

Final Economic Analysis for Listing of 10 Freshwater Fish and 1 Crayfish Species as Injurious under the Lacey Act

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Introduction

The U.S. Fish and Wildlife Service (Service) is publishing a final rule to add 10 fish species and 1 crayfish species (11 species) to the list of injurious species at title 50, section 16.13 of the Code of Federal Regulations (CFR) under the Lacey Act: 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*), wels catfish (*Silurus glanis*), and common yabby (*Cherax destructor*). The listing prohibits importation and interstate transportation of live individuals of these species, none of which is native to the United States.

Of the 11 species, only one population of one species (zander) is found in the wild in the United States. Of the 11 species, 4 species (crucian carp, Nile perch, wels catfish, and yabby) have been imported in small numbers since 2011 (LEMIS 2016); and seven species have not been imported to our knowledge. The Lacey Act (18 USC 42 as amended) authorizes the Secretary of the Interior to add to the injurious wildlife list by regulation those wild mammals, wild birds, fish, mollusks, crustaceans, amphibians, reptiles, and the offspring, eggs, or hybrids of any of the aforementioned, which are injurious to human beings, to the interests of agriculture, horticulture, forestry, or to the wildlife or wildlife resources of the United States. The lists of injurious wildlife are found at 50 CFR 16.11-15. This economic analysis supports the final rule that is being published in the *Federal Register* ("Injurious Wildlife Species; Listing 10 Freshwater Fish and 1 Crayfish").

The Service published a proposed rule to add the 10 freshwater fish and 1 crayfish species to the list of injurious wildlife under the Lacey Act on October 30, 2015 (80 FR 67026), and the 60-day public comment period closed on December 29, 2016. The Service received 20 comments. The Service also sought peer review from three experts and received comments from all three.

We did not receive any quantifiable economic data on trade in any of the 11 species from the public and peer comments. We received comments from several of Florida's State agencies explaining that the Nile perch is allowed to be farmed in the State under strict regulations, but they did not give any quantitative information on the extent of the industry, if live Nile perch are transported alive to another State, or even if Nile

perch are actually currently being farmed. Therefore, we have no economic information on the effect of the final rule on Nile perch.

The Law Enforcement Committee of the Great Lakes Fisheries Commission conducted a brief survey of their member agencies and received the following feedback about concerns regarding the potential pathways of introduction for the species proposed for listing:

- Nile perch and zander were placed on a watch list last year in the report, “Live Food Fish Industry Risk Assessment” commissioned by the Ontario Ministry of Natural Resources and Forestry. This report indicated that, while none of the species were found to be for sale in Ontario, they are extensively cultured and found in the live food fish trade in other parts of the world.
- A Chicago Chinatown market was recently investigated after having been discovered advertising live crucian carp for sale; however, upon closer inspection, the fish were determined to be to be live goldfish.
- The wels catfish has a small niche among large-fish enthusiasts. There is some internet trade of this species based on research done by the invasive species program area, but one has to look hard to find someone that has them available.

This information shows that there are potential markets for at least a few of the species.

None of comments included any information that the zander is of economic importance though it may be present in one lake. None of the comments we received on any species alters the overall results of the draft economic analysis.

The injuriousness evaluation shows that these 11 nonnative species pose a significant risk of becoming invasive if introduced into the United States, based partly on a history of invasiveness elsewhere in the world and a suitable climate match in parts of the United States. Reports from Europe, Asia, Australia, and Africa have shown that these species have become established in the wild outside of their native ranges to the detriment of native ecosystems and ecosystem services. Several of the species were intentionally introduced to areas outside their native range for commercial fishing or aquaculture, sport fishing, or as ornamentals for display.

To our knowledge, two of the species (crucian carp and Nile perch) have been introduced into waters of the United States in previous decades but failed to become established. The zander (*Sander lucioperca*) has become established in a single lake in North Dakota.

The Service reviewed import data from the Service’s Law Enforcement Management Information System (LEMIS) to determine if any of the 11 species have been imported alive or as eggs in the last 5 years. Little information was available because most of the species did not need to be itemized separately by importers on the import declaration form; however, importers are free to itemize without a specific request, and some imports of the 11 species may have been recorded to the species level. In October

2013, at the Branch of Aquatic Invasive Species’ request and in preparation for this rulemaking, the Office of Law Enforcement issued a “Notice to the Wildlife Import/Export Community” asking importers to separate the 11 species of concern on different lines of the declaration form (Form 3-177, whether filed electronically or in paper form). Species codes had already existed (meaning this type of request had already been made) for crucian carp, Nile perch, and European perch; hence, we have some data from 2000. However, that data includes all purposes for importation, such as dead, skins, and bones. For this economic analysis, we are interested only in the live specimens and egg imports.

