SEDAR

Southeast Data, Assessment, and Review

SEDAR 91

US Caribbean Spiny Lobster St. Croix

SECTION II: Data Workshop Report

<January 2025>

SEDAR
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1. INTRODUCTION

1.1 WORKSHOP TIME AND PLACE

The SEDAR 91 Data Workshop was held November 13-15, 2024, in St Thomas, USVI. In addition to the in-person workshop, a series for webinars were held before (June and October 2024) the meeting.

1.2 TERMS OF REFERNCE

Data Workshop Terms of Reference:

1. 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

    e. Include data through at least 2022.

2. 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.

3. 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

Matt Damiano (Lead Analyst)..NMFS/SEFSC
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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			
SEDAR91-DW-01	Summary of participatory modeling workshops to understand ecological, social and economic dimensions of the U.S. Virgin Islands lobster fishery	Juan Agar, Mandy Karnauskas, Kelsi Furman, Matt McPherson, Manoj Shivlani	11/1/2024
SEDAR91-DW-02	Summary of participatory modeling workshops to understand ecological, social and economic dimensions of the Puerto Rican lobster fishery	Mandy Karnauskas, Juan Agar, Matt McPherson, Kelsi Furman, Manoj Shivlani	11/1/2024
SEDAR91-DW-03	PR/DNER/Commercial Fisheries Statistics Program Report Signs of the Abundance of Spiny Lobster Panulirus argus Observed by Commercial Landings Reported during 2014-2023	Daniel Matos-Caraballo, Jesús León-Fernández, Luis A. Rivera-Padilla, and Wilson Santiago-Soler	11/15/2024
SEDAR91-DW-04	SEDAR 91 Trip Interview Program (TIP) Size Composition Analysis of Caribbean Spiny Lobster (Panulirus argus) in Puerto Rico, U.S. Caribbean, 1981-2023	Katherine Godwin, Adyan Rios	11/20/2024
SEDAR91-DW-05	SEDAR 91 Trip Interview Program (TIP) Size Composition Analysis of Caribbean Spiny Lobster (Panulirus argus) in St. Thomas/St. John, U.S. Caribbean, 1981-2023	Katherine Godwin, Adyan Rios	11/20/2024
SEDAR91-DW-06	SEDAR 91 Trip Interview Program (TIP) Size Composition Analysis of Caribbean Spiny Lobster (Panulirus argus) in St. Croix, U.S. Caribbean, 1981-2023	Katherine Godwin, Adyan Rios	11/20/2024
SEDAR91-DW-07	SEDAR 91 Commercial Landings of Caribbean Spiny Lobster (Panulirus argus, Panulirus guttatus) in Puerto Rico, US Caribbean, 1983-2023	M. Refik Orhun, Katherine Godwin, Kim Johnson, and Stephanie Martínez Rivera	11/24/2024

SEDAR91-DW-08	SEDAR 91 Commercial Landings of Caribbean Spiny Lobster (Panulirus argus) in St. Thomas and St. John, US Caribbean, 1975-2023	M. Refik Orhun, Katherine Godwin, Kim Johnson, and Stephanie Martínez Rivera	11/24/2024
SEDAR91-DW-09	SEDAR 91 Commercial Landings of Caribbean Spiny Lobster (Panulirus argus) in St. Croix, US Caribbean, 1975-2023	M. Refik Orhun, Katherine Godwin, Kim Johnson, and Stephanie Martínez Rivera	11/24/2024
Reference Documents			
SEDAR91-RD01	On the productivity and technical efficiency of the Puerto Rican queen conch Aliger gigas fishery	Juan Agar and Daniel Solis	10/9/2024
SEDAR91-RD02	Socio-economic Profile of the Small-scale Dive Fishery in the Commonwealth of Puerto Rico	Juan J. Agar and Manoj Shivlani	10/9/2024
SEDAR91-RD03	Determining the age-size relationship of Panulirus argus in the southwest area of Puerto Rico	Ana G. Medina Martinez	10/9/2024
SEDAR91-RD04	Annual Juvenile Recruitment of Spiny Lobsters, Panulirus Argus (Decapoda, Palinuridae), in a Shallow Seagrass Bed and a Deeper Hard Bottom off Western Puerto Rico	Nilda M. Jiménez, Ernest H. Williams, Jr. and Aida Rosario	10/10/2024
SEDAR91-RD05	Patterns of Spiny Lobster (Panulirus argus) Postlarval Recruitment in the Carribbean: A CRTR Project	Mark J. Butler IV, Angela M. Mojica, Eloy Sosa-Cordero, Marines Millet and Paul Sanchez-Navarro	10/10/2024
SEDAR91-RD06	Developing a population assessment for Caribbean spiny lobster *Panulirus argus* in the United States Virgin Islands: lessons learned	Lee Richter[1] and Michael W Feeley[2]	11/7/2024
SEDAR91-RD07	Estimate of In-water Size Structure of Spiny Lobsters in St. Thomas	Tyler B. Smith, Sarah L. Heidmann, Rosmin S. Ennis, Viktor W. Brandtneris, Adeline Shelby,	11/7/2024

