Final Report of Virginia Fishery Resource Grant (VFRGP) Project FRG 2020-01

Project Title: Industry collaboration to determine predation impact of Invasive Blue Catfish on Blue Crabs in the lower reaches of James River: 1-year continuation of FRG 2018-14

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Project Purpose

There is an overwhelming amount of invasive catfish in Chesapeake Bay with little known impact they have on valued traditionally important commercial and recreational species, as blue crab. With limited natural predation information for blue crab relative to blue catfish, especially in areas where both species range overlaps, partnering with VIMS and VMRC to fill this gap in the science has provided valuable abundance information for our blue crab populations and further expands the understanding of the blue catfish range extension into these higher salinity habitats. Industry fishing efforts supported by the VA Fishery Resource Grant Program (VFRGP) were used to help quantify predatory impact of blue catfish on blue crabs from higher salinity areas of the James River where current data is lacking. This report summarizes data collected within the 1-year extension (2019-2020). Summary results from the original funded study FRG18-14 (2018-2019) are included in Appendix A.

Original FRG Program proposal FRG18-14 (2018-2019)

Background

The blue catfish Ictalurus furcatus were first introduced to Virginia tidal water in 1974 and currently inhabit all major Virginia tributaries of the Chesapeake Bay (Jenkins and Burkhead 1994, Schloesser et al. 2011). More recently, blue catfish have spread to Maryland waters and are multiplying at an alarming rate. The James River tributary has the largest number of blue catfish (Schloesser et al. 2011) in Virginia. The amount of blue catfish inhabiting the James River is unknown but is likely to be over five million (Fabrizio et al. 2009, Greenlee 2011) and blue catfish are estimated to be over 75% of the freshwater-tidal biomass (Schloesser et al. 2011). In recent years, blue catfish have extended their range further down river than ever thought they would. We are catching blue catfish in salinities of 22 ppt as far down as the James River Bridge. This is very alarming for the welfare of all the native species that invasive catfish feed on. If blue catfish are not stopped or slowed down and reduced in numbers, they could spread all over the Chesapeake Bay and tributaries. Not to mention all the commercial watermen and recreational fisher that would be affected by blue catfish destructive feeding behavior on valued species as blue crab, spot, croaker, white perch, striped bass, trout and American eel.

Rationale for 1-year project extension

VMRC and VIMS scientists believed it would be beneficial to extend the study by 1 year to ensure the we have adequate sample sizes for summer and fall seasonal estimates of predation impacts on blue crab (we had fewer blue catfish stomach samples than anticipated in summer/fall 2018). Virginia had a record wet year in 2018 and as such, fish and blue crab distribution may not have been representative. One of the goals of this study was to characterize predation impacts on blue crab in higher salinity environments: thus, a one-year extension allowed us to examine diets in 2019-2020, when conditions may be more similar to the long-term 'norm".

Methods

The scope of work for this study was divided into specific tasks among collaborators: fishing/sampling and environmental data by industry through the VFRG, and diet analysis by VIMS. Sampling protocol was established through a collective collaboration between industry (Trice) and VIMS (Fisher, Fabrizio, Tuckey) in the course of multiple advisory meetings. The sampling design was a stratified random design with 2 strata, Hogg Island Bay and Burwell's Bay: the strata ensure broad spatial coverage of the lower James River sub estuary and allowed for estimating predatory impact in two salinity zones. The selected study sites comprise areas of the river where blue catfish and blue crabs commonly co-occur, as evidenced by long-term, monthly surveys by VIMS. Each stratum (salinity zone) was initially partitioned into ~2 km X 2km grids (sites) and enumerated to permit random selection of grids for sampling. There were 38 grids in Hogg island Bay and 29 grids in Burwell's Bay. After the first two sampling efforts, it was determined by Trice and Fisher that the sampling grids were too small for random sampling the diverse stratum, restricting fishing effort (using 4 nets) to habitat not conducive to blue catfish. Upon advisory to VIMS scientists, the two strata were repartitioned into larger sampling grids of ~4km x 4km, resulting in 12 grids in Hogg island and 9 in Burwell's Bay. Expanding the grids allowed more flexibility to target fish within any given randomly selected grid.

