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RIVER PROJECT

Fish Survey Report 2022

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Purpose

As part of a 34-year research effort, Hudson River Park conducts a year-round survey to monitor local fish population dynamics and connect our community to the River. This fish survey informs our understanding of fish diversity and abundance in the Park. By tracking fish diversity over time, we can see broad changes within population dynamics and within specific species — for example, the average size of fish — and infer how seasonal changes and major events, like storms, affect local species.

Key Questions

- How do fish populations 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**) starting May 2022
- 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, where survey traps were monitored in 2022

Fig. 2 | Pier 26 gangway and floating dock, a new survey site that came online in May, 2022

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Major Findings

In 2022, a total of 14 species were collected, with Pier 26 observing 9 species and Pier 40 observing 10 Four species (American eel, northern pipefish, summer flounder and white perch) were unique to Pier 26, four were unique to Pier 40 (butterfish, cunner, scup and striped bass), and five species (black sea bass, tautog, lined seahorse, oyster toadfish and skilletfish) were collected at both sites. Three species (black sea bass, oyster toadfish, and tautog) represented over 91% of the total catch (**Table 1**), while in 2021 these species composed 84% of total catch.

Fig. 3 | Two juvenile black sea bass on measure board. Black sea bass were the most caught species in 2022, with a majority of these individuals being juvenile.

Species	Pier 40 Catch	Pier 26 Catch*	Total 2022 Catch	% Total Catch
Black sea bass	106	43	149	32.9%
Oyster Toadfish	110	37	147	32.5%
Tautog	46	73	119	26.3%
Lined seahorse	6	13	19	4.2%
Northern pipefish		3	3	0.7%
Scup	3		3	0.7%
Skilletfish	1	2	3	0.7%
Cunner	2		2	0.4%
Striped bass	2		2	0.4%
Summer flounder		2	2	0.4%
American eel		1	1	0.2%
Butterfish	1		1	0.2%
White perch		1	1	0.2%
Winter flounder	1		1	0.2%
Total	278	175	453	

Table 1 | Total catch by species and study site 2022. *Pier 26 traps were deployed in May 2022 and do not reflect a full year of sampling.

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Thirty Years' of Data

Between 1988 and 2022, species richness shows a slight decline over time (**Fig. 4a**), while species evenness shows a steeper rate of decline within this same period (**Fig. 4b**). This indicates that while the overall number of species collected as a part of this ongoing survey have 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 exactly is driving this decrease in evenness of the fish population in the Park's sanctuary waters. There are a number of 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 the shifts in fish populations over the last 3 decades.

With the introduction of two conterminous sampling sites in 2022, more data will be able to be gathered in the coming years to assess geospatial differences within the Park and determine the consistency of these trends between historic trap locations.

