European Bullhead (*Cottus gobio*)
Ecological Risk Screening Summary

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1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2016):

"Europe: North Baltic in Scandinavia south to stream Maurine in southwesternmost [sic] of corner of Baltic basin (Germany); lower reaches of streams and rivers and along coast of Sweden, Finland, Russia southwest to Estonia.; Danube (except upper tributaries Save and Arges), Elbe, Ems, Weser and Rhône drainages; tributaries of upper Rhine downriver (northward) to about Mannheim; a few of uppermost tributaries of River Tevere, central Italy; Adriatic drainages from Potenza in Italy to Zrmanja in Croatia, except Timavo spring. […] Records of sculpins from Neretva drainage in Bosnia-Herzegovina possibly belong to *Cottus gobio*."

From WildScreen (2017):

"The bullhead is widely distributed in England and Wales but in Scotland is only known from the Forth and Clyde catchments [JNCC 2008]. Elsewhere, the species is found in Europe, but it does not have such a favourable status there, and so it is listed in Annex II of the Habitats Directive [Environment Agency 1998]."

Status in the United States

From Baker et al. (2015):

"Status: Not established in North America, including the Great Lakes"

Means of Introductions in the United States

No records of introductions of *Cottus gobio* in the United States were found.

Remarks

From Nolte et al. (2005):

"Phylogeographic analyses of mitochondrial DNA of European sculpin populations, the so-called *Cottus gobio* complex, have revealed several clearly distinct groups across Central Europe (Englbrecht et al. 2000; Volckaert et al. 2002). This makes them one of the most deeply substructured European fish taxa studied so far."

"According to Freyhof et al. (2005) the sculpins here referred to as Scheldt sculpins correspond to *Cottus perifretum*, Rhine sculpins to *Cottus rhenanus* and those from more eastern rivers to *Cottus gobio*. Invasive sculpins are formally retained in *Cottus perifretum*, which does not affect the conclusions presented here."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2016):

"Taxonomic Status: Current Standing: valid

Kingdom Animalia
  Subkingdom Bilateria
    Infrakingdom Deuterostomia
      Phylum Chordata
        Subphylum Vertebrata
          Infraphylum Gnathostomata
            Superclass Osteichthyes
              Class Actinopterygii

Subclass Neopterygii
Infraclass Teleostei
Superorder Acanthopterygii
Order Scorpaeniformes
Suborder Cottoidei
Superfamily Cottoidea
Family Cottidae
Genus *Cottus*
Species *Cottus gobio* Linnaeus, 1758"

From Eschmeyer et al. (2017):

"***gobio, Cottus*** Linnaeus [C.] 1758:265 [Systema Naturae, Ed. X v. 1] Stream Freudenbach at Lockstädt, 53°12'N, 12°01'E, Lower Elbe River drainage, Germany. Neotype: NRM 51803. Neotype designated by Fricke 1999:38, but withdrawn in Fricke 2000:639. For a discussion of the types and neotype designation see Freyhof et al. 2005:129. •Valid as *Cottus gobio* Linnaeus 1758 -- (Berg 1949:1145, Neyelov 1973:593, Sideleva 1982:81, Fedorov in Whitehead et al. 1986:1247, Lelek 1987:274, Mrakovcic et al. 1995:184, Chereshnev 1996:606, Kottelat 1997:169, Reshetnikov et al. 1997:758, Sideleva 1998:151, Fricke 1999:38, Bogutskaya et al. 2001:46, Parin et al. 2002:S73, Hanel 2003:61, Bogutskaya & Naseka 2004:186, Freyhof et al. 2005:124, Hanel & Lusk 2005:337, Fricke 2007:26, Shedko & Miroshnichenko 2007:24, Kottelat & Freyhof 2007:508, Sideleva 2009:210, Bianco 2013:10, Goto et al. 2014:[10], Parin et al. 2014:243, Sideleva et al. 2015:430). **Current status:** Valid as *Cottus gobio* Linnaeus 1758. Cottidae."

Size, Weight, and Age Range

From Froese and Pauly (2016):

"Maturity: Lm 4.2 range ? - ? cm
Max length: 18.0 cm TL male/unsexed; [Muus and Dahlström 1968]; common length: 10.0 cm TL male/unsexed; [Muus and Dahlström 1968]; max. reported age: 10 years [Seppälä et al. 2007]"

From Baker et al. (2015):

"Cottus gobio lives up to about 4 years (Tomlinson and Perrow 2003)."

