In its nonnative range, the common yabby has proven to out-compete native crayfish species for food and habitat (Beatty 2006, Gherardi 2011a). Native freshwater crayfish species are also at risk from parasitic infections from the common yabby (Gherardi 2011a).

Summary of the Presence of the 11 Species in the United States

Only one of the 11 species, the zander, is present in the wild within the United States. There has been a small established population of zander within Spiritwood Lake (North Dakota) since 1989. Crucian carp were reportedly introduced to Chicago lakes and lagoons during the early 1900s. Additionally, Nile perch were introduced to Texas reservoirs between 1978 and 1985. However, neither the crucian carp nor the Nile perch established populations, and these two species are no longer present in the wild in U.S. waters. These examples demonstrate that the interest may exist for future attempts at introductions into the United States for these and the other species. Because these species are not yet present in the United States, except for one species in one lake, but have been introduced, become established, and been documented as causing harm in countries outside of their native ranges, regulating them now to prohibit importation and interstate transportation and thus prevent the species' likely introduction and establishment in the wild and likely harm to human beings, to the interests of agriculture, or to wildlife or wildlife resources is critical to preventing their injurious effects in the United States.

Rapid Screening

The first step that the Service performed in selecting species to evaluate for listing as injurious was to prepare a rapid screen. We asked, without doing a full risk assessment on each potential species, how could we quickly assess which species out of thousands of foreign species not yet found in the United States should be categorized as high-risk of invasiveness? Our method was to conduct rapid screenings and compile the information in Ecological Risk Screening Summaries (ERSS) for each species to determine the Overall Risk Assessment of each species. More information on the ERSS process and its peer review is posted online at *http://www.fws.gov/*

injuriouswildlife/Injurious_prevention.html, http://www.fws.gov/science/pdf/ERSS-Process-Peer-Review-Agenda-12-19-12.pdf, and *http://www.fws.gov/science/pdf/ERSS-Peer-Review-Response-report.pdf.* The ERSS reports also served to subsequently provide some of the information for the injurious wildlife evaluation criteria. This procedure incorporates scores for the history of invasiveness, climate matching between the species' range (native and invaded ranges) and the United States, and certainty of assessment to determine an Overall Risk Assessment score.

For the 11 species under consideration, all species have a high risk for history of invasiveness.

For the 11 species considered, overall climate match ranged from medium for the Nile perch, to high for the remaining nine fish and one crayfish species. The climate match analysis (Australian Bureau of Rural Sciences 2010) incorporates 16 climate variables to calculate climate scores that can be used to calculate a Climate 6 ratio (see USFWS 2014 for additional details). Using the Climate 6 ratio, species can be categorized as having a low (0.000 to 0.005), medium (greater than 0.005 to less than 0.103), or high (greater than 0.103) climate match (Bomford 2008; USFWS 2014). This climate matching method is used by some projects funded under the Great Lakes Restoration Initiative to direct efforts to prevent the invasion of aquatic species in the Great Lakes. For this proposed rule, the Service expanded the source ranges (native and nonnative distribution) of several species for the climate match from those listed in the ERSSs. The revised source ranges included additional locations referenced in FishBase (Froese and Pauly 2010), the CABI ISC, and the *Handbook of European Freshwater Fishes* (Kottelat and Freyhof 2007). Additional source points were also specifically selected for the stone moroko's distribution within the United Kingdom (Pinder *et al.* 2005). There were no revisions to the climate match for the Nile perch, Amur sleeper, or common yabby. The target range for the climate match included the States, District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands.

For the 11 species under consideration, the certainty of assessment (with sufficient and reliable information) was high for all species.

The Overall Risk Assessment, which is determined from a combination of scores for history of invasiveness, climate match, and certainty of assessment, was found to be high for all 11 species. A high score for the Overall Risk Assessment indicates that the assessed species would be a greater threat of invasiveness than a species with a low score. The Amur sleeper, crucian carp, Eurasian minnow, European perch, Nile perch, Prussian carp, roach, stone moroko, wels catfish, zander, and common yabby are high-risk species.

Injurious Wildlife Evaluation Criteria

Once we determined that the 11 species were good candidates for evaluating because of their invasive risk, we used the criteria below to evaluate whether a species qualifies as injurious under the Act. The analysis using these criteria serve as a general basis for the Service's regulatory decision regarding all injurious wildlife listings. Biologists within the Service evaluated both the factors that contribute to and the factors that reduce the likelihood of injuriousness. These factors were developed by the Service.

(1) Factors that contribute to being considered injurious:

• The likelihood of release or escape;

• Potential to survive, become established, and spread;

• Impacts on wildlife resources or ecosystems through hybridization and competition for food and habitats, habitat degradation and destruction, predation, and pathogen transfer;

• Impacts to endangered and threatened species and their habitats;

• Impacts to human beings, forestry, horticulture, and agriculture; and

• Wildlife or habitat damages that may occur from control measures.

(2) Factors that reduce the likelihood of the species being considered as injurious:

• Ability to prevent escape and establishment;

• Potential to eradicate or manage established populations (for example, making organism sterile);

• Ability to rehabilitate disturbed ecosystems;

• Ability to prevent or control the spread of pathogens or parasites; and

• Any potential ecological benefits to introduction.

For this proposed rule, a hybrid is defined as any progeny (offspring) from any cross involving a parent from one of the 11 species. These progeny would likely have the same or similar biological characteristics of the parent species (Ellstrand and Schierenbeck 2000, Mallet 2007), which, according to our analysis, would indicate that they are injurious to human beings, to the interests of agriculture, or to wildlife or wildlife resources of the United States.

Factors That Contribute to Injuriousness for Crucian Carp

Current Nonnative Occurrences

This species is not currently found within the United States. The crucian carp has been introduced and become established in Croatia, Greece, France, Italy, and England (Crivelli 1995, Kottelat and Freyhof 2007).

Potential Introduction and Spread

Potential pathways of introduction into the United States include stocking for recreational fishing and through misidentified shipments of ornamental fish (Wheeler 2000, Hickley and Chare 2004, Innal and Erk'ahan 2006, Sayer *et al.* 2011). Additionally, crucian carp may be misidentified as other carp species, such as the Prussian carp or common carp, and thus they are likely underreported (Godard and Copp 2012).

The crucian carp prefers a temperate climate (as found in much of the United States) and tolerates high summer air temperatures (up to 35 °C (95 °F)) and can survive in poorly oxygenated waters (Godard and Copp 2012). The crucian carp has an overall high climate match with a Climate 6 ratio of 0.355. This species has a high climate match throughout much of the Great Lakes region, southeastern United States, and southern Alaska and Hawaii. Low matches occur in the desert Southwest.

If introduced, the crucian carp is likely to spread and become established in the wild due to its ability to be a habitat and diet generalist and adapt to new environments, to its long life span (maximum 10 years), and to its ability to establish outside of the native range.

Potential Impacts to Native Species (Including Threatened and Endangered Species)

As mentioned previously, the crucian carp can compete with native fish species, alter the health of freshwater habitats, hybridize with other invasive and injurious carp species, and serve as a vector of the OIE-reportable fish disease SVC (Ahne *et al.* 2002, Godard and Copp 2012). The introduction of crucian carp to the United States could result in increased competition with native fish species for food resources (Welcomme 1988). The crucian carp consumes a variety of food resources, including plankton, benthic invertebrates, plant materials, and detritus (Kottelat and Freyhof 2007). With this varied diet, crucian carp would directly compete with numerous native species.

The crucian carp has a broad climate match throughout the country, and thus its introduction and establishment could further stress the populations of numerous endangered and threatened amphibian and fish species through competition for food resources.

The ability of crucian carp to hybridize with other species of Cyprinidae (including common carp) may exacerbate competition over limited food resources and ecosystem changes, and thus, further challenge native species (including native threatened or endangered fish species).

Crucian carp harbor the fish disease SVC and additional parasitic infections. Although SVC also infects other carp species, this disease can also be transmitted through the water column to native fish species causing fish mortalities. Mortality rates from SVC have been documented up to 70 percent among juvenile fish and 30 percent among adult fish (Ahne *et al.* 2002). Therefore, as a vector of SVC, this fish species may also be responsible for reduced wildlife diversity. Crucian carp may outcompete native fish species, thus replacing them in the trophic scheme. Large populations of crucian carp can result in considerable predation on aquatic plants and invertebrates. Changes in ecosystem cycling and wildlife diversity may have negative effects on the aesthetic, recreational, and economic benefits of the environment.

Potential Impacts to Humans

We have no reports of the crucian carp being directly harmful to humans.

Potential Impacts to Agriculture

The introduction of crucian carp is likely to affect agriculture by contaminating commercial aquaculture. This fish species can harbor Spring Viremia of Carp (SVC), which can infect numerous fish species, including common carp, koi (*C. carpio*), crucian carp, bighead carp (*Hypophthalmichthys nobilis*), silver carp, and grass carp (Ahne *et al.* 2002). This disease can cause serious fish mortalities, and thus can detrimentally affect the productivity of several species in commercial aquaculture facilities, including grass carp, goldfish, koi, fathead minnows (*Pimephales promelas*), and golden shiner (*Notemigonus crysoleucas*) (Ahne *et al.* 2002, Goodwin 2002).

Factors That Reduce or Remove Injuriousness for Crucian Carp

Control

Lab experiments indicate that the piscicide rotenone (a commonly used natural fish poison) could be used to control a crucian carp population (Ling 2003). However, rotenone is not target-specific (Wynne and Masser 2010). Depending on the applied concentration, rotenone kills other aquatic species in the water body. Some fish species are more susceptible than others, and the use of this piscicide may result in killing native species. Control measures that would harm other wildlife are not recommended as mitigation plans to reduce the injurious characteristics of this species and therefore do not meet control measures under the Injurious Wildlife Evaluation Criteria.

No other control methods are known for the crucian carp, but several other control methods are currently being used or are in development for introduced and invasive carp species of other genera. For example, the U.S. Geological Survey (USGS) is developing a method to orally deliver a piscicide (Micromatrix) specifically to invasive bighead carp (*Hypophthalmichthys nobilis*) and silver carp (Luoma 2012). This developmental control measure is expensive and not guaranteed to prove effective for any carps.

Potential Ecological Benefits for Introduction

We are not aware of any documented ecological benefits for the introduction of crucian carp.

Factors That Contribute to Injuriousness for Eurasian Minnow

Current Nonnative Occurrences

This species is not currently found within the United States. The Eurasian minnow was introduced to new waterways in its native range of Europe and Asia (Sandlund 2008). This fish species has been introduced to new locations in Norway outside of its native range there (Sandlund 2008, Hesthagen and Sandlund 2010).

Potential Introduction and Spread

Likely pathways of introduction include release or escape when used as live bait, unintentional inclusion in the transport water of intentionally stocked fish (often with salmonids), and intentional introduction for vector (insect) management (Sandlund 2008). Once introduced, this species can spread and establish in nearby waterways.

