

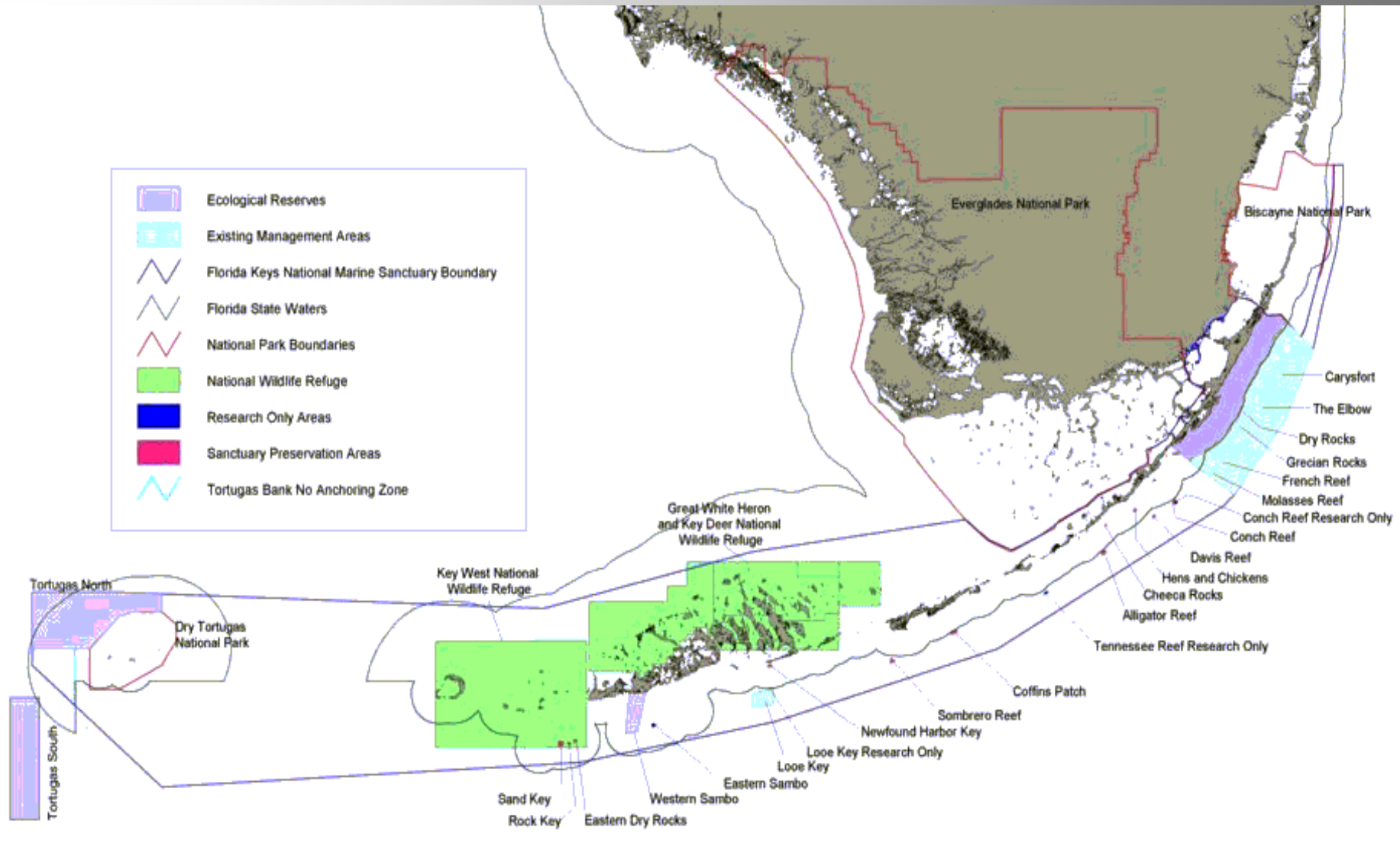
***U.S. Coral Reef Task Force 10/24/06:
Restoration Planning in the Florida
Keys National Marine Sanctuary***



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Sanctuary Resources Manager

FKNMS



2900 square nautical miles of Sanctuary
500-600 reported vessel groundings annually
≈15% occur in coral reef-type substrate

Small vessels make small injuries...



Typical small vessel injuries:



Mounding (head-type) Corals

Typical Small Vessel Injuries:



Branching Corals

Large vessels make large injuries...





*Spur and groove coral formation flattened
by large commercial vessel*

How are reports of problems received and handled ?



How FKNMS receives notification:

- *FFWCC dispatch in majority of cases*
- *Occasionally USCG notifies*
- *FPS and NPS, in certain circumstances*
- *Directly from salvors responding to vessel in distress*
- *Charter boat operators (diving, fishing, tour, etc.)*
- *Private individuals*

How FKNMS handles problem:

Depending on the nature of the injury (size, severity, other circumstances, FKNMS Assessment Biologists and resource managers will respond immediately or visit the injury site as soon as possible (with orientation from responding FFWCC LEO) to conduct injury assessment

A large blue and white research vessel with an orange cabin is the central focus, surrounded by several smaller white boats on a blue sea. The scene is set against a clear blue sky.

Is coordination with other agencies required,

and if so, how is it handled?

Coordination with other agencies:

- *In every Sanctuary resource injury situation, coordination with FFWCC*
- *In some cases, coordination w/ USCG (especially oil spill or threat thereof)*
- *Occasionally, coordination with adjacent National and State Parks*

Coordination handled through:

- *Communication*
- *Playing nice with others*

The need for injury assessments on coral reefs

- *Documentation of impacts to marine resources for MPA management purposes (eg., natural vs. human perturbations and identifying areas for additional/better channel marking)*
- *Critical for determination of extent of new impacts in grounding “hotspots” (superimposed injuries)*
- *Support for law enforcement/legal actions*
- *Quantification of injury for primary restoration planning*
- *Baseline data for development of future monitoring efforts*

*3 types of action that can be taken
against a responsible party:*

Enforcement Actions (civil penalties) -

- *Summary settlements - $\leq 1\text{ m}^2$ coral or $\leq 10\text{ m}^2$ seagrass*
- *Section 307's - formulaic, based on civil penalty schedule*

*Natural Resource Damage Action (NRDA)
claims*

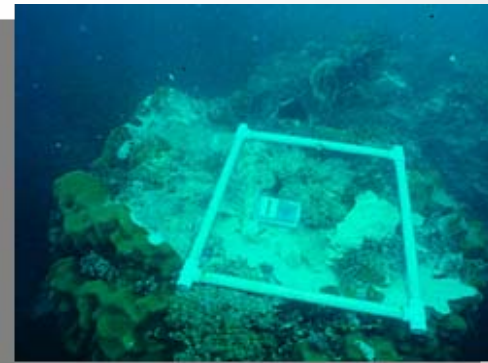
NRDA Claim



Whenever a grounding occurs within a national marine sanctuary, NOAA can seek damages to cover response, injury and damage assessment, restoration and replacement of the damaged habitat or acquisition of equivalent habitat, and compensation of the public for the value of the damaged resources until full recovery.

