

FEEDING PROTOCOL IMPACTS ON GROWTH, SKELETAL ANOMALIES AND ORGAN ONTOGENY IN LARVAL ATLANTIC COD (*Gadus morhua*)

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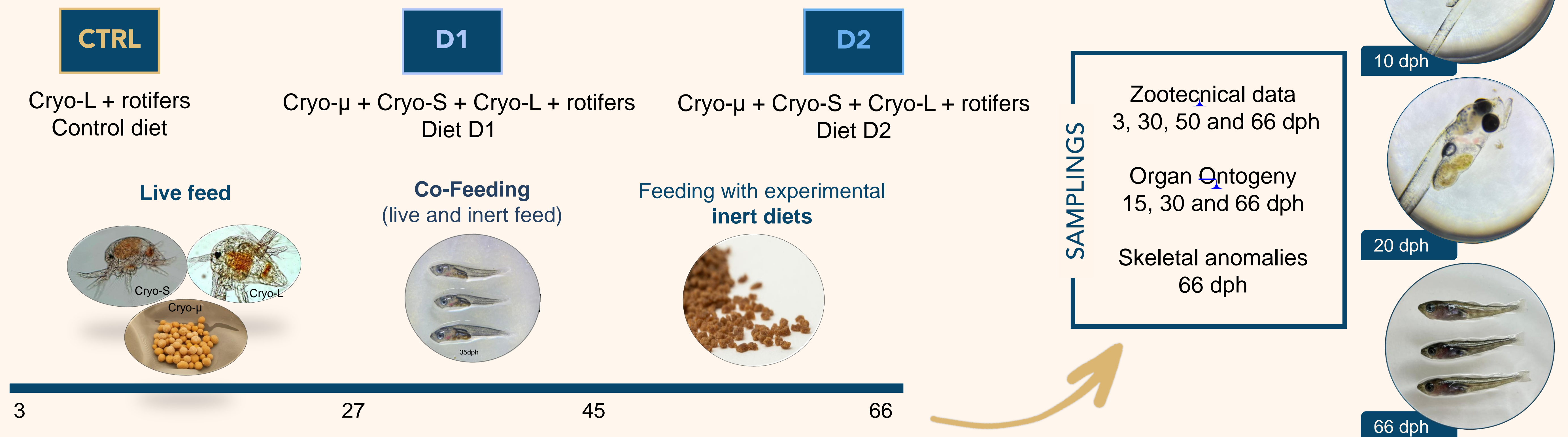
INTRODUCTION

Nutrition during Atlantic cod's early larvae stages is key to ensure juveniles' quality. Barnacle nauplii are a potential live feed for marine fish larvae in co-feeding protocols. The weaning phase also comprises challenges, hence the need for balanced microdiets including appropriate levels of essential fatty acids, present in the form of dietary phospholipids (PL), and/or triacylglycerols (TAG).

AIM Understand the potential of a start-feed protocol with barnacle nauplii and plankton eggs and two novel **micro diets** on survival, growth performance, skeletal anomalies, and organ ontogeny in Atlantic cod larvae.

MATERIALS & METHODS

This study included one control (CTRL) and two experimental groups (D1, D2), in triplicate, with different feeding protocols:



RESULTS & DISCUSSION

- Zootechnical results with the inclusion of barnacle nauplii follow previous studies with natural zooplankton, which is supported by similarities in their nutritional profile.