Table 1 shows the four species that have been declared for importation as live specimens from 2011 to 2015 (LEMIS 2016). Although we have data from 2000, here we used only the data from the last 5 years as the most relevant. The results show that the total value of all live individuals of the four species was \$5,789 for approximately 6,500 individuals (exact number is not known because one shipment was by weight, not number of individuals). No eggs were reported as imports in any of the LEMIS data.

Table 1. Number of known live importations and values for each species that was imported from 2011 to 2015 (LEMIS 2016).

Species	Number of Importations	Number of Individuals	Total Value \$	Mean \$ per individual
Crucian carp	1	6,220	3,194	0.51
Nile perch	20	242	2,129	8.80
Wels catfish	3*	15 (and 27 kg (60 lb))	939*	30.20**
Yabby	1	25	13	0.52
TOTAL	25	6,502**	5,789	0.89**

*including one shipment by weight **excluding the one shipment by weight

Based on our evaluation of the injurious nature of all 11 species, the objective of this listing is to prohibit their importation and interstate transportation and thus prevent the species’ likely introduction, establishment, and spread in the wild and harm to the interests of agriculture, wildlife, and wildlife resources.

If any of these species enter the United States and are released into the wild under the appropriate conditions, they could survive and establish populations in many types of water bodies. There are a number of ways that these introduced aquatic species can harm United States interests, including, but not limited to:

- Prey on native fish, including sportfish and endangered species, as well as farmed (aquaculture) species.
- Compete with native species for food, habitat, and other resources.
- Serve as a vector for infectious diseases.

- Prey on invertebrates and juvenile or small fish, thus modifying the structure of native aquatic communities.

Any of these effects decrease social welfare, either through direct effects on human activities (such as reduced profit from aquaculture or reduced pleasure in fishing) or indirect effects on humans (such as lost existence value for pristine streams). This final rule seeks to avoid such probable harmful effects on the United States.

The following sections address the benefits and costs of the final rule as required by Executive Order 12866 and the certification of no effect on small entities as required by the Small Business Regulatory Enforcement Act (SBREFA). In each case, a “No Action” alternative is compared to listing under the Lacey Act and to a voluntary refrain on importation by the live animal importers based on risk screens provided by the Service.

Need for Action

This action will prevent the type of harm that has already been caused by numerous other invasive and injurious species that have entered the United States from other countries. Industries, governments, and communities must spend millions of dollars to defend against damage from injurious species. For example, zebra mussels (*Dreissena polymorpha*) cost an estimated \$1 billion annually in recreational fishery losses, controls, and other costs in the Great Lakes and Pacific Northwest areas, as well as cleaning of water intake pipes, filtration equipment, power generating equipment, damage to docks and recreational or commercial boats (Corn and Johnson 2013). Millions of dollars more are spent to limit the spread of such species as silver carp (*Hypophthalmichthys molitrix*) and brown tree snake (*Boiga irregularis*). Public well-being is also decreased by the effects of invasive and injurious species on the environment. A river overrun with 40-pound silver carp that leap out of the water at the approach of a motorboat can result in serious injury to people in boats and can render boating dangerous and unpleasant. No unregulated market forces exist that can shift these costs to the individuals responsible for them.

Many invasive and injurious species have been imported to the United States unintentionally, while others were brought here intentionally. In either case, unregulated market forces failed to provide adequate incentives to prevent the escape and survival of these species. The unregulated market does not require those entities importing a species or transporting a species across state lines to bear the full costs and liabilities for all of the consequences of their actions. The Lacey Act provides a framework for preventing pathways that lead to introduction, establishment, and spread of injurious species and the negative externalities that they cause.

State or municipal government actions alone are insufficient to address the international and interstate threat of invasive species. While States have major responsibilities for wildlife within their borders, invasive species ignore political boundaries. States do not have authority to regulate importation or interstate transportation. Therefore, Federal action is necessary. The Lacey Act provides a Federal mechanism to prevent the introduction, establishment, and spread of injurious species into and throughout the United States by prohibiting the importation and interstate transportation of injurious species.

