

Romero, J.F., Gardner, I.A., Price, D., Thakur, K. (2019). Simulation modelling of ISAv spread in farmed salmon populations in British Columbia. In, Emerging Canadian Veterinary Scholars Summit, Faculty of Veterinary Medicine, University of Calgary. Canada. Nov 1 – 3, 2019. (Oral presentation)

Romero, J.F., Al-Mamun, M.A., Gröhn, Y.T. (2015). Small ruminant brucellosis in northern Portugal, a case control analysis of risk factors. In 16th Annual Merit-NIH National Veterinary Scholars Symposium, University of California, Davis. USA. Jul 30 – Aug 2, 2015 (Poster presentation)

Awards

UPEI student research travel funding (UPEI Faculty of Graduate Studies)

The James E. Bateman Memorial Graduate Scholarship in Aquatic Health Research (AVC GSR and Awards Committees, UPEI)

Killam Properties Inc. Scholarship (AVC or Graduate Studies, UPEI)

Emerging Canadian Veterinary Scholars Summit travel award (Faculty of Veterinary Medicine, University of Calgary)

Veterinary Investigator Program fellowship award (College of Veterinary Medicine, Cornell University)

Erasmus program bursary for research internship at the National Veterinary Institute, Technical University of Denmark

Biographical Data

Originally from Portugal, João Romero joined the Atlantic Veterinary College (AVC) in January 2019 to pursue his graduate studies in Health Management and Epidemiology. His academic background and training are in Veterinary Epidemiology. João earned his DVM and master's degree in Veterinary Medicine from the University of Lisbon, Portugal. His master's research evaluated the implementation of a national eradication program for small ruminant brucellosis in northern Portugal. His PhD thesis research at the AVC involves the use of simulation modelling approaches to support mitigation strategies for economically important viral diseases in Canadian salmon aquaculture.

University of Prince Edward Island

Faculty of Veterinary Medicine
Summary of Thesis

Submitted in Partial Fulfilment
of the Requirements for the

DEGREE OF DOCTOR OF PHILOSOPHY

João Romero
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Applications of simulation modelling to inform viral disease management in Canadian salmon aquaculture

Two of the most concerning viral diseases affecting farmed salmon in Canada are infectious salmon anaemia (ISA) and infectious hematopoietic necrosis (IHN). Despite epidemiologic differences between the two viruses, both can be transmitted between marine salmon farms in the water column. However, limited research has been conducted on the transmission dynamics of ISA virus (ISAV) and IHN virus (IHNV) among marine farmed salmon populations in Canada. Furthermore, some aspects of ISAV epidemiology and cost-effectiveness of its mitigation in Atlantic Canada require further investigation.

Research documented in this thesis aimed to provide additional insights about the epidemiology of ISAV in Atlantic Canada. A population-level descriptive study reported epidemiologic findings of an ISAV outbreak in the region.

A simulation modelling framework was developed for the purpose of investigating the dynamics of waterborne pathogen transmission in marine salmon aquaculture. This framework allowed for development of models that simulate waterborne infection spread within net-pens, and between net-pens (both within and between farm sites), as well as surveillance, detection, and depopulation measures. Technical characteristics and structure of the framework were described, and a case study demonstrated the framework functionalities. The newly-developed modelling framework was used to simulate IHNV incursions and subsequent spread along the coast of British Columbia and the implementation of a viral disease management plan (VDMP) by salmon companies. Different scenarios were explored to assess VDMP effectiveness compared with alternative mitigation measures.

Finally, to help the salmon aquaculture industry plan for expansion of production capacity in Atlantic Canada, a simulation modelling approach was used to assess the cost-effectiveness of ISAV outbreak mitigation strategies, considering different percentages of active licensed farms. For each model scenario, direct costs of ISAV mitigation interventions were estimated from model outputs.

This research demonstrates the value of descriptive epidemiologic studies and simulation modelling in aquatic health management. Ultimately, research findings documented herein provide insights to inform policy and disease management decisions to reduce viral disease risk in Canadian salmon aquaculture.

Publications

Romero, J. F., Gardner, I. A., Hammell, L., Groman, D., Whelan, D., O'Brien, N., Hawkins, L. J., Burnley, H., & Thakur, K. (2022). Descriptive epidemiology of variants of infectious salmon anaemia virus in four Atlantic salmon farms in Newfoundland and Labrador, Canada. *Journal of Fish Diseases*, 45(6), 919–930. <https://doi.org/10.1111/jfd.13617>

Romero, J.F., Gardner, I.A., Saksida, S., McKenzie, P., Garver, K.A., Price, D., Thakur, K. (2022). Simulated waterborne transmission of infectious hematopoietic necrosis virus among farmed salmon populations in British Columbia, Canada following a hypothetical virus incursion. *Aquaculture*. Volume 548, Part 2, ISSN 0044-8486. <https://doi.org/10.1016/j.aquaculture.2021.737658>

Romero, J.F., Gardner, I.A., Price, D., Halasa, T., Thakur, K. (2021). DTU-DADS-Aqua: a simulation framework for modelling waterborne spread of highly infectious pathogens in marine aquaculture. *Transboundary and Emerging Diseases*. 1-16. <https://doi.org/10.1111/tbed.14195>

Romero, J.F. (2018). Implementation of the Small Ruminant Eradication Programme at Vila Real Division of Food and Veterinary. [Master's Thesis, Universidade de Lisboa, Faculdade de Medicina Veterinária, Lisboa]. <http://hdl.handle.net/10400.5/15891>

Presentations

Romero, J.F., Gardner, I.A., Thakur, K. (2021). A mathematical modelling approach to assist infectious disease management in marine aquaculture. In, *Aquaculture Europe 2021 – Student workshop session*. Funchal, Madeira, Portugal. (Oral presentation)

Romero, J.F., Gardner, I.A., Saksida, S., Price, D., Garver, K.A., Thakur, K. (2021). Epidemiological modelling of waterborne spread of infectious hematopoietic necrosis virus in farmed salmon populations. In, *Aquaculture Europe 2021*. Funchal, Madeira, Portugal. (Oral presentation)

Romero, J.F., Gardner, I.A., Price, D., Halasa, T., Thakur, K. (2020). DTU-DADS-Aqua: a simulation framework to assist infectious disease management planning in marine aquaculture. In, *Conference of Research Workers in Animal Diseases 2020*. (Oral presentation)

Romero, J.F., Gardner, I.A., Price, D., Thakur, K. (2020). Epidemiological modelling of waterborne spread of infectious salmon anaemia virus among marine sites. In, *ACFFA Fall Forum 2020*. Canada. (Oral presentation)