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Early nutritional regulation of genes involved in the biosynthesis of very long-chain (>C_{24}) polyunsaturated fatty acids (VLC-PUFA) in *Sparus aurata* and *Solea senegalensis*.

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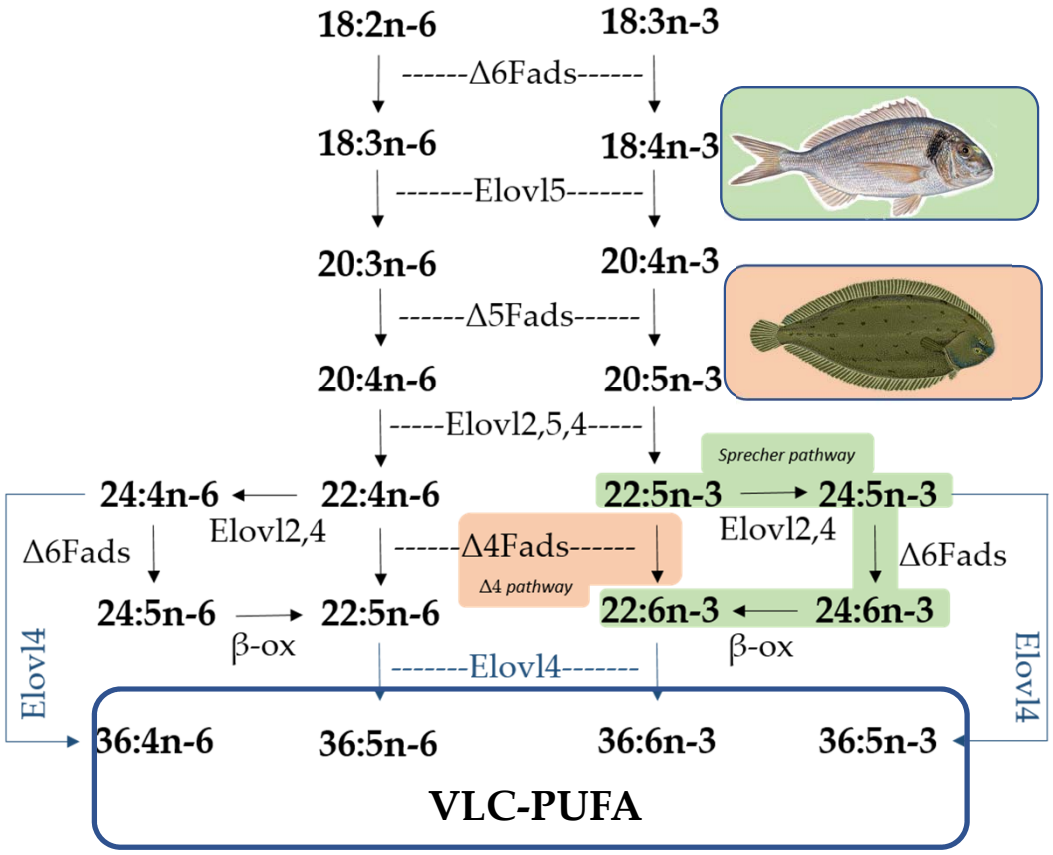
INTRODUCTION

Biosynthetic pathways of long-chain (LC-PUFA; C20-24) and very long-chain polyunsaturated fatty acids (VLC-PUFA; >C24) in fish.



VLC-PUFA

Although **present in small amounts**, play **important** roles for the correct development and functionality of **neural tissues**.

Studies on VLC-PUFA in fish are scarce.

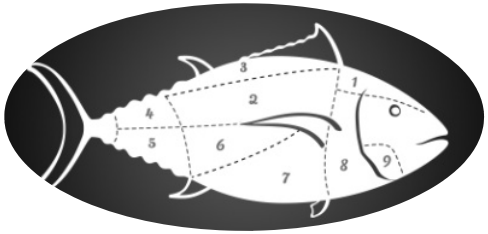
Their biosynthesis, mediated by Elovl4 proteins, **is substrate-dependent**. i.e. shorter fatty acid precursors (**LC-PUFA**), are required, which are mostly incorporated by the **diet.**

Nutritional regulation of *elovl4*, as well as other **elongase and desaturase genes** involved in LC-PUFA biosynthesis (*elovl5*, *fads2*) has been proposed as a **strategy to enhance endogenous production of LC-PUFA and VLC-PUFA in fish farming.**

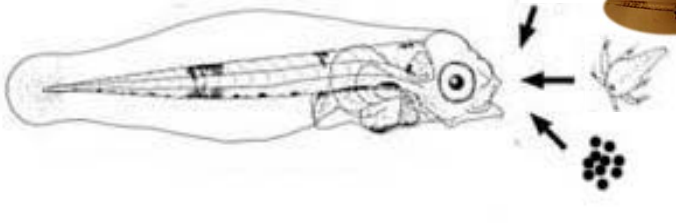
Can biosynthesis of VLC-PUFA be regulated by dietary LC-PUFA content in early life-cycle stages, i.e. larvae and post-larvae ?

