

2024 New Jersey Beach-Nesting Bird Project Report



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**NJ DEP Fish and Wildlife
Endangered and Nongame Species Program**



*Piping Plover at Seaside Park
Photo courtesy of Teri Bowers*

The New Jersey DEP Fish and Wildlife – Endangered and Nongame Species Program (NJFW) is responsible for the monitoring and management of beach-nesting birds on all state, county, and municipal sites and for the collation of statewide data (including federal and private properties).

This report offers a summary of nesting in 2024 for the four primary species of conservation concern that comprise this group in NJ – Piping Plover (federally threatened, state endangered), Black Skimmer (state endangered), Least Tern (state endangered) and American Oystercatcher (species of special concern).

Due to a constraint on resources, not all potential sites in the state were surveyed for all species. All known nesting sites for Piping Plover and Least Tern were monitored. All known beach-strand nesting sites for Black Skimmer were monitored but no marsh island sites were monitored (note: aerial surveys for wading birds in May and June did not detect any colonies). All known beach-strand nesting sites for American Oystercatcher were monitored but only a small percentage of marsh sites were monitored.

Each species has slightly different nesting phenology and habitat requirements. Some species are solitary nesters (plovers and oystercatchers) while others are colonial (terns and skimmers). These differences can lead to not only distinctive management strategies but also to vastly disparate reproductive outcomes (at a given site, one species may be successful while another may fail). It can therefore be difficult to formulate conclusions for the group, so results are presented by species.

However, there were some commonalities across species. As has been the case for many years, predation was the major factor in poor reproductive success for many nesting birds. It should be noted that direct human disturbance (nests being stepped on or run over, for example) is not a primary limiting factor in nest success solely because of the intense management that partners across the state engage in to prevent these types of losses (although indirect disturbance remains a key issue, especially for chicks). Unlike many years, especially as of late, flooding and storm-related losses were at historic lows in 2024. It was hoped that species managers would be able to capitalize on the lack of flooding to improve reproductive output; unfortunately, the predator pressure was such that this was not achieved for nearly any species. In response to the predator challenges, NJFW continued to experiment with fladry and modified enclosure designs. Results from these efforts were mixed and more details can be found in the Appendix.

The distribution of beach-nesting birds, with one exception, is continuing to converge on a worrying trend, which is fewer active sites and the federal sites playing a disproportionate role in hosting birds. Piping Plovers (high percentage on federal sites) and Black Skimmers (decreasing number of active sites) have been exhibiting this pattern for some time but now it appears Least Terns are following suit. American Oystercatchers are the exception and continue to be distributed rather evenly throughout the state, which may be partially explained by their elasticity in nesting site selection. However, it should be noted that their largest concentration is on federal property.

Banding of beach-nesting bird species continued in 2024. A limited number of plovers were banded from the Barnegat Light Restoration Area and at a few specific sites throughout the state. A modest number of Black Skimmers were banded by NJFW and The Wetlands Institute (TWI) at Horseshoe Island and Stone Harbor Point. A relatively high number of American Oystercatchers were banded by NJFW and TWI (with considerable assistance from the Conserve Wildlife Foundation of NJ) at a wide variety of sites.

Although the productivity for Piping Plovers was at record lows in many areas, the Barnegat Light Restoration Area continued to attract new breeding adults and outperform state productivity trends, underscoring how important vegetation maintenance is to the longevity of a coastal restoration project. Horseshoe Island continued to attract high numbers of breeding and migratory species, including, for the first time, breeding Piping Plovers. The third year of the five-year management rights agreement for the island, as granted by the Tidelands Resource Council, was a success on the human disturbance front as NJFW Bureau of Law Enforcement officers were able to continue to lend critical support to the endeavor. Details on the 2024 season at Horseshoe Island will be made available in a standalone report (including nesting results for nesting Royal and Common Terns and site use by migratory birds).

The NJFW wishes to express its deep gratitude to our seasonal staff and all the cooperators, interns, and volunteers that worked determinedly to ensure that New Jersey's beach-nesting bird species remain part of our coastal landscape for as long as possible.

Special thanks to Max Carroll for his help in compiling data for this report.

Data from partners was provided by USNPS -Gateway National Recreation Area – Sandy Hook Unit, USFWS – Edwin B. Forsythe National Wildlife Refuge & Cape May National Wildlife Refuge, the Conserve Wildlife Foundation of New Jersey, The Nature Conservancy, and The Wetlands Institute.

Two related reports are available for 2024; one is focused solely on Piping Plover (available November 2024) and a second on Horseshoe Island (available January 2025). Either can be requested through NJFW or located on the NJFW website.

[Jump to:](#)

[NJ Beach-nesting Bird Sites 2024 Map](#)

[Piping Plover Nesting Summary](#)

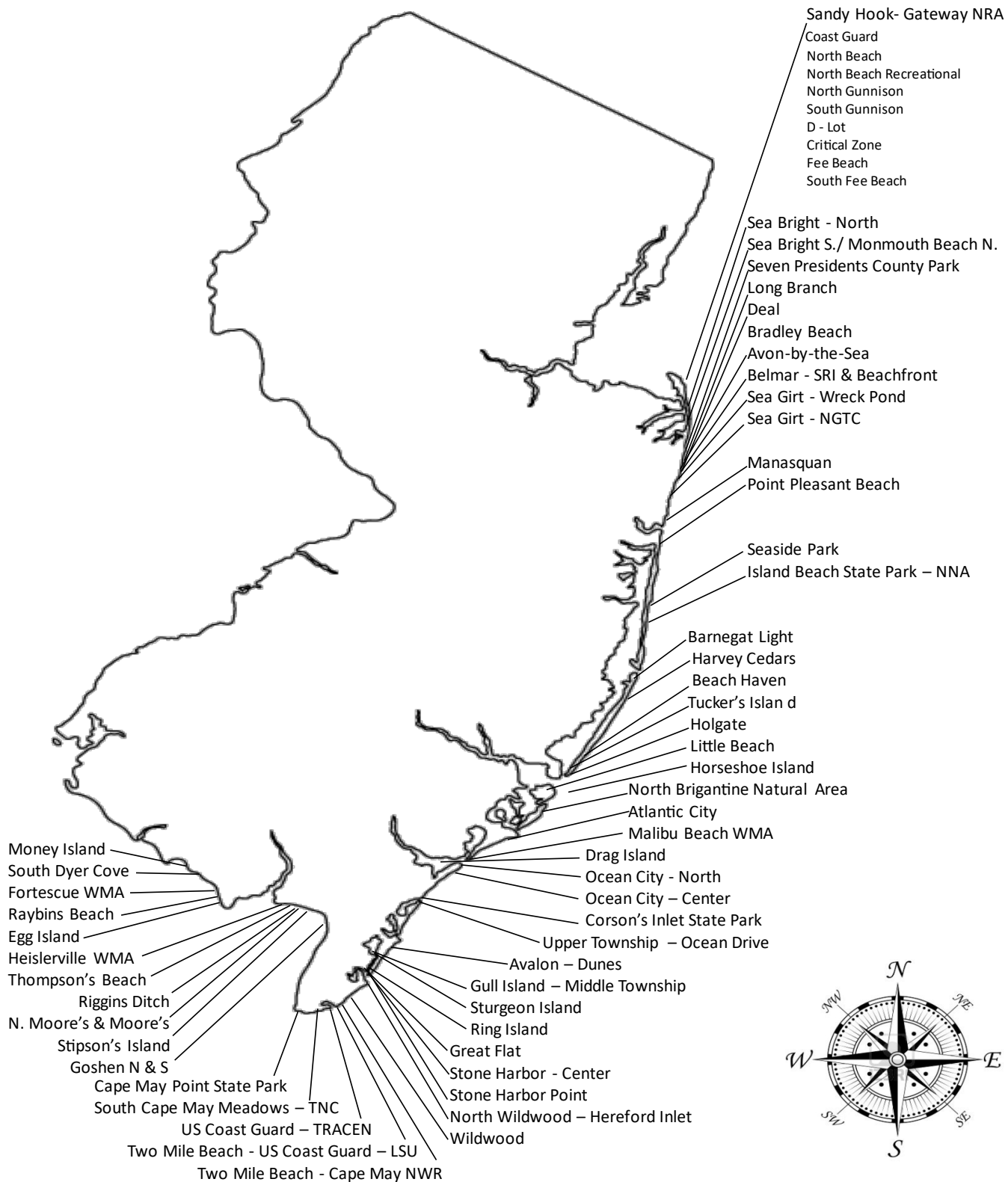
[Black Skimmer Nesting Summary](#)

