

Gudgeon (*Gobio gobio*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, April 2011

Revised, April 2018

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1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2018):

“Europe: Atlantic Ocean, North and Baltic Sea basins, from Loire drainage eastward, eastern Great Britain, Rhône and Volga drainages, upper Danube and middle and upper Dniestr and Dniepr drainages; in Finland, north to about 61°N. [...] Eastern and southern limits unclear [Kottelat and Freyhof 2007]. Occurs as far east as Korea [Robins et al. 1991].”

From Freyhof (2011):

“Austria; Belarus; Belgium; Czech Republic; Denmark; Estonia; Finland; France; Germany; Latvia; Liechtenstein; Lithuania; Luxembourg; Netherlands; Norway; Poland; Russian Federation; Slovakia; Sweden; Switzerland; Ukraine; United Kingdom”

Status in the United States

This species has not been reported as introduced or established in the United States. No documentation was found to suggest trade of this species occurs in the United States.

Means of Introduction into the United States

This species has not been reported as introduced or established in the United States.

Remarks

From Freyhof (2011):

“Usually considered to be a morphologically variable species, with different morphologies reflecting adaptations to different habitats. Kottelat and Freyhof's [*sic*; 2007] morphological and molecular data indicate that in fact several species are confused under the name *G. gobio* in the Black and Caspian Sea basins.”

From DAISIE (2018):

“Synonyms

Bungia nigrescens Keyserling, 1861
Cobitis fundulus Wulff, 1765
Cyprinus gobio Linnaeus, 1758
Gobio gobio acutipinnatus (non Menschikov, 1939)
Gobio gobio albanicus Oliva, 1961
Gobio gobio bulgarica Drensky, 1926
Gobio gobio carpathicus krymensis Delyamure, 1937
Gobio gobio carpathicus sarmaticus Slastenenko, 1934
Gobio gobio carpathicus Vladykov, 1925
Gobio gobio feraeensis Stephanidis, 1973
Gobio gobio gymnostethus Ladiges, 1960
Gobio gobio holurus Fowler, 1976
Gobio gobio insuyanus Ladiges, 1960
Gobio gobio intermedius Battalgi, 1944
Gobio gobio kovatchevi Chichkoff, 1937
Gobio gobio krymensis Banarescu & Nalbant, 1973
Gobio gobio lepidolaemus holurus Berg, 1914
Gobio gobio lepidolaemus lindbergi Turdakov & Piskarev, 1955
Gobio gobio lepidolaemus skadarensis Karaman, 1937
Gobio gobio longicirris Berg, 1914
Gobio gobio magnicapitata Gundrizer, 1967

Gobio gobio microlepidotus Battalgi, 1942
Gobio gobio muresia Jaszfalusi, 1951
Gobio gobio nikolskyi Turdakov & Piskarev, 1955
Gobio gobio ohridana Karaman, 1924
Gobio gobio ohridanus Karaman, 1924
Gobio gobio prosopyga Berg, 1914
Gobio gobio saramaticus Berg, 1949
Gobio gobio sarmaticus Berg, 1949
Gobio gobio sibiricus Nikolsky, 1936
Gobio fluviatilis Cuvier, 1842
Gobio fluviatilis cynocephalus (non Dybowski, 1869)
Gobio fluviatilis lepidolaemus Kessler, 1872
Gobio gobio
Gobio gobio balcanicus Dimovski & Grupche, 1977
Gobio gobio brevicirris Berg, 1914
Gobio gobio gobio (Linnaeus, 1758)
Gobio gobio katopyga Berg, 1914
Gobio gobio lepidolaemus Kessler, 1872
Gobio latus Anikin, 1905
Gobio lepidolaemus causacica Kamensky, 1901
Gobio lepidolaemus Kessler, 1872
Gobio obtusirostris Valenciennes, 1842
Gobio phoxinoides De la Pylaie, 1835
Gobio saxatilis Koch, 1840
Gobio vulgaris Heckel, 1836
Leuciscus gobio (Linnaeus, 1758)”

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2018):

