Horseshoe Island
2024 Report

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In partnership with the USFWS Edwin B. Forsythe National Wildlife Refuge

CONSERVE WILDLIFE
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NEW JERSEY DEP
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U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

EXECUTIVE SUMMARY

Horseshoe Island is an offshore island just southeast of the Little Egg Inlet. It can be observed on aerial imagery beginning in 2017, where it likely was occupied as habitat for migrant and roosting birds. By 2020, it likely reached sufficient elevation to support nesting but due to the Covid pandemic limiting opportunities for field work, nesting was not confirmed until 2021. It was immediately apparent that this island was critical to migratory, roosting, and nesting coastal avian species but that human disturbance could threaten to undermine its full potential. In winter 2022, the New Jersey Department of Environmental Protection Fish and Wildlife (NJFW) petitioned the Tidelands Resource Council, whose jurisdiction the island falls under, for management rights. These were granted in March 2022 for a period of five years and include a seasonal closure to all human use from March 1 - September 30 of each year.

NJFW and The Conserve Wildlife Foundation of New Jersey (CWF) (working on behalf of Edwin B. Forsythe NWR) jointly collected avian biological data, human use data, and conducted outreach for the public. Monitoring commenced on April 10 and concluded on September 27. Biological monitoring objectives were to visit the site at least 3x/week (including both weekend days), conduct American Oystercatcher and Piping Plover surveys at least 3x/week, and a migratory shorebird survey at least 1x/week and breeding colonial species survey at least 1x/week. Staff posted informational signs around the perimeter of the island. Public outreach was conducted on-site with boaters and off-site through information on websites.

A total of 50 avian species have been documented using the island (including three federally listed and six state listed species) for migratory, breeding, or roosting purposes. Six species were documented breeding, including Piping Plover (first year they nested at this site), Black Skimmer (largest skimmer colony in the state), Least Tern (second largest colony in the state), American Oystercatcher (third largest concentration for the state), Royal Tern (northernmost colony in the Western Hemisphere), and Common Tern. Of note among the migratory species that utilized the island in 2024 was Roseate Tern (a federally and state listed species) and Red Knot (a federally and state listed species), whose numbers peaked at 405 and represented a significant migratory flock on the New Jersey Atlantic coast.

Signage and staff presence at the site educating the public about the closure was an effective strategy to reduce human disturbance. Breeding and migratory species continued using the western side of the island (where the majority of boat landings take place) to a high degree this year, signaling that the closure has a positive impact on increasing the amount of habitat available to the birds. In the third year of the closure, human use was lower and compliance was higher compared to 2022 and 2023. NJFW law enforcement personnel continued to conduct their own patrols as well as respond to situations that field technicians were not able to resolve on their own.

The third year of management under the agreement with the Tidelands Resource Council was deemed another success, as extremely high numbers of birds continued to utilize the entire island. In 2025 and beyond, partnering agencies plan to continue to engage in outreach efforts (both on- and off-island), continue to engage law enforcement as needed, increase the number of site visits each week, and work towards collecting site use data in the non-breeding season. Horseshoe Island is a true gem of the New Jersey coastline, but one that is ephemeral in nature. The partners on this project are committed to ensuring its full potential for avian species of conservation concern is reached for as long as it is present on the landscape.

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INTRODUCTION

Figure 1. Location of Horseshoe Island

Horseshoe Island (HOIS) is located immediately south of and adjacent to the Little Egg Inlet just offshore of Little Beach Island, New Jersey (Figure 1). A shoal/bar that was tidally overwashed on a consistent basis was present in the same location for several years, however, it transitioned to an island that regularly remains above high tide (Figure 2). At the same time, regular use of the island by the public for recreational purposes was also noted in 2021; many of the activities were not compatible with bird use, potentially reducing the available area for use by the birds, limiting reproductive success of nesting birds, and disturbing other non-nesting species. Given all the intersecting factors, in the winter of 2022, NJFW and the Refuge petitioned the state's Tidelands Resource Council for management rights of the island to benefit its wildlife. The council approved a five-year Management Rights Agreement (MRA) in March 2022 that included a provision to seasonally close the island and its adjacent tidal waters to all public uses from March 1-September 30.

Figure 2. Aerial view of Horseshoe Island in May 2024, looking east. Photo credit: Sam Galick

The size, configuration, and elevation of HOIS has changed considerably over the past several years since implementation of the MRA, as would be expected in a dynamic coastal inlet system, but especially notable changes were observed in 2024. Foremost, the overall size of the island (at high tide) dramatically increased in 2024, providing more nesting habitat. The expansion of HOIS in 2024 included an entire new spit on the southern edge of the island; that spit continued to grow westward throughout the season. The addition of the new spit also spurred the creation of a new sheltered lagoon area. In general the inter-lagoons of HOIS are now more numerous and complex, creating considerably more highly suitable foraging opportunities, especially for migratory shorebirds and Piping Plovers. Although elevation is not being formally measured, the northwestern portion of HOIS was visibly higher at the start of the breeding season, and did not suffer any overwash that significantly lowered/flattened it during the season (as has occurred in some past years). As a result, colonial nesters using this area were more successful than in the past. In 2024, for the first time, a sizeable forming dune survived the previous fall and winter storms. Upon visiting the island for the first time in April of 2024, a vegetated dune was already present near the middle of the eastern side of the island. Other small dunes and more vegetation continued to grow in this area as the season went on, aided by relatively less severe tidal overwash this season. Overall, the main part of HOIS appeared to be continuing to shift slightly more westward towards the mid-island of Little Beach in 2024 and increased shoals were observed to the southwest, also in the direction of Little Beach. A deep channel still separates HOIS and Little Beach and it remains to be seen if HOIS will eventually connect with this barrier island. A great deal of uncertainty still exists about the long-term future of HOIS and sudden changes to its physical characteristics are always a possibility, however, in the short-term, HOIS appears to be in an accreting stage.

Shorebird nesting was first confirmed at HOIS in 2021, including by state endangered Black Skimmer and Least Tern, among other species. High numbers of migratory and staging shorebirds were also observed on HOIS that year, including the federally threatened/state endangered Red Knot. Many of the species using the island are identified as Focal Species of Greatest Conservation Need under the state's Wildlife Action Plan (NJSWAP, March 2018). Mammalian predators are absent from the island, which is a rare occurrence in New Jersey, especially for beach nesting bird species, further increasing its importance.

2024 was the third year that the MRA was in effect at HOIS. The perimeter of the island, especially those areas on the west side where boats typically land, were marked with signs indicating the public closure. Regular maintenance of signage was needed due to periodic storms and tidal overwash of the site, although in general, fewer coastal storms in 2024 meant less maintenance was needed this year. Staff from NJFW and CWF (working on behalf of the Refuge) regularly visited HOIS from April-September, conducting 62 crew visits undertake biological monitoring, maintain signage, and help deter public usage.

Continuing in 2024 were NJFW law enforcement patrols to help reduce human disturbance. Less enforcement visits or responses were needed in 2024, as the heightened presence by law enforcement in 2023, which resulted in a dramatic decrease in the number of boat landings and people/dogs documented on the island that year, appears to have had a more long-term effect of reinforcing the closure with the public.

Several outreach strategies were implemented in 2024, as per the MRA and as was done in past years, including social media posts, public presentations, and supplying information for inclusion in news articles. When staff was on-site they attempted to educate the public regarding the closure and directed them to online resources to learn more. Online resources about HOIS include a website (https://dep.nj.gov/njfw/conservation/horseshoe-island/), a video that was produced by NJFW in 2022 and included contributions from the Refuge and CWF, (video can be viewed at

https://youtu.be/7UTVuRU_aCQ), and status update video produced by NJFW in 2024 (https://www.youtube.com/watch?v=d7OtwMfOPhA). The outreach efforts over the initial few years appear to have been effective. Combined with regular law enforcement presence, fewer watercraft landings and human disturbance incidents have occurred each year.

This report provides a detailed account of the nesting and other avian usage at HOIS in 2024, as well as the monitoring and management effort conducted by NJFW, CWF, and the Refuge.

