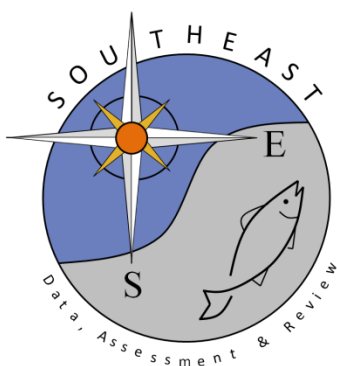Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Yellowtail Snapper in the Puerto Rico

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SEDAR84-DW-15

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Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Yellowtail Snapper in the Puerto Rico

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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: Yellowtail Snapper

Year Range: 2001 to 2021

Geographic Range: Puerto Rico
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:
Puerto Rico:
YTS_dens_NCRMP_0121_20240112.xlsx
YTS_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 Yellowtail Snapper Assessment for Puerto Rico.

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 in Puerto Rico 2021 was 234.

Calibration

Two levels of calibration were needed to incorporate the historical transect data. First, we analyzed the regionally restricted transect data from 2001 to 2013 in La Parguera in Puerto Rico. 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 (2016–2021). 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, $\pm$ SE). 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 yellowtail snapper surveyed, 2) pre-exploited density estimates filters sizes to only include those that are less than minimum size limit (12 inches TL), set by management, in federal waters and 3) exploited density estimates filters sizes to include all sizes greater than or equal to 12 inches TL (or, 25cm 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

Puerto Rico

Table 3.- Number of reef fish visual survey sites (left column) and number of yellowtail snapper (*Ocyurus chrysurus*) length observations (right column) by hard-bottom strata from the reef fish visual surveys in the Puerto Rico coral reef ecosystem (2001–2021). Empty cells indicate zero samples (left column) or no observations (right column).

Year	0 - 12 meters					12 - 30 meters					Site Total	Length Total
	Aggregate	Bedrock	Patch	Pavement	Coral/Rock	Aggregate	Bedrock	Patch	Pavement	Coral/Rock		
2001	15		6	5		2		5	3		**36**	**42**
2002	21		11	9	1	5		8	15	1	**71**	**93**
2003	18		16	3	2	8		15	20		**82**	**90**
2004	16		12	7	5	17		13	11	2	**83**	**66**
2005	17		7	5	1	20		14	24	7	**95**	**72**
2006	10		5	10		42		9	21	3	**100**	**155**
2007	21		18	28	1	46		14	36	9	**173**	**288**
2008	7		4	8		30		7	25	5	**86**	**92**
2009	18		12	8		42		5	24	7	**116**	**244**
2010	13		1	14		12		10	16	8	**74**	**116**
2011	6		3	9	1	3		5	19	5	**51**	**138**
2012	1		1	8		11		2	12		**35**	**165**

