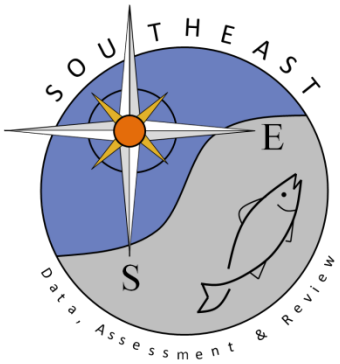
Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Stoplight Parrotfish in the St. Croix

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

SEDAR84-DW-14

16 February 2024



Please cite this document as:

Grove, Laura Jay W., Jeremiah Blondeau, and Jerald S. Ault. 2024. Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Stoplight Parrotfish in the St. Croix. SEDAR84-WP-14. SEDAR, North Charleston, SC. 11 pp.

SEDAR 84-WP-XX

Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Stoplight Parrotfish in the St. Croix

NOAA Fisheries
Southeast Fisheries Science Center
Population and Ecosystem Monitoring
Division 75 Virginia Beach Drive
Miami, FL 33149

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

02-16-2024

Fishery-independent size-structure and density estimates for Yellowtail Snapper are compiled from the following data:

1. National Coral Reef Monitoring Program's (NCRMP) Reef fish Visual Census Metadata for the U.S. Caribbean (SEDAR80-WP-02)
    a. Historic belt-transect (BT) estimates (2001–2015)
    b. Present reef visual census stationary point count (RVC-SPC) estimates (2016–2021)

Parameters for data prepared for SEDAR84 fishery-independent reef fish visual survey data:

Species: Stoplight Parrotfish

Year Range: 2001 to 2021

Geographic Range: St. Croix

Survey Design: Stratified-random sampling on hard-bottom coral reef habitats from 0 to 30 m.

Sampling Mode: Fishery-independent reef fish visual surveys.

Survey Methodology: Fully calibrated estimates that consider the change in sampling methodology from Belt Transects (BT) to RVC Stationary Points Counts (RVC-SPC) to allow for

multi-decadal evaluations.

Survey Dataset Names:
St. Croix:
SLP_dens_NCRMP_0121_20240112.xlsx
SLP_size_NCRMP_0121_20240112.xlsx

Overview

This document outlines the data and methodologies used to estimate density and abundance-at-length compositions for the SEDAR84 Stoplight Parrotfish Assessment for St. Croix.

For more background details about the reef visual survey program (historic and NCRMP), methodology, data, and sampling coverage including maps of all survey sites completed by year (2001–2019) in each U.S. Caribbean sampling domain (Puerto Rico, St. Thomas/St. John, and St. Croix) see SEDAR80-WP-02 (Grove et al. 2021). Sampling in 2021 had similar island-wide coverage for each of the island assessments as previous NCRMP surveys. Total samples reduced in St. Croix in 2021 to 148 as a result of weather and covid-related sampling restrictions.

Calibration

Two levels of calibration were needed to incorporate the historical transect data. First, we analyzed the regionally restricted transect data from 2001 to 2011 in Buck Island Reef National Monument. We determined that similar density distributions existed within strata between the regional data and whole island-wide data, and that each strata was represented in the sampling for proper area weighting. Secondly, a robust method calibration was conducted to convert belt transect (BT) densities (2001–2015) to RVC stationary point count (RVC-SPC) densities (2017–2021). In short, paired BT and RVC-SPC sampling was conducted a number of times within each survey strata. Density and occurrence were modeled in a two-stage GLM regression using a "delta" framework for estimation of the gear correction (method calibration) factors. The method calibration factor was then applied to the BT dataset prior to any domain level estimations (Ault et al. 2020). For more details, see Grove et al. 2022 Appendix I.

Analyses

Domain-wide density and variance estimates were calculated using standard stratified random design-based principles (Smith et al. 2011). Metric estimates and associated variance were computed in each strata and multiplied by the stratum weighting factor. Area weighted stratum density and variance was then summed across all strata for the final domain-wide estimate. All density data are presented as reef visual census stationary point count (RVC-SPC) estimates (number per 178 m^2, ± 1). For more details, see Grove et al. 2022 Appendix II. Three different time series estimates of density are presented in this working paper and made available as complete datasets; 1) population-level estimates include all sizes of stoplight

parrotfish surveyed, 2) pre-exploited density estimates filters sizes to only include those that are less than minimum size limit (9 inches FL), set by management, and 3) exploited density estimates filters sizes to include all sizes greater than or equal to 9 inches FL (or, 23cm FL).