The Eurasian minnow prefers a temperate climate (Froese and Pauly 2013). This minnow is capable of establishing in a variety of aquatic ecosystems ranging from freshwater to brackish water (Sandlund 2008). The Eurasian minnow has an overall high climate match with a Climate 6 ratio of 0.397. The highest climate matches are in the northern States, including Alaska. The lowest climate matches are in the Southeast and Southwest.

If introduced to the United States, the Eurasian minnow is highly likely to spread and become established in the wild due to this species' traits as a habitat generalist and generalist predator, with adaptability to new environments, high reproductive potential, long life span, extraordinary mobility, social nature, and proven invasiveness outside of the species' native range.

Potential Impacts to Native Species (Including Endangered and Threatened Species)

Introduction of the Eurasian minnow can affect native species through several mechanisms, including competition over resources, predation, and parasite transmission. Introduced Eurasian minnows have a more serious effect in waters with fewer species than those waters with a more developed, complex fish community (Museth *et al.* 2007). In Norway, dense populations of the Eurasian minnow have resulted in an average 35 percent reduction in recruitment and growth rates in native brown trout (Museth *et al.* 2007). In the United States, introduced Eurasian minnow populations would likely compete with and adversely affect Atlantic salmon, State-managed brown trout, and other salmonid species.

Eurasian minnow introductions have also disturbed freshwater benthic invertebrate communities (Næstad and Brittain 2010). Increased predation by Eurasian minnows has led to shifts in invertebrate populations and changes in benthic diversity (Hesthagen and Sandlund 2010). Many of the invertebrates consumed by the Eurasian minnow are also components of the diet of the brown trout, thus exacerbating competition between the introduced Eurasian minnow and brown trout (Hesthagen and Sandlund 2010). Additionally, Eurasian minnows have been shown to compete with brown trout (Hesthagen and Sandlund 2010) and to consume vendace (a salmonid) larvae (Huusko and Sutela 1997). If introduced, the Eurasian minnow's diet may include the larvae of U.S. native salmonids, including Atlantic salmon, sockeye salmon (*Oncorhynchus nerka*), and trout species (*Salvelinus* spp.).

The Eurasian minnow serves as a host to parasites, such as *Gyrodactylus aphyae,* that it can transmit to other fish species, including salmon and trout (Zietara *et al.* 2008). Once introduced, these parasites would likely spread to native salmon and trout species.

Depending on pathogenicity, parasites of the *Gyrodactylus* species may cause high fish mortality (Bakke *et al.* 1992).

Potential Impacts to Humans

We have no reports of the Eurasian minnow being harmful to humans.

Potential Impacts to Agriculture

The Eurasian minnow may impact agriculture by affecting aquaculture. This species harbors a parasite that may infect other fish species and can cause high fish mortality (Bakke *et al.* 1992). Eurasian minnow populations can adversely impact both recruitment and growth of brown trout. Reduced recruitment and growth rates can reduce the economic value associated with brown trout aquaculture and recreational fishing.

Factors That Reduce or Remove Injuriousness for Eurasian Minnow

Control

Once introduced, it is difficult and costly to control a Eurasian minnow population (Sandlund 2008). Eradication may be possible from small water bodies in cases where the population is likely to serve as a center for further spread, but no details are given on how to accomplish that (Sandlund 2008). Control may also be possible using habitat modification or biocontrol (introduced predators); however, we know of no published accounts of long-term success by either method. Both control measures of habitat modification and biocontrol cause wildlife or habitat damages and are expensive mitigation strategies, and therefore, are not recommended or considered appropriate under the Injurious Wildlife Evaluation Criteria as a risk management plan for this species.

Potential Ecological Benefits for Introduction

There has been one incidence where the Eurasian minnow was introduced as a biocontrol for the Tune fly (Simuliidae) (Sandlund 2008). However, we do not have information on the success of this introduction. We are not aware of any other documented ecological benefits associated with the Eurasian minnow.

Factors That Contribute to Injuriousness for Prussian Carp

Current Nonnative Occurrences

This species is not found within the United States. However, it was recently reported to be established in waterways in southern Alberta, Canada, which is the first confirmed record in the wild in North America (Elgin *et al.* 2014). The Prussian carp has been introduced to many countries of central and Western Europe. This species' current nonnative range includes the Asian countries of Armenia, Turkey, and Uzbekistan and the European countries of Belarus, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Poland, and Switzerland (Britton 2011); it also includes the Iberian Peninsula (Ribeiro *et al.* 2015).

Potential Introduction and Spread

Potential pathways of introduction include stock enhancement, recreational fishing, and aquaculture. Once introduced, the Prussian carp will naturally disperse to new waterbodies.

The Prussian carp prefers a temperate climate and resides in a variety of freshwater environments, including those with low dissolved oxygen concentrations and increased pollution (Britton 2011). The Prussian carp has an overall high climate match with a Climate 6 ratio of 0.414. This fish species has a high climate match to the Great Lakes region, northern Plains, some western mountain States, and parts of California. The Prussian carp has a medium climate match to much of the United States, including southern Alaska and regions of Hawaii. This species has a low climate match to the southeastern United States, especially Florida and along the Gulf Coast. This species is not found within the United States but has been recently discovered as established in Alberta, Canada (Elgin *et al.* 2014); the climate match was run prior to this new information, so the results do not include any actual locations in North America.

If introduced, the Prussian carp is likely to spread and establish as a consequence of its tolerance to poor quality environments, rapid growth rate, very rare ability to reproduce from unfertilized eggs (gynogenesis), and proven invasiveness outside of the native range.

Potential Impacts to Native Species (Including Threatened and Endangered Species)

The Prussian carp is closely related and behaviorally similar to the crucian carp (Godard and Copp 2012). As with crucian carp, introduced Prussian carp may compete with native fish species, alter freshwater ecosystems, and serve as a vector for parasitic infections. Introduced Prussian carp have been responsible for the decreased biodiversity and overall populations of native fish (including native Cyprinidae), invertebrates, and plants (Anseeuw *et al.* 2007, Lusk *et al.* 2010). Thus, if introduced to the United States, the Prussian carp will likely affect numerous native Cyprinid species, including chub, dace, shiner, and minnow fish species (Froese and Pauly 2013). Several of these native Cyprinids, such as the laurel dace (*Chrosomus saylori*) and humpback chub (*Gila cypha*) are listed as endangered or threatened under the Endangered Species Act.

Prussian carp can alter freshwater habitats. This was documented in Lake Mikri Prespa (Greece), where scientists correlated increased turbidity with increased numbers of Prussian carp (Crivelli 1995). This carp species increased turbidity levels by disturbing sediment during feeding. These carp also intensively fed on zooplankton, thus resulting in increased phytoplankton abundance and phytoplankton blooms (Crivelli 1995). Increased turbidity results in imbalances in nutrient cycling and ecosystem energetics. If introduced to the United States, Prussian carp could cause increased lake and pond turbidity, increased phytoplankton blooms, imbalances to ecosystem nutrient cycling, and altered freshwater ecosystems.

Several different types of parasitic infections, such as black spot disease (Posthodiplostomatosis) and from *Thelohanellus,* are associated with the Prussian carp (Ondračková *et al.* 2002, Markovíc *et al.* 2012). Black spot disease particularly affects young fish and can cause physical deformations, decreased growth, and decrease in body condition (Ondračková *et al.* 2002). These parasites and the respective diseases may infect and decrease native fish stocks.

Prussian carp may compete with native fish species and may replace them in the trophic scheme. Large populations of Prussian carp can cause heavy predation on aquatic plants and invertebrates (Anseeuw *et al.* 2007). Changes in ecosystem cycling and wildlife diversity may have negative effects on the aesthetic, recreational, and economic benefits of the environment.

Potential Impacts to Humans

We have no reports of the Prussian carp being harmful to humans.

Potential Impacts to Agriculture

The Prussian carp may impact agriculture by affecting aquaculture. As mentioned in the *Potential Impacts to Native Species* section, Prussian carp harbor several types of parasites that may cause physical deformations, decreased growth, and decrease in body condition (Ondračková *et al.* 2002).

Impaired fish physiology and health detract from the productivity and value of commercial aquaculture.

Factors That Reduce or Remove Injuriousness for Prussian Carp

Control

We are not aware of any documented control methods for the Prussian carp. The piscicide rotenone has been used to control the common carp and crucian carp population (Ling 2003) and may be effective against Prussian carp. However, rotenone is not target-specific (Wynne and Masser 2010). Depending on the applied concentration, rotenone kills other aquatic species in the water body. Some fish species are more susceptible than others, and, even if effective against Prussian carp, the use of this piscicide may result in killing native species (Allen *et al.* 2006). Control measures that would harm other wildlife are not recommended as mitigation to reduce the injurious characteristics of this species and therefore do not meet control measures under the Injurious Wildlife Evaluation Criteria.

Potential Ecological Benefits for Introduction

We are not aware of any documented ecological benefits for the introduction of the Prussian carp.

Factors That Contribute to Injuriousness for Roach

Current Nonnative Occurrences

This species is not found in the United States. The roach has been introduced and become established in England, Ireland, Italy, Madagascar, Morocco, Cyprus, Portugal, the Azores, Spain, and Australia. (Rocabayera and Veiga 2012:Dist. table).

Potential Introduction and Spread

Potential introduction pathways include stocking for recreational fishing and use as bait fish. Once introduced, released, or escaped, the roach naturally disperses to new waterways within the watershed.

This species prefers a temperate climate and can reside in a variety of freshwater habitats (Riehl and Baensch 1991). Hydrologic changes, such as weirs and dams that extend aquatic habitats that are otherwise scarce, enhance the potential spread of the roach (Rocabayera and Veiga 2012). The roach has an overall high climate match to the United States with a Climate 6 ratio of 0.387. Particularly high climate matches occurred in southern and central Alaska, the Great Lakes region, and the western mountain States. The Southeast and Southwest have low climate matches.

If introduced, the roach is likely to spread and establish due to its highly adaptive nature toward habitat and diet choice, high reproductive rate, ability to reproduce with other cyprinid species, long life span, and extraordinary mobility. This species has also proven invasive outside of its native range.

Potential Impacts to Native Species (Including Endangered and Threatened Species)

Potential effects to native species from the introduction of the roach include competition over food and habitat resources, hybridization, altered ecosystem nutrient cycling, and parasite and pathogenic bacteria transmission. The roach is a highly adaptive species and will switch between habitats and food sources to best avoid predation and competition from other species (Winfield and Winfield 1994:385–6). The roach consumes an omnivorous generalist diet, including benthic invertebrates (especially mollusks), zooplankton, plants, and detritus (Rocabayera and Veiga 2012). With such a varied diet, the roach would likely compete with numerous native fish species from multiple trophic levels. Such species may include shiners, daces, chubs, and stonerollers, several of which are federally listed as endangered or threatened.

