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Towards reproduction in captivity of European eel  
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World-wide, eel populations have decreased strongly in numbers since the 1970s. Despite management measures and other protective efforts, the European eel is on the IUCN red list as 'critically endangered'. The existing eel farms still depend on the catches of glass eels in nature which are then raised to market size. Only a restricted number of glass eels is available for aquaculture and societal concern exists about the lack of sustainability. Livestock Research and the Aquaculture and Fisheries group of the Wageningen University and Research Centre collaborate with DUPAN in a research trajectory that aims to reproduce European eel in captivity (See also 'DUPAN Foundations accelerate eel conservation in Holland' in this booklet).

*Recent development of tools for conditioning of broodstock: feminisation and simulated migration*

In nature, European eels (*Anguilla anguilla*) sexually mature during and/or after the ~6000 km semelparous reproductive migration from their freshwater habitats to the spawning grounds in the Sargasso Sea. In captivity, eels have been stimulated to mature with the purpose to artificially reproduce by injecting gonadotropins, either through hypophysation or, more recently, with recombinant FSH and LH. As the use of wild migrant silver eels as broodstock for artificial reproduction trials has become difficult due to management protection measures, conditioning methods should be developed to use farmed eels as broodstock.

One such method was developed for Japanese eels and concerns the feminisation of glass eels through feeding estradiol-17 $\beta$  for 5-6 months which accelerates the previtellogenic oocyte development. Recently, we showed that early sexual maturation of farmed European eel can be enhanced by a simulated migration under mimicked photothermal conditions (Mes et al., 2016). With this tool to make farmed eels silver we have developed another important tool for the conditioning of farmed broodstock eels. In collaboration with ZFcreens BV (Leiden, the Netherlands), we have also combined both methods (Böhm et al., 2016): 1) For the first time European eels were feminised; 2) Feminised eels were then subjected to simulated migration to assess the effects on maturation, and 3) Feminised migrant eels were subsequently stimulated to fully mature by hypophysation. Correlations between the individual maturation responses to simulated migration and to hormonal injections were analysed to identify potential predictors for the selection of farmed broodstock. Results showed that the feminisation procedure for European eels had been successful. All eels were stimulated in their early maturation by simulated migration as indicated by an increase of the eye index. Fourteen out of the eighteen feminised migrants could be fully matured by hypophysation after 11-17 weekly injections. The eye indices after simulated migration correlated positively with the weight increase after injection 11 as a result of the hydration response of the oocytes (0.9-13.6%) and indicating the speed of the maturation response. The eels that ovulated were those that had the higher eye indices after simulated migration. Therefore we can conclude that simulated migration can be applied for both conditioning and selection of feminised broodstock eels.

*Current studies and future perspectives*

Currently, in a first phase project of the research trajectory with DUPAN and in collaboration with the Dutch Ministry of Economic Affairs, the developed tools are used in reproduction trials with wild, farmed and feminised eels. For this purpose, facilities have been expanded from a large swim-gutter to experimental freshwater and seawater RAS set-ups and a larval hatchery system. The aims are: 1) Optimal conditioning of the broodstock eels by feminisation, optimal feeding and simulated migration; 2) Subsequent artificial reproduction in order to optimise and newly develop larval rearing systems and diets.

In a second phase we will upgrade our efforts to routine larval production and optimal larval feeding and growth by making use of state-of-the-art genomic tools and expanding our internal, national and international collaborations. Ultimately, the research trajectory is expected to supply aquaculture with glass eels and close the production cycle. This way, both eel aquaculture as well as management of the natural populations could become sustainable.

Mes, D., Dirks, R.P., Palstra, A.P. (2016) Simulated migration under mimicked photothermal conditions enhances sexual maturation of farmed European eel (*Anguilla anguilla*). *Aquaculture* 452: 367-372.

Böhm, T., Graziano, M., Blom, E., Brittij, S.A., Dirks, R.P.H., Palstra, A.P. (2016) Simulated migration of feminised eels to stimulate and predict the sexual maturation response. Annual conference COST action FITFISH (www.fitfish.eu), April 22 2016, Belgrade, Serbia.