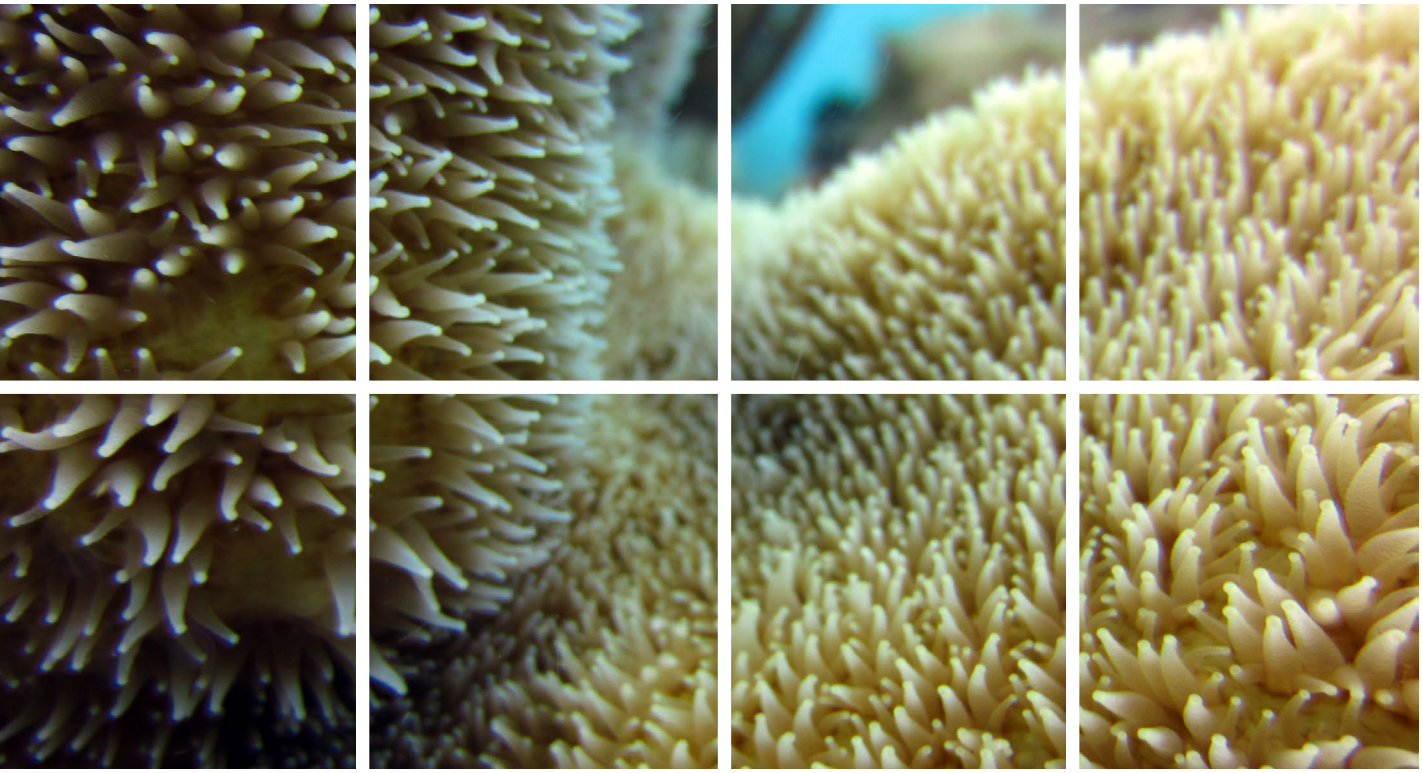
NATIONAL CORAL REEF MONITORING PROGRAM

Biological Monitoring Atlantic/Caribbean

St. John and St. Thomas
U.S. Virgin Islands



2013

Mission Data Report

December 2015

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National Coral Reef Monitoring Program
Biological Monitoring, Atlantic/Caribbean
St. Thomas and St. John, U.S. Virgin Islands
2013 Mission Data Report

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Significant Contributors

The following persons contributed significantly to the development of protocols, sample allocation, field logistics, and data management and support.

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INTRODUCTION

Background

The National Coral Reef Monitoring Program (NCRMP) is a strategic plan developed by NOAA's Coral Reef Conservation Program (CRCP) to monitor all U.S. coral reef ecosystems with standardized methodologies (http://www.coris.noaa.gov/monitoring/). The monitoring goal is to generate large-scale regional status and trend information for a broad-scale perspective to local jurisdictional or other survey programs. The program includes data collection for fish, corals, socio-economics and climate and is implemented in the Pacific and Atlantic basins.

In the Atlantic/Caribbean region, NCRMP biological field data is collected biennially at each location and targets hard bottom habitats to depths of 30 m (Figure 1). NCRMP fish monitoring protocols were modified from existing protocols in the U.S. Virgin Islands (USVI), Puerto Rico (Pittman et al. 2008, 2010; Friedlander et al., 2013) and the Flower Garden Banks (Caldow et al., 2009; Clark et al., 2014). New benthic protocols were implemented in the 2013 NCRMP field mission for benthic cover and coral demographics.

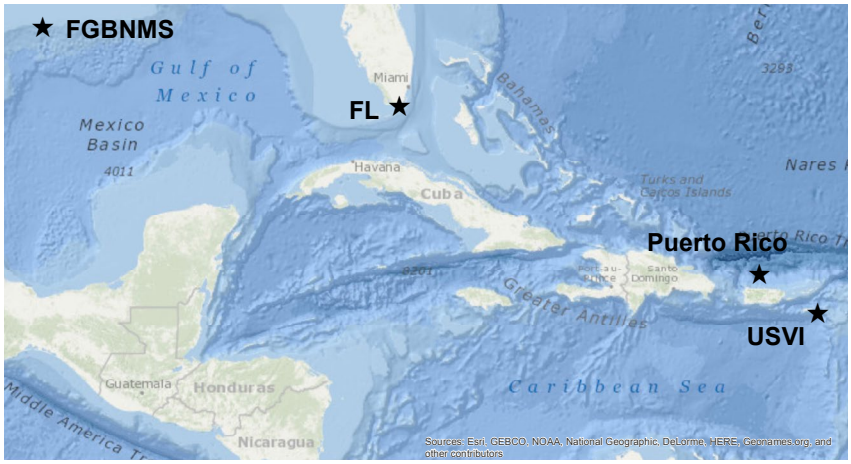


Figure 1. Coral reef areas surveyed by NOAA and partners for the Atlantic/Caribbean National Coral Reef Monitoring Program (NCRMP): U.S. Virgin Islands, Puerto Rico, Florida and Flower Garden Banks National Marine Sanctuary.

The primary monitoring objectives include:

- Develop consistent survey designs, field protocols and training tools
- Survey fish and coral communities to track status and trends
- Collect water samples for NCRMP Climate team
- Provide status and trend information to local resource managers
- Disseminate data to the public
- Provide data summaries annually

This report addresses a subset of the Atlantic/Caribbean sampling domain and provides summary statistics for reef fish and benthic data collected during 2013 surveys in the USVI (St. John and St. Thomas only). All data used in this report are available upon request.

Accomplishments and highlights of the 2013 USVI Mission

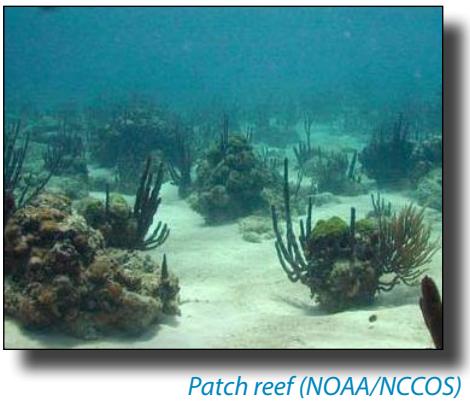
- Trained 37 divers from 7 agencies
  - *NOAA*
  - *National Park Service*
  - *University of the Virgin Islands*
  - *University of Miami*
  - *Nova Southeastern University*
  - *USVI Dept. of Planning and Natural Resources*
  - *The Nature Conservancy*
- 283 fish and Line point-intercept (LPI) surveys; 221 coral demographic surveys
- First island-wide survey for St. Thomas and first for the domain of St. John/Thomas
- 72 water collections for NCRMP Climate team
- Transportable data entry system

METHODS

Sampling domain and design

The targeted sampling domain included hardbottom habitat in water depths less than 30 m (Table 1). All areas within regions were stratified by habitat type (pavement, patch reef, aggregate reef, bedrock, scattered coral and rock in sand (SCR), predicted hardbottom (hereafter referred to as hard) and by depth zone: shallow (1-12.9 m) and deep (13-30 m; Figure 2). The hard habitat type was derived from bathymetry metrics such as rugosity using ENVI software version 5.1 (Exelis Visual Information Solutions, Boulder, Colorado). Hard habitats were delineated in areas that lacked coverage from existing benthic habitat maps but were otherwise suitable for NCRMP surveys (i.e., hard substrate in depth less than 100 ft). Maps of strata were created using the most recent and best available habitat maps and bathymetry. An additional level of stratification was included for administrative area. These levels included St. Thomas East End Reserves (STEER), Virgin Islands National Park (VIIS), Virgin Islands Coral Reef National Monument (VICR) and outside of these areas (Open; Figure 2). Biotope was also a field used in sample allocation. These levels included mid-shelf reef (MSR), Sail Rock, St. Thomas and St. John. Sample site allocation by strata was determined on a proportional area basis of each habitat type due to limitations on pre-existing data for alternate approaches to optimizing sample allocation (Appendix 1). This report presents data summaries by habitat type and administrative area, where relevant depth and biotope are also identified.

Aggregate reef (NOAA/NCCOS)



Patch reef (NOAA/NCCOS)

Table 1. Sampling terms and definitions.

Term	Definition
Region	United States Virgin Islands (USVI)
Sub-region	Areas within the geographic reporting unit. In this report, these include St. Thomas and St. John (USVI)
Strata	Habitat type (bedrock, aggregate reef, patch reef, pavement, SCR, predicated hard) Depth zone (shallow: 1-12.9 m, deep: 13-30 m) Administrative area (STEER, VIIS, VICR, Open) Biotope (MSR, Sail Rock, St. John, St. Thomas)
Reporting Unit	A collection of sample sites, typically a region and in some cases a management unit
Sample site data	The average values of estimated observed quantities from fish and benthic surveys conducted at each site. Typically derived from a pair of simultaneous surveys (Fish/LPI and coral demographic). Sites are tied to geographic coordinates.

Site selection

Prior to each regional survey, sample site locations were randomly selected from the comprehensive site list within the sampling domain. Where divers identified a site as unsuitable (e.g., no hardbottom habitat or exceeded maximum survey depth) or inaccessible (e.g., due to inclement weather conditions) the dive was terminated and an alternate site was picked from the randomized list, ideally to meet the same strata requirements. In some cases, these changes resulted in incomplete spatial coverage of targeted strata.

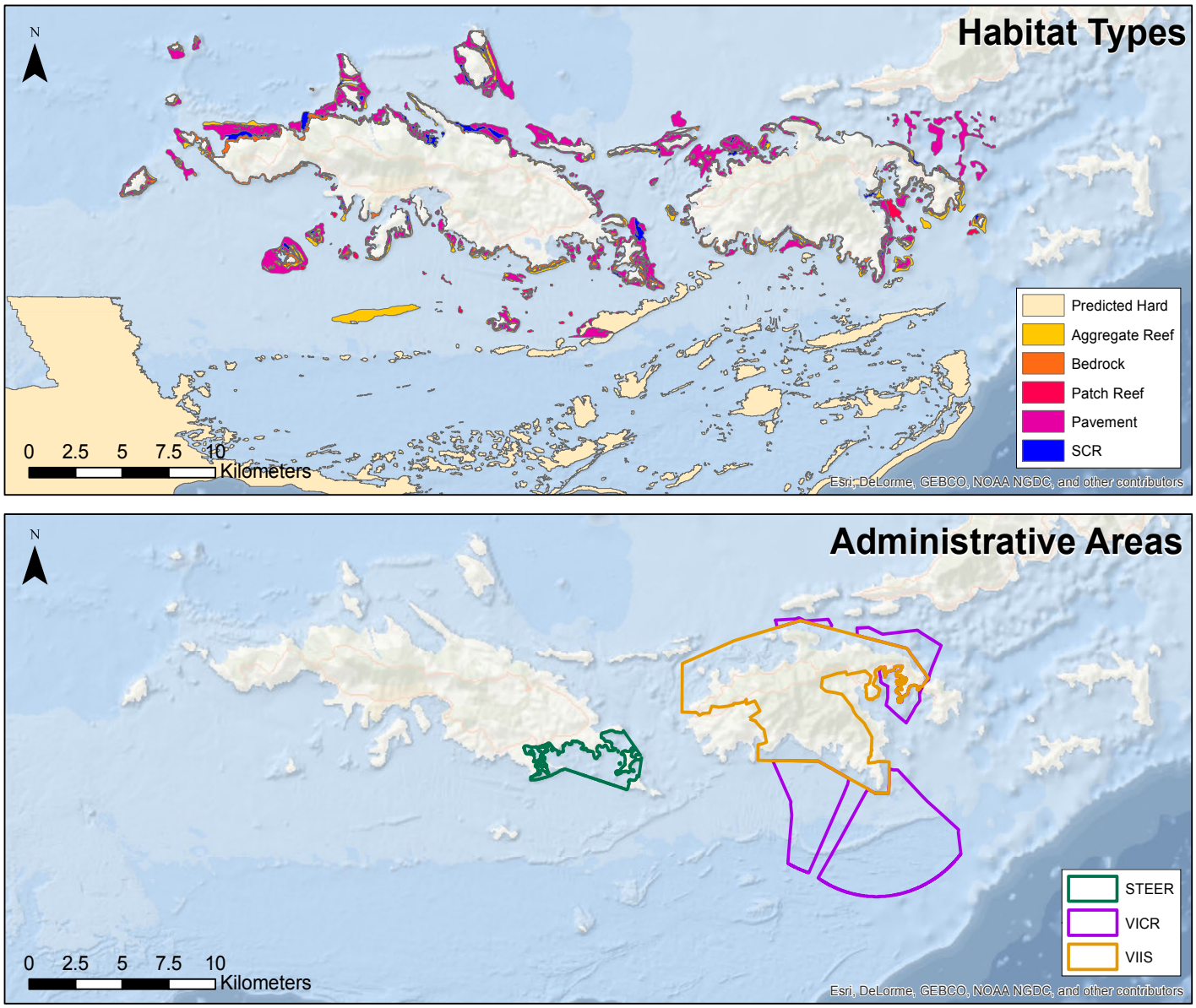


Figure 2. NCRMP 2013 USVI hardbottom habitat types (top) and administrative areas (bottom). STEER = St. Thomas East End Reserves; VICR = Virgin Islands Coral Reef National Monument; VIIS = Virgin Islands National Park; all areas outside these three regions are referred to as Open in this report.

Fish surveys

Fish surveys were conducted along 25x4 m transects (100 m^2) using a fixed survey duration (15 minutes) independent of habitat type or complexity (NOAA, 2013a). Divers quantified fish that were observed in the water column and on the substrate, including under ledges and in holes. The number of individuals per species was recorded in 5 cm size class increments up to 35 cm using visual estimation of fork length. In addition, an estimate of actual fork length was recorded for certain managed species of all sizes. These species included all grouper and snapper species, as well as the hogfish (*Lachnolaimus maximus)*. If an individual could not be identified to species, it was identified to the extent possible (i.e., genus or family). Individuals greater than 35 cm were recorded as an estimate of the actual fork length to the nearest centimeter.

Fish diver (NOAA/NCCOS)

METHODS

Benthic surveys

Line point-intercept (LPI) surveys

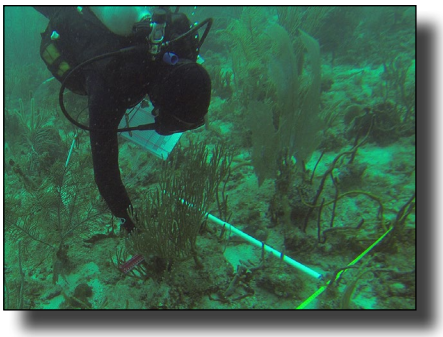
Benthic composition was surveyed using line point-intercept (LPI) surveys, in which divers estimated cover of biotic and abiotic benthic habitat (NOAA, 2013b). In this method, benthic cover was identified at 100 points spaced at 20 cm intervals along a 20 m length of the fish transect. Each sample point was identified to predetermined major functional categories or to species for corals and select algae.

Line point-intercept diver (NOAA/NCCOS)

Coral demographic surveys

Coral abundance, density, size, and condition were surveyed on non-juvenile (>4 cm) scleractinian coral species (NOAA, 2013c). These demographic surveys were conducted at a subset of sample sites along the first 10x1 m of the fish transect on sites where fish and demographic surveys co-occurred. At sites where fish, LPI, and demographic surveys were not conducted simultaneously, the same site coordinate was used.

Each coral colony with diameter greater than or equal to 4 cm was identified to species and three dimensions were measured (cm): maximum diameter (diameter of widest skeletal unit), perpendicular diameter (length perpendicular to maximum diameter), and height (measured from base of skeletal unit). For colonies less than 4 cm, presence was recorded to estimate species richness. If an individual could not be identified to species, it was identified to the extent possible (i.e., genus or family). Coral condition measurements included old mortality, recent mortality, bleaching and disease. Old mortality and recent mortality were recorded as a percentage of dead skeletal cover. Coral bleaching was categorized as total, partial or none. Coral disease was not recorded in 2013 but was included in subsequent years.



Coral demographic diver (NOAA/NCCOS)

Invertebrate key species surveys

At each fish/LPI survey site, divers surveyed for select macroinvertebrates including lobsters (*Panulirus argus* and *P. gutattus*), queen conch (*Lobatus gigas*), long-spined sea urchins (*Diadema antillarum*) and species of corals under consideration for listing under the Endangered Species Act at the time of the surveys (Table 2; NOAA, 2013b; http://www.nmfs.noaa.gov/pr/species/invertebrates/corals.htm). Within a 25x2 m survey area, abundance of these three macroinvertebrates was recorded, as was presence or absence of each listed coral species (Table 2). These surveys were typically conducted by the LPI diver after completion of LPI surveys or the fish diver after the completion of fish and topographic complexity surveys.

*Table 2. Coral species under consideration in 2013 for listing under the Endangered Species Act. Presence or absence of these species was identified as part of the rapid benthic surveys (25x2 m survey area). + indicates species listed as Threatened in 2006. * indicates species listed as Threatened in 2014.*

Agaricia lamarcki	*Dendrogyra cylindrus**	*Orbicella annularis**
*Acropora palmata+**	*Dichocoenia stokesii*	*Orbicella franksi**
*Acropora cervicornis+**	*Mycetophyllia ferox**	*Orbicella faveolata**

Topographic complexity surveys

Topographic complexity surveys were conducted by the fish diver after the fish census was completed (NOAA, 2013d). Minimum and maximum depth, and maximum vertical relief within the 25x4 m transect, were recorded, along with an estimate of surface area topography as a relative proportion of different relief categories. In this methodology, the 100 m^2 transect was divided into 24 smaller 2x2 sampling units (12 on each side of the transect), and each sampling unit was scored for maximum vertical relief using one of the following six categories: <0.2 m, 0.2-<0.5 m, 0.5-<1.0 m, 1.0-<1.5 m, 1.5-<2 m and >2 m.

Topographic complexity survey (NOAA/NCCOS)

Data entry and storage

Data were entered into an offline database application. Upon completion of a field mission, all data were migrated to a web-accessed database on a server.

Data quality control

Data quality control was implemented at three main stages:

1. Ongoing routine training of observers (initial detailed training, annual refresher training).
2. Data check following data collection, where divers trade datasheets immediately upon returning to boat after dive, to ensure all data were collected accurately and required information is complete.
3. Independent reviewers compared datasheets with database entries.

Data handling

The site is the base sample unit for this study, and data estimates (e.g., biomass, density and percent cover) were calculated by taking the total number per survey area. Note coral density is presented as corals/m^2.

Calculations of fish biomass per site

Biomass was calculated using published length-weight relationships based on the allometric scaling law,

$$W = aL^b$$

where *L* is length in centimeters and W is weight in grams, *a* is a condition factor related to body form, and *b* is the scaling exponent indicating either isometric or allometric growth. The midpoint of each size class was used for *L* values up to 35 cm, and the actual length was used for fish >35 cm. For fish in the 0-5 cm size class, 3 cm was used as the mid-point because we do not typically observe fish <1 cm. Values for *a* and *b* by species were obtained from FishBase (Froese and Pauly, 2008). Biomass for species with no published length-weight relationships was calculated using terms for the closest congener with the most similar morphology.

Trophic groups surveyed included piscivores, herbivores, invertivores and zooplanktivores and were defined for each species based on diet information from Randall (1967). It is important to note that these groups are not mutually exclusive because many fish species can be classified into two or more of these groups based on diet. In those circumstances the trophic group was assigned based on the dominant diet component.

Calculations of coral colony mean size

Estimates of coral colony mean size were obtained by calculating the mean of three dimensions measured in the field: longest diameter, perpendicular diameter and height. Note that this is not tailored to species morphology, and as such likely underestimates area of some species (e.g., branching Acroporids). Estimates of mortality were not subtracted from coral area.

METHODS

Calculation of region-scale estimates from the stratified sampling design

The stratified-random survey design was used to produce estimates of the survey populations. Weighted means, standard errors (SE) and coefficients of variance (CV) for a suite of fish and benthic metrics were calculated using the "survey" package in R statistical software (Lumley, 2013). Summary statistics were generated at both the overall region level as well as for specific domains (i.e., habitat type, administrative area).

RESULTS

This section summarizes fish and benthic community data collected in 2013 (Table 3). All surveys were conducted around the islands between depths of 0.3-30.4 m. Administrative areas included the Virgin Island National Park (VIIS) and the Virgin Island Coral Reef National Monument (VICR) on St. John and the St. Thomas East End Reserves (STEER) on St. Thomas.

Table 3. List of strata and surveys by region for USVI 2013 sampling period. Sample weights for each survey type were calculated as the number of cells per strata/number of sites by survey type. MSR = Mid-Shelf Reef, STEER = St. Thomas East End Reserves, VICR = Virgin Islands Coral Reef National Monument, VIIS = Virgin Islands National Park, SCR = Scattered coral and rock in sand.

Region	Strata					# Sites by survey type		
	Biotope	Habitat type	Administrative unit	Depth	# cells per strata	LPI	Fish	Demo
USVI	MSR	Aggregate Reef	Open	Deep	96	3	3	1
USVI	MSR	Aggregate Reef	VICR	Deep	181	5	5	1
USVI	MSR	Hard	Open	Deep	2325	12	12	12
USVI	MSR	Hard	VICR	Deep	11	2	2	1
USVI	MSR	Patch Reef	Open	Deep	44	1	1	1
USVI	MSR	Patch Reef	VICR	Deep	142	3	3	1
USVI	MSR	Pavement	Open	Deep	1600	8	8	7
USVI	MSR	Pavement	VICR	Deep	643	7	7	4
USVI	MSR	SCR	Open	Deep	31	1	1	1
USVI	MSR	SCR	VICR	Deep	35	2	2	1
USVI	Sail Rock	Hard	Open	Deep	9502	8	8	7
USVI	St. John	Aggregate Reef	Open	Deep	976	7	7	4
USVI	St. John	Aggregate Reef	Open	Shallow	633	4	4	3
USVI	St. John	Aggregate Reef	VICR	Deep	152	3	3	3
USVI	St. John	Aggregate Reef	VICR	Shallow	110	4	4	3
USVI	St. John	Aggregate Reef	VIIS	Deep	507	5	5	4
USVI	St. John	Aggregate Reef	VIIS	Shallow	567	6	6	4
USVI	St. John	Bedrock	Open	Deep	19	3	3	3
USVI	St. John	Bedrock	Open	Shallow	634	5	5	4
USVI	St. John	Bedrock	VICR	Shallow	78	4	4	3
USVI	St. John	Bedrock	VIIS	Shallow	483	5	5	5
USVI	St. John	Patch Reef	Open	Deep	646	2	2	1
USVI	St. John	Patch Reef	Open	Shallow	160	4	4	3
USVI	St. John	Patch Reef	VICR	Deep	48	2	2	0
USVI	St. John	Patch Reef	VICR	Shallow	37	1	1	0
USVI	St. John	Patch Reef	VIIS	Deep	248	6	6	4
USVI	St. John	Patch Reef	VIIS	Shallow	170	3	3	3
USVI	St. John	Pavement	Open	Deep	2185	10	10	10
USVI	St. John	Pavement	Open	Shallow	767	6	6	6
USVI	St. John	Pavement	VICR	Deep	165	2	2	1

Table 3. Continued...

Region	Strata					# Sites by survey type		
	Biotope	Habitat type	Administrative unit	Depth	# cells per strata	LPI	Fish	Demo
USVI	St. John	Pavement	VICR	Shallow	72	3	3	3
USVI	St. John	Pavement	VIIS	Deep	999	11	11	6
USVI	St. John	Pavement	VIIS	Shallow	1017	11	11	9
USVI	St. John	SCR	Open	Deep	94	3	3	2
USVI	St. John	SCR	Open	Shallow	223	1	1	1
USVI	St. John	SCR	VICR	Deep	36	2	2	1
USVI	St. John	SCR	VICR	Shallow	68	4	4	3
USVI	St. John	SCR	VIIS	Deep	29	2	2	2
USVI	St. John	SCR	VIIS	Shallow	196	4	4	4
USVI	St. Thomas	Aggregate Reef	Open	Deep	2365	8	8	5
USVI	St. Thomas	Aggregate Reef	Open	Shallow	1189	9	9	8
USVI	St. Thomas	Aggregate Reef	STEER	Deep	102	3	3	0
USVI	St. Thomas	Aggregate Reef	STEER	Shallow	135	3	3	3
USVI	St. Thomas	Bedrock	Open	Deep	683	5	5	3
USVI	St. Thomas	Bedrock	Open	Shallow	2405	11	11	9
USVI	St. Thomas	Bedrock	STEER	Shallow	542	7	7	7
USVI	St. Thomas	Patch Reef	Open	Deep	561	4	4	2
USVI	St. Thomas	Patch Reef	STEER	Deep	46	2	2	2
USVI	St. Thomas	Patch Reef	STEER	Shallow	22	1	1	1
USVI	St. Thomas	Pavement	Open	Deep	4980	21	21	16
USVI	St. Thomas	Pavement	Open	Shallow	2564	13	13	13
USVI	St. Thomas	Pavement	STEER	Deep	243	4	4	4
USVI	St. Thomas	Pavement	STEER	Shallow	466	7	7	7
USVI	St. Thomas	SCR	Open	Deep	981	3	3	3
USVI	St. Thomas	SCR	Open	Shallow	396	5	5	4
USVI	St. Thomas	SCR	STEER	Deep	47	2	2	2

Effort summary

Surveys were conducted in 12 days in July 2013. A total of 283 surveys were completed, including 283 fish sites, 283 benthic sites, and 203 coral demographic sites (Figure 3; Appendix 2).

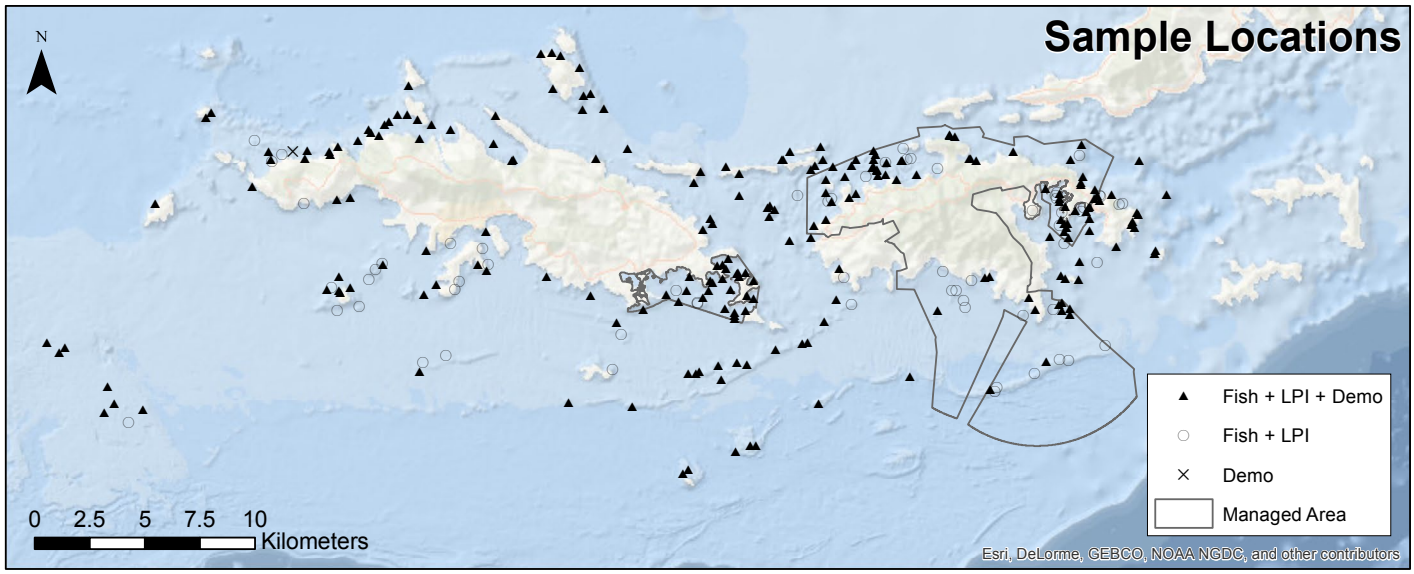


Figure 3. NCRMP 2013 USVI survey sites for fish, benthic habitat (LPI), and coral demographics (Demo).

RESULTS

Fish

In the NCRMP USVI 2013 survey sampling period, 283 fish surveys were completed.

Total fish density

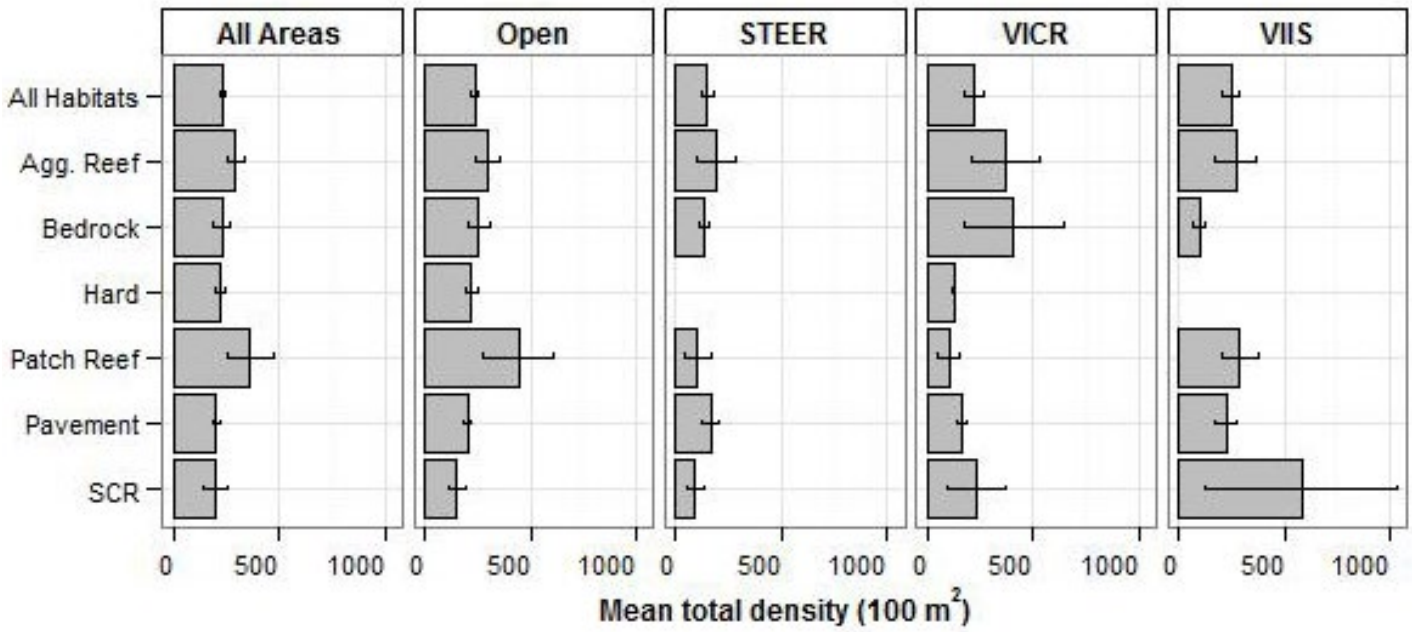


Figure 4. NCRMP 2013 USVI total fish density (#/100 m²), shown by administrative area (columns) and habitat type (rows). Weighted means with standard error bars.

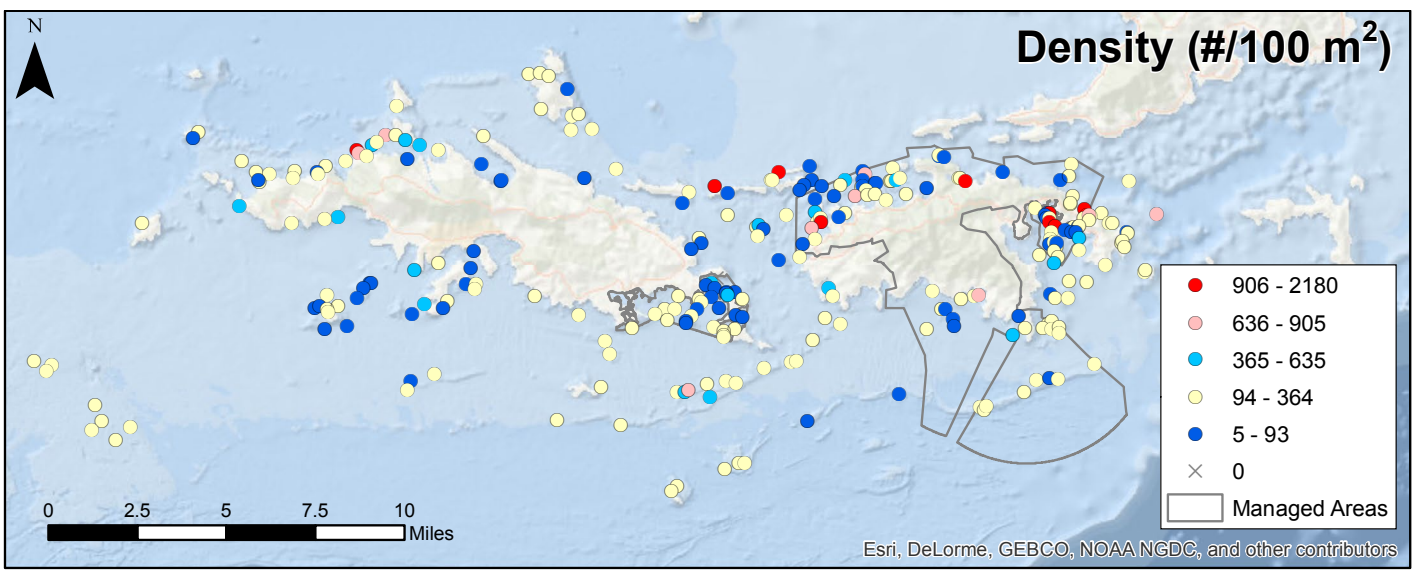


Figure 5. NCRMP 2013 USVI observed total fish density (#/100 m²), shown by standard deviation categories (>2.5, 1.5-2.5, 0.50-1.5, -0.50 – 0.50, <-0.5). Yellow circles symbolize the mean +/- 0.5 standard deviation.

