

Faculty of Veterinary Medicine
Summary of Dissertation

Submitted in Partial Fulfilment
of the Requirements for the

DEGREE OF DOCTOR OF PHILOSOPHY

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Epidemiological and statistical analyses of publicly available data on farmed and wild salmon to understand fish health, mortality, and sea lice dynamics

Salmon aquaculture is a globally important food production sector that contributes to food security and supports coastal economies. In many salmon-producing regions, regulatory oversight requires routine monitoring and reporting of fish health, mortality, treatments, and parasitic infestations, resulting in the generation of extensive datasets. Despite their expanding volume, scope, and accessibility, publicly available datasets remain underutilized for integrated epidemiological analyses of fish health, mortality, and sea lice dynamics, and relatively few studies have undertaken cross-regional comparisons. Publicly available monitoring data from wild salmon populations further extend opportunities for comparative and integrative analyses. The overall objective of this thesis was to apply epidemiological and statistical methods to publicly available aquaculture and wild salmon datasets to investigate patterns of fish health events, mortality, and sea lice dynamics in British Columbia (BC), Canada, and Norway. Fish health and mortality event data from Fisheries and Oceans Canada were used to examine spatiotemporal patterns in farmed Atlantic salmon. Yellow mouth disease and salmonid rickettsial septicaemia (SRS) emerged as the most frequently reported conditions, exhibiting distinct spatial clustering and disease-specific temporal trends. Analyses of mortality events revealed an increasing incidence over time, with treatment-related mortalities, particularly those associated with sea lice control, reported most frequently. Environmental stressors such as low dissolved oxygen (LDO) and harmful algal blooms (HABs) were also identified as a leading causes of mortality and were clustered mostly in the Southwest coast of Vancouver Island. Sea lice monitoring data from the Broughton Archipelago were used to compare lethal laboratory-based and non-lethal field-based sampling methods in juvenile wild salmon. Non-lethal sampling generally produced higher prevalence and abundance estimates, particularly for non-motile stages, highlighting the influence of sampling methodology on surveillance outcomes. Long-term sea lice monitoring data from BC and Norway were further analysed to evaluate the empirical relationship between total motile and adult female sea lice abundance. These analyses revealed positive but heterogeneous associations, demonstrating that life-stage thresholds are not directly interchangeable and vary by region, season, and production cycle. Overall, this thesis demonstrates the epidemiological value of open and publicly available salmon monitoring datasets and underscores their potential to support reproducible research, cross-jurisdictional comparisons, and evidence-informed aquaculture management.

Publications

Jyoti, S., Jia, B., Saksida, S., Stryhn, H., Price, D., Revie, C. W., & Thakur, K. K. (2024). Spatiotemporal patterns of mortality events in farmed Atlantic salmon in British Columbia, Canada, using publicly available data. *Scientific Reports*, 14(1), 32122.

Jyoti, S., Jia, B., Saksida, S., Stryhn, H., Price, D., & Thakur, K. K. (2024). Utilization of publicly available data to summarize spatio temporal patterns of fish health events of Atlantic salmon (*Salmo salar*) reported by marine finfish industries in British Columbia (BC), Canada. *Journal of Fish Diseases*, 47(12), e14022.

Submitted:

Jyoti, S., Revie, C. W., Stryhn, H., Saksida, S., Price, D., Krkošek, M., Stewardson, L., & Thakur, K. K. Comparison of lethal and non-lethal sampling methods for sea lice monitoring on juvenile wild salmon populations on the Pacific coast of Canada & Thakur, K. K. Royal Society Open Science (Manuscript submitted).

Jyoti, S., Stryhn, H., & Thakur, K. K. Delousing measures and associated mortality events in farmed salmon in British Columbia, Canada. Aquaculture (Manuscript submitted)

In preparation:

Jyoti, S., Revie, C. W., Stryhn, H., Saksida, S., Price, D., & Thakur, K. K. Assessing sea lice life-stage-specific abundance metrics to quantify regulatory equivalence: The case of British Columbia, Canada, and Norway. In preparation for submission to Preventive Veterinary Medicine.

Presentations

Jyoti, S. & Thakur, K. K. Comparison of lethal laboratory and non-lethal field sampling methods for sea lice monitoring on wild salmon populations on the Pacific coast of Canada. Aquaculture Association of Canada (AAC) conference, 2025. Oral presentation.

Jyoti, S., Jia, B.,& Thakur, K. K. Spatiotemporal patterns of mortality events in farmed Atlantic salmon in British Columbia, Canada, using publicly available data, 2025. One Health: Antimicrobial Resistance and Emerging Zoonoses Conference Poster presentation

Jyoti, S., Jia, B.,& Thakur, K. K. Spatio-temporal descriptions of mortality events of farmed Atlantic salmon (*Salmo salar*) in British Columbia. 17th International Symposium on Veterinary Epidemiology and Economics (ISVEE), 2024. Oral presentation.

Jyoti, S., Jia, B.,& Thakur, K. K. Utilization of publicly available data to summarize spatio-temporal patterns of fish health events of Atlantic salmon (*Salmo salar*) reported by marine finfish industries in British Columbia (BC), Canada, 2024. Canadian Emerging Veterinary Scholars Summit (CEVSS). Oral presentation.

Jyoti, S., Jia, B.,& Thakur, K. K. Spatio-Temporal Description of Patterns of Health and Mortality Events of Farmed Atlantic Salmon (*Salmo salar* L.) in British Columbia.

Canadian Association of Veterinary Epidemiology and Preventive Medicine (CAVEPM), 2023. Poster presentation.

Biographical Data

Born in Kathmandu, Nepal

Awards

2025- The Atlantic Canada Centre for Disease Ecology Modelling (ACCDMi) Scholarship

2025- G. Murray & Hazel Hagerman Scholarship at AVC

2025- Art Fitzgerald Graduate Research Scholarship

2025- UPEI International Graduate Student Award

2024- Canadian One Health Training Program on Emerging Zoonoses (Canopy) Scholarship

2024- Dr. Ian Dohoo Award