Shared Beaches, Contrasting Spatial Dynamics: Interannual Nesting Distribution of Shorebirds and Seabirds on an Urban Barrier Peninsula

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Introduction

Sandy beaches and barrier islands provide critical nesting habitat but experience rapid environmental and human-driven change. We compared five beach-nesting bird species across four Rockaway Peninsula sectors during 2025–2026. We asked whether shorebirds and seabirds differed in the spatial breadth and interannual consistency of their nesting distributions within this urban coastal landscape.

Study Area

- **Beach 37th–56th St.**: Managed urban beach with wide sand, low dunes, high recreation, and nearby infrastructure.
- **Fort Tilden**: Semi-natural beach with developed dunes, maritime vegetation, wetlands, and relatively low human disturbance.
- **Breezy Point Ocean Side**: Exposed, largely undeveloped oceanfront with wide beaches, extensive dunes, and strong Atlantic influence.
- **Breezy Point Bay Side**: Sheltered Jamaica Bay habitat with tidal flats, salt marshes, and spatially constrained sandy nesting areas.

Methodology

Nests were monitored weekly for 15 weeks per year across four Rockaway Peninsula sectors during 2025–2026. Nests were identified, geolocated, and grouped as shorebirds or seabirds. Analyses compared nest abundance, composition, proportional sector allocation, and spatial breadth. Interannual redistribution was quantified using total variation distance (D) in an exploratory, descriptive framework.

$$D = \frac{1}{2}\sum_{i}\left|p_{i,2025} - p_{i,2026}\right|$$

where $p_{i,2025}$ and $p_{i,2026}$ are the proportions of nests in sector i during each year. [1]

Main Results

Nesting patterns differed strongly among sectors. Beach 37th–56th showed the greatest aggregation, dominated by clustered Least Terns. Fort Tilden supported only dispersed shorebirds. Ocean Side showed broader, linear distributions, with Piping Plovers expanding spatially in 2026. Bay Side had the sparsest distribution, with large areas lacking recorded nests.

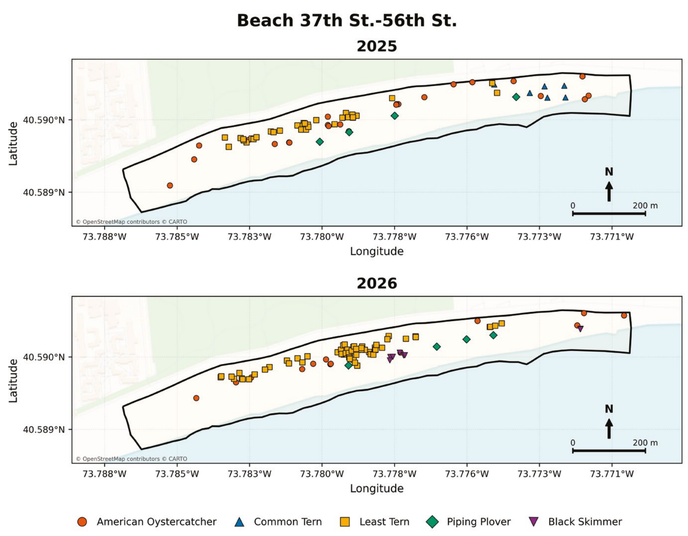

Figure 1. Recorded nest locations in Beach 37th St.-56th St. during 2025 and 2026. The 2026 map shows increased Least Tern representation and the occurrence of Black Skimmer while nesting remains distributed along the same managed urban sector.

