RIVERKEEPER®

The Hudson River’s Species are in Decline

January 2020

The Hudson River represents one of the planet’s greatest migratory corridors: Each year, millions of fish enter the estuary to renew their populations. While the water has undoubtedly become cleaner in recent decades, centuries of habitat alteration, toxic dumping, and overfishing have taken their toll on every single species.

Rainbow smelt has disappeared from the Hudson completely. Atlantic tomcod and winter flounder are on the verge of “extirpation,” or localized extinction. Others show significant to severe declines.

Striped bass populations had made a comeback years ago, but are now declining due to overfishing. The Atlantic States Marine Fisheries Commission and anglers all along the coast are concerned. The decline 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 shortnose 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.

The downward trends in Hudson River species are alarming. To give the fish a fighting chance, we have to do more.

Governor Cuomo’s Restore Mother Nature initiative is an opportunity to restore important habitat and to protect species in decline.

Here is a survey of the status of 16 Hudson River species as of January 2020.

Summary: 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 some signs 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 overharvesting.
- **Hogchoker** (*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 percent 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.

Data: Fishes in decline

Rainbow smelt (*Osmerus mordax*): Completely extirpated from the Hudson

- Rainbow smelt has not been seen in the Hudson River Estuary (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.

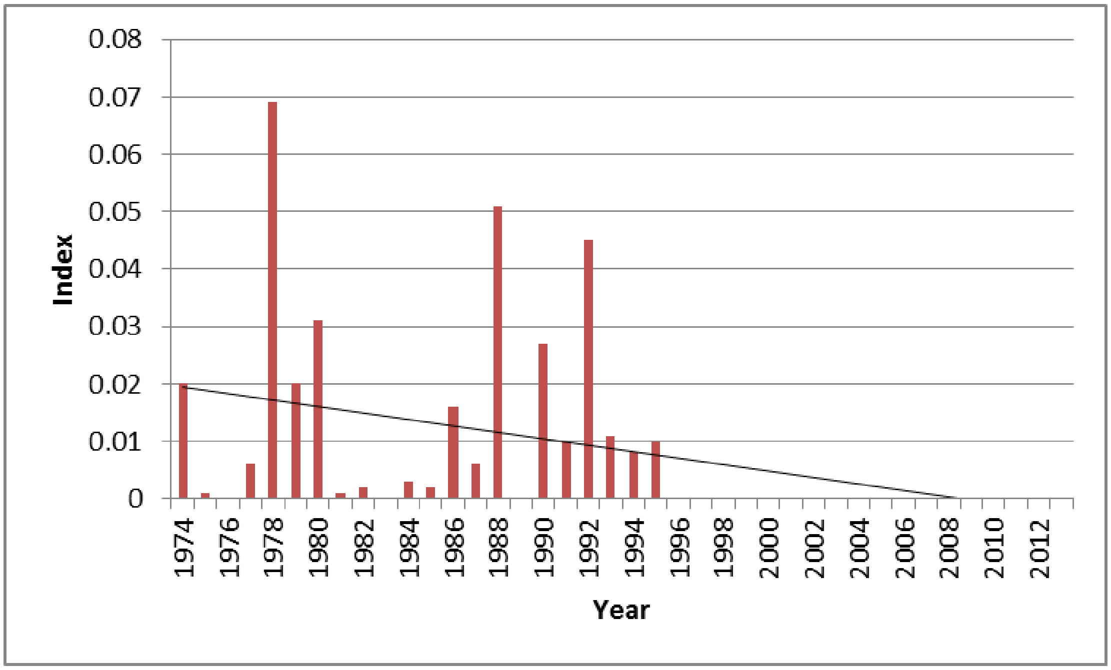

Figure 1. The juvenile index for rainbow smelt in the Hudson, showing a decreasing trend through time. No fish have been recorded since 1995. (Henderson and Seaby 2015)

Winter flounder *(Pseudopleuronectes americanus)*: Depleted, long term decline, possibly vanishing from climate change

- Populations of the Southern New England / Mid-Atlantic Bight stock are depleted;
- Commercial moratoriums and draconian restrictions have been implemented to no avail;
- Winter flounder enter the estuary in winter to spawn and migrate back to deeper waters in response to thermal conditions and trophic availabilities;
- Winter flounder declines are linked to overfishing, habitat alteration, pollution, predation and climate change;
- There are signs of "inbreeding depression," with loss of genetic diversity;
    - Winter flounder are near the southern edge of their range in the HRE.

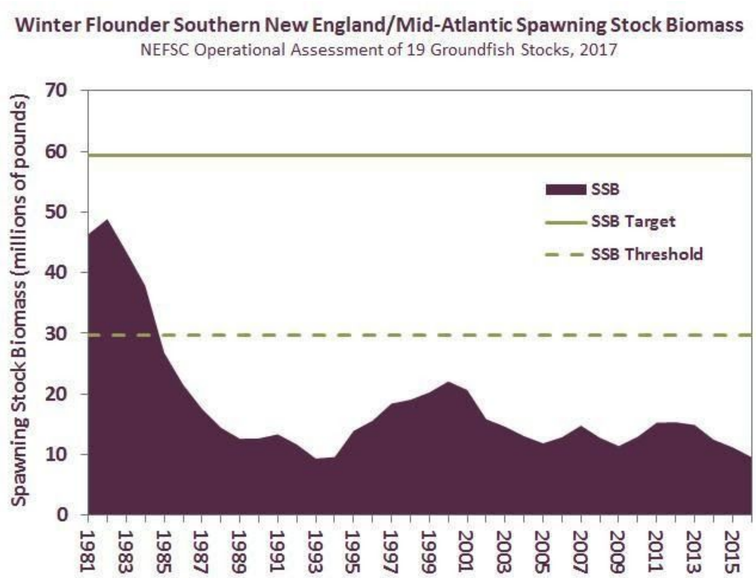

Figure 2. the spawning stock biomass of winter flounder form the Southern New England/Mid-Atlantic stock of winter flounder shown well below sustainable thresholds (dashed line) and far below optimal spawning stock biomass targets (solid line) (ASMFC 2019)

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.

