

**SUMMARY OF 1999 MASSACHUSETTS
PIPING PLOVER CENSUS DATA**

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SUMMARY OF 1999 MASSACHUSETTS PIPING PLOVER CENSUS DATA

Observers reported a total of 501 pairs of Piping Plovers (*Charadrius melodus*) at 97 sites in Massachusetts during the 1999 breeding season. An additional 49 sites were monitored one or more times during May and June, but no breeding pairs were detected. Breeding pairs are defined as pairs observed with either a nest or unfledged chicks or that exhibit site tenacity and evidence of pair bonding and territoriality for at least two weeks. Overall observer effort in 1999, measured as number of sites surveyed and intensity of census effort at each site, was roughly comparable to previous efforts conducted annually since 1986.

During the 1999 breeding season, we suspect that at least 14 pairs moved to new territories on the same beach and renested, or nested at more than one site. These included pairs that departed territories before the end of the first week of June and pairs that established territories and nested after mid-June. These pairs were included in counts for all beaches where they occurred, but were tallied only once in regional and state totals for numbers of pairs and numbers of pairs for which fledging data were reported (Tables 1, 3).

The 1999 total of 501 pairs is the highest count of Piping Plovers recorded in Massachusetts since comprehensive statewide surveys began in 1986, but is an increase of only six pairs (1.2%) over the 1998 count of 495 pairs (Table 2). Numbers of pairs increased in three regions of the state, declined in four, and were unchanged in one (Table 3).

In addition to estimating total pairs present during the breeding season, cooperators also censused pairs at all occupied sites and 49 historic or potential sites during the standardized 1999 Atlantic Coast "Index Count" from 29 May to 6 June. The objective of the Index Count is to minimize double-counting of pairs that move between or within sites, thereby providing an index to population trends that may be more precise than the Total Count. The 1999 Index Count was 498 pairs, 99% of the Total Count of 501 pairs, and a 4.8% increase over the 1998 Index Count of 475 pairs (Tables 1, 2).

Sites with the largest number of breeding pairs in the state in 1999 were Crane Beach in Ipswich (44 pairs), South Beach in Chatham (41), Sandy Neck in Barnstable (32), South Monomoy Island in Chatham (25) and Race Point – South Beach in Truro and Provincetown (19). A total of 17 sites reported ≥ 10 pairs, and collectively they accounted for 62% of all pairs. At the other end of the size spectrum, 60 sites with ≤ 3 pairs collectively supported 19% of the state's Piping Plover population.

Overall mean productivity for Massachusetts in 1999 was 1.60 chicks fledged per pair based on data from 490 of 501 pairs (98%) at 90 of 97 (93%) nesting beaches (Tables 1, 2). A chick was considered fledged if it survived ≥ 25 days or was observed in flight, whichever occurred first. Only three regions of the state (South Shore, Elizabeth Islands, Martha's Vineyard) averaged < 1.5 chicks per pair (Table 3).

Based on reports from cooperators statewide, observed nest success was 0.61 (387 of 634 nests hatched ≥ 1 egg). For 615 nests for which complete data were reported, observed hatching success was 0.59 (1,334 of 2,269 eggs hatched) and fledging success was 0.57 (762 of 1,334 chicks survived to fledge).

Abandonment was again the most commonly identified cause of nest loss in 1999, followed by unidentified predators, nest flooding, and predation by skunks, crows, foxes and gulls (Table 4). Wire predator exclosures were used to protect 436 of 634 nests (69%). Nearly 14% of nests in exclosures were abandoned (60 of 436 nests) compared to only 4% of nests without exclosures (8 of 198 nests). Causes of nest abandonment were reported as unknown in 26 of 68 instances (38%) (Table 5). The most commonly suspected causes of nest abandonment were harassment by predators (22 nests), death of one of the adults (5 nests), and severe inclement weather (5 nests).

Observed nest success (percentage of nests that hatched ≥ 1 egg) was 75% for nests protected with exclosures compared to only 40% for nests without exclosures (Table 6). Similarly, 70% of eggs protected with exclosures hatched compared to only 39% of unprotected eggs (Table 7).

