Molecular ontogeny of first-feeding European eel larvae

Digestive system functionality of fish larvae relies on the onset of genetically pre-programmed and extrinsically influenced digestive functions. This study explored how algal supplementation (green-water) until 14 days post hatch (dph) and the ingestion of food [enriched rotifer (Brachionus plicatilis) paste] from 15 dph onward affects molecular maturation and functionality of European eel larval ingestion and digestion mechanisms. For this, we linked larval biometrics to expression of genes relating to appetite [ghrelin (ghrl), cholecystokinin (cck)], food intake [proopiomelanocortin (pomc)], digestion [trypsin (try), triglyceride lipase (tgl), amylase (amyl)], energy metabolism [ATP synthase F0 subunit 6 (atp6), cytochrome-c-oxidase 1 (cox1)], growth [insulin-like growth factor (igf1)] and thyroid metabolism [thyroid hormone receptors (thraA, thrβB)]. Additionally, we estimated larval nutritional status via nucleic acid analysis during transition from endogenous and throughout the exogenous feeding stage. Results showed increased expression of ghrl and cck on 12 dph, marking the beginning of the first-feeding window, but no benefit of larviculture in green-water was observed. Moreover, expression of genes relating to protein (try) and lipid (tgl) hydrolysis revealed essential digestive processes occurring from 14 to 20 dph. On 16 dph, a molecular response to initiation of exogenous feeding was observed in the expression patterns of pomc, atp6, cox1, igf1, thraA and thrβB. Additionally, we detected increased DNA contents, which coincided with increased RNA contents and greater body area, reflecting growth in feeding compared to non-feeding larvae. Thus, the here applied nutritional regime facilitated a short-term benefit, where feeding larvae were able to sustain growth and better condition than their non-feeding conspecifics. However, RNA:DNA ratios decreased from 12 dph onward, indicating a generally low larval nutritional condition, probably leading to the point-of-no-return and subsequent irreversible mortality due to unsuccessful utilization of exogenous feeding. In conclusion, this study molecularly identified the first-feeding window in European eel and revealed that exogenous feeding success occurs concurrently with the onset of a broad array of enzymes and hormones, which are known to regulate molecular processes in feeding physiology. This knowledge constitutes essential information to develop efficient larval feeding strategies and will hopefully provide a promising step toward sustainable aquaculture of European eel.

General information
Publication status: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Living Resources, Section for Marine Ecology and Oceanography, Billund Aquaculture Service Aps, L'Institut Français de Recherche pour l'Exploitation de la Mer, Helmholtz Centre for Ocean Research Kiel, Auburn University
Corresponding author: Politis, S. N.
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Frontiers in Physiology
Volume: 9
Article number: 1477
ISSN (Print): 1664-042X
Ratings:
BFI (2018): BFI-level 1
Scopus rating (2018): CiteScore 3.22 SJR 1.153 SNIP 0.986
Web of Science (2018): Impact factor 3.201
Web of Science (2018): Indexed yes
Original language: English
Electronic versions:
Publishers version
DOIs:
10.3389/fphys.2018.01477
Source: FindIt
Source ID: 2440732276
Research output: Contribution to journal › Journal article – Annual report year: 2018 › Research › peer-review