



# AQUACULTURE *update*

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## SUSCEPTIBILITY OF ATLANTIC AND SOCKEYE SALMON TO IHN VIRUS IN SEA WATER

Infectious hematopoietic necrosis (IHN) is a serious viral disease of Pacific salmon (particularly sockeye and chinook salmon) and of rainbow and steelhead trout. Recently, there have also been indications that Atlantic salmon may be susceptible to the disease: in Washington State, an IHN epizootic occurred among Atlantic salmon fry being reared in water whose source contains a feral population of sockeye salmon. The most severe losses due to IHN tend to occur in very young fish but there have also been reports of IHN affecting older fish. To date, all reports of the disease have been from fish in fresh water. Nothing is known about the susceptibility of salmonids to IHN virus in sea water or the threat that the virus may pose for salmon farmed in sea water.

Atlantic salmon are being increasingly cultured in seawater netpens in British Columbia, and sockeye salmon, which are potential sources of the virus, are now being farmed on an experimental basis. Seawater transmission experiments were therefore conducted because of the concern that sockeye salmon might serve as a source of IHN infections for other cultured salmonids in netpens. Atlantic and sockeye salmon post-smolts

were challenged with IHN virus by bath exposure and by cohabitation with IHN-injected Atlantic and sockeye salmon. The procedures are outlined below.

Bath challenges of Atlantic and sockeye salmon were conducted by immersing 20 fish of each species in 9°C sea water containing  $8.98 \times 10^3$  plaque forming units (pfu) of IHN virus/mL for 3 hr. Each species was placed in a separate tank supplied with flowing sea water. Fish were fed and monitored daily for losses for 8 weeks.

Cohabitation transmission studies in sea water were performed by holding uninfected Atlantic and sockeye salmon with fish that had been injected intraperitoneally with  $1.6 \times 10^3$  pfu/mL of IHN virus. Ten fish of each species were injected and placed in separate tanks; 22 Atlantic salmon and 25 sockeye salmon were then added to each tank for the cohabitation study. Fish were held and fed for 8 weeks and monitored daily for losses.

Results (Table 1) demonstrated for the first time that IHN virus can be transmitted in sea water: Atlantic and sockeye salmon exposed to the virus in sea water developed IHN infections



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and died from the disease. Atlantics were infected by both the immersion and cohabitation methods -- whereas sockeye were infected only by the cohabitation method and then only when Atlantics were the source of the virus. Presumably, Atlantics, which yield higher tissue titers of the virus than do sockeye, also release higher concentrations of virus to the water. The data also strongly suggest that Atlantics are more susceptible to the virus than sockeye. This is evident from the deaths due to IHN following exposure by the bath and cohabitation methods and from the injection study where twice as many deaths occurred in Atlantics.

Affected fish were dark and lethargic, but showed no external hemorrhages or erythema. Infected Atlantics exhibited severe focal hemorrhages in the viscera, pale livers, bloody ascites, and anemia. In contrast, internal signs in the sockeye salmon were restricted to anemia.

This study demonstrates how important it is to avoid introducing IHN-infected fish to netpens. The marked susceptibility of Atlantic salmon to IHN virus, noted in this study, is of particular importance to the netpen aquaculture industry in B.C. because as mentioned before, the industry is relying

increasingly heavily on this species. Because the gross signs observed in this study were similar to those seen in Gram-negative septicemias (e.g. vibriosis), viral assays should be considered when conducting diagnostics on pen-reared fish.

Chinook salmon, which at present is the most widely farmed species in B.C., is also susceptible to IHN. Additional exposure studies are planned to determine the susceptibility of chinook salmon in sea water.

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Susceptibility of Atlantic and sockeye salmon  
to IHN virus in sea water

Challenge protocol	Cumulative mortality due to IHN - 8 weeks	Mean viral titer* pfu/g kidney tissue
Bath		
Sockeye	0/20	0
Atlantic	2/20	7.1x10 <sup>4</sup>
Injection		
Sockeye	4/10	6.9x10 <sup>5</sup>
Atlantic	8/10	3.3x10 <sup>6</sup>
Cohabitation with injected sockeye		
Sockeye	0/25	0
Atlantic	2/22	1.2x10 <sup>6</sup>
Cohabitation with injected Atlantics		
Sockeye	1/25	1.6x10 <sup>3</sup>
Atlantics	6/22	1.2x10 <sup>6</sup>

All experiments were conducted in sea water at 9°C.

Mean weight: sockeye salmon - 19.2g; Atlantic salmon - 86.9g.

\*Determined for moribund and dead fish.