As usual, few causes of chick mortality were directly observed or could be confidently surmised. In a few instances, causes of death could be determined with confidence or were strongly suspected based on convincing circumstantial evidence. In a number of other instances, chicks were found dead but cause of death could not be determined or surmised with any degree of certainty. At Parker River National Wildlife Refuge, a newly hatched chick died after the egg from which it hatched was illegally taken from the nest on the day of hatching. At Crane Beach, two chicks died while hatching, on a day when the temperature one inch above the sand's surface measured over 130 °F, and two chicks died followed repeated attacks from neighboring adult Piping Plovers. Two other chicks were found dead in the intertidal zone, outside of symbolic fencing near a large Least Tern roosting area, and another chick was found dead inside its nest exclosure. At Duxbury Beach, a 19 day-old chick that was noticeably small for its age and behaved unusually disappeared. Prior to its disappearance, it often ran into the water and was washed over by waves. Five chicks from two broods, aged five and 14 days, disappeared from Town Neck Beach in Sandwich after a storm on June 14. Similarly, five chicks aged 5-20 days disappeared on South Monomoy Island after a July 2 storm with 40 mph winds. A one day-old chick at Howe's Street Beach in Dennis with apparent neurological problems was taken to a veterinary facility where it subsequently died. A ten day-old chick found dead on North Beach in Chatham had a visible wound on the neck. A 15 day-old chick was reportedly found dead at Chapin Beach in Dennis by a beachgoer, who thought it might have been pecked to death by a bird, judging by its wounds. The carcass was never observed by a biologist or shorebird monitor, however.

At Sandy Neck in Barnstable, the extreme vulnerability of Piping Plover chicks to off-road vehicles was repeatedly demonstrated; four unfledged chicks were run over and killed in four separate incidents between 1 June and 11 July, 1999. In one instance, a

chick was run over by a law enforcement officer on an open all-terrain vehicle. Two chicks were run over in two separate incidents by unescorted vehicles driving to or from private cottages. The fourth chick was killed by a vehicle that illegally gained access onto Sandy Neck after midnight and made a pass up and down a portion of the beach. As a result of these incidents, and after consultations with the U.S. Fish and Wildlife Service and MassWildlife, the town of Barnstable instituted a strict program of escorting essential vehicles to and from cottages through areas where unfledged plover and tern chicks were present.

Observers reported a total of seven adult Piping Plovers found dead in Massachusetts between 21 May and 25 July, the most reported since we began keeping records in the mid-1980's. At Crane Beach, one adult was killed outside a predator exclosure; a resident kestrel that had been harassing plovers and perching on exclosures was suspected. On South Monomoy Island, a dead adult was found inside a predator exclosure; the necropsy report identified cause of death as small puncture wounds to the chest, either from a raptor or small mustelid. Two adults at South Beach in Chatham were found dead near exclosures and were believed killed by skunks, based on large numbers of tracks around the exclosures and at the spots where plover body parts, feathers, and/or blood were found. Two adults were found dead inside exclosures at Norton Point Beach on Martha's Vineyard; one exclosure had skunk scat and abundant tracks around it, the other had abundant gull tracks around it. Finally, an adult plover was found dead on the Oak Bluffs-Edgartown Road that traverses Sylvia State Beach in Edgartown on Martha's Vineyard. We believe this was one of the adults that hatched chicks on the beach near this busy paved road and that it was hit by a passing motor vehicle.

As always, we extend our sincere thanks to the many biologists, seasonal staff, beach managers, landowners, and volunteers that participated in conservation efforts on behalf of Piping Plovers and other coastal waterbirds in Massachusetts in 1999. We especially thank the 60 individuals who participated in population monitoring and submitted the data that are summarized in this report.

Table 1. Abundance, distribution, and productivity of Piping Plovers in Massachusetts, 1999.

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
NORTH SHORE					
Salisbury Beach, Salisbury	0 ^e	nd ^f	nd	nd	SvO
Salisbury Bch. St. Res., Salisbury	0 ^g	nd	nd	nd	SvO
Plum Island-North End, Newburyport/Newbury	0	0	0	0	DM, PD
Parker River NWR, Newbury/Rowley	15	15 ^h	13	15 ^h	DM, PD
Sandy Point State Res., Ipswich	3	4 ⁱ	3	4 ⁱ	DM, PD
Crane Beach, Ipswich	43	44 ^j	89	44 ^j	WC
Coffin's Beach, Gloucester	1	1 ^k	nd	0	SH
Wingaersheek Beach, Gloucester	0	nd	nd	nd	SH
Good Harbor Beach, Gloucester	0	nd	nd	nd	SH
SOUTH SHORE					
Third Cliff, Scituate	2	2	4	2	SH
Fourth Cliff, Scituate	1	1	1	1	SH
Duxbury Beach, Duxbury/Plymouth	11 ^l	12 ^l	11	12 ^l	JM, RC

