

Advanced feeding strategies for enhanced and circular sustainable livestock and aquaculture production

How do they work?



FISH

FEFAC asked in autumn 2022 to its members what they can do to support the European livestock and aquaculture in the transition towards more sustainable production practice. This consultation showed that **animal nutrition has the potential to address many challenges** that may be common to all species or species specific and are applicable to all or some production systems (intensive, extensive, organic, etc.).

The purpose of this factsheet is to provide general information on **how animal nutrition solutions specific to fish work** to address key priority challenges, broken down in three categories: **environment, animal health and animal welfare**. It complements the fact sheet on feeding techniques applicable to all species.

In addition, a number of **specific techniques, strategies and formulations**, supported by strong scientific evidence have been selected by FEFAC members and **showcased on the [FEFAC website](#)**, with detailed information on the conditions of use, the trade-offs, the economic aspects, the regulatory limitations when exist, as well as bibliographic references (mostly meta-analysis) for those who want to learn more.

ENVIRONMENTAL CHALLENGES

One of the most important environmental challenges for fish feed is the **risk of halieutic resource depletion** linked to the feeding of fish with fish meal and fish oil produced from wild fish. With the huge development of aquaculture worldwide, the need to secure sustainable management of marine fish has become critical and sustainability schemes have been developed during the last decades to secure that fishmeal/fish oil from wild fish used in the EU nowadays are from sustainable sources.

Another important and specific issue for aquaculture is the **prevention of feed wastage**: since the feed is distributed in water, any surplus feed not consumed by fish can deposit at the bottom of deep water.

The key environmental challenges identified by FEFAC members where animal feeding strategies can play a specific role for ruminants are i) **halieutic resource depletion**, further integration in **circular economy** and iii) **nutrient losses**.

How can animal feeding strategies help aquaculture address environmental challenges?

Concerning the replacement of fish-derived feed ingredients, attention was initially put on substituting animal-based proteins with plant-based proteins. However, a plant-based diet has a negative impact on the gut health of carnivorous fishes. Therefore, attention is now put on **using sustainable products of animal origins for feed use**.

- Priority number one is the use of **fish trimmings** coming from the processing of wild and farmed fish, in compliance with the intraspecies recycling ban. This contributes to improving the contribution of aquaculture to the circular bioeconomy.
- The second priority is to use **proteins and oils&fats from farmed insects and polychaetes fed with by-products from the circular economy**. At this stage, it is not legally permitted to feed insects or polychaetes with catering waste or with other non-edible vegetable biomass such as sludge including from fish farming.
- The third priority is to use natural marine resources from lower trophic levels and not used for human consumption: this is the case in particular of **krill and zooplankton**. The exploitation of these resources requires a good understanding of the quantities that can be used without affecting marine biodiversity and ecosystem balance.

Another option is to use **proteins and oil (omega 3) produced with microorganisms such as bacteria, yeasts, fungi or microalgae**.

As far as minimization of **losses of nutrients** is concerned the attention is put on three strategies:

- **Controlling the distribution of feed**: precision feeding based on videos enables to better control of the amount of feed distributed to animals.
- **Increasing the retention of the feed in water**: the incorporation of gums and fats in feed increases the duration of flotation of the feed in water and therefore delays its deposition and sedimentation under cages.
- **Recovering of nutrients**, including from fish faeces by **growing algae** for feed use.

ANIMAL HEALTH CHALLENGES

Like other species, **infectious diseases** are a major threat to fish health. This is even more problematic for carnivorous species, due to the increased need to replace part of the fishmeal with other protein sources preferably from animal origin. Diets based on vegetal proteins are indeed known to have a direct effect on gut microbiota and intestinal barrier. So far, animal protein sources other than fishmeal

are in limited quantities at the moment and pending the supply increases, proteins from plant origin are currently the most important alternative.

How can animal feeding strategies support fish health?

Among all potential dietary interventions to help animals face potential pathogenic challenges, the use of **probiotics and yeast** in fish feed are among the most effective solutions to support fish gut health and ongoing research on **bacteriophages** shows also promising results.

ANIMAL WELFARE CHALLENGES

The science around the welfare of fish is under development. So far, one of the most critical parameters affecting the welfare of fish is **parasites**, in particular sea lice.

How can animal feeding strategies support fish welfare?

One strategy to reduce the exposure of fish to sea lice is to **deliver the feed at a depth below 10 meters** since sea lice larvae are usually present in surface waters.