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Survey of Recreational Blue Crabbing in the New York Marine & Coastal District

2016

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Abstract

Blue crab are important benthic predators and valuable prey to a wide diversity of species. The impacts of climate change are projected to benefit the survival and productivity of blue crab in the New York Marine & Coastal District. Although it has been shown that the recreational blue crab fishery is a major fishery sector in NY, a summary of effort, gear use, catch per unit effort (CPUE), and blue crab biological information has not existed for this fishery since 1985 (Briggs 1985). The goal of this survey is to monitor effort, CPUE, and blue crab biological information on an annual basis within the recreational blue crab fishery. This information is essential to creating a comprehensive estimate of the blue crab population so that New York's blue crab resource can be properly assessed and managed. 2016 was the pilot year for this survey and consisted primarily of an on-site intercept survey at public access sites throughout the Great South Bay. A digital logbook was also created to collect additional information from recreational crabbers both inside and outside the geographic limits, which may not be captured solely by the on-site intercept survey.

Introduction

Blue crabs (*Callinectes sapidus*) are an important member of the marine ecosystem. As predators, they play a vital role in regulating essential fish habitat (e.g. benthic and saltmarsh communities), and as a prey species they act as a food source to a wide diversity of ecologically and economically valuable organisms (Baird and Ulanowicz, 1989; Hines 2007). Historically, the New York Marine & Coastal District (NYMCD) (Fig. 1) has been near the northern limit of the blue crab's range. There is strong evidence to suggest that the impacts of climate change will start to lift the physiological constraints placed on blue crabs, resulting in increased winter survival, productivity, and northward range expansions of their populations (Hines and Johnson, 2010; Johnson, 2015; Hare et al., 2016). To effectively manage this species, the impacts that climate change will have on New York's blue crab fisheries will need to be quantified as these changes present themselves.

The recreational blue crab fishery is a relatively data poor fishery in the NYMCD. The National Oceanographic and Atmospheric Administration's (NOAA) Marine Recreational Information Program (MRIP) collects information about recreational fisheries in New York (NY), but does not collect data on the recreational blue crab fishery. Fisheries dependent data on the NY recreational blue crab fishery was briefly investigated by the

New York State Department of Environmental Conservation (NYSDEC) from 1981 – 1983 (Briggs 1985). This study helped to provide a snapshot of effort, gear, and landings of the recreational fishery, and helped to identify the recreational blue crab fishery as a major fishery sector (Briggs 1985). In 2016, The Survey of Recreational Blue Crabbing in the NYMCD was initiated to once again collect information on this fishery. This survey will be conducted on an annual basis and will be used to characterize harvest and monitor for changes in catch and effort within the recreational blue crab fishery. The information obtained from this survey will be used to develop a comprehensive estimate of the blue crab population so that the status of New York's blue crab resource can be properly assessed and managed.

Methods

For 2016, the Survey of Recreational Blue Crabbing in the NYMCD was composed primarily of an on-site intercept survey. The Great South Bay (GSB) estuary was chosen for the intercept survey. This estuary has a large geographic area, numerous public access fishing sites, and its shores have been known to attract large numbers of recreational crabbers (Briggs 1998). Thirty sampling stations within the estuary were chosen based on NOAA's MRIP sampling station list and NYSDEC staff knowledge of popular crabbing areas (Fig. 2). The intercept survey was conducted each month from June through October. The GSB estuary was divided into three zones (west, central, and east) containing ten stations each. Five stations within each of these zones were randomly selected and visited once a month. Microsoft Excel was used to randomly select the day, start time (9AM or 12PM), station, and order of stations that would be visited each month. This ensured that 15 of the 30 sampling sites would be randomly selected and visited once a month in a logistically appropriate manner. During a station visit, NYSDEC staff approached all recreational crabbers actively crabbing at the site and asked if they would be willing to participate in the intercept survey. Information including start time, estimated finish time, gear type and quantity, and number of blue crab harvested and released were collected during the interview. NYSDEC staff also asked permission to collect data on sex, maturity, and carapace width (CW) of the blue crabs which were being harvested. To minimize observation error, CW was measured by flipping the crab onto its back on top of the measuring board, and measuring from the tip of one lateral spine to the tip of the other lateral spine to the nearest millimeter. Air temperature, water temperature, salinity, and dissolved oxygen were also recorded with a handheld thermometer and YSI Model 85

handheld oxygen, conductivity, salinity, and temperature system at each station visited.

Data Analysis and Results

Effort

Seventy five station visits were conducted during the months of June through October 2016. NYSDEC staff completed a total of 81 separate interviews during the 75 station visits. The number of successful interviews completed was tallied for the year, each month and for each station then divided by the number of site visits. This resulted in an average of 1.1 completed interviews per site visit for 2016. Completed interviews per site visit were minimal in June, peaked in July, and then gradually decreased throughout the remainder of the season (Fig. 3). The stations with the most interviews per site visit were Captree Fishing Pier (North) (n = 4.6), followed by Town of Babylon Municipal Dock (n = 3.3), and Captree Fishing Pier (South) (n = 2.7) (Fig. 3).

Gear

The recreational crabbers interviewed deployed a wide variety of gear combinations to obtain their catch. The various gear types that recreational crabbers used were separated out into gear combination bins. The popularity of each gear combination, the average number of individual gears used within each gear combination, and the Catch per Unit Effort (CPUE) for each gear combination was determined. The most popular gear choice was a hand line + dip net combination which was found to be used by 38% of the crabbers interviewed. Other popular gears included the use of collapsible traps only, which was found to be used by 26% of crabbers interviewed, and a combination of hand line + dip net + collapsible trap, which was found to be used by 11% of crabbers interviewed. Seven percent of crabbers also used ring nets only (Fig. 4). The average number of each specific gear fished by crabbers was 3 hand lines, 1 dip net, 2 - 3 collapsible traps, and 4 ring nets (Fig. 5). For 2016, ring nets were found to be the gear with the highest CPUE (4.3 crabs/hour), followed by the hand line + dip net + collapsible trap combination (3.2 crabs/hour), and the hand line + dip net combination (2.9 crabs/hour) (Fig. 6).

Size, Sex, and Maturity

For the 2016 season, recreational crabbers allowed NYSDEC staff to collect size, sex, and maturity data on 94% of the blue crabs that were harvested. In total, 302 blue crabs were sampled. Seventy eight percent of the crabs sampled were found to be legal size (≥ 4.5” or 114 mm). CW frequencies were plotted for all crabs harvested (Figs. 7 - 11). To avoid skewing CW and CPUE analysis, the data

from this survey was queried to exclude those crabs sampled with a CW less than 4.5”/114 mm (i.e. illegal harvest). The mean, median, mode, and max CW for legal sized immature female, male and mature female crabs was calculated for 2016 (table 1). And, the average CW per month for immature female, male, and mature female crabs was plotted (Fig. 12). The mean CW of legally harvested male blue crabs for 2016 was 4.95” (126 mm). Male average CW was largest in the month of October. On average, male crabs harvested in October had a CW of 5.01” (128 mm). The mean CW of mature female blue crabs for 2016 was 5.4” (137 mm). The average CW of mature females was largest in August. On average, mature female crabs harvested in August had a carapace width of 5.6” (141 mm). Harvest of legal sized immature females was found to occur mostly in July. The mean CW of immature females caught in July was 4.6” (118 mm).

Catch per unit Effort

The average CPUE or crabs harvested per hour (crab per hour) was calculated for the year, each month, and each station. For 2016, the average CPUE for all interviews combined was 2.5 crabs per hour. The two crabbers interviewed in June did not harvest any blue crab therefore CPUE was zero for this month. Average CPUE for all stations combined rose to 1.9 crab per hour in July, and then peaked in August at 3.9 crab per hour. Average CPUE declined in September to 2.4 crab per hour, then increased to 2.8 crab per hour in October (Fig. 13). For 2016, Heckscher State Park, Town of Islip Great River Dock, and Town of Babylon Municipal Dock had the highest average CPUE with 4.5, 4.1, and 3.9 crab per hour, respectively (Fig. 14).

The average number of crabs caught and released (not harvested) per hour was calculated for the year and each month. For 2016, the average number of crabs caught and released per hour was 5.5 crabs per hour for all interviews combined. Crabs caught and released showed a similar monthly trend to those harvested, peaking in August at 8.3 crabs per hour, and then dropping quickly in September and October to 4.2 and 1.7 crabs per hour respectively. To help identify trends in life history and migration patterns, egg bearing females caught and released per hour, a subset of the total crabs caught and released, was also calculated for each month. The number of egg bearing female blue crabs caught and released peaked in July and August at 1.1 and 0.7 crabs per hour respectively (Fig. 15). The release of egg bearing females was mostly reported at high salinity stations (e.g. Captree Fishing Piers) (Fig. 18).

The percent of total crabs harvested (crabs harvested / (harvested + released)) was calculated to observe monthly trends in

percent of total catch in which crabs were harvested. The percent of total catch in which crabs were harvested rose slowly each month to 36% in September, and peaked at 63% in October. October was the only month in which recreational crabbers were able to harvest more crabs than they released (i.e. > 50%) (Fig. 16).

Catch Composition

The catch composition (sex and maturity) for legal sized crab at each station and for each month was mapped to help identify geographic trends in life stages and migration patterns. Catch composition shows that in July the north shore of the bay held mostly males (n= 52) mixed with some legal sized immature females (n= 4) and few mature females (n= 2). The areas of high salinity (≥ 30 ppt) (Fig. 17) were composed mostly of mature females (n= 18) mixed with some males (n = 8). Mature females were the primary composition of catch in these high salinity areas for all months of sampling. In August, mature females became present in the catch of the north shore of the bay (n= 23), with one legal sized immature female caught as well. Males were caught at most stations throughout the bay (n= 42), but more so on the north shore (n= 34). Mature females were still caught on the north shore of the bay in September (n= 7), but it seems that males started to dominate the catch composition in this area at this time (n= 27). One legal sized immature female was caught on the north shore of the bay in September. In October, catch on the north shore of the bay was composed only of males (n= 20) and the high salinity areas were composed of mostly mature females (n= 8) (Fig. 18).

Physical Sampling

The results of physical sampling showed favorable dissolved oxygen readings for most stations throughout the sampling season with some marginal readings in the month of August (Fig. 19). For the 2016 sampling season, the average air temperature for all site visits was 78°F (25.6°C) and the average water temperature for all site visits was 74°F (23.3°C). Monthly air and water temperatures were both the warmest in July and August and showed the greatest declines between September and October (Fig. 20).

Discussion

Effort

The total number of interviews completed per month divided by the number of station visits provides an index of effort for the on-site intercept survey. A trend that shows an increase in intercepts per site visit would suggest that recreational crabbers are putting more effort into crabbing. The number of interviews conducted per site visit will be

monitored each year to gauge if recreational effort responds to changes blue crab abundance. Recreational blue crabbing is known as a summertime activity in the NYMCD. The peak in number of interviews per site visit in the month of July may be attributed to recreational crabbers responding to the change from spring to summertime climate. Captree State Park and Town of Babylon Municipal Dock both saw high numbers of interviews per site visit. The two sites also both had repeat interviews with the same individuals from month to month. High numbers of interviews at these sites might suggest a historically productive area for recreational blue crabbing.

Gear

The hand line + dip net gear combination were the most popular gears used. This might be because these are relatively cheap and simple gears to use. Crabbers would tie one end of a length of line to a raw chicken drumstick or Atlantic menhaden chunk and the other end of the line to the dock. Once a crab attached to the bait, they slowly pulled the line in until they could scoop up their catch with a dip net. The hand line + dip net gear combination had increased in use since the 1981 – 1983 study. During the previous survey, Briggs found collapsible traps to be the most popular gear type used by recreational crabbers of the GSB (93 – 96%) followed by the hand line + dip net combination (14 – 21%) (Briggs 1985). The opposite was true for 2016. Dip nets, collapsible traps, and ring nets are commonly sold at local bait and tackle shops and other outdoor retail shops around Long Island. Ease of access to these gear types may contribute to occurrences of use. The number of each gear type used can likely be attributed to the space available on the dock to deploy these gears and amount of effort the crabber is willing to take to tend the gear. Ring nets were found to only be used at stations with strong tidal currents (e.g. Captree Fishing Piers). A lead sinker would be tied in the middle of the ring net next to the bait to keep the net close to the bottom in strong currents. It is hard to tell if ring nets are more effective than other gears because they were only observed being used at Captree State Park. The high CPUE the rings nets exhibited may or may not be attributed to the site itself. It is logical that the hand line + dip net combination had a higher CPUE with the addition of a collapsible trap because of the increase number of gear types being fished.

