National Park Service
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Shorebird Monitoring and Management at Cape Hatteras National Seashore

2018 Annual Report



ON THE COVER
Least tern chicks at Cape Hatteras National Seashore.
Photography by NPS

Shorebird Monitoring and Management at Cape Hatteras National Seashore

2018 Annual Report

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Executive Summary

Cape Hatteras National Seashore (Seashore), located on the Outer Banks of North Carolina from Nags Head, NC, to Ocracoke Inlet, contains many ecologically important habitats such as marshes, tidal flats, and riparian areas that support a variety of shorebirds, including threatened species and species of special concern. Piping plovers (*Charadrius melodus*), American oystercatchers (*Haematopus palliatus*), colonial waterbirds, and Wilson's plovers (*Charadrius wilsonia*) are monitored and managed at the Seashore to promote successful reproduction and to protect their habitat. Shorebird monitoring and management is conducted in compliance with the Cape Hatteras National Seashore Off-Road Vehicle Management Plan, as amended by the Review and Adjustment of Wildlife Protection Buffers Environmental Assessment (NPS 2010a, 2010b, 2015a, 2015b).

Piping Plovers

In 2018, there were three pairs of piping plovers and three nests identified. The first nest was found on April 25, 2018 and the last active brood was documented as fledged on July 7, 2018. All three nests hatched and produced a total of 11 chicks. Three chicks successfully fledged from two broods, resulting in a fledge rate of 1.0 chicks/breeding pair; the highest rate since 2010. Chick loss was attributed to predation by ghost crab or unknown reasons. Since 1997, fledge rates have ranged from 0.0 to 2.0 chicks/pair at the Seashore. The mean fledge rate from 1997 to 2018 is 0.67 chicks/pair.

American Oystercatchers

Twenty-five pairs of American oystercatchers nested at the Seashore in 2018. A total of 40 nests were identified, which includes re-nests from failed nest attempts. The first nest was found on April 17, 2018 and the last chick was fledged on August 21, 2018. Eighteen of the 40 nests hatched and produced a total of 34 chicks. Twelve pairs of American oystercatchers were successful in fledging 20 chicks, which is 0.8 fledged chicks/pair; this is the highest fledge rate since 2011. Since 2001, fledge rates have ranged from 0.08 to 1.3 chicks/pair at the Seashore with a mean fledge rate of 0.61 chicks/pair from 2012 to 2018.

Colonial Waterbirds

Fifteen colonies were identified at the Seashore in 2018: nine on Hatteras Island, one on Green Island, and five on Ocracoke Island. Least terns nested in fourteen of the colonies. Four colonies hosted multiple species. Observations from peak nest surveys produced a total of 475 least tern nests with 15 chicks, 72 common tern nests with 12 chicks, 50 gull-billed tern nests in two colonies on Oracoke Island with 10 chicks, 368 black skimmer nests with 116 chicks. Productivity in colonial waterbird colonies is very difficult to determine. Of the 15 documented colonies, colonial waterbird fledges or juveniles were observed in 12 of them, but it is undetermined if these fledges were from the monitored colonies or passing through from other areas. Twelve colonies contained least tern fledges while black skimmer fledges were observed on Cape Point and Ocracoke's South Point, totaling about 300 fledges.

Wilson's Plover

In 2018, no Wilson's plover nesting activity was documented at the Seashore.

Human Disturbance

Throughout the 2018 season, resource management staff documented 429 pedestrian, 21 off-road vehicle (ORV), and 52 dog, boat or horse intrusions in protected areas including all prenesting areas and wildlife protection buffers. These numbers are conservative since sites are not monitored continuously, weather erases tracks, and staff does not disturb incubating pairs or young in order to document disturbance. It is important to note that most of the resource protection areas contained multiple bird species, including oystercatchers, colonial waterbirds, and piping plovers.

Most human violations in resource protection areas were not witnessed, but were documented based on vehicle, pedestrian, or dog tracks left in the sand. Pedestrian entry most often required visitors to lift or stoop under the string that connected all posted signs, while vehicular entry required visitors to drive through or around a sign boundary. Visitors' unleashed dogs are also a threat to protected species and continue to be an issue of significant concern. Human activity was not identified as a cause of any of the nesting loss in any of the nests observed on the Seashore in 2018 and it cannot be determined if the intrusions had a disturbance effect on the monitored bird species.

Predator Observations

Depredation by mammals, birds, and ghost crabs have affected the success of many nests and broods over the years at the Seashore. During the 2018 breeding season, the United States Department of Agriculture's (USDA) Wildlife Services entered into an Interagency Agreement with The Department of Interior's National Park Service (NPS) to provide for the removal of mammalian predators on Cape Hatteras National Seashore. The Seashore determined that the predators of greatest concern were coyotes (*Canis latrans*) on Bodie Island, red fox (*Vulpes vulpes*) and raccoon (*Procyan lotor*) at Cape Point, and raccoon, feral cat, and mink (*Neovison vison*) on Ocracoke Island.

USDA Wildlife Services employees conducted 15 nights of trapping on Bodie Island and Hatteras Island from May 9 through May 24, 2018. Traps were set on Ocracoke Island on May 10 and removed on May 17. Predator exclosures were built by Seashore staff and placed around piping plover nests to reduce predator pressure.

Field staff documented any natural signs (e.g., track or scat) of predators as they walked through the protected areas during surveys to determine if predator pressure may have affected the status of a particular nest or brood. Mammalian depredation events can be difficult to assess as there are rarely remains that would indicate the type of predator. The constantly shifting sands driven by wind often obliterate tracks, and when tracks are present, soft sands can make determining species problematic. Avian depredation is also difficult to detect due to minimal physical signs. Ghost crab depredation was responsible for some of the 8 lost piping plover chicks. Twenty of the 40 American oystercatcher nests lost were depredated (one by an unknown canid, one by fox, two by feral cat, three by coyote, two by raccoon, one by avian, and ten by unknown predators). Ten of the 15 waterbird colonies had predator interactions including from gulls, fox, ghost crabs, raccoons, coyotes.

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Introduction

Cape Hatteras National Seashore (Seashore) was established to preserve significant segments of unspoiled barrier islands along the Outer Banks of North Carolina from Nags Head, NC, to Ocracoke Inlet. The Seashore's 67-mile long series of dynamic barrier islands face the Atlantic Ocean on the east side and the Pamlico sound on the west side. The Seashore contains ecologically important ecosystems, such as marshes, tidal flats, and riparian areas including habitats for the piping plover (*Charadrius melodus*), a species federally listed as threatened. Habitats also support the gull-billed tern (*Gelochelidon nilotica*), a species listed as threatened by the North Carolina Wildlife Resources Commission (NCWRC), and NCWRC special concern species, including American oystercatchers (*Haematopus palliatus*), Wilson's plovers (*Charadrius wilsonia*) and colonial waterbirds (least terns [*Sternula antillarum*], common terns [*Sterna hirundo*], and black skimmers [*Rynchops niger*]). The Seashore is designated a Globally Important Bird Area (Audubon 2017), a designation that recognizes areas with populations and habitats important at the global level.

With over two million visitors each year, the Seashore is a popular recreation destination, and visitors participate in a variety of activities including beach recreation, fishing, hiking, hunting, boating, nature study, photography, wildlife viewing, and off-road vehicle (ORV) use on beaches. Shorebirds, both breeding and nonbreeding, are affected by human disturbances, habitat loss, and predation. Human disturbance, direct or indirect, may lead to the abandonment of nests or loss of chicks. Depredation by mammals, birds, and ghost crabs have affected the success of many nests and broods over the years at the Seashore as well. The Seashore monitors and manages shorebirds and their habitat to meet conservation goals, including promoting successful reproduction. Shorebird nesting and foraging areas are protected with closures and buffers and ORVs are regulated on the Seashore

Resource Protection Areas

Resource protection areas include prenesting closures and wildlife protection buffers. Prenesting closures protect known potential shorebird breeding habitat from human activity and are established prior to breeding activity where nesting has occurred more than once in the past five years. These areas are temporarily closed to public entry during the nesting season. Prenesting closures provide a disturbance-free area for birds to establish territories and nest in their preferred habitat. Buffers are set up using



Cape Hatteras Beach at Cape Hatteras National Seashore. NPS

barriers during the brood rearing phase around nesting and foraging areas to protect birds from direct and indirect human sources of mortality including human recreation and ORV use. Between breeding seasons, there are resource closures to protect migrating and wintering piping plovers on the Seashore.

Cape Hatteras National Seashore Off-Road Vehicle Management Plan

The ORV Management Plan protects resources, minimizes conflict among users, and promotes visitor safety. The ORV Management Plan includes establishment of areas temporarily closed to public entry (such as pre-nesting closures and wildlife protection buffers required for nesting shorebird adults and chicks) and requires that ORVs have a permit to drive on Seashore beaches (NPS 2010a, 2010b). The ORV Management Plan was developed from 2007 to 2010 and was accompanied by a special regulation detailing requirements for ORV use at the Seashore. Copies of the ORV Management Plan and related documents are available at http://parkplanning.nps.gov/caha.

The National Defense Authorization Act of 2014 directed the Seashore to conduct a review of established wildlife protection buffers and modify them, based on peer-reviewed science, to the shortest duration possible and the smallest area possible. The Seashore made a decision to implement modified wildlife buffers (NPS 2015a, 2015b) in June of 2015 and those buffers were partially implemented in 2015 and fully implemented in 2016.



Off-road vehicles (ORVs) at Cape Hatteras National Seashore. NPS

Piping Plover Management and Monitoring

Background

Piping plovers (*Charadrius melodus*) are small shorebirds that prefer to nest in wide, flat, sandy beaches with very little vegetation. They typically lay three to four eggs in a shallow scrape in the sand. Upon completion of the clutch, the pair incubates the nest for 27 to 30 days (Cairns 1982). Within hours of hatching, chicks are able to move about and feed on their own (Cairns 1982). The Atlantic population was listed as threatened under the Endangered Species Act in 1986 (USFWS 1985). Monitoring focuses on locating and protecting breeding territories to aid in determining nest and brood success.

The Seashore manages and monitors piping plovers following the Piping Plover Management at Cape Hatteras National Seashore Standard Operating Procedures (PIPL SOP; NPS 2014b) and the Cape Hatteras National Seashore Off-Road Vehicle Management Plan, as amended by the Review and Adjustment of Wildlife Protection Buffers Environmental Assessment (NPS 2010a, 2010b, 2015a, 2015b).

Management

Prenesting Closures

In 2018, Seashore staff evaluated all potential breeding habitat for piping plovers and recommended prenesting closures by March 1. Areas of suitable habitat that have had individual piping plover nests in more than one of the past five years and new habitat that was particularly suitable for shorebird nesting (such as the habitat at new inlets or overwash areas) were posted as prenesting closures using symbolic fencing (string between posts) or with other closure signs by March 15 (NPS 2010a, 2010b, 2015a, 2015b).

Breeding Piping Plovers

Wildlife protection buffers extend 50 m around nests or breeding behavior (i.e., scraping, territorial, courtship, or mating). The 2015 modification to the off-road vehicle (ORV) management plan reduced the wildlife buffers when unfledged chicks were present; buffers were reduced from 1000 m to 200–500 m in ORV areas based on extensive monitoring, and from 300 m down to 100 m in vehicle-free areas (NPS 2010a, 2010b, 2015a, 2015b).



Piping plover standing in an off-road vehicle (ORV) track at Cape Hatteras National Seashore. NPS

Predator exclosures, which have been used at the Seashore since 1994 to reduce predator pressure on piping plover nests and nesting adults, were constructed around nests when clutches reached three or more eggs. The circular exclosures (approximately 10 ft in diameter), consist of 2 x 4-in welded wire fence, anchored by steel rebar and topped with a 3/4-in mesh netting to dissuade avian predators. Exclosures were installed following the guidelines established in the U.S. Fish & Wildlife Service Piping Plover Recovery Plan (USFWS 1996, Appendix F). Thereafter, the nests were briefly approached once weekly to inspect the exclosure, verify the number of eggs, and check for signs of predators (PIPL SOP; NPS 2014b).



Piping plover eggs at Cape Hatteras National Seashore. NPS

During daily observations, field technicians documented foraging locations for piping plover chicks. Since chicks were not observed continuously from dawn to dusk or during the night, actual territories may be larger than recorded. On occasions where chicks were lost soon after hatching, foraging territory outside the immediate vicinity of the nest could not be determined due to lack of direct observations. At Cape Point, an established grid system at the historical breeding territories (with points located 75 m apart) was utilized by staff to obtain accurate locations for chicks. When chicks were observed, their locations were recorded relative to the grid points. The individual brood foraging areas designate the area in which the brood was observed on any given day until they fledged or were determined to be lost (PIPL SOP; NPS 2014b).

Migrating and Winter Piping Plovers

In the fall, and to a lesser degree in the spring, large numbers of piping plovers migrate through the Seashore. Winter resource closures are established on points and spits to provide protection for migrating and wintering piping plovers that utilize the Seashore as foraging grounds. The resource closures are installed in locations based on habitat (i.e. mud flats) used by wintering piping plovers in more than one of the past five years. Winter resource closures that restrict both ORV and pedestrian access were established at the end of breeding season and upon removal of the prenesting closures at Bodie Island Spit and Ocracoke's South Point (NPS 2010a, 2010b, 2015a, 2015b).