U.S. Caribbean

Table 1A.- Hard-bottom habitat code abbreviations and habitat names where reef fish visual surveys were collected in the U.S. Caribbean coral reef ecosystem. Shaded habitats (rows) were combined for analyses: AGRF & BDRK (dark gray) and PVMT & SCR (light gray).

Habitat Code	Habitat Name
AGRF	Aggregate Reef
BDRK	Bedrock
PTRF	Patch Reef (Aggregate and Individual)
PVMT	Pavement
SCR	Scattered Coral and Rock

Table 1B.- Depth code abbreviations, depth name, and depth range (m) where reef fish visual surveys were collected in the U.S. Caribbean coral reef ecosystem.

Depth Code	Depth Name	Range (m)
SHLW	Shallow	0 to < 12m
DEEP	Deep	≥ 12 to 30m

Table 2.- Percent of U.S. Caribbean sampling domain area (i.e., Puerto Rico, St. Thomas/St. John, and St. Croix) within each analysis strata (strata code).

Strata Code	Puerto Rico	St. Thomas/John	St. Croix
AGRFSHLW	8.4	11.8	4.3
AGRFDEEP	9.3	25.2	3.8
PTRFSHLW	7.3	0.9	1.9
PTRFDEEP	4.4	3.4	1.2
PVMTSHLW	24.6	13.2	25.4
PVMTDEEP	46	45.5	63.4

St. Croix

Table 3.- Number of reef fish visual survey sites (left column) and number of stoplight parrotfish (*Sparisoma viride*) length observations (right column) by hard-bottom strata from the reef fish visual surveys in the St. Croix coral reef ecosystem (2001–2021). Empty cells indicate zero samples (left column) or no observations (right column).

	0 - 12 meters					12 - 30 meters						
Year	Aggregate	Bedrock	Patch	Pavement	Coral/Rock	Aggregate	Bedrock	Patch	Pavement	Coral/Rock	Site Total	Length Total
2001	12		14	35	12			9	2	2	**86**	**376**
2002	7		15	21	10			8	14	1	**76**	**318**
2003	38	6	13	72	7	3		3	21	2	**165**	**455**
2004	23	4	14	46	9	2		4	7	5	**114**	**413**
2005	43	4	17	46	11	9	1	7	25	7	**170**	**485**
2006	34	2	18	48	20	6		13	38	6	**185**	**400**
2007	13	1	14	23	5	1		7	24	2	**90**	**230**
2008	16		27	62	3	5		12	35	7	**167**	**344**
2009	15		23	61	9	4		8	32	5	**157**	**277**
2010	17		15	38	5	3		2	33	5	**118**	**344**
2011	3			19					17	2	**41**	**86**

2012	15	5	13	64	6	35	19	79	26	**262**	**492**
2015	15	4	14	47	17	33	19	75	15	**239**	**444**
2017	11	1	14	33	5	46	19	47	5	**181**	**810**
2019	29	8	32	46	10	74	35	72	8	**314**	**1116**
2021	14		19	19	2	43	12	35	4	**148**	**694**

