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

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1 Native Range, and Status in the United States

Native Range
From Kottelat and Freyhof (2007):

"Europe to Asia: Black, Caspian and Aral Sea basins. Introduced throughout the world. Wild stocks are only present naturally in rivers draining to the Black, Caspian and Aral Sea. 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)."

Status in the United States
From Nico et al. (2014):

"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."

"Records of introductions are available for the following states: Alabama (Smiley 1886, Baird 1887, McDonald 1886, 1893, Spencer et al. 1964, Smith-Vaniz 1968, Dahlberg and Scott 1971a, Swift et al. 1977, Mettee et al. 1987, 1996, Boschung 1992, Rasmussen 1998); Arizona (Rule

1885, Taggart 1885, Evermann and Rutter 1895, Gilbert and Scofield 1898, Miller and Lowe 1967, Minckley 1973, Lee et al. 1980 et seq., Tilmant 1999, USFWS 2005, Illinois Natural History Survey Fish Collections); Arkansas (Baird 1887, McDonald 1887, 1893, Courtenay 1970, Lee et al. 1980 et seq., Robison and Buchanan 1988, Rasmussen 1998, USFWS 2005, Mississippi Museum of Natural Science 2004, Illinois Natural History Survey Fish Collections); California (Smiley 1886, Smith 1896, Shebley 1917, Lampman 1946, La Rivers 1962, Moyle et al. 1974, Moyle 1976, Lee et al. 1980 et seq., Moyle and Daniels 1982, Smith 1982, Tilmant 1999, Sommer et al. 2001, Moyle 2002, USFWS 2005, Matern [et al.] 2002, Illinois Natural History Survey Fish Collections); Colorado (Smiley 1886, Baird 1887, McDonald 1886, Ellis 1974, Wiltzius 1981, Woodling 1985, Zuckerman and Behnke 1986, Rasmussen 1998, Tilmant 1999, Illinois Natural History Survey 2004); Connecticut (Smiley 1886, Ravenel 1896, Webster 1941, Lee et al. 1980 et seq, Whitworth 1996); Delaware (Smiley 1886, Baird 1887, McDonald 1886, Lee et al. 1976, Raasch and Altemus 1991, USFWS 2005); District of Columbia (Tilmant 1999); Florida (Baird 1887, McDonald 1886, Anonymous 1892, Courtenay et al. 1974, Swift et al. 1977, Shafland 1996, Anonymous 2001, Nico 2005); Georgia (Smiley 1886, Baird 1887, McDonald 1886, 1893, Anonymous 1892, Worth 1895, Ravenel 1896, 1898, Hildebrand 1923, Dahlberg and Scott 1971a, 1971b, Burkhead et al. 1997, Walters 1997); Hawaii (Cobb 1902, Jordan and Evermann 1902, 1905, Brock 1960, Maciolek 1984, Devick 1991, Tilmant 1999, Mundy 2005); Idaho (Smith 1896, Lampman 1946, Linder 1963, Simpson and Wallace 1978, Wydoski and Whitney 1979, Lee et al. 1980 et seq., Idaho Fish and Game 1990, Sigler and Sigler 1996, USFWS 2005, Amercian Fisheries Society 2001); Illinois (Smiley 1886, Baird 1887, McDonald 1886, Hay 1894, Sweeney 1902, Smith 1979, Lee et al. 1980 et seq., Emery 1985, Laird and Page 1996, Rasmussen 1998, Illinois Natural History Survey 2004, USFWS 2005); Indiana (Smiley 1886, Anonymous 1892, Hay 1894, Sweeney 1902, Blatchley 1938, Gerking 1945, Nelson and Gerking 1968, Lee et al. 1980 et seq., Emery 1985, Burr and Page 1986, Tilmant 1999, USFWS 2005); Iowa (Cleary 1956, Bailey and Allum 1962, Lee et al. 1980 et seq., Burr and Page 1986, Harlan et al. 1987, Young et al. 1997, USFWS 2005, Rasmussen, unpublished data); Kansas (Smiley 1886, Anonymous 1892, Ravenel 1896, Dyche 1914, Breukelman 1946, Call 1961, Cross 1967, Lee et al. 1980 et seq., Cross and Collins 1995, Rasmussen 1998, Tilmant 1999); Kentucky (McDonald 1893, Worth 1895, Ravenel 1896, Clay 1975, Lee et al. 1980 et seq., Burr and Page 1986, Burr and Warren 1986, Powers and Ceas 2000); Louisiana (Baird 1887, McDonald 1886, Anonymous 1892, Douglas and Davis 1967, Douglas 1974, Lee et al. 1980 et seq, Piler personal communication.); Maine (Everhart 1976); Maryland (Ferguson 1876, Smiley 1886, McDonald 1886, 1893, Anonymous 1892, Ravenel 1898, Truitt et al. 1929, Schwartz 1963, Lee et al. 1976, 1980 et seq., Tilmant 1999, Starnes et al. 2011); Massachusetts (McDonald 1886, Baird 1887, Lee et al. 1980 et seq., Hartel 1992, Hartel et al. 1996, Bozeman and Charp 2001, USFWS 2005); Michigan (Smiley 1886, McDonald 1893, Hubbs and Cooper 1936, Hubbs and Lagler 1958, Emery 1985, Tilmant 1999, Cudmore-Vokey and Crossman 2000, University of Michigan Museum of Zoology 2004); Minnesota (Baird 1887, McDonald 1886, 1893, Moore and Bream 1965, Eddy and Underhill 1974, Phillips et al. 1982, Emery 1985, Burr and Page 1986, Rasmussen 1998, Tilmant 1999, Myers 2004, Minnesota Sea Grant 2004, USFWS 2005); Mississippi (Smiley 1886, Baird 1887, McDonald 1886, 1893, Cook 1959, Ross and Brenneman 1991, Schramm and Basler 2004, Mississippi Museum of Natural Science 2004); Missouri (Smiley 1886, McDonald 1893, Ravenel 1896, 1898, Pflieger 1971, 1975, 1997, Burr and Page 1986, Young et al. 1997, Rasmussen 1998, USFWS 2005, Mississippi Museum of Natural Science 2004); Montana (Brown 1971, Courtenay 1985, Holton