Primary goal of the NOAA/FDEP Coral 312 program:

To prepare rapid, cost-effective, litigation-quality claims for injuries to coral resources resulting from vessel groundings and other mechanical injuries, and to implement the restoration and monitoring of coral reef ecosystem injuries

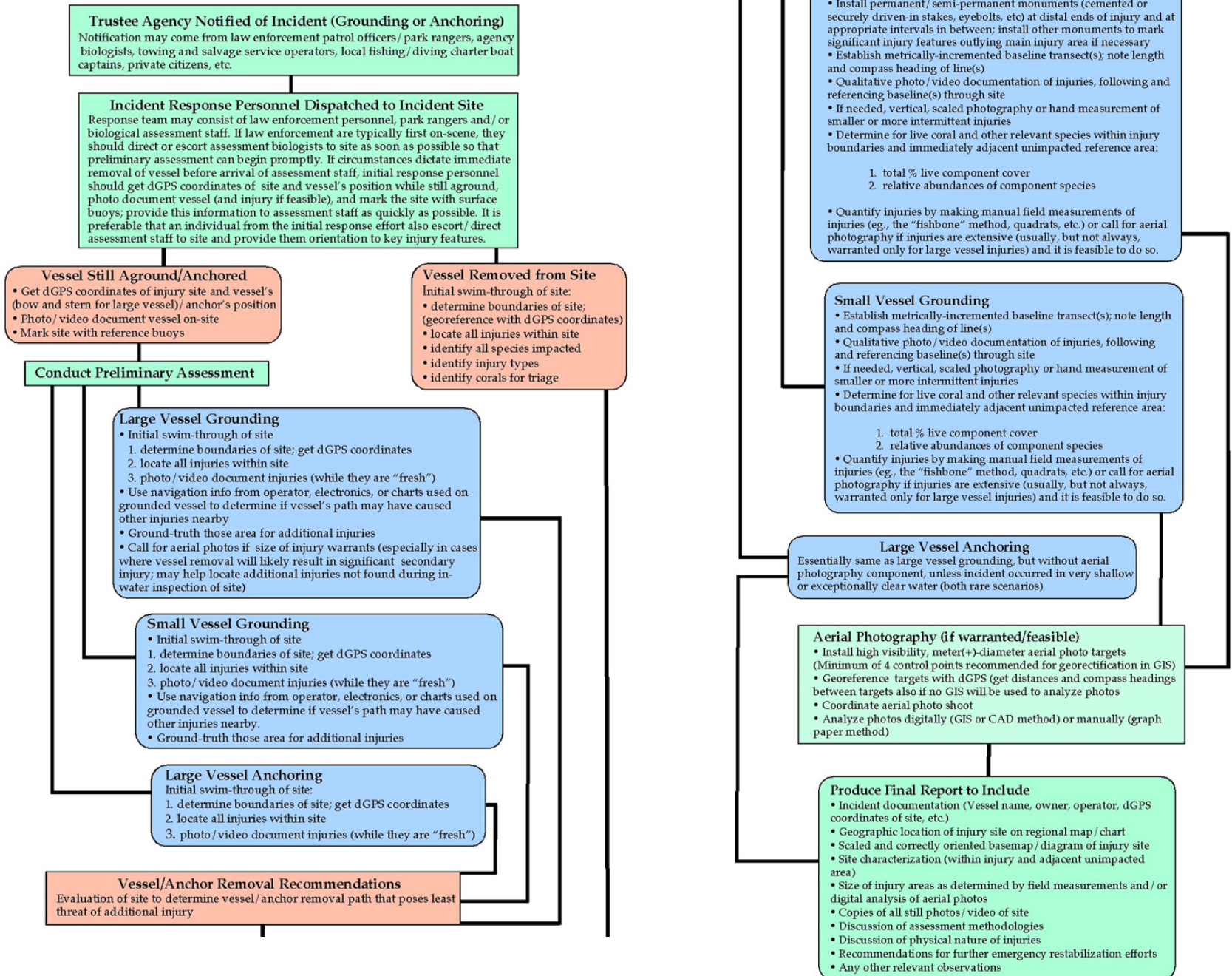


The Coral 312 Program uses an interdisciplinary team of biologists, economists, lawyers, and resource managers to assess and recover natural resource damages from the vessel owner/operator who cause these injuries. The funds collected are then used to implement the restoration of and monitor restored coral reef ecosystems

The Coral 312 Program assessment protocol includes the following steps:

- *Field assessment*
- *Application of injury recovery trajectories*
- *Application of an ecological service-scaling model (HEA)*

Coral Reef Injury Assessment Flow Chart



Manual Assessment Techniques



• *Compass*

• *Photo/Video*

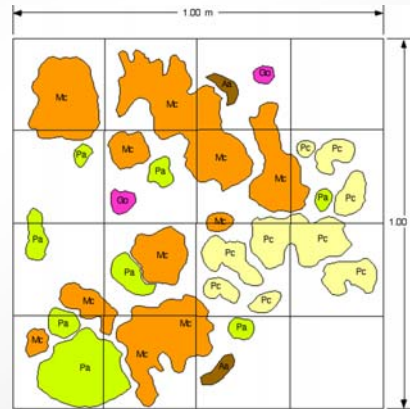
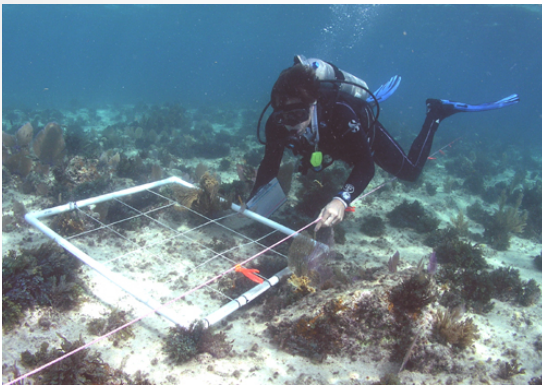


• *Meter Tape*

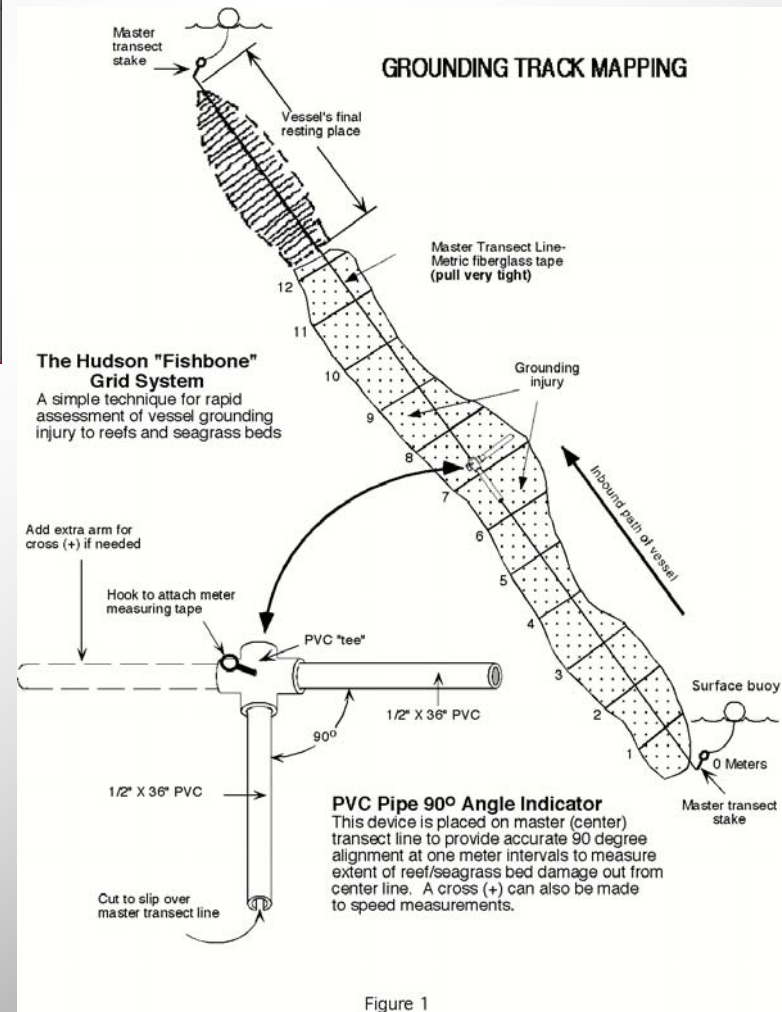


• *GPS*

• *Quadrat Data*



Species	Area	% Cover
Mc <i>Milypora complanata</i>	0.208 m ²	20.8
Pa <i>Porites astreoides</i>	0.063 m ²	6.3
Pc <i>Palythoa caribaeorum</i>	0.074 m ²	7.4
Ag <i>Agaricia agaricites</i>	0.007 m ²	0.7
Gg <i>Gorgonian (sp. ?)</i>	0.006 m ²	0.6