DESCRIPTION OF MONITORING

HOIS was co-monitored by NJFW and the Refuge, which were represented by staff from the Endangered and Nongame Species Program (ENSP) and CWF, respectively. ENSP took the lead on posting signage on the island but both crews engaged in the initial placement and ongoing maintenance. Both crews shared weekend monitoring and public outreach responsibilities. All monitoring data were recorded via and stored on NestStory, an internet-based data collection tool. Monitoring on HOIS began in 2024 on April 10 and ended on September 27. Over the course of the season, the combined field staffs provided monitoring coverage of HOIS for a total of 62 site visits. Monitoring frequency in April and early May averaged 1-2 days a week, with less coverage being dictated by weather factors and because it was still in the earlier stages of nesting activity for some species. During the prime breeding and recreational boating/activity period from Memorial Day Weekend to Labor Day, monitoring notably increased, a total of 49 crew visits were recorded during that period, representing about half (48%) of the days during that period. The longest gap of coverage in that period was just four days (twice). Consistent coverage was aided, in part, by relatively calm seas and good weather over the summer of 2024. Special attention was paid to staff being present on both weekend days and holidays during this period, as weather allowed. After the early part of August, monitoring frequency was reduced as nesting began to wind down and less staff were available, and by September visits were only made once a week.

Compared to other beach-nesting bird sites in New Jersey, HOIS presented unique monitoring challenges due to its status as an offshore island that is only accessible by boat. As a result, monitoring efforts were particularly influenced by tidal cycles and weather conditions. Crews were especially cognizant of high winds and swells, which can make operating small watercraft through Little Egg Inlet unsafe. Taking these logistical restrictions into account, staff from each branch collaborated to achieve the following monitoring objectives each week during the peak nesting and migration periods:

1. Minimum of two site visits per week, preferably three times a week, including at least one weekday and both weekend days
2. American Oystercatcher nest/brood checks for each pair on every visit
3. Piping Plover nest/brood checks for each pair on every visit (once nesting was confirmed)
4. At least one comprehensive colonial species survey once every week
5. At least one comprehensive shorebird/migrant survey once every week

Monitoring Frequency

As previously described, monitoring frequency changed throughout the season as nesting activity and management responsibilities intensified or lessened. Weekend coverage began on Memorial Day Weekend and continued for the remainder of the season to maintain staff presence during the most likely periods of high human activity. ENSP and CWF crews divided monitoring responsibilities on weekends, with each crew

providing coverage on one weekend day. In addition to weekend coverage, staff aimed to conduct at least one weekday site visit, for a minimum total of three monitoring days each week.

Site visit length varied considerably depending on the scope and purpose of each mission. For example, short visits (between 30 minutes to an hour) could include checking a colony's status after suspected flood damage or sighting an American Oystercatcher brood(s) on its fledge date. Longer visits (up to 6 hours) included thorough surveys, colony counts, more complete nest/brood checks, banding, sign maintenance, and outreach. As nesting has increased on HOIS and because the island was notably larger in 2024, visits tended to be longer in 2024, on average.

American Oystercatcher Monitoring

American Oystercatcher monitoring occurred from April 10 (nests were found on the first site visit of the season) through July 26, formal monitoring ceased once the last chick was confirmed to be fledged. Upon determining nesting territories for breeding oystercatcher pairs, staff searched for nests within those territories using behavioral cues and tracking as aids. Once a nest was discovered, staff assigned an oystercatcher pair to the nest based on behavioral observations and band re-sights. Conditions permitting, staff aimed to perform nest checks per on each site visit with a visual confirmation of the egg count and status (e.g., laying, incubating, hatching, etc.). Estimated hatch dates were calculated by adding 28 days to the date staff determined the final egg was laid. Nests found at full clutch were given a "no later than" estimated hatch date, which was calculated by adding 28 days to the date of discovery. All egg and nest losses were recorded along with the suspected cause of loss (e.g., flooding, burial, depredation, etc.).

Once nests hatched, staff monitored the location and status of each brood. Similar to nest checks, staff aimed to conduct brood checks on every visit with visual counts of the chicks and GPS coordinates marking the broods' locations on the island. Direct brood observations for oystercatchers can be difficult as adult oystercatchers are particularly sensitive to human disturbance and will hide their easily camouflaged chicks among piles of wrack. As a result, staff attempted to scope oystercatcher broods from a distance whenever possible. If a brood could not be directly observed, staff used behavioral cues from the adults to help determine if a pair was still brooding chicks. A brood's estimated fledge date was calculated by adding 35 days to the determined hatch date. Chicks are considered fledged upon direct observation on their fledge date. To reduce uncertainty, broods are checked at least two additional times following their fledge date.

Piping Plover Monitoring

Up until 2024, Piping Plover monitoring on HOIS was largely focused on migratory and foraging birds (by nearby breeders), including band resighting, when possible. Some very limited "territorial" behavior was previously noted, but no nesting occurred. This changed in 2024 when advanced breeding behavior and pair establishment was observed, and nesting was confirmed, relatively late in the breeding season. Once courting pairs were first noted and continuing through the egg laying, nest incubation, and brood rearing, monitoring of plovers at HOIS was done on a frequent basis, including nest/brood checks on each visit while the birds were active. Formal Piping Plover monitoring occurred on HOIS from June 5 until August 3, when nests or chicks were present, although sporadic plover breeding activity was observed on HOIS as early as April, so informal monitoring began then. All three pairs that eventually laid eggs also hatched chicks, however, none of the pairs were able to raise their chicks to the fledgling stage, so once broods were confirmed to be lost, monitoring for Piping Plovers ceased, as the time during the nesting season when they would renest had passed. Monitoring

protocols for Piping Plovers was the same as already outlined for American Oystercatchers, although the estimated hatch dates (27 day cycle) and fledge date (25 days), differed, although the fledge date was not relevant in 2024 as no Piping Plover chicks ultimately fledged from HOIS.

Colonial Species Monitoring

Staff monitored breeding colonies of Black Skimmers, Least Terns, Common Terns, and Royal Terns at HOIS. Areas containing nesting birds were divided into six sub-colonies (HOIS 1-6), based on their location on the island (Figure 3). These designations were roughly established based on assignment from the previous years and current (2024) areas of nesting concentration, however, they are some arbitrary, as the island changes year to year and within the season. To this point, only four sub-colonies areas were designated in 2023 but due to growth of and topographical changes to the island since 2023, nesting also expanded to new areas in 2024. "HOIS 1" included birds nesting on the southwestern section of the island. "HOIS 2" included birds nesting on the northwestern section of the island. "HOIS 3" included birds nesting in an area spanning from the northwestern to the northeastern section of the island. "HOIS 4" included birds nesting in the central and mid-east portion of the island. "HOIS 5" was a newly forming southern spit of the island. During the season it continued to grow in width and towards the west. "HOIS 6" included birds nesting on a "spit", sometimes connected to area "1" during extreme low tides, that was near the central and eastern portions of the island between areas "4" and "5".

