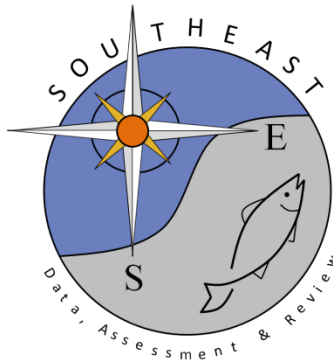


SEDAR 91 Commercial Landings of Caribbean Spiny Lobster (*Panulirus argus*) in St. Croix, US Caribbean, 1975-2023

M. Refik Orhun<sup>1</sup> \*, Katherine Godwin<sup>3</sup>, Kim Johnson<sup>2</sup>, and Stephanie Martínez Rivera<sup>1</sup>

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November 22, 2024

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## 1. Introduction

Commercial fishery landings in St. Croix (STX) were obtained from self-reported fisher logbook data (Caribbean Commercial Logbook, CCL). Logbook reporting began in 1974, however, landings were initially reported by gear type (e.g., net fish, hook fish, pot fish, and spear fish) and as either snapper/grouper or as other fin fish group during the period 1974-1995 (Valle-Esquivel and Díaz 2004). Beginning in 1996 (St. Croix) and 1997 (St. Thomas and St. John) 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 1998 (St. Croix) and 2000 (St. Thomas and St. John). Classification of Caribbean Spiny Lobster by species, however, began in 1974 (partial year, changes to reporting forms are usually implemented in July). Commercial fishery landings data for Caribbean Spiny Lobster in STX were available for the years 1975-2023.

## 2. Methods

Commercial landings of Caribbean Spiny Lobster were compiled from 1975 to 2023 for STX. The commercial landings were provided in pounds and the number of trips with reported Spiny Lobster landings were summed by year and fishing gear group.

### 2.1 Gear groups

Individual fishing gear names used by Caribbean Spiny Lobster fishers in STX logbooks (1975-2023) are shown in a column titled “GEAR NM” in Table 1. In order to classify the landings into gear groups by the individual gears (or GEAR NMs) with similar size selectivity, length composition data of Caribbean Spiny Lobster from the Fishery Dependent (FD) Trip Interview Program (TIP) database were analyzed using generalized linear models (GLMs). The statistical analysis conducted by Godwin et al. (2024) showed which gears had significantly different length distributions.

Based on the result of the GLMs and reported commercial landings, commercial landings of Caribbean Spiny Lobster were classified into 2 gear groups (Table 1).

Table 1: The classification of the commercial logbook gears into gear groups.

<b>GEAR NM</b>	<b>GEAR GROUP</b>
LOBSTER TRAP	TRAPS
DIVING BY HAND	DIVING ALL
TRAPS	TRAPS
UNKNOWN	DIVING ALL
DIVING	DIVING ALL
GILLNET	DIVING ALL
LINE FISHING	DIVING ALL

SEINE NET	DIVING ALL
COMBINED GEARS	DIVING ALL
DIVING WITH NETS	DIVING ALL
CASTNET	DIVING ALL
NETS	DIVING ALL
TRAMMEL NET	DIVING ALL
BY HAND WITH SCUBA	DIVING ALL
FISH TRAP	TRAPS
BY HAND	DIVING ALL
TRAP-UNKNOWN TYPE	TRAPS
BY SNARE WITH SCUBA	DIVING ALL
SPEARGUN WITH SCUBA	DIVING ALL
SKIN DIVING AND SCUBA	DIVING ALL
GILL NET	DIVING ALL
SPEARFISHING WITH SCUBA	DIVING ALL
HAND GAFF WHILE SCUBA DIVING	DIVING ALL
HAND SNARE WHILE SKIN DIVING	DIVING ALL
BY HAND WHILE SKIN DIVING	DIVING ALL
HAND GAFF WHILE SKIN DIVING	DIVING ALL
HANDLINE	DIVING ALL
SPEARFISHING WHILE SKIN DIVING	DIVING ALL

## 2.2 Outliers

Outlier removal was conducted by using a mean and standard deviation method. We calculated the values to define outliers by gear group and island (Table 2). 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 removed from the dataset. Due to the outlier removal, the yearly commercial landings for Caribbean Spiny Lobster compiled in SEDAR91 may not match with previous SEDARs. However, we provided the commercial landings for Caribbean Spiny Lobster in STX after the outlier analysis and without the outlier analysis.

Table 2: Commercial landings of Caribbean Spiny Lobster in pounds equal to three standard deviations from the mean (i.e., 99.73% quantile) by gear group used for the outlier analysis. Trips with pounds landed greater than the indicated value were removed from the dataset.