Size, Sex, and Maturity

With few exceptions, recreational crabbers were receptive to NYSDEC staff during the interviews, and requests to sample their catch. Subsamples of harvest were sometimes taken

to avoid inconveniencing or upsetting the recreational crabber being interviewed. This explains why 100% of the catch was not able to be sampled for the year. CW frequencies and mean, median, mode, and max CW will be monitored each year to observe if trends develop in the size of the blue crabs harvested by the recreational community. Monthly average CW will also be monitored for changes and trends on annual basis. On average, the mature females being harvested had a larger CW than the males being harvested. Mature female blue crabs tend to have a larger body size for developing ovaries and to increase capacity for egg production (Hines 1982). Recreational crabbers harvested far fewer mature female blue crabs than male blue crabs. This could be caused from fewer interactions of recreational crabbers with mature female crabs, or because recreational crabbers that do catch mature females make the choice not to harvest them. On multiple occasions, recreational crabbers have told NYSDEC staff that they release mature female crabs to promote the health of the stock. The largest mature females were caught in August. These large females observed in August could be a combination of immature females molting into maturity on the north shore of the bay at this time and those egg bearing females seen in higher salinity regions in July who have since spawned and released their egg mass. It is not completely clear why the observed mature female CW fluctuated each month. Males exhibit a slight drop in average CW between July and August followed by a gradual increase to a peak in October. The initial drop may be a response from the cohort of larger males being harvested in July during peak recreational effort. And the gradual increase in CW into October may coincide with the gradual decrease in recreational effort and harvest, allowing the remaining crabs to molt into larger sizes during those months. Male blue crabs molt one to three times as adults (Hines 2007). The timing of these molts is variable and depends on factors such as length of growing season, water temperature, and food availability (Smith and Chang 2007).

Catch per Unit Effort

The annual CPUE of crabs being harvested and released will also be monitored each year to observe if trends develop. The monthly peaks and dips in CPUE of crabs harvested is likely to be influenced by the timing in which cohorts or age classes of blue crabs grow or molt into a legal size range. When a cohort molts into a size greater than 4.5”, CPUE may rise. CPUE may fall when this cohort is fished down to a lower abundance, then rise again when the next cohort molts into a size greater than 4.5”. The abundance of crabs greater than 4.5” is also influenced by other factors such as commercial harvest, natural mortality,

and by immigration and emigration of crabs into and out of the estuary. The monthly trend which showed a gradual increase in percent of total catch in which crabs were harvested can be attributed to a combination of increased occurrence of harvestable crabs and a decrease in occurrence of crabs less than 4.5" (i.e. those crabs being released). A decrease of crabs less than 4.5" may be attributed to growth (i.e. those molting into a size class larger than 4.5") and to those immature females who have molted into maturity and have begun their fall migration away from the sampling stations on the north shore of the bay.

Catch Composition

Overall, catch composition shows that males make up the largest percentage of catch at the stations near the creeks and rivers of the north shore of the bay. Briggs also observed males dominating the catch on the north shore of the bay in the 1981 - 1983 study (Briggs 1985). Large immature females, those nearing their molt into maturity, are also found on the north shore of the bay in July. Immature females move into creeks and rivers to find mates during the summer. Briggs also found immature females only along the north shore of the bay during his study (Briggs 1985). Once the immature females have found their mate, they complete their terminal molt into maturity (Millikin and Williams 1980). These mature females, which can be seen in the north shore of the bay in August and to a lesser degree September, remain in the mating area to feed and accumulate nutritional stores throughout summer and early fall (Tankersley et al. 1998). Dropping water temperatures and a shorter photoperiod initiates the mature female's migration to the higher salinity waters near the mouth of the estuary (Aguilar et al. 2005). This can be seen in the October catch composition map in which the north shore of the bay is composed of all males, and the high salinity stations are composed primarily of mature females. The mature females seen at the high salinity stations throughout the summer are most likely those females who migrated there the previous fall and were developing eggs, and spawning this season. This idea is substantiated by the catch of egg bearing females at the high salinity stations in July and August. In the 1981 - 1983 study, Briggs also observed a large catch of adult females and egg bearing females at the same high salinity stations (Briggs 1985).

Physical Sampling

The physiological temperature thresholds for blue crab growth are 48°F (8.9 °C) – 93°F (34 °C) (Tagatz 1968; Leffler 1972). As water temperatures drop below 50°F (10 °C) the crabs bury into the sediment to overwinter and cease growth (Aguilar et al. 2005). Overwintering mortality may play an important

role in regulating blue crab populations in NY waters (Bauer and Miller 2010a). The NOAA National Centers for Environmental Information records show that air temperatures in the NY coastal region have been increasing since 1895 and that the 2015 temperatures were 2.6°F above the 1901 – 2000 base period average temperature of 51°F (Figs. 21, 22). Also, winter (December – March) temperatures in the NY coastal region were 8°F above the 20th century average of 33.1°F in 2016 (Fig. 23). These were the highest winter time temperatures on record for this region (tied with 2012). NOAA's records, and temperature data from the intercept survey will be monitored as the Survey of Recreational Blue Crabbing in the NY Marine District progresses to see if any trends in blue crab biological data and CPUE within the fishery develop in response to these changes in temperatures.

Conclusions

2016 was the pilot year for the GSB on-site intercept survey. The intercept survey allowed NYSDEC staff to record detailed information from recreational crabbers that previously did not exist. With this survey, the NYSDEC is now actively collecting and monitoring data about recreational effort, gear use, CPUE, and blue crab biological information from recreational crabbers in the GSB. In an effort to improve the survey and to collect a greater volume of data from recreational crabbers, station visits may be increased from 15 to 30 stations per month in the 2017 season. Also, certain sampling stations may be eliminated or replaced if they are found not to have recreational crabbers on a continuous basis.

The GSB on-site intercept survey currently acts as an index of information for recreational blue crabbing for the entirety of the NYMCD. A digital log book was developed to supplement the intercept survey and to obtain more complete data about recreational blue crabbing for the NYMCD as a whole. Due to technical difficulties, the digital logbook did not become live until very late in the 2016 season, but is now currently operational. The goal of the digital logbook is to collect additional information from recreational crabbers both inside and outside the geographic limits and time constraints of the GSB survey, in order to capture information which may be missed by the intercept survey. Recreational crabbers within the NYMCD can now visit the NYSDEC webpage at any time with their browser enabled cellphone, tablet or computer to submit information about each of their crabbing trips. Like the intercept survey, the digital logbook will be used to monitor annual and monthly trends in recreational effort, gear use, CPUE, and blue crab biological information within each geographic statistical area of the NYMCD.

When data from the recreational blue crab fishery is combined with landings data from the NY commercial blue crab fishery and fisheries independent sampling programs, the NYSDEC will be able to obtain a clearer picture of removals and inputs from the NY blue crab population. This data will be instrumental in moving toward developing a comprehensive estimate of the blue crab population size. The data from the Survey of Recreational Blue Crabbing in the NY Marine & Coastal District will allow for better informed and more effective management actions to be taken to improve the health of the NY blue crab fishery.

Figure 1. A map on New York's Marine and Coastal District. Note the Great South Bay on the south shore of Long Island. Great South Bay is the sampling area for the on-site intercept survey.

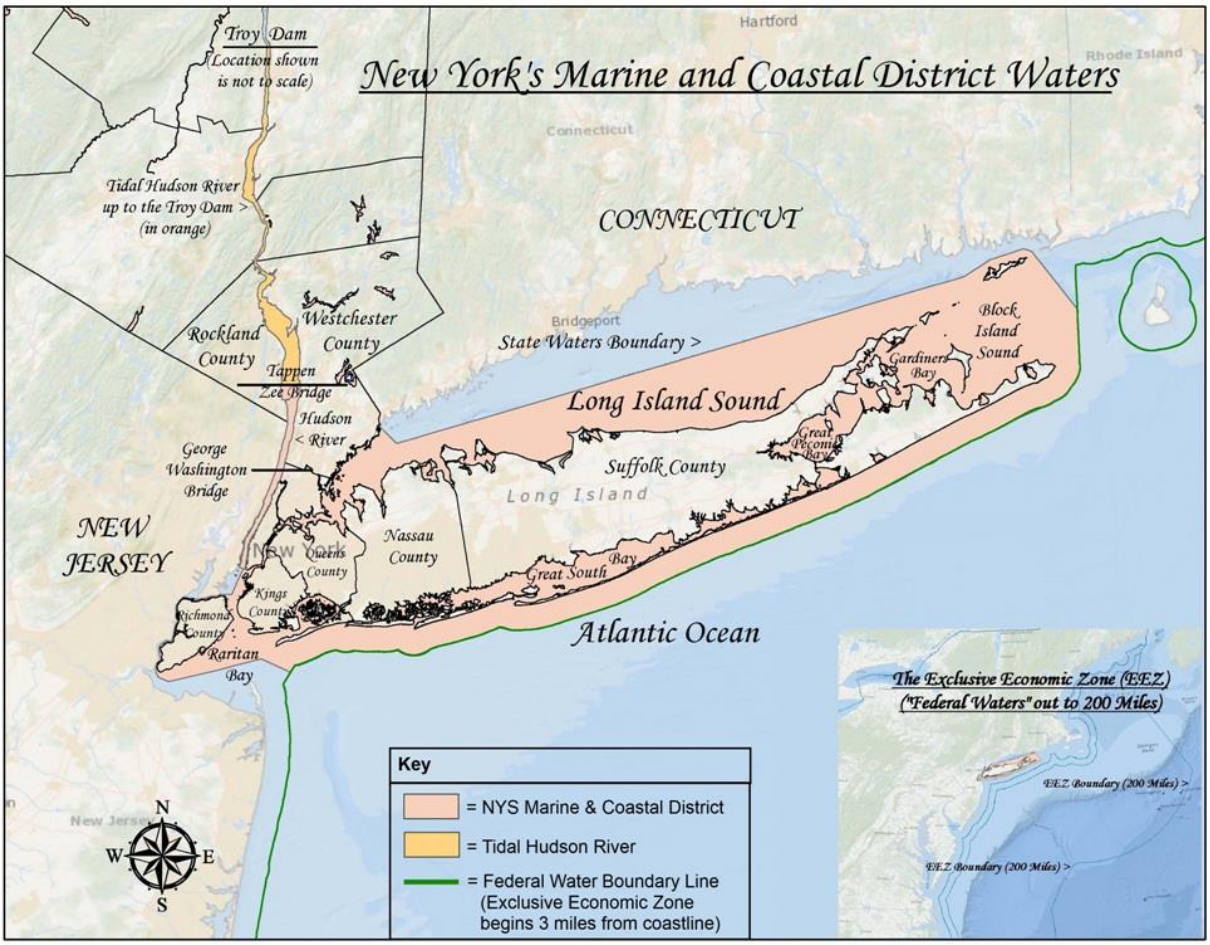
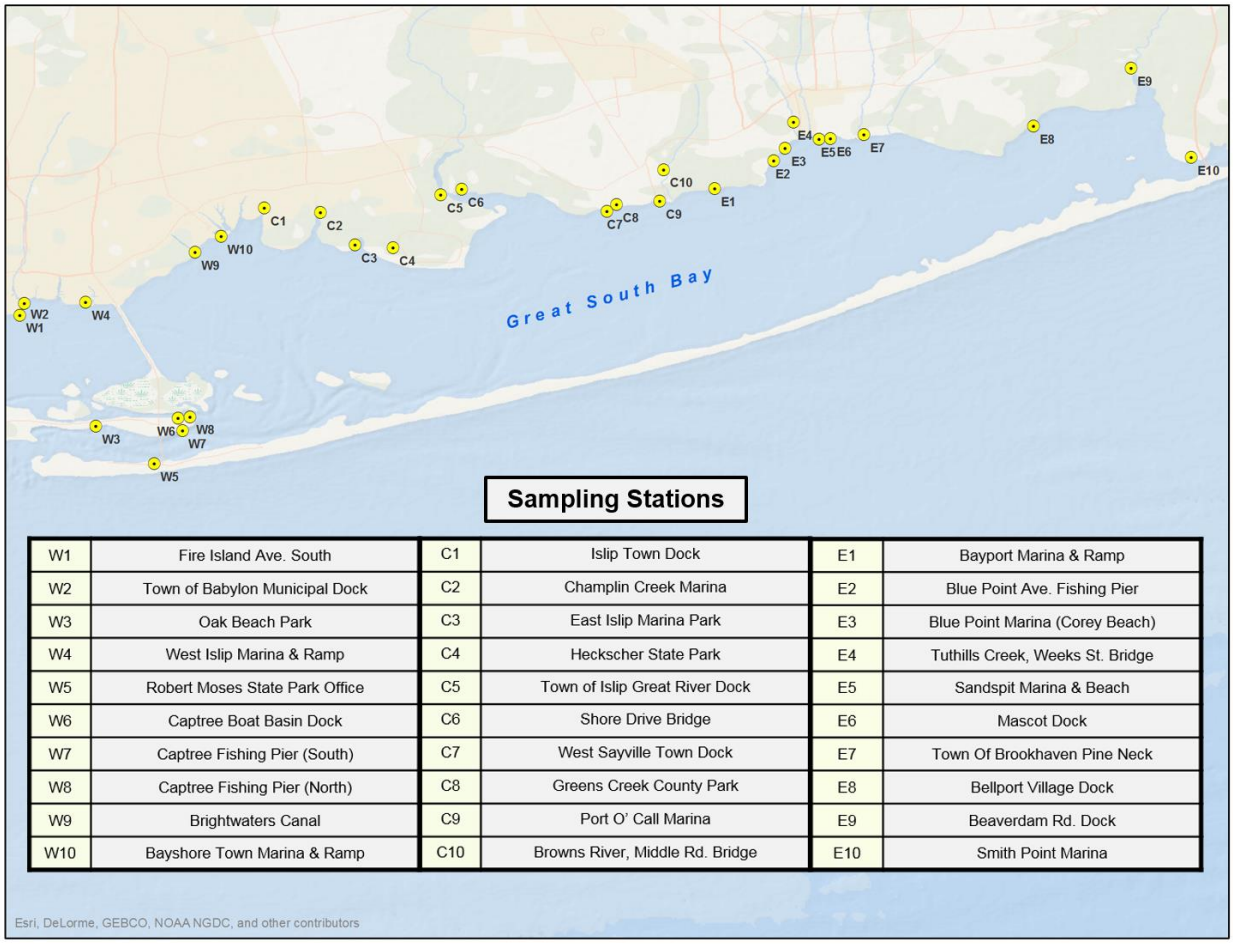


