

# CHESAPEAKE QUARTERLY

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## *Bay Blues*

*How Blue Catfish Are  
Changing the Bay*

*in this issue*

Volume 23, Number 2

Invasive blue catfish have spread to most of the Chesapeake Bay's major rivers. In this issue, explore the problems and potential these fish bring to the region.

This print edition of *Chesapeake Quarterly* includes the issue's feature story, "Bay Blues," and a sidebar, "Dive Deeper: Eating Blue Catfish Safely." Read more articles in our complete online issue at [chesapeakequarterly.net](http://chesapeakequarterly.net) or scan code:



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Cover: Blue catfish caught on the Potomac River in Maryland.

PHOTO, MADELEINE JEPSEN

# Belly of the Beast

## Can the Bay Stomach Blue Catfish Appetites?

by Madeleine Jepsen

The wood duck slid gracefully into the Nanticoke River, bobbing along with the waves as it pecked at water bugs for a mid-afternoon meal. Minutes later, the wood duck became a meal—for a 47-pound blue catfish.

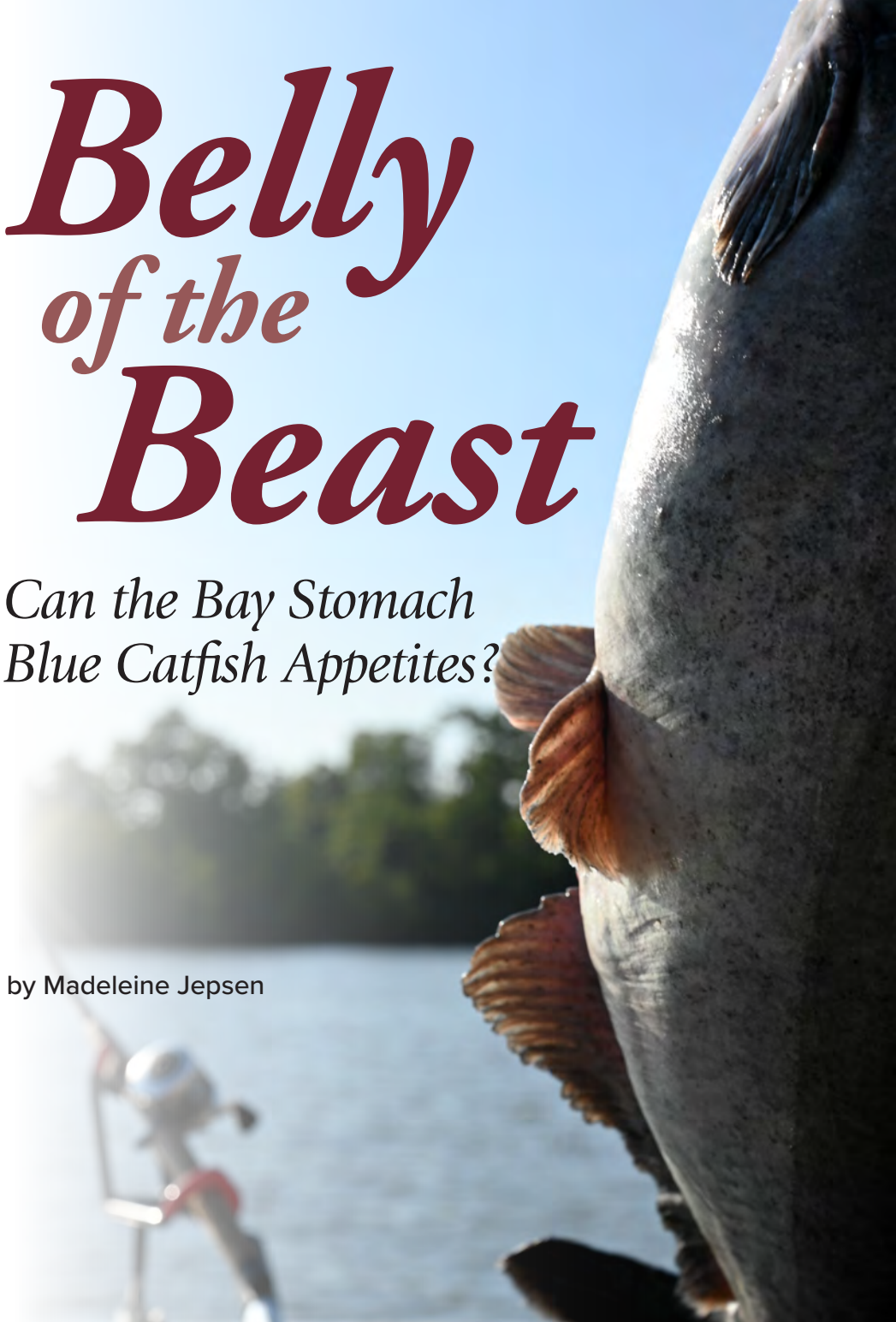
As far as Salisbury University researchers could figure, the blue catfish had swallowed the wood duck alive. The duck carcass they removed from the catfish's stomach didn't contain

any buckshot, and the duck's lungs indicated it hadn't drowned before the blue catfish swallowed it.