Total fish biomass

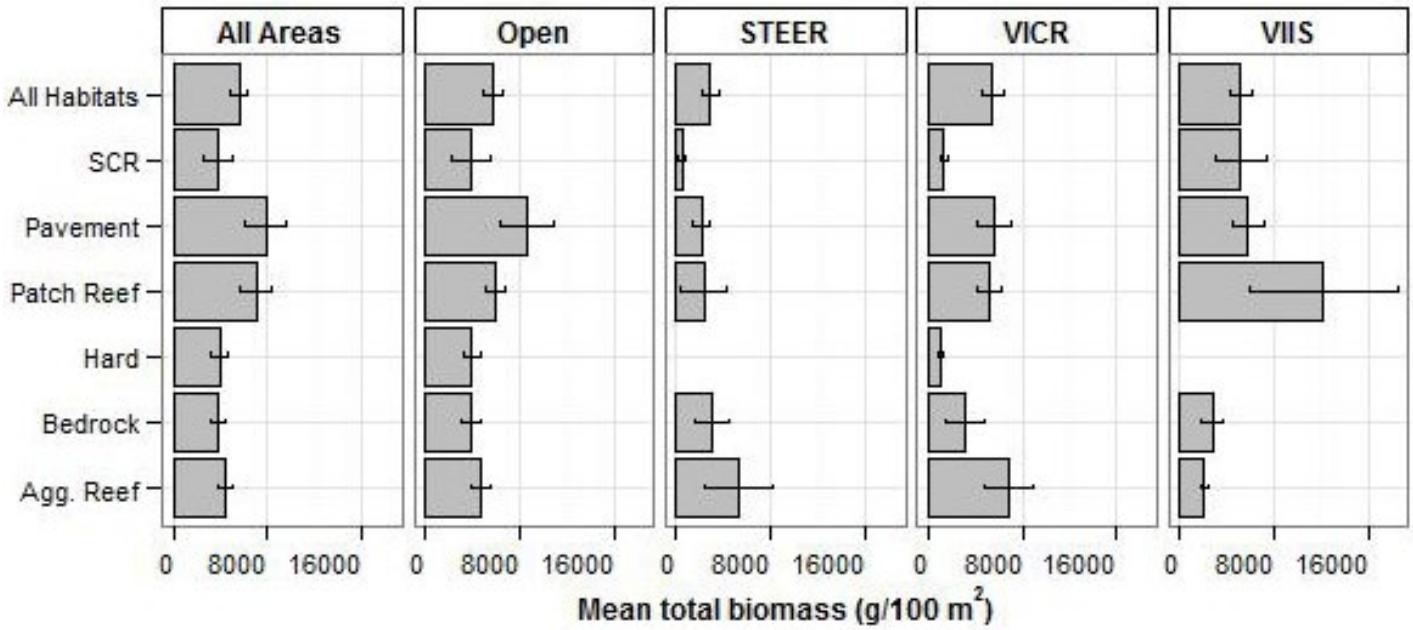


Figure 6. NCRMP 2013 USVI total fish biomass (g/100 m²), shown by administrative areas (columns) and habitat type (rows). Weighted means with standard error bars.

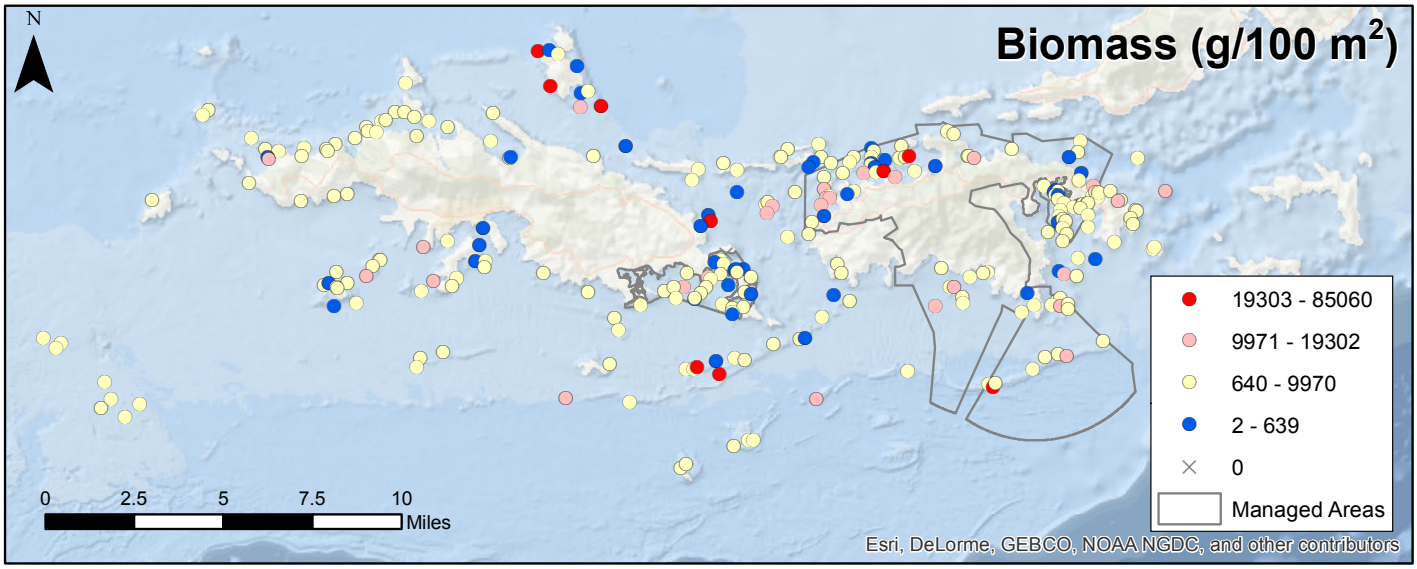


Figure 7. NCRMP 2013 USVI observed total fish biomass (g/100 m²), shown by standard deviation categories, (1.5 – >2.5, 0.5 – 1.5, -0.50 – 0.50, <-0.50). Yellow circles symbolize the mean +/- 0.5 standard deviation.

RESULTS

Species richness

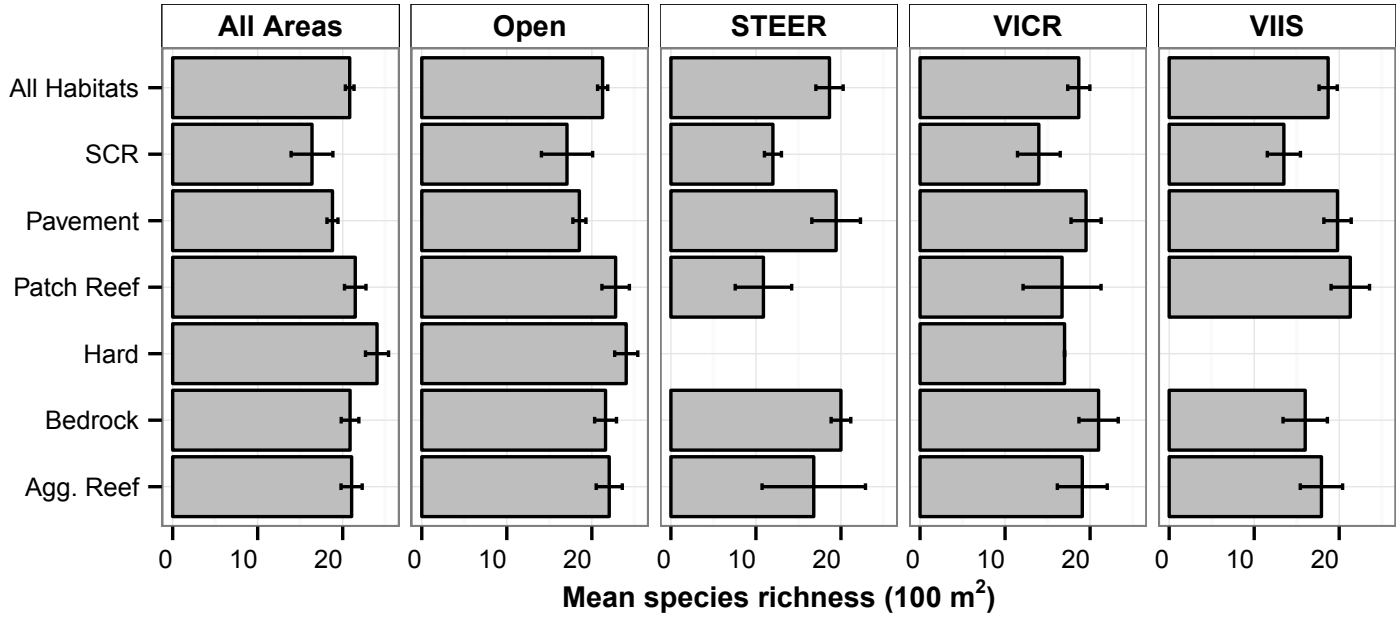


Figure 8. NCRMP 2013 USVI species richness (species #/100 m²), shown by administrative areas (columns) and habitat type (rows). Weighted means with standard error bars.

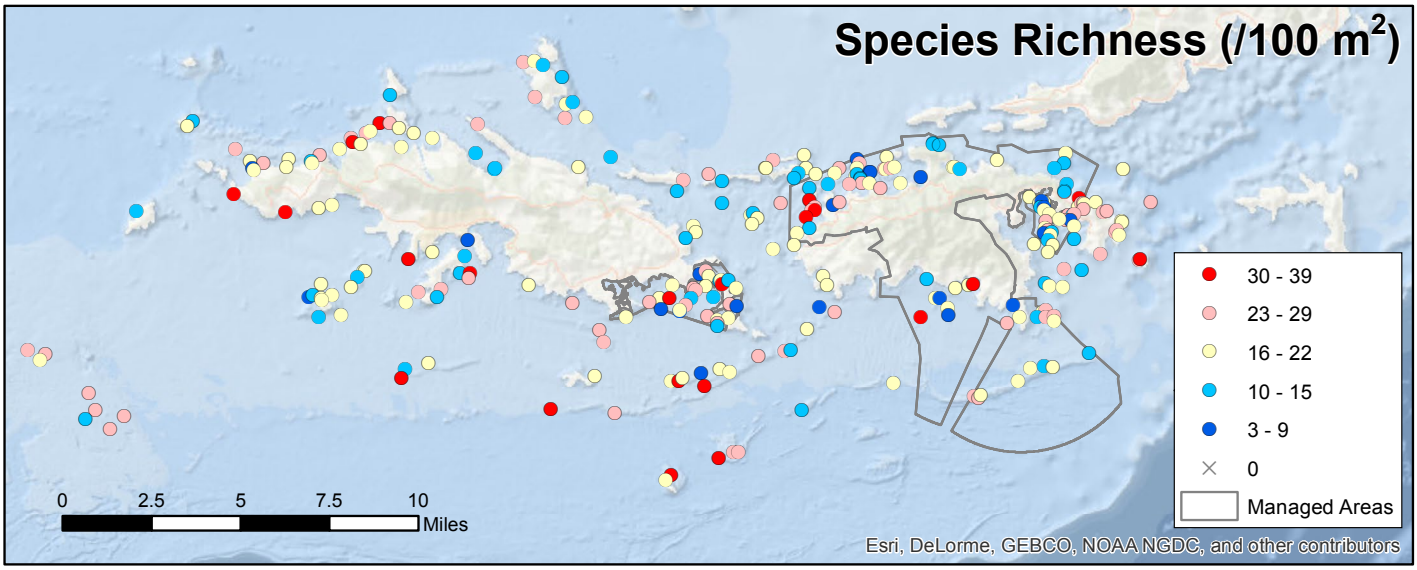
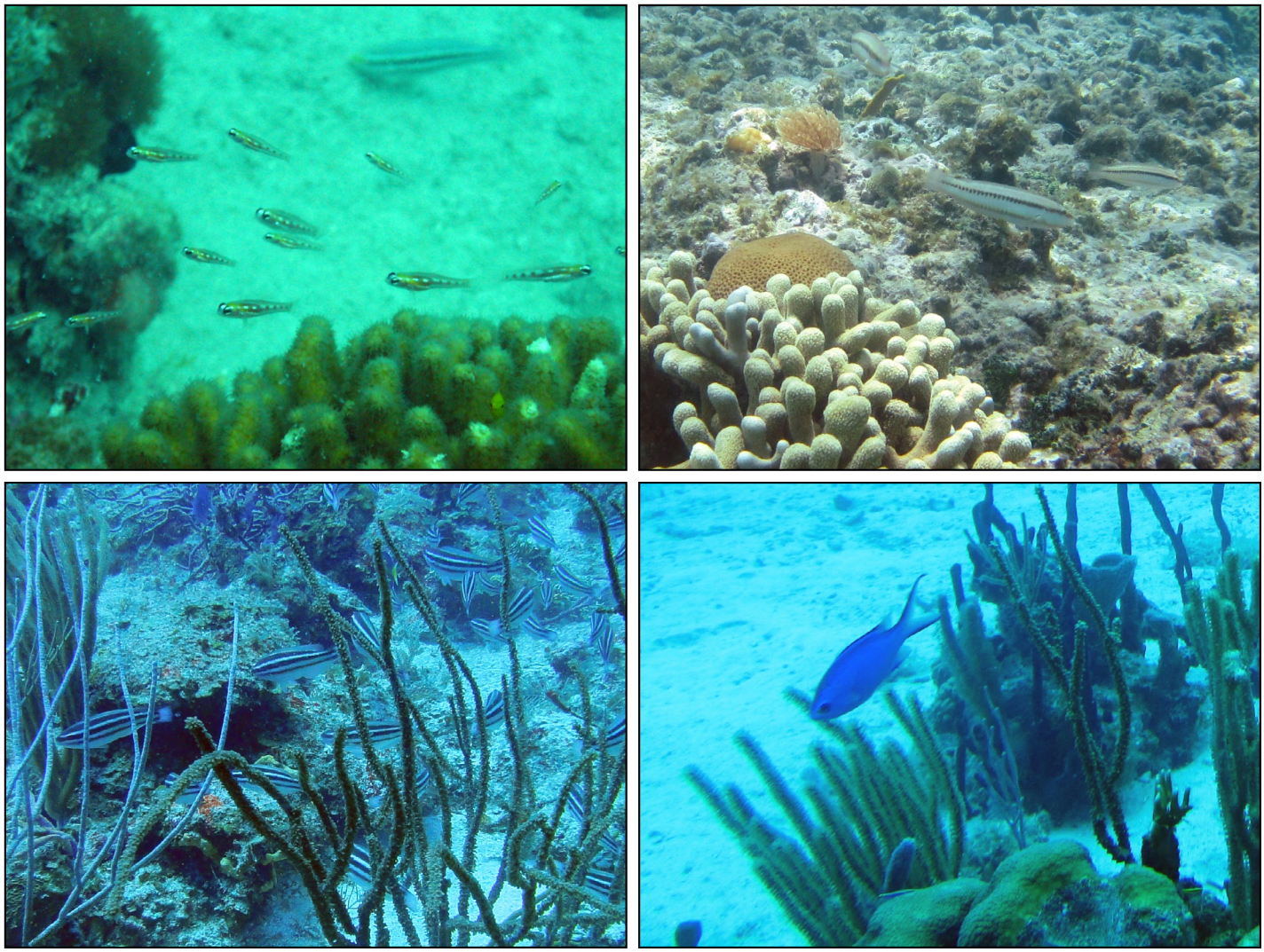


Figure 9. NCRMP 2013 USVI fish species richness, shown by standard deviation categories (1.5 – >2.5, 0.5 – 1.5, 0.50 – -0.5, -0.50 – -1.50, <-1.5). Yellow circles symbolize the mean +/- 0.5 standard deviation. All data ranges reflect actual values.

Overall

Table 4. Top ten fish species by observed mean density (left), mean biomass (center), and frequency of occurrence (right). Species are sorted in descending order.

Rank	Density	Biomass	Occurrence (%)
1	*Coryphopterus personatus/hyalinus*	*Megalops atlanticus*	*Sparisoma aurofrenatum*
2	*Thalassoma bifasciatum*	*Sparisoma viride*	*Halichoeres garnoti*
3	*Stegastes partitus*	*Caranx latus*	*Acanthurus coeruleus*
4	*Halichoeres garnoti*	*Balistes vetula*	*Thalassoma bifasciatum*
5	*Scarus taeniopterus*	*Carcharhinus perezi*	*Stegastes partitus*
6	*Chromis cyanea*	*Acanthurus coeruleus*	*Acanthurus bahianus*
7	*Sparisoma aurofrenatum*	*Lutjanus analis*	*Scarus taeniopterus*
8	*Scarus iseri*	*Sphyraena barracuda*	*Sparisoma viride*
9	*Halichoeres bivittatus*	*Sparisoma aurofrenatum*	*Scarus iseri*
10	*Acanthurus coeruleus*	*Scarus taeniopterus*	*Canthigaster rostrata*



Photos of fish species around St. John and St. Thomas, USVI (clockwise from top left): Coryphopterus personatus/hyalinus *(NOAA/NCCOS),* Halichoeres bivittatus *(L. Rutten, Nova Southeastern University),* Scarus taeniopterus *(M. Feeley, NPS), and* Chromis cyanea *(NOAA/NCCOS).*

RESULTS

Density and spatial distribution of key fish families

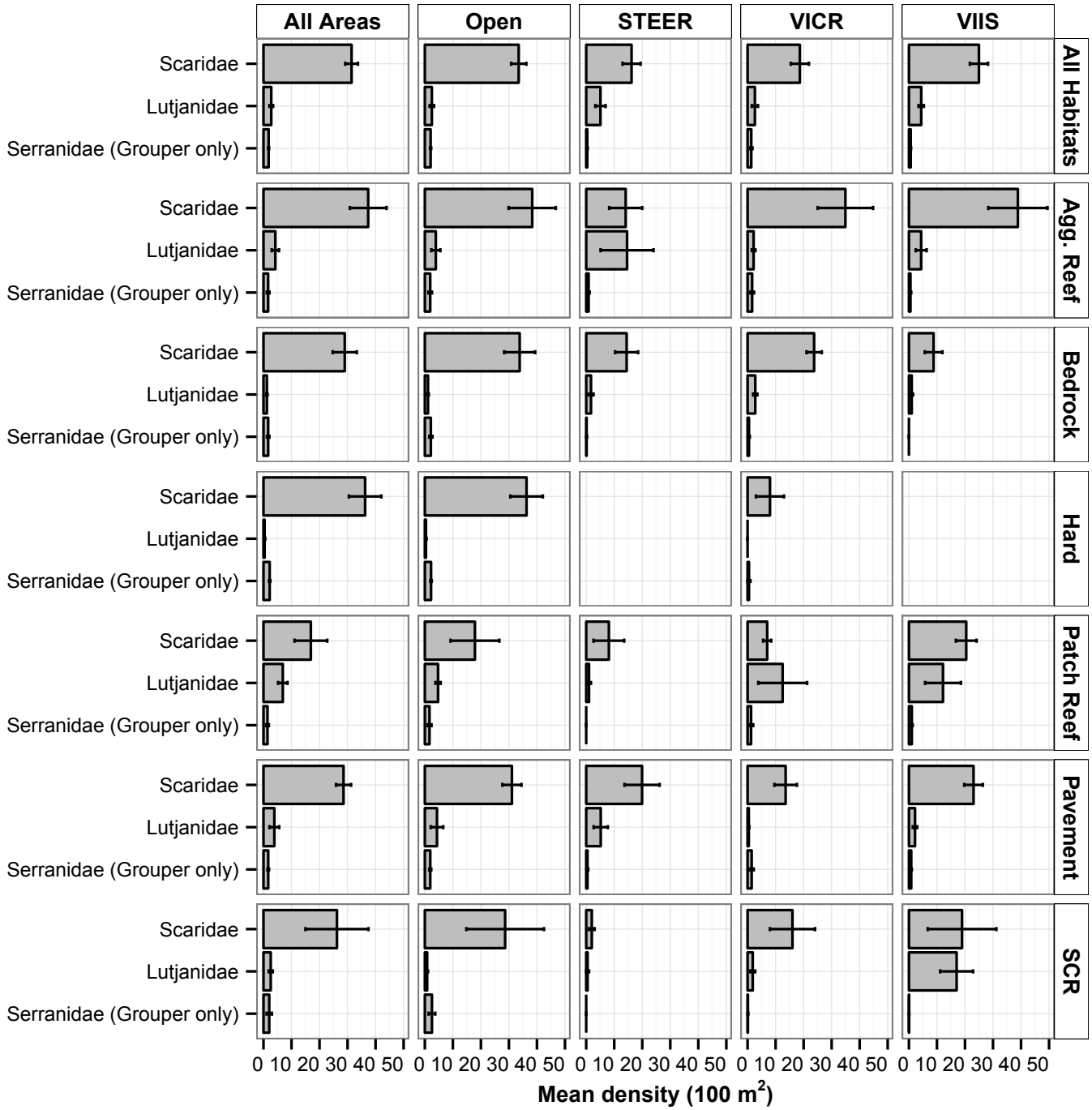


Figure 10. NCRMP 2013 USVI mean density (#/100 m^2) of key fish families: Scaridae (all parrotfish), Lutjanidae (all snappers), and Serranidae (groupers only) shown by administrative areas (columns) and habitat type (rows). Weighted means with standard error bars.

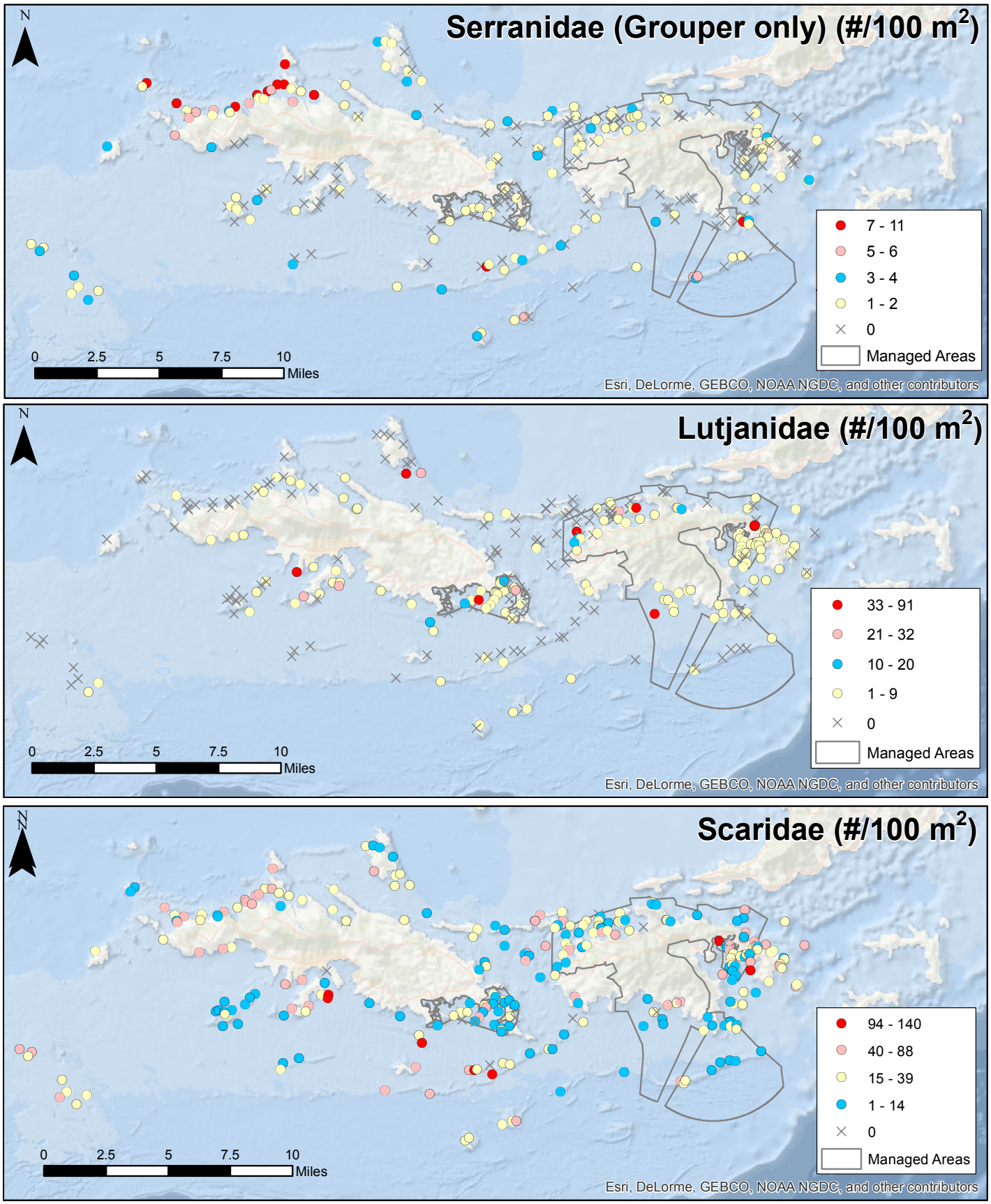


Figure 11. NCRMP 2013 USVI observed density (#/100 m²) of: Serranidae (grouper only; top), Lutjanidae (all snappers; middle) and Scaridae (all parrotfish; bottom), shown by standard deviation categories (>2.5, 1.5 – 2.5, 0.5 – 1.5, -0.50 – 0.50). Yellow circles symbolize the mean +/- 0.5 standard deviation.

RESULTS

Density and spatial distribution of key fish species

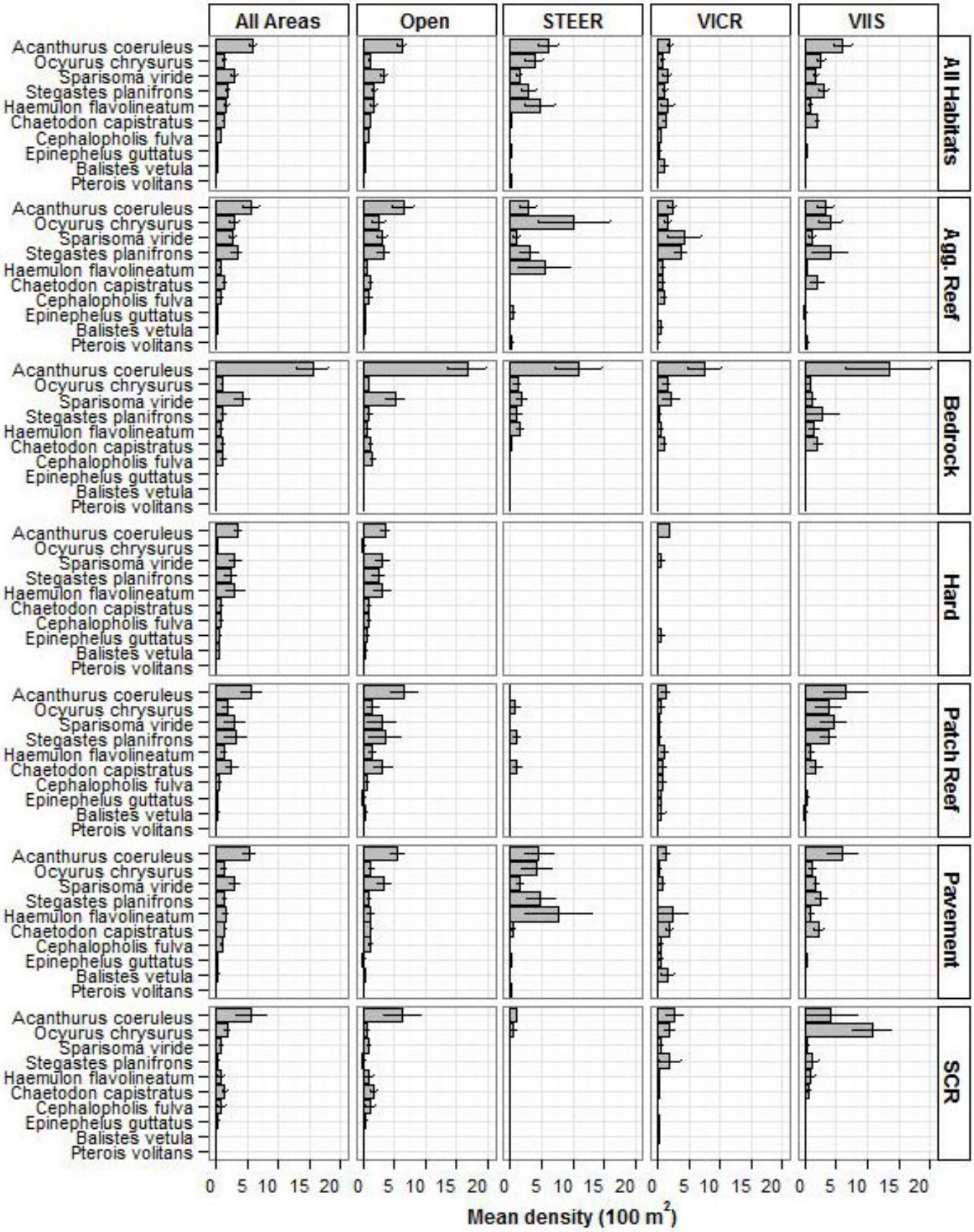


Figure 12. NCRMP 2013 USVI density (#/100 m²) of key fish species, shown by administrative area (columns) and habitat type (rows). Weighted means with standard error bars.

