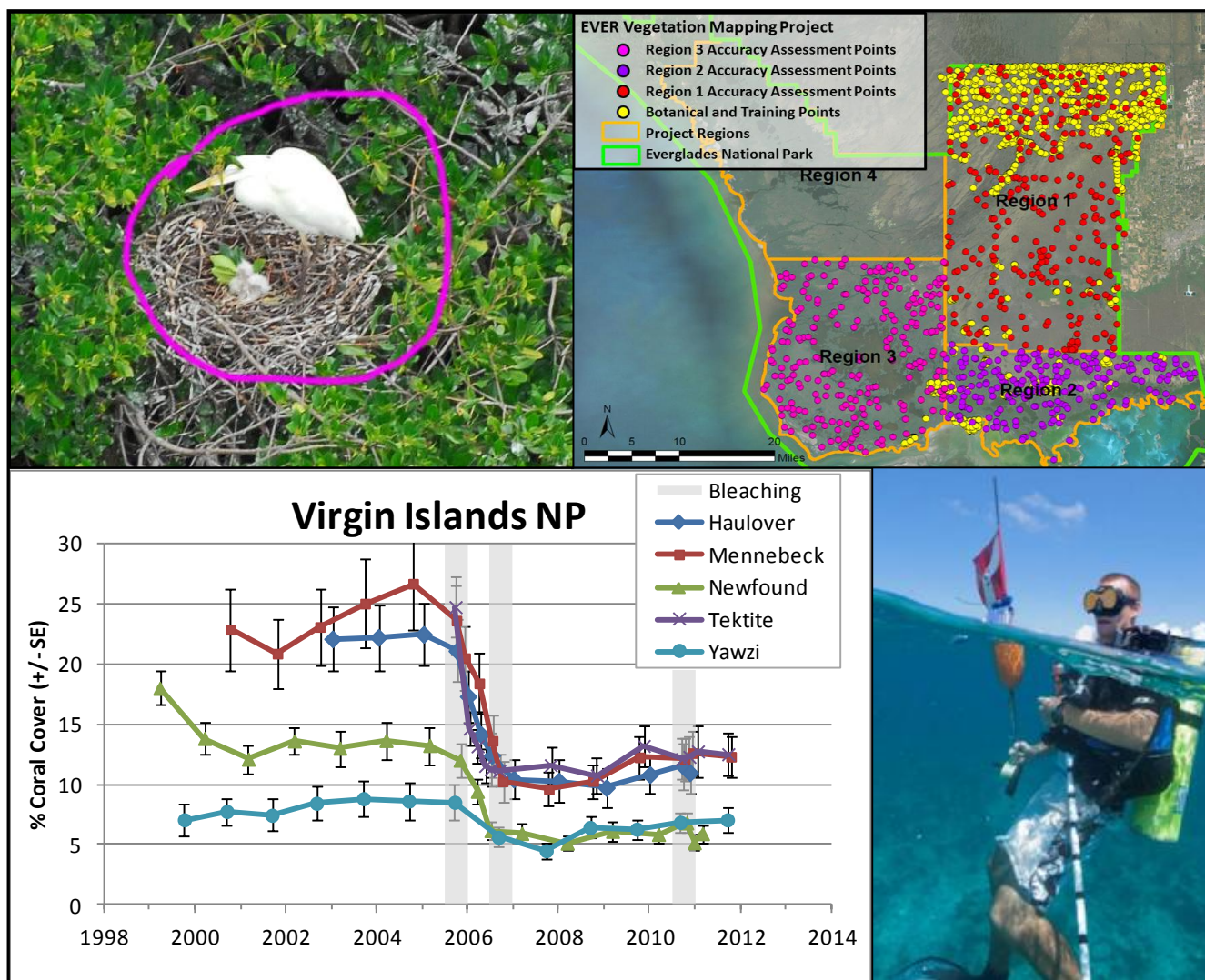




Annual Administrative Report (FY 2011) and Work Plan (FY 2012) for Inventories and Vital Signs Monitoring

South Florida / Caribbean Network

Natural Resource Report NPS/SFCN/NRR—2012/488



ON THE COVER

Clockwise from top left: Image of tabulated great egret on nest from Colonial Nesting Birds Protocol. Map of field and accuracy assessment points supplied by SFCN to USACE for EVER vegetation map project. SCA intern Lee Richter participating in BISC reef fish visual census survey. Graph showing changes in stony coral cover at VIIS monitored reef sites.

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National Park Service South Florida / Caribbean Network

18001 Old Cutler Rd.
Suite 419
Palmetto Bay, FL 33157

January 2012

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate high-priority, current natural resource management information with managerial application. The series targets a general, diverse audience, and may contain NPS policy considerations or address sensitive issues of management applicability.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

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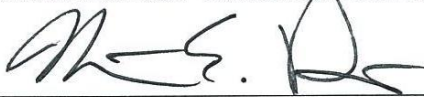
**ANNUAL ADMINISTRATIVE REPORT (FY 2011) AND
WORK PLAN (FY 2012) FOR INVENTORIES AND VITAL SIGNS
MONITORING**

FY 2011-FY 2012

South Florida / Caribbean Network

Includes: Biscayne National Park, Big Cypress National Preserve, Buck Island Reef National Monument, Dry Tortugas National Park, Everglades National Park, Salt River Bay National Historical Park and Ecological Preserve, and Virgin Islands National Park.

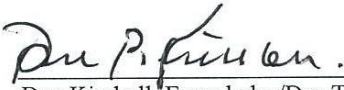
South Florida / Caribbean Network Approval Signatures



Matt Patterson, Network Coordinator, South Florida / Caribbean Network

11-30-11

Date



Dan Kimball, Everglades/Dry Tortugas National Parks
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11-30-2011

Date



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Executive Summary

The South Florida/Caribbean Network (SFCN) includes seven national parks with significant natural resources in the southern tip of the state of Florida and the U.S. Virgin Islands of St. Croix and St. John: Big Cypress National Preserve (BICY), Biscayne National Park (BISC), Buck Island Reef National Monument (BUI), Dry Tortugas National Park, Everglades National Park, Salt River Bay National Historical Park and Ecological Preserve (SARI), and Virgin Islands National Park (VIIS). In FY 2011 the SFCN received \$1,983,354.43 from the Inventory and Monitoring (I&M) program, the NPS Vegetation Mapping program, and the NPS Water Resources Division. SFCN also received \$160,000 from the Army Corps of Engineers (ACOE) to assist with vegetation mapping of Everglades National Park. Together, these funding sources enabled the SFCN to construct vegetation and benthic habitat maps for several parks, to support a biological inventory of Biscayne National Park, and to continue operational monitoring for core vital signs.

SFCN's Vital Signs Monitoring Plan is focused on protocol development and monitoring for the areas that emerged as top priorities in the planning phase of the group's establishment. Tailoring monitoring efforts to focus on key resources in each of the Caribbean parks makes SFCN's work directly relevant to the management needs of each park. Top priorities include marine benthic community Vital Sign monitoring in Biscayne National Park (BISC), Dry Tortugas National Park (DRTO), Virgin Islands National Park (VIIS), and Buck Island Reef National Monument (BUI). Marine Fish Community monitoring is a high priority in BISC, DRTO, VIIS, and Virgin Islands Coral Reef National Monument (VICR). SFCN continued to support an inventory of all species in Biscayne National Park (named the BioBlitz). Supporting actions were focused on report development and data management. SFCN has successfully expanded our program by hiring a Natural Resource Condition Assessment ecologist, an Everglades Vegetation Map Program Manager, an Everglades Vegetation Map Technician, a Marine Research Assistant, a Water Quality Post Doc, as well as three Student Conservation Association Interns (SCA's) in FY11. FY11 activities delivered completed vegetation maps for both Salt River Bay National Historical Park and Ecological Preserve (SARI) and Dry Tortugas National Park (DRTO), as well as a benthic habitat map for DRTO. Work continues on vegetation maps for western BICY, EVER, BISC, and VIIS. A draft report and map for offshore BISC is currently in review.

Sixty seven percent (67% or \$1,327,218) of the FY11 budget was focused on personnel, 6% (\$120,358) on cooperative agreements, 11% (\$224,888) on contracts, 8% (\$167,642) on operations, 4% (\$87,168) on travel, 3% (\$56,081) on Regional assessments, and 1% repayment of \$30,000 to GULN.

The FY12 budget proposes spending \$2,056,992 with the following allocations: 73% (\$1,495,667) on personnel, 4% (\$86,750) on cooperative agreements, 11% (\$219,225) on contracts, 7% (\$147,918) on operations, and 4% (\$80,000) on travel, and 1.3% (\$27,432) on Regional assessments.

Program Accomplishments Summary

Inventories

- Vegetation Maps:
 - SFCN completed the Salt River Bay National Historical Park and Ecological Preserve (SARI) vegetation map. The final report (National Resource Technical Report NPS/SFCN/NRTR—2011/448) was submitted to the National Vegetation Mapping Inventory Program as an interactive DVD. Copies are available on the SFCN web page.
 - SFCN completed the Dry Tortugas National Park (DRTO) vegetation map and completed the final report (National Resource Technical Report NPS/SFCN/NRTR—2011/469) which was submitted to the National Vegetation Mapping Inventory Program as an interactive DVD. Copies are available on the SFCN web page.
 - SFCN completed the Buck Island Reef National Monument (BUIS) vegetation map, report (National Resource Technical Report NPS/SFCN/NRTR—2010/293), and interactive DVD. The final products were submitted to the National Vegetation Mapping Inventory Program and copies made available on the SFCN web page.
 - The Virgin Islands National Park (VIIS) vegetation map has been completed. A total of 133 locations were visited between May and October of 2009 to assess the original University of the Virgin Islands (UVI) map. SFCN visited another 108 locations in April of 2011, and also used 22 additional data points from the US Forest Service's Forest Inventory and Monitoring (FIA) data set to check and assess the newly created NPS vegetation map. The new vegetation map is estimated to be eighty seven percent (87%) accurate based on these assessment points.
 - SFCN is collaborating with the Army Corps of Engineers who are mapping Everglades National Park (EVER) through the Comprehensive Everglades Restoration Plan RECOVER program. SFCN is assisting with field identification of training points and conducting a field accuracy assessment. The USACE/NPS interagency team visited 120 botanical training points in FY11 during three botanical training sessions. SFCN staff visited and classified a total of 490 training points in order to objectively define the accuracy of the interpretation and classification process. Classification and data entry for all these points is complete.
- Benthic Habitat Maps:
 - SFCN completed the benthic habitat map and corresponding report for Dry Tortugas National Park (DRTO). All data layers including the report are available for distribution on DVD and at the SFCN website.
 - A revision of the benthic habitat map for Biscayne National Park (BISC) is in progress. Revisions to the initial 2008 map product funded by SFCN and the Florida Fish and Wildlife Research Institute are made using a combination of LiDAR, imagery and field data. The associated report will be completed in FY12.
- The small and medium mammal inventory for Big Cypress National Preserve (BICY) and Everglades National Park (EVER) is nearly complete. SFCN is waiting upon the cooperator to address some final issues in the report.

- The bat inventory database has been cleaned up and used to create species lists for each of the seven parks in the South Florida/ Caribbean Network.
- The Biscayne BioBlitz 2010 report is in review by the associated BioBlitz scientists. Bioblitz 2010 resulted in two new species to science: a lichen (*Graphis brittonii*) and a tardigrade (*Archechiniscus biscaynaei*). Initial estimates of 1027 species tallied increase the overall Biscayne National Park species list by 39% (532 species are new additions).

Vital Signs Monitoring

- Marine Benthic Communities:
 - SFCN conducted marine benthic community monitoring in BISC, DRTO, VIIS, and BUIS.
 - SFCN tracked the unusually warm water temperatures in the U.S. Virgin Islands and in response filmed additional video of U.S. Virgin Islands coral. Results show bleaching in 2010 was less severe than in 2005 with no significant loss of coral cover.
 - The Coral Reef Communities Protocol has undergone extensive revisions and will be out for review in early FY2012.
- Marine Fish Communities:
 - SFCN conducted marine fish community monitoring in BISC, DRTO in partnership with NOAA, University of Miami, Florida Fish and Wildlife Conservation Commission, and park staff. SFCN conducted marine fish community monitoring in VIIS/VICR in partnership with NOAA, University of Miami, and park staff.
- Colonial Nesting Birds:
 - In BISC monthly helicopter flights were conducted to complete a temporal picture of bird nesting in BISC. Major progress has been made on the protocol and SOPs and completion is expected in FY12.
 - SFCN created Standard Operating Procedures for existing monitoring of colonial nesting birds at BUIS and VIIS based upon interviews with park staff and existing documents for the purpose of clearly documenting the current protocols, monitoring and data and determining ways to collaborate on reporting results across the network. These SOPs have been submitted for review to the respective parks. BUIS comments have been incorporated. VIIS comments are still pending.
- Forest Ecotones and Community Structure, Mangrove-Marsh Ecotone:
 - SFCN is writing a draft of the Forest Vegetation Monitoring Protocol which incorporates the Forest Ecotones, Community Structure, and Mangrove-Marsh Ecotone Vital Signs.
 - SFCN conducted a pilot study to test data collection and analysis methods for monitoring ecotonal movement at four mangrove/marsh sites and one pineland/hammock site in EVER.
 - To date, two mangrove-marsh ecotone monitoring areas have been established in EVER.
 - In BICY six historic vegetation plots were relocated and resampled. Four plots were in the Raccoon Point area and two were northwest of the intersection of Tamiami

- Trail and Raccoon Point Road. In BISC, two long-term forest plots on Old Rhodes Key were sampled.
- Investigated ten potential vegetation monitoring plots in SARI. These plots were selected with a Generalized Random Tessellated Stratified (GRTS) monitoring design.
 - Coastal Geomorphology: A second soil elevation Table (SET) monitoring site was established in BISC.
 - Invasive/Exotic Plants:
 - SFCN completed a draft of the SFCN Early Detection Protocol for Invasive Exotic Plants which is currently in review. The first year of data collection has begun.
 - Invasive / Exotic Animals
 - The SFCN helped host a non-native fish discussion workshop held at the Southern Division of the American Fisheries Society Meeting in Tampa, Florida (Jan. 14 – 16). This discussion workshop was organized in collaboration with the U.S. Army Corps of Engineers (USACE).
 - The SFCN attended a week-long U.S. Fish and Wildlife Service (USFWS) electrofishing course offered at the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Feb. 27 – Mar. 4).
 - SFCN continues collaborating with Dr. Jennifer Rehage of Florida International University to investigate how man-made canals function as habitat for both native and non-native fishes. The results of this 2 year study will assist design of the non-native fish in canals monitoring protocol.
 - SFCN assisted with the location and removal of the invasive lionfish at network parks primarily through notification of fish locations to oversight groups.
 - Periphyton: SFCN conducted a third round of pilot study sampling in Big Cypress National Preserve. The goal of the 2010 sampling is to characterize temporal variability in the structure of diatom communities, across the hydrological basins in the northwest portion of the preserve. in which 36 samples were collected.
 - Fish and macroinvertebrates: a new aquatic invertebrate sample processing room was set up in the SFCN garage complete with 2 stereomicroscopes and video equipment. This area is used to process aquatic invertebrates sampled in wet prairies and marshes.
 - Land use change: We conducted a pilot trend analysis of zoning data, land use permit records, and NPScape indicator variables for most of Miami-Dade county in FY11. This pilot comparison serves as a proof-of-concept trends analysis of changes in zoning and land use. A larger dataset of zoning records for Monroe, Collier, Hendry, Palm Beach, and significant portions of Miami-Dade and Broward counties was consolidated into dataset (municipalities in Broward and Miami-Dade (MD missing Coral Gables, Palmetto Bay, Pinecrest, Hialeah, Miami Beach, and others). . The draft summary report is in review. A draft SOP for the land use and zoning trends analysis is in review, and will be delivered as final in FY12.

Water Quality Monitoring

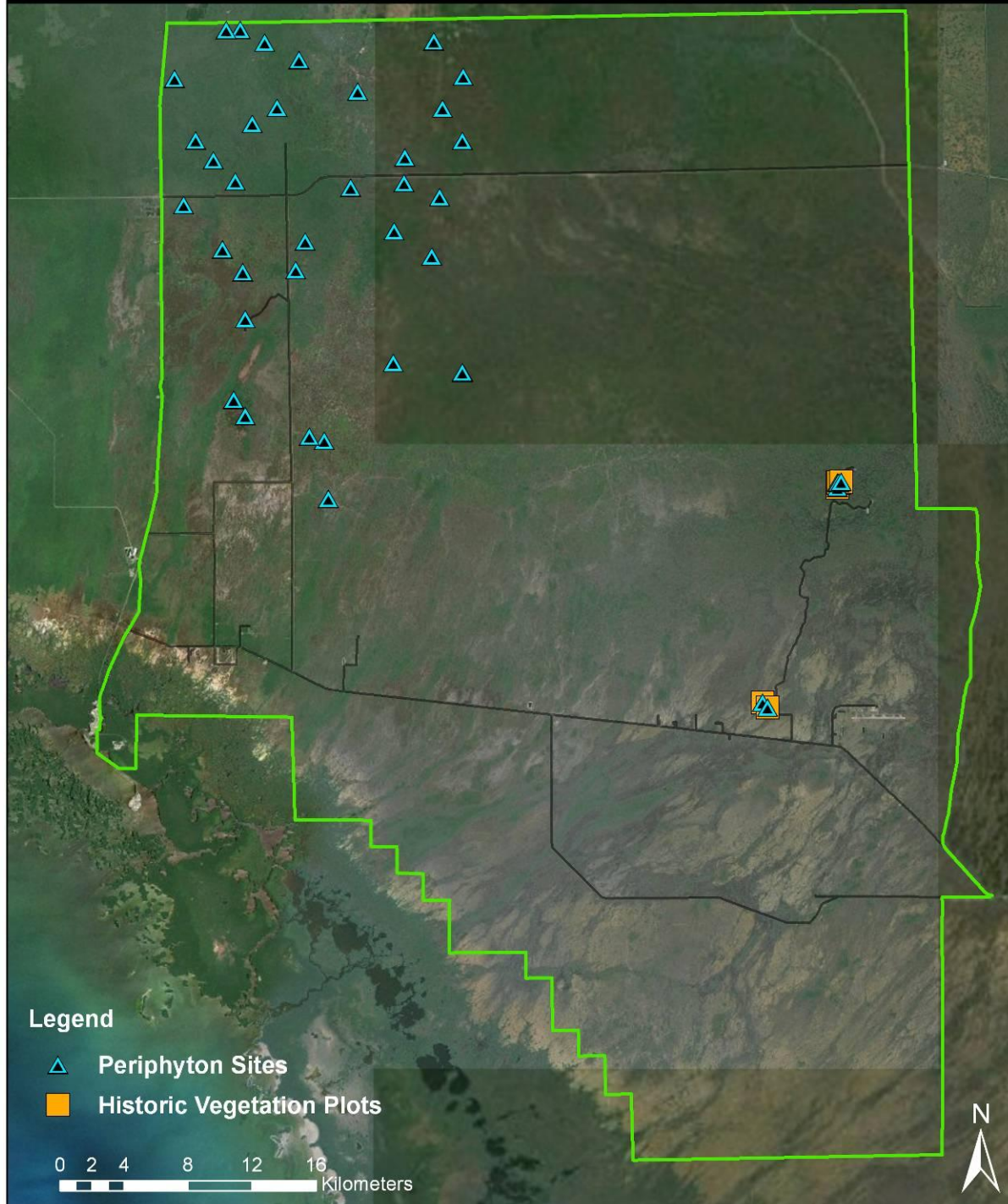
- Contaminants:
 - SFCN continued the collaboration with Dr. Tim Bargar and David Alvarez of the U.S. Geological Survey to assess levels of Emerging Pollutants of Concern (EPOCs) in near shore waters of Biscayne Bay. SFCN conducted 2 sampling events in April and September of FY11. During these events SFCN deployed and retrieved 16 and 22 polar organic chemical integrative samples (POCIS) respectively.
 - SFCN obtained preliminary results for EPOC and contaminants sampling events following the Deep Water Horizon offshore well explosion and subsequent oil spill.
- Marine Benthic Communities: SFCN used reef water temperature data to track unusually warm reef temperatures (similar to 2005) at U.S. Virgin Islands reefs and alert the parks to the potential bleaching event. Warm temperatures triggered additional video data collection in case a large scale coral bleaching/disease event occurred (similar to what occurred in 2005). The data continue to demonstrate the important effect of tropical storm systems (e.g. rainfall, clouds, and wind driven vertical mixing) on reef water temperatures.
- The Coral Reef Water Temperature Protocol has undergone extensive revisions and will be out for review in early FY2012.
- Mike Feeley, SFCN Marine Ecologist, participated in the FWC & FKNMS Water Temperature Data Sharing Meeting in St. Petersburg, FL. The objective is to create and maintain a data clearing house website to disseminate *in-situ* temperature data collected in south Florida. A data clearing house should help optimize monitoring efforts among NGO's, state, and Federal agencies.
- Nutrient Dynamics and Water Chemistry: Dr. Andrew Braumberger, water quality post-doc, was hired to work with SFCN on the Nutrient Dynamics and Water Chemistry vital signs via a cooperative agreement with Jim Fourqurean and Joe Boyer of Florida International University.
- Surface Water Hydrology: SARI and BUIS staff sent weather station and crest gage station data to SFCN. The SARI station has been dismantled in FY11. This station had deteriorated from weathering and is no longer useful. SFCN developed basic reporting procedures and is finalizing QA/QC procedures. A finalized SOP will be delivered in FY12.

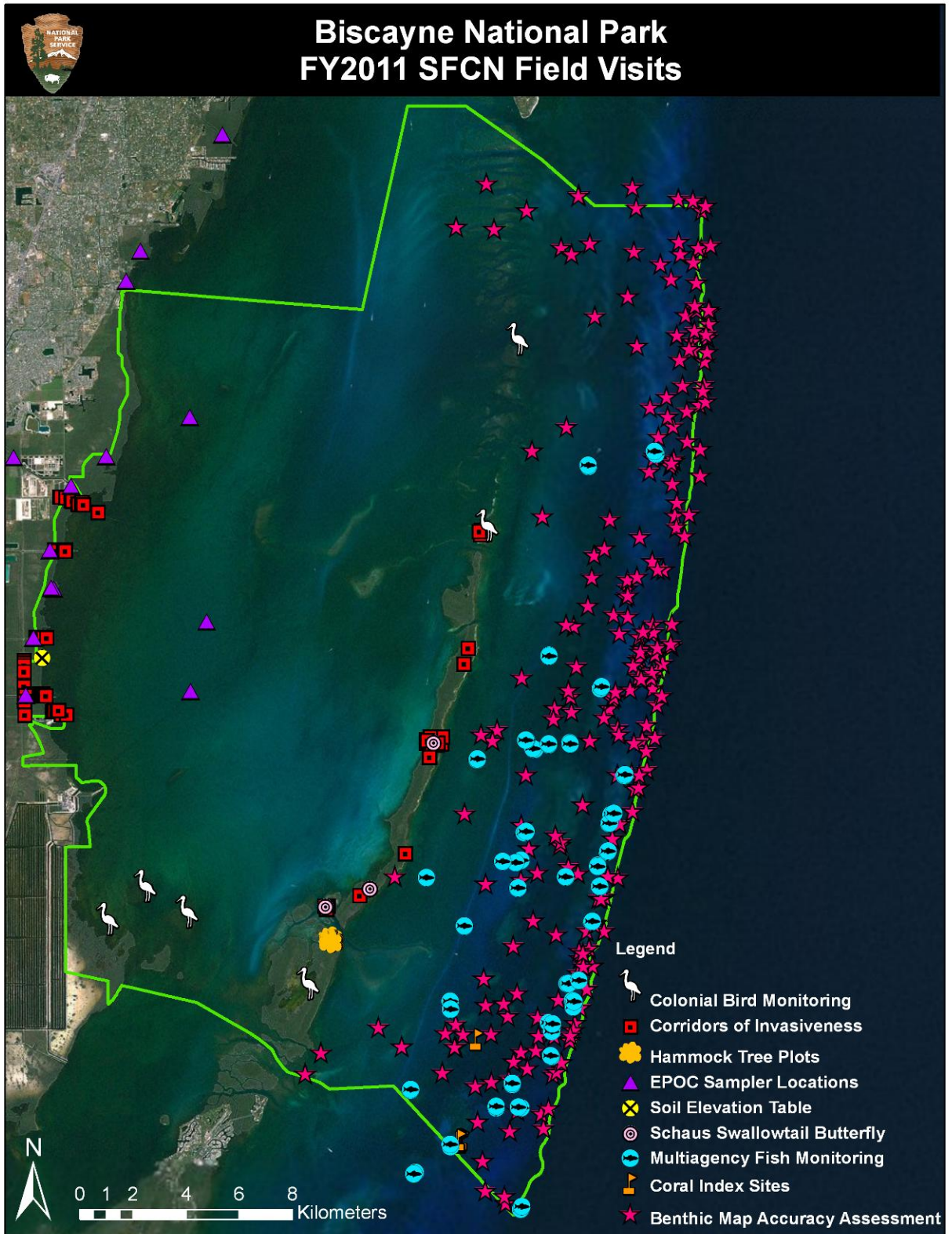
FY2011 SFCN Field Work Maps

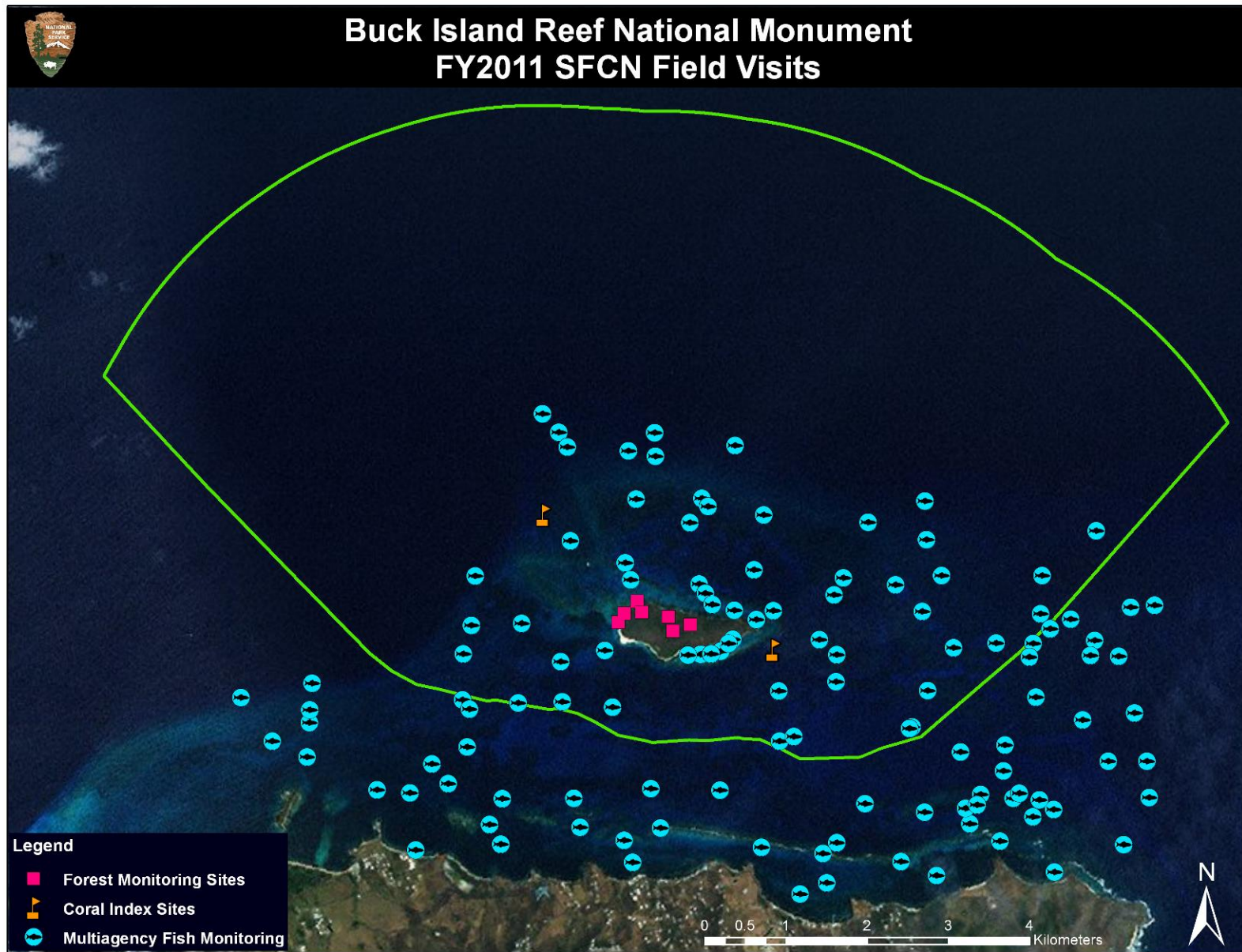
Most of SFCN's vital sign protocols and reporting strategies with partners are still in development. In place of completed vital signs reports, we are providing maps showing work accomplished in the park this year by SFCN as interim deliverables (in the case of the reef fish monitoring and invasive/exotic animals, SFCN conducts work with partner agencies and park staff).



Big Cypress National Preserve FY2011 SFCN Field Visits

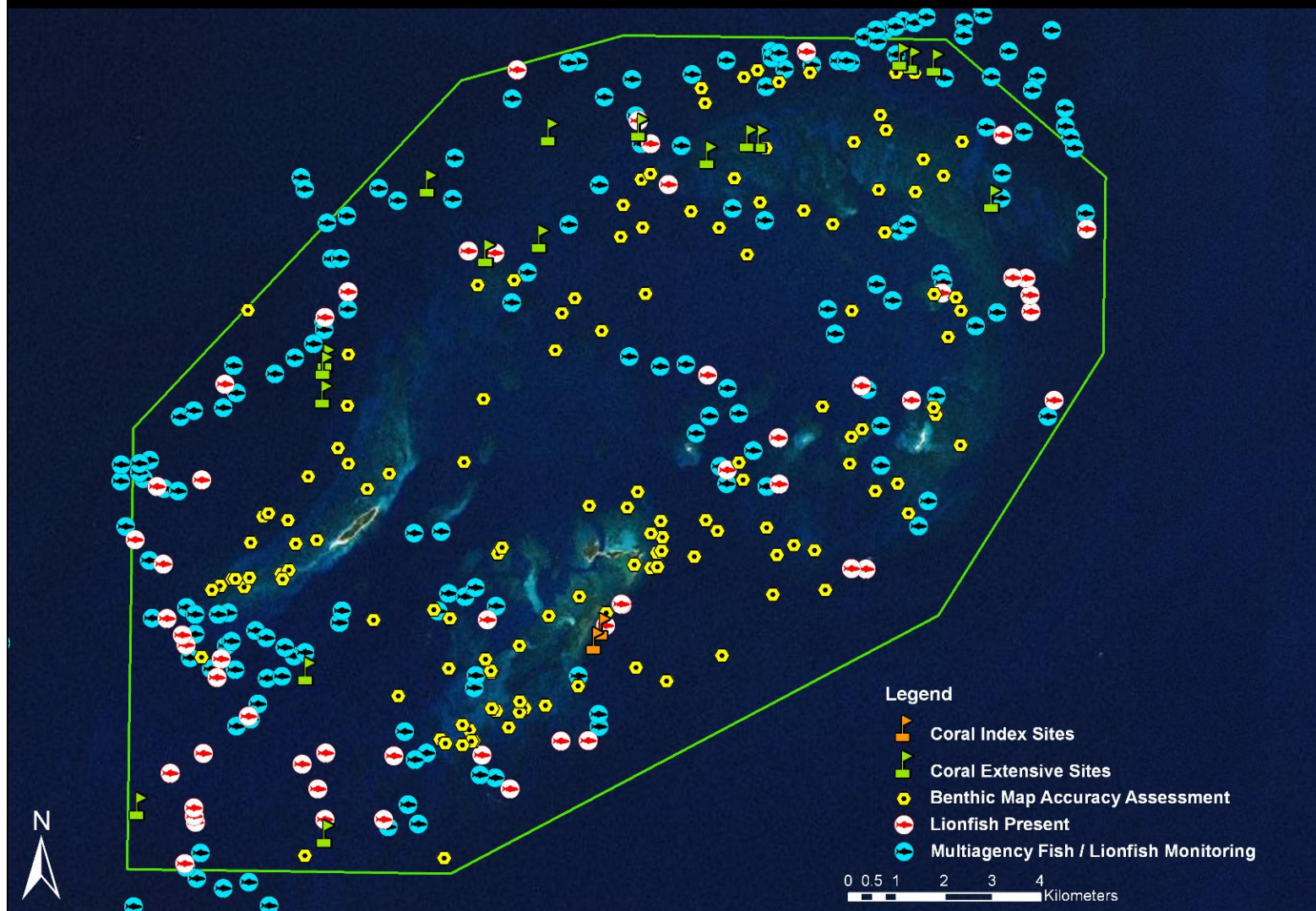


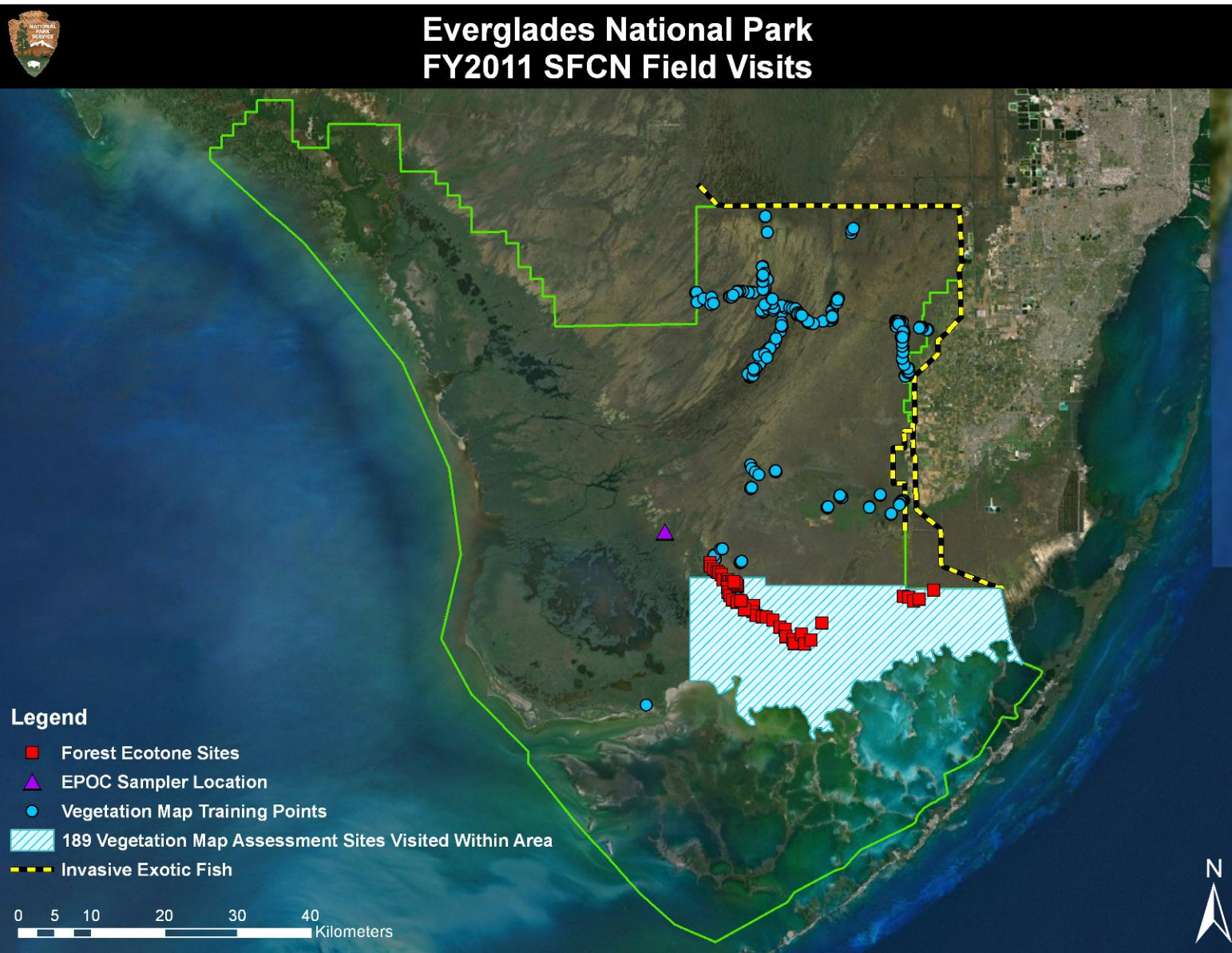






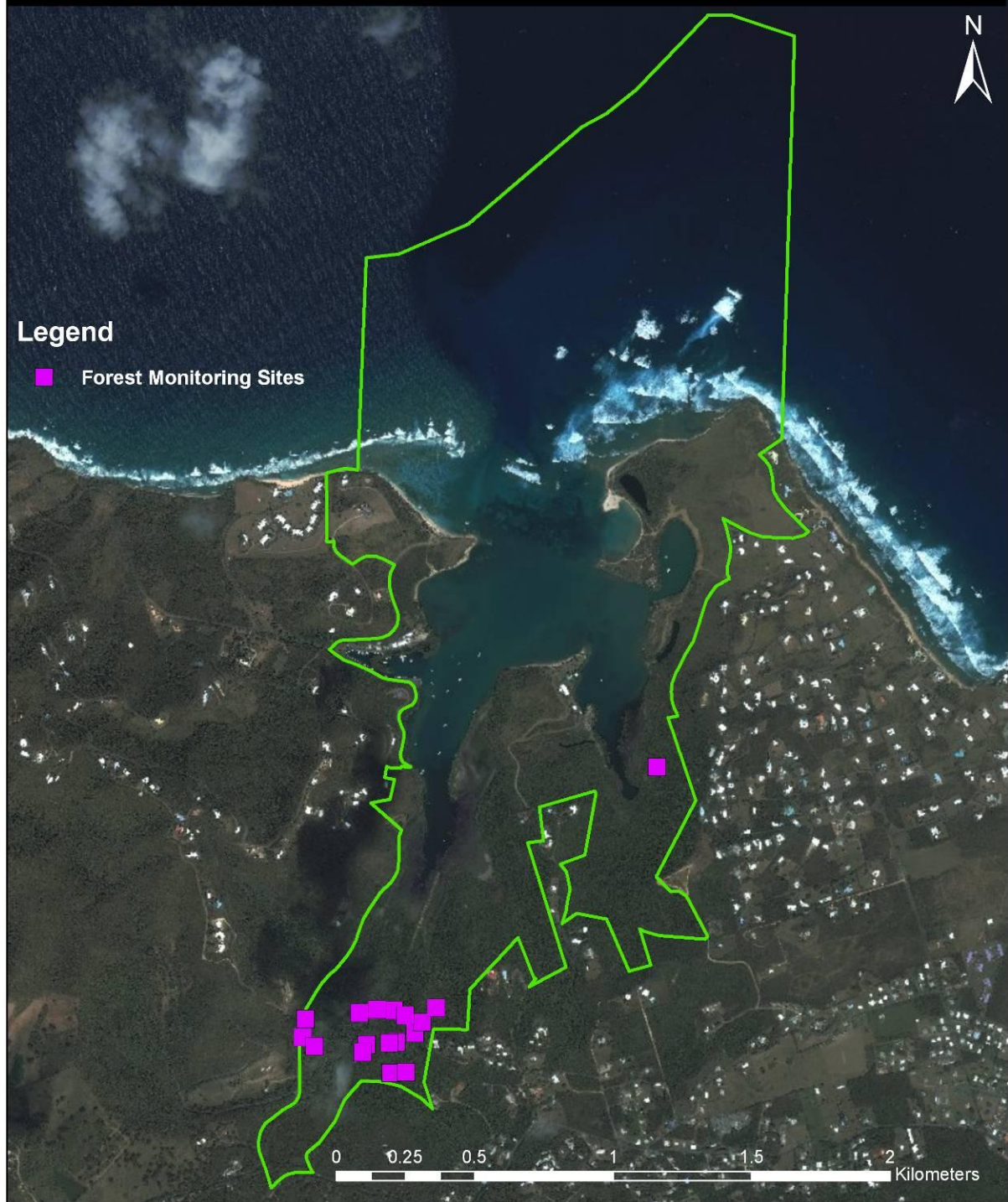
Dry Tortugas National Park FY2011 SFCN Field Visits





