Final Report of Fishery

Resource Grant Project 2018

Conducted by George Trice

Project title: Industry collaboration to determine predation impact of Invasive Blue Catfish on Blue Crabs in the lower reaches of James River.

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Introduction

The blue catfish *Ictalurus furcatus* was first introduced to Virginia tidal waters in the 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 in 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. Blue catfish are currently being caught as far down river as the James River Bridge in salinities of 22ppt. This is very alarming for the welfare of all the native species that invasive catfish feed on. If blue catfish are not controlled, they could spread into the Chesapeake Bay and inhabit all of its tributaries. Both commercial and recreational fishers will be increasingly affected by the blue catfish destructive feeding behavior on valued species as blue crab.

Because of its invasive and extremely high abundance, blue catfish are a prime candidate for expanded commercial harvest, with markets developing for fish of all sizes. Studies have shown that a certain form of electrofishing (low-frequency electrofishing, LFE) is very effective in harvesting catfish in Virginia tributaries. During FRG supported commercial LFE pilot studies (2014 through 2016), over 700,000 pounds of invasive catfish were harvested (Trice 2014, 2015, 2016). The commercial LFE likely lowered invasive blue and flathead catfish populations, which helps relieve resource pressure on native species. Removal of invasive catfish also helps reduce predation of native species. Several species of commercial concern (American eel *Anguilla rostrata*, striped bass *Morone saxatilis*, white perch *M. Americana*, blue crab *Callinectes sapidus*) have been reported in blue catfish stomachs.

The efficiency of commercial LFE in low to medium conductive waters is documented through FRG supported projects; however, LFE has also been identified as a gear-type that becomes less efficient in higher conductive (salinity) water. During the 2017 FRG project, a larger Gas Generated Pulsator (GPP) was tested in the lower reaches of the James and Pamunkey Rivers (9.0kw GPP vs 7.5kw GPP) to see how far down river this gear could function as a commercial gear-type. The efficiency in raising catfish at conductivities above 2000 u/cm S (1ppt salinity) was significantly reduced, with the inability to raise any significant catfish observed at conductivities 10,000-13,000 u/cm S (5-7 ppt salinity). In the James River, salinities can change drastically over only a couple of miles due to the salt-wedge changing with the tides. This area falls between Chippokes Creek and the mouth of the Chickahominy River down to Burwell's Bay. These areas of the James River support a large volume of blue crab, with blue crabs routinely observed in the stomachs of blue catfish harvested from these areas (Fisher, personal observation).

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. A diet study by Virginia Tech (Schmitt et al., 2017) identified blue crab as a prey item of blue catfish. However, the level of predation was not clear due to low sample size in these lower reaches of the James River and the study was not conducted throughout a full year which would include seasonal changes in blue catfish-blue crab interactions. Abundance of blue crab is monitored by recruitment and both fishing and natural mortality, including predation. With the high abundance of blue catfish in the James River, this estimate of predation by blue catfish could play a significant role with managing blue crabs in Chesapeake Bay.

Blue catfish predation on blue crabs in higher salinity areas of the rivers was identified as a priority in the November 2017 NOAA Sustainable Fisheries Goal Implementation Team Catfish Task Force symposium. At the symposium, gaps in the current science were discussed, with the need to perform an additional diet study on blue catfish from the lower reaches of the James River, which were not represented well in previous study. Understanding that sampling gear type in these areas (high salinity) could pose a problem, industry was identified as the best vehicle for obtaining the data with collaborations from VIMS and VMRC. With coordination through VIMS, Fabrizio and Fisher, and leveraged funding from VMRC, sampling of blue catfish using anchored gill nets for diet analysis from the lower reaches of the James River was conducted. This is an FRG supported collaboration between industry, scientists, and resource managers to quantifying the predatory impact of blue catfish on blue crabs from higher salinity areas of the James River where current data is lacking.

