

APPLICATION COVER PAGE – 1 OF 2 (PROJECT BASIC CRITERIA)

Section 1: Application Cover Page; Basic Criteria

Please use this page, or re-create as is.

1. **PROJECT TYPE:** *(As mandated by the RESTORE Act, funds may only be used for one or more of the allowable uses listed below, which the County cannot amend or change. Carefully review each criteria listed below and determine if your project will achieve one or more of the allowable uses below. Projects that do not meet at least one of the allowable uses below will not be considered for funding. Check all that apply.)*
 - Restoration and protection of natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast Region.
 - Mitigation of damage to fish, wildlife, and natural resources.
 - Implementation of a federally approved marine/coastal management plan, including fisheries monitoring.
 - Workforce development and job creation.
 - Improvements to or on state parks in coastal areas affected by the Deepwater Horizon oil spill.
 - Infrastructure projects benefiting economy or ecological resources, including port infrastructure.
 - Coastal flood protection and related infrastructure.
 - Planning assistance.
 - Activities to promote tourism and seafood in the Gulf Coast region, for one or more of the following:
 - Promotion of tourism in the Gulf Region, including recreational fishing.
 - Promotion of the consumption of seafood harvested from the Gulf Coast Region.
2. **CONTACT INFORMATION:** *(Include at least one name, phone number, email address, and organization name if applicable)*
 - Organization: Bonefish and Tarpon Trust
 - Address: PO Box 529
 - City, State, Zip Code: St. James City, FL 33956
 - Contact Person
 - Name: Dr. Aaron Adams
 - Title: Director of Operations
 - Phone: (239)-283-4733
 - Email Address: aaron@bonefishtarpontrust.org

APPLICATION COVER PAGE – 2 OF 2 (PROJECT SUMMARY)

Section 2: Application Cover Page; Project Summary Information

Please use this page, or re-create as is.

3. Project Name: *(Provide a short succinct title for the project)*

A Geospatial Update and Economic Assessment of Injuries to Seagrasses Caused by Vessel Groundings in the Florida Keys

4. Project Executive Summary: *(Provide a concise summary or abstract in the space below; do not exceed the space below.)*

Seagrass banks in the Florida Keys area well-known for providing a host of important ecosystem services. However, ongoing vessel groundings continue to fragment these resources and thus jeopardize their integrity, and functions and services. Although groundings are universally recognized as a threat to these critical, Monroe County habitats, there has not been a systematic survey of the injury extent for almost 20 years. To guide Monroe County in its stewardship role and to inform leaders as to the scope of threat for these ongoing injuries, we propose to conduct a new, comprehensive inventory of injuries to seagrass habitat of Monroe County. We will use state-of-the-art GIS-based techniques incorporating digital remote sensed imagery and ground-truthing to provide a georeferenced assessment of all stages of vessel grounding injury and recovery. Additionally, we will build on Bonafish and Tarpon Trust's recent economic assessment of game fish injury to create an evaluation of the economic impact of these groundings. We will synthesize the inventory and economic evaluation to provide County leaders a roadmap for response, mitigation and planning to avoid, minimize and recover these critical services for the County.

5. Range of Benefit: Does this project have a

- Local benefit?
- Keys-wide benefit?
- Regional benefit?
- Gulf-wide benefit?

(Provide the location of the project and a brief description of the area that is benefiting; do not exceed the space below.)

Florida Keys, Monroe County waters and adjacent communicating water bodies including Florida Bay and the entirety of the Florida Keys National Marine Sanctuary.

6. Project Cost: *(Provide the actual/estimated project cost, the amount being requested with this submission, and the amount of match committed to the project from any source. Please make clear the total project costs and the amount you are requesting.*

There is an opportunity to provide detailed cost/request/match information in the narrative section (see question 8.)