<b>GEAR NAMES</b>	<b>99.73% Quantile</b>
LOBSTER TRAP	250
BY SNARE WITH SCUBA	305
DIVING	120
BY HAND WITH SCUBA	119
HAND SNARE WHILE SKIN DIVING	469
FISH TRAP	319
TRAP-UNKNOWN TYPE	290
BY HAND	106
TRAPS	198
GILLNET	100
DIVING BY HAND	143
COMBINED GEARS	131
UNKNOWN	124
BY HAND WHILE SKIN DIVING	110
SKIN DIVING AND SCUBA	112
SPEARFISHING WITH SCUBA	103
SEINE NET	93
CASTNET	96
LINE FISHING	88
DIVING WITH NETS	64
HAND GAFF WHILE SCUBA DIVING	60
SPEARGUN WITH SCUBA	60
TRAMMEL NET	56
HANDLINE	51

HAND GAFF WHILE SKIN DIVING	30
NETS	30
GILL NET	25
SPEARFISHING WHILE SKIN DIVING	15

### *2.3 Confidentiality*

Confidential data were determined based on the number of fishers that reported commercial landings by year and gear group. If the number of fishers was less than 3 then those data were considered confidential.

### *2.4 Discards*

Species-specific commercial discard reporting started in 2003 in STX for Caribbean Spiny Lobster.

## **3. Results**

### *3.1 Commercial landings*

Commercial landings of Caribbean Spiny Lobster in St. Croix from 1975 to 2023, were approximately 1,288-167,988 pounds per year (Table 3, Figure 1). Trips per year varied between approximately 66-4,474 (Table 3, Figure 2). The landings from 1975 to 1977 were confidential by year.

The commercial landings by year and gear group are shown in Table 4 and Figure 3, and the number of trips in Figure 4. The landings from 1975 to 1982 were confidential by year and gear.

Table 3: Commercial landings of Caribbean Spiny Lobster in pounds and the number of trips that reported Caribbean Spiny Lobster landings in St. Croix .

Year	Landings (lbs)	Trips (n)
1978	4,981	157
1979	3,077	87
1982	2,693	125
1983	4,479	245
1984	7,564	345
1986	5,969	239
1987	13,031	536
1988	8,012	308

1990	19,472	567
1991	37,246	1,080
1992	21,132	701
1993	37,177	1,207
1994	29,789	938
1995	25,029	988
1996	28,841	1,152
1997	35,947	1,386
1998	42,791	1,519
1999	53,325	1,656
2000	89,025	2,566
2001	116,622	3,286
2002	116,275	3,434
2003	106,040	3,319
2004	125,414	3,590
2005	120,931	3,567
2006	146,589	4,094
2007	167,988	4,474
2008	148,001	3,695
2009	149,812	3,842
2010	139,684	3,539
2011	109,749	2,519
2012	87,074	2,045
2013	59,397	1,584
2014	39,724	1,069
2015	44,962	1,008
2016	31,582	834
2017	26,193	708



2018	10,970	313
2019	15,721	395
2020	22,312	447
2021	39,782	925
2022	28,078	648
2023	42,542	949
Total	2,365,022	66,086

\*Confidential data by year were removed. Total landings (lb) of confidential data is 22,575. Total number of trips of confidential data is 874. The landings from 1975 to 1977 were confidential by year.

