Migratory Fish: Human Induced Declines in Population

Executive Summary

Human intervention in the Chesapeake Bay has led to a serious decline in migratory fish populations. Human intervention in this case refers to: artificial waterway blockages, climate change, invasive species introduction, overharvesting, and decreased water quality as a result of sediment and nutrient pollution. These factors are all threatening the balance of the Chesapeake Bay's ecosystem, and could lead to an eventual collapse of the species in the watershed. These issues are pressing and current, with migratory fish struggling to survive in the Bay, and in some cases not returning.

Migratory fish are an excellent Bay health indicator, as these species are sensitive to things like water quality, temperature, and especially waterway blockages. If these species are not able to reach their natal rivers and streams, reproductive efficiency falls dramatically and these species and their juveniles become victims to predation and harmful environmental impacts they cannot adapt to in time.

There are several solutions that would make a great positive impact on Bay health and the return of migratory fish. These solutions are: dam removals, invasive species management plans, establishment and marketing of blue catfish as an economically viable fishery, protecting and restoring riparian buffers, and improving water quality controls. Economically, these solutions are sound, and can help in revitalizing sustainable fisheries and industry within the Bay region. In implementing these solutions, some are cost-effective, some may require some investment, but all of them would improve the health of the Chesapeake Bay ecosystem.

Key Findings

1. Migratory fish species serve as an excellent indicator of health in the Chesapeake Bay, as they are sensitive to water temperature, quality, and predation. The decline of migratory fish species shows an overall decline in Bay health.
2. Nature-based solutions are a cost effective way to improve the quality of the Chesapeake Bay, and increase climate resilience.
3. Dams, pollution, harmful algal blooms, climate change, and invasive species are all key factors threatening not only migratory fish populations, but industry and recreation in the Chesapeake Bay.

The Cultural Impact of Declines in Migratory Fish

The Chesapeake Bay is one of the most economically, historically, and culturally significant areas in Virginia and along the East Coast. The Bay has long brought economic prosperity, industry, and recreation for those living in the region. However, the Bay's health has been in jeopardy for some time, and it is due to the intervention of humans. Overharvesting the Bay's natural resources, constructing dams, and polluting waterways are all aspects of human intervention that have been detrimental to the Bay's health. Migratory fish are an essential part of the Bay's ecosystem, as well as its tributaries. Native species like American shad, river herring, and Atlantic sturgeon are both culturally significant and act as Bay health indicators: the fewer the fish, the less healthy the bay is. There is a delicate balance in the Chesapeake Bay ecosystem, and human intervention has been tipping the scales for generations. This paper serves to highlight the causes and determinants of the decline in migratory fish in the Chesapeake Bay watershed, and offers solutions to address these issues.

Migratory Fish as a Bay Health Indicator

Human involvement in the Chesapeake Bay has destabilized its naturally-occurring ecosystems, harming not only native species, but also the industries that have laid their claim here. Industries like the blue crab fishery, which averages $34 million annually[1], and the menhaden fishery are being threatened by increased predation from invasive species, decreased water quality due to pollution, and overharvesting. These cumulative threats have destabilized the region entirely by disrupting the natural flow of the food chain. Birds of prey like osprey, bald eagles, and red-shouldered hawks will often consume species of migratory fish in the Bay. In particular, declines in the Bay's menhaden population have significant impacts on osprey in the region, such as decline in reproductive rates in osprey when there are fluctuations in menhaden populations[2]. Research suggests that in order for osprey populations to stabilize or increase, menhaden levels in the bay should return to pre-1980's levels[3].

