

## Response to Physical Impacts on Coral Reefs in Puerto Rico and the USVI

July 2014



US reefs are impacted by 3 - 4 large groundings and hundreds of small incidents annually. In the aftermath of groundings, impacted corals are often broken, dislodged, or flipped over. These fragments are subject to abrasion, scour, and sedimentation, which ultimately result in death. Unchecked, these damages can result in reef loss and instability. However, if dislodged fragments can be collected and stabilized shortly after physical impacts then the probability of survival increases substantially (>90%).

Response to physical impacts is a Jurisdictional Priority in both PR/USVI, an identified capacity gap in both jurisdictions, and a priority element of the draft *Acropora* recovery plan. Puerto Rico and the USVI have acknowledged that because of internal limitations and the need for quick and flexible response that more robust action on the part of NOAA was necessary to help stem the unchecked and unnecessary coral losses that were occurring after physical impacts. In 2009, an emergency response support contract with a local firm was set up. This in combination with the RC's on-the-ground presence in the region has enabled NOAA to address the numerous impacts that were occurring annually.

The support contract provides NOAA, PR DNER, and USVI DPNR the support that is needed in order to have a functional emergency restoration operation. Since 2009, the RC has performed restoration at 35 sites in PR and the VI where there were physical impacts to coral reefs and have reattached over 15,000 corals (Table 1). A notification network along with a form to report grounding incidents (Appendix 1) has been set up with the US Coast Guard, salvors, and the local communities so that we are notified immediately of impacts. This notification system has allowed us to often get personnel onsite while the vessel is still aground on the reef. In many of these cases, our team has been able to provide feedback to the salvors to minimize further impacts during vessel extractions, saving countless corals. On multiple occasions we have found that the salvors preferred extraction path would have resulted in significant additional damage and on more than one occasion prevented entire thickets of *Acropora spp.* from being destroyed. A report from one of those incidents can be found in Appendix 2.

<b>Year</b>	<b>Total # of Incidents Reported</b>	<b>On-Site Confirmation</b>	<b>Restoration Implemented</b>	<b># Corals Reattached</b>	<b>Acropora/ ESA coral Damage *</b>
2009	51	26%	14%	9,074	10%
2010	32	47%	9%	1,045	13%
2011	54	72%	11%	915	9%
2012	36	47%	11%	3,040	17%
2013	28	36%	11%	200	11%
2014**	28	59%	36%	1,000	27%
<b>Total/ Average</b>	<b>229</b>	<b>48%</b>	<b>15%</b>	<b>15,274</b>	<b>12%</b>

**Table 1: Summary of NOAA RC grounding response activities since 2009. \* In 2014, the candidate species for ESA were included in the estimate. \*\* Data as of 7/9/2014.**

Funding for this work was provided from NOAA’s Restoration Center, the Coral Reef Conservation Program, Protected Resources Division, Assessment and Restoration Division and the South East Regional Office. In addition to physical impact response, the support contract that has been set up has also served as a vehicle for funding additional restoration, research and monitoring activities in the region. Funds have been further leveraged by getting private parties and insurance companies to directly cover the cost of emergency restoration at multiple sites. This was only possible because we had the capability to do immediate post-grounding site assessment and an approved/permitted contractor.

