EUROPEAN ASSOCIATION OF FISH PATHOLOGISTS 9-12 SEPTEMBER 2019 PORTO, PORTUGAL

FINNISH FOOD AUTHORITY
Ruokavirasto • Livsmedelsverket

# Feed associated rainbow trout gastroenteritis (RTGE) in a recirculation aquaculture system (RAS) fish farm

Viljamaa-Dirks S, Enbom T

*Veterinary Bacteriology and Pathology, Finnish Food Authority, Kuopio, Finland*

## Background

- Recirculating aquaculture systems (RAS) are an important future technique as an environmentally friendly production of animal protein.
- The possibilities to control water parameters are better than in conventional flow through systems.
- Each system is unique and acquires specific knowledge of the technical performance in relation to the local water parameters, and anything added to the system, including fish and feed.

## Aim of the study

- To study the reason for a case of elevated mortality in a RAS farm in connection with a specific fish feed.

## Materials and Methods

- Rainbow trout 100-400 g in size experienced elevated mortality.
- The fish were examined by routine pathological, bacteriological and virological methods.
- Suspicion of the involvement of the experimental feed used in the farm: the diet of two fish groups (tanks 1 and 2) was changed to a commercial feed.
- After ten weeks fish in Tank 2 got the original feed again in a slightly different format, while the fish in Tank 1 was continued with the commercial feed.
- Before switching the diet and after six weeks 10 fish from each of the tanks were studied for histopathological changes in the epithelium of the alimentary canal. The level of supranuclear vacuolization in the columnar cells and the number of mucous cells, lymphocytes and necrotic cells was classified into categories normal or not seen (0), slightly elevated (1), elevated (2), and clearly elevated (3) in the epithelium of the stomach, pyloric area and lower intestine.

Figure 1. Gastric dilation and haemorrhagic intestine of rainbow trout juveniles with RTGE-syndrome.

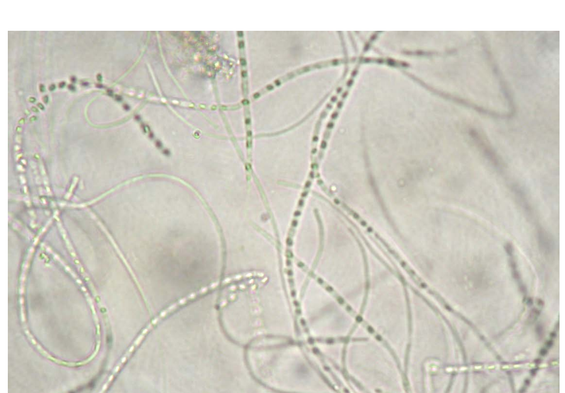

Figure 2. Slender filamentous bacteria (SFB) associated with RTGE syndrome in the intestinal content of rainbow trout. Light microscopy 400x

## Results

- Initially the fish exhibited signs of digestive problems including a dilation of the stomach packed with feed or watery mucus (Fig. 1).
- The intestine was unevenly filled, sometimes containing mucus, sometimes hemorrhagic areas (Fig. 1).
- Microscopical examination revealed bacteria resembling rainbow trout gastroenteritis (RTGE) associated segmented filamentous bacteria (SFB) in the gut (Fig. 2).
- Histopathological examination showed necrotic areas and an elevated number of lymphocytes in the intestinal epithelium.
- After changing the diet, most of the symptoms disappeared.
- In the feeding experiment, the symptoms returned in a milder form in Tank 2 that was switched back to the original feed.
- The intestinal epithelium of the fish in Tank 2 showed less supranuclear vacuolization and an elevated number of lymphocytes and necrotic cells compared with the commercial feed given to the group in Tank 1 (Fig. 3 and 4). There were no significant differences in the epithelium of the stomach nor in the number of mucous cells between the groups.

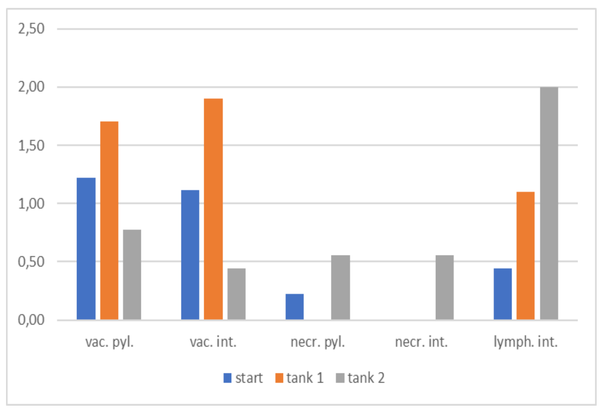


Figure 3. Histological comparison of the intestinal epithelium before and after the feeding experiment, combined results from ten fish/group. **tank 1** commercial feed **tank 2** experimental feed **vac.** supranuclear vacuolisation of the columnar cells **pyl**. pyloric area i**nt**. lower intestine **necr.** necrotic cells in the epithelium l**ymph.** lymphocytes in the epithelium

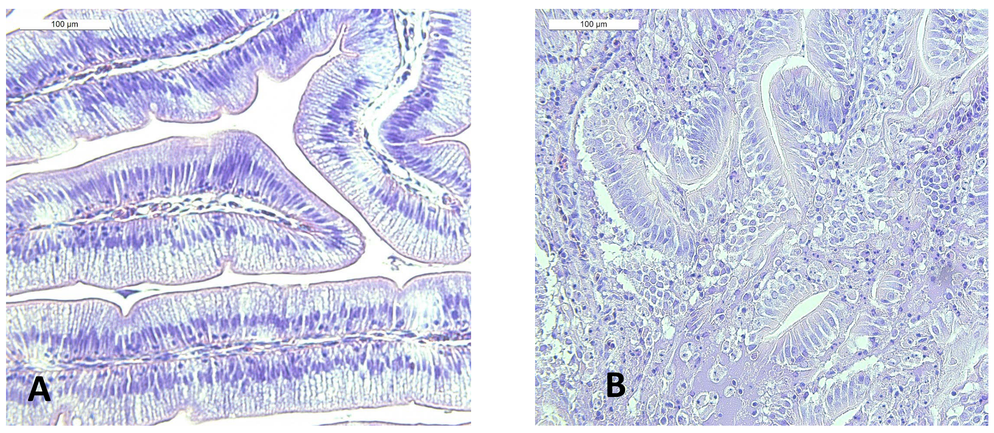


Figure 4. The intestinal epithelium of the rainbow trout from Tank 1 (A) and Tank 2 (B). Note the lack of supranuclear vacuolisation and the abundance of necrotic cells in B.

## Conclusions

- The experimental feed initially fed to the fish caused digestive problems.
- Feeding experiment showed that the experimental feed was less adsorbed (supranuclear vacuolization) and caused more irritation of the intestine (more lymphocytes and necrotic cells).
- The poor digestibility of the feed might have caused a favorable environment for the SFB bacteria, leading to RTGE syndrome and mortality.
- As the SFB bacteria is able to sporulate it remains the question how long they will survive in the RAS system where the risk factors for the development of RTGE including appropriate temperature and heavy feeding are present.

Corresponding author: satu.viljamaa-dirks@ruokavirasto.fi