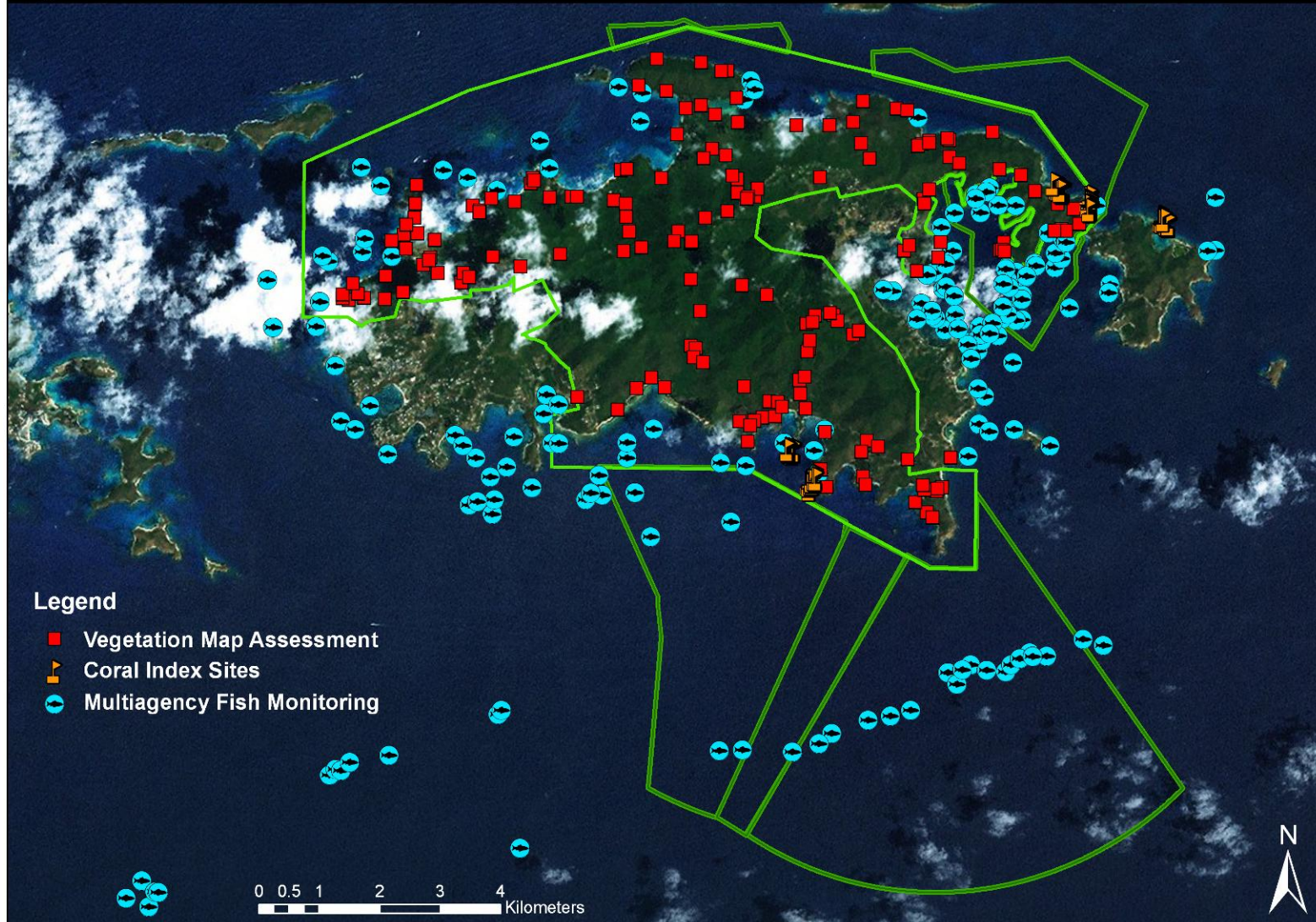


Salt River Bay National Historical Park & Ecological Preserve FY2011 SFCN Field Visits





Virgin Islands National Park FY2011 SFCN Field Visits



I. Program Accomplishments

The accomplishments and scheduled activities are described separately under the three SFCN branches:

- I.A Marine Ecology Branch
- I.B Community Ecology Branch
- I.C Data Management, Analysis and Reporting Branch

Each section describes new staff, inventory activities and vital signs monitoring activities that relate to their branch. Water quality accomplishments and scheduled activities are described separately in section I.D.

I.A Marine Ecology Branch

Overview

The Marine Ecology Branch made significant progress during FY11 on benthic habitat mapping and detailed marine resource monitoring of network parks. Mr. David Bryan was hired to fill the SFCN/University of Miami Marine Fisheries Science Post doc position in April 2011. Mr. Andy Davis, Biological Science Technician, was transferred from SFCN/VIIS to the SFCN office in Palmetto Bay in April 2011. Mr. Andy Estep was rehired to fill the Biological Science Technician position at the SFCN/VIIS office in August 2011.



Figure 1. Rob Waara on a habitat survey in Dry Tortugas National Park.

The 2010 Benthic Habitat Map for DRTO was published in thesis form by Mr. Robert Waara (in partial fulfillment of a Master of Science degree from the University of Miami's Rosenstiel School of Marine and Atmospheric Science). Rob successfully characterized all areas in DRTO previously identified as "Unknown". Rob also created a GIS layer that identifies habitats with higher potential for fish and benthic biodiversity, and merged disparate data sources into a single GIS layer describing DRTO bathymetry .

The Marine Ecology team completed the final field accuracy assessment of the BISC benthic habitat map in FY11. SFCN plans to publish the BISC Benthic Habitat Map and final summary report in FY12.

The Marine Ecology Branch successfully completed annual coral monitoring of index sites in South Florida and Caribbean parks. Index sites are specifically selected reefs where 20 randomly placed transects are sampled. There are 2 index sites in DRTO (Bird Key Reef and Bird Key North), 2 index sites in BISC (Amanda's Reef and Ball Buoy Reef), 5 index sites in VIIS (Tektite Reef, Haulover Reef, Yawzi Reef, Mennebeck Reef, and Newfound Reef), and 2

index sites in BUIS (South Fore Reef and Western Spur and Groove). The Marine Ecology group surveyed 18 additional extensive coral monitoring sites throughout DRTO (identified above by green flags in DRTO monitoring map). Reef water temperature data was downloaded from all intensive and extensive sites in all regional parks.

The Marine Ecology Branch assisted SFCN partners with annual reef fish monitoring in DRTO, VIIS, VICR and BISC. A draft marine fish visual assessment protocol for the Caribbean region is in development. This protocol will document the collaborative interagency effort (NPS, NOAA/SEFSC, NOAA/CCMA, UMiami) to obtain/use the fisheries independent database from St. Croix and St. John, as well as the most recent bathymetric and habitat information available. A Caribbean protocol planning meeting to advance this effort is scheduled for January 2012 .

Park Dive Effort

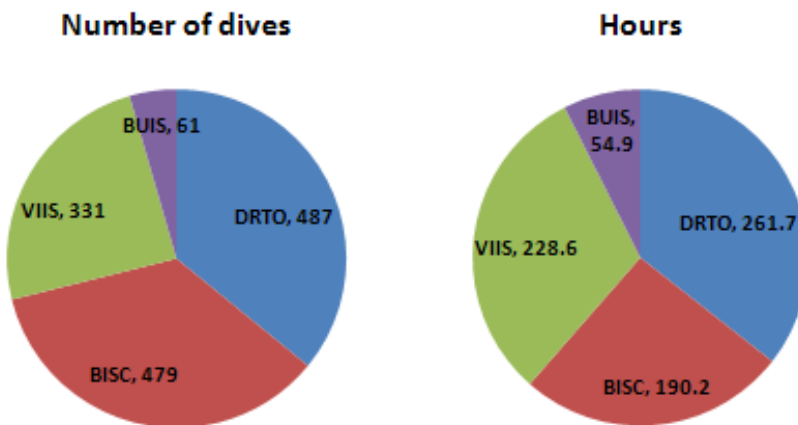
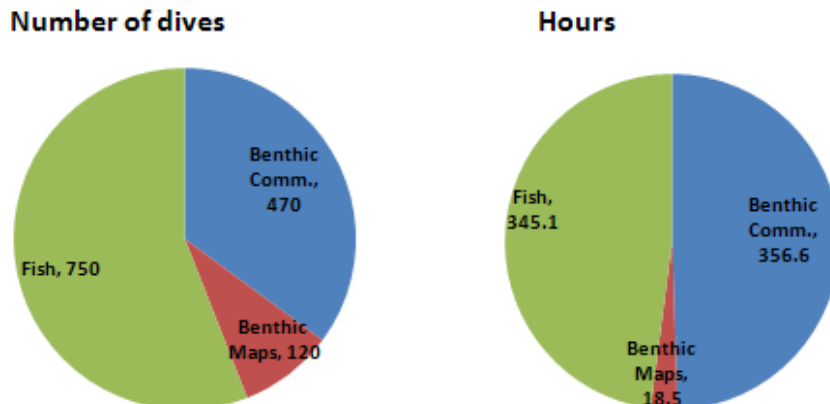


Figure 2. Regional work effort by the SFCN Marine Ecology Branch in FY11 by park (top) and by projects (bottom) measured in number of dives and total hours.

Project Dive Effort



Inventories

Dry Tortugas National Park (DRTO) Benthic Habitat Map

Project Overview: SFCN, in partnership with the Florida Fish and Wildlife Research Institute, (FWRI) contracted with Avineon, Inc. to provide a full benthic habitat map for all of the submerged areas of DRTO. An initial marine benthic habitat map was completed in 2008 by Avineon, Inc. SFCN conducted an accuracy assessment of the 2008 map and found the overall acceptable classification accuracy to be 83.2% with a lower 90% confidence limit (CL) of 79.8%. Separating hard-bottom and soft-bottom habitats accuracy assessments resulted in a hard-bottom habitat classification accuracy of 75.2% (with a lower 90% CL of 69.1%), and a soft-bottom habitat classification accuracy of 89.4% (with a lower 90% CL of 85.2%). This analysis resulted in prioritizing accuracy improvements of the hard-bottom habitat. To meet this objective, SFCN used a new higher resolution side scan sonar tool, and compared collected data with 2054 field data points derived from multiple sources. SFCN revised the 2008 Avineon benthic map using these new data sets and improved the mapping product.

Project Status: Complete and published 2011.

In June 2011 SFCN conducted an accuracy assessment of the 2010 benthic habitat map for DRTO. The assessment was accomplished by using 2010 Interagency Reef fish Visual Census (RVC) benthic data and corresponding photos, combined with additional Accuracy Assessment (AA) sites to complete a final assessment of all benthic habitat classes. A total of 253 accuracy assessment points were completed, including 116 RVC sites and 137 AA sites (Figure 2). Two hundred twenty seven points matched habitat classifications exactly, and the entire sample yielded an overall accuracy of 90% for the 2010 map (up from 83.2% in 2008) (Table 1). After revisions, the accuracy of hardbottom habitats (Aggregate Patch Reefs, High & Low Relief Spur & Groove, Reef Terrace, Individual Patch Reef, Pavement, Reef Rubble and Patchy Coral/Rock in Unconsolidated Sediment) improved from 75.2 % in 2008 to 88% in the 2010 map. The accuracy of softbottom habitats (Unconsolidated Sediment, Submerged Rooted Vegetation) improved from 89.4% to 94%. A full summary of the accuracy assessment by habitat class is presented in Table 1.

Reanalysis of the 2008 Avineon map by SFCN increased the total area of hardbottom habitat reported. Known hardbottom area increased from 8660.2 hectares in 1998 to 10126.8 hectares in 2008 to 15922.8 hectares in the 2010 map. The 2010 map also sub-divided two hard bottom categories, creating a more complex identification scheme (Figure 2). In general, there was substantial improvement in the precision of the benthic map in areas that will greatly assist both fish and coral reef monitoring and management.

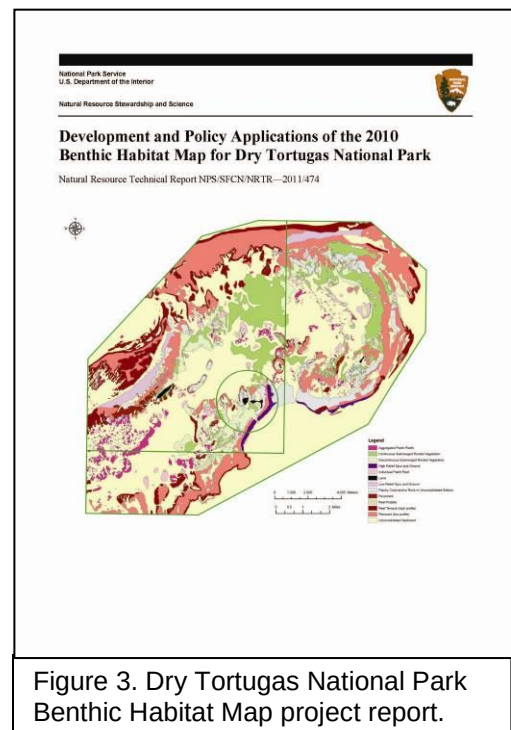


Figure 3. Dry Tortugas National Park Benthic Habitat Map project report.

Careful analysis of the results reveals that High Relief Spur and Groove and Reef Rubble map classes have the highest rate of classification errors . The reasons for this determined as a part of the accuracy assessment: a) the inside edges of the largest polygons of High Relief Spur and Groove category were actually Low Relief Spur and Groove (with some minor redrawing of the line work, the accuracy was greatly improved in this category); and b) the Reef Rubble category was difficult to determine via remote sensing data due to imagery similarities with the Reef Remnant map class. Reef rubble created difficulties during photointerpretation because of the mixed characteristics of this map class.

Table 1. Summary of accuracy assessment results. The table provides the total number Reef fish Visual Census (RVC points), field Accuracy Assessment (AA) points, number of points with an exact match to the field classification, the number deemed acceptable, and finally the acceptable accuracy. Lower 90% confidence intervals are provided for the overall map, within hardbottom communities, and within softbottom communities, some with Submerged Rooted Vegetation (SRV).

Map_Class	# RVC points	# Field points	Total RVC + Field points	# Points exact match to field classification	# Points acceptable classification		Acceptable accuracy	Std Err	Lower 90% CI
					N	Y			
Aggregated Patch Reefs	20		20	20		20	100%	--	
High Relief Spur and Groove	13	7	20	12	8	12	60%	11%	
Individual Patch Reef	20		20	20		20	100%	--	
Low Relief Spur and Groove	4	15	19	14		19	100%	--	
Patchy Coral and/or Rock in Unconsolidated Bottom	5	15	20	13	1	19	95%	5%	
Pavement		20	20	10	4	16	80%	9%	
Reef Rubble	1	19	20	7	8	12	60%	11%	
Reef Terrace (high profile)	22		22	18		22	100%	--	
Remnant (low profile)	20	3	23	21	1	22	96%	4%	
Total Hardbottom	105	79	184	135	22	162	88%	2%	83.4%
Continuous SRV	2	18	20	10		20	100%	--	
Discontinuous SRV		20	20	10	4	16	80%	9%	
Unconsolidated Sediment	9	20	29	25		29	100%	--	
Total Unconsolidated Sediment	11	58	69	45	4	65	94%	3%	87.2%
Grand Total	116	137	253	180	26	227	90%	2%	86.0%

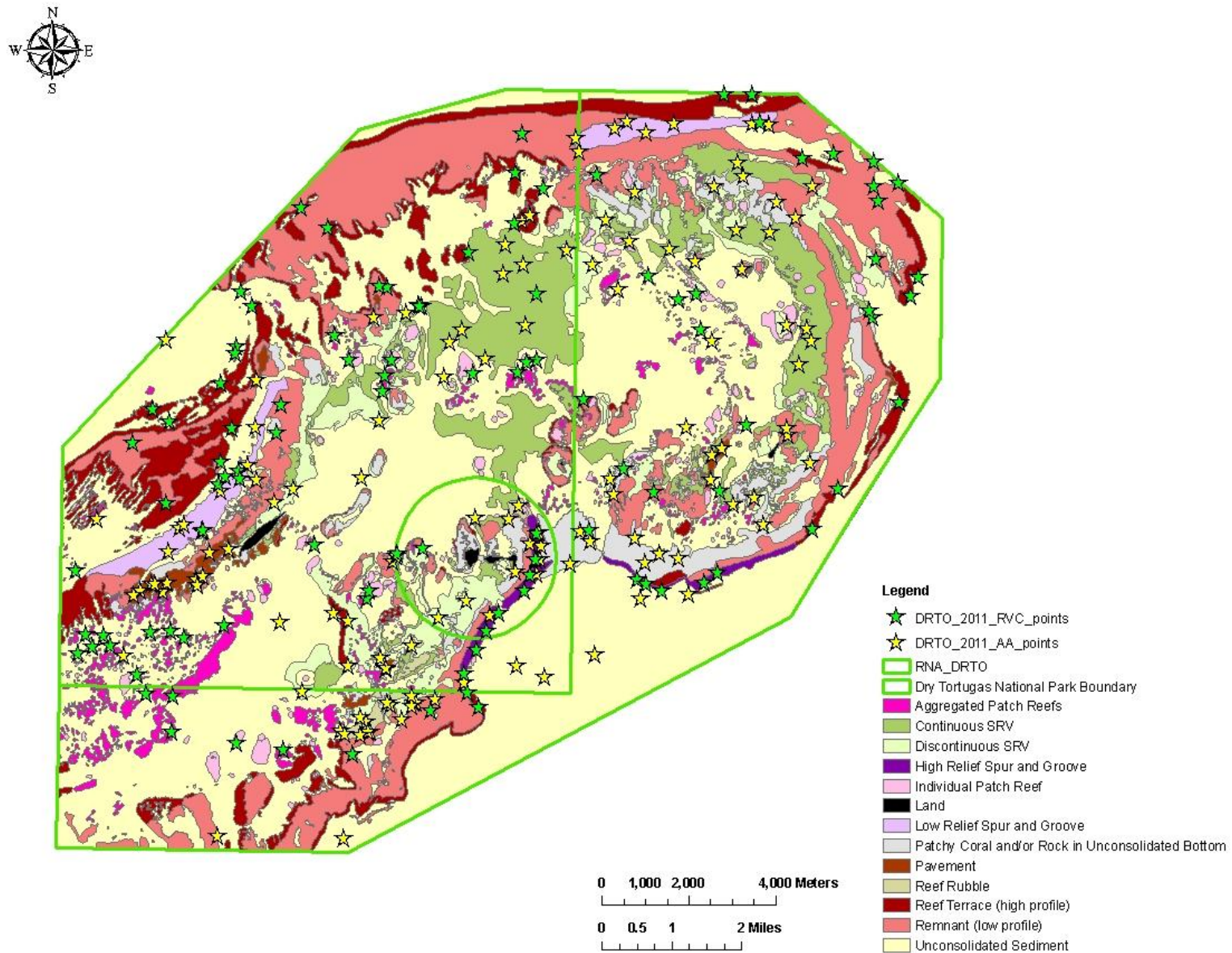


Figure 4. 2010 Benthic Habitat Map of Dry Tortugas National Park with the 2011 accuracy assessment points for both RVC and AA sites.

Biscayne National Park (BISC) Benthic Habitat Map

Project Overview: SFCN in partnership with the Florida Fish and Wildlife Research Institute (FWRI) contracted Avineon, Inc. to conduct photointerpretation of aerial photography (1 ft resolution) collected in 2005 for the seaward portion of Biscayne National Park. The first draft of the benthic habitat map was delivered in October 2008. This effort was complemented by a 288 point accuracy assessment conducted by SFCN staff in 2009. Overall, 33.2% of the accuracy assessment points had an exact match. The acceptable classification accuracy rate is 80.7%, or 75.5% at the lower 90% confidence interval. Acceptable accuracy is differentiated from exact matches based on six distinct rationale. Mismatched classifications are acceptable if it is an issue of classification scale, consistent misidentification of a class, an equivalent class, the presence of a polygon edge, the habitat is reasonably classifiable as more than one class, or an error in field classification. This discussion is thoroughly described on page 19 of Waara et al. 2010.

The SFCN acquired LiDAR data in January 2009 (5m horizontal, 10cm vertical resolution). With the acquisition of the LiDAR data and over 500 field data points, it became clear that revising the BISC benthic habitat map would be a useful endeavor which would enhance the acceptance and accuracy to the final map product. After the first phase of revision, the SFCN visited 83 non-random sites in order to better characterize common habitat signatures viewed in the LiDAR and aerial datasets.

During the revision in FY10, the SFCN made the decision to adopt the parent classification format of NOAA's Coral Reef Conservation Program's (CRCP) Classification Scheme for Mapping the Shallow-water Coral Ecosystems of Southern Florida (Version 3.2). SFCN migrated to Madley's 2002 "A System for Classification of Habitats in Estuarine and Marine Environments (SCHEME) for Florida" as it was directly adaptable to the NOAA classification and provided additional sub-habitat categories that were desirable in the BISC and DRTO benthic maps.

SFCN completed the revision of the hard bottom habitats in June of FY10. 1267 modifications were made to the Avineon draft. Changes in total area for each habitat class can be viewed in Figure 4. The low relief spur and groove and remnant (low profile) classes did not exist in the previous classification scheme.

A total of 2715 soft bottom polygons were reviewed and revised as necessary. Revisions were completed in December of FY11, and 1224 modifications took place. These included line adjustments, attribute changes, and polygon removal/addition. Changes in soft bottom are illustrated in Figure 6. The primary change which occurred was an elimination of the unconsolidated sediment/unknown map class. The majority of which was reclassified as unconsolidated sediment.

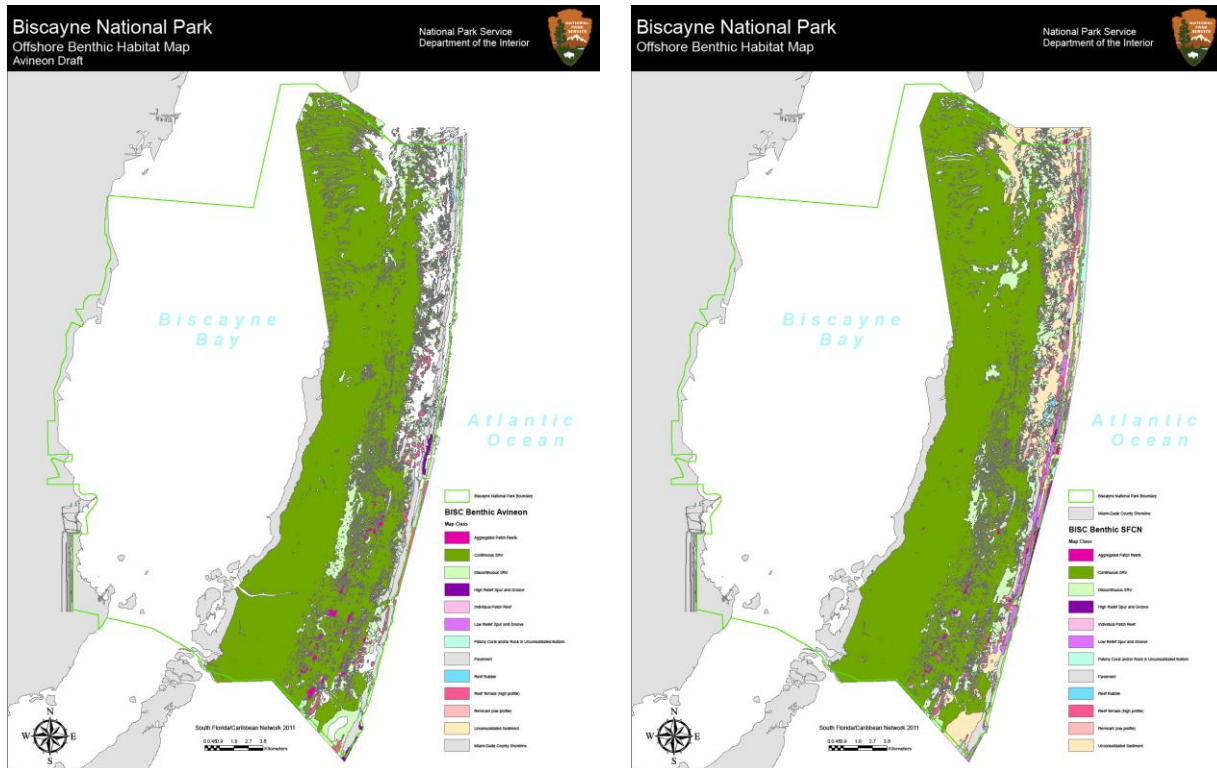


Figure 5. BISC benthic maps: The 2008 Avineon (left) and the 2011 revised SFCN map (right).

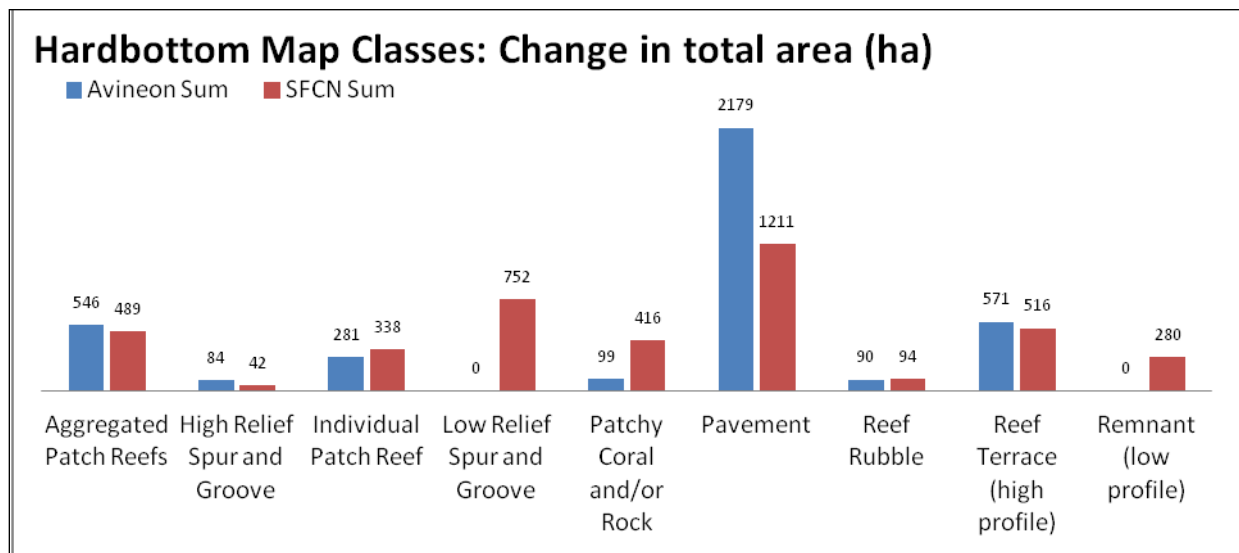


Figure 6. Changes in hardbottom area by habitat type which took place between the Avineon benthic map and the revised map drafted by the SFCN.

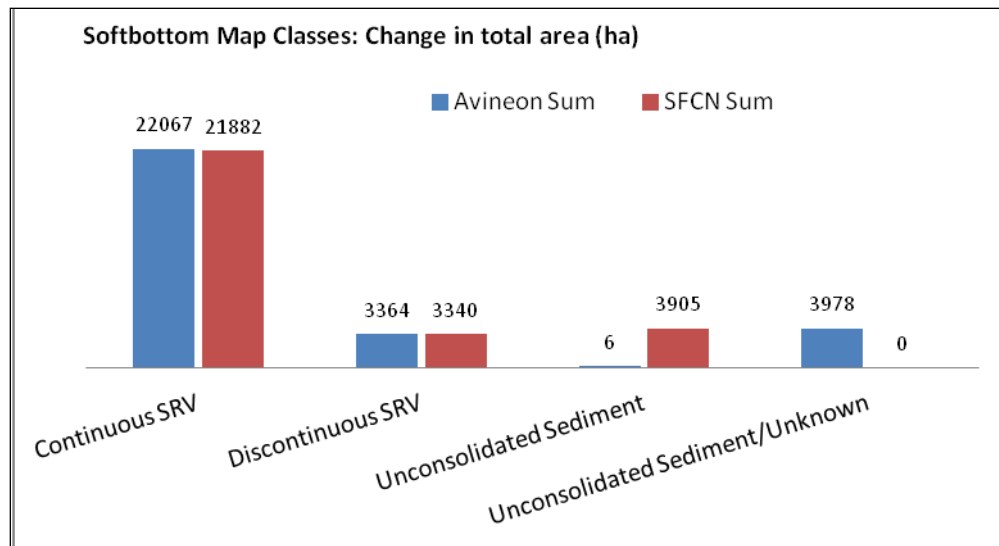


Figure 7. Changes in softbottom area by habitat type which took place between the Avineon benthic map and the revised map drafted by the SFCN.

Project Status: A second accuracy assessment was performed in the spring and summer of 2011. The assessment consisted of 232 points (Figure 8). The SFCN revised draft possessed an exact accuracy of 80.17%, an acceptable accuracy of 94.40%, and a calculated accuracy of 91.2% at the lower 90% confidence interval.

An exact match was designated when the habitat code assigned by field observers directly matched that of the map. There were cases when the habitats assigned by observers did not match those of the map but they were designated an exact match anyway. These cases were dictated by strong supporting evidence provided by a number of additional field observations (RHA's, RVC's, previous AA points, or any number of ground truthing points). These observations were defined as microhabitats (habitats smaller than the 0.5ha MMU).

The revised map performed best with the exact identification of individual and aggregated patch reefs along with continuous SRV (submerged rooted vegetation). Difficulties were most often encountered with pavement, reef rubble, and high relief spur and groove, with high relief spur and groove frequently being misinterpreted for low relief spur and groove. This suggests the resolution of the LiDAR and aerial photography data may not support classification of these habitats in BISC. It may also suggest higher variability between high and low relief spur and groove habitats along the reef tract.

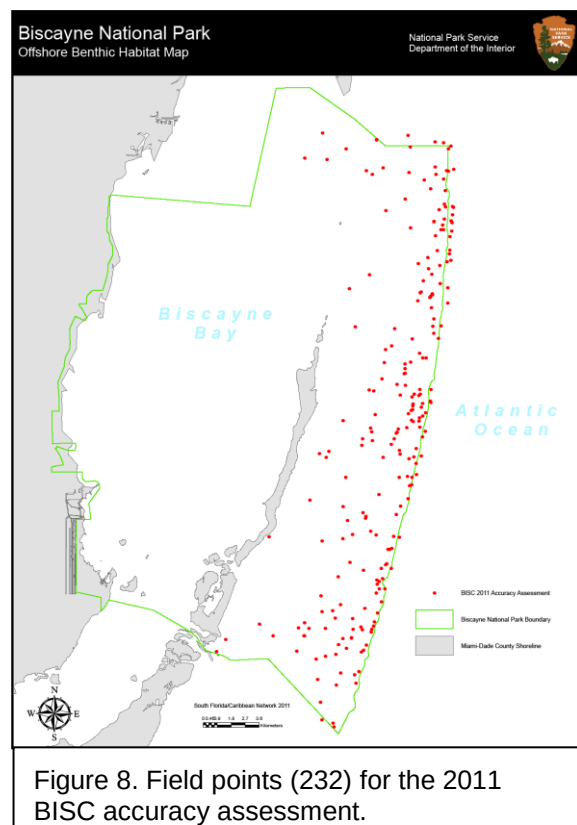


Figure 8. Field points (232) for the 2011 BISC accuracy assessment.

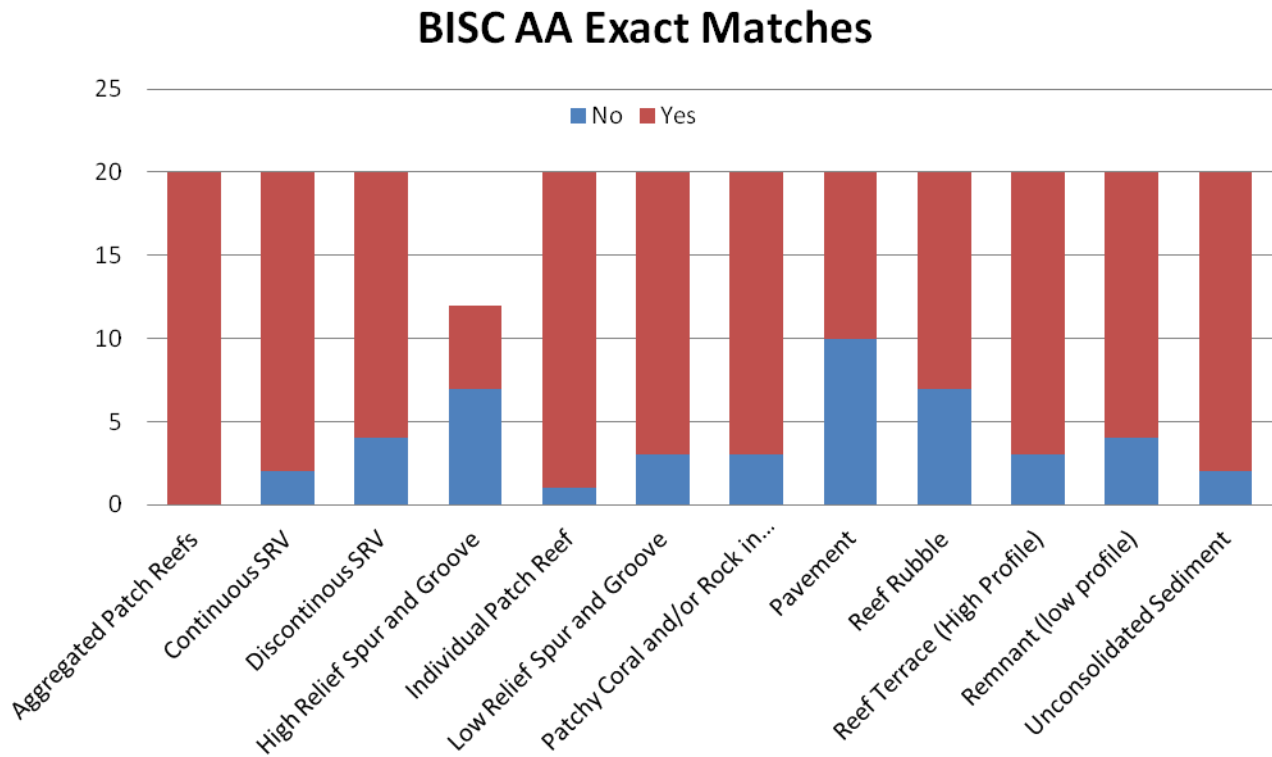


Figure 9. The distribution of exact matches (reds) by map class.

It is also notable that the majority of mismatched classifications due to classification scale occur among the reef terrace, aggregated patch reefs, and discontinuous SRV habitats. Reef terraces are actually small patches of degraded reef remnant. Aggregated patch reefs generally occur in areas of continuous or discontinuous SRV and will often contain either habitat in small densities (<0.5 ha). Similarly, when an observer descends on a meadow of seagrass they are unable to tell if it is larger or smaller than 0.5ha. This calculation was made using the aerial photographs in ArcMap.

Overall, the map has exhibited great improvement (summarized in Table 2). The mapping report is being updated to include the second accuracy assessment and subsequent revisions. When completed, the report will be peer reviewed, and will be published in the NPS Technical Report Series. The final product will be a DVD package containing the BISC benthic habitat map and associated data layers along with the mapping report and appendices. The anticipated completion of the report and DVD is FY12.

Table 2. Exact, acceptable, and calculated accuracy of the first draft BISC map provided by Avineon in 2008 and the map revised by the SFCN completed in 2011.