		Jeremiah Blondeau	
SEDAR91-RD08	Displaced juvenile and subadult Caribbean spiny lobsters show strong orientation toward home dens	Michael J. Childress a,*, Coral Holt a, Rodney D. Bertelsen b	11/14/2024
SEDAR91-RD09	Ocean acidification disrupts the orientation of postlarval Caribbean spiny lobsters	Philip M. Gravinese, Heather N. Pag, Casey B. Butler, Angelo Jason Spadaro, Clay Hewett, Megan Considine, David Lankes & Samantha Fisher	11/14/2024
SEDAR91-RD10	Relationships between postlarval settlement and commercial landings of Caribbean spiny lobster (Panulirus argus) in Florida (USA)	Emily Hutchinson, Thomas R. Matthews , Gabrielle F. Renchen	11/14/2024
SEDAR91-RD11	Gastric mill ossicles record chronological age in the Caribbean spiny lobster (*Panulirus argus*)	Emily Hutchinson, Thomas. R Matthews, Erica Ross, Samantha Hagedorn , Mark J. Butler IV,	11/14/2024
SEDAR91-12	Spiny Lobster SEAMAP Program Survey 2021-23	Department of Natural and Environmental Resources	11/14/2024
SEDAR91-13	Progress Report: Independent fishery data collection for lobster (Panulirus argus) and conch (Lobatus gigas) under the SEAMAP-C program	Juan J. Cruz Motta	11/14/2024

2. Life History

2.1 Overview

No new life history information was available for the SEDAR Panel to discuss during the data workshop. Therefore, sections 2.2-2.6 were carried over from SEDAR 57.

2.2 Stock Definition and Description

The Caribbean spiny lobster (hereafter referred to as spiny lobster), occurs in the Caribbean Sea, the Gulf of Mexico and the Western Central and South Atlantic Ocean. North Carolina marks its northernmost limit whereas Brazil marks its southernmost limit (Bliss 1982). The spiny lobster occurs from the extreme shallows of the littoral fringe to depths exceeding 100 meters (Kanciruk 1980; Munro 1974). CFMC (1981) reports that its distribution off Puerto Rico extends to the edge of the shelf, which is described as the 100−fathom contour (183 meters). Shallow areas with mangroves and seagrass (*Thalassia testudinum*) beds serve as nursery areas where available (Munro 1974). Generally, spiny lobsters move offshore when they reach reproductive size (Phillips et al. 1980). These animals are primarily carnivores, and serve as the major benthic carnivores in some ecosystems (Kanciruk 1980), feeding upon smaller crustaceans, mollusks and annelids (Cobb and Wang 1985).

2.3 Meristic & Conversion factors

Length-weight conversions were estimated using the Trip Interview Program (TIP) database. TIP records were filtered according to island platform (Puerto Rico, St. Thomas and St. John, and St. Croix). Records were further filtered such that retained records consisted only of those with paired length-weight measurements that had reported units of measure (e.g., mm or kg) and corresponding measurement type (e.g., carapace length or whole weight). A subsequent evaluation of data entry and/or measurement errors led to the removal of 1 record for St. Croix (Table 2.1)

Length-weight relationships were fit as log-linear functions in the R statistical computing software (Quinn and Deriso 1999, R Development Core Team 2012). The relationship for length (mm CL) to weight (kg whole weight) is:

$$W = aL^b$$

Model fitting was carried out using linear regression on the log transformed equation:

$$log(W) = log(a) + b * log(L)$$

Analyses were carried out separately for males, females, and for both sexes combined. For St. Croix, a total of n=20,046 L-W observations were available from TIP (n male=11,684; n female=8,362) from 1981 to 2017 (Fig. 2.1). The largest individual by length was 212.2 mm CL (1.5 kg), while the largest individual by weight was 4.5 kg (183.5 mm CL). Carapace length to weight conversion for St. Croix spiny lobsters are provided in Table 2.2.

2.4 Natural Mortality

During SEDAR 8, various sources are referenced with respect to natural mortality, including Olsen and Koblic 1975, Medley and Ninnes 1996, and FAO 2001. Natural mortality was specified at 0.36 for adult lobsters and used for all ages during SEDAR 8. During SEDAR 46 (Spiny lobster St. Thomas and St. Croix), consideration was given to natural mortality estimates from tagging studies, with estimates typically occurring between 0.26 and 0.44 year^{-1} for adult spiny lobster, with the most reliable estimates suggested to be in the range of 0.30 to 0.40 (FAO 2001). A point estimate of 0.34, calculated from a variant of Pauly's equation, is also widely reported (Cruz et al. 1981). Point estimates based on longevity were also considered, but require evidence of maximum age, which is difficult to obtain for lobsters (Kanciruk 1980). This issue is reinforced by additional statements made by Olsen and Koblic (1975). Further discussion about spiny lobster longevity can be found on pg 27, SEDAR 46, Data and Workshop report (SEDAR 2016). Several spiny lobster stock assessments in the Caribbean have used 0.34 to 0.36 year^{-1} in base model runs (Cruz 2001; Gongora 2010; SEDAR 2005; Babcock et al. 2014). During the SEDAR 57 data workshop, participants identified a mark- recapture dataset from a study undertaken by the St. Thomas Fishermen's Association (Olsen et al. 2017). Analysts determined obtaining an estimate of natural mortality from this study for use in the assessment was not feasible; this was potentially due to an underestimate of reporting practices stated by Olsen et al. (2017), which resulted in an unreasonably high (M > 2.0 per year) estimate of natural mortality (see SEDAR 57 Final Assessment Report).

2.5 Reproduction

Die (2005) estimated a logistic maturity curve from TIP prior to 1990, when landing of egg bearing females was permitted. Data from Puerto Rico, St. Thomas, and St. John were aggregated for the purpose of model fitting. Two model parameterizations were considered, in both cases, length at 50% maturity were similar being either 91 mm or 92 mm CL.

For SEDAR 8 (2005), fecundity-at-length was obtained for Cuba spiny lobster (FAO 2001):

$$E = 0.5911L^{4.5677}$$

where E is number of eggs and L is carapace length in mm.

