

Piping Plover Nesting Results in New Jersey:2020

Prepared by

Emily Heiser and Christina Davis

New Jersey Division of Fish and Wildlife

Endangered and Nongame Species Program



Photo Courtesy of Sam Galick

SUMMARY OF FINDINGS:

One hundred three (103) pairs of Piping Plovers nested in New Jersey in 2020, a 10% decrease compared to 2019 (114 pairs). The 2020 population is below the statewide long-term average (116 pairs) and the state's peak population of 144 pairs in 2003. State-wide productivity in 2020 (1.29 fledglings/pair) remained above the long-term average (1.05 fledglings/pair) but below the federal recovery goal (1.50 fledglings/pair).

The total number of adults recorded for the entire nesting season (228) was higher than the number of adults recorded during the date-restricted Atlantic Coast census survey conducted June 1-9 (210). The final number of pairs for the season (103) also increased from the pair number tallied during the date-restricted census period (95). An unusually high number of unpaired adults were recorded this season (23), one of the highest recorded since federal listing in 1986. Several adults exhibited consistent breeding behavior, sometimes with other adults, but no nest was ever located for these adults. Due to intense monitoring, it is not believed enough nests were missed to explain this phenomenon.

The northern Monmouth County region remains the stronghold of the state's population with the largest percentage of pairs (48 pairs or 47% of the statewide total). Sandy Hook maintains the highest number of pairs (40) in the state. Sea Bright continued its reign with the highest number of pairs per municipal beach in the state (6) for the fifth year in a row but declined precipitously from its previous ten pairs population over the last three years. The region consisting of southern Monmouth County and central Ocean County accounted for 7% of the statewide total (7 pairs). The Holgate and Little Beach units of E.B. Forsythe National Wildlife Refuge combined with the state's North Brigantine Natural Area, maintained a significant portion of the statewide total (41 pairs or 40%). Cape May County, the regions consisting of Ocean City to Cape May, accounted for 7% of the statewide total (7 pairs) and saw another small population increase this year (seven pairs in 2020, five pairs in 2019, three pairs in 2018).

From a site level perspective, the most significant shifts in 2020 occurred in Monmouth and Ocean Counties. The northern Monmouth County population declined 14% as compared to 2019 (48 pairs in 2020, 56 pairs in 2019). This decline is mainly attributed to the loss of pairs at Sea Bright and Monmouth Beach. The Barnegat Light population decreased 50% in 2020 (2 pairs in 2020, 4 pairs in 2019). The remainder of the state's population plateaued or increased. The Holgate and Little Beach Units of E.B. Forsythe NWR maintained record-level pair numbers in 2020 with only a minor decline compared to last season (40 pairs in 2019, 39 pairs in 2020). Cape May County's population and distribution experienced a slight increase with two historic nesting sites revived at U.S. Coast Guard Training Center of Cape May (last active in 2013) and the northern portion of Ocean City (last active in 2005).

Pairs nested at 20 sites statewide in 2020 with two sites gained and nine sites lost – the most deserted nesting areas recorded since federal listing. Several deserted nesting sites hosted only one pair in 2019 so they were vulnerable to being lost. New Jersey Division of Fish and Wildlife (NJDFW) monitored ten of the active nesting sites (50% of the sites statewide), accounting for 24 nesting pairs (23% of the nesting pairs statewide). NJDFW typically monitors approximately half of the state’s nesting sites but the total number of active pairs monitored dropped in 2020, reversing an upward trend from the previous five years. The majority of the state’s population remained on federal property (79 pairs or 77% of the statewide total).

Statewide pair-nest success (the percentage of pairs that successfully hatch at least one nest) was low this year (69%) mainly due to COVID-19 challenges. Sandy Hook was unable to utilize predator exclosures on nests due to their COVID-19 protocols on social-distancing (98% pair-nest success in 2019 versus 53% pair-nest success in 2020). Elsewhere in the state, pair-nest success increased at nearly every site compared to 2019. At NJDFW-monitored sites, pair-nest success (83%) was up from 2019 (73%) and was well above the long-term average (68%).