In addition to the winter resource closures, permanent Vehicle Free Areas (VFA), especially those at Bodie Island Spit, Cape Point, South Beach and North Ocracoke, provide relatively undisturbed areas for migratory and wintering piping plovers.

Monitoring

Breeding Piping Plovers

Daily nest monitoring began in early March 2018 and occurred from at least 75–100 m away when any piping plovers were present in the area to minimize disturbance to incubating birds, but close enough to be able to document incubation, nest abandonment, and abnormal behavior. Morning and evening monitoring began five to seven days prior to the expected hatch date.

During ORV access hours, brood monitoring was continuous at Cape Point; broods were monitored as early as 6:00 a.m. and monitoring extended to dusk. This continuous monitoring occurred because there was a probability that the chicks might move to within 200 m of ORV activity. Observers documented brood status, behavior, individual bird and brood movements, human disturbance, predator interactions, and significant environmental events

An established grid system with points located 75 m apart was utilized to aid staff in obtaining more accurate locations for individual birds and chick movement from a distance without disrupting their regular behavior patterns. This grid system was established in 2013 and uses 75 x 75-m squares that assist staff in monitoring daily movements on piping plover broods to estimate the size of the areas the birds use. The grid system consists of PVC piping installed at 75-m intervals with predator deterrents on top of the pipes. (PIPL SOP; NPS 2014b)

Migrating and Wintering Piping Plovers

Monitoring of migratory and wintering shorebirds is conducted in accordance with the Southeast Coast Network Inventory & Monitoring Network protocol (Byrne et al. 2009). Monitoring of migrating and wintering piping plovers was conducted spring 2017 through spring 2018, though monitoring did not occur on all survey dates due to limited staffing. Surveys were not conducted in June when all the piping plovers present were assumed to be breeders and not migrants.

Per the protocol, transect sampling consisted of a two-tiered approach comprised of high-intensity and low-intensity sampling. High-intensity sites were sampled on a weekly basis whereas the low-intensity sites were sampled on a monthly basis. There are approximately 660 potential surveys with 220 and 440 surveys assigned to high- and low-intensity sampling sites, respectively. Semi-permanent transect locations have been established along the entire ocean shoreline. The majority of transects were one mile in length and were numbered Park Mile 0 through Park Mile 74. Some transects at points and spits vary in length due to the constantly changing shorelines, and therefore require more than one transect due to a larger topographical area. Surveys were performed by trained technicians.

In addition to our transect monitoring, an experienced volunteer conducted weekly plover counts during spring and fall migrations. Piping plovers were counted utilizing a spotting scope and individuals were recorded as banded, unbanded, or not scanned. We used these surveys to provide total piping plover counts using locations at a particular time and to monitor for banded birds. If the observer was not able to clearly see above and below both leg joints when searching for color bands or flags, the bird was counted as "not scanned." Band combination



Piping plover chicks. NPS

and a GPS location for each banded piping plover were recorded. For large groups of piping plovers, mostly found on South Point, the count and band surveys were divided into separate tasks. A total count was taken and then the area was visually divided into smaller areas demarcated by landmarks. The observer spent approximately eight to ten hours scanning the smaller areas and identifying as many bands as possible.

Results and Discussion

Breeding Piping Plovers

Productivity

In 2018, nesting was identified at two sites: Cape Point on Hatteras Island and South Point on Ocracoke Island (Appendix A, Maps 18 and 28; Appendix B). The first nest of the 2018 breeding season was discovered on April 25 and the last active brood fledged on July 7.

Three nests were produced by three breeding pairs and all three nests successfully hatched at least one chick. A total of 11 eggs were documented, of which 11 hatched for a hatch rate of 100% (Table 1). The average incubation period was 27 days and ranged from 26 to 28 days (this calculation excludes nests found at full clutch because exact age of the eggs is unknown).

Nest Failures and Chick Mortality

Zero nests (0%) were lost prior to hatching and eight of the 11 chicks produced by the three nests (73%) were lost prior to fledging. A total of three chicks fledged from two nests (Table 1). The age at fledging was 27 days for all three chicks. Three chicks fledged from two breeding pairs yielding a total fledge rate of 1.0 chick fledged/breeding pair (Figure 1). This fledge rate is the highest recorded since 2010 (Figure 1). Reasons for chick loss were mostly unknown; however, some loss occurred from ghost crab depredation.

Table 1. Piping plover nest and chick success at Cape Hatteras National Seashore in 2018.

Location	Breeding Pairs	Total Nests	Nests Hatched	Nests Lost/ Abandoned	Total Eggs	Total Eggs Hatched	Total Chicks Fledged	Total Chicks Lost
Cape Point	2	2	2	0	8	8 (100%)	3	5
South Point	1	1	1	0	3	3 (100%)	0	3
TOTAL:	**3**	**3**	**3**	**0**	**11**	**11 (100%)**	**3**	**8**

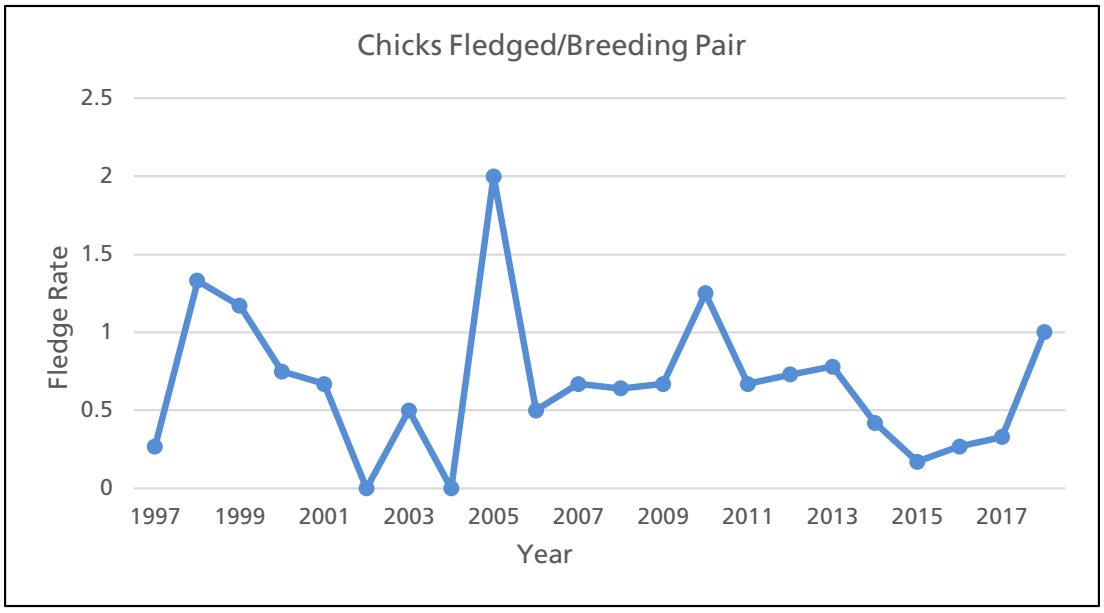


Figure 1. Piping plover fledge rate (chicks/pair) at Cape Hatteras National Seashore, 1997–2018.

Since 1997, fledge rates have ranged from 0.0 to 2.0 chicks/pair at the Seashore. The mean rate from 1997 to 2018 was 0.67 chicks/pair. The fledge rate of 1.0 chicks/pair in 2018 is above the average. The majority of chick mortality occurred soon after hatching; loss occurred from one to 14 days after hatching with an average of 7 days.

Chick Movement

The furthest observed distances traveled by the three broods this season from their respective nests (straight line distance) were approximately 845 m (site 18PIPLHI01), 357 m (site 18PIPLHI02), and 345 m (site 18PIPLOI01). The estimated foraging area sizes for the broods were calculated at 6.3 hectares (site 18PIPLHI01), 4.00 hectares (site 18PIPLHI02), and 1.00 hectares (site 18PIPLOI01). Brood foraging areas were considered to be any area they were observed feeding in once they left the nest site after hatching.

Migrating and Wintering Piping Plovers

From April 2017 through March 2018 (excluding the month of June) 66 surveys were conducted at six high-intensity sites on the points and spits (Park Miles 4, 5, 45, 46, 58, and 59). A total of 62 piping plover were counted during all surveys; 12 in resource protection areas, 40 in ORV areas, and 10 in vehicle free areas. Nine of the plovers were observed in high-intensity sampling sites and 53 were observed in low-intensity sampling sites.

In the separate counts conducted by a volunteer for the Seashore, a total of 22 piping plover counts occurred during the 2018 fall migration from July 7 through August 20. The majority of piping plovers were observed on Ocracoke's South Point; the minimum piping plover count during the survey period was seven individuals and the maximum was 211 individuals (Table 2). A total of 121 banded piping plovers were documented during these counts. (S. Maddock, personal communication; Table 2).

Table 2. 2018 Fall migration piping plover counts, Cape Hatteras National Seashore.

Date	Location	Total Observed	Banded	Not Scanned
7/7/2018	Ocracoke South Point	7	3	0
7/11/2018	North Flood Tidal Delta Shoal Oregon Inlet	0	0	0
7/11/2018	Northwest Flood Tidal Delta Shoal	0	0	0
7/11/2018	Green Island	0	0	0
7/14/2018	Ocracoke South Point	58	12	4
7/20/2018	North Flood Tidal Delta Shoal Oregon Inlet	2	1	0
7/20/2018	Northwest Flood Tidal Delta Shoal Oregon Inlet	3	1	0
7/20/2018	Green Island	3	2	0
7/22/2018	Ocracoke South Point	129	26	5
7/26/2018	North Flood Tidal Delta Shoal Oregon Inlet	4	1	0
7/26/2018	Northwest Flood Tidal Delta Shoal Oregon Inlet	0	0	0
7/26/2018	Green Island	0	0	0
7/28/2018	Ocracoke South Point	128	26	8
8/4/2018	Ocracoke South Point	183	35	16
8/8/2018	Northwest Flood Tidal Delta Shoal Oregon Inlet	1	0	0
8/8/2018	Green Island	1	0	0
8/8/2018	North Flood Tidal Delta Shoal Oregon Inlet	2	1	0
8/11/2018	Ocracoke South Point	198	38	16
8/17/2018	Ocracoke South Point	211	39	14
8/20/2018	North Flood Tidal Delta Shoal Oregon Inlet	4	3	0
8/20/2018	Green Island	4	0	0
8/20/2018	Northwest Flood Tidal Delta Shoal Oregon Inlet	3	1	0

Seventy-three individuals were banded in the north Atlantic states and Canadian provinces, 30 originated from the south Atlantic, five were banded in the Great Lakes region, and two originated from the Bahamas. Partial bands were recorded for 11 individuals and origin could not be determined. (S. Maddock, personal communication; Table 3).

Multiple birds stayed on Ocracoke's South Point for long periods during migration; individual birds stayed two, three, or four weeks. This demonstrates the importance of the South Point area on Ocracoke Island as a fall migration stopover site for piping plovers and may be the only site on the Atlantic coast where such large numbers can be observed during migration.

Table 3. Origins of piping plovers observed at Cape Hatteras National Seashore based on where individuals were banded.

Banding Origin	Number of piping plovers Observed
Georgia	1
Massachusetts	2
Michigan	5
North Carolina	26
New Jersey	18
New York	14
Rhode Island	8
Virginia	3
New Brunswick	12
Nova Scotia	9
Newfoundland	1
Ontario	4
Prince Edward Island	5
Bahamas	2

American Oystercatcher Management and Monitoring

Background

American oystercatchers (*Haematopus palliatus*) are ground-nesting shorebirds native to North Carolina. As with many shorebirds, their numbers have been in sharp decline over the past 20 years. The American oystercatcher is designated as a Special Concern Species by the North Carolina Wildlife Resources Commission and a Species of High Concern in the U.S. Shorebird Conservation Plan (Brown et al. 2001). Throughout its range, habitat loss and fragmentation due to beach development has resulted in nesting attempts in marginal habitat. Marginal habitat is thought to lead to an increased number of unsuccessful nesting attempts from breeding pairs. Off-road vehicle (ORV) use on the beach can lead to direct mortality of chicks and eggs and pedestrian disturbance can indirectly cause loss of nests or chicks. The main cause of direct mortality of chicks and eggs in the Seashore is believed to be mammalian predators.

The park manages and monitors American oystercatchers following the American Oystercatcher Monitoring at Cape Hatteras National Seashore document (NPS 2017) and the Cape Hatteras National Seashore Off-Road Vehicle Management Plan, as amended by the Review and Adjustment of Wildlife Protection Buffers Environmental Assessment (NPS 2010a, 2010b, 2015a, 2015b).

Management

Prenesting Closures

In 2018, Seashore staff evaluated all potential breeding habitat for American oystercatchers and recommended prenesting closures by March 1. Areas of suitable habitat that have had individual American oystercatcher nests in more than one of the past five years and new habitat that was particularly suitable for shorebird nesting (such as the habitat at new inlets or overwash areas) were posted as prenesting closures using symbolic fencing (string between posts) or with other closure signs by March 15 (NPS 2010a, 2010b, 2015a, 2015b).

