

University of Prince Edward Island

Faculty of Veterinary Medicine  
Summary of Dissertation

Submitted in Partial Fulfilment  
of the Requirements for the

## **DEGREE OF MASTER OF SCIENCE**

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## **Assessment of the Effects of Agricultural Pesticide Chlorpyrifos on American Lobster Larvae (*Homarus americanus*)**

Chlorpyrifos is an organophosphate that is currently used to reduce arthropod pests. Coastal marine ecosystems may be exposed to agricultural pesticides via adsorption to agricultural soil runoff or as spray drift. Using acute exposures in seawater (28 PSU), the 24 h and 48 h median lethal concentrations of chlorpyrifos were established for stage IV *Homarus americanus* (1.56 µg/L and 1.33 µg/L respectively). Exposure to sublethal concentrations allowed the measurement of movement, acetylcholinesterase activity, intermoult period, specific growth rate, and moult increment.

Acetylcholinesterase activity was found to be inhibited in lobsters sampled immediately post-exposure to 0.50, 0.57, and 0.82 µg/L chlorpyrifos but activity was recovered after a period in clean seawater (9 to 15 d). Sublethal growth effects were an increased intermoult period, decreased specific growth rate, and decreased moult increment after 48 h exposure to chlorpyrifos (0.82 µg/L). After 48 h of exposure, surviving lobsters were processed for Illumina RNA sequencing (RNA-seq). Genes of interest with significant changes using RNA-seq were verified using reverse transcriptase quantitative polymerase chain reaction (RT-qPCR). Analysis of RNA-seq and the confirmation of gene expression patterns via RT-qPCR results found significantly changes to expression of genes related to stress response (glutathione peroxidase 3 and heat shock protein 60), hypoxia response (hairy, astakine 2, hemocyanin), moulting (cytochrome P450 307a1-like and chitinase), and immunity (astakine 2) physiological pathways. Changes to gene expression were most notable in lobsters exposed to 0.57 µg/L chlorpyrifos. The current study suggests that *H. americanus* stage IV larvae were marginally less sensitive to chlorpyrifos compared to other decapods and that acute lethality of *H. americanus* larvae is not likely to occur with chlorpyrifos concentrations previously reported from aquatic environments but physiological effects to growth, movement, and gene expression were observed at sublethal concentrations.