DEVELOPMENT OF FEEDS FOR JUVENILE ATLANTIC BLUEFIN TUNA (*Thunnus thynnus,* L): EFFECT OF LIPID LEVEL AND SOURCE

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Introduction
The development of formulated diets and feeds is essential to increase production of farmed tuna species. Although there is limited knowledge in this area for Pacific Bluefin tuna (*Thunnus orientalis*) in Japan, no major attempts have been made with Atlantic Bluefin tuna (*Thunnus thynnus*; ABT). In the present study, two trials were performed using inert formulated diets as juvenile feeds for weaned ABT in order to establish adequate dietary levels of both lipid and omega-3 long-chain polyunsaturated fatty acids (LC-PUFA).

Materials and methods
The nutritional trials consisted of two consecutive 10-day feeding trials (A and B) with weaned 41 dah ABT juveniles, from two different batches of spawned ABT eggs. Each trial investigated two experimental extruded feeds in comparison to the commercial reference feed (MGK) to bench-mark the growth performance of the experimental feeds. In the first trial, ABT (initial weight = 2.9±0.9g) were fed for 10 days with either MGK or two experimental feeds, differing in dietary lipid levels (15 or 20%), using krill oil (KO) as the sole lipid source in order to estimate the optimal lipid content. In the second trial, fish (initial weight = 3.3 ± 0.6g) were fed either MGK, 15KO or a feed containing 15% lipid with a combination (1:1, v/v) KO and rapeseed oil (RO) (15KORO). At the end of each experimental trial samples of liver were collected for lipid and molecular analysis.

Results
In Trial A, fish fed MGK displayed the highest growth, followed by 15KO, with 20KO displaying the lowest growth although no differences were found in terms of fish survival. Thus, a lipid content of 15% was considered better than 20% for ABT juveniles. In Trial B, fish fed 15KO and 15KORO showed the highest growth in terms of weight and fork length (including weight gain and SGR). Increasing dietary lipid level or adding RO to the feeds did not increase liver lipid content as compared to 15KO. The liver fatty acid profile largely reflected dietary intake confirming very limited LC-PUFA biosynthetic activity for this teleost species. Consequently, the liver of fish fed 15KO and 20KO displayed the highest contents of docosahexaenoic acid (DHA). The hepatic expression of genes for lipid and fatty acid metabolism, transcription factors, and antioxidant enzymes was investigated with many of the genes showing regulation by both dietary lipid and LC-PUFA contents.

Discussion and conclusion
The present study showed promising results that suggest ABT juveniles can be grown on inert dry feeds that support good fish growth and the accumulation of the health-promoting fatty acid DHA. Results from the trials indicate that diets with relatively high protein to lipid ratios of between 3 and 4 could support good growth of juvenile ABT. Diet had no significant impact on survival, partly due to high variability among treatments. In the present study, liver fatty acid profiles generally reflected those of diets, as shown previously in other fish studies (Betancor et al. 2014; Araújo et al. 2017). This clearly indicates that, despite being relatively short, the feeding trials were sufficiently long in these very fast growing animals to result in changes to the biochemical composition that would be expected in fish doubling their weight

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In conclusion, the present study suggests that ABT juveniles can be grown on inert extruded dry feeds that result in good fish growth and accumulation of the health-promoting fatty acid DHA. Furthermore, a blend of VO and KO could be used as the dietary lipid source up to a dietary lipid level of 15 % without affecting fish performance. The expression of lipid metabolism genes in ABT liver showed a different response to dietary lipid level/fatty acid profile, consistent with previous data indicating limited n-3 LC-PUFA biosynthetic capability in ABT. However, gene expression showed some differences between the two trials, which highlight how the genetic background of different batches of ABT juveniles could affect the regulation of metabolic gene expression and thus be a factor in weaning success. The expression of antioxidant enzymes was also altered by diet, related to dietary contents of antioxidant nutrients. Thus, further studies are required in order to fully elucidate the lipid and fatty acid requirements of this iconic species in relation to dietary sources and production costs.

References:

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