Authority

The Lacey Act provides that the Secretary of the Interior may amend by regulation the list of injurious wildlife prohibited from importation and interstate transportation (18 USC 42(a)(1)).

Baseline and Alternatives

Three alternatives are considered in this rule-making:

1. No Action-Baseline: Allow importation and interstate transportation of these species within the United States and cope with the future consequences of their introduction into United States habitats in other ways.
2. Injurious Wildlife Listing: Prohibit importation and interstate transportation in these species, except as permitted for scientific, educational, medical, and zoological purposes.
3. Voluntary refrain: Do not amend the list of injurious wildlife, but instead encourage a voluntary refrain on importation and interstate transportation of these 11 species by the live animal trade businesses, even though the species are not listed as injurious. This follows a Memorandum of Understanding (MOU) between the Service, Pet Industry Joint Advisory Council, and the Association of Fish and Wildlife Agencies (USFWS 2013) but is not limited to the parties in the MOU.

The effects of the alternatives are compared to a baseline scenario. Under Alternative 1, the No Action Baseline, no action is taken with regard to trade in these species. Importers will be able to bring the species into the United States for any purpose. Several of the species are raised for food in commercial aquaculture operations outside of their native range and currently outside of the United States. Others have been released into natural water bodies outside of the United States to add to sport fishing opportunities. Several species also serve as aquarium fish or pond ornamentals outside the United States. This experience abroad indicates that the threat from these species is

not merely speculative. Aquaculturists, anglers, and aquarium enthusiasts may have the same incentives in the United States that existed elsewhere to import these species.

Seven of these species have not been imported in the last 5 years. Four of these species have been imported in small numbers during the last several years, but these numbers and the associated import value are so small (less than \$6,000 value by 13 importers over 5 years) that we do not consider this being in trade. Therefore, the listing of these 11 species should have little or no economic impact on small businesses or the U.S. economy as a whole. We have no information that would predict the prices and quantities of these species that might result if they were to enter into trade in this country. Lacking that information, any attempt to quantify the economic impacts (that is, producer and consumer surplus gains) that would result from introduction of these species into the United States would be purely speculative. The following qualitative discussion outlines the likely costs and benefits of each alternative.

Expected Costs of Alternatives

Under Alternative 1 (the No Action alternative), we expect importers may eventually introduce these species to United States markets. The injurious wildlife provisions of the Lacey Act is permissive in that otherwise lawful importation or interstate transportation of a species may occur until it is designated as injurious by statute or by regulation. International agreements, such as Convention on International Trade in Endangered Species of Wild Fauna and Flora, North American Free Trade Agreement, and General Agreement on Tariffs and Trade, also affect the import of wildlife; however, none prohibits the importation of these 11 species. Additionally, U.S. Department of Agriculture and the Centers for Disease Control have the authority to regulate imports of live animals, primarily used to prevent the spread of diseases to agriculture and humans; however, neither currently prohibits the importation of these species. If these 11 species are not listed as injurious, the importation and interstate transport of the species will not be prohibited (unless regulated by a smaller jurisdiction). The following examples characterize the effects that could be expected from introduction of these species into waters of the United States under the No Action Alternative.

The crucian carp (*Carassius carassius*) is a freshwater fish species native to regions of north and central Europe (Godard and Copp 2012). This fish species has been widely introduced and established in Croatia, Greece, 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 2014a), and Turkey (Innal and Erk'akan 2006). The crucian carp competes with native fish species, alters the health of freshwater habitats and hybridizes with other carp species

(Godard and Copp 2012). If introduced and established in United States waters, the crucian carp could have similar effects on other nonnative carp species, which has been linked to declines of some native fish species in the United States. Crucian carp can also harbor the virus that causes spring viraemia of carp (SVC), which infects numerous fish, such as carp, pike, and perch (Ahne *et al.* 2002). This disease can result in fish mortality, and thus can be detrimental to commercial and recreational fisheries and aquaculture.

