

Subject: Monitoring Plan

From: "Graham, Bruce" <bgraham@conshelf.com>

Date: Wed, 21 Feb 2007 14:38:11 -0500

To: Craig Lilyestrom <craig.lilyestrom@drna.gobierno.pr>, Tom Moore
<Tom.Moore@noaa.gov>

CC: David Smith <dsmith@IndependentMaritime.com>, ekappelin
<ekappelin@independentmaritime.com>, "Mulcahy, Robert" <rmulcahy@conshelf.com>,
"McCarthy, Anne" <amccarthy@conshelf.com>, "Hart, Alan" <ahart@conshelf.com>

Craig/Tom

The RP has had a chance to review the proposed monitoring plan for the emergency restoration at the Margara site. We have provided comments, rationale, and supportive references (as applicable) concerning specific content for the scope of work and overall level of effort as it relates to the program objectives.

Following your review, we would like to schedule a conference call to discuss the monitoring.

Best regards,

Bruce

Bruce Graham
Senior Scientist-Marine Specialist

Continental Shelf Associates, Inc.
759 Parkway Street
Jupiter, Florida 33477-9596
phone: 561-746-7946
cell: 561-758-5721
fax: 561-747-2954
bgraham@conshelf.com

RP Response: Trustee-Revised Monitoring Plan for Emergency Restoration at the *M/T Margara* Restoration Site

The purpose of the monitoring efforts is to determine relative success of coral/substrate reattachment as a means of long-term restoration for the shelf habitat and provide guidance in future restoration efforts. The stated objectives for the proposed monitoring plan are as follows:

- Evaluate the temporal stability of reattached biota and natural substrate; and
- Evaluate the relative health of reattached hard corals.

Previous monitoring programs designed by both by RP designated experts and Trustees have adhered to these basic tenets for monitoring shelf habitat restorations. These programs are numerous, documented, and well accepted by representatives from both sides. The monitoring plan submitted by the RP proposes procedures and tasks that meet the stated objectives while trying to minimize observer bias and method variance. The proposed program components are easily repeated by people who may be assigned to conduct future monitoring surveys.

During the Emergency Restoration (ER) conducted at the *M/T Margara* grounding site, field-tested techniques were utilized for reattachment of displaced biota (with the exception of the majority of *Acropora cervicornis* fragments) and associated substrate. The reattachment technique includes two principle tasks:

1. **Biological triage** – the repositioning, righting, and caching displaced corals and “live rock” fragments found at and adjacent to the impact areas; and
2. **Reattachment** – the reattachment of cached biota and associated reef substrate, primarily utilizing Portland cement.

ER programs with active monitoring have documented these techniques and the documentation showed the success and survivorship of reattached biota utilizing cement is greater than 95% (Hudson and Goodwin, 1997; NCRI, 2003; MRI, 2004; Franklin et. al., 2005). The same ER technique (reattachment of biota and substrate using Portland cement) was utilized at all restored locations of the *M/T Margara* site.

The RP-submitted monitoring plan recommends sampling at 20 of the 34 marked reattachment sites. Random selection of these 20 reattachment sites should provide for sampling greater than 1% of reattached hard corals. Sampling 1% of the reattached hard corals should be adequate to assess relative success of the ER technique that has documented success throughout the world from a wide variety of marine habitats.

The Trustee-revised monitoring plan proposes reference sampling from 10 quadrats at 13 sites (130 quadrats), which is a 13-fold increase from the RP-submitted monitoring plan. The excessive amount of reference sites and associated quadrats appears to be related to the

Trustee differentiation of impact area types, which is probably not related to the relative success of the ER. The sampling of 10 random reference stations proposed in the RP-submitted monitoring plan is adequate to detect significant habitat regional changes due to external factors (e.g., major storms) and compare relative success of sampling parameters with experimental stations.

It is the RP's contention that all impacted areas of the *M/T Margara* grounding site support the same general biological assemblage characteristics of the near-shore shelf within a water depth of 10 to 16 m. The differentiation of impact area types, by the Trustees, is superficial as they relate to the relative success of the ER. Relative success of the ER is probably not attributable to local, geographic spatial variability and/or the number of colonies reattached at a specific location. Primary variables affecting the ER success will probably be related to the reattachment substrate preparation, the personnel conducting the reattachment (i.e., level of experience), the proper use of reattachment materials, the amount of handling during reattachment, the cement/coral ratio, and the condition of the biota prior to reattachment (cache duration, orientation, and pre-cache condition).

