



COASTAL RESOURCES DIVISION
ONE CONSERVATION WAY • BRUNSWICK, GA 31520 • 912.264.7218
COASTALGADNR.ORG

MARK WILLIAMS
COMMISSIONER

DOUG HAYMANS
DIRECTOR

Blue Crab Advisory Panel

January 14, 2020 – 6:00PM

Susan Shipman Environmental Learning Center, Brunswick
(5:45PM - Assemble to serve dinner)

- 6:00 Welcome
- 6:05 MFAC Operational Guidelines approval & review of current vacant BCAP seats
- 6:15 Blue Crab Data & Management Review
 - Fisheries Independent: Ecological Monitoring Trawl Survey
 - Fisheries Dependent: Commercial Landings
 - Fishery Management Plan Review
- 6:45 CRD Coastal Incentive Grant Report: Recreational Crabbing in Coastal Georgia
- 7:30 Terrapin Excluder Device Discussion



Georgia Blue Crab FMP Update January 14, 2019

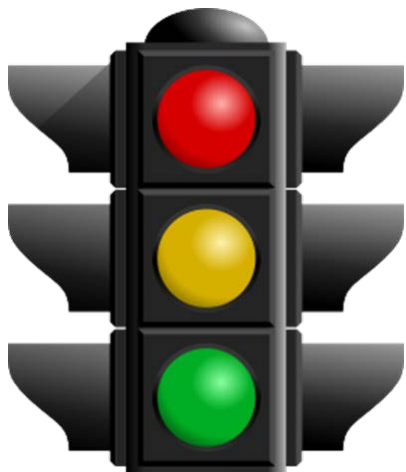
Jared Flowers



Present Blue Crab FMP (June 2008)

- Established as a result of a four year drought (1998-2003) and DOC/NMFS Fishery Failure Declaration (May 2003). Updated in June 2008.
- Threshold Management Approach
 - Data Sources:
 - GADNR EMS Trawl Survey - Spawning Stock
 - Commercial Trip Tickets CPUE (Catch per Trip)
 - Recommendations:
 - Thresholds were set at upper 95%, lower 81% and 95% confidence intervals
 - If a threshold is exceeded for 6 consecutive months a management action can be implemented
 - Implementation will remain until the threshold is NOT exceeded for three consecutive months.

Fishery Management Plan



“Traffic Light Analysis”

“Trigger Management”

“Adaptive Management”

“Threshold Management”

Georgia Blue Crab Management

Criteria for a Threshold “Trigger” Action

- 6 consecutive months must be beyond the threshold value.
- Both Trawl and Commercial CPUE’s must agree.
- Other datasets will be incorporated as time series increases.
- Action can remain in effect up to 90 days (3 months) or until catches fall **WITHIN** acceptable values (recover).
- Actions will be reviewed by DNR Biologists and this advisory panel before implementation.

Georgia Blue Crab Management

Recommended Management Options for each Trigger*

Threshold Value 1: ($> 81\%$ Upper C.I.)

- Relax regulations on harvest of sponge crabs.



Threshold Value 2: ($\leq 81\%$ Lower C.I.)

- Seasonal restrictions on female harvest.
- Can be adults, peelers, or both.
- Does not need to be immediately after the the threshold is reached – Can be timed to allow for biological considerations.



Threshold Value 3: ($\leq 95\%$ Lower C.I.)

- A prohibition on ALL female harvest (hard & peelers)
- Complete harvest moratorium



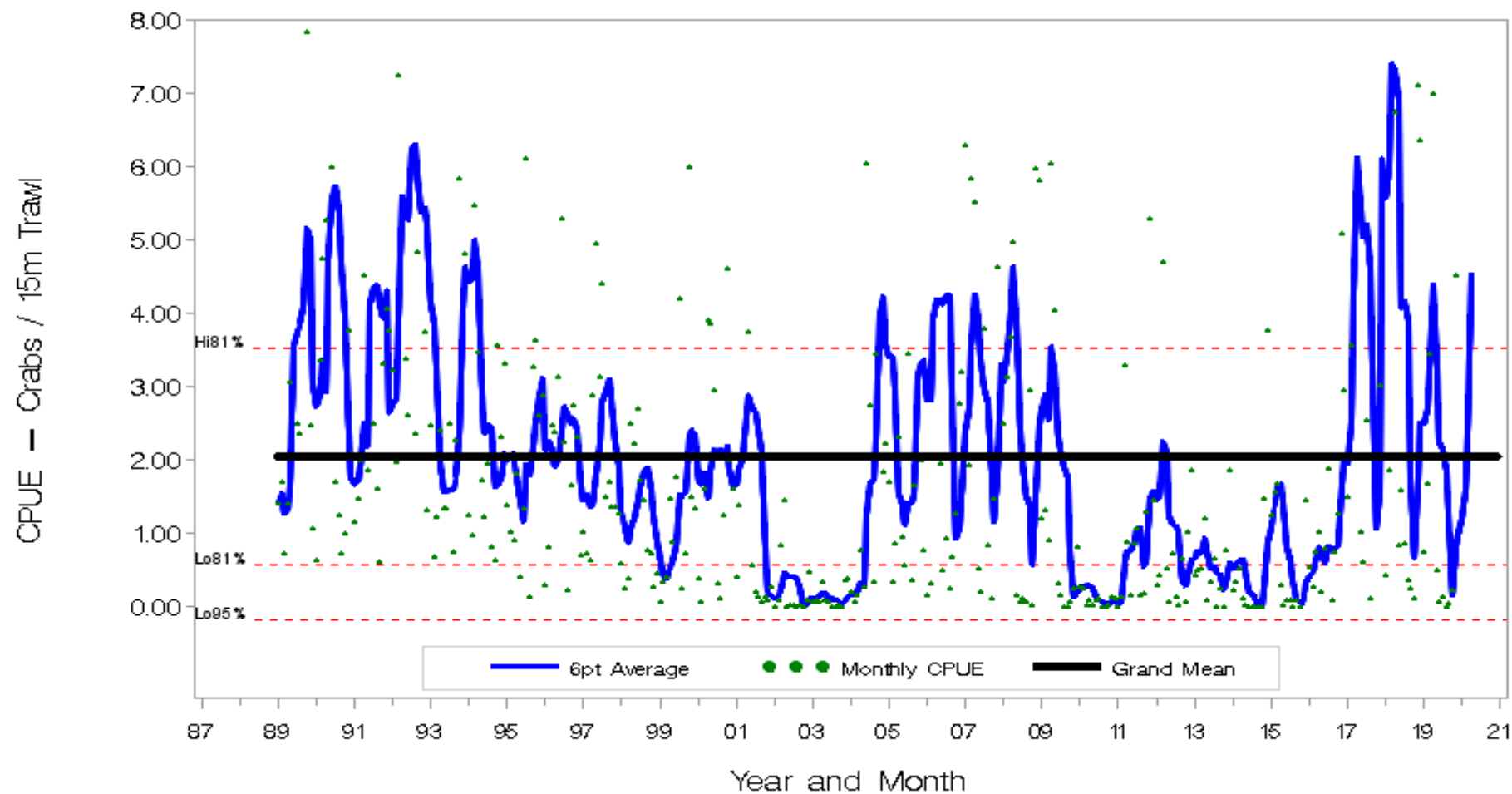
*: As written in 2008 Georgia Blue Crab Fishery Management Plan

Georgia Blue Crab Management

What Happens When a Trigger is “Fired”

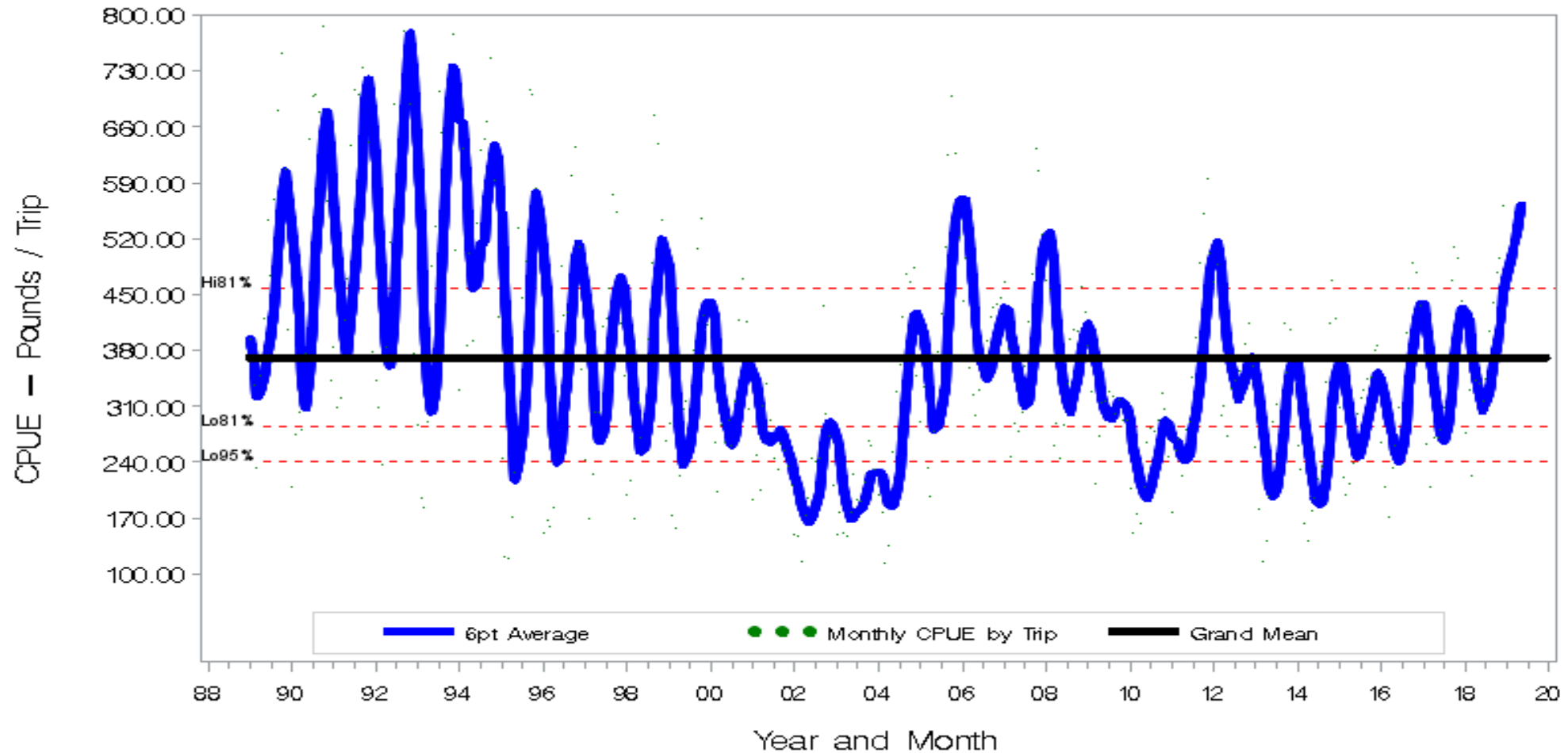
- **Steps to Take**
 1. Update all datasets
 2. Monitor closely beginning in the 4th consecutive month
 3. Convene a meeting of the Blue Crab AP
 - a. Consider the options
 - b. Make a recommendation based on the options
 4. Create an administrative order for Commissioner’s approval.
- **Time Frame:** 30 days to implement.
- **Duration of Action:** Up to 90 days (3 months) but can be continued if circumstances persist.

EMTS Spawning Stock



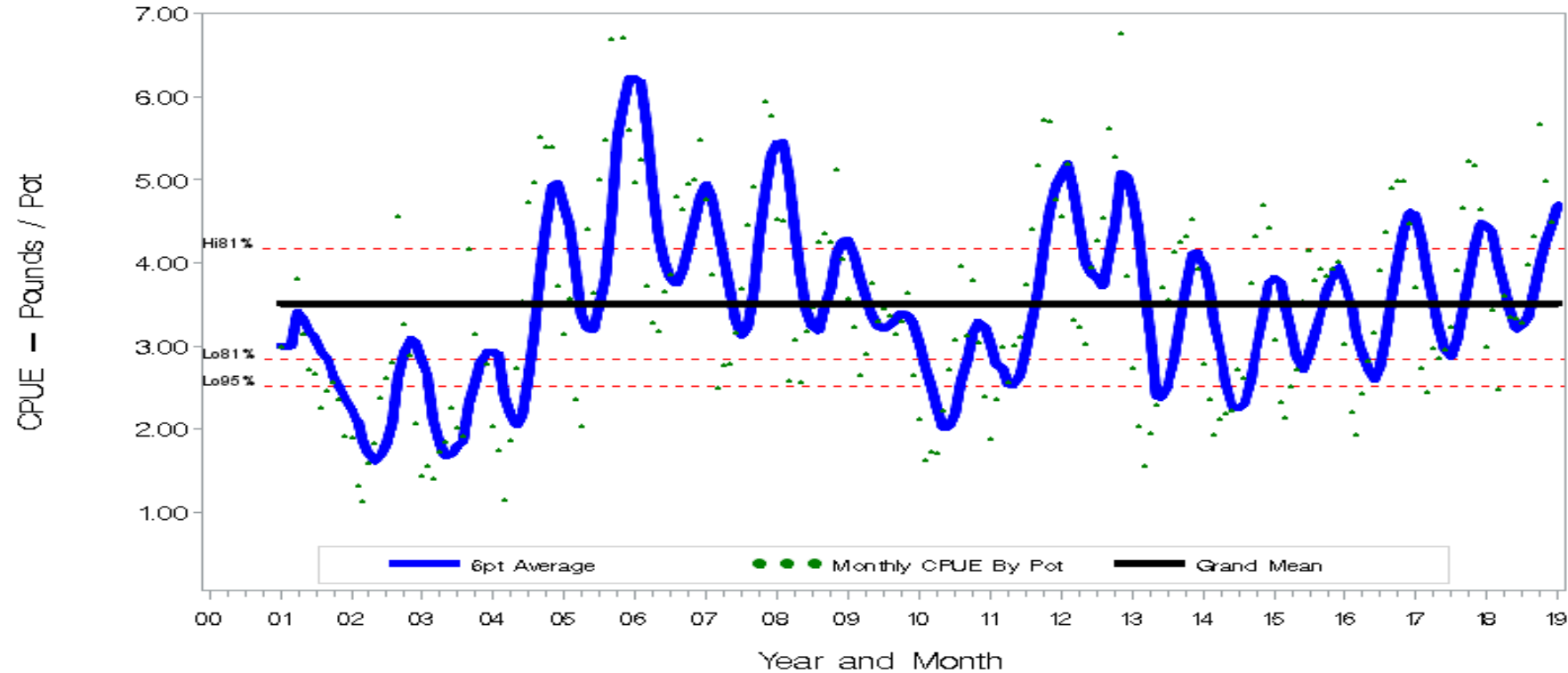
Trigger Values (in #/trawl): Hi81%: 3.47 Lo81%: 0.54 Lo95%: 0.01. Grand Mean: 2.01
Presently: 2 months (Nov-Dec) above the Hi 81% CI

Commercial CPUE (lbs/trip)



Trigger Values (in lbs/trip): Hi81%: 459 Lo81%: 284 Lo95%: 240. Grand Mean: 371
No triggers have been met in almost 10 years

Commercial Catch and Effort (pounds per trap)**



Trigger Values (in lbs/pot): Hi81%: 4.18 Lo81%: 2.82 Lo95%: 2.48. Grand Mean: 3.50