Appendix 1

<h2 style="text-align: center;">Natural Resource Trustee Incident Report</h2> <p style="font-size: small; text-align: center;">This form is for reporting incidents (vessel groundings, spills, anchor damage, marine debris, plane crashes etc.) to NOAA that have the potential to cause physical damage to marine resources (corals, seagrass, mangroves, etc).</p> <p style="text-align: center;"><b>For Immediate Assistance Please Call:</b> 1-888-521-6622 or 727-537-6622 (NOAA) 941-538-2476 (PR) or 340-776-8608 (USVI)</p> <p style="font-size: x-small; text-align: center;">Please call-in all incidents requiring immediate assistance and incidents involving commercial vessels. <span style="float: right;">Email Report to: PRVI.Trustee@NOAA.gov</span></p>	
<p><b>Vessel / Incident Information</b></p> <p>Vessel Name: <u>DRIFTER</u> Incident Date: <u>21 APR 10</u> Time: <u>1139Z</u></p> <p>Vessel Description: <u>BLUE</u> Type: <u>Rec. Sailboat</u> Length: <u>36</u> Draft: <u>    </u></p> <p>Incident Type: <u>Vessel Grounding</u> Reg. #/IMO#: <u>TEXAS 566254</u> Time Freed: <u>N/A</u></p> <p>Incident Description: <u>VSL AGROUND ON REEF IN POSN 1805N 06714W</u></p> <p>Natural Resource Affected (coral, seagrass, rocks): <u>    </u></p> <p>Pollution Status/Notes: <u>None</u></p> <p>Fuel Onboard (type/qty): <u>UNK</u> Vessel Cargo: <u>None</u></p>	
<p><b>Incident Location</b></p> <p>Geographic Location: <u>5NM W OF JOYUDA CABO ROJO</u> Nearest Town: <u>CABO ROJO</u></p> <p>Lat/Lon (Initial): <u>1805N</u> N, <u>06714W</u> W Notes: <u>Position reported by DRIFTER</u></p> <p>Lat/Lon (Alt): <u>    </u> N, <u>    </u> W Notes: <u>    </u></p> <p style="font-size: x-small;">Please attempt to gather and note if position is exact grounding location, any pertinent details, position type (GPS, Chart Plot, ADF) and source (vessel, CG, FURA). For large vessel groundings please request a GPS position of both the bow and stern of the vessel. Please request multiple bow/stern positions during extraction.</p> <p>Vessel Route (from/to): <u>ENR BOQUERON, CABO ROJO</u></p> <p>Location Notes: <u>    </u></p>	
<p><b>Reporting Source / Owner / Operator Information</b></p> <p>Reporting Source: <u>MIKE MCALOON</u> Primary Phone: <u>281-851-6217</u> Alt Phone: <u>    </u></p> <p>Vessel Operator: <u>SAME</u> Primary Phone: <u>281-851-6217</u> Alt Phone: <u>    </u></p> <p>Operator Address: <u>2951 MARINA KEY DR, SUITE 130469 LEAK CITY TX 77573</u></p> <p>Vessel Owner: <u>MIKE MCALOON</u> Primary Phone: <u>281-851-6217</u> Alt Phone: <u>    </u></p> <p>Owner Address: <u>SAME</u></p>	
<p><b>Additional Information</b></p> <p>Salvage Company: <u>TUG TORPEDO</u> Primary Phone: <u>UNK</u> Alt Phone: <u>    </u></p> <p>Salvage Status/Notes: <u>CURRENTLY ASSISTING S/V DRIFTER</u></p> <p>SAR Status/Notes: <u>2POB THE S/V DRIFTER, BOTH ARE SAFE</u></p> <p>Recommendations*/Additional Notes: <u>    </u></p> <p style="font-size: x-small;">*tug cable floats, minimize cables touching bottom, minimize vessel movement, confirm safe exit path)</p>	
<p><b>Report Information</b></p> <p>Entity Filling Out Report: <u>US COAST GUARD</u> Name: <u>OS2 RAMOS</u></p> <p>Email: <u>ssjcc@uscg.mil</u> Primary Phone: <u>787-289-2041</u> Alt Phone: <u>    </u></p>	
<p><b>Submittal Information</b></p> <p>Please fill-in all appropriate and available information to the maximum extent possible without delaying notification and email to PRVI.Trustee@NOAA.GOV or Fax to 1-888-521-6622. Feel free to submit additional forms as more information becomes available. Email and Fax notifications will be auto forwarded to Puerto Rico DNER &amp; US Virgin Islands DPNR.</p> <p style="text-align: center;"><b>E-Mail Form</b></p> <p style="font-size: x-small; text-align: center;">This form is designed to facilitate communication between NOAA and the Reporting Source and does not constitute formal notification when required by the National Contingency Plan.</p>	