Breeding American Oystercatchers

Wildlife protection buffers extend 150 m around American oystercatcher breeding behavior (scrapes or nests) and 200 m around unfledged chicks. In some circumstances, an ORV corridor was established to allow for vehicle passage in front of nests when there was no other way to get around the nest



American oystercatchers at Cape Hatteras National Seashore. NPS



A freshly hatched American oystercatcher chick at Cape Hatteras National Seashore. NPS

on a route. As chicks commenced their movement away from the nest sites, the protection areas were expanded when necessary to ensure adequate buffers (NPS 2010a, 2010b, 2015a, 2015b).

Breeding pairs of American oystercatchers were located through daily surveys of potential habitat on both oceanside and soundside beaches. Birds were monitored closely for nesting when observed regularly at the same location or when demonstrating territorial or breeding displays. If nests or scrapes were found, observers marked the location with a handheld GPS unit (NPS 2017). Resource closures were installed (or modified) as necessary to maintain the required buffer distances (NPS 2010a, 2010b, 2015a, 2015b).

Nonbreeding American Oystercatchers

Nonbreeding American oystercatchers are classified as lone birds or pairs of birds that are unassociated with nests at the Seashore. Three surveys were conducted in all park districts on June 4, 6, and 8 to account for nonbreeding American oystercatchers. The locations of individuals and pairs were estimated after the breeding season concluded using a handheld GPS. Presence of color bands/flags was also recorded. After the conclusion of the breeding season the highest daily number of nonbreeding American oystercatchers on the Seashore was reported.

Banding

In addition to carrying out actions indicated by the ORV management plan, trained technicians banded American oystercatcher adults and chicks under North Carolina State University's banding permit. Banding aids in tracking survival of individuals, determining breeding success of individual pairs, documenting movement of young birds to other areas, and determining breeding site fidelity. Banded birds also allow North Carolina State University and the Seashore staff to coordinate data with scientists from other states to examine genetics, migration patterns, and long-term survival rates of American oystercatchers.

Monitoring

Pairs with active nests were monitored daily from at least 75–100 m away when any American oystercatchers were present in the area to minimize disturbance to incubating birds, but close enough to be able to document incubation, nest abandonment, and abnormal behavior. Each nest was observed closely near expected hatch dates for signs of chicks. Expected hatch dates were calculated from an average nest incubation period of 29 days from first egg laid or 24 days from last egg laid (Baicich and Harrison 1997). If an incubating bird was not observed on the nest, the nest was checked for the presence of eggs and, if the eggs were missing, the area was

inspected for signs of predators. Once hatched, staff attempted to observe each chick daily for the purposes of detecting presence/loss, fledge success, and to ensure that proper buffers were in place (NPS 2017).

Results and Discussion

Breeding American Oystercatchers

Productivity

In 2018, 25 pairs of American oystercatchers nested at the Seashore: two pairs on Bodie Island, 10 pairs on Hatteras Island, 12 pairs on Ocracoke Island, and one pair on Green Island. The first nest of the season was found on April 17 and the last nest was found on June 24.

Nineteen breeding pairs held territories within the prenesting closures and 34 of the 40 nesting attempts occurred inside the prenesting closures (Appendix A maps; Appendix C). Altogether, these pairs produced a total of 40 nests, including re-nests, of which 18 nests hatched. Twelve pairs of American oystercatchers were successful in fledging 20 chicks, which is 0.8 fledged chicks/pair (Table 4). This fledge rate is the highest recorded since 2011 (Figure 2). For the fifteen nests with known start dates, the average incubation period was 27 days. Chicks fledged 42 days after hatching on average.

Table 4. Summary of American oystercatcher reproductive success at Cape Hatteras National Seashore from 2012 to 2018.

Year	Breeding Pairs	Total Nests	Nests Hatched	Successful Pairs (at least 1 chick fledged)	Number of Chicks Fledged	Fledge Rate
2012	22	30	18	11	15	0.68
2013	27	42	19	10	15	0.55
2014	26	38	18	8	9	0.35
2015	25	43	19	11	13	0.52
2016	26	41	13	9	12	0.46
2017	24	53	9	2	2	0.08
2018	25	40	18	12	20	0.8

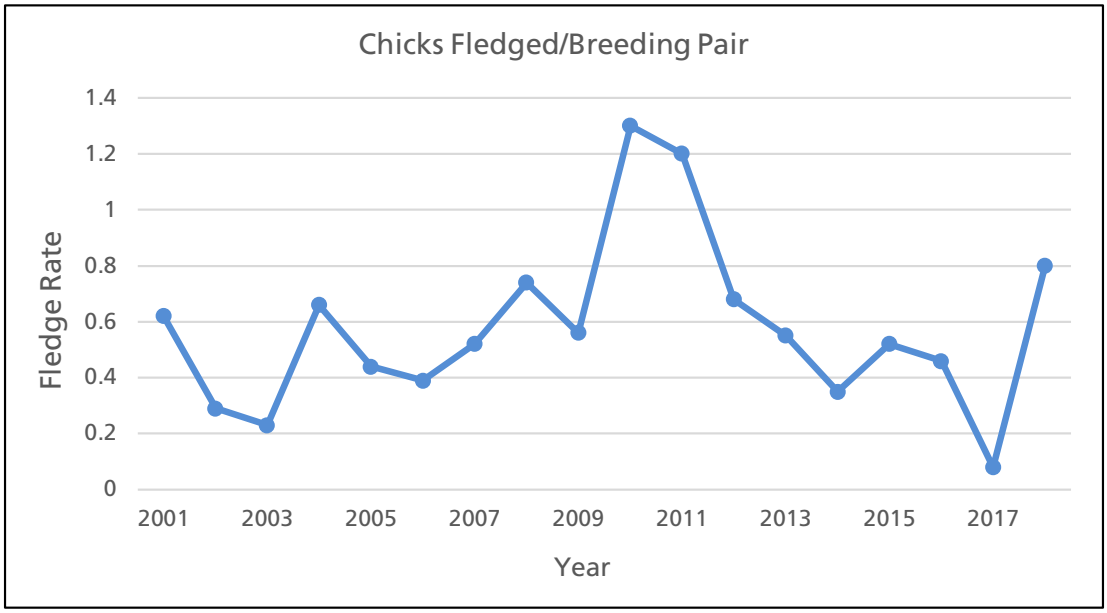


Figure 2. American oystercatcher fledge rate (chicks/pair) and linear trend at Cape Hatteras National Seashore, 2001–2018.

Nest Failures and Chick Mortality

Twenty-two nests were lost in the 2018 breeding season. Two nests were abandoned, ten nests were depredated, and ten were lost to unknown causes. Of the 10 nests lost to depredation, one was taken by an unknown canid species, one by fox, two by feral cat, two by raccoon, three by coyote, and one by avian predator. The most likely canid predators at the Seashore are coyote and fox. Mammalian, ghost crab, or avian predators (e.g., gulls and crows) are believed to be responsible for the other ten nests lost to unknown causes. Of the 25 pairs with known nesting dates, 12 pairs (48%) re-nested at least once after their first nest was lost.

Determining cause of chick loss is even more difficult than determining cause of nest loss. In the 2018 season, there were six complete brood failures and three partial brood failures. One chick was lost to siblicide and thirteen chicks were lost to unknown causes. Siblicide is the killing of an infant individual by its close relatives; in this case the death was caused by an older sibling. Chicks can move large distances and it is sometimes difficult to locate them. Environmental conditions surrounding the brood site may obscure evidence of predation and searches for missing chicks may be hampered since many types of disturbances can cause the chicks to hide out of view.

Nonbreeding American Oystercatchers

The peak count during the June survey window for nonbreeding American oystercatchers was 25 individuals on June 4 (Table 5). Zero were observed on Bodie Island, ten on Hatteras Island, and 15 on Ocracoke Island. Some banded birds that were reproductively mature did not nest, possibly due to their inability to find, establish, and hold a territory, or inability to find a mate of breeding age.

Table 5. Nonbreeding American oystercatcher survey results during the predetermined dates in June 2018 at Cape Hatteras National Seashore.

Date	Bodie	Hatteras	Ocracoke	Totals
4-Jun	0	10	15	25
6-Jun	0	4	10	14
8-Jun	2	4	7	13

Banded American Oystercatchers

In 2018, four new pairs and three new individuals joined the Seashore's breeding population for a total of 25 American oystercatcher pairs. Of the four new pairs, three pairs had been observed at the Seashore in previous years but this was their first season to nest.

A total of 232 American oystercatchers have been banded at the Seashore since 2002, consisting of 52 adults and 180 chicks. Ten chicks were banded in 2018. As the result of this long-term cooperative banding project with North Carolina State University, the Seashore has begun to document banded chicks surviving to adulthood and joining the breeding population. Banded birds enable staff to identify breeding pairs and unpaired individuals with confidence.

Colonial Waterbird Management and Monitoring

Background

Colonial waterbirds nest in large groups (colonies), and obtain their food from the water. Terns, gulls, pelicans, skimmers, and wading birds are examples of colonial waterbirds. The Seashore beaches provide traditional nesting habitat for several species of special concern as well as state-listed species, including the common tern (*Sterna hirundo*), least tern (*Sterna antillarum*), and black skimmer (*Rynchops niger*). Less common nesters include the gull-billed tern (*Gelochelidon nilotica*), white ibis (*Eudocimus albus*), and tricolored heron (*Egretta tricolor*).

The park manages and monitors colonial waterbirds following the Colonial Waterbird Management at Cape Hatteras National Seashore Standard Operating Procedures (CWB SOP; NPS 2014a) and the Cape Hatteras National Seashore Off-Road Vehicle Management Plan, as amended by the Review and Adjustment of Wildlife Protection Buffers Environmental Assessment (NPS 2010a, 2010b, 2015a, 2015b).

Management

Prenesting Closures

In 2018, Seashore staff evaluated all potential breeding habitat for colonial waterbirds and recommended prenesting closures by April 1. Areas of suitable habitat that have had concentrations of more than 10 colonial waterbird nests in more than one of the past five years and new habitat that is particularly suitable for shorebird nesting (such as the habitat at new inlets or overwash areas) were posted as prenesting closures using symbolic fencing (string between posts) or with other closure signs by April 15. Because colonial waterbird colonies may shift locations from year to year, off-road vehicle (ORV) ramps and pedestrian access points that have had colonies in more than one of the past five years will remain open until scraping or nesting is observed (NPS 2010a; NPS 2010b; NPS 2015a; NPS 2015b).



The black skimmer is a colonial waterbird that nests at Cape Hatteras National Seashore. NPS/Phil Ziegler



Least tern chicks at Cape Hatteras National Seashore. NPS

Breeding Colonial Waterbirds

The ORV management plan does not specify what parameters constitute an active colonial waterbird colony. The Colonial Waterbird SOP states that, "each distinct group of nesting colonial waterbirds will be considered a colony and receive a name designation if there are two or more nests within 200 m or less of one other." Also, activity that triggers a resource closure must include physical evidence of established breeding such as a scrape or a nest; behavior alone (e.g. copulation or fish-flashing) will not suffice. Least tern buffers are 100 m for breeding behavior (scrapes or nests) and unfledged chicks (NPS 2010a, 2010b, 2015a, 2015b). Other protected colonial waterbird species receive a 180 m buffer for all breeding activity and unfledged chicks (NPS 2014a, 2015a). Resource closures were modified as the colonies expanded to maintain the required buffer sizes from the outer-most scrapes, nests, or chicks in the colony.

Monitoring

After identifying suitable nesting habitat and installing prenesting closures, colony activity surveys and monitoring took place on all Seashore beaches. Colonial waterbirds were observed for courtship behaviors, such as fish flashing, copulation, and scraping. Data collection began when physical scrapes were observed and a resource closure was installed around the area. Trained technicians observed the area daily from at least 75–100 m away from the colony. Efforts were made to minimize entry into colonies to prevent colony disturbance.

Colonies were surveyed during the peak nesting period for each species, which generally is during the first part of June for tern species, but can be later for species such as black skimmers (NPS 2010a, 2010b, 2015a, 2015b).

The highest nest count was reported as the nesting peak; timing of nesting peak varies based on the start date of the colony and progression of the colony. Additional surveys occurred when a colony start date was early or delayed, when predators, storms, or other weather significantly impacted colony sites, and when the colony grew and more accurate information regarding breeding estimates was obtained. If chicks were observed prior to the first week of June, then it was acceptable to perform a walk-through survey. The distance from the outermost scrapes, nests, or chicks to the resource closure boundary were checked during observation periods to ensure all scrapes, nests, or chicks were within the specified buffer areas.

Results

Colonies

In 2018, 15 colonies were identified at the Seashore: nine on Hatteras Island, one on Green Island, and five on Ocracoke Island (Table 6; Appendix A maps). If not already present, a resource closure was installed to provide the colony with protection. Per the ORV management plan, locations of colonies containing more than 10 colonial waterbird nests in more than one of the past five years will be considered for future placement of prenesting closures (NPS 2010a, 2010b, 2015a, 2015b).

Table 6. Colonies observed during the 2018 breeding season at Cape Hatteras National Seashore.