2.6 Age and Growth

During SEDAR 8, von Bertalanffy growth curves for males and females were obtained from Leon et al. (1994) for Cuba (SEDAR 2005). Since SEDAR 8, several additional publications have become available for von Bertalanffy growth curves from regions such as Cuba, Puerto Rico, and Mexico (Table 2.3). Also, during SEDAR 46 (Spiny lobster St. Thomas & St. Croix), von Bertalanffy growth parameters from Leon et al. (1995) were reviewed, noting similar values used in other stock assessment (i.e., Gongora 2010; Babcock et al. 2014). These point estimates were also compared to a more recent study by Leon et al. (2005) and analyses in SEDAR 46 were based on a single growth curve for both sexes. During the SEDAR 57 data workshop, participants identified a mark-recapture dataset from a study undertaken by the St. Thomas

Fishermen's Association (Olsen et al. 2017). During SEDAR 57, analysts determined that obtaining a growth curve from this study for use in the assessment was not feasible. This was due to an absence of the largest size classes in the data set, though results verified that growth in Puerto Rico (Table 2.3) was generally consistent with growth in St. Thomas (see SEDAR 57 Final Assessment Report).

Table 2.1 Records manually removed from St. Croix TIP prior to L-W model fitting.

L	W	Sex
1005	0.775	M

Table 2.2 Fitted conversion functions from length (mm CL) to weight (kg whole weight) by island platform.

Island platform	Year	n	a	b
St. Croix				
Males	1981-2017	11684	1.271E-05	2.413
Females	1981-2017	8362	2.323E-05	2.290
Males + Females	1981-2017	20046	1.821E-05	2.339

Table 2.3 von Bertalanffy growth parameters, noting values used in SEDARs 8 and 46 (i.e., Leon et al. (1995)) and with emphasis on studies that have been subsequently produced.

Study	Region/Country	Source	Sex	$L\infty$ (mm)	K
Leon et al. (1995)	Cuba	Length frequency	M	184	0.24
			F	155	0.22
Leon et al. (2005)	Cuba	Length frequency	Both	184	0.24
Mateo (2004)	Puerto Rico	Length frequency	M (1999)	197	0.24
			M (2000)	195	0.24
			F (1999)	191	0.25
			F (2000)	185	0.23
Velazquez-Abunader et al. (2015)	Mexico, Yucatan	Length frequency	M	203	0.28
			F	189	0.34

Puerto Rico

St. Thomas / St. John
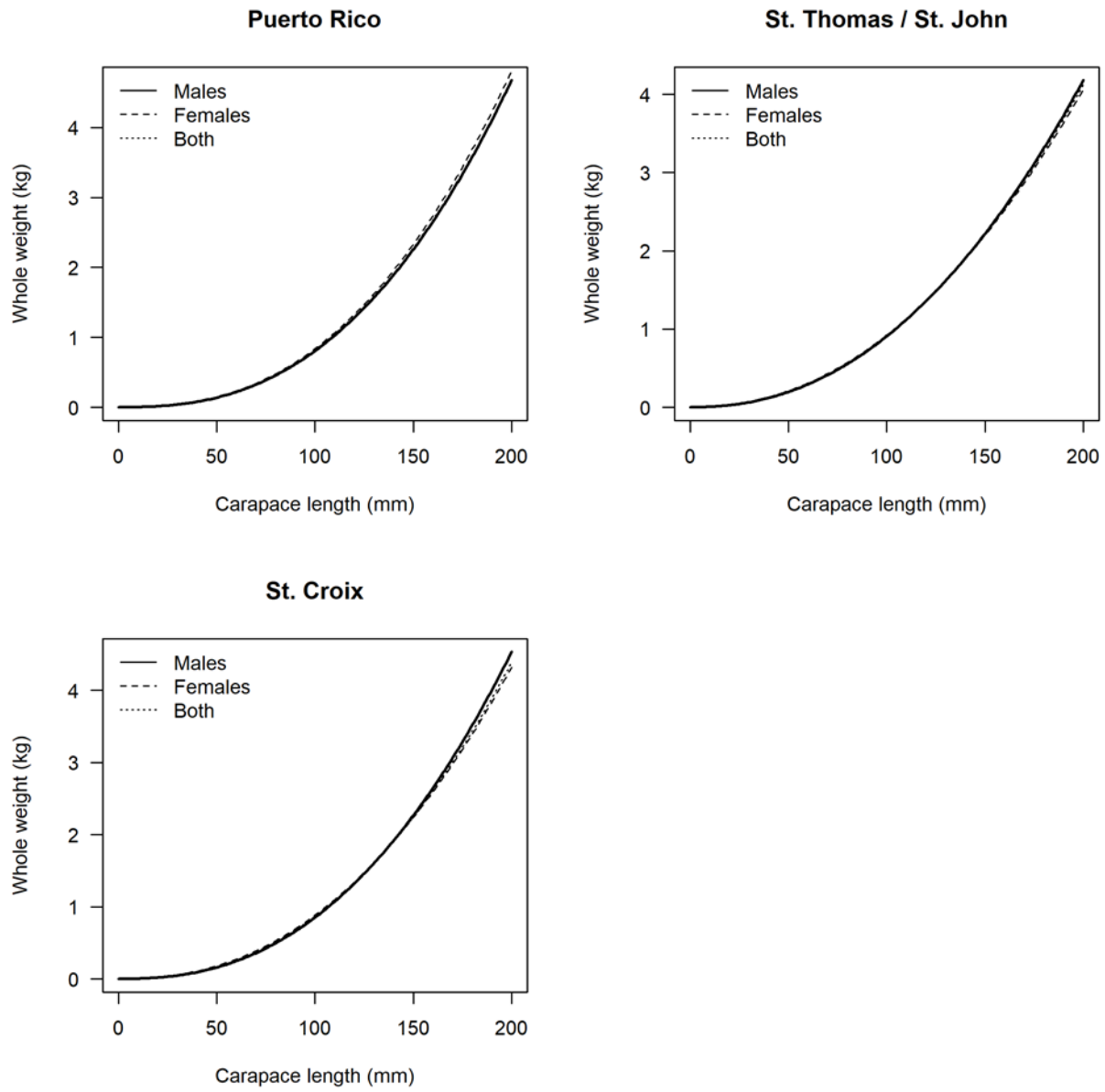
St. Croix

Figure 2.1 Length-weight curves for spiny lobster of Puerto Rico, St. Thomas/St. John, and St. Croix.

