January 28, 2022

The Honorable Jared Huffman, Chair
Subcommittee on Water, Oceans, and Wildlife
Committee on Natural Resources
1332 Longworth House Office Building
Washington, DC 20515

The Honorable Cliff Bentz, Ranking Member
Subcommittee on Water, Oceans, and Wildlife
Committee on Natural Resources
1329 Longworth House Office Building
Washington, DC 20515

Testimony of Jeremy Cherson
Senior Manager of Government Affairs
Riverkeeper

Re: New York - New Jersey Watershed Protection Act H.R. 4677

Introduction

Riverkeeper protects and restores the Hudson River from source to sea and safeguards drinking water supplies, through advocacy rooted in community partnerships, science and law. We envision a future in which the Hudson River, its tributaries and watershed, and the New York City drinking watershed are: restored to ecological health and balance, free-flowing, resilient, and teeming with life, reliable sources of safe, clean drinking water, recovered from historic and inequitable environmental harms, safe and accessible for swimming, fishing, boating and other recreational activities and valued and stewarded by all. We strongly support H.R. 4677 as a regional and watershed-wide approach that can meet the needs of the tens of millions of residents living within the boundaries of the New York-New Jersey Watershed Protection Act (Watershed Act).

The New York-New Jersey watershed is home to more than 15 million people and home to some of the nation's busiest and economically important maritime ports. The region also has a legacy of environmental pollution including the nation's largest superfund site due to General Electric's disposal of toxic PCBs in the Hudson River. The Watershed Act will help accelerate the recovery of the Hudson River watershed through providing financial support for projects already included in the multitude of science based plans developed by state and local governments as well as the region's robust civic organizations on the front lines of habitat restoration, environmental justice, water protection, and creating a climate resilient future. An annual $50 million investment in a regional approach to watershed management is needed given the scale of the region stretching from the nation's largest metropolitan area to New York City's drinking water reservoir system in the Catskill Mountains and Putnam and Westchester Counties to the Adirondack mountains and the Hudson's largest tributary, the Mohawk River. Additionally over 100,000 New Yorkers in seven communities in the mid-Hudson receive their drinking water directly from intakes along the Hudson River, providing opportunities for the Watershed Act to provide multiple benefits at a regional scale.

There is an urgent need to invest in habitat restoration, climate resilience, green infrastructure, and wastewater systems, as extremes of precipitation due to climate change are taxing already

undersized and failing infrastructure. The region is fortunate to have a plethora of plans developed such as the Hudson River Comprehensive Restoration Plan and the New York State Department of Environmental Conservation Hudson River Estuary Program's latest five year action agenda, among many others. The Watershed Act will help provide support for state, local, and regionally developed plans.[1] Additionally, the Watershed Act's 75-percent federal cost share is an essential component of the bill to help ensure that environmental justice organizations and smaller organizations have fair access to grant funds. We have learned considerably from existing programs such as the Delaware River Partnership and built those lessons learned into H.R. 4677 to ensure a just and equitable distribution of federal funds.

Restoring Fragmented Ecosystems

The rivers and streams in the Hudson Valley, alone, are home to approximately 1,600 dams, the vast majority of which are both outdated and obsolete. These dams don't just fragment waterways, they disconnect entire watersheds, alter ecosystems, and consequently cause some of the most significant negative impacts to the ecological health of our rivers and streams. Most migratory fishes are in precipitous decline in the Hudson Valley, if not coastwide, and fragmentation caused by dams is a major reason. Dams delay or deny adaptive migration patterns and cause physiological stress as these fishes expend unnecessary amounts of energy attempting to pass artificial obstacles to access critical ancestral habitat.

Removing outdated and obsolete dams can restore natural flow regimes, reconnect rivers with their floodplains, and allow free mobility of aquatic organisms into critical spawning & nursery habitat, which will support more robust and diverse populations assemblages for a wide variety of species.

New York State is several years into establishing a Dam Removal program, which the Watershed Act could help accelerate in the Hudson River watershed.

Here's how the Watershed Act could accelerate the removal of obsolete dams to restore habitat:

- Provide reliable, continued funding opportunities for high-priority dam removal projects on state, county, municipal and private lands.
- NYS has a large inventory of publicly-owned dams and many are in states of disrepair. Funding authorized by the Watershed Act will tear down a significant barrier to removing obsolete dams on state property rather than continually maintaining & repairing them at taxpayer expense.
- Provide key funds to support the Hudson River Estuary Program Five-Year Action Agenda goals on dam removal.[2]

Habitat Restoration through the Reconfiguration of Improperly Designed Culverts

[1] The Hudson River Estuary Program Action Agenda, Mohawk River Action Agenda, Hudson-Raritan Comprehensive Restoration Plan, Hudson River Comprehensive Restoration Plan, Drinking Water Source Protection Plans, The New York-New Jersey Harbor and Estuary Action Agenda, Federal Urban Waters Partnership, and Long Term Control Plans.
[2] https://www.dec.ny.gov/press/123073.html

In the Hudson Valley, two-thirds of our road crossings are not passable to aquatic organisms. Like obsolete dams, road culverts that are undersized or poorly designed act as barriers to a variety of aquatic organisms and also present hazards to human communities during storm events. Such culverts can fragment streams and wetlands, which then inhibits biological continuity and prevents organisms from accessing critical habitats. Poorly designed culverts can also act like dams by blocking or delaying migration patterns and causing the same physiological stresses. If crossing structures are not large enough, or lack dry passage, riparian wildlife may choose to cross over the road surface rather than pass through the structure.

Restoring Critical Wetlands & Riparian Habitat

Wetlands habitat restoration provides three key benefits that the Watershed Act can help ensure are protected, restored, and expanded. Restoring wetlands not only increases biodiversity by improving areas for organisms to renew and restore their populations, it can also improve coastal resilience and sequester carbon.

Increasing Biodiversity: Preserving and restoring wetlands, forests, fields, streams, underwater grasses and mudflats in the Hudson River watershed will provide thousands of species of plants, fish and wildlife with critical habitat to flourish. Habitat restoration supports increased resiliency which is critical to maintaining a functioning ecosystem during times of environmental stress such as periods of extreme weather, climate change and accelerated sea-level rise. In fragmented landscapes such as those predominating in NY today, protecting wetlands, riparian corridors, & critical habitat will facilitate biological connectivity and ecological integrity, which are essential to vibrant & diverse ecosystems.

Improving Coastal Resilience: A healthy ecosystem with greater biodiversity and variety of habitats is more adaptive in response to climate change. Preserving low-lying natural areas along shorelines to allow wetlands to ‘migrate’ and removing dams to restore sediment transport in tributaries will allow shallows and wetlands to continue to exist as sea-level rises. Implementing ecologically enhanced shoreline practices will allow communities to protect important properties and infrastructure from rising sea-levels and extreme storms while preserving habitat value.

Habitat protection and restoration will preserve critical functions these habitats contribute to the ecosystem, including fish spawning, nursery and forage habitats, and improved water quality. The construction of side channels in the upper estuary will increase spawning and forage habitats for many species. Side channels also provide critical low-flow refuge habitats for fish and wildlife during high flow periods associated with high discharge from extreme weather events.

Carbon Sequestration: In restoring critical habitat we can also capture and sequester carbon to offset impacts of climate change. Forests and wetlands not only capture atmospheric carbon but forests, in particular, are sources of transpiration, which mitigates heat-island effects. Wetlands represent important carbon sinks in addition to the other ecological services they provide. Restored lands must not be converted to other uses and must be preserved for all perpetuity to protect against extreme weather events.

Preventing the Spread of Invasive Species Through the Canal Systems

The increasing presence of aquatic invasive species (AIS) is an enormous threat to biodiversity here in New York State and the bistate region. Invasive species can threaten native species and destabilize the ecosystem. The spread of AIS occurs largely as a result of pathways for the movement of such species, like New York's expansive canal system, which grant access to areas that otherwise would have been inaccessible or impassable to them.

A significant threat facing the Hudson River is Asian carp (bighead and silver), tench, & round gobies. Round gobies have been identified in the Mohawk River near Utica. Tench are in Lake Ontario and the St. Lawrence River systems. Major populations of both species of Asian carp are currently limited to the Mississippi basin, but to forestall these fish from moving through the Great Lakes, electrical barriers have been placed in some canals, but they have not been 100 percent effective. However, eradicating an introduced species, once established, is costly and often not feasible. The most effective method to check the spread of introduced species is to completely deny their access to our ecosystems. The Watershed Act can help support barrier projects as well as eDNA sampling and other monitoring studies to prevent the spread of invasive species.