Location	Observed Colonies	Colonies Containing > 10 Nests
Bodie Island	0	0
Green Island	1	0
Hatteras Island	9	6
Ocracoke Island	5	3
Total	**15**	**9**

Observations from peak nest surveys (Table 7) produced a park total of 475 least tern nests with 15 chicks, 72 common tern nests with 12 chicks, 50 gull-billed tern nests with 10 chicks, 368 black skimmer nests with 116 chicks. The multi-species colonies on South Point were the most species-diverse and highest nest-producing colonies on the seashore, containing nests from least tern, common terns, gull-billed terns, and black skimmers. This season two multi-species colonies occurred on South Point, one on the north end of Ocracoke Island, and one on Cape Point. This was the first time black skimmer nests have been documented on Cape Point. The remaining colonies were comprised of only least terns and one colony was only common terns.

Table 7. Nests, eggs, and chicks observed per species during peak nesting surveys in 2018 at Cape Hatteras National Seashore.

Species	Nests	Eggs	Chicks
Least tern	475	928	15
Common tern	72	127	12
Gull-billed tern	50	107	10
Black skimmer	368	949	116



Common tern eggs at Cape Hatteras National Seashore. NPS

Two colonial waterbird breeding locations were established and deemed lost before colony status could officially be determined (prior to the walk-through survey dates).

- Site 18-CWB-GI02 on Green Island was active (common tern scrapes only) from June 22–July 6. Adults abandoned this potential nesting site prematurely for unknown reasons.
- Site 18-CWB-BH03 on Hatteras Island was active (least tern scrapes only) from June 3 to June 19. Adults abandoned this potential nesting site prematurely for unknown reasons.

Productivity

Productivity in colonial waterbird colonies is very difficult to determine. While it is certain that multiple colonies fledged chicks, there are no definitive numbers for colonial waterbird productivity at the Seashore. Observed fledged chicks (or juveniles, very similar in appearance) could be from a particular colony or just passing through from elsewhere. Of the 15 documented colonies, colonial waterbird fledges or juveniles were observed in 12 of them. Twelve colonies contained least tern fledges while black skimmer fledges were observed on Cape Point and Ocracoke's South Point, totaling about 300 fledglings.

Two walk-through nest abundance surveys were performed during the 2018 peak breeding and nesting season. These surveys were performed for each colony to aid in refining nest counts and to more accurately classify colonies. Resource management staff make a great effort to quantify nest numbers by documenting birds in incubating posture as an alternative to conducting more frequent walk-through counts outside of peak nesting (CWB SOP; NPS 2014a).

Nest Failures and Chick Mortality

Three factors at the Seashore are believed to contribute to the loss of nests or chicks on a yearly basis: predator disturbance, abandonment, and weather. On multiple occasions, more than one of these occurred. Ten of the 15 waterbird colonies had predator interactions including from gulls, fox, ghost crabs, raccoons, and coyotes. Persistent pressure from predators has historically proven to result in abandonment of nests and/or colony failure. During the 2018 colonial waterbird breeding season, there were no significant weather events that may have negatively affected nesting or chicks at the Seashore.

Historical Comparison

Figures 3 through 6 show historical numbers of documented nests for commonly observed nesting species of colonial waterbirds. Nesting tern species at the Seashore saw an increase in least tern nesting and the highest number of gull-billed tern and black skimmer nests since 2012. This increase could be attributed to several factors; there were no significant weather events during the nesting season, and the installation of yearly prenesting closures and maintenance of appropriate wildlife protection buffers may have had a positive influence on the number of colonial waterbird pairs nesting at the Seashore by providing less human disturbance within nesting habitat.

Common tern nesting activity continues to decrease on the Seashore, though there was a one-year increase in 2016. Quality and quantity of suitable nesting habitat continues to be a concern for nesting terns. Much of the traditional habitat at the points/spits (where the largest least tern colonies have occurred in the past) has given way to expanding dune systems, thus eliminating the sandy shell-beds that this species depends on for nesting. Significant weather events (i.e. direct impacts from hurricanes) have been absent in recent years or have failed to wash over the dunes and reestablish the important shell-bed habitat.

There were four multi-species colonies observed this season that contained all of the nesting black skimmers at the Seashore. The two colonies on Ocracoke's South Point, had all of the gull-billed terns detected on the Seashore, in addition to least terns, common terns and a robust black skimmer colony. A third separate colony on the north end of Ocracoke Island had least tern and black skimmer nests. In the fourth multi-species colony on Cape Point, black skimmer nests were documented for the first time.

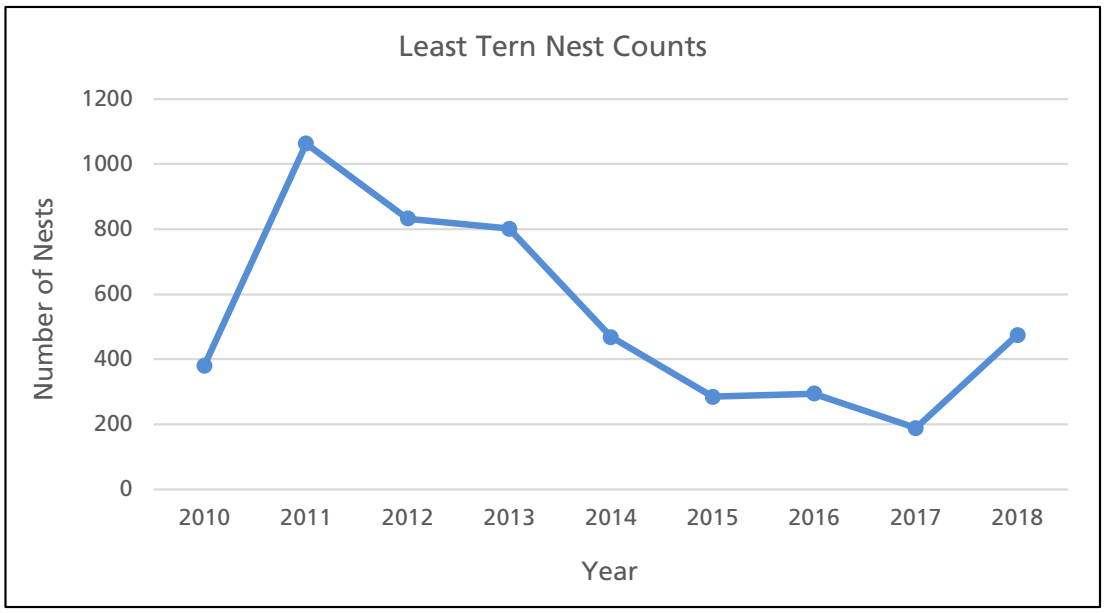


Figure 3. Historical least tern peak nest counts at Cape Hatteras National Seashore, 2010–2018.

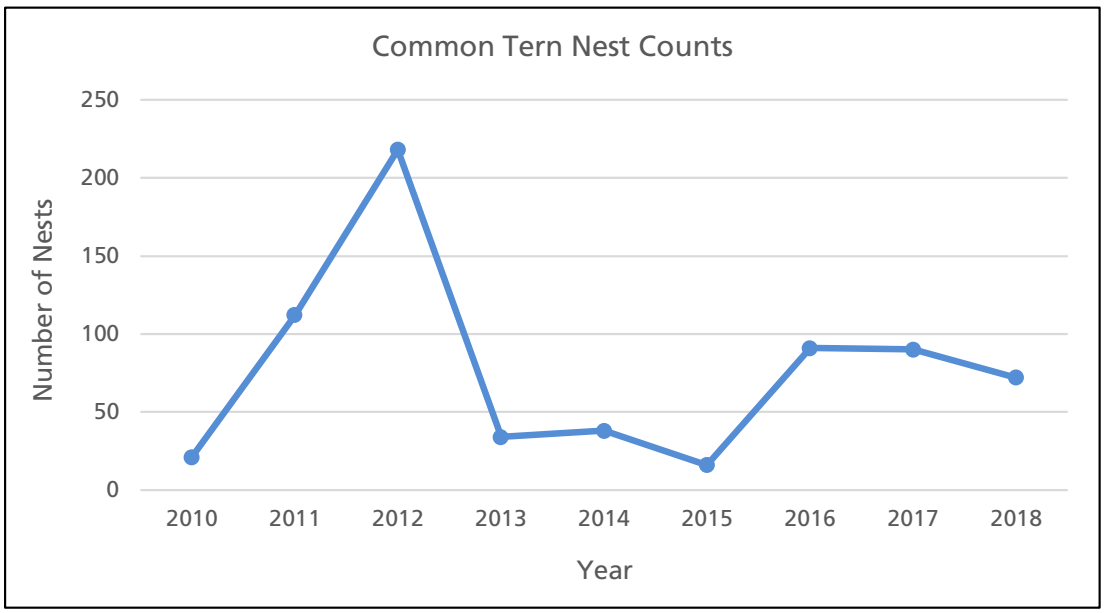


Figure 4. Historical common tern peak nest counts at Cape Hatteras National Seashore, 2010–2018.

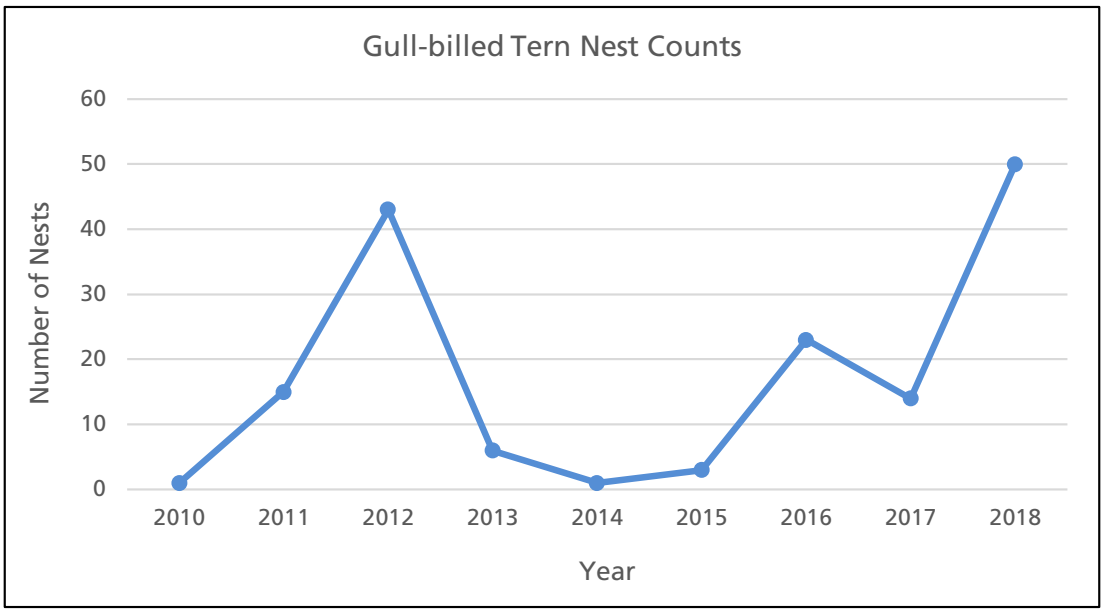


Figure 5. Historical gull-billed tern peak nest counts at Cape Hatteras National Seashore, 2010–2018.

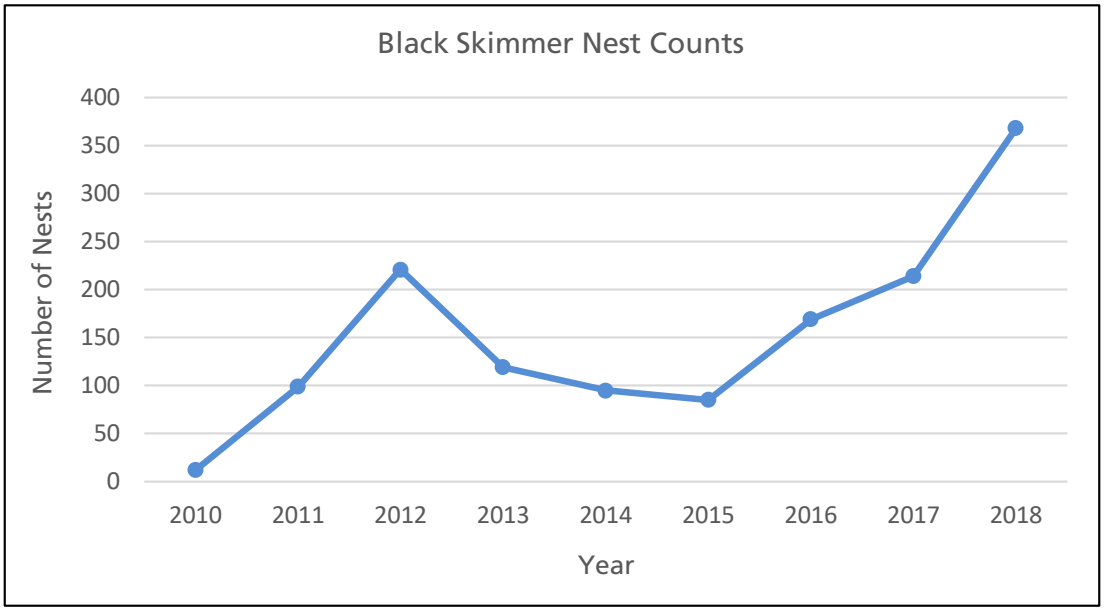


Figure 6. Historical black skimmer peak nest counts at Cape Hatteras National Seashore, 2010–2018.

