

## PETITION

**To: SALLY JEWELL, SECRETARY, U.S. DEPARTMENT OF THE INTERIOR**

**Petition: To Amend 50 CFR §16.13 to List 43 High Risk Fish, Crayfish, and Mollusk Species as Injurious Species under the Lacey Act**

**Submitted by:** Center for Invasive Species Prevention

**Date:** September 19, 2016

### PETITION

The Center for Invasive Species Prevention (CISP, see [www.cisp.us](http://www.cisp.us)) is a public interest non-profit organization that strives to advance policy and non-governmental approaches to prevent the introduction and spread of invasive species. We engage stakeholders; educate the public and decision-makers; and advocate for effective measures to government officials. One of our priorities is limiting the introduction of invasive animals.

#### Justification

Here CISP proposes that the Department of the Interior regulate 43 new species as “injurious” under the Lacey Act, 18 USC §42(a)(1). Over the last several years, the U.S. Fish and Wildlife Service (USFWS) itself has provided the detailed foundation for this proposal. The USFWS’s peer-reviewed Ecological Risk Screening Summaries (ERSS), posted on the bureau’s website at: [www.fws.gov/fisheries/ANS/erss\\_high\\_risk.html](http://www.fws.gov/fisheries/ANS/erss_high_risk.html), provide a synthesis of data on each of the species evaluated. Based on this synthesis the USFWS has determined that 63 total aquatic species pose a “high” overall risk of invasiveness.

These 63 include 46 species of fish, eight crustaceans and nine mollusks. One fish on the USFWS website (mrigal, *Cirrhinus cirrhosus*) appears to have been listed as “high risk” in error and one of the mollusks (zebra mussels, genus *Dreissena*) is already regulated as “injurious” under the Lacey Act, (50 CFR § 16.13(a)(2)(iii)). Also, the Department of the Interior already has formally proposed that eleven of the 63 species with ERSS’s linked on the website should be listed as “injurious”. That is, on September 30, 2015, the agency proposed to add ten non-native fish and one non-native crustacean species. They are not

included in this Petition; however, this Petition builds on, and is the logical next step after this, pending USFWS’ multi-species listing.<sup>1</sup>

The Proposed Amendment, below, provides the 43 “high risk” species that should be regulated. The ERSSs for these broke down their overall risk into three elements: a) the species’ history of invasiveness, b) how closely its climate tolerance matches the U.S. climate, and c) the level of certainty in the USFWS’ assessment. A total of 31 species with posted ERSSs (22 fish, four crustaceans and five mollusks) rate as “high risk” overall and were found to be “high risk” under all three elements.

Another group of twelve species rate “high risk” overall and “high risk” for the two elements other than the certainty of their risk assessment, which rated “medium.” These include: nine fish species, two crustaceans, and one mollusk. These species qualify for an “injurious” listing also based on their documented histories of invasiveness and how well they match the U.S. climate. They are also included herein.

This Petition excludes seven species with USFWS ERSSs that were rated “high: overall”, but were below a high rating for their history of invasiveness or climate match.<sup>2</sup> As a result, the 43 total species included here represent the highest range of the 63 “high risk” species.<sup>3</sup>

The specific justification for proposing the 43 High Risk species is provided in the USFWS’ own ERSS for each. The Appendix hereto provides a Summary of the invasion risk for these species, excerpted directly from each ERSS, to which the Appendix links. Based on the agency biologists’ findings they all clearly meet the Lacey Act criteria for listing as “injurious”.

While the voluntary program of non-importation promoted by the USFWS on its webpages associated with the ERSSs is a commendable hope, the program cannot be relied upon to be effective. Voluntary programs potentially can create a “perverse” incentive leading to the opposite of the hoped-for result. There are risks of enabling a “niche market” among non-complying industry members who do not agree with the voluntary restrictions. For example, past experience with voluntary “do not sell” lists for

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<sup>1</sup> The eleven USFWS-proposed species are: Crucian carp (*Carassius carassius*); Prussian carp (*Carassius gibelio*); Wels catfish (*Silurus glanis*); Eurasian minnow (*Phoxinus phoxinus*); Stone moroko (or topmouth gudgeon) (*Pseudorasbora parva*); European perch (*Perca fluviatilis*); Nile perch (*Lates niloticus*); Roach (*Rutilus rutilus*); Amur sleeper (*Perccottus glenii*); Zander (*Sander lucioperca*); and Yabby crayfish (*Cherax destructor*).

<sup>2</sup> The seven excluded species are: Banded tilapia (*Tilapia sparrmanii*); Tucunaré Amarela (*Cichla kelberi*) Vendace (*Coregonus albula*); Northern whitefish (*Coregonus peled*); Australian redclaw, (*Cherax quadricarinatus*) Giant African snail (*Achatina fulica*); and Wrinkled dune snail (*Candidula interseca*)<sup>33</sup> Several ERSSs have pages labeled “draft”; however this Petition does not exclude those ERSSs because those drafts, which are several years old, appear as complete and well-supported as others without that label.

nursery plant species shows they have in some cases had the opposite of their intended effects.<sup>3</sup>

Proactive regulation under the Lacey Act remains the chief effective tool for preventing harm from imports of high risk invasive wild animals. Indeed, the USFWS plainly invested a major amount of funds and staff time over several years to research and write the scores of posted ERSSs, following an elaborate peer-reviewed process, such that it would be a waste of agency resources were the USFWS not to follow through and take regulatory action for at least the clear high risk species.

The current absence of Federal controls over the importation of, and interstate commerce in, these 43 species has created excessive and unnecessary risk that they will enter, invade and spread within the United States. None of these species provide any essential economic or other benefits that outweighs their current or potential harm to the United States.