## Minimizing Damage to Corals during the Salvage of the S/V “Arena”

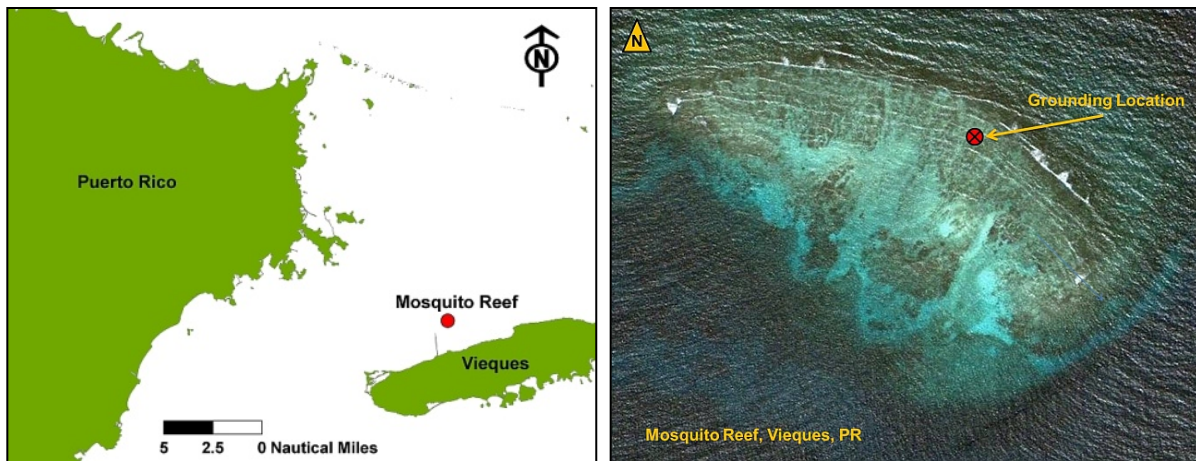
December 2010



### Introduction

The sailing vessel “Arena” ran aground on Mosquito Reef north of Vieques, Puerto Rico (Lat N18.1615<sup>o</sup>, Lon W65.4956<sup>o</sup>, Figure 1) on November 2010 while adrift in rough sea conditions. The vessel grounded on the shallow fore-reef and was carried onto the reef crest by the breaking waves. A salvage effort was conducted by Sea Tow on December 8, 2010 to remove the vessel. Seaventures, a coral reef restoration contractor, initiated work to minimize impacts to vulnerable marine resources at the grounding site and related to the salvage operations. Priority attention was given to avoiding impacts the staghorn coral (*Acropora cervicornis*), a threatened species, as well as other coral species in the area. This report describes the methods and results from the work to avoid impacts to the coral reef from the salvage operation.





**Figure 1. Location of the vessel grounding on Mosquito Reef located approximately 1.5 nautical miles north of Vieques, Puerto Rico (left). The approximate location of where the vessel came to rest on the reef crest of Mosquito Reef, Vieques (right).**

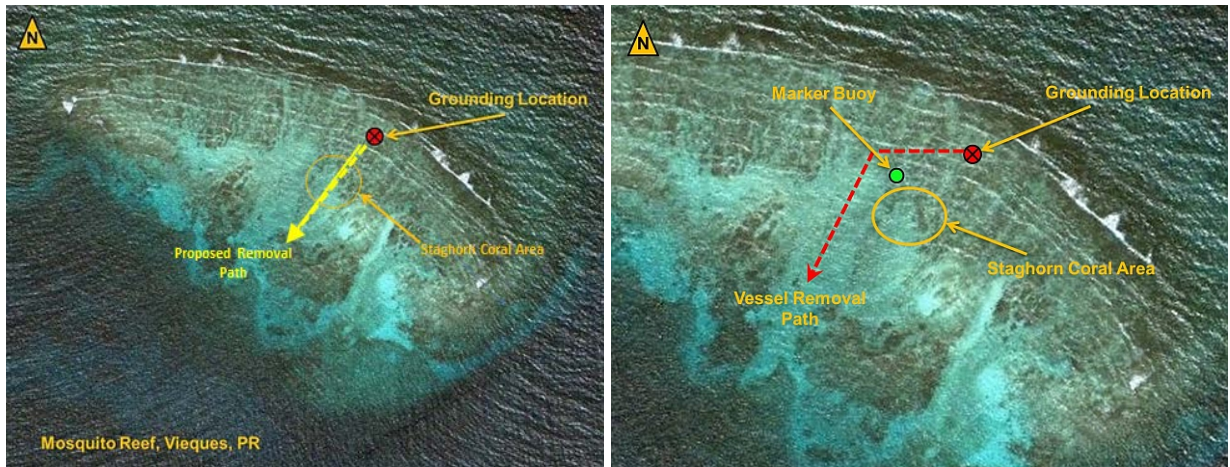
### **Minimizing Damage to Coral Resources**