“Kingdom Animalia
 Subkingdom Bilateria
 Infrakingdom Deuterostomia
 Phylum Chordata
 Subphylum Vertebrata
 Infraphylum Gnathostomata
 Superclass Actinopterygii
 Class Teleostei
 Superorder Ostariophysi
 Order Cypriniformes
 Superfamily Cyprinoidea
 Family Cyprinidae
 Genus *Gobio*
 Species *Gobio gobio* (Linnaeus, 1758)”

“Current Standing: valid”

Size, Weight, and Age Range

From Froese and Pauly (2018):

“Maturity: L_m 9.3 range ? - ? cm

Max length : 21.0 cm TL male/unsexed; [Verreycken et al. 2011]; common length : 12.0 cm TL male/unsexed; [Maitland and Campbell 1992]; max. published weight: 220.00 g [Maitland and Campbell 1992]; max. reported age: 8 years [Maitland and Campbell 1992]”

Environment

From Froese and Pauly (2018):

“Freshwater; brackish; benthopelagic; pH range: 7.0 - 7.5; dH range: 10 - 20; potamodromous.”

“[...] 2°C - 18°C [Riehl and Baensch 1991; assumed to be recommended aquarium water temperatures]”

Climate/Range

From Froese and Pauly (2018):

“Temperate; [...] 67°N - 36°N, 10°W - 142°E”

Distribution Outside the United States

Native

From Froese and Pauly (2018):

“Europe: Atlantic Ocean, North and Baltic Sea basins, from Loire drainage eastward, eastern Great Britain, Rhône and Volga drainages, upper Danube and middle and upper Dniestr and Dniepr drainages; in Finland, north to about 61°N. [...] Eastern and southern limits unclear [Kottelat and Freyhof 2007]. Occurs as far east as Korea [Robins et al. 1991].”

From Freyhof (2011):

“Austria; Belarus; Belgium; Czech Republic; Denmark; Estonia; Finland; France; Germany; Latvia; Liechtenstein; Lithuania; Luxembourg; Netherlands; Norway; Poland; Russian Federation; Slovakia; Sweden; Switzerland; Ukraine; United Kingdom”

Introduced

Froese and Pauly (2018) report that *Gobio gobio* has been introduced and become established in Ireland, Italy, Norway, Spain, Portugal, and Morocco.

From McDowall (2008):

“Gudgeon became established in [an] Auckland [New Zealand] pond. Once discovered, attempts were made to exterminate them, and as far as is known, there are now no gudgeon in New Zealand.”

Means of Introduction Outside the United States

Froese and Pauly (2018) report the following reasons for introduction: accidental (Ireland), unknown (Italy, Portugal), bait (Norway), fisheries (Spain), and forage (Morocco).

From McDowall (2008):

[...] gudgeon (*Gobio gobio*) were introduced illegally [to New Zealand] with a view to establishing populations for anglers.”

Short Description

From Froese and Pauly (2018):

“Dorsal spines (total): 2 - 3; Dorsal soft rays (total): 5-7; Anal spines: 2-3; Anal soft rays: 6 - 8; Vertebrae: 39 - 41. Diagnosed from other congeners in Europe by the possession of the following characters: barbel reaching beyond anterior eye margin, usually to middle of eye; snout length greater than postorbital distance; head length 26-30% SL; eye diameter 5-7% SL; 1.0-1.4 times in interorbital distance in over about 6 cm SL specimens (less in smaller ones), 2.4-2.8 times in head depth; head depth 15-17% SL at nape, 43-51% HL at eye; body depth 19-23% SL; head width 14-16% SL, 49-57% HL; caudal peduncle depth 30-34% HL; breast naked between pectorals; scales between anus and anal origin 4-5; scales on lateral line usually 39-42 + 2; and scales around caudal peduncle usually 12-14 [Kottelat and Freyhof 2007]. Caudal fin with 19 rays [Spillman 1961]. Scalar formula: 38-45 [Keith and Allardi 2001].”

