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MARINE ANEMIA IN PEN-REARED SALMON

A blood proliferative disorder of seawater-reared chinook salmon, referred to as "marine anemia," caused high mortalities at several netpen sites in the Sechelt area, British Columbia during the fall and winter of 1988.

The disease is characterized by pallor of the gills due to severe anemia, and affected fish often exhibit exophthalmos (popeye), ascites (fluid in the visceral cavity), and enlargement of the spleen and kidney. Petechiae (small hemorrhages) are observed in the skeletal muscle and viscera of some fish. Histological examination revealed prominent proliferation of actively dividing hemoblasts (immature blood cells) in the orbit of the eye, pancreas, liver, wall of the intestine, kidney interstitium, spleen and heart. The precise cell type of the hemoblasts has not been determined, but the histological changes are suggestive of leukemia. Leukemia is characterized by abnormal proliferation of certain blood cells, which usually results in an increase of white blood cell precursors in the blood. Leukemia is caused by various agents, including physical and chemical carcinogens, and infectious agents such as viruses.

We have transmitted marine anemia in the laboratory by injection of crude homogenates and cell-free filtrates of kidney tissue, which indicates that the disease is caused by an infectious agent. All exposed fish exhibited the disease and concurrent bacterial kidney disease (BKD) infections. Concurrent infections with BKD were also observed in the field, but, at this time, we believe that marine anemia is a

different disease. Although marine anemia and BKD cause similar gross (macroscopic) changes (e.g., popeye, enlarged kidney and spleen, and anemia), whitish focal pustules typical of BKD are not associated with marine anemia. Histological changes of marine anemia are also distinctly different from BKD. Moreover, many affected fish in netpens, especially during winter months, showed no BKD lesions or detectable *Renibacterium* organisms. If marine anemia is a different disease, then the disease apparently predisposes fish to BKD.

Marine anemia was first recognized in market-size chinook salmon that were introduced to sea water in 1987, but we have recently seen the disease in 1988 smolts at affected sites. Although marine anemia has only been observed in sea water in British Columbia, an identical disease was observed in freshwater-reared chinook salmon at a hatchery in Washington State in 1974. This suggests that the disease in B.C. may have originated in smolts prior to seawater introduction.

Further studies are planned or underway to determine the cause of marine anemia, its transmissibility by cohabitation, susceptibility of other salmonid species, and its geographical distribution. In addition, we are investigating the relationship of marine anemia to BKD.

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