- Total Project Cost: \$260,030
- RESTORE Request Amount: \$260,030 % of project cost: 100
- Secured Cash Match (Committed funding from other sources): \$ % of project cost:
- In-kind Match Value: \$45,000 % of project cost: 17
- Funding Gap: \$ % of project cost:
- Anticipated Cash Match (potential funding from other sources)*: \$ % of project cost:

* These funds must be secured within 1 year of project award.

APPLICATION PROJECT BUDGET

Section 3: Project Budget

PROJECT BUDGET	Activity/Item	Cost	FUNDING		
			Anticipated RESTORE Funding	Cash Match	In-kind Match
Planning/Design/Permitting					
	Survey Design	\$7,481			\$5,000
	Site Visits (planning)	\$9,214			\$5,000
	Image Acquisition	\$35,935			
	Administration*:	\$2,494			
	Planning Subtotal:	\$55,124			\$10,000
Construction or Project Activity(ies)					
	Administration*:				
	Construction Subtotal:	\$0			
Monitoring					
	Data Collection	\$26,881			
	Site Visits (ground truthing)	\$9,462			\$25,000
	Administration*:				
	Monitoring Subtotal:	\$36,344			\$25,000
Project Cost					
	Remote Sensing Analysis and Document Production	\$104,162			
	Economic Analysis	\$64,400			\$10,000
	Planning	\$55,124			
	Monitoring	\$36,344			
	Total Administration*:				
	TOTAL Project Cost:	\$260,030			\$45,000
Estimated Costs by Year					
	Year 1	\$260,030			

*Notes: Only complete the sections of the budget that are applicable for your project. Please refer to question 8 to provide further explanation of budget details. *The RESTORE Act places a total 3% cap on administrative expenses. We are uncertain at this point how this will be applied, how "administration" will be defined or assigned, or whether projects may even be able to include administration. We are waiting on further guidance from US Treasury rules to define this. Please keep this in mind as you develop your budget. Administrative costs typically include but may not be limited to overhead costs for basic operational functions (insurance, utilities), as well as costs associated with admin staff such as accountants, legal, etc.*

APPLICATION QUESTIONS – DETAILED PROJECT INFORMATION

Section 1. Application Narrative; Detailed Project Information

Please respond clearly and specifically to each of the following questions. Use 12 pt. font, 1 inch margins, and pagination, to aid in readability. There is no page limit, but please be as brief as possible. To complete your submission, please attach your response to these questions to the application cover pages and the budget page.

7. Project Description:

Injuries to bank top habitats in the Florida Keys and elsewhere arising from vessel groundings are widely documented (Kuss 1991, Krueger 1994, Sargent et al. 1995, SFNRC 2008)¹. Here we propose to utilize RESTORE Act funds to evaluate the abundance and distribution of seagrass injuries in Monroe County. For the first time we would place the complete seagrass injury status of Monroe County in a Geographic Information System (GIS) that would facilitate mitigation planning and allow for ongoing tracking of injury trajectories and their recovery. Additionally, we would conduct a comparative analysis with past studies in an attempt to discern patterns of injury over time; the last complete study of the area was conducted 18 years ago, long before systematic damage assessment and restoration of seagrass beds in the Florida Keys National Marine Sanctuary (FKNMS) was initiated (Kirsch et al. 2005).

The health of bank top (typically seagrass) environments where anglers and guides seek prizes game fishes is of great ecological and economic significance (Sargent et al. 1995, Fedler 2013). Thus, Bonefish and Tarpon Trust (BTT) a non-profit organization whose mission is to conserve and enhance global bonefish, tarpon, and permit fisheries and their environments through stewardship, research, education, and advocacy has great interest in this resource. To accomplish this mission, BTT serves as a repository of information for these species and their prey and habitats, works to nurture these populations, supports research on these fisheries and their environments, and educates and works with government to ensure effective management of these resources. BTT recognizes that a great deal of science has been conducted that guides management of these habitats and that many levels of management plans have been devised. Documenting injury (and economic consequences) to these systems, particularly the location and trends of injury, are needed to effectively guide both mitigative and regulatory efforts.