Improving Water Quality to Fight Harmful Algal Blooms ("HABs")

Without swift and proper management, HABs will increasingly occur in our waterways, threatening drinking water and reducing the viability of aquatic habitat. Any successful effort to prevent HABs must utilize a range of measures to protect water quality and reduce conditions causing such blooms, including: land acquisition or conservation easements; restoring forest buffers in priority watersheds; and comprehensive approaches to stream management and pollution control.

Such a comprehensive program to fight HABs would yield many benefits for local communities including: the improvement of water quality, reduction and mitigation of flooding, protection of wildlife habitat and the maintenance and enhancement of public access and recreational activities. The Watershed Act could support projects that fund and foster best management plans for farmland, such as establishing natural vegetative buffers consisting of trees and shrubs and berms between farm fields and developments that border water bodies; and, providing incentives for curtailing farm and development runoff and the planting of cover crops between cash crops seasons. As HABs increase in the future, the Watershed Act could provide a key source of funding for implementing waterbody specific Harmful Algal Bloom Action Plans spearheaded by the New York State Department of Environmental Conservation.[3]

Support for Habitat Restoration Planning and Ecosystem Monitoring

To support monitoring environmental quality to assess progress toward the goals of this Act Fund the Hudson River Biological Monitoring Program.[4] As part of the Hudson River Settlement Agreement of 1980, the operators of Indian Point and other power plants in the Hudson Valley were required to conduct an annual Hudson River Biological Monitoring Program ("Hudson River

[3] https://www.dec.ny.gov/chemical/113733.html
[4]https://www.sciencedirect.com/science/article/pii/S1470160X21010098#:~:text=The%20Hudson%20River%20Biological%20Monitoring%20Program%20(HRBMP)%20is%20one%20of,programs%20in%20the%20United%20States.&text=The%20surveys%20became%20an%20annual,regulators%2C%20and%20Hudson%20River%20NGOs.

BMP") to track the status of important fish species. With the shuttering of Indian Point utility companies will no longer conduct (or fund) the Hudson River BMP.

The Hudson River BMP is the most comprehensive continuous fish survey in the world. It encompasses the entire estuarine portion of the Hudson River and had been continuously conducted for four decades. It is simply the best long-term fish ecology survey of any temperate estuary. Hudson River BMP data has formed the basis of approximately 500 peer-reviewed publications, and supported numerous student dissertations. Science derived from the data directly benefits important fisheries in the Hudson. With looming climatic change and the constant threat of invasive species there is an ever more compelling need to track ecological responses empirically.

Continuing the Hudson River BMP would provide invaluable information and facilitate needed understanding of current conditions, factors affecting and means of restoring a variety of species as well as improving the environmental conditions needed to support them. The Watershed Act and subsequent implementing program could benefit greatly from supporting the Hudson River BMP to support quantitative assessments of the long term trajectory of the system's health. A 40-year database is far too important a resource and investment to relinquish. In the eyes of the public, it is only through measuring our success can we maintain broad public support for future expenditures on habitat restoration and species conservation.

Project example: Hudson River Habitat Restoration (HRHR) Program

The Hudson River Habitat Restoration Ecosystem Restoration Feasibility Study is being conducted by the U.S. Army Corps of Engineers (USACE) and the New York State Department of Environmental Conservation (NYSDEC).[5] Projects identified in the Integrated Feasibility Report and Environmental Assessment for Hudson River Habitat Restoration Ecosystem Restoration Study would restore high quality habitat, including habitat for iconic species in decline. The Watershed Act could provide a critical source of federal funding to implement the project recommendations included in this federal-state partnership. One important project identified in the study is side-channel restoration for Schodack Island constituting 8.5 acres of critical habitat for fish such as the American shad and river herring in addition to 19.1 acres of tidal wetland restoration that if completed would provide immense benefits to the Hudson River estuary. The recommended projects were authorized in the Water Resources Development Act of 2020 for a total cost of $44,638,000. Projects identified that do not receive future appropriations could move forward with future funding from a program created by the Watershed Act.

Drinking Water Protection and the Hudson 7

Municipal leaders from "The Hudson 7" – the seven communities that draw drinking water from the Hudson River – have a formal agreement that formed the "Hudson River Drinking Water Intermunicipal Council. Five intakes along the mid-Hudson supply more than 100,000 people in the Towns of Esopus, Lloyd, Hyde Park, City and Town of Poughkeepsie and the Village and Town of Rhinebeck with drinking water. The communities that form the Hudson 7 work together to foster

[5] https://www.nan.usace.army.mil/Missions/Environmental/Environmental-Restoration/Hudson-River-Habitat-Restoration/

cooperative management of their primary drinking water source in addition to applying for grants together awarded through New York's Clean Water Infrastructure Act under their Intermuniciple grant program. The Watershed Act can help strengthen the work of the Hudson 7 through providing the resources needed to improve water quality and increase the climate resilience of their facilities.

Public Access and Swimming

Riverkeeper Patrol Boat Captain John Lipscomb has observed the Hudson River Estuary throughout 20-plus years of routine river patrols. These observations suggest that if there were more public beaches, people would use them. The Watershed Act could provide the necessary partnerships to reopen the Hudson to the public once again with new beaches. One-tenth of the sites where primary contact recreation is commonly observed are official public or private bathing beaches (five of 51). Of the 51 sites where we frequently observe in- and on-water recreation, eight locations — ranging from Gay's Point State Park to Little Stony Point at Hudson Highlands State Park — where swimming takes place as frequently as at the river's four public bathing areas and one private beach. If it's a warm summer weekend day, swimming is as likely to take place at these locations as at the official beaches. Lifeguards aren't present at these spots, water quality is not monitored by county health departments, and swimming may not be officially sanctioned, making these swim sites more risky than official bathing beaches. Riverkeeper has identified 38 other locations where swimming takes place commonly, but less frequently, and/or other primary contact recreation or paddle sports take place frequently.

Water quality is variable at these locations.[6] Overall, most sites sampled by Riverkeeper and Lamont-Doherty Earth Observatory are safe for swimming, most of the time. But that leaves many days – including days after summer thunderstorms, when water may be unsafe in many locations. Investing in continued water quality improvements is essential to meeting the public's desire for in- and on-water recreation, and that desire will only grow as climate change makes our summers heat up. The Watershed Act could provide critical funding for new beaches across the Hudson River to ensure the public has the ability to access our waterways.

New York City Plans Need Federal Support

Facing a staggering 20 billion gallons of annual combined sewer and stormwater overflow to the Hudson River, New York City has developed multiple action plans to improve water quality, manage stormwater, and protect residents from flooding due to extreme weather events and usual annual precipitation events. With underinvestment and lack of appropriate funding, however, the city is falling short of targets laid out in the New York State-approved Long Term Control Plans (LTCPs) and the state-approved green infrastructure program. In addition to the LTCPs, the city has created multiple other critical action plans to address urgent stormwater management needs, NYC waterfront access, and Hudson River resilience. These plans include the NYC Parks Department's Wetlands Management Framework[7] for New York City, The Mayor's Office of Resiliency's New York City Stormwater Resiliency Plan[8] and Combating Storm-Related Extreme Weather in New York

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[6] https://www.riverkeeper.org/water-quality/hudson-river/

[7] https://naturalareasnyc.org/media/pages/wetlands/cf007d5e6f-1621282492/nac_wmf_final_20200317-singles-1-1.pdf

[8] https://www1.nyc.gov/assets/orr/pdf/publications/stormwater-resiliency-plan.pdf

City[9] and New York City Department of CIty Planning's Comprehensive Waterfront Plan.[10] Each of these plans requires federal level investment to execute. The Watershed Protection Act could help make these visions a reality.

Green Infrastructure Installations for Urban Landscapes

The Watershed Act would provide needed resources to urban areas to install large-scale green infrastructure, or vegetated practices designed to infiltrate, absorb and filter polluted stormwater. Such installations would have tremendous benefits for local waterways and local economies. In many cities in the Hudson River watershed, such stormwater runs off impervious surfaces like sidewalks and streets and mixes with sanitary sewage from homes and businesses to overflow sewer systems. In New York City alone, these discharges happen on roughly one out of every three days, causing a total of 21 billion gallons of polluted "combined sewer overflows" to discharge without treatment to surface waters every year.

