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Building a Habitat Suitability Index for Olympia Oyster Restoration

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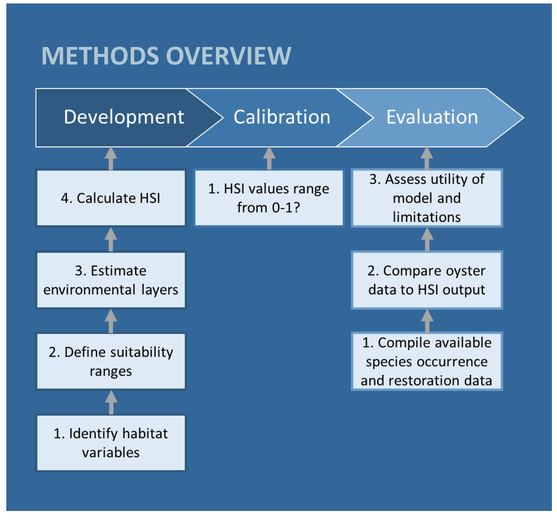
INTRODUCTION

Olympia oysters – the west coast's only native oyster species – are scarce throughout their range. An estimated 4% of oyster "beds" remain in the southern Salish Sea compared to historic populations. Restoration efforts are underway coastwide.

- Location within bays and estuaries is an important factor in restoration project outcomes.
- Restoration practitioners are interested in new tools to support identifying potential restoration sites.
- Habitat suitability index (HSI) models have been widely applied for oyster restoration and resource management.
- This study presents a preliminary spatial HSI model for Olympia oyster restoration in the southern Salish Sea.



DEFINING HABITAT SUITABILITY

Habitat requirements for Olympia oyster survival, reproduction, and population persistence were identified from a thorough literature review. Tidal elevation, mean spring/summer temperature, mean winter salinity, and maximum current velocity were selected as "threshold" habitat variables to include in the index, and HSI scores were assigned based on the literature. Risk of low salinity events and residence time were included in the HSI as additional "exclusion" habitat variables (i.e., score of 0 or 1). Table 1 shows the suitability ranges for the threshold habitat variables included in this study, reclassified by four possible HSI score values, as shown in the key. The methodology applied to synthesize literature and translate suitable ranges to HSI scores was adapted from Lewis et al. (2019).

Table 1. Suitability ranges and HSI scores for four threshold habitat variables. The ranges below were defined using the "Framework to Identify Suitable Bivalve Habitat in Estuaries." (Lewis et al., 2019).

Tidal Elevation (ft. MLLW)

	Subtidal																					High Intertidal
Elevation	<-10	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	>10
HSI SCORE																							

Mean spring/summer temperature (C)

	Cold																												Very Warm
Temperature	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	>38
HSI SCORE																														

Mean wet season salinity (psu or ppt)

	Fresh																												Marine
Salinity	0	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	>32
HSI SCORE																																	

Maximum current velocity (m/s)

	Slow																																Fast
Current Velocity	0.00					0.10					0.20					0.30					0.40					0.50					0.60					0.70					0.80					0.90					1.00	>1
HSI SCORE																																																					

Key: 0 | 0.33 | 0.66 | 1

HSI RESULTS – LIBERTY BAY

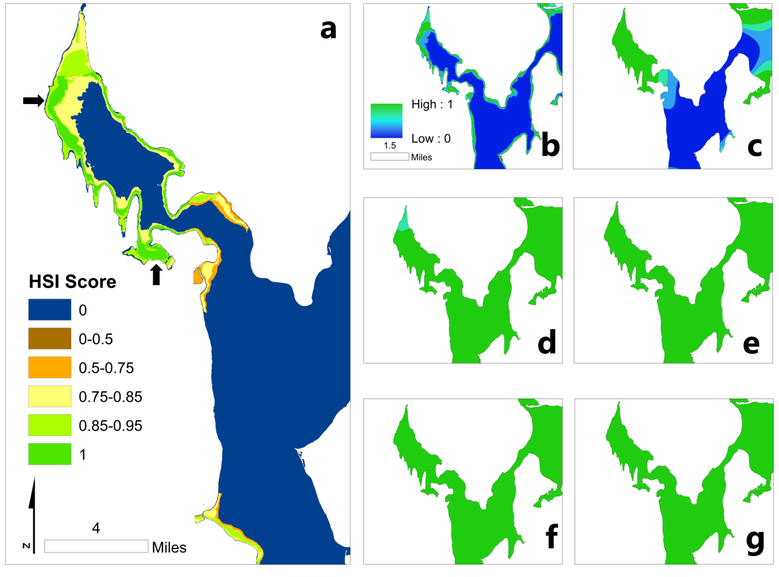


Figure 1. HSI model applied to Liberty Bay, Washington. Panel **a** shows the overall HSI score, and panels **b-g** show the reclassified habitat variable layers used to calculate the overall HSI score.

Figure 1 shows the results of applying the HSI to Liberty Bay, Washington.

> Elevation (b), current velocity (c), salinity (d), and temperature (e) layers are combined by taking the geometric mean of the reclassified values (reclassification shown in Table 1).

> This threshold mean was then multiplied by the reclassified residence time (f) and low salinity event (g) layers to calculate the overall HSI for Liberty Bay (a).

> Optimal habitat (HSI=1) according to the index exists primarily along the western shore and in Dogfish Bay (arrows), and in a narrow band along the eastern shore.

> Preliminary evaluation of the index finds that oysters occur where HSI>0.65 in West Sound. In Hood Canal, oysters occur where HSI=0 and where HSI>0.5 (Figure 2).

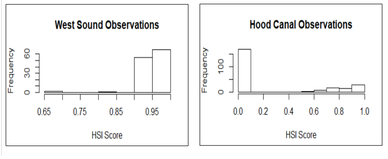


Figure 2. Oyster observations and extracted HSI scores for West Sound (n=125) and Hood Canal (n=235).

DISCUSSION

> This study presents an initial effort to develop and apply an HSI model to identify suitable habitat for Olympia oyster restoration in the southern Salish Sea.

> Results suggest that the HSI may identify suitable habitat in some areas (e.g., Liberty Bay and Dyes Inlet); however, analysis is needed to understand where the model may overpredict suitability and/or fail to identify suitable habitat for restoration.

> Potential applications of this work include using the model to preliminarily identify potential restoration sites, exploring potential climate change impacts to suitable habitat, comparing HSI scores with restoration outcomes, and others.

> Further research could focus on assessing the accuracy of environmental layers used to define the index and determining the best data sources, examining relationships between habitat variables and restoration outcomes using statistical methods, and gathering and analyzing data on restoration project outcomes.

Acknowledgments & References

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Comments, questions, suggestions, collaboration?

I would love to hear from you!
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