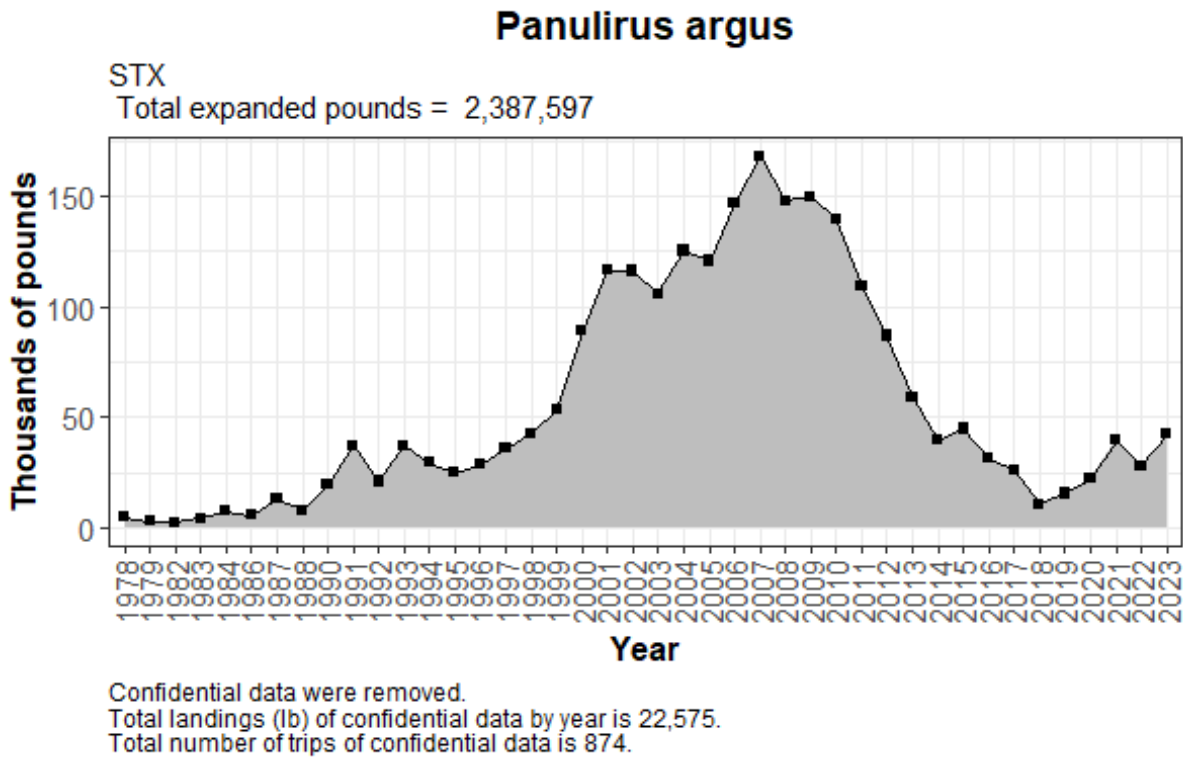
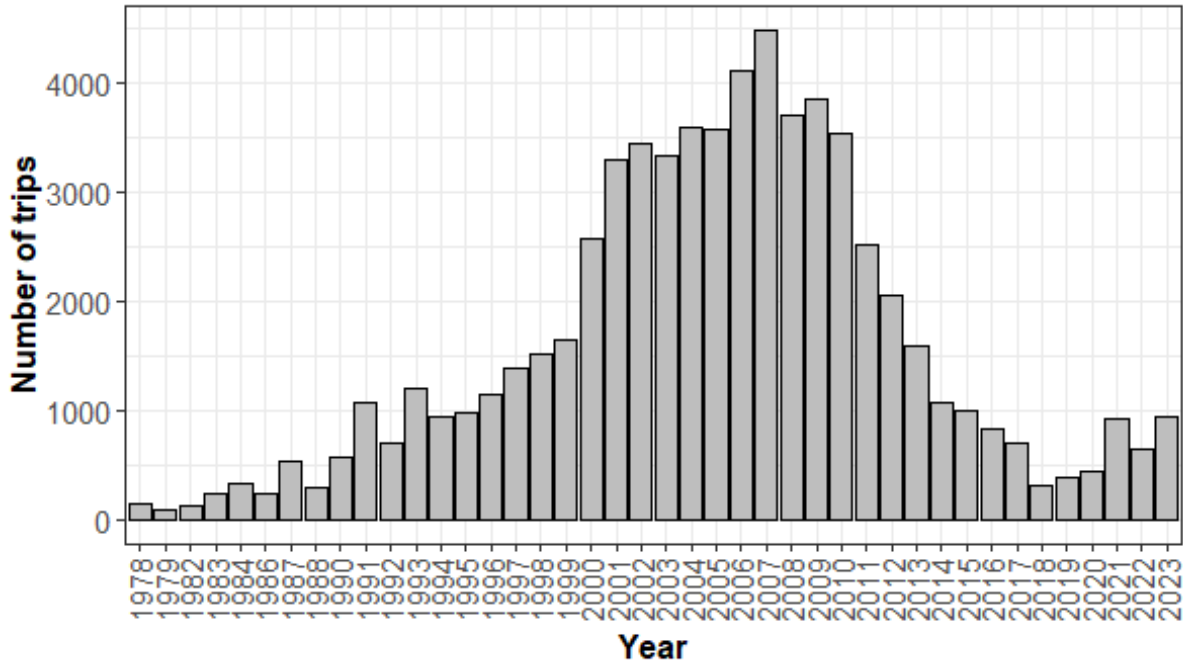


Figure 1: The time series of commercial landings in pounds of Caribbean Spiny Lobster in St. Croix. The landings from 1975 to 1977 were confidential by year.



Confidential data were removed.  
 Total landings (lb) of confidential data by year is 22,575.  
 Total number of trips of confidential data is 874.

Figure 2: The time series of number of trips of Caribbean Spiny Lobster in St. Croix. The landings from 1975 to 1977 were confidential by year.