## **DEPARTMENT OF INTERIOR REGULATORY AUTHORITY**

The applicable authority rests with Interior’s USFWS under the Lacey Act, through its program of listing and regulating Injurious Wildlife, codified at 18 USC §42(a)(1). For listed taxa, the agency can prohibit:

*...importation into the United States, any territory of the United States, the District of Columbia, the Commonwealth of Puerto Rico, or any possession of the United States, or any shipment between the continental United States, the District of Columbia, Hawaii, the Commonwealth of Puerto Rico, or any possession of the United States.*

Such listings depend on a finding that the animal taxa is “injurious,” elaborated in the statute as (in pertinent part):

*...wild mammals, wild birds, fish (including mollusks and crustacea), amphibians, reptiles, ....which the Secretary of the Interior may prescribe by regulation to be injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States....*

### **Text of Proposed Amendment**

Pursuant to Section 553(e) of the Administrative Procedure Act, this Petition requests the

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<sup>3</sup> Caton, B.P. 2005. *Availability in Florida nurseries of invasive plants on a voluntary “do not sell” list*. Unpublished report by USDA APHIS Plant Protection and Quarantine, Center for Plant Health Science and Technology, Raleigh, North Carolina, USA.

Secretary of the Interior to adopt the following amendment to the USFWS regulation on injurious species at 50 CFR §16.13, (additions show in **redline**; note: the scientific and common names used are those used by USFWS on its website, above):

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

(a) Upon an exporter filing a written declaration with the District Director of Customs at the port of entry as required under § [14.61](#) of this chapter, live or dead fish, mollusks, and crustaceans, or parts thereof, or their gametes or fertilized eggs, may be imported, transported, and possessed in captivity without a permit except as follows:

(1) No such live fish, mollusks, crustacean, or any progeny or eggs thereof may be released into the wild except by the State wildlife conservation agency having jurisdiction over the area of release or by persons having prior written permission from such agency.

(2) The importation, transportation, or acquisition of any of the species listed in this paragraph is prohibited except as provided under the terms and conditions set forth in § [16.22](#):

(i) Live fish or viable eggs of walking catfish, family Clariidae.

(ii) Live mitten crabs, genus *Eriocheir*, or their viable eggs.

(iii) Live mollusks, veligers, or viable eggs of zebra mussels, genus *Dreissena* and:

(A) *Bithynia tentaculata* (faucet snail).

(B) *Corbicula fluminea* (Asian clam).

(C) *Dreissena rostriformis bugensis* (Quagga mussel).

(D) *Limnoperna fortune* (golden mussel).

(E) *Potamopyrgus antipodarum* (New Zealand mudsnail).

(F) *Sinanodonta woodiana* (Chinese pond mussel).

(iv) Any live fish or viable eggs of snakehead fishes of the genera *Channa* and *Parachanna* (or their generic synonyms of *Bostrychoides*, *Ophicephalus*, *Ophiocephalus*, and *Parophiocephalus*) of the Family Channidae, including but not limited to:

(A) *Channa amphibeus* (Chel or Borna snakehead).

(B) *Channa argus* (Northern or Amur snakehead).

(C) *Channa asiatica* (Chinese or Northern Green snakehead).

(D) *Channa aurantimaculata*.

(E) *Channa bankanensis* (Bangka snakehead).

(F) *Channa baramensis* (Baram snakehead).

- (G) *Channa barca* (barca or tiger snakehead).
- (H) *Channa bleheri* (rainbow or jewel snakehead).
- (I) *Channa cyanospilos* (bluespotted snakehead).
- (J) *Channa gachua* (dwarf, gaucha, or frog snakehead).
- (K) *Channa harcourtbutleri* (Inle snakehead).
- (L) *Channa lucius* (shiny or splendid snakehead).
- (M) *Channa maculata* (blotched snakehead).
- (N) *Channa marulius* (bullseye, murrel, Indian, great, or cobra snakehead).
- (O) *Channa maruloides* (emperor snakehead).
- (P) *Channa melanoptera*.
- (Q) *Channa melasoma* (black snakehead).
- (R) *Channa micropeltes* (giant, red, or redline snakehead).
- (S) *Channa nox*.
- (T) *Channa orientalis* (Ceylon or Ceylonese Green snakehead).
- (U) *Channa panaw*.
- (V) *Channa pleurophthalmus* (ocellated, spotted, or eyespot snakehead).
- (W) *Channa punctata* (dotted or spotted snakehead).
- (X) *Channa stewartii* (golden snakehead).
- (Y) *Channa striata* (chevron or striped snakehead).
- (Z) *Parachanna africana* (Niger or African snakehead).
- (AA) *Parachanna insignis* (Congo, square-spotted African or light African snakehead).
- (BB) *Parachanna obscura* (dark African, dusky, or square-spotted snakehead).

- (v) Any live fish, gametes, viable eggs, or hybrids of the following Asian carp species in family Cyprinidae:
  - (A) *Hypophthalmichthys harmandi* (largescale silver carp).
  - (B) *Hypophthalmichthys molitrix* (silver carp).
  - (C) *Hypophthalmichthys nobilis* (bighead carp).
  - (D) *Mylopharyngodon piceus* (black carp).

**New section**

(vi) Any live fish, gametes, viable eggs or hybrids of:

- (A) *Acanthogobius flavimanus* (yellowfin goby).
- (A) *Alburnus alburnus* (bleak).
- (B) *Alosa pseudoharengus* (alewife).
- (C) *Cichlasoma bimaculatum* (black acara).
- (D) *Coregonus lavaretus* (powan).
- (E) *Ctenopharyngodon idella* (grass carp).
- (F) *Cyprinella lutrensis* (red shiner).
- (H) *Cyprinus carpio* (common carp).

