

Immigrated goby species in the Rhine system



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1. Origin and distribution

Today, four immigrated goby species have established in the Rhine area: The western tubenose goby, bighead goby, round goby, and the monkey goby. In the near future, the appearance of the racer goby (all 5 species of the Gobiidae-family) and of the Amur sleeper (Odontobutidae family) is expected. Today, the most frequently occurring goby species in the Rhine are the round goby, the bighead goby and the monkey goby (see Table 1).

Origin: ponto-caspian area: Black Sea, Caspian Sea, lower reaches of the tributaries to these areas

Main migration corridor¹: Danube, Main-Danube-Canal (accomplishment: 1992)

Distribution:

- Independent immigration through the Canal; in addition, migration over long distances due to:
 - o transportation in ships' ballast water²
 - o transportation of egg batches on hulls³
 - o inadvertent stocking together with other fish species⁴
 - o release of bait fish⁵
 - o transfer of Danube water into R. Main⁶

Additionally, anthropogenic modifications of waters support the establishing of stocks of goby, e.g.:

- Embankment consolidation with stone blocks to which gobies may clutch with their ventral fins having become sucker cups even under influence of waves (natural or caused by ships)¹
- Establishing of preferred feeding organisms from the original distribution area



Figure 1: Egg batch, round goby, photo: J. Fischer.

¹ Wiesner et al. 2010

² e. g. Ahnelt et al. 1998, Wonham et al. 2000

³ Sokolov et al. 1994

⁴ Friedl & Sampl 2000

⁵ Prášek & Jurajda 2005

⁶ Schöll 2008, Landwüst 2006

Table 1: Immigrated goby species and their distribution in the Rhine and its major navigable tributaries

Source (if not mentioned otherwise): Wiesner et al. (2010).