[Least Tern Nesting Summary](#)

[American Oystercatcher Nesting Summary](#)

[Appendix: NJFW Predation Management Strategies: Fladry and Modified Exclosures](#)

New Jersey Beach-Nesting Bird Sites: 2024



This map represents all the Atlantic Coast and Delaware Bayshore sites where breeding and breeding outcomes were documented. It does not show sites that were monitored but no active nesting detected or sites that nesting did/may have occurred but where there was no monitoring, as was largely the case for the marsh islands of the Atlantic Coast for American Oystercatcher.

Piping Plover Nesting Summary

- **Eighty-nine (89) pairs of Piping Plovers nested in New Jersey in 2024**, a 25% decrease from 2023 and 2022 (both years were 118) and a 35% decrease from 2021 (137) and the **lowest pair count ever recorded since 1987** (prior low was 92 pairs in 2014).
- **Pairs nested at 20 sites statewide**, a decrease from 24 in 2023 and 26 in 2022. The distribution continues to favor the federal properties (54% at EB Forsythe NWR, 16% at Gateway NRA – Sandy Hook Unit, 4% at Cape May NWR/USCG for a total of 74% of the state’s population).
- **The 89 pairs laid 159 nests. Of those nests, 50 hatched (31%), 103 failed (65%) and six had an unknown outcome (4%).** Of the 103 that failed, 71 were lost to predators (69% of failures), 1 to flooding (1% of failures), 7 to abandonment (7% of failures), and 24 had undetermined cause of failure (23% of failures).
- **Statewide pair-nest success** (the percentage of pairs that successfully hatch at least one nest) **increased in 2024 compared to 2023** (55% vs. 47%, respectively) but was lower than the period since federal listing (68%).
- **The statewide productivity rate was 0.54 fledglings/pair**, similar to 2023 (0.53) but lower than 2022 (0.85). Prior to 2021, the last time it dipped below 1.20 fledglings/pair was in 2013 (also 0.85 fledglings/pair). The 2024 rate represents the third lowest state-wide productivity since 1987, when it was 0.39 in 1997 (second lowest was 2023). The productivity goal is 1.50 fledglings/pair and rates below 1.00 fledglings/pair in NJ can correlate with population decreases.
- **Eleven (11) nests were exclosed**, or 7% of nesting attempts. The exclosed nest hatch rate was 82%. **The abandonment rate for exclosed nests was 9%.** The number of nests that are exclosed has dropped dramatically in recent years (prior to 2019, it generally ranged between 60-80% of nest attempts) Exclosures (predator cages) can increase the likelihood of plover nests hatching but also increase the likelihood of adult mortality. After especially high abandonment rates in 2023 and 2022 (51% and 23% respectively, compared to historical rates of 3%-16% in 2008-2021), all species managers in NJ trended towards much lower use of exclosures. However, given that they can be effective, NJFW did experiment with modified designs (see Appendix for details) to some success.
- **The majority of plovers (74%) are still nesting on federal properties.** The continued funneling of birds to these areas is not a sustainable path to recovery, especially as habitat changes (i.e. vegetation encroachment and erosion) at these sites make them less suitable.
- The decrease in pairs was expected, as productivity was low in 2023 (0.53), but steeper than anticipated. The correlation between productivity in one year and pair number in the next continues to be perplexing in New Jersey. Over at least the last ten years, the population does not seem to respond in a predictable way. For example, the (relatively) high productivity of 2014-2020 did not translate into much higher pair numbers; similar productivity in 2021 and 2022 had two different results in pair number in 2022 and 2023; the decrease in productivity in 2023 resulted in a dramatic decrease in 2024 (25% decrease in pairs). Species managers need to further investigate these relationships, as they are at the core of recovery efforts.
- Twenty-one Piping Plovers were banded in NJ in 2024 and there were 66 total banded breeding plovers documented in NJ this season. Of those, six were banded in DE and three in NY, so at least 14% of banded breeding individuals were not from NJ. There were also at least six banded bachelor birds that were not able to find mates; all of those were from DE. This suggests that the NJ productivity/pair relationship may be even more fraught with complication, as immigration is likely playing a role in helping to sustain the NJ breeding population (although in other cases, NJ banded plovers are emigrating to nearby states).

Please see the standalone 2024 Piping Plover Nesting Results in NJ report for additional details.

