# Fishery-Independent Reef Fish Visual Survey Data in the U.S. Caribbean: National Coral Reef Monitoring Program

Laura Jay W. Grove, Jeremiah Blondeau, and Jerald S. Ault

SEDAR103-DW-4

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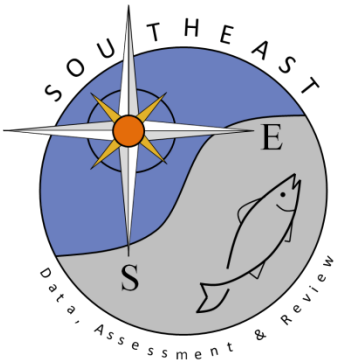

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*SEDAR 103: US Caribbean Application of Alternate Assessment Methods*

## Summary

Fishery-independent visual survey data were collected from 2001 to 2025 across hard-bottom coral habitats (0–30 m depth) in three U.S. Caribbean survey domains: Puerto Rico, St. Croix, and St. Thomas/St. John, U.S. Virgin Islands. Over this 25-year timeframe, the survey implementation evolved from regionally constrained sampling (2001–2011) to island-wide monitoring under the National Coral Reef Monitoring Program (NCRMP; 2012–present). A formal *in situ* calibration study successfully reconciled a 2016 methodology shift, enabling full time-series integration. For all years, reef fish are enumerated to the species level and measured to the nearest centimeter. The survey's stratified random sampling design produces weighted domain-wide estimates for total and size-structured abundance, density, occurrence, biomass, and mean length that can directly inform both single-species fishery assessments and broader ecosystem-based management.

# I. Introduction

The National Oceanic and Atmospheric Administration (NOAA) Coral Reef Conservation Program's (CRCP) National Coral Reef Monitoring Program (NCRMP) supports reef fish sampling on hard-bottom coral habitats from 0 to 30 m depth. In the U.S. Atlantic and Caribbean, the Southeast Fisheries Science Center (SEFSC) is the point of contact and manager of the Reef fish Visual Census (RVC) data. While the NOAA portion of NCRMP is consistently CRCP-funded, the reef fish survey is a multi-agency collaborative effort that relies on federal, territorial, academic, non-governmental organizations, and other regional partners to provide divers, vessels, and supplies.

Presently, the NCRMP RVC stationary point count (SPC) survey is conducted biennially and is designed to assess the status and trends of reef fish populations and communities using standard metrics such as abundance, density, occurrence, biomass, richness, and mean length. These RVC-SPC data inform stock spatial distribution, community composition, effects of exploitation, and fish population changes inside versus outside of management zones (e.g., marine protected areas).

The fishery-independent visual survey data presented herein span from 2001 to 2025. Over this 25-year year timeframe, the survey underwent several updates. From 2001 to 2011, historical pre-NCRMP survey data were collected annually at a regional-scale using the belt-transect (BT) method. Between 2012 and 2017, the survey's design, periodicity, geographic coverage, and sampling method evolved following its inclusion into NCRMP and collaboration with the SEFSC. From 2019 to 2025, NCRMP surveys have been consistently implemented, collecting monitoring data every other year (odd years) at an island-wide scale using the RVC-SPC method. A formal *in situ* calibration study directly compared the BT and RVC-SPC methods, generating calibration factors that allow for use of the full time series (Ault et al. 2024, Ault et al. 2020). For more information about the underlying rationale for improvements and details about the survey programs (historic and NCRMP), methodology, data, and sampling coverage including maps of survey sites by year in each U.S. Caribbean sampling domain from 2001 to 2019 see SEDAR80-WP-02 (Grove et al. 2021).

# II. Sampling Method

## A. Survey Design

For all sampling years (2001–2025), the survey design includes three distinct survey domains: (1) Puerto Rico; (2) St. Croix, U.S. Virgin Islands (USVI); and (3) St. Thomas/St. John, USVI.

***Pre-NCRMP Surveys (2001–2011)***

A detailed description of the historical design is provided in "*A Cooperative Multi-Agency Reef Fish Monitoring Protocol for the U.S. Virgin Islands Coral Reef Ecosystem*" (Bryan et al. 2013). Briefly, from 2001 to 2011, the historical, regional survey design used simple stratified random sampling to collect reef fish monitoring data from 0 to 30 m. The survey was stratified by benthic habitat types (e.g., hard-bottom and soft-bottom categories), management type, and geographic zones. Survey sites were randomly assigned proportional to stratum area (number of sites based on stratum size), the equivalent to simple random sampling, in each of the three survey domains (Menza et al. 2008; Bryan et al. 2013).

***NCRMP Surveys (2012–present)***

A detailed description of the present survey sampling design is provided in a National Park Service led publication, *"A Cooperative Multi-Agency Reef Fish Monitoring Protocol for the U.S. Virgin Islands Coral Reef Ecosystem: Protocol Narrative Version—2.0"* (Feeley et al. 2025). This detailed document specifically refers to the U.S. Virgin Islands; however, all survey modifications discussed were also subsequently applied to Puerto Rico. Briefly, in 2012, an island-wide survey design targeting hard-bottom habitats from 0 to 30 m was adapted from the long-term, two-stage stratified survey design for reef fish developed in southern Florida (Brandt et al. 2009; Smith et al. 2011).

This survey design has two fundamental components: stratification and allocation. Stratification accounts for fishes' habitat use and patchy distribution of abundance by partitioning the heterogeneous survey domain into distinct areas (strata) homogenous abundance and variance. Specifically, the domain is divided into sectors of low, moderate, and high variance using mapped environmental variables (i.e., habitat and depth). The allocation process determines the total sample size needed to meet a target coefficient of variation (CV) for selected reef fish species and distributes that effort across strata. To maximize design performance, sampling effort is assigned disproportionately across strata through an optimal allocation scheme. This method uses both stratum area and fish density variance (standard deviation) to determine effort per stratum, ensuring the sample size directly leverages the stratified domain. Ultimately, the final number of survey sites represents a balance between estimator precision (i.e., a CV of 20% or less is targeted for selected species), and the physical (i.e., boats, personnel) and budgetary constraints of NCRMP and its partners.

The island-wide sampling design is presently optimized for selected economically and ecologically important reef fish species: blue tang, *Acanthurus coeruleus*; coney, *Cephalopholis fulva*; French grunt, *Haemulon flavolineatum*; foureye butterflyfish, *Chaetodon capistratus*; queen triggerfish, *Balistes vetula*; red hind, *Epinephelus guttatus*; stoplight parrotfish, *Sparisoma viride*; and yellowtail snapper, *Ocyurus*

*chrysurus* (Feeley et al. 2025). While the survey design is optimized for selected target species, all fish species of similar trophic groups, life histories, and behaviors are well represented in the resulting dataset.

## B. Methodology

### *Belt-Transect Surveys (2001–2015)*

The historical U.S. Caribbean belt transect (BT) method consisted of a single visual BT covering an area of 100 $m^2$ (BT dimensions 25 x 4 m), adapted from Brock (1954). To identify and enumerate fishes, the BT diver swam slowly in one direction along the transect, recording fish ahead of or perpendicular to their path, but never in the area already surveyed. Fishes were identified to the species level and the number of individuals per species was tallied by fork length (FL) into 5 cm size bins up to 35 cm (0–5, 5–10 cm, etc.). Fishes >35 cm FL were recorded to the nearest cm, including economically and ecologically important species such as groupers, snappers, hogfish, and lionfish. BT survey time was standardized to 15 minutes, and surveys were terminated if visibility was < 2 m (Grove et al. 2021).

### *RVC Stationary Point Count Surveys (2016–present)*

The reef visual census (RVC) stationary point count (SPC) method, adapted from Bohnsack and Bannerot (1986), uses two paired divers, each surveying adjacent, non-overlapping 15 m diameter cylinders (177 $m^2$ cylinder area). The two divers simultaneously survey reef fish from the sea floor to the sea surface while centered within their respective, imaginary cylinders. Divers use an all-purpose tool (APT) consisting of a 1 m PVC pipe marked with 10 cm increments and a 30 cm perpendicular attachment at one end with 1 cm marked increments to measure fish. For the first five minutes, divers identify all observed fish to the species level. In the subsequent five minutes, individuals are enumerated by species and FL size is recorded to the nearest cm. As additional species are encountered, they are similarly counted, measured, and added to the appropriate time period (5–10 minutes or 10–15 minutes). For select economically and ecologically important species including groupers, snappers, hogfish, and lionfish, FL is recorded to the nearest cm for the first 10 individuals, with any additional fish recorded in three categories: minimum, maximum, and mode (most frequent). All other species sizes are recorded to the nearest cm using these three categories. If distinctly different life stages for a species are apparent, they are recorded as separate entries by size grouping. Total RVC-SPC survey time ranges from 15 to 25 minutes, depending on habitat type and fish biomass present. Only the data from the first 10 minutes are included in the analysis-ready dataset for fishery-targeted and non-cryptic mobile species, providing a standardized “snapshot” of reef fish abundance and size structure. Surveys are not conducted if visibility is < 4 m. For more details, please see the publicly available NCRMP RVC-SPC survey protocol (CRCP 2025).

## C. Geographic Range

***Pre-NCRMP Surveys (2001–2011)***

From 2001 to 2011, the historical U.S. Caribbean surveys had a constrained geographic coverage. These regional surveys occurred on hard and soft-bottom habitats from 0 to 30 m depth within specific areas in each of the three survey domains: (1) Puerto Rico: southwest Puerto Rico (La Parguera Natural Reserve); (2) St. Croix: northeastern St. Croix (Buck Island Reef National Monument and Salt River Bay National Historic Park and Ecological Reserve); and (3) St. Thomas/St. John: large portions of St. John (Virgin Islands National Park and Virgin Islands Coral Reef National Monument). St. Thomas was not sampled during the pre-NCRMP survey period (Figure 1).

