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Abstract

We conducted a gillnet survey from May through September 2014, at two locations in Charlotte Harbor, Florida: Long Point (LP) and Pine Island (PI). Elasmobranchs and teleosts were sampled using two different methodologies: 1) the same methodology as a previous survey conducted by Mote Marine Laboratory from 1995 to 2004 and in 2013; and 2) the methodology used in the NMFS-coordinated Gulf of Mexico Shark Pupping and Nursery (GULFSPAN) program. The goals of our study were to characterize changes in abundance and species composition of coastal sharks between the two survey periods (1995-2004 vs. 2013-2014); evaluate the potential of the fishery-independent survey to monitor trends in abundance of other fish species found in the area; compare the selectivity of the historical single panel net used by Mote with the selectivity of the multi-panel net used in GULFSPAN projects; and estimate seasonal growth patterns for juvenile blacktip sharks. In the single panel net, blacktip shark catch showed a 7-fold decrease in CPUE between 2013 and 2014 (5.34 sharks set-hr^{-1} in 2013 compared with 0.78 sharks set-hr^{-1} in 2014). This pattern of odd years showing higher catch rates than even years was also observed in the past and may be a reflection of the biennial reproductive cycle of blacktip sharks. Bonnethead CPUE in 2014 was comparable to 2013 (2.83 sharks set-hr^{-1} in 2013, 2.44 sharks set-hr^{-1} in 2014). Species composition of other sharks and non-shark species was also similar in the two surveys. Ladyfish displayed relatively high CPUE in PI (1.26 fish set-hr^{-1}), while all other species displayed relatively low CPUEs throughout Pine Island Sound. In the multi-panel net, half of the non-shark bycatch was caught in the smallest (3.0”) mesh, including a large number of yellowfin menhaden (141 individuals) and gafftopsail catfish (70 individuals). Shark CPUE in the multi-panel net was higher than for the single panel net (2.11 sharks set-hr^{-1} vs. 0.78 sharks set-hr^{-1}), with the highest blacktip catches occurring in the smaller mesh sizes. The CPUE results can provide relative abundance indices for use in stock assessments for blacktip sharks and other species of commercial or recreational importance. Blacktip catch in the multi-panel net was low (38 individuals) and few sharks were caught in the larger mesh sizes, thus additional data are needed to compare the selectivity of the two nets and estimate seasonal growth patterns for blacktip sharks.

Introduction

Numerous studies have found coastal sharks to be especially vulnerable to overexploitation due to their low reproductive output and high susceptibility to fishing gear and habitat degradation (Dulvy et al. 2014, Burgess et al. 2005, Baum and Myers 2004, Baum et al. 2003, Cortes 2002a,b). Coastal habitat degradation is of particular concern for many sharks species found in the Gulf of Mexico, as these often rely on bays and estuaries as nursery grounds for their young (Bethea *et al.* 2009). In 1992, the state of Florida started regulating its shark fisheries as a response to widespread overfishing of shark populations in the Atlantic and Gulf of Mexico. This decision was quickly followed by actions at the federal level where, in 1993, the National Marine Fisheries Service implemented the Atlantic Shark Fisheries Management Plan (FMP), the first federal management regime for sharks in federal waters. Two of the main objectives of the FMP were to establish and protect local nursery habitats (NMFS 1993) and initiate a shark data collection program. As a result, efforts have been made to better characterize the relative abundance, nursery habitats and basic biology of sharks common to Florida waters (Bethea *et al.* 2009).

This report summarizes results from Mote Marine Laboratory's Center for Shark Research (CSR) juvenile blacktip shark survey for 2014. The Mote CSR has been conducting fishery-independent surveys on the west coast of Florida since 1991 with the primary objective of determining the relative abundance of juvenile blacktip sharks in eastern Gulf of Mexico nursery areas. Other coastal shark species commonly found occupying these areas include bonnethead (*Sphyrna tiburo*) and Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) (Hueter and Tyminski, 2007). This survey furthermore allows for the evaluation of long-term data on nursery habitat preferences, migration patterns and pre-release and post-release mortality rates of elasmobranchs (Hueter *et al.* 2006), as well as provides information on the abundance and habitat selection of a number of teleost species, including ladyfish, pompano, Spanish mackerel, gafftopsail catfish and cownose rays. It will also allow, through a net selectivity comparison study, for the Mote Marine Laboratory historical data to be considered in the blacktip shark stock assessment in the future.

Project Goals

The present study objectives are to:

1) Characterize the relative abundance and community composition of coastal sharks in Charlotte Harbor, FL to quantify changes in relative abundance between the past survey (1995-2004) and present survey conducted in 2013 and 2014.

2) Evaluate the potential of the fishery-independent gillnet survey to monitor trends in abundance of other fish species such as Spanish mackerel, cownose rays, ladyfish, pompano, gafftopsail catfish, yellowfin menhaden and harvestfish.

3) Characterize the difference in the size composition and catch rates of the two types of nets, to calibrate VIMS/Mote data with NMFS data from the GULFSPAN program for comparative purposes of gauging relative abundance and other variables.

4) Estimate the seasonal growth pattern of blacktip sharks based on modal size progression.

Methods

The 2013 study was conducted following the sampling methodology used in the 1995-2004 Mote gillnet surveys (referred to from here on as "past survey"), with two exceptions: 1) locations were restricted to one area, Charlotte Harbor, as opposed to the past survey, which had focused the effort in three Florida coastal areas, Yankeetown, lower Tampa Bay and Charlotte Harbor (Fig. 1); and 2) we alternated sets between two different nets, a single panel net and a multi-panel net whose specifications are detailed below. In 2013 and 2014, monthly, random stratified, fishery-independent sampling by gillnet was conducted from May through September at two locations: Pine Island (PI) and Long Point (LP). Each location was divided into ten 1x1 km grid cells (Fig. 1), with depths ranging from 2-15 ft (0.6-4.6 m) and averaging 7 ft (2 m). For quantitative assessment of relative abundance, standardized sets were conducted each month in each grid, in five of the ten 1 X 1 km grid cells; the five per grid were selected randomly each month. In 2014, 40 quantitative sets were carried out in Charlotte Harbor using #208 (0.52 mm diameter) monofilament, 4.5" (11.4 cm) stretch mesh, 400 yd X 10 ft (366 X 3 m) weighted gillnets. Another 40 sets were carried out using gillnets consisting of six different mesh size panels, which are used in the GULFSPAN program (SEDAR 2012). Stretched mesh sizes in those nets ranged from 3.0" (7.6 cm) to 5.5" (14.0 cm) in steps of 0.5" (1.3 cm). Each panel was 10 ft (3m) deep and 100 ft (30.5 m) long. Panels were strung together and fished as a single gear.

At the end of each one-hour set, all shark catch was identified, sexed, measured and weighed. Reproductive status was also recorded; neonates were recognized by an open umbilical scar, young-of-the-year animals (YOYs) were identified by a closed scar, and differences between juveniles and adults were based on clasper rigidity for males and size for females. Live sharks were marked with conventional tags and released. Condition of release (on a scale from 1 to 5, 1 indicating excellent condition and 5 indicating pre-release death) was recorded to estimate post-release mortality using tag returns (Hueter *et al.* 2006). Fin clips were taken from blacktip sharks to inform future studies aimed at describing the genetic relatedness of blacktip sharks in Charlotte Harbor. Non-shark catch (rays, bony fishes and other vertebrates) was counted, measured (up to 10 individuals per species per set), rated as alive or dead, and returned to the water. Environmental data including depth, tide, salinity, temperature, bottom type, and weather were collected for each set to characterize the shark nursery habitat. Shark and non-shark catch data were converted to CPUE (fish set-hr^{-1}) for analyses of relative abundance.

<u>We would like to make note of a change in methodologies in our analysis of the catch data.</u> In last year's report, we calculated CPUE from catch-per-successful-set only. This year, we decided it was more appropriate to calculate CPUE based on catch-per-set (i.e. including sets with zero catches) since that is the metric used by the GULFSPAN program (SEDAR 2012). As such, CPUE values for past surveys were recomputed to make 2014 values and past survey values directly comparable. The CPUEs reported in this document reflect that change. As a result, there may be slight differences in CPUE values between this report and last year's report.

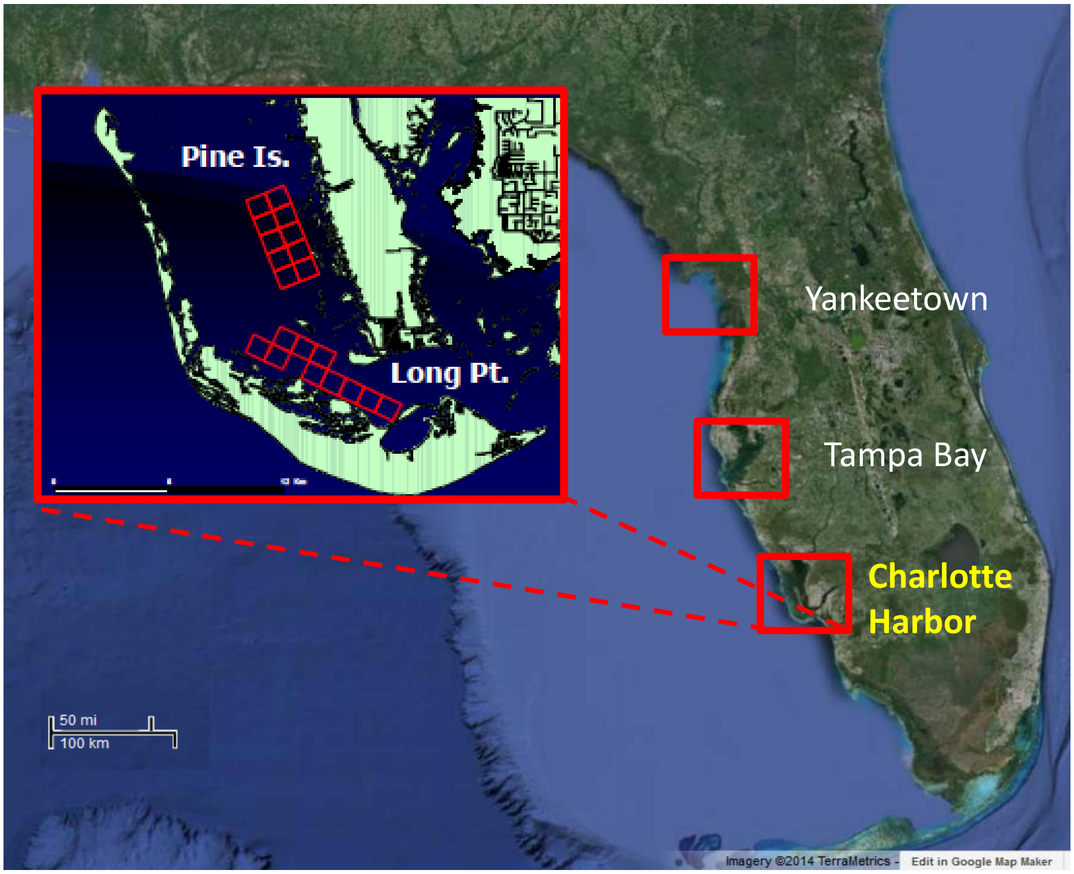

Figure 1: Florida map, highlighting the three study areas from the past gillnet surveys and secondary map of the grid layouts for the two study sites (Pine Island and Long Point) surveyed in all survey years including 2014.

Results

Environmental factors

Water temperatures measured at each site were relatively high for all months compared to the past survey (Fig. 2). Both LP and PI set the highest August temperature ever recorded in the survey (33.5°C and 33.7°C, respectively). The water temperature in 2014 ranged from 27.7°C to 33.5°C for LP and 27.8°C to 33.7°C for PI, compared to the past survey range for LP, 20.4-32.4°C, and for PI, 20.7-33.6°C. Similarly, salinities in 2014 were on the higher end of the range (LP: 27.3-35.3 ppt; PI: 29.7-36.4 ppt) compared to the past survey (LP: 14.3-38.0 ppt; PI: 15.4-40.0 ppt; Fig. 2). The overall salinity in each site, averaged across all months, was the highest ever recorded in the survey (LP: 28.8 ppt; PI: 31.1 ppt). September 2014 had the highest salinity ever recorded for that month (LP: 29.4 ppt; PI: 31.6).

1. *Single panel Net*

Sharks

A total of 209 sharks were caught in the 2014 survey across all months and sites (Table 1). Bonnetheads (*Sphyrna tiburo*) were the most abundant sharks caught in 2014 (n=131) comprising 63% of total shark catch, followed by blacktip sharks (*Carcharhinus limbatus*, n=42, 20% of total shark catch) and scalloped hammerhead (*Sphyrna lewini*, n=26, 12% of total shark catch; Fig. 3). These three species comprised 95% of total shark catch. Over half (58%) of the total scalloped hammerheads caught over all years were caught in 2014. Three more species were also caught in 2014, which include great hammerhead (*Sphyrna mokarran*, n=4), Atlantic sharpnose shark (*Rhizoprionodon terraenovae*, n=4) and bull shark (*Carcharhinus leucas*, n=2; Table 1). A total of 101 sharks were tagged and released, two sharks escaped from the net prior to workup and 106 sharks did not survive. Species with the highest at-the-boat mortality rates were bonnetheads (n=68, 52% mortality), scalloped hammerheads (n=18, 69% mortality) and blacktip sharks (n=18, 43% mortality; Table 1). Eight scalloped hammerheads and three great hammerheads were tagged and released alive.

