

CLASSIFICATION

200X-XXX-XXXXX  
EKME # XXXXXX

MEMORANDUM FOR THE MINISTER

**INDICATIONS OF A POSSIBILITY OF INFECTIOUS DISEASES ASSOCIATED  
WITH POOR SURVIVAL OF SOUTHERN BC SALMON STOCKS**

(Information Only)

**SUMMARY**

- An infectious disease may be adversely affecting the survival of sockeye, chinook, and coho salmon in southern BC.
- By combining biotelemetry and genomics, DFO staff have associated poor survivorship of adult migrating Fraser sockeye salmon with a pattern of gene responses which may indicate a viral infection.
- In addition, lesions were found in the brains of over 70% of the Fraser sockeye salmon sampled in the marine approaches in 2009. The incidence dropped to 50% of the sockeye sampled in the lower river, and to less than 30% of the sockeye at the spawning grounds, suggesting an association between the presence of lesions and early mortality.
- Additional work is in progress to determine whether a viral infection is present. A parasitic infection could also be responsible for the lesions.

**Background**

- Over the past 12 years, some sockeye salmon stocks have experienced unprecedented levels of en-route and pre-spawning mortality during return migration in the Fraser River. While elevated river temperatures are clearly associated with these losses, growing evidence points to a novel disease which may have affected survivorship.
- By combining biotelemetry and genomics, DFO staff have associated poor survivorship of adult migrating salmon with a pattern of gene responses which may indicate a viral infection. Sockeye salmon carrying this signature pattern in 2006 experienced 30-60% higher en route and pre-spawning mortality in the river than salmon that did not show

the gene response pattern. The pattern was detected in sockeye sampled up to 300 km seaward of the Fraser River.

- Brain dissections (in 2009) revealed that 30-40% of adult migrating sockeye salmon in 2006 contained lesions in their optic lobe. For 2008, brain dissections (in September 2009) revealed similar lesions in 50-60% of adult sockeye salmon in the marine approaches and lower Fraser River, but in only 20% of fish at the spawning grounds, suggesting an association between the presence of lesions and en-route mortality. For 2009, brain dissections revealed lesions in over 70% of the sockeye salmon sampled in the marine approaches, in 50% in the lower river, and in less than 30% at the spawning grounds.
- Given these results, additional samples of juvenile sockeye were examined in September 2009. Based on 2008 samples, 50% of Chilko smolts and 80% of Cultus Lake smolts leaving the natal rearing areas in May displayed the gene response pattern. Brain dissections revealed a similar incidence level of lesions, as well as the presence of lesions in stocks outside of the Fraser River.
- Lesions were observed in coho, Chinook, and sockeye smolts sampled in the ocean in June and September/October of 2008 and 2009. For each species in each year, there was a notable decline in incidence between June and September/October (average 40% incidence in June, 10% in September/October), indicating an association with early ocean mortality in all three species.

#### **Analysis / DFO Comment**

- The cause of the lesions is still under investigation. One possibility is a retroviral infection. Retroviruses are often vertically transmitted (mother to egg), and because lesions were detected in smolts, a viral infection may already be active in natal rearing areas.
- Another possibility is a myxosporean (parasitic) infection. The Animal Health Centre of the BC Government Ministry of Agriculture and Lands found myxosporean spores in 11/12 samples examined. Myxosporean infections are known to have a significant impact on swimming performance of sockeye smolts.
- To date no work has been done to isolate or identify a virus or parasite, nor has infectivity been demonstrated in controlled experiments – these steps are essential to confirming infectious diseases.
- The presence of a virus or parasite does not confirm disease or the cause of mortalities. The virulence of pathogens can depend upon the level of stress of the fish (for example, chronically stressed because of high river temperatures). Also, non-lethal infections can weaken immunity and increase the susceptibility of fish to other pathogens and to predation.
- Most information on disease and associated mortality comes from hatchery or farmed fish because these fish can be observed when they become sick. In wild fish, we do not observe mortality events (especially in the ocean) because the fish simply disappear.

There is essentially no regular disease/fish health screening on wild salmon or any other wild fish.

**Recommendations / Next Steps**

- Media lines are being updated to reflect this new information
- Additional research is planned to clarify whether or not a viral infection is present.

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Claire Dansereau

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I concur,  
Gail Shea      *(this part only if for decision)*  
Minister, Fisheries and Oceans

Attachment (1) *(if applicable)*  
Description of the attachment(s) *(if applicable)*

Officers / DGs / ADMs / initials of the admin clerk or typist