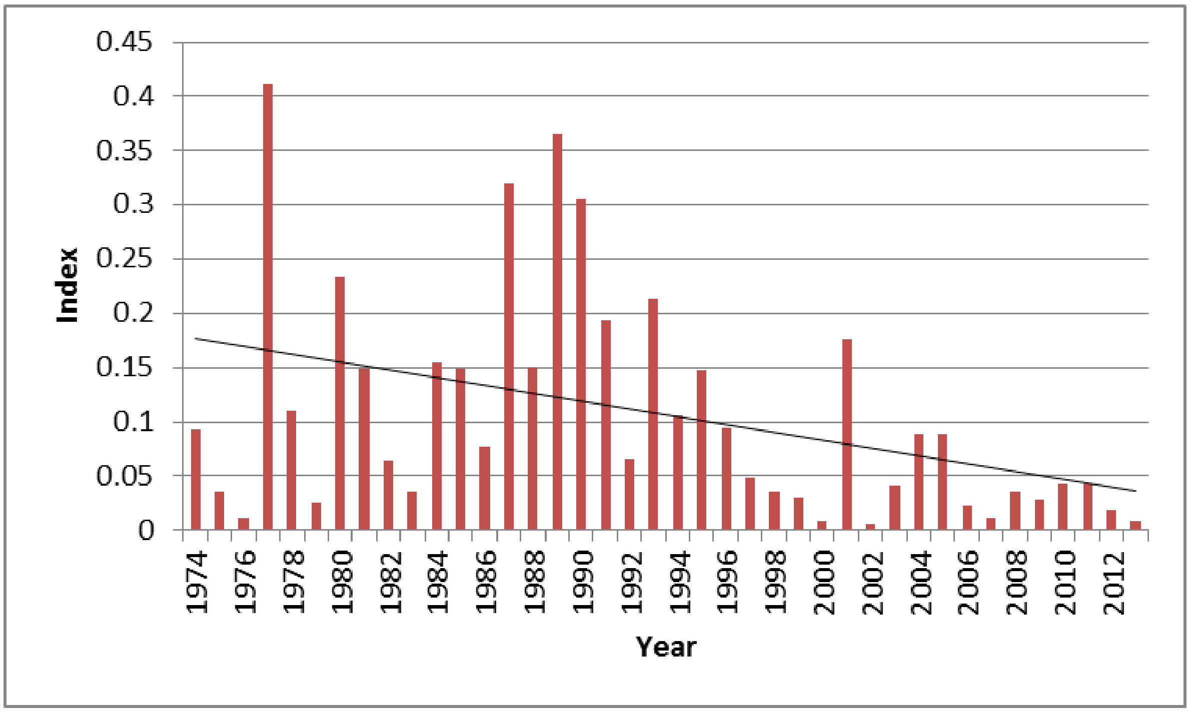

Figure 3. The juvenile index for Atlantic tomcod in the Hudson, showing a decreasing trend through time. Data is from the 2013 year class report. (Henderson and Seaby 2015)

American eel (*Anguilla rostrata*): Long term decline, threatened

- American eels are at historic lows due to combination of overfishing, habitat loss primarily 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 U.S. waters;
- American eels in the HRE are declining. They are hardly present in ancestral waters where they were once extremely abundant, including the Wallkill and the Mohawk rivers;
- 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.

