Evaluation of the available length-frequency information in the US Caribbean Trip Interview Program (TIP) data

Meaghan D. Bryan

SEDAR30-AW-02

Date Submitted: 2 October 2012
Updated: 14 November 2012

Please cite this document as:

Bryan, M.D. 2012. Evaluation of the available length-frequency information in the US Caribbean Trip Interview Program (TIP) data. SEDAR30-AW-02. SEDAR, North Charleston, SC. 35 pp.

Evaluation of the available length-frequency information in the US Caribbean Trip Interview Program (TIP) data

By

Meaghan Bryan

Submitted: October 2, 2012
Updated: November 14, 2012

SEDAR30-AW-02

SFD Contribution No. SFD-2012-023

Introduction

The length information from the Trip Interview Program (TIP) played an integral role in the assessment of silk snapper, queen snapper, and redtail parrotfish during SEDAR 26 due to limited species-specific fishery-dependent and fishery-independent data. Species-specific, fishery-dependent and fishery-independent data are currently limited for blue tang and queen triggerfish in the US Caribbean. As such, the length information from the TIP database will likely play an important role in the upcoming assessment of blue tang and queen triggerfish.

The first goal of this report is to summarize the available TIP length data. The second goal is to identify species-specific strata that have sample sizes large enough to carry out length-based population analyses for each species. Strata were defined by island and gear type to account for potential differences in selectivity. Individual gears were assigned to one of four main gear types, which follow the definitions from SEDAR 26.

Data

Blue tang

Summary of sample size

Between 1983 and 2012, there were 36,952 blue tang lengths measured in the US Caribbean (Table 1). Of those, 141 lengths were from Puerto Rico, 3039 lengths were from St. Thomas/St. John, and 33,772 lengths were from St. Croix (Table 1).

Table 2 summarizes the number of length observations, the number of sampling years, and the average number of samples per year by island and gear type. The number of blue tang lengths and the number of years with blue tang lengths were minimal in Puerto Rico. Over the course of 21 years, 2,996 blue tang lengths were measured from the pot and trap fishery in St. Thomas/St. John (Table 2). This is an average of ~143 blue tang lengths per year (Table 2). Very few blue tang lengths were associated with other gear types in St. Thomas/St. John. In St. Croix, the majority of blue tang lengths were from the pot and trap fishery. A total of 32,220 blue tang caught by pots and traps were measured over 29 years with an average of 1,111 measurements per year (Table 2). A total of 1,462 blue tang lengths were from the St. Croix net fishery and only 90 blue tang lengths were from the St. Croix hook and line fishery(Table 2).

The remainder of this report will focus on the length data for strata with annual sample sizes that are seemingly sufficient to conduct mean length analyses. Appendices A and B summarize the annual number of length measurements for all the island-gear type combinations for blue tang and queen triggerfish, respectively.

Length frequency

Figure 1 shows annual length-frequency plots for blue tang caught by the St. Thomas and St. John pot and trap fishery. Sample size varied over the years with a minimum of five lengths in 1983 and a maximum of 407 lengths in 2010. Overall the size range of the blue tang in this stratum was between 5cm and 35cm with variable central tendency estimates (Figure 1, Table 4). The mean length estimates ranged between 17.25cm and 22.5 cm (5cm range), the median length estimates ranged between 16.5cm and 22.5 cm (6cm range), and the mode estimates ranged between 15.75 cm and 21.75cm (6cm range, Table 4). All distributions, except in 1986 and 1988, were positively skewed (Table 4). In 1988, all lengths were less than 20cm (Figure 1).

The annual length-frequency plots for blue tang caught by the St. Croix pot and trap fishery are shown in Figure 2. The length distributions and the range of the annual central tendency estimates were fairly tight over time (Table 5). The annual mean length estimates ranged between 17.4cm and 20.08cm, the median length estimates ranged between 18 cm and 19.5 cm, and the modes ranged between 17.25cm and 18.75 cm (Table 5). The length-frequency distributions were positively skewed in all years, except 2006 where there were only 10 lengths measurements (Figure 2).

The blue tang length data from Puerto Rico are not presented in length-frequency histograms given the limited number of samples and the limited time span of these data.

Queen triggerfish

Summary of sample size

Between 1983 and 2002, there were 25,073 queen triggerfish lengths from the US Caribbean (Table 1). Of those, 8,018 lengths were from Puerto Rico, 8,036 lengths were from St. Thomas/St. John, and 9,019 lengths were from St. Croix (Table 1).

Table 3 summarizes the number of length observations, the number of sampling years, and the average number of samples per year by island and gear type. The pot and trap fishery, irrespective of island, was associated with the greatest number of queen triggerfish lengths, greatest number of years with length samples, and greatest average number of length samples per year. In Puerto Rico, all other gear types, even though they were associated with a sufficient total number of lengths, had an insufficient average number of length samples per year (see Appendix B for annual sample sizes). In St. Thomas/St. John and St. Croix, the number of lengths from other gear types was not sufficient.

Length frequency

Figures 3-5 show the annual length-frequency distributions and Tables 6-8 summarize the central tendencies and skewness of the annual length-frequency data for queen triggerfish

captured by the pot and trap fishery in Puerto Rico, St. Thomas/St. John, and St. Croix, respectively.

The central tendency statistics for queen triggerfish caught by the pot and trap fishery in Puerto Rico indicate a shift towards larger individuals starting in the late 1990s (Table 6). The annual modes were closer to 20cm before 1998 and then shifted towards a mode of 30cm after 1998 (Table 6, Figure 3). Large queen triggerfish were measured throughout the time-series, but in late 1990s queen triggerfish with lengths greater than 45cm were measured more frequently than earlier in the time series (Figure 3).

Figure 4 shows the length-frequency distributions for queen triggerfish captured by the pot and trap fishery in St. Thomas/St. John and Table 7 summarizes the central tendencies and skewness of the annual length-frequency data. The time-series has significant data gaps; data were missing in 1989, 1990, and between 1996 and 2002 (Table 7). The annual mean and median length estimates ranged between ~24.5cm and 34.5cm and the annual modes ranged between 20.25cm and 36.75cm (Table 7). The central tendency estimates were variable over time and the range was large (Table 7, Figure 4). Unlike Puerto Rico, there was no discernible trend in the central tendencies over time or the length-frequency distributions.

The length-frequency distributions for the pot and trap fishery in St. Croix were fairly consistent over time (Figure 5). The range in the mean and median length estimates was between 22cm and 30cm and the modes ranged between 20.75cm and 30.75cm (Table 8). These estimates were variable over time with no apparent trend (Table 8).

Summary

Blue tang

Overall, the number of blue tang lengths and the number of years sampled were small for the majority of strata that were evaluated. Two strata, the pot and trap fishery in St. Thomas/St. John and the pot and trap fishery in St. Croix, have sufficient sample sizes over the time-series and were recommended for subsequent length-based analyses. This recommendation was made in isolation of the available life history data.

Queen triggerfish

Three strata; the pot and trap fishery in Puerto Rico, the pot and trap fishery St. Thomas/St. John, and the pot and trap fishery St. Croix, were recommended for use in length-based analyses for queen triggerfish. This recommendation was made in isolation of the available life history data. The overall number of lengths and the time-series coverage among the other gear types in Puerto Rico were seemingly sufficient. The average number of lengths per year, however, was low; therefore, the length data associated with the dive/spear/by hand fishery, the hook and line fishery, and the net fishery were not recommended for use. The

number of queen triggerfish lengths for the hook and line fisheries and the net fisheries in St. Thomas/St. John and St. Croix were limited and the time-series coverage for these fisheries was minimal. They were, therefore, not recommended for use in length-based analyses.

Table 1. Number of length measurements for blue tang and queen triggerfish by island for years 1983-2012.

Species	Total	Puerto Rico	St Thomas/ St John	St Croix
Blue tang	36952	141	3039	33772
Queen triggerfish	25073	8018	8036	9019

Table 2. The number of length measurements, the number of sampling years, and the mean number of length measurements per year for blue tang by island and gear type. * Candidate for length-based analysis.

Island	Gear type	Number of lengths	Number of years sampled	Mean number of lengths per year
-	Pots & traps	62	1	-
Puerto Rico	Hook & line	1	1	1
Puerto Rico	Nets	121	6	20.2
Puerto Rico	Pots & traps	19	6	3.2
St. Thomas/St John	Hook & line	21	2	10.5
St. Thomas/St John	Nets	22	3	7.33
*St. Thomas/St John	Pots & traps	2996	21	142.6
St. Croix	Hook & line	90	3	30
St. Croix	Nets	1462	15	97.5
*St. Croix	Pots & traps	32220	29	1111

Table 3. The number of length measurements, the number of sampling years, and the mean number of length measurements per year for queen triggerfish by island and gear type. * Candidate for length-based analysis.

Island	Gear type	Number of lengths	Number of years sampled	Mean number of lengths per year
-	Pots & traps	122	2	-
Puerto Rico	Dive/Spear/By Hand	1011	26	38.8
Puerto Rico	Hook & line	933	28	33.3
Puerto Rico	Nets	1157	26	44.5
*Puerto Rico	Pots & traps	4917	28	175.6
St. Thomas/St John	Dive/Spear/By Hand	6	1	6
St. Thomas/St John	Hook & line	297	12	24.75
St. Thomas/St John	Nets	2	2	1
*St. Thomas/St John	Pots & traps	7731	21	368.14
St. Croix	Dive/Spear/By Hand	644	12	53.67
St. Croix	Hook & line	313	12	26.08
St. Croix	Nets	37	7	5.28
*St. Croix	Pots & traps	8025	28	286.61

Table 4. Summary of the central tendencies and skewness of the blue tang length frequency data from the St. Thomas and St. John pot and trap fishery. Estimates correspond to the annual length frequency plots shown in Figure 1.