	Avineon	SFCN	% Improvement
Exact	33.2%	80.2%	141.5%
Acceptable	80.7%	94.4%	17.0%
Lower 90%	75.5%	91.2%	20.8%

Biscayne National Park Offshore Benthic Habitat Map

National Park Service
Department of the Interior

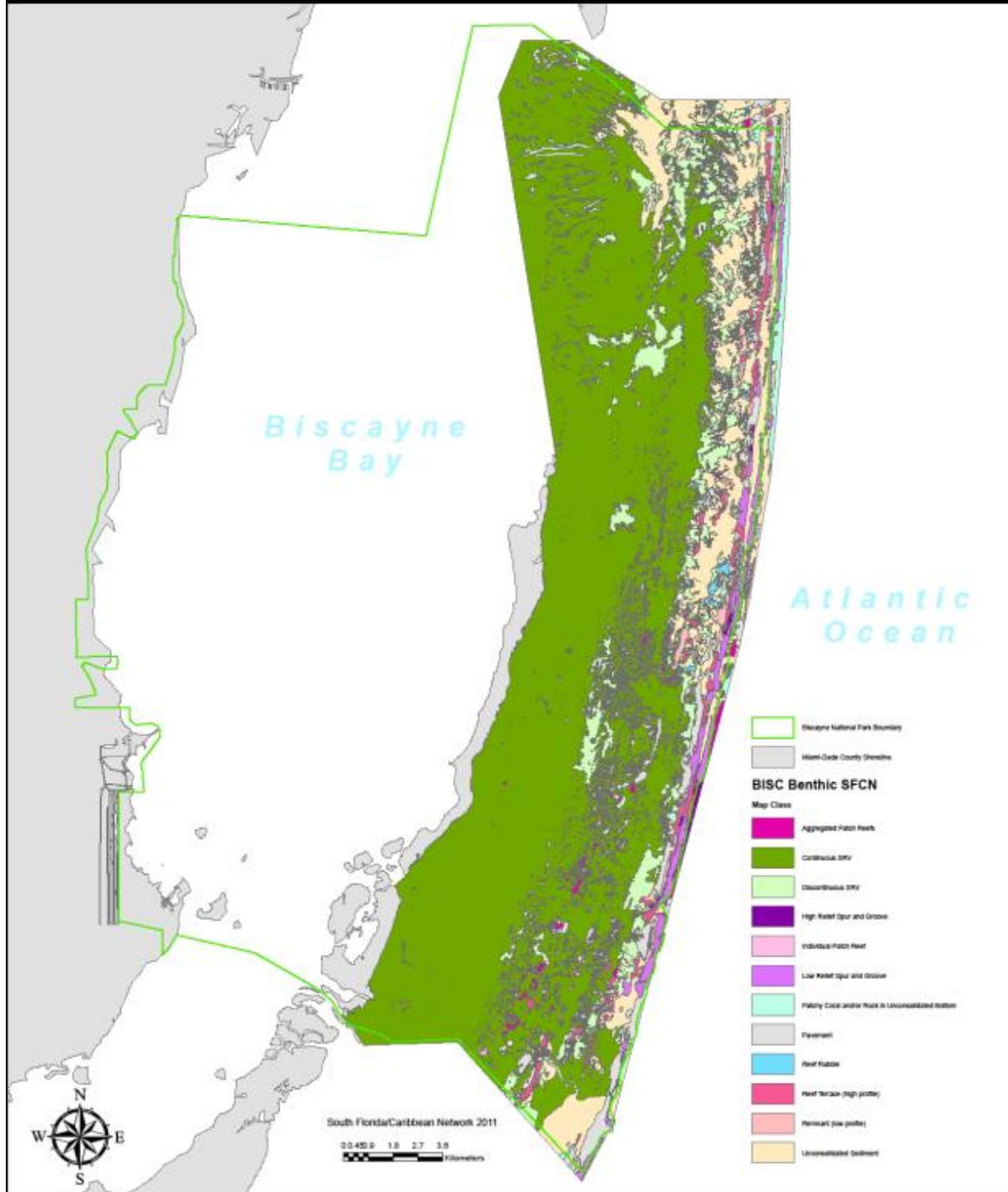


Figure 10. Enlarged version of the revised 2011 SFCN draft of the BISC benthic habitat map.

Vital Signs Monitoring

Marine Benthic Communities Vital Sign (BISC, BUIS, DRTO, VIIS)

Marine Benthic Communities Protocol

Project overview: The Coral Reef Monitoring Protocol guides the monitoring of this imperiled community within four national parks of the SFCN: BISC, DRTO, VIIS and BUIS. Coral reef communities within the SFCN are among the best quality Caribbean and Western Atlantic Coral reefs protected by the National Park Service. These reefs support incredible diversity, including conchs, lobsters, and endangered sea turtles. Reefs also play a vital role for humans by supporting fisheries, nursery areas, tourism, pharmaceutical bio-prospecting and shoreline protection to name a few. Monitoring coral reefs was identified as a national priority in President Clinton's Executive Order 13089.

The objectives for this protocol include:

- 1) To detect changes over time in percent cover of major taxonomic groups (e.g. coral, algae [turf, calcareous, macroalgae], gorgonians, sponge, substrate), and community-level indicators of habitat condition (e.g. coral species diversity, coral community structure, and rugosity).;
- 2) tracking trends and severity in reef-associated covariates such as coral bleaching, coral disease and presence of the herbivorous sea urchin, *Diadema antillarum* and
- 3) maintaining a video archive of the transects and digital photographic record of disease lesions encountered on the transects to allow for quantification and future analyses of benthic components not identified in this protocol.

Accomplished in FY11: The Coral Reef Monitoring Protocol has been completely revised in 2011. This process includes the archiving of historical aspects of the protocol and revising the standard operating procedures (SOPs) to reflect changes in software, video technology and sample design. SOPs were written for sections on data summaries, QA/QC and collecting species diversity data. The protocol now includes 21 SOPs and 4 appendices.

Continuation in FY12: The protocol will be finalized and sent out for peer review in 2012.



Figure 11. The Coral Reef Monitoring Protocol revision will be completed in 2012.

Dry Tortugas National Park (DRTN)

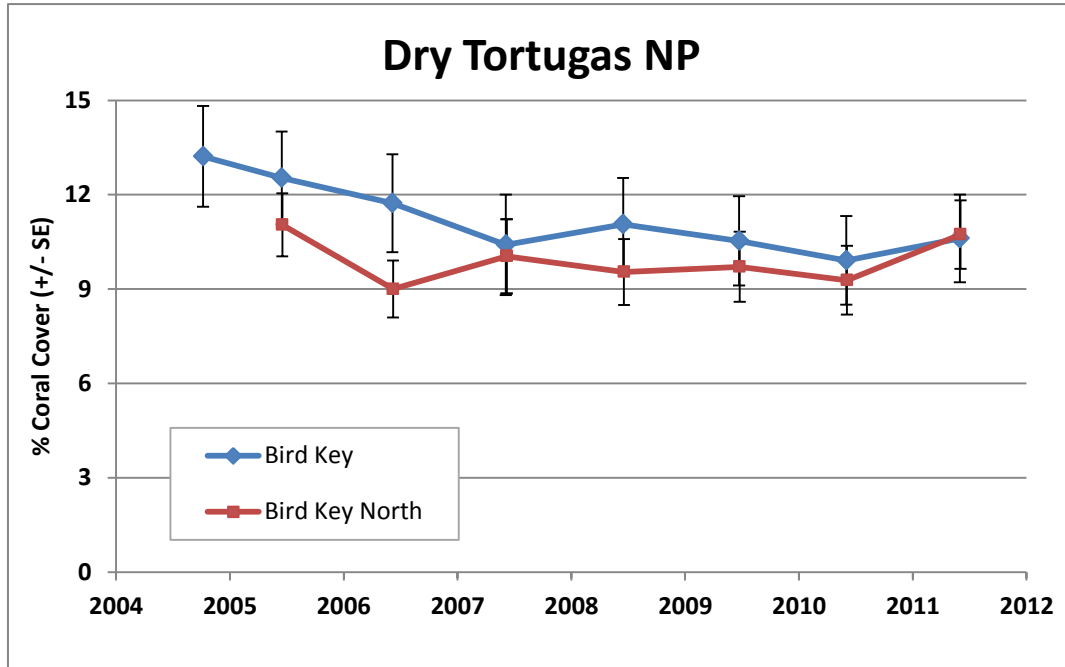


Figure 12. Trends in live stony coral cover at Bird Key and Bird Key North Reefs, DRTN.



Figure 13. Very large star coral, *Montastraea faveolata* at Bird Key Reef, DRTN, June 2010.

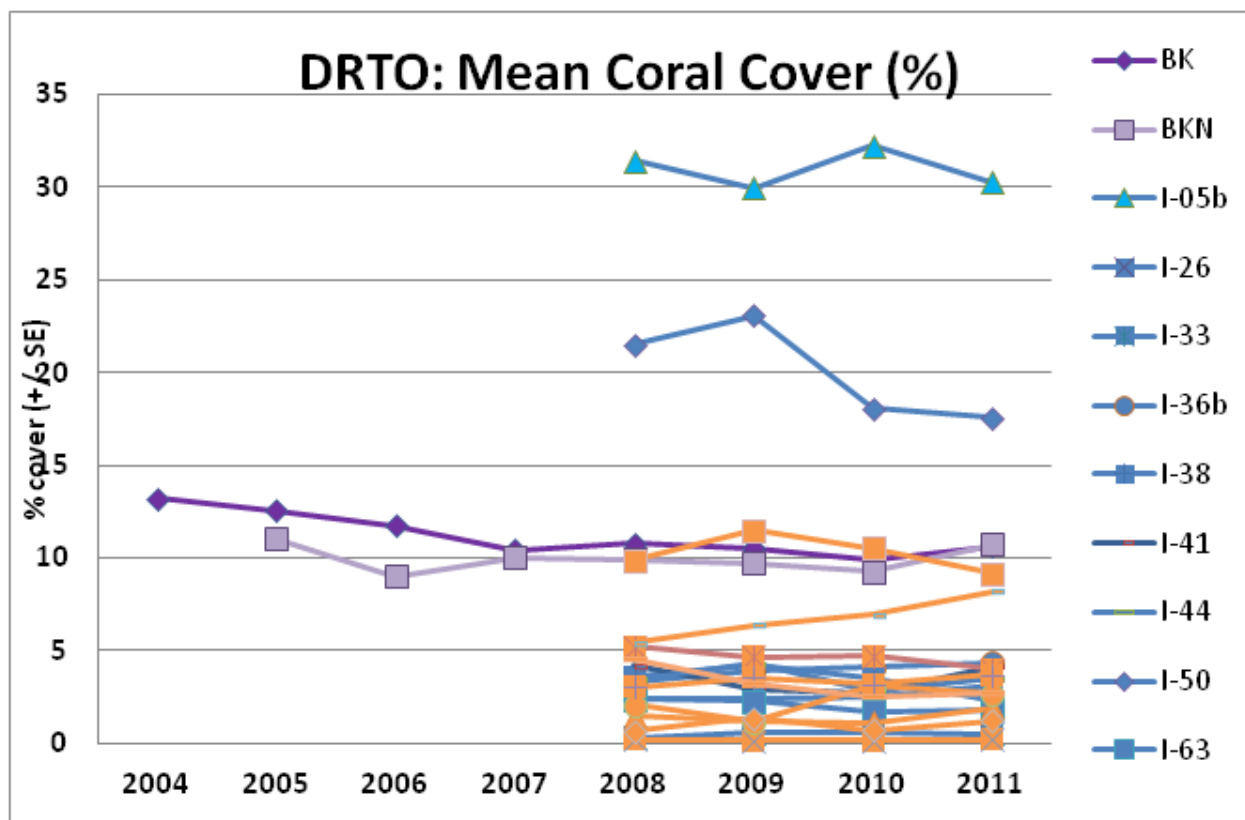


Figure 14. Trends in live stony coral cover at all survey sites in DRT0 including extensive sites and Bird Key and Bird Key North Reefs.

Accomplished in FY11: SFCN staff visited and monitored the 18 extensive sites for coral reef monitoring, these sites were originally installed in FY 08 (9 sites inside and 9 outside of the newly established Research Natural Area [RNA] (Table 3)). Data is collected using the Coral Reef Monitoring Protocol (which includes the High Definition video for benthic component cover), *Diadema antillarum* abundance, coral disease presence/type and measurements, and reef-depth water temperature co-located at each sample site. SFCN staff concurrently conducted annual coral reef index site monitoring, (protocols and data collected as listed above) at the Bird Key and Bird Key North Reefs (analysis complete and included within this report). These index sites now include seven and eight years of data.

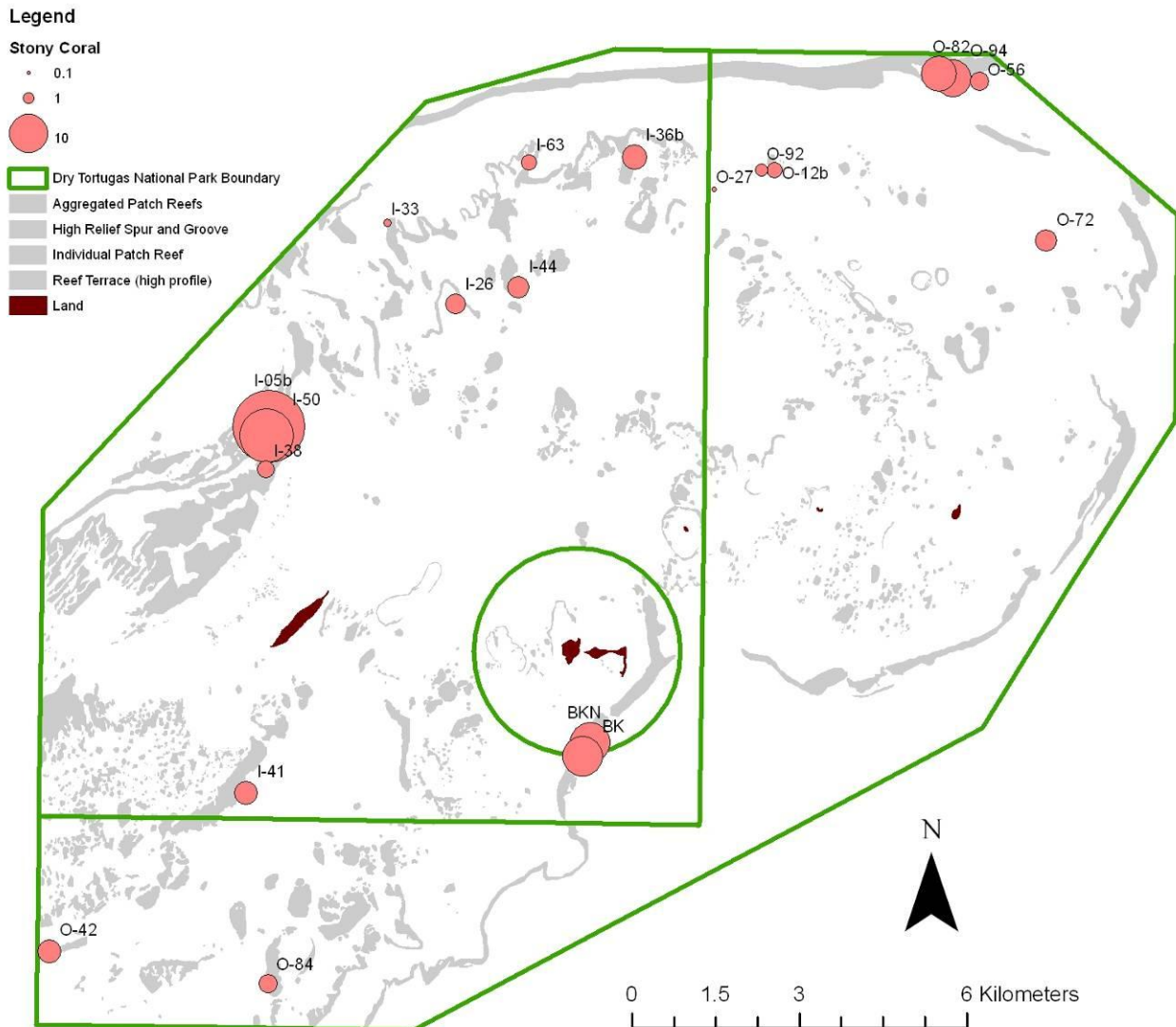


Figure 15. Average percent stony coral cover in 2011 at Dry Tortugas extensive sites and Bird Key sites overlain on map classes with potential for higher coral cover.

Continuation in FY12: SFCN are evaluating data from the Bird Key sites to determine how sampling effort there will continue. We will also evaluate year 4 coral community data from the extensive sites. Specifically, we will examine levels of variation to determine if sufficient power exists to detect changes over time and differences between the Research Natural Areas (RNA - locations where more stringent fishing and boat use policies are applied) and non-RNA areas of the park. Also, SFCN will evaluate including additional well-developed hard-bottom reef communities not previously included in the old DRTO map and thus not part of the original sampling domain, modifying sampling allocation as is feasible. SFCN staff will conduct annual sampling of both index and extensive sites throughout the park.

Table 3. Average percent cover from 2008 and 2009 for Dry Tortugas index and extensive sites by major category.

	Site	% Stony Coral	% Gorgonians (soft coral)	% Sponge	% Coralline Algae	% Turf Algae	% Macro Algae	% Bare Substrate
Bird Key	Bird Key North	10.7	12.3	0.9	0.9	39.7	31.1	4.4
	Bird Key	10.6	14.7	0.9	1.9	27.1	39.2	5.3
Inside RNA	I-05b	30.3	2.8	3.8	1.0	15.7	45.5	0.4
	I-50	17.6	2.3	0.8	0.0	12.5	50.7	15.6
	I-36b	4.4	3.8	2.3	0.0	49.3	24.5	14.8
	I-41	4.2	23.1	7.2	0.4	31.6	21.9	11.3
	I-44	3.5	6.0	4.1	0.9	40.4	34.9	8.3
	I-26	3.1	22.4	0.7	0.4	39.1	28.2	3.7
	I-38	2.3	2.5	2.9	0.7	25.6	53.6	12.4
	I-63	1.8	11.7	3.3	0.8	21.6	39.3	19.9
	I-33	0.5	7.9	2.4	1.7	28.9	41.7	16.6
Outside RNA	O-94	9.1	4.0	1.3	0.4	26.3	37.4	18.6
	O-82	8.2	0.8	1.3	0.4	28.9	38.7	21.1
	O-42	4.0	4.1	8.7	2.6	16.6	57.4	5.9
	O-72	3.7	6.5	0.8	2.2	42.1	40.8	3.8
	O-84	2.7	10.4	4.8	0.8	14.8	51.8	14.4
	O-56	2.7	4.0	2.5	0.7	26.3	41.4	21.2
	O-12b	1.9	26.6	1.1	2.0	33.1	31.5	3.4
	O-92	1.2	19.0	1.5	0.7	31.0	44.2	1.9
	O-27	0.2	14.4	0.6	0.4	27.6	36.4	20.2
Average	Bird Key Sites	10.7	13.5	0.9	1.4	33.4	35.1	4.9
	Inside RNA Sites	7.5	9.2	3.1	0.6	29.4	37.8	11.4
	Outside RNA Sites	3.8	10.0	2.5	1.1	27.4	42.2	12.3
Median	Bird Key Sites	10.7	13.5	0.9	1.4	33.4	35.1	4.9
	Inside RNA Sites	3.5	6.0	2.9	0.7	28.9	39.3	12.4
	Outside RNA Sites	2.7	6.5	1.3	0.7	27.6	40.8	14.4

Biscayne National Park BISC

Accomplished in FY11: SFCN staff conducted annual coral reef community monitoring of index sites at Ball Buoy Reef and Amanda's Reef. These two sites now have nine years of monitoring data. Data at both sites were collected using the Coral Reef Monitoring Protocol (which includes the HD video for benthic component cover), *Diadema antillarum* abundance, coral disease presence/type and measurements, and reef-depth water temperature co-located at each sample site.

Continuation in FY12: SFCN will expand upon our coral reef monitoring efforts in FY11. Exact sample sizes will depend on levels of variation in the evaluation of Dry Tortugas Research Natural Area (RNA) data along with multiple benthic data sources (e.g., accuracy assessment data and data from fish habitat characterizations). SFCN staff will also conduct annual coral reef index site monitoring.

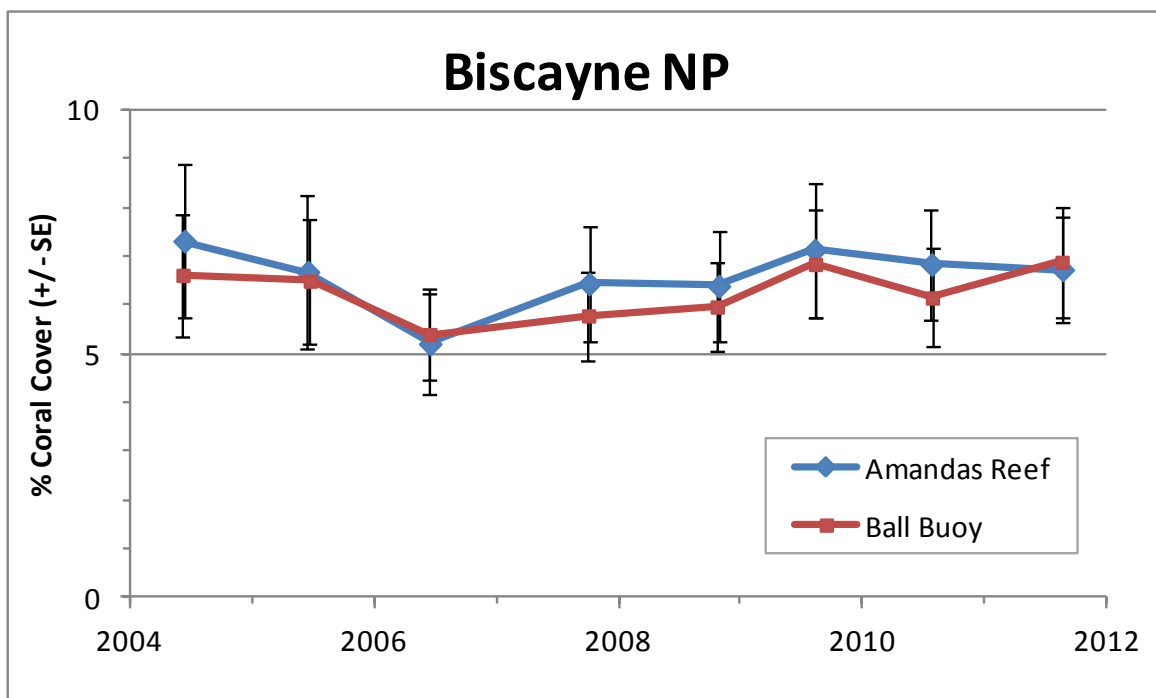


Figure 16. Trends in live stony coral cover at Ball Buoy and Amanda's Reef, BISC.

Virgin Islands National Park (VIIS)

Accomplished in FY11: SFCN staff conducted annual coral reef index site monitoring in VIIS (Tektite Reef, Haulover Reef, Yawzi Reef, Mennebeck Reef, and Newfound Reef). Data were collected using the Coral Reef Monitoring Protocol (which includes the High Definition (HD) video for benthic component cover), *Diadema antillarum* abundance, coral disease presence/type and measurements, and reef-depth water temperature co-located at each sample site. The sites in VIIS have between 7-13 years of data (Figure 17).

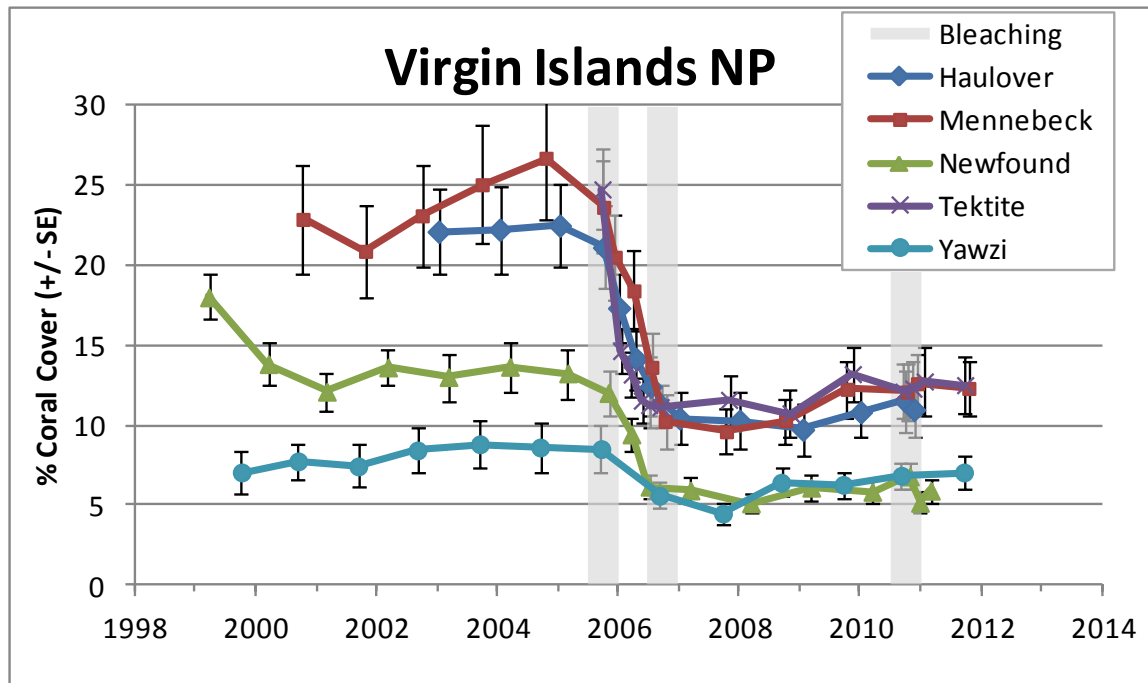


Figure 17. Trends in live stony coral cover at index sites throughout VIIS. Grey bars indicate coral bleaching/disease event of 2005 that continued into 2006 and the coral bleaching event in 2010.

Buck Island Reef National Monument (BUIS)

Accomplished in FY11: SFCN staff conducted annual coral reef index site monitoring in BUIS (South Fore Reef and Western Spur and Groove). Data were collected using the Coral Reef Monitoring Protocol (which includes the HD video for benthic component cover), *Diadema antillarum* abundance, coral disease presence/type and measurements, and reef-depth water temperature co-located at each sample site. The BUIS sites have ten and twelve years of sampling data respectively.

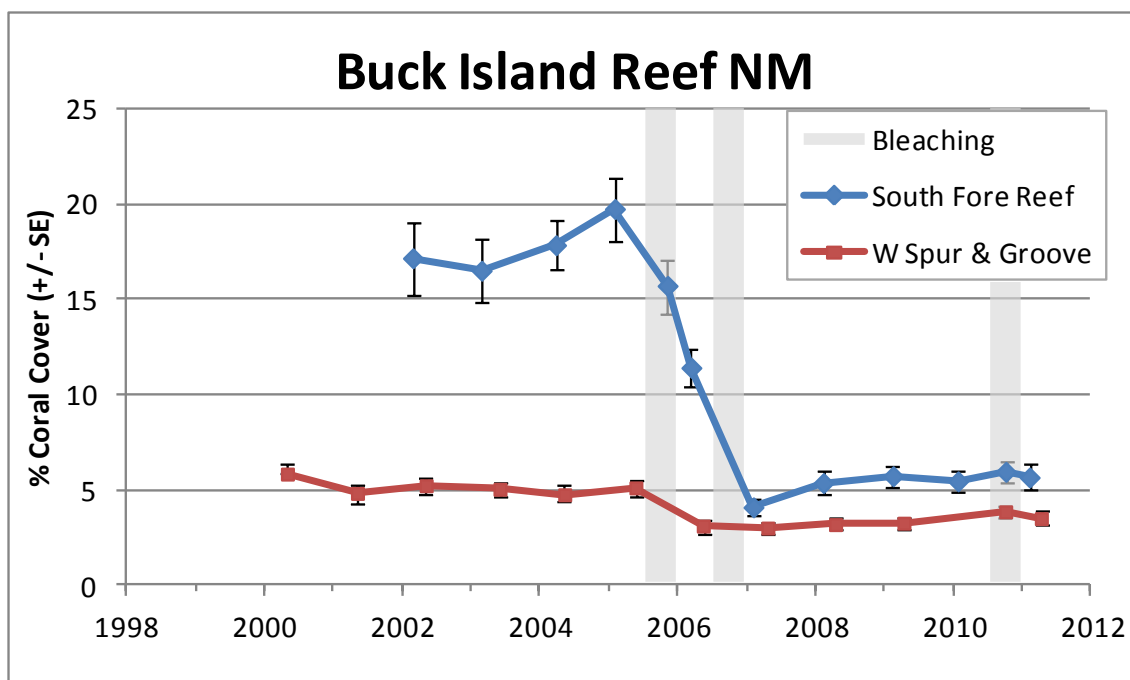


Figure 18. Trends in live stony coral cover at Western Spur and Groove and South Fore Reefs, BUIS. Grey bars indicate coral bleaching/disease event of 2005 that continued into 2006 and the coral bleaching event in 2010.

Virgin Islands coral bleaching event update: Elevated reef-depth water temperatures in the Virgin Islands from October 2009–October 2010 caused coral bleaching. (See the water temperature graphs and discussion in the "Water Quality Monitoring section Marine Benthic Communities – Coral Reef Water Temperature" (page 68). First signs of coral bleaching were observed in May 2010. Water temperatures in August and September 2010 were above the bleaching threshold for corals ($\sim 29.5^{\circ}\text{C}$), which triggered episodic benthic monitoring of index sites in the Virgin Islands. This increased monitoring frequency revealed significant differences between the bleaching (and coral disease) event of 2005 and the bleaching in 2010 (summarized in Table 4).

Table 4. Comparisons of effects on coral cover during the 2005 and 2010 coral bleaching events. Extreme bleaching indicated by total loss of color from corals (white), while moderate bleaching stress is indicated by slight discoloration of coral cover.

2005-2006	2010-2011
94.3% bleached	62.4% bleached
50.4% extreme (white)	5.4% extreme (white)
87.5% white or pale	74.6% only slight discoloration
Major disease outbreak	No disease outbreak
61.1% decline in coral cover	No significant loss in coral cover

Continuation in FY12: SFCN will conduct annual coral reef index site monitoring at sites in VIIS and BUIS.

Data Management, Analysis, and Reporting.

Accomplished in FY11: A power analysis was completed regarding the use of extensive (4-transect) monitoring sites in DRTO for the purpose of possible revising that park's design and assisting in the design of other parks in the network. Preliminary results suggest that 5 sites may be needed per strata rather than 9 to detect a proportion change of 25%.

A comparison between Digital Video (DV) and High Definition video (HD) monitoring results was completed and is incorporated as an appendix to the protocol. The improved image quality delivered by High Definition cameras allowed more detailed identification of important benthic communities. A signed rank test directly comparing transects videoed with both types of cameras showed the following enhancements associated with the use of High Definition video:

- Increase in the number of usable “dots” per transect from an average of 266 to 341 – (from the increase in the number of frames per transect, removing camera “wand” from the picture, and decreasing “shadow” category).
- Increase in the average number of coral species detected per transect from 4.0 to 4.8.
- Decrease in average % unknown by 0.7% and decrease in % hard coral of unknown spp. by 0.1%
- Small increases in the % live coral cover (both for all coral species (0.4%) and for 3 individual coral species)
- Increase in % macro algae (both for all macro-algae species (2.3%) and by type).
- Small increases in % sand (0.6%), other (worms, fish, etc) (0.06%), and the gorgonian *Briareum asbestinum* (0.05%)

Future interpretations of results will need to take the effect of enhanced sensitivity of monitoring with High Definition cameras into account and we will explore what removing % Unknown from calculations does to the results (i.e. does it eliminate some of this difference). Overall the comparison between the DV and HD formats physically demonstrated an improvement in image quality and resolution and statistically showed an increase in identification to more detailed levels of important benthic communities such as coral and macro algae. The overall conclusion is that the HD has increased our ability to monitor the benthic habitat and was a worthwhile investment.

Other notable accomplishments in data management, analysis, and reporting of Marine Benthic communities include:

- Automated QA/QC procedures were identified as needed and work has begun with incorporating them into the database at the data entry step.
- A coral graphing template has been developed to assist easy reporting of coral data (see Figures 12, 14, 16, 17, 18 above). Associated automated reporting queries are being built into the coral database.

Continuation in FY12: Power analysis results and the revised benthic habitat maps will be applied to the coral extensive sites monitoring design for DRTO and BISC.

A comprehensive reporting strategy for coral monitoring index sites and extensive sites will be drafted and implemented. Automated reporting will be completed in the coral database and automated reporting will be developed for coral disease and *Diadema* to support these reports.

Annual data summaries and resource briefs will be created and delivered to the parks. A multi-park comprehensive analysis report will be initiated (and hopefully completed). QA/QC procedures will be finalized and incorporated into the database.

Marine Benthic Communities – Seagrass and Conch (BISC, BUIS, DRTO, VIIS)

Accomplished in FY11: The evaluation of the historical and current seagrass protocols in use within the network and how these can be used or integrated into network seagrass monitoring continued in FY11. The feasibility of conducting surveys for queen conch (*Strombus gigas*) in conjunction with the seagrass monitoring is also being considered. (This species is listed under the vital sign “Marine Exploited Invertebrates”)

Continuation in FY12: SFCN will submit a seagrass protocol for review in FY12 and implementation by 2013.

Marine Fish Communities Vital Sign (BISC, BUIS, DRTO, VIIS)

Accomplished in FY11: A reef fish Caribbean protocol meeting was held February 17, 2011 at the University of Miami (UM-RSMAS) to develop the cooperative protocol for monitoring reef fish communities in the U.S. Virgin Islands. Research scientists from UM-RSMAS, NOAA’s Southeast Fisheries Science Center (SEFSC), NOAA’s Biogeography Branch and SFCN attended. Topics discussed included the scope of the document, sampling design and domain, available benthic habitat maps, data entry, field methodology and key metrics to be measured. Mr. David Bryan, UM/NPS Research Associate, will be in charge of protocol development and advised by Dr. Jerry Ault and Steve Smith, UM-RSMAS; Dr. Mike Feeley, Matt Patterson, Dr. Andrea Atkinson, NPS.

In April 2011, an Interagency South Florida Reef fish Visual Census (RVC) training meeting was held at SFCN headquarters in Palmetto Bay. In attendance were 47 research scientists from NOAA SE Fisheries Science Center, UM-RSMAS, Florida Fish and Wildlife Research Institute (FWRI), Florida International University (FIU), Florida



Figure 20. Andy Davis shows his data collected on a RVC survey in BISC.

Department of Environmental Resource Management (DERM) and Florida Department of Environmental Protection (DEP) and NPS, including research staff from BISC and DRTO. Participants at the meeting received training and updates on field methodology and data management for the 2011 season.

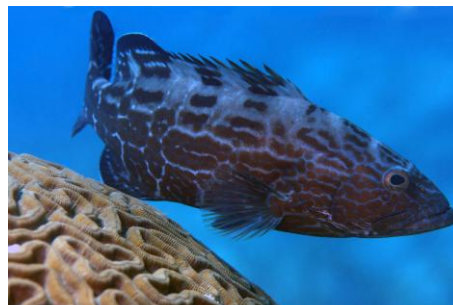


Figure 19. A juvenile black grouper swims past a brain coral in BISC (R. Waara).

During June 2011, SFCN staff (4) collaborated with FWRI, NOAA, and UM-RSMAS research scientists on a 10 day reef fish monitoring cruise in DRTO on the M/V Spree. This cruise was scheduled and contracted by DRTO to meet performance measures that are due in 2012 for the 5-Year

Report on the Implementation of the no-take Research Natural Area (RNA). Two hundred twelve sites were sampled by two teams of two divers using a two-stage stratified random survey design on the Dry Tortugas rise. This survey design targets all hard bottom habitats within DRTO and the RNA occurring deeper than 6 m. Generally these cruises survey the Tortugas every other year and consist of two 10-day cruises on the Dry Tortugas rise, Tortugas Bank and open use areas of the Tortugas.

A ten day interagency Keys-wide RVC (**R**ef-fish **V**isual **C**ensus) survey of the entire Florida Keys Reef tract on the M/V Spree completed 17 offshore sites in the BISC region in June 2011. In addition, SFCN staff surveyed 43 inshore sites in and near the BISC region (Figure 15) during August - September 2011. In total, 57 sites were surveyed within the BISC region by the South Florida Interagency effort. The data collected will provide fishery metrics (length frequency and relative abundance) to assess the status of important reef fish populations within BISC compared to baseline data and data collected throughout the entire south Florida ecosystem, including DRTO.