Approximately 940 *A. cervicornis* fragments were reattached utilizing three techniques that differ, primarily on the type of material used for support of the reattached fragment. The Trustee-revised monitoring plan has proposed sampling over 50% of the reattached fragments (approximately 15 fragments at 36 sites). The RP-submitted monitoring plan proposed sampling 10% to 20% of the reattached *A. cervicornis* fragments and considered each of the three techniques to determine the relative success of the ER. The level of sampling effort proposed in the RP-submitted plan is considered adequate since the relative success of *A. cervicornis* ER is probably not attributable to the moderate technique differences, but most likely to the unmeasured variables, including the personnel conducting the reattachment, the amount of handling during and prior to reattachment, the size of fragment, the cache duration and orientation, and the pre-cache condition.

Reattached *A. cervicornis* fragments should be monitored for the same sampling parameters as other species of reattached corals, as discussed below. Observations concerning the presence of algae, corallivores, and fragment encrusting growth should be noted; however linear/lateral growth rate determination is considered out of scope for monitoring the relative success of the ER. Growth rates are going to be more closely related to pre-reattachment condition (Soong and Chen, 2003) and local environmental conditions (e.g., movement or flow of water and shading) rather than ER techniques.

Trustee-revised monitoring plan proposes the use of the Atlantic and Gulf Rapid Reef Assessment technique to evaluate relative health of the reattached corals (exclusive of *A. cervicornis*). Although the technique is called "rapid," it is time consuming and much of the data is subjective and inclined to a high degree of sampling error. Some of the proposed data to be collected from the monitoring sites is not related to health of reattached coral and seems to be more for qualitatively assessing general ecological trends of the habitat. Coral data should include identification, location within the quadrat, size range (e.g., less/greater than 6 in. maximum diameter), tissue color (i.e., normal, blanched, or bleached), presence of disease/injury, interspecific events (e.g., clionid sponge intrusion), tactile stability, and

presence/absence (following baseline survey). Trustee-proposed data, which includes old/recent mortality, damselfish presence/gardens, and percent cover, are superfluous for assessing the health and stability of the reattached coral.

Trustees have collected transect data to establish the baseline condition of the post-ER *M/T Margara* site. Trustees should provide specific information concerning transects, such as selection criteria, location within site, sampling area (m²), and sampling repeatability. It appears transects are intended to detect changes concerning epibiota size structure, density, diversity, and condition as an indication of relative success of the ER. If this is their intention, is it reasonable to suggest that we propose utilizing Trustee-established transects to monitor the holistic condition of the site in lieu of any proposed quadrat data (exclusive of *A. cervicornis*)?

Summary:

The Trustee-revised plan proposed over an eight-fold increase in sampling stations for reattached biota/substrate (exclusive of *A. cervicornis*) and an evaluation of at least 1,300 corals. Trustee-revised monitoring plan similarly proposed a four-fold increase in sampling stations for *A. cervicornis* and an evaluation of over 500 fragments. The level of effort proposed in the Trustee-revised monitoring plan is perceived to be inordinate and includes components that are not germane to meeting the stated objectives for evaluating the relative success of the ER.

It is the RP's position that a 2-year monitoring program should be adequate to determine the relative success of the ER and fulfill the stated program objectives. If there are problems affecting the ER success related to reattachment substrate preparation, the personnel conducting the reattachment (i.e., level of experience), the proper use of reattachment materials, the amount of handling during reattachment, the cement/coral ratio, and the condition of the biota prior to reattachment (cache duration, orientation, and pre-cache condition), they will probably be detected during the first year of monitoring.

References:

- Franklin, E. C., J. H. Hudson, and J. Anderson. 2005. *M/V Wave Walker* Coral reef restoration baseline monitoring report – 2004 Florida Keys National Marine sanctuary, Monroe County, FL. Marine Sanctuaries Conservation Series NMSP-06-08. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Sanctuary Program, Silver Springs, MD. 15 pp.
- Hudson J. H. and W. B. Goodwin. 1997. Restoration and growth rate of hurricane damaged pillar coral (*Dendrogyra cylindrus*) in the Key Largo National Marine Sanctuary, Florida. Proc. 8th Intl. Coral Reef Symp. 1: 567-570.
- Marine Resources Inc. 2004. Baseline Monitoring - *MSC Diego*: Florida Keys National Marine Sanctuary. Report for Houck, Hamilton & Anderson, P.A.

National Coral Reef Institute. 2003. Hollywood Ocean Outfall Stony Coral Transplantation Monitoring Second Monitoring Event - Draft Report. Report for Hazen and Sawyer.

Soong, K. and T. Chen. 2003. Coral transplantation: regeneration and growth of *Acropora* fragments in a nursery. *Rest. Ecol.* 11 (1): 622-71.

Marine Resources Inc. and CSA merged their operations in January 2006.