Wilson's Plover Management and Monitoring

Background

The Wilson's plover (*Charadrius wilsonia*) is a ground-nesting shorebird native to North Carolina. Wilson's plovers generally lay two to three eggs in a small, shallow depression or scrape. The pair can take up to five days from the laying of the first egg to completion of the clutch (Bergstrom 1988). When all of the eggs are laid, the pair incubates the nest for 23 to 27 days until hatching. Both the eggs and chicks are cryptic in coloration which makes them difficult to locate. Chicks are precocial and follow the adults to locations where they forage for crustaceans, particularly fiddler crabs, and insects found in and on the sand. The Wilson's plover is listed as a Species of Special Concern in North Carolina. Plover nesting habitat is vulnerable to destruction from development, erosion, and weather events (e.g., tropical storms and extreme high tides). Disturbance from recreational activities can cause plovers to abandon their nests leaving their eggs exposed to predation and overheating.

The Seashore manages and monitors Wilson's plovers following the procedures for piping plovers in the Piping Plover Management at Cape Hatteras National Seashore Standard Operating Procedures (PIPL SOP; NPS 2014b) and the Cape Hatteras National Seashore Off-Road Vehicle Management Plan, as amended by the Review and Adjustment of Wildlife Protection Buffers Environmental Assessment (NPS 2010a, 2010b, 2015a, 2015b).

Management

Prenesting Closures

In 2017, Seashore staff evaluated all potential breeding habitat for Wilson's plovers and recommended prenesting closures by March 1. Areas of suitable habitat that have had individual Wilson's plover nests in more than one of the past five years and new habitat that was particularly suitable for shorebird nesting (such as the habitat at new inlets or overwash areas) were posted as prenesting closures using symbolic fencing (string between posts) or with other closure signs by March 15 (NPS 2010a,S 2010b, 2015a, 2015b). Prenesting closures for piping plovers and other species protected all Wilson's plover habitat in 2017 and prior years.

Breeding Wilson's Plovers

Wildlife protection buffers are 50 m for breeding behavior (scrapes or nests) and 100 m (pedestrian) for unfledged chicks. As chicks commence their movement away from the nest sites, the protection



Wilson's plover. NPS

areas are expanded when necessary to ensure adequate buffers. (NPS 2010a) In 2018, wildlife protection buffers were not required for Wilson's plovers because there were no breeding pairs.

Field staff monitor for Wilson's plover arrival and breeding behavior in early March. Predator exclosures are constructed around any nests found when clutches reach three or more eggs. The circular exclosures (approximately 10 ft in diameter), consist of 2 x 4-in welded wire fence anchored by steel rebar and topped with a ¾-in mesh netting to dissuade avian predators. Exclosures are installed following the guidelines established in the U.S. Fish & Wildlife Service Piping Plover Recovery Plan (USFWS 1996, Appendix F). Thereafter, the nests are briefly approached once weekly to inspect the exclosure, verify the number of eggs, and check for signs of predators. Predator exclosures have been used at the Seashore since 1994 to reduce predatory pressure on piping plover nests and nesting adults, and were used to protect Wilson's plover nests beginning in 2009 with the first documented nest at the Seashore. No predator exclosures were set up on Wilson's plover nests since no nests were found.

Monitoring

Daily nest monitoring normally begins in early March. No breeding adults or nests were found in 2018. In years when Wilson's plovers are detected, protocol requires that nest monitoring occur from at least 75–100 m away when any piping plovers are present in the area to minimize disturbance to incubating birds, but close enough to be able to document incubation, nest abandonment, and abnormal behavior. Morning and evening monitoring begins five to seven days prior to the expected hatch date. Due to the alert and protective nature of adults, the pairs are rarely observed incubating, but are often documented outside the exclosure. Observation times are minimized to reduce disturbance to the nesting pair. After hatching, staff attempt to monitor the broods daily. The predator exclosure is removed once the adults and chicks leave the nest site and move on to the foraging grounds. Adults prefer to forage with their chicks in vegetated intertidal mudflats where the chicks can easily be concealed for safety. Broods are assumed to be in areas where adults are documented as being territorial with other shorebirds.

Results and Discussion

Breeding Wilson's Plovers

Productivity

In 2018, no Wilson's plover breeding pairs or nests were identified.

Since 2009, fledge rates have ranged from 0.0 to 1.0 chicks/pair at the Seashore (Table 8). The mean rate from 2009 to 2017 was 0.31 chicks/pair. The fledge rate for 2017 was 0.0 chicks/pair. The average time to fledge was 28 days, but some broods were not observed with fledged chicks until more than 35 days after hatching.

Table 8. Summary of Wilson's plover reproductive success at Cape Hatteras National Seashore, 2009—2018.

Year	Breeding Pairs	Total Nests	Nests Hatched	Successful Pairs (at least 1 chick fledged)	Number of Chicks Fledged	Fledge Rate
2009	1	1	1	0	0	0
2010	2	2	2	1	2	1.0
2011	1	1	1	0	0	0
2012	4	4	2	2	4	1.0
2013	4	4	3	3	3	0.75
2014	3	3	2	0	0	0
2015	4	3	2	0	0	0
2016	3	3	2	0	0	0
2017	1	2	1	0	0	0
2018	0	0	0	0	0	n/a

Conclusions

In 2018, Cape Hatteras National Seashore had 25 pairs of oystercatchers that produced 20 fledglings, or young birds that are able to fly. Colonial waterbird nests, including least terns and black skimmers, totaled 965, nearly 300 more than in 2017. Although the number of piping plover nests decreased from six to three, three chicks fledged this year. One fledgling per nest suggests a positive trend, since in previous years only half of those numbers were observed. The Seashore continues to monitor the breeding behavior and productivity of these shorebirds.

In the near future, Cape Hatteras National Seashore will begin a habitat modification experiment with partners from Virginia Tech designed to help improve nesting habitat. We also plan to study least tern behavior during vehicle and pedestrian interactions in order to better define the wildlife protection zone distances for our colonial waterbird species. This study could lead to new adaptive management strategies to help improve our monitoring and to help balance visitor access to our beaches.



Black skimmers at Cape Hatteras National Seashore. NPS

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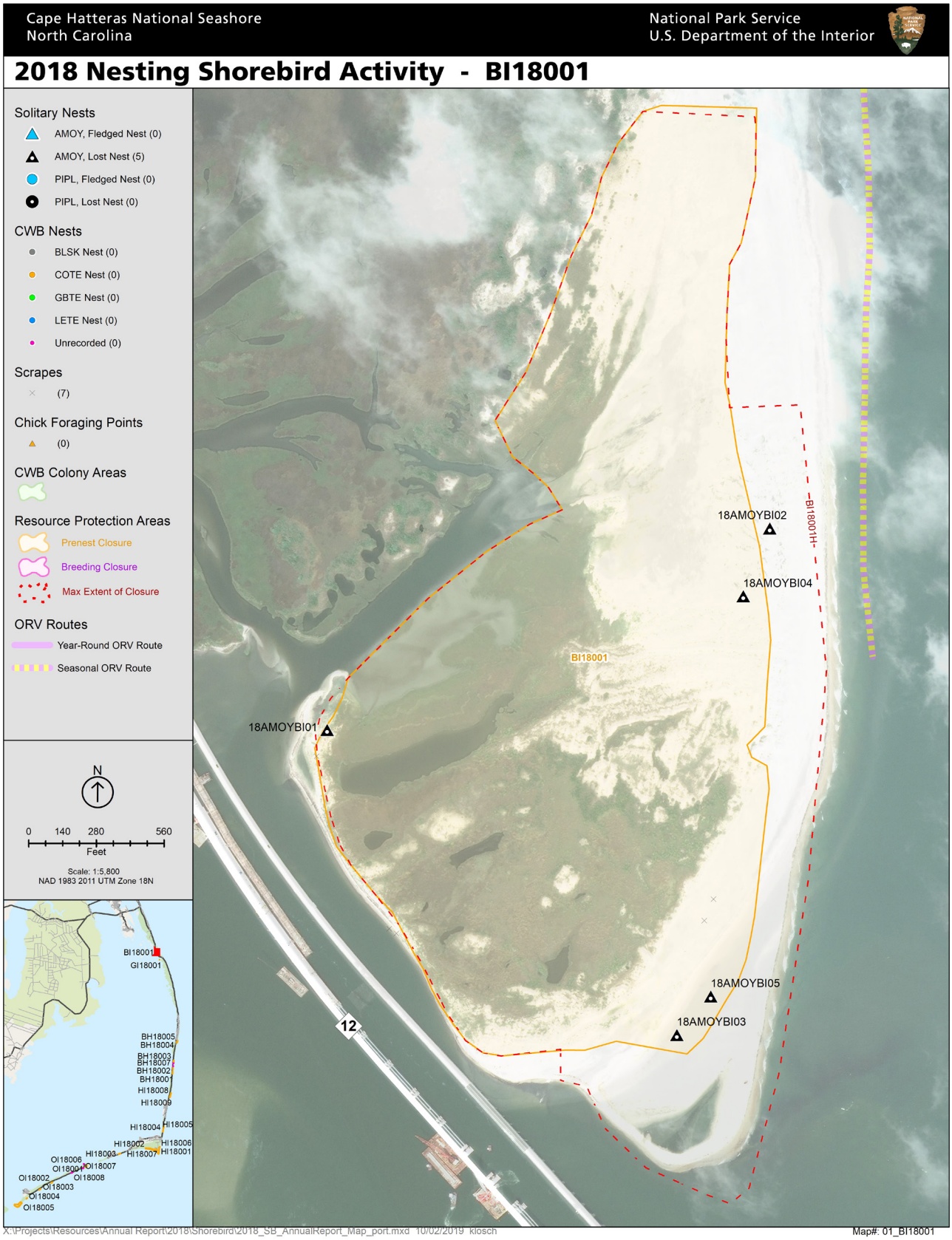
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Appendix A. Shorebird Breeding Activity Maps



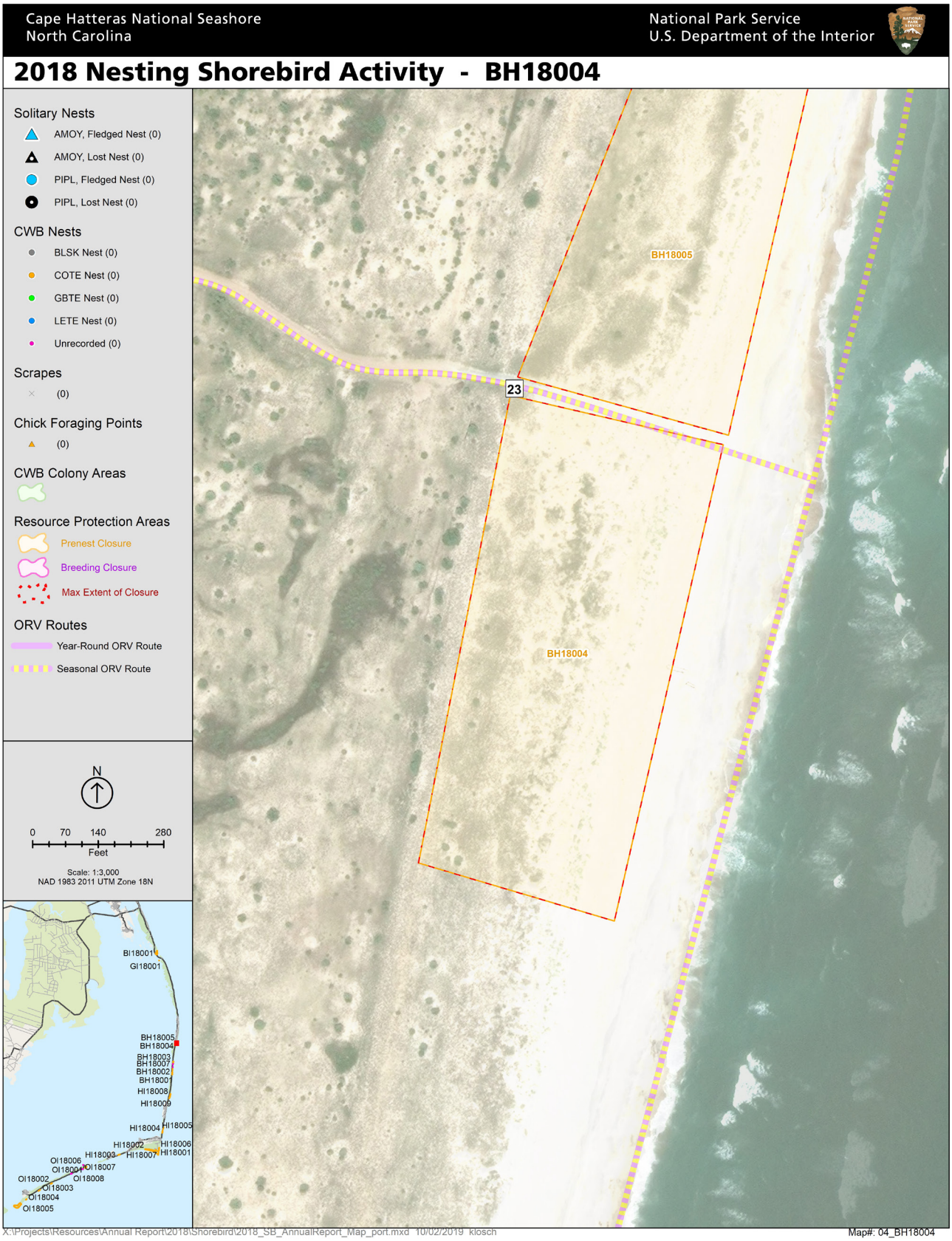
Map 1. 2018 shorebird activity at Bodie Island site 18001.