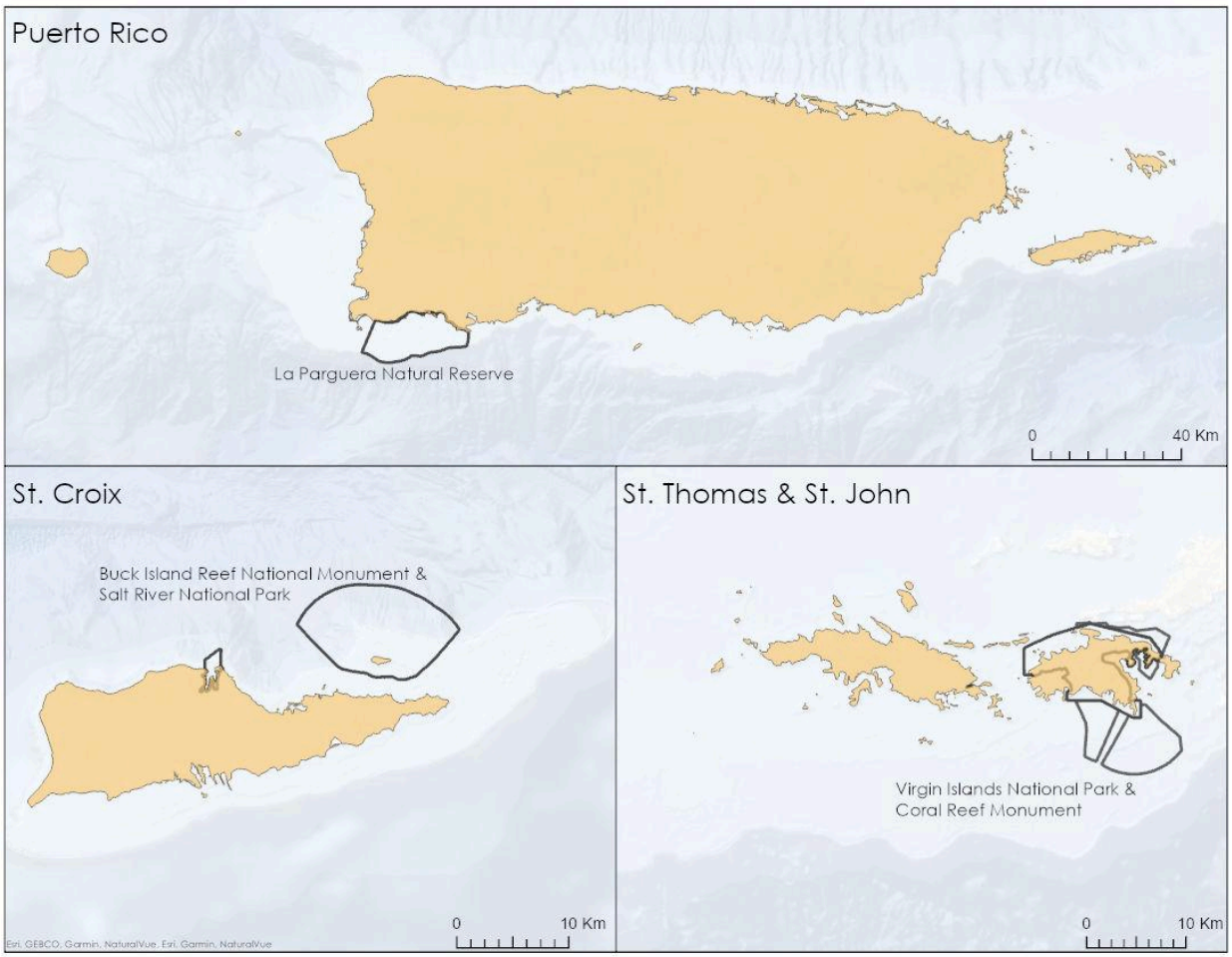


**Figure 1.** Regional sampling boundaries (black polygons) for pre-NCRMP surveys collected from 2001 to 2011 in each of the three survey domains (Puerto Rico, St. Croix, and St. Thomas/St. John).

***NCRMP Surveys (2012–present)***

From 2012 to 2025, U.S. Caribbean surveys have been integrated into the NCRMP sampling framework. Sampling expanded to island-wide monitoring in each of the three survey domains: (1) Puerto Rico, (2) St. Croix, USVI, and (3) St. Thomas/St. John, USVI. Under this framework, a stratified random survey design allocates sampling sites across hard-bottom habitats from 0 to 30 m depth in each survey domain (Figure 2).

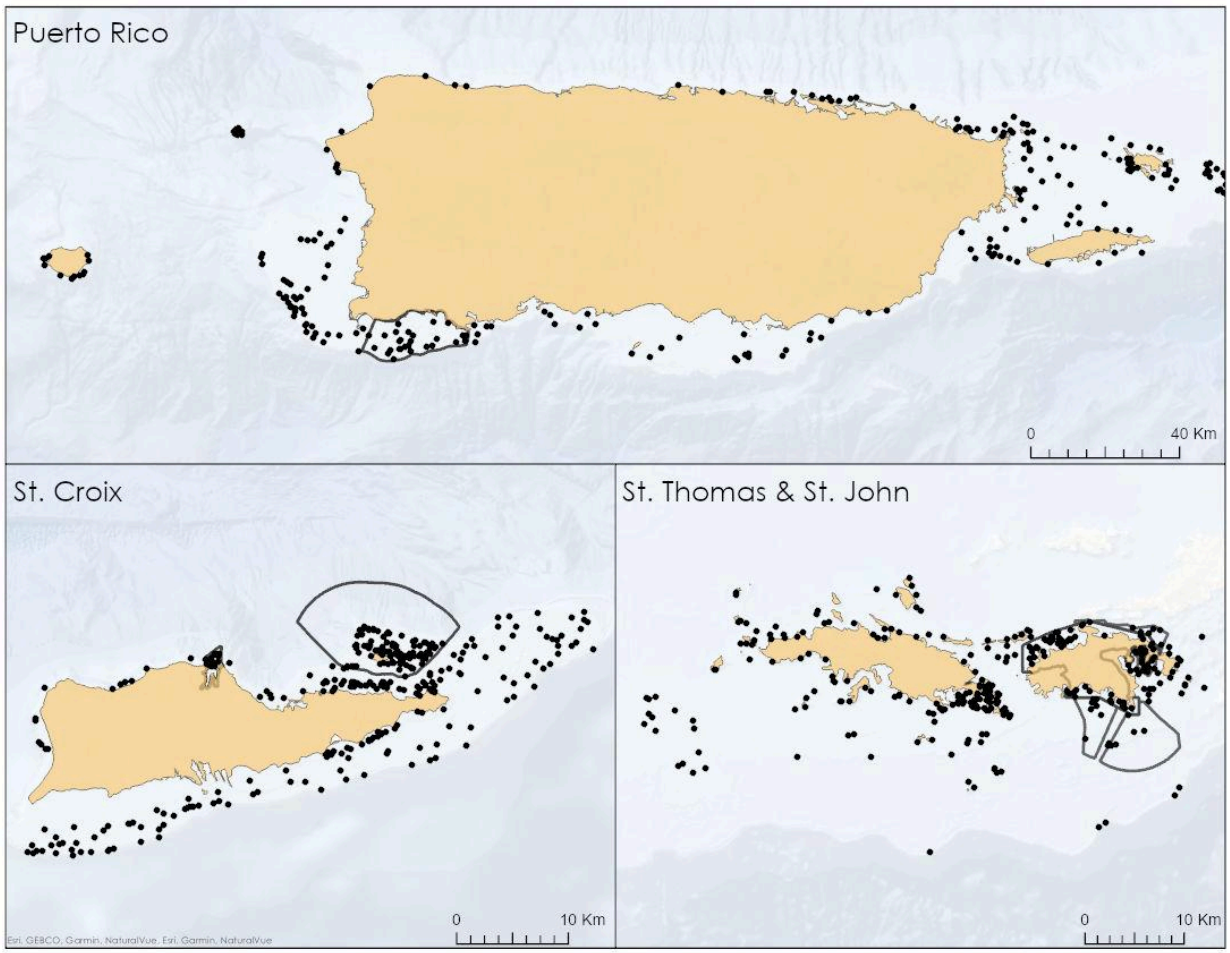


**Figure 2.** Geographic distribution of island-wide NCRMP survey sites (2012–present) across the three U.S. Caribbean survey domains (Puerto Rico, St. Croix, and St. Thomas/St. John). The 2025 survey year is shown as a representative example.

## D. Periodicity

***Pre-NCRMP Surveys (2001–2011)***

From 2001 to 2011, surveys were conducted annually in each of the three U.S. Caribbean survey domains. Sampling in each survey domain occurred during two-week blitz missions during summer (June to August) and winter/spring months (January to March).

***NCRMP Surveys (2012–present)***

From 2012 to 2017, survey periodicity transitioned to a rotational schedule that varied by U.S. Caribbean survey domain. The three survey domains were sampled on the following regional rotation schedule: (1) Puerto Rico, 2012, 2014, and 2016; (2) St. Croix, 2012, 2015, and 2017; and (3) St. Thomas/St. John, 2013, 2015, and 2017 (Table 1). Sampling mainly occurred during two-week blitz missions in the summer months (May to October; i.e., 6 weeks total).

In 2019, NCRMP transitioned to a consistent biennial sampling schedule where all three U.S. Caribbean survey domains are sampled in the same year. As a result, Puerto Rico, St. Croix, and St. Thomas/St. John sampling occurred in 2019, 2021, 2023, and 2025. NCRMP plans to continue sampling in the U.S. Caribbean every other year in odd years. In the USVI, biennial sampling continues to consist of two-week blitz missions (i.e., four weeks total) with the first blitz mission scheduled to St. Croix in May/June followed by a second blitz mission to St. Thomas/St. John in July/August. In Puerto Rico, sampling is contracted to regional experts that survey from June through October (2016 to present).

