Black Carp (*Mylopharyngodon piceus*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2024
Revised, January 2025
Web Version, 12/18/2025

Organism Type: Fish
Overall Risk Assessment Category: Uncertain

Photo: U.S. Geological Survey Columbia Environmental Research Center. Public domain. Available: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=573 (February 2024).

1 Native Range and Status in the United States

Native Range
From Nico and Neilson (2024):

"Most major Pacific drainages of eastern Asia from the Pearl River (Zhu Jiang) basin in China north to the Amur River (Heilong Jiang) basin of China and far eastern Russia; possibly native to the Honghe or Red rivers of northern Vietnam (Nico et al. 2005)."

Status in the United States
According to Nico and Neilson (2025), *Mylopharyngodon piceus* is established in multiple locations in Arkansas, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee. They also report a failed introduction in West Virginia in 2015.

From Hunter and Nico (2015):

"During the 1980s, some USA aquaculture farms in the Mississippi River Basin also became Black Carp producers, developing the capabilities to rear the species in captivity and produce functionally sterile triploids (Nico et al. 2005; Papoulias et al. 2011). These production farms marketed Black Carp as a biological control agent against pond snails, selling and distributing live individuals, both diploids (fertile) and triploids (sterile), to aquaculture farms throughout much of the lower Basin and elsewhere."

"Federal and state regulations, many implemented over the past 10 years, have reduced the overall distribution and numbers of Black Carp among USA fish farms. […] At present, Arkansas and Mississippi are the primary states that still permit use of Black Carp in aquaculture and together now hold all or most of the known captive Black Carp in the Mississippi River Basin (Nico and Jelks 2011)."

Regulations

Mylopharyngodon piceus is listed by the U.S. Fish and Wildlife Service as injurious wildlife under 18 U.S.C. 42, the Lacey Act (USFWS 2025).

From Nico and Jelks (2011):

"States retain rights to regulate black carp already within their jurisdiction. Although many states now ban black carp, a few states in the lower Mississippi basin still permit breeding programs and allow use of black carp for snail control in ponds."

Mylopharyngodon piceus is regulated in Arkansas (AGFC 2022), Arizona (Arizona Game and Fish Commission 2022), California (CDFW 2021), Colorado (CPW 2023), Connecticut (Connecticut DEEP 2020), Florida (FFWCC 2022), Georgia (State of Georgia 2023), Hawaii (HDOA 2019), Illinois (Illinois DNR 2015), Iowa (Iowa NRC 2015), Kansas (KDWP 2023), Kentucky (KDFWR 2022), Louisiana (Louisiana Revised Statutes 2022), Michigan (Michigan Compiled Laws 2022), Minnesota (Minnesota DNR 2022), Missouri (MDC 2023), Montana (Montana FWP 2023), North Carolina (North Carolina DEQ 2022), North Dakota (NDGF 2023), New Mexico (NMDGF 2023), Nevada (Nevada Board of Wildlife Commissioners 2022), New York (New York DEC 2022), Ohio (ODNR 2022), Oklahoma (ODWC 2023), Oregon (ODFW 2022), Pennsylvania (PFBC 2022), Tennessee (TWRA 2022), Washington (WDFW 2022), Wisconsin (Wisconsin DNR 2022), and Wyoming (WGFD 2022). Please refer back to state agency regulatory documents for details on the regulations, including restrictions on activities involving this species. While effort was made to find all applicable regulations, this list may not be comprehensive. Notably, it does not include regulations that do not explicitly name this species or its genus or family, for example, when omitted from a list of authorized species with blanket regulation for all unnamed species.

Means of Introductions within the United States

From Nico and Neilson (2024):

“This species was first brought into the United States in the early 1970s as a "contaminant" in imported Grass Carp stocks. These fish came from Asia and were sent to a private fish farm in Arkansas (Nico et al. 2005). Subsequent introductions of Black Carp into this country occurred in the early 1980s. During this period it was imported as a food fish and as a biological control agent to combat the spread of yellow grub (*Clinostomum margaritum*) in aquaculture ponds (Nico et al. 2005). The first known record of an introduction of Black Carp into open waters occurred in Missouri in 1994 when thirty or more Black Carp along with several thousand bighead carp reportedly escaped into the Osage River, Missouri River drainage, when high water flooded hatchery ponds at an aquaculture facility near Lake of the Ozarks. Owners of the Missouri facility where the escapes reportedly took place have denied that Black Carp ever escaped from their facility (Nico et al. 2005). In any case, flooding of aquaculture facilities and associated numbers and types of escaped fishes are very poorly documented in the public record. There is evidence that large portions of the lower Mississippi River basin where aquaculture farms are present have been subject to large-scale floods on a number of occasions over the past few decades. Consequently, it is likely that aquaculture was the source of some or all of the Black Carp present in the lower Mississippi River basin. Nearly all fish farms with Black Carp are in lowland areas and flood events increase the probability that more Black Carp will eventually escape fish farms (Nico et al. 2005:245). A genetic analysis of Black Carp in the Mississippi River basin supported the hypothesis that aquaculture was the likely introduction source for the region, and that wild populations in the basin likely resulted from multiple introductions (Hunter and Nico 2015).”

“There is also a risk that Black Carp may be spread by other means. According to one aquaculture farmer, hundreds of young Black Carp were accidentally included in shipments of live baitfish sent from Arkansas to bait dealers in Missouri as early as 1994 (Nico et al. [2005]:5). In addition, because of the continued widespread distribution of Grass Carp across the United States, there remains the possibility that shipments may inadvertently contain Black Carp (Nico et al. 2005). Juveniles, in particular, are difficult to distinguish from Grass Carp young. As such, Nico et al. (2005) expressed concern over the increased risk that the species be misidentified and unintentionally introduced as "Grass Carp" to some areas.”

From Whitledge et al. (2022):

“Black Carp were first imported into the USA during the 1970’s and have commonly been used for biological control of snails (Nico et al. 2005). Snails targeted for biological control using Black Carp are intermediate hosts of parasitic trematodes which can infest Channel Catfish (*Ictalurus punctatus*) and other food fish raised in aquaculture ponds (Nico et al. 2005; Nico and Jelks 2011).”

Remarks

This ERSS was previously published in May 2019. Revisions were completed to incorporate new information and conform to updated standards.

From Nico and Neilson (2024):

"Chick et al. (2003) believed that their Illinois capture was the first wild record of Black Carp in the United States, but Nico et al. (2005) provided new information indicating that Louisiana commercial fishers had been collecting Black Carp in Louisiana since the early 1990s. However, until recently the Louisiana commercial fishers thought that the Black Carp in their nets were just an unusual type of Grass Carp—somewhat darker and with a higher dorsal fin and more pointed head or snout (Nico et al. 2005:xiii). The Black Carp that escaped in Missouri may have been triploid and thus considered sterile (Anonymous [1994]). However, it also was rumored that these fish may have been brood stock. All wild Black Carp examined to date taken in Louisiana waters have been found to be diploid (Nico et al. 2005)."

From USFWS (2007):

"Black carp can either be triploids (presumed sterile) or diploids (capable of reproduction). Triploid fish are created by adding an additional chromosome set (3 total) to induce sterility. Triploidy is one management tool to prevent reproduction and control populations in stocked fish. Externally, triploid fish are indistinguishable from diploid fish. Fish farmers have been successful in inducing triploidy in both black carp and grass carp. Triploids can be distinguished from diploids by testing the red blood cells."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to Fricke et al. (2024), *Mylopharyngodon piceus* (Richardson 1846) is the current valid name for this species.

From ITIS (2024):

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 *Mylopharyngodon*
                          Species *Mylopharyngodon piceus* (Richardson, 1846)

Size, Weight, and Age Range

From Nico and Neilson (2024):

"Large adults may be more than 1.5 m total length and 70 kg or more in weight; the largest specimen, unconfirmed, from the Chang (Yangtze) River basin reportedly measured 2.2 m."

From Froese and Pauly (2024):

"Maturity: L_m [length at maturity] 91.5, range 100 - ? cm
Max length : 180 cm TL [total length] male/unsexed; [IGFA 2001]; common length : 12.2 cm SL [standard length] male/unsexed; [Nichols 1943]; max. published weight: 35.0 kg [Novikov et al. 2002]; max. reported age: 13 years [Nico et al. 2005]."

"Maximum age probably exceeds 15 years; the figure of 20 years is not supported by data (Nico et al. 2005)."

Environment

From Nico and Neilson (2024):

"This species can be found in rivers, streams, or lakes; however, it requires large rivers to reproduce. It inhabits waters that range in temperatures from 0–45°C (Nico et al. 2005)."

From Froese and Pauly (2024):

"Adults inhabit large lowland rivers and lakes, preferably with clear water and high oxygen concentrations."

