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Evaluation of Seagrass Planting and Monitoring Techniques: Implications for Assessing Restoration Success and Habitat Equivalency

Susan S. Bell,[1,2] Alexander Tewfik,[1,3] Margaret O. Hall,[4] and Mark S. Fonseca[5]

Abstract

Restoration has become an integral part of coastal management as a result of seagrass habitat loss. We studied restoration of the seagrass (*Halodule wrightii*) near Tampa Bay, Florida. Experimental plots were established in June 2002 using four planting methods: three manually planted and one mechanically transplanted by boat. Seagrass cover was recorded at high resolution (meter scale) annually through July 2005. Natural seagrass beds were concurrently examined as reference sites. We also evaluated the suitability of a commonly used protocol (Braun-Blanquet scores, BB) for comparing the development of seagrass cover using the planting methods and quantifying spatial patterns of cover over time. Results show that BB scores mirrored conventional measures of seagrass characteristics (i.e., shoot counts and above- and belowground biomass) well when BB scores were either low or very high. However, more caution may be required at intermediate cover scores as judged by comparison of BB scores with direct measurement of seagrass abundance. Significant differences in seagrass cover were detected among planting methods and over time (2002–2005), with manual planting of rubber band units resulting in the highest cover. In contrast, the peat pot and mechanical planting methods developed very low cover. Recovery rates calculated from development of seagrass spatial cover were less than those reported for natural expansion. Importantly, time to baseline recovery may be substantially greater than 3 years and beyond standard monitoring timelines. Prolonged recovery suggests that the rate of service returns, critical for estimating compensatory restoration goals under habitat equivalency analysis, may be severely underestimated.

Key words: Florida, habitat equivalency analyses, *Halodule wrightii*, patch, recovery, restoration, seagrass.

Introduction

Ecosystem restoration has been an integral part of conservation strategies. A central goal of these strategies has been the creation of a naturally dynamic system requiring no further human intervention to persist and function. To implicitly test this restoration goal, studies have monitored attributes of restored areas and compared them to natural conditions (e.g., Simenstad & Thom 1996). Viewed as field experiments, restoration efforts can offer insight into species colonization patterns over large spatial scales (Bell et al. 1997) and successional processes within ecosystems—both of which might be much more difficult to discern under natural conditions (Young et al. 2005).

[1] Department of Biology, University of South Florida, Tampa, FL 22620-5200, U.S.A.
[2] Address correspondence to S. S. Bell, email sbell@cas.usf.edu
[3] WorldFish Center, Natural Resources Management, PO Box 500 GPO, 10670 Penang, Malaysia
[4] Florida Fish and Wildlife Conservation Commission, 100 Eighth Avenue SE, St. Petersburg, FL 33701-5020, U.S.A.
[5] National Ocean Service/NOAA National Centers for Coastal Ocean Science Center for Coastal Fisheries and Habitat Research, Beaufort, NC 28516-9722, U.S.A.

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Seagrasses are marine angiosperms inhabiting mainly subtidal areas that provide critical ecosystem services including provision of structural habitat, foraging sites and sediment stabilization (e.g., Jackson et al. 2001; Larkum et al. 2006). Vital ecological functions of seagrasses, however, are often impacted by anthropogenic activities, leading to seagrass loss (Short & Wyllie-Echeverria 1996; Walker et al. 2006). Recovery of impacted seagrass habitats, even after removal of disturbance, via natural processes may be slow, given that some seagrass species lack traits to colonize quickly previously occupied areas (e.g., Kirkman 1997). Thus, restoration via introduction of seagrass plants has become an important strategy in coastal management.

Seagrass restoration is geographically widespread (e.g., Piazzi et al. 1998; Paling et al. 2001), with most efforts replanting seagrass as small planting units (Fonseca et al. 1998; Lord et al. 1999) or sods (e.g., Paling et al. 2003). Success rate of restoration as measured by plant survival, establishment, and/or cover to levels similar to reference conditions is highly variable and often low; in the United States, approximately 50% of seagrass restoration projects failed to meet success criteria (Fonseca et al. 1998). This poor record may be a result of the lack of suitable