Vŏnē Research Inc.

Diving to Make a Difference!

In partnership with

Cry of the Water and Palm Beach County Reef Rescue

Site Lauderdale-by-the-Sea Elkhorn Coral Reattachment Broward County, FL

One-Week Monitoring Report

Report to Florida Fish & Wildlife Conservation Commission
Re: SAL# 08SRP-1091 (Site Lauderdale-By-The-Sea)

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EXECUTIVE SUMMARY

Vŏnē Research Inc. was informed about a fragment of Acropora palmata lying on the hardbottom and sand offshore of Lauderdale-By-The-Sea in June 2008. Dan and Stephanie Clark from Cry of the Water and Ed Tichenor from Palm Beach County Reef Rescue (PBCRR) asked Vŏnē Research to apply for a permit to re-attach the fragment to hardbottom reef. On July, 11, 2008, Vŏnē Research received the permit. On July 17, 2008, Vŏnē Research, Dan and Stephanie Clark and Ed Tichenor reattached the Acropora palmata fragment to the reef and established an adjacent reference coral for survivability comparison.

The fragment was discovered and re-attached offshore of Lauderdale-By-The-Sea, FL, thus the site is named after the town (Figure 1). Site Lauderdale-By-The-Sea is herein referred to as the reattachment site. Repairs included reattaching the fragment of coral to the hard reef substrate. Furthermore, Vŏnē Research photographed the reattachment site and will monitor it, with the help of Cry of the Water and PBCRR, in order to document changes of the reattached coral over time and compare those changes to an ecologically similar reference coral (Figures 2 and 3). Monitoring dives will be performed within six months, one year and two years from the re-attachment date.

Vŏnē Research Inc. has found that reattachment efforts such as the one performed at Lauderdale-By-The-Sea and that we demonstrated at previous reattachment sites are viable restoration methods when performed by trained divers in a timely manner. In the past, our restoration efforts have shown significant success and coral survivability.

INTRODUCTION

Coral reefs and associated habitats are characterized by their high species diversity supporting up to one-quarter of all marine fish species (Chabanet et al. 2005; Jameson et al. in press; McAllister 1988),which is correlated to their high gross productivity (Chabanet et al. 2005; Jameson et al. in press). Over half of the the fisheries species which are managed in the United States spend a stage of their life on or around coral reefs (Jameson et al. in press). The role of coral reefs in cultivating biodiversity, fisheries, coastal protection through diffusing the intensity of waves, aesthetics, and its increasing importance for tourism revenue make this ecosystem an extremely valuable natural resource providing numerous benefits to humans. Coral reefs contribute to economic benefits estimated at $375 billion per year worldwide (Jameson et al. in press). In Florida, recreational use of coral reefs generated approximately $1.6 billion US dollars in 1990 (Jameson et al. in press). However, the conditions and health of coral reefs in southeast Florida have been, and continue to be, negatively impacted by both natural and anthropogenic variables (SFCRI 2006, Collier 2006) which will eventually reverse the positive affects that coral reefs have on the economy of Florida, comercial fisheries, and the quality of life of Florida residents and visitors. The current rate of degradation of natural habitats worldwide due to human impact is unprecedented in history (Vitousek 1997). These systems are deteriorating far beyond the level where simple conservation methods, such as setting aside an area for preservation, can correct the situation.

Anthropogenic impacts include but are not limited to coastal development, beach renourishment, increased nutrient load and sedimentation due to runoff, dredging activities, cable drags, anchor damage, Carbon Dioxide build-up in the atmosphere and groundings. Coral growth rates are very slow thus coral ecosystems may take decades to recover from such activities if they can recover at all. Corals are colonial organisms that house themselves in a calcareous structure and host an endosymbiotic alga (zooxanthellae), which assists with primary production on the reef. Coral reefs increase at the gradual rate of 1 to 5 meters per 1000 years (Jaap 2000). Due to this growth rate, damaged reefs may not naturally recover in our lifetime. A more aggressive approach involving actively restoring damaged sites is needed if this ecosystem is to be saved. As our reefs continue to disappear at an alarming rate, the act of reef restoration may become the dominant conservation act (Rinkevich 2005). Reef restoration efforts such as coral transplants and coral reattachment can help to reverse some anthropogenic impacts such as cable drags, anchor damage and groundings. Vŏnē Research Inc. has been permitted by the State of Florida to respond to such events that impact reefs in Broward County in order to document damage, stabalize and repair reefs.