Figure 2. A map of the 2016 on-site intercept survey stations.



Sampling Stations

W1	Fire Island Ave. South	C1	Islip Town Dock	E1	Bayport Marina & Ramp
W2	Town of Babylon Municipal Dock	C2	Champlin Creek Marina	E2	Blue Point Ave. Fishing Pier
W3	Oak Beach Park	C3	East Islip Marina Park	E3	Blue Point Marina (Corey Beach)
W4	West Islip Marina & Ramp	C4	Heckscher State Park	E4	Tuthills Creek, Weeks St. Bridge
W5	Robert Moses State Park Office	C5	Town of Islip Great River Dock	E5	Sandspit Marina & Beach
W6	Captree Boat Basin Dock	C6	Shore Drive Bridge	E6	Mascot Dock
W7	Captree Fishing Pier (South)	C7	West Sayville Town Dock	E7	Town Of Brookhaven Pine Neck
W8	Captree Fishing Pier (North)	C8	Greens Creek County Park	E8	Bellport Village Dock
W9	Brightwaters Canal	C9	Port O' Call Marina	E9	Beaverdam Rd. Dock
W10	Bayshore Town Marina & Ramp	C10	Browns River, Middle Rd. Bridge	E10	Smith Point Marina

Figure 3. A map showing the number of completed interviews at each station per month. The figure shows the average number of interviews completed per station visit for each month of the survey.

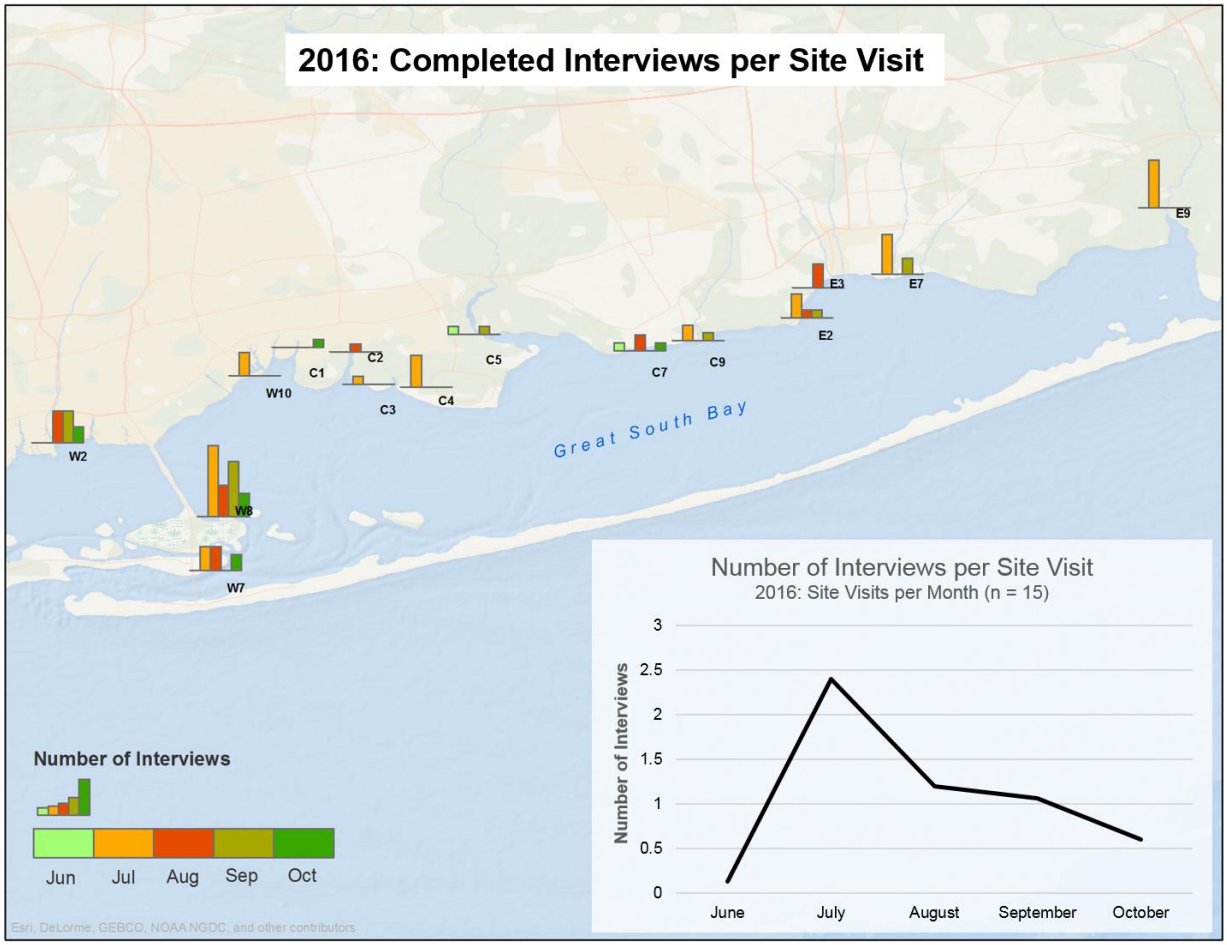


Figure 4. Percent of all completed interviews in which a specific gear combination was observed used by a recreational crabber.

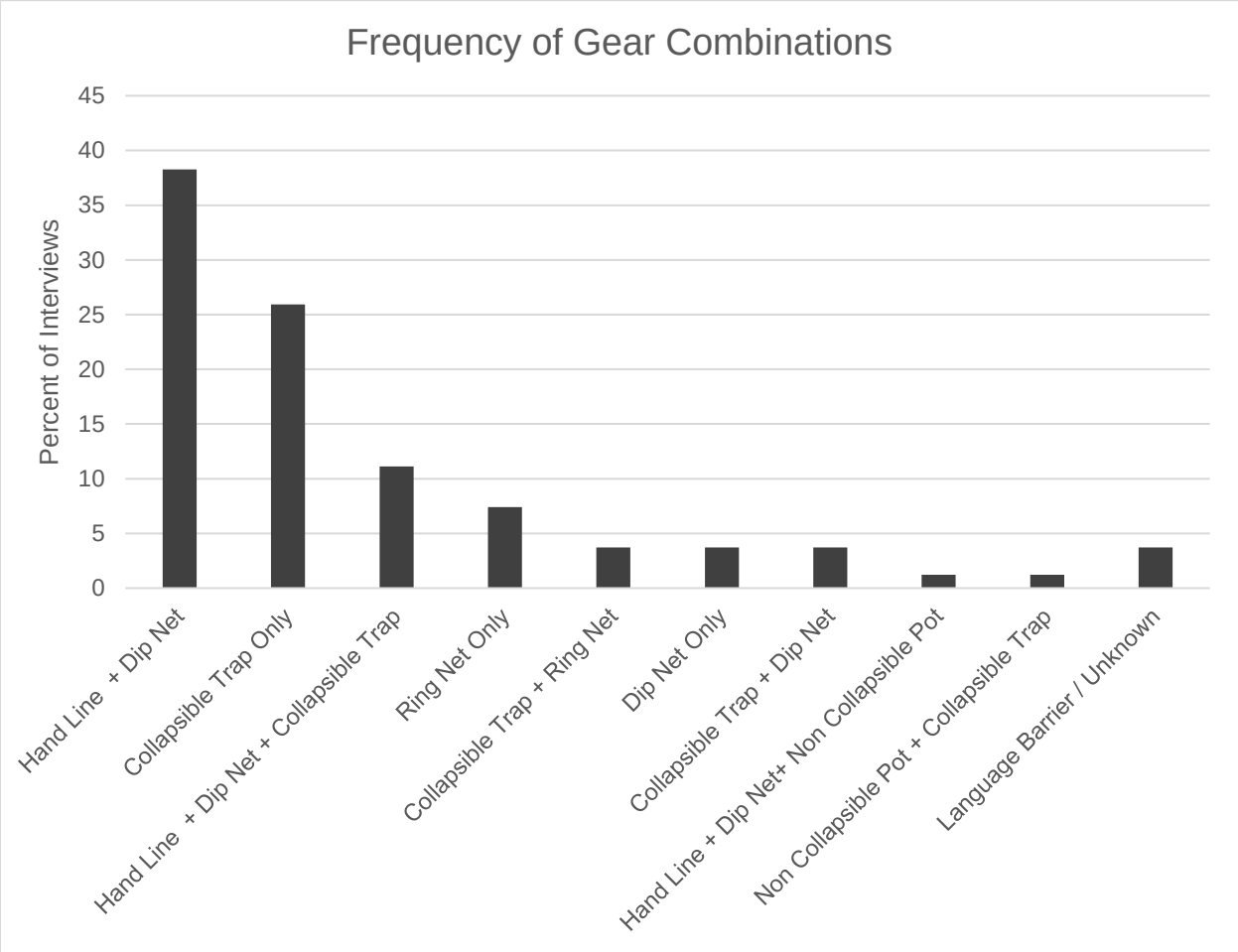


Figure 5. The average number of individual gear type used when it was being used (for all interviews).