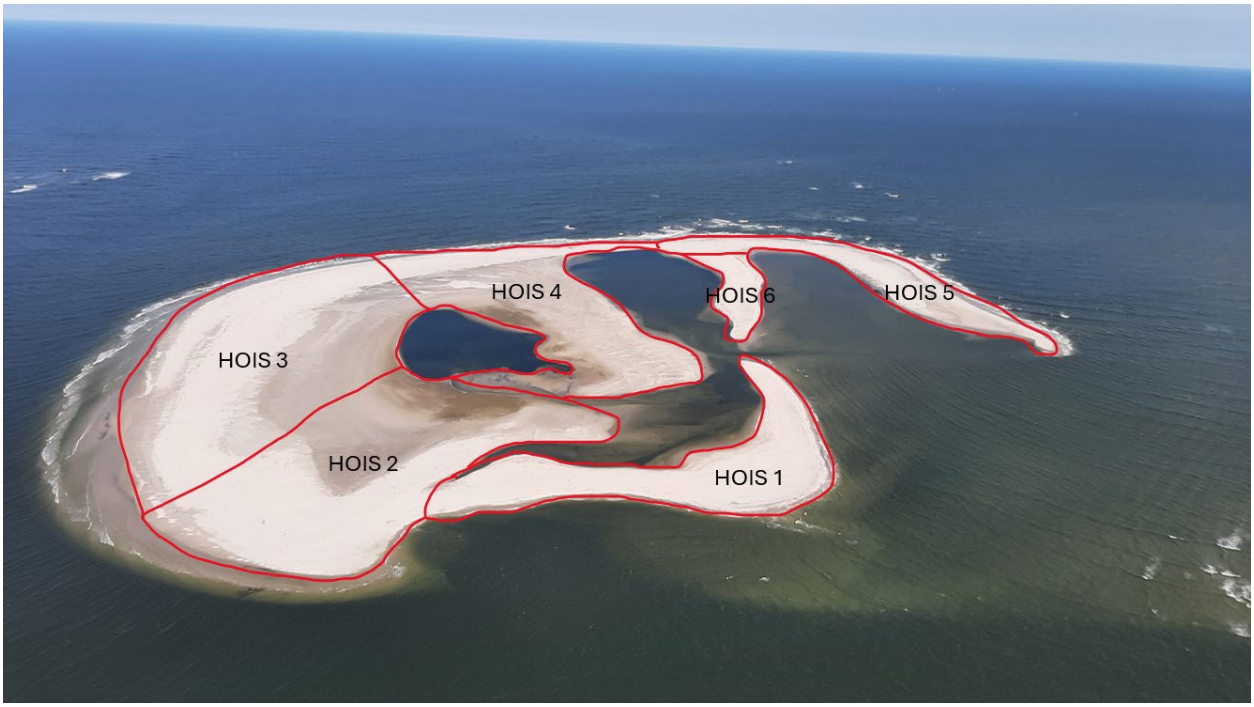

Figure 3. Area designations of HOIS in 2024 for monitoring and data collection purposes.

The goal was to conduct colony counts at least once a week at HOIS from late May through late September (or until colonial species nesting was completed), following survey protocols established by ENSP. Counts were performed for each species within the six sub-colonies. Staff counted the total number of adults present within the colony as well as the total number of incubating adults, as indicated by sitting posture. The weekly incubating adult counts provided an estimate for the number of active nests, in lieu of a visual nest count that would require entering (and disturbing) the colonies. Once hatching occurred, staff counted the number of

downy chicks, feathered chicks, and fledglings present during each survey. Counts were generally conducted from the periphery of the colony to minimize disturbance, but staff did occasionally enter the colonies to confirm the presence of eggs or chicks. Depending on the size and complexity of the colony, multiple crew members would conduct independent counts and report an average to reduce outliers. Whenever possible, staff also re-sighted any banded adults present in the Black Skimmer and Royal Tern colonies. Any significant events impacting the status of the colonies, such as depredation, flooding, or human disturbance, were noted along with the date and general proximity to the colony. GPS coordinates were also recorded around the perimeter of each colony to record its general location. Trail cameras were also placed within and near the colonies by CWF staff. Recordings from these cameras did not provide quantitative data but were able to offer valuable information about flood and predation activity, as well as potential use for outreach.

Shorebird/Migrant Surveys

The goal was to conduct shorebird and waterbird surveys at least once a week at HOIS to assess how migrants and non-breeding species utilized the island. During these surveys, staff recorded the abundance of shorebirds and waterbirds foraging and/or roosting on the island and its adjacent sandbar. Birds were identified to the lowest taxonomic level possible based on expertise and sighting conditions. Attempts were made to distinguish between individuals who utilized the site as both migrants and breeding individuals) for example, Royal Terns and Common Terns). The complete list of nonbreeding species observed on HOIS in 2024 can be found in the Avian Use section, below.

Additional Monitoring and Management Responsibilities

In addition to the four primary monitoring objectives, staff performed other tasks as needed including sign maintenance and public outreach. To provide education about the island's closure and help discourage unauthorized boat landings, staff installed the following signage on Horseshoe Island (Appendix B.2).

- Multiple large format "No Landing" signs in the most heavily used landing zones (the southwestern corner and the northwestern corner of the main island).
- One large QR code sign on the western side of the island, which provided a link to the NJFW webpage about HOIS (https://dep.nj.gov/njfw/conservation/horseshoe-island/) It was designed to be large enough to scan from a passing boat, without landing.
- Small format signage along the entire perimeter of the island (with information regarding the island's closure, with the exception of the new southern most spit that grew throughout the season in 2024.

Signage was originally posted around the perimeter of the island on April 26, staff regularly repaired and replaced signposts throughout the season in response to tidal events and suspected vandalism and theft. All signage was removed from the island on September 27, so the island was signed for a full five months.

Public outreach was conducted primarily on weekend monitoring days and involved educating the public on the seasonal closure, if landings or near landings occurred. To record human activity on HOIS, staff documented all watercraft landings on HOIS and its surrounding areas by recording the number of people, boats, jet skis, and dogs present. Whenever possible, staff recorded watercraft registration numbers, descriptions of disturbance,

and notes about boater interactions, which are all maintained in a database. To supplement human use surveys taken during HOIS site visits, CWF staff conducted additional surveys during routine monitoring days at Little Beach Island when the west side of HOIS could be directly observed from Little Beach. Surveys from Little Beach were conducted during periods of low human activity (weekday mornings) and represented brief (approximately one hour) durations.

AVIAN USE

Breeding and migratory bird species were observed using the entirety of HOIS throughout the seasonal closure (Table 1). While breeding and migratory use of the island overlaps, the species groups vary. Breeding birds at HOIS were comprised of state-listed beach-nesting bird species: Piping Plover (federally threatened, state endangered), Black Skimmer (endangered), Least Tern (endangered), Common Tern (species of special concern), and American Oystercatcher (species of special concern). Royal Terns (stable) continued to nest at HOIS for the fourth documented year. Piping Plovers were observed nesting for the first time on HOIS in 2024. Prior to this year, Piping Plovers were noted regularly using the island as a foraging area and a migratory stopover but had not yet nested. Three pairs nested on the island this season. Of the pairs, two birds were known marked birds that had previously attempted nesting this year on Holgate. Additional marked migrant Piping Plovers were also noted using the island. Royal Terns typically limit breeding south of the Delmarva peninsula. They have been observed nesting before in New Jersey prior to the existence of HOIS, at Hereford Inlet (2008, 2009, 2015, 2016). Horseshoe Island is considered the northernmost colony of breeding Royal Terns in the Northern Hemisphere. Notable sized flocks of Red Knots (federally threatened, state endangered) were observed using HOIS to roost and forage on both their south- and north-bound migrations.

Table 1. All Avian Species Observed on HOIS

Species Common Name	Scientific Name	State Listing Status	Breeding on HOIS	Species Common Name	Scientific Name	State Listing Status	Breeding on HOIS
Surf Scoter	*Melanitta perspicillata*	-	N	American Herring Gull	*Larus smithsonianus*	S	N
Black Scoter	*Melanitta americana*	-	N	Great Black-backed Gull	*Larus marinus*	S	N
Red-breasted Merganser	*Mergus serrator*	-	N	Lesser Black-backed Gull	*Larus fuscus*	S	N
American Oystercatcher	*Haematopus palliatus*	SC	Y	Black Skimmer	*Rhynchops niger*	E	Y
Black-bellied Plover	*Pluvialis squatarola*	S	N	Least Tern	*Sterna antillarum*	E	Y
American Golden-Plover	*Pluvialis dominica*	S	N	Gull-billed Tern	*Gelochelidon milotica*	SC	N
Semipalmated Plover	*Charadrius semipalmatus*	S	N	Caspian Tern	*Hydroprogne caspia*	SC	N
Piping Plover*	*Charadrius melodus*	E	Y	Black Tern	*Chlidonias niger*	S	N
Whimbrel	*Numenius phaeopus*	S	N	Forster's Tern	*Sterna forsteri*	S	N
Marbled Godwit	*Limosa fedoa*	S	N	Common Tern	*Sterna hirundo*	SC	Y
Short-billed Dowitcher	*Limnodromus griseus*	S	N	Roseate Tern*	*Sterna dougallii*	E	N
Lesser Yellowlegs	*Tringa flavipes*	S	N	Sandwich Tern	*Thalasseus sandvicencis*	S	N
Willet	*Tringa semipalmata*	S	N	Royal Tern	*Thalasseus maximus*	S	Y
Greater Yellowlegs	*Tringa melanoleuca*	S	N	Double-crested Cormorant	*Nannopterum auritum*	S	N
Ruddy Turnstone	*Arenaria interpres*	SC	N	White Ibis	*Eudocimus albus*	-	N
Red Knot*	*Calidris canutus*	E	N	Snowy Egret	*Egretta thula*	SC	N
Sanderling	*Calidris alba*	SC	N	Great Egret	*Ardea alba*	S	N
Dunlin	*Calidris alpina*	S	N	Great Blue Heron	*Ardea herodias*	SC	N
White-rumped Sandpiper	*Calidris fuscicollis*	S	N	Brown Pelican	*Pelecanus occidentalis*	S	N
Least Sandpiper	*Calidris minutilla*	S	N	Osprey	*Pandion haliaetus*	S	N
Western Sandpiper	*Calidris mauri*	S	N	Bald Eagle	*Haliaeetus leucocephalus*	SC	N
Semipalmated Sandpiper	*Calidris pusilla*	SC	N	Peregrine Falcon	*Falco peregrinus*	T	N
Parasitic Jaeger	*Stercorarius parasiticus*	S	N	Tree Swallow	*Tachycineta bicolor*	S	N
Laughing Gull	*Leucophaeus atricilla*	S	N	Barn Swallow	*Hirundo rustica*	S	N
Ring-billed Gull	*Larus delawarensis*	S	N	Song Sparrow	*Melospiza melodia*	S	N