Biology

From Froese and Pauly (2018):

“Occurs in nearly all types of riverine and lacustrine habitats with sand bottom. Found in small mountain streams, large lowland rivers and large lakes [Kottelat and Freyhof 2007]. Inhabits fast flowing rivers with sand or gravel bottom but may also occur in still waters. Forms schools. Feeds on insect larvae, mollusks, and crustaceans. Normally active during the day but if they are disturbed, in particular, by predators, they can defer their activity to periods when light intensity is weak. Capable of emitting squeaking sounds. These vocalizations, which is a means by which fish communicate with each other, vary with the degree of activity and the temperature and are independent of the season of reproduction [Billard 1997]. Breeds in shallow water over stones, sand or plant material. Eggs are released above substrate and drift with current, sinking to bottom and sticking to substrate. Larvae and juveniles occur on the bottom and prefer detritus-rich sandy habitats and low current [Kottelat and Freyhof 2007].”

“Spawns once a year for several years in low productivity streams, but exhibits multiple spawning within a season in high productivity environments [Mann et al. 1984; McEvoy and McEvoy 1992].”

From Freyhof (2011):

“Gregarious. Lives up to five years.”

Human Uses

From Froese and Pauly (2018):

“Fisheries: commercial; aquarium: commercial; bait: usually”

Diseases

From Fabian et al. (2013):

“Tissue samples taken from [...] gudgeon, *Gobio gobio* (L.) [and several other species] were found to be positive for KHV [koi herpesvirus] with a large variation in prevalence and a concentration range of 1–180 copies per 1250 ng DNA [...]”

Koi herpesvirus disease is OIE-reportable.

From Ortega et al. (1995):

“Upstream and downstream from rainbow trout farms in which IPN [infectious pancreatic necrosis] virus was detected, we could isolate this pathogen from nase and gudgeon, fish species living in the rivers. This means that these species act as asymptomatic carriers of the virus, as observed in previous studies (Ortega, 1991).”

From Rehulka et al. (2015):

“An outbreak [of *Vibrio cholerae* infection] occurred in wild populations of [several fish species including] gudgeon, *Gobio gobio* (Linnaeus, 1758) [...]”

“Strains of *V. cholerae* non-O1/non-O139 can on rare occasion cause a severe cholera-like disease, but they are usually isolated from patients with mild diarrhoea and extra-intestinal infections, from seafood and from the environment. These strains usually do not produce cholera enterotoxin.”

From Blažek et al. (2008):

“Seasonal changes in occurrence, infracommunity composition and microhabitat distribution of the monogenean parasites of gudgeon *Gobio gobio* (L.) were studied during two years in the River Haná (Czech Republic). Altogether 212 specimens of gudgeon were examined and a total of 6456 specimens of eight monogenean species were recorded: *Dactylogyrus cryptomeris*,

Gyrodactylus gobiensis, *Gyrodactylus gobii*, *Gyrodactylus gasterostei*, *Gyrodactylus vimbi*, *Gyrodactylus markakulensis*, *Gyrodactylus sedelnikowi* and *Paradiplozoon homoion*.”

“Monogeneans are common members of fish parasite communities in freshwater and marine habitats.”

Threat to Humans

From Froese and Pauly (2018):

“Harmless”

3 Impacts of Introductions

From Winfield et al. (2011):

“Introductions of fish species have now occurred in all of the largest lakes of Scotland (Loch Lomond), Northern Ireland (Lough Neagh), Wales (Llyn Tegid) and England (Windermere). [...] Of the 10 introduced (or alien or non-native) species documented above, four of them (common bream, gudgeon, roach and ruffe) have established abundant populations. Although causality has not been demonstrated, two of these species (roach and ruffe) have apparently caused or currently threaten harm, supporting the hypothesis that at least some of these introductions have become invasive.”

From Hesthagen and Sandlund (2007):

“Gudgeon and sunbleak are more recent introductions to Norway and have very restricted distributions. Gudgeon was first observed in the River Numedalslågen (southern Norway) in 1991 and 1992 (Eken & Borgstrøm, 1994). Surveys carried out in 1996 and 1997 demonstrated that the abundance and distribution area of gudgeon had increased quite dramatically in this river system during the past 4–5 years, being found over a river stretch of 58 km (Pethon & Barstad, 1998). In 2004, gudgeon was also recorded in one lake in southernmost Norway. Gillnet catches indicated fairly high densities, representing several age classes (Lura, 2004).”

