



The organic trout farm Skravad Mølle between Viborg and Hobro, Denmark produces about 8 tonnes of portion sized organic rainbow trout per year

Organic Aquaculture

– the link between sustainable production and superior products

The first Danish organic rainbow trout with the Danish red Ø label was introduced to the market in 2005. The demand for organic trout is increasing and Danish trout farmers are currently converting to organic production. However, the development of organic trout production in Denmark has been challenged by a very strict national legislation for organic aquaculture production.

The objectives of the research include the most critical areas in the chain that forms the link between organic feed production, organic fish rearing, and the consumer. The main focus is on organic fish feeds in which non-renewable fishmeal is partially replaced by sustainable organic vegetable proteins.

Aquaculture production

The global production of fish in aquaculture amounts to about 50 million tonnes. The wild catch amounts to about 95 million tonnes, of which fish for human consumption accounts for about 60 million tonnes. This means that about 45 % of the consumed fish is produced in aquaculture. FAO estimates that the request for farmed fish will have increased by a further approx. 40 million tonnes by year 2030. Aquaculture is thus growing more rapidly than all other animal food-producing sectors due to increasing demand and a concurrent decline in wild capture fisheries.

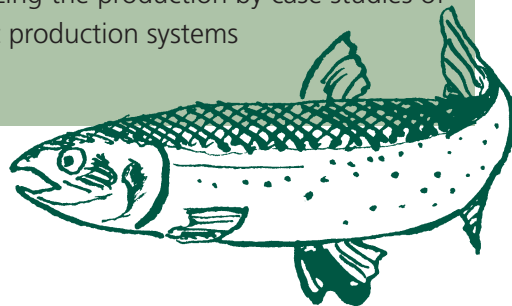
Danish aquaculture produces about 40,000 tonnes of rainbow trout and about 2,000 tonnes of European eel. The organic production includes rainbow trout, which amounts to about 1 % of the total production.

Sustainable Organic Fish Feed

Fish feed is one of the most important factors in aquaculture production. It is widely anticipated that global aquaculture expansion will encounter an inevitable future shortfall of non-renewable resources such as fishmeal and fish oil, necessitating the exploration of alternative strategies for fish feeds. The principles of organic aquaculture encourage the development of feeds that do not deplete global fish stocks. Fish discard and cut-offs may be potential alternative ingredients, but this conflicts with the Danish environmental regulations because of their high phosphorus content. Intuitively, partial substitution of fishmeal and fish oil by sustainable organic plant protein and oil sources seems a good alternative, since fish feed (including organic) contains more than 60 % fishmeal on a fat-free basis.

The objectives of the ORAQUA project are to investigate

- ▶ Availability of relevant organically produced vegetables with a high protein content
- ▶ The effect of the organic vegetable protein sources on growth and digestibility in rainbow trout
- ▶ The influence of organic protein and oil on eating quality
- ▶ The influence of organic vegetables on the health and welfare of farmed fish
- ▶ Optimizing the production by case studies of organic production systems



Protein content in organic vegetables

The main focus is on the need for competitive, organically produced vegetables with a high protein content. As plant crops generally have a lower protein content than fishmeal, this also includes the possibility of concentrating the protein fraction of existing protein sources with a relevant amino acid profile compared to that of fishmeal. The plant crops pea, rape and lupine have been processed and the protein fractions elevated to 72 %, 37 % and 55 %, respectively. In comparison, fishmeal contains 70 – 72 % protein and regulations stipulate that the fishmeal used in aquaculture production should come from sustainable stocks.

Experimental diets are produced based on optimized feed recipes. In contrast to conventional feed, synthetic amino acids are not allowed in the optimisation of the amino acid profile in organic fish feed.

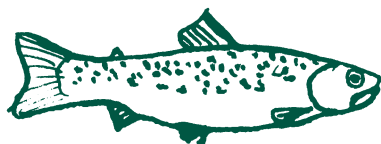
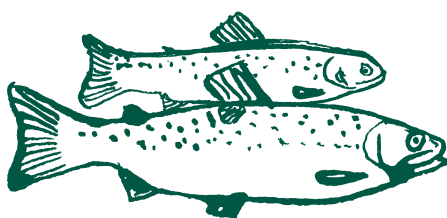


Fish performance indicators

The qualities of the organic feed recipes are studied in terms of their digestibility and nutrient availability. These studies, in turn, are related to analyses of fish performance indicators such as:

- ▶ Feed conversion efficiency
- ▶ Specific growth rate
- ▶ Health
- ▶ Welfare performance

Case studies are carried out to optimize current production systems. The studies also include field studies of selected experimental feed from the pilot experiments as well as monitoring of the general health and welfare status of the fish.



Health status in organic production

Health status and disease susceptibility may also be affected if an altered feed composition (for example, the replacement of fishmeal with vegetable sources) is insufficient with regard to essential nutrients like amino acids and vitamins or may harm the digestive tract of the fish. This latter consideration is of particular relevance because the production of organic rainbow trout allows the usage of only one antibiotic treatment in a full production cycle. That is, between the time the fish enter the farm at approximately 25 g and until slaughter. This requires attention to husbandry practices that improve fish welfare and prevent diseases. In particular, prophylactic measures such as vaccination may be important in organic production.

The impact of organic feed recipes on product quality will be investigated to ensure that organic fish are of high quality. This will comprise objective sensory and biochemical analyses of the flesh to obtain an overall picture of their eating quality.

The project addresses some of the major challenges to a successful development of sustainable organic fish farming in Denmark.



Warm smoked organic trout with a compote of raisin.

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Publications

Jokumsen, A. (2006): Gennembrud for økologiske fisk. *Økologisk Jordbrug*, 366. (In Danish)

Jokumsen, A. (2006): Vidensyntese om økologisk fiskeopdræt. *Nyhedsbrev fra FØJO, august 2006*. www.foejo.dk

Jokumsen, A., Larsen, V.J., Dalsgaard, I., Nielsen H.H., Jessen, P. og Kold, J.: (2006): Økologisk Fiskeopdræt. Vidensyntese om udviklingsmuligheder indenfor økologisk fiskeopdræt i Danmark. *FØJO rapport nr. 21, 2006*.
Redaktør: A. Jokumsen. 110 sider. (In Danish)

Jokumsen, A. (2008): Flere økologiske fisk. *Økologisk Jordbrug*, 405. (In Danish)

Links

Project website: www.oraqua.elr.dk/uk
www.eco-aquafish.dk

About ICROFS

The International Centre for Research in Organic Food Systems (ICROFS) is a "centre without walls" where the research is performed in interdisciplinary collaboration between research groups in different institutions. The centre is an expansion of the former research centre DARCOF, which the Danish Government in 2008 decided to give an international mandate and an international board.

The main purpose of ICROFS is to coordinate and monitor international research in organic food and farming systems in order to achieve optimum benefit from the allocated resources. Further, the aim of ICROFS is to initiate research and create impact of the research results through support and dissemination of high quality research of international standard.

More information at www.icrofs.org