** : Not considered in 2008 FMP due to the short time series

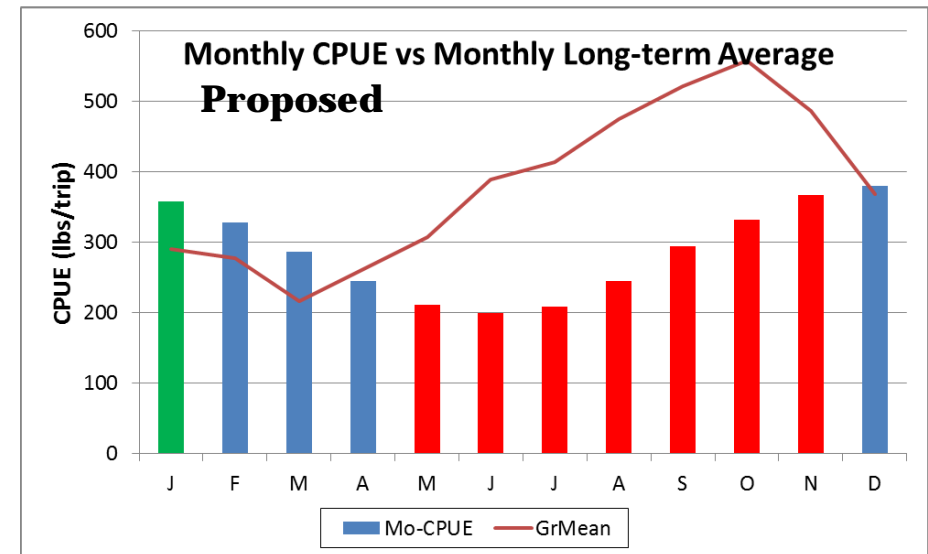
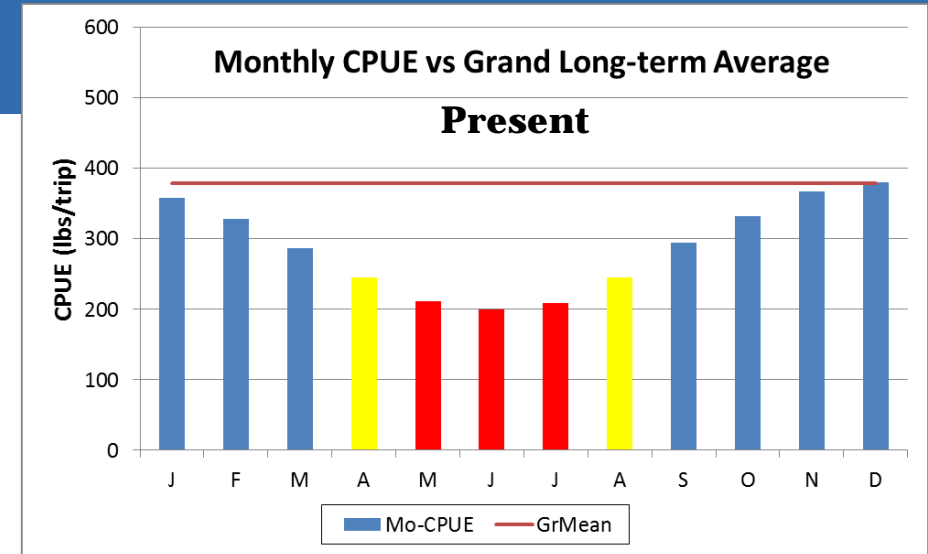
Issues to Consider





Previously Presented to BCAP

- Same Data – 2013 Commercial CPUE
- Using Long-term mean (top) vs monthly long-term mean (bottom)
- Bar color indicates status

Month	2013 CPUE	Long-term Average (89-14)	
		By Month	Overall
J	357.68	290.80	378.54
F	328.87	277.90	
M	286.55	216.59	
A	245.50	262.53	
M	210.97	307.17	
J	199.90	388.85	
J	209.14	413.66	
A	245.36	474.97	
S	295.16	521.56	
O	332.66	558.04	
N	366.73	486.99	
D	380.63	367.94	

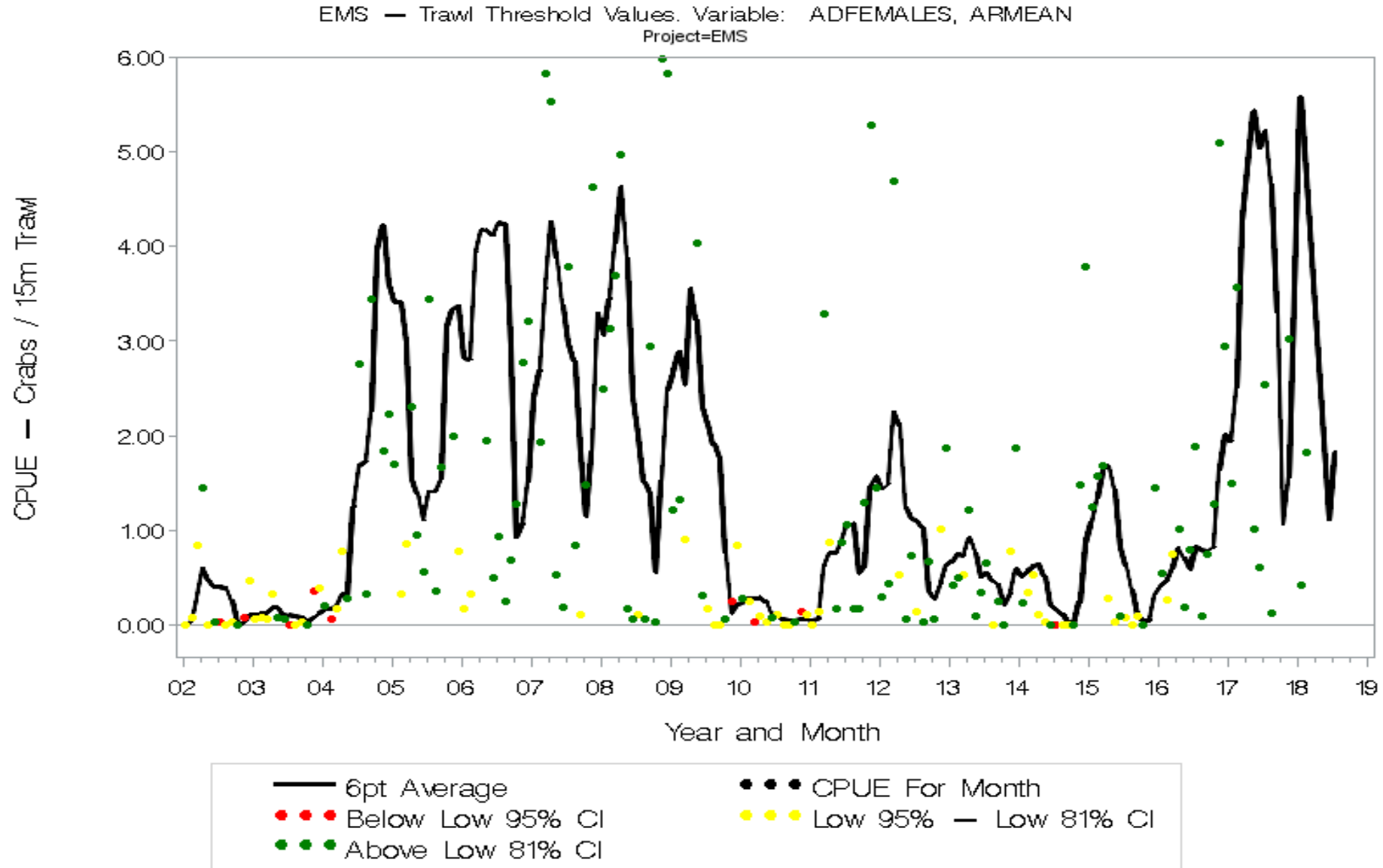
2013 Commercial Crab Harvest



	Within Acceptable Ranges
	Below the lower 95% Confidence Interval
	Below the lower 81% Confidence Interval
	Above the upper 81% Confidence Interval

Alternative Method – Monthly Comparison

EMTS – Adult Females



Proposed Changes to the Plan

- **Data Sets**
 - Continue with EMTS Spawning Stock – Abundance Characteristic
 - Replace Commercial lbs/trip with lbs per pot – Harvest Characteristic
 - Develop an estimate of juveniles – Recruit Characteristic
 - Include MSPHS data?
- **Time Series**
 - Should be consistent for all datasets – Start with 2002
 - Continue with Monthly Analysis
 - Continue with 6 consecutive months to trigger
 - Begin using Traffic Light Analysis/Approach

Moving Forward

FMP Update

- Evaluate our surveys and data inputs
 - Is there enough data for us to make decisions?
 - Are there better methods for management?
- Evaluate threshold management plan
 - Is it adequate?
 - Evaluate thresholds and management actions

Moving Forward

Address Research and Monitoring Needs

- Establish full-time water quality monitoring
 - Placed in key river systems statewide
 - At minimum record temperature and salinity
 - Use data to standardize EMTS data
- Investigate options for a dedicated crab survey
 - Various surveys used by other states
 - Incorporate survey into future management plans

Estimating the Impact of Recreational Crabbing in Georgia

Blue Crab Advisory Panel
January 14, 2019



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Acknowledgements



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Background

- Popular recreational activity
- Formal recreational crabbing survey hasn't been conducted in over 20 years
- Identified management need
- Continued population growth along Georgia coast



Project Goals

1. Characterize Georgia's recreational blue crab fishery:
 - Effort and catch
 - Direct and indirect economic impacts from crabbing trip expenditures,
 - Opinion and knowledge of crabbing regulations
2. Develop outreach resources to educate recreational crabbers on the importance of conserving Georgia's blue crab fishery



Crabbing Survey

- **Online Survey**

- 18 questions

- Effort
- Catch
- Economic expenditures
- Demographics
- Contact information

- **Dock Intercept Survey**

- 22 questions

- Same as online survey + regulations opinion and knowledge questions

2018-2019 CIG Recreational Blue Crab Dock Intercept Survey

Date:	Interview Time:	Interview Number:
Location:		County:
Interviewer:		

Confidentiality Statement:
 This study is being conducted by the University of Georgia's Marine Extension and Georgia Sea Grant Program in collaboration with the Coastal Resources Division of the Georgia Department of Natural Resources. Your participation is voluntary, and your responses will be kept confidential.

- Not counting today, have you participated in recreational crabbing in Georgia within the last 5 years?
 - Yes
 - No *If "no," have participant answer number 2, and then exit the survey.*
- What is the zip code of your primary residence?
- On average, how many days in a given year do you participate in recreational crabbing in Georgia?
- Where do you typically go recreational crabbing?

<input type="checkbox"/> Private dock	<input type="checkbox"/> Beach or bank
<input type="checkbox"/> Public dock/pier	<input type="checkbox"/> Boat
<input type="checkbox"/> Bridge	<input type="checkbox"/> Other _____
- What is the primary gear type that you use for recreational crabbing?

<input type="checkbox"/> Crab pot* <small>commercial style</small>	<input type="checkbox"/> Hand line and dip net
<input type="checkbox"/> Collapsible trap	<input type="checkbox"/> Seine net
<input type="checkbox"/> Ring net	<input type="checkbox"/> Don't know
<input type="checkbox"/> Hand line only	<input type="checkbox"/> Other _____
<input type="checkbox"/> Dip net only	

If participant answers (crab pot), go to number 6.
 If (other choices), go to number 7.
- *How many days a week do you typically check your crab pots?

<input type="checkbox"/> 1	<input type="checkbox"/> 4	<input type="checkbox"/> 7
<input type="checkbox"/> 2	<input type="checkbox"/> 5	<input type="checkbox"/> More than 7 days
<input type="checkbox"/> 3	<input type="checkbox"/> 6	
- On average, how many blue crabs do you catch and **RELEASE** during a typical day of recreational crabbing?

<input type="checkbox"/> Less than 5	<input type="checkbox"/> 21-25	<input type="checkbox"/> 41-45
<input type="checkbox"/> 6-10	<input type="checkbox"/> 26-30	<input type="checkbox"/> 46-50
<input type="checkbox"/> 11-15	<input type="checkbox"/> 31-35	<input type="checkbox"/> Over 50
<input type="checkbox"/> 16-20	<input type="checkbox"/> 36-40	<input type="checkbox"/> Don't know
- On average, how many blue crabs do you catch and **KEEP** during a typical day of recreational crabbing?

<input type="checkbox"/> Less than 5	<input type="checkbox"/> 21-25	<input type="checkbox"/> 41-45
<input type="checkbox"/> 6-10	<input type="checkbox"/> 26-30	<input type="checkbox"/> 46-50
<input type="checkbox"/> 11-15	<input type="checkbox"/> 31-35	<input type="checkbox"/> Over 50
<input type="checkbox"/> 16-20	<input type="checkbox"/> 36-40	<input type="checkbox"/> Don't know
- How many days, on average, make up a typical recreational crabbing trip for you?

<input type="checkbox"/> 1	<input type="checkbox"/> 4
<input type="checkbox"/> 2	<input type="checkbox"/> 5
<input type="checkbox"/> 3	<input type="checkbox"/> More than 5 days
- How many hours, on average, do you spend recreational crabbing* during a typical day?

<input type="checkbox"/> Less than an hour	<input type="checkbox"/> 7-9 hours
<input type="checkbox"/> 1-3 hours	<input type="checkbox"/> Greater than 10 hours
<input type="checkbox"/> 4-6 hours	

*For participants who set crab pots from a boat, "crabbing" includes boat time to and from their crabbing location.

Show crabber separate sheet with answer choices, and have him/her provide the appropriate letter choice for each question.

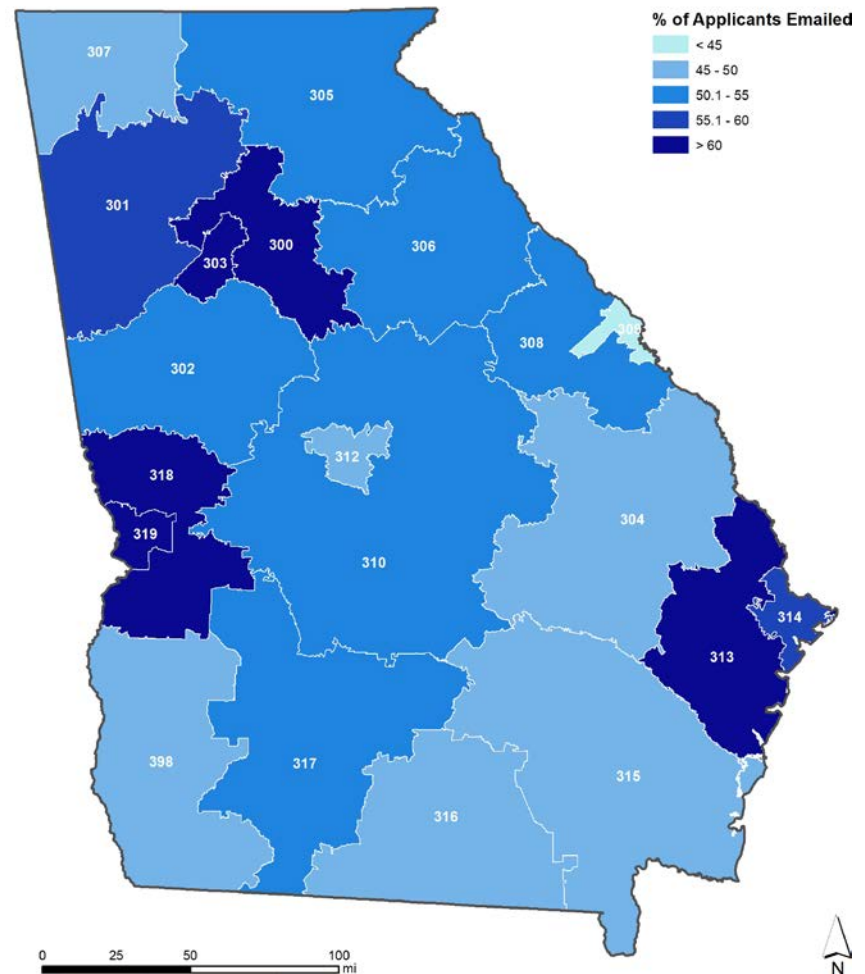
- For the following, please provide your best estimate if applicable: On AVERAGE....
 - How much do you spend on crabbing gear annually? _____
 - How much do you spend on bait per trip? _____
 - How much do you spend on ice per trip? _____
 - How much do you spend on fuel per trip? _____
 - How much do you spend on food per trip? _____
 - How much do you spend on lodging per trip? _____

1



Online Survey Sample

- SIP permit holders: 2013-2018
- Total number of license holders: 753,000
- 397,055 emails provided
 - Survey sent Jan and Feb 2019
- 7,641 survey responses
- Number of emails sent to each 3-digit zip code region proportional to total overall representation in records database
 - <0.00% difference