Likewise, introduction of the roach would likely detrimentally affect native mollusk species (including mussels and snails), some of which may be federally endangered or threatened. One potentially affected species is the endangered Higgins' eye pearly mussel (*Lampsilis higginsii*), which is native to the upper Mississippi River watershed, where there is high climate match for the roach species. Increased competition with and predation on native species may alter trophic cycling and diversity of native aquatic species.

In Ireland, the roach has hybridized with the rudd (*Scardinius erythrophtalmus*) and the bream (*Abramis brama*). Although the bream is not found in the United States, the rudd is already considered invasive in the Great Lakes (Fuller *et al.* 1999, Kapuscinski *et al.* 2012). Hybrids of roaches and rudds could exacerbate the potential adverse effects (competition) of each separate species (Rocabayera and Veiga 2012).

Large populations of the roach may alter nutrient cycling in lake ecosystems. Increased populations of roach may prey heavily on zooplankton, thus resulting in increased phytoplankton communities and algal blooms (Rocabayera and Veiga 2012). These changes alter nutrient cycling and can consequently affect native aquatic species that depend on certain nutrient balances.

Several parasitic infections, including worm cataracts, black spot disease, and tapeworms, have been associated with the roach (Rocabayera and Veiga 2012). The pathogenic bacterium *Aeromonas salmonicida* also infects the roach, causing furunculosis (Wiklund and Dalsgaard 1998). This disease causes skin ulcers and hemorrhaging. The disease can be spread through a fish's open sore. This disease affects both farmed and wild fish. The causative bacteria *A. salmonicida* has been isolated from fish in United States freshwaters (USFWS 2011). The roach may spread these parasites and bacteria to new environments and native fish species.

Potential Impacts to Humans

We have no reports of the roach being harmful to humans.

Potential Impacts to Agriculture

The roach may affect agriculture by decreasing aquaculture productivity. Roach can hybridize with other fish species of the subfamily Leuciscinae, including rudd and bream (Pitts *et al.* 1997, Kottelat and Freyhof 2007). Hybridization can reduce the reproductive success and productivity of the commercial fisheries.

Roaches harbor several parasitic infections (Rocabayera and Veiga 2012) that can impair fish physiology and health. The pathogenic bacterium *Aeromonas salmonicida* infects the roach, causing furunculosis (Wiklund and Dalsgaard 1998). The disease can be spread through a fish's open sore and can infect farmed fish. Introduction and spread of parasites and pathogenic bacterium to an aquaculture facility can result in increased incidence of fish disease and mortality and decreased productivity and value.

Factors That Reduce or Remove Injuriousness for Roach

Control

An introduced roach population would be difficult to control (Rocabayera and Veiga 2012). Application of the piscicide rotenone may be effective for limited populations of small fish. However, rotenone is not target-specific (Wynne and Masser 2010). Depending on the applied concentration, rotenone kills other aquatic species in the water body. Some fish species are more susceptible than others, and the use of this piscicide may result in killing native species. Control measures that would harm other wildlife are not recommended as mitigation to reduce the injurious characteristics of this species and therefore do not meet control measures under the Injurious Wildlife Evaluation Criteria.

Potential Ecological Benefits for Introduction

We are not aware of any documented ecological benefits for the introduction of the roach.

Factors That Contribute to Injuriousness for Stone Moroko

Current Nonnative Occurrences

This fish species is not found within the United States. The stone moroko has been introduced and become established throughout Europe and Asia. Within Asia, this fish species is invasive in Afghanistan, Armenia, Iran, Kazakhstan, Laos, Taiwan, Turkey, and Uzbekistan (Copp 2007). In Europe, this fish species' nonnative range includes Albania, Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Lithuania, Moldova, Montenegro, the Netherlands, Poland, Romania, Russia, Serbia, Slovakia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom (Copp 2007). The stone moroko's nonnative range also includes Algeria and Fiji (Copp 2007).

Potential Introduction and Spread

The primary introduction pathways are as unintentional inclusion in the transport water of intentionally stocked fish shipments for both recreational fishing and aquaculture, released or escaped bait, and released or escaped ornamental fish. Once introduced, the stone moroko naturally disperses to new waterways within a watershed. Since the 1960s, this fish has invaded nearly every European country and many Asian countries (Copp *et al.* 2005).

The stone moroko inhabits a temperate climate (Baensch and Riehl 1993) and a variety of freshwater habitats, including those with poor dissolved oxygen concentrations (Copp 2007). The stone moroko has an overall high climate match with a Climate 6 ratio of 0.557. This species has a high or medium climate match to most of the United States. The highest matches are in the Southeast, Great Lakes, central plains, and West Coast.

If introduced, the stone moroko is highly likely to spread and establish. This fish species is a habitat generalist, diet generalist, quick growing, highly adaptable to new environments, and highly mobile. Additionally, the stone moroko has proven invasive outside of its native range (Copp 2007, Kottelat and Freyhof 2007, Witkowski 2011).

Potential Impacts to Native Species (Including Endangered and Threatened Species)

In much of the stone moroko's nonnative range, the introduction of this species has been linked to the decline of native freshwater fish species (Copp 2007). The stone moroko could potentially adversely affect native species through predation, competition, disease transmission, and altering freshwater ecosystems (Witkowski 2011).

Stone moroko introductions have mostly originated from unintentional inclusion in the transport water of intentionally stocked fish species. In many stocked ponds, the stone moroko actually outcompetes the farmed fish species for food resources, which results in decreased production of the farmed fish (Witkowski 2011). The stone moroko's omnivorous diet includes insects, fish, fish eggs, molluscs, planktonic crustaceans, algae (Froese and Pauly 2014), and plants (Kottelat and Freyhof 2007). With this diet, the stone moroko would compete with many native U.S. freshwater fish, including minnow, dace, sunfish, and darter species.

In the United Kingdom, Italy, China, and Russia, the introduction of the stone moroko correlates with dramatic declines in native fish populations and species diversity (Copp 2007). The stone moroko first competes with native fish for food resources and then predates on the eggs, larvae, and juveniles of these same native fish species (Pinder 2005, Britton *et al.* 2007).

The stone moroko is a vector of the pathogenic, rosette-like agent *Sphaerothecum destruens* (Gozlan *et al.* 2005, Pinder *et al.* 2005), which is a documented pathogen of farmed and wild European fish. The stone moroko is a healthy host for this deadly, nonspecific pathogen that could threaten aquaculture trade, including that of salmonids (Gozlan *et al.* 2009). This pathogen infects a fish's internal organs causing spawning failure, organ failure, and death (Gozlan *et al.* 2005). This pathogen has been documented as infecting the sunbleak (*Leucaspius delineatus*), which are native to eastern Europe, and Chinook salmon (*Oncorhynchus tshawytscha*), Atlantic salmon, and the fathead minnow (*Pimephales promelas*), which are native to the United States (Gozlan *et al.* 2005).

The stone moroko consumes large quantities of zooplankton. The declines in zooplankton population results in increased phytoplankton populations, which in turn causes algal blooms and unnaturally high nutrient loads (eutrophication). These changes can cause imbalanced nutrient cycling, decrease dissolved oxygen concentrations, and adversely impact the health of native aquatic species.

Potential Impacts to Humans

We have no reports of the stone moroko being harmful to humans.

Potential Impacts to Agriculture

The stone moroko may affect agriculture by decreasing aquaculture productivity. This species often contaminates farmed fish stocks and competes with the farmed species for food resources, resulting in decreased aquaculture productivity (Witkowski 2011). The stone moroko is an unaffected carrier of the pathogenic, rosette-like agent *Sphaerothecum destruens* (Gozlan *et al.* 2005, Pinder *et al.* 2005). This pathogen is transmitted through water and causes reproductive failure, disease, and death to farmed fish. This pathogen is not species-specific and has been known to infect cyprinid and salmonid fish species. *Sphaerothecum destruens* is responsible for disease outbreaks in North American salmonids and causes mortality in both juvenile and adult fish (Gozlan *et al.* 2009). If this pathogen was introduced to an aquaculture facility, it is likely to spread and infect numerous fish, resulting in high mortality. Further research is needed to ascertain this pathogen's prevalence in the wild environment (Gozlan *et al.* 2009).

Factors That Reduce or Remove Injuriousness for Stone Moroko

Control

An established, invasive stone moroko population would be both difficult and costly to control (Copp 2007). Additionally, this fish species has a higher tolerance for the piscicide rotenone than most other fish belonging to the cyprinid group (Allen *et al.* 2006). Applications of rotenone for stone moroko control is likely to adversely impact native aquatic fish species. Control measures that would harm other wildlife are not recommended as mitigation to reduce the injurious characteristics of this species and therefore do not meet control measures under the Injurious Wildlife Evaluation Criteria.

Potential Ecological Benefits for Introduction

We are not aware of any documented ecological benefits for the introduction of the stone moroko.

Factors That Contribute to Injuriousness for Nile Perch

Current Nonnative Occurrences

This species is not currently found within the United States. The Nile perch is invasive in the Kenyan, Tanzanian, and Ugandan watersheds of Lake Victoria and Lake Kyoga (Africa). This species has also been introduced to Cuba (Welcomme 1988).

Potential Introduction and Spread

This species was stocked in Texas reservoirs, although this population failed to establish (Fuller *et al.* 1999, Howells 2001). However, with continued release events, we anticipate that the Nile perch is likely to establish. Likely introduction pathways include use for aquaculture and recreational fishing. Over the past 60 years, the Nile perch has invaded, established, and become the dominant fish species within this species' nonnative African range (Witte 2013).

The Nile perch prefers a tropical climate and can inhabit a variety of freshwater and brackish habitats (Witte 2013). The Nile perch has an overall medium climate match with a Climate 6 ratio of 0.038. Of the 11 species in this rule, the Nile perch has the only overall medium climate match to the United States. However, this fish species has a high climate match to the Southeast (Florida and Gulf Coast), Southwest (California), Hawaii, Puerto Rico, and the U.S. Virgin Islands.

If introduced into the United States, the Nile perch is likely to spread and establish due to this species' nature as a habitat generalist and generalist predator, long life span, quick growth rate, high reproductive rate, extraordinary mobility, and proven invasiveness outside of the species' native range (Witte 2013, Asila and Ogari 1988, Ribbinick 1982).

Potential Impacts to Native Species (Including Endangered and Threatened Species)

Potential impacts of introduction of the Nile perch include outcompeting and preying on native species, altering habitats and trophic systems, and disrupting ecosystem nutrient cycling. The Nile perch can produce up to 15 million eggs per breeding cycle (Asila and Ogari 1988), likely contributing to this species' efficiency and effectiveness in establishing an introduced population.

Historical evidence from the Lake Victoria (Africa) basin indicate that the Nile perch outcompeted and preyed on at least 200 species endemic fish species, leading to their extinction (Kaufman 1992, Snoeks 2010, Witte 2013). Many of the affected species were haplochromine cichlid fish species, and the populations of native lung fish (*Protopterus aethiopicus*) and catfish species (*Bagrus docmak, Xenoclarias eupogon, Synodontis victoria*) also witnessed serious declines (Witte 2013). By the late 1980s, only three fish species, including the cyprinid *Rastrineobolas argentea* and the introduced Nile perch and Nile tilapia (*Oreochromis niloticus*) were common in Lake Victoria (Witte 2013).

