FIRST FEEDING OF THE EUROPEAN HAKE *Merluccius merluccius* : GROWTH UNDER NATURAL DIETS AND LARVAL FATTY ACID PROFILE

M. Nande[1,6]*, D. Costas[2], O. Palmeiro[3], M.J. Lago[1], A. Casal[2], J. Iglesias[1], N. Costoya[2], M. Pérez[1], E. Paredes[2], J.J. Otero[1], F. Padrós[4], M. Carrason[4], M. Gómez-Gesteira[5] and P. Presa[6]

[1]Grupo de Acuicultura Marina. IEO-Vigo, Radio Faro, 50, 36390 Vigo (Spain) E-mail: mnande@uvigo.es
[2]Toralla Marine Station (ECIMAT), 36331 University of Vigo, Galicia, Spain
[3]Grupo de Ecoloxía e Bioloxía, Fac. Ciencias do Mar, Universidade de Vigo, 36310 Vigo, Spain
[4]Servei de Diagnòstic Patològic en Peixos. Fac. Veterinària, UAB 08193 Bellaterra, Catalunya
[5]EPhysLab, Universidade de Vigo, Fac. Ciencias, 32004, Ourense, Spain
[6]Marine Genetic Resources Lab., Fac. Marine Sciences, University of Vigo, 36310 Vigo, Spain

Introduction

Diets diminishing dependence on live preys are of upmost technical and economic interest in marine aquaculture. When juveniles of marine fishes showing a fully developed digestive tract are late-weaned a large rearing success is warranted (e.g. Person-le Ruyet et al. 1993). However, early weaning of hake larvae using foodstuff microdiets is technically achievable during their first 2 months, i.e. around 3 mg dry weight at day 60 and the earlier the weaning the higher the savings on Artemia and Zooplancton production. In this study we pursued 1) to test dry weight gain of hake larvae fed Artemia vs. Zooplancton during their first two months, and 2) to analyse the fatty acid content of starving larvae as well as those grown under different natural diets (**Figures 1, 2 and 3**).

Material & Methods

Hake eggs were drawn from spontaneous spawns of the broodstock from IEO-Vigo. Hatching occurred 5 days later and 3 DPH larvae were seeded in culture tanks at 25±5 ind/l, ambient light (400 lux), salinity 36‰, temperature 15±1ºC and mild aeration in open circuit. After 15 DPH they were fed Artemia metanauplii (A), Artemia/Zooplancton (A/Z), Zooplankton (Z), Rotifer/Zooplankton (R/Z) at 0.2 ind/ml daily enriched with *I. galbana* and *Nannochloropsis gaditana* at 100,000 cells/ml - 250,000 cells/ml. Wild zooplankton was collected once a week, fitted into 400 L tanks and fed microalgae. Fifteen larvae were sampled at days 3, 15, 30, 45 and 60 DPH for stomach analyses (**Figure 4**). Extracts of FAs (Bligh and Dyer, 1959) were analysed on starving larvae using GC-MS and the methyl ester of the C19:0 fatty acid as internal standard.