Buoys and Stakes for Temporary, Long Term and Permanent Site Marking

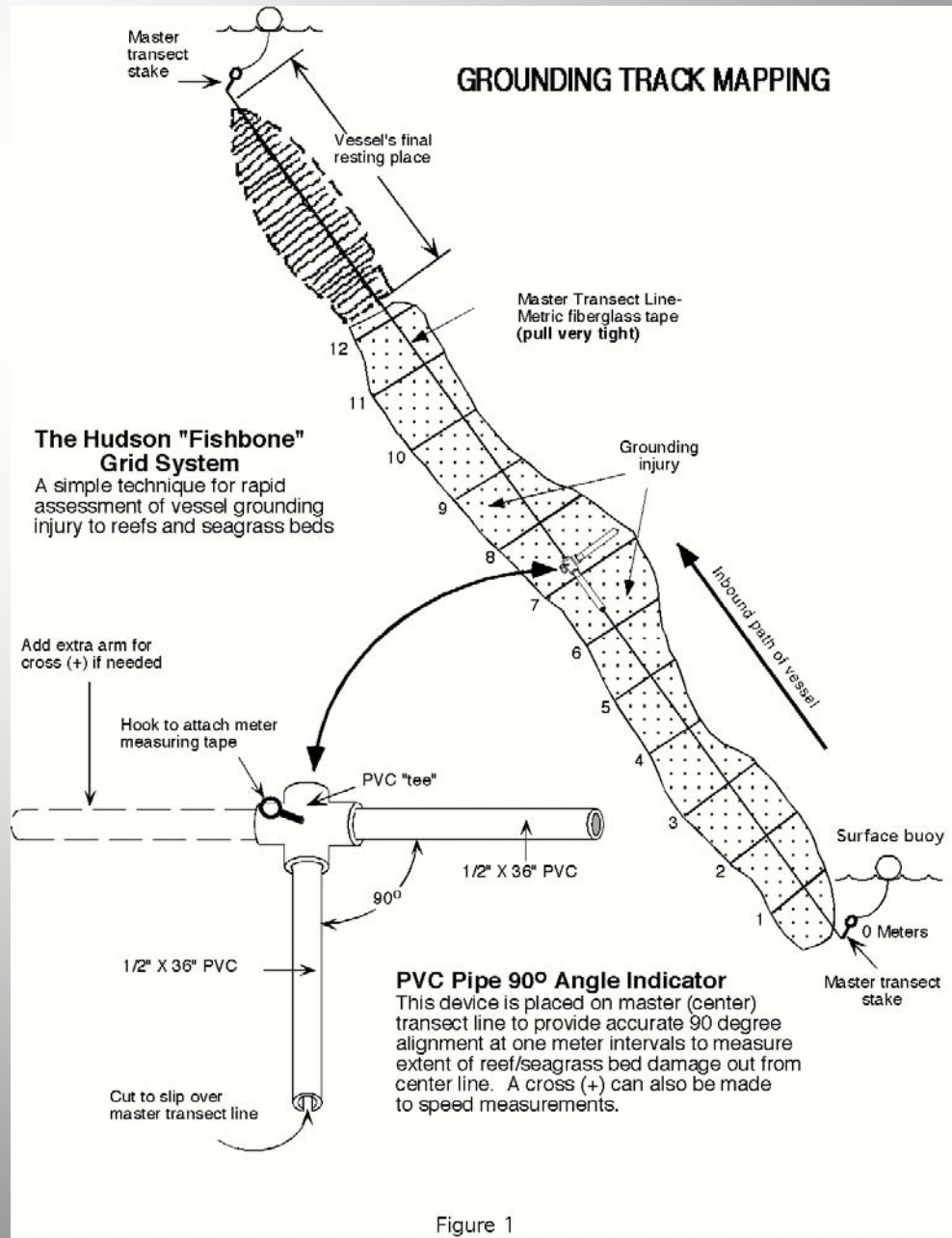
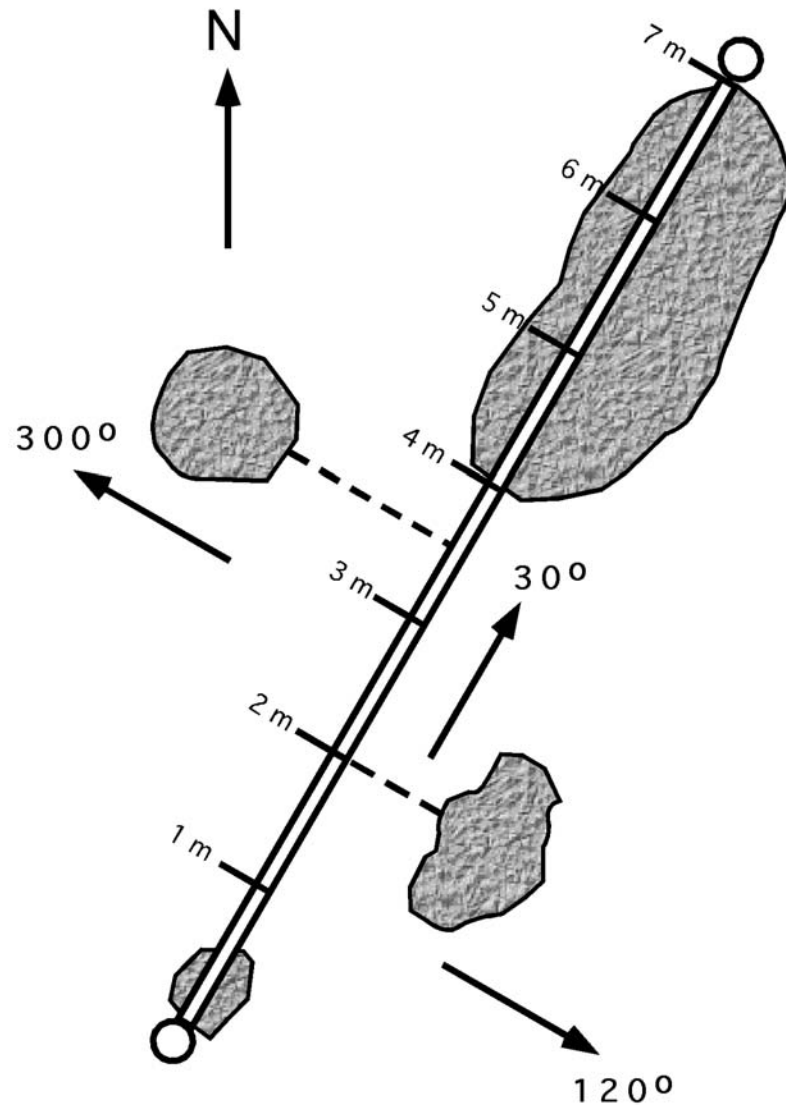