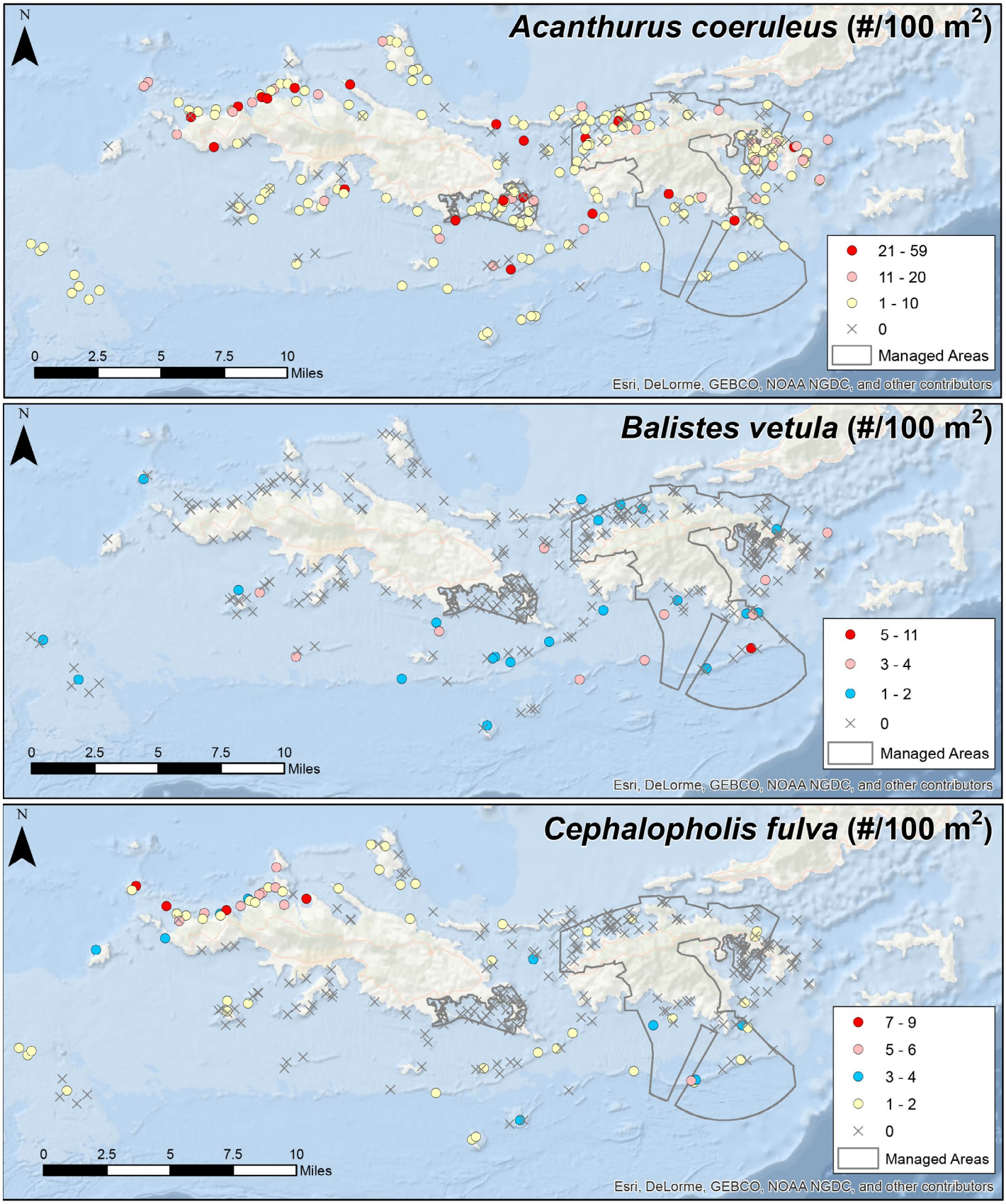


Figure 13. NCRMP 2013 USVI observed density (#/100 m²) of: Acanthurus coeruleus *(top; blue tang),* Balistes vetula *(queen triggerfish; middle), and* Cephalopholis fulva *(coney; bottom) shown by standard deviation categories. Standard deviation categories for* A. coeruleus *and* B. vetula*: -0.50 – 0.50, 0.5 – 1.5, 1.5 – 2.5; and for* C. fulva*: -0.50 – 0.50, 0.5 – 1.5, 1.5 – 2.5, >2.5. Yellow circles symbolize the mean +/- 0.5 standard deviation (Note: except for* B. vetula*, as the mean was <1).*

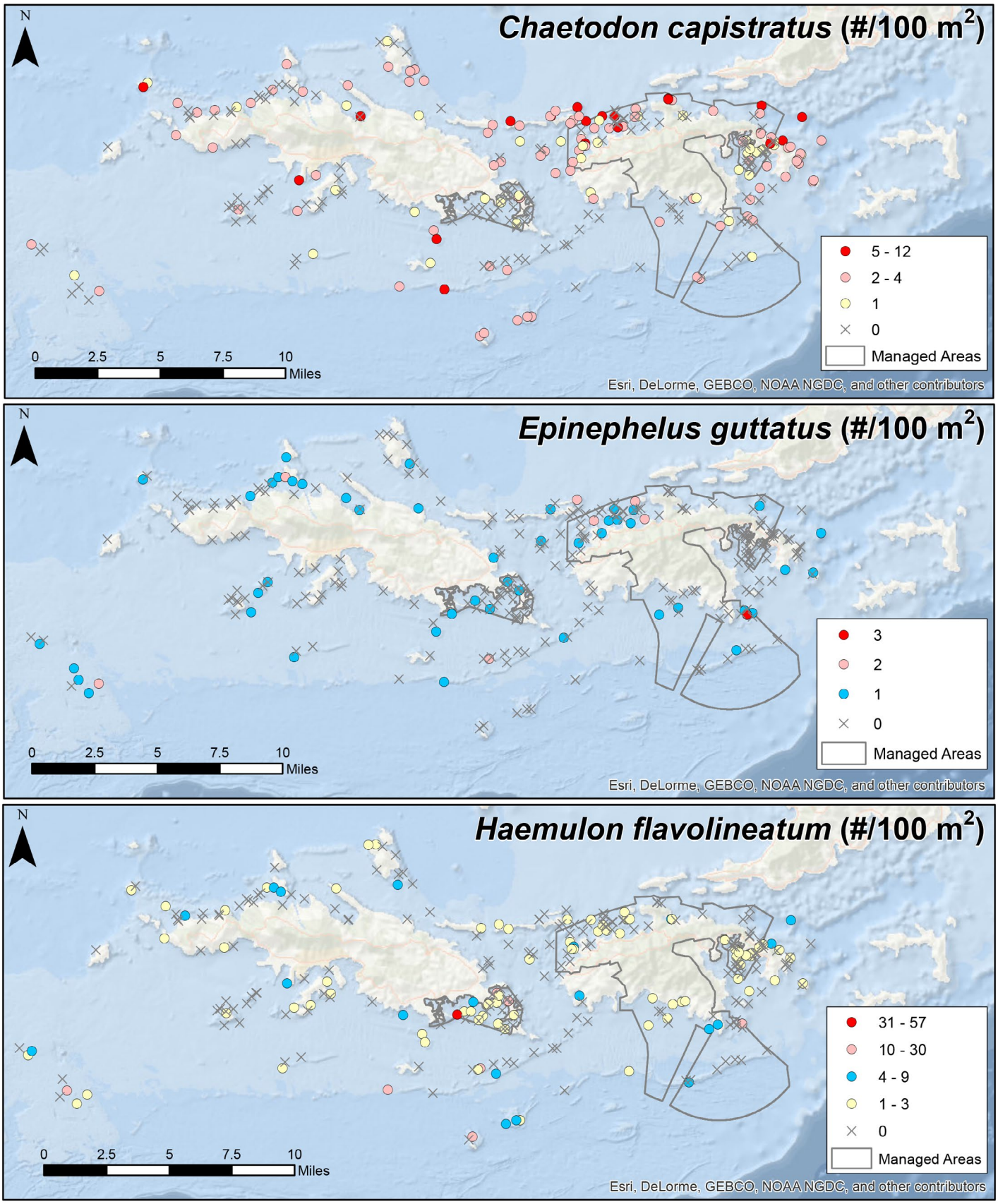


Figure 14. NCRMP 2013 USVI observed density (#/100 m²) of Chaetodon capistratus *(foureye butterflyfish; top),* Epinephelus guttatus *(red hind; middle) and* Haemulon flavolineatum *(French grunt; bottom) shown by standard deviation categories Standard deviation categories for* C. capistratus *and* E. guttatus*: -0.50 – 0.50, 0.5 – 1.5, 1.5 – 2.5; and for* H. flavolineatum*: -0.50 – 0.50, 0.5 – 1.5, 1.5 – 2.5, >2.5. Yellow circles symbolize the mean +/- 0.5 standard deviation. (Note: except for* E. guttatus*, as the mean was <1).*

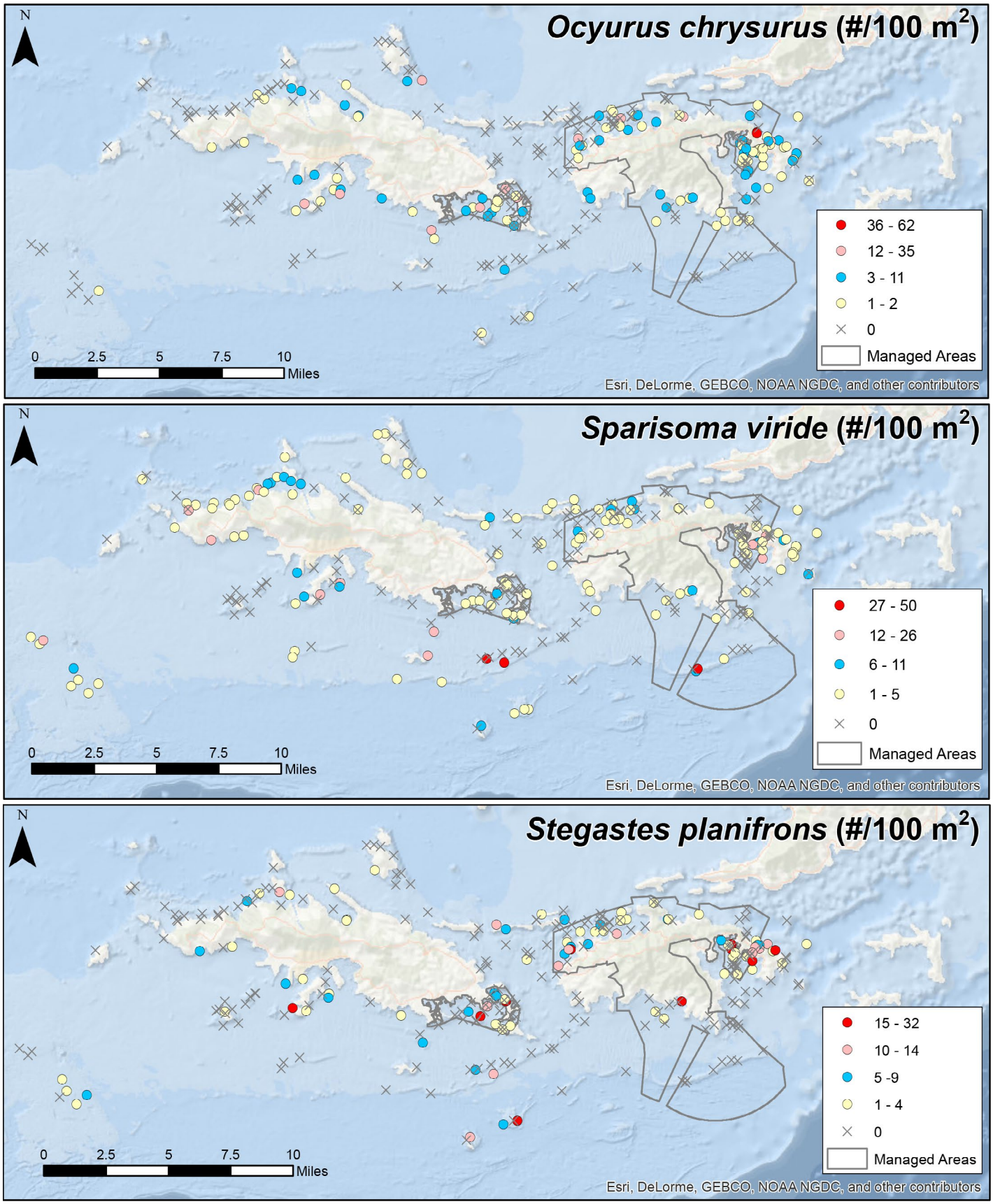


Figure 15. NCRMP 2013 USVI observed density (#/100 m²) of Ocyurus chrysurus *(yellowtail snapper),* Sparisoma viride *(stoplight parrotfish), and* Stegastes planifrons *(threespot damselfish) shown by standard deviation categories (>2.5, 1.5 – 2.5, 0.5 – 1.5, -0.50 – 0.50). Yellow circles symbolize the mean +/- 0.5 standard deviation.*

RESULTS

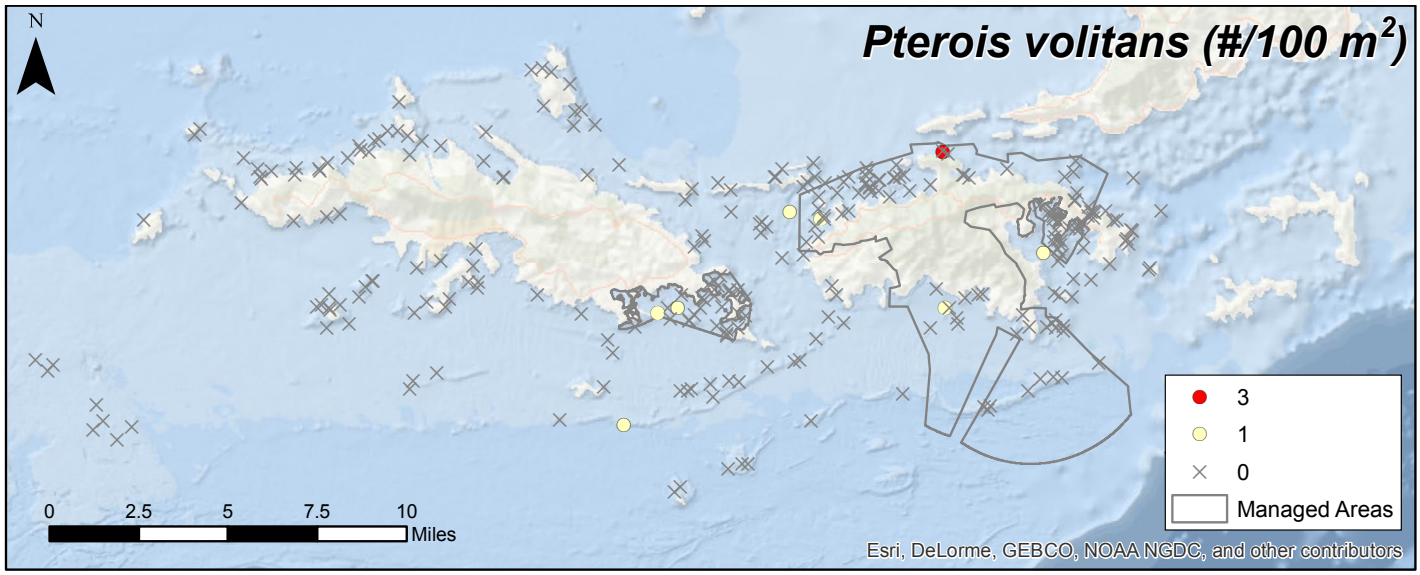
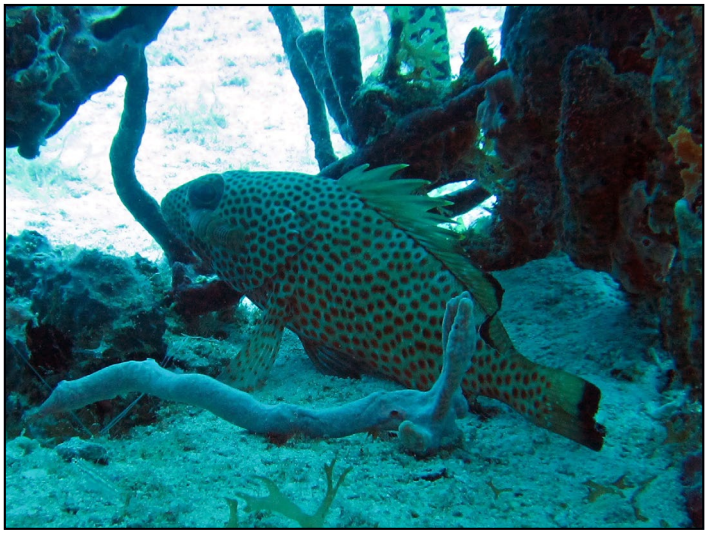


Figure 16. NCRMP 2013 USVI observed density (#/100 m²) of Pterois volitans *(red lionfish). Because the species was encountered at such low numbers in very few locations, observed site values are shown rather than ranges of standard deviation.*



Photos of P. volitans *(A. Sabine, USVI DPNR) and* E. guttatus*; NOAA/NCCOS) recorded around St. Thomas and St. John, USVI in 2013.*

Benthic habitats

In the NCRMP USVI 2013 survey sampling period, 283 LPI and key species surveys and 203 demographic surveys were completed.

Cover of benthic habitat categories

Cover data from LPI surveys were grouped together into the following general categories: abiotic – hard, soft, rubble; biotic – algae, bare substrate (hard), bare substrate (rubble), bare substrate (soft), hard corals, sponges, soft corals, seagrasses, cyanobacteria, hydrocoral and invertebrate species, and other species.

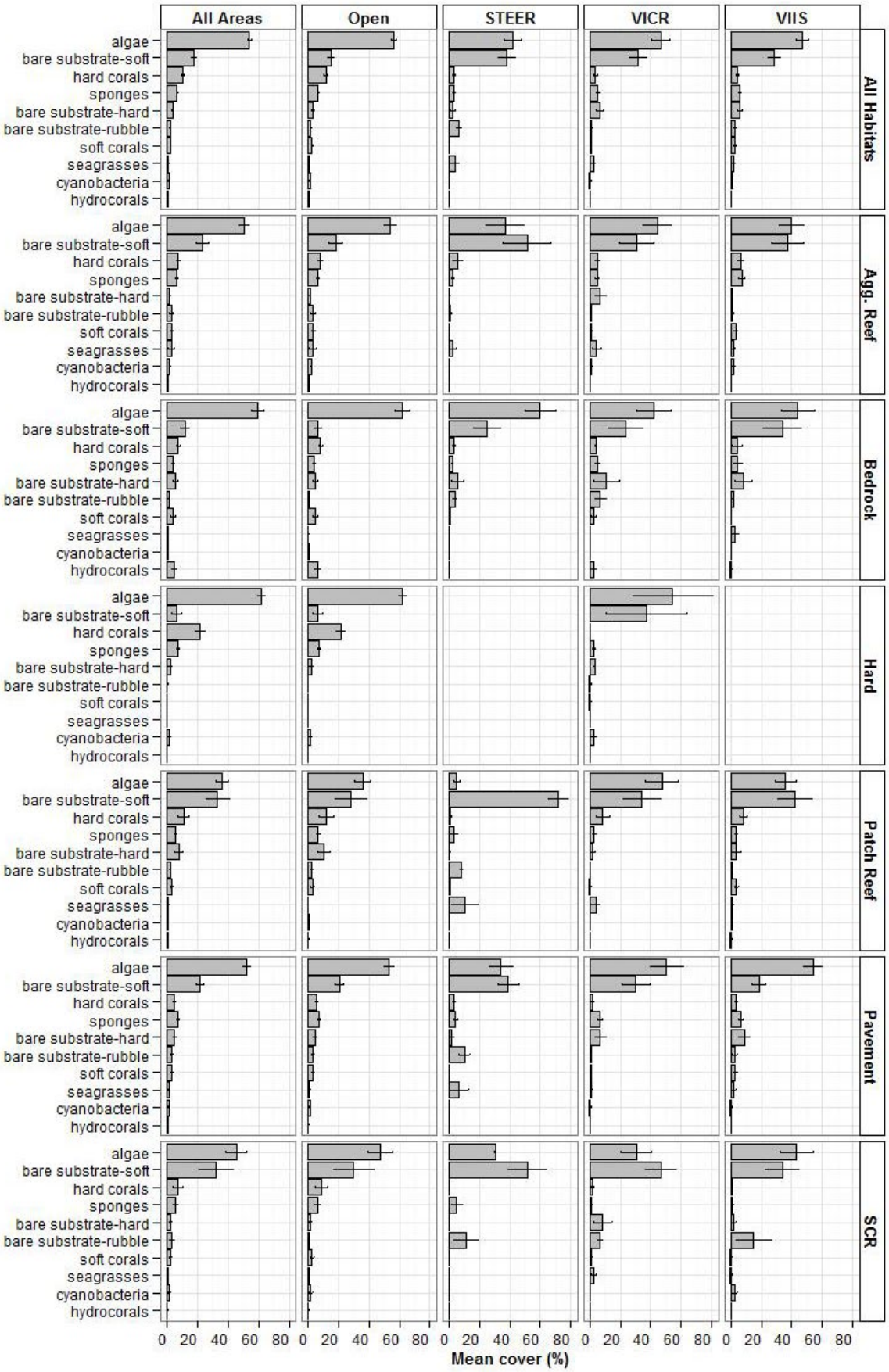


Figure 17. NCRMP 2013 USVI general benthic habitat cover (%), shown by administrative area (columns) and habitat types (rows). Weighted means with standard error bars. No hard (predicted hardbottom) habitat sites were surveyed by LPI methods in STEER or VIIS.

RESULTS

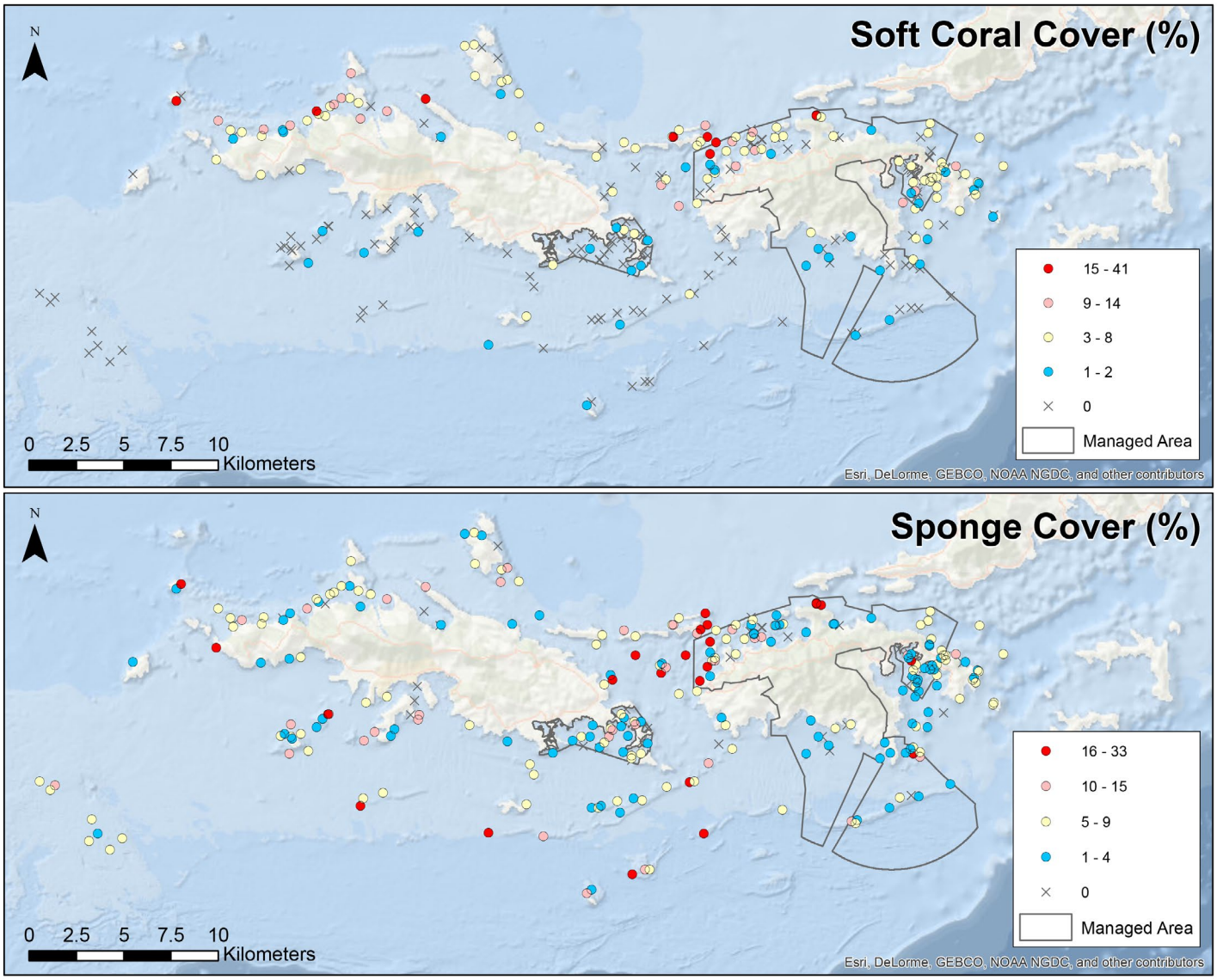


Figure 18. NCRMP 2013 USVI observed soft coral (top) and sponge (bottom) cover (%), shown by standard deviation categories (>1.5, 0.50 – 1.5, -0.50 – 0.50, <-0.50). Yellow circles symbolize the mean +/- 0.5 standard deviation.

Examples of gorgonians (soft coral; NOAA/NCCOS) and sponges (L. Richter, NPS) observed around St. Thomas and St. John, USVI in 2013.

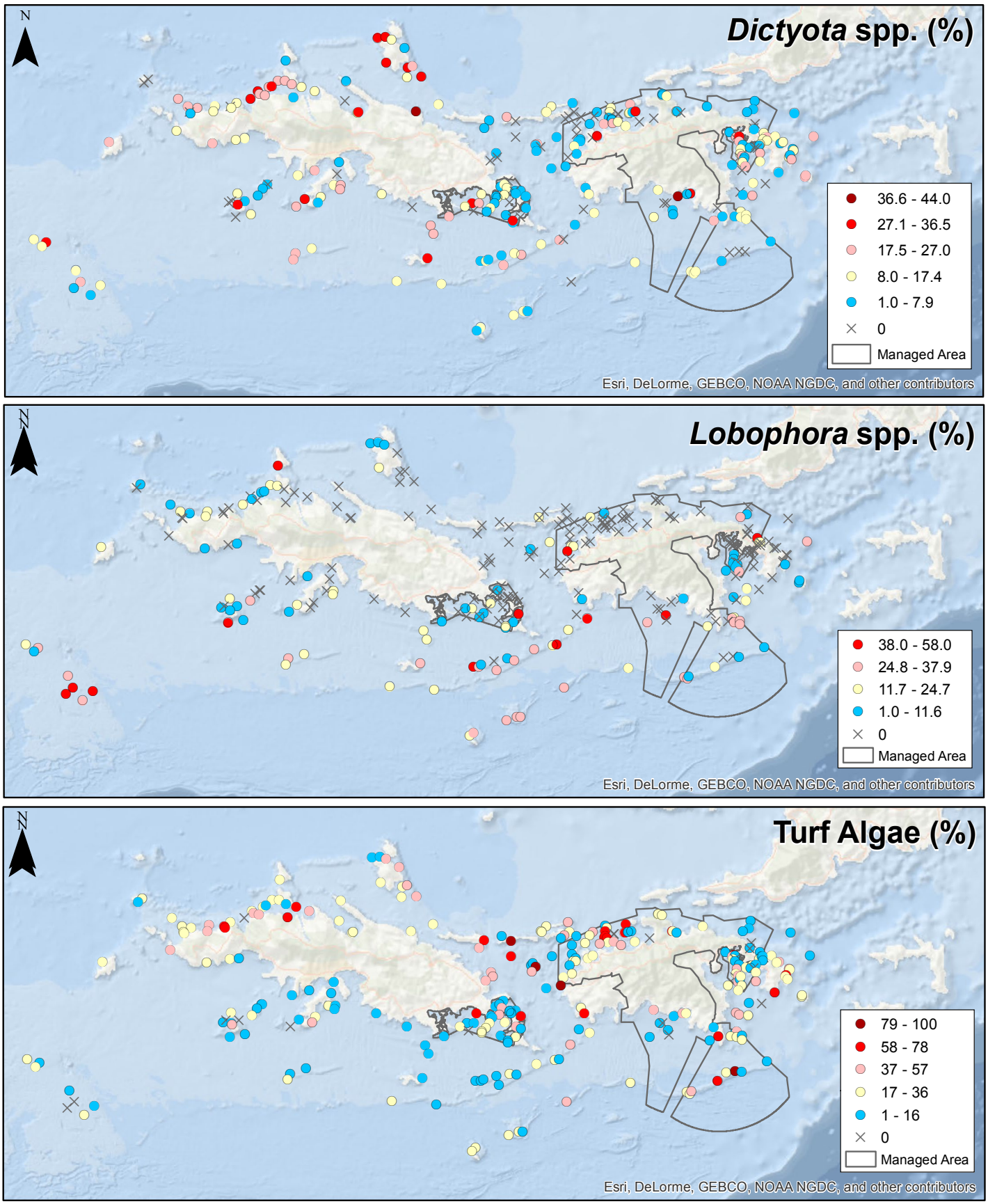


Figure 19. NCRMP 2013 USVI observed: Dictyota *species (top),* Lobophora *species (middle), and turf algae (sediment and no sediment) cover (%), shown by standard deviation categories. Yellow circles symbolize mean +/- 0.5 standard deviation. Standard deviation categories for* Dictyota *and turf algae: >2.5, 1.5 – 2.5, 0.50 – 1.5, -0.50 – 0.50, <-0.50; and for* Lobophora*: >1.5, 0.50 – 1.5, -0.50 – 0.50, <-0.50.*

RESULTS

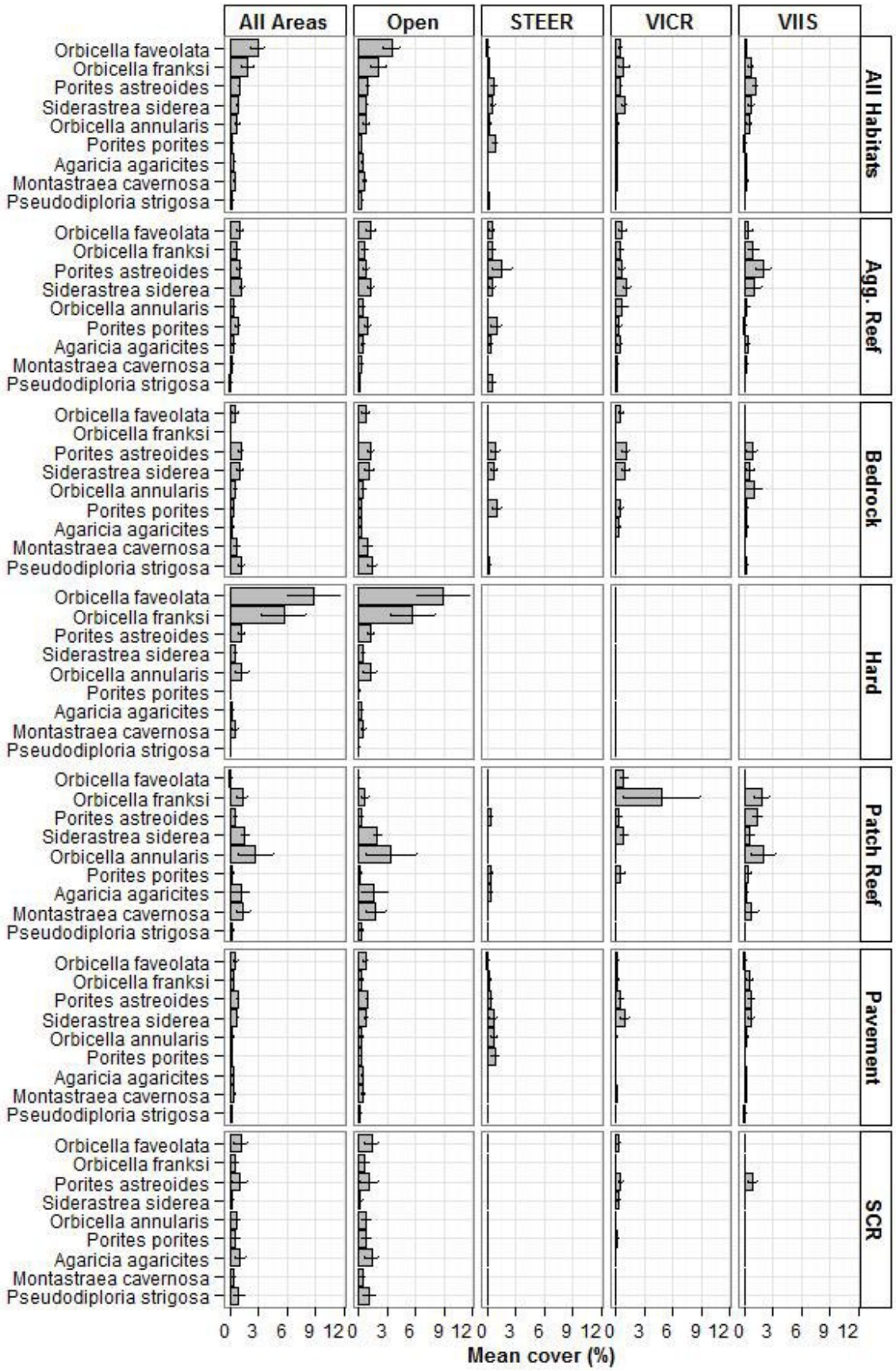


Figure 20. NCRMP 2013 USVI coral species with highest cover (%), shown by administrative area (columns) and habitat type (rows). Weighted means with standard error bars. No predicted hard (predicted hardbottom) habitat was surveyed during coral demographics in STEER, VICR or VIIS.

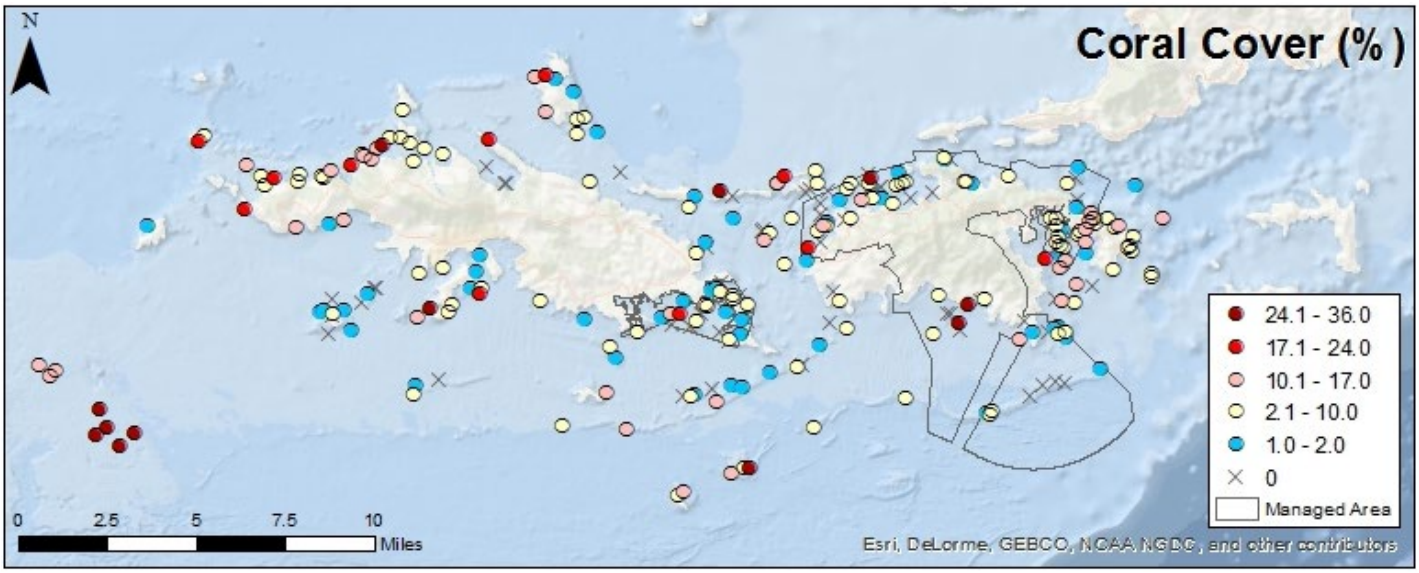
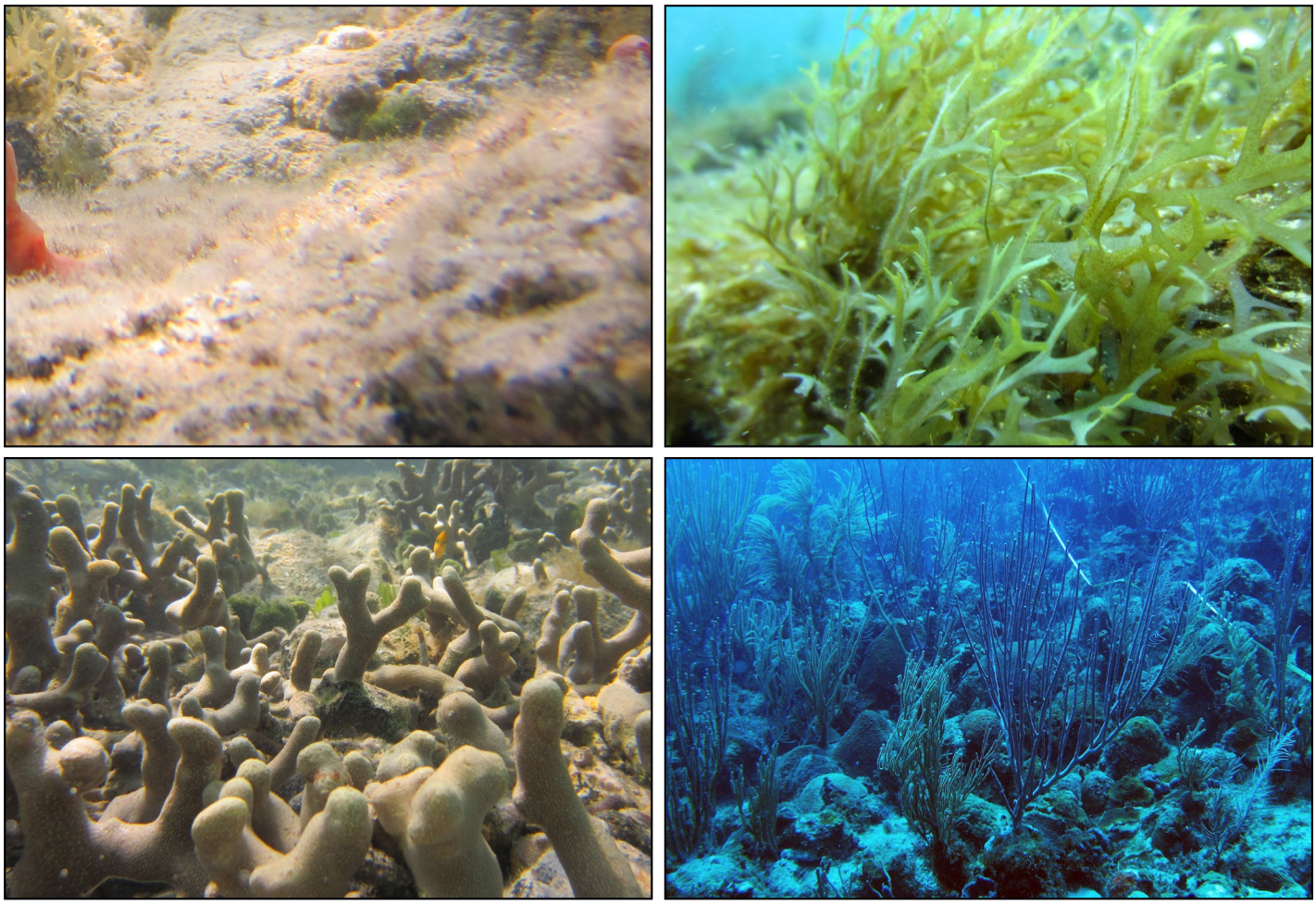


Figure 21. NCRMP 2013 USVI observed scleractinian coral cover (%), shown by standard deviation categories (>1.5, 0.50 – 1.5, -0.50 – 0.50, -1.5 – -0.50, <-1.5). Yellow circles symbolize the mean +/- 0.5 standard deviation.