The Eurasian minnow (*Phoxinus phoxinus*) is native to the brackish and freshwater streams, rivers, ponds, and lakes throughout Eurasia (Sandlund 2008, Froese and Pauly 2014e). This fish species is expanding its nonnative, invasive range (Hesthagen and Sandlund 2010.). The Eurasian minnow affects native species through competition, predation, and parasite transmission. In Norway, this fish competes with brown trout (*Salmo trutta*) for food resources and preys on vendace (a salmonid) larvae (Huusko and Sutela 1997). High density populations of this fish species have resulted in an average of 35 percent reduction in recruitment and growth rates of brown trout (Museth *et al.* 2007). If introduced to the U.S., this fish species could decrease native salmon and trout populations. Thus, this species' introduction could reduce wildlife diversity and the economic value of salmonid fisheries and aquaculture.

The Prussian carp (*Carassius gibelio*) is native to regions of Asia and central Europe and eastward to Siberia (Britton 2011). The Prussian carp's 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, Switzerland (Britton 2011), and recently in the Iberian Peninsula (Ribeiro *et al.* 2015). The Prussian carp is closely related and behaviorally similar to the crucian carp. Like the crucian carp, introduced Prussian carp may compete with native fish species, alter freshwater habitats, and serve as a vector for parasitic infections for native and aquaculture fish. Introduced populations of Prussian carp have decreased biodiversity and populations of native fish, invertebrates, and plants (Anseeuw *et al.* 2007, Lusk *et al.* 2010). A significant trait is that Prussian carp have a very rare mode of reproduction among fish. Introduced populations often include, or are solely composed of, naturally occurring triploid females that can undergo natural gynogenesis, allowing them to reproduce from unfertilized eggs (Vetemaa *et al.* 2005, Britton 2011). Thus, the eggs can hatch without being fertilized by male Prussian carp. In Greece, introduced Prussian carp have increased lake turbidity levels and intensively fed on zooplankton; thus, increasing the frequency of algal blooms and changing nutrient availability and cycling (Crivelli 1995). Increased turbidity and algal blooms reduce the aesthetic and recreational value of freshwater rivers and lakes (Pretty 2003). The Prussian carp was

recently documented for the first time in North America, established in southern Alberta, Canada (Elgin *et al.* 2014).

The roach (*Rutilus rutilus*) is native to regions of Europe and Asia (Kottelat and Freyhof 2007). The roach has been introduced and become established in Ireland, Italy, Madagascar, Morocco, Cyprus, Portugal, the Azores, Spain, and Australia (Rocabayera and Veiga 2012). Introduced roach compete with other species for food and habitat resources, hybridize with closely-related species, alter habitats and nutrient cycling, and transmit parasites and pathogenic bacteria. The roach is a highly adaptive species and will switch between habitats and food sources to best avoid predation and competition (Winfield and Winfield 1994). The pathogenic bacterium *Aeromonas salmonicida* infects the roach causing the disease furunculosis (Wiklund and Dalsgaard 1998). This disease causes skin ulcers and hemorrhaging and can be spread through a fish's open sore. The roach may spread the pathogen that causes this disease to both farmed and wild fish populations. If introduced, the roach may reduce native fish populations causing decreased wildlife diversity and economic damage to aquaculture, fisheries, and recreational resources.

The stone moroko (*Pseudorasbora parva*) is native to Asia including southern and central Japan, Taiwan, Korea, China, and the Amur River basin (Copp 2007). This fish species was first introduced in Europe (Romania) in the early 1960s. By 2000, this fish species had invaded nearly every European country and additional countries in Asia (Copp 2007). Introduced populations of the stone moroko affect native species through predation, competition, disease transmission, and altering freshwater ecosystems (Witkowski 2011). Both predation and competition can result in the decline of populations and decreased wildlife diversity. Additionally, the stone moroko is an unaffected vector of the pathogenic rosette-like agent *Sphaerothecum destruens* (Gozlan *et al.* 2005; Pinder *et al.* 2005). This agent is a documented pathogen of farmed and wild European fish. It causes spawning failure, organ failure, and death in some fish species (Gozlan *et al.* 2005). If introduced, the stone moroko may reduce wildlife diversity and damage aquaculture, fisheries, and recreational resources.