New Jersey Piping Plover Nesting Summary by Site: 2024

SITE	Pairs	Pairs Hatched	Chicks Fledged	Pair Success	Fledge Rate	SP Fledge Rate
Sandy Hook NRA	14	5	7	0.36	0.50	1.40
<i>Coast Guard</i>	1	0	0	0.00	0.00	0.00
<i>North Beach</i>	3	2	4	0.67	1.33	2.00
<i>North Beach Rec</i>	3	0	0	0.00	0.00	0.00
<i>North Gunnison</i>	2	1	2	0.50	1.00	2.00
<i>South Gunnison</i>	1	1	1	1.00	1.00	1.00
<i>Critical Zone</i>	1	0	0	0.00	0.00	0.00
<i>Fee Beach</i>	2	0	0	0.00	0.00	0.00
<i>South Fee Beach</i>	1	1	0	1.00	0.00	0.00
Monmouth Beach –North ¹	1	1	0	1.00	0.00	0.00
Region 2 Subtotal	15	6	7	0.40	0.47	1.17
Seaside Park	1	1	3	1.00	3.00	3.00
Island Beach SP NNA	2	2	3	1.00	1.50	1.50
Barnegat Light ²	7	6	12	0.86	1.71	2.00
Region 3 Subtotal	10	9	18	0.90	1.80	2.00
<i>Holgate – EBF NWR</i>	48	22	17	0.46	0.35	0.77
Horseshoe Island	3	3	0	1.00	0.00	0.00
Region 4 Subtotal	51	25	17	0.49	0.33	0.68
Ocean City - North	2	1	1	0.50	0.50	1.00
Ocean City - Center	1	1	0	1.00	0.00	0.00
Region 5 Subtotal	3	2	1	0.67	0.33	0.50
Corson's Inlet SP	3	2	3	0.67	1.00	1.50
Region 6 Subtotal	3	2	3	0.67	1.00	1.50
Stone Harbor Point	3	2	0	0.67	0.00	0.00
Two Mile Beach	4	3	2	0.75	0.50	0.67
<i>Cape May NWR</i>	3	2	1	0.67	0.33	0.50
<i>Coast Guard (LSU)</i>	1	1	1	1.00	1.00	1.00
Region 7 Subtotal	7	5	2	0.71	0.29	0.40
NJFW sites TOTAL	23	19	22	0.83	0.96	1.16
All NJ sites TOTAL	89	49	48	0.55	0.54	0.98

Active Sites **20**

¹This site includes Sea Bright – South and Monmouth Beach – North

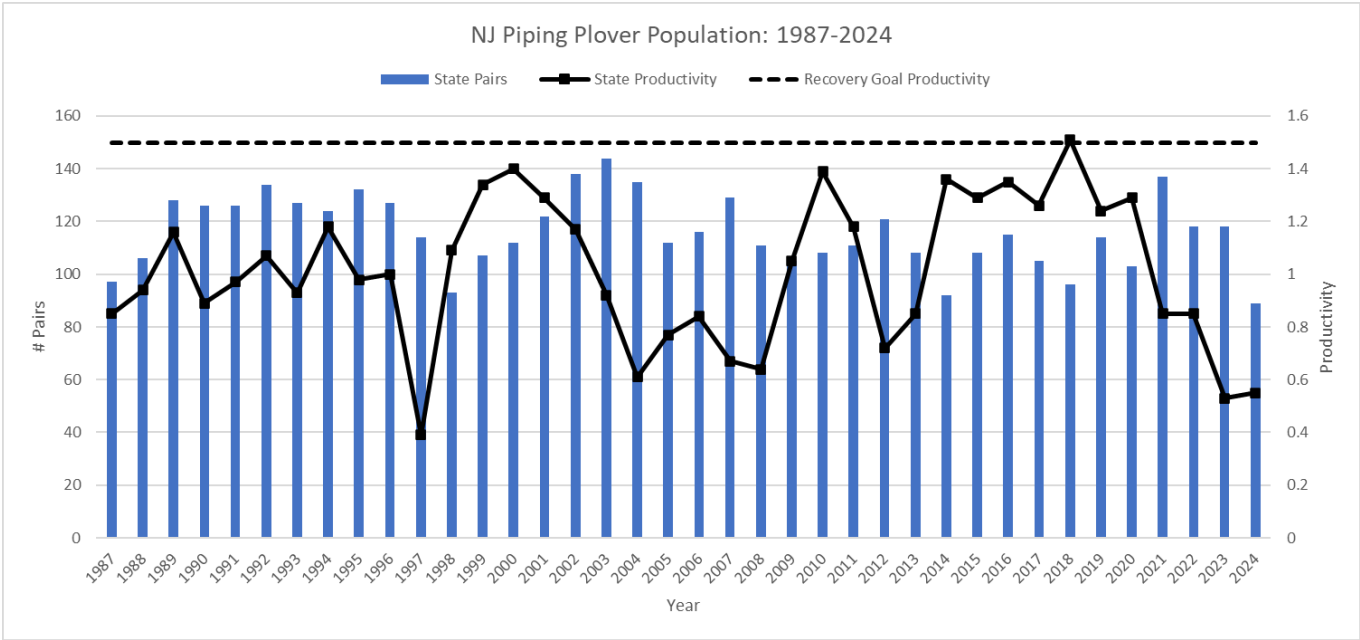
² This site includes Borough of Barnegat Light and Barnegat Light Restoration Area (BLRA). BLRA fledge rate was fledglings/pair

Pair Success equals the percentage of pairs that hatched young (at least one chick observed).

Fledge Rate equals the number of chicks fledged per pair.

Successful Pair (SP) Fledge Rate equals the number of chicks fledged per pair that successfully hatched young.

New Jersey Piping Plover Population: 1987-2024



Black Skimmer Nesting Summary

- Black Skimmer breeding bird counts were conducted approximately every week at active sites from arrival on breeding grounds (mid-May) until nesting ceased (August) on beaches along the entire Atlantic coast. Marsh islands were not ground surveyed this year, but aerial surveys in May and June did not detect any active colonies. All sites were visited 3-7x/week for management and outreach for the duration of the nesting season.
- **A total of 2,341 adults were present at active sites.** This figure is the cumulative total of site counts that occurred in the peak survey period, which took place 19-25 June. The sum of the peak adult number from each site was 2,485. The larger the difference between these two numbers, the more likely it is there was failure at any given colony and then relocation/renesting to another colony; that was not the case this year and largely attributed to the lack of flooding and storms.
- **A peak count of 648 incubating adult Black Skimmers were tallied** in the 26 June – 2 July survey period. The incubation number was lower than might be expected given the number of adults present and was almost certainly lower than how many nested. As is generally the case, vegetation at Stone Harbor Point blocked observers from garnering the most accurate count of these ground nesters but walk-through colony counts are not safe or effective at this site.
- Black skimmer statewide **productivity appeared to be moderate-high with 996 fledglings produced statewide.** This translates to 1.53 fledglings/pair if calculated on the peak incubating adult count (648). If we simply halve the peak period total adult number (1,171) and use that as pair count, the productivity is 0.85 fledglings/pair. The true rate is likely somewhere in the middle. The total fledge count likely would have been higher, were it not for a fox family targeting the colony at Stone Harbor Point. There were 10-15 near-fledges killed each night for about a week; had the chicks been younger, it is nearly certain the colony would have collapsed. It was only the relatively older age of the chicks, many of which were beginning to fly, that appeared to save them.
- **There were just three documented Black Skimmer colonies in the state in 2024, the lowest ever recorded since records begin in 1976.** On a more positive note, the overall number of skimmers in the state does not appear to be declining with the number of colonies, but there continues to be concern about funneling breeding birds into fewer sites.
- TWI and NJFW partnered together to band 46 adult and juvenile skimmers in 2024. TWI was also able to outfit one adult bird with a GPS PinPoint tag, bringing the total number of adults tracked with transmitters in 2021-2024 to 20 (only one adult was tracked this year due to difficulty trapping adults at Stone Harbor Point as a result of colony configuration). Preliminary results reveal interesting patterns that will help guide future management, but that data is not yet available as data collection is on-going.
- Over the course of 2024, 125 individuals banded in NJ from 2016-2024 were observed either on their migration or wintering grounds. Reports from out of state came from NY, MD, NC, SC, GA, and FL. A total of 423 skimmers have been banded in NJ since 2016 and the resight database contains over 4,300 records.
- Please note that the data in the following table is presented both in terms of peak tallies of each site *and* the peak counts statewide in the week-long survey windows. It is presented by site so that the peak use of any given location can be understood. However, simply tallying these peaks can lead to double counting individuals since this species is known to use multiple sites in one year (e.g., a colony fails at one site and they re-nest at another site.) so the statewide peak window count is an effort to account for that issue and add context to the site total figures. In 2024, colonies were successful so the two “peak” counts are not far apart (this is not always the case).