From Bianco and Ketmaier (2005):

“Since 1994, when studies on *G[obio] benacensis* were performed (Bianco & Taraborelli 1986, Bianco 1994, Bianco 1994 [*sic*], 1995), all the Italian populations belonged to the endemic *G. benacensis*, which was transplanted also outside its original range. At present, as a result of hidden introductions, among the examined populations, *G. gobio* was found in three basins out of the five investigated: River Meletta in northern Italy, River Assino in central and River Badolato in southern Italy where gudgeon are invasive and tend to occupy the running waters of the *Barbus* zone. Probably this species will also interfere with other rheophilic cyprinids [*sic*] species, such as barbels and the minnow *Telestes muticellus* (Bonaparte, 1837).”

“Still pure populations of *G. benacensis* survive at least in River Tagliamento near the town of San Vito al Tagliamento and in Ombrone river where the Italian gudgeon was introduced probably before the year 1983 and where it forms quite scarce populations.”

From Crivelli (2006):

“The population [of *Romanogobio benacensis*, formerly known as *Gobio benacensis*] is highly fragmented, largely due to alleged competition from the introduced *Gobio gobio*.”

“It has disappeared from several basins where it has been replaced by *Gobio gobio*.”

From Bianco (2009):

“The species was quite common in river drainages of the Padano-Venetian district (Delmastro 1982), but has since disappeared from many localities and been replaced by the introduced Danubian species *Gobio gobio*.”

From Bianco (2014):

“*Gobio benacensis* Pollini, 1816 [is a] Padano-Venetian [Italian] endemic species now relegated to very few habitats, and largely extinct in this district. The cause of its progressive extinction is mainly due to introduction of the European gudgeon, *Gobio gobio*; the two species differentiate by bio/ecological and genetic characters. In addition to reaching larger sizes (14–15 cm SL versus 80–110 in *G. benacensis*), the *G. gobio* is gregarious, forming very large communities in stream environments; *G. benacensis* is less invasive and less numerous.”

4 Global Distribution



Figure 1. Reported global distribution of *Gobio gobio*. Map from GBIF Secretariat (2017). Because the eastern and southern limits of the distribution of *G. gobio* are “unclear” according to Froese and Pauly (2018), the above mapped occurrences reported outside of Europe were not included in the climate matching analysis as it remains unknown whether the occurrences represent established populations. The occurrence reported off the coast of France was not included in the climate matching analysis because this species occurs in brackish and freshwater environments, not marine environments (Froese and Pauly 2018).

5 Distribution within the United States

This species has not been reported in the US.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) was high in the Great Lakes, Ohio River basin, central Appalachians, near Seattle, and in scattered locations in the Interior West. Medium matches occurred everywhere else except for areas of low match in peninsular Florida, along the Gulf Coast, in the vicinity of the Lower Colorado River in the Southwest, and along the Pacific Coast from northern California to the Olympic Peninsula of Washington. Climate 6 score indicated that the contiguous U.S. has a high climate match overall. Scores of 0.103 and greater are classified as high match; Climate 6 score for *G. gobio* was 0.259.

