SEDAR

Southeast Data, Assessment, and Review

SEDAR 84

US Caribbean Yellowtail Snapper – St. Thomas/St. John

SECTION II: Data Workshop Report

April 2024

SEDAR
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1 INTRODUCTION

1.1 WORKSHOP TIME AND PLACE

The SEDAR 84 Data Workshop was held January 23-25, 2024, in San Juan, Puerto Rico. In addition to the in-person workshop, a series for webinars were held before (July and December 2023) the meeting.

1.2 TERMS OF REFERNCE

Data Workshop Terms of Reference:

1. Develop a stock assessment model for Puerto Rico and St. Thomas/St. John Yellowtail Snapper and St. Croix Stoplight Parrotfish stocks using an appropriate approach.
2. Review available data inputs and provide tables and figures including, but not limited to:
   a. Commercial and recreational catches and/or discards.
   b. Length/age composition data
   c. Life history and ecological information
   d. Indices of abundance
3. Construct a stock assessment model that is appropriate for the available data.
4. Provide recommendations for future research in areas such as sampling, fishery monitoring, and stock assessment. Include specific guidance on research goals, data to be collected, and how the research will inform stock assessment.

5. Prepare the Data Workshop report providing complete documentation of workshop actions and decisions in accordance with project schedule deadlines (Section II of the SEDAR assessment report).

1.3 LIST OF PARTICIPANTS

Data Workshop Participants

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1.4 LIST OF DATA WORKSHOP WORKING PAPERS & REFERNCE DOCUMENTS

Document #	Title	Authors	Date Submitted
Documents Prepared for the Data Workshop			
SEDAR84-DW-01	Radiocarbon Age Validation for Caribbean Parrotfishes	Jesus Rivera Hernández and Virginia Shervette	9 January 2024 Updated: 5 March 2024
SEDAR84-DW-02	SEDAR 84 Commercial fishery landings of Yellowtail Snapper (*Ocyurus chrysurus*) in St. Thomas and St. John, US Caribbean, 2012-2022	Stephanie Martínez Rivera, Kimberley Johnson, and M. Refik Orhun	18 January 2024 Updated: 21 February 2024
SEDAR84-DW-03	SEDAR 84 Commercial fishery landings of Stoplight Parrotfish (*Sparisoma viride*) in St. Croix, US Caribbean, 2012-2022	Stephanie Martínez Rivera, Kim Johnson, and M. Refik Orhun	18 January 2024 Updated: 21 February 2024

SEDAR84-DW-04	Analysis of SEAMAP-C hook and line survey data for yellowtail snapper in Puerto Rico (1992-2020)	Walter Ingram, Refik Orhun, and Carlos M. Zayas Santiago	19 January 2024
SEDAR84-DW-05	Summary of Management Actions for Stoplight Parrotfish (*Sparisoma viride*) from St. Croix (1985 - 2021) as Documented within the Management History Database	G. Malone	22 January 2024 Updated: 21 February 2024
SEDAR84-DW-06	Summary of Management Actions for Yellowtail Snapper (*Ocyurus chrysurus*) from Puerto Rico and St. Thomas/St. John (1985 - 2021) as Documented within the Management History Database	G. Malone	22 January 2024 Updated: 21 February 2024
SEDAR84-DW-07	Addressing Critical Life History Gaps for U.S. Caribbean Yellowtail Snapper: Bomb radiocarbon of age estimation method and a summary of the regional demographic patterns for size, age, and growth	Virginia Shervette, Jesus Rivera Hernandez, Sarah Zajovits	22 January 2024 Updated: 15 February 2024
SEDAR84-DW-08	U.S. Caribbean Yellowtail Snapper Population Demographics, Growth, and Reproductive Biology: Addressing Critical Life History Gaps	Virginia Shervette, Jesus Rivera Hernandez, Noemi Pena Alvarado	18 February 2024
SEDAR84-DW-09	SEDAR 84 Trip Interview Program (TIP) Size Composition Analysis of Yellowtail Snapper (*Ocyurus chrysurus*) in Puerto Rico, U.S. Caribbean, 1983-2022	Katherine Godwin, Adyan Rios, Kyle Dettloff	21 February 2024
SEDAR84-DW-10	SEDAR 84 Trip Interview Program (TIP) Size Composition Analysis of Yellowtail Snapper (*Ocyurus chrysurus*) in St. Thomas/St. John, U.S. Caribbean, 1983-2022	Katherine Godwin, Adyan Rios, Kyle Dettloff	21 February 2024
SEDAR84-DW-11	SEDAR 84 Trip Interview Program (TIP) Size Composition Analysis of Stoplight Parrotfish (*Sparisoma viride*) in St. Croix, U.S. Caribbean, 1983-2022	Katherine Godwin, Adyan Rios, Kyle Dettloff	21 February 2024
SEDAR84-DW-12	SEDAR 84 Commercial fishery landings of Yellowtail Snapper	Stephanie Martínez Rivera, Kimberley	21 February 2024

	(Ocyurus chrysurus) in Puerto Rico, US Caribbean, 2012-2022	Johnson, and M. Refik Orhun	
SEDAR84-DW-13	Length-Frequency Snapshot of Yellowtail Snapper from Image Analysis in Puerto Rico	Derek Soto, Alejandro Carrera Montalvo, Todd Gedamke	22 February 2024
SEDAR84-DW-14	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	16 February 2024
SEDAR84-DW-15	Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Yellowtail Snapper in the Puerto Rico	Laura Jay W. Grove, Jeremiah Blondeau, and Jerald S. Ault	16 February 2024
SEDAR84-DW-16	Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Yellowtail Snapper in St. Thomas/John	Laura Jay W. Grove, Jeremiah Blondeau, and Jerald S. Ault	16 February 2024

	Reference Documents	
SEDAR84-RD01	Selectividad Pesquera del Buche (Seno) en Chinchorros de Playa con mallas de 2.5, 2.0 y 1.0 pulgadas, a lo largo de la costa Oeste y Noreste de la Isla de Puerto Rico	Edgardo Ojeda Serrano, Omayra Hernandez Vak, and Samuel Garcia Vazquez
SEDAR84-RD02	Monitoring of Mesophotic Habitats and Associated Benthic and Fish/Shellfish Communities from Abrir la Sierra, Bajo de Sico, Tourmaline, Isla Desecheo, El Seco and Boya 4, 2018-20 Survey	Jorge R, Garcia-Sais, Stacey Williams, Evan Tuohy, Jorge Sabater-Clavell and Milton Carlo
SEDAR84-RD03	Population Size, Growth, Mortality and Movement Patterns of Yellowtail Snapper (*Ocyurus chrysurus*) in the U.S. Virgin Islands Determined Through a Multi institutional Collaboration	St. Thomas Fishermen's Association

SEDAR84-RD04	S8-DW-09: An Update on the Reported Landings, Expansion Factors and Expanded Landings for the Commercial Fisheries of the United States Virgin Islands (with Emphasis on Spiny Lobster and the Snapper Complex)	Mónica Valle-Esquivel and Guillermo Díaz
SEDAR84-RD05	SEDAR68-DW-13: Marine Recreational Information Program Metadata for the Atlantic, Gulf of Mexico, and Caribbean regions	Vivian M. Matter and Matthew A. Nuttall
SEDAR84-RD06	Nearshore habitats as nursery grounds for recreationally important fishes, St. Croix, U S. Virgin Islands	Ivan Mateo
SEDAR84-RD07	Seasonal Patterns of Juvenile Fish Abundance in Seagrass Meadows in Teague Bay Bank Barrier Reef Lagoon, St. Croix, U.S. Virgin Islands	Ivan Mateo and William J. Tobias
SEDAR84-RD08	The Distribution of Herbivorous Coral Reef Fishes within Fore-reef Habitats: the Role of Depth, Light and Rugosity	Michael Nemeth and Richard Appeldoorn
SEDAR84-RD09	The Use of Vertical Distribution Data in the Identification of Potential Spawning Sites and Dispersal Pathways for Parrotfish (Genera *Sparisoma* and *Scarus*) within Territorial Waters of the U.S. Virgin Islands	Kristen A. Ewen
SEDAR84-RD10	Evaluating the impact of invasive seagrass *Halophila stipulacea* on settlement, survival, and condition factor of juvenile yellowtail snapper, *Ocyurus chrysurus*, in St. Thomas, USVI	Sophia Victoria Costa

2 Life History

2.1 Overview

Table 2.1 provides a summary of parameters, definitions, nomenclature, and units for the life history parameters included within this report. Yellowtail Snapper life history data were provided in Shervette et al. (2024b).

2.2 Stock Definition and Description

The Yellowtail Snapper stock was defined by the CFMC Island-based Fishery Management Plan. The St. Thomas/St. John (SSTJ) stock is defined as the population within the U.S. Virgin Island's territorial waters; i.e., the island platforms of St. Thomas and St. John and the adjacent EEZ.

2.3 Meristic & Conversion factors

The length-length and length-weight relationship equations with parameters for Yellowtail Snappers collected 2013-2023 for the combined sexes (Shervette et al. 2024) are shown in Table 2.2.

2.4 Natural Mortality

The DW panel recommended that the assessment team explore various methods of estimating natural mortality (M) based on life history parameters. This may include methods that apply one point estimate to the entire age range of the fish, such as Hewitt and Hoenig (2005) or Then et al. (2015). Additional, and perhaps preferred methods, include using the methods of Charnov et al. (2013) which features age-varying natural mortality as a function of size of the fish. The age specific M may be calculated using the von Bertalanffy population growth parameters, L_∞ and K, and the predicted fork length at the mid-point of each age. The mid-point of each year class can be used to represent the mean size of the fish in a calendar year.

2.5 Reproduction

Yellowtail Snapper reproductive data were provided in Shervette et al. (2024). The overall male to female sex ratio was estimated to be 1:1.04. A total of 892 mature female and 856 mature male Yellowtail Snapper had reproductive phase information. The months with the greatest proportion of spawning capable females were March and April. Males with testes in the spawning capable phase occurred in all months of the year. Yellowtail snapper from the U.S. Caribbean exhibit year-round spawning with peak spawning from March-April.

A total of 454 female Yellowtail Snapper samples were evaluated for maturity and indicators of active spawning to use in estimating spawning fraction, spawning interval, and spawning frequency. Female Yellowtail Snapper spawning fraction overall was 0.13; overall spawning interval, defined as the number of days between spawning events in a female, was 7 days, indicating that a female spawns approximately 49 times over the estimated ~365-day spawning season.

When examining trends in spawning fraction, interval and frequency by length, spawning frequency increased with increasing length class. Females in the smallest fork length (FL) class had an estimated spawning frequency of six times over the spawning season, while females in the largest FL class had an estimated spawning frequency of 69 times over the spawning season. Similar increases in spawning frequency occurred when examined by age classes. Females in the oldest age class (13+ y) spawned approximately 85 times a year.

A total of 949 U.S. Caribbean Yellowtail Snapper samples with length, age, and sexual maturity information were used to obtain estimates of length and age at 50, 90, and 95% maturity (Shervette et al. 2024). Results are shown in Tables 2.3a (length at maturity) and 2.3b (age at maturity).

2.6 Age and Growth

Table 2.4 provides the results of fitting the von Bertalanffy (VB) growth parameters for various length variables (Shervette et al. 2024). Figure 2.1 shows the fishery-dependent (FD) and fishery independent length-at-age data and the predicted overall VB growth curve. A summary list of available life history inputs is provided in Table 2.5; from Shervette et al. (2024).