Scientific name	English name	Other names	First detection (year) & place/water body in the Rhine system	State of distribution in the Rhine system in 2011; habitats, nourishment	physiognomic characteristics; length
Gobiidae family (gobies)					
<i>Proterorhinus semilunaris</i>	Freshwater/western tubenose goby	German: Marmorierte Süßwassergrundel; French: gobie demilune; Dutch: marm grondel	1997 in R. Lohbach (drains into the R. Main system and is partly supplied with water from the Main-Danube Canal) ⁷	large sub-sections of the R. Main, Rhine and Moselle, mostly in low densities ⁸ ; lives hidden between stones and other water body structures, such as dead wood and water plants; opportunistic feeder with food preferences strongly depending on habitat, e.g. larvae of chironomids, water louse, chrysalides of ephemera, and many more ^{8,9}	marbled markings of the body; tubular prolonged opening of the nose; 7-9 cm
<i>Ponticola kessleri</i>	Bighead goby	German: Kesslergrundel; French: gobie de Kessler; Dutch: Kesslers grondel	2006 in R. Main near Freudenberg (unpublished BfG data); 2006 in the Rhine near Königswinter ¹¹	very frequent in parts of the R. Main and the Rhine; with more than 50 % share of individuals one of the most frequent fish species on the banks of the Lower Rhine ¹⁰ ; settles on stone blocks of bank stabilization structures; according to studies on the Lower Rhine low share of fish as nutritive element ¹⁵	longest head of the 5 Gobiidae species in Central Europe; big mouth; up to 20 cm
<i>Neogobius melanostomus</i>	Round goby	German: Schwarzmaulgrundel; French: gobie à taches noires; Dutch: zwartbekgrondel	2004 in the Netherlands; presumably the specimen were transported with the ballast water of ships from the Baltic Sea which these ships had gained via the canal- and riversystem of Eastern Europe ¹²	share of individuals in the Lower Rhine above 10 % (2009) ¹⁰ ; high density of all age classes in the Rhine near Worms (as of September 2010, September 2012) and in the Moselle near Bernkastel-Kues (September 2012; unpublished data of the BfG); adult specimen often feed on molluscs and might be favoured by the occurrence of the immigrated migratory mussel <i>Dreissena polymorpha</i> (since about 1840 ¹³) and the Quagga mussel <i>D. Rostriformis gubensis</i> (since 2006 ¹⁴) and the basket clam <i>Corbicula</i> sp. ^{15,16} ("invasion meltdown" ¹⁷); according to an investigation on the Lower Rhine no fish as nutritive element ¹⁵	dark spot at the back end of the front dorsal fin; up to 30 cm
<i>Neogobio fluviatilis</i>	Monkey goby	German: Flussgrundel; French: gobie fluviatile; Dutch: pontische stroomgrondel	2008 in the Rhine near Duisburg ¹¹ ; 2009 in Dutch sections of the Rhine ¹⁸ ; settlements already existed in the Odra region; no information on migration corridor	prefers calm sections of the water body with sand and gravel river bottom substrate ¹⁹ ; frequent occurrence in such habitats in the Lower Rhine already in 2009 ¹⁰ ; according to investigations on the Lower Rhine no fish as nutritive element ¹⁵	silvery-creamy to greyish-green base colour; series of dark pigment spots along the middle of the side; slimmer than other goby species; up to 15 cm
<i>Babka gymnotrachelus</i>	Racer goby	German: Nackthalsgrundel; French: gobie coureur; Dutch: naakthalsgrondel	so far not identified in the Rhine system; immigration from the German Danube where the species has already settled or the catchment of the Baltic Sea which has been reached via the canals in Eastern Europe are expected	prefers sandy to muddy river bottom substrate and possibilities to hide, such as dead wood, macrophytes or stones; contrary to the bighead goby and the round goby, in the Austrian Danube this species rarely settles on stone blocks of bank stabilization structures or settles in low densities ¹⁹ ; opportunistic feeder with food preferences strongly depending on habitat, e.g. amphipods, midge larvae and chrysalids of diptera, etc. ²⁰	dark, slanting spots/stripes on the sides; up to 16 cm
Odontobutidae family (Freshwater sleepers)					
<i>Percottus glenii</i>	Amur sleeper, Chinese sleeper	German: Amur-Schläfergrundel, Chinesische Schläfergrundel; French: goujon de l'Amour; Dutch: amoergrondel	Origin: East Asia; at present no occurrence known in the Rhine system; however, immigration is to be expected, as the species has already settled in the catchment of the Baltic Sea and sections of the Danube following releases by aquarian hobbyists in the European part of Russia in the beginning of the 19th century.	overgrown banks of flowing and stagnant small to medium sized water bodies; dug into the mud during periods of frost or dry periods; they are said to be tolerant to variations in temperature and oxygen; opportunistic feeder with food preferences strongly depending on the habitat, e.g. larvae of chironomids, ephemera, crustaceans, etc. ²¹	no ventral fin having become sucker cups; up to 25 cm

⁷ Landwüst 2006⁸ Adamek et al. 2010⁹ French & Jude 2001¹⁰ Borcharding et al. 2011¹¹ Staas unveröffentl. Daten in Borcharding et al. 2011¹² van Beek 2006¹³ Thienemann 1950¹⁴ Molloy et al. 2007¹⁵ Borcharding et al. 2012¹⁶ Corkum et al. 2004¹⁷ Simberloff & Von Holle 1999¹⁸ van Kessel et al. 2009¹⁹ Wiesner 2005²⁰ Grabowska & Grabowski 2005²¹ Koščo et al. 2008



Figure 2: Goby species in the Rhine catchment. Upper left: Bighead goby with the characteristic sucker cup of grown together ventral fins. Upper right: Western tubenose goby from the Moselle (August 2008). Below left: Bighead goby from R. Main at Freudenberg (October 2006). Below right: Juvenile round goby from the Rhine at Worms (September 2010). Photos: BfG

2. Possible impact on the ecosystem

The following interactions of goby species existing in the Rhine or to be expected with already existing organisms exist or are to be expected but are difficult to appreciate or to predict²².

