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Fish Survey Report 2023

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Purpose

For the last 35 years, the Park's River Project has conducted a trap survey to monitor local fish population dynamics. This fish survey informs our understanding of fish diversity and abundance in the Park and collects animals for the Wetlab to connect the community to the environment. By tracking fish diversity over time, we can see broad changes within populations and within specific species as well as infer long-term trends in our aquatic friends.

Key Questions

- How does fish abundance & diversity vary between years and species?
- How does Pier 40 compare to Pier 25/26 in terms of species and abundance?

Methods

- Traps were emptied 3-5 times a week during the most active parts of the year (May to October) and minimum once a week in the off-season.
- Surveillance consisted of checking 8 traps (four minnow traps and four crab pots) at Pier 40 (**Fig. 1**) and Pier 26 (**Fig. 2**)
- All fish caught were identified and measured (cm), then were either held temporarily for education in the River Project Wetlab aquarium or released.
- Data analysis was performed using Microsoft Excel

Fig. 1 | Pier 40 gangway and floating dock

Fig. 2 | Pier 26 gangway and floating dock

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Major Findings

In 2023, a total of 17 species were collected, with 9 species observed at both Pier sampling locations. Summer flounder, American white perch, American silver perch, and striped bass were only observed at Pier 26, while scup, butterfish, goby, and butterflyfish were only observed at Pier 40. All other, more abundant species, with catch >3, were observed at both trap sites. Tautog, oyster toadfish, and black sea bass made up 81.1% of the total catch for 2023 (**Table 1**), while in 2022 these species represented over 91% of total catch.

Fig. 3 | A spotfin butterflyfish (found deceased upon discovery) – the largest butterfly our survey has ever caught!

Species	Pier 26 Catch	Pier 40 Catch	Total 2023 Catch	% Total Catch
Tautog	56	73	129	37.8%
Oyster toadfish	17	67	84	25.4%
Black sea bass	11	50	61	17.9%
Skilletfish	8	9	17	5.0%
Cunner	2	10	12	3.5%
Lined seahorse	2	6	8	2.3%
Feather blenny	3	7	10	2.9%
Northern pipefish	3	1	4	1.2%
Summer flounder	3	0	3	<1%
Scup	0	3	3	<1%
American white perch	3	0	3	<1%
American eel	1	1	2	<1%
Butterfish	0	1	1	<1%
Naked goby	0	1	1	<1%
American silver perch	1	0	1	<1%
Striped bass	1	0	1	<1%
Spotfin butterflyfish	0	1	1	<1%
Total	111	230	341	

Table 1 | Total catch by species and study site 2023, up to Dec 13th

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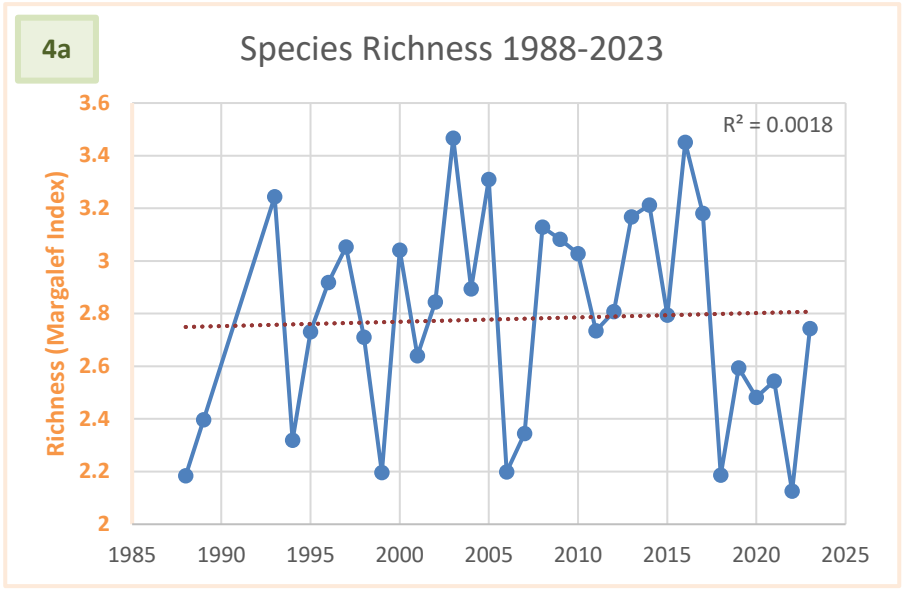
Thirty Years of Data