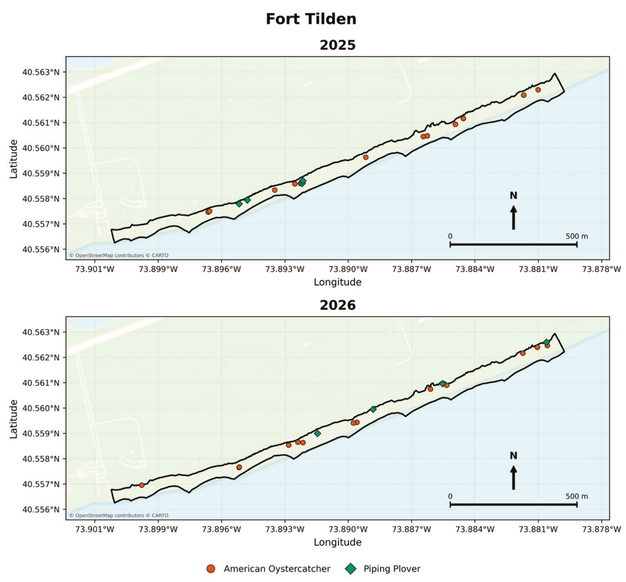

Figure 2. Recorded American Oystercatcher and Piping Plover nest locations in Fort Tilden during 2025 and 2026. Both years contained shorebird nests and no recorded seabird nests in this sector.

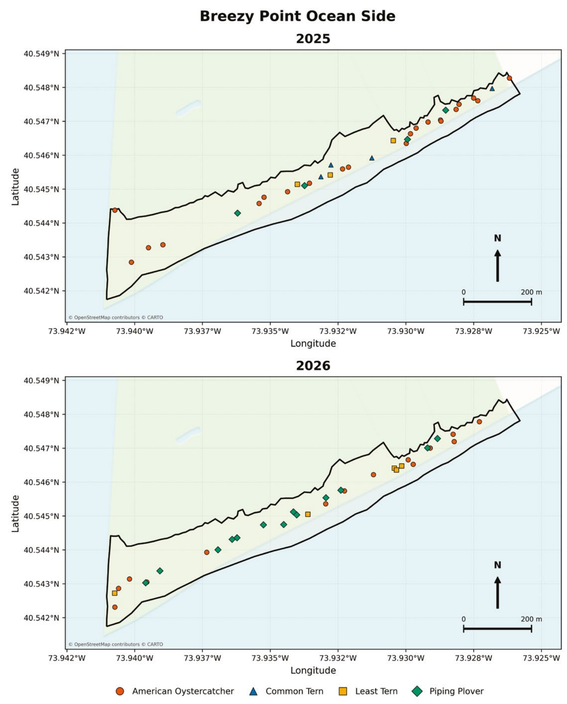

Figure 3. Recorded nest locations on Breezy Point Ocean Side during 2025 and 2026. The maps visually support the increased proportional importance of Ocean Side for Piping Plover in 2026 while showing continued occurrence of American Oystercatcher and a smaller seabird component.

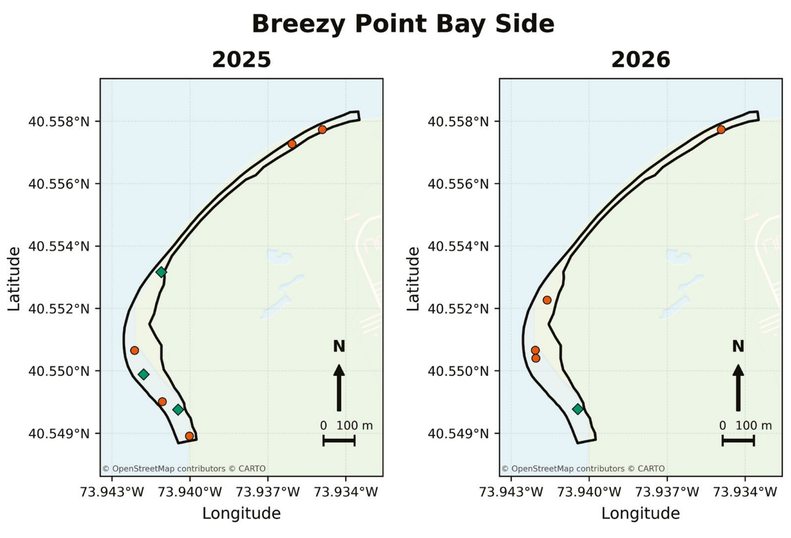

Figure 4. Recorded American Oystercatcher and Piping Plover nest locations on Breezy Point Bay Side during 2025 and 2026. This sector contained shorebirds in both years and no recorded seabird nests.