The Nile perch (*Lates niloticus*) is a very large fish with an average body length of 1 meter (3.3 feet), maximum length of 2 meters (m) (6.6 feet (ft)) (Ribbink 1987, Froese and Pauly 2014h), and maximum weight of 200 kilograms (441 pounds) (Ribbink 1987). The Nile perch is a predatory fish native to much of central, western, and eastern Africa (Witte 2013). The species is common in the Nile, Chad, Senegal, Volta, and Zaire River basins and brackish Lake Mariout near Alexandria, Egypt, on the Mediterranean coast (Azeroual *et al.* 2010, Witte 2013). This fish species was introduced into Lake Victoria in

Africa in an effort to improve the local fishery. Since this species' introduction in Lake Victoria, it has become the top predator in the system and subsequently comprised greater than 90 percent of demersal (bottom-dwelling) fish mass within this lake (Witte 2013). This fish is considered responsible for the decreased populations of native fish species (lungfish and catfish species) and the local extinction of at least 200 haplochromine cichlid fish species. The disappearance of many native fish species has drastically altered Lake Victoria's trophic level structure and biodiversity. These changes have resulted in increased lake eutrophication (excess nutrient load) and frequency of algal blooms (Witte 2013). The introduction and establishment of the Nile perch has been so devastating to the Lake Victoria ecosystem that the species has been named as one of the 100 "World's Worst" Invaders (Snoeks 2005, ISSG 2015). If introduced and established in the United States, the Nile perch would likely prey on native fish species (such as mudminnows, cyprinids, sunfish, and darters) and compete with larger native fish, such as largemouth bass (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*), as well as blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), and flathead catfish (*Pyodictis olivaris*). These native fish are integral components of freshwater ecosystems, and are also economically important to both commercial and recreational fisheries.

The Amur sleeper (*Perccottus glenii*) is native to the freshwater regions of northeastern China, northern North Korea, and the Far East of Russia (Reshetnikov and Schliewen 2013). The species is invasive in western Russia and 16 other countries: Mongolia, Belarus, Ukraine, Lithuania, Latvia, Estonia, Poland, Hungary, Romania, Slovakia, Serbia, Bulgaria, Moldova, Kazakhstan, Croatia, and recently Germany, where it is dispersing up the Danube River (Reshetnikov and Schliewen 2013). Introduction of the Amur sleeper could result in the decline of native invertebrate, amphibian, and fish species through competition and predation. Additionally, this fish species harbors parasites that can be transmitted to native and aquacultured fish species. Declining populations of native fish species could reduce wildlife diversity and reduce the visual, economic, and recreational benefits of native species and their natural habitat.

The European perch (*Perca fluviatilis*) is native to Europe (Snoeks 2010) and regions of Asia including Afghanistan, Armenia, Azerbaijan, Georgia, Iran, Kazakhstan, Mongolia, Turkey, and Uzbekistan (Froese and Pauly 2014k). This fish species has become established in Ireland, Italy, Spain, Australia, New Zealand, China, Turkey, Cyprus, Morocco, and South Africa (FAO 2014). The European perch competes with native fish species for both food and habitat resources (Closs *et al.* 2003) and is responsible for the local extinction of native fish in introduced areas (Snoeks 2010). Additionally, this fish species is capable of forming dense populations, which results in

stunted growth where food resources are limited (NSW DPI 2013). These perch are voracious predators, and in one instance, consumed 20,000 trout fry from an Australian reservoir in less than 72 hours (NSW DPI 2013). The European perch would likely compete with the yellow perch (*Perca flavescens*), a species native to the United States, for food and habitat. Additionally, the European perch could hybridize with yellow perch, 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 resulting in endangered classification and even extinction (Mooney and Cleland 2001). 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 2014p). The European perch also harbors the virus causing Epizootic Haematopoietic Necrosis (EHN), which can be spread to native fish stocks (NSW DPI 2013) and to aquaculture stocks. The European perch reduces native wildlife diversity and reduces the value of commercial and recreational fisheries through competition, predation, hybridization, and disease transmission.

The zander (*Sander lucioperca*) is native to the freshwater basins of the Caspian Sea, Baltic Sea, Black Sea, Aral Sea, North Sea, and Aegean Sea (Godard and Copp 2011). The zander is a native fish species in much of eastern Europe, the Scandinavian Peninsula, and regions of Asia. This fish species has been introduced and become established in part of Asia (China, Kyrgyzstan, and Turkey), Africa (Algeria, Morocco, Tunisia), and much of Europe (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 2014l). The zander has been introduced to the United States, and a small established population is present in Spiritwood Lake (North Dakota) (Fuller 2009). If the zander becomes established in other locales within the United States, the zander may reduce native fish populations through competition (Linfield and Rickards 1979), predation (Kangur and Kangur 1998, Jepsen *et al.* 2000, Koed *et al.* 2002), parasite transmission (Kvach and Mierzejewska 2011), and hybridization (Godard and Copp 2011, Fuller 2009). The parasites may also be transmitted to aquaculture fish. Declining populations of native fish species reduces wildlife diversity and the value of commercial and recreational fisheries.