3. Commercial Fishery Statistics

3.1 Biological Sampling

3.1.1 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 the 1980s with frequent updates in best practices; the latest being in 2017. Data are collected by trained shore-based samplers (Beggerly et al., 2022).

3.1.2 Length Composition Sampling Intensity

The TIP data pertaining to Caribbean Spiny Lobster in St. Croix consists of 21,122 length observations across 1,642 unique port sampling interviews (Figure 3.1.1). Of the Caribbean spiny lobster measured, 21,100 were carapace length observations (99.9%). Plots and summary statistics of the currently available length frequency data of Caribbean spiny lobster sampled from the predominant gears in St. Croix are included in the working paper (Godwin et al. 2024).

3.1.3 Length Distributions

A variety of fishing gears were used by St. Croix commercial fishers to catch Caribbean spiny lobster. A generalized linear mixed model (GLMM) was fit to TIP data to compare mean size composition among gear types. The purpose of analysis was to identify gear groups among the commercial fishing gears with groups based upon Caribbean spiny lobster size composition. Gears with size compositions that were not significantly different were assigned to the same gear group. The analysis identified no difference between among gear specific size compositions and the gears with nonconfidential data are provided in Table 3.1.1. Summary statistics produced by the GLMM analysis of the available length frequency data from 1981 to 2023 are also found in Table 3.1.1. 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 plot for all gears combined of Caribbean spiny lobster carapace lengths collected across the time series 1981-2023 are summarized in Figure 3.1.2. Aggregated density plots of Caribbean spiny lobster landed by nonconfidential gears are summarized in Figure 3.1.3.

3.1.4 Adequacy of Size Composition Data for Characterizing Catch

Due to reducing levels of available data throughout the time series, TIP data can be considered to inform selectivity, but likely will not be sufficient to inform annual population trends in the SEDAR 91 assessment. A weight-length analysis was not conducted to identify outliers in the TIP data. A cutoff of 2.5cm minimum and 25cm maximum length was implemented to remove notable outliers in the TIP dataset (Godwin et al 2024).

Decisions:
- Consider TIP data to inform selectivity in the assessment models and allow the assessment nalyst to explore the data for any evidence of annual population trends.
- Supply complete TIP time series for use in SEDAR 91 investigations.
- Compare aggregated length density of SEAMAP-C data with that of TIP data.

3.2 Commercial Landings

3.2.1 Overview

Commercial fishery landings in St. Croix, referred to as "STX" were obtained from self-reported fisher logbook data (Caribbean Commercial Logbook, CCL). Classification of Caribbean Spiny Lobster by species began in 1974, which was a partial year (Valle-Esquivel and Díaz 2004). Commercial fishery landings data for Caribbean Spiny Lobster in STX were available for the years 1975-2023.

3.2.2 Outlier Analysis

An outlier analysis was conducted by using a mean and standard deviation method. If the landings of Caribbean Spiny Lobster reported on a trip were greater than three standard deviations from the mean (i.e., 99.73% quantile), they were marked for removal from the dataset. Outliers were identified for each gear group across all years. Total landings with and without outliers are shown in Figure 3.2.1 and the percent change in landings with outliers removed is shown in Table 3.2.1.

Decisions:
- SEDAR 91 Panel decided to use the St. Croix commercial landings without removing the outliers.
- Panel recommended using the landings time series starting in 1975.

3.2.3 St. Croix Caribbean Spiny Lobster Fishery

Logbook data are recorded by fishing year, which runs from July 1 through June 30 of the following year. However, data in this report are recorded by calendar year. St. Croix's Caribbean Spiny lobster fishery was dominated by diving as the major gear and accordingly all gears, except for trap gear, were merged into a "diving all" gear group following the protocol of the prior Caribbean Spiny Lobster assessment and its update (SEDAR 57, 2019; SEDAR 57 Update, 2022) shown in Orhun et al. (2024). The commercial landings were presented in pounds by year and fishing gear group are shown in Table 3.2.2. Note that landings from 1975 to 1982 were confidential by year and gear.

3.3 Commercial Discards

Species-specific commercial discard reporting began in July 2003 and the first full year of reporting was 2004 in the USVI for Caribbean Spiny Lobster. Commercial discards were infrequently reported by fishers. Plenary group discussion resulted in the recommendation that discard mortality be considered minimal.

Decision:
- Discard mortality of spiny lobster was considered minimal and therefore represent a very minor source of mortality due to fishing (as per SEDAR 57)

3.4 Commercial Effort

Commercial trips with reported Caribbean Spiny Lobster landings per year and gear group were compiled from 1983 to 2023 (Table 3.4.1). Note that effort data from 1975 to 1982 were confidential by year and gear.

Table 3.1.1 GLMM analysis summary results for St. Croix TIP Caribbean Spiny Lobster lengths (cm) from 1981 to 2023. The column titled "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. Only nonconfidential data shown.