Comparing annual CPUEs of 2013 and 2014, for which monthly coverage was the same, we found a 7 fold decrease in blacktip CPUE between 2013 and 2014 (5.34 sharks set-hr^{-1} in 2013 compared with 0.78 sharks set-hr^{-1} in 2014). Bonnethead 2014 CPUE was comparable to 2013 (2.83 sharks set-hr^{-1} in 2013, 2.44 sharks set-hr^{-1} in 2014). In LP, the total shark CPUE observed in 2014 was slightly over two-thirds of the CPUE observed in 2013 (Table 2). In PI, the total shark CPUE observed in 2014 was one-third the CPUE observed in 2013. Total shark CPUE for the past survey (1995-2004) ranged from 2.24–5.83 sharks set-hr^{-1} for LP and 2.01-9.26 sharks set-hr^{-1} for PI, whereas the total shark CPUE for 2013 and 2014 was 6.62 and 4.58 sharks set-hr^{-1}, respectively, in LP and 10.75 and 3.30 sharks set-hr^{-1}, respectively, in PI (Table 2). This year (2014) the CPUE was higher in LP than PI, similar to 1997, 2000, 2001 and 2004 (Table 2). Interestingly, the shark CPUE in 2013 was also within the mid to upper range for all months in LP, but the monthly CPUE in PI was on the lower range for most months except in July. The July CPUE for 2013 in PI was three times higher than the next highest CPUE for that month. The 2014 CPUE in LP was comparable to past surveys years, whereas the 2014 CPUE in PI was the second lowest annual CPUE ever recorded (Table 2).

CPUE data for the months of July and August combined (only 2 months systematically sampled throughout the study years) are presented in Figure 4. In contrast to the 2013 survey, the blacktip shark catch was especially low this year, showing a seven-fold decrease in CPUE from 2013 to 2014 (Fig. 4). However, compared to the 1995-2004 survey years, CPUE for this species was within the lower part of the range (Fig. 4). CPUE for blacktip sharks in 2014 was similar between sites (Fig. 4) and across months (Fig. 5). In 2014, June had the lowest CPUE and September had the highest. This contrasts with the past survey where May had the highest CPUE. The CPUE in 2014 was lower than in the past survey for all months except September, which had comparable CPUE values to both the past survey and 2013 (Fig. 5). The peak in CPUE observed last year in July was not observed this year (Fig. 5). The mean length for blacktip sharks caught in this year's survey was slightly higher than in previous years (Fig. 6) because the majority caught were juveniles in 2014, whereas a mix of YOYs and juveniles were caught in other years. For blacktip sharks this year, a total of 14 YOYs were caught compared with only 2 neonates (mean length= 53cm) and 26 juveniles (mean length= 65cm). The sex ratio between males and females was 1:1 (n_{males}= 19, $n_{females}$= 21, not recorded= 2). In 2013, the mean fork length was the lowest with the highest CPUE, however, this year's survey in 2014 had the second to highest mean length, but one of the lower CPUEs (Fig. 7).

Although bonnetheads were the dominant shark species this year (Fig. 3), the CPUE indicates that the catch was slightly below the average CPUE recorded from the past survey period (historical mean using only July and August months for comparison purposes) and below that observed in 2013 (Fig. 4). Looking at 2014 catches by site, we see that PI had a low CPUE relative to the historical mean, whereas CPUE in LP fell close to the historical mean. This compares to 2013 where both sites had CPUEs falling close to the historical mean (Fig. 4). The combined site CPUE for bonnetheads in 2014 followed the same monthly trend as the past survey CPUE, which includes peaks in June and August and a dip in CPUE in July (Fig. 5). Fewer large bonnetheads were caught this year compared to the past survey, causing observed mean length to be lower than in previous years (Fig. 6). A total of 4 YOYs (mean length= 46 cm), 49 juveniles (mean length= 64 cm) and 74 adults (mean length= 58 cm) were captured in 2014 (Fig. 6). In addition, 5 times more adult male bonnethead sharks were caught than adult females (62 males vs. 12 females), whereas there were 1.5 times more juvenile females captured than males.

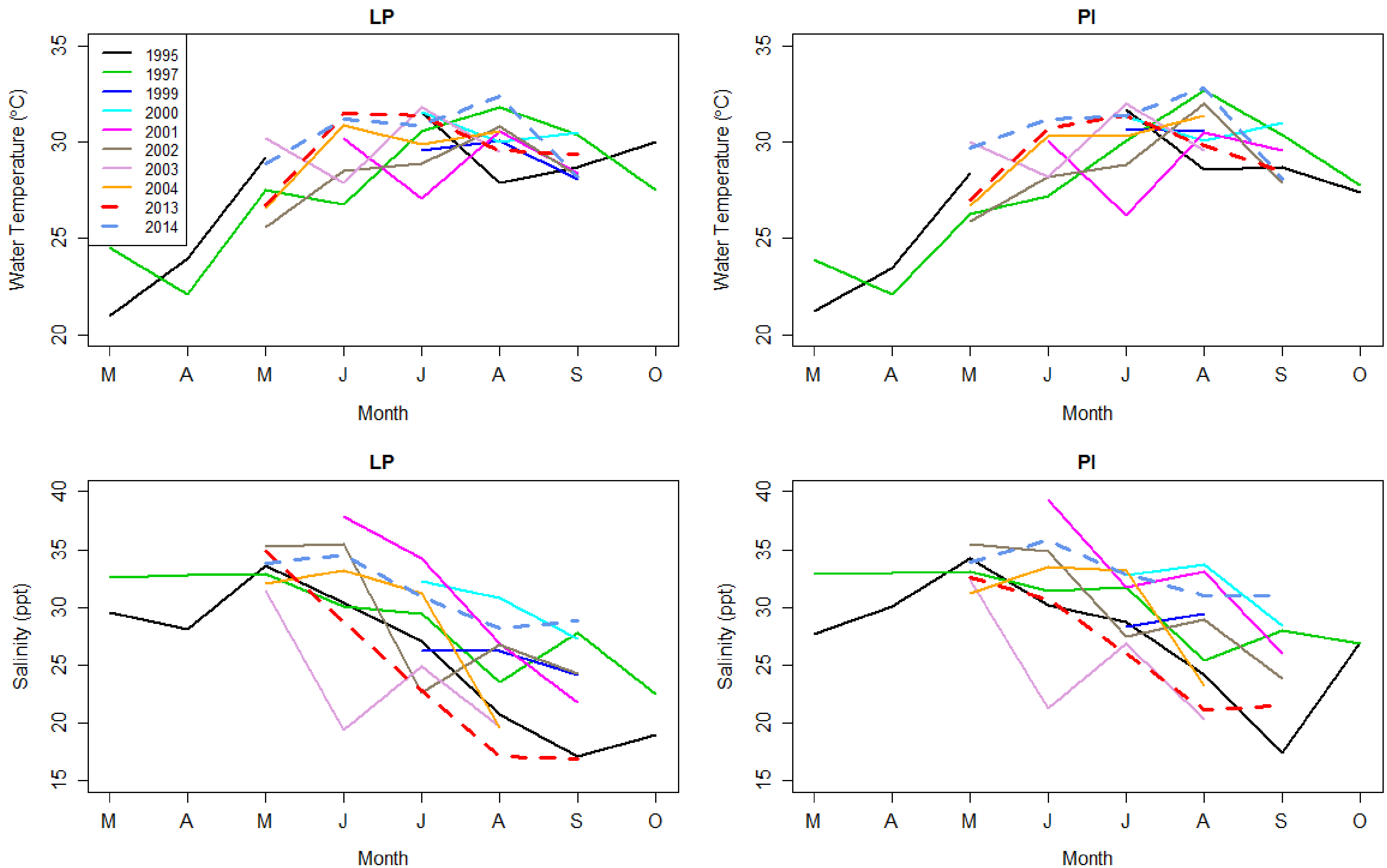

Figure 2: Mean water temperatures (°C) and salinities (ppt) of the 2 grids in Charlotte Harbor (LP and PI) by month and year. 2013 and 2014 survey data are shown by the red and blue dashed line, respectively.

Table 1: Total number of individuals caught in each site and across sites in 2014 and percent immediate, observable mortality. Rows shaded in gray indicate species caught in previous years that were not caught in 2014.

Species		LP		PI		Sites combined	
Scientific name	**Common name**	**Total catch**	**%dead**	**Total catch**	**%dead**	**Total catch**	**%dead**
Sphyrna tiburo	Bonnethead	80	46.2	51	60.8	131	51.9
Carcharhinus limbatus	Blacktip shark	9	33.3	33	45.5	42	42.9
Sphyrna lewini	Scalloped hammerhead	22	68.2	4	75.0	26	69.2
Sphyrna mokarran	Great hammerhead	2	0	2	50.0	4	25.0
Rhizoprionodon terraenovae	Atlantic sharpnose shark	2	50.0	2	0	4	25.0
Carcharhinus leucas	Bull shark	0	0	2	0	2	0
Carcharhinus acronotus	Blacknose shark	0	0	0	0	0	0
Negaprion brevirostris	Lemon shark	0	0	0	0	0	0
Ginglymostoma cirratum	Nurse shark	0	0	0	0	0	0
	TOTAL:	**115**		**94**		**209**	

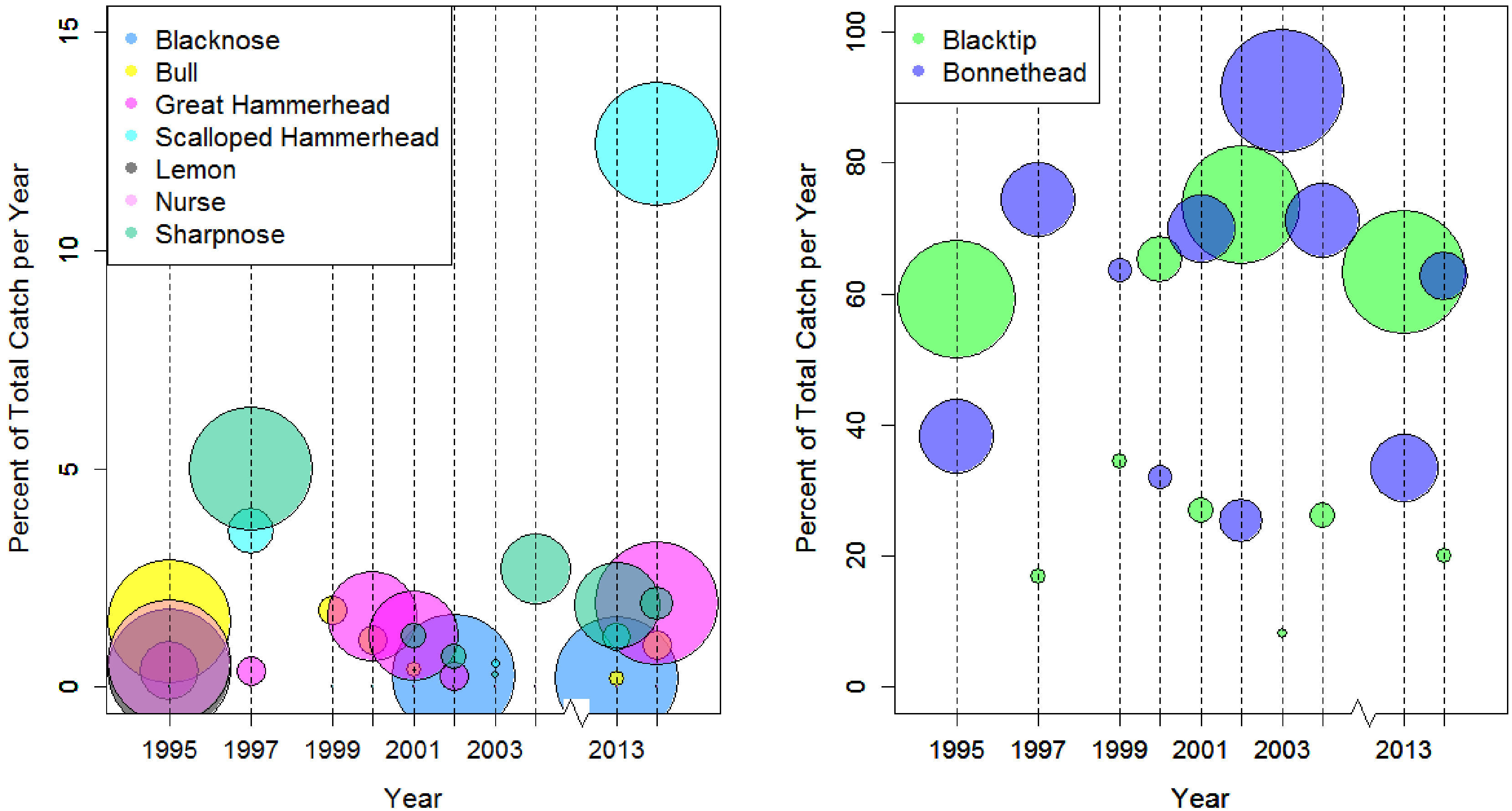

Figure 3: Shark catch composition observed each year. Relative size of the bubble represents the size of the catch relative to the total catch across all years of study for that particular species. The panel on the left includes data from the 7 least prominent species and the panel on the right includes data from the 2 most prominent species.

Table 2: Total number of sharks caught in each site for each month and year, and associated effort (set-hr) and CPUE (sharks set-hr^{-1}) data.

