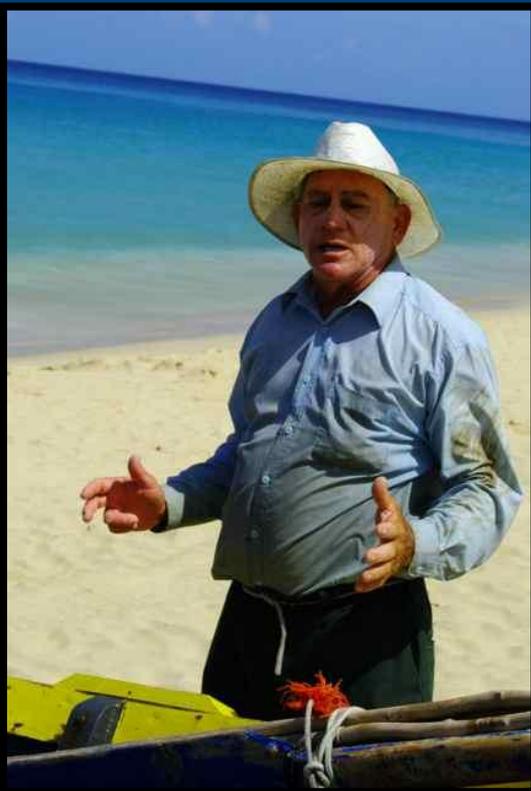


# Genesis of a cooperative fishery independent survey for an island platform in the US Caribbean

(An introduction to a pilot study)

GCFI; November 5, 2010

NOAA



**NOAA  
FISHERIES  
SERVICE**

**Todd Gedamke and  
Jennifer Schull**

# Fish Trap Survey on St. Croix Shelf

## OUTLINE

- Need for survey
- Survey methods and design that make this survey unique
- Preliminary results

# Motivation for Study

1) What is the need?

2) Why conduct a fishery-independent survey?

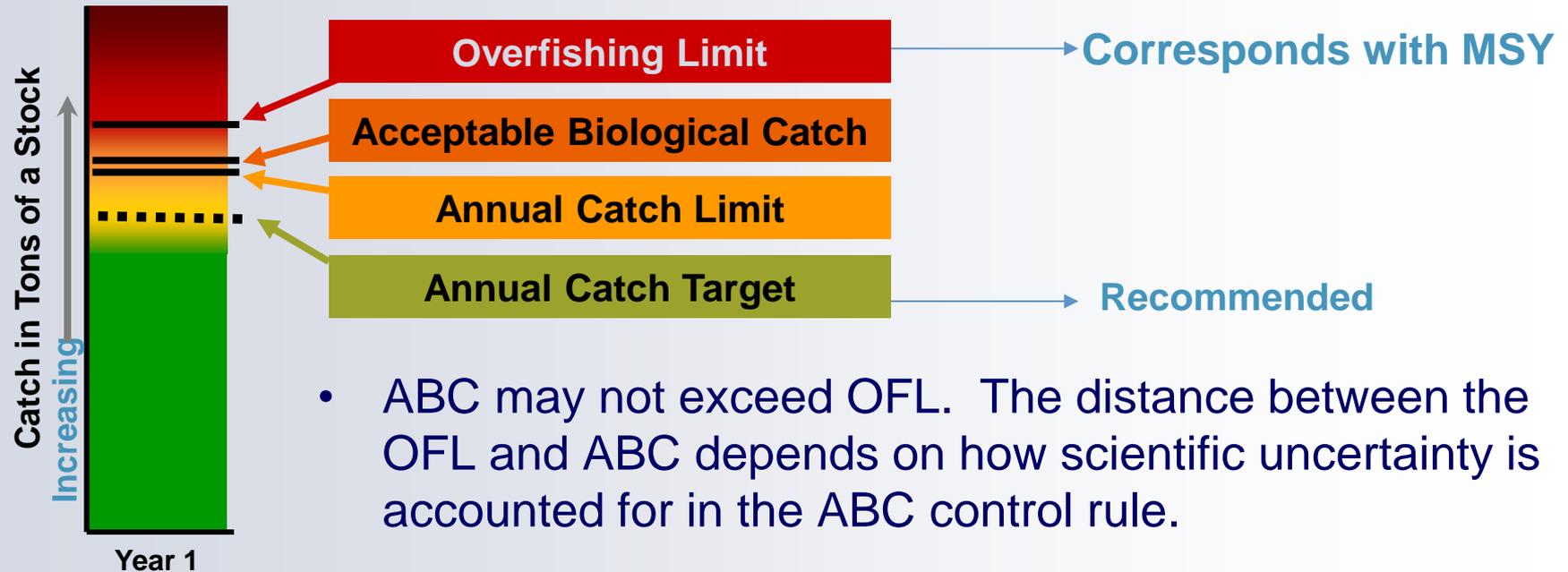
3) Why use a cooperative design?



# Definition Framework

## OFL $\geq$ ABC $\geq$ ACL

Difficult to assess with limited data



- ABC may not exceed OFL. The distance between the OFL and ABC depends on how scientific uncertainty is accounted for in the ABC control rule.
- The ACL may not exceed the ABC.
  - ABC is one of the fishing level recommendations under MSA section 302(h)(6).

§ 600.310 (f)(1)-(7)



# Motivation for Study

## 1) What is the need?

- Data inadequate to conduct comprehensive assessments of fish stocks in the US Caribbean
- Consequently unable to provide substantive management advice to the Caribbean Fishery Management Council
- ACL process has highlighted this need and put pressure on the Southeast Fishery Science Center

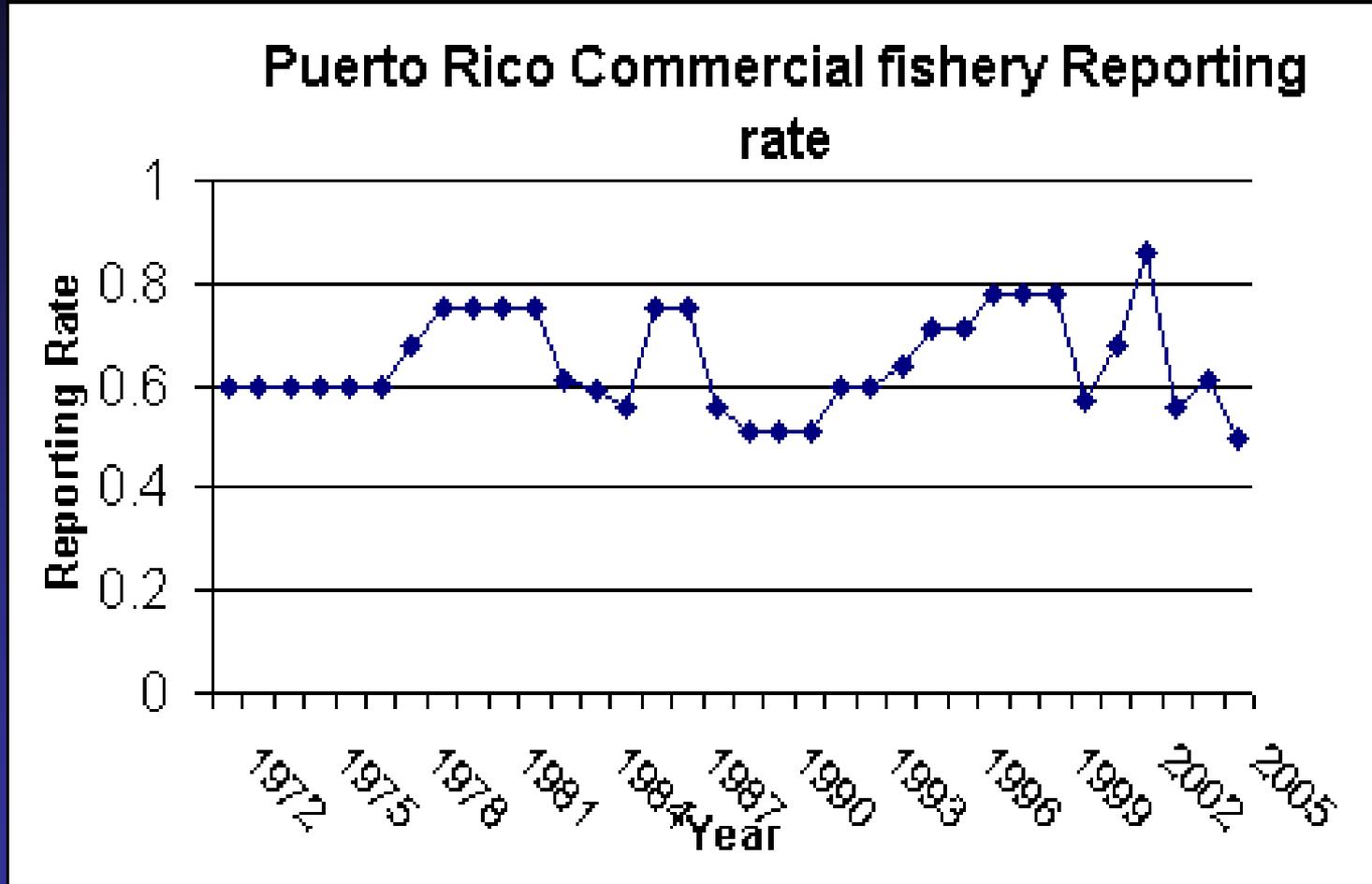
## 2) Why conduct a fishery-independent survey?