The haplochromine cichlid species comprised 15 subtrophic groups with varied food (detritus, phytoplankton, algae, plants, mollusks, zooplankton, insects, prawns, crabs, fish, and parasites) and habitat preferences (Witte and Van Oijen 1990, Van Oijen 1996). The depletion of so many fish species has drastically altered the Lake Victoria ecosystem's trophic level structure and biodiversity. These changes resulted in abnormally high lake eutrophication and frequency of algal blooms (Witte 2013).

The depletion of the native fish species in Lake Victoria by Nile perch led to the loss of income and food for local villagers. Nile perch are not a suitable replacement for traditional fishing. Fishing for this larger species requires equipment that is prohibitively more expensive, requires processing that cannot be done by the wife and children, requires the men to be away for extended periods, and decreases the availability of fish for household consumption (Witte 2013).

If introduced to the United States, the Nile perch are expected to prey on small native fish species, such as mudminnows, cyprinids, sunfishes, and darters. Nile perch would likely prey on, compete with, and decrease the species diversity of native cyprinid fish. Nile perch are expected to compete with larger native fish species, including largemouth bass, blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), and flathead catfish (*Pyodictis olivaris*). These native fish species are not only economically important to both commercial and recreational fishing, but are integral components of freshwater ecosystems.

Potential Impacts to Humans

We have no reports of the Nile perch being harmful to humans.

Potential Impacts to Agriculture

We are not aware of any reported effects to agriculture. However, Nile perch may affect aquaculture if they are unintentionally introduced into aquaculture operations in the United States, such as when invaded watersheds flood aquaculture ponds or by accidentally being included in a shipment of fish, by outcompeting and preying on the aquacultured fish.

Factors That Reduce or Remove Injuriousness for Nile Perch

Control

Nile perch grow to be large fish with a body length of 2 m (6 ft) and maximum weight of 200 kg (440 lb) (Ribbinick 1987). Witte (2013) notes that this species would be difficult and costly to control. We are not aware of any documented reports of successfully controlling or eradicating an established Nile perch population.

Potential Ecological Benefits for Introduction

We are not aware of any documented ecological benefits for the introduction of the Nile perch.

Factors That Contribute to Injuriousness for the Amur Sleeper

Current Nonnative Occurrences

This species has not been reported within the United States. The Amur sleeper is invasive in Europe and Asia in the countries of Belarus, Bulgaria, Croatia, Estonia, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Serbia, Slovakia, Ukraine, Russia, and Mongolia (Froese and Pauly 2014, Grabowska 2011).

Potential Introduction and Spread

Although the Amur sleeper has not yet been introduced to the United States, the likelihood of introduction, release, or escape is high as evidenced by the history of introduction over a broad geographic region of Eurasia. Since its first introduction outside of its native range in 1916, the Amur sleeper has invaded 15 Eurasian countries and become a widespread, invasive fish throughout European freshwater ecosystems (Copp *et al.* 2005, Grabowska 2011). The introduction of the Amur sleeper has been attributed to release and escape of aquarium and ornamental fish, unintentional and intentional release of Amur sleepers used for bait, and the unintentional inclusion in the transport water of intentionally stocked fish (Reshetnikov 2004, Grabowska 2011, Reshetnikov and Ficetola 2011).

Once this species has been introduced, it has proven to be capable of establishing (Reshetnikov 2004). The established populations can have rapid rates of expansion. Upon introduction into the Vistula River in Poland, the Amur sleeper expanded its range by 44 km (27 mi) the first year and up to 197 km (122 mi) per year subsequently (Grabowska 2011).

Most aquatic species are constrained in distribution by temperature, dissolved oxygen levels, and lack of flowing water. However, the Amur sleeper has a wide water temperature preference (Baensch and Riehl 2004), can live in poorly oxygenated waters, and may survive in dried-out or frozen water bodies by burrowing into and hibernating in the mud (Grabowska 2011). The Amur sleeper has an overall high climate match with a Climate 6 ratio of 0.376. The climate match is highest in the Great Lakes region (Ohio, Indiana, Illinois, Michigan, Wisconsin, and Minnesota), central and high Plains (Iowa, Nebraska, and Missouri), western mountain States (South Dakota, North Dakota, Montana, Wyoming, and Colorado), and central to eastern Alaska.

If introduced, the Amur sleeper is extremely likely to spread and become established in the wild due to this species' ability as a habitat generalist, generalist predator, rapid growth, high reproductive potential, adaptability to new environments, extraordinary mobility, and a history of invasiveness outside of the native range.

Potential Impacts to Native Species (Including Endangered and Threatened Species)

The Amur sleeper is a voracious generalist predator whose diet includes crustaceans, insects, and larvae of mollusks, fish, and amphibian tadpoles (Bogutskaya and Naseka 2002, Reshetnikov 2008). Increased predation with the introduction of the Amur sleeper has resulted in decreased species richness and decreased population of native fish (Grabowska 2011). Declines in lower trophic level populations (invertebrates) result in increased competition among native predatory fish, including the European mudminnow (*Umbra krameri*) (Grabowska 2011), which is listed as vulnerable on the IUCN Red List (Freyhof 2011). Two species similar to the European mudminnow, the eastern mudminnow (*Umbra pygmaea*) and the central mudminnow (*Umbra limi*), are native to the eastern United States. Both these species are integral members of freshwater ecosystems, with the eastern mudminnow ranging from New York to Florida (Froese and Pauly 2013), and the central mudminnow residing in the freshwater of the Great Lakes, Hudson Bay, and Mississippi River basins (Froese and Pauly 2013). Introduced Amur sleepers could prey on and reduce the population of native U.S. mudminnow species.

In some areas, the Amur sleeper's eating habits have been responsible for the dramatic decline in juvenile fish and amphibian species (Reshetnikov 2003). Amur sleepers prey on juvenile stages and can cause decreased reproductive success and reduced populations of the native fish and amphibians (Mills *et al.* 2004). Both the European mudminnow and lake minnow (*Rhynchocypris percnurus;* an IUCN Red List endangered species) have been negatively affected by the Amur sleeper's predatory nature (Grabowska 2011).

The introduction or establishment of the Amur sleeper is likely to reduce native wildlife biodiversity. In the Selenga River (Russia), the Amur sleeper competes with native Siberian roach (*Rutilus rutilus lacustris*) and Siberian dace (*Leuciscus leuciscus baicalensis*) for food resources. This competition results in decreased populations of native fish species, which may result in negative effects on commercial fisheries and in economic losses (Litvinov and O'Gorman 1996, Grabowska 2011).

Species similar to Siberian roach and Siberian dace that are native to the United States include those of the genus *Chrosomus,* such as the blackside dace (*Chrosomus cumberlandensis*), northern redbelly dace (*C. eos*), southern redbelly dace (*C. erthrogaster*), and Tennessee dace (*C. tennesseensis*). Like with the Siberian roach and the Siberian dace, introduced populations of the Amur sleeper may compete with native dace fish species consequently resulting in population declines of these native species.

Additionally, the Amur sleeper harbors parasites, including *Nippotaenia mogurndae* and *Gyrodactylus perccotti.* The introduction of the Amur sleeper has resulted in the simultaneous introduction of both parasites to the Amur sleeper's nonnative range. These parasites have in essence expanded their own nonnative range and successfully infected new hosts of native fish species (Košuthová *et al.* 2008).

Potential Impacts to Humans

We have no reports of Amur sleeper being harmful to humans.

Potential Impacts to Agriculture

The Amur sleeper may affect agriculture by decreasing aquaculture productivity. This fish species hosts parasites, including *Nippotaenia mogurndae* and *Gyrodactylus perccotti.* These parasites may switch hosts (Košuthová *et al.* 2008) and infect farmed species involved in aquaculture. Increased parasite load impairs a fish's physiology and general health, and consequently may decrease aquaculture productivity.

Factors That Reduce or Remove Injuriousness for Amur Sleeper

Control

Once introduced and established, it would be difficult, if not impossible, to control or eradicate the Amur sleeper. All attempts to eradicate the Amur sleeper once it had established a reproducing population have been unsuccessful (Litvinov and O'Gorman 1996). Natural predators include pike, snakeheads, and perch (Bogutskaya and Naseka 2002). Not all freshwater systems have these or similar predatory species, and thus would allow the Amur sleeper population to be uncontrolled.

Some studies have indicated that the Amur sleeper may be eradicated by adding calcium chloride ($CaCl_2$) or ammonium hydroxide (NH_4OH) to the water body (Grabowska 2011). However, this same study found that the Amur sleeper was one of the most resistant fish species to either treatment. Thus, the use of either treatment would likely negatively affect many other native organisms and is not considered a viable option. Control measures that would harm other wildlife are not recommended as mitigation to reduce the injurious characteristics of this species and therefore do not meet control measures under the Injurious Wildlife Evaluation Criteria.

Potential Ecological Benefits for Introduction

We are not aware of any documented ecological benefits for the introduction of the Amur sleeper.

Factors That Contribute to Injuriousness for European Perch

Current Nonnative Occurrences

This fish species is not found within the United States. The European perch has been introduced and become established in several countries, including Ireland, Italy, Spain, Australia, New Zealand, China, Turkey, Cyprus, Morocco, Algeria, and South Africa.

Potential Introduction and Spread

The main pathway of introduction is through stocking for recreational fishing. Once stocked, this fish species has expanded its nonnative range by swimming through connecting waterbodies to new areas within the same watershed.

The European perch prefers a temperate climate (Riehl and Baensch 1991, Froese and Pauly 2014). This species can reside in a wide variety of aquatic habitats ranging from freshwater to brackish water (Froese and Pauly 2014). The European perch has a Climate 6 ratio of 0.438, with locally high matches to the Great Lakes region, central Texas, western mountain States, and southern and central Alaska. Hawaii ranges from low to high matches. Much of the rest of the country has a medium climate match.

If introduced to the United States, the European perch is likely to spread and establish in the wild as a generalist predator that is able to adapt to new environments and outcompete native fish species. Additionally, this species has proven to be invasive outside of its native range.

Potential Impacts to Native Species (Including Threatened and Endangered Species)

The European perch can impact native species through outcompeting and preying on them and by transmitting disease. This introduced fish species competes with other European native species for both food and habitat resources (Closs *et al.* 2003) and has been implicated in the local extirpation (in Western Australia) of the mudminnow (*Galaxiella munda*) (Moore 2008, ISSG 2010).