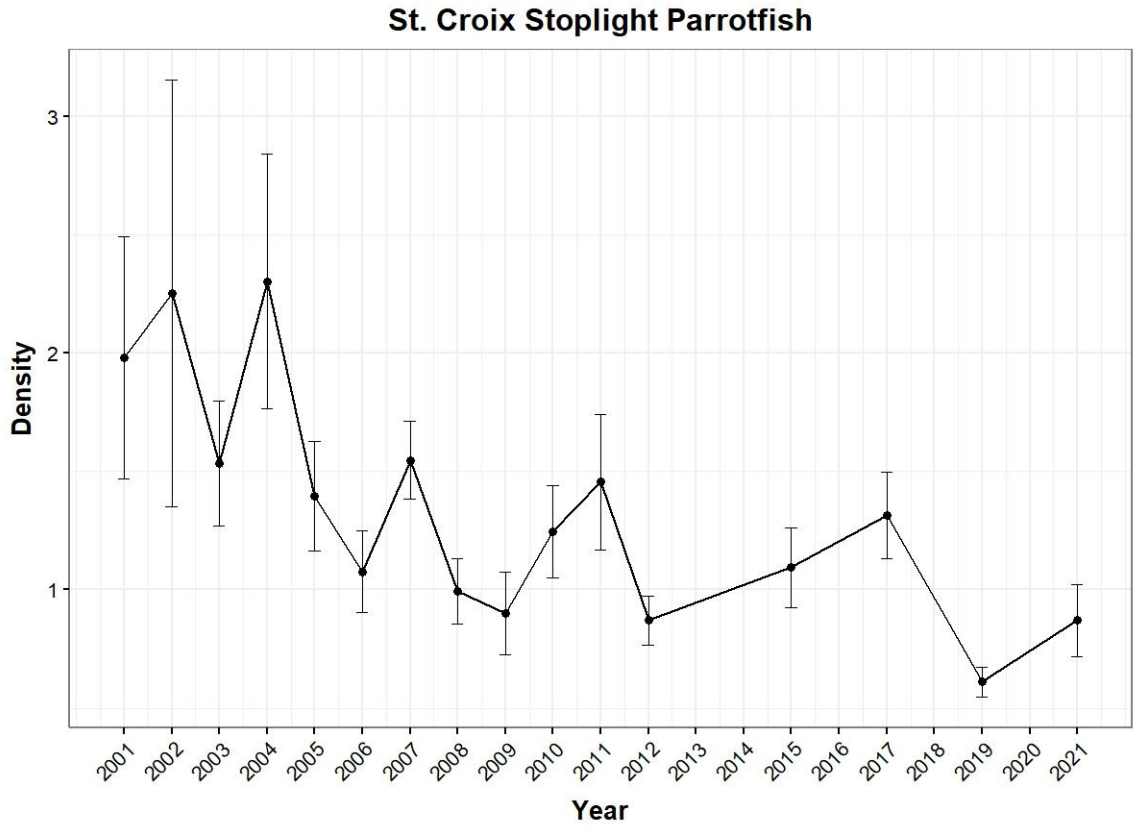


Figure 1.- Time series (2001–2021) of stoplight parrotfish (*Sparisoma viride*) mean population density (number per 178 m^2, $\pm$ SE) from the reef fish visual surveys in the St. Croix coral reef ecosystem.