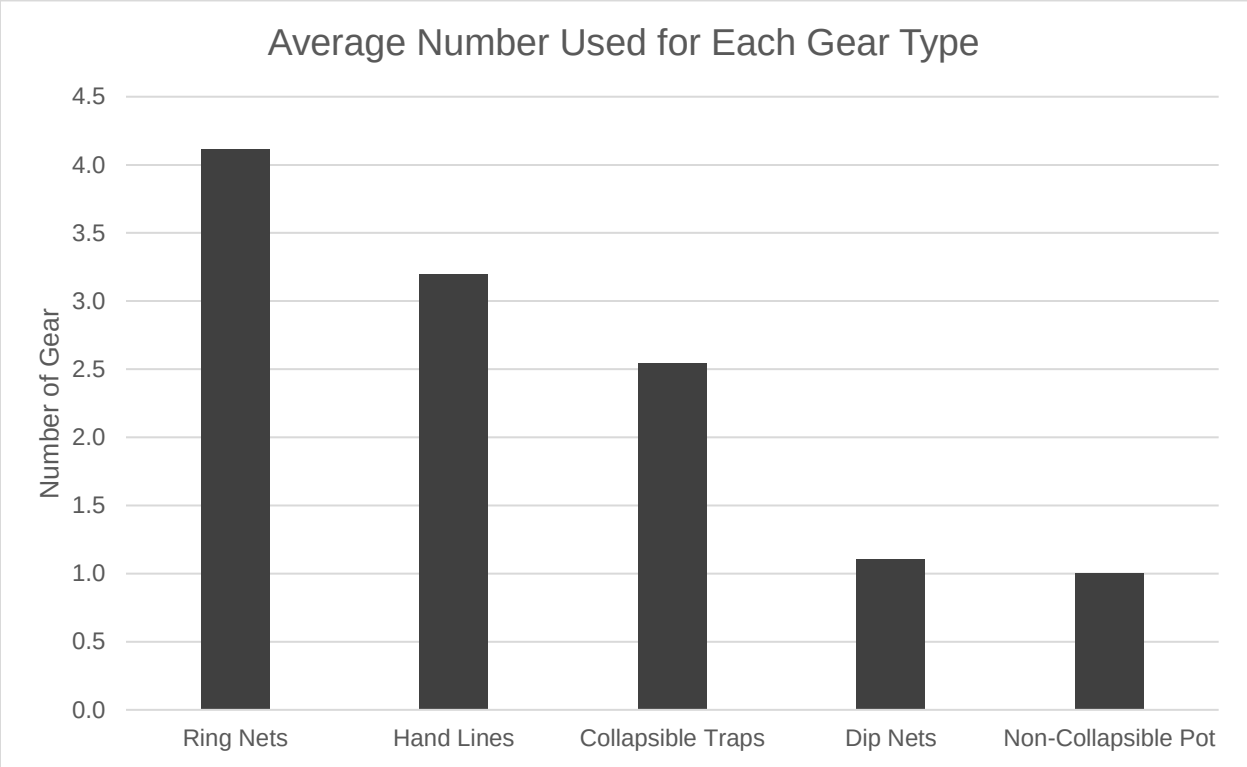


Figure 6. CPUE of legal sized blue crab per gear combination. The total number of crab caught with a specific gear combination divided by the total hours crabbed with that gear combination.

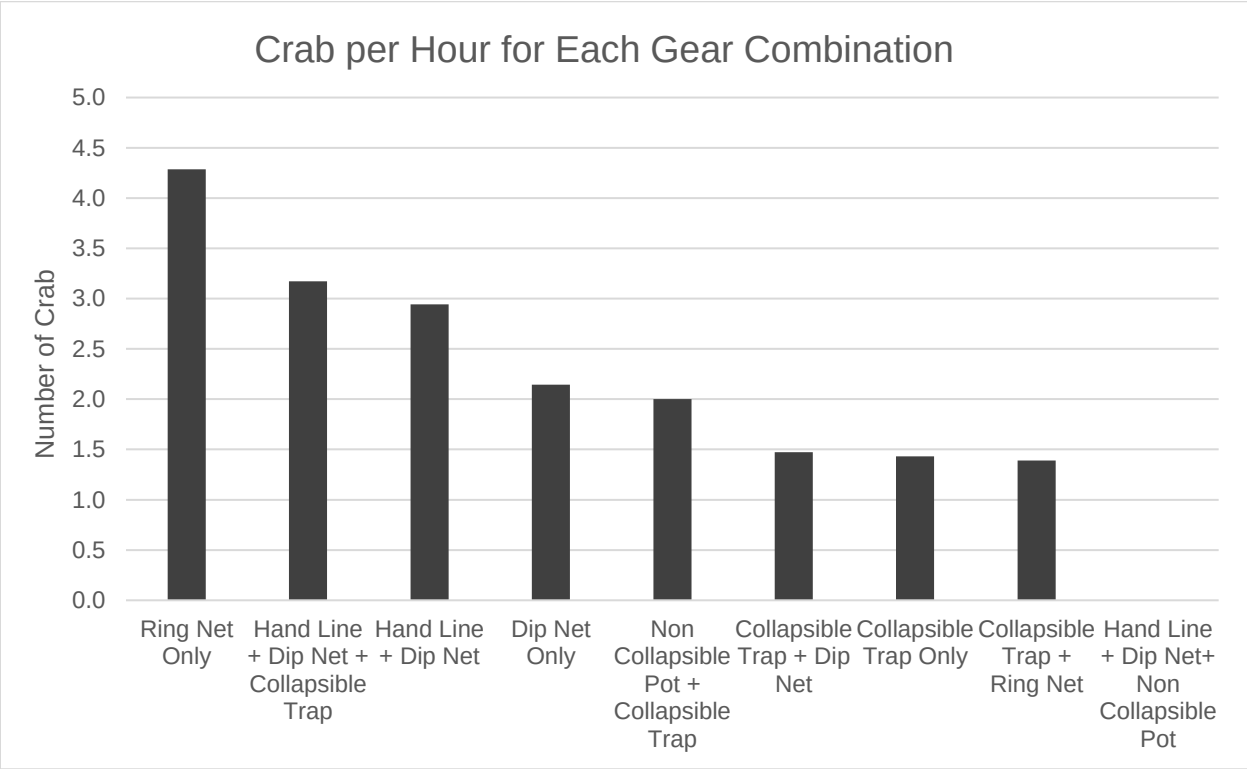


Figure 7. Carapace width frequencies of recreationally harvested legal sized male blue crabs.

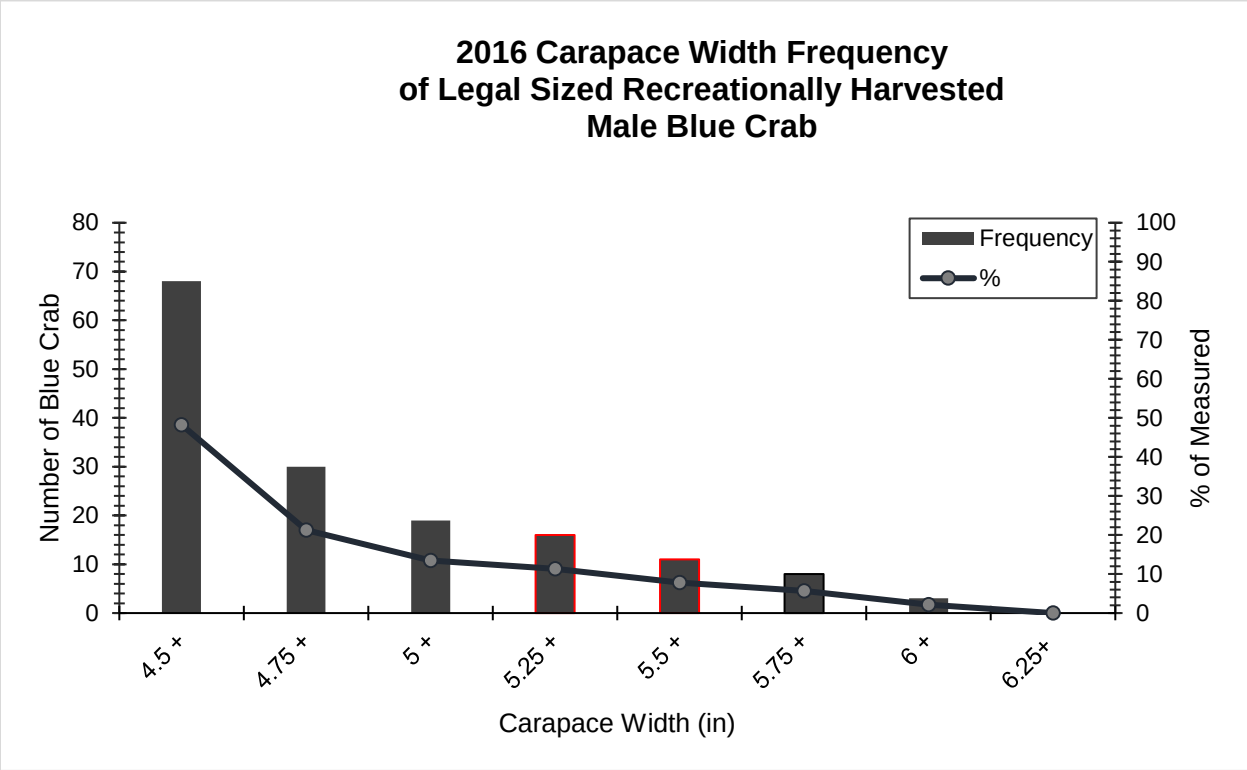


Figure 8. Carapace width frequencies of recreationally harvested illegal sized male blue crabs.

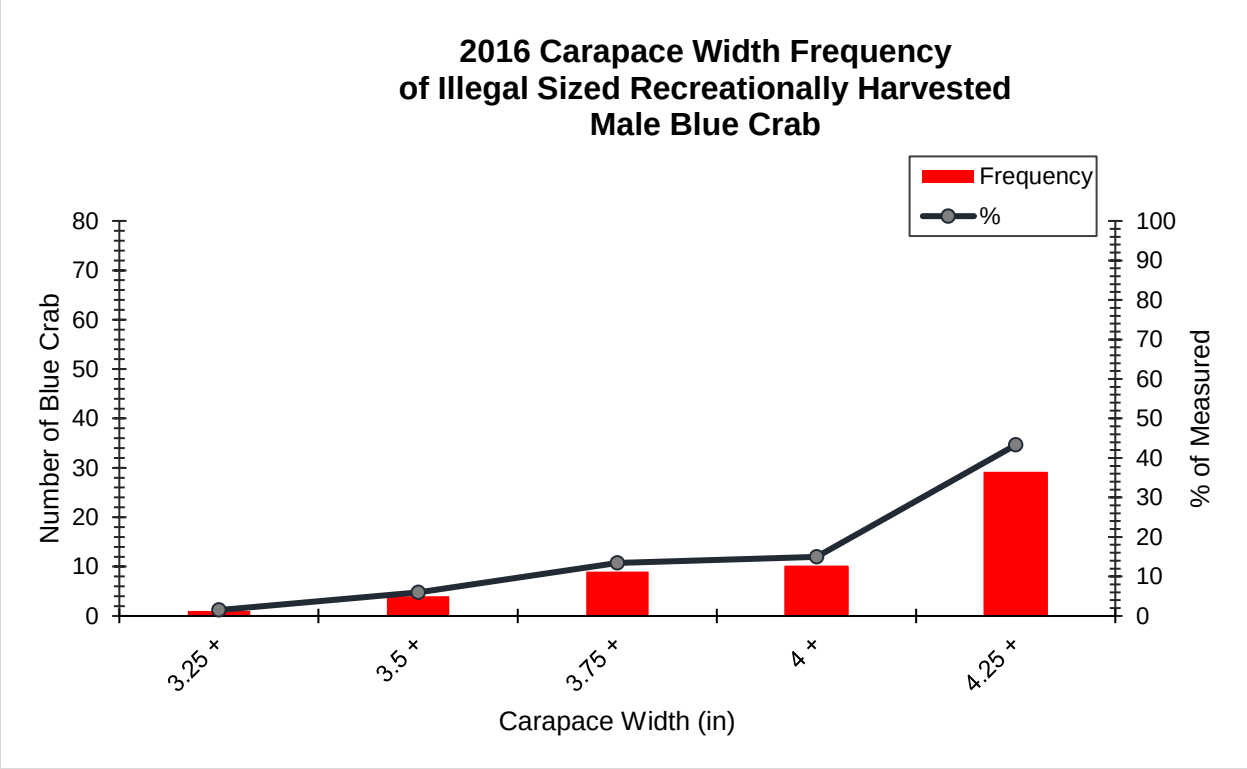


Figure 9. Carapace width frequencies of recreationally harvested legal sized mature female blue crabs. For 2016, there was only 1 illegal sized mature female harvested (4.37”).

