Summary of the Trip Interview Program data for Spiny Lobster from the US Caribbean

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Introduction

Trip Interview Program

The Trip Interview Program (TIP) is a port sampling program that collects data to provide information that is otherwise not collected through logbook reporting. Size frequency data, species composition information, and sometimes other biological information are collected. Information about fishing area, fishing gear, etc., is collected.

This working paper summarizes the individual carapace length measurements from 1980-2017 that are currently available for use in the SEDAR 57 stock assessment of Caribbean Spiny Lobster. At the time that this pre-decisional working paper was prepared, the data entry in Puerto Rico for years 2016 and 2017 were not yet complete (Daniel Matos, personal communication, May 22, 2018). Since port samplers are actively entering those data, another extraction of the TIP database with additional complete years may or may not become available for use in SEDAR 57. Final model inputs are due August 3, 2018.

Methods

The methods used to prepare the TIP data for SEDAR 57 are similar to those described by Bryan (2015). Preparing the TIP carapace length measurements of Spiny Lobster for use in assessment methods involves three steps:

1. Evaluate gear types and recommend aggregation strategies

2. Evaluate spatial characteristics and recommend strata for potential spatial analyses

3. Evaluate annual sample sizes and recommend gear and spatial strata for SEDAR 57

Gear Types and Gear Groupings

Table 1 reproduces the gear type groupings recommended in 2016 for SEDAR 46. Those gear groupings were recommended based on an analysis of all TIP interviews in Puerto Rico, St. Thomas/St. John, and St. Croix. To determine if different gear groupings should be recommended for SEDAR 57, a further in-depth evaluation of the primary and secondary gears by island is included that summarizes only the TIP interviews where Spiny Lobsters were measured (SL interviews).

Primary Gears

Table 2 provides the number of SL interviews by island and primary gear. Previous analyses for SEDAR 46 showed that each island had somewhat different predominant gear types, and that seven main gears made up 95% of the intercepted trips on each island. The current analysis again reveals that the islands have somewhat different predominant gears, but that only three or four primary gears made up more than 95% of the SL interviews from each island.

- In Puerto Rico (PR), 96.1% of SL interviews were associated with the following 4 primary gears: BY HAND, DIVING GEAR (74.3%); POTS AND TRAPS, FISH (15.2%); POTS AND TRAPS, SPINY LOBSTER (3.9%); TRAMMEL NETS (2.7%).

- In St. Thomas/St. John (STT), 96.3% of SL interviews were associated with the following 4 primary gears: POTS AND TRAPS, FISH (48.1%); POTS AND TRAPS, SPINY LOBSTER (28.0%); BY HAND, DIVING GEAR (12.9%); POTS AND TRAPS, CMB (7.4%).

- In St. Croix (STX), 97.9% of SL interviews were associated with the following 3 primary gears: POTS AND TRAPS, FISH (52.4%); BY HAND, DIVING GEAR (40.6%); SPEARS (4.9%).

Primary Gear Recommendations

Because so many of the SL interviews in the TIP data are associated with only a few gears, it is not recommended to retain interviews associated with other primary gears. To aid in identifying other potentially relevant but uncommon gears, analysts attending the Data Workshop will be able to generate additional summary tables not included here, pending that confidentiality requirements can be met. Given that all other gears are associated with relatively few interviews, their inclusion would be unlikely to change the recommendations in the sections that follow. Appropriate groupings of the primary gear types identified above are explored next.

Gear Groupings

Multiple gears can be recorded as part of the TIP interview. Table 2 shows the percentage of interviews associated with each predominant primary gear that also reported a secondary gear. The numbers reflect the assumption that if a secondary gear was unspecified or recorded as NA, a single gear was used. This information can be used to infer what gears are frequently used together.

Gear Group Recommendations

Table 1 shows the TIP gear types recommended for SEDAR 57. The groupings reflect gears that are both frequently used together (Table 2) and are assumed to have similar selectivities. Slightly different groups are recommended for each island, reflecting the differences in their predominant primary gears. The primary gears that make up each gear type by island are also summarized here.

	Diving Gear Type	**Pots and Traps Gear Type**	**Trammel Nets Gear Type**
PR	BY HAND, DIVING GEAR	POTS AND TRAPS, FISH POTS AND TRAPS, SPINY LOBSTER	TRAMMEL NETS
STT	BY HAND, DIVING GEAR	POTS AND TRAPS, FISH POTS AND TRAPS, SPINY LOBSTER POTS AND TRAPS, CMB	NA
STX	BY HAND, DIVING GEAR SPEARS	POTS AND TRAPS, FISH	NA

Interviews reporting more than one gear type are not recommended for use in length based models. This is recommended to ensure the length data associated with a particular gear type reflects its selectivity rather than the combination of multiple selectivities. This action results in either no loss or a relatively small loss of interviews associated for each aggregated gear type. Only one gear type and island combination (pots_traps in Puerto Rico) would have a reduction in total interviews greater than 1%:

- 99.8% of interviews retained for diving gear type in Puerto Rico
- 97.7% of interviews retained for pots and traps gear type in Puerto Rico
- 100% of interviews retained for trammel nets gear type in Puerto Rico
- 99.6% of interviews retained for pots and traps gear type in St. Thomas/St. John
- 100% of interviews retained for diving gear type in St. Thomas/St. John
- 99.2% of interviews retained for pots and traps gear type in St. Croix
- 99.9% of interviews retained for diving gear type in St. Croix

Fishing Areas

Fishing area and county landed can be reported as part of the TIP interview. Understanding how the spatial distribution of the samples in TIP compare to the spatial distribution of the reported landings is one element to determining if the TIP length data are sufficiently spatially representative of total removals of spiny lobster.

Puerto Rico Fishing Areas

In Puerto Rico the county landed matches with a municipality.

- Puerto Rico Diving Gear Type: SL interviews were most frequently reported in municipalities in west Puerto Rico (53.3%) followed by south (32.3%), east (11.9%), and north (1.4%). 1.1% of interviews did not specify the county landed. From 1989 to 2003, most SL interviews were from municipalities in south Puerto Rico. From 2003-2015, most SL interviews were from municipalities in west Puerto Rico.

- Puerto Rico Pots and Traps Gear Type: SL interviews were most frequently reported in municipalities in south Puerto Rico (35.2%) followed by east (25.8%), west (23.3%), and north 11.1%). 4.6% of interviews did not specify the county landed. In the five most recent years of data (2011-2015), more than half of the SL interviews (59.0%) were from municipalities in the south of Puerto Rico.