The cause of nest failure was determined in 59 of the 82 failed nesting attempts statewide (72%). Depredation was the leading cause of nest failure (38 or 46%) in the state for the eighth consecutive year. Of the depredated nests, nearly half (18 or 47%) were lost to mammals and the majority of those (14 or 78%) were lost to red fox. The remainder of mammalian depredated nests were lost to opossum (three or 17%) and raccoon (one or 5%). Avian depredation by crow, gull and undetermined avian species was found to be the cause of six nest losses (16%). The remaining depredated nests were lost to ghost crab (one or 3%) or unknown predator species (13 or 34%). Flooding was responsible for 15 nest losses or 18% of the total failed nesting attempts. Nest abandonment was lower in 2020 (four or 5%) and notably just one of those was exclosed. Nest loss due to eggs being blown over or buried led to two failures (3%). The cause of nest failure could not be determined in 23 (28%) nest losses. This is markedly higher than in previous years and could be partially due to the challenges managers faced with COVID-19 restrictions on field staff.

The statewide fledgling rate, which includes data collected and provided by all state cooperators, was 1.29 fledglings/pair. This is a slight increase in productivity compared to 2019 (1.24 fledglings/pair) but remains below the productivity goal (1.50 fledglings/pair) established by the USFWS Recovery Plan for Atlantic Coast Piping Plovers. Looking at long-term trends, statewide productivity has remained above 1.00 fledglings/pair for an unprecedented seven consecutive years. This has historically not been the case in New Jersey with productivity dipping as low as 0.39 fledglings/pair (1997). Statewide productivity is slightly above the 1.245 fledglings/pair range-wide threshold for population maintenance also established in the Recovery Plan. NJDFW-monitored sites were well above 2019 (1.09 fledglings/pair) with a productivity of 1.54 fledglings/pair and above the long-term average (0.97 fledglings/pair). This is only the fourth time since federal listing that NJDFW-monitored sites exceeded the Recovery Plan’s goal of 1.50 fledglings/pair. Identifying factors contributing to chick mortality remains difficult as scant evidence is typically left behind.

Productivity varied considerably by individual site and region. Overall productivity was higher in nearly every region when compared to 2019. However, Monmouth County saw a decline in productivity (0.99 fledglings/pair in 2020 versus 1.23 fledglings/pair in 2019) but still contributed 34% of the total fledged chicks this season. Sandy Hook’s productivity declined significantly (0.78 fledglings/pair in 2020 versus 1.29 fledglings/pair in 2019) which is mostly explained by the decrease in hatched nests due to COVID-19 regulations on exclosure use. While Sea Bright’s pair number decreased, productivity increased (2.17 fledglings/pair in 2020 versus 1.30 fledglings/pair in 2019). Ocean County municipal and state properties (Island Beach State Park and Barnegat Light) maintained a high level of productivity with 1.67 fledglings/pair. Notably, Barnegat Light saw its highest productivity since 2015 (2.50 fledglings/pair). The Holgate, Little Beach, and North Brigantine Natural Area region maintained a strong level of productivity (1.68 fledglings/pair) and the highest productivity it has had since 2014. This area contributed 52% of the total fledged chicks

produced in 2020. Cape May County continues to increase in pair numbers and productivity (0.86 fledglings/pair in 2020 versus 0.60 fledglings/pair in 2019) but still falls below the long-term statewide productivity average (1.05 fledglings/pair).

DISCUSSION and CONCLUSION:

After a promising increase in the breeding pair population in 2019 (114 pairs), New Jersey saw a 10% decline in pair numbers in 2020 (103 pairs). Looking at pair numbers over the last decade, New Jersey appears to have a population in flux, with sharp increases and decreases every few years. In 2020, pair number dropped across all regions of the state, except in Cape May County where there was a modest two pair increase. The greatest drop in pairs was observed in Monmouth County where several municipal sites that held small populations (one to two pairs) in 2019 were deserted. Marked birds that were once observed nesting at Sea Bright and other municipal beaches in Monmouth County were noted at Sandy Hook where, presumably, habitat is preferred due to limited disturbance and other optimal habitat features. This does not account for all pairs lost on municipal beaches from 2019 to 2020 but may account for some of the pair number shifts. However, this shift did not contribute to a population gain at Sandy Hook, indicating that site may be losing pairs overall.

