Crucian Carp *(Carassius carassius)*
Ecological Risk Screening Summary

Web Version – September 2014


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1 Native Range and Nonindigenous Occurrences

Native Range
From Schofield et al. (2011):

"Europe and Siberia (Raicu et al. 1981 [cited by Schofield et al. (2011) but not accessed for this report])."

Status in the United States
From Schofield et al. (2011):

"Crucian carp were reported as thriving in the lagoons and parks of Chicago, Illinois, in the early 1900s (Meek and Hildebrand 1910 [cited by Schofield et al. (2011) but not accessed for this report]). However, a more recent work on Illinois fishes (Smith 1979 [cited by Schofield et al. (2011) but not accessed for this report]) suggested this population disappeared long ago."

Means of Introductions to the United States
Unknown

Remarks
From Schofield et al. (2011):

"There are no recent reports of crucian carp in the U.S. An earlier report that either the crucian carp or a hybrid (with goldfish [*Carassius auratus*]) had been introduced into Texas (Howells 1992, Fuller et al. 1999 [cited by Schofield et al. (2011) but not accessed for this report]) is now considered unlikely. The introduction and status of this species remains uncertain."

"Because of this species' similarity to goldfish, and because of possible hybridization, characters may overlap and positive identification may be difficult. Similar to the goldfish, the crucian carp is known to hybridize with the common carp *Cyprinus carpio* (Berg 1964, Muus and Dahlstrom 1978, Wheeler 1978 [cited by Schofield et al. (2011) but not accessed for this report])."

"Eddy and Underhill (1974 [cited by Schofield et al. (2011) but not accessed for this report]) reported that both the goldfish and the crucian carp had been introduced into the United States, but they provided no additional details concerning the latter species. Welcomme (1988) reported that *C. carassius* was established in Chicago in the 1900s but later died out; however, he did not provide documentation for that record and we have found no additional information to support it."

"There is some confusion in the literature surrounding the use of the names crucian carp and Prussian carp. Lever (1996 [cited by Schofield et al. (2011) but not accessed for this report]) listed Prussian carp as an alternative or local vernacular name sometimes used for the crucian carp; however, Berg (1964) and most others use the name Prussian carp for *Carassius auratus gibelio*. In the 1800s, Baird witnessed fish taken out of the Hudson River, New York; Baird later wrote that these fish appeared to be "hybrids between goldfish and the Prussian carp" (Redding 1884 [cited by Schofield et al. (2011) but not accessed for this report]). In that instance, it is not certain as to which species Baird is referring to in using the term Prussian carp. Cole (1905 [cited by Schofield et al. (2011) but not accessed for this report]) quoted from one of Baird's reports, in which Prussian carp is treated as synonymous with *Cyprinus carassius* (=*Carassius carassius*?)."

2 Biology and Ecology

Taxonomic Hierarchy

From ITIS (2011):

"Kingdom Animalia
  Phylum Chordata
    Subphylum Vertebrata
      Superclass Osteichthyes
        Class Actinopterygii
          Subclass Neopterygii
            Infraclass Teleostei
              Superorder Ostariophysi
                Order Cypriniformes

Superfamily Cyprinoidea
Family Cyprinidae
Genus Carassius Nilsson, 1832 -- Crucian carps
Species Carassius carassius (Linnaeus, 1758) -- crucian carp

Taxonomic Status: valid"

Size, Weight, Age [Longevity]

From Froese and Pauly (2011):

"Max length : 64.0 cm TL male/unsexed; (Koli 1990 [cited by Froese and Pauly (2011) but not accessed for this report]); common length : 15.0 cm TL male/unsexed; (Muus and Dahlström 1968 [cited by Froese and Pauly (2011) but not accessed for this report]); max. published weight: 3,000 g (Muus and Dahlström 1968); max. reported age: 10 years (Kottelat and Freyhof 2007 [cited by Froese and Pauly (2011) but not accessed for this report])."

Environment

From Froese and Pauly (2011):

"Demersal [bottom-dwelling]; potamodromous [migrates wholly within freshwater] (Riede, K. 2004 [cited by Froese and Pauly (2011) but not accessed for this report]); freshwater; brackish; depth range 5 - ? m (Allardi and Keith 1991 [cited by Froese and Pauly (2011) but not accessed for this report])."

Climate/[Geographic]Range

From Froese and Pauly (2011):

"Temperate; 2°C - 22°C (Riehl and Baensch 1991 [cited by Froese and Pauly (2011) but not accessed for this report]); 69°N - 35°N, 10°W - 169°E."