Between 1988 and 2023, species richness is observed to be highly variable with large inter-annual fluctuation, but overall, no significant trend. (**Fig. 4a**) Species evenness, on the other hand, shows a steeper rate of decline (**Fig. 4b**). This indicates that while the overall number of species collected as a part of this ongoing survey has not changed significantly, species composition is shifting. Fish that once used to be more prevalent, such as cunner and tomcod, have become far less abundant while others - oyster toadfish, tautog and black sea bass – now make up a greater total proportion of the catch.

It is unknown what is driving this decrease in evenness of the fish population in the Park's sanctuary waters. There are several potential factors, ranging from changing temperatures forcing smaller and cold-water fishes towards alternate habitats to the proliferation of robust opportunists (toadfish, tautog, black sea bass) filling the gaps left by diminishing species or contributing to their decline via predation or competition. More comprehensive data analysis is underway to attempt to elucidate subtler shifts in fish populations over the last 3 decades.



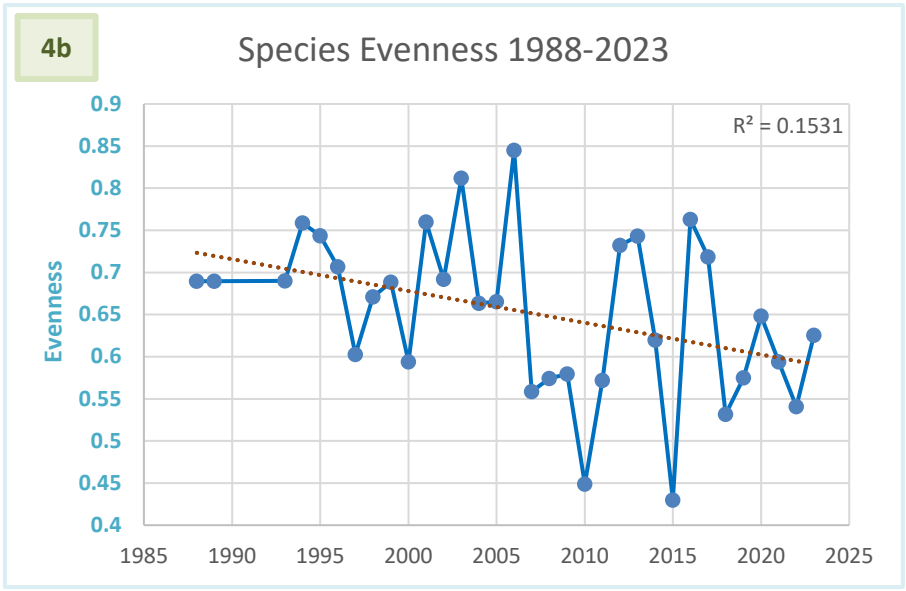


Fig. 4a and 4b | Species richness (**a**) and evenness (**b**) from 1988 to 2023. *Data up to Dec.13th

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Catch Per Unit Effort

Over the years, the trap survey has changed locations several times (2006, 2011, and 2020) and between sites (Piers 25/26 & Pier 40), with varying numbers of traps, especially prior to 2006. To compare fish data between these differing methods, Catch Per Unit Effort (CPUE) was calculated using the following formula:

$$CPUE = \frac{\#\ of\ Fish}{\#\ of\ Functional\ Traps * \#\ of\ Days\ Since\ Last\ Trap\ Checking}$$

The Fish Ecology Survey makes use of two types of traps: minnow pots and crab pots. Due to the difference in the entrance size and grating, these traps select for fish at different size classes. Minnow pots catch smaller fish and exclude larger fish, while crab pots catch larger organisms and release smaller ones.

There was substantial species overlap between the two varieties, including the tautog, black sea bass, oyster toadfish, and skilletfish. However, other species were found exclusively in crab or minnow pots (**Fig. 5a**). Crab pot-exclusive species included lined seahorse, northern pipefish, scup, and summer flounder. Minnow pot-exclusive species consisted of striped bass, butterfish, and feather blenny.