[1]Status Codes: E=Endangered, T= Threatened, SC = Special Concern, S = Stable, - = Not listed
* Federally listed species

Breeding Use

Piping Plovers nested on Horseshoe Island for the first time in 2024. Prior to this year, Piping Plovers were observed utilizing the island as a migratory stopover location and foraging location for nearby breeding birds (Holgate and Little Beach). Piping Plovers are known to "prospect" habitat in seasons leading up to a first nesting attempt at a new location. Three pairs of Piping Plovers attempted nesting on HOIS in 2024 and all

nests hatched. Territorial breeding activity was observed through much of the early-nesting season (April-May) and the first plover nest was found on June 5. Pair-nest success was high compared to the state-wide total (100% pair-nest success on HOIS, 55% pair-nest success state-wide). This was unsurprising considering the lack of mammalian predators on the island. Of the three pairs, one was found with chicks before a nest could be located. Unfortunately, no fledglings were confirmed, which *was* surprising considering the lack of mammalian predators, low rates of human disturbance, and what appears to be an abundance of foraging resources. In at least one of the brood losses, flooding was considered to be the leading cause of brood failure. Additional possibilities for chick loss may include avian predators (Peregrine Falcon, Great Horned Owl, various gull species) and close proximity to aggressive colonial nesting birds. With the continual decline in habitat suitability of nearby nesting sites like North Brigantine Natural Area, Little Beach, and Holgate (contained 54% of the state's population of Piping Plovers in 2024), the proximity of Horseshoe Island to these areas may present an opportunity for refuge for a high number of pairs in the state. Managers must continue to implement restrictions on human disturbance and address low fledgling rates in the future.

The first ***American Oystercatcher*** nest on the island was recorded April 9. By the end of the breeding season, a total of 16 pairs nested on HOIS. This was a 33% increase in pair number over 2023 (12 pairs). Pair distribution was widespread across the island, utilizing all habitat for breeding and brood rearing. The seasonal closure continued to deter human use of the western edge, and six Oystercatcher pairs utilized those areas for nesting, the same as 2023 and a 67% increase over 2022 (two pairs). Pair-nest success (the percentage of pairs that successfully hatch at least one nest) was considerably higher than the state-wide total (81% pair-nest success on Horseshoe, 38% pair-nest success for the state). Like Piping Plovers, the lack of mammalian predators on the island is the main cause for the noticeable difference between HOIS and other nesting locations in the state in terms of pair-nest success. Sites elsewhere in the state were plagued with predation issues (accounting for 56% of nest loss statewide). There were 24 nest attempts on the island by American Oystercatchers: 13 nests hatched and 11 failed (Figure 4). Of the failed nests, five were lost to flooding, one was lost to avian predation, and five nests were lost to undetermined causes. A total of 26 chicks hatched from 13 pairs. Of the hatched chicks, 24 reached fledge age resulting in a productivity rate of 1.50 fledglings/pair. The recommended goal set by the American Oystercatcher Working Group is 0.50 fledglings/pair. Horseshoe Island accounted for 23% of the statewide total of American Oystercatcher fledglings in 2024. The island remains crucial habitat for American Oystercatchers as lack of mammalian predators indicates higher rates of hatching and fledgling success.

Figure 4. Location and fate of 2024 Piping Plover and American Oystercatcher nests

Colonial nesting waterbirds are comprised of species that prefer nesting in large numbers with nests as close as one to two yards from each other. Nest specific data is not collected in the same manner for colonial nesting waterbirds as compared to territorial nesting birds (Piping Plovers and American Oystercatchers) due the high disturbance this type of survey entails for these species. Colonial nesters were first noted on the island on May 9 (Least Tern). As more colonial nesting waterbirds arrived, the colonies eventually encompassed the entirety of the island. For the purposes of monitoring, the island was split into six areas: HOIS 1, HOIS 2, HOIS 3, HOIS 4, HOIS 5, and HOIS 6. Multiple species were spread across all areas (Figure 4).

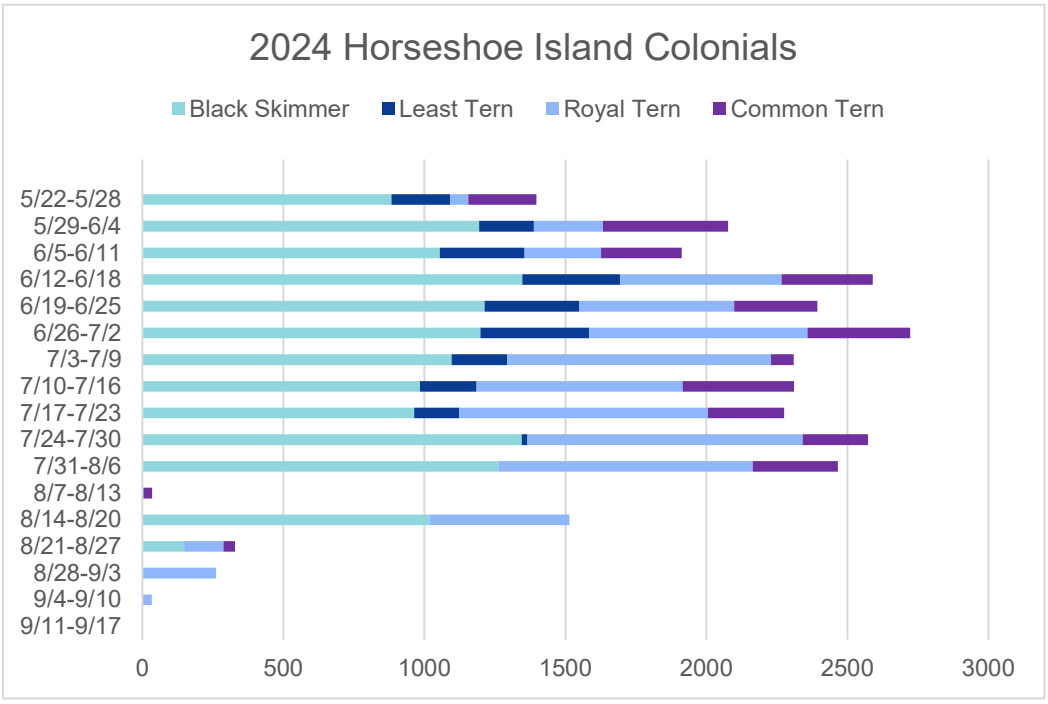

Figure 5. Total colonial species breeding adults, by week.