Methods

The scope of work for this study was divided into specific tasks among collaborators; fishing/sampling and environmental data by industry, and diet analysis by VIMS. Sampling protocol was established through a collective collaboration between industry (Trice) and VIMS (Fabrizio, Fisher, 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 2 km 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 ~4 km X 4 km, 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 2018 through July 2019. 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 colored 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 (4^{th} net) per set. Continued low catch in late fall-early winter resulted in the addition of 2 more nets (6 total) in December 2018 per set. With increased catch in spring 2019, effort was reduced by fishing 4 nets per set starting in May 2019. Soak time was also of concern during the course of the study due to possible rapid evacuation of stomach content by blue catfish. Initially, a 24 hr 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 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 all 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 2018-July 2019)

A continuation of this study has been granted for another full year period as the result of record rainfall through 2017/18 in Virginia, which may have affected fish and blue crab distributions. One of the goals of this study was to characterize predation impacts on blue crab in higher salinity environments; thus, a one-year extension will allow us to examine diets in 2019-2020, when conditions may be more similar to the long-term 'norm'. Because this study is a continuation, results presented in this report are for the 2018-2019 FRG supported sampling effort, with preliminary diet information included.

In total, 2615 blue catfish were caught during the gill net sampling effort for diet analysis; 1,175 on Hogg Island and 1,440 in Burwell's Bay. All corresponding environmental and site characteristics data of blue catfish caught has been recorded and incorporated into predation analyses. The overall total number of blue catfish caught by season and size (Figure 1) depicts low catch rates during the summer corresponding to high fresh water influx (rainfall) into the system. These low catch rates prompted an increase in fishing effort by increasing the number of nets fished. Large fish categories (>400 mm) dominated catch during each seasonal sampling period. From the total fish caught, 1445 had empty stomachs and 1170 had prey items in their stomachs (full stomachs). Blue catfish predation on blue crab is calculated from those fish that contained prey items in their stomach, part of which was blue crab, and reported as percent of fish containing prey items (number of blue catfish with blue crabs in stomach divided by the total number of blue catfish with full stomachs X 100). The percent of blue catfish with blue crab found in stomachs varied between fish size and season (Figure 2). Predation on blue crabs was greatest in the larger fish within each season, with the greatest percent predation observed in the 401-500mm fish size category during winter sampling. Predation intensity on blue crab was greatest during winter sampling, reaching approximately 7% (Figure 3).

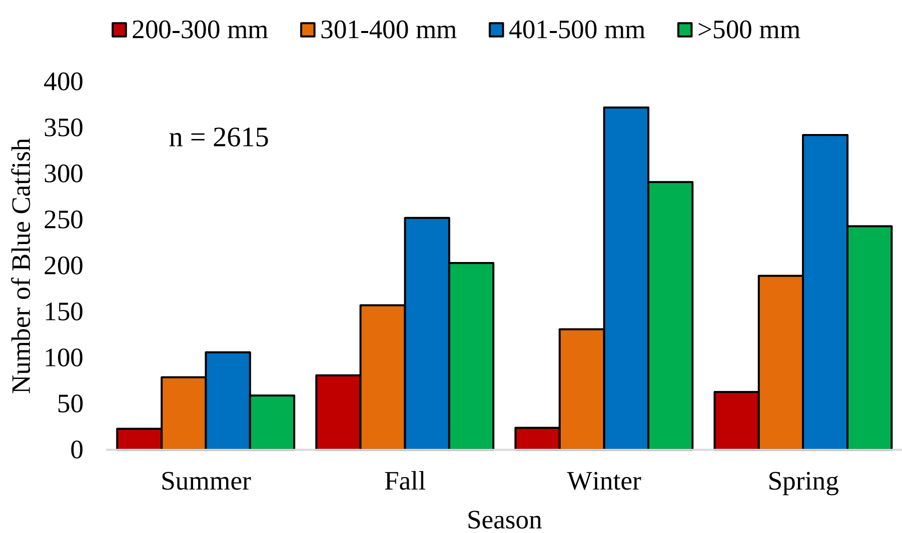

Figure 1. Total number of blue catfish collected (as of July 10, 2019), broken down by season and size class. Size Classes are defined as (1) 200 to 300 mm, (2) 301 to 400 mm, (3) 401 to 500 mm, (4) > 500 mm.