The ongoing and repeated destruction of seagrasses and associated living resources (e.g., corals and sponges) have long been recognized as significant threat to the structural integrity, ecosystem function, and bioeconomic value of these systems (Zieman 1976, Durako et al. 1992, Folitt et al. 1992, Whitfield et al. 2002, Engeman et al. 2008). As a result, extensive research has been conducted on understanding the etiology of these injuries and developing techniques for their mitigation (Fonseca et al. 1998, Kenworthy et al. 2000, 2002, Uhrin and Holmquist 2003, Kirsch et al. 2005, Fonseca et al. 2004, Hammerstrom et al. 2007, Uhrin et al. 2009, 2011).

¹ Literature Cited will be provided upon request.

Despite the long history of study and attempts at intervention (hampered by limited resources), vessel groundings continue daily leading to the decline of these important natural resources. Degradation and loss of these habitats not only results in loss of ecosystem services but in loss of economic services as well. The saltwater recreational fishery in Florida has an annual economic impact that exceeds \$6 billion (ASA 2013)², with a significant amount of this effort in the Florida Keys. In fact, the Florida Keys are credited with being the birthplace of “flats fishing,” which brings hundreds of millions of dollars to South Florida. For example, recreational fishing in the Florida Everglades region has an annual economic impact >\$1 billion and supports an estimated 12,000 full-time equivalent jobs. A recent study of the Florida Keys shows that the annual economic impact of all Florida Keys saltwater fishing is \$741 million, with \$427 million of that from the Flats Fishery (Fedler 2013). This means that a single county in Florida, Monroe County, accounts for 16% of the statewide economic impacts of saltwater fishing. The Flats Fishery also accounts for 4,340 full-time equivalent jobs. In addition, the fisheries of the Florida Keys have an important cultural component, with many of the fishing guides being third-generation guides and part of the fabric of the Florida Keys community.

Bonefish & Tarpon Trust is also conducting a project in the Florida Keys to map important fishing areas for the Flats Fishery for use in the ongoing management revision for the Florida Keys National Marine Sanctuary. This has never been done before. This work will identify the important fishing areas and habitats and designate these areas in such a way so as to ensure their conservation for the fishery into the future. Many of the seagrass banks of concern, due to groundings, propeller scarring, and other disturbances, are within this important fishing area, which further underscores the need for this study. Moreover, these seagrass banks are focal points for the Flats Fishery, providing habitat for tarpon, permit, and bonefish. Degradation of these seagrass banks negatively impacts the flats fishery. Thus, a geographically correct and up-to-date inventory will provide important, actionable information to guide actions that help vessel operators avoid creating injuries in the first place.

For this project, we would update the 18 year-old comprehensive assessment of vessel-damaged shallow water habitats of Monroe County in the Florida Keys and adjacent waters through remote sensing and ground-truthing to create an interactive geodatabase. We would coordinate these efforts with the damage assessment and recovery team of the FKNMS, the County, and the fishing guide associations. To our knowledge, no comprehensive inventory has been done for the Keys environment since 1995 by Sargent et al. This geographic database will guide restoration site selection and provide a baseline through and beyond the project for guiding subsequent management opportunities.

BTT’s ongoing fishing area mapping project is providing information on spatial use patterns by the economically important recreational flats fishery. (This is a catch-and-release fishery that targets bonefish, tarpon, and permit.) The resulting maps will define current use of seagrass banks of concern and of banks that are not yet damaged (control or comparison sites). In addition, we will augment surveys of fishing guides engaged in this fishery about their historical

² American Sportfishing Association. 2013. Sportfishing in America – An economic Force for Conservation. Alexandria, VA: American Sportfishing Association. 12pp.

use of seagrass banks and whether they have observed changes in fishing quality and fish abundance at these banks and attempt to determine whether this may be associated with injury distribution and abundance.