2.7 SEDAR Panel Discussions on Use of Life History Data for Assessment Analyses

Table 2.6 shows the life history parameters used in SEDAR 46 and those provided in Shervette et al. (2024).

Issue 1: Are sufficient life history data available?

Options:

- Use recent and regionally relevant life history data made available in SEDAR working papers.
- Use previously established life history parameters obtained from literature reviews.

Decision:

- Tentatively accept the life history parameters presented. The life history team will work with the assessment team to finalize the working paper.
- Aggregate the maturity data from USCA and SEAMAP-C.

Rationale:

- Both datasets show a reproduction peak from March to June, suggesting that the data can be combined.
- We are tentatively accepting the life history parameters provided. Providing the submission of the working paper, the team will review the results.

2.8 Life History Tables

Table 2.1 Summary of parameters, definitions, nomenclature and units for model parameters included within this report.

Parameter	Definition	Management Strategy evaluation Stock Input	Real world data input	Units
$L\infty$	Asymptotic length	Linf	vbLinf	mm FL
K	Brody growth coefficient	K	vbK	year $^{-1}$
$t0$	Theoretical age at length 0	t0	vbt0	years
α	Weight-length scalar	a	wla	dimensionless
β	Weight-length power	b	wlb	dimensionless
$W\infty$	Asymptotic weight	--	--	g
Lm	Length at maturity	L50	L50	mm FL
tm	Age at maturity	--	--	years
$t\lambda$	Maximum age	Max. age	Max. Age	years
$L\lambda$	Mean length of Max age	--	--	mm FL
M	Natural mortality	M	Mort	year $^{-1}$
$S\lambda$	Survivorship to Max age	--	--	dimensionless

Table 2.2 Regression equations for U.S. Caribbean Yellowtail Snapper length-length and length-weight relationship. n=number of fish.

Variables				
x	y	n	Equation	R^2
SL	FL	1538	$y = 1.1156x + 7.9985$	0.9974
SL	TL	1520	$y = 1.4435x - 69857$	0.9917
SL	Wt	1532	$y = 0.00008x^{2.7772}$	0.9842
FL	SL	1538	$y = 0.8694x – 6.4783$	0.9974
FL	TL	1530	$y = 1.2937x – 17.299$	0.9944
FL	Wt	1542	$y = 0.00004x^{2.8642}$	0.9882
TL	SL	1520	$y = 0.687x – 6.92$	0.9917
TL	FL	1530	$y = 0.7686x + 14.945$	0.9944
TL	Wt	1524	$y = 0.00005x^{2.7185}$	0.9839

Table 2.3a,b Caribbean Yellowtail Snapper a) lengths (mm FL) and b) ages (years) as sexual maturity. Values in parentheses are 95% prediction intervals.

a)

Variable	Sexes Combined	Female	Male
Number of samples	1876	922	954
L50	194 (189 - 199)	207 (202 - 211)	182 (174 - 190)
L90	238 (233 - 242)	244 (238 - 249)	229 (221 - 235)
L95	253 (246 - 258)	256 (248 - 264)	245 (235 - 253)

b)

Variable	Sexes Combined	Female	Male
Number of samples	949	482	464
A50	1.5 (1.4 - 1.6)	1.5 (1.3 - 1.9)	1.6 (1.4 - 1.7)
A90	2.2 (2.0 - 2.3)	2.1 (1.9 - 2.3)	2.3 (2.0 - 2.6)
A95	2.4 (2.2 - 2.6)	2.3 (2.0 - 2.6)	2.5 (2.2 - 2.9)

Table. 2.4 U.S. Caribbean Yellowtail Snapper VBGF results. Parameter estimates are provided using FL and TL. Also provided are computed parameter estimates using to= -0.96 for comparison with the Caribbean study by Manooch and Drennon (1987) and using to= -1.93 for comparison with growth parameter estimates for Florida Yellowtail Snapper as reported in SEDAR 64.

Model	Loo(mm)	K	to	R2
FLmm	508 (479-547)	0.12 (0.10-0.14)	-2.73 (-3.29- -2.26)	0.70
TLmm	653 {635-648)	0.11 (0.10-0.13)	-2.67 (-3.18- -2.18)	0.70
FL mm to-fixed Carib	424 (415-434)	0.23 (0.22-0.24)	-0.96	0.68
FL mm to-fixed Fla	467 (454-481)	0.16 (0.15-0.18)	-1.93	0.70

Table 2.5 Summary of Yellowtail Snapper studies focused on estimating growth parameters. * indicates that a fixed t_0 value of -0.96 was used so that other growth parameters results from the Shervette et al. 2024 study could be compared to results from Manooch and Drennon (1987) ** indicates that a fixed t_0 value of -1,93 was used so that other growth parameter results from the Shervette et al. 2024 study could compared to results from Florida (SEDAR 64/Stevens et al. 2019).

Study Area Study Citation	Time period (n) sample source	Size range (mean) mm	Age range (mean) y	$L_\infty/K/t_0$ Opaque zone formation	Comments
U.S. Caribbean Current study	2013-2023 (1554) FI + FD	FL: 28-572 (291)	0-26 (5)	FL: 508/0.12/-2.73 424/0.23/-0.96* 467/0.16/-1.93** Mar-Jun	Age validation via radiocarbon
U.S. Caribbean Manooch and Drennon 1987	1983-1984 (468) FD	FL: 140-590	1-17	FL: 503/0.14/-0.96 Mar-May	Used back-calculated size-at-age
Cuba Claro 1983	1972-1974 (3593) FD	FL: 160-460	0-6	FL: 681/0.16/-0.85 Mar-Jun	No validation of age estimates; otoliths read whole
FL east coast Allman et al. 2005	1980-2002 (6679) FI + FD	FL: 115-605 (312)	1-17 (4)	FL: 410/0.27/-2.03 Feb-May	
Southeast FL Garcia et al. 2003	1994-1999 (1528) FD	FL: 220-561	1-13	FL: 484/0.17/-1.87 Mar-May	
Southeast FL Johnson 1983	1979-1980 (807) FD	FL: 134-567	1-14	FL: 451/0.28/-0.36	
Florida SEDAR 2020	1980-2017 (42,985) FD (<1% FI)	FL: 100-600*	0-28	FL: 426/0.20/-1.93 Mar-Jun	Growth model accounted for truncated size-at-age

Table 2.6 Life history parameter values for Yellowtail Snapper provided by Shervette et al., 2024 and those used in SEDAR46. Values provided include the mean and CVs. Units are defined in Table 2.1 Asterisks denote values where the CV was not reported in the literature and instead imputed by SEDAR 46 Life History Working Group.

Parameter	Yellowtail Snapper (Shervette et al. 2024)	Yellowtail Snapper (SEDAR 46)
vbLinf	508	502.5 (0.05)
vbK	0.12	0.139 (0.16)
vbt0	-2.73	−0.96 (0.45)
wla	4.0E-05	3.45E-05 (0.05*)
wlb	2.8642	2.859 (0.05*)
W∞		1,870
L50	194	248 (0.15*)
Tm		3.939 (0.25*)
Lλ		471.1
Max. Age	26	19
Mort (M)		0.189 (0.083*)
Sλ		0.0276

2.9 Life History Figures

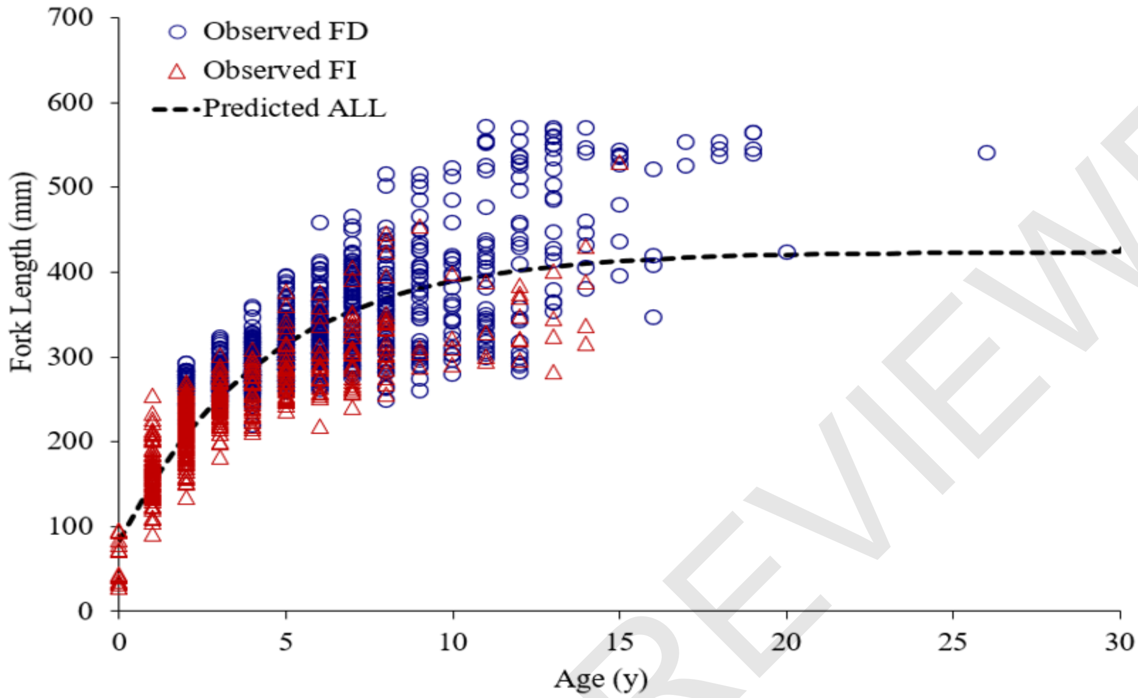

Figure 2.1 U.S. Caribbean Yellowtail Snapper length-at-age for FD and FI samples and van Bertalanffy growth based on t_0 = - 0.93.

3 Commercial Fishery Statistics

3.1 Commercial Landings

3.1.1 Overview

Commercial fishery landings in St. Thomas and St. John (STTJ) were obtained from self-reported fisher logbook data (Caribbean Commercial Logbook, CCL). Reporting of Yellowtail Snapper by species and fishing gear did not begin until July 2011 in the U.S. Virgin Islands, therefore, the first complete year of species-specific data is 2012. Logbook data is recorded by fishing year, which runs from July 1 through June 30 of the following year. However, data in this report are recorded in calendar year. Commercial fishery landings data for Yellowtail Snapper in STTJ were available for the calendar years 2012-2022 (Martinez et al. 2024). Commercial fishery landings in pounds of Yellowtail Snapper in STTJ by year and gear group are provided in Table 3.1.1.

3.1.2 Outlier removal

Outlier removal was conducted by using a mean and standard deviation method. If the landings of Yellowtail Snapper reported on a trip were greater than three standard deviations from the mean (i.e., 99.73% quantile), they were removed from the dataset. Two methods were used to identify outliers: Method 1, the values to define outliers were calculated by gear group across all years (Table 3.1.2), and Method 2, the values to define outliers were calculated by year and gear group (Table 3.1.2). Due to the outlier removal, the yearly commercial landings for Yellowtail Snapper compiled in SEDAR84 may not match landings provided for previous SEDARs.