1990, Young et al. 1997, Tilmant 1999, USFWS 2005); Nebraska (Bailey and Allum 1962, Morris et al. 1974, Lee et al. 1980 et seq., Texas Parks and Wildlife Department. 2001, Nebraska Parks and Wildlife Commission, personal communication); Nevada (Smith 1896, Miller and Alcorn 1946, Miller 1952, Lampman 1946, La Rivers 1962, Bradley and Deacon 1967, Deacon and Williams 1984, Scoppettone et al. 1998, Tilmant 1999, Insider Viewpoint 2001, USFWS 2005, Vinyard 2001); New Hampshire (Scarola 1973); New Jersey (Smiley 1886, Nelson 1890, Ravenel 1898, Fowler 1906, 1952, Stiles 1978, USFWS 2005); New Mexico (McDonald 1886, Baird 1887, Koster 1957, Lee et al. 1980 et seq., Sublette et al. 1990, Platania 1991, New Mexico Game and Fish 2000); New York (Smiley 1886, McDonald 1893, Bean 1903, Lee et al. 1980 et seq., Werner 1980, Emery 1985, Smith 1985); North Carolina (Anonymous 1892, Worth 1895, Ravenel 1896, Cahoon 1953, Lee et al. 1980 et seq., Menhinick 1991, USFWS 2005); North Dakota (Owen et al. 1981, Young et al. 1997, Power and Ryckman 1998, USFWS 2005); Ohio (Jordan 1882, Smiley 1886, Baird 1887, McDonald 1886, 1893, Anonymous 1892, Trautman 1981, Emery 1985, Burr and Page 1986, Tilmant 1999, USFWS 2005); Oklahoma (McDonald 1893, Bean 1896, Hall 1956, Miller and Robison 1973, Lee et al. 1980 et seq., Rasmussen 1998); Oregon (Smith 1896, Lampman 1946, Wydoski and Whitney 1979, Lee et al. 1980 et seq., Bond 1994, Logan et al. 1996, USFWS 2005); Pennsylvania (Smiley 1886, McDonald 1893, Hendricks et al. 1979, Cooper 1983, Pearson and Krumholz 1984, Tilmant 1999, Anonymous 2000, USFWS 2005); Rhode Island (Lapin, personal communication, Lee et al. 1980 et seq.); South Carolina (Baird 1887, McDonald 1886, 1893, Ravenel 1898, Hildebrand 1923, Dahlberg and Scott 1971a, 1971b, Loyacano 1975, Lee et al. 1980 et seq., Fretwell 2004); South Dakota (Anonymous 1892, Worth 1895, Cleary 1956, Shields 1958a, 1958b, Moyle and Clothier 1959, Underhill 1959, Bailey and Allum 1962, Lee et al. 1980 et seq., Young et al. 1997, USFWS 2005); Tennessee (McDonald 1886, Baird 1887, Anonymous 1892, Bean 1896, Ravenel 1896, Kuhne 1939, Ryon and Loar 1988, Etnier and Starnes 1993, Tilmant 1999, USFWS, Mississippi Museum of Natural Science 2004); Texas (Smiley 1886, Baird 1887, McDonald 1886, 1893, Bean 1896, Baughman 1950, Lee et al. 1980 et seq., Conner and Suttkus 1986, Howells 1992, Texas System of Natural Laboratories, Inc. and USGS 1994, Texas System of Natural Laboratories, Inc 1996, Red River Authority of Texas 2001, Texas Parks and Wildlife Department 1993,1994, 2001, USFWS 2005, Anonymous 1994); Utah (Tanner 1936, Sigler and Miller 1963, Vanicek et al. 1970, Lee et al. 1980 et seq., Sigler and Sigler 1996, Tilmant 1999); Vermont (Countryman 1975, Lee et al. 1980 et seq.); Virginia (Smiley 1886, Baird 1887, 1889, McDonald 1886, 1893, Anonymous 1892, Worth 1895, Bean 1896, Ravenel 1896, 1898, Lee et al. 1980 et seq., Jenkins and Burkhead 1994, Tilmant 1999); Washington (Smith 1896, Chapman 1942, Lampman 1946, Wydoski and Whitney 1979, Lee et al. 1980 et seq., Beecher and Fernau 1982, Wydoski and Whitney 2003, USFWS 2005, Four Seasons Campground and Resort 2003); West Virginia (Clay 1962, Lee et al. 1980 et seq., Stauffer et al. 1995, USFWS 2005); Wisconsin (Johnson and Becker 1980, Becker 1983, Emery 1985, Burr and Page 1986, Fago 1992, Tilmant 1999, Jansen 2003, USFWS 2005); and Wyoming (Baxter and Simon 1970, Stone 1995)."