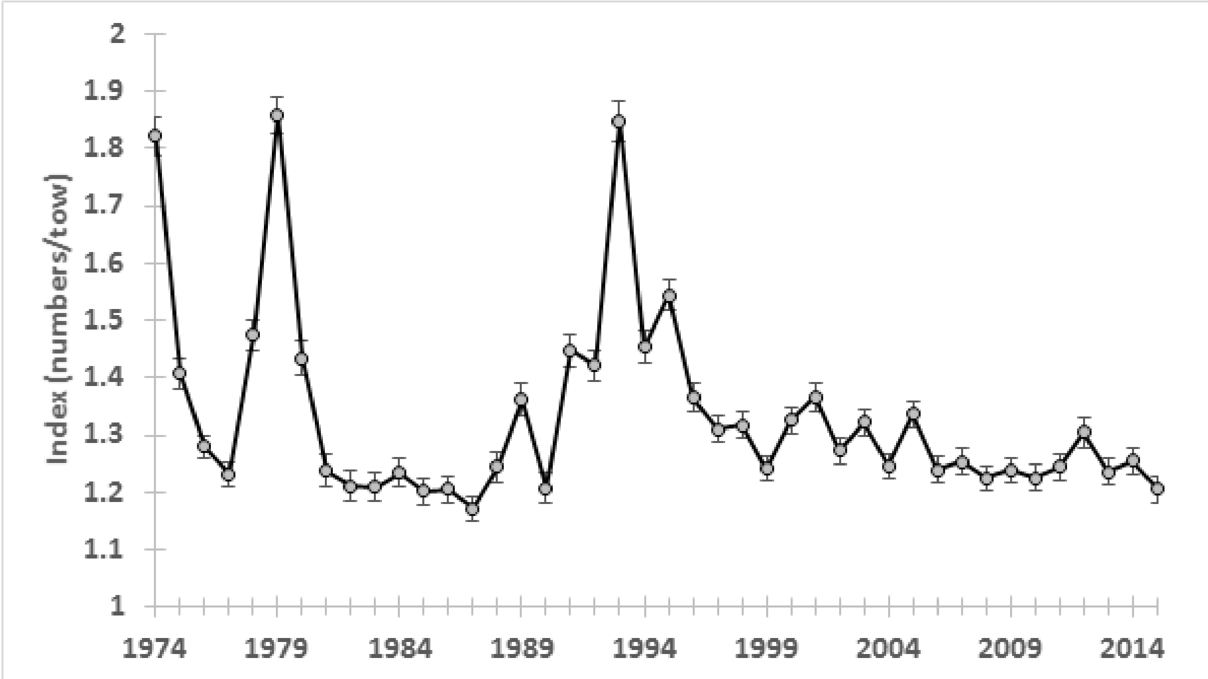

Figure 4. GLM-standardized index of abundance for Young of Year (YOY) American eels in the Hudson River Estuary, 1974–2014. GLM is used with statistics when numbers are based upon compounded calculations. (ASMFC 2017)

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 tenfold decline that is possibly linked to the striped bass biomass and other unknown factors that impact fecundity;
- Water withdrawals from power plants, causing entrainment and impingement, could have a significant impact on small fish such as the bay anchovy.

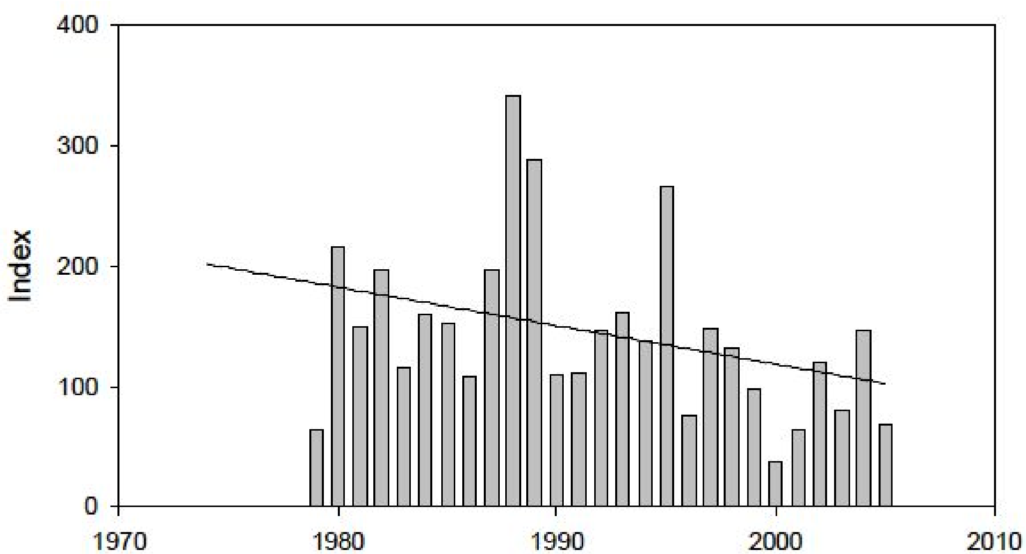

Figure 5. Juvenile index of bay anchovy in the Hudson River over a time (Seaby and Henderson 2008)

Hogchoker (*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.