The largest proportion of catch from crab pots was comprised of tautog, followed by oyster toadfish. These two species made up 84% of total crab pot CPUE. The largest proportion of minnow pot CPUE was made up of black sea bass, followed by oyster toadfish, with the two species collectively making up 68% of minnow pot CPUE in 2023.

These differences in species by trap type are likely due to one or more traits:

1. Maximum size -- Minnow trap exclusives tend to be too small to be collected by crab pots and vice versa

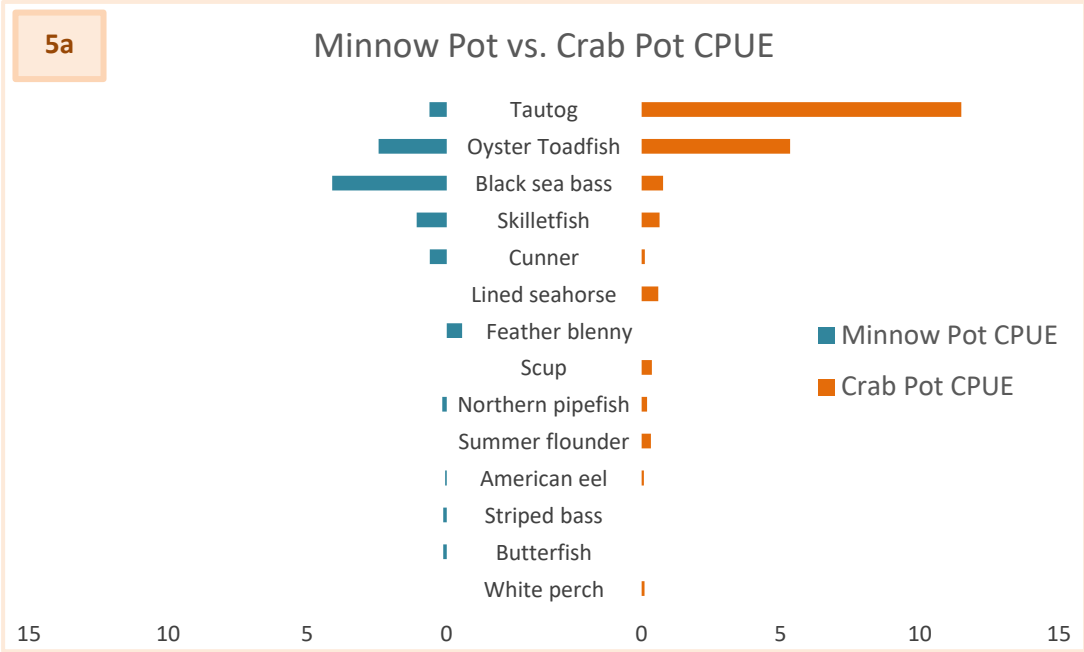

Fig. 5a | Comparison of CPUE between minnow pots and crab pots in 2023. *Data current up to Dec. 13th

2. Life stages in which they live in the River (e.g. Black sea bass juveniles appear to be more prevalent than their adults and vice versa for tautog)
3. Behavior (e.g. Seahorses are likely to hold onto the bars of a crab pot)

This was the first year of having both Piers 26 and 40 monitored for the entire year. The difference in species caught between these sites were minimal, with only four species being exclusive to one pier (**Fig. 5b**). It should be again noted that "site-exclusive" taxa were low in abundance, with total annual catch of 3 individuals or fewer, and are often observed at other pier locations in other years.