Photos of benthic biota around St. John and St. Thomas, USVI in 2013 (clockwise from top left): turf algae, Dictyota *spp. and* Porites *spp. (L. Richter, NPS); and coral community (NOAA/NCCOS).*

RESULTS

Coral species richness

Table 5. NCRMP USVI 2013 coral species richness (number of coral species) for the region and by administrative area for two survey methods, line point intercept and demographic, and overall.

Survey Method	All 2013 NCRMP USVI surveys	Administrative Area			
		STEER	*VIIS*	*VICR*	*OPEN*
Line Point-intercept	38	17	21	18	32
Demographic	50	26	34	33	48
All methods combined	50	29	34	35	48

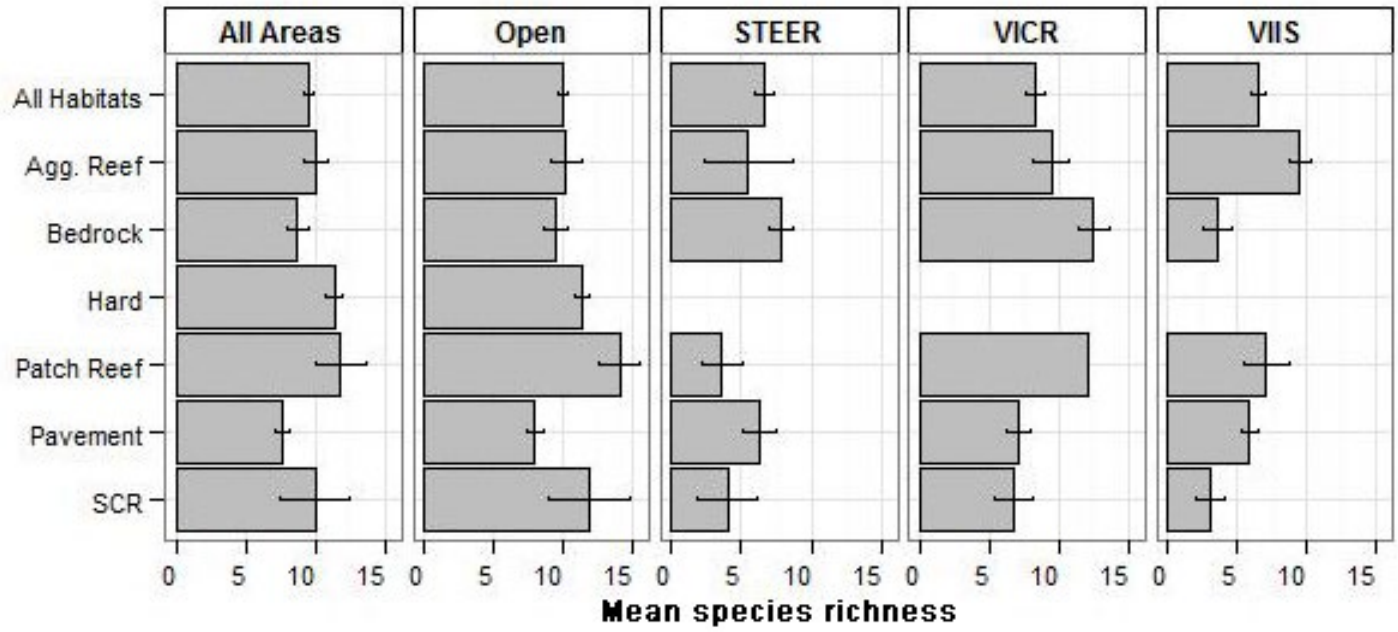


Figure 22. NCRMP 2013 USVI coral species richness, shown by habitat type (rows) and administrative areas (columns). Weighted means with standard error bars. No predicted hardbottom (hard) habitat was surveyed for coral demographics in STEER, VICR or VIIS.

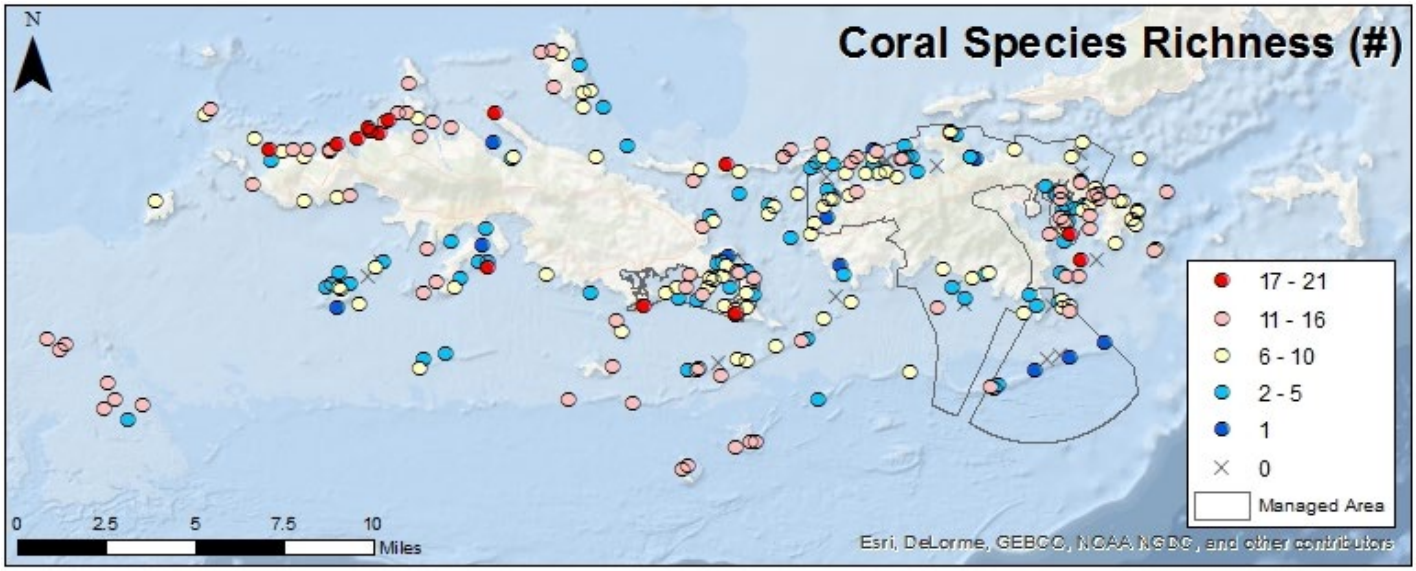


Figure 23. NCRMP 2013 USVI observed scleractinian coral richness (# coral species per site), shown by standard deviation categories (>1.5, 0.50 – 1.5, -0.50 – 0.50, -1.5 – -0.50, <-1.5). Yellow circles symbolize the mean +/- 0.5 standard deviation. Species richness includes both LPI and demographic data.

Coral density

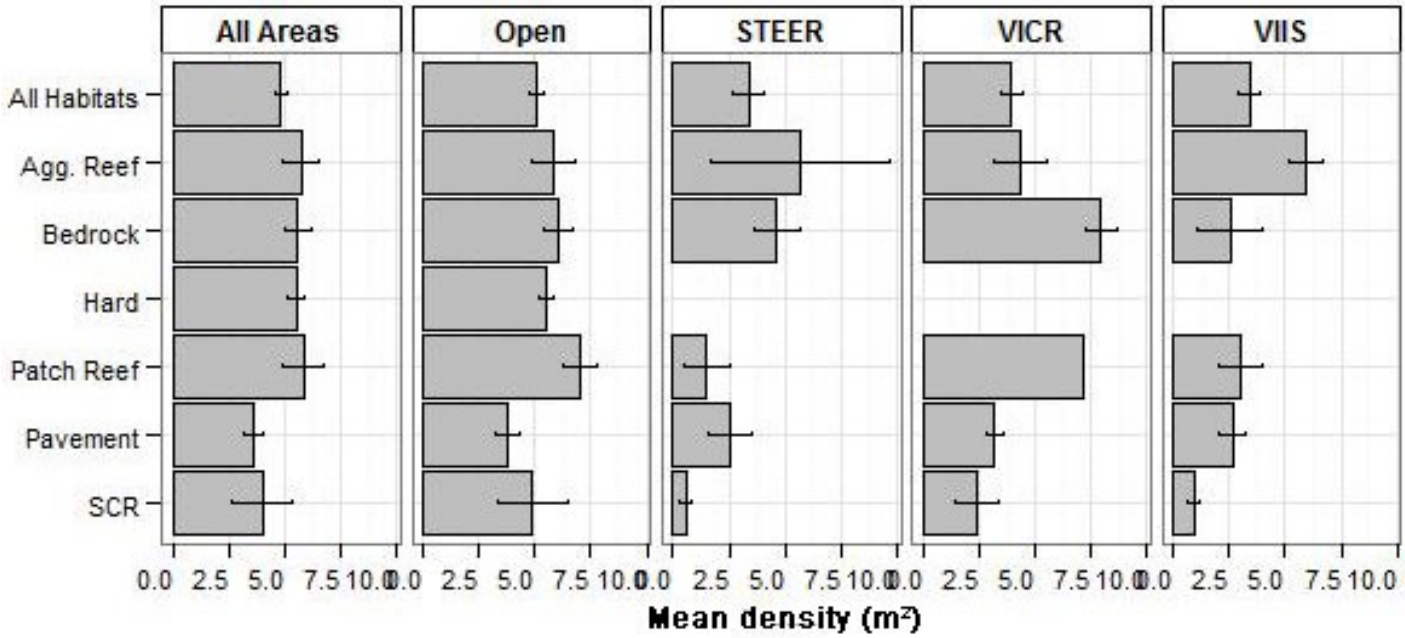


Figure 24. NCRMP 2013 USVI overall scleractinian coral density (corals / m²) shown by administrative area (columns) and habitat type (rows). Weighted means with standard error bars. No hard (predicted hardbottom) habitat was surveyed for coral demographics in STEER, VICR or VIIS.

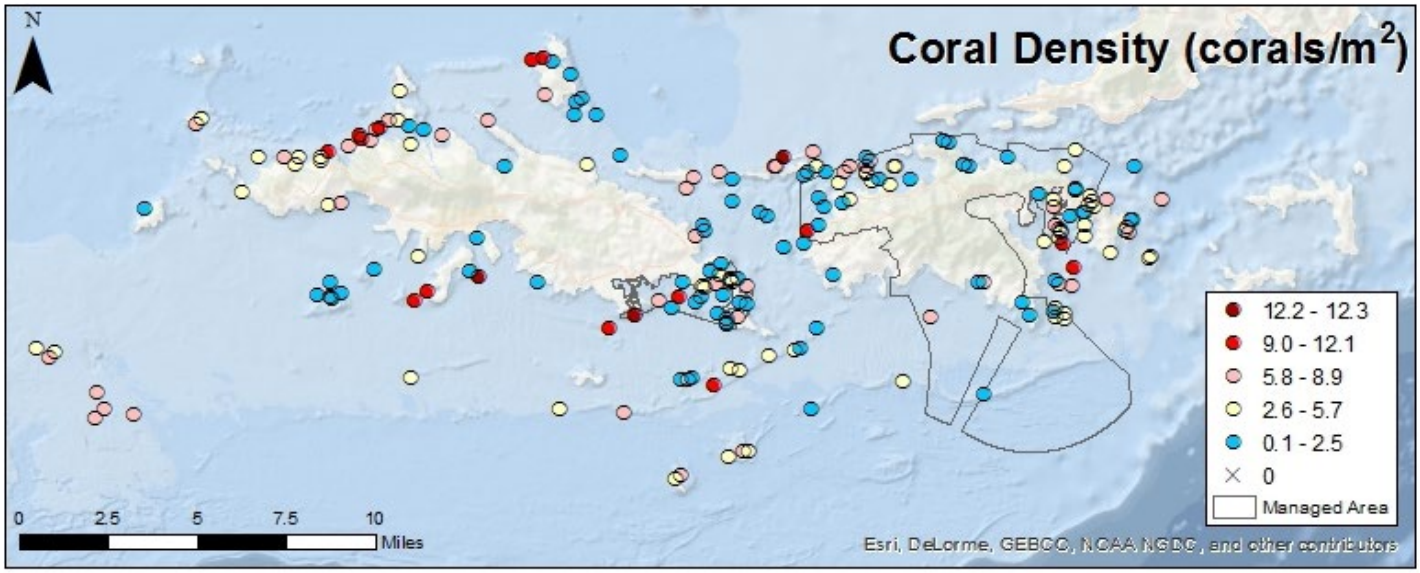


Figure 25. NCRMP 2013 USVI observed stony coral density (corals/m²), shown by standard deviation categories (>1.5, 0.50 – 1.5, -0.50 – 0.50, -1.5 – -0.50, <-1.5). Yellow circles symbolize the mean +/- 0.5 SD.

RESULTS

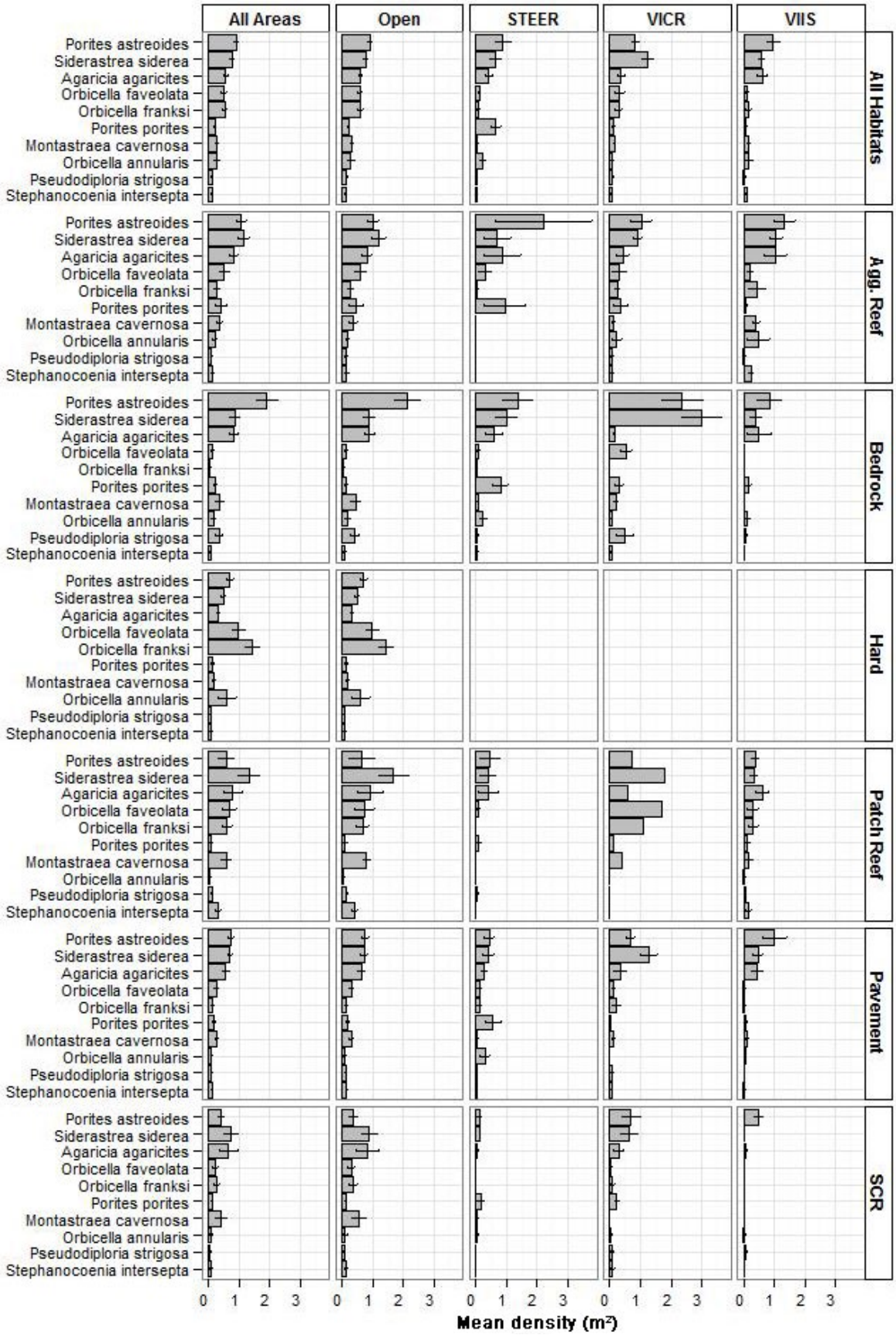


Figure 26. NCRMP 2013 USVI mean density (corals/m²) of most abundant corals, shown by administrative area (columns) and habitat type (rows). Weighted means with standard error bars. No hard (predicted hardbottom) habitat was surveyed for coral demographics in STEER, VICR or VIIS.

Coral size estimations

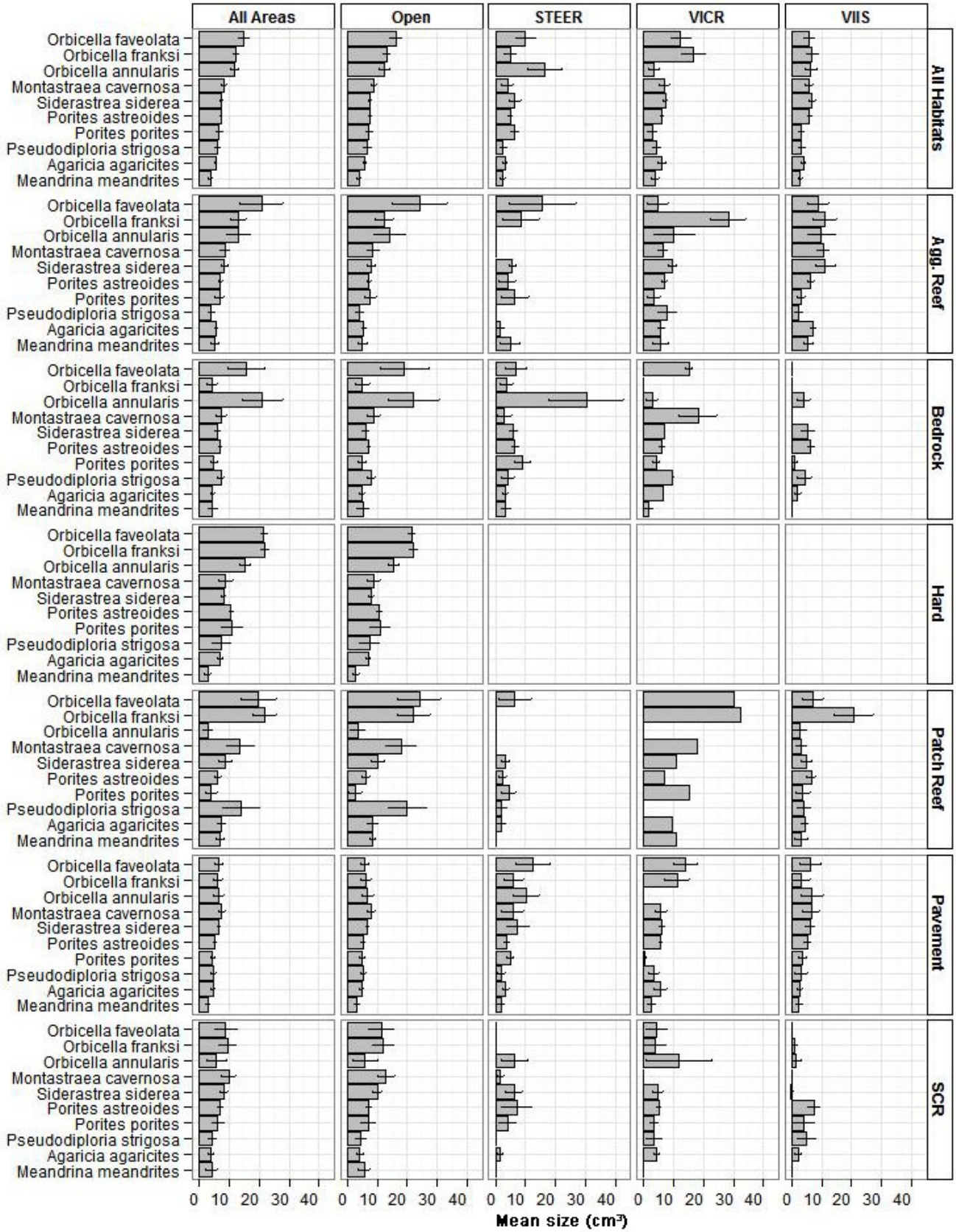


Figure 27. Mean size (cm³) of largest coral species, shown by administrative area (columns) and habitat type (rows) in NCRMP 2013 USVI sampling effort. Weighted means with standard error bars. No hard (predicted hardbottom) habitat was surveyed for coral demographics in STEER, VICR or VIIS.

RESULTS

Coral condition

Coral mortality

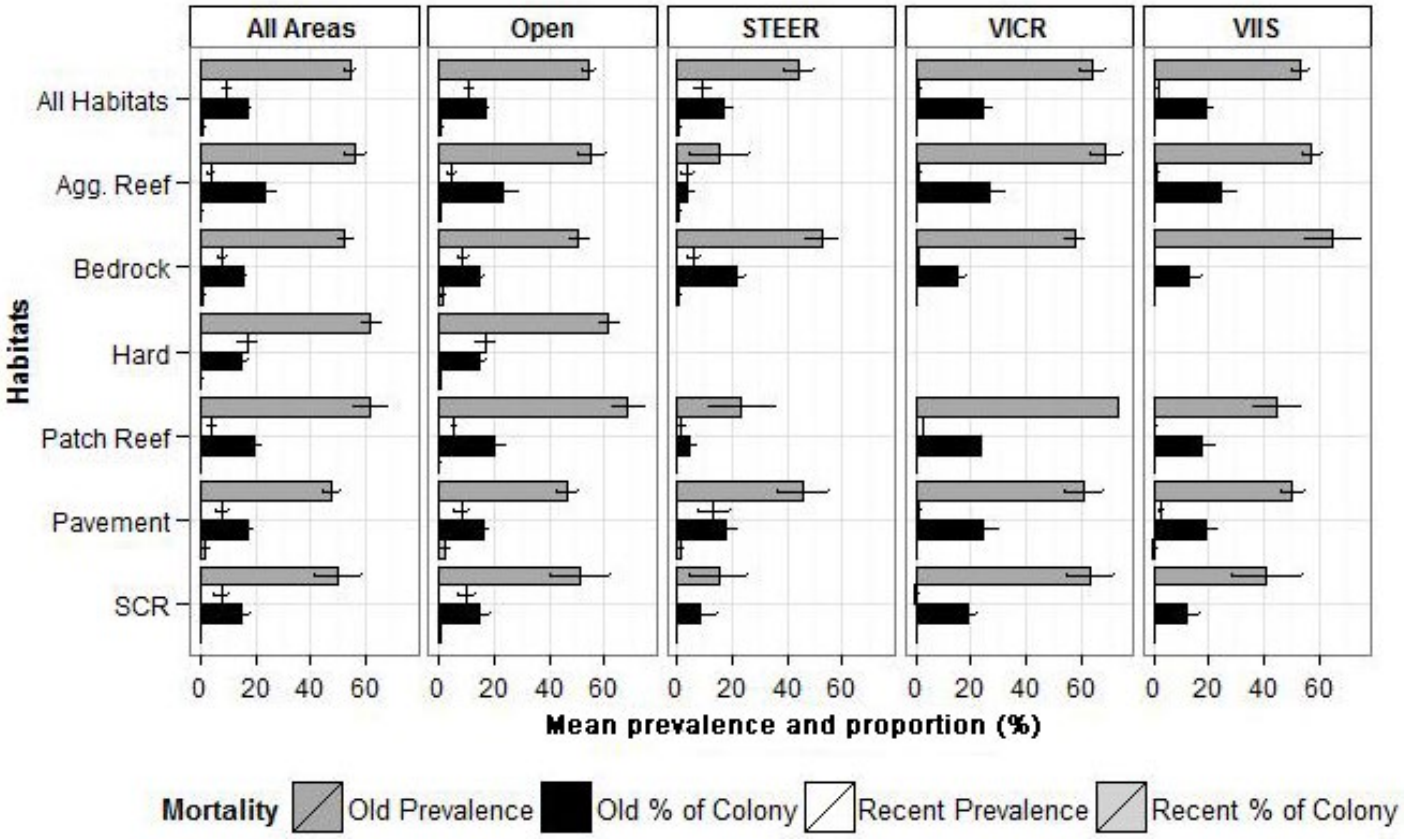


Figure 28. NCRMP 2013 USVI overall mean mortality prevalence and proportion (%) of corals within administrative areas (columns) and habitat types (rows). Weighted means with standard error bars. No hard (predicted hardbottom) habitat was surveyed for coral demographics in STEER, VICR or VIIS.

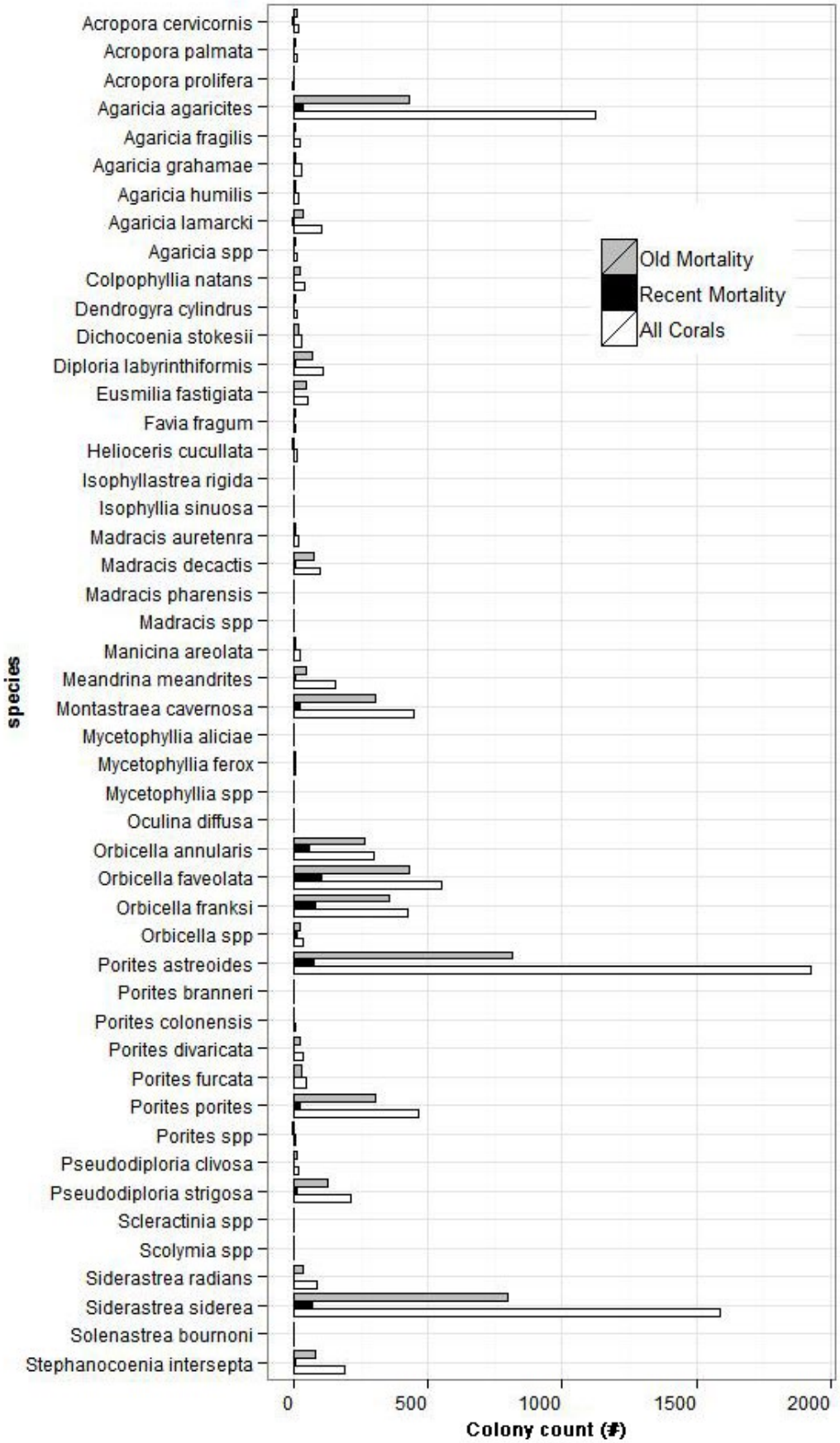


Figure 29. NCRMP 2013 USVI prevalence of mortality as counts of colonies with old mortality (gray), recent mortality (black), and the total number of colonies counted for each coral species counted in demographic surveys (white).

RESULTS

Coral bleaching

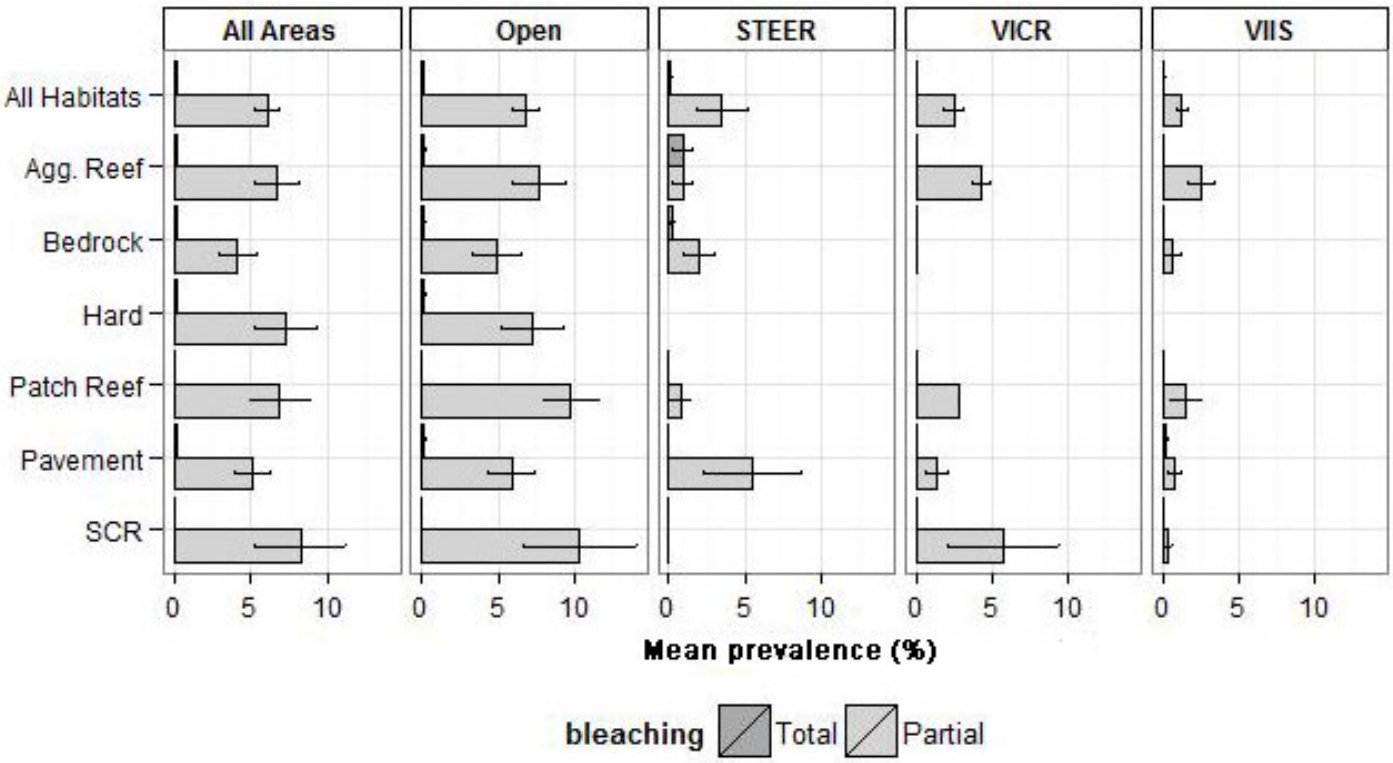
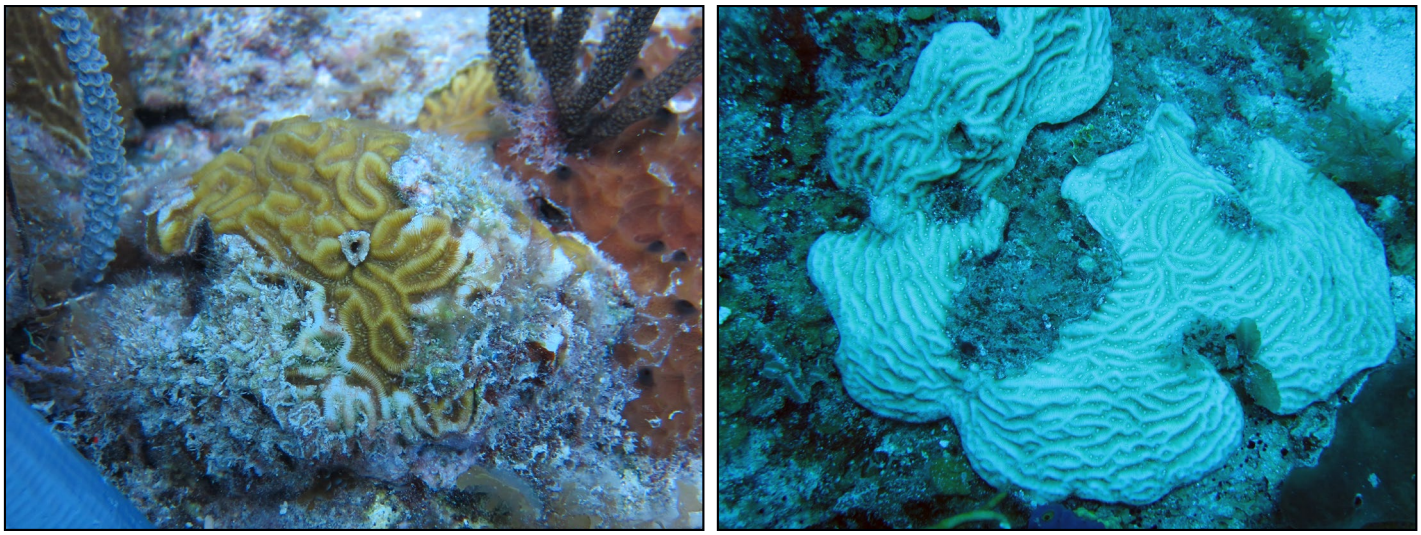


Figure 30. NCRMP 2013 USVI bleaching prevalence by administrative area (columns) and habitat type (rows). Weighted means and standard error bars. No hard (predicted hardbottom) habitat was surveyed for coral demographics in STEER, VICR or VIIS.