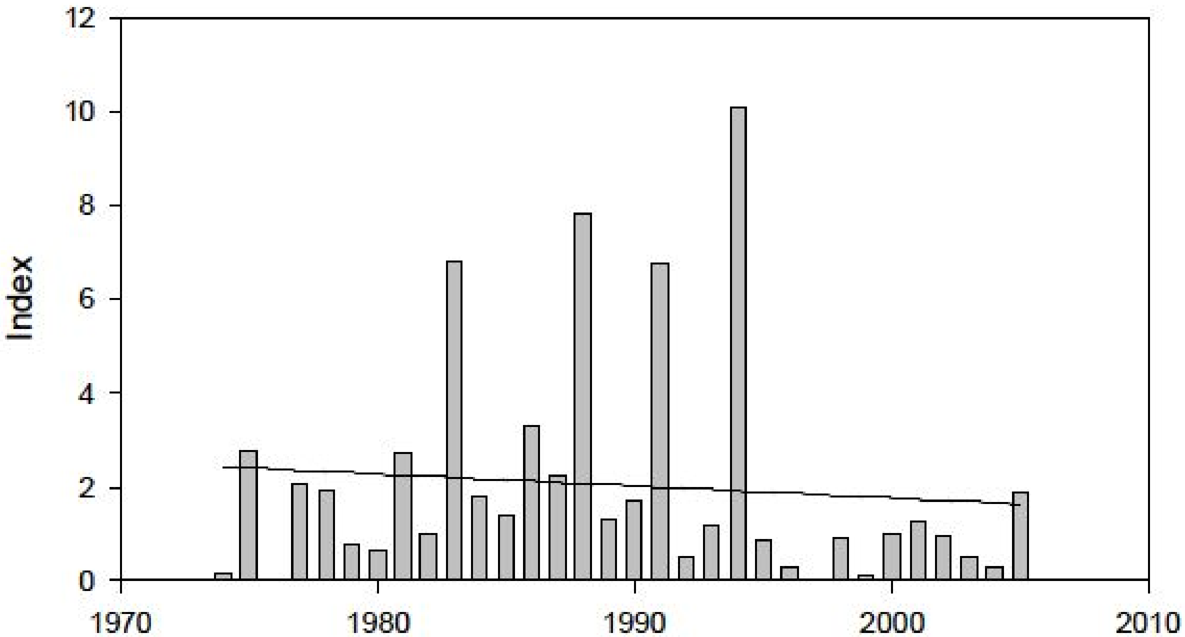

Figure 6. hogchoker showing a slight downward trend (Seaby and Henderson 2008)

Atlantic sturgeon (*Acipensor oxyrinchus*): Endangered

- 2017 stock assessment concluded that Atlantic sturgeon stock was depleted coastwide;
- There has been a 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 human activity;
- 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 demand for sturgeon eggs (caviar) and 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.

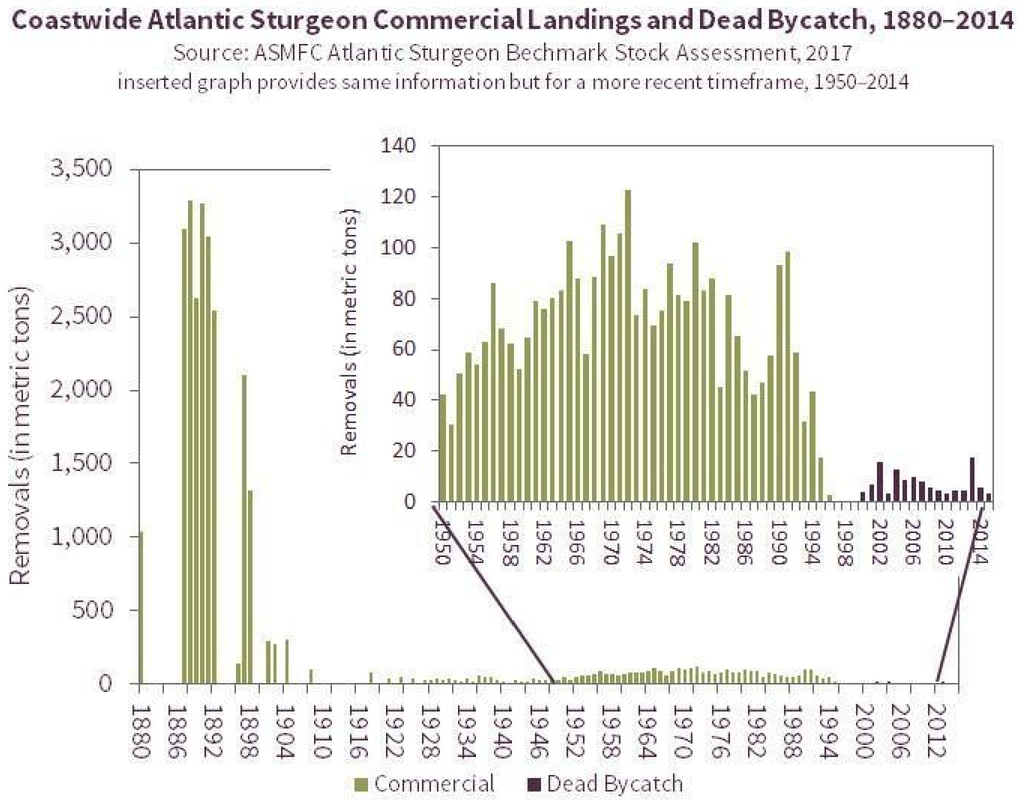

Figure 7. Sturgeon populations were severely overfished beginning in the 1880s until the 1997 overfished, the ASMFC called for a coastwide moratorium through at least 2038, in order to build up the stock. (ASMFC 2018).

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 U.S. Fish and Wildlife Service 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;
- Riverwide population estimates in the 1990s showed the spawning population had increased substantially from that observed in the 1970s.

Lined seahorse (*Hippocampus erectus*): Vulnerable

- There are no definitive numbers of seahorse populations in HRE;
- Their presence indicates the water quality and health of our waterways, but they are listed as vulnerable by the International Union for Conservation of Nature since 1996;
- They have 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;
- White catfish have been in steep decline in the HRE since 1990.