Following Hurricane Ida, it is clear that green infrastructure interventions are necessary to relieve the burden on the region's sewer systems and reduce the risk of devastating loss of life and damage from flooding. The current capacity for the City's combined sewer system is overwhelmed when it rains 1.75 inches per hour, with some portions of the system overwhelmed by as little as one tenth of an inch of rain per hour. Rainfall data from Hurricane Ida indicated that New York City saw a catastrophic 3.15 inches of rain per hour.

By retaining stormwater where it lands, green infrastructure reduces the burden on municipal sewer systems, mitigates neighborhood flooding, and decreases polluted discharges. Vegetated green infrastructure also improves local air quality, provides habitat for wildlife, mitigates heat island effect, creates recreational spaces, and serves as recreational areas. Just as important, installation and maintenance of green infrastructure creates livable-wage jobs.

Conclusion

The New York - New Jersey Watershed Protection Act will help the region receive the resources needed to put existing plans into action with federal support from the U.S. Fish and Wildlife Service. The time has come for the marquee waterbody of the nation's largest metropolitan region to receive the dedicated federal funding it deserves. Despite being the nation's largest Superfund site, the Hudson River has made tremendous progress thanks to years of partnerships to improve water quality, habitat, and chemicals such as PCBs, however declining aquatic species, including many fishes demands renewed attention and support. Riverkeeper thanks Congressman Tonko for introducing this important legislation and we thank the subcommittee for considering our testimony.

CC: heather.pacheco@mail.house.gov
The Honorable Raul Grivalva, Chair, Committee on Natural Resources
The Honorable Bruce Westerman, Ranking Member, Committee on Natural Resources
The Honorable Paul Tonko, Member, Committee on Natural Resources

[9] https://www1.nyc.gov/assets/orr/pdf/publications/WeatherReport.pdf
[10] https://www.waterfrontplan.nyc/

Appendix A: Species decline in the Hudson River

The Hudson River Estuary represents one of the planet's greatest migratory corridors as each year millions of fish enter the Hudson River Estuary to renew their populations. While the Hudson River Estuary has undoubtedly become cleaner in the past several decades, several hundred years of habitat alterations, toxic legacies, and over-harvest have taken their toll on every species in the estuary.

Of 16 species Riverkeeper examined, one (rainbow smelt) has disappeared from the Hudson completely, two (Atlantic tomcod and winter flounder) are on the verge of extirpation, and the rest show significant to severe declines. This downward trend of the Hudson's most charismatic fish species is alarming and we must act now.

Striped bass populations had made a comeback some years ago, but now are declining due to overfishing. The Atlantic States Marine Fisheries Commission and anglers all along the coast are concerned about this trend. The decline in striped bass has raised alarms because it highlights the complex relationships between species and the consequences that reductions in the population of one species can have on others.

In a natural environment, species interact constantly with their habitat and with each other. When these relationships are damaged or broken, individual species suffer and the entire ecosystem is weakened. And when ecological impacts occur in early life stages, the species as a whole cannot flourish. The Hudson River's iconic fish will continue to decline if we do not act now to protect them and their natural habitat.

Atlantic and short-nosed sturgeon are the only species currently showing any signs of promise, due to decades of protection under the Endangered Species Act and a moratorium on fishing. However, they remain endangered because the species are slow to mature (it takes 20 years to reach maturity and lay eggs) and they have not yet recovered from decades of overharvesting.

Governor Cuomo's Revive Mother Nature initiative is an opportunity to act now to restore important habitat and to protect species in decline. The information provided below is intended to strengthen the case for the initiative and help target investments now and into the future.

Key Species in Decline

- **Rainbow smelt (Os*merus mordax*): Extirpated** from the Hudson River Estuary due to warming temperatures.

- **American eel (*Anguilla rostrata*): Long-term decline** and threatened by overfishing, habitat loss mainly due to dams, food web alterations, predation, toxins and an invasive parasite.
- **Atlantic sturgeon (*Acipensor oxyrinchus*): Endangered** due to prior overharvesting and slow reproductive rate as well as loss of habitat, water pollution and other anthropogenic disturbances. Shows sign of slow recovery.
- **Atlantic tomcod (*Microgadus tomcod*): Vanishing,** facing extirpation due to temperature changes and exposure to PCBs.
- **Bay anchovy (*Anchoa mitchilli*): Long-term decline**, cause unknown but may be related to changes in predation patterns.
- **Bluefish (*Pomatamus saltrix*): In decline.** The species is known to be overfished.
- **Eastern oyster: (*Crassostrea virginica);* In decline** due to habitat alteration and over-harvesting.
- **Hog choker (*Trinectes maculatus*): In decline,** cause unknown
- **Lined seahorse (*Hippocampus erectus*): Vulnerable** to habitat disruption and poor water quality.
- **River herring and American shad (*Alosa spp.*) Stocks depleted by 99%** and in long-term decline due to overfishing, loss of river habitat, and dams that block access to spawning grounds.
- **Shortnose sturgeon (*Acipensor brevirostrum*): Endangered** due to prior overharvesting and slow reproductive rate. Shows signs of recovery.
- **Striped bass (*Morone saxatilis*): In decline.** The species is overfished.
- **Weakfish (*Cynoscion regalis*): Depleted,** cause unknown and in long-term decline.
- **White perch (*Morone americanus*): In decline,** cause unknown.
- **White catfish: (*Ameiurus catus):* Vanishing**, cause unknown.
- **Winter flounder *(Pseudopleuronectes americanus)*: Depleted, Vanishing** due to overfishing, habitat alteration, pollution, predation, and climate change.

Fishes in Decline

Rainbow Smelt (Os*merus mordax*): Completely extirpated from Hudson

- Rainbow smelt has not been seen in the HRE for the past 10 years;
- Rainbow smelt are a cold water fish and it is believed that warming temperatures forced the rainbow smelt out of the Hudson River

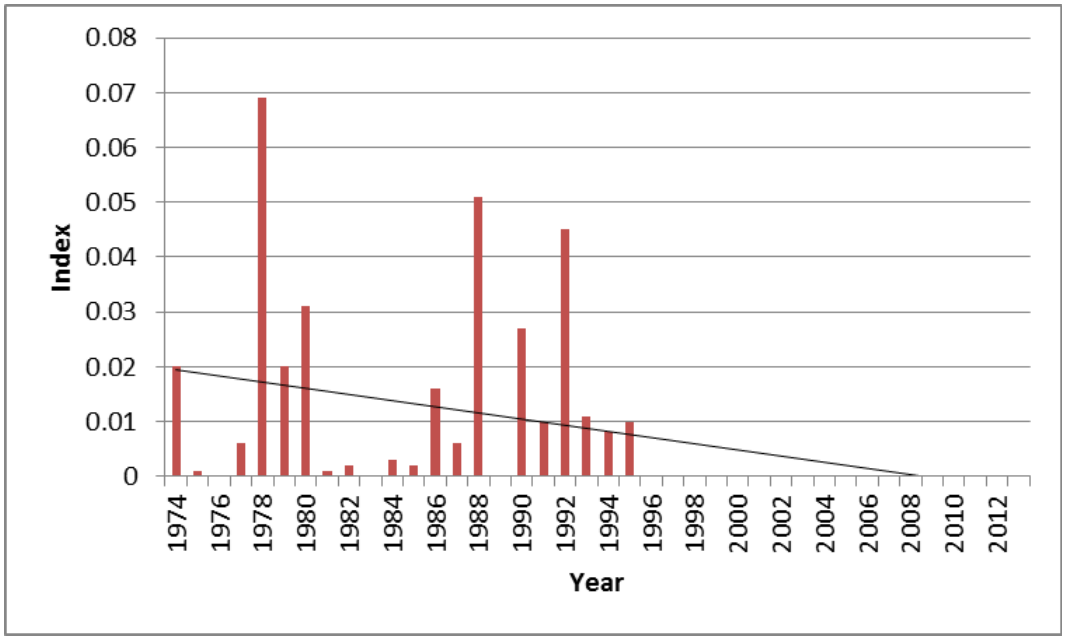

Figure 1. The juvenile index for rainbow smelt in the Hudson, showing a decreasing trend through time. No fish have been recorded since 1995. (Henderson and Seaby 2015)