New Jersey has long struggled to meet the 1.50 fledglings/pair goal set forth by the Recovery Plan, only once hitting the goal in 2018. When correlating pair number to productivity, no consistent pattern emerges. There are periods in the mid-2000s when the population was similarly positioned, but with much lower productivity. New Jersey has attained relatively high productivity for seven consecutive years (ranging from 1.24 fledglings/pair to 1.51 fledglings/pair), but the population has not responded as expected, given previous correlations of pair number and productivity. Instead, pair numbers have increased only marginally and been stricken with steep declines in between periods of gains. Whether rising or falling, they have stayed well below the peak of 144 pairs recorded in 2003. It should be noted that a high number of individuals (23) were observed this season without a mate and/or confirmed nest. If added to the total number of adults in 2020, this number reflects the pair number of 2019 (114 pairs). This is another curious pattern that has emerged in recent years (2017 and 2018) when the pair number is low. It is not fully understood why these individuals are not attempting to nest. Identifying and addressing factors contributing to pair recruitment and retention is paramount to move New Jersey away from instability and towards recovery of this species.

Federal lands such as Gateway National Recreation Area's Sandy Hook Unit and E.B. Forsythe National Wildlife Refuge's Holgate and Little Beach Units have consistently maintained the majority of the state's population over the last decade. In 2020, the two areas combined held 77% of the state's breeding pairs and 73% of all chicks fledged. Holgate, which saw drastic and positive habitat modification after Hurricane Sandy in 2012, has continued to host successful pairs and produce chicks. The population more than doubled at Holgate in 2019 and they sustained that in 2020. These sites play the most critical role in the recovery of this species in the state.

State-owned and municipal nesting sites strive to mimic the optimal conditions on federal lands but are often plagued by disturbance due to high recreational use. Barnegat Light and Corson's Inlet State Park both achieved successes in the conservation and management of Piping Plovers this year. Led by Rutgers University and Conserve Wildlife Foundation of New Jersey, Barnegat Light underwent a multi-scale habitat restoration project that was completed in winter 2020. Forty acres of land were cleared of dense, woody vegetation and a large foraging pond was added to the site creating prime Piping Plover habitat free of recreational disturbance. Of the two pairs nesting at Barnegat Light in 2020, both were utilizing habitat in the restoration area and none were nesting on the highly recreated front beach habitat. While data analysis of habitat use is ongoing, chicks that hatched in the restoration area foraged in the newly created pond 78% of the time they were observed this year. Seven chicks fledged from Barnegat Light and this was the highest productivity (2.50 fledglings/pairs) recorded there in five years. In Cape May County, Corson's Inlet State Park is part of an unmodified inlet

system that saw a return of Piping Plovers last year for the first time in a decade. Corson's Inlet has a history of struggling to fledge chicks and pairs often failed due to depredation and high levels of recreational use. Two pairs nested there in 2020 and the first brood was regularly observed attempting to forage on the backside inlet but was unable due to pedestrians and boats landed in the area. Through a partnership with the Division of Parks and Forestry (NJDPF), NJDFW worked to implement a closure of the heavily recreated bayside habitat to boat landing and pedestrian use ahead of the second pair's nest hatching. The closure was approximately 220m of low-wave energy foraging habitat and was manned by volunteers, NJDFW and NJDPF employees. The chicks were noted using that area undisturbed for several hours at a time and were observed there in approximately 60% of the brood locations recorded this year. The first pair (pre-closure) did not fledge any chicks and the second pair (post-closure) fledged two chicks. NJDFW must continue to utilize strategies like these (restoration and intense management) to successfully simulate conditions like those on federal properties.

COVID-19 played a significant and challenging role in the management and monitoring of Piping Plovers this year. All cooperators reported staffing challenges with delayed start dates and social distancing protocols on staff's ability to accomplish "teamwork" tasks. Volunteer programs were delayed, and intern use was ultimately terminated. This was particularly felt at Sandy Hook where exclosure use was null and therefore, nest success was significantly impacted. Sandy Hook typically excloses approximately 100% of their nests leading to high nest hatch rates. No nests were exclosed in 2020 leading to a nearly 50% decline in nest success. In addition to staffing troubles impacting management strategies, COVID-19 caused an influx of people to the coastline. All cooperators indicated that this was one of the busiest seasons on record. This made managing Piping Plovers extremely difficult for field staff working on sites that were open to the public. Spring fencing was especially challenging with travel restrictions, staffing delays, and an increase of beachgoers in what is typically a quieter portion of the season. Outreach suffered significantly as volunteers were delayed and staff struggled to interact with people while practicing social distancing.

It was a challenging season for all cooperators in the state due to COVID-19. However, the strong foundation of partnerships on the federal, state, municipal, non-profit, and university levels proved to be resilient and adaptive. Productivity was strong for the seventh consecutive year and can partly be attributed to species managers relying on each other for innovative habitat management strategies. The decline in pair numbers continues to trouble biologists throughout the state working on this species. Factors contributing to this decline remain complex and likely vary widely year-to-year. Sea-level rise, habitat loss, human alteration of the coastline, and human subsidized predators are just a few of the challenges New Jersey faces. Continued research addressing the pair instability in New Jersey is needed if the state population is going to move towards recovery. NJDFW remains committed to recovering Piping Plovers in the most densely populated state in the nation.