Migratory fish are geared towards regional reproduction cycles[4]. Most species of migratory fish will travel to their natal freshwater rivers to spawn during their reproductive season before returning to their life in either salt or brackish waterways. Their ability to migrate in and out of the Bay's waterways is key to ensuring healthy populations continue to thrive. However, several key issues are impacting the Chesapeake Bay's migratory fish populations, including impasses (dams), rising temperatures (climate change), lack of suitable spawning

[1] NOAA fisheries One stop shop. (n.d.). https://www.fisheries.noaa.gov/foss/f?p=215%3A200%3A%3A%3A%3A%3A%3A

[2] Watts, B. D., & Hines, C. (2025). Response: Commentary: Demographic response of Osprey within the lower Chesapeake Bay to fluctuations in Menhaden stock. *Frontiers in Marine Science*, *12*. https://doi.org/10.3389/fmars.2025.1565843

[3] Watts, B. D., Stinson, C. H., McLean, P. K., Glass, K. A., Academia, M. H., & Byrd, M. A. (2024). Demographic response of Osprey within the lower Chesapeake Bay to fluctuations in Menhaden stock. *Frontiers in Marine Science*, *10*. https://doi.org/10.3389/fmars.2023.1284462

[4] *Fish Migration, Horizontal.* Arnold, Shipley, Siskey, Encyclopedia of Ocean Sciences, Volume 2 pg. 205-216. 2019 (https://doi.org/10.1016/B978-0-12-409548-9.11339-9)

habitat (submerged aquatic vegetation), decreased water clarity and quality (sediment and nutrient pollution), and increased predation from invasive species (blue catfish). All of these issues can be traced back, one way or another, to human involvement at some point in the history of the Bay.

Impacts of Dam Construction on Migratory Fish

Migratory fish are particular about their spawning locations, with many only returning to the same rivers they were born in to reproduce. Their migration is made possible by the intricate network of streams, creeks, and rivers that make up the Chesapeake Bay's tributaries. Waterway blockages, such as human-made dams, have impeded the ability of migratory fish to access and move freely within their natal rivers. These dams not only inhibit or prevent native migratory fish from reaching their destinations, they can also benefit non-native species, such as invasive crayfish that are positively impacted due to the impounded flow regimes of waterways which are beneficial to the more resilient and adaptive invasive crayfish[5]. Crayfish mating, foraging and growth are linked to waterway flows, and when those flows are impacted it can displace native crayfish species, and contribute to the success of invasive crayfish.

Thousands of dams and other blockages are strewn throughout the Chesapeake's tributaries that negatively impact migratory fish species' ability to reach their natal spawning locations. There are currently eleven dams that impact the American shad population in the James River and have ultimately led, in part, to zero shad in the James River since 2021[6]. Other

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[5] Barnett, Z. C., & Adams, S. B. (2021). Review of dam effects on Native and invasive crayfishes illustrates complex choices for conservation planning. *Frontiers in Ecology and Evolution*, *8*. https://doi.org/10.3389/fevo.2020.621723

[6] *State of the James.* (2025). James River Association. https://thejamesriver.org/wp-content/uploads/2025/10/2025-SOTJ-Indicator-Narriative-and-Graphs.pdf

factors include increased water withdrawals, waterway blockages, predation by invasive species, and climate change.

Declining migratory fish populations due to dams and other human-made barriers makes clear that habitat connectivity is extremely important not only for terrestrial species but also for aquatic species like migratory fish. Anadromous fish, like American shad for example, require the ability to return to their spawning rivers in particular times of the year, and making that as easy as possible would bolster their populations[7]. When these fish cannot reach their destination, spawning can occur in less-than-ideal conditions, which increases instability in both effective egg fertilization and juvenile success[8].

Impact of Climate Change on Migratory Fish

Increasing water temperatures create a myriad of problems for migratory fish in the Chesapeake Bay, limiting their ability to both travel and successfully reproduce. Higher temperatures have been shown to increase energy expenditure, which is of great importance for migratory fish, as these species tend to feed irregularly and infrequently while migrating[9]. This means that a significant portion of migratory fish species are unable to successfully reach their spawning waters to reproduce due to the increased cost of energy, which they cannot expend. Longer migrations at higher temperatures create issues for migratory fish and their energy stores,

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[7] Acolas, M.-L., & Lambert, P. (2016). Life histories of anadromous fishes. *An Introduction to Fish Migration*, 63–85. https://doi.org/10.1201/b21321-9