Anchored gill nets were set and fished twice monthly in Hogg Island Bay and Burwell's Bay sections of the James River from August 2019 through July 2020. Each gill net was 91.4 m X 1 m and constructed using 3 equal size net panels arranged in random order with the following mesh sizes: 133 mm, 140 mm, and 152 mm. Each net was color coded representing arrangement of randomly placed mesh panels. Initially 3 gill nets were set in each stratum per sampling period (3 nets set per stratum(6 total) in the early part of the month and 3 nets per stratum in the later part of the month), but during the course of the study the number of nets used varied due to fluctuating catch rates. In September, low catch rates prompted the addition of 1 more net (4th net) per set. Continued low catch in late fall- early winter resulting in the addition of 2 more nets (6 total) in December 2018 per set. With increased catch in spring of 2019, effort was reduced by fishing 4 nets per set starting May 2019. Soak time was also of concern during the course of the study due to possible rapid evacuation of stomach contents by blue catfish. Initially, a 24-hour soak time was established (August- September 2018), but after discussions between collaborators, a reduced soak period of ~16 hours was targeted. Environmental data (water temperature and salinity from both surface and bottom), sampling site characteristics (depth, bottom type, relationship to sub-tributaries), and by catch was recorded. Additionally, each net fished was equipped with temperature sensor (HOBO) to record bottom temperature profiles during soak periods. All blue catfish caught were placed in color coded totes corresponding to the net color code. Fish were iced within 2 hours of capture and transported to VIMS for diet analysis. Diet Analyses will be reported by VIMS staff, which will include prey species with focus on the percent of blue catfish feeding on blue crabs. This data will be used to estimate the relative importance of blue crabs in the diet of blue catfish as well as the degree to which blue crabs are selected as prey.

Results (August 2019- July 2020)

This is a continuation of a previous study due to record rainfall through 2017-2018 in Virginia, which may have affected fish and blue crab distributions. In order to more accurately characterize predation impacts on blue crab in higher salinity environment, this one-year extension has allowed us to examine diets in 2019-2020, where conditions have been more similar to the long-term 'norm'. Results presented in this report are for the 2019-2020 FRG supported sampling effort, with preliminary diet information included. Note there is delay in the stomach contact analysis results due to the global pandemic.

In total, 6390 blue catfish were caught during the gillnet sampling effort for diet analysis: 3361 on Hogg Island and 3029 in Burwell's Bay. Environmental data during each sampling trip was averaged over nets fished, and provided in Figures 1 and 2. All corresponding environmental and site characteristics data of blue catfish caught has been recorded and incorporated into predation analysis.

A total of 128 items were observed in blue catfish stomachs during this study. Prey items and incidental material found in the stomachs of blue catfish over the course of this study are listed in table 2. Percentage and frequency of prey items observed in stomachs will be determined by VIMS staff and reported in final report “Predation impacts of invasive blue catfish on blue crabs in estuarine environments” (Grant Number: V777810) submitted to the VA Marine Resource Commission.