- Puerto Rico Trammel Nets Gear Type: SL interviews were most frequently reported in municipalities in west Puerto Rico (80.9%) followed by south (18.5%).

Recommendations Puerto Rico Fishing Areas

At the data workshop, trends in the number of TIP interviews will be compared to the number of logbook trips by year, gear type, and coast. This will help determine if the TIP data are spatially representative of the distribution of the fishery as well as if spatial analyses are feasible and necessary.

Given the low number of SL interviews by gear and year in the TIP data for the trammel net gear types in Puerto Rico (Table 3), it is not recommended to consider the feasibility of spatial analyses for this gear type.

St. Thomas and St. John Fishing Areas

In the USVI, the county landed is St.Croix, St. Thomas, or St. John. Bryan (2015) summarized and explored the maps used in the USVI over time to report fishing area in the TIP data. She found that the the changes in the fishing area maps for St. Thomas and St. John and the overlap in use of these maps for reporting made it difficult to devise a consistent time-series of area assignments. These issues, combined with relatively few SL interviews, made it only possible to assign if the reported area fished was in either St. Thomas or St. John.

- St. Thomas Pot and Trap Gear Type: The reported area fished for SL interviews was most frequently St. Thomas (90.5%) followed by St. John (7.6%). The reported area fished in 1.9% of SL interviews was either unknown or outside of STT (ex. in PR or STX).

- St. Thomas Diving Gear Type: The reported area fished for SL interviews was most frequently St. Thomas (87.7%) followed by St. John (11.0%). The reported area fished for 1.4% of SL interviews was either unknown or outside of STT (ex. in PR or STX).

St. Thomas and St. John Fishing Areas Recommendation

Given the low number of SL interviews by gear and year in the TIP data for St. Thomas and St. John (Table 3), it is not recommended to spatially stratify these data. Some analyses of the spatial representativeness of the TIP data may be possible by comparing the trends in SL interviews by gear and area fished to trends of the trips in the logbook data that reported landing Spiny Lobster.

St. Croix Fishing Areas

Considering the changes in the fishing area maps of St. Croix, Bryan (2015) identified that a feasible option was to aggregate the fishing area data and create two areas, east and west St. Croix. East St. Croix would represent areas C3, C4, C5, St. Croix-East, St. Croix-Northeast, and St. Croix southeast. West St. Croix would represent areas C1, C2, C6, St. Croix-West, St. Croix-Northwest, and St. Croix southwest. Areas St. Croix-North and St. Croix-South would have to be ignored as they overlap the east and west fishing areas. They made up less than 1% of all TIP interviews in St. Croix. However, among SL interviews, the east and west St. Croix grouping results in larger proportions of interviews in St. Croix that would be ignored. Especially before 1997.

Time Period	Pots and Traps Areas Fished (percent reported)	Diving Areas Fished (percent reported)
1981-2011 (all years)	East STX (85.9%) **Other (11.1%)** West STX (3.0%)	East STX (68.7%) **Other (7.8%)** West STX (23.5%)
1987-2011	East STX (94.8%) West STX (4.3%) **Other (0.9%)**	East STX (73.7%) West STX (25.5%) **Other (1.1%)**

St. Croix Fishing Areas Recommendations

Given the low number of SL interviews by gear and year in the TIP data for St. Croix (Table 3), it is not recommended to further stratify beyond gear type. Some analyses of the spatial representativeness of the TIP data may be possible by comparing the trends in SL interviews by gear and area fished to trends of the trips in the logbook data that reported landing Spiny Lobster.

Summary of TIP Carapace Length Data for Spiny Lobster

TIP length data are summarized though 2015 for Puerto Rico and through 2017 for St. Croix, St. Thomas and St. John. The data were subset to only include measurements relevant to the spiny lobster fishery by excluding values larger than the 99.5th percentile (178mm CL; 7 inches) as well as values smaller than the 0.5th percentile (64mm; 2.5 inches) . Summaries of annual sample sizes and length frequency distributions for each gear type and island combinations are presented for each of the predominant aggregated gear types.

Prevalence in Gear Types

Puerto Rico had the most spiny lobster carapace length measurements (50,767) in the TIP data, followed by St. Croix (18,570) and St. Thomas/St. John (12,773). The majority of lengths collected from Puerto Rico and St. Croix were associated with two gear types: Diving (PR: 35,214, 69.4%; STX: 7,871, 42.4%) and Pots and Traps (PR: 12,162, 24.0%; STX: 10,302, 55.5%). The predominant gear type in St. Thomas/St. John was Pots and Traps (11,665, 91.3%). Excluding years without any samples, the mean number of annual samples by island and gear type are shown below.

Island	Gear Type	Average Annual Sample Size of SL Carapace Lengths (number of years with SL interviews)
PR	Diving	1,067 (33)
	Pots and Traps	358 (34)
	Trammel Nets	48 (24)
STT	Pots and Traps	449 (26)
	Diving	78 (9)
STX	Pots and Traps	396 (26)
	Diving	292 (27)

Given the relatively small average annual sample sizes of carapace length measurements for spiny lobster for the trammel net gear type in Puerto Rico (49), it is not recommended for use as a gear type in SEDAR 57. Similarly, given the few years of data for the Diving gear type in St. Thomas (9), it is not recommended for use as a gear type during SEDAR 57. The annual length frequency distributions (Figures 1-5) and summary plots of carapace lengths reported in TIP (Figures 6-10) by gear type are included at the end of this report.

References

Bryan, M.D. 2015. Summary of the Trip Interview Program Data from The US Caribbean. SEDAR46-DW-05. SEDAR, North Charleston, SC. 152 pp.

Table 1. Gear names found in US Caribbean TIP database and the gear groupings recommended for SEDAR 46 (Bryan 2015) and gear grouping by island put forth for SEDAR 57 (PR: Puerto Rico; STT: St. Thomas\St. John; STX: St.Croix).