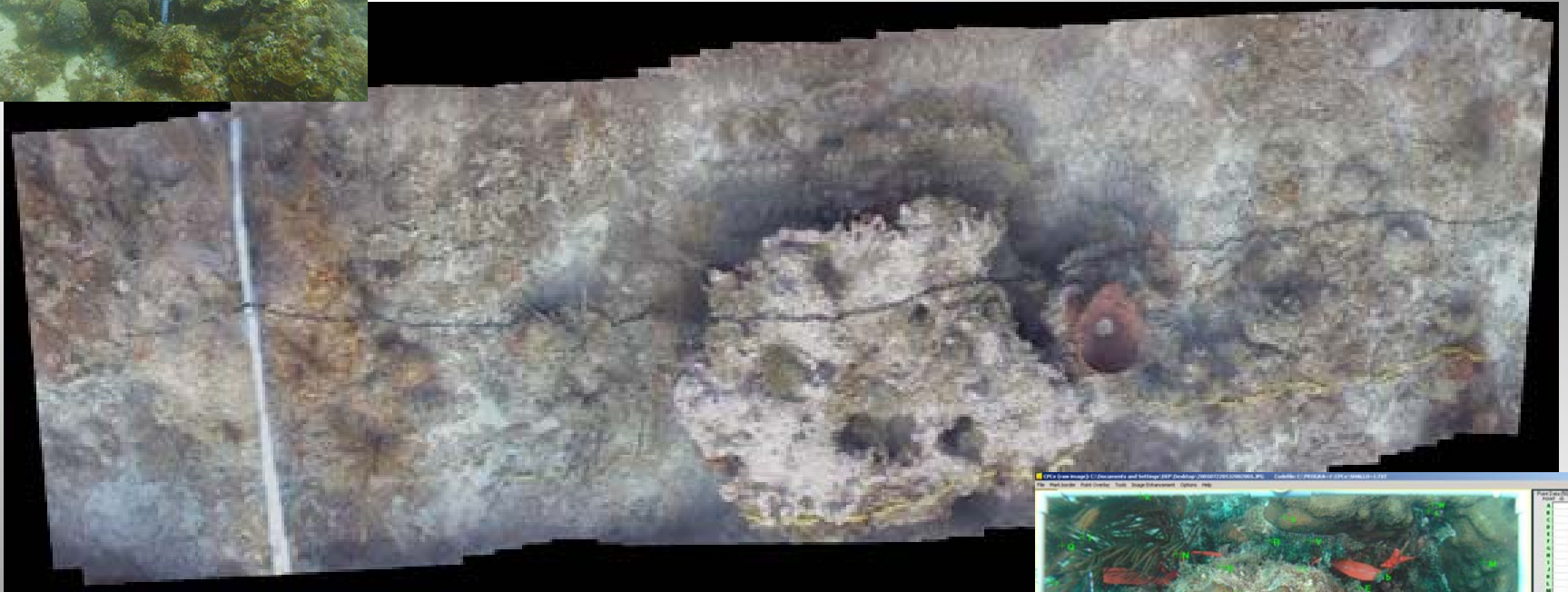
Figure 1

Measurement/Mapping of Intermittent Coral Injury



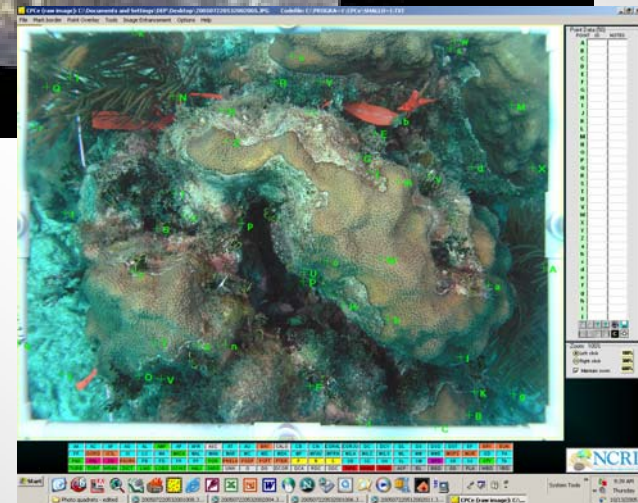


Video transect techniques



Linear video image collage

- *RavenView*
- *Snap DV*



Point count analysis of single frame from video

Underwater positioning/mapping systems



M/V Casitas - NW Hawaiian Islands

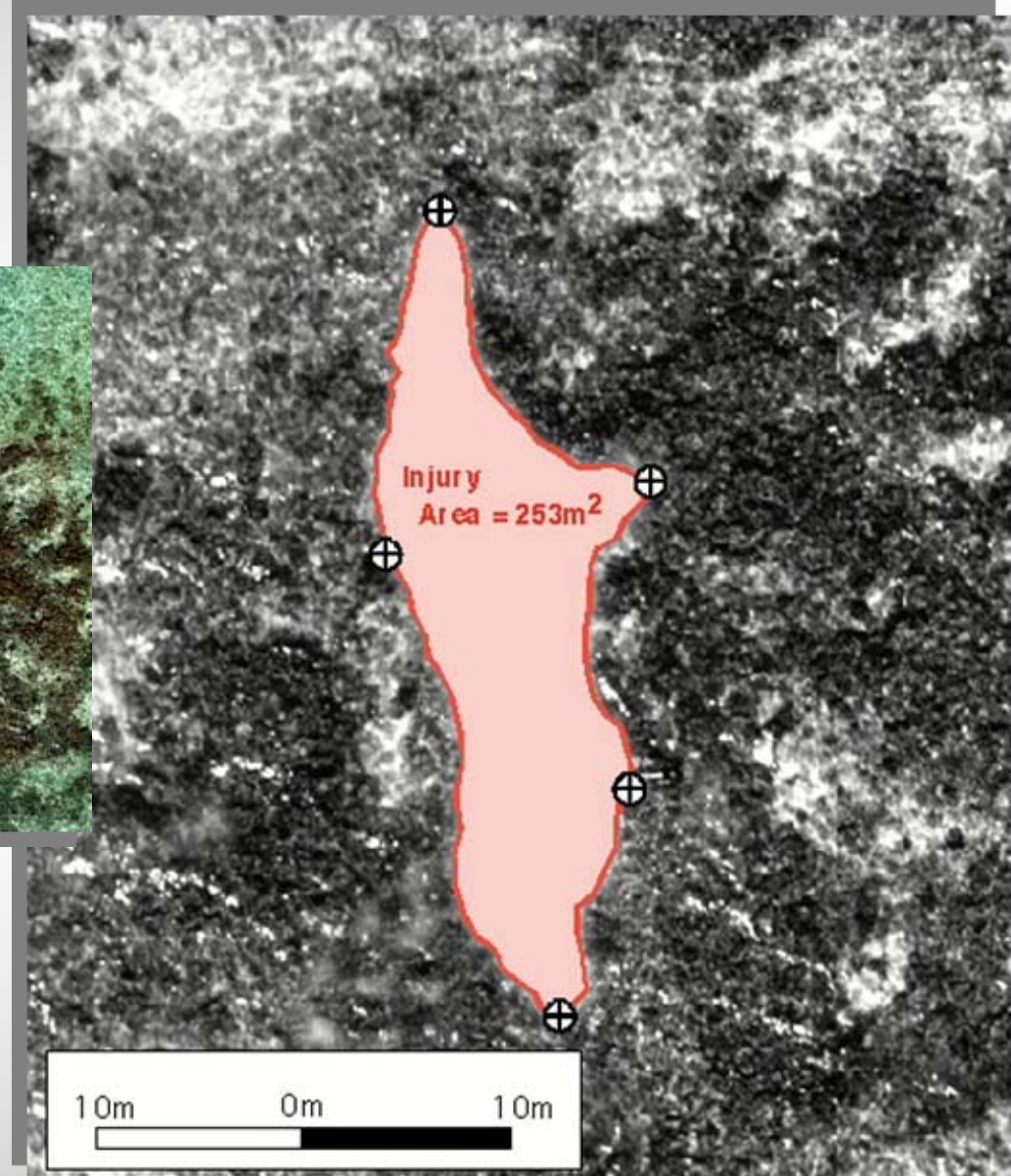
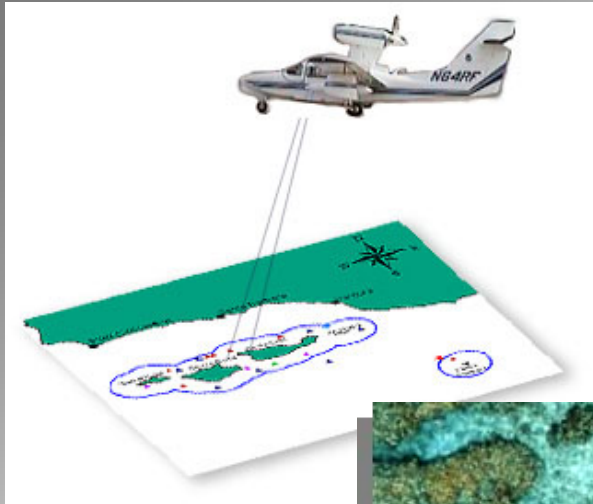