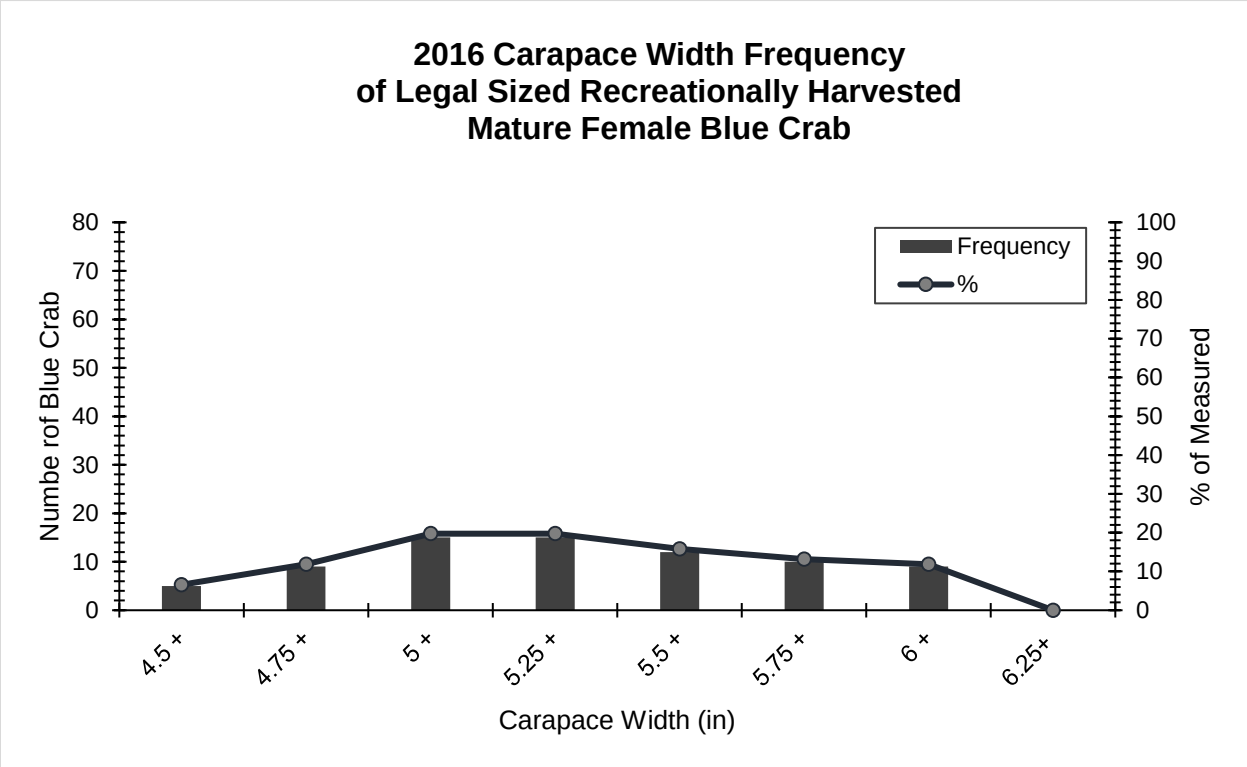


Figure 10. Carapace width frequencies of recreationally harvested legal sized immature female blue crabs.

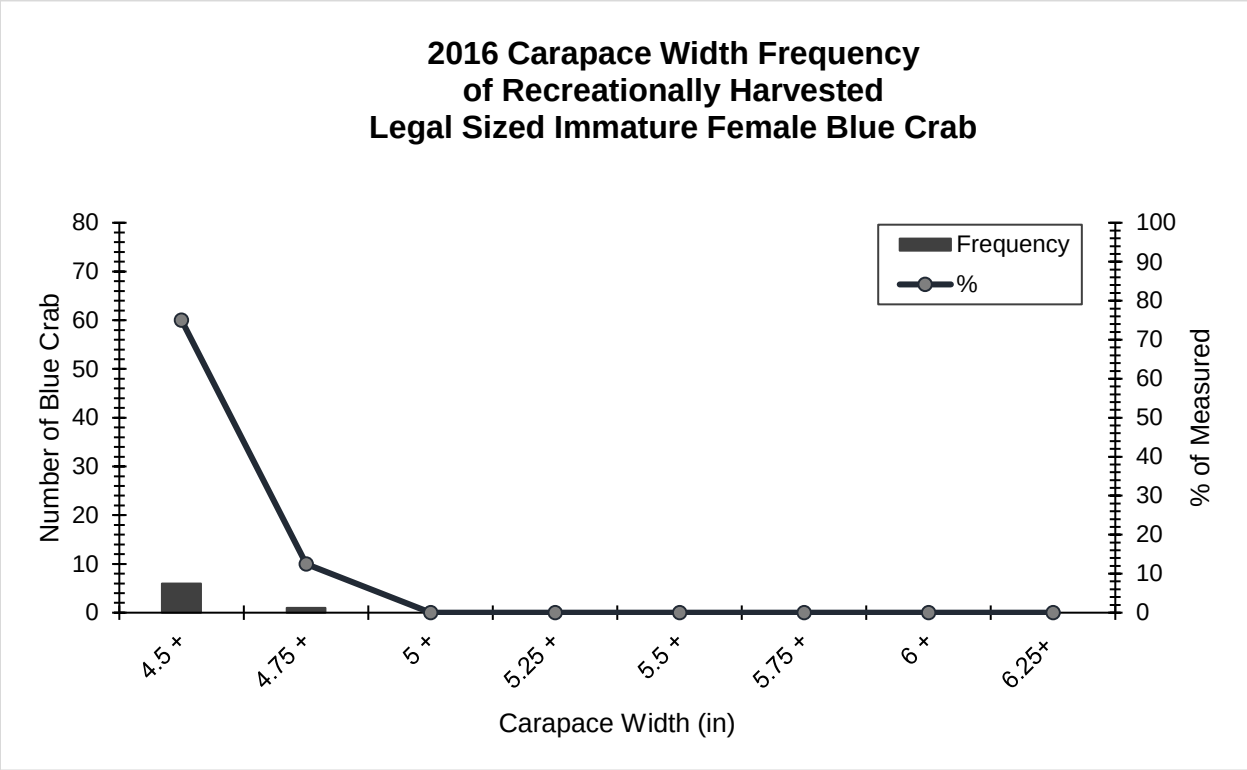


Figure 11. Carapace width frequencies of recreationally harvested illegal sized immature female blue crabs.

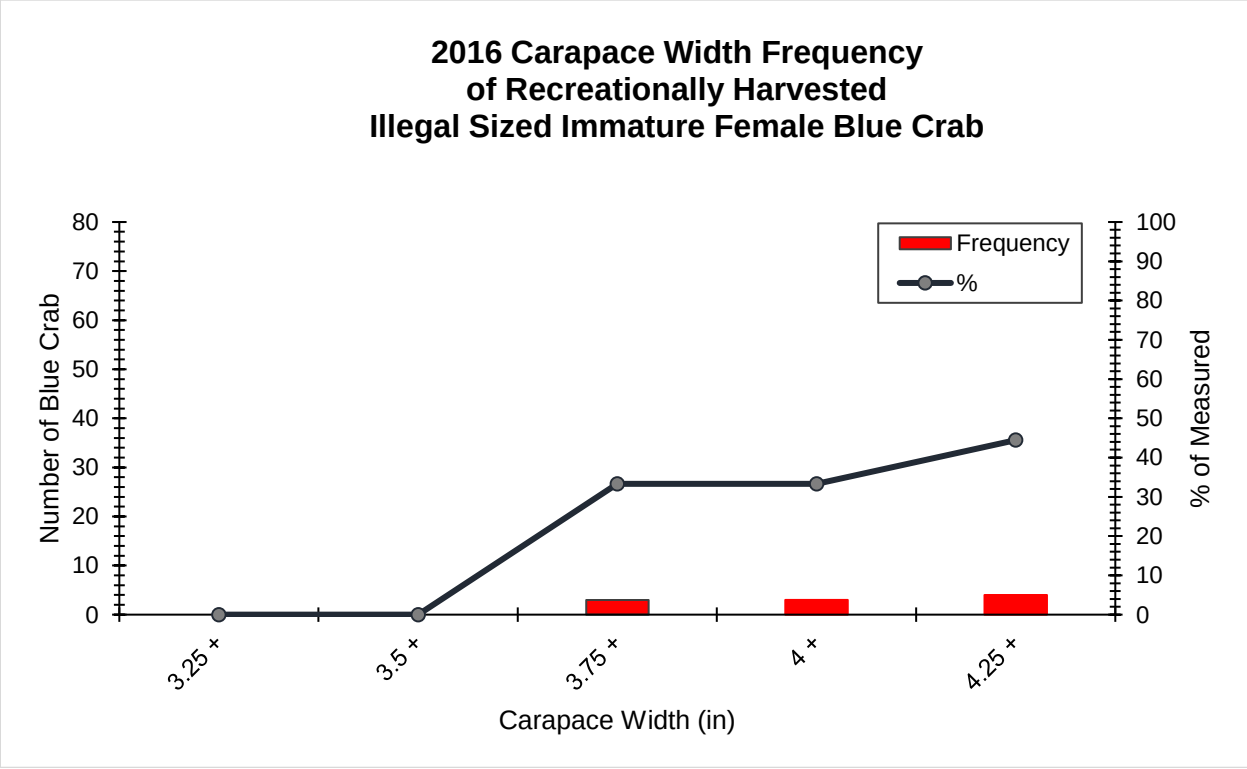


Table 1. The mean, median, mode, and max carapace widths for legal sized male, mature and immature female blue crab being harvested in 2016 during the intercept survey.

2016	Immature Female		Male		Mature Female	
Mean	4.6”	118 mm	4.95”	126 mm	5.4”	137 mm
Median	4.6”	118 mm	4.8”	122 mm	5.4”	138 mm
Mode	4.5”	115 mm	4.6”	117 mm	5.1”	130 mm
Max	4.9”	124 mm	6.1”	156 mm	6.2”	158 mm

Figure 12. The average carapace widths of legal sized male, mature and immature female blue crabs being harvested per month. No crabs were harvested in the interviews conducted in June.