Species	Gear	Island	Year	Mean	Median	Mode	Skewness
Blue tang	Pots and traps	St. Thomas and St. John	1983	19.80	16.50	15.75	0.77
			1984	19.40	19.50	17.25	0.69
			1985	21.60	21.00	17.25	0.78
			1986	21.10	21.00	20.25	-0.68
			1987	19.70	19.50	17.25	0.43
			1988	17.23	18.00	18.75	-0.74
			1991	20.45	19.50	18.75	0.75
			1992	18.58	18.00	17.25	1.20
			1993	20.03	19.50	17.25	1.10
			1994	20.02	19.50	18.75	0.79
			1995	19.60	19.50	18.75	0.40
			1996	22.26	21.00	20.25	0.90
			2002	21.84	21.00	18.75	0.96
			2003	22.50	22.50	20.25	0.36
			2004	21.58	21.00	20.25	1.32
			2005	19.47	19.50	18.75	1.56
			2006	18.32	18.00	17.25	0.36
			2008	21.00	21.00	21.75	0.00
			2009	21.55	21.00	21.75	0.53
			2010	21.01	21.00	20.25	1.16

Table 5. Summary of the central tendencies and skewness of the blue tang length frequency data from the St. Croix pot and trap fishery. Estimates correspond to the annual length frequency plots shown in Figure 2.

Species	Gear	Island	Year	Mean	Median	Mode	Skewness
Blue tang	Pots and traps	St. Croix	1985	19.13	19.50	17.25	0.94
			1986	19.31	18.00	17.25	1.36
			1987	18.88	18.00	17.25	1.31
			1988	18.84	18.00	17.25	1.42
			1989	18.34	18.00	17.25	0.86
			1990	17.76	18.00	17.25	1.44
			1991	18.38	18.00	17.25	7.37
			1992	18.57	18.00	17.25	1.26
			1993	18.40	18.00	17.25	1.09
			1994	18.44	18.00	17.25	1.36
			1995	18.45	18.00	17.25	1.15
			1996	18.52	18.00	17.25	0.94
			1997	18.31	18.00	17.25	0.60
			1998	18.70	18.00	17.25	1.33
			1999	18.60	18.00	17.25	0.69
			2000	18.63	18.00	17.25	1.59
			2001	19.04	18.00	17.25	0.57
			2002	19.16	19.50	17.25	0.92
			2003	19.50	18.75	17.25	0.63
			2004	20.00	19.50	18.75	0.46
			2005	20.08	19.50	18.75	0.39
			2006	17.40	18.00	17.25	-0.59
			2007	18.88	18.00	17.25	1.04
			2008	19.32	19.50	18.75	1.31
			2009	19.09	19.50	18.75	0.21
			2010	18.94	18.00	17.25	0.76
			2011	19.55	19.50	18.75	1.09

Table 6. Summary of the central tendencies and skewness of the queen triggerfish length frequency data from the Puerto Rican pot and trap fishery. Estimates correspond to the annual length frequency plots shown in Figure 3.

Species	Gear	Island	Year	Mean	Median	Mode	Skewness
Queen triggerfish	Pots and traps	Puerto Rico	1983	27.53	27.00	26.25	0.66
			1984	28.98	28.50	29.25	1.03
			1985	27.33	27.00	23.25	0.66
			1986	27.31	25.50	23.25	0.86
			1987	28.88	28.50	29.25	0.54
			1988	28.01	28.50	27.75	0.36
			1989	27.31	27.00	29.25	0.29
			1990	28.54	28.50	27.75	0.72
			1991	27.99	27.00	26.25	1.30
			1992	27.70	27.00	21.75	1.82
			1993	27.13	27.00	23.25	0.47
			1994	27.08	25.50	23.25	0.85
			1995	26.59	25.50	24.75	0.78
			1996	30.50	28.50	27.75	2.69
			1997	27.89	26.25	24.75	0.31
			1998	31.78	28.50	24.75	1.90
			1999	36.57	30.00	27.75	0.90
			2000	35.12	30.00	32.25	0.90
			2001	29.10	28.50	27.75	0.10
			2002	31.42	30.00	32.25	1.74
			2003	36.77	33.00	32.25	0.93
			2004	34.85	33.00	32.25	1.48
			2005	33.25	33.00	32.25	-0.16
			2006	28.94	28.50	30.75	0.52
			2007	34.28	31.50	24.75	1.64
			2008	27.30	27.00	30.75	0.28
			2009	36.38	36.00	26.25	0.01
			2011	29.88	28.50	27.75	0.38

Table 7. Summary of the central tendencies and skewness of the queen triggerfish length frequency data from the St. Thomas and St. John pot and trap fishery. Estimates correspond to the annual length frequency plots shown in Figure 4.

Species	Gear	Island	Year	Mean	Median	Mode	Skewness
Queen triggerfish	Pots and traps	St. Thomas and St. John	1983	28.76	28.50	23.25	0.53
			1984	31.29	31.50	32.25	-0.30
			1985	31.50	31.50	29.25	0.07
			1986	32.94	33.00	36.75	-0.71
			1987	28.53	28.50	24.75	0.27
			1988	31.42	31.50	32.25	0.31
			1991	31.50	31.50	30.75	NaN
			1992	27.84	28.50	27.75	0.49
			1993	29.51	30.00	27.75	0.43
			1994	29.68	28.50	26.25	0.63
			1995	29.44	28.50	27.75	0.50
			1996	26.67	25.50	23.25	1.76
			2002	32.44	32.25	33.75	0.21
			2003	34.13	34.50	35.25	-0.08
			2004	32.64	31.50	30.75	3.25
			2005	31.49	31.50	30.75	-0.18
			2006	29.82	30.00	20.25	0.60
			2008	30.41	31.50	32.25	-0.22
			2009	32.41	33.00	33.75	-0.13
			2010	32.31	33.00	32.25	-0.03
			2011	31.72	31.50	35.25	0.20

Table 8. Summary of the central tendencies and skewness of the queen triggerfish length frequency data from the St. Croix pot and trap fishery. Estimates correspond to the annual length frequency plots shown in Figure 5.

Species	Gear	Island	Year	Mean	Median	Mode	Skewness
Queen triggerfish	Pots and traps	St. Croix	1983	30.86	30.00	29.25	0.38
			1984	28.58	28.50	29.25	0.24
			1985	29.21	28.50	26.25	1.57
			1986	29.95	30.00	26.25	0.55
			1987	27.64	27.00	27.75	0.28
			1988	26.96	27.00	26.25	0.95
			1989	26.45	27.00	26.25	0.83
			1990	27.46	27.00	23.25	0.85
			1991	27.22	27.00	29.25	0.72
			1992	27.10	27.00	24.75	0.57
			1993	27.68	27.00	26.25	0.32
			1994	27.32	27.00	24.75	0.62
			1995	26.08	25.50	24.75	0.63
			1996	25.30	25.50	24.75	0.44
			1997	26.90	27.00	24.75	0.09
			1998	26.16	27.00	26.25	0.16
			1999	27.12	27.00	23.25	0.35
			2000	26.31	27.00	26.25	-0.16
			2001	23.43	22.50	20.25	0.71
			2002	28.41	28.50	29.25	0.10
			2003	28.50	28.50	27.75	NaN
			2004	26.38	26.25	21.75	0.27
			2005	22.23	21.00	20.25	0.04
			2007	27.86	27.00	24.75	0.51
			2008	25.42	25.50	24.75	-0.06
			2009	28.93	28.50	27.75	0.58
			2010	28.92	28.50	30.75	0.09
			2011	28.30	28.50	27.75	0.17

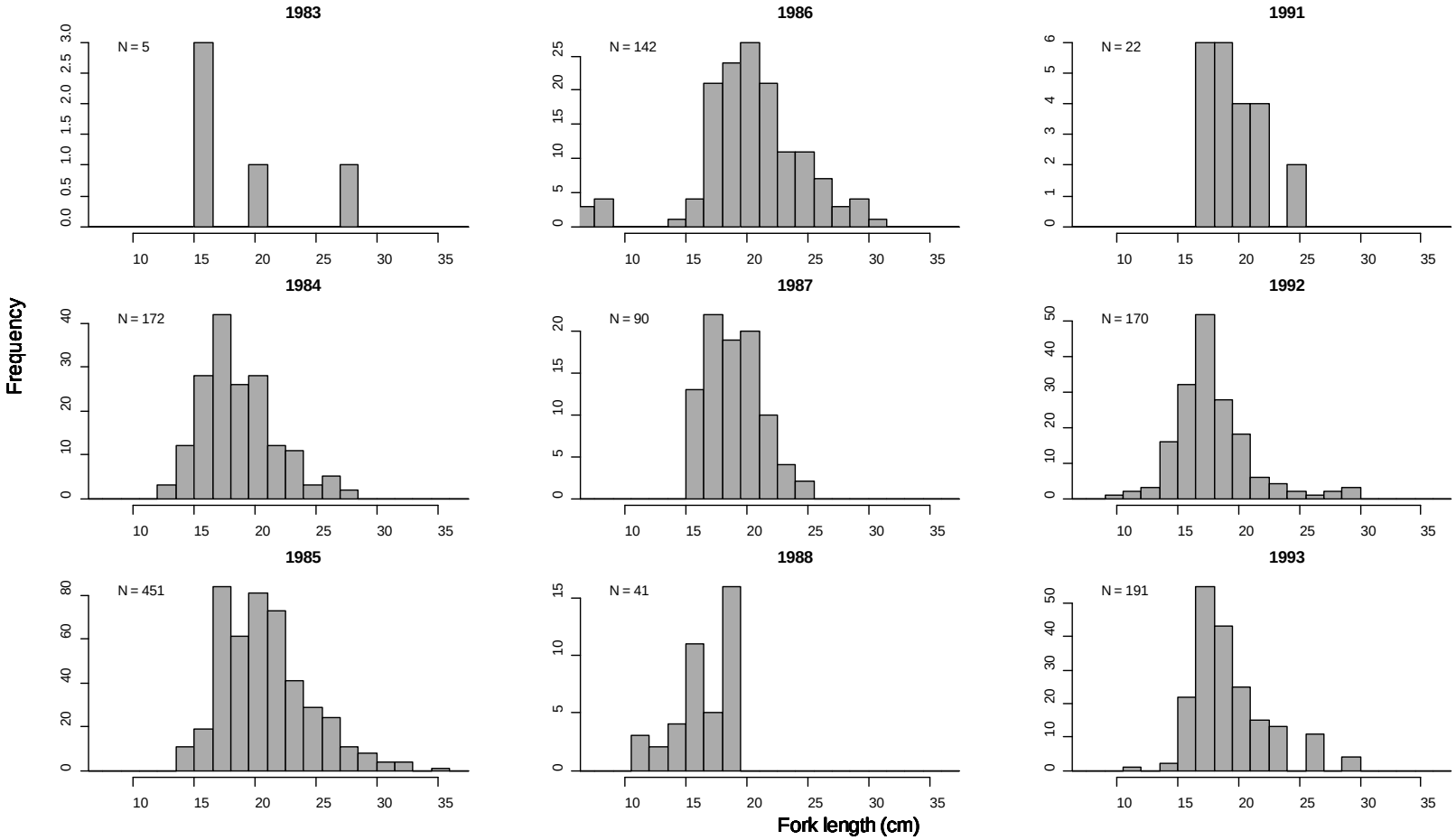

Figure 1. Annual length-frequency plots for blue tang caught by the St. Thomas and St. John pot and trap fishery. The N in each panel denotes sample size. Bin size is 1.5cm.