The wels catfish (*Silurus glanis*) is a giant fish, commonly growing 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). Although the maximum reported age is 80 years (Kottelat and Freyhof 2007), the average lifespan of a wels catfish is 15 to 30 years. The wels catfish is native to eastern Europe and western Asia including the North Sea, Baltic Sea, Black Sea, Caspian Sea, and

Aral Sea basins (Rees 2012). This catfish species has been introduced and become established in China; the North African countries of Algeria, Syria, Tunisia; and the European countries of Belgium, Bosnia-Herzegovina, Croatia, Cyprus, Denmark, Finland, France, Italy, Portugal, Spain, and the United Kingdom (Rees 2012, Froese and Pauly 2014m). The introduction of wels catfish may reduce native fish populations through competition, predation, disease transmission, and altering the natural habitat. This catfish species has a voracious generalist diet extending to invertebrates, fish, crayfish, eels, small mammals, and birds (Copp *et al.* 2009). The wels catfish is a carrier of the virus that causes SVC and can transmit this fatal pathogen to native fish species (Hickey and Chare 2004) and to aquacultured fish. This catfish species also excretes large amounts of phosphorus and nitrogen to the freshwater habitat (Schaus *et al.* 1997, McIntyre *et al.* 2008) that can result in eutrophication, increased algal blooms, and decreased oxygen levels. Changes in water quality cannot only affect the health of native fish and mollusks, but also the value of commercial and recreational fisheries.

The common yabby (*Cherax destructor*) is a crayfish (related to and resembling a small lobster) native to regions of south and eastern Australia. This species has been introduced and become established in western Australia, Tasmania, China, South Africa, Zambia, Italy, Spain, and Switzerland (Gherardi 2012). The species can survive in temperatures from 1 °C (34 °F) to 35 °C (95 °F) as well as long periods of drought (Withnall 2000). Yabbies are capable of digging burrows up to 2 m (6.5 ft) deep (Withnall 2000). This burrowing behavior has resulted in increased erosion and collapse of dam walls for yabby farmers (Withnall 2000). The common yabby is also a known carrier of the parasite *Thelohania parastaci* which causes “chalky tail,” muscle deterioration, and host death (Moodie *et al.* 2003). If introduced to the United States, this crayfish species could spread pathogens among species of native crayfish, including the endangered Nashville crayfish (*Orconectes shoupi*) and to aquacultured crayfish. While the yabbies can accumulate heavy metal contaminants from polluted waters and may require consumption advisories (Gherardi 2010), these advisories are not expected to be any more stringent than those for crayfish species that are not considered injurious.

Alternative 2, which lists the species under the Lacey Act, avoids the ecosystem, agricultural, and infrastructure costs of the No Action alternative discussed above. The listing would add marginally to the work of wildlife inspection offices at United States ports of entry by increasing the number of species that need to be watched for and identified in incoming shipments. Federal wildlife enforcement agencies are authorized to enforce the interstate transport provisions of the Lacey Act and assist State law enforcement in the affected States. To the extent Federal wildlife enforcement agents

investigate, they may have added costs due to the listing. The listing would also add marginally to the Service's permit office workload with a potential increase of permit applications for scientific, educational, medical, and zoological purposes.

Of the 11 species, only one population of one species (zander) is found in the wild in the United States. Of the 11 species, four species (crucian carp, Nile perch, wels catfish, and common yabby) have been imported in 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 final rule would be negligible, if not nil. Thus, listing the 11 species under the Lacey Act would have little to no immediate effect on any entities. With this final rule, the Service is striving to be proactive without harming U.S. trade. A possibility exists that there will be a future desire by some importers to import one of these species. This listing would forestall that opportunity, but estimating those discounted future costs would be purely speculative. Based on our evaluation of the injurious traits of all 11 species, the objective of this listing is to prohibit importation and interstate transportation and thus prevent the species' likely introduction, establishment, and spread in the wild and harm to the interests of agriculture, wildlife, or wildlife resources.