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Winter Flounder *(Pseudopleuronectes americanus)*: Depleted, long-term decline, inbreeding depression, possibly vanishing from climate change

- Populations of the SNE/MAB stock are depleted
- Commercial moratoriums & draconian restrictions have been implemented to no avail;
- WF enter the HRE in winter to spawn and migrate back to deeper waters in response to thermal conditions and trophic availabilities;
- Winter flounder declines linked to overfishing, habitat alteration, pollution, predation, & climate change.
- Winter flounder are near the southern edge of their range in the HRE

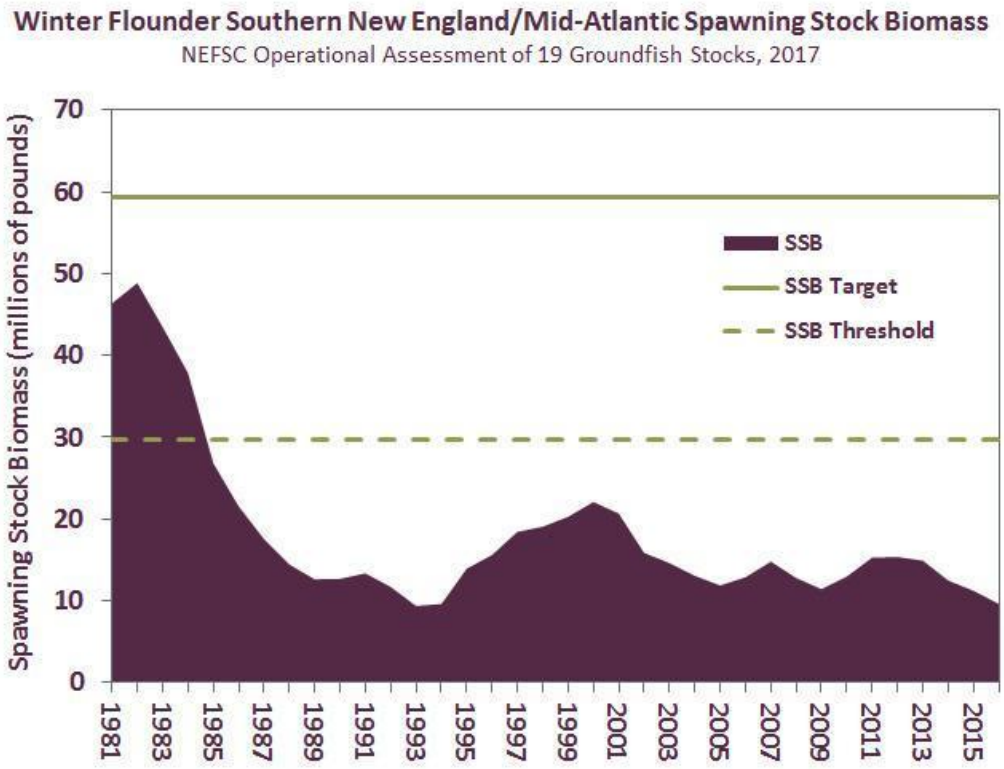

Figure 2. the spawning stock biomass of winter flounder form the Southern New England/Mid-Atlantic stock of winter flounder shown well below sustainable thresholds (dashed line) and far below optimal spawning stock biomass targets (solid line) (ASMFC 2019)

Atlantic Tomcod (*Microgadus tomcod*): Vanishing, facing extirpation

- Tomcod is an anadromous fish and the Hudson is its southern spawning limit;
- Tomcod is in long-term decline in the Hudson and suffering from exposure to PCBs;
- The fate of tomcod may be related to river water temperature;
- Because it is at the southern extremity of its geographical range sensitivity to climatic factors, particularly temperature would be anticipated;
- The tomcod population is showing year-to-year variation, but is in long-term decline.

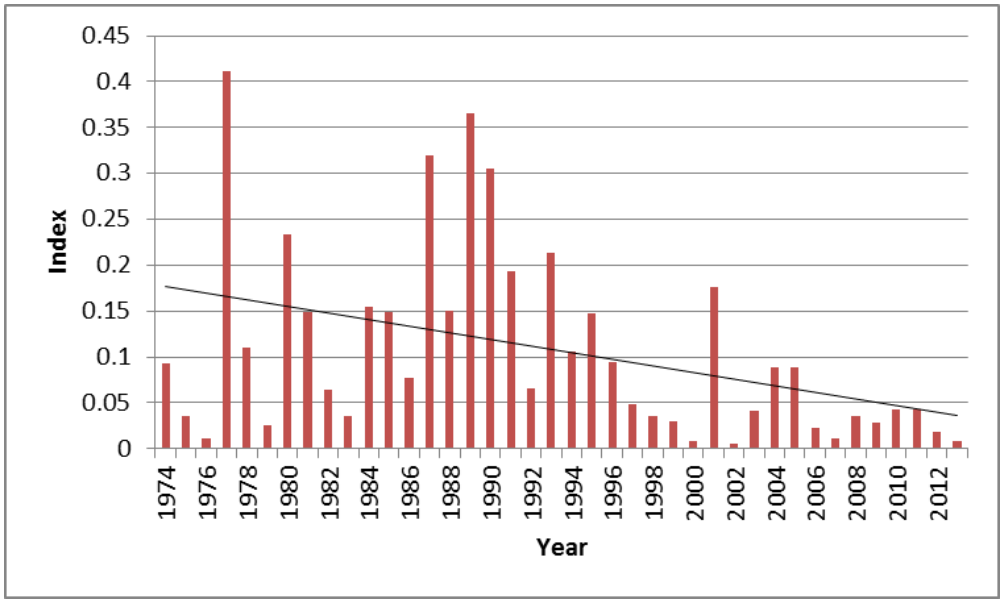

Figure 3. The juvenile index for Atlantic tomcod in the Hudson, showing a decreasing trend through time. Data is from the 2013 year class report. (Henderson and Seaby 2015)

American Eel (*Anguilla rostrata*): Long-term decline and threatened

- American eels are at historic lows due to synergistic combination of overfishing, habitat loss mainly due to dams, food web alterations, predation, turbine mortality from hydroelectric dams, toxins and contaminants, and an invasive parasite;
- American eels spawn once and die;
- American eel populations are depleted in US waters, and whose range has declined 30%
- American eels in the HRE are declining;
- Studies in the HRE have shown that each dam blocks 90 percent of upstream eel movement within tributaries;
- 50 percent of the American eels in the Hudson River tributaries are infected with Japanese swim bladder parasites, known as *Anguillicoloides crassus,* which may impact their return to the Sargasso Sea to spawn.

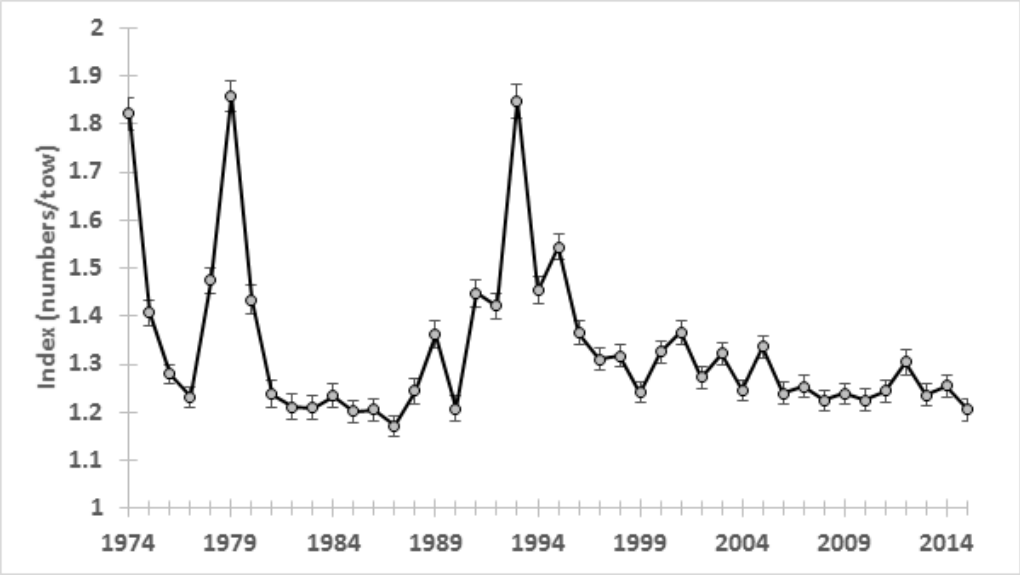

Figure 4. GLM-standardized index of abundance for Young of Year (YOY) American eels in the Hudson River Estuary, 1974–2014. GLM is used with statistics when numbers are based upon compounded calculations. (ASMFC 2017)

Bay Anchovy (*Anchoa mitchilli*): Long-term decline, cause unknown

- Bay anchovies are an important forage fish especially for avian and juvenile piscivorous fishes such as striped bass, bluefish, summer flounder, and weakfish;
- Bay anchovies are in long-term decline, with a 10-fold decline that is possibly linked to the striped bass biomass and other unknown factors that impact fecundity;
- Water withdrawals causing entrainment and impingement from power plants could have a significant impact on small fish such as the bay anchovy.