Figure 21. Multiagency Fish Monitoring Sites in BISC region in 2011. Total Sites monitored: 57; Total sites monitored by SFCN: 43 (each site consists of 2 sub-sites)

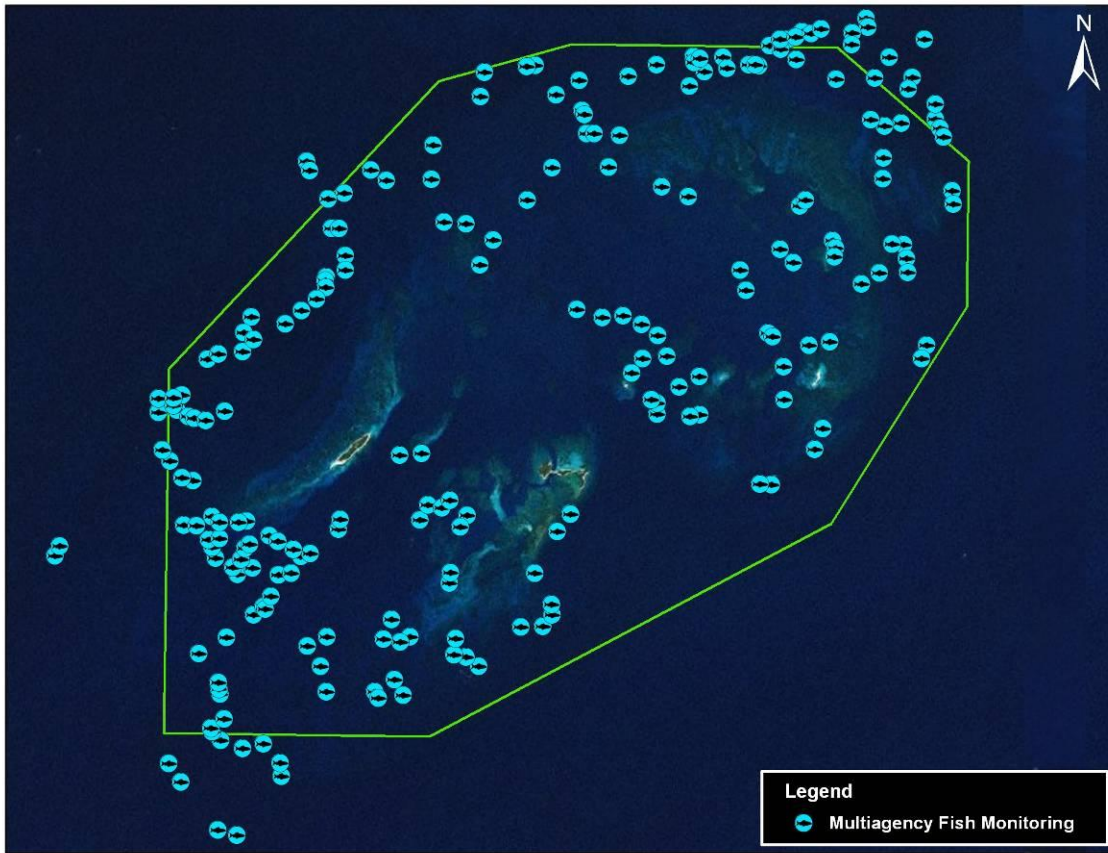


Figure 22. Multiagency Fish Monitoring Sites in Dry Tortugas National Park.
Total Sites monitored: 215 (each site consists of 2 sub-sites)



Figure 23. SCA Marine Ecology Intern Lee Richter returns from a RVC dive in BISC.

SFCN scientists (3) partnered with NOAA Biogeography and NPS resource managers at VIIS during two one-week missions designed to inventory, characterize and monitor fish and fish-associated communities around St. John, including VIIS, VICR and open use areas. Sampling at 172 locations around St. John occurred in July 2011. At each sample location, the fish assemblage characterizations are co-located with estimates of benthic cover along a 25 meter transect. SFCN staff did not participate in the BUIS 2010 mission; however the mission was successfully completed in October with 122 sites surveyed.

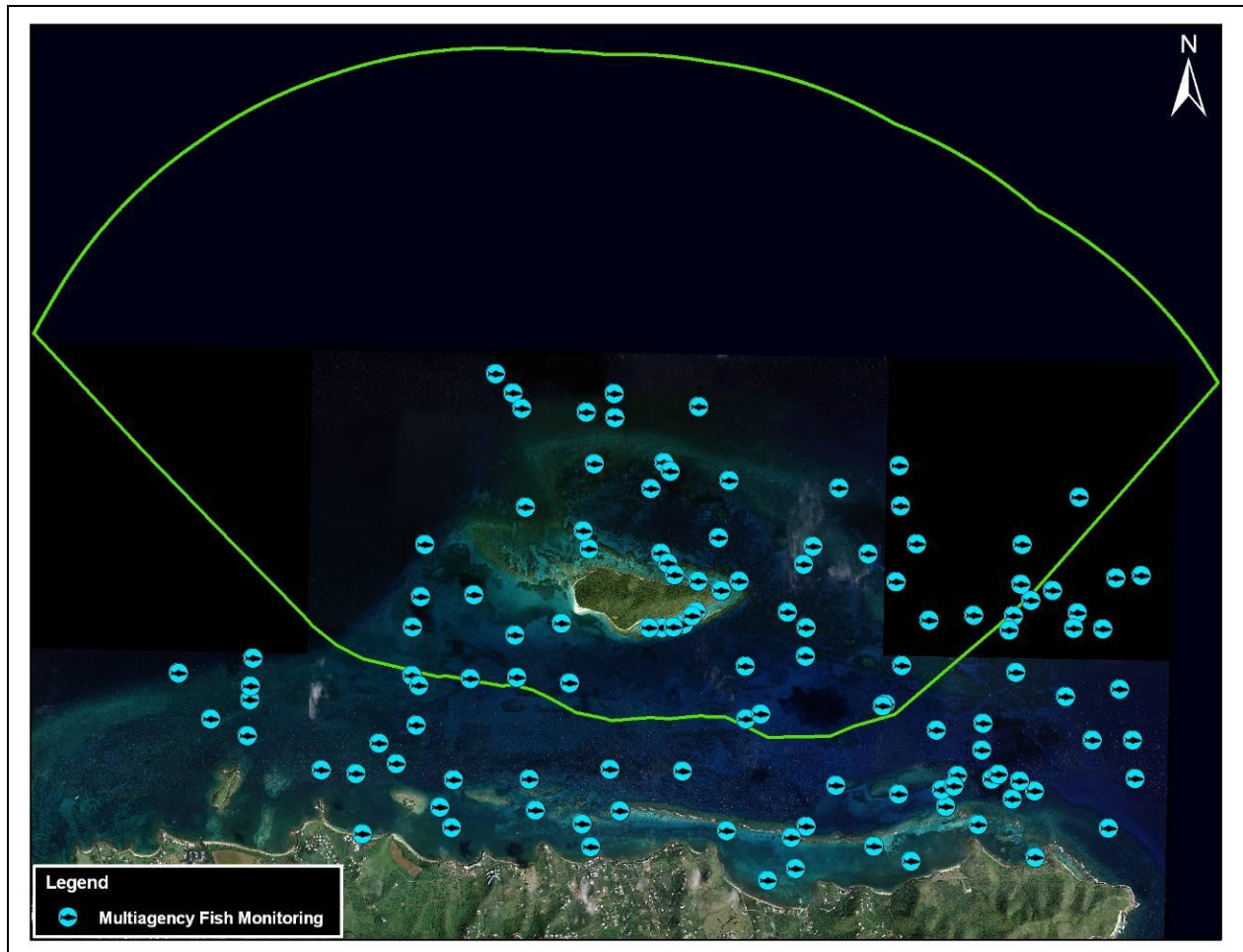


Figure 24. Multiagency Fish Monitoring Sites in Buck Island Reef National Monument (BUIS) 122 sites monitored in 2010.

SFCN continued the pilot study to co-locate surveys of fish assemblages with the benthic video transects at the index sites at VIIS and BUIS. Coordinated fish/benthic habitat video transects began in January 2009 and occurred at all Virgin Islands index sites sampled thereafter. Transect sampling design changed from a fish survey on each 20x10 meter video transect, to surveying only 12 of the 20 transects, but expanding the twelve sampled transects by five additional meters (25 m total).

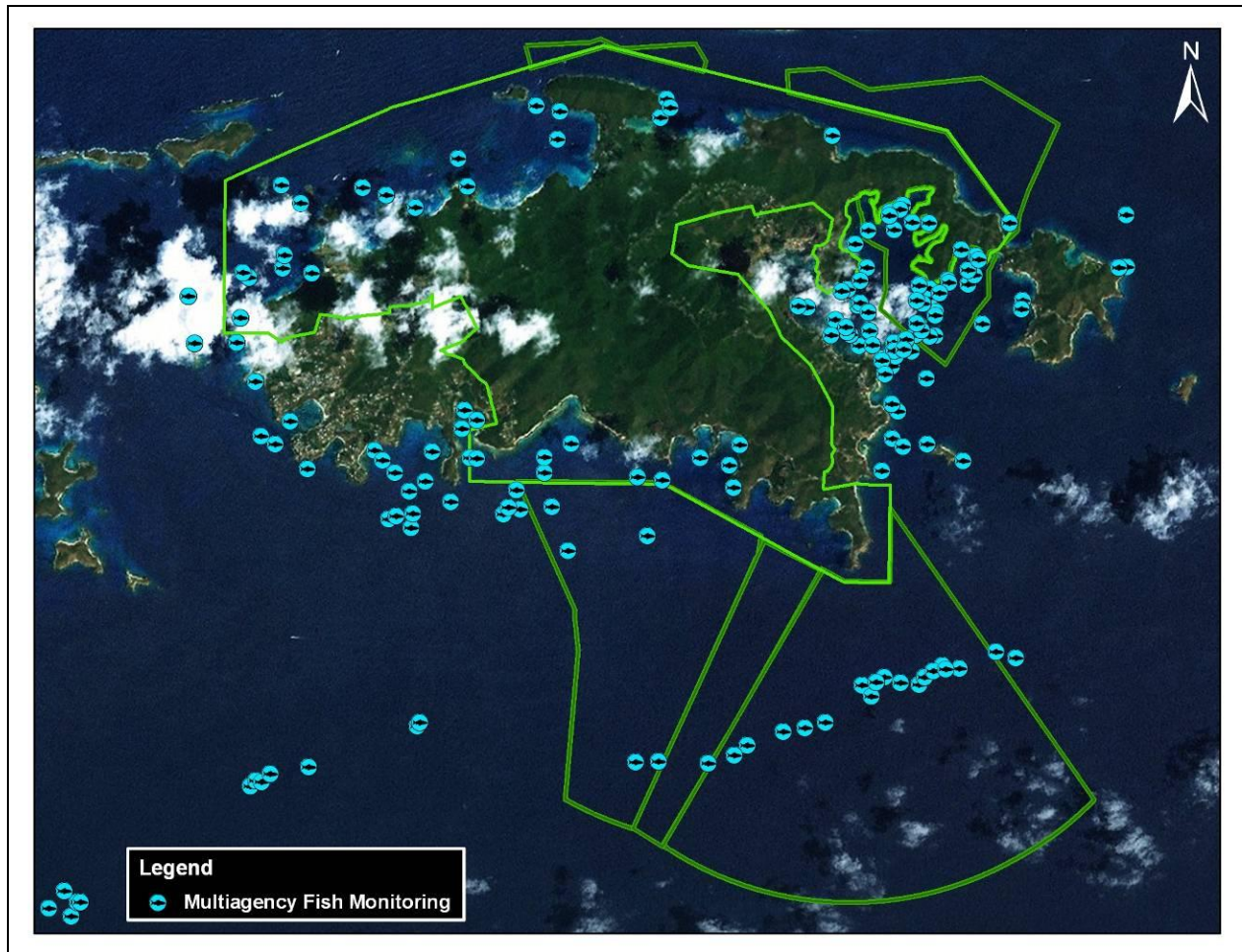


Figure 25. Multiagency Fish Monitoring Sites in Virgin Islands National Park and Coral Reef National Monument. Total sites monitored in 2011: 172

SFCN conducted annual monitoring of adult fish at four index sites in VIIS, (HA, YZ, TK, NF) in partnership with USGS scientist, Dr. Alan Friedlander. This is the 23rd year of collaborative annual sampling with this project.

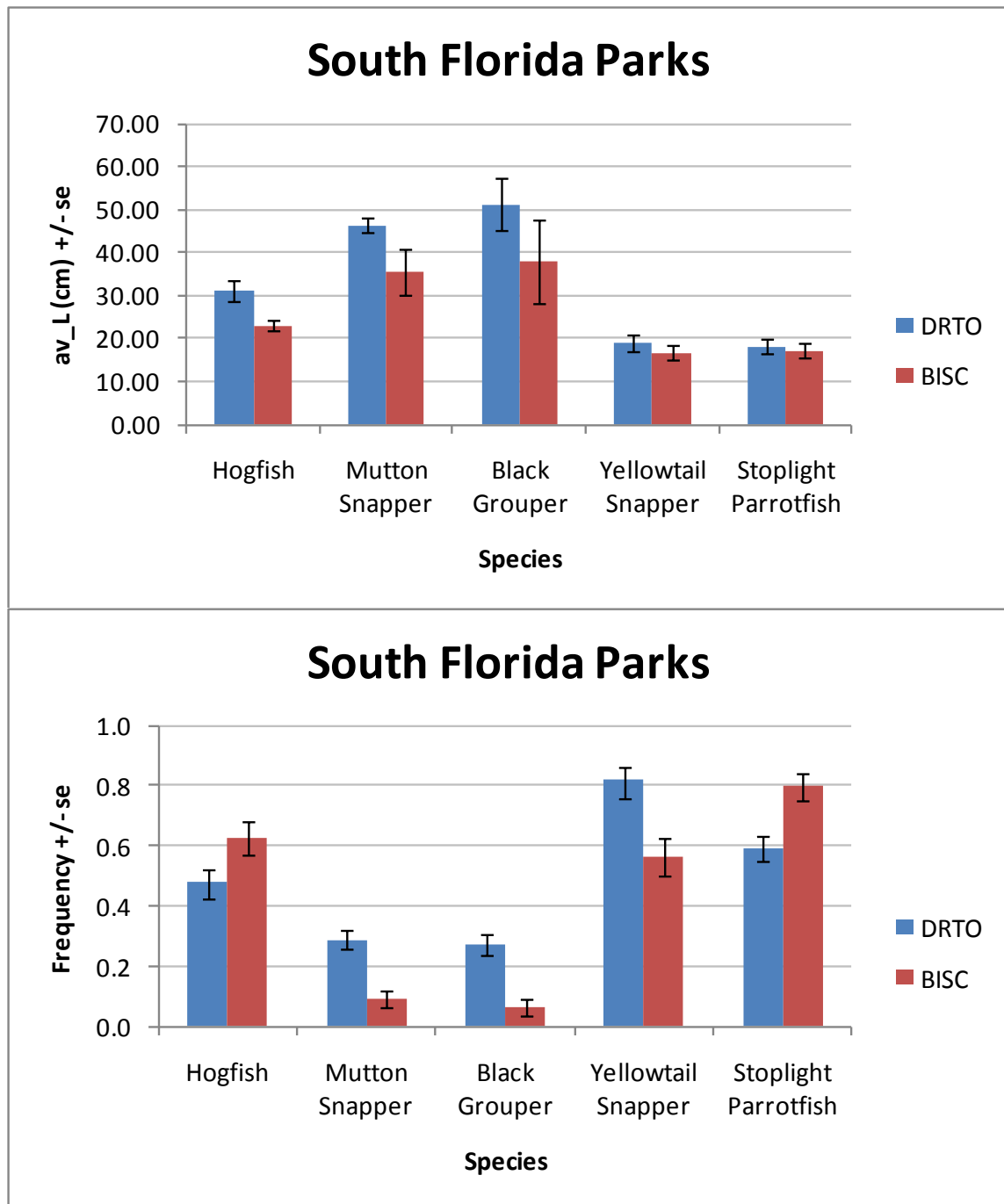


Figure 26. Sample domain stratified random survey estimates for annual average length $\pm$ SE (cm) and annual average occurrence $\pm$ SE (average proportion of diver cylinders with presence > 0) for key reef fish species in South Florida National Parks 2000-2010.

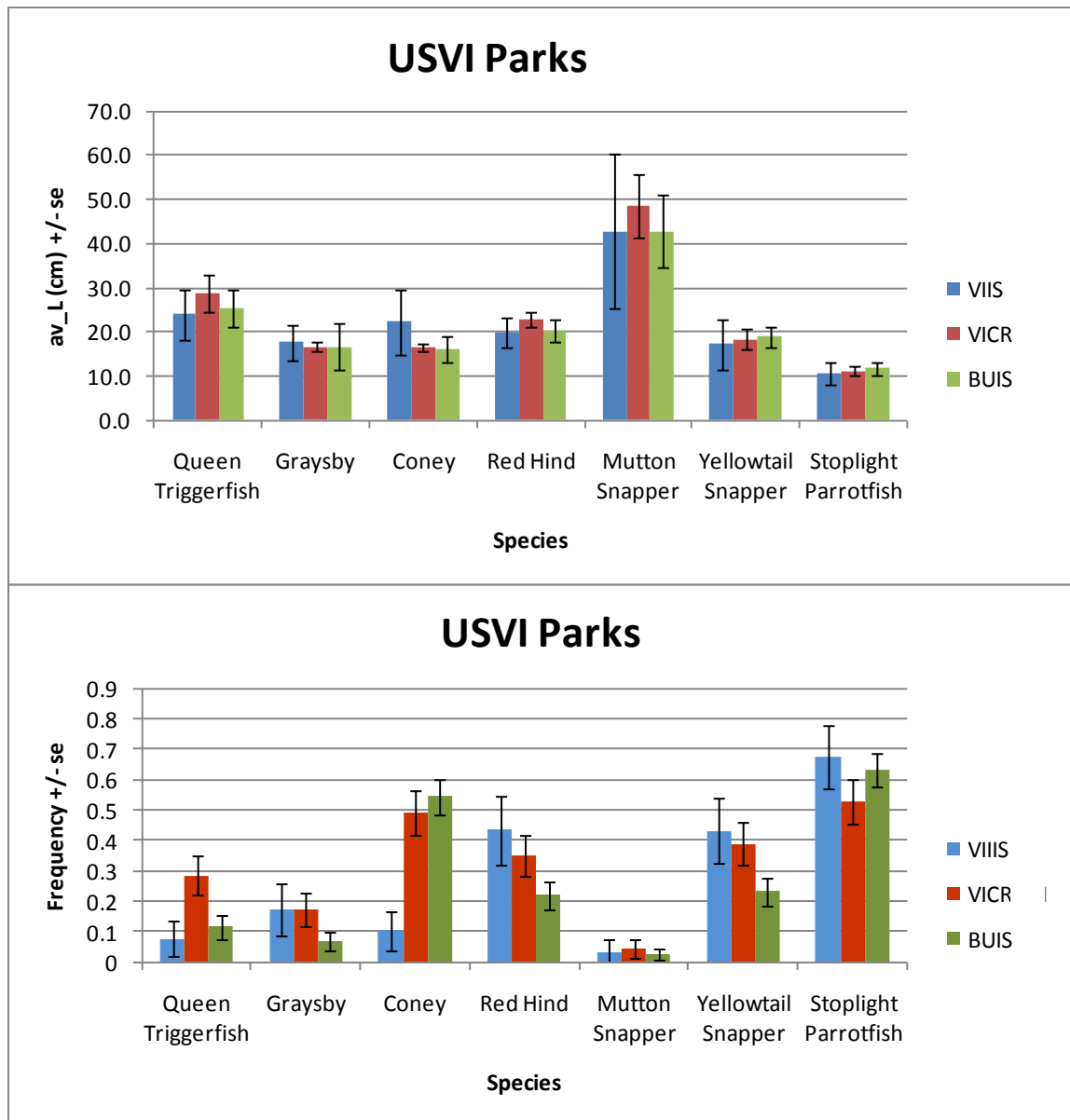


Figure 27. Sample domain simple random survey estimates for annual average length +/- se (cm) (top) and annual average occurrence +/- se (average proportion of diver transects with presence > 0) (bottom) for key reef fish species in USVI National Parks 2001 – 2010 (VICR years 2003-2010).

A 10 year summary of mean length and frequency of occurrence of key fish species is reported in Figures 19 and 20. The south Florida reefs (DRTO and BISC) utilize a 2-stage Stratified Random Survey (StRS) method to generate estimates of fish per unit area. USVI National Parks (VIIS, BUIS and VICR) report similar estimates of mean fish length and frequency of occurrence using 10 years of randomized fish census surveys detected on 100 m² transects located on hard bottom habitat only.

Results indicate that Mutton snapper were significantly larger and had a greater frequency of occurrence in DRTO (closed to commercial fishing w/ a 46 mi² no-take reserve) compared to BISC (open to commercial and recreational fishing). In addition, hogfish were significantly

larger in DRTO, but occurred more frequently in BISC. Black grouper occurred more frequently in DRTO, however average annual lengths were not significantly greater than BISC. Key reef fish monitored in USVI parks had similar sizes (avg. length) across VIIS, VICR and BUIS with annual the average length all < 30 cm for these key species except mutton snapper. Of note, the prevalence of cones and graysby was inversely proportional between VIIS and BUIS.

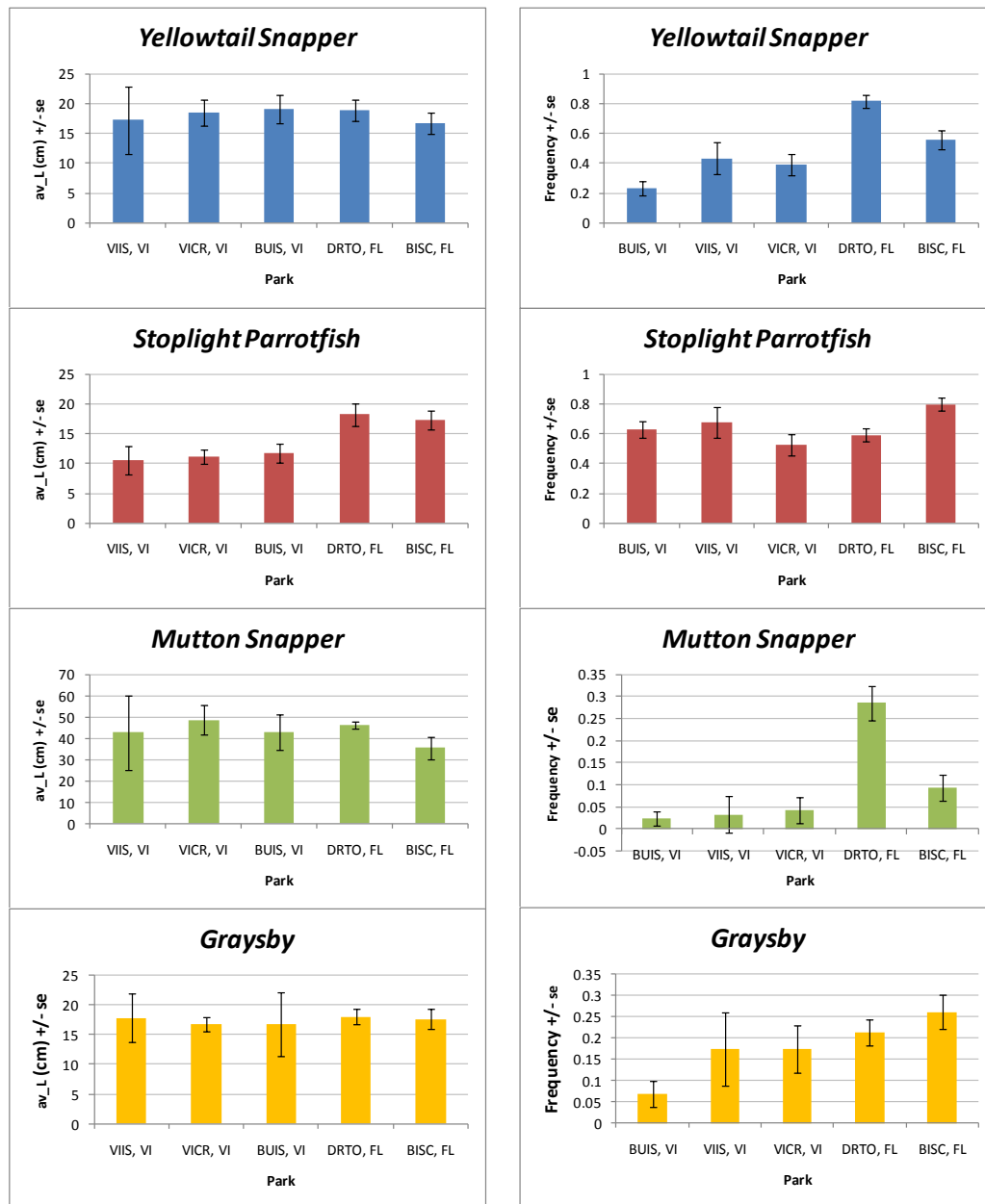


Figure 28. Sample domain survey estimates for annual average length +/- SE (cm) (left) and annual average occurrence +/- SE (average proportion of diver transects with presence > 0) (right) for yellowtail snapper, stoplight parrotfish, mutton snapper and graysby in SFCN National Parks (VIIS 2001-2010; VICR 2003-2010; DRTO and BISC 2000-2010).

A comparison of key reef species (yellowtail, stoplight parrotfish, graysby and mutton snapper) commonly found across all network parks reveals that stoplight parrotfish were significantly larger in south Florida parks (DRTO, BISC; average length range, 10.6 cm – 11.7 cm) compared to all USVI parks (VIIS, VICR, BUIS; average length range 17.2 cm – 19.04 cm). Stoplight parrotfish were more prevalent in BISC compared to all parks except VIIS. In general, there were no significant differences in the average length of yellowtails or mutton snapper between south Florida and USVI parks, however both species were significantly more prevalent in DRTO.

Continuation in FY12: Mr. David Bryan, Marine Fisheries Science Research Associate, will continue to develop the cooperative protocol for monitoring reef fish communities in the U.S. Virgin Islands and Puerto Rico. SFCN will continue to partner with the NOAA Biogeography team during fish and benthic habitat characterization missions in BUIS and VIIS. In addition, a 2 year calibration study comparing visual point counts vs. transects counts of reef fish in the USVI will begin in 2012. The goal of this pilot project is to determine the most appropriate method to meet park management objectives. One possible outcome of this study is the adoption of a single field methodology across the south Florida and Caribbean region. A second possible outcome is the creation of conversion factors that can be used to interpret historical data collected with a variety of similar methods. If these goals are achieved, the result could be that NPS parks can provide managers precise quantitative estimates of reef fish community health for all Caribbean parks on an annual basis, and be able to reconstruct trends in fish abundance from past data for the duration of historical monitoring. Another expected outcome of this effort is the development of a key reef fish species list and data monitoring metrics for each of the parks.

These changes in monitoring protocol should result in a more efficient survey methodology and increased ability to detect change over time.

The Tortugas will be sampled during two 10 day cruises scheduled May 31st – June 9th and July 24th – August 3rd 2012. These RVC cruises are interagency efforts, that include scientists from NPS, UM-RSMAS, NOAA and FWRI. . The cruises will survey the Dry Tortugas rise, including DRTO and the Research Natural Area, Tortugas Bank and surrounding open use areas of the FKNMS. SFCN staff will continue to collaborate with BISC and NOAA to conduct RVC monitoring in BISC during 2012. A 7 day Keys-wide RVC cruise is planned June 24th – 30th. It is anticipated that BISC research staff will participate in south Florida RVC missions in 2012. SFCN will continue co-locating fish surveys on benthic video transects at the index sites within VIIS and BUIS.

Data Management and Reporting

A comprehensive reporting strategy for reef fish population monitoring will be outlined in FY12. Automated reporting of important metrics (occurrence, density, length frequency distribution, etc.) will be developed with our partners (UMiami, NOAA/SEFSC, NOAA/CCMA) for key regional reef fish species to support timely production of reports. Annual data summaries and resource briefs can be created and delivered to the parks. The goal will be to deliver a multi-park comprehensive analysis report in FY12.

Other Projects

Lionfish. SFCN will monitor the lionfish population in BISC, DRTO, VIIS and BUIS using RVC data in south Florida and NOAA/CCMA data in the USVI in FY12. Metrics (size, density, frequency of occurrence and spatial distribution) will be analyzed and compared across the four regional parks using data collected in 2008 - 2012.

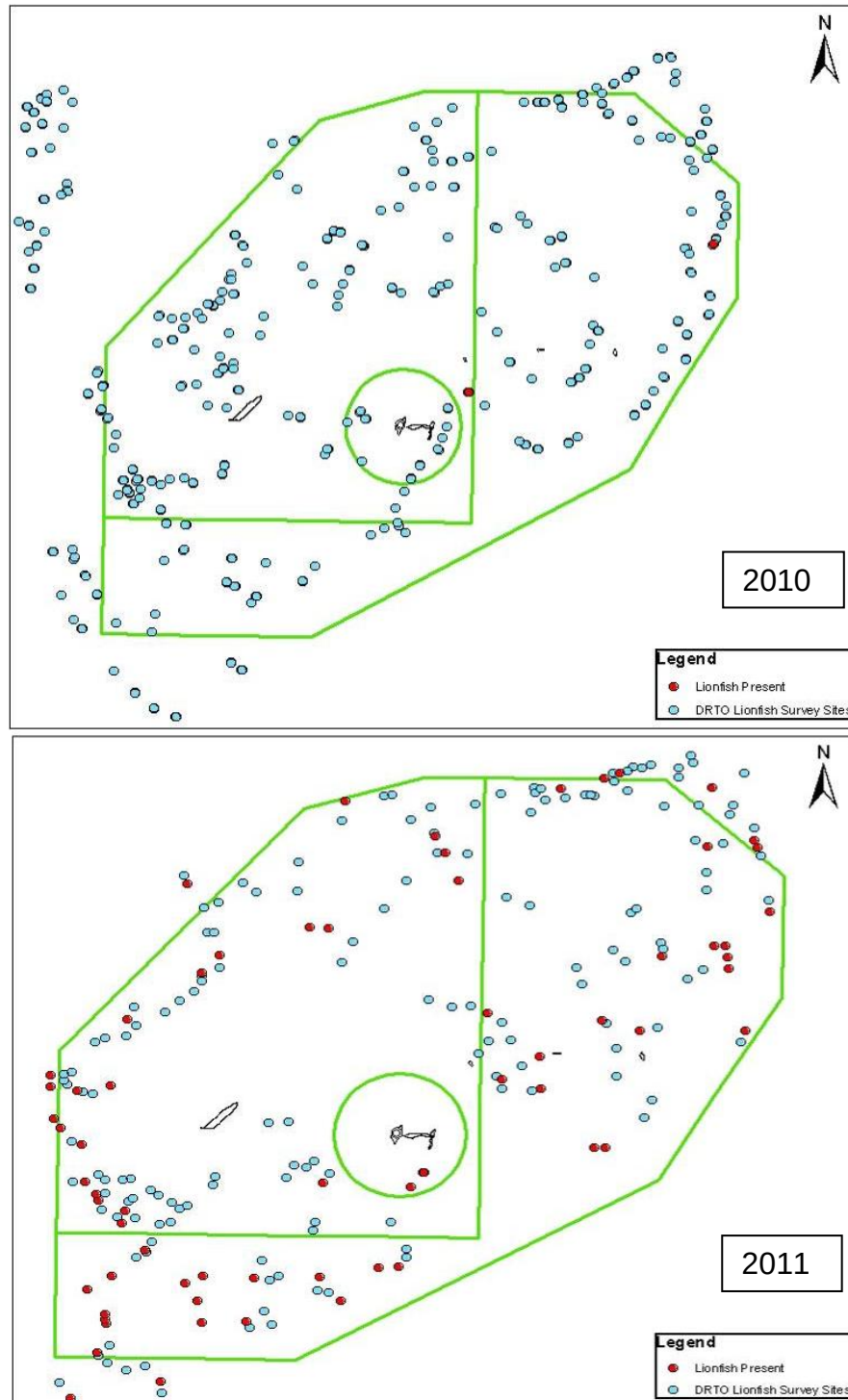


Figure 29. DRTO RVC sites surveyed in 2010 (top) and 2011 (bottom) where lionfish were present (red). Two lionfish were observed at two sites in 2010 and 153 lionfish were observed at 68 sites in 2011.

I.B Community Ecology Branch

Overview

The Community Ecology Branch made considerable progress on the planned vital signs while still progressing on four vegetation mapping projects. The Community Ecology Branch spent 2,601.5 person hours in the field during FY11. The Community Ecology Branch successfully and safely used 51.9 hours of helicopter flight time (22.3 hours colonial bird monitoring, 3 hours periphyton sampling, 2.2 hours ecotonal, and 20.1 hours for vegetation mapping) to overcome remote access issues related to field work in the South Florida Parks. We would like to thank BICY Resource Management (RM) for paying for 3 hours flight time for periphyton sampling.

The Community Ecology Branch staff has experienced some changes this year. Our pursuit of work on the Everglades and Big Cypress Vegetation Map with the U.S. Army Corps of Engineers and the NPS National Vegetation Mapping Program resulted in successful acquisition of funds for creating a vegetation map, and an agreement to loan of 2 FTE's to SFCN from WASO. This has allowed us to hire Joaquin Alonso as project manager and Helena Giannini as the biological technician on the Vegetation map project. With Joaquin's promotion we were able to bring in Robert Muxo as a replacement biological technician concentrating on the Colonial Bird Vital Sign.

Our full-time Resource Management Intern, Tiara Thanawastien, completed her time in our office in FY11. Tiara has found successful employment with a local environmental consulting company using the skills she developed in our office to successfully compete for new projects. This year we were awarded funding for the National Science Foundation Long Term Ecological Research Experience for Undergraduates internship program (Michelle Prats).

Currently, the small and medium mammals inventory project is in the final report writing phase. There was extensive database cleanup associated with this project and a draft report has been reviewed. These comments have been returned to University of Florida and the USGS for further polishing so that the completed report has maximum utility.

We have completed two vegetation map reports this year (DRTO, SARI). In addition, there are two vegetation map projects generally completed but in final stages of having final reports sent to the National Vegetation Map office for WASO review and acceptance (BISC, western BICY). There are two other vegetation mapping projects requiring extensive effort: EVER/BICY and VIIS. EVER/BICY is a five year project conducted collaboratively with the U.S. Army Corp of Engineers (ACOE) as part of Everglades Restoration. The National Vegetation Mapping program of the NPS has provided \$180K in funding to help support the EVER/BICY vegetation mapping project. This funding will support staff time managing the project and conducting the field work that is required to produce an objectively validated map. The VIIS map report will be completed in FY12.

We are still working on the development of the monitoring protocol for colonial nesting birds (Great White Heron, Great Egret, and Double-crested Cormorant) in BISC. The protocol is mostly complete and all SOPs have been developed as well as the database.

The Community Ecology group made significant progress on our Forest Ecotones and Community Structure and Mangrove-Marsh Ecotones vital signs in FY11. Three standard operating procedures (SOP's) for Forest Structure sampling, digital monitoring of ecotones, and field installation of witness posts in ecotones were written. Other actions conducted in FY11 included sampling six legacy vegetation plots in BICY, and writing a summary report for Elliot Key resampling. The digitized vegetation maps of the area between Flamingo and Joe Bay in Everglades National Park (1980) and a the Turner River Road area (1982) are in final review and are expected to be complete by the end of the 2011 calendar year.

We installed the second Soil Elevation Table site in BISC. The corridor of invasiveness protocol has been sent out for external review. Official initial year field work occurred for corridors of invasiveness along with the generation of the 2009 pilot year summary report and the 2011 report. We helped host a discussion workshop on non-native fish at the Southern Division of the American Fisheries Society Meeting for the Invasive/Exotic Animals vital sign. We also collaborated on pilot sampling of border canals for non-native fish. Four of the SFCN staff attended the U.S. Fish and Wildlife Service electrofishing course and the USFWS instructors have asked Raul Urgelles to help instruct an upcoming electrofishing course. The pilot work for periphyton vital signs continues. Equipment and planning for Aquatic Invertebrates and freshwater fish and large macro invertebrates also occurred.

Additional collaboration occurred with the USGS for contaminant sampling in BISC and non-native fishes monitoring with Dr. Jen Rehage (FIU). The Community Ecology Branch successfully competed for a U.S. Fish and Wildlife Service Coastal Program Grant to fund the Schaus Swallowtail Butterfly (*Heraclides aristodemus pnoceanus*) habitat enhancement in Biscayne National Park.

Finally, using POCIS we sampled twice and collected soil samples for the National Park Service/USGS Water Quality Partnership Emerging Pollutants of Concern (EPOCs) in near shore waters of Biscayne Bay project (3 year and \$300K USGS internal funds). This effort is a collaboration with the USGS's Dr. Tim Bargar (Florida Integrated Science Center), Dr. David Alvarez (Columbia Environmental Research Center), and Adam Foster (Florida Water Science Center). It appears that the Miami-Dade Water and Sewer Department's Wastewater Reuse Pilot Project has been discontinued at this point in time.

The Community Ecology Branch has made three presentations of its work this year as well.

Inventories

Small Mammals Inventory (BICY, EVER)

Project Overview: The University of Florida and U.S. Geological Survey have been collaborating on the small and medium sized mammal inventory for Everglades National Park and Big Cypress National Preserve. A draft report was submitted and reviewed by SFCN and comments were returned.