"We think it was a predatory incident where maybe, *Jaws*-style, it came up underneath and snatched the wood duck from the top of the water," says Noah Bressman, a Salisbury University researcher who studies blue catfish.

The incident made headlines, even beyond the Bay. Blue catfish (*Ictalurus furcatus*) have gained notoriety around

PHOTO, MADELEINE JEPSEN / MARYLAND SEA GRANT



the Bay for their voracious appetites and sheer abundance. Reports like this one of blue catfish stomach contents testify to their ability—and willingness—to eat anything they can fit their jaws around.

Wood ducks are only a small footnote in the long list of creatures found in blue catfish stomachs by researchers like Bressman. This list also includes blue crabs (*Callinectes sapidus*), river herring (including *Alosa pseudoharengus* and *Alosa aestivalis*), American eel (*Anguilla rostrata*), gizzard shad (*Dorosoma cepedianum*), and aquatic plants. In the last decade, blue catfish researchers have studied thousands of blue catfish

stomachs to get a handle on what they're eating, and where.

### The Bay's Hungry Newcomer

In 1974, the Virginia Department of Wildlife Resources (then known as the Department of Game and Inland Fisheries), introduced blue catfish to the James and Rappahannock rivers as a potential trophy fish for anglers to catch. They arrived in rivers where other fish populations like striped bass (*Morone saxatilis*) had fallen to low levels due to habitat loss, overfishing, and pollution. Many forage fish like river herring, which serve as a food source for striped bass and other fish,

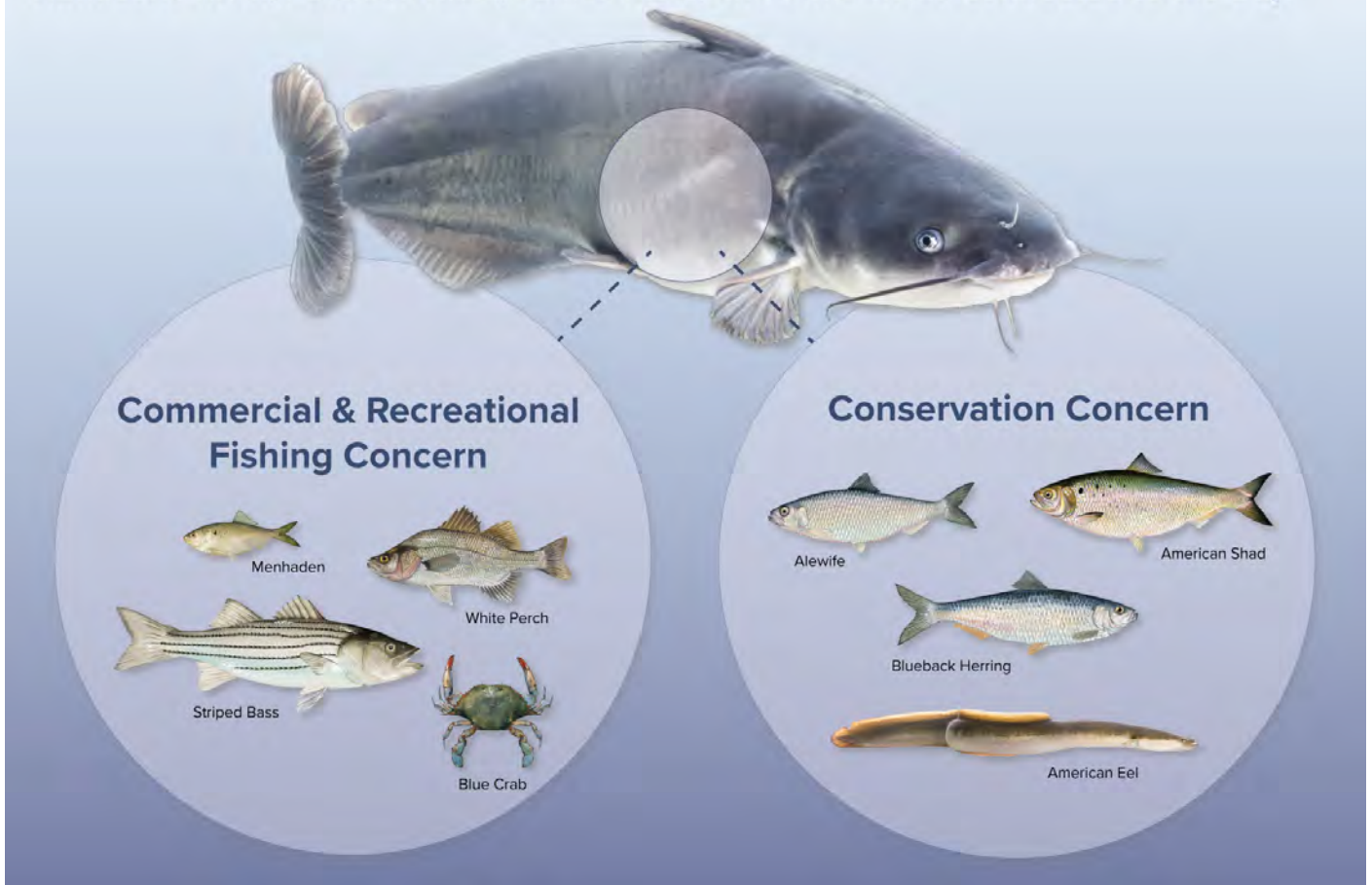
were also reaching historically low levels. Ten years later, the department introduced blue catfish to the York River as well.