"Common carp has also been collected the Cidra, Guajataca, and Loiza reservoirs and the Lajas Irrigation Canal in Puerto Rico (Felix Grana, personal communication)."

Means of Introductions in the United States

From Nico et al. (2014):

"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."

Remarks

From Nico et al. (2014):

"Carp is only established in the Florida panhandle. It does not appear to be established in South Florida."

"Balon (1995) reviewed the origin and history of domestication of common carp in Europe and elsewhere. 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. 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. Pflieger (1997) reported that the total weight and value of common carp taken by commercial fishermen in Missouri exceeded that of any other fish. 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. 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."

"DeVaney et al. (2009) performed ecological niche modeling to examine the invasion potential for common carp and three other invasive cyprinids (grass carp *Ctenopharyngodon idella*, black carp *Mylopharyngodon piceus*, and tench *Tinca tinca*). The majority of the areas where common carp have been collected, stocked, or have become established had a high predicted ecological suitability for this species."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2011):

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

Taxonomic Status: Valid."

Size, Weight, and Age Range
From Kottelat and Freyhof (2007):

"Maturity: Lm 35.1, range 25 - 36 cm; Max length : 110 cm SL male/unsexed; 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 Koch (2014):

A 64-year-old common carp was captured in Lake Gervais, Little Canada, Minnesota. The mean age of captured carp (n=127) was 31 years.

Environment
From Kottelat and Freyhof (2007):

"Freshwater; brackish; benthopelagic; pH range: 7.0 - 7.5; dH range: 10 - 15; potamodromous (Riede 2004)."

Climate/Range
From Kottelat and Freyhof (2007):

"Subtropical; 3°C - 35°C (Eaton et al. 1995); 60°N - 40°N."

Distribution Outside the United States
Native
From Kottelat and Freyhof (2007):

"Europe to Asia: Black, Caspian and Aral Sea basins. Introduced throughout the world. Wild stocks are only present naturally in rivers draining to the Black, Caspian and Aral Sea. 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)."

Introduced
From Kottelat and Freyhof (2007):

This species is reported as introduced in Thailand, Hawaii, Taiwan, Belarus, Indonesia, Albania, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Liechtenstein, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Bosnia Herzegovina, Botswana, Brunei, Quebec, Croatia, Czechoslovakia, Ecuador, French Polynesia, Guam, Haiti, Hong Kong, Jamaica, Kuwait, Kyrgyzstan, Lebanon, Lesotho, Latvia, Lithuania, Mozambique, Namibia, New Caledonia, Paraguay, Azores Is, East Timor, Reunion, Saudi Arabia, Singapore, Slovenia, Swaziland, Syria, Tajikistan, Togo, Turkey, Tanzania, Israel, Jordan River, Afghanistan, Myanmar, Iran, Nepal, Burundi, Argentina, Malaysia, Mexico, New Zealand, Poland, Romania, UK, Canada, Uruguay, South Africa, Mitidja Oueds, Finland, Australia, Chile, Estonia, Murgab

(Turkmenistan), British Columbia, Brazil, Japan, Kazakhstan (Lake Balkhash), Kenya, Sri Lanka, Madagascar, Philippines, Morocco, Zimbabwe, Cuba, Egypt, India, Colombia, Venezuela, Bolivia, Peru, Zambia, Congo, Dominican Republic, Puerto Rico, Guatemala, Nigeria, Iraq, Honduras, China, Papua New Guinea, Bangladesh, Rwanda, Ghana, Uganda, Nicaragua, Pakistan, El Salvador, Lao PDR, Tunisia, Central African Republic, Cyprus, Suriname, Cambodia, Viet Nam, Cameroon, Malawi, Korea, Sudan, Costa Rica, Hungary, Côte d'Ivoire, Mauritius, Panama, Former USSR, Angola (Pangula Lake), and Bhutan (FAO 1997).

From GISD (2014):

"C. carpio is the third most frequently introduced species world-wide (Welcomme 1992, in Saikia and Das 2009)."

Means of Introduction Outside the United States
From Kottelat and Freyhof (2007):

Reasons given for the introduction of this species include aquaculture, fisheries, diffused from other countries, angling, snail control, research, ornamental, accidental, weed control and unknown (FAO 1997). The species is reported to be established and having negative impacts on native populations in some areas where introduced (FAO 1997).