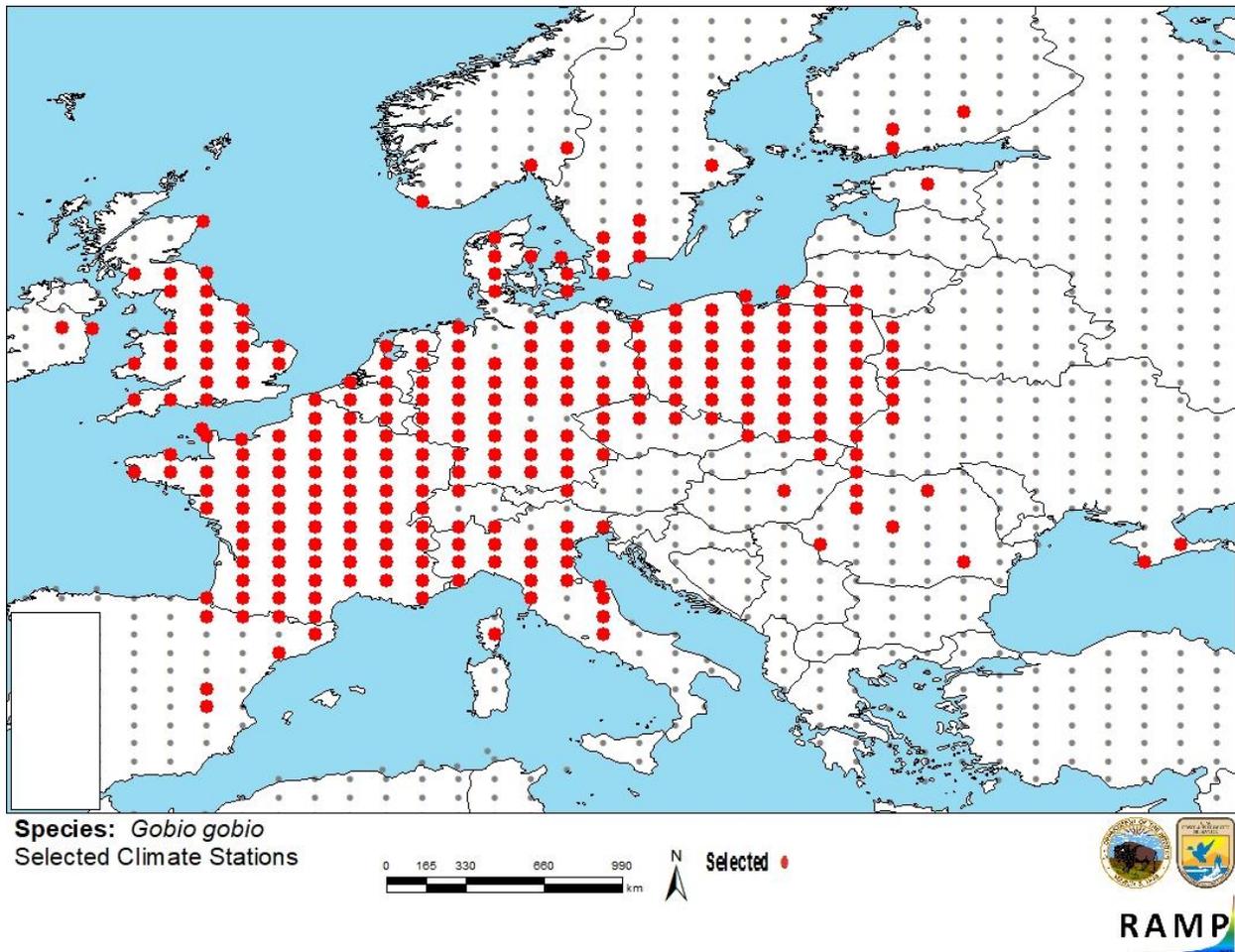


Figure 2. RAMP (Sanders et al. 2014) source map showing weather stations in Europe selected as source locations (red) and non-source locations (gray) for *G. gobio* climate matching. Source locations from GBIF Secretariat (2017).

