Common Carp (*Cyprinus carpio*)
Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, September 2014
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1 Native Range and Status in the United States

Native Range

Froese and Pauly (2018a) list *Cyprinus carpio* as native to Armenia, Azerbaijan, China, Georgia, Kazakhstan, Mongolia, Turkey, Uzbekistan, Austria, Bulgaria, Czech Republic, Hungary, Moldova, Russia, Serbia, Slovakia, Ukraine

From Froese and Pauly (2018a):

"Europe to Asia: Black, Caspian and Aral Sea basins. […] Wild stocks are only present naturally in rivers draining to the Black, Caspian and Aral Sea [Kottelat and Freyhof 2007]. A reophilic wild population in the Danube is assumed to be the origin of the European species; this population is now under threat [Kottelat 1997]."

"Inhabits Lake Sevan, Akhurian and Metsamor rivers and some reservoirs of Armenia [Gabrielyan 2001]."

"[In China:] Known as "li-yü" at Tungting Lake [Nichols 1943]. Also occurs in Ulungur lake, Erqishi and Yili rivers [Walker and Yang 1999]. […] Also found in Beijiang River [Shiming et al. 2011]."

“[In Kazakhstan and Uzbekistan:] Occurs in the Aral Sea [Reshetnikov et al. 1997].”

“[In Turkey:] Known from the European Black Sea watersheds, Anatolian Black Sea watersheds, Aegean Sea watersheds, western, eastern and central Anatolian lake watersheds and Anatolian Mediterranean Sea watersheds.”

“[In Czech Republic:] Considered critically endangered in 2000 [Lusk and Hanel 2000], but recently extirpated [Lusk et al. 2011]. The wild form of this species occurs in the lower stretches of the rivers Morava (in a stretch about 30 km long) and Dyje (in a stretch about 25 km long). Former range consisted of considerably longer part of the stream of these rivers.”

“[In Russia:] Occurs in the Caspian and Black seas and the Sea of Azov [Reshetnikov et al. 1997]. Recorded from the Amur River drainage [Bogutskaya and Naseka 2002a].”

Status in the United States

From Froese and Pauly (2018a):

“[In Puerto Rico:] Reintroduced in 1990-1995 from the USA. Popular in the country as aquarium fishes and as ornamentals for ponds. Wild populations used in sportfishing. […] Known from Cidra, Guajataca and Loiza Reservoirs (Felix Grana pers. comm.).”

“Chesapeake Bay: intoduced [*sic*] to the Chesapeake Bay region in 1877, common carp resident in all major tributaries of the bay, ranging donw [*sic*] into brackish water with salinities as high as 17.6% [Murdy and Musick 2013].”

“Known from Kaua'i [Mundy 2005]. In Hawaii, carps can be found in reservoirs on all the main islands; occasionally, escaped domestic koi can be found in streams; doughballs and corn kernels are favored baits for carp in the Wahiawa Reservoir, where this species is established; Hawaiians observe the Japanese tradition of Boy's Day wherein a carp replica called koi nobori, meaning to "to hang and fly a carp" is flown for every male member of the family because carp symbolizes strength [Yamamoto and Tagawa 2000].”

Nico et al. (2018a) list *Cyprinus carpio* as present in Alabama since 1964, Arizona since 1885, Arkansas since 1950, California since 1872, Colorado since 1879, Connecticut since 1940, Delaware since 1879, Washington D.C. since 1999, Florida since 1890, Georgia since 1923, Guam since 2004, Hawaii since 1870, Idaho since 1882, Illinois since 1894, Indiana since 1894, Iowa since 1900, Kansas since 1880, Kentucky since 1942, Louisiana since 1955, Maine since 1880, Maryland since 1874, Massachusetts since 1980, Michigan since 1880, Minnesota since 1833, Mississippi since 1902, Missouri since 1879, Montana since 1876, Nebraska since 1901, Nevada since 1833, New Hampshire since 1880, New Jersey since 1890, New Mexico since 1964, New York since 1830, North Carolina since 1940, North Dakota since 1929, Ohio since 1879, Oklahoma since 1882, Oregon since 1880, Pennsylvania since 1958, Puerto Rico since 2005, Rhode Island since 1980, South Carolina since 1923, South Dakota since 1909, Tennessee since 1939, Texas since 1880, Utah since 1881, Vermont since 1833, Virginia since 1974,

Washington since 1881, West Virginia since 1933, Wisconsin since 1900, and Wyoming since 1970.

From Nico et al. (2018a):

"Recorded from all states except Alaska. In their summary table, Bailey and Smith (1981) indicated that *Cyprinus carpio* is widely distributed in the Great Lakes basin.
Carp is only established in the Florida panhandle [within that State]. It does not appear to be established in South Florida."

"Several agents of the U.S. Fish Commission documented the early years of common carp propagation and stocking in the United States (e.g., Smiley 1886; Smith 1896; Cole 1905). Although this species was popular in the early 1870s as a food fish, common carp fell into wide disfavor soon after and is now considered a nuisance fish because of its abundance and detrimental effects on aquatic habitats."

"Pflieger (1997) reported that the total weight and value of common carp taken by commercial fishermen in Missouri exceeded that of any other fish."

From Nico et al. (2018b):

"Common carp is fished commercially in the Great Lakes (Brown et al. 1999, Dann and Schroeder 2003)."

Means of Introductions in the United States

From Froese and Pauly (2018a):

"Introduced by the aquarium industry and by the University of Puerto Rico."

From Nico et al. (2018a):

"Several agents of the U.S. Fish Commission documented the early years of common carp propagation and stocking in the United States (e.g., Smiley 1886; Smith 1896; Cole 1905). Although this species was popular in the early 1870s as a food fish, common carp fell into wide disfavor soon after and is now considered a nuisance fish because of its abundance and detrimental effects on aquatic habitats."

"There is some question as to when and where common carp was first introduced into the United States. DeKay (1842) reported that the species was first brought into the United States from France by Henry Robinson of Orange County, New York in 1831 and 1832. In a letter to DeKay, Robinson detailed that he kept the fish in ponds and for several years released one to two dozen carp during the spring in the Hudson River near his residence, thereby creating a commercial fishery for the species. S. F. Baird of the U.S. Fish Commission examined fish taken from the Hudson River, as well as area fish then being sold on the New York markets, and reported that they were goldfish or goldfish hybrids and not true common carp (Redding 1884; Cole 1905). Whitworth (1996) cited early literature indicating common carp had been introduced into

Connecticut as early as the 1840s; however, we question the positive identity of the species. Smith (1896) reported that common carp first appeared in the United States in 1872 when J. A. Poppe of Sonoma, California, imported five specimens from Germany and propagated them in private ponds for commercial purposes, mainly distributing them to applicants as a food fish (Smith 1896; Lampman 1946). In 1877, the U.S. Fish Commission imported common carp from Germany and for the next two decades the agency began stocking and distributing the species as food fish throughout much of the United States and its territories (Smiley 1886; Smith 1896; Cole 1905). State fish commissions also were commonly involved in distributing the species (e.g., Johnson and Becker 1980). Records from the early 1880s indicate that common carp stocked in farm ponds frequently escaped into open waters as a result of dam breaks or flood events (Smiley 1886). By 1885, the U.S. Fish Commission was actively stocking lakes and rivers throughout the country, often the fish were released from railroad tank cars at bridge crossing directly into streams (e.g., McDonald 1886). As a result of subsequent population growth and dispersal, common carp spread even further. More recently introductions of common carp have resulted because of the use of juvenile carp as bait fish (e.g., Swift et al. 1977). Various unusual genetic strains of common carp have been introduced into open waters the United States. In addition to the normal scaled carp, the U.S. Fish Commission distributed both mirror carp and leather carp varieties in the late 1800s (Smiley 1886; Cole 1905). Colorful varieties of common carp (i.e., nishikigoi or koi) are kept as pets in garden ponds and some have been introduced to ponds and public water bodies (Balon 1995). However, only a small percentage of common carp records in U.S. open waters are based on koi. Another cultured variety occasionally found in open waters is the Israeli carp (Robison and Buchanan 1988). Their presence in South Florida is believed to be the result of released bait with this species as a contaminant."

"Because common carp have a higher salinity tolerance than most freshwater fishes, Swift et al. (1977) hypothesized that it may be spreading from one coastal stream to another through fresh or nearly fresh coastal waters in the Gulf area during periods of heavy rainfall and run-off, periods when salinities are greatly reduced."

Remarks

A previous version of this ERSS was published in 2014.

From Nico et al. (2018a):

"In Eurasia there are two poorly defined subspecies *C. c. carpio* and *C. c. haematopterus*; unfortunately, feral common carp, descendants of earlier escapees or introductions, have greatly confused the picture (Balon 1995). Several genetic strains—some bred in aquaculture or used as ornamentals (e.g., leather carp, mirror carp, Israeli carp, koi)—are recognized by some as separate varieties (Robison and Buchanan 1988; Balon 1995)."

From Nico et al. (2018b):

"*Cyprinus carpio* has hybridized with goldfish (*Carassius auratus*) and, in Europe, with the locally native crucian carp (*Carassius carassius*). However, crucian x common carp hybrids were found in just 3 of 10 populations in which the two species geographically overlapped (Hanfling et al. 2005, Taylor and Mahon 1977)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to Fricke et al. (2018), *Cyprinus carpio* Linnaeus 1758 is the valid name for this species; it is also the original name.

From ITIS (2018):

"Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Ostariophysi
Order Cypriniformes
Superfamily Cyprinoidea
Family Cyprinidae
Genus *Cyprinus*
Species *Cyprinus carpio* Linnaeus, 1758"

Size, Weight, and Age Range

From Froese and Pauly (2018a):

"Maturity: L_m 34.9, range 25 - 36 cm
Max length : 120 cm TL male/unsexed; [Murdy et al. 1997]; common length : 31.0 cm TL male/unsexed; [Chugunova 1959]; max. published weight: 40.1 kg [Machacek 2007]; max. reported age: 38 years [Hinton 1962]"

From GISD (2018):

"[…] weigh up to 60 kg (Allen 1989, in Pinto *et al.* 2005), […]"

"They have a typical lifespan of 13 to 20 years in the wild with a reported specimen of 47 years in captivity (Chumchal 2002; Kuliyev & Agayarova 1984)."

