

Distribution and status of seagrasses in Moreton Bay, Australia, and an evaluation of community based monitoring (Seagrass-Watch).

Paul Finn¹, Nicola Udy², Simon Baltais³, Keira Price¹ and Paul Maxwell⁴.

¹Seagrass-Watch Moreton Bay, Queensland Conservation.

²Queensland Parks and Wildlife Service, Moreton Bay District Office.

³Wildlife Preservation Society of Queensland, Bayside Branch.

⁴Ecosystem Health Monitoring Program, Queensland Environmental Protection Agency.



Introduction

- Seagrass-Watch is community based monitoring of seagrass resources. It was developed in 1998 by DPI, CRC Reef Research, QPWS and community groups, and is now operating all over the world.
- Seagrass meadows are an important coastal habitat and are indicative of ecosystem health at the land-sea interface.
- There are seven seagrass species in Moreton Bay covering an area of approximately 250 km².

Aim

- To raise awareness on the condition and trend of near-shore seagrass ecosystems and provide an early warning of major coastal environment changes.

Methods

- The volunteers represent a diverse cross-section of society (Figure 1). There are 288 individuals signed up, 221 have been trained in the methods of Seagrass-Watch and 138 have adopted sites and are currently monitoring on average 35 sites per monitoring period.
- In Moreton Bay, seagrass condition is visually assessed at two to five sites nested within 17 locations (53 sites total, Figure 2).
- Detailed descriptions of the methods are reported in McKenzie *et al.* (2000 & 2001). Briefly, groups of two to four volunteers head along three 50 m long transects, 25 m apart, running perpendicular to the shoreline and score the % seagrass cover within a 0.5 m² quadrat every five m, making a total of 33 samples per site per visit.
- Nine of the 33 quadrats sampled by volunteers during each monitoring session are photographed and later scored by a trainer for data quality assurance.



Figure 1. Some examples of volunteer teams.

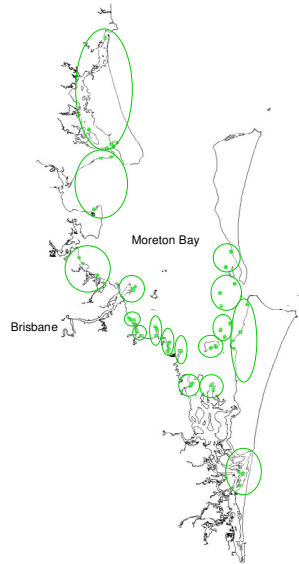


Figure 2. Map of Moreton Bay showing the arrangement of the 17 locations (circled) and 53 sites.

2. Distribution and status.

- Since Seagrass-Watch commenced, seagrass distribution appears to be relatively stable in Moreton Bay. Although there may have been some minor distributional shifts within seagrass meadows, no site has gone from supporting seagrass to being completely devoid or vice versa. We are currently using GPS mapping techniques to gain greater accuracy in detecting these minor distributional shifts.
- There appears to be a decline in seagrass cover over time (Figure 4), particularly in the north section, however some of the sample sizes are very small and further monitoring and analyses are required to understand this trend. There is cause to keep a cautious eye on seagrass in the north section of the Bay as *Zostera muelleri* is the dominant species at most sites and has been shown in other studies to be relatively resilient and stable through time.

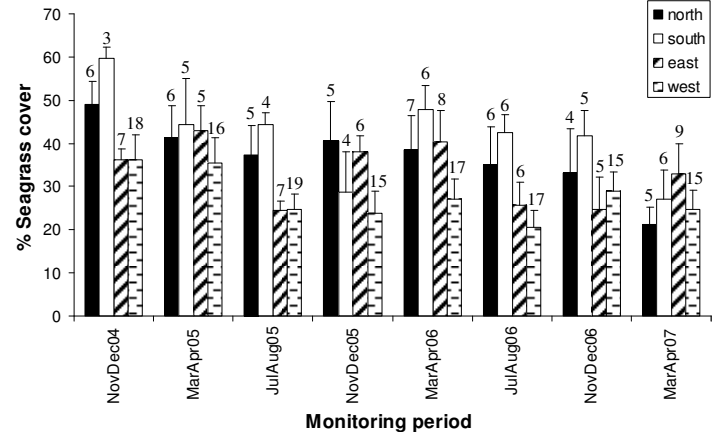


Figure 4. The percent seagrass cover (means and standard errors shown) for particular sections of Moreton Bay (north, south, east and west) for eight monitoring periods from November-December 2004 to March-April 2007. The number of sites monitored within each section during each monitoring period appears above the bars.