"The thinking was they're a freshwater fish, they're not going to be problematic, and we have them in the state. Let's give it a whirl," explained Virginia Department of Wildlife Resources Biologist Margaret Whitmore. "I've heard a million different iterations of that story."

And within a decade, the experimental introduction showed early signs of success. Record-breaking sized blue catfish began to be more widely caught in the rivers where they were intro-

## Blue Catfish Diet

These important fishes have been found in the stomachs of blue catfish from the Nanticoke River, Patuxent River, James River, and other rivers connected to the Bay.



Blue catfish have consumed fish that are important to fishers and conservationists. GRAPHIC, JILL GALLAGHER / MARYLAND SEA GRANT



*A Salisbury University researcher scoops a blue catfish into a net after stunning the catfish with low-frequency electrofishing gear.*  
 PHOTO, ZACHARY CRUM / SALISBURY UNIVERSITY

duced, and the trophy fishery boomed in the early 2000s. The James River’s recreational blue catfish fishery generated roughly \$2.5 million in economic value in 2002.

But the experiment worked too well. By the late 90s, blue catfish were appearing in tributaries further up the Bay, like the Patuxent River—well outside the range where they were first introduced. Today, blue catfish can be found in tributaries on Maryland’s Eastern and western shores, and in most Virginia tributaries. As the blue catfish swam into new waters, they brought their appetites with them.

### **Stomach Contents Provide Clues for Researchers**

Like coroners analyzing the stomach contents of a victim, Chesapeake Bay researchers determine the final meal of a blue catfish by studying its stomach contents. Collectively, researchers

across the Bay have examined more than 15,000 blue catfish stomachs to determine what—and how much—blue catfish are eating.

But before researchers can analyze stomach contents, they first must catch enough blue catfish to draw meaningful conclusions from their diet studies. For most researchers, this involves catching blue catfish throughout the year from various regions within the rivers they are studying. Many research teams also ensure their study includes enough catfish of different sizes to learn about how the blue catfish diet changes as they grow.

Most of the major diet studies in the Bay rely on a catch method called low-frequency electrofishing, which temporarily stuns blue catfish by emitting electric current from a boat into the water. Low-frequency electrofishing affects only scaleless fish, so the researchers can sample blue catfish



*Fish chunks pulled from the stomach of a blue catfish, each in various stages of digestion.*

PHOTO, ZACHARY CRUM / SALISBURY UNIVERSITY

without affecting other fish nearby. As the stunned fish float to the surface, researchers scoop them up with nets and bring them onto the boat.

Once the catfish are on the boat, researchers measure and weigh each fish before cataloging its stomach contents. This allows them to link the fish's size to its eating habits. Scientists collect stomach contents by cutting out the entire stomach for dissection back in the lab, or by pumping the catfish's stomach and collecting the contents for later analysis.

"The big fish have so much blood and guts, the boat becomes unworkable after you cut up three or four of them—it's just grotesque. Often, they were big enough fish that we could literally reach our whole arm into their stomach and pull everything out manually. It was pretty gross, but we all got used to it, and it kept the boat from being a disaster," says Joe Schmitt, who studied thousands of blue catfish as part of his PhD research at Virginia Tech.

Once the catfish's stomach contents are collected from the field, researchers return to the laboratory to identify the prey items contained in each catfish stomach. For the smallest blue catfish, researchers use a microscope to count and identify tiny clams and invertebrates from their stomachs.

The timing of a blue catfish's last meal can affect identification of stomach contents. If their meal was relatively recent, researchers can sometimes identify the prey just by looking at the fish. But for slimier stomach contents that are already partially digested, researchers determine the genus and species of that sample through genetic sequencing.

### The Bay Buffet

From baby striped bass and blue crabs hiding in wetlands as they grow into adults, to alewife and blueback herring swimming upstream, the Chesapeake Bay is a veritable buffet line for predators like blue catfish, which eat whatever they can find.

One of the main dietary studies in Maryland waters focused on the Nanticoke River. Led by Salisbury Univer-



*A blue catfish held up with a fish gripper over the Potomac River.*

PHOTO, MADELEINE JEPSEN / MARYLAND SEA GRANT

sity's Assistant Professor of Physiology Noah Bressman and a master's student, Zachary Crum, the study analyzed stomach contents from more than 1,000 blue catfish.

They found that the most common species in Nanticoke blue catfish stomachs were blue crabs, white perch, and river herring such as blueback herring, gizzard shad, and alewife. In the spring, blue catfish shorter than 14 inches had eaten mainly aquatic plants and algae.