- The obvious reason – meets assumptions of ‘standard’ models and easier to interpret
- It will be the first comprehensive spatial study of St. Croix
- It will provide some limited guidance for fisheries management (e.g. Z’s from length frequencies, closed/open comparison, etc.)
- Improve relationships between industry and managers
- If relationships improve, this may improve the quality of fisher-reported data

## 3) Why use a cooperative design?

- Cost-effective way to get spatially comprehensive snapshot of resources.
- ‘Cooperative’ environment will foster trust and build bridges between industry and managers
- Transparency of data

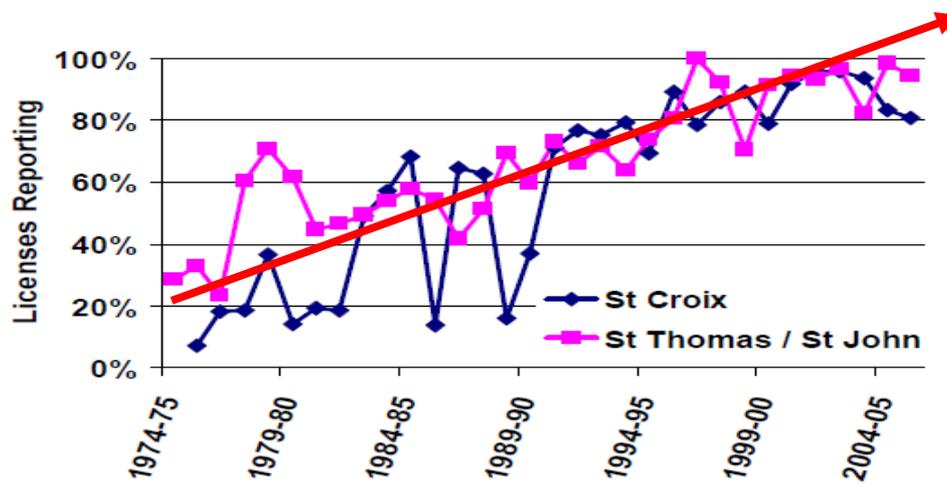
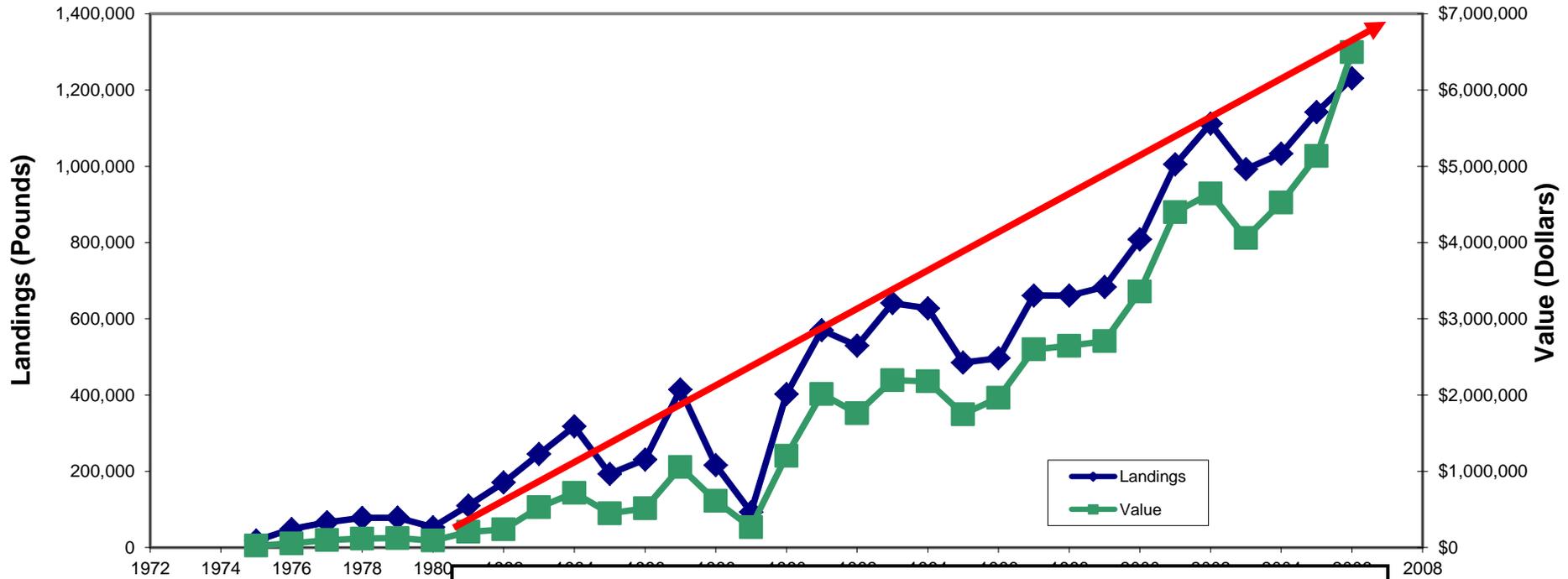
# Commercial Fishery Reporting Rates



~50%

# Reported Landings Only (Not expanded)

## St. Croix



# Recreational Fisheries Data

- Recreational fishing survey (MRFSS) initiated in Puerto Rico in 2000 showing recreational landings make up a significant proportion of the total finfish catch.
- MRFSS is not conducted in the US Virgin Islands
- Occasional, short-term recreational surveys do occur, e.g. May-Sept. 2000 when 50,000 recreational conch fishers were estimated in Puerto Rico and the Virgin Islands
- There is no long-term, ongoing monitoring of recreational fishing in the US Caribbean other than MRFSS in Puerto Rico

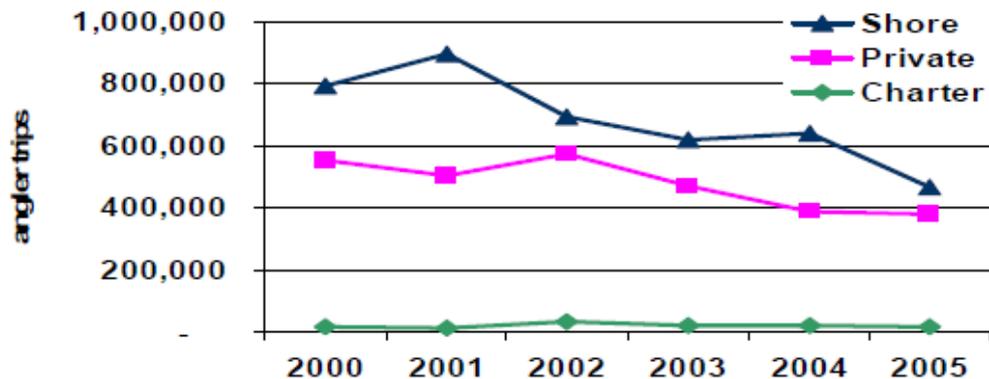


Figure 14. Estimated angler trips for Puerto Rico by mode from the Marine Recreational Fisheries Statistical Survey.

# Fisheries Independent Data

Data set	Years	Area	Methods	Target
Reef fish monitoring USVI Nat'l Park	1982-present	St. John, Buck Island St. Croix	Visual surveys, traps	Reef fish, conch, benthos
Reef fish surveys (PR DNER)	1988-present	Western PR, SE St. Thomas	Trap, hook and line	Reef fish
REEF and AGRRA surveys	1990-present	PR, USVI, BVI	Trained volunteers' observations	Reef fish
Seamap Reef Fish Sampling	1991-present	Western PR, St. Croix, St. Thomas	Trap, hook and line	Reef fish
Reef ecology, disease, and restoration	1997-present	Mona, Desecheo, La Parguera PR	Visual surveys, permanent & random sites	Corals, fish assemblages
Territorial Coral Reef Monitoring	2001-present	USVI, Vieques*, Desecheo*	Transects and roving diver	Reef fish, coral
Caribbean reef fish survey	2001-present	La Parguera PR, Buck Island St. Croix, St. John	Habitat-stratified visual surveys	Reef fish, benthos
Coral ecosystem studies	2001-present	La Parguera, Culebra, St. John	Visual surveys of permanent transects	Reef fish, benthos
PR deep reef surveys	2004-present?	Desecheo, Vieques, Bajo de Cico	Transects at 30-50m depths	Reef fish, coral?
Queen conch population/habitat use	2005-2007	St. John	Tag-recapture, sonic tracking	Queen conch
Shallow water surveys	2001-2003, 2005	St. John - 3 bays	Random visual transects, lift nets	Reef fish, conch, lobster
Trap impacts on reefs	2001-present	PR, USVI	Spp. comp of traps, diver surveys	Fish assemblages, benthos
AUV	?	Portions of deep shelf PR and USVI	Transects?	Benthos, but note other spp.

# Fisheries Independent Data

- **Short time series – no useful time series to conduct stock assessments**
- **Spatially limited**

# **Trip Interview Program (TIP)**

# Trip Interview Program (TIP)

- Data collected by port samplers
- Provides length frequency of sampled catch
- In terms of characterizing catch (e.g. species composition, landings verification, or CPUE) there are several issues:
  - 1) Very small fraction of the total landings are sampled. On the order of 1-2% in the USVI and 3-5% for PR.
  - 2) There is no underlying sampling design, so unsure if the samples are representative of the total catch.
  - 3) Questions as to whether samples were complete catch samples (i.e. 100% of catch sampled for length).

# Motivation for Study

1) What is the need?

2) Why conduct a fishery-independent survey?

3) Why use a cooperative design?