Examples of coral mortality (M. Miller, NOAA/SEFSC) and coral bleaching (L. Rutten, Nova Southeastern University) observations around St. Thomas and St. John, USVI in 2013.

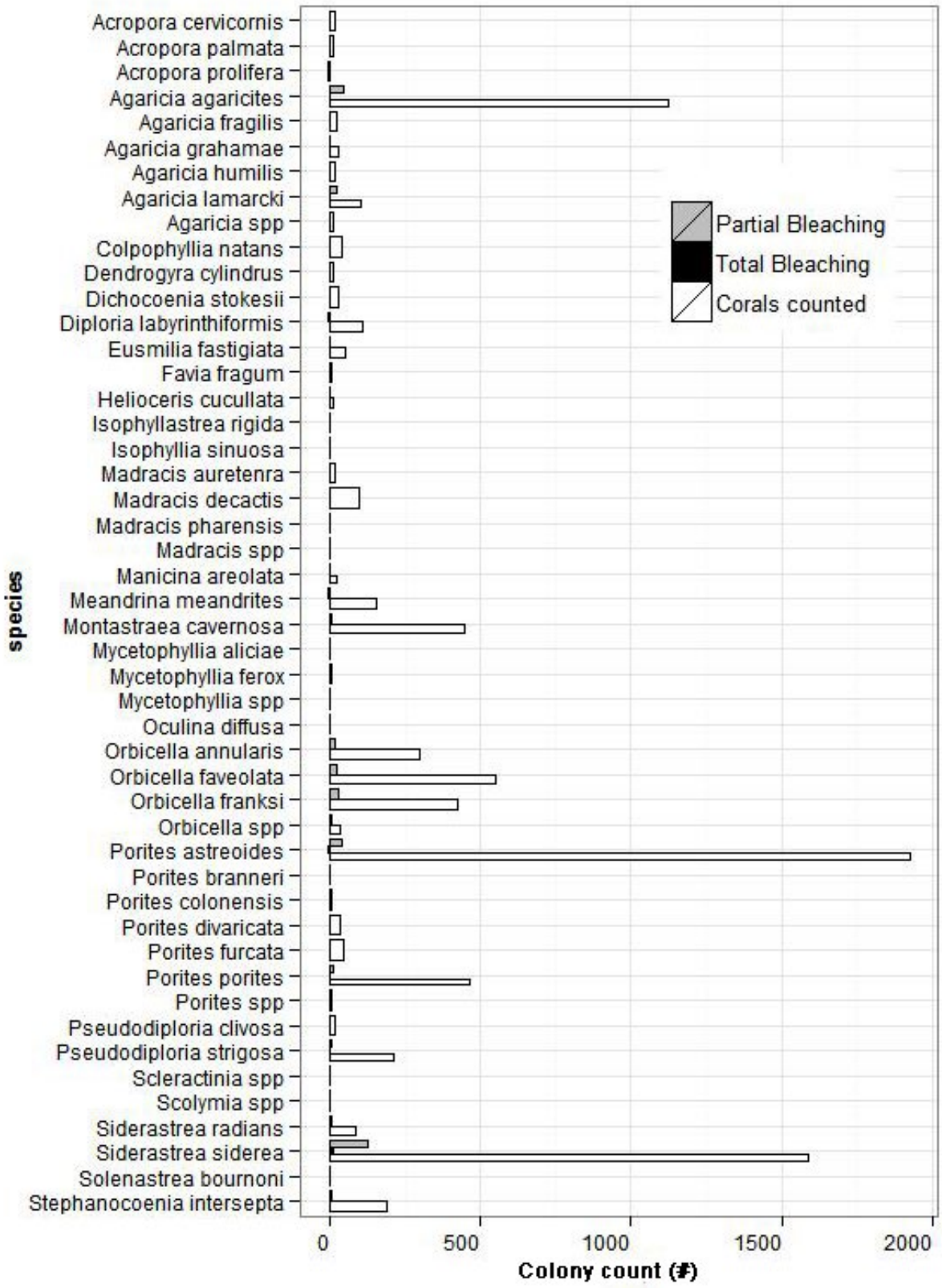


Figure 31. NCRMP 2013 USVI prevalence of bleaching as counts of colonies with partial bleaching (gray), total bleaching (black) and the total number of colonies counted for each coral species counted during demographic surveys (white).

RESULTS

Threatened coral species

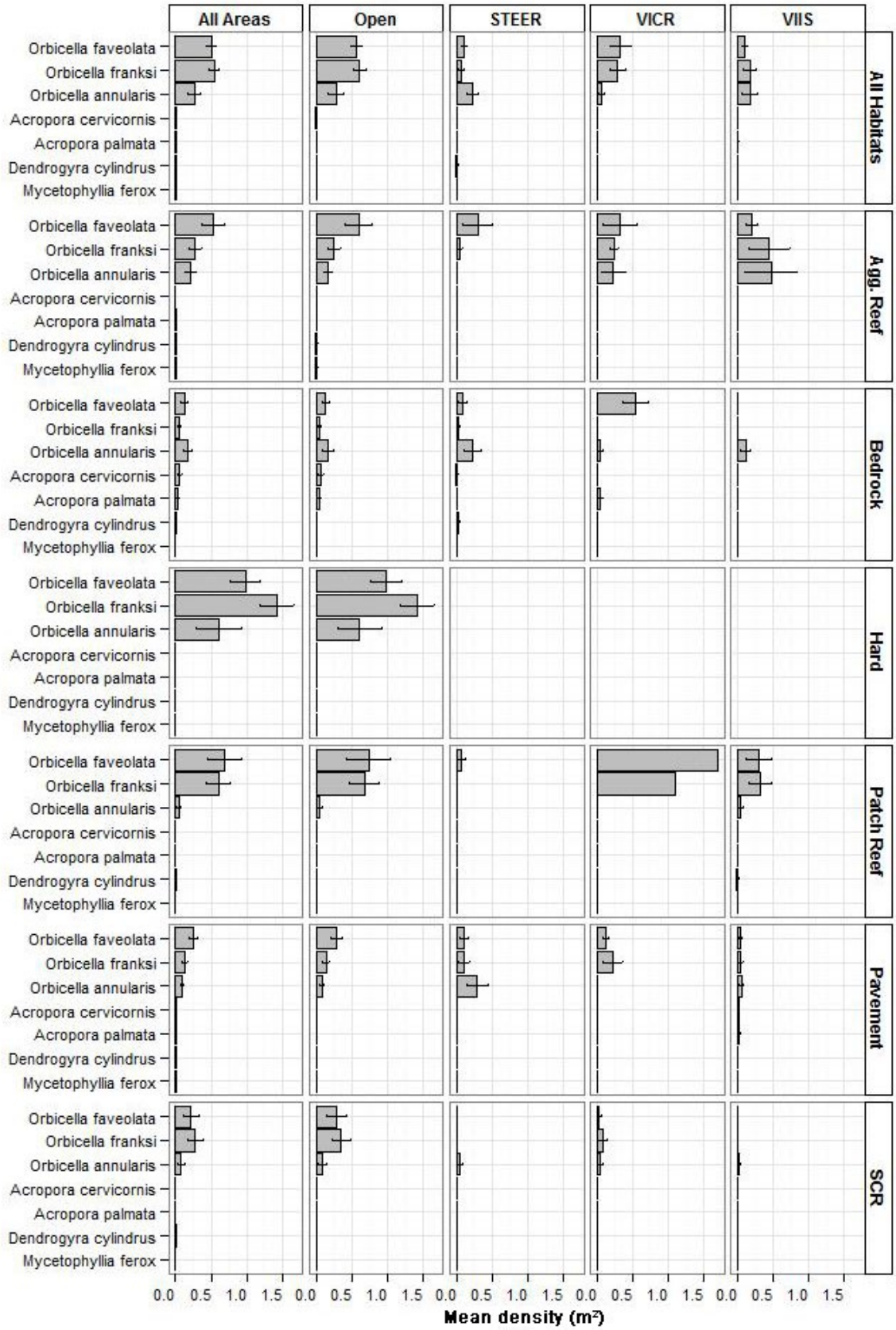


Figure 32. NCRMP 2013 USVI mean species level density (corals / m²) of corals listed as Threatened under the Endangered Species Act (ESA), shown by administrative area (columns) and habitat type (rows). Weighted means with standard error bars. No hard (predicted hardbottom) habitat was surveyed for coral demographics in STEER, VICR, or VIIS.

Acropora cervicornis and *Acropora palmata*

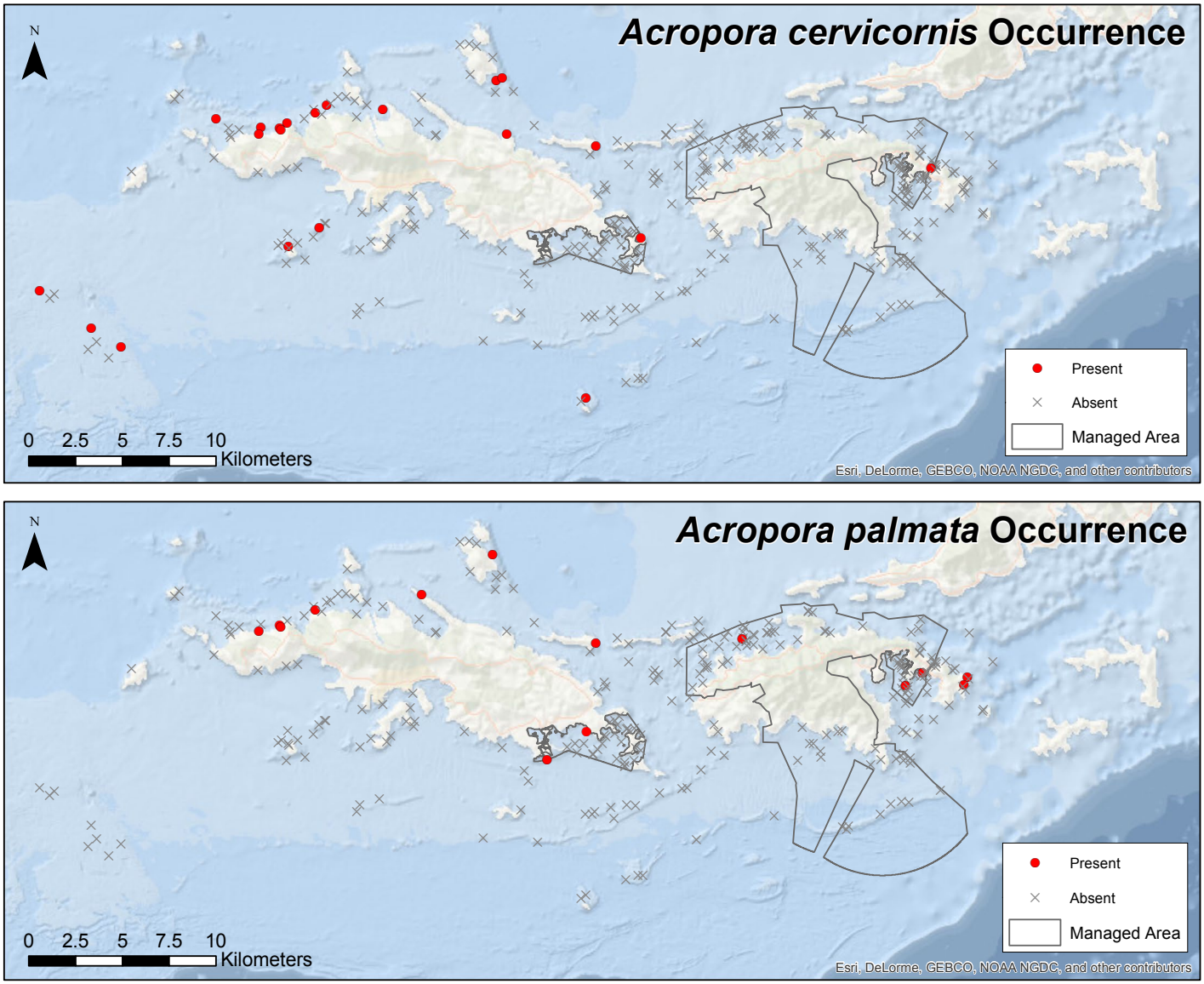
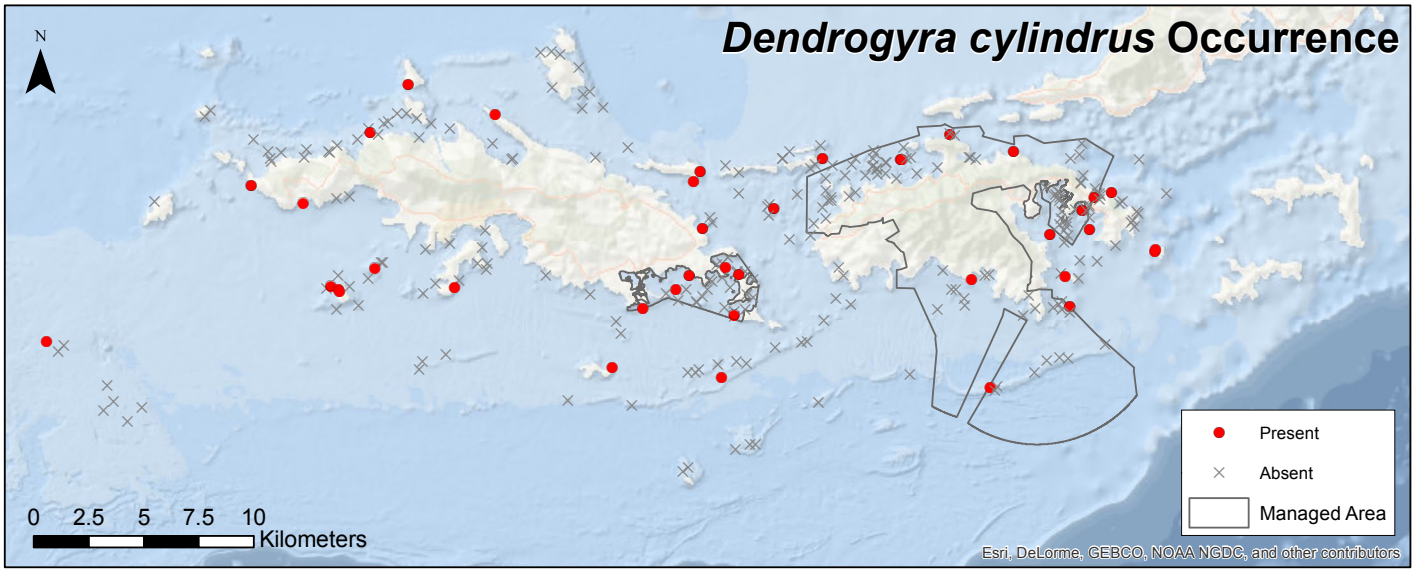


Figure 33. NCRMP 2013 USVI observations of Acropora cervicornis *(top) and* Acropora palmata *(bottom).*

Photos of A. cervicornis *(L. Rutten, Nova Southeastern University),* A. palmata *(L. Henderson, USVI DPNR) and* D. cylindrus *(L. Rutten) observed around St. Thomas and St. John, USVI in 2013.*

RESULTS

Dendrogyra cylindrus and *Mycetophyllia ferox*



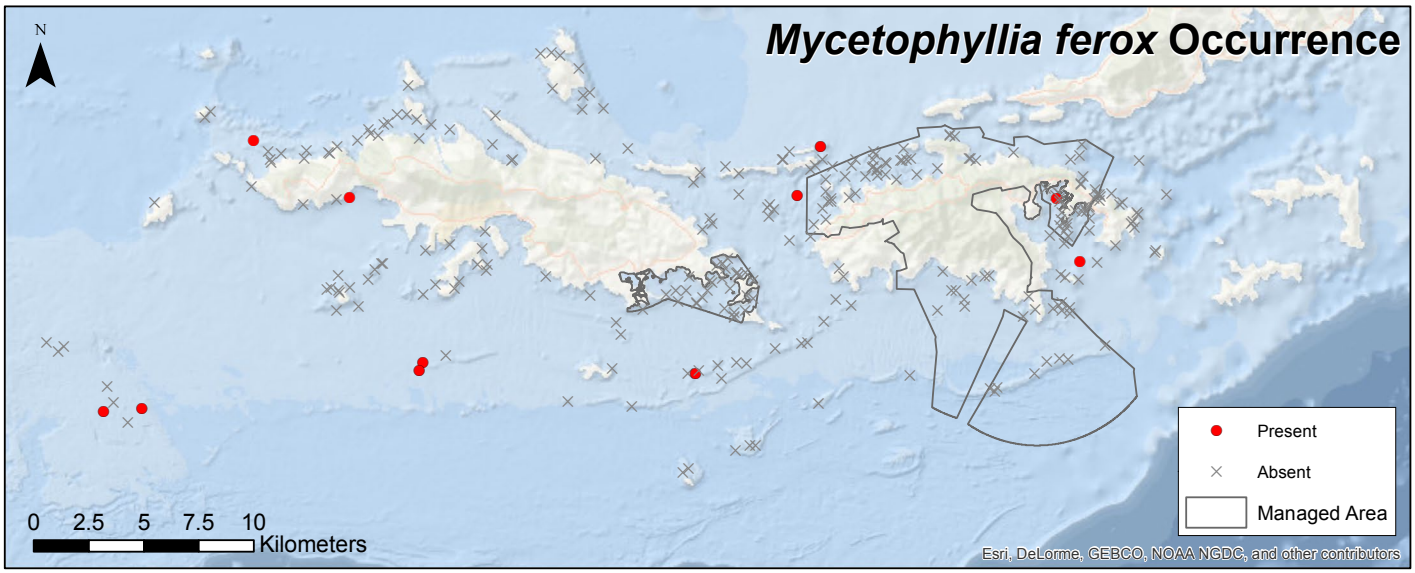
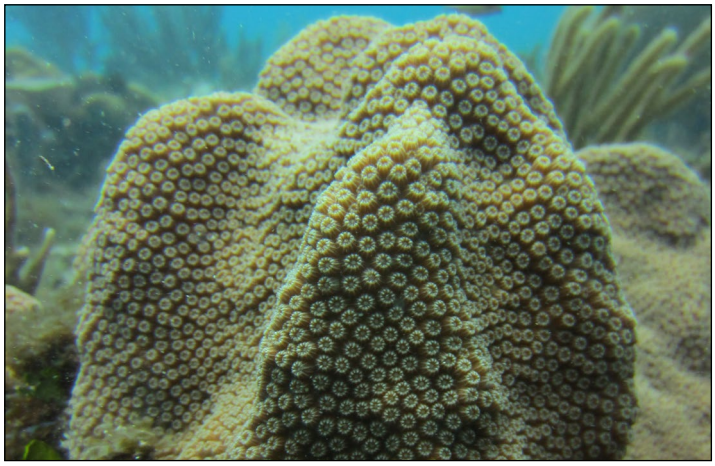


Figure 34. NCRMP 2013 USVI observations of Dendrogyra cylindrus *(top) and* Mycetophyllia ferox *(bottom).*



Photos of O. annularis *(NOAA/NCCOS) and* O. faveolata *(L. Richter, NPS) observed around St. Thomas and St. John, USVI.*

Orbicella annularis

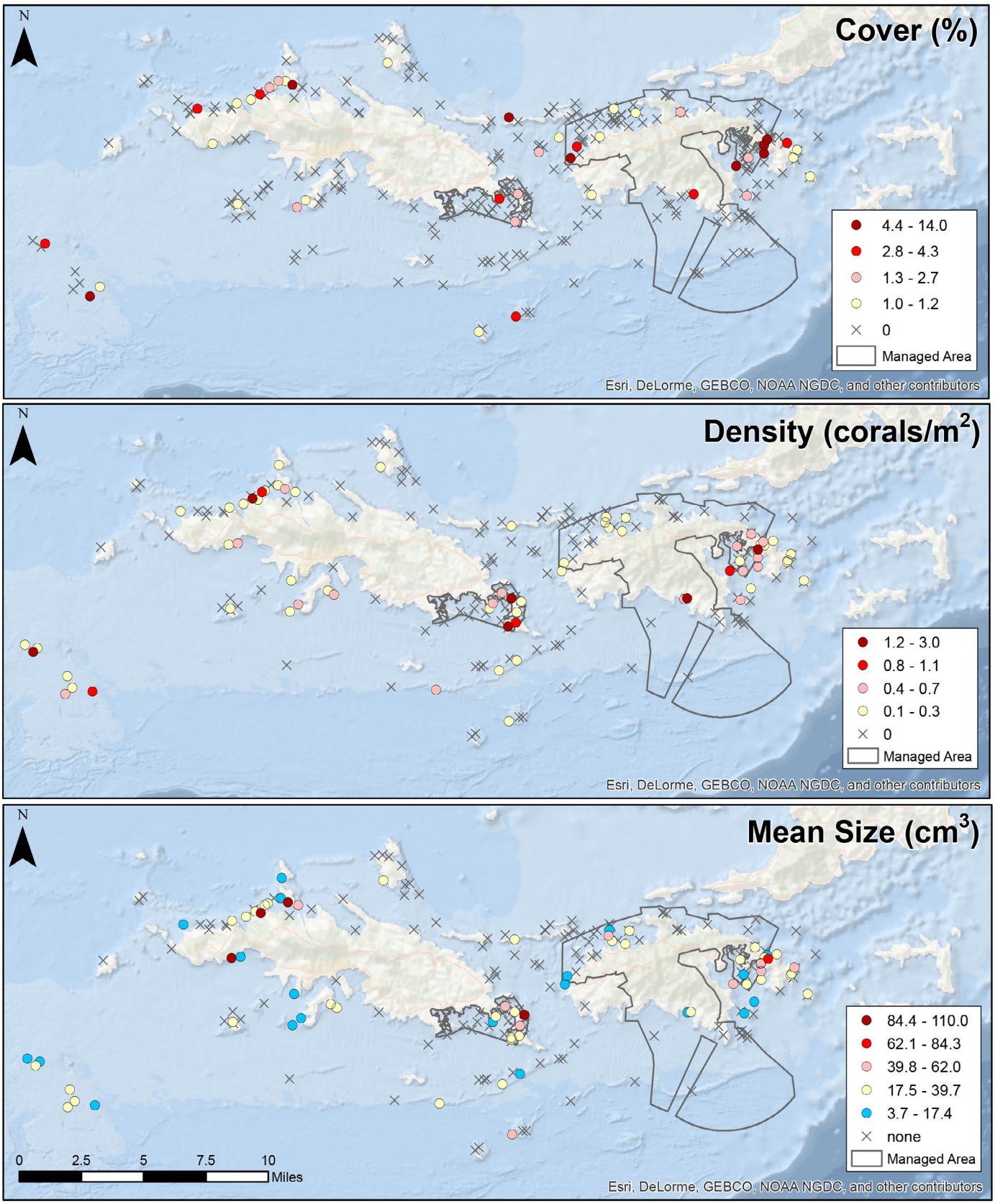


Figure 35. NCRMP 2013 USVI observed: cover (%; top), density (coral/m^2; middle), and mean size (cm^3; bottom) for Orbicella annularis, *shown by standard deviation categories. Standard deviation categories for cover and density: >2.5, 1.5 – 2.5, 0.5 – 1.5, -0.50 – 0.50, and for mean size: >2.5, 1.5 – 2.5, 0.5 – 1.5, -0.50 – 0.50, <-0.50. Yellow circles symbolize the mean +/- 0.5 standard deviation.*

RESULTS

Orbicella faveolata

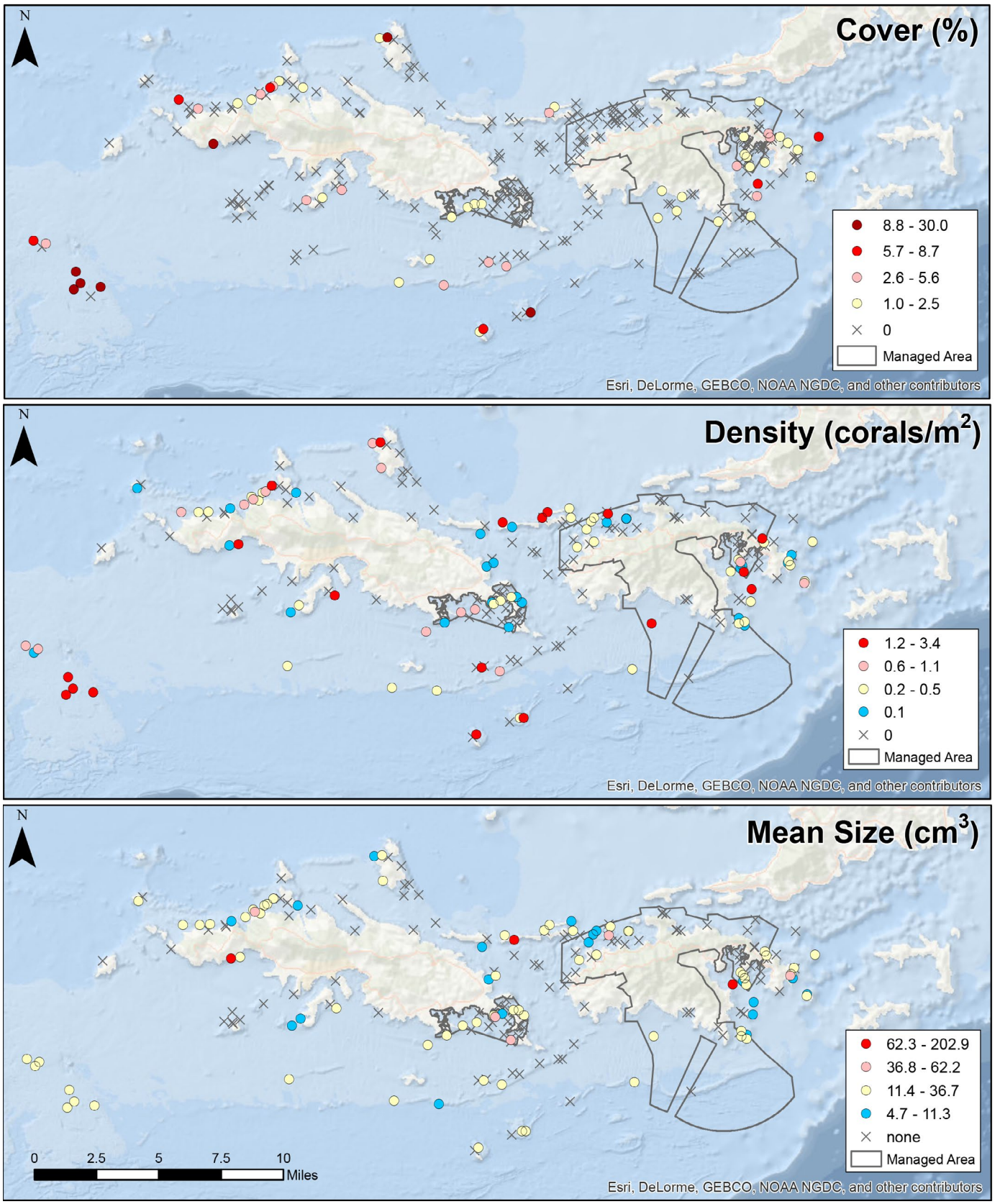


Figure 36. NCRMP 2013 USVI observed: cover (%; top), density (coral/m^2; middle), and mean size (cm^3; bottom) for Orbicella faveolata, *shown by standard deviation categories. Standard deviation categories for cover: >2.5, 1.5 – 2.5, 0.50 – 1.5, 0.5 - -0.5, and for density and mean size: >1.5, 0.50 – 1.5, 0.50 – -0.05, <-0.50. Yellow circles symbolize the mean +/- 0.5 standard deviation.*

Orbicella franksi

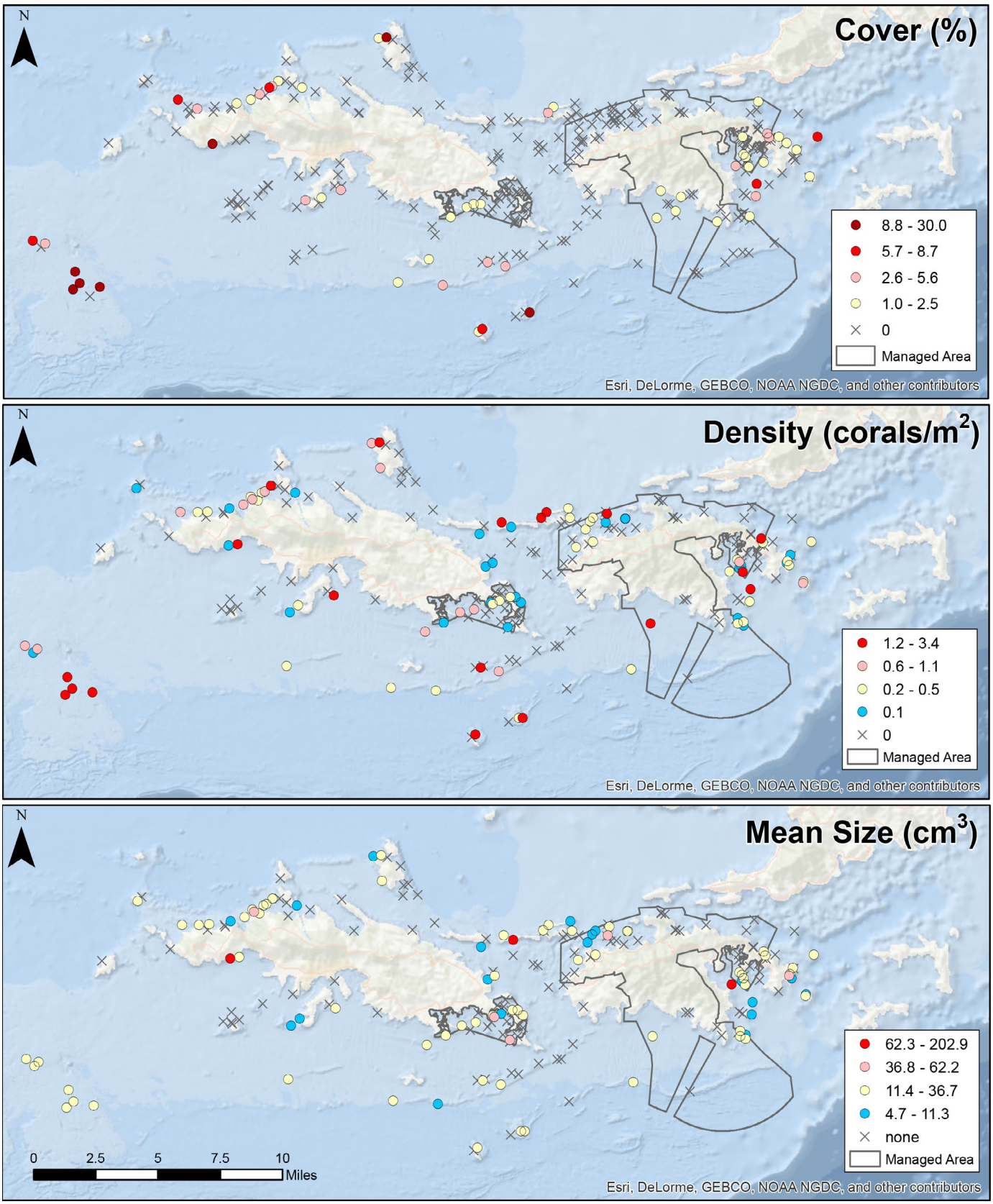


Figure 37. NCRMP 2013 USVI observed: cover (%; top), density (coral/m^2; middle), and mean size (cm^3; bottom) for Orbicella franksi, *shown by standard deviation categories. Standard deviation categories for cover and density: >2.5, 1.5 – 2.5, 0.50 – 1.5, <0.50, SD categories for mean size: >1.5, 0.50 – 1.5, -0.50 – -0.05, <-0.50. Yellow circles symbolize the mean +/- 0.5 standard deviation.*

