

**Seafood sustainability: Novel aquafeed for biofortified Common Carp**



**SUMMARY**

Common Carp (*Cyprinus carpio* L.) is a freshwater fish species farmed extensively throughout Europe, Asia and Latin America. Carp has a variable nutrient content, and usually contains low levels of omega-3 fatty acids in its muscle. Carp's nutritional quality for human consumption can be improved by selecting the right feed composition and enrichment with nutrients. This knowledge output consists of a novel fish feed blend for common carp, which is biofortified using sustainable ingredients derived from macro and micro algae, and yeast. The blend has been formulated, manufactured and tested at a pilot scale. Nutritional value, safety, economic viability, and legal compliance for use in animal feeds were assessed. Results show improved nutritional value of common carp fillets farmed using the novel feed, with high market acceptance and lower production costs. The blend complies with legal and safety standards.



**KNOWLEDGE NEED**

Fish is a rich source of important nutrients including trace minerals such as iodine and selenium, and fatty acids such as omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Biofortification of fish through nutritional enhancement of their feed is a potential strategy to ensure better intake of these essential elements in human diets, and to overcome nutritional deficiencies. To establish farmed fish as a future successful functional food, there is a need to know the effect of enriching fish feeds with iodine, selenium and fatty acids on the final fish product, in terms of nutritional value, safety and legal compliance.



**RESULTS**

This Knowledge Output concerns the effects of a biofortified fish diet with salmon oil, iodine-rich seaweed and selenised-yeast on essential and toxic elements levels in common carp (*Cyprinus carpio*). The fortified diet resulted in increased iodine, selenium and iron, and lower copper and bromine in biofortified carp muscle. They did however increase arsenic and mercury in the fillets. The consumption of 150 g of fortified carp enabled a significantly higher contribution to the daily recommended intake (DRI) of iron (21%) and selenium (88%) than non-fortified fish. Moreover, the exposure to lead decreased with the consumption of biofortified carp (26–95%). In addition, the effect of carp feeding with omega-3-enriched feed (*Schizochytrium* sp. meal or salmon oil) on nutritional quality indicators and culinary quality was evaluated. Fillets obtained from carps fed with the experimental feed contained less protein and more crude fat and had larger muscle fibres, but scored higher in the sensory evaluation of moisture and fishy taste. The use of *Schizochytrium* sp. meal as a source of EPA and DHA gave much better results than salmon oil, as it allowed a higher content of these valuable fatty acids to be reached, without compromising quality. However, to meet the demands of the carp sector (no cost increase), feed fortified with salmon oil was chosen for the farm scale trial. These results support the strategy of developing eco-innovative biofortified farmed common carp using sustainable, natural, safe and high-quality ingredients in feeds, to enable consumers to overcome nutritional deficiencies without significantly increased feed costs.



**IMPACTS**

Availability of fortified farmed fish may enable consumers to overcome nutritional deficiencies, which could contribute to an improved health profile of the European population. Reducing the need for fish meal and oils, this knowledge also contributes towards improving the ecological and social sustainability of fish feeds. It has the potential to reduce the environmental impact of fish farming and improve consumer perception of the industry.

**Contributes to the UN Sustainable Development Goal 12:** Responsible consumption and production.

## END-USERS & APPLICATIONS

➔ **Common carp feed producers:** can use this knowledge to develop and produce novel feed formulas for carp, resulting in a functional food with improved DRI of iodine and selenium in human diets, as well as increased fatty acids, while reducing the environmental impact of aquaculture and lowering costs.

➔ **Common carp farmers and producers:** can use the functional feeds to improve the quality and nutritional value of their fish, while at the same time maintaining production levels and promoting aquaculture as a sustainable and environmentally friendly sector.

➔ **Scientific community:** aquaculture researchers and those working in the area of seafood sustainability can use the validated datasets and new knowledge to support further Research and Development on the effects of sustainable fish feeds on fish production and welfare.

## DISSEMINATION AND EXPLOITATION

### Scientific publications:

- Barbosa V *et al.* (2020). Enriched feeds with iodine and selenium from natural and sustainable sources to modulate farmed gilthead seabream (*Sparus aurata*) and common carp (*Cyprinus carpio*) fillets elemental nutritional value. *Food and Chemical Toxicology*, 139, 111330. DOI: 10.1016/j.fct.2020.111330
- Sobczak M *et al.* (2020). Quality improvement of common carp (*Cyprinus carpio* L.) meat fortified with n-3 PUFA. *Food and Chemical Toxicology*, 139, 111261. DOI: 10.1016/j.fct.2020.111261
- Eljasik P *et al.* (2020). Plasma biochemistry, gene expression and liver histomorphology in common carp (*Cyprinus carpio*) fed with different dietary fat sources. *Food and Chemical Toxicology*, 139, 111300. DOI: 10.1016/j.fct.2020.111300
- Open access versions of all publications and validated data sets are available at [seafoodtomorrow.eu](https://seafoodtomorrow.eu)

### Exploitation activities for policy makers:

- Managers, regulators and policy makers will be reached through the final **SEAFOOD<sup>TOMORROW</sup>** event, EC info session, and a dedicated EU policy event.

### Exploitation activities for seafood industry:

- Aquaculture industry magazine: Eljasik P, Sobczak M. (2019) Karp nie tylko od święta. *Magazyn Przemysłu Rybnego*, 4 (130), 54-55.
- IPMA, ZUT and SPAROS have reached carp farmers in Poland and shared this knowledge through pilot trial of the feeds.
- Horizon Results Platform: [seafoodtomorrow.eu/horizon-results-platform](https://seafoodtomorrow.eu/horizon-results-platform)
- The seafood industry and scientific community have been reached through oral presentations at several national conferences in Poland.

### Dissemination activities for society / all users:

- Project newsletter and news articles
- Promotion on Twitter and LinkedIn



## INNOVATION STATUS

Technology Readiness Level 7 – system prototype demonstration in operational environment

**Patents and IPR:** Not applicable. Knowledge generated in the project has been widely disseminated and is open to industrial use.



## FUTURE RESEARCH

A potential area for further studies would be on fortified nutrients bioaccessibility and bioavailability. Additional collaborative tests should be performed between feed producers, carp farmers and the retail sector to further demonstrate the benefits of the biofortification strategy in terms of human nutrition and market economics. To complete and qualify the system, the potential impacts must be showcased to attract investors to support further Research and Development, bring this solution to market, and carry out further market analysis.

## CONTACT AND CONTRIBUTORS

**Contact:** Piotr Eljasik , [peljasik@zut.edu.pl](mailto:peljasik@zut.edu.pl) | Małgorzata Sobczak, [msobczak@zut.edu.pl](mailto:msobczak@zut.edu.pl) | Remigiusz Panicz, [rpanicz@zut.edu.pl](mailto:rpanicz@zut.edu.pl)

**Contributors:** ZUT, Sparos, IPMA