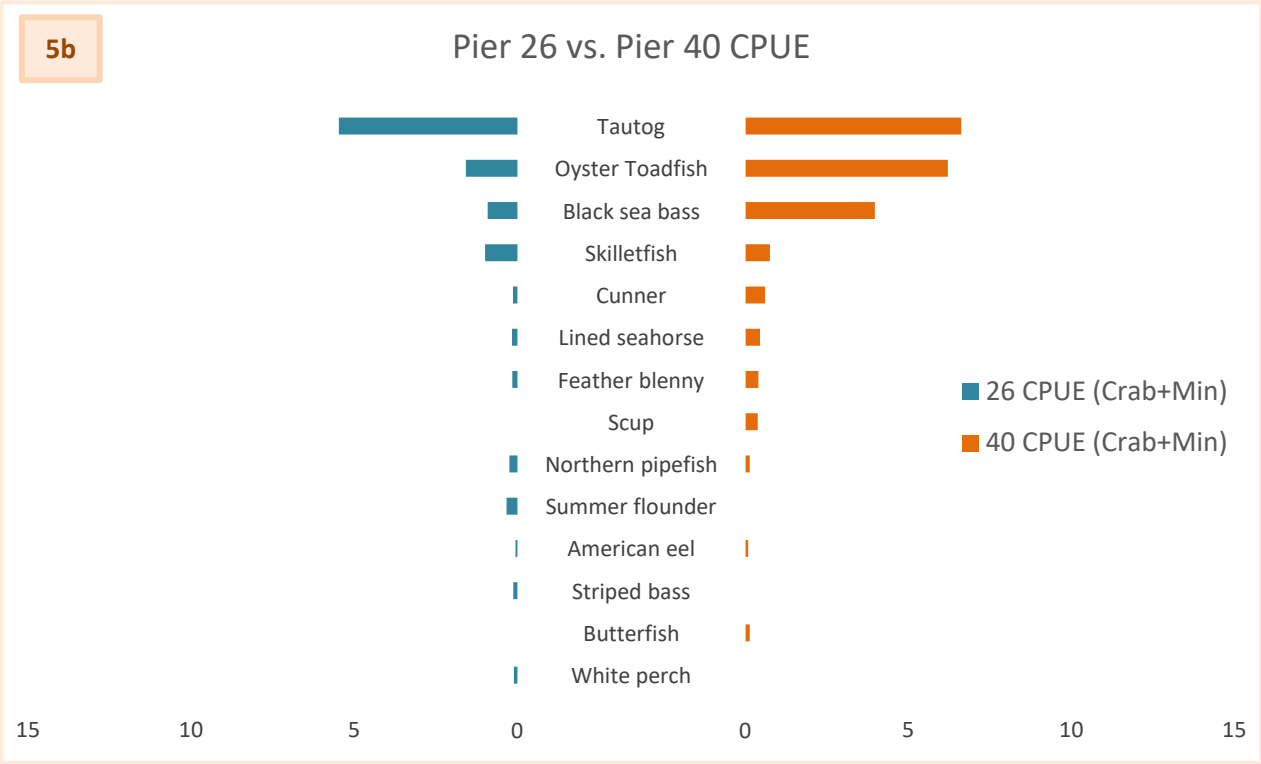

Fig. 5b | Comparison of CPUE between Pier 26 and 40 locations in 2023. *Data current up to Dec 13th

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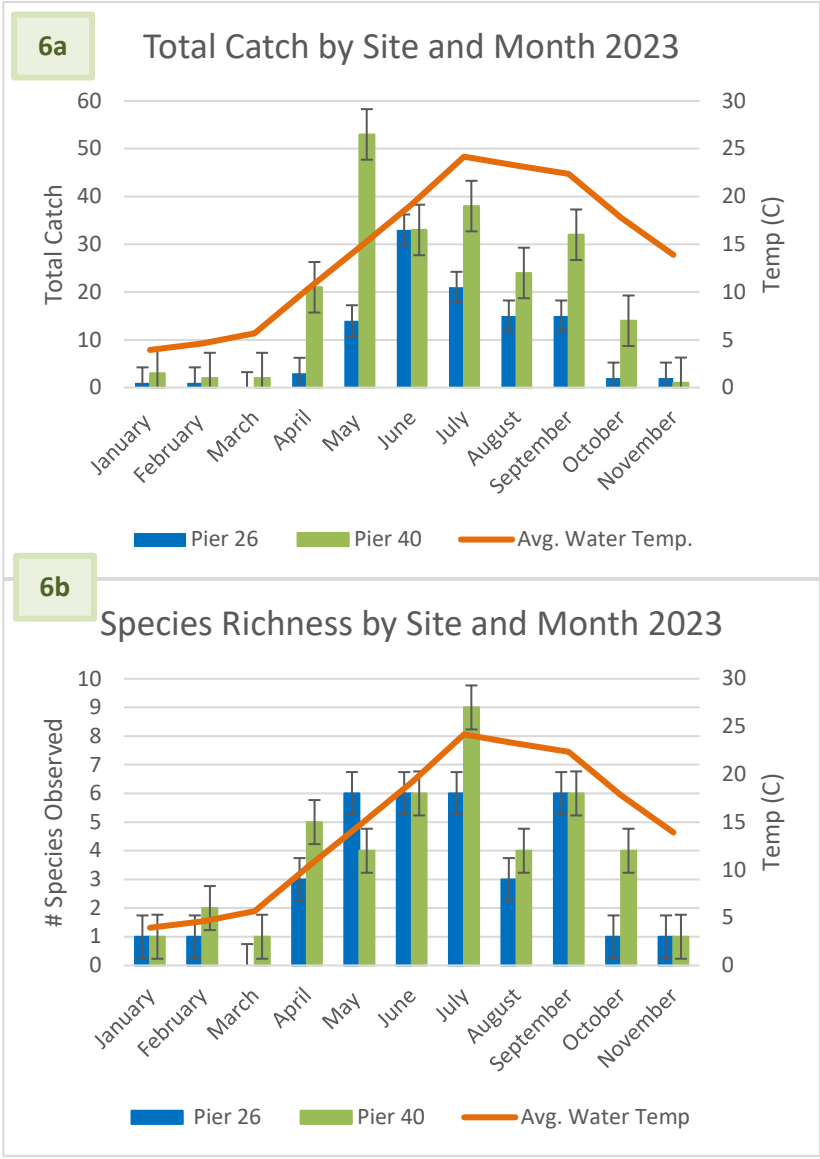
Abundance & Diversity

