

Fish Survey Report 2024



Purpose

For the last 36 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 throughout the Estuarine Sanctuary. The survey also enables us to collect animals for the Wetlab, a native aquarium and education space where we connect the community to the ecology of the river. 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 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 at minimum once a week in the off-season.
- Surveillance consisted of checking eight (8) traps (four minnow traps and four crab traps) at Pier 40 West (**Fig. 1A**), Pier 40 East (**Fig. 1C**) and Pier 26 (**Fig. 1C**). Four (4) rectangular box traps were deployed at Pier 40 East that were active in summer and fall.
- All fish caught were identified and measured (cm), then were either held temporarily for education in the River Project Wetlab aquarium or released.
- Data were analyzed using Microsoft Excel.

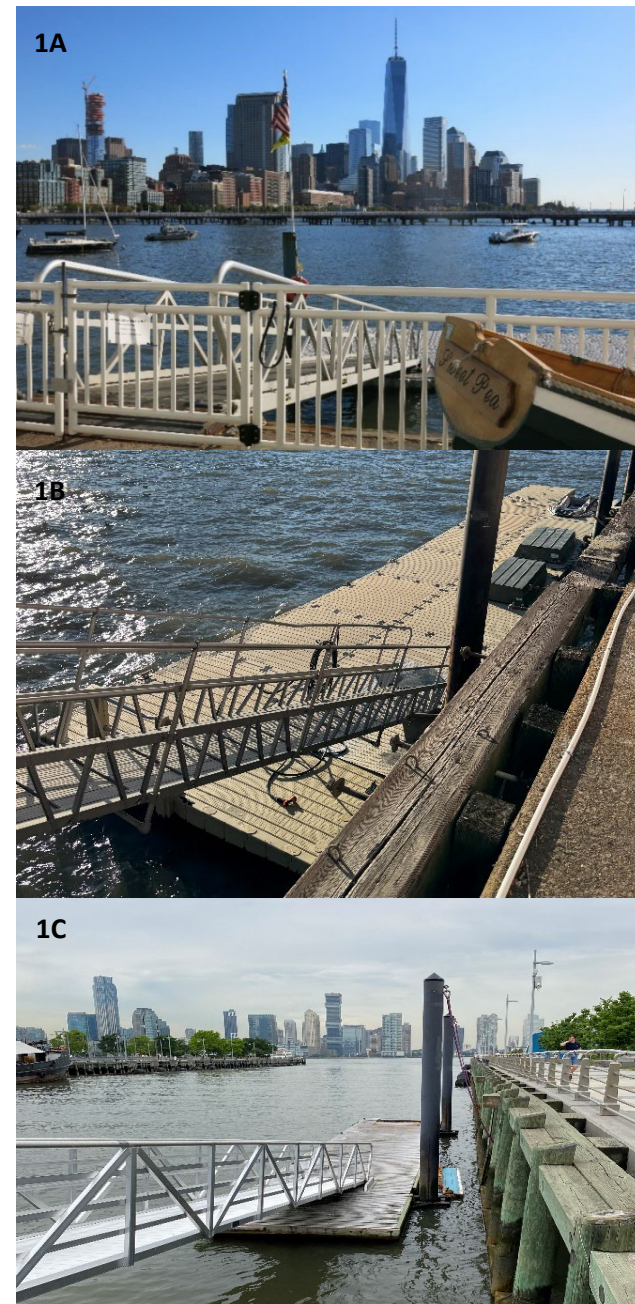


Fig. 1 | Fish survey trap sites, 2024, **A**) Pier 40 West, **B**) Pier 40 East, and **C**) Pier 26 floating docks.

Methods: Survey Traps

Our fish ecology survey utilizes three types of traps: Crab, minnow, and box traps. Pier 26 is home to four minnow and four crab traps, while Pier 40 is home to four minnow and four crab traps and additionally up to four box traps from July-October 2024.

Crab traps are sturdy, quadrilateral cages made up of metal mesh with openings of about 1.5-2". They have 4" wide entry points for fish to enter the trap and are approximately 2'x2'x1' in dimensions.