- food competition → reduction of stocks of some indigenous species
- effects on feeding organisms (indigenous invertebrates, small fish, fish eggs and larvae)
- impact on the stocks of predators (predator fish, cormorant)
- competition for habitats (e.g. gaps), spawning grounds (e.g. bottom side of stones) etc. → possibly reduction of stock of bullheads (*Cottus spec.*)
- introduction of parasites (so far no evidence)

3. Recommendations

Since anthropogenic modifications are in particular most favourable to goby species in the navigation lanes, it will most probably not be possible to considerably drive back

²² see Vanderploeg et al. 2000 + 2002, Paintner 2007, Copp et al. 2008, Corkum et al. 2004, Wiesner et al. 2010, Kottelat & Freyhof 2007, S. 549/550; Bzoma & Stempniewicz 2001, zit. in Corkum et al. 2004

goby species which have already established in the Rhine catchment. At the same time it is highly unlikely that, on the long run and with reasonable efforts, it will be possible to prevent the introduction of species still to be expected, such as the racer goby. Presumably, it will only be possible to avoid the introduction of gobies to standing waters, for which stocking restrictions might be issued.

However, it is no longer possible to protect the indigenous fauna of the Rhine and its tributaries from a confrontation with invasive species. An attempt should however be made to stabilize the stocks of particularly concerned indigenous species still to be determined by renaturing measures, improvement of river continuity, targeted support programmes for species to such an extent that a permanent preservation of stocks is possible which coexist with immigrated goby species and eventually with further invasive species. Therefore, within the on-going determination of stocks of fish and of the macrozoobenthos, indications of detrimentally impacted indigenous species must be followed in order to eventually introduce targeted investigations into the impacts of gobies on the indigenous fauna of the Rhine system. These investigations may then be followed by measures taken in favour of these species targeted at a permanent securing of their stocks and coexistence with the introduced goby species.

4. Literature

- Adamek, Z., Jurajda, P., Prasek, V. & Sukop, I. (2010):** Seasonal diet pattern of non-native tubenose goby (*Proterorhinus semilunaris*) in a lowland reservoir (Musov, Czech Republic). *Knowledge and Management of Aquatic Ecosystems* 397 (2), 02-02
- Ahnelt, H., Bănărescu, P., Spolwind, R., Harka, Á. & Waidbacher, H. (1998):** Occurrence and distribution of three gobiid species (Pisces, Gobiidae) in the middle and upper Danube region – Examples of different dispersal patterns? *Biologia* 53, 665-678
- Borcherding, J., Staas, S., Krüger, S., Ondračková, M., Šlapanský, L. & Jurajda, P. (2011):** Non-native Gobiid species in the lower River Rhine (Germany): recent range extensions and densities. *Journal of Applied Ichthyology* 27 (1), 153-155
- Borcherding, J., Dolina, M., Heermann, L., Knutzen, P., Krüger, S., Matern, S., van Treeck, R. & Gertzen, S. (2012, in press):** Feeding and niche differentiation in three invasive gobies in the Lower Rhine, Germany, *Limnologia*
- Bzoma, S. & Stempniewicz, L. (2001):** Great cormorants (*Phalacrocorax carbo*) diet in the Gulf of Gdansk in 1998 and 1999. Third International Symposium on Functioning of Coastal Ecosystems in Various Geographical Regions, June 19–22, 2001, Institute of Oceanography, University of Gdansk
- Copp, G.H., Kováč, V., Zweimüller, I., Dias, A., Nascimento, M., Balázšová, M. (2008):** Preliminary study of dietary interactions between invading Ponto-Caspian gobies and some native fish species in the River Danube near Bratislava (Slovakia). *Aquatic Invasions* 3 (2), 193-200
- Corkum, L.D., Sapota, M.R. & Krzystof, E.S. (2004):** The round goby, *Neogobius melanostomus*, a fish invader on both sides of the Atlantic Ocean. *Aquatic Invasions* 6, 173-181
- French, J.R.P. & Jude, D.J. (2001):** Diets and diet overlap of nonindigenous gobies and small benthic native fishes co-inhabiting the St. Clair River, Michigan. *Journal of Great Lakes Research* 27 (3), 300-311
- Friedl, T. & Sampl, H. (2000):** Erstnachweis der Marmorierten Grundel (*Proterorhinus marmoratus* PALLAS) in der Steiermark. *Österreichs Fischerei* 53, 189-191
- Grabowska, J. & Grabowski, M (2005):** Diel-feeding activity in early summer of racer goby *Neogobius gymnotrachelus* (Gobiidae): a new invader in the Baltic basin. *Journal of Applied Ichthyology* 21, 282-286
- Koščo, J., Manko, D., Miklisova, D. & Košuthova, L. (2008):** Feeding ecology of invasive *Percottus glenii* (Perciformes, Odontobutidae) in Slovakia. *Czech Journal of Animal Science* 53 (11), 479-486
- Kottelat, M. & Freyhof, J. (2007):** Handbook of European Freshwater Fishes. Kottelat, Cornol, Switzerland and Freyhof, Berlin, Germany, 646 p.
- Landwüst, C. von (2006):** Expansion of *Proterorhinus marmoratus* (Teleostei, Gobiidae) into the River Moselle (Germany). *Folia Zoologica* 55 (1), 107-111

