

Farmed nelma (*Stenodus leucichthys*) is susceptible to flavobacteria

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Abstract

Nelma, *Stenodus leucichthys nelma* (Pallas 1773), is a migratory coregonid originating from North American and Siberian rivers [1–3]. Another subspecies *Stenodus leucichthys leucichthys* (Güldenstädt 1772) lives in the tributaries of the Caspian Sea. Adult weight is expected to be 15–25 kg and the fish is growing quickly also at low temperatures [4], which would make it a desirable cultured species in northern countries. An experimental batch was therefore imported to Finland in the spring of 2010 from Russia, where a brood stock is held in a fish farm in North-West Russia.

Nelma was imported as eggs to a quarantine facility in an inland fish farm. The quarantine was a separate hall containing several glass fiber tanks. The facility was using surface water and the effluent water was treated with UV and peracetic acid before release.

It appeared impossible to get suitable samples of the brood stock in Russia to ensure health status similar to the Finnish inland area. Instead, hatchlings and fry were controlled several times for viral and bacterial infections using standard bacteriological and virological methods [5]. In addition, rainbow trout (*Oncorhynchus mykiss*) and arctic charr (*Salvelinus alpinus*) were used as sentinels, and examined for the presence of viruses and bacteria after being kept in the effluent water of the nelma fry for two months. All examinations performed on clinically healthy fish gave negative results.

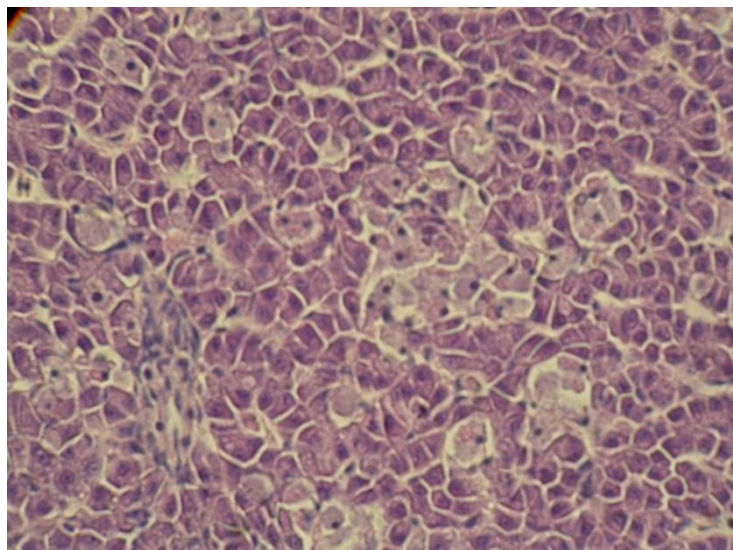
During the first and second year several episodes of disease outbreaks were recorded in the nelma. The fry had elevated mortality during the third week after hatching. A batch was sent to the laboratory for diagnosis. The fish were transported in oxygenated water, but not all survived the transfer. The fish had no external symptoms except anemic gills. No parasites were detected by microscopy. In the histopathological study, moderate epithelial hyperplasia was seen. The virological examination gave a negative result. In the bacteriological study no specific pathogens were detected on blood medium. On Anacker-Ordal medium (15 °C), yellow colonies were detected from a part of the samples inoculated from the gills. Slender, Gram-negative rod-shaped bacteria were identified as *Flavobacterium psychrophilum* based on the colony form and API Zym reactions.

A few weeks later *F. columnare* infection caused tail rot in the nelma kept under overcrowded conditions. The tail of affected fish was eroded, and some of the fish also suffered from gill rot. By direct microscopy, no parasites were detected, but masses of long, slender, gliding bacteria were seen on the affected areas. Internal organs appeared normal. There was no bacterial growth from kidney samples on blood medium. Bacteriological samples from the affected areas and the liver were inoculated on Anacker-Ordal medium and ¼-nutrient

medium [6]. On almost all ¼-nutrient medium plates and on a few of the Anacker-Ordal plates (both incubated at 15 °C) numerous rhizoid yellow colonies were seen. Slender, Gram-negative bacterium was identified as *F. columnare* based on the colony morphology and API Zym profile.

In October, the nelma were about five months old and weighed from 5 to 12 g. In one tank, slight elevation in mortality of up to 0.5 % in a few days was seen. The fish had erythematic skin lesions on the sides. Inner organs appeared normal, but in the histopathological examination single cell necrosis was seen in the liver (Fig. 1). Samples from the kidney and hind gut were inoculated on blood agar medium, and samples from skin lesions, gills and spleen on ¼-nutrient agar medium. No specific growth was obtained on blood agar medium. Smooth yellow colonies were growing abundantly from the skin and/or gill samples, but only from one spleen sample as well. The slender, Gram-negative rods were again identified as *F. psychrophilum*.

Figure 1. Liver tissue of a nelma fry, suffering from a *F. psychrophilum*-infection. Note the single necrotic cells with pycnotic nucleus and foamy appearance.



The fish were vaccinated in April 2011 against furunculosis, vibriosis and *F. psychrophilum*. Nevertheless, fish were diseased with skin lesions in May. The fish weight was now approximately 17 g. Externally, the fish had round necrotic areas on the skin. Fin rot was detected as well. In the abdominal cavity, heavy reaction to the vaccination was seen, with unabsorbed vaccine, dark pigment deposits and fibrin. Histology showed granulomatous peritonitis. In the gills, an extensive amount of eosinophilic slime cells were seen. Inoculations from skin lesions, as well as from gills, spleen, liver and kidney on ¼-nutrient medium (15 °C) gave a moderate to good growth of yellow colonies, again identified as *F. psychrophilum*.

During the second summer, the juveniles exhibited skin lesions and tail rot, but the mortality was not elevated. The fish weight was 35 g. The lesions were clearly marked but in most cases shallow (Fig. 2). In bacteriological studies, yellow colonies were again obtained on ¼-nutrient medium (20 °C) from skin lesions, gills and occasionally from the spleen. *F. psychrophilum* was identified as the cause of the problems.



Figure 2. Nelma juveniles suffering from skin lesions caused by *F. psychrophilum*.

To the knowledge of the authors there are no published case reports of infections caused by *Flavobacterium* species in nelma. The experience from Finland so far suggests that nelma might exhibit a disease susceptibility pattern that differs from the closely related whitefish (*Coregonus lavaretus*), which seldom develops acute disease signs caused by *Flavobacterium* sp. infections (The Finnish Food Safety Authority, unpublished). Columnaris disease, caused by *F. columnare*, appears in nelma as in several other fish species, causing skin lesions, necrotic patches in the gills and ulcerating tail rot. Nelma fry, infected with *F. psychrophilum*, do not show the typical signs of rainbow trout fry syndrome, with the heavy splenic involvement. The pathology connected with *Flavobacterium* sp. infections in the internal organs of nelma seems in general to be minor. This might also be the reason why there have been no high mortalities connected with the disease episodes. However, since the diagnosed bacterial infections were in the described cases always treated with antibiotics, the development of the infection without interference is not known at the present time.

References

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