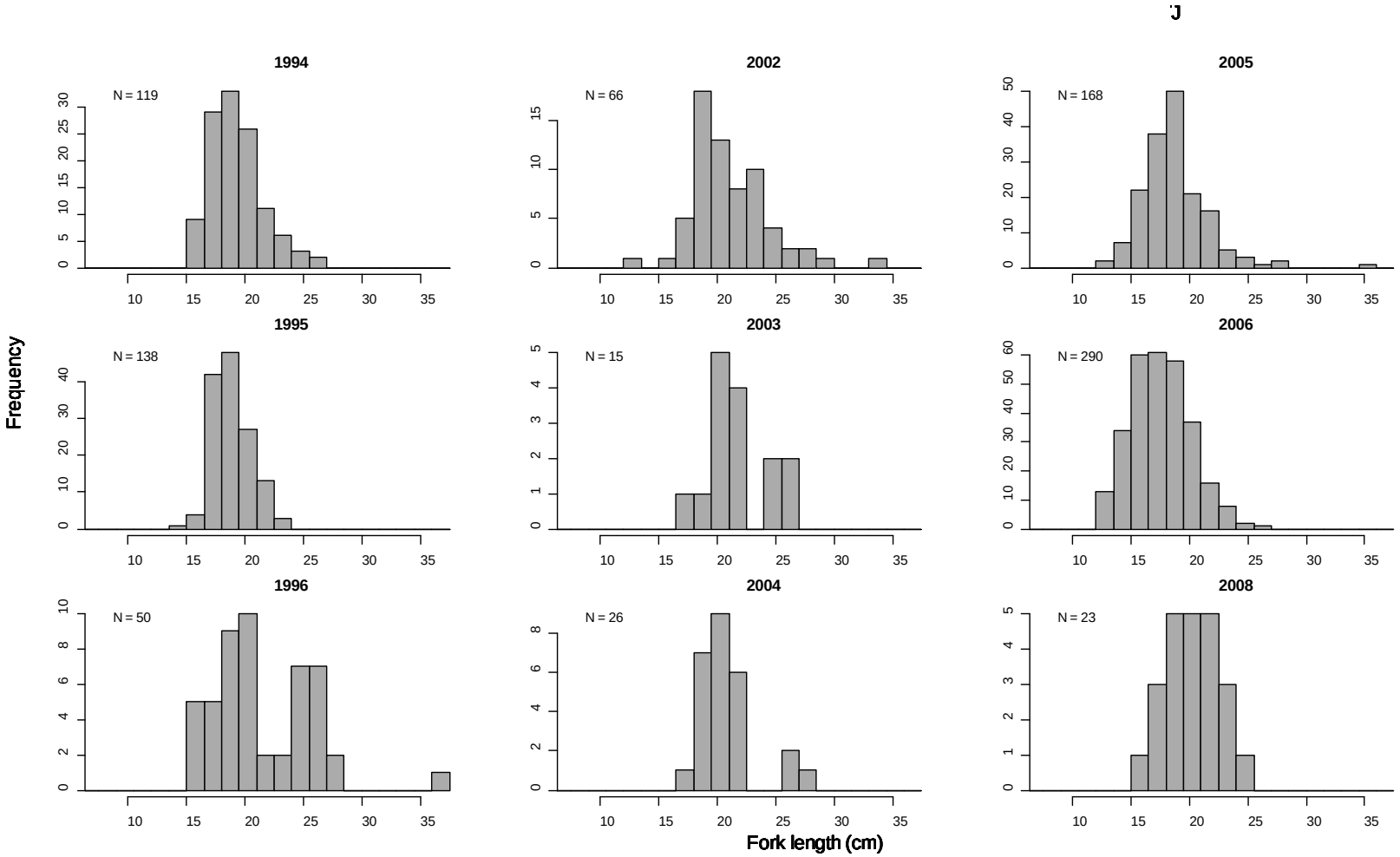

Figure 1. continued

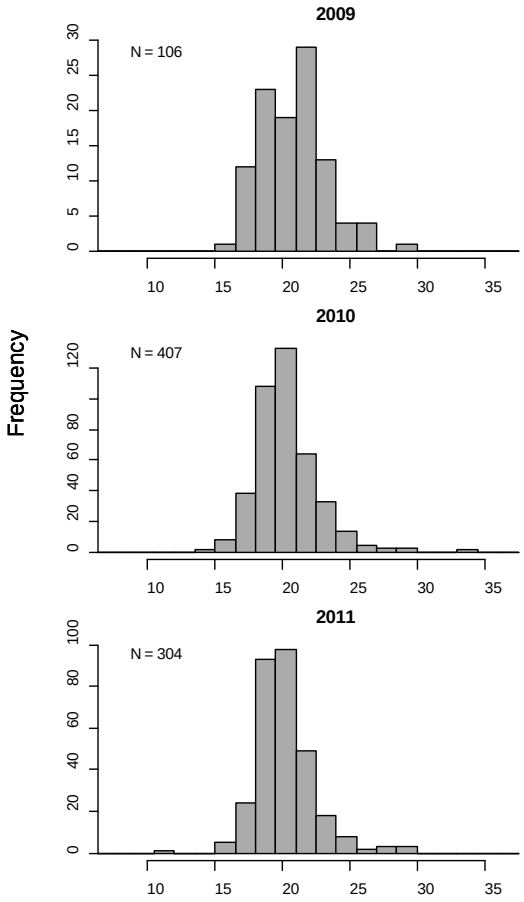

Figure 1. continued

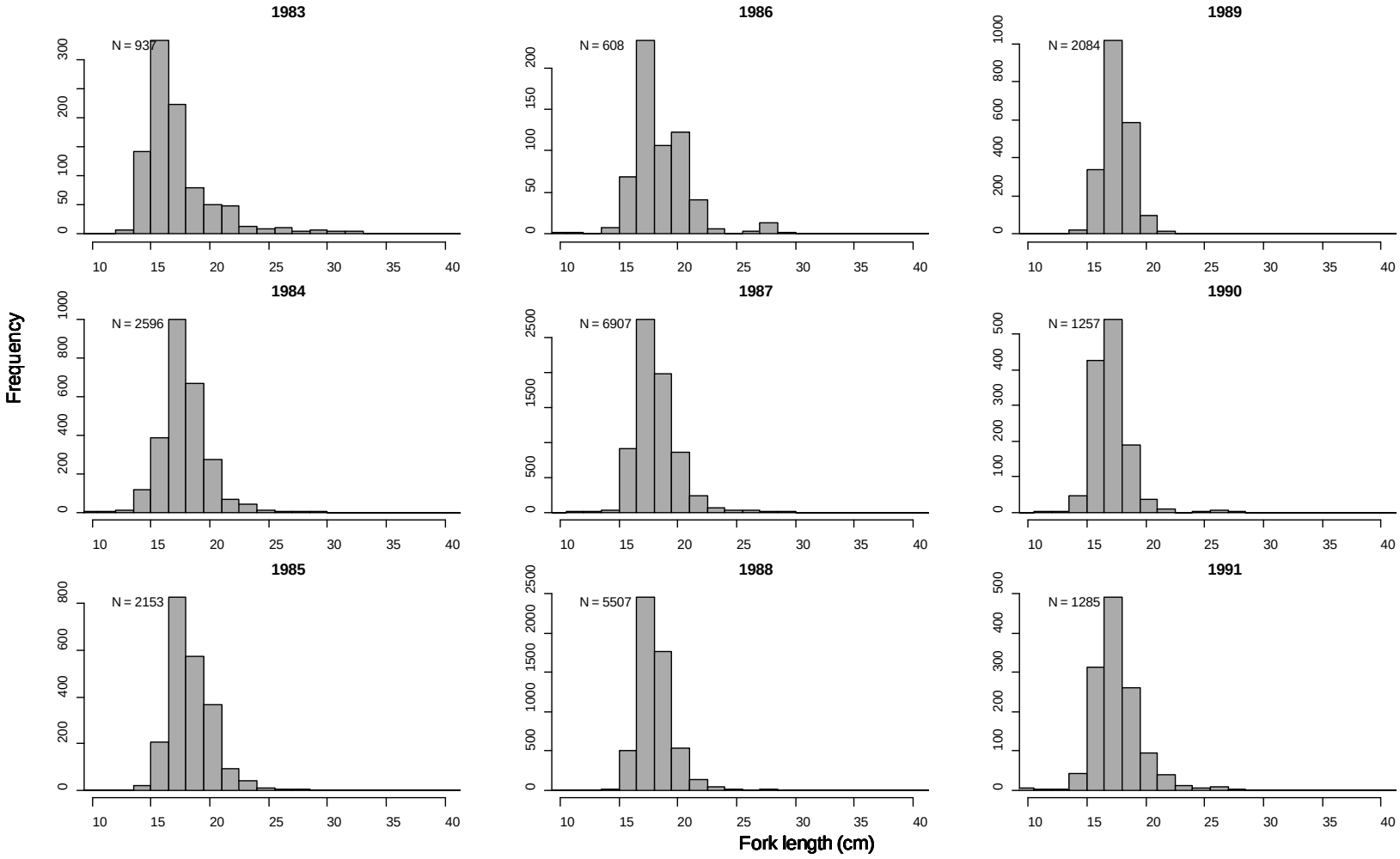

Figure 2. Annual length-frequency plots for blue tang caught by the St. Croix pot and trap fishery. The N in each panel denotes sample size. Bin size is 1.5cm.