STUDY SITE

Site Lauderdale-By-The-Sea and the reference site are characterized by the presence of hexacorals, octocorals and sponges that are significant constituents of the macrofauna growing on a hardbottom reef which parallels the coast (Figure 1).

The reattachment site is located at an approximate depth of 3 meters at GPS coordinates N 26° 10.910' and W 80 ° 05.593' (Figure 1 and 2). An adjacent undamaged *A. palmate* colony was chosen as a reference site a (Figure 1 and 2) to be used as a control for monitor the progress of the reattachment. Depth at this site is approximately 3 meters, and contains similar coral types and ecological parameters as those of the reattachment site. The reference site is located adjacent to the reattached fragment on the same portion of reef.

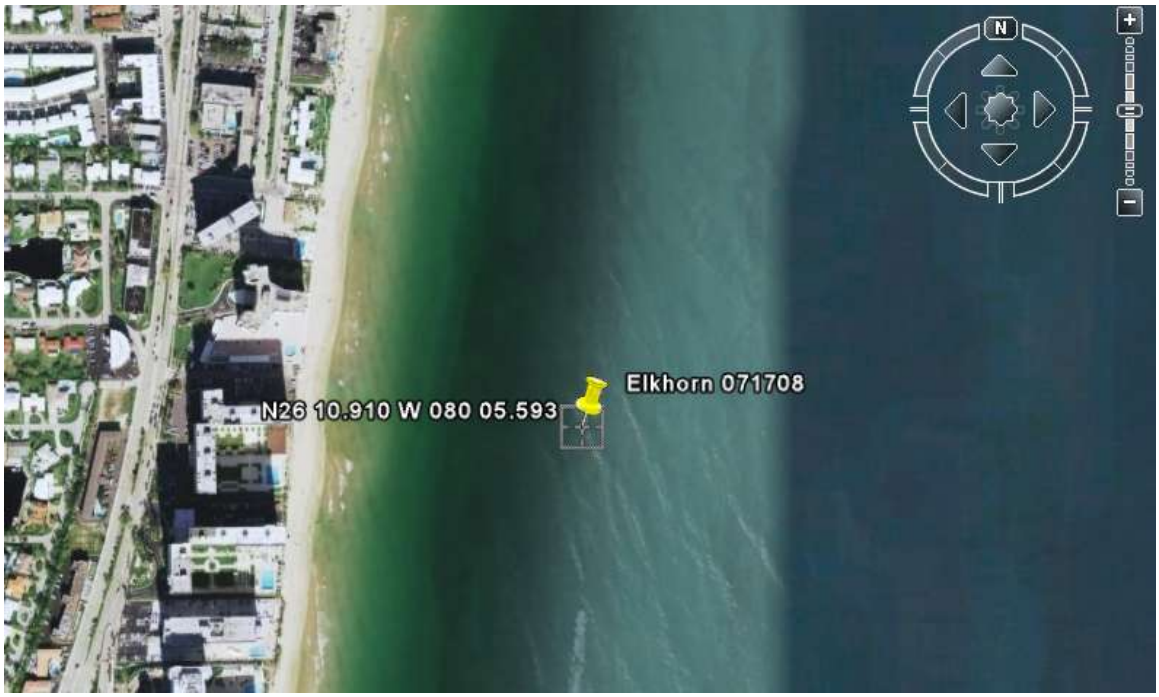

Figure1. Areal photographs showing Lauderdale-By-The-Sea Elkhorn Coral # 071708 reattachment site and GPS coordinates offshore.

