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Blue Catfish Management Needs & Options

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<u>Purpose:</u>

This document describes needs and options pertaining to the management of blue catfish populations in tidewater tributaries of Virginia and Maryland, and draws extensively from two recent papers (Fabrizio et al. 2009; Schloesser et al. *in press*) that (1) synthesize our current state of knowledge, and (2) identify research investigations needed to address current resource management concerns.

<u>Current Knowledge and Management Needs</u>

The blue catfish (*Ictalurus furcatus*) is a large, long-lived freshwater species native to the Mississippi, Missouri, and Ohio river drainages of the central and southern United States. In recent decades, stocking programs and unauthorized human introductions have established blue catfish populations in reservoirs and rivers of several states, including Virginia and Maryland. These populations support commercial and recreational fisheries for blue catfish. Following introduction to the James, York, and Rappahannock rivers, inoculation populations expanded rapidly into tidal riverine habitats, resulting in the invasion of blue catfish into oligohaline and mesohaline waters of Chesapeake Bay tributaries. Blue catfish are now a common species in all Atlantic slope rivers of the Commonwealth. Frequently, blue catfish are the dominant species (by number and weight) in portions of these rivers. We have a unique opportunity for understanding the spread of this non-native species beyond the commonly studied freshwater habitats typically used by blue catfish in their native range.

Fisheries programs at VIMS, VCU, VDGIF, and MDDNR use a variety of gear types to sample both the freshwater and tidal portions of the major coastal rivers. Such sampling can be used to infer changes in spatial distribution and relative abundance of blue catfish, composition of the diet of adult blue catfish, variations in age and growth rates, and concentrations of bioaccumulating contaminants (such as PCBs, TBT, and Hg).

Below, we describe current knowledge and gaps in our knowledge that represent challenges to informed management of this resource. We identify fruitful areas for research to complement existing information and to further understand the processes driving range expansion of this species in coastal tributaries. Investigations based on these questions could potentially lead to identification of effective management strategies for these populations in tidal rivers of Chesapeake Bay.

1. Spatial Distribution

Blue catfish inhabiting large rivers prefer channel habitats characterized by the presence of complex structure (e.g., trees, sunken vessels, pilings), depths exceeding 6 meters, and salinities less than 6 ppt. Since the 1990s, blue catfish abundance has increased in the James, York, Rappahannock, and Potomac rivers; in recent years, captures of blue catfish have also been documented in the Potomac, Piankatank, Patuxent and Nanticoke rivers, even though these rivers were not stocked by state agencies. Blue catfish populations in Chesapeake Bay tributaries are spreading into waters of higher and higher salinity each year, and indeed, individuals have been found in salinities ranging up to 14.7 ppt, beyond their published 'preferred habitat'. Expansion into the mesohaline region of the tributaries suggests that blue catfish can tolerate (and perhaps even adapt to) higher salinity waters than previously reported. It should also be noted that dam removal in the Rappahannock River and establishment of fish passage on the James River facilitated colonization of upriver, nontidal habitats (i.e., Piedmont regions).

Aside from these broad descriptions, patterns of longitudinal movements by individuals among estuarine, tidal riverine, and upriver habitats are not well understood. The following research questions could shed light on factors that contribute to the successful colonization of riverine habitats:

- What is the proximal stimulus for the observed down-estuary range expansion of blue catfish in coastal tributaries? Knowledge gained from understanding how and when individuals colonize new areas may be applied to newly established populations in other rivers for predicting and managing spreading episodes.

- Where are the critical nursery areas in the oligohaline and mesohaline reaches of the coastal tributaries? Identifying regions of higher production can help delineate habitat types in which to target management efforts.

- What is the salinity tolerance of eggs and larvae? Narrowing the range occupied by early life history stages into critical habitats can help focus management efforts.

2. Relative Abundance

Blue catfish inhabit both freshwater and brackish habitats of Chesapeake Bay tributaries, yet the relative contribution of these habitats to overall production is unknown. Established fisheries surveys to estimate relative abundance of blue catfish in these portions of Virginia's coastal rivers currently use different sampling designs; integration of abundance information from these surveys will require the development of new statistical approaches to permit integration of data from different sampling designs into a single index of abundance. Using such data, the dynamics of these populations may be modeled to provide insight about the harvest levels necessary to reduce the population, and to determine if those levels can be achieved through regulated fisheries. We note that current harvest levels are restricted by limited market demand. Because of human health risks (see below), mechanisms other than an increased market for human consumption will need to be explored. In addition, increasing commercial harvest levels may incur conflicts with the recreational trophy fishery for blue catfish in Virginia and Maryland. A significant, nationally recognized trophy fishery for blue catfish occurs in the James River, VA, and generates millions of dollars annually for Virginia's economy. Maximizing removals while allowing for a trophy fishery will be a necessity and challenge for management.

- What is the relationship between relative abundance of blue catfish and their range expansion into mesohaline and oligohaline habitats in coastal tributaries?

- What is the relative importance of estuarine versus tidal freshwater habitats to population dynamics and distribution? Ensuring a precise index of abundance is necessary to accurately gauge the growth of catfish populations and measure efficacy of management actions.

- How have blue catfish populations affected the abundance and distribution of native shellfish and fish populations, particularly the native white catfish? Declines in the abundance of native white catfish have been documented following the introduction of blue catfish. Population-level effects of an increasing blue catfish population on other aquatic resources should be investigated to fully understand the consequences of growing blue catfish populations.