[8]Bayse, S. M., Regish, A. M., & McCormick, S. D. (2021). Survival and spawning success of American shad (Alosa sapidissima) in varying temperatures and levels of glochidia infection. *Fish Physiology and Biochemistry*, *47*(6), 1821–1836. https://doi.org/10.1007/s10695-021-01018-4

[9]Peer, A. C., & Miller, T. J. (2014). Climate change, migration phenology, and fisheries management interact with unanticipated consequences. *North American Journal of Fisheries Management*, *34*(1), 94–110. https://doi.org/10.1080/02755947.2013.847877

as they tend to burn through their energy stores more quickly in hotter environments[10]. Longer migrations as a result of waterway blockages mean more time spent expending energy travelling upstream in higher water temperatures.

Warmer temperatures are impacting the migration of these fish, but also the habitats they utilize during their migrations throughout the Bay and its tributaries[11]. Arrival and departure times for migrations may shift as a result of climate change, or in the worst case, result in a loss of habitat and population size for migratory fish. A study conducted by the Virginia Institute of Marine Sciences (VIMS) indicated that these shifts may result in both short-term and long-term changes, such as longer spawning periods, spawning locations closer to the mouth of the Bay, and population decreases.[12]

Water quality and clarity are also impacted by climate change and nutrient pollution, which creates harmful algal blooms (HABs) that are toxic to both fish and humans. As temperatures rise, instances of HABs become more frequent, resulting in the degradation of the ecosystem and habitat of the Chesapeake Bay and its tributaries[13]. HABs tend to be a result of nutrient pollution, particularly excess nitrogen and phosphorus from agricultural runoff, which contribute to the growth and spread of the algae across a portion of impacted waterways. Nutrient pollution also

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[10]Martin, E. H. (2018). Assessing and prioritizing barriers to aquatic connectivity in the Eastern United States. *JAWRA Journal of the American Water Resources Association*, *55*(2), 401–412. https://doi.org/10.1111/1752-1688.12694

[11] Min, M. A., Buchanan, R. A., & Scheuerell, M. D. (2025). Modeling climate and hydropower influences on the movement decisions of an anadromous species. *Global Change Biology*, *31*(10). https://doi.org/10.1111/gcb.70533

[12]Crear, D. P., Watkins, B. E., Friedrichs, M. A., St-Laurent, P., & Weng, K. C. (2020). Estimating shifts in phenology and habitat use of cobia in Chesapeake Bay under climate change. *Frontiers in Marine Science*, *7*. https://doi.org/10.3389/fmars.2020.579135

[13]Creekmore, L.H., 1999, Algal toxins: Information and Technology Report, 4 p.

contributes to a decrease in submerged aquatic vegetation (SAV) species[14]. SAV, like any other plant species, requires sunlight to grow adequately. Impacts to water quality and clarity from HABS make it immensely difficult for critical SAV species to grow, as HABs tend to occur on the surface of the water, which blocks sunlight for both fish and aquatic vegetation.

SAV species are another excellent indicator of Bay health, and when there is an adequate population of these species, it indicates that the Bay's water is sufficient in both clarity and quality. SAV species play a critical role for migratory fish by providing habitat for juvenile fish and locations that are ideal for spawning[15]. There have been serious declines in SAV growth in the Chesapeake watershed as a result of sediment and nutrient pollution[16]. Sediment pollution refers to rainfall erosion and river transportation, and that gradually accumulates at the bottom of rivers and waterways and results in sediment pollution[17]. One of the leading pollutants in the James River that impacts both turbidity and water quality is sediment pollution[18]. Sediment and nutrient pollution are often the result of stormwater runoff, and in the James River specifically, from combined sewer overflows, which discharge pollutants into the river, impacting water quality, water clarity, and native fish and plant species.