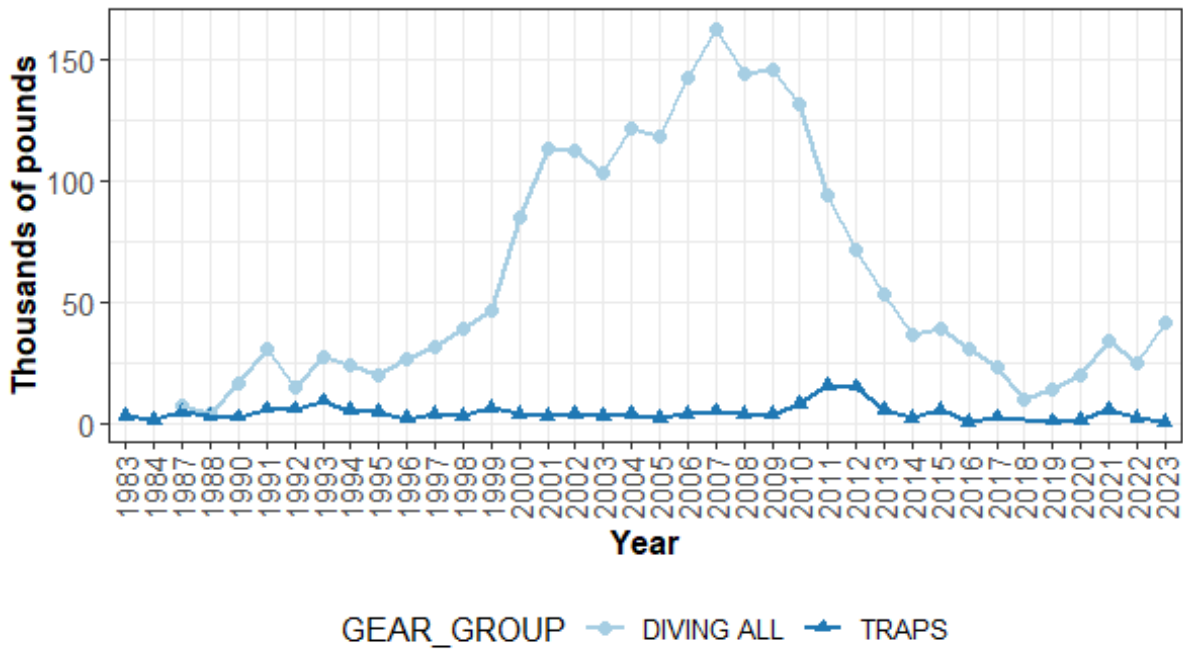
Table 4: Commercial landings of Caribbean Spiny Lobster in pounds by gear group that reported Caribbean Spiny Lobster landings in St. Croix .

TRIP YEAR	TOTAL LBS TRAPS	TRIPS TRAPS	TOTAL LBS DIVING ALL	TRIPS DIVING ALL
1983	3,248	204	*	*
1984	1,591	147	*	*
1987	5,233	214	7,798	322
1988	3,367	113	4,645	195
1990	2,859	151	16,613	416
1991	6,240	228	31,006	852
1992	6,325	251	14,807	450
1993	9,483	376	27,694	831

1994	5,528	184	24,261	754
1995	4,884	192	20,145	796
1996	2,331	146	26,510	1,006
1997	4,258	183	31,689	1,203
1998	3,457	154	39,334	1,365
1999	6,498	225	46,827	1,431
2000	4,260	190	84,765	2,376
2001	3,516	112	113,106	3,174
2002	3,886	113	112,389	3,321
2003	3,231	101	102,809	3,218
2004	3,900	94	121,514	3,496
2005	2,563	137	118,368	3,430
2006	3,993	141	142,596	3,953
2007	5,477	215	162,511	4,259
2008	4,226	135	143,775	3,560
2009	3,927	93	145,885	3,749
2010	8,575	170	131,109	3,369
2011	15,707	200	94,042	2,319
2012	15,453	188	71,621	1,857
2013	6,010	113	53,387	1,471
2014	2,564	68	37,160	1,001
2015	5,655	97	39,307	911
2016	951	40	30,631	794
2017	2,875	57	23,318	651
2018	*	*	10,277	304
2019	1,284	32	14,437	363
2020	1,924	36	20,388	411
2021	5,783	54	33,999	871