Minnow traps (**Fig. 2B**) are significantly smaller than crab traps with much finer mesh grade, shaped like two baskets joined by a hinge. Each side has a round opening that is just under 1" across, with a total length of about 1.4'.

Box traps (**Fig. 2A**) are the largest traps utilized this year, comprised of a rectangular, welded steel frame 3'x1.7'x1.1' in dimension with fine fabric mesh tied into a cod end that can be opened to empty the contents of the trap. There is one, long and narrow opening for fish 1.5' long and 1" wide.

Having differently sized traps allows broader surveillance of species to observe fish of different sizes, life stages, etc. Minnow traps tend catch smaller fish and exclude larger fish, while crab traps catch larger organisms and release smaller ones (and also are a favorite haunt of the local seahorses!). Box traps can catch large but flatter fish like summer and winter flounder, and even smaller species that are less commonly observed in the survey.



Fig. 2 | Hudson River Park staff checking **A**) a box trap at Pier 40 East and **B**) a minnow trap at Pier 26.

Major Findings

In 2024, a total of 20 species were collected, of which 11 were observed at both Pier 40 and Pier 26. Cunner and gray snapper were only observed at Pier 26, while gobies, striped bass, American silver perch, Atlantic tomcod, northern sea robin, and spotted scorpionfish were only observed at Pier 40. All other, more abundant species were observed at both trap locations. Aside from the usual crab and minnow traps used at Piers 26 and 40 East, Pier 40 West was online from January until June, and box traps at Pier 40 were active from July until October. Tautog, oyster toadfish, and black sea bass made up 57.3% of the total catch for 2024 (**Table 1**), while in 2023 these species represented 81.1% of total catch.



Fig. 3 | Hudson River Park Staff checking a crab trap at Pier 26

Table 1 | Total 2024 catch by species and study site, up to Dec. 17th

Species	Pier 26	Pier 40 W	Pier 40 E	Box	Total 2024	% Total Catch
Oyster toadfish	17	8	20	34	79	25.6%
Black sea bass	14	10	16	18	58	18.8%
Blackfish (Tautog)	19	9	12	0	40	12.9%
Goby, spp.	0	0	4	25	29	9.4%
Skilletfish	9	2	8	7	26	8.4%
Lined seahorse	9	2	10	1	22	7.1%
Northern pipefish	1	1	7	3	12	3.9%
American Eel	1	0	8	0	9	2.9%
Spot	0	0	0	8	8	2.6%
Feather blenny	2	0	2	0	4	1.3%
Flounder, summer	1	0	0	3	4	1.3%
Striped bass	0	0	0	4	4	1.3%
Perch, american silver	0	0	1	2	3	1.0%
Perch, white	1	0	2	0	3	1.0%
Flounder, winter	1	0	1	1	3	1.0%
Atlantic tomcod	0	0	0	1	1	0.3%
Cunner	1	0	0	0	1	0.3%
Sea robin, northern	0	0	0	1	1	0.3%
Snapper, Gray	1	0	0	0	1	0.3%
Spotted scorpionfish	0	0	0	1	1	0.3%
Total	77	32	91	109	309	

Notable Species

In the 36 years of operation, the fish ecology survey has observed 55 species of fish in Hudson River Park waters. While a few of these species are so commonly seen that we expect to collect them every year, others are observed much less frequently. In 2024, we caught a few such uncommon species of note.

One of these is the spotted scorpionfish (*Scorpaena plumieri*), a tropical/marine stray that is not usually seen this far upstream. This specimen caught at Pier 40 during this year's survey (**Fig. 4B**) marks the 238th species of fish confirmed in the Hudson River watershed by the New York State Department of Environmental Conservation. Till now, it had never before been seen in the Park or in any other known Hudson River location. Scorpionfish are typically found in reefs and rocky areas in the Atlantic Ocean. Like other members of the *Scorpaenidae* family, they can deliver a potent venom via their dorsal spines in self-defense.

A gray snapper (*Lutjanus griseus*) is a tropical/marine stray whose reach stretches from Massachusetts to the Gulf. The individual caught at Pier 26 (**Fig. 4A**) was the first our fish ecology survey has seen since 2005. While they regularly grow up to 400mm, the length of the two individuals caught by our survey (35mm, 40mm) makes it clear that they are juveniles, highlighting the importance of estuaries and nearshore habitats as nursery grounds for larger marine species.