Environment

From Froese and Pauly (2018a):

"Freshwater; brackish; benthopelagic; pH range: 7.0 - 7.5; dH range: 10 - 15; potamodromous [Riede 2004]. […]; 3°C - 35°C [assumed to be water temperature] [Eaton et al. 1995]; […]"

"Common carp are acclimated to a variety of habitats and extremes of environment, eg [*sic*] high salinities and low oxygen concentrations [Kailola et al. 1993]. They have been observed to gulp air at the surface of oxygen-depleted waters [de Moor and Bruton 1988]. During winter carp go into deeper water which will be comparatively warmer than water in shallow areas."

From Nico et al. (2018a):

"Crivelli (1981) reported that the common carp occurred in brackish-water marshes with salinities up to 14 ppt in southern France. In North America, the common carp inhabits brackish and saline coastal waters of several states bordering the Atlantic and Pacific Oceans and Gulf of Mexico (Schwartz 1964; Moyle 2002) as well as the Atlantic and Pacific coasts of Canada (McCrimmon 1968). It has been captured in U.S. waters with salinities as high as 17.6 ppt (Schwartz 1964)."

"Trautman (1981) found common carp most abundant in streams enriched with sewage or with substantial runoff from agricultural land, but he reported it to be rare or absent in clear, cold waters, and streams of high gradient."

From NatureServe (2018):

"Carp can live in water with turbidities in excess of 200 JTU and secchi disc visibilities less than 8 cm (3.2 in) (Jester 1974). A pH level greater than 10.5 or less than 5.0 is harmful (Edwards and Twomey 1982)."

Climate/Range

From Froese and Pauly (2018a):

"Subtropical; […]; 60°N - 22°N, 7°E - 144°E"

"Does well at elevations above 500 m."

From GISD (2018):

"They are found at low altitudes (up to 500-m elevation; Reynolds 1983, Driver et al. 2005, in Jones & Stuart 2006), […]"

Distribution Outside the United States

Native

Froese and Pauly (2018a) list *Cyprinus carpio* as native to Armenia, Azerbaijan, China, Georgia, Kazakhstan, Mongolia, Turkey, Uzbekistan, Austria, Bulgaria, Czech Republic, Hungary, Moldova, Russia, Serbia, Slovakia, Ukraine

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“Inhabits Lake Sevan, Akhurian and Metsamor rivers and some reservoirs of Armenia [Gabrielyan 2001].”

“[In China:] Known as "li-yü" at Tungting Lake [Nichols 1943]. Also occurs in Ulungur lake, Erqishi and Yili rivers [Walker and Yang 1999]. […] Also found in Beijiang River [Shiming et al. 2011].”

“[In Kazakhstan and Uzbekistan:] Occurs in the Aral Sea [Reshetnikov et al. 1997].”

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“[In Czech Republic:] Considered critically endangered in 2000 [Lusk and Hanel 2000], but recently extirpated [Lusk et al. 2011]. The wild form of this species occurs in the lower stretches of the rivers Morava (in a stretch about 30 km long) and Dyje (in a stretch about 25 km long). Former range consisted of considerably longer part of the stream of these rivers.”

“[In Russia:] Occurs in the Caspian and Black seas and the Sea of Azov [Reshetnikov et al. 1997]. Recorded from the Amur River drainage [Bogutskaya and Naseka 2002a].”

Introduced

From GISD (2018):

“The common carp (*C. carpio*) is one of the first fish species whose distribution was widely extended by human introduction; in the first centuary [*sic*] AD carp gradually spread across Europe with the assistance of the Romans, who would have found carp in the Danube River (Koehn, Brumely & Gehrke 2000; Balon 1995, in Saikia & Das 2009).”

From Froese and Pauly (2018a):

“[In Algeria:] [FAO 1996] previously used stated [*sic*] that the species was not established. H. Kara ([Kara 2012], comm. pers., 3 April 2014) confirmed that it was introduced in 1860 and is well established for a long time.”

“[In Ethiopia:] Introduced to the Lake Aba Samuel in 1940 probably from Italy.”

“[In Kenya:] Introduced in Tana River [Seegers et al. 2003], Lake Naivasha [Seegers et al. 2003] and upper reaches of Athi River [Okeyo 1998].”

“[In Namibia:] Known from Lower Orange, and Interior [Hay et al. 1999]. Also in Windhoek (Collected: D. Okeyo); Omatako drainage; may eventually enter Okavango River drainage [Okeyo 2003].”

“[In Rwanda:] Introduced in upper and middle Akagera system and Lake Karago [De Vos et al. 2001].”

“[In Réunion:] Non acclimatised [Keith 2002].”

“[In South Africa:] Recorded from Lake Gariep, upper Orange River [Winker et al. 2011, 2012] and the Great Fish river [Weyl et al. 2009].”

“[In Tanzania:] Dodoma and Morogoro; occur in fish ponds and dams.”

“[In Zimbabwe:] Found in dams in the Lake Kariba, Middle and Lower Zambezi, Limpopo and Uper Save/Runde systems.”

“[In Afghanistan:] Occurs in Amu Darya up to Panj, Murgab, Tedzhen, Lake Gusar, Qonduz and Khanabad [Coad 1981].”

“[In Bhutan:] Found in Gaylegphug ponds [Petr 1999].”

“[In Cambodia:] Occurs in Mekong basin [Rainboth 1996], Tonle Sap and Great Lake [Lim et al. 1999].”

“[In India:] Found in Kashmir Valley [Kullander et al. 1999], Western Ghats [Sehgal 1999], ponds and lakes of Nilgiris, Periyar Lake, Chalakkudy river system, Chimmony and Peechi-Vazhani WLS, Nilgiri Biosphere Reserve, Southern Keral River systes, Achenkoil River and Bangalore and Kolar districts, Karnataka [Radhakrishnan et al. 2012], Maharashtra [Archarya and Iftekhar 2000]; Pykara dam and River and Kamaraj sagar, Ooty, Tamil Nadu [Arunachalam and Manimekalan 2000]. Introduced to India in 1939 [Shaji et al. 2000]. Present in Naninital, Bhimtal and Naukuchiatal lakes [Pal and Kundu 2011], also in Adma and Jayanti rivers [Ray and Mishra 2011].”

“[In Indonesia:] Common in the upper Baliem River, Irian Jaya [Allen 1991]. Also introduced to Lake Poso [Kottelat 1990].”

“[In Iran:] Reported from the Caspian Sea [Iranian Fisheries Company and Iranian Fisheries Research Organization 2000].”

“[In Japan:] Occurs in Hokkaido, Honshu, Shikoku, and Kyushu. Also recorded from Lake Biwa [Fisheries Management Division of the Shiga Prefecture Agriculture and Fisheries Department 2007]. […] Rare in Shiga Prefecture [Wildlife Survey Group in Shiga Prefecture 2005].”

“[In Kazakhstan:] Introduced in Lake Balkhash and Irtysh river [Mitrofanov and Petr 1999].”

“[In South Korea:] Recorded from the Han, Nakdong, Kum, Youngsan and Sumjin rivers [Jang et al. 2002].”

“[In Kyrgyzstan:] Occurs in Lake Issyk-kul [Savvaitova and Petr 1999].”

“[In Laos:] Known from the Mekong basin from above Pak Beng to the Khoné Falls [Hill and Hill 1994]. Found in Ban Hang Khone, a village on an island in the middle of the mainstream Mekong River just below the Great Khone Waterfalls in Khong District, Champasak Province [Baird 1998].”

“[Shrestha 1994] confirms introduction of this species in Nepal. Two strains exists: German carp introduced from India and Israeli/mirror carp from Israel.”

“[In Pakistan:] Occurs in the Northern areas [Akhtar 1991a], North West Frontier Province (NWFP), Punjab, Sindh, Balochistan [Mirza 2002, 2003], Azad Jammu and Kashmir [Akhtar 1991b].”

“[In Philippines:] Introduced to Lake Mainit, Mindanao [Pauly et al. 1990; Mercene 1997; Labajo and Nuñeza 2003; De Guzman et al. 2008];including Kalinawan River [De Guzman et al. 2008], lakes Naujan and Taal [Mercene 1997]; Laguna de Bay [Palma et al. 2005]; Lake Paoay, Ilocos Norte; Magat R, Nueva Viscaya; Lake Bato and Lake Buhi, Camarines Sur; Cagayan River, Isabela [Herre 1953]; Lake Buluan [Yap et al. 1983]; and Lake Lanao [Mercene 1997; Mamaril 2001; Ismail et al. 2014]. Collected from CLSU fish pond, Nueva Ecija and Lake Taal Laurel, Batangas as a living specimen [Central Luzon State University 1996]. Recorded from Candaba Swamp and Pampanga River [Paz-Alberto et al. 2009].”

“[In Singapore:] Introduced in the 1900s, reintroduced by 2000. The common and Chinese carps were introduced during the early history of Singapore. They formed the basis for an important aquaculture after 1945, but rising land values have now rendered this activity uneconomic and it has declined considerably in recent years probably due to predation on juveniles by *Parachromis managuensis* [B. Y. Tang, personal communication].”

“[In Sri Lanka:] Regularly stocked in hill country reservoirs and stocking has been extended to the low country dry zone tanks. Occurs in the Nuwara Eliya and has established itself in the Mahaweli basin.”

“[In Thailand:] Occurs in the Mekong basin at the Low Pamong [Hill and Hill 1994].”

“[In Turkmenistan:] May not be an introduced species but just translocated around Turkmenistan. Transported from the Amu Darya into the Murgab in 1894, from Murgab to Tedgen in 1952. It has been widely introduced around the country: Kara Kum channel, Lake Sarykamysh, the Murgab, salty Lake Yaskhan (the western Uzboi), and other water bodies.”

“[In Vietnam:] Found in Ba Be Lake [Sung 1998]. Present in Dakrong River [Nguyen et al. 2011a] and Da River [Bui et al. 2009; Nguyen et al. 2011b].”

“[In Azores Islands:] Recorded from the São Miguel Lake.”

“[In Belarus:] The Belarusian carp population originated from natural spread via the Dnieper River and intentional seeding of waterbodies, especially in the second half of the 20th century [Zhukov 1988]. It is now present in all parts of the country [Mastitsky et al. 2007].”

“[In Belgium:] Naturalized in Flanders [Verreycken et al. 2007].”