Gear	Mean	Estimated Marginal Mean	LCL	UCL	Group	Lobster (n)	Interview (n)	Percentage
POTS AND TRAPS; FISH	10.61	2.37	2.36	2.37	1	11,249	824	54.20
BY HAND; DIVING GEAR	10.56	2.36	2.35	2.37	1	8,162	693	39.33
POTS AND TRAPS; CMB	10.62	2.33	2.30	2.37	1	763	33	3.68

Table 3.2.1 Comparison of all reported landings and landings after outlier removal of commercial landings of Caribbean Spiny Lobster in pounds for St. Croix .

Year	Landings (lbs.)	Landings outlier removed (lbs.)	Difference (%)
1975	2,167	2,167	0.0
1976	2,217	2,217	0.0
1977	8,168	4,728	42.1
1978	4,981	4,646	6.7
1979	3,077	2,187	28.9
1980	1,288	1,288	0.0
1981	2,104	1,924	8.6
1982	2,693	2,693	0.0
1983	4,479	4,479	0.0
1984	7,564	7,564	0.0
1985	4,424	4,424	0.0
1986	5,969	5,969	0.0
1987	13,031	13,031	0.0
1988	8,012	8,012	0.0
1989	2,207	2,207	0.0
1990	19,472	19,135	1.7
1991	37,246	35,460	4.8
1992	21,132	20,982	0.7
1993	37,177	37,027	0.4
1994	29,789	29,789	0.0
1995	25,029	25,029	0.0
1996	28,841	28,841	0.0
1997	35,947	35,947	0.0
1998	42,791	42,349	1.0
1999	53,325	51,738	3.0
2000	89,025	85,886	3.5
2001	116,622	115,702	0.8
2002	116,275	116,275	0.0
2003	106,040	105,890	0.1
2004	125,414	125,285	0.1
2005	120,931	120,036	0.7
2006	146,589	145,108	1.0
2007	167,988	166,694	0.8
2008	148,001	146,231	1.2
2009	149,812	147,364	1.6
2010	139,684	138,099	1.1
2011	109,749	107,869	1.7
2012	87,074	85,024	2.4
2013	59,397	59,272	0.2
2014	39,724	39,604	0.3
2015	44,962	43,917	2.3
2016	31,582	31,381	0.6
2017	26,193	26,193	0.0
2018	10,970	10,700	2.5
2019	15,721	15,319	2.6

Year	Landings (lbs.)	Landings outlier removed (lbs.)	Difference (%)
2020	22,312	22,207	0.5
2021	39,782	38,799	2.5
2022	28,078	27,189	3.2
2023	42,542	38,476	9.6
Total	2,387,597	2,352,353	1.5

Table 3.2.2 Commercial landings of Caribbean Spiny Lobster in pounds by gear group that reported Caribbean Spiny Lobster landings in St. Croix .

YEAR	TOTAL TRAPS LBS	TOTAL ALL DIVING LBS	GRAND TOTAL LBS
1983	3,248	*	*
1984	1,591	*	*
1985	*	*	5,969
1986	*	*	7,564
1987	5,233	7,798	13,031
1988	3,367	4,645	8,012
1989	*	*	2,207
1990	2,859	16,276	19,472
1991	6,240	29,220	37,246
1992	6,325	14,657	21,132
1993	9,483	27,544	37,177
1994	5,528	24,261	29,789
1995	4,884	20,145	25,029
1996	2,331	26,510	28,841
1997	4,258	31,689	35,947
1998	3,457	38,892	42,791
1999	6,498	45,240	53,325
2000	4,260	81,626	89,025
2001	3,516	112,186	116,622
2002	3,886	112,389	116,275
2003	3,231	102,659	106,040
2004	3,900	121,385	125,414
2005	2,563	117,473	120,931
2006	3,993	141,115	146,589
2007	5,477	161,217	167,988
2008	4,226	142,005	148,001
2009	3,927	143,437	149,812
2010	8,359	129,740	139,684
2011	14,880	92,989	109,749
2012	14,403	70,621	87,074
2013	6,010	53,262	59,397
2014	2,564	37,040	39,724
2015	5,655	38,262	44,962
2016	951	30,430	31,582
2017	2,875	23,318	26,193
2018	*	10,007	10,970
2019	1,284	14,035	15,721
2020	1,924	20,283	22,312
2021	5,257	33,542	39,782
2022	2,797	24,392	28,078
2023	827	37,649	42,542

*Confidential data by year and gear were removed. Total landings (lb.) of confidential data is 42,347. The landings from 1975 to 1982 were confidential by year and gear.

Table 3.4.1 Commercial landings of Caribbean Spiny Lobster in pounds by gear group that reported Caribbean Spiny Lobster landings in St. Croix .

TRIP YEAR	TRIPS TRAPS	TRIPS DIVING ALL	TOTAL TRIPS
1983	204	*	*
1984	147	*	*
1985	*	*	*
1986	*	*	*
1987	214	322	536
1988	113	195	308
1989	*	*	*
1990	151	416	567
1991	228	842	1,080
1992	251	449	701
1993	376	830	1,207
1994	184	754	938
1995	192	796	988
1996	146	1,006	1,152
1997	183	1,203	1,386
1998	154	1,362	1,519
1999	225	1,419	1,656
2000	190	2,357	2,566
2001	112	3,168	3,286
2002	113	3,321	3,434
2003	101	3,217	3,319
2004	94	3,495	3,590
2005	137	3,423	3,567
2006	141	3,942	4,094
2007	215	4,249	4,474
2008	135	3,547	3,695
2009	93	3,741	3,842
2010	169	3,360	3,539
2011	196	2,313	2,519
2012	185	1,852	2,045
2013	113	1,470	1,584
2014	68	1,000	1,069
2015	97	907	1,008
2016	40	793	834
2017	57	651	708
2018	*	302	313
2019	32	360	395
2020	36	410	447
2021	52	868	925
2022	42	603	648
2023	33	907	949