In addition to potentially competing with the native yellow perch (*Perca flavescens*), the European perch may also hybridize with this native species, resulting in irreversible changes to the genetic structure of this important native species (Schwenk *et al.* 2008). Hybridization can reduce the fitness of the native species and, in some cases, has resulted in drastic population declines causing endangered classification and even extinction (Mooney and Cleland 2001). Furthermore, the yellow perch has value for both commercial and recreational fishing and is also an important forage fish in many freshwater ecosystems (Froese and Pauly 2014). Thus, declines in yellow perch populations can result in serious consequences for upper trophic level piscivorous (fish-eating) fish. Additionally, European perch can form dense populations competing with each other to the extent that they stunt their own growth (NSW DPI 2013).

European perch prey on zooplankton, macroinvertebrates, and fish; thus, the introduction of this species can significantly alter trophic level cycling and affect native freshwater communities (Closs *et al.* 2003). European perch are reportedly voracious predators that consume small Australian fish (pygmy perch *Nannoperca spp.,* rainbowfish (various species), and carp gudgeons *Hypseleotris spp.*); and the eggs and fry of silver perch (*Bidyanus bidyanus*), golden perch (*Macquaria ambigua*), Murray cod (*Maccullochella peelii*), and introduced trout species (rainbow, brook (*Salvelinus fontinalis*), and brown trout (NSW DPI 2013). In one instance, European perch consumed 20,000 newly released nonnative rainbow trout fry from a reservoir in southwestern Australia in less than 72 hours (NSW DPI 2013). Rainbow trout are native to the western United States. If introduced into U.S. freshwaters, European perch would be expected to prey on rainbow trout and other native fish.

The European perch can also harbor and spread the viral disease Epizootic Haematopoietic Necrosis (EHN) (NSW DPI 2013). This virus can cause mass fish mortalities and affects silver perch, Murray cod, *Galaxias* fish, and Macquarie perch (*Macquaria australasica*) in their native habitats. This continued spread of this virus (with the introduction of the European perch) has been partly responsible for declining population of native Australian fish species (NSW DPI 2013). This virus is currently restricted to Australia but could expand its international range with the introduction of European perch to new waterways where native species would have no natural resistance.

Potential Impacts to Humans

We have no reports of the European perch being harmful to humans.

Potential Impacts to Agriculture

The European perch may affect agriculture by decreasing aquaculture productivity. The European perch may potentially spread the viral disease Epizootic Haematopoietic Necrosis (EHN) (NSW DPI 2013) to farmed fish in aquaculture facilities. Although this virus is currently restricted to Australia, this disease can cause mass fish mortalities and is known to affect other fish species (NSW DPI 2013).

Factors That Reduce or Remove Injuriousness for European Perch

Control

It would likely be extremely difficult, if not impossible, to control or eradicate a population of European perch. However, Closs *et al.* (2003) examined the feasibility of physically removing (by netting and trapping) European perch from small freshwater environments. Although these researchers were able to reduce population numbers through repeated removal efforts, European perch were not completely eradicated from any of the freshwater lakes. Biological controls or chemicals might be effective; however, they would also have lethal effects on native aquatic species. Control measures that would harm other wildlife are not recommended as mitigation to reduce the injurious characteristics of this species and therefore do not meet control measures under the Injurious Wildlife Evaluation Criteria.

Potential Ecological Benefits for Introduction

We are not aware of any documented ecological benefits for the introduction of the European perch.

Factors That Contribute to Injuriousness for Zander

Current Nonnative Occurrences

The zander was intentionally introduced into Spiritwood Lake (North Dakota) in 1989 for recreational fishing. The North Dakota Game and Fish Department reports a small, established population in this lake (Fuller 2009). The most recent report was of a 32-in (81.3 cm) fish caught by an angler in 2013 (North Dakota Game and Fish 2013). This was the largest zander in the lake reported to date, which could indicate that the species is finding suitable living conditions. We are not aware of any other reports of zanders within the United States. This fish species has been introduced and become established through much of Europe, regions of Asia (China, Kyrgyzstan, and Turkey), and Africa (Algeria, Morocco, and Tunisia). Within Europe, zanders have established populations in Belgium, Bulgaria, Croatia, Cyprus, Denmark, France, Italy, the Netherlands, Portugal, the Azores, Slovenia, Spain, Switzerland, and the United Kingdom.

Potential Introduction and Spread

The zander has been introduced to the United States and a small population exists in Spiritwood Lake, North Dakota. Primary pathways of introduction have originated with recreational fishing and aquaculture stocking. The zander has also been introduced to control unwanted cyprinids (Godard and Copp 2011). Additionally, the zander disperse unaided into new waterways.

The zander prefers a temperate climate (Froese and Pauly 2014). This species resides in a variety of freshwater and brackish environments, including turbid waters with increased nutrient concentrations (Godard and Copp 2011). The overall climate match is high with a Climate 6 ratio of 0.374. The zander has high climate matches in the Great Lakes region, northern Plains, western mountain States, and Pacific Northwest. Medium climate matches include southern Alaska, western mountain States, central Plains, and mid-Atlantic and New England regions. Low climate matches occur in Florida, along the Gulf Coast, and desert Southwest regions.

If introduced, the zander would likely establish and spread as a consequence of its nature as a generalist predator, ability to hybridize with multiple fish species, extraordinary mobility, long life span (maximum 24 years) (Godard and Copp 2011), and proven invasiveness outside of the native range.

Potential Impacts to Native Species (Including Endangered and Threatened Species)

The zander may affect native fish species by outcompeting and preying on them, transferring pathogens to them, and hybridizing with them. The zander is a top-level predator and competes with other native piscivorous fish species. In Western Europe, increased competition from introduced zanders resulted in population declines of native northern pike and European perch (Linfield and Rikards 1979). If introduced to the United States, the zander is projected to compete with native top-level predators such as the closely related walleye (*Sander vitreus*), sauger (*Sander canadensis*), and northern pike.

The zander is a piscivorous predator with a diet that includes juvenile smelt, ruffe, European perch, vendace, roach, and other zanders (Kangur and Kangur 1998). The zander also feeds on juvenile brown trout and Atlantic salmon (Jepsen *et al.* 2000; Koed *et al.* 2002). Increased predation on juvenile and young fish disrupts the life cycle and reproductive success. Decreased reproductive success results in decreased populations (and sometimes extinction) (Crivelli 1995) of native fish species. If introduced, predation by zander could decrease native populations of cyprinids (minnows, daces, and chub species), salmonids (Atlantic salmon and species of Pacific salmon (*Oncorhynchus* spp.), and yellow perch.

The zander is a vector for the trematode parasite *Bucephalus polymorphus* (Poulet *et al.* 2009), which has been linked to decreased native cyprinid populations in France (Lambert 1997, Kvach and Mierzejewska 2011). This parasite may infect native cyprinid species and result in their population declines.

The zander can hybridize with both the European perch and Volga perch (*Sander volgensis*) (Godard and Copp 2011). Our native walleye and sauger also hybridize (Hearn 1986, Van Zee *et al.* 1996, Fiss *et al.* 1997), providing evidence that species of this genus can readily hybridize. Hence, there is concern that zander may hybridize with walleye (Fuller 2009) and sauger (P. Fuller, pers. comm. 2015). Zander hybridizing with native species could result in irreversible changes to the genetic structure of native species (Schwenk *et al.* 2008). Hybridization can reduce the fitness of a native species and, in some cases, has resulted in drastic population declines leading to endangered classification and, in rare cases, extinction (Mooney and Cleland 2001).

Potential Impacts to Humans

We are not aware of any documented reports of the zander being harmful to humans.

Potential Impacts to Agriculture

The zander may impact agriculture by affecting aquaculture. This species is a vector for the trematode parasite *Bucephalus polymorphus* (Poulet *et al.* 2009), which has been linked to decreased native cyprinid populations in France (Lambert 1997, Kvach and Mierzejewska 2011). This parasite may infect and harm native U.S. cyprinid species involved in the aquaculture industry.

Factors That Reduce or Remove Injuriousness for Zander

Control

An established population of zanders would be both difficult (if not impossible) and costly to control (Godard and Copp 2011). In the United Kingdom (North Oxford Canal), electrofishing was unsuccessful at eradicating localized populations of zander (Smith *et al.* 1996).

Potential Ecological Benefits for Introduction

Zanders have been stocked for biomanipulation of small planktivorous fish (cyprinid species) in a small, artificial impoundment in Germany to improve water transparency with some success (Drenner and Hambright 1999). However, in their discussion on using zanders for biomanipulation, Mehner *et al.* (2004) state that the introduction of nonnative predatory species, which includes the zander in parts of Europe, is not recommended for nature diversity and bioconservation purposes. We are not aware of any other documented ecological benefits of a zander introduction.

Factors That Contribute to Injuriousness for Wels Catfish

Current Nonnative Occurrences

This fish species is not found in the wild in the United States. The wels catfish has been introduced and become established in China; Algeria, Syria, and Tunisia; and the European countries of Belgium, Bosnia-Herzegovina, Croatia, Cyprus, Denmark, Finland, France, Italy, Portugal, Spain, and the United Kingdom (Rees 2012).

Potential Introduction and Spread

The wels catfish has not been introduced to U.S. ecosystems. Potential pathways of introduction include stocking for recreational fishing and aquaculture. This catfish species has also been introduced for biocontrol of cyprinid species in Belgium and through the aquarium and pet trade (Rees 2012). Wels catfish were introduced as a biocontrol for cyprinid fish in the Netherlands, where it became invasive (Rees 2012). Once introduced, this fish species can naturally disperse to connected waterways.

The wels catfish prefers a temperate climate. This species inhabits a variety of freshwater and brackish environments. This species has an overall high climate match with a Climate 6 ratio of 0.302. High climate matches occur in the Great Lakes, western mountain States, West Coast, and southern Alaska. All other regions had a medium or low climate match.

If introduced, the wels catfish is likely to establish and spread. This species is a generalist predator and fast growing, with proven invasiveness outside of the native range. Additionally, this species has a long life span (15 to 30 years, maximum of 80 years) (Kottelat and Freyhof 2007). This species has an extremely high reproductive rate (30,000 eggs per kg of body weight), with the maximum recorded at 700,000 eggs (Copp *et al.* 2009). The wels catfish is highly adaptable to new warmwater environments, including those with low dissolved oxygen levels (Rees 2012). The invasive success of this species is likely to be further enhanced by increases in water temperature expected to occur with climate change (Rahel and Olden 2008, Britton *et al.* 2010a).

Potential Impacts to Native Species (Including Threatened and Endangered Species)

The wels catfish may affect native species through outcompeting and preying on native species, transferring diseases to them, and altering their habitats. This catfish is a giant predatory fish (maximum 5 m (16 ft), 306 kg (675 lb)) (Copp *et al.* 2009; Rees 2012) that will likely compete with other top trophic-level, native predatory fish for both food and habitat resources. Stable isotope analysis, which assesses the isotopes of carbon and nitrogen from food sources and consumers to determine trophic level cycling, suggests that the wels catfish has the same trophic position as the northern pike (Syväranta *et al.* 2010). Thus, U.S. native species at risk of competition with the wels catfish are top predatory piscivores and may include species such as the northern pike, walleye, and sauger. Additionally, the wels catfish can be territorial and unwilling to share habitat with other fish (Copp *et al.* 2009).