New Jersey Black Skimmer Nesting Summary by Site: 2024

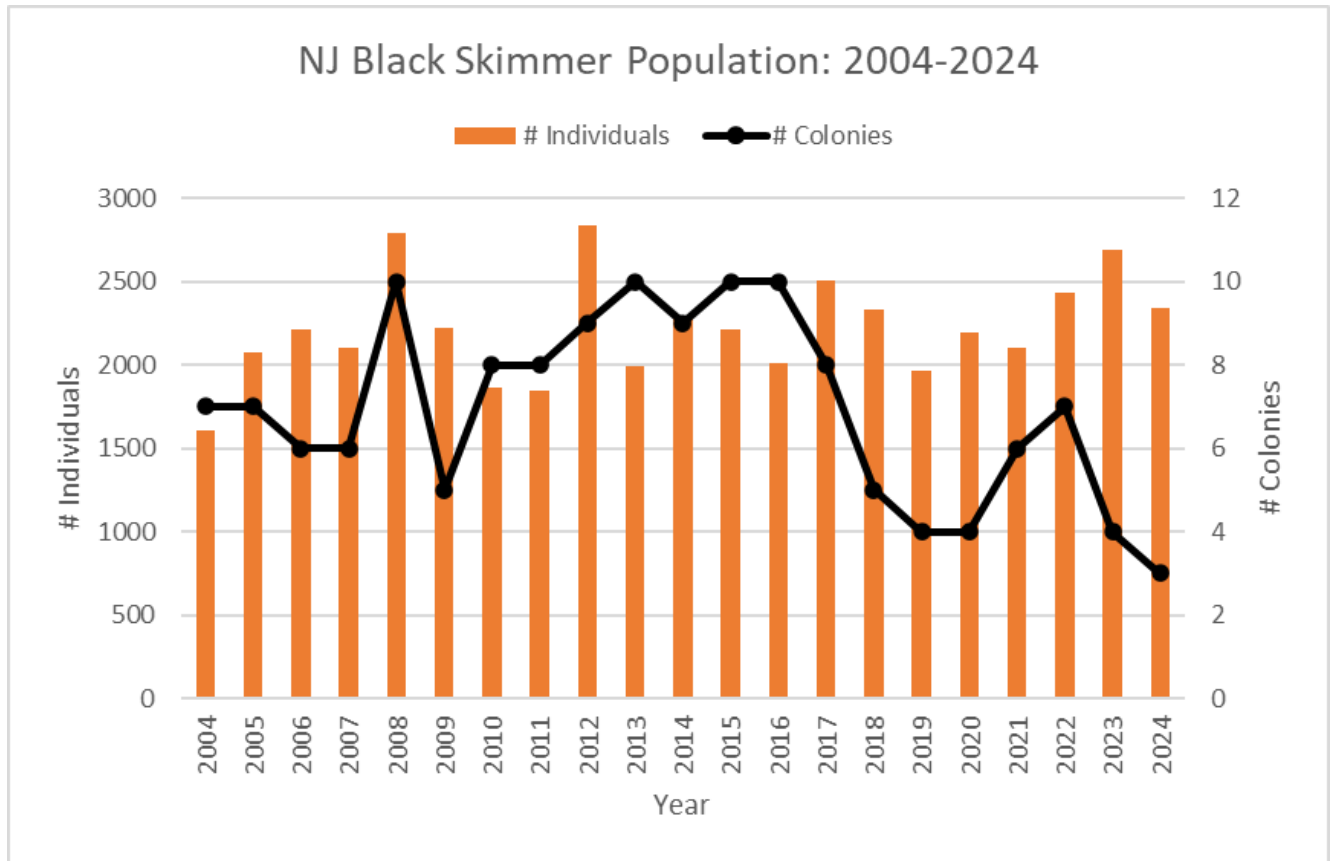
SITE	Peak Total Adult Count	Peak Incubating Adult Count	Chicks Fledged	Fledge Rate
Holgate – EB Forsythe NWR	240	90	88	0.98
Horseshoe Island ¹	1,347	625	578	0.92
Stone Harbor Point	898	285	330	1.15
NJFW sites TOTAL	2,245	910	908	--
All NJ sites TOTAL	2,485	1,000	996	--
Statewide Peak Window Count	2,341	648	--	--
	(6/19-6/25)	(6/26-7/2)		
# Active Sites	3			

“**Fledge Rate**” equals the number of chicks fledged per incubating adult. This number should be considered an estimate as there is not a high degree of confidence in the incubating adult and fledged number as these data points are very difficult to collect. Because of this difficulty, there is no statewide fledge rate tallied here.

“**Peak Total Adult Count**” & “**Peak Incubating Adult Count**” are the highest adult counts observed at any point during the breeding season. “**Statewide Peak Window Count**” represents the highest tally for one one-week survey window. This species can exhibit a high degree of intra-year movements so both numbers are important to understand the distribution of adults and habitat use (on site and state levels) in NJ.

¹ This site is jointly managed by NJFW and EB Forsythe NWR/Conserve Wildlife Foundation of NJ

New Jersey Black Skimmer Population: 2014-2024



Note: The number of colonies only includes sites where active nesting was documented.