3.1.3 Snapper Fishery

Beginning in 1997 part of commercial landings were reported by species group (e.g., snappers, groupers, parrotfishes, surgeonfishes, etc.), and by gear (hook and line, gill net, SCUBA, trap, etc.). All commercial fishery data reports included species groups beginning in 2000. In July of 2011, commercial landings were reported by species and gear. Snapper complex (1997-2011) and species-specific snapper (2011-2022) landings are summarized in Table 3.1.3 and Figure 3.1.1. Note that landings prior to 2000 may be incomplete.

3.2 Commercial Discards

Commercial discards reported by calendar year were not significant (Martinez et al. 2024).

3.3 Commercial Effort

Commercial trips with reported Yellowtail Snapper landings per year were compiled from 2012 to 2022 (Table.3.3.1). The table includes the number of trips by year and fishing gear.

3.4 Biological Sampling

3.4.1 Overview

The NOAA Fisheries, Southeast Fisheries Science Center Trip Interview Program (TIP) collects length and weight data from fish landed by commercial fishing vessels, along with information about fishing area and gear. Data collection began in 1983 with frequent updates in best practices; the latest being in 2017. Data are collected by trained shore-based samplers (Beggerly, Stevens, and Baertlein 2022).

3.4.2 Length Composition Sampling Intensity

The TIP data pertaining to Yellowtail Snapper in St. Thomas/St. John are comprised of 20,064 length observations across 1,078 unique port sampling interviews during the period 1983-2022. Of the Yellowtail Snapper measured, 19,927 are fork lengths (99.3%). Figure 3.4.1 displays the sample availability by year and gear. Plots and summary statistics of the currently available length frequency data of Yellowtail Snapper sampled from the predominant gears in St. Thomas/St. John are included in the working paper (Godwin et al. 2024).

3.4.3 Length Distributions

A variety of fishing gears were used by STTJ commercial fishers to catch Yellowtail Snapper. An analysis was conducted to establish gear groups among the many commercial fishing gears with groups based upon Yellowtail Snapper size composition differences among the gears. The resulting groups are recorded in Table 3.4.1. Summary statistics produced by a generalized linear mixed model (GLMM) analysis of the available length frequency data from 2012 to 2022 (the years corresponding to species specific reporting of commercial landings data) are found in Table 3.4.1. Gear groups were identified based on GLMM analysis using a gamma-distributed dependent variable and a covariate to account for changes in mean size over time. Random effects for interview ID and categorical year were included to account for non-independence of observations. The aggregated density plots of Yellowtail Snapper fork lengths collected across three or more unique interviews per gear groups across the time series (years with species specific commercial landings data) are summarized in Figures 3.4.2. Aggregated density plots of gears representing 2% or more of the samples are summarized in Figure 3.4.3.

3.4.4 Adequacy of Size Composition Data for Characterizing Catch

Due to reasonable levels of available data after 2012, TIP data can be considered to inform selectivity and annual population trends in the SEDAR 84 assessment pending an investigation into the comparison of interview and catch report quantities by gear groups and year. If the proportion of TIP trips interviewed compared to CCL trips reported by gear is low or highly variable, the workshop panel recommended combining TIP data across all years to inform commercial fleet selectivity, not annual population trends.

The landings data collected before 2012 were not species-specific, and current model configurations do not require length composition data before the first year of landings data. However, all length composition data should be supplied to the analytical team, allowing them to investigate other potential models. Further investigation into the filtering process will need to be executed to understand the high number of length and weight pairs flagged as possible outliers. As necessary, the analysts will communicate the high uncertainty across the measurement units associated with the TIP data for Yellowtail Snapper.

3.5 SEDAR Panel Discussion of Commercial Statistics Data for Assessment Analyses

3.5.1 Adequacy of Commercial Landings Data

Issue 1: Are analysis-ready commercial landings data available for SEDAR 84?

Options:
- Use all available data (including data before 2012 and hindcast partitioning of landings recorded as species groups)
- Only use data starting in 2012, the first full year of species-specific reporting of the snapper group

Decision:
- Do not hindcast landings before 2012
- Provide a full-time series associated with the total landings of the snapper group over all years of available landings data

Rationale:
- Due to inconsistent levels of Yellowtail Snapper among all snappers after 2012, we cannot hindcast.

Issue 2: What should the gear fleets be for the commercial landings data?

Options:
- Use one fleet (handline) while including an explanation of gears within the fleet.
- Use gear groups informed by the TIP data (handline, traps, and rod and reel) with others parsed in for modeling but separate for reporting.

Decision:
- Gear groups of “Fish Traps,” “Handline,” and “Rod and Reel” were established, with all other gears allocated to fleets proportionally.

Rationale:
- Results of GLM analyses of gear-specific size composition and expert opinion regarding gear similarities indicate three potential gear groups (Fish Traps, Handline, and Rod and Reel).
- The length data from all other gears was insufficient to characterize the size composition of the landings from those gears.

Issue 3: How uncertain are the commercial landings from 2012 - 2022?

Options:
- Consider uncertainty around the landings (e.g. +/- 5% for 2016-present, +/-15% 2012-2015)
- Consider directional bias (e.g. + 5% for 2016-present, +15% 2012-2015)

Decision:

- Consider directional bias (e.g. + 5% for 2016-present, +15% 2012-2015)

Rationale:

- During 2012-2015, the commercial logbook forms lacked the option to select Yellowtail Snapper. Instead, fishermen had to write it in as an additional species. Inconsistent reporting of write-in species suggests underreporting in those years.
- From 2016 to now, Yellowtail Snapper appears on all logbook forms in the US Virgin Islands.

Issue 4: Should data outliers in the commercial landings be flagged for additional investigation?

Options:

- Identify and flag outliers
- Do not identify and flag outliers

Decision:

- Conduct outlier analysis flagging by year and gear

Rationale:

- Through the flagging process, we can identify outliers to investigate further, allowing us to understand the situations occurring within the fishery and their potential impact. For example, a significant jump in outliers could be attributed to the new style of fishing, indicating that these outliers are still valid trips.

3.5.2 Adequacy of Discard and Discard Mortality Data

Issue 1: Do we have estimates of commercial discards and estimates of discard mortality?

Options:

- Use the available reported discards data.
- Do not use the available reported discards data.
- Use expert opinion to inform estimates of discard mortality.
- Use discard mortality estimates in the published literature.

Decision:

- Discards of Yellowtail Snapper are assumed to be negligible, with minimal discard mortality.

  Rationale:
- Discarding is negligible within the Yellowtail Snapper STTJ fishery to the point that the mortality of discards is insignificant.
- Commercial logbook forms did not have species-specific discards before July 2015; therefore, discards before that time are unknown.

3.5.3 Adequacy of Length Composition Data

Issue 1: Are analysis-ready size data available for SEDAR 84?

Options:
- Use filtered TIP lengths available by year from 1983 to 2022
- Use filtered TIP lengths available by year from 2012 to 2022
- Use filtered TIP lengths combined across years from 2012 to 2022 to inform selectivity
- Do not recommend using TIP lengths for any year

Decision:
- Use TIP data after 2012 to inform selectivity and annual population trends in SEDAR 84 assessment pending an investigation into comparing interview and catch report quantities by gear groups and year.
- Apply filtering based on the condition factor.
- Supply complete TIP time series for SEDAR 84 investigations.
- Investigate how the length-weight relationship varies by month and year (seasonality and reproduction).
- Try to obtain tagging research data on St. Thomas.
- Try to acquire the National Parks Service dataset for St. John. This dataset documents when fishing was allowed in the National Parks.
- Try to obtain the life history information from a 1987 age and growth study of Yellowtail Snapper.

Rationale:
- If the proportion of TIP trips interviewed compared to CCL trips reported by gear is low or highly variable, combine TIP data across all years to inform commercial fleet selectivity, not annual population trends.
- The landings data collected before 2012 were not species-specific, and current model configurations do not require length composition data before the first year of landings data. However, all length composition data should be supplied to the analytical team, allowing them to investigate other potential models.
- Investigate the filtering process further. The high number of flagged pairs of length and weights need to be better understood. Alternatively, communicate high uncertainty across the measurement units associated with the TIP data for Yellowtail Snapper.

3.6 Commercial Statistics Tables

Table 3.1.1 Commercial landings of Yellowtail Snapper in St. Thomas/St. John from 2012-2022 reported in pounds by year and gear group.

Year	Handline	Other	Rod and reel	Traps	Total Landings
2012	22,813	7,392	192	2,854	33,251
2013	15,782	5,036	335	2,532	23,685
2014	20,982	5,872	668	3,739	31,261
2015	19,462	1,863	379	2,569	24,273
2016	20,835	2,564	900	3,735	28,034
2017	16,134	2,017	969	3,652	22,772
2018	15,521	1,023	468	4,365	21,377
2019	18,818	1,015	627	4,421	24,881
2020	21,246	376	844	3,990	26,456
2021	11,756	10	1,441	3,270	16,477
2022	12,565	27	1,953	3,439	17,984

Table 3.1.2 Comparison of commercial landings of Yellowtail Snapper in St. Thomas/St. John from 2012-2022 in relation to the outlier removal methods.

Year	Landings (no outlier removal)	Landings (outlier removal method 1)	Landings (outlier removal method 2)	Diff (method 1)	Diff (method 2)
2012	33,251	33,191	31,660	-0.2%	-4.8%
2013	23,685	22,260	22,215	-6.0%	-6.2%
2014	31,261	30,811	30,811	-1.4%	-1.4%
2015	24,273	22,356	23,588	-7.9%	-2.8%
2016	28,034	27,634	26,734	-1.4%	-4.6%
2017	22,772	22,315	21,707	-2.0%	-4.7%
2018	21,377	20,977	20,847	-1.9%	-2.5%
2019	24,881	24,401	24,109	-1.9%	-3.1%
2020	26,456	26,216	25,566	-0.9%	-3.4%
2021	16,477	16,477	16,078	0.0%	-2.4%
2022	17,984	17,834	17,489	-0.8%	-2.8%

Table 3.1.3 Commercial landings of all snapper species reported in St. Thomas/St. John from 1997-2022 by year. Note that landings prior to 2000 may be incomplete.

Year	Landings (lbs)
1997	12,721
1998	65,395
1999	127,568
2000	150,222
2001	175,734
2002	167,232
2003	160,215
2004	140,574
2005	151,595
2006	174,824
2007	156,015
2008	145,188
2009	143,604
2010	121,187
2011	76,193
2012	53,682
2013	35,889
2014	50,794
2015	40,053
2016	42,947
2017	35,367
2018	33,710
2019	35,052
2020	34,738
2021	24,486
2022	26,550

Table 3.3.1 Commercial trips that reported Yellowtail Snapper landings in St. Thomas/St. John from 2012-2022 reported by year and gear group.

Year	Handline	Other	Rod and reel	Traps	Total Trips
2012	435	48	12	352	847
2013	291	30	10	320	651
2014	309	38	15	309	671
2015	311	20	24	272	627
2016	409	17	55	389	870
2017	289	15	61	480	845
2018	253	22	38	513	826
2019	283	15	55	451	804
2020	292	5	45	495	837
2021	191	4	45	456	696
2022	190	4	74	435	703

Table 3.4.1 Generalized linear mixed model (GLMM) analysis summary results for the TIP data of Yellowtail Snapper fork lengths in St. Thomas/St. John from 2012 to 2022. The column "group" indicates the group(s) where mean lengths are not statistically different from other gears with matching group number(s). The "n" column indicates the number of unique lengths recorded for each gear. The "Percentage" column indicates the percent of the total recorded lengths for each gear. Gears that make up less than 2% are shaded in gray.

