Monkey Goby (*Neogobius fluviatilis*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, February 2011
Revised, September 2016
Web Version, 10/30/2017

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1 Native Range and Status in the United States

Native Range

From CABI (2011):

"freshwater, estuarine and coastal habitats of the Caspian Sea, Black Sea, Azov Sea and Sea of Marmara basins as well as the rivers flowing into them, e.g. Danube, Dniester, Dnieper, Don, Kuban, Southern Bug, Volga and Ural (Pinchuk et al., 2003)"

Status in the United States

From Baker et al. (2015):

"Not established in North America"

Means of Introductions to the United States

From Baker et al. (2015):

"Not established in North America"

Remarks

From Baker et al. (2015):

"Synonyms and Other Names:
babka goby, Monkey goby, Sand goby, River goby, *Gobius fluviatilis*, *Apllinia fluviatilis*, *Neogobius fluviatilis fluviatilis*, *Gobius sordidus*, *Gobius steveni*, *Gobius fluviatilis nigra*"

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2016):

"Kingdom Animalia – Animal, animaux, animals
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata – cordés, cordado, chordates
Subphylum Vertebrata – vertebrado, vertébrés, vertebrates
Infraphylum Gnathostomata
Superclass Osteichthyes – bony fishes, poissons osseux, osteíceto, peixe ósseo
Class Actinopterygii – ray-finned fishes, spiny rayed fishes […]
Subclass Neopterygii – neopterygians
Infraclass Teleostei
Superorder Acanthopterygii
Order Perciformes – perch-like fishes
Suborder Gobioidei – gobies, gobies
Family Gobiidae – true gobies, gobies, gobios, gobies
Genus Neogobius Iljin, 1927 – round gobies
Species Neogobius fluviatilis (Pallas, 1814) – babka goby"

"Taxonomic Status: valid"

Size, Weight, and Age Range

From Froese and Pauly (2016):

"Max length : 20.0 cm SL male/unsexed; [Kottelat and Freyhof 2007]; max. reported age: 5 years [Kottelat and Freyhof 2007]."

Environment

From Froese and Pauly (2016):

"Benthopelagic; freshwater; brackish."

From Baker et al. (2015):

"This species is found in Manyas Lake, Turkey, which has […] dissolved oxygen levels of 6.10-10.90 mg/L (Sasi and Berber 2010). This species is able to survive in highly variable salinity gradients ranging from 0-7 ppt (Lejk et al. 2013). *Neogobius fluviatilis* occurs in the Aral Sea, a brackish water body that has an average salinity of 10 ppt (Plotnikov et al. 2012). In the early 1970s, this species had successfully established in Lake Balaton, which experienced eutrophication in the 1960s."

Climate/Range

From Froese and Pauly (2016):

"Temperate; 4°C - 20°C [Baensch and Riehl 1991], preferred ?; 56°N - 36°N, 25°E - 54°E"

Distribution Outside the United States

From Froese and Pauly (2010):

"Eurasia: Azov and Black Sea basins. Invasive in rivers of northern Black Sea basin, recorded in 1997 from middle Vistula (Poland), reaching from Dniepr via a navigation canal. In Danube upriver to Hungary, in Dniepr up to Belurus. Introduced in Lake Balaton, Hungary around 1970."

From NOBANIS (2016):

"Country	Introduction year	Status	Frequency
Belarus (BY)		Established	Common
Germany (DE)	2008	Established	Not known
Netherlands (NL)	2009	Established	Common
Poland (PL)	1997	Established	Rare"

From DAISIE (2016):

"Country	Status
Belarus	Alien
Croatia	Alien/Unknown
European part of Russia	Alien/Established
Poland	Alien/Established
Serbia	Alien/Established"

Means of Introduction Outside the United States

From CABI (2011):

"The species was not intentionally introduced anywhere. Its dispersal is considered to be both natural and passive. Shipping and man-made alterations of the river system seem to facilitate monkey goby expansion in large rivers of eastern and central Europe. Cargo vessels and ships with ballast water provide shelter and concealment for the species and a means of long distance transport, especially during reproductive seasons when males guard fertile eggs deposited in nests, settled possibly in any available holes of ship hulls. Harbours, reservoirs and artificial banks with rip-rap habitats are often preferred by gobiids and facilitate their establishment, and are sources for further expansion."