Least Tern Nesting Summary

- Least Tern breeding bird surveys were conducted every week from mid-May until the end of August at beaches along the entire Atlantic coast. Sites were visited 3-7x/week for management and outreach for the duration of the nesting season.
- **A total of 1,436 adults were present at active sites.** This figure is the cumulative total of site counts that occurred in the peak survey period, which took place 5-11 June. The summed peak adult number from each site was 1,664. The difference between these two numbers can suggest failure at a given site and then relocation/renesting to another site; by and large, this was not the case in 2024 (there was a lot of failure, but not a lot of evidence of widespread shifting of sites to re-nest). The total adult count number was the highest tallied since 2003 (1,737).
- **A peak count of 773 incubating adult Least Terns were observed** in the 12-18 June survey period. **Productivity was low for Least Terns with 146 fledglings produced** statewide at 0.28 fledglings/pair, based on the peak number of incubating adults. (Unlike skimmers, Least Terns do not tend to nest in deep vegetation and there is a greater confidence in the incubating adult number).
- **The number of active Least Tern colonies (11) decreased again** compared to 2023 (13) and 2022 (18) and was the lowest ever recorded since 1976. The loss of many municipal and private sites continued to be apparent this year, as was the continued importance of Holgate. The decrease of colonies now appears to be a trend and suggests species managers should continue to monitor this closely.
- **Predators were the primary limiting factor for this species this year**, as flooding (generally the other major factor) was not as much of an issue in 2024. Loss by predators is especially frustrating at sites like Horseshoe Island and Stone Harbor Point, where other colonial species found success. Camera, track, and observation data has not been fruitful, so more data is needed to understand this dichotomy. Some speculate that their diminutive size is playing a role in their failures, while larger colonials are succeeding. Species managers continue to work on addressing these issues, but they seem especially intractable for this species. The Nature Conservancy at South Cape May Meadows has continued to demonstrate that wire fencing to exclude mammalian predators can be effective, but this is not always possible at other sites across the state, due to demand on resources and the more dynamic nature of the habitat of those colonies. However, its effectiveness cannot be denied.
- The relative stability of this population over the last two decades continues to be somewhat perplexing, given years of what appears to be poor productivity. Least Terns live a long time, which is beneficial for the individuals who nest in NJ and rarely find widespread success. This species is not banded, so biologists cannot track them to determine if the population is being sustained by immigrants from other states. If immigration is not occurring, there is a sense that a decline should be expected in coming years. Future banding studies and/or research on Least Tern population dynamics would be beneficial to monitoring and management.
- Please note that the data in the following table is presented both in terms of peak tallies of each site *and* the peak counts statewide in the week-long survey windows. It is presented by site so that the use of any given location can be understood. However, simply tallying these peaks can lead to double counting individuals since this species is known to use multiple sites in one year (e.g. a colony fails at one site and they re-nest at another site) so the statewide peak window count is an effort to reduce that issue and add context to the site total figures. In 2024, colonies were not successful, but widespread re-nesting at different sites did not appear to occur so the two “peak” counts are not as far apart as they can sometimes be.

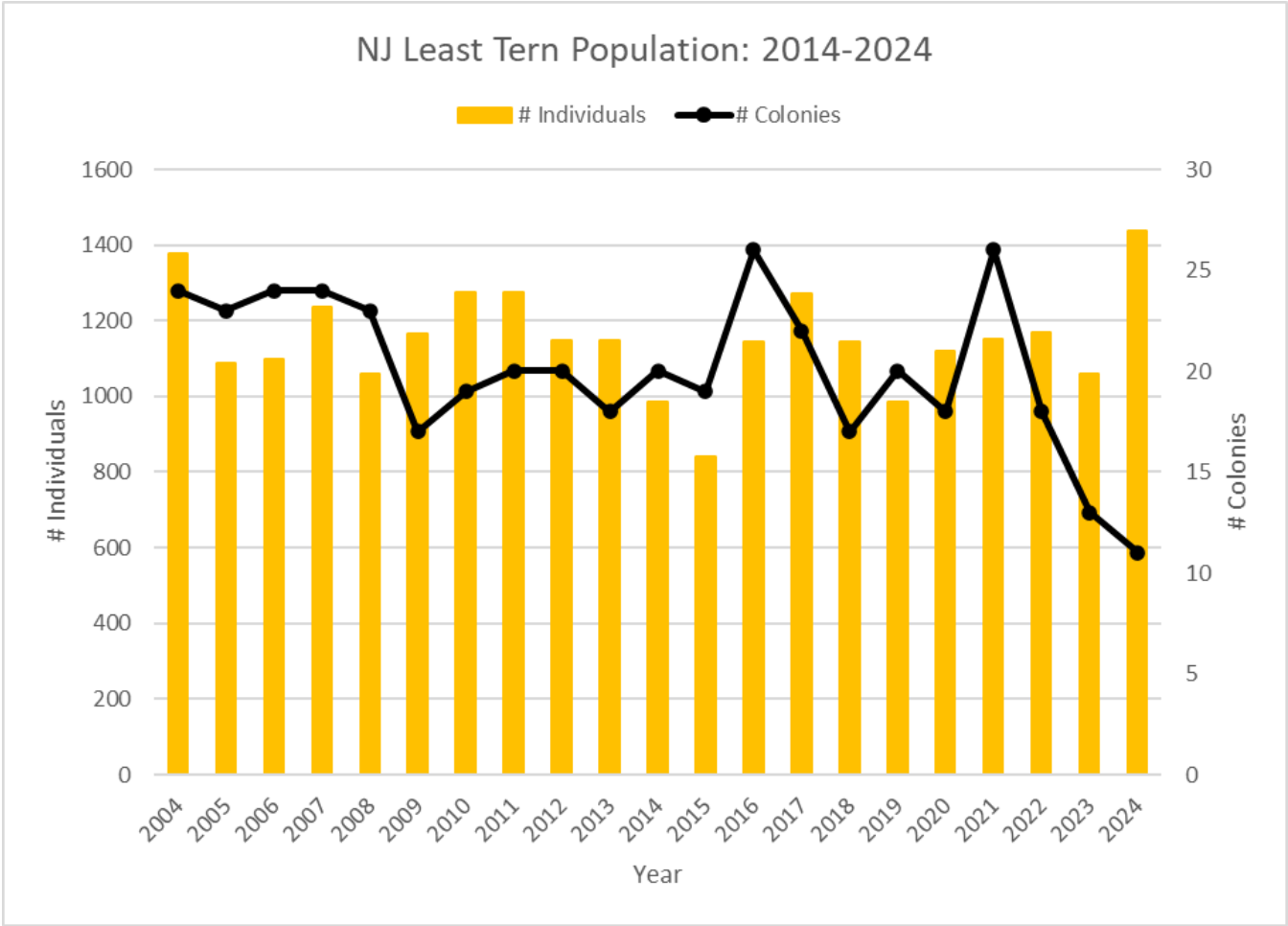
New Jersey Least Tern Nesting Summary by Site: 2024