Dock Intercept Surveys

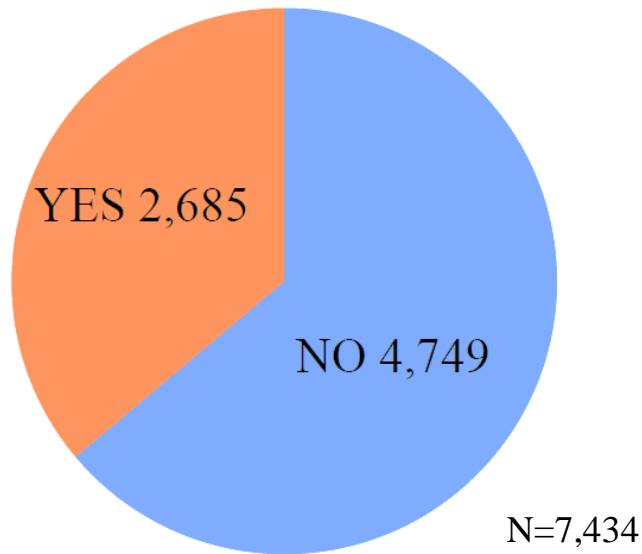
- Public access points
- Oct 2018-Jul 2019
- Active crabbers
- 142 survey responses



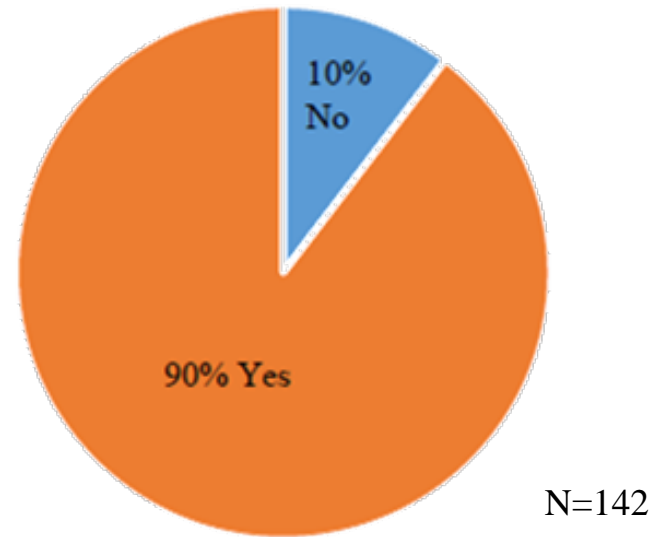
Frank Downing Fishing Pier, Chatham County



Recreational Crabbing Participation



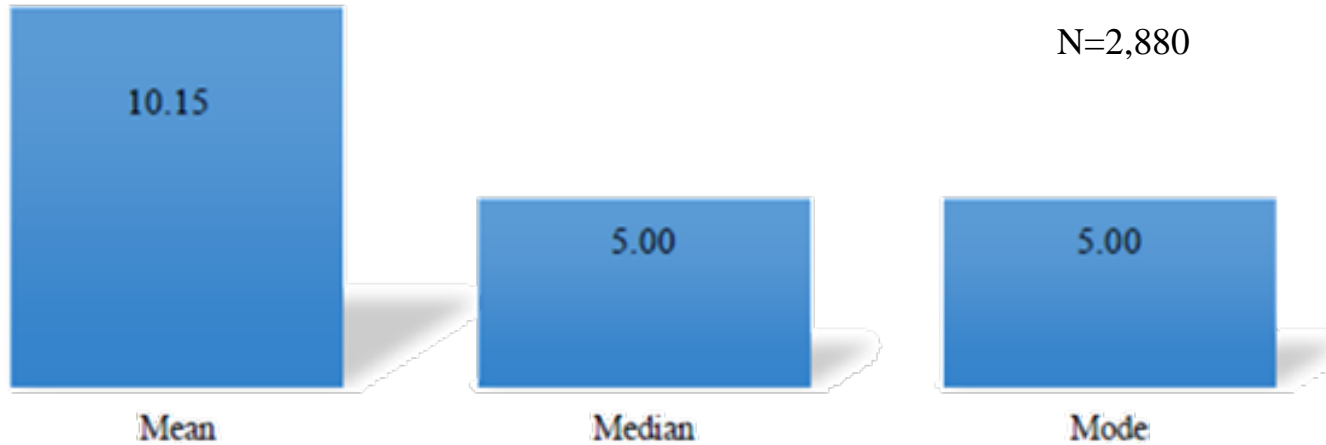
36.1% of online respondents indicated they had participated in recreational crabbing in Georgia within the last 5 years.



Not counting the day they were surveyed, **90%** of dock intercept respondents indicated they had participated in recreational crabbing in Georgia within the last 5 years.

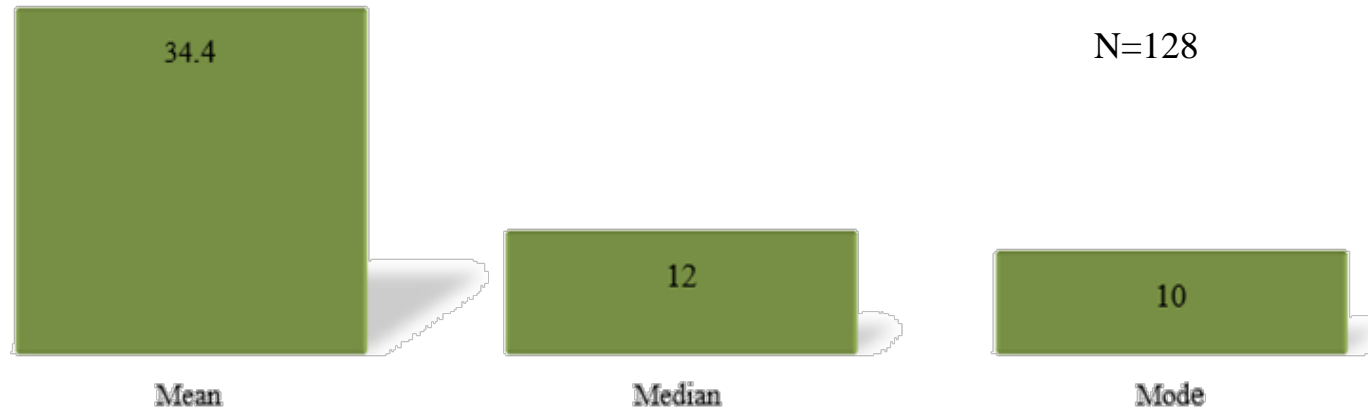


Recreational Crabbing Participation



Online respondents spent an average of **10 days** crabbing in a given year.

Responses ranged from 0 to 364 days per year.

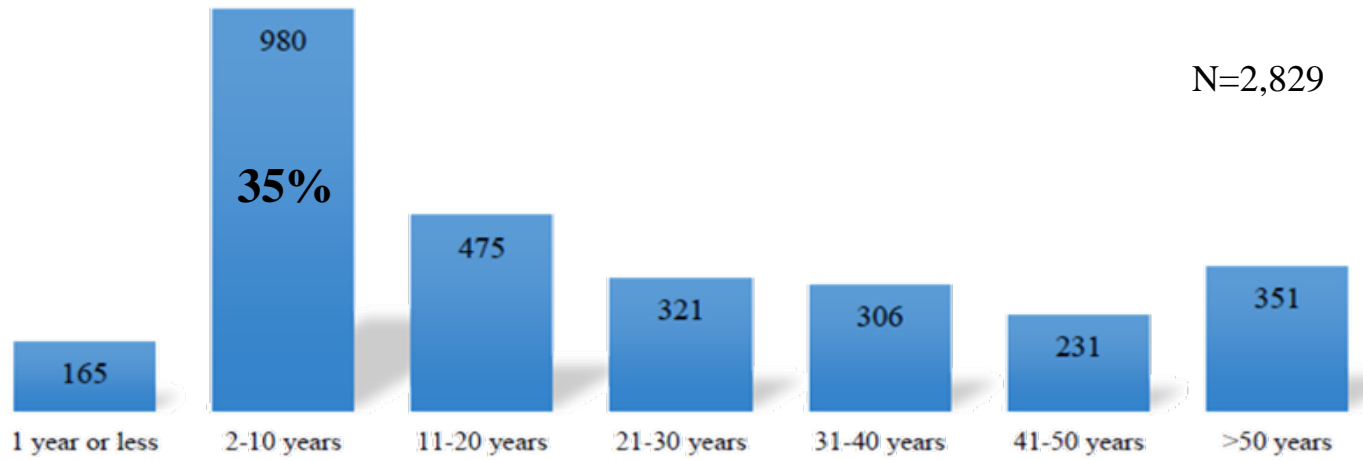


Dock respondents spent an average of **34 days** crabbing in a given year.

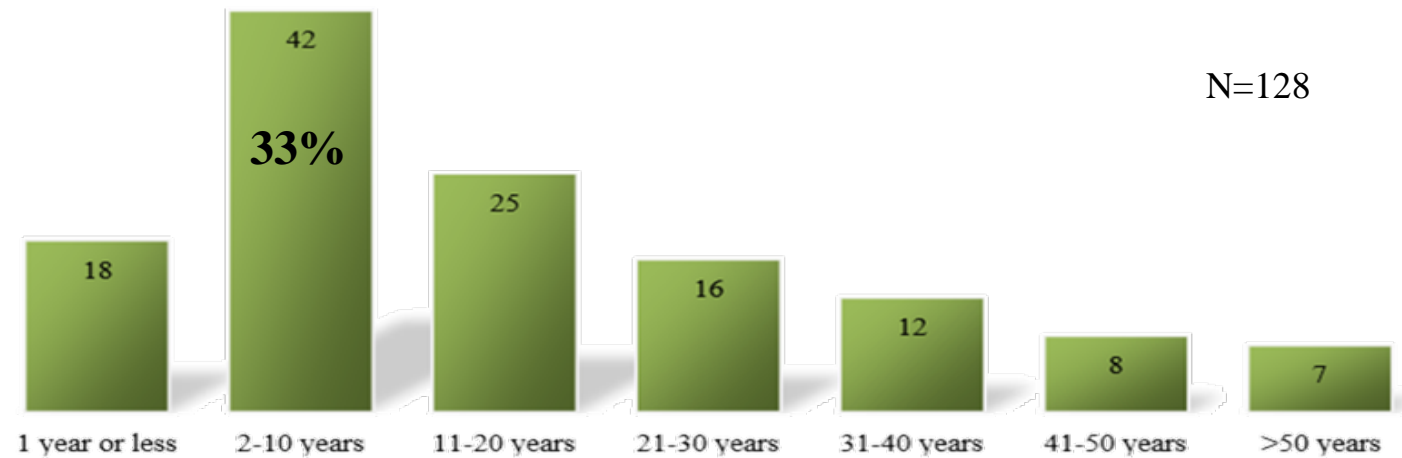
Responses ranged from 0.5 to 320 days per year.



Recreational Crabbing Participation



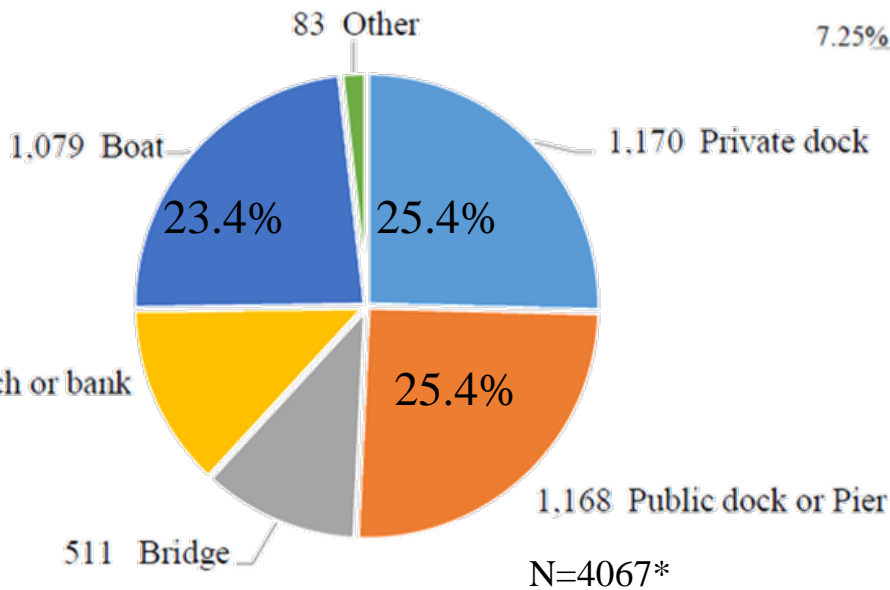
Online respondents spent an average of **21.35 years** crabbing in Georgia.



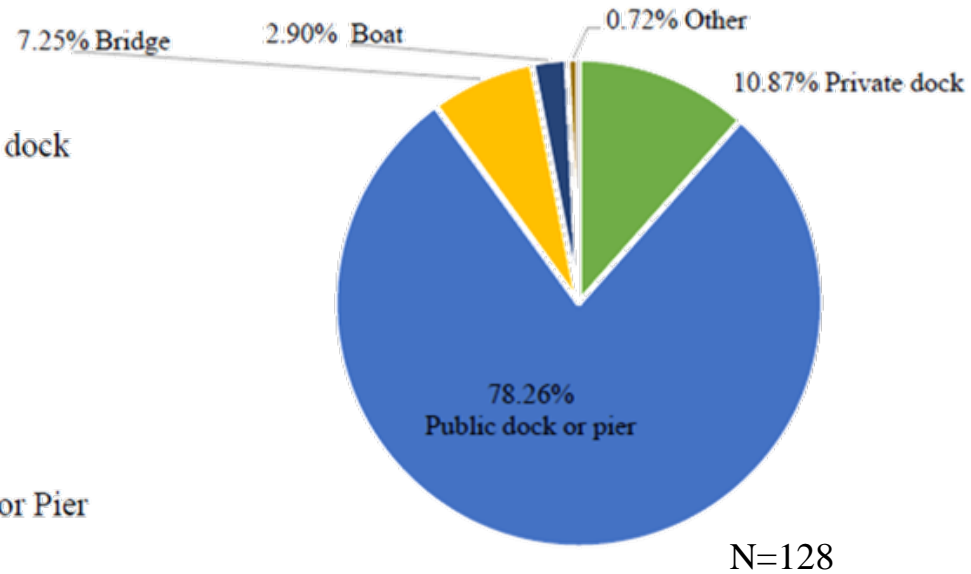
Dock respondents spent an average of **17.85 years** crabbing in Georgia.



Crabbing Locations



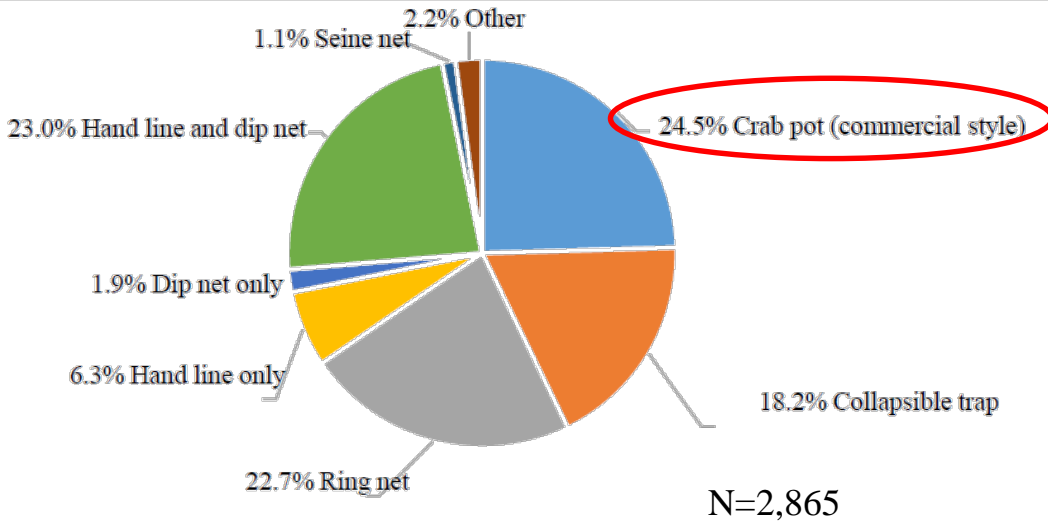
Private docks, public docks/piers, and boats were the most frequent crabbing locations identified by online respondents.



