Fisheries

TEC Significance

The Hudson River estuary is perhaps the most studied of any estuarine ecosystem worldwide. Findings from those studies highlight the interplay of its aquatic habitats and the commercial and recreational fisheries it supports. Those findings further emphasize the relationship of human activities to the wellbeing of the biota and its fisheries in the estuary watershed and worldwide. There is a wide array of factors that limit the productivity of the Hudson River estuary which certainly include, but are not limited to, climate change, by-catch, exotic species and legacy factors such as large-scale dredging and contamination. Evidence of the cultural and economic significance of the fishes and fisheries to the estuary is now widely present on the iconic white placards emblazoned with Atlantic Sturgeon depicted in blue, those marking bridges over tributaries within the watershed.

An estimate of the 1999 value of commercial fishing, recreational fishing and seafood industries to New York State was reported as $11.5 billion dollars (New York Sea Grant, 2001). Although not broken out in the report, the estuarine contribution to that number was probably provided largely by finfish, specifically migratory Striped Bass and herring American Shad, but also resident Largemouth and Smallmouth Bass. Historical accounts suggest the harvest value of American Shad in the late eighteen-hundreds, worth $3.9 million in 2006 U.S. dollars (Limburg, Hattala, Kahnle & Waldman, 2006) and prize money of about $40,000 for winners of Bassmaster National Tournaments during the mid-1980s, targeting Largemouth and Smallmouth Bass.

Some estuary fishes, particularly migratory, are central to significant offshore, or “out of estuary,” fisheries where they provide a major contribution to the oceanic food web. Because of the movement between state, federal and international waters, many estuary species are studied, monitored and regulated through interstate and federal oversight. The fishes comprising the commercial and recreational fisheries differ greatly in their habitat needs but the estuary itself provides a diversity and abundance of aquatic habitat that mostly supports those needs. The importance of the estuary to the North Atlantic ecosystem has very recently become obvious and newsworthy by the grand presence of humpback whales feeding on fish in the New York Bight.

The commercial fishes frequenting the estuary are all native and are mostly diadromous (e.g. migratory), spending time during various life stages in either salt or freshwater. The diadromous fishes of the estuary are the most difficult to manage and have been the most overfished, particularly Atlantic Sturgeon and American Shad; neither of which may now be fished. Most adult migratory fishes are found in fresh water during the spring when they spawn. Their young spend varying times in the estuary until they leave to mature at sea, returning later to their natal water to spawn. American Eels have an opposite life history, spawning in the Sargasso Sea but maturing for considerable time as females in freshwater or males, for shorter duration, in brackish water. Some resident fishes also spend portions of their lives

separated by sex. Male blue crabs are mostly found in fresh water as far upriver as the Federal Lock and Dam in Troy, NY, while females are located further down estuary, often in brackish water.

Some resident recreational fishes occur as invasives or through introduction and most inhabit areas supporting submerged aquatic vegetation rooted in softer substrates year-round (e.g. fresh or brackish tidal wetlands and other types of shallow, off-channel embayments). Additionally, resident recreational fishes are found around docks, derelict boats or other structure. These species are attractive targets of shore anglers and those fishing from smaller boats, such as Black Bass anglers. They are also accessible to young children, introducing them to the estuary and fishing.

Eleven other sections of this plan relate to the below actions in varying ways relative to commercial and recreational fisheries. Fish habitat issues are also treated in the Shallow Water and Intertidal Wetlands TEC, Tributary Connectivity and Barriers TEC the Sediment TEC, Public Access TEC and Water Access and Navigation Safety and Natural Resource Interactions TEC. Water quality is covered in the Storm and Wastewater TEC, the Contaminants TEC and again in the Sediment TEC. The Hudson River Shorelines and Riparian Areas TEC and the Resilient Waterfronts and Community Shorelines TEC also relate to habitat and estuary productivity. The Resilient Plant and Animal Communities TEC has the closest affinity to this section of the plan and treats the issue of invasive species, an extremely important consideration for commercial and recreational fisheries, more in-depth than the above actions. The Estuary Education TEC presents the most ubiquitous topic of all and is extremely relevant to this and all the other TECs.

