Coupling of migration behaviour and individual fitness in European Eel - The effects of ambient salinity on eel spawner quality

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1 Introduction

Overall recruitment of European eel (*Anguilla anguilla*) remarkably decreased since the early 1980ies, with observed losses of up to 99%. Although a coherent explanation for this phenomenon is still missing, several possible causes are under suspicion, among others: (1) overfishing, (2) oceanographic / climatic changes, (3) migration inhibitors, (4) contamination of aquatic habitats with xenobiotics, as well as (5) parasites and infectious diseases (Dekker 2003a, b; van Ginneken and Maes 2005).

As a result of the steep decline in European eel numbers, the European Commission reacted with a proposal for a Community Action Plan for protection and recovery of the severely depleted eel stocks (Council Regulation EC 2007). The regulation includes the preparation of management plans for each eel river basin by the member states with the objective to reduce anthropogenic mortalities so as to permit the escapement to the sea of at least 40% of the silver eel biomass relative to the best estimate of escapement that would have existed without anthropogenic influences (Council Regulation EC 2007). One of the measures include that 60% of eels less than 12 cm in length caught annually should be reserved for restocking to suitable habitats (Council Regulation EC 2007).

Methods

In a new attempt we combined life history information as revealed by otolith microchemistry with detailed information on the individual health status of yellow and silver eels. By reconstructing the migratory history of specimens sampled in the North Sea, the Baltic Sea and various northern German freshwater sites using LA-ICP-MS methodology, we tried to better understand the influence of ambient salinity on spawner quality characteristics like parasite infestation, HVA and EVEX infections.

Results and Discussion

Otolith microchemistry turned out to be a valuable tool to differentiate between stocked and non-stocked eel in Baltic Sea tributaries, since the brackish water signal of this hyposaline inland sea can be easily recognized in trace element profiles. Preliminary results point to a percentage of stocked eels in the Western Baltic of less than 20%, a value that implies either a still high natural recruitment or alternatively a low survival of stocked eel.

In any case, pre-spawning migration patterns could be shown to be complex, especially for eels of the purely marine sampling site off the island of Helgoland in the North Sea, with no evidence for eels that spent their whole life in a purely marine environment.

Investigations on the infections rate of northern German eels with *Herpesvirus anguillae* (HVA) revealed a remarkably low prevalence of 2%. The results show the

presence of HVA in freshwater as well as marine habitats, but the virus apparently is still absent from many locations. Restocking plans with eel juveniles should avoid an unwilling introduction of the virus into these habitats.
The comparative examination of the parasite fauna in different habitats shows distinct differences in parasite species composition and diversity and a distinct negative correlation between species diversity and salinity gradient. *Anguillicola crassus* and *Pseudodactylogyrus* spp. were found at all freshwater and brackish water sampling sites with rather high prevalence. Only eels that move early to a purely marine environment are at little risk to get infected with neozoan parasites and may be favoured to reach their spawning grounds in good condition.

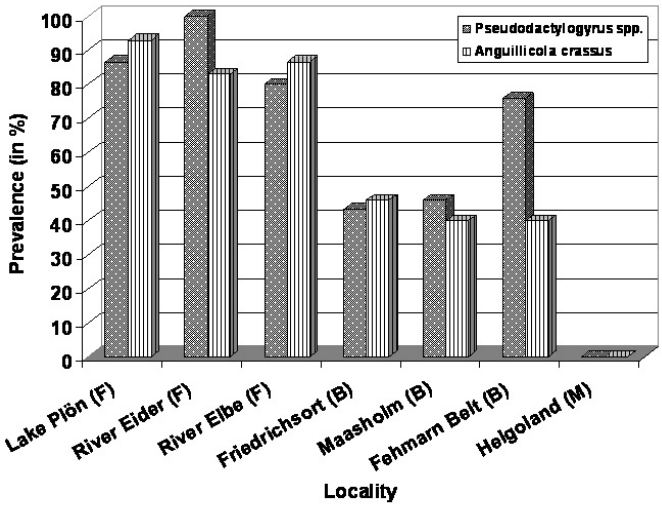

Figure 1. Prevalence (%)of infection for *Anguillicola crassus* (right columns) and *Pseudodactylogyrus* spp. (left colums) for different freshwater (F), brackish (B) and marine (M) locations in northern Germany

Conclusions

In conclusion, it can be stated that eels staying in a purely marine environment are obviously at much lower risk to get infected with pathological parasites and viruses and may therefore be favoured to reach their spawning grounds in good condition. The common practice of catching glass eel in river estuaries for an unselective restocking of freshwater systems all over Europe might therefore even worsen the problem of declining eel stocks by further diluting the number of eels that would stay in marine coastal habitats.

References

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