Impacts of Predation on Migratory Fish

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[14] Ruhl, H. A., & Rybicki, N. B. (2010). Long-term reductions in anthropogenic nutrients link to improvements in Chesapeake Bay Habitat. *Proceedings of the National Academy of Sciences*, *107*(38), 16566–16570. https://doi.org/10.1073/pnas.1003590107

[15] Michel, C. J., Burford, B. P., Takata, L. K., Lehman, B. M., Demetras, N. J., & Harrison, L. R. (2025). The impact of submerged aquatic vegetation removal on fish predation in a tidal river channel. *Estuaries and Coasts*, *49*(1). https://doi.org/10.1007/s12237-025-01614-0

[16] Turner, J. S., Friedrichs, C. T., Parrish, D. B., & Fall, K. A. (2026). Chesapeake Bay Water Clarity: Challenges and successes. *Annual Review of Marine Science*, *18*(1), 89–119. https://doi.org/10.1146/annurev-marine-040224-120528

[17] Wang, T., Xu, S., & Liu, J. (2017). Dynamic assessment of comprehensive water quality considering the release of sediment pollution. *Water*, *9*(4), 275. https://doi.org/10.3390/w9040275

[18] *State of the James.* (2025). James River Association. https://thejamesriver.org/wp-content/uploads/2025/10/2025-SOTJ-Indicator-Narriative-and-Graphs.pdf

Another issue that impacts migratory fish populations is predation, specifically by invasive species. Blue catfish are an invasive species that were introduced into the James and Rappahannock rivers in the 1980s and have become one of the biggest threats to migratory fish in the Chesapeake watershed[19]. Blue catfish are a cause for concern because of both biological and behavioral factors. Firstly, blue catfish are incredibly resilient, able to survive in salinities of up to ten practical salinity units (PSU) to forage for food[20]. Ten PSU salinity translates to brackish waters, but the habitat suitable for blue catfish is around four to seven PSU, which is fresher water. Second, blue catfish have high rates of sexual maturity, food consumption, and reproduction[21], which facilitates their explosive ubiquity in the Chesapeake Bay watershed, compared to native species of the Chesapeake watershed, especially considering the effect of climate change on less resilient species. The ability of blue catfish to survive in differing haline—or salinity—zones, like mesohaline and oligohaline, means that the foraging territory for blue catfish is extensive, and when coupled with the impacts of climate change, can extend even further.

Blue catfish also have a myriad of other biological abilities, like fat storage and low metabolic rates, that enable them to survive in habitats of low prey availability[22]. They are voracious and generalist hunters, which facilitates their aggressive behaviors and feeding habits.

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[19] Schmitt, J. D., Hallerman, E. M., Bunch, A., Moran, Z., Emmel, J. A., & Orth, D. J. (2017). Predation and prey selectivity by nonnative catfish on migrating alosines in an Atlantic Slope estuary. *Marine and Coastal Fisheries*, *9*(1), 108–125. https://doi.org/10.1080/19425120.2016.1271844

[20] Nepal, V., & Fabrizio, M. C. (2019). High salinity tolerance of invasive blue catfish suggests potential for further range expansion in the Chesapeake Bay Region. *PLOS ONE*, *14*(11). https://doi.org/10.1371/journal.pone.0224770

[21] Martin, K. A., Bosworth, B. G., Liyanage, S. S. N., Wood, K. R., Abernathy, J. W., Beck, B. H., Bruce, T. J., Roy, L. A., Dunham, Rex. A., & Butts, I. A. E. (2025). Spermatogenesis, hormonal fluctuations, and testicular gene expression changes in male blue catfish, ictalurus furcatus, throughout pubescent and early adult stages of development. *BMC Genomics*, *26*(1). https://doi.org/10.1186/s12864-025-12293-3

[22] Nepal, V., Fabrizio, M. C., & Brill, R. W. (2021). Effects of food limitation on growth, body condition and metabolic rates of non-native blue catfish. *Conservation Physiology*, *9*(1). https://doi.org/10.1093/conphys/coaa129

They are especially threatening to native migratory fish populations, as juvenile fish tend to be relatively easy for blue catfish to catch and consume. The average blue catfish is around two feet long and weighs about six pounds, and can consume around 10 percent of its body weight per day[23]. Some blue catfish can grow to be more than 100 pounds and live up to 25 years[24].