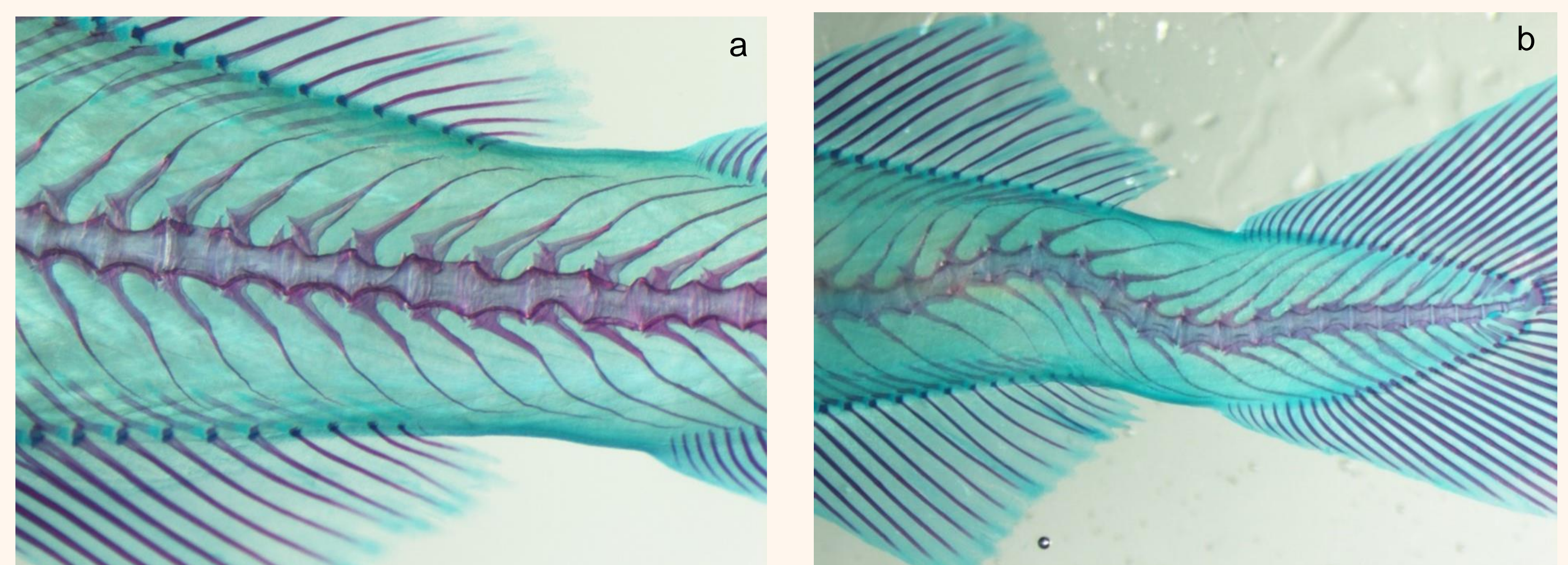
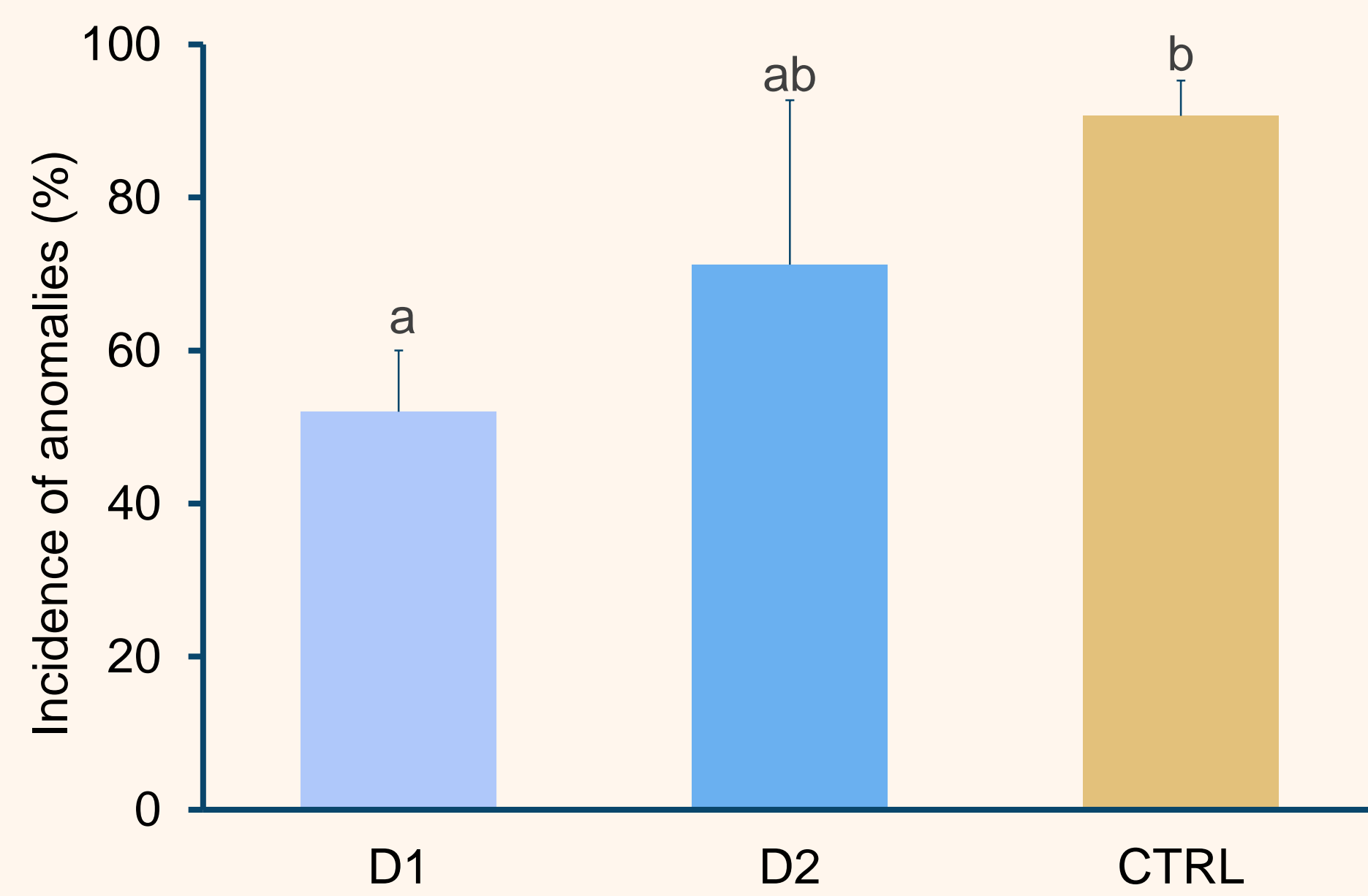