SITE	Site Peak Total Adult Count	Site Peak Incubating Adult Count	Chicks Fledged	Fledge Rate
Deal	1	1	0	0.00
Barnegat Light (Restoration Area)	36	12	11	0.92
<i>EB Forsythe NWR</i>				
Holgate – Northern Overwash	250	95	3	0.03
Holgate – Inlet	400	220	28	0.13
Horseshoe Island ¹	385	260	4	0.02
Corson’s Inlet State Park	19	9	0	0.00
Stone Harbor Point	135	97	0	0.00
North Wildwood – Hereford Inlet	60	24	20	0.83
USCG - TRACEN	16	6	0	0.00
South Cape May Meadows – TNC	345	173	80	0.46
Cape May Point State Park	17	7	0	0.00
NJFW sites TOTAL	669	416	35	--
All NJ sites TOTAL	1,664	904	146	--
Statewide Peak Window Count	1,436	773	--	--
	(6/5-6/11)	(6/12-6/18)		
# Active Sites	11			

- “**Fledge Rate**” equals the number of chicks fledged per incubating adult. This number should be considered an estimate as there is not a high degree of confidence in the incubating adult and fledge numbers. As these data points are very difficult to collect.
- “**Peak Total Adult Count**” & “**Peak Incubating Adult Count**” are the highest adult counts observed at any point during the breeding season. “**Statewide Peak Window Count**” represents the highest tally for one two-week survey window. This species can exhibit a high degree of intra-year movements so both numbers are important to understand the distribution of adults and habitat use (on site and state levels) in NJ.

¹This site is jointly managed by NJFW and EB Forsythe NWR/Conserve Wildlife Foundation of NJ

New Jersey Least Tern population: 2004-2024



Note: The number of colonies only includes sites where active nesting was documented.

American Oystercatcher Nesting Summary

- Although American Oystercatchers are a management priority in areas of high human disturbance, resource limitations dictate that the data collected on this non-listed species is not comprehensive to the state; it is well known that many individuals nest in the marsh, but the vast majority are not tracked (although the number tracked in the marsh increases each year in an effort to rectify this). The locations listed in the table are all monitored sites with reproductive information available and were visited between 1x/week (or less) to 7x/week.
- **There was another increase in the number of pairs that were monitored by NJFW and partners compared to 2023 (206 vs. 199 pairs).** However, since there is not yet an ability to monitor all of the pairs in the state, it is difficult to put this into context. A better index may be to look at just Atlantic coast beach-strand pairs, where a longer and more comprehensive dataset exists. In 2024, **there was another increase in beach-strand pairs to 154** (146 in 2023, 138 in 2022). The nesting sites with the highest pair numbers on the beach-strand in 2024 were Holgate (53), Stone Harbor Point (26), Horseshoe Island (15), and Sandy Hook (11). Of the known 206 pairs, 78 pairs (38%) hatched at least one egg.
- **There were 395 nesting attempts. Eighty (80) nests hatched (20%), 310 (78%) nests failed, and five (2%) nests had an unknown outcome.** Of the 310 failed nests, 174 (56%) were lost to predators, 34 (11%) to flooding, 93 (30%) to an undetermined cause (many of these are likely predators, but there was not enough evidence to confirm), seven (2%) to abandonment and two (1%) to being blown over and buried.
- The American Oystercatcher Working Group recommends a reproductive goal of 0.50 fledglings/pair. **The reproductive output of monitored pairs in 2024 was 0.51 fledglings/pair.** Some of this rate is explained by the effect of the low hatch rate (20% of nests hatched). However, once the chicks hatched they fared well, with 105 of the 158 hatched chicks fledging. Holgate and Horseshoe Island fledged 63% of the state's fledglings, even though they only hosted 33% of the tracked pairs.
- NJFW and The Wetlands Institute banded 42 (31 and 11, respectively) American Oystercatchers this season, a higher-than-average number for a single year. This was primarily due to a chick feeding behavioral study led by NJFW where individuals were marked (results not yet available) as well as the continued use of the corral for trapping, which has led to a higher capture rate.
- Of the four species, American Oystercatchers continue to show the greatest elasticity in their nesting, utilizing natural areas of marsh islands and beaches. They also use a greater variety of atypical areas – highly groomed beaches, rooftops, and grassy strips in parking lots among them. The number of pairs that are monitored by NJFW and partners continues to increase each year but the reasons for the increase are not fully understood. Some of the increase could be due to pairs shifting to the beach-strand, where focused monitoring is occurring, and they are now being captured in datasets (when they may have been absent from it when in marsh). It could be due to a continuing effort among partners to increase monitoring of marsh and bayside pairs. As is observed with other species, immigration from other states may play a role. It is also possible that the reproductive output needed to increase this population is lower than previously presumed, and management strategies (especially on the beach-strand where most work is focused) are working. To that end, there is some evidence that management may be working, as evidenced by apparent increases in NJ being supported by the estimated 45% increase since 2008 documented across the Atlantic Coastal states (as measured by counts of wintering flocks).