# Motivation for Study

## 1) What is the need?

- Data inadequate to conduct comprehensive assessments of fish stocks in the US Caribbean
- Consequently unable to provide substantive management advice to the Caribbean Fishery Management Council
- ACL process has highlighted this need and put pressure on NOAA NMFS

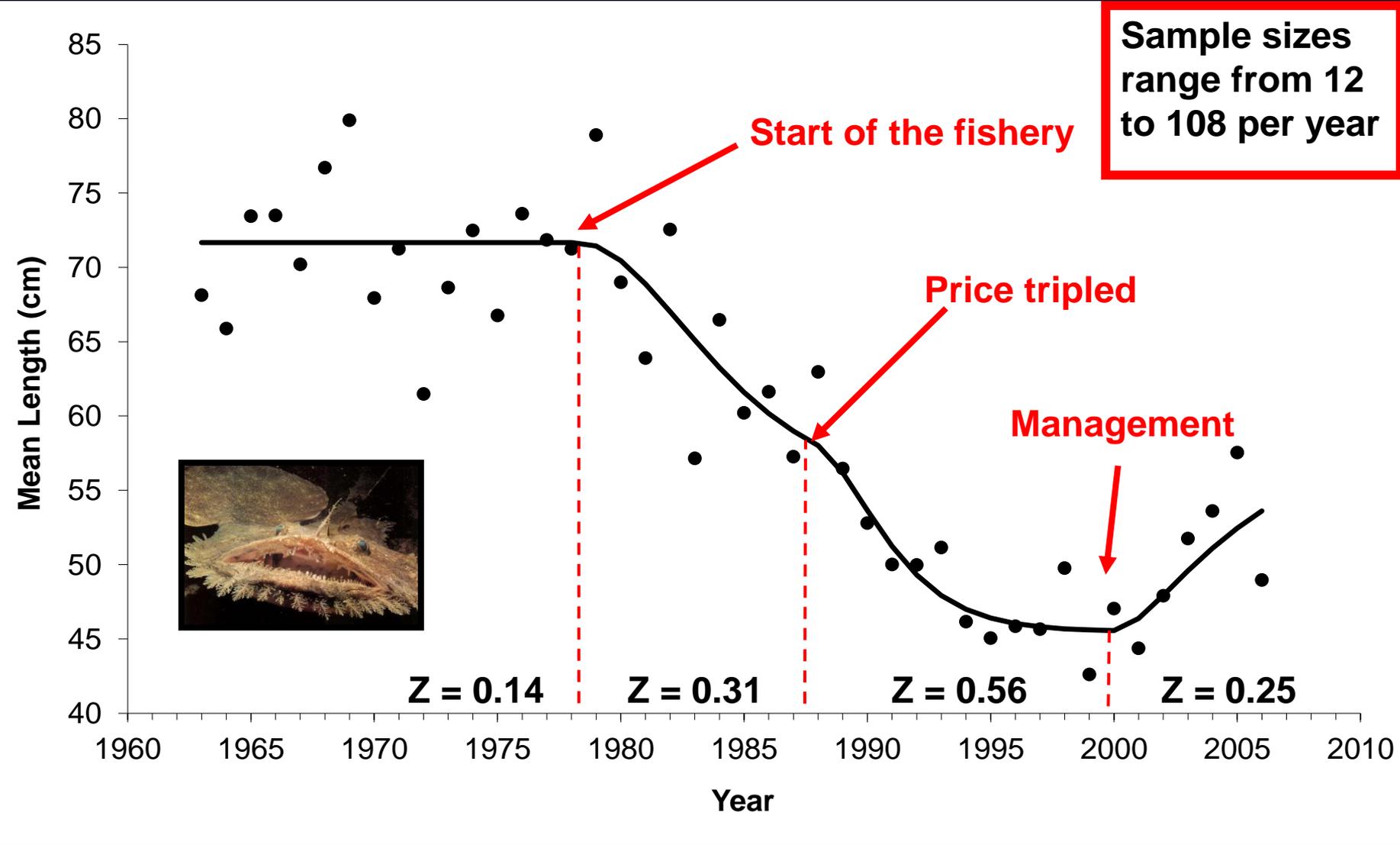
## 2) Why conduct a fishery-independent survey?

- The obvious reason – meets assumptions of ‘standard’ models and easier to interpret
- It will be the first comprehensive spatial study of St. Croix
- It will provide some limited guidance for fisheries management (e.g. Z’s from length frequencies, closed/open comparison, etc.)
- Improve relationships between industry and managers
- If relationships improve, this may improve the quality of fisher-reported data

## 3) Why use a cooperative design?

- Cost-effective way to get spatially comprehensive snapshot of resources.
- ‘Cooperative’ environment will foster trust and build bridges between industry and managers
- Transparency of data

# Goosefish Mortality Estimates--Northern Management Region NEFSC Fall Groundfish Survey



# Motivation for Study

1) What is the need?

2) Why conduct a fishery-independent survey?

3) Why use a cooperative design?

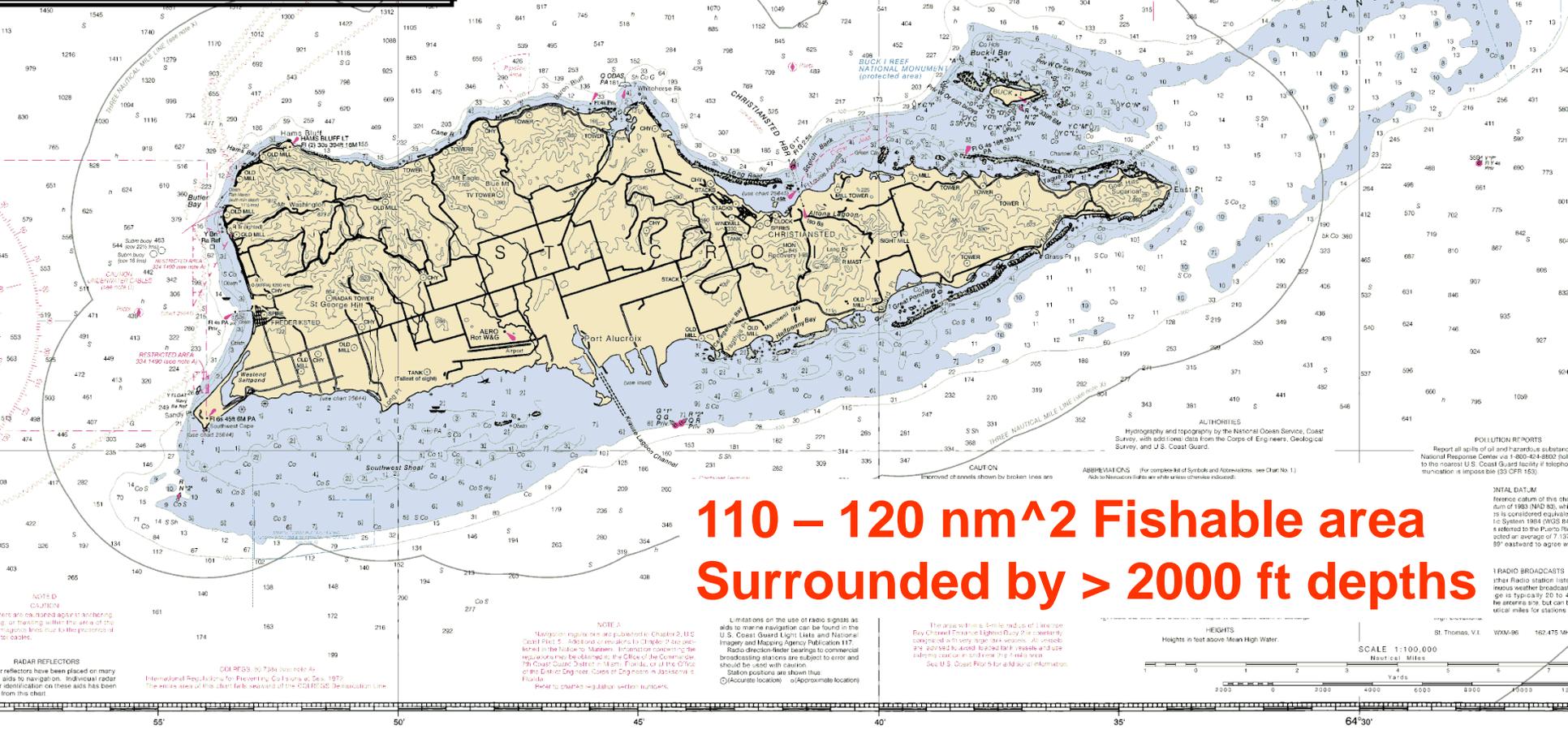
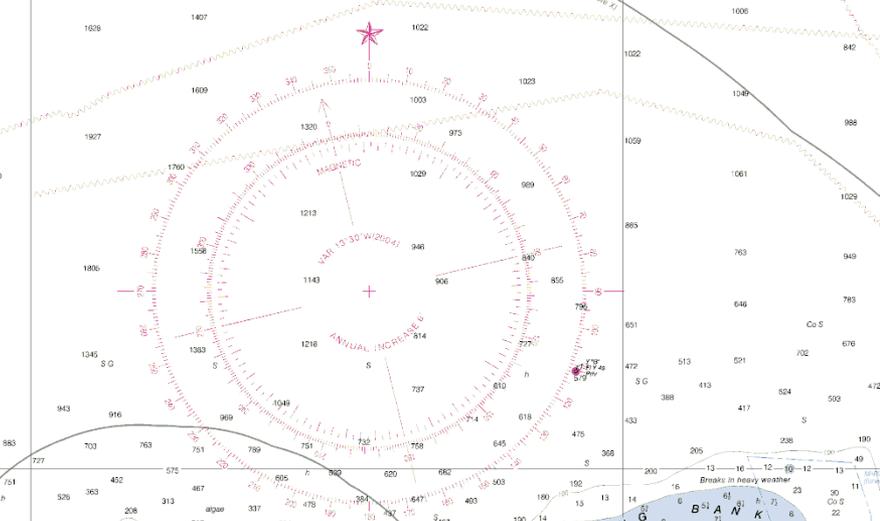
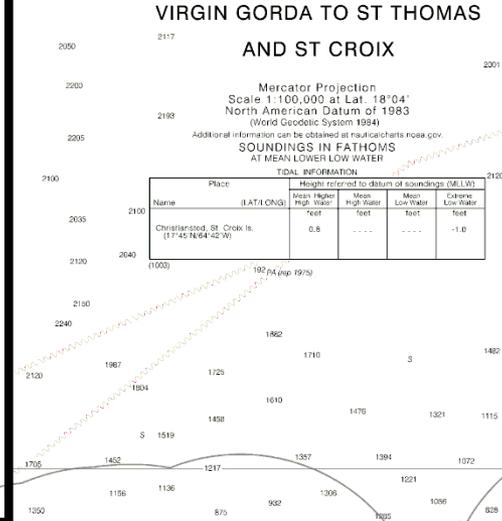
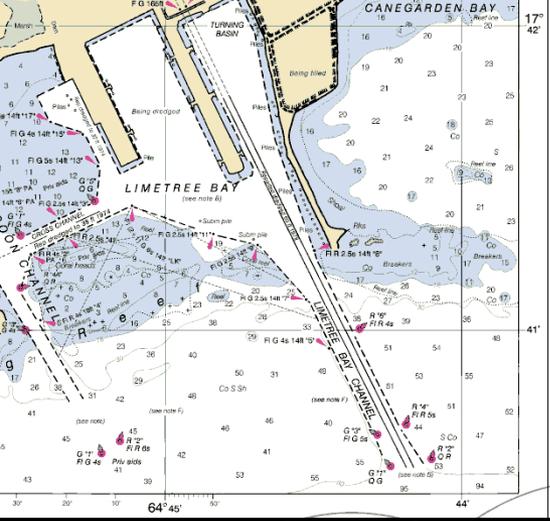
# Motivation for Study