Further, blue catfish reach sexual maturity at a much faster rate than other fish in the Chesapeake Bay watershed, at around 4 years old.[25] This allows them to breed faster and facilitates an extremely quick reproductive cycle. The ubiquity of blue catfish in the Chesapeake watershed directly correlates to lower populations of native migratory fish, such as American eel, American shad, and blueback herring[26], and contributes to the destabilization of the watershed's ecosystem. Since their introduction to the James and Rappahannock rivers, blue catfish have not been managed effectively, leading to their success—and a significant decline in native wildlife—in the Chesapeake watershed.

Economic Impacts of Declining Migratory Fish Populations

The economic impact of invasive species, rising water temperatures due to climate change, dams, barriers, and HABs in the Chesapeake Bay watershed is something that cannot be ignored. Invasive species predation on keystone species like blue crab, menhaden, and river herring impacts fisheries and places the Chesapeake Bay's seafood industry in jeopardy. Some of

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[23] Fisheries, N. (2026, July 10). *Blue catfish*. https://www.fisheries.noaa.gov/species/blue-catfish
[24] *Blue catfish | NOAA fisheries*. Species Directory: Blue Catfish. (2026, October 7). https://www.fisheries.noaa.gov/species/blue-catfish
[25] Liyanage, S. S., Bosworth, B. G., Martin, K. A., Wood, K. R., Nowicki, A. E., Abernathy, J. W., Sankappa, N. M., Beck, B. H., Bruce, T. J., Litvak, M. K., Dunham, R. A., Roy, L. A., Wang, X., & Butts, I. A. (2025). Age-related reproductive performance and transcriptome profiling of testis in male blue catfish, ictalurus furcatus. *BMC Genomics*, *26*(1). https://doi.org/10.1186/s12864-025-12014-w
[26] Hilling, C. D., Jiao, Y., Schmitt, J. D., Fabrizio, M. C., Angermeier, P. L., & Orth, D. J. (2025). Management strategy evaluation to assess trade-offs associated with invasive blue catfish fisheries and predation impacts. *Marine and Coastal Fisheries*, *17*(1). https://doi.org/10.1093/mcfafs/vtaf004

the most lucrative fisheries in the Chesapeake Bay are greatly impacted by numerous different factors, which are costing industry in the Chesapeake Bay to lose revenue.

The blue crab is one of the largest economic, and culturally significant fisheries in the Chesapeake Bay watershed[27], and is impacted by climate change and invasive species predation. Blue crabs migrate seasonally, following warmer water temperatures, which moves them closer to the foraging territory of blue catfish, increasing predation and negatively impacting blue crab populations in the Bay[28]. Other migratory species like American shad and hickory shad are also routinely impacted by blue catfish predation regardless of season, which has led to a drastic decline in shad populations in the Bay[29].

The menhaden fishery in the Chesapeake Bay is one of the largest on the East Coast of the United States, and is primarily commercial through the Omega Proteins corporation, and is greatly impacted by climate change and overharvesting[30]. Rising temperatures negatively impact menhaden reproduction in numerous ways that reduce population resilience and declines in regional menhaden availability[31]. Another impact that must be addressed is the overharvesting of menhaden in the Bay in order to process the fish into fish oils and other products. When both

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[27] *Blue crabs*. Chesapeake Bay Program. (n.d.). https://www.chesapeakebay.net/issues/whats-at-risk/blue-crabs

[28] Schmitt, J. D., Peoples, B. K., Bunch, A. J., Castello, L., & Orth, D. J. (2019a). Modeling the predation dynamics of invasive blue catfish (ictalurus furcatus) in Chesapeake Bay. *Fishery Bulletin*, *117*(4), 277–290. https://doi.org/10.7755/fb.117.4.1

[29] Schmitt, J. D., Peoples, B. K., Bunch, A. J., Castello, L., & Orth, D. J. (2019a). Modeling the predation dynamics of invasive blue catfish (ictalurus furcatus) in Chesapeake Bay. *Fishery Bulletin*, *117*(4), 277–290. https://doi.org/10.7755/fb.117.4.1

