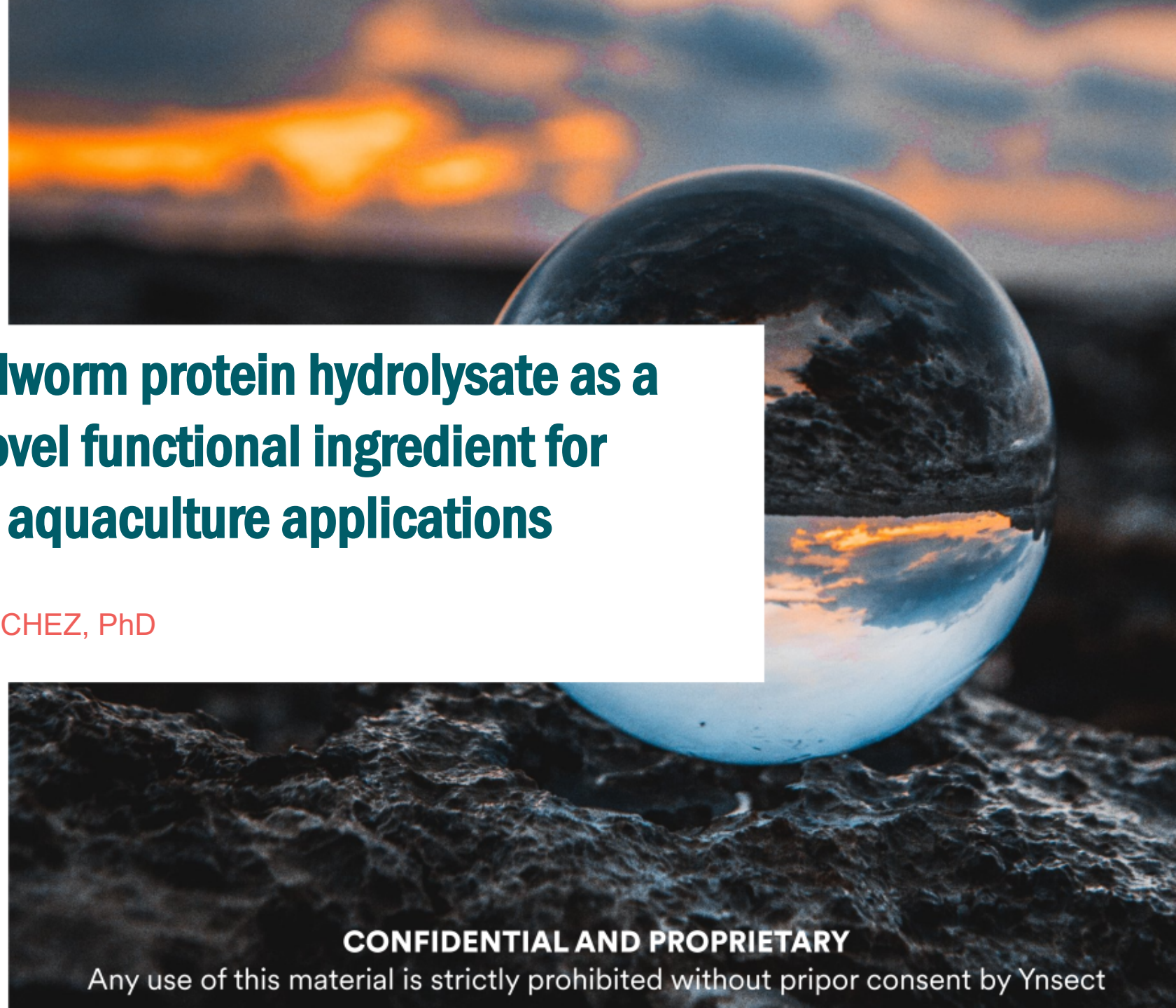
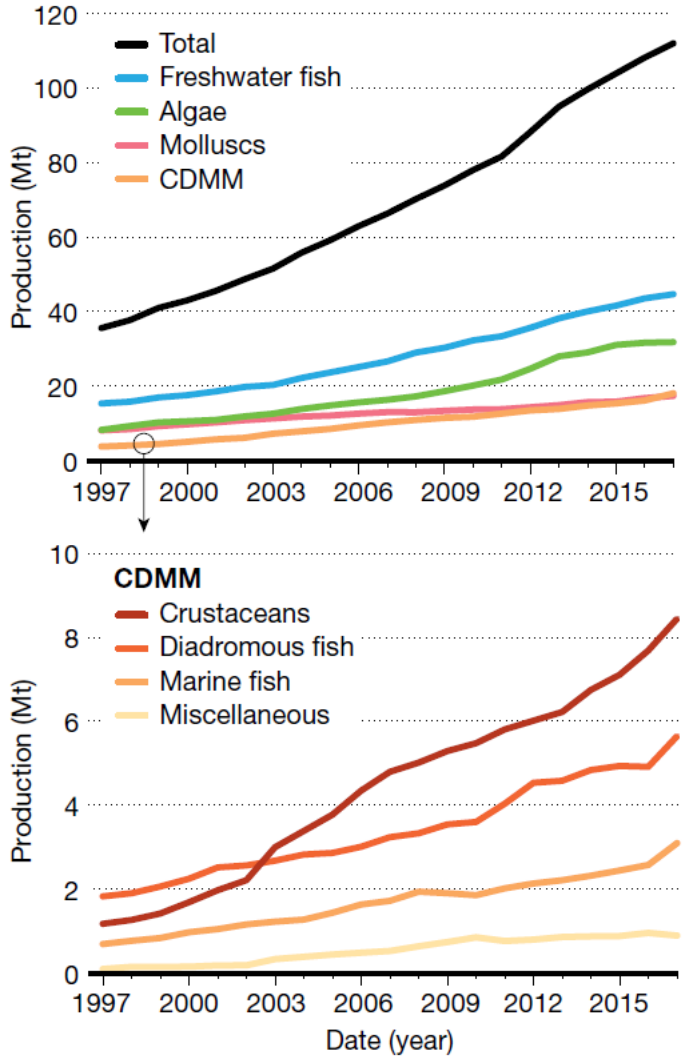
Mealworm protein hydrolysate as a novel functional ingredient for aquaculture applications