Everglades National Park (EVER) Vegetation Mapping Project - In Progress

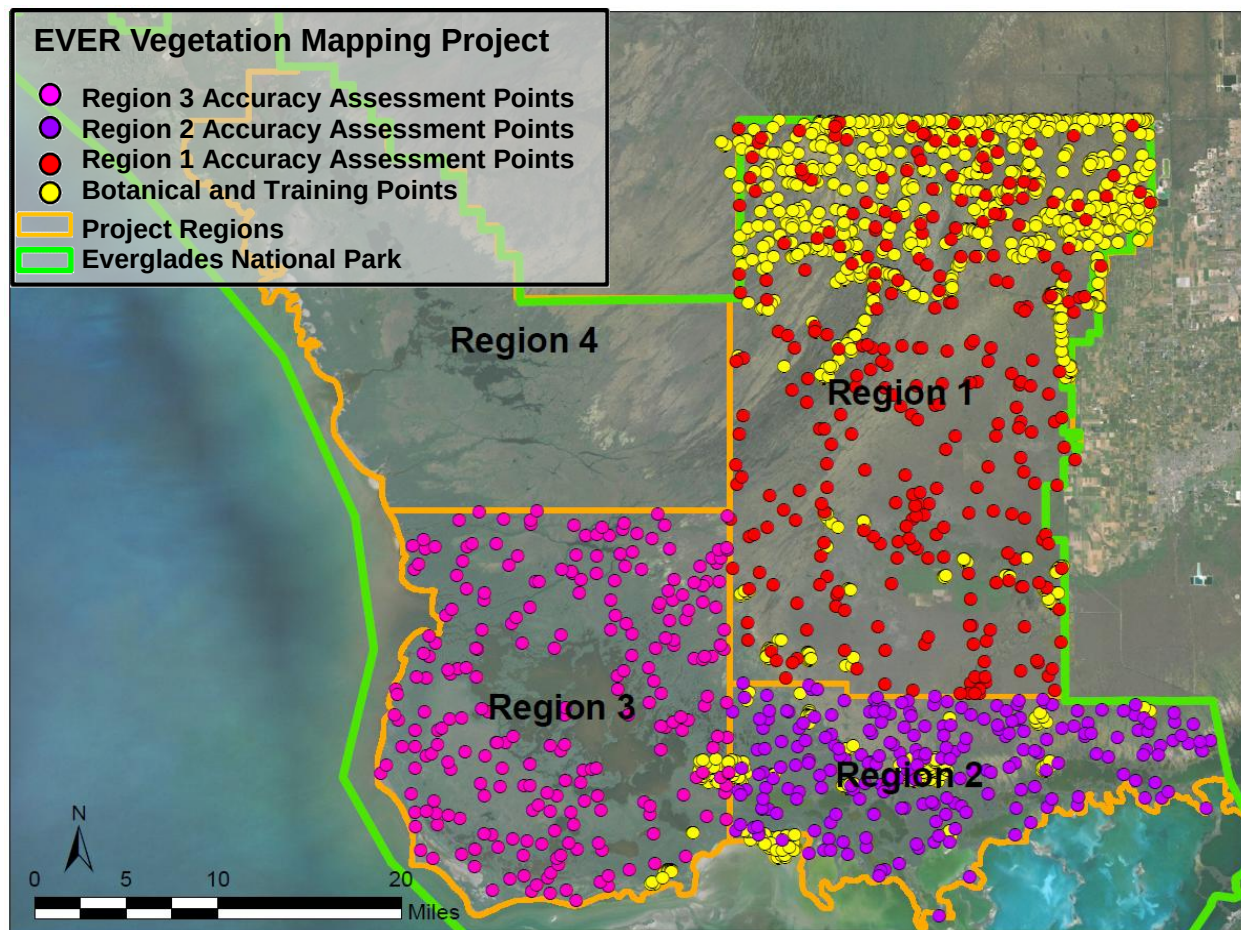


Figure 30. SFCN is assisting the EVER Vegetation Mapping Project by providing the USACE with field logistic support, botanical knowledge, and ground-truthing (accuracy assessment).

Project Overview: The project is currently mapping all of Everglades National Park (EVER) and the eastern 2/3 of Big Cypress National Preserve (BICY) as an effort to map the vegetation communities of the remaining portions of Comprehensive Everglades Restoration Plan (CERP). This is a joint project between the United States Army Corps of Engineers (USACE) who is performing the photointerpretation and the National Park Service (NPS) who is providing field logistic support, botanical knowledge, and ground-truthing (accuracy assessment).

The SFCN botanical personnel provide the USACE photointerpreters with three separate, week-long, botanical training sessions per year. Photointerpreters (PI) receive training in basic knowledge of South Florida ecology, botany, and plant identification to support their interpretation and classification process. SFCN also provides training point field data that allows for the creation of a photointerpreter's key for vegetation classification. The SFCN also is providing a concurrent accuracy assessment (ground-truthing) of the regional maps in order to anticipate and reduce mapping errors where possible. A minimum of 210 randomly selected grid cells are chosen per region to enable an accurate and detailed field-based ground-truthing process. SFCN's work is improving map accuracy by reducing the time lag between initial photo acquisition, interpretation, and ground-truthing. This increases the project's efficiency and reduces errors due to vegetation changes caused by disturbance events such as hurricanes or fires.

Project Status: The EVER and BICY mapping continues to progress. During the last year, kick off meetings were held between the agencies involved to clarify overall project goals, data acquisition methods, data forms, and field logistics. Recruitment of all personnel to be involved in the mapping project was finally accomplished by both agencies (NPS and USACE) by the beginning of summer. The creation of a training point and an accuracy assessment database has been completed along with a draft copy of a user guide.

SFWMD and USACE photointerpreters completed mapping section 1 of region 1. QA/QC of this section will be conducted utilizing accuracy assessment points collected by SFCN. Currently USACE photointerpreters are mapping section 2 of region 1 (Figure 30).

Three botanical training sessions have been conducted for the 2011 fiscal year, consistent with the interagency agreement. A total of 120 botanical training points have been visited with USACE personnel as part of their field training. A total of 490 training points have been visited and classified in order to provide additional support for photointerpreters in the interpretation and classification process. A total of 525 accuracy assessment points have been visited for region 1 and region 2. Classification and data entry for all these points has been completed.

Continuation for FY12: The accuracy assessment points for region 3 have been generated and reviewed by EVER resource managers to make sure they include any areas of particular interest. SFCN is ready to begin flying to collect accuracy assessment data for region 3. SFCN also plans to complete three more botanical training sessions for the USACE, and to collect training point data as requested by USACE photointerpreters.

As the map products are generated they will be submitted to the National Vegetation Mapping Inventory Program, as well as the park and its partners.

Virgin Islands National Park (VIIS) Vegetation Map Accuracy Assessment - In Progress

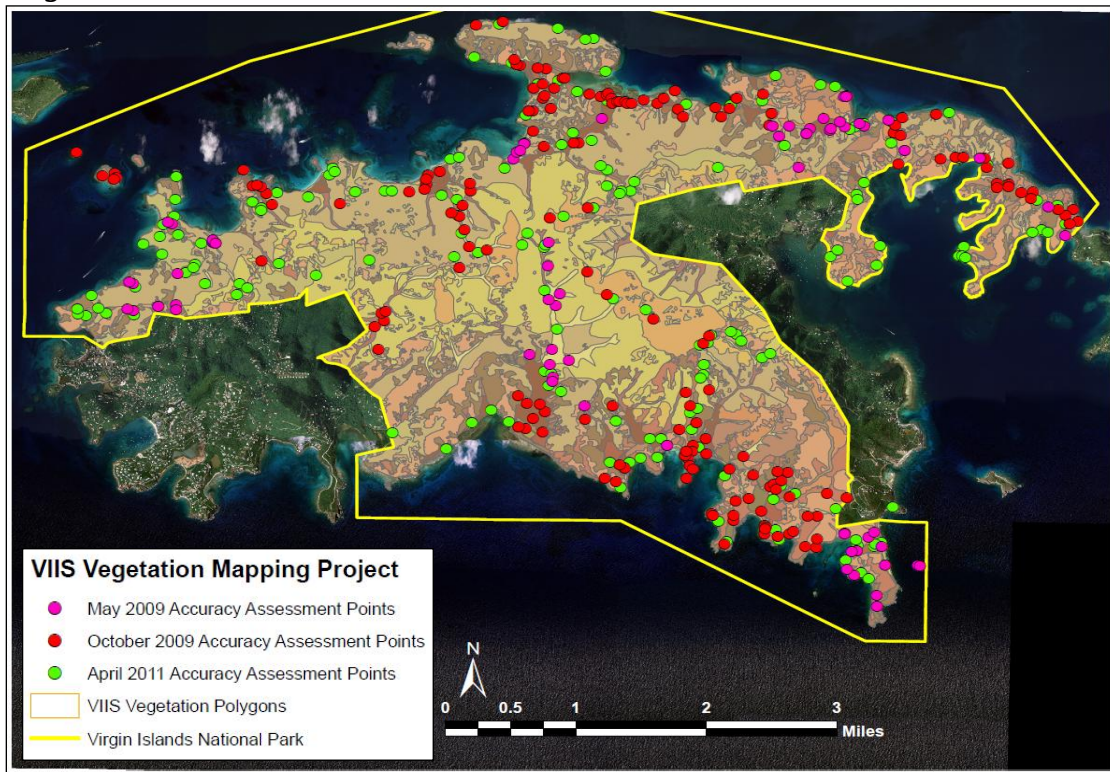


Figure 31. SFCN is updating the VIIS vegetation map based upon field data, LiDAR, and 2007 aerial imagery.

Project Overview: A vegetation map of Virgin Islands National Park's produced by the Eastern Caribbean Center, Conservation Data Center from the University of the Virgin Islands (UVI) in 2001 covers from the shoreline to the highest peak of the park, Bordeaux Mountain. This map was created utilizing aerial imagery from 1994. VIIS Park staff that had used the map indicated their sense that the map was relatively accurate, however, there was not a formal accuracy assessment of the product at the time it was created. SFCN visited 133 randomly selected locations in order to assess the accuracy of the map. Only 40% were determined to have a correct map classification.

Consequently, SFCN has attempted to correct a number of obvious shortcomings of the UVI vegetation map. This was accomplished by using newer 2007 aerial imagery with a 0.9 foot GSD resolution which included Red Green Bands (RGB), Green Red Vegetation Index (GRVI), and Albedo layers. Additionally, manipulation of 3m and 5m Light Detection and Ranging (LiDAR) sensor datasets, that included a Bare Earth (BE) and first return LiDAR layer, allowed SFCN to generate elevation, slope, and vegetation height (veg wedge) data sets that were used to further refine the map.

Analysis of field data collected to check the UVI map allowed the creation of an error matrix that indicated some obvious corrections of vegetation types. Refinement of the vegetation

classification method along with all the above mentioned procedures facilitated photointerpretation and enabled creation of a new map.

Project Status: The map itself has been completed. SFCN visited another 108 locations in April of 2011, and also used 22 additional data points from the US Forest Service's Forest Inventory and Monitoring (FIA) program to assess the newly created NPS vegetation map. Of these points, 87% were classified accurately on the new map .

Continuation in FY12: SFCN is in the process of compiling a summary project report. The document will be consistent with the format required by the National Vegetation Mapping Inventory Program, and contains the SFCN's accuracy assessment result as an appendix . The final products will be submitted to the National Vegetation Mapping Inventory Program, as well as the parks and its partners as an interactive DVD.

Western Big Cypress National Preserve (BICY), Northwestern Everglades National Park (EVER), and Florida Panther National Wildlife Refuge Vegetation Mapping Project – Final Deliverable Accepted, Final Report in Development

Project Overview: SFCN contracted with Avineon, Inc. to map one third (1/3) of BICY and a small portion of EVER. We used the same approach as the CERP RECOVER mapping project using a 50m x 50m grid cell approach and the "Vegetation Classification System for South Florida Natural Areas" by Rutchey *et al.* (2005). The project was broken into 4 sections. Accuracy assessment points were randomly chosen in each section and were classified by two botanists in a helicopter concurrently with the mapping process. Mapped cells were attributed based on dominant vegetation community.

Project Status: The contractor submitted final corrections to the map and submitted an accompanying technical report, all field training point data, and metadata. SFCN has approved these final deliverables and the contract was completed.

Continuation in FY12: SFCN is in the process of compiling a summary project report. The document will be consistent with the format required by the National Vegetation Mapping Inventory Program, and contains the SFCN's accuracy assessment result as an appendix. The final products will be submitted to the National Vegetation Mapping Inventory Program, as well as the parks and partners as an interactive DVD. The intent is for this map to merge seamlessly with the mapping project by the USACE for Eastern Big Cypress National Preserve and Everglades National Park, and to release these products together as a single report.

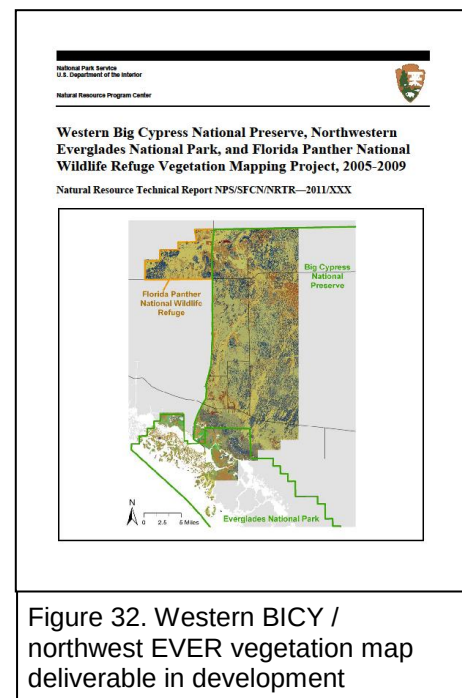


Figure 32. Western BICY / northwest EVER vegetation map deliverable in development

Draft Terrestrial Vegetation Map of Biscayne National Park (BISC), derived from aerial photography, NDVI, and LiDAR

– Final Map Deliverable Accepted, Final Report in Development

Project Overview: BISC includes 41 mangrove-dominated islands with extensive areas of tropical hardwood hammock, as well as a narrow strip of mangrove-dominated shoreline on the mainland. The vegetation map was created by Pablo L. Ruiz, Patricia A. Houle, and Michael S. Ross of Florida International University with funding from the National Vegetation Mapping Inventory Program. Polygon creation depended primarily upon 2005 aerial imagery (30cm, 5-band), Normalized Difference Vegetation Index (NDVI), and 2002 LiDAR data (mainland only). The vegetation map features a six-level hierarchical vegetation classification system (Rutchev *et al.* 2005), with all polygons defined to at least the third level.

Project Status: The final map was submitted by the cooperator and the accuracy assessment completed in FY09. The map has been updated with the results of the accuracy assessment.

Continuation in FY12: SFCN is in the process of compiling a summary project report. The document will be consistent with the format required by the National Vegetation Mapping Inventory Program, and contains both the SFCN's accuracy assessment result and the FIU report as an appendix. The final products will be submitted to the National Vegetation Mapping Inventory Program, as well as the park and its partners as an interactive DVD.

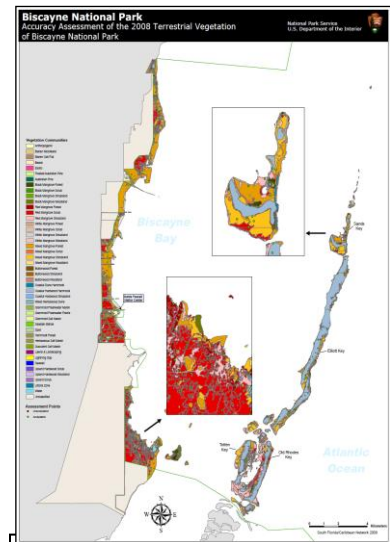


Figure 33. Biscayne National Park vegetation map final deliverables are in development.

Dry Tortugas National Park (DRTO) Vegetation Map - Completed

Project Overview: The National Park Service Vegetation Mapping Inventory Program funded the NPS South Florida/Caribbean Network to map the seven islands of Dry Tortugas National Park in 2009. The vegetation map of Dry Tortugas National Park was created using in field polygon delineation instead of the more commonly applied practice of photointerpretation of aerial imagery (used for all vegetation maps described previously in this document). Trimble GeoXT GPS devices can be used in the field to produce a finely detailed vegetation map (vegetation census). The SFCN developed a vegetation classification system that could be used for the vegetation map of Dry Tortugas National Park. The Dry Tortugas vegetation classification system that we created conforms to the Rutchev *et al.* (2006) South Florida Vegetation Classification System in addition to those vegetation communities unique to the Dry Tortugas.

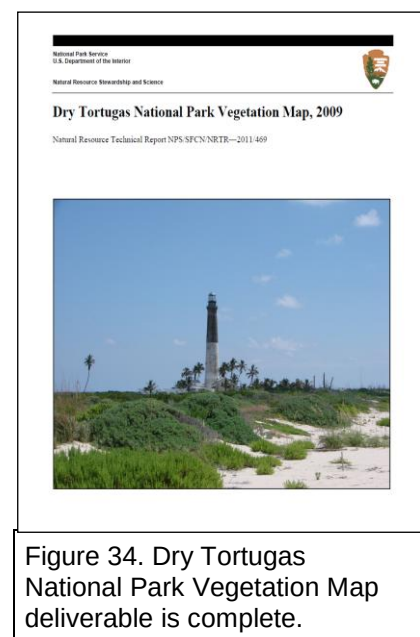


Figure 34. Dry Tortugas National Park Vegetation Map deliverable is complete.

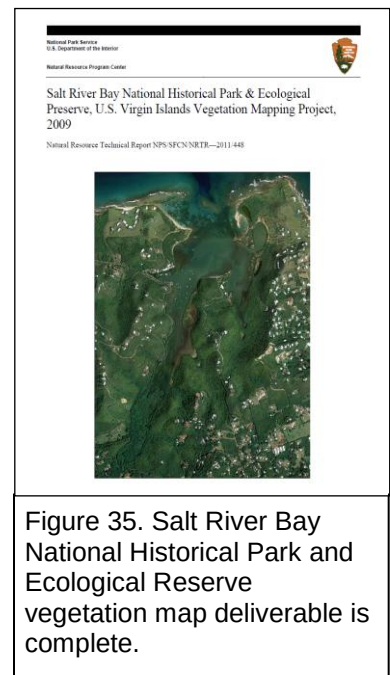
SFCN established a cooperative agreement with Florida International University for the Resource Management Intern Program with one deliverable being the development of a vegetation map of Dry Tortugas National Park. This report is a deliverable under task agreement #J2117072808 and cooperative agreement #H5000060104.

Project status: The map and report are complete and the final report (National Resource Technical Report NPS/SFCN/NRTR—2011/469) was submitted to the National Vegetation Mapping Inventory Program as an interactive DVD. Copies are available on the SFCN web page.

Salt River Bay National Historical Park & Ecological Preserve (SARI) Vegetation Map – Completed

Project Overview: The National Park Service Vegetation Mapping Inventory Program funded the NPS South Florida/Caribbean Network to create a vegetation map of SARI. The Salt River vegetation map was made through photointerpretation based on aerial imagery of a single U.S. Army Corps of Engineers natural color GeoTIFF orthophoto acquired as part of a larger collection in 2006-2007. Three field trips collected data for 150 field points, the latest in July 2009. Based on photointerpretation and data collected from these trips, 244 polygons have been delineated with 58 vegetation map classes. Four hundred and nine acres (166 hectares) were mapped within the park and includes 100% of the terrestrial acreage within the park boundaries. The vegetation classification system was created based on vegetation physiognomic class, “Caribbean Formations” from Areces-Mallea *et al.* (1999), “U.S. Virgin Islands Sub-formations” from Gibney *et al.* (2000), and alliances/associations defined by the SFCN based on data from vegetation plots and field notes. All proposed new classifications are intended for use within Salt River Bay National Historical Park & Ecological Preserve and are not meant to represent the greater geographic region of Saint Croix or the Virgin Islands.

Project Status: The map and report are complete and the final report (National Resource Technical Report NPS/SFCN/NRTR—2011/448) was submitted to the National Vegetation Mapping Inventory Program as an interactive DVD. Copies are available on the SFCN web page.



Vital Signs Monitoring

Colonial Nesting Birds Vital Sign (BISC)

Accomplished in FY11; The SFCN completed its third year of monitoring colonial nesting birds in Biscayne National Park (BISC). The results of monitoring have yielded valuable nesting data (see table below) that will allow for the observation of species-specific nesting patterns and trends. The monitoring consists of taking photographs of nesting activities on six island-colonies. Photographs are taken from a helicopter on a monthly basis. The photographs are analyzed for active nests and compared sequentially to ensure nests are not double-counted. The information is then recorded on data sheets and, once analyzed, can be used to help determine long-term trends in nesting populations of colonial birds in BISC. The species of birds in BISC can be broken down into three functional types based on their feeding behavior: divers, stalk and strike, and tactile. Double-crested Cormorants are divers and the most abundant bird in BISC with 92% of the nests. Different nesting seasonality is evident for the various species, as well as for species with similar feeding methods. Roseate Spoonbills and White Ibis are both tactile feeders, yet each species nests during different seasons. These trends provide indicators of conditions in the park that support nesting behavior.

Table 5. 2010 sum totals of active nest in island colonies of BISC. Counts are by species and by month.

Species	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Double-crested Cormorants	239	257	307	459	403	638	399	464	385	207	35	58	3851
Great Blue Heron	2	0	0	2	0	1	0	0	0	1	2	4	12
Great Egret	0	0	20	19	0	6	5	0	0	0	0	0	50
Great White Heron	14	6	0	5	2	6	0	0	1	13	15	14	76
Roseate Spoonbill	2	1	0	1	0	0	0	0	0	1	4	2	11
White Ibis	0	0	0	92	50	35	22	0	0	0	0	0	199
Total	257	264	327	578	455	686	426	464	386	222	56	78	4199



Figure 36. Aerial photographs to be analyzed.

Biscayne National Park - Colonial Bird Survey - Photo Processing Data Sheet

Processing date: 5/25/2011 Photo processor(s): J. Alonzo Flight date: 2010119 Field observer(s): R.V. JA

Site: ☐ Mangrove Point ☐ Arsenicker Key ☐ West Arsenicker ☐ Mangrove Key ☒ Jones Lagoon
☐ Soldier Key ☐ Black Point ☐ Ragged Key 5 ☐ Other:

File name(s) of photos used: 13
 2010119_BISC-BF-0001.jpg

2010119_BISC-BF-0002.jpg

Species codes	No. of active nests	No. of nests with chicks	No. of nests with eggs	Species codes	No. of active nests	No. of nests with chicks	No. of nests with eggs
DCCO	95		16	WHIB			
GWHE	10	2		LBHE			
GBHE	1			TRHE			
GREG				REEG			
SNEG				BAEA			
ROSP	12	3		OSPR			
BRPE				ANHI			
MAFR				Other	1	0	0

Comments: DCCO = 10 + 10 + 14 + 15 + 2 + 12 + 1 + 4 + 11 + 16 + 13 + 13 + 13 + 2 + 12 + 14 + 1 + 1 + 1 + 3 + 2 + 1 = 95
 GWHE = 2 + 2 + 2 + 1 + 2 + 1 = 10
 ROSP = 1 + 1 + 1 + 1 + 1 + 1 + 3 + 1 + 1 = 12
 GBHE = 1

Figure 37. The compiled corresponding data sheet.

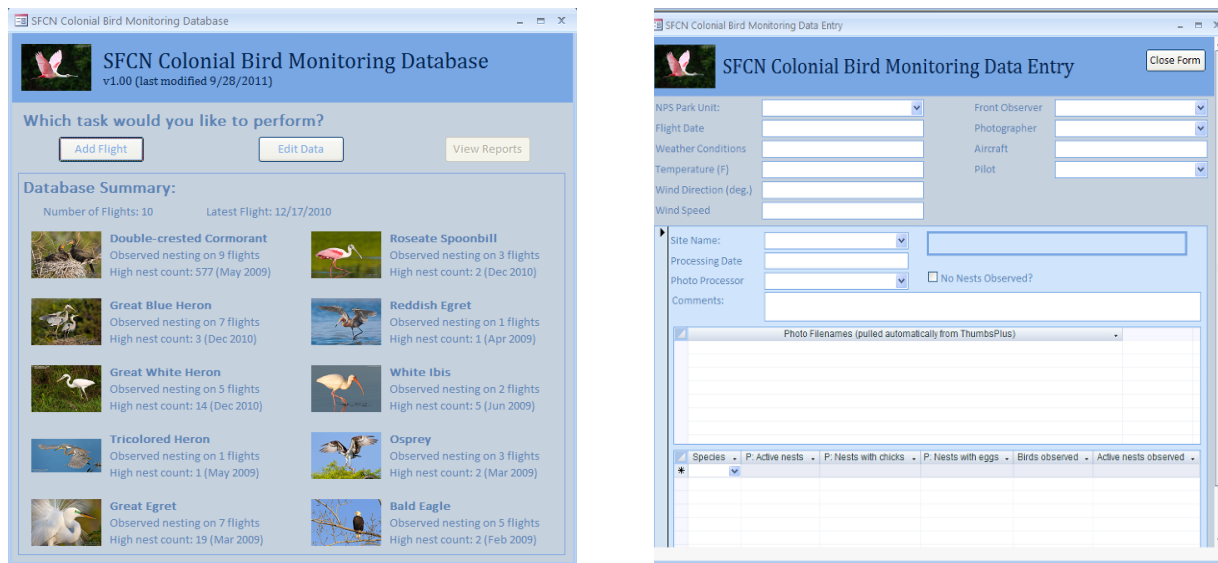


Figure 38. The new Access database developed by the SFCN can provide reports more efficiently than spreadsheets.



Figure 39. This photograph, from Jones Lagoon, shows a Great White Heron on a nest with a chick. The magenta colored circle denotes an active nest with a chick.

The process of data collection and processing resulted in the completion of several Standard Operating Procedures (SOPs). The SOPs completed to date include: Flying in a Helicopter, Camera Setup and Photography Methods, Thumbs plus and Photo Archive, Data Collection Methods, and Data Entry, Editing and Proofing. An SOP for Data Reporting is currently under development. These SOPs have streamlined training, provided for staff succession, and allowed for better consistency in data collection and processing. One flight was performed to determine the feasibility of using a fixed-wing aircraft for BISC, but it has been determined a helicopter is better suited for the data collection required.

For the year 2011, no monitoring flights were performed in BICY. A rare and intense fire season within the Big Cypress National Preserve forced postponement of scheduled flights that extended beyond the nesting season. Timing of the flights is crucial to ensure accurate data, and we

remain confident in our ability to execute this monitoring program since the FY11 fire season was a rare condition for BICY.

Using input from BUIS, VIIS, and EVER, the SFCN has authored SOPs for colonial bird monitoring in their respective parks. The SFCN is currently waiting for input from the remaining network parks to finalize developing their monitoring SOPs.

Continuation in FY12: SFCN will continue monthly helicopter flight monitoring in BISC. The Colonial Bird Monitoring Protocol and related SOPs will be refined as needed and an SOP for data reporting will be completed. We will try to get data gathered from network parks monitoring projects and report it through SFCN.

In the nesting season of 2012, the SFCN plans two fixed-wing aircraft flights through BICY searching for confirmation of bird colonies. Due to a reduction of funding for CERP-RECOVER, Dr. Peter Frederick's efforts to continue monitoring colonial birds may be reduced or eliminated, if this occurs, SFCN will be the only group able to conduct spatially extensive monitoring of wading bird nests in BICY.

Forest Ecotones and Community Structure, Mangrove-marsh Ecotone, Wetland Ecotones and Community Structure Vital Signs (BICY, BISC, BUIS, DRTO, EVER, SARI, VIIS)

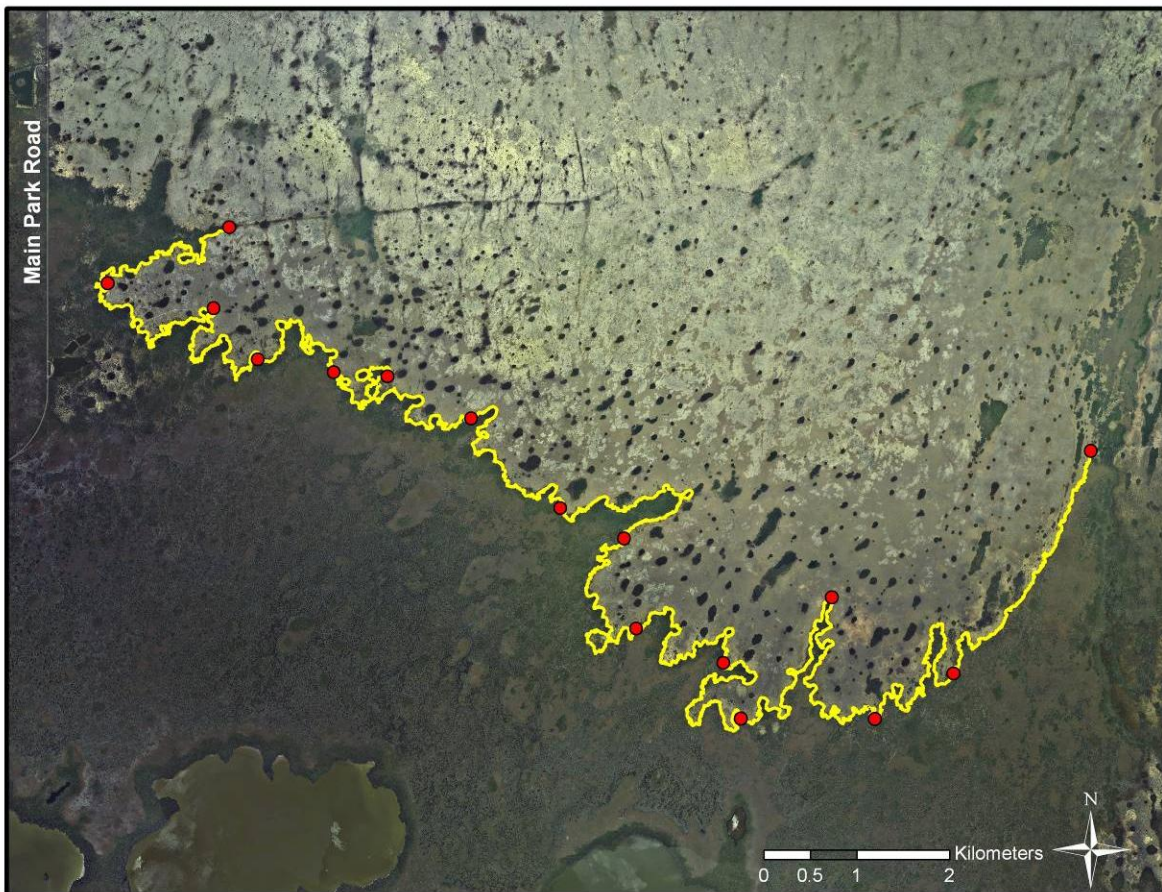


Figure 40. Mangrove-marsh ecotonal movement monitoring area installed west of Taylor Slough, EVER. Yellow line is the digitized ecotonal boundary (treeline) and the red points are the ground truth sites.

Vegetation Monitoring Protocol Development

Accomplished in FY11: SFCN is drafting the Forest Vegetation Monitoring Protocol which incorporates both the Forest Ecotones and Community Structure and Mangrove-Marsh Ecotone Vital Signs. SFCN also has a partial draft of the Wetland Vegetation Monitoring Protocol which includes the Wetland Ecotones and Community Structure Vital Sign.

SFCN began field implementing the Forest Vegetation Monitoring Protocol in FY11. To date, two mangrove-marsh ecotone monitoring areas have been established in EVER. The monitoring areas of interest include the area from Main Park Road to Mahogany Hammock and from near Main Park Road to west Taylor Slough. These two areas cover more than 80km of mangrove-marsh ecotone using a method that combines remote monitoring with aerial imagery and on-the-ground field measurements in order to obtain a regional perspective. This work represents the beginning of year one for mangrove-marsh ecotonal movement monitoring. SFCN also began the process of site selection for core forest monitoring plots. An oversample draw of points, using GRTS methodology, was performed for SARI. SFCN began scouting and evaluating these points for possible core monitoring sites in May 2011. Additional pilot vegetation data for power analysis was also collected while at SARI. Potential forest monitoring sites were also scouted at BUIS during this visit. The SFCN staff spent approximately 227 field hours working on the ecotonal work and 321 field hours working on the forest structure parts of this vital sign. We see this time commitment increasing for the foreseeable future.

Continuation in FY12: The Forest Vegetation Monitoring Protocol will be finished and submitted for external review during the first half of FY12. Further development of the draft of the Wetlands Vegetation Monitoring Protocol is pending results of funding changes and reorganization of existing monitoring in EVER as part of the Comprehensive Everglades Restoration Plan (CERP).

SFCN will establish three additional mangrove-marsh ecotone monitoring areas (yielding a total of five areas) and conclude year one baseline data collection for this portion of the Forest Vegetation Monitoring Protocol. SFCN will also begin establishing forest structure plots in various park units and begin collecting data for year one of that portion of the Forest Vegetation Monitoring Protocol.

Legacy Vegetation Monitoring: Big Cypress National Preserve (BICY) - Relocation and sampling of historic Gunderson and Loope (1982) vegetation plots



Figure 41. SFCN crew resampling pineland vegetation plots at Raccoon Point.

Accomplished in FY11: Six historic vegetation plots were relocated and resampled by the SFCN in FY2011. Four plots were in the Raccoon Point area of BICY and two were northwest of the intersection of Tamiami Trail and Raccoon Point Road although they were originally included as part of the Pinecrest map and study area of BICY by Gunderson and Loope (1982). The Raccoon Point area included two pineland plots, one cypress dome, and one dwarf cypress prairie plot. The “Pinecrest” plots were dwarf cypress prairie. These data have not yet been analyzed.

Continuation in FY12: In FY12, SFCN will attempt to relocate and resample the remaining seven historic vegetation plots in BICY that were established by Gunderson and Loope. These plots have been added to the SFCN Forest Vegetation Monitoring Protocol as part of a set of legacy plots separate from our core monitoring plots. The work planned for FY12 will conclude our initial resampling of historic plots in BICY. The return period for revisiting these plots has yet to be determined.

Legacy Vegetation Monitoring: Biscayne National Park (BISC) – Relocation and resampling of permanent forest plots

Accomplished in FY11: There were thirty-two long term tree plots established by Bradley Bennett in 1995 and 1996 and sampled by Brooke Shamblin until 1998 in BISC. The tree plots are 20m x 20m squares and include nested 5m x 5m sapling subplots and .5m x .5m seedling plots. There are eight tree plots each on four islands (Elliott Key, Sands Key, Old Rhodes Key, Totten Key). The eight tree plots on Elliott Key were re-sampled in FY10. Analysis of the tree plots shows a decrease of 167 trees with the tree basal area only slightly higher since 1997. The trees exhibiting the highest density loss were the pioneer species *Eugenia foetida* (Spanish stopper), *Pithecellobium keyense* (Blackbead), and *Metopium toxiferum* (Poisonwood). This data suggests a maturing forest where the pioneer species are thinning out, while other species, especially *Coccoloba diversifolia* (Pigeon Plum) are becoming larger trees. The results of this work were reported in a first draft technical report written in FY11. Two long-term forest plots on Old Rhodes Key were sampled in BISC in FY11. Analyses of the two Old Rhodes Key plots indicated mortality of four individuals and recruitment of seven trees. The basal area increment increased by 1,971 cm² for the 800 m² sampled. This initial analysis suggests a low mortality of trees, but the trees are becoming larger.

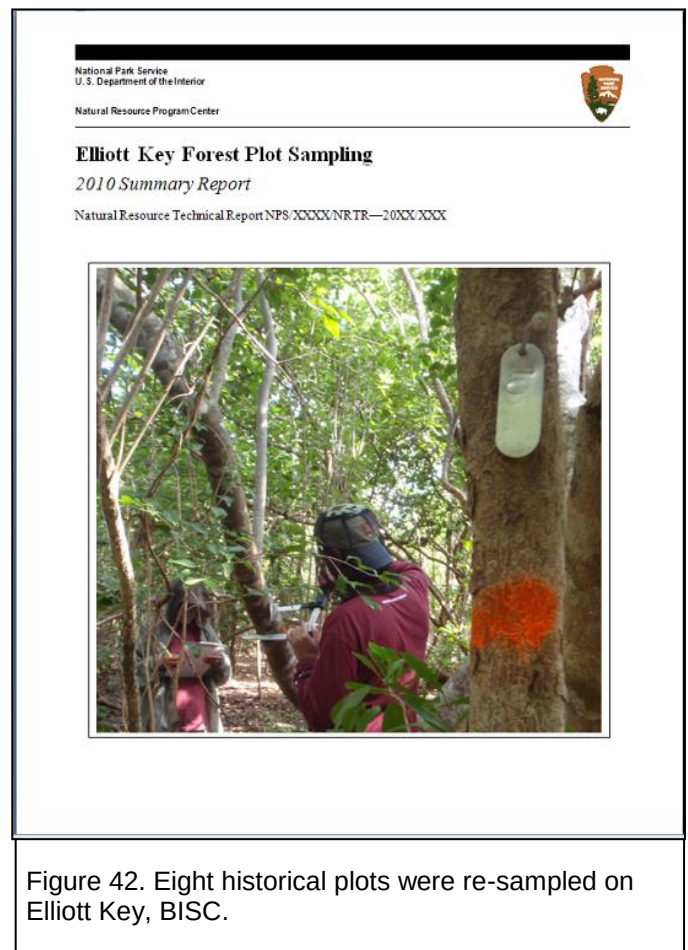


Figure 42. Eight historical plots were re-sampled on Elliott Key, BISC.

Salt River Bay National Historical Park & Ecological Preserve (SARI) – Re-visit of permanent exotic plant removal efficacy vegetation plots.



Figure 43. Permanent exotic plant removal efficacy plot showing tagged trees and location of a seedling plot in SARI.

Accomplished in FY11: In May 2011, the SFCN re-visited the efficacy plots for a quick check to see what was replacing the treated vegetation. In four of the five plots, the exotic Guinea Grass (*Urochloa maxima*) was dominating, with the presence of many seedlings and re-sprouts of the exotic Tan Tan (*Leucaena leucocephala*). The other plot (Plot 3) is located in a native dry forest which had low exotic plant cover. In this plot, the exotics that were treated (mainly Tan Tan) were dead with little re-sprouting occurring. These observations suggest that in areas of high exotic plant cover, continued re-treatment may be necessary to keep the exotics under control until native vegetation is able to become established. Within Plot 3, SFCN continued measuring the trees within the 15m radius circle and established four seedling subplots. A total of 697 trees were tagged and measured, with the Black Mampoo (*Guapira fragrans*) as the dominant tree species. In the seedling plots, the dominant species was *Eugenia biflora*.

Continuation in FY12: Complete the sampling of Plot 3. This data is being used in the Forest Vital Sign Monitoring to help determine the proper plot size and logistics regarding Forest Structure plots in the Virgin Island parks units.

Coastal Geomorphology Vital Sign - Soil Elevation Tables (SET)(BISC)



Figure 44. SFCN crew established a second Soil Elevation Table monitoring site in BISC.

Accomplished in FY11: We established the second soil elevation monitoring site in BISC this year. Building upon the assessed 21 potential sites in FY09, this site was picked to minimize confounding effects. This site had low trash content, no berm present, low potential for discovery by public, ease of access, moderate sapling presence and enough distance from tidal creeks to minimize hydrologic impacts. Both soil elevation sites within BISC are on the main shoreline and within Biscayne Bay Coastal Wetlands restoration foot print. We have a draft copy of the protocol which builds upon the NPS protocol Monitoring Salt Marsh Elevation Cape Code National Seashore and the Louisiana Department of Natural Resources Coastal Restoration Division.

Continuation in FY12: We will finish adapting the SFCN SET protocols. We will take initial measurements and establish stage monitoring equipment at the site. We will explore SET establishment in SARI and VIIS.

