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Heart and Skeletal Muscle Inflammation (HSMI) Backgrounder

Heart and Skeletal Muscle Inflammation (HSMI) General Background

Symptoms and Diagnosis

- Heart and skeletal muscle inflammation (HSMI) is a low level chronic disease that was first diagnosed in 1999, in farmed Atlantic salmon in Norway.
- It has only been found to affect farm-raised Atlantic salmon, and is noted after fish have been transferred to sea and in freshwater hatcheries that use seawater in their production (Johansen et al., 2008).
- It is usually noted 5–9 months after sea- transfer with abnormal swimming behaviour, anorexia and maximum 20% mortality.
- It causes circulatory failure, and blood clots in the heart cavity.
- HSMI is diagnosed by histological observation of changes in the heart and skeletal muscle.

HSMI Detection

- HSMI has been diagnosed in farmed Atlantic salmon in Norway (Kongtorp et al., 2004) and Scotland (Ferguson et al., 2005).

HSMI and PRV

- Research is ongoing, but the cause of HSMI is yet to be determined. (Siah, et al, 2015). Although Piscine Orthoreovirus (also known as Piscine Reovirus) (PRV) has been proposed to be the causal agent of HSMI (Palacious et al., 2010; øvoll et al., 2012) recent studies using molecular diagnostics have found PRV to be present in farmed Atlantic salmon that are clinically healthy, as well as those suffering

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from HSMI, and has been found in wild salmon that have not been shown to have HSMI (Øvoll et al., 2012; Garseth et al., 2013, Garver, et al., 2016). The high prevalence of PRV in fish without HSMI symptoms has raised questions as to whether PRV is the sole cause of the disease HSMI.

- In addition to Norway and Scotland, PRV genetic material has also been detected in farmed Atlantic salmon in Chile and Ireland (Rodger et al., 2014; Kibenge et al., 2013) from hatchery Chinook and coho salmon in Washington State at 6 different locations encompassing the Columbia River, Salish Sea and coastal area (WFRC, 2014) from farmed Atlantic salmon and wild Chinook and coho salmon in British Columbia (BC), Canada and in wild coho salmon from Alaska (Kibenge et al, 2013, Marty et al, 2014). Despite PRV presence, there have been no previously published reports of HSMI disease in Ireland or North America including the Pacific Northwest and Alaska.
- Additionally, genomic sequencing of PRV from British Columbia revealed some genetic differences when compared to PRV from the North Atlantic and Chile (Kibenge *et al.* 2013).

HSMI and Wild Salmon

- HSMI has not been reported in wild salmon populations anywhere globally. Although high levels of PRV genetic material have been detected in wild and cultured salmon there has been no evidence of HSMI disease (See Meyers, 2014 for references).
- In North America, surveys detected the presence of PRV genetic material in wild and cultured Chinook and coho salmon from Washington State, British Columbia, and Alaska, where years of surveillance have reported no presence of HSMI (See Meyers, 2014 for references).
- Molecular testing of archived fish tissues in British Columbia has shown that PRV was present in asymptomatic wild and farmed Pacific salmon since 1987 and may have been present as early as 1977 before Atlantic salmon were imported for aquaculture. (See Meyers, 2014, for references).
- Published scientific study of 200 wild juvenile pink salmon in BC (sampled in 2008) found no evidence of PRV or HSMI.

HSMI Testing in BC

- Skeletal muscle began to be sampled as part of Fisheries and Oceans Canada's Fish Health Audit & Surveillance Program in 2013 (DFO, 2015).

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- Of the 1,013 Audit Program Atlantic Salmon sampled from 2014 and 2015, only two of the fish had both moderate skeletal muscle inflammation and significant cardiomyopathy. (DFO, 2015)
- Although some pathologists have summarized lesions present in samples from the audit program as "HSMI-like" or "consistent with HSMI", these diagnoses have not been consistent with a clinical pattern that matches HSMI (DFO, 2015).

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