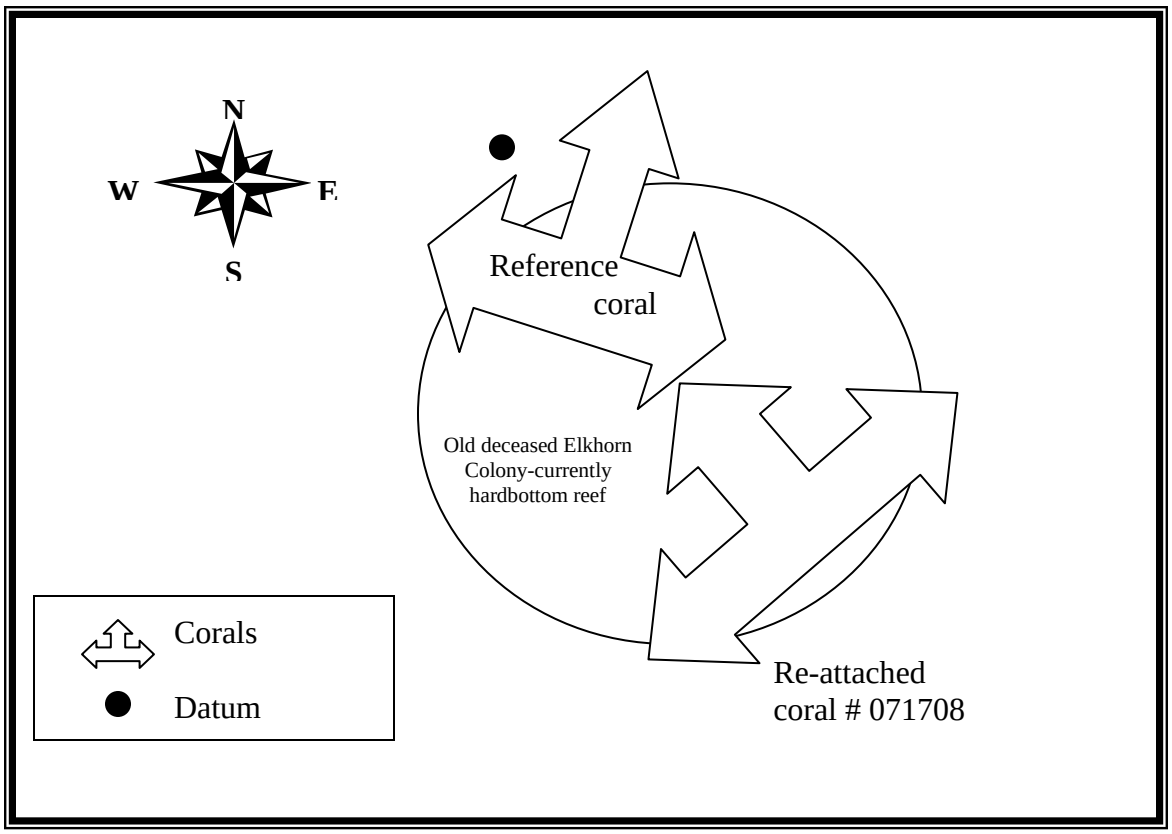

Figure 2. Map of the Re-attachment Site and Reference Site Lauderdale-By-The-Sea.