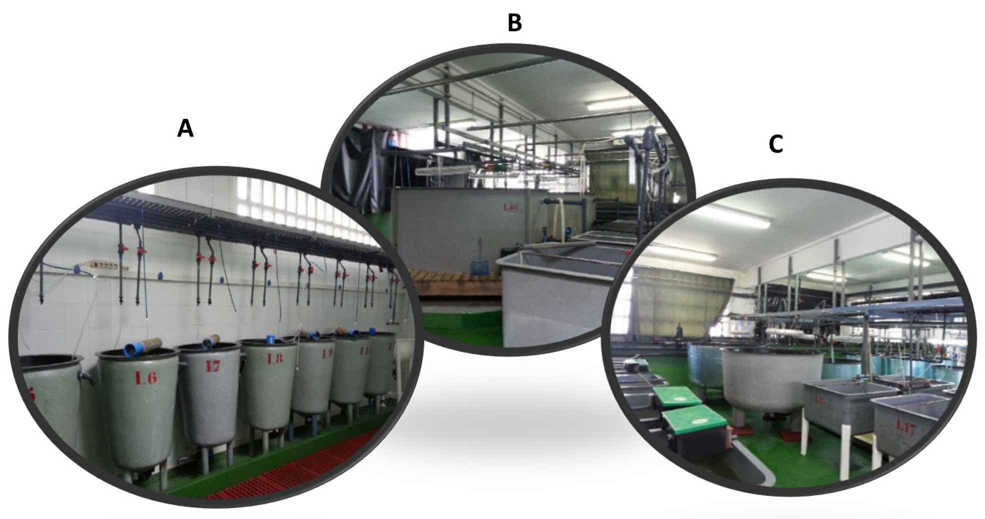

Figure 1. (A) Incubation tanks, (B, C) Hatchery

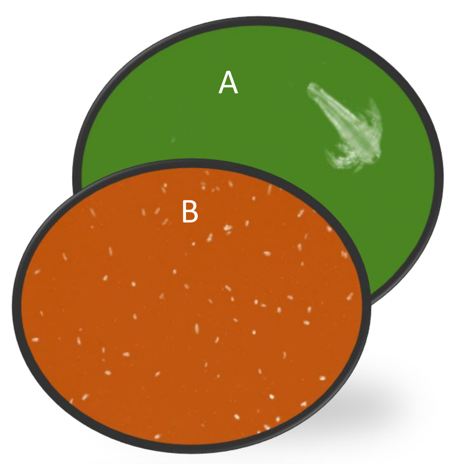

Figure 2. Traditional prey (A) Artemia, (B) Rotifer

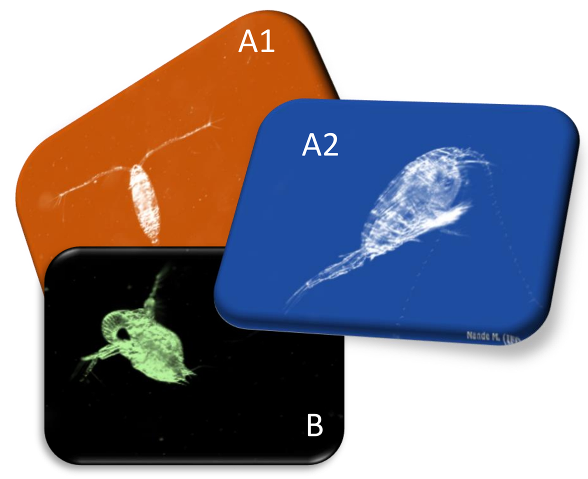

Figure 3. Zooplankton prey. (A1, A2) Copepods and (B) Cladocera

Results

Dry weight of 10 DPH larvae fed Z did not differ from A ($p < 0.05$). Significant differences in dry weight were seen between 15 DPH larvae fed Z or Z/R vs. those fed A or A/Z ($p < 0.05$) being bigger larvae fed A and A/Z. At 30 DPH larvae fed A showed half the weight of those fed Z/A. From 30 DPH to 45 DPH growth curve increased significantly from 0.65±0.2 mg to 2.4 ± 0.05 mg in larvae fed Z/A. At 45 DPH no significant differences were seen among larvae fed Z/A in different volumes assayed (**Figures 5 and 6**). FAs concentration at 1 DPH was 170 mg/g (dw); at day 3 DPH an increment of total FAs concentration was observed (185 mg/g) at 10ºC whilst it decreased slightly at the other two temperatures. After 7 DPH a sharp decrease (70 – 100 mg/g) was observed at the 3 temperatures and no survival was observed at 18ºC by 10 DPH. Total FAs decreased to 60 mg/g by day 13 DPH and the same trend was observed in the concentration of unsaturated, mono and polyunsaturated FAs, as well as the concentrations of 5c8c11c14c-20:4 (arachidonic acid) and the sum of 5c8c11c14c17c-20:5 + 4c7c10c13c16c19c-22:6 (EPA + DHA) (**Figure 7**).