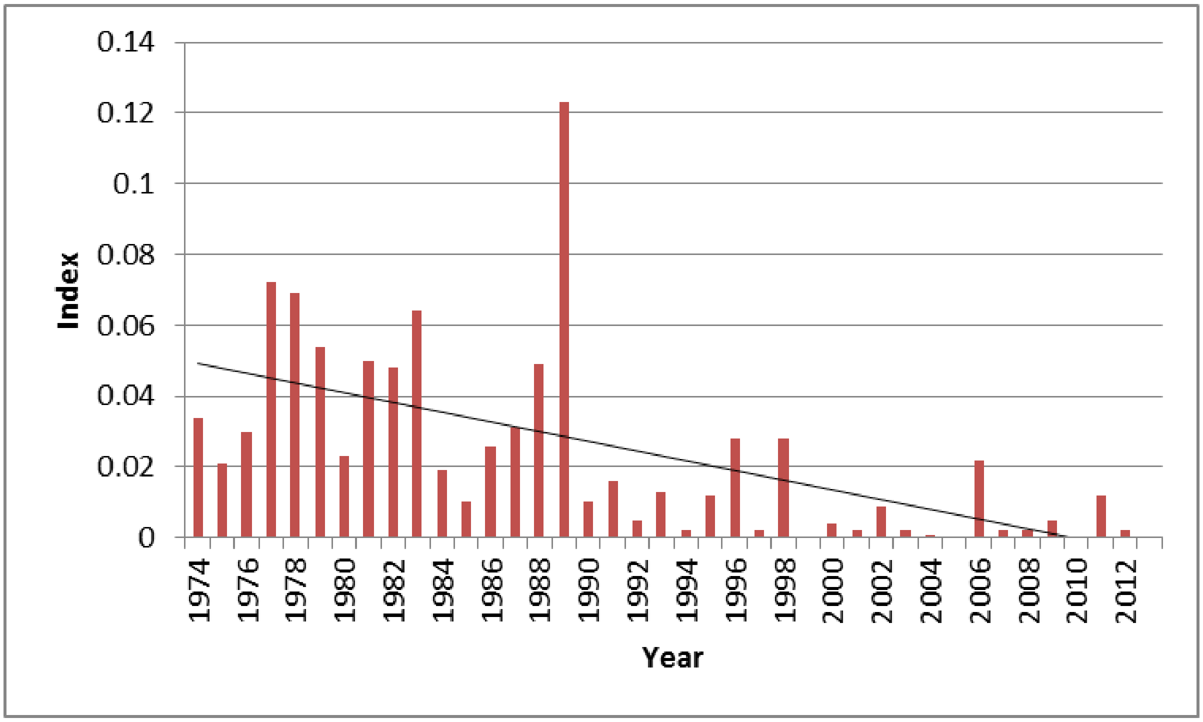

Figure 8. Juvenile index of white catfish in the Hudson River showing a long-term decline. (Henderson and Seaby 2015)

River herring and shad (*Alosa spp.*): Stocks depleted, long term decline

- Category includes blueback herring (*Alosa aestivalis*), alewives (*Alosa pseudoharengus*), American shad (*Alosa sapadissima*), and hickory shad (*Alosa mediocris*);
- All species are at historic lows coastwide;
- These fishes have been devastated by decades of overfishing (directed and incidental) and centuries of lost 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;
- Young-of-year 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 known about them, but they are in significant decline for likely the same reasons as American shad.

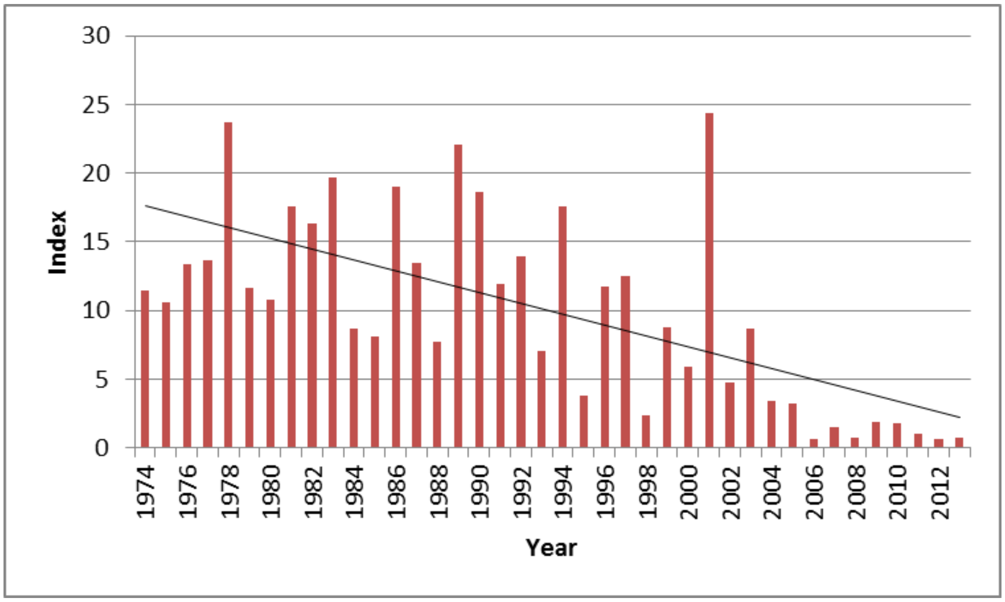

Figure 9. The juvenile index for American shad in the Hudson showing a decreasing trend through time. (Henderson and Seaby 2015)

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.