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
Plymouth Beach, Plymouth	11	11 ^m	4	11 ^m	OM
Ellisville, Plymouth ⁿ	3	3	4	3	MZ
Sagamore Beach, Bourne and Sandwich	5	5	8	5	MZ
Scusset Beach State Res., Sandwich	3	3	3	3	MZ
UPPER CAPE					
Mashnee Dike	1	2	4	2	MZ
Black Beach/Sippewisset, W. Falmouth	1	1	0	1	BBa, MBa
Woodneck Beach, W. Falmouth	0	0	0	0	BBa, MBa
Washburn Island, Falmouth ^o	4	4	11	4	KCo
South Cape Beach, Mashpee	6 ^p	6 ^p	7	6 ^p	KCo
New Seabury, Mashpee	1	1	6 ^q	1	KCo
Rock Landing/Maushop Village, Mashpee	nd	nd	nd	nd	-
Popponesset Spit, Mashpee	4	4	13	4	BBa
Town Neck Beach, Sandwich	3	3	5	3	IC
Springhill Beach, Sandwich	10	10	16	10	IC
East Sandwich Beach, Sandwich	0	0	0	0	IC, LT

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
Scorton (Neck) Creek, Sandwich	4 ^r	4 ^r	7	4 ^r	LT
Scorton Shores, Sandwich	2	2	3	2	LT
Sandy Neck, Barnstable	32 ^s	32 ^s	32	32 ^s	CN, RK
Sampson's Is.-Dead Neck, Barnstable	8	9	19	9	MBa, KJ
Dowse's Beach, Osterville	0	0	0	0	MBa
Long Beach, Centerville	3	3	11	3	MBa, MW
Squaw Island, Hyannisport	3	3	7	3	MBa, AD
Kalmus Park Beach, Hyannis	5 ^t	4 ^t	7	4 ^t	MBa, LG, MW, AD
Gray's Beach, Yarmouth	4	4	4	2	GA, MB
Seagull Beach/Radio City, Yarmouth	3	3	7	3	GA, MB
Great Island, Yarmouth	6	6	13	6	GA, MB
Bass River Beach, Yarmouth	0	nd	nd	nd	GA, MB
West Dennis Beach, Dennis	1	1	4	1	PC
Chapin Beach, Dennis	1	1	2	1	RCr, PC
Mayflower Beach, Dennis	0	nd	nd	nd	RCr, PC
Howes St. Beach, Dennis	1	1	3	1	RCr, PC
Town Landings, Dennis	0	nd	nd	nd	RCr

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
Corporation Beach, Dennis	0	nd	nd	nd	PC, RCr
Sesuit Beach, Dennis	0	nd	nd	nd	RCr
Quivett Neck/Coles Pond, Dennis	0	0	0	0	PC, RCr
Wings Island, Brewster	0	nd	nd	nd	RCr
Robbins Hill Beach, Brewster	nd	nd	nd	nd	-
Town Beach, Brewster	0	nd	nd	nd	RCr
Ellis Launching Beach, Brewster	0	nd	nd	nd	RCr
Crosby's Landing Beach, Brewster	0	nd	nd	nd	RCr
Paine's Creek, Brewster	0	nd	nd	nd	RCr
Merkel Beach/Wychmere, Harwichport	0 ^u	0 ^u	0	0	LB
Red River Beach, Harwich	nd	nd	nd	nd	-
LOWER CAPE					
Forest Beach, Chatham	nd	nd	nd	nd	-
Cockle Cove/Ridgevale Beach, Chatham	1	1	0	1	LB, KT
Harding Beach, Chatham	1	1	1	1	LB, KT, PC
Harding Beach Point, Chatham	0	nd	nd	nd	SKo

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
North Monomoy Island, Chatham	1	1	3	1	SKo
South Monomoy Island, Chatham	21	25 ^v	35	25 ^v	SKe, SKo
South Beach, Chatham	40	41	27	41	HB, MJ, CMe
Tern Island, Chatham	1	1	4	1	LB, PC, SS
Nauset Beach, Chatham	13	13	33	13	BK
Nauset Beach, Orleans	6	6 ^w	10	6 ^w	AR, KC
Nauset Spit (Heights), Orleans	12	13 ^{x,y}	27	13 ^{x,y}	AR, KC
New Island, Orleans	0	0	0	0	MH
Skaket Beach, Orleans	nd	nd	nd	nd	-
Rock Creek (north side), Orleans	nd	nd	nd	nd	-
First Encounter Beach, Eastham	nd	nd	nd	nd	-
Coast Guard Beach, Eastham	14	14	21	14	MH
Marconi Beach/LeCount Hollow, Wellfleet	10	10	11	10	MH
Sunken Meadow Spit, Wellfleet	1	1	3	1	MBa
Lieutenant's Island, Wellfleet	1	1	0	1	MBa
Indian Neck, Wellfleet	nd	nd	nd	nd	-

