U.S. Fish & Wildlife Service

Tench (*Tinca tinca*)
Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, February 2011
Revised, August 2014, September 2014, April 2018
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1 Native Range, and Status in the United States

Native Range

From Froese and Pauly (2018):

"Eurasia: hypothesized as native in most Europe, naturally absent only in Ireland, Scandinavia north of 61°30'N, eastern Adriatic basin and western and southern Greece where it is now introduced. In Asia, native eastward to western Yenisei drainage south of 60° N."

From Freyhof and Kottelat (2008):

"Albania; Andorra; Armenia; Austria; Azerbaijan; Belarus; Belgium; Bosnia and Herzegovina; Bulgaria; China; Croatia; Czech Republic; Denmark; Estonia; Finland; France; Georgia; Germany; Gibraltar; Greece; Holy See (Vatican City State); Hungary; Iran, Islamic Republic of;

Italy; Jersey; Kazakhstan; Latvia; Liechtenstein; Lithuania; Luxembourg; Macedonia, the former Yugoslav Republic of; Moldova; Monaco; Mongolia; Montenegro; Netherlands; Norway; Poland; Portugal; Romania; Russian Federation; San Marino; Serbia; Slovakia; Slovenia; Spain; Sweden; Switzerland; Turkey; Turkmenistan; Ukraine; United Kingdom; Uzbekistan"

Status in the United States

The USGS Nonindigenous Aquatic Species database (Nico et al. 2018) reports that tench has been stocked or reported in the following U.S. states: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, and Wisconsin.

From Nico et al. (2018):

"**Status:** The tench has been documented for 38 states. Baughman (1947) indicated that this species was established in California, Colorado, Idaho, Washington, and apparently Oregon; he also quoted information of previously breeding populations in Maryland. In a more recent work, Page and Burr (1991) considered it established in California, Colorado, Connecticut, and Washington, and possibly Delaware, Maryland, and New York. Courtenay et al. (1991) believed it to be established in California, Colorado, Connecticut, Idaho, and Washington."

"Dill and Cordone (1997) found evidence that the tench is still established in California, but described its distribution as very limited."

"Although the data are more than a decade old, Woodling (1985) confirmed that the species continued to survive in several Colorado waters. Zuckerman and Benhke [*sic*] (1986) also noted that the species persisted in Colorado, but they indicated populations in the San Luis Valley had declined dramatically in recent years."

"Whitworth (1996) reported that no specimens had been obtained in Connecticut for over fifteen years."

"There is recent literature indicating the species is still established in Washington and, probably, Idaho. For instance, in their analysis of Northwest drainages, McPhail and Lindsey (1986) listed tench as present in the upper, middle, and lower Columbia River system and in the Chehalis river system. Although Idaho was not listed by Page and Burr (1991), the continued presence or established status of tench in that state has been documented by several authors (i.e., Simpson and Wallace 1978; Courtenay et al. 1991, Idaho Fish and Game 1996)."

"Koster (1957) stated that this species occurred in the middle Rio Grande Valley of New Mexico, and Bond (1973) described its distribution in Oregon as the Columbia River and probably the lower Willamette River. Lee et al. (1980 et seq.) also recorded tench as established in Oregon and New Mexico. However, in more recent works, Sublette et al. (1990) considered it extirpated from New Mexico, and Courtenay et al. (1986) believed that tench had been extirpated from both Oregon and New Mexico. In his revised treatment of Oregon fishes, Bond (1994) noted tench as introduced to the Columbia River and stated that the species was once present in lower Willamette River. The Willamette is a tributary of the Columbia River. Although it seems to be the case that tench are no longer present in Oregon, Bond (1973, 1994) did not definitively state that the Willamette River population was the only Columbia River site with tench known in that state."

"[Tench] likely has been extirpated in Delaware (contrary to Page and Burr 1991), where surveys since 1950 have failed to find the species (M. Raasch, personal communication).
[…] Its present status in both Maryland and New York is unclear. According to Baughman (1947) it was temporarily established in Maryland. Schwartz (1964) concluded that wild populations no longer exist in Maryland. In fact, he indicated that the last wild specimens known from the state were taken from the C & O Canal at Buzzard's Hole, Maryland, in 1911; however, Schwartz did note that some tench may exist in Catoctin and Huntington creeks, Frederick County, as a result of escape from commercial ponds where the fish were reared for sale to the 'dime-store goldfish trade.' Apparently Schwartz did not consider tench in the two creeks to be reproducing. However, Lee et al. (1984) noted that it may occur in isolated areas of Piedmont in Maryland. Rohde et al. (1994) did not mention tench in their recent work on fishes of Delaware, Maryland, and Virginia. Similarly, Smith (1985) did not mention tench in his treatment of New York fishes. Nevertheless, Schmidt (1986), in his analysis of fish distribution in 14 Atlantic coastal drainages, listed tench as introduced to lowland lacustrine habitats in the Delaware, Long Island, and Housatonic drainages. Shortly after its introduction, Smith and Bean (1899) indicated that the species was becoming common in the Potomac River. Much more recently, Hocutt et al. (1986) listed it as introduced to the Potomac River. However, Jenkins and Burkhead (1994) concluded that there was no evidence that the species persists in the Potomac drainage, a conclusion also reached by Starnes et al. (2011)."