Invasive/Exotic Plants Vital Sign - Corridors of Invasiveness (BICY, BISC, EVER)

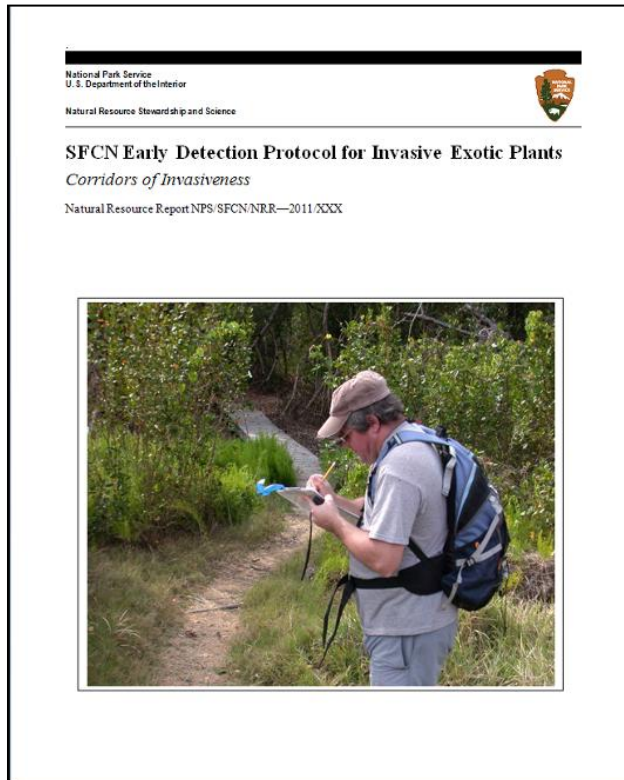


Figure 45. The SFCN Early Detection Protocol for Invasive Exotic Plants is near completion and will be sent out for final review.

Accomplished in FY11: The Corridors of Invasiveness Vital Sign monitors for new invasive-exotic plant species establishing in corridors. Additionally, our collaboration with the FLACO EPMT allows for early detection and rapid response to these plants. With the completion of the pilot study for the Corridors of Invasiveness Protocol, the data were analyzed and the protocol written in FY10. The protocol returned from the SFCN internal review process and was re-written based on comments received. The protocol is now complete and has been sent out for external peer review. The summary report for the 2009 pilot study came back from the review process and corrections have been made. This report is now ready to be sent with the protocol for official acceptance.

Official field work on this Vital Sign was initiated in 2011 in BISC. A total of 35.71 miles were surveyed and 33 species of exotic plants found. Of these species, three of them were new to the park. The new species were the Karum Tree (*Pongamia pinnata*), Bo Tree (*Ficus religiosa*), and the Java Plum (*Syzygium cumini*). All three species were treated. Small infestations were treated on the spot, while large infestations were reported to the park and to the Exotic Plant Management Team. A summary report for the 2011 survey was completed and ready for submittal.

Continuation in FY12: Implementation of this protocol in EVER will start in spring of 2012 and a summary report for the findings that year will be written.

Invasive/Exotic Animals Vital Sign (EVER, BICY)

Accomplished in FY11: The SFCN helped host a non-native fish discussion workshop held at the Southern Division of the American Fisheries Society Meeting in Tampa, Florida (Jan. 14 – 16). This discussion workshop was organized through a collaboration of Everglades National Park (EVER), U.S. Army Corps of Engineers (USACE), and the SFCN. The goals of this workshop were to address the potential impacts of non-native fishes on EVER as a result of Everglades restoration, propose options for the management of non-native fishes that can be incorporated into future restoration plans, and discuss the opposing viewpoints held by state and federal agencies concerning the handling of non-native fish inhabiting the canals adjacent to EVER. As a result, a “white paper” was composed by USACE facilitators to address these concerns and is currently under review for online publication.



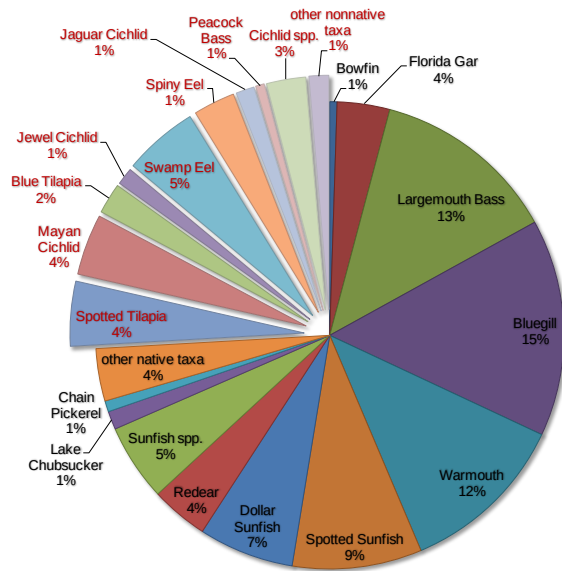
Figure 46. Spotted tilapia (*Tilapia mariea*) collected in the L-31W canal bordering Everglades National Park; one of several non-native fish species caught by USACE fisheries biologists Jack Killgore and Jan Hoover during their south Florida visit (inset photo).

The SFCN attended a week-long U.S. Fish and Wildlife Service (USFWS) electrofishing course offered at the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Feb. 27 – Mar. 4). The SFCN electrofishing boat and equipment were brought to this course for evaluation and testing by the instructors. Based on the suggestions and recommendations of the instructors, further field evaluations were conducted by SFCN staff. These investigations allowed us to determine electrical field output, standardize electrofishing power, and determine electrode type efficiency.

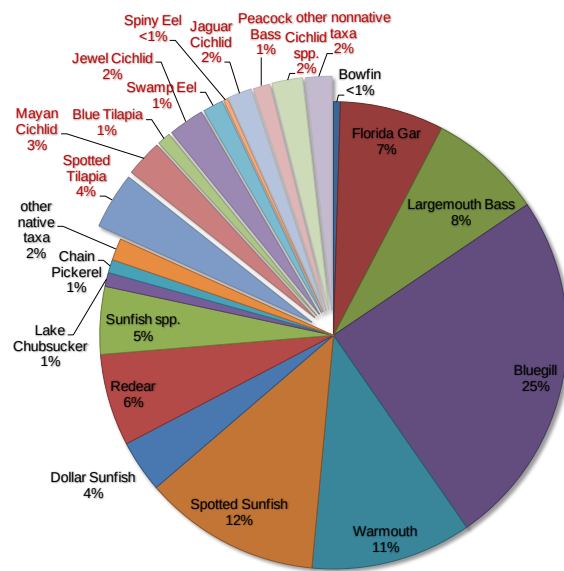


Figure 47. Wildlife biological technician Raul Urgelles gives a brief description of the SFCN electrofishing boat and equipment setup to a crowd of course participants and to USFWS fisheries biologist and course instructor Alan Temple.

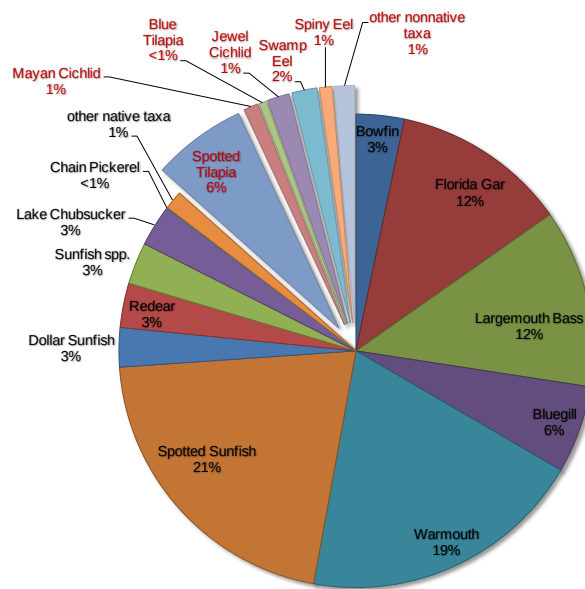
The SFCN continued their collaboration with Dr. Jennifer Rehage of Florida International University (FIU) who conducted the second year of their Critical Ecosystem Studies Initiative (CESI) project, which is investigating how man-made canals function as habitat for both native and non-native fishes. SFCN staff participated in extensive canal electrofishing conducted by FIU during the dry season (Feb. 22 – Apr. 26). The SFCN will design its Non-Native Fish Monitoring Program in the canals adjacent to EVER based on the outcome of the CESI project. The SFCN staff spent approximately 564 field-hours working on this vital sign. We see this time commitment being relatively high for FY11, but predict a reduction in the out years, once the more truncated ongoing monitoring work begins.



Early Wet Season (June 2010)



Late Wet Season (Oct. – Nov. 2010)



Dry Season (Feb. – Apr. 2011)

Figure 48. Pie charts showing the percent-composition of electrofishing samples in canals for the 2010 early and late wet seasons and 2011 dry season. Nonnative taxa are represented in red text and comprised 23% of the total catch for the early wet season (1,185 fish), 19% of the total catch for the late wet season (2,714 fish), and 13% of the total catch for the dry season (5,406 fish).

Continuation in FY12: The SFCN will move forward in coordinating efforts with EVER and FIU personnel regarding fieldwork. Raul Urgelles will continue to communicate regularly with all involved parties and update them on the status of the SFCN's progress toward this collaborative effort. The SFCN will evaluate modifications from the current electrofishing methodology to determine limitations of the currently collected data (i.e., nighttime electrofishing, electrofishing depletion study, use of minnow traps, Rotenone, Fyke net sampling, etc.). The final invasive/exotic fish protocol should be in draft form by the end of FY13.

Periphyton Vital Sign (BICY)

Accomplished in FY11: In November 2010, the SFCN conducted its third sampling of periphyton in the Big Cypress National Preserve (BICY). The goal of the 2010 sampling was to detect any temporal variability in the structure of diatom communities both within and among the hydrological basins in the northwest portion of the preserve. Periphyton mat samples were once again collected from sites in six hydrological basins, three nutrient-impacted and three unimpacted, topographically defined by watershed boundaries and flow direction. The sample size was decreased from the previous year's collection: 36 samples in 2010 as opposed to 65 samples in 2009. The goal of the 2010 sampling was to investigate temporal changes in periphyton communities at sites that had been repeatedly sampled. Sites within the basins were accessed by helicopter and by all-terrain vehicles (ATVs). Samples were preserved and sent to Dr. R. Jan Stevenson at Michigan State University for diatom identification and community analyses.

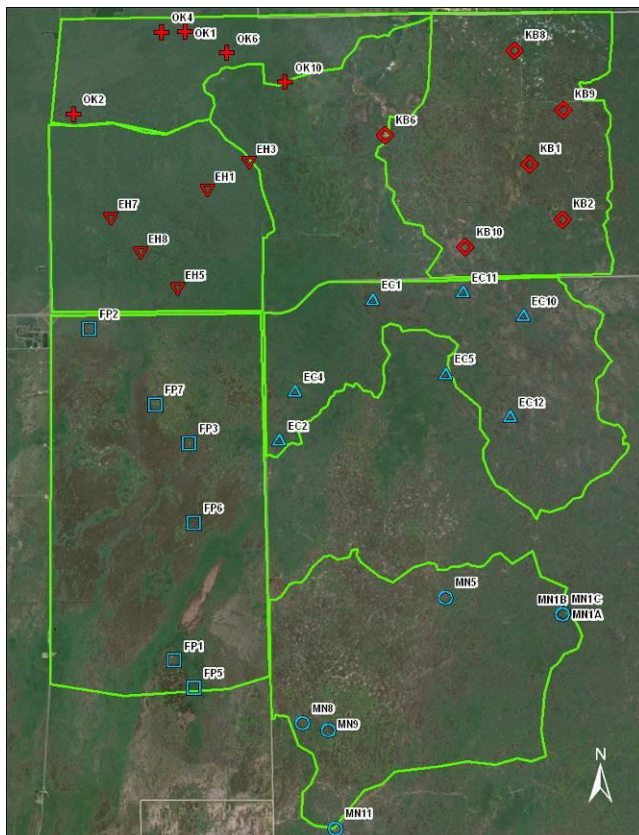


Figure 49 (Left). The 36 sites sampled for periphyton in November 2010.

Figure 50 (Above). SFCN community ecologist Kevin Whelan prepares to exit helicopter at sampling site.

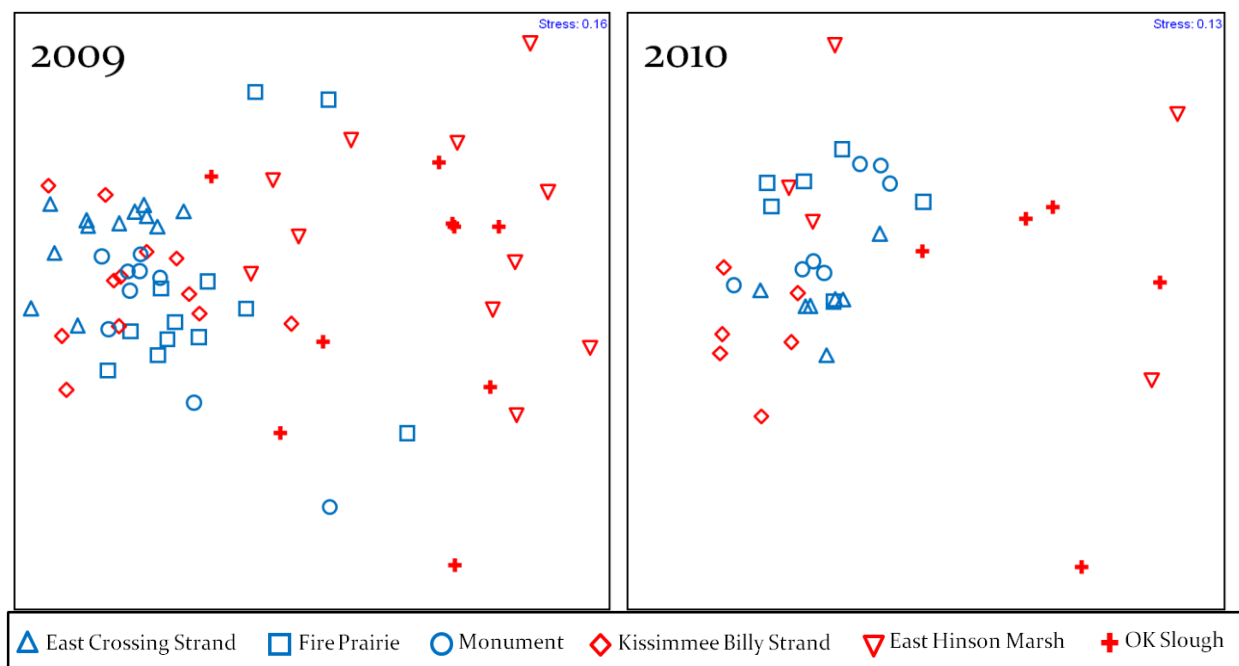


Figure 51. Non-Metric Multi-Dimensional Scaling (NMDS) graph of diatom communities in periphyton mats collected from sites in impacted basins (red symbols) and unimpacted basins (blue symbols), sampled in Big Cypress National Preserve in 2009 and 2010.

The Stevenson lab provided the SFCN with preliminary results of their analyses on the diatom communities found in the 2009 and 2010 periphyton samples. These results showed distinct diatom assemblages in impacted versus unimpacted sites within northwest BICY, with the exception of the Kissimmee Billy Strand basin. Kissimmee Billy Strand was selected *a priori* as an impacted basin; however, diatom community species composition there is similar to community species composition in unimpacted basins. Analyses of the data will determine if there is spatial and temporal variation in the diatom communities within each basin.

Continuation in FY12: The SFCN will again sample periphyton from the six hydrological basins delineated within northwest BICY and will continue to coordinate with BICY staff (hydrologist Robert Sobczak, hydrological technician Paul Murphy, and biological technician John Kellam) for logistical support during the collection. The goal for Fall 2011 sampling is to determine temporal variability from the previous two years. After this sampling event, the SFCN should be able to produce a BICY Periphyton Protocol in the end of FY12.

Freshwater Fish and Large Macro-invertebrates Vital Sign (BICY)

Accomplished in FY11: The SFCN did not conduct any sampling of freshwater fish and large macro-invertebrates due to time constraints. Monitoring for this vital sign initially called for a coordinated sampling effort of this and two other relevant vital signs: Periphyton and Aquatic Invertebrates in Wet Prairies and Marshes. All sampling would take place in the northwest portion of Big Cypress National Preserve (BICY). We completed our sample-processing room. The room is furnished with two Leica stereo microscopes and associated video equipment. An HDV camcorder is attached to one of the microscopes and displays the view on an LCD screen, to allow for training and ease of identification.

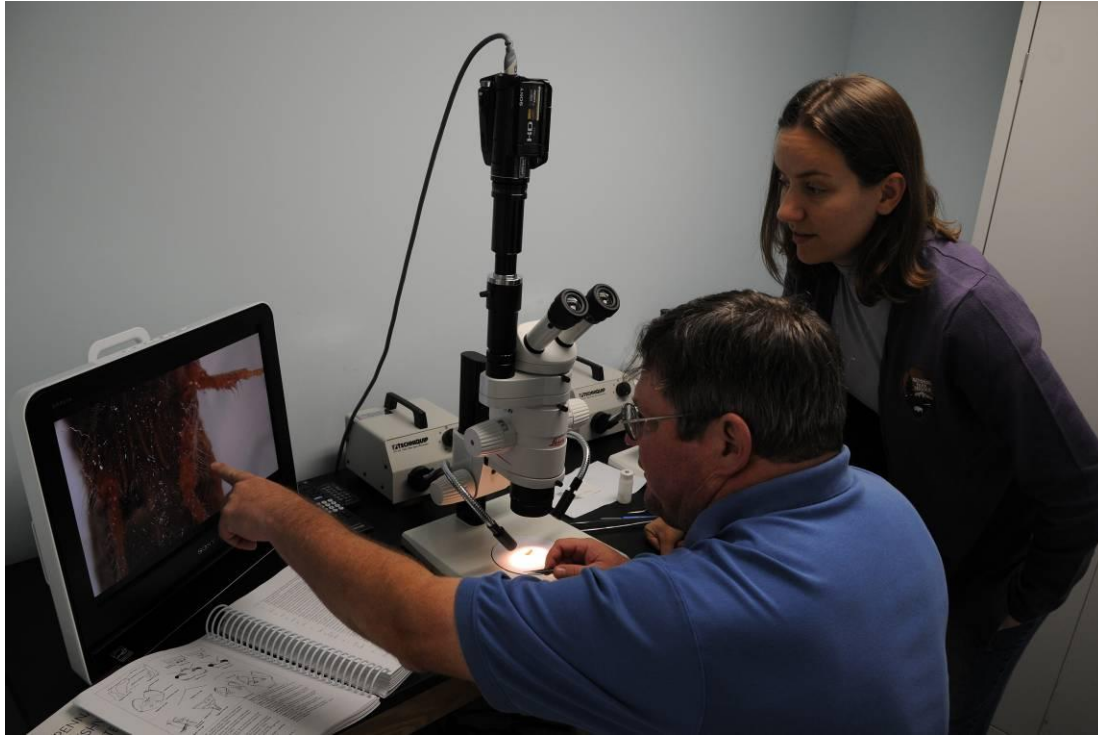


Figure 52. SFCN botanist Brooke Shamblin and biological technician Helena Giannini use a stereomicroscope and video equipment to discuss key features in the identification of a dragonfly larva.

Continuation in FY12: The earliest that the SFCN will initiate a pilot study to sample fish and macro-invertebrates in the northwest portion of BICY would be in FY13. Sampling methodology for this vital sign will either be similar to that used to sample forested areas (BICY, Audubon of Florida) or marshes (EVER, Florida International University). The SFCN will determine if sampling sites for this vital sign will be located next to existing periphyton sampling sites or have its own sample frame.

Aquatic Invertebrates in Wet Prairies and Marshes Vital Sign (BICY)

Accomplished in FY11: The project initially called for a coordinated sampling effort of this vital sign with the Periphyton and Freshwater Fish and Large Macro-invertebrates vital signs, in the northwest portion of Big Cypress National Preserve (BICY). The SFCN did not conduct any field sampling of aquatic invertebrates in wet prairies and marshes; however, we did explore the use of a U.S. Fish and Wildlife Service (USFWS) protocol: “Procedure for the Collection of Field Identifiable Freshwater Wetland Macroinvertebrates Using a Time-Limited Qualitative Dip-Net Method.” The advantage of which is no need for extensive post-sampling invertebrate identification. There is a strong relationship between macro-invertebrate communities and water quality impacts.

Continuation in FY12: The SFCN will continue to communicate with USFWS biologist Steve Mortellaro on the application of the above sampling method. We will initiate a pilot study and attempt to apply this sampling method in the field in BICY. The pilot study will be conducted in sites near current periphyton sampling locations in order to be able to build upon current knowledge. Sampling for this vital sign may be done in conjunction with future fish and macro-invertebrate sampling.

I.C Data Management, Analysis, and Reporting Branch

Overview

The Data Management, Analysis and Reporting Team worked this year to assist vegetation and benthic map production; review and resolve issues on the Small and Medium Mammal project; GIS, data management, and analytical support to the various vital sign and water quality monitoring projects underway; provide IT support to SFCN; further develop the SFCN web page; develop various QA/QC, reporting and graphing templates and procedures; and provide information support to the parks. When Rick Jacobson, our former Administrative Assistant, took another job in June, Rachel Vargas took over timekeeping and other administrative tasks and Brian Witcher took over budget tracking. The team also helped with the field implementation of some of the vital signs with Brian Witcher providing assistance with reef fish monitoring and coral monitoring. Presentations were given at the George Wright Society conference in March.

Michiko Squires, Kelly Bowman, Elle Anzinger all finished up internships working with SFCN. Mario Londono became the new SCA intern in May. Jed Redwine was hired as the new Natural Resource Condition Assessment Ecologist. Brian Witcher received a promotion to a GS-12, Judd Patterson was converted as a SCEP to a permanent position, and Rachel Vargas was converted from a SCEP position to a GS-7 term position.

A total of 4 new computers were purchased in FY11. Currently there are a total of 24 functioning workstations and 8 laptops in the Florida SFCN office. A new automatic tape backup system was purchased and installed in the VIIS IT closet of building 3. This system will allow daily backup and quarterly archiving of files written by SFCN and VIIS to the SFCN-island based server. SERO Regional IT staff installed a Juniper VPN box, providing a secure connection to the DOI intranet. A DOI-T1 circuit was installed at Florida SFCN office, providing intranet access to the office and allowing for long-awaited connectivity between SFCN and VIIS servers.

A report tracking database was developed and all SFCN reports were uploaded into NRInfo and to the SFCN web page. The team continues to work on completing reporting loop pathways, developing automated database reports and queries, graphing templates and reporting templates. A SOP was developed this year allowing photos entered into a Thumbs plus database to be renamed using fields in the database, allowing a software-independent, information-rich version of photos to be given to parks and cooperators. A revised SFCN Network Brochure was created.

Staff fulfilled at least 29 requests for spatial data, reports, and analysis assistance from national parks, universities, NGO's and state/federal agencies.

Judd Patterson and Jeff Miller were successful in partnering with Garmin to get the NPS boundaries for VIIS, VICR, BUIS and SARI on Garmin GPS base maps. Jeff is seeking input from VIIS for information (e.g., proper mooring use and payment details) that will be placed on the electronic maps. Additionally, Julia Brunner (NPS), Cliff McCreedy (NPS), Lauren Wenzel (NOAA) and Russell Callender (NOAA) have been enlisted through contact with Jeff in the effort to get NPS marine area boundaries on NOAA paper charts.

The sections below only addresses issues not covered in other branches above.

Inventories

Biscayne BioBlitz

Project Status: Data from scientists who took samples from Biscayne Bioblitz 2010 was collected, QA/QC'd, and a summary report drafted. Interviews were conducted with the Incident Command section leads and lessons learned are included with the report. Draft reports were sent to participating scientists for review.

BioBlitz 2010 produced some powerful results. The numbers as of the draft September 2011 report are:

- Total participation was estimated at over 2500 people including over 1300 students and 170 scientists and researchers.
- 532 of 1027 species identified during BioBlitz (52%) were new to the park list. The overall park species list was increased by 39%.
- A new tardigrade species to science was identified and named after Biscayne National Park: *Archechiniscus biscaynaei*
- A new lichen species to science and a new lichen genus to science were discovered and will be published soon. Seven species of lichen found are new to North America.
- Major increases in species documented in the park occurred in taxa such as algae, ants, butterflies/moths, corals, lichens, sponges, tardigrades, and other marine invertebrates.

Table 6. Count of species identified in Biscayne National Park during BioBlitz 2010 as of September 2011.

Taxa Group	Total # species detected during BioBlitz	# New species to park list	Percent new species
Amphibian	4		0%
Mammal	8		0%
Reptile	9	*	0%
Fish	161	5	3%
Bird	86	3	3%
Vascular Plant	211	21	10%
Coral	49	25	51%
Other Marine Invertebrate	255	238	93%
Insect	57	54	95%
Non-vascular Plant	126	125	99%
Fungus (Lichen)	61	61**	100%
Grand Total	1027	532	52%

* 1 new snake subspecies detected during BioBlitz

** includes 1 new species to science and 7 species new to North America

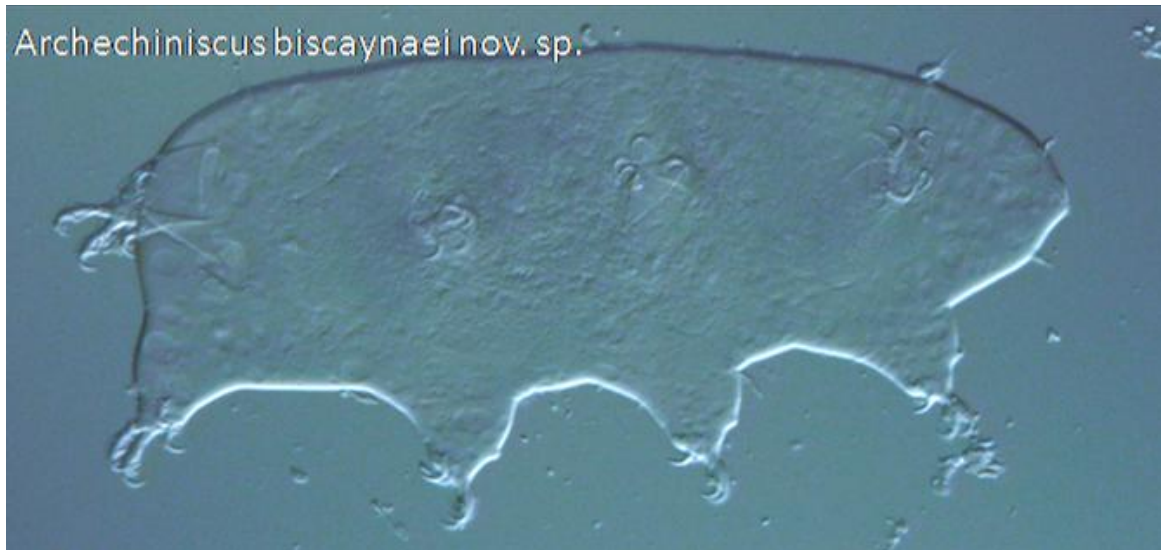


Figure 53. New tardigrade species to science found during BioBlitz 2010 was named after Biscayne National Park. Photo credit: William R. Miller, Baker University.

The new list of species found in Biscayne National Park has already been used to update the park web page and will be used to update the National Park Service NPSpecies database.

From an Inventory and Monitoring program viewpoint, Biscayne National Park's BioBlitz greatly increased lists of species in taxa not covered under I & M program inventories, i.e. invertebrates, fungi, and non-vascular plants. The I & M program had previously funded inventories of vertebrates and vascular plants with a goal of identifying at least 90% of these species in the park. With only 0-3% of vertebrate species and 10% of vascular plant species new to the park list, this goal was likely met. And as six of the 21 new plant species were exotics, including a tomato plant, some could easily have been introduced after the original plant inventory in 2004.

Continuation in FY12: Comments from participating scientists and some additional species identifications submitted will be incorporated into the database and report and the report finalized and published. The species new to the park list, digital voucher specimen information, any relevant references, and the record of observation will be uploaded into NPSpecies database (located at <https://irma.nps.gov/App/Species/Welcome>).

Inventory of bats – (BICY, BISC, BUIS, DRTO, EVER, SARI, VIIS)

Project status: Species lists by park were harvested from the Anabat software files (summary list provided in Table 7).

Continuation in FY12: A brief report will be available in early 2012.

Table 7. Bat species detected by park.

Scientific Name	Common Name	BICY	BISC	BUIS	DRTO	EVER	SARI	VIIS
<i>Artibeus jamaicensis</i>	Antilles fruit bat							X
<i>Brachyphylla cavernarum</i>	n/a						X	X
<i>Corynorhinus rafinesquii</i>	Rafinesques big-eared bat	X						
<i>Eptesicus fuscus</i>	Big brown bat	X	X			X		
<i>Eumops glaucinus</i>	Wagner's mastiff bat	X	X			X		
<i>Lasiurus intermedius</i>	Northern yellow bat	X	X			X		
<i>Lasiurus seminolus</i>	Seminole bat	X				X		
<i>Molossus molossus</i>	Cuban house bat	X	X	X		X	X	X
<i>Mormoops blainvilli</i>	Antillean ghost-faced bat							X
<i>Myotis austroriparius</i>	Southeastern myotis	X						
<i>Noctilio leporinus</i>	Fishing bat						X	X
<i>Nycticeius humeralis</i>	Evening bat	X	X			X		
<i>Pipistrellus subflavus</i>	Eastern pipistrelle	X				X		
<i>Tadarida brasiliensis</i>	LeContes free-tailed bat	X	X	X		X	X	X
Total Species Detected	14	10	6	2	0	8	4	6

Vegetation Mapping Web Page and Benthic Habitat Mapping Page

The Vegetation Mapping inventories web page which contains final vegetation mapping project data, reports, and maps has been updated with two new vegetation maps published this year- the vegetation map of Dry Tortugas National Park and the vegetation map of Salt River Bay National Historical Park and Ecological Preserve.

(http://science.nature.nps.gov/im/units/sfcn/veg_maps.cfm)

A Benthic Communities Extent and Distribution vital sign webpage; i.e. benthic mapping, was created this year and includes the final report, project data, and maps for the Dry Tortugas Benthic Habitat Mapping project.

(http://science.nature.nps.gov/im/units/sfcn/benthic_mapping.cfm)

Continuation in FY12: SFCN will continue to update final vegetation mapping project files and data as needed and will upload all final product files for the Biscayne National Park Benthic Habitat Mapping project to our website once it is finalized.

Vital Signs Monitoring



Colonial nesting birds (BISC, DRTO)

Accomplished in FY11: An Access database was developed to store the field and photo data collected for colonial birds in BISC. The three years of pilot data has been entered and now a series of reports can be developed. Scheduling problems did not allow Judd Patterson to assist Sonny Bass of EVER with colonial bird monitoring this year.

Continuation in FY12: We expect to assist with data summary/reporting for colonial bird monitoring in BISC. Judd will again assist the DRTO and BISC monitoring efforts as requested.

Invasive/Exotic Plants – Digital Aerial Sketch Mapping (BICY, EVER)

Accomplished in FY11: Judd Patterson provided Tony Pernas with aerial imagery and logistical support while preparing for his 2011 flights.

Continuation in FY12: The Data Management, Analysis and Reporting Branch will work with Tony Pernas of the NPS-EPMT program to develop a protocol/SOP for the Digital Aerial Sketch Mapping that Tony currently conducts. EPMT staff will be taking a lead role and we will be providing assistance. SFCN will be providing assistance in post-processing of the digital sketch mapping with the SFCN-SCA contributing 2 weeks of time.

Land use change (BICY, BISC, BUIS, EVER, SARI, VIIS)

Accomplished in FY11: SFCN performed a proof-of-concept analysis of land use trends using the NPScape data provided by the Washington Support Office of the NPS (WASO) office, the zoning data obtained from counties in South Florida, and permitting data gathered for the community of Cutler Bay. The analysis was based on the changes occurring in land uses surrounding NPS units as indicated by factors such as population density, housing density, urban development expansion, permit applications, and zoning. A SOP was developed for translating Cutler Bay's permitting records to geocoded addresses using ArcMap. Permit records were also obtained from Collier County. All of the above has been summarized in a report and presented at the 3 Year Review.

Continuation in FY12: SFCN will contact local county government entities and inquire about the intervals in which zoning data is updated as well as permitting records (if available). SFCN will also contact local agencies in the U.S. Virgin Islands to obtain all available zoning and permitting data. SFCN will try to develop a draft protocol by the end of FY12 or early FY13.

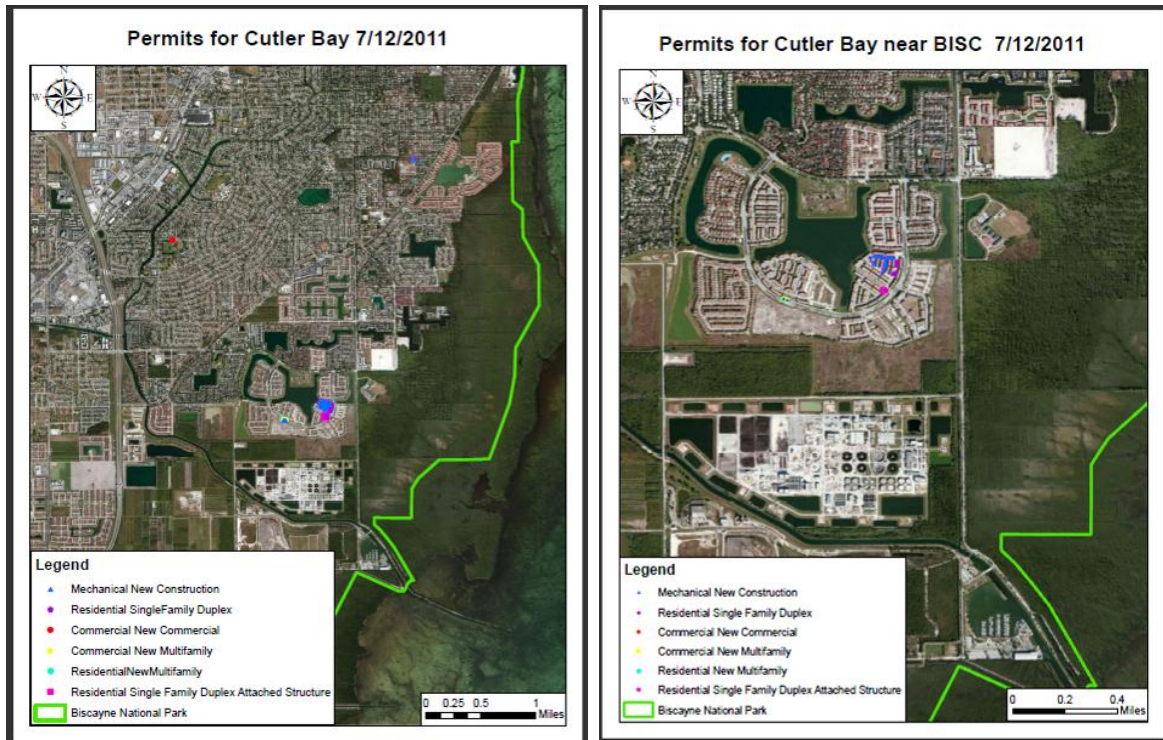


Figure 54. Tracking changes in permits. These are two maps showing addresses of permits in Cutler Bay that were geocoded in ArcMap. The first map shows permits in the city limits of Cutler Bay. The second map shows a cluster permits in Cutler Bay near the Biscayne National Park boundary. The permit types consist of residential and new constructions.

Sea Turtles (BUIS)



Figure 55. Hawksbill Sea Turtle. SFCN has updated a legacy sea turtle database for BUIS.

Accomplished in FY11: The SFCN developed a set of queries to view several of the trends within this dataset.

Continuation in FY12: More extensive reporting will be developed to better tell the story of sea turtle nesting success at BUIS. We will also work with BUIS staff to improve documentation of legacy database fields, as well as convert existing location system to UTM coordinates. We will talk with VIIS, BISC, and EVER to see if they are interested in using the database.

Web page reporting for Vital Signs

Accomplished in FY11: Using the Marine Fish Communities template, four new vital signs webpages were created: Air Quality, Benthic Communities Extent and Distribution, American Crocodile, and Amphibians. Also, Marine Benthic Communities was updated with 2010 Coral reef bleaching and disease data from the U.S. Virgin Islands.

(http://science.nature.nps.gov/im/units/sfcn/air_quality.cfm)

(<http://science.nature.nps.gov/im/units/sfcn/crocodile.cfm>)

(<http://science.nature.nps.gov/im/units/sfcn/amphibians.cfm>)

(http://science.nature.nps.gov/im/units/sfcn/coral_bleaching.cfm).

Continuation in FY12: SFCN will continue to work on summarizing and reporting on other vital sign web pages. In particular, we will focus on the many Category I vital signs whose protocols are currently in development. We will also seek additional guidance from the parks on the level of reporting effort the network will put towards reports/web pages to create for vital signs monitored by the parks and other organizations. In addition SFCN will generate web page links to existing monitoring program documents. In some cases this may simply involve creating links to the CERP RECOVER System Status Report. Web pages currently being worked on include:

- Coastal Geomorphology
- Colonial Nesting Birds
- Contaminants (EPOC samplings)
- Forest Ecotone and Community Structure
- Invasive/Exotic Animals
- Invasive/Exotic Plants (update)
- Land Use Change
- Mangrove Marsh Ecotone
- Marine Benthic Communities
- Periphyton
- Sea Turtles
- Surface Water Hydrology

Reporting Strategies

Accomplished in FY11: In an attempt to make reporting results as easy as possible for SFCN staff, our team is working to develop automated reporting, graphing templates and reporting templates where possible to support the protocols.

For the Corridors of Invasiveness protocol, reports have been built into the database that can be cut and pasted into a pre-formatted Natural Resource Data Series report template. Minor changes to dates, areas surveyed, and special issues are easily incorporated into the template and this allows reports to be generated quickly.