Black Skimmers nested at three colonies statewide with the largest colony located on HOIS. The colony at HOIS produced approximately 60% of the state's fledglings. Black Skimmers were first observed scouting the habitat on May 21. The colony grew to a peak count of 1,374 breeding adults with 625 incubating throughout the season (May – September). Black Skimmers settled into five sub-colonies across the island. All sub-colonies had high numbers of adults ranging from 250-500 adults during peak counts. HOIS 2 contained the highest proportion of adults and chicks. Flooding has been an issue for Black Skimmers in prior years at HOIS but that was not the case in 2024. Little to no predation was observed by monitors or on game cameras. All sub-colonies produced a total of 578 fledglings, marking this the most successful season for Black Skimmers at HOIS.

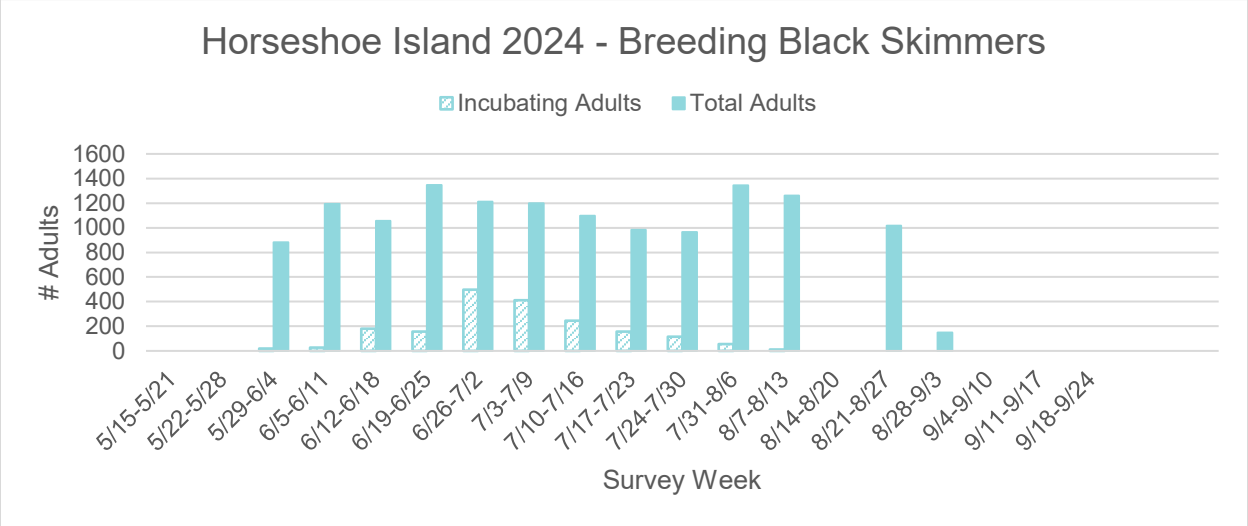

Figure 6. Total breeding Black Skimmer adults and adults incubating, by week.

Least Terns had a peak count of 330 total breeding adults with 260 incubating adults. In terms of habitat utilization, Least Terns were noted foraging and roosting across the entire island. Breeding Least Terns were congregated on HOIS 4 and HOIS 6. Colonial chicks are counted at three separate stages of development – downy, feathered and fledged. Through the season, low numbers of all three stages were observed which indicates there was a potential issue with predation for both eggs and young chicks in the Least Tern colony. Flooding did not seem to be a persistent issue this year. Low fledgling counts were observed (3 total fledglings). It remains to be seen why other colonial nesters on Horseshoe are finding success but Least Terns cannot. Prior seasons (2021, 2022, and 2023) have all produced low productivity and nest success. It should be noted that with the continued increase of other colonial nesting species to the island, it is possible that Least Terns and their diminutive size are unable to compete for prime habitat and are being pushed to less desirable locations on the island. Additional theories include that avian predators (Peregrine Falcons, Great Horned Owls) could be impacting the colony and remain undetected by monitors and game cameras. A Peregrine Falcon was observed hunting Common Tern chicks but there was no direct evidence to support it caused the failure of the substantial Least Tern colony. Future seasons should focus increased efforts on game camera use within the Least Tern colony to discern the causes of failure and address them as is possible.

Figure 7. Total breeding Least Tern adults and adults incubating, by week.

Royal Terns nested successfully on HOIS for the fourth consecutive breeding season. Northeastern Royal Terns breed along coastal Virginia south to Florida, with an irregular colony forming in southeastern Maryland (Buckley et al. 2021). Although they have been recorded previously nesting in New Jersey (2008, 2009, 2015, 2016), this unusual colony highlights the ecological importance of HOIS. Royal Tern habitat, as described in Birds of The World, "is barren sandy barrier beaches…typified by inaccessibility, high visibility, the absence of mammalian predators, and surrounded by shallow waters near the mouth of bays" (Buckley et al. 2021). The island offers all the requirements of ideal Royal Tern habitat. The first occurrence of Royal Terns was noted on May 24. Between 25-30 Royal Tern nests were located within HOIS 4 on May 29. The main Royal Tern colony formed between HOIS 3 and HOIS 4. A peak count of 935 breeding adults were recorded on the island with 433 incubating nests. This was similar to 2023 counts (1,178 breeding adults with 404 incubating). Chick rearing was mainly concentrated to HOIS 3 located on the northern arm of the island. As the season progressed and chicks continued to grow, activity of the colony shifted west towards HOIS 2, the area most vulnerable to human disturbance. Increased monitoring and enforcement efforts have curbed human disturbance in these areas allowing full use of the island for birds. A total of 317 Royal Tern fledglings were produced. Compared to 2023 productivity (65 fledglings produced), this is a nearly 400% increase in fledglings. Prior seasons were highly impacted by flooding. While some flooding was noted throughout the season, 2024 was considered to be successful in terms of nest and chick success for Royal Terns at HOIS. In addition to breeding birds, HOIS offered refuge to many migrant and staging flocks of Royal Terns from mid-July through September. Several migrant and breeding Royal Terns were marked adults banded in Virginia between 2018 and 2019. New Jersey launched a Royal Tern mark-recapture project in 2024 at Horseshoe Island (more information in "Banding" section).

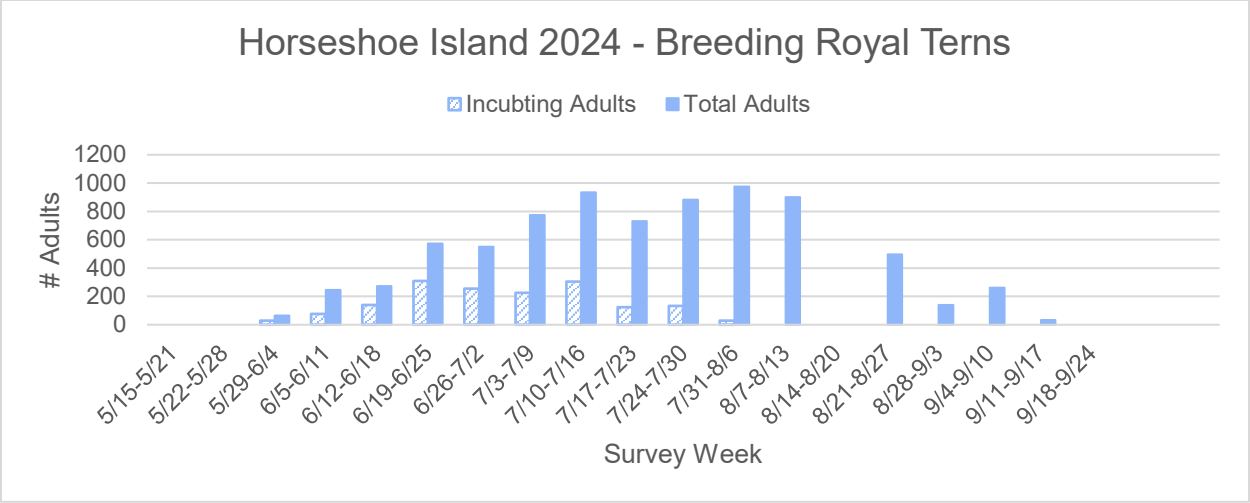

Figure 8. Total breeding Royal Tern adults and adults incubating, by week.