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
Jeremy Point/Great Island, Wellfleet	12	12	30	12	MH
Pamet Harbor-South, Truro	1	1	0	1	CW
Pamet Harbor-North/Corn Hill Beach, Truro	2	2	6	2	CW
Pond Village Beach, Truro	nd	nd	nd	nd	-
Pilgrim Beach/Beach Point, Truro	2	2	5	2	CW
Ballston Beach/Newcomb Hollow, Truro	5	5	11	5	EH
Longnook Beach, Truro	0	0	0	0	EH
Highland Beach, Truro	0	0	0	0	EH
High Head/Head of the Meadow, Truro	1	1	4	1	EH
Race Point-South Beach, Provincetown/Truro	19	19	28	19	EH
Race Point-North Beach, Provincetown	2	3 ^z	4	3 ^z	EH
Long Point/Wood End, Provincetown	8	8	14	8	EH
BRISTOL COUNTY					
Stony Point Dike, Wareham	2	2	4	2	MZ
Long Beach Point, Wareham	nd	nd	nd	nd	-

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
Little Harbor Beach, Wareham	nd	nd	nd	nd	-
Strawberry Point, Mattapoisett	0	0	0	0	JHa
West Island, Fairhaven	1	1	3	1	JB, JH, NL
Winsegansett Heights, Fairhaven	0	0	0	0	JB, JH, NL
Round Hill Beach, Dartmouth	0	0	0	0	JB, JH, NL
Salters Pond, Dartmouth	0	0	0	0	JB, JH, NL
Demarest Lloyd State Park, Dartmouth	1	1	2	1	JB, JH, NL
Little Beach/Barney's Joy, Dartmouth	11	11	18	11	JB, JH, NL
Gooseberry Neck, Westport	0	0	0	0	JB, JH, NL
Horseneck Beach, Westport	15	15	42	15	JB, JH, NL
Acoaxet, Westport	0	0	0	0	JB, JH, NL
Cockeast Pond, Westport	1	1	2	1	JB, JH, NL
Richmond Pond, Westport	1	1	4	1	GV, JH
Bay Point, Swansea	0	0	0	0	AW
ELIZABETH ISLANDS					
Naushon Island	1	1	nd ^{aa}	nd	JHa

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
Pasque Island-Robinson's Hole	3	3	nd	nd	JHa
Pasque Island-Cobbly	nd	0	nd	nd	JHa
Pasque Island-Quick's Hole	nd	0	nd	nd	JHa
Nashawena Island-Quick's Hole	3	4	1	4	LR
Nashawena Island-Canapitsit	nd	0	nd	nd	JHa
Cuttyhunk Island	1	1	nd	nd	SM
Penikese Island	0	0	0	0	BB, CM
MARTHA'S VINEYARD					
Eastville Point Beach, Oak Bluffs	1	1	0	1	RCu, SJ
Harthaven, Oak Bluffs	1	1	3	1	DS
Sylvia State Beach, Edgartown	6	6 ^{bb}	6	6 ^{bb}	RCu, SJ
Cow Bay, Edgartown	nd	nd	nd	nd	-
Eel Pond/Little Beach, Edgartown	2	2	4	2	DS
Lighthouse Beach, Edgartown	0	0	0	0	DS
Chappaquiddick Beach, Chappaquiddick	0	0	0	0	DS, TWW
Cape Pogue Elbow/The Narrows,	3	3	0	3	KC