• *AquaMap*



• *CobraTac*

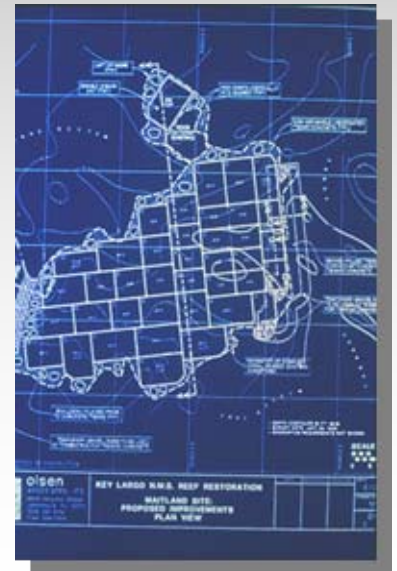
Aerial photo analysis



How to Plan an Effective Restoration Effort



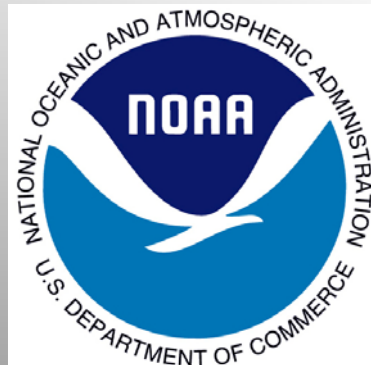
- *A thorough injury assessment is essential for planning*
- *Must be tailored to the injury (all same, all different)*
- *Guided by trustees' management plan/policies (eg., FKNMS Management Plan and Coral Restoration Programmatic Environmental Impact Statement)*
- *May include vessel debris/loose rubble removal*



**CORAL REEF AND HARD BOTTOM RESTORATION PLAN
FLORIDA KEYS NATIONAL MARINE SANCTUARY
MONROE COUNTY, FL**

Prepared by:

**National Oceanic and Atmospheric Administration
Florida Department of Environmental Protection**



1. INTRODUCTION

1.1 Common Coral Injuries

1.2 Economic and Ecological Importance of Coral

2. NATURAL RESOURCEDAMAGE ASSESSMENT & RESTORATION AUTHORITY

3. RESTORATION ALTERNATIVES

3.1 Restoration Techniques

3.1.1 No-Action

3.1.2 Emergency Stabilization

3.1.3 Framework and Rubble Stabilization

3.1.4 Structural Restoration

3.1.5 Coral Transplantation

3.2 Criteria for Restoration Alternatives

4. *NAME* GROUNDING and PREFERRED RESTORATION ALTERNATIVES

4.1 Grounding Site

4.2 Preferred Primary Restoration Alternatives

5. COMPENSATORY RESTORATION

5.1 Scaling Compensatory Restoration

5.1.1 Methods for Scaling Direct Human Use Losses

5.1.2 Method for Scaling Ecological Service Losses

5.2 Pooled Recoveries

5.3 Compensatory Restoration Alternatives

5.4 Preferred Compensatory Restoration Alternatives

6. MONITORING

6.1 Site Identification

6.2 Monitoring Variables and Methods

6.3 Preferred Monitoring Alternatives and Schedule

7. ENVIRONMENTAL REVIEW, SUPERVISION AND PERMITTING

7.1 Categorical Exclusion

7.2 Permitting

7.3 Supervision of Restoration Activities

8. RESTORATION AND MONITORING COSTS

8.1 Response, Damage Assessment, and Interest Costs

8.2 Primary Restoration, Monitoring, and Oversight Costs

8.3 Compensatory Restoration, Monitoring, Oversight Costs

8.4 Estimated Restoration and Monitoring Costs

Monitoring restoration:

- *Monitoring plan developed by FKNMS monitoring biologists and 312 case team*
- *Most monitoring conducted in house,*
- *Although baseline monitoring may be performed by capable contractor upon completion of restoration project*
- *Monitoring costs are part of total claim package*

contractor rates							
Year of restoration:						2006	
Number of square meters to be restored							
Number of square meters restored per day							

Description	Participant / Item	Qty	Units	Price/Unit	Cost		
Primary Restoration							
<i>Mob/Demobilization</i>	Sr. Scientist/Ops Manager		days				
	Scientific Diver		days				
<i>Labor</i>	Sr. Scientist/Ops Manager		days	\$1,398.25	\$0.00	\$1,306.80	1398.254
	Scientific Diver		days	\$918.05	\$0.00	\$858.00	918.0457
	Commercial Diver		days	\$861.55	\$0.00	\$805.20	861.5506
	Commercial Diver		days	\$861.55	\$0.00	\$805.20	861.5506
	Principal Supervisor		days	\$1,525.37	\$0.00	\$1,425.60	1525.368
<i>Oversight</i>	FKNMS Sr. Biologist		days	\$1,886.94	\$0.00	\$1,763.52	1886.937
<i>Materials</i>	Drill		each	\$141.83	\$0.00		
	Drill bits		box	\$94.54	\$0.00		
	Expansion bolts		each	\$2.10	\$0.00		
	Tags		each	\$3.15	\$0.00		
	Portland cement		square meter	\$44.37	\$0.00		
	Truck		day	\$157.59	\$0.00		
	Cement Mixer		day	\$105.06	\$0.00		
	DGPS Leica 941DX		day	\$157.59	\$0.00		
	Fathometer		day	\$131.33	\$0.00		
	Digital still camera		day	\$105.06	\$0.00		
	Underwater video system		day	\$262.66	\$0.00		
	Video tapes		each	\$5.66	\$0.00		
	Commercial dive equipment		person per day	\$315.19	\$0.00		
	Air compressor		day	\$52.53	\$0.00		
	Scuba gear		per diver per day	\$26.27	\$0.00		
	Scuba tanks		per tank per day	\$8.41	\$0.00		
	Electric compressor scuba		day	\$157.59	\$0.00		
	28-ft boat		day	\$682.91	\$0.00		

<i>Travel Distance</i>			miles	\$0.485	\$0.00		
<i>Travel Time</i>	Sr. Scientist/Ops Manager		days	\$1,398.25	\$0.00		
	Scientific Diver		days	\$918.05	\$0.00		
	Commercial Diver		days	\$861.55	\$0.00		
	Commercial Diver		days	\$861.55	\$0.00		
<i>Lodging*</i>	Sr. Scientist/Ops Manager		days		\$0.00		
	Scientific Diver		days		\$0.00		
	Commercial Diver		days		\$0.00		
	Commercial Diver		days		\$0.00		
<i>Per diem</i>	Sr. Scientist/Ops Manager		days	\$157.59	\$0.00		
	Scientific Diver		days	\$157.59	\$0.00		
	Commercial Diver		days	\$157.59	\$0.00		
	Commercial Diver		days	\$157.59	\$0.00		
				Subtotal	0		
Primary Documentation							
<i>Labor</i>	Sr. Scientist/Ops Manager		days	\$1,306.80	\$0.00		
	Scientific Diver		days	\$858.00	\$0.00		
<i>Oversight</i>	FKNMS Sr. Biologist		days	\$1,763.52	\$0.00		
<i>Data Analysis</i>	Principal		days	\$1,425.60	\$0.00		
<i>Figures</i>	Operations Manager		days	\$1,306.80	\$0.00		
<i>Video</i>	Survey Technician		days	\$858.00	\$0.00		
<i>Materials</i>	Drill		each	\$141.83	\$0.00		
	Drill bits		box	\$94.54	\$0.00		
	Expansion bolts		each	\$2.10	\$0.00		
	Tags		each	\$3.15	\$0.00		
	DGPS Leica 941DX		day	\$157.59	\$0.00		
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	Video tapes		each	\$5.66	\$0.00		
	Electric compressor scuba		day	\$157.59	\$0.00		
	28-ft boat		day	\$682.91	\$0.00		
<i>Report Review</i>	Principal		days	\$1,425.60	\$0.00		
<i>Computer Time</i>			days	\$40.00	\$0.00		
				Subtotal	0		
* Lodging included in per diem for contractors							
				Total:	\$0.00		

**Capt. Bonehead
NRDA CLAIM SUMMARY**

Date of Incident
Location
FWCC Citation Number
Vessel Name
Vessel Description
Vessel Owner
Vessel Operator
Total Area Injured (sq. meters)
Primary Restoration Required?
Compensatory Restoration Required?