Common Terns had a high count of 444 total breeding adults with 250 incubating adults. The birds were spread across four of the six sub-colonies that formed but were most densely concentrated on HOIS 2 and HOIS 3. Approximately 144 chicks fledged from HOIS. Productivity for Common Terns is not monitored statewide (they nest on beaches and in the marsh) so it is difficult to put into perspective the site's overall contribution to regional success. However, there was an aerial survey this year so state-wide numbers of adult Common Terns are available. Between the marsh islands and other beach sites, there were ~2,640 adults tallied in late May throughout the state, meaning HOIS accounted for about 17% of the state's documented population. On one visit to the island, a Peregrine Falcon was observed taking chicks from the Common Tern colony at HOIS 2. It did not appear that this was a persistent problem for Common Terns or any of the other larger colonial waterbirds (Royal Terns, Black Skimmers). Considering prior seasons where flooding was a persistent issue, 2024 was largely a success for this species on the island.

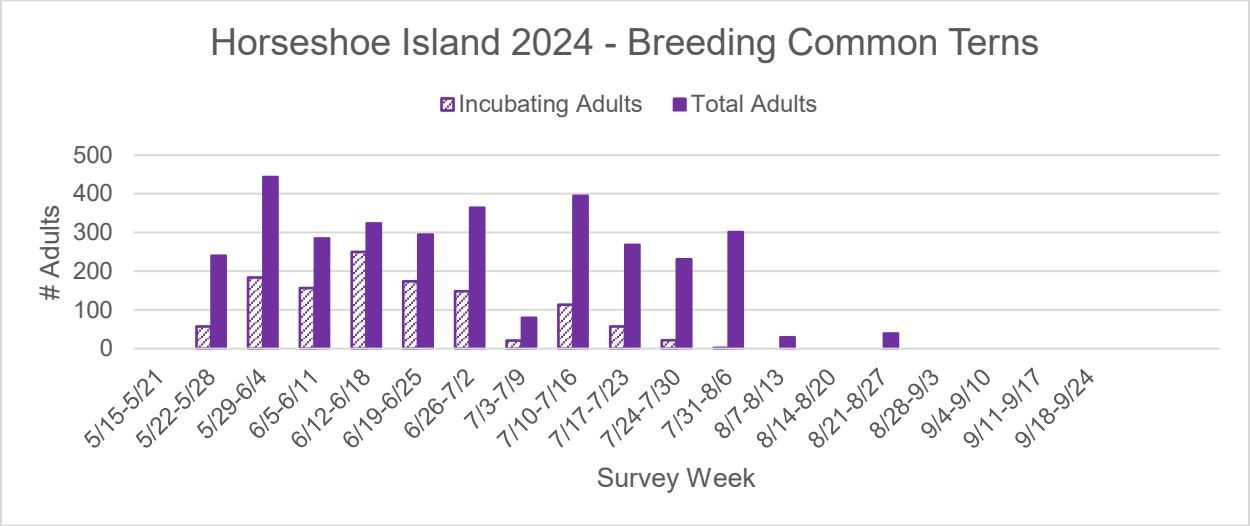

Figure 9. Total breeding Common Tern adults and adults incubating, by week.

Migratory Use

Horseshoe Island was used as a migratory stopover site by a variety of shorebirds and other avian species along coastal New Jersey (see Table 1 for full species list). Several shorebird and waterbird species were noted on the island throughout the season which further highlights the island's importance as a disturbance-free refuge for otherwise constantly disturbed bird species. Migrants regularly used the entirety of the island but were particularly attracted to the lagoon areas and the intertidal waters surrounding the island for foraging (Figure 10). Roosting migrant flocks were widespread across the island. Weekly shorebird surveys were conducted by monitoring crews. While the island was used by a diverse group of bird species, this report section will focus on species with priority listing status and/or notable use of the island: Red Knots (federally threatened, state endangered), Piping Plover (federally threatened, state endangered), Roseate Tern (federally endangered, state endangered) and Brown Pelican (stable).

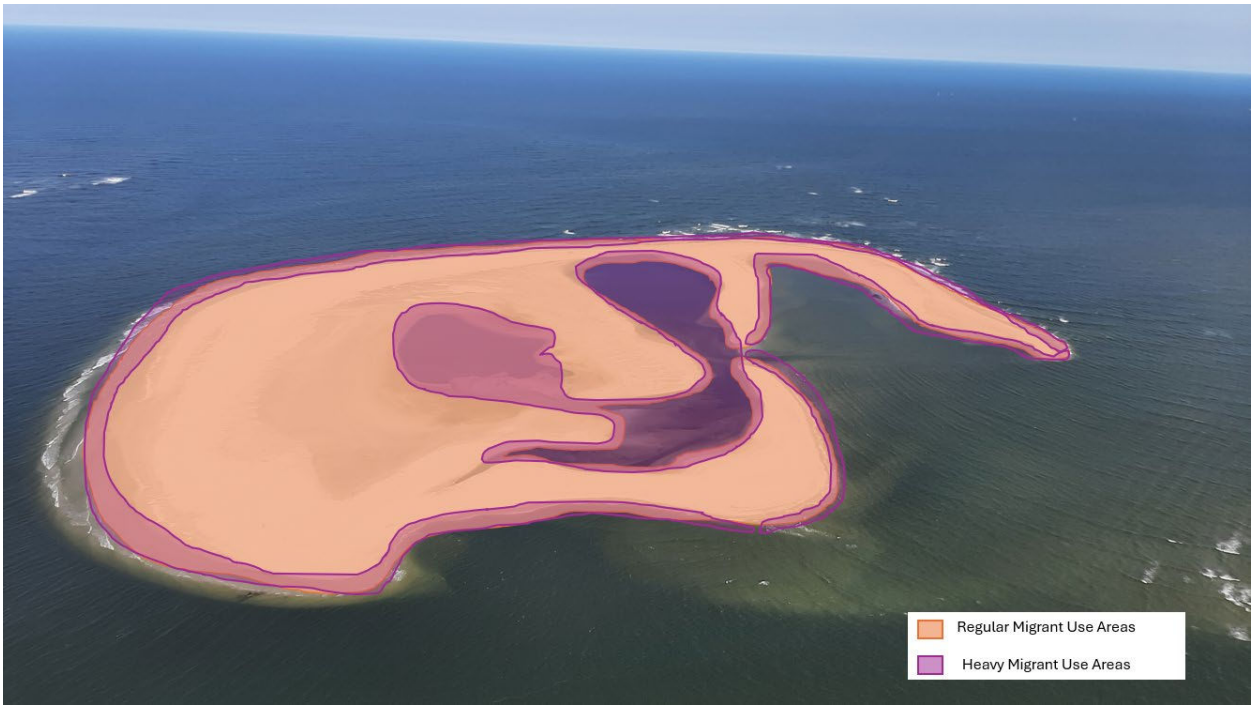

Figure 10. Use of HOIS by migratory species

Red Knot occurrence was prioritized during each visit to the island in addition to weekly shorebird surveys. Eleven surveys included Red Knot sightings with counts ranging from 1 individual to over 400. The site hosted a large flock of knots (405) on August 11, which was the peak count for the 2024 season. Since regular surveys of the island began in 2021, Red Knot use has been monitored and typically peaks during the end of July/beginning of August.

Previously collected geo-locator data from Red Knots indicate that many birds depart the US on long migratory flights over the ocean during their southbound migration (USFWS, 2021*)*. Some make additional stops along the way while others complete their migration uninterrupted to wintering grounds in South America. From 2020-2023, there were 295 *rufa* Red Knots outfitted with GPS/satellite tags across their, resulting in tens of thousands of data points (Perkins 2024). Of these, there were 28 birds, or 9.5% of all tagged birds, recorded on or immediately adjacent to HOIS (W.Walsh, personal communication, January 6, 2025). This data played a role

in expanding the USFWS proposed Critical Habitat designation for HOIS and the surrounding shoals. The proximity of HOIS to these other protected areas increases the island's value for migrating knots by allowing birds to shift among habitats based on food, predators, disturbance, weather, tides, and other conditions.