Environment

From Froese and Pauly (2016):

"Freshwater; brackish; demersal; pH range: 7.0 - 7.5; dH range: 10 - ?; potamodromous [Riede 2004]; depth range 2 - 2 m [Chinese Academy of Fishery Sciences 2003]."

"Occurs in cold, clear and fast-flowing water of small stream to medium-sized rivers as well as on gravel or rocky shores of cold lakes and in slightly brackish waters along eastern coast of Baltic coast [Kottelat and Freyhof 2007]."

From Baker et al. (2015):

"This species can inhabit brackish waters, too, as it occurs in the coastal waters of the Baltic Sea (salinity < 7 ppt) (Kontula and Väinölä 2001). The upper thermal limit for *Cottus gobio* adults is 27.6°C and lower thermal limit is 2.5°C (Elliot and Elliot 1995). It is widely distributed in Europe. Its distribution is limited by higher temperatures and lower oxygen levels (Hänfling et al. 2002). The density of *Cottus gobio* is negatively correlated to DOC concentration (Utzinger et al. 1998). *Cottus gobio* is absent in waters above 3 mg C L-1. The density and biomass of *Cottus gobio* is higher in hardwater streams with high concentrations of dissolved calcium carbonate (Mills and Mann 1983)."

Climate/Range

From Froese and Pauly (2016):

"Subtropical; 1°C - 16°C (Adamicka, 1991); 70°N - 40°N, 6°W - 60°E"

Distribution Outside the United States

Native

From Froese and Pauly (2016):

"Europe: North Baltic in Scandinavia south to stream Maurine in southwesternmost of corner of Baltic basin (Germany); lower reaches of streams and rivers and along coast of Sweden, Finland, Russia southwest to Estonia.; Danube (except upper tributaries Save and Arges), Elbe, Ems, Weser and Rhône drainages; tributaries of upper Rhine downriver (northward) to about Mannheim; a few of uppermost tributaries of River Tevere, central Italy; Adriatic drainages from Potenza in Italy to Zrmanja in Croatia, except Timavo spring. […] Records of sculpins from Neretva drainage in Bosnia-Herzegovina possibly belong to *Cottus gobio*."

From WildScreen (2017):

"The bullhead is widely distributed in England and Wales but in Scotland is only known from the Forth and Clyde catchments [JNCC 2008]. Elsewhere, the species is found in Europe, but it does not have such a favourable status there, and so it is listed in Annex II of the Habitats Directive [Environment Agency 1998]."

Introduced

From Froese and Pauly (2016):

"Locally introduced in Scheldt drainage in Belgium."

From Baker et al. (2015):

"*Cottus gobio* is widespread in Europe. This species is nonindigenous in the south-eastern Pyrenees watershed (Mann et al. 1984, Vila-Gispert et al. 2005). *Cottus gobio* has been reported

to occur in habitats that were once considered inhabitable for the species in the Lower Rhine in the Netherlands and Germany (Cazemir 1988, De Nie 1997, Lelek and Köhler 1993, Nolte et al. 2005, Schleuter 1991, Van der Brink et al. 1990)."

Means of Introduction Outside the United States

From Frilund et al. (2009):

"Despite the fact that human introductions may have taken place, we find that natural dispersal from the geographically close Swedish populations is the most plausible explanation for the new registrations of *C. gobio* in Lierne. The species migration pattern in River Tana in Finnmark County, where the species now has dispersed 5 km upstream from the Utsoki outlet, also shows its ability for upstream dispersal (Eero Niemela, Finnish Game and Fisheries Research Institute, Teno River Research Station, Utsjoki, pers. comm.). The time-period of the dispersal is still unknown, and the sculpin may still be expanding its home range in these water systems."

Short Description

From Froese and Pauly (2016):

"Dorsal spines (total): 6 - 8; Dorsal soft rays (total): 15-18; Anal spines: 0; Anal soft rays: 10 - 13; Vertebrae: 31 - 34. Caudal fin with 13 to 14 rays [Keith and Allardi 2001]."

