# Depth is an important driver of nearshore benthic fish communities in the Salish Sea

## Introduction Objective Paragraph:

This project aims to determine if abiotic variables can act as proxies for nearshore fish biodiversity and explores with through three objectives. First, we will determine how fish species richness, abundance, and biomass vary with four abiotic variables, tidal current speed, depth, percent rock cover, and benthic slope, using linear mixed effect models. Second, using the variables of primary importance identified in our first objective, we will explore how community composition varies with that variable using a non-metric multidimensional scaling plot (nMDS). Third, we will explore how the life history of the observed fish species differ with the variable of primary importance. For these analyses, individual fish lengths were used in a partial pooling mixed effect model analysis to provide predictions for all species, even those with limited data.

## Methods

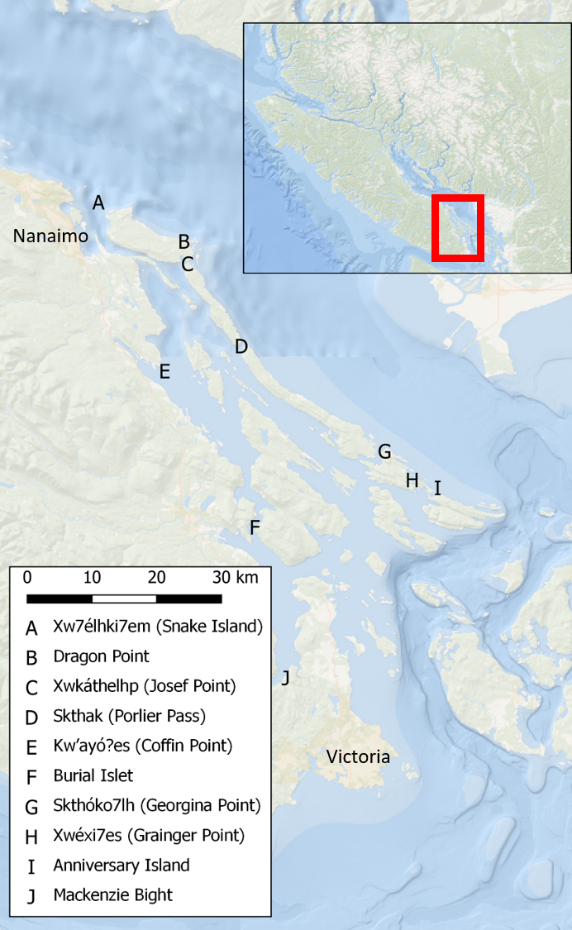


Figure 1: Map of survey sites within the Southern Gulf Islands BC Canada. High current sites are coloured red, low current sites are coloured blue. Current speed categories were defined by using the inflection point of all daily maximum current speeds at all sites. Hul’q’umin’um’ site names are used when they could be found in the literature.

## Results Figures and Captions

*Abiotic data analysis*

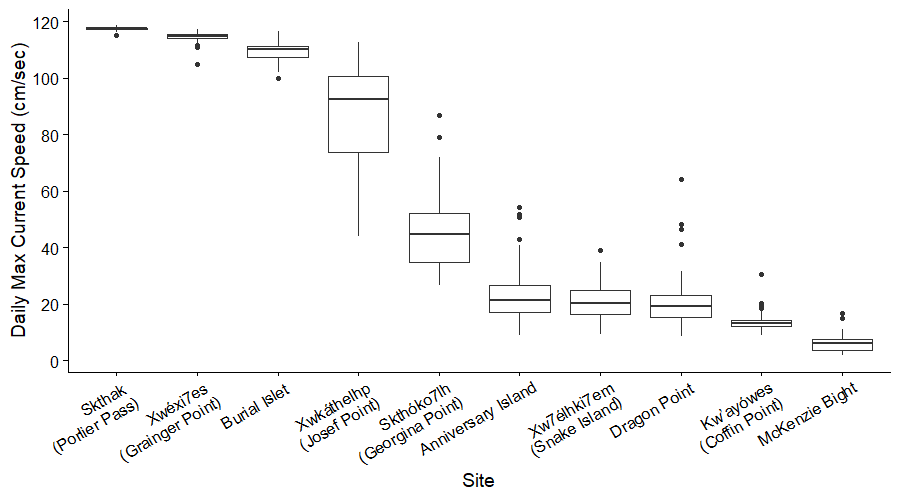


Figure 3: Daily maximum current speeds at each site presented as boxplots, indicating the median and quartiles with whiskers extending to 1.5 times the interquartile range.

