



University
of Victoria

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

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BSc (University of Victoria, 2015)

**“Variability in the Energy Density of Prey and its Consequences for
Growth in Juvenile Chinook Salmon”**

Department of Biology

Monday, March 25, 2019
9:00 A.M.
Clearihue Building
Room B017

Supervisory Committee:

Dr. Francis Juanes, Department of Biology, University of Victoria (Supervisor)
Dr. Rana El-Sabaawi, Department of Biology, UVic (Member)
Dr. John Dower, School of Earth and Ocean Sciences, UVic (Outside Member)

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Chair of Oral Examination:

Dr. Perry Howard, Department of Biochemistry and Microbiology, UVic

Abstract

Understanding how energy flows through ecosystems reveals underlying ecological patterns that can drive processes such as growth and survival of organisms. To understand how energy is transferred through organisms, the energy content or energy density (ED) of both consumers and prey must be determined. To facilitate the ease of ED measurement across taxa, I developed a model to estimate the ED of organisms using percent ash-free dry weight (AFDW). Using data obtained from 11 studies with broad taxonomic, temporal and spatial coverage, I compared common predictors of ED using linear models. AFDW was determined to be the superior predictor of ED relative to previous metrics and was predictive for a broad range of taxonomic groups including aquatic invertebrates, aquatic vertebrates, aquatic plants and terrestrial invertebrates. This AFDW model enables measurement of ED with minimal cost and time investment, which allows ED to be more readily determined for diverse taxa. Next, I applied the AFDW method to the diet of a pelagic consumer, juvenile Chinook Salmon, to determine the effect of variable prey ED on growth. In 2017, I collected monthly zooplankton and fish samples of known importance in the diet of juvenile Chinook Salmon to look for finescale taxonomic, temporal and spatial differences in ED. Decapod zoeae and megalopae differed significantly from each other and showed family level variability in ED. Amphipods also showed significant species-level variability in ED. Temporal differences were observed, but did not reveal a consistent pattern among groups. Spatial variability was not significant. Using bioenergetics models, growth of juvenile Chinook Salmon was predicted to be greater when using fine-scale ED estimates. This difference was not substantial on average, but in some cases represented more than a two-fold difference in growth between coarse- and fine-scale estimates. These results suggest the need for higher resolution diet ED data when determining growth projections for juvenile Chinook Salmon. With the aid of the AFDW model presented in this thesis, the effort required to obtain these data is greatly reduced.