		LP			PI		
Year	**Month**	**Catch**	**Effort** *(set-hr)*	**CPUE** *(sharks set-hr^{-1})*	**Catch**	**Effort** *(set-hr)*	**CPUE** *(sharks set-hr^{-1})*
1995	3	16	8.30	1.93	8	7.30	1.10
1995	4	27	7.80	3.46	25	7.10	3.52
1995	5	15	7.38	2.03	174	10.27	16.95
1995	6	32	7.15	4.48	104	8.65	12.02
1995	7	26	7.72	3.37	17	7.58	2.24
1995	8	9	7.25	1.24	10	6.67	1.50
1995	9	20	6.35	3.15	46	8.07	5.70
1995	10	1	6.93	0.14	5	8.33	0.60
	TOTAL:	**146**	**58.88**	**2.48**	**389**	**63.97**	**6.08**
1997	3	18	6.82	2.64	2	6.45	0.31
1997	4	12	6.58	1.82	2	6.15	0.33
1997	5	8	6.87	1.17	6	8.02	0.75
1997	6	18	7.28	2.47	11	7.10	1.55
1997	7	53	7.30	7.26	26	6.70	3.88
1997	8	22	6.30	3.49	37	6.53	5.66
1997	9	19	6.43	2.95	16	6.52	2.46
1997	10	21	6.98	3.01	9	6.82	1.32
	TOTAL:	**171**	**54.57**	**3.13**	**109**	**54.28**	**2.01**
1999	7	30	7.62	3.94	18	7.38	2.44
1999	8	15	8.03	1.87	44	8.88	4.95
1999	9	6	7.10	0.85	NA	NA	NA
	TOTAL:	**51**	**22.75**	**2.24**	**62**	**16.27**	**3.81**
2000	7	75	6.83	10.98	55	7.20	7.64
2000	8	19	6.75	2.81	27	7.20	3.75
2000	9	2	6.47	0.31	9	6.53	1.38
	TOTAL:	**96**	**20.05**	**4.79**	**91**	**20.93**	**4.35**
2001	6	14	6.77	2.07	10	6.30	1.59
2001	7	16	6.87	2.33	3	6.30	0.48
2001	8	127	8.22	15.46	63	7.83	8.04
2001	9	8	6.83	1.17	16	6.90	2.32
	TOTAL:	**165**	**28.68**	**5.75**	**92**	**27.33**	**3.37**
2002	5	36	7.72	4.67	176	8.77	20.08
2002	6	25	7.38	3.39	7	6.33	1.11
2002	7	4	7.03	0.57	46	7.28	6.32
2002	8	32	7.12	4.50	60	7.40	8.11
2002	9	41	6.97	5.89	11	6.63	1.66
	TOTAL:	**138**	**36.22**	**3.81**	**300**	**36.42**	**8.24**
2003	5	6	6.02	1.00	0	6.28	0.00
2003	6	68	7.37	9.23	162	8.10	20.00
2003	7	41	7.27	5.64	29	6.57	4.42
2003	8	4	6.25	0.64	67	6.92	9.69
	TOTAL:	**119**	**26.90**	**4.42**	**258**	**27.87**	**9.26**
2004	5	37	6.68	5.54	7	6.08	1.15
2004	6	27	6.02	4.49	27	5.73	4.71
2004	7	69	7.25	9.52	45	6.90	6.52
2004	8	21	6.48	3.24	62	7.27	8.53
	TOTAL:	**154**	**26.43**	**5.83**	**141**	**25.98**	**5.43**
2013	5	42	5.92	7.10	6	5.72	1.05
2013	6	95	7.18	13.23	1	1.45	0.69
2013	7	50	6.90	7.25	251	8.28	30.30
2013	8	11	8.90	1.24	25	6.68	3.74
2013	9	35	6.28	5.57	19	5.95	3.19
	TOTAL:	**233**	**35.18**	**6.62**	**302**	**28.08**	**10.75**
2014	5	13	5.05	2.57	11	4.98	2.21
2014	6	21	5.08	4.13	26	5.67	4.59
2014	7	8	3.73	2.14	21	6.22	3.38
2014	8	51	5.83	8.74	15	5.78	2.59
2014	9	22	5.40	4.07	21	5.83	3.60
	TOTAL:	**115**	**25.10**	**4.58**	**94**	**28.48**	**3.30**

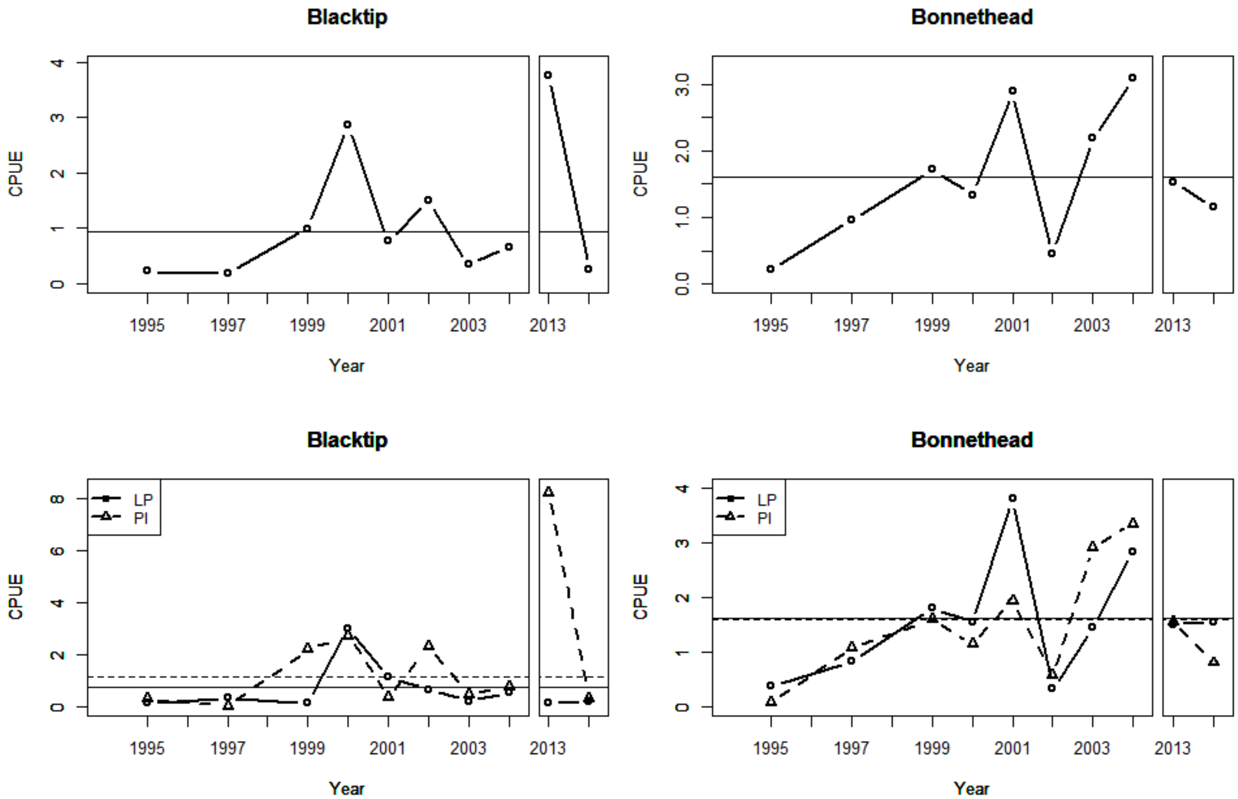

Figure 4: Yearly CPUE indices for blacktip shark and bonnethead across all sites (top row) and between sites (bottom row). The horizontal reference lines indicate mean CPUE from the past survey period: on the top row, the mean is calculated for sites combined, and on the bottom row, solid lines refer to the mean in LP and dashed lines to the mean in PI. **Note:** Only data from the months of July and August are included here since those are the only months that have been consistently sampled across the years.

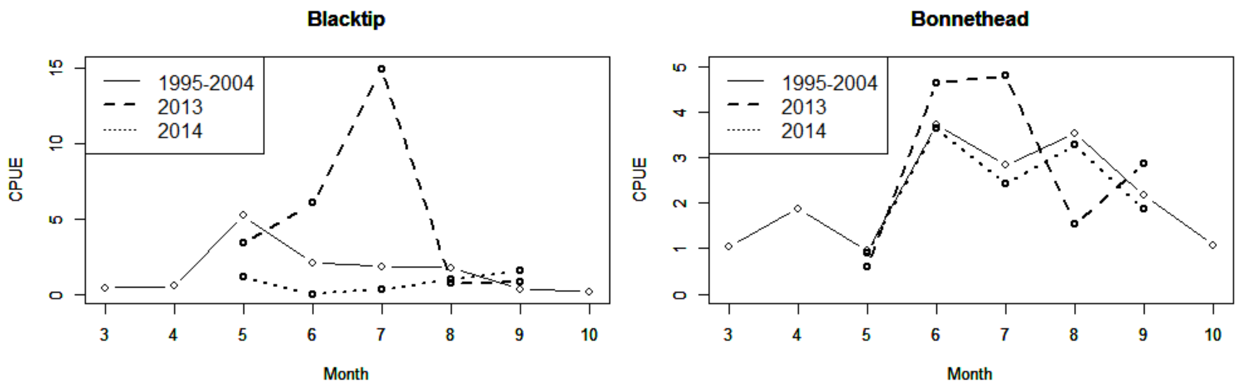

Figure 5: Monthly CPUE indices for blacktip sharks and bonnetheads, past surveys vs. 2013 and 2014.

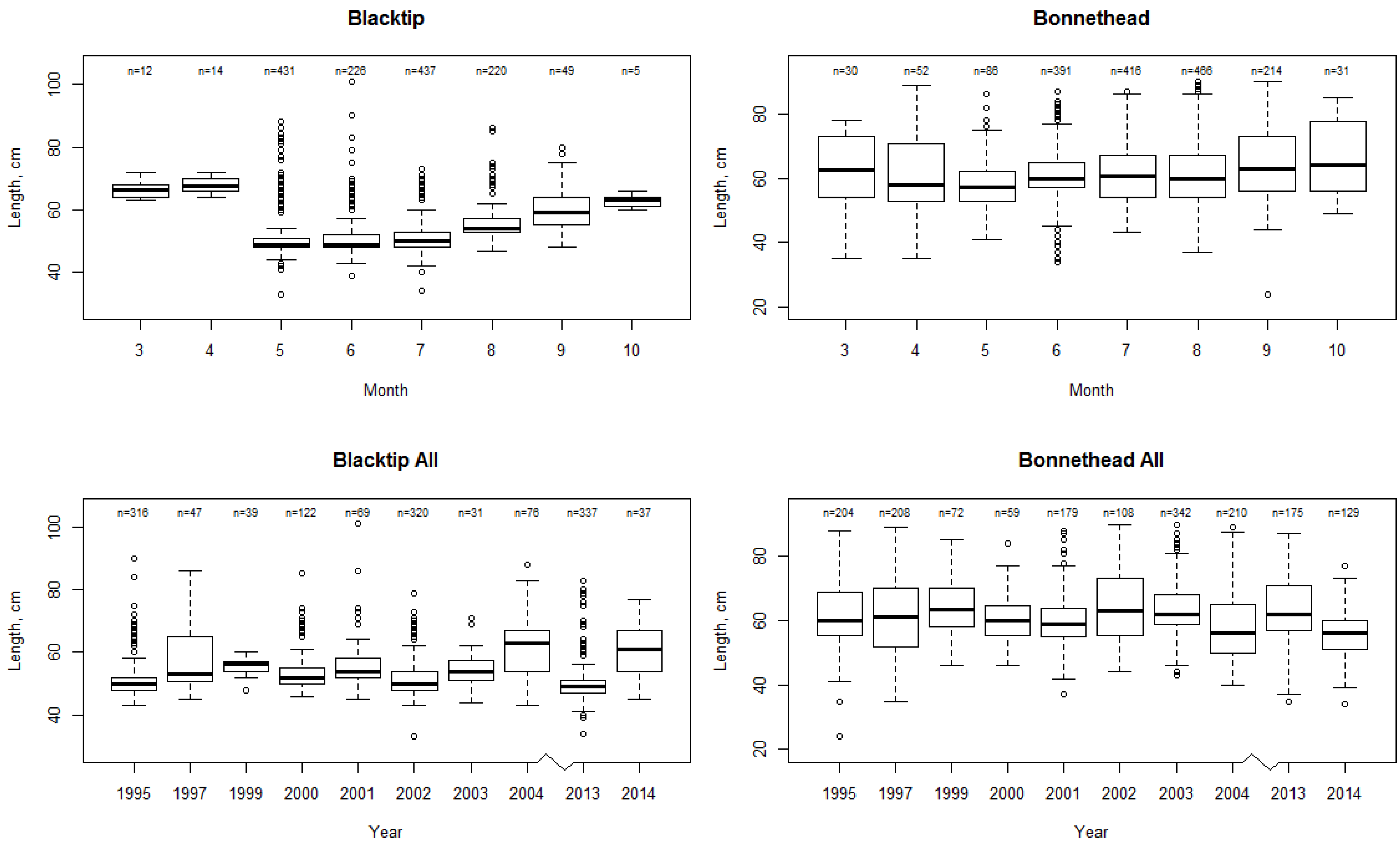

Figure 6: Monthly (years collapsed, top row) and yearly (bottom row) observed length composition (in fork length) of shark species across sites (only the 2 species with the highest overall catch are presented)