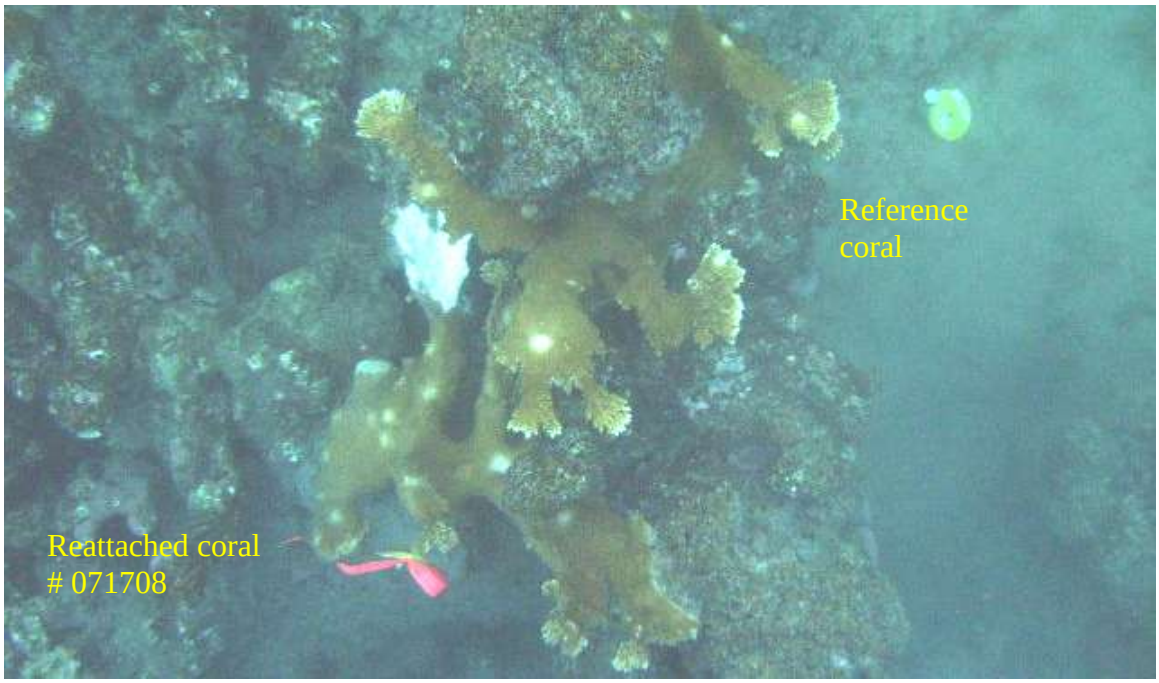

Figure 3. Reattachment and reference sites adjacent to each other on existing elkhorn coral colony, now part of the hardbottom reef.

COLONY HISTORY

Cry of the Water first documented the *Acropora palmata* colony in the summer of 2006 returning to the site periodically using landmarks as navigational aids. The colony appears to be a remnant of a larger colony. The *palmata* colony is within 800 feet of two active outfall discharge a/c cooling tower pipes just off the surf zone discharging warm water. Drainage Struture ID # 16 and 17. (Olson & CP&E 2001) A file review found no NPDES discharge permits exist for either point source in what appears to be a violation of the Federal Clean Water Act.

Dan Clark photographed the colony in January of 2007. (Appendix B) In November of 2007 the location of the *palmata* colony was reported to Jennifer Moore, Acropora Coordinator for NOAA Fisheries Service, Protected Resources Division.

On June 11, 2008 Dan Clark escorted PBCRR divers Ed Tichenor and Terry St. Jean to the site where they discovered the *palmata* fragment on the hardbottom and sand. Ed Tichenor video taped the colony and fragment on June 11, 2008 and again on July 17, 2008 during the fragment reattachment. The fragment June 11 photo appears on the cover page.

In the nearshore area of Broward County *Acropora palmata and Acropora Cervicornis* is concentrated between Port Everglades and Lauderdale-by-the-Sea. This reach of Broward beach has never had a large scale dredge and fill project and has not been subjected to the long term silt, sediment and turbidity problem seen from these projects.

METHODS & MATERIALS

Multiple dive teams performed initial survey and reef restoration dives in June and July 2008. Initial survey dives were performed by Cry of the Water and PBCRR, the broken fragment was discovered during a June 11, 2008 site inspection. On July 17, 2008 Võnē Research Inc., Cry of the Water, and PBCRR personnel performed the reef restoration procedure. Portland cement was mixed with ocean water and formed into balls. The cement was then placed into zip-lock baggies for transport to the reattachment site. SCUBA teams were deployed onto the damaged reef from the beach, to perform coral reattachment. The SCUBA divers scrubbed the reattachment site on hardbottom clean of algae and loose sediment. Then a cement ball was firmly pressed onto the cleaned area and the coral fragment was firmly pressed onto the cement. Initial reef restoration monitoring included comparing the reattached coral to that of a colony of *A. palmata* that was not broken from the reef. The reference and reattachment sites will be revisited within six months, one year and two years after the initial reattachment date. The two sites were photographed and corals were measured. Yellow, Plexiglas tags embedded with identification markings were fixed to the reattachment and reference sites to ensure proper identification of corals for future monitoring efforts.