Alternative 3 is based on an existing MOU between the Service, Pet Industry Joint Advisory Council, and the Association of Fish and Wildlife Agencies (USFWS 2013) but is not limited to the importers represented by the MOU. The alternative envisions a voluntary refrain by the public (such as leading importer organizations that represent the ornamental fish, aquaculture, sportfishing, bait, and other trades that might benefit from importing these species) from importing these 11 species. Voluntary cooperation to not import these species will not have any enforcement provisions or legal restraint on the public, industries, or members of the organizations. Voluntary cooperation may create a situation in which the first importer will have no competition as all of the other importers continue to comply. Therefore, the species could become less available on the market and, therefore, more profitable to import. If there is a large enough profit to be made, the market may eventually exploit this opportunity and import one or more of these species. Eventually other dealers will see the opportunity, the agreement may break down, and the species could be introduced to the United States. However, while some importers might realize some economic gain from importing one of these species, it is also likely that the importation could negatively affect their own industry in the long term. For example, the wels catfish may provide sportfishing opportunities but may cause declines in other recreationally important sportfish. Another species, the Nile perch, was introduced into Africa's Lake Victoria to provide larger fish for human consumption but is implicated in the loss of approximately 200 species of endemic fish

that local villagers utilized. The loss of these native fish resulted in the loss of income and food for traditional fishermen. The costs of Alternative 3 are likely to be smaller than those of Alternative 1 to the extent that the voluntary cooperation forestalls imports but have the potential to be similar to Alternative 1.

Expected Benefits of Alternatives

Information about these species in foreign countries indicates that some consumers could benefit economically from continuing to allow importation and interstate transport of these 11 species under the No Action alternative. Any benefits ultimately derive from consumer demand for the animal. In general, when consumers enjoy a product, they gain equal to or more utility from its use than they paid for it. Otherwise, they would have kept their money and bought something else. For example, people buying these species for display expect to enjoy having the display, garnering equal to or more utility from their ownership than their purchase price. The difference between the price they would be willing to pay and the price they need to pay for it is the “consumer surplus,” which is an element of expected benefits. The Service has no information to quantitatively estimate the consumer surplus that might be derived from allowing imports of these species for various purposes, including aquaculture, sportfishing, and ornamental display. Any such quantitative estimate would be purely speculative.

Producers (for example, importers, distributors, aquaculturists, and pet shops) could also benefit economically from continuing to allow importation and interstate transportation of these 11 species under the No Action alternative. The importation and interstate transport of new species could offer new sales opportunities and drive purchases of food, farm ponds and other enclosures, and ancillary equipment. Producers supplying these species could gain from their sale. The difference between the amount a producer is paid and the amount a producer would be willing to accept is the “producer surplus,” which is another element of the expected benefits. Again, the Service has no information on which to base a quantitative estimate of these benefits. Any such quantitative estimate would be purely speculative.

Some of the 11 species might be raised for food or introduced to water bodies to increase sportfishing opportunities. Trying to predict the benefits that might be derived from these uses would also be speculative. The evidence from introductions in Europe and Africa strongly suggest that any benefit to those who introduce the species is temporary and ultimately outweighed by impairment to indigenous stocks and habitat.

The benefits of the No Action alternative are lost by selecting either of the other alternatives. The loss of benefits from importation is an opportunity cost of Alternatives 2 and 3. By choosing one action, the opportunities afforded by another action are

eliminated. Alternative 2 prohibits importation and interstate transportation and so forestalls any of the benefits that could be derived from those activities. If we assume complete compliance with the voluntary constraints of Alternative 3, it also forestalls any benefits to importers.

Listing these species now, before U.S. industries begin trading in them, ensures that this listing has little or no effect on current economic conditions. In addition, the listing gives industries certainty about which species will be prohibited from importation and interstate transportation in the future.

Benefit-Cost Comparison

Table 2 summarizes the sources of costs and benefits of each alternative.