## E. Sample Size

Sample size varies by survey year from 2001 to 2025 (Table 1). Presently, NCRMP strives to sample a target number of 250 sites in each of the three U.S. Caribbean survey domains. The actual number of sites sampled varies due to weather conditions, partner support, and resource constraints/opportunities.

**Table 1.** National Coral Reef Monitoring Program (NCRMP) data and pre-NCRMP data are shown for hard-bottom habitats from 0 to 30 m of water depth. The number of primary sample units (i.e., survey sites) successfully sampled by year and survey domain. Belt-transect surveys occurred from 2001 to 2015. The historical (regional) sampling design was used from 2001 to 2011 and from 2012 to present NCRMP surveys began an island-wide sampling design (hashed line). Reef visual census stationary point count (RVC SPC) surveys began in 2016 to present (solid gray line). NCRMP is presently funded to collect surveys in the U.S. Caribbean every other year (odd years).

| Year | St. Croix (n) | St. Thomas/ St. John (n) | Puerto Rico (n) |
|---|---|---|---|
| 2001 | 86 | 25 | 36 |
| 2002 | 76 | 72 | 71 |
| 2003 | 165 | 109 | 82 |
| 2004 | 114 | 128 | 83 |
| 2005 | 170 | 128 | 95 |
| 2006 | 185 | 127 | 100 |
| 2007 | 90 | 129 | 173 |
| 2008 | 167 | 134 | 86 |
| 2009 | 157 | 132 | 116 |
| 2010 | 118 | 134 | 74 |
| 2011 | 41 | 133 | 51 |
| 2012 | 262 | - | 35 |
| 2013 | - | 275 | - |
| 2014 | - | - | 223 |
| 2015 | 239 | 255 | - |
| 2016 | - | - | 240 |
| 2017 | 181 | 237 | - |
| 2018 | - | - | - |
| 2019 | 314 | 322 | 203 |
| 2020 | - | - | - |
| 2021 | 148 | 165 | 234 |
| 2022 | - | - | - |
| 2023 | 275 | 287 | 248 |
| 2024 | - | - | - |
| 2025 | 325 | 340 | 232 |

## F. Population Metrics

Domain-wide population and variance estimates are calculated using standard stratified random design-based principles (Smith et al. 2011). Metric estimates and associated variance are computed in each strata, multiplied by the stratum weighting factor and then summed across all strata for the final domain-wide estimate. Estimated metrics can be calculated for the overall population across all life stages or restricted to specific length classes based on exploited phase or sexual maturity (e.g., exploited-phase weighted domain density). For more details on the computational formulae for single-stage stratified random sampling design, see **Appendix I**.

***Weighted Total Domain Abundance***

Total number of individual fish of a given species or group scaled to the survey domain area.

***Weighted Domain Density***

The number of individual fish of a given species or group per unit area. All density estimates are reported as ind/177$m^2$ (RVC-SPC cylinder area) within a survey domain. This metric can be used as a relative abundance index.

***Weighted Domain Occurrence***

Likelihood in which a given species or group occurs within a survey domain. All occurrence estimates are reported as a decimal (0–1).

***Weighted Domain Biomass***

Total weight (kg) of individual fish of a given species or group per unit area. All biomass estimates are reported as kg/177$m^2$ (RVC-SPC cylinder area) within a survey domain.

***Weighted Domain Mean Length***

Average observed length (fork length in cm) of a given species within a survey domain.

***Weighted Domain Size-Structured Abundance***

Total abundance of species estimated across discrete size bins (1 cm or greater length bins) within a survey domain. This metric can also be expressed as relative frequency per size bin.

# III. Results

NCRMP fish surveys regularly observe >200 unique fish species each survey year. Many of these species are consistently observed and ~40% of the individual species have a coefficient of variation (CV) of density less than 25% in the U.S. Caribbean (Table 2). A 25% CV of density allows for statistically detecting a 50% change; thus, a lower CV increases the ability to detect differences. For more detail on the reef fish species with >1% occurrence during the 2025 survey year in each of the three survey domains (Puerto Rico, St. Croix, and St. Thomas/St. John) see **Appendix II**.

**Table 2.** Total species richness, species occurrence (number of species with ≥ 1% occurrence), and high-precision species estimates (number of species with a coefficient of variation [CV] of density ≤ 25%) for the three U.S. Caribbean survey domains. Data shown reflect the 2025 sampling period as a representative example of island-wide National Coral Reef Monitoring Program (NCRMP) data (2012–present).

| Domain | Total Richness | Number of species ≥ 1% Occurrence | Number of species ≤ 25% CV |
|---|---|---|---|
| Puerto Rico | 220 | 147 | 51 |
| St. Croix | 214 | 124 | 49 |
| St. Thomas/St. John | 236 | 157 | 74 |

A formal *in situ* calibration study was conducted to reconcile the 2016 methodology shift, enabling full time-series integration. Empirical calibration factors were generated to convert historical BT survey counts to RVC-SPC equivalents, with all final results reported in NCRMP RVC-SPC metrics. Presently, species-specific calibration factors are available for 80 individual fish species; factors derived from higher taxonomic levels (e.g., genus and family) are under development for the remaining fish species.

As an example, the calibrated full time series for weighted domain density (i.e., a relative index of abundance) is presented for queen triggerfish (*Balistes vetula*) in the St. Thomas and St. John survey domain (Figure 3). This example highlights the timing of both the spatial coverage expansion and the survey methodology transition. The island-wide data were used as part of the SEDAR80 (SEDAR 2022) assessment process and have been expanded here to include the most recent survey years.

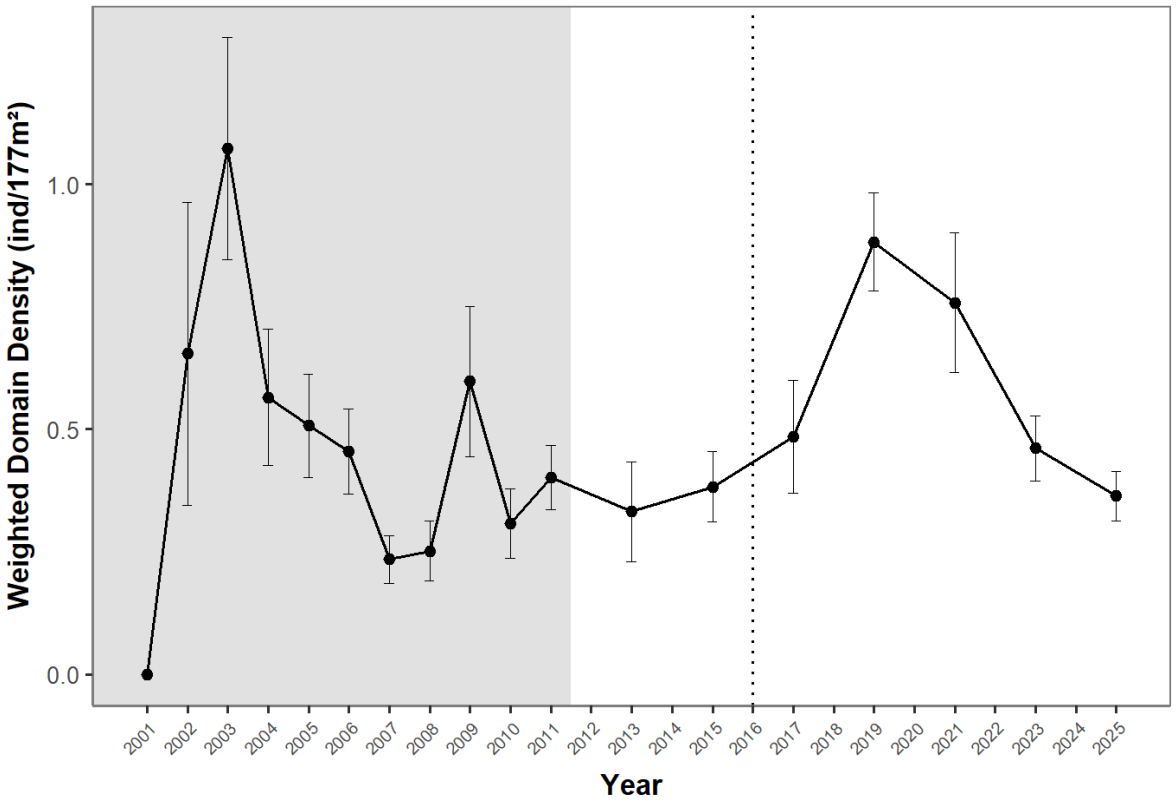


**Figure 3.** Relative index of abundance time series for queen triggerfish (*Balistes vetula*) in the St. Thomas and St. John survey domain. The gray background indicates pre-NCRMP regional surveys, while the white background denotes NCRMP island-wide surveys. The vertical dotted line marks the transition from original belt transect (BT) to the present stationary point count (RVC-SPC) methodology.

Examples of domain-wide population and variance estimates for yellowtail snapper (*Ocyurus chrysurus*) in the St. Thomas and St. John survey domain provides a demonstration of the primary analytical outputs derived from these fishery-independent visual survey data. Standard metrics include weighted domain estimates of total abundance, density (ind/177m$^2$), occurrence, biomass (kg/177m$^2$), mean length (fork length in cm), and size-structured abundance evaluated across 5-cm length bins (Figure 4).