Reported Gear	SEDAR 46 Gear Type	SEDAR 57 Gear Type
BY HAND	dive_byhand_spear	
BY HAND, DIVING GEAR	dive_byhand_spear	Diving (STX, STT & PR)
SKIN DIVING	dive_byhand_spear	
SPEARS	dive_byhand_spear	Diving (STX)
SPEARS, DIVING	dive_byhand_spear	
POTS AND TRAPS, CMB	pots_traps	Pots and Traps (STT)
POTS AND TRAPS, FISH	pots_traps	Pots and Traps (STX, STT & PR)
POTS AND TRAPS, SPINY LOBSTER	pots_traps	Pots and Traps (STT & PR)
FLOATING TRAPS (SHALLOW)	pots_traps	
LINES HAND	Handline	
REEL, ELECTRIC OR HYDRAULIC	Handline	
ROD AND REEL, ELECTRIC (HAND)	Handline	
LINES POWER TROLL OTHER	Troll	
REEL, MANUAL	Troll	
ROD AND REEL	Troll	
TROLL LINE, MANUAL	Troll	
GRABS, HOOKS	hook_other	
HOOKS, SPONGE	hook_other	
BUOY GEAR, VERTICAL	longline	
LINES LONG DRIFT WITH HOOKS	longline	
LINES LONG SET WITH HOOKS	longline	
LINES LONG, REEF FISH	longline	
GILL NETS, DRIFT, RUNAROUND	Gill_net	
GILL NETS, OTHER	Gill_net	
ENTANGLING NETS (GILL) UNSPC	Gill_net	
FYKE AND HOOP NETS	FYKE AND HOOP NETS	
TRAMMEL NETS	TRAMMEL NETS	TRAMMEL NETS (PR)
, CAST NETS	CAST NETS	
DIP NETS	DIP NETS	
ENCIRCLING NETS (PURSE)	ENCIRCLING NETS (PURSE)	
HAUL SEINES	HAUL SEINES	

Table 2. Number of TIP interviews by island (STATE LANDED), primary gear (STANDARD GEARNAME 1) and percentage of interviews associated with spiny lobster carapace length measurements that reported a secondary gear type (STANDARD GEARNAME 2). Percentages are shown for each island and gear. These numbers reflect the assumption that if a secondary gear was unspecified or recorded as NA, a single gear was used. TIP data are summarized though 2015 for Puerto Rico data and through 2017 for St. Croix, St. Thomas and St. John.

Island (Number of interviews)	Primary Gears (Number of Interviews)	Secondary Gears (Percent reported)
Puerto Rico (6,028)	BY HAND, DIVING GEAR (4,477)	No Secondary Gear (99.8%)
	POTS AND TRAPS, FISH (916)	No Secondary Gear (91.7%) POTS AND TRAPS, SPINY LOBSTER (6.3%)
	POTS AND TRAPS, SPINY LOBSTER (236)	No Secondary Gear (86.0%) POTS AND TRAPS, FISH (10.2%) BY HAND, DIVING GEAR (3.4%)
	TRAMMEL NETS (162)	No Secondary Gear (100%)
St. Thomas/ St. John (568)	POTS AND TRAPS, FISH (273)	No Secondary Gear (92.7%) Pots and Traps lobster (6.6%)
	POTS AND TRAPS, SPINY LOBSTER (159)	No Secondary Gear (88.7%) POTS AND TRAPS, FISH (11.3%)
	POTS AND TRAPS, CMB (42)	No Secondary Gear (100%)
	BY HAND, DIVING GEAR (73)	No Secondary Gear (100%)
St. Croix (1,472)	POTS AND TRAPS, FISH (772)	No Secondary Gear (99.2%)
	BY HAND, DIVING GEAR (597)	No Secondary Gear (96.8%) SPEARS (3.0%)
	SPEARS (72)	BY HAND, DIVING GEAR (81.9%) No Secondary Gear (18.1%)

Table 3. Average number of TIP interviews per year by island and gear type, excluding years without any samples and excluding data from Puerto Rico in 2016 and 2017.

Island	Gear type	Number of years with TIP Interviews	Average number of interviews per year
Puerto Rico	Diving	33	135
	Pots and Traps	34	33
	Trammel Nets	24	7
St. Thomas/St. John	Pots and Traps	26	18
	Diving	9	8
St. Croix	Pots and Traps	26	29
	Diving	27	25