World Distribution

From Froese and Pauly (2011):

"Eurasia: North, Baltic, White, Barents, Black and Caspian Sea basins; Aegean Sea basin only in Maritza drainage; eastward to Kolyma drainage (Siberia); westward to Rhine and eastern drainages of England. Absent from North Sea basin in Sweden and Norway. In [the] Baltic basin north to about 66°N. Widely introduced to Italy, England and France but possibly often confused with *Carassius gibelio* (Kottelat and Freyhof 2007). At least one country reports adverse ecological impact after introduction."

Short description

From Froese and Pauly (2011):

"Dorsal spines (total): 3 - 4; Dorsal soft rays (total): 13-22; Anal spines: 2 - 3; Anal soft rays: 5 - 7; Vertebrae: 32. Diagnosed from its congeners in Europe by having the following characters: body golden-green shining color; last simple anal and dorsal rays weakly serrated; 23-33 gill rakers; lateral line with 31-36 scales; free edge of dorsal convex; anal fin usually with 6½ branched rays; and peritoneum white (Kottelat and Freyhof 2007). Caudal fin with 18-20 rays (Spillman 1961 [cited by Froese and Pauly (2011) but not accessed for this report]). No barbels. The third dorsal and anal-fin rays are strong and serrated posteriorly."

Biology

From Froese and Pauly (2011):

"Occurs in shallow ponds, lakes rich in vegetation and slow moving rivers. Burrows in mud in the dry season or during winter (Allardi and Keith 1991). Usually restricted to densely vegetated backwaters and oxbows of lowland rivers. Can survive at high temperatures and at very low oxygen concentrations during summer and under ice cover (Kottelat and Freyhof 2007). Tolerates cold, organic pollutants, and low oxygen levels in the water (Billard 1997 [cited by Froese and Pauly (2011) but not accessed for this report]). Feeds all day but mainly at night on plankton, benthic invertebrates, plant materials and detritus. Usually does not occur in waters with rich ichthyofauna and abundant predatory species, but very abundant in the absence of other fish species. Spawns in dense submerged vegetation (Kottelat and Freyhof 2007). Live up to about 10 years. There is a gradual but continuing extirpation of *Carassius carassius* in many water bodies, especially in Danube drainage and central Europe, possibly to due competition with introduced *Carassius gibelio* in non-optimal habitats (Kottelat and Freyhof 2007)."

Human uses

From Froese and Pauly (2011):

"Fisheries: highly commercial; aquaculture: commercial; gamefish: yes; aquarium: commercial; bait: occasionally."

From Frimodt (1995):

"Marketed fresh and frozen; eaten fried, broiled and baked."

Diseases

OIE-Reportable Fish Diseases:
Spring viraemia of Carp (Fijan, 1999)

Other Diseases:
From Froese and Pauly (2011):

"Dactylogyrus Gill Flukes Disease, Parasitic infestations (protozoa, worms, etc.)
Trichodinosis, Parasitic infestations (protozoa, worms, etc.)
Skin Flukes, Parasitic infestations (protozoa, worms, etc.)

False Fungal Infection (Epistylis sp.), Parasitic infestations (protozoa, worms, etc.)
Turbidity of the Skin (Freshwater fish), Parasitic infestations (protozoa, worms, etc.)”

Threat to humans

Potential pest (FAO 1997).

3 Impacts of Introductions

Papers by Bartley (2006) and Coad (1995) have indicated adverse impacts but could not be accessed for specific information.

From FAO (1997):

“Naturally reproducing in Ooty Lake at Nilgiris. Formed an important fishery for a few years, which declined drastically due to introduction of *Cyprinus carpio*. It is of negligible economic importance and easily interbreeds with *Cyprinus carpio*. This species has successfully established in the Indian water and is generally used for aquari[a]. It generally interbreeds with the common carp and obviously affects the aquaculture since it competes for food and space with other cultured species and also affects the indigenous fish species.”

From: Wittenburg (2005)

“Rarely found. Its use as a bait fish is illegal. Have competed with native fish species and increased water turbidity effecting aquatic community changes.”

From: Welcomme (1988)

“Populations established in quiet, slow flowing waters of the Central part of the country. It occupies the same niche as local species e.g. *Cheirodon* or *Percichthys* spp.”