RESULTS

Key species of mobile macroinvertebrates

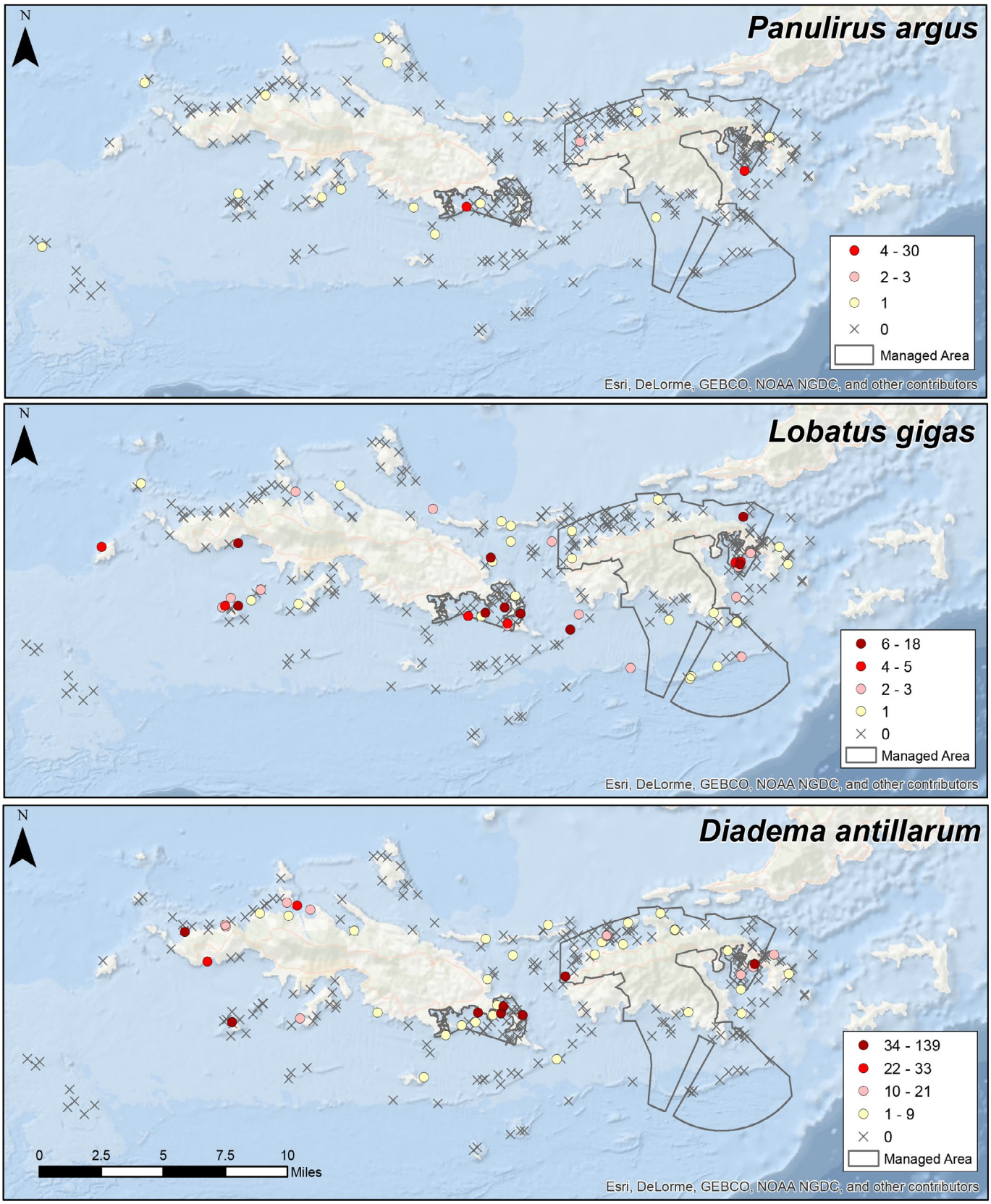


Figure 38. NCRMP 2013 USVI observed abundance of: Panulirus argus *(Caribbean spiny lobster; top),* Lobatus gigas *(queen conch; middle), and* Diadema antillarum *(long-spined sea urchin; bottom), shown by standard deviation categories. Standard deviation categories for* P. argus *: >1.5, 0.50 – 1.5, <0.50; and for* L. gigas *and* D. antillarum*: >2.5, 1.5 – 2.5, 0.50 – 1.5, <0.50. Yellow circles symbolize mean +/- 0.5 SD.*

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Strata Abbreviations

Habitat Type

AGRF	Aggregate reef habitat
BDRK	Bedrock habitat
HARD	Predicted hardbottom habitat
PTRF	Patch reef habitat
PVMT	Pavement habitat
SCR	Scattered coral and rock in sand habitat

Biotope

MSR	Mid-shelf reef
STJ	St. John
STT	St. Thomas

Administrative Area

OPEN	Sites that are not within any administrative areas in USVI
STEER	St. Thomas East End Reserves
VICR	Virgin Islands Coral Reef National Monument
VIIS	Virgin Islands National Park

Appendix 1: Site Allocation Tables by Biotope and Administration Strata

Fish	Shallow						Deep					
	BDRK	PVMT	PTRF	AGRF	SCR	HARD	BDRK	PVMT	AGRF	PTRF	SCR	HARD
Sail Rock	0	0	0	0	0	0	0	0	0	0	0	8
MSR OPEN	0	0	0	0	0	0	0	8	2	2	2	3
STEER	4	4	3	2	2	0	2	3	3	2	2	0
STT OPEN	11	12	7	2	4	0	2	10	6	4	2	0
STJ OPEN	4	5	4	3	3	0	5	21	11	4	6	0
VICR	2	2	3	2	2	0	0	3	3	2	2	0
VICR MSR	0	0	0	0	0	0	0	4	3	3	2	2
VIIS	4	6	4	3	3	0	2	6	4	3	2	0

Coral	Shallow						Deep					
	BDRK	PAVE	PTRF	AGGR	SCR	HARD	BDRK	PAVE	AGGR	PTRF	SCR	HARD
Sail Rock	0	0	0	0	0	0	0	0	0	0	0	5
MSR OPEN	0	0	0	0	0	0	0	5	1	1	1	2
STEER	3	3	2	1	1	0	1	2	2	1	1	0
STT OPEN	7	8	5	1	3	0	1	7	4	3	1	0
STJ OPEN	3	3	3	2	2	0	3	14	7	3	4	0
VICR	1	1	2	1	1	0	0	2	2	1	1	0
VICR MSR	0	0	0	0	0	0	0	3	2	2	1	1
VIIS	3	4	3	2	2	0	1	4	3	2	1	0

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Appendix 2. NCRMP USVI 2013 Field Mission Sample Sites

Site	Latitude	Longitude	Depth (ft)	Island	Habitat type	Depth	Admin Area	Demo	LPI	Fish	Rugosity
250	18.29788	-64.79451	86	STJ	Hard	deep	OPEN	X	X	X	0.295833
221	18.27609	-64.7574	98	STJ	Patch reef	deep	OPEN	X	X	X	0.364583
235	18.30477	-64.78275	60	STJ	Pavement	deep	OPEN		X	X	0.413461
383	18.30696	-64.7894	79	STJ	SCR	deep	OPEN	X	X	X	0.1
179	18.31604	-64.68544	51	STJ	Bedrock	deep	OPEN	X	X	X	0.364583
180	18.36923	-64.79666	67	STJ	Bedrock	deep	OPEN	X	X	X	0.327083
351	18.31778	-64.69302	41	STJ	Bedrock	deep	OPEN	X	X	X	0.1625
127	18.31603	-64.78619	16	STJ	Bedrock	shallow	OPEN		X	X	0.408333
128	18.33973	-64.66248	12	STJ	Bedrock	shallow	OPEN	X	X	X	0.804166
129	18.34336	-64.66063	21	STJ	Bedrock	shallow	OPEN	X	X	X	0.722916
321	18.31644	-64.69112	17	STJ	Bedrock	shallow	OPEN	X	X	X	9.664583
322	18.31962	-64.78811	5	STJ	Bedrock	shallow	OPEN	X	X	X	0.310416
164	18.34819	-64.67676	33	STJ	Agg. reef	deep	OPEN	X	X	X	0.31875
165	18.35	-64.67631	70	STJ	Agg. reef	deep	OPEN		X	X	0.120833
166	18.35045	-64.67678	82	STJ	Agg. reef	deep	OPEN		X	X	2.701666
168	18.36685	-64.80989	59	STJ	Agg. reef	deep	OPEN	X	X	X	0.583333
343	18.32289	-64.67746	83	STJ	Agg. reef	deep	OPEN		X	X	0.1
344	18.33355	-64.69791	41	STJ	Agg. reef	deep	OPEN	X	X	X	0.858333
345	18.35115	-64.64793	60	STJ	Agg. reef	deep	OPEN	X	X	X	0.670833
108	18.34737	-64.66682	23	STJ	Agg. reef	shallow	OPEN		X	X	0.5
109	18.35806	-64.83156	23	STJ	Agg. reef	shallow	OPEN	X	X	X	0.3875
110	18.36382	-64.79566	31	STJ	Agg. reef	shallow	OPEN	X	X	X	0.360416
310	18.32717	-64.65291	30	STJ	Agg. reef	shallow	OPEN	X	X	X	0.458333
177	18.36071	-64.83727	85	STJ	Patch reef	deep	OPEN	X	X	X	0.284615
349	18.33044	-64.69173	87	STJ	Patch reef	deep	OPEN		X	X	0.929166
116	18.33883	-64.66295	18	STJ	Patch reef	shallow	OPEN	X	X	X	0.40625
117	18.34691	-64.66824	18	STJ	Patch reef	shallow	OPEN		X	X	0.5625
118	18.35095	-64.67159	25	STJ	Patch reef	shallow	OPEN	X	X	X	0.494444
314	18.33071	-64.80951	33	STJ	Patch reef	shallow	OPEN	X	X	X	0.227083
192	18.32327	-64.68504	69	STJ	Pavement	deep	OPEN	X	X	X	0.41875
193	18.34057	-64.8186	69	STJ	Pavement	deep	OPEN	X	X	X	0.879166
194	18.34418	-64.81911	54	STJ	Pavement	deep	OPEN	X	X	X	0.339583
195	18.34509	-64.81818	57	STJ	Pavement	deep	OPEN	X	X	X	0.110416
196	18.34903	-64.83146	63	STJ	Pavement	deep	OPEN	X	X	X	0.247826
197	18.36115	-64.79137	82	STJ	Pavement	deep	OPEN	X	X	X	0.19375
198	18.3646	-64.65989	55	STJ	Pavement	deep	OPEN	X	X	X	0.425
199	18.36366	-64.81316	48	STJ	Pavement	deep	OPEN	X	X	X	0.583333
200	18.36366	-64.81269	47	STJ	Pavement	deep	OPEN	X	X	X	0.641666
362	18.36153	-64.79895	52	STJ	Pavement	deep	OPEN	X	X	X	0.154166
143	18.33216	-64.80054	26	STJ	Pavement	shallow	OPEN	X	X	X	0.172916
144	18.33748	-64.66152	25	STJ	Pavement	shallow	OPEN	X	X	X	0.2625
145	18.34093	-64.68095	36	STJ	Pavement	shallow	OPEN	X	X	X	0.6375
146	18.34291	-64.66015	24	STJ	Pavement	shallow	OPEN	X	X	X	0.289583
330	18.32973	-64.66949	30	STJ	Pavement	shallow	OPEN	X	X	X	0.308333
331	18.33596	-64.6809	29	STJ	Pavement	shallow	OPEN	X	X	X	0.285416
205	18.32807	-64.65244	38	STJ	SCR	deep	OPEN	X	X	X	0.510869
206	18.35971	-64.80083	68	STJ	SCR	deep	OPEN	X	X	X	0.2375
365	18.34926	-64.8064	82	STJ	SCR	deep	OPEN		X	X	0.433333

Site	Latitude	Longitude	Depth (ft)	Island	Habitat type	Depth	Admin Area	Demo	LPI	Fish	Rugosity
337	18.3433	-64.81626	29	STJ	SCR	shallow	OPEN	X	X	X	0.310416
240	18.27748	-64.70398	99	STJ	Hard	deep	VICR		X	X	0.210416
241	18.28249	-64.69883	97	STJ	Hard	deep	VICR	X	X	X	0.4
213	18.27098	-64.72283	87	STJ	Agg. reef	deep	VICR	X	X	X	0.383333
214	18.27146	-64.72	89	STJ	Agg. reef	deep	VICR		X	X	0.447916
215	18.31105	-64.73789	71	STJ	Agg. reef	deep	VICR		X	X	0.110416
369	18.2701	-64.72093	88	STJ	Agg. reef	deep	VICR		X	X	0.328571
370	18.31104	-64.73978	70	STJ	Agg. reef	deep	VICR		X	X	0.222916
218	18.30285	-64.74585	79	STJ	Patch reef	deep	VICR	X	X	X	0.508333
219	18.30431	-64.73404	84	STJ	Patch reef	deep	VICR		X	X	0.1
220	18.30702	-64.73454	84	STJ	Patch reef	deep	VICR		X	X	0.520833
223	18.28345	-64.69316	94	STJ	Pavement	deep	VICR		X	X	0.120833
224	18.28904	-64.67383	102	STJ	Pavement	deep	VICR		X	X	0.266666
225	18.302	-64.68909	61	STJ	Pavement	deep	VICR	X	X	X	0.372916
226	18.30333	-64.69241	81	STJ	Pavement	deep	VICR	X	X	X	0.570833
227	18.30426	-64.68911	50	STJ	Pavement	deep	VICR	X	X	X	0.51
228	18.30649	-64.69244	51	STJ	Pavement	deep	VICR	X	X	X	0.2625
376	18.28303	-64.68938	88	STJ	Pavement	deep	VICR		X	X	0.1
236	18.30375	-64.6962	88	STJ	SCR	deep	VICR		X	X	0.1
237	18.30557	-64.69385	80	STJ	SCR	deep	VICR	X	X	X	0.1625
124	18.33902	-64.69181	10	STJ	Bedrock	shallow	VICR	X	X	X	3.222916
125	18.34036	-64.69324	25	STJ	Bedrock	shallow	VICR	X	X	X	0.404166
126	18.3458	-64.6914	12	STJ	Bedrock	shallow	VICR	X	X	X	0.1
320	18.34542	-64.68336	16	STJ	Bedrock	shallow	VICR		X	X	0.7875
162	18.34362	-64.6824	64	STJ	Agg. reef	deep	VICR	X	X	X	0.1
163	18.35269	-64.6787	84	STJ	Agg. reef	deep	VICR	X	X	X	0.8625
341	18.33317	-64.68986	45	STJ	Agg. reef	deep	VICR	X	X	X	1.0625
104	18.3459	-64.68099	20	STJ	Agg. reef	shallow	VICR	X	X	X	0.477083
106	18.35295	-64.69999	8	STJ	Agg. reef	shallow	VICR	X	X	X	0.845833
307	18.34308	-64.69279	24	STJ	Agg. reef	shallow	VICR		X	X	0.416666
308	18.34759	-64.69379	27	STJ	Agg. reef	shallow	VICR	X	X	X	0.245833
174	18.35119	-64.69476	50	STJ	Patch reef	deep	VICR		X	X	0.1
348	18.34893	-64.69522	63	STJ	Patch reef	deep	VICR		X	X	0.189583
114	18.35028	-64.6957	41	STJ	Patch reef	shallow	VICR		X	X	0.366666
190	18.36664	-64.68546	75	STJ	Pavement	deep	VICR		X	X	0.23125
191	18.37116	-64.68456	51	STJ	Pavement	deep	VICR	X	X	X	0.375
140	18.33541	-64.69177	38	STJ	Pavement	shallow	VICR	X	X	X	0.189583
141	18.33858	-64.69038	36	STJ	Pavement	shallow	VICR	X	X	X	0.183333
142	18.34403	-64.68713	16	STJ	Pavement	shallow	VICR	X	X	X	0.35
203	18.33722	-64.69085	26	STJ	SCR	deep	VICR	X	X	X	0.2875
204	18.3381	-64.6937	67	STJ	SCR	deep	VICR		X	X	0.1
150	18.34544	-64.68147	14	STJ	SCR	shallow	VICR	X	X	X	0.14
151	18.34894	-64.6938	10	STJ	SCR	shallow	VICR	X	X	X	0.1
334	18.34361	-64.68429	25	STJ	SCR	shallow	VICR		X	X	1.46875
335	18.35075	-64.69382	37	STJ	SCR	shallow	VICR	X	X	X	0.291666
119	18.30862	-64.70665	16	STJ	Bedrock	shallow	VIIS	X	X	X	0.110416
121	18.31658	-64.72565	10	STJ	Bedrock	shallow	VIIS	X	X	X	0.322916
123	18.36774	-64.71385	21	STJ	Bedrock	shallow	VIIS	X	X	X	0.435416
316	18.30368	-64.70377	16	STJ	Bedrock	shallow	VIIS	X	X	X	0.393478

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Site	Latitude	Longitude	Depth (ft)	Island	Habitat type	Depth	Admin Area	Demo	LPI	Fish	Rugosity
318	18.33714	-64.79917	18	STJ	Bedrock	shallow	VIIS	X	X	X	0.7875
157	18.35044	-64.67773	78	STJ	Agg. reef	deep	VIIS	X	X	X	0.741666
158	18.36168	-64.78334	64	STJ	Agg. reef	deep	VIIS	X	X	X	0.527083
159	18.36272	-64.76821	83	STJ	Agg. reef	deep	VIIS	X	X	X	0.1
160	18.36395	-64.78147	57	STJ	Agg. reef	deep	VIIS	X	X	X	0.583333
340	18.36272	-64.76868	82	STJ	Agg. reef	deep	VIIS		X	X	0.120833
98	18.31518	-64.73131	22	STJ	Agg. reef	shallow	VIIS		X	X	0.2375
99	18.31705	-64.72376	19	STJ	Agg. reef	shallow	VIIS	X	X	X	0.735416
100	18.35772	-64.77194	36	STJ	Agg. reef	shallow	VIIS	X	X	X	0.566666
101	18.36067	-64.74643	32	STJ	Agg. reef	shallow	VIIS		X	X	0.1
102	18.36368	-64.76207	27	STJ	Agg. reef	shallow	VIIS	X	X	X	0.433333
103	18.37426	-64.74136	38	STJ	Agg. reef	shallow	VIIS	X	X	X	0.310416
169	18.35714	-64.78613	73	STJ	Patch reef	deep	VIIS	X	X	X	0.252083
170	18.36463	-64.75782	67	STJ	Patch reef	deep	VIIS		X	X	1.120833
171	18.36629	-64.77298	84	STJ	Patch reef	deep	VIIS	X	X	X	5.4375
172	18.36764	-64.77394	80	STJ	Patch reef	deep	VIIS	X	X	X	0.1
346	18.35074	-64.79411	45	STJ	Patch reef	deep	VIIS	X	X	X	0.410416
347	18.35722	-64.77715	62	STJ	Patch reef	deep	VIIS		X	X	0.958333
111	18.34907	-64.67913	10	STJ	Patch reef	shallow	VIIS	X	X	X	2.697916
112	18.34995	-64.78133	29	STJ	Patch reef	shallow	VIIS	X	X	X	0.252083
113	18.36486	-64.73228	10	STJ	Patch reef	shallow	VIIS	X	X	X	0.2875
181	18.34668	-64.79312	60	STJ	Pavement	deep	VIIS		X	X	0.829166
182	18.34669	-64.7917	57	STJ	Pavement	deep	VIIS	X	X	X	0.6375
183	18.34805	-64.79172	56	STJ	Pavement	deep	VIIS		X	X	0.46875
184	18.35571	-64.79416	59	STJ	Pavement	deep	VIIS	X	X	X	0.2875
185	18.35807	-64.68395	90	STJ	Pavement	deep	VIIS	X	X	X	0.120833
186	18.3648	-64.68922	79	STJ	Pavement	deep	VIIS	X	X	X	0.227083
187	18.37383	-64.73899	67	STJ	Pavement	deep	VIIS	X	X	X	0.227083
188	18.37472	-64.74136	50	STJ	Pavement	deep	VIIS	X	X	X	0.238
352	18.30092	-64.70894	66	STJ	Pavement	deep	VIIS		X	X	0.439583
354	18.34395	-64.70546	71	STJ	Pavement	deep	VIIS		X	X	1.24
355	18.36416	-64.75971	50	STJ	Pavement	deep	VIIS		X	X	0.508333
131	18.3582	-64.76864	23	STJ	Pavement	shallow	VIIS	X	X	X	0.335416
132	18.35832	-64.75539	20	STJ	Pavement	shallow	VIIS	X	X	X	0.358333
133	18.35952	-64.77244	22	STJ	Pavement	shallow	VIIS	X	X	X	0.1
134	18.35997	-64.77244	20	STJ	Pavement	shallow	VIIS	X	X	X	0.1625
135	18.36086	-64.77435	9	STJ	Pavement	shallow	VIIS	X	X	X	0.9625
136	18.36131	-64.77387	8	STJ	Pavement	shallow	VIIS	X	X	X	0.704166
137	18.36369	-64.7616	24	STJ	Pavement	shallow	VIIS	X	X	X	0.402083
138	18.36403	-64.7739	31	STJ	Pavement	shallow	VIIS	X	X	X	0.372916
139	18.36866	-64.76118	37	STJ	Pavement	shallow	VIIS		X	X	0.497916
324	18.31868	-64.74364	32	STJ	Pavement	shallow	VIIS		X	X	0.2375
326	18.35599	-64.76389	19	STJ	Pavement	shallow	VIIS	X	X	X	0.875
201	18.3549	-64.68487	38	STJ	SCR	deep	VIIS	X	X	X	0.279166
202	18.35535	-64.68488	40	STJ	SCR	deep	VIIS	X	X	X	0.189583
147	18.34857	-64.78415	12	STJ	SCR	shallow	VIIS	X	X	X	0.141666
148	18.36398	-64.7299	6	STJ	SCR	shallow	VIIS	X	X	X	0.141666
149	18.36486	-64.73275	7	STJ	SCR	shallow	VIIS	X	X	X	0.477083
332	18.33944	-64.79399	24	STJ	SCR	shallow	VIIS	X	X	X	0.1

Site	Latitude	Longitude	Depth (ft)	Island	Habitat type	Depth	Admin Area	Demo	LPI	Fish	Rugosity
242	18.23725	-64.85204	84	STT	Hard	deep	OPEN	X	X	X	0.43
243	18.24699	-64.82566	73	STT	Hard	deep	OPEN	X	X	X	0.416666
244	18.24701	-64.8233	99	STT	Hard	deep	OPEN	X	X	X	0.438
245	18.26231	-64.87641	77	STT	Hard	deep	OPEN	X	X	X	0.297916
246	18.26443	-64.79653	89	STT	Hard	deep	OPEN	X	X	X	0.247916
248	18.28876	-64.80387	67	STT	Hard	deep	OPEN	X	X	X	0.308333
249	18.28923	-64.80151	93	STT	Hard	deep	OPEN	X	X	X	0.120833
385	18.23542	-64.85438	73	STT	Hard	deep	OPEN	X	X	X	0.372916
387	18.24467	-64.83179	98	STT	Hard	deep	OPEN	X	X	X	0.65
388	18.26385	-64.90385	87	STT	Hard	deep	OPEN	X	X	X	0.525
389	18.28639	-64.8152	63	STT	Hard	deep	OPEN	X	X	X	0.277083
216	18.27584	-64.96782	96	STT	Agg. reef	deep	OPEN	X	X	X	0.466666
217	18.28229	-64.95654	95	STT	Agg. reef	deep	OPEN		X	X	0.141666
371	18.27947	-64.96644	97	STT	Agg. reef	deep	OPEN		X	X	0.152083
229	18.27397	-64.83824	77	STT	Pavement	deep	OPEN	X	X	X	0.729166
230	18.27609	-64.85245	92	STT	Pavement	deep	OPEN	X	X	X	0.13125
231	18.27613	-64.84914	87	STT	Pavement	deep	OPEN	X	X	X	0.816666
232	18.27938	-64.83971	93	STT	Pavement	deep	OPEN	X	X	X	0.1
233	18.27995	-64.82742	72	STT	Pavement	deep	OPEN	X	X	X	0.45
234	18.28081	-64.83169	65	STT	Pavement	deep	OPEN	X	X	X	0.4
381	18.27704	-64.84772	90	STT	Pavement	deep	OPEN	X	X	X	0.708333
207	18.2577	-65.10282	86	STT	Hard	deep	OPEN	X	X	X	0.516666
208	18.25923	-65.0863	88	STT	Hard	deep	OPEN	X	X	X	0.8375
209	18.26136	-65.09861	89	STT	Hard	deep	OPEN	X	X	X	0.666666
210	18.2681	-65.10153	89	STT	Hard	deep	OPEN	X	X	X	0.591666
211	18.28415	-65.12016	82	STT	Hard	deep	OPEN	X	X	X	0.55625
212	18.28588	-65.12775	79	STT	Hard	deep	OPEN	X	X	X	0.5
367	18.25375	-65.09238	94	STT	Hard	deep	OPEN		X	X	0.583333
368	18.28187	-65.1225	82	STT	Hard	deep	OPEN	X	X	X	0.422727
67	18.34548	-65.00408	37	STT	Bedrock	deep	OPEN	X	X	X	0.7
68	18.35051	-65.04056	44	STT	Bedrock	deep	OPEN	X	X	X	0.675
69	18.37408	-64.99069	89	STT	Bedrock	deep	OPEN	X	X	X	0.945833
287	18.32792	-64.95516	28	STT	Bedrock	deep	OPEN		X	X	0.216666
288	18.34352	-65.01825	28	STT	Bedrock	deep	OPEN		X	X	1.3975
19	18.35835	-64.84812	19	STT	Bedrock	shallow	OPEN	X	X	X	1.414583
20	18.36054	-65.03217	21	STT	Bedrock	shallow	OPEN		X	X	0.78125
21	18.36205	-65.01799	23	STT	Bedrock	shallow	OPEN	X	X	X	0.5875
22	18.36333	-64.89311	32	STT	Bedrock	shallow	OPEN	X	X	X	0.121739
23	18.36397	-65.00713	10	STT	Bedrock	shallow	OPEN	X	X	X	0.51
24	18.36716	-65.00386	28	STT	Bedrock	shallow	OPEN	X	X	X	1.204166
25	18.37186	-64.9864	19	STT	Bedrock	shallow	OPEN	X	X	X	14
26	18.37273	-64.98973	34	STT	Bedrock	shallow	OPEN	X	X	X	1.34375
27	18.3783	-65.06075	35	STT	Bedrock	shallow	OPEN	X	X	X	0.23125
261	18.30846	-65.00271	11	STT	Bedrock	shallow	OPEN	X	X	X	0.7125
262	18.30942	-64.95306	24	STT	Bedrock	shallow	OPEN		X	X	0.779166
50	18.31311	-64.98999	86	STT	Agg. reef	deep	OPEN		X	X	0.152083
52	18.31724	-64.93944	49	STT	Agg. reef	deep	OPEN	X	X	X	0.683333
54	18.3195	-64.93899	51	STT	Agg. reef	deep	OPEN		X	X	0.477083
56	18.36904	-65.03983	74	STT	Agg. reef	deep	OPEN		X	X	0.570833

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Site	Latitude	Longitude	Depth (ft)	Island	Habitat type	Depth	Admin Area	Demo	LPI	Fish	Rugosity
57	18.37662	-64.96375	50	STT	Agg. reef	deep	OPEN	X	X	X	0.19375
58	18.38053	-64.97846	61	STT	Agg. reef	deep	OPEN	X	X	X	1.260416
279	18.30885	-65.00791	58	STT	Agg. reef	deep	OPEN	X	X	X	0.1
282	18.34645	-64.99841	62	STT	Agg. reef	deep	OPEN	X	X	X	0.216666
4	18.31115	-64.96112	47	STT	Agg. reef	shallow	OPEN	X	X	X	0.625
5	18.3126	-64.95121	26	STT	Agg. reef	shallow	OPEN		X	X	2.60625
6	18.33487	-64.84692	19	STT	Agg. reef	shallow	OPEN	X	X	X	0.31875
7	18.35381	-64.85091	30	STT	Agg. reef	shallow	OPEN	X	X	X	0.258333
8	18.38051	-64.93636	28	STT	Agg. reef	shallow	OPEN	X	X	X	2.5375
9	18.4003	-64.90062	12	STT	Agg. reef	shallow	OPEN	X	X	X	0.230434
253	18.3021	-64.87211	38	STT	Agg. reef	shallow	OPEN	X	X	X	0.1
254	18.30986	-64.99799	62	STT	Agg. reef	shallow	OPEN	X	X	X	0.1375
255	18.37069	-64.96889	14	STT	Agg. reef	shallow	OPEN	X	X	X	0.383333
62	18.29162	-64.88145	69	STT	Patch reef	deep	OPEN		X	X	0.566666
63	18.30177	-64.99412	70	STT	Patch reef	deep	OPEN		X	X	0.252083
64	18.3073	-64.89487	47	STT	Patch reef	deep	OPEN	X	X	X	0.19375
65	18.30703	-64.96628	55	STT	Patch reef	deep	OPEN	X	X	X	0.429166
74	18.27758	-64.88509	53	STT	Pavement	deep	OPEN		X	X	0.620833
75	18.29657	-64.8834	58	STT	Pavement	deep	OPEN	X	X	X	0.416666
76	18.30032	-65.00356	89	STT	Pavement	deep	OPEN		X	X	0.110416
77	18.31433	-65.00278	61	STT	Pavement	deep	OPEN	X	X	X	0.141666
78	18.31949	-64.98392		STT	Pavement	deep	OPEN	X	X	X	0.110416
79	18.33942	-64.84366	63	STT	Pavement	deep	OPEN	X	X	X	0.152083
82	18.36753	-64.87944	95	STT	Pavement	deep	OPEN	X	X	X	0.1
83	18.37641	-64.98409	52	STT	Pavement	deep	OPEN	X	X	X	0.658333
84	18.37733	-64.98221	58	STT	Pavement	deep	OPEN	X	X	X	0.702083
85	18.38315	-64.89901	79	STT	Pavement	deep	OPEN	X	X	X	0.364583
86	18.38369	-64.89002	86	STT	Pavement	deep	OPEN	X	X	X	0.19375
87	18.3916	-64.91187	46	STT	Pavement	deep	OPEN	X	X	X	0.65
89	18.406	-64.91724	63	STT	Pavement	deep	OPEN	X	X	X	0.683333
90	18.4065	-64.91251	59	STT	Pavement	deep	OPEN	X	X	X	0.458333
292	18.30978	-65.00603	49	STT	Pavement	deep	OPEN		X	X	0.1
293	18.3172	-64.9872	31	STT	Pavement	deep	OPEN		X	X	0.1625
294	18.31949	-64.98439	70	STT	Pavement	deep	OPEN		X	X	0.120833
295	18.33717	-64.84269	54	STT	Pavement	deep	OPEN	X	X	X	0.740476
296	18.36459	-65.03363	62	STT	Pavement	deep	OPEN	X	X	X	0.386363
298	18.38058	-65.05842	82	STT	Pavement	deep	OPEN	X	X	X	0.19375
299	18.38995	-64.89577	48	STT	Pavement	deep	OPEN	X	X	X	0.1625
34	18.31479	-64.91387	21	STT	Pavement	shallow	OPEN	X	X	X	0.172916
35	18.33304	-64.94009	19	STT	Pavement	shallow	OPEN	X	X	X	0.120833
36	18.36487	-65.00761	18	STT	Pavement	shallow	OPEN	X	X	X	0.473913
37	18.36522	-65.01708	35	STT	Pavement	shallow	OPEN	X	X	X	0.466666
38	18.37444	-64.95569	31	STT	Pavement	shallow	OPEN	X	X	X	0.375
39	18.37836	-64.96992	22	STT	Pavement	shallow	OPEN	X	X	X	0.49375
40	18.38057	-64.97421	21	STT	Pavement	shallow	OPEN	X	X	X	0.433333
41	18.38902	-64.8986	25	STT	Pavement	shallow	OPEN	X	X	X	0.13125
42	18.39232	-64.97387	27	STT	Pavement	shallow	OPEN	X	X	X	0.314583
43	18.40518	-64.90871	26	STT	Pavement	shallow	OPEN	X	X	X	0.341666
269	18.31946	-64.94324	9	STT	Pavement	shallow	OPEN	X	X	X	0.1

Site	Latitude	Longitude	Depth (ft)	Island	Habitat type	Depth	Admin Area	Demo	LPI	Fish	Rugosity
271	18.3251	-64.96554	37	STT	Pavement	shallow	OPEN	X	X	X	0.46875
272	18.34329	-65.0821	88	STT	Pavement	shallow	OPEN	X	X	X	0.164814
94	18.36375	-65.02795	69	STT	SCR	deep	OPEN		X	X	0.45
95	18.3647	-65.02322		STT	SCR	deep	OPEN	X			
96	18.36951	-64.99537	53	STT	SCR	deep	OPEN	X	X	X	0.516666
302	18.36144	-65.03265	70	STT	SCR	deep	OPEN	X	X	X	0.1
44	18.32625	-64.94143	20	STT	SCR	shallow	OPEN		X	X	0.110416
45	18.36207	-64.92905	19	STT	SCR	shallow	OPEN	X	X	X	0.216666
46	18.36876	-64.93717	36	STT	SCR	shallow	OPEN	X	X	X	0.175
274	18.30756	-65.00223	20	STT	SCR	shallow	OPEN	X	X	X	0.341666
275	18.36252	-64.92859	20	STT	SCR	shallow	OPEN	X	X	X	0.214583
12	18.30795	-64.82772	15	STT	Bedrock	shallow	STEER	X	X	X	0.358333
13	18.31413	-64.84339	12	STT	Bedrock	shallow	STEER	X	X	X	0.45625
14	18.3143	-64.82495	14	STT	Bedrock	shallow	STEER	X	X	X	0.670833
15	18.3154	-64.85239	15	STT	Bedrock	shallow	STEER	X	X	X	0.674
18	18.31916	-64.83682	7	STT	Bedrock	shallow	STEER	X	X	X	0.679166
258	18.30208	-64.82813	25	STT	Bedrock	shallow	STEER	X	X	X	0.220833
260	18.31508	-64.8382	23	STT	Bedrock	shallow	STEER	X	X	X	1.166666
47	18.30459	-64.84897	55	STT	Agg. reef	deep	STEER		X	X	0.1
48	18.30504	-64.84897	55	STT	Agg. reef	deep	STEER		X	X	0.216666
277	18.30992	-64.85801	43	STT	Agg. reef	deep	STEER		X	X	0.55
1	18.30996	-64.85375	36	STT	Agg. reef	shallow	STEER	X	X	X	1.841666
3	18.32323	-64.83592	38	STT	Agg. reef	shallow	STEER	X	X	X	0.1
252	18.32095	-64.83826	3	STT	Agg. reef	shallow	STEER	X	X	X	0.345833
61	18.31695	-64.83207	49	STT	Patch reef	deep	STEER	X	X	X	0.120833
283	18.30541	-64.85702	60	STT	Patch reef	deep	STEER	X	X	X	0.1
11	18.3174	-64.8316	43	STT	Patch reef	shallow	STEER	X	X	X	0.306
70	18.30289	-64.83713	47	STT	Pavement	deep	STEER	X	X	X	0.283333
72	18.3106	-64.83484	47	STT	Pavement	deep	STEER	X	X	X	0.1
289	18.29977	-64.83283	49	STT	Pavement	deep	STEER	X	X	X	0.345833
290	18.30732	-64.84663	46	STT	Pavement	deep	STEER	X	X	X	0.225
28	18.30807	-64.86224	37	STT	Pavement	shallow	STEER	X	X	X	0.345652
30	18.31323	-64.84244	27	STT	Pavement	shallow	STEER	X	X	X	0.435416
32	18.31743	-64.82829	34	STT	Pavement	shallow	STEER	X	X	X	0.120833
33	18.32003	-64.84061	3	STT	Pavement	shallow	STEER	X	X	X	0.202083
266	18.30113	-64.83285	40	STT	Pavement	shallow	STEER	X	X	X	0.179166
267	18.30708	-64.82487	42	STT	Pavement	shallow	STEER	X	X	X	0.1
268	18.31605	-64.83112	33	STT	Pavement	shallow	STEER	X	X	X	0.414583
92	18.31005	-64.84429	49	STT	SCR	deep	STEER	X	X	X	0.110416
300	18.29887	-64.83282	62	STT	SCR	deep	STEER	X	X	X	0.110416

APPENDICES

Appendix 3. Fish survey Supplemental Information

Appendix 3A. Fish species summary

For all fish species observed in NCRMP USVI 2013 surveys, weighted means, standard errors and coefficient of variance (%) for fish density (#/100 m^2), biomass (g/100 m^2), and frequency of occurrence (%).