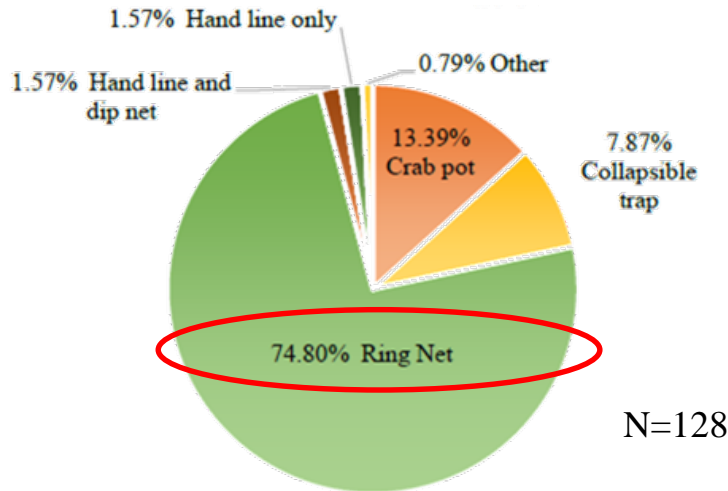
Public docks/piers, private docks, and bridges were the most frequent crabbing locations identified by dock respondents.



Recreational Gear Types



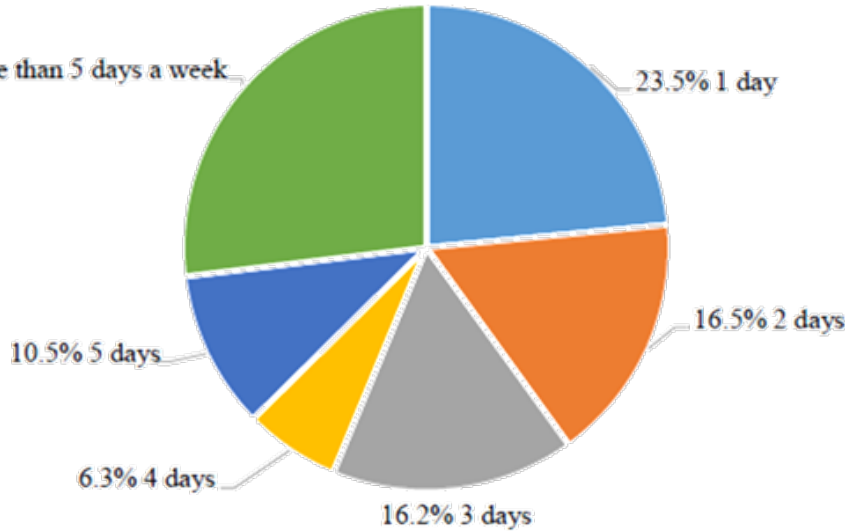
The most popular type of gear used by online respondents included **crab pots, hand line and dip nets and ring nets.**



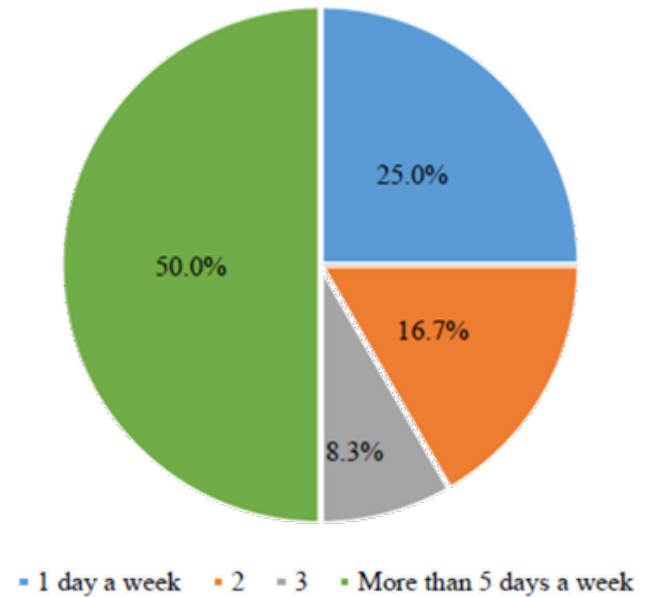
The most popular type of gear used by dock respondents were **ring nets, crab pots, and collapsible traps.**



Checking Crab Pots



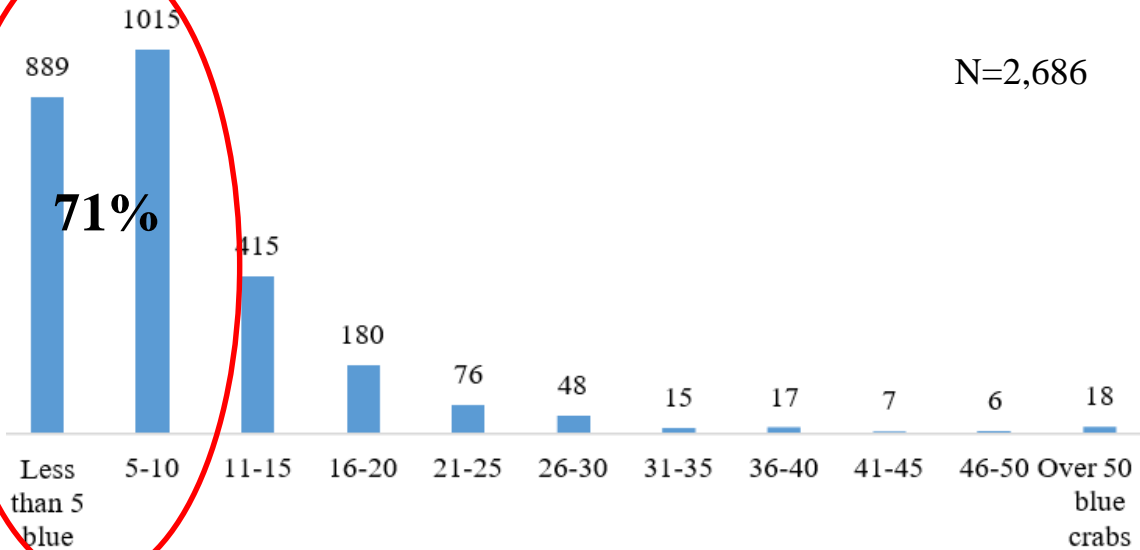
37.4% of online respondents who use crab pots as their primary gear type (N=684) check their traps 5 or more days a week.



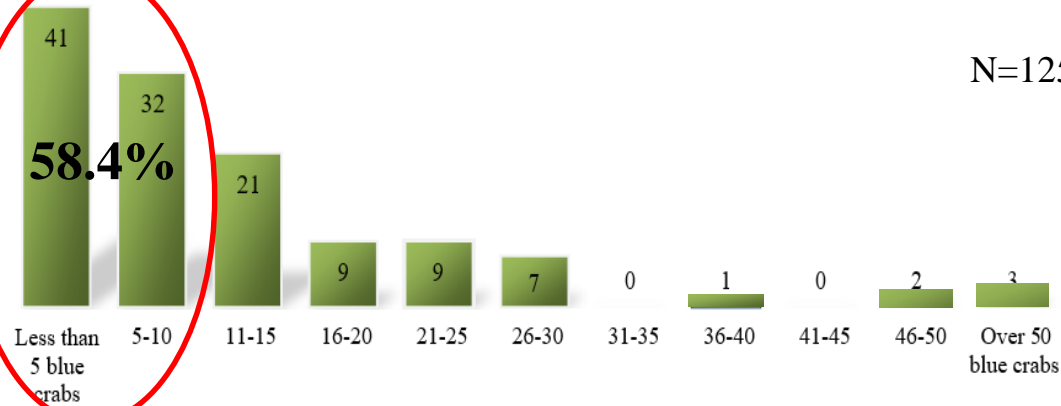
50% of dock respondents who use crab pots as their primary gear type (N=17) check their traps more than 5 days a week.



Recreational Catch



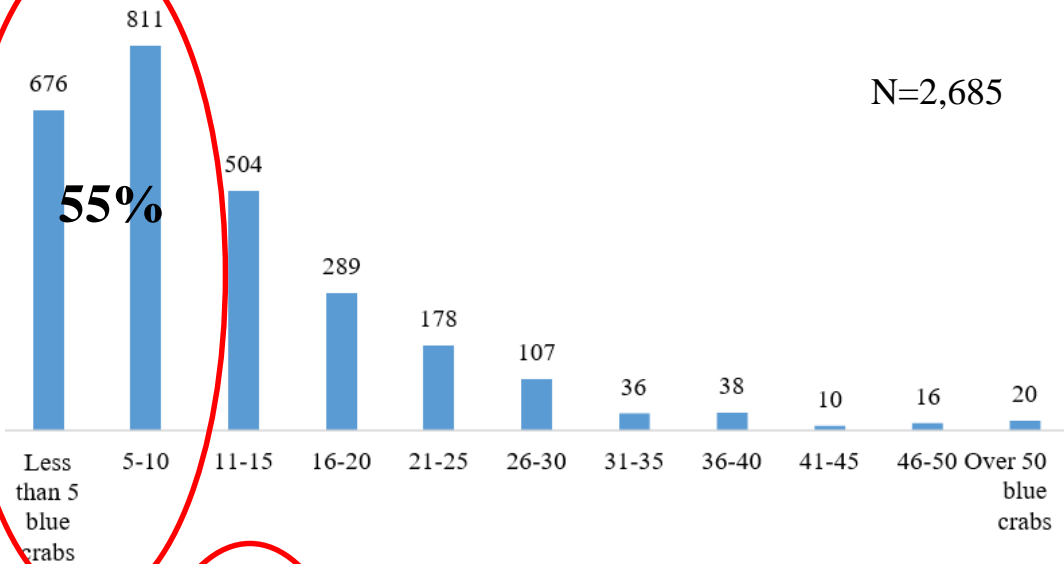
38% of online respondents catch and RELEASE **5-10 crabs** during a typical trip.



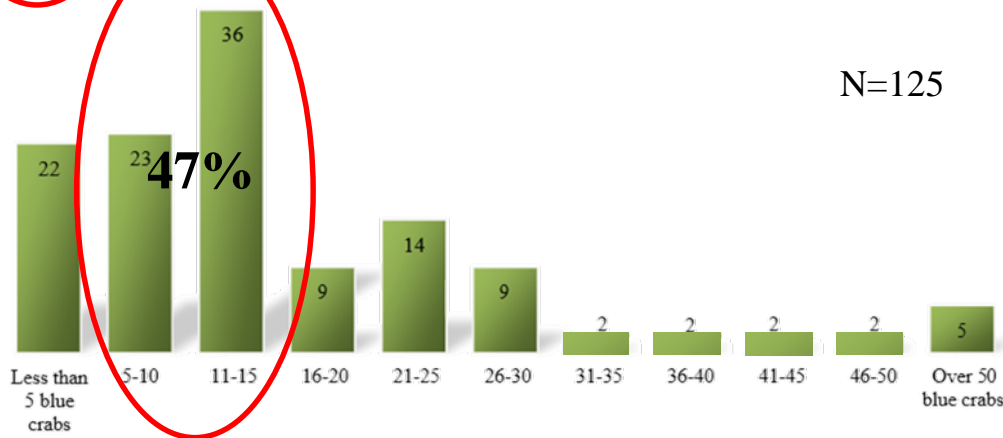
33% of dock respondents catch and RELEASE **less than 5 crabs** during a typical trip.



Recreational Catch



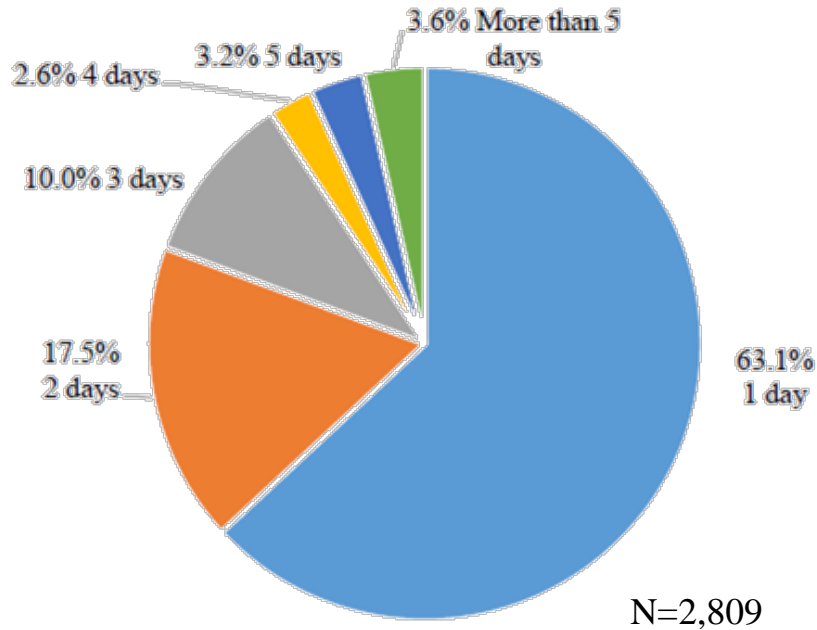
30% of online respondents catch and **KEEP 5 to 10 crabs** during a typical trip.



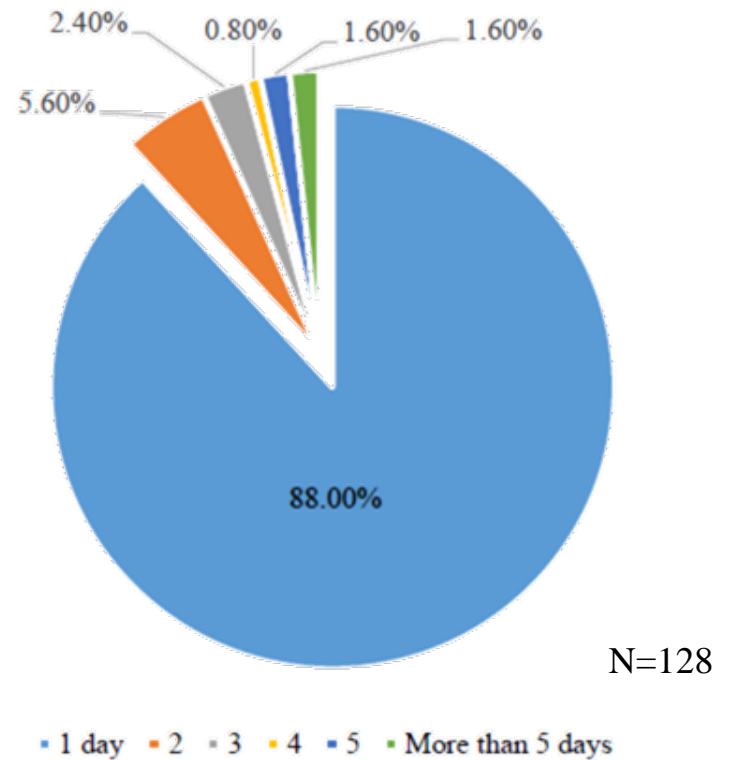
Approximately 29% of dock respondents catch and **KEEP 11-15 crabs** during a typical trip.



Crabbing Effort



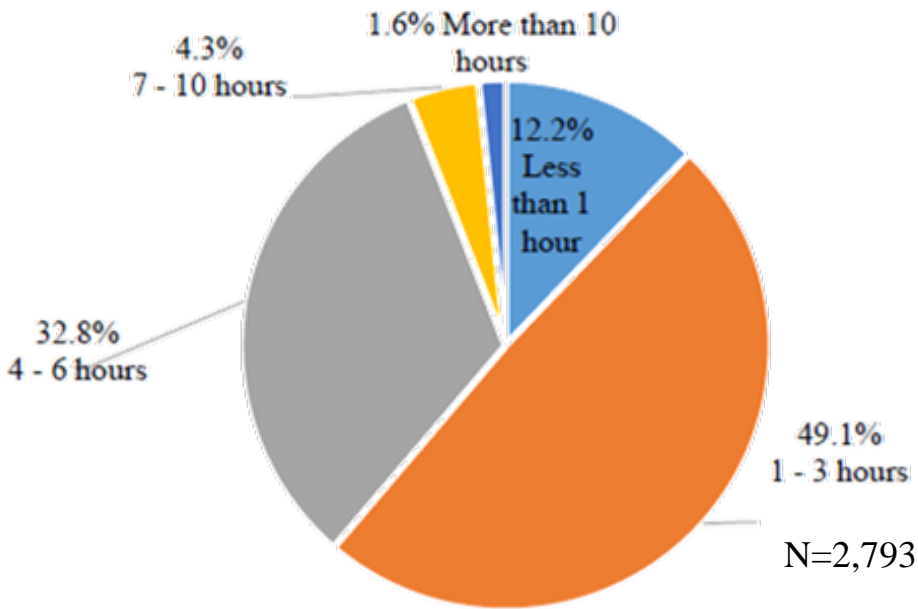
63.1% of respondents indicated a typical crabbing trip is **one day**.