Fig.1. Examples of Atlantic cod larvae with a. malformed vertebrae and b. lordosis and kyphosis, observed at 66 dph, detected by double staining (alcian blue and alizarin red S).

- Group D1 exhibited a significantly lower incidence of skeletal anomalies, compared to CTRL, which could be related to the dietary PL source.
- Severe anomaly occurrence was 48% lower in group D1 and 27% lower in group D2 when compared to the CTRL.

Table 1. Adapted scoring system (1-5) for the histological evaluation of Atlantic cod larvae in anterior intestine, posterior intestine, liver and eye. ACLV refers to area covered with lipid vacuoles.

dph	Group	Anterior intestine Villi length/ Goblet cells	Posterior intestine ACLV	Liver ACLV	Eye Ontogeny
30	D1	4/-	4	4	4
	D2	3/-	4	4	3
	CTRL	4/-	2	2	3
66	D1	5/5	4	4	3
	D2	4/4	3	3	3
	CTRL	4/4	4	4	3

- D1 showed an overall accelerated organ ontogeny compared to D2 and CTRL, which could be due to PL origin.
- Delayed development in the CTRL compared to D1, likely due to beneficial effects of the D1 microdiet and its combination with the live feed protocol applied.

CONCLUSION

- The experimental group co-fed Cryo-μ, Cryo-S, Cryo-L and rotifers, and **micro diet D1**, resulted in cod larvae with a lower incidence of skeletal anomalies, and had a positive effect on organ ontogeny.
- These results highlight the potential for optimizing start-feed protocols for Atlantic cod larvae.