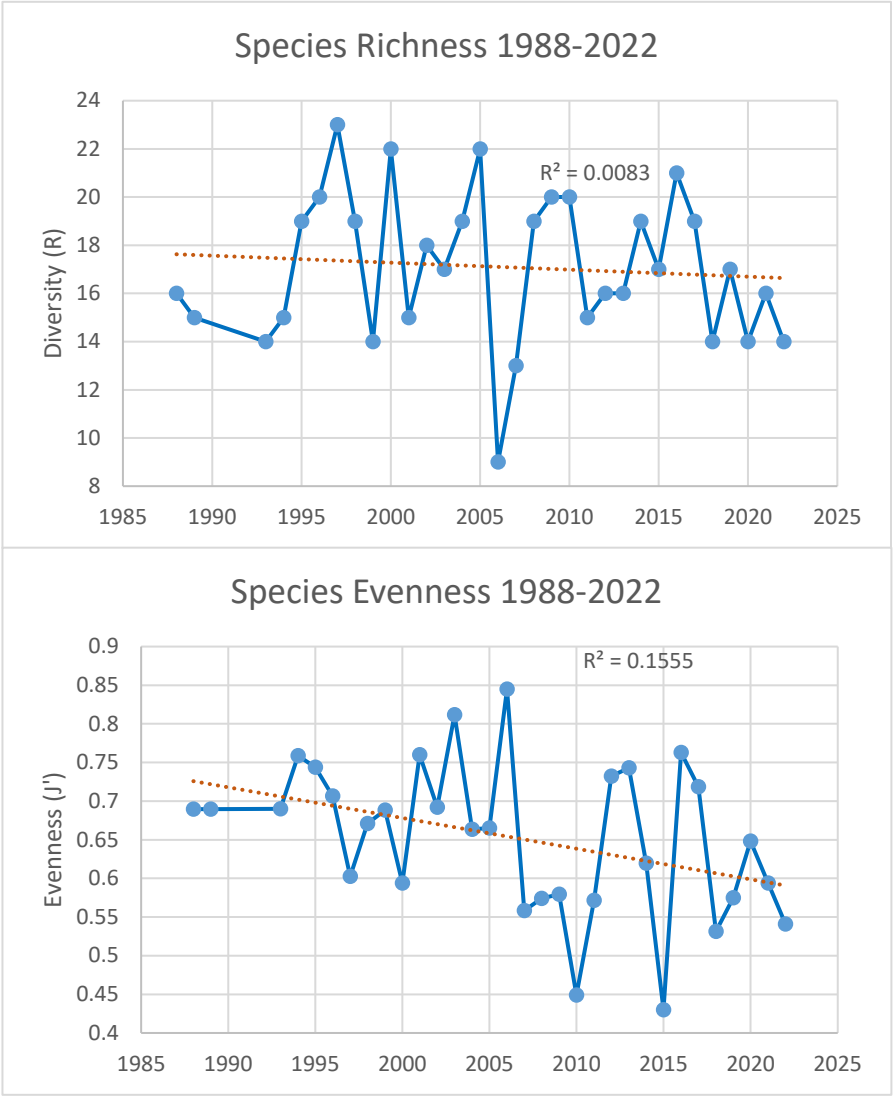

Fig. 4a and 4b | Species richness (# of species) and evenness from 1988 to present. The trap survey has changed locations several times over the years in 2006, 2011, and 2020 between Piers 25/26 & Pier 40, with varying numbers of traps, especially prior to 2006

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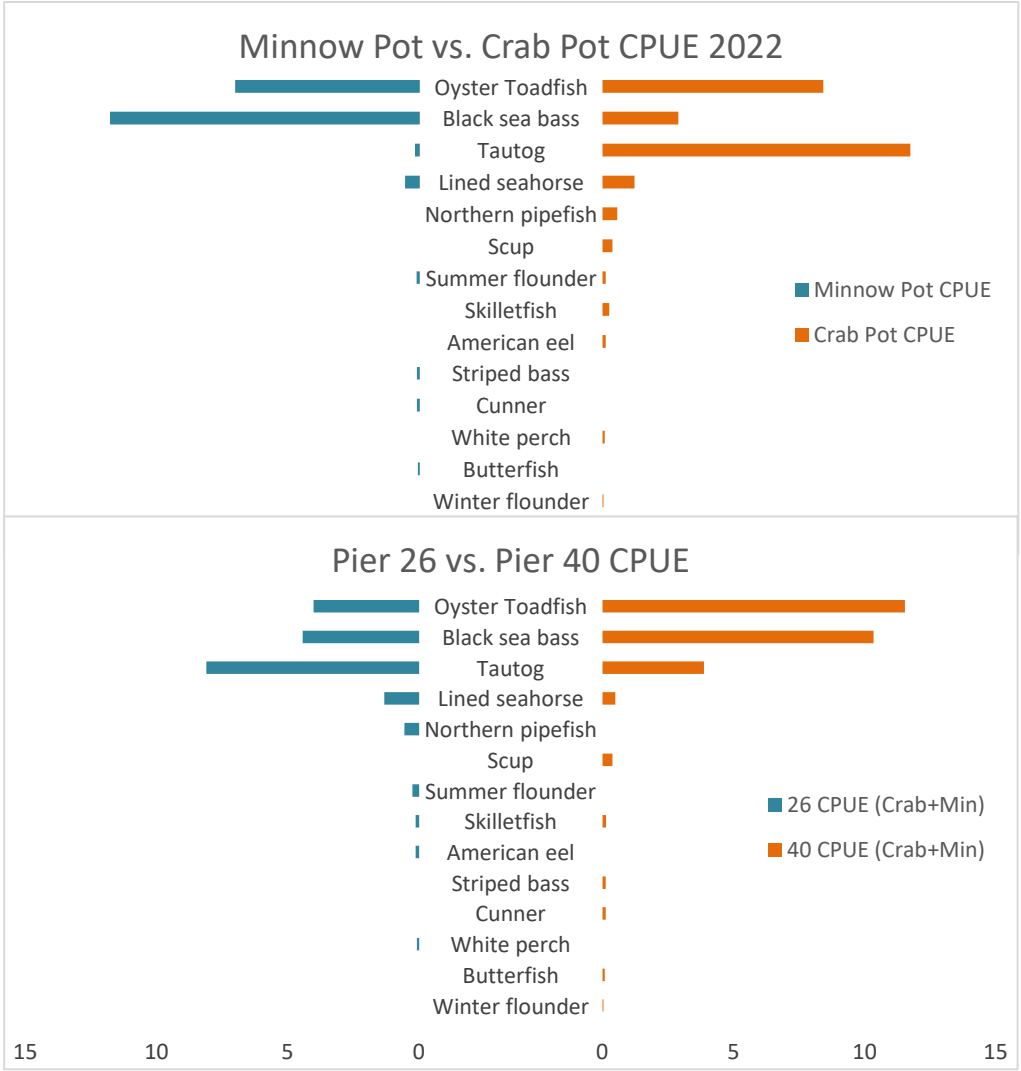
2022 Catch Per Unit Effort