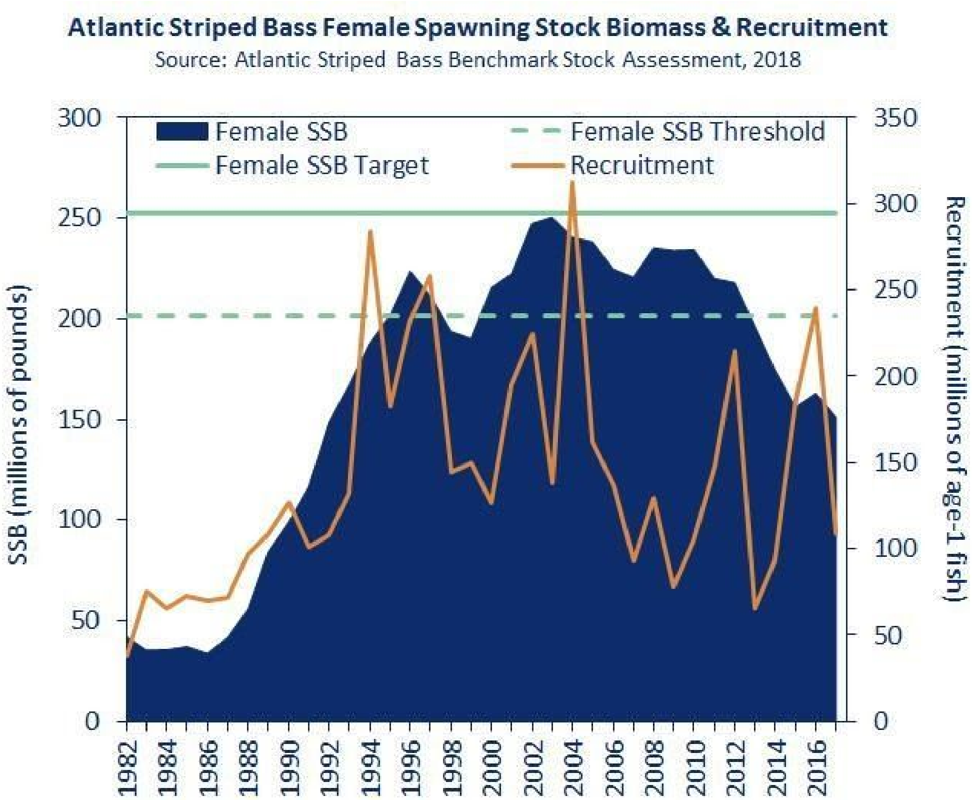

Figure 10. Spawning stock biomass of Atlantic is below ASMFC thresholds (dashed line) and well below optimal target population levels (solid line). (ASMFC 2018)

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.

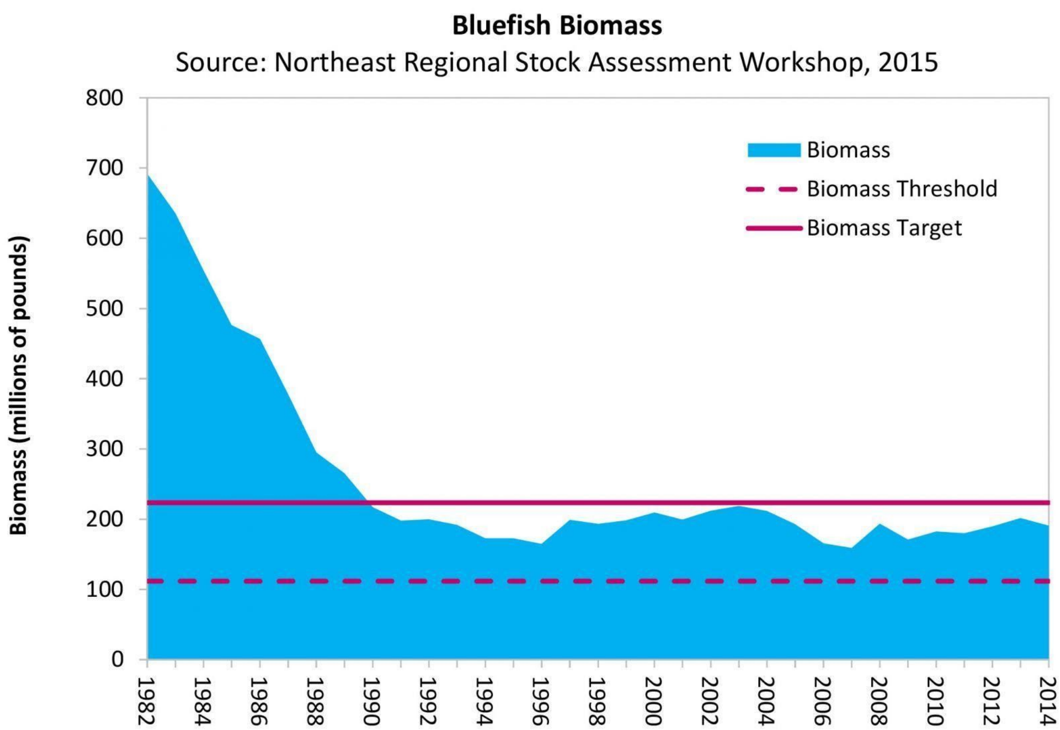

Figure 11. Bluefish are overfished and their biomass is in decline since the 1980s (ASMFC 2019)

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

- Latest stock assessment indicates weakfish are 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.