"In the Danube the monkey goby was detected for the first time outside its natural distribution area in 1965, prior to construction of dams (Banarescu, 1970). Later (after 2000) it was recorded in a few localities in the Serbian section of the Danube and its tributaries there, e.g. the Sava and Czerna rivers (Simonovic et al., 2001). Thus, although the monkey goby is native to Serbia, its expansion to many new localities has been observed. A similar expansion also occurred in Ukraine in the Dnieper and its tributaries, and in Russia in the Volga (Smirnov, 1986; Slynko et al., 2001; Vasil'eva, 2003)."

"In Hungary the monkey goby was recorded for the first time in Lake Balaton in 1970 (Biró, 1971, 1972), and since 1984 in the Hungarian stretch of the Danube. The next records of its upstream migration come from Slovakia, where in 2001 it was collected in the Hungarian–Slovak section of the Danube (Stránai and Andreji, 2001). It also entered some of its tributaries like the Hron (Stránai and Andreji, 2001), Bodrog and Tisza rivers (Harka, 1997; Ahnelt et al., 1998), and in 2003 the Rába River at the border of Austria (Harka and Biró, 2007). In 2008 the species was collected in the German section of the Rhine in Duisburg harbour, and subsequently in 2009 it was observed in the Netherlands (the Waal River of the Rhine River system), possibly as a result of monkey goby dispersal through the Rhine–Main–Danube Canal (Van Kessel et al., 2009)."

"The upstream migration of the monkey goby in the Dnieper River began quite early as it was recorded in the middle section of the river in 1856 and again in 1932, at locations currently within the Ukraine (Berg, 1949). It was reported in the Belarusian part of the river in 1936 (Vorontzov, 1937). It penetrated to its tributary, the Pripyat River, in the early 1950s (Voronin, 1957). Due to the Dnieper–Bug canal that connects the basins of the Black Sea and the Baltic Sea (through the Pripyat River and the Muchavets River, a small tributary of the Bug River) it migrated to the Bug River (a tributary of the Vistula) in Poland, where it was found in 1997 only a few kilometers downstream of its convergence with the Dnieper-Bug canal (Danilkiewicz, 1998; Semenchenko et al., 2011)."

"In subsequent years, the species expanded downstream in the Vistula River and reached the river mouth in 2003 (Grabowska et al., 2008). The rate of spread in the Vistula River was estimated as 122 km per year (Semenchenko et al., 2011). Genetic analysis of introduced populations in the upper Danube/Hron River and Vistula River basins indicates a north-west

Black Sea origin. Two distinct pathways of their expansion are identified: the Danube River and the Dnieper-Pripyat-Bug River system (Neilson and Stepien, 2011)."

Short Description

From Froese and Pauly (2016):

"Dorsal spines (total): 7; Dorsal soft rays (total): 14-18; Anal spines: 1; Anal soft rays: 12 - 17. This species is distinguished from its congeners entering freshwater in the Black Sea basin by the following characters: first branched ray of second dorsal about twice as long as penultimate ray; completely scaled nape; pelvic-disc fraenum with small rounded lobes and the length is less than 1/6 of width at base; pelvic disc reaching 90-100% of distance between its origin and anus; scales in midlateral series 55-61 + 2-4; posterior part of first dorsal without black spot [Kottelat and Freyhof 2007]."

From CABI (2011):

"Its coloration is rather pale, sandy to brownish grey, with small brownish irregular spots above the lateral line, along which there is a row of 8-9 or more rectangular black spots of larger size. The fish appears semi-transparent especially in the abdominal part where miomers are clearly visible under the skin. A dark streak runs from the eye to the angle of upper lip. First and second dorsal fins have 3-4 dark pigmented streaks, other fins more or less pale."

"The dimorphism between sexes, apart from in the breeding season, is not clearly visible. Breeding males are much darker than females, sometimes almost black with distinct yellow or orange edges of dorsal and caudal fins. Tips of dorsal fins are elongated in spawning males."

Biology

From Froese and Pauly (2016):

"Occurs in inshore habitats, estuaries and brackish- and fresh-water lagoons and lakes; large to medium sized rivers and streams; on sand or mud bottom. It is one of the most abundant fish in lowland rivers. This species lives up to 5 years; spawns for the first time at 2 years; spawning season in April to July, locally until September, when temperature is above 13°C; females may repeat spawning during a season. Males with body completely black with yellow fin margins during the spawning season; these excavate nests under any kind of hard substrate and guard eggs until hatching; with adhesive eggs deposited on stones, shells and aquatic plants. Feeds on a variety of invertebrates, especially molluscs [Kottelat and Freyhof 2007]."

Human Uses

From CABI (2011):

"In Turkey, *Neogobius fluviatilis* is important to minor commercial fisheries, aquarium, and bait (Sasi and Berber 2010). They may serve as a source of food for economically important fish species such as pike-perch *Stizostedion lucioperca* (Lenhardt et al. 2010)."