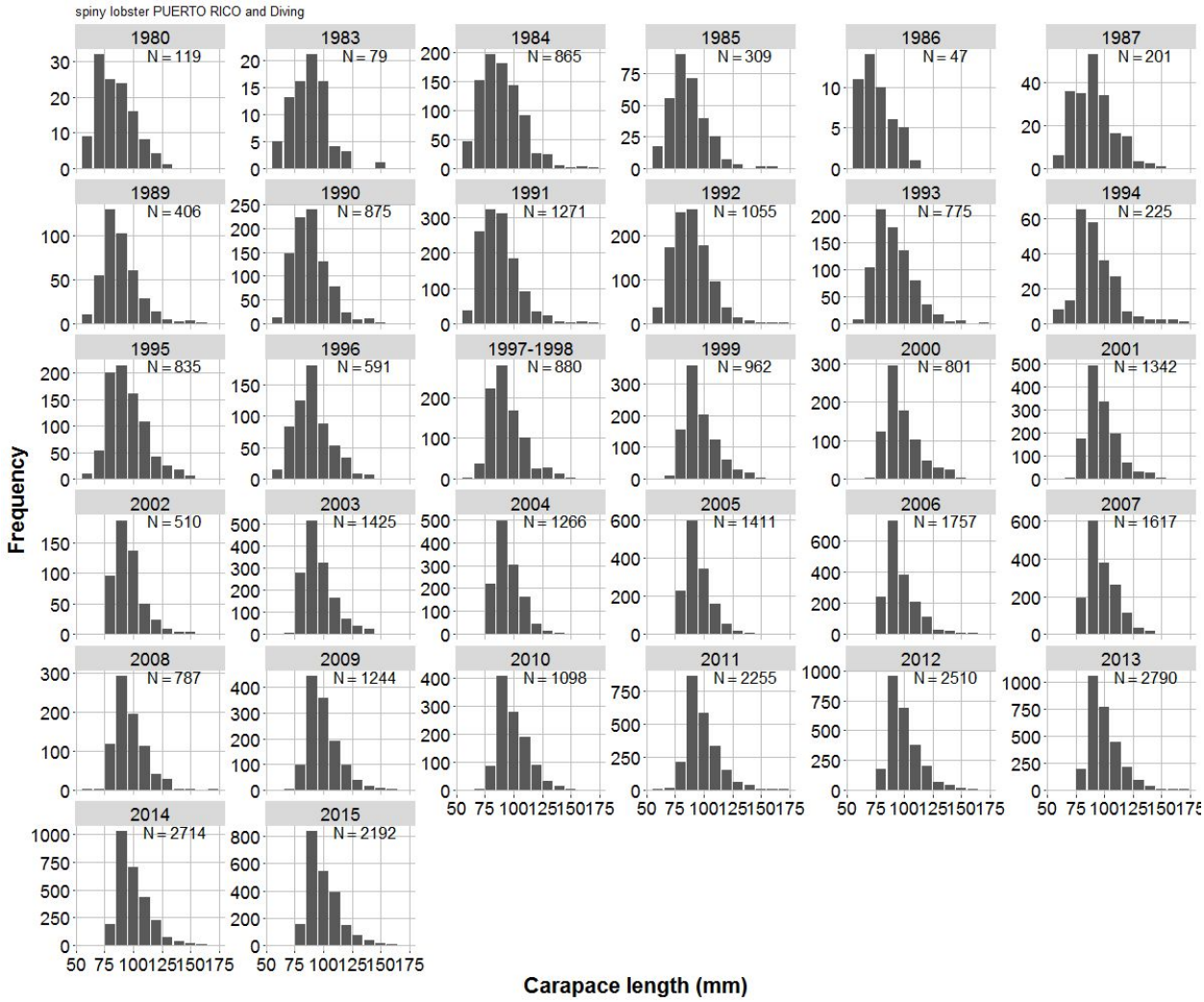

Figure 1. Spiny lobster length frequency associated with diving in Puerto Rico. N indicates the number of lengths per year (or years). Years are aggregated as necessary to meet confidentiality requirements. Each bar represents a 10mm length bin. Partial years of data (2016 and 2017) are excluded.

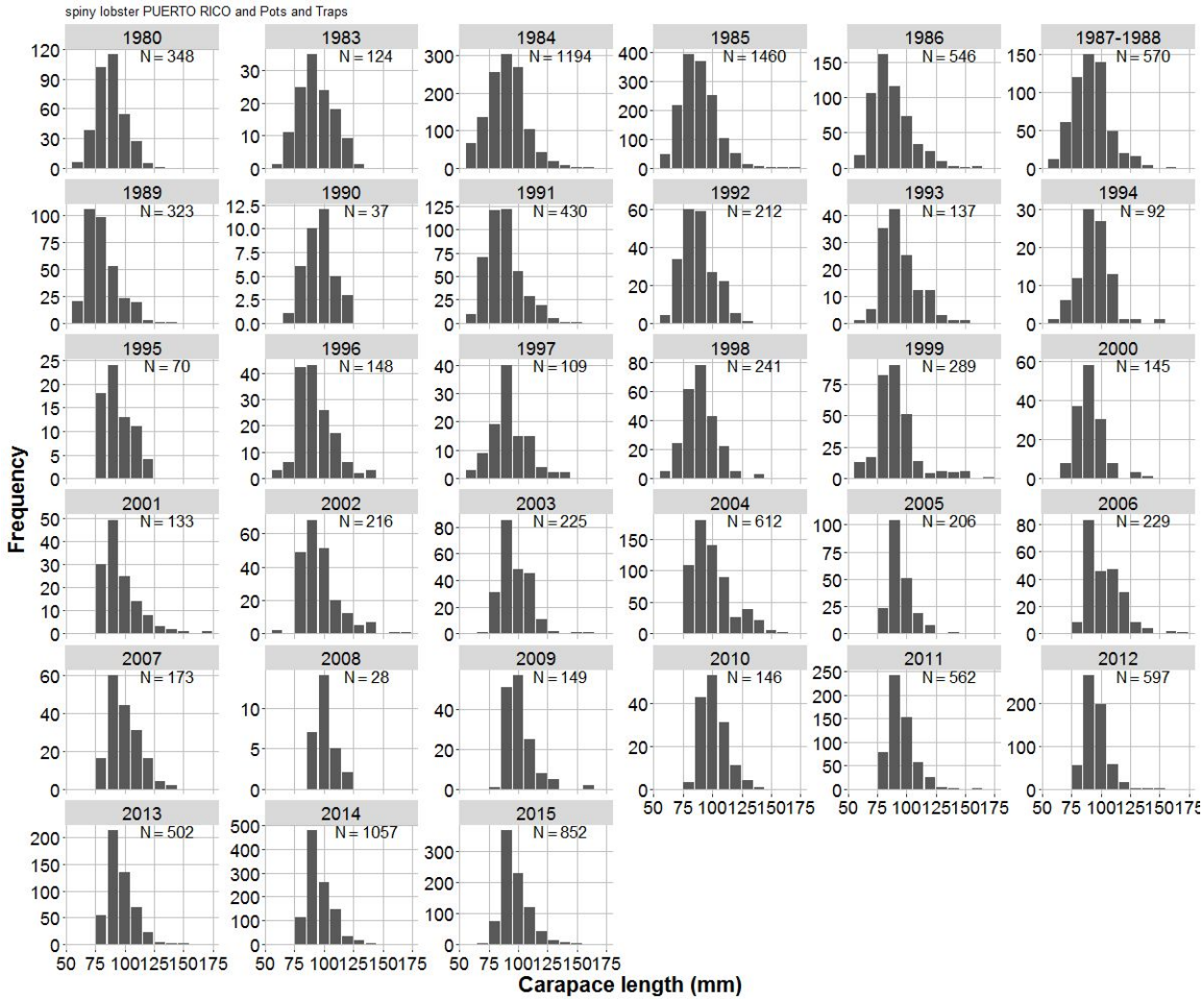

Figure 2. Spiny lobster length frequency associated with pots and traps in Puerto Rico. N indicates the number of lengths per year (or years). Years are aggregated as necessary to meet confidentiality requirements. Each bar represents a 10mm length bin. Partial years of data (2016 and 2017) are excluded.