1) What is the need?

2) Why conduct a fishery-independent survey?

3) Why use a cooperative design?

**Cost-effective approach which begins to build bridges between stakeholders and managers. Use of NOAA 'white vessels' cost prohibitive given overall value of US Caribbean Fisheries (~\$14 million/year)**



Mercator Projection  
 Scale 1:100,000 at Lat. 19°04'  
 North American Datum of 1983  
 (World Geodetic System 1984)  
 Additional information can be obtained at nauticalcharts.noaa.gov  
**SOUNDINGS IN FATHOMS**  
 AT MEAN LOWER LOW WATER

TIDAL INFORMATION

Name	Place (IATA/CNG)	Heights referred to datum of soundings (MLLW)			
		Mean Higher High Water	Mean High Water	Mean Low Water	Extreme Low Water
Christiansted, St. Croix Is.	(17°45'N 64°42'W)	0.8	-----	-----	-1.0

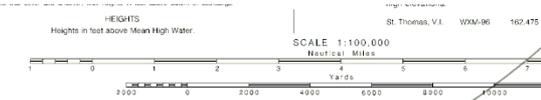
**110 – 120 nm<sup>2</sup> Fishable area  
 Surrounded by > 2000 ft depths**

**NOTE A**  
 Navigation regulations are published in Chapter 2, U.S. Coast Pilot 5. Additional regulations to Chapter 2 are published in the Notice to Mariners. Information concerning the regulations may be obtained in the Office of the Commander, Third Coast Guard District in Miami, Florida, or at the Office of the District Engineer, Coast of Engineers in Jacksonville, Florida.  
 Refer to chapter regulation section numbers.

Limitations on the use of radio signals as aids to marine navigation can be found in the U.S. Coast Guard Light Lists and National Proprietary and Mapping Agency Publication 117. Radio direction-finder bearings to commercial broadcasting stations are subject to error and should be used with caution. Station positions are shown thus:  
 (O) Accurate location (o) Approximate location

The area within a three-mile radius of Limetree Bay Channel Entrance Lighted Buoy (the boundary depicted with very light dark waves). All vessels are advised to avoid "black" vessels and to use extreme caution in conditions of reduced visibility. See U.S. Coast Pilot 5 for additional information.

**CAUTION**  
 Improved channels shown by broken lines are subject to change.  
**ABBREVIATIONS** For complete list of Symbols and Abbreviations, see Chart No. 1.  
**HEIGHTS** Heights in feet above Mean High Water.  
**AUTHORITIES** Hydrography and topography by the National Ocean Service, Coast Survey; with additional data from the Corps of Engineers, Geological Survey, and U.S. Coast Guard.  
**POLLUTION REPORTS** Report all spills of oil and hazardous substances to the nearest U.S. Coast Guard facility. If telephone communication is impossible file (33 CFR 153).  
**INTIAL DATUM** Reference datum of this chart is the datum of 1983 (NAVD 83), which is considered equivalent to System 1984 (WGS 84) as referred to the datum. The charted average of 7.1378° eastward to agree with the datum.



# Fisherman designed and built 40 identical traps



**Local fishermen and vessels used to conduct study. Local contractor (Hank Tonnemacher; Seven Seas Ltd.) implemented the project.**



All fish identified,  
measured, and  
photographed by  
scientific staff



# Objectives of Study

- 1) Integrate information from existing habitat mapping projects with local, historical fishing patterns to develop a statistically sound survey. Sampling intensity will be designed to evaluate the spatial resolution that is required given the patchy nature of the resource and use of accessory habitat/fisheries information.**
- 2) Develop a cooperative sampling program with the local fishing community to cost effectively implement the survey. Our focus will be on model which will be transferable to other regions/locations.**
- 3) Conduct statistical analysis to provide immediate information to the Council's ACL process. The results will provide the first spatially comprehensive snapshot of relative reef fish abundances in the US Caribbean.**

# Integrating Existing Products

- Visual Survey sites
- Directed Studies (e.g. spawning aggregations)
- Habitat Mapping
- Coral Reef Monitoring / MPA work
- Socioeconomic Studies
- Fishery Dependent Information

## The State of Coral Reef Ecosystems of the U.S. Virgin Islands

Paige Rothenberger<sup>1</sup>, Jeremiah Blondeau<sup>2</sup>, Carrollyn Cox<sup>3</sup>, Susan Curtis<sup>4</sup>, William S. Fisher<sup>5</sup>, Virginia Garrison<sup>6</sup>, Zandy Hillis-Starr<sup>7</sup>, Christopher F.G. Jeffrey<sup>8</sup>, Elizabeth Kadison<sup>2</sup>, Ian Lundgren<sup>7</sup>, W. Jeffrey Miller<sup>9</sup>, Erinn Muller<sup>10</sup>, Richard Nemeth<sup>2</sup>, Shona Paterson<sup>11</sup>, Caroline Rogers<sup>12</sup>, Tyler Smith<sup>2</sup>, Anthony Spitzack<sup>12</sup>, Marcia Taylor<sup>13</sup>, Wesley Toller<sup>14</sup>, Julie Wright<sup>15</sup>, Dana Wusinich-Mendez<sup>18</sup> and Jeannette Waddell<sup>8</sup>

Additional Contributions: Jordan Gass<sup>17</sup>, Nadine Noorhasan<sup>18</sup>, David Olsen<sup>19</sup> and Douglas Westphal<sup>20</sup>

(source: The State of Coral Reef Ecosystems of the U.S. Virgin Islands. Rothenberger et al. 2008)

**Fish assemblages and benthic habitats of Buck Island Reef National Monument (St. Croix, U.S. Virgin Islands) and the surrounding seascape:  
A characterization of spatial and temporal patterns**

A cooperative investigation between NOAA and the National Park Service



May 2008

NOAA Technical Memorandum NOS NCCOS 71

Simon J Pittman  
Sarah D Hile  
Christopher FG Jeffrey  
Chris Caldow  
Matt S Kendall  
Mark E Monaco  
Zandy Hillis-Starr

**Fish assemblages and benthic habitats of Buck Island Reef National Monument (St. Croix, U.S. Virgin Islands) and the surrounding seascape:  
A characterization of spatial and temporal patterns**

Simon J Pittman<sup>1,2</sup>, Sarah D Hile<sup>1</sup>, Chris FG Jeffrey<sup>1</sup>, Chris Caldow<sup>1</sup>, Matt S Kendall<sup>1</sup>,  
Mark E Monaco<sup>1</sup> and Zandy Hillis-Starr<sup>3</sup>

<sup>1</sup> NOAA/National Ocean Service/National Centers for Coastal Ocean Science/Center for Coastal Monitoring and Assessment/Biogeography Branch

<sup>2</sup> Marine Science Center, University of the Virgin Islands, St. Thomas, U.S. Virgin Islands

<sup>3</sup> National Park Service, St. Croix, U.S. Virgin Islands

Biogeography Branch

Center for Coastal Monitoring and Assessment (CCMA)