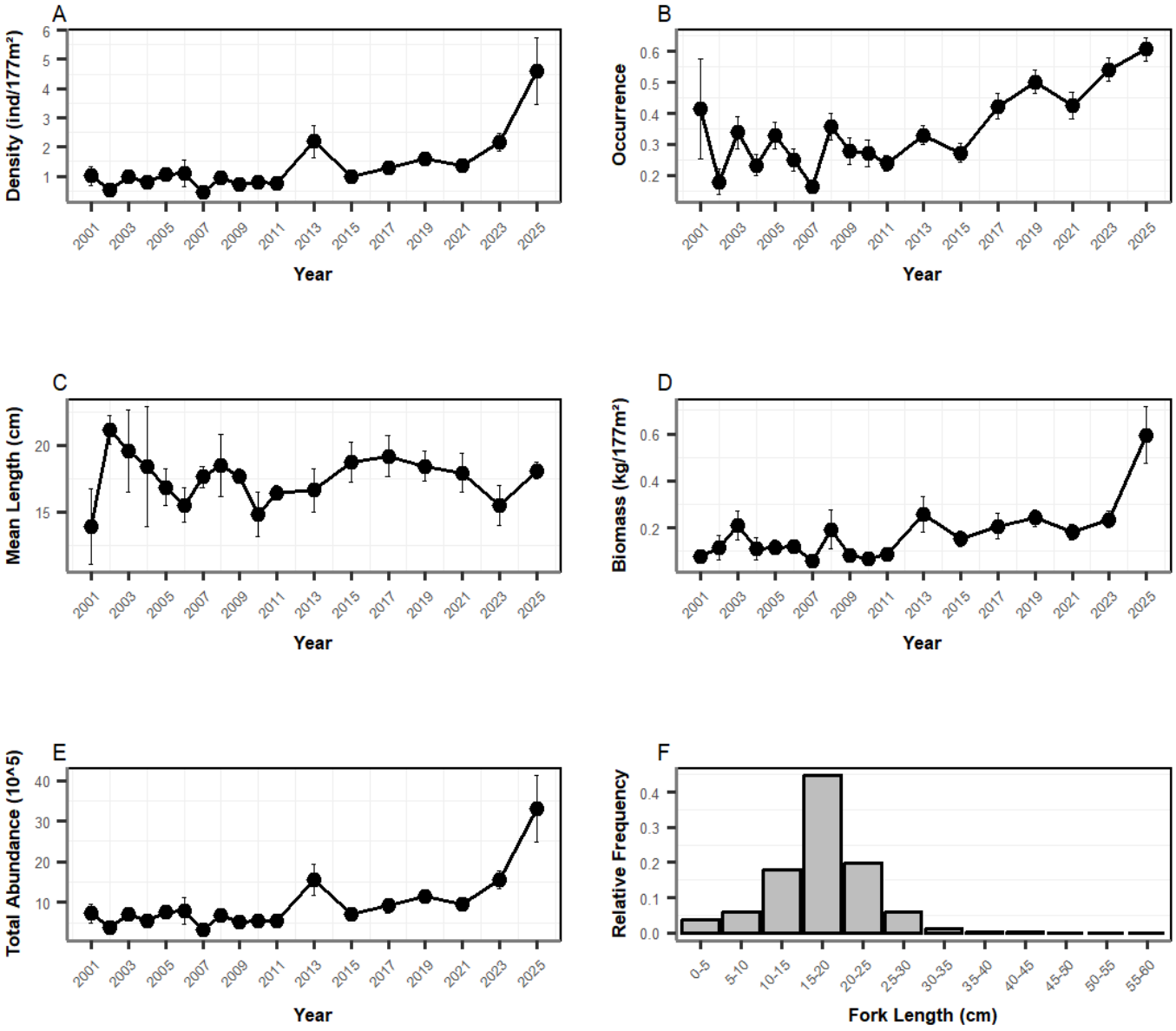


**Figure 4.** Population dynamics for yellowtail snapper (*Ocyurus chrysurus*) from 2001 to 2025. Time-series panels display annual estimates for (A) mean density (individuals/177m²), (B) proportional occurrence, (C) mean fork length (cm), (D) mean biomass (kg/177m²), (E) total abundance (scaled by $10^5$), and (F) overall relative frequency distribution of fork lengths (cm) for the sampled population in 2025. For all time-series plots (A–E), solid black circles represent the annual weighted mean estimate, and error bars denote standard error (SE).

# IV. Discussion

NCRMP's comprehensive sampling design strategy provides a broad, population-level perspective on the shallow-water (≤ 30 m) coral reef fish communities in the U.S. Caribbean. By recording species-specific counts and individual lengths across the entire assemblage, the dataset captures economically important, fishery-targeted stocks (e.g., groupers and snappers), ecologically valuable functional groups (e.g., herbivores and smaller prey species), and species of management concern (e.g., ESA-listed and invasive taxa).

The weighted domain data are available to inform a variety of fisheries and ecosystem assessments. This includes traditional single-species assessments such as SEDAR80 (SEDAR 2022ab) and SEDAR84 (SEDAR 2025abc), which relied on relative abundance indices and size composition data, as well as length-based risk assessments that evaluate exploited life stages to provide insight into fishing impacts relative to established sustainability benchmarks (e.g., Ault et al. 2019, 2024). Beyond single-species management, these data support broader, multi-species frameworks that integrate benthic, environmental, and socio-economic data, such as Integrated Ecosystem Assessments (Southeast Integrated Ecosystem Assessment Program 2025) and NCRMP coral reef status reports (Towle et al. 2022).

The NCRMP fishery-independent visual survey offers a rigorous design, a multi-decadal time series, and high-quality multi-species data that provide a versatile foundation for new and emerging alternative methods that rely on fishery-independent data, including those under consideration in SEDAR103.

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# Appendix I

Computational formula for single-stage stratified random sampling design used for reef fish visual surveys.

| Symbol | Definition | Computational Formula |
|---|---|---|
| $h$ | Stratum subscript | |
| $i$ | Diver sample unit subscript | Grid cell |
| $k$ | Substratum subscript | |
| $a_{hik}$ | Area of the *i*th diver unit in substratum k in stratum *h* | Grid cell size = $50\ m\ x\ 50\ m$ |
| $a_{hi}$ | Area of the *i*th diver unit in stratum *h* | |
| $A_{hk}$ | Area of substratum *k* in stratum *h* | $A_{hk} = \sum_{i=1}^{N_{hk}} a_{hik}$ |
| $A_h$ | Area of stratum *h* | $A_h = \sum_{i=1}^{N_h} a_{hi}$ |
| $A$ | Area of entire survey domain | $A = \sum_h A_h$ |
| $n_{hk}$ | Number of sampled diver units *i* in substratum *k* in stratum *h* | |
| $n_h$ | Number of sampled diver units *i* in stratum *h* | |
| $N_{hk}$ | Total possible number of diver units in substratum *k* in stratum *h* | Total number of grid cells |
| $N_h$ | Total possible number of diver units in stratum *h* | Total number of grid cells |
| $w_{hk}$ | Substratum *k* weighting factor | $w_{hk} = \frac{N_{hk}}{\sum_{hk} N_{hk}}$ |
| $w_h$ | Stratum *h* weighting factor | $w_h = \frac{N_h}{\sum_h N_h}$ |
| $\overline{D}_{hk}$ | Mean density in substratum *k* | $\overline{D}_{hk} = \frac{1}{n_{hk}} \sum_i D_{hik}$ |

| | | |
|---|---|---|
| $\overline{D}_h$ | Mean density in stratum *h* | $\overline{D}_h = \frac{1}{n_h}\sum_i D_{hi}$ |
| $s_{hk}^2$ | Sample variance among diver units *i* in substratum *k* in stratum *h* | $s_{hk}^2 = \frac{\sum_i (D_{hik} - \overline{D}_{hk})^2}{n_{hk} - 1}$ |
| $s_h^2$ | Sample variance among diver units *i* in stratum *h* | $s_h^2 = \frac{\sum_i (D_{hi} - \overline{D}_h)^2}{n_h - 1}$ |
| $var[\overline{D}_{hk}]$ | Variance of mean density substratum *k* in stratum *h* | $var[\overline{D}_{hk}] = \left(1 - \frac{n_{hk}}{N_{hk}}\right)\frac{s_{hk}^2}{n_{hk}}$ |
| $var[\overline{D}_h]$ | Variance of mean density in stratum *h* | $var[\overline{D}_h] = \left(1 - \frac{n_h}{N_h}\right)\frac{s_h^2}{n_h}$ |
| $\overline{D}_{st}$ | Domain-wide mean density for a stratified random survey | $\overline{D}_{st} = \sum_h w_h\, \overline{D}_h$ |
| $var[\overline{D}_{st}]$ | Variance of domain-wide mean density | $var[\overline{D}_{st}] = \sum_h w_h^2\, var[\overline{D}_h]$ |
| $SE[\overline{D}_{st}]$ | Standard error of domain-wide mean density | $SE[\overline{D}_{st}]\sqrt{var[\overline{D}_{st}]}$ |
| $CV[\overline{D}_{st}]$ | Coefficient of variation (CV) of domain-side mean density | $CV[\overline{D}_{st}] = \frac{SE[\overline{D}_{st}]}{\overline{D}_{st}}$ |
| $n^*$ | Number of diver unit samples required to achieve a specified variance | $n^* = \frac{(\sum_h w_h s_h)^2}{V(\overline{D}_{st}) + \frac{1}{N}\sum_h w_h s_h^2}$ |
| $V[\overline{D}_{st}]$ | Desired variance of domain-wide mean density using a target CV of domain-wide mean density | $V[\overline{D}_{st}] = (CV[\overline{D}_{st}] \cdot \overline{D}_{st})^2$ |
| | Proportional allocation | $n_h = n \cdot w_h$ |
| | Neyman or optimal allocation | $n_h = n\left(\frac{w_h s_h}{\sum_h w_h s_h}\right)$ |

# Appendix II

Weighted domain estimates for reef fish species with >1% occurrence during the 2025 survey year in each of the three U.S. Caribbean survey domains (Puerto Rico, St. Croix, and St. Thomas/St. John). Mean density (ind/177 m2) and mean length (cm) are presented alongside their associated standard errors (SE). Cells containing a dash (-) indicate that a species was not observed or had <1% occurrence in a survey domain, i.e., data were insufficient to calculate the metric.