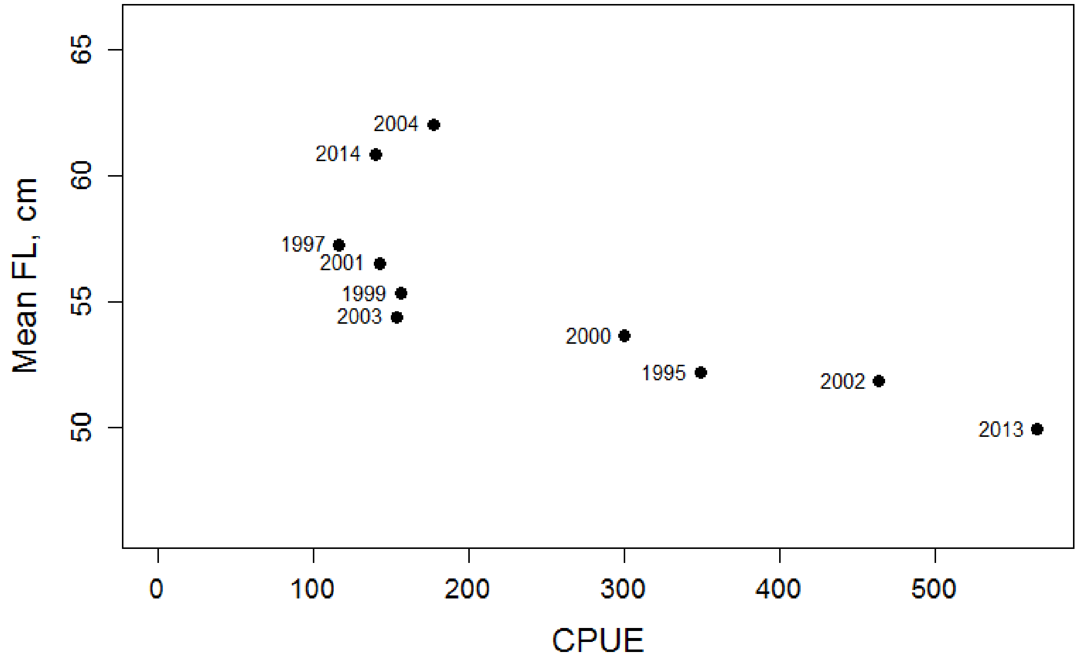

Figure 7: Blacktip shark mean length vs. CPUE. **Note:** Only data from the months of July and August are included here since those are the only months that have been consistently sampled across the years.

Non-shark catch

Non-shark catch comprised 42% of the 2014 catch in numbers, with a total of 17 species caught. Gafftopsail catfish (*Bagre marinus*) and ladyfish (*Elops saurus*) comprised a quarter each of the non-shark catch (Table 3). Pompano (*Trachinotus carolinus*), Atlantic thread herring (*Opisthonema oglinum*), hardhead catfish (*Arius felis*)and Spanish mackerel (*Scomberomorus maculatus*) together comprised another 30% of the non-shark catch (Table 3). Most non-shark catch was returned to the water alive (Table 4). However, like in 2013, yellowfin menhaden, ladyfish, and Spanish mackerel showed the highest rates of gillnet mortality (75-100%; Table 4).

All species commonly encountered in the past survey were caught in 2014, with the exception of cownose rays (*Rhinoptera bonasus*) (Table 3, Fig. 8). The only species that was caught in 2014 and had not been seen in the historical (1994-2004) survey was longnose gars (*Lepisosteus osseus*), which was also caught in 2013. This year's survey had moderate levels of diversity compared to other years of the survey (Fig. 8). Species composition differed across years, however, similarly to other years, gafftopsail catfish was close to the highest non-shark species caught in the 2014 survey (Fig. 8), with ladyfish being the highest. 1995 and 2014 are the only years where smooth butterfly rays (*Gymnura micrura*) were observed. The 2014 bluefish (*Pomatomus saltatrix*) catch and spotted seatrout (*Cynoscion nebulosus*) catch both represented 30% of this species' catch across all years of the survey.

CPUE data for the months of July and August combined (the only 2 months systematically sampled throughout the study years) are presented in Figure 9 and 10. All species show similar levels of variability in the CPUE data, expect for Spanish mackerel for which CPUE is fairly consistent (Fig. 9, 10). Pompano and menhaden both show similar trends in CPUE between LP and PI, whereas other species show more variability between sites, with PI generally showing higher catches and higher variability in catches (Fig. 10). For ladyfish, CPUE in the PI grid was much higher in 2014 compared with the mean CPUE observed of the course of the past surveys. The ladyfish CPUE in 2014 was comparable to CPUEs observed in 1999 and 2001. Pompano, Spanish mackerel, yellowfin menhaden, and gafftopsail catfish all showed similar CPUEs between sites in 2014, with CPUEs consistently lower than the overall mean CPUE across all years of the survey (Fig. 9, 10).

Several patterns emerged when comparing the monthly CPUE from the past survey with the 2013 monthly CPUE data (Fig. 11). The high 2014 CPUE associated with ladyfish is attributed to atypically high catches in August of that year. Spanish mackerel 2014 CPUE did display a peak in September, as had previously been observed (Fig. 11). Pompano 2014 monthly CPUE was lower than the historical averages observed in each month. Menhaden CPUE was similar to the historical data but much lower than 2013 July and September CPUEs. Gafftopsail catfish CPUE for May and June was comparable to historical data but lower in July, August and September (Fig. 11).

The length distribution of the top species (in abundance) caught for every year of the surveys is shown in Figure 12. Mean size ranged from 28.2-33.6cm for pompano, 31.6-39.6cm for ladyfish, 46.3-55.4cm for Spanish mackerel, 20.6-23.2 for yellowfin menhaden, 31.5-40.6cm for gafftopsail catfish and 50.5-71cm for cownose rays. The range of sizes observed for pompano and Spanish mackerel in 2014 fell above the legal size limit of 28 cm and 30.5 cm respectively (Fig. 12). Lengths for the top 6 species were also fairly consistent across months. A larger number of small gafftopsail catfish (<30cm FL) were observed in June compared with other months in the year (Fig. 13).

Table 3: List of non-shark species caught across the years. Species' % catch in the past survey and 2013 compared with 2014.

Common Name	Scientific Name	% total catch for 1994-2004	% total catch for 2013	% total catch for 2014
Batfish, Polka-dot	*Ogcocephalus radiatus*	0.04%	-	-
Bluefish	*Pomatomus saltatrix*	0.16%	0.15%	1.34%
Burrfish, Striped	*Chilomycterus schoepfi*	0.52%	0.46%	1.34%
Catfish, Gafftopsail	*Bagre marinus*	36.64%	28.92%	26.17%
Catfish, Hardhead	*Arius felis*	2.51%	5.69%	6.71%
Cobia	*Rachycentron canadum*	0.80%	-	-
Cowfish, Scrawled	*Lactophrys quadricornis*	0.16%	0.15%	-
Croaker, Atlantic	*Micropogonias undulatus*	-	0.15%	-
Filefish, Orange	*Aluterus schoepfi*	0.08%	-	-
Flounder, Gulf	*Paralichthys albigutta*	0.60%	-	-
Flounder, Ocellated	*Ancylopsetta quadrocellata*	0.16%	-	-
Gar, Longnose	*Lepisosteus osseus*	-	0.62%	0.67%
Guitarfish, Atlantic	*Rhinobatos lentiginosus*	0.08%	-	-
Harvestfish	*Peprilus alepidotus*	0.16%	5.38%	0.67%
Herring, Atlantic Thread	*Opisthonema oglinum*	3.07%	2.15%	9.40%
Jack, Crevalle	*Caranx hippos*	1.39%	4.00%	1.34%
Jenny, Silver	*Eucinostomus gula*	0.04%	-	-
Kingfish, Southern	*Menticirrhus americanus*	-	0.15%	-
Ladyfish	*Elops saurus*	10.03%	5.69%	25.50%
Leatherjacket	*Oligoplites saurus*	0.08%	-	-
Lizardfish, Inshore	*Synodus foetens*	0.08%	-	-
Lookdown	*Selene vomer*	0.16%	0.31%	-
Mackerel	*Scomberomorus sp.*	0.04%	-	-
Mackerel, Spanish	*Scomberomorus maculatus*	5.97%	1.85%	6.71%
Menhaden, Yellowfin	*Brevoortia smithi*	2.11%	6.00%	2.68%
Perch, Silver	*Bairdiella chrysoura*	0.04%	-	-
Permit	*Trachinotus falcatus*	1.12%	-	-
Pinfish	*Lagodon rhomboides*	0.48%	0.77%	2.01%
Pompano	*Trachinotus carolinus*	13.10%	12.15%	8.72%
Ray, Cownose	*Rhinoptera bonasus*	16.96%	21.69%	-
Ray, Smooth Butterfly	*Gymnura micrura*	0.04%	-	0.67%
Ray, Spotted Eagle	*Aetobatus narinari*	0.56%	0.31%	-
Seahorse	*Hippocampus spp.*	0.04%	-	-
Searobin	*Prionotus spp.*	0.04%	-	-
Seatrout, Sand	*Cynoscion arenarius*	0.56%	2.31%	-
Seatrout, Spotted	*Cynoscion nebulosus*	0.36%	-	2.01%
Sharksucker, Live	*Echeneis naucrates*	0.04%	-	-
Sharksucker, Whitefin	*Echeneis neucratoides*	0.04%	-	-
Spadefish	*Chaetodipterus faber*	0.32%	0.31%	3.36%
Spot	*Leiostomus xanthurus*	0.04%	-	-
Stingray, Atlantic	*Dasyatis sabina*	0.56%	-	0.67%
Stingray, Bluntnose	*Dasyatis say*	0.32%	-	-
Stingray, Roughtail	*Dasyatis centroura*	-	0.31%	-
Stingray, Southern	*Dasyatis americana*	0.24%	0.46%	-
Tripletail	*Lobotes surinamensis*	0.28%	-	-
	TOTAL	100%	100%	100%

Table 4: Total number of individuals caught in each site and across sites in 2014 and percent immediate, observable mortality.

Species		LP		PI		Sites combined	
Scientific name	**Common name**	**Total catch**	**%dead**	**Total catch**	**%dead**	**Total catch**	**%dead**
Bagre marinus	Catfish, Gafftopsail	15	20	24	12.5	39	15.4
Elops saurus	Ladyfish	2	100	36	80.6	38	81.6
Opisthonema oglinum	Herring, Atlantic Thread	1	0	13	23.1	14	21.4
Trachinotus carolinus	Pompano	6	0	7	0	13	0
Arius felis	Catfish, Hardhead	5	0	5	0	10	0
Scomberomorus maculatus	Mackerel, Spanish	6	100	4	100	10	100
Chaetodipterus faber	Spadefish	1	0	4	0	5	0
Brevoortia smithi	Menhaden, Yellowfin	0	0	4	75	4	75
Lagodon rhomboides	Pinfish	0	0	3	0	3	0
Cynoscion nebulosus	Seatrout, Spotted	1	0	2	50	3	33.3
Pomatomus saltatrix	Bluefish	1	0	1	0	2	0
Chilomycterus schoepfi	Burrfish, Striped	1	0	1	0	2	0
Caranx hippos	Jack, Crevalle	0	0	2	0	2	0
Lepisosteus osseus	Gar, Longnose	1	0	0	0	1	0
Peprilus alepidotus	Harvestfish	0	0	1	0	1	0
Gymnura micrura	Ray, Smooth Butterfly	0	0	1	0	1	0
Dasyatis sabina	Stingray, Atlantic	0	0	1	0	1	0
	TOTAL	**40**		**110**		**150**	

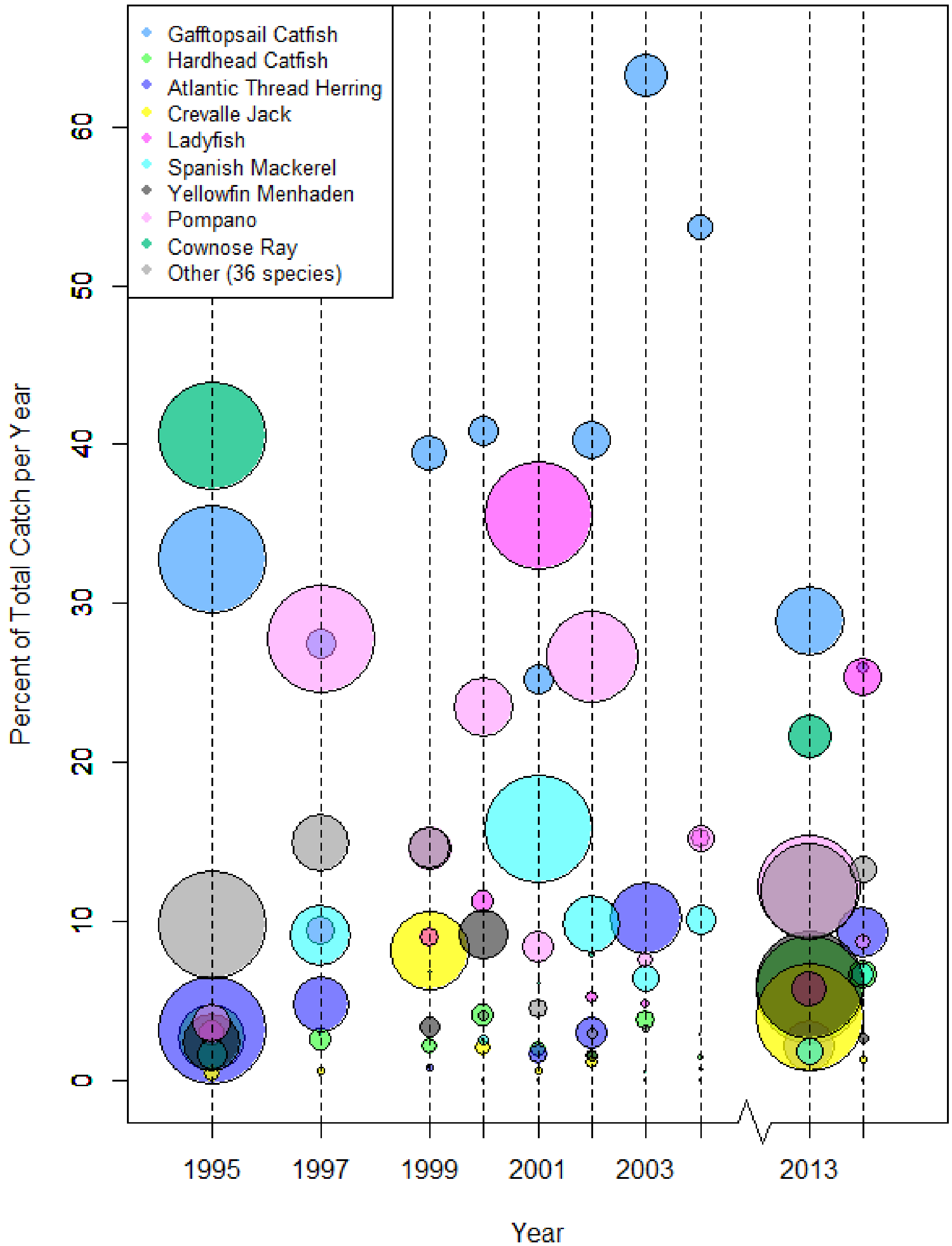

Figure 8: Non-shark catch composition observed each year. Relative size of the bubble represents the size of the catch relative to the total catch across all years of study for that particular species. "Other" category consists of all species with a total of less than 20 individuals caught throughout the entire survey (1995-2014).