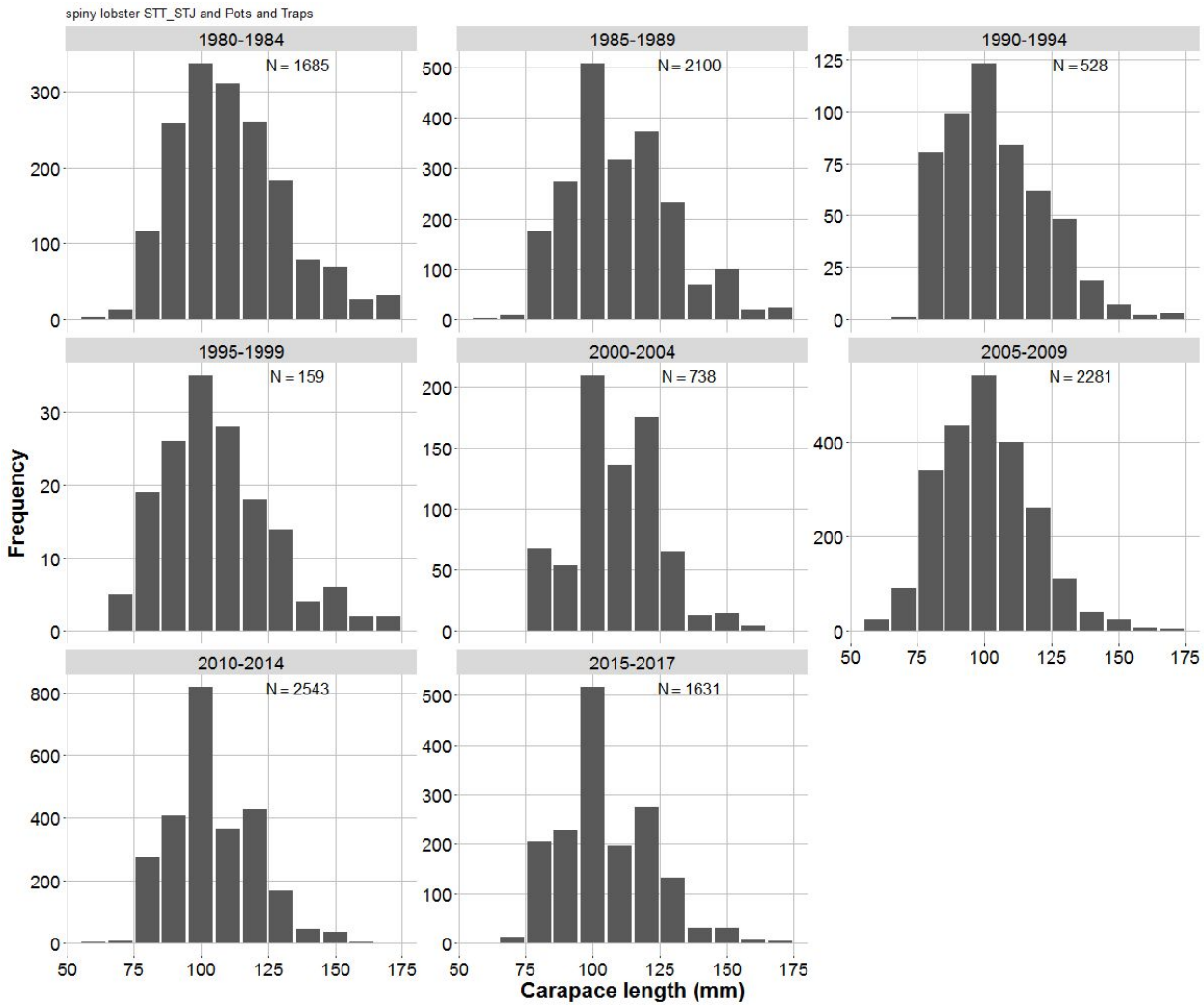

Figure 3. Spiny lobster length frequency associated with pots and traps in St. Thomas/St. John. N indicates the number of lengths per year (or years). Years are aggregated as necessary to meet confidentiality requirements. Each bar represents a 10mm length bin.

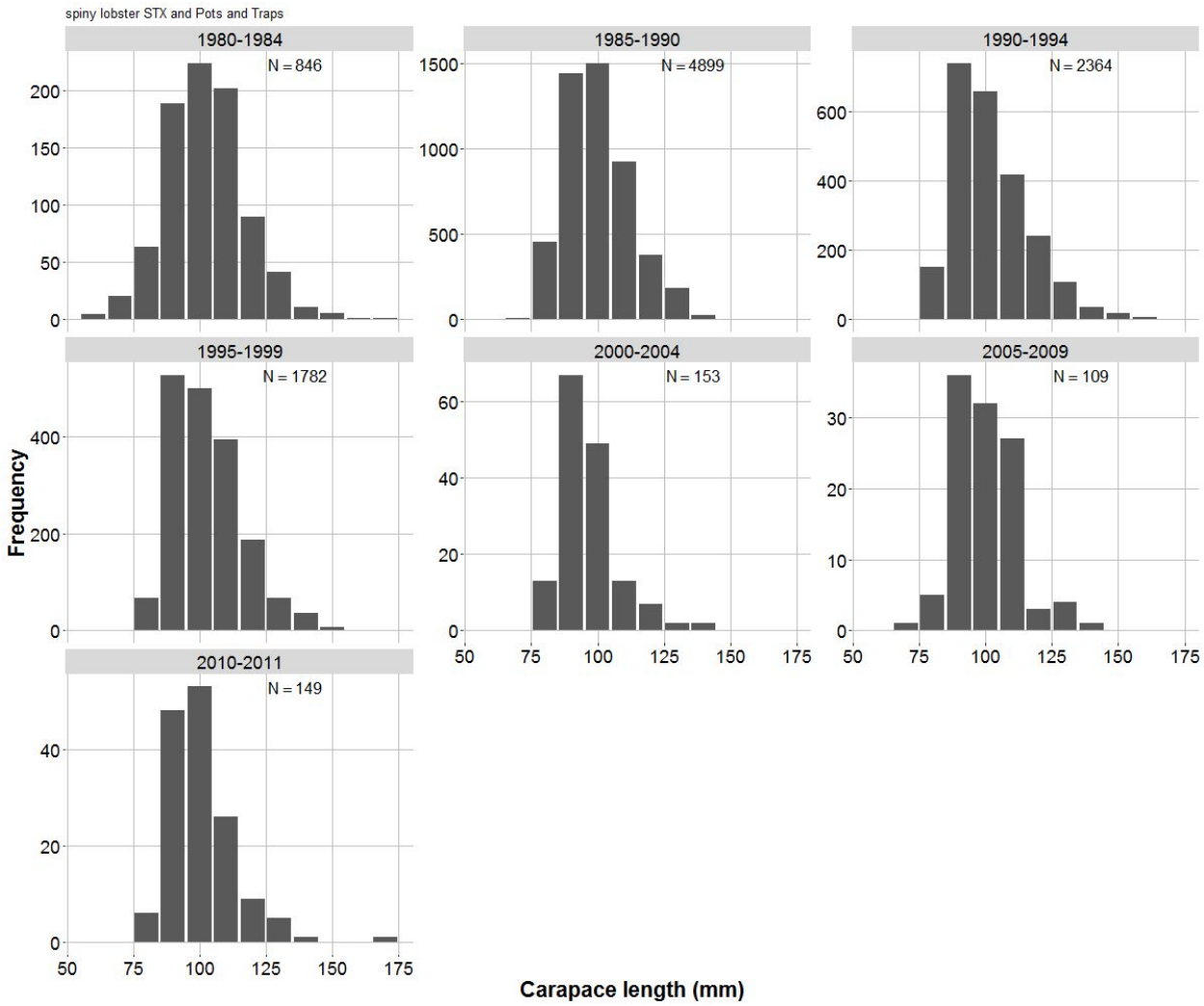

Figure 4. Spiny lobster length frequency associated with pots and traps in St. Croix. N indicates the number of lengths per year (or years). Years are aggregated as necessary to meet confidentiality requirements. Each bar represents a 10mm length bin.

