The eyes have it: A comparison of field estimates versus digital evaluation of percent cover of SAV and substrate in Tillamook Bay, OR

Jennifer C. Boyer, Anthony F. D'Andrea, Stacy N. Galleher, Kelsey L. Adkisson, Natalie A. Amoroso, and Amy M. Hutmacher

Oregon Department of Fish and Wildlife, Marine Resources Program, Shellfish Project, Newport, OR ODFW.SEACOR@state.or.us

Introduction

Submerged aquatic vegetation (SAV) provides an important suite of benefits to estuarine species: primary production, a source of habitat, protection from predation, and food. SAV also provides essential ecosystem services such as filtration, nutrient storage and cycling, and recreational enjoyment. Differences in SAV habitat and substrate within an estuary may have substantial effects on the distribution and abundance of other estuarine species. Classification and characterization of percent cover of SAV and substrate is critical in mapping estuarine habitat to track changes over time.

We measured SAV and substrate cover on intertidal mudflats located in Tillamook Bay, Oregon as a major component of a larger study to determine habitat characteristics associated with clam abundance. Performing field estimates of SAV and substrate percent cover is subjective and can vary greatly between individuals, creating a potential source of error that can skew analysis and lead to inaccurate results. This study compared estimates of SAV percent cover for sample sites using a field-based rapid assessment method (RAM) and photographs digitally post-processed with the software program CPCe[1].

Figure 1. Field crew members assessing percent cover using RAM while in the field.

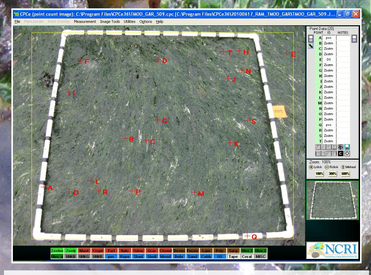


Figure 2. Digitally processed sample site photo for percent cover using CPCe.

Approach

RAM

- Qualitatively estimated SAV and substrate percent cover at sample sites within three tideflat regions of Tillamook Bay (Figure 1).
- SAV categories included all eelgrass and macroalgal species present in Tillamook Bay; substrate categories included sand, gravel, cobble, and shell.
- Minimum percent cover estimates began at 5%.

CPCe

- Customized CPCe cover codes and output files for Tillamook Bay.
- Digitally analyzed in triplicate fifteen randomly selected photos of sites previously analyzed with RAM (45 photos total; Figure 2).
- Omitted rare species (<5% of total cover).
- Statistically compared percent cover determined by CPCe with RAM percent cover.

Results

- We found overall consistencies between both methods with the exception of the amount of red algae (χ^2 p-value = 0.0017) and shell (χ^2 p-value < 0.0001; Table 1).
- We saw greater significant differences in percent cover between tideflats compared to between the assessment methods (Table 2).
- Sources of error were the inclusion of rare species (≤5%) and possible overestimation using RAM (Figure 3).

Comparison of RAM with CPCe Percent Cover Analysis			
Cover Category	CPCe μ	RAM μ	χ^2 p-value
Eelgrass	1.2	1.2	0.79
Red Algae	0.00	0.067	0.0017*
Brown Algae	0.092	0.13	0.14
Green Algae	0.47	0.54	0.31
Substrate	0.71	0.70	0.95
Sand	0.53	0.53	0.80
Gravel	0.12	0.056	0.17
Cobble	0.058	0.095	0.45
Shell	0.00	0.010	<0.0001*

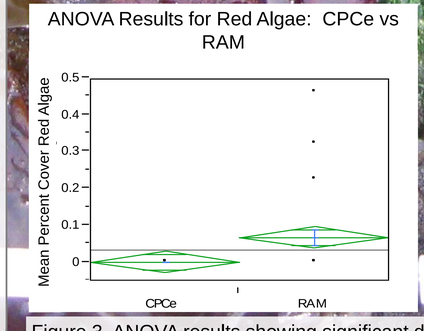
* = p<0.05

Table 1. Comparison of means for percent cover categories between RAM and CPCe assessment methods showing significant differences only for red algae and shell.

Effects of Tideflat and Analysis Type (CPCe or RAM) on Percent Cover Results		
Category	Tideflat χ^2 p-value	Analysis type χ^2 p-value
Eel grass	<0.0001*	0.39
Red algae	<0.0001*	0.0006*
Brown algae	<0.0001*	0.31
Green algae	<0.0001*	0.33
Substrate	0.043*	0.97

* = p<0.05

Table 2. Comparison of the effects of location (tideflat) versus type of analysis (CPCe or RAM) on differences in percent cover showing greater variation between tideflats than between analysis methods.



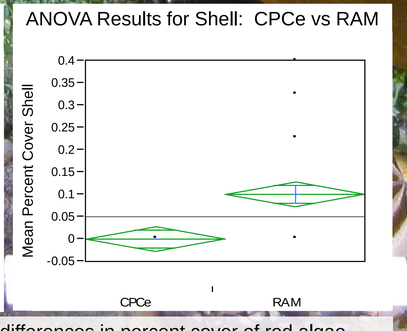


Figure 3. ANOVA results showing significant differences in percent cover of red algae (left) and shell (right) between assessment methods resulting from the inclusion of rare species and/or possible overestimation using RAM. All data was normalized with an arcsine square-root transformation.

Major Findings

- The use of CPCe appears to render slightly more accurate and precise percent cover determinations compared to the in-field RAM approach but requires more post-processing time.
- RAM provides immediate percent cover results that are fairly accurate at a slightly coarser scale.
- Using a minimum of 5% for present species complicated the comparison between analysis methods because rare species could not be removed from the RAM data without skewing the results.
- Adjusting our RAM to group SAV species into functional categories or for rare species using smaller bin sizes (<5%) may remove complications, allowing greater flexibility and accuracy in conducting statistical and overall habitat analyses.

Implications

- CPCe is customizable to suit various landscapes. With minor adaptations it is a useful percent cover analysis tool applicable to a wide variety of environments.
- CPCe can be used to verify or spot-check qualitative percent cover assessments quickly while removing sources of bias.
- Retention of processed photos and output files enables users to perform QA/QC on an as-needed basis.
- CPCe is a useful tool if species identification is uncertain: photos with sufficient resolution can be post-processed quickly after species have been taxonomically identified.
- Computer programs like CPCe allow for flexibility to calculate percent cover in the field or lab, which allows for more efficient use of intertidal survey time.

Acknowledgments

The Shellfish Project is supported by recreational shellfish license fees. Special thanks to the 2010 Shellfish Team and the ODFW Tillamook Field Office.

CPCe Citation

Kohler, K.E. and S.M. Gill, 2006. Coral Point Count with Excel extensions (CPCe): A Visual Basic program for the determination of coral and substrate coverage using random point count methodology. Computers and Geosciences, Vol. 32, No. 9, pp. 1259-1269, DOI:10.1016/j.cageo.2005.11.009.