The interaction with this important stakeholder group in the Florida Keys will give us nearly unprecedented information on the direct and indirect impact of these groundings on this economically vital fishing enterprise. Through this comparison, we will transparently demonstrate the potentially additive cost of these injuries to our society as well as the benefit of their conservation in a manner that will provide a clear line of sight from injury to economic consequence, a foundation for actionable guidance by the management community.

Section Summary: Background

- Seagrass banks in the Florida Keys, including within the boundaries of the Florida Keys National Marine Sanctuary (FKNMS) are a critical resource, including seafloor stabilization, storm protection of shorelines and feeding, nursery, and refuge habitat for ecologically and economically important fauna, including sport and game fish.
- These banks suffer localized heavy injury from vessel groundings. Funding has been limited to support testing and establishment of vessel grounding avoidance strategies.
- Vessel groundings often increase in size with time if not repaired, eliminating additional habitat and destabilizing the ancient bank formations.
- These ongoing injuries contribute to degradation of the bank top and associated channel ecosystems and their functional service level as critical habitat for commercial and recreationally important fish and their prey.
- There has not been a systematic inventory of injuries to this critical resource across Monroe County in 18 years; these data have also never been systematically compiled in a GIS.
- Linking injury abundance and distribution to use patterns will provide an objective assessment of economic impacts to the critically important Flats Fishery that, in turn, cascades through the south Florida economy.

Objectives

- Perform a geographically registered inventory of seagrass injuries throughout Monroe County waters.
- Conduct a comparative analysis with previous surveys (e.g., Sargent et al. 1995) to determine a change in injury status.
- Conduct a use analysis of the flats and determine intersections of injuries with fishing effort to produce an economic impact assessment.
- Provide resource managers with a GIS-based product that may be readily updated to facilitate allocation of mitigation efforts and guide management strategies.
- Update and promulgate actionable management guidance.

Approach

- Compile the most recent existing aerial and/or satellite imagery of Monroe County that clearly visualizes seagrass habitats.
- Perform ground-truth assessment for injury assessment accuracy.
- Map seagrass injuries by classes used in injury assessment protocols (e.g., propeller scars, blowholes, and sediment ejecta berms).
- Conduct a geographically organized comparative analysis with previous studies to determine:
 - Change (if any) in overall abundance of injuries,
 - Change (if any) in location of injury “hot spots,” and
 - Potential trends in injury rates normalized for vessel use.
- Based on injury extent, perform an economic impact analysis for the County.
- Provide recommendations for mitigative actions.

Outcomes

- Support sustainable local jobs (maintaining enhanced navigation, fishing support, and tourism support).
- Informed guidance of management alternatives based on economic and ecological consequences.
- Effective, science-based restoration planning that results in measurable increases in ecosystem services, particularly with regard to economically important fisheries.
- Help reduce the pace of injury to these critical habitats.

8. Budget Narrative/Financial Feasibility/Cost-Effectiveness:

Project costs will arise from initial inventory and ground-truthing, site familiarization, economic data collection and analysis, GIS project building, and reporting. These costs include a mix of capital expenditures (imagery acquisition, software maintenance, and minimal expendables for field operations), any sub-contracts (e.g., guide services), and labor with associated overhead. Total cost over the 1-year life of the project: **\$260,030**.

Beyond the match, other funding is to be determined. There are ongoing efforts for assessment and restoration by the FKNMS in partnership with the State of Florida, by the Aquatic Preserves and potentially other organizations. We will work to team with those groups and leverage activities to optimize project funding.

9. Technical Feasibility:

The technical approaches described here (remote sensing inventory and economic impact assessment) are all established, published methods with examples (as cited) through the Florida Keys and nearby environments. What sets this project apart is the overall experience of the team and the unique fusion of GIS capability, understanding the foundation of seagrass ecology, and restoration with economic evaluation.