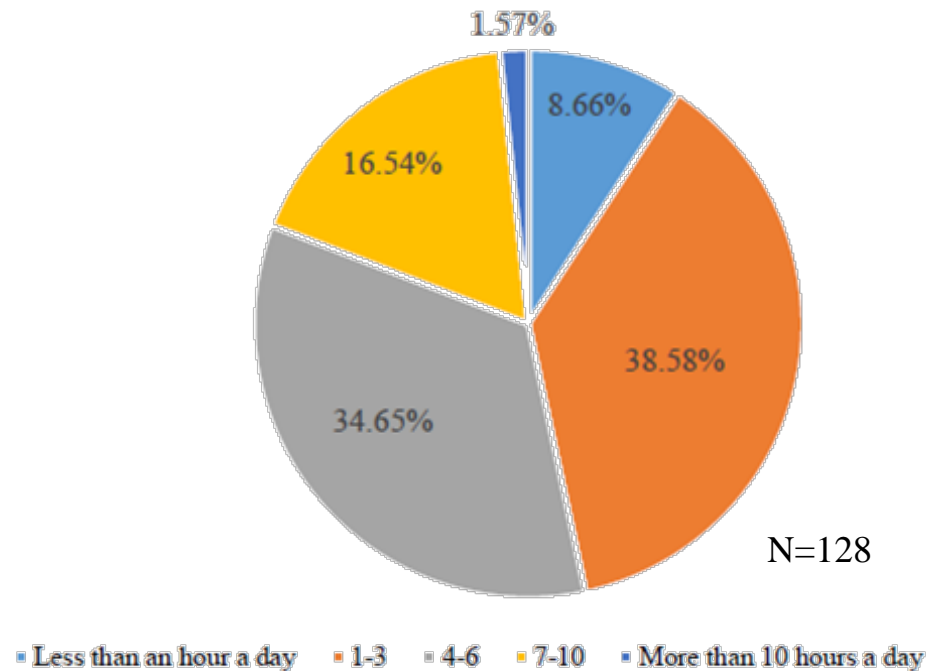
88% of dock respondents indicated a typical crabbing trip **one day**.



Crabbing Effort



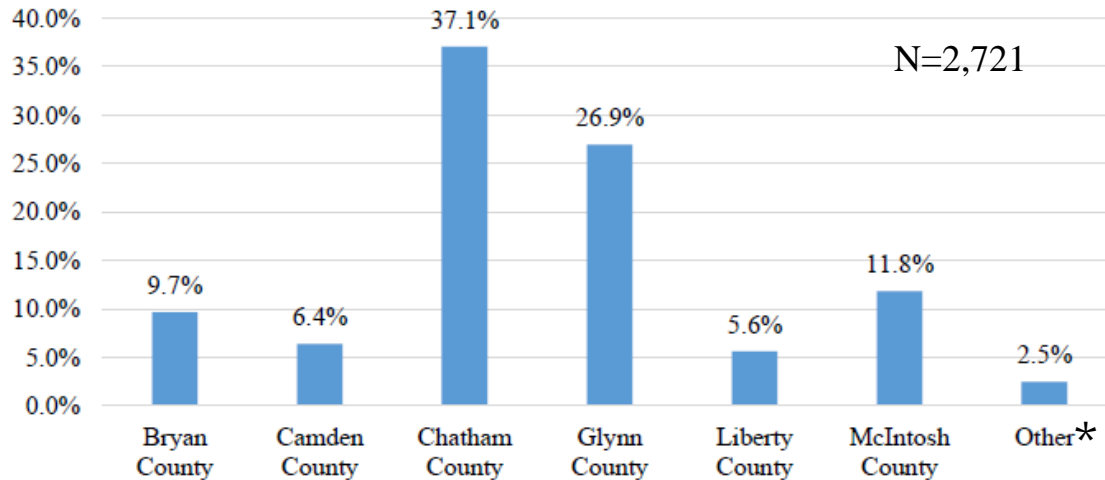
Approximately 50% of online respondents spend between **1 and 3 hours** crabbing during a typical day.



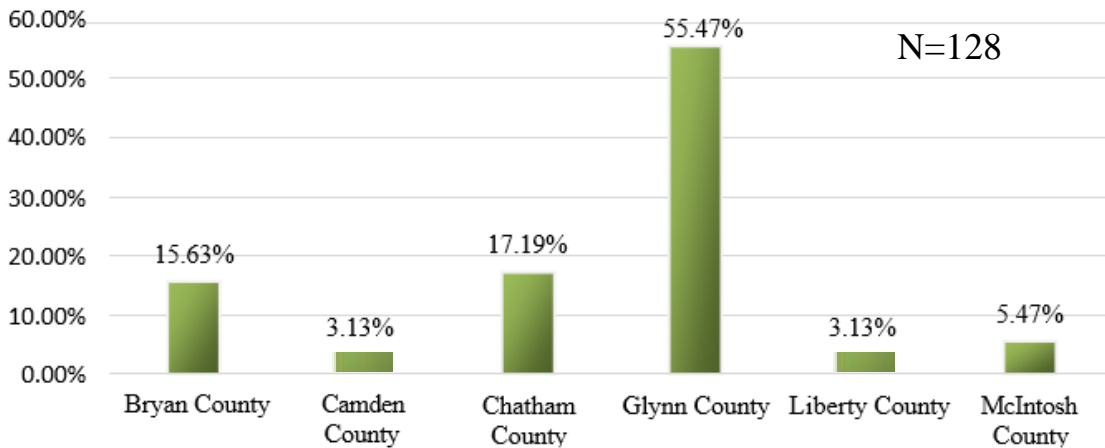
Approximately 39% of dock respondents spend between **1 and 3 hours** crabbing during a typical day.



Effort by County



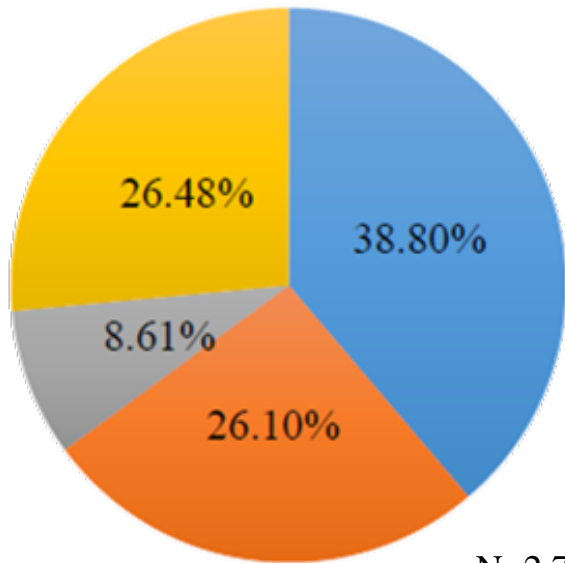
Chatham and Glynn Counties were identified as the two most frequent counties where online respondents participated in recreational crabbing.



Glynn* and Chatham Counties were identified as the two most frequent counties where dock respondents participated in recreational crabbing.

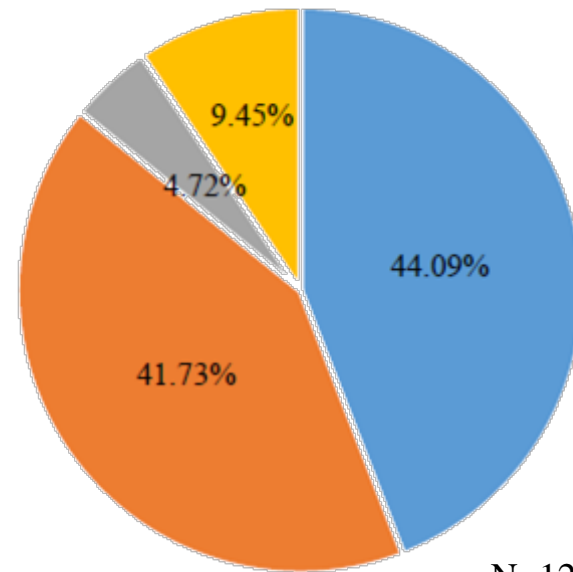


Distance to Crabbing Destinations



N=2,714

■ 0 - 10 miles ■ 11-100 miles ■ 101-200 miles ■ >200 miles



N=128

The average distance online respondents traveled from their primary residence to reach their crabbing destination was **104 miles**.

Responses ranged from 0 miles to 3,000 miles.

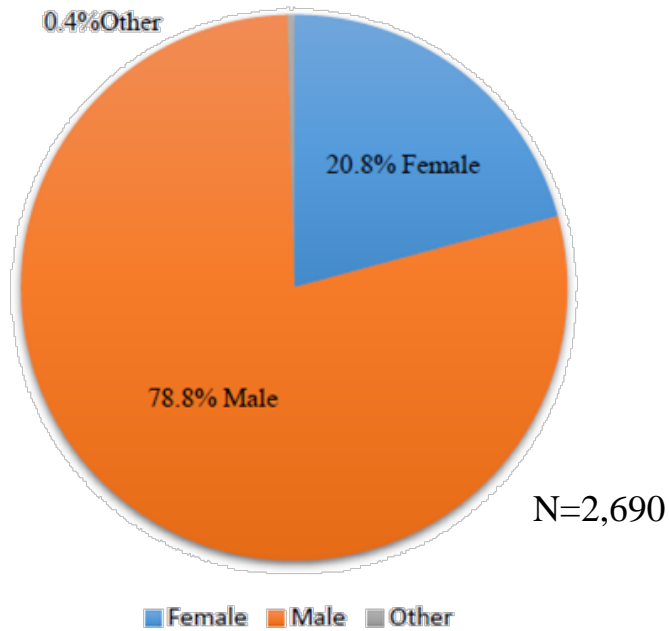
The average distance dock respondents traveled from their primary residence to reach their crabbing destination was **68 miles**.

Responses ranged from 0 miles to 1,200 miles.



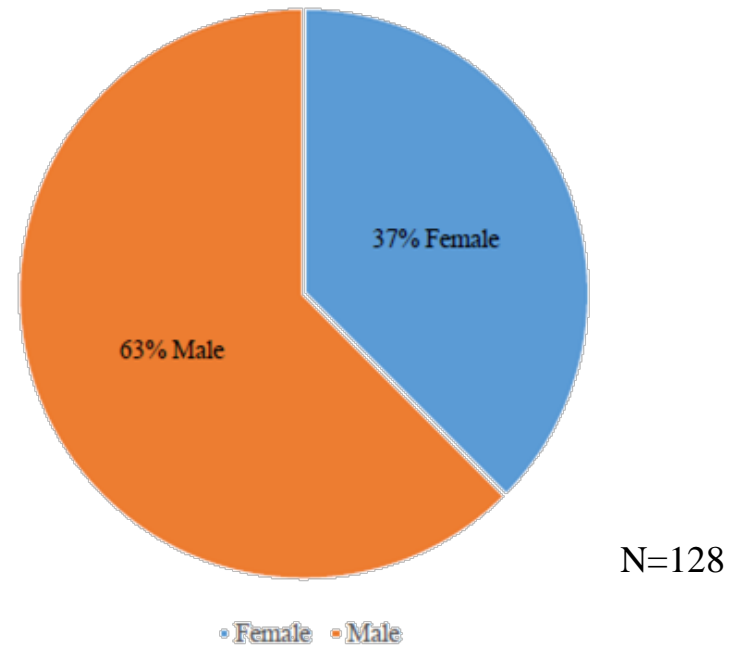
Demographics-Gender

Online Survey



Male: 78.8%
Female: 20.8%

Dock Intercept



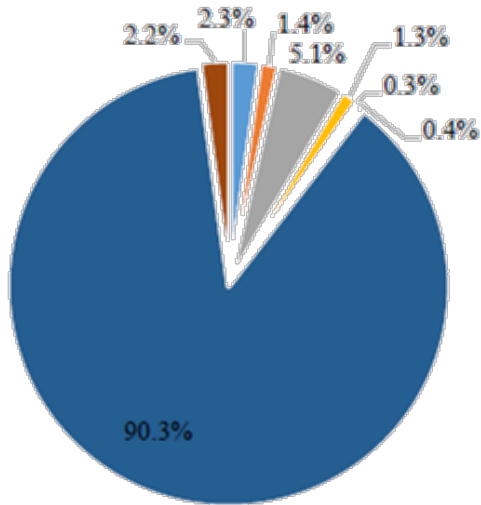
Observation Only

Male: 63%
Female: 37%



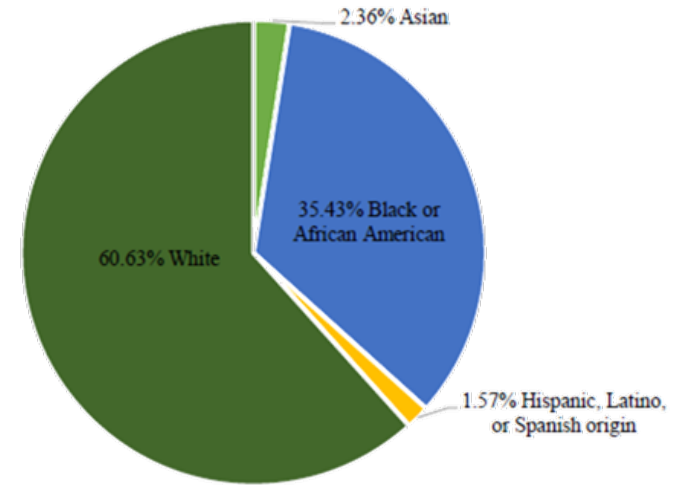
Demographics-*Ethnicity*

Online Survey



N=2,691

Dock Intercept



N=128

- American Indian or Alaska Native
- Black or African American
- Middle Eastern or North African
- White
- Asian
- Hispanic, Latino, or Spanish origin
- Native Hawaiian or Other Pacific Islander
- Other