“[In Denmark:] Introduced in the 16th century. Scattered distribution. Regarded as a Danish species [Frier 1994].”

“[In Estonia]: Encountered rarely in the Gulf of Riga and Gulf of Finland [Ojaveer and Pihu 2003].”

“[In France:] Occurs all over France except in the mountainous regions of the Alps and the Pyrénées. Known from Gironde estuary [Rochard and Elie 1994].”

“[In Germany:] Rare and not reproducing in the Neckar [Günther 1853].”

“[In Greece:] Known from Prespa lakes [Crivelli et al. 1997].”

“[In Ireland:] Recorded from the Lough Neagh catchment, Northern Ireland; caught in the littoral zone of Lurgan Park Lake, a small eutrophic water body which drains into Lough Neagh [Winfield and Bean 1991].”

“[In Italy:] Annual stocking recorded. Known from the Italian peninsula and islands [Bianco and Ketmaier 2001; Bianco 2014], and recorded from Ombrone, Albegna and Fiora [Bianco and Ketmaier 2001].”

“[In Montenegro:] Recorded from the River Moraca [Kovačić and Sanda 2007].”

“[In Poland:] Introduced in the 80s from Hungary and Thailand. Mentioned as *Cyprinus carpio* koi. Reported as introduced in the 13th-14th century [Solarz 2005].”

“[In Portugal:] Found in Tagus estuary [Thiel et al. 2003].”

“[In Romania:] Introduced in the 1300s.”

“[In Russia:] This has been translocated to areas within the country for aquaculture and stocking in open waters. It has escaped from aquaculture facilities and has now widely established self-sustaining populations [Bogutskaya and Naseka 2002b].”

“[In Slovenia:] Population has declined due to destruction of spawning grounds, and introduction of artificially reared carp.”

"[In Canada:] Ranges from British Columbia to New Brunswick [Coker et al. 2001]. Recorded from the sea along the Pacific coast [Carl et al. 1959; Barraclough and Robinson 1971]."

"[In Mexico:] Introduced and established in the Lerma River basin. […] Recorded from the Balsas river basin [Contreras-MacBeath et al. 1998]."

"[In Australia:] Introduced to freshwaters of the southern half of Australia from the Warrego River in Queensland [Kailola et al. 1993] to Perth, Western Australia, most common in Murray-Darling system [Paxton et al. 1989]. They are also found in several Victorian and South Australian coastal streams [Fisheries and Wildlife Division, Victorian Ministry for Conservation 1976] and from Lake Frome in the arid region of South Australia [Kailola et al. 1993]. European carp were introduced in Tasmania in 1960 or 1961 [Fisheries and Wildlife Division, Victorian Ministry for Conservation 1976], but have since been eradicated there [Kailola et al. 1993]."

"European carp have been introduced to Australia several times in the last 150 years. The 'Prospect group' were introduced in the late 1850s [Hume et al. 1983]. It is only since the most recent introduction in 1959-60 that European carp have become widespread, establishing populations in many areas within the Murray-Darling River system."

"European carp have been declared noxious fish in most Australian States."

"It is illegal to breed European carp for sale in Victoria [Hume et al. 1983] and South Australia."

"[In New Zealand:] Recorded from the North I, widespread only in the north but range is expanding [Chadderton et al. 2003]."

"[In Papua New Guinea:] Common in a few isolated localities such as Lake Kopiago, and the Lower and Middle Sepik and Ramu river systems."

"[In Argentina:] Recorded in Rio de la Plata [López et al. 2003]."

"[In Brazil:] Recorded in the Piracicaba river [Silvano and Begossi 2001] and the Uruguay River [Zaniboni Filho et al. 2004]."

"[In Finland:] Has established in aquaculture but not in the wild [Welcomme 1988]. Introduced to southern Finland. No natural reproduction; dependent on continous [*sic*] stocking with one or two years old fish."

"[In Honduras:] Has established in aquaculture through assisted/artifical [*sic*] reproduction. Has not established in the wild [Welcomme 1988]."

"[In Jamaica:] Polycultured on a pilot scale in a few commercial farms. Held as broodstock by the Inland Fisheries Unit (IFU) and a few commercial farmers."

"[In Malawi:] Established in aquaculture through assisted/artificial reproduction. Has not established in the wild [Welcomme 1988]."

In addition to the countries mentioned above, Froese and Pauly (2018a) list *Cyprinus carpio* as introduced to Botswana, Cameroon, Central African Republic, Cote d'Ivoire, Egypt, Ghana, Lesotho, Madagascar, Mauritius, Morocco, Mozambique, Nigeria, Togo, Tunisia, Uganda, Bangladesh, Brunei Darussalam, Cyprus, Hong Kong, Iraq, Israel, Jordan, Lebanon, Malaysia, Myanmar, Syria, Taiwan, Timor-Leste, Albania, Bosnia Herzegovina, Croatia, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, Costa Rica, Cuba, Dominican Republic, El Salvador, Guatemala, Haiti, Nicaragua, Panama, Fiji, Bolivia, Chile, Colombia, Paraguay, Peru, Suriname, Uruguay, and Venezuela. It is present but not established in the wild in Swaziland, Sudan, and Zambia.

Additionally GISD (2018) lists *Cyprinus carpio* as alien and established in Angola, Burundi, Central Pacific Territories, North Korea, Kuwait, and New Caledonia. It is listed as present in containment facilities in Republic of the Congo, Ecuador, Saudi Arabia, and Tajikistan. It is listed as alien and status uncertain in Turkey. It is listed as formally introduced but extinct in French Polynesia.

Pagad et al. (2018) lists *Cyprinus carpio* as alien in Democratic Republic of the Congo, Micronesia, Mongolia, Trinidad and Tobago, and United Arab Emirates in addition to the areas listed above.

Means of Introduction Outside the United States

From Froese and Pauly (2018a):

"It is introduced from Uganda to Kenya in 1969 for aquaculture [Seegers et al. 2003], […]"

"[In Swaziland:] Utilized by the Fisheries section of the Ministry of Agriculture and C-operatives as part of its attempt to establish aquaculture in the lowveld areas of the country. Stocked in various small private dams with no records of escapee populations (Pers. comm., Klaasen 1997)."

"[In China:] A popular cultured fish, introduced from its native range to other regions in the country for culture and extensive stocking in all kinds of inland waters [Ma et al. 2003]."

"In 1915, two thousand fry were brought from Hong Kong to Manila upon the suggestion of Alvin Seale. Most of these were placed in a pond at Dulauan, Cotabato. When the Rio Grande de Mindanao flooded, the fish escaped and established in the Pulangi and its tributaries between Dulauan and Fort Pikit. Fry were also introduced in lakes Dapao and Nunungan, Lanao in 1916 [Herre 1924]."

"The Belarusian carp population originated from natural spread via the Dnieper River and intentional seeding of waterbodies, especially in the second half of the 20th century [Zhukov 1988]."

"[In Russia:] This has been translocated to areas within the country for aquaculture and stocking in open waters. It has escaped from aquaculture facilities and has now widely established self-sustaining populations [Bogutskaya and Naseka 2002b]."

From GISD (2018):

"Carp have been introduced into Australia both deliberately, in an attempt to imitate the European environment, and accidentally, through the escape of ornamental or aquaculture fish (NSW Department of Primary Industries 2005). The importation of carp was probably because of the desire of some of the colonists to imitate a European environment in Victoria. The Acclimatisation Society of Victoria (1861) which was established from the short-lived Zoological Society of Victoria (1857) aimed to offer salmon, trout, carp and other fish for anglers (Gillbank 1980, in Koehn Brumley & Gehrke 2000).It has been introduced as a food fish, into temperate freshwaters, throughout the world. (Aguirre and Poss, 2000)Introduced [*sic*] into many places for angling/sport. (FishBase, 2003)It [*sic*] has been introduced as an ornamental fish, into temperate freshwaters, throughout the world. (Aguirre and Poss, 2000)"

Short Description

From Froese and Pauly (2018a):

"Dorsal spines (total): 3 - 4; Dorsal soft rays (total): 17-23; Anal spines: 2-3; Anal soft rays: 5 - 6; Vertebrae: 36 - 37. Diagnosed from other cyprinid species in Europe by having the following characters: 2 pairs of barbels; dorsal fin with 15-20½ branched rays; caudal fin deeply emarginate [Kottelat and Freyhof 2007]. Pharyngeal teeth 1, 1, 3:3, 1,1, robust, molar-like with crown flattened or somewhat furrowed. Scales large and thick. `Wild carp ' is generally distinguished by its less stocky build with height of body 1:3.2-4.8 in standard length. Very variable in form, proportions, squamation, development of fins, and color. Caudal fin with 3 spines and 17-19 rays [Spillman 1961]. Last simple anal ray bony and serrated posteriorly; 4 barbels; 17-20 branched dorsal rays; body grey to bronze [Kottelat 2001]."

From GISD (2018):

"The common carp (*Cyprinus carpio*) may be recognised by its small eyes, thick lips, two barbels at each corner of the mouth, large scales, and strongly serrated spines in the dorsal and anal fins (NSW Department of Primary Industries 2005). The colour of carp varies; in the wild, they are usually olive green to bronze or silvery in colour with a paler underside (NSW Department of Primary Industries 2005). Koi carp are an ornamental strain which are brightly coloured with orange, yellow, white and black markings; if they escape into the wild, however, koi carp soon revert to the wild colouring (NSW Department of Primary Industries 2005). Some variants, known as mirrored carp, are only partly scaled, with a few very large scales in patches or along the midline; all strains belong to the same species (*Cyprinus carpio*) (NSW Department of Primary Industries 2005)."

Biology

From Froese and Pauly (2018a):

“Adults inhabit warm, deep, slow-flowing and still waters such as lowland rivers and large, well vegetated lakes [Kottelat and Freyhof 2007]. Hardy and tolerant of a wide variety of conditions but generally favor large water bodies with slow flowing or standing water and soft bottom sediments. Thrive in large turbid rivers [Scott and Crossman 1998]. Most active at dusk and dawn. […] Adults often undertake considerable spawning migration to suitable backwaters and flooded meadows. Larvae survive only in very warm water among shallow submerged vegetation. River regulation and hybridization with domesticated stocks, East Asian congeners and their hybrids have caused continuous decline of wild populations [Kottelat and Freyhof 2007].”