Diseases

From Baker et al. (2015):

"*Neogobius fluviatilis* is known to be the carrier of some species of parasites, and, it had the greatest parasite diversity and the lowest parasite abundance compared to 2 other non-native goby species found in the Danube River (Ondracková et al. 2005). None of the parasites were brought to the Danube by the introduction of *Neogobius* fishes; rather, they were common in the Danube. The parasite loads in *Neogobius fluviatilis* in the Danube River were similar to the parasite loads in their native range. Parasites of *Neogobius fluviatilis* in the Danube River include trematoda *Nicolla skrjabini* (Iwanitzky, 1928), *Metagonimus yokogawai* (Katsurada, 1912), *Apatemon cobitidis* (Linstow, 1980), *Pomphorhynchus laevis* (Müller, 1776), *Raphidascaris acus* (Bloch, 1779), ciliophora *Ichthyophthirius multifiliis* (Fouquet, 1876), *Eimeria daviesae* (Molnár 2000), and *Goussia kessleri* (Molnár 2000) (Molnár 2006). Specimens of *Neogobius fluviatilis* in the Vistula River were infected with the metacercariae of *Bucephalus polymorphus,* a parasite that also infects zebra mussels (Kvach and Mierzejewska 2011). The effects of the parasites infecting *Neogobius fluviatilis* on zebra mussels have not been reported."

From Grabowska et al. (2010):

"Population of monkey goby in the Vistula River is infected by monogenean parasite *Gyrodactylus proterorhini* […] (Ondračková et al. 2007)."

Threat to Humans

From Baker et al. (2015):

"It has not been reported that *Neogobius fluviatilis* 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):

"After its introduction to the Aral Sea in the mid-1950s, *Neogobius fluviatilis* naturalized and its abundance grew quickly (Plotnikov et al. 2012). By the mid-1960s, *Neogobius fluviatilis* as well as other undesirable introduced goby species coincided with a significant reduction in the abundance of benthic invertebrates (Markova et al. 1972, Plotnikov et al. 2012, Yablonskaya et al. 1973); however, it is unknown if *Neogobius fluviatilis* was responsible for the decline of benthic invertebrates."

"Where introduced, *Neogobius fluviatilis* may potentially impact native fish populations. A marked decline in tubenose goby in the Danube River was attributed to the rapid expansion of round goby and monkey goby populations in 2004 (Molnár 2006)."

"*Neogobius fluviatilis* makes up a substantial proportion of the diets of piscivorous fish such as *Sander lucioperca* and *S. volgensis* in Lake Balaton (Specziár 2011). The effects of non-native prey on the diets of *S. lucioperca* and *S. volgensis* or on predator-prey relationships has not been explored."

From Grabowska et al. (2010):

"The nonnative species are also often blamed for predation on eggs and fry of native ones and due to that decrease of their reproduction success. This kind of prey was not often found in the diet of racer goby and monkey goby in the Włocławski Reservoir (Kostrzewa & Grabowski 2003, Grabowska & Grabowski 2005, Kakareko et al. 2005)."

From Van Kessel et al. (2011):

"The presence of *N. fluviatilis* did not significantly shift habitat use of the small native benthic fish species. *N. fluviatilis* did not display a clear preference for shelter and this species did not interact with *C. perifretum* or *B. barbatula*. In a similar way to *N. melanostomus*, competitive behaviour of *N. fluviatilis* could also be underestimated since the experiments were conducted outside the spawning season of the latter species."

From Sindilariu and Freyhof (2003):

"On a shallow, sandy shore of River Danube, Danube delta, food overlap of *Neogobius fluviatilis*, *Benthophilus stellatus* (Gobiidae), *Blicca bjoerkna* (Cyprinidae) and *Gymnocephalus schraetser* (Percidae) was analysed comparing the food niche of gobiids, known to be invasive to Central Europe, with other co-occurring common fish species. The food overlap between gobiids and coexisting species was found to be low due to different food preferences and due to different spatial distribution within the habitat examined."

4 Global Distribution

Figure 1. Global distribution of *N. fluviatilis*. Map from GBIF (2016).

5 Distribution Within the United States

From Baker et al. (2015):

"Not established in North America"

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 region and Interior West. Climate match was medium for much of the remainder of the contiguous U.S., with low matches along the Gulf Coast and coastal Pacific Northwest being the major exceptions. Climate 6 score indicated that the continental U.S. has a high climate match. A high climate match is represented by a Climate 6 score of 0.103 or greater; climate match of *N. fluviatilis* is 0.329.