For the Coral Reef Water Temperature protocol, Coral Reef Monitoring Protocol, and Weather Station protocol, graphing templates have been developed. In the case of the Reef Water Temperature database, a Graphing Template query updates data in the graphing template and all graphs will automatically update upon opening of the graphing template file. The graphing templates are in MS Excel to allow them to be easily modified for special needs by any SFCN staff.

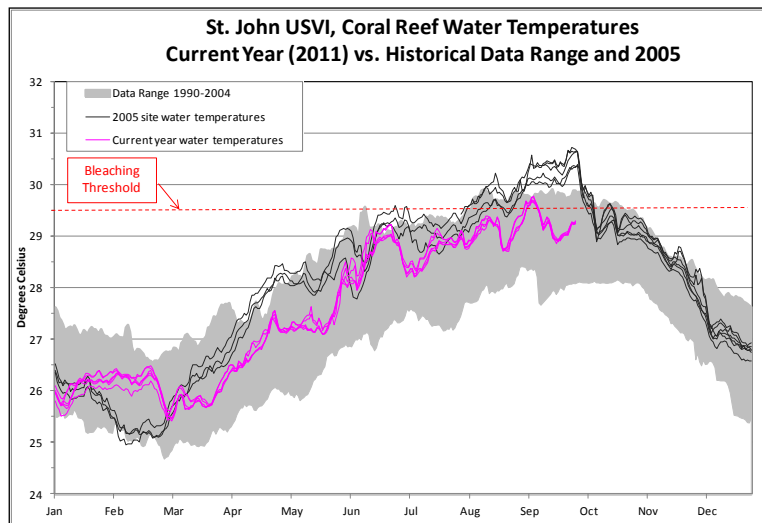
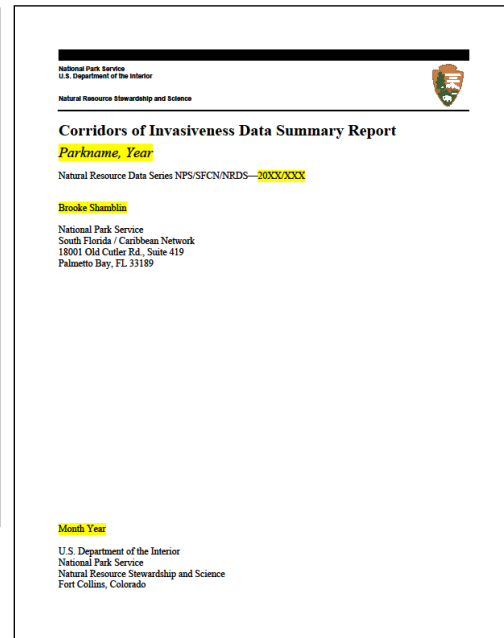


Figure 56. SFCN is developing data summary report templates (above) and graphing templates (right) to assist getting data published and available to managers in a timely fashion.



Continuation in FY12: Development of tools and templates to make reporting easier will continue. Publishing data summaries and making results available on the internet will be a high priority.

Big Cypress National Preserve (BICY) and Everglades National Park (EVER) Natural Resource Condition Assessment

Accomplished in FY11: Jed Redwine was hired as the new NRCA Ecologist. SFCN worked to organize GIS data and metadata for dozens of vector and raster datasets.

Continuation in FY12: The NRCA ecologist will hold initial scoping meetings with EVER and BICY superintendents and resource management staff, to consider frameworks, identify key resources/issues for inclusion, available data and information sources, report out scale(s), and identify/document data gaps where possible. SFCN will assist NPS staff in data mining existing data and information and processing it into forms needed for project analyses. A Phase I Summary report will be completed.

I.D Water Quality Monitoring

Contaminants (BISC, DRTO, EVER)

Accomplished in FY11: The SFCN continued the collaboration with USGS to assess levels of emerging pollutants of concern (EPOCs) and wastewater contaminants that enter the near shore waters of Biscayne Bay and Biscayne National Park. The SFCN again worked in conjunction with the US Geological Survey's Dr. Tim Bargar (Florida Integrated Science Center) and Dr. David Alvarez (Columbia Environmental Research Center) to complete the second and third phase of the project by deploying passive sampling devices at the mouths of several canals that empty into the Bay in April/May and September /October of 2011 respectively.



The polar organic chemical integrative samplers (POCIS) are designed to sample water-soluble (polar or hydrophilic) organic chemicals from aqueous environments. Chemicals sampled can include complex mixtures of pesticides, prescription and nonprescription drugs, personal care and common consumer products, industrial and domestic use materials and degradation products of these compounds. The samplers remain submerged for approximately 30 days before they are recovered by SFCN and USGS staff and returned to the USGS laboratories for analysis. For the project the SFCN provides logistics, field and equipment support to deploy and recover the samplers.

During April and May of FY11 SFCN deployed POCIS at 16 locations in near shore waters of Biscayne Bay. This included 4 more locations than the first phase (See Figure 29). The additional locations were selected to also sample waters coming through the rehydration areas proposed by the Miami-Dade Water and Sewer Department in their Wastewater Reuse Pilot Project. This pilot project would release treated waste water into selected wetlands along the Biscayne Bay coastline (see Figures 30 and 31). This diversion of water flow that eventually would make it to the Bay would serve two purposes; rehydration and filtration.

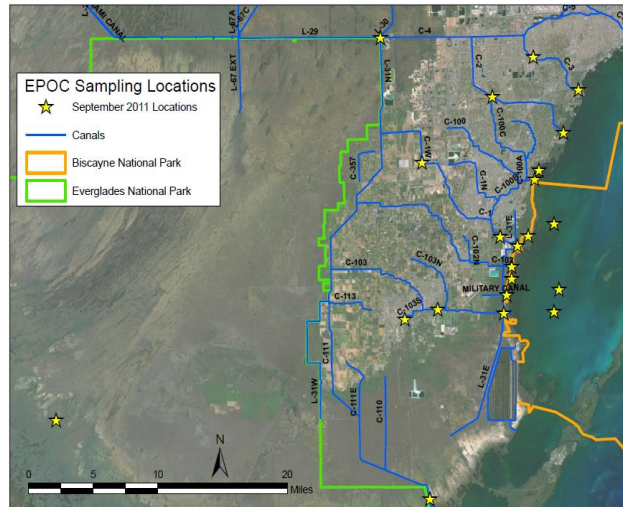


Figure 57. 2011 EPOC sampling locations.

For the sampling event initiated in September 2011, an additional 6 new sampling locations were included for a total of 22 sampling locations. The additional 6 sampling locations were selected for the possibility to detect the presence of contaminants, if any, upstream from the source of water diversion (See Figure 29). These results would serve as a comparison of contaminants to the downstream sampling sites.

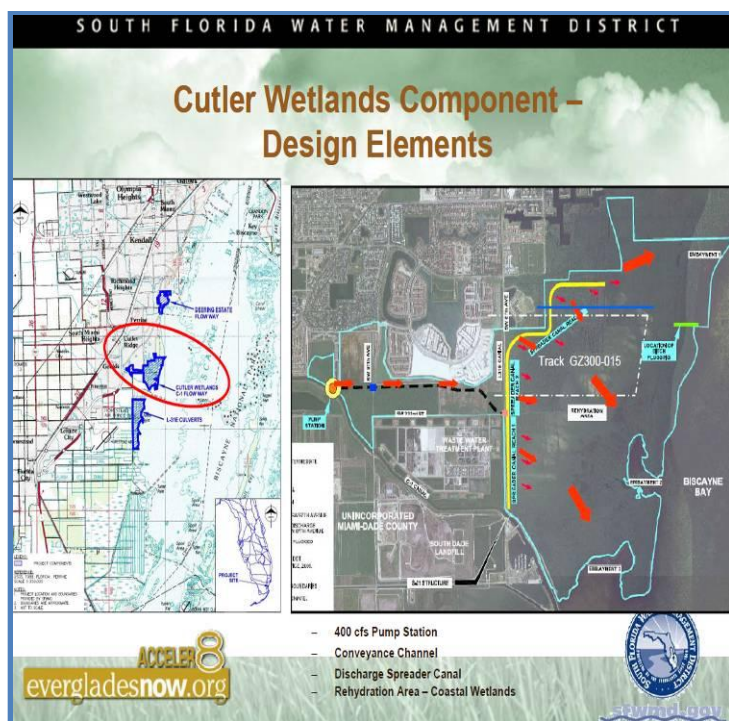


Figure 58. The proposed rehydration projects design elements.

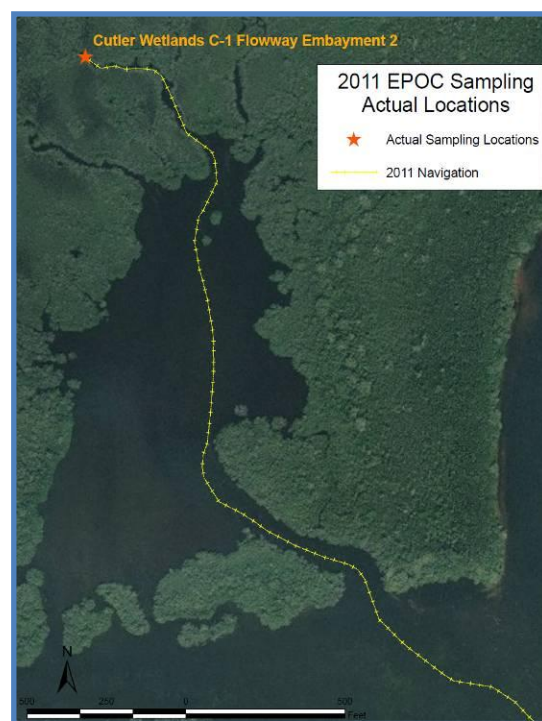


Figure 59. Actual location of POCIS sampler in the Cutler Wetlands.

Also in FY11: SFCN obtained results from previous sampling events. The following results were shared by the US Geological Survey's Dr. Tim Bargar (Florida Integrated Science Center) and Dr. David Alvarez (Columbia Environmental Research Center). These results stem from the previous sampling events (see annual FY10 annual report) where SFCN in conjunction with USGS sampled for EPOC's (see above), and for oil components from the Deep Water Horizon oil spill.

Baseline Petroleum Hydrocarbon Contamination near Dry Tortugas, Everglades, and Biscayne National Parks

Early predictions for the Deepwater Horizon (DWH) oil spill were that oil components from the DWH would enter the Gulf Loop Current and be transported through the Florida Strait adjacent to Biscayne, Dry Tortugas, and Everglades National Parks. Since baseline data are instrumental in determining adverse environmental impacts as a result of hazardous chemical discharges, passive water samplers (SPMDs) were deployed at 18 different locations (3 in Biscayne, 10 in Everglades, and 5 in Dry Tortugas) in these parks to determine existing petroleum hydrocarbon (PAH) concentrations. One set of SPMDs were deployed for up to 26 days beginning in mid-May to determine what were likely to be baseline conditions. Following their retrieval, a second set of SPMDs were immediately deployed at the same locations and left for approximately 30 days to encompass a period during which components from the DWH were predicted to be nearing Dry Tortugas National Park. The detected concentrations of individual PAHs were at least two orders of magnitude less than the state of Florida's marine water quality criteria values with no clear difference between the first and second deployments. Based on data collected from mesophotic reefs in proximity to the DWH spill location, PAH levels in waters of the parks were significantly lower than those near the spill site and likely represent a background condition in

which normal boat traffic and aerial deposition of combustion generated products are the PAH sources for the parks.

Baseline Aquatic Contamination and Endocrine Status in a Resident Fish Species of Biscayne National Park and in the Adjacent Coastal Environment

A component of the Comprehensive Everglades Restoration Plan is rehydration of the coastal wetlands adjacent to Biscayne National Park (Park). Before the planned rehydration of the wetlands begins, it is necessary to understand the threats to the Park's resources from existing organic wastewater contaminant (OWC) levels to differentiate them from potential impacts from OWCs introduced by the rehydration. In September of 2009, passive water samplers were deployed for a period of one month at the mouths of nine different canals where they enter Biscayne Bay (Bay) and at three locations within the Bay. Based on the total number of detected contaminants, waters in the C-111 canal were the most contaminated while the least contaminated locations were the Central and North Bay locations. Very few wastewater chemicals were detected indicating low wastewater contribution to Biscayne Bay. The C-1 canal, which passes the South Dade Wastewater Treatment Plant, did not have a greater wastewater contaminant load relative to the other canals. Additional sampling is underway to determine if (1) seasonality plays a role in contaminant introduction into the Bay, (2) OWCs are partitioning into sediments and the biota (fish), and (3) the endocrine status of a resident fish species. A dry season sampling was completed in May of 2011 while a wet season sampling was initiated in September of 2011. Data from these two deployments have not been received. Sediments will be collected in October of 2011 while fish will be sampled during the wet season of 2012.

Continuation in FY12: Deployment of the third set of samplers occurred in September FY11 and SFCN is scheduled to retrieve the 22 POCIS samplers currently in the water in mid-October FY12. This time sediment samples will be collected from each location at the time of passive sampler retrieval as well. Composite sediment samples will be collected from each Bay, coastal wetland, and canal mouth location at the time of sampler retrieval. Any compounds present in the sediment samples could be an indication of their long-term presence in the water column and give insight into conditions in the Bay and coastal wetlands. Elevated contamination in the passive samplers and sediment samples downstream of the potential sources, when compared to the upstream samples, could indicate a net contribution of contaminants from the source to the waters in the canal. This project took substantial field effort with 507 field hours required to accomplish the work.

The 3 year project is expected to continue in conjunction with the USGS through FY12 and FY13 in order to establish baseline aquatic and soil sediment contamination and eventually endocrine status in resident fish populations of Biscayne National Park and in the adjacent coastal wetlands.

Marine Benthic Communities – Coral Reef Water Temperature (BISC, BUIS, DRTO, VIIS)

Accomplished in FY11: Reef temperature data was collected at all coral index sites in VIIS, BUIS, BISC, DRTO, and all coral extensive sites in DRTO (Figs. 45-49). All sites show typical seasonal variation in water temperatures, ranging from 17.0°C to 31.7°C at South Florida sites and from 24.7°C to 30.7°C at sites in the Virgin Islands.

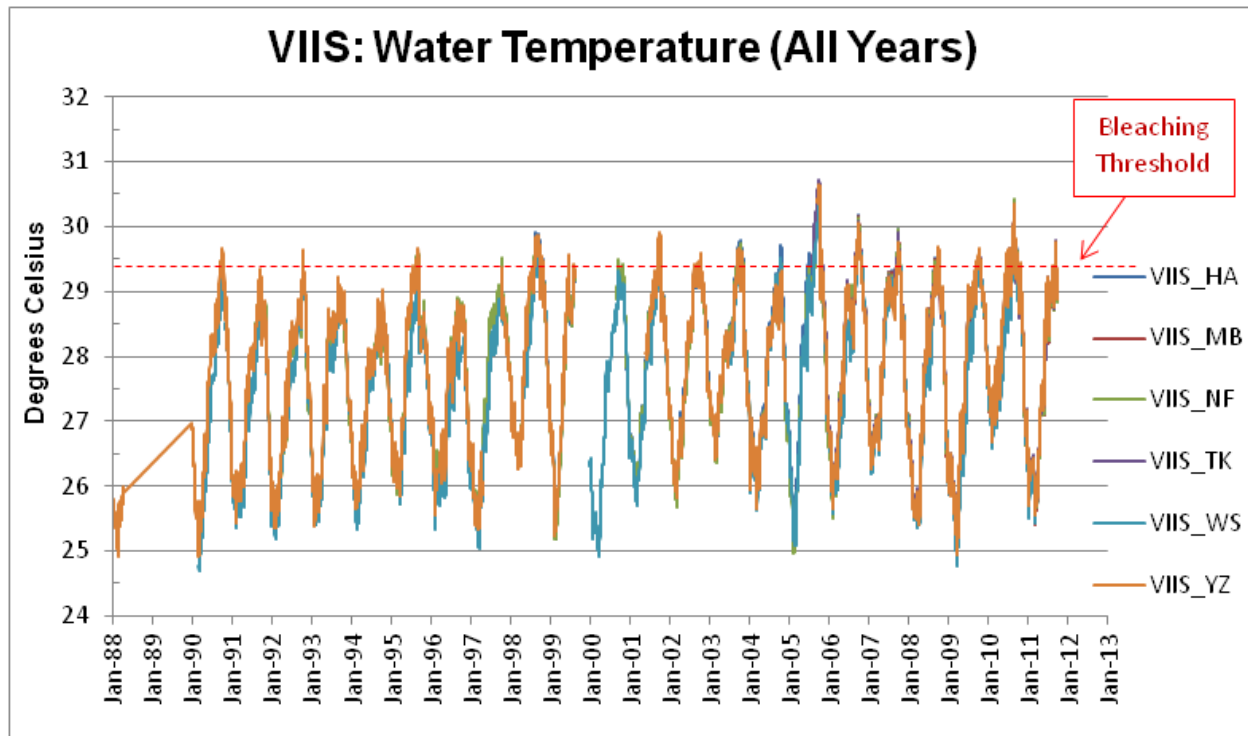


Figure 60. Virgin Islands National Park (VIIS) water temperature summary graph. Graph shows water temperature data from the six sites in VIIS since 1988. The bleaching stress threshold of 29.5 °C is shown.

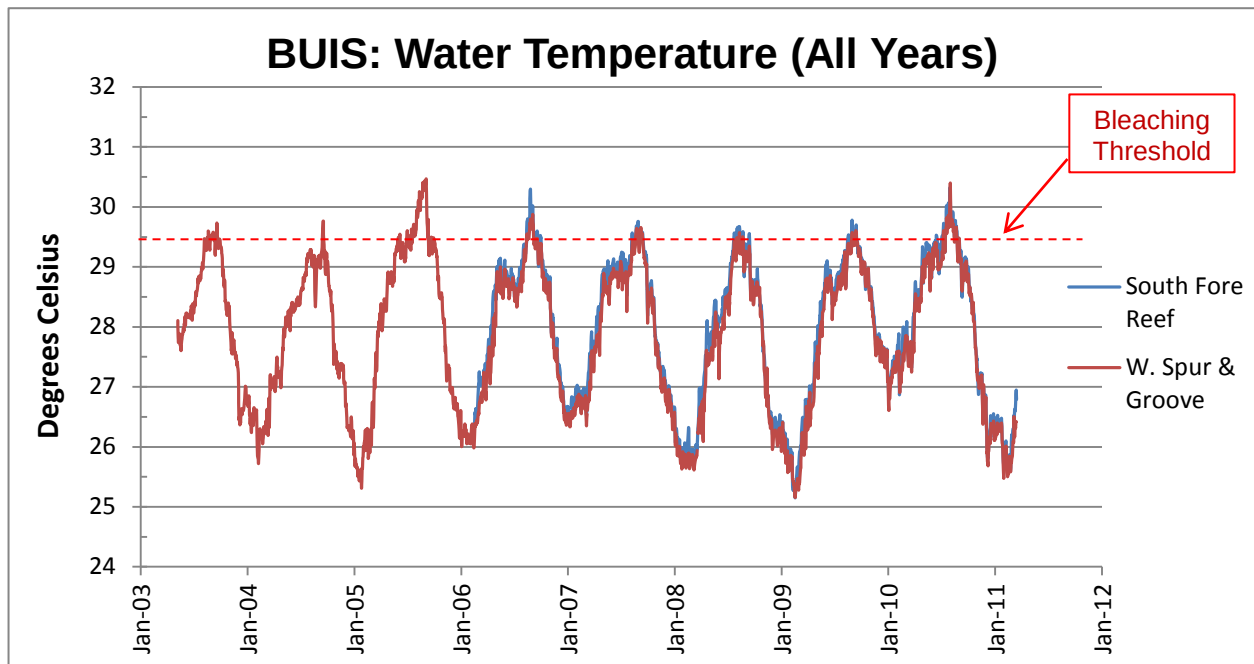


Figure 61. Buck Island Reef National Monument (BUIS) water temperature summary graph. Graph shows water temperature data from the two index sites in BUIS since 2002. The bleaching stress threshold of 29.5 °C is shown.

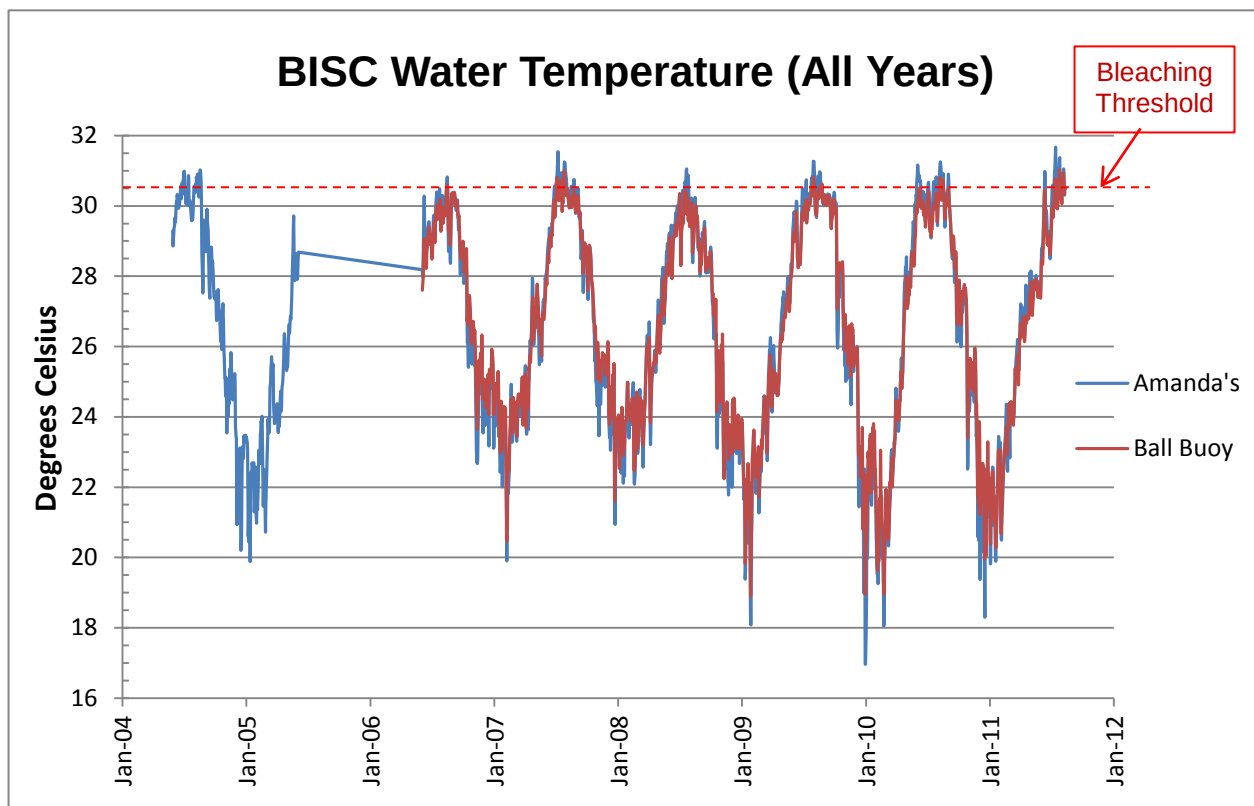


Figure 62. Biscayne National Park (BISC) water temperature summary graph. Graph shows water temperature data from the two index sites in BISC since 2003. The bleaching stress threshold of 30.5 °C is shown.

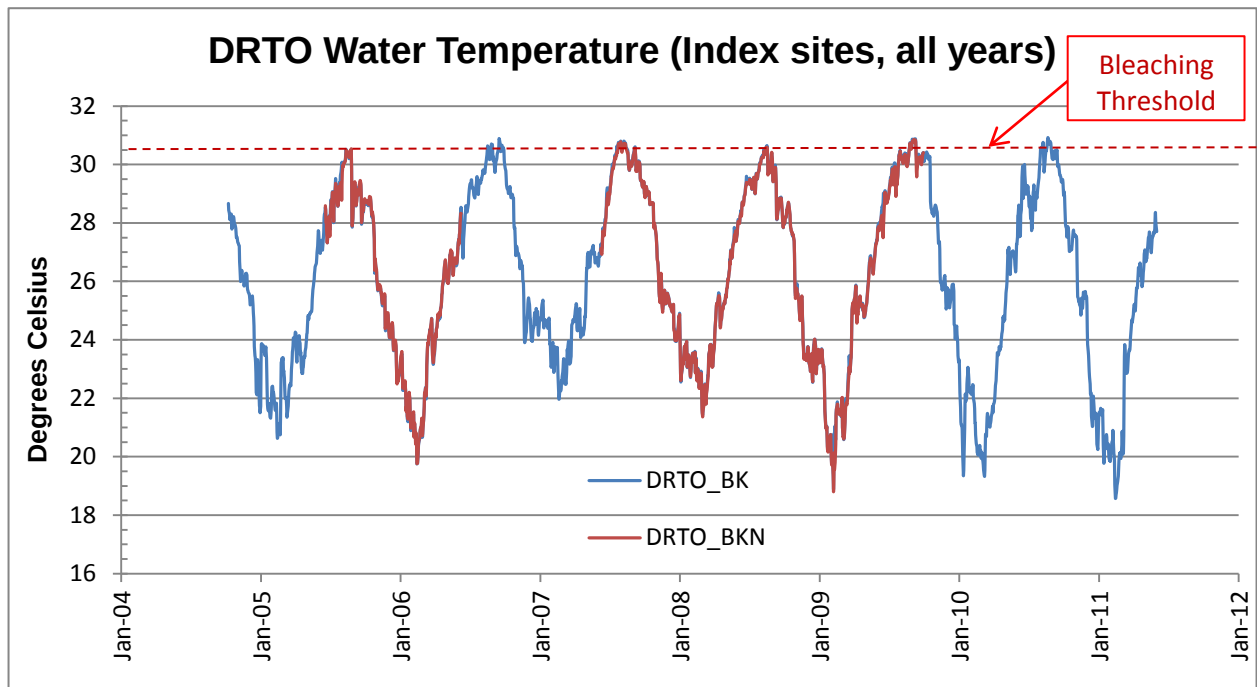


Figure 63. Dry Tortugas National Park (DRT0) water temperature summary graph. Graph shows water temperature data from the two index sites in DRT0 since 2004. The bleaching stress threshold of 30.5 °C is shown.

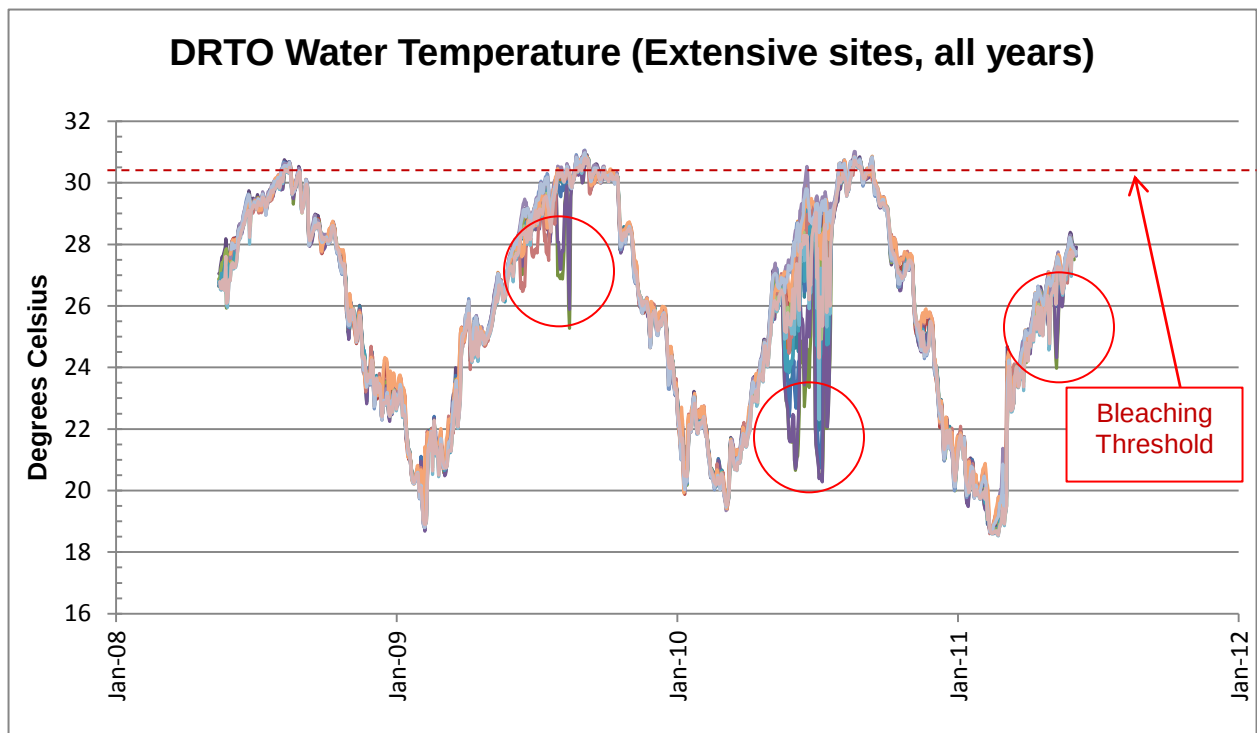


Figure 64. Dry Tortugas National Park water temperature summary graph. Graph shows water temperature data from the 18 index sites in DRT0 since 2008. The bleaching stress threshold of 30.5 °C is shown. The three red circles indicate cold-water events, occurring in late spring through early summer.

Temperature data from the DRTO index and extensive sites reveal that benthic resources are subject to a wide variance in thermal stress. In particular, temperature records from the extensive sites show cold-water events from the past three years, occurring between late April and early June, designated by red circles in Figure 64. The most severe recorded event occurred in June 2010, where several extensive sites were affected (Fig. 64). It is suspected that this cold-water anomaly is from upwelling, influenced by currents off the Tortugas Bank, along the northwestern edge of the park. During the cold-water events, sites I-50, I-05, and I-38 experienced the lowest temperatures, likely due to the proximity to Tortugas Bank and the comparatively deep nature of these three extensive sites.

Elevated water temperatures in the USVI during FY10 led to coral bleaching. SFCN conducted episodic monitoring of VI which extended into the first half of FY11 (see Marine Benthic Communities – Virgin Islands accomplishments page 13).

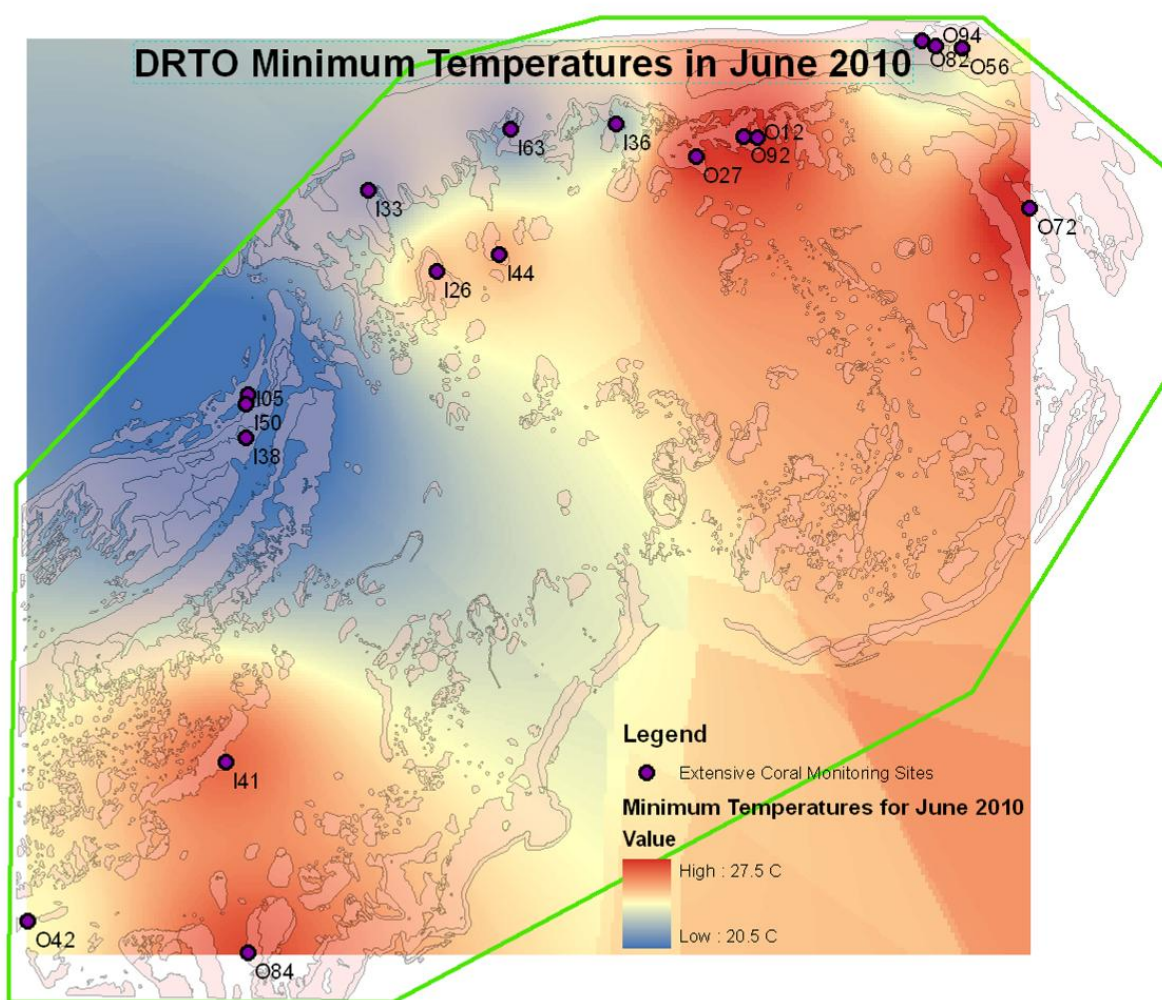


Figure 65. Thermal gradient across DRTO in June 2010, when a strong cold-water event was recorded. The red-blue gradient is derived from temperatures recorded at the extensive sites. Sites I-05, I-50, and I-38 were subject to the coldest temperatures. Locations of hard-bottom habitats are displayed in light pink for reference.

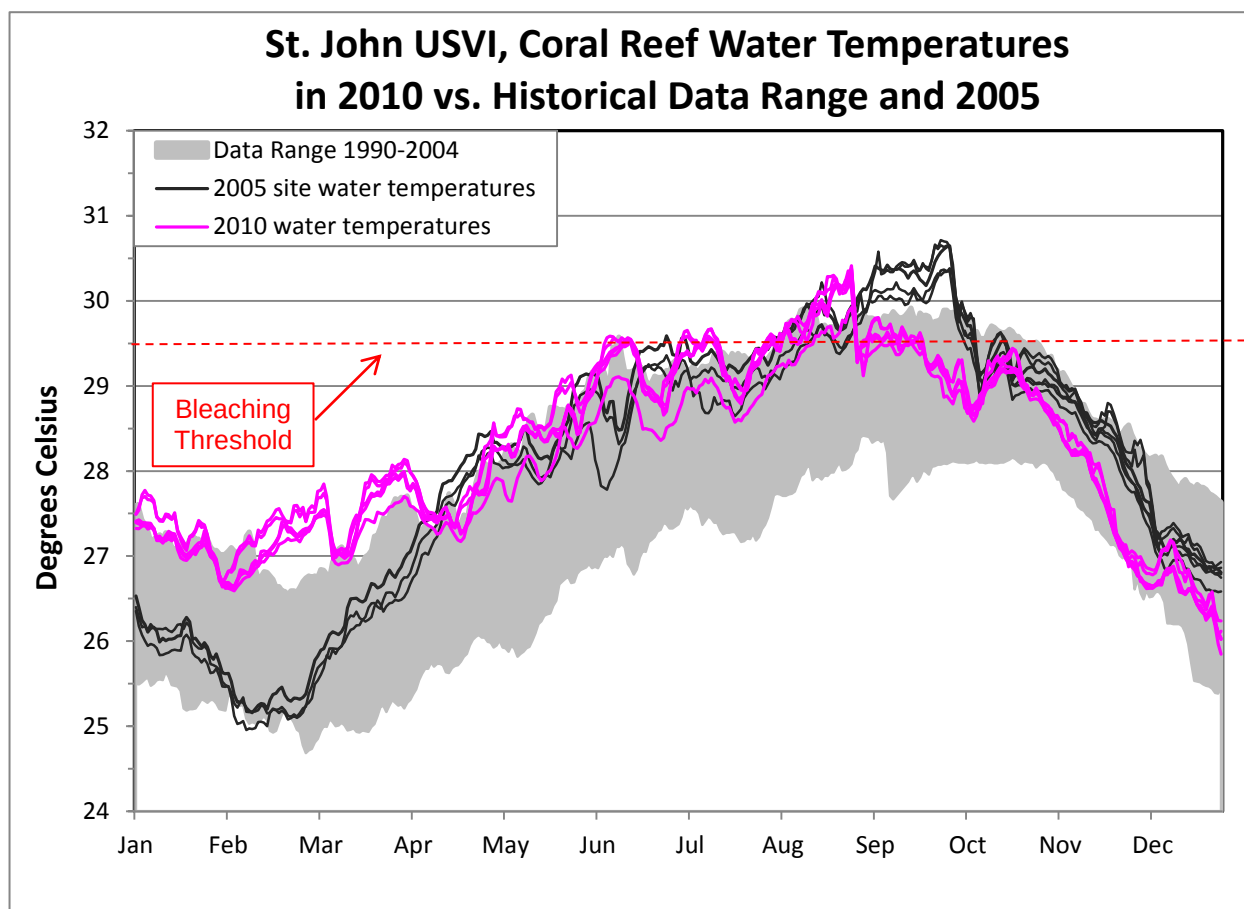


Figure 66. The water temperature in 2010 for Virgin Islands National Park compared with 2005 (a horrific bleaching year) and the 1990-2004 range of daily average temperatures for all sites. The bleaching stress threshold of 29.5 °C is shown.