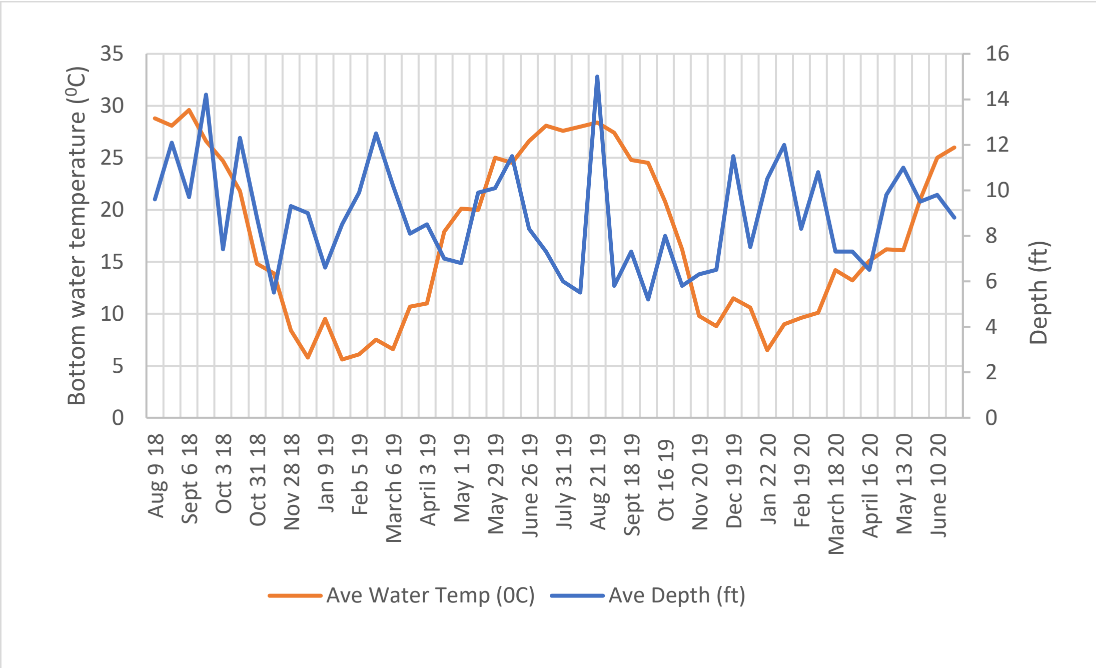

Figure 1. Average water depth (ft) and bottom temperature (^{0}C) during fishing efforts.

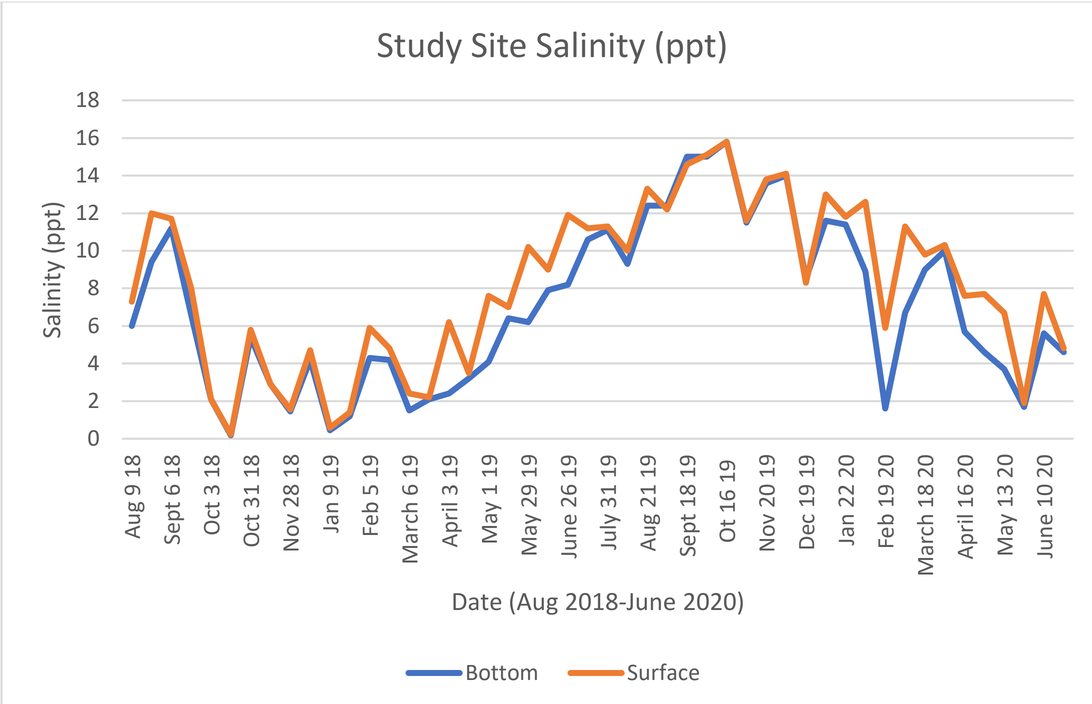

Figure 2. Average surface and bottom salinity (ppt) during fishing effort.