Bonefish and Tarpon Trust has and continues to support research on the utilization of these habitats, providing a unique, geospatial context of their utilization (**Ms. Brooke Denkert Black**, GIS Specialist, BTT) and economic analysis (**Dr. Tony Fedler** of Human Dimensions Consulting, author of the recent Flats Fishing economic assessment). The team includes **Dr. Aaron Adams** who has conducted extensive fish habitat ecology and fisheries work throughout the Caribbean, including disturbance ecology, determining fish habitat use patterns, and fish ontogenetic habitat shifts. In his research, he frequently interacts with fishery user groups to conduct studies and apply results to conservation and management. Recent work has included using recreational fisheries as conservation tools in regional management.

Dr. Adams and staff at BTT have excellent relationships with the flats fishing guide associations in the Florida Keys (Florida Keys Fishing Guides Association, Middle Keys Fishing Guide Association, Key West and Lower Keys Fishing Guide Association), which will be used to inform use patterns of injured (and non-injured) areas in support of the economic evaluation.

Ms. Black has extensive experience mapping stakeholder spatial use patterns, habitats in a GIS format. Her knowledge of the Florida Keys fisheries (guides and anglers) is extensive, and she will assist **Dr. Adams** in providing access to important information within this group.

Additionally, one of the world's leading authorities on seagrass ecology and restoration (**Dr. Mark Fonseca** of CSA) will provide oversight on the entire project. **Dr. Fonseca** recently retired from NOAA where he senior authored much of the foundation science and guidance used by State and Federal authorities for the restoration and conservation of seagrass habitats nationally and, in particular, in the Florida Keys. He has worked in the Florida Keys since the 1980s and published numerous key papers on restoration of seagrasses both in the Keys and throughout Florida.

Mr. Keith VanGraafeiland will serve as the GIS manager for the project and will have responsibility for development, execution, and production of the GeoPortal. He is the Geospatial Services Business Line Manager for CSA and is responsible for all ArcGIS, AutoCad, ERDAS Imagine, and other GIS-related projects. He has extensive experience in development of data standards and nomenclature for database and filing structure. Under his supervision, the GIS Department produces and manages maps, metadata, images, reports, and plans for assessments, submittals, and reports. **Mr. VanGraafeiland** is an experienced geographer, GIS analyst, cartographer, and remote sensing analyst. **Mr. VanGraafeiland** is currently involved in the management and development of the GCRO NRDA Geospatial Database, including 2D and 3D cartographic and statistical product generation for visualization, reporting, and decision-making purposes. The geodatabase contains over 60,000 sample locations, 500,000 benthic photos, and other various survey datasets.

10. Readiness for Implementation/Permitting Considerations:

We are ready for immediate implementation; this work can be conducted year-round in the Florida Keys.

11. Project Completion Timetable:

Tasks	1st qtr of project year	2nd qtr of project year	3rd qtr of project year	4th qtr of project year
Compile the most recent existing aerial and/or satellite imagery of Monroe County that clearly visualizes seagrass habitats	X			
Perform ground-truth assessment for injury assessment accuracy	X			
Map seagrass injuries by classes used in injury assessment protocols (e.g., propeller scars, blowholes and sediment ejecta berms)		X	X	
Conduct a geographically organized comparative analysis with previous studies		X	X	
Based on injury extent, perform an economic impact analysis for the County			X	X
Provide recommendations for mitigative actions			X	X

12. Environmental Benefits:

The value of restoring and maintaining the integrity of the seagrass and associated communities scales linearly with area; more seagrass habitat proportionally equals more ecological services and Essential Fish Habitat, including extraordinarily high faunal abundance and richness, which includes not only commercial and game species but their prey (Sogard et al. 1989a,b,c Holmquist et al. 1989, Powell et al. 1989, Fonseca et al. 1996b, 2000). Additional environmental benefits derived from the maintenance of these ancient formations (Wanless et al. 1989) include mitigation of storm waves and surge, providing foundation for mangrove habitats and bird rookeries, water filtration and clarification, water level and temperature mitigation (Powell et al. 1989), and wading bird feeding areas (Powell 1987). In order to plan regional restoration efforts and galvanize support for improved impact avoidance, documentation of the damage and its economic consequences must be linked and publicized. Defining the problem frames our ability to guide mitigative actions and realize environmental benefits.