*Confidential data by year and gear were removed. Total landings (lb.) of confidential data is 42,347. Total number of trips of confidential data is 1721. Data from 1975 to 1982 were confidential by year and gear.
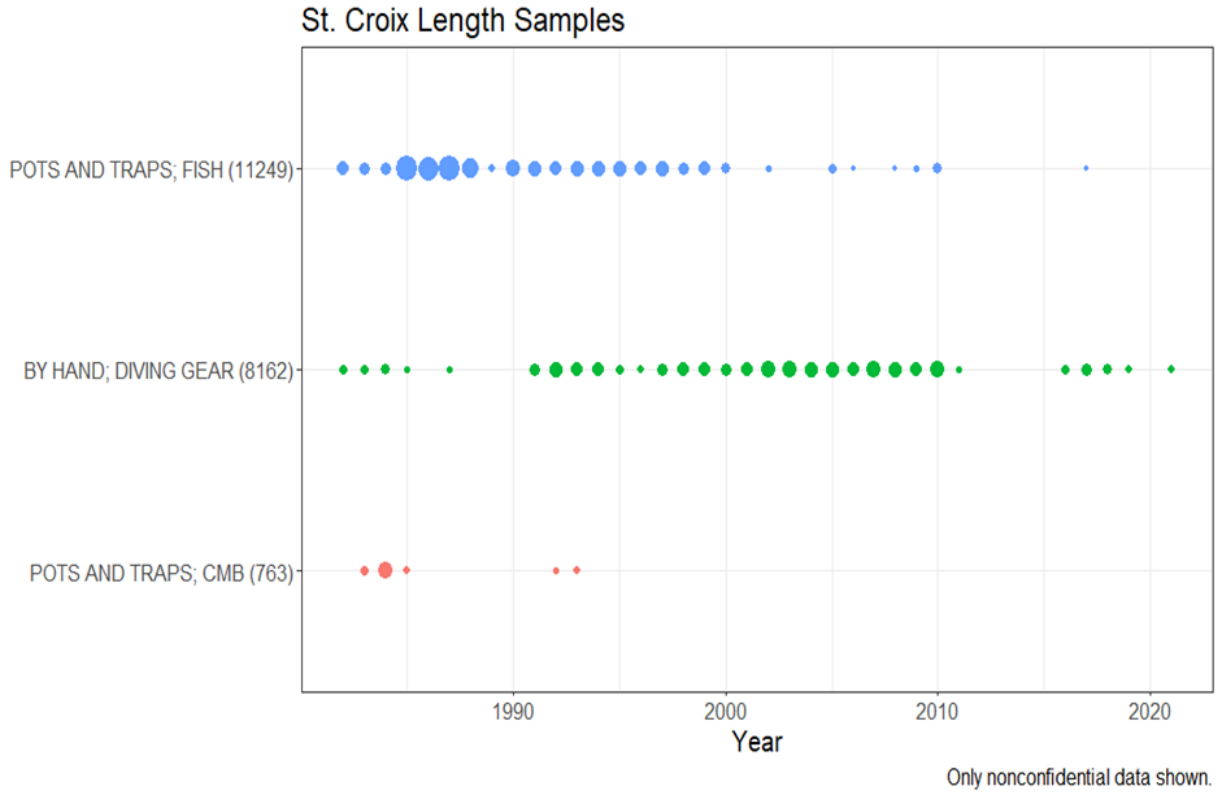
Figure 3.1.1 Plot showing relative number of Caribbean Spiny Lobster lengths in St. Croix across time collected. Each point is color specific to the gear it represents. Gears are arranged from most to least abundant.
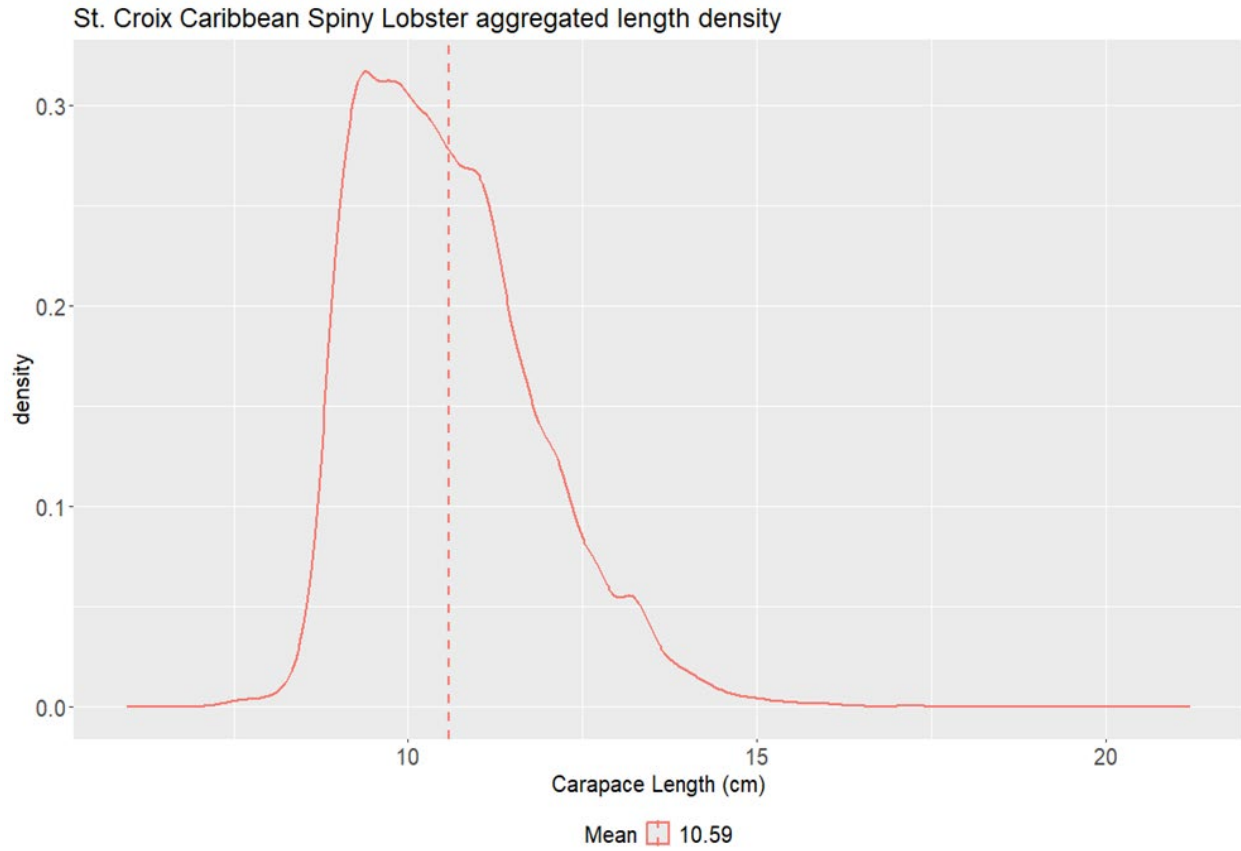
St. Croix Caribbean Spiny Lobster aggregated length density

