Accuracy Assessment for NOAA Florida Keys Mapping

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Introduction

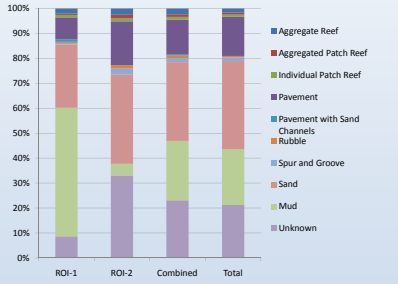
As part of a regional mapping and monitoring effort in the Florida Keys, NOAA required an independent accuracy assessment to statistically test the accuracy of the GIS-based benthic habitat map recently produced for the Lower Keys. Resources, budgets, and logistical constraints precluded a comprehensive assessment of the entire mapped area, thus biogeographically-representative corridors within the total benthic habitat map area were selected for performing the accuracy assessment. The corridors not only captured a wide diversity of habitats, but were also characterized by frequent transitions between habitat types ensuring a well-distributed, representative set of survey locations. As the Florida Keys benthic habitat mapping effort proceeds, the area of mapped benthic habitats gets considerably larger than the area assessed for accuracy, making it important to evaluate new areas for accuracy.

Accuracy Assessment Methodology

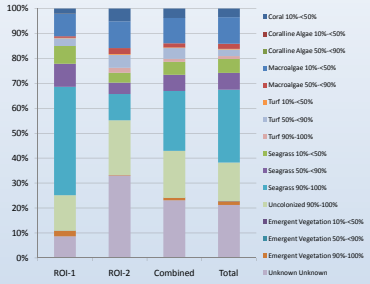
The classification scheme used herein was designed by NOAA and its partners for the benthic habitat mapping program initiated in 1999. A meeting was held on June 11 and 12, 2008 to review the most recent developments in sampling protocol and the map classification scheme.

A total of 1036 sampling stations were visited, of which 957 were used in the accuracy assessment. The sites were selected using a stratified random sampling protocol that equally distributed sampling points amongst the detailed structure categories. Most sites were sampled by deploying a weighted drop camera with the vessel drifting in idle and recording 30-120 seconds of dGPS-referenced video. The shallowest sites were sampled by snorkel, waverunner, or kayak, using a hand-held dGPS for navigation and a housed camera to record video. Each sampling station was assigned a classification in the field. These field classifications were reevaluated post-survey during a systematic review of video and photographic data. The efficacy of the benthic habitat map was assessed by a number of classification metrics derived from error matrices of the Major and Detailed levels of Geomorphological Structure and Biological Cover. The known map proportions were used to remove the bias introduced to the producer's and user's accuracies by differential sampling intensity.

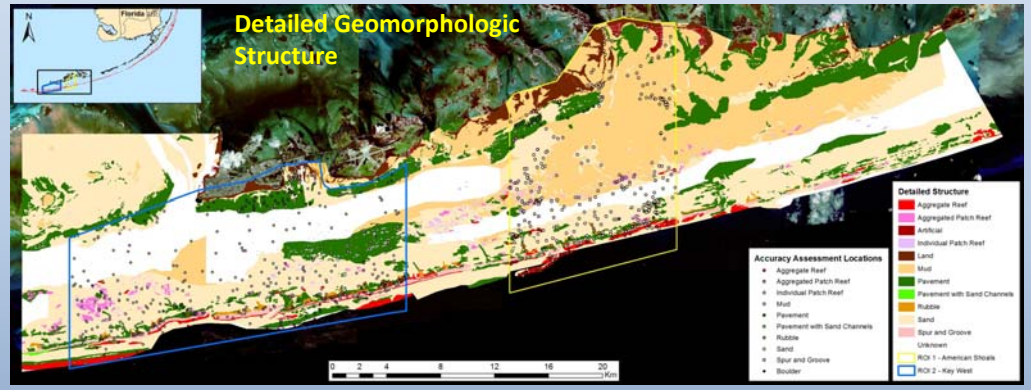
Sampling methods used for data collection. The primary method was to drop a video camera from a boat (top row, left: view of camera; right: example of video). Shallow-water sites were visited by either kayak, waverunner, or snorkel (bottom row) to collect site data with an portable underwater camera.