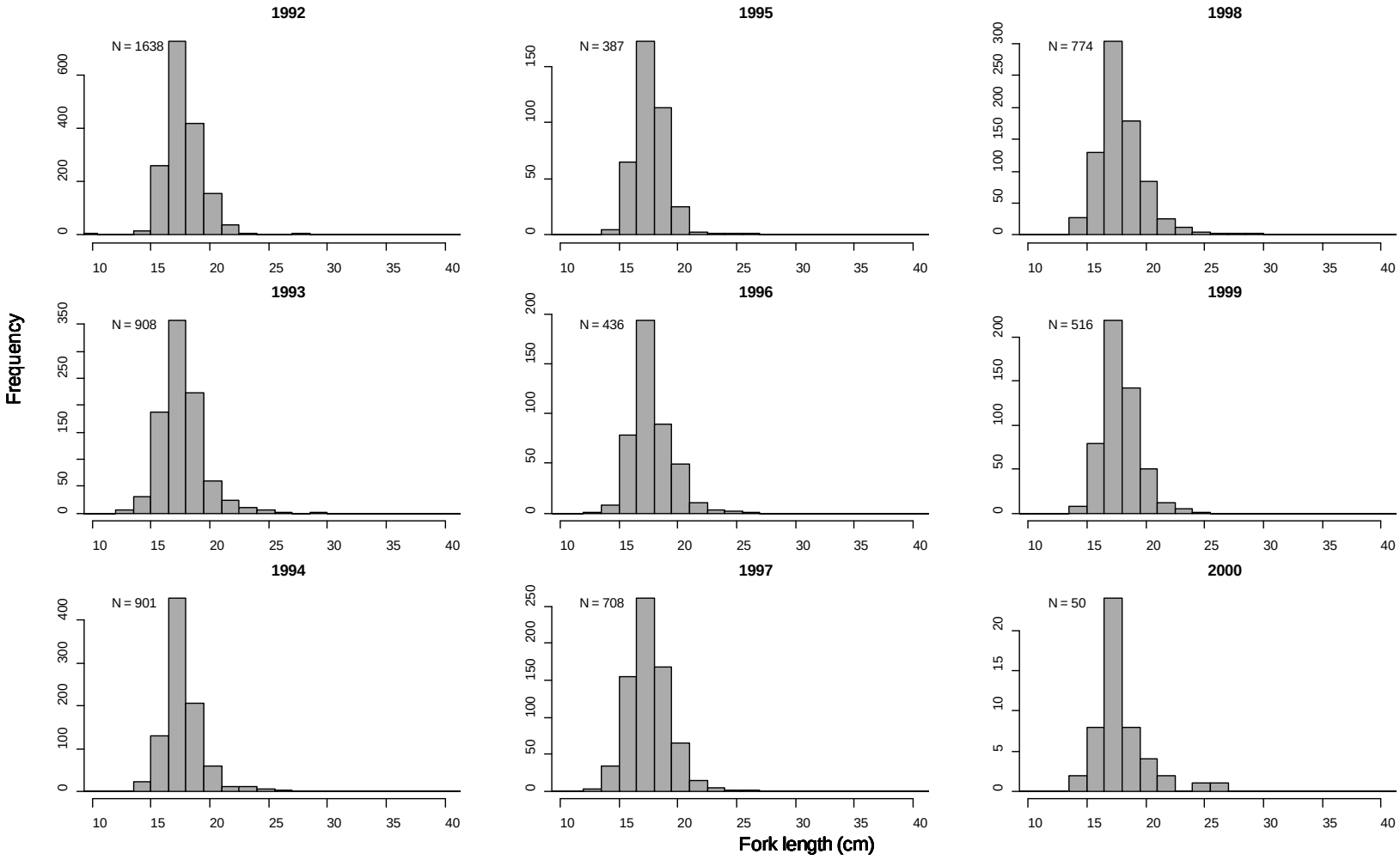

Figure 2. continued.

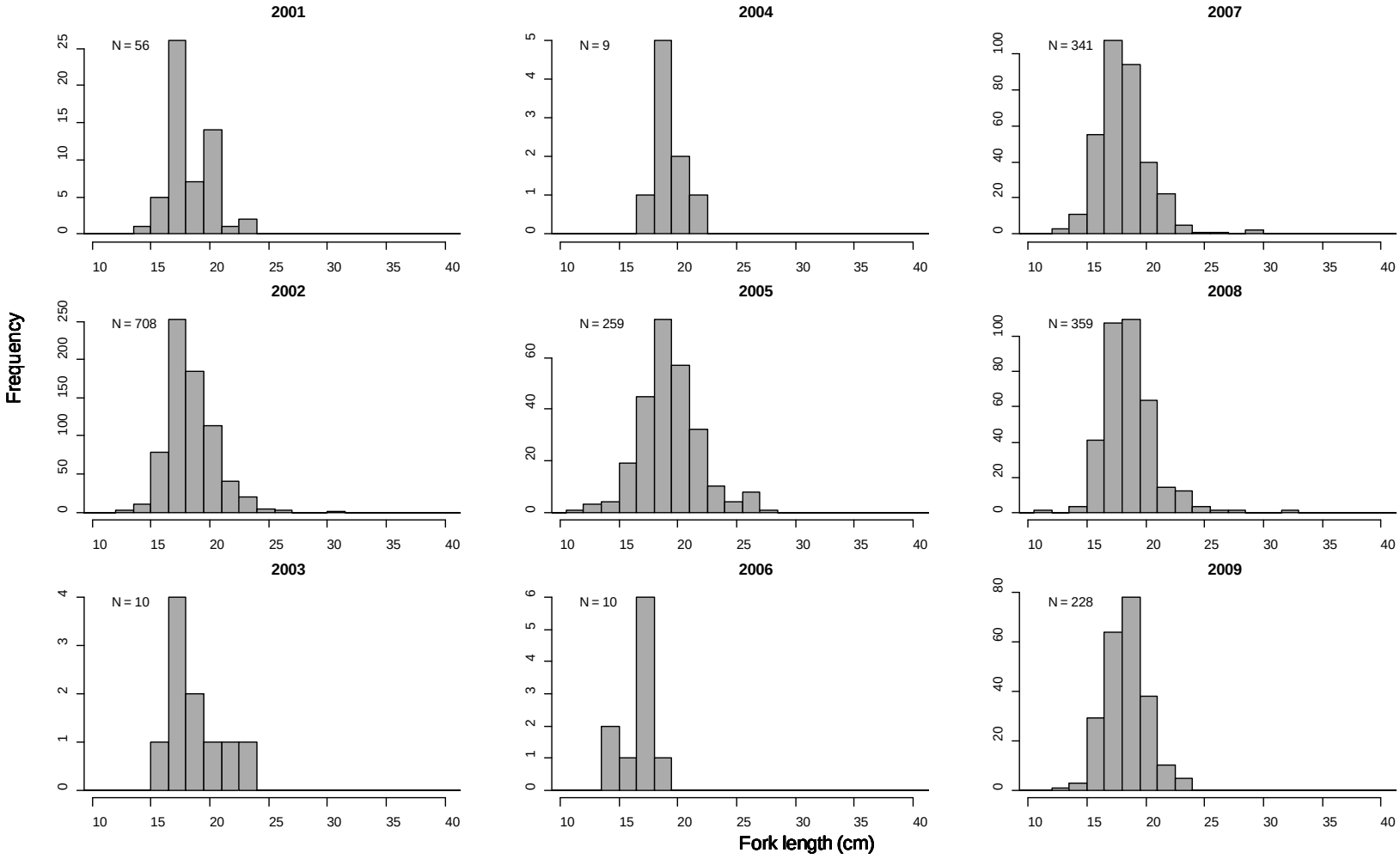

Figure 2. continued.

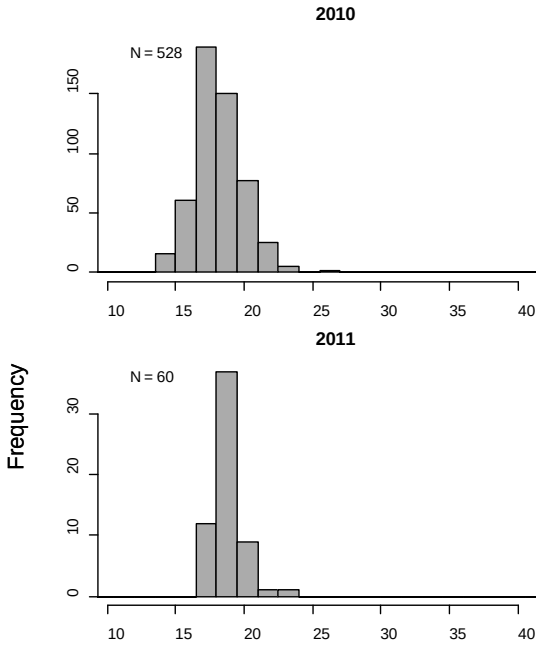

Figure 2. continued.

