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Accuracy Assessment

The resulting maps were compared with the 245 field reference points. All 245 reference points were used to support the interpretation and mapping in some fashion and so can not be truly considered as completely independent validation. The resulting maps were also compared with an independent set of 41 bottom sampling points collected as part of a seagrass-sediment study conducted during the summer of 2003 by the New Jersey office of the Natural resources Conservation Service (Chris Smith and David Friedman). These additional 41 bottom sample points were collected in an area along the eastern shore of central Barnegat Bay in an area deemed of high image quality. At each sampling point, a sediment grab sample was taken and the presence/absence of seagrass determined for an approximately $5m^2$ area. The spatial locations of the 41 sampling points were recorded using a non-differentially collected GPS receiver (Garmin Map 12) with an approximate positional error of ± 15m. The presence/absence data for the 245 and 41 sampling points were compared with the same location from the digital seagrass map and summarized in a contingency table and producer's/user's accuracy and Kappa statistic (a measure of agreement corrected for chance agreement) computed.

The seagrass density data for the 245 field reference points were categorized into 4 seagrass density classes (absent, sparse, moderate and dense), compared with the same location from the digital seagrass map and summarized in a contingency table (Table 1a). The overall accuracy was 68.2% and Kappa statistic was 56.5%, which can be considered as a moderate degree of agreement between the two data sets. Aggregating the data into a simple presence vs. absence comparison (Table 1b) shows a higher level of agreement

with an overall accuracy of 82.8% and a Kappa statistic of 63.1%. Examination of Table 1b reveals that most of the disagreement was due to a high error of omission, i.e., a number of points confirmed as seagrass in the field sampling data were not mapped as seagrass (32 out of 245 points or 13.1%). 20 out of these 32 points (62.5 %) were categorized as Sparse Seagrass (i.e., 10-39%) in the field.

The presence/absence data for the 41 independent sampling points were compared with the same location from the digital seagrass map and summarized in a contingency table (Table 2). The overall accuracy was 70.7% and Kappa statistic was 43%, which can be considered as a moderate degree of agreement between the two data sets. Examination of the Table 2 reveals that most of the disagreement was due to a high error of commission, i.e., a number of points mapped as seagrass were not confirmed as seagrass in the field sampling data (9 out of 41 points or 22.0%). These 9 points were relatively equally spaced across the 3 categories of seagrass density (3 in 10-39%, 2 in 40-79%, and 4 in 80-100%).

The agreement between the mapped results and the original field reference as well as independent reference data were only moderate (i.e., 68% for the 4 category map and 83% for the presence/absence map based on the original field reference data and 71% for the simple presence/absence map as compared to independent reference data). The comparison with the original reference data suggests that most of the error is due to the omission of Sparse Seagrass beds. These results are similar to Moore et al. (2000) who found that their aerial photo-interpretation tended to underestimate percent cover at low SAV densities. It should also be noted that while the imagery was collected in early May, the field reference points were not sampled until after the imagery collection, in some cases up to several weeks later. Thus reference points that may not have had distinctly visible seagrass at the time of data collection only to have sparse seagrass densities later in the growing season. A majority of the disagreement in the independent data comparison was due to a comparatively high error of commission and may not be a true measure of the map accuracy but rather be due to: 1) the mismatch between the footprint area of the reference sample in relation to the size of the minimum mapping unit for the

seagrass maps; and 2) high positional error (± 15m) of the reference samples. Due to the natural fine scale patchiness within even dense beds, the comparatively small footprint of the reference data (approximately $5m^2$) could sample bare patches (i.e., below the minimum mapping unit size of 1 ha) within an otherwise extent bed. Likewise, the high positional error (± 15m) of the reference samples coupled with the fine scale patchiness could also result in a disagreement between the reference data and the mapping.

Table 1. Contingency table comparing seagrass density from field reference data and the GIS seagrass maps for 245 points.

1a. 4 categories: Seagrass Absent, Sparse, Moderate vs. Dense

	Reference				
GIS Map	Seagrass Absent	Seagrass sparse	Seagrass moderate	Seagrass dense	User's Accuracy
Seagrass: Absent	67	20	9	3	68%
Seagrass: sparse	4	37	14	3	64%
Seagrass: moderate	0	4	40	6	80%
Seagrass: dense	6	2	7	23	61%
Producer's Accuracy	87%	59%	57%	66%	68%

1b. 2 categories: Seagrass Present vs. Absent

	Reference	Reference	
GIS Map	Seagrass Absent	Seagrass Present	User's Accuracy
Seagrass Absent	67	32	68%
Seagrass Present	10	136	93%
Producer's Accuracy	87%	81%	83%

Table 2. Contingency table comparing seagrass presence/absence from independent field sampling data and the GIS seagrass maps for 41 points.

	Reference	Reference	

GIS Map	Seagrass Absent	Seagrass Present	User's Accuracy
Seagrass Absent	14	3	82%
Seagrass Present	9	15	62%
Producer's Accuracy	61%	83%	71%