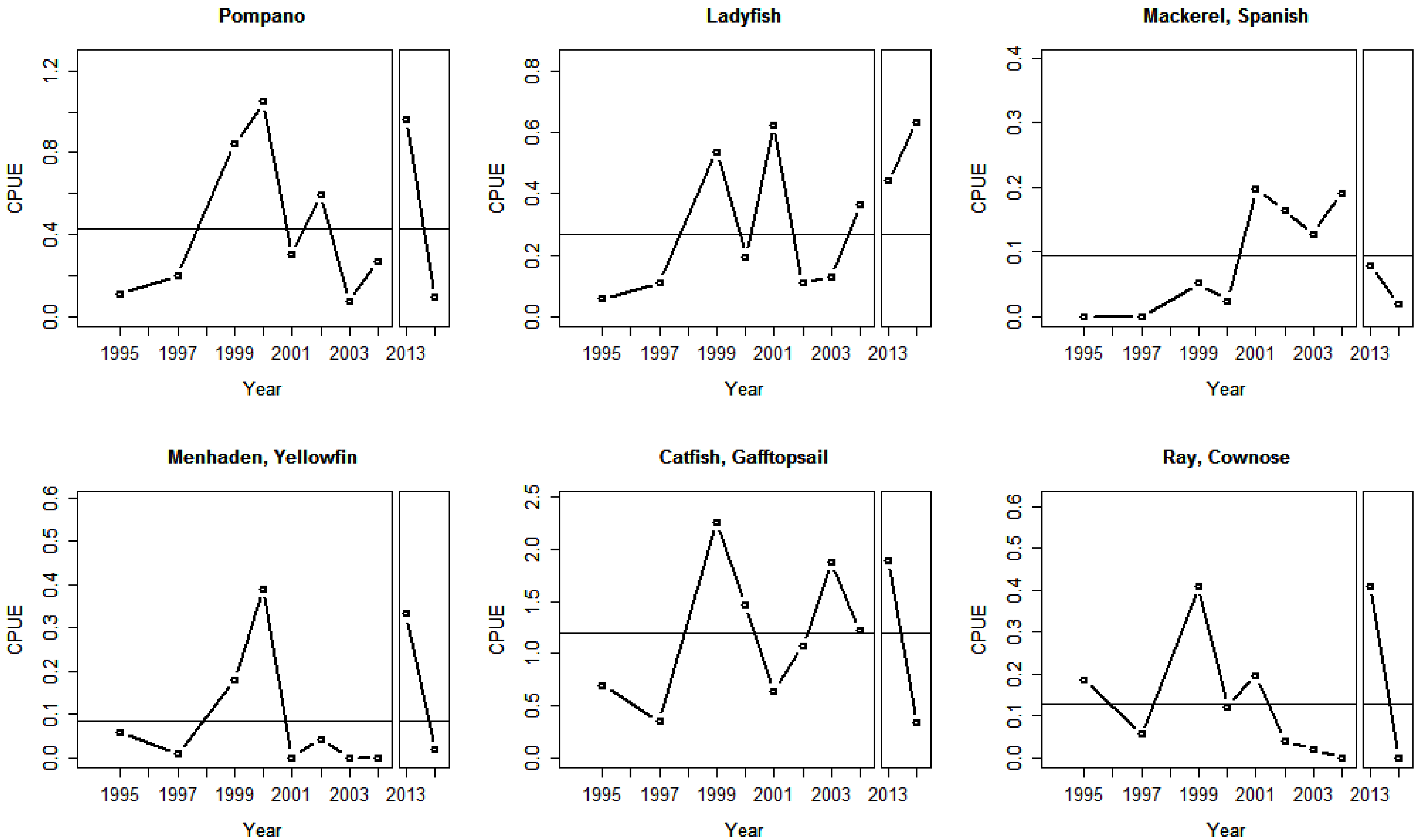

Figure 9: CPUE for the top 6 non-shark species caught per year in Charlotte Harbor. The horizontal reference line indicates mean CPUE from the past survey period. **Note:** Only data from the months of July and August are included here since those are the only months that have been consistently sampled across the years.

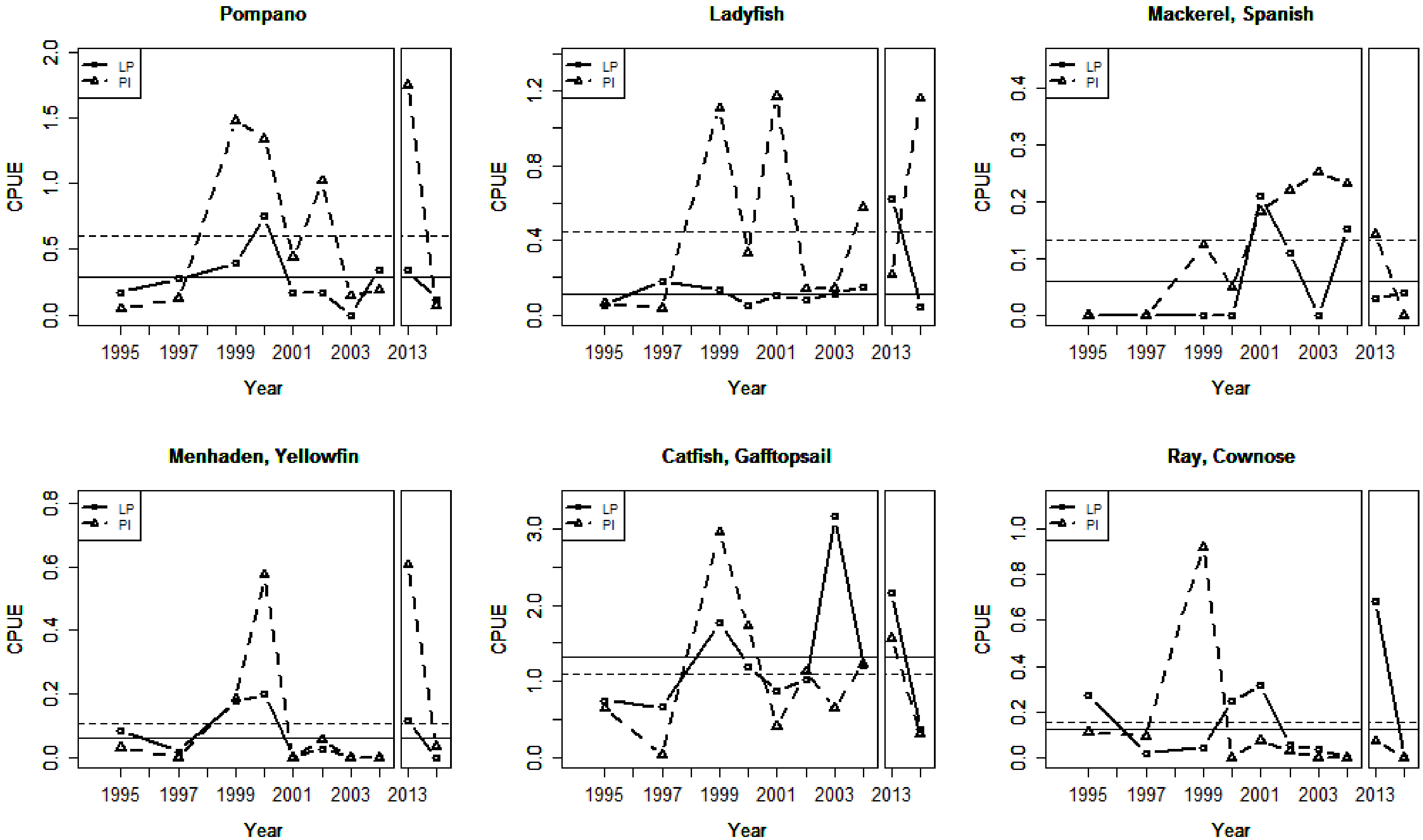

Figure 10: CPUE for the top 6 non-shark species caught per year in each grid. The horizontal reference lines indicate mean CPUE from the past survey period. Solid lines refer to the mean in LP and dashed lines to the mean in PI. **Note:** Only data from the months of July and August are included here since those are the only months that have been consistently sampled across the years.

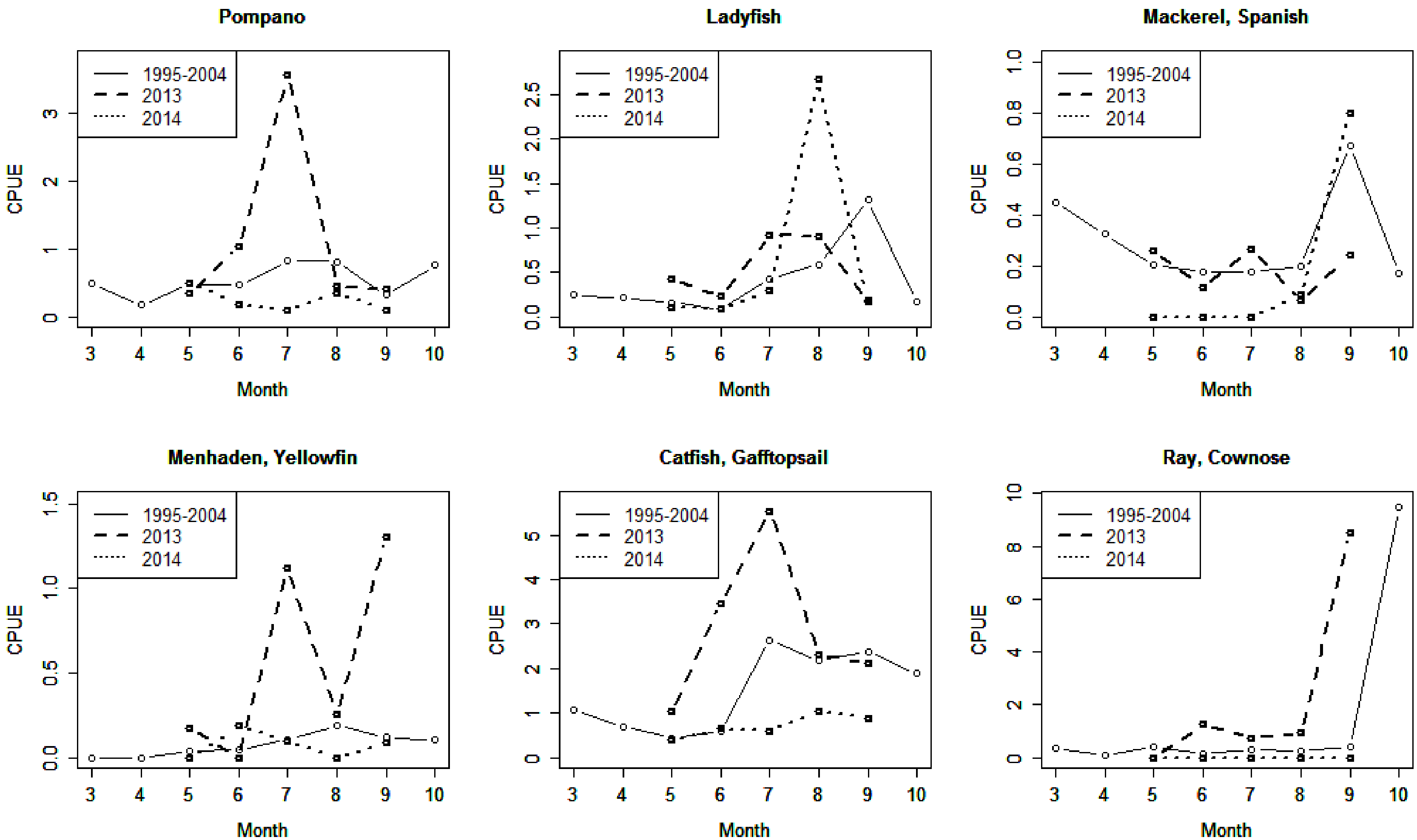

Figure 11: Monthly CPUE indices for the top 6 non-shark catch species caught, past survey vs. 2013 and 2014.