3. Comparison with Ecosystem Health Monitoring Program water quality data.

- Seagrass-Watch data over the last four years (i.e. 12 monitoring periods from Mar/Apr03 to Nov/Dec06) was compared with water quality data from 2000-2007. Groups of EHMP sites were associated with groups of adjacent Seagrass-Watch sites.
- A correlation matrix was used to reduce the number of water quality variables used in analyses down to five that were not highly correlated with each other: secchi depth, oxygen saturation, total nitrogen, water temperature and ecosystem health index (EHI) value. EHI is the proportion of the waterway's area that complies with established water quality objectives.
- In an all-subsets multiple regression the EHI value contributed the most (although a negligible 8 %) to the explained variance in percent seagrass cover ($r^2=0.08$, Table 1). Although the explained variance (r^2) increased gradually with the addition of subsequent water quality variables, the model became consistently less efficient (most efficient models are those with relatively low BIC values) and explained a maximum of only 15 % of the variation in seagrass cover among locations ($r^2=0.15$, Table 1).
- There appears to be no strong correlation between percent seagrass cover and any of the water quality variables used. It would be erroneous to infer that water quality has no effect on seagrass. The lack of correlation may be explained by temporal and spatial differences in sampling.
- This result suggests that EHMP water quality data is a poor surrogate for seagrass condition and therefore provides good evidence that both programs are necessary to provide a complete picture of the ecological health of Moreton Bay.

Table 1. Selected results of an all-subsets multiple regression comparing percent seagrass cover (dependant variable) with five water quality characteristics across locations. This table shows the best models for each number of predictors, based on the explained variance (r^2), and the Schwarz Bayesian Information Criterion (BIC) for each model.

No. of predictors	Model	r^2	BIC
1	Ecosystem Health Index (ehi) value	0.08	109.99
2	secchi depth + ehi value	0.11	112.09
3	secchi depth + total nitrogen + ehi value	0.13	114.62
4	secchi depth + oxygen + total nitrogen + ehi value	0.15	117.27
5	secchi depth + oxygen + water temperature + total nitrogen + ehi value	0.15	120.11

Results & Discussion

1. Accuracy and consistency of the data collected by volunteers.

- Data collected by volunteers are generally very accurate. There was a strong positive correlation between the seagrass cover estimates of the volunteers' and trainers' ($r=0.85$, $v=2423$, $P<0.001$).
- In the majority of cases (84 %, Figure 3), the visual estimation of seagrass percent cover made by the volunteers' and independently by the trainers' were less than 19 % different.

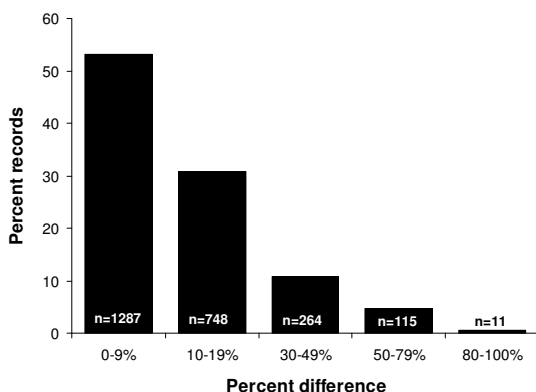
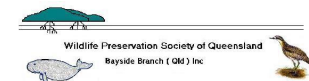


Figure 3. Percent records (0.5 m² quadrats) against each of five categories of percent difference in the visual estimation of seagrass percent cover between volunteer and trainer, for all photographs that were able to be validated (n=2425) since the Seagrass-Watch program commenced.

Supported by:



References:
 McKenzie, L. J., Campbell, S. J. & Roder, C. A. (2001). Seagrass-Watch: Manual for mapping and monitoring seagrass resources by community (citizen) volunteers. (QFS, NFC, Cairns) 94pp.
 McKenzie, L. J., Lee Long, W. J., Coles, R. G., & Roder, C. A. (2000). Seagrass-Watch: Community based monitoring of seagrass resources. Biol. Mar. Medit. 7: 393-396.