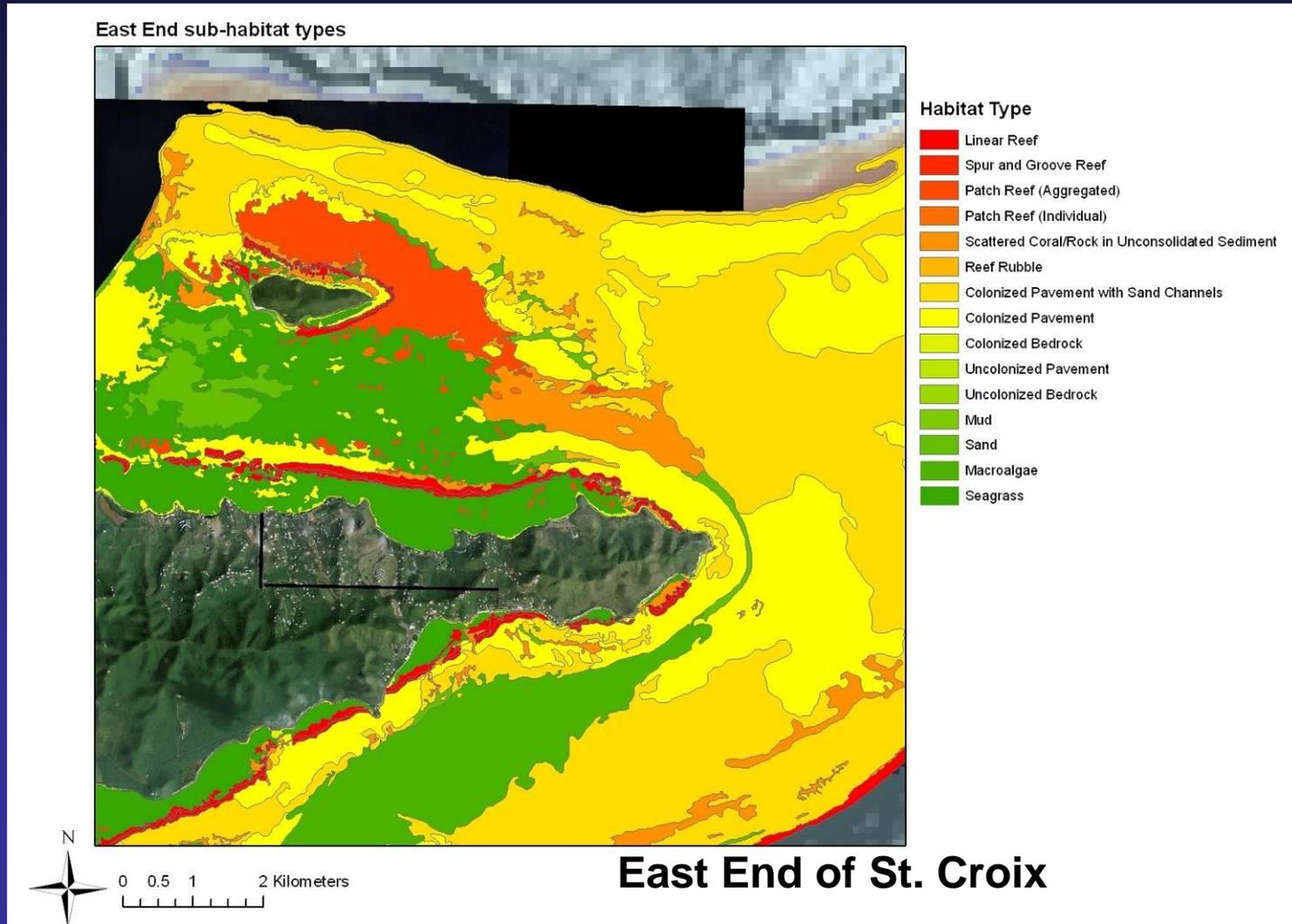
NOAA/NOS/National Centers for Coastal Ocean Science

1305 East West Highway (SSMC-IV, N/SCI-1)

Silver Spring, MD 20910

# Survey Design was an iterative process

- Partnered with NOS/Biogeography team (Simon Pitman/Mark Monaco) and staff/students at UVI (Jeremiah Blondeau) for GIS/survey design support
- Stratification by habitat type and closed/open areas



# Comparison of species abundance, composition, and length structure between open and closed areas

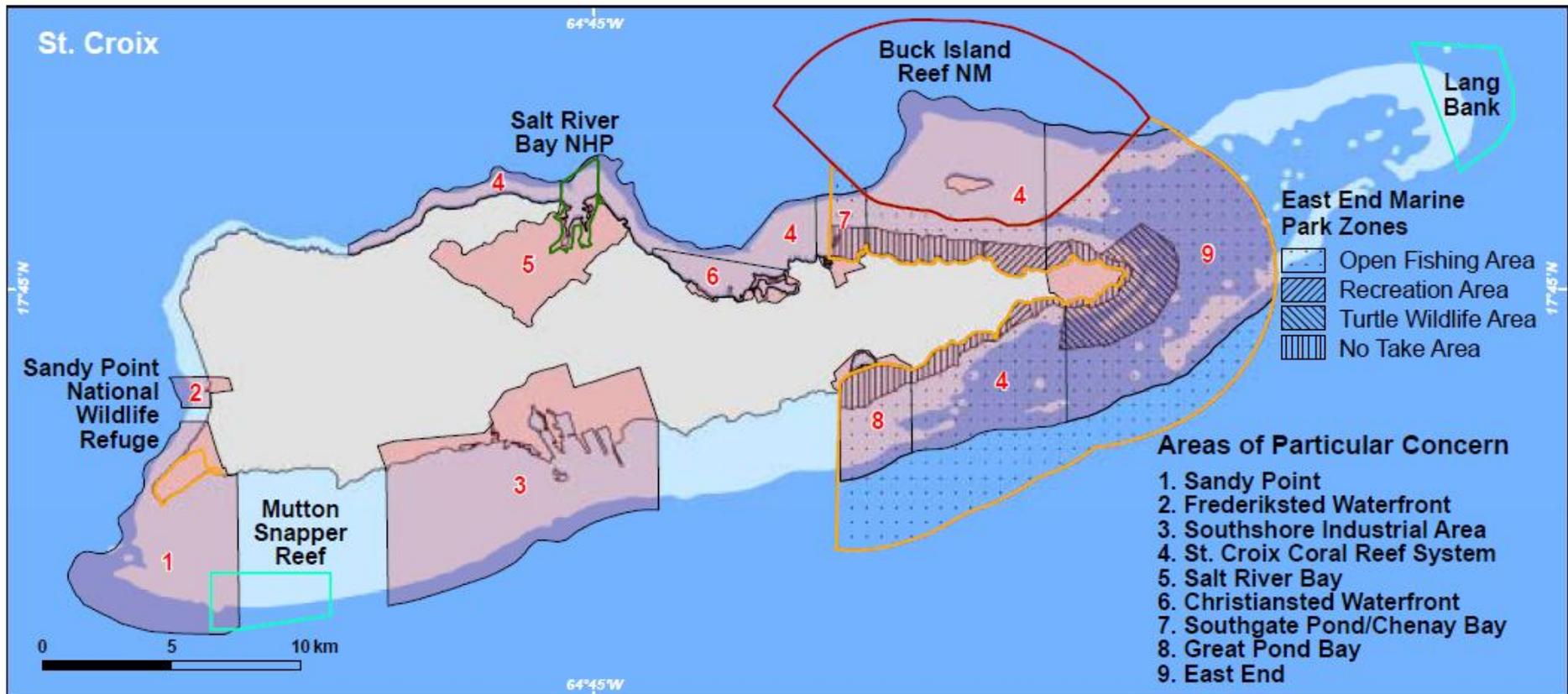


Figure 2.40. Map of the USVI showing managed areas mentioned in this chapter. Map: K. Buja.

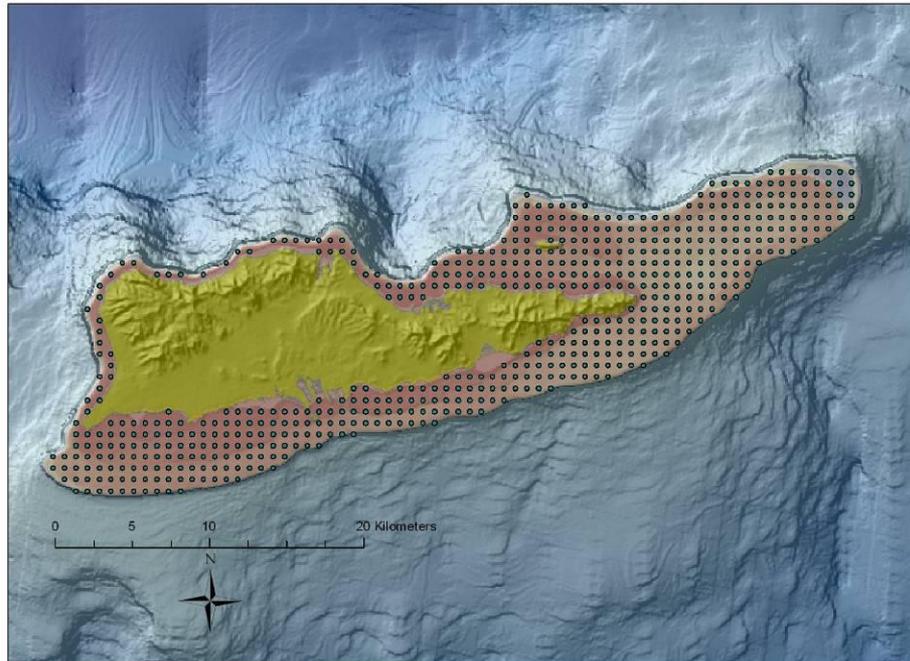
# Combination of systematic, stratified, and fixed stations

Images produced by UVI-NOS/Biogeography Program

600 random points in hardbottom habitat



597 equally spaced points



- Given budget we will be able to cover ~ 600 stations
- Fishable shelf area ~110 nm<sup>2</sup>
- ~4-6 stations/nm

## Overlap existing visual survey locations

- comparisons of trap catch to 'absolute' visual counts
- insights as to species specific and size catchability