Figure 4. Stomach contents. (a) 8 DPH, (b) 15 DPH, (c) 30 DPH and (d) 45 DPH

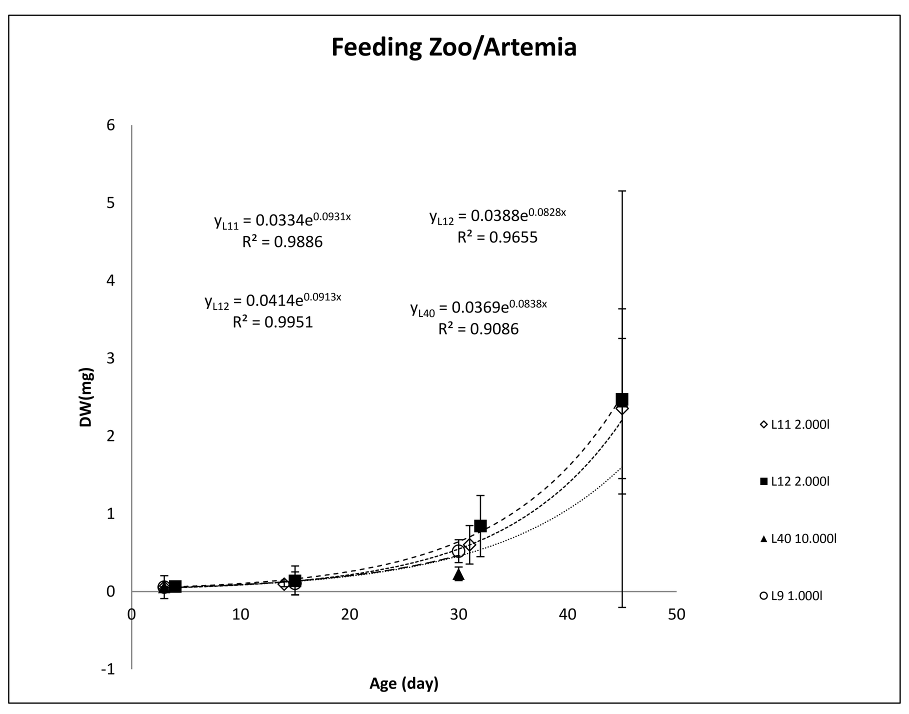

Figure 5. Growth rate of hake larvae fed Artemia and wild zooplankton

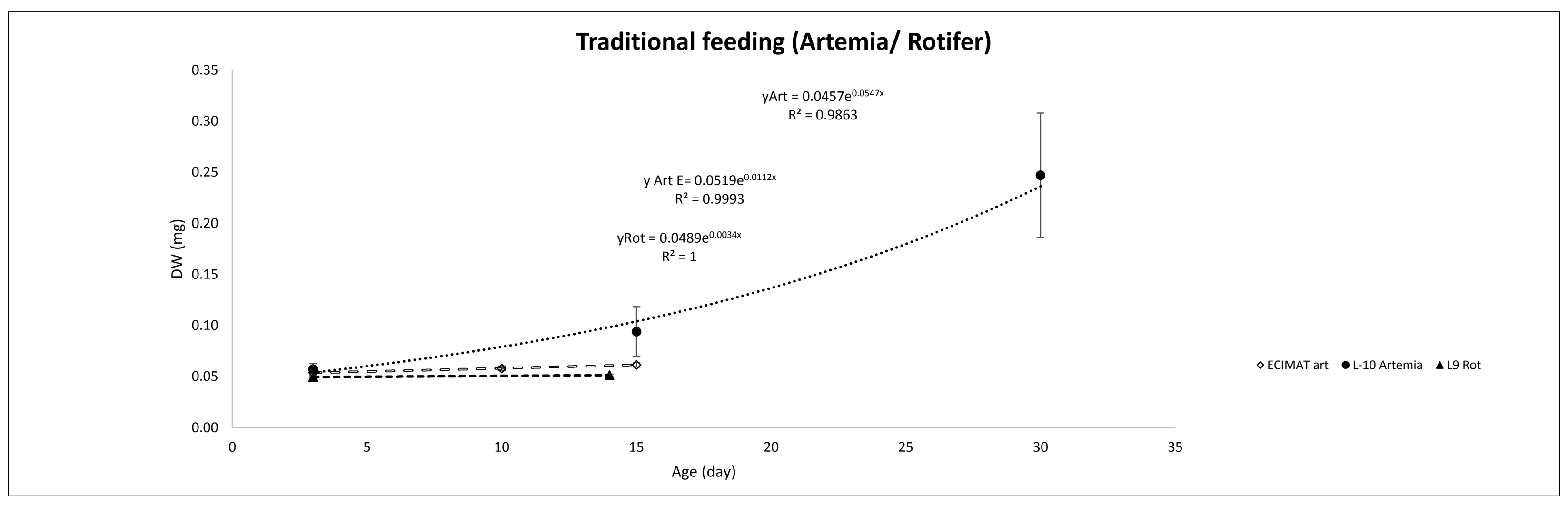

Figure 6. Growth rate of hake larvae fed Artemia and Rotifer.