Goal

"Restore the signature fisheries of the Hudson River estuary to their full potential, ensuring future generations the opportunity to make a seasonal living from the estuary's assets and to fish for recreation and consume their catch without concern for their health" (NYS DEC, 2015a).

TEC Context

Historical Context

Hudson River estuary habitats, and the fish found within them, have been impacted by man since the watershed was first inhabited after the last ice age. However, human impacts did not become significant until the industrial revolution. Since then the estuary has been dredged, filled, dammed, polluted through myriad types of discharge, bounded and segmented by infrastructure, and armored and developed to shoreline by industry and residences. The river bed has also been plowed and furrowed, particularly at large anchorages, and the wakes of large boats and even small motorized boats has disrupted natural shorelines. Its waters have been withdrawn to cool power plants and returned hot to the river. Some fresh river water has even been floated away in ship's holds as ballast water as well as potable water and it is used as a drinking water source for some estuary communities. Its natural or native aquatic biota has been poisoned, restricted from some habitat access, bombarded with invasive or introduced species, over harvested in or outside the estuary and contaminated beyond safe levels or unlimited consumption by humans or estuary biota. Hudson River estuary fishes have at various times also been poached alive in power plant cooling water or impinged on power plant trash racks, maimed or dismembered by boat and ship propellers, asphyxiated from pollution, poisoned or displaced and overfished. Estuarine native vegetation has been killed or transplanted by dredging, fill or competition from invasives, shading and even for a time coincidental to herbicide applied to water chestnut.

Current State

Despite serious past abuses, considerable portions of the estuary's habitat now remain for commercial and recreational fishes. However, habitat fragmentation or lack of connectivity remains a problem, particularly for diadromous fishes including American Eels and members of the herring family including American Shad. The Federal Lock and Dam at Troy, NY now limit the extent of shad spawning, partially and temporally blocking off upstream portions of the Hudson once used by Shad. Changes in timing of lock operation might facilitate American Shad migration upstream again. However, any lock operation has the potential to facilitate an upstream extension of invasive migratory aquatic species. Additionally, the most downstream of dams on some tributaries preclude or limit spawning of River Herring and resident fishes including native White Suckers and introduced Smallmouth Bass. Such dams further up the respective tributaries further limit access to juvenile American Eel habitat.

Non-native and otherwise invasive species pose a serious threat to the future of Hudson River fisheries. Zebra mussels, an invasive brought to the estuary in ballast, bilge or live well water, have impacted herring through competition for the planktonic food organisms that both the young herring and the zebra mussels feed on. Possibly the nutritional quality of different organisms that are a partial substitute diet for young herring may have some influence on herring egg or larval viability. Round Gobies, small invasive benthic fish now in the Mohawk, are expected to make their way to the estuary and will surely impact the Hudson food web when they arrive. Fisheries managers are fearful that Asian carp will gain access from the Mohawk River should they find their way into the Great Lakes. Unlike Grass Carp, already in the Estuary, the other Asian carp species are filter feeders and would seriously compete with and consume river herring during their planktonic infancy and juvenile development. New invasive fishes would also compete for food with young of the year of many other fishes. Gizzard Shad, a recently established intruding filter feeder may already be competing with American Shad and river herring. Grass Carp, an invasive and perhaps already established in the estuary, feed on aquatic vegetation but are unfortunately not capable of controlling more fibrous plants. Water chestnut, introduced into the Mohawk over 100 years ago, continues to proliferate, shading out other more desirable rooted aquatic vegetation as does hydrilla which was most likely introduced as a hitchhiker on a boat trailer or outboard motor.