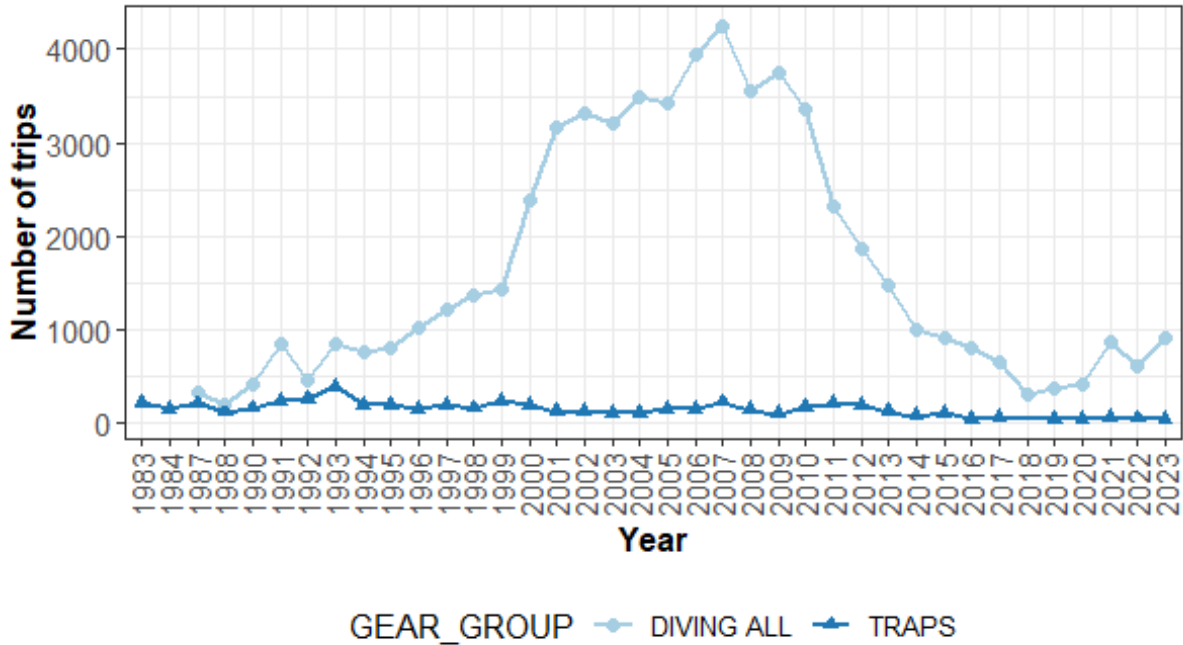
2022	2,797	42	25,281	606
2023	827	33	41,715	916
Total	174,686	5,229	2,165,719	60,001

\*Confidential data by year and gear were removed. Total landings (lb) of confidential data is 47,192. Total number of trips of confidential data is 1,730. The landings from 1975 to 1982 were confidential by year and gear.



Confidential data were removed.  
 Total landings (lb) of confidential data by year and gear is 47,192.  
 Total number of trips of confidential data is 1730.

Figure 3: Commercial landings in pounds of Caribbean Spiny Lobster by year and gear group in St. Croix. The landings from 1975 to 1982 were confidential by year and gear.



Confidential data were removed.  
 Total landings (lb) of confidential data by year and gear is 47,192.  
 Total number of trips of confidential data is 1730.

Figure 4: Number of trips of Caribbean Spiny Lobster by year and gear group in St. Croix. The landings from 1975 to 1982 were confidential by year and gear.

### 3.2 Commercial landings after outlier analysis by gears

Commercial landings of Caribbean Spiny Lobster in St. Croix from 1975 to 2023, were approximately 1,288-166,694 pounds per year (Table 5, Figure 5). The landings from 1975 to 1977 were confidential by year. Comparison of commercial landings after outlier analysis is shown in Table 7. Trips per year varied between approximately 66-4,464 (Table 5, Figure 6). The commercial landings by year and gear group are shown in Table 6 and Figure 7, and the number of trips in Figure 8. The landings from 1975 to 1982 were confidential by year and gear.

Table 5: Commercial landings of Caribbean Spiny Lobster in pounds and the number of trips that reported Caribbean Spiny Lobster landings in St. Croix .