Our box traps at Pier 40 also caught an Atlantic tomcod (*Microgadus tomcod*) (**Fig. 4C**), which has not been seen in our traps since 2019. Atlantic tomcod were once a much more common catch within the Park, but abundance has declined significantly since 2005. Possible reasons for this decline range from increasing water temperatures to changes in species composition that may enhance competition for resources with other benthic fish like tautog and oyster toadfish.



Fig. 4 | Notable species caught by the fish ecology survey. **A**) Gray snapper (*Lutjanus griseus*), **B**) spotted scorpionfish (*Scorpaena plumieri*), **C**) Atlantic tomcod (*Microgadus tomcod*).

Thirty Years of Data

Between 1988 and 2024, species richness is observed to be highly variable with large inter-annual fluctuation, and although the trend shows a slight ($R^2=0.01$) increase, this is not statistically significant overall (**Fig. 5A**). Likewise, species evenness shows a slight ($R^2=0.15$), not statistically significant decrease (**Fig. 5B**). 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, one of which is increasing water temperatures which force smaller and cold-water fishes towards alternate habitats. Another possibility is that fishes that are less- niche dependent are filling the gaps left by diminishing species or otherwise contributing to their decline via predation or competition.

The large increase in species richness between 2022 and 2024 is likely due to the addition of new box traps at Pier 40, expansion of the survey to two dedicated sites, and the fact that there were two Pier 40 sites concurrently active April-May of 2024.

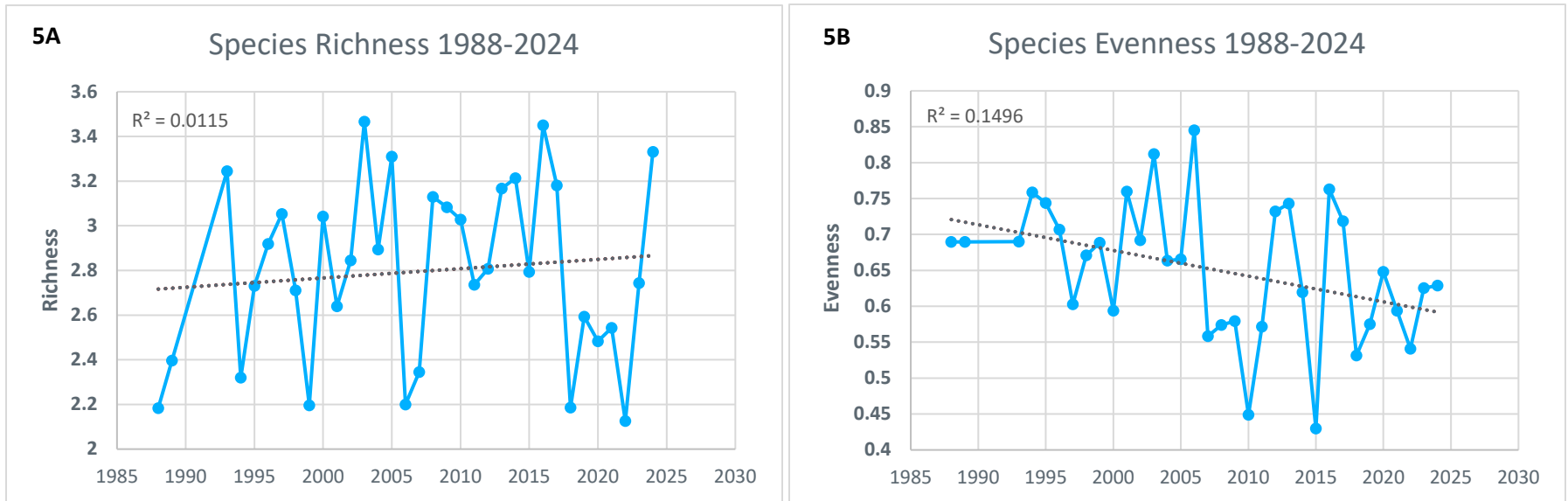


Fig. 5 | Species richness (Margalef Index) (**A**) and evenness (**B**) from 1988 to 2024. *Data up to Dec.17th

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:

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

The fish ecology survey primarily makes use of two types of traps: minnow and crab traps. From July to October, we added an additional 4 box traps as part of Rutgers’ Dr. Thomas Grothues’ research. Due to the difference in entrance size and grating, these traps select for fish at different size classes.