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
Chappaquiddick					
Arruda's Pt./The Jetties, Chappaquiddick	1	1	2	1	KC
Leland/East Beaches, Chappaquiddick	0	0	0	0	KC
Wasque, Chappaquiddick	1	2	2	2	KC
Norton Point Beach, Edgartown	7	7	2	7	RCu, SJ, ND
South Beach, Edgartown	nd	nd	nd	nd	-
Edgartown Great Pond/Job's Neck, Crackatuxet Pd., Edgartown ^{cc}	0	1	2	1	DS, SM, TWW
Oyster and Paqua Ponds, Edgartown	1	1	nd	0	DS, SM
Watcha Pond, W. Tisbury	0	nd	nd	nd	DS, SM
Tisbury Great Pond/Black Point Pond/Quansoo/ Long Point, Chilmark ^{dd}	5	5	2	5	DS, CE, SM
Chilmark Pond, Chilmark	1	1	0	1	DS, TWW
Lucy Vincent Beach, Chilmark	1	1	1	1	RCu
Long Beach/Squibnocket Beach, Chilmark	4	5 ^{ee}	9	5 ^{ee}	DS
Moshup Trail Beach, Gay Head	0	0	0	0	DS, TWW
Dogfish Bar, Gay Head	2	2	1	2	DS
Lobsterville Beach, Gay Head	1	1	3	1	DS, LTD

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
Cedar Tree Neck/Lambert's Cove, West Tisbury	nd	nd	nd	nd	-
Great Rock Bight Preserve	0	0	0	0	TWW
Sepiessa Point Reservation	1	1	0	1	TWW
Tashmoo, Tisbury	3	3	10	3	DS
Wilfred's Pd. and Mink Meadows Beach, Vineyard Haven	1	1	1	1	DS, TWW
Northern Pines Shores, Vineyard Haven	0	0	0	0	TWW
Nomans Land	nd	nd	nd	nd	-
NANTUCKET					
Great Point	1	1 ^{ff}	0	1 ^{ff}	LR
The Galls	2	2	0	2	LR
Coskata-West Beach ^{gg}	0	0	0	0	LR
Coskata-Inner Trail ^{hh}	0	0	0	0	LR
Coatue	1	1 ⁱⁱ	0	1 ⁱⁱ	KCB, JL
Coskata-East Beach ^{hh}	0	0	0	0	LR

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
Coskata Inlet/The Haulover ^{hh}	3	3	3	3	KCB, JL
Wauwinet	0	0	0	0	TT
Squam Pond	0	1 ^{jj}	0	1 ^{jj}	KCB
Quidnet/Sesachacha Pond	1	2	2	2	TT
Low Beach-Siasconset	1	1	2	1	BP
Low Beach/Tom Nevers	7	7	17	7	VT
Surfside	0	0	0	0	TT
Hummock Pond	2	2	4	2	KCB, JL
Smith Point	12	13 ^{kk}	27	13 ^{kk}	VT
Eel Point	7	7	8	7	KCB
Dionis Beach	0	nd	nd	nd	VT, TS
Quaise Point	0	nd	nd	nd	VT, TS
Tuckernuck Island	2	2	nd	0	VT, TS
Muskeget Island	2	2	nd	0	VT, TS

Location	<u>Number of pairs</u>		No. chicks fledged ^c	No. pairs for which fledge data reported	Source ^d
	Index Count ^a	Total Count ^b			
TOTALS	498	501	785	490	

^a Index Count = number of territorial pairs counted between 29 May and 6 June, 1999, the standardized Index Count period for the Atlantic Coast population.

^b Total Count = total number of territorial pairs present during all or a portion of the breeding season. Pairs that are suspected of nesting at more than 1 site are only tallied once in regional and state Total Counts and numbers of pairs for which fledging data were reported.

^c Chicks fledged are defined as chicks ≥ 25 days of age or observed in flight, whichever occurs first.

^d Key to sources: AD = Anastasia Drayton, AR = Anna Resnick, AW = Anthony Waring, BB = Brad Blodget, BBa = Brandon Barr, BK = Briana Kane, BP = Bruce Perry, CE = Chris Eagan, CM = Carolyn Mostello, CMe = Colby Meacham, CN = Christine Nelson, CW = Chris Werle, DM = Deborah Melvin, DS = Debra Swanson, EH = Ed Hoopes, GA = Greg Arcuri, GV = Griff Venator, HB = Holly Busse, IC = Ilana Cantrell, JB = Jennifer Boie, JHa = Jeremy Hatch, JH = John Hill, JL = Jerome Light, JM = Janet Moore, KC = Kate Conde, KCo = Kerry Collier, KCB = Karen Combs-Beattie, KJ = Karin Jakubowski, KT = Kathy Tuxbury, LB = Lawrence Barker, LG = Laura Gill, LR = Lloyd Raleigh, LT = Lisa Tokarz, LTD = Leah Tofte-Dorr, MB = Melinda Burns, MBa = Matt Bailey, MH = Mary Hake, MJ = Martha Jason, MW = Meghan Walker, MZ = Margo Zdravkovic, ND = Nathan Durawa, NL = Nicole LeBlanc, OM = Owen Muise, PC = Phoebe Costerisan, PD = Pam Denmon, RC = Ryan Chandler, RCr = Ryan Crehan, RCu = Robert Culbert, RK = Richard Kirby, SH = Scott Hecker, SJ = Susan Jones, SKe = Shannon Keane, SKo = Stephanie Koch, SM = Scott Melvin, SvO = Susi von Oettingen, TS = Tracy Sundell, TT = Tara Torcoletti, TWW = Tara Whiting-Watson, VT = Vincent Todd, WC = Wayne Castonguay