Figure 3.1.2 Aggregated density plot of lengths(cm) of Caribbean Spiny Lobster in St. Croix , all gears combined. Dotted line represents mean length.
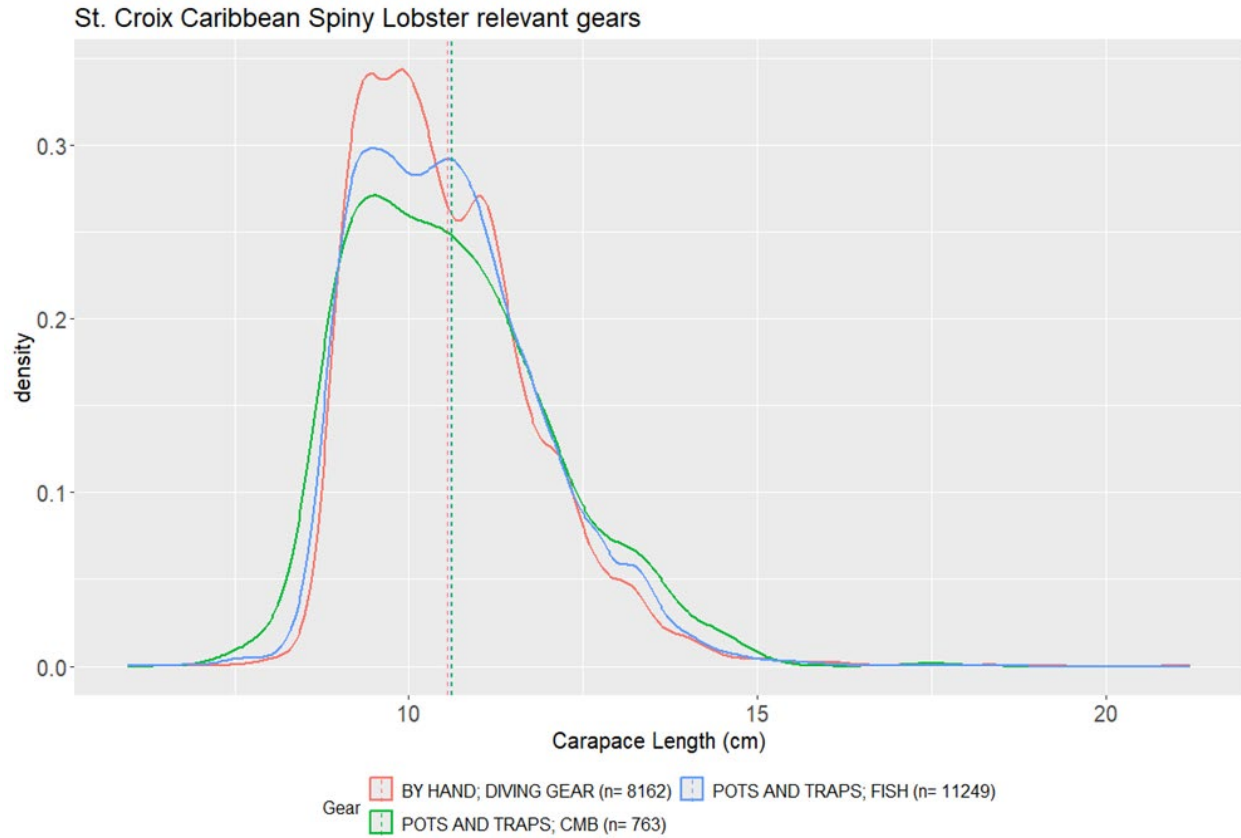
Figure 3.1.3 Aggregated density plot of lengths(cm) of nonconfidential gears recorded for Caribbean Spiny Lobster in St. Croix from 1981 to 2023 . Dotted line represents mean length. Mean lengths can be found in **Table 3.1.1**.
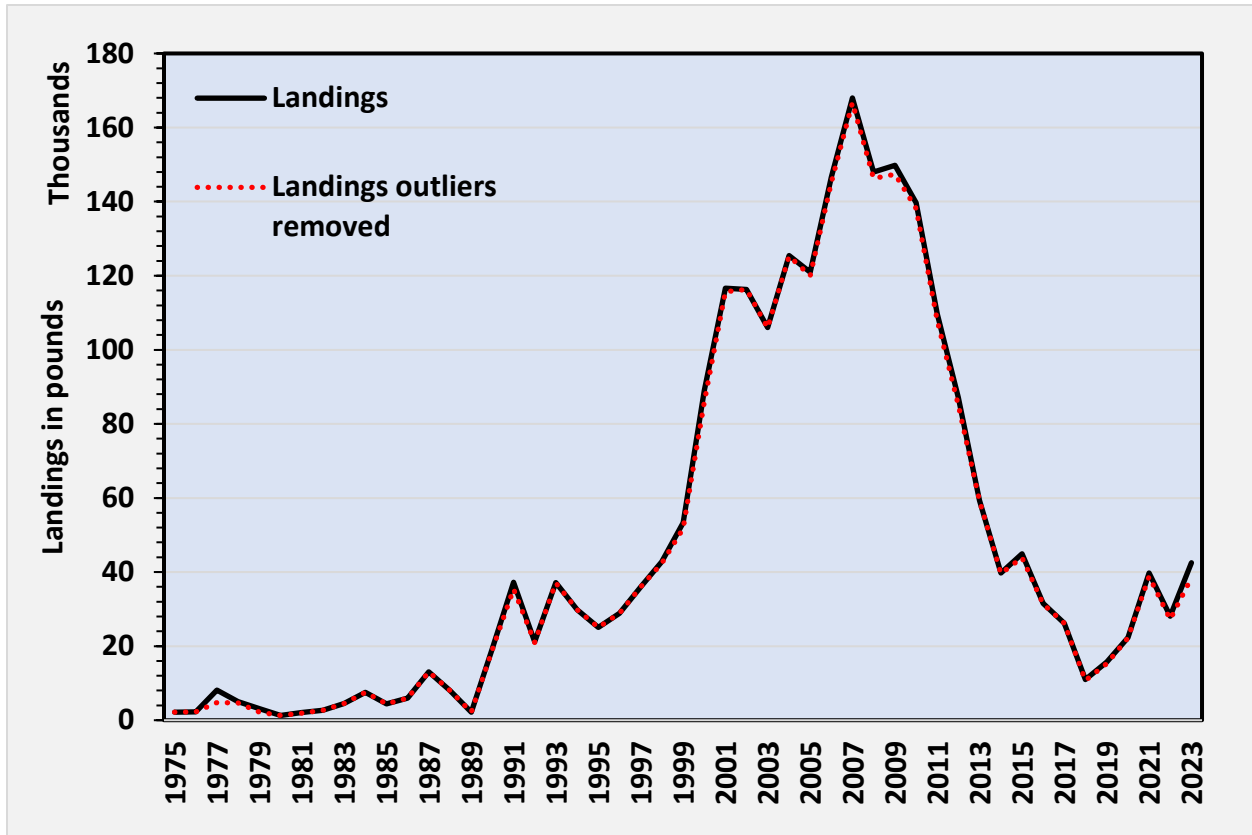
Figure 3.2.1 Commercial landings of Caribbean Spiny Lobster landings of St. Croix with and without the outliers removed.