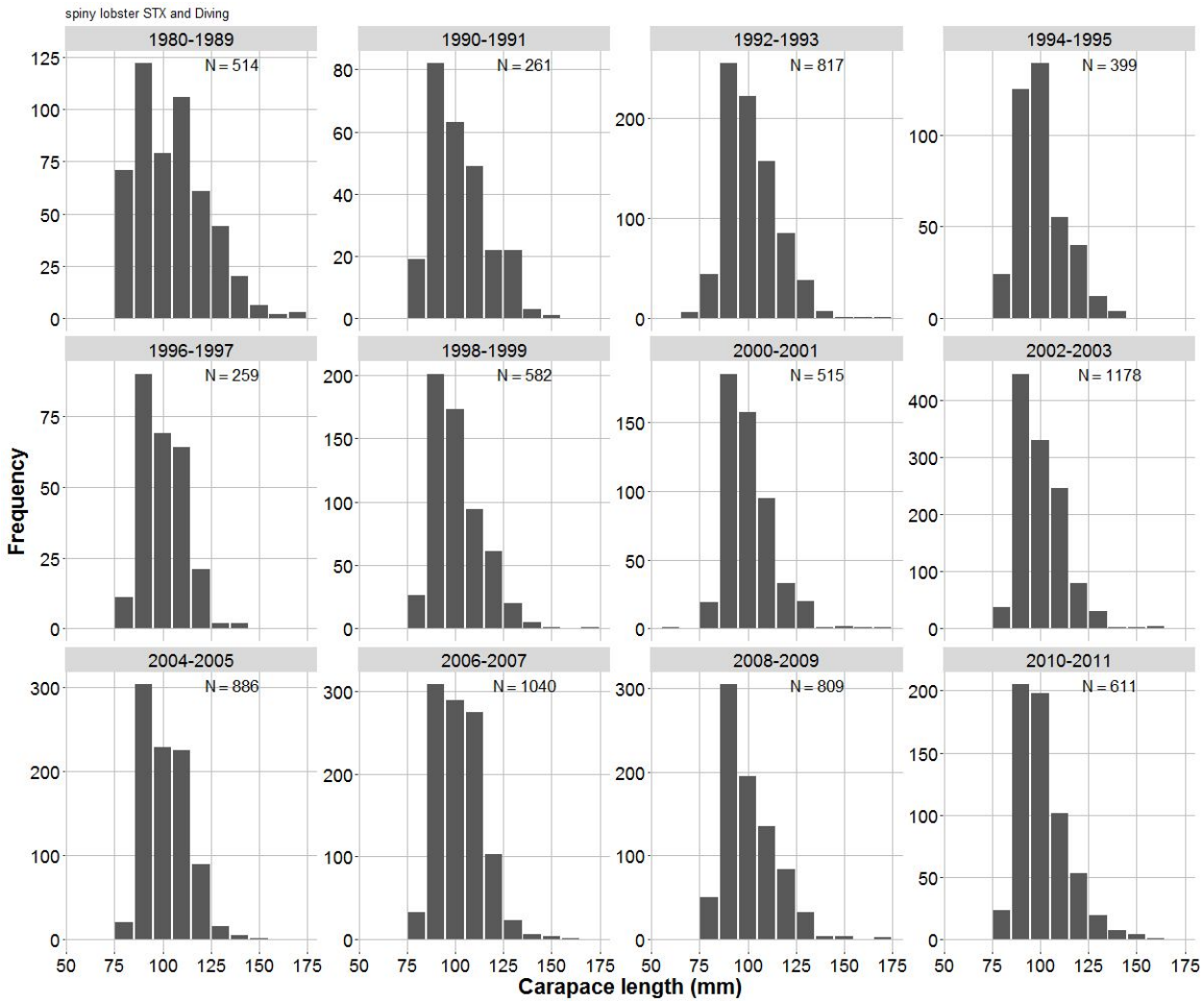

Figure 5. Spiny lobster length frequency associated with diving in St. Croix. N indicates the number of lengths per year (or years). Years are aggregated as necessary to meet confidentiality requirements. Each bar represents a 10mm length bin.