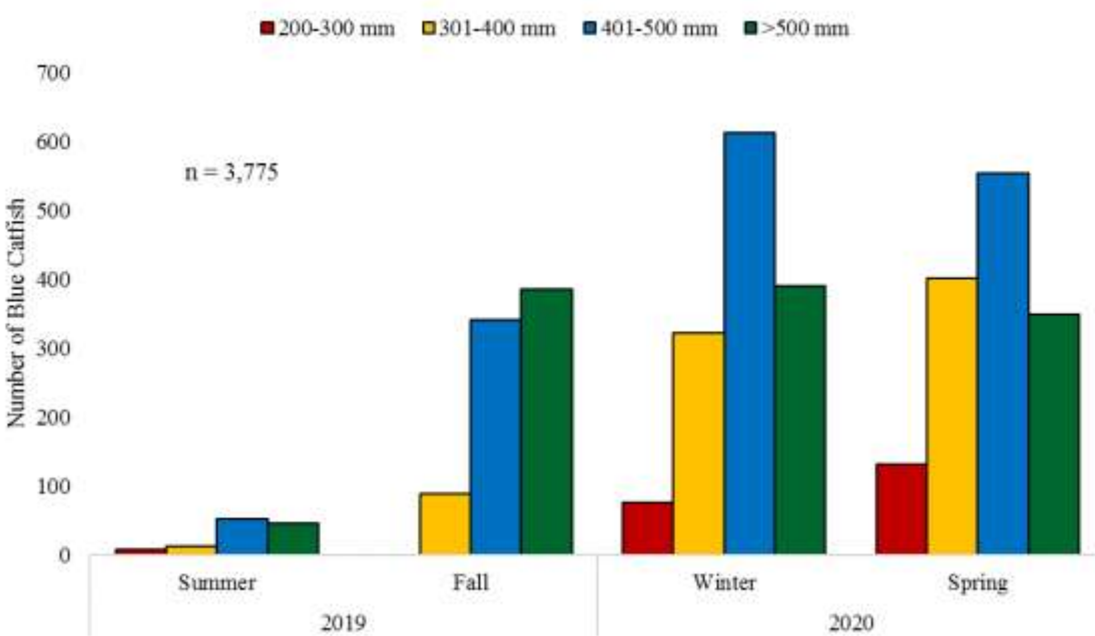

Figure 3. Total number of blue catfish collected from summer 2019 to spring 2020, broken down by season and size class. Size classes are defined as (1) 200-300mm, (2) 301-400mm, (3) 401-500mm, (4) >500mm.

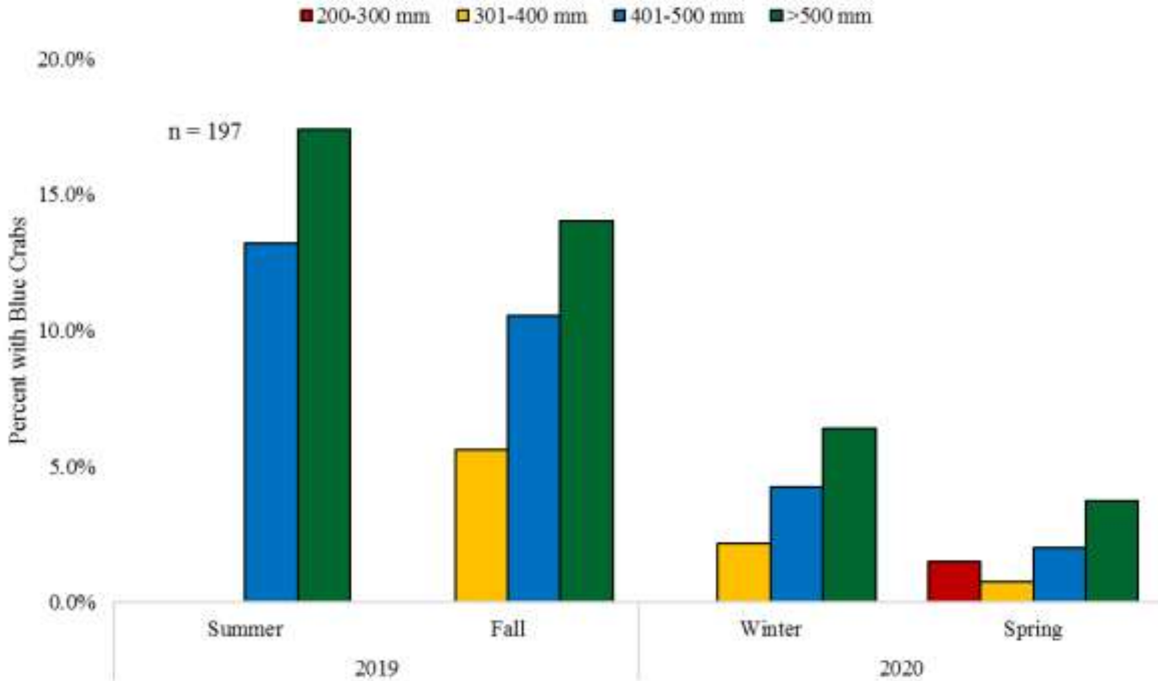

Figure 4. Percent of blue catfish collected from summer 2019 to spring 2020 with blue crabs in stomach broken down by season and size class. Note the percentages displayed here are preliminary, as not all fish stomachs collected have been analyzed to-date due to work-related restrictions caused by the COVID-19 pandemic.