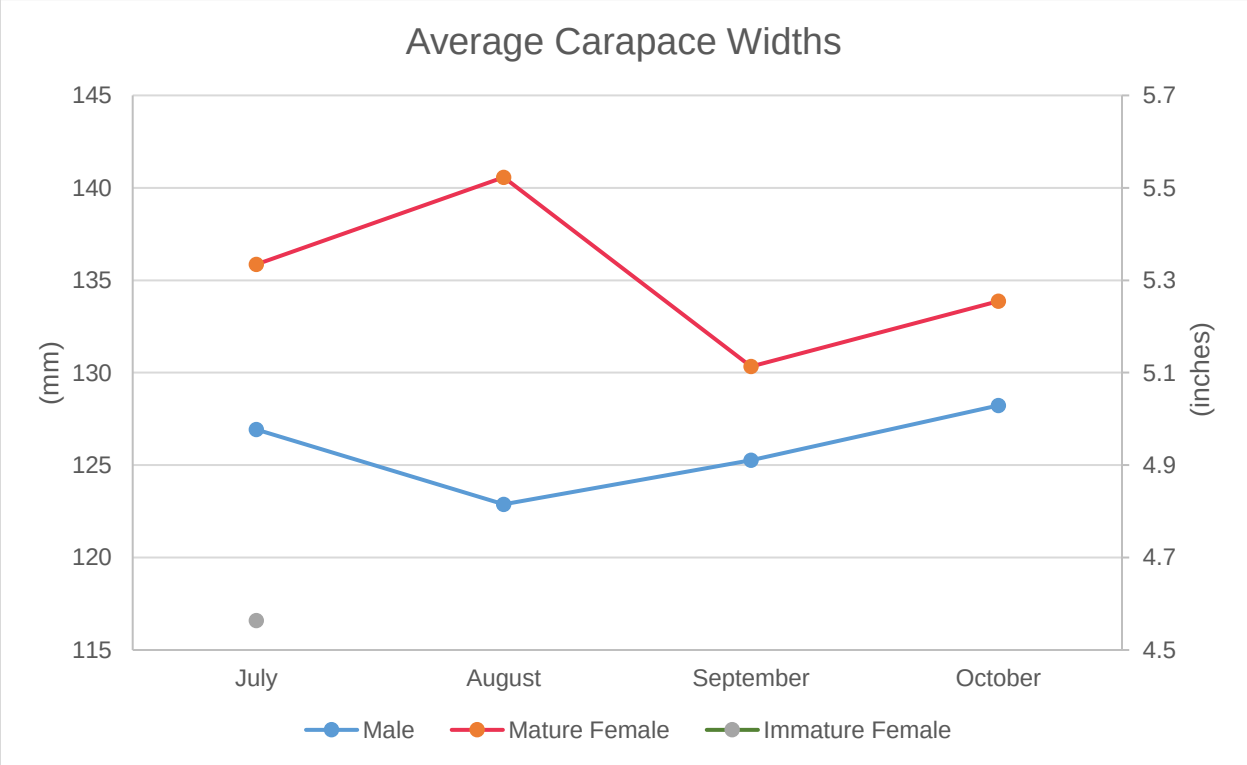


Figure 13. CPUE of legal sized blue crab harvested (yellow) and sub legal sized blue crab released (blue) per month for 2016. The total number of crab harvested or released divided by the total hours crabbed per month.

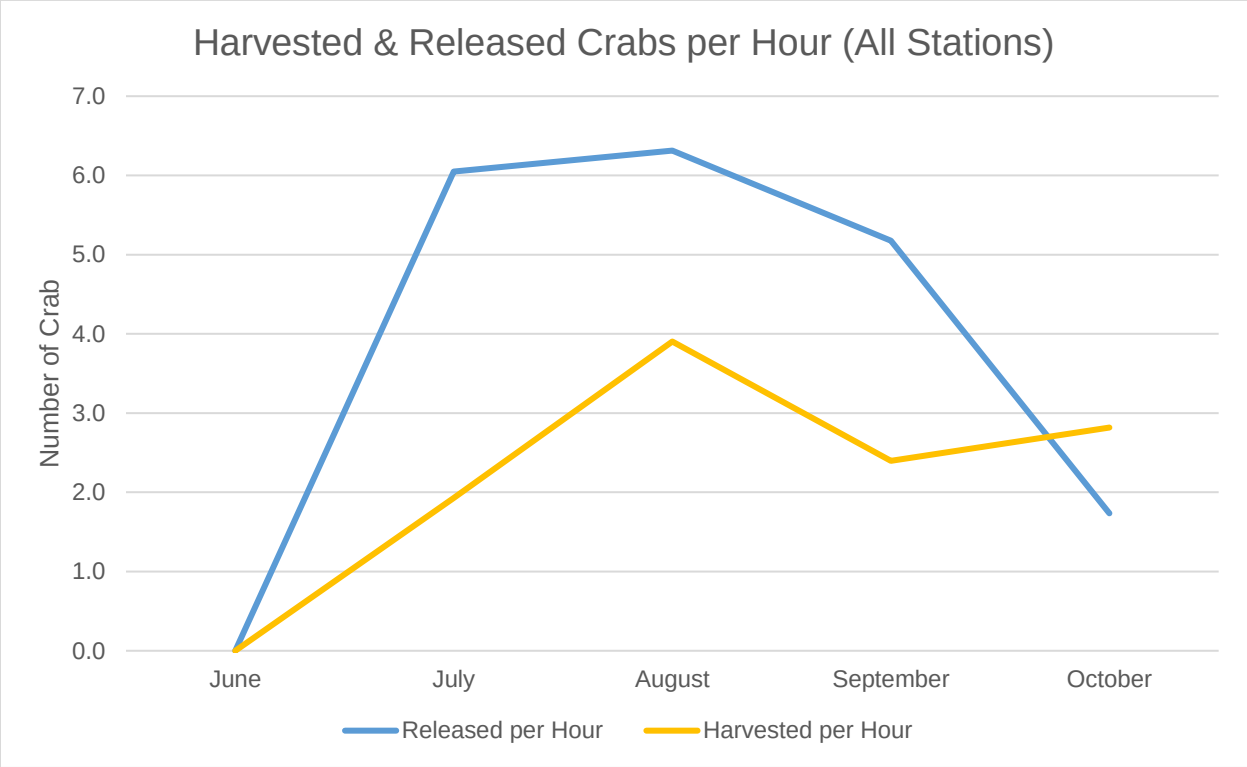


Figure 14. CPUE of legal sized blue crab harvested per station for 2016. The total number of crab harvested divided by the total hours crabbed at each station.

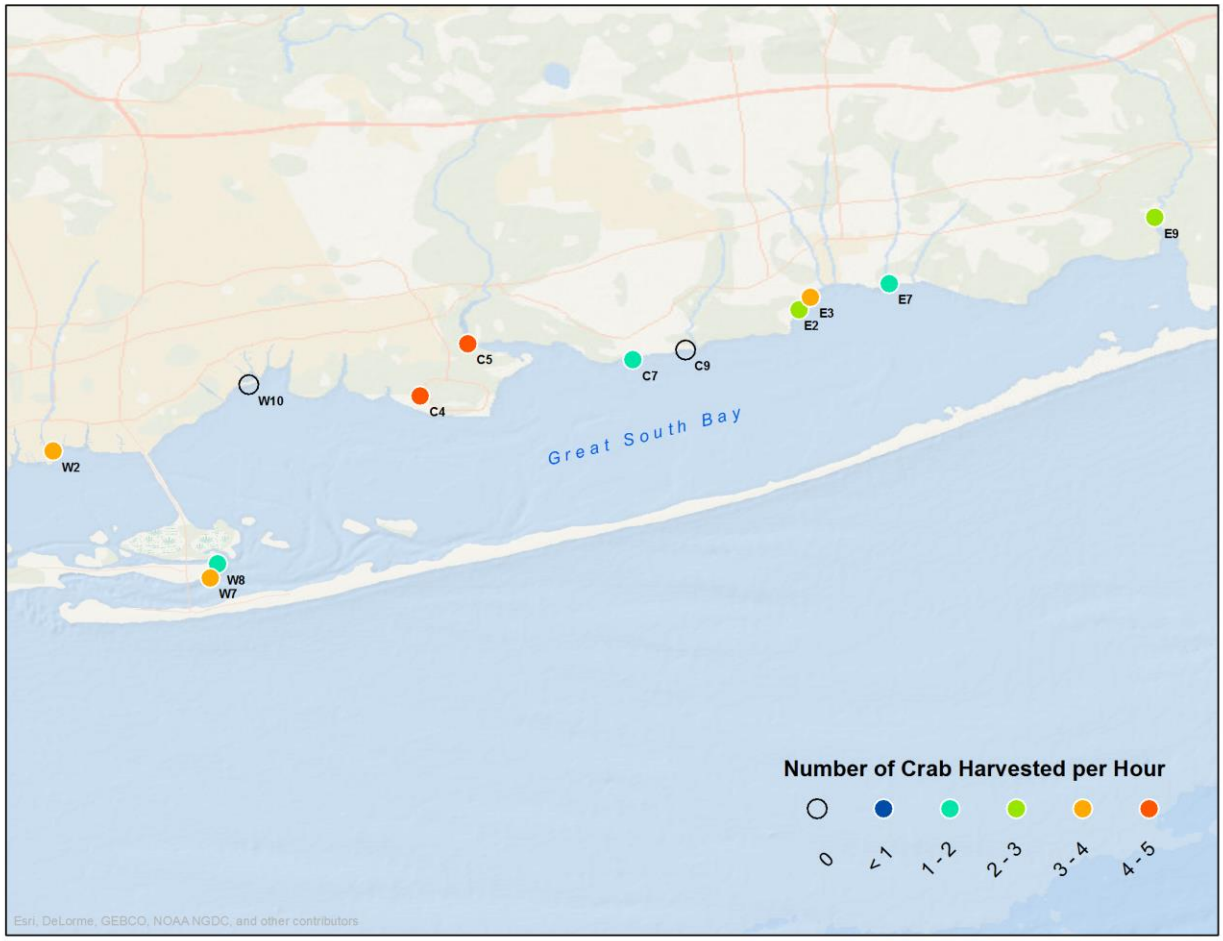


Figure 15. CPUE of all sub legal sized blue crab released (blue) and egg bearing females released (pink) per month for 2016. The total number of sub legal sized crab and egg bearing females released divided by the total hours crabbed per month.

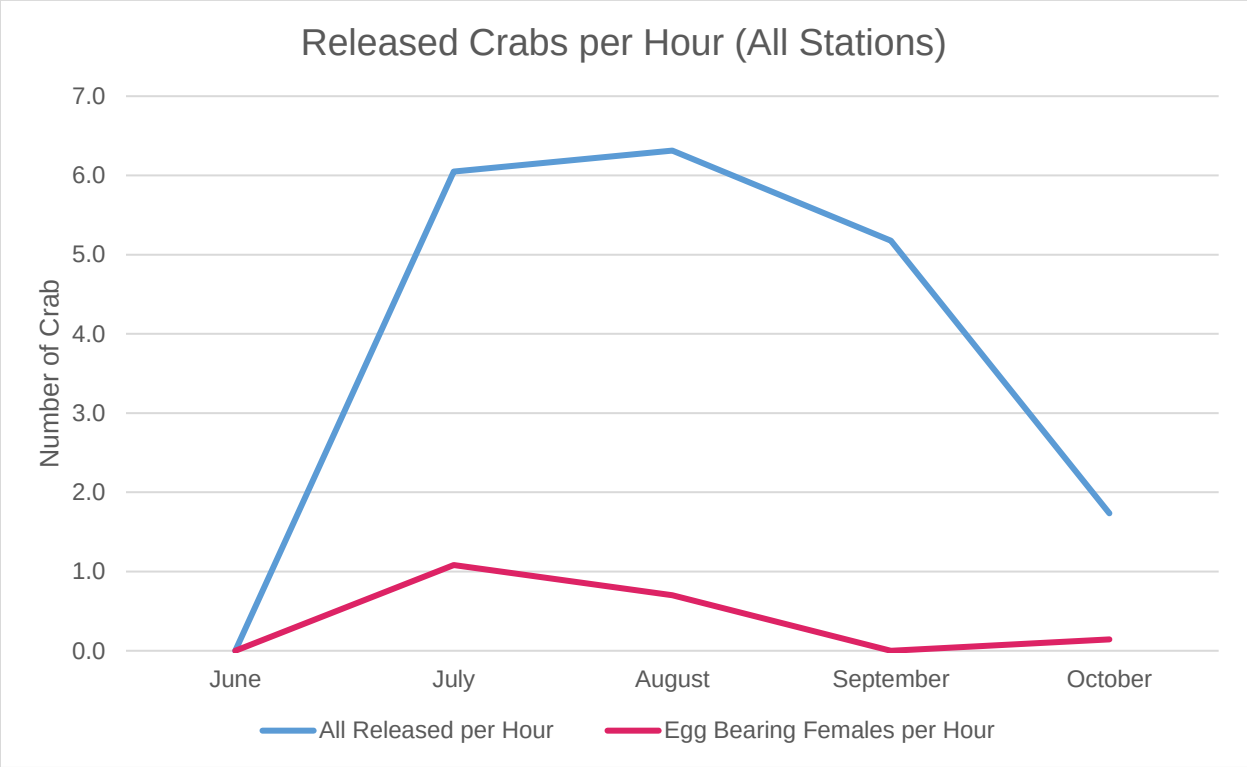


Figure 16. The percent of the total catch (crabs harvested / (harvested + released)) which were legally harvested per month.