- (I) *Gymnocephalus cernua* (ruffe).
- (J) *Hypomesus nipponensis* (wakasagi).
- (K) *Ictalurus furcatus* (blue catfish).
- (L) *Misgurnus anguillicaudatus* (Oriental weatherfish).
- (M) *Morone americana* (white perch).
- (N) *Neogobius melanostomus* (round goby).
- (O) *Odontesthes bonariensis* (Argentinian silverside).
- (P) *Oreochromis aureus* (blue tilapia).
- (Q) *Oreochromis mossambicus* (Mozambique tilapia).
- (R) *Oreochromis niloticus* (Nile tilapia).
- (S) *Parachromis managuensis* (Jaguar guapote).
- (T) *Poecilia reticulata* (guppy).
- (U) *Pterois miles* (Devil firefish).
- (V) *Pterois volitans* (red lionfish).
- (W) *Pterygoplichthys pardalis* (Amazon sailfin catfish).
- (X) *Pterygoplichthys multiradiatus* (Orinoco sailfin catfish).
- (Y) *Pterygoplichthys disjunctivus* (vermiculated sailfin catfish).
- (Z) *Pylodictis olivaris* (flathead catfish).
- (AA) *Rhodeus ocellatus* (rose bitterling).
- (BB) *Sarotherodon melanotheron* (blackchin tilapia).
- (CC) *Scardinius erythrophthalmus* (rudd).
- (DD) *Tilapia mariae* (spotted tilapia).
- (EE) *Tilapia zillii* (redbelly tilapia); and

**New section**

- (vii)- Any live crayfish, gametes, viable eggs or hybrids of:
- (A) *Oronectes limosus* (spiny-cheek crayfish).
  - (B) *Oronectes propinquus* (northern clearwater crayfish).
  - (C) *Oronectes rusticus* (rusty crayfish).
  - (D) *Oronectes virilis* (virile crayfish).
  - (E) *Pacifastacus leniusculus* (signal crayfish).
  - (F) *Procambarus clarkia* (red swamp crayfish).

**CONCLUSION**

Robust regulatory protections aimed at conserving native fauna and healthy ecosystems in the United States are urgently called for. The Secretary should promptly ensure that the 43 species in this Petition are officially listed as “injurious” in 50 CFR §16.13.

Respectfully submitted,



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**Appendix USFWS Summaries of the Invasion Risk of the 43 Species in the Petition**

Note: the summary paragraphs are excerpted directly from each Ecological Risk Screening Summary (ERSS), at the links and pages given.

**MOLLUSKS (6 species)**

**Family Bithyniidae**

*Bithynia tentaculata* (faucet snail).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Bithynia-tentaculata-ERSS-revisionJuly2015.pdf> p. 9. Draft. February 2011; revised September 2014, July 2015.  
Accessed July 12, 2016.

The faucet snail, *Bithynia tentaculata*, has a broad native distribution across Europe. It has been introduced to the U.S. and is currently established at locations in the Great Lakes, Northeast, and West. It is a likely competitor with native mollusks and is known to foul water systems where introduced. *B. tentaculata* is a host for parasites that have been responsible for tens of thousands of waterfowl deaths in the Upper Mississippi River. Climate match is high for *B. tentaculata* in the contiguous U.S. Overall risk for this species is high.

**Family Corbiculidae**

*Corbicula fluminea* (Asian clam).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Corbicula-fluminea-ERSS-revisionJuly2015.pdf> p. 12. Draft. February 2011; reviewed September 2014, July 2015.  
Accessed July 12, 2016.

*C. fluminea* has become an established invasive species in many parts of the United States. With a very high climate match, the species has the potential to establish across the country.

The ease of spread, large numbers of offspring produced sexually or asexually, wide habitat tolerances, ability to outcompete native species, and potential to cause negative economic impacts make this a very high risk species.

### Family Dreissenidae

*Dreissena rostriformis bugensis* (quagga mussel).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Dreissena-rostriformis-bugensis-ERSSrevision-June2015.pdf> p. 13. Draft. February 2011; revised June 2015, June 2015. Accessed July 12, 2016.

Establishment and impacts in the United States are occurring. Spreading of this nonindigenous species is likely between watersheds, where transportation of boats and other watercraft is common. *D. rostriformis bugensis* can profoundly modify ecosystem characteristics through cascading effects of its water filtration behavior. Thick encrustations of mussels form on manmade structures or within raw water systems, affecting operation and efficiency. *D. bugensis* can have major detrimental impacts on recreational and commercial shipping/boating as well as on water-using industries, potable water treatment plants, and electric power stations. Major impacts have been reported for native species in the Great Lakes. Overall risk assessment is high.

### Family Hydrobiidae

*Potamopyrgus antipodarum* (New Zealand mudsnail).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Potamopyrgus-antipodarum-ERSSrevision-June2015.pdf> p. 12. Draft. February 2011; revised June 2015. Accessed July 13, 2016.

*P. antipodarum*, native to New Zealand, has been introduced to Europe, Asia, North America, and Australia. Its small size, ability to withstand desiccation and temperature variation, and parthenogenic reproduction facilitate its accidental introduction and establishment in new locations. The species can be found living in extremely high densities (tens of thousands per square meter) in some locations. Negative impacts have been documented on native macroinvertebrates, mollusks, and fish. Its impacts have been likened to those of the zebra mussel (*Dreissena polymorpha*). Climate match with the contiguous US is high. Overall risk for this species is high.

### Family Mytilidae

*Limnoperna fortunei* (golden mussel).

[https://www.fws.gov/fisheries/ANS/erss/highrisk/Limnoperna\\_fortunei\\_WEB-7-24-2014.pdf](https://www.fws.gov/fisheries/ANS/erss/highrisk/Limnoperna_fortunei_WEB-7-24-2014.pdf) p. 12. Web Version 7/24/2014. Accessed July 13, 2016.

*Limnoperna fortunei* is a euryhaline bivalve mussel native to China and southeast Asia. This species has not yet been reported in U.S. waters. However, it has caused significant environmental problems in South America, where it became established in 1991. This species was likely introduced through ballast water releases, and has spread rapidly through a large portion of South America. *Limnoperna fortunei* alters food webs and increases water clarity by filtering large quantities of plankton. This species clogs pipes and intake screens and fouls boats, nets, and other equipment. Impacts of *Limnoperna fortunei* are often compared to impacts of



*Dreissena polymorpha*, the zebra mussel. The climate match with the U.S. is high for this highly invasive species, leading to an overall risk rating of high.

