

Biology, abundance and feeding ecology of the round goby (*Neogobius melanostomus*) in the eastern German Baltic

Christina Henseler (1, 2), *Christiane Bock* (1, 2), *Paul Kotterba* (1), *Helmut Winkler* (2), *Daniel Oesterwind* (1)

(1) *Thünen Institute of Baltic Sea Fisheries, Rostock Germany*; (2) *University of Rostock, Rostock Germany*
Contact details: christina.henseler@freenet.de

Summary

The Ponto-Caspian round goby *Neogobius melanostomus* has spread to various locations worldwide as an invasive species and is now amongst others present in the Great Lakes, European river systems and in the Baltic Sea. We investigated the abundance and feeding ecology of the round goby in different habitat types in the Greifswalder Bodden situated in the eastern German Baltic. Round goby samples were taken with a beam trawl and the diet composition was examined on the basis of stomach content analyses. Abundances of *N. melanostomus* were significantly higher in shallower littoral habitats with dense macrophyte coverage than in deeper, less structured open sand habitats indicating a preference for complex habitats. Round goby diet expressed an ontogenetic diet shift. Whereas smaller individuals (0-50 mm TL) primarily consumed zooplankton and ostracods, the diet of larger round gobies (> 51 mm TL) increasingly relied on molluscs and polychaetes. This study offers new insights into the ecology of *N. melanostomus* in the German Baltic and provides a basis for further research on this invasive species and its impact in the Baltic Sea.

Introduction

The round goby (*Neogobius melanostomus*) is native to the Ponto-Caspian region and has been introduced to several areas as an invasive species. Amongst others it can be found in the Great Lakes in North America, in several European river and canal systems and in the Baltic Sea, underlining its remarkable euryhaline character (Corkum et al., 2004). Round gobies are known to negatively impact invaded ecosystems through increased predation on benthic invertebrates (Lederer et al., 2006) and a competition for space and food with native fish species is suggested (Karlson et al., 2007). In the Baltic Sea studies about *N. melanostomus* mainly refer to the area of its original introduction, the Gulf of Gdansk where this species was first recorded in 1990, and the northern territories. Studies from other regions are scarce. Therefore, we investigated the distribution and feeding ecology of the round goby in the eastern German Baltic within the framework of the BONUS project BIO-C³.

Materials and Methods

The study area Greifswalder Bodden, a semi-enclosed inshore lagoon, is situated at the German coast of the Western Baltic Sea. Round goby samples were taken in three different habitat types at Gahlkower Haken located in the southern part of the Bodden using a beam trawl that was towed over the sea floor with a small boat. Habitat types included the “*Potamogeton*-zone” (PZ) between 1 and 2 m water depth characterized by a very dense coverage with macrophytes. The “*Zostera*-zone” (ZZ) was sampled between 3 and 4 m depth. Macrophyte beds in this habitat were patchily distributed and interrupted by areas of bare sand. In the “subphytal zone” (SZ) between 5 and 7 m water depth only bare sand covered the ground. In every habitat type three hauls were conducted and samples were taken on one day respectively in October and November 2014. In August a pilot sampling was carried out which included one of the three habitats described above. In the laboratory round gobies were measured for total length (TL) and weight and were divided into three length classes LC (LC1: 0-50 mm TL; LC2: 51-100 mm TL; LC3: 101-150 mm TL). Stomach contents from ten round gobies per length class and haul were examined. Thereby, gobies were dissected ventrally and the stomach separated from the remaining digestive tract. Only prey organisms that had been in the stomach were

identified to the lowest possible taxonomic level. The presence of the single prey taxa was noted for each fish dissected.

Results and Discussion

Round goby abundance differed significantly between the habitat types in October and November. In both months the mean abundance of *N. melanostomus* was significantly higher in the PZ than in the ZZ and SZ (Figure 1, only October shown). Hence, round gobies seem to prefer the shallower, more structured habitat with dense submerged aquatic vegetation (SAV) at Gahlkower Haken. In aquaria experiments this species commonly favours complex habitats (i.e. rock, cobble, macrophytes) over open sand habitats (e.g. Bauer et al., 2007) which agrees with our findings. The observed preference for the PZ in the Bodden might be based on the higher availability of hiding places and thus a reduced predation risk in this habitat. Indeed, round gobies are exposed to a higher predation in open sand habitats compared to complex ones (Belanger and Corkum, 2003). Better feeding opportunities i.e. the higher availability of invertebrate prey associated with high macrophyte coverage might contribute to the observed habitat preference.

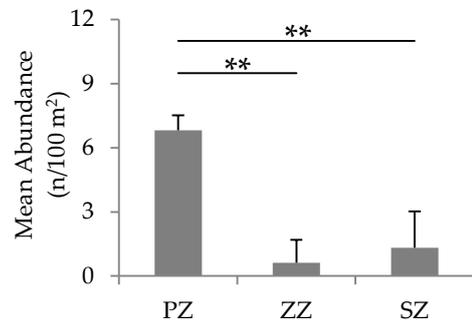


Figure 1: Mean abundance (+SD) of round gobies in October compared between the habitats (see text). Double asterisks: highly significant difference (ANOVA, $p < 0.01$, $F_{2,6} = 22.851$).

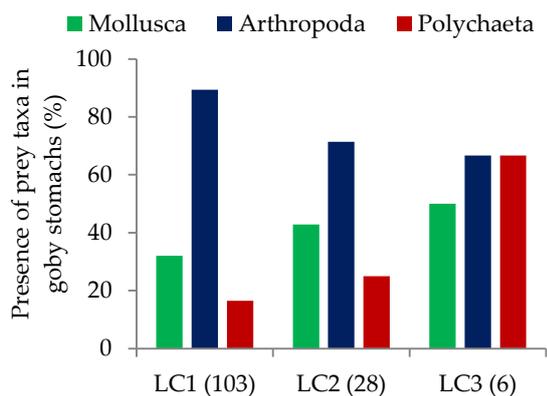


Figure 2: Diet of the three length classes (LC, see text). Presence of prey taxa in goby stomachs is shown (%). Numbers in brackets represent the number of non-empty stomachs in each LC.

The diet composition showed distinct differences between *N. melanostomus* length classes. LC1- and LC2- round gobies relied on arthropods as their primary food source (Figure 2). However, they fed on different crustacean prey taxa (data not shown) indicating an ontogenetic diet shift from zooplankton and ostracods towards larger crustaceans. In LC3 less arthropods, but an increased amount of polychaetes and molluscs, was consumed (Figure 2). These results are in accordance with previous findings which commonly report an ontogenetic diet shift with increasing molluscivory for round gobies (e.g. Karlson et al., 2007). Thereby, the diet of larger *N. melanostomus* (> 6 cm TL) is dominated by bivalves such as zebra and common mussels.

References

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