What they're eating can vary by season, since the Bay hosts migratory fish like river herring, American shad, and eels. Migratory species use the Bay's rivers as a seasonal passageway con-

necting the ocean habitats where they spend most of the year to the freshwater areas where they lay eggs.

In the spring, blueback and alewife herring—collectively called river herring—return from the sea to spawn in freshwater, passing through the Chesapeake Bay on their way. As river herring travel through the Bay, they serve as a food source for striped bass and other commercially important fish. Historically, river herring spawned in most tributaries along the East Coast, but dams and development have blocked many passages to their spawning grounds. In addition to this loss of spawning habitat, river herring are also swept up in fishing nets targeting other

fish species. As a result, both species of river herring are designated species of conservation concern.

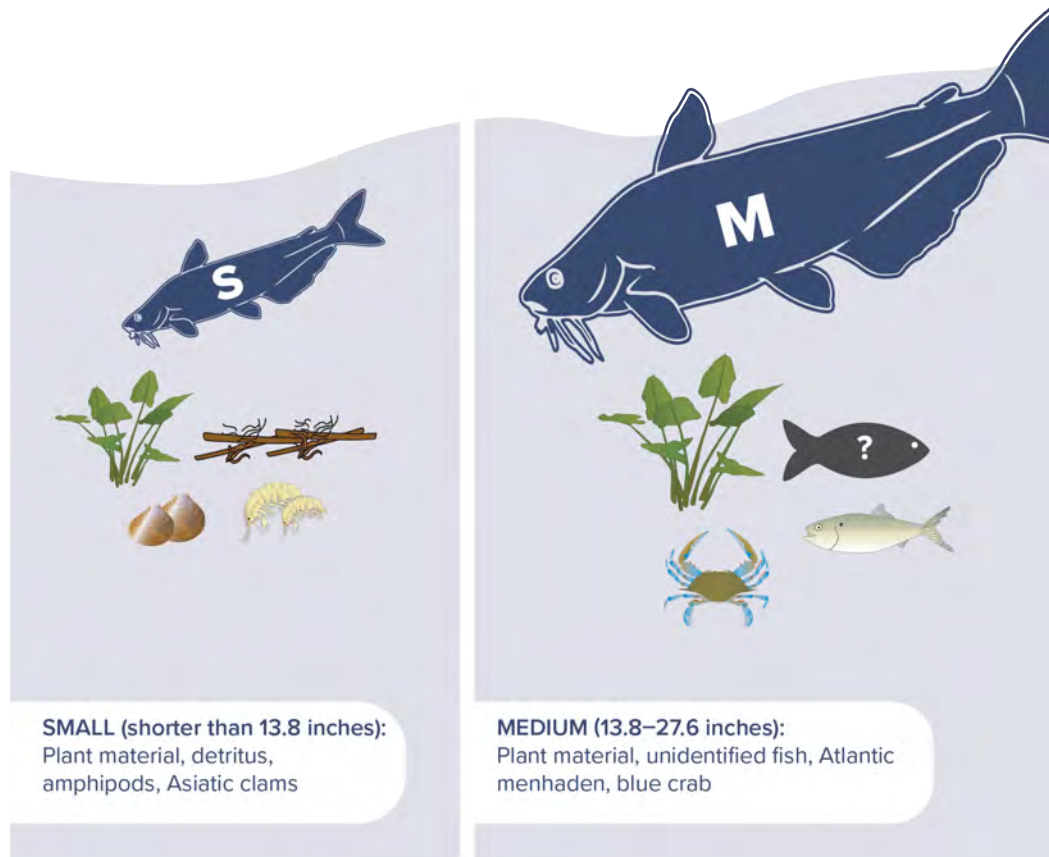
Not all blue catfish eat an equal amount of river herring. Blue catfish longer than 27.6 inches (700 millimeters) had the most impact on migratory fish, compared to smaller catfish examined in the study.

“That’s definitely something of note, because if managers are trying to reduce impacts to those species, they might manage such that individuals above 700 millimeters are removed from the population,” Crum says.

This research isn’t the first to note that blue catfish are consuming species of conservation concern in Maryland waters. A 2017 diet analysis from the Maryland Department of Natural Resources in the Potomac River also showed that river herring made up around 20% of the diet items identified in blue catfish stomachs—showing that blue catfish are gobbling down these fish as they migrate, thereby undermining conservation efforts like creating fish passages for river herring.

With thousands of tastebuds on their skin to smell prey items nearby, blue catfish are formidable predators. They bring their keen sense of smell and taste with them as they hunt for prey. The faster blue catfish grow, the sooner

## As blue catfish grow



The top four diet items found in the stomachs of small, medium, and large blue catfish in the Chesapeake Bay. GRAPHIC, JILL GALLAGHER / MARYLAND SEA GRANT



River herring swim in Maryland tributaries while migrating to their spawning grounds.