### Family Unionidae

*Sinanodonta woodiana* (Chinese pond mussel).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Sinanodonta-woodiana-ERSS-revisionJuly2015.pdf> pp. 9-10. Draft. March 2011; revised July 2015. Accessed July 13, 2016.

*Sinanodonta woodiana*, a unionid mussel species from East Asia, has been introduced widely through transport with Asian carp species during the mussel's parasitic larval stage. This species is known to outcompete native mussels in life, and alter macroinvertebrate community structure with the presence of its empty shells in death. *S. woodiana* has already successfully established at one location in the US. Risk exists for additional introductions and establishment in the eastern and midwestern United States as climate match is high and this species spreads rapidly. Overall risk of this species is high.

### FISH (31 species)

#### Family Atherinopsidae

*Odontesthes bonariensis* (Argentinian silverside).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Odontesthes-bonariensis-WEB-7-142014.pdf> p. 8. Web Version 7/14/2014. Accessed July 12, 2016.

*Odontesthes bonariensis* is native to South America and has been implicated in the displacement of native fish species in areas outside of its native range. This species has been introduced to other areas of South America, as well as Italy, Israel, and Japan for aquaculture purposes. Though negative impacts from introductions have been reported, this species has had a positive impact on aquaculture and tourism in many places. It is unknown whether *Odontesthes bonariensis* would impact native fish if established in the United States; at this time negative impacts on fish have been limited to two genera in Lake Titicaca. This species is also known to alter plankton communities and water clarity. There are no reports of this species in the U.S. Climate match with the continental U.S. is high. The overall risk for this species is high.

#### Family Cichlidae

(A) *Cichlasoma bimaculatum* (black acara).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Cichlasoma-bimaculatum-WEB-10-1812.pdf> p. 8. Web Version 10/18/2012. Accessed July 12, 2016.

*C. bimaculatum* is established in Florida, spawns throughout the year, and competes for spawning habitat with native species of fish in south Florida drainage canals at trust resource sites including national parks, national preserves, and national wildlife refuges. *C. bimaculatum* is known to harbor and transmit bacterial pathogens that can cause a fatal disease (tuberculosis) among a wide variety of fish, as well as irritating skin lesions and pulmonary complications in humans (Gray et al. 1990, Howard et al. 1987, Landsell et al.

1993, Nigrelli et al. 1963, and Parisot et al. 1970). The overall risk of this species is considered high due its disease carrying aspects (See Sec. 2 and 8).

(B) *Oreochromis aureus* (blue tilapia).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Oreochromis-aureus-ERSS-revision-July2015-with-GCC-projections.pdf> p. 12. Draft. April 2011; revised July 2014, July 2015. Accessed July 12, 2016.

*O. aureus* has been transported around the world because of its high value for fisheries and aquaculture. It is a particularly cold-tolerant species of tilapia, and climate match with the contiguous U.S. is high. Although *O. aureus* is primarily a planktivore, its diet is highly adjustable to available food sources. This species carries with it several potential threats to native species including resource competition, hybridization, and disease, and it has been implicated in declines of native fish and mollusks. Overall risk posed by this species is high.

(C) *Oreochromis mossambicus* (Mozambique tilapia).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Oreochromis-mossambicus-ERSS-revisionJuly-2015.pdf> pp. 13-14. Draft. April 2011; revised August 2014, July 2015. Accessed July 12, 2016.

*O. mossambicus* has a truly circumglobal distribution currently thanks to its high value to humans for commercial and recreational fishing, aquaculture, the aquarium trade, mosquito and macrophyte control, and biological research. Where *O. mossambicus* has been introduced outside its native range in southeastern Africa, numerous impacts have been documented on native fish and macrophytes.

In addition to impacts of herbivory, competition, and predation, *O. mossambicus* is susceptible to numerous parasitic, bacterial, and viral diseases which could be transmitted to native fish populations. Climate match to the contiguous U.S. is high. Overall risk of this species is high.

(D) *Oreochromis niloticus* (Nile tilapia).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Oreochromis-niloticus-ERSS-revision-July2015.pdf> pp. 13-14. Draft. April 2011; revised August 2014, July 2015. Accessed July 12, 2016.

*O. niloticus* has been transported around the world because of its high value for fisheries and aquaculture. Climate match to the contiguous U.S. is high. The species has already established wild populations in Florida, Alabama, and Mississippi, with the climate match suggesting highest risk of further establishment in the Southeast and California. Impacts of *O. niloticus* in its introduced range include eutrophication of water bodies through its influences on the plankton community, competition with native fishes, hybridization, and in some cases, reduced fishing success. Overall risk posed by this species is high.

(E) *Parachromis managuensis* (jaguar guapote).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Parachromis-managuensis-ERSS-revisionJuly-2015.pdf> pp. 10-11. Draft. February 2011; revised July 2014, July 2015. Accessed July 12, 2016.

*Parachromis managuensis* has shown an ability to establish populations within the U.S. Although the impacts of this species in the U.S. are not well-studied, *P. managuensis* has been associated with declines of native fish species in multiple locations globally. The climate match analysis, which indicates that the contiguous U.S. is a high match for *P. managuensis* is slightly misleading. Both of the locations where *P. managuensis* became

established in the West (Utah and Nevada) were private ponds, and cold winter temperatures limited dispersal outside of these ponds (Nico et al. 2015). Therefore, it is likely that the climate in the West is not as highly suitable as the climate match would suggest. Nevertheless, the potential for the species to spread in the South and especially Florida is a very real threat. The overall risk posed by this species is high.

(F) *Sarotherodon melanotheron* (blackchin tilapia).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Sarotherodon-melanotheron-WEB-10-0112.pdf> p. 12. Web Version 10/1/2012. Accessed July 12, 2016.