| | Puerto Rico | | St. Croix | | St. Thomas/St. John | |
|---|---|---|---|---|---|---|
| Species | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) |
| *Abudefduf saxatilis* | 0.508 (**0.138**) | 6.839 (**1.654**) | 0.235 (**0.058**) | 6.698 (**1.758**) | 0.775 (**0.187**) | 10.754 (**0.266**) |
| *Acanthemblemaria aspera* | 0.009 (**0.006**) | 3.000 (**-**) | 0.027 (**0.027**) | 1.991 (**0.030**) | 0.002 (**0.001**) | 1.500 (**0.023**) |
| *Acanthurus bahianus* | 8.402 (**0.804**) | 12.251 (**0.421**) | 8.825 (**0.593**) | 10.455 (**0.405**) | 6.877 (**0.576**) | 12.667 (**0.419**) |
| *Acanthurus chirurgus* | 0.898 (**0.198**) | 14.911 (**0.806**) | 2.621 (**0.520**) | 10.628 (**1.040**) | 3.852 (**0.632**) | 15.319 (**0.460**) |
| *Acanthurus coeruleus* | 3.598 (**0.338**) | 12.703 (**0.378**) | 3.273 (**0.304**) | 11.942 (**0.362**) | 5.388 (**0.583**) | 12.553 (**0.587**) |
| *Acanthostracion polygonia* | 0.001 (**0.001**) | 25.000 (**0.000**) | 0.028 (**0.010**) | 18.072 (**3.015**) | 0.000 (**0.000**) | 20.000 (**-**) |
| *Acanthostracion quadricornis* | 0.002 (**0.001**) | 26.336 (**0.120**) | 0.007 (**0.005**) | 33.761 (**5.655**) | 0.002 (**0.002**) | 12.000 (**-**) |
| *Acanthemblemaria spinosa* | • (**-**) | • (**-**) | 0.038 (**0.022**) | 1.845 (**0.155**) | 0.036 (**0.028**) | 1.046 (**0.129**) |
| *Aetobatus narinari* | • (**-**) | • (**-**) | • (**-**) | • (**-**) | 0.006 (**0.006**) | 192.035 (**8.302**) |
| *Amblycirrhitus pinos* | 0.043 (**0.013**) | 5.337 (**0.220**) | 0.167 (**0.044**) | 4.748 (**0.311**) | 0.043 (**0.019**) | 5.965 (**0.427**) |
| *Anisotremus surinamensis* | 0.014 (**0.011**) | 24.936 (**1.836**) | 0.002 (**0.001**) | 31.205 (**0.266**) | 0.023 (**0.016**) | 29.958 (**2.368**) |
| *Anisotremus virginicus* | 0.246 (**0.136**) | 23.743 (**1.019**) | 0.001 (**0.001**) | 16.416 (**0.094**) | 0.037 (**0.028**) | 20.805 (**0.856**) |
| *Apogon binotatus* | • (**-**) | • (**-**) | 0.007 (**0.005**) | 3.776 (**0.133**) | 0.017 (**0.012**) | 5.092 (**1.099**) |
| *Apogon maculatus* | • (**-**) | • (**-**) | 0.011 (**0.007**) | 3.154 (**0.134**) | 0.002 (**0.002**) | 5.000 (**0.000**) |
| *Aulostomus maculatus* | 0.045 (**0.015**) | 28.366 (**2.014**) | 0.023 (**0.008**) | 30.731 (**5.252**) | 0.093 (**0.015**) | 29.950 (**2.415**) |
| *Balistes vetula* | 0.593 (**0.080**) | 25.251 (**0.611**) | 1.734 (**0.305**) | 32.396 (**0.984**) | 0.364 (**0.050**) | 29.683 (**1.025**) |
| *Bodianus rufus* | 0.258 (**0.045**) | 13.885 (**1.454**) | 0.125 (**0.025**) | 17.907 (**0.755**) | 0.145 (**0.032**) | 20.960 (**1.360**) |
| *Bothus lunatus* | 0.011 (**0.009**) | 21.273 (**0.653**) | 0.022 (**0.009**) | 24.144 (**2.936**) | 0.009 (**0.006**) | 15.829 (**1.782**) |
| *Calamus calamus* | 0.052 (**0.029**) | 18.604 (**0.912**) | 0.048 (**0.043**) | 22.425 (**2.105**) | 0.242 (**0.045**) | 20.124 (**1.340**) |
| *Calamus nodosus* | • (**-**) | • (**-**) | • (**-**) | • (**-**) | 0.060 (**0.032**) | 30.515 (**0.702**) |
| *Calamus pennatula* | 0.130 (**0.029**) | 19.412 (**1.210**) | 0.003 (**0.003**) | 32.000 (**-**) | 0.010 (**0.005**) | 20.340 (**0.280**) |
| *Calamus penna* | 0.045 (**0.024**) | 18.964 (**0.837**) | 0.000 (**0.000**) | 34.000 (**-**) | 0.015 (**0.008**) | 27.395 (**0.587**) |
| *Cantherhines macrocerus* | 0.002 (**0.001**) | 25.000 (**0.323**) | 0.005 (**0.004**) | 30.183 (**0.642**) | 0.017 (**0.007**) | 12.988 (**3.830**) |
| *Cantherhines pullus* | 0.033 (**0.010**) | 12.010 (**2.316**) | 0.032 (**0.009**) | 7.650 (**0.967**) | 0.027 (**0.012**) | 14.980 (**1.055**) |
| *Canthigaster rostrata* | 0.732 (**0.072**) | 4.921 (**0.147**) | 0.603 (**0.105**) | 4.386 (**0.169**) | 1.109 (**0.101**) | 5.221 (**0.182**) |
| *Canthidermis sufflamen* | 0.034 (**0.027**) | 29.811 (**0.529**) | 0.054 (**0.040**) | 31.698 (**1.351**) | 0.024 (**0.018**) | 34.153 (**2.326**) |

| Species | Puerto Rico | | St. Croix | | St. Thomas/St. John | |
|---|---|---|---|---|---|---|
| | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) |
| *Carangoides bartholomaei* | 0.526 (**0.362**) | 22.566 (**5.256**) | 0.071 (**0.025**) | 26.880 (**1.257**) | 0.041 (**0.020**) | 31.714 (**1.854**) |
| *Caranx crysos* | 1.152 (**0.610**) | 19.968 (**3.301**) | 0.238 (**0.097**) | 22.105 (**1.563**) | 1.326 (**0.324**) | 18.297 (**1.152**) |
| *Caranx latus* | 0.018 (**0.018**) | 11.650 (**-**) | 0.002 (**0.002**) | 42.438 (**0.129**) | 0.085 (**0.050**) | 36.230 (**0.739**) |
| *Caranx lugubris* | 0.013 (**0.006**) | 46.746 (**0.799**) | • (**-**) | • (**-**) | 0.017 (**0.012**) | 45.000 (**0.367**) |
| *Carcharhinus perezii* | 0.001 (**0.001**) | 90.000 (**-**) | 0.006 (**0.004**) | 133.131 (**3.130**) | 0.009 (**0.005**) | 151.535 (**6.937**) |
| *Caranx ruber* | 4.279 (**1.424**) | 15.034 (**1.578**) | 1.558 (**0.623**) | 17.604 (**1.943**) | 3.647 (**0.693**) | 18.350 (**1.194**) |
| *Centropyge argi* | 0.090 (**0.056**) | 3.772 (**0.217**) | 0.022 (**0.022**) | 4.225 (**-**) | • (**-**) | • (**-**) |
| *Cephalopholis cruentata* | 0.390 (**0.044**) | 13.418 (**0.512**) | 0.136 (**0.022**) | 14.479 (**0.882**) | 0.452 (**0.037**) | 16.267 (**0.697**) |
| *Cephalopholis fulva* | 0.979 (**0.136**) | 16.485 (**0.796**) | 1.474 (**0.118**) | 17.522 (**0.416**) | 0.459 (**0.087**) | 20.883 (**0.464**) |
| *Chaetodon capistratus* | 0.985 (**0.102**) | 8.567 (**0.253**) | 0.312 (**0.041**) | 8.710 (**0.366**) | 1.213 (**0.098**) | 8.510 (**0.232**) |
| *Chaetodon ocellatus* | 0.055 (**0.018**) | 10.173 (**1.080**) | 0.073 (**0.025**) | 12.032 (**0.745**) | 0.024 (**0.006**) | 10.399 (**0.237**) |
| *Chaetodon sedentarius* | 0.042 (**0.015**) | 10.243 (**0.608**) | 0.034 (**0.019**) | 8.514 (**0.708**) | 0.067 (**0.025**) | 9.878 (**0.432**) |
| *Chaetodon striatus* | 0.289 (**0.042**) | 9.239 (**0.342**) | 0.536 (**0.056**) | 9.887 (**0.374**) | 0.116 (**0.026**) | 9.636 (**0.591**) |
| *Chromis cyanea* | 3.365 (**0.506**) | 4.711 (**0.211**) | 4.989 (**0.785**) | 4.872 (**0.378**) | 6.405 (**0.816**) | 5.808 (**0.230**) |
| *Chromis multilineata* | 1.184 (**0.358**) | 3.839 (**0.293**) | 0.877 (**0.176**) | 4.424 (**0.642**) | 0.552 (**0.106**) | 7.344 (**0.498**) |
| *Clepticus parrae* | 1.114 (**0.407**) | 11.154 (**2.112**) | 0.459 (**0.094**) | 10.450 (**1.940**) | 4.311 (**1.821**) | 14.956 (**1.512**) |
| *Coryphopterus dicrus* | • (**-**) | • (**-**) | 0.003 (**0.001**) | 3.568 (**0.036**) | 0.082 (**0.019**) | 2.804 (**0.168**) |
| *Coryphopterus glaucofraenum* | 0.524 (**0.108**) | 3.513 (**0.213**) | 0.705 (**0.194**) | 2.823 (**0.110**) | 0.424 (**0.104**) | 3.415 (**0.158**) |
| *Coryphopterus personatus* | 6.336 (**1.699**) | 2.188 (**0.074**) | 6.518 (**1.805**) | 1.873 (**0.162**) | 44.966 (**4.942**) | 2.092 (**0.190**) |
| *Coryphopterus venezuelae* | 0.485 (**0.223**) | 1.836 (**0.157**) | • (**-**) | • (**-**) | 0.021 (**0.010**) | 3.609 (**0.271**) |
| *Cryptotomus roseus* | 0.256 (**0.085**) | 4.398 (**0.604**) | 0.237 (**0.098**) | 4.612 (**0.366**) | 0.584 (**0.247**) | 5.645 (**0.565**) |
| *Ctenogobius saepepallens* | 0.083 (**0.050**) | 2.993 (**0.035**) | 0.059 (**0.031**) | 2.882 (**0.120**) | 0.019 (**0.009**) | 3.818 (**0.149**) |
| *Dasyatis americana* | 0.008 (**0.006**) | 86.911 (**20.093**) | 0.014 (**0.006**) | 56.398 (**5.265**) | 0.004 (**0.002**) | 61.430 (**2.964**) |
| *Decapterus macarellus* | 0.225 (**0.160**) | 14.885 (**0.446**) | 0.114 (**0.102**) | 20.326 (**0.023**) | 1.918 (**1.322**) | 13.688 (**0.381**) |
| *Decapterus punctatus* | 0.588 (**0.587**) | 9.870 (**-**) | 0.533 (**0.415**) | 20.264 (**0.001**) | 0.487 (**0.293**) | 18.435 (**0.547**) |
| *Diodon holocanthus* | 0.002 (**0.002**) | 13.000 (**0.000**) | 0.006 (**0.004**) | 23.061 (**3.007**) | 0.003 (**0.002**) | 29.777 (**1.000**) |
| *Diodon hystrix* | 0.008 (**0.004**) | 30.811 (**0.308**) | 0.006 (**0.004**) | 35.899 (**2.444**) | 0.008 (**0.003**) | 32.598 (**1.353**) |
| *Echeneis naucrates* | 0.010 (**0.009**) | 17.694 (**0.226**) | 0.000 (**0.000**) | 16.000 (**-**) | 0.001 (**0.001**) | 26.500 (**0.000**) |
| *Echeneis neucratoides* | 0.020 (**0.009**) | 16.910 (**4.121**) | 0.000 (**0.000**) | 60.000 (**-**) | • (**-**) | • (**-**) |
| *Elagatis bipinnulata* | 0.036 (**0.036**) | 35.000 (**-**) | 0.010 (**0.009**) | 30.184 (**1.529**) | 0.160 (**0.053**) | 19.705 (**2.176**) |
| *Elacatinus chancei* | 0.056 (**0.021**) | 2.852 (**0.079**) | 0.062 (**0.047**) | 2.008 (**0.046**) | • (**-**) | • (**-**) |
| *Elacatinus evelynae* | 0.143 (**0.034**) | 3.091 (**0.056**) | 0.178 (**0.074**) | 2.571 (**0.146**) | 0.053 (**0.011**) | 2.708 (**0.508**) |

