University of Victoria | Graduate Studies

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

of

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BSc Hon. (University of Victoria, 2015)

"Long-term Spatial-temporal Eelgrass (*Zostera marina*) Habitat Change (1932-2016) in the Salish Sea using Historic Aerial Photography and Unmanned Aerial Vehicle"

Department of Geography

Wednesday, May 9, 2018
10:00 A.M.
Clearihue Building
Room B007

Supervisory Committee:
Dr. Maycira Costa, Department of Geography, University of Victoria (Co-Supervisor)
Dr. Tara Sharma, Department of Geography, UVic (Co-Supervisor)
Dr. Rosaline Canessa, Department of Geography, UVic (Member)

External Examiner:
Dr. Margot Hessing-Lewis, Nearshore Marine Ecology, Hakai Institute

Chair of Oral Examination:
Dr. Michael McGuire, Department of Electrical and Computer Engineering, UVic

Dr. Stephen Evans, Acting Dean, Faculty of Graduate Studies

Abstract

Eelgrass (*Zostera marina*) is a critical nearshore marine habitat for juvenile Pacific salmon (*Oncorhynchus* spp.) as they depart from their natal streams. Given the poor marine survival of Coho (O. *kisutch*) and Chinook (O. *tshawytscha*) salmon juveniles in recent decades, it is hypothesized that deteriorating eelgrass habitats could contribute to their low survival. The primary goal of this research was to investigate the possible long-term spatial-temporal trends in eelgrass habitat in the Salish Sea and was addressed by two main objectives: (1) Define a methodology for mapping eelgrass habitats using UAV imagery to create a baseline for long-term mapping; and (2) Assess changes in eelgrass area coverage and fragmentation over the period of 1932-2016 using historic aerial photographs and Unmanned Aerial Vehicle (UAV) imagery, and assess the relationship between eelgrass and residential housing density and shoreline activities. Three study sites in the Southern Gulf Islands of the Salish Sea were chosen for analysis. The overall accuracies of eelgrass delineation from UAV imagery were 95.3%, 88.9%, and 90.1% for Village Bay, Horton Bay, and Lyall Harbour, respectively. The UAV method was found to be highly effective for this size of study site, however results were impacted by the environmental conditions at the time of acquisition, namely: sun angle, tidal height, cloud cover, water clarity, and wind speed. The results from the first objective were incorporated into a long-term dataset of historic aerial photography and used to evaluate changes in eelgrass area and fragmentation. All three eelgrass meadows showed a deteriorating trend in eelgrass condition. On average, eelgrass area coverage decreases by 41% while meadow complexity as indicated by the shape index increases by 76%. Shoreline activities (boats, docks, log booms, and shoreline armouring) and residential housing density increased markedly at all sites over the study period. By using a linear correlation model, it was revealed that eelgrass areal coverage and fragmentation (Shape Index) were, in general, very strongly correlated to these landscape-level coastal environmental indicators. While this correlation model is not meant to show a direct causative impact on eelgrass at these sites, these results suggest an overall deterioration of coastal environmental health in the Salish Sea due to a dramatic increase in the use of the coastal zone, as well as likely declines in water quality due to urbanization.