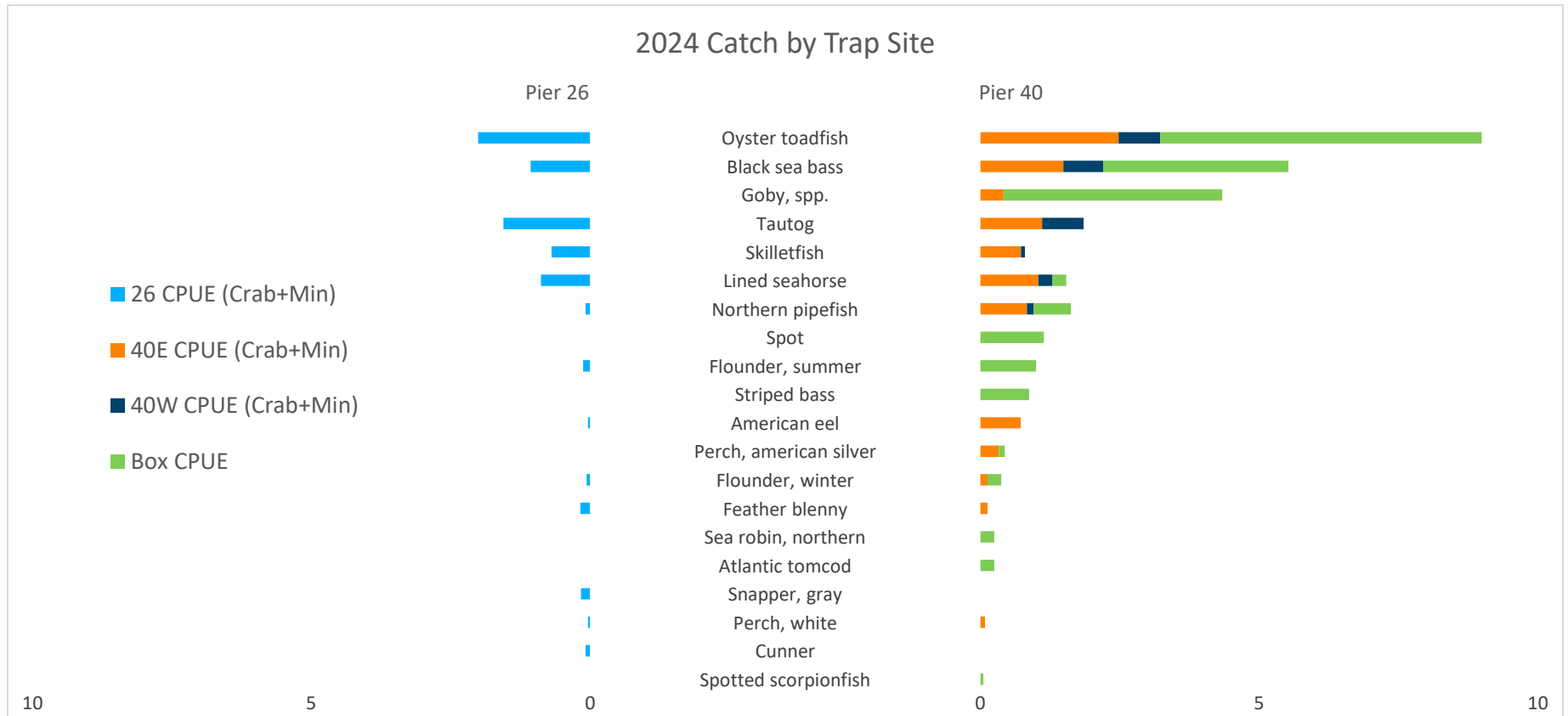


Fig. 6 | Comparison of catch abundance between Pier 26 and 40 locations in 2024. *Data current up to Dec 17th

There was substantial species overlap between the trap varieties, including oyster toadfish, black sea bass, tautog, and lined seahorse, among others. Other species were found exclusively in crab, minnow, or box traps, respectively (**Fig. 6**). White perch were exclusively observed in crab traps. Minnow trap-exclusive species consisted of gray snapper, American eel, cunner, and American silver perch. Box trap-exclusive species consisted of striped bass, Atlantic tomcod, northern sea robin, summer flounder, spot, and spotted scorpionfish.