"Although the tench has maintained breeding populations in a few places, the frequent absence of this species in most fish samples suggests that the tench is no longer present in many areas where it had previously been introduced and, in some cases, was temporarily established (e.g., Hall 1956; Morris et al. 1974; Hendricks et al. 1979; Courtenay et al. 1986; Menhinick 1991). Ravenel (1896) reported that the U.S Fish Commission stocked 1,600 tench in the Musconetcong River in New Jersey. That is the only record of the species in that state."

"During the late 1800s, the U.S. Fish Commission distributed tench to many states. In many cases the Commission documented that tench were released into specific rivers or lakes. However, for a number of states the Commission simply noted that tench were distributed to 'various applicants' without indicating whether or not these fish were ever released into open waters (Baughman 1947). Later data indicated that tench were found or collected in open waters of a few of these states (e.g., Arizona), but for ten states (i.e., Alabama, Arkansas, Florida, Kentucky, Louisiana, Massachusetts, Michigan, West Virginia, Wisconsin, and possibly Utah) the presence of this species in open waters has not been adequately confirmed. Nevertheless, it is conceivable that some of the tench delivered by the Commission to various applicants eventually found their way to open waters as a result of floods, dam breaks, or because of intentional releases. Such losses were frequent with common carp, another cyprinid widely distributed by the U.S. Fish Commission during the late 1800s (Smiley 1886). Tanner (1936) listed tench as one of the species introduced into Utah streams, but he provided no details."

Means of Introduction into the United States

From Nico et al. (2018):

"This species was imported into North America from Germany by the U.S. Fish Commission in 1877 apparently for use as a food and sport fish (Baird 1879). The Commission apparently spent several years learning to culture tench, for it was not until well into the 1880s that the agency started to seriously distribute the species in the United States. According to Baughman (1947), the Commission planted more than 138,000 tench across North America during the period 1886 to 1896. By the end of that period, the Commission had provided tench to at least 36 different states. Shortly thereafter, the agency discontinued working with tench and turned over their hatchery ponds to the rearing of bass (Baughman 1947). The U.S. Fish Commission stocked tench into lakes and ponds in the Pacific states, including Idaho, Oregon, and Washington, in 1895 (Smith 1896). Additional introductions occurred in Washington when tench exhibited at the 1909 Worlds Fair, held in Seattle, were dumped into a large pond on the University of Washington campus. Some of these fish later were transferred to Lake Washington; the population eventually spread to Lake Union (Wydoski and Whitney 2003)."

"Although most tench introductions were the result of intentional stockings, some introductions were the result of escape from holding facilities. In 1889, many of the fish, including an estimated 25 tench, held in federal ponds in Washington, D.C., escaped into the Potomac River during a flood (McDonald 1893). However, tench had been introduced to the Potomac River prior to that date. For instance, Smiley (1889) recorded the taking of tench from that river during March 1887."

"Evermann and Kendall (1895) reported the escape of tench from the Neosho fish hatchery into Spring Branch near Neosho in southwestern Missouri. Baughman (1947) discussed the escape of tench into the Olentangy River of Ohio after the banks of an artificial lake collapsed in 1898. Schwartz (1964) stated that tench had escaped from commercial ponds into creeks in Maryland."

"Tench were first brought to California in 1922. At that time, specimens obtained in Italy were illegally released into a private reservoir near Half Moon Bay, San Mateo County; the species was later spread to other California waters by ranchers (Shapovalov 1944; Dill and Cordone 1997)."

Remarks

From Nico et al. (2018):

"A name used in some of the early literature for this species is *Tinca vulgaris*."

"DeVaney et al. (2009) performed ecological niche modeling to examine the invasion potential for tench and three other invasive cyprinids (common carp *Cyprinus carpio*, grass carp *Ctenopharyngodon idella*, and black carp *Mylopharyngodon piceus*). All of the current established populations of tench were in areas of predicted high suitability for this species.

Interestingly, many areas where tench failed to become established or is currently extirpated (e.g., Great Lakes region) also had a moderate to high predicted suitability. DeVaney et al. (2009) attributed this potentially to negative interactions with sunfishes or unmeasured environmental factors."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2018):

"Kingdom Animalid
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Ostariophysi
Order Cypriniformes
Superfamily Cyprinoidea
Family Cyprinidae
Genus *Tinca*
Species *Tinca tinca* (Linnaeus, 1758)"

"Current Standing: valid"

Size, Weight, and Age Range

From Froese and Pauly (2018):

"Maturity: L_m ?, range 20 - ? cm
Max length : 70.0 cm SL male/unsexed; [Allen et al. 2002]; common length : 20.0 cm TL male/unsexed; [Muus and Dahlström 1968]; max. published weight: 7.5 kg [Muus and Dahlström 1968]"

From GISD (2018):

"Sexual maturity attained at around the age of two. Long-lived, with individuals surviving to 20 years of age or more (McDowall, 2000)."

Environment

From Froese and Pauly (2018):

"Freshwater; brackish; demersal; potamodromous [Riede 2004]; depth range 1 - ? m [Darwin 1877]."

From GISD (2018):

"Able to tolerate low oxygen concentrations and a wide range of temperatures, from 4 to 24°C."

Climate/Range

From Froese and Pauly (2018):

"Temperate; […] 64°N - 36°N, 10°W - 104°E"

From Nico et al. (2018):

"Zuckerman and Behnke (1986) […] noted the occurrence of tench at two sites in Colorado at elevations greater than 2,850 meters."