Response and Damage Assessment Costs (as of Date)

NOAA Response, Damage Assessment, and Interest	\$0.00
State of Florida Response, Damage Assessment, and Interest	\$0.00
Subtotal Response, Damage Assessment, and Interest	\$0.00

Primary Restoration, Monitoring, and Oversight Costs

NOAA Primary Restoration	\$0.00
NOAA Primary Monitoring	\$0.00
NOAA Primary Oversight*	
Subtotal NOAA Primary Costs	\$0.00

Compensatory Restoration, Monitoring, and Oversight Costs

NOAA Compensatory Restoration	\$0.00
NOAA Compensatory Monitoring	\$0.00
NOAA Compensatory Oversight	\$0.00
Subtotal NOAA Compensatory Costs	\$0.00

TOTAL VALUE OF NOAA and STATE OF FLORIDA CLAIM (2005\$)	\$0.00
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Restabilization of dislodged/fragmented coral colonies (simple reattachment)



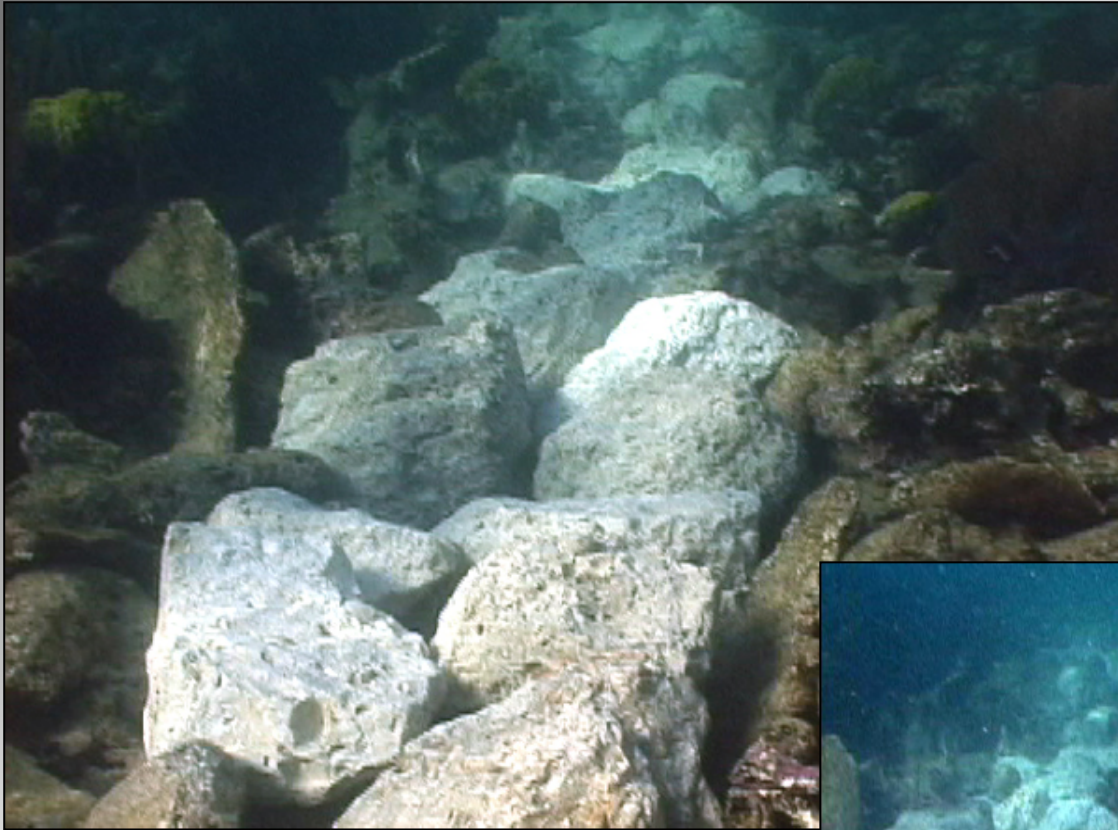
M/V Adaro
Grecian Rocks Reef
August, 2003



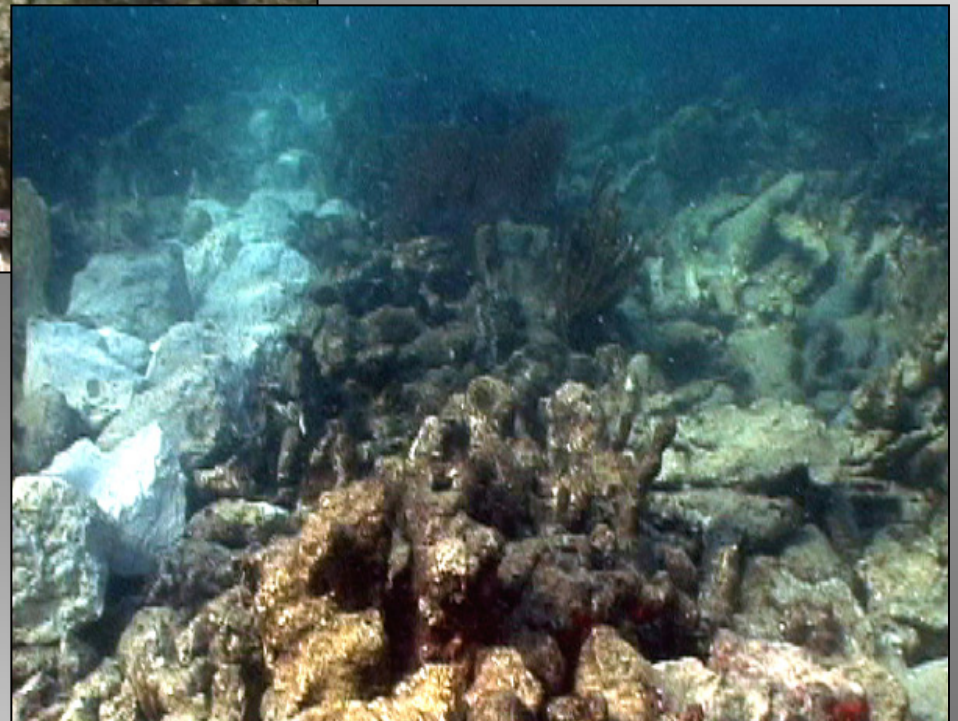
Over 800 colonies of live coral dislodged by vessel grounding



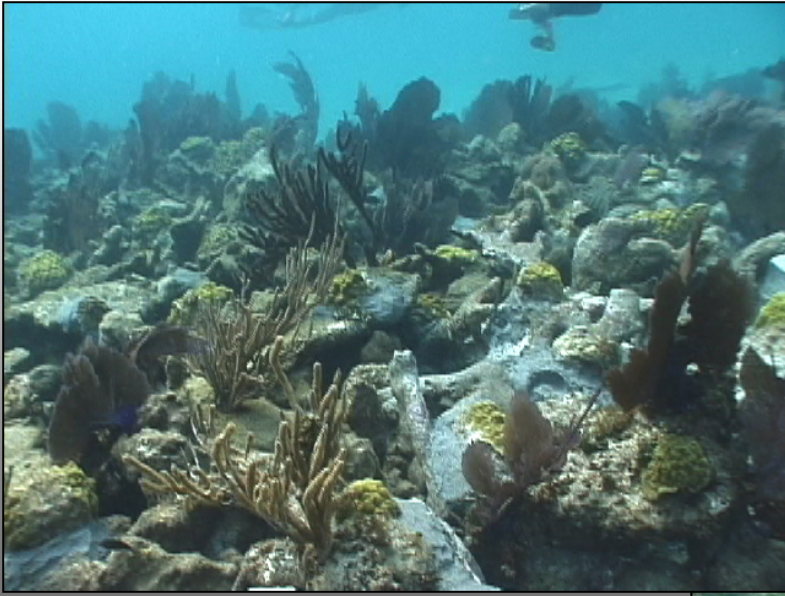
Grounding track : Twin 38 meter long prop-dredged trenches across the reef crest; 193 m² area of impact



Quarried limestone boulders of fossil coral material were used as backfill for trenches.



