AQUACULTURE update

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IHN and Its Occurrence in Sea-Farmed Atlantic Salmon

Infectious haematopoietic necrosis (IHN) is caused by a virus that is widespread in British Columbia sockeye salmon and kokanee stocks in fresh water. The disease has now been diagnosed for the first time in Atlantic salmon in a British Columbia seawater farm. The purpose of this Aquaculture Update is, first, to familiarize aquaculturists with the virus and the disease it causes. Second, this Update provides a sketch of what can happen when IHN occurs on a salmon farm and recommends steps to be taken should an infection occur at another site.

Background:

In British Columbia and Alaska, IHN virus has been isolated from most sockeye and many kokanee stocks tested. It has also been found in rainbow trout and chinook and coho salmon. In the Columbia River system, a different strain of the same virus affects mostly steelhead and rainbow trout. A third strain, found in the Sacramento River area in California, affects mainly chinook. Coho are rarely susceptible to any of these IHN virus strains and have only been infected under very extreme pathogen loads.

IHN is primarily a disease of very young fish. Fry are especially susceptible following emergence from the gravel until about the 3-gram stage, but in some cases fingerlings have been affected. Natural die-offs of 2-year-old kokanee have been described from two lakes on Vancouver Island.

The IHN virus is known to be spread from fish to fish through the water in natural outbreaks in fresh water, and recent experiments at the Pacific Biological Station have shown that this mode of transmission can also occur in sea water (Aquaculture Update 55). Fish surviving the disease are thought to carry the virus in a non-detectable and non-infectious "resting stage." Survivors of an outbreak are therefore not likely to present a hazard to other fish in their vicinity. With the internal stress caused by the approach of spawning, the virus again becomes detectable and infectious. Infected spawners are therefore a source of the "active" virus.

Vertical transmission (parent to offspring via the egg) appears unlikely. The virus attached to the outside of the egg capsule can generally be inactivated with proper surface disinfection. In sockeye enhancement projects in Alaska, millions of eggs are reared annually. Even though some parent fish are infected with the virus, juveniles are grown successfully through the use of thorough egg disinfection and the use of ground water supplies free of the IHN virus during the virus-sensitive stage. However, a few groups of alevins are lost each year to a variety of causes, including the IHN virus.

Outside of its host the IHN virus is inactivated over time. In sea water at 15°C, 99% of the viral particles are inactivated within 3 weeks. However, in fresh water at 10°C, some viral particles were found to be viable after 7 weeks. The virus does not replicate at elevated temperatures and it is completely inactivated within 140 min at 38°C. Because of its temperature susceptibility and its host specificity, the IHN virus does not present any human health risk. It is inactivated below pH 4 and above pH 10. Therefore, ensiling of dead fish at low pH will kill the virus.

In young fish, losses due to IHN sometimes exceed 90%. Most outbreaks

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occur at temperatures below 12°C. Affected fry are usually lethargic although there may be periods of hyperactivity. Many fish are popeyed and darker than normal. The abdomen is often swollen, and pale faecal casts trailing from the vent are characteristic. There may be haemorrhages in the yolk-sac, on the body, and in the fins. Fish may be anaemic and visceral organs may be pale. Pinpoint haemorrhages may be seen in the fat and other areas.

In the IHN outbreak in sea water-reared Atlantic salmon, affected fish swam slowly, had pale gills, and displayed haemorrhages on the skin, fins, or in the eyes. Internally, fish had pinpoint haemorrhages on their peritoneal surfaces, pyloric caecal fat, and skeletal musculature. The kidney was pale and showed patchy haemorrhages. Microscopic examination showed a breakdown in blood vessel walls leading to multiple haemorrhages throughout the body. Samples sent by the farm operator to a private laboratory for a viral assay were found to be virus-positive and the isolate was confirmed as IHN virus at the Pacific Biological Station.

The Atlantic salmon in which the IHN virus was detected were hatched from imported eggs that had been incubated and reared in quarantine for one year as required by the Atlantic Salmon Importation Policy. During the quarantine period the fish had been tested on four occasions and no virus was detected. The IHN outbreak began in a group of these fish following their transport by well-boat from the quarantine facility to a sea site. The fish did not handle the transportation to the sea farm well and experienced significant mortalities during transport and on arrival at the farm. Losses subsided, but approximately six weeks later another increase in mortality began. Mortalities in the first affected pen peaked in about seventeen days and dropped back to normal low levels five weeks after the start of the disease. However, the disease then appeared in pens adjacent to the original pen. These pens showed a similar pattern of mortality and clinical signs over the next six weeks. Aeromonas hydrophila was also isolated from kidney and spleen of some fish. This opportunistic bacterial infection was treated with oxytetracycline. But because the IHN virus is unaffected by the drug, losses continued. Mortality on the farm has since dropped back to normal levels in all pens.

At the present time, the source of the virus is unknown. However, there is no indication that the pathogen originated in the freshwater quarantine facility. As already mentioned, the stock had been tested four times during the quarantine period and had proved virus-negative at each testing. Efforts to identify the source are continuing.

Once the problem was diagnosed, the farm placed itself under voluntary isolation (quarantine) and reported the occurrence to DFO. Measures were implemented to prevent the spread of the virus, a prime goal being to prevent its spread to river systems lacking sockeye and kokanee and considered to be IHN virus-free. The measures taken involved: 1) placing the farm under quarantine, 2) not moving any live fish from the site, 3) carrying out all disinfection steps needed to ensure that the virus is not spread from the farm with equipment and personnel, 4) disposing of all dead fish via the acid silage process, and 5) undertaking to harvest stocks before they are physiologically ready to re-enter fresh water (i.e. not using any of the fish as broodstock). Monitoring of the affected fish is being carried out by DFO.

Recommendations:

Occurrence of IHN on a fish farm may be a serious problem for the producer. If an outbreak is suspected, obtain a diagnosis as quickly as possible and implement the steps outlined above. Culture of the IHN virus from fresh kidney and spleen is the most reliable diagnostic approach. Samples should be submitted iced, but not frozen, to ensure maximum survival of the virus. To maximize the chance of an unequivocal diagnosis, preserved tissues should also be submitted for histological analysis.

Specific actions by the farmer to mitigate the impact of the infection on seawater farms are suggested below. If the infection is localized in one part of the farm, early destruction of the fish in the infected pen may prevent transmission of the virus to neighbouring pens. If affected pens can be isolated from other pens, the impact of the disease on the farm may be minimized. Single year class sites will avoid the problem of having several year-classes placed under quarantine. Fish on an affected farm may be harvested at market size, following the quarantine period.

Survivors of an IHN outbreak should not be used as broodstock, because recent work on surface disinfection of eggs has indicated that the process may not inactivate all viral particles associated with the egg surface. Eggs from infected fish could therefore pose a risk to the hatchery receiving them and to salmonids in a river system receiving effluent from the hatchery.

Note:

If fish on an affected site are intended for transfer to another site, special application must be made to the Fish Transplant Committee before implementing such transfer.

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