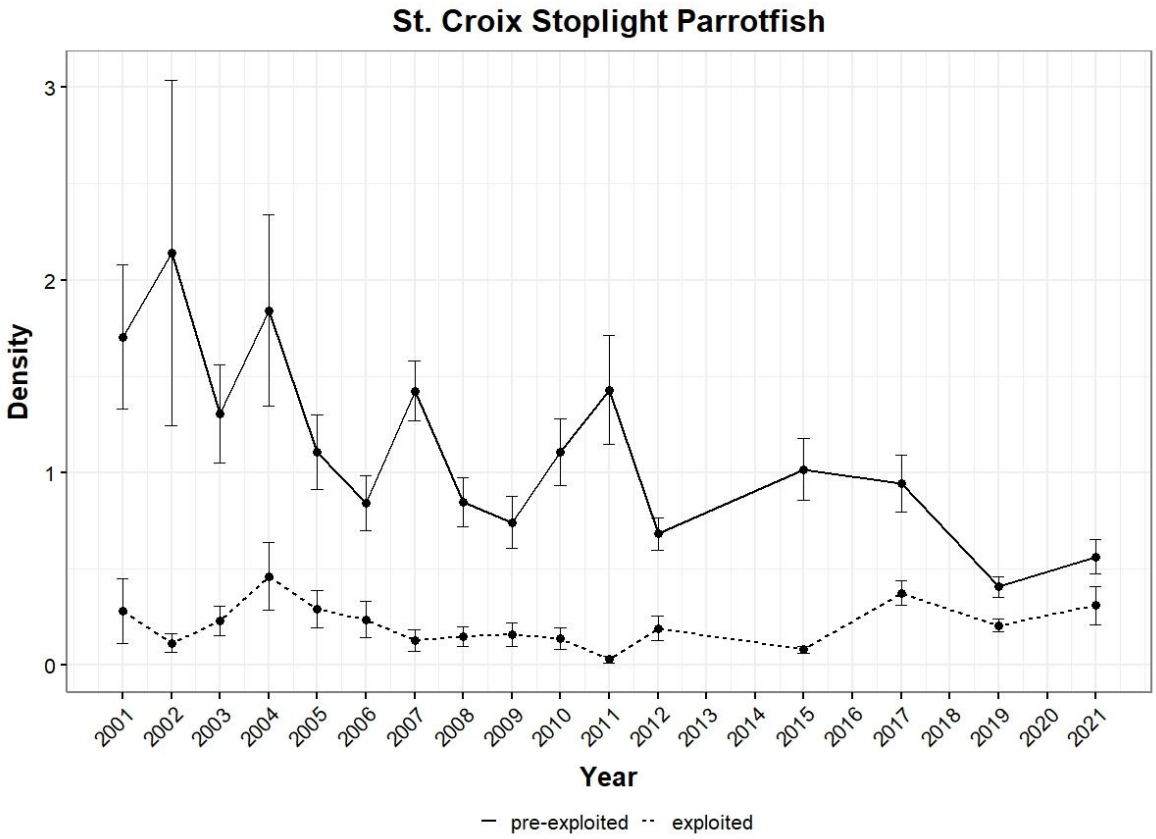


Figure 2.- Time series (2001–2021) of pre-exploited (solid line, < 25 cm) and exploited (dotted line, ≥ 25 cm) stoplight parrotfish mean population density (number per 178 m^2, ± SE) from the reef fish visual surveys in the St. Croix coral reef ecosystem.