Short description
From Kottelat and Freyhof (2007):

"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. 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). Also Suzuki and Yamaguchi 1980, Suzuki and Yamaguchi 1984."

Biology
From Kottelat and Freyhof (2007):

"Adults inhabit warm, deep, slow-flowing and still waters such as lowland rivers and large, well vegetated lakes. 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 1973). Most active at dusk and dawn. Both adults and juveniles feed on a variety of benthic organisms and plant material. Spawns along shores or in backwaters. 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."

Human uses

From Kottelat and Freyhof (2007):

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

"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)."

Diseases

From Kottelat and Freyhof (2007):

Water mold Disease (l.), Fungal diseases; Fin-rot Disease (late stage), Bacterial diseases; Red spot Disease, Bacterial diseases; Anchor worm Disease, Parasitic infestations; SVC, Viral diseases; Fish louse Infestation 1, Parasitic infestations; Coccidiosis (intestine), Parasitic infestations; Boil Disease, Parasitic infestations; Costia Disease, Parasitic infestations; Dactylogyrus Gill Flukes Disease, Parasitic infestations; Fish leech Infestation, Parasitic infestations; Trichodinosis, Parasitic infestations; Lymphocystis Disease, Viral diseases; Skin Flukes, Parasitic infestations; Fungal Gill Rot (sanguinis), Fungal diseases; Chilodonella Disease, Parasitic infestations; Worm Cataract, Parasitic infestations; Fin Rot (early stage), Bacterial diseases; Lymphocystis Disease (dark), Viral diseases; White spot Disease, Parasitic infestations; Trichodinosis, Parasitic infestations; Skin Flukes, Parasitic infestations; Trichodinella Infection 1, Parasitic infestations; Trichodina Infection 1, Parasitic infestations; Trichodina Infection 2, Parasitic infestations; Trichodina Infection 3, Parasitic infestations; Trichodinella Infection 2, Parasitic infestations; Myxobolus Infection 3, Parasitic infestations; Myxobolus Infection 4, Parasitic infestations; Trichodina Infection 5, Parasitic infestations; Myxobolus Infection 1, Parasitic infestations; Trichodina Infection 7, Parasitic infestations; Trichodinella Infection 3, Parasitic infestations; Thelohanellus Infection 1, Parasitic infestations; Anchorworm Disease (Lernaea sp.), Parasitic infestations; Dactylogyrus Gill Flukes Disease, Parasitic infestations; Trichodinosis, Parasitic infestations; Turbidity of the Skin (Freshwater fish), Parasitic infestations; Pallisentis Disease, Parasitic infestations; Columnaris Disease (l.), Bacterial diseases; Aeromonosis, Bacterial diseases; Infectious ascites (Ornament.), Bacterial diseases; Columnaris Disease (e.), Bacterial diseases; Unspecified tumors, Neoplasia (tumors of unknown origin); Hole-in-the-Head Disease, Parasitic infestations; Turbidity of the Skin (Freshwater fish), Parasitic infestations; Bacterial Infections (general), Bacterial diseases; Koi Herpes Virus, Viral diseases; Fish Pox Disease, Viral diseases; Congenital Deformities, Others; Carp Iridovirus, Viral diseases; Carp Coronovirus Infection, Viral diseases; Carp Reovirus, Viral diseases; Enteric Redmouth Disease, Bacterial diseases; Edwardsiellosis, Bacterial diseases; Epitheliocystis, Bacterial diseases; Capillaria Infestation 3, Parasitic infestations; Pseudocapillaria Infestation 1, Parasitic infestations; Myxobolus Infection 3, Parasitic infestations; Myxobolus Infection 3, Parasitic infestations; Anchor worm Disease, Parasitic infestations; Myxobolus Infection 3, Parasitic infestations and Velvet Disease 2 (Piscinoodinium sp.), Parasitic infestations.

SVC, Viral Diseases and **Koi Herpes Virus** are OIE-reportable.

Threat to humans

Potential pest.

3 Impacts of Introductions

From Nico et al. (2014):

"The common carp is regarded as a pest fish because of its widespread abundance and because of its tendency to destroy vegetation and increase water turbidity by dislodging plants and rooting around in the substrate, causing a deterioration of habitat for species requiring vegetation and clean water (Cole 1905, Cahoon 1953, Bellrichard 1996, Laird and Page 1996). 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). 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 (2014):

"This species has been nominated as among 100 of the "World's Worst" invaders."

"*C. carpio* is the third most frequently introduced species world-wide (Welcomme 1992 in Saikia and 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, [and] Koehn et al. 2000, in Jones and Stuart 2006)."

"Ecosystem Change: In shallow aquatic ecosystems, common carp can be considered "ecosystem engineers" or "keystone modifiers" (Jones et al. 1994, [and] Mills et al. 1993 in Parkos [et al.] 2003) in that they have strong effects on benthic communities. Aquatic macrophytes are integral to ecosystem functioning (Stansfield et al. 1997 in Nunn et al. 2007). Carp are known to damage aquatic macrophytes. [Macroinvertebrates] are keystone species in aquatic ecosystems (Scheffer 1998, [and] Scheffer et al. 2001 in Shin-ichiro et al. 2009). Shin-ichiro and colleagues (2009) found carp significantly influenced benthic macroinvertebrates."