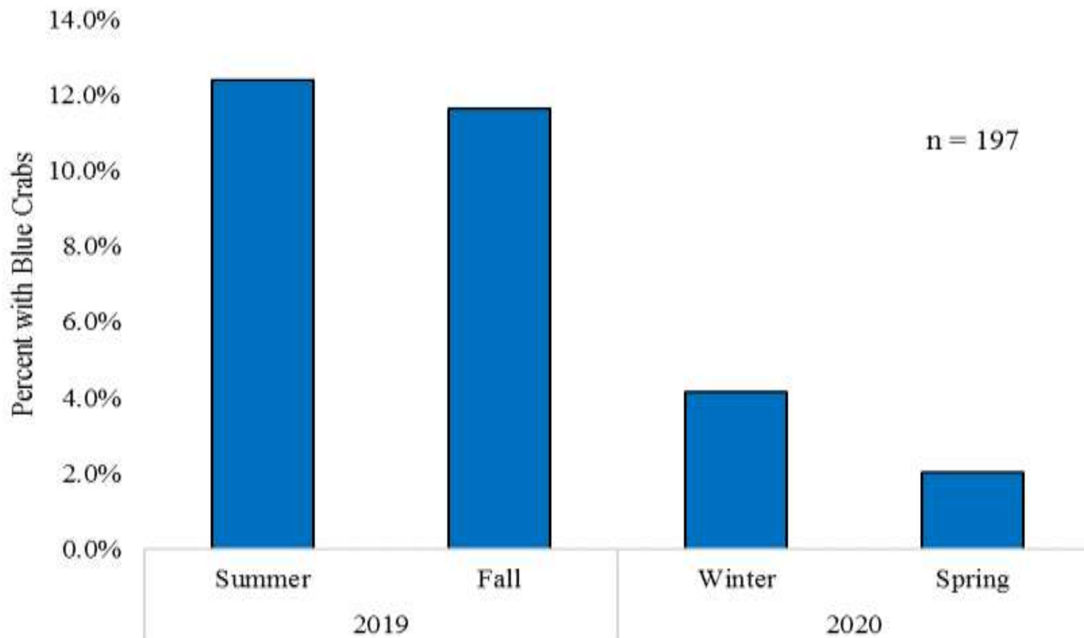

Figure 5. Percent of blue catfish collected from summer 2019 to spring 2020 with blue crabs in stomach broken down by season. Note the percentage displayed here are preliminary as not all fish stomachs collected have been analyzed to-date due to work-related restrictions caused by the COVID-19 pandemic.

	Count
Fish with empty stomachs	2449
Fish with full stomachs	1326
Total collected	3775

Table 1. Preliminary summary of blue catfish collected from summer 2019 to spring 2020 with and without prey items in stomachs.