| Species | Puerto Rico | | St. Croix | | St. Thomas/St. John | |
|---|---|---|---|---|---|---|
| | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) |
| *Elacatinus oceanops* | • (-) | • (-) | 0.001 (**0.001**) | 2.000 (-) | 0.015 (**0.012**) | 2.973 (**0.259**) |
| *Emblemaria pandionis* | 0.002 (**0.002**) | 5.000 (**0.000**) | 0.022 (**0.015**) | 3.000 (**0.288**) | • (-) | • (-) |
| *Epinephelus guttatus* | 0.555 (**0.076**) | 23.134 (**0.760**) | 0.379 (**0.039**) | 24.068 (**0.810**) | 0.354 (**0.043**) | 25.494 (**1.165**) |
| *Epinephelus morio* | • (-) | • (-) | 0.000 (**0.000**) | 30.000 (**0.000**) | 0.025 (**0.010**) | 38.859 (**1.553**) |
| *Epinephelus striatus* | 0.026 (**0.007**) | 32.961 (**2.442**) | 0.045 (**0.013**) | 32.313 (**2.022**) | 0.067 (**0.014**) | 34.596 (**1.902**) |
| *Equetus punctatus* | 0.024 (**0.012**) | 6.936 (**1.363**) | 0.004 (**0.001**) | 14.573 (**0.340**) | 0.014 (**0.004**) | 17.161 (**1.149**) |
| *Gerres cinereus* | 0.055 (**0.021**) | 13.618 (**0.432**) | 0.020 (**0.007**) | 19.027 (**0.123**) | 0.114 (**0.032**) | 18.215 (**1.257**) |
| *Ginglymostoma cirratum* | 0.050 (**0.014**) | 173.820 (**6.750**) | 0.089 (**0.026**) | 147.536 (**6.901**) | 0.049 (**0.018**) | 137.820 (**7.408**) |
| *Gnatholepis thompsoni* | 0.101 (**0.040**) | 3.792 (**0.513**) | 0.325 (**0.085**) | 3.689 (**0.125**) | 0.251 (**0.081**) | 3.779 (**0.229**) |
| *Gramma loreto* | 0.906 (**0.253**) | 3.774 (**0.367**) | 0.203 (**0.033**) | 3.704 (**0.316**) | 0.352 (**0.059**) | 3.914 (**0.176**) |
| *Gymnothorax miliaris* | 0.004 (**0.004**) | 27.500 (-) | 0.003 (**0.003**) | 12.346 (**0.136**) | 0.008 (**0.004**) | 35.226 (**6.373**) |
| *Gymnothorax moringa* | 0.021 (**0.011**) | 28.666 (**2.840**) | 0.005 (**0.002**) | 43.121 (**0.208**) | 0.004 (**0.002**) | 37.778 (**1.945**) |
| *Haemulon album* | • (-) | • (-) | 0.001 (**0.000**) | 34.400 (**0.198**) | 0.008 (**0.003**) | 37.354 (**1.282**) |
| *Haemulon aurolineatum* | 2.820 (**2.038**) | 12.655 (**0.741**) | 0.109 (**0.043**) | 9.715 (**0.655**) | 1.686 (**0.316**) | 15.798 (**0.314**) |
| *Haemulon carbonarium* | 0.405 (**0.153**) | 21.785 (**3.597**) | 0.086 (**0.030**) | 16.093 (**2.090**) | 0.112 (**0.047**) | 20.449 (**0.600**) |
| *Haemulon chrysargyreum* | 0.135 (**0.096**) | 5.176 (**3.703**) | 0.013 (**0.008**) | 15.423 (**0.171**) | 0.213 (**0.114**) | 13.881 (**0.773**) |
| *Haemulon flavolineatum* | 0.824 (**0.227**) | 13.541 (**0.829**) | 0.517 (**0.080**) | 14.916 (**0.699**) | 1.302 (**0.138**) | 15.486 (**1.007**) |
| *Haemulon macrostomum* | 0.224 (**0.113**) | 23.251 (**1.089**) | 0.005 (**0.004**) | 27.014 (**0.300**) | 0.019 (**0.009**) | 21.261 (**0.542**) |
| *Haemulon melanurum* | • (-) | • (-) | 0.029 (**0.020**) | 16.120 (**2.072**) | 0.002 (**0.001**) | 17.166 (**0.861**) |
| *Haemulon parra* | 0.002 (**0.001**) | 24.028 (**0.571**) | 0.044 (**0.030**) | 30.596 (**0.366**) | 0.019 (**0.013**) | 20.039 (**0.557**) |
| *Haemulon plumierii* | 0.583 (**0.122**) | 16.000 (**0.802**) | 0.109 (**0.044**) | 23.493 (**1.559**) | 0.188 (**0.040**) | 24.177 (**1.416**) |
| *Haemulon sciurus* | 0.132 (**0.034**) | 18.840 (**1.072**) | 0.047 (**0.027**) | 24.640 (**1.024**) | 0.278 (**0.043**) | 20.543 (**1.787**) |
| *Halichoeres bivittatus* | 5.029 (**0.488**) | 6.521 (**0.246**) | 18.632 (**1.621**) | 6.622 (**0.130**) | 8.580 (**0.924**) | 7.054 (**0.247**) |
| *Halichoeres cyanocephalus* | 0.017 (**0.008**) | 13.272 (**0.831**) | 0.100 (**0.035**) | 13.231 (**1.543**) | 0.009 (**0.006**) | 11.596 (**1.760**) |
| *Halichoeres garnoti* | 4.863 (**0.467**) | 7.140 (**0.261**) | 6.771 (**0.572**) | 6.866 (**0.233**) | 7.386 (**0.481**) | 7.864 (**0.168**) |
| *Halichoeres maculipinna* | 0.945 (**0.121**) | 6.643 (**0.294**) | 1.554 (**0.175**) | 6.557 (**0.292**) | 0.816 (**0.121**) | 7.663 (**0.219**) |
| *Halichoeres pictus* | 0.006 (**0.004**) | 7.324 (**0.173**) | 0.137 (**0.068**) | 4.457 (**0.704**) | 0.758 (**0.178**) | 7.168 (**0.422**) |
| *Halichoeres poeyi* | 1.344 (**0.258**) | 6.088 (**0.244**) | 0.306 (**0.068**) | 7.198 (**0.802**) | 0.376 (**0.093**) | 6.849 (**0.295**) |
| *Halichoeres radiatus* | 0.200 (**0.057**) | 9.700 (**0.943**) | 0.275 (**0.043**) | 9.744 (**2.519**) | 0.213 (**0.037**) | 11.889 (**3.625**) |
| *Hemiramphus brasiliensis* | 0.366 (**0.286**) | 15.975 (**0.359**) | • (-) | • (-) | • (-) | • (-) |
| *Heteropriacanthus cruentatus* | 0.010 (**0.004**) | 18.755 (**0.565**) | 0.004 (**0.001**) | 19.717 (**0.152**) | 0.006 (**0.002**) | 16.899 (**0.629**) |
| *Holocentrus adscensionis* | 0.499 (**0.094**) | 16.083 (**0.602**) | 0.689 (**0.083**) | 17.548 (**0.624**) | 1.009 (**0.190**) | 17.285 (**0.428**) |