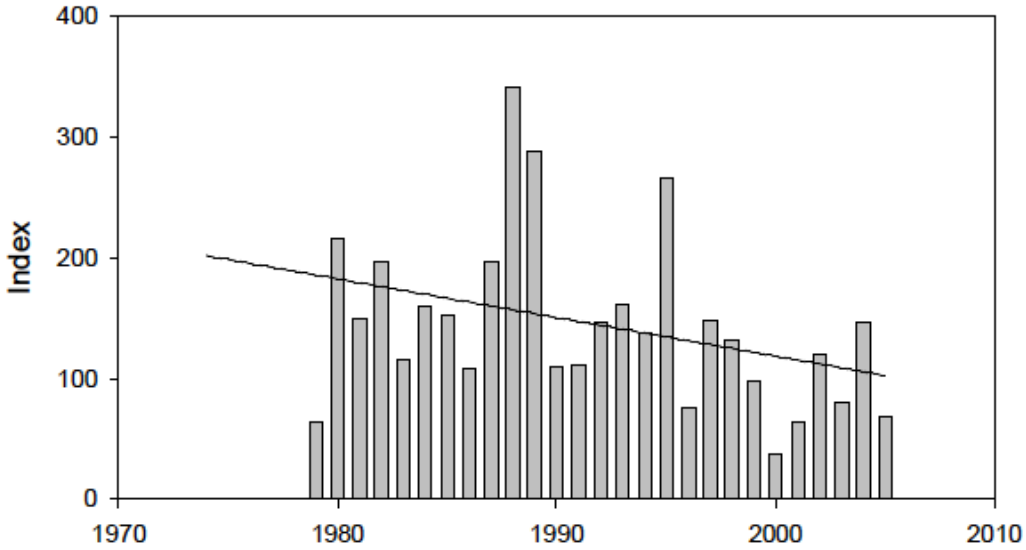

Figure 5. Juvenile index of bay anchovy in the Hudson River over a time (Seaby and Henderson 2008)

Hog Choker (*Trinectes maculatus*): In decline

- Hogchoker were once one of the most abundant fishes in the estuary;
- Recent abundances of hogchoker are low and recruitment has been poor.

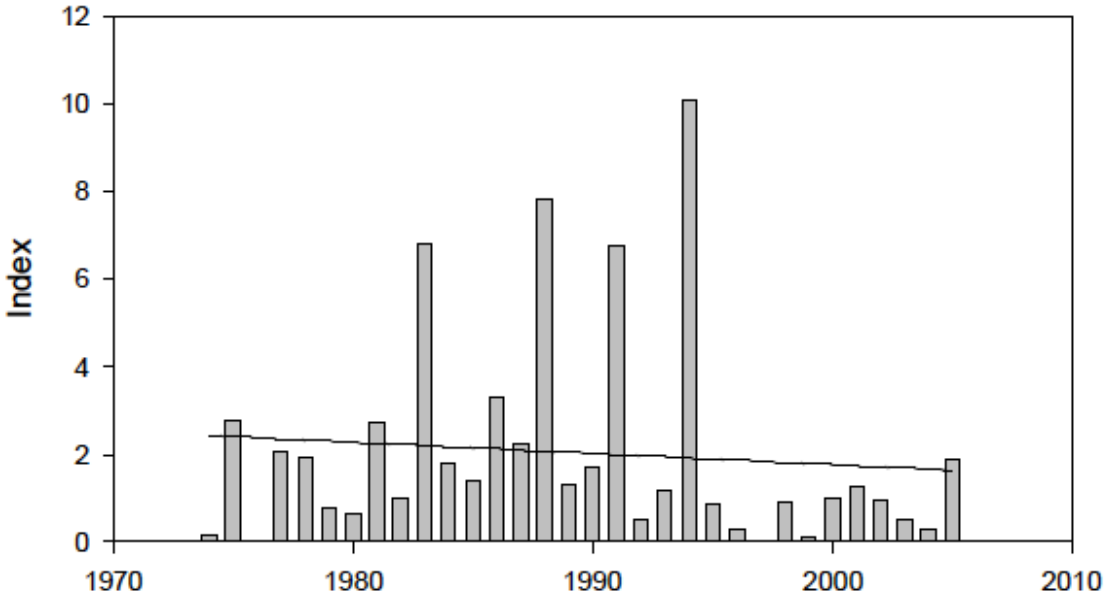

Figure 6. hogchoker showing a slight downward trend (Seaby and Henderson 2008)

Atlantic Sturgeon (*Acipensor oxyrinchus*): Endangered

- 2017 stock assessment concluded that Atlantic sturgeon stock was depleted coastwide
- There has been slight positive trend in sturgeon recruitment in the HRE, but that news is overshadowed by the loss of adult fish during Tappan Zee Bridge construction
- Populations of Atlantic sturgeon have declined primarily due to overfishing (directed and incidental), loss of habitat, habitat alteration, limited access to spawning areas, water pollution, ship strikes, water withdrawals and other anthropogenic occurrences.
- During the 1800s and early 1900s, the HRE, served as dumping ground for pollutants that lead to major oxygen depletions and resulted in high fish losses;
- Great demands for sturgeon eggs (caviar) and the fish's smoked flesh resulted in overexploitation of sturgeon stocks;
- Damming of the Hudson River for hydroelectric and navigation purposes cut sturgeon off from their upriver spawning grounds;
- Maintenance dredging of the Hudson's navigation channel and trapping of sturgeon eggs and larvae in turbines of power plants are also considered problems

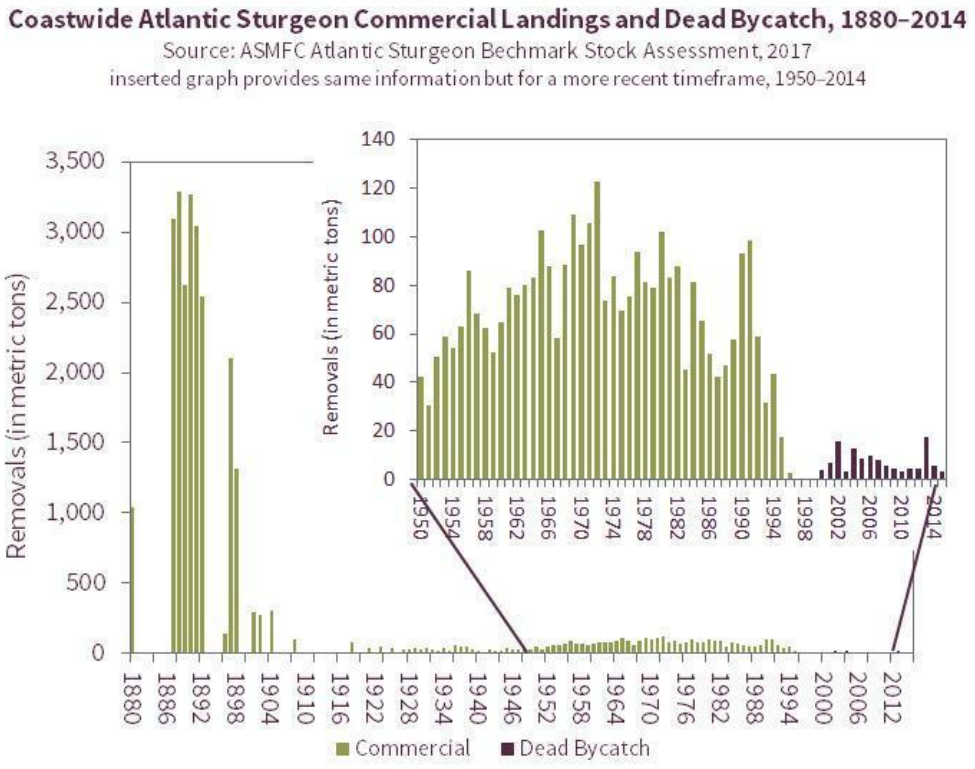

Figure 7. Sturgeon populations were severely overfished beginning in the 1880s until the 1997 overfished, the ASMFC called for a coastwide moratorium through at least 2038, in order to build up the stock. (ASMFC 2018).