The largest proportion of catch from crab traps was comprised of black sea bass, followed by oyster toadfish. These two species made up 63.1% of total crab trap CPUE. The largest proportion of minnow trap CPUE was also made up of black sea bass, followed by oyster toadfish, with the two species collectively making up 55.9% of minnow trap CPUE in 2024.

These differences in species composition and abundance by trap type are likely due to one or more traits that vary between taxa:

1. Maximum size - Minnow trap exclusives tend to be too small to be collected by crab traps and vice versa
2. Life stage - Certain fishes appear to be more prevalent in the river during particular life stages (e.g., Black sea bass juveniles appear to be more prevalent than the adults and vice versa for tautog)
3. Behavior - habits of fish that make them more or less likely to be collected by a particular trap type (e.g. Seahorses are likely to hold onto the bars of a crab trap)

Varying collection gear & sampling techniques is critical to study biodiverse environments like the Lower Hudson Estuary. The Park is also currently analyzing environmental DNA samples taken from 2021-2024 with the assistance of Dr. Sam Chew Chin to understand more holistically the fish assemblages of the Estuarine Sanctuary. This work is a continuation of efforts that began with a partnership with Cold Spring Harbor Lab, funded by the Lounsbery Foundation. Preliminary results show 47 distinct species across 42 samples from 2021-2023. An additional 15 samples from this time frame as well as 23 from 2024 are still being sequenced and analyzed. The Park hopes to utilize this broad-spectrum analytical tool to supplement the fish ecology survey in order to paint a fuller picture of our thriving estuary.