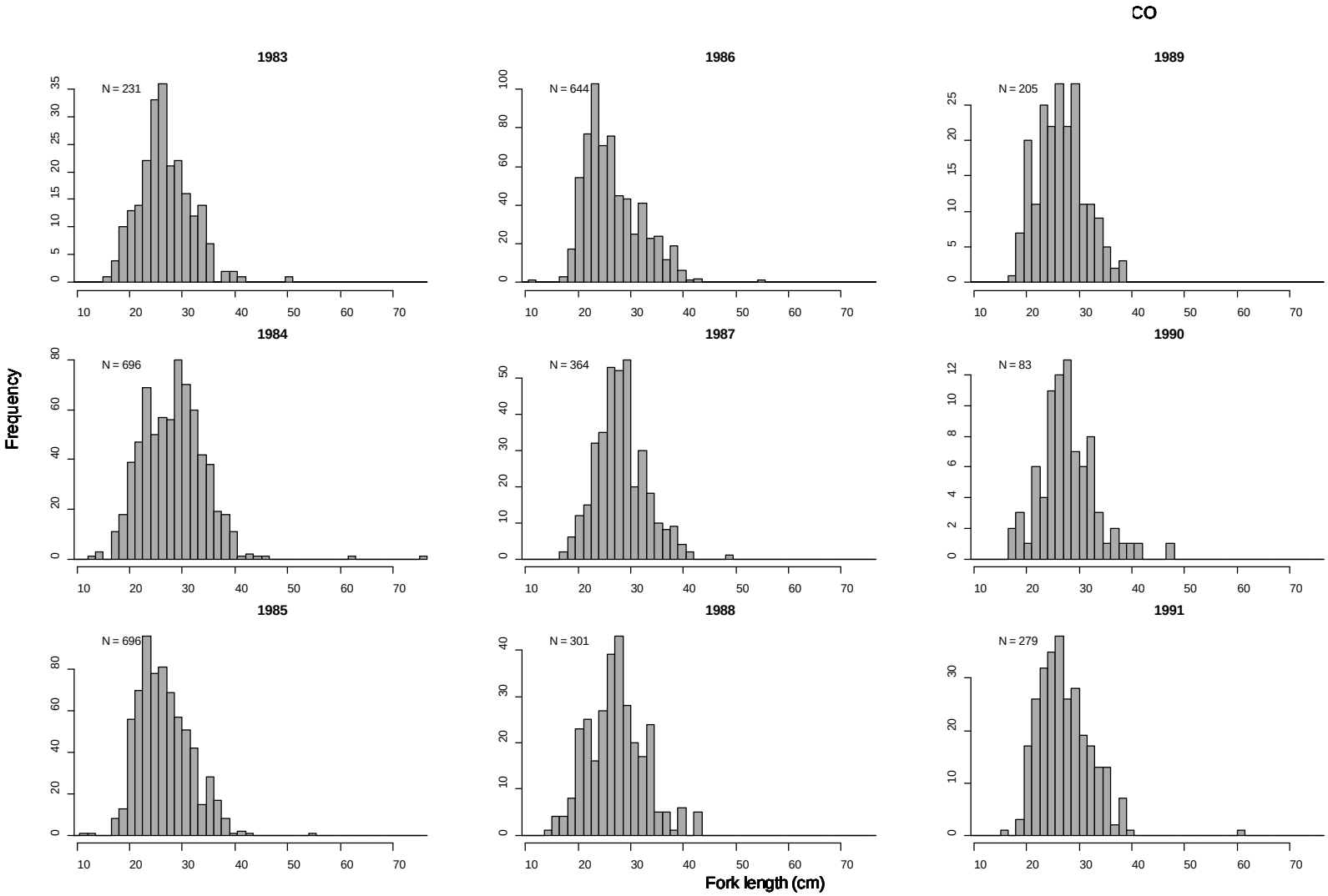

Figure 3. Annual length-frequency plots for queen triggerfish caught by the Puerto Rican pot and trap fishery. The N in each panel denotes sample size. Bin size is 1.5cm.

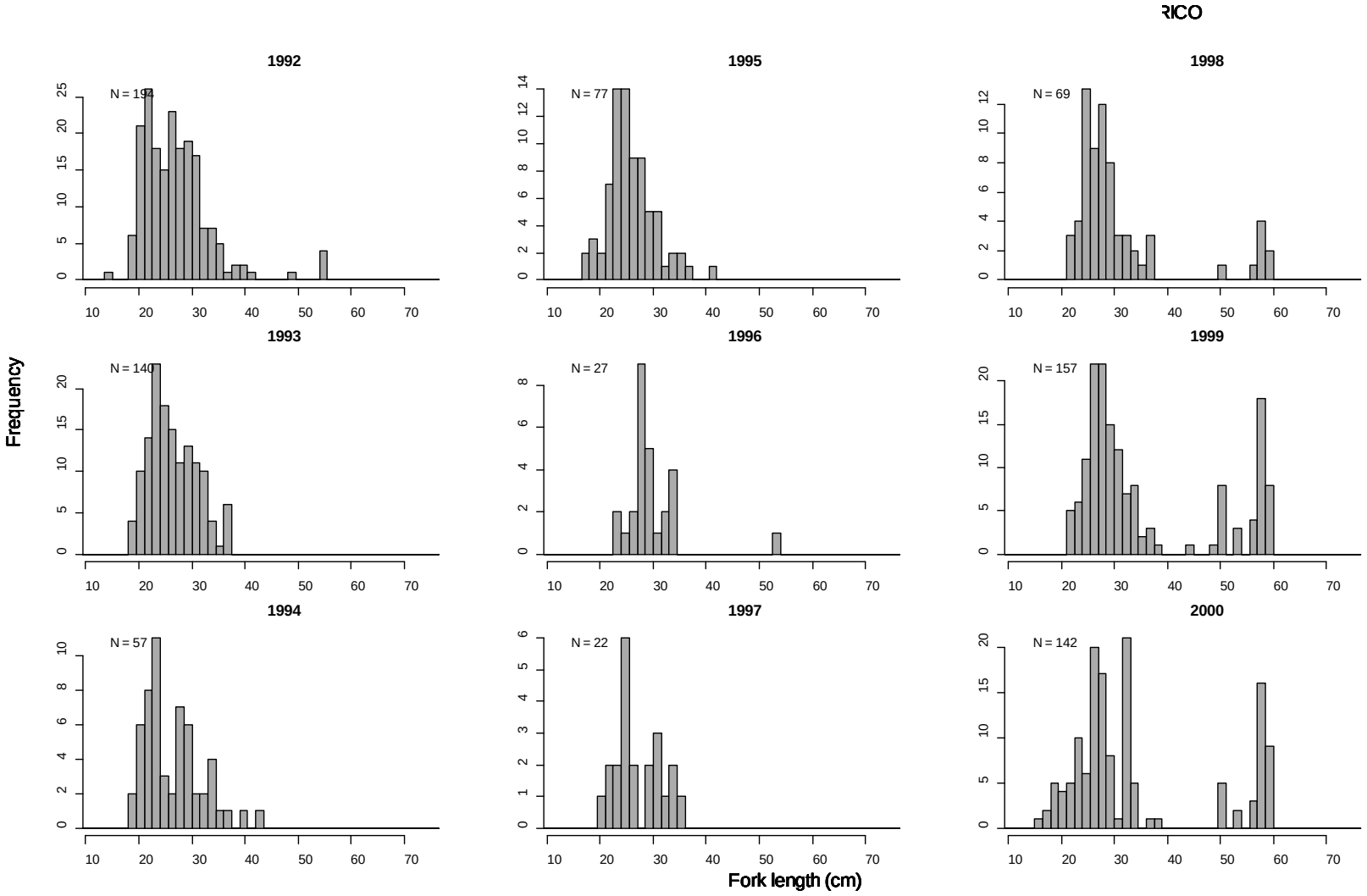

Figure 3. continued.

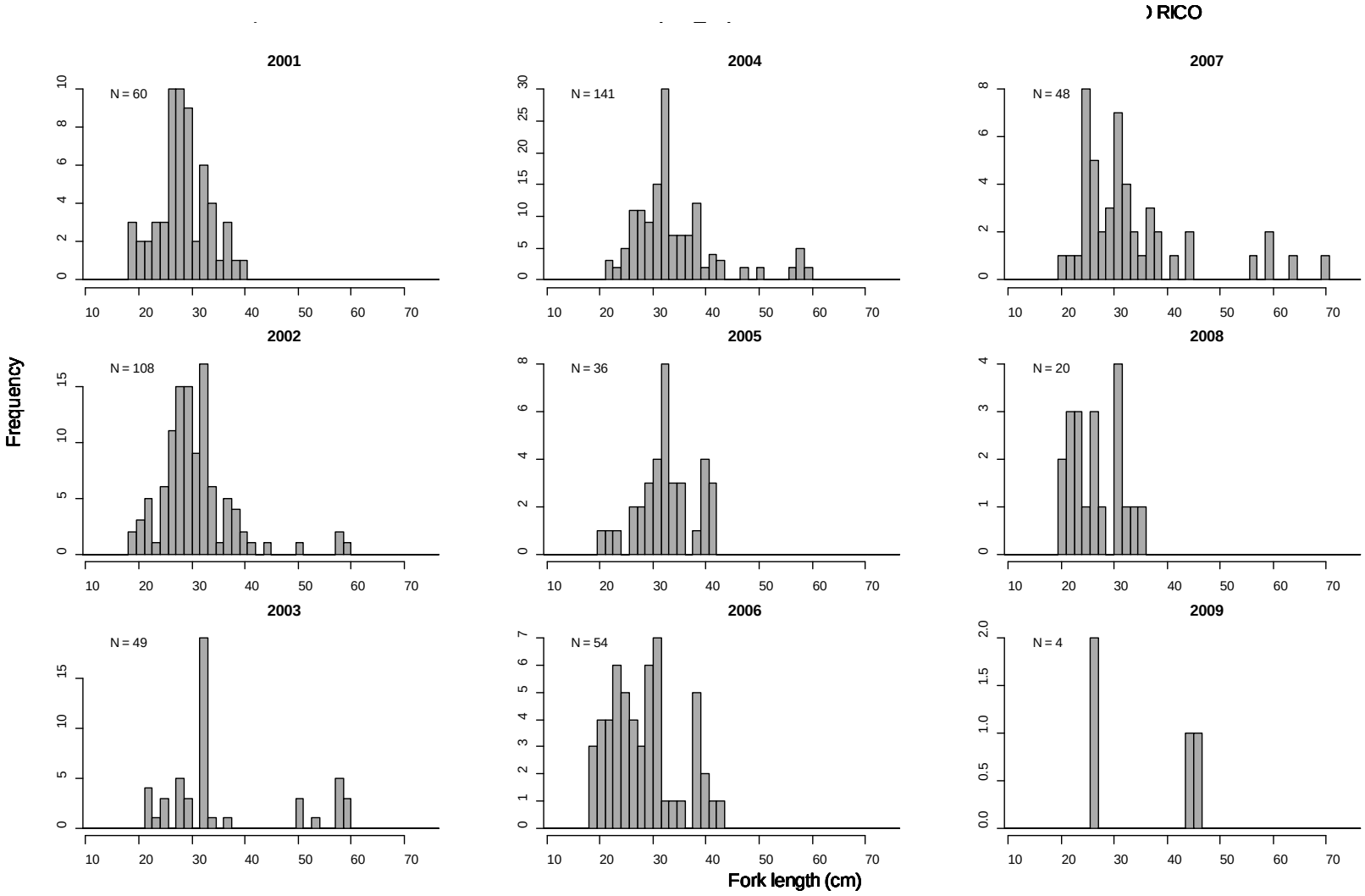

Figure 3. continued.