| Species | Puerto Rico | | St. Croix | | St. Thomas/St. John | |
|---|---|---|---|---|---|---|
| | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) |
| *Holacanthus ciliaris* | 0.047 (**0.011**) | 22.750 (**1.697**) | 0.029 (**0.015**) | 22.097 (**3.394**) | 0.111 (**0.027**) | 22.240 (**1.633**) |
| *Holocentrus rufus* | 1.473 (**0.122**) | 16.373 (**0.312**) | 1.144 (**0.105**) | 16.822 (**0.455**) | 0.907 (**0.084**) | 17.849 (**0.292**) |
| *Holacanthus tricolor* | 0.143 (**0.032**) | 13.876 (**0.924**) | 0.193 (**0.028**) | 11.169 (**1.415**) | 0.159 (**0.030**) | 13.222 (**0.832**) |
| *Hypoplectrus aberrans* | 0.001 (**0.001**) | 7.000 (**0.000**) | 0.005 (**0.004**) | 10.000 (**-**) | 0.085 (**0.015**) | 8.703 (**0.678**) |
| *Hypoplectrus chlorurus* | 0.052 (**0.011**) | 8.016 (**0.834**) | 0.001 (**0.001**) | 9.000 (**0.029**) | 0.245 (**0.034**) | 8.124 (**0.288**) |
| *Hypoplectrus guttavarius* | 0.002 (**0.001**) | 6.806 (**0.114**) | • (-) | • (-) | 0.035 (**0.013**) | 8.457 (**0.712**) |
| *Hypoplectrus indigo* | 0.015 (**0.007**) | 9.209 (**0.317**) | 0.001 (**0.001**) | 10.750 (**0.019**) | 0.045 (**0.011**) | 10.147 (**0.228**) |
| *Hypoplectrus nigricans* | 0.030 (**0.009**) | 8.228 (**0.461**) | 0.001 (**0.001**) | 9.139 (**0.043**) | 0.110 (**0.014**) | 9.169 (**1.051**) |
| *Hypoplectrus puella* | 0.072 (**0.016**) | 6.940 (**0.769**) | 0.015 (**0.008**) | 6.842 (**0.803**) | 0.506 (**0.043**) | 7.987 (**0.239**) |
| *Hypoplectrus tann* | 0.001 (**0.001**) | 12.000 (**0.000**) | 0.000 (**0.000**) | 12.000 (**-**) | 0.078 (**0.019**) | 6.161 (**0.304**) |
| *Hypoplectrus unicolor* | 0.069 (**0.013**) | 6.817 (**0.409**) | 0.004 (**0.001**) | 7.209 (**0.055**) | 0.260 (**0.032**) | 7.822 (**0.414**) |
| *Kyphosus sectatrix* | 0.101 (**0.041**) | 23.774 (**1.465**) | 0.008 (**0.005**) | 32.512 (**0.238**) | 0.099 (**0.055**) | 36.507 (**2.229**) |
| *Labrisomus nigricinctus* | • (-) | • (-) | • (-) | • (-) | 0.006 (**0.006**) | 4.000 (**-**) |
| *Labrisomus nuchipinnis* | 0.038 (**0.023**) | 3.229 (**0.247**) | • (-) | • (-) | • (-) | • (-) |
| *Lactophrys bicaudalis* | • (-) | • (-) | 0.008 (**0.005**) | 14.825 (**0.738**) | 0.009 (**0.003**) | 10.943 (**0.857**) |
| *Lachnolaimus maximus* | 0.091 (**0.021**) | 26.304 (**1.278**) | 0.000 (**0.000**) | 38.000 (**0.000**) | 0.035 (**0.010**) | 34.883 (**2.561**) |
| *Lactophrys trigonus* | 0.006 (**0.005**) | 20.679 (**1.631**) | 0.006 (**0.004**) | 35.548 (**2.663**) | 0.000 (**0.000**) | 10.000 (**-**) |
| *Lactophrys triqueter* | 0.041 (**0.013**) | 15.622 (**0.909**) | 0.073 (**0.019**) | 13.365 (**0.482**) | 0.039 (**0.008**) | 15.562 (**1.757**) |
| *Lutjanus analis* | 0.046 (**0.015**) | 42.920 (**1.891**) | 0.096 (**0.032**) | 34.245 (**2.251**) | 0.157 (**0.031**) | 38.748 (**2.087**) |
| *Lutjanus apodus* | 1.464 (**1.123**) | 25.010 (**0.953**) | 0.047 (**0.009**) | 21.933 (**1.862**) | 0.820 (**0.427**) | 23.165 (**0.314**) |
| *Lutjanus cyanopterus* | 0.025 (**0.013**) | 58.595 (**4.893**) | 0.002 (**0.001**) | 86.037 (**0.601**) | 0.005 (**0.003**) | 72.018 (**4.275**) |
| *Lutjanus griseus* | 0.126 (**0.043**) | 18.377 (**0.547**) | 0.019 (**0.009**) | 23.382 (**0.173**) | 0.729 (**0.260**) | 26.121 (**0.527**) |
| *Lutjanus jocu* | 0.039 (**0.016**) | 37.607 (**9.985**) | • (-) | • (-) | 0.056 (**0.029**) | 34.121 (**2.792**) |
| *Lutjanus mahogoni* | 0.211 (**0.101**) | 17.417 (**0.834**) | 0.047 (**0.015**) | 18.035 (**1.791**) | 0.050 (**0.018**) | 22.542 (**0.648**) |
| *Lutjanus synagris* | 0.249 (**0.069**) | 16.987 (**1.461**) | 0.038 (**0.011**) | 14.585 (**1.045**) | 0.604 (**0.263**) | 19.923 (**0.580**) |
| *Malacoctenus boehlkei* | 0.039 (**0.027**) | 4.189 (**0.519**) | 0.001 (**0.001**) | 2.500 (**-**) | 0.010 (**0.005**) | 3.119 (**0.091**) |
| *Malacoctenus macropus* | 0.025 (**0.018**) | 3.307 (**0.139**) | 0.017 (**0.008**) | 2.601 (**0.252**) | 0.066 (**0.042**) | 1.912 (**0.104**) |
| *Malacanthus plumieri* | 0.267 (**0.046**) | 21.739 (**0.856**) | 0.327 (**0.054**) | 27.283 (**1.472**) | 0.039 (**0.012**) | 30.239 (**1.175**) |
| *Malacoctenus triangulatus* | 0.216 (**0.049**) | 4.318 (**0.221**) | 0.218 (**0.055**) | 3.383 (**0.135**) | 0.082 (**0.030**) | 3.701 (**0.192**) |
| *Megalops atlanticus* | 0.003 (**0.002**) | 67.670 (**0.227**) | • (-) | • (-) | 0.017 (**0.006**) | 111.508 (**4.668**) |
| *Melichthys niger* | 0.838 (**0.220**) | 20.052 (**0.836**) | 0.696 (**0.150**) | 25.364 (**1.662**) | 0.439 (**0.206**) | 24.147 (**0.795**) |
| *Microspathodon chrysurus* | 0.306 (**0.053**) | 10.484 (**1.643**) | 0.270 (**0.060**) | 9.534 (**1.109**) | 0.339 (**0.056**) | 8.701 (**1.205**) |