^e Single adult observed feeding in intertidal zone 200 m north of Public Access #10 in Salisbury on 4 June.

^f nd = no data available

^g One plover seen feeding in intertidal zone on front beach north of the pavillion at Salisbury Beach State Reservation on 4 June. No nest was found or suspected.

^h We assumed that nest 3B at Parker River NWR was a reneest of nest 3A (abandoned after 3 June); 3B was located approximately 20 m from where 3A had been, and only one pair of plovers was ever observed in this section of beach. We assumed that pair 15 (no nest found, pair disappeared after 8 June) moved elsewhere and nested. This pair is tallied in Total Count and pairs with fledge data for Parker River NWR, but not in regional or state totals.

ⁱ We assumed that pairs 1 (nest abandoned 20 May) and 2 (nest abandoned 25 May) at Sandy Point State Reservation later renested elsewhere. These pairs are tallied in Total Count and pairs with fledge data for Sandy Point, but not in regional or state totals.

^j We assumed that pair 40 at Crane Beach (nest depredated on 3 June) later renested elsewhere. This pair is tallied in Total Count and pairs with fledge data for Crane Beach, but not in regional or state totals.

^k A single pair was reported scraping at Coffin's Beach by a local resident; this was confirmed by Scott Hecker during the Index Count period. The pair disappeared soon thereafter, and we assumed they later nested elsewhere. This pair is tallied in Total Count for Coffin's Beach, but not in regional or state totals.

^l We assumed that nest 13 at Duxbury Beach (found with one egg on 19 June) was a reneest of nest 3 (depredated on 28 May). These were tallied as a single pair in site totals.

^m We assumed that pair 4 at Plymouth Beach (nest lost on 21 May) later renested elsewhere. This pair is tallied in Total Count and pairs with fledge data for Plymouth Beach, but not in regional or state totals.

ⁿ Ellisville includes both Ellisville State Park and the private beach along the south side of Ellisville Harbor.

^o The Washburn Island site included a small sand island (Gull Island) adjacent to the western tip of the ocean-facing beach.

^p We assumed that South Cape Beach pairs SC-4 (nest flooded on 24 May) and SC-6 (never nested) eventually nested elsewhere. These pairs are tallied in Total Count and pairs with fledge data for South Cape Beach, but not in regional or state totals.

^q It was reported (KCo) that the single pair at New Seabury hatched and fledged two broods of chicks. The first nest (four eggs) hatched on 29 May and all four chicks fledged. The second nest (three eggs) hatched on 22 July and two chicks fledged.

^r We assumed that nest 5A at Scorton Neck (found with two eggs on 11 June) was likely a reneest of 4A (abandoned with one egg on 4 June). These were tallied as a single pair in site totals.

^s We assumed that four pairs that lost nests at Sandy Neck likely renested elsewhere later in June: nests 20 (lost on 25 May), 23 (depredated on 31 May), 24 (depredated on 1 June) and 27 (lost to gull predation on 1 June). These pairs are tallied in Total Count and pairs with fledge data for Sandy Neck, but not in regional or state totals.

^t A fifth pair was present at Kalmus Park on 22 and 25 May, and sometime during the Index Count period. However, no data were reported to indicate that this pair was present and exhibiting site-specific territorial and/or courtship behavior for two weeks, the prerequisite for being tallied as a breeding pair in the Total Count.

^u One or two plovers, and some scrapes, were observed at Merkel Beach in mid-May. They were present for less than two weeks, however, so were not tallied as a breeding pair.

^v We assumed that pair 9 at South Monomoy (nest lost on 14 May) later renested as pair 27 (one egg found 18 June), 28 (one egg found 19 June), or 29 (three eggs found 25 June); pair 9 is excluded from site totals. We assumed that these other two late nests were renests of pairs that had moved from other locations; these pairs are tallied in Total Count and pairs with fledge data for South Monomoy, but not in regional or state totals.

