D. 3.2.1. Technical note.

**Dietary fatty acids and robustness of rainbow trout fry**

Ivar Lund\*, Alfred Jokumsen.

Technical University of Denmark, DTU Aqua, Section for Aquaculture, The North Sea Research Centre, DK-9850 Hirtshals, Denmark

The Organic Regulation of fish farming states strong limitations on the sourcing of protein and fat ingredients in organic feed, i.e. aiming to phase out fish oil (FO) obtained from wild fish stocks and this may lead to a higher inclusion of other oils, especially vegetable oils (VO) as these are widely used.

Several studies have been carried out to investigate the possibility of using plant-based diets in rearing fish. Only very few of them have challenged start feeding fish with diets in which both fishmeal (FM) and FO have been substituted, while studies on larger grow out fish have shown that a combined replacement of FM and fish oil (FO) is feasible without detrimental effects in growth performance when the theoretical requirements for essential amino acids and fatty acids are met by the diet.

Some recent studies have revealed, that it is possible to completely substitute FM and FO in feeds for rainbow trout over a 3 –year production cycle, but observed some limitations, such as reduction in feed-intake, offspring viability; smaller egg size and lower growth (Lazarotto et al., 2015). Other studies on rainbow trout with use of all plant based ingredients have caused a higher lipid deposition in the perivisceral fat. The lower growth performance could be a combination of lower feed intake and lower feed efficiency. This poorer growth effect of a totally plant-based diet is believed to be mainly related to the replacement of FM and not to the FO substitution as reported for several species investigated, rainbow trout; European seabass and gilthead sea bream. While it may not be recommended to fully substitute both the FM and FO with alternatives (vegetables) in diets for rainbow trout fry, a fully or partial replacement of either FM or FO could be possible.

Relatively little information exists about how and if dietary FO replacement with vegetable oils and concomitantly change in FA composition may affect not only performance and survival, but also physiological markers such stress resilience and immunocompetence.

Obvious changes in muscle fatty acid (FA) signatures and membranes (i.e. LC PUFAs) occur with the replacement of FO by vegetable oils (VO).

The possible effects on fish health and welfare merits interest for research in this area. Indeed, adequate nutrition is essential to maintain health and to reduce disease susceptibility and pathological changes, and dietary lipids (as well as other nutritional factors) have specific actions on the immune response. In gilthead seabream (*Sparus aurata*) both the redox balance (Saera-Vila et al., 2009) and the cortisol response after stress confinement (Ganga et al.2011) were altered by a high replacement of FO by VOs. Even lower VO replacement levels (50-60%) increased the cumulative mortality in gilthead seabream challenged with Vibrio alginolyticus.

*Dansk resume*

Ifølge EU regelsættet for økologisk akvakultur skal den økologiske fiskeproduktion udelukkende være baseret på økologisk yngel. Da medicinbehandling af økologisk ørred er uønsket og kun er tilladt i stærkt begrænset omfang, er ynglens robusthed overfor bl.a. den alvorligste yngelsygdom i dansk ørredopdræt, YDS (”yngeldødeligheds-syndrom”), særdeles vigtig. Ynglens robusthed kan muligvis relateres til ynglens swim-up adfærd (first feeding) og performance under opvæksten. Indholdet af specifikke essentielle Ω-3 fedtsyrer i foderet til ynglen er særlig vigtig for fiskens vækst, sundhed og velfærd, herunder robusthed overfor stress.

Der mangler imidlertid viden om evt. effekt af erstatning af fiskeolie med plantebaserede olier og deraf følgende ændringer i fedtsyre sammensætning og evt. afledede effekter på vækst og overlevelse, samt fysiologiske markører som stress resilience og immunkompetence.

*References*

Lazzarotto, V., Corraze, G., Leprevost, A., Quillet, E., Dupont-Nivet, M., Médale, F. 2015. Three-Year Breeding Cycle of Rainbow Trout (*Oncorhynchus mykiss*) Fed a Plant-Based Diet, Totally Free of Marine Resources: Consequences for Reproduction, Fatty Acid Composition and Progeny Survival. Plos One <https://doi.org/10.1371/journal.pone.0117609>. pg 1-17.

Saera-Vila A, Benedito-Palos L, Sitjà-Bobadilla A, Nácher-Mestre J, Serrano R, Kaushik S, Pérez-Sánchez J 2009. Assessment of the health and antioxidant trade-off in gilthead sea bream (Sparus aurata L.) fed alternative diets with low levels of contaminants. Aquaculture. 2009; 296, 87–95.

Ganga R, Montero D, Bell JG, Atalah E, Ganuza E, Vega-Orellana O, Tort L, Acerete L, Afonso JM, Benitez-Sanatana T, Fernández Vaquero A, Izquierdo M. 2011. Stress response in sea bream (Sparus aurata) held under crowded conditions and fed diets containing linseed and/or soybean oil. Aquaculture 311, 215-223.