Shortnose Sturgeon (*Acipensor brevirostrum*): Endangered

- Shortnose sturgeon are endangered for many of the same reasons as Atlantic sturgeon
- While the shortnose sturgeon was rarely the target of a commercial fishery, it often was taken incidentally in the commercial fishery for Atlantic sturgeon.
- In the 1950s, sturgeon fisheries declined on the east coast which led the USFWS to conclude that the fish had been eliminated from the rivers in its historic range (except the Hudson River) and was in danger of extinction.
- River-wide population estimates in the 1990's showed the spawning population had increased substantially from that observed in the 1970's;

Lined Seahorse (*Hippocampus erectus*): Vulnerable listing by International Union for Conservation of Nature

- There aren't any definitive numbers of seahorse populations in HRE
- Their presence indicates the water quality and health of our waterways, but they are listed as vulnerable since 1996 (IUCN);
- They have they lost habitat to pollution and coastal development.

White catfish: (*Ameiurus catus):* Steep decline, downward trend

- White catfish are found in all the estuaries along the Atlantic coast from the Hudson to Florida;
- They are slow-growing, maturing at 3 - 4 years old;
- White catfish have been in steep decline in the HRE from 1990 onwards.

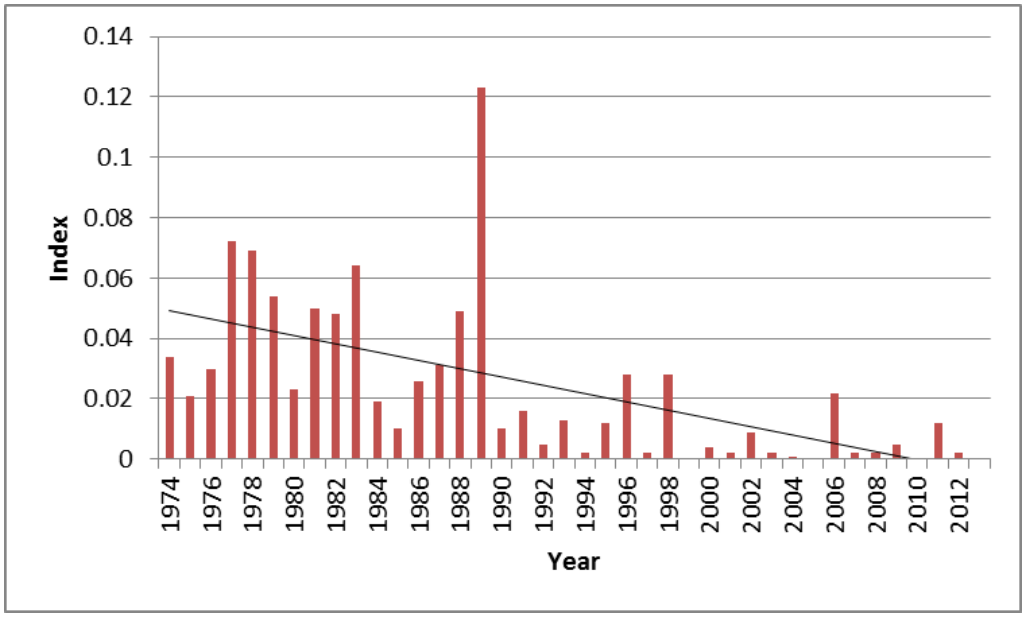

Figure 8. Juvenile index of white catfish in the Hudson River showing a long-term decline. (Henderson and Seaby 2015)

River Herring and Shad (*Alosa spp.*): Stocks depleted, in long-term decline

- River herring and shad: includes blueback herring (*Alosa aestivalis*), alewives (*Alosa pseudoharengus*), American shad (*Alosa sapadissima*), and hickory shad (*Alosa mediocris*);
- All species are historic lows coastwide;
- These fishes have been devastated by decades of overfishing (directed and incidental), and centuries of lost of river habitat due to channelization, dredging and instream construction, filling of spawning grounds, and dams (including hydropower dams) that impede their upriver migration and spawning habitat;
- **American shad stocks are not recovering.** Recent assessments show that current restoration actions need to be reviewed and new efforts need to be identified and applied;
- YOY index for American Shad (2017) shows consecutive years of recruitment failure;
- **American shad has been declining in the Hudson for many years;**
- The 2017 stock assessment indicates that **river herring remain depleted at historic lows on a coastwide basis;**
- Hickory shad are poorly monitored, with very little is known about them, but they are in significant decline for likely the same reasons as American shad.

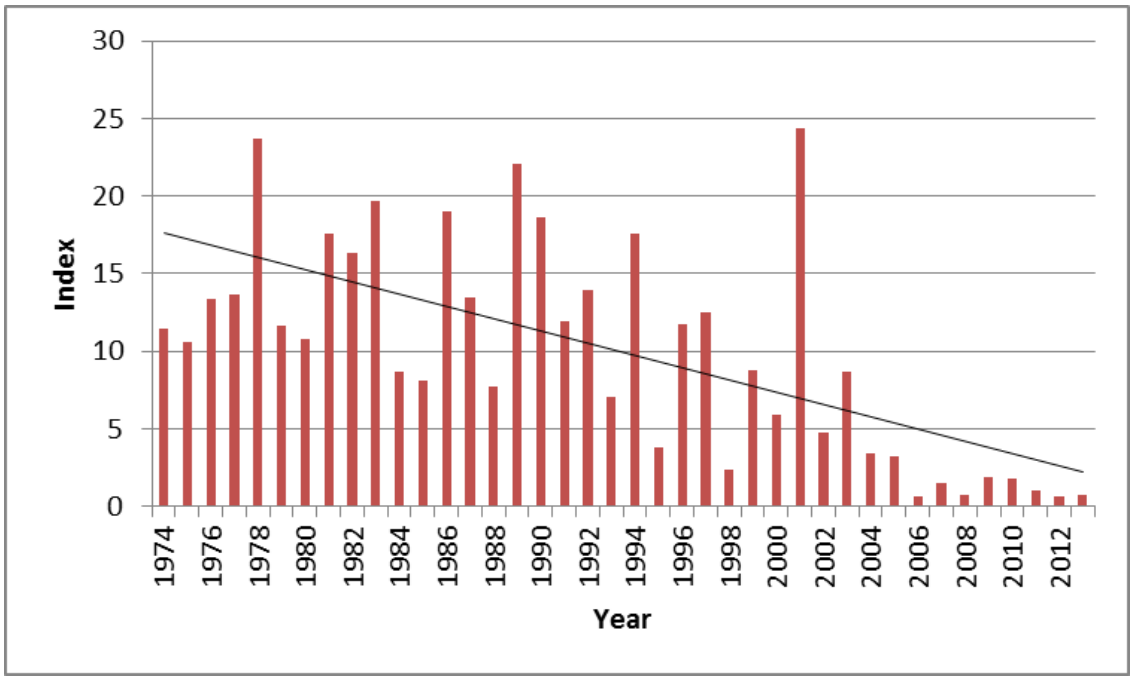

Figure 9. The juvenile index for American shad in the Hudson showing a decreasing trend through time. (Henderson and Seaby 2015)

Striped Bass (*Morone saxatilis*): In decline, overfished

- **Since 2004, striped bass have been in steady decline;**
- **Most mortality is related to recreational fishing pressure and dead discards;**
- Periods of poor and variable recruitment have contributed to the decline;
- The HRE is the second largest spawning ground for striped bass;
- Robust striped bass populations cannot be sustained by a declining forage base.