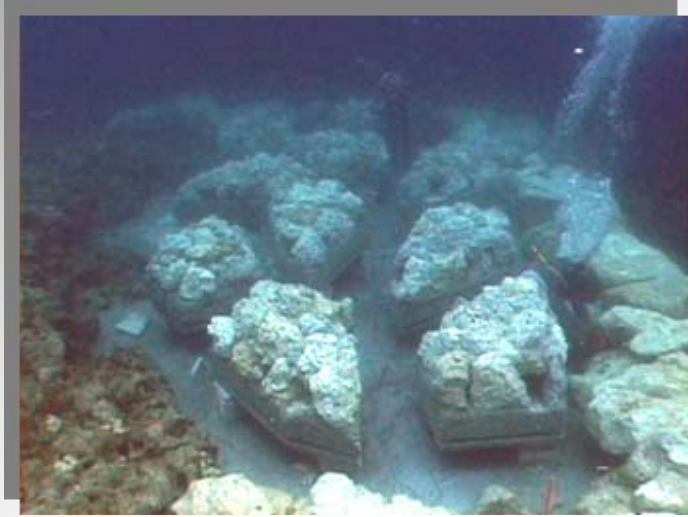
View of backfilled trench, left, and untouched trench filled with loose coral framework debris.



Two views of the final product



Replacement/recreation of impacted or destroyed reef framework structure



Wellwood



Elpis



Connected



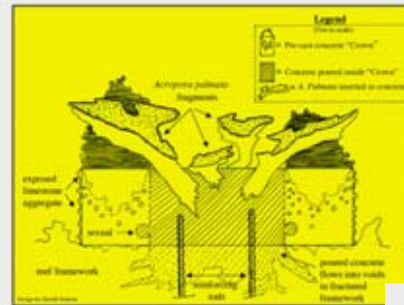
Houston



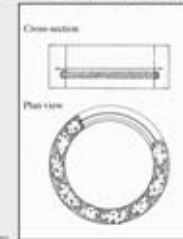
Maitland



Cross-Section of Reef Crown



Cross-section and Plan view of Reef Crown



M/V Connected



*Photo of reef crown at Connected site,
February, 2004*

*R/V Columbus Iselin
47 meter research vessel
August 10, 1994
Looe Key Reef*



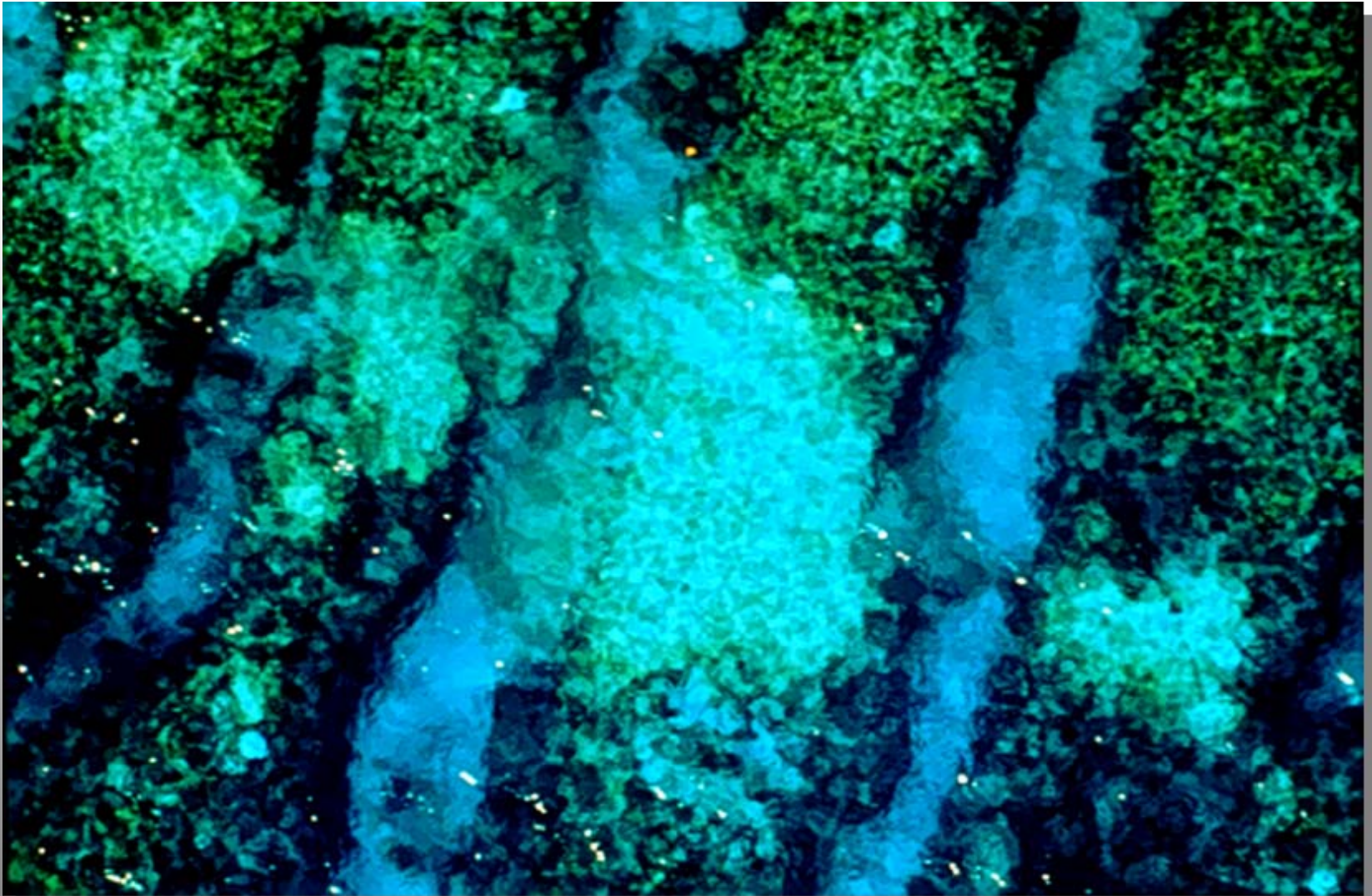


Looe Key reef crest prior to grounding...



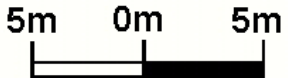
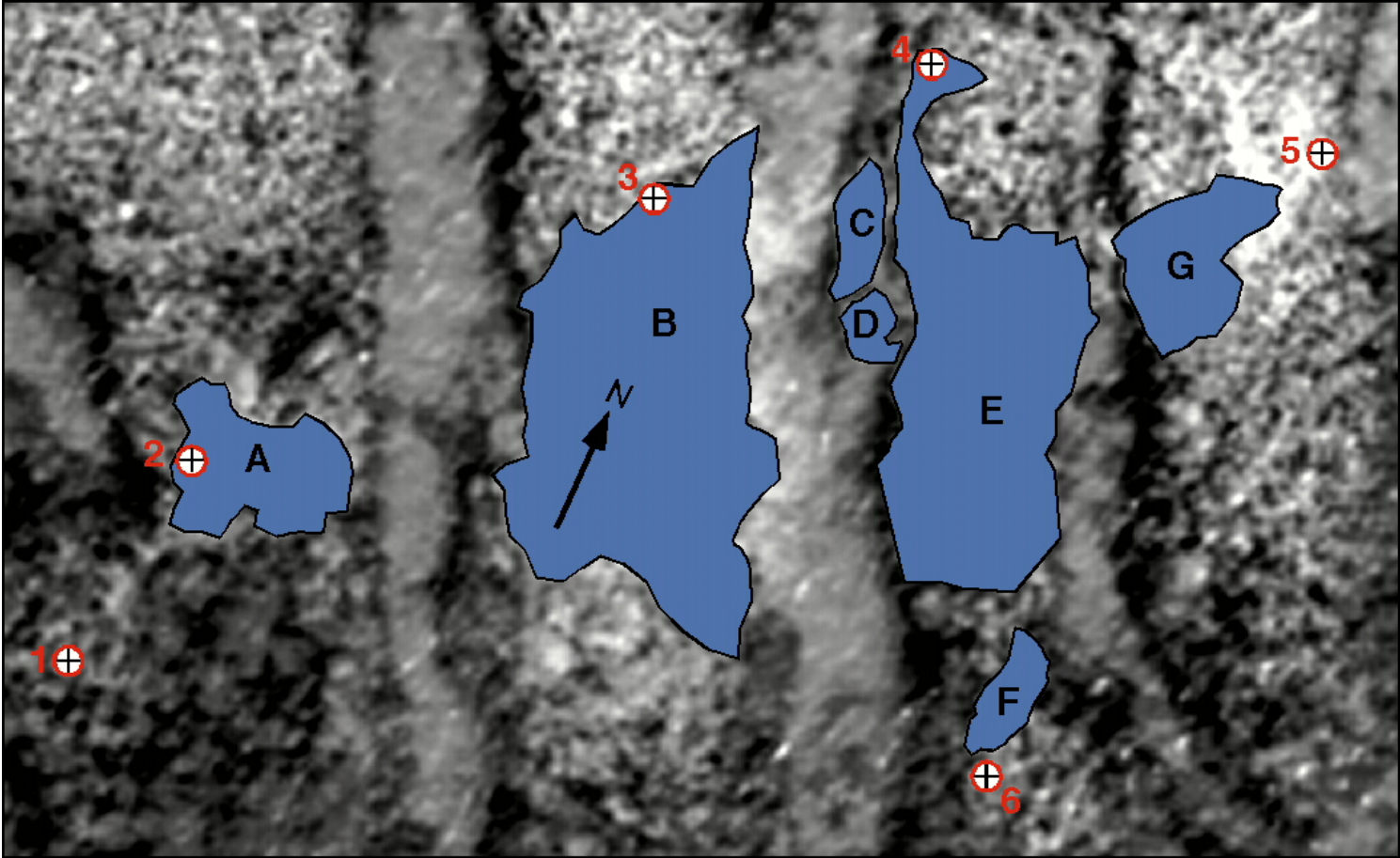
...and after