From Baker et al. (2015):

"*Cottus gobio* is a small fish with a large head that accounts for about 25% of the total body length (Tomlinson and Perrow 2003). Its eyes are on the top of its head. The mouth has an extremely wide gape. The body is dorso-ventrally flattened, and tapers to the end. It possesses a strong rear-pointing spine that originates from the operculum. The pectoral fins are extremely large. The pelvic fins are well-developed, curve outwards, and lie flush with the bottom of the fish. *Cottus gobio* has two dorsal fins. The first dorsal fin has 6 – 9 spines. The second dorsal fin has 15 – 18 soft rays. It has mottled skin which allows it to remain cryptic. There are no scales on the skin, except on the complete lateral line."

From WildScreen (2017):

"During the spawning period males become black in colour with a white-tipped dorsal fin, and females become plump [Environment Agency 1998]."

Biology

From Froese and Pauly (2016):

"Feeds on small bottom invertebrates, mainly insects, crustaceans. Pink to yellow eggs are found in clumps attached to undersides of large stones [Pinder 2001]. Contrary to statements in older literature, eggs and larvae of fishes are not a common food item [Adamicka 1984]."

“Spawns once a year for several years in low productivity streams, but exhibits multiple spawning within a season in high productivity environments [Fox 1978; McEvoy and McEvoy 1992]. Also [Backes et al. 1995]. Male protects several batches of eggs--deposited below a stone--for about 3 weeks. Larvae are not guarded and may occasionally been eaten [Adamicka 1991].”

From Baker et al. (2015):

“It exhibits low dispersal distances of less than 1 km (Downhower et al. 1990) and its movement upstream can be prevented by obstructions that are at least 18 cm high (Utzinger et al. 1998). *Cottus gobio* is solitary and territorial (Smyly 1957). It is most active during the night (Andreasson 1973) and has cryptic coloration that changes with its background (Mills and Mann 1983).”

“*Cottus gobio* feeds on benthic invertebrates and its diet changes seasonally (Smyly 1957). During the winter, *Gammarus* amphipods were a large component of their diet (Mills and Mann 1983). Peak consumption of Plecoptera nymphs occurred in the summer. Brown trout (*Salmo trutta*), Pike (*Esox lucius*), eel (*Anguila anguila*), chub (*Leuciscus cephalus*), and perch (*Perca fluviatilis*) prey on *Cottus gobio* (Tomlinson and Perrow 2003). Piscivorous birds such as the grey heron (*Ardea cinerea*), kingfisher (*Alcedo atthis*), and the dipper (*Cinclus cinclus*) also prey on *Cottus gobio*.”

“Reproduction occurs over a single long brood cycle from February to June (Fox 1978, Marconato et al. 1993) and females produce 1-4 egg batches per year (Mills and Mann 1983). Males construct a nest by digging a cavity in the sand (Morris 1954). The males guard the nest, sitting at the entrance. Once a female is near the entrance, the male bites her and moves her into the nest. The female lays her eggs on the underside of the roof of the nest. The male exhibits parental care for the eggs for about 1 month by fanning to ventilate the nest. During the term of parental care, the males lose on average 13.5 - 18.8% of their weight, and were observed to cannibalize on their own eggs if their chance of obtaining other food items was low (Marconato et al. 1993).”

Human Uses

From Froese and Pauly (2016):

“Fisheries: of no interest; bait: occasionally”

Diseases

No records of OIE reportable diseases were found.

From Baker et al. (2015):

“*Phyllodistomum folium* is a parasite of *Cottus gobio* (Smyly 1957) and infects the urinary bladder (Dawes 1968).”

From Bailly (2008):

"Host of *Diocus gobinus* (Müller O.F., 1776) (parasitic: ectoparasitic)
Lernaea cyprinacea Linnaeus, 1758 (parasitic: ectoparasitic)"

Threat to Humans

From Froese and Pauly (2016):

"Harmless"

From Baker et al. (2015):

"It has not been reported that *Cottus gobio* poses a threat to human health or water quality. There is no evidence that this species negatively impacts infrastructure, economic sectors, recreational activities and associated tourism, or the aesthetic appeal of the areas it inhabits."