Is this species-specific?

What body regions are the main target?



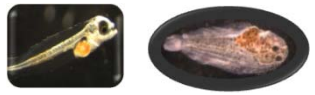
MATERIALS AND METHODS



Experiment 1

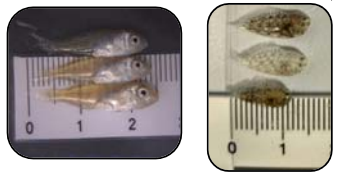
Early larvae (9 dah) **fed** ***Brachionus plicatilis*** enriched (**Rot E; high LC-PUFA**) or not enriched (**Rot NE; low LC-PUFA**) during 7 d

Experiment 2



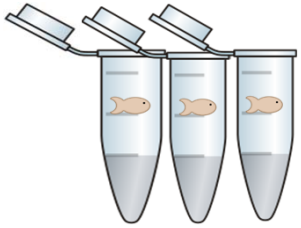
Late larvae (25 dah) **fed** ***Artemia franciscana*** **met**anauplii enriched (**Art E; high LC-PUFA**) or not enriched (**Art NE; low LC-PUFA**) during 15 d

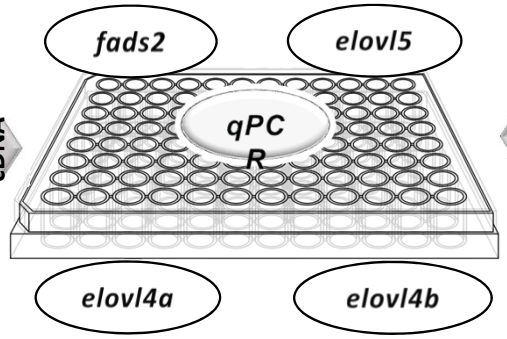
Experiment 3



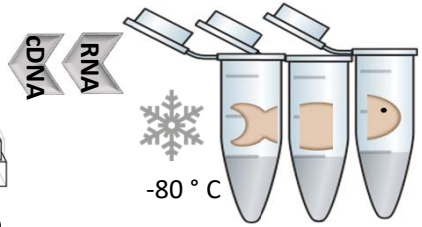
Postlarvae fed inert micro-diets (O.5-0.8 mm): **High** (diet 1), **medium** (diet 2) and **low** (diet 3**) LC-PUFA content** during 30 d

Early larvae: Pools of whole larvae were processed (n=3)





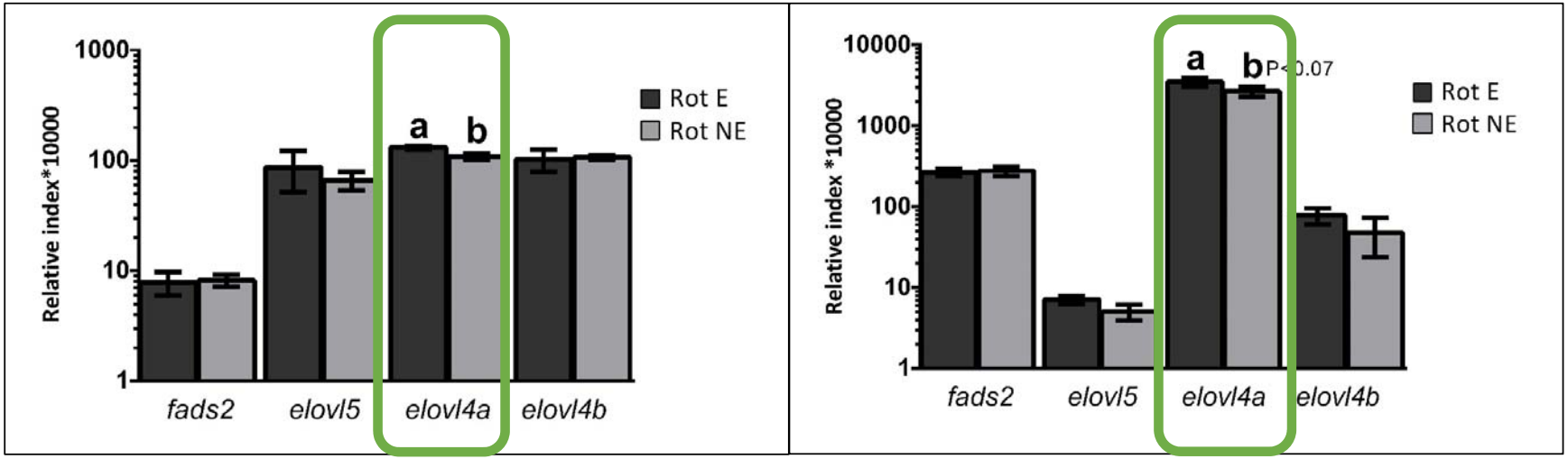
Late larvae and postlarvae: Head, viscera and muscle were individually differentiated and processed separately (n=3).