*Fish species richness, abundance, and biomass analyses*

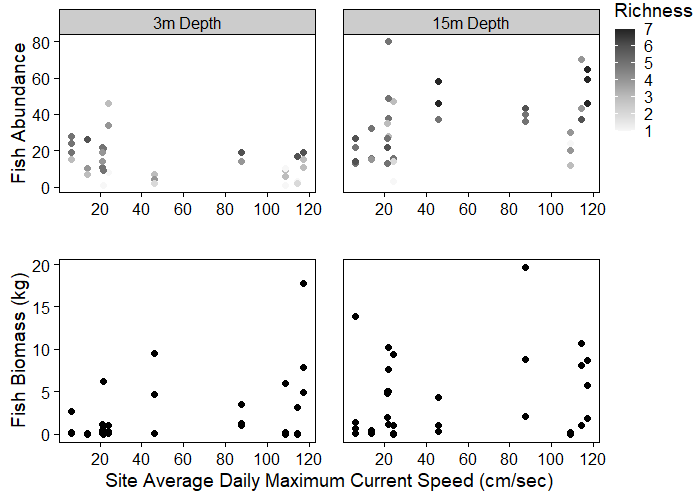


Figure 4: Individual transect fish abundance and biomass at each site average daily maximum current speed. Grey shaded circles in the abundance plot (top) represent the transect species richness (via shade) and abundance (via vertical position), black circles in the biomass plot (bottom) represent transect biomass. The number of replicate transects at each site and depth were inconsistent due to site sampling logistic limitations.

*Model results*

*Fish community results*

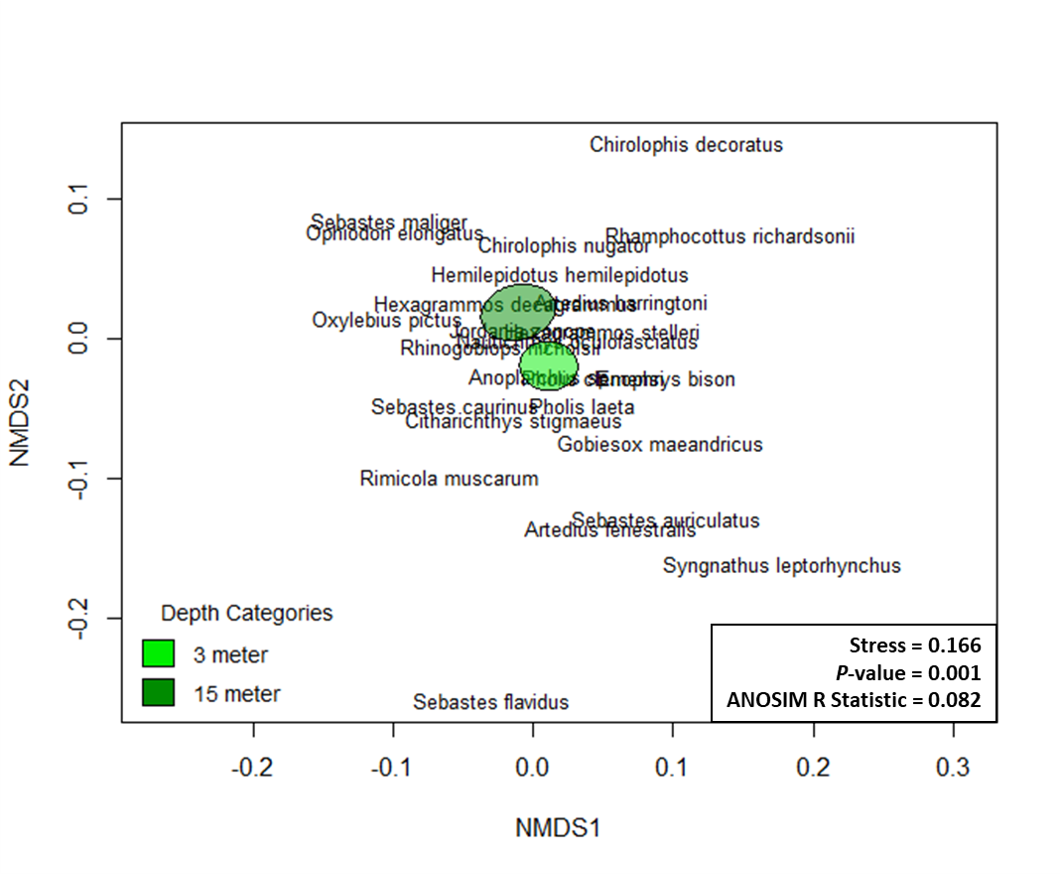
****

Figure 11: Non-metric multi-dimensional scaling (nMDS) plot of the Gower dissimilarity measure of fish community dissimilarities for current category or depth transects. Each symbol represents a replicate transect. The shape represents the transect depth (circle for 3 meter depth and triangle for 15 meter depth) and colour represents current category (blue for low current and red for high current).