PHOTO, WILL PARSON / CHESAPEAKE BAY PROGRAM

they leap from eating mostly plants to eating mostly other fish. This has resulted in concerns among anglers and fishery managers that blue catfish are eating commercially and recreationally important fish from the Bay—and competing with these fish for food and shelter.

### How Big is a Blue Catfish’s Appetite?

One of the first studies to estimate food consumption rates for blue catfish focused on four tidal tributaries of the Chesapeake Bay: the James River, the Mattaponi River, the Pamunkey River, and the Rappahannock River. On average, a blue catfish eats roughly 2–5% of its body weight in food in a day during peak feeding season.

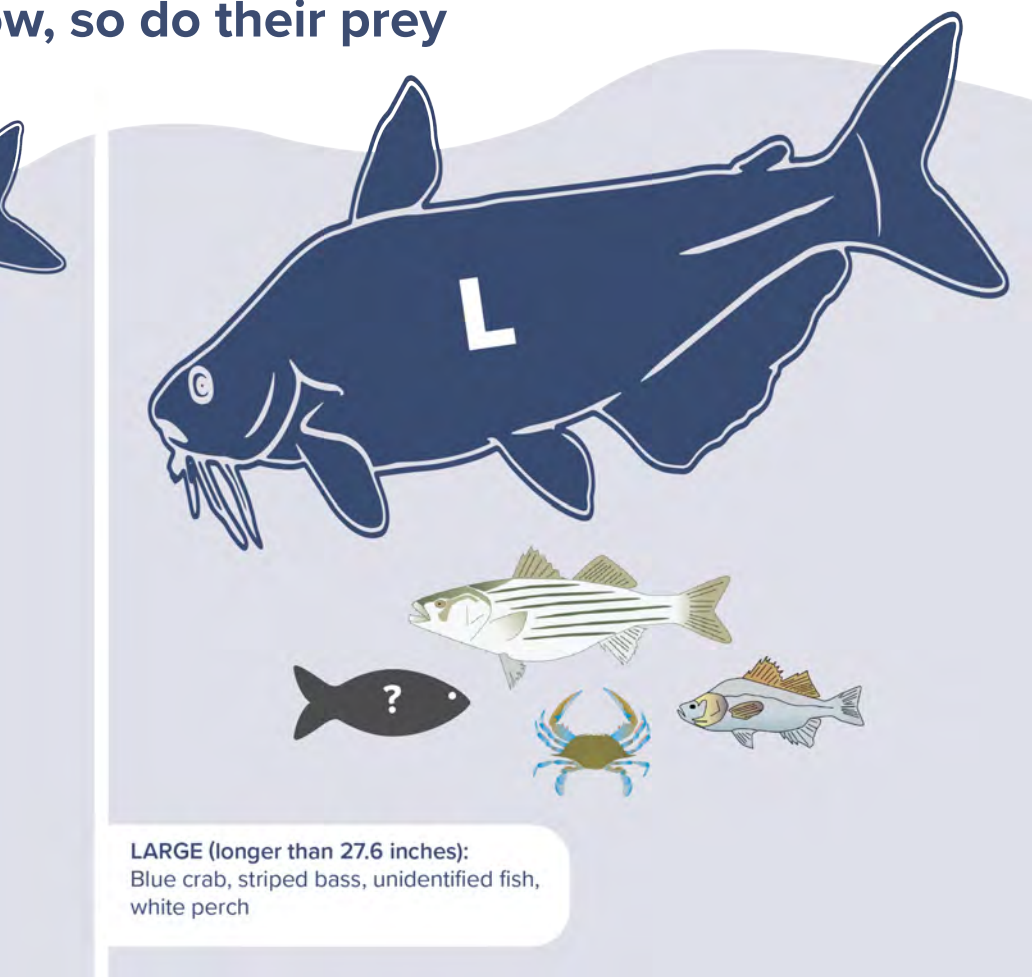
“This is the first time we’ve looked at how much blue catfish are eating both

in the field and the lab using natural food sources, and for larger fish,” says Schmitt, who led the study of more than 1,200 catfish as part of his Virginia Tech PhD research.

In addition to diet studies based on fieldwork, the researchers also measured how much a blue catfish would eat in a laboratory setting if they had unlimited food available to them—in this case, blue crab or gizzard shad—and found that the catfish could eat anywhere from 8–9% of their body weight in a day. That means a 30-pound fish could eat about 2.5 pounds of food per day.

Overall, the average feeding rates for blue catfish were similar to the feeding rates for other nonnative species like largemouth bass (*Micropterus salmoides*) and channel catfish (*Ictalurus punctatus*). While blue catfish aren’t atypical

## ow, so do their prey



Nanticoke River during studies at Salisbury University about blue catfish diets.



Jeremy Green and Zachary Crum with a blue catfish.

PHOTO, ZACHARY CRUM / SALISBURY UNIVERSITY

in how much food they eat, their abundance in many rivers means there are more stomachs to fill. In some sections of the James River, a study estimated that blue catfish make up as much as 75% of the river's biomass—meaning that 3 out of every 4 pounds of fish in the river are blue catfish.