| Year												
2014	31	14	19	36	6	42	4	20	37	14	**223**	**522**
2016	24	7	14	38	8	48	2	27	57	15	**240**	**670**
2019	38	10	16	28	9	42	1	16	27	16	**203**	**872**
2021	29	8	14	46	4	48	2	28	43	12	**234**	**1238**
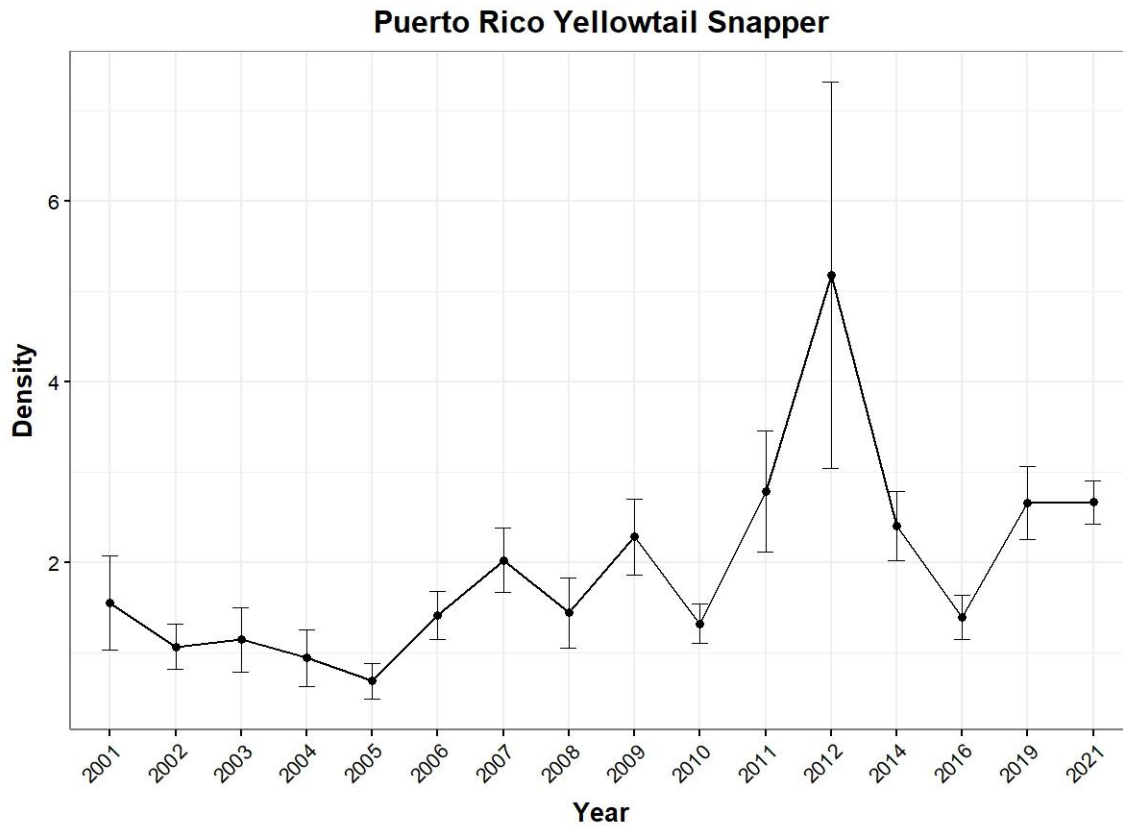
Figure 1.- Time series (2001–2021) of yellowtail snapper (*Ocyurus chrysurus*) mean population density (number per 178 m², ± SE) from the reef fish visual surveys in the Puerto Rico coral reef ecosystem.
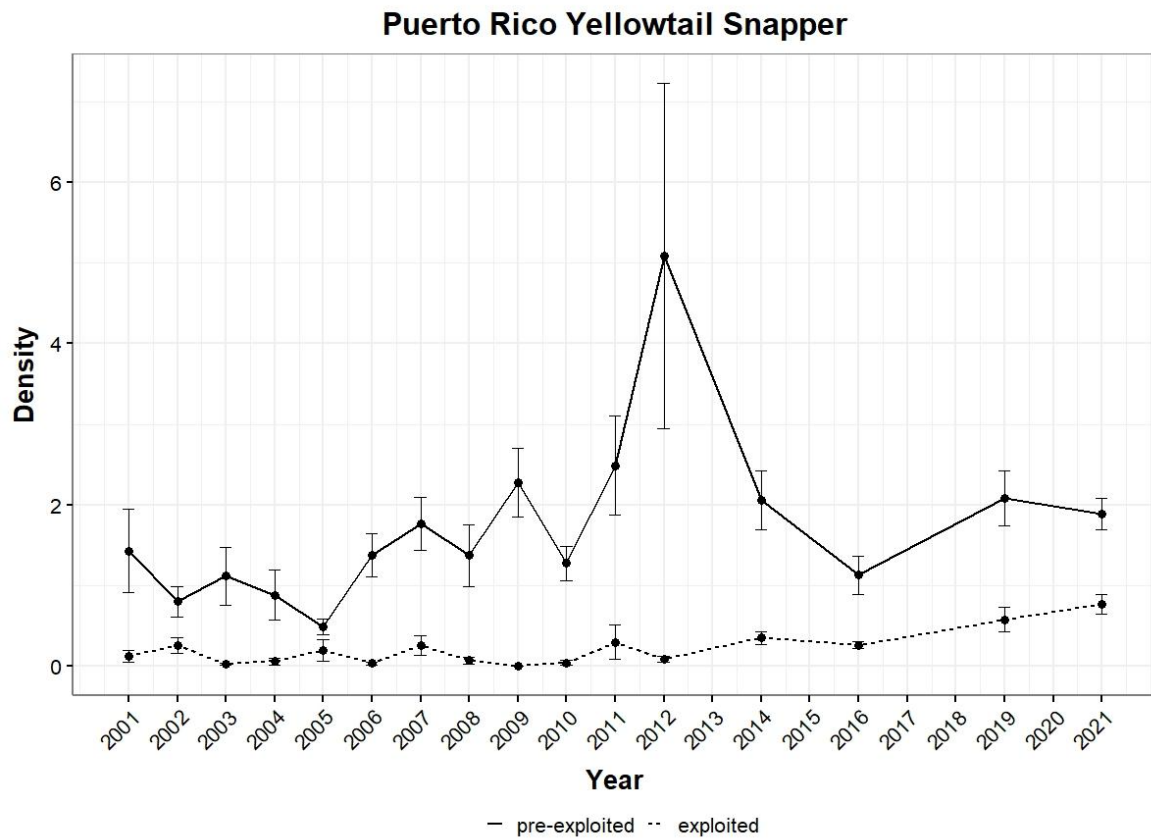
Figure 2.- Time series (2001–2021) of pre-exploited (solid line, < 25 cm) and exploited (dotted line, ≥ 25 cm) yellowtail snapper mean population density (number per 178 m², ± SE) from the reef fish visual surveys in the Puerto Rico coral reef ecosystem.