[30] Anstead, K. (Ed.). (n.d.). *Menhaden and forage fish management – fish, fishing, and conservation*. Menhaden and Forage Fish Management. https://pressbooks.lib.vt.edu/fishandconservation/chapter/menhaden-and-forage-fish-management/

[31] Humphrey, J., Wilberg, M. J., Houde, E. D., & Fabrizio, M. C. (2014). Effects of temperature on age‐0 atlantic menhaden growth in Chesapeake Bay. *Transactions of the American Fisheries Society*, *143*(5), 1255–1265. https://doi.org/10.1080/00028487.2014.931299

issues are coupled, it is observed that there is unsustainable harvesting of menhaden in conjunction with a less resilient and survivable species, it is seemingly inevitable that there is a steep decline in menhaden populations.

Increasing difficulties for migratory fish as a result of invasive species predation, climate change, and sediment pollutants will inevitably result in economic decline in the Chesapeake Bay region due to declines in migratory fish populations. Overharvesting exacerbates these issues further by increasing difficulties in reproduction, and fish reaching sexual maturation.

Practical Solutions to Restore Native Migratory Fish Populations

Despite the negative impacts to the Chesapeake Bay's ecosystem health and migratory fish populations described above, there are numerous opportunities to reverse these impacts. Dam removals, engineered aquatic organism passages, runoff and sediment controls, invasive species marketing, and riparian buffers can significantly benefit migratory fish in the Chesapeake Bay watershed.

Dam Removal and Aquatic Habitat Connectivity

One of the most impactful solutions to improving populations of migratory fish would be the removal of dams, as giving these species easier access to their spawning grounds would bolster their growth[32]. There have been numerous proposals for dam removals across the Chesapeake watershed, like the Rapidan Dam in the Rappahannock and Baber's Mill Dam in

[32] Huang, C. S., Legett, H. D., Plough, L. V., Aguilar, R., Fitzgerald, C., Gregory, B., Heggie, K., Lee, B., Richie, K. D., Harbold, W., & Ogburn, M. B. (2023). Early detection and recovery of river herring spawning habitat use in response to a mainstem dam removal. *PLOS ONE*, *18*(5). https://doi.org/10.1371/journal.pone.0284561

Rock Island Creek, a James River tributary[33]. Other programs related to fish passage are growing across the watershed. Nonprofit organizations, such as Wild Virginia[34], and state agencies, such as the Department of Wildlife Resources[35], promote habitat connectivity and restoration across the Chesapeake watershed. These initiatives are greatly beneficial to migratory fish populations, as one of the leading causes of population decline for migratory fish is simply difficulty reaching their natural habitats.

There are tens of thousands of dams across the eastern United States, and millions of road-stream crossings, which can inhibit migratory fish species from reaching their desired destinations. Fortunately, there is growing momentum for dam removals and proposals for implementing infrastructure for aquatic organism passage, which has significant cobenefits for communities. Research done by the North Atlantic Aquatic Connectivity Collaborative has shown that crossings with adequate aquatic organism passages tend to be more resilient to failure during large storm events[36]. The implementation of aquatic organism passages would then also have a sound economic rationale for their implementation, as flood resiliency and water quality would improve as a result[37].

Water Quality Controls

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[33]Virginia Department of Wildlife Resources. (n.d.). *Fish passage program | virginia dwr*. DWR: Fish Passage Program. https://dwr.virginia.gov/fishing/fish-passage/

[34] Collaborative, V. S. W. C. (2026, May 5). *Virginia's Habitat Connectivity Hub*. ArcGIS StoryMaps. https://storymaps.arcgis.com/stories/7d09dfd6b426487eb50ac75bb01d81ef

[35] *Virginia's wildlife corridor action plan*. Virginia DWR. (n.d.). https://dwr.virginia.gov/wildlife/corridors/