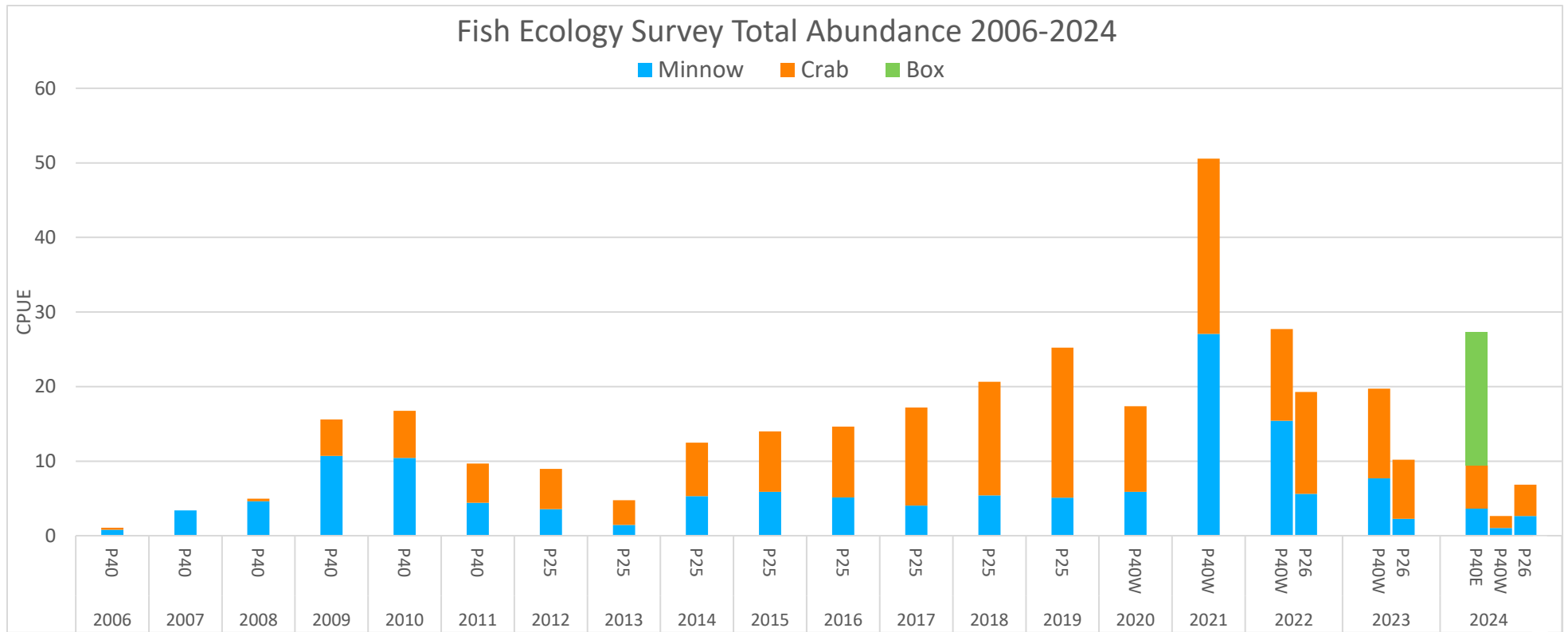


Fig. 7 | Total fish abundance by year and location, delineated by trap type, 2006-2024.

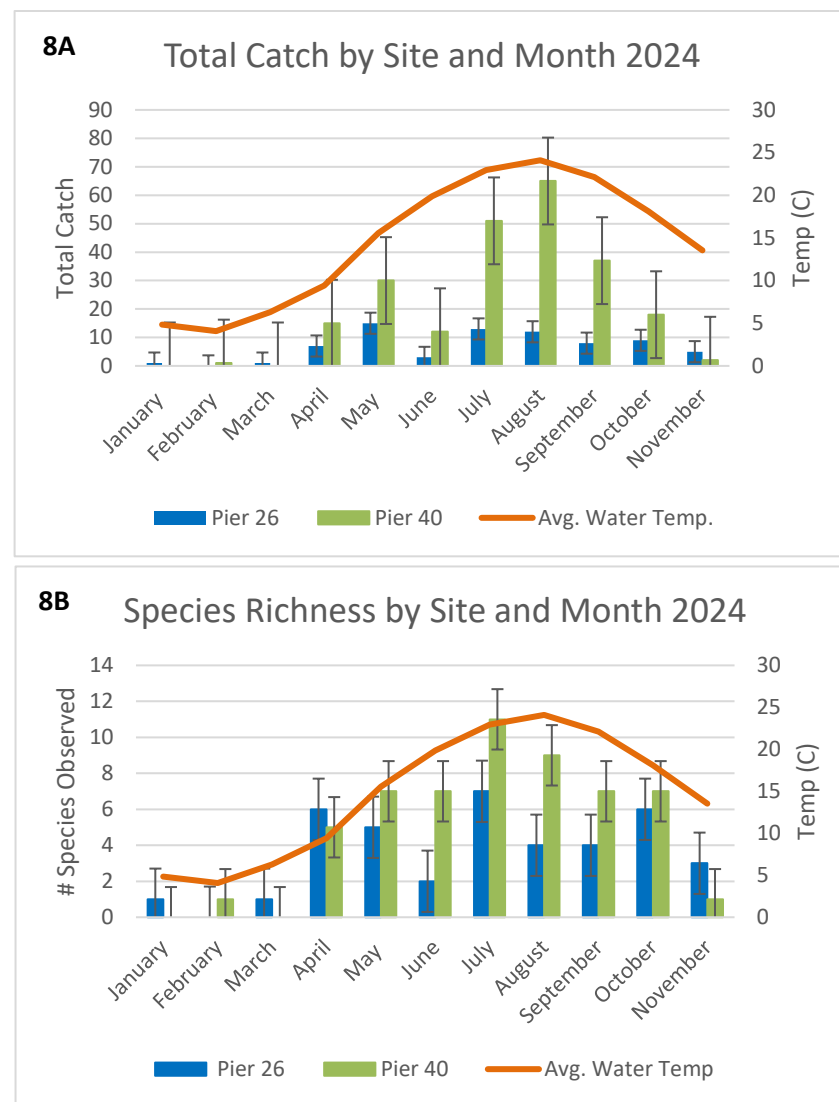
When taking a longitudinal view of catch per unit effort (**Fig. 7**), significant interannual variation is observed across the years. The highest CPUE for an individual site was observed at Pier 40 West (P40W) in 2021. It should be noted that CPUE for Pier 40W in 2024 is particularly low because this site was replaced with P40E in June, directly preceding our season of highest catch. That said, CPUE for both crab and minnow pots has steadily declined since 2021. This may be reflective of general ongoing decline of fish populations known to be occurring throughout the globe, though this may be in part due to the reduction in number of traps in 2020 from 24 to 8, resulting in higher catch per trap. An interesting trend presented by this nearly 20-year dataset is the proportion of catch contributed by trap type. In the early 2000s, crab traps contributed relatively insignificantly to overall CPUE compared to minnow traps, but this role is reversed 2011-2024, where crab traps consistently make up >50% of total CPUE (with the exception of P40W in 2021 and 2022). The role of trap type and structure as they contribute to observed catch, species richness, size of individuals, and other factors is an ongoing topic of discussion, but these data suggest that we are seeing larger species and older individuals of year-round residents making up a higher relative proportion of catch. Inclusion of box traps in 2024 as part of an experiment with Rutgers University was an exciting opportunity to explore how novel structures can help to more thoroughly survey fish species present in the Park. The degree of catch observed from these traps, alongside their contribution of some rare and even a novel fish species (four in total not seen in other traps) to the survey catch makes the River Project team excited to deploy these trap structures at both Pier 40 and Pie 26 sites in 2025.