Puerto Rico Yellowtail Snapper
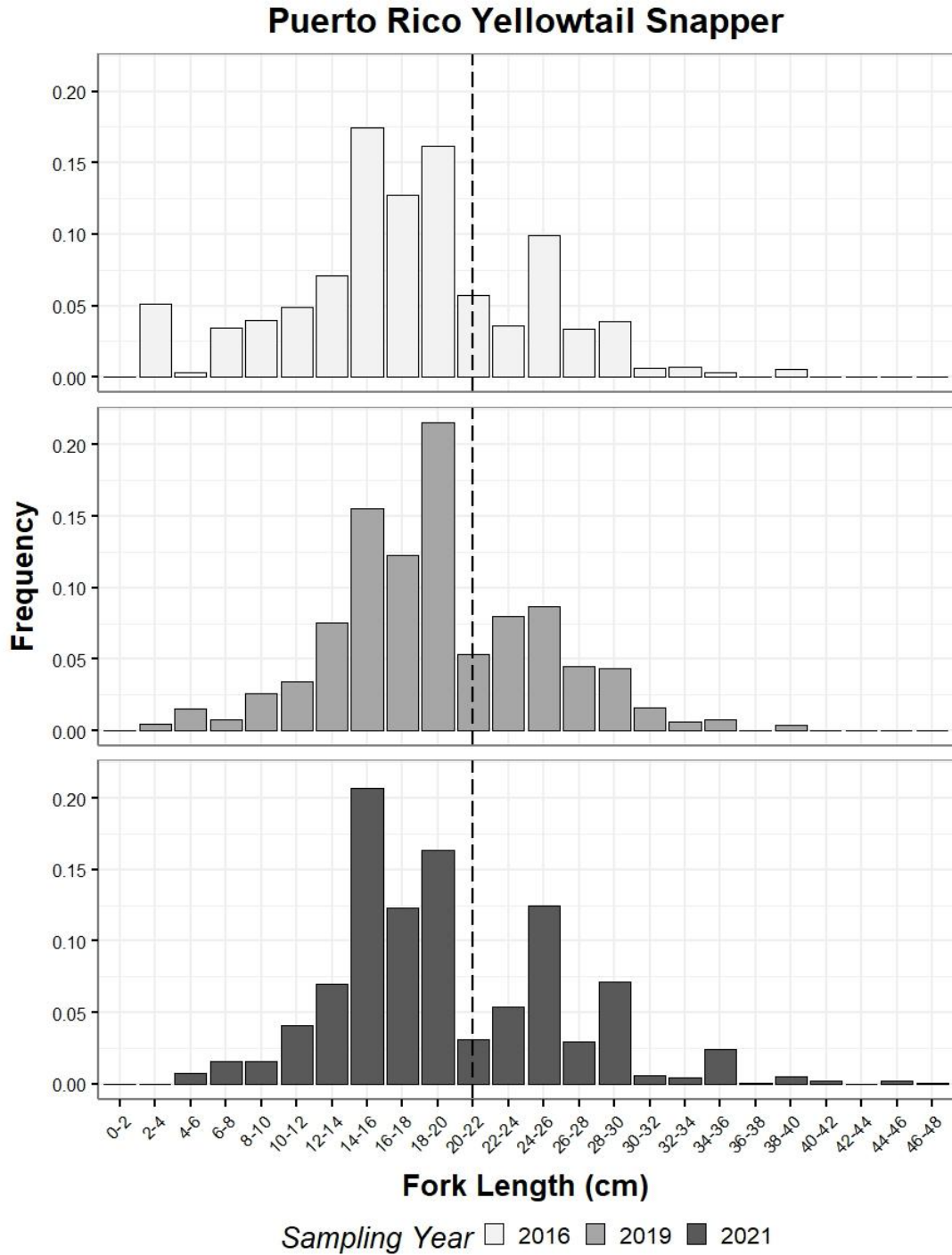
Figure 3.- Yellowtail snapper population size-frequency distribution at 2-cm bins from the 2016 - 2021 NCRMP RVC-SPC Puerto Rico surveys. Vertical dashed line is length at capture (25.0 cm fork length).
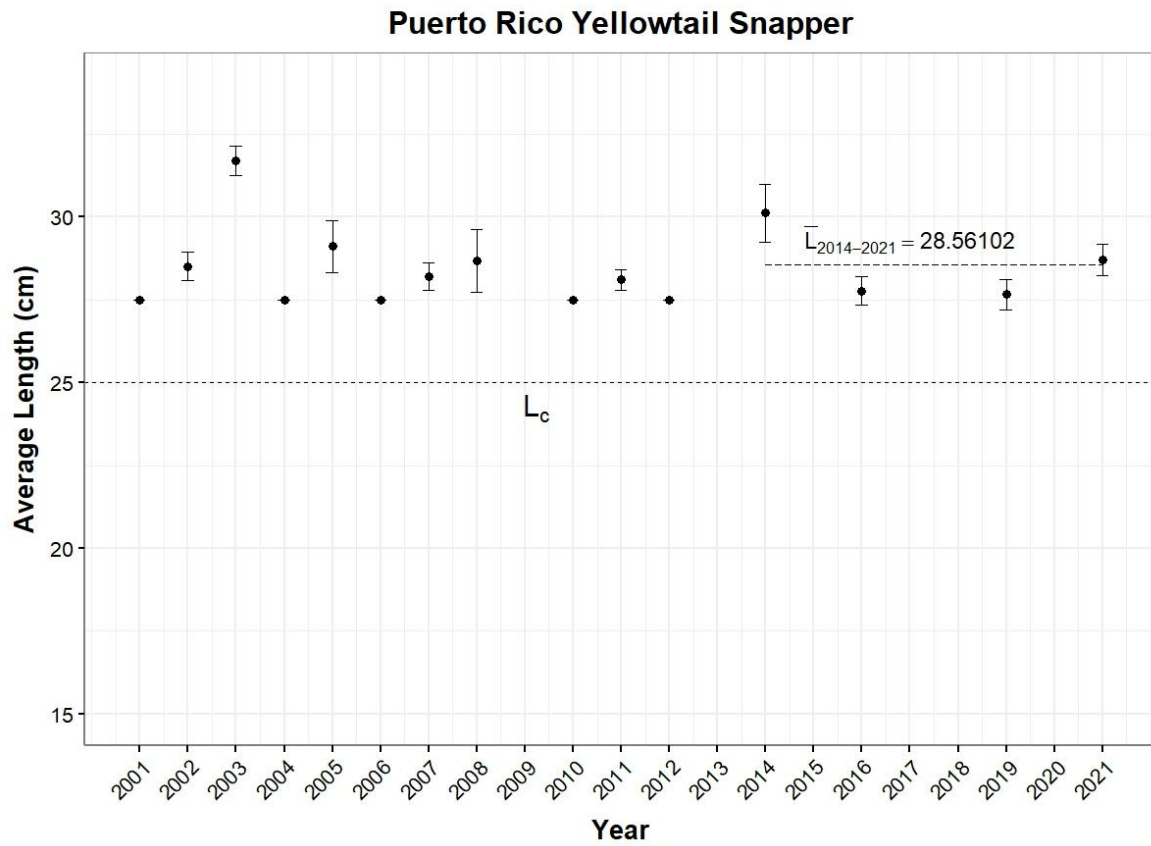
Figure 4.- Time series (2001–2021) of exploited phase ($L_c >= 25$ cm) yellowtail snapper average size (cm $\pm$ SE) from the reef fish visual surveys in the Puerto Rico coral reef ecosystem. Long dashed line segment represents the mean of island-wide (2014-2021) average lengths.

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