Gear	Mean	Estimated Marginal Mean	LCL	UCL	Group	Fish (n)	Interview (n)	Percentage	Gear Group
LINES HAND	32.14	3.44	3.42	3.47	2	7,353	210	85.93	Hand Line
POTS AND TRAPS; FISH	30.24	3.38	3.36	3.41	1	778	149	9.09	Traps
ROD AND REEL	34.43	3.58	3.51	3.64	3	174	15	2.03	Rod and Reel
REEL; ELECTRIC OR HYDRAULIC	31.23	3.51	3.39	3.64	1,2,3	139	5	1.62	Hand Line, Traps, or Rod and Reel
HAUL SEINES	30.05	3.44	3.34	3.54	1,2,3	81	8	0.95	Hand Line or Traps
ROD AND REEL; ELECTRIC (HAND)	33.15	3.44	3.32	3.57	1,2,3	20	4	0.23	Hand Line, Traps, or Rod and Reel
POTS AND TRAPS; SPINY LOBSTER	30.53	3.41	3.28	3.54	1,2,3	8	4	0.09	Hand Line, Traps, or Rod and Reel

3.7 Commercial Statistics Figures

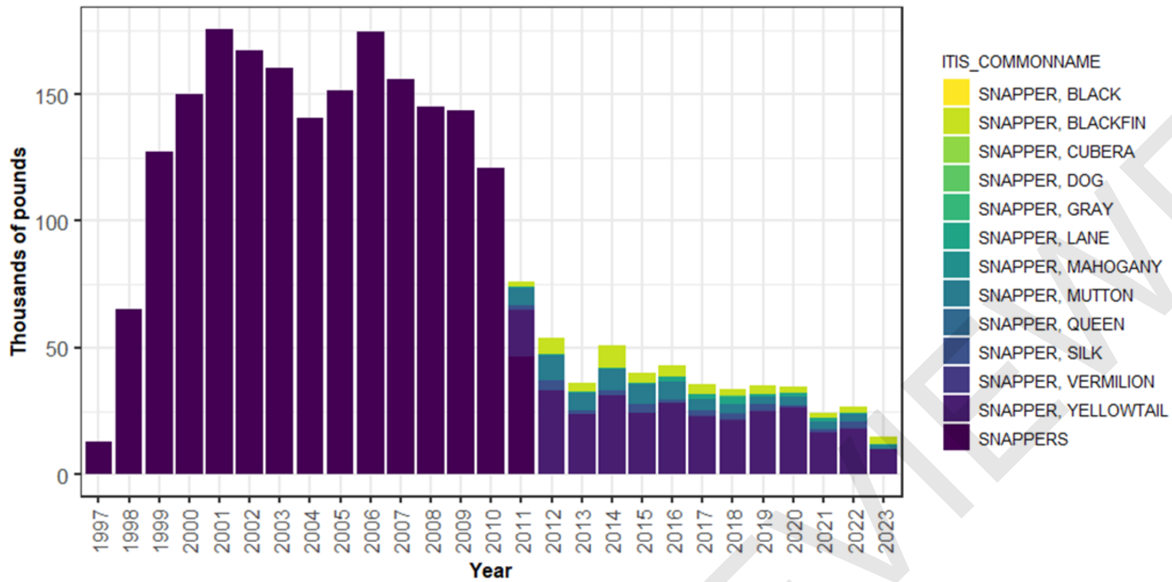

Figure 3.1.1 Commercial landings of all snapper species reported in St. Thomas/St. John from 1997-2022 by year.

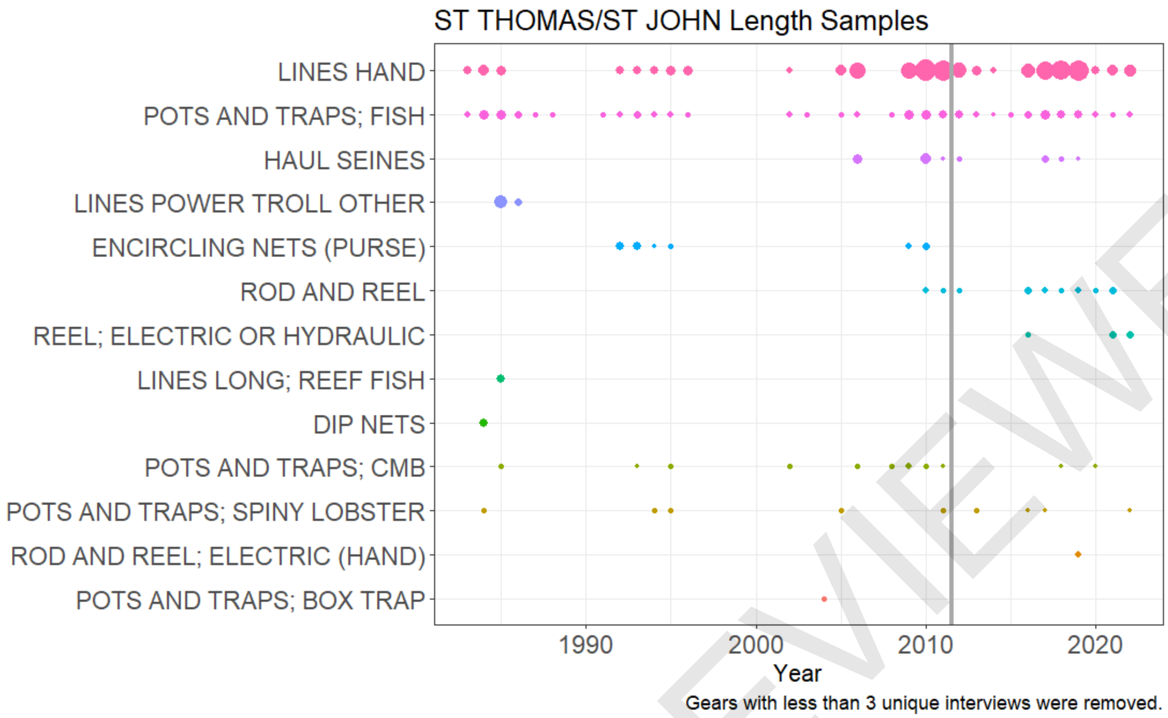

Figure 3.4.1 Plot showing relative number of Yellowtail Snapper in St. Thomas /St. John over time. Each point is color specific to the gear it represents. Gears are arranged from largest to smallest sample size of individual recorded lengths. Gray vertical line denotes the beginning of the truncated time series in 2012 (those years with species specific commercial landings data).

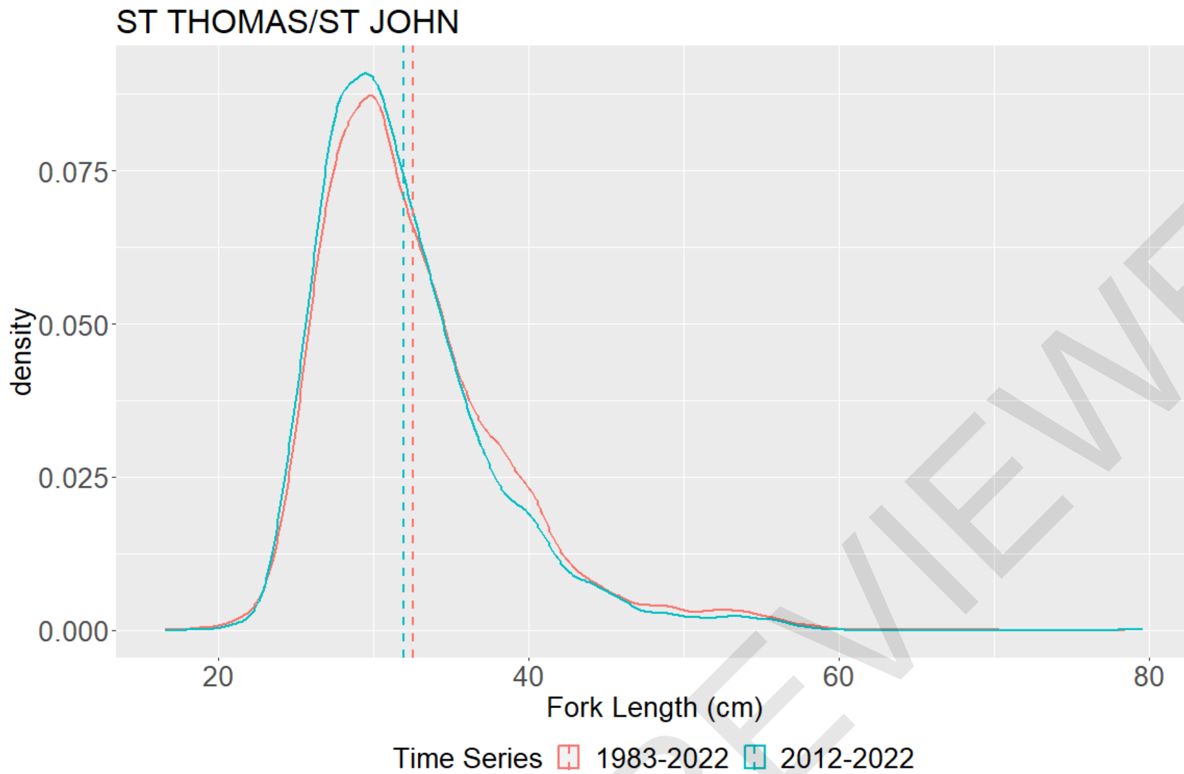

Figure 3.4.2 Aggregated density plot of lengths (cm) of Yellowtail Snapper in St. Thomas /St. John, all gears combined. Dotted line represents mean length. The period 1983-2022 includes all years with TIP data. The period 2012-2022 includes those years with corresponding species-specific commercial landings data.