“Spawn in marginal, shallow, weed-infested areas. A polytypic plastic species with a marked tendency to produce `varieties' [*sic*] and `races' [*sic*] in response to selective breeding and environmental influences. Carp is polygamous. A spawning female is usually followed by several males. Under tropical conditions carp breeds throughout the year. It is a seasonal spawner in temperate waters [Alikunhi 1966]. Females are known to lay more than a million eggs in a season; breeds at a [water] temperature range of 15° C to 20°C; eggs hatch in 4 days [Pethiyagoda 1991]. Obligatory plant spawners [Balon 1990]. "[…] The sticky eggs are attached to water plants or other submerged objects. Reproductive success is restricted to years when the water level starts rising in May and when high temperatures and flooding of terrestrial vegetation last for a long period during May and June" [Kottelat and Freyhof 2007].”

“Undertakes reproductive and trophic/dispersal upstream migration during the wet season in May-July through Hoo Som Yai at the Great Fault Line on the Mekong River, Champassack Province [Laos] [Singhanouvong et al. 1996].”

“A female 47 cm in length produces about 300,000 eggs [Hart 1973]. Young are probably preyed upon by northern pike, muskellunge, and largemouth bass.”

“Common carps are active swimmers that can leap obstacles up to 1 meter high and negotiate torrential flows [Merrick and Schmida 1984].”

From Nico et al. (2018a):

“In its native range, the species occurs in coastal areas of the Caspian and Aral Seas (Berg 1964; Barus et al., 2001) as well as the estuaries of large Ukrainian and Russian rivers. […] In the U.S., the common carp is more abundant in manmade impoundments, lakes, and turbid sluggish streams receiving sewage or agricultural runoff, and less abundant in clear waters or streams with a high gradient (Pflieger 1975; Trautman 1981; Ross 2001; Boschung and Mayden 2004). Pflieger (1975) noted that the common carp tends to concentrate in large numbers where cannery or slaughter-house wastes are emptied into streams.”

“Larval common carp feeds primarily on zooplankton. In its native range, juveniles and adults feed on benthic organisms (e.g., chironomids, gastropods and other larval insects), vegetation,

detritus and plankton (e.g., cladocerans, copepods, amphipods, mysids). Feeding habits are similar in the U.S., where the diet is composed of organic detritus (primarily of plant origin), chironomids, small crustaceans, and gastropods (Summerfelt et al. 1971; Eder and Carlson 1977; Panek 1987). The common carp have shown to be an important seed dispersal vector for aquatic plants (VonBank 2018). The common carp is very active when feeding and its movements often disturb sediments and increase turbidity, causing serious problems in some regions especially where the species is abundant. The species also retards the growth of submerged aquatic vegetation by feeding on and uprooting plants (King and Hunt 1967)."

From GISD (2018):

"Over portions of its native range, common carp may be sexually mature as early as by the end of its first year, but three to four years is more common. Male carp mature before female carp (Pinto et al. 2005)."

Human Uses

From Froese and Pauly (2018a):

"Utilized fresh and frozen [Frimodt 1995]. Aquarium keeping: in groups of 5 or more individuals; minimum aquarium size >200 cm; not recommended for home aquariums [BMELF 1999]."

"In Japan, carp is particularly symbolic on Boy's Day (May 5) because it represents strength, thus a carp replica called koi nobori, meaning to "to hang and fly a carp" is flown for every male member of the family on that day [Yamamoto and Tagawa 2000]."

"One of the most frequently found species in the pet and aquarium stores [in Spain] [Maceda-Veiga et al. 2013]."

"Marketed cleaned and iced, or smoked [Scott and Crossman 1998]. Also a popular fish sold in live fish markets. Found in 2 out of 6 live fish markets near the Lakes Erie and Ontario [Rixon et al. 2005]. Rarely utilized as a game fish [Coker et al. 2001]."

"European carp first appeared in commercial catches in inland fisheries [in Australia] in the early 1970s (catch records for carp before this date are thought to consist of a mixture of goldfish and European carp). In Victoria in 1971 special licenses were issued to fishers for European carp in rivers normally closed to fishing. These fishers used electro-fishing gear, and were based at Echuca and Koondrook. They worked the rivers in the Murray River valley [Fisheries and Wildlife Division, Victorian Ministry for Conservation 1976]. Low catches have seen electro-fishing activities cease there in recent years [Hume et al. 1983]. In the Gippsland Lakes, European carp are taken using electro-fishing gear, beach seines and gillnets. Catches for the State fluctuated widely between 1964-65 and 1983-84, peaking at 487 t in 1975-76 and 464 t in 1979-80. For the same period, 66% of the European carp catch came from the Gippsland Lakes."

From Nico et al. (2018a):

"Several agents of the U.S. Fish Commission documented the early years of common carp propagation and stocking in the United States (e.g., Smiley 1886; Smith 1896; Cole 1905). Although this species was popular in the early 1870s as a food fish, common carp fell into wide disfavor soon after and is now considered a nuisance fish because of its abundance and detrimental effects on aquatic habitats. [While still consumed at a subsistence level and popular in some sport fish sectors, see below, the majority of the United States population considers it a 'trash fish'.]"

From Nico et al. (2018b):

"*Cyprinus carpio* has high lipid content and has been used to test contamination levels in the Great Lakes for comparison with human consumption guidelines (Gewurtz et al. 2010, Pérez-Fuentetaja et al. 2010).

Furthermore, *C. carpio* is fished commercially in the Great Lakes by both Canada and U.S. (Becker 1983, Brown et al. 1999, Dann and Schroeder 2003). It is also important as ornamental/aquarium fish, particularly if subspecies are considered (koi) (Rixon et al. 2005). It is a popular sport fish in parts of the U.S. According to Scott and Crossman (1973), the recreational pursuit of *C. carpio* was not considered common in Canadian waters historically, although it has been gaining popularity among anglers and in the tourism fisheries and fish markets in the Great Lakes region. Becker (1983) also described the growing presence of *C. carpio* in many branches of Wisconsin's recreational and commercial fisheries."

From GISD (2018):

"*C. carpio* production is the second highest farmed fish production in the world, mainly in Asia (Milstein 1992, in Saikia & Das 2009)."

"Common carp are highly appreciated by many recreational fisheries, particularly in Europe including the United Kingdom, the Czech Republic and Germany (Linfield 1980, Vacha 1998, Wedekind et al. 2001, in Arlinghaus & Mehner 2003)."

Diseases

Infection with *Aphanomyces invadans*, spring viraemia of carp virus, and koi herpesvirus are OIE-reportable diseases.

According to Harikrishnan et al. (2005), *Cyprinus carpio* can be infected with *Aphanomyces invadans*.

From Shivappa et al. (2008):

"Spring viraemia of carp virus (SVCV) or *Rhabdovirus carpio* is associated with severe systemic illness and mortality in carp species (Fijan 1999). Koi, *Cyprinus carpio* L., are especially susceptible to SVCV."

From Gilad et al. (2004):

"In 1998, a herpes-like virus, designated Koi herpesvirus (KHV), was isolated from koi *Cyprinus carpio* koi in Israel and the USA undergoing outbreaks of a serious and apparently new disease (Hedrick et al. 1999, 2000)."

From Froese and Pauly (2018a):

"Parasitized by *Bothriocephalus acheilognathi* […]"

Froese and Pauly (2018a) list water mold disease, Fin-rot Disease (early and late stage), Red spot Disease, Anchor worm Disease (*Lernaea* sp.), Fish louse Infestation 1, Coccidiosis (intestine), Boil Disease, Costia Disease, *Dactylogyrus* Gill Flukes Disease, Fish leech Infestation, Trichodinosis, Lymphocystis Disease, Skin Flukes, Fungal Gill Rot (sanguinis), *Chilodonella* Disease, Worm Cataract, Lymphocystis Disease (dark), White spot Disease, *Trichodinella* Infection 1, 2, 3, *Trichodina* Infection 1, 2, 3, 5, 7, *Myxobolus* Infection 1, 3, 4, *Thelohanellus* Infection 1, Turbidity of the Skin (Freshwater fish), *Pallisentis* Disease, Columnaris Disease (l., e.), Aeromonosis, Infectious ascites (Ornament.), Neoplasia (tumors of unknown origin), Hole-in-the-Head Disease, Fish Pox Disease, Congenital Deformities, Carp Iridovirus, Carp Coronovirus Infection, Carp Reovirus, Enteric Redmouth Disease, Edwardsiellosis, Epitheliocystis, *Capillaria* Infestation 3, *Pseudocapillaria* Infestation 1, and Velvet Disease 2 (*Piscinoodinium* sp.) as additional diseases or parasites of *Cyprinus carpio*.

Froese and Pauly (2018b) list *Acanthocephalus alabamensis*, *Argulus foliaceus*, *Arugulus carpionis*, *Aspidogaster dectis*, *A. ijimai*, *Asymphylodora japonica*, *Caligus dentatus*, *C. orientalis*, *Caryophyllaeus laticeps*, *Chilodonella cyprini*, *Cucullanus cyprini*, *Dactylogyrus anchoratus*, *D. dulkeiti*, *D. extensus*, *D. intermedius*, *D. minutus*, *D. vastator*, *Ergasilus briani*, *E. caeruleus*, *E. ludhianata*, *E. peregrinus*, *E. seiboldi*, *Gryporhynchus cheilancristrotus*, *G. pusillus*, *Gyrodactylus kathariner*i, *G. kherulensis*, *G. nagibinae*, *G. ophiocephali*, *G. osoblahensis*, *G. procerus*, *G. shulmani*, *G. sprostonae*, *G. stankowici*, *Ichthyobodo necator*, *Ichthyophthirius multifiliis*, *Lernae carassii*, *Lernaea cyprinacea*, *L. oryzophila*, *L. polymorpha*, *Ligictaluridus floridanus*, *Ligula intestinalis*, *Mitraspora cyprini*, *Myxobolus cyprinicola*, *M. paratoyamai*, *M. tanakai*, *Neoergasilus japonicus*, *N. longispinosus*, *Piscinoodinium pillulare*, *Paracoenogonimus ovatus*, *Paradilepis scolecina*, *Paraergasilus brividigitus*, *P. longidigitus*, *P. rylovi*, *Raphidascaris cyprini*, *R. acus*, *Sinergasilus undulatus*, *Sphaerostoma bramae*, *Trichodina domerguei*, and *Tylodelphys clavata* as additional parasites of *Cyprinus carpio*.