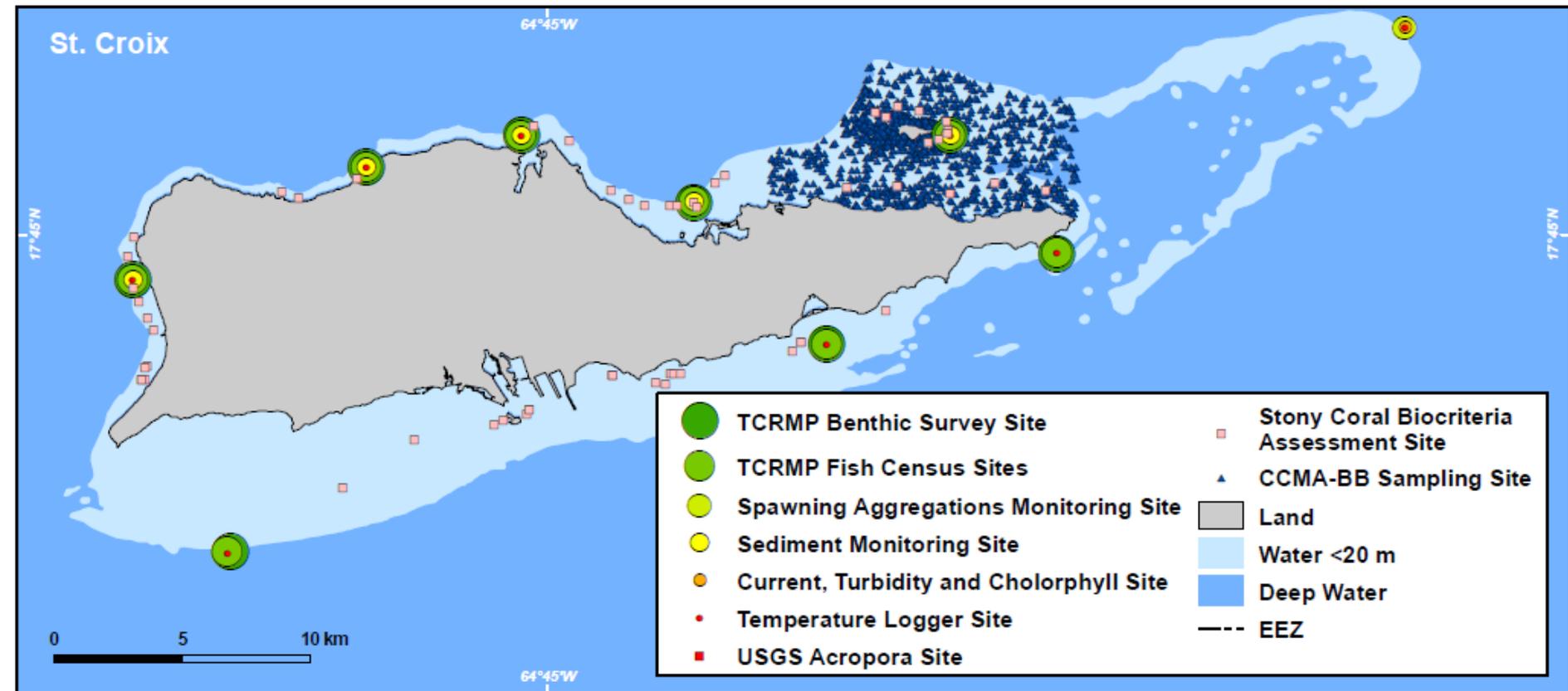


Figure 2.13. Locations of monitoring and research efforts occurring in the USVI between 2004 and 2007. Map: K. Buja.

**St. Croix Comprehensive (Entire Shelf)  
Statistical Design**

**600 total stations**

# Base Stratification of soft/hard bottom and open/closed areas (4 levels)



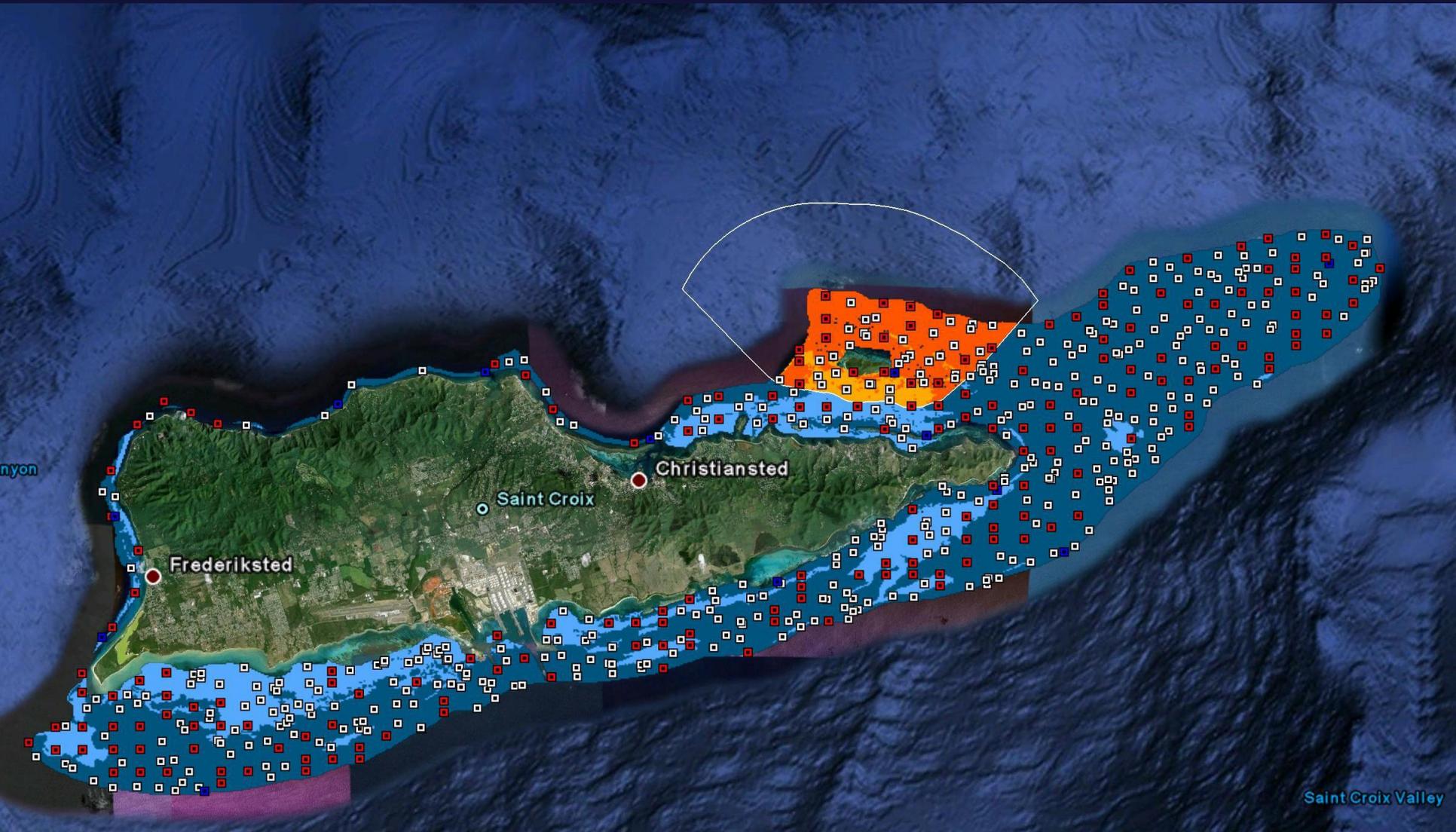
# 10 fixed stations that represent UVI time series



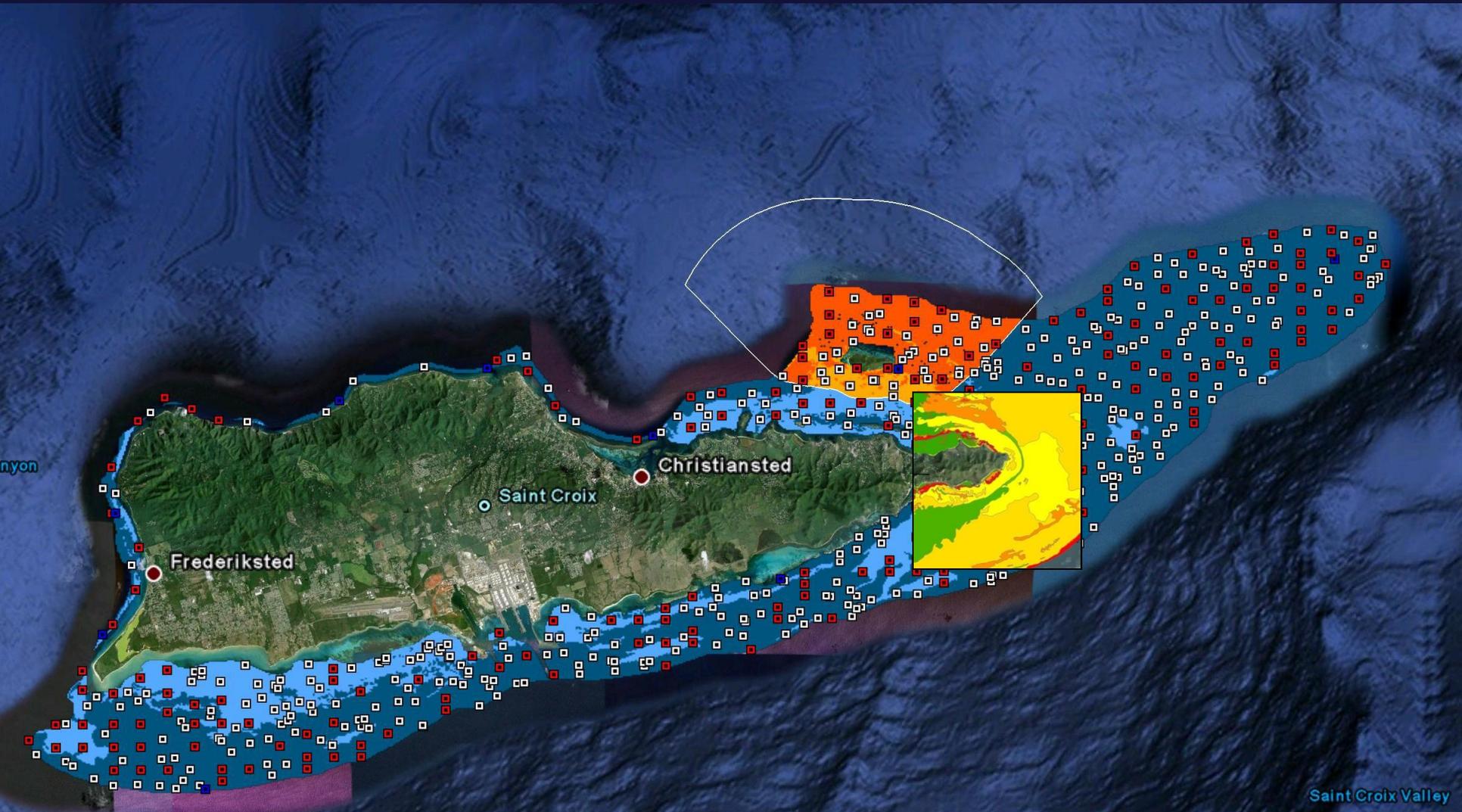
# 400 stratified random stations allocated proportionally by area



An additional 200 stations added by novel geostatistical allocation design developed by John Walter and Todd Gedamke (SEFSC). Entire shelf searched over 30 m resolution for sample location that minimizes the variance of the geostatistical/kriging sample mean.



