GAINING INSIGHTS INTO THE INITIATION OF VITELLOGENESIS IN EELS

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Background
A negative correlation exists between the maturation stage at the start of the ocean reproductive migration and the migration distance to the spawning grounds for the various eel species. The European eel Anguilla anguilla migrates up to 6,000 km and leaves in a previtellogenic state. The shortfin eel A. australis migrates 2-4,000 km and leaves in an early vitellogenic state. In this study, we compared previtellogenic European silver eels with immature yellow eels, and early vitellogenic silver shortfin with yellow eels, to gain insights into the initiation of vitellogenesis.

Methods
- Immediately after being caught and at the catch site, measurements were performed and eels (N=6 yellow and N=6 silver eels for each species) were sampled for blood and tissues.
- Eye index (EI), gonadosomatic index (GSI) and hepatosomatic index (HSI) were calculated.
- 11-ketotestosterone (11-KT) and 17β-estradiol (E2) were measured by specific radio-immunoassay.
- RT-PCR in pituitary: dopamine D2B receptor d2br, gonadotropin-releasing hormone receptors 1 and 2 gnrhr1 and 2, follicle-stimulating hormone-β fshβ and growth hormone gh.
- RT-PCR in liver: estrogen receptor 1 esr1.
- RT-PCR in ovaries: follicle-stimulating hormone receptor fshr, androgen receptors α and β ara and b, vitellogenin receptor vtgr and P450 aromatase cyp19.
- For each species, fold-change (FC) expression was determined of yellow vs. silver eels and these were compared between species.

Results
GSI values of 3.0 ± 0.2% in silver shortfin eels reflected a vitellogenic maturation state while GSI values of 1.5 ± 0.1% indicated previtellogenesis in European silver eels. Plasma 11KT levels were much higher in shortfin than in European silver eels (82.3 ± 11.3 vs. 1.2 ± 0.3 ng mL⁻¹), whereas plasma E2 levels were higher in European silver eels (3.1 ± 0.5 vs. 1.5 ± 0.1 ng mL⁻¹).

Increased dopaminergic signaling and activation of the brain-pituitary-gonad (BPG) axis
In the pituitary of shortfin eels, expression of d2br, gnrhr1 and 2, and fshβ was up-regulated in the silver-stage compared to yellow-stage females (Fig. 1).

In the gonads, expression of fshr, ara and b expression was up-regulated in silver shortfin eels (Fig. 2). For the European eel, d2br, gnrhr1 and 2, fshβ, fshr, ara and b expression did not show any change between yellow and silver eels (Fig. 1 and 2).

Increased liver sensitivity
Expression of esr1 in European eels was low while esr1 expression was up-regulated over 100-fold in silver shortfin eels (Fig. 3).

Synthesis
Differences along the BPG axis between the European eel and the shortfin eel during silverying suggest events that occur during the initiation of vitellogenesis. Pituitary dopaminergic signaling (d2br) is increased, the BPG reproductive axis (gnrhr1 and 2, fshβ, fshr, and ara and b) is activated and liver sensitivity (esr1) is increased (Table 1).

Conclusions
The initiation of vitellogenesis is characterised by:
- Increased dopaminergic signaling (d2br)
- Activation of the BPG axis (gnrhr1 and 2, fshβ, fshr, ara, arb).
- Increased liver sensitivity (esr1)