New Jersey American Oystercatcher Nesting Summary by Site: 2024

All Monitored Sites

SITE	Pairs	Pairs Hatched	Chicks Fledged	Pair Success	Fledge Rate
Sandy Hook NRA	11	0	0	0.00	0.00
<i>Coast Guard</i>	2	0	0	0.00	0.00
<i>North Beach</i>	3	0	0	0.00	0.00
<i>North Gunnison</i>	1	0	0	0.00	0.00
<i>South Gunnison</i>	1	0	0	0.00	0.00
<i>D-Lot</i>	1	0	0	0.00	0.00
<i>Critical Zone</i>	1	0	0	0.00	0.00
<i>Fee Beach</i>	1	0	0	0.00	0.00
<i>South Fee Beach</i>	1	0	0	0.00	0.00
Sea Bright - North	1	0	0	0.00	0.00
Sea Bright- South	1	0	0	0.00	0.00
Seven Presidents Park	1	0	0	0.00	0.00
Region 2 Subtotal	14	0	0	0.00	0.00
Long Branch	1	0	0	0.00	0.00
Deal	1	0	0	0.00	0.00
Bradley Beach	2	0	0	0.00	0.00
Avon	1	0	0	0.00	0.00
Belmar-Shark River Inlet	1	0	0	0.00	0.00
Belmar – Beachfront	2	1	0	0.50	0.00
Sea Girt – Wreck Pond ¹	1	0	0	0.00	0.00
National Guard Training Center ¹	1	0	0	0.00	0.00
Manasquan	1	0	0	0.00	0.00
Point Pleasant	1	0	0	0.00	0.00
Barnegat Light	3	2	4	0.67	1.33
Harvey Cedars	1	0	0	0.00	0.00
Beach Haven	1	1	3	1.00	3.00
Region 3 Subtotal	16	4	7	0.25	0.44
Holgate	53	33	42	0.62	0.79
Tucker's Island	1	1	3	1.00	3.00
Little Beach	1	0	0	0.00	0.00
Horseshoe Island	15	13	24	0.87	1.50
North Brigantine Natural Area	1	0	0	0.00	0.00
Region 4 Subtotal	71	47	69	0.66	0.97
Atlantic City	1	1	2	1.00	2.00
Malibu WMA	2	1	1	0.50	0.50
Region 5 Subtotal	3	2	3	0.67	1.00
Ocean City – North	1	0	0	0.00	0.00
Drag Island	3	0	0	0.00	0.00
Rainbow Island Bridge	1	1	1	1.00	1.00
Upper Township Ocean Drive	1	0	0	0.00	0.00
Corson's Inlet State Park	2	1	2	0.50	1.00
Avalon – Dunes	3	0	0	0.00	0.00
Region 6 Subtotal	11	2	3	0.18	0.27
Gull Island – Middle Township	13	6	3	0.38	0.23
Sturgeon Island	5	1	1	0.20	0.20
Ring Island	6	0	0	0.00	0.00
Great Flat	4	0	0	0.00	0.00
Stone Harbor Point	26	6	9	0.23	0.35
North Wildwood	3	3	4	1.00	1.33
Wildwood	1	0	0	0.00	0.00
Two-Mile Beach	7	1	1	0.14	0.14
<i>Cape May NWR</i>	3	0	0	0.00	0.00
<i>USCG LSU</i>	4	1	1	0.25	0.25
Coast Guard-TRACEN	1	0	0	0.00	0.00
Cape May Meadows	7	4	3	0.57	0.43
<i>The Nature Conservancy</i>	5	3	2	0.60	0.40
<i>Cape May Point State Park</i>	2	1	1	0.50	0.50
Region 7 Subtotal	73	21	21	0.27	0.28
Money Island ¹	1	0	0	0.00	0.00
South Dyer Cove	1	1	1	1.00	1.00
Fortescue WMA ¹	1	0	0	0.00	0.00
Raybins Beach	1	0	0	0.00	0.00
Egg Island	1	0	0	0.00	0.00
Heislerville WMA ¹	1	0	0	0.00	0.00
Thompson's Beach ¹	2	0	0	0.00	0.00
Riggins Ditch	1	0	0	0.00	0.00
North Moore's Beach	2	1	0	0.50	0.00
Moore's Beach	4	1	1	0.25	0.25
Stipson's Island	2	0	0	0.00	0.00
Goshen - North	2	0	0	0.00	0.00
Goshen - South	1	0	0	0.00	0.00
Region 8 Subtotal	18	3	2	0.17	0.11
All NJ sites TOTAL	206	79	105	0.38	0.51
# Active Sites	62				

¹ The same pair nested at two nearby sites. Therefore "subtotals" and "totals" are less than the sum of individual sites.

Appendix to the 2024 New Jersey Beach-Nesting Bird Project Report:

Fladry and Modified Exclosures

Prepared by Christina “Kashi” Davis and Emily Heiser, NJ DEP Fish and Wildlife

Predation of nests is a primary driving factor of low productivity for all beach-nesting bird species with a conservation status in New Jersey. A number of techniques are already used to mitigate this threat, with varying degrees of success. As predation remains a limiting factor for the recovery of these species despite those approaches, in 2024 NJFW biologists continued experimenting with two approaches to mitigate this risk. The two approaches were fladry and modified exclosure design.

Note: Estimated costs are only for equipment; they do not include labor costs for installation, or in-person and/or remote (trail cams) monitoring.

Approach I: Fladry

Option 1 – Traditional fladry

Description: Fladry is a line of brightly colored nylon flags that are attached to a line of polywire. This line is attached to posts and creates a perimeter around a sensitive area, such as a tern colony. The flagging hangs low to the ground and its constant motion (due to wind) makes it unattractive to some mammalian predators, who are wary of crossing through it. It is most commonly used on western pasturelands, to prevent wolf and coyote predation of livestock. The polywire can also be electrified as an additional layer of protection (although that step was still not taken in 2024).



Clockwise: APHIS-WS staff deploying fladry in 2023, fladry line at BLSK colony at Stone Harbor Point 2023, coyote tracks approaching fladry line and turning back in 2023, fladry polygon at USCG – TRACEN around an AMOY nest in 2024, fladry polygon at Seaside Park in 2024 around a PIPL nest/ brood area in 2024.

Sites Deployed: Seaside Park, Stone Harbor Point, USCG - TRACEN

Target Species: Mammalian and avian nest predators (primarily fox and coyote)

Cost: \$1079/.25 mile for fox configuration (18" flags spaced 9" apart) or \$879/.25 mile for coyote configuration (18" flags spaced 18" apart), \$130/.25 mile poles (but can use same poles as standard nesting fence in some scenarios), zip ties to secure to poles (cost variable depending on vendor and number needed). Equipment can be reused, so costs are reduced with each use. Fladry is not widely available so there is also shipping to consider. From JONCO Industry Solutions in Wisconsin, it was ~\$50 to New Jersey.

Pros: Provides an option to protect colonies; installation is straight-forward; provided additional visual cues to humans that this area was off limits.

Cons: Continues to show some promise, but difficult to fully ascertain effectiveness; only targets mammalian predators (not avian or invertebrates), needs regular maintenance (at least daily and ideally more) as streamers wrap around polywire; effectiveness may be impacted by storms and sand accretion.

Additional Comments: In 2024, ENSP also experimented with fladry around solitary nesters (2023 was only colonial nesters). There was some concern that the fladry would prevent the birds from entering their nesting areas, as it is deployed close to the ground and these are species that walk in and out of these sites and can be sensitive to disturbances. It was first deployed around an American Oystercatcher nest in a conservative perimeter. The birds showed no negative reaction or aversion to the fladry (the adults flew over it to access the nest) and the nest persisted at the site longer than nearby nests, so it showed promise. Unfortunately, the coyote eventually jumped over the line and depredated the nest. It was next deployed around a plover brood (after hatching). This brood was highly mobile and only one block was outfitted with fladry. The plovers (adults and chicks) walked freely through the fladry with no apparent negative reaction or aversion to the fladry. The chicks did fledge, but it is hard to determine how important a role the fladry played in that, as they used multiple areas on site.

Rating: Still shows some promise, additional experimentation warranted.

Further Experimentation: Fully enclose colony sites (did not have enough in our inventory to do this as the only colonies that persisted this year were quite large); experiment more with the solitary nesters.