USGS.gov describes *S. melanotheron* as spreading rapidly and transferring diseases to other fishes. FishBase.org lists *S. melanotheron* as a Potential Pest, and the United Nations (2010) lists it as having adverse ecological impacts. Additional sources specific to the invasiveness of *S. melanotheron* could not be found, but many other tilapia species have been described as highly invasive (see “Description of impacts”).

(G) *Tilapia mariae* (spotted tilapia).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Tilapia-mariae-WEB-10-1-12.pdf> p. 11. Web Version October 1, 2012. Accessed July 12, 2016.

*T. mariae* is established in several U.S. states. A multitude of sources report negative impacts of its introduction in multiple locations. (See “Description of Impacts.”) This fish species is currently expanding its range where it can. Areas of high to medium climate match have a significant risk of invasion.

(H) *Tilapia zillii* (redbelly tilapia).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Tilapia-zillii-WEB-8-21-2014.pdf> p. 12. Web Version 8/21/2014. Accessed July 12, 2016.

[*Tilapia zillii*] is a freshwater and brackish water species native to Africa and Eurasia. This species is used for aquaculture, mosquito control, and weed control; introductions sometimes result from pond escapes. This species has established in over 30 countries outside of its native range, including the United States. *Tilapia zillii* feeds heavily on macrophytes, sometimes completely eliminating them from the system. This can lead to reductions in the abundance of native fishes due to lack of food, cover, and spawning habitat. The condition of the endangered Killifish is likely impacted by the introduction of *Tilapia zillii*. Climate match for the contiguous U.S. is high, especially in the southern half of the country. Overall risk for this species is high.

## Family Clupeidae

*Alosa pseudoharengus* (alewife). <https://www.fws.gov/fisheries/ANS/erss/highrisk/Alosa-pseudoharengus-WEB-8-182014.pdf> p. 12. Web Version 8/18/2014. Accessed July 12, 2016.

*Alosa pseudoharengus* is a marine and freshwater fish native to the Atlantic coast of North America and associated streams and rivers. This species has spread to the Great Lakes and various states through man-made channels and stocking. Climate match with the contiguous U.S. is high. *Alosa pseudoharengus* is an efficient zooplanktivore, and causes changes in the zooplankton community. Those changes can cause declines in native fishes, especially planktivorous salmonids. This species also consumes pelagic larvae of native fishes. Salmonids that consume *Alosa pseudoharengus* are at risk of a thiamine deficiency in their offspring. This species is prone to mass die-offs which are a nuisance for lakeshore property owners and the recreation industry. Overall risk for this species is high.

## Family Cobitidae

*Misgurnus anguillicaudatus* (Oriental weatherfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Misgurnus-anguillicaudatus-WEB-8-2112.pdf> pp. 9-10. Web Version 8/21/2012. Accessed July 12, 2016.

*M. anguillicaudatus* has been established in the US and many other countries worldwide and is continually expanding. There is a high risk of additional introductions, establishment, and impacts in other areas because this species is highly adaptable, quick to reproduce, and is extremely popular in the aquaculture and aquarium industry. Multiple authors have found that this species has caused reductions in macroinvertebrate populations, altered aquatic habitats, and are vectors for certain fish parasites. Due to the impacts from introduction of this species into Australia, importation of this species was banned in 1986. Climate match with the US is high, with very high readings surrounding the Great Lakes.

## Family Cyprinidae

(A) *Alburnus alburnus* (bleak).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Alburnus-alburnus-WEB-7-21-2014.pdf> p. 10. Web Version 7/21/2014. Accessed July 12, 2016.

*Alburnus alburnus* is a freshwater and brackish water fish native to areas of Europe and Asia. This species has established populations in several countries outside of its native range including Spain, Italy, and Cyprus. The spread of this species has been facilitated by stream modifications and by intentional transportation to new areas for use as bait or forage fish for non-native sport fish. This species can form high-density shoals. In some areas this species is competing with native fish for resources, causing increased algal biomass, and hybridizing with native fish, giving this species a high rating for invasiveness. Climate match with the U.S. is high, especially in the Great Lakes area. The overall risk for this species is high.

(B) *Ctenopharyngodon idella* (grass carp).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Ctenopharyngodon-idella-WEB-8-11-2014.pdf>

p. 15. Web Version 8/11/2014. Accessed July 12, 2016.

*Ctenopharyngodon idella* is a freshwater fish native to the Amur River system in Asia. This species consumes aquatic plants and invertebrates. It is commonly used for aquaculture and for weed control. *Ctenopharyngodon idella* has established in the United States and Europe, where it causes a variety of impacts. This species removes aquatic vegetation, causing changes in the food web and in the physical habitat of an ecosystem. This species promotes algal blooms and might compete with native species for food. *Ctenopharyngodon idella* also carries several diseases. Climate match with the contiguous U.S. is high, especially in the Mississippi River basin. Overall risk for this species is high.

(C) *Cyprinella lutrensis* (red shiner).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Cyprinella-lutrensis-WEB-8-4-2014.pdf> p.13. Web Version 8/4/2014. Accessed July 12, 2016.

*Cyprinella lutrensis* is a freshwater fish native to the central U.S. and northern Mexico. Introductions

to other areas throughout the United States are occurring via bait fish movement, aquarium releases, and fish movement through watersheds. Red Shiners are known to displace native species, as well as dilute the gene pool for native shiners via hybridization. Climate match with the contiguous U.S. is high. Overall risk for this species is high.

(D) *Cyprinus carpio* (common carp).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Cyprinus-carpio-WEB-09-10-2014.pdf> p. 16. Web Version 9/10/2014. Accessed July 12, 2016.