White: 90.3%

African American: 5.1%

Observation Only

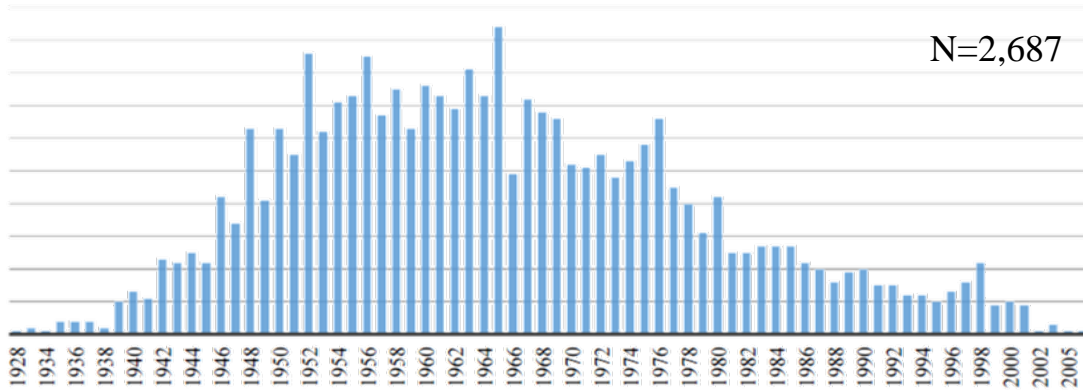
White: 61%

African American: 35%



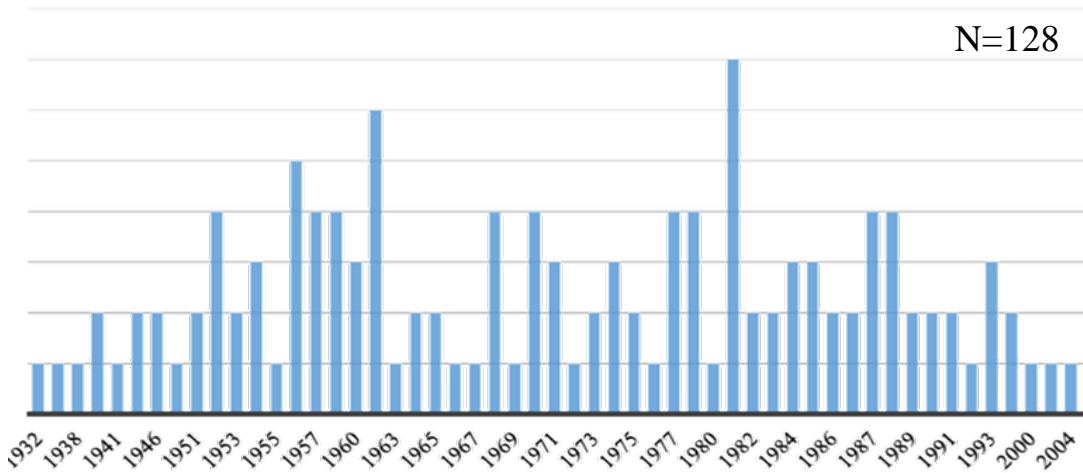
Age of Participants

Year Born



Online Survey

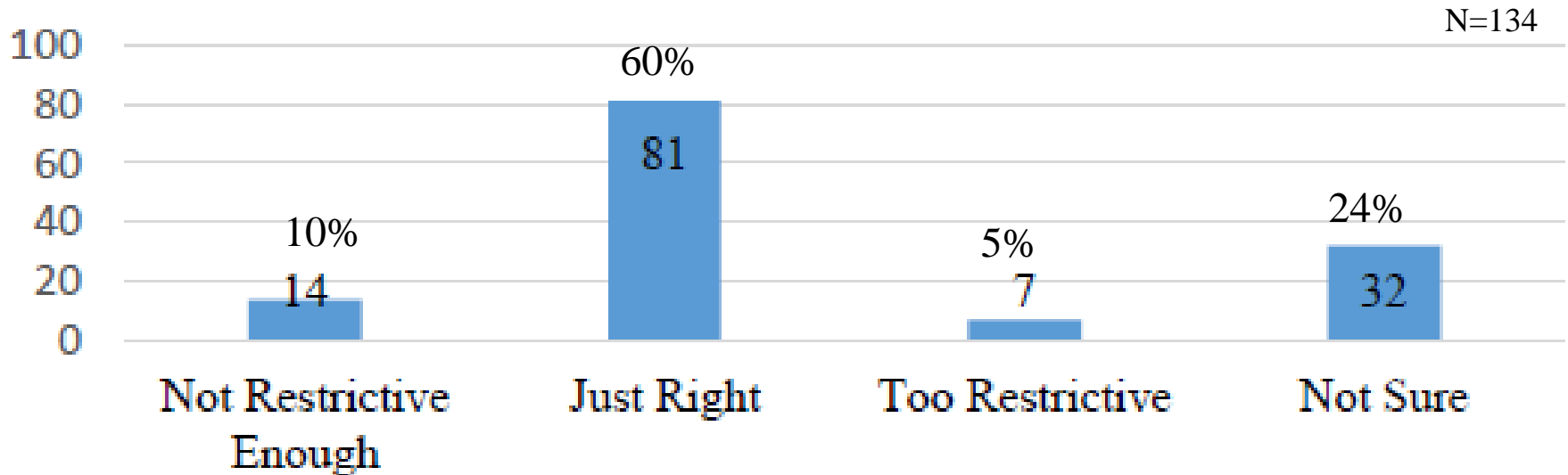
Year Born



Dock Intercept



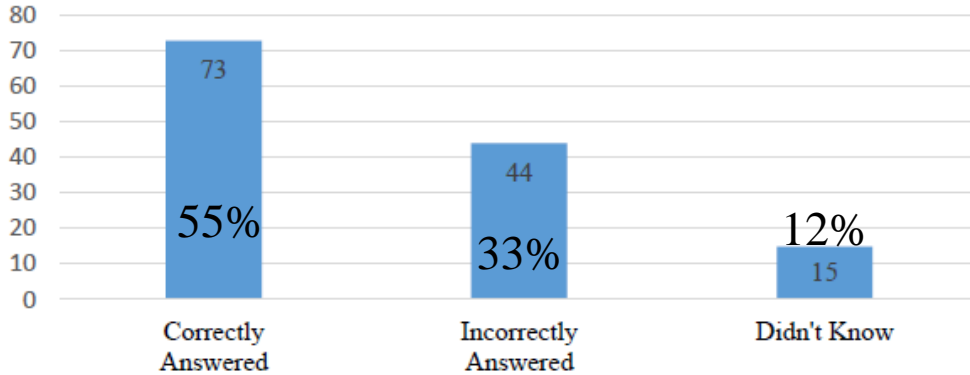
Opinion of Recreational Blue Crab Regulations



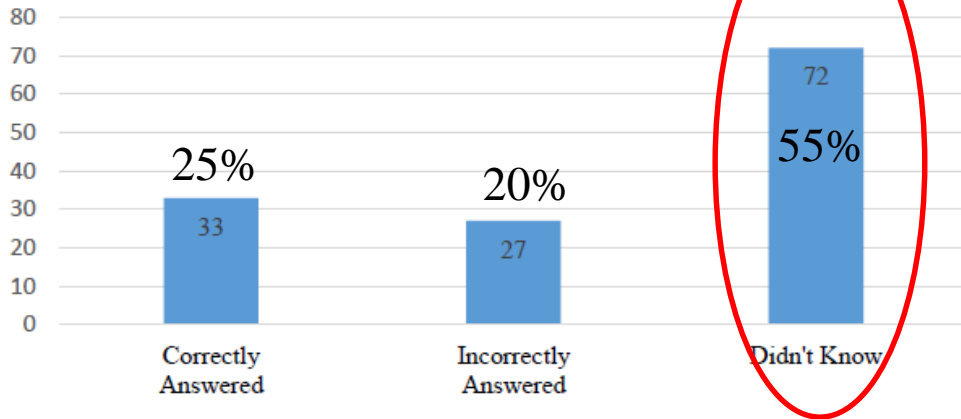
60% of dock intercept respondents indicated the Georgia’s recreational blue crab regulations were *“just right.”*



Knowledge of Crabbing Regulations



55% of respondents correctly answered that the minimum size limit of a blue crab, other than a peeler or a mature adult female, that can be legally harvested is 5 inches.



25% of respondents correctly answered that the recreational daily bag limit was a bushel.

N=132



Legal to Harvest?



86% of respondents correctly answered that this sponge crab would be illegal to harvest.



78% of respondents correctly answered that this sponge crab would also be illegal to harvest.

N=134



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Legal to Harvest?



74% of respondents correctly answered that this mature female crab would be legal to harvest.



24% of respondents correctly answered that this immature female crab would be illegal to harvest.

*60% of respondents said it would be legal to harvest.**

N=134



Contacts for Future Recreational Crabbing Studies



Annual Demand for Goods

TABLE 1. Annual Demand for Goods Attributable to Recreational Crabbing by an Estimated 79,280 Licensed Individuals

Category	Average Annual Amount Spent per Survey Respondent	Annual Total for 79,280 Licensed Individuals
Fuel	\$93.93	\$7,446,388
Food & Beverage/Ice	\$79.50	\$6,303,006
Lodging	\$52.35	\$4,150,437
Bait	\$40.44	\$3,205,919
Equipment	\$22.58	\$1,789,837
		\$22,895,588

Source: CVIOG, Calculated from Crabbing Survey and DNR data



Estimated Economic Impact

TABLE 2. Estimated Economic Impacts of Recreational Crabbing on the Coastal Counties and the Remainder of Georgia

Coastal Counties				
	Employment*	Labor Income**	Value Added**	Economic Output**
Direct Effect	338.0	\$8,986,591	\$13,704,297	\$8,660,557
Indirect Effect	19.3	\$719,479	\$1,292,424	\$2,413,433
Induced Effect	47.7	\$1,813,742	\$3,432,217	\$5,876,013
Total Effect	405.0	\$11,519,811	\$18,428,937	\$16,950,002
Remainder of Georgia				
	Employment	Labor Income	Value Added	Economic Output
Direct Effect	0.0	0	0	0
Indirect Effect	1.1	\$71,286	\$123,542	\$263,322
Induced Effect	1.4	\$75,552	\$133,773	\$258,182
Total Effect	2.4	\$146,838	\$257,314	\$521,504
Georgia Total				
	Employment	Labor Income	Value Added	Economic Output
Direct Effect	338.0	\$8,986,591	\$13,704,297	\$8,660,557
Indirect Effect	20.4	\$790,765	\$1,415,966	\$2,676,755
Induced Effect	49.1	\$1,889,293	\$3,565,989	\$6,134,194
Total Effect	407.5	\$11,666,649	\$18,686,252	\$17,471,506

*Jobs

**2018 dollars

Source:
CVIOG,
IMPLAN




Crabbing Expos and Videos



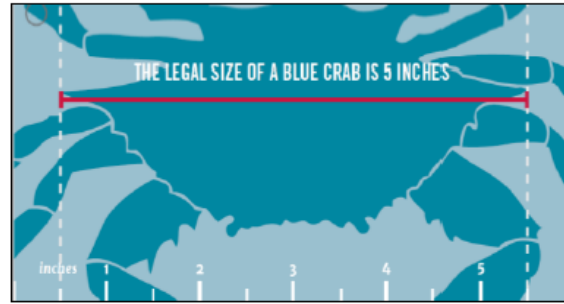
Recreational Blue Crabbing Reference Cards

RECREATIONAL BLUE CRABBING GUIDELINES



Marine Extension and Georgia Sea Grant
UNIVERSITY OF GEORGIA | Sea Grant

This guide aims to provide quick and easy reference for recreational blue crabbers to maintain legal and sustainable practices. Please note that this guide is only a reference. For the most up-to-date saltwater fishing and crabbing regulations visit <https://coastalga.edu/recreational-fishing>.



BLUE CRABBING REGULATIONS

A fishing license and **Saltwater Information Program (SIP) permit** is required for those 16 years of age and older.

A recreational crabber may possess up to **six standard size crab traps** (2 feet by 2 feet) with **two escape rings** on each trap.

Recreational crabbers may take no more than one bushel of crabs during any 24-hour period. No more than two bushels may be taken recreationally or possessed during a 24-hour period on a boat with more than one person on board.

One and a half 5-gallon buckets full of Jimmy-size (5 to 7 inch) blue crabs is approximately the same as **one bushel** of blue crabs.

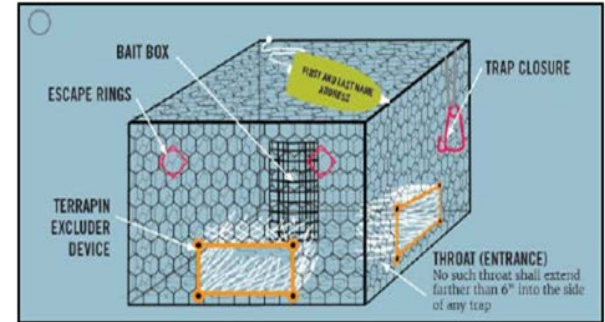
Unless otherwise designated, the saltwaters of Georgia are open year-round for recreational crabbing at any time of day.



LEGAL SIZE OF BLUE CRABS

It is unlawful to take or possess any crab that is **less than 5 inches** from spike to spike across the back (other than a "peeler" or a mature adult female crab).

Peelers, or crabs that show signs of molting, **must measure at least 3 inches** from spike to spike across the back.



LEGAL CRAB HARVEST

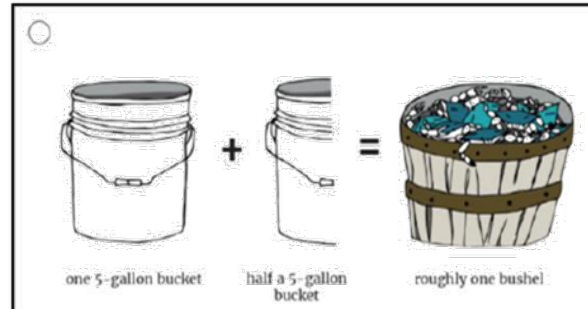
You can distinguish male blue crabs from female blue crabs by looking at the shape of their abdomen or "apron."

Mature male blue crabs, or "Jimmies," have a strongly tapered apron that resembles an inverted T or the Washington Monument.

Mature female blue crabs, or "Sooks," have a broad, rounded apron, similar to the Capital dome.

Immature females, also known as "she-crabs" or "Sallies," have a triangular shaped apron.

It is unlawful to harvest female sponge (egg-bearing) crabs. Sponge crabs have a mass of eggs on their underside. As the eggs develop, the sponge goes from **orange to black** in color. Eggs of any color are alive and the sponge crab should be returned to the water.



CRABBING WITH A CRAB POT

Georgia residents and their immediate family living on private docks **don't need a license** to use a crab trap on their property.

A recreational crabber may possess up to **six standard size crab traps** (2 feet by 2 feet) with **two escape rings** on each trap.

Diamondback terrapin excluder devices, or "TEDs," fit on the outer entrance funnels on crab traps. Although not legally required, these devices prevent terrapins from getting caught in the traps and drowning.

Recreational crabbers are required to mark their traps with a **fluorescent green buoy** bearing the owner's name and address in one-inch letters.

<https://gacoast.uga.edu/fishing-resources/>



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gacoast.uga.edu

Thank You!

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U.S. Representation





Diamondback Terrapin By-catch in the Crab Pot Fishery

Proposed Regulations to Reduce Mortality in Crab Pots

Mark Dodd
Georgia DNR

Diamondback Terrapin Conservation

Purpose

- Present information on terrapin mortality in crab pots
 - Describe conservation measures considered for terrapin protection
 - Present proposed conservation plan
 - Seeking input on the proposal
- *Important to recognize that the current plan is a proposal and is not set in stone



Diamondback Terrapin Conservation

- Small-medium sized turtle
- Concentric rings and grooves on scales of carapace
- Light-green color with dark flecks or markings
- Feet are strongly webbed
- Very attractive turtles, popular in pet trade.
- Historically harvested for food in Georgia



Diamondback Terrapin Conservation

-Terrapins are generally found in the small tidal creeks and along estuarine shorelines from Cape Cod to Texas.

-Not found in open sounds or rivers away from shoreline

-Spend their entire lives in salt marsh.

-Conservation concern throughout their range with regulations in place to protect them from mortality in crab pots in 4 states.

New York- BRDs in commercial and recreational pots in designated areas

New Jersey- BRDs in commercial and recreational pots within 150 ft of shoreline

Maryland- BRDs in recreational pots

Delaware- BRDs in recreational pots



Diamondback Terrapin Conservation

Listed as a State Protected Species



Status-Unusual

“resident species which exhibits special or unique features and because of these features deserves special consideration in its continued survival in the state”

Terrapin Mortality in Crab Pots

Commercial Crab Pots

-DNR funded a statewide terrapin survey in 2007-2008 (UGA).

-Single-year capture recapture abundance estimates.

-Used seine net to capture terrapins.