Piping Plovers were regularly observed on the island throughout the migratory seasons (spring and fall). While the island now hosts breeding Piping Plovers, migrant use of the island continues to remain critical for this species. Piping Plovers typically begin fall migration in early July, when many NJ beaches are still crowded. It is suspected that spring migrants also use the island on a regular basis, however regular monitoring of the island is not available until mid-April so little data exists for March through mid-April. Marked adults were regularly noted on the island and known breeding birds from Holgate were observed utilizing the island for foraging. At least four marked adults were observed foraging on the island throughout fall migration. Many unmarked adults were also noted using the island indicating that this site is of relative importance to migrating Piping Plovers. To wit, a high count of 33 adults was observed on August 1. This is the highest documented use of HOIS by migrant Piping Plovers since monitoring began in 2021.

Roseate Terns were observed twice this season as migrants using HOIS as a stopover site. The North Atlantic population of Roseate Tern is listed as federally endangered, largely due to habitat loss. The high numbers of all tern species using HOIS demonstrates the importance of the island as a stopover for migratory species that are threatened and endangered. Roseate Terns nested on New Jersey beaches prior to 1980 and were ultimately extirpated as a breeding bird in the state due to habitat loss.

Brown Pelicans were regularly observed roosting on HOIS in 2024. Brown Pelicans are a regular occurrence during the summer months in New Jersey, but large roosting flocks are uncommon. The high count of Brown Pelicans on HOIS in 2024 was 203 adults and juveniles on August 25. Few records at or above 150 individuals exist in eBird records for New Jersey, further highlighting the importance of HOIS for Brown Pelicans. Use of the island by pelicans was mostly spread across the eastern berm. The intertidal waters surrounding the island, which provided excellent foraging opportunities, were heavily used by this species.

Banding Projects

In 2024, New Jersey Fish and Wildlife expanded a mark-recapture program focused on Horseshoe Island. For a number of years, the state has targeted Piping Plovers, Black Skimmers, and American Oystercatchers for various marking projects looking at demographics, survivorship, behavioral observations, and other characteristics to better inform conservation and management strategies of these species.

Piping Plovers are marked using four color bands placed on the upper portion of the bird's legs. Piping Plovers in New Jersey are marked on a situational basis. Little Egg Inlet (Holgate, Little Beach, Horseshoe Island, North Brigantine Natural Area) offers the largest stretch of undisturbed coastline and is considered to be the most critical habitat complex in the state for this species. Holgate currently hosts 54% of the state's nesting population. A portion of the birds nesting at this site are banded from a previous research study in New Jersey that ended in 2019. Through that marking project, we know that at least two adults that nested on Horseshoe this season attempted nesting at Holgate and failed before moving to Horseshoe. The remaining birds were unmarked so it is unknown whether or not they attempted and failed at other sites in the state. Of the remaining 4 unmarked adults that nested on the island, 2 were marked in 2024 to better inform future movements of this species within this critical habitat complex.

American Oystercatchers have been widely marked in the state across all nesting sites. When comparing weights of chicks banded over a five-year period, it appeared that chicks from sites with more human disturbance were counterintuitively heavier than chicks from sites with little to no disturbance. Other studies looking at breeding shorebirds in New Jersey (specifically Piping Plover), indicated the opposite. Managers questioned what this could mean in terms of the way in which they manage this species in the state. In 2024, data was collected from all nesting sites that hatched American Oystercatcher chicks by recording one-hour behavioral observations, including rate at which chicks were provisioned and if they were able to feed themselves/had access to alternative foraging. Two chicks were marked at Horseshoe Island this year and chick observations were conducted to contribute to the statewide research project. Results from this study are not yet available.

Black Skimmers were first banded at Horseshoe Island in 2023 and this continued in 2024 when 42 juveniles were marked. NJFW and The Wetlands Institute (TWI) have been collecting mark-recapture data on Black Skimmers at known nesting colonies in the state since 2016. Adults have also been tagged with satellite transmitters that show movements between colonies and inform previous data gaps concerning forage distances in the state. In addition to informing statewide knowledge of Black Skimmers, NJFW and TWI collected fecal samples in 2024 for a range-wide diet study. This study is being conducted on a regional level to look at forage fish distribution across the Atlantic coast. Results from this study are not yet available.

Royal Terns were banded for the first time in New Jersey at HOIS in 2024 (~40 juveniles were banded in this pilot year effort). Marked breeding adults have been well documented within the breeding colony. Approximately 200 unique individuals were recorded associated with the colony in 2023 by monitors. The majority of these birds were tagged by the state of Virginia and Virginia Tech associated with their project to create natural and artificial nesting habitat to offset the destruction of a large breeding site due to a construction project. Additionally, regular flocks of migrant Royal Terns are recorded throughout the state each year. This marking project looks to study juvenile dispersal and survivorship of Royal Terns from the colony at Horseshoe Island. At the time of this publication (early 2025), several marked bids have already been resighted at sites in New Jersey (Belmar and North Wildwood), in Delaware, and in Florida. Additional information on marked individuals within the Horseshoe Island colony will be made available in the future, as it becomes available.

HUMAN DISTURBANCE

Compared to many beach-nesting bird sites in the state, human disturbance at HOIS is relatively low as access is only by boat. Nevertheless, there is a high degree of risk associated with any human disturbance because of the large concentration of breeding birds present on the island (see Avian Use, above). A seasonal closure to all types of human disturbance is the primary means by which this threat was reduced at HOIS. ENSP and CWF staff work to help the public understand the purpose of the closure through site signage (including the QR sign that links to the NJFW HOIS webpage) and direct outreach. They informed the public about the stipulations of the MRA. However, they were not able to take any enforcement actions in a scenario where a member of the public refused to leave the site during the time periods of the closure (and thus their presence disturbed birds and/or resulted in habitat avoidance). This was an on-going issue in 2022 and an area that was recommended for improvement in the 2022 HOIS report.

In winter 2023, ENSP worked with their colleagues in the NJ DEP Fish and Wildlife Bureau of Law Enforcement to make plans for routine patrols and response patrols by Conservation Police Officers (CPOs) for

the 2023 field season. Protocol for response patrols was that the field crew would make initial contact with the boater, informing them of the closure and MRA. If the boater refused to leave after outreach attempts were made, the field crew would call the CPOs via the 1-877-WARN-DEP hotline. While most boaters complied after the outreach attempts, a small but significant portion deliberately disregarded the island's closure by landing and refusing to leave. This protocol was successful in 2023 and continued in 2024. CPOs were contacted three times by staff during the monitoring period and officers responded on each occasion, but the boaters left before they arrived (response times were less than one hour). Over the course of the 2024 season, CPOs conducted boat patrols and made vessel stops, which resulted in ~50 public contacts. The addition of the CPOs to the management of the island has made a dramatic difference in the amount of documented human disturbance for 2023 and 204 (with law enforcement support) compared to 2022 (before law enforcement support) (Figure 11).