PCBs, continue to be a health problem to humans and fish. Currently the Environmental Protection Agency is considering a Department of Environmental Conservation request to have more PCB contaminated materials dredged from the river bottom upstream of the Federal Lock and Dam at Troy, NY. Monitoring of fishes for contaminants continues and the health department publishes advisories about consumption of fish taken from the estuary and river, mostly relative to PCBs but also including mercury and other contaminants. The status of key fish populations is also monitored, some of the monitoring mandated by agreement among members of the Atlantic States Marine Fishes Commission. Recreational fisheries are managed through regulations published in a fisheries guide printed for and distributed by the Department of Environmental Conservation. Free registration for anglers age 16 and older is mandated to fish the estuary and its tributaries up to the first barrier impassable to fishes. Anglers age 16 and older fishing only for freshwater fishes are required to purchase a freshwater fishing license. The marine registry provides no revenue for the management of recreational fisheries for migratory fishes.

The commercial fishery historically marketed catches from gill nets either drifted or staked and most of the catch was transported up or down river to Albany or New York City. For the purposes of this plan a commercial fishery is strictly defined as revenue generating regardless of the gear used for that fishery. Recreational fisheries in this plan are defined as those fisheries pursed for sport, pleasure or

recreational use. Two migratory fishes predominated in the past commercial fisheries, American Shad and Atlantic Sturgeon when the commercial fisheries dominated the fisheries of the estuary. The estuary fisheries are now dominated by recreational anglers but there is a commercial bent to the recreational fisheries. Today the largest recreational fishery is for pre-spawned Striped Bass, that in the early Spring when adult Striped Bass return to the estuary to spawn. There is a large commercial aspect to that fishery however, from charter boat captains who hire out to anglers and provide them the chance to catch Stripers during the spawning run. There is also a limited commercial fishery for river herring and small American Eels, those taken mostly for sale as bait for the Striped Bass fisherman but some also for human consumption. Blue crabs are also harvested commercially and recreationally. American Shad have been most recently fished for recreation but even that fishery for them has been closed because of low numbers of fish. Black Bass in the estuary provide both commercial and recreational fisheries. Bass tournaments are most certainly commercial in nature, but anglers do also fish for estuarine Black Bass for recreation. All recreational fisheries in the estuary also contribute to the economy of the estuary, particularly using the services and goods provided at marinas, thus making them commercial also.

Management of the migratory fishes, particularly Atlantic Sturgeon and American Shad has been facilitated somewhat in recent years by studies to determine hooking mortality of angler caught fish. Survival of Striped Bass caught on bait on non-offset circle hooks was shown to be better than that of Striped Bass caught on bait and "j" hooks. The survival efficacy of non-offset circle hooks is attributed to the fact that they more frequently hook fish in the mouth than "J" hooks. Current regulations for fishing gear for Striped Bass angled in the estuary only suggest the use of non-offset circle hooks. Since the Striped Bass fishery is regulated by size limits catch and release is mandated for off size fish. Consequently, survival of those non-legal-size fish is partially key to the management of those fish. American Shad, on the other hand are normally angler caught with lures that most frequently hook the fish in the mouth. Survival was shown to be good for fish caught and released and, there was a high percentage of released fish during the study and in findings from creel census. It would appear therefore that the American Shad recreational fishery in the estuary might be opened for catch and release, despite the low numbers of adult spawners returning to the estuary in recent years.

Management of Atlantic Sturgeon is exacerbated from a variety of causes, particularly overfishing long ago for their economic value. They are long lived but slow to mature, almost two decades for females to reach spawning age and size. Their habitat preference in the estuary is deep water, that deep water being the dredged shipping channel for most of the estuary length. Now, deep draft barges, restricted to that shipping channel for navigation are a real displacer of water in the estuary in passing over sturgeon on the bottom below. Strikes from the propellers of the tugs pushing those barges are often blamed for the battered Atlantic Sturgeon carcasses sometimes found floating.