Distribution Outside the United States

Native

From Froese and Pauly (2018):

"Eurasia: hypothesized as native in most Europe, naturally absent only in Ireland, Scandinavia north of 61°30'N, eastern Adriatic basin and western and southern Greece where it is now introduced. In Asia, native eastward to western Yenisei drainage south of 60° N."

From Freyhof and Kottelat (2008):

"Albania; Andorra; Armenia; Austria; Azerbaijan; Belarus; Belgium; Bosnia and Herzegovina; Bulgaria; China; Croatia; Czech Republic; Denmark; Estonia; Finland; France; Georgia; Germany; Gibraltar; Greece; Holy See (Vatican City State); Hungary; Iran, Islamic Republic of; Italy; Jersey; Kazakhstan; Latvia; Liechtenstein; Lithuania; Luxembourg; Macedonia, the former Yugoslav Republic of; Moldova; Monaco; Mongolia; Montenegro; Netherlands; Norway; Poland; Portugal; Romania; Russian Federation; San Marino; Serbia; Slovakia; Slovenia; Spain; Sweden; Switzerland; Turkey; Turkmenistan; Ukraine; United Kingdom; Uzbekistan"

Introduced

According to Froese and Pauly (2018), tench was introduced internationally starting before the 18th century and continuing until at least 1997. In the locations where tench has been introduced, its status is as follows:

- **Established:** Italy, Turkey, Kyrgyzstan, Ireland, Norway, New Zealand, India, Australia, Netherlands, Canada, South Africa, Chile, Zimbabwe, Indonesia, Finland, Morocco, Damachi fish farm (Uzbekistan), and Japan.
- **Unknown:** Portugal, British Columbia (Canada), Cyprus, and China.
- **Not established:** El Golea (Algeria), Madagascar, Zambia, Jordan River, and Tunisia.

From NIES (2018):

"Not established in Japan, despite an introduction to Saitama Pref."

Means of Introduction Outside the United States

Froese and Pauly (2018) report the following as reasons for introductions of *T. tinca*: accidental, fisheries, aquaculture, angling/sport, phyto-zooplankton control, diffused from other countries, snail control.

Short Description

From Froese and Pauly (2018):

"Dorsal spines (total): 4; Dorsal soft rays (total): 8-9; Anal spines: 3-4; Anal soft rays: 6 - 8; Vertebrae: 39 - 41. Body thickset, heavy, and laterally compressed, the caudal peduncle characteristically deep and short. Skin thickened, slimy; the scales small, embedded. Overall coloration olive-green, at times dark green or almost black, with golden reflections on ventral surface. Head triangular, eye orange-red, small; snout relatively long; interorbital broad; mouth terminal, small in size with thick lips and a pair of well-developed barbels, one at each corner of the mouth. Caudal fin with 19 rays [Spillman 1961]. Diagnosed from other cyprinid species in Europe by the following characters: body golden greenish brown; one pair of barbel (maxillary); lateral line with 96-115 scales, small and deeply embedded; dorsal fin with 8-9½ branched rays; and anal fin with 6-9½ branched rays [Kottelat and Freyhof 2007]."

From Nico et al. (2018):

"In addition to the normal- or wild-colored tench, the U.S. Fish Commission distributed an orange-yellow or reddish variety, the golden tench, to various applicants in the United State during the late 1800s (Bean 1896). That genetic strain apparently was only distributed as an ornamental. There is no evidence that this ornamental variety was introduced to open waters. The golden tench is still used as an ornamental fish in European ponds (Scott and Crossman 1973; Muus and Dahlstrom 1978)."

Biology

From Froese and Pauly (2018):

"Typically found in shallow, densely vegetated lakes and backwaters. Often overwinters buried in mud. Larvae and juveniles confined to dense vegetation [Kottelat and Freyhof 2007]. Adults inhabit warm lakes and pools with weed and mud bottom. […] Feeds on detritus, benthic animals and plant materials. Adult often prey mainly on molluscs. Spawns among dense vegetation in still water [Kottelat and Freyhof 2007]."

From GISD (2018):

"External fertilisation. Spawns during summer, releasing thousands to millions of tiny eggs (c. 1mm diameter) amongst aquatic weeds. Fry hatch in around a week (McDowall, 2000)."

Human Uses

From Froese and Pauly (2018):

"Fisheries: commercial; aquaculture: commercial; gamefish: yes; aquarium: public aquariums"

"Used as a fodder fish for bass [Skelton 1993]. Utilized fresh and frozen; eaten pan-fried, broiled, and baked [Frimodt 1995]. Popular with amateur sport fishers. Its flesh is highly esteemed [Billard 1997]."

From Innal and Erk'akan (2006):

"The introduction of tench (*Tinca tinca*) is not of commercial importance in Turkey owing to its slow growth rate and tasteless flesh. However, it is used for cleaning carp pools and aiding mineralization in aquatic systems of poly-culture."

Diseases

From Froese and Pauly (2018):

"Tench Reovirus Infection, Viral diseases
Pseudocapillaria Infestation 1, Parasitic infestations (protozoa, worms, etc.)"

From Marcogliese et al. (2009):

"At least 50 helminths and crustaceans have been reported from tench (Pavlovskii, 1964; Hoffman, 1999), and yet few records exist for parasites of this fish in North America, despite its widespread distribution in the United States."