RICO

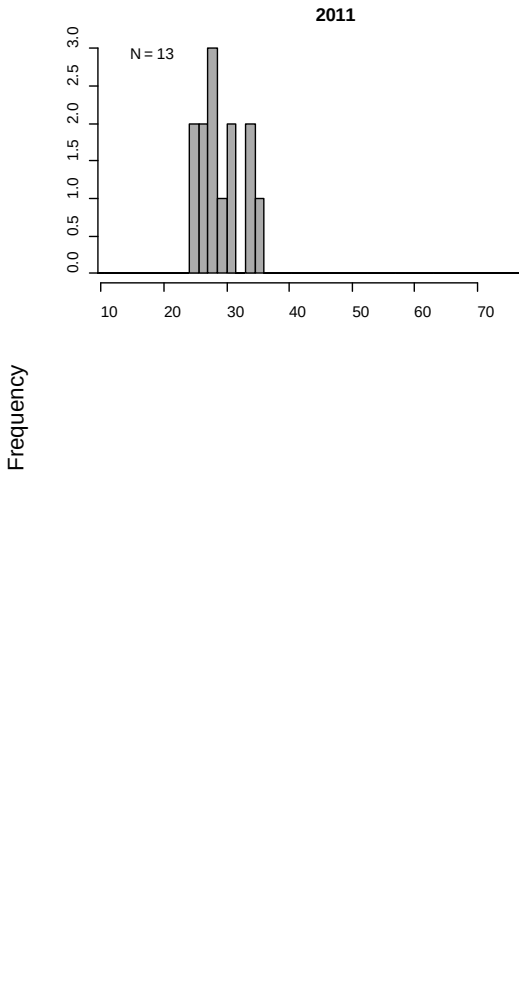

Figure 3. continued

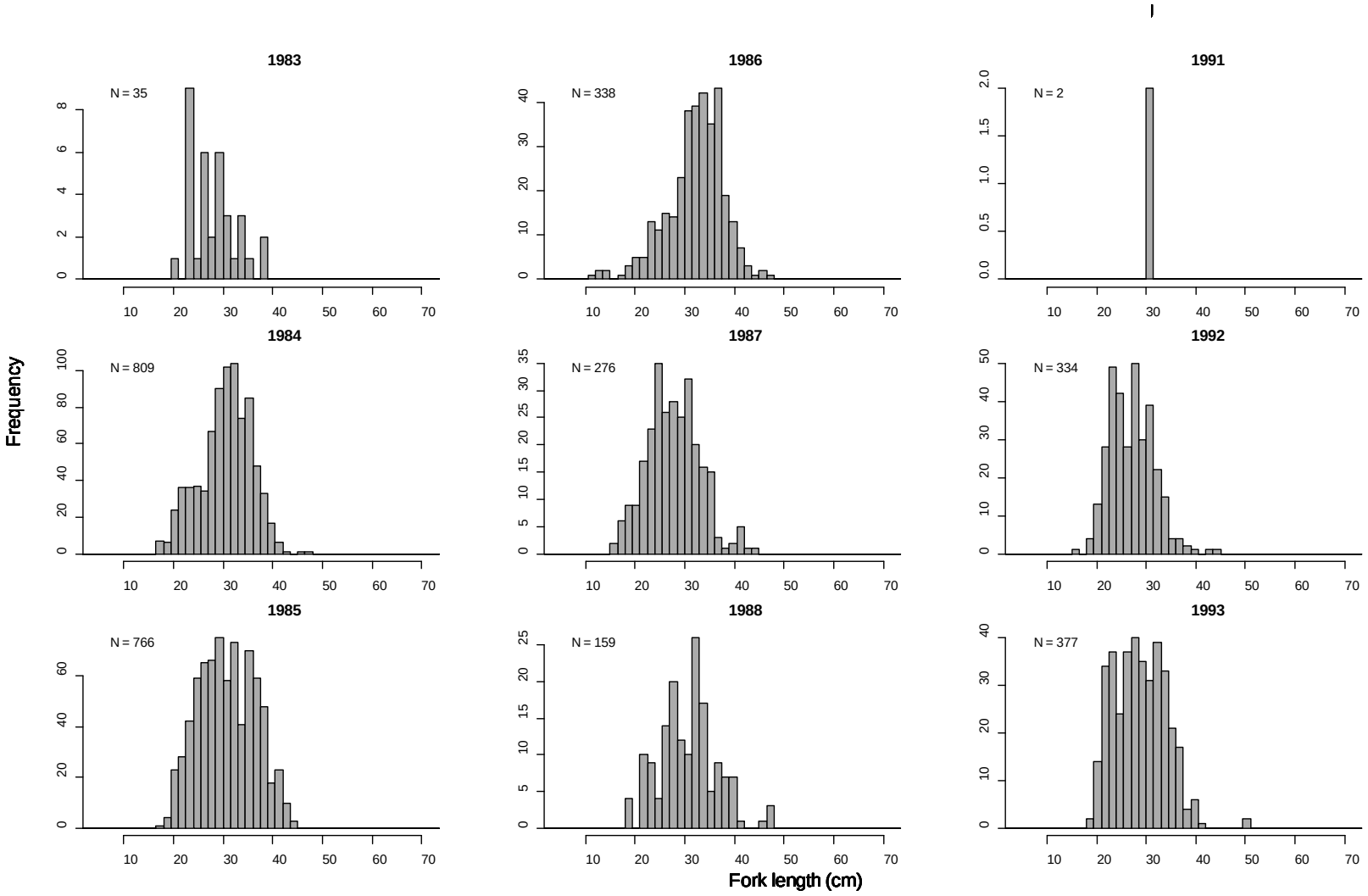

Figure 4. Annual length-frequency plots for queen triggerfish caught by the St. Thomas and St. John pot and trap fishery. The N in each panel denotes sample size. Bin size is 1.5cm.