Lorena SANCHEZ, PhD



Aquaculture: A growing sector



(Naylor, 2021)

One of the fastest growing sector of the world food economy

> 10%/year

> 50%  consumed

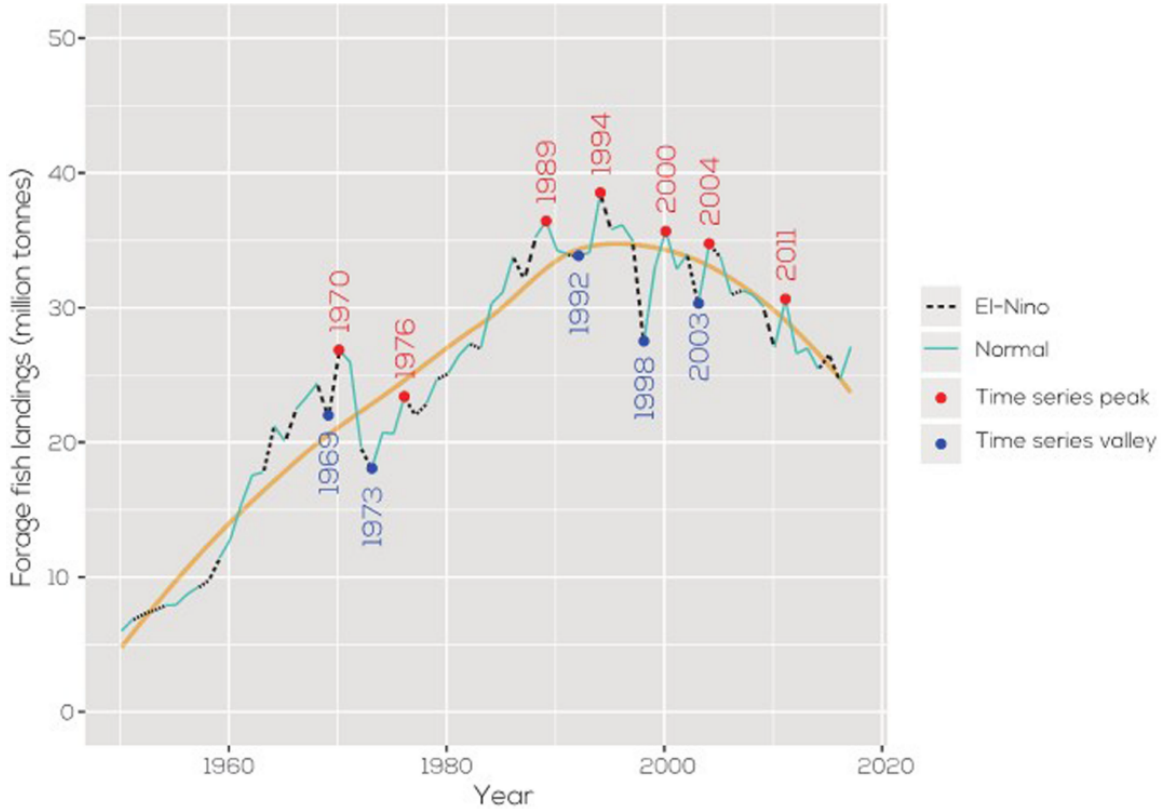
(FAO, 2018)