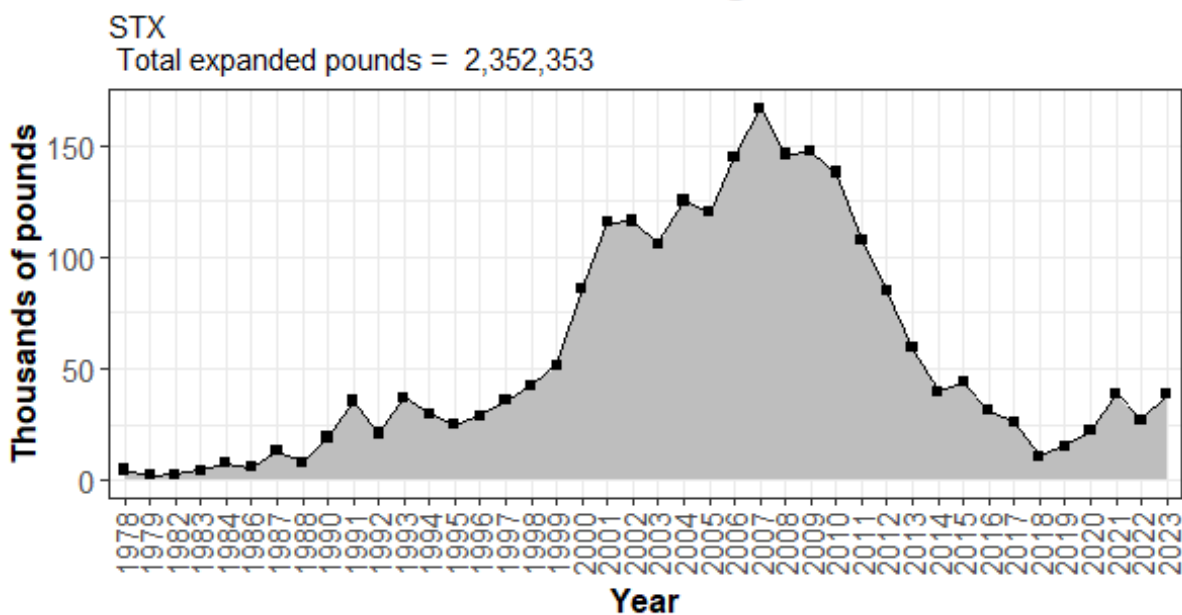
Year	Landings (lbs)	Trips (n)
1978	4,646	155
1979	2,187	84
1982	2,693	125
1983	4,479	245

1984	7,564	345
1986	5,969	239
1987	13,031	536
1988	8,012	308
1990	19,135	565
1991	35,460	1,070
1992	20,982	700
1993	37,027	1,206
1994	29,789	938
1995	25,029	988
1996	28,841	1,152
1997	35,947	1,386
1998	42,349	1,516
1999	51,738	1,644
2000	85,886	2,547
2001	115,702	3,280
2002	116,275	3,434
2003	105,890	3,318
2004	125,285	3,589
2005	120,036	3,560
2006	145,108	4,083
2007	166,694	4,464
2008	146,231	3,682
2009	147,364	3,834
2010	138,099	3,529
2011	107,869	2,509
2012	85,024	2,037
2013	59,272	1,583

2014	39,604	1,068
2015	43,917	1,004
2016	31,381	833
2017	26,193	708
2018	10,700	311
2019	15,319	392
2020	22,207	446
2021	38,799	920
2022	27,189	645
2023	38,476	940
Total	2,333,398	65,918

\*Confidential data by year were removed. Total landings (lb) of confidential data is 18,955. Total number of trips of confidential data is 870. The landings from 1975 to 1977 were confidential by year.

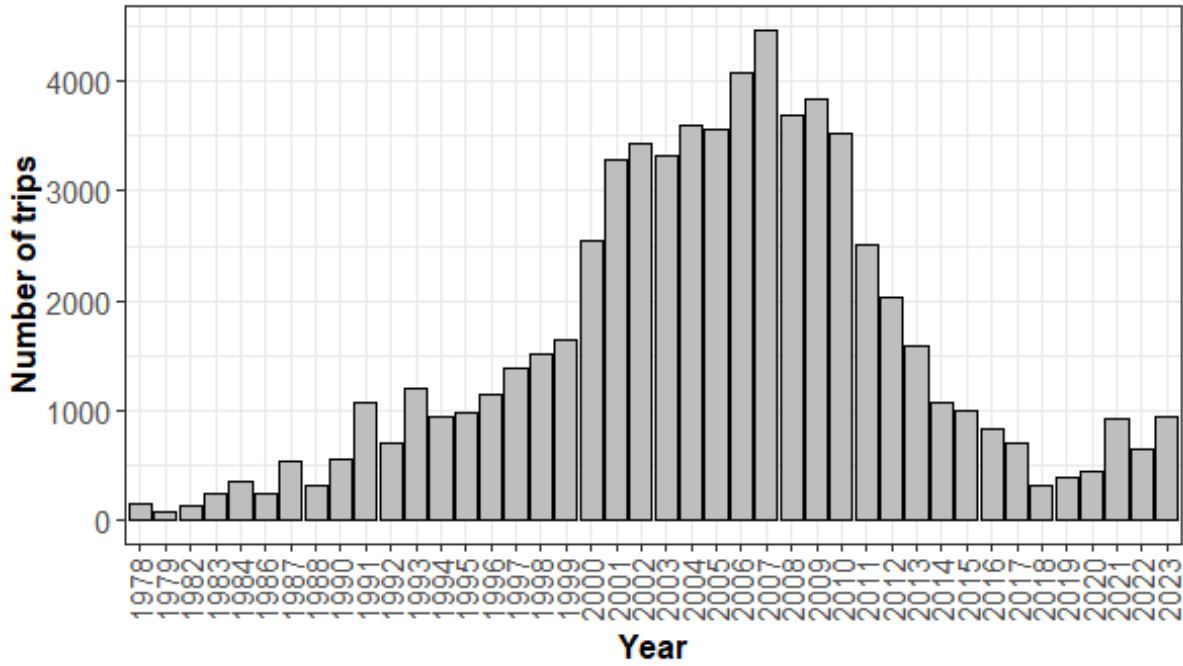
## Panulirus argus



Confidential data were removed.  
Total landings (lb) of confidential data by year is 18,955.  
Total number of trips of confidential data is 870.