Analysis of water temperatures show heating regime leading to the 2005 bleaching event was within the normal historical range, while leading to the 2010 bleaching, water temperatures were warmer than normal. Additionally, the magnitude and duration of the heat stress was greater in 2005 than in 2010 (Fig. 66).

A major effort this year involved QA/QC of all historical water temperature data and incorporation of that data into the coral reef water temperature database. This allowed analyses of the Virgin Islands datasets for trends. Analyses of the temperature data from three locations (Newfound Reef, Windspirit Reef, Yawzi Reef) between 1990 and 2010 (with data interpolation to fill gaps) reveal annual average temperatures have increased significantly over that time period. Seasonal analysis shows that mean summer temperatures (Aug-Oct) have also increased. While winter temperatures also appear to be increasing, the trend is not statistically significant (Fig. 67). However it is not yet possible at this time to separate this trend from the Atlantic Multi-Decadal Oscillation, so caution must be used when interpreting these results with respect to climate change.

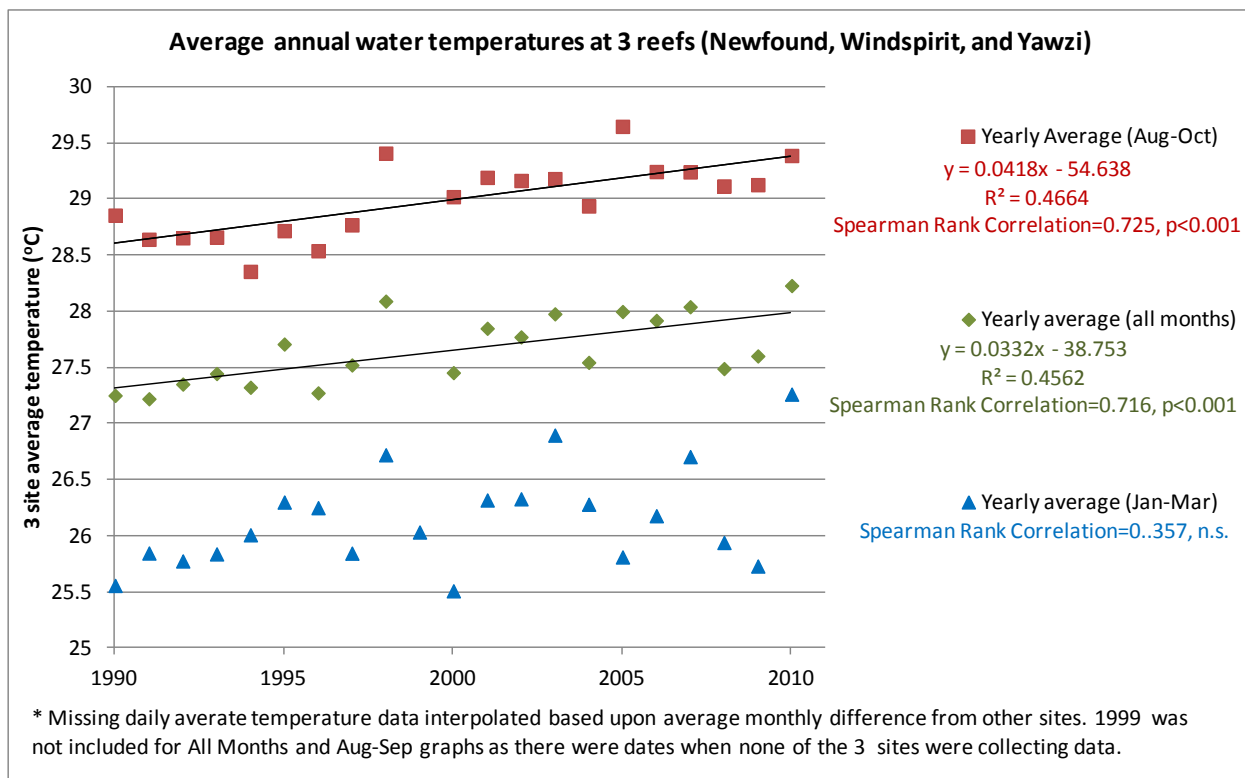


Figure 67. Average annual water temperatures at Newfound, Windspirit, and Yawzi index sites in VIIS. Missing data was interpolated by using the average monthly difference from the other two reefs. We then created a 3 site daily average and used that data to calculate yearly temperature averages, yearly warmest month averages (Aug-Oct) and yearly coldest month averages (Jan-March). Spearman Rank Correlations were conducted to determine trends. It is not yet possible at this time to separate this trend from the Atlantic Multi-Decadal Oscillation, so caution must be used when interpreting these results with respect to climate change.

Continuation in FY12: Water temperature data will continue to be collected at all sites in FY12. Exports of data for the SFCN web page and Data ForEVER database at EVER are in development for early FY12. SFCN plans to publish the long-term water temperature data record at VIIS. Analysis of DRTO water temperatures will continue to evaluate spatial/depth patterns across the park.

Coral Reef Water Temperature Protocol

Project overview: The Coral Reef Water Temperature Protocol serves as a guide for the deployment, maintenance, and data management of the SFCN temperature loggers, integral for a more comprehensive understanding of the connection between corals and water temperature within SFCN parks. Coral reef water temperature has been found to be a critical covariate when trying to analyze long-term coral reef monitoring results and the relationship between coral bleaching and survival. Corals and many other marine organisms exist in a relatively narrow temperature range; seawater temperature data thus provide information that is important to analyze conditions of marine systems. Physiological stress, due to both abnormally high and low temperatures, can lead to coral bleaching when the coral host loses zooxanthellae from its tissue. Reef water temperature data have been collected by SFCN in regional parks since 1990, although

the NPS and USGS first deployed temperature loggers around VIIS in 1988. Currently these loggers are deployed as part of long-term coral reef monitoring program. This effort has been expanded throughout the network, with 30 long-term *in-situ* water temperature monitoring sites managed by SFCN in DRTO, BISC, BUIS, and VIIS.

The database developed with this protocol will be a repository for SFCN parks' legacy reef water temperature data as well as SFCN ongoing monitoring data. The water temperature database has been updated to include QA/QC procedures and reporting queries. A graphing template was developed which will allow quick database export and graphing of water temperature data, speeding up the ability to rapidly report results and concerns to park management.

Accomplished in FY11: The Coral Reef Water Temperature Protocol has undergone revision and is in the final stages of the internal review process.

Continuation in FY12: It is anticipated that this protocol will be sent out for invited external review and published in FY12.

Nutrient Dynamics and Water Chemistry (BISC, DRTO, EVER, SARI, VIIS)

Accomplished in FY11: Dr. Andrew J. Bramburger, water quality post-doc, was hired to work with SFCN on the Nutrient Dynamics and Water Chemistry vital signs via a cooperative agreement with Jim Fourqurean and Joe Boyer of Florida International University in December 2010. Dr. Bramburger separated from SFCN in August 2011 to take a Research Scientist position at an educational institution in Canada.

While ongoing monitoring of water quality parameters and ecological Vital Sign status remain important tools for park management, the mechanistic and statistical relationships between water quality and benthic community characteristics remain largely uninvestigated. Several parks within the SFCN – Biscayne National Park, Buck Island Reef National Monument, Dry Tortugas National Park, Everglades National Park, Salt River Bay National Historic Park and Ecological Reserve and Virgin Islands National Park – include marine and estuarine environments. The status of Vital Signs within marine and estuarine areas, and indeed the structure and dynamics of marine benthic communities are heavily influenced by water quality.

The objective of this study is to compile and summarize existing water quality and benthic community monitoring data for marine and estuarine areas within SFCN parks. We intend to report on the status and long-term trends in water quality parameters associated with the SFCN Estuarine Salinity, Nutrient Dynamic and Submerged Aquatic Vegetation vital signs. In addition to reporting activities, existing and continuously collected water quality data will also evaluate relationships between water quality metrics and response variables including seagrass blade nutrient data and seagrass community data and determine critical thresholds in water quality

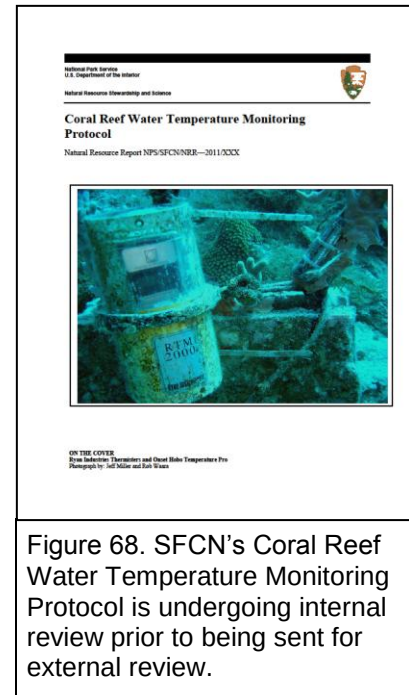


Figure 68. SFCN's Coral Reef Water Temperature Monitoring Protocol is undergoing internal review prior to being sent for external review.

parameters. Subsequently, community data will be used to develop predictive, probabilistic models of community change in response to water quality conditions.

Currently, several investigators and agencies are conducting water quality and ecological monitoring in marine and estuarine habitats in South Florida, the Florida Keys and the Caribbean. Some of these monitoring programs include sites located within SFCN parks, especially Everglades and Biscayne National Parks. Due to data sharing and public access requirements, much of the data collected by these programs is available for download from internal NPS databases and from the internet, coupled with metadata and Standard Operating Procedures for collection and reporting.

During the exploratory phase of this project, monitoring data was acquired by downloading or by direct requests to investigators. Water quality and community data from several LTER sites within Everglades National Park were compiled during FY11. Additional water quality data from the Southwestern Florida Shelf and from Florida Keys National Marine Sanctuary (FKNMS), which includes sites within Dry Tortugas National Park were also compiled. The following is a list of QA/QC'd base data sets on the SFCN server created from compiled raw data: Z:\SFCN\Projects\Water Quality\data\Water Quality Datasets August.

Water Quality:

1. SERC – SFL Estuaries Water Quality Dataset
2. SERC – LTER Water Quality Dataset
3. SERC Florida Keys Sanctuary Water Quality Dataset
4. SERC Little Venice Water Quality Dataset
5. NOAA Water Quality Dataset
6. Fourquran LTER Water Quality Dataset

Seagrass:

1. LTER Seagrass Community Dataset
2. LTER Seagrass Nutrient Dataset
3. LTER Seagrass Productivity Dataset
4. LTER Seagrass Stable Isotope Dataset
5. FKNMS Seagrass Monitoring Permanent Sites
6. FKNMS Seagrass Monitoring Seasonal Sites
7. Little Venice Seagrass Dataset

Water quality and seagrass data from the LTER sites was used in the initial statistical evaluation due to co-location of sites and lengthy sampling record. In initial exploratory phase of this study, seagrass tissue nutrient ratios were used as community response variables, and three-parameter sigmoidal curves were fitted to response variable points. Derivative analysis will be used to determine the position of thresholds in biological responses to individual water quality parameters. All derived datasets are also archived on the SFCN server.

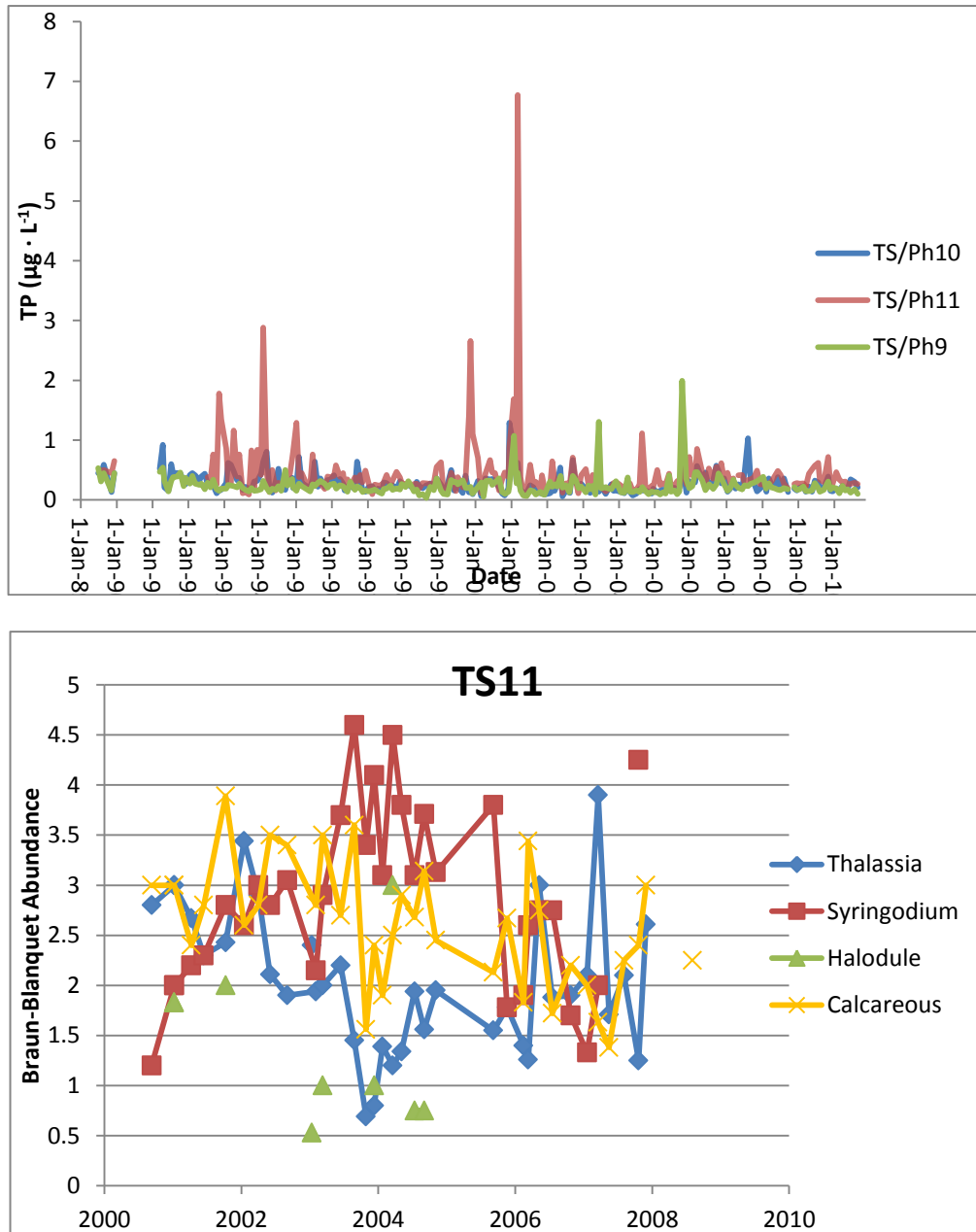


Figure 69. Graphical examples of Florida Bay (LTER) water quality (total phosphorus) and seagrass community (Braun-Blanquet) data sets.

Continuation in FY12: The FIU/SFCN Water Quality Research Scientist Post-doctoral position has been announced by Dr. James Fourqurean. Position interviews and hiring of the position are planned for early FY12. As the project continues, SOPs will be developed for the acquisition, analysis, and reporting of pertinent monitoring data from the appropriate sources once meaningful water quality and community response parameters are identified. SOPs will be written to describe procedures for reporting water quality values in relation to state criteria for nutrients etc. and critical threshold values for coral communities (temperature) etc. Additionally,

SOPs will incorporate a description of methods for inputting water quality measurements into risk assessment models and reporting risk-modeling results.

With EVER's permission, SFCN will work with WRD to migrate DataForEVER to Storet. For VIIS we will be working with the VIIS Data manager to finish their water quality monitoring database.

Estuarine Salinity patterns (BISC, EVER)

Accomplished in FY11: No progress due to other SFCN time constraints.

Continuation in FY12: SFCN Data Management and Reporting Staff will further work with Sarah Bellmund to report this CERP indicator and NPS vital sign on the SFCN web as well as provide links to the CERP RECOVER System Status Report. SFCN will also contact Erik Stabenau for Florida Bay estuarine salinity patterns reports.

Surface water hydrology (BICY, EVER)

Continuation in FY12: For BICY and EVER the SFCN will continue to maintain links to regional hydrology summaries by Bob Sobczak of BICY and EVER; additionally, SFCN will use the Everglades Depth Estimation Network (EDEN) pulling together hydropatterns at key long term hydrology stations (e.g. P205 station).

Surface water hydrology – Weather stations (BUIS, SARI)

Accomplished in FY11: SARI and BUIS weather stations were affected by inclement weather early in FY11. The SARI weather station was disassembled at the beginning of FY11 due to severe weather damage and according to park personnel was not possible to reassemble. The BUIS weather stations data collection was affected by hurricane weather, as well as software and hardware problems. This station was also disassembled, but park personnel were able to get it back up and running again. Data collection from these weather stations was not continuous and does not encompass the entire fiscal year. However, the data that was collected was sent to SFCN by park personnel and saved in a manner that is consistent with the Weather Station Protocol and associated SOPs.

Continuation in FY12: BUIS park staff, if possible, should continue sending data to the SFCN collected from the remaining weather stations (BUIS), as long as weather and equipment permits. SFCN could attempt to utilize NOAA's Integrated Coral Observing Network (ICON) monitoring station at SARI, which currently monitors many of the same parameters. SFCN will finalize QA/QC procedures, finalize the Weather Station Protocol, and begin basic reporting procedures. SFCN is close to finalizing an SOP for transferring data to the DataForEVER database, maintained by the Physical Resources Branch of Everglades National Park.

Surface water hydrology (SARI)

Accomplished in FY11: No data was collected from the crest gauge (an instrument designed to observe maximum water elevations in streams) at SARI during FY11. According to park staff they do not have the personnel to regularly and consistently collect this data.

Continuation in FY12: SFCN is not certain whether or not SARI park staff will continue to collect and send monthly crest gauge data to SFCN.

Other water quality related monitoring

A number of other vital signs strongly relate to water quality but are covered under the vital signs monitoring section including periphyton, aquatic invertebrates, freshwater fish and large macro-invertebrates, seagrass, and coral.

SFCN continues supporting Biscayne National Park staff with negotiations between the park and Miami-Dade Water and Sewer Department's Wastewater Reuse Pilot Project

The Miami-Dade Water and Sewer Department's proposal for the development of a Wastewater Reuse facility adjacent to the park's western boundary has been suspended at this time. NPS concerns still include the ability for the advanced wastewater treatment to adequately process water to make it clean enough to have no negative impacts to the park ecosystems and adjacent lands. SFCN continues to assist in this project by its collaboration with the USGS investigating EPOCs from canal discharge into the bay. This will ensure any pilot project that goes forward would be able to produce scientifically defensible results to more fully understand the consequences of treated wastewater entering the park.

II. Public Interest Highlights

Biscayne National Park – Adams Key Plant Identification Walk

On February 14, 2011, SFCN botanist Brooke Shamblin led a plant walk on Adams Key. The focus of the walk was to teach BISC staff and volunteers how to identify the trees and shrubs growing naturally in the hardwood hammocks. These hardwood hammocks are located on the islands within BISC and are tropical in origin, making them a unique habitat compared with the more temperate forests located throughout the rest of the United States.

Miami Beach High School – Presentation on the National Park Service Mission and Plant Walk

On May 25, 2011, SFCN botanist Brooke Shamblin was invited to give a talk at Miami Beach High School about the mission of the National Park Service and about the many different projects performed by the SFCN office. Three biology classes received the presentation and Mr. Shamblin led one class on a plant ecology and identification walk around the campus.

Biscayne National Park - National Geographic BioBlitz

Scientists continued to turn in results from the Biscayne BioBlitz 2010 event throughout 2011. Two new species to science resulted: a lichen (*Graphis brittonii*) and a tardigrade (*Archechiniscus biscaynaei*). As of September 2011, the draft numbers include a total of 1027 species tallied of which 532 were new to the park list, increasing the overall park species list by 39%.

Water Temperature & Coral Bleaching

Virgin Islands coral bleaching event update: Episodic monitoring was conducted during September 2010 – March 2011 in response to coral bleaching in the summer of 2010 (see summary in Marine Benthic Communities section, page 36). During late summer 2011, temperatures again exceeded the bleaching threshold but widespread bleaching was not observed during annual monitoring so no episodic monitoring was conducted.

OW-USS Intern with Marine Fish Communities

Miss Naomi Blinick, an Our World - Underwater Scholarship Society Intern with NPS' Submerged Resource Center, spent 30 hours in September documenting RVC surveys in BISC with SFCN scientists. The society provides firsthand experiences in underwater-related disciplines to young people considering careers in the underwater world and offers summer internships in North America for 1 – 3 month periods to college undergraduates and graduating seniors. Miss Blinick posted a blog and photographs of her experience at: <http://owussnorthamerica.org/?p=1053>



Figure 70. (From left to right). Andy Davis checks the BISC RVC map to scope out the day's dive sites. A school of small French Grunts swims by a large colony of Elkhorn Coral in BISC. Biologist Rob Waara, NPS Volunteer Devon Nemire-Pepe, REEF Intern Molly Sinnott, Fisheries Biologist Andy Davis, Naomi Blinick, Marine Ecologist Mike Feeley, and SCA Intern Lee Richter (credit N. Blinick).

Garmin updates park boundaries and regulations on Garmin devices

Judd Patterson and Jeff Miller were successful in partnering with Garmin to get the NPS boundaries for VIIS, VICR, BUIS and SARI on Garmin GPS base maps. Jeff is seeking input from VIIS for information (e.g., proper mooring use and payment details) that will be placed on the electronic maps. Additionally, Julia Brunner (NPS), Cliff McCreedy (NPS), Lauren Wenzel (NOAA) and Russell Callender (NOAA) have been enlisted through contact with Jeff in the effort to get NPS marine area boundaries on NOAA paper charts.

Review of extinction potential for 82 species of coral

Matt Patterson, SFCN Network Coordinator, participated on the Biological Review Team (BRT) to evaluate the extinction potential of 82 species of coral. SFCN data were used to help document declines in *Montastraea annularis* complex species in the Caribbean. The BRT findings are currently being reviewed and will be forwarded to National Marine Fisheries Service in Spring 2012 for consideration for ESA listing.

III. Staffing

SFCN Staff, Associated Post-docs, and Interns

Matt Patterson, Network Coordinator
Andrea Atkinson, Quantitative Ecologist
Michael Feeley, Marine Ecologist
Kevin R. T. Whelan, Community Ecologist
Brian Witcher, Data Manager
William “Jeff” Miller, Fisheries Biologist
Judd Patterson, GIS/Data Management Specialist
Rachel Vargas, Data Management/Outreach Technician
Andy Davis, Marine Biological Technician
Andy Estep, Marine Biological Technician
Rob Waara, Marine Biological Technician
Brooke Shamblin, Vegetation Technician
Raul Urgelles, Wildlife Technician
Robert Muxo, Community Technician
Joaquin Alonso, Everglades Vegetation Map Program Manager
Everglades Vegetation Map Technician
Jed Redwine, Natural Resource Condition Assessment Ecologist
David Bryan, Marine Research Assistant
Tim Fotinos, Vegetation Postdoctoral Research Assistant
Lee Richter, Student Conservation Association Intern
Mario Londono, Student Conservation Association Intern
Rick Jacobson, Administrative Assistant (left)
Andrew Bramberger, Water Quality Postdoctoral Research Assistant (left)
Jonathan Moser, Resource Management Intern (left)
Jose Luciani, Resource Management Intern (left)
Tiara Thanawastien, Resource Management Intern (left)
Lindsay Jones, Student Conservation Association Intern (left)
Kelly Bowman, Student Conservation Association Intern (left)
Elizabeth Anzinger, Student Conservation Association Intern (left)

Board of Directors

Pedro Ramos, Superintendent, Big Cypress National Preserve
Mark Lewis, Superintendent, Biscayne National Park
Joel Tutein, Superintendent, Buck Island Reef National Monument/ Salt River Bay National
Historical Park and Ecological Preserve/ Christiansted National Historic Site
Dan Kimball, Superintendent, Everglades National Park/ Dry Tortugas National Park
Mark Hardgrove, Superintendent, Virgin Islands National Park / Virgin Islands Coral Reef
National Monument
Matt Patterson, Network I&M Coordinator
Larry West, Regional I&M Coordinator

Science and Technical Committee

Ron Clark, Resource Management Chief, Big Cypress National Preserve
Elsa Alvear, Resource Management Chief, Biscayne National Park

Zandy Hillis-Starr, Resource Management Chief, Buck Island Reef National Monument/ Salt River Bay National Historical Park and Ecological Preserve
Robert Johnson, South Florida Natural Resource Center Director, Everglades National Park / Dry Tortugas National Park
Dave Hallac, Biological Branch Chief, Everglades National Park / Dry Tortugas National Park
Rafe Boulon, Resource Management Chief, Virgin Islands National Park / Virgin Islands Coral Reef National Monument
Carol Daniels, South Florida / Caribbean Cooperative Ecosystem Studies Unit Coordinator

Volunteers in the Park (V.I.P)

Twelve VIPs worked with the Community Ecology Branch, four VIPs worked with Marine Ecology and one VIP with the Data Management Branch for a total of 1342 volunteer hours in FY11 (approximate value of the volunteer effort was \$24,209.68).

Michelle P.volunteered 50 hours of field work at the South Florida/Caribbean Network. She worked with the community ecology team as part of the Coastal Geomorphology Vital sign. She worked on platform prefabrication as well as installation.

Sohaib A.(Miami Dade High School student) volunteered 40 hrs helping with Colonial Bird Nest counting. Jonathan G. (Miami Dade Middle School student) volunteered 20 hrs helping with Colonial Bird Nest counting

Brandon A.(FIU Earth and Environment student) has volunteered 140 hours of office and fieldwork. Brandon helped gather vegetation data of mangrove-marsh ecotone transition zones, in the office he worked on counting birds and on digitizing mangrove-marsh ecotones.

Maria S. (FIU Earth and Environment student) volunteered 102 hrs. Maria has worked in the office on Colonial Birds and in the field sampling canals as part of the Invasive/Exotic Animals Vital Sign.

Clayton M., Francisco P., Viktoria B., Elisa B., Jeff N., all volunteered 60 hrs each on the Everglades Vegetation Mapping project and Kristen F., Jeff B. volunteered 120 hrs each on the Everglades Vegetation Mapping project.

Devon N., a recent graduate of the University of North Carolina at Ashville (BS Biology), volunteered 360 hours assisting with the Marine Fish Communities Vital Sign program. Devon assisted with preparation of data sheets and organization of the field sampling protocol, including creating an Arcmap georeferenced site selection habitat map of BISC. She also provided field support, assisting with boat operations on Reef fish Visual Census surveys and Accuracy Assessment surveys on the BISC Habitat Map.

Molly S., Julianna M. and Claire K. (REEF Interns) volunteered a total of 70 hours of field support assisting with the Marine Fish Communities Vital Sign assisting with data management during BISC Reef Fish Visual Census surveys.

Mario L. volunteered for 40 hours of support assisting the data management branch with a GIS project that created a site selection model for Coral Reef monitoring in BISC.

IV. Reports, Publications and Presentations

Published journal articles, open file reports, reports, resource briefs, presentations

Journal Articles

Alonso J., J. T. Heinen. 2011. Miami Dade County's Environmentally Endangered Lands Program: Local Efforts for a Global Cause. *Natural Areas Journal* 31(2):183-189.

Brandt, M.E., B.I. Ruttenberg, R. Waara, J. Miller, B. Witcher, A.J. Estep and M. Patterson. *In review*. Dynamics of an acute coral disease outbreak associated with the macroalgae *Dictyota* spp. In Dry Tortugas National Park, Florida, U.S.A. Submitted to *Bull Mar Sci*. (Resubmitted after review in *Coral Reefs*).

Eakin, C.M., J.A. Morgan, S. F. Heron, T. B. Smith, G. Liu. 2010. Caribbean Corals in Crisis: Record Thermal Stress, Bleaching, and Mortality in 2005. *PLoS ONE* 5(11): e13969. doi:10.1371/journal.pone.0013969

Reports and related products

Alonso, J. *DRAFT*. Standard Operating Procedure: Buck Island Seasonal Bird Surveys for Brown Pelicans and Least Terns. 9pp.

Alonso, J. *DRAFT*. Standard Operating Procedure: Virgin Islands Brown Pelican Monitoring Program. 4pp.

Brainard, R.E., C. Birkeland, C.M. Eakin, P. McElhany, M.W. Miller, M. Patterson, and G.A. Piniak. 2011. Status review report of 82 Species of Corals under the U.S. Endangered Species Act. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-27, 530 p. + 1 Appendix.

Brandt, M.E., N.Zurcher, A. Atkinson, A. Acosta, J.S. Ault, J.A. Bohnsack, M.W. Feeley, D.E. Harper, J.H. Hunt, G.T. Kellison, D.B. McClellan, M.E. Patterson, S.G. Smith. 2011. The opportunities and challenges in development of a multi-agency program to monitor and assess reef fish populations in the Florida Keys coral reef ecosystem. *Proc. 62nd Gulf Carib. Fish. Inst.* November 2 – 6, 2009. Cumana, Venezuela.

Fotinos, T. and K.R.T. Whelan. In progress. 30 Years of Vegetation Change at Turner River, Big Cypress National Preserve, Florida (Intended Journal *Florida Scientist*).

Luciani, J. M., K. R. T. Whelan, R. B. Shamblin, R. M. Vargas, J. M. Patterson. 2011. Dry Tortugas National Park vegetation map, 2009. *Natural Resource Technical Report NPS/SFCN/NRTR—2011/469*. National Park Service, Fort Collins, Colorado.

May, L.A., A.R. Avadanei, C.S. Rogers, J. Miller, and C.M. Woodley. 2010. Microbial Community Analysis of *Acropora palmata* Mucus Swabs, Water and Sediment Samples from Hawksnest Bay, St. John, U.S. Virgin Islands NOAA Technical Memorandum NOS NCCOS CCEHBR. 6 pp.

Moser, J. G., K. R. T. Whelan, R. B. Shamblin, A. J. Atkinson, J. M. Patterson. 2011. Salt River Bay National Historical Park & Ecological Preserve, U.S. Virgin Islands, Vegetation Mapping Project, 2009. Natural Resource Technical Report. NPS/SFCN/NRTR—2011/448. National Park Service, Fort Collins, Colorado.

Shamblin, R.B., K.R.T. Whelan, and C. O. Ariori. *DRAFT*. SFCN Early Detection Protocol for Invasive Exotic Plants, Corridors of Invasiveness. Natural Resource Report NPS/SFCN/NRR—20XX/XXX. National Park Service, Fort Collins, Colorado.

Shamblin, R. B., and K.R.T.Whelan. 2010. 2009 Pilot Year Summary Report of the Corridors of Invasiveness Monitoring in Big Cypress National Preserve, Biscayne National Park, and Everglades National Park. Natural Resource Technical Report NPS/SFCN/NRTR—20XX/XXX. National Park Service, Fort Collins, Colorado.

Waara, R. J. 2011. "Development and Policy Applications of the 2010 Benthic Habitat Map for Dry Tortugas National Park." *Open Access Theses*. Paper 247.

Waara, R. J. 2011. Development and policy applications of the 2010 benthic habitat map for Dry Tortugas National Park. Natural Resource Technical Report NPS/SFCN/NRTR—2011/474. National Park Service, Fort Collins, Colorado.

Whelan, R. T. K., C. Ariori, T. Thanawastien and J. M. Patterson. *DRAFT*. Digitization of 1981 Vegetation Map of the Coastal Region between Flamingo and Joe Bay of Everglades National Park (East Map). Natural Resource Report NPS/SFCN/NRR—2010/XXX. National Park Service, Fort Collins, Colorado.

Whelan, R. T. K., C. Ariori, T. Thanawastien and J. M. Patterson. *DRAFT*. Digitization of 1981 Vegetation Map of the Coastal Region between Flamingo and Joe Bay of Everglades National Park (West Map). Natural Resource Report NPS/SFCN/NRR—2010/XXX. National Park Service, Fort Collins, Colorado.

Whelan, R. T. K., C. Ariori, T. Thanawastien and J. M. Patterson. *DRAFT*. Digitization of 1982 Vegetation Map of Turner River Road Area of Big Cypress National Preserve. Natural Resource Report NPS/SFCN/NRR—2010/XXX. National Park Service, Fort Collins, Colorado.

Presentations, Posters, and Resource Briefs

Alonso J., Urgelles R., Whelan, K. R.T. 2011. Monitoring Colonial Nesting Birds in Biscayne National Park. George Wright Society on Parks, Protected Areas, and Cultural Sites: Rethinking Protected Areas in a Changing World. March 14 – 18, 2011. New Orleans, LA.

Atkinson A., J. Miller, R. Waara, J. Patterson, B. Witcher, and K. R.T. Whelan. 2011 Using Coral Video Monitoring and Water Temperature Data to Demonstrate a Variety of Analytical Methods. George Wright Society on Parks, Protected Areas, and Cultural Sites: Rethinking Protected Areas in a Changing World. March 14 – 18, 2011. New Orleans, LA.

Feeley, M., A. Acosta, T. Switzer, J. Hunt, P. Barbera, D. Morley and M. Burton. 2010. Spawning aggregations and migrations patterns of mutton snapper in Dry Tortugas, Florida. Linking Science to Management: A Conference & Workshop on the Florida Keys Marine Ecosystem. Oct. 19 - 22, 2010. Hawk's Cay, Duck Key, FL.

Feeley, M., A. Acosta, T. Switzer, J. Hunt, P. Barbera, D. Morley and M. Patterson. 2011. Reef Fish movements from the Dry Tortugas National Park Research Natural Area. George Wright Society on Parks, Protected Areas, and Cultural Sites: Rethinking Protected Areas in a Changing World. March 14 – 18, 2011. New Orleans, LA.

Fotinos T., K. R.T. Whelan, R. B. Shamblin, C. Cabal, and T. Thanawastien 2011. Monitoring Mangrove/Marsh Ecotonal Movement. George Wright Society on Parks, Protected Areas, and Cultural Sites: Rethinking Protected Areas in a Changing World. March 14 – 18, 2011. New Orleans, LA.

Miller, J. Feb 2010. State of the VI Coral Reefs. Presentation to St. John Rotary Club. St. John USVI

Miller J. Weekly Nov 2010 - April 2011. Reef Life. Presentation at Maho Bay Ecocamp, St. John USVI.

Miller, J., A. Davis, M. Patterson, J. Patterson , B. Witcher, A. Atkinson, R. Waara, A. Estep. Feb 2011. Virgin Islands Corals in Hot Water Again. George Wright Society on Parks, Protected Areas, and Cultural Sites: Rethinking Protected Areas in a Changing World. March 14 – 18, 2011. New Orleans, LA.

Patterson, Judd. 2011. Managing the Biscayne BioBlitz Data Storm. George Wright Society on Parks, Protected Areas, and Cultural Sites: Rethinking Protected Areas in a Changing World. March 14 – 18, 2011. New Orleans, LA.

Patterson, Matt. National Park Service's Marine Protected Areas. FIU Marine Protected Areas class. SFCN office, April 11, 2011

SFCN. 2011. South Florida / Caribbean Network. Fact Sheet.

Vargas, R., J. Moser, K. R. T. Whelan, J. Luciani, A. Atkinson, J. Patterson, R. Shamblin, and B. Witcher. 2011. The Vegetation Mapping of Four Small Parks. George Wright Society on Parks, Protected Areas, and Cultural Sites: Rethinking Protected Areas in a Changing World. March 14 – 18, 2011. New Orleans, LA.

Waara, R., M. Patterson, J. Miller, A. Estep, A. Davis, M. Feeley, B. Witcher, J. Patterson, R. Vargas, A. Atkinson, S. Locker and D. Polandro. 2010. The New and Improved Dry Tortugas National Park 2010 Benthic Habitat Map. Linking Science to Management: A Conference & Workshop on the Florida Keys Marine Ecosystem. Oct. 19 - 22, 2010. Hawk's Cay, Duck Key, FL.

Waara, R., M. Patterson, J. Miller, A. Estep, A. Davis, M. Feeley, B. Witcher, J. Patterson, R. Vargas, A. Atkinson. 2011. Development and policy applications of the 2010 benthic habitat map for Dry Tortugas National Park. George Wright Society on Parks, Protected Areas, and Cultural Sites: Rethinking Protected Areas in a Changing World. March 14 – 18, 2011. New Orleans, LA.

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Witcher, B. and R. Vargas. 2011. Deepwater Horizon Oil Spill: South Florida/Caribbean Network Field efforts and Data Management. George Wright Society on Parks, Protected Areas, and Cultural Sites: Rethinking Protected Areas in a Changing World. March 14 – 18, 2011. New Orleans, LA.

V. Connect the Dots – Resource Condition Summary Tables

Abbreviated SFCN draft Connect the Dot Resource Condition Summary tables are can be downloaded from

<http://www1.nrintra.nps.gov/im/units/sfcn/connect.cfm>

Only data from coral reef monitoring, EPMT monitoring, Air Quality, and some CERP-RECOVER monitoring are included this year in the tables with placeholders for remaining vital signs.

Background

The “Connect the Dots” effort is a strategic, long-term framework (over a period of years to decades) for coordinating the efforts of the I&M networks, Natural Resource Condition Assessment Program, park planning (e.g., Foundation Statement, General Management Plan, Resource Stewardship Strategy), park-funded monitoring and research relevant to assessing natural resource condition, and other research and monitoring efforts. A Natural Resource Summary Table will eventually be developed for each park as part of the park’s Resource Stewardship Strategy document. The Natural Resource Summary Table framework demonstrates the connection of science to management through the planning process.

The 32 I&M networks were required to develop a first draft of a Vital Signs Supporting Table for each park, which will feed into the larger Natural Resource Summary Table. The draft excel spreadsheets listed on our Intranet site summarize the key measures of resource condition that the I&M network will routinely provide data for as part of our ‘Job 1’ duties of measuring the condition of selected park resources. If the park superintendent or Chief of Natural Resources thinks this Connect the Dots framework is a good idea and requests assistance from network staff to populate additional rows and columns of the Natural Resource Summary Table, network staff should contribute data and expertise to the extent that data and staff time are available to assist the park.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 964/112566, January 2012

National Park Service
U.S. Department of the Interior



Natural Resource Stewardship and Science

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