LITERATURE CITED:

U.S. Fish & Wildlife Service. 1996. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. Hadley, MA. 258 pp.

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Table 1. Number of pairs of Piping Plovers at New Jersey nesting sites: 2011-2020

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sandy Hook NRA	49	50	43	47	53	51	40	38	41	40
<i>Coast Guard</i>	4	4	3	4	3	5	3	3	3	2
<i>North Beach</i>	14	14	13	14	15	14	13	11	10	11
<i>North Beach Recreational</i>	0	0	0	0	0	1	1	1	3	2
<i>North Gunnison</i>	9	13	8	8	10	8	6	6	8	8
<i>South Gunnison</i>	4	5	7	9	8	7	5	3	3	4
<i>E-Lot</i>	0	0	0	0	0	0	0	0	1 ¹	0
<i>Visitor Center</i>	0	0	0	0	0	1	0	0	1 ¹	0
<i>D-Lot</i>	1	0	0	0	0	0	0	0	0	0
<i>Skeleton Hill Island</i>	1	0	0	0	0	0	0	0	0	0
<i>Critical Zone</i>	5	6	5	4	7	6	5	6	6	6
<i>Hidden Beach</i>	5	4	3	4	4	4	3	3	1	0
<i>B-Lot</i>	0	0	0	0	0	0	0	0	1 ¹	0
<i>Fee Beach</i>	5	3	4	4	6	4	3	3	5 ¹	4
<i>South Fee Beach</i>	1	1	0	0	0	1	1	2	1	3
Sea Bright - North	2	2	0	0	1	6	10	10	10	6
Monmouth Beach - North ²	0	0	2	1	1 ¹	5	3	3	4 ¹	2
Monmouth Beach - South	0	0	0	0	0	0	0	1	0	0
Seven Presidents Park	2	0	0	1	1 ¹	1	1	0	2 ¹	0
Region 2 subtotal	53	52	45	49	55	63	54	52	56	48
Belmar – Shark River Inlet	0	0	0	1	0	0	0	1	1	0
Sea Girt – Wreck Pond	0	1	0	0	0	0	0	0	1 ¹	0
Sea Girt – NGTC	0	0	0	0	0	0	0	0	2 ¹	1
Island Beach SP NNA	0	0	0	0	0	0	0	4	4	4
Island Beach SP SNA	0	0	0	0	0	1	1	0	1 ¹	0
Barnegat Light	3	1	2	1	1	3	5	3	3 ¹	2
Loveladies	0	0	0	0	0	0	0	0	1	0
Region 3 subtotal	3	2	2	2	1	4	6	8	11	7
Long Beach Township	0	0	0	0	0	0	1 ¹	0	0	0
EB Forsythe NWR	23	32	35	26	38	37	37	31	40	39
<i>Holgate</i>	6	14	12	12	24	25	22 ¹	18	29 ¹	29
<i>Little Beach</i>	17	18	23	14	14	12	15	13	12 ¹	10
North Brigantine NA	5	8	6	3	5	5	4	2	2	2
Region 4 subtotal	28	40	41	29	43	42	41	33	42	41
Seaview Harbor Marina	1	1	1	0	1 ¹	0	0	0	0	0
Malibu WMA	0	0	0	1	1 ¹	0	0	0	0	0
Ocean City - Center	1	0	0	0	0	0	0	0	0	0
Ocean City – North	0	0	0	0	0	0	0	0	0	2
Region 5 subtotal	2	1	1	1	1	0	0	0	0	2
Corson's Inlet SP	0	0	0	0	0	0	0	0	2	2
Strathmere NA	1	1	2 ¹	1	0	0	0	0	0	0
Strathmere (Upper Twp.)	2	2	4 ¹	2	0	0	0	0	0	0
Avalon - Dunes	5	5	3	3 ¹	2 ¹	1	1	0	0	0
Region 6 subtotal	8	8	8	6	2	1	1	0	2	2
Stone Harbor Point	10	9	6	4 ¹	6 ¹	5	3	3	3	2
N. Wildwood - Hereford	1	1	1	1	1	0	0	0	0	0
Coast Guard - TRACEN	0	2	1 ¹	0	0	0	0	0	0	1
Cape May City	0	0	1 ¹	0	0	0	0	0	0	0
Cape May Meadows	6	6	3	1	0	0	0	0	0	0
<i>The Nature Conservancy</i>	4	3	1	0	0	0	0	0	0	0
<i>Cape May Point SP</i>	2	3	2	1	0	0	0	0	0	0
Region 7 subtotal	17	18	11	6	6	5	3	3	3	3
Total Pairs	111	121	108	92	108	115	105	96	114	103
Pairs at NJDFW sites	35	36	29	19	17	27	29	27	33	24