Figure 5: The time series of commercial landings in pounds of Caribbean Spiny Lobster in St. Croix. The landings from 1975 to 1977 were confidential by year.





Confidential data were removed.  
 Total landings (lb) of confidential data by year is 18,955.  
 Total number of trips of confidential data is 870.

Figure 6: The time series of number of trips of Caribbean Spiny Lobster in St. Croix. The landings from 1975 to 1977 were confidential by year.

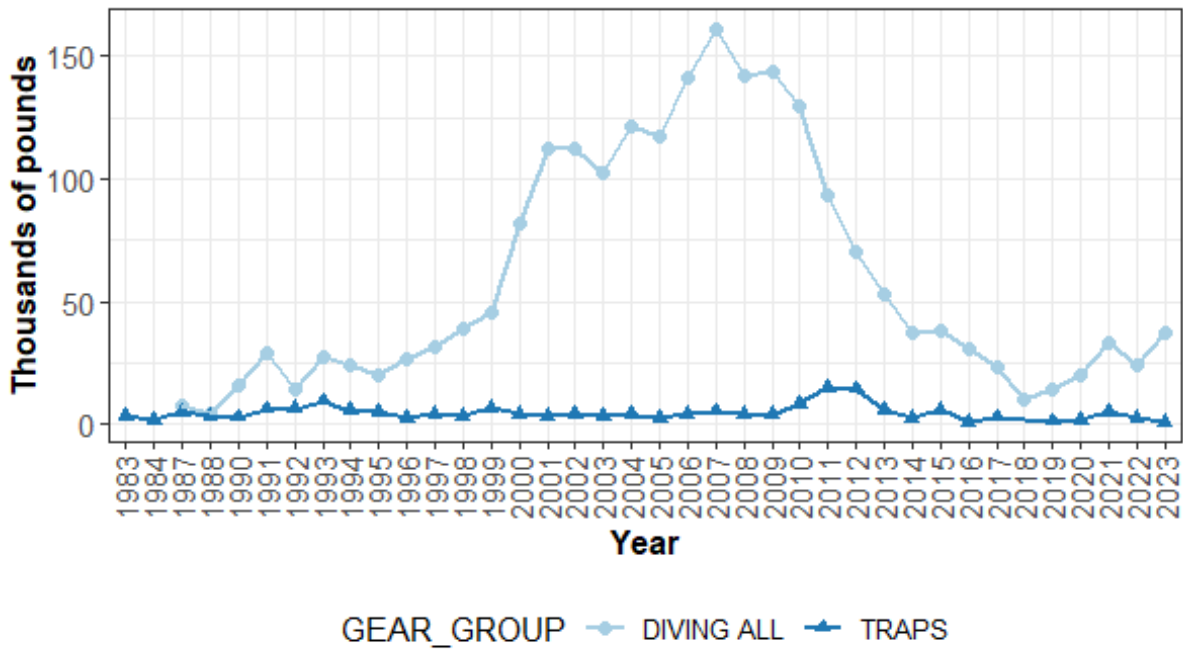
Table 6: Commercial landings of Caribbean Spiny Lobster in pounds by gear group that reported Caribbean Spiny Lobster landings in St. Croix .

TRIP YEAR	TOTAL LBS TRAPS	TRIPS TRAPS	TOTAL LBS DIVING ALL	TRIPS DIVING ALL
1983	3,248	204	*	*
1984	1,591	147	*	*
1987	5,233	214	7,798	322
1988	3,367	113	4,645	195
1990	2,859	151	16,276	414
1991	6,240	228	29,220	842
1992	6,325	251	14,657	449
1993	9,483	376	27,544	830

1994	5,528	184	24,261	754
1995	4,884	192	20,145	796
1996	2,331	146	26,510	1,006
1997	4,258	183	31,689	1,203
1998	3,457	154	38,892	1,362
1999	6,498	225	45,240	1,419
2000	4,260	190	81,626	2,357
2001	3,516	112	112,186	3,168
2002	3,886	113	112,389	3,321
2003	3,231	101	102,659	3,217
2004	3,900	94	121,385	3,495
2005	2,563	137	117,473	3,423
2006	3,993	141	141,115	3,942
2007	5,477	215	161,217	4,249
2008	4,226	135	142,005	3,547
2009	3,927	93	143,437	3,741
2010	8,359	169	129,740	3,360
2011	14,880	196	92,989	2,313
2012	14,403	185	70,621	1,852
2013	6,010	113	53,262	1,470
2014	2,564	68	37,040	1,000
2015	5,655	97	38,262	907
2016	951	40	30,430	793
2017	2,875	57	23,318	651
2018	*	*	10,007	302
2019	1,284	32	14,035	360
2020	1,924	36	20,283	410
2021	5,257	52	33,542	868