From Nico et al. (2018a):

"Hartel et al. (1996) noted that more than 20,000 common carp were killed by a bacterial disease over a short period of time in the Merrimack River in the late 1970s."

Poelen et al. (2014) list the following additional parasites and diseases for *Cyprinus carpio*: *Lactococcus raffinolactis*, *L. lactis*, cyprinid herpesvirus 1, 3, *Myxidium cuneiforme*,

Thelohanellus nikolskii, *T. kitauei*, *Sphaerospora renicola*, *Aeromonas eucrenophila*, *A. jandaei*, *A. veronii*, *A. sobria*, *A. hydrophila* (flesh-eating bacteria), *Myxobolus longisporus*, *M. shantungensis*, *M. koi*, *M. dispar*, *M. basilamellaris*, *M. cyprini*, *Flavobacterium columnare*, *F. psychrophilum*, *Listonella anguillarum*, epidemic cholera (*Vibrio cholerae*), *Acinetobacter junii*, *Kurthia gibsonii*, *Streptococcus iniae*, *Citrobacter freundii*, *Dactylogyrus achmerowi*, *D. arquatus*, *D. auriculatus*, *D. amphibothrium*, *D. anchoracanthus*, *D. arcuatus*, *D. cryptomeres*, *D. falciformis*, *D. formosus*, *D. lamellatus*, *D. molnari*, *D. mrazeki*, *D. phoxini*, *D. sahuensis*, *D. solidus*, *D. yinwenyingae*, *D. inexpectatus*, *Eudiplozoon nipponicum*, *Atractolytocestus huronensis*, *A. sagitattus*, *Diplostomum mergi*, *D. chromatophorum*, *D. rutili*, *D. helveticum*, *D. paracaudum*, *D. paraspathaceum*, *D. parviventosum*, *Diplostomum* sp., *D. spathaceum*, *Goussia carpelli*, *Pseudomonas aeruginosa*, *Philometroides cyprini*, *Philometroides* sp., *Khawia sinensis*, K. *iowensis*, *K. japonensis*, *Mycobacterium marinum*, *Hebesoma violenteum*, *Neoechinorhynchus manasbalanse*, *N. australis*, *N. rutili*, *Parvitaenia samfyia*, *Gyrodactylus schulmani*, *G. elegans*, *G. medius*, *G. baicalensis*, *G. carpio*, *G. cyprini*, *G. derjavini*, *G. fairporti*, *G. gurleyi*, *G. longoacuminatus*, *G. nemachili*, *G. stankovici*, *G. vimbi*, *Gyrodactylus* sp., *G. carpio*, *Capillaria petrushchewskii*, *C. patzcuarensis*, *Schulmanella petruschewskii*, *Bolbophorus confusus*, *Diplostomulum clavatum*, *Neascus vetestai*, *Neascus* sp., *Carassotrema wui*, *C. koreanum*, *Arhthmorhynchus brevis*, *Pomphorhynchus kawi*, *P. kashmirensis*, *Pomphorhynchus* sp., *P. megacanthus*, *P. oreini*, *P. laevis*, *Brentisentis* sp., *Pallisentis ussuriense*, *P. celatus*, *Metarhadinorhynchus cyprini*, *Bathybothrium rectangulum*, *Breviscolex orientalis*, *Caryophyllaeus brachycollis*, *C. fimbriceps*, *Caryophyllaeus* sp., *Glaridacris laruei*, *G. oligorchis*, *Dilepis unilateralis*, *Digramma interrupta*, *Gryporhynchus pusillum*, *Valipora unilateralis*, *V. campylancristrota*, *Ancyrocephalus paradoxus*, *Ancyrocephalus* sp., *Diplozoon paradoxum*, *D. kashmirensis*, *Pseudacolpenteron pavlovskii*, *Cleidodiscus* sp., *Paradiplozoon homoion*, *P. alburni*, *P. zeller*, *Paradiplozoon* sp., *Anisakis schupakovi*, *Contracaecum aqualii*, *C. squalii*, *C. microcephalum*, *C. spiculigerum*, *C. multipapillatum*, *C. rudolphii*, *Porrocaecum reticulatum*, *Ascaris carpionis*, *Spinitectus gigi*, *Spinitectus* sp., *Skrjabillanus cyprinae*, *Philometra* sp., *Rhabdochona cyprini*, *R. guptii*, *R. soodi*, *R. denudata*, *Baruscapillaria appendiculata*, *Pseudocapillaria tomentosa*, *P. philippinensis*, *Ornithocapillaria appendiculata*, *Bunodera luciopercae*, *Crepidostomum cooperi*, *Aspidogaster amurensis*, *A. limacoides*, *A. conchicola*, *A. decatis*, *Bucephalus polymorphus*, *Hysteromorpha triloba*, *Posthodiplostomum brevicaudatum*, *P. cuticola*, *P. minimum*, *Apophallus venustus*, *Ascocotyle coleostoma*, *Cryptocotyle concava*, *Heterophyopsis continua*, *Metagonimus yokogawai*, *M. takahashii*, *Asymphylodora tincae*, *A. imitans*, *A. kubanicum*, *A. markewitschi*, *Asymphylodora* sp., *Ichthyocotylurus pileatus*, *Sanguinicola armata*, *Sanguinicola* cf. *inermis*, *Parabucephalopsis prosthorchis*, *Pseudorhipidocotyle elopichthys*, *Rhipidocotyle campanula*, *Clinostomum complanatum*, *C. schizothoraxi*, *Neodiplostomum* sp., *Echinochasmus beleocephalus*, *E. donaldsoni*, *E. japonicus*, *E. pertfoliatus*, *Echinochasmus* sp., *E. milvi*, *Phyllodistomum cyprini*, *P. dogieli*, *P. elongatum*, *Centrocestus armatus*, *C. caninus*, *C. formosanus*, *Centrocestus* sp., *Haplorchis pumilio*, *H. taichui*, *Macrostomum borealis*, *Orientotrema* sp., *Nanophyetus salmincola*, *Allocreadium carparum*, *A. isoporum*, *Crowcrocaecum skrjabini*, *Azygia* sp., *Sphaerostomum globiporum*, *S. bramae*, *Apharyngostrigea cornu*, *Cucullanus* sp., *Archigetes iowensis*, *A. sieboldi*, *Desportesius brevicaudatus*, *Leptorhynchoides thecatus*, *Cyclustera ralli*, *Syncuaria squamata*, *Triaenophorus nodulosus*, *Spiroxys contorta*, *Neogryporhynchus cheilancristrotus*, *Gnathostoma nipponicum*, *G. hispidum*, *G. spinigerum*, *Acanthocephalus dirus*, *A. anguillae*, *A. lucii*, *A. clavula*,

Proteocephalus torulosus, *Proteocephalus* sp., *Camallanus lacustris*, *Corynosoma strumosum*, *Eubothrium crassum*, *Tetraonchus monenteron*, eel swimbladder nematode (*Anguillicola crassus*), Chinese river fluke (*Clonorchis sinensis*), cat liver fluke (*Opisthorchis felineus*), *Bothriocephalus gowkongensis*, *Caryophyllaeides fennica*, *Argulus appendiculosus*, *Cestodaria* sp., *Pseudoamphileptus macrostoma*, carp picornavirus 1, carp sprivivirus, fisavirus 1, and Halastavi arva RNA virus.

Threat to Humans

From Froese and Pauly (2018a):

"Potential pest"

From GISD (2018):

"By stirring up river substrate and reducing aquatic vegetation carp can makes waterways unattractive and can render the water unsuitable for swimming or for drinking by livestock (NIWA 2003)."

From Nico et al. (2018b):

"Common carp is fished commercially in the Great Lakes (Brown et al. 1999, Dann and Schroeder 2003). However, a recent study of contaminant levels in Lake St. Clair and the St. Clair River indicated that while most carp were below the general human consumption guidelines for mercury content, high PCB levels are of concern for both sensitive and general populations, especially in medium- to large-size fish (Gewurtz et al. 2010)."

3 Impacts of Introductions

From Weber and Brown (2009):

"Common carp in shallow lakes increase turbidity, phytoplankton, and blue-green algae; mobilize nutrients; and decrease macrophytes, macroinvertebrates, and fishes (Lamarra 1975; Parkos et al., 2003; Egertson and Downing, 2004). Common carp populations function as ecosystem engineers by regulating bottom-up and top-down processes. Introduced common carp are not regulated by topdown processes (i.e., experience minimal predation) and are not limited by bottom-up processes (i.e., prey resources); thus, common carp can regulate ecosystems through a middle-out framework. Ecosystem effects imposed by common carp may be greater than those caused by other native benthivores and occur even at relatively low common carp densities, with increases in undesirable ecosystem effects with increases in common carp biomass (Parkos et al., 2003; Chumchal et al., 2005). Ecosystem engineering by common carp can transform lakes from clear to turbid water, with ecosystem-wide consequences (Scheffer, 1998; Haas et al., 2007)."

From Parkos et al. (2003):

"The use of mesocosms allowed us to control the fish community in our experiment, making it possible to separate the effects of common carp from those of other fishes (e.g., other benthic and planktivorous fish). […] In our experiment, systems without common carp were characterized by clear water, with extensive aquatic macrophyte structure, numerous macroinvertebrate predators, and small-bodied zooplankton grazers. The addition of common carp produced a system with highly turbid, nutrient-rich water, few aquatic macrophytes, low numbers of macroinvertebrate predators, many zooplankton grazers, and abundant phytoplankton. Even though some effects of common carp were stronger at a high biomass of fish, in general, the influence of common carp on aquatic systems was strong at both low and high fish abundance and distinct from the effects of a native benthic fish."

From Froese and Pauly (2018a):

"[…], and has invaded dams and some parts of rivers where it replaced indigenous tilapias as dominant species [Seegers et al. 2003]."

"Has been implicated in the introduction of many fish parasites in South Africa [de Moor and Bruton 1998; Winker et al. 2011]. Populations collected from Lake Gariep had shorter maturation and generation times as well as had faster growth performance compared to other populations in Europe. This emphasizes the potential of the species to rapidly colonize and dominate new freshwater systems [Winker et al. 2011]."