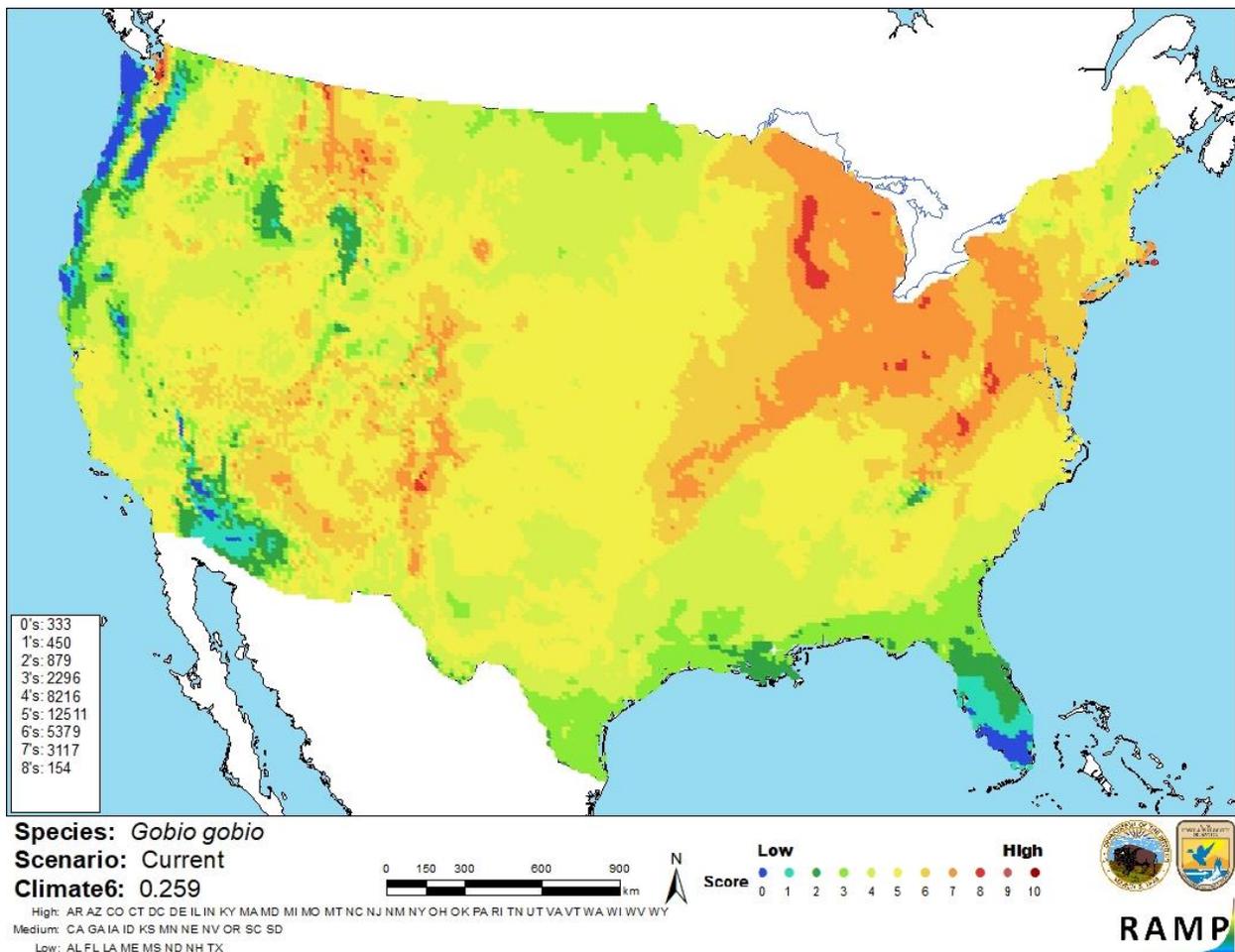


Figure 3. Map of RAMP (Sanders et al. 2014) climate matches for *G. gobio* in the contiguous United States based on source locations reported by GBIF Secretariat (2017). 0=Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

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 |
|--|---------------------------|
| $0.000 \leq X \leq 0.005$ | Low |
| $0.005 < X < 0.103$ | Medium |
| ≥ 0.103 | High |

7 Certainty of Assessment

Information is readily available on the biology and ecology of *Gobio gobio*. The southern and eastern limits of the native distribution of *G. gobio* are uncertain, but the distribution within northern and western Europe is well known. Impacts of introduction have been documented but without a lot of detail, so the certainty of this assessment is medium.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Gobio gobio is a cyprinid fish widely distributed across Europe and possibly through Asia. Introduced populations have become established in Norway, Ireland, Italy, Spain, Portugal, and Morocco, mostly for reasons related to angling. No introductions have yet been reported in the United States, but within the contiguous U.S., climate match is high. Introduced populations are often characterized by high abundance; the only negative impact reported is localized extinction of *Romanogobio benacensis* (formerly recognized as *Gobio benacensis*) in Italy. The mechanism of the displacement of *R. benacensis* by *G. gobio* has not been explained. The overall risk assessment category for *G. gobio* is high with medium certainty because of the continuing questions surrounding distribution and impacts of this species.