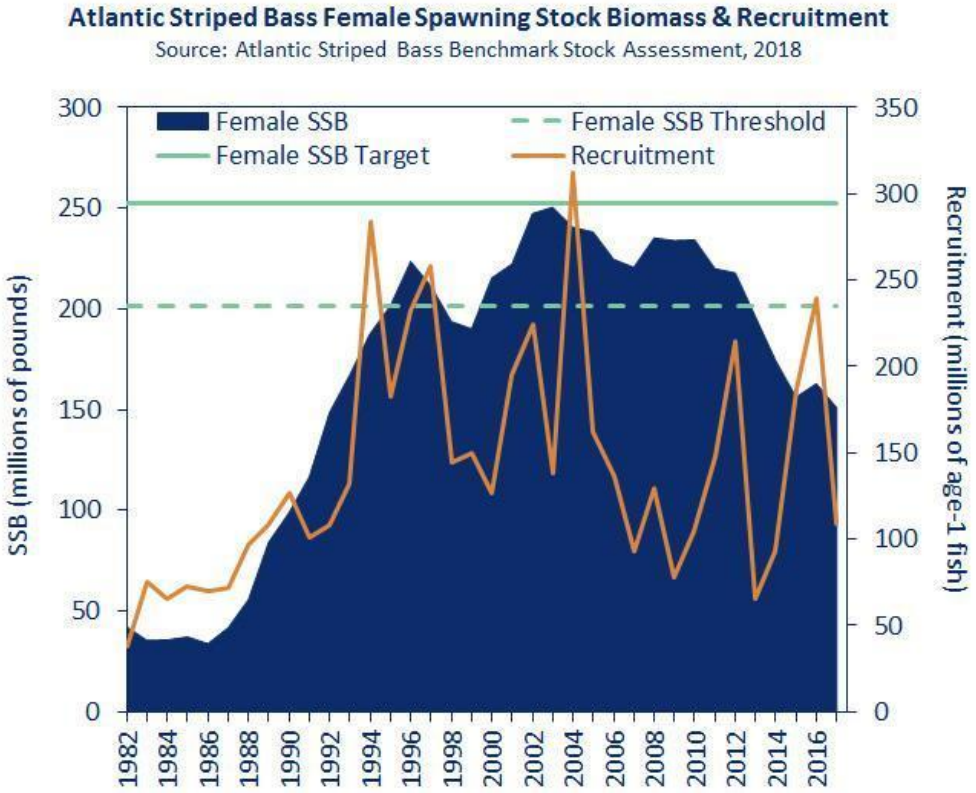

Figure 10. Spawning stock biomass of Atlantic is below ASMFC thresholds (dashed line) and well below optimal target population levels (solid line). (ASMFC 2018)

Bluefish (*Pomatamus saltrix*): In decline, overfished

- Bluefish like striped bass are a prized marine fish known for their fighting ability, but populations have contracted mostly due to the recreational fishery;
- Latest surveys by ASMFC show bluefish to overfished;
- Bluefish biomass has declined significantly since the 1980s.

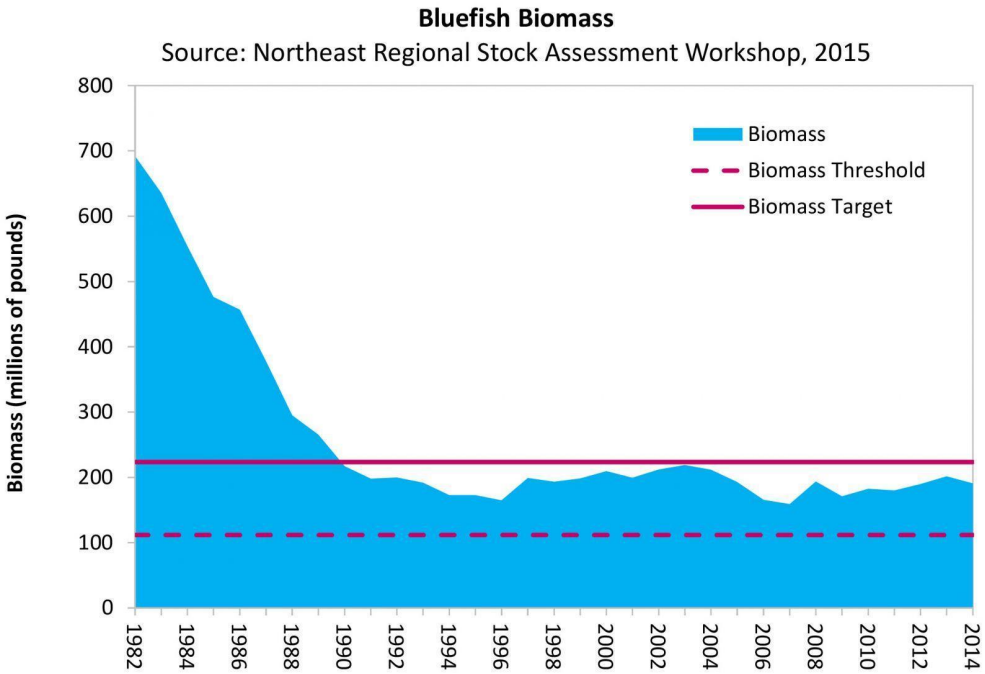

Figure 11. Bluefish are overfished and their biomass is in decline since the 1980s (ASMFC 2019)

Weakfish (*Cynoscion regalis*): Depleted, long-term decline

- Latest stock assessment indicates weakfish is depleted and in long-term steep decline
- Assessments indicate natural mortality has been increasing;
- The weakfish population has been experiencing very high levels of total mortality (including fishing mortality and natural mortality), which prevents the stock from recovering.

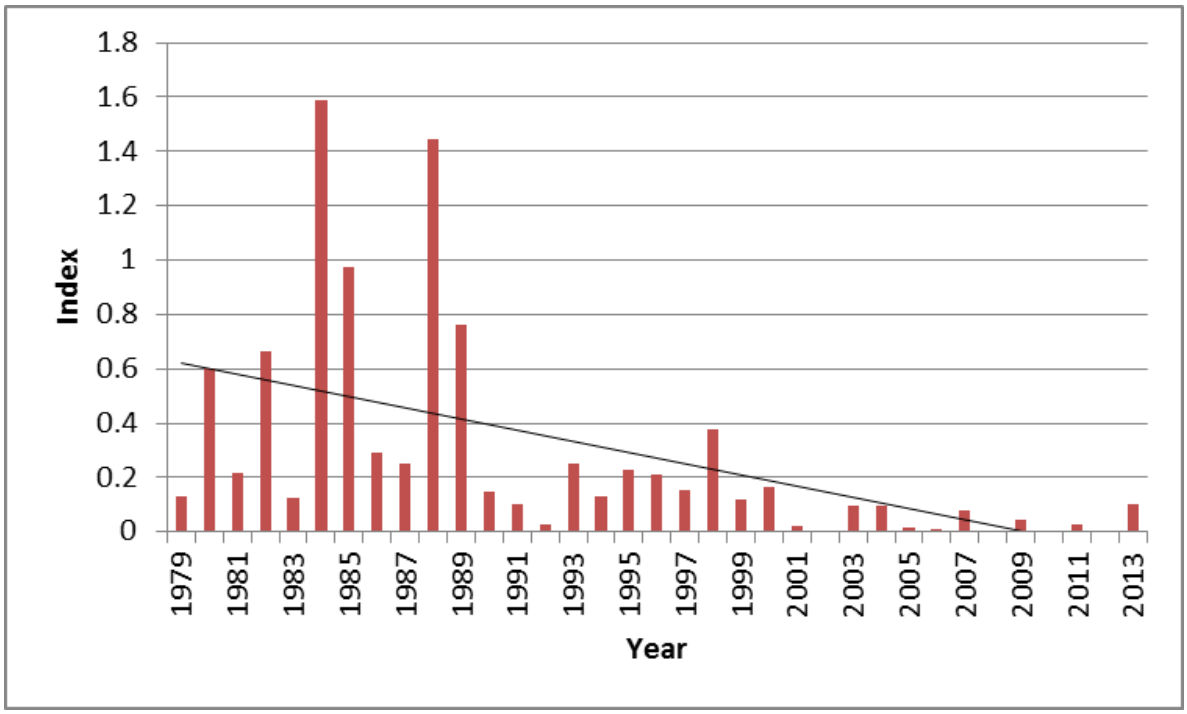

Figure 12. The juvenile index for weakfish in the Hudson, showing a decreasing trend through time (Henderson and Seaby 2015).