Table 2. Costs and Benefits of the Alternatives

Alternative	Costs	Benefits
1. No Action	<ul style="list-style-type: none"> • Harm to the interests of agriculture, wildlife, or wildlife resources. • Ongoing cost to control. • No certainty for industry 	<ul style="list-style-type: none"> • Consumer and producer surplus from potential importation and interstate transport of the 11 species.
2. Injurious Wildlife listing	<ul style="list-style-type: none"> • Possible future lost consumer or producer surplus from prohibiting importation and interstate transportation of the 11 species. • Possible added inspection costs. 	<ul style="list-style-type: none"> • Avoided harm to the interests of agriculture, wildlife, or wildlife resources. • Avoided cost to control or eradicate. • Certainty for industry.
3. Voluntary Cooperation	<ul style="list-style-type: none"> • Possible future lost consumer or producer surplus from prohibiting importation and interstate transportation of the 11 species. • Risk of introduction through non-compliance. • No certainty for industry 	<ul style="list-style-type: none"> • Possible avoided harm to the interests of agriculture, wildlife, or wildlife resources. • Possible avoided cost to control or eradicate.

Past experience with other aquatic invasive species, and with these species in other countries, has shown that the costs of damage to native wildlife and wildlife resources, habitat, agriculture, and infrastructure, far exceed the benefits of continuing to allow importation and interstate transport of these the species. The No Action alternative will ultimately have the highest costs and fewest benefits. The costs to prevent the establishment of an invasive species before it is introduced are minuscule compared to the costs to control and manage these species once they are established in U.S. environments. While purely voluntary cooperation may slow down and reduce the risk of introduction of the species to the environment, it creates an opportunity for individuals to profit by breaking away from the self-imposed restraint. We find it most likely that voluntary cooperation will not function perfectly and will eventually break down and lead to the importation of the injurious species. Only Alternative 2 offers low implementation costs and avoids the harmful effects of the species.

Regulatory Flexibility Analysis - Certification of No Impact on Small Entities

The Service has determined that the final rule will not have a significant economic impact on a substantial number of small entities. Seven of these species are not currently or recently in trade in the United States, so businesses do not derive any revenue from their sale. The total value of all live individuals of the four species that were imported from 2011 to 2015 was \$5,789 for approximately 6,500 individuals (exact number is not known because one shipment was by weight, not number of individuals) (LEMIS 2016). Therefore, this rule should have little or no economic impact on small businesses. The rule does not impose any additional reporting or record-keeping requirements.

Paperwork Reduction Act

None of the options under consideration have any reporting or recordkeeping requirements. Compliance will consist of not initiating importation or interstate transportation in the 11 species. Compliance, therefore, would not be unduly burdensome on small entities. Different application of the regulation to reduce the impact on small entities is unnecessary and would defeat the objective of the regulation. However, information about the listing and how to comply will be distributed on the Service's internet site and through the industry media.

Regulatory Conflict and Overlap

Several Federal programs are involved in the prevention of the introduction of invasive species into the United States. The objective of the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) is to protect the health of American agriculture. APHIS has the authority to regulate the imports affecting domesticated animals and crops. We provided a summary of this rule to APHIS during the development of the rule and we received no concerns. We also provided a summary to other agencies, such as the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the U.S. Coast Guard, which have some authorities with regard to aquatic invasive species, and we received no concerns. We contacted other agencies with related interests, including: Customs and Border Protection, Army Corps of Engineers, Small Business Administration, U.S. Forest Service, Environmental Protection Agency, Department of Homeland Security, and Council on Environmental Quality, as well as the Department of the Interior and various Interior bureaus, and we received no concerns.

States may also regulate the possession, sale, or use of species within their borders. The Service is not aware of any State authorities related to these 11 species that overlap or conflict with the Service's Lacey Act authority.

Need for a Final Rule

The threat posed by these 11 species is evident. These 11 nonnative species have a history of invasiveness elsewhere in the world and have a high climate match in parts of the United States. Although these 11 species are not currently found in ecosystems within the United States (except for one species in one lake), we anticipate that these species would become invasive if introduced and established. 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 Lacey Act, the Service has the ability to prevent the introduction, establishment, and spread of injurious wildlife that poses a threat to the interests of agriculture, wildlife, and wildlife resources of the United States by prohibiting the importation and interstate transportation of such wildlife. We find preventing the introduction, establishment, and spread of injurious wildlife within the United States by prohibiting importation and interstate transportation, consistent with the Lacey Act, to be the most economically effective and efficient approach for avoiding the adverse ecological effects and economic costs often caused by injurious species.

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