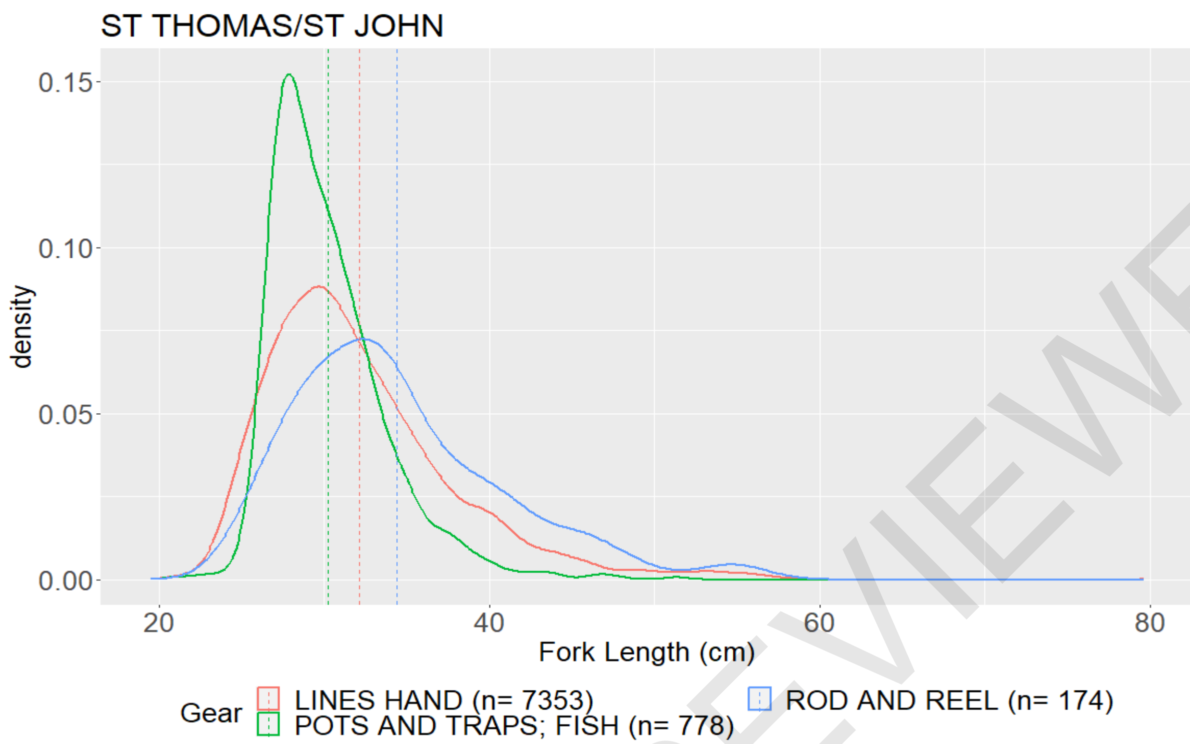

Figure 3.4.3 Aggregated density plot of lengths (cm) by gears with greater than 2% of total samples for Yellowtail Snapper in St. Thomas/St. John from 2012 to 2022. Dotted line represents mean length.

4 Recreational Fishery Statistics

4.1 Overview

U.S. Virgin Islands fishing tournament data were collected by the USVI Department of Planning and Natural Resources, Division of Fish and Wildlife staff serving as official weighmasters. Tournaments consist of kid's tournaments, spearfishing tournaments, and rod & reel/trolling tournaments. Data collected includes tournament name, date, vessel name, captain name, length of tournament, species landed, species weight, and species length.

Data were available for the years 2000-2022 from a total of 30 tournaments over the time series with data collected from 1-4 tournaments per year. A total of 1,074 Yellowtail Snapper were caught across all 30 tournaments. Of those observed fish, 671 were weighed and 198 lengths were measured. From 0 to 67 Yellowtail Snapper were measured per year and fewer than 10 fish were measured in 16 years of the 21 year time series (tournaments were not sampled in every year). From 0 to 206 Yellowtail Snapper were weighed per year with fewer than 10 fish weighed in 11 years of the time series.

4.2 SEDAR Panel Discussion of Recreational Landings Data for Assessment Analyses

Issue 1: Can tournament data inform recreational removals?

Options:
- Investigate tournament data from 2000-2022 further.
- Do not use the tournament data.

Decision:
- Do not use the tournament data. The limited tournament data available for Yellowtail Snapper in St. Thomas and St. John is considered negligible.

Rationale:
- Tournament data with Yellowtail Snapper is only available for 12 unique tournaments.
- Tournament data is a fraction of a percent of the commercial landings data; therefore, the utility of this data for the current analysis is negligible.
- Time series runs from 2000-2022, however years in which there are consecutive data are 2002-2003, 2010-2015, and 2019-2022 showing a lack of consistency across time.
- Across time series, there are 877 records in which lengths and/or weights cannot be verified due to a lack of units.
- Most data come from kid's tournaments which landed mainly juvenile and subadult yellowtail snapper.
- There is a lack of data for CPUE analysis due to the low number of records with gear type identified.
- Tournament data is negligible for this SEDAR; however, this dataset could be applicable to future SEDAR's.

5 Measures of Population Abundance

5.1 Overview

The SEDAR 84 DW Panel reviewed several measures of abundance from both fishery independent and fishery dependent data sources during the workshop. The following sections briefly summarize these data or provide references that summarize the methods and data.

5.2 Review of Working Papers

SEDAR84-DW-15 (Grove et al. 2024): NCRMP FI Survey of Yellowtail Snapper (*Ocyurus chrysurus*) in St. Thomas/St. John, U.S. Virgin Islands, summarized NCRMP survey data for Yellowtail Snapper from 2014 to 2022.

5.3 National Coral Reef Monitoring Program - NCRCMP

5.3.1 Methods, Gears, and Coverage

This document outlines the data and methodologies used to estimate density and abundance-at-length compositions for the SEDAR84 Yellowtail Snapper Assessment for St. Thomas and St. John.

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 were reduced in St. Thomas and St. John in 2021 to 165 as a result of weather (Figure 5.3.1)

Two levels of calibration were needed to incorporate historical transect data. First, we analyzed the regionally restricted transect data from 2001 to 2011 in Virgin Island National Park and Virgin Islands Coral Reef National Monument in St. John. 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.

The National Coral Reef Monitoring Program (NCRMP) has a sampling depth limit of 30 m, and thus only represent shallow water fish populations. However, a majority of the fisheries areas, particularly on the northern and southern shelf of St. Thomas and St. John, are in depths between 30-65 m (Kadison et al., 2017). The Coral Reef Conservation Program (CRCP) funded a pilot survey to target the upper mesophotic habitats of St. Thomas and St. John from 2020–2022. The DCRMP program used NCRMP survey design and sampling methodologies for direct comparisons (Figure 5.3.2). For more details about the DCRMP program, data and sampling coverage see Grove et al. (in press).

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 m2, ±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 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). Time series indices and length frequency compositions were analyzed and presented separately for NCRMP and DCRMP surveys.

5.3.2 Sampling Intensity – Time Series

Sampling Intensity and the time series of the NCRMP reef survey in St. Thomas/St. John is illustrated in Table 5.3.1. Sampling began in 2001 and was conducted every year from 2001 to 2012 and then from 2014, 2016, 2019 and 2021. Samples were divided to 0-12m and the 12-30m strata. Sampling was only conducted on hard-bottom strata which were distinguished into five categories (shown in alphabetical order)

- Aggregate
- Bedrock
- Patch
- Pavement
- Coral/Rock

Additional information of sampling intensity consisted of total number observations of Yellowtail Snapper and the number of lengths measured, each by year.

The upper mesophotic zone DCRMP survey time series data from 2020 to 2022 is shown in Table 5.3.2. Here only habitat types are distinguished in the survey:

- Aggregate
- Patch
- Pavement

5.3.3 Size Data

Length size frequency distribution of Yellowtail Snapper population in St. Thomas and St, John from the NCRMP survey are shown for 2017, 2019, and 2021 in Figure 5.3.3 and for the DCRMP survey for the years 2020 to 2022 are shown in Figure 5.3.4

5.3.4 Catch Rates in Numbers per Area Sampled

The time series of estimated mean Yellowtail Snapper population density in numbers per sampled area; i.e., per 178 m^2 +/- SE, is shown Figure 5.3.5. In addition, a time series of estimated population density of the pre-exploited phase; i.e., fish <25cm fork length, was constructed and compared to that of the exploited phase fish; i.e., > 25cm, in Figure 5.3.6 which also included the 2020-2022 from the DCRMP survey.

5.4 Fishery-Dependent Measures

5.4.1 Overview

US Caribbean commercial logbook (CCL) landings and effort were used to construct nominal indices of abundance. CCL data are self-reported. Species specific reporting in the U.S. Virgin Islands landings started in 2012 (1st full year) and the time series from 2012-2022 was considered. After calculating the proportion positive Yellowtail Snapper trips by gear group (Table 5.4.1) and examining the reported landings by gear group (Table 3.1.1), only hook & line gear had sufficient data to explore the construction of an index of abundance.

5.4.2 Methods of Estimation

Effort variables explored for constructing a nominal index of abundance included,

- Hours fished
- Lines count

-Hooks per line count

The following units of effort considered

- Hook hours (hours fished * lines count * hooks per line count)
- Fishing lines hours (hours fished * lines count)
- Hooks per line hours (hours fished * hooks per line count)
- Hours fished

Based on the exploratory analysis of the relationship between CPUE (calculated as pounds of landed Yellowtail Snapper/unit of fishing effort; e.g., per hook hour, per hour fished, etc.) and effort (Figure 5.4.1). Hook hours was deemed as the most appropriate effort measure to calculate CPUE (Fig. 5.4.1)

5.4.3 Sampling Intensity

All commercial fishers are required to report landings and effort to CCL. CCL reporting is therefore considered to be census of commercial landings and fishing effort. Any underreporting has not been quantified.

5.4.4 Size/Age data

CCL includes only landed fish, therefore TIP data provides size composition data for this index

5.4.5 Catch Rates – Number and Biomass

Catch rates were consistent throughout the time series, approximate 5 pounds of Yellowtail Snapper landed per hook hour fished (Figure 5.4.2). Nominal catch rates are shown; i.e., this CPUE series has not been standardized to account for fishing practices and other effects that may mask true trends in Yellowtail Snapper abundance.

5.4.6 Uncertainty and Measures of Precision

Coefficients of variance (CV) around the nominal CPUE index were rather were large throughout the time series (Figure 5.4.2).

5.5 SEDAR Panel Discussion of Indices Data for Assessment Analyses

Issue 1: Should the fishery-independent density estimates from NCRMP be used in SEDAR 84?

Options:

- Use the density estimates and length composition data from 2013 forward, which includes years calibrated to account for the transition from belt transect to cylinder survey method.
- Use all years of data, 2001-2022, with the caveat that data from 2001-2011 was not an island-wide survey.

Decision:
- Use the NCRMP data from 2013 to 2022.
- Ensure the length at first capture used to define the exploited population aligns with the lengths observed in the port sampled data. (SEFSC TASK)
- Include the DCRMP information separately. Document caveat that there are other areas where larger fish can occur not captured in these surveys

Rationale:
- The NCRMP survey is the most consistent island-wide survey available.

Issue 2: Should fishery-dependent information (commercial logbooks) be considered to conduct abundance indices?

Options:
- Consider this information.
- Do not consider this information.
- Investigate the dataset further.

Decision:
- Do not consider this information for an abundance index.

Rationale:
- Time spent fishing does not necessarily translate to nominal CPUE, equating to where you could look at patterns over time. Experienced commercial fishermen know how to target the species effectively, which may differ from inexperienced fishermen. Therefore, we must include other aspects within the index to make it more representative.

5.6 Measure of Population Abundance Tables

Table 5.3.1 Number of reef fish visual survey sites by hard-bottom strata and depth categories per year from the reef fish visual surveys in the St. Thomas and St. John coral reef ecosystem (2001–2021). Empty cells indicate zero samples. Length totals represent the number of individual length observations recorded.

	0 - 12 meters					12 - 30 meters						
Year	**Aggregate**	**Bedrock**	**Patch**	**Pavement**	**Coral/Rock**	**Aggregate**	**Bedrock**	**Patch**	**Pavement**	**Coral/Rock**	**Site Total**	**Length Total**
2001	6		1	8	1	2		1	5	1	**25**	**42**
2002	11	9	4	18	2	2			24	2	**72**	**105**
2003	16	6	8	19	9	22		3	23	3	**109**	**132**
2004	16	10	4	16	8	35		5	27	7	**128**	**119**
2005	26	6	9	13	6	30		6	25	7	**128**	**160**
2006	29	7	2	10	2	43		14	11	9	**127**	**176**
2007	29	10	5	13	3	41		9	11	8	**129**	**112**
2008	18		9	12	7	43		15	16	14	**134**	**171**
2009	27	6	13	8	3	46		9	14	6	**132**	**139**
2010	20	6	6	22	7	28		12	20	13	**134**	**127**
2011	27	5	9	11	9	43		11	9	9	**133**	**182**
2013	31	28	13	32	14	73	4	20	34	26	**275**	**601**
2015	21	13	17	25	15	62	1	29	48	24	**255**	**269**
2017	36	22	13	7	5	68	3	19	38	26	**237**	**802**
2019	49	39	13	19	14	88	4	32	36	28	**322**	**1428**
2021	17	22	4	15	6	56	1	7	24	13	**165**	**680**

Table 5.3.2 Number of DCRMP 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 St. Thomas and St. John coral reef ecosystem (2020–2022).