The site was located from the beach using a Garmin GPS and underwater navigational aids such as landmarks and reef ledges.

Photographs and video were then taken using a Reefmaster digital camera and a Sony HDV camera secured in a Sea View underwater housing.

RESULTS

The coral was successfully reattached, however the cement did not set as quickly as desired. The surge in the area caused some of the cement to slide off of the attachment site . We do believe that the majority of the cement will hold, however we will revisit the site within the month to ensure the restoration effort is successful.

The reattached *A. palmata* has a bleached area on it that is dead. Moreover, the proximal end of the fragment which was on the sand is also dead. Both the fragment and the reference colony have white splotches on them (Appendix A).

Table 1. Measurements of approximate area covered by living tissue of coral observed at Reattachment Site Lauderdale-By-The-Sea in 2008.

Coral #	Area Covered (cm^2)	
	July 2008	Comments
071708	2368	Bleached area is dead, white splotches present on colony.
Reference Coral	1200	White splotches present on colony.

DISCUSSION

Vŏnē Research Inc. has found that reattachment efforts such as the ones demonstrated by Vŏnē Research Inc. at Reef Lauderdale-By-The-Sea can be a viable restoration method when performed by trained divers.

RECOMMENDATIONS

Based on our evaluation of the initial reattachment effort, Vŏnē Research recommends the following actions:

1) Monitor the stability of the cement used to adhere the fragment within one week of July 17, 2008.
2) Reduce the response time to reef damage events to promote higher survivability and reef recovery. Historically, this resulted in a higher success of coral restoration projects (Jaap 2000).

3 DAY MONITORING REPORT

Cry of the Water divers returned to the site on June 20, 2008, three days after reattchment and performed a follow-up site inspection. Surge in the area did cause some of the cement to slide off the attachment site but the majority of the cement held in place. The portland cement was firmly cured and the attached fragment is securely held in place.

Dives observed one of the white spots that was visible on the reference coral had increased in size from the July 17, 2008 dive. White spots were not visible on the June 11, 2008 site inspection. (Appendix B)

We are concerned with how fast the white spots have increased in size. Team will return to the site within the next week to document the change in the spots on the colony.

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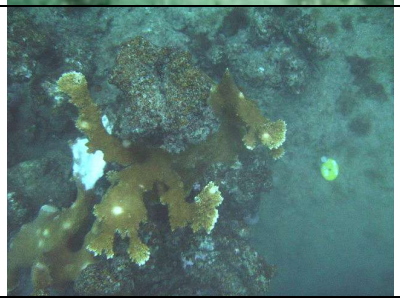
APPENDIX A