- What level of removal (harvest) is required to reduce population densities, and how might this harvest intensity be achieved? We currently do not know the feasibility of reducing blue catfish population abundance in coastal tributaries through fishery removals because we do not know the harvest level necessary to result in a significant decline in abundance of blue catfish.

- What strategies should be considered to ensure both trophy fisheries and food fish fisheries for blue catfish in tidal tributaries? Can these goals be obtained simultaneously?

3. Feeding Habits

Blue catfish are omnivorous, and have a diverse diet composed of benthic, pelagic, and terrestrial prey. These include, but are not limited to, various fish species (e.g., menhaden, American shad, bay anchovy), small crustaceans, worms, clams, mussels, and crabs. In the Mattaponi River, blue catfish are important consumers of native freshwater mussels (VDGIF). Blue catfish >300 mm total length in the tidal James and Rappahannock rivers are largely piscivorous, although larger predators continued to consume a wide range of prey types (Chandler 1997). In the James, Pamunkey, Mattaponi, and Rappahannock rivers, fish prey dominated the stomach contents of blue catfish greater than 600 mm TL (VDGIF). Stable isotope analyses of blue catfish from several coastal rivers in Virginia demonstrated that the introduced catfishes represent a trophic level above that occupied by native predatory fishes (MacAvoy et al. 2009, MacAvoy et al. 2000, Garman and Macko 1998). A feeding behavior of blue catfish that could potentially complicate interpretation of diet studies (including stable isotope analyses) is that of scavenging decomposing carcasses; such behavior requires consideration in future trophic analyses.

- How do blue catfish diets vary seasonally, regionally, and with fish size? For example, are blue catfish from low (0-6 ppt) and high salinity (6-18 ppt) habitats using different prey? In addition, further diet studies are warranted in shallow water (<4 feet) habitats that are currently not adequately sampled. Ecosystem effects of blue catfish feeding (including effects on commercially and recreationally important species) must be characterized to fully understand the potential ecosystem consequences of range and population expansion of this species.

- What is the role of blue catfish in aiding the spread of introduced freshwater mussels? Minimizing the negative effect of expanding blue catfish populations on other aquatic resources is a primary goal of effective management.

4. Age and Growth

Blue catfish growth (in length) in Virginia tidal tributaries is linear through age 15+, whereas weight gain over this time span is exponential (VDGIF). This is an unusual pattern of growth considering that blue catfish mature between ages 4 and 7. Growth rates of blue catfish from the James River are greater than those of fish from the Rappahannock River (VDGIF) and appears to be unaffected by the high density of this species in the James River. Differences in annual mortality rates and variations in recruitment result in different age-frequency distributions of fish in the James, Pamunkey, and Rappahannock Rivers, suggesting that population structure exists among Virginia tributaries and that management of individual river populations (stocks) may be more effective than managing blue catfish as a single stock.

- What is the relationship between environment and population structure (i.e., are populations in each tributary unique with respect to population characteristics such as growth rate and mortality rate)?

5. Bioaccumulation of Contaminants

Blue catfish tissues collected from the tidal James River exhibited high concentrations of several organic contaminants including PCBs, organotin compounds (i.e., TBT), and DDE (Garman et al. 1998). Concentrations of PCBs in muscle tissue were correlated positively with fish size, and the majority of fish greater than 600 mm TL exceeded the FDA action level for PCB concentrations in the edible fillet of fish (2 ppm), posing a health risk to anglers consuming blue catfish from the upper James River (Harris and Jones 2008). In contrast, total PCB concentrations in smaller blue catfish (<200 mm TL) were consistently below 2 ppm (dry mass). Due to observed contaminant concentrations in larger fish and the associated human health concerns, only one blue catfish greater than 32 inches (813 mm) TL per person per day may be legally harvested (VDGIF). Because of slow growth rates and high mortality rates, blue catfish greater than 32 inches in length account for less than 1% of the population. A recent mercury risk assessment (Bullene 2008) demonstrated that patterns of blue catfish consumption by recreational anglers in the James and York River systems did not result in significantly increased health risks from higher mercury exposure. Additional studies by the Virginia Department of Health assessed PCBs, mercury, and other chemical contaminants, resulting in concerns about human consumption of blue catfish greater than 32 inches (813 mm) from these systems.

- Is the expansion of the blue catfish fishery limited by the susceptibility of individual fish to bioaccumulate toxic substances? Attempts to regulate abundance of blue catfish may be focused on removals of the more abundant fraction that is less than 32 inches (813 mm) in length, but contemporary information on the contaminant burden of these fish is lacking. An updated contaminants study focused on the previously-documented analytes (e.g., PCBs, TBT) as well as mercury is necessary for all sizes of blue catfish to properly address consumption risks based on size limits.

- What are the current concentrations of PCBs and other contaminants in blue catfish? Contemporary information is lacking and risk assessments would benefit from PCB analyses of multiple size classes of fish, representing sizes of fish typically consumed by anglers.

6. Management Options

Based on our synthesis of blue catfish studies from tidal tributaries of Chesapeake Bay, and considering information presented at the recent International Symposium on Catfish (July 2010, St. Louis, MO), we suggest the following options may be considered:

- Coordinated management of blue catfish fisheries throughout the Chesapeake Bay region. Commercial, recreational food, and recreational trophy fisheries exist in Maryland and Virginia, but trophy fisheries for blue catfish in Maryland no longer qualify for Angler Citations.

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