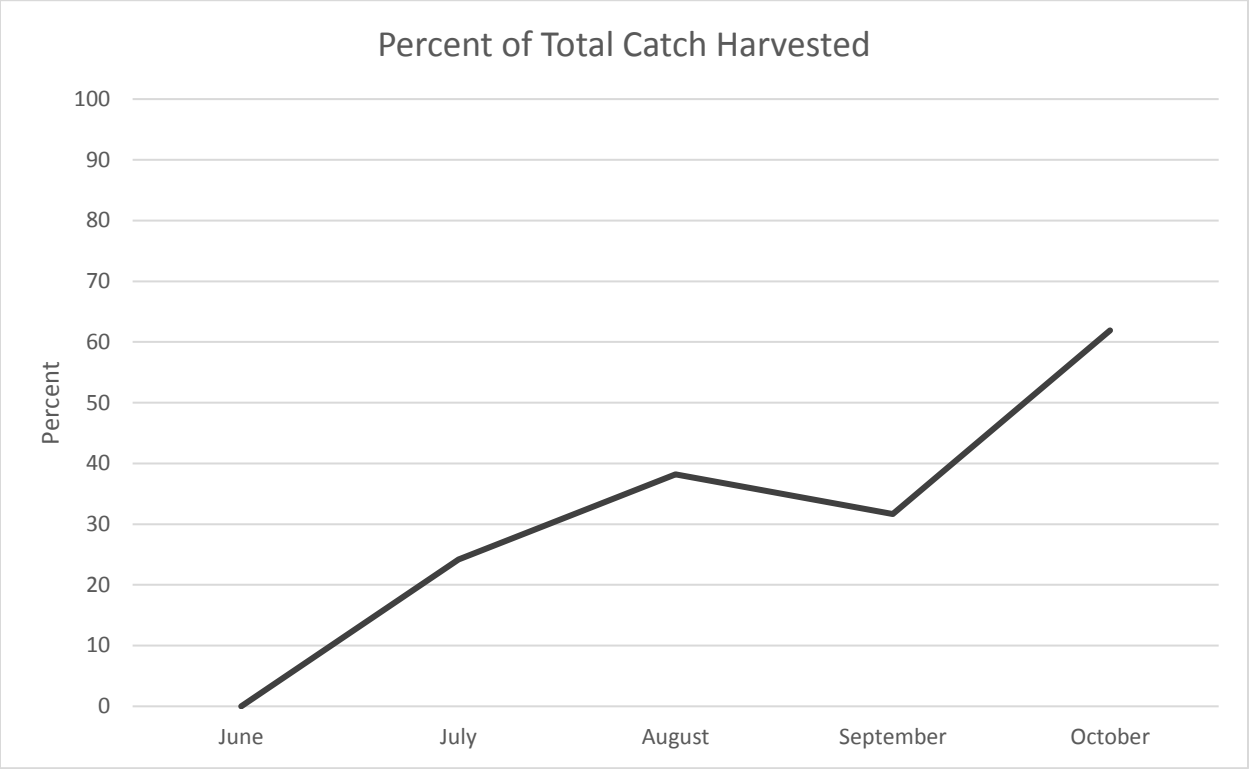


Figure 17. A map showing the average salinity measured at each station for 2016.

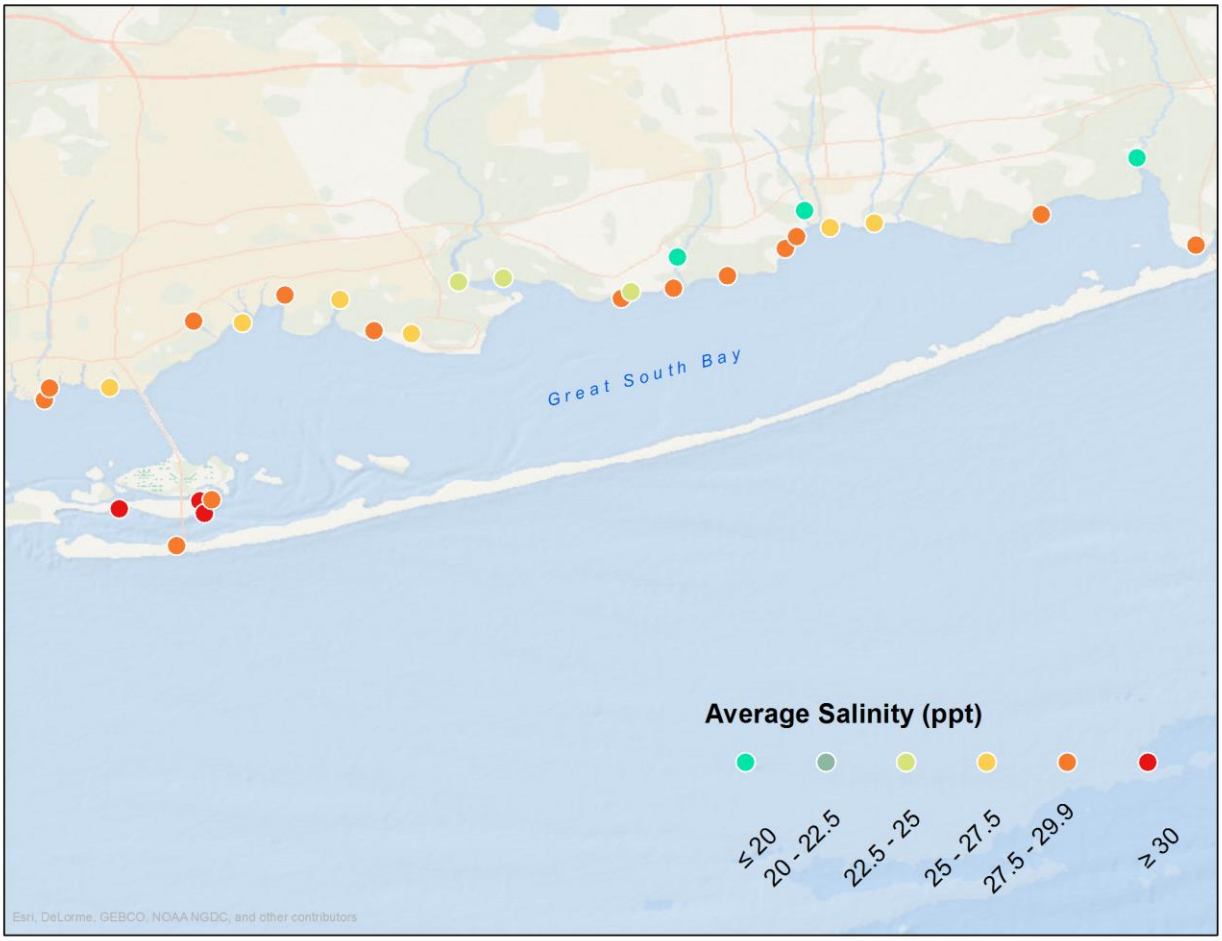


Figure 18. The monthly catch composition of legal sized male, mature and immature female blue crab harvested at stations with completed interviews in 2016. *Release of egg bearing females included.*

Figure 19. Maps showing the dissolved oxygen readings measured at each station visit per month.

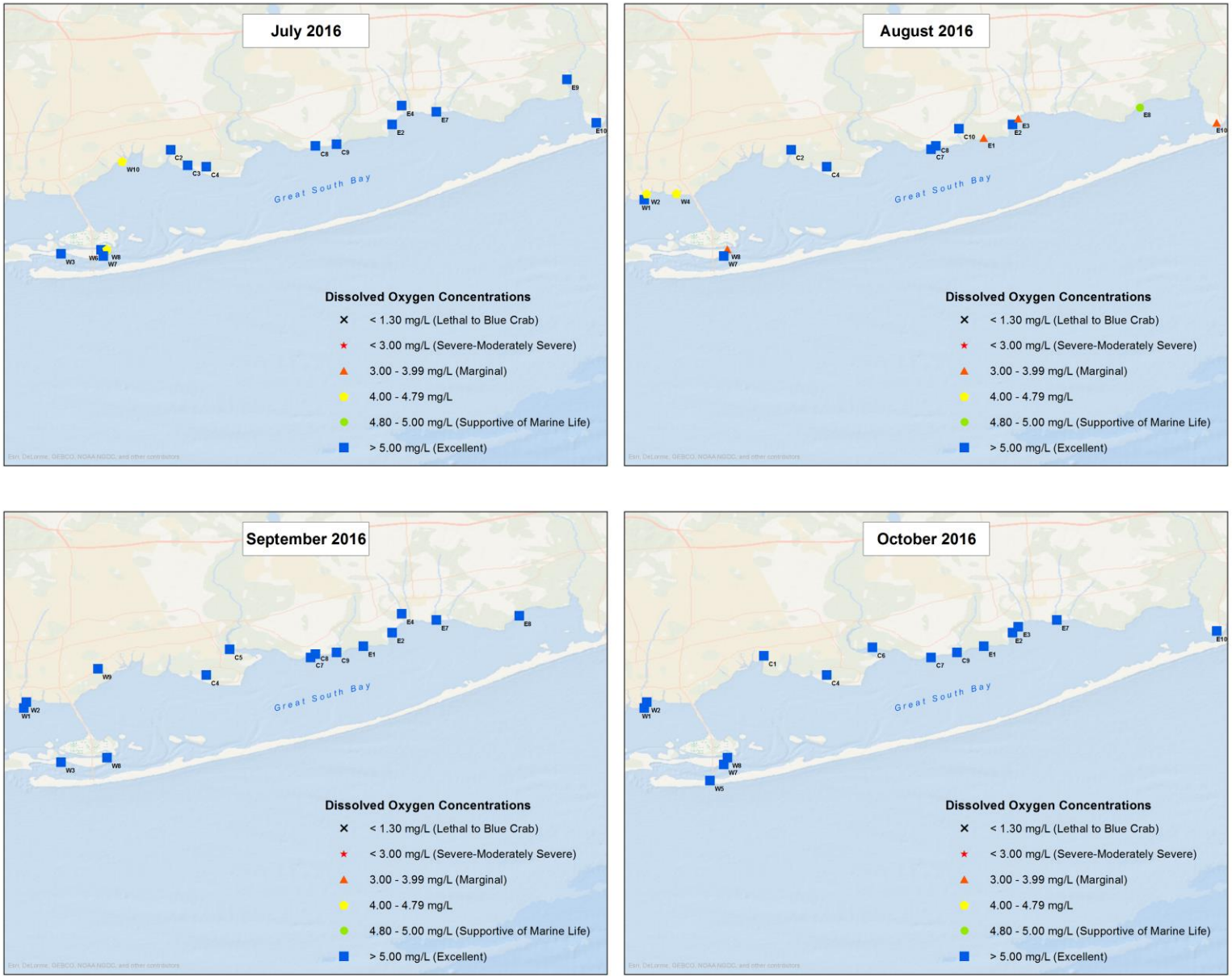


Figure 20. The average air and water temperatures measured during each month of the 2016 intercept survey.