*Fish length analyses*

**Appendix**

A1: Species observed and their total recorded abundances. Species are grouped based on which transect depths they were observed on.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Observed | | FishBase |
| Species Name | Total Abundance | Minimum Length (cm) | Maximum Length (cm) | Maximum Length (cm) |
| Species observed at both depths | |  |  |  |
| *Rhinogobiops nicholsii* | 776 | 2 | 11 | 15 |
| *Artedius harringtoni* | 459 | 1 | 10 | 10 |
| *Jordania zonope* | 153 | 2 | 14 | 15 |
| *Sebastes caurinus* | 86 | 4 | 65 | 58 |
| *Hexagrammos decagrammus* | 68 | 7 | 52 | 61 |
| *Oxylebius pictus* | 37 | 9 | 14 | 25 |
| *Chirolophis nugator* | 7 | 6 | 7 | 15 |
| *Pholis laeta* | 7 | 5 | 13 | 25 |
| *Hemilepidotus hemilepidotus* | 7 | 8 | 22 | 51 |
| *Anoplarchus sp.* | 6 | 6 | 11 | 20 |
| *Nautichthys oculofasciatus* | 6 | 5 | 13 | 20 |
| *Sebastes auriculatus* | 3 | 5 | 24 | 56 |
|  |  |  |  |  |
| Only at 3 meter depths | |  |  |  |
| *Artedius lateralis* | 8 | 3 | 10 | 14 |
| *Hexagrammos stelleri* | 6 | 8 | 16 | 48 |
| *Gobiesox maeandricus* | 5 | 4 | 10 | 16 |
| *Enophrys bison* | 1 | - | 23 | 37 |
| *Rimicola muscarum* | 1 | - | 3 | 7 |
| *Syngnathus leptorhynchus* | 1 | - | 10 | 33 |
|  |  |  |  |  |
| Only at 15 meter depths | |  |  |  |
| *Sebastes maliger* | 12 | 6 | 23 | 61 |
| *Ophiodon elongatus* | 9 | 25 | 75 | 152 |
| *Rhamphocottus richardsonii* | 4 | 2 | 7 | 9 |
| *Citharichthys stigmaeus* | 3 | 2 | 9 | 17 |
| *Sebastes flavidus* | 3 | 17 | 24 | 66 |
| *Chirolophis decoratus* | 2 | 12 | 13 | 42 |
| *Pholis clemensi* | 1 | - | 5 | 13 |

**Suggestions for journals**

* Ecological Applications

*Ecological Applications is concerned broadly with* ***the applications of ecological science to environmental problems****. It publishes papers that develop scientific principles to* ***support environmental decision-making****, as well as papers that discuss the application of ecological concepts to environmental issues, policy, and management. Papers may report on experimental tests, actual applications, scientific decision support techniques, economic analyses, social implications of environmental issues, or other relevant topics. Statistical or experimental methods papers that support research and applications are welcome. Papers submitted to Ecological Applications should be accessible to both scholars and practitioners.*

Impact factor: 4.25

Online only (no print copy of the journal)

No limit on number of figures – colour figures incur no additional publication charges

Data must be made publicly available

$75/pdf page

* Ecological Indicators

*The ultimate aim of* Ecological Indicators *is to* ***integrate the monitoring*** *and* ***assessment*** *of* ***ecological*** *and* ***environmental indicators******with management practices****. The journal provides a forum for the discussion of the applied scientific development and review of traditional indicator applications as well as for theoretical, modelling and quantitative approaches such as index development.*

Impact factor: 4.96

Online only

~ 7,000 words, max 10,000 words

No limit on the number of figures

$2500 flat fee

* CPS Fish and Aquat Sci

Impact factor 2.85

*The* Canadian Journal of Fisheries and Aquatic Sciences*is the primary publishing vehicle for the multidisciplinary field of aquatic sciences. The journal publishes perspectives (syntheses, critiques, and re-evaluations), discussions (comments and replies), articles, and rapid communications, relating to* ***current research on*** *-omics, cells, organisms, populations,* ***ecosystems, or processes that affect aquatic systems****. The journal seeks to amplify, modify, question, or redirect accumulated knowledge in the field of fisheries and aquatic science.*

No mandatory fees, $1500 to publish open access w/ DFO discount, $250/colour figure

Max 10,000 words

No limit on the number of figures

* AFS – Marine and Coastal Fisheries

Impact factor: 1.74

*Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science publishes original and innovative research that synthesizes information* ***on biological organization across spatial and temporal scales*** *to promote ecologically sound fisheries science and management. This Gold Open Access journal provides an international venue for studies of marine, coastal, and estuarine fisheries, with emphasis on species' performance and responses to perturbations in their environment, and promotes the development of* ***ecosystem-based fisheries science and management****. The journal encourages contributors to identify and address challenges in population dynamics, assessment techniques and management approaches, human dimensions and socioeconomics, and ecosystem metrics to improve fisheries science in general and make informed predictions and decisions.*

150 page max!

No additional charges for colour figures

$1,980 flat fee