Not all rivers have as many blue catfish as the James River, but understanding blue catfish feeding rates helps resource managers put a number on how much blue catfish are eating, and the impact that can have for the Bay's native species.

The Salisbury researchers found that blue catfish in the Nanticoke River begin eating a fish-based diet when they're around 19 inches in size. This is sooner than they transition to a fish-based diet in other Bay tributaries. For comparison, Virginia Tech diet studies found that blue catfish in the James, Pamunkey, Mattaponi, and Rappahannock rivers all became piscivorous at lengths larger than 25 inches.

Now that researchers have learned more about blue catfish diets and how much blue catfish eat in a day, these rates can be combined with population estimates—the number of individual blue catfish in a river—to estimate how much total food blue catfish are eating in each river. Feeding rate averages can also be paired with other studies to examine how much blue catfish affect individual species.

"When you start putting all these pieces together, you get a more holistic picture of the impact of blue catfish on our native species," Whitmore says. "Consumption rate is a really important step in that process. It really is a gateway to answering a lot of questions down the line."

Schmitt's lab mate at Virginia Tech, Corbin Hilling, combined these food consumption rates with population estimates from the James River to calculate how much blue catfish may be preying on native species and species of concern.

His models estimated that in the James River, blue catfish could be eating around 5.4 metric tons of striped bass, 46.9 metric tons of river herring, and 98.3 metric tons of Atlantic menhaden (*Brevoortia tyrannus*) each year.



A tangle of commercially harvested blue crabs (above). A partially digested blue crab recovered from a blue catfish stomach (at right).

ABOVE PHOTO, NICOLE LEHMING / MARYLAND SEA GRANT;  
PHOTO AT RIGHT, ZACHARY CRUM / SALISBURY UNIVERSITY



“In a nutshell, we were taking population size, the percent of that fish in their diet, and then how much they eat per year, and that's how we derived that estimate,” Schmitt says of Hilling’s modeling.

Their appetites aren’t limited to species of concern—the model also estimated that blue catfish could be eating around 108 metric tons of smaller blue catfish annually in the James River. They also prey on other invasive species such as Asiatic clam (*Corbicula fluminea*).

### Blue Versus Blue

As blue catfish spread and multiply, they’ve encroached on the iconic Maryland Blue: the Bay’s blue crab popula-

tions. Blue catfish are known to prey on blue crabs. Salisbury University’s researchers found that in the Nanticoke River, blue crabs made up about half the food items found in the stomachs of blue catfish longer than 27 inches.

Species don’t abide by state lines in the Chesapeake Bay—blue crabs and many other fish move to different parts of the Bay during different seasons. Every winter, mature female crabs migrate south into Virginia waters to spawn. One 2015 model estimated blue catfish in the James River eat more than 400 metric tons of blue crabs annually, based on stomach contents combined with population estimates. That means blue catfish in the James River could be eating rough-

ly 5% of the blue crab harvest for the entire state of Virginia.

“Granted, there’s uncertainty in the models we’ve developed, but if they’re eating 5% of total statewide harvest in the James alone, that, to me, is still pretty significant,” Schmitt says.

A 2022 study, led by Mary Fabrizio at the Virginia Institute of Marine Science, sampled a roughly 77 square mile section of the lower James River, between Richmond and the Chesapeake Bay. Of the blue catfish eating blue crabs sampled by her team, those blue catfish averaged about one blue crab per day. Fabrizio estimated that blue catfish consume a noteworthy 2.3 million blue crabs per year in just that portion of the James River. The



research team also found that blue catfish longer than 19.5 inches were more than seven times as likely to be eating blue crabs than the blue catfish between 8–12 inches long.

“It turns out that catfish are eating mostly juvenile crabs—anything less than 90 millimeters [3.5 inches] in carapace width,” Fabrizio says.

Fabrizio has shared her study’s results with resource managers at the Virginia Marine Resources Commission. Resource managers will factor this impact into the blue crab stock assessment model they will begin in 2025. Stock assessments help resource managers set harvest limits based on blue crab populations in the Bay, as well as the factors influencing blue crab populations, like water quality and mortality from predators like blue catfish.

### Bringing Solutions to the Table

As researchers have poured years of work into diet studies, anglers, restaurants, and fishmongers have worked to whet human appetites for Chesapeake Bay blue catfish. Wild-caught blue cat-



*Chef David Murray displays blue catfish cakes and sheetpan-roasted blue catfish and vegetables on a bun at the Chesapeake Culinary Arts Center.*

PHOTO, MADELEINE JEPSEN / MARYLAND SEA GRANT

# Dive Deeper: Eating Blue Catfish Safely

*One size does not fit all when it comes to fish consumption advisories*

**F**or those eating fish at restaurants and grocery stores, many precautions are in place to ensure the fish in packages or on plates is healthy and safe to eat. But anglers who frequently eat what they catch may be at a higher risk of health impacts. Maryland agencies offer science-based advice about which fish are healthiest to eat, and in what quantities.