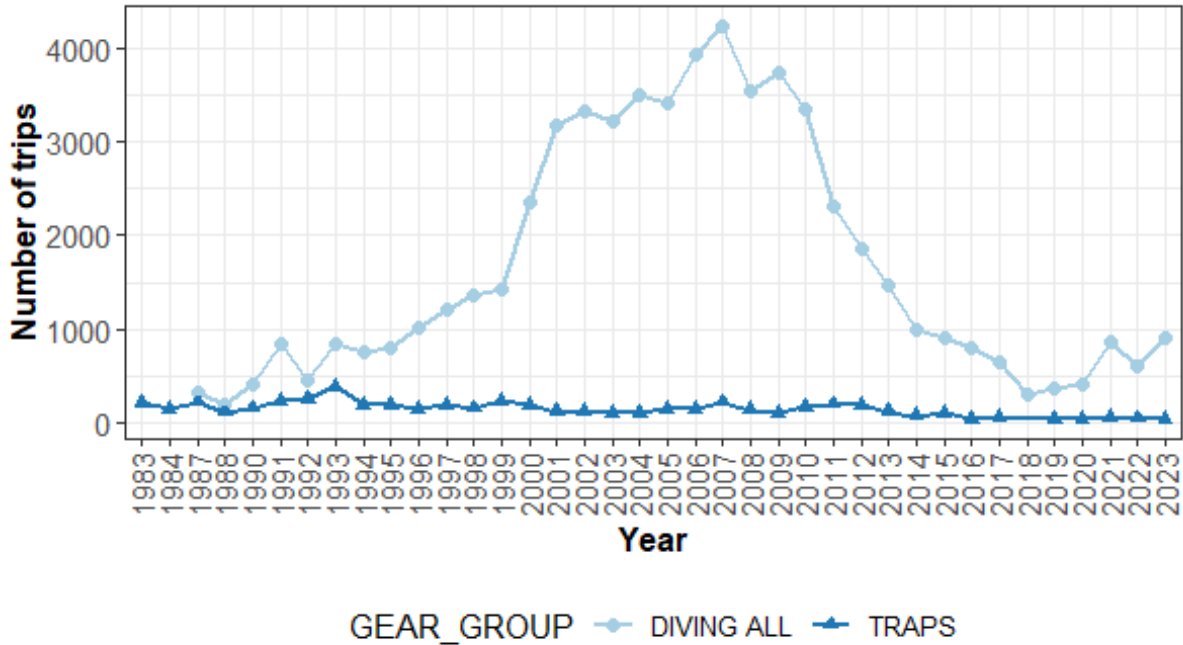
2022	2,797	42	24,392	603
2023	827	33	37,649	907
Total	172,067	5,219	2,137,939	59,848

\*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. The landings from 1975 to 1982 were confidential by year and gear.



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.

Figure 7: Commercial landings in pounds of Caribbean Spiny Lobster after outlier removal by year and gear group in St. Croix. The landings from 1975 to 1982 were confidential by year and gear.



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.

Figure 8: Number of trips of Caribbean Spiny Lobster by year and gear group after outlier removal in St. Croix. The landings from 1975 to 1982 were confidential by year and gear.

Table 7: 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 analysis (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
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

### *3.3 Commercial discards*

Few reports of discarded lobster are available. Following the recommendation of SEDAR 57, lobster discard mortality is presumed to be negligible.

## **4. Literature Cited**

Godwin, K., Rios, A. and K. Dettloff. 2024. SEDAR 91 Trip Interview Program (TIP) Size Composition Analysis of Caribbean Spiny Lobster (*Panulirus argus*) in St. Croix, U.S. Caribbean, 1981-2023. SEDAR-91-DW-06. 8pp.

SEDAR 57. 2019. "SEDAR 57 Stock Assessment Report U.S. Caribbean Spiny Lobster." North Charleston SC. <http://sedarweb.org/sedar-57>. SEDAR, North Charleston, SC. 232 pp.

SEDAR 57 Update. 2022. "SEDAR 57 Stock Assessment Update St. Croix Caribbean Spiny Lobster." SEDAR, North Charleston, SC. 13 pp.

Valle-Esquivel, M., and Díaz, G. 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). 48 pp.