This type of impact has been reported from Argentina (Ref. 1739 in FishBase 2009), Australia (NSW Department of Primary Industries 2005), Canada (FishBase 2009), Chile (FishBase 2009), Republic of the Congo (FishBase 2009), Cyprus (FishBase 2009), India (FishBase 2009), Kenya (FishBase 2009, Britton et al. 2007), Madagascar (FishBase 2009), Malawi (FishBase 2009), Morocco (FishBase 2009), New Zealand (FishBase 2009, DOC Undated), Papua New Guinea (Coates and Ulaiwi 1995, FishBase 2009), Singapore (FishBase 2009), Switzerland (FishBase 2009), Tunisia (FishBase 2009), and Uruguay (FishBase 2009).

"Habitat Alteration: Carp may pose a threat to wetlands that are used by many fish as spawning and nursery habitats (Parkos [et al.] 2003)."

This type of impact has been reported from Australia (Roberts et al. 1995, Jones and Stuart 2009), China (Jia et al. 2008), Mexico (Zambrano et al. 1999, Hinjosa-Garro and Zambrano 2004), Poland, Portugal (FishBase 2009), the United Kingdom (Gordon Copp personal communication 2006 in FishBase 2009), and the United States (Hutchinson 1975, Lodge 1991, Newman 1991, Cowl et al. 1998, and Persson and Crowder 1998 in Miller and Provenza 2007; Miller and Provenza 2007).

"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)."

This type of impact has been reported from Australia (Harris 1995 in Pinto et al. 2005) and the United States.

"Modification of nutrient regime: Carp increase nutrients in the water column in two ways: by sediment resuspension and by excretion (Lamarra 1975 [and] Brabrand et al. 1990 in Chumchal 2002)."

This type of impact has been reported from Australia (NSW Department of Primary Industries 2005, Pinto et al. 2005, and King et al. 1997 in Pinto et al. 2005), Canada (Lougheed et al. 1998 in Pinto et al. 2005), and the United States (Lougheed et al. 1998 in Pinto et al. 2005).

"Reduction in native biodiversity: In California, USA, carp have been implicated in the gradual disappearance of native fishes (Moyle 1976a in Nico [et al.] 2009). Data from Miller and Crowl (2006) suggests that carp can significantly affect species abundance and diversity of macrophytes and some macroinvertebrates. Common carp negatively affected macrophyte abundance by reduction of light availability, increase of siltation rates, ingestion of plant matter and uprooting during feeding activity (Parkos [et al.] 2003).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 and Painter 1991 in Zambrano et al. 1999) and elsewhere."

This type of impact has been reported from Argentina (Ref. 1739 in FishBase 2009), Australia (Fletcher et al. 1985, King and Hunt 1967, Driver et al. 1997, and Roberts 1995 in Pinto et al. 2005; Fletcher et al. 1985; NSW Department of Primary Industries 2005; South Australia Government Undated), Canada (Refs 1998 and 1995 in FishBase 2009, Lougheed et al. 1998 in Pinto et al. 2005), Kenya (Hickey and Harper 2002 in Hickley et al. 2004, Hickley et al. 2004, FishBase 2009), Mexico (Ref 6447 in FishBase 2009, Hinojosa-Garro and Zambrano 2004), New Zealand (Ref 13730 in FishBase 2009), Papua New Guinea (Coates and Ulaiwi 1995), the United States (Lougheed et al. 1998 in Pinto et al. 2005, Heckman et al. 1981, National Archives Microfilm Publications 1850-1902, and Brotherson 1981 in Miller and Provenza 2007; Miller and Provenza 2007), and Venezuela (FishBase 2009).

"Physical disturbance: Carp stir up bottom sediments during feeding, resulting in increased siltation and bioturbidity (Arlinghaus and Mehner 2003; Parkos [et al.] 2003; Lee et al. 1980 in Nico Maynard and Schofield 2009)."

This type of impact has been reported from Australia (NSW Department of Primary Industries 2005), India (FishBase 2009), Kenya (Petr 2000 in Hickley et al. 2004), and the Netherlands (Meijer et al. 1990 in Hickley et al. 2004).

"Threat to endangered species: Non-native fish can drive native species to local extinction (Zambrano et al. 2006).Predation: Carp prey on macroinvertebrtes (Parkos [et al.] 2003). There is also evidence that common carp prey on the eggs of other fish species (Moyle 1976a, Taylor et al. 1984, [and] Miller and Beckman 1996 in Nico Maynard and Schofield 2009)."

"Competition: Laird and Page (1996, in Nico [et al.] 2009) stated that common carp may compete with ecologically similar species such as carp suckers and buffalo fish."