"[In India:] Caused the disappearance of native genus *Schizothorax* from waters to which it has been introduced."

"[In Italy:] Indirectly interferes with native species by altering the habitat [Bianco 2014]."

"Parasitized by *Bothriocephalus acheilognathi* which was introduced into the country [Mexico] with carp which has become widely disseminated in the country and has been found in at least 15 fish species [Perez-Ponce de Leon et al. 2000]."

"European carp have been declared noxious fish in most Australian States."

"It is illegal to breed European carp for sale in Victoria [Hume et al. 1983] and South Australia."

From Nico et al. (2018a):

"Available literature indicates common carp may destroy aquatic macrophytes directly by uprooting or consuming the plants, or indirectly by increasing turbidity and thereby reducing light for photosynthesis. Bellrichard (1996) found that alterations in macrophyte biomass are due more to direct effects of common carp. In their review of the literature, Richardson et al. (1995) concluded that common carp has had noted adverse effects on biological systems including destruction of vegetated breeding habitats used by both fish and birds, and an increase in turbidity. It stirs up the bottom during feeding, resulting in increased siltation and turbidity (Lee

et al. 1980 et seq.). This feeding behavior also destroys rooted aquatic plants that provide habitat for native fish species and food for waterfowl (Dentler 1993). Bonneau and Scarnecchia (2015) found that carp eradication and exclusion from reservoir tributaries allowed for increased benthic invertebrate community diversity and abundance, and the return of submerged aquatic vegetation."

"There is also evidence that common carp prey on the eggs of other fish species (Moyle 1976; Taylor et al. 1984; Miller and Beckman 1996). For this reason, it may be responsible for the decline of the razorback sucker *Xyrauchen texanus* in the Colorado River basin (Taylor et al. 1984). In another case, Miller and Beckman (1996) documented white sturgeon *Acipenser transmontanus* eggs in the stomachs of common carp in the Columbia River. In California, carp have been implicated in the decrease in water clarity in Clear Lake, Lake County, and in the gradual disappearance of native fishes (Moyle 1976). McCarraher and Gregory (1970) wrote that in 1894 there was documentation that Sacramento perch *Archoplites interruptus* were becoming more scarce because carp was destroying their spawning grounds. Laird and Page (1996) stated that common carp may compete with ecologically similar species such as carpsuckers and buffalos. Because this species has been present in many areas since the first surveys, its impacts on many of the native fishes are difficult to determine. Once established in a water body, common carp is difficult and expensive to eliminate (e.g., Cahoon 1953)."

From GISD (2018):

"*C. carpio* is the third most frequently introduced species world-wide (Welcomme 1992, in Saikia & Das 2009). On every continent where it has been introduced it has reduced water quality and degraded aquatic habitats (McCrimmon 1968, Roberts et al. 1995, King et al. 1997, Koehn et al. 2000, in Jones & Stuart 2006)."

"Shin-ichiro and colleagues (2009) found carp significantly influenced benthic macroinvertebrates."

"Modification of natural benthic communities: Carp are believed to stimulate algal bloom formation by increasing nutrient release from sediments and decreasing algal grazing by cladocerans (which the juvenile carp prey upon) (Pinto et al. 2005).
Modification of nutrient regime: Carp increase nutrients in the water column in two ways: by sediment resuspension and by excretion (Lamarra 1975, Brabrand et al. 1990, in Chumchal 2002)."

"The loss of rooted macrophytes due to carp activity is intuitively likely to lead to a decline in biological diversity, in endemic fish, amphibians, and reptiles in Mexico (Crowder & Painter 1991, in Zambrano et al. 1999) and elsewhere."

"Economic/Livelihoods: Growth rates and stocks of other fish may be impacted by competition with carp (Arlinghaus & Mehner 2003), including perch. Carp provide an important source of protein in some third world countries (FishBase 2009).

Human nuisance: By stirring up river substrate and reducing aquatic vegetation carp can makes waterways unattractive and can render the water unsuitable for swimming or for drinking by livestock (NIWA 2003)."

CABI (2018) lists the following threatened species as potentially impacted by *Cyprinus carpio*: *Gila nigra*, *Gila nigraescens*, *Gila robusta*, *Oncorhynchus clarkii henshawi*, *Pacifastacus fortis*, *Percina jenkinsi*, *Plagopterus argentissimus*, *Rhinichthys oculus lethoporus*, *Xyrauchen texasnus*, and *Zizania texana*.

From Nico et al. (2018b):

"The role of *C. carpio* as an ecosystem engineer is well documented. For instance, following the installation of a carp barrier at Cootes Paradise Marsh (Lake Ontario), average turbidity was reduced by 40% in open water and 60% in vegetated areas, although further implications for plants and wildlife were difficult to assess due to variation in environmental conditions (Lougheed et al. 2004). […] One study analyzed the relationship between common carp biomass, vegetative cover, and waterfowl abundance over time in a shallow inland lake in Illinois (Bajer et al. 2009). The authors found that small densities of common carp (<30 kg/ha) did not have significant effects on vegetation or waterfowl, but a subsequent increase to over 250 kg/ha was strongly correlated with a decrease in vegetative cover from its original value of 94% to just 17% (Bajer et al. 2009). Furthermore, waterfowl activity dropped to ~10% of its original value. The authors suggested a threshold of 100 kg/ha past which common carp exert extensive ecological damage to shallow lakes (Bajer et al. 2009)."

"A great deal of the common carp's environmental impact is thought to come from indirect effects on habitat and the environment. For instance, in Mexico, populations of a native crayfish (*Cambarellus montezumae*) notably decreased with increasing carp density (Hinojosa-Garro and Zambrano 2004). However, further analysis indicated that *C. carpio* was not consuming the crayfish; rather, the destruction and depletion of crayfish habitat by common carp, particularly of algal species and macrophytes, were deemed to be the major mechanism of crayfish decline (Hinojosa-Garro and Zambrano 2004).

Miller and Crowl (2006) executed research in a eutrophic lake involving in situ observations of *C. carpio* impact through the use of cages and exclosures. They documented both direct and indirect effects of common carp on overall species composition, abundance, and plant species diversity. *Cyprinus carpio* also appeared to have indirect effects on macroinvertebrate community composition (Miller and Crowl 2006). A similar experiment set up enclosures within experimental ponds and noted that higher biomasses of *C. carpio* were positively related to phosphorus level, turbidity, and zooplankton biomass and negatively related to abundance of macroinvertebrates and macrophytes (Parkos et al. 2003). In comparison, channel catfish (*Ictalurus punctatus*), a native benthivore, affected phosphorus concentration and zooplankton communities, but had no significant effect on turbidity, macroinvertebrates, macrophytes, or suspended solids (Parkos et al. 2003).

In a biomanipulative experiment, Schrage and Downing (2004) removed >75% of the *C. carpio* population in Ventura Marsh, IA. In comparison to the adjacent reference site, they found that

the removal of common carp had cascading effects, including an increase in water quality related to decreased suspended solid and phytoplankton biomass. Within a few weeks, the authors noted an increase in *Daphnia* sp. and *Ceriodaphnia* sp. biomass as well as macrophyte diversity and density. The major limiting factor on maximum phytoplankton biomass appeared to switch from phosphorous abundance to zooplankton abundance, as suspended inorganic sediment settled to the bottom (Schrage and Downing 2004).

Common carp has also been experimentally added to freshwater coastal wetland sites (Delta Marsh, Manitoba, Canada) at densities of 150, 300, 600, and 1200 kg•ha-1 (Badiou and Goldsborough 2010). The authors found that density of common carp was positively related to nutrient concentrations in the water column, suspended solids, and chlorophyll a concentrations. Furthermore, carp density was negatively related to dissolved oxygen concentrations, photic depth, and submersed macrophyte density (Badiou and Goldsborough 2010). These findings support the hypothesis that common carp may facilitate phytoplankton growth via increased nutrient loading in the water. Nevertheless, significant reduction in submersed macrophyte biomass was not observed, possibly because turbidity was relatively limited and the euphotic zone continued to span the entire water column at all carp densities (Badious and Goldsborough 2010). Their results also suggested that suspension of solids increases as the colonized water body decreases in size, possibly due to a limited prey populations and increased forage activity by common carp. In this system, common carp populations were estimated to resuspend 37 to 361 kg of sediment per day, relative to pre-stocked conditions (Badiou and Goldsborough 2010)."

"In a study of 129 lakes in Iowa, a negative relationship was discovered between *C. carpio* abundance and sportsfish abundance (bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), and white crappie (*P. annularis*)) (Jackson et al. 2010). This relationship could be due to the poor water quality (e.g., high nutrient levels and low water clarity), which was also associated with high *C. carpio* abundance; however, *C. carpio*'s role in the decline of the sportsfish populations was not conclusively determined (Jackson et al. 2010)."

From NatureServe (2018):

"Tyron (1954) conducted an experiment to test the effect of carp on aquatic vegetation by setting up screened carp exclosures in a Pennsylvania lake. The exclosures had an average of 3.9 g of dried plants/sq meter compared with 1.4 g/sq meter in adjacent open quadrats. King and Hunt (1967) used carp exclosures in a lake marsh and found a significantly higher weight of plant species inside the exclosures. Chara (*CHARA* sp.) was eaten and leafy pondweed (*POTAMOGETON FOLIOSUS*) was uprooted by the carp; sago pondweed (*P. PECTINATUS*) and crispus (*P. CRISPUS*) were not affected by carp activity. At carp densities less than 300 lb/acre (336 kg/ha), plant growth was most affected in early and late summer but, at higher carp densities, plants were adversely affected throughout the growing season.

Robel (1961) stocked enclosures with known numbers of carp in a Utah marsh and compared the amount of vegetation and turbidity levels with empty control enclosures. There was no difference in turbidity between control and experimental enclosures. Vegetative productivity in control

enclosures was not different from that in enclosures with less than 200 lbs carp/acre (224 kg/ha) but was significantly higher than in enclosures with over 400 lb carp/acre (448 kg/ha)."

"Lamarra (1976) proposed that carp densities of 200 kg/ha are high enough to possibly cause serious levels of eutrophication through carp feeding and digestion. Carp densities of 200 kg/ha in two Minnesota ponds were sufficient to increase the amount of chlorophyll a, net community production, and community respiration. From in situ experiments, Lamarra concluded that these increases were caused by the rapid recycling of nutrients, especially phosphorus, by carp."