**Existing Habitat information will add ability to post-stratify and inform design of future surveys.**

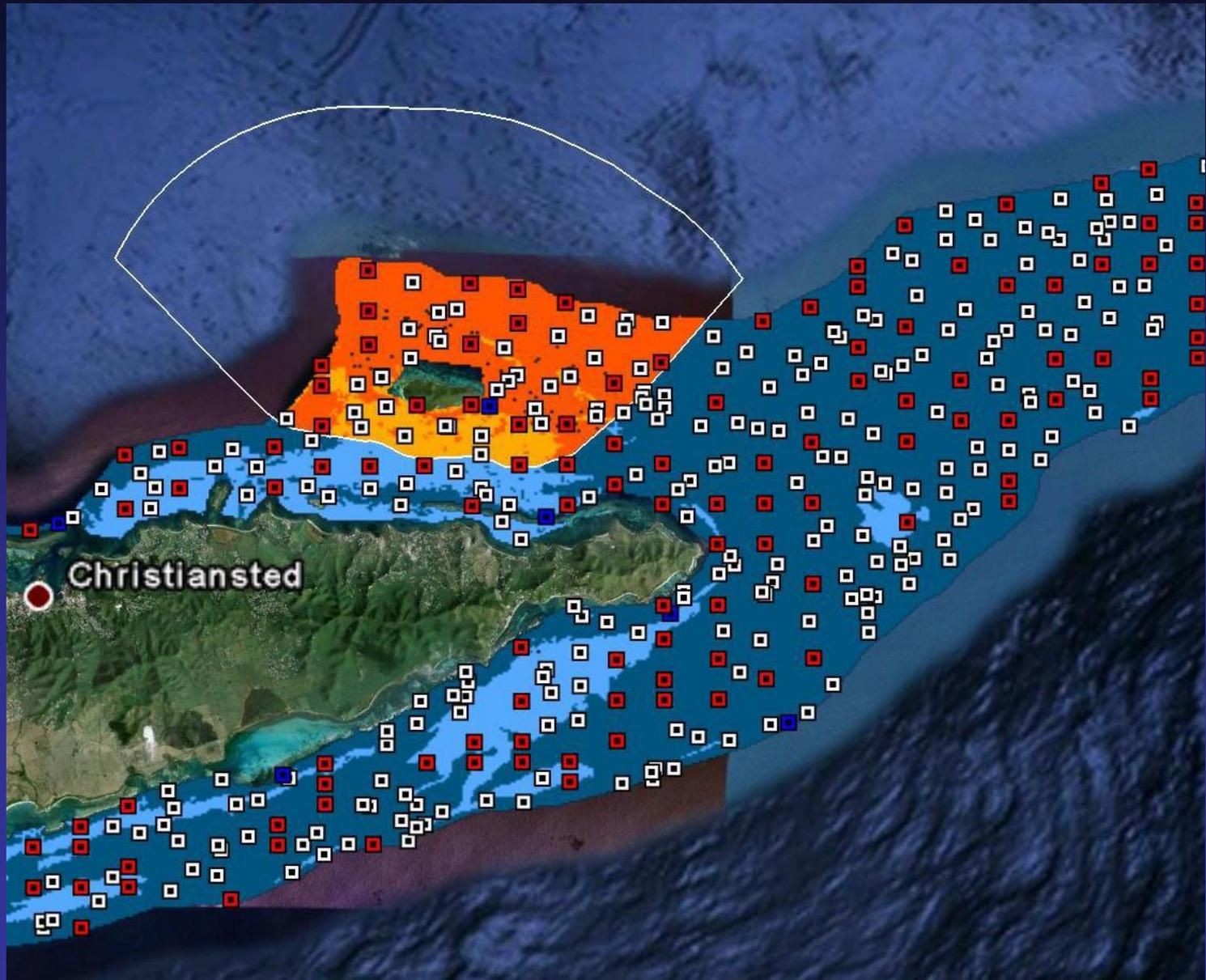


# **Buck Island Addendum (10/13/10) to Statistical Design and overall program**

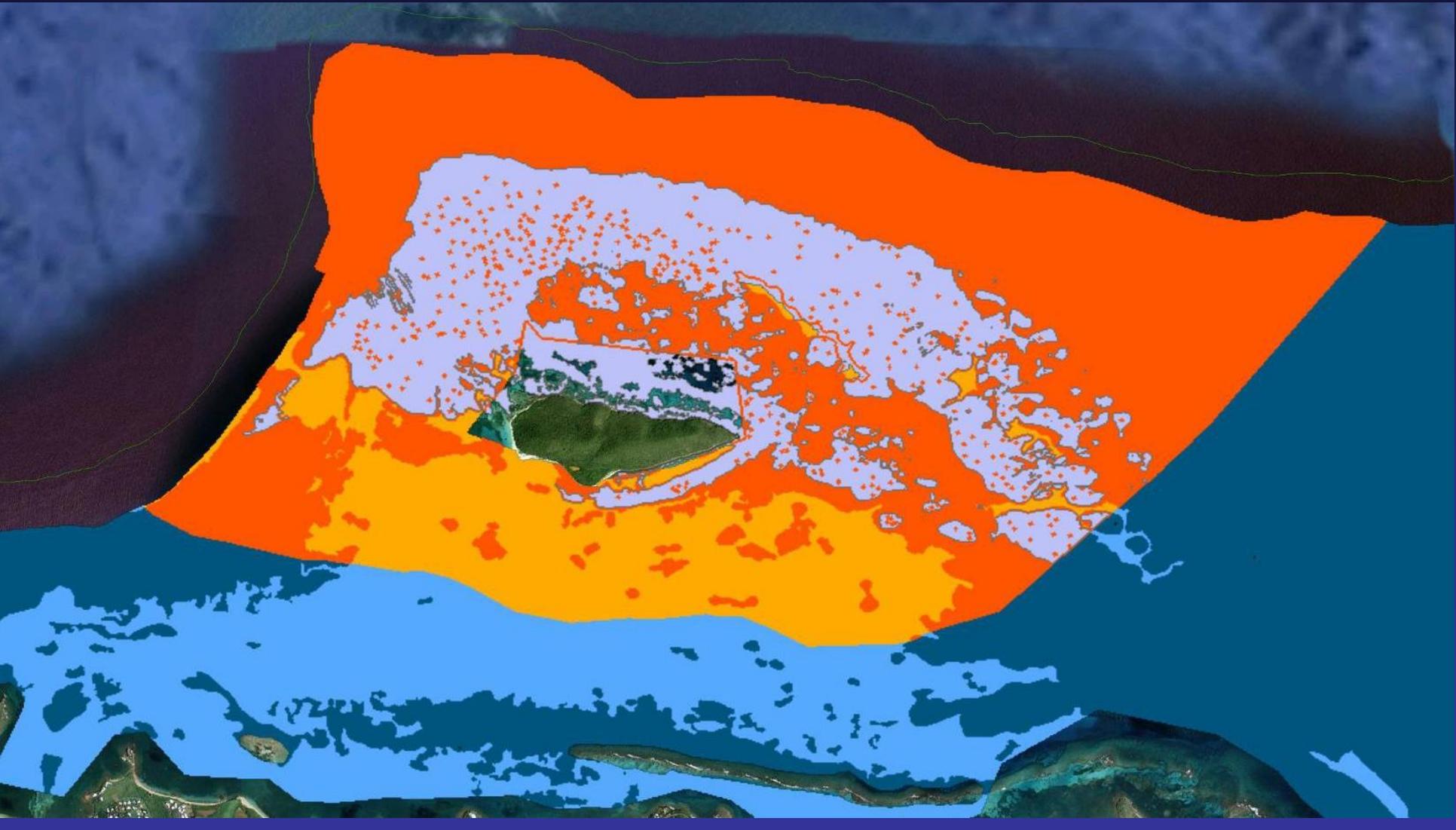
**Commercial fisherman not allowed to participate so  
cooperative component removed from study**

