



European Commission

Production of high quality fish feed from enchytraeid biomass

Denmark



DESCRIPTION OF THE PROJECT

Today, fish fry production is based almost exclusively on rotifers and Artemia, which both need to be enriched with fish oils or algae before use. This is expensive and time-consuming and the nutritional quality of these types of live feed is not optimal.

This project proposes utilizing decomposing seaweed as a substrate for the mass production of enchytraeids to be used as feed and/or feed ingredient for aquaculture. The focus species ('*Enchytraeus*') occurs naturally in decaying seaweed and may reach enormous densities. *Enchytraeus* has an ideal nutrient composition with high protein and lipid content and abundant long chain omega-3 fatty acids (FA).

The project hypothesizes that *Enchytraeus* can be industrially mass produced in the right conditions and provide a feed ingredient surpassing, in quality and sustainability, the ingredients obtained from fish and insect meals.

The project found that the highest growth rate of *Enchytraeus* occurred at 15-22 °C and a salinity of the substrate between 8 and 15 ppt. Using potting soil mixed with dried and re-wetted seaweed as a substrate it was shown in laboratory scale trials that ca. 90 g fresh biomass per L substrate per 3 months can be produced. In semi-industrial mass production scale, the team could produce ca. 200 g fresh biomass per 6 L substrate per 2 months with relatively little man-power and running costs.

The team developed a highly efficient extraction procedure (>90% efficiency) based on heat extraction and have used hundreds of kg *Enchytraeus* biomass in trials with 6 species of fish. The laboratory experiments indicate that

Enchytraeus can synthesize important omega-3 fatty acids de novo (i.e., without essential precursors in the feed given to the worms), and the produced worms have a reasonable content of EPA and other long-chain fatty acids. *Enchytraeus* have about 50% protein on a dry weight basis, and the amino acid profile is highly suitable for fish feed.

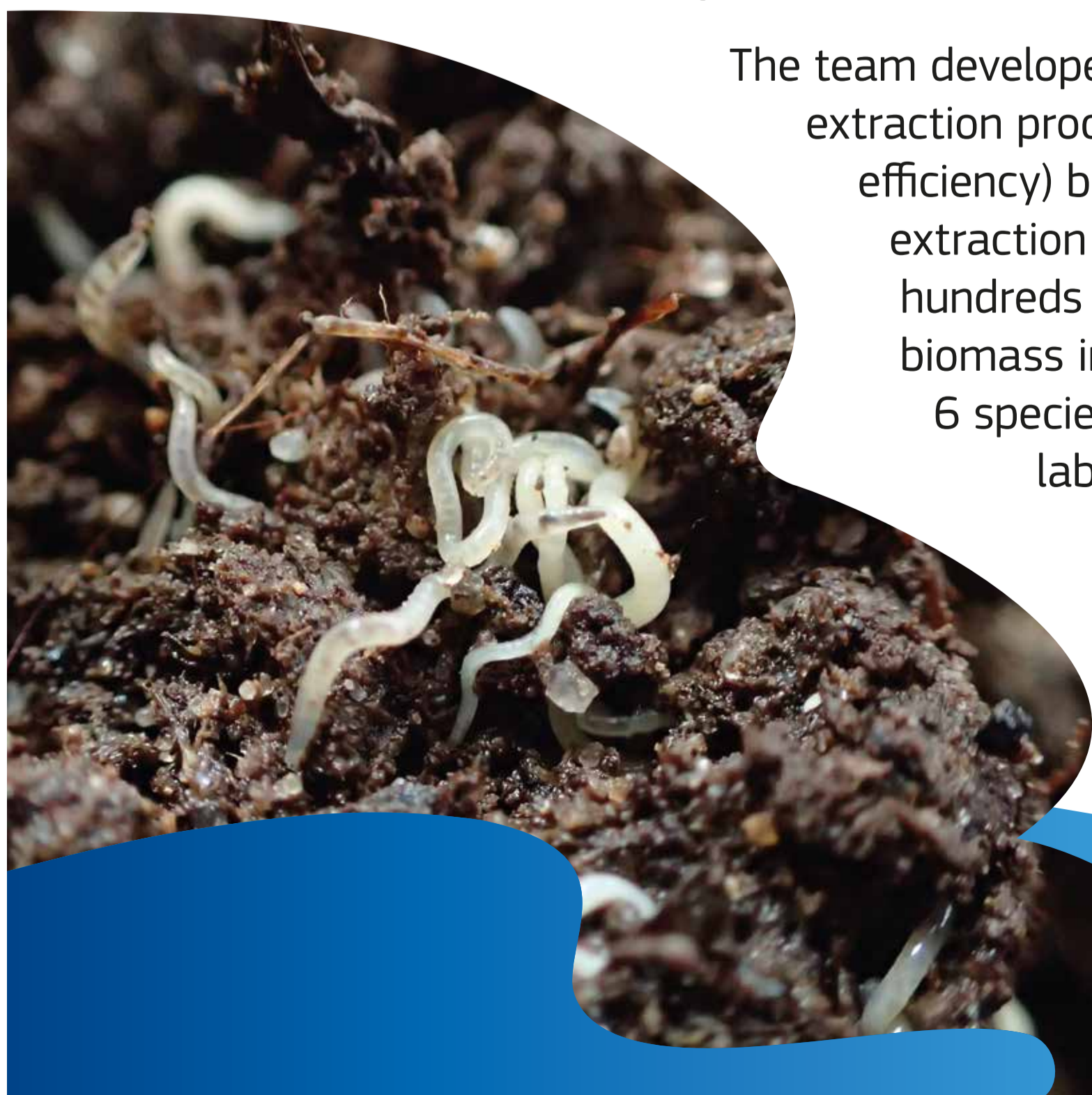
The team tested the utility of live *Enchytraeus* for young juveniles of six species of cultured fish. Turbot, flounder and white fish grew significantly better on live worms than on a standard dry feed. Halibut and ballan wrasse grew just as well, whereas *Enchytraeus* was not a suitable live feed for kingfish.

MAIN OUTCOMES OF THE PROJECT

- Initiatives and new types of feed that promote the production of fish in aquaculture and contribute to reducing the emission of greenhouse gases.
- *Enchytraeus* can grow on industrial organic residues and thus contribute to a circular bio-economy.
- *Enchytraeus* as live food can replace marine food sources and thus reduce fishing pressure on the marine environment.
- Cryopreserved *Enchytraeus* as live feed has the potential to revolutionize aquaculture as we know it, by ensuring growth potential and survival of currently cultivated fish species in aquaculture and enabling the rearing of new fish species in aquaculture.
- by using *Enchytraeus* worms as live feed the fish farmer can postpone weaning onto dry feed until the fish is large enough to eat and utilize dry feed optimally.

FACTS AND FIGURES

Amount of payment	1.243.299,26 million DKK (75% EU, 25% national)
Program	EHFF



FAMENET