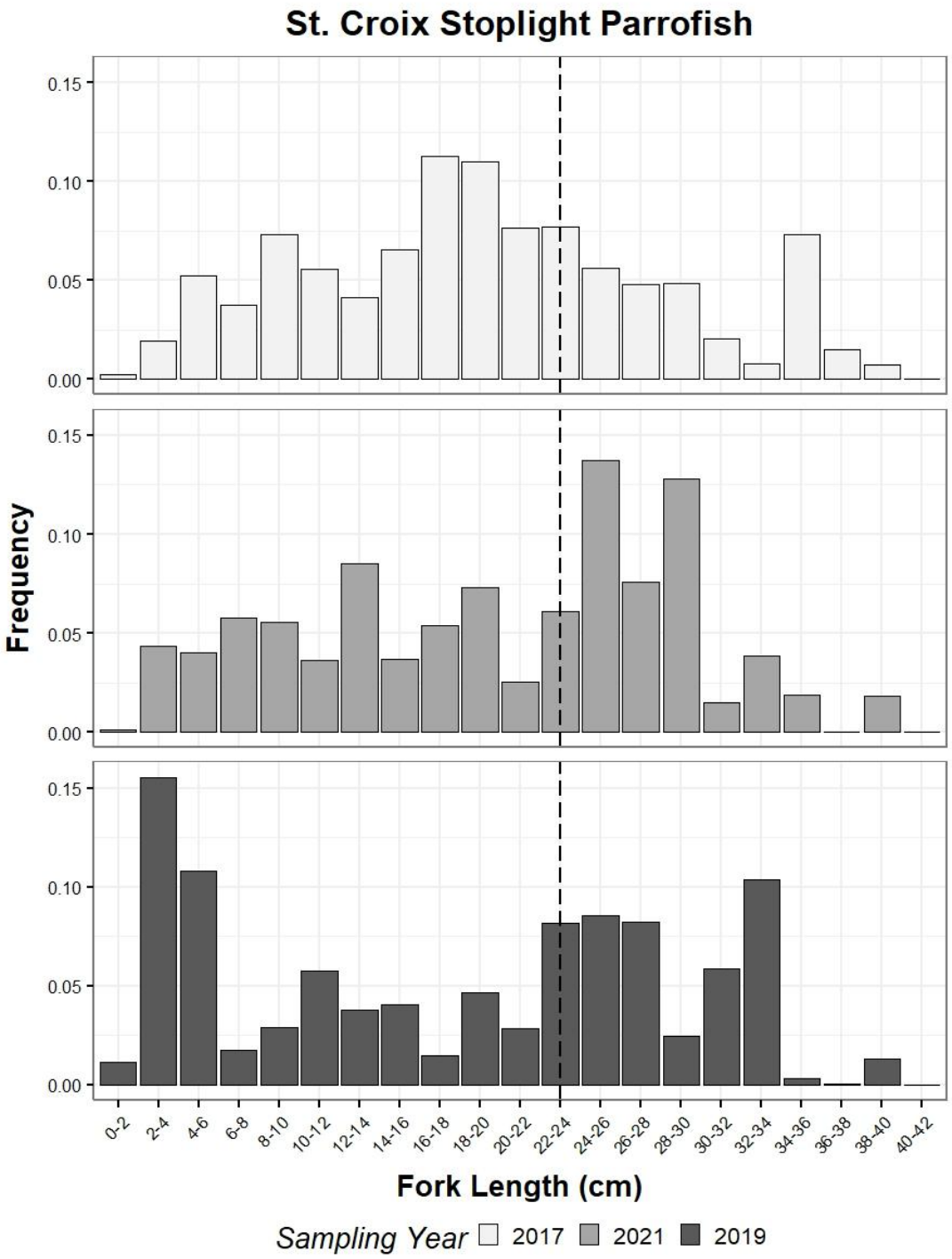


Figure 3.- Stoplight parrotfish population size-frequency distribution at 2-cm bins from the 2017 - 2021 NCRMP RVC-SPC St. Croix surveys. Vertical dashed line is length at capture (23.0 cm fork length).