3 Impacts of Introductions

From Baker et al. (2015):

"There is insufficient information available to determine whether *Cottus gobio* poses a threat to other species or water quality. There are no reports on how it affects or interacts with other species. It is unknown whether this species alters the physical components of the ecosystem."

4 Global Distribution

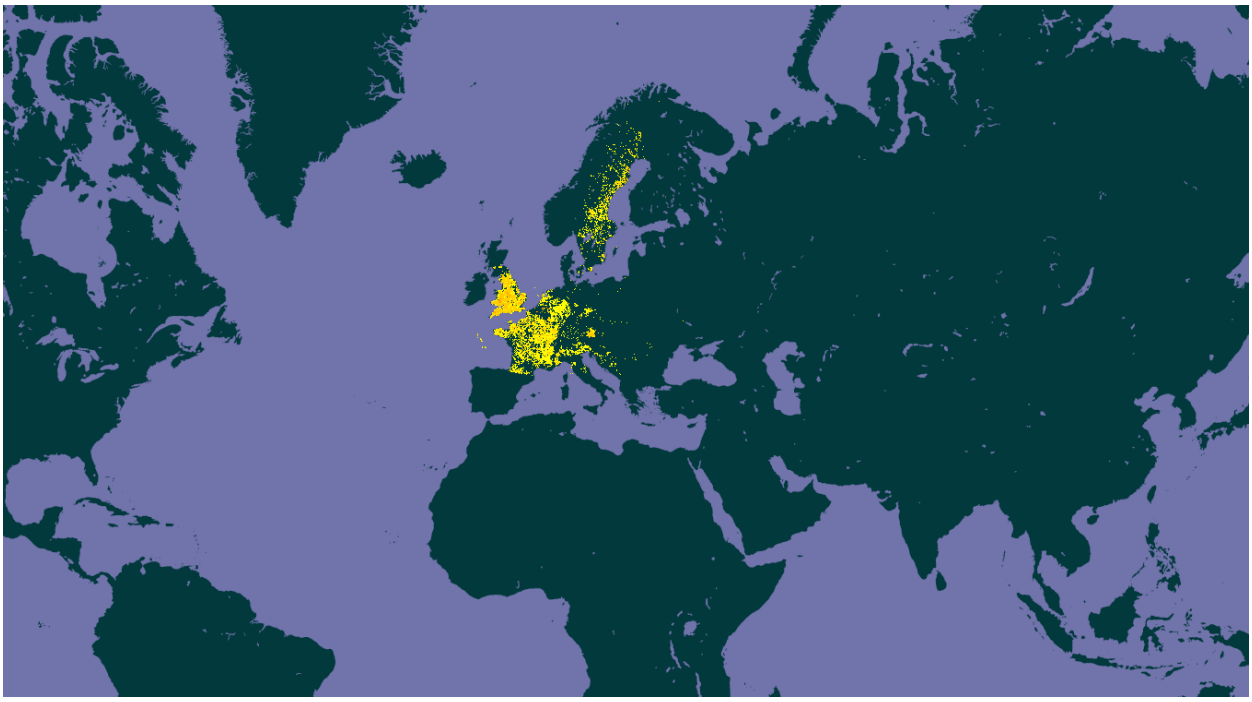

Figure 1. Known global distribution of *Cottus gobio*. Map from GBIF (2013).

5 Distribution Within the United States

No records of introductions of *Cottus gobio* in the United States were found.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Cottus gobio* was high around the Great Lakes, Appalachia, and in areas of the Great Plains. The match was low in areas of the west, particularly the Pacific Northwest, the border with Mexico, the Gulf Coast, and Florida. The match was medium everywhere else. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the Continental U.S. was 0.255, high, and high in Arizona, Arkansas, Colorado, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Michigan, Missouri, Montana, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, Tennessee, Virginia, Vermont, Washington D.C., West Virginia, Wisconsin, and Wyoming.