Assessment Elements

- **History of Invasiveness: High**
- **Climate Match: High**
- **Certainty of Assessment: Medium**
- **Remarks/Important additional information: Host of the etiologic agent of the OIE-reportable koi herpesvirus disease.**
- **Overall Risk Assessment Category: High**

9 References

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

- Bianco, P. G. 2009. Threatened fishes of the world: *Gobio benacensis* (Pollini, 1816). *Environmental Biology of Fishes* 84:39-40.
- Bianco, P. G. 2014. An update on the status of native and exotic freshwater fishes of Italy. *Journal of Applied Ichthyology* 30:62-77.
- Bianco, P. G., and V. Ketmaier. 2005. Will the Italian endemic gudgeon, *Gobio benacensis*, survive the interaction with the invasive introduced *Gobio gobio*? *Folia Zoologica* 54(Suppl. 1):42-49.
- Blažek, R., J. Jarkovský, B. Koubková, and M. Gelnar. 2008. Seasonal variation in parasite occurrence and microhabitat distribution of monogenean parasites of gudgeon *Gobio gobio* (L.). *Helminthologica* 45(4):185-191.
- Crivelli, A. J. 2006. *Romanogobio benacensis*. The IUCN Red List of Threatened Species 2006: e.T61343A12465317. Available: <http://www.iucnredlist.org/details/full/61343/0>. (April 2018).

- DAISIE European Invasive Alien Species Gateway. 2018. *Gobio gobio*. Available: <http://www.europe-aliens.org/speciesFactsheet.do?speciesId=50183#>. (April 2018).
- Fabian, M., A. Baumer, and D. Steinhagen. 2013. Do wild fish species contribute to the transmission of koi herpesvirus to carp in hatchery ponds? *Journal of Fish Diseases* 36:505-514.
- Freyhof, J. 2011. *Gobio gobio*. The IUCN Red List of Threatened Species 2011: e.T184448A8277959. <http://www.iucnredlist.org/details/full/184448/0>
- Froese, R., and D. Pauly, editors. 2018. *Gobio gobio* (Linnaeus, 1758). FishBase. Available: <http://fishbase.org/summary/Gobio-gobio.html>. (April 2018).
- GBIF Secretariat. 2017. GBIF backbone taxonomy: *Gobio gobio* (Linnaeus, 1758). Global Biodiversity Information Facility, Copenhagen. Available: <https://www.gbif.org/species/4409628>. (April 2018).
- Hesthagen, T., and O. T. Sandlund. 2007. Non-native freshwater fishes in Norway: history, consequences and perspectives. *Journal of Fish Biology* 71(Suppl. D):173-183.
- ITIS (Integrated Taxonomic Information System). 2018. *Gobio gobio* (Linnaeus, 1758). Integrated Taxonomic Information System, Reston, Virginia. Available: https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=163658#null. (April 2018).
- McDowall, B. 2008. Coarse fish - cyprinids – goldfish, carp and others. *In Te Ara - the Encyclopedia of New Zealand*. Available: <http://www.TeAra.govt.nz/en/coarse-fish/page-2>. (April 2018).
- Ortega, C., J. L. Múzquiz, J. Docando, E. Planas, J. L. Alonso, and M. C. Simón. 1995. Ecopathology in aquaculture: risk factors in infectious disease outbreak. *Veterinary Research* 26(1):57-62.
- Rehulka, J., P. Petras, M. Marejkova, and E. Aldova. 2015. *Vibrio cholerae* non-O1/non-O139 infection in fish in the Czech Republic. *Veterinarni Medicina* 60(1):16-22.
- Sanders, S., C. Castiglione, and M. Hoff. 2014. Risk Assessment Mapping Program: RAMP. U.S. Fish and Wildlife Service.
- Winfield, I. J., J. M. Fletcher, and J. B. James. 2011. Invasive fish species in the largest lakes of Scotland, Northern Ireland, Wales and England: the collective UK experience. *Hydrobiologia* 660:93-103.

10 References Quoted But Not Accessed

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.