*Cyprinus carpio* is a freshwater and brackish water fish native to the Caspian, Black, and Aral Sea basins. This species is now established in locations worldwide, including the U.S. Only Alaska has not had a documented introduction of this species, and the species has established in all other states except Maine. *Cyprinus carpio* is used for aquaculture, commercial fisheries, aquaria, and bait, which has promoted its spread. Negative impacts of this species are well-studied. The primary impacts of this species are habitat modification and reduction of the abundance of macrophytes and macroinvertebrates. When foraging for benthic organisms, this species uproots macrophytes and disturbs sediments. The resultant increase in turbidity and phosphorus loading promotes algal blooms, degrades water quality, prevents growth of macrophytes, and possibly causes effects on higher organisms. This species has also been implicated in the decline of native fish due to competition and egg predation. *Cyprinus carpio* is also a known carrier of OIE reportable diseases. Climate match with the contiguous U.S. is high. Overall risk for this species is high.

(E) *Rhodeus ocellatus* (rose bitterling).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Rhodeus-ocellatus-WEB-10-01-12.pdf> p. 7. Web Version 10/1/2012. Accessed July 11, 2016.

*R. ocellatus* is native to parts of Southeast Asia, but has been introduced to other parts of Asia through accidental means. The introduction of this species into Japanese waters has led to the near extinction of a Japanese sub-species of *R. ocellatus* due to hybridization and competition. This species has not been introduced in the United States [sic] Climate match with the United States is high, especially in the Southeast.

(F) *Scardinius erythrophthalmus* (rudd).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Scardinius-erythrophthalmus-ERSSrevision-June-2015.pdf> p. 11. Draft. February 2011; revised June 2015. Accessed July 12, 2016.

Establishment of *S. erythrophthalmus* is occurring in the United States, Canada, and Eurasia. Climate match is high, so there is a high likelihood that *S. erythrophthalmus* will establish itself in new waterways, if allowed to invade them. The species is known to change macrophyte communities through selective grazing, which has sometimes contributed to regime shifts in the lakes it has invaded. Overall risk for this species is high.

## Family Gobiidae

(A) *Acanthogobius flavimanus* (yellowfin goby).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Acanthogobius-flavimanus-WEB-8-192014.pdf> p. 10. Web Version 8/19/2014. Accessed July 12, 2016.

*Acanthogobius flavimanus* is a marine and freshwater fish native to eastern Asia. This species has been introduced to Australia, Mexico, and the United States. *Acanthogobius flavimanus* has established populations in estuaries in California. The main impact of these newly

established populations is competition with native sculpins and the endangered Tidewater Goby, which has led to reduced abundance and extirpations. This species has a high climate match with the contiguous U.S. Overall risk for this species is high.

(B) *Neogobius melanostomus* (round goby).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Neogobius-melanostomus-WEB-8-82014.pdf> p. 13. Web Version 8/8/2014. Accessed July 12, 2016.

*Neogobius melanostomus* is a euryhaline fish native to the Sea of Azov, Black Sea, and Caspian basins. This species has been introduced to multiple countries, including the United States. This species has established in the Midwest and Northeast, and there is evidence of negative impacts. *Neogobius melanostomus* has become an important part of the food web in the Great

Lakes to the advantage of some native species, but also at the expense of others. Several documents indicate that *Neogobius melanostomus* has a significant diet overlap with native fishes, which could indicate competition for food. This species feeds on fry and eggs of important sport fishes such as Smallmouth Bass. This species is also known to disrupt the spawning of native sculpins. Native fish abundance has decreased following invasion by *Neogobius melanostomus*. Climate match with the contiguous U.S. is high. The overall risk for this species is high.

**Family Ictaluridae**

(A) *Ictalurus furcatus* (blue catfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Ictalurus-furcatus-WEB-8-1-2014.pdf> p.12. Web Version 8/1/2014. Accessed July 12, 2016.

*Ictalurus furcatus* is a freshwater and brackish water fish native to portions of the Mississippi River basin, Texas, and Mexico. Stocking, aquaculture, and migration have all contributed to the spread of this species throughout much of the southern half of the U.S. Impacts such as hybridization with native species, reduction of native fish abundance, and alteration of local habitats have been reported for this species. The high climate match, ability to reproduce rapidly, and generalist diet all contribute to making this species one of concern for the contiguous U.S. The overall risk for this species is high.

(B) *Pylodictis olivaris* (flathead catfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Pylodictis-olivaris-WEB-9-3-2014.pdf> p. 13. Web Version 9/3/2014. Accessed July 12, 2016.

*Pylodictis olivaris* is a freshwater fish native to the lower Great Lakes and the Mississippi River basin. This species has been introduced throughout much of the U.S. for sportfishing. Climate match with the contiguous U.S. is high. There is a good deal of evidence that this species reduces native fish abundance where introduced, and this species is widely considered to be invasive. The overall risk for this species is high.

**Family Loricariidae**

(A) *Pterygoplichthys disjunctivus* (vermiculated sailfin catfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Pterygoplichthys-disjunctivus-WEB-8-2-2014.pdf>

p. 11. Web Version 9/2/2014. Accessed July 12, 2016.

*Pterygoplichthys disjunctivus* is a freshwater fish native to the Madeira River basin in South America. This species has spread to several non-native countries including the U.S., where it has established populations in Florida, Texas, Mississippi, North Carolina, and Nevada. It is popular in the aquarium trade and was likely released by aquarists. While ecological impacts are mostly unknown, several sources describe negative, or potentially negative impacts. These include increased siltation, bank erosion, competition with native species for food, destruction of fishing gear, and disruption of endangered species. *Pterygoplichthys disjunctivus* and other members of the genus *Pterygoplichthys* are described by many sources as highly invasive. This species has a high climate match with the contiguous U.S. Overall risk for this species is high.

(B) *Pterygoplichthys multiradiatus* (Orinoco sailfin catfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Pterygoplichthys-multiradiatus-WEB-8-2812.pdf> p. 9. Web Version 8/28/12. Accessed July 12, 2016.

*P. multiradiatus* is established in several U.S. locations. While ecological impacts in these locations are largely unknown, other types of negative impacts have occurred, including siltation and erosion due to tunneling by males (Nico et al. 2012). Furthermore, negative ecological impacts have been described in other invasive locations like India and the Philippines (Krishnakumar et al. 2009).

(C) *Pterygoplichthys pardalis* (Amazon sailfin catfish).