4 Global Distribution

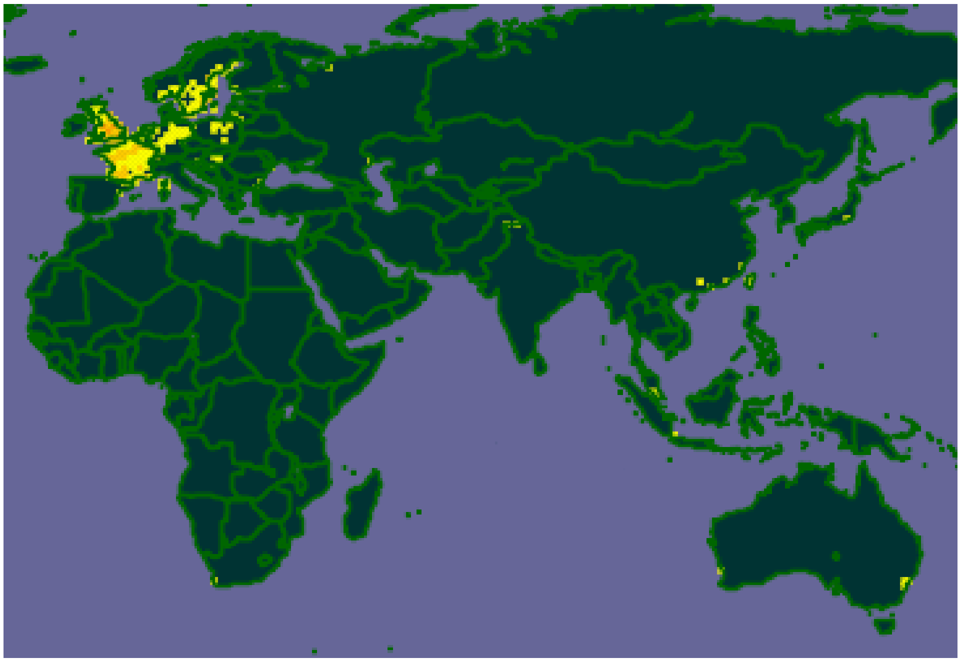

Figure 1. Global distribution of *C. carassius*. Map from GBIF (2011).

5 Distribution within the United States

Figure 2. Distribution of *C. carassius* in the US. Map from USGS (2011). Established population near Chicago now believed to be extirpated.

6 CLIMATCH

Summary of Climate Matching Analysis

The climate match (Australian Bureau of Rural Sciences 2011; 16 climate variables; Euclidean Distance) was medium to high throughout the US, except for low matches in the extreme desert southwest. Climate 6 match indicated that the U.S. has a high climate match. The range for a high climate match is 0.103 and greater, climate match of *C. carassius* is 0.498.

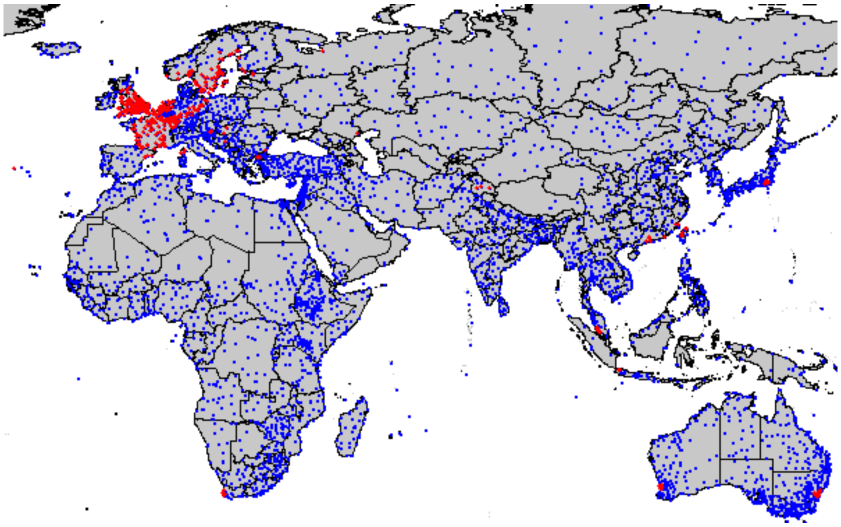

Figure 3. CLIMATCH (Australian Bureau of Rural Sciences 2011).
source map showing weather stations selected as source locations (red) and non-source locations (blue) for *C. carassius* climate matching. Source locations from GBIF (2011). Only established locations were used.