Based on:

Windell R. M, Bailey L. L, Young J. K., Livieri T. M., Eads D. A., and Breck S. W. 2022. Improving evaluation of nonlethal tools for carnivore management and conservation: evaluating fladry to protect an endangered species from a generalist mesocarnivore. *Animal Conservation*: 25 (2022) p. 125-136

Young J.K., Draper, J., Breck, S.W., 2019, Mind the Gap: Experimental Tests to Improve Efficacy of Fladry for Nonlethal Management of Coyotes. *Wildlife Society Bulletin* 43(2):265–271; 2019

Option 2 – “Poor man’s” fladry

Description: “Poor man’s” fladry, or PMF, was an innovation of NJFW seasonal Jordan Heine, who suggested experimenting with multiple lines of the nylon twine near the ground to help deter mammalian predators, by making it harder for them to easily enter and exit fenced areas, after the traditional fladry inventory was exhausted. It was so named as it utilizes materials that are much less expensive than traditional fladry. When PMF was used on plover nests, the lowest line was still high enough off the ground that the birds could easily enter/exit the fenced area. When it was used on oystercatcher nests, the perimeter was large enough that the birds flew in and out of the area but were still able to make their final approach to the nest by foot. The line, for either species, was then flagged at a higher density than is usual for our standard symbolic fencing.



L to R: Example of “Poor’s Man’s” fladry (PMF)

Sites Deployed: Sites in Monmouth and Ocean Counties around Piping Plover and American Oystercatcher nests

Target Species: Mammalian predators, especially red fox

Cost: \$6.25/500’ of nylon twine, \$3.50/150’ of vinyl flagging

Pros: Provides an option to protect colonies and solitary nesters; installation is straight-forward; showed promise as a deterrent; provided additional visual cues to humans that the area was roped off; more cost effective than traditional fladry.

Cons: PMF materials can only be used one time; concern over bird mobility being impacted (although that was not observed in 2024; all birds readily accepted it); only targets mammalian predators (not avian or invertebrate predators); can cause a larger degree of concern for entanglements compared to standard symbolic fencing in the event of storms and it being knocked down (this was not an issue in the relatively calm 2024 season).

Additional Comments: The PMF did seem to help reduce the presence of fox activity within fenced areas, but this was not studied in a structured way, so further experimentation is recommended.

Rating: Results potentially promising (despite small sample size), additional experimentation warranted.

Further Experimentation: Continue to experiment on solitary nesters and consider experimenting on small colonies (not practical for large areas).

Approach II: Modified Exclosure Design

Description: NJFW had higher than average abandonment rates of exclosed nests in 2022 and 2023. Many of the abandonments were related to adult mortality, especially by fox. NJFW exclosed nests are outfitted with trail cameras, so there was ample opportunity to study the way these predation events took place. Review of this footage prompted biologists to consider exclosure design and if modifications could be made to thwart the attempts by fox and other predators.

Pigeon Spikes: As noted in the 2023 appendix, pigeon spikes outfitted on the top of the exclosure appear to help reduce predation by owls and falcons. All exclosures deployed by NJFW now feature these spikes. The photos below show the commercially available pigeon spikes utilized by NJFW and an image of an exclosure at night to better see the spikes mounted along the top (can also see a fox undeterred by electric line along the bottom, a strategy that has now been abandoned by NJFW due to recent evidence of ineffectiveness).



Skirts: Despite the exclosures being buried below ground 1.5’-2’ down, observational evidence suggested that fox were generally not deterred by having to dig down to get under the exclosure. In 2023 and 2024, NJFW began adding a “skirt” to an exclosure, buried and extending outward of the bottom of the exclosure, which a fox would encounter almost immediately when digging. In the small sample size this year, there were not any nests dug under that were outfitted with a skirt. The photo below shows the skirt as it was placed – it is then covered with sand and does not inhibit the bird’s access to the nest.



Two other observations that biologists made after reviewing trail camera footage were that the birds often flew up to try and escape a circling fox and that the fox's speed and agility as it ran around the circular enclosure was difficult for the plovers to evade. Biologists attempted to address these issues in two ways: a modified top and triangle shape with wings.

Modified Top: The first was to outfit a traditionally shaped enclosure with a modified top so that a bird that was trying to fly up and escape the enclosure may find a hole to fly through. It is difficult to make a hole that is large enough for a bird to escape without making it so large that other predators can get in but biologists replaced a strip in the center of the blueberry netting with a swatch of enclosure wire, with periodic areas cut so as to provide an escape hatch. The enclosure wire was then bent upwards to discourage any avian predators from entering through the hole.



Triangle with Wings: The second modification design was meant to attempt to slow the fox down by adding hard corners and obstacles, which ideally would allow the plover to run out of an enclosure and fly before the fox could get to it. This was accomplished by creating a triangular enclosure which was then outfitted with three “wings” on each corner.



NJFW took a conservative approach to deploying these new designs in 2024. Just six exclosures were deployed; one round with modified top and five triangular ones. All of them had pigeon spikes but not all of them had skirts. The modified top one did not have a skirt and was dug under, causing a nest loss. However, both adults survived. The five nests outfitted with the triangular exclosures all hatched.

Sites Deployed: Island Beach State Park, Barnegat Light

Target Species: Mammalian and avian plover nest predators (primarily fox, coyote, owls, and falcons)

Cost: Depends on vendor and amount purchased, but initial investment was approximately \$30-35/exclosure for wire, \$120/exclosure for bird spikes, \$20/exclosure for chicken wire as skirt, \$8/exclosure blueberry netting, \$6-10/exclosure for wood posts, nominal costs (a few dollars) for zip ties for a total of ~\$190/exclosure. All material but the zip ties and blueberry netting can be reused, so the price does go down per exclosure deployment.

Pros: Modifications may allow exclosures to be deployed at higher rates in NJ again, if the trend of fewer adult mortalities holds; total time to deploy similar to traditional shape with electric; birds accepted the new styles with no issue; similar costs to traditional shape with with electric; provides a non-lethal option for predation management.

Cons: the skirt is cumbersome to set up and this task cannot be split up from others to give birds a break (the way that can occur when electrifying an exclosure); the skirt is difficult to remove at end of season; can only be used on plovers so the other species do not benefit; does not address issues with ghost crabs.

Additional Comments: NJFW was relieved to have a season with no exclosure-related adult mortality on its sites and is committed to continuing to experiment with modifications. As with everything in beach-nesting bird management, it is understood that “it will work until it doesn’t”. It is possible, and probably even likely, that fox, falcons, and other predators will find a way around these modifications so they are being undertaken with the understanding that there is no silver bullet for exclosure design. However, there has not been a confirmed adult mortality loss by a falcon/owl for a Piping Plover nesting in an exclosure outfitted with pigeon spikes in 2023 or 2024, and no adult mortality loss by any species for a Piping Plover in a modified exclosure in 2024. It is noted that the skirts do take a significant amount of time to deploy, so managers should carefully consider whether a nest being dug under is likely at a given site before deploying.

Rating: High. NJFW plans to deploy additional modified exclosures in 2025 to continue to test these styles.

Further Experimentation: NJFW was satisfied with the triangular configuration, and will be deploying it again in 2025. It is possible a hybrid of the two will be trailed – the triangle w/ wings shape and adding the modified top.