Map 2. 2018 shorebird activity at Green Island site 18001.



Map 3. 2018 shorebird activity at Bodie Hatteras site 18005.



Map 4. 2018 shorebird activity at Bodie Hatteras site 18004.



Map 5. 2018 shorebird activity at Bodie Hatteras site 18003



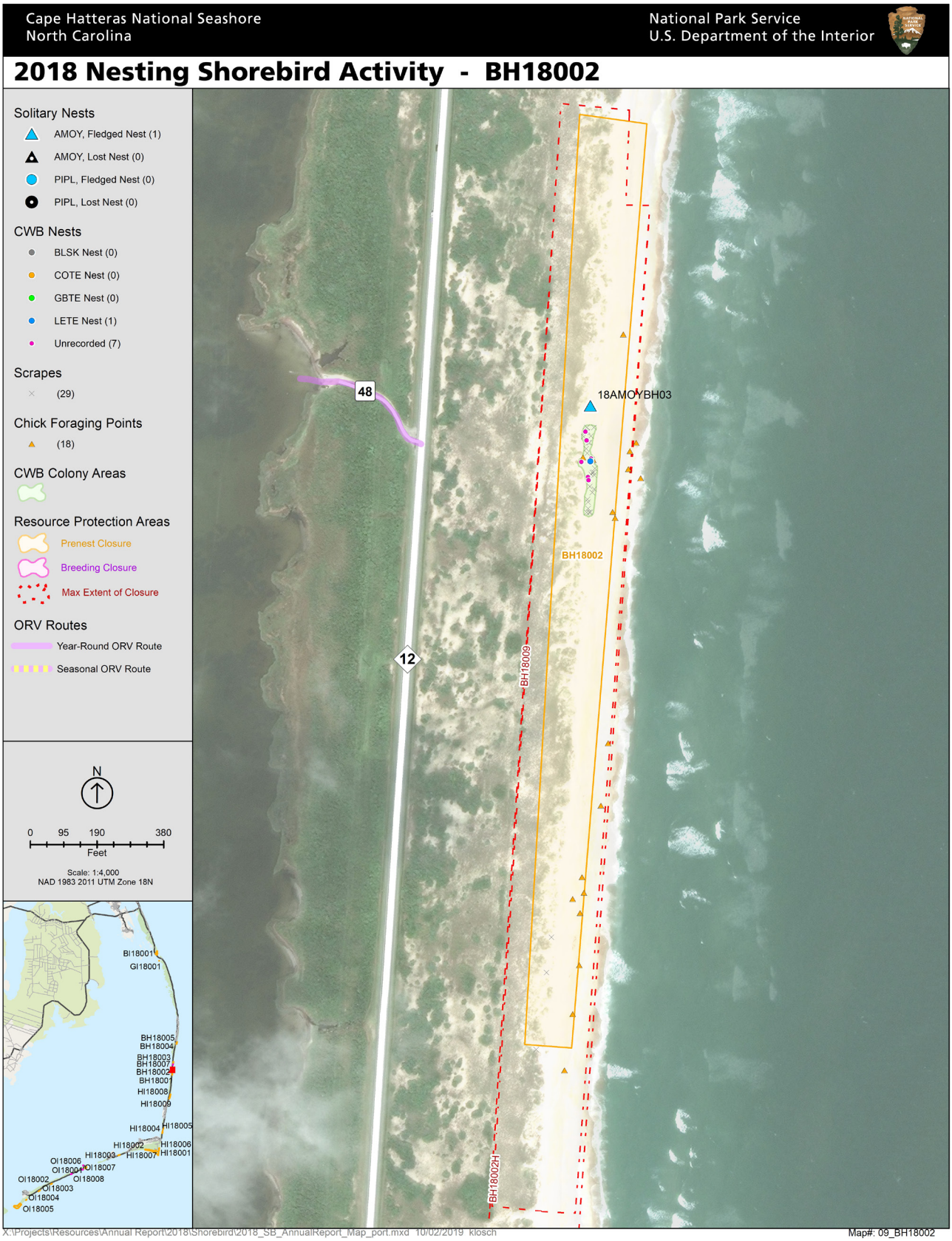
Map 6. 2018 shorebird activity at Bodie Bodie Hatteras site 18006.



Map 7. 2018 shorebird activity at Bodie Hatteras site 18007.



Map 8. 2018 shorebird activity at Bodie Hatteras site 18008



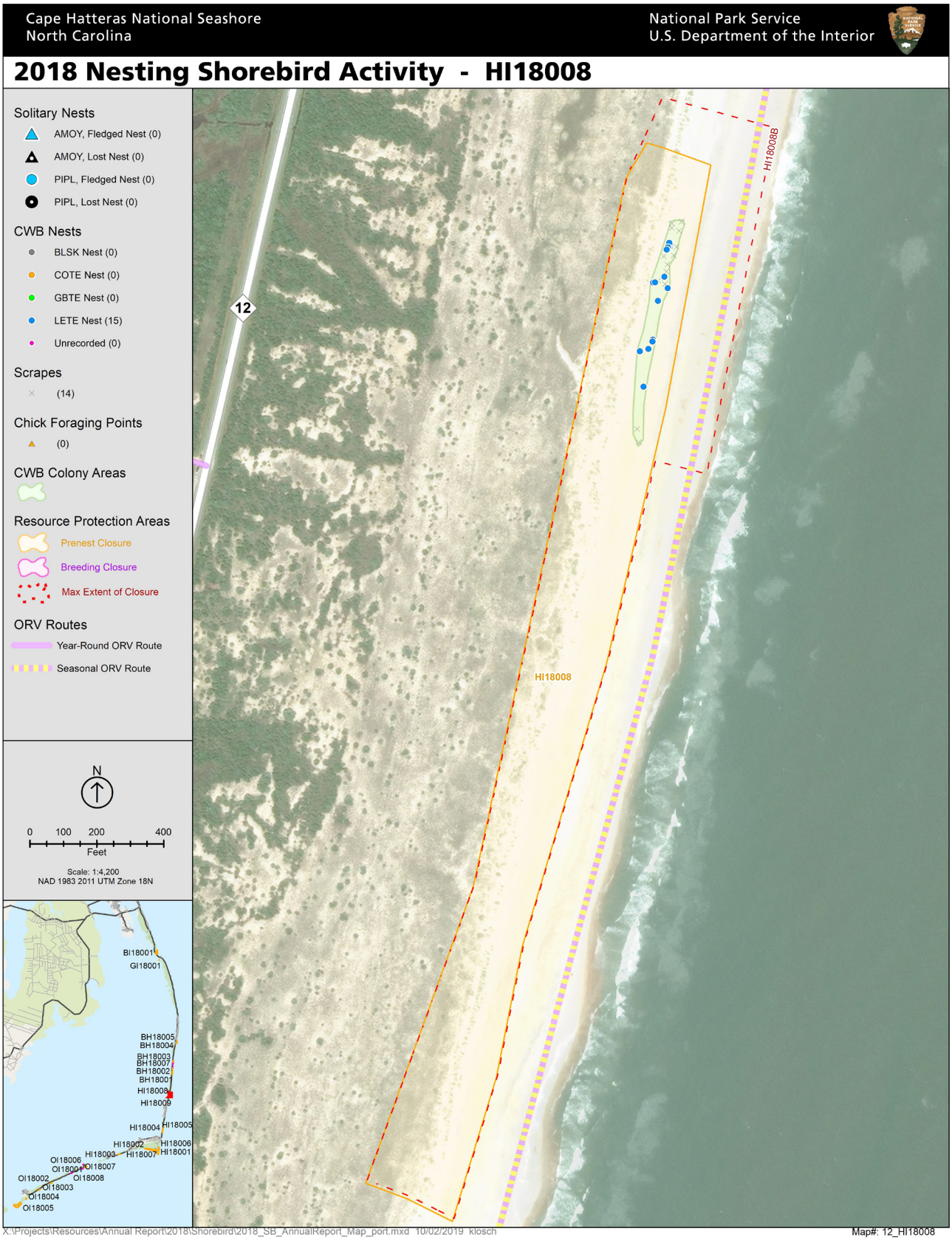
Map 9. 2018 shorebird activity at Bodie Hatteras site 18002.



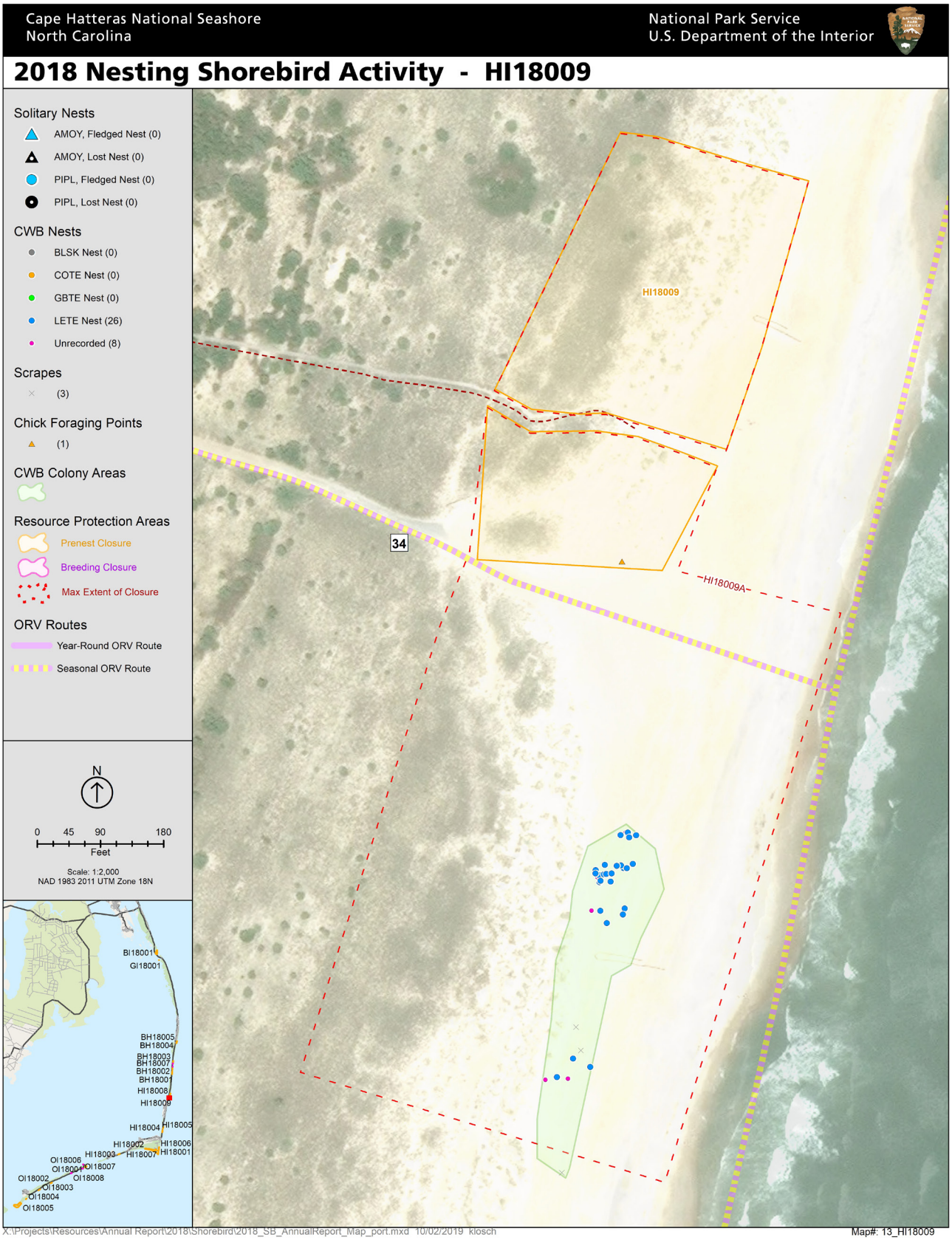
Map 10. 2018 shorebird activity at Bodie Hatteras site 18009.



Map 11. 2018 shorebird activity at Bodie Hatteras site 18001.



Map 12. 2018 shorebird activity at Hatteras Island site 18008.



Map 13. 2018 shorebird activity at Hatteras Island site 18009.