Relies on quality aquafeeds in which fishmeal (FM) produced from wild harvested fish is still considered the most effective protein source

(FAO, 2018)

Source: Naylor, R. L.; et al. A 20-Year Retrospective Review of Global Aquaculture. Nature 2021, 591 (7851), 551–563. https://doi.org/10.1038/s41586-021-03308-6.

Aquaculture: Challenges



(Naylor, 2021)

In wild capture fish since 2000

- Overexploitation
- Harvest restrictions

- Explore alternative ingredients

Dependance of FM and FO

Source: Naylor, R. L.; et al. A 20-Year Retrospective Review of Global Aquaculture. Nature 2021, 591 (7851), 551–563. https://doi.org/10.1038/s41586-021-03308-6.

Functional Aquafeeds Supplements

Specialty ingredients provide superior performance through incorporation of

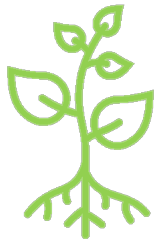
- Growth
- Health
- Survival

- Nutrient leaching from the feed
- Feces disaggregation / Diarrhea

Unique tailor-made functional aquafeeds that can boost profitability

Yeast extracts

Hydrolysates



Phytogenics

Probiotics

Prebiotics

Source: Soto, J. O., de Jesús Paniagua-Michel, J., Lopez, L., & Ochoa, L. (2015). Functional feeds in aquaculture. In Springer Handbook of Marine Biotechnology (pp. 1303– 1319). Berlin Heidelberg: Springer.

Hydrolysates in Aquaculture: Fish

Protein Sources

Hydrolysis

Peptide and AA enriched ingredient

Growth performance

Nutrient utilization

Immune response

Disease resistance

Increase feed palatability (attractant)

Simplify the biological nutrient uptake

Peptide bioactivities

Especially for larvae and juveniles

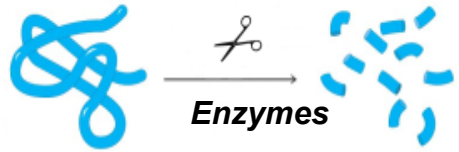
Low – Moderate Inclusion

5-10% replacement of FM

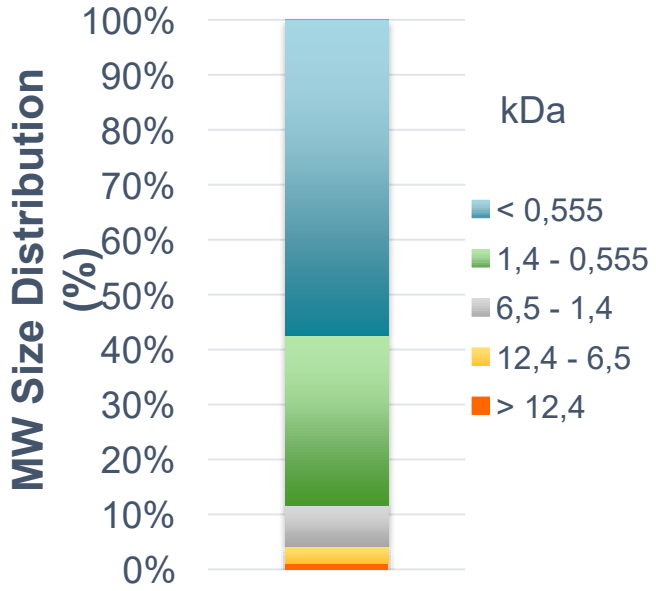
Source: Siddik, M. A. B.; et al. Enzymatic Fish Protein Hydrolysates in Finfish Aquaculture: A Review. Rev. Aquacult. 2021, 13 (1), 406–430. https://doi.org/10.1111/raq.12481.