**No access to a substantial section of park deemed  
critical habitat which effects statistical design**

# Proportional Allocation by Area and Hard/Soft Bottom

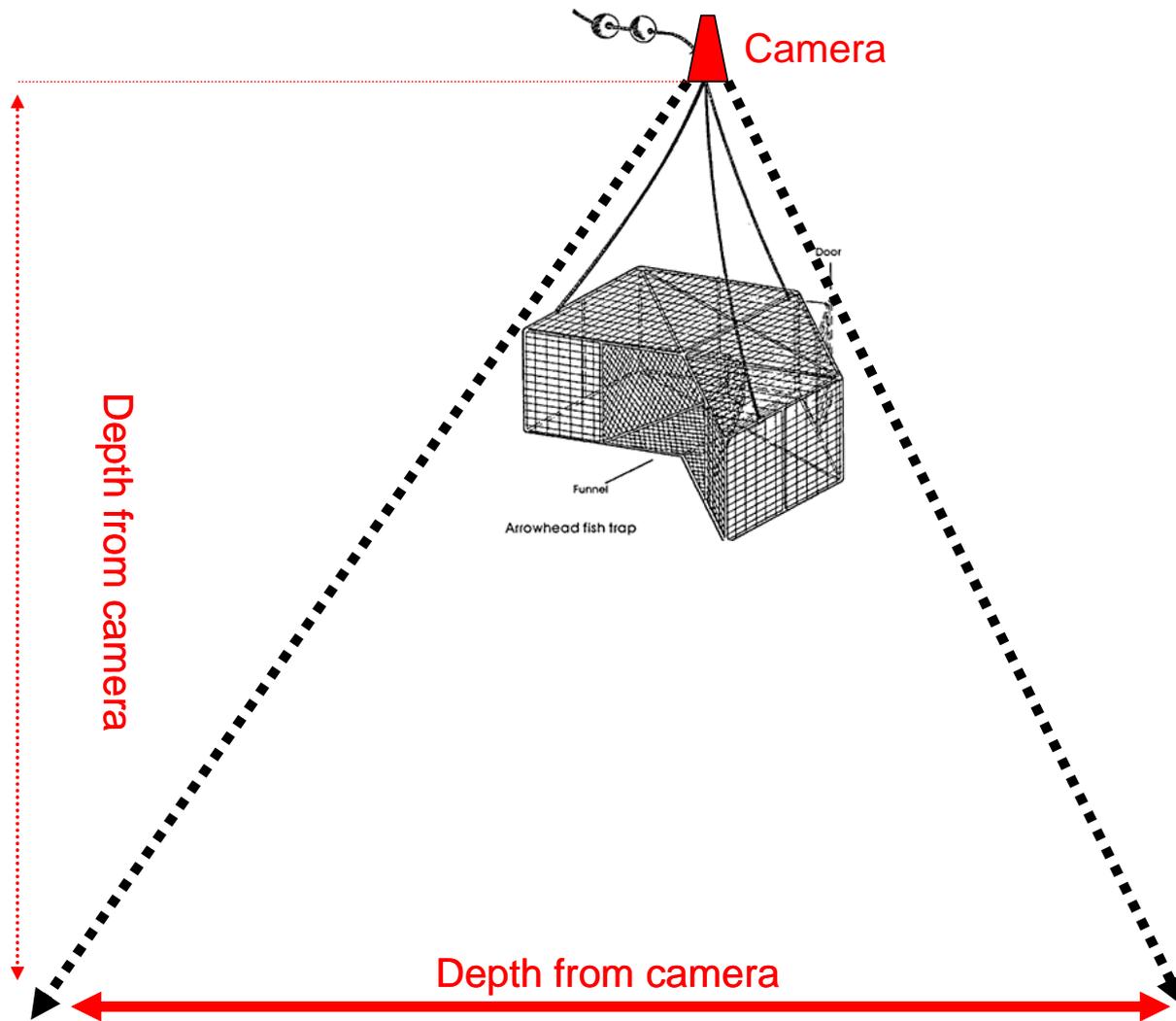


**Elimination of significant amounts of 'critical habitat' during final permit phase (light blue areas designated by Inverse Distance Relationship to known Acropora sites) – Affected overall sample design**



# Requirement to use camera on all sets/hauls – Has been successful

Figure 1a: Viewing range of Seaviewer camera.



# Project began on October 10, 2010.

# Expected Completion Date: November 10, 2010

## NOAA Fish Trap Research

*Please do not disturb these buoys  
or the traps they are attached to*

*This study is to be completed  
by November 15, 2010.  
Your cooperation is greatly  
appreciated. Thank you!*

*Call 340-642-7816 with any questions*

National Park Service  
U.S. Department of the Interior

Buck Island Reef NM / Salt River Bay NHP & EP



### NOAA Fisheries Trap Survey – STX/BUIS

November 1-5, 2010

National Park Service and NOAA National Marine Fisheries Service -Southeast Fisheries Science Center, will be conducting a fish trap research project to accurately determine what Antillean fish traps catch using scientific methodology. Fish traps will be deployed within Buck Island Reef NM waters in all habitat types, sand, sea grass, and adjacent to reef areas, from November 1 - 5, 2010. Buck Island Reef NM will have 56 of the 600 trap locations to be deployed around St. Croix. This will be one of many tests to determine if the park fishing closure is succeeding in increasing fish stocks inside the park. The project will help NOAA NMFS gain a better understanding of the reported catches in fish traps around St. Croix. This information will be critical in understanding the status of the St. Croix fishery.

### NOAA Fish Trap Research

*Please do not disturb these buoys  
or the traps they are attached to*

*This study is to be completed  
by November 15, 2010.  
Your cooperation is greatly  
appreciated. Thank you!*

*Call 340-642-7816 with any questions*

Each Trap has  
2 surface floats –  
one orange, and  
one white

#### Team includes:

Todd Gedamke, NOAA/NMFS  
Henry Tonnemacher, Contractor  
Liam Carr, Texas AM/Researcher  
Ian Lundgren, NPS

Sandy Schexnayder, Contractor  
Cynthia Grace, U of So. Florida  
Zandy Hillis-Starr, NPS

**Operations:** NPS M/V Osprey will be used for the study at Buck Island Reef NM. Captain Henry (Hank) Tonnemacher will be operating boat for trap deployments and retrievals.

**Duration:** Mission will be conducted from November 1-5, 2010 from 7:30am to 5pm.

**Questions:** Please contact NPS Headquarters at 340-773-1460 x 236 or x 235 or Captain Tonnemacher, Seven Seas Limited, 340-642-7816.

Announcements posted in dive shops,  
stores, and emailed to officials

- ~500 stations completed to date (as of 11/2/2010)
- Total number of fish = 2,310
- Number of different species = 56



Species	Number Caught	% of Total			
White Grunt	483	20.91	Foureye Butterflyfish	10	0.43
Queen Triggerfish	310	13.42	Bermuda Chub	7	0.30
Blue Tang	240	10.39	Caribbean Spiny Lobster	7	0.30
Banded Butterflyfish	183	7.92	Chub	7	0.30
Doctorfish	154	6.67	Lane Snapper	7	0.30
Yellowtail Snapper	145	6.28	French Grunt	5	0.22
Black Durgon	109	4.72	Green Moray Eel	5	0.22
Red Hind	100	4.33	<b>Nassau Grouper</b>	5	0.22
Schoolmaster	87	3.77	Queen Angelfish	5	0.22
Blue Runner	61	2.64	Porkfish	4	0.17
<b>NO FISH</b>	<b>59</b>	<b>2.55</b>	Squirrelfish	4	0.17
Spotfin Butterflyfish	37	1.60	Whitespotted Filefish	4	0.17
Ocean Surgeonfish	36	1.56	French Angelfish	3	0.13
Nurse Shark	28	1.21	Gray Angelfish	3	0.13
Scrawled Filefish	27	1.17	Mutton Snapper	3	0.13
Caesar Grunt	22	0.95	Princess Parrotfish	2	0.09
Smooth Trunkfish	22	0.95	Rock Beauty	2	0.09
Bluestriped Grunt	21	0.91	Bar Jack / Yellow Jack	1	0.04
Scrawled Cowfish	17	0.74	Batwing Coral Crab	1	0.04
Cottonwick	14	0.61	Conch	1	0.04
Bar Jack	12	0.52	Flying Gunard	1	0.04
Spotted Trunkfish	12	0.52	Gray Triggerfish	1	0.04
Coney	11	0.48	Great Barracuda	1	0.04
Honeycomb Cowfish	11	0.48	Horse-eye Jack	1	0.04
Schoolmaster Snapper	11	0.48	Ocean Triggerfish	1	0.04
Foureye Butterflyfish	10	0.43	Orange filefish (?, partly eaten)	1	0.04
			Sargassum Triggerfish	1	0.04
			Spiny Lobster	1	0.04
			Trunkfish	1	0.04
			Unidentified Jack (eaten)	1	0.04
			Yellow Jack	1	0.04
			Yellowfin Grouper	1	0.04

## **Key points:**

- **Squid bait for 24 hr soaks will only provide snapshot of segment of fisheries. To target parrotfish, for example would likely require different bait and longer soak times.**
- **Sampling only conducted during October-November and temporal differences in catchability should be addressed in future work.**
- **Fisher interviews/input is key to follow up studies.**

# **Pilot Project- Proof of Concept – dynamic process incorporating expertise of local communities, managers, and regional researchers.**

## **Pro's –**

- **First spatially comprehensive fishery-independent data set**
- **Build bridges between stakeholders. Cooperative program instills a sense of transparency to the fishing community.**
- **Addresses well voiced opinion to evaluate closed areas**
- **Designed survey removes 'skill' affect and provides greater ability to interpret data**

## **Con's –**

- **Difficult political environment and communities upset with ACL process and NMFS as a whole.**
- **Traps. Best choice given recommendations from fishers and ability to sample the most diverse number of species. Minimal mortality through use of release cages and potential for collaborative tagging studies.**

*Science, Service, Stewardship*



**Thank you!**

**Genesis of a cooperative fishery  
independent survey for an island  
platform in the US Caribbean**

**Todd Gedamke,  
Jennifer Schull**

**Tom Daley  
St. Croix Trap Fisherman**