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

² This site includes Sea Bright – South and Monmouth Beach - North

Table 2. New Jersey Piping Plover window census results: June 1-9, 2020

	State Census Count			Final Season Count		
	# Pairs	# Unpaired Adults ¹	# Total Adults	# Pairs	# Unpaired Adults ¹	# Total Adults
Sandy Hook Coast Guard	1	0	2	2	0	4
Sandy Hook North Beach	7	0	14	11	0	22
Sandy Hook North Beach Recreational	2	0	4	2	0	4
Sandy Hook North Gunnison	8	0	16	8	0	16
Sandy Hook South Gunnison	4	1	9	4	1	9
Sandy Hook E-Lot	0	0	0	0	0	0
Sandy Hook Visitor Center	0	0	0	0	0	0
Sandy Hook Critical Zone	5	0	10	6	0	12
Sandy Hook Hidden Beach	0	1	1	0	1	1
Sandy Hook B-Lot	0	0	0	0	0	0
Sandy Hook Fee Beach	4	0	8	4	0	8
Sandy Hook South Fee Beach	3	0	6	3	0	6
Sea Bright North	6	6	18	6	6	18
Monmouth Beach North ²	2	0	4	2	0	4
Monmouth Beach South	0	0	0	0	0	0
Seven Presidents Park	0	0	0	0	0	0
Long Branch	0	0	0	0	0	0
Region 2 subtotal	42	8	92	48	8	104
Avon-by-the-Sea	0	0	0	0	2	2
Belmar - Shark River Inlet	0	0	0	0	0	0
Sea Girt - Wreck Pond	0	0	0	0	0	0
Sea Girt - NGTC	1	0	2	1	0	2
Island Beach SP – Northern NA	4	0	8	4	1	9
Island Beach SP – Southern NA	0	2	2	0	2	2
Barneget Light	2	1	5	2	1	5
Loveladies	0	0	0	0	0	0
Region 3 subtotal	7	3	17	7	6	20
Long Beach Township	0	0	0	0	0	0
Holgate	28	5	61	29	6	63
Little Beach	10	2	22	10	2	22
North Brigantine NA	2	0	4	2	0	4
Region 4 subtotal	40	7	87	41	8	89
Brigantine Beach	0	0	0	0	0	0
Brigantine - Inlet (Cove)	0	0	0	0	0	0
Seaview Harbor Marina	0	0	0	0	0	0
Malibu WMA	0	2	2	0	0	0
Ocean City - North	1	0	2	2	0	4
Ocean City - Center	0	0	0	0	0	0
Region 5 subtotal	1	2	4	2	0	4
Corson's Inlet SP	2	0	4	2	0	4
Strathmere Natural Area	0	0	0	0	0	0
Strathmere (Upper Twp.)	0	0	0	0	0	0
Whale Beach	0	0	0	0	0	0
Townsend's Inlet	0	0	0	0	0	0
Sea Isle	0	0	0	0	0	0
Avalon - North	0	0	0	0	0	0
Avalon - Dunes	0	0	0	0	0	0
Stone Harbor - Oceanfront	0	0	0	0	0	0
Region 6 subtotal	2	0	4	2	0	4
Stone Harbor Point	2	0	4	2	0	4
N. Wildwood - Hereford Inlet	0	0	0	0	0	0
2-Mile Beach - USFWS	0	0	0	0	0	0
2-Mile Beach - LSU	0	0	0	0	0	0
Coast Guard - TRACEN	1	0	2	1	1	3
Cape May City	0	0	0	0	0	0
Cape May Meadows - TNC	0	0	0	0	0	0
Cape May Meadows - CMPSP	0	0	0	0	0	0
Cape May Point Borough	0	0	0	0	0	0
Region 7 subtotal	3	0	6	3	1	7
Total	95	20	210	103	23	228