Mealworm Hydrolysate

Enzymatically hydrolyzed *T. molitor* proteins



• Protein	**71.3%**	**15.6%**
• Fat	**14.1%**	**2.5%**
• Ashes	**4.2%**	**5.4%**
• Moisture	**5.7%**	**75%**
• Digestibility	**98.1%**	**100%**



99% Components **<12 kDa**

88% Components **<1.4 kDa**

Stable nutritional composition → production of a consistent end-product

Notes: Protein Kjeldahl – Nx6.25. Digestibility: Pepsic

Juvenile Trout Growth Performance Trial (RAS)

INSTITUTO TECNOLÓGICO AGRARIO

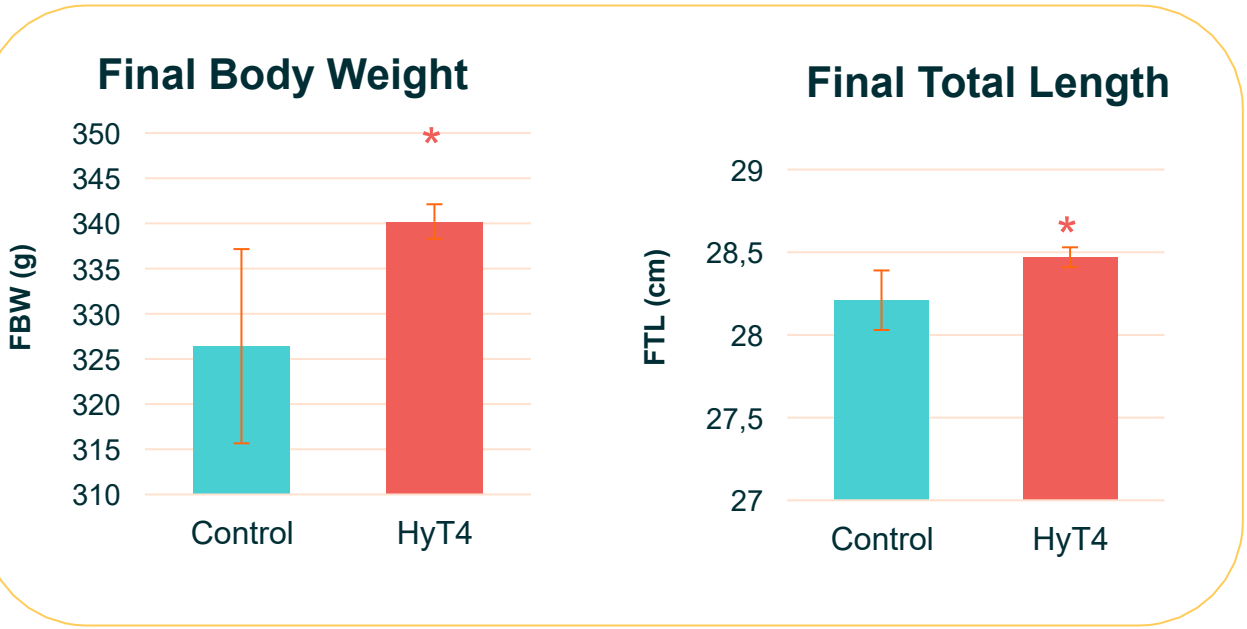
EXPERIMENTAL SETUP

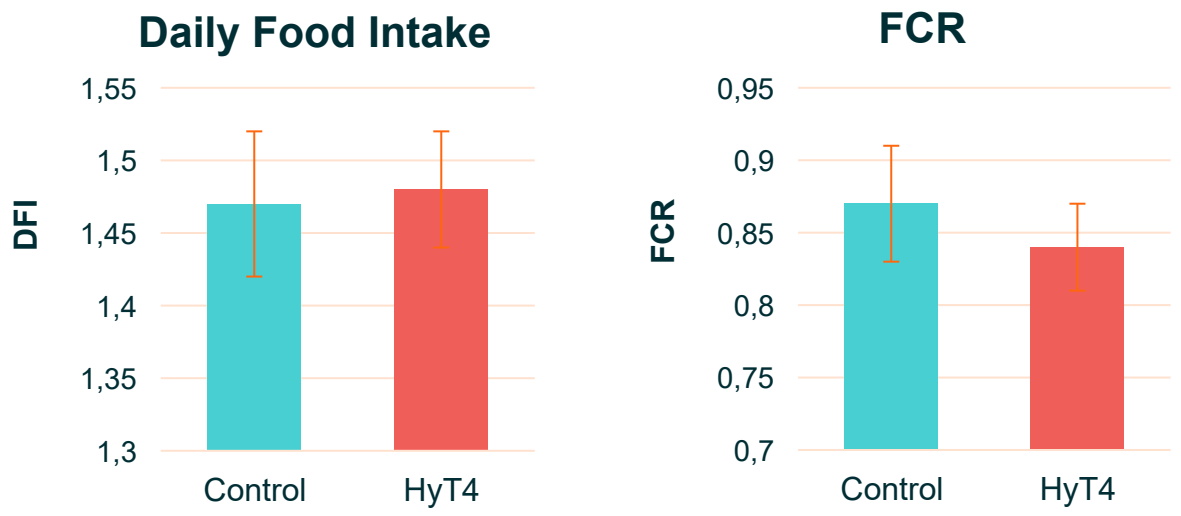
Hy_L: 4% (1% DM) [Coating]