Typically utilizing an ambush technique but also known to be an opportunistic scavenger (Copp *et al.* 2009), the wels catfish are generalist predators and may consume native invertebrates, fish, crayfish, eels, small mammals, birds (Copp *et al.* 2009), and amphibians (Rees 2012). In France, the stomach contents of wels catfish revealed a preference for cyprinid fish, mollusks, and crayfish (Syväranta *et al.* 2010). Birds, amphibians, and small mammals also contributed to the diet of these catfish (Copp *et al.* 2009). This species has been observed beaching itself to prey on land birds on a river bank (Cucherousset 2012). Native cyprinid fish potentially affected include native chub, dace, and minnow fish species, some of which are federally endangered or threatened. Native freshwater mollusks and amphibians may also be affected, some of which are also federally endangered or threatened. Increased predation on native cyprinids, mollusks, crustaceans, and amphibians can result in decreased species diversity and increased food web disruption.

The predatory nature of the wels catfish may also lead to species extirpation (local extinction) or the extinction of native species. In Lake Bushko (Bosnia), the wels catfish is linked to the extirpation of the endangered minnow-nase (*Chondrostoma phoxinus*) (Froese and Pauly 2014). Although nase species are native to Europe, the subfamily Leuciscinae includes several native U.S. species, such as dace and shiner species, which may be similar enough to serve as prey for the catfish.

Furthermore, because the roach can hybridize with other fish species of the subfamily Leuciscinae as stated above, and this subfamily includes several U.S. native species, the roach will likely be able to hybridize with some U.S. native species.

The wels catfish is a carrier of the virus that causes SVC and may transmit this virus to native fish (Hickley and Chare 2004). The spread of SVC can deplete native fish stocks and disrupt the ecosystem food web. SVC transmission would further compound adverse effects of both competition and predation by adding disease to already-stressed native fish.

Additionally, this catfish species excretes large amounts of phosphorus and nitrogen to the freshwater environment (Schaus *et al.* 1997, McIntyre *et al.* 2008). Excessive nutrient input can disrupt nutrient cycling and transport (Boulêtreau *et al.* 2011) that can result in increased eutrophication, increased frequency of algal blooms, and decreased dissolved oxygen levels. These decreases in water quality can affect both native fish and mollusks.

Potential Impacts to Humans

There are anecdotal reports of exceptionally large wels catfish biting or dragging people into the water, as well as reports of a human body in a wels catfish's stomach, although it is not known if the person was attacked or scavenged after drowning (Der Standard 2009; Stephens 2013; National Geographic 2014). However, we have no documentation to confirm harm to humans.

Potential Impacts to Agriculture

The wels catfish could impact agriculture by affecting aquaculture. The wels catfish may transmit the fish disease SVC to other cyprinids (Hickley and Chare 2004, Goodwin 2009). An SVC outbreak could result in mass mortalities among farmed fish stocks at an aquaculture facility.

Factors That Reduce or Remove Injuriousness for Wels Catfish

Control

An invasive wels catfish population would be difficult, if not impossible, to control or manage (Rees 2012). We know of no effective methods of control once this species is introduced because of its ability to spread into connected waterways, high reproductive rate, generalist diet, and longevity.

Potential Ecological Benefits for Introduction

We are not aware of any documented ecological benefits for the introduction of the wels catfish.

Factors That Contribute to Injuriousness for the Common Yabby

Current Nonnative Occurrences

The common yabby has moved throughout Australia, and its nonnative range extends to New South Wales east of the Great Dividing Range, Western Australia, and Tasmania. This crayfish species was introduced to Western Australia in 1932, for commercial farming for food from where it escaped and established in rivers and irrigation dams (Souty-Grosset *et al.* 2006). Outside of Australia, this species has been introduced to China, South Africa, Zambia, Italy, Spain, and Switzerland (Gherardi 2011a) for aquaculture and fisheries (Gherardi 2011a). The first European introduction occurred in 1983, when common yabbies were transferred from a California farm to a pond in Girona, Catalonia (Spain) (Souty-Grosset *et al.* 2006). This crayfish species became established in Spain after repeated introduction to the Zaragoza Province in 1984 and 1985 (Souty-Grosset *et al.* 2006).

Potential Introduction and Spread

The common yabby has not established a wild population with the United States. Souty-Grosset *et al.* (2006) indicated that the first introduction of the common yabby to Europe occurred with a shipment from a California farm. However, there is no recent information that indicates that the common yabby is present or established in the wild within California. Primary pathways of introduction include importation for aquaculture, aquariums, bait, and research. Once it is found in the wild, the yabby can disperse on its own in water or on land.

The common yabby prefers a tropical climate but tolerates a wide range of water temperatures from 1 to 35 °C (34 to 95 °F) (Withnall 2000). This crayfish can also tolerate both freshwater and brackish environments with a wide range of dissolved oxygen concentrations (Mills and Geddes 1980). The overall climate match was high, with a Climate 6 ratio of 0.209 with a high climate match to the central Appalachians and Texas.

If introduced, the common yabby is likely to establish and spread within U.S. waters. This crayfish species is a true diet generalist with a diet of plant material, detritus, and zooplankton that varies with seasonality and availability (Beatty 2005). Additionally, this species has a quick growth (Beatty 2005) and maturity rate, high reproductive rate, and history of invasiveness outside of the native range. The invasive range of the common yabby is expected to expand with climate change (Gherardi 2011a). The yabby can also hide for years in burrows up to 5 m (16.4 ft) deep during droughts, thus essentially being invisible to anyone looking to survey or control them (NSW DPI 2015).

Potential Impacts to Native Species (Including Endangered and Threatened Species)

Potential impacts to native species from the common yabby include outcompeting native species for habitat and food resources, preying on native species, transmitting disease, and altering habitat. Competition between crayfish species is often decided by body size and chelae (pincer claw) size (Lynas 2007, Gherardi 2011a). The common yabby has large chelae (Austin and Knott 1996) and quick growth rate (Beatty 2005), allowing this species to outcompete smaller, native crayfish species. This crayfish species will exhibit aggressive behavior toward other crayfish species (Gherardi 2011a). In laboratory studies, the common yabby successfully evicted the smooth marron (*Cherax cainii*) and gilgie (*Cherax quinquecarinatus*) crayfish species from their burrows (Lynas *et al.* 2007). Thus, introduced common yabbies may compete with native crustaceans for burrowing space and, once established, aggressively defend their territory.

The common yabby consumes a similar diet to other crayfish species, resulting in competition over food resources. However, unlike most other crayfish species, the common yabby switches to an herbivorous, detritus diet when preferred prey is unavailable (Beatty 2006). This prey-switching allows the common yabby to outcompete native species (Beatty 2006). If introduced, the common yabby could affect macroinvertebrate richness, remove surface sediment deposits resulting in increased benthic algae and compete with native crayfish species for food, space, and shelter (Beatty 2006). Forty-eight percent of U.S. native crayfish are considered imperiled (Taylor *et al.* 2007, Johnson *et al.* 2013). The yabby's preference for small fishes, such as eastern mosquitofish *Gambusia holbrooki* (Beatty 2006), could imply a potential threat to small native fishes.

The common yabby eats plant detritus, algae and macroinvertebrates (such as snails) and small fish (Beatty 2006). Increased predation pressure on macroinvertebrates and fish may reduce populations to levels that are unable to sustain a reproducing population. Reduced populations or the disappearance of certain native species further alters trophic level cycling. For instance, species of freshwater snails are food sources for numerous aquatic animals (fish, turtles) and also may be used as an indicator of good water quality (Johnson 2009). However, in the past century, more than 500 species of North American freshwater snails have become extinct or are considered vulnerable, threatened, or endangered by the American Fisheries Society (Johnson *et al.* 2014). The most substantial population declines have occurred in the southeastern United States (Johnson 2009), where the common yabby has a medium to high climate match. Introductions of the common yabby could further exacerbate population declines of snail species.

In laboratory simulations, this crayfish species also exhibited aggressive and predatory behavior toward turtle hatchlings (Bradsell *et al.* 2002). These results spurred concern about potential aggressive and predatory interactions in Western Australia between the invasive common yabby and that country's endangered western swamp turtle (*Pseudemydura umbrina*) (Bradsell *et al.* 2002). There are six freshwater turtle species that are federally listed in the United States (USFWS Draft Environmental Assessment 2015), all within the yabby's medium or high climate match.

The common yabby is susceptible to the crayfish plague (*Aphanomyces astaci*), which affects European crayfish stocks (Souty-Grosset *et al.* 2006). North American crayfish are known to be chronic, unaffected carriers of the crayfish plague (Souty-Grosset *et al.* 2006). The common yabby can carry other diseases and parasites, including burn spot disease *Psorospermium* sp. (Jones and Lawrence 2001), *Cherax destructor* bacilliform virus (Edgerton *et al.* 2002), *Cherax destructor* systemic parvo-like virus (Edgerton *et al.* 2002), *Pleistophora* sp. microsporidian (Edgerton *et al.* 2002), *Thelohania* sp. (Jones and Lawrence 2001, Edgerton *et al.* 2002, Moodie *et al.* 2003), *Vavraia parastacida* (Edgerton *et al.* 2002), *Microphallus minutus* (Edgerton *et al.* 2002), *Polymorphus biziurae* (Edgerton *et al.* 2002), and many others (Jones and Lawrence 2001, Longshaw 2011). If introduced, the common yabby could spread these diseases among native crayfish species, resulting in decreased populations and changes in ecosystem cycling.

The common yabby digs deep burrows (Withnall 2000). This burrowing behavior has eroded and collapsed banks at some waterbodies (Withnall 2000). Increased erosion or bank collapse results in increased sedimentation, which increases turbidity and decreases water quality.

Potential Impacts to Humans

The common yabby's burrowing behavior undermines levees, berms, and earthen dams. Weakened levees, berms, and dams could result in problems and delays involving water delivery infrastructure. This could be a particular problem in southern Louisiana or the Everglades, where levees and berms are major features for flood control.

Several crayfish species, including the common yabby, can live in contaminated waters and accumulate high heavy metal contaminants within their tissues (King *et al.* 1999, Khan and Nugegoda 2003, Gherardi 2010, Gherardi 2011b). The contaminants can then pass on to humans if they eat these crayfish. Heavy metals vary in toxicity to humans, ranging from no or little effect to causing skin irritations, reproductive failure, organ failure, cancer, and death (Hu 2002, Martin and Griswold 2009). Therefore, the common yabby may directly impact human health by transferring metal contaminants through consumption (Gherardi 2010).

Potential Impacts to Agriculture

The common yabby may affect agriculture by decreasing aquaculture productivity. The common yabby can be host to a variety of diseases and parasitic infections, including the crayfish plague, burn spot disease, *Psorospermium* sp., and thelohaniasis (Jones and Lawrence 2001, Souty-Grosset *et al.* 2006). These diseases and parasitic infections can infect other crayfish species (Vogt 1999) resulting in impaired physiological functions and death. Crayfish species (such as red swamp crayfish (*Procambarus clarkii*)) are involved in commercial aquaculture and increased incidence of death and disease would reduce this industry's productivity and value.