American Eel	Crustaceans-Parts	Oyster Toadfish
Amphipod (Corophium spp.)	Daggerblade Grass Shrimp	Peanut
Amphipod (Gammarus spp.)	Dead Mans Fingers - Bryozoans	Plants-Seed
Amphipod (Unid.)	Drums	Polychaete (Unid.)
Animal Tubes	Eastern Oyster	Ribbed Mussel
Atlantic Croaker	Eels	Rock
Atlantic Menhaden	Fiddler Crabs	Roughneck Shrimp
Atlantic Mud Crab	Fish (Unid.)	Sand
Atlantic Rock Crab	Fish Scales	Sand Shrimp
Atlantic Silversides	Fishing Lure	Scup
Atlantic Surfclam	Flounders	Sea Anemones
Bait(Scrap)-Unidentified Meat	Gastropods	Sessile Barnacles
Bay Anchovy	Gizzard Shad	Sessile Tunicates
Bees	Grass Shrimp	Shrimp (Unid.)
Beetles	Gravel	Shrimps (Penaeid)
Birds-Feather-(Feather)	Gulf Stream Flounder	Silver Perch
Birds-Feather-Unidentified	Herrings	Slender Isopod
Bivalves (Mytilidae)	Hogchoker	Softshell Clam
Bivalves-Bivalve - Unidentified	Hydroid - Sertularia Spp.	Species Unidentified
Blackcheek Tonguefish	Hydroid (Unid.)	Spot
Blue Catfish	Insects	Spotted Hake
Blue Crab	Isopod (Ancinus Depressus)	Stink Bugs
Blue Crab-Female, Adult	Isopod (Chiridotea)	Striped Bass
Blue Crab-Female, Juvenile	Isopod (Cymothoa)	Summer Flounder
Blue Crab-Male	Isopod (Cymothoidae)	Swimming Crabs
Blue Mussel	Isopod (Politolana Concharum)	Tanaid
Blueback Herring	Isopod (Unid.)	Topminnows
Bluegill	Jackknife Razor Clam	Trash,plastic
Bony Fishes	Leafhoppers	Tube Worms-Tubes
Brown Shrimp	Leaf-Leaf	Unid. Material
Bryozoans	Macoma Clams	Unidentified Mud Shrimp
Bullhead Catfishes	Macro Algae-Macro Algae	Unidentified Seagrass
Burrow Worms	Mantis Shrimp	Unidentified Whelks (Nassarius Spp.)
Caddisflies	Mollusc Meat (Unid.)	Unidentified Worm
Cancer Crab	Molluscs	Vegetation
Clam (Unid.)	Molluscs-Shell	Weakfish
Clam Worm	Moon Snails (Unidentified)	White Perch
Commensal Crabs	Mud	Wood
Common Anchovies	Mud Crab (Unid.)	
Common Burrower Amphipod	Mysid (M. bigelowi)	
Corn	Mysid (Unid. Mysidae)	
Crab (Unid.)	Nematodes	
Crabs And Shrimp-Crab Parts	Northern Quahog	

Crabs And Shrimp-Decapod - Unidentified	Northern White Shrimp
Crustaceans	Oligochaetes

Table 2. Prey items and incidental material found in blue catfish stomachs.

Comments

This concludes a two-year study investigating the blue catfish predation on blue crabs from the subestuary of the lower reaches of the James River. This report provides blue catfish fishery catch data on the fish-sampling component of an overall collaborative blue catfish diet study. Diet analyses will be reported by VIMS staff within a final industry report, which will include total prey species found with focus on the percent of blue catfish feeding on blue crabs. This data will be used to estimate the relative importance of blue crabs in the diet of blue catfish as well as the degree to which blue crabs are selected as prey. With limited natural predation, information for blue crab relative to blue catfish, especially in areas where both species range overlaps, this collaborative work will help fill these gaps in the science and will provide valuable abundance information for our blue crab populations and further expands the understanding of the blue catfish range extension into these higher salinity habitats. Information and data generated by this study will be provided to VA Sea Grant, VIMS, VMRC, and the NOAA Chesapeake Bay Office Invasive Catfish Taskforce, and published on-line through VIMS VFRGP webpage.

Acknowledgements

This work was performed as the result of partnering between resource managers, academia, and our commercial fishing industry. Gratitude goes to Rob O'Reilly, Pat Geer, and Alexa Kretsch from the Virginia Marine Resource Commission (VMRC) for management guidance and leveraging funding in support of this work. Bob Fisher and Karen Hudson (VIMS) performed project management, advisory, and reporting assistance for this FRG project, with commercial fishing performed by George Trice and crew. Scheduling of sampling periods, laboratory preparation of captured fish for diet analysis and data entry was conducted by Jack Buchanan (VIMS).

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Appendix A

Summary results from FRG18-14 (2018-2019) study.