"Four parasite species were found in tench in 2000 [in the Richelieu River in Quebec], the nematode *Raphidascaris acus* being the most prevalent, and the copepod *Ergasilus megaceros* the most abundant […] Two cestodes were found in fewer numbers, including *Valipora campylancristrota* and an unidentified larval proteocephalid […]"

"All of the parasite species found infecting tench in the Richelieu River have been reported on other fishes in North America."

From Kir and Tekin-Özan (2005):

"In this study, helminth parasites in tench of Kovada Lake [Turkey] and seasonal variation of these parasites were investigated monthly from March 2003 to February 2004. A total of 6 species of helminth parasites were found on 51 of 105 fish examined. The following parasites were found: *Gyrodactylus medius, Asymphylodora tincae, Caryophyllaeus laticeps,* plerocercoids of *Ligula intestinalis, Proteocephalus torulosus* and *Bothriocephalus acheilognathi*."

From Oguz Öztürk et al. (2013):

"This study investigates the presence of metazoan parasites on tench (*Tinca tinca* L.) in Lake Uluabat, Turkey. Data were obtained from on-site surveys carried out between April 1998 and January 2000. Six parasite species were identified: *Dactylogyrus macracanthus* Wegener, 1909; *Asymphlodora tincae* (Mooder, 1790); *Acanthocephalus lucii* (Müller, 1787); *Ergasilus sieboldi* Nordmann, 1832; *Argulus foliaceus* Linne, 1758; and *Piscicola geometra* Linne, 1758."

From Fabian et al. (2013):

"In tissue samples from wild fish species, KHV [koi herpesvirus]-specific DNA sequences were detected by means of the Gilad PCR in 49 of 453 individuals analysed […] There was no morbidity or mortality observed in any of the fish species examined. Tissue samples taken from […] tench, *Tinca tinca* L. […] were found to be positive for KHV […]"

Koi herpesvirus is an OIE-reportable disease.

From Ashraf et al. (2016):

"Natural SVCV [spring viraemia of carp virus] infections have been reported in other cyprinid fish, including […] tench (*Tinca tinca*) […] (Fijan, 1984; Shchelkunov & Shchelkunova, 1989; Ahne et al., 2002)."

Spring viraemia of carp is an OIE-reportable disease.

Threat to Humans

From Froese and Pauly (2018):

"Harmless"

3 Impacts of Introductions

From Nico et al. (2018):

"For the most part, unknown. In the 1940s this species was reported to be a nuisance because of high abundance in certain parts of Maryland and Idaho (Baughman 1947). The diet consists mainly of aquatic insect larvae and molluscs (Scott and Crossman 1973). Moyle (2002) considered it a potential competitor for food with sport fishes and native cyprinids. In their discussion of tench introduced to Africa, de Moor and Bruton (1988) noted that the species is known to stir up bottom sediments, possibly affecting water quality, but not to the extent of common carp *Cyprinus carpio*."

From GISD (2018):

"Impacts specific to tench are difficult to find, as this species is often lumped together with others in the Cyprinidae family, such as koi and common carp. In Australia it is thought that tench may directly compete with trout and native fish for food resources (IFS, 2000). The ability of tench to survive in degraded environments causes some confusion, as it is unclear whether they contribute to this degradation or simply inhabit a niche that native fish cannot occupy. Most impacts are likely to be related to the wide range of organisms consumed by tench. An experimental study by Bekliog[l]u & Moss (1998) showed that tench can increase periphyton (algal) biomass through selective predation on gastropods, which keep periphyton under control through grazing. This 'trickle-down' effect could have negative impacts on aquatic communities if it occurs to a significant extent in the wild. Impacts of tench were reviewed by Rowe (2004). There is no evidence that they affect other fish directly, however, a number of studies have implicated them in water quality decline."

From CABI (2018):

"*Tinca tinca* was introduced into the River Murray [southeastern Australia] in 1876 and has spread rapidly throughout the Murray-Darling System. A small population has been reported in the Onkaparinga River. Numbers were reduced in the 1970s when the common carp population increased. *T. tinca* do not represent a serious threat to native fish in Australia."

"Their omnivorous diet and tolerance of a wide range of environmental conditions has [led] to some countries labelling tench an invasive species, due to concerns over competition with native fish (ISSG, 2011)."

From Avlijaš et al. (2018):

"[…] the impacts of tench in North America are largely unknown and have been documented elsewhere, primarily in Europe and Australasia. Baughman (1947) provided anecdotal evidence from various parts of the United States that tench has a history as a nuisance species where it settles in high densities and, in such cases, has been considered a detriment to sport fisheries. According to Pérez et al. (2003), impacts of the aquaculture of several alien fishes including tench are said to have "created an adverse situation" for native fishes in Chile. Moyle (2002) considered tench to be a potential competitor to native cyprinids. Trophic overlap, and thus potential competition, with other cyprinids, eel, and waterfowl has been reported in Europe (Giles et al. 1990; Kennedy and Fitzmaurice 1970). Through competition, tench is suspected to have caused declines in the catch of common carp in Turkish waters (Innal and Erk'akan 2006); however, they can coexist with grass carp (*Ctenopharyngodon idella*) (Petridis 1990). Negative impacts could also arise from predation on fish eggs, which are sometimes conspicuous in tench stomachs (Wydoski and Whitney 2003)."