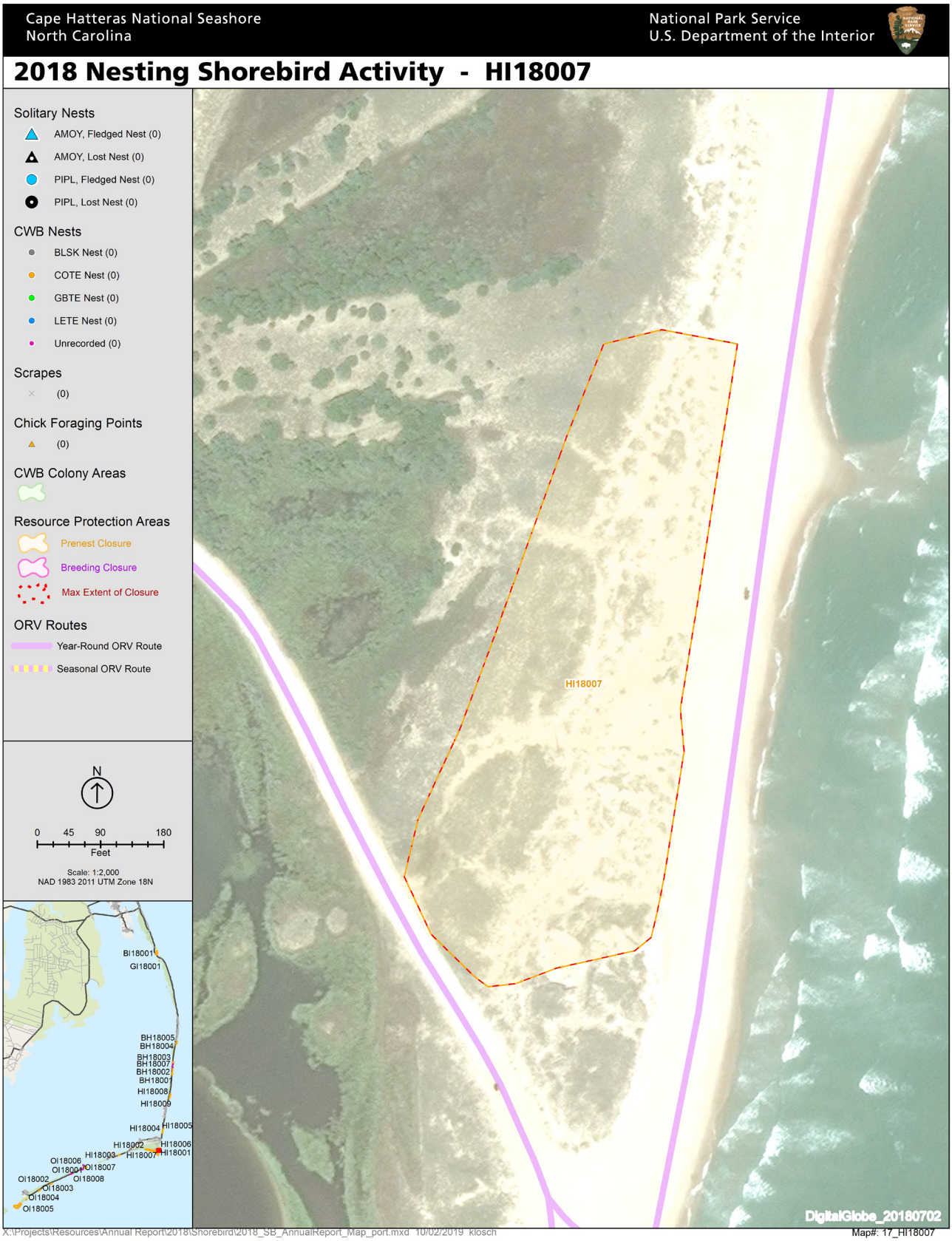
Map 14. 2018 shorebird activity at Hatteras Island 18004.



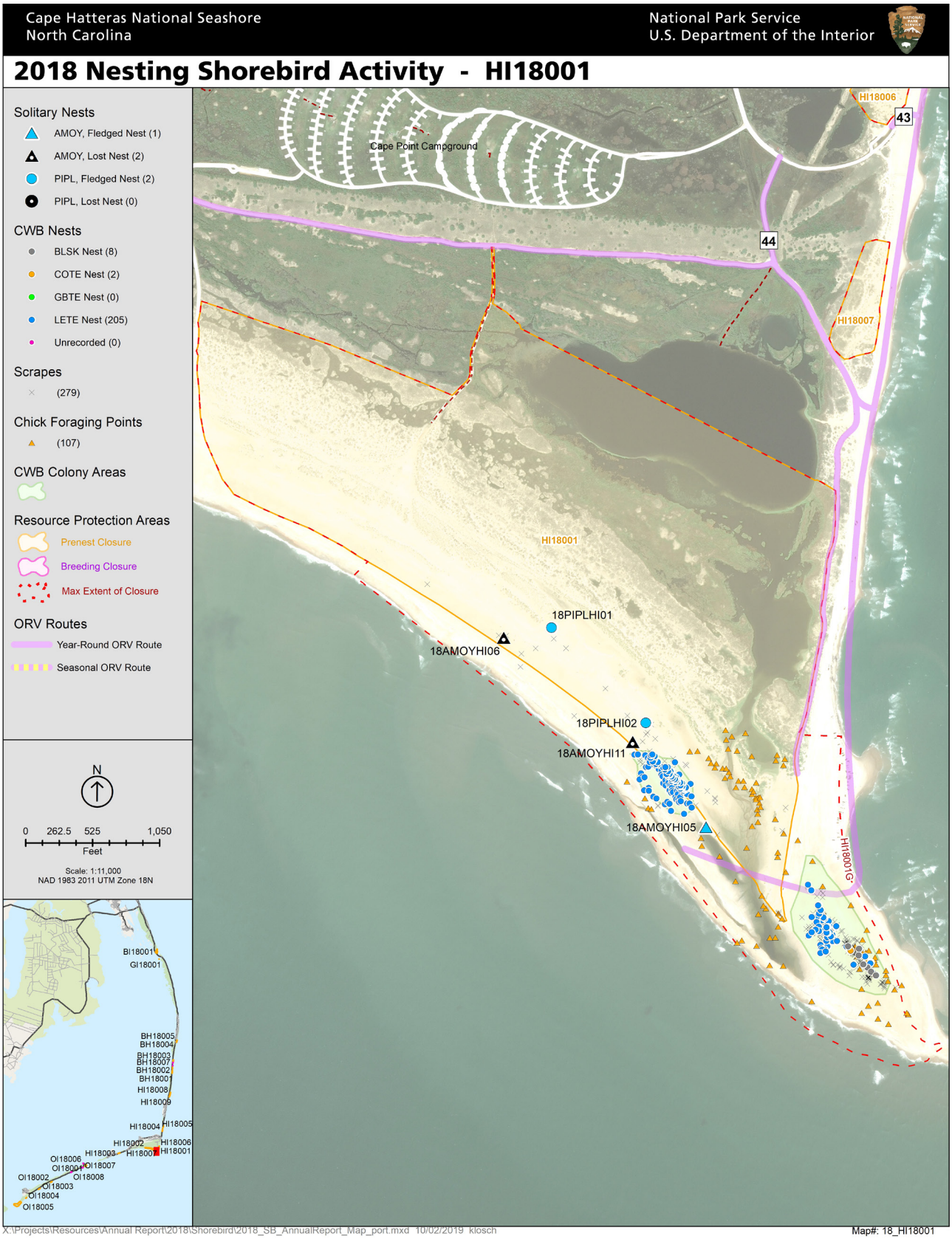
Map 15. 2018 shorebird activity at Hatteras Island site 18005.



Map 16. 2018 shorebird activity at Hatteras Island site 18006.



Map 17. 2018 shorebird activity at Hatteras Island site 18007.



Map 18. 2018 shorebird activity at Hatteras Island site 18001.



Map 19. 2018 shorebird activity at Hatteras Island site 18002.



Map 20. 2018 shorebird activity at Hatteras Island site 18003.



Map 21. 2018 shorebird activity at Ocracoke Island site 18006.



Map 22. 2018 shorebird activity at Ocracoke Island site 18007.



Map 23. 2018 shorebird activity at Ocracoke Island site 18001.



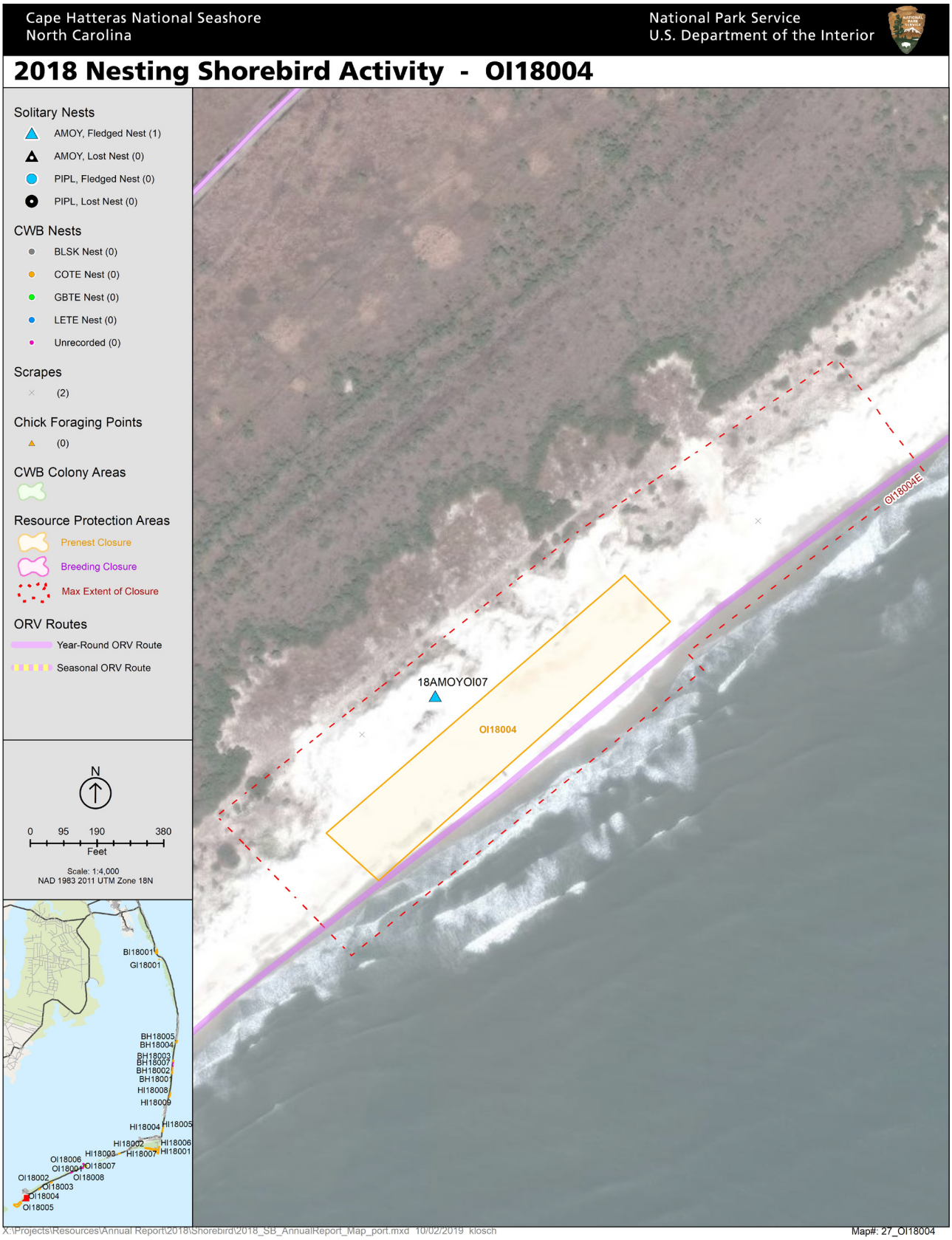
Map 24. 2018 shorebird activity at Ocracoke Island site 18008.