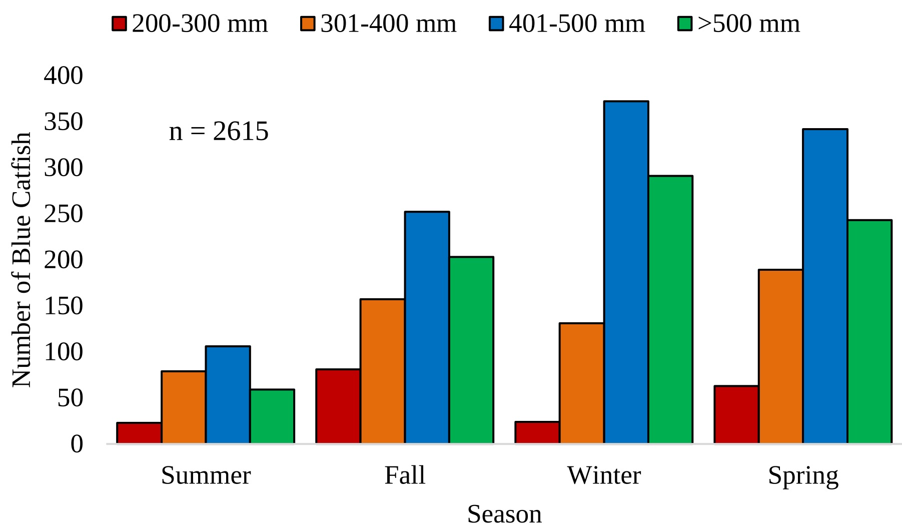

Figure 1. Total number of blue catfish collected (as of July 10, 2019), broken down by season and size class. Size Classes are defined as (1) 200 to 300 mm, (2) 301 to 400 mm, (3) 401 to 500 mm, (4) > 500 mm.

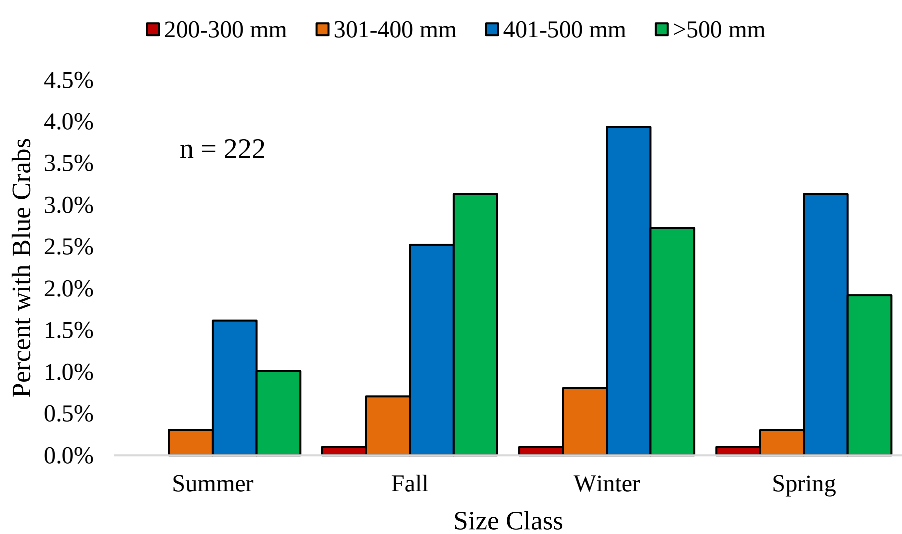

Figure 2. Percent of blue catfish with blue crabs in stomach (as of July 10, 2019), broken down by season and size class.

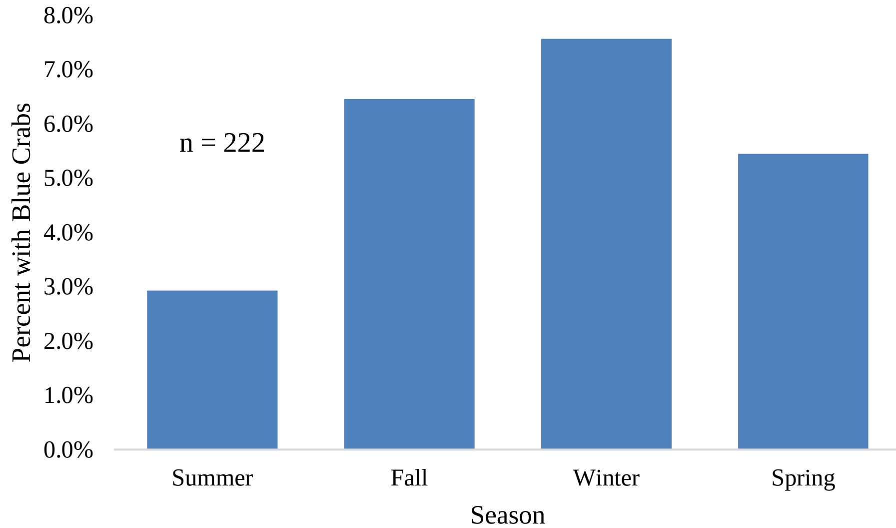

Figure 3. Percent of blue catfish with blue crabs in stomach (as of July 10, 2019), broken down by season.