[36] *Aquatic connectivity scoring systems for non-tidal crossings : North Atlantic Aquatic Connectivity Collaborative : UMass Amherst*. North Atlantic Aquatic Connectivity Collaborative. (2015). https://streamcontinuity.org/resources/aquatic-connectivity-scoring-systems-non-tidal-crossings

[37] Martin, E. H. (2018a). Assessing and prioritizing barriers to aquatic connectivity in the Eastern United States. *JAWRA Journal of the American Water Resources Association*, *55*(2), 401–412. https://doi.org/10.1111/1752-1688.12694

The Virginia Department of Environmental Quality (DEQ) manages the Erosion and Sediment Program (VESCP) which would require Virginia localities to provide provisions for the VESCP to coordinate flood insurance, flood plain management, and other programs requiring compliance prior to authorizing a land-disturbing activity, noncompliance would result in financial penalties of up to $32,500. This program monitors sediment pollution as a result of new construction, which can cause soil compaction and increased stormwater runoff, especially during large storm events. Legislation passed in 2026 to increase penalties for localities without these controls[38]. Implementing these controls and increasing penalties for violations serve as pathways to improve water quality benefit both native aquatic vegetation and migratory fish species.

Another potential solution for improving water quality involves mussel hatcheries. Mussels can naturally filter around 15 gallons of water per day.[39] Implementing projects like living shorelines and installations of artificial reefs, made from concrete and other materials, to recruit and promote mussel settlements, would drastically increase both the population density of native mussel species[40], but also the quality of water while providing a necessary food source to the many species of the Chesapeake Bay.

Marketing of Blue Catfish

[38] *House Bill NO. 1350,* 2026 Session, 2026 Introduced. https://lis.virginia.gov/bill-details/20261/HB1350/text/HB1350

[39] Wood, J., Bukaveckas, P., Galbraith, H., Gattis, M., Gray, M., Ihde, T., Kreeger, D., R., McLaughlin, S., Hahn, S., & Harvey, A. (2021). Incorporating freshwater mussels into the Chesapeake Bay restoration effort. Chesapeake Bay Program Science and Technical Advisory Committee. https://www.chesapeake.org/stac/wp-content/

[40] Lipcius, R. N., & Burke, R. P. (2018). Successful recruitment, survival and long-term persistence of eastern oyster and hooked mussel on a subtidal, artificial restoration reef system in Chesapeake Bay. *PLOS ONE*, *13*(10). https://doi.org/10.1371/journal.pone.0204329

Viewing the invasive blue catfish problem through an economic lens also helps put potential solutions into perspective. Blue catfish are detrimental to the commercial fisheries of the Chesapeake Bay. In Virginia alone, the blue crab fishery averages about $34 million annually and is often impacted by overharvesting and predation by invasive species like blue catfish[41]. Meanwhile, revenue from the blue catfish industry in Virginia is currently limited, reaching $2.2 million at its height in 2024.[42] Ultimately, there is great opportunity to harvest blue catfish without fear of overharvesting.

Considering that blue catfish make up roughly 75% of the biomass in the James River[43], there are opportunities to establish fisheries outside of recreational and sport fishing. While there are economic benefits to trophy fishing for larger blue catfish, the problem lies with the amount of the population that are not trophy sized. By establishing a fishery for blue catfish, Virginia could substantially increase revenue for both blue catfish but also for the other fisheries blue catfish are impacting through predation.

One potential opportunity to manage blue catfish populations is to increase demand for them as a sustainable food source for both people and pets. The federal Mitigation Action & Watermen Support (MAWS) Act of 2025 would create a pilot program to establish a market for blue catfish in the Chesapeake Bay by incorporating the unusable pieces of the catfish, parts that

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[41] NOAA fisheries One stop shop. (n.d.). https://www.fisheries.noaa.gov/foss/f?p=215%3A200%3A%3A%3A%3A%3A%3A

[42] NOAA fisheries One stop shop. (n.d.). https://www.fisheries.noaa.gov/foss/f?p=215%3A200%3A%3A%3A%3A%3A%3A