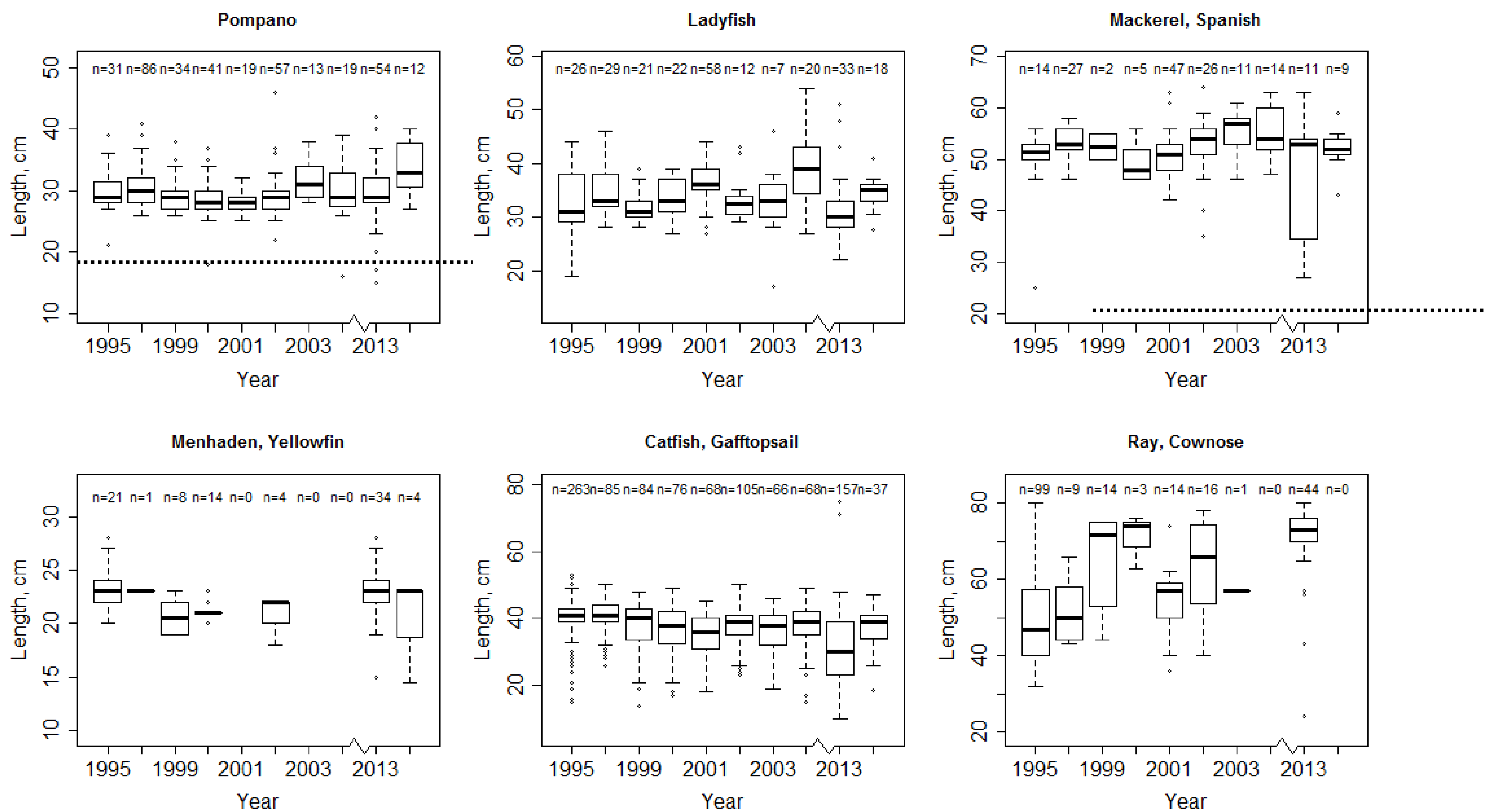

Figure 12: Observed length composition (in fork length) of non-shark species per year (only the 6 species with the highest overall catch are presented). Dotted lines represent legal size for landing the species in the state of Florida. **Note:** Sample sizes denoted by "n=" corresponds to the number of fish measured in that year. They differ from total catch since we only measure the first 10 animals of the same species in each set.

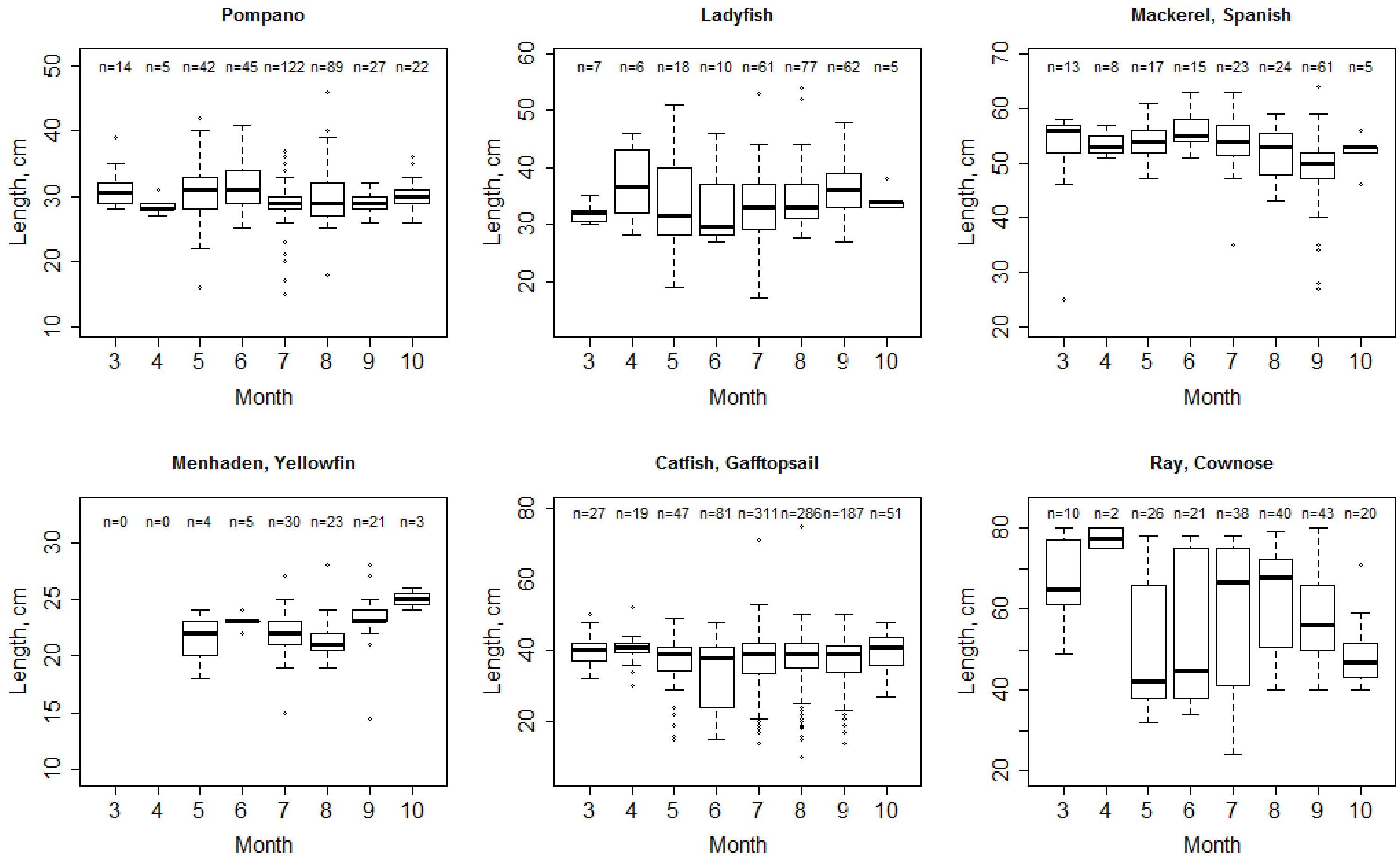

Figure 13: Observed length composition (in fork length) of non-shark species per month, all years combined (only the 6 species with the highest overall catch are presented). **Note:** Sample sizes denoted by "n=" corresponds to the number of fish measured in that month. They differ from total catch since we only measure the first 10 animals of the same species in each set.

2. *Multi-panel Net*

Sharks

2014 was the first year of fishing with the multi-panel net. A combined total of 40 sets were carried out in LP and PI from May through September. Half as many sharks were caught in the multi-panel (n=103) compared to the single panel net (n=209; Table 2, 5a). A total of 57 bonnetheads, 38 blacktip sharks, 4 Atlantic sharpnose sharks, 3 scalloped hammerheads and 1 blacknose shark were caught in the multi-panel net. About 50% of the total shark catch was caught in each site for the multi-panel net, where mesh size 4.0" and 4.5" had the top two highest catches (n= 27 and 23, respectively; Table 5a).

A total of 5 neonates, 12 YOYs,16 juveniles and 5 unknown life stage blacktip sharks were caught by the multi-panel net and each life stage was caught in each mesh size (Table 5b, 6a). The smallest mesh size, 3.0", caught the most blacktips sharks (n=12) which includes 3 neonates and 2 YOYs and mesh size 4.0" caught the second most of this shark species (n=8). The remaining mesh sizes caught a total of 4 or 5 blacktips sharks (Table 5b). PI had the highest CPUE for each life stage compared to LP for combined months and for combined life stages, PI had about six times greater CPUE than LP (1.97 and 0.33 sharks set-hr^{-1}, respectively; Table 6b). In June and September, the multi-panel net caught much higher numbers of blacktip sharks in PI than LP. The remaining months, May, July and August, had comparable CPUE values in both sites (Fig. 14). In addition, there was a wide range of blacktip sizes observed across months (42-102 cm), with the largest individual caught in the mesh size 5.0". Compared to the single panel net, the blacktip average lengths from the multi-panel net were higher in June, July and September (Fig. 6, 15).

In the multi-panel net, 4 YOY, 28 juvenile and 23 adult bonnethead sharks were caught, with only mesh size 4.0" catching the three life stages. All other mesh sizes, excluding 5.0" mesh, caught both juveniles and adults. Across all months sampled and combined life stages for bonnetheads, LP had a higher CPUE than PI (1.86 and 1.41 sharks set-hr^{-1}, respectively; Table 6a). In addition, the highest monthly CPUE was observed in August in LP (Fig. 14). The length distributions for bonnethead sharks were comparable across months (range: 38-74 cm) and comparable to the single panel data (Fig. 6, 15). The average length across all months in 2014 from the multi-panel net was 56.1 cm (n=57) and average length across all months from the past survey data from the single panel net was 62.1 cm (n=540).

Table 5a. Total number of sharks caught by mesh size in each site, LP and PI.

Mesh size (in)	LP	PI	Total
3	6	12	18
3.5	12	5	17
4	12	15	27
4.5	10	13	23
5	5	8	13
5.5	2	3	5
Total	**47**	**56**	**103**

Table 5b. Total number of blacktip sharks caught by mesh size in each site, LP and PI.

Mesh size (in)	LP	PI	Total
3	1	11	12
3.5	2	3	5
4	0	8	8
4.5	0	4	4
5	2	3	5
5.5	1	3	4
Total	**6**	**32**	**38**

Table 6a. CPUE (number of sharks set-hr^{-1}) for bonnetheads (*Sphyrna tiburo*) by life history stage and area sampled. Means (standard deviations) are presented.

Life Stage	PI	LP
Neonates	0	0
YOYs	0.12 (1.19)	0.11 (0.83)
Juveniles	0.49 (0.65)	1.09 (0.74)
Adults	0.74 (0.77)	0.6 (0.83)
Unknown	0.06 (0.79)	0.05 (0.83)
All	1.41 (0.76)	1.86 (0.79)

Table 6b. CPUE (number of sharks set-hr^{-1}) for blacktip sharks (*Carcharhinus limbatus*) by life history stage and area sampled. Means (standard deviations) are presented.

Life Stage	PI	LP
Neonates	0.25 (0.77)	0.05 (0.88)
YOYs	0.68 (1.13)	0.05 (0.9)
Juveniles	0.74 (1.22)	0.22 (0.94)
Adults	0	0
Unknown	0.31 (1.27)	0
All	1.97 (1.03)	0.33 (0.91)

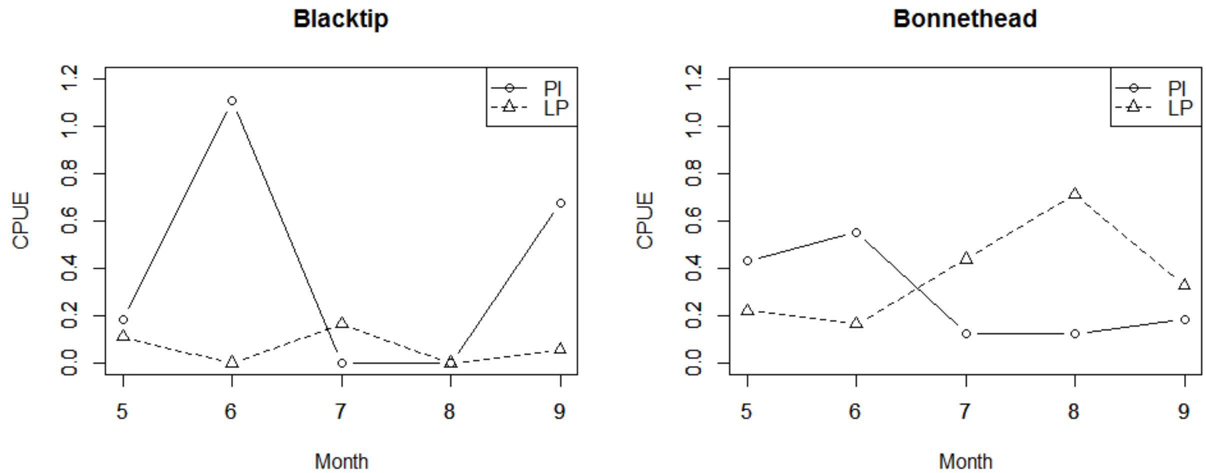

Figure 14. CPUE (shark set-hr-1) by month in 2014 for multi-panel net for blacktip and bonnethead sharks for each site.