Scientists from the Maryland Department of the Environment (MDE) monitor the Chesapeake Bay’s rivers and streams each year, collecting fish and testing them for contaminants linked to human health risks. When the fish they test contain certain levels of a contaminant, MDE creates a fish consumption advisory.

These advisories provide health guidelines about what species of fish of certain sizes and from certain water bodies should be eaten in limited quantities. The guidelines include how often people can safely consume fish from certain areas to avoid health risks.

Like other fish, blue catfish can accumulate harmful chemicals by eating other contaminated fish or insects, a process known as bioaccumulation. Similar to bioaccumulation in the aquatic food chain, these contaminants can accumulate in people who eat fish. Blue catfish from 12 water bodies are included in current fish advisories as of fall 2024.

Many of these consumption advisories are related to polychlorinated biphenyls or PCBs, a group of man-made industrial compounds that linger in the environment and are linked to negative health effects.



*Blue catfish tacos served at the Chesapeake Culinary Arts Center.*

PHOTO, MADELEINE JEPSEN / MARYLAND SEA GRANT

These advisories range from “avoid entirely” in sections of the Anacostia River, to “no limit” for adults eating blue catfish from Marshyhope Creek, a tributary of the Nanticoke River.

MDE’s fish consumption advisories for PCBs err on the side of caution. If a person were to eat more than the recommended limit every month for 30 years, they would have an increased risk of 1 in 100,000 of developing cancer or another negative health impact due to consumption of that fish.

“To put that into perspective, it’s riskier to get in the car, it’s riskier to smoke cigarettes or eat fatty foods,” says John Backus, program manager for MDE’s Environmental Assessment and Standards Program. “It’s a low risk, but the consequences are legitimate and significant.”

MDE also offers general advice for anglers who cook and clean their catch to minimize contaminants. These suggestions include removing fish skin from the entire fish, fat from the fish’s back and belly, and dark meat from fish filets before cooking them, since contaminants can accumulate in these parts of the fish.

**Are the fish you catch safe to eat regularly?  
Check for fish consumption advisories in waters near you:  
[mde.maryland.gov](http://mde.maryland.gov)**


fish have made their way onto dozens of restaurant menus around the Bay and can be found on grocery store shelves around the country.

At the Chesapeake Culinary Center in Denton, Maryland, blue catfish filets are a common sight at cooking stations for chefs-in-training, on plates at the student-run restaurant, and in to-go containers for the center's community meal series on Wednesday nights.

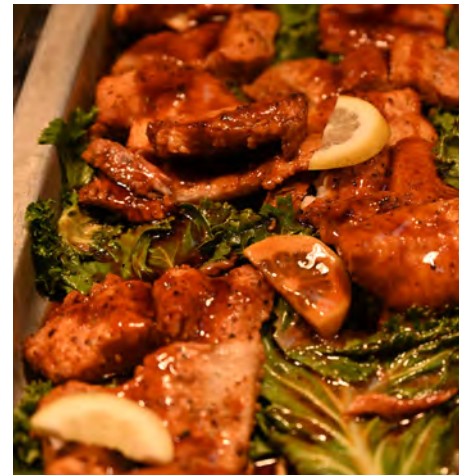
"It's an excellent opportunity for our students to get hands-on training, a way to feed the local community, and a net positive for the Bay," says Chef David Murray, director of operations at the Chesapeake Culinary Center. There is a tasty benefit of the blue catfish's fish-heavy diet. Those who cook and

eat blue catfish describe them as "light and flaky," with a clean flavor and nutritious profile.

Researchers will continue integrating diet studies with emerging abundance studies. As scientific knowledge of blue catfish progresses, this research could show how many pounds of blue catfish need to be removed to reduce the number of blue crabs, striped bass, river herring, and other fish they are eating.

Until then, these Bay blues will continue to fill commercial fishers' longlines, recreational anglers' coolers, chefs' cooking stations, and dinner plates around the Bay and beyond. 

—By Madeleine Jepsen,  
[mjepsen@mdsg.umd.edu](mailto:mjepsen@mdsg.umd.edu)



*Blue catfish with a Kabayaki glaze served in a University of Maryland dining hall.*

PHOTO, MADELEINE JEPSEN /  
MARYLAND SEA GRANT

**"It's an excellent opportunity for our students to get hands-on training, a way to feed the local community, and a net positive for the Bay."**

*Chef David Murray, director of operations at the Chesapeake Culinary Arts Center*



## RECIPE

# Chesapeake Blue Catfish Tacos

Chef Keyia Yalcin of Baltimore's Fishnet Restaurant shared an easy and delicious recipe with us. Find the recipe and cooking video on [chesapeakequarterly.net](http://chesapeakequarterly.net). For more ways to cook wild-caught Chesapeake blue catfish at home, visit the Maryland's Best website at [marylandsbest.maryland.gov](http://marylandsbest.maryland.gov).