^w We assumed that pair ONB-2 at Nauset Beach – Orleans (nest lost to overwash on 18 May), likely renested as either pair ONB-6 (one egg found on 26 May) or ONB-7 (one egg found on 7 June). Therefore, ONB-2 was not considered indicative of a separate pair and was not tallied in site totals.

^x We assumed that pair 13 at Nauset Spit (three eggs found on 3 July, hatched on 27 July) had previously nested elsewhere. This pair is tallied in Total Count and pairs with fledge data for Nauset Spit, but not in regional or state totals.

^y It was reported, and we assumed, that pairs 3 and 4 at Nauset Spit both renested (NS-3B, NS-4B) after chicks were lost at approximately one day of age.

^z We assumed that pair 1 at Race Point–North (nest abandoned 14 May) later renested elsewhere. This pair is tallied in Total Count and pairs with fledge data for Race Point–North, but not in regional or state totals.

^{aa} All suitable beaches on Naushon Island were visited on 19 June. The only plovers observed were a single pair with three chicks ≥ 15 days old on beach west of Lackey's Bay, on the south shore.

^{bb} The sixth pair at Sylvia State Beach was present throughout the Index Count period, but no nest was found. We assume this pair nested elsewhere either before or after the Index Count. This pair is tallied in total count and pairs with fledge data for Sylvia State beach, but not in regional or state totals.

^{cc} Although no pair was detected at Edgartown Great Pond during the Index Count period, a pair with scrapes was present at the pond opening prior to this period, and SM observed single males on the front beach at the west end of Edgartown Great Pond and east at Job's Pond.

^{dd} This site also includes the Lewis property and Long Point Wildlife Refuge.

^{ee} One of the pairs at Squibnocket that abandoned a nest between 9 and 13 May soon disappeared and is presumed to have nested elsewhere. This pair is tallied in Total Count and pairs with fledge data for Squibnocket, but not in regional or state totals.

^{ff} A pair was present and courting at Great Point until 4 June, but no nest was found. We assume they later nested elsewhere. This pair is tallied in Total Count and pairs with fledge data for Great Point, but not in regional or state totals.

^{gg} Coskata-West Beach refers to the beach along the Nantucket Sound side of Coskata, from the south end of The Galls south and west to the boundary of Coatue. This is the same area that was referenced as Coskata-North Beach in 1993 and as part of The Galls in 1991 and 1992. Census data for Great Point, The Galls, and Coskata-West Beach were not reported separately in 1996 or 1997.

^{hh} Coskata-Inner Trail refers to the inland trail running south and west from Coskata toward Coatue. Coskata-East Beach refers to the beach along the eastern (Atlantic) side of Coskata, including the washover at The Glades. Coskata Inlet is the inlet from Nantucket Harbor into Coskata Pond.

ⁱⁱ The pair at Coatue abandoned their nest on 2 June and were not seen in vicinity again. This pair is tallied in Total Count and pairs with fledge data for Coatue, but not in regional or state totals.

^{jj} The pair at Squam Pond was present from 2 to 28 April; scrapes were observed but no nest was found. We assumed this pair was subsequently tallied elsewhere, so this pair is tallied in Total Count and pairs with fledge data for Squam Pond, but not in regional or state totals.

^{kk} We assumed that pair 6 at Smith Point (lost nest on 19 May) later renested elsewhere. This pair is tallied in Total Count and pairs with fledge data for Smith Point, but not in regional or state totals.

Table 2. Summary of abundance and productivity of Piping Plovers in Massachusetts, 1985-1999.

Year	Index Count ^a	Total Count ^b	Mean chicks fledged/pair	Pairs with fledge data
1999	498	501	1.60	490 (98)
1998	475	495	1.50	471 (95)
1997	457	483	1.33	468 (97)
1996	437	454	1.35	441 (97)
1995	413	441	1.62	426 (97)
1994	329	352	1.80	334 (95)
1993	258	289	1.92	264 (91)
1992	207	213	2.03	206 (97)
1991	148	160	1.72	156 (98)
1990	111	140	1.38	125 (89)
1989	-	137	1.59	123 (90)
1988	-	134	1.29	114 (85)
1987	-	126	1.07	89 (71)
1986	-	139	-	-
1985	-	131	-	-

^a Index Count = total number of territorial pairs counted during 9-day standardized Index Count period from last Saturday in May through first Sunday in June.