According to Siriwardena (2019), *Mylopharyngodon piceus* prefer water pH of 7.5-8.5 and dissolved oxygen (DO) levels greater than 5 mg/l.

Climate

According to Siriwardena (2019), *Mylopharyngodon piceus* prefers tropical/megathermal climate or dry (arid and semi-arid) climate.

From Froese and Pauly (2024):

"Subtropical; […] 53°N - 15°N, 100°E - 140°E (Nico et al. 2005)."

Distribution Outside the United States

Native

From Nico and Neilson (2024):

"Most major Pacific drainages of eastern Asia from the Pearl River (Zhu Jiang) basin in China north to the Amur River (Heilong Jiang) basin of China and far eastern Russia; possibly native to the Honghe or Red rivers of northern Vietnam (Nico et al. 2005)."

Introduced

From NIES (2025):

“Range in Japan: Breed at Lake Kasumigaura and Lake kitaura [sic] in Ibaraki Pref. [Prefecture], Tonegawa and Edogawa River System. Released and inhabit Ishikari river in Hokkaido Pref., Harunako Lake in Gunma Pref. and several rivers in Okayama Pref.”

“Establishment in Kasumigaura Lake was confirmed in 1956.”

From Dyldin et al. (2023):

“Also in southern Russia, where it is the object of breeding in Volga River basin (Caspian Sea), and acclimatized in Kuban (including Krasnodar Reservoir) basin, Krasnodar Region and Republic Adygea since 1960 (Moskul, 1998; Emtyl’ and Ivanenko, 2002; Ivanchev and Ivancheva, 2010). Introduced into Western Siberia (Novosibirsk Reservoir), but not naturalized there (Interesova, 2016).”

Drăgan et al. (2024) report *M. piceus* as casual in Romania.

From Jarić et al. (2015):

“Six non-native fish species have been confirmed as unsuccessful invaders in the Danube River basin (Holčík 2006; Lenhardt et al. 2011; Kottelat and Freyhof 2007): […] black carp (*Mylopharyngodon piceus*) […] These species were reported as either intentionally or unintentionally introduced in the river, but failed to establish viable populations.”

From Espinosa-Pérez and Ramírez (2015):

“[…] *Mylopharyngodon piceus* (Richardson, 1846), was reported [from Mexico] by Contreras-Balderas (1999) as a farmed species without currently new records.”

According to Espinosa-Pérez and Ramírez (2015), the current status of *Mylopharyngodon piceus* in Mexico requires verification.

Yankova (2016) reports *M. piceus* as present in Bulgaria through artificial reproduction, no natural reproduction.

From Piria et al. (2018):

“[…] black carp (*Mylopharyngodon piceus* Cyprinidae), were introduced into Skadar Lake shared between Albania and Montenegro, likely by the Albanians in 1963 (Holčik, 1991) and were recorded in Montenegro in 1973 (Vukovićz & Knežević, 1978) and 1983 (Knežević & Marić, 1986). […] [they] have acclimatized to their new environments, although natural reproduction has not been confirmed.”

According to Kuljanishvili et al. (2021), *Mylopharyngodon piceus* was introduced to Armenia in the 1990s but is not established.

According to Froese and Pauly (2025), *Mylopharyngodon piceus* has also been introduced and is established outside its native range in Cuba, Turkmenistan, Uzbekistan, and Vietnam; probably established in Costa Rica; probably not established in Germany; not established in Albania, Austria, the Czech Republic, Hungary, Israel, Taiwan, or Thailand; and the status of introductions is unknown in Bangladesh, Egypt, Iran, Kazakhstan, Latvia, Moldova, Morocco, and Ukraine.

According to Siriwardena (2019), *Mylopharyngodon piceus* has also been introduced in Belarus, Costa Rica, Iran, Lithuania, Serbia, Slovakia, and Panama. Evidence of natural reproduction and establishment in the wild is noted only for Costa Rica.

Means of Introduction Outside the United States

From NIES (2025):

"Accidental: Hitchhiking on seed release of grass carp (*Ctenopharyngodon idella*)"

According to Froese and Pauly (2024), some introductions of *Mylopharyngodon piceus* have been intentional for purposes of stocking, aquaculture, snail control, phyto- and zooplankton control, and research.

Short Description

From Siriwardena (2019):

"*M. piceus* is a blackish-brown fish with blackish-grey fins and an elongated, relatively compressed body (US Fish and Wildlife Service, 2023). Its scales are very large with dark edges, giving the fish a cross-hatched appearance (Crosier and Molloy, 2004). It has a pointed head with an arc-shaped terminal mouth (FAO, 1985). It has a short and pointed dorsal fin which is located above pelvic fins containing 7-8 rays (Crosier and Molloy, 2004) […] *M. piceus* closely resembles the grass carp in appearance (body shape and size; coloration; appearance; position; shape of fins; position and size of eyes), but may be most easily distinguished by differences in the formation of the pharyngeal teeth (Crosier and Molloy, 2004) […]"

From Froese and Pauly (2024):

"Dorsal spines (total): 0; Dorsal soft rays (total): 7 - 9; Anal spines: 0; Anal soft rays: 8 - 10. Anatomy of the pharyngeal apparatus is the main distinguishing characteristic; throat teeth typically form a single row of 4-5 large molariform teeth on each of the two arches, with formula typically 1,4 - 4,1."

Biology

From Nico and Neilson (2022):

“Black Carp are notable molluscivores […] Black Carp also consume some invertebrate species. In a diet analysis of 109 U.S. wild caught Black Carp, 16.5% of non-empty stomachs contained snails, 22.8% contained bivalve mussels, and 35.7% contained insect larvae (Poulton et al. 2019). This species can eat until full, which normally leads to a decrease in locomotion and its ability to avoid predation. However, when faced with a threat of predation, Black Carp can regurgitate excess food to increase speed and escape predators (Zhao et al. 2020).”

“Reproduction takes place in late spring and summer when water temperatures and/or water levels rise (Nico et al. 2005). Spawning has been reported to extend into early fall in the Upper Mississippi River (Sleeper 2019). Both male and female Black Carp are broadcast spawners; females are capable of releasing hundreds of thousands of eggs into flowing water, which then develop in the pelagic zone (Nico et al. 2005). After fertilization, the eggs become semi buoyant (Sukhanova, 1967 as cited in Nico et al. 2005). They hatch in 1 to 2 days, depending on water temperatures (optimum 26–30°C), and the yolk sac is absorbed in 6 to 8 days (Nico et al. 2005). Black Carp become sexually mature at 4 to 6 years after which they migrate back to their spawning grounds (Nico et al. 2005). Successful reproduction is known only from riverine habitats (Nico et al. 2005).”

From Siriwardena (2019):

“4-year-old juveniles are capable of consuming around 1-2 kg of molluscs per day. Upon maturity it is capable of reproducing annually. In its native range, spawning begins once water temperatures increase to 26-30°C, water levels begin to rise, and molluscs are readily available.”

From Froese and Pauly (2024):

“Larvae feed on zooplankton, then on ostracods and aquatic insects. At about 120 mm SL, juveniles start to prey on small snails and clams while larger juveniles and adults feed almost entirely on molluscs. Undertake upriver migration and spawns in open waters. Deposit pelagic or semipelagic eggs which hatch while drifting downstream. Larvae settle into floodplain lakes and channels with little or no current (Kottelat and Freyhof 2007).”

Human Uses

From Siriwardena (2019):

“Human food and beverage > fresh meat
Human food and beverage > whole”

From Froese and Pauly (2024):

“Fisheries: highly commercial; aquaculture: commercial”

From Nico and Neilson (2024):

"The Black Carp […] has been used by U.S. fish farmers to prey on and control disease-carrying snails in their farm ponds; more recently, this species has been proposed as a biological control for the introduced zebra mussel *Dreissena polymorpha*. Although the subject has been debated, to date, there is no experimental evidence that indicates Black Carp would be effective in controlling zebra mussels."

Diseases

No information was found associating *Mylopharyngodon piceus* with any diseases listed by the World Organisation for Animal Health (2024).

According to Siriwardena (2019), *Mylopharyngodon piceus* carries grass carp reovirus (a pathogen) and grass carp haemorrhagic disease.

From Nico and Williams (1996):

"Black carp in the Amur River carry the digenetic fluke, *Aspidogaster conchicola*, in their intestines. Black carp become infested after feeding on the fluke's primary host, the bivalve mollusk *Cristcaria* [sic] *plicata*. Amur River black carp also carry metacercaria of *Metogonimus yokogawai*. Infestation results from feeding heavily on the intermediate host, the mollusk Melania. Another diet-related parasite reported infecting black carp is *Khawia sinensis*. Oligochaetes that serve as intermediate hosts to "sea pink" (taxa?) are also preyed upon by black carp (Evtushenko et al. 1994, and references therein)."