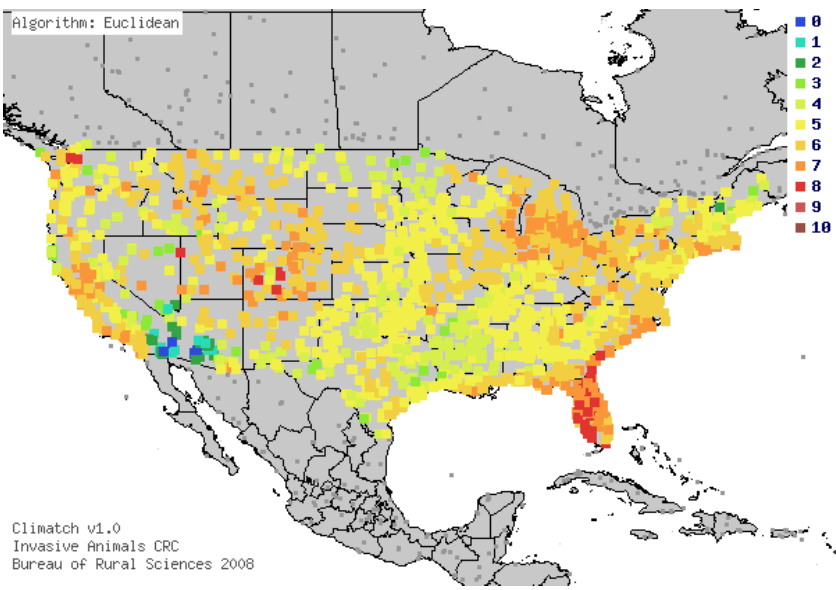

Figure 4. Map of CLIMATCH (Australian Bureau of Rural Sciences 2011) climate matches for *C. carassius* in the continental United States based on source locations reported by GBIF (2011). 0= Lowest match, 10=Highest match.

Table 1. CLIMATCH (Australian Bureau of Rural Sciences 2011) climate match scores

CLIMATCH Score	0	1	2	3	4	5	6	7	8	9	10
Count	7	17	20	35	220	684	661	275	41	0	0
Climate 6 Proportion =			0.498	(High)							

7 Certainty of Assessment

Information on the biology, invasion history, and impacts of this species is sufficient to give an accurate description of the risk posed by this species. Certainty of this assessment is high.

8 Risk Assessment

Summary of Risk to the Continental United States

C. carassius was once believed to have an established population in Chicago. This population is believed to have been extirpated long ago. Identification of this species is difficult due to its similarity with the widespread *C. auratus*. This species is known to hybridize with other carp species, has a high climate match, and is a known carrier of spring viraemia of carp, which is an OIE-reportable disease. Research has also implicated this species as a competitor with native fishes, and has shown its ability to alter habitats. Climate match with the U.S. is high.

Assessment Elements

- **History of Invasiveness (See Section 3):** High
- **Climate Match (See Section 6):** High
- **Certainty of Assessment (See Section 7):** High
- **Overall Risk Assessment Category: High**

Projected impacts to the continental U.S. and Great Lakes connected basin are summarized in Tables 1 and 2.

Table 1. Generalized, projected impacts of *C. carassius* on natural resources of the continental United States. The climate match is high between the native/established ranges of *C. carassius* and that of the continental United States. Therefore, details of impacts are too numerous to list in this screening report. Specific details of impacts will depend on local ecological structure (i.e., fish species composition, population abundance, and community structure; food resource biomass and community structure; and habitat variables).

	Projected Level of		

Threat	Impact to Natural Resources of the Continental U.S.	Description of Impact	Projections of Impacts to Natural Resources of the Continental U.S.
Habitat Degradation	High	Wittenburg (2005) listed this as a species that increases turbidity affecting aquatic community changes.	These impacts are projected to be greatest in lakes/rivers/streams with soft bottom sediments. Reduced light levels in habitats with submerged aquatic vegetation probably will cause major alterations in habitat.
Species Extirpation/Extinction	Medium-High	*C. carassius* has been reported to compete with native species, can hybridize with other carp species, and is a carrier of spring viraemia of carp. (FAO 1997, Fijan 1999)	Hybridization with other carp species is probable, but may not be damaging to native species. As a carrier of spring viraemia, the impacts to other species could be significant.
Food Web Disruption	Low	*C. carassius* may replace species in a particular food web, but there is no research detailing how native food webs may be disrupted.	Research has shown that *C. carasssius* does compete for food resources. Food consumed as juveniles is predominantly zooplankton, whereas food consumed as adults is predominantly benthic macroinvertebrates (Froese and Pauly 2010). Juveniles of most fishes consume zooplankton, and many ecologically and economically important fishes consume benthic macroinvertebrates. The severity of competition will depend on native fish community composition, and food resource limitations.