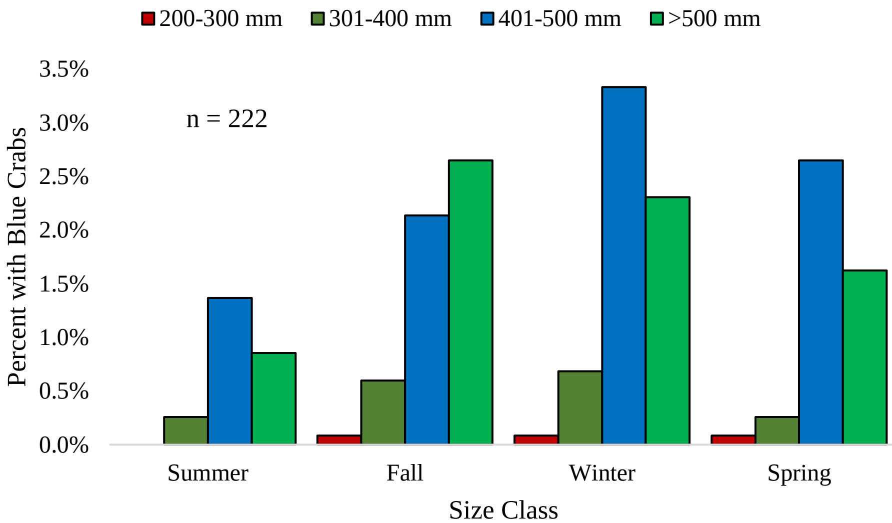

Figure 2. Percent of blue catfish with blue crabs in stomach (as of July 10, 2019), broken down by season and size class.

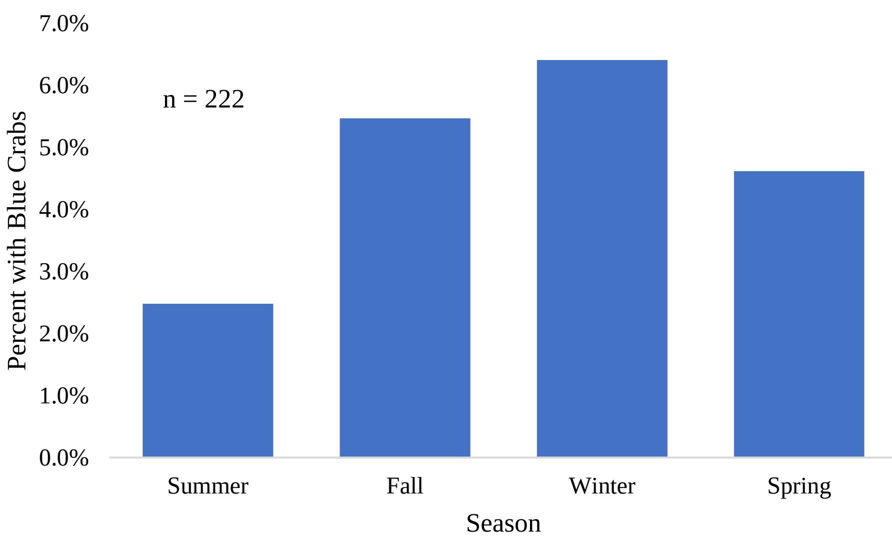

Figure 3. Percent of blue catfish with blue crabs in stomach (as of July 10, 2019), broken down by season.

Comments

This report provides information on the fish-sampling component of an ongoing blue catfish diet study. Many fish obtained to date from this effort are still being analyzed for prey items, which results in preliminary finding being reported at this time. One full year of sampling has taken place, with another full year of sampling yet to be performed investigating blue catfish predation on blue crabs from the lower reaches of the James River. Data generated by this study will continually be shared with Va Sea Grant, VIMS, and VMRC. At the completion of the study, a final report will be prepared and submitted to the VFRG program. VIMS scientist will provide a comprehensive final report to VMRC with results presented to the NOAA Sustainable Fisheries Goal

Implementation Team Catfish Task Force. Further publications from this work will target scientific journals by VIMS collaborators. Results from this collaborative study could likely have an important impact on estimating abundance of blue crab in Chesapeake Bay while providing further information on non-native blue catfish range extension. Further, it has fostered cooperative working relationships between stakeholders while co-producing science-based information and further identifying applied research needs, which will ultimately enhance the blue catfish and blue crab fisheries.

Acknowledgements

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