[https://www.fws.gov/fisheries/ANS/erss/highrisk/Pterygoplichthys\\_pardalis\\_WEB\\_8-2912.pdf](https://www.fws.gov/fisheries/ANS/erss/highrisk/Pterygoplichthys_pardalis_WEB_8-2912.pdf) p. 8. Web Version 8/29/12. Accessed July 12, 2016.

While ecological impacts are still not fully understood, several sources describe this species as highly invasive and potentially causing negative impacts. Other types of negative impacts were also described, like increased sedimentation and siltation (Nico et al. 2009). This species is also currently established in the U.S. and has a high climate match.

## Family Moronidae

*Morone americana* (white perch).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Morone-americana-WEB-7-30-2014.pdf> p. 14. Web Version 7/30/2014. Accessed July 12, 2016.

*Morone americana* is a euryhaline fish native to the East Coast of the U.S. and Canada. This species has spread to other areas east of the Rocky Mountains by bait fish release and fish movement through watersheds. Several types of impacts have been documented for this species. Fish eggs are an important part of the diet of *Morone americana*; egg predation on Walleye eggs has been implicated in the decline of at least one Walleye fishery. *Morone americana* is believed to be competing with native Yellow Perch, Black Bullhead, and several forage fish species as their diets overlap. considerable growth rate decreases have been seen in native fishes. Hybridization between *Morone americana* and several native species is occurring in the U.S. Climate match with the contiguous U.S. is high, with most likely habitat east of the Rocky Mountains. The overall risk for this species is high.

## Family Osmeridae

*Hypomesus nipponensis* (wakasagi).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Hypomesus-nipponensis-WEB-7-312014.pdf> p. 9. Web Version 7/31/2014. Accessed July 12, 2016.

*Hypomesus nipponensis* is a freshwater and brackish water fish native to Japan. This species consumes plankton and invertebrates. *Hypomesus nipponensis* is spread from its original stocking locations in California and is now well established throughout northern California. This species has a high climate match with the US, with many areas of high and medium climate match across the country. There are a few descriptions of negative impacts due to its introduction, including its hybridization with the endangered delta smelt (*Hypomesus transpacificus*). Trenham et al. (1998) confirmed the occurrence of hybridization, but failed to find any resulting negative impacts to the delta smelt population. Therefore, the use of this hybridization as support for *Hypomesus nipponensis*'s history of invasiveness is questionable. Dill and Cordone (1997) found that *Hypomesus nipponensis* negatively impacted kokanee salmon and threadfin shad. Based on this impact and the potential risk to an endangered species, the invasiveness of this species is high. The overall risk for this species is high.

### Family Percidae

*Gymnocephalus cernua* (ruffe).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Gymnocephalus-cernua-ERSS-revisionJune%202015.pdf> pp. 10-11. Draft. February 2011; revised July 2014, June 2015. Accessed July 12, 2016.

Establishment and impacts of *G. cernua* in the Great Lakes region are occurring. There is high risk of additional introduction, establishment and impacts in other areas throughout the US by bait fish movement and fish movement through watersheds and flooding. The ruffe is very adaptable and is an extremely aggressive feeder, reducing populations of forage fish consumed by native piscivorous fishes. Consequences have been seen in fish populations in a number of locations across the globe due to the ruffe. Climate match with the contiguous US is high. The overall risk for this species is high.

### Family Poeciliidae

*Poecilia reticulata* (guppy). <https://www.fws.gov/fisheries/ANS/erss/highrisk/Poecilia-reticulata-ERSS-revision-July2015.pdf> pp. 10-11. Draft. March 2011; revised July 2015.

Accessed July 12, 2016. *Poecilia reticulata* is a popular fish for aquaria and for research, and was originally introduced to many countries as a method of mosquito control. Where introduced, *P. reticulata* has been documented to have adverse impacts on native fishes and invertebrates through competition, predation, and disease. *P. reticulata* is currently established in the western U.S., where it has been implicated in the decline of White River springfish (*Crenichthys baileyi*) and Utah sucker (*Catostomus ardens*). Climate match to the continental U.S. is high, with highest matches in Florida and the West. Overall risk posed by this species is high.

### Family Salmonidae

*Coregonus lavaretus* (powan). <https://www.fws.gov/fisheries/ANS/erss/highrisk/Coregonus-lavaretus-ERSS-revision-July2015.pdf> pp. 8-9. Draft. August 2012; revised September 2014, July 2015. Accessed July 14, 2016.

*C. lavaretus* is a salmonid fish species native to Europe. Introductions to counties outside its native range have resulted in negative impacts for native species. The species is one of the most widely introduced fish species in northern Europe and has partially or completely



displaced many native Arctic charr (*Salvelinus alpinus*) populations. Foraging by introduced *C. lavaretus* can change the structure of the zooplankton community. *C. lavaretus* is also a carrier of viral haemorrhagic septicaemia, an OIE-reportable disease. Climate match with the contiguous U.S. is high with highest matches occurring in the Great Lakes. Overall risk for this species is high.

### Family Scorpaenidae

(A) *Pterois miles* (devil firefish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Pterois-miles-WEB-7-28-2014.pdf> p. 12. Web Version 7/28/2014. Accessed July 12, 2016.

*Pterois miles* is a marine species native to the Indian Ocean. It is found from the Red Sea south to Port Alfred, South Africa and east to Sumatra, Indonesia. *Pterois miles* lives in coastal waters in muddy habitats. It feeds on fish. *Pterois miles* has fin spines which are venomous and may cause human death. This species has spread to the Atlantic Ocean and the eastern Mediterranean. Introductions for the species have also been reported in the United States, and have resulted in established populations. Those introductions have also facilitated the spread of the species to Bermuda, Jamaica and Puerto Rico. Impacts from those introductions include reduced populations of prey fish, reduction in recruitment of endemic species, exponential population growth of *Pterois miles* and deleterious changes in coral-reef communities. Climate match with the United States is high, with the entire Atlantic and Gulf of Mexico Coasts likely habitat. No further research is needed to understand the negative impacts from introductions of this species. Certainty of this assessment is high. Overall risk posed by this species is high.