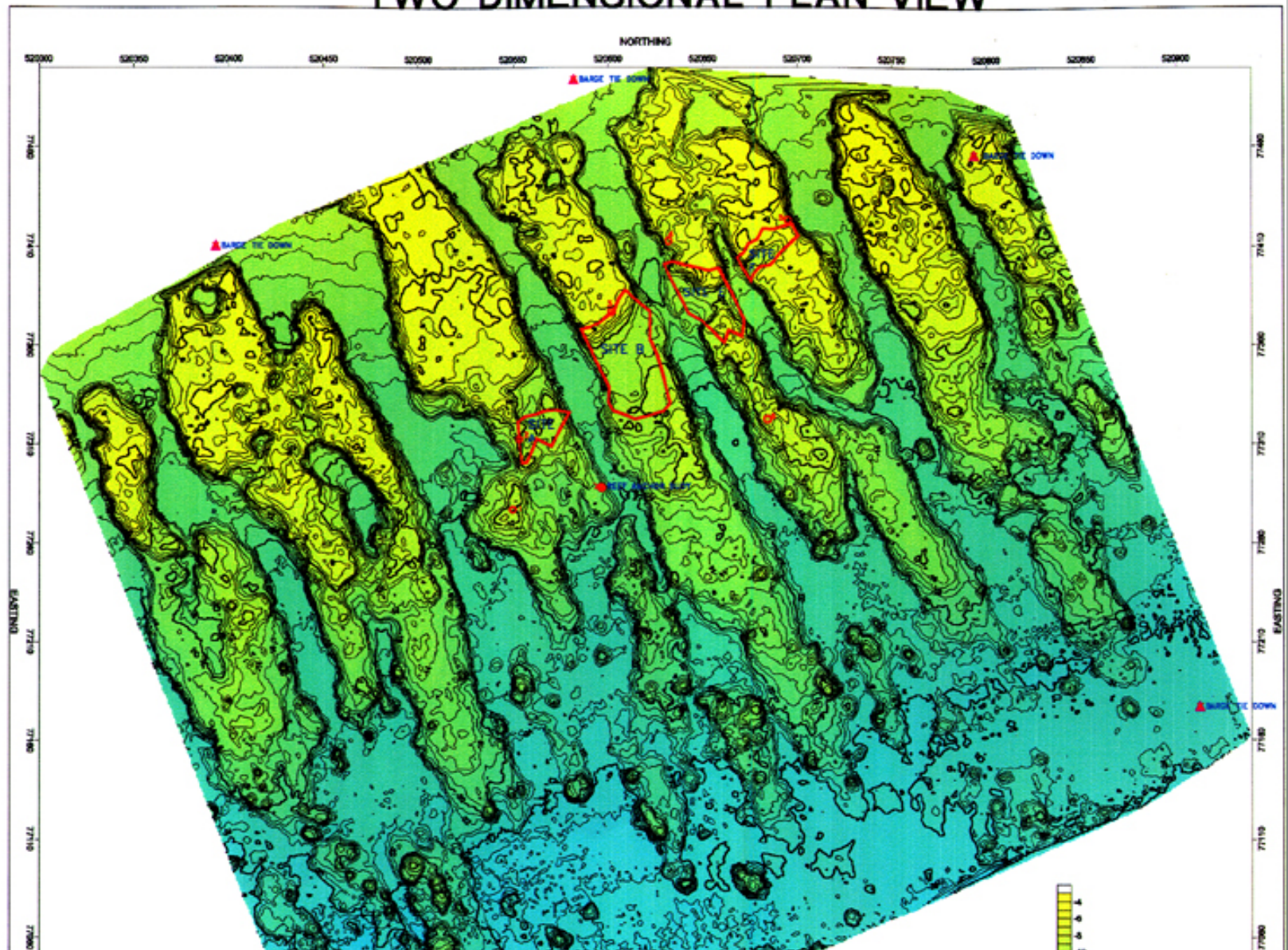


Aerial photo of Iselin grounding site

Aerial photo of Iselin site, digitized and injury scars outlined for quantification by CAD software



LOOE KEY FLORIDA, ECHOSCAN MULTIBEAM SURVEY TWO-DIMENSIONAL PLAN VIEW



The Iselin grounding destroyed 345 square meters of living coral and 338 square meters of the reef framework, killing or displacing large numbers of hard corals, sea fans, sponges, fish and other marine creatures. This was further exacerbated by subsequent storm damage. Prior to primary structural restoration of the site, a doubling of the volume of reef structure lost due to excavation of weakened reef framework by storm-generated wave action (Hurricanes Georges and Mitch, 1998) was documented by FKNMS DARP staff.

Iselin *grounding site restoration*



Boulder deployment

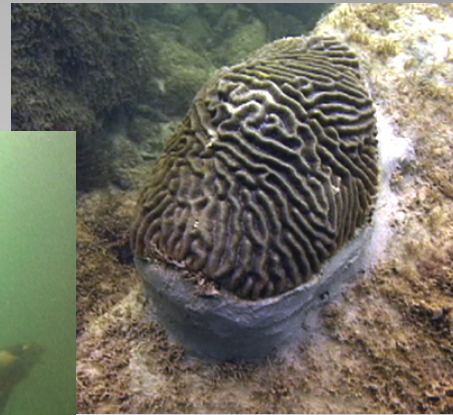
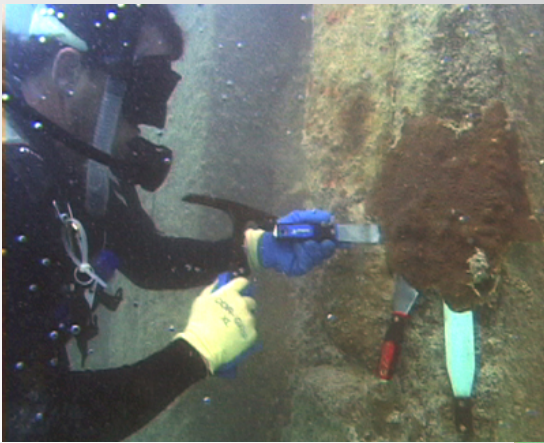
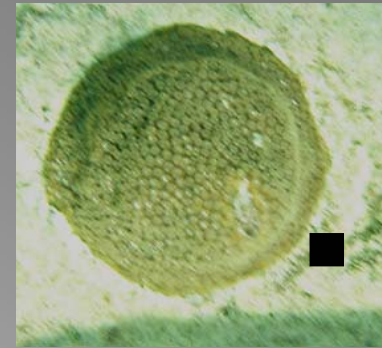
Iselin *grounding site restoration*



Grouted boulders



The finished product



Transplantation/Relocation of coral colonies into impacted site to expedite recolonization

Monitoring is an essential component of any major coral reef restoration effort...