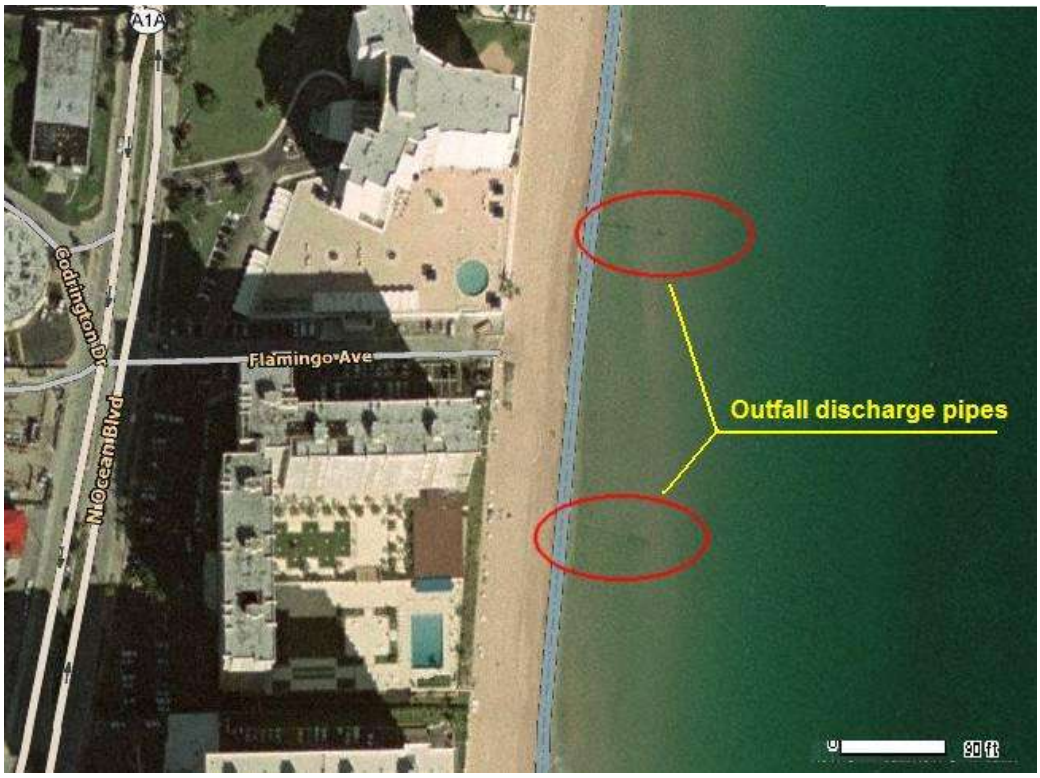
Photographs of coral at the Reference and Reattachment sites in July 17, 2008

Fragment July 17, 2008

Reference coral, June 11, 2008

Appendix A. Photographs of coral at the reattachment site July 17, 2008.

Reattachment and Reference Sites		
Coral	**July 17, 2008**	**July 17, 2008**
071708: Elkhorn Coral *Acropora palmate*		
REF: Elkhorn Coral *Acropora palmata*		



Location of wastewater discharge pipes.