"According to Evtushenko et al. (1994), the most serious parasitic problem of black carp in the Yangtze River basin is "inflammation of the viscera caused by parasitic fish lice.""

"Although several papers indicated black carp are highly resistant to parasitism and diseases, Lin (1955) found that both black carp and grass carp succumb easily to bacterial diseases such as intestinal inflammation, dysentery, and gill rot. The two species also reportedly have a lower tolerance of foul water than other fishes."

From Scholz and Salgado-Maldonado (2000):

"*Centrocestus formosanus* was first reported from Mexico by López-Jiménez (1987) as metacercariae encysted on the gills of the introduced cyprinid, the black carp *Mylopharyngodon piceus*, and other fish from a fish farm in central Mexico. López-Jiménez (1987) suggested that *C. formosanus* had been introduced to Mexico with the introduction of the black carp in 1979 and later infected other native fish in the Tezontepec de Aldama farm (López-Jiménez, 1987; Vélez-[Hernández] et al., 1998)."

According to Poelen et al. (2014), *Mylopharyngodon piceus* has the following parasites or diesases: *Aeromonas hydrophila, Aspidogaster amurensis, Asymphylodora japonica, Austrodiplostomum compactum, Bothriocephalus acheilognathi, Bothriocephalus phoxini, Camallanus cotti, Carassotrema koreanum, Carassotrema pterorchis, Cucullanus spp.,* *Dactylogyrus lamellatus, Dactylogyrus magnihamatus, Dactylogyrus nasali, Diplostomum hupehensis, Diplostomum mergi, Diplozoon spp., Hebesoma violenteum, Orientotrema spp., Opisthorchis sinensis, Parasymphylodora japonica, Pseudocapillaria tomentosa, Sanguinicola armatus, Schyzocotyle acheilognathi, Sindiplozoon diplodiscus, Sinergasilus major, Spirocamallanus fulvidraconis,* Chinese Liver Fluke, and Aquareovirus C.

Threat to Humans

From Froese and Pauly (2024):

"Potential pest (Bartley 2006)."

From Siriwardena (2019):

"It serves as intermediate host for human parasites (e.g. schistosoma), or parasites relevant to fish culture, such as the yellow and white grubs in channel catfish and stripe bass farming (Mitchell, 1995 as stated in Rothbard et al., 1996)."

3 Impacts of Introductions

No documented impacts of introductions of *Mylopharyngodon piceus* could be found. The following quotations detail **potential, anecdotal,** or **highly generalized** information on impacts of introduction from *Mylopharyngodon piceus*.

From Nico and Neilson (2024):

"Black carp readily feed on native snails, mussels, clams, and the U.S.-nonnative clam *Corbicula fluminea* (Porreca et al. 2022). There is high potential that the black carp would negatively impact native aquatic communities by feeding on, and reducing, populations of native mussels and snails, many of which are considered endangered or threatened (Nico et al. 2005). Given their size and diet preferences, black carp have the potential to restructure benthic communities by direct predation and removal of algae-grazing snails. Mussel beds consisting of smaller individuals and juvenile recruits are probably most vulnerable to being consumed by black carp (Nico et al. 2005). Furthermore, based on the fact that black carp attain a large size (well over 1 meter long), both juvenile and adult mussels and snails of many species would be vulnerable to predation by this fish (Nico et al. 2005). Fish farmers report that black carp are very effective in reducing the numbers of snails in some ponds. Recently, Wui and Engle (2007) argued that black carp can eliminate 100% of the snails in a single pond. Although their assumption that black carp are capable of eliminating all common pond snails in ponds is open to debate, the effectiveness of black carp in significantly reducing snail populations in aquaculture ponds indicates that any black carp occurring in the wild may cause significant declines in certain native mollusk populations in North American streams and lakes (Nico et al. 2005). Because the life span of black carp is reportedly over 15 years, sterile triploid black carp in the wild would be expected to persist many years and therefore have the potential to cause harm native mollusks by way of predation (Nico et al. 2005)."

From Siriwardena (2019):

"Establishment of *Mylopharyngodon piceus* populations in the wild could have serious adverse impacts, due to predation on native mollusc species, including threatened and endangered species and fingernail clam populations, a primary food source of migrating waterfowl and fish (Rothbard et al., 1996). *M. piceus* are hosts to parasites, flukes, bacterial and viral diseases. It could possibly transfer these to other fish species."

From Whitledge et al. (2022):

"Stable isotope and diet studies have documented trophic overlap between Black Carp and native benthic fishes in the Mississippi River basin, suggesting the potential for interspecific competition for benthic invertebrate prey (Nico et al. 2011; Poulton et al. 2019; Evans 2020)."

Mylopharyngodon piceus is regulated federally and in approximately 30 U.S. States. See section 1.

4 History of Invasiveness

The History of Invasiveness for *Mylopharyngodon piceus* is classified as Data Deficient. Nonnative introductions have led to established populations in the United States and several other countries, but all impacts of introductions discussed in the literature are currently theoretical. There remains no clear, convincing, and reliable documentation of negative impacts of introduction of *Mylopharyngodon piceus* in the scientific literature.

5 Global Distribution

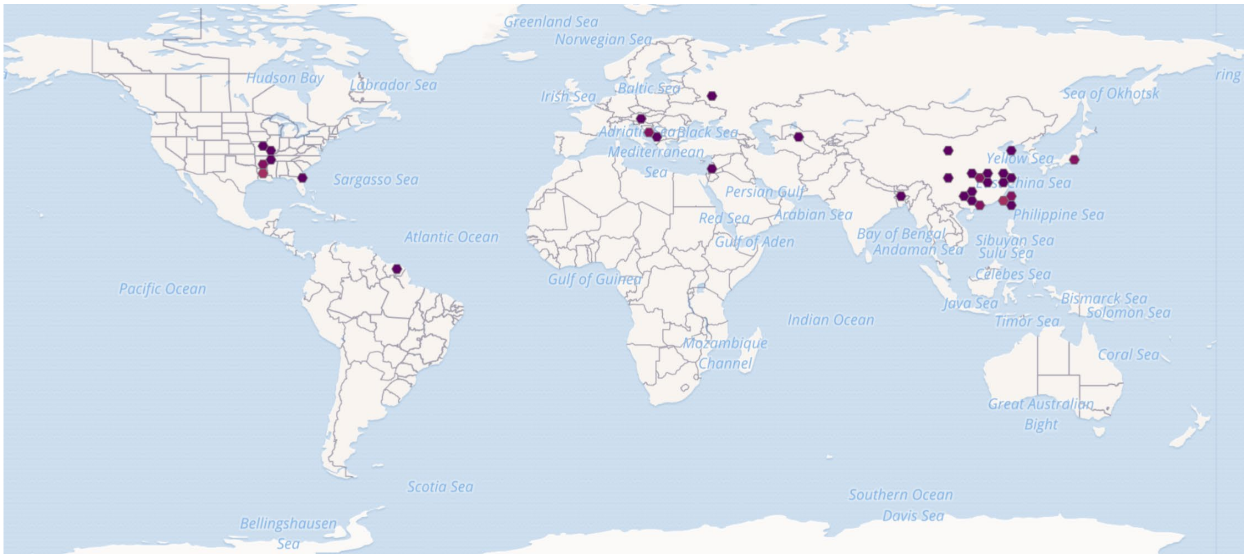

Figure 1. Reported global distribution of *Mylopharyngodon piceus*. Map from GBIF Secretariat (2024). Observations are reported from North and South America (United States, French Guiana), Asia (China, Taiwan, Japan, Bangladesh, Uzbekistan, Israel), and Europe (Russia, Montenegro, Austria). Points in Florida (United States), French Guiana, western China, Taiwan, Bangladesh, Israel, and Europe were not used to select source points for climate matching because they are not known to represent established populations.

No georeferenced occurrences were found to represent portions of the established range of *Mylopharyngodon piceus* in Vietnam, far eastern Russia, Turkmenistan, or Costa Rica.