Trends and Drivers

Overfishing is thought to continue, not in the estuary but in the open waters of Mid- and North Atlantic. American Shad from the Hudson are taken commercially from mixed stocks in Delaware Bay and the Bay of Fundy. Consequently, some American Shad native to the estuary are harvested before they can return to the estuary to spawn thus exacerbating already low levels of stock recruitment.

Sea level rise expected from climate change will most likely increase the upstream intrusion of the salt wedge into the estuary, shortening the freshwater portion of the estuary to the Federal Lock and Dam. Increasing water temperatures, also expected, might mean earlier spawning by both resident and migratory fishes; those spawning in the spring anyway. Increased water temperatures will also lengthen the growing season for biota and may hasten growth. Hastened growth may shorten exposure to

predation. However, increased growth rates might lead to earlier maturation and shorten the lives of smaller, normally short-lived organisms. All of these, and other, potential changes to life history and habitat could, consequently, alter the mechanics of the aquatic food web. Habitat disruption as a cost to changes in navigation practices including the addition of more anchorages or docking of larger vessels is also predicted.

On a positive note, the nuclear power plant at Indian Point, probably the largest influence on fish populations in the estuary, is scheduled to close in 2021. That closure portends a significant change in the population dynamics of the estuarine biota and necessitates continued Long River Surveying of the aquatic biota.

Constraints

Fisheries management constraints in the estuary include the typical lack of funding and staff resources, but financial resources are not the only limiting factor. Those resources essential to adequately meet the mandates imposed through cooperative management of fishes under the jurisdiction of the Atlantic States Marine Fisheries Commission have not proven sufficient to improve effective management for many species. Constraints on the commercial fishery are thought to be principally issues of overfishing, and primarily overfishing outside the estuary. This remains a significant technological and regulatory challenge to management of commercial fisheries. Finally, an inability to quickly change rules, laws and legislation to allow for management of year classes of fishes of relatively short life spans precludes refined management of stocks of those fishes, particularly American Shad and river herring.

The physical nature of the Hudson Valley is also a limiting factor in the face of sea level rise as many of the current vegetated shallow areas are expected to transition to open water. Steep valley walls and developed floodplains are expected to preclude the migration of many, essential, shallow water habitats, thus reducing overall spawning, rearing and resting habitat. Additional habitat features also hamper management effectiveness, including barriers to upstream fish passage. One such barrier is the Federal Lock and Dam in Troy, NY. However, such barriers are sometimes critical for fisheries management. Asian Carp, an invasive fish now in the Mississippi River, pose a big threat to the ecosystem and are of concern. It is feared they will reach the estuary via the Mohawk River from the Great Lakes but breaking that connection defeats the purpose of the canal. Such inherent conflicts are prevalent relative to the management of Hudson River commercial and recreational fisheries. The challenge to current and future resource managers is to evaluate the trade-offs among equally unpopular decisions, make very difficult decisions and execute implementation strategies.

Action Table

Objective	Action	Complete by
Objective 1: Restore and manage a suite of aquatic habitats proportional to those now present or favoring habitats most important to fishes of greatest ecological, economic or cultural significance while accounting for sea level rise caused by	Action 1A: Where shoreline alteration is necessary, design and construct structures to provide habitat attributes now present, particularly cover, On-going (also see Resilient Waterfronts and Community Shorelines TEC)	On-going
Objective 2: Slow or eliminate, if possible, the proliferation of invasive aquatic biota, by	Action 2A: Block passage of aquatic biota through the canal system, particularly at Oneida Lake, to prevent access from the Great Lakes	2050