Species	Mean density (#/100 m^2)	SE density (#/100 m^2)	CV density (%)	Mean biomass (g/100 m^2)	SE biomass (g/100 m^2)	CV biomass (%)	Occurrence (%)
Ablennes hians	0.01	0.01	100	<0.01	<0.01	100	0.54
Abudefduf saxatilis	0.30	0.10	33.26	7.77	3.00	38.57	7.01
Acanthemblemaria aspera	0.01	0.01	100	<0.01	<0.01	100	0.50
Acanthemblemaria maria	<0.01	<0.01	75.94	<0.01	<0.01	75.94	0.31
Acanthemblemaria species	<0.01	<0.01	100	<0.01	<0.01	100	0.21
Acanthemblemaria spinosa	0.01	<0.01	60.68	<0.01	<0.01	60.68	0.52
Acanthostracion polygonius	0.03	0.03	100	0.21	0.21	100	2.72
Acanthostracion quadricornis	<0.01	<0.01	100	0.05	0.05	100	0.21
Acanthurus bahianus	5.07	0.55	10.92	160.70	18.55	11.54	72.68
Acanthurus chirurgus	3.69	0.60	16.23	125.24	27.52	21.97	44.92
Acanthurus coeruleus	6.01	0.53	8.79	258.16	36.62	14.19	80.45
Acanthurus species	0.08	0.05	61.06	0.09	0.05	55.02	1.90
Amblycirrhitus pinos	0.04	0.02	39.89	0.04	0.02	60.70	3.35
Anisotremus surinamensis	<0.01	<0.01	100	1.44	1.44	100	0.11
Anisotremus virginicus	0.01	0.01	64.44	4.30	3.66	85.01	1.21
Apogon quadrisquamatus	0.02	0.02	71.74	0.01	0.01	71.74	1.00
Apogon townsendi	0.02	0.01	76.71	0.01	0.01	76.71	0.99
Astrapogon stellatus	<0.01	<0.01	100	<0.01	<0.01	100	0.05
Atherinomorus species	3.50	2.53	72.35	0.92	0.67	72.35	0.45
Aulostomus maculatus	0.07	0.02	26.32	6.10	2.84	46.54	6.55
Balistes capriscus	<0.01	<0.01	100	8.67	8.67	100	0.44
Balistes vetula	0.28	0.07	26.28	281.52	94.59	33.60	14.60
Bodianus rufus	0.12	0.03	28.57	12.63	4.29	33.95	11.08
Bollmannia boqueronensis	<0.01	<0.01	100	<0.01	<0.01	100	0.12
Bothus lunatus	0.01	0.01	76.98	0.05	0.04	76.98	0.76
Calamus bajonado	0.01	0.01	85.55	2.40	1.70	70.73	0.65
Calamus calamus	0.22	0.04	18.96	20.11	5.05	25.10	13.00
Calamus species	<0.01	<0.01	87.93	0.53	0.37	71.18	0.17
Cantherhines pullus	0.01	0.01	47.90	1.13	0.64	56.58	1.38
Canthidermis sufflamen	0.01	0.01	100	5.19	5.19	100	0.23
Canthigaster rostrata	1.23	0.15	12.20	2.63	0.50	18.95	55.91
Carangoides bartholomaei	0.01	0.01	100	2.08	2.08	100	0.50
Carangoides ruber	1.21	0.59	48.62	25.24	11.96	47.38	14.93
Caranx crysos	0.01	0.01	68.96	4.43	2.65	59.86	0.65
Caranx latus	0.21	0.21	100	325.79	325.80	100	0.46

Species	Mean density (#/100 m²)	SE density (#/100 m²)	CV density (%)	Mean biomass (g/100 m²)	SE biomass (g/100 m²)	CV biomass (%)	Occurrence (%)
Carcharhinus perezi	0.01	0.01	100	275.94	275.95	100	0.54
Centropyge argi	0.06	0.03	60.54	0.26	0.24	92.44	3.71
Cephalopholis cruentata	0.60	0.11	18.16	33.01	5.43	16.46	31.97
Cephalopholis fulva	0.87	0.13	15.06	84.98	17.11	20.14	36.03
Chaenopsis limbaughi	<0.01	<0.01	100	<0.01	<0.01	100	0.09
Chaetodon capistratus	1.24	0.12	9.96	21.26	2.93	13.78	48.57
Chaetodon ocellatus	0.02	0.01	51.58	0.94	0.60	64.05	1.39
Chaetodon sedentarius	0.12	0.03	25.69	1.93	0.64	33.33	6.93
Chaetodon striatus	0.28	0.09	30.36	5.47	1.67	30.58	15.11
Chromis cyanea	9.45	1.79	18.92	72.80	14.06	19.32	46.76
Chromis multilineata	1.78	0.72	40.59	16.01	4.35	27.18	10.75
Clepticus parrae	3.46	1.34	38.75	112.75	48.79	43.27	14.78
Clupeidae species	0.45	0.45	100	0.02	0.02	100	0.04
Coryphopterus dicrus	0.32	0.09	28.79	0.21	0.06	28.20	7.91
Coryphopterus eidolon	0.01	0.01	44.83	0.03	0.02	60.43	0.93
Coryphopterus glaucofraenum	2.02	0.57	28.18	1.44	0.38	26.30	40.79
Coryphopterus lipernes	0.01	0.01	54.83	0.01	0.01	54.85	1.40
Coryphopterus personatus / hyalinus	69.00	10.71	15.52	45.25	7.02	15.51	43.34
Coryphopterus species	<0.01	<0.01	100	<0.01	<0.01	100	0.09
Cryptotomus roseus	0.38	0.26	68.01	1.68	0.65	38.52	4.76
Ctenogobius saepepallens	<0.01	<0.01	100	<0.01	<0.01	100	0.45
Dasyatis americana	0.01	<0.01	68.27	21.27	13.58	63.84	0.51
Decapterus macarellus	0.79	0.70	87.72	40.64	37.78	92.96	0.51
Decapterus species	0.37	0.32	86.45	9.24	8.93	96.68	0.67
Diodon hystrix	0.01	0.01	100	6.86	6.86	100	0.68
Diplectrum bivittatum	0.01	0.01	70.73	0.01	0.01	70.74	0.33
Diplectrum formosum	<0.01	<0.01	100	0.02	0.02	100	0.22
Doratonotus megalepis	<0.01	<0.01	100	<0.01	<0.01	100	0.30
Elacatinus chancei	0.01	0.01	61.86	<0.01	<0.01	61.86	0.86
Elacatinus evelynae	0.36	0.07	17.83	0.09	0.02	17.86	16.84
Elacatinus oceanops	0.01	0.01	100	<0.01	<0.01	100	0.54
Elacatinus prochilos	0.01	0.01	100	0.02	0.02	100	0.45
Emmelichthyops atlanticus	0.03	0.03	88.15	0.02	0.02	88.17	0.30
Epinephelus adscensionis	0.03	0.01	36.05	2.63	1.86	70.44	3.30
Epinephelus guttatus	0.33	0.06	18.48	177.23	53.63	30.26	28.11
Equetus punctatus	0.01	<0.01	52.60	0.59	0.53	89.53	0.93
Eucinostomus gula	<0.01	<0.01	100	0.21	0.21	100	0.18
Gerres cinereus	0.01	<0.01	30.65	0.19	0.07	38.11	1.26

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Species	Mean density (#/100 m²)	SE density (#/100 m²)	CV density (%)	Mean biomass (g/100 m²)	SE biomass (g/100 m²)	CV biomass (%)	Occurrence (%)
Ginglymostoma cirratum	0.02	0.01	52.01	76.40	48.49	63.47	1.52
Gnatholepis thompsoni	0.28	0.08	30.12	0.17	0.10	58.14	9.21
Gobiidae species	0.01	0.01	68.07	0.01	<0.01	68.13	0.70
Gramma loreto	0.74	0.30	40.07	0.47	0.16	33.12	15.78
Gymnothorax miliaris	0.01	0.01	71.76	0.04	0.04	88.37	0.76
Gymnothorax moringa	0.02	0.01	60.19	1.19	1.00	83.89	1.53
Haemulon album	<0.01	<0.01	100	0.09	0.09	100	0.09
Haemulon aurolineatum	1.50	0.46	30.48	53.12	25.52	48.05	10.91
Haemulon carbonarium	0.03	0.01	40.82	3.37	1.48	44.04	1.96
Haemulon chrysargyreum	0.06	0.05	85.65	2.13	1.83	85.65	0.94
Haemulon flavolineatum	1.69	0.41	24.25	82.17	20.31	24.71	39.92
Haemulon macrostomum	0.01	<0.01	88.74	1.18	1.11	94.20	0.52
Haemulon plumierii	0.17	0.12	67.99	16.67	7.51	45.07	3.59
Haemulon sciurus	0.09	0.03	35.14	20.30	10.79	53.17	5.54
Haemulon species	4.56	2.90	63.51	1.73	1.07	62.12	2.87
Haemulon striatum	0.01	0.01	100	0.01	0.01	100	0.54
Halichoeres bivittatus	6.33	1.03	16.19	26.26	4.11	15.67	37.96
Halichoeres garnoti	11.34	0.98	8.67	37.96	3.55	9.35	80.87
Halichoeres maculipinna	0.96	0.19	19.99	1.96	0.33	16.87	29.90
Halichoeres pictus	0.17	0.09	53.58	0.62	0.40	64.36	4.82
Halichoeres poeyi	0.29	0.07	23.49	1.13	0.30	26.85	11.63
Halichoeres radiatus	0.18	0.03	15.44	1.90	0.47	24.48	11.42
Heteroconger longissimus	0.25	0.16	61.75	11.06	8.32	75.28	0.63
Heteropriacanthus cruentatus	<0.01	<0.01	78.80	0.41	0.32	78.80	0.41
Hippocampus species	0.01	0.01	100	0.02	0.02	100	0.54
Holacanthus ciliaris	0.08	0.03	39.71	11.04	4.93	44.64	6.31
Holacanthus tricolor	0.42	0.10	24.41	22.41	4.70	20.97	26.60
Holocanthus species	0.05	0.05	100	15.30	15.30	100	2.72
Holocentrus adscensionis	0.36	0.08	21.25	35.68	8.99	25.19	22.47
Holocentrus rufus	1.10	0.13	12.06	47.79	6.43	13.45	50.52
Hypoplectrus aberrans	<0.01	<0.01	100	<0.01	<0.01	100	0.07
Hypoplectrus chlorurus	0.26	0.09	32.49	1.36	0.44	32.68	14.23
Hypoplectrus guttavarius	0.01	0.01	54.78	0.05	0.03	54.78	1.05
Hypoplectrus indigo	<0.01	<0.01	100	0.06	0.06	100	0.31
Hypoplectrus nigricans	0.12	0.06	48.68	0.76	0.29	37.71	7.97
Hypoplectrus puella	0.54	0.07	13.28	3.02	0.60	19.69	34.67
Hypoplectrus species	0.09	0.02	21.01	0.28	0.11	39.24	6.93
Hypoplectrus unicolor	0.13	0.03	25.69	1.08	0.35	32.98	9.21
Inermia vittata	0.01	0.01	100	0.04	0.04	100	0.30

Species	Mean density (#/100 m²)	SE density (#/100 m²)	CV density (%)	Mean biomass (g/100 m²)	SE biomass (g/100 m²)	CV biomass (%)	Occurrence (%)
Kyphosus sectator	0.04	0.02	71.14	2.97	2.18	73.38	1.50
Lachnolaimus maximus	0.04	0.02	63.75	5.79	3.20	55.26	1.47
Lactophrys bicaudalis	<0.01	<0.01	100	<0.01	<0.01	100	0.04
Lactophrys trigonus	0.04	0.03	73.69	0.60	0.31	51.52	3.79
Lactophrys triqueter	0.03	0.01	34.40	3.12	1.42	45.58	3.10
Liopropoma rubre	0.03	0.03	100	0.16	0.16	100	2.72
Lutjanus species	<0.01	<0.01	100	<0.01	<0.01	100	0.18
Lutjanus analis	0.11	0.03	22.77	244.49	69.17	28.29	8.38
Lutjanus apodus	0.13	0.04	32.84	40.13	13.88	34.57	7.88
Lutjanus cyanopterus	0.03	0.03	100	91.18	91.18	100	2.72
Lutjanus griseus	0.45	0.41	90.21	64.97	55.61	85.60	1.81
Lutjanus jocu	0.03	0.01	40.39	18.14	7.64	42.11	2.54
Lutjanus mahogoni	0.03	0.03	92.44	4.58	4.16	90.82	0.91
Lutjanus synagris	0.72	0.39	54.38	123.47	69.01	55.89	6.08
Malacanthus plumieri	0.07	0.02	30.84	19.89	8.69	43.70	5.13
Malacoctenus boehlkei	0.02	0.01	44.44	0.01	<0.01	44.44	1.68
Malacoctenus macropus	0.13	0.06	48.05	0.09	0.04	48.00	5.20
Malacoctenus triangulatus	0.15	0.05	30.22	0.06	0.03	39.11	7.82
Megalops atlanticus	0.03	0.02	64.19	696.77	409.37	58.75	1.63
Melichthys niger	0.03	0.03	100	3.31	3.31	100	0.44
Microspathodon chrysurus	0.35	0.07	20.15	10.94	2.20	20.14	14.64
Monacanthus ciliatus	0.03	0.02	92.11	0.01	0.01	92.06	0.44
Monacanthus species	<0.01	<0.01	100	4.90	4.90	100	0.30
Monacanthus tuckeri	0.02	0.01	45.80	0.06	0.03	54.88	1.70
Mulloidichthys martinicus	0.08	0.03	33.31	7.02	3.25	46.25	3.27
Myripristis jacobus	0.27	0.08	28.28	18.61	5.60	30.11	8.41
Neoniphon marianus	0.07	0.06	79.29	2.70	2.35	86.91	3.84
Nes longus	0.06	0.04	68.51	0.03	0.02	67.44	0.88
Nicholsina usta	0.01	0.01	100	0.05	0.05	100	0.54
Ocyurus chrysurus	1.28	0.21	16.17	111.65	17.65	15.80	29.52
Ophioblennius macclurei	0.04	0.03	72.64	0.15	0.12	80.30	1.68
Opistognathus aurifrons	0.47	0.11	24.17	2.17	1.14	52.29	15.38
Opistognathus whitehursti	<0.01	<0.01	100	<0.01	<0.01	100	0.05
Parablennius marmoreus	0.03	0.01	55.00	0.01	<0.01	55.00	2.01
Paradiplogrammus bairdi	0.01	<0.01	60.07	<0.01	<0.01	60.07	0.57
Pareques acuminatus	0.01	0.01	100	0.03	0.03	100	0.54
Phaeoptyx xenus	<0.01	<0.01	100	<0.01	<0.01	100	0.11
Pomacanthus arcuatus	0.21	0.09	40.59	70.96	31.50	44.40	12.40
Pomacanthus paru	0.13	0.04	30.15	50.90	24.39	47.91	8.69

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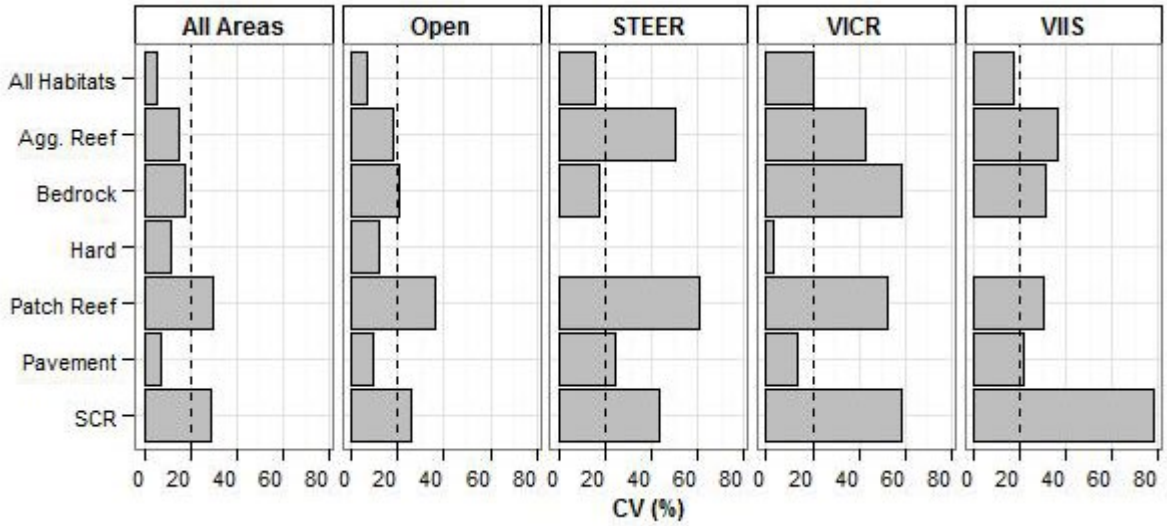
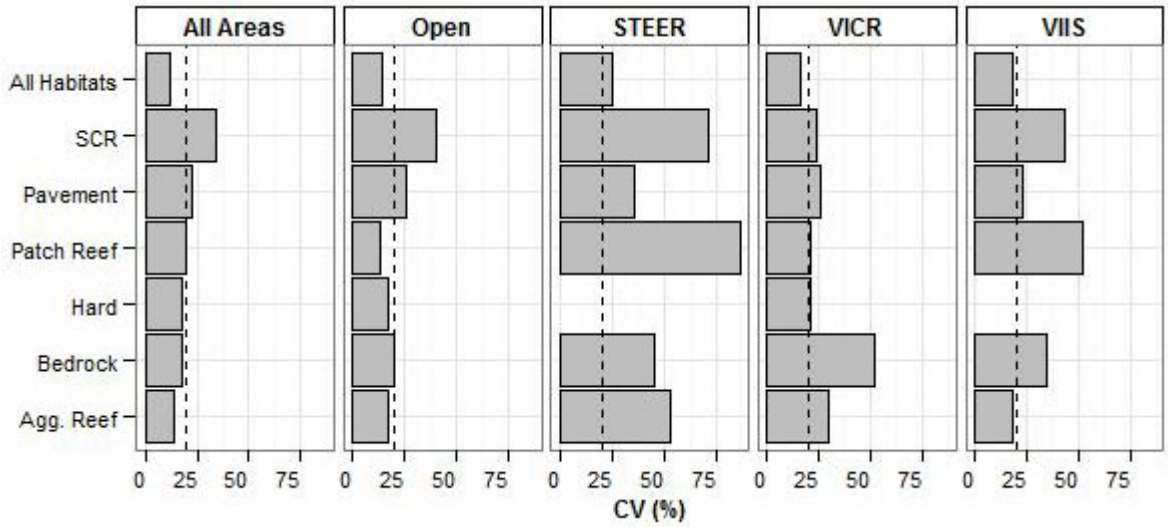
Species	Mean density (#/100 m²)	SE density (#/100 m²)	CV density (%)	Mean biomass (g/100 m²)	SE biomass (g/100 m²)	CV biomass (%)	Occurrence (%)
Prognathodes aculeatus	0.05	0.03	61.15	0.49	0.36	73.95	4.16
Pseudupeneus maculatus	0.75	0.12	16.36	22.29	5.44	24.41	33.34
Ptereleotris calliura	0.01	<0.01	72.01	0.01	0.01	91.67	0.54
Ptereleotris helenae	0.24	0.15	64.05	0.28	0.17	58.77	2.55
Pterois volitans	0.02	0.01	44.32	8.75	4.98	56.90	1.60
Rypticus saponaceus	0.01	0.01	100	0.15	0.15	100	0.50
Sargocentron coruscum	0.09	0.08	96.42	3.23	3.12	96.42	0.77
Sargocentron vexillarium	0.08	0.06	68.95	0.69	0.45	65.23	4.54
Scarus iseri	7.57	0.93	12.25	84.62	10.29	12.16	58.05
Scarus taeniopterus	10.88	1.68	15.40	193.08	22.98	11.90	64.00
Scarus vetula	0.21	0.05	23.02	37.16	10.99	29.57	14.63
Schultzea beta	1.61	1.51	93.60	1.05	0.99	93.60	0.65
Scomberomorus regalis	0.02	0.02	74.68	15.78	12.33	78.11	1.14
Scorpaena plumieri	0.01	<0.01	86.56	0.37	0.26	70.72	0.53
Scorpaena species	<0.01	<0.01	100	0.03	0.03	100	0.31
Seriola rivoliana	<0.01	<0.01	100	0.79	0.79	100	0.08
Serranus baldwini	0.17	0.07	44.74	0.24	0.11	45.80	3.89
Serranus tabacarius	0.50	0.10	20.44	4.23	1.08	25.42	20.70
Serranus tigrinus	0.86	0.18	21.07	6.65	1.53	23.04	29.77
Serranus tortugarum	5.25	1.89	35.97	13.97	9.66	69.16	14.16
Sparisoma atomarium	0.73	0.19	25.71	2.05	0.87	42.63	20.26
Sparisoma aurofrenatum	8.46	0.61	7.24	193.71	16.36	8.44	89.53
Sparisoma chrysopterum	0.07	0.03	35.50	4.93	1.82	36.96	4.30
Sparisoma radians	0.07	0.03	43.22	0.08	0.04	53.14	2.68
Sparisoma rubripinne	0.12	0.05	38.73	27.76	11.78	42.42	4.65
Sparisoma species	<0.01	<0.01	100	<0.01	<0.01	100	0.21
Sparisoma viride	2.94	0.44	15.03	340.68	78.49	23.04	62.73
Sphoeroides spengleri	0.01	<0.01	74.52	0.05	0.04	74.51	0.42
Sphyraena barracuda	0.05	0.02	33.85	220.26	102.74	46.65	4.03
Stegastes adustus	0.74	0.23	31.45	5.36	2.45	45.72	16.17
Stegastes diencaeus	0.27	0.08	28.81	2.11	0.61	28.73	6.47
Stegastes leucostictus	2.19	0.35	16.14	7.71	1.83	23.73	44.07
Stegastes partitus	12.75	1.55	12.14	19.61	3.60	18.34	73.47
Stegastes planifrons	1.93	0.33	17.19	13.90	2.53	18.24	32.86
Stegastes variabilis	1.53	0.21	13.90	7.21	1.32	18.26	37.02
Synodus intermedius	0.05	0.01	26.60	6.42	3.94	61.40	5.10
Thalassoma bifasciatum	22.26	2.21	9.95	38.22	5.34	13.98	79.14
Xyrichtys martinicensis	<0.01	<0.01	67.89	0.02	0.02	94.08	0.30
Xyrichtys species	0.01	0.01	100	0.03	0.03	100	0.30
Xyrichtys splendens	0.06	0.04	69.51	0.25	0.23	89.37	1.77

Appendix 3B. Fish coefficient of variance

Total fish density



Total fish biomass



Total fish richness

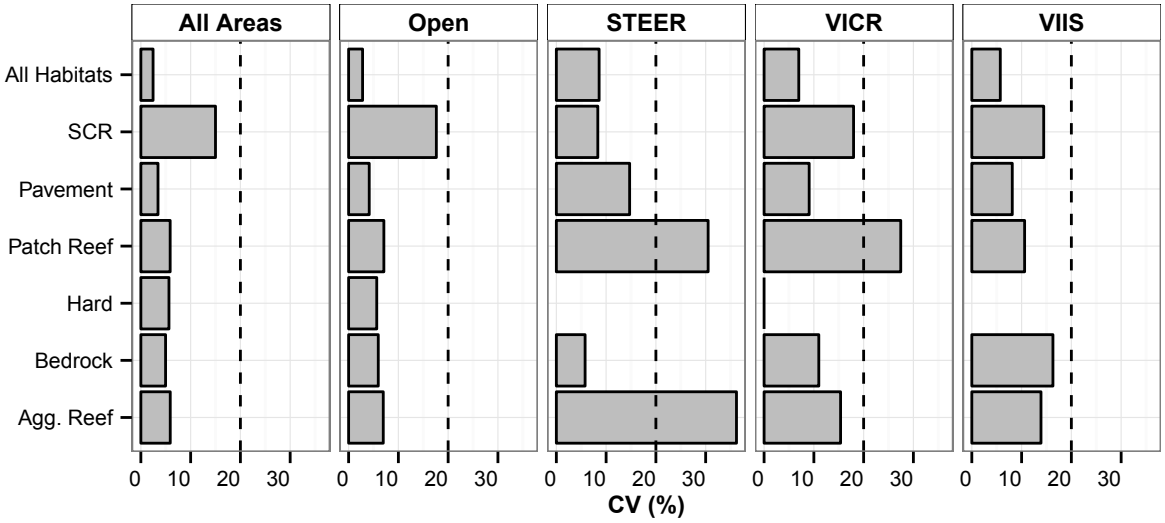


Figure 3B-1. Coefficient of variance (CV) for: total fish density (per 100 m²; top), total fish biomass (g/100m²; middle), and species richness (per 100 m²; bottom), shown by administrative area (columns) and habitat type (rows). Dashed vertical line indicates 20% CV.

Density of key families

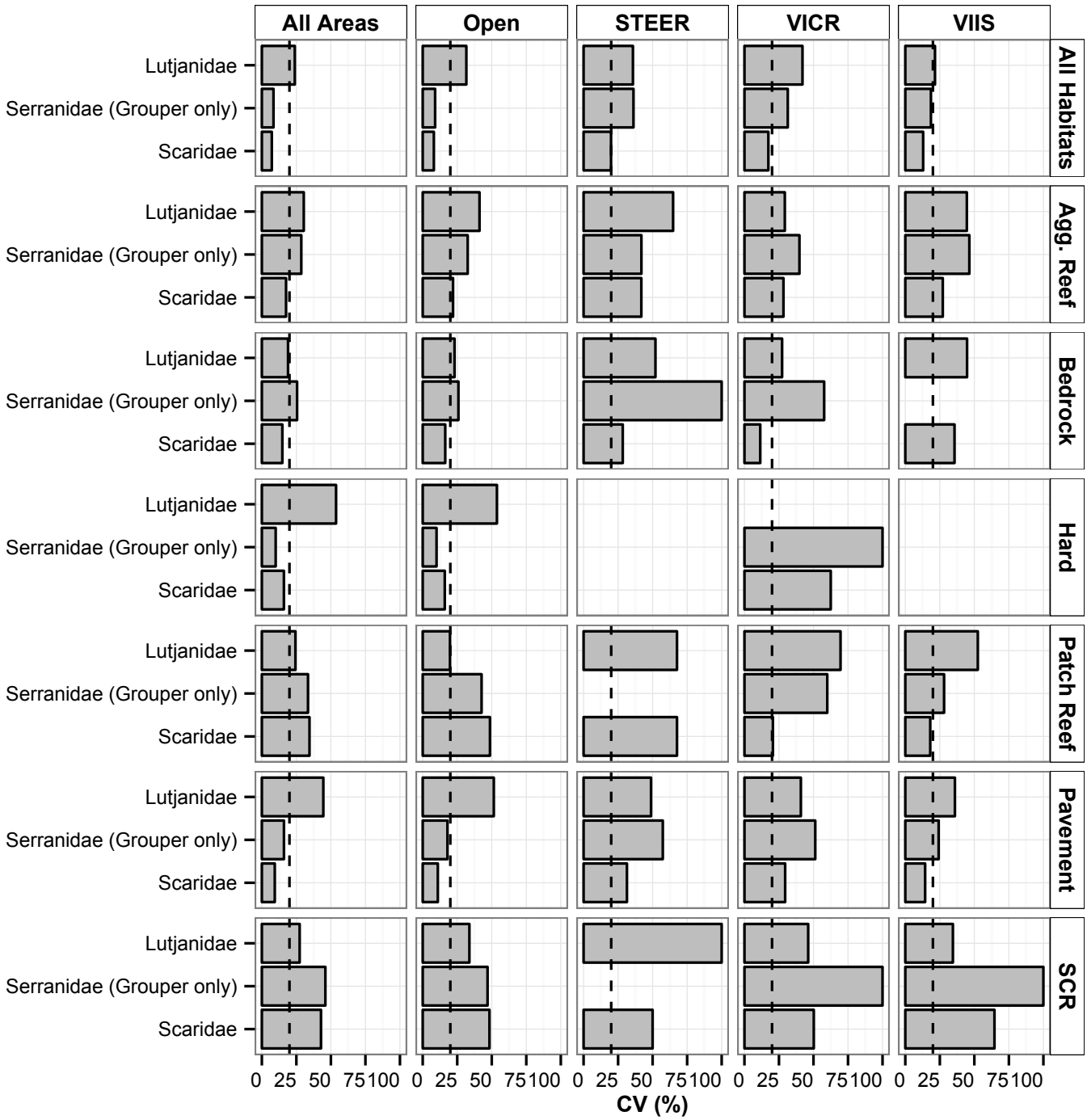


Figure 3B-2. Coefficient of variance (CV) for density (per 100 m^2) of key fish families, shown by administrative area (columns) and habitat type (rows). Dashed vertical line indicates 20% CV.

Density of key fish species

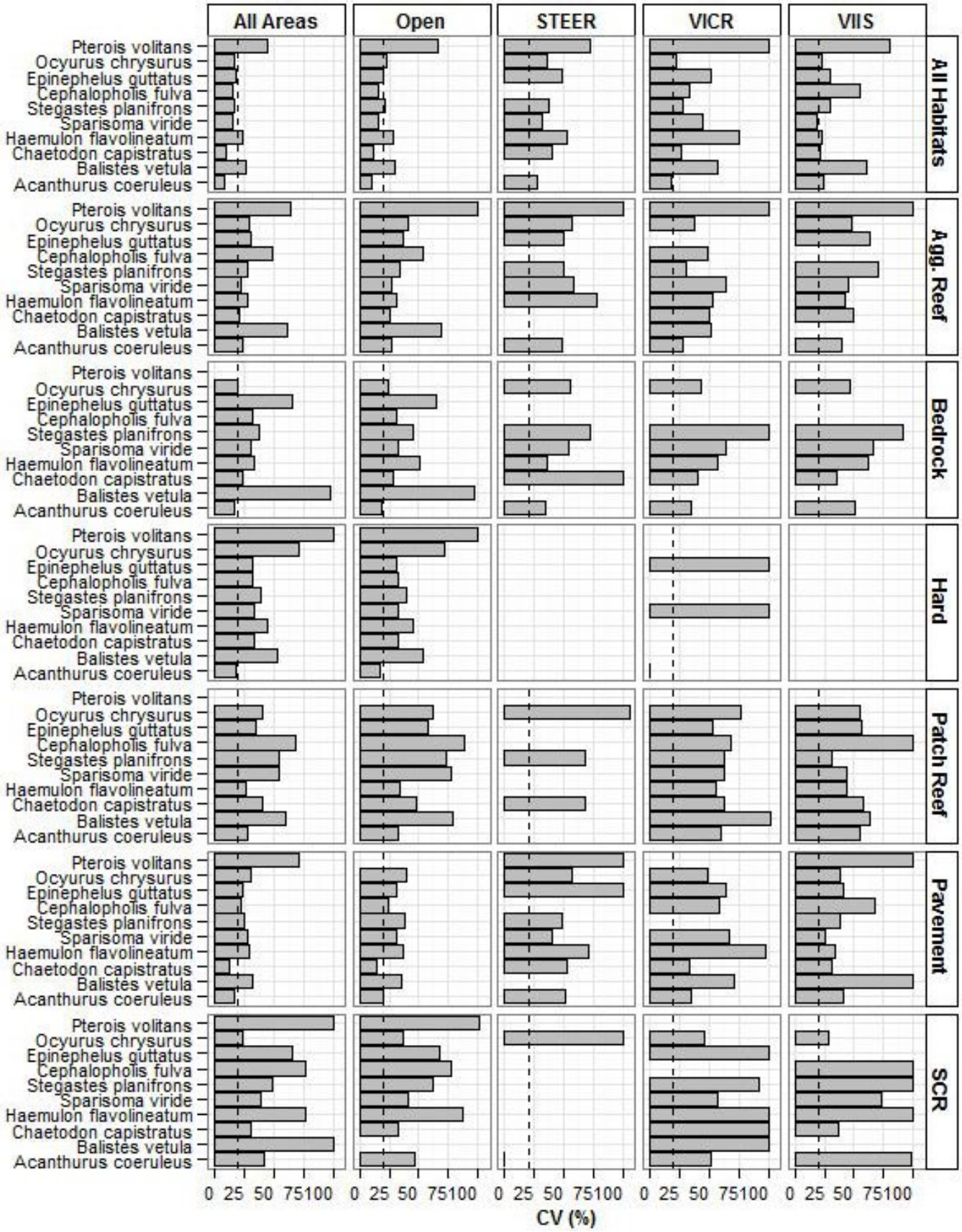


Figure 3B-3. Coefficient of variance (CV) for density (per 100 m^2) of key fish species, shown by administrative area (columns) and habitat type (rows). Dashed vertical line indicates 20% CV.