6 Distribution Within the United States

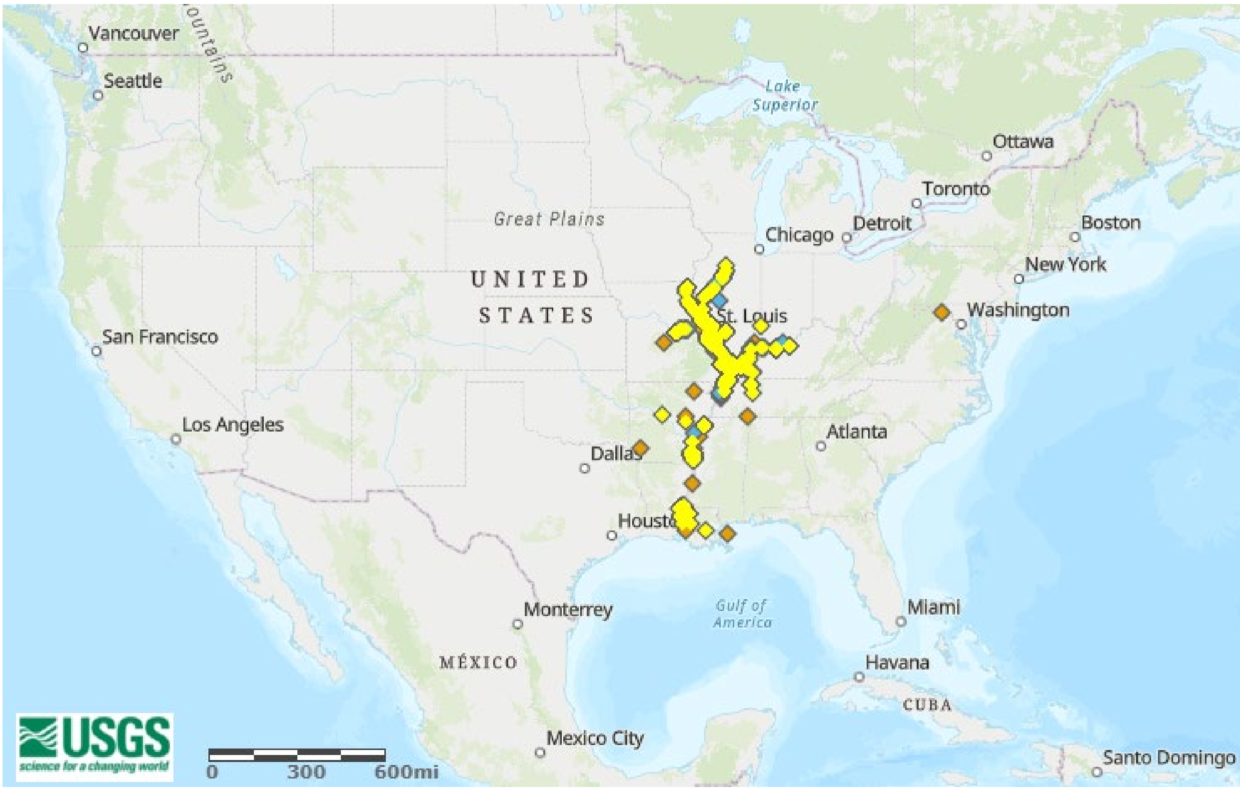

Figure 2. Reported distribution of *Mylopharyngodon piceus* in the United States. Map from Nico and Neilson (2025). Observations are reported from Illinois, Missouri, Kentucky, Tennessee, Arkansas, Louisiana, and West Virginia. Yellow points represent established populations. Blue points (representing diploid fish occurrences) and orange points (diploid or triploid fish occurrences) do not represent established populations and were not used to select source points for the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Mylopharyngodon piceus* in the contiguous United States was mostly high and medium. The areas of highest match were along the lower and middle stretches of the Mississippi River, where the species is already established. There were also areas of high match along the Atlantic coast from Florida to Massachusetts. The areas of medium match were primarily in the central and western United States, except for low matches along the Pacific coast and along the Sierra and Cascade mountain ranges. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.681, indicating that Yes, there is establishment concern for this species. The Climate 6 score is calculated as: (count of target points with scores ≥ 6)/(count of all target points). Establishment concern is warranted for Climate 6 scores greater than or equal to 0.002 based on an analysis of the establishment success of 356 nonnative aquatic species introduced to the United States (USFWS 2024).

Projected climate matches in the contiguous United States under future climate scenarios are available for *Mylopharyngodon piceus* (see Appendix). These projected climate matches are provided as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.

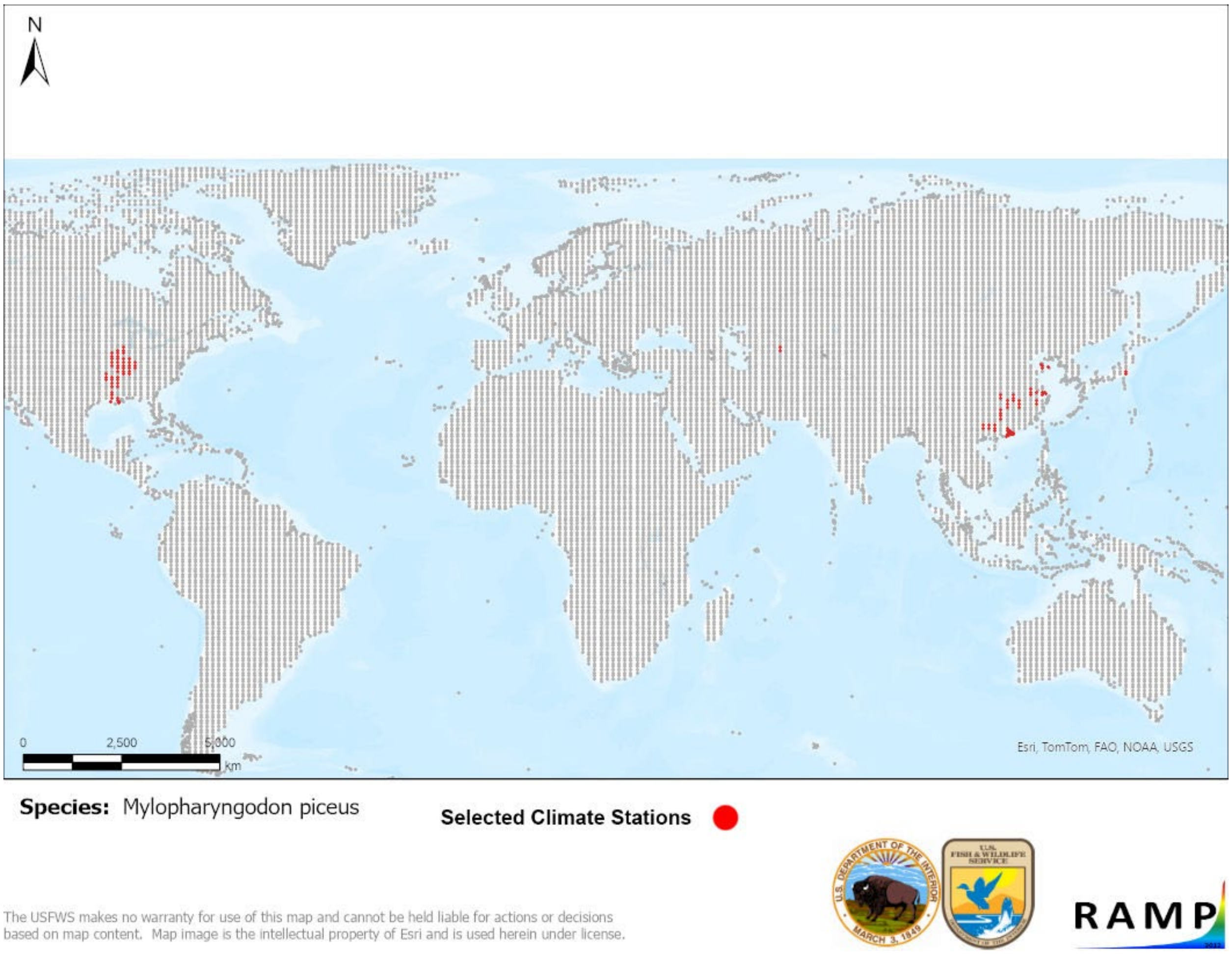

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations in North America and Asia selected as source locations (red; United States, Uzbekistan, China, and Japan) and non-source locations (gray) for *Mylopharyngodon piceus* climate matching. Source locations from GBIF Secretariat (2024) and Nico and Neilson (2025). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