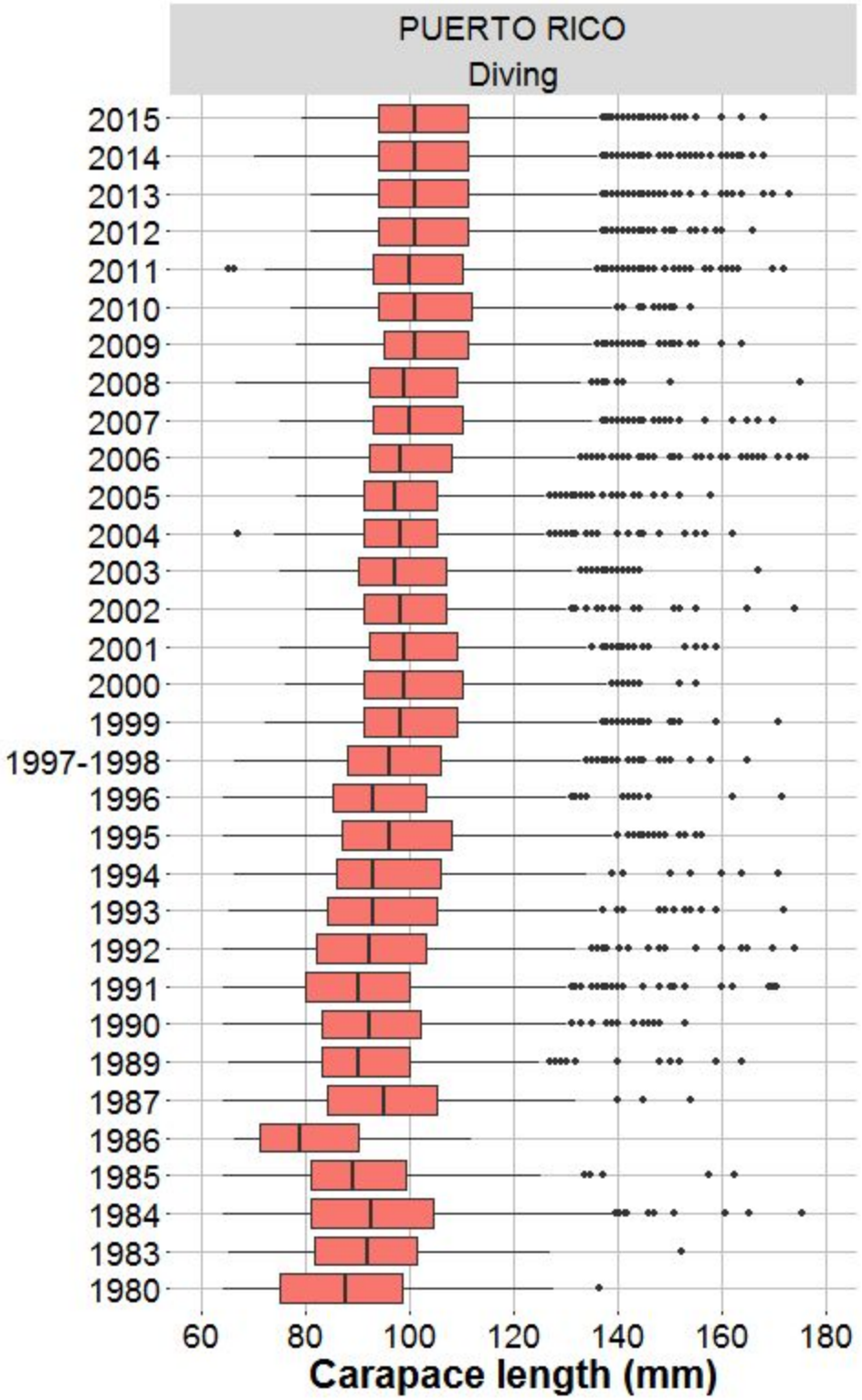

Figure 6. Box plot of Spiny lobster carapace lengths associated with diving in Puerto Rico. Years are aggregated as necessary to meet confidentiality requirements. A minimum size limit of 3.5 inch carapace length (88.9mm) was implemented in 1985. Partial years of data (2016 and 2017) are excluded.

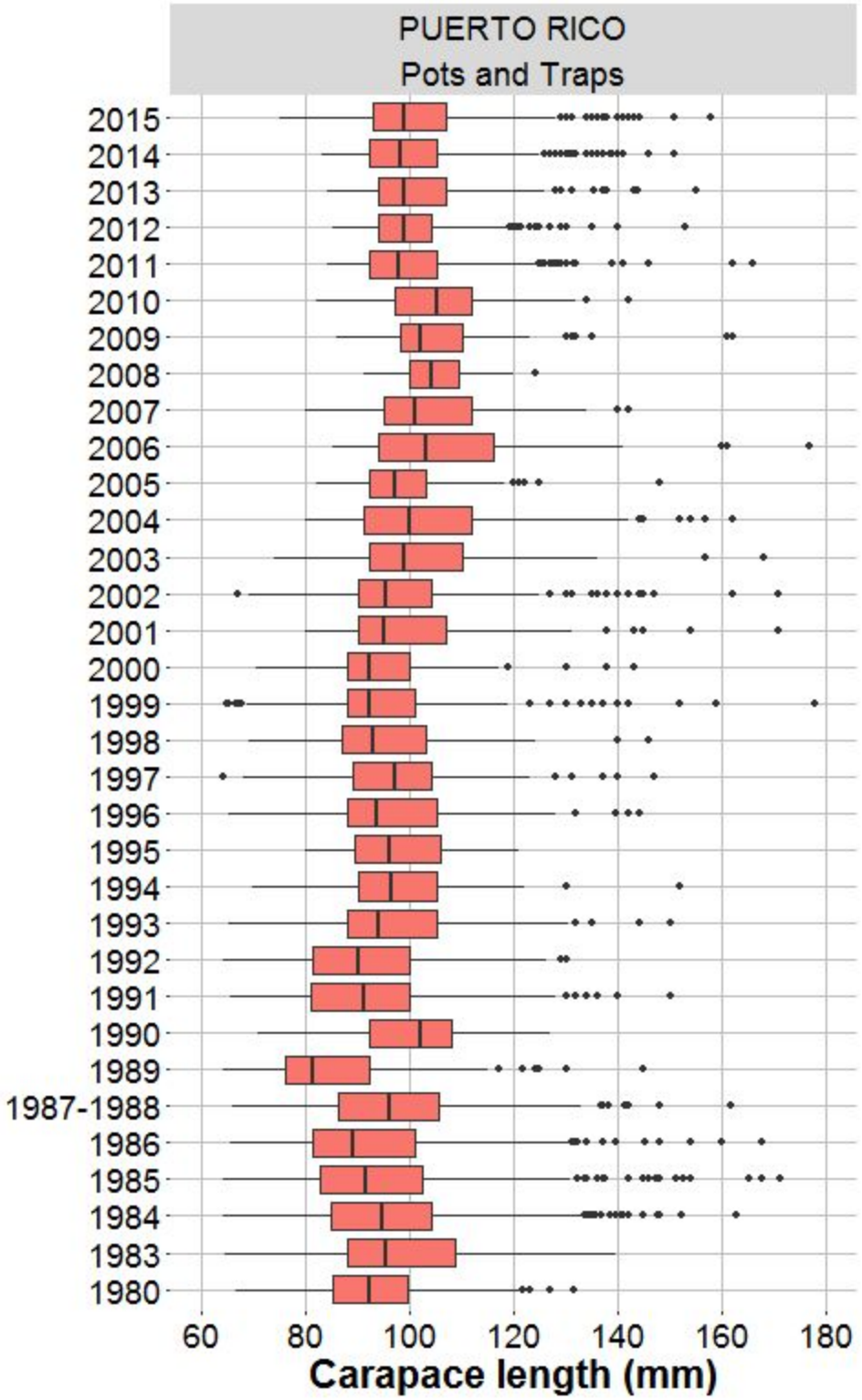

Figure 7. Box plot of Spiny lobster carapace lengths associated with diving in Puerto Rico.Years are aggregated as necessary to meet confidentiality requirements. A minimum size limit of 3.5 inch carapace length (88.9mm) was implemented in 1985. Partial years of data (2016 and 2017) are excluded.