¹ "Unpaired Adults" includes adults engaged in breeding behavior, sometimes with other adults, but are never confirmed with a nest

² This site includes Sea Bright – South and Monmouth Beach - North

Table 3. New Jersey Piping Plover nesting summary by sites: 2020

2020						
SITE	Pairs	Pairs Hatched	Chicks Fledged	Pair Success	Fledge Rate	SP Fledge Rate
Sandy Hook NRA	40	21	31	0.53	0.78	1.48
<i>Coast Guard</i>	2	0	0	0.00	0.00	0.00
<i>North Beach</i>	11	4	7	0.36	0.64	1.75
<i>North Beach Recreational</i>	2	2	1	1.00	0.50	0.50
<i>North Gunnison</i>	8	8	15	1.00	1.88	1.88
<i>South Gunnison</i>	4	4	5	1.00	1.25	1.25
<i>Critical Zone</i>	6	1	1	0.17	0.17	1.00
<i>Fee Beach</i>	4	1	0	0.25	0.00	0.00
<i>South Fee Beach</i>	3	1	2	0.33	0.67	2.00
Sea Bright - North	6	4	13	0.67	2.17	3.25
Monmouth Beach – North ¹	2	1	1	0.50	0.50	1.00
Region 2 Subtotal	48	26	45	0.54	0.94	1.73
Sea Girt - NGTC	1	1	3	1.00	3.00	3.00
Island Beach SP NNA	4	4	5	1.00	1.25	1.25
Barneгат Light	2	2	5	1.00	2.50	2.50
Region 3 Subtotal	7	7	13	1.00	1.86	1.86
EB Forsythe NWR	39	30	65	0.77	1.67	2.17
<i>Holgate</i>	29	21	51	0.72	1.76	2.43
<i>Little Beach</i>	10	9	14	0.90	1.40	1.56
North Brigantine NA	2	2	4	1.00	2.00	2.00
Region 4 Subtotal	41	32	69	0.78	1.68	2.16
Ocean City North	2	1	3	0.50	1.50	3.00
Region 5 Subtotal	2	1	3	0.50	1.50	3.00
Corson's Inlet SP	2	2	2	1.00	1.00	1.00
Region 6 Subtotal	2	2	2	1.00	1.00	1.00
Stone Harbor Point	2	2	0	1.00	0.00	0.00
Coast Guard – TRACEN	1	1	1	1.00	1.00	1.00
Region 7 Subtotal	3	3	1	1.00	0.33	0.33
NJDFW sites TOTAL	24	20	37	0.83	1.54	1.85
All NJ sites TOTAL	103	71	133	0.69	1.29	1.87
# Active Sites	20					

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

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

Fledge Rate equals the number of chicks fledged per pair.