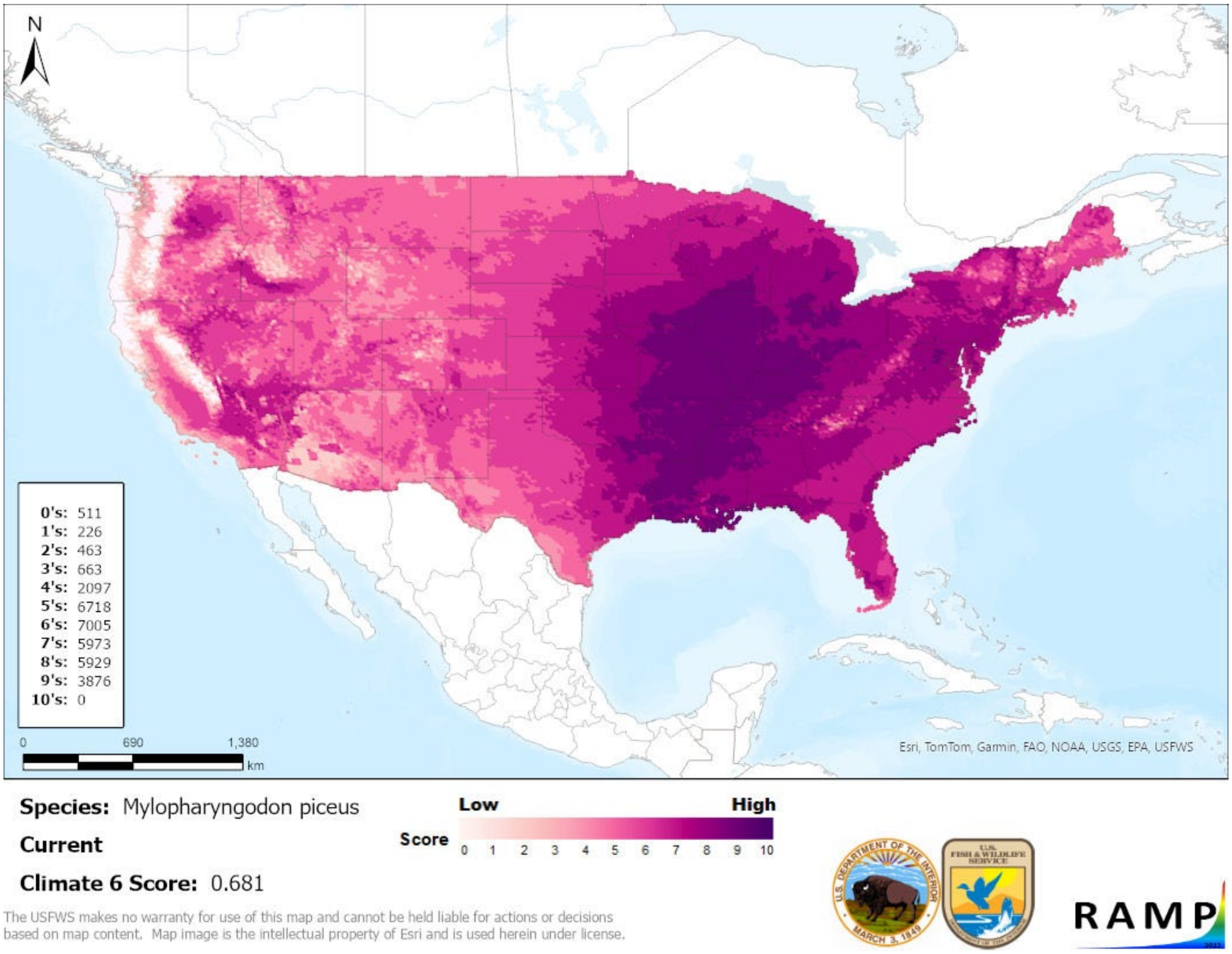

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Mylopharyngodon piceus* in the contiguous United States based on source locations reported by GBIF Secretariat (2024) and Nico and Neilson (2025). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Mylopharyngodon piceus* is classified as Low. Adequate information is available on the biology, ecology, and distribution of *M. piceus,* but not on the impacts of introduction. Nonnative populations of *Mylopharyngodon piceus* have become established in locations where it has been introduced, and many sources describe potential impacts, but no sources were found to have documented impacts. Further studies are needed to fully evaluate the risk posed by this species to the United States.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Mylopharyngodon piceus, Black Carp, is a fish that is native to many Pacific drainages of eastern Asia. Black carp inhabit large lowland rivers and lakes, with reproduction occurring exclusively in rivers. *Mylopharyngodon piceus* are primarily molluscivores and are often employed in aquaculture as a biocontrol agent for nuisance molluscs. *M. piceus* are also commercially fished in some locations. This species is regulated in most U.S. states and is currently listed federally as an injurious species. Potential impacts of introduction of *Mylopharyngodon piceus* include population declines of native mollusks due to predation, disease and parasite transfer, and competition with native benthic fishes. However, the History of Invasiveness for *Mylopharyngodon piceus* is classified as Data Deficient due to the lack of documentation of such impacts where nonnative populations are established. The climate matching analysis for the contiguous United States indicates establishment concern. Areas of highest match were located within the Mississippi River basin. Areas of lowest match were along the Pacific Coast. The Certainty of Assessment for this ERSS is classified as Low due to the absence of research documenting impacts or lack of impacts of introduction. The Overall Risk Assessment Category for *Mylopharyngodon piceus* in the contiguous United States is Uncertain.

Assessment Elements

- **History of Invasiveness (see Section 4): Data Deficient**
- **Establishment Concern (see Section 7): Yes**
- **Certainty of Assessment (see Section 8): Low**
- **Remarks, Important additional information: Federally listed by the U.S. Fish and Wildlife Service as an injurious wildlife species.**
- **Overall Risk Assessment Category: Uncertain**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in section 11.

[AGFC] Arkansas Game and Fish Commission. 2022. Certain exotic species prohibited. Arkansas Game and Fish Commission Code Book 26.13.

Arizona Game and Fish Commission. 2022. Restricted live wildlife. Arizona Administrative Code R12-4-406.

[CDFW] California Department of Fish and Wildlife. 2021. Restricted species laws and regulations manual 671. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=28427&inline (October 2022).

[CPW] Colorado Parks and Wildlife. 2023. Possession of aquatic wildlife. 2 Code of Colorado Regulations 406-0, Article VIII #012.

Connecticut [DEEP] Department of Energy and Environmental Protection. 2020. Importation of fish, birds, and quadrupeds. Regulations of Connecticut State Agencies 26-55.

Drăgan O, Rozylowicz L, Ureche D, Falka I, Cogălniceanu D. 2024. Invasive fish species in Romanian freshwater. A review of over 100 years of occurrence reports. NeoBiota 94:15–30.

Dyldin YuV, Orlov AM, Hanel L, Romanov VI, Fricke R, Vasil'eva ED. 2023. Ichthyofauna of the fresh and brackish waters of Russia and adjacent areas: annotated list with taxonomic comments. 2. Order Cypriniformes, suborders Catostomoidei, Cobitoidei and Cyprinoidei. Journal of Ichthyology 63:636–686.

[FFWCC] Florida Fish and Wildlife Conservation Commission. 2022. Conditional nonnative species list. Tallahassee: Florida Fish and Wildlife Conservation Commission. Available: https://myfwc.com/wildlifehabitats/nonnatives/conditional-species-list/ (October 2022).

Fricke R, Eschmeyer WN, van der Laan R, editors. 2024. Eschmeyer's catalog of fishes: genera, species, references. California Academy of Science. Available: http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (February 2024).

Froese R, Pauly D, editors. 2024. *Mylopharyngodon piceus* (Richardson, 1846). FishBase. Available: https://www.fishbase.us/summary/SpeciesSummary.php?ID=4602&AT=black+carp (February 2024).

Froese R, Pauly D, editors. 2025. *Mylopharyngodon piceus* (Richardson, 1846). FishBase. Available: https://fishbase.de/summary/Mylopharyngodon_piceus.html (December 2025).

GBIF Secretariat. 2024. GBIF backbone taxonomy: *Mylopharyngodon piceus* (Richardson, 1846). Copenhagen: Global Biodiversity Information Facility. Available: https://www.gbif.org/species/2362110 (February 2024).

[HDOA] Hawaii Department of Agriculture. 2019. Non-domestic animal import rules. Hawaii Administrative Rules Chapter 4-71.

Hunter ME, Nico LG. 2015. Genetic analysis of invasive Asian black carp (*Mylopharyngodon piceus*) in the Mississippi River Basin: evidence for multiple introductions. Biological Invasions 17:99–114.

Illinois [DNR] Department of Natural Resources. 2015. Injurious species. 17 Illinois Administrative Code chapter 1, part 805.

Iowa [NRC] Natural Resource Commission. 2015. Aquatic invasive species. Iowa Administrative Code 571-90.

[ITIS] Integrated Taxonomic Information System. 2024. *Mylopharyngodon piceus.* Reston, Virginia: Integrated Taxonomic Information System. Available: https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=639618#null (February 2024).

Jarić I, Jaćimović M, Cvijanović G, Knežević-Jarić J, Lenhardt M. 2015. Demographic flexibility influences colonization success: profiling invasive fish species in the Danube River by the use of population models. Biological Invasions 17:219–229.

[KDFWR] Kentucky Department of Fish and Wildlife Resources. 2022. Importation, possession, and prohibited aquatic species. 301 Kentucky Administrative Regulations 1:122.

[KDWP] Kansas Department of Wildlife and Parks. 2023. Importation and possession of certain wildlife; prohibition, permit requirement, and restrictions. Kansas Administrative Regulations 115-18-10.

Kuljanishvili T, Mumladze L, Japoshvili B, Mustafayev N, Ibrahimov S, Patoka J, Pipoyan S, Kalous L. 2021. The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge and Management of Aquatic Ecosystems 422:32.