White Perch (*Morone americanus*): In decline, cause unknown

- White perch are in decline and the present population size has declined by 60% since 1970s and 1980s;
- It is believed that impingement, entrainment, and increased striped bass predation have impacted white perch;
- Predatory shifts call into question the inter-relatedness of all species and when the forage base declines, predators will shift their attention to other species;
- More research is needed to identify the reasons for the white perch declines.

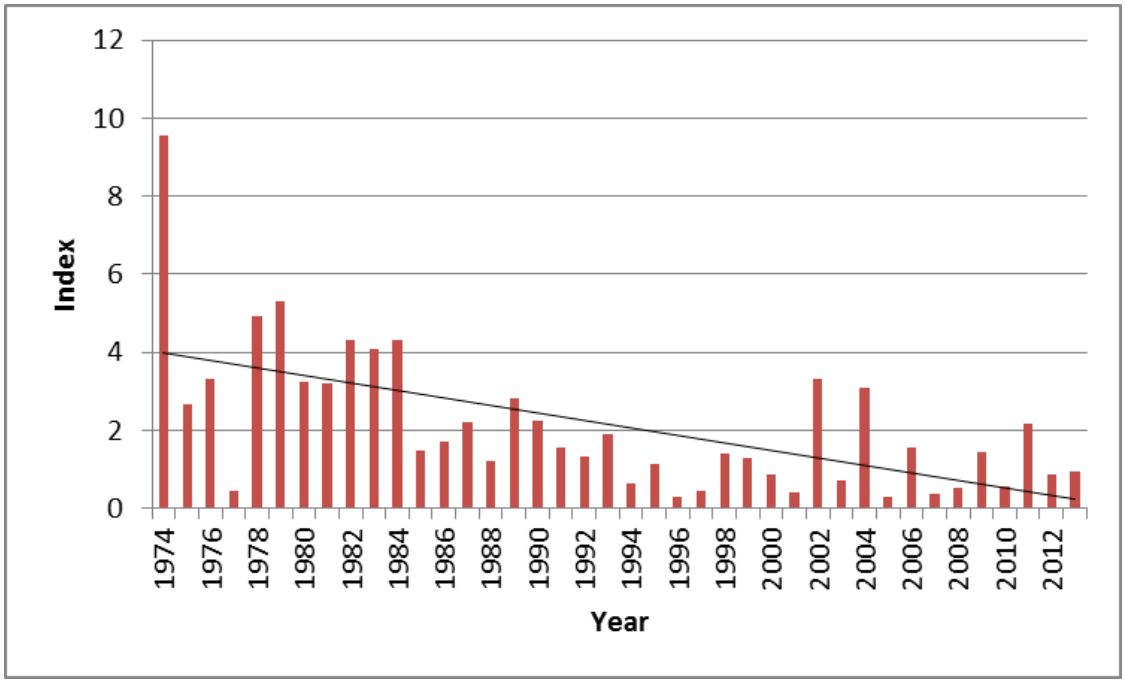

Figure 13. Yearling white perch showing a long-term decline. (Henderson and Seaby 2015)

Eastern Oyster (*Crassostrea virginica);* In decline, habitat alteration and over-harvest

- Oysters have been devastated by centuries of pollution, habitat degradation and over-harvest;
- The Hudson River Estuary was reported to have had 350 square miles of oyster reefs and was estimated that the New York Harbor contained nearly half of the world's oysters;
- The loss of oysters and other shellfish to the Hudson River Estuary is incomprehensible and incalculable due to their ecosystem function and service;
- 25 million oysters have been planted in NY Harbor but the population remains unsustainable.

Related Environmental Conditions

Temperature and dissolved oxygen are indirectly linked and both strongly impact aquatic life in the Hudson River Estuary. The temperature regime in the Hudson River Estuary is notably extreme for a temperate estuary, while also exhibiting one of the widest seasonal ranges for an estuary of its size. The natural temperature regime has a strong influence on the fish community, and makes the species present particularly vulnerable to changes associated with climate change or the localized effects from power plant discharges. The mean annual temperature in the Hudson River is now about 4° F warmer than those recorded in the 1960s and recent observations show that seasonal variations are becoming more extreme.

Increased temperature can affect survival, growth and metabolism, activity, swimming performance and behavior, reproductive timing and rates of gonad development, egg development, hatching success, and morphology. Temperature also influences the survival of fishes stressed by other factors such as toxins, disease, or parasites. Many of these effects will occur well below the upper lethal temperatures. As a consequence of increasing water temperature, dissolved oxygen concentrations decrease, which then results in many fish and other aquatic organisms living in sub-optimal conditions during warmer months. These changing environmental conditions are sufficient to impact temperature-sensitive fishes, while also stressing other members of the aquatic community. Compounding the chemical and thermal changes in the Hudson River is a toxic legacy whose residual chemicals move through food chains, becoming concentrated in fish and affecting their survival, growth, and reproduction.

Rising Water Temperatures

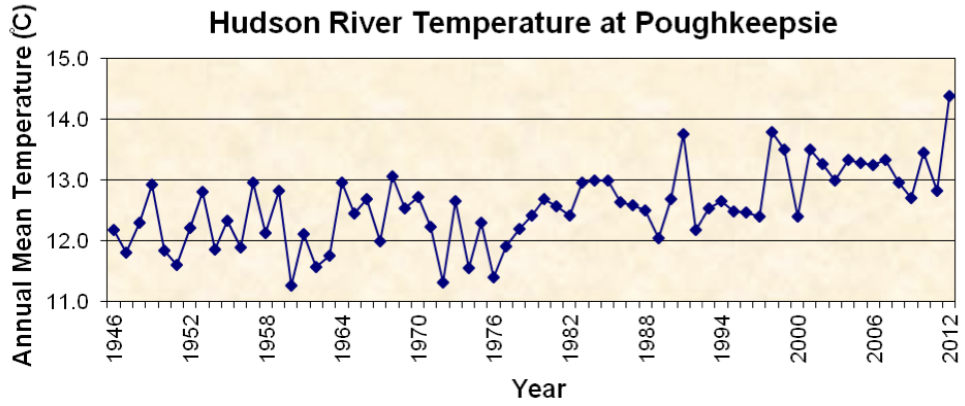

Figure 14. Statistically significant increase in mean average annual water temperature measured at the Poughkeepsie Water Treatment Facility. The mean annual temperature in recent years is about 4°F above that recorded in the 1960s. (Seaby and Henderson 2008)

Dissolved Oxygen Declines

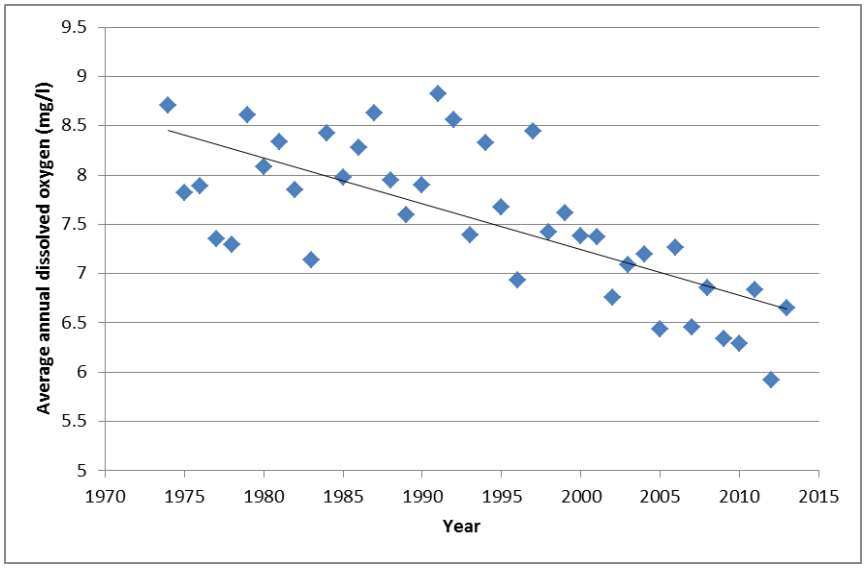

Figure 15. Average Annual Dissolved Oxygen (mg/l) from Beach Seine surveys, 1974 to 2013 (Henderson and Seaby 2015)

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