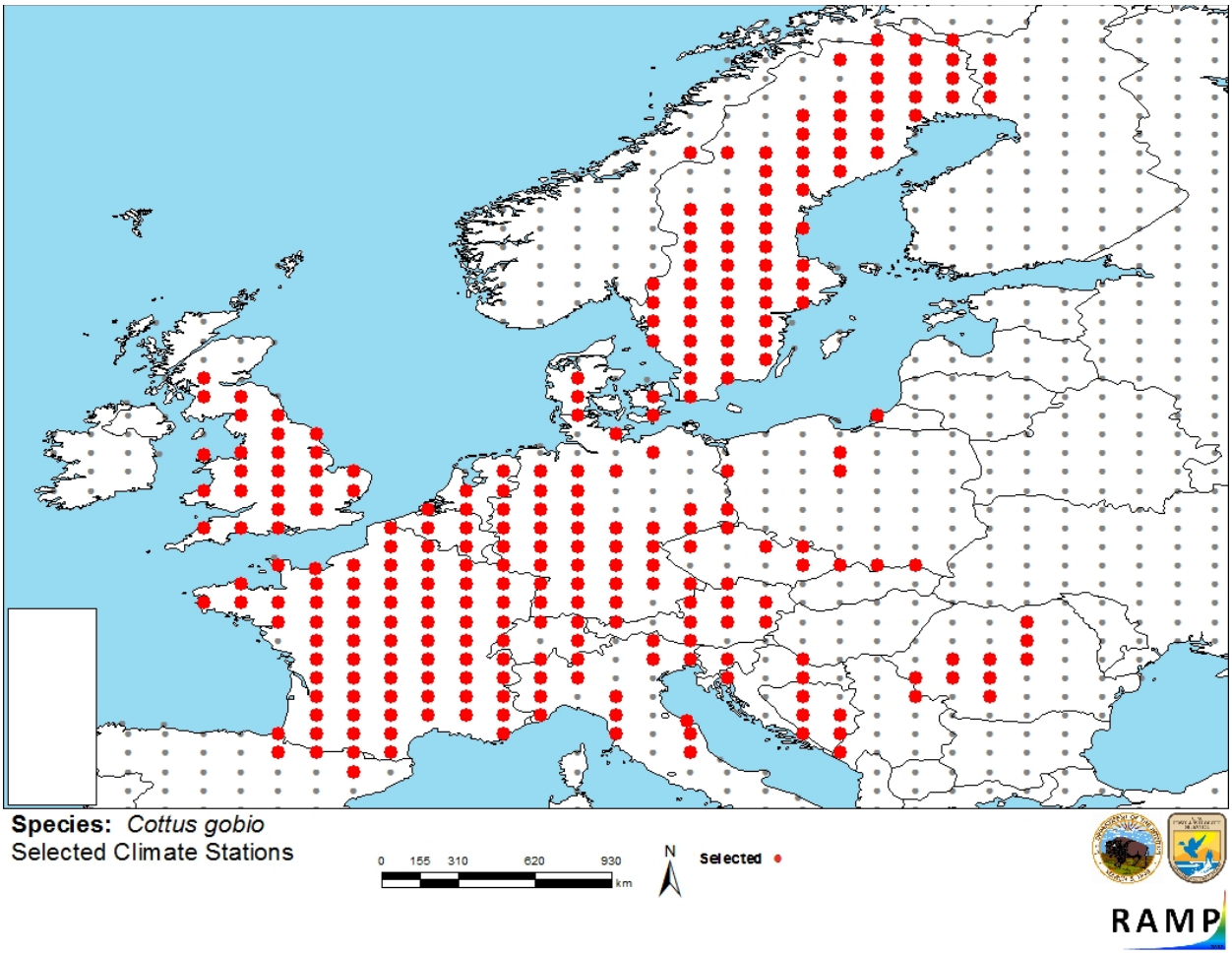

Figure 2. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (grey) for *Cottus gobio* climate matching. Source locations from GBIF (2013).