4 Global Distribution

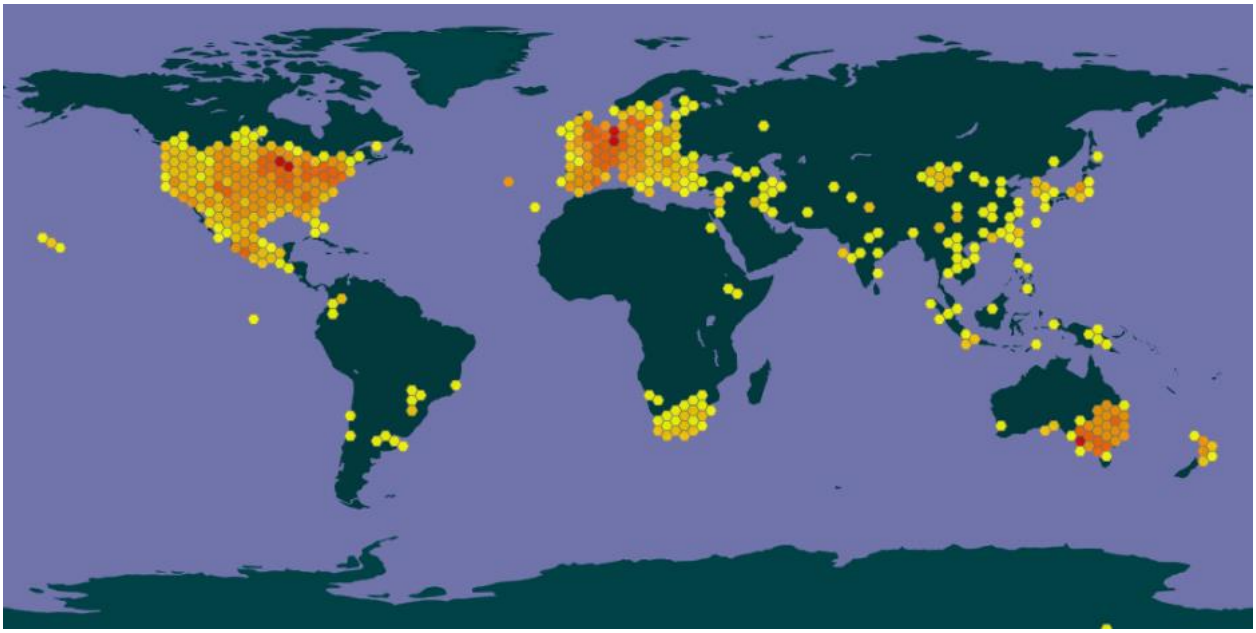

Figure 1. Known global distribution of *Cyprinus carpio*. Map from GBIF Secretariat (2018).

5 Distribution Within the United States

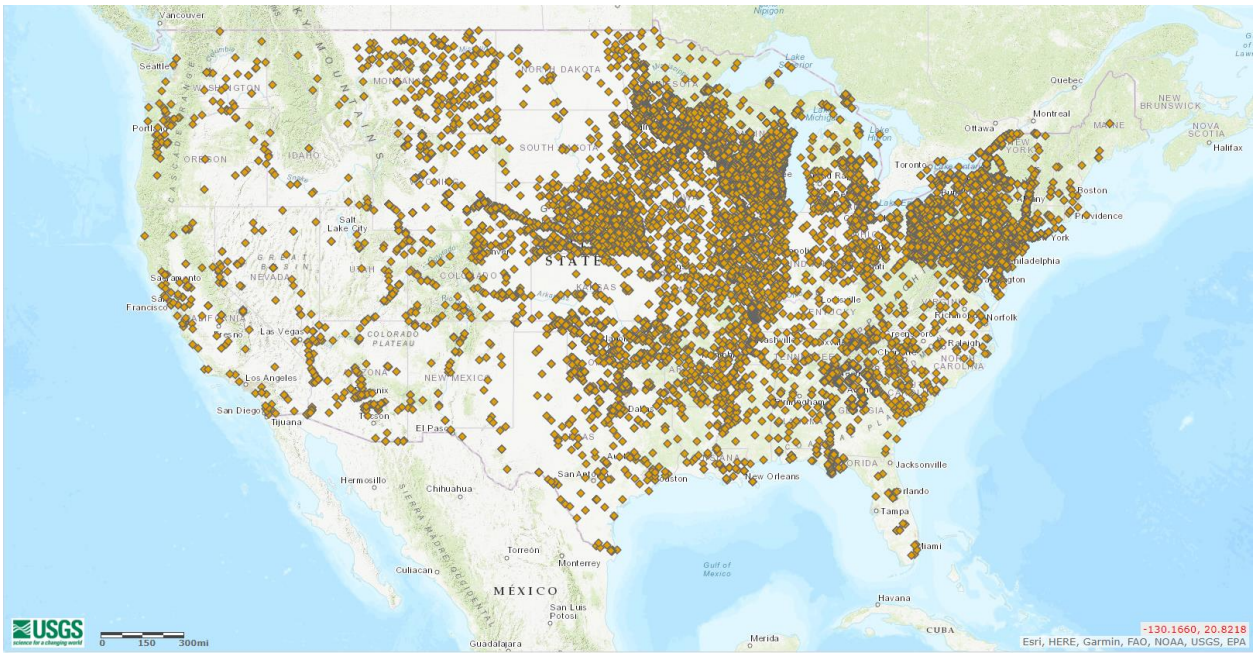

Figure 2. Known distribution of *Cyprinus carpio* in the contiguous United States. Map from Nico et al. (2018a).

Locations in southern Florida (Figure 2) were not used as source points for the climate match. *Cyprinus carpio* is considered to not be established in Florida outside of the panhandle area (Nico et al. 2018a).

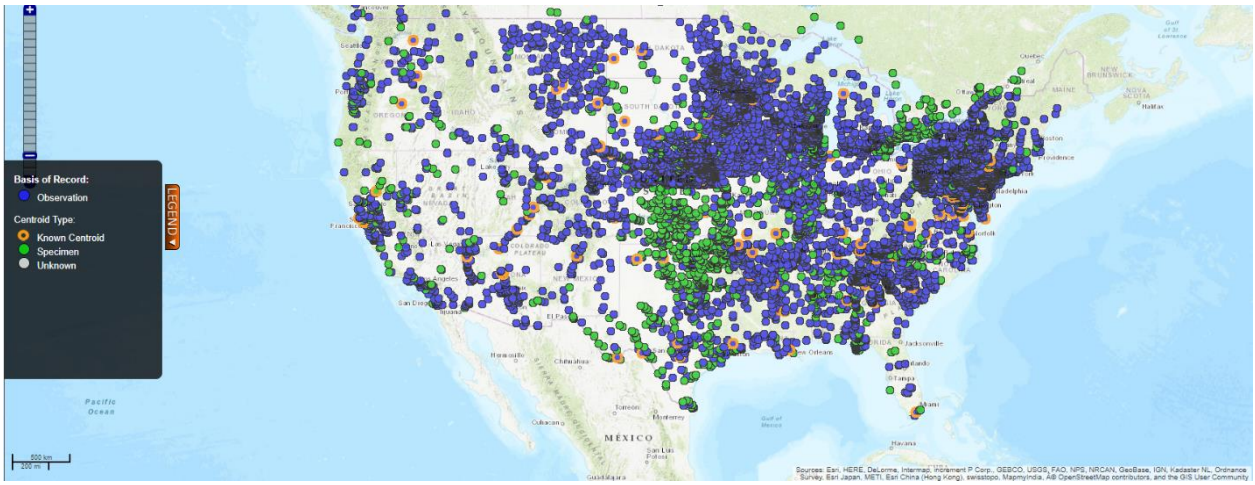

Figure 3. Additional known distribution of *Cyprinus carpio* in the contiguous United States. Map from BISON (2018).

Locations in southern Florida (Figure 3) were not used as source points for the climate match. *Cyprinus carpio* is considered to not be established in Florida outside of the panhandle area (Nico et al. 2018a).

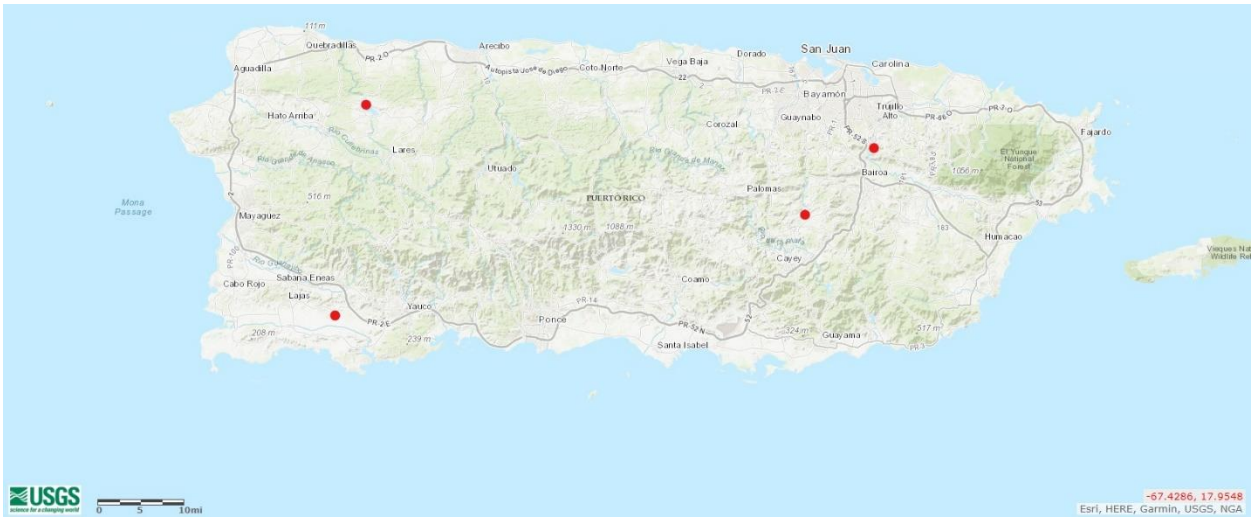

Figure 4. Known distribution of *Cyprinus carpio* in Puerto Rico. Map adapted from Nico et al. (2018a).