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

Table 4. New Jersey Piping Plover nesting summary: 1987-2020

Site	AVG 87-20					
	Pairs	Pairs Hatch	Chicks Fledge	Pair Success	Fledge Rate	SP Fldg Rate
Sandy Hook Coast Guard	5.12	3.91	7.35	0.79	1.43	1.84
Sandy Hook North Beach	10.38	7.97	14.18	0.76	1.36	1.80
Sandy Hook North Beach Recreational	1.60	1.60	1.60	1.00	1.10	1.10
Sandy Hook North Gunnison	5.93	4.75	7.43	0.76	1.15	1.43
Sandy Hook South Gunnison	4.45	3.17	5.14	0.68	1.09	1.45
Sandy Hook - E-Lot	0.50	0.50	0.50	1.00	1.00	1.00
Sandy Hook Visitor's Center	0.40	0.20	0.00	0.50	0.00	0.00
Sandy Hook D-Lot	0.20	0.20	0.40	1.00	2.00	2.00
Sandy Hook Skeleton Hill Island	0.20	0.00	0.00	0.00	0.00	0.00
Sandy Hook Critical Zone	4.21	3.21	3.64	0.75	0.87	1.18
Sandy Hook Hidden Beach	3.28	2.20	4.48	0.67	1.32	1.86
Sandy Hook - B-Lot	0.50	0.00	0.00	0.00	0.00	0.00
Sandy Hook Fee Beach	4.22	3.04	4.74	0.71	1.16	1.47
Sandy Hook South Fee Beach	1.29	0.93	2.21	0.79	1.90	2.23
Sea Bright North	5.48	3.76	7.57	0.60	1.23	1.87
Monmouth Beach North	2.50	1.86	3.45	0.78	1.41	1.73
Monmouth Beach South	0.57	0.57	1.71	1.00	3.00	2.40
Seven Presidents Park	1.44	1.13	2.06	0.76	1.43	1.46
Long Branch	0.20	0.20	0.20	1.00	1.00	1.00
Region 2 Subtotal	39.53	29.74	51.03	0.75	1.30	1.75
Belmar - Shark River Inlet	0.60	0.20	0.40	0.33	0.67	0.67
Sea Girt - Wreck Pond	0.70	0.50	0.60	0.60	1.00	1.00
Sea Girt - NGTC	0.83	0.67	0.83	0.67	1.33	0.00
Mantoloking	4.07	3.40	6.67	0.81	1.40	1.58
Island Beach SP - Northern Natural Area	2.14	2.17	2.50	0.80	0.75	0.75
Island Beach SP - Southern Natural Area	0.60	0.40	0.60	0.67	1.00	1.00
Island Beach SP - Dike	1.00	0.29	0.43	0.28	0.39	1.00
Barnegat Light	3.82	2.71	4.50	0.77	1.38	1.83
Highbar	0.20	0.20	0.00	1.00	0.00	0.00
Loveladies	0.73	0.73	1.18	1.00	1.63	1.63
Region 3 Subtotal	7.00	5.26	8.82	0.76	1.32	1.76
Long Beach Township	0.25	0.25	1.00	1.00	4.00	4.00
Holgate	15.68	10.79	16.76	0.67	1.06	1.67
Little Beach	12.79	7.45	11.70	0.62	0.96	1.60
North Brigantine N. A.	6.10	3.90	7.66	0.65	1.29	1.50
Region 4 Subtotal	33.68	21.38	34.76	0.62	1.02	1.61
Brigantine Beach	6.00	4.07	4.00	0.58	0.57	0.73
Brigantine - Inlet (Cove)	1.31	1.00	1.77	0.81	1.70	2.00
Longport Sodbanks	0.50	0.17	0.50	0.25	0.75	1.50
Malibu Wildlife Management Area	0.56	0.56	0.67	1.00	1.20	1.20
Seaview Harbor Marina	0.33	0.33	0.67	1.00	2.00	2.00
Ocean City - North	2.70	1.85	2.65	0.69	0.87	1.28
Ocean City - Center	4.33	2.86	2.05	0.67	0.39	0.58
Region 5 Subtotal	7.65	5.24	5.65	0.68	0.80	1.05
Corson's Inlet State Park	3.12	2.23	2.23	0.74	0.93	0.89
Corson's Sodbank	0.20	0.20	0.00	1.00	0.00	0.00
Strathmere NA	0.73	0.45	0.82	0.64	1.21	1.29
Strathmere	2.45	1.50	1.14	0.69	0.53	0.73
Whale Beach	4.88	3.35	3.65	0.56	0.63	0.98
Sea Isle City - North	2.87	1.80	3.27	0.66	1.32	1.95
Sea Isle City - South	2.07	1.43	1.14	0.59	0.50	0.66
Townsend's Inlet	1.53	1.29	1.53	0.85	0.99	1.12
Avalon - North	1.72	1.56	2.00	0.96	1.18	1.22
Avalon - Dunes	3.65	2.26	2.50	0.64	0.82	1.07
Region 6 Subtotal	14.09	9.65	10.76	0.72	0.82	1.09
Stone Harbor Point	7.45	3.32	2.82	0.47	0.38	0.75
Champagne Island	0.70	0.30	0.40	0.33	0.67	0.80
N. Wildwood - Hereford Inlet	1.56	1.00	0.67	0.54	0.33	0.36
N. Wildwood - Oceanfront	2.00	1.42	0.50	0.69	0.21	0.28
Wildwood Crest	0.20	0.20	0.00	1.00	0.00	0.00
USFWS - Cape May NWR	0.20	0.20	0.00	1.00	0.00	0.00
Coast Guard - LSU	1.26	0.68	0.58	0.43	0.42	0.55
Coast Guard - TRACEN	2.71	1.82	2.32	0.63	0.86	1.14
Cape May	0.79	0.64	0.79	0.63	0.50	0.50
Cape May Meadows	4.39	3.76	4.12	0.82	0.95	1.14
The Nature Conservancy	3.52	2.97	3.16	0.92	1.04	1.10
Cape May Point SP	1.61	1.35	1.61	0.69	0.80	0.83
Higbee/Magnesite	0.20	0.20	0.00	1.00	0.00	0.00
Cape May Ferry	0.33	0.00	0.00	0.00	0.00	0.00
Region 7 Subtotal	14.24	9.41	9.29	0.63	0.62	0.89
Total NJDFW only	50.15	33.79	46.00	0.68	0.97	1.40
Total State	116.03	80.68	120.32	0.70	1.05	1.48