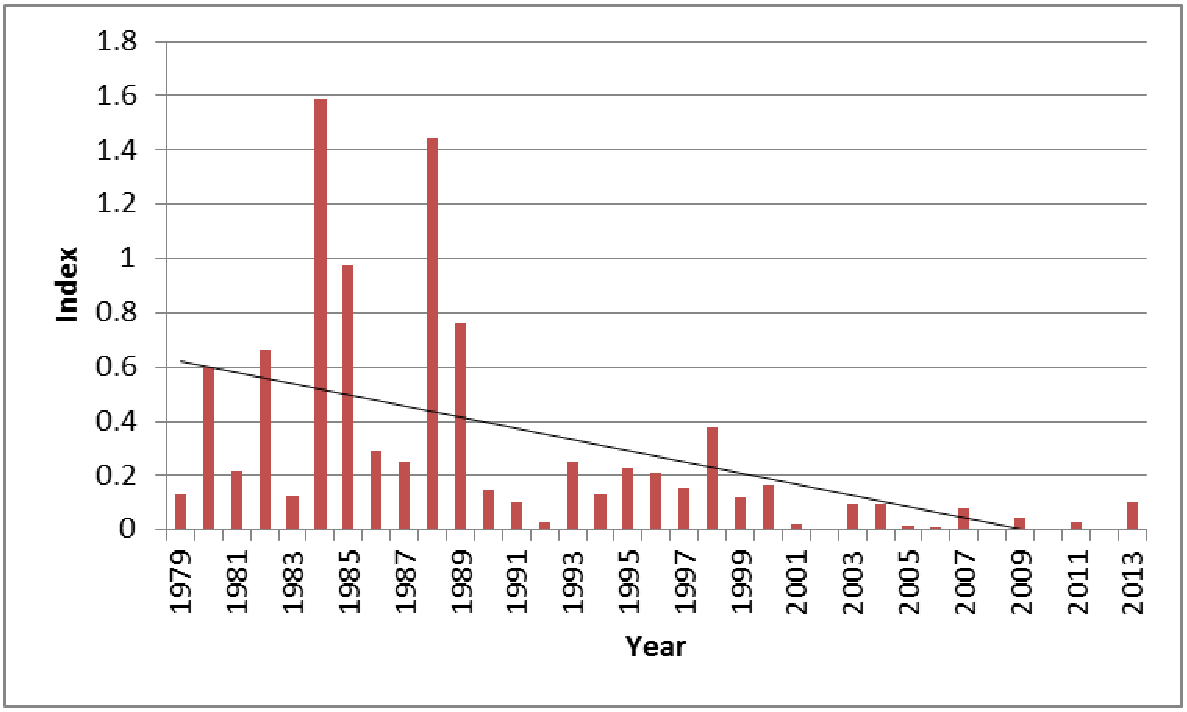

Figure 12. The juvenile index for weakfish in the Hudson, showing a decreasing trend through time (Henderson and Seaby 2015).

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

- White perch are in decline, and the present population size has declined by 60 percent 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 interrelatedness of all species. 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.

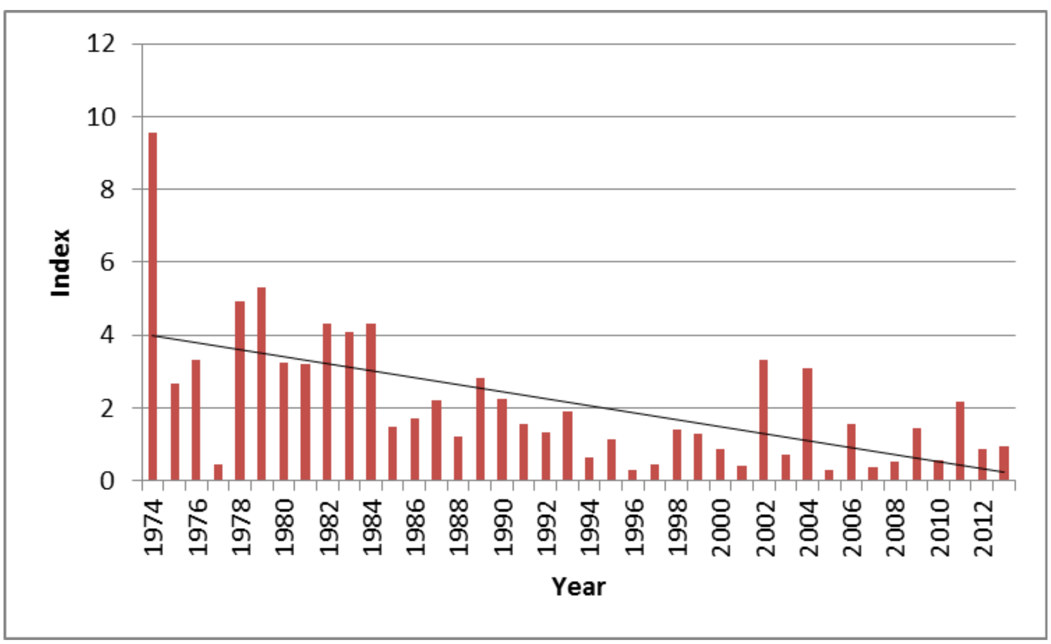

Figure 13. Yearling white perch showing a long-term decline. (Henderson and Seaby 2015)

Eastern oyster (*Crassostrea virginica);* In decline

- Oysters have been devastated by centuries of pollution, habitat degradation and overharvest;
- The Hudson River Estuary was reported to have had 350 square miles of oyster reefs. New York Harbor was estimated to contain 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 New York Harbor, but the population remains unsustainable.

Related environmental conditions

Temperature and dissolved oxygen are indirectly linked. Both strongly impact aquatic life in the Hudson River Estuary. The temperature regime, or pattern, 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 in the 1960s. 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 suboptimal 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. Residual chemicals move through food chains, becoming concentrated in fish and affecting their survival, growth and reproduction.