	30 - 60 meters				
Year	**Aggregate**	**Patch**	**Pavement**	**Site Total**	**Length Total**
2020	75	48	39	**162**	**376**
2021	59	23	16	**98**	**258**
2022	33	21	35	**89**	**160**

Table. 5.4.1 Number trips that reported Yellowtail Snapper landings in St. Thomas/St. John by year and gear group expressed as a percentage of the total trips of Yellowtail Snapper landed by gear group and year.

Year	Traps (%)	Hook/line (%)	Dive (%)	Nets (%)
2012	22.0	70.6	2.1	27.1
2013	22.7	62.3	9.5	29.3
2014	22.8	69.5	1.5	22.2
2015	19.8	55.7	9.0	10.9
2016	26.1	56.7	3.9	9.2
2017	40.9	63.9	3.2	6.4
2018	49.5	60.6	3.4	9.4
2019	42.0	69.3	1.9	7.5
2020	41.6	76.8	0.0	4.2
2021	35.6	63.3	4.1	0.0
2022	35.8	49.1	2.4	1.1

5.7 Measure of Population Abundance Figures

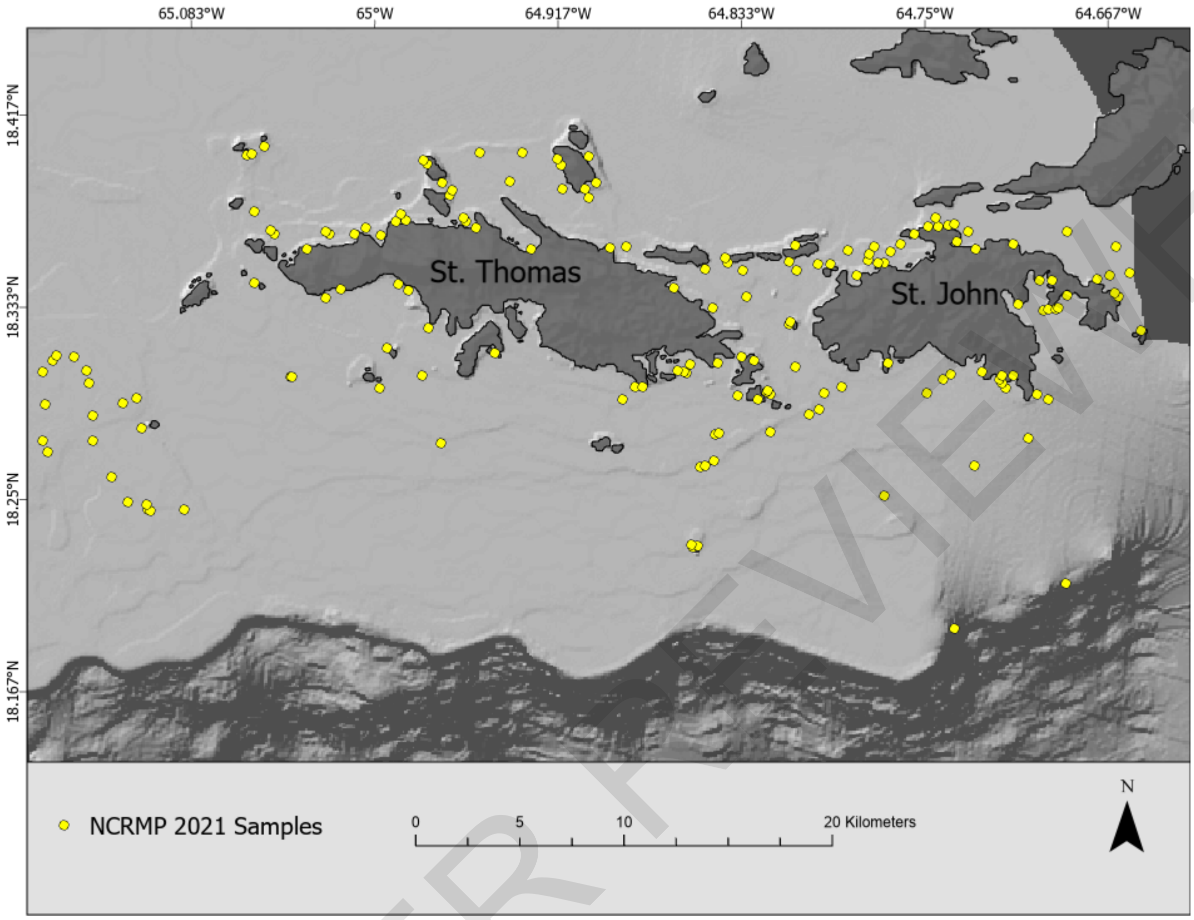

Figure 5.3.1 St. Thomas and St. John NCRMP sampling sites 2021 (n = 165).

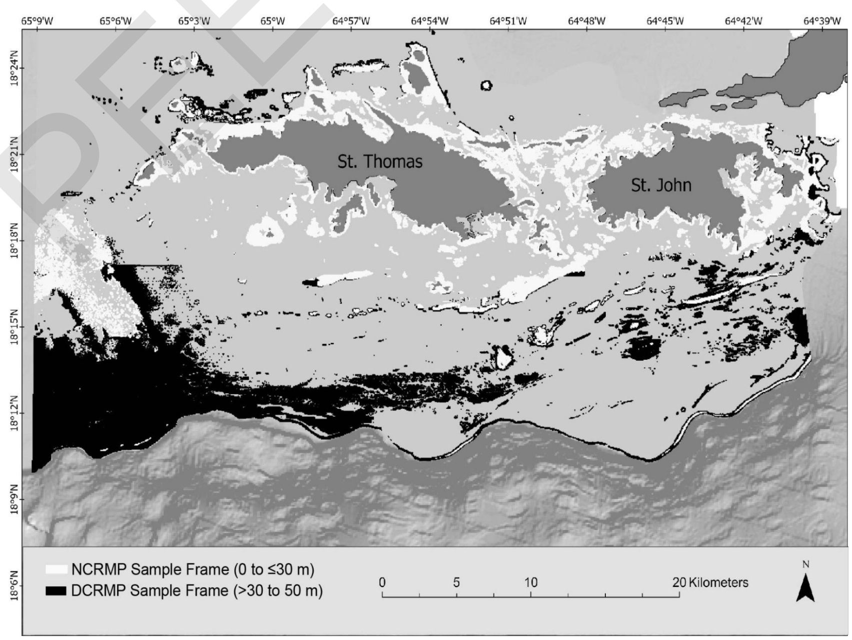

Figure 5.3.2 St. Thomas and St. John NCRMP (white) and DCRMP (black) sampling domain.

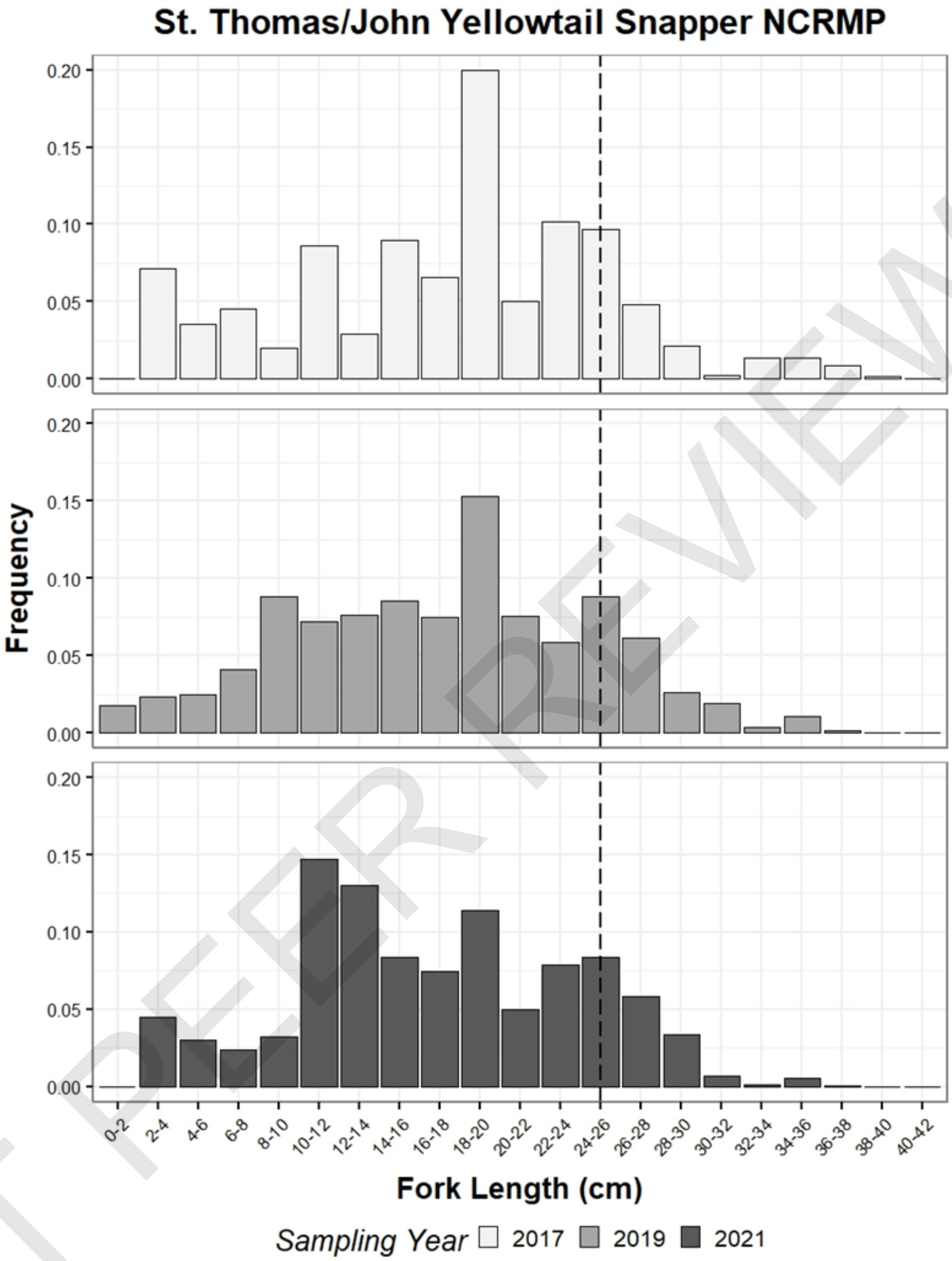

Figure 5.3.3 Yellowtail Snapper population size-frequency distribution at 2-cm bins from the 2017 - 2021 NCRMP RVC-SPC St. Thomas and St. John surveys. Vertical dashed line is length at capture (25.0 cm fork length).