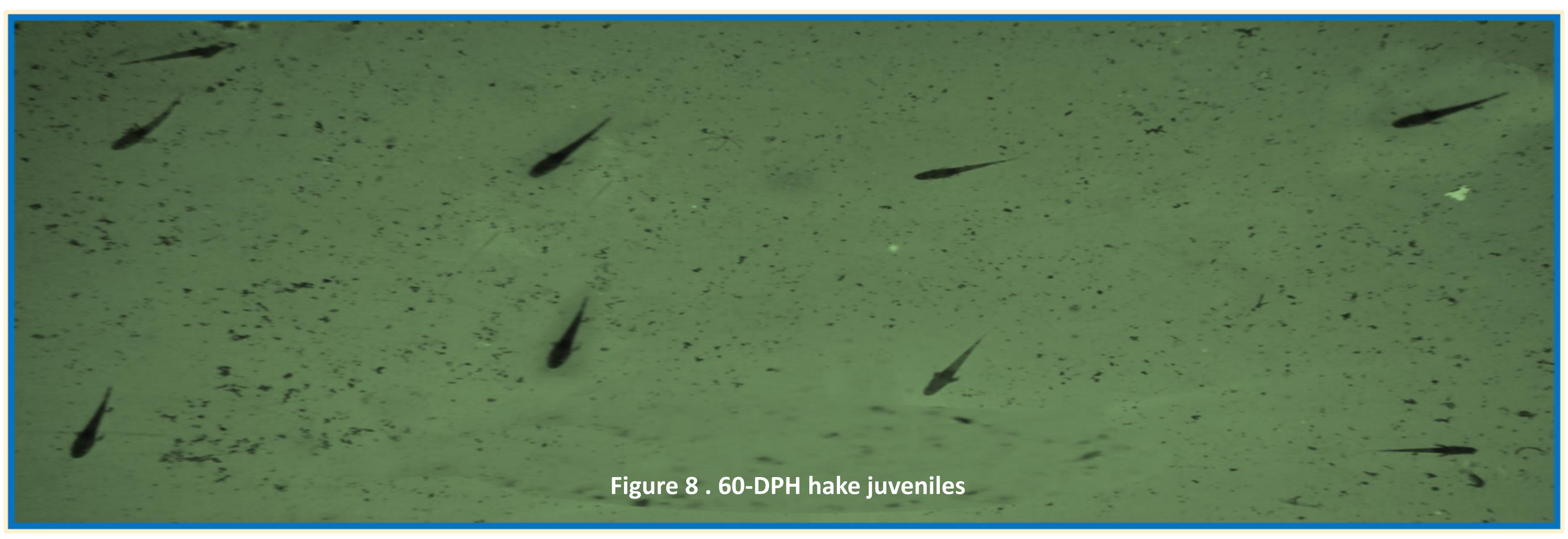

Figure 8 . 60-DPH hake juveniles

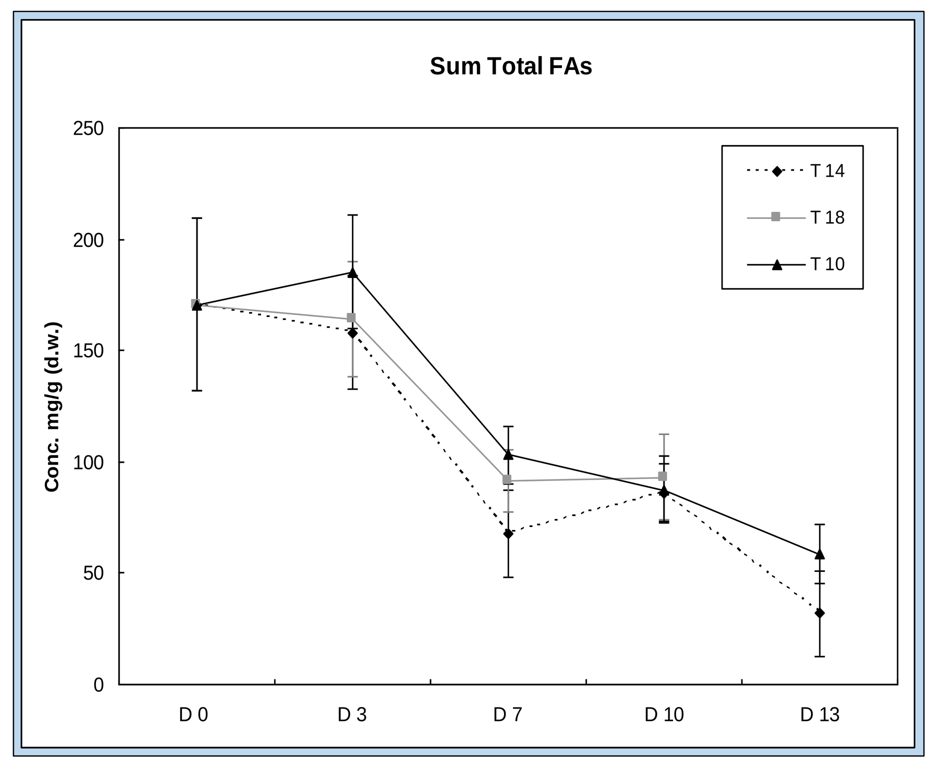

Figure 7. Composition of fatty acids during starvation period

Discussion and conclusions

From mouth opening (6 DPH) to 15 DPH larvae fail incorporating zooplankton but succeeded on Artemia (440 um x 150 um W L) (Iglesias et al. 2011). The influence of zooplankton on larvae weight was critical afterwards. Conjugated diets composed of small zooplankton (copepods nauplii and copepodites) and Artemia seem to be a successful strategy for first feeding in hake. The volume of culture tanks was positively correlated to larvae survival and no apparent significant differences appeared among FA types assayed.

References

Iglesias J., M. J. Lago, F. J. Sánchez & R. Cal. 2010. Capture, transport and acclimatation to captivity of European hake, *Merluccius merluccius* L.: preliminary data on feeding and growth. Aquaculture Research 41: 607-609.

Sánchez F.J., R. Cal, J.J. Otero, M.J. Lago, C. Gómez & J. Iglesias. 2011. The first spontaneous spawning of European hake *Merluccius merluccius* L.: characteristics of eggs and early larval stages. Aquaculture Research 2011, 1-5.

Iglesias, J., M.J. Lago, J. Otero, F.J. Sánchez & R. Cal. 2011. Tamaño de presa optimo en la primera alimentación de las larvas de la merluza europea, *Merluccius merluccius*. Proceedings XIII Congreso Nacional de Acuicultura. Madrid, Spain, Oct. 2011

Person-Le Ruyet, J., J.C. Alexandre, L. Thébaud, C.I Mugnier. 1993. Marine Fish Larvae Feeding: Formulated Diets or Live Prey? Journal of the World Aquaculture Society 24(2): 211–224.

Bligh, E.G. & W.J. Dyer. 1959. A rapid method of total lipid extraction and purification. Can. J. Biochem. Physiol. 37(8): 911-917.

Acknowledgements

The authors acknowledge the financial support through actions HAKEUP and HAKEU+ from the AEOE-ECIMAT strategic alliance funded by the Competitive Research Units´ Consolidation Program and co-funded by the European Regional Development Fund (ERDF) (Operative Program Galicia 2007-2013, Consellería de Cultura, Educación e Ordenación Universitaria of Xunta de Galicia). Support was also lent by Ministerio de Economía y Competitividad through project LETSHAKE co-funded by FEDER (AGL2013- 48468-R) and from IEO through project GENMOL2.