RESULTS

Experiment 1: Nutritional regulation in early larvae

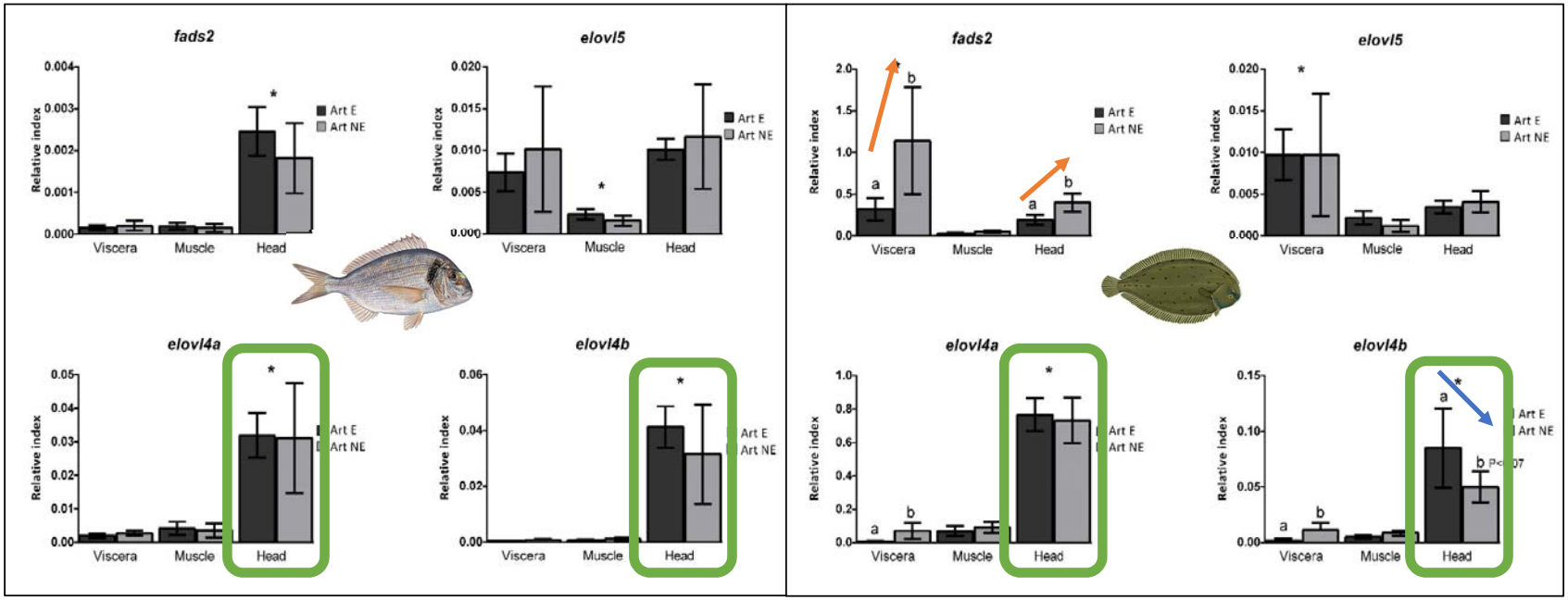
S. aurata fed rotifers diets during 7d	*S. senegalensis* fed rotifers diets during 7d



- *Elovl4a* was **up-regulated** in both fish **fed** enriched rotifers, i.e. **high dietary LC-PUFA content**.