Data: Rising water temperature

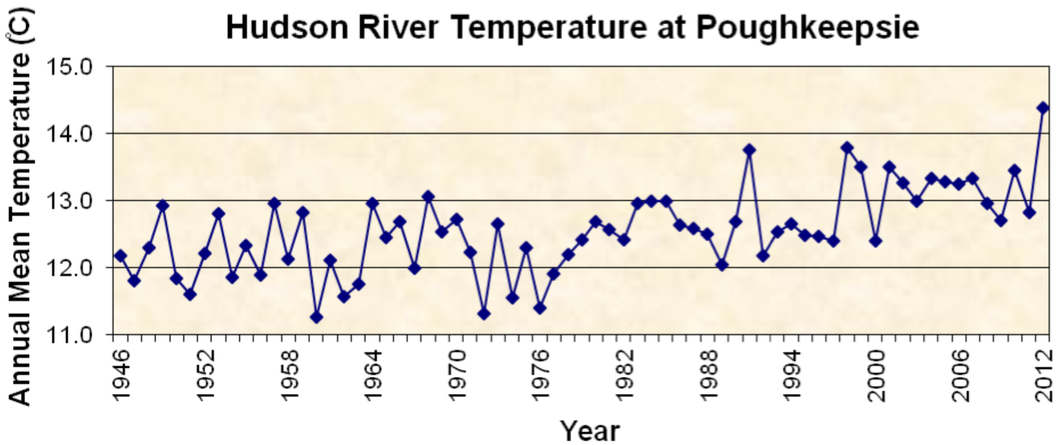

Figure 14. Statistically significant increase in mean average annual water temperature measured at the Poughkeepsie Water Treatment Facility. The mean annual temperature in recent years is about 4°F above that recorded in the 1960s. (Seaby and Henderson 2008)

Data: Dissolved oxygen

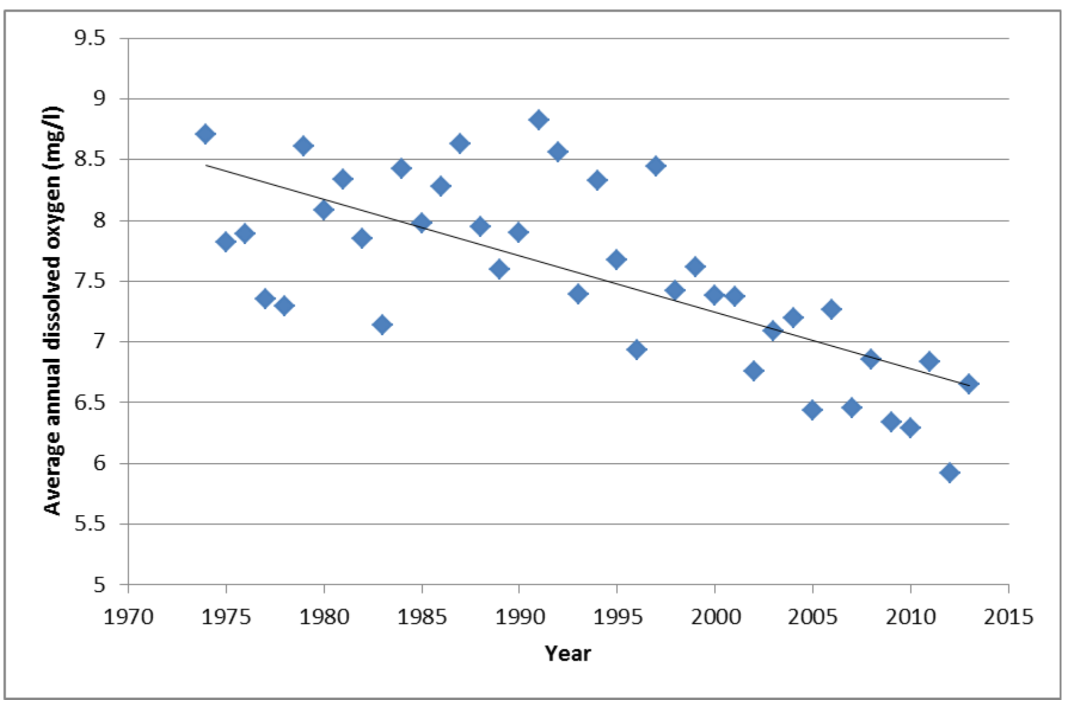

Figure 15. Average Annual Dissolved Oxygen (mg/l) from Beach Seine surveys, 1974 to 2013. (Henderson and Seaby 2015)

References

Atlantic States Marine Fisheries Commission (2017) American Eel Benchmark Stock Assessment Update

Atlantic States Marine Fisheries Commission (2018) Atlantic Striped Bass Benchmark Stock Assessment Update

Atlantic States Marine Fisheries Commission (2018) Atlantic Sturgeon Benchmark Stock Assessment Update

Atlantic States Marine Fisheries Commission (2019) Bluefish Operational Stock Assessment Update

Atlantic States Marine Fisheries Commission (2019) Winter Flounder Summary

Henderson PA and Seaby RMH (2015) The status of fish populations and the ecology of the Hudson. Pisces Conservation Ltd.

Seaby RMH and Henderson PA (2008) The status of fish populations and the ecology of the Hudson. Pisces Conservation Ltd.