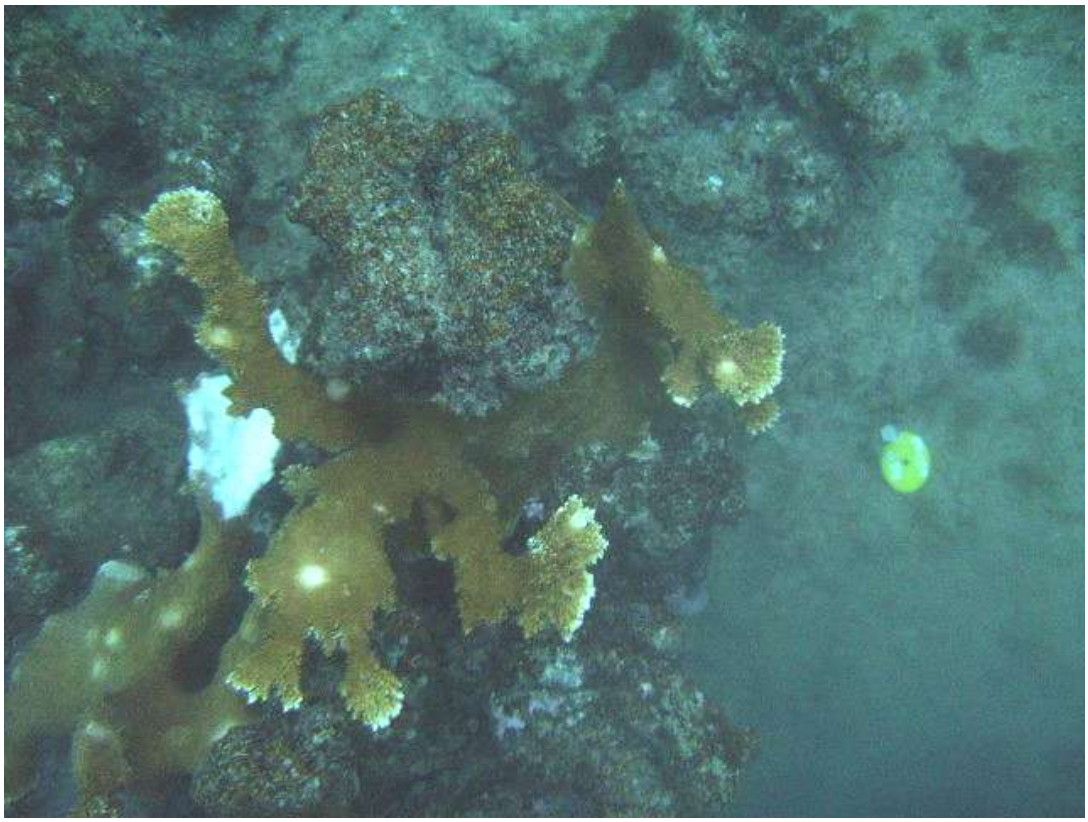
Fragment, June 11 2008

APPENDIX B

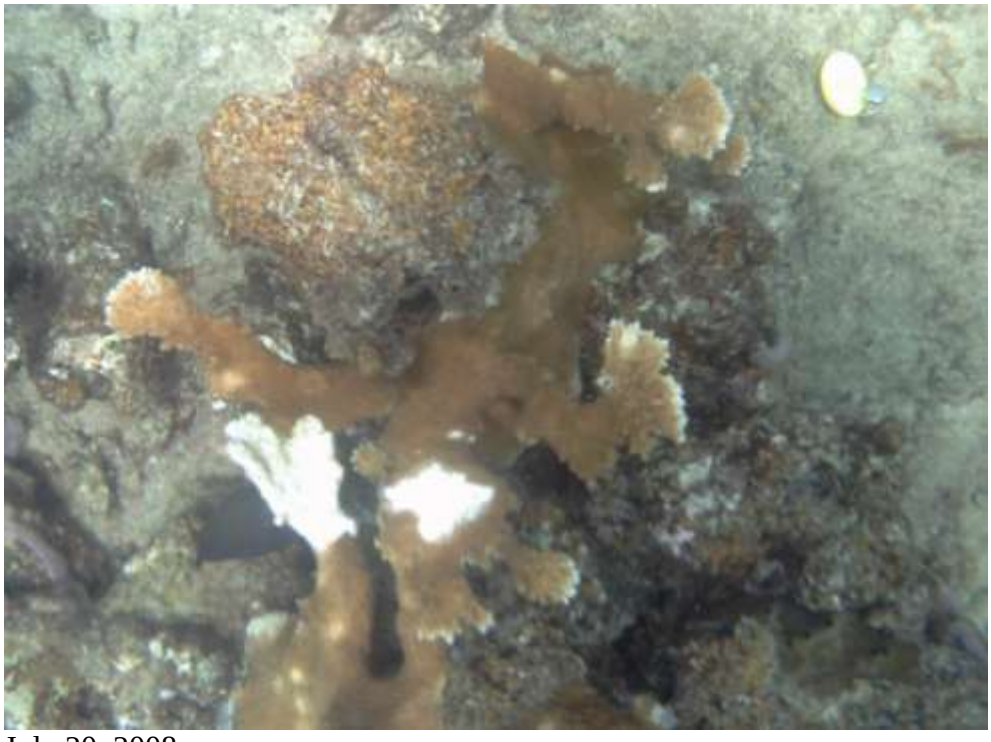
Photographs of coral at the Reference site January 2007,
June 11, 2008, July 17, 2008, July 20, 2008, and July 22, 2008

Elkhorn Colony, January 2007

June 11, 2008



July 17, 2008, Photo from above



July 20, 2008

July 22, 2008