In 2023, monthly catch and species richness varied slightly compared to previous years. The highest monthly catch was observed in May with a total of 67 fish caught (**Fig. 6a**) as opposed to the typically observed peak catch in July and August. Monthly species richness peaked in July with a total of 15 species observed across both study sites (**Fig. 6b**).

Total yearly catch was significantly higher at Pier 40 than Pier 26 with the Pier 40 site observing more than twice the number of individuals caught at Pier 26 (**Table 1, Fig. 6a**).

Both total catch and species observed exhibited a significantly strong positive correlation with water temperature (catch R=0.72 p<.05, richness R=.76 p<0.01). The warmest months are observed to be when most teleost fish are predominantly active and encompass most species' migration periods. Fish were most active in the estuary April-September, with activity decreasing significantly outside of these time periods alongside dropping temperatures. Historically, July and August are often when non-resident or unexpected species make their way into the lower Hudson, including marine species such as pufferfish and tropical strays like butterflyfish, though this year one Spotfin butterflyfish was observed in November.



Figs. 6a and 6b | Total catch, species richness and average water temperature at Pier 26 and Pier 40 sites in 2023. *Data up to 11.15

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Take Aways

In 2023, a total of 17 species were observed across two study sites in Hudson River Park. This is in line with the current average number of species observed in survey setup each year (14.75 species), and the highest richness observed since 2017. As noted, there is a large degree of inter-annual variation overall, but especially in the catch of less abundant species, with prolific fish like black sea bass, oyster toadfish and tautogs being observed each season. Among these more abundant species, tautogs in 2023 made up a much greater proportion of total catch compared to 2022, while black sea bass and oyster toadfish catch was lower than the previous year. Year to year variation in catch is expected alongside natural variations in water quality, food sources and available habitat, and is expected in typical population dynamics.

Fig. 8 | A gravid blue crab (*Callinectes sapidus*) — one of the most common species caught in the survey outside of fish.