This type of impact has been reported from Australia (Adamek 1998, Koehn et al. 2000, and Koehn & O'Connor 1990a in Koehn 2004; FishBase 2009; McDowall 1996 and Mallen-Cooper and Stuart 2003 in Jones and Stuart 2009; Nicol et al. 2004 and Koehn et al. 2000a in Nicol et al. 2004; Nicol et al. 2004; Jones and Stuart 2006), China (Jia et al. 2008), India (FishBase 2009), Madagascar (FishBase 2009), Mexico (Hinojosa-Garro and Zambrano 2004), Papua New Guinea (Ref 2847 in FishBase 2009), and Poland.

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

This type of impact has been reported from Algeria (FishBase 2009), Argentina (FishBase 2009), Australia, Belgium (FishBase 2009), Bolivia, Cambodia (FishBase 2009), the Republic of the Congo (FishBase 2009), Costa Rica (FishBase 2009), Croatia (FAO 1997 in FishBase 2009), Cyprus (FishBase 2009), Estonia (FishBase 2009), Hungary (FishBase 2009), India (FishBase

2009), Indonesia (FishBase 2009), the Islamic Republic of Iran (FishBase 2009), Iraq (FishBase 2009), Kenya (FishBase 2009), Kyrgyzstan (FishBase 2009), the Lao People's Democratic Republic (FishBase 2009), Lesotho (FishBase 2009), Madagascar (FishBase 2009), Malawi (FishBase 2009), Malaysia (FishBase 2009), Mexico (FishBase 2009, Zambrano et al. 1999), Morocco (FishBase 2009), Mozambique (FishBase 2009), Myanmar (FishBase 2009), Namibia (FishBase 2009), Nepal (FishBase 2009), Netherlands (FishBase 2009), Nicaragua (FishBase 2009), Pakistan (FishBase 2009), Papua New Guinea (Coates and Ulaiwi 1995, Coates 1993b in Coates and Ulaiwi 1995), Paraguay (FishBase 2009), Poland (FishBase 2009), Puerto Rico (FishBase 2009), Romania (FishBase 2009), South Africa (FishBase 2009), Switzerland (FishBase 2009), Thailand, Turkmenistan (FishBase 2009), the United Kingdom (Nunn et al. 2007), and Vietnam (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)."

Disease transmission

This type of impact has been reported from Australia (Environment ACT Undated, NSW Department of Primary Industries 2005), Mexico (Ref 48731 in FishBase 2009), and South Africa.

Hybridization

This type of impact has been reported from Turkmenistan (Ref 30700 in FishBase 2009).

For additional information on location-specific impacts, please see GISD (2014).

From Váradi (2014):

"*C. carpio* has been used in aquaculture almost throughout human history, being cultured in China since at least 475 BC. Its ornamental forms in Japan (koi) are still symbolic of courage and energy. *C. carpio* is a native of Asia, from where it was spread by humans through Europe, and is now established on all continents except Antarctica – it can be considered the world´s most widely distributed freshwater fish. It is important in many parts of the world and continues to be used both in pond and captive fisheries because of its potentially rapid growth in eutrophic waters and ability to tolerate adverse environmental conditions. *C. carpio* is also highly prized by anglers in many countries. However it is considered as a pest in North America, Australia and New Zealand (Dowal 1996). As a zooplankton feeder in the juvenile stage and a benthic feeder later on, *C. carpio* may contribute considerably to algal (including cyanobacterial) blooms."

"Adverse impacts of carp on the natural water ecosystems have been proved in some places. Carp have uprooted aquatic plants and destroyed the aquatic weed populations (Laird and Page 1996). They also increase the turbidity of waters by digging and stirring the upper layer of the bottom. As a consequence of this, light penetration decreases, which destroys the macrophyte populations in the spawning areas of phytophil species. Carp may directly consume the eggs of other species (Miller and Beckman 1966). By destroying the spawning substrata, by consumption of eggs of native species (Tyus and Saunders 2000) and by competing with species having similar feeding habit (Laird and Page 1995) the presence of carp may be one reason why the populations of native species are declining."

Parkos et al. (2003):

"We examined the effects of adult common carp (*Cyprinus carpio*) on shallow aquatic ecosystems and compared the effects with those of a native benthic fish, channel catfish (*Ictalurus punctatus*). Experimental ponds contained enclosures (0.06 ha) with a low carp biomass (174 kg·ha^{1}), high carp biomass (476 kg·ha^{1}), high catfish biomass (416 kg·ha^{1}), and no fish. We measured abiotic factors (turbidity, suspended solids, total phosphorus), as well as effects on adjacent trophic levels (aquatic macrophytes, zooplankton, and aquatic macroinvertebrates) from July to September. Common carp was positively related to total phosphorus, turbidity, suspended solids, and zooplankton biomass, and negatively related to macrophyte and macroinvertebrate abundance. Suspended solids in the carp treatments consisted primarily of inorganic particles. Carp were either positively or negatively related to phytoplankton, depending on zooplankton abundance. A high biomass of carp had greater effect on nutrients, turbidity, and suspended solids than a low biomass. Channel catfish was positively related to total phosphorus concentrations and altered zooplankton composition, but did not affect turbidity, suspended solids, macroinvertebrates, and macrophytes. These results suggest that common carp have a stronger influence on water quality and aquatic community structure than benthic fish native to North America."