The fish ecology survey makes use of two types of traps: minnow pots and crab pots. Because of the difference in the size of their entrances and grating, these traps select for fish at different size classes: minnow pots catch smaller fish and exclude larger fish while crab pots catch much larger organisms while releasing smaller organisms through their larger grating size.

While there was a good deal of species overlap between the two varieties (tautog, black sea bass, oyster toadfish, lined seahorse, and summer flounder), other species were found exclusively in crab or minnow pots (**Figs. 5a & 5b**). Crab pot exclusive species included American eel, northern pipefish, scup, skilletfish and white perch. Minnow pot exclusive species included butterfish, cunner and striped bass.

The largest proportion of catch from crab pots was made up of tautog, followed by oyster toadfish, with these two species making up over 75% of total crab pot CPUE (**Fig. 5a**). On the other hand, the largest proportion of CPUE from minnow pots was made up of black sea bass followed by oyster toadfish, with the two species collectively making up 94% of minnow pot CPUE in 2022 (**Fig. 5b**).

These differences in species by trap type are likely because of each species' 1) maximum size - Minnow trap exclusives tend to be too small to be collected by crab pots and vice versa, 2) life stages in which they live in the River – black sea bass juveniles appear to be more prevalent than their adults and vice versa for tautog, and/or 3) behavior – seahorses & pipefish like to hold on to the bars of a crab pot and exhibit a lower



Figs. 5a and 5b | CPUE in minnow and crab pots 2022, CPUE by site 2022

frequency in minnow pots. CPUE for oyster toadfish and black sea bass was much higher at Pier 40 than at Pier 26, while CPUE for tautog and lined seahorse were higher at Pier 26.