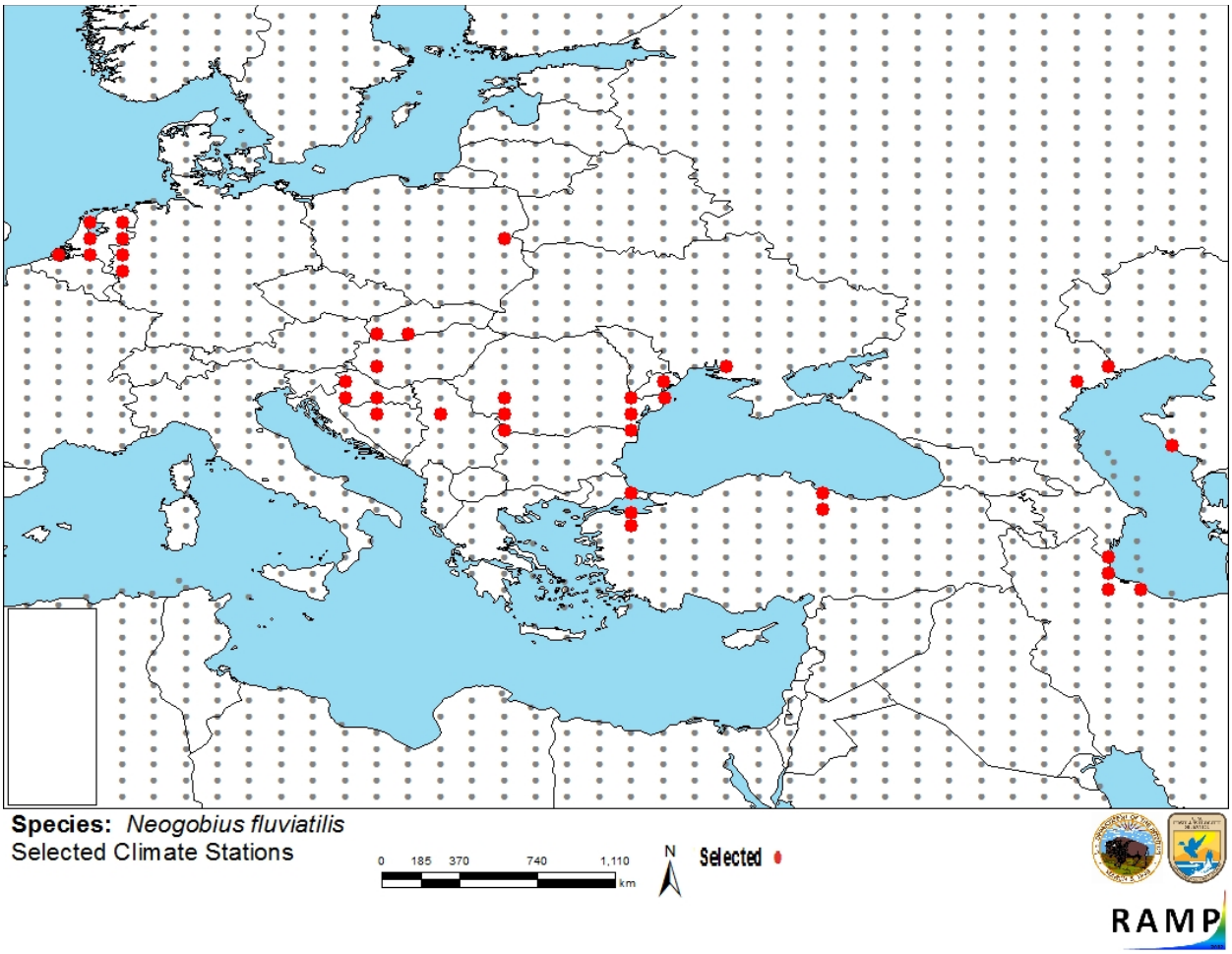

Figure 2. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *N. fluviatilis* climate matching. Source locations from CABI (2011) and GBIF (2016).