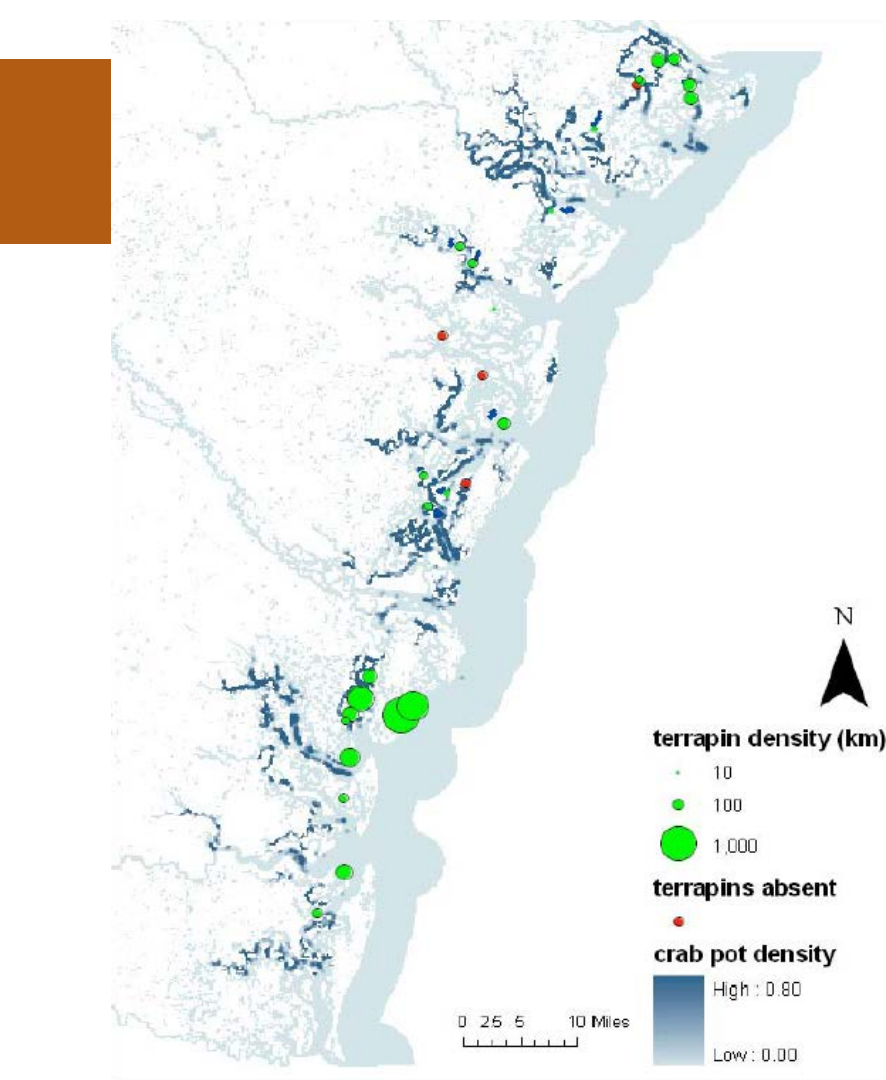
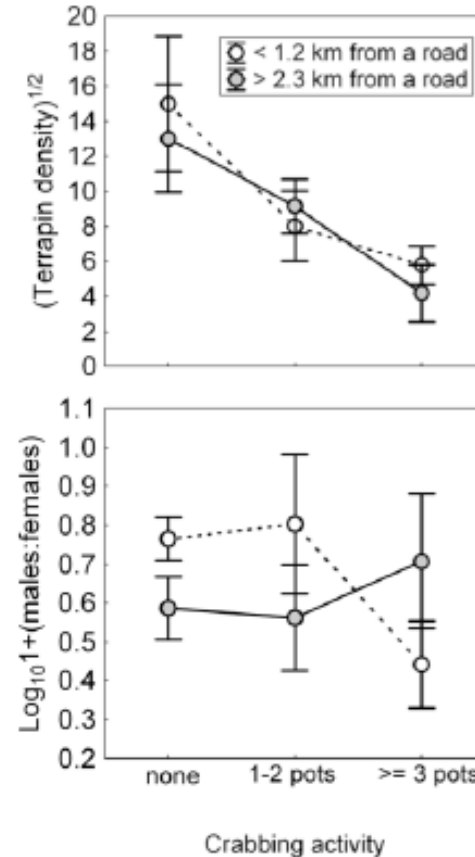
-Sampled in 29 randomly selected creeks

-Found significantly reduced abundance in creeks with heavy crabbing pressure. Terrapins were completely absent from several creeks.

-Single crab pot with over 100 dead terrapins documented.

-Terrapin densities were similar to creeks in South Carolina that have sustained significant declines.

-Found 2 creeks with abundance 4-5 times higher than the rest of the state.



Terrapin Mortality in Crab Pots

Additional Data on Commercial Crab Pots

-DNR conducted a characterization of bycatch in commercial crab pots 2003-2006 (Page et al. 2013).

-Observed 91 crabbing trips (5,707 traps).

-24 terrapin captures

-A total of 2,853,500 trap days during study

-Estimated 12,000 terrapin mortalities over 3 yrs

-Study biased toward large creeks.

-Currently, Georgia crabs are listed as a seafood to **avoid** by SeafoodWatch as a result of terrapin mortality.

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ARTICLE

Characterization of the Bycatch in the Commercial Blue Crab Pot Fishery in Georgia, November 2003–December 2006

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Abstract

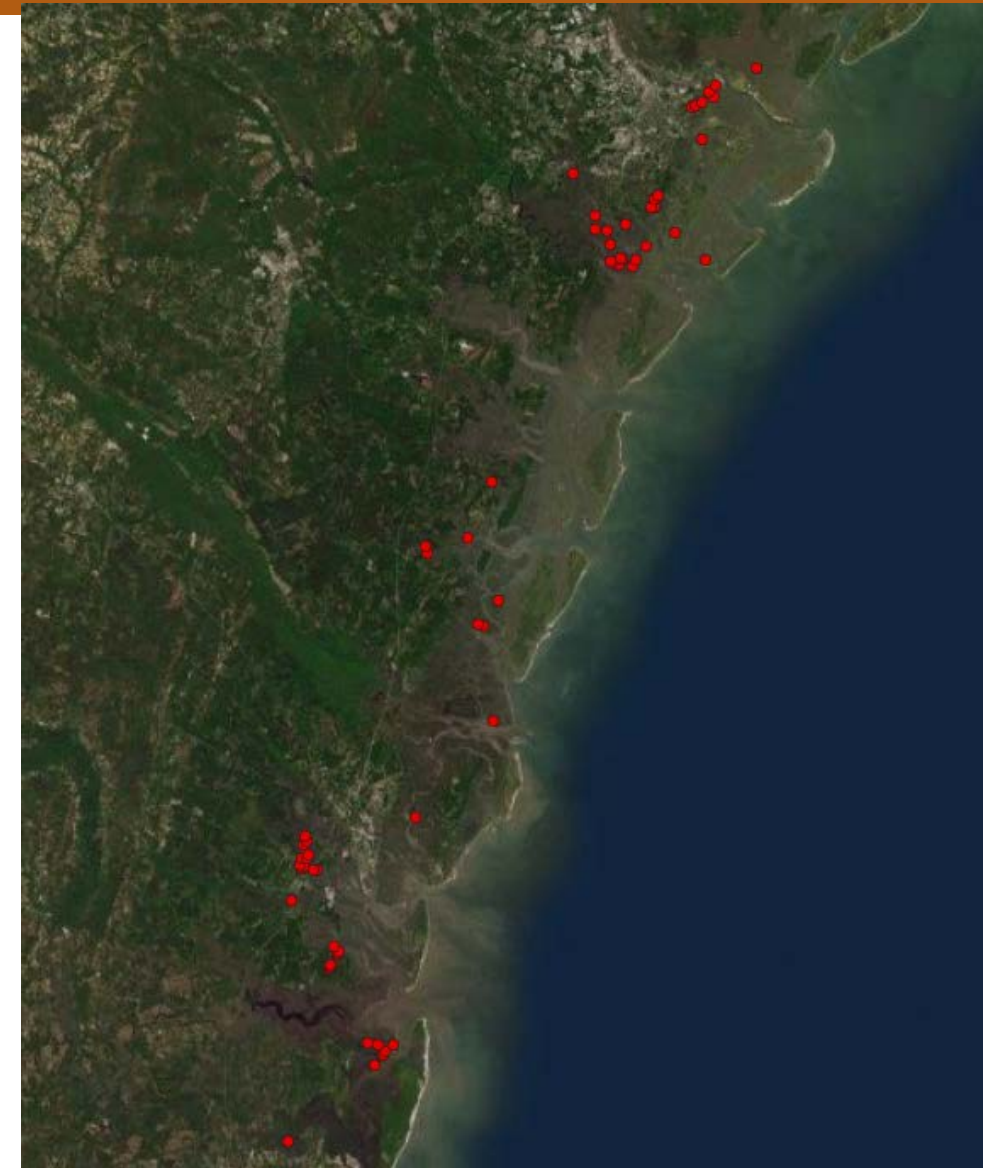
Bycatch studies have been conducted in many fisheries in Georgia, but none has focused on the commercial pot fishery for blue crab *Callinectes sapidus*. The purpose of this study was to identify abundance and seasonality of finfish and invertebrate bycatch species in the commercial blue crab fishery in Georgia. Between November 2003 and December 2006, observers accompanied volunteer commercial blue crab fishers randomly selected from a list of willing participants. A total of 91 trips were observed, with 5,707 commercial blue crab pots sampled. Soak times, or fishing effort, ranged from 24 to 168 h, averaging 55.8 h/trap for each trip. The number of traps sampled each trip ranged from 5 to 163, with a mean of 62.7 traps per trip. We collected 306 finfish and 4,972 invertebrates in this study period. The most numerous finfish were Southern Flounder *Paralichthys lethostigma* ($n = 52$), Atlantic Spadefish *Chaetospira liver* ($n = 50$), Oyster Toadfish *Opsanus beta* ($n = 50$), Hardhead Catfish *Ariopsis felis* ($n = 46$), and Southern Kingfish *Menticorax americanus* ($n = 37$). The most numerous invertebrates species were hermit crabs *Pagurus* spp. ($n = 2,341$), spider crabs *Lilacea* spp. ($n = 532$), stone crabs *Neopippe mercenaria* ($n = 438$), channelled whelk *Hydrobia ulitiformis* ($n = 1,570$), and knobbed whelk *Hydrobia caricea* ($n = 25$). The similarity of bycatch by season was compared using a Morisita similarity index, and results were that Southern Flounder, Atlantic Spadefish, Oyster Toadfish, spider crabs, channelled whelk, and stone crabs varied seasonally. Of all species observed, we conclude that channelled whelk populations may be impacted by this fishery.


The blue crab *Callinectes sapidus*, a member of the Portunidae family, is a common swimming crab commercially and recreationally targeted in several states along the eastern U.S. seaboard, including Georgia. A popular food item, the species is often sold live to various restaurants, processing facilities, or individual consumers. Fishermen may employ any of several gear types to harvest the species, though most commercial crabbers in Georgia utilize pots to harvest blue crabs. While the number of commercial crabbers in Georgia has declined in recent years (totaling < 150 annually), the blue crab fishery remains extremely

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AVOID	Type	Method	Location
	Crab, Blue Blue-Claw, Hardshell crab, Kani, Softshell Crab	Pots	U.S. - Georgia, Western Central Atlantic Ocean

Terrapin Mortality in Crab Pots

Additional Data on Commercial Crab Pots

-Study conducted in Harris Neck National Wildlife Refuge (Lovich et al. 2018).

-Conducted head counts of terrapins and counted crab pots.

-Model found that increase of 1 crab pot in a creek led to a 75% decline in terrapin head counts.

Spatial distribution of estuarine diamond-backed terrapins (*Malaclemys terrapin*) and risk analysis from commercial blue crab (*Callinectes sapidus*) trapping at the Savannah Coastal Refuges Complex, USA

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ABSTRACT

The diamond-backed terrapin (*Malaclemys terrapin*) is a small marine turtle distributed along the Atlantic and Gulf Coasts of the USA. Terrapin populations are declining throughout their range and one of the main causes is mortality by drowning in bycatch in commercially fished blue crab (*Callinectes sapidus*) trap sets. We conducted head counts of terrapins and documented the distribution and number of crab pots on the Savannah Coastal Refuges Complex in southeast Georgia, USA. Using an index for representing relative degree of crabbing pressure, we conducted a spatial risk analysis for each of the four refuges surveyed. We fit a series of generalized linear mixed effect models to test hypotheses about the scale (creek vs. refuge) and scale of which terrapin relative abundance respond to crab trapping and environmental variables. Several models were found to be at high risk of overfitting to the data. We found that blue crab trap density was a strong predictor of terrapin head counts per month. The best model relating terrapin counts to crab trapping revealed a negative effect of crab pots calculated at the refuge level and included a positive association between head count and trap sets. The estimated effect of crab pot number at the refuge level scale suggests that an increase in crab pot density of one per creek is associated with a 74.0% decline in terrapin head counts, underscoring the vulnerability of terrapin populations to crab pot mortality. Mitigation of this mortality factor via redesigned crab traps with bycatch reduction devices may be necessary to maintain healthy terrapin populations on the refuges.

1. Introduction

Overharvest of wildlife species is a major cause of declining populations. Unsustainable use can occur through deliberate harvest for food and other commercial purposes, or passively through excessive bycatch of non-target species (Cox et al. 2007). Bycatch of species as bycatch can have significant negative environmental and economic consequences (Hilborn and Stepien, 2007) for populations, food web, ecosystems, and fisheries (Crowder and Menni, 1998). Although some of the best examples of overharvest involve marine fisheries (e.g., Olson, 2005; Pauly et al., 2003), many species of reptiles are also overharvested at unsustainable levels (Silliman et al., 2008), including by bycatch (Stammann et al., 2011).

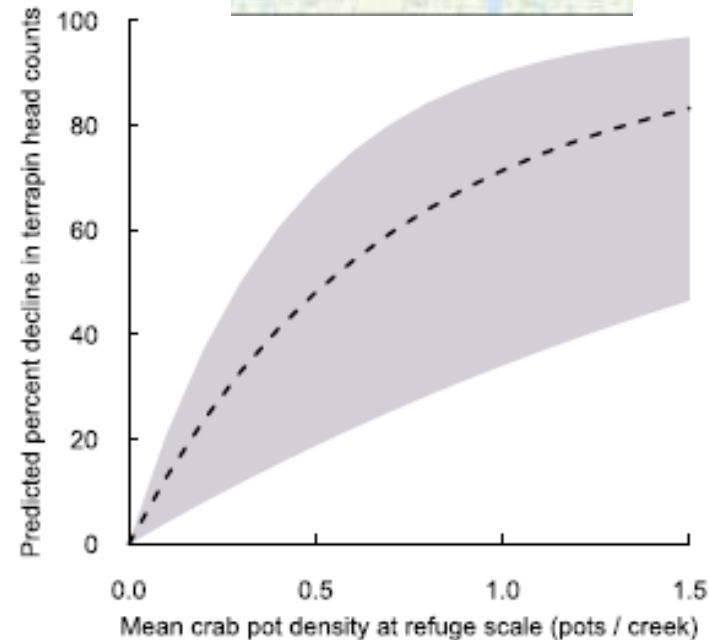
Of the 206 turtle species in the world (Turtle Taxonomy Working Group, 2017), the diamond-backed terrapin (*Malaclemys terrapin*) is the only one that lives in estuarine brackish to salt marsh and brackish estuaries (Stammann et al., 2011). Terrapins are found along the Atlantic and Gulf Coasts of the USA (Drost and Lovich, 2005) with an

isolated population of subspecies prominence in Bermuda (reviewed by Lovich and Hart in press). Salt marshes and adjoining nearshore areas are also important for commercial harvest of shrimp, crabs, and shellfish (Ortiz et al., 2016), some of which require traps to bycatch mortality. Throughout their range, terrapins also face a multitude of other threats including habitat destruction and modification (Gard et al., 2013), and mortality of nesting females (Covach et al., 2017; Jones et al., 2006), and land use (Stammann et al., 2011; Woodruff et al., 2017) and pollution (Droste et al., 2011; Stammann et al., 2007). As a result of population declines reported throughout the range of terrapins, they are a species of conservation concern in several states in the USA (Buller et al., 2006; Hart and Lee, 2006).

Of all the threats facing terrapin populations, the most significant appears to be accidental drowning as bycatch in commercial and recreational traps (also known as pots or seed harvesters) used to collect blue crabs (*Callinectes sapidus*) for human consumption (Hilborn, 1983; Segal and Gilmore, 1995). Conservative estimates project that tens of thousands of terrapins (mostly juveniles, males, and subadult females)

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Terrapin Mortality in Crab Pots

Recreational Pots

- Another source of terrapin mortality in crab pots is the recreational crab pot fishery.
- We have no information on terrapin mortality in recreational pots.
- Catch rates for recreational pots at docks are presumed to be high because traps are not always checked regularly.
- Traps may be set in shallow areas that terrapins are known to use and often not accessible by boat.
- There are licenses for 3,728 recreational docks in Georgia, so mortality could be high enough to have a population level effect.
- Declines in terrapins have been linked to recreational crabbing in other states.