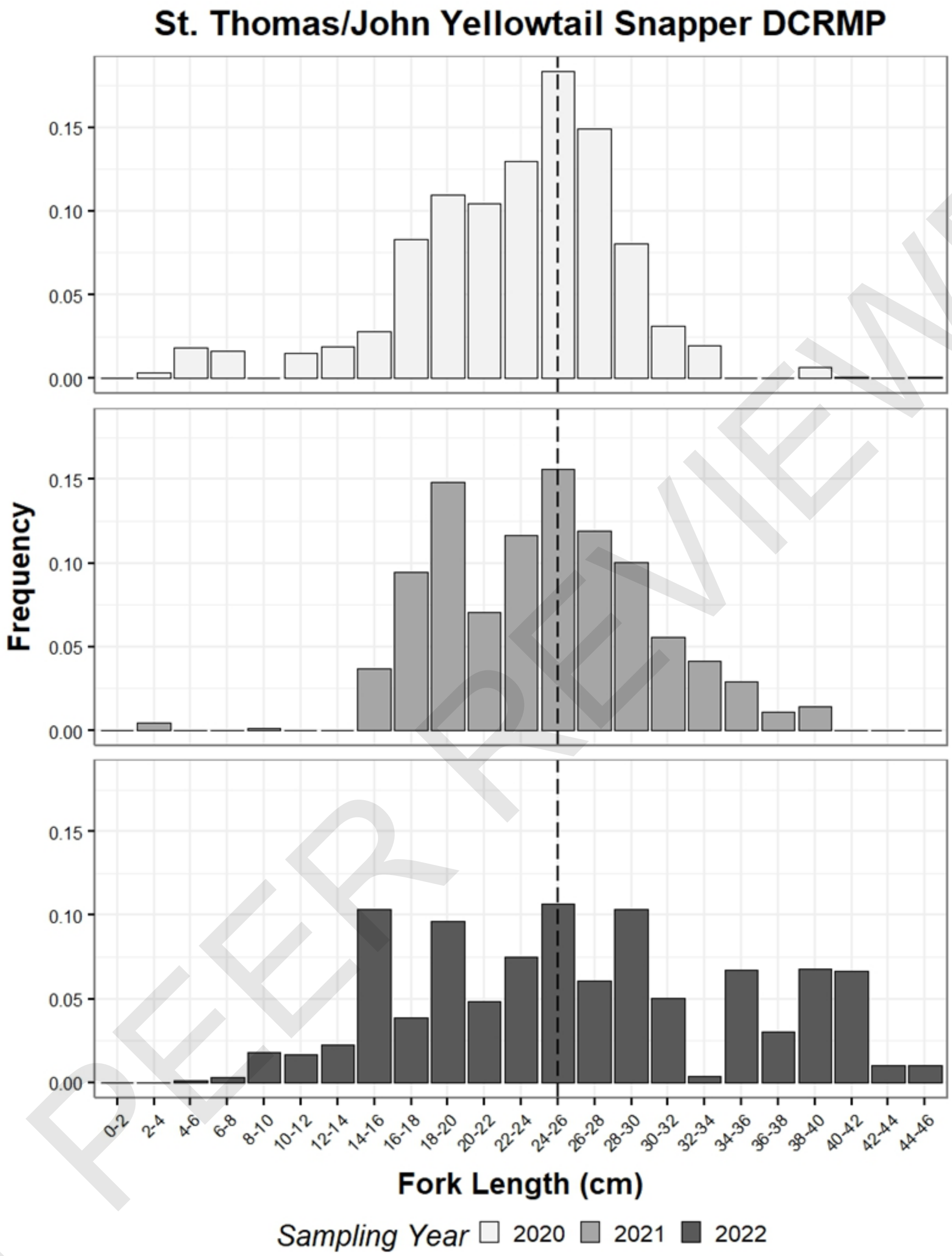

Figure 5.3.4 Yellowtail Snapper population size-frequency distribution at 2-cm bins from the 2020 - 2022 DCRMP RVC-SPC St. Thomas and St. John surveys. Vertical dashed line is length at capture (25.0 cm fork length).

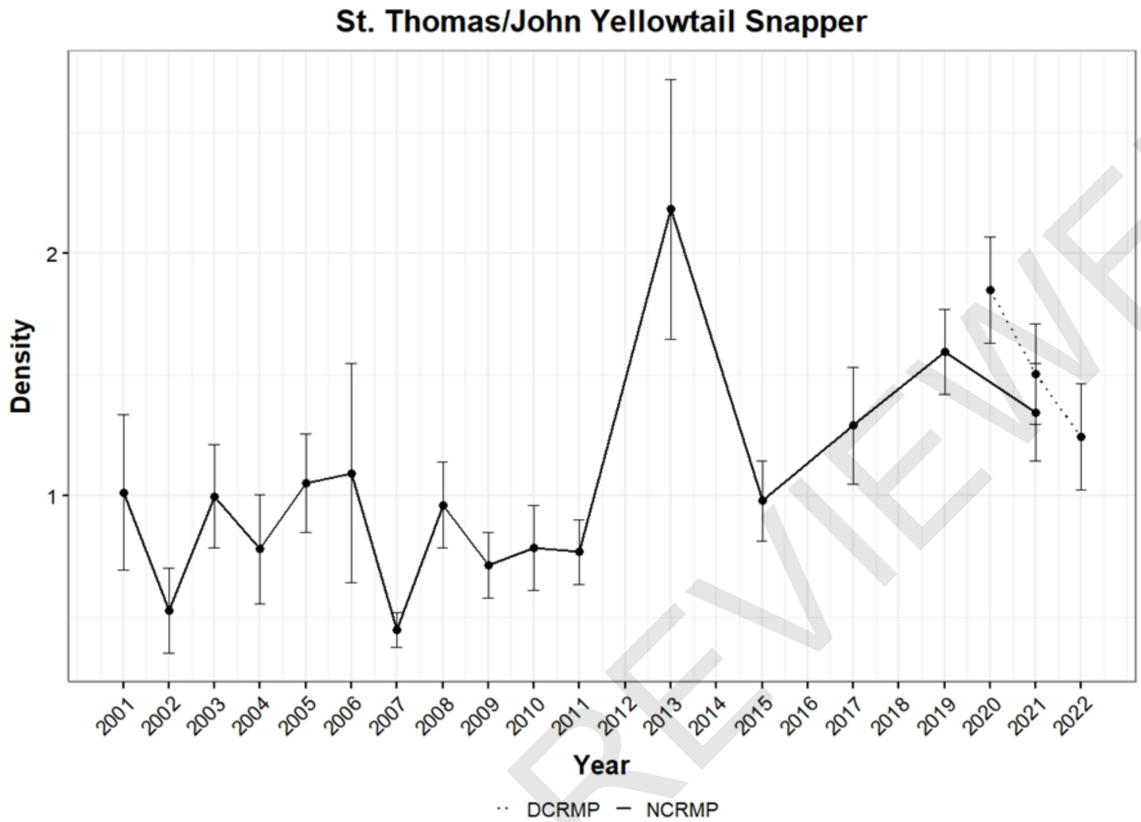

Figure 5.3.5 Time series (2001–2021) of Yellowtail Snapper (Ocyurus chrysurus) mean population density (number per 178 m2, ± SE) from the NCRMP (solid line) and DCRMP (dotted line) reef fish visual surveys in the St. Thomas and St. John coral reef ecosystem.

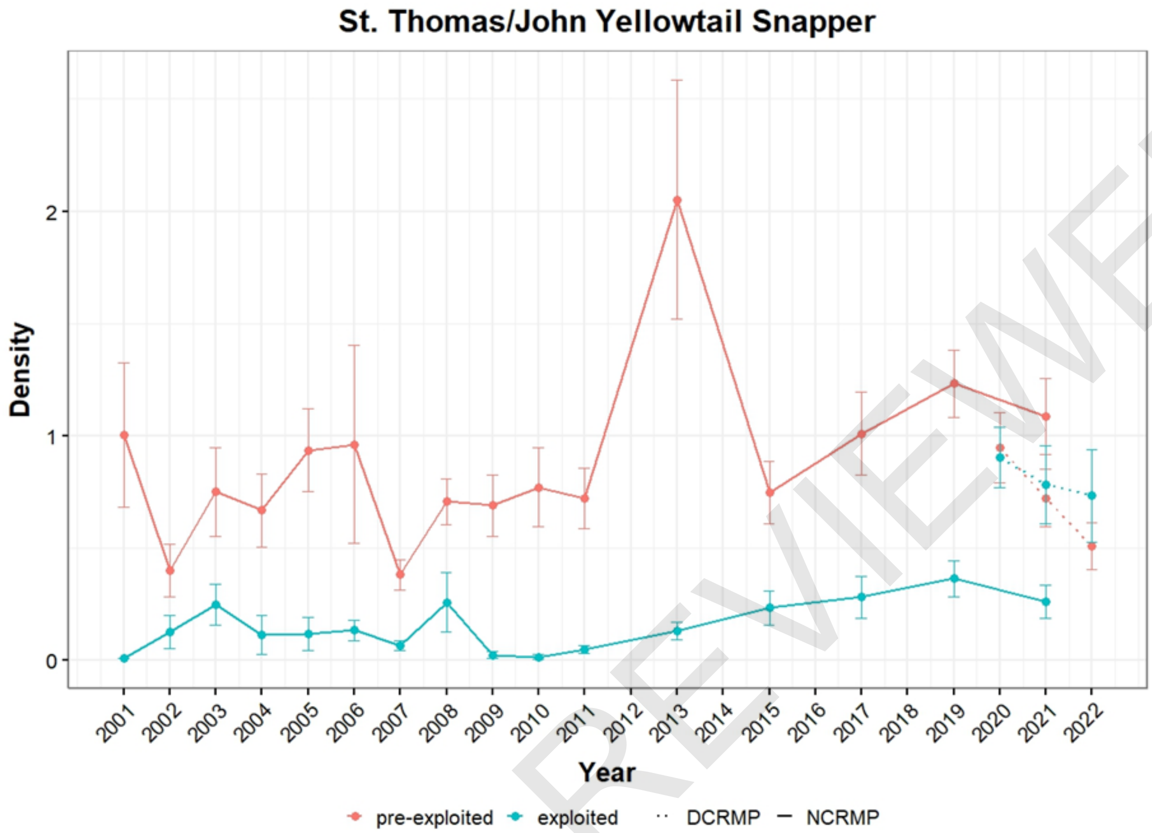

Figure 5.3.6 Time series (2001–2022) of Yellowtail Snapper (Ocyurus chrysurus) mean population density (number per 178 m2, ± SE) from the NCRMP (solid line) and DCRMP (dotted line) in the pre-exploited (blue, < 25 cm) and exploited (red, ≥ 25 cm) reef fish visual surveys in the St. Thomas and St. John coral reef ecosystem.