Key Findings

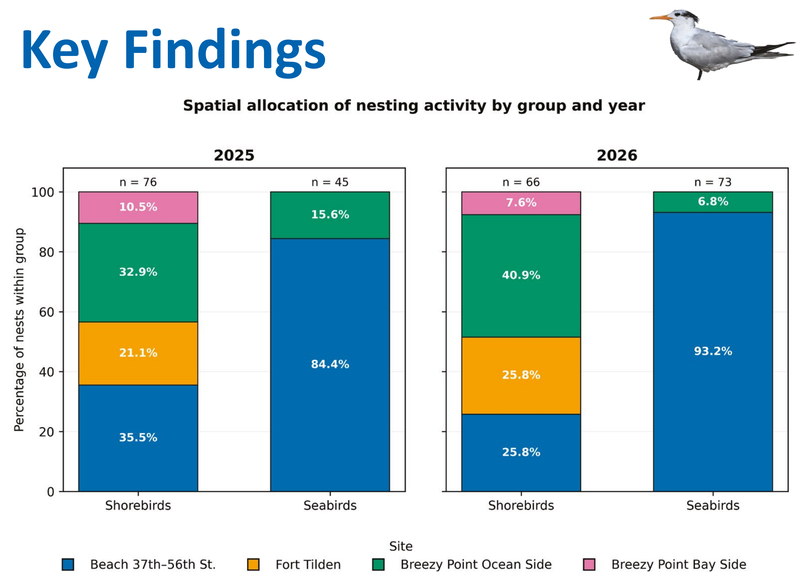

Figure 5. Proportional allocation of shorebird and seabird nests among four Rockaway Peninsula sectors in 2025 and 2026. Each bar totals 100%; **n** indicates the number of recorded nests.

Table 1. Species-level interannual redistribution and primary spatial patterns. D is total variation distance; NC indicates not calculated because the species was not recorded in both years.

Species	Ecological group	D	Primary descriptive result
American Oystercatcher	Shorebird	0.108	Broad, relatively consistent allocation
Piping Plover	Shorebird	0.324	Largest redistribution; Breezy Point Ocean Side reached 59.1%
Common Tern	Seabird	NC	Recorded only in 2025
Least Tern	Seabird	0.009	Stable allocation despite nest increase
Black Skimmer	Seabird	NC	Recorded only in 2026; all nests at Beach 37th–56th St.

- **Nest numbers and spatial redistribution were decoupled.** Least Tern nests increased substantially, but their proportional allocation remained nearly unchanged. Thus, increased nesting activity did not represent spatial expansion.
- **Seabird composition changed within a stable spatial center.** Common Tern was recorded only in 2025 and Black Skimmer only in 2026, yet seabird nesting remained concentrated at Beach 37th–56th St. This localized pattern is consistent with the colonial organization of terns, although the underlying mechanisms were not evaluated [2].
- **Shorebirds maintained broader but species-specific distributions.** American Oystercatcher remained comparatively consistent across all sectors, whereas Piping Plover showed greater redistribution toward Ocean Side. Species sharing the same barrier system should therefore not be expected to respond uniformly [3].
- **The four sectors provided complementary nesting functions.** Beach 37th–56th St. supported the principal seabird concentration, while the remaining sectors contributed to broader shorebird coverage. Rockaway should therefore be viewed as a spatial mosaic rather than as interchangeable beach habitat [4].

Conservation Implications

Management should combine core-site protection with peninsula-wide flexibility. Prioritize seasonal protection at Beach 37th–56th St., the primary seabird sector, and continue monitoring Ocean Side, the only other sector used by seabirds. Fort Tilden and Bay Side should remain under peninsula-wide shorebird protection because both species used all four sectors [5]. Future monitoring should integrate redistribution, reproductive success, habitat, and disturbance. Because only two seasons were examined, these results represent an exploratory baseline rather than long-term trends or causal mechanisms.

References
[1] https://doi.org/10.1111/2041-210X.70041
[2] https://doi.org/10.1093/czoolo/60.4.500
[3] https://doi.org/10.1016/j.biocon.2021.109178
[4] https://doi.org/10.1002/wsb.820
[5] https://doi.org/10.1002/ece3.4564

Seabirds remained spatially concentrated while shorebirds retained broader spatial coverage and showed stronger species-specific redistribution between years.

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