13. Economic Benefits:

The aesthetics of injured habitats, easily observed by visitors to the Keys, give an undesirable impression. Public expectations of experiencing an unspoiled and attractive tropical landscape are not met when seagrass and coral habitats are visibly injured, diminishing the value of these resources in supporting tourism. Their restoration and the demonstration of caring, effective management are expected to provide enjoyment and shared stewardship perception. Thus, the social benefit of preserving a natural landscape cascades through the community and economic network by reinforcing the expectations of the public to encounter striking tropical environments, which in turn promotes their shared opinion, desire to return, and expenditures in the local community to support those visits.

Direct job support also results from this project. Ground-truthing and economic assessment will require remuneration for guides and support services. By defining the new extent of injury and its location, this project will yield a basis for active restoration efforts and their associated workforce.

The recreational flats fishery of the Florida Keys depends on healthy and abundant habitats. Multiple life stages of bonefish, tarpon, and permit depend on seagrass and other shallow Keys habitats (e.g., limestone pavement with soft corals, patchreef, and edge habitats of seagrass banks), and loss and degradation of these habitats has negatively impacted the fisheries. In addition, the fishery requires widespread healthy habitats—both to suit the ontogenetic needs of these species and to support the fishery. The flats fishery is almost entirely a “sight-fishery,” such that participants search for, stalk, and then cast lures to spotted fish to try to catch them. This approach means that the number of boats or wading anglers per unit of habitat must be relatively low, thus requiring extensive habitat coverage. Moreover, the habitat requirements of bonefish, tarpon, and permit require a habitat mosaic (rather than a monospecific seagrass bed, for example), which is provided by seagrass banks and their surrounding habitats.

Moreover, other species of economically important fish species (e.g., snapper and grouper) also use these habitats. The recently completed economic study shows that the Flats Fishery of the Florida Keys has an annual economic impact of \$427 million, which is a significant portion of the Keys’ entire saltwater fishery impact of \$741 million. In fact, the Florida Keys (a single county in Florida) accounts for 16% of statewide recreational saltwater fishery economic impact. Given that the fishery depends on healthy habitats and that the fishery has declined in recent years concurrent with habitat degradation and loss, preservation of these critical habitats will undoubtedly have positive effects on this important fishery.

14. Community Economic and/or Environmental Resilience Benefits:

Koch et al. (2009) have shown how the maintenance of nearshore habitats such as seagrass and mangrove provides a non-linear and, thus, disproportionately larger service to the protection of onshore infrastructure. The anastomosing bank structure and the associated seagrass and mangroves moderates water flow, wave action, and storm surge; therefore, restoring and maintaining these habitats is an integral part of how the Keys withstand storms (*sensu* Wanless 1989). Besides the tremendous ecological service cascade, including fauna, carbon

sequestration, and primary production, the aforementioned physical stability promotes shoreline stability and mitigates wave damage during storms.

15. Complements to Existing Efforts/Public Acceptance:

This work strongly complements ongoing efforts by the Florida Keys National Marine Sanctuary and potentially the Aquatic Preserves to prevent, monitor, and restore vessel-injured seagrass habitats. Staff now at CSA played pivotal roles in the development of the science that supports these efforts and will bring that experience and expertise to bear in order to fully and effectively integrate the activities of this project with those of the management strategy of the FKNMS. This assessment effort is also timely in that it coincides with the ongoing FKNMS management review, thus can provide added value to habitat protection strategies that will be part of the new management plan. This effort complements the ongoing efforts of the State and county to raise awareness of seagrass beds and to educate vessel operators on how to avoid injuries to these habitats³. Finally, this effort builds off of the existing effort by BTI through their recent release of the Economic Impact of the Florida Keys Flats Fishery report⁴, which met with wide acclaim.