"Tench is commonly infected by a diverse assemblage of parasites and diseases (Kennedy and Fitzmaurice 1970; Ozturk 2002; Svobodova and Kolarova 2004; Ergonul and Altindağ 2005; Marcogliese et al. 2009; Alaş et al. 2010), allowing for potential transmission to other animals. For example, in a Turkish lake, 40% of 272 individuals were infected with the Holarctic cestode *Ligula intestinalis*, which can be transmitted to piscivorous waterfowl (Ergonul and Altindağ 2005). In the Richelieu River, tench carry the cestode *Valipora campylancristota*, which can reduce growth and cause mortality in cyprinids; the cestode has rarely been found in North American fishes and might have been introduced to Quebec by the tench (Marcogliese et al. 2009). Most tench in the Richelieu River have been found to also carry a parasitic copepod, *Ergasilus megaceros*, new to Canada (Marcogliese et al. 2009). In Europe and the UK, tench carry a congeneric species, *Ergasilus sieboldi*, which is considered a serious pest for aquaculture (Kennedy and Fitzmaurice 1970). Tench is also infected by diverse microbial pathogens, including spring viraemia of carp (Svobodova and Kolarova 2004)."

"Predation by adult tench can limit invertebrate abundance. In experimental enclosures, tench can reduce crayfish populations (Neveu 2001) and the biomass of snails and bivalves (Bronmark 1994; Beklioglu and Moss 1998). Heavy predation on snails (Beklioglu and Moss 1998) and increased inorganic nitrogen cycling caused by tench excretions (Williams et al. 2002) promote excessive epiphytic growth that interferes with the growth of submerged macrophytes such as *Elodea canadensis* (Bronmark 1994). These kinds of trophic cascades might require high densities of fish (e.g., >200 $kg \cdot ha^{-1}$; Williams et al. 2002). In New Zealand, the presence of tench with other introduced fishes, rudd (*Scardinius erythrophthalmus*), goldfish (*Carassius auratus*), and common carp contributes to regime shifts in which macrophyte-dominated clearwater lakes are transformed to devegetated turbid lakes (Schallenberg and Sorrell 2009). Tench can contribute to declines in water quality (Rowe et al. 2008) by preferentially feeding on large herbivorous zooplankton (Ranta and Nuutinen 1984; Beklioglu et al. 2003) and by disturbing sediments (de Moor and Bruton 1988). Although they do not cause sediment suspension to the same extent as common carp, they might nonetheless be detrimental to submerged macrophytes (de Moor and Bruton 1988)."

From Innal and Erk'akan (2006):

"[*T. tinca*] has caused a decline in the catch of carp (*Cyprinus carpio*). Carp cannot maintain economical populations in sympatry with *Tinca tinca*, since there is competition between *T. tinca* and *C. carpio* in Kayaboğazı Dam Lake. Tench are very well adapted and has been the dominant population for some time. In order to increase the density of mirror carp, it will be necessary to control the tench population in this lake (Alas et al. 1998). Carp has been stocked in Çamkoru pond since reservoir construction, but in competition with tench, Carp has not maintained viable populations (Innal [2004])."

From Brönmark (1994):

"The effects of predation by two benthivorous fishes, tench (*Tinca tinca*) and Eurasian perch (*Perca fluviatilis*), on benthic macroinvertebrates, epiphytic algae, and submerged macrophytes were studied in a field experiment, using cages (2 m x 3 m x 0.8 m) placed in a eutrophic pond in southern Sweden. Cages were assigned to four different treatments: fishless controls, tench, perch, and tench + perch. […] Nonmolluscan benthic macroinvertebrates were not greatly affected by the presence of fish, whereas predation by tench dramatically reduced the biomass of snails and bivalves. Tench had an indirect, positive effect on the biomass of periphyton through a reduction of grazing pressure by snails […] Further, in the cages with low snail and high periphytic biomass (tench and tench + perch cages), growth of the dominant submerged macrophyte (*Elodea canadensis*) was reduced, probably due to shading by periphyton. This experiment confirms that a predator can have profound effects on interactions in benthic food chains and that the strength of the indirect interactions is dependent on the strength of the direct interactions."

From Economidis et al. (2000):

"The species shows a rather neutral ecological character and contributes to the enhancement of fish production in lakes."