Louisiana Revised Statutes. 2022. Exotic fish; importation, sale, and possession of certain exotic species prohibited; permit required; penalty. Title 56, section 319.

[MDC] Missouri Department of Conservation. 2023. Prohibited species. 3 Missouri Code of State Regulations 10-4.117.

Michigan Compiled Laws. 2022. Transgenic and nonnative organisms. Chapter 324, part 413.

Minnesota [DNR] Department of Natural Resources. 2022. Minnesota invasive species laws. Saint Paul: Minnesota Department of Natural Resources. Available: https://www.dnr.state.mn.us/invasives/laws.html (October 2022).

Montana [FWP] Department of Fish, Wildlife, and Parks. 2023. Exotic wildlife. Administrative Rules of Montana 12.6.22.

Nico LG, Jelks HL. 2011. The black carp in North America: an update. Pages 89–104 in Chapman DC, Hoff MH, editors. Invasive Asian carps in North America. Bethesda, Maryland: American Fisheries Society Symposium 74.

Nico LG, Neilson ME. 2024. *Mylopharyngodon piceus.* Nonindigenous Aquatic Species Database. Gainesville, Florida: U.S. Geological Survey. Available: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=573 (February 2024).

Nico LG, Neilson ME. 2025. *Mylopharyngodon piceus.* Nonindigenous Aquatic Species Database. Gainesville, Florida: U.S. Geological Survey. Available: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=573 (December 2025).

Nico LG, Williams JD. 1996. Risk assessment on black carp (Pisces: Cyprinidae). Report to the Risk Assessment and Management Committee of the Aquatic Nuisance Species Task Force, Washington, D.C.

[NIES] National Institute for Environmental Studies. 2025. *Mylopharyngodon piceus*. Invasive species of Japan. Tsukuba, Japan: National Research and Development Agency, National Institute for Environmental Studies. Available: https://www.nies.go.jp/biodiversity/invasive/DB/detail/50070e.html (December 2025).

North Carolina [DEQ] Department of Environmental Quality. 2022. Possession of certain fishes. 15A North Carolina Administrative Code 10C .0211.

[NDGF] North Dakota Game and Fish Department. 2023. ANS species list. Bismarck: North Dakota Game and Fish Department. Available: https://gf.nd.gov/ans/species (October 2023).

[NMDGF] New Mexico Department of Game and Fish. 2023. Director's species importation list. Santa Fe: New Mexico Department of Game and Fish. Available: https://www.wildlife.state.nm.us/download/enforcement/importation/information/Importation-Info-Directors-Species-Importation-List-1-3-2023.pdf (October 2023).

Nevada Board of Wildlife Commissioners. 2022. Hunting, fishing and trapping; miscellaneous protective measures. Nevada Administrative Code 503.

New York [DEC] Department of Environmental Conservation. 2022. Prohibited and regulated invasive species. 6 New York Codes, Rules and Regulations 575.3.

[ODNR] Ohio Department of Natural Resources. 2022. Ohio's injurious aquatic invasive species. Publication 5490 R0120. Available: https://ohiodnr.gov/static/documents/wildlife/fish-management/Injurious%20Aquatic%20Invasive%20Species.pdf (October 2022).

[ODFW] Oregon Department of Fish and Wildlife. 2022. Importation, possession, confinement, transportation and sale of nonnative wildlife. Oregon Administrative Rules 635-056.

[ODWC] Oklahoma Department of Wildlife Conservation. 2023. Restriction on aquatic species introduction. 800 Oklahoma Administrative Code 20.

[PFBC] Pennsylvania Fish and Boat Commission. 2022. Aquatic invasive species. Harrisburg: Pennsylvania Fish and Boat Commission. Available: https://www.fishandboat.com/Resource/AquaticInvasiveSpecies/Pages/default.aspx (October 2022).

Piria M, Simonović P, Kalogianni E, Vardakas L, Koutsikos N, Zanella D, Ristovska M, Apostolou A, Adrović A, Mrdak D, Tarkan AS, Milošević D, Zanella LN, Bakiu R, Ekmekçi FG, Povž M, Korro K, Nikolić V, Škrijelj R, Kostov V, Gregori A, Joy MK. 2018. Alien freshwater fish species in the Balkans—vectors and pathways of introduction. Fish and Fisheries 19:138–169.

Poelen JH, Simons JD, Mungall CJ. 2014. Global Biotic Interactions: an open infrastructure to share and analyze species-interaction datasets. Ecological Informatics 24:148–159.

Sanders S, Castiglione C, Hoff M. 2023. Risk Assessment Mapping Program: RAMP. Version 5.0. U.S. Fish and Wildlife Service.

Scholz T, Salgado-Maldonado G. 2000. The introductions and dispersal of *Centrocestus formosanus* (Nishigori 1924) (Digenea: Heterophyidae) in Mexico: a review. The American Midland Naturalist 143(1):185–200.

Siriwardena S. 2019. *Mylopharyngodon piceus* (black amur). In CABI Compendium. Wallingford, United Kingdom: CAB International. Available: https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.73511 (February 2024).

State of Georgia. 2023. Wild animals. Rules and Regulations of the State of Georgia subject 391-4-8.

[TWRA] Tennessee Wildlife Resources Agency. 2022. Rules and regulations of live wildlife. Rules of the Tennessee Wildlife Resources Agency 1660-01-18.

[USFWS] U.S. Fish and Wildlife Service. 2007. Rules and regulations: injurious wildlife species: black carp (*Mylopharyngodon piceus*). Federal Register 72(201):59019–59035.

[USFWS] U.S. Fish and Wildlife Service. 2024. Standard operating procedure: how to prepare an "Ecological Risk Screening Summary." Version 3. Available: https://www.fws.gov/media/standard-operating-procedures-how-prepare-ecological-risk-screening-summary-2024 (December 2024).

[USFWS] U.S. Fish and Wildlife Service. 2025. Summary of species currently listed as injurious wildlife under (18 U.S.C. 42) Lacey Act. Available: https://www.fws.gov/page/summary-of-species-currently-listed-as-injurious-wildlife (December 2025).

[WDFW] Washington Department of Fish and Wildlife. 2022. Invasive/nonnative species. 220 Washington Administrative Code 640.

[WGFD] Wyoming Game and Fish Commission. 2022. Regulation for aquatic invasive species. Wyoming Administrative Rules Chapter 62.

Whitledge GW, Kroboth PT, Chapman DC, Phelps QE, Sleeper W, Bailey J, Jenkins JA. 2022. Establishment of invasive black carp (*Mylopharyngodon piceus*) in the Mississippi River basin: identifying sources and year classes contributing to recruitment. Biological Invasions 24:3885–3904.

Wisconsin [DNR] Department of Natural Resources. 2022. Invasive species identification, classification and control. Wisconsin Administrative Code NR 40.

World Organisation for Animal Health. 2024. Animal diseases. Paris: World Organisation for Animal Health. Available: https://www.woah.org/en/what-we-do/animal-health-and-welfare/animal-diseases/ (February 2024).

Yankova M. 2016. Alien invasive fish species in Bulgarian waters: an overview. International Journal of Fisheries and Aquatic Studies 4(2):282–290.

11 Literature Cited in Quoted Material

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

Anonymous. 1994. Black carp escape to Missouri waters. The LMRCC (Lower Mississippi River Conservation Committee) Newsletter 1(1) (June):11.

Bartley DM, editor. 2006. DIAS. Introduced species in fisheries and aquaculture: information for responsible use and control (CD-ROM). Rome: FAO.

Chick JH, Maher RJ, Burr BM, Thomas MR. 2003. First black carp captured in U.S. Science 300:1876–1877.

Contreras-Balderas S. 1999. Annotated checklist of introduced invasive fishes in México, with examples of some recent introductions. Pages 31–52 in Claudi R, Leach JH, editors. Nonindigenous freshwater organisms: vectors, biology, and impacts. Boca Raton: Lewis Publishers.

Crosier DM, Molloy VDP. 2004. *Mylopharyngodon piceus* - black carp. Available: www.wes.army.mil/el/ansrp/mylopharyngodon_piceus.htm (June 2004).

Emtyl' MH, Ivanenko AM. 2002. Fishes of the South-Western Russia: study guide. Krasnodar, Russia: Kuban State University.

Evans HS Jr. 2020. Comparison of resource use by invasive Black Carp and native fish using isotopic niche and diet analyses. Masters thesis. Carbondale: Southern Illinois University.

Evtushenko NY, Potrolchov AS, Zinkovskii OG. 1994. The black carp as a subject for acclimatization (Review). Hydrobiological Journal 30(5):1–10.

FAO. 1985. Training manual: integrated fish farming in China. Available: https://www.fao.org/3/AC233E/AC233E00.htm#TOC.