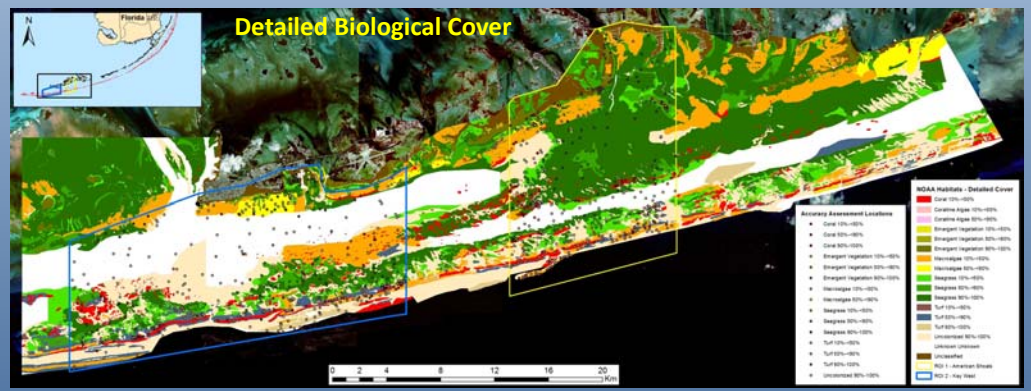


Percent mapped area of Detailed Geomorphologic Structure



Percent mapped area of Detailed Biological Cover





Accuracy Assessment Area 1 (ROI-1) (yellow) and Area 2 (ROI-2) (Blue), within the overall NOAA mapped region of the Lower FL Keys. ROI-1 included the seaward seafloor south of Cudjoe and Sugarloaf Keys including American Shoals. ROI-2 included the region between Sand Key and Eastern Sambo from the shoreline intertidal zone to the outer bank/shelf escarpment at a depth of approximately 33m. Top figure is benthic habitat map classified by Detailed Geomorphologic Structure with the AA locations classified by their Accuracy Assessment ID for the same class. Bottom figure is benthic habitat map classified by Detailed Biological Cover with the AA locations classified by their Accuracy Assessment ID for the same class.

Error Matrices

Standard

TRUE (GROUND-TRUTHED) (j)

MAJOR STRUCTURE	hard	soft	$n_{i.}$	USERS Accuracy (%)
hard	426	70	496	85.9
soft	13	448	461	97.2
$n_{.j}$	439	518	957	<= n
PRODUCERS Accuracy (%)	97.0	86.5	P_o	91.3%

MAP (i)

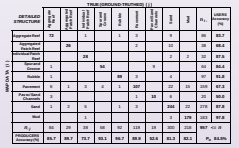
T_e = 0.827 ± 0.036

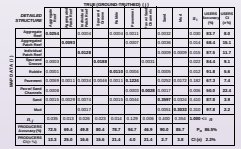
Adjusted for Map Proportion

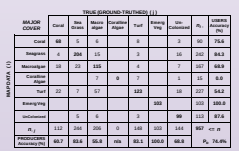
TRUE (GROUND-TRUTHED)(j)

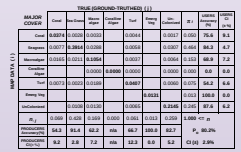
MAJOR STRUCTURE	hard	soft	$\pi_{.j}$	USERS Accuracy (%)	USERS CI (± %)
hard	0.2406	0.0395	0.280	85.9	3.1
soft	0.0203	0.6996	0.720	97.2	1.5
$n_{.j}$	0.261	0.739	1.000	<= n	
PRODUCERS Accuracy (%)	92.2	94.7	P_o	94.0%	
PRODUCERS CI (± %)	3.9	1.1	CI (±)	1.4%	

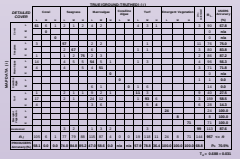
MAP (i)

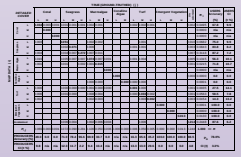












Error matrices of combined ROIs for Major and Detailed structure and cover categories; L = 10 -< 50%, M = 50 -< 90%, H = 90 - 100%. Blank cells indicate 0 occurrences.

Summary

The true error of non-sampled portions of the map is ultimately unknown and further sampling in these areas of the map would allow for a better understanding of the entire map accuracy, however, the combined accuracy assessments ensured that a well-distributed, representative set of monitoring locations were surveyed that closely represented the entire mapped region. For this reason it is thought to be a good measure of the map accuracies for the broader area. Many of the Biological Cover habitats were very small relative to the overall percentage of the entire mapped area; therefore the total map accuracy adjusted for marginal map proportions was likely a better gauge of the overall map accuracy than P_o. This, however, should not diminish the use of Tau as a metric to gauge map accuracy. Adjusting for marginal map proportions does not account for the probabilities of error due to increased number of classes, thus both metrics should be used as a gauge of the overall accuracy of the map products. As the Florida Keys benthic habitat mapping effort proceeds, it is important to evaluate new areas to understand both local and regional map accuracies. With NOAA support, NCRI is planning to conduct at least two more assessments of newly mapped areas; one in the middle Keys, and one in the upper Keys.

Acknowledgements

This work is dedicated to the late Miles Anderson, who tirelessly devoted the last few years of his life to create the benthic habitat maps of the Florida Keys. He will be forever missed. This research was partially funded by the National Oceanic and Atmospheric Administration Coastal Ocean Program under award NA03NOS4260046 to Nova Southeastern University for the National Coral Reef Institute.