4 Global Distribution

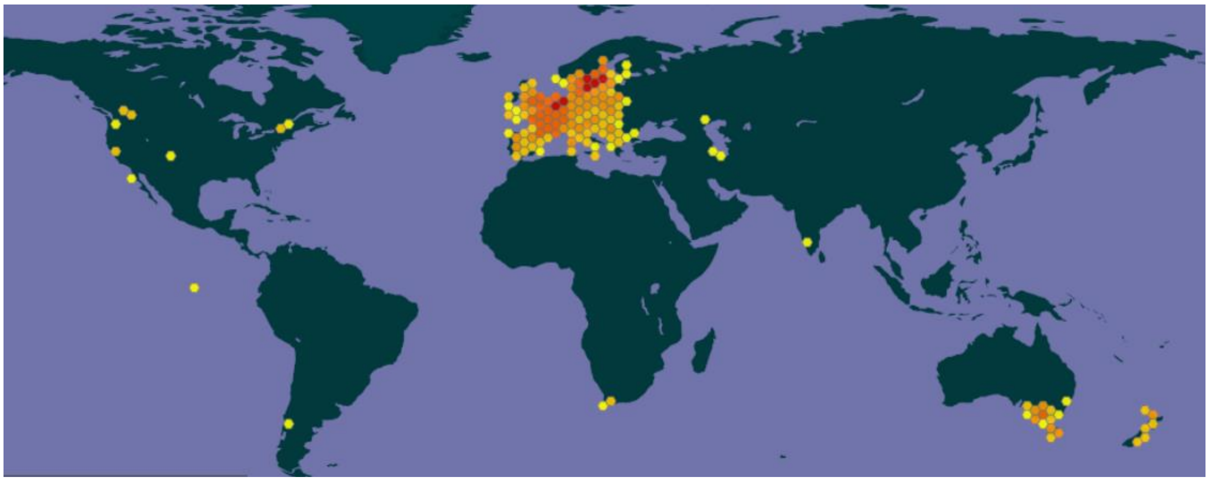

Figure 1. Reported global distribution of *Tinca tinca*. Map from GBIF Secretariat (2017). The point off the coast of Baja California, Mexico, was excluded from the climate matching analysis because the point appears to be an error; no established populations of *T. tinca* have been reported in Mexico (see Distribution Outside the United States), and the location is in salt water but this species is only known from fresh and brackish water. The point off the coast of Ecuador was excluded because its location is marine as well.

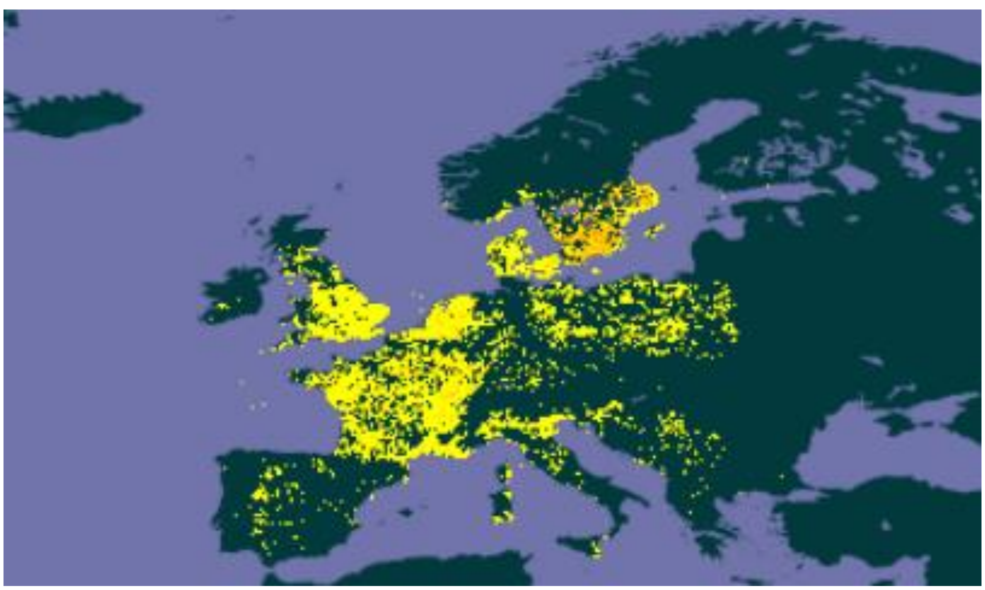

Figure 2. Reported European distribution of *Tinca tinca*. Map from GBIF Secretariat (2017).