- Molloy, D. P., A. bij de Vaate, T. Wilke & L. Giamberini (2007):** Discovery of *Dreissena rostriformis bugensis* (Andrusov 1897) in Western Europe. *Biological Invasions* 9, 871-874
- Paintner, S. (2007):** Schwarzmeergrundeln auf dem Vormarsch! Ausbreitung von Neozoen, Auswirkungen auf die heimische Fischfauna und Fischerei. Tagungsband 19. SVK-Fischereitagung, 5. März 2007, Künzell bei Fulda, 13 S.
- Pelz, G.R. & Brenner, T. (2000):** Fische und Fischerei in Rheinland-Pfalz: Bestandsaufnahme, fischereiliche Nutzung, Fischartenschutz. Mainz: Ministerium für Umwelt und Forsten Rheinland-Pfalz (Hrsg.), 258 S.
- Prášek, V. & Jurajda, P. (2005):** Expansion of *Proterorhinus marmoratus* in the Morava River basin (Czech Republic, Danube R. watershed). *Folia Zoologica* 54, 189-192
- Schöll, F. (2008):** Der Main-Donau-Kanal als Drehscheibe wandernder Tierarten. In: Wasser- und Schifffahrtsdirektion Süd (Hrsg.): Jahresbericht 2007, 69-70
- Simberloff, D. & Von Holle, B. (1999):** Positive interactions of nonindigenous species: invasional meltdown? *Biological Invasions* 1, 21-32
- Sokolov, L.I., Sokolova, V.A., Pegasov, M.I., Shatunovskii, M.I. & Kistenev, A.N. (1994):** The ichthyofauna of the Moscow River within the boundaries of the city of Moscow. *Journal of Ichthyology* 34, 141-151
- Thienemann, A. (1950):** Verbreitungsgeschichte der Süßwassertierwelt Europas. In: Thienemann, A. (Hrsg.): Die Binnengewässer 18. Schweizerbart, Stuttgart, 809 S.
- van Beek, Gé C.W. (2006):** The round goby *Neogobius melanostomus* first recorded in the Netherlands. *Aquatic Invasions* 1 (1), 42-43
- Vanderploeg, H.A., Nalepa, T.F., Jude, D.J., Mills, E.L., Holeck, K.T., Liebig, J.R., Grigorovich, I.A. & Ojaveer, H. (2002):** Dispersal and emerging ecological impacts of Ponto-Caspian species in the Laurentian Great Lakes. *Canadian Journal of Fisheries and Aquatic Sciences* 59, 1209-1228
- van Kessel, N., Dorenbosch, M. & Spikmans, F. (2009):** First record of Pontian monkey goby, *Neogobius fluviatilis* (Pallas, 1814), in the Dutch Rhine. *Aquatic Invasions* 4 (2), 421-424
- Wiesner, C. (2005):** New records of non-indigenous gobies (*Neogobius* spp.) in the Austrian Danube. *Journal of Applied Ichthyology* 21, 324-327
- Wiesner, C.; Wolter, C., Rabitsch, W. & Nehring, S. (2010):** Gebietsfremde Fische in Deutschland und Österreich. *BfN-Skripten* 279, 192 S
- Wonham, M.J., Carlton, J.T., Ruiz, G.M. & Smith, L.D. (2000):** Fish and ships: relating dispersal frequency to success in biological invasions. *Marine Biology* 136, 1111-1121