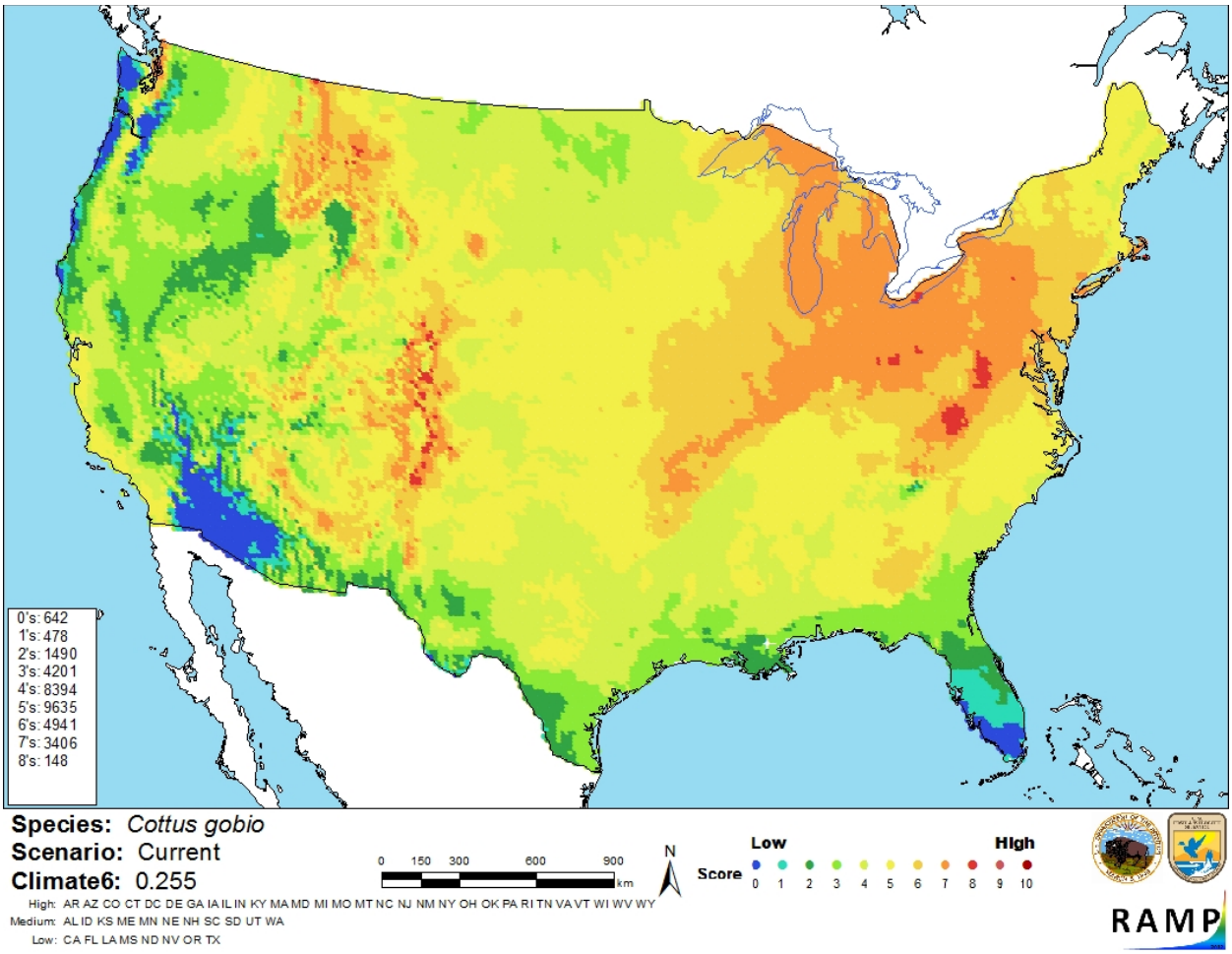

Figure 3. Map of RAMP (Sanders et al. 2014) climate matches for *Cottus gobio* in the continental United States based on source locations reported by GBIF (2013). 0 = Lowest match, 10 = Highest match.

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

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

7 Certainty of Assessment

The certainty of assessment is medium. There was more than adequate biological and ecological information available about *Cottus gobio*. Information on the history of invasiveness is lacking. One record of introduction was found but some sources state that it is likely a natural range expansion instead of a non-native introduction.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness for *Cottus gobio* is not documented. One record of introduction into Norway was found but some authors (Frilund et al. 2009) state that it is more likely a natural range expansion instead of a non-native introduction. There were some records of invasive hybridized sculpins, but it was not clear where they were invading and which species were producing the hybrids. The climate match was high, particularly in the Great Lakes and areas of the Great Plains. The certainty of assessment is medium. The overall risk assessment category is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): Medium**
- **Remarks/Important additional information** No additional remarks.
- **Overall Risk Assessment Category: Uncertain**

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

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