PHOTO, LOGAN BILBROUGH / MARYLAND SEA GRANT EXTENSION

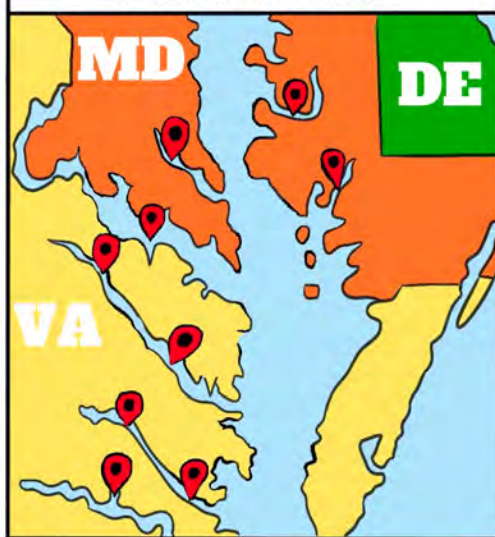
# The Catfish Conundrum

by Sydney Sauls (author) and Zuri Hurley (illustrator)

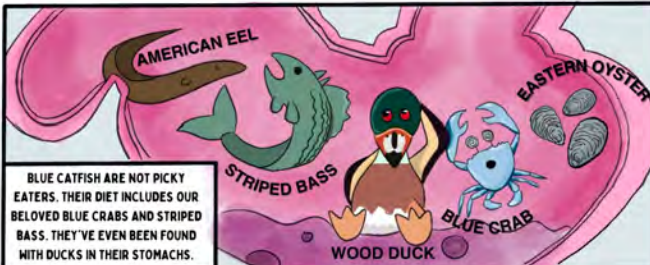
BLUE CATFISH WERE INTRODUCED TO VIRGINIA RIVERS IN 1974 TO OFFER ANGLERS A FUN, NEW FISH TO CATCH.



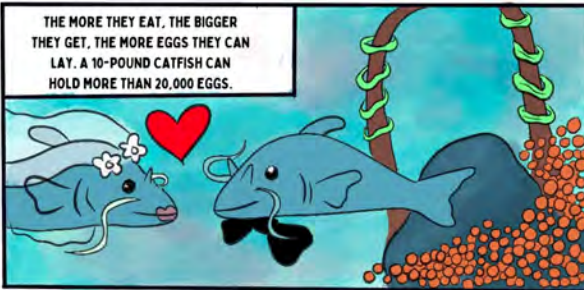
EXPERTS THOUGHT THEY COULD ONLY LIVE IN THE RIVERS WHERE THEY WERE INTRODUCED. BUT OVER TIME, THEY SPREAD TO OTHER AREAS IN THE BAY.



BLUE CATFISH ARE NOT PICKY EATERS. THEIR DIET INCLUDES OUR BELOVED BLUE CRABS AND STRIPED BASS. THEY'VE EVEN BEEN FOUND WITH DUCKS IN THEIR STOMACHS.



THE MORE THEY EAT, THE BIGGER THEY GET, THE MORE EGGS THEY CAN LAY. A 10-POUND CATFISH CAN HOLD MORE THAN 20,000 EGGS.



EVENTUALLY THEY BECOME SO LARGE THAT MOST PREDATORS ARE NO LONGER A THREAT.



WITHOUT PRESSURE FROM PREDATORS, BLUE CATFISH STEAL FOOD AND HABITATS FROM OUR NATIVE WILDLIFE, THREATENING THE HEALTHY BALANCE OF THE CHESAPEAKE BAY.



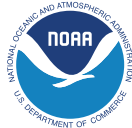
YOU CAN HELP BY BUYING BLUE CATFISH AT A RESTAURANT OR COOKING IT AT HOME. THEY'RE DELICIOUS!



• FISHCAKE ON A BUN

• CATFISH DIP

• CATFISH TACOS



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Visit [chesapeakequarterly.net](http://chesapeakequarterly.net) or scan the QR code below to read the full issue, which includes these four stories and more about invasive blue catfish and their impact on the Chesapeake Bay.

**Fish Out of Water**



A bounty of invasive blue catfish has led to new opportunities for commercial watermen, but can processors keep pace? Learn more about the hurdles and opportunities shaping the future of Maryland’s blue catfish industry.

PHOTO, WILL PARSON / CHESAPEAKE BAY PROGRAM

**Mouths to Feed**



Dining halls, school cafeterias, and food pantries are using blue catfish as a nutritious protein source for their clients. Learn more about these large-scale efforts that bring a tasty solution to the table.

PHOTO, LOGAN BILBROUGH / MARYLAND SEA GRANT EXTENSION

**Taking Stock**



Researchers are on a mission to model the Bay’s blue catfish populations—but first they have to gather crucial data about these invasive fish.

PHOTO, MEGHAN MARCHETTI / VIRGINIA DEPARTMENT OF WILDLIFE RESOURCES

**An Appetite for Invasives**



From blackened Chesapeake Channa to curried wild-caught Chesapeake blue catfish, “invasivore” campaigns recruit the public to help remove invasive species from the water—one bite at a time.

PHOTO, RYAN HAGERTY / US FISH AND WILDLIFE SERVICES



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