Figure 1. New Jersey Piping Plover population and productivity: 1987-2020

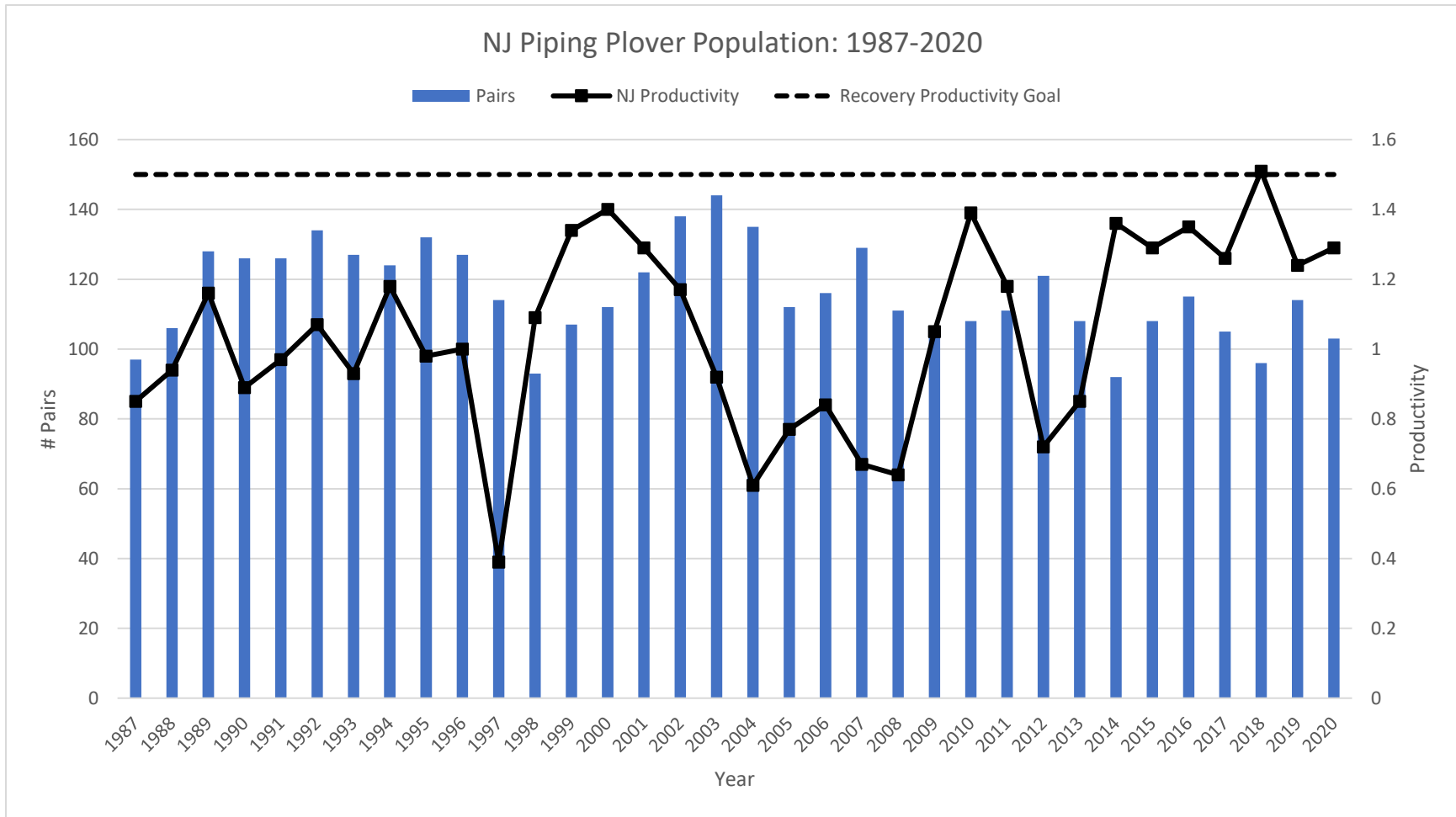


Figure 2. Causes of Piping Plover nest failure in New Jersey, all sites: 2020

