University of Victoria | Graduate Studies

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

of

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BSc (Simon Fraser University, 2013)

# "Integrated Multi-Trophic Aquaculture with the California Sea Cucumber (*Parastichopus californicus*): Investigating Grow-out Cage Design for Juvenile Sea Cucumbers Co-cultured with Pacific Oysters (*Crassostrea gigas*)"

Department of Geography

Monday, September 10, 2018
10:30 A.M.
David Turpin Building
Room B215

Supervisory Committee:
Dr. Christopher Pearce, Department of Geography, University of Victoria (Co-Supervisor)
Dr. Stephen Cross, Department of Geography, UVic (Co-Supervisor)

External Examiner:
Dr. Shawn Robinson, St. Andrews Biological Station, Fisheries and Oceans Canada

Chair of Oral Examination:
Dr. Patrick Dunae, Department of Political Science, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

## Abstract

Excess nutrients in the form of uneaten food or waste from intensive, monospecies aquaculture farms can have negative effects on the surrounding natural ecosystem, causing eutrophication and benthic habitat degradation. Biomitigative techniques such as Integrated Multi-Trophic Aquaculture (IMTA) are being investigated for their ability to reduce these negative environmental impacts. IMTA is the co-culture of multiple species from complementary trophic levels, physically orientated in such a way that excess waste nutrients from the fed component are intercepted by the extractive species. For IMTA systems to become a sustainable aquaculture design alternative, it is important to ensure that infrastructure orientation and stocking densities of the extractive species maximize the amount of excess nutrients intercepted and overall system efficiency. Previous research has shown that the majority of wastes from fed finfish are made up of large organic particulates which sink rapidly to the benthos underneath or near the fish cages and which would be available to benthic deposit-feeding species. The California sea cucumber (*Parastichopus californicus*) is a promising extractive species for IMTA on the west coast of Canada due to its deposit-feeding behaviour and its relatively high market price. Owing to the sea cucumber's morphology and ability to move through restricted spaces, containment can be difficult without reducing nutrient transfer and overall IMTA system efficiency (i.e. mesh sizes needed to contain small sea cucumbers may restrict flow of farm particulates to them). The overall goal of the present work is to effectively contain juvenile sea cucumbers in such a way that maximizes benthic extraction of large-particulate nutrients within an IMTA system.