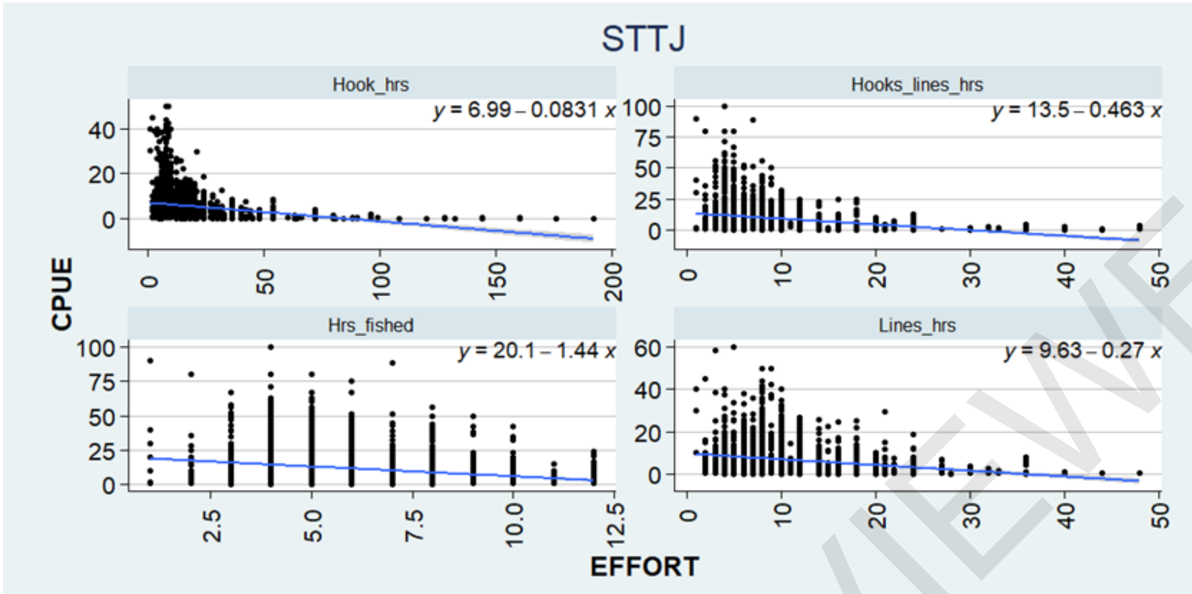

Figure 5.4.1 Exploratory analysis of different variables for suitability as a measure of effort. Hook hours (upper left) was chosen due to the minimal change in CPUE over increasing effort (hook hours); i.e., slope of the line is lowest (-0.0831).

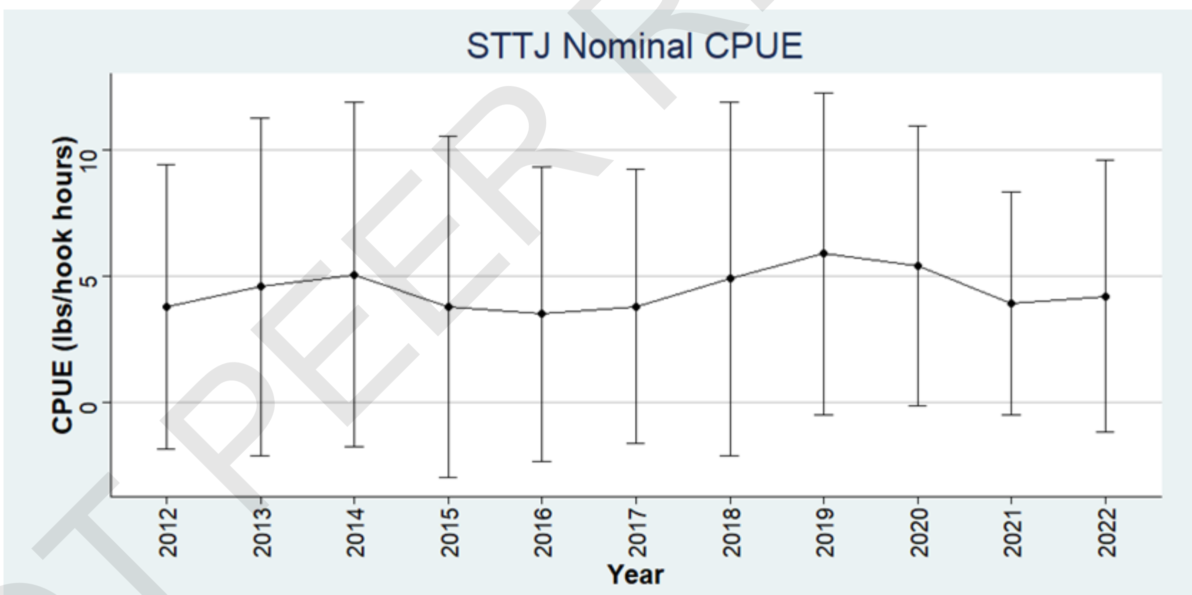

Figure 5.4.2 Nominal CPUE index in pounds per hook hours landed for the commercial Yellowtail Snapper fishery in the St. Thomas/St. John from 2012 to 2022,

6 SEDAR Panel Research Recommendations

6.1 Life History Research Recommendations

Issue 1: Are sufficient life history data available?

Research recommendations:

- Life history sampling should be done with statisticians to ensure more efficient collection programs (e.g., optimizing sample sizes within size bins).
- Ensure statistically robust sample sizes of small and large size classes of fish.

6.2 Commercial Statistics Research Recommendations

6.2.1 Commercial Landings Research Recommendation

Issue 1: Are analysis-ready commercial landings data available for SEDAR 84?

- Investigate trends in effort, major socioeconomic and environmental events, and associated effects on the demographics, gears used, and species landed.
- Increased port sampling is needed in St. Thomas and St. John to enable analyses required for quantifying removals.
- Conduct recreational fishery port sampling surveys to determine removals due to recreational fishing.
- Investigate the applicability of hindcasting for all snappers combined or other applicable future assessments.

Issue 2: What should the gear fleets be for the commercial landings data?

- Investigate cases where there may be a miscommunication between databases, which can impact the gear types (i.e., hook and line unknown)
- Operationalize a gear grouping process for future SEDAR assessments.

Issue 3: How uncertain are the commercial landings from 2012 - 2022?

No research recommendation.

Issue 4: Should data outliers in the commercial landings be flagged for additional investigation?

- Operationalize an outlier flagging process for future SEDAR assessments.

6.2.2 Length Composition Research Recommendation

Issue 1: Are analysis-ready size data available for SEDAR 84?

- Increase collection efforts to increase sample size in TIP.
- Work with port samplers and fishers to implement the trip interview program better and ensure critical fishing times are captured adequately (e.g., at night).

- Develop a data management system to link TIP to CCL. A linked system would require changing the overarching structure of collecting fishery-dependent data. A fishery information network system for the US Caribbean could comprehensively resolve this issue.
- Operationalize an outlier flagging process for future SEDAR assessments.
- Investigate if relative weight at a given length has changed across years or clusters of years.
- Examine the number of trips when considering the representativeness of TIP samples; do not limit the investigation to the number of fish or the weight of the catch, samples, and trips.
- Going forward, we need a recommendation on how to do a new sampling strategy that is more holistic.

6.3 Recreational Fishery Statistics Research Recommendations

Issue 1: Can tournament data inform recreational removals?

- This data type would be valuable for pelagic species, like wahoo and mahi, with consistent effort and catch. Therefore, this dataset should continue to be explored and standardized for future assessments. There is consistent participation in and support for these tournaments by participants.

6.4 Measures of Population Abundance Research Recommendations

Issue 1: Should the fishery-independent density estimates from NCRMP be used in SEDAR 84?

- Continue DCRMP work in the future.
- Look into National Parks transect data and compare it to the NCRMP data
- Provide RVC to DCRMP comparison for the 2021 year. If they are similar in that year, then what we see in 2022 is more a pulse of large fish than a difference in where the fish are.

Issue 2: Should fishery-dependent information (commercial logbooks) be considered to conduct abundance indices?

- Look into environmental patterns or fisher behavior as an assignment of CPUE or effort that we can use to look into changes in the population.
- Request for USVI fisher to provide their logbooks to further investigate the fisher behavior as an index assignment for CPUE.

7 Literature Cited

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, SG Smith, BL Richards, AJ Yau, BJ Langseth, JM O'Malley, CH Boggs, MP Seki, GT DiNardo. 2018. Towards fishery-independent biomass estimation for Hawaiian Islands deepwater snappers. Fisheries Research 208: 321-328.

Ault, JS, SG Smith, MW Johnson, LJW 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.

Beggerly, S, M Stevens, H Baertlein. 2022. Trip Interview Program Metadata. SEDAR74-DW-14. SEDAR, North Charleston, SC. 10pp.

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, 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.

Charnow, E, H Gislason, JG Pope. 2012. Evolutionary assembly rules for fish life histories. Fish Fisheries Vo.14(2): 213-224.

Godwin, K, A Rios, K Dettloff. 2024. SEDAR 84 Trip Interview Program (TIP) Size Composition Analysis of Yellowtail Snapper (Ocyurus chrysurus) in St. Thomas/St. John, U.S. Caribbean, 1983-2022. SEDAR84-DW-10. SEDAR, North Charleston, SC. 10pp.

Grove, LJW, J Blondeau, JS Ault. 2024. Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Yellowtail Snapper in St. Thomas/John. SEDAR84-WP-15. SEDAR, North Charleston, SC. 15pp.

Grove, LJW, J Blondeau, 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, 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.

Grove, LJW, J Blondeau, D Swanson, S Heidmann, SG Smith, M Johnson, V Brandtneris, S Sagarese, TB Smith. (in press). Expansion of an established fishery-independent survey into the US Virgin Islands' upper mesophotic zone: feasibility and management implications. Bulletin of Marine Science.

Hewitt, DA and JM Hoenig. 2005 Comparison of two approaches for estimating natural mortality based on longevity. Fishery Bulletin of the United States of America, 103, 433-437.

Kadison, E, M Brandt., R Nemeth, J Martens, J Blondeau, T Smith. (2017). Abundance of commercially important reef fish indicates different levels of over-exploitation across shelves of the U.S. Virgin Islands. PLOS ONE 12(7)

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.

Martínez, S, K Johnson, MR Orhun. 2024. SEDAR 84 Commercial fishery landings of Yellowtail Snapper (Ocyurus chrysurus) in St. Thomas and St. John, US Caribbean, 2012-2022. SEDAR84-DW-02. SEDAR, North Charleston, SC. 15pp.

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

Shervette, V, J Rivera-Hernandez, Noemi Pena Alvarado. 2024. U.S. Caribbean Yellowtail Snapper Population Demographics, Growth, and Reproductive Biology: Addressing Critical Life History Gaps SEDAR84-WP-08. SEDAR, North Charleston, SC. 29 pp.

Southeast Data Assessment and Review (SEDAR) 46 SAR v2 2016. SEDAR 46 Stock Assessment Report Caribbean Data-Limited Species. April 2016, SEDAR, North Charleston, SC 373 pp. Available from https://sedarweb.org/documents/sedar-46-final-stock-assessment-report-caribbean-data-limited-species/

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.

Then, AY., JM Hoenig, NMG Hall, A Hewitt. 2015. Evaluating the predictive performance of empirical estimators of natural mortality rate using information on over 200 fish species. *ICES Journal of Marine Science*, Volume 72, Issue 1, January 2015, Pages 82–92, https://doi.org/10.1093/icesjms/fsu136.

Valle-Esquival, M, and G Díaz. 2004. An Update on the Reported Landings, Expansion Factors and Expanded Landings for the Commercial Fisheries of the United States Virgin Islands (with Emphasis on Spiny Lobster and the Snapper Complex). NOAA/NMFS/SEFSC Miami Laboratory SFD-2004/051 (SEDAR-8-DW-09). 48pp.