We expect this to be widely embraced as the degradation and economic value of the channel and bank systems is commonly recognized, if insufficiently documented, and solutions considered long overdue.

16. Compliance with Federal, State, Local Regulations:

This assessment will not require permitting and, thus, there are no anticipated conflicts with regulatory requirements beyond those requiring compliance with management of funding as stipulated by Treasury rules, etc.

17. Project Management Capacity:

Bonefish and Tarpon Trust (BTT) is a non-profit organization whose mission is to conserve and enhance global bonefish, tarpon, and permit fisheries and their environments through stewardship, research, education, and advocacy. To accomplish this mission, BTT serves as a repository of information for these species and their prey and habitats, works to nurture these populations, supports research on these fisheries and their environments, and educates and works with the government to ensure effective management of these resources. Thus, the health of bank top and channel environments where anglers and guides seek these prizes game fishes is of great concern to BTT. BTT recognizes that a great deal of science has been conducted that guides management of these habitats and that many levels of management plans have been devised. However, implementing these plans has proved challenging in the Nation's current fiscal climate. And because those well-considered plans have yet to be implemented, they still remain to be evaluated for their efficacy. Until we implement the concepts of bank and channel protection, we cannot learn, adapt, and refine those plans to

³ <http://myfwc.com/research/habitat/seagrasses/information/protect/>. Interestingly, the lead photograph at this location was taken over 20 years ago, emblematic of the long, but largely futile, effort to prevent ongoing injury of these habitats.

⁴ <http://www.bonefishtarpontrust.org/images/stories/BTT%20-%20Keys%20Economic%20Report.pdf>

provide true protection of these critical resources. BTT will team with science-oriented partners to develop this injury inventory and economic consequences assessment.

To conduct this work, BTT will partner with CSA Ocean Science Inc. (CSA). CSA specializes in multidisciplinary projects concerning potential environmental impacts of activities throughout the world. CSA personnel have conducted and/or consulted on numerous hard bottom natural resource restorations, coral translocations, artificial reef programs, seagrass restoration and mitigation programs, and damage assessment/restoration projects that were conducted for numerous clients and involved varied scopes of work and magnitude.

Primary objectives of restoration include accelerating habitat recovery and reducing liability for lost ecological services associated with natural resource damage. CSA's Natural Resources Assessment & Restoration Business Line provides the services of professional, experienced staff to assess, enhance, rehabilitate, and monitor marine habitats damaged and/or at risk from proposed actions, accidents, and natural events. CSA also provides mitigation planning and artificial reef designs for coastal infrastructure projects.

CSA staff are trained and equipped to conduct surveys of hardbottom habitats, coral reefs, oyster reefs, seagrass beds, and unvegetated soft bottom habitats in connection with environmental permitting, marine construction, litigation, dredging projects, habitat reclamation, and vessel grounding events. Such projects may require habitat creation, restoration, injured biotic community repair, baseline data collection and monitoring, all tasks in which CSA is highly proficient. CSA has developed and field-tested new methods for reattaching and transplanting hard and soft corals and sponges in addition to having designed and installed innovative reef structural habitat enhancements as a means of accelerating biological recovery.

For over 25 years, CSA has been conducting seagrass habitat injury assessments and monitoring in south Florida and Federally protected areas. Our personnel come from a wide range of backgrounds, including marine science and research, resource management, marine surveying (visual and acoustic), environmental permitting, biological and geotechnical surveying, and oceanography. Our staff have developed innovative techniques and applied state-of-the-art equipment to conduct injury assessments, habitat characterizations and mapping, and environmental restoration and mitigation projects. CSA has been part of the evolution and advancement of injury assessment and restoration techniques and continues to seek methods to improve data collection and habitat remediation. Notably, CSA personnel have assisted in, developed, and conducted or participated in a significant number of all the Natural Resource Damage Assessment (NRDA)/restoration projects completed in the State of Florida.