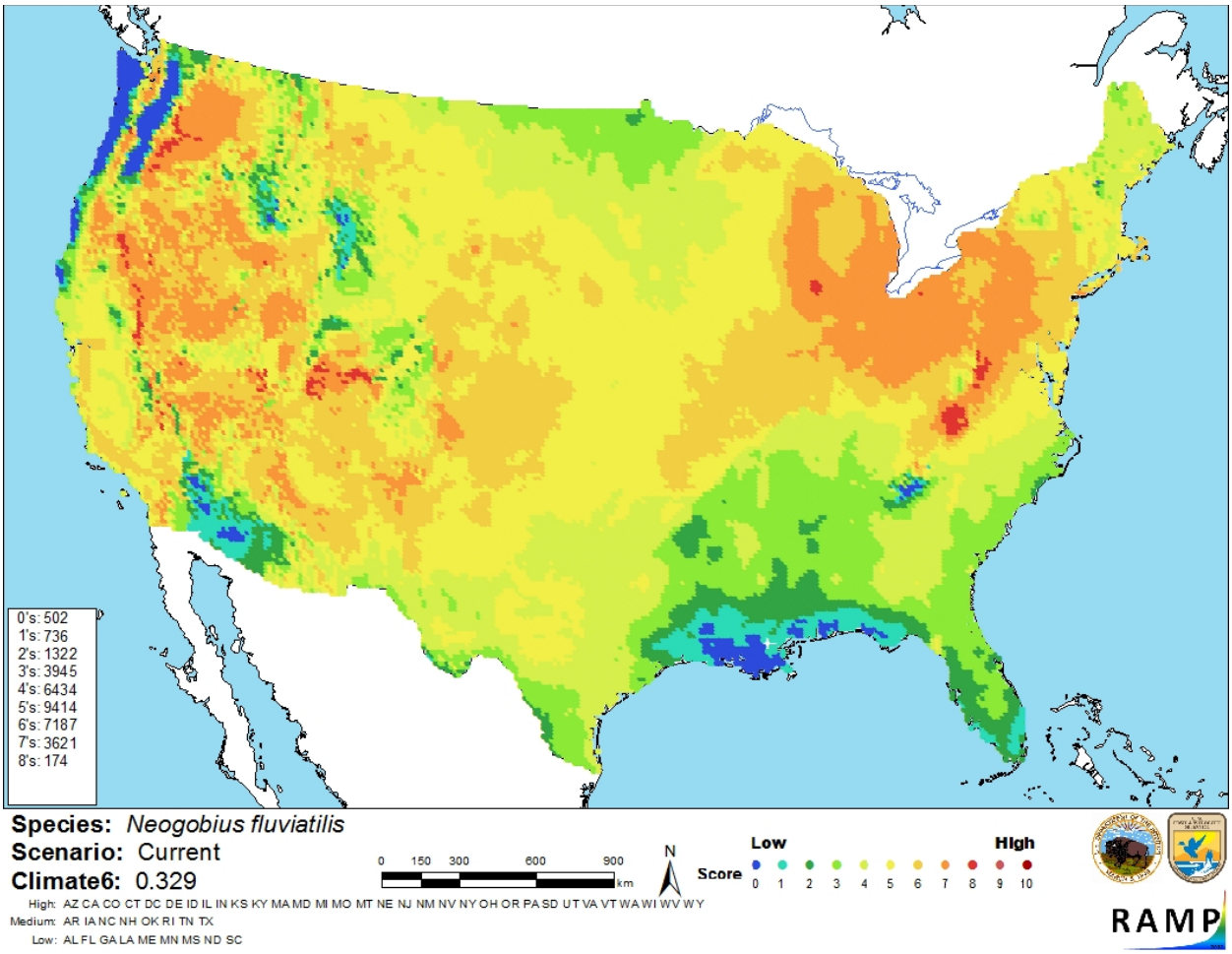

Figure 3. Map of RAMP (Sanders et al. 2014) climate matches for *N. fluviatilis* in the contiguous United States based on source locations reported by CABI (2011) and GBIF (2016). 0= Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

The "High", "Medium", and "Low" climate match categories are based on the following table:

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

7 Certainty of Assessment

Information on the biology of this species is abundant. However, studies on impacts of the species in its introduced range are rare. While impacts have been expected, there is no clear evidence that impacts are occurring. Certainty of this assessment is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

N. fluviatilis has invaded continental Europe and established new populations through diffusion and likely also shipping pathways. The species has become abundant in some locations. However, data on what impacts this invader might have on local ecosystems are extremely limited, and multiple studies have failed to find impacts among measured variables. Most of the concern surrounding this species comes from related species, such as the round goby *(N. melanostomus*), whose ability to invade and alter ecosystems is well known. *N. fluviatilis* exhibits high climate match to the contiguous U.S., particularly in the Great Lakes region and Interior West. Overall risk for this species is uncertain.

Assessment Elements

- **History of Invasiveness (Section 3): Uncertain**
- **Climate Match (Section 6): High**
- **Certainty of Assessment (Section 7): Low**
- **Overall Risk Assessment Category: Uncertain**

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