Figure 5. Known distribution of *Cyprinus carpio* in Hawaii. Map from Nico et al. (2018a).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Cyprinus carpio* was high across the contiguous United States. There was one area of medium match along the northern Pacific Coast. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.998, high. The range for a high climate score is 0.103 and above. All states had high individual climate scores.

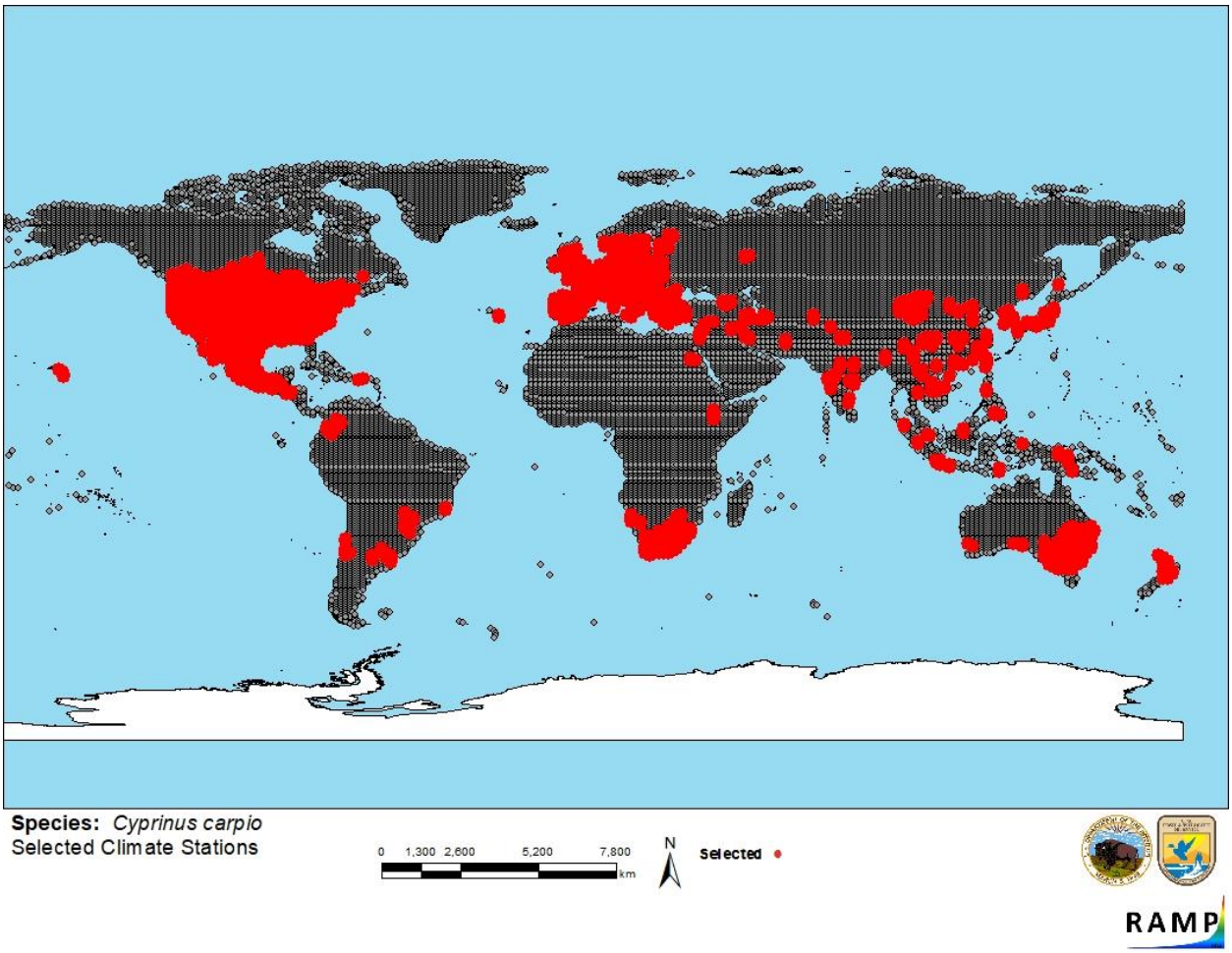

Figure 6. RAMP (Sanders et al. 2018) source map showing weather stations on all continents except Antarctica selected as source locations (red) and non-source locations (gray) for *Cyprinus carpio* climate matching. Source locations from BISON (2018), GBIF Secretariat (2018), and Nico et al. (2018a).

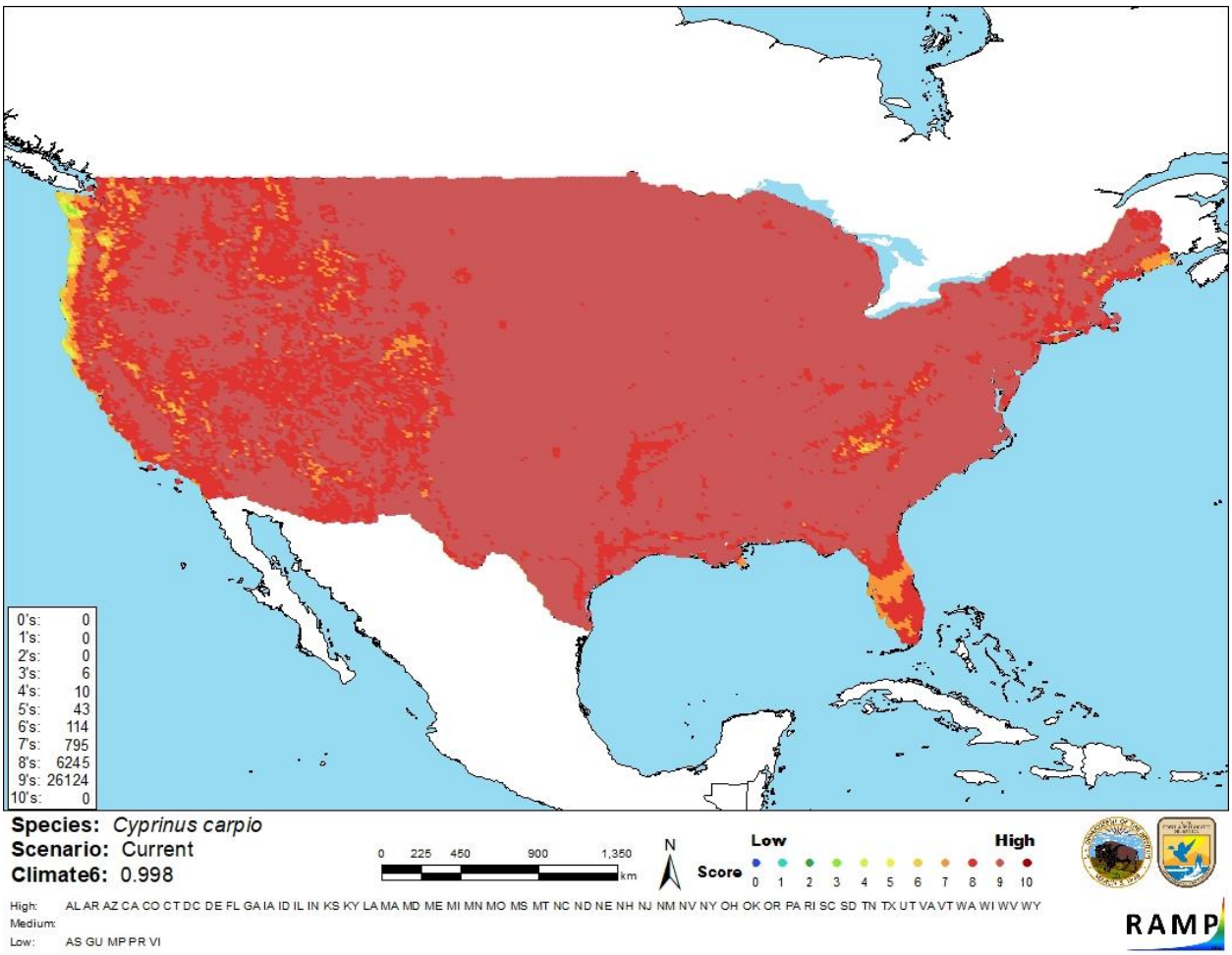

Figure 7. Map of RAMP (Sanders et al. 2018) climate matches for *Cyprinus carpio* in the contiguous United States based on source locations reported by BISON (2018), GBIF Secretariat (2018), and Nico et al. (2018a). 0 = Lowest match, 10 = Highest match.

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

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

7 Certainty of Assessment

The biology, distribution, and negative impacts of *Cyprinus carpio* are well documented in the scientific literature. Many studies demonstrate negative impacts from *Cyprinus carpio* introductions. No further information is needed to evaluate the negative impacts the species is having where introduced. The distribution and introduction history are also well documented. Certainty of this assessment is high.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Common Carp (*Cyprinus carpio*) is a fresh and brackish water fish native from Europe to Asia in the Caspian, Black, and Aral Sea basins. *Cyprinus carpio* is used for aquaculture, commercial, subsistence, and sport fisheries, aquaria, and bait, which has promoted its spread. *C. carpio* prefers slower moving waters and can tolerate poor water quality. There are many morphological variations of this species, including the ornamental mirror carp and koi. It is culturally significant in Japan, where it represents strength. The history of invasiveness is high. This species is now established in many locations worldwide, including the United States. Within the United States, only Alaska has not had a documented introduction of this species, and the species has established in all other states. It is also established in the U.S. territory of Puerto Rico. Negative impacts of this species are well-documented in peer-reviewed literature. 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 in the United States and Mexico due to competition and egg predation. It is considered a nuisance fish in many introduced countries and is listed as noxious in many Australian states. *Cyprinus carpio* is also a known carrier of OIE-reportable diseases; no records were found of *C. caprio* spreading an OIE-reportable disease with introduction. *C. carpio* has spread other diseases with introduction (i.e. *Bothriocephalus acheilognathi* in Mexico). The Climate match with the contiguous United States is high. Virtually all of the contiguous United States had a high climate match. Given the amount and quality of information, the certainty of assessment is high. Overall risk for this species is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): High**
- **Remarks/Important additional information:** Host of numerous diseases/parasites some of which are OIE-reportable and listed as a potential pest.
- **Overall Risk Assessment Category: High**

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