Holčik J. 1991. Fish introductions in Europe with particular reference to its Central and Eastern part. Canadian Journal of Fisheries and Aquatic Sciences 48(Supplement 1):13–23.

Holčík J. 2006. Is the naturalization of the paddlefish in the Danube River basin possible? Journal of Applied Ichthyology 22(Supplement 1):40–43.

IGFA. 2001. Database of IGFA angling records until 2001. Fort Lauderdale, Florida: IGFA.

Interesova EA. 2016. Alien fish species in the Ob River basin. Russian Journal of Biological Invasions 7(2):156–167.

Ivanchev VP, Ivancheva EY. 2010. Cyclostomata and fishes of the Ryazan region and adjacent areas. Ryazan, Russia: Golos gubernii.

Kottelat M, Freyhof J. 2007. Handbook of European freshwater fishes. Cornol: Publications Kottelat and Berlin: Freyhof.

Knežević B, Marić D. 1986. Contribution to the knowledge of introduced ichthyofauna of Yugoslavia – the occurrence of *Mylopharyngodon piceus* (Richardson, 1845) (Cyprinidae, Pisces) in Lake Skadar. Ichthyos 3:13–17.

Lenhardt M, Markovic G, Hegedis A, Maletin S, Cirkovic M, Markovic Z. 2011. Non-native and translocated fish species in Serbia and their impact on the native ichthyofauna. Reviews in Fish Biology and Fisheries 21:407–421.

Lin SY. 1955. Chinese systems of pond stocking. Indo-Pacific Fisheries Council Proceedings 5 (1954):113–125.

López-Jiménez S. 1987. Enfermedades más frecuentes de las carpas cultivadas en México. Acuavisión, Rev. Mex. Acuacult. 2(9):11–13.

Moskul GA. 1998. Fishes of the reservoirs of Kuban Basin. Krasnodar, Russia: Krasnodar Book Publishers.

Nichols JT. 1943. The freshwater fishes of China. Natural history of Central Asia. Volume IX. New York: The American Museum of Natural History.

Nico LG, Demopoulos A, Gualtieri M, Wieser C. 2011. Use of stable isotopes and mercury to assess trophic positions of black carp and other large fishes in the Red-Atchafalaya River System, Louisiana, USA. Pages 105–119 in Chapman DC, Hoff MH, editors. Invasive Asian carps in North America. Bethesda, Maryland: American Fisheries Society Symposium 74.

Nico LG, Williams JD, Jelks HL. 2005. Black carp: biological synopsis and risk assessment of an introduced fish. Bethesda, Maryland: American Fisheries Society. Special Publication 32.

Novikov NP, Sokolovsky AS, Sokolovskaya TG, Yakovlev YM. 2002. The fishes of Primorye. Vladivostok, Russia: Far Eastern State Technical Fisheries University.

Papoulias DM, Candrl J, Jenkins JA, Tillitt DE. 2011. Verification of ploidy and reproductive potential in triploid black carp and grass carp. Pages 251–266 in Chapman DC, Hoff MH, editors. Invasive Asian carps of North America. Bethesda, Maryland: American Fisheries Society Symposium 74.

Porreca AP, Butler SE, Tiemann JS, Parkos JJ. 2022. Differential vulnerability of native and non-native mollusks to predation by juvenile black carp. Biological Invasions 24:495–504.

Poulton BC, Kroboth PT, George AE, Chapman DC, Bailey J, McMurray SE, Faiman JS. 2019. First examination of diet items consumed by wild-caught black carp (*Mylopharyngodon piceus)* in the U.S. American Midland Naturalist 182:89–108.

Rothbard S, Rubinshtein I, Shelton WL. 1996. The black carp, *Mylopharyngodon piceus,* as a biocontrol of freshwater molluscs. Proceedings of 6th International Zebra Mussel and Other Aquatic Nuisance Species Conference, Dearborn, Michigan.

Sleeper WG. 2019. Black Carp reproductive ecology: documenting reproductive success of a novel invader. Master's thesis. Cape Girardeau, Missouri: Southeast Missouri State University.

US Fish and Wildlife Service. 2023. Black carp. Available: https://www.fws.gov/species/black-carp-mylopharyngodon-piceus.

Vuković T, Knežević B. 1978. Record of *Ctenopharyngodon idella* (Valenciennes) in Yugoslavian part of the Lake Skadar. Ribarstvo Jugoslavije 33:142. (In Serbian.)

Vélez-Hernández EM, Constantino-Casas F, García-Márquez LJ, Osorio-Sarabia D. 1998. Gill lesions in common carp, *Cyprinus carpio* L., in Mexico due to the metacercariae of *Centrocestus formosanus*. Journal of Fish Diseases 21:229–232.

Wui YS, Engle CR. 2007. The economic impact of restricting use of black carp for snail control on hybrid striped bass farms. North American Journal of Aquaculture 69:127–138.

Zhao J, Wen Y, Zhu S, Ye J, Zhu J, Ye Z, Jordan A. 2020. Solving post-prandial reduction in performance by adaptive regurgitation in a freshwater fish. Proceedings of the Royal Society B: Biological Sciences 287:20202172.

Appendix

Summary of Future Climate Matching Analysis

Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF Secretariat (2024) and Nico and Neilson (2025).

Under the future climate scenarios (figure A1), on average, high climate match for *Mylopharyngodon piceus* was projected to occur in the Appalachian Range, Great Lakes, Mid-Atlantic, Northeast, and Southeast regions of the contiguous United States. Areas of low climate match were projected to occur in the Northern Pacific Coast region. The area of highest match was centered on the Great Lakes under all scenarios but this area shifted its southern border northward and decreased in size particularly under the SSP5 2085 scenario. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.506 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.714 (model: IPSL-CM6A-LR, SSP3, 2055). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species under future scenarios. The Climate 6 score for the current climate match (0.681, figure 4) falls within the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085, the most extreme climate change scenario. At the 2055 time step, areas within the Southwest saw a large increase in the climate match relative to current conditions, but under the 2085 time step, the climate match was more similar to the current climate match. Additionally, under one or more time step and climate scenarios, areas within the Colorado Plateau, Great Basin, Great Lakes, and Northeast, and Western Mountains saw a moderate increase in the climate match relative to current conditions. Primarily at the 2085 time step, areas within California, the Colorado Plateau, Great Lakes, Gulf Coast, Mid-Atlantic, Northern Plains, Southeast, Southern Atlantic Coast, Southern Florida, Southern Plains, and Southwest saw a moderate decrease in the climate match relative to current conditions. No large decreases were observed regardless of time step and climate scenarios, except for a small area in the Lower Mississippi River basin under the SSP5, 2085 scenario. Additional, very small areas of large or moderate change may be visible on the maps (figure A3).