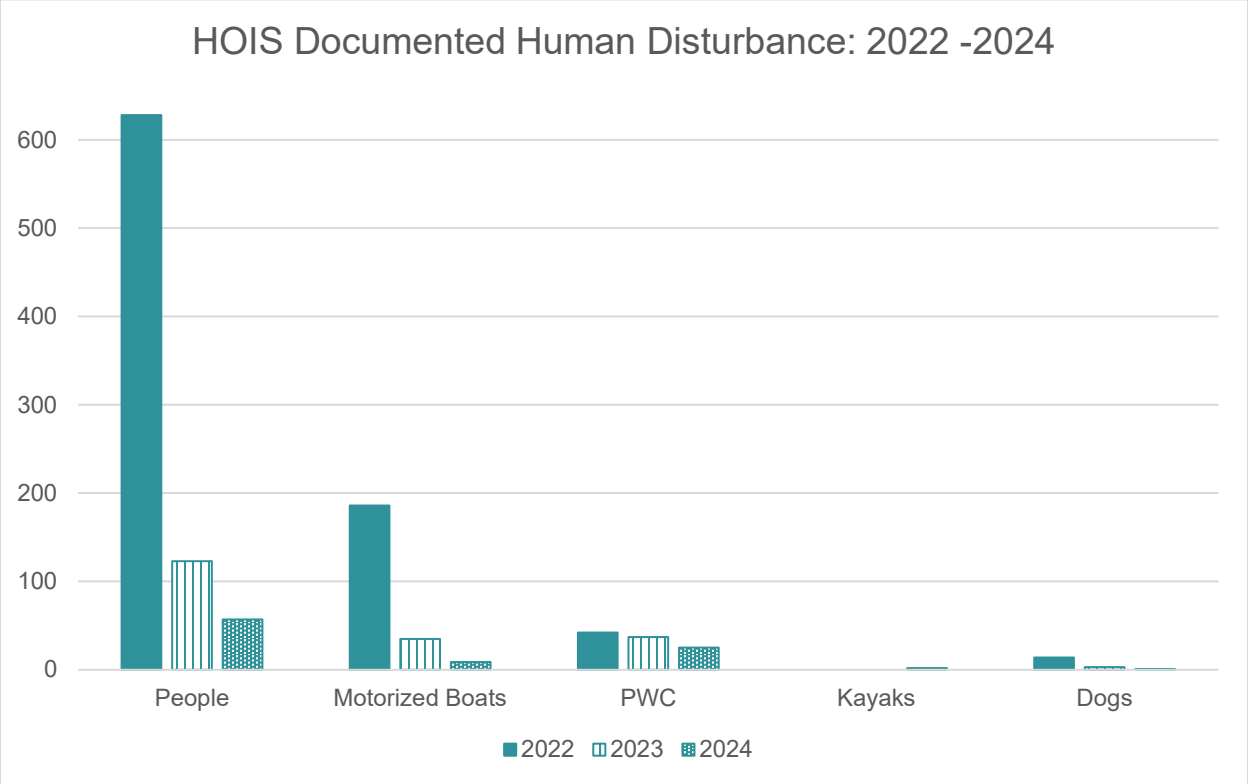

Figure 11. Documented human disturbance on HOIS: 2022-2024

Watercraft landings on HOIS in 2024 were recorded on 13, or 19%, of site visits. This is a decrease from 2023 when watercraft landings were recorded on 24, or 35%, of site visits and 2022, when recorded on 33, or 46%, of site visits. As expected, human activity increased as the spring gave way to summer and was higher on weekends/holidays, which represented 8 (62%) of days with recorded landings (although this rate was lower than in the past; that is, more weekday usage as percent of total use).

Although monitoring began in April, the first recorded public boat landing did not occur until June 1, notably the weekend *after* Memorial Day (i.e. there were no recorded landings during Memorial Day Weekend). The number of landings continued in the following months but there was never a peak period of site use, as has been

recorded in the past. Most landings or attempted landings (those intercepted by staff) consisted of a single motorized boat and/or personal watercraft (PWC). PWC had an additional impact; while not all landed, they would circle the island and zip into the lagoons, flushing birds. The first landings/attempted landings by kayak were also recorded in 2024.

The western side of HOIS is typically more susceptible to boat landings since it is more sheltered from wave action. As a result, human activity was particularly disturbing to brooding plovers, oystercatchers, and colonial birds located near these areas. However, this is also where staff are stationed on days when present and were able to intercede before landing occurred. As a result, many boats now land at Little Beach (part of the Refuge), which is closed year-round to the public. ENSP and CWF staff documented 66 watercraft landings on Little Beach in 2024, down from 111 in 2023 but still up from 27 in 2022. Additional signage, as well as outreach and federal enforcement, will likely be necessary to deter watercraft landings on Little Beach.

Overall, the signage continued to be successful in influencing many boaters' behavior. Enforcement of the closure by law enforcement officials in this, and prior, years is also likely playing a role in the reduction of boat landings. The argument from boaters was that they were exempt from restrictions while below the mean high tide line continued in 2024 (please note that HOIS's intertidal zone is specifically included under the MRA and is permitted to be closed to reduce disturbance to nesting and foraging birds). In 2024, there also appeared to be a small, but consistent, group of boaters that would verbally harass staff and make profane gestures at them, stating that they were going to fight to get control of the island. It remains to be seen what this will involve, as no NJFW or Refuge official channels have been contacted regarding these statements.

When signage and outreach did not work, the ability to call CPOs continued to provide a number of benefits. First, their uniformed appearance again led to the public better respecting the legitimacy of the closure and allowed them to achieve the desired outcome (boater leaving the site). Second, their presence very likely helped to continue to drive the reduction in overall site use by people, as it was now evident to the public that patrols were occurring and that landing at the site would not be permitted (another factor is that it was the third year of the closure and compliance can also naturally improve in restricted areas as the public becomes more aware). Finally, it provided an important support system for field staff, who now had a protocol in place for when public interactions turned abusive. Their aid this season was once again invaluable and should continue in future years, as resources allow.

RECOMMENDATIONS

- Continue to conduct outreach on the island to educate members of the public about the use of the site by nesting and migrating birds and to convey details of the seasonal closure.
- Continue to conduct outreach off-island through traditional media (newspapers, magazines) and social media. This could include targeted posts with nesting updates and creating additional videos to share with the public.
- Continue law enforcement presence on the site and regular patrols to reinforce the seasonal closure.
- Increase biological monitoring for a minimum of 4x/week. This includes both breeding and non-breeding/migratory species, which both rely on the island.
- Maintain signage on site to ensure there is island-wide coverage to inform the public of the closure, especially as the perimeter changes throughout the course of the season (due to natural processes exerted on a dynamic island).

- Investigate the feasibility of monitoring the island year-round to provide data on the importance of the site to wintering birds. This could include in-person visits as well as mining spatial data that is collected via GPS tags on a myriad of species.
- Continue to expand the banding and resighting program for all species on site to better understand population demographics of each species.
- If the Shore Protection Rule is adopted, work with the Tidelands Resource Council to incorporate the additional habitat protections the regulation will provide.
- Consider sediment management to keep HOIS as an island and prevent it from attaching to Little Beach (where mammalian predators and law enforcement will be more of an issue).

CONCLUSION

The third year of management under the MRA built on the successes of the first two years and made strides towards additional improvements. The island once again attracted a wide variety of species, including many listed species, who used the site for migrating, roosting, and/or nesting (especially notable was the addition of Piping Plover to the breeding suite of species). The island continued to grow in size, which increased challenges for its protection, but also increased the amount of space available to avian species. An increase in highly suitable habitat for coastal species is extremely rare in New Jersey and one that species managers worked hard to take advantage of, by increasing signage, site visits, and outreach to the public. Staff presence on the island greatly contributed to the effectiveness of the closure and that was only made stronger by the ability to call in CPOs as needed.

The quality of the biological data collected in 2024 continued to meet a high standard. This allowed biologists to document the avian use of the island in a comprehensive manner and to highlight its immense value to these species. HOIS has solidified its position as one of the, if not the, most significant sites for avian species in the state, particularly in the coastal landscape. Species managers continue to manage the site with the knowledge that while its lifespan is unknown, every year it is present and suitable will be highly beneficial for the species that have now come to rely on it for foraging, migratory stopovers, and breeding. Continued and improved protections are critical for as many years as the island persists.

LITERATURE CITED

Buckley, P. A., Buckley, F. G., and Mlodinow S. G. 2021. Royal Tern (*Thalasseus maximus*), version 1.1. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.royter1.01.1

Davis, C., E. Heiser. 2024. 2024 New Jersey Beach-Nesting Bird Project Report. New Jersey Department of Environmental Protection, Fish and Wildlife, Trenton, NJ.

New Jersey Department of Environmental Protection. 2018. New Jersey's State Wildlife Action Plan. New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Trenton, NJ.

Perkins, G. 2024. Migratory Bird Satellite Tracking Synthesis: Using cutting edge data to advance understanding of Red Knot migration and breeding patterns. Ninox Consulting Ltd. report prepared for Environment and Climate Change Canada and the U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service. 2021. Rufa Red Knot Habitat Methods. Galloway, New Jersey. 12pp.

Appendix A. Photographs
A.1. Examples of bird activity

Top to bottom: Royal Terns and Black Skimmers utilizing undisturbed shoreline of HOIS, first plover nest located on HOIS. Photo credit of colonial pictures: Teri Bowers

Top to bottom: Inaugural Royal Tern Banding (photo credit: Meredith Wray), examples of the way eggs are laid directly on the sand, making them very susceptible to human disturbance.

A.2. Examples of signage

Photo credits: NJFW