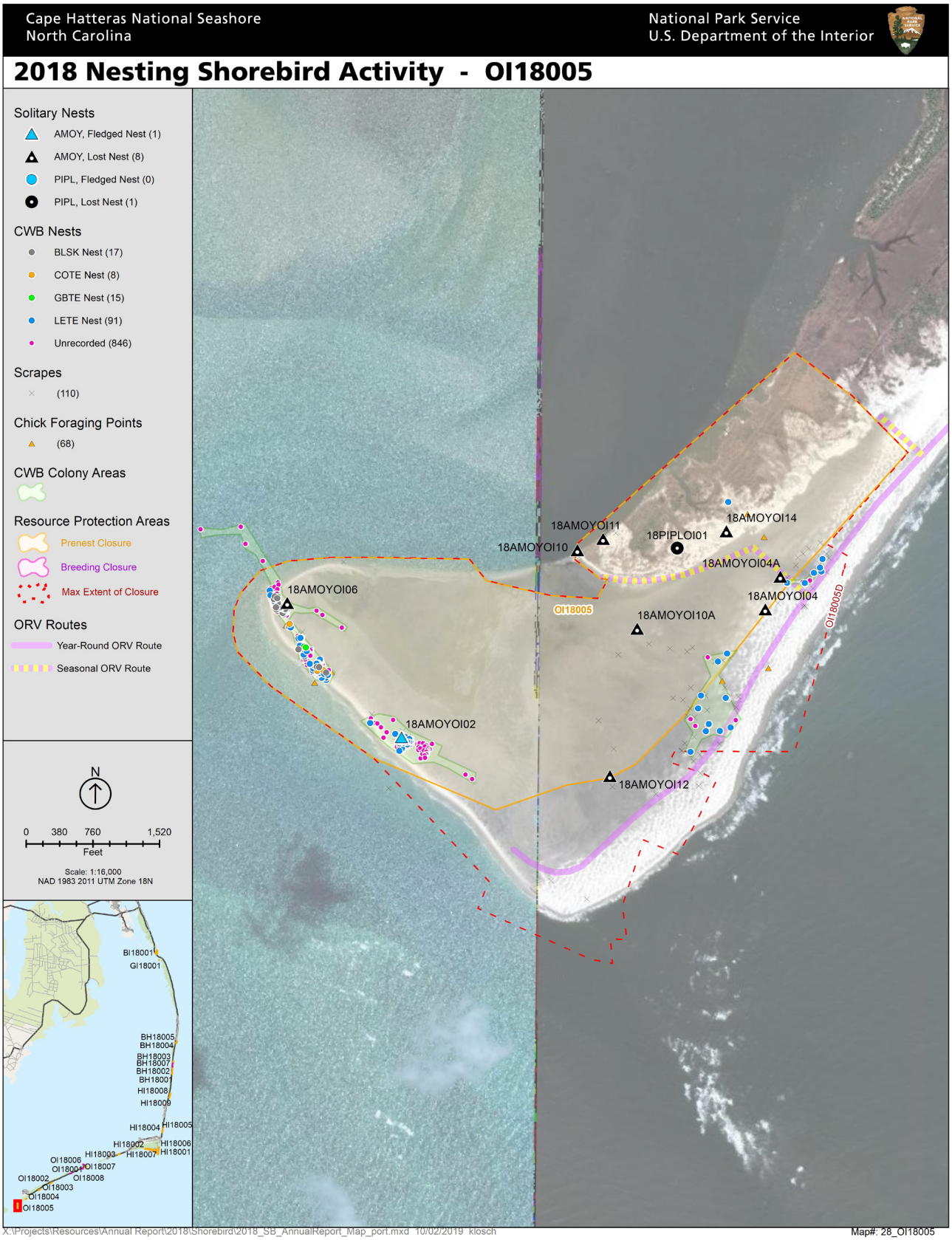
Map 25. 2018 shorebird activity at Ocracoke Island site 18002.



Map 26. 2018 shorebird activity at Ocracoke Island site 18003.



Map 27. 2018 shorebird activity at Ocracoke Island site 18004.



Map 28. 2018 shorebird activity at Ocracoke Island site 18005.

Appendix B. 2018 Piping Plover Productivity Data

Table B-1. Hatteras Island productivity data for 2018. Hatteras Island totals: 2 piping plover pairs, 2 nests, 8 eggs, 8 chicks, and 3 fledglings. Seashore totals: 3 piping plover pairs, 3 nests, and 3 fledglings.

Nest #	Pair #	Start Date	Total # Eggs	Date Exclosure Installed	Hatch Date	Total # Chicks	# Fledged	Fledge Date	# Eggs/chicks Lost, Date Lost, Reason
18PIPLHI01	HI01	4/25	4	5/1	6/5	4	1	6/22	5/27, 1 chick lost, ghost crab 5/30, 1 chick lost, unknown 6/8, 1 chick lost, unknown
18PIPLHI02	HI02	5/13	4	5/20	6/11	4	2	7/7	6/12, 1 chick lost, ghost crab 6/15, 1 chick lost, unknown

Table B-2. Ocracoke Island productivity data for 2018. Ocracoke Island totals: 1 piping plover pair, 1 nest, 3 eggs, 3 chicks, and 0 fledglings. Seashore totals: 3 piping plover pairs, 3 nests, and 3 fledglings.

Nest #	Pair #	Start Date	Total # Eggs	Date Exclosure Installed	Hatch Date	Total # Chicks	# Fledged	Fledge Date	# Eggs/chicks Lost, Date Lost, and Reason
18PIPLOI01	OI01	5/27	3	5/14	6/5	3	0	--	6/12, 1 chick lost, unknown 6/13, 1 chick lost, unknown 6/18, 1 chick lost, unknown

Appendix C. 2018 American Oystercatcher Productivity Data

Table C-1. Green Island productivity data for 2018. Green Island totals: 1 American oystercatcher pair, 1 nest, 1 egg, 0 chicks, 0 fledglings, 1 nests lost. Seashore totals: 25 American oystercatcher pairs, 40 nests, and 20 fledglings. All bands are darvic green (DG) unless otherwise noted.

Nest #	Pair #	Bands	Location	Start Date	Total # Eggs	Hatch Date	Total # Chicks	# Fledged	Fledge Date	Date Lost, # Eggs/Chicks Lost, Reason
87AM07GI01	GI01	11/UM	Central GI	5/10	1	–	–	–	–	5/18, 1 egg lost, unknown

Table C-2. Bodie Island productivity data for 2018. Bodie Island totals: 2 American oystercatcher pairs, 5 nests, eight eggs, 0 chicks, 0 fledglings, 5 nests lost. Seashore totals: 25 American oystercatcher pairs, 40 nests, and 20 fledglings. All bands are darvic green (DG) unless otherwise noted (UNB = unbanded).

Nest #	Pair #	Bands	Location	Start Date	Total # Eggs	Hatch Date	Total # Chicks	# Fledged	Fledge Date	Date Lost, # Eggs/Chicks Lost, Reason
18AMOYBI01	BI01	CXM/UNB	1.3 mi S R4	4/23	3	–	–	–	–	4/30, eggs lost, canid
18AMOYBI02	BI02	RdAF7/UNB	1.2 mi S R4	5/7	3	–	–	–	–	5/18, 3 eggs lost, unknown
18AMOYBI03	BI01	CXM/UNB	Marker 21C	5/30	2	--	–	--	–	6/13, 2 eggs, canid
18AMOYBI04	BI02	RdAF7/UNB	1.2 mi S R4	5/30	2	--	–	--	–	7/11, 2 eggs, canid
18AMOYBI05	BI01	CXM/UNB	1.5 mi S R4	6/24	1	--	–	--	–	7/22, 1 egg, unknown

Table C-3. Bodie Hatteras productivity data for 2018. Bodie Hatteras totals: 3 American oystercatcher pairs, 4 nests, 13 eggs, 7 chicks, 5 fledglings, 1 nest lost. Seashore totals: 25 American oystercatcher pairs, 40 nests, and 20 fledglings. All bands are darvic green (DG) unless otherwise noted (UNB = unbanded).

Nest #	Pair #	Bands	Location	Start Date	Total # Eggs	Hatch Date	Total # Chicks	# Fledged	Fledge Date	Date Lost, # Eggs/Chicks Lost, Reason
18AMOYBH01	BH01	27/CXR	0.7 mi N R30	4/17	1	–	–	–	–	4/29, 3 eggs, unknown
18AMOYBH02	BH02	CXN/CXP	0.2 mi N R27	4/23	1	–	–	–	–	4/25, 1 egg, unknown
18AMOYBH02A	BH02	CXN/CXP	0.2 mi N R27	4/26	3	5/24	3	3	6/30	–
18AMOYBH03	BH03	L9/UNB	0.7 mi N R27	4/23	3	5/21	1	1	6/27	5/21, 2 eggs, unknown
18AMOYBH04	BH01	27/CXR	0.5 mi N R30	5/10	3	6/6	3	1	7/14	6/9, 2 chicks, unknown

Table C-4. Hatteras productivity data for 2018. Hatteras totals: 7 American oystercatcher pairs, 14 nests, 30 eggs, 9 chicks, 7 fledglings, 8 nests lost. Seashore totals: 25 American oystercatcher pairs, 40 nests, and 20 fledglings. All bands are darvic green (DG) unless otherwise noted (UNB = unbanded).

Nest #	Pair #	Bands	Location	Start Date	Total # Eggs	Hatch Date	Total # Chicks	# Fledged	Fledge Date	Date Lost, # Eggs/Chicks Lost, Reason
18AMOYHI01	HI01	AT/UNB	0.23 mi S SBPK	4/18	1	–	–	–	–	5/7, 1 egg, unknown
18AMOYHI02	HI02	H2/XT	0.77 mi W R45	4/25	3	5/23	3	3	7/7	–
18AMOYHI03	HI03	R0/CM2	0.4 mi W R45	4/25	3	–	–	–	–	5/4, 3 eggs, red fox
18AMOYHI04	HI04	99/XW	2.54 mi S R38	4/26	3	–	–	–	–	5/22, 3 eggs, feral cat
18AMOYHI05	HI05	H3/OrHT	1.03 mi E R45	4/28	2	5/26	1	1	7/5	5/28, 1 egg, abandoned
18AMOYHI06	HI06	LA/UNB	0.32 mi E SPRD	5/5	3	–	–	–	–	5/12, 3 eggs, canide
18AMOYHI07	HI07	LY/UNB	2.00 mi S R38	5/7	1	–	–	–	–	5/9, 1 egg, abandoned
18AMOYHI08	HI01	AT/UNB	0.23 mi S SBPK	5/7	1	–	–	–	–	5/13, 1 egg, unknown
18AMOYHI09	HI07	LY/UNB	2.19 mi S R38	5/14	2	–	–	–	–	5/27, 1 egg, feral cat 5/31, 1 egg, unknown
18AMOYHI10	HI03	R0/CM2	0.26 mi W R45	5/16	3	6/11	2	2	7/27	6/14, 1 egg, abandoned
18AMOYHI11	HI06	LA/UNB	0.55 mi E SPRD	5/23	2	6/26	1	–	–	6/28, 1 egg, abandoned 7/1, 1 chick, unknown
18AMOYHI12	HI01	AT/UNB	0.43 mi W SBPK	5/27	2	–	–	–	–	6/11, 2 eggs, unknown
18AMOYHI13	HI04	99/XW	2.71 mi S R38	6/6	2	7/4	1	1	8/21	7/5, 1 egg, abandoned
18AMOYHI14	HI07	LY/UNB	2.01 mi S R38	6/14	2	7/12	1	–	–	7/15, 1 egg, abandoned 7/24, 1 chick, unknown

Table C-5. Ocracoke Island productivity data for 2018. Ocracoke Island totals: 12 American oystercatcher pairs, 16 nests, 40 eggs, 18 chicks, 8 fledgling, 7 nests lost. Seashore totals: 25 American oystercatcher pairs, 40 nests, and 20 fledglings. All bands are darvic een (DG) unless otherwise noted (UNB = unbanded).

Nest #	Pair #	Bands	Location	Start Date	Total # Eggs	Hatch Date	Total # Chicks	# Fledged	Fledge Date	Date Lost, # Eggs/Chicks Lost, Reason
18AMOYOI01	OI01	UNB/UNB	0.6 mi S R68	4/27	2	–	–	–	–	5/16, 2 eggs, raccoon
18AMOYOI02	OI02	XL/UNB	1.84 mi S R72	4/29	3	5/25	3	3	7/5	–
18AMOYOI03	OI03	CL/UNB	0.96 mi N R67	7/30	3	–	–	–	–	6/1, 3 eggs, abandoned
18AMOYOI04	OI04	LK/WE	1.0 mi S R72	4/30	1	–	–	–	–	5/6, 1 egg, abandoned
18AMOYOI04a	OI04	LK/WE	1.0 mi S R72	5/5	2	–	–	–	–	5/12, 2 eggs, unknown
18AMOYOI05	OI05	CCH/L4	0.4 mi S R59	5/1	2	–	–	–	–	5/6, 2 eggs, avian
18AMOYOI06	OI06	LM/UNB	1.9 mi S R72	5/3	3	5/31	1	–	–	5/25, 2 eggs, unknown 6/9, 1 chick, unknown
18AMOYOI07	OI07	CK3/UNB	0.67 mi N R72	5/4	2	6/3	1	1	7/12	5/20, 1 egg, unknown
18AMOYOI08	OI08	87/UNB	Spoil Dune	5/4	3	5/30	2	1	7/9	6/1, 1 egg, abandoned 6/11, 1 chick, siblicide
18AMOYOI09	OI09	CK2/UNB	1.5 mi N R63	5/6	3	6/5	2	2	7/16	6/8, 1 egg, abandoned
18AMOYOI010	OI10	HA/UNB	1.3 mi S R72	5/11	2	–	–	–	–	5/21, 2 eggs, unknown
18AMOYOI011	OI11	MN/UNB	1.2 mi S R72	5/11	3	5/29	2	–	–	6/2, 2 chicks, unknown 6/4, 1 chick, unknown
18AMOYOI12	OI12	TW/UNB	1.53 mi S R72	5/13	3	6/11	2	–	–	6/11, 2 chicks, unknown 6/12, 1 egg, avian
18AMOYOI13	OI05	CCH/L4	0.3 mi N R59	5/17	2	6/16	2	1	7/26	7/22, 1 chick, unknown
18AMOYOI14	OI04	LK/WE	1.0 mi S R72	5/21	2	6/17	2	–	–	6/23, 2 chicks, unknown
18AMOYOI15	OI01	UNB/UNB	0.68 mi S R68	5/27	3	–	–	–	–	6/10, 3 eggs, raccoon
18AMOYOI16	OI10	HA/UNB	1.3 mi S R72	6/2	1	–	–	–	–	6/9, 1 egg, unknown

Cape Hatteras National Seashore
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National Park Service
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