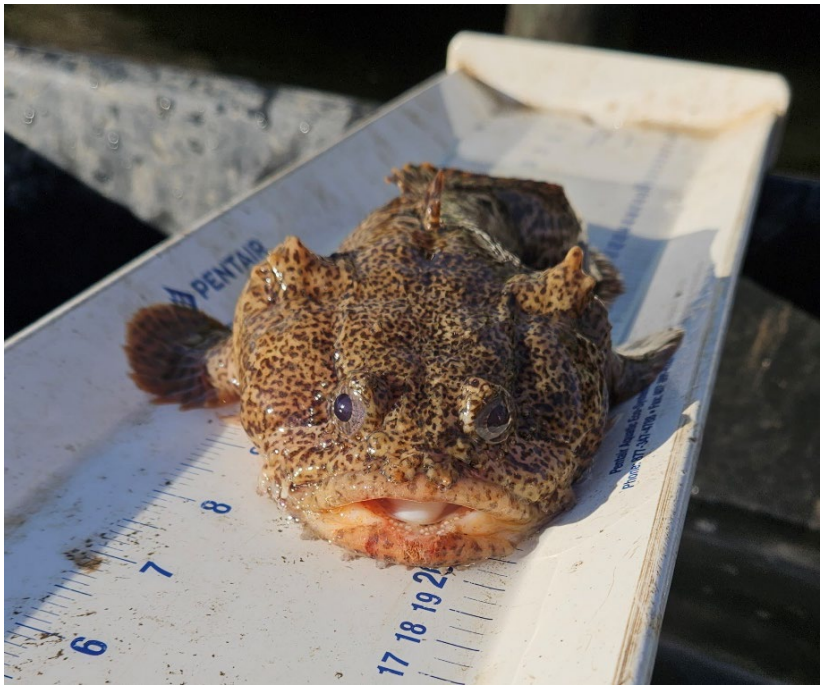

Fig. 9 | Oyster toadfish (*Opsanus tau*) on measure board

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Future Directions

The Park's River Project will continue to collect data about the fish in the Park as the Fish Ecology Survey continues. This year marks the first full year of a planned long-term, multi-site dataset that will allow Park staff to better understand differences in available micro-habitat throughout Hudson River Park. As both sites continue to be monitored, we are excited to explore long term catch patterns. Additionally, staff have begun sampling for temperature and salinity during each trap checking session using a CTD (conductivity, temperature, and depth) device to provide higher resolution, site-specific metadata on these important water quality parameters. Better understanding of these site conditions may be able to help elucidate differences in observed catch and species richness between the two sites.

Fig. 10 | White perch (*Morone americana*) on measure board

Fig. 11 | A juvenile striped bass collected from traps

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References

Able, K.W. & Duffy-Anderson, J.T. (2005). A synthesis of impacts of piers on juvenile fishes and selected invertebrates in the lower Hudson River. Institute of Marine and Coastal Sciences, Rutgers, The State University of New Jersey. https://rucore.libraries.rutgers.edu/rutgers-lib/27585/

Able, K.W. & Manderson, J.P. (1998). The Distribution of Shallow Water Juvenile Fishes in an Urban Estuary: The Effects of Manmade Structures in the Lower Hudson River. *Estuaries, 21* (4B), 731-744.

Able, K.W., Manderson, J.P., and Studholme, A.L. (1999). Habitat quality for shallow water fishes in an urban estuary: the effects of man-made structures on growth. *Marine Ecology Progress Series, 187*, 227-235.

Bain, M.B., Meixler, M.S., and Eckerlin, G.E. (2006). *Final Report: Biological Status of Sanctuary Waters of the Hudson River Park in New York.* Cornell University Center for the Environment and the Department of Natural Resources.

Duffy-Anderson, J.T., Manderson, J.P., and Able, K.W. (2003). A characterization of juvenile fish assemblages around man-made structures in the New York-New Jersey harbor estuary, U.S.A. *Bulletin of Marine Science, 72*(3), 877-889.

Grothues, T.M. & Able, K.W. (2010). *Association of Adult Fishes with Piers in the Lower Hudson River: Hydroacoustic Surveys for an Undersampled Resource.* Final Report to the Hudson River Foundation. Grothues_003_07A_final_report.pdf

Grothues, T.M. & Able, K.W. (2013). *Final Report: Impacts of shoreline modifications on fishes and crabs in New York Harbor.* Institute of Marine and Coastal Sciences, Rutgers University. Grothues_004_11A_final_report.pdf

Levinton, J.S. & Waldman, J.R (2006). *The Hudson River Estuary.* Cambridge University Press. https://books.google.com/books?hl=en&lr=&id=6EjpxuZAsH0C&oi=fnd&pg=PR9&ots=nazj1OtHRn&sig=Cy-COwKchsZGiLcRWCkiKpC4i0Q#v=onepage&q&f=false

Stinnette, I., Taylor, M., Kerr, L., Pirani, R., Lipuma, S., Lodge, J. State of the Estuary 2018. Hudson River Foundation. New York, NY. https://www.hudsonriver.org/NYNJHEPStateoftheEstuary.pdf

WWF (2020) Living Planet Report 2020 - Bending the curve of biodiversity loss. Almond, R.E.A., Grooten M. and Petersen, T. (Eds). WWF, Gland, Switzerland. https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-FULL.pdf