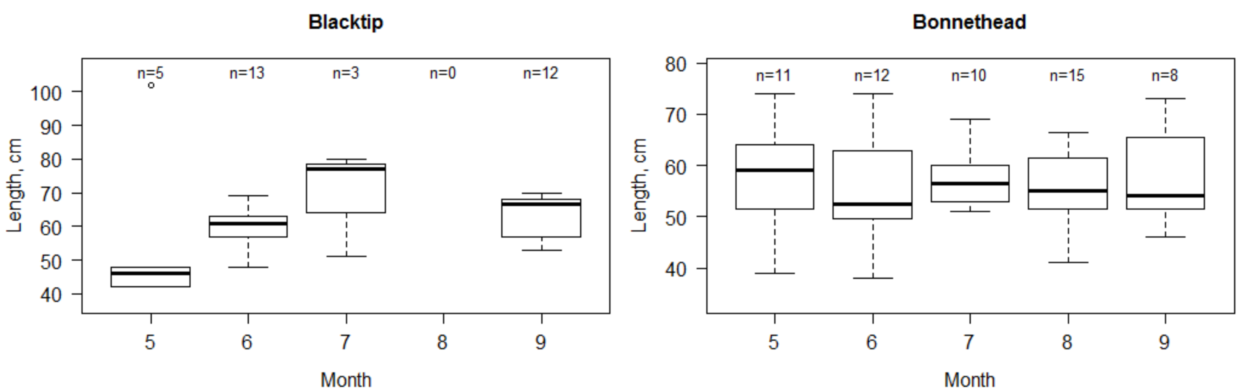

Figure 15: Observed length composition (in fork length) of blacktip and bonnethead sharks per month in the multi-panel net in 2014.

Non-shark catch

A total of 26 non-shark species were caught in the multi-panel net across all months and mesh sizes. A few new species were caught in the multi-panel net this year compared to all other Mote's single panel net surveys (Table 7). These species comprise yellowfin mojarra (*Gerres cinereus*), sand perch (*Diplectrum formosum*) and snapper (*Lutjanus spp.*). The scrawled filefish (*Aluterus scriptus*) was a species that was uniquely caught this year in both the multi-panel and single panel nets (Table 7). 75% of the total non-shark catch was caught in PI (246/ 330 individuals), whereas only 87 individuals were caught in LP (Table 8). However, both sites had almost the same number of species caught (LP=18 and PI=19 species).

A little over one-third of the total catch was yellowfin menhaden caught in PI, 83% of which was caught in mesh size 3.0" and 3.5" (Table 7). The second highest catch was the gafftopsail catfish comprising 21% of the total catch (Table 8). Gafttopsail catfish were caught in all mesh sizes, but the majority (81%) was similarly caught in the smaller mesh size of 3.0" and 3.5". In general, the 3.0" mesh size caught 58% (193/333) of the total catch, 3.5" mesh size caught 24% (79/333), 7.5% caught in 4.0" mesh size, 4.5% in 4.5" mesh size, 2% in 5.0" mesh size and 4% in 5.5" mesh (Table 7). Similarly the number of species caught also decreased by mesh size (Mesh size 3.0"=16 species, 3.5"=12, 4.0"=9, 4.5"=8, 5.0"=5, 5.5"=6).

The length distribution of yellowfin menhaden was similar across months, with monthly averages ranging from 23.1-24.6 cm (n=93; Fig. 16). Yellowfin menhaden CPUE was unusually high in June and September in PI (9.0 and 11.2 fish set-hr^{-1}, respectively) compared with LP, which exhibited considerably lower and fairly constant monthly CPUEs, ranging from 0 to 1.2 fish set-hr^{-1} (Fig. 17). Gafttopsail catfish length averaged over all months (29.9 cm) was slightly lower than the average lengths that have historically been observed in the single panel net (range: ~35-42cm; Fig. 12). That observation holds in 2014, where the average length of catfish caught in the multi-panel net was lower than that of catfish caught in the single panel net. In addition, the CPUE for gafttopsail catfish for each site was higher in the multi-panel net (LP: 1.2 fish set-hr^{-1}; PI: 1.6 fish set-hr^{-1}) than the single panel net (Fig. 17) in 2014, however, the CPUE for the multi-panel net fell within the typical CPUE range observed in past surveys (Fig. 10). Spanish mackerel, the third most abundant species caught in the multi-panel net, had average lengths ranging from 39 to 46 cm across the months sampled. The average length observed for this species in the multi-panel net (42.0 cm) was lower than the average length observed in the past survey (range: 42.4-55.4 cm, average= 50.0 cm) and the single panel net in 2014 (52.1 cm). Similar to what was observed in the single panel net, CPUE for Spanish mackerel was typically higher in PI than LP in each month of the survey. In addition, CPUE in PI and LP is higher in August than the rest of the months in the multi-panel net (2.3 and 0.8 fish set-hr^{-1}; Fig. 17), which is similar to past survey trends and the 2014 single panel net (Fig. 11). Lastly, in 2014, ladyfish caught by the multi-panel net exhibited similar length and CPUE trends as in the single panel net. More specifically, the large CPUE spike observed in PI in August was also observed in the multi-panel net (Fig. 17; Fig. 10).

Table 7: Total number of non-shark species caught by mesh size in each site, LP and PI. Stars indicate species that were not previously encountered in the survey.

Mesh Size (in)	Common Name	Scientific Name	LP	PI	Total
3.0			**40**	**153**	**193**
	Bluefish	*Pomatomus saltatrix*		2	2
	Catfish, Gafftopsail	*Bagre marinus*	15	27	42
	Catfish, Hardhead	*Arius felis*	4	1	5
	Cobia	*Rachycentron canadum*	1		1
	Croaker, Atlantic	*Micropogonias undulatus*		2	2
	Filefish, Scrawled	*Aluterus scriptus*	1		1
	Jack, Crevalle	*Caranx hippos*	2	12	14
	Ladyfish	*Elops saurus*	2	1	3
	Mackerel, Spanish	*Scomberomorus maculatus*	4	12	16
	Menhaden, Yellowfin	*Brevoortia smithi*	10	86	96
	*Mojarra, Yellowfin	*Gerres cinereus*		1	1
	*Perch, Sand	*Diplectrum formosum*		1	1
	Pinfish	*Lagodon rhomboides*		3	3
	Seatrout, Spotted	*Cynoscion nebulosus*	1	2	3
	*Snapper	*Lutjanus spp.*		3	3
3.5			**24**	**55**	**79**
	Bluefish	*Pomatomus saltatrix*		3	3
	Catfish, Gafftopsail	*Bagre marinus*	7	8	15
	Catfish, Hardhead	*Arius felis*	2	1	3
	Cowfish, Scrawled	*Lactophrys quadricornis*	1		1
	*Filefish, Scrawled	*Aluterus scriptus*	1	1	2
	Herring, Atlantic Thread	*Opisthonema oglinum*	1		1
	Jack, Crevalle	*Caranx hippos*		1	1
	Ladyfish	*Elops saurus*		1	1
	Mackerel, Spanish	*Scomberomorus maculatus*	4	7	11
	Menhaden, Yellowfin	*Brevoortia smithi*	8	31	39
	Pinfish	*Lagodon rhomboides*		1	1
	Pompano	*Trachinotus carolinus*		1	1
4.0			**12**	**13**	**25**
	Bluefish	*Pomatomus saltatrix*		1	1
	Catfish, Gafftopsail	*Bagre marinus*	6	2	8
	Catfish, Hardhead	*Arius felis*		1	1
	Harvestfish	*Peprilus alepidotus*	2		2
	Ladyfish	*Elops saurus*		2	2
	Mackerel, Spanish	*Scomberomorus maculatus*	2	2	4
	Menhaden, Yellowfin	*Brevoortia smithi*		4	4
	Pompano	*Trachinotus carolinus*	1	1	2
	Searobin	*Prionotus spp.*	1		1
4.5			**5**	**10**	**15**
	Burrfish, Striped	*Chilomycterus schoepfi*	1		1
	Catfish, Gafftopsail	*Bagre marinus*	1	2	3
	Filefish, Planehead	*Stephanolepis hispidus*		1	1
	Gar, Longnose	*Lepisosteus osseus*	1		1
	Ladyfish	*Elops saurus*		3	3
	Mackerel, Spanish	*Scomberomorus maculatus*	1		1
	Menhaden, Yellowfin	*Brevoortia smithi*		1	1
	Pompano	*Trachinotus carolinus*	1	3	4
5			**3**	**5**	**8**
	Catfish, Gafftopsail	*Bagre marinus*	1		1
	Ladyfish	*Elops saurus*		3	3
	Menhaden, Yellowfin	*Brevoortia smithi*		1	1

	Ray, Spotted Eagle	*Aetobatus narinari*	1		1
	Stingray, Atlantic	*Dasyatis sabina*	1	1	2
5.5			**3**	**10**	**13**
	Catfish, Gafftopsail	*Bagre marinus*		1	1
	Cowfish, Scrawled	*Lactophrys quadricornis*	2		2
	Herring, Atlantic Thread	*Opisthonema oglinum*		2	2
	Jack, Crevalle	*Caranx hippos*		1	1
	Ladyfish	*Elops saurus*	1	5	6
	Pompano	*Trachinotus carolinus*		1	1
	Total		**87**	**246**	**333**

Table 8: Total number of individuals caught in each site and across sites in 2014 and percent immediate, observable mortality.

Species		**LP**		**PI**		**Sites combined**	
Scientific name	**Common name**	**Total catch**	**%dead**	**Total catch**	**%dead**	**Total catch**	**%dead**
Pomatomus saltatrix	Bluefish	0	0	6	100	6	100
Chilomycterus schoepfi	Burrfish, Striped	1	0	0	0	1	0
Bagre marinus	Catfish, Gafftopsail	30	33.3	40	25	70	28.6
Arius felis	Catfish, Hardhead	6	0	3	33.3	9	11.1
Rachycentron canadum	Cobia	1	100	0	0	1	100
Lactophrys quadricornis	Cowfish, Scrawled	3	0	0	0	3	0
Micropogonias undulatus	Croaker, Atlantic	0	0	2	0	2	0
Stephanolepis hispidus	Filefish, Planehead	0	0	1	0	1	0
Aluterus scriptus	Filefish, Scrawled	2	0	1	0	3	0
Lepisosteus osseus	Gar, Longnose	1	0	0	0	1	0
Peprilus alepidotus	Harvestfish	2	50	0	0	2	50
Opisthonema oglinum	Herring, Atlantic Thread	1	100	2	100	3	100
Caranx hippos	Jack, Crevalle	2	0	14	14.3	16	12.5
Elops saurus	Ladyfish	3	100	15	86.7	18	88.9
Scomberomorus maculatus	Mackerel, Spanish	11	100	21	81	32	87.5
Brevoortia smithi	Menhaden, Yellowfin	18	38.9	123	26	141	27.7
Gerres cinereus	Mojarra, Yellowfin	0	0	1	0	1	0
Diplectrum formosum	Perch, Sand	0	0	1	0	1	0
Lagodon rhomboides	Pinfish	0	0	4	0	4	0
Trachinotus carolinus	Pompano	2	0	6	16.7	8	12.5
Aetobatus narinari	Ray, Spotted Eagle	1	0	0	0	1	0
Prionotus spp.	Searobin	1	0	0	0	1	0
Cynoscion nebulosus	Seatrout, Spotted	1	100	2	50	3	66.7
Lutjanus spp.	Snapper	0	0	3	33.3	3	33.3
Dasyatis sabina	Stingray, Atlantic	1	0	1	0	2	0
	TOTAL	**87**		**246**		**333**	