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)."

4 Global Distribution

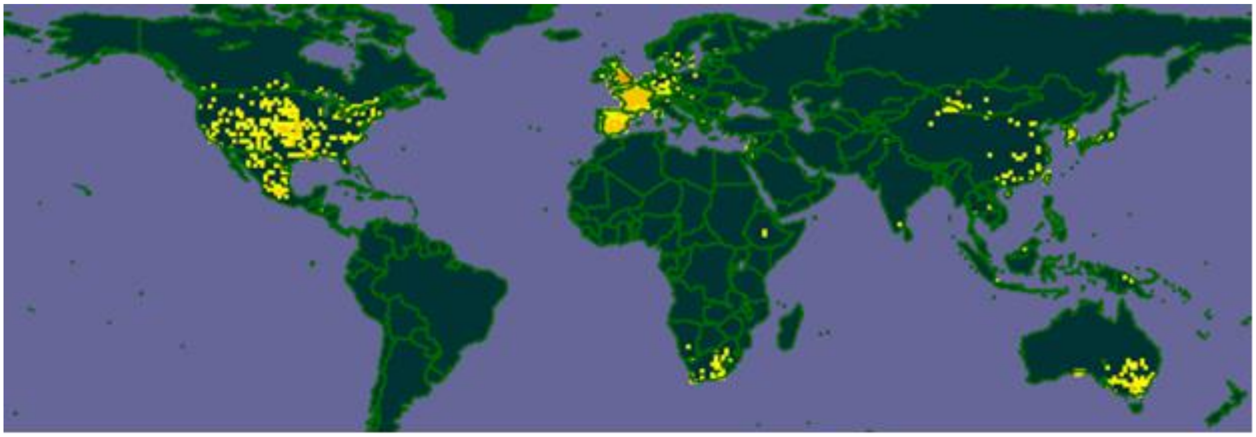

Figure 1. Global distribution of *Cyprinus carpio*. Map from GBIF (2011).

5 Distribution within the United States

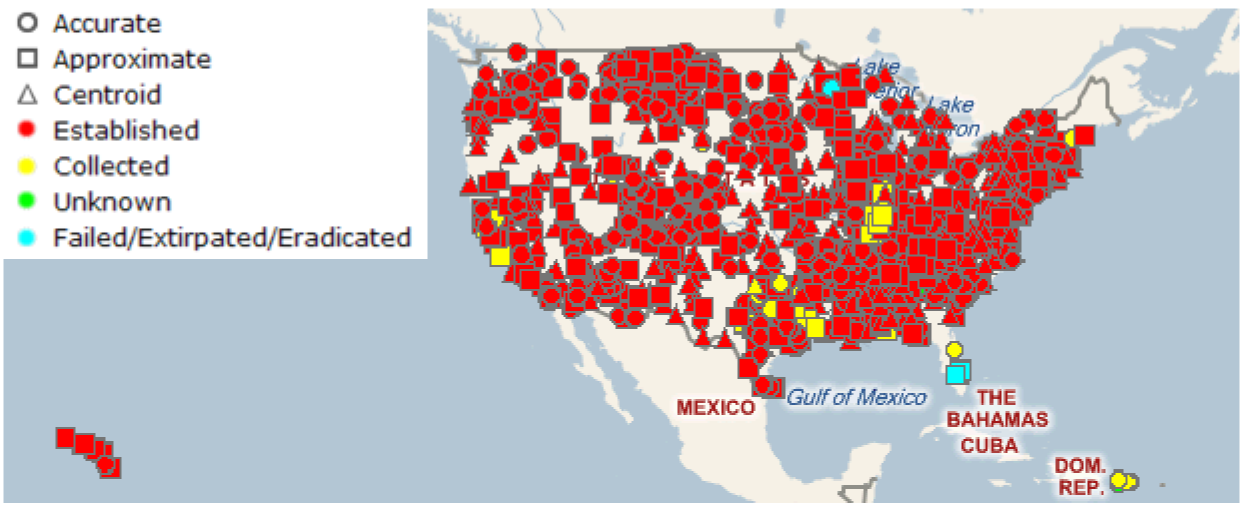

Figure 2. U.S. distribution of *Cyprinus carpio*. Map from Nico et al. (2014).

6 CLIMATCH

Summary of Climate Matching Analysis

The climate match (Australian Bureau of Rural Sciences 2008; 16 climate variables; Euclidean Distance) was high across the entire contiguous U.S. Climate 6 proportion indicated that the contiguous U.S. has a high climate match. The range for a high climate match is 0.103 and greater; climate match of *Cyprinus carpio* is 0.999.