(B) *Pterois volitans* (red lion fish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Pterois-volitans-WEB-7-28-2014.pdf> p. 12. Web Version 7/28/2014. Accessed July 12, 2016.

*Pterois volitans* is a marine species native to the Indo-Pacific. It is found from the Cocos-Keeling Islands and Western Australia in the eastern Indian Ocean to the Marquesas and Oeno (Pitcairn group), north to southern Japan and southern Korea, south to Lord Howe Island, northern New Zealand, and the Austral Island. *Pterois volitans* inhabit lagoon and seaward reefs from turbid inshore areas to depths of 50 m. Often solitary, they hide in unexposed places at daytime often with head down and practically immobile. Pelagic juveniles expatriate over great distances and the reason for their broad geographical range. The species hunt small fishes, shrimps, and crabs at night, using its widespread pectorals trapping prey into a corner, stunning it and then swallowing it in one sweep. *Pterois volitans* has fin spines which are venomous and it may cause ciguatera fish poisoning. Introductions of this species to the United States have resulted in established populations. Those introductions have also resulted in the spread of the species to numerous other locations both north and south. Impacts from those introductions include reduced populations of prey fish, reduction in recruitment of endemic species and deleterious changes in coral-reef communities. Climate match with the contiguous United States is high, with the Atlantic and Gulf of Mexico coasts likely habitat. Overall risk posed by this species is high.

**CRUSTACEANS (6 species)****Family Astacidae**

*Pacifastacus leniusculus* (signal crayfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Pacifastacus-leniusculus-ERSS-revisionJune2015.pdf> p. 10. Draft. February 2011; revised June 2015. Accessed July 13, 2016.

Native to the Pacific Northwest, *P. leniusculus* [sic] has established itself in new areas of the US, Europe, and Japan. Its invasion has led to the decline of native crayfish species, both through competition and as a vector of crayfish plague. This crayfish also alters native habitats, reduces abundances of macroinvertebrates and macrophytes, and influences the behavior of native fish. High climate matches in a good portion of the US increase the risk. Overall risk for this species is high.

**Family Cambaridae**

(A) *Orconectes limosus* (spiny-cheek crayfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Orconectes-limosus-ERSS-revision-June2015.pdf> p. 8, Draft. April 2014; revised June 2015. Accessed July 14, 2016.

*O. limosus* is a freshwater crayfish native to the northeastern United States. This species has established itself in Europe where it is rapidly spreading and considered an invasive species. It has reportedly had significant impact on the native crayfish where introduced, as well as on at least one fish species. It is a carrier of the crayfish plague and susceptible to white spot disease, and it can reproduce by parthenogenesis. Climate match with the United States is high, with much of the United States east of the Mississippi River predicted to be good habitat for this species. Overall risk posed by this species is high.

(B) *Orconectes propinquus* (northern clearwater crayfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Orconectes-propinquus-ERSS-June2015.pdf> p. 8. Draft. June 2015. Accessed July 13, 2016.

*Orconectes propinquus* is a crayfish species native to the Midwest and Northeast US. It is threatened over parts of its native range by the invasion of rusty crayfish, *O. rusticus*, but some research suggests that *O. propinquus* itself has negative impacts on non-native ecosystems. Where *O. propinquus* has been introduced into lakes in northern Wisconsin and the upper peninsula of Michigan, macrophytes and native crayfish have declined. In 2010, established populations of *O. propinquus* were discovered in Colorado; no studies have been published yet on the potential impacts of the species in this location so far outside its native range. Climate match for the contiguous US is high. Overall risk for this species is high, with medium certainty.

(C) *Orconectes rusticus* (rusty crayfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Orconectes-rusticus-ERSS-revisionJune2015.pdf> pp. 11-12. Draft. February 2011; revised September 2014, May 2015. Accessed July 13, 2016.

Establishment and impacts in the Midwest, Northeast, and few locations in Western United States are occurring. There is high risk of additional introduction, establishments and impacts in other areas throughout the United States through bait bucket introductions or

range expansion. There are documented instances of *O. rusticus* displacing native crayfish species and lowering the abundance and diversity in aquatic vegetation and invertebrates in areas they invade. In at least some cases, ecosystems are unable to recover from the effects of *O. rusticus* even after its population is reduced. The species is reported to be somewhat salinity tolerant. It could impact estuarine environments. Climate match with the United States is high. Overall assessment for this species is high.

(D) *Orconectes virilis* (virile crayfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Orconectes-virilis-ERSS-revisionJune2015.pdf> p. 10. Draft. February 2011; revised June 2015. Accessed July 13, 2016. *Orconectes virilis* is a crayfish native to the northern US that has been introduced to other parts of the contiguous US, Mexico, and Europe. Its introductions have resulted in declines of native macrophytes, macroinvertebrates, and fish. The species is known to carry and/or be susceptible to two OIE-reportable diseases. High climate match and history of invasiveness argues for a high risk of spread and impact of this species. Overall risk is high.

(E) *Procambarus clarkia* (red swamp crayfish).

<https://www.fws.gov/fisheries/ANS/erss/highrisk/Procambarus-clarkii-ERSS-revisionMay2015.pdf> p. 12. Draft. February 2011; revised May 2015. Accessed July 14, 2016.

*P. clarkii* is known to outcompete native crayfish and rapidly take over habitat where it invades. It is an agricultural pest and has been shown to reduce populations of native macrophytes, amphibians, mollusks, macroinvertebrates, and fish. Furthermore, it alters the ecosystem it inhabits, changing water quality and sediment characteristics. *P. clarkia* is a vector for multiple OIE-reportable diseases. In the US, this species is an extremely popular food item, and has escaped from aquaculture in many areas. Climate match is high for every state in the contiguous US, and as this species is known to have adverse impacts, the overall risk is high.