[43] Hafner, K. (2025, October 14). Virginia may soon lift restrictions on catching invasive blue catfish. https://www.vpm.org/news/2025-10-14/virginia-blue-catfish-invasive-species-chesapeake-bay-dwr-moore-simonds

could not be filleted, into pet food, animal feed, and aquaculture feed[44]. This piece of legislation addresses the invasive blue catfish issue through an economically viable lens, as investing in blue catfish as a commercial fishery would lead to payoffs not only for the catfish industry but also for other commercial fisheries in the Chesapeake. Establishing a program through which blue catfish could be managed at-scale creates the opportunity for migratory fish to thrive once again in the Chesapeake Bay and its tributaries.

Restoring Riparian Buffers

As rising water temperatures negatively impact migratory fish populations, we must look to nature-based solutions. Another solution that has proven to greatly impact the effects of climate change and sediment pollution is riparian buffers. Riparian buffers are swaths of trees and natural landscape on the edges or banks of rivers and streams. Riparian buffers have numerous benefits: improving climate resilience, erosion and sediment controls, providing tree canopy for shade, and assisting in additional habitat for juvenile fish species[45]. These buffers grow and integrate with the surrounding environment, creating complex root systems that help with erosion control, sediment pollution, stormwater runoff, and drainage during large storm events[46]. These buffer systems also provide improved tree canopy, shading rivers and waterways from direct sunlight, which helps in regulating the water's temperature.

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[44] *H.R. 4294,* MAWS Act 2025. 2nd Session, March 18th, 2026.https://www.congress.gov/bill/119th-congress/house-bill/4294?loclr=cga-committee-schedule

[45] Graziano, M. P., Deguire, A. K., & Surasinghe, T. D. (2022). Riparian buffers as a critical landscape feature: Insights for Riverscape Conservation and policy renovations. *Diversity*, *14*(3), 172. https://doi.org/10.3390/d14030172

[46] Majumdar, A., & Avishek, K. (2025). Mitigating riparian buffer zone degradation through policy interventions and learnings from best practices. *Discover Environment*, *3*(1). https://doi.org/10.1007/s44274-025-00288-6

Riparian buffer installations are relatively simple and cost-effective, making them one of the most successful instances of resisting the effects of climate change. Riparian buffers are a crucial component of improving the quality of Virginia's rivers and waterways and require protection. The loss of riparian buffers has led to stream narrowing and losses of habitat around streams and rivers[47]. So, not only is it important to increase installations of riparian buffers, but it is also equally important to protect and conserve these spaces so that they continue to benefit water quality and provide crucial habitat for Virginia's native species.

Conclusion

Throughout the history of the United States, there have been countless instances of human intervention in the environment without accounting for the sustainability of those practices. The installation of dams and river blockages may have once served a purpose, but now they serve to inhibit migratory fish and other organisms' safe passage. Habitats in the Chesapeake are being lost due to climate change and a lack of flood control, leading to increased sediment pollution. HABs are increasing in frequency due to rising temperatures and nutrient pollution, and are actively detrimental to not only fish species, but their habitats and humans, as well. Invasive species introduced by humans are prolific, and their impacts are prevalent. Blue catfish are and have been destroying the Chesapeake ecosystem through voracious and aggressive hunting behaviors.

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In combatting the effects of human intervention in the Chesapeake Bay, it would serve to understand the history and culture the Bay has long provided for those in the region. For Indigenous populations, migratory fish signified the coming of spring and successfully surviving the winter, and these communities often celebrated this with events like shad planking which traditionally involved harvesting and smoking American shad on bonfires[48]. Now, there are few shad in Chesapeake Bay tributaries, and the tradition of shad planking in the Chesapeake's tributaries has become a thing of the past. The detrimental effects of human interference in the environment has and will continue to be shown in the Chesapeake Bay. However, by implementing best management practices, enacting erosion and sediment pollution controls, removing dams and other manmade barriers, and managing invasive species, it is possible for the Chesapeake Bay to recover.

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