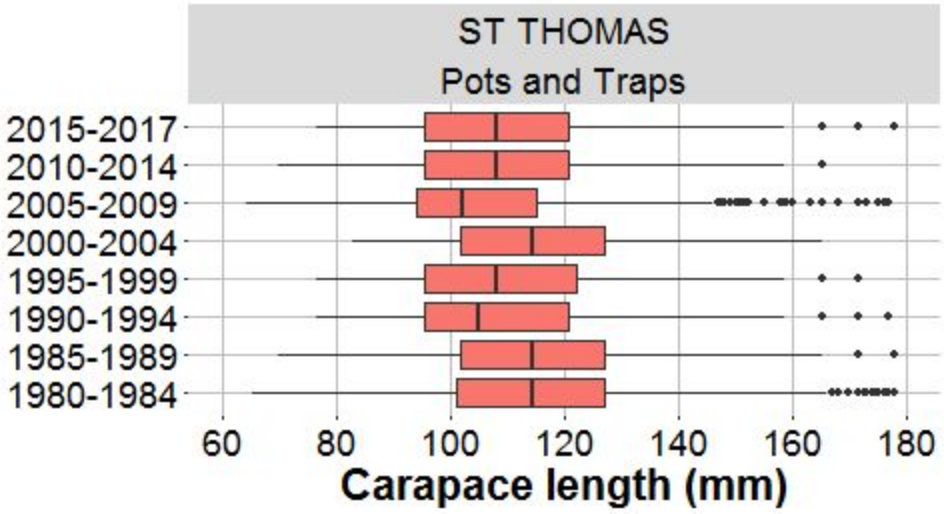

Figure 8. Box plot of Spiny lobster carapace lengths associated with pots and traps in St. Thomas/St. John. Years are aggregated as necessary to meet confidentiality requirements. A minimum size limit of 3.5 inch carapace length (88.9mm) was implemented in 1985.

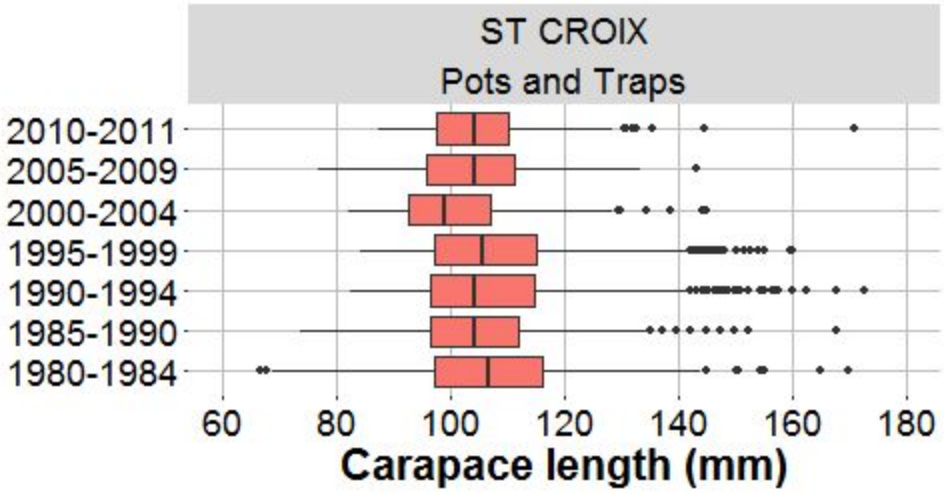

Figure 9. Box plot of Spiny lobster carapace lengths associated with pots and traps in St. Croix. Years are aggregated as necessary to meet confidentiality requirements. A minimum size limit of 3.5 inch carapace length (88.9mm) was implemented in 1985.

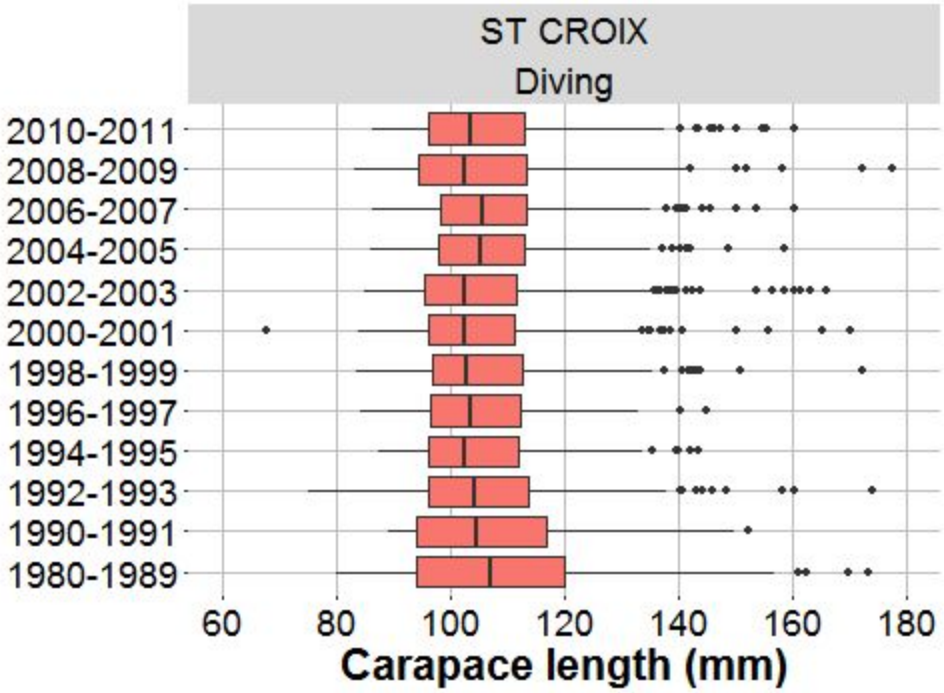

Figure 10. Box plot of Spiny lobster carapace lengths associated with diving in St. Croix. Years are aggregated as necessary to meet confidentiality requirements. A minimum size limit of 3.5 inch carapace length (88.9mm) was implemented in 1985.