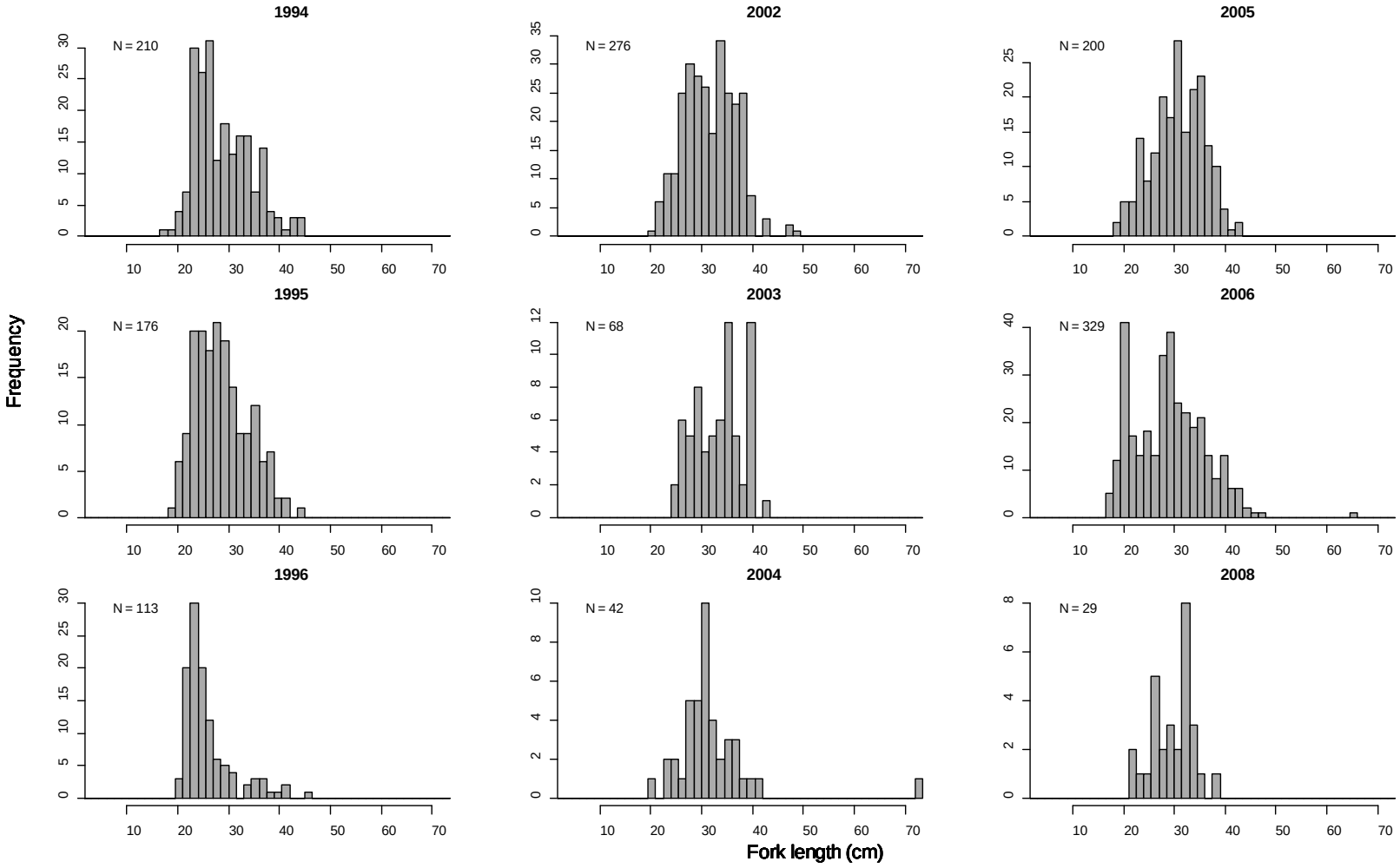

Figure 4. continued

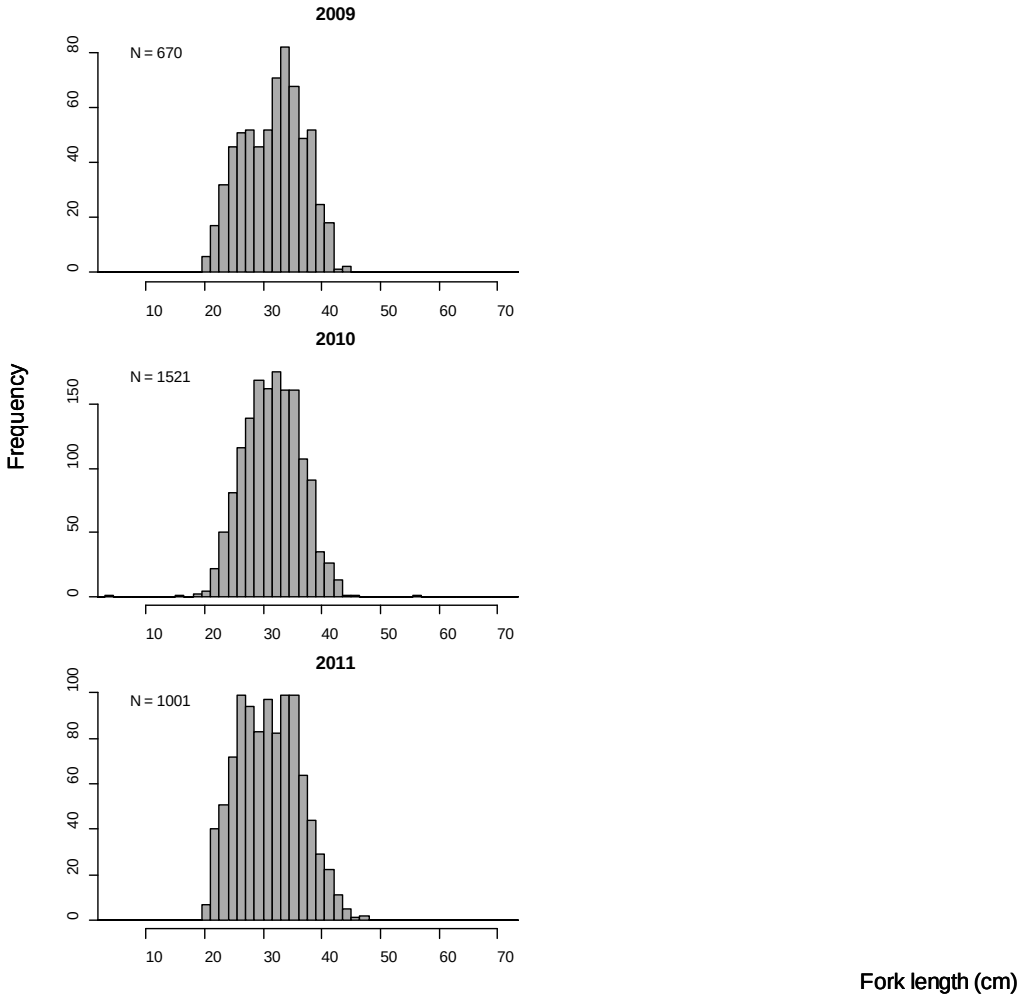

Figure 4. continued

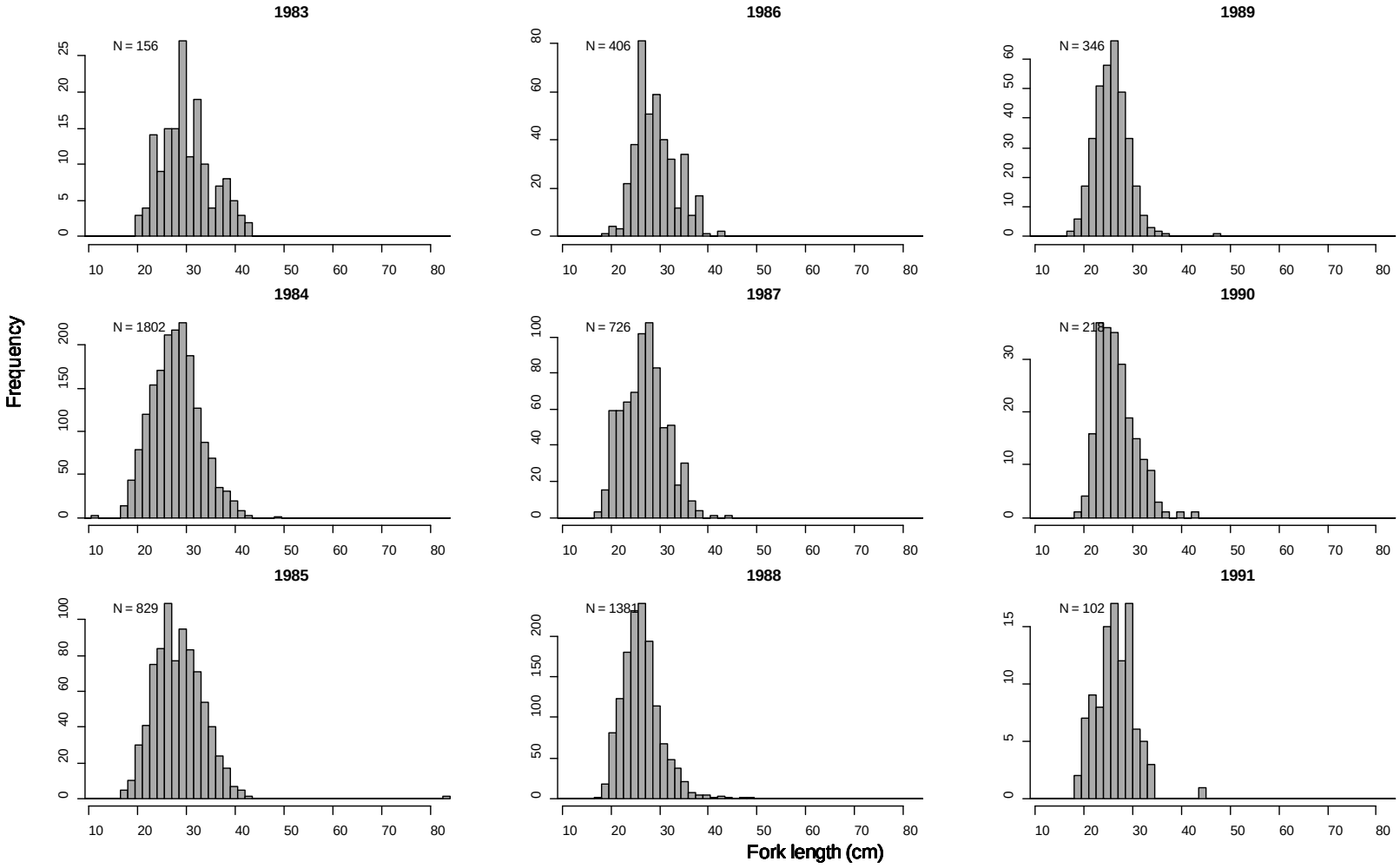

Figure 5. Annual length-frequency plots for queen triggerfish caught by the St. Croix pot and trap fishery. The N in each panel denotes sample size. Bin size is 1.5cm.