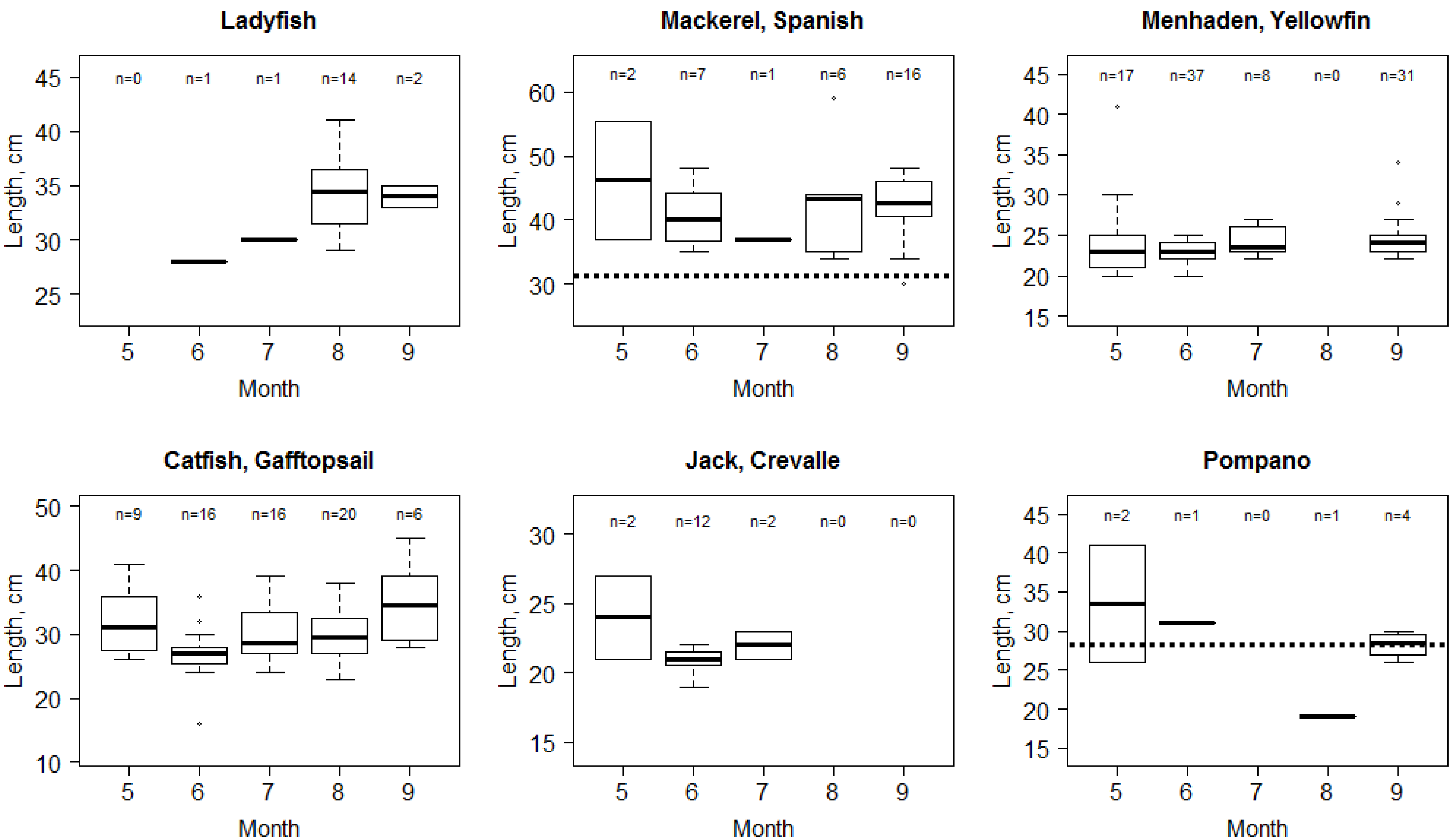

Figure 16: Observed length composition (in fork length) of non-shark species per month in the multi-panel net (only the 6 species with the highest overall catch are presented). Dotted lines represent legal size for landing the species in the state of Florida. **Note:** Sample sizes denoted by "n=" corresponds to the number of fish measured in that month. They differ from total catch since we only measure the first 10 animals of the same species in each set.

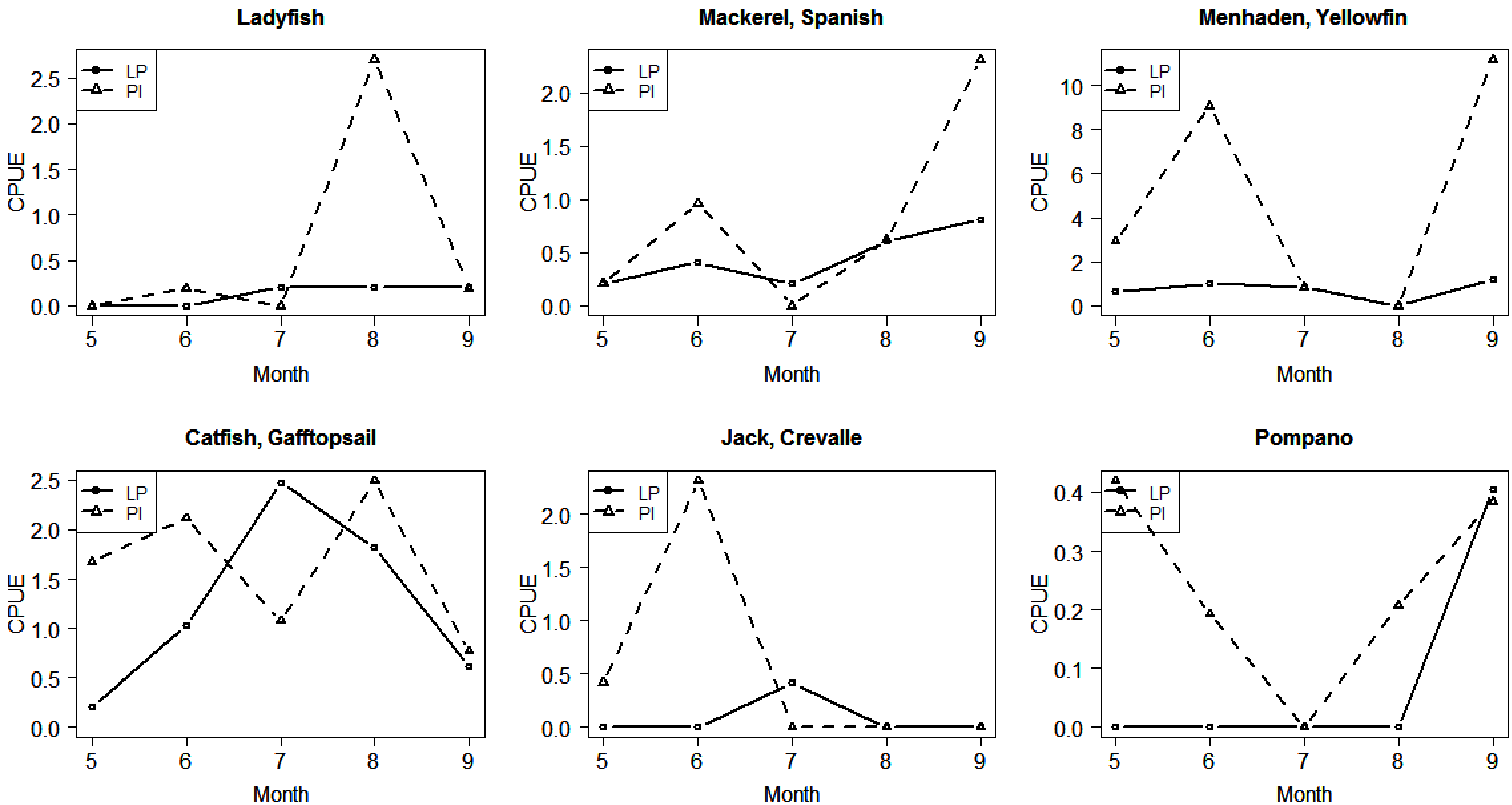

Figure 17: CPUE (fish set-hr^{-1}) by month in 2014 for multi-panel net for the 6 species with the highest overall catch.

Discussion and Conclusion

In contrast to 2013's unusually high catches of blacktip sharks, 2014's catches remained low from May through August. CPUE values were on the lower end of those observed in the past survey (1994-2004) and the size distribution of blacktips was on the higher end, with few neonates captured. There are two likely explanations for the differences observed: 1) 2014 had a less successful recruitment year than 2013; and/or 2) environmental conditions affected the distribution and abundance of individuals in the sound.

To address the first point, since blacktip sharks are known to have a biennial ovarian cycle with a 11-12 month gestation period followed by a year-long "resting" period (Baremore and Passerotti 2013, Castro 1996), it may be that the group of mature, gravid females associated with last year's pupping event was larger than that associated with this year's pupping event. This would cause changes in neonate and YOY abundance from year to year. This pattern of high and low recruitment years has also been observed in the past where odd years (1997, 1999, 2001 and 2003) show relatively high CPUE and low mean sizes, whereas even years (2000 and 2002) show low CPUE and high mean sizes.

For the second point above, we noted in last year's report that 2013 was characterized by record summer rainfalls and increased flood gate openings, which together greatly lowered salinity in the area and led to a notable decrease in water quality caused by sediment resuspension. In contrast, 2014 had average or slightly below average monthly rainfall and warmer than average temperatures (Weather Warehouse 2015) and we did not observe any signs of decreased water quality in the area. Water temperature and salinity, despite being within reasonable range, were relatively high compared to the past survey, and August showed record mean water temperatures in both LP and PI. In 2013, local aggregations inflating the catch rates were likely to be, in part, a result of sharks seeking out higher salinity areas. Similarly, a dip in CPUE was also observed for blacktips in August 2014 when water temperature and salinity were particularly high. Although juvenile blacktip sharks are known to tolerate a wide range of salinities and temperatures (Hueter and Tyminski 2007), they have also been shown to prefer moderate temperatures and salinities (Froeschke *et al.* 2010). The decrease in CPUE we observed may therefore have been due to blacktip sharks moving away from our sampling area to more favorable conditions in adjacent waters.

Bycatch species also appeared to be affected by the high temperatures. Yellowfin menhaden were virtually absent from August sets in both the single and multi-panel net but reappeared in September when water temperatures dropped back down. In contrast, these high temperatures were associated with high catches for ladyfish and gafftopsail catfish, indicating these species may tolerate and/or prefer higher temperatures than menhaden. Overall, pompano, Spanish mackerel, yellowfin menhaden, and gafftopsail catfish all showed similar CPUEs between sites this year, with CPUEs consistently lower than the overall mean CPUE across all years of the survey

Bonnetheads were the dominant shark catch (63%), which was comparable to 1997, 1999, 2001 and 2004. The bonnethead CPUE seasonal pattern observed in 2014 is similar to that observed in the past survey and includes a decrease in July. Additionally, CPUE for bonnetheads was higher in LP than PI. We speculate that the habitat and substrate type may influence the local abundance for bonnetheads; for example, seagrass beds are more common in LP than PI and may be a more suitable habitat for this shark species. Bonnethead CPUE was fairly consistent across months and seemed unaffected by the high temperatures and salinities experienced in 2014. Their heightened tolerance to changes in environmental conditions compared with blacktip sharks was also observed in 2013. This can likely be explained, in part, by the fact that blacktip sharks targeted by the gear are largely immature individuals, while the bonnetheads caught by this gear are mostly mature individuals. Surprisingly, the third highest shark catch in 2014 was scalloped hammerheads, which surpassed the past third most abundant shark, Atlantic sharpnose shark, caught over all years. It appears that two other years, 1997 and 2013, were the two other main contributors to the total scalloped hammerhead catch.

The goal of fishing with the multi-panel net was two-fold: 1) obtain a conversion factor so Mote's data can be compared with the GULFSPAN data and included in the blacktip shark stock assessment; and 2) estimate the seasonal growth pattern of blacktip sharks. We caught sharks in every mesh size, with the highest catches occurring in the intermediate sized mesh (4.0"-4.5"). Yet, only 103 sharks were caught by the multi-panel net, with 5 to 27 sharks caught in each panel. In particular, only 4 to 12 blacktip sharks were caught in each panel. Due to this low sample size, selectivity for each mesh size of the multi-panel net could not be calculated. In 2013, we showed through an analysis of past and present survey data that we could obtain a good representation of the seasonal growth of juvenile blacktip sharks through August but after that it appeared the fish might be outgrowing the survey gear; this year we hoped to resolve that issue by using multiple mesh sizes but we caught too few blacktips. We will need additional years of data to get a representative sample of blacktip shark sizes and catches in each panel from which to calculate a conversion factor and define the seasonal growth of blacktip sharks.

The multi-panel net allowed for new species to be caught, including yellowfin mojarra, sand perch, and snapper. The scrawled filefish was another species that was uniquely caught this year, but it was also caught in the single-panel net. The additional mesh sizes also allowed us to catch a wider range of sizes for the species commonly caught in the survey, such as yellowfin menhaden, gafftopsail catfish and Spanish mackerel. For bycatch species, the highest catches occurred in the lower mesh sizes, which is not surprising since the area is a nursery ground for a large number of species.

In conclusion, 2014 was a low productive year for sharks and other fish species alike compared to both 2013 survey and the past surveys (1995-2004), but Charlotte Harbor continued to provide habitat for blacktip sharks and bonnetheads as well as many other local, coastal species of fishes. We attempted to obtain a gear selectivity conversion factor between the single panel and multi-panel mesh that would allow us to directly compare our relative abundance data with the northern Gulf of Mexico data within and across years. Unfortunately, more data will be needed to resolve this issue. Similarly, because few blacktip sharks were caught in 2014 compared to total combined number, the lengths collected this year did not add any new information to the overall length frequencies shared in the 2013 report. With additional data, our survey could serve as an additional source of fisheries-independent data to inform the stock assessment for blacktip sharks, which remains the most important shark species in the Florida recreational fishery and the second-most important species (after the sandbar shark *C. plumbeus*) in the Florida commercial shark fishery. For the non-shark catch, the multi-panel net was able to catch a wider range of sizes and species than the single panel net had in the past. These new data will be of value for monitoring trends in abundance of non-shark species in the eastern Gulf of Mexico.

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