Factors That Reduce or Remove Injuriousness for the Common Yabby

Control

In Europe, two nonnative populations of the common yabby have been eradicated by introducing the crayfish plague. Since this plague is not known to affect North American crayfish species, this may be effective against an introduced common yabby population

(Souty-Grosset *et al.* 2006). However, this control method is not recommended because it would introduce disease into the environment and has the potential to mutate and harm native crayfish. Control measures that would harm native wildlife are not recommended as mitigation to reduce the injurious characteristics of this species and therefore do not meet control measures under the Injurious Wildlife Evaluation Criteria.

Potential Ecological Benefits for Introduction

We are not aware of any potential ecological benefits for introduction of the common yabby.

Conclusions for the 11 Species

Crucian Carp

The crucian carp is highly likely to survive in the United States. This fish species prefers a temperate climate and has a native range that extends through north and central Europe. The crucian carp has a high climate match throughout much of the continental United States, Hawaii, and southern Alaska. If introduced, the crucian carp is likely to spread and become established due to its ability as a habitat generalist, diet generalist, and adaptability to new environments, long life span, and proven invasiveness outside of its native range.

Since the crucian carp is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at spreading its range; has negative impacts of competition, hybridization, and disease transmission on native wildlife (including endangered and threatened species); has negative impacts on humans by reducing wildlife diversity and the benefits that nature provides; has negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of crucian carp to new locations, or recover ecosystems affected by this species, the Service finds the crucian carp to be injurious to agriculture and to wildlife and wildlife resources of the United States.

Eurasian Minnow

The Eurasian minnow is highly likely to survive in the United States. This fish species prefers a temperate climate and has a current range (native and nonnative) throughout Eurasia. In the United States, the Eurasian minnow has a high climate match to the Great Lakes region, coastal New England, central and high Plains, West Coast, and southern Alaska. If introduced, the Eurasian minnow is likely to spread and establish due to its traits as a habitat generalist, generalist predator, adaptability to new environments, increased reproductive potential, long life span, extraordinary mobility, social nature, and proven invasiveness outside of its native range.

Since the Eurasian minnow is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at expanding its range; has negative impacts of competition, predation, and disease transmission on native wildlife (including endangered and threatened species); has negative impacts on humans by reducing wildlife diversity and the benefits that nature provides; has negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the Eurasian minnow to new locations, or recover ecosystems affected by this species, the Service finds the Eurasian minnow to be injurious to agriculture and to wildlife and wildlife resources of the United States.

Prussian Carp

The Prussian carp is highly likely to survive in the United States. This fish species prefers a temperate climate and has a current range (native and nonnative) that extends throughout Eurasia. In the United States, the Prussian carp has a high climate match to the Great Lakes region, central Plains, western mountain States, and California. This fish species has a medium climate match to much of the continental United States, southern Alaska, and regions of Hawaii. Prussian carp have already established in southern Canada near the U.S. border, validating the climate match in northern regions. If introduced, the Prussian carp is likely to spread and establish due to its tolerance to poor quality environments, rapid growth rate, ability to reproduce from unfertilized eggs, and proven invasiveness outside of its native range.

Since the Prussian carp is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at spreading its range; has negative impacts of competition, habitat alteration, hybridization, and disease transmission on native wildlife (including threatened and endangered species); has negative impacts on humans by reducing wildlife diversity and the benefits that nature provides; has negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the Prussian carp to new locations, or recover ecosystems affected by this species, the Service finds the Prussian carp to be injurious to agriculture and to wildlife and wildlife resources of the United States.

Roach

The roach is highly likely to survive in the United States. This fish species prefers a temperate climate and has a current range (native and nonnative) throughout Europe, Asia, Australia, Morocco, and Madagascar. The roach has a high climate match to southern and central Alaska, regions of Washington, the Great Lakes region, and western mountain States, and a medium climate match to most of the United States. If introduced, the roach is likely to spread and establish due to its highly adaptive nature toward habitat and diet choice, high reproductive rate, ability to reproduce with other cyprinid species, long life span, extraordinary mobility, and proven invasiveness outside of its native range.

Since the roach is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at spreading its range; has negative impacts of competition, predation, hybridization, altered habitat resources, and disease transmission on native wildlife (including endangered and threatened species); has negative impacts on humans by reducing wildlife diversity and the benefits that nature provides; has negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the roach to new locations, or recover ecosystems affected by this species, the Service finds the roach to be injurious to agriculture and to wildlife and wildlife resources of the United States.

Stone Moroko

The stone moroko is highly likely to survive in the United States. This fish species prefers a temperate climate and has a current range (native and nonnative) throughout Eurasia, Algeria, and Fiji. The stone moroko has a high climate match to the southeast United States, Great Lakes region, central Plains, northern Texas, desert Southwest, and West Coast. If introduced, the stone moroko is likely to spread and establish due to its traits as a habitat generalist, diet generalist, rapid growth rate, adaptability to new environments, extraordinary mobility, high reproductive rate, high genetic variability, and proven invasiveness outside of its native range.

Since the stone moroko is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at spreading its range; has negative impacts of competition, predation, disease transmission, and habitat alteration on native wildlife (including threatened and endangered species); has negative impacts on humans by reducing wildlife diversity and the benefits that nature provides; has negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the stone moroko to new locations, or recover ecosystems affected by this species, the Service finds the stone moroko to be injurious to agriculture and to wildlife and wildlife resources of the United States.

Nile Perch

The Nile perch is highly likely to survive in the United States. This fish species is a tropical invasive and its current range (native and nonnative) includes central Africa. In the United States, the Nile perch has an overall medium climate match to the United States. However, this fish species has a high climate match to the Southeast, California, Hawaii, Puerto Rico, and the U.S. Virgin Islands. If introduced, the Nile perch is likely to spread and establish due to its nature as a habitat generalist, generalist predator, long life span, quick growth rate, high reproductive rate, extraordinary mobility, and proven invasiveness outside of its native range.

Since the Nile perch is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at spreading its range; has negative impacts of competition, predation, and habitat alteration on native wildlife (including endangered and threatened species); has negative impacts on humans by reducing wildlife diversity and the benefits that nature provides (including through fisheries); and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the Nile perch to new locations, or recover ecosystems affected by this species, the Service finds the Nile perch to be injurious to the interests of wildlife and wildlife resources of the United States.

Amur Sleeper

The Amur sleeper is highly likely to survive in the United States. Although this fish species native range only includes the freshwaters of China, Russia, North and South Korea, the species has a broad invasive range that extends throughout much of Eurasia. The Amur sleeper has a high climate match to the Great Lakes region, central and high plains, western mountain States, Maine, northern New Mexico, and southeast to central Alaska. If introduced, the Amur sleeper is likely to spread and establish due to its nature as a habitat generalist, generalist predator, rapid growth rate, high reproductive potential, adaptability to new environments, extraordinary mobility, and history of invasiveness outside of its native range.

Considering the Amur sleeper's past history of being released into the wild; ability to survive and establish outside of its native range; success at spreading its range; negative impacts of competition, predation, and disease transmission on native wildlife (including endangered and threatened species); negative impacts on humans by reducing wildlife diversity and the benefits that nature provides; negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the Amur sleeper to new locations, or recover ecosystems affected by this species, the Service finds the Amur sleeper to be injurious to agriculture and to wildlife and wildlife resources of the United States.

European Perch

The European perch is highly likely to survive in the United States. This fish species prefers a temperate climate and has a current range (native and nonnative) throughout Europe, Asia, Australia, New Zealand, South Africa, and Morocco. In the United States, the European perch has a medium to high climate match to the majority of the United States except the desert Southwest. This species has especially high climate matches in the southeast United States, Great Lakes region, central to southern Texas, western mountain States, and southern to central Alaska. If introduced, the European perch is likely to spread and establish due to its nature as a generalist predator, ability to adapt to new environments, ability to outcompete native species, and proven invasiveness outside of its native range.

Since the European perch is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at spreading its range; has negative impacts of competition, predation, and disease transmission on native wildlife (including endangered and threatened species); has negative impacts on humans by reducing wildlife diversity and the benefits that nature provides; has negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the European perch to new locations, or recover ecosystems affected by this species, the Service finds the European perch to be injurious to agriculture and to wildlife and wildlife resources of the United States.

Zander

The zander is highly likely to survive in the United States. This fish species prefers a temperate climate and has a current range (native and nonnative) throughout Europe, Asia, and northern Africa. In the United States, the zander has a high climate match to the Great Lakes region, northern Plains, western mountain States, and Pacific Northwest. Medium climate matches extend from southern Alaska, western mountain States, central Plains, and mid-Atlantic, and New England regions. If introduced, the zander is likely to spread and establish due to its nature as a generalist predator, ability to hybridize with other fish species, extraordinary mobility, long life span, and proven invasive outside of its native range.

Since the zander is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at spreading its range; has negative impacts of competition, predation, parasite transmission, and hybridization with native wildlife; has negative impacts on humans by reducing wildlife diversity and the benefits that nature provides; has negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the zander to new locations, or recover ecosystems affected by this species, the Service finds the zander to be injurious to agriculture and to wildlife and wildlife resources of the United States.

Wels Catfish

The wels catfish is highly likely to survive to survive in the United States. This fish species prefers a temperate climate and has a current range (native and nonnative) throughout Europe, Asia, and northern Africa. This fish species has a high climate match to much of the United States. Very high climate matches occur in the Great Lakes region, western mountain States, and the West Coast. If introduced, the wels catfish is likely to spread and establish due to its traits as a generalist predator, quick growth rate, long life span, high reproductive rate, adaptability to new environments, and proven invasiveness outside of its native range.

Since the wels catfish is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at spreading its range; has negative impacts of competition, predation, disease transmission, and habitat alteration on native wildlife (including endangered and threatened species); has negative impacts on humans by reducing wildlife diversity and the benefits that nature provides; has negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the wels catfish to new locations, or recover ecosystems affected by this species, the Service finds the wels catfish to be injurious to agriculture and to wildlife and wildlife resources of the United States.

Common yabby

The common yabby is highly likely to survive in the United States. This crustacean species prefers a tropical climate and has a current range (native and nonnative) that extends to Australia, Europe, China, South Africa, and Zambia. The common yabby has a high climate match to the eastern United States, Texas, regions of Washington, and regions of southern Alaska. If introduced, the common yabby is likely to spread and establish due to its traits as a diet generalist, quick growth rate, high reproductive rate, and proven invasiveness outside of its native range.