- Bianco, P. G. 1994. L'ittiofauna continentale dell'Appennino umbro-marchigiano, barrier semipermeabile allo scambio di component primarie tra gli opposti versanti dell'Italia central. [The continental fish fauna of Umbria and Marche Appenine region which acts as a semi-permeable barrier to the exchange of primary components between the opposite sides of Central Italy.] *Biogeographia* 17:427-485. (In Italian with English summary.)
- Bianco, P. G. 1995. I pesci d'acqua dolce delle Marche: origini, problem di conservazione e nuove prospettive di gestione. [The freshwater fishes from the Marche Region: origins, conservation problems, and new management perspectives.] Pages 229-257 in E. Biondi, editor. *Atti Convegno Salvaguardia beni Ambientali delle Marche*, Ancona. (In Italian.)
- Bianco, P. G., and T. Taraborelli. 1986. *Gobio gobio benacensis* (Pollini, 1816) sottospecie valida per l'Italia (Pisces, Cyprinidae). [*Gobio gobio benacensis* (Pollini, 1816), a valid subspecies to Italy (Pisces, Cyprinidae).] *Bollettino del Museo Civico di Storia Naturale di Verona* 11:525-536. (In Italian with English summary.)
- Billard, R. 1997. *Les poissons d'eau douce des rivières de France. Identification, inventaire et répartition des 83 espèces*. Delachaux & Niestlé, Lausanne, Switzerland.
- Delmastro, G. 1982. *I pesci del bacino del Po*. CLESAV, Milan, Italy.
- Eken, M., and R. Borgstrøm. 1994. Sandkryper – ny fiskeart for Norge. *Fauna* 47:120-123. (With English summary.)
- Keith, P., and J. Allardi, coordinators. 2001. *Atlas des poissons d'eau douce de France*. Muséum National d'Histoire Naturelle, Paris. *Patrimoines Naturels* 47:1-387.
- Kottelat, M., and J. Freyhof. 2007. *Handbook of European freshwater fishes*. Publications Kottelat, Cornol, Switzerland, and Freyhof, Berlin.
- Lura, H. 2004. *Biologiske undersøkelser i Nesheimsvassdraget, Farsund kommune*. Ambio Miljørådgivning AS, report 10202–1.
- Maitland, P. S., and R. N. Campbell. 1992. *Freshwater fishes of the British Isles*. HarperCollins Publishers, London.
- Mann, R. H. K., C. A. Mills, and D. T. Crisp. 1984. Geographical variation in the life-history tactics of some species of freshwater fish. Pages 171-186 in G. W. Potts, and R. J. Wootton, editors. *Academic Press*, London.

- McEvoy, L. A., and J. McEvoy. 1992. Multiple spawning in several commercial fish species and its consequences for fisheries management, cultivation and experimentation. *Journal of Fish Biology* 41(Suppl. B):125-136.
- Ortega, C. 1991. Papel de diversas especies icticas no naturalmente sensibles a la Necrosis Pancreatica Infecciosa (IPN) que habitan los rios aragoneses como portadores del virus IPN, y su detección mediante diferentes técnicas diagnosticas. Doctoral thesis. Facultad de Veterinaria, Universidad de Zaragoza, Spain.
- Pethon, P., and G. Barstad. 1998. Grundling (*Gobio gobio*) i Numedalslågen – utbredelse, habitatpreferanser og næringsvalg. Resultatrapport 1997. Zoologisk Museum, Universitetet i Oslo, Oslo, Norway.
- Riehl, R., and H. A. Baensch. 1991. *Aquarien Atlas*, volume 1. Mergus, Verlag für Natur-und Heimtierkunde, Melle, Germany.
- Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1991. World fishes important to North Americans. Exclusive of species from the continental waters of the United States and Canada. *American Fisheries Society Special Publication* 21.
- Spillman, C.-J. 1961. *Faune de France: poissons d'eau douce*, volume 65. Fédération Française des Sociétés Naturelles, Paris.
- Verreycken, H., G. Van Thuyne, and C. Belpaire. 2011. Length-weight relationships of 40 freshwater fish species from two decades of monitoring in Flanders (Belgium). *Journal of Applied Ichthyology* 2011:1-5.