species and extent (also see Resilient Plant and Animal Communities)	Action 2B: Follow the New York State Aquatic Invasive Species Management Plan, 2015 (NYS DEC, 2015b) and update the plan and management actions as more about invasive species and their control becomes known	Ongoing
	Action 2C: Enact and enforce legislation, when necessary, to help prevent the spread and proliferation of invasive aquatic	Ongoing
	Action 2D: Strictly enforce regulations and laws already enacted to prevent the spread of aquatic invasive species	Ongoing
	Action 2E: Educate the public on invasive aquatic biota	Ongoing
Objective 3: Effectively enhance management of the fishes and fisheries of the estuary through regulation, research, monitoring, education and public access	Action 3A: Manage diadromous fishes and fisheries through, laws, regulations, ordinances and agreements that recognize the estuarine home ownership and protect stocks of fishes subjected to fisheries outside of home waters	Ongoing
	Action 3B: Provide public access to estuary fishes, their habitats and fisheries to maximize the potential for public use, safety and enjoyment	Ongoing
	Action 3C: Continually inform publics of estuary fishes, their fisheries and how and where to best access and use those resources	Ongoing
	Action 3D: Monitor young of the year and adult abundance and biological characteristics of important estuary fishes to provide information to guide and determine the effectiveness of management decisions	Ongoing
	Action 3E: Secure transfer of specimens from utility monitoring program for immediate and future analysis	2020
	Action 3F: Establish multi-stakeholder working group to develop alternative monitoring strategies in light off the pending closure of Indian Point Nuclear Facility	2020

Action Narrative

- 1A. Where engineered shorelines are essential, incorporate and provide aquatic cover for biota by design and construction. That cover from surface roughness and texture and on a larger scale, interstitial spaces of different size, some exposed to light, different flow velocities and different depths.
- 2A. Determine means and put in place barriers to movement of biota into the Hudson Watershed through the canal systems. Methods could include electric barriers or disconnecting fill. Fill would exacerbate navigation but could be mitigated by methods developed and implemented to move vessels across barriers.
- 2D. This should be a dedicated part of any state program relative to invasives and should make use of all media.
- 3A. The ability of resource agencies to manage through legal means needs update. This includes enacting new legislation and enforcement of law.
- 3C. Education is critical to public appreciation, protection and stewardship of the commercial and recreational fisheries of the estuary. Additionally, it is essential to facilitate enactment of rules, regulations, laws and legislation and enforcement. All media should be used for such education.

- 3D. The status of the estuary biota is dynamic. Management of Hudson River estuary resources is mandated. Monitoring is key to any management. Consequently, the management of the commercial and recreational fisheries of the estuary necessitates funding. Currently, recreational fishing for diadromous fishes in the estuary only requires free "marine registration". Funding for management of that resource should be provided, at least in part, by anglers purchase of a NYS saltwater fishing license. Saltwater recreational fishing licenses are required by most or all other Atlantic states.

Research Needs

- In estuary aspects of American Shad population dynamics need to be reviewed regarding changes in competition for food, predation from invasive or intrusive species, salt front migration with changes in flow and navigation lock operation.
- Nutritional studies of estuary aquatic biota need to be done to rule out the possibility that diet change has diminished the reproductive capacity of fishes of the herring family, particularly American Shad.
- Imprinting of fishes, particularly American Shad, needs research to determine its role in reduction of Hudson estuary stocks, especially time of imprinting and perhaps location in the estuary.
- Continuation the estuary long river aquatic surveys by the utilities until (2021) and beyond is necessitated to determine impacts to aquatic biota due to close down of the Indian Point nuclear facility.
- Seasonal habitat and use needs of estuary fishes must be studied. That to help prevent, reduce or mitigate impacts from in estuary effects of climate change and development projects.
- Long-term studies of efficacies of various estuary habitat modifications designed to mitigate consequences of water level change and salt front migration need to be initiated for baseline data acquisition.
- The proliferation of apex predators, particularly marine mammals, raises the scepter of their populations exceeding carrying capacity of the oceans. Man continues to compete with those animals and marine fishes for their food. The role of marine mammals, now protected by the Marine Mammals Protection Act, must be researched relative to the marine ecosystem to allow their management in concert with other marine biota.
- Impacts of submarine energy transmission cables on fishes coincidental with effect of offshore wind farm development need study. This is especially relevant for fishes often found near the bottom and biota in nearby substrate.

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