5 Distribution within the United States

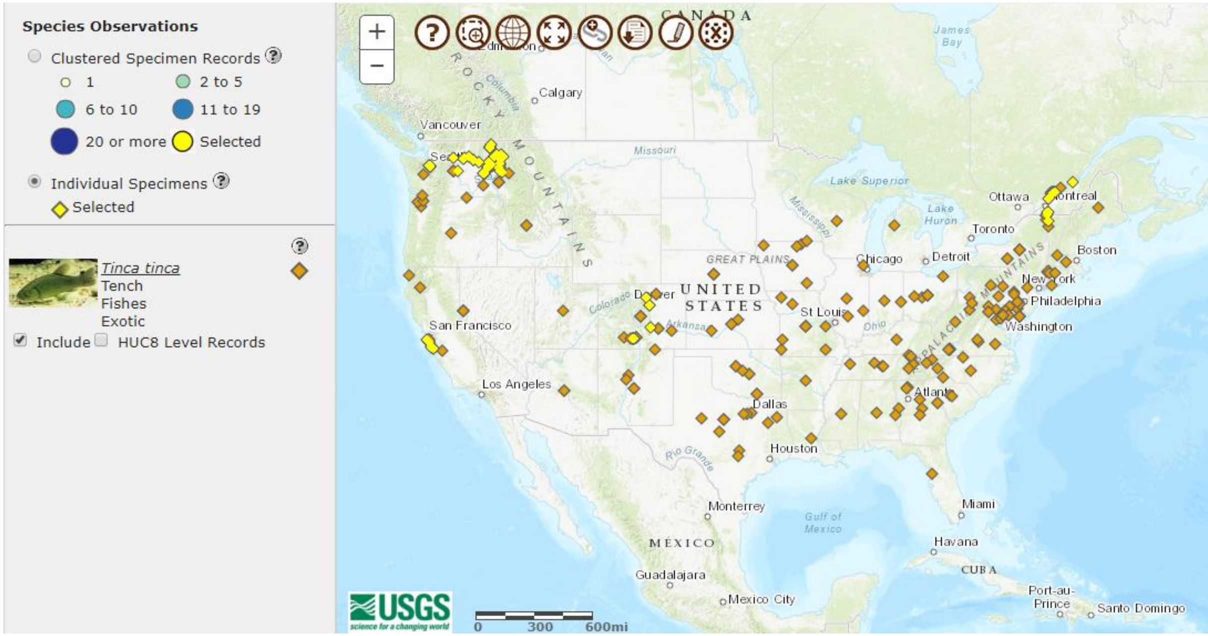

Figure 3. Reported distribution of *Tinca tinca* in the contiguous United States. Map from Nico et al. (2018). Yellow points indicate currently established locations of the species, as described by Nico et al. (2018). Brown points represent other collection locations.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) was high in the Rocky Mountains, coastal California, northern New England, and parts of New York and Pennsylvania. Medium climate match was found across much of the remainder of the contiguous U.S., with low climate match occurring primarily in southern Arizona, Florida, and along the Gulf Coast, with scattered small areas of low match elsewhere. Climate 6 score indicated that the contiguous U.S. has a high climate match overall. The range for a high climate match is 0.103 and greater; Climate 6 score for *Tinca tinca* was 0.551.

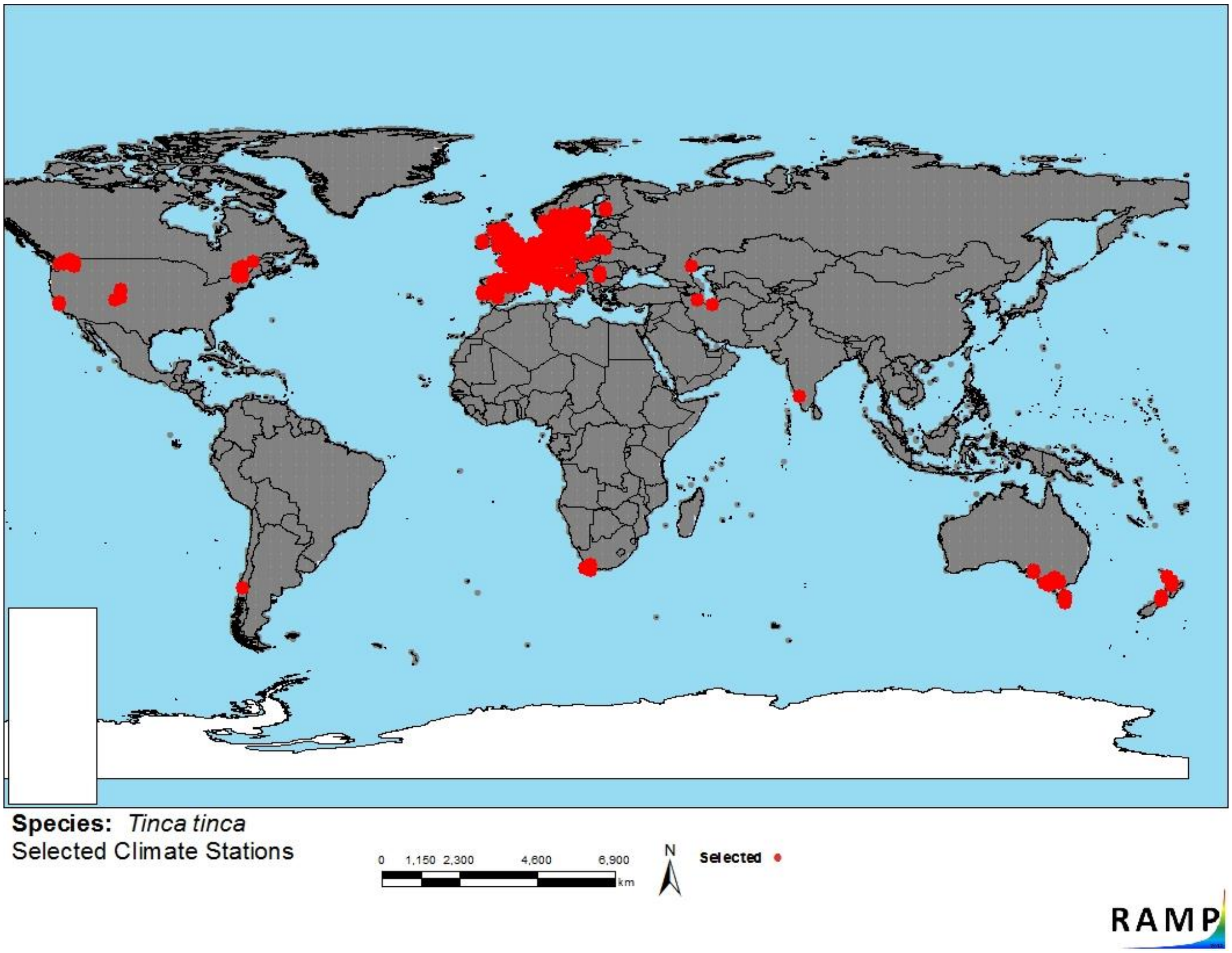

Figure 4. RAMP (Sanders et al. 2014) source map showing weather stations selected throughout the world as source locations (red) and non-source locations (gray) for *Tinca tinca* climate matching. Source locations from GBIF Secretariat (2017) and Nico et al. (2018).