4. Recreational Fishery Statistics

There are currently no data available on recreational landings in St. Croix.

5. Measures of Population Abundance

5.1 Overview

The panel was presented with summaries of the fishery-independent research conducted by The University of the Virgin Islands in cooperation with the Southeast Fisheries Science Center (RD-05), and by the National Park Service in Buck Island Reef National Monument and Salt River National Historical Park in St. Croix, US Virgin Islands and St. John, US Virgin Islands (RD-06). The panel discussed concerns about using data collected from the two studies for indices of relative abundance, principally due to short time series and small sample sizes, and recommended they not be considered for use in either the STX or STTJ assessment models.

6. Research Recommendations

- When developing new research projects, consider how those projects can be designed to include data collection and/or analyses that would inform ecosystem models and analyses. The original objectives of the project should not be compromised, however.

6.1 Life History Research Recommendations

- Life history studies focused on the US Caribbean – generate region-specific parameters for growth, fecundity, natural mortality.
- Look for ongoing growth/aging work via SEAMAP-C
- Merge selectivity studies, life history data collection, and fishery-independent survey frameworks to determine how to get best data for stock assessment.

6.2 Commercial Fishery Statistics Research Recommendations

6.2.1 Length Composition Research Recommendations

- Compare SEAMAP-C to TIP size composition

6.2.2   Commercial Landings Research Recommendations

- Track number of fishers per year in relation to annual landings.
- Support connectivity studies – consider spiny lobster as one stock vs. by island (metapopulation).
- Investigate weak/lack of correlation between TIP and landings data
- Demand analysis: look at price per pound (survey), market preferences, trends and correlation with landings, and for all islands.
- Investigate recruitment connectivity between island platforms, e.g., STX seeding PR, and other "hypotheses."
- Survey to determine the presence/absence of large lobsters in STX – are they available and not harvested?
- Market survey to determine whether the size of the lobster being landed is a response to the market preference/availability.
- Increase funding for port samplers to improve TIP data collection in PR and USVI.
- Propose new gear type of "diving on traps" in TIP reports (larger conversation to be had among those collecting and collating data):
    - a) Recommended this be a conversation including all jurisdictions,
    - b) Periodically review gears on forms to ensure they are accurate.

6.2.3   Discards and Discard Mortality Research Recommendations

- Discard information in the catch reports doesn't include data on length or sex in current reporting schema

6.3 Indices Research Recommendations

-     The panel recommended moving forward with planned lobster trap surveys in the US Virgin Islands.

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