The primary objective established to minimize the impact of the grounding on the marine resources was to prevent damage to corals from salvage operations, whenever this was feasible. Communication was established early on with Sea Tow, the company conducting the salvage operations, to coordinate efforts for work on-site and particularly with the methods planned for towing the vessel off the reef. An initial survey was conducted along with personnel from the marine resource management agencies including NOAA and the Puerto Rico Department of Natural and Environmental Resources (DNER). This was done to determine the specific site conditions and decide on the best approach to accomplish the protection of the existing coral resources. The survey involved establishing the location and quantity of coral colonies around the grounding site and determining which corals were in the direct path planned for the vessel removal.

Special emphasis was placed on determining the location of staghorn coral (*Acropora cervicornis*) colonies since this species is listed as threatened and it was known to occur in the area of the grounding. Two areas with small staghorn coral thickets in approximately 1-1.5 m depth were located 50m to the south-southwest of where the vessel had come to rest on the reef crest (Figure 2). An additional 10 isolated small to medium sized colonies of staghorn coral were located in the vicinity of the salvage operations. Upon consultation with the salvage supervisor, it was determined that a removal path could be planned to minimize impacts to the staghorn corals. To assist this effort buoys were placed to the north of the staghorn coral area (Figure 3).



**Figure 2: Staghorn coral (*Acropora cervicornis*) thickets located near the grounded vessel and the focus of efforts to minimize damage to corals.**



**Figure 3: Diagram showing the removal path proposed originally by the salvers (left) and the final path established for removing the vessel to minimize coral damage (right). It also depicts the area where staghorn corals are located and the marker buoy used for guidance.**

In addition to *A. cervicornis*, an area of *Porites spp.* (*P. porites* and *P. furcata*) was found located adjacent to the vessel and in the removal path selected by salvage operations (Figure 4). Coral colonies within close proximity of the vessel and at risk of immediate damage were temporarily relocated to a cache location for later reattachment to the reef. Approximately 200 colonies of *P. porites* and *P. furcata* with sizes ranging from 10-40 cm diameter were cached by divers utilizing plastic bins (Figure 5). Additionally, 300 individual braches or small groups of branches of *Porites* colonies were cached as well. Cached corals were moved approximately 50m to the south to an area of bare reef substratum (Figure 5).





**Figure 4:** *Porites* colonies adjacent to the vessel. A portion of these corals were moved to avoid damage during vessel removal.



**Figure 5:** Divers from NOAA, Sea Ventures and DNER caching finger corals for later reattachment (left). *Porites* colonies in cache prior to reattachment (right).

### **Reattachment of Relocated Corals**

During the vessel removal, several small staghorn coral colonies were fragmented by the rigging of lines used to tow the vessel off the reef. However the areas of staghorn coral containing the thickets were not impacted. After the vessel removal the branch fragments were collected in plastic bins and moved to suitable adjacent areas for stabilization. Approximately 300 fragments of *A. cervicornis* with sizes ranging from 10-20cm were stabilized on hardbottom near undamaged staghorn coral thickets. These

fragments were lodged into crevices on the reef to promote reattachment by tissue overgrowth since fragmentation is a natural strategy for reproduction of this species. Some fragments were also reattached by embedding the lower portions of the fragments in cement. Securing the staghorn coral fragments in this manner will prevent them from being dislodged by the surge of the waves resulting in increased tissue damage before reattachment.

The cached *Porites* colonies were reattached to bare areas of the reef substratum utilizing a mixture of hydraulic cement and sand. The selection of reattachment sites was done by locating areas of the reef that were bare of live corals and other biota. Approximately 200 *Porites* colonies were reattached by embedding the lower portions of the colonies without live tissue into the uncured cement mixture. Larger colonies with multiple branches were secured individually. An additional 400 individual branches or ‘nubbins’ were grouped in bunches to simulate larger natural colonies. Numbered tags were nailed to the bottom near a subset of reattached colonies for future monitoring of these corals (Figure 6).



**Figure 6: Transplanted *Porites* colonies that were reattached to the bottom with cement.**