APPENDICES

Appendix 4. Benthic Surveys Supplemental Information

Appendix 4A. Benthic species summary

For all coral species observed in the NCRMP USVI 2013 surveys, weighted means, standard error, and coefficient of variance (%) for coral cover (%) from LPI surveys and coral density (corals /m^2) from demographic surveys. Additionally, number of colonies counted (demographic surveys) and frequency of occurrence (%) are included. * indicates ESA species.

Species	Mean Cover (%)	SE Cover (%)	CV cover (%)	Mean Density (corals/ 100 m^2)	SE Density (corals/ 100 m^2)	CV Density (%)	Number of Colonies	Occurrence (%)
*Acropora cervicornis**	0.08	0.06	68.10	0.01	<0.01	44.00	17	8.13
*Acropora palmata**	0.01	0.01	71.74	0.01	<0.01	39.85	13	5.30
Acropora prolifera	0.00	0.00	100.00	<0.01	<0.01	74.03	3	0.71
Agaricia agaricites	0.38	0.09	23.59	0.57	0.05	9.27	1122	56.18
Agaricia fragilis	<0.01	<0.01	100.32	0.01	<0.01	36.47	24	4.59
Agaricia grahamae	<0.01	<0.01	100.04	0.03	0.01	27.03	28	5.65
Agaricia humilis	<0.01	<0.01	75.79	0.02	0.01	45.39	20	4.2
Agaricia lamarcki	0.20	0.09	44.14	0.06	0.01	21.01	102	27.21
Agaricia spp.	0.09	0.04	42.92	0.01	<0.01	49.60	11	5.30
Colpophyllia natans	0.16	0.07	45.75	0.03	0.01	25.03	38	11.31
*Dendrogyra cylindrus**	0.02	0.01	51.60	<0.01	<0.01	41.87	10	14.84
Dichocoenia stokesii	0.03	0.01	36.62	0.02	<0.01	25.33	28	22.61
Diploria labyrinthiformis	0.07	0.02	32.99	0.05	0.01	15.51	111	22.61
Diploria spp.	<0.01	<0.01	100.12	0.00	0.00	100.00	0	<1.00
Eusmilia fastigiata	0.06	0.03	55.06	0.02	0.01	22.30	50	12.37
Favia fragum	0.00	0.00	100.00	<0.01	<0.01	57.08	7	1.41
Helioceris cucullata	<0.01	<0.01	96.82	0.01	<0.01	44.47	12	3.53
Isophyllastrea rigida	0.00	0.00	100.00	<0.01	<0.01	71.16	2	0.71
Isophyllia sinuosa	0.00	0.00	100.00	<0.01	<0.01	99.75	1	<1.00
Madracis auretenra	0.03	0.03	85.28	0.01	0.01	51.26	15	2.83
Madracis decactis	0.06	0.03	49.66	0.08	0.02	20.32	100	18.02
Madracis pharensis	0.00	0.00	100.00	<0.01	<0.01	100.07	1	<1.00
Madracis spp.	<0.01	<0.01	76.47	<0.01	<0.01	100.23	2	1.06
Manicina areolata	0.01	0.01	70.55	0.01	<0.01	35.62	22	6.01
Meandrina meandrites	0.11	0.03	23.31	0.08	0.01	13.32	156	27.56
Montastraea cavernosa	0.50	0.10	20.29	0.28	0.04	13.42	448	41.34
Mycetophyllia aliciae	0.01	0.01	99.51	<0.01	<0.01	87.73	2	1.06
*Mycetophyllia ferox**	<0.01	<0.01	100.24	<0.01	<0.01	55.67	4	3.89
Mycetophyllia spp.	0.00	0.00	100.00	<0.01	<0.01	72.66	2	0.71
Oculina diffusa	0.00	0.00	100.00	<0.01	<0.01	100.01	1	<1.00
*Orbicella annularis**	0.71	0.23	32.21	0.26	0.09	34.31	296	50.53

Species	Mean Cover (%)	SE Cover (%)	CV cover (%)	Mean Density (corals/ 100 m²)	SE Density (corals/ 100 m²)	CV Density (%)	Number of Colonies	Occurrence (%)
*Orbicella faveolata**	2.90	0.75	25.95	0.50	0.07	14.46	553	52.65
*Orbicella franksi**	1.85	0.64	34.57	0.54	0.07	13.55	424	48.06
Orbicella spp.	0.49	0.31	61.81	0.05	0.02	38.31	32	6.71
Porites astreoides	0.97	0.12	12.29	0.90	0.07	8.32	1924	71.02
Porites branneri	0.00	0.00	100.00	<0.01	<0.01	71.05	2	0.71
Porites colonensis	0.00	0.00	100.00	0.01	<0.01	62.40	7	1.77
Porites divaricata	<0.01	<0.01	100.28	0.02	0.01	34.44	32	7.07
Porites furcata	0.01	0.01	55.14	0.01	<0.01	35.49	44	7.77
Porites porites	0.28	0.06	20.23	0.20	0.04	17.42	465	44.88
Porites spp.	0.05	0.02	44.91	<0.01	<0.01	47.28	8	3.89
Pseudodiploria clivosa	0.01	0.01	65.92	0.01	<0.01	47.37	17	4.59
Pseudodiploria strigosa	0.27	0.06	22.24	0.12	0.02	15.36	214	35.34
Scleractinia spp.	0.00	0.00	100.00	<0.01	<0.01	70.90	2	0.71
Scolymia spp.	0.00	0.00	100.00	<0.01	<0.01	90.64	2	0.71
Siderastrea radians	0.12	0.04	30.16	0.03	0.01	25.60	84	16.61
Siderastrea siderea	0.80	0.09	11.46	0.76	0.06	7.34	1591	69.96
Siderastrea spp.	0.04	0.02	47.10	0.00	0.00	100.00	0	2.12
Solenastrea bournoni	0.00	0.00	100.00	<0.01	<0.01	99.94	1	<1.00
Stephanocoenia intersepta	0.05	0.02	32.58	0.11	0.02	13.86	187	30.74

Appendix 4A. Benthic coefficient of variance

Cover of benthic habitat categories

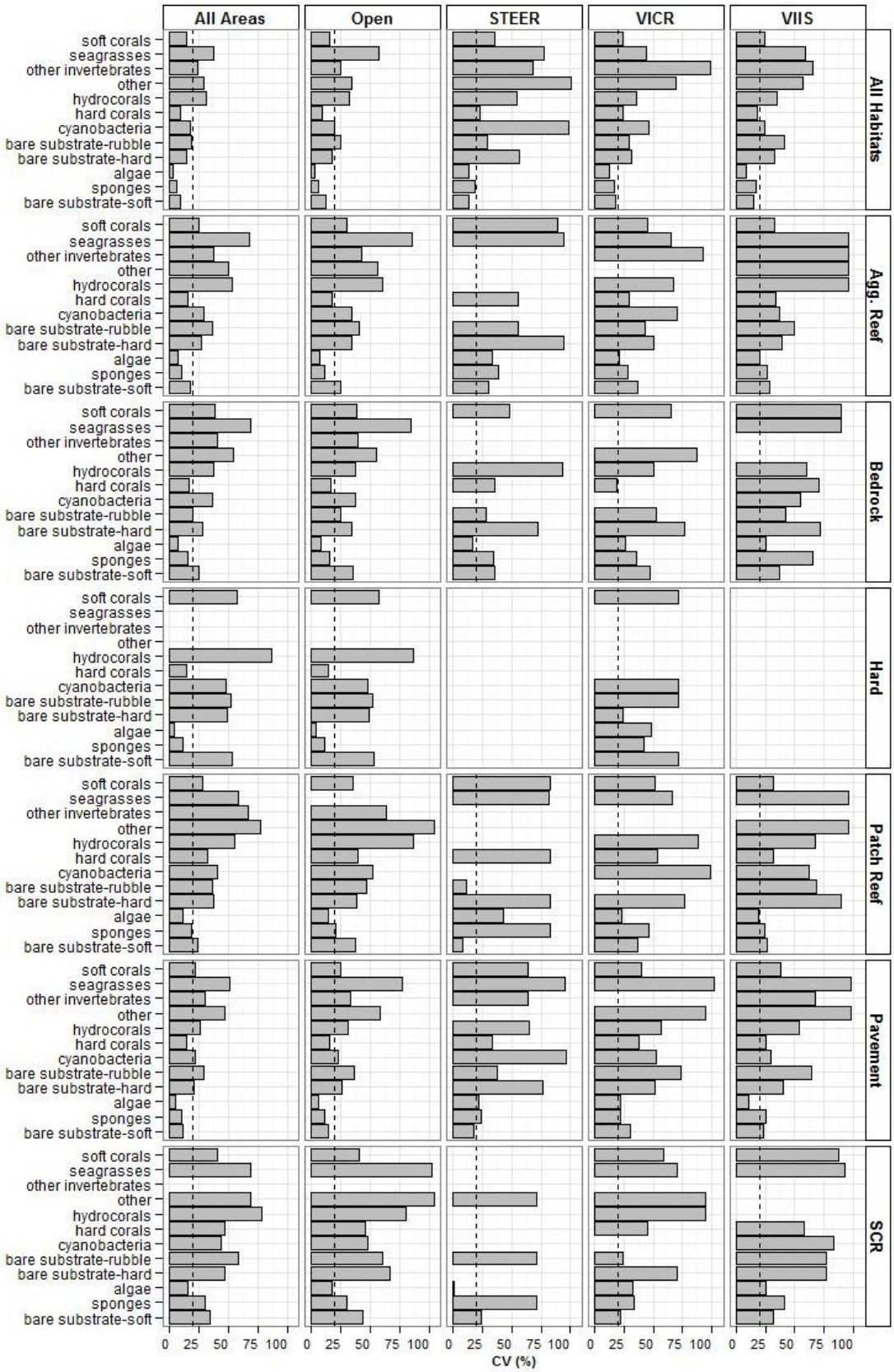


Figure 4B-1. Coefficient of variance for cover of benthic habitat categories by administrative areas (columns) and habitat type (rows). Dashed vertical line indicates 20% CV.

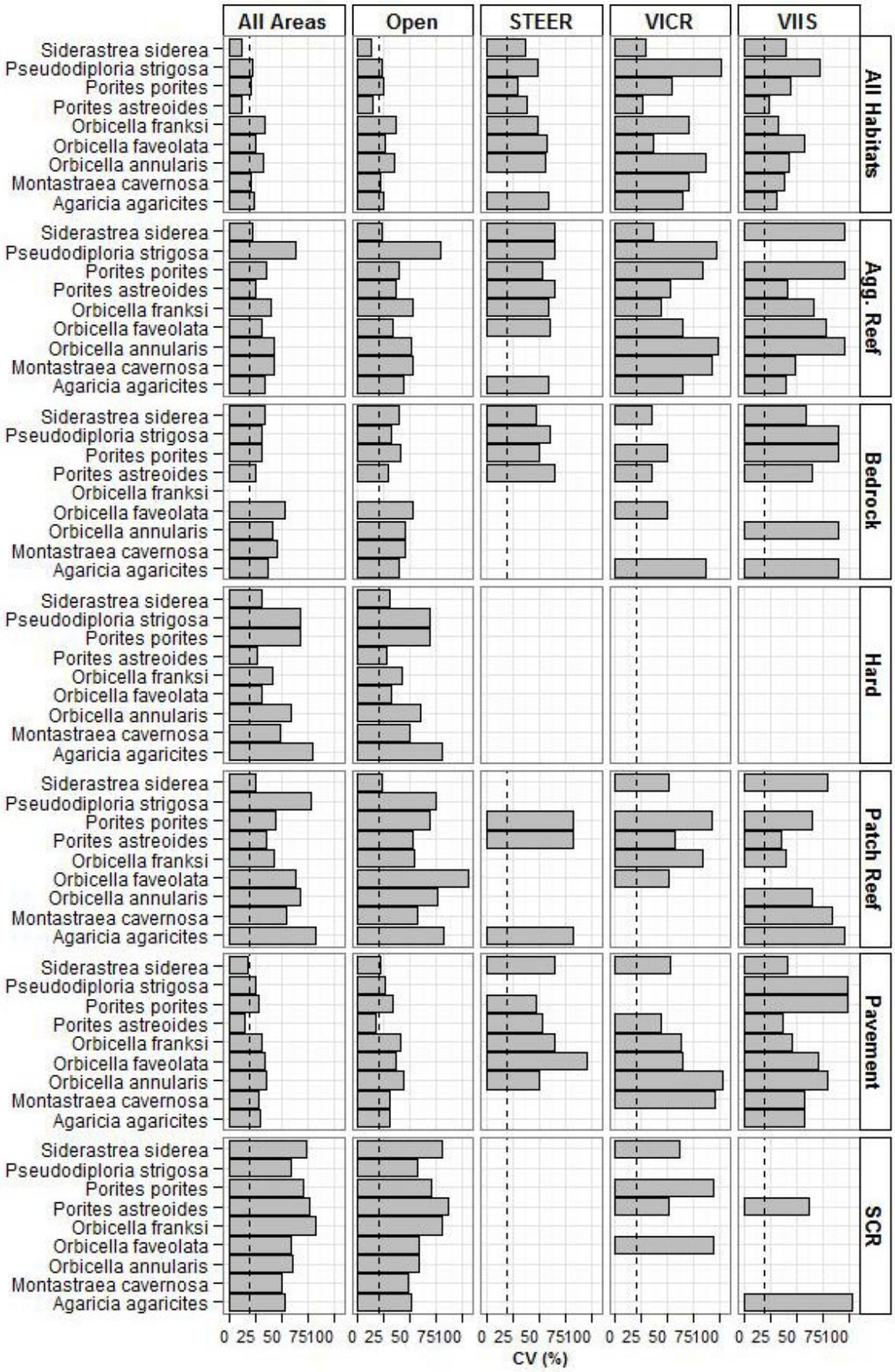


Figure 4B-2. Coefficient of variance for select coral species by administrative areas (columns) and habitat type (rows). Dashed vertical line indicates 20% CV.

Coral richness

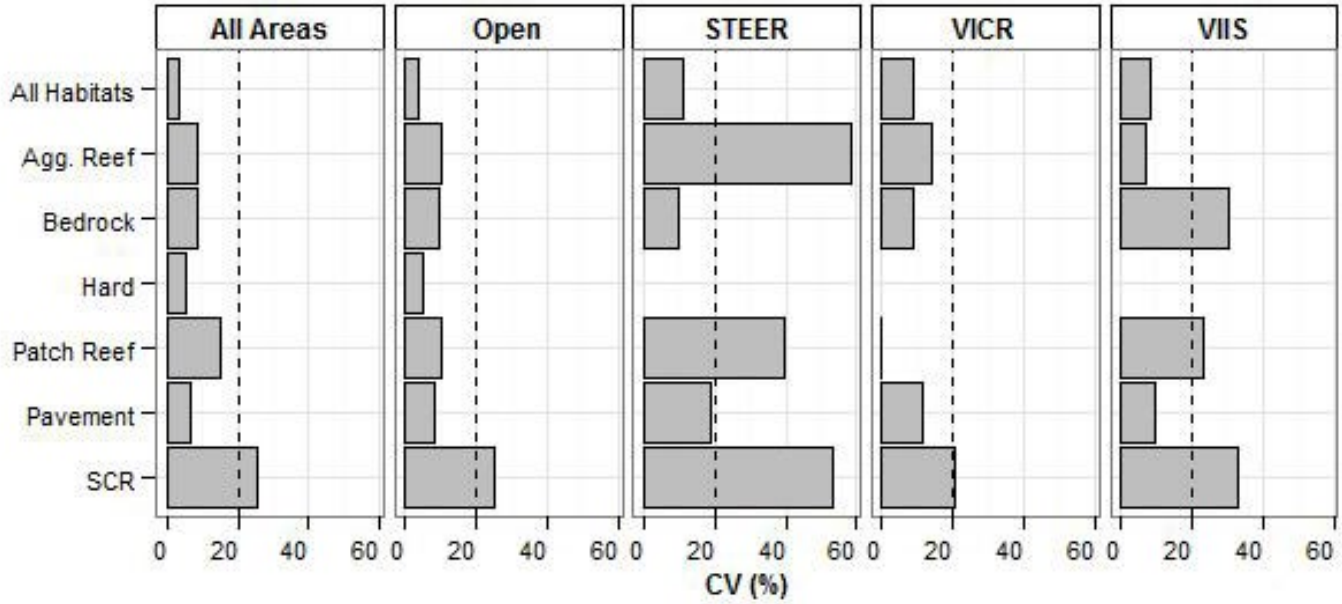


Figure 4B-3. Coefficient of variance (CV) for coral species richness by habitat (rows) and administrative areas (columns). Dashed vertical line indicates 20%.

Coral density

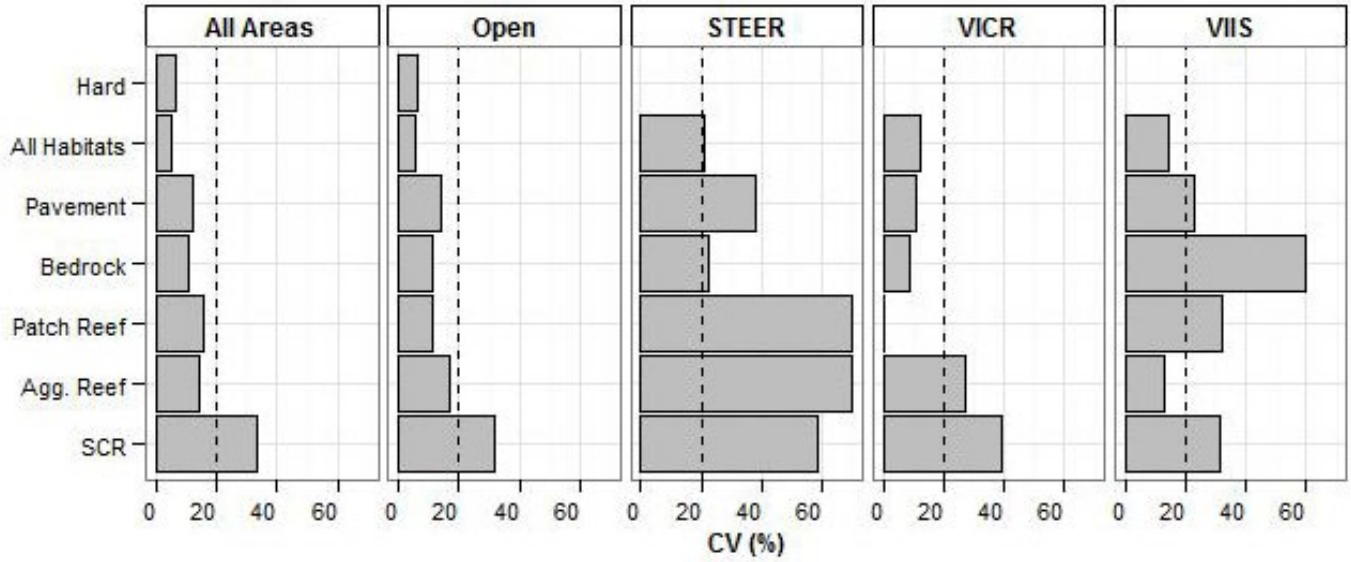


Figure 4B-4. Coefficient of variance (CV) for total coral density by habitat (rows) and administrative areas (columns). Dashed vertical line indicates 20% CV.

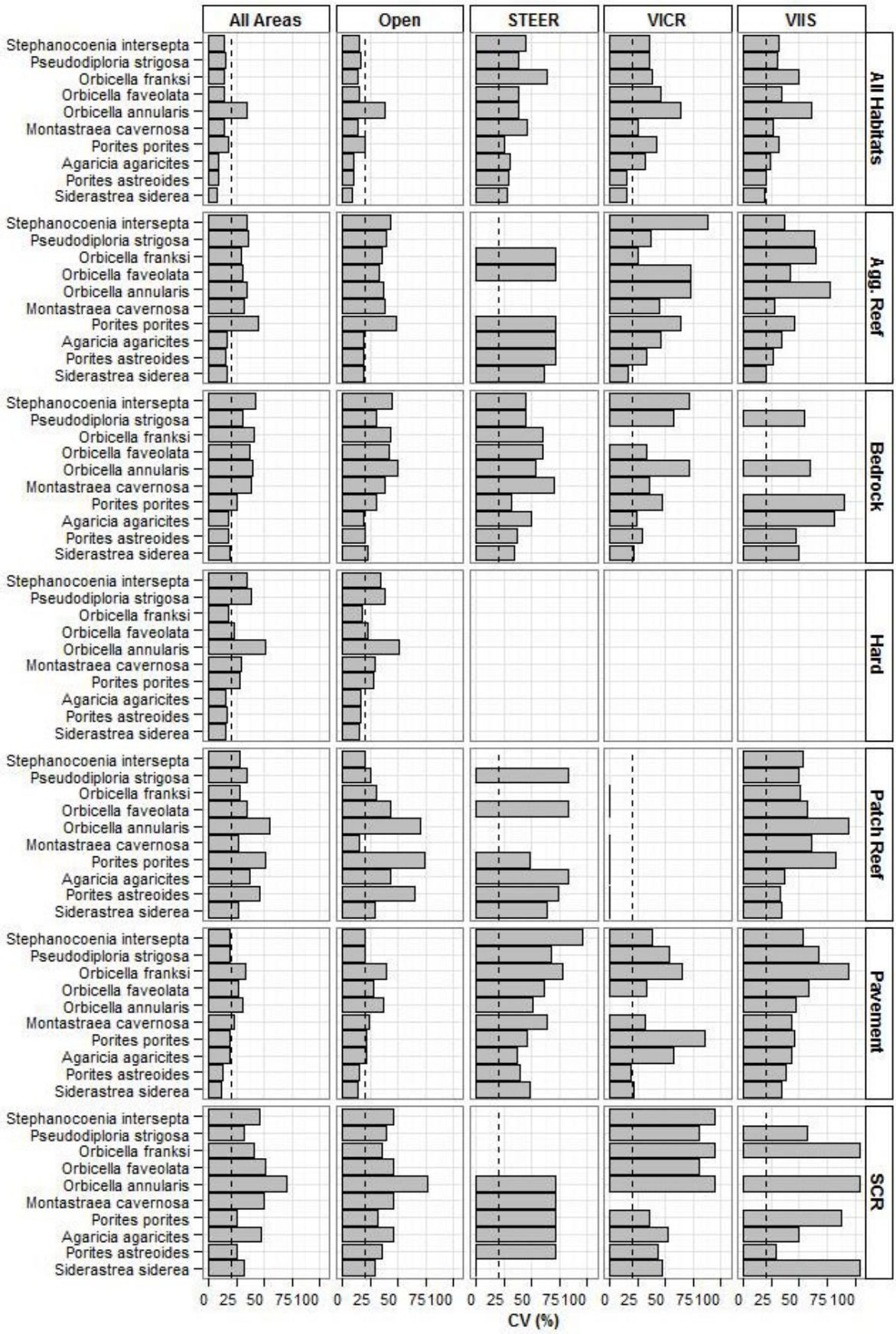


Figure 4B-5. Coefficient of variance for coral species level density for the most abundant coral species by administrative areas (columns) and habitat type (rows). Dashed vertical line indicates 20% CV.

APPENDICES

Coral size estimations

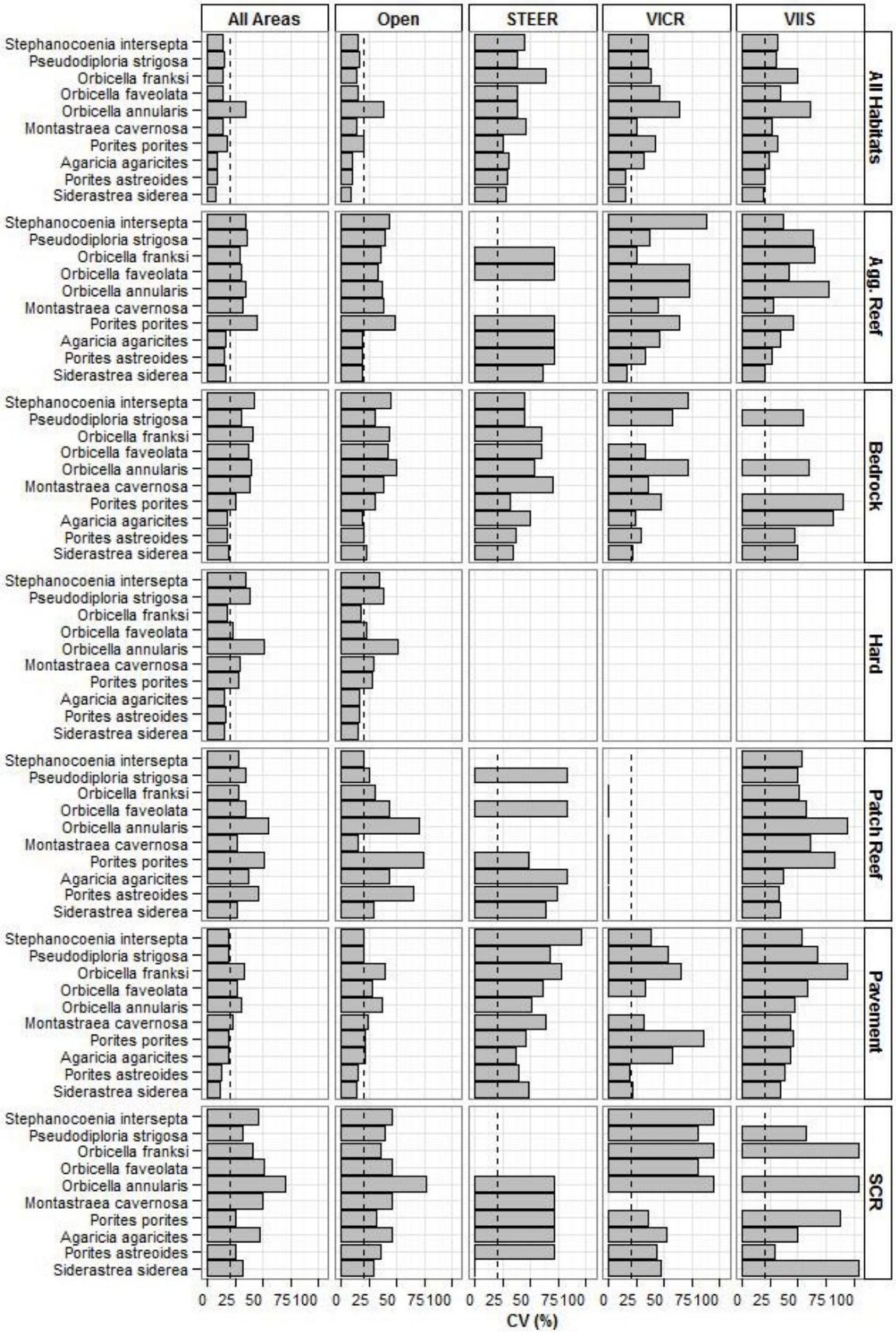


Figure 4B-6. Coefficient of variance for mean size (cm3) of select coral species, shown by administrative areas (columns) and habitat type (rows). Dashed vertical line indicates 20%.

Threatened coral species

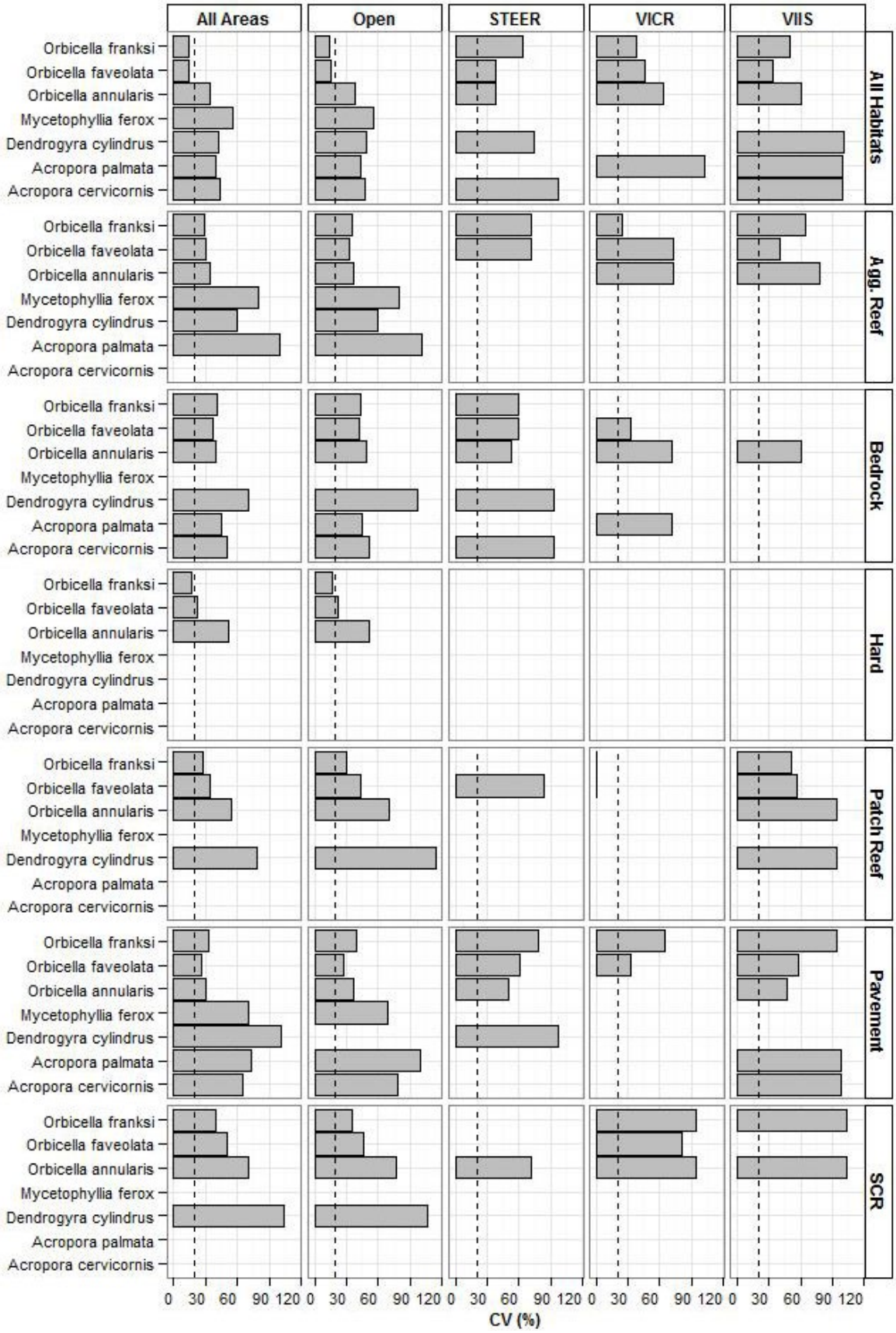


Figure 4B-7. Coefficient of variance for ESA coral species density by administrative areas (columns) and habitat type (rows). Dashed vertical line indicates 20%.

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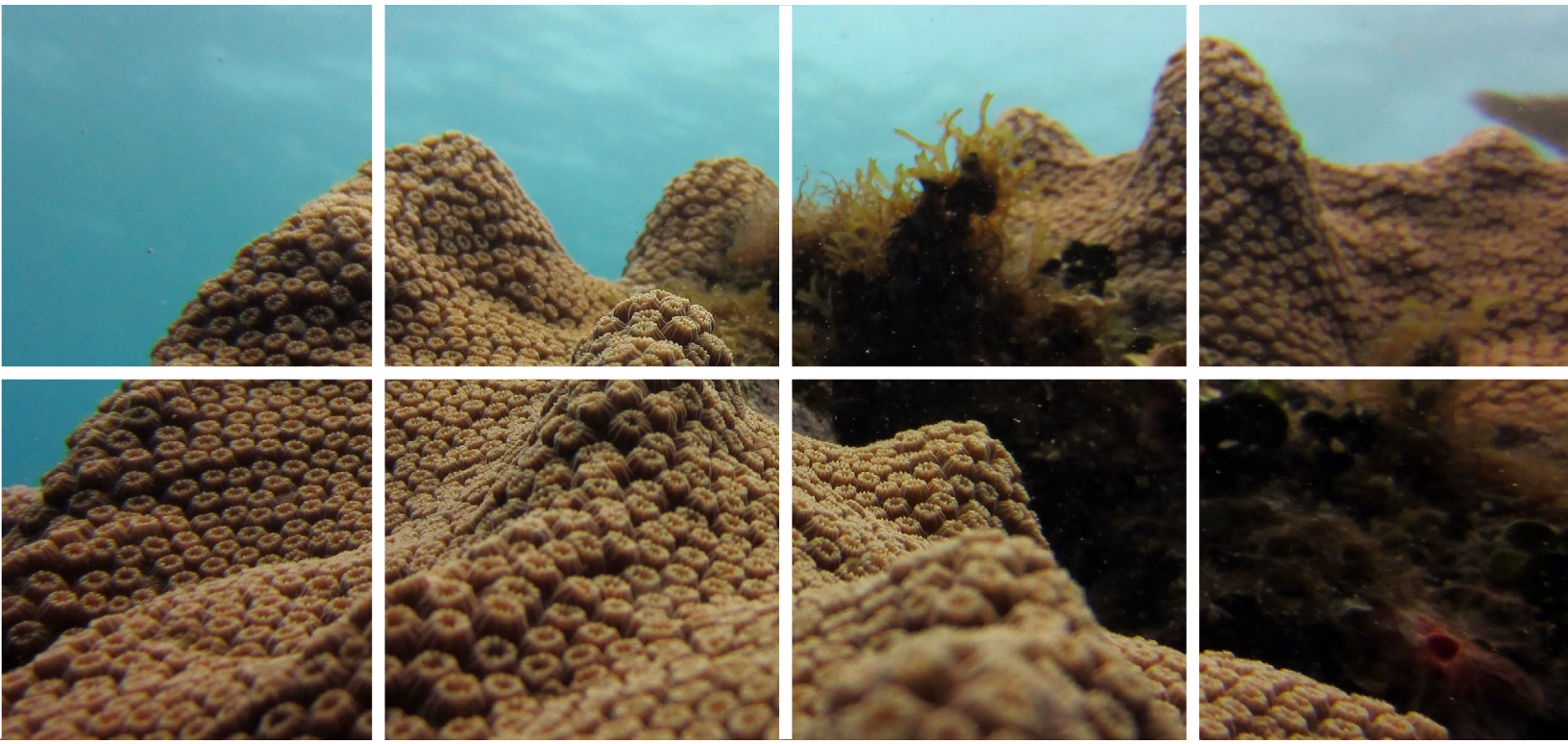

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