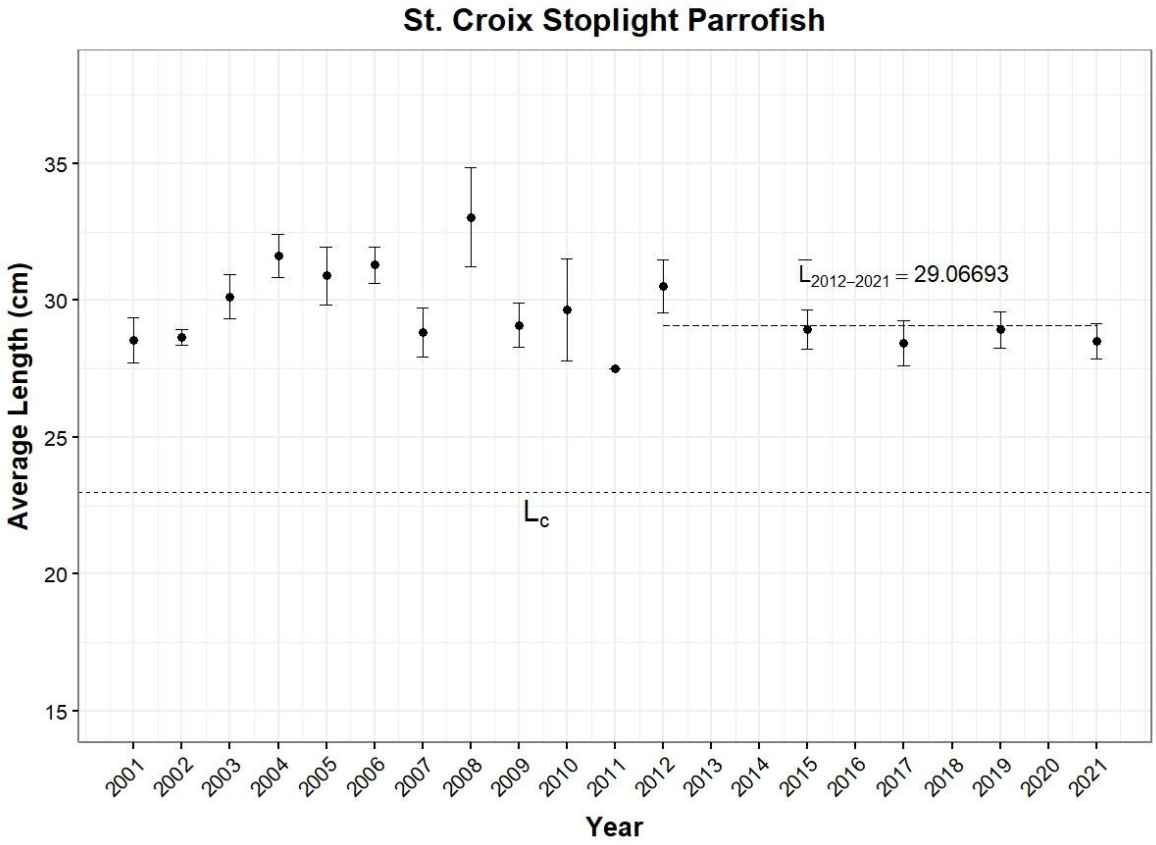


Figure 4.- Time series (2001–2021) of exploited phase (L_c >= 23 cm) stoplight parrotfish average size (cm $\pm$ SE) from the reef fish visual surveys in the St. Croix coral reef ecosystem.

References

Ault, JS, GA Diaz, SG Smith, J Luo, and JE Serafy. 1999. An efficient sampling survey design to estimate pink shrimp population abundance in Biscayne Bay, Florida. North American Journal of Fisheries Management 19: 696–712.

Ault, J.S., Smith, S.G., Richards, B.L., Yau, A.J., Langseth, B.J., O'Malley, J.M., Boggs, C.H., Seki, M.P., DiNardo. G.T. 2018. Towards fishery-independent biomass estimation for Hawaiian Islands deepwater snappers. Fisheries Research 208: 321-328.

Ault, JS, SG Smith, MW Johnson, and LJ Grove. 2020. Gear calibration factors for U.S. Caribbean coral reef fish visual surveys. Final Technical Report on NOAA Grant No. NA15OAR4320064 SEFSC CREU. 56 p.

Bryan, DR, AJ Atkinson, JS Ault, ME Brandt, JA Bohnsack, MW Feeley, ME Patterson, BI Ruttenberg, SG Smith, and BD Witcher. 2013. A cooperative multi-agency reef fish monitoring protocol for the U.S. Virgin Islands coral reef ecosystem. Natural Resource Report NPS/SFCN/NRR—2013/672. National Park Service, Fort Collins, Colorado.

Bryan, DR, SG Smith, JS Ault, MW Feeley, and CW Menza. 2016. Feasibility of a region-wide probability survey for coral reef fish in Puerto Rico and the U.S. Virgin Islands. Marine and Coastal Fisheries 8(1): 135–146.

Cochran, WG. 1977. Sampling Techniques. Third edition, John Wiley and Sons, New York.

Grove, LJW, J Blondeau, and JS Ault. 2022. Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Queen Triggerfish in the U.S. Caribbean. SEDAR80-WP-08. SEDAR, North Charleston, SC. 32 pp.

Grove, LJW, J Blondeau, and JS Ault. 2021. National Coral Reef Monitoring Program's Reef fish Visual Census Metadata for the U.S. Caribbean. SEDAR80-WP-02. SEDAR80, North Charleston, SC. 55 p.

Law, AM. 2007. Simulation modeling and analysis. Fourth edition, McGraw Hill, New York.

Lohr, SL. 2010. Sampling: Design and Analysis. Second edition, Brooks/Cole, Boston.

Robson, DS. 1966. Estimation of the relative fishing power of individual ships. ICNAF Research Bulletin 3: 5–15.

Smith, SG, JS Ault, JA Bohnsack, DE Harper, J Luo, and DB McClellan. 2011. Multispecies survey design for assessing reef-fish stocks, spatially explicit management performance, and ecosystem condition. Fisheries Research 109:25–41.