^b Total Count = total number of territorial pairs present during all or a portion of the breeding season.

Table 3. Summary of Piping Plover abundance (total pairs) and productivity (mean number of chicks fledged per pair) by region of Massachusetts, 1997 – 1999.

Region	Total pairs			Mean chicks fledged/pair		
	1997	1998	1999	1997	1998	1999
North Shore	47	56	61	1.83	1.64	1.72
South Shore	31	36	36	1.71	1.50	0.95
Upper Cape	92	94	102	1.49	1.91	1.81
Lower Cape	172	167	177	1.26	1.28	1.56
Bristol County	36	34	32	1.47	1.53	2.34
Elizabeth Islands	14	11	9	0.00	0.00	0.25
Martha's Vineyard	54	49	44	0.92	0.96	1.12
Nantucket, Tuckernuck, and Muskeget Islands	36	48	40	0.84	2.13	1.75
Total	483	495	501	1.33	1.50	1.60

Table 4. Reported causes of Piping Plover nest failures (n = 247) in Massachusetts, 1999.

Cause of nest failure	Number of nests		Total
	With exclosure	Without exclosure	
Abandonment	60	8	68
Unknown predator	6	31	37
Overwash/flooding	21	15	36
Skunk	26	9	35
Crow	1	15	16
Fox	3	8	11
Gull	0	10	10
Eggs failed to hatch	1	1	2
Coyote	0	1	1
Grackle	1	0	1
Opossum	0	1	1
Other ^a	3	3	6
Unknown	1	22	23
Total	123	124	247

^a "Other" causes of nest failure included 1 exclosed nest lost to vandalism, 1 exclosed nest lost to an unidentified small mammal, 1 exclosed nest suspected lost to rats, 1 unexclosed nest lost to fox or skunk, 1 unexclosed nest lost to skunk or gull, 1 unexclosed nest lost to vandalism or predation.

Table 5. Suspected causes of Piping Plover nest abandonments (n = 68) in Massachusetts, 1999.

Cause of nest abandonment	Number of nests		Total
	With exclosure	Without exclosure	
Unknown	24	2	26
Fox harassment	9	1	10
Adult killed/died	5	0	5
Severe inclement weather ^a	3	2	5
Gull harassment	4	0	4
Eggs failed to hatch	2	1	3
Human disturbance	2	0	2
Partial destruction of clutch ^b	2	0	2
Crow harassment	1	0	1
Skunk harassment	1	0	1
Kestrel harassment	1	0	1
Territorial dispute with other PIPL pair	0	1	1
Adult disappeared	0	1	1
Multiple causes ^c	6	0	6
Total	60	8	68

^a "Severe inclement weather" included strong winds and heavy rain. (For 2 exclosed nests, rain, winds and rising pond level may have contributed to abandonment.)

^b "Partial destruction of clutch" included 1 exclosed nest in which 2 eggs were broken (unknown cause) and other 2 eggs abandoned 2 days later, and 1 nest in which 2 eggs were preyed on by gulls, the nest was subsequently exclosed, then remaining eggs were abandoned the same day.

^c "Multiple causes" included skunk and crow harassment (1 exclosed nest), fox and skunk harassment (1 exclosed nest), gull and/or crow harassment (2 exclosed nests), gull, crow and cat harassment (1 exclosed nest), vehicle and dog harassment (1 exclosed nest).

Table 6. Comparison of Piping Plover nest success in Massachusetts, 1999, with and without predator exclosures.

Fate of nests	<u>Number of nests (%)^a</u>	
	With exclosure	Without exclosure
Successful ^b	313 (75)	74 (40)
Unsuccessful	102 (25)	109 (60)
Total	415 (100)	183 (100)

^a Not included in this table are 35 nests lost to flooding (21 exclosed, 15 unexclosed) that presumably would have been lost regardless of whether or not exclosures were used.

^b Nests were considered successful if they hatched ≥ 1 egg.

Table 7. Comparison of Piping Plover hatching success in Massachusetts, 1999, with and without predator exclosures.

Fate of nests	<u>Number of eggs (%)^a</u>	
	With exclosure	Without exclosure
Hatched	1124 (70)	210 (39)
Depredated/failed	485 (30)	327 (61)
Total	1609 (100)	537 (100)

^a Not included in this table are 123 eggs lost to flooding (75 exclosed, 48 unexclosed) that presumably would have been lost regardless of whether or not exclosures were used.