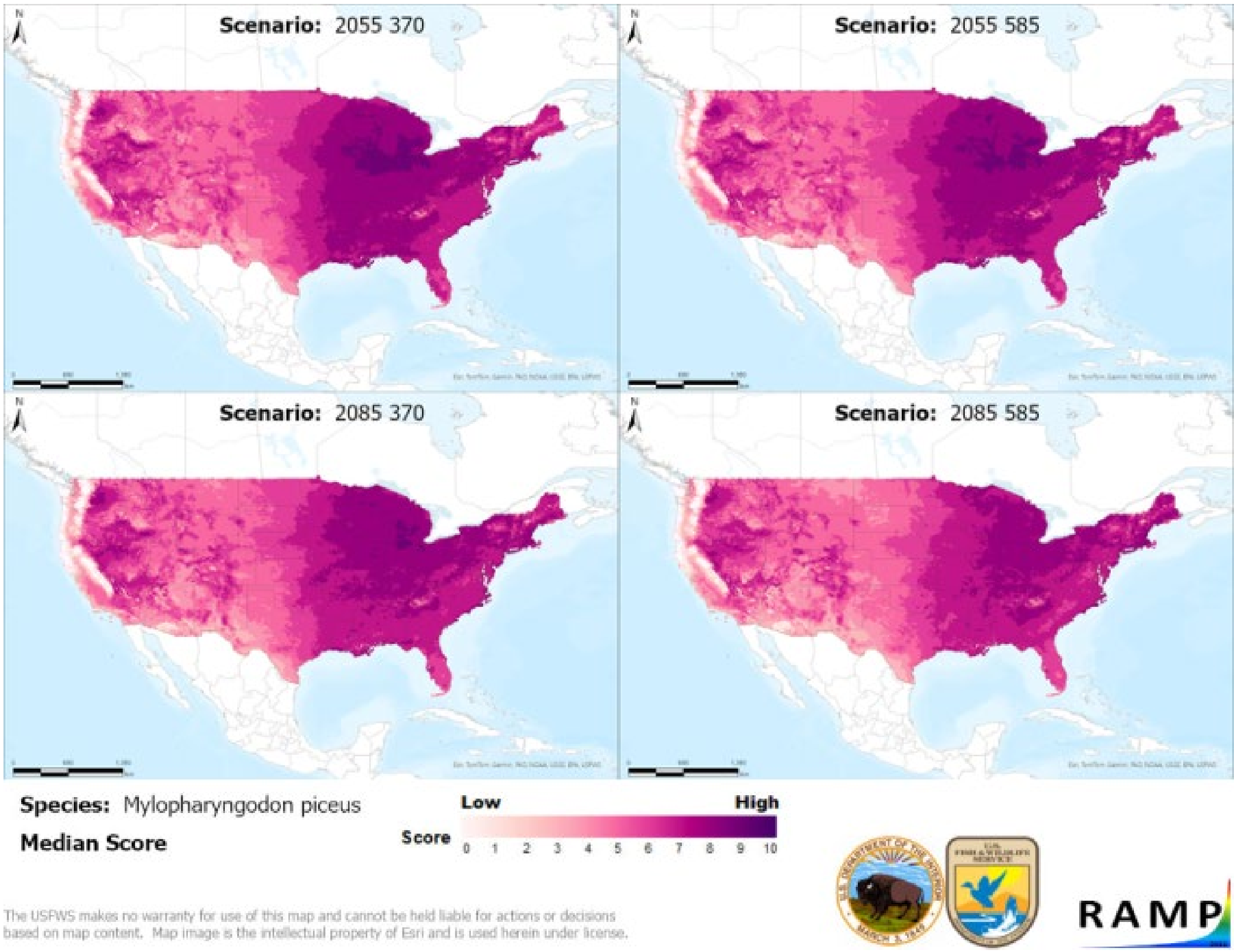

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Mylopharyngodon piceus* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2024) and Nico and Neilson (2025). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

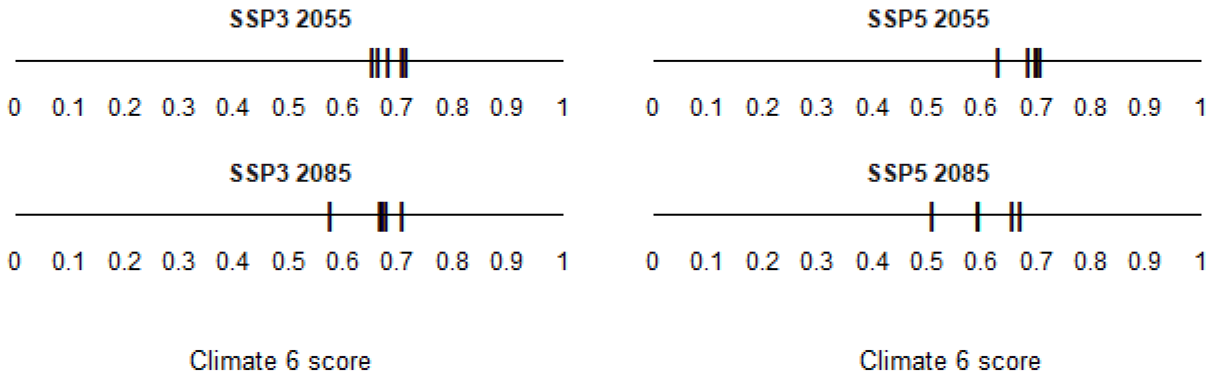

Figure A2. Comparison of projected future Climate 6 scores for *Mylopharyngodon piceus* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0.

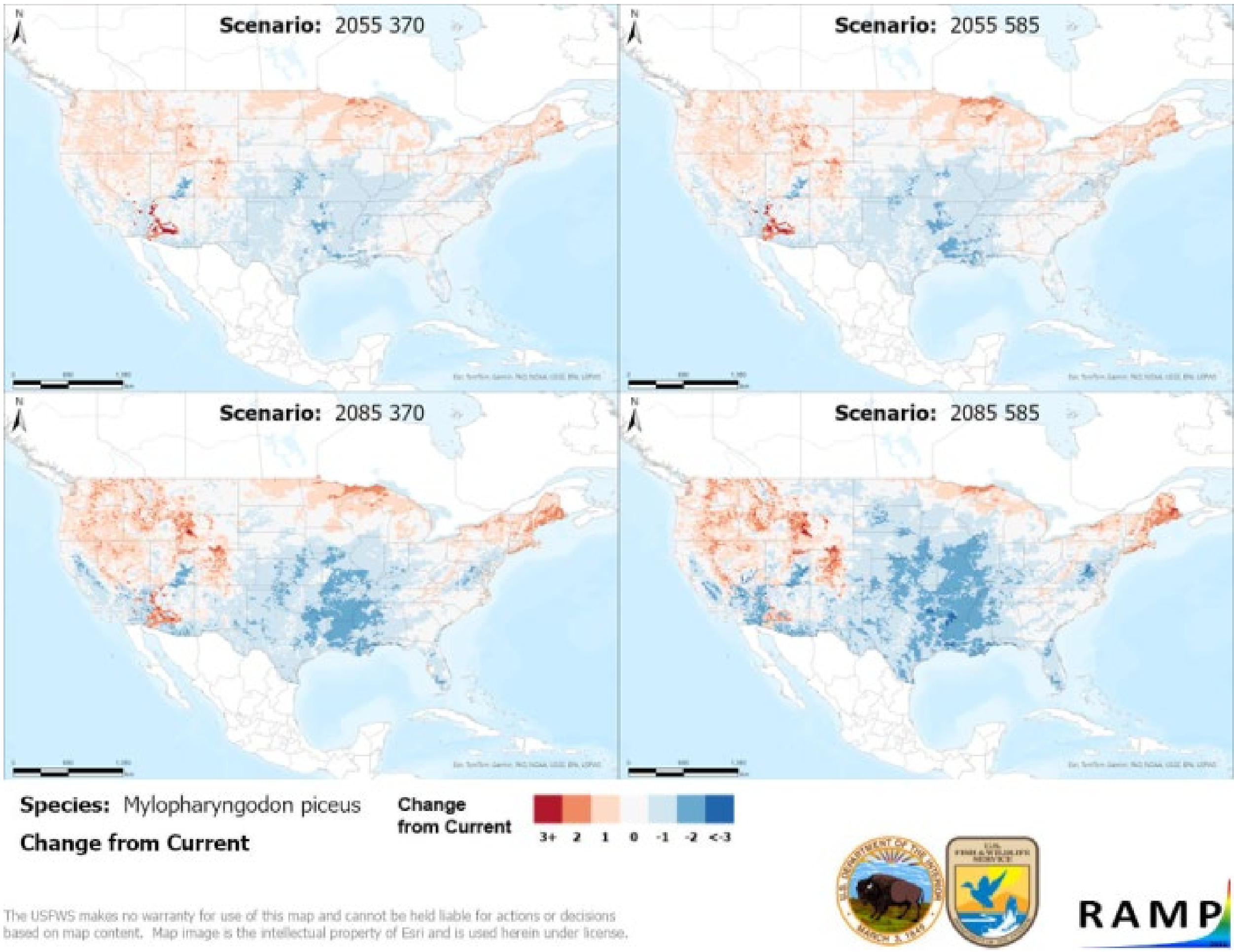

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Mylopharyngodon piceus* based on source locations reported by GBIF Secretariat (2024) and Nico and Neilson (2025). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. Shades of blue indicate a lower target point score under future scenarios than under current conditions. Shades of red indicate a higher target point score under future scenarios than under current conditions. Darker shades indicate greater change.

Literature Cited

GBIF Secretariat. 2024. GBIF backbone taxonomy: *Mylopharyngodon piceus* (Richardson, 1846). Copenhagen: Global Biodiversity Information Facility. Available: https://www.gbif.org/species/2362110 (February 2024).

[IPCC] Intergovernmental Panel on Climate Change. 2021. Climate change 2021: the physical science basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

Karger DN, Conrad O, Böhner J, Kawohl T, Kreft H, Soria-Auza RW, Zimmermann NE, Linder HP, Kessler M. 2018. Data from: Climatologies at high resolution for the earth's land surface areas. EnviDat. Available: https://doi.org/10.16904/envidat.228.v2.1.

Karger DN, Conrad O, Böhner J, Kawohl T, Kreft H, Soria-Auza RW, Zimmermann NE, Linder P, Kessler M. 2017. Climatologies at high resolution for the Earth land surface areas. Scientific Data 4:170122.

Nico LG, Neilson ME. 2025. *Mylopharyngodon piceus.* Nonindigenous Aquatic Species Database. Gainesville, Florida: U.S. Geological Survey. Available: https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=573 (December 2025).

Sanders S, Castiglione C, Hoff M. 2023. Risk Assessment Mapping Program: RAMP. Version 5.0. U.S. Fish and Wildlife Service.