Abundance & Diversity

In 2024, monthly catch and species richness varied slightly compared to previous years. The highest monthly catch was observed in August with a total of 86 fish caught (**Fig. 8A**). Monthly species richness peaked in July with a total of 14 species observed across both sampling locations (**Fig. 8B**).

Total yearly catch was significantly higher at Pier 40 than Pier 26 with the Pier 40 site observing more than three times the number of individuals caught at Pier 26 (**Table 1, Fig. 8A**). This may be due to the number of traps at Pier 40 (12-16) compared to Pier 26 (8), but controlling for effort shows that Pier 40 indeed experiences higher rates of fish catch over the past several years.

Both total catch and species observed exhibited a significantly strong positive correlation with water temperature (catch $R^2=0.84$; $p<0.01$, richness $R^2=0.85$; $p<0.01$). The warmest months are observed to be when the majority of teleost fish are most active and encompass most species' migration periods. Fish catch was highest in the estuary April-September, with catch 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.



Figs. 8| A) Total catch, **B)** species richness, and average water temperature at Pier 26 and Pier 40 sites in 2024. *Data up to Dec. 17th.

Take Aways

In 2024, a total of 20 species were observed across two study sites in Hudson River Park. This is in line with the current average number of species observed in the survey each year (17.2 species), and the highest richness observed since 2016. There is a large degree of inter-annual variation, especially in the catch of less abundant species, while prolific fish like black sea bass, oyster toadfish, and tautogs are observed in high numbers each season. Among these more abundant species, oyster toadfish made up a higher proportion of total catch in 2024 compared to 2023, while tautog and black sea bass catch were both lower than the previous year. Many less abundant species, including lined seahorse and northern pipefish made up a larger proportion of this year's catch compared to last year. With the introduction of the box traps to the fish ecology survey, we observed a novel species in the watershed (spotted scorpionfish) as well as particularly rare species in the survey (Atlantic tomcod, northern sea robin). This 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. 9 | A gravid blue crab (*Callinectes sapidus*) — one of the most common species caught in the survey outside of fish.



Fig. 10 | Oyster toadfish (*Opsanus tau*) on measure board

Future Directions

The Park's River Project will continue to collect fish abundance and diversity data 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. Staff are continuing to sample 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. Additionally, Park staff plan to incorporate box traps into both survey sites in future years, allowing for improved analysis of catch dynamics between Pier 26 and Pier 40 sites, as well as comparison with ongoing mobile species monitoring carried out as part of the Tribeca Habitat Enhancement project.



Fig. 11 | White perch (*Morone americana*) on measure board



Fig. 12 | A juvenile striped bass collected from traps

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