| Species | Puerto Rico | | St. Croix | | St. Thomas/St. John | |
|---|---|---|---|---|---|---|
| | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) |
| *Monacanthus tuckeri* | 0.010 (**0.007**) | 4.490 (**0.106**) | 0.010 (**0.006**) | 5.081 (**0.036**) | 0.035 (**0.017**) | 4.457 (**0.434**) |
| *Mulloidichthys martinicus* | 2.552 (**2.471**) | 14.968 (**0.548**) | 0.072 (**0.017**) | 13.914 (**1.749**) | 0.127 (**0.033**) | 17.335 (**1.021**) |
| *Mycteroperca bonaci* | 0.002 (**0.001**) | 56.500 (**0.872**) | • (-) | • (-) | 0.009 (**0.006**) | 36.834 (**1.459**) |
| *Myrichthys breviceps* | 0.006 (**0.005**) | 73.993 (**1.795**) | 0.000 (**0.000**) | 50.000 (-) | 0.002 (**0.002**) | 50.000 (-) |
| *Myripristis jacobus* | 0.131 (**0.046**) | 14.152 (**0.820**) | 0.045 (**0.011**) | 12.036 (**1.803**) | 0.252 (**0.093**) | 12.625 (**0.667**) |
| *Neoniphon marianus* | 0.039 (**0.025**) | 12.485 (**0.091**) | 0.003 (**0.001**) | 15.895 (**0.045**) | 0.049 (**0.018**) | 12.937 (**0.715**) |
| *Nes longus* | • (-) | • (-) | 0.001 (**0.001**) | 1.750 (-) | 0.012 (**0.011**) | 3.000 (**0.000**) |
| *Ocyurus chrysurus* | 3.323 (**0.396**) | 18.489 (**0.429**) | 0.671 (**0.125**) | 21.142 (**0.872**) | 4.607 (**1.150**) | 18.097 (**0.619**) |
| *Ophioblennius macclurei* | 0.118 (**0.048**) | 6.666 (**0.268**) | 0.061 (**0.015**) | 4.933 (**0.384**) | 0.032 (**0.008**) | 5.220 (**0.499**) |
| *Opistognathus aurifrons* | 0.517 (**0.115**) | 6.787 (**0.684**) | 0.596 (**0.174**) | 6.379 (**0.687**) | 1.458 (**0.281**) | 6.117 (**0.259**) |
| *Pareques acuminatus* | 0.017 (**0.012**) | 10.017 (**0.273**) | 0.005 (**0.004**) | 10.850 (**0.311**) | 0.003 (**0.002**) | 9.828 (**1.393**) |
| *Paranthias furcifer* | 0.014 (**0.011**) | 13.625 (**0.013**) | • (-) | • (-) | 0.025 (**0.023**) | 17.508 (**0.458**) |
| *Parablennius marmoreus* | • (-) | • (-) | 0.023 (**0.008**) | 3.126 (**0.068**) | 0.042 (**0.038**) | 5.792 (**0.226**) |
| *Pomacanthus arcuatus* | 0.168 (**0.035**) | 27.407 (**1.494**) | 0.010 (**0.006**) | 30.423 (**1.681**) | 0.418 (**0.057**) | 25.386 (**1.184**) |
| *Pomacanthus paru* | 0.078 (**0.018**) | 26.130 (**1.372**) | 0.042 (**0.018**) | 22.592 (**2.983**) | 0.141 (**0.027**) | 22.525 (**1.772**) |
| *Priolepis hipoliti* | • (-) | • (-) | 0.005 (**0.004**) | 1.157 (**0.116**) | 0.010 (**0.007**) | 2.343 (**0.180**) |
| *Prognathodes aculeatus* | 0.015 (**0.010**) | 6.125 (**0.316**) | 0.013 (**0.009**) | 5.071 (**0.337**) | 0.036 (**0.020**) | 6.307 (**0.367**) |
| *Pseudupeneus maculatus* | 0.740 (**0.104**) | 12.516 (**0.361**) | 0.580 (**0.103**) | 11.947 (**0.459**) | 1.091 (**0.113**) | 13.525 (**0.400**) |
| *Pterois volitans* | 0.061 (**0.020**) | 17.826 (**1.650**) | 0.020 (**0.007**) | 13.620 (**3.439**) | 0.083 (**0.029**) | 21.679 (**1.154**) |
| *Rhomboplites aurorubens* | 0.012 (**0.009**) | 20.063 (**0.026**) | • (-) | • (-) | 0.024 (**0.017**) | 18.633 (**0.292**) |
| *Risor ruber* | • (-) | • (-) | 0.000 (**0.000**) | 1.000 (-) | 0.027 (**0.023**) | 2.264 (**0.149**) |
| *Rypticus saponaceus* | 0.016 (**0.008**) | 20.693 (**1.212**) | 0.016 (**0.008**) | 18.211 (**1.107**) | 0.001 (**0.001**) | 16.000 (-) |
| *Sargocentron coruscum* | • (-) | • (-) | 0.015 (**0.006**) | 12.169 (**1.321**) | 0.033 (**0.018**) | 12.035 (**0.242**) |
| *Sargocentron vexillarium* | 0.041 (**0.018**) | 8.698 (**0.189**) | 0.022 (**0.014**) | 17.157 (**2.068**) | 0.016 (**0.014**) | 10.047 (**0.331**) |
| *Scarus iseri* | 3.837 (**0.392**) | 10.721 (**0.600**) | 2.195 (**0.321**) | 11.802 (**0.730**) | 11.102 (**0.665**) | 8.373 (**0.414**) |
| *Scarus taeniopterus* | 1.954 (**0.219**) | 13.057 (**0.399**) | 2.772 (**0.343**) | 15.192 (**0.760**) | 1.789 (**0.254**) | 12.356 (**1.206**) |
| *Scarus vetula* | 0.060 (**0.016**) | 22.727 (**3.474**) | 0.136 (**0.023**) | 19.324 (**1.470**) | 0.218 (**0.042**) | 16.541 (**1.814**) |
| *Scorpaena plumieri* | 0.007 (**0.005**) | 8.408 (**2.402**) | 0.011 (**0.006**) | 20.239 (**1.241**) | • (-) | • (-) |
| *Scomberomorus regalis* | 0.027 (**0.009**) | 44.131 (**2.980**) | 0.025 (**0.010**) | 42.409 (**0.940**) | 0.087 (**0.020**) | 46.466 (**2.382**) |
| *Serranus baldwini* | 0.176 (**0.082**) | 4.093 (**0.268**) | 0.079 (**0.023**) | 4.022 (**0.216**) | 0.254 (**0.087**) | 5.011 (**0.254**) |
| *Serranus tabacarius* | 0.205 (**0.050**) | 6.743 (**0.412**) | 0.165 (**0.052**) | 11.146 (**0.816**) | 1.027 (**0.217**) | 7.649 (**0.395**) |
| *Serranus tigrinus* | 0.961 (**0.095**) | 6.221 (**0.190**) | 0.687 (**0.073**) | 7.025 (**0.190**) | 0.961 (**0.103**) | 6.994 (**0.158**) |

| Species | Puerto Rico | | St. Croix | | St. Thomas/St. John | |
|---|---|---|---|---|---|---|
| | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) | Density (SE) | Mean Length (SE) |
| *Serranus tortugarum* | 0.551 (**0.194**) | 4.381 (**0.178**) | 0.019 (**0.014**) | 6.808 (**0.963**) | 3.548 (**1.112**) | 4.340 (**0.444**) |
| *Sparisoma atomarium* | 1.421 (**0.333**) | 5.971 (**0.332**) | 0.508 (**0.135**) | 4.705 (**0.125**) | 1.251 (**0.283**) | 4.917 (**0.142**) |
| *Sparisoma aurofrenatum* | 2.788 (**0.203**) | 11.828 (**0.363**) | 4.822 (**0.351**) | 11.312 (**0.411**) | 5.798 (**0.352**) | 11.406 (**0.311**) |
| *Sparisoma chrysopterum* | 0.361 (**0.093**) | 16.400 (**1.447**) | 0.284 (**0.049**) | 20.187 (**1.370**) | 0.208 (**0.041**) | 17.938 (**2.128**) |
| *Sparisoma radians* | 0.088 (**0.067**) | 5.765 (**0.111**) | 0.388 (**0.081**) | 5.359 (**0.278**) | 0.287 (**0.079**) | 5.343 (**0.461**) |
| *Sparisoma rubripinne* | 0.483 (**0.104**) | 18.585 (**1.247**) | 0.378 (**0.168**) | 21.284 (**1.803**) | 0.256 (**0.056**) | 19.253 (**3.319**) |
| *Sparisoma viride* | 0.965 (**0.134**) | 18.742 (**1.959**) | 0.691 (**0.088**) | 16.986 (**1.754**) | 1.963 (**0.169**) | 14.001 (**0.924**) |
| *Sphyraena barracuda* | 0.130 (**0.022**) | 83.848 (**3.741**) | 0.127 (**0.026**) | 77.087 (**2.739**) | 0.101 (**0.018**) | 83.687 (**4.538**) |
| *Stegastes adustus* | 1.714 (**0.290**) | 5.442 (**0.970**) | 1.016 (**0.208**) | 5.332 (**0.573**) | 1.083 (**0.116**) | 5.445 (**0.344**) |
| *Stegastes diencaeus* | 0.028 (**0.013**) | 5.656 (**0.157**) | 0.294 (**0.062**) | 6.458 (**0.541**) | 0.443 (**0.065**) | 6.221 (**0.709**) |
| *Stegastes leucostictus* | 0.212 (**0.052**) | 5.475 (**0.394**) | 0.572 (**0.090**) | 4.451 (**0.434**) | 1.194 (**0.166**) | 4.646 (**0.335**) |
| *Stegastes partitus* | 22.265 (**2.655**) | 4.112 (**0.152**) | 38.753 (**2.967**) | 4.281 (**0.139**) | 17.449 (**1.368**) | 4.655 (**0.110**) |
| *Stegastes planifrons* | 0.260 (**0.058**) | 4.527 (**1.009**) | 0.242 (**0.095**) | 4.261 (**0.602**) | 1.457 (**0.172**) | 5.048 (**0.334**) |
| *Stegastes variabilis* | 1.602 (**0.227**) | 5.281 (**0.282**) | 0.311 (**0.070**) | 4.941 (**0.345**) | 2.613 (**0.254**) | 5.197 (**0.201**) |
| *Synodus intermedius* | 0.027 (**0.011**) | 10.598 (**1.022**) | 0.010 (**0.005**) | 12.345 (**4.361**) | 0.068 (**0.014**) | 13.674 (**1.145**) |
| *Synodus saurus* | 0.008 (**0.005**) | 9.599 (**1.072**) | • (-) | • (-) | 0.003 (**0.002**) | 15.667 (**0.299**) |
| *Thalassoma bifasciatum* | 21.529 (**2.111**) | 5.122 (**0.147**) | 35.527 (**1.990**) | 5.477 (**0.130**) | 14.341 (**1.079**) | 6.277 (**0.166**) |
| *Xanthichthys ringens* | 0.032 (**0.017**) | 14.289 (**0.444**) | 0.003 (**0.002**) | 15.646 (**0.041**) | 0.184 (**0.123**) | 12.068 (**0.898**) |
| *Xyrichtys martinicensis* | 0.241 (**0.230**) | 9.691 (**0.124**) | 0.059 (**0.034**) | 7.383 (**0.054**) | • (-) | • (-) |
| *Xyrichtys splendens* | 0.295 (**0.170**) | 7.756 (**2.043**) | 0.352 (**0.162**) | 6.471 (**0.434**) | 0.082 (**0.027**) | 8.074 (**0.599**) |