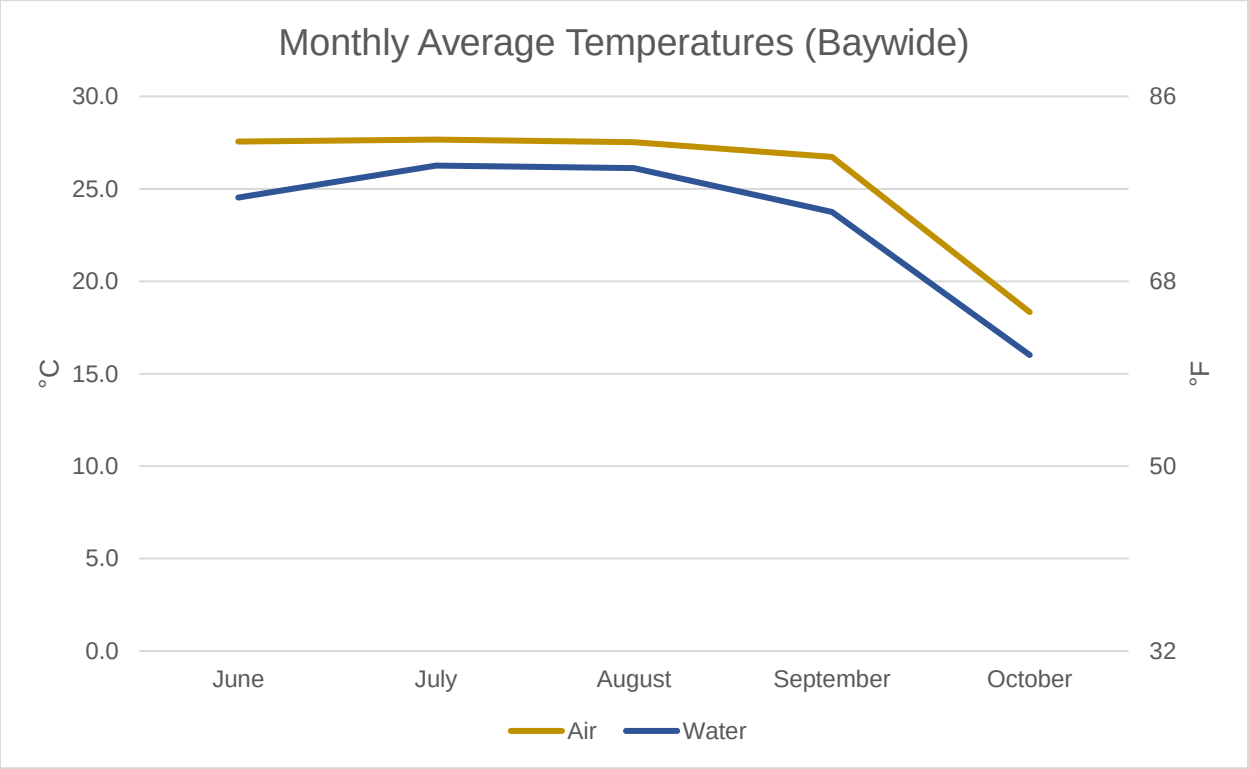


Figure 21. A time series of average air temperature for the New York Coastal Region (Climate Division 4) from 1895 – 2016 (NOAA National Centers for Environmental Information, 2016).

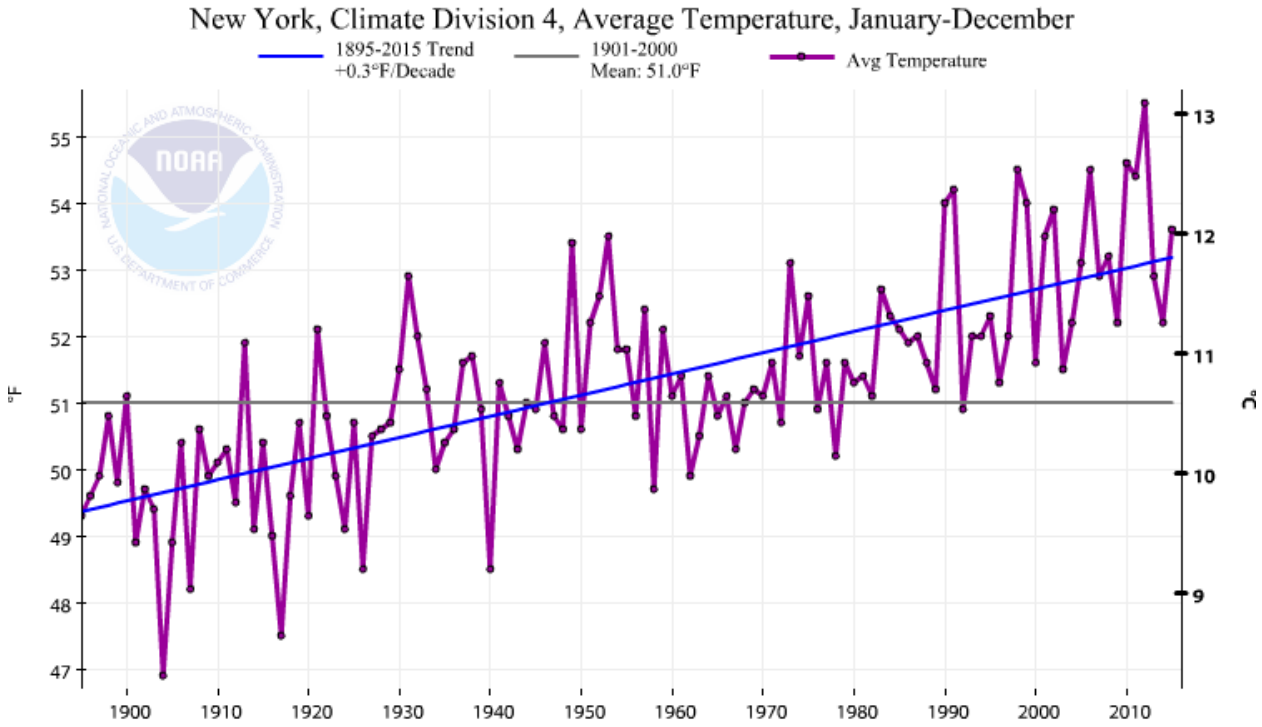


Figure 22. A time series showing the departure from mean annual air temperature in the NY Coastal Region (“Climate at a Glance”, 2016).

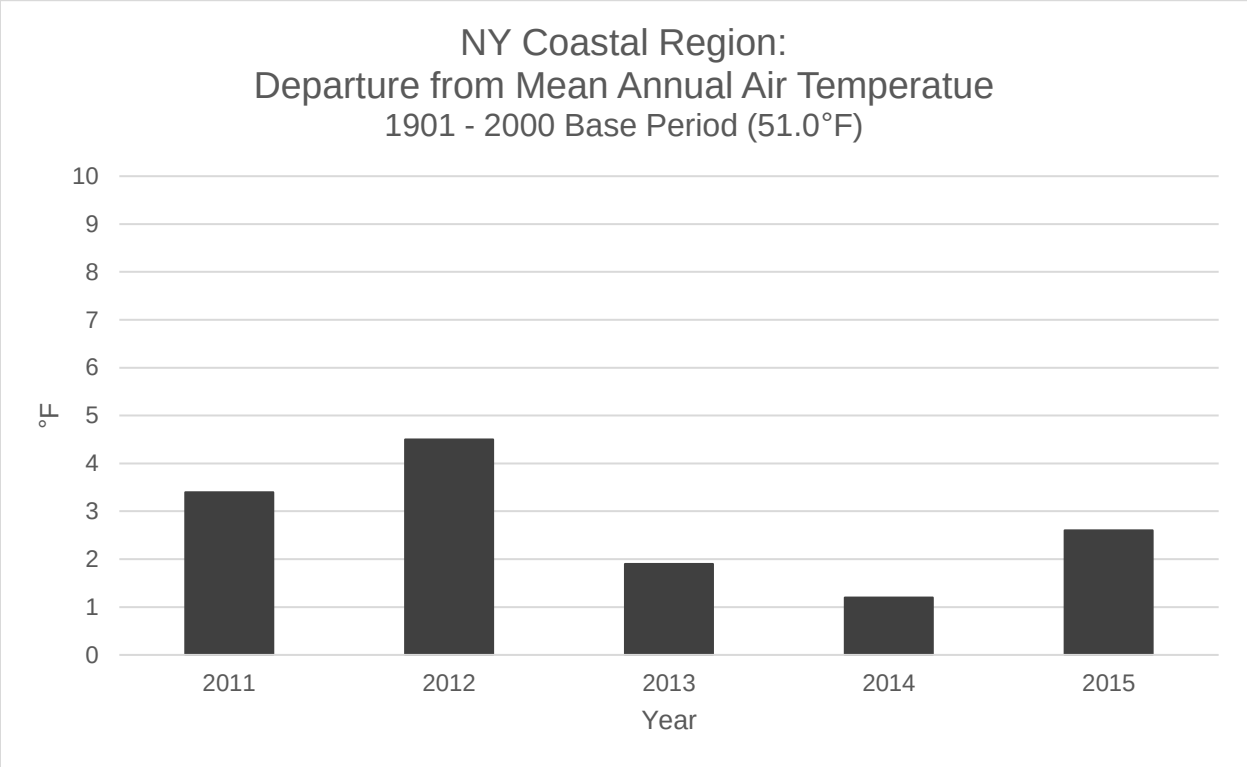
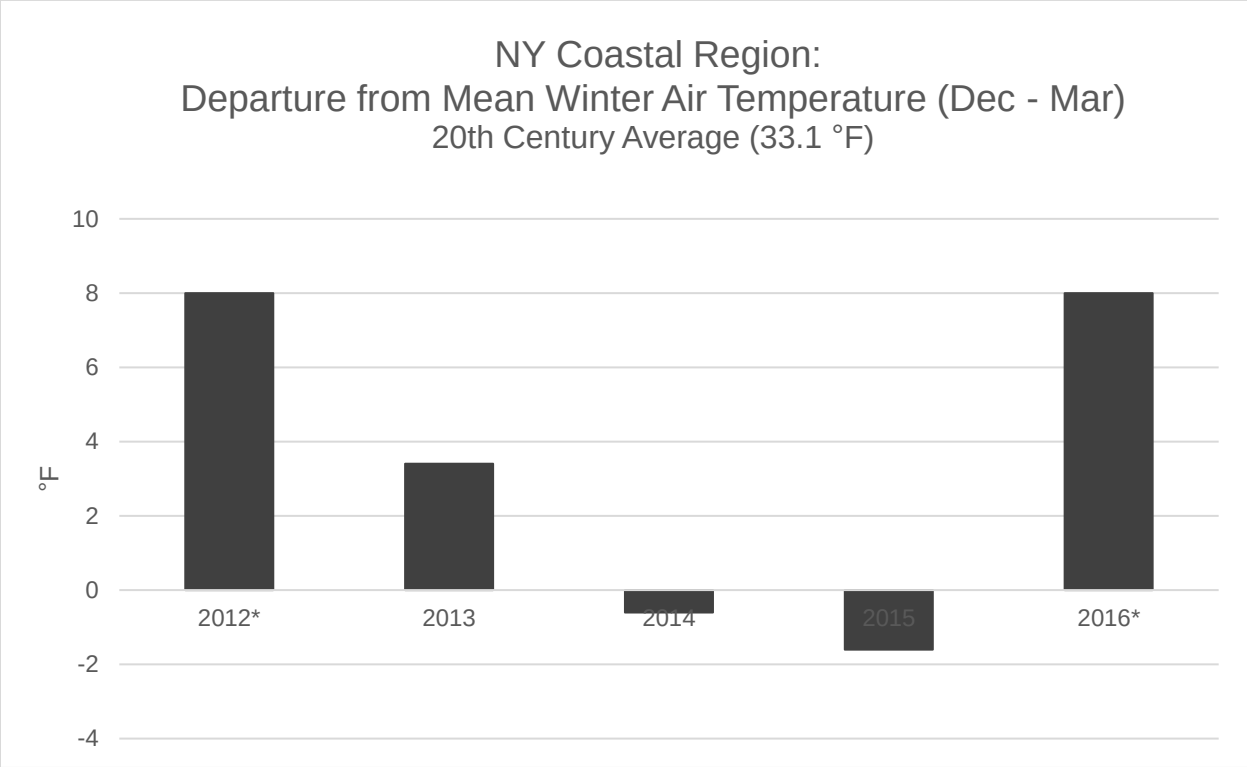


Figure 23. A time series showing the departure from mean winter (Dec. – Mar.) air temperature in the NY Coastal Region ("Climate at a Glance", 2016).
** 2012 & 2016 were the warmest winters on record.*



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