CSA has specialized experience in the collection of field data, data analyses, report preparation and presentation, expert witness testimony, and administrative assistance for project management. CSA has demonstrated the ability to deliver quality work requiring a wide range of regulatory knowledge to meet project schedules while controlling costs and working with specialized sub-contractors, as is proposed here for the economic assessment. CSA's broad

range of in-house capabilities and equipment inventory provides the management and field support required to safely and successfully complete multidisciplinary marine projects.

18. Additional Information:

See footnote 4 for a link to the economic impact assessment regarding the Florida Keys flats fishery. Otherwise, rather than burden this application with redundant documentation of the scope of the problem in the Florida Keys, we first direct the reader to these two links (last tested 8/29/13) that provide a full sense of scale regarding the historical scope of this problem:

Sargent, F., Leary, T., Crewz, D.W., Krueger, C.R. 1995. Scarring of Florida's seagrasses: assessment and management options. Fla. Mar. Res. Inst. Tech. Rep. No. 1. 43p. + 13. http://research.myfwc.com/publications/publication_info.asp?id=35289

And

SFNRC. 2008. Propeller Scarring of seagrass in Florida Bay: associations with physical and visitor use factors and implications for Natural Resource Management. South Florida Natural Resources Center, Everglades National Park, Homestead, FL, Resource Evaluation Report, SFNRC Technical Series 2008:1. 27 pp. <http://www.nps.gov/ever/naturescience/upload/PropellersScarLaResSecure.pdf>

Full report:

<http://www.nps.gov/ever/naturescience/loader.cfm?csModule=security/getfile&PageID=205607>

For brevity, we present a sequence of site-specific photographs that show the destructiveness and concerns surrounding of a typical small grounding.

Figures 1 through 4 show a series of images relating to a seagrass and shallow coral grounding event. Figure 1 show how a large vessel grounded, leaving twin scars from its propellers.

Figure 2 shows the 'blowhole,' that is the characteristic sediment and seagrass excavation that arises when the vessel has lost momentum but propulsion is maintained; this only takes seconds to occur, but many years to recover (Zieman 1976, Fonseca et al. 2004). **Figure 3** is an aerial photo of the same grounding injury after the removal of the vessel; the blowhole and prop scars are now visible in their full extent. **Figure 4** is another aerial image showing an assessment team on the site. Note how the adjacent channels have no markers for their entry points and how opaque the water surface is, making detection of navigable channels apart from dangerous and vulnerable grounding areas difficult to detect.

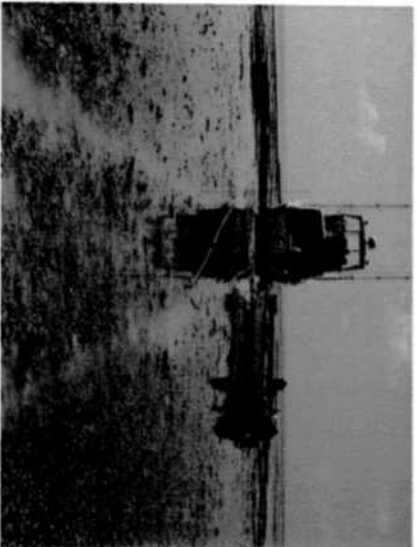


Figure 1. Vessel grounding on bank top showing propeller scars.



Figure 2. Vessel grounding on bank top showing propeller-excavated blowhole. Blowholes occur as the vessel operator attempts to free the vessel by powering up engines once aground.



Figure 3. Aerial image showing the grounding site from Figures 1 and 2 after removal of the vessel. The linear prop scars and blowhole area are clearly visible.



Figure 4. Aerial view of grounding site with survey team present. Note the absence of informational markers to describe the adjacent channel and the difficulty viewing the presence of the bank with sun glare.