Degradation of Fish Stocks	High	Impact due to the ability of *C. carassius* to pass spring viraemia to native fish species.	Infected *C. carassius* may spread the disease to cultured fish stocks or other cyprinids in U.S. waters. Mortality rates can be as high as 90% (Fijan 1999).
Competition	Medium	Direct competition with other species at the same trophic level and habitat (Welcomme 1988)	Cyprinidae species in lentic and slowly running aquatic habitats are at risk to be impacted by the introduction of *C. carassius*, where those species share similar diets and limited food resources.
Predation	Low	*C. carassius* preys mainly upon plant matter and invertebrates. Predation impacts will mainly focus on those species.	*C. carassius* are at risk to compete with, and replace, similar species in a habitat's trophic structure. This may increase predation pressure on species of invertebrates, and herbivory on aquatic plants. Changes in abundance of plants would affect predation on invertebrates. No increased predation pressure is expected on native fish species.
Reproductive Interference	Low	*C. carassius* can potentially hybridize with other Cyprinidae species. (FAO 1997)	Hybridization constitutes a large threat to any Cyprinidae species, whose numbers may already be declining. Successful hybridization between *C. carassius* and Cyprinidae species native to the U.S. has not been documented in literature, but is a possibility given this species hybridization history in Europe.

Table 2. Generalized, projected impacts of *C. carassius* on natural resources of the connected Great Lakes Basin (i.e., Great Lakes, connecting channels, and tributaries). The climate match is high between the native/established ranges of *C. carassius* and that of the connected Great Lakes Basin. Therefore, details of impacts are too numerous to list in this screening report. Specific details of impacts will depend on local ecological structure (i.e., fish species composition, population abundance, and community structure; food resource biomass and community structure; and habitat variables).

	Projected Level of		

Threat	Impact to Natural Resources of the Connected Great Lakes Basin	Description of Impact	Projections of impacts to Natural Resources of the Connected Great Lakes Basin
Habitat Degradation	High	The increased turbidity caused by sediment perturbation by *C. carassius* will probably degrade habitats (Wittenburg 2005)	Increases in turbidity levels will likely most impact coastal and shallow portions of the Great Lakes. Reduced light levels in habitats with submerged aquatic vegetation probably will cause major alterations in habitat.
Species Extirpation/Extinction	Medium-High	*C. carassius* has been reported to compete with native species, can hybridize with other carp species, and is a carrier of spring viraemia of carp. (FAO 1997, Fijan 1999)	Great Lakes species at risk to be impacted most directly are native Cyprinidae species through three mechanisms: 1) Resource competition between carp species and native species with similar habitat and food requirements is projected; 2) Hybridization is greatest risk with other carp species, so effects to native fishes should be limited; and, 3)As a carrier of spring viraemia, the impacts to other species could be significant.
Food Web Disruption	Low	*C. carassius* may replace species in a particular food web, but there is no research detailing how native food webs may be disrupted.	Research has shown that *C. carassius* does compete for resources with similar species. However no research was found indicating competition outside their trophic group. This will probably be true in the Great Lakes Basin.
Degradation of Fish Stocks	Medium	Impact due to the ability of *C. carassius* to pass spring viraemia to native fish species.	Impacts to native fish species will depend on fish community structure (i.e., which species are located in areas where infected C. carassius are introduced/established).
Competition	Low	Direct competition with other species at	Native species in lentic and slowly running aquatic habitats

		the same trophic level and habitat. (Welcomme 1988)	are likely to be impacted by the introduction of *C. carassius*. In the Great Lakes, a commercially harvested species, or closely related species (i.e., cyprinids) occupying near shore and slow moving rivers connecting the lakes are at greatest risk to be impacted.
Predation	Low	*C. carassius* preys mainly upon plant matter and invertebrates. Predation impacts will mainly focus on those species.	*C. carassius* can outcompete and replace similar species in a habitat's trophic structure. This may increase predation pressure on species of invertebrates, and herbivory on aquatic plants. Changes in abundance of plants would affect predation on invertebrates. No increased predation pressure on native fish species is expected. In the Great Lakes, areas with submerged aquatic vegetation beds will face the greatest impacts.
Reproductive Interference	Low	*C. carassius* can potentially hybridize with other carp species. (FAO 1997)	The potential for hybridization in the Great Lakes Basin is more probable with *C. carassius* and other carp species.

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