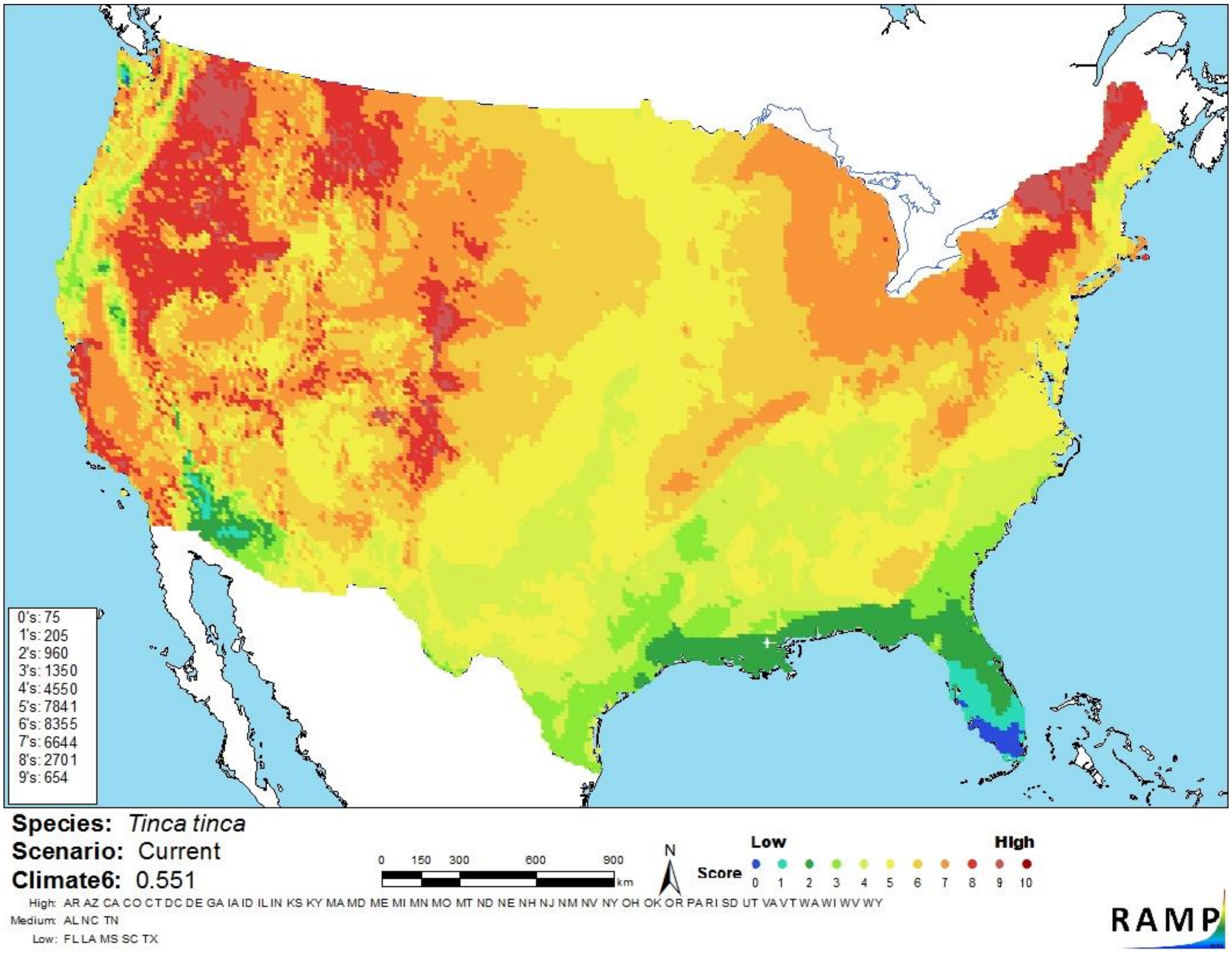

Figure 5. Map of RAMP (Sanders et al. 2014) climate matches for *Tinca tinca* in the contiguous United States based on source locations reported by GBIF Secretariat (2017) and Nico et al. (2018). 0=Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

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

Information on the biology and distribution of this species is readily available. Some information is available on the impacts of *T. tinca* introduction, with peer-reviewed literature well represented. Species-specific impacts are less readily available because *T. tinca* has often been grouped together with co-located invasive species in impact studies. The certainty of this assessment is medium.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Tinca tinca is a freshwater and brackish water cyprinid fish native to Eurasia. This species has established in many countries outside of its native range, including the U.S. This species has a high climate match with the contiguous U.S. overall. Bait bucket introductions, flooding, and natural range expansion are all possible vectors for this species to be introduced to new areas. Impacts include direct effects on native carp abundance and molluscan biomass, plus indirect effects on macrophyte growth and water quality. Two OIE-reportable diseases have been detected in *T. tinca*. However, not all locations where *T. tinca* has been introduced have reported impacts of introduction, and numerous introductions have failed to progress to population establishment. Overall risk assessment category is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): Medium**
- **Remarks/Important Additional Information: Two OIE-reportable diseases (koi herpesvirus disease and spring viraemia of carp) have been reported in *T. tinca*. The species is host to more than 50 parasites in its native range.**
- **Overall Risk Assessment Category: High**

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