Experiment 2: Nutritional regulation in late larvae

S. aurata fed *A. franciscana* during 15 d	*S. senegalensis* fed *A. franciscana* during 15 d



- **Head → *elovl4.***
- ***S. aurata:***

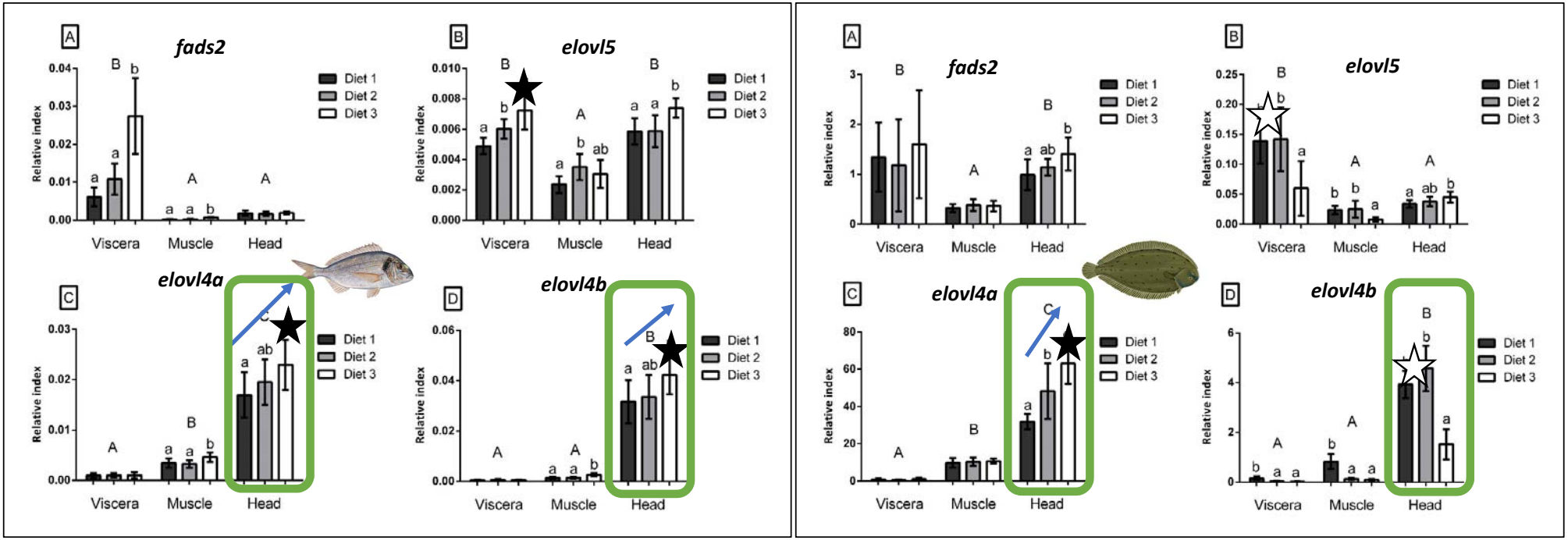
no gene expression **differences** associated to **dietary LC-PUFA content.**

- ***S. senegalensis*:**

While ***fads2*** was up-regulated in fish fed Art NE (low LC-PUFA diet), an **opposite pattern** was found for ***elovl4b*** in **head.**

Experiment 3: Nutritional regulation in postlarvae

S. aurata fed microdiets during 30 d	*S. senegalensis* fed microdiets during 30 d



- **Head → *elovl4*.**
- Except for ***S. senegalensis elovl4b***, ***elovl4*** **genes** from **both fish** were **up-regulated** in the **head** of fish fed Diet 3 (**low LC-PUFA**).
- An **opposite *elovl5* expression pattern** (viscera) was observed **between species** in response to LC-PUFA dietary content.

Summarizing…

- With the exception of ***S. senegalensis elovl4b,*** a **dietary LC-PUFA reduction** resulted in an **up-regulation of *elovl4*** genes **in the head of both fish**.

- This may indicate that a deficient dietary LC-PUFA content could **increase the *elovl4* gene** transcription **to compensate the lack of VLC-PUFA substrates**, i.e. LC-PUFA, in both species.

- This apparently **intra-** and **inter-specific differences** in the ***elovl4*** **expression pattern** can be accounted by the hypothetically **different VLC-PUFA needs** associated with **each life-stage** and the **LC-PUFA dietary** availability.

CONCLUSIONS

- ***Elovl4*** **expression is tissue-specific**, with high transcript abundance in the **head** from **both fish** studied**.** This can be associated to hypothetical **high VLC-PUFA requirements** necessary for optimal development and functionality of **fish neural tissues**.

- ***Fads2, elovl5*** and ***elovl4*** **genes can be regulated by dietary LC-PUFA** in both fish studied.

- **Nutritional regulation of *elovl4* seem to be species-specific**.

- **A correct dietary supply of LC-PUFA could be key along** different **development** stages, not only "per se", i.e., related to the essential nature of this fatty acid on its own, but also as a bottleneck **substrate for a correct VLC-PUFA synthesis**.

¡¡Thanks for listening!!

Acknowledgments

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