Terrapin Mortality in Crab Pots

Derelict Pots

-Derelict pots represent another potentially significant source of mortality for terrapins.

-Derelict pots include pots that have been lost (no control line/float) or left in the water for temporary storage.

-We have no information on the level of terrapin mortality in derelict pots.

-Anecdotal information indicates mortality could be high.



Problem

-Data shows a significant reduction in terrapin abundance as a result of commercial crab fishery.

-Intent is to pursue a regulation to reduce terrapin bycatch.

-Accomplished through GADNR Board rule.

Goal:

Reduce terrapin mortality in crab pots with no effect on crab harvest

Important Considerations:

-DNR is committed to crab fishery

-We do not want proposed regulations to have an effect on harvest rates.

-We have a proposal but it may not be best way to accomplish our goal.

-We are seeking input on our current proposal.



MacKay River, Glynn Co. 2007



Little Tybee, Chatham Co. 2019

Management Actions Considered to Reduce Terrapin Mortality

Terrapin Excluders (BRDs)

-There are several commercially available BRDs designs including orange plastic TOP-ME BRD and BRDs can be handmade with heavy gauge wire.

-A large number of studies have been conducted on BRD efficiency including a study by MAREX in Georgia.

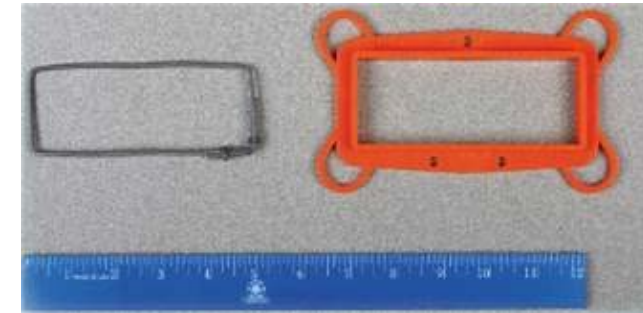
-Overall, standard 2" x 6" opening reduced terrapin captures by approximately 95%

-No statistical differences were found between control traps and traps with BRDs for:

- daily catch rates
- crab lengths
- proportion of legal sized hard shelled crabs
- proportion of legal grade 1 crabs

-Overall number of crabs caught when using excluders was reduced by:

- Plastic Excluder\Vertical external attachment- 30%
- Plastic Excluder\Internal horizontal attachment-18%
- Plastic excluder \Horizontal external attachment-14%



Management Actions Considered to Reduce Terrapin Mortality

Terrapin Excluders cont.

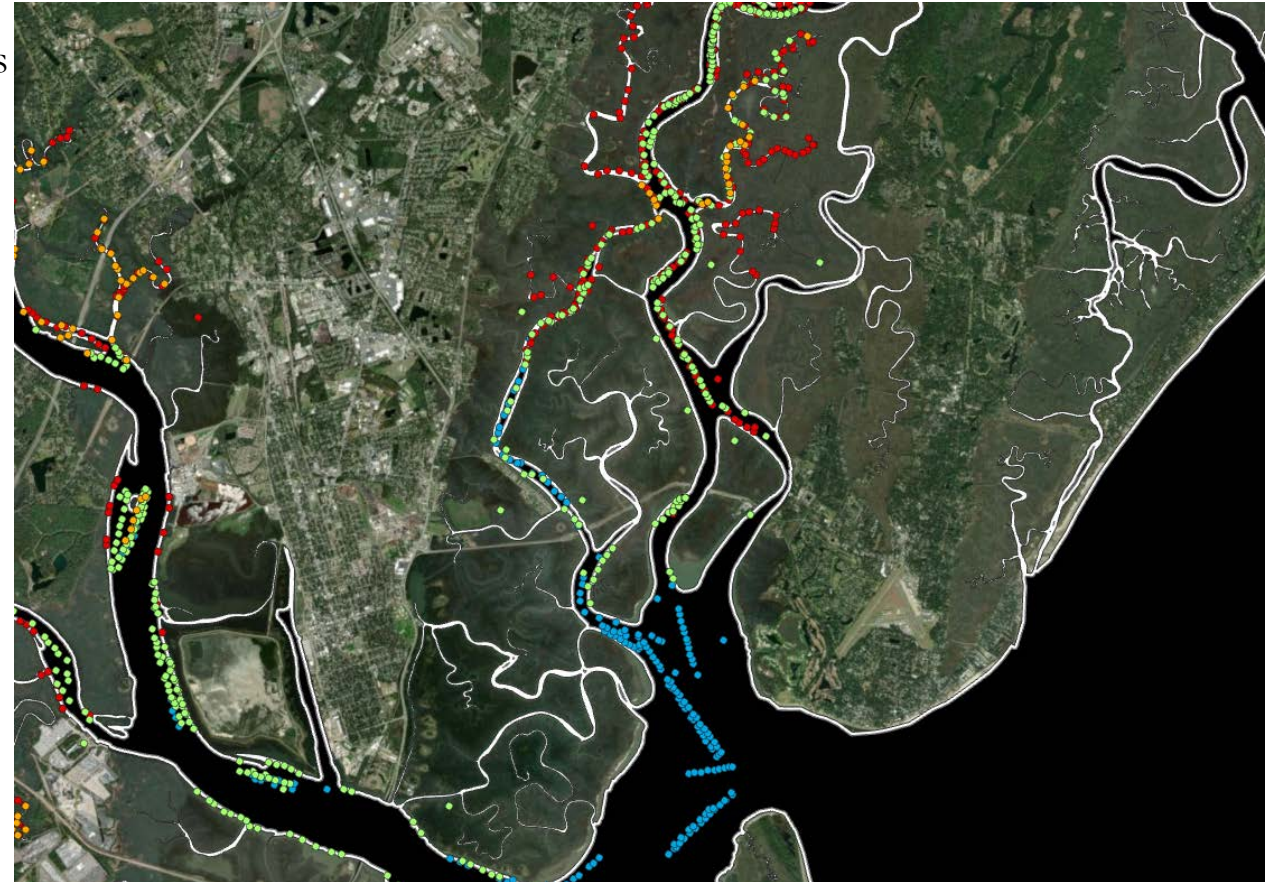
- Considered use of BRDs only in habitat where we expect terrapins to occur (small tidal creeks, estuarine shoreline)
- 100 ft buffer encompasses all of the habitat used by terrapins.
- Plotted crab trap locations from bycatch study examined buffer widths

75 ft buffer- **24%** traps require BRDs (range 8-35%)

100 ft buffer- **32%** traps require BRDs (range 12-45%)

150 ft buffer- **45%** traps require BRDs (range 20-61%)

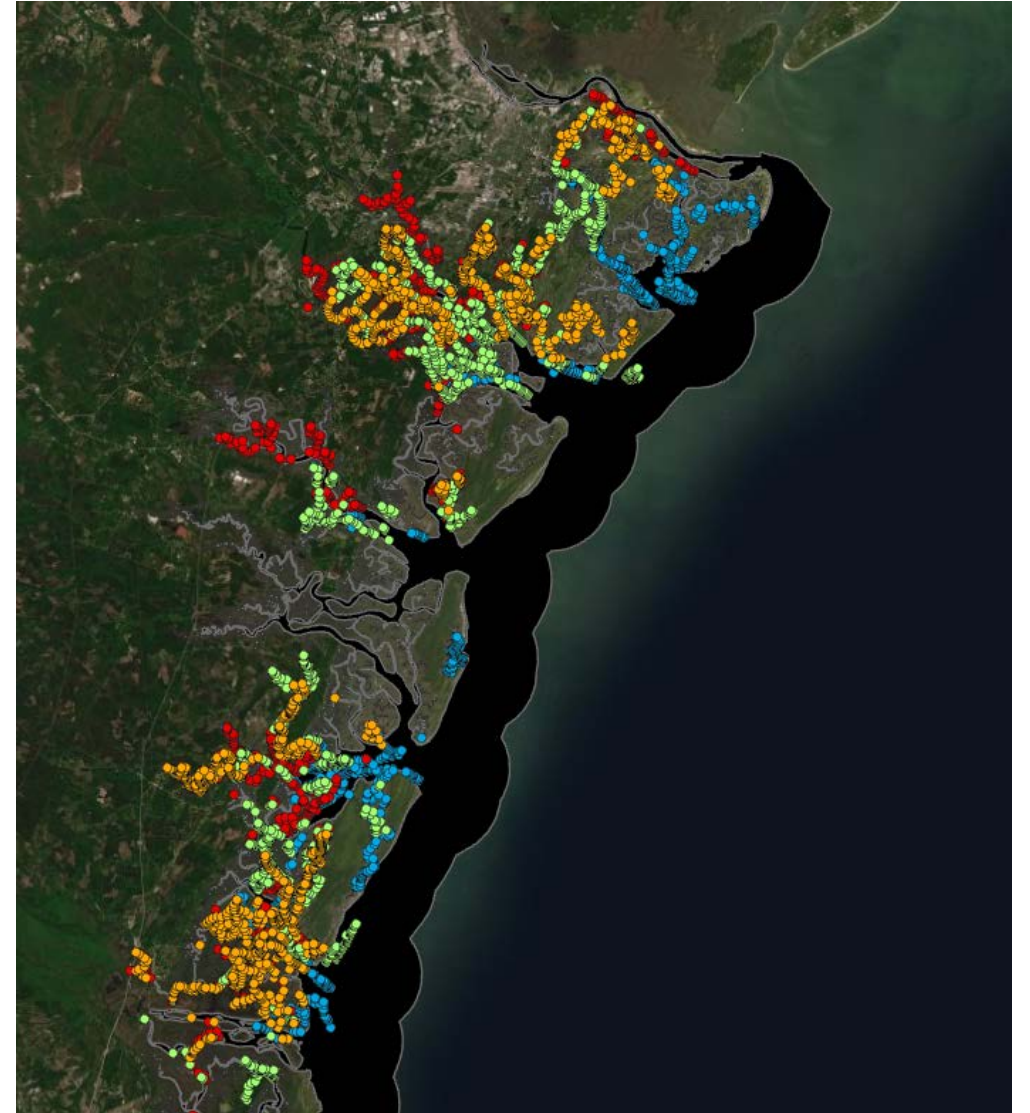
200 ft buffer- **55%** traps require BRDs (range 28-71%)



Management Actions Considered to Reduce Terrapin Mortality

Time/Area Closures

- Terrapins occur year-round in tidal creeks.
- Terrapins were captured in DNR by-catch study March through August and October.
- Terrapins are found in all areas where commercial crabbers fish with the exception of open sounds and rivers.
- Closing small tidal creeks to crabbing would result in the loss of 50% of the area used by crabbers.
- Closing headwaters of small tidal creeks would not be sufficient to protect terrapins.
- We could not find a combination of time/area closures that helped achieve the primary goal.



Management Actions Considered to Reduce Terrapin Mortality

Derelict pot removal, biodegradable panels and soak times

-Derelict pot removal program

Limited effectiveness due to high turbidity making it hard to find pots.

Hard to remove traps in areas with soft mud and high tidal amplitude.

Expensive

Have to remove all actively fished traps and have a 2-week period with no fishing

-Soak Times

In general, decreasing soak time leads to an increase in terrapin survival.

Can be effective in reducing mortality for traps that are left in the water for short-term storage.

Down side is that it soak times are unenforceable.

-Biodegradable panels

Required in all commercial crab pots in New Jersey.

Panel is 5" x 8" and attached with twine or non-stainless 3/16 wire.

Attractive because effective for reducing threat from derelict and abandoned gear.

Downside is that they require maintenance.



Management Actions Considered to Reduce Terrapin Mortality

Special Conservation Zones

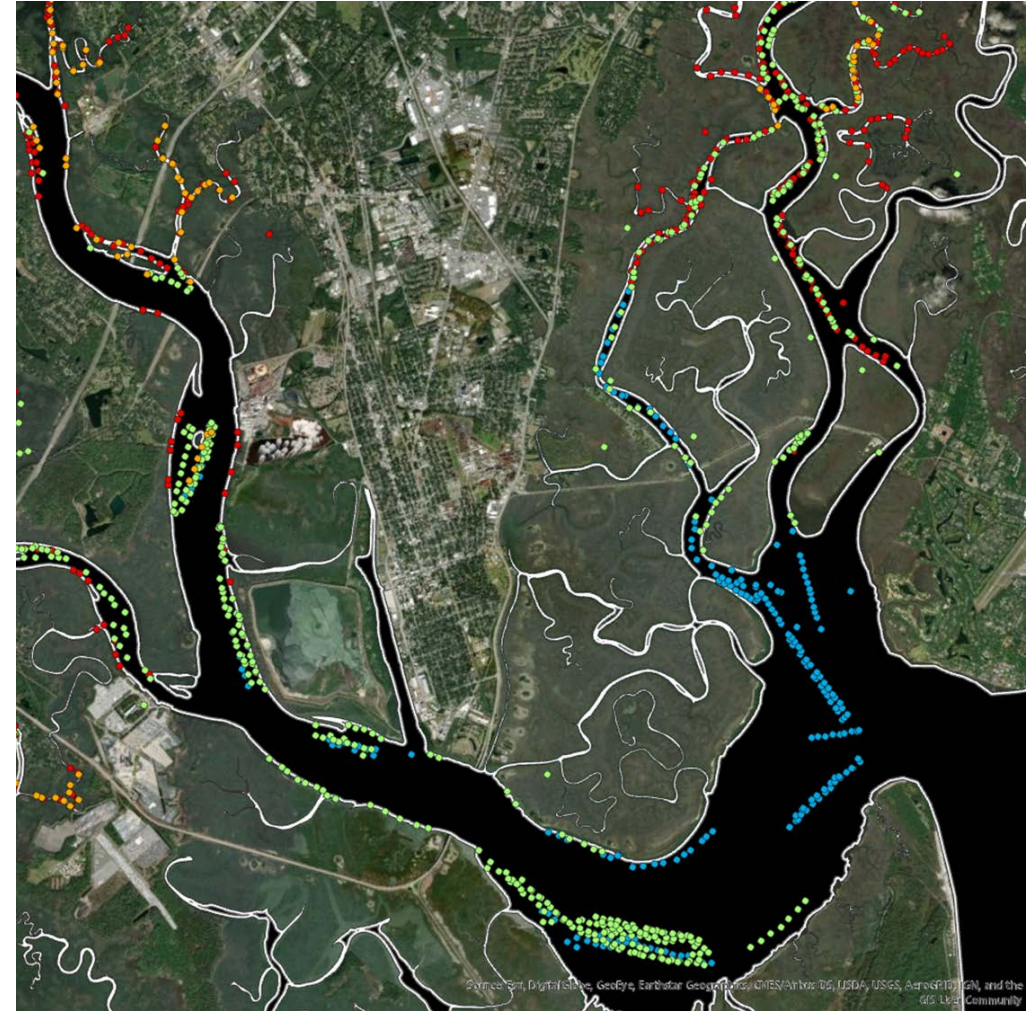
- Designating no fishing conservation zones can be beneficial for management
- Important to use as a control to assess effectiveness of conservation efforts.
- We have identified a site with no commercial crabbing as a result of limited access that has terrapin densities at 3 times rest of habitat.



Diamondback Terrapin Conservation

Proposed conservation plan

1. Required use of 2" x 6" terrapin excluder (BRDs) in commercial pots in waters less than 200 ft in width or within 100 ft of a river or sound shoreline.
2. Required use of 2" x 6" terrapin excluders (BRDs) in all recreational crab pots.
3. Process will be adaptive and will include a mechanism to approve new BRDs if they are determined to meet goals of regulation.
4. One time statewide derelict trap removal and required use of biodegradable panels.
5. Establishment of a terrapin conservation zone (no commercial crabbing) in Postell Creek, St. Simons.



Diamondback Terrapin Conservation

Questions for BCAP

1. Are the proposed regulations the best way to approach the problem?
2. How to we get input from commercial crab permit holders and recreational crabbers?