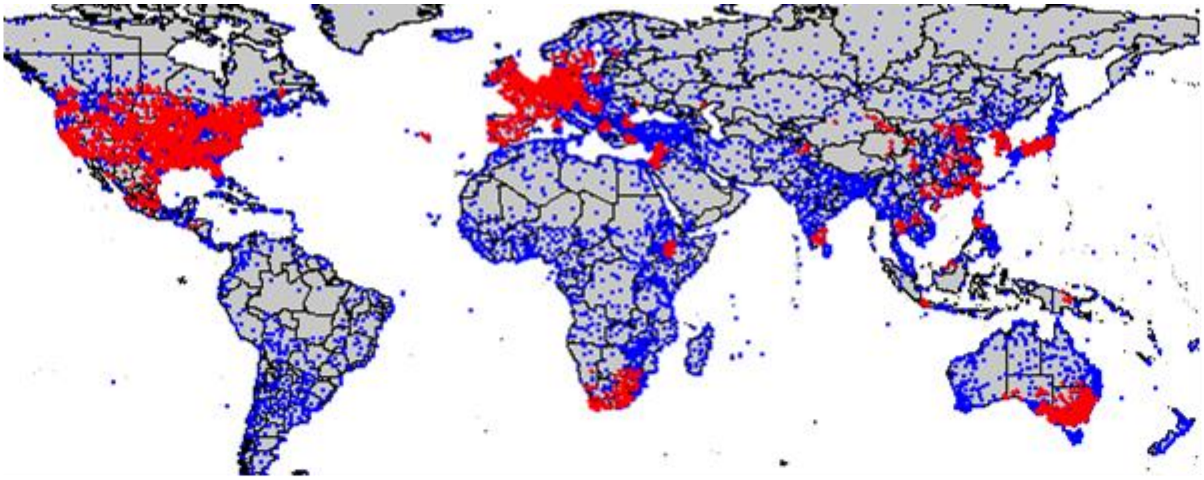

Figure 3. CLIMATCH (Australian Bureau of Rural Sciences 2008) source map showing weather stations selected as source locations (red) and non-source locations (blue) for *Cyprinus carpio* climate matching. Source locations from GBIF (2011) and Nico et al. (2014).

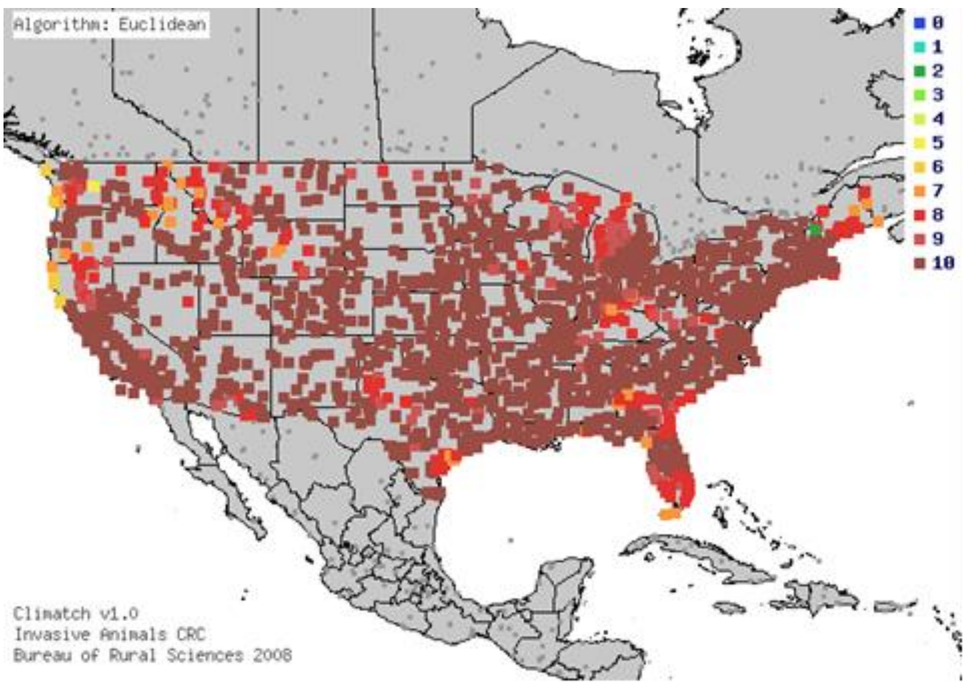

Figure 4. Map of CLIMATCH (Australian Bureau of Rural Sciences 2008) climate matches for *Cyprinus carpio* in the contiguous United States based on source locations reported by GBIF (2011) and Nico et al. (2014). 0= Lowest match, 10=Highest match.

Table 1. CLIMATCH (Australian Bureau of Rural Sciences 2008) climate match scores.

CLIMATCH Score	0	1	2	3	4	5	6	7	8	9	10
Count	0	0	1	0	0	1	11	45	197	113	1606
Climate 6 Proportion =			0.999	(High)							

7 Certainty of Assessment

The biology, distribution, and negative impacts of *Cyprinus carpio* are adequately documented in the scientific literature. No further information is needed to evaluate the negative impacts the species is having where introduced. Certainty of this assessment is high.

8 Risk Assessment

Summary of Risk to the Contiguous United States

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.

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 63 diseases/parasites some of which are OIE-reportable and listed as a potential pest.
- **Overall Risk Assessment Category: High**

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Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

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