Since the common yabby is likely to escape or be released into the wild; is able to survive and establish outside of its native range; is successful at spreading its range; has negative impacts of competition, predation, and disease transmission on native wildlife (including endangered and threatened species); has negative impacts on humans through consumption of crayfish with heavy metal bioaccumulation and by reducing wildlife diversity and the benefits that nature provides; has negative impacts on agriculture by affecting aquaculture; and because it would be difficult to prevent, eradicate, or reduce established populations, control the spread of the common yabby to new locations, or recover ecosystems affected by this species, the Service finds the common yabby to be injurious to humans, to the interests of agriculture, and to wildlife and the wildlife resources of the United States.

Summary of Injurious Wildlife Factors

The Service used the injurious wildlife evaluation criteria (see Injurious Wildlife Evaluation Criteria) and found that all of the 11 species are injurious to wildlife and wildlife resources of the United States, 10 are injurious to agriculture, and the yabby is injurious to humans. Because all 11 species are injurious, the Service proposes to add these 11 species to the list of injurious wildlife under the Act. The table shows a summary of the evaluation criteria for the 11 species.

TABLE: SUMMARY OF INJURIOUS WILDLIFE EVALUATION CRITERIA FOR 11 SPECIES

Species	Factors that contribute to being considered injurious					Factors that reduce the likelihood of being injurious	
	Nonnative occurrences	Potential for introduction and spread	Impacts to native species [1]	Direct impacts to humans	Impacts to agriculture [2]	Control [3]	Ecological benefits for introduction
Crucian Carp	Yes	Yes	Yes	No	Yes	No	No.
Eurasian Minnow	Yes	Yes	Yes	No	Yes	No	Negligible.
Prussian Carp	Yes	Yes	Yes	No	Yes	No	No.
Roach	Yes	Yes	Yes	No	Yes	No	No.
Stone Moroko	Yes	Yes	Yes	No	Yes	No	No.
Nile Perch	Yes	Yes	Yes	No	No	No	No.
Amur Sleeper	Yes	Yes	Yes	No	Yes	No	No.
European Perch	Yes	Yes	Yes	No	Yes	No	No.
Zander	Yes	Yes	Yes	No	Yes	No	Negligible.
Wels Catfish	Yes	Yes	Yes	No	Yes	No	No.
Common Yabby	Yes	Yes	Yes	Yes	Yes	No	No.

[1] Includes endangered and threatened species and wildlife and wildlife resources.
[2] Agriculture includes aquaculture.
[3] Control—"No" if wildlife or habitat damages may occur from control measures being proposed as mitigation.

Required Determinations

Regulatory Planning and Review

Executive Order 12866 provides that the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget will review all significant rules. The Office of Information and Regulatory Affairs has determined that this rule is not significant.

Executive Order (E.O.) 13563 reaffirms the principles of E.O. 12866 while calling for improvements in the nation's regulatory system to promote predictability, to reduce uncertainty, and to use the best, most innovative, and least burdensome tools for achieving regulatory ends. The executive order directs agencies to consider regulatory approaches that reduce burdens and maintain flexibility and freedom of choice for the public where these approaches are relevant, feasible, and consistent with regulatory objectives. E.O. 13563 emphasizes further that the regulatory system must allow for public participation and an open exchange of ideas. We have developed this rule in a manner consistent with these principles.

Regulatory Flexibility Act

Under the Regulatory Flexibility Act (as amended by the Small Business Regulatory Enforcement Fairness Act [SBREFA] of 1996) (5 U.S.C. 601, *et seq.*), whenever a Federal agency is required to publish a notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the effect of the rule on small entities (that is, small businesses, small organizations, and small government jurisdictions). However, no regulatory flexibility analysis is required if the head of an agency certifies that the rule would not have a significant economic impact on a substantial number of small entities (5 U.S.C. 605(b)).

The Service has determined that this proposed rule will not have a significant economic impact on a substantial number of small entities. Of the 11 species, only one population of one species (zander) is found in the wild in the United States. Of the 11 species, one species (yabby) has evidence of being in negligible trade in the United States; three species (crucian carp, Nile perch, and wels catfish) have been imported in only small numbers since 2011; and seven species are not in U.S. trade. Therefore, businesses derive little or no revenue from their sale, and the economic effect in the United States of this proposed rule would be negligible, if not nil. The draft economic analysis that the Service prepared supports this conclusion (USFWS Draft Economic Analysis 2015). In addition, none of the species requires control efforts, and the rule would not impose any additional reporting or recordkeeping requirements. Therefore, we certify that, if made final as proposed, this rulemaking would not have a significant economic effect on small entities, as defined under the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*).

Small Business Regulatory Enforcement Fairness Act

The proposed rule is not a major rulemaking under 5 U.S.C. 804(2), the Small Business Regulatory Enforcement Fairness Act. This proposed rule:

a. Would not have an annual effect on the economy of $100 million or more.

b. Would not cause a major increase in costs or prices for consumers; individual industries; Federal, State, or local government agencies; or geographic regions.

c. Would not have significant adverse effects on competition, employment, investment, productivity, innovation, or the ability of U.S.-based enterprise to compete with foreign-based enterprises.

The 11 species are not currently in trade or have been imported in only small numbers since 2011, when we specifically began to query the trade data for these species. Therefore, there should be a negligible effect, if any, to small businesses with this proposed rule.

Unfunded Mandates Reform Act

The Unfunded Mandates Reform Act (2 U.S.C. 1501 *et seq.*) does not apply to this proposed rule since it would not produce a Federal mandate or have a significant or unique effect on State, local, or tribal governments or the private sector.

Takings

In accordance with E.O. 12630 (Government Actions and Interference with Constitutionally Protected Private Property Rights), the proposed rule does not have significant takings implications. Therefore, a takings implication assessment is not required since this rule would not impose significant requirements or limitations on private property use.

Federalism

In accordance with E.O. 13132 (Federalism), this proposed rule does not have significant federalism effects. A federalism summary impact statement is not required since this rule would not have substantial direct effects on the States, in the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among the various levels of government.

Civil Justice Reform

In accordance with E.O. 12988, the Office of the Solicitor has determined that this proposed rule does not unduly burden the judicial system and meets the requirements of sections 3(a) and 3(b)(2) of the E.O. The rulemaking has been reviewed to eliminate drafting errors and ambiguity, was written to minimize litigation, provides a clear legal standard for affected conduct rather than a general standard, and promotes simplification and burden reduction.

Paperwork Reduction Act of 1995

This proposed rule does not contain any collections of information that require approval by OMB under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*). This proposed rule will not impose recordkeeping or reporting requirements on State or local governments, individuals, businesses, or organizations. We may not conduct or sponsor and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number.

National Environmental Policy Act

The Service has reviewed this proposed rule in accordance with the criteria of the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), Department of the Interior NEPA regulations (43 CFR 46), and the Departmental Manual in 516 DM 8. This action is being taken to protect the natural resources of the United States. A draft environmental assessment has been prepared and is available for review by written request (see **FOR FURTHER INFORMATION CONTACT**) or at *http://www.regulations.gov* under Docket No. FWS–HQ–FAC–2013–0095. By adding the 11 species to the list of injurious wildlife, the Service intends to prevent their introduction and establishment into the natural areas of the United States, thus having no significant impact on the human environment.

Clarity of Rule

In accordance with E.O. 12866 and 12988 as well as the Presidential Memorandum of June 1, 1998, all rules must be written in plain language. This means that each published rulemaking must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences;

(e) Use lists and tables wherever possible.

If you feel that this proposed rule has not met these requirements, send comments by one of the methods listed in the **ADDRESSES** section. This will better help to revise the rulemaking and comments should be as specific as possible. For example, comments should include the numbers of sections or paragraphs that are unclearly written, which sections or sentences are too long, and the sections that should include lists or tables.

Government-to-Government Relationship With Tribes

In accordance with the President's memorandum of April 29, 1994, Government-to-Government Relations with Native American Tribal Governments of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. We have evaluated potential effects on federally recognized Indian tribes and have determined that there are no potential effects. This proposed rule involves the prevention of importation and interstate transport of 10 live fish species and 1 crayfish, as well as their gametes, viable eggs, or hybrids, that are not native to the United States. We are unaware of trade in these species by tribes as these species are not currently in U.S. trade, or they have been imported in only small numbers since 2011.

Effects on Energy

On May 18, 2001, the President issued Executive Order 13211 on regulations that significantly affect energy supply, distribution, or use. Executive Order 13211 requires agencies to prepare Statements of Energy Effects when undertaking certain actions. This proposed rule is not expected to affect energy supplies, distribution, or use. Therefore, this action is not a significant energy action and no Statement of Energy Effects is required.

References Cited

A complete list of all references used in this rulemaking is available from *http://www.regulations.gov* under Docket No. FWS–HQ–FAC–2013–0095 or from *http://www.fws.gov/injuriouswildlife/.*

Authors

The primary authors of this proposed rule are the staff of the Branch of Aquatic Invasive Species at the Service's Headquarters (see **FOR FURTHER INFORMATION CONTACT**).

List of Subjects in 50 CFR Part 16

Fish, Imports, Reporting and recordkeeping requirements, Transportation, Wildlife.

Proposed Regulation Promulgation

For the reasons discussed within the preamble, the U.S. Fish and Wildlife Service proposes to amend part 16, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as follows:

PART 16—INJURIOUS WILDLIFE

■ 1. The authority citation for part 16 continues to read as follows:

Authority: 18 U.S.C. 42.

■ 2. Amend § 16.13 by revising paragraph (a)(2)(v) and by adding paragraphs (a)(2)(vi) through (x). The revision and additions read as follows:

§ 16.13 Importation of live or dead fish, mollusks, and crustaceans, or their eggs.

(a) * * *

(2) * * *

(v) Any live fish, gametes, viable eggs, or hybrids of the following species in family Cyprinidae:

(A) *Carassius carassius* (crucian carp).

(B) *Carassius gibelio* (Prussian carp).

(C) *Hypophthalmichthys harmandi* (largescale silver carp).

(D) *Hypophthalmichthys molitrix* (silver carp).

(E) *Hypophthalmichthys nobilis* (bighead carp).

(F) *Mylopharyngodon piceus* (black carp).

(G) *Phoxinus phoxinus* (Eurasian minnow).

(H) *Pseudorasbora parva* (stone moroko).

(I) *Rutilus rutilus* (roach).

(vi) Any live fish, gametes, viable eggs, or hybrids of *Lates niloticus* (Nile perch), family Centropomidae.

(vii) Any live fish, gametes, viable eggs, or hybrids of *Perccottus glenii* (Amur sleeper), family Odontobutidae.

(viii) Any live fish, gametes, viable eggs, or hybrids of the following species in family Percidae:

(A) *Perca fluviatilis* (European perch).

(B) *Sander lucioperca* (zander).

(ix) Any live fish, gametes, viable eggs, or hybrids of *Silurus glanis* (wels catfish), family Siluridae.

(x) Any live crustacean, gametes, viable eggs, or hybrids of *Cherax destructor* (common yabby), family Parastacidae.

* * * * *

Dated: September 30, 2015.

Michael J. Bean

Principal Deputy Assistant Secretary for Fish and Wildlife and Parks.

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