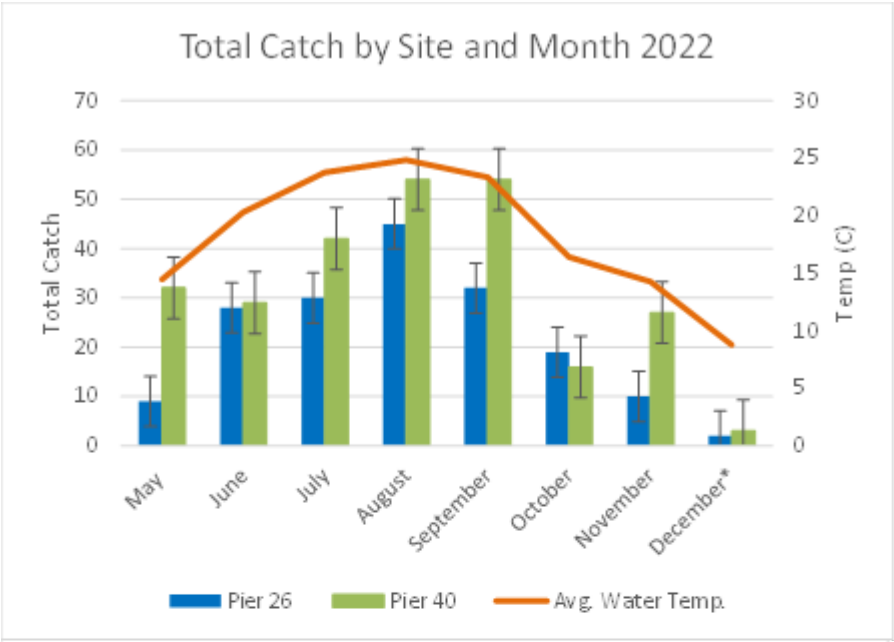
2022 Abundance & Diversity

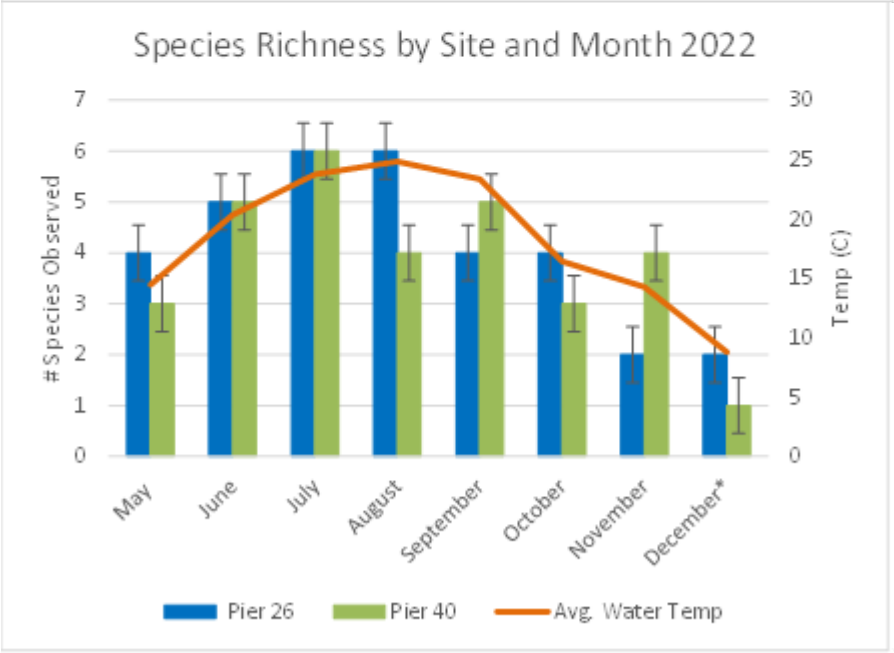
In 2022, monthly catch and species richness followed similar trends to previous years: highest overall catch was observed in August (**Fig. 6a**) while greatest species richness was observed in July (**Fig. 6b**).

Total catch was similar between sites with a few notable discrepancies in May, September, and November. The difference in total catch in May could be because traps were deployed that month at Pier 26 and thus had less time in the water.

Species richness was similar across Pier 40 and Pier 26 sites except for August, in which there were more species observed at Pier 26, and vice versa in November.

As expected, both total catch and species observed exhibited significantly strong positive correlation with water temperature ($p<0.01$), as the warmest months tend to be when most teleost fishes are predominantly active and encompass most species' migration periods. Both resident and transient species are actively utilizing the estuary from approximately May-October, outside of which fish activity tends to decrease accordingly with 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 butterflyfishes.





Figs. 6a and 6b | Total catch, species richness and average water temperature at Pier 26 and 40 sites, May-November 2022. *Data current up to 12/8/22

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Take Aways

In 2022, a total of 13 species were observed across two study sites in Hudson River Park. Three species (butterfish, scup, and striped bass) that were not caught in 2021 made an appearance in 2022, while several species that were observed in 2021 (Atlantic menhaden, feather blenny, winter flounder, spotted hake, and American silver perch) were absent this year. Overall, there tends do be major inter-annual variation in catch of less-abundant species.

Over the past 10 years, CPUE of fish caught in the survey has steadily increased barring dips in 2020 (due to trap removal during COVID pandemic) and in 2022. These data suggest that the abundance of fishes is increasing within the sampled micro-habitats of Hudson River Park's Estuarine Sanctuary but is likely not representative of a larger regional trend, as it is generally known that fish populations are declining overall both in the Hudson (Stinette et al., 2018) and worldwide (WWF, 2020).

The Park's River Project will continue to study and work to protect the vibrant community of fishes that call the Hudson River Estuary.

Fig. 8 | Tautog (*Tautoga onitis*) on measure board

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

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Future Directions

River Project will continue to collect data about the fishes in the park as the Fish Ecology Survey continues. In 2022, the study expanded to a second survey site on Pier 26. As 2023 will mark the first full year of both sites operating simultaneously, full year comparisons between Pier 26 and Pier 40 will make assessing for potential differences in micro-habitats possible and may shed light on hetero/homogeneity of the Estuarine Sanctuary. Additionally, River Project staff are working with SUNY Stony Brook's Chen Lab to further analyze our historic fish ecology data going back to 1988 and integrate this with larger Hudson River fish ecology datasets. Chen Lab's statistical analysis and modeling expertise will help to shed light on the decades of fish data collected in the Park and hopefully elucidate new trends that will inform the Park and NYC environmental community about the status of fishes in the Estuary.

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