Control: FM-based pellets

BW_i = 37.1 g

84-day assay





Values are expressed as mean ± standard deviation. Asterisk denote significant differences among experimental groups and Control group (Student t-test, $P < 0.05$; $n = 4$).

No significant differences in CF, **WG**, **SGR**, DFI, **FCR**, VSI, HSI

Salmon short-growth trial (RAS)

Norwegian University of Life Sciences

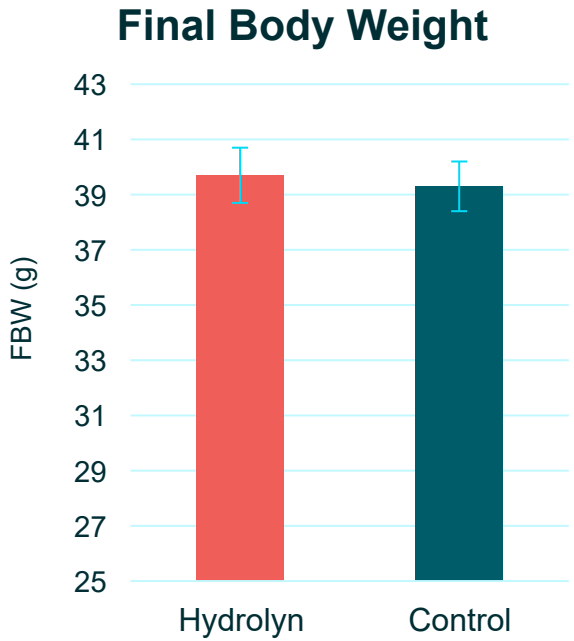
EXPERIMENTAL SETUP

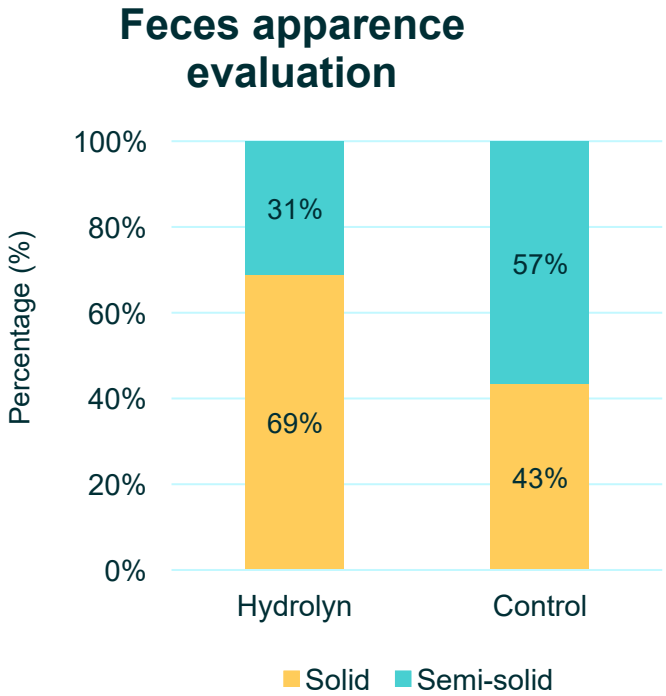
Hy_L: 4% (1% DM) [Coating]

Control: Skretting commercial pellets (no coating)

BW_i = 16.7 g

21-day assay





High Feed Intake for both diets: No appetite problem

Importance in RAS → Quality of water is critical

Conclusions

Novel functional aquafeed tested in juvenile Salmonoids as a model: Trout and Salmon

Mealworm-based protein hydrolysate (1% DM):

- Higher fish growth performance
- Improved feces consistency → water quality (RAS)

Potential to have a role on the pathway to more sustainable practices.

Acknowledgements

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Ynsect