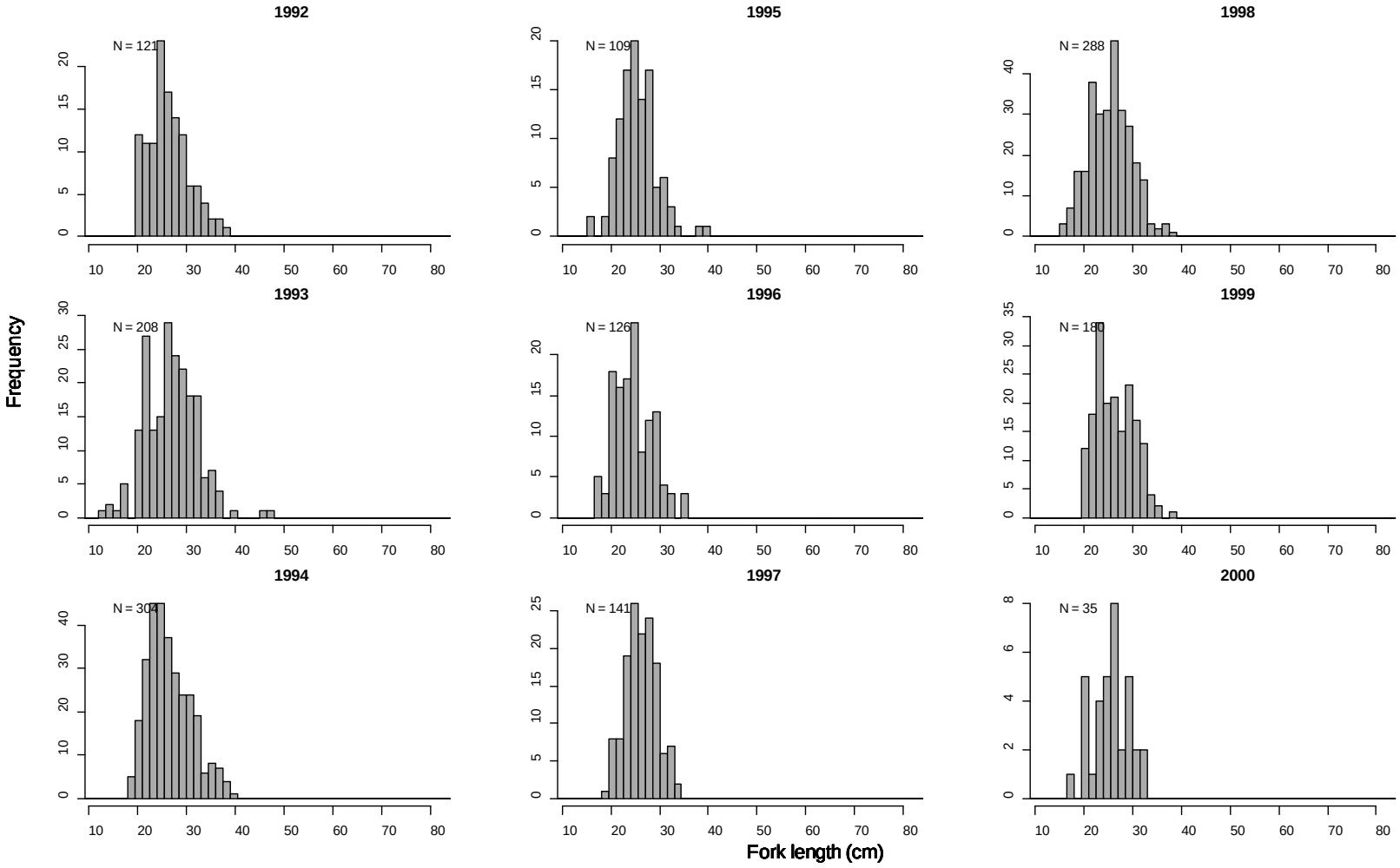

Figure 5. continued

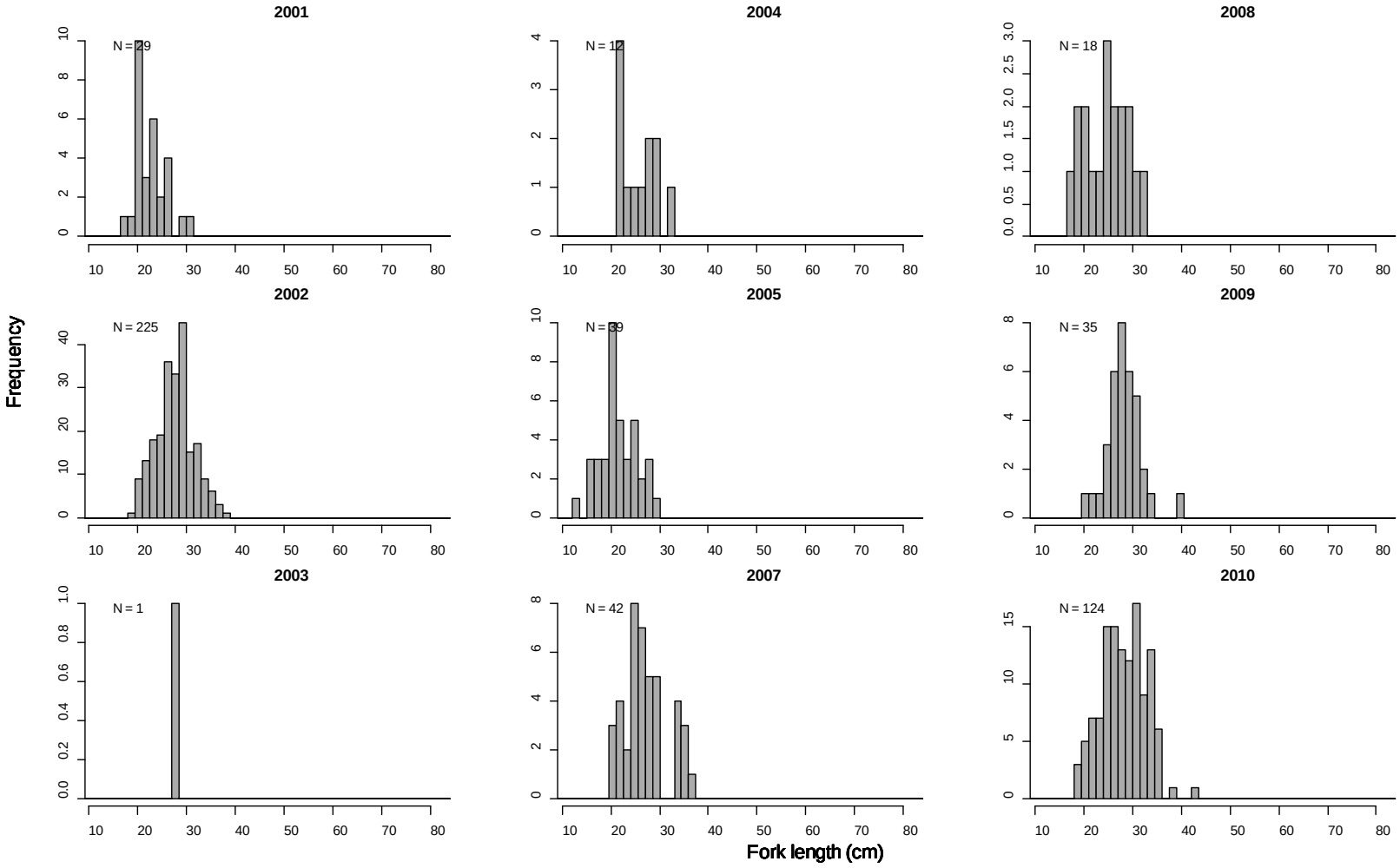

Figure 5. continued

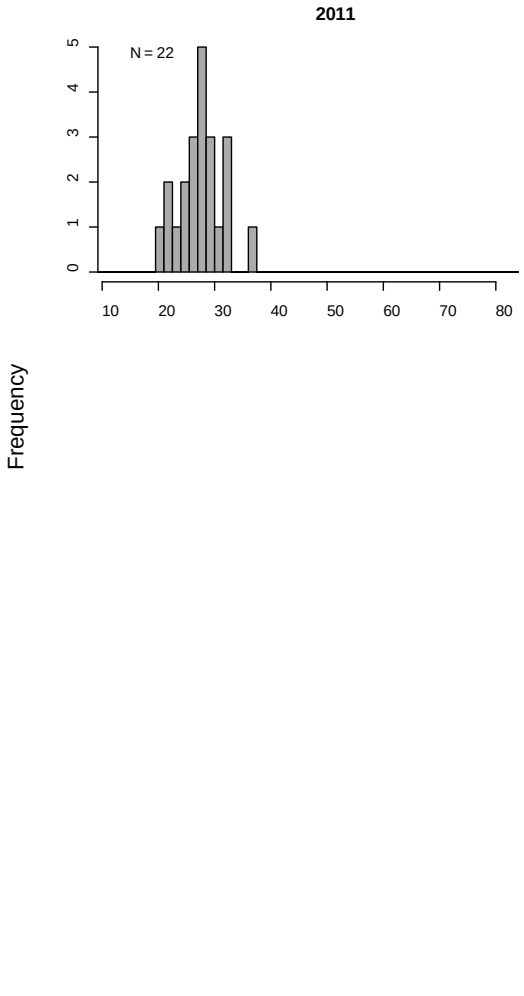

Figure 5. continued

Appendix A. Annual number of length measurements for blue tang by island and gear type.

Puerto Rico	Hook and line	Nets	Pots and trap	Total
1985	1			1
1986			2	2
1987			7	7
1988		8	2	10
1991			3	3
2000		1		1
2005		6		6
2006		83	2	85
2008		20		20
2009		3		3
2011			3	3
St. Thomas and St. John	Hook and line	Nets	Pots and trap	Total
1983			5	5
1984			172	172
1985			451	451
1986	10		142	152
1987			90	90
1988			41	41
1991			22	22
1992			170	170
1993		2	191	193
1994	11		119	130
1995			138	138
1996			50	50
2002			66	66
2003			15	15
2004			26	26
2005			168	168
2006		1	290	291
2008			23	23
2009			106	106
2010		19	407	426
2011			304	304

Appendix A. continued

St. Croix	Hook and line	Nets	Pots and trap	Total
1983			937	937
1984			2596	2596
1985			2153	2153
1986			608	608
1987			6907	6907
1988			5507	5507
1989			2084	2084
1990			1257	1257
1991			1285	1285
1992			1638	1638
1993	68		908	976
1994		1	901	902
1995	9	132	387	528
1996		33	436	469
1997		10	708	718
1998		34	774	808
1999	13		516	529
2000		15	50	65
2001		162	56	218
2002		335	708	1043
2003		153	10	163
2004		204	9	213
2005		204	259	463
2006			10	10
2007		27	341	368
2008		60	359	419
2009		43	228	271
2010		49	528	577
2011			60	60

Appendix B. Annual number of length measurements for queen triggerfish by island and gear type.

Puerto Rico	Diver	Hook and line	Nets	Pots and traps	Total
1983		20	4	231	255
1984	3	23		696	722
1985	1	6		696	703
1986	3	23	16	644	686
1987	1	37	14	364	416
1988	6	62	38	301	407
1989	15	29	19	205	268
1990		3	28	83	114
1991	1	72	26	279	378
1992	23	94	16	194	327
1993	6	66	12	140	224
1994	34	17	5	57	113
1995	9	32	3	77	121
1996	4	15	23	27	69
1997		8	26	22	56
1998	57	34	38	69	198
1999	65	47	31	157	300
2000	42	6	35	142	225
2001	44	5	65	60	174
2002	61	23	45	108	237
2003	20	113	58	49	240
2004	44	29	31	141	245
2005	124	34	124	36	318
2006	104	37	163	54	358
2007	42		43	48	133
2008	104	33	64	20	221
2009	64	53	93	4	214
2010	130	7	137		274
2011	4	5		13	22

Appendix B. continued

St. Thomas and St. John	Diver	Hook and line	Nets	Pots and traps	Total
1983		3		35	38
1984		3	1	809	813
1985		7		766	773
1986		1		338	339
1987				276	276
1988				159	159
1991				2	2
1992				334	334
1993		3		377	380
1994		3		210	213
1995				176	176
1996				113	113
2002				276	276
2003				68	68
2004				42	42
2005		6		200	206
2006		2		329	331
2008				29	29
2009		7		670	677
2010	6	118	1	1521	1646
2011		141		1001	1142
2012		3			3

Appendix B. continued

St. Croix	Diver	Hook and line	Nets	Pots and traps	Total
1983	16	73		156	245
1984	10	81		1802	1893
1985		52		829	881
1986		12		406	418
1987		16		726	742
1988		54		1381	1435
1989				346	346
1990				218	218
1991				102	102
1992				121	121
1993				208	208
1996				113	113
2002				276	276
2003				68	68
2004				42	42
2005		6		200	206
2006		2		329	331
2008				29	29
2009		7		670	677
2010	6	118	1	1521	1646
2011		141		1001	1142
2012		3			3