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PREDATOR CONTROL FOR THE PROTECTION OF THE FEDERALLY ENDANGERED GREAT LAKES PIPING PLOVER (*Charadrius melodus*) AT DIMMICK'S POINT, NORTH MANITOU ISLAND

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Abstract: The recovery plan for the federally endangered Great Lakes Piping Plover (*Charadrius melodus*) identifies the need for predator control/removal to increase Piping Plover chick fledging success. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services entered into an interagency agreement with the National Park Service to conduct predator management on North Manitou Island (NMI), Dimmick's Point, located in Sleeping Bear Dunes National Lakeshore, during the 2003-2005 field seasons. Six control methods were used to remove American Crow (*Corvus brachyrhynchos*), Common Raven (*Corvus corax*), Ring-billed Gull (*Larus delawarensis*), and Herring Gull (*Larus argentatus*) species. Preliminary results seem to suggest that predator control has had some positive benefits for the Piping Plover fledging success on NMI.

Key words: American crow, *Charadrius melodus*, common raven, corvids, herring gull, piping plover, predator control, ring-billed gull

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INTRODUCTION

The Great Lakes Piping Plover (*Charadrius melodus*) is critically endangered and was federally listed in 1986, under provisions of the U.S. Endangered Species Act of 1973, as amended (USFWS 1985). Many efforts have been made to increase the hatching and fledging success of this species, including construction of nest predator exclosures, establishment of psychological fencing to keep visitors at a safe and acceptable distance from nest sites, public education and outreach, intensive monitoring, egg salvage, and captive rearing. Several of these efforts have increased the hatching success, however, poor fledging success continues to be one of the primary limiting factors for recovery throughout the Great Lakes (USFWS 2003).

Plover chicks are precocial and often within 4 hours post-hatch are venturing outside of the exclosure to begin foraging for food, making them vulnerable to a myriad of predators. Data on chick disappearance indicate chicks are particularly vulnerable to predation from 0-10 days of age (Stucker and Cuthbert 2003), and predators are suspected in the majority of disappearances of unfledged chicks (USFWS 2003).

The Recovery Plan for the Great Lakes Piping Plover identifies predator control/removal as a high priority. The plan identifies the need for development of proper predator control protocols for all nesting sites and identification of responsible parties for implementation of predator control actions. Additionally, population modeling efforts indicate that the

population is in danger of extinction unless current reproduction and survival rates increase (Plissner and Haig 2000).

Sleeping Bear Dunes National Lakeshore (park), a unit of the National Park Service (NPS), began an active Piping Plover recovery program in 1993 and has supported as much as 34% of the Great Lakes breeding population, with the majority of plover nests located at Dimmick's Point, North Manitou Island (NMI), and at Platte Point on the mainland.

The park's recovery program included establishing exclosures and psychological fencing, salvaging eggs, informing visitors about plover conservation efforts, and intensively monitoring adults and chicks until chicks fledged. In 2001 and 2002, employees and volunteers monitored plover broods for a minimum of 16 hours per day, even monitoring through the night in 2001 for 10 days post hatch.

The goal of this intensive monitoring was to increase chick fledging success by discouraging attempted predation events and/or conclusively determine predators, however, chicks continued to disappear without witnessing the predation. The intensive monitoring was extremely labor intensive, requiring 90% of the park's Natural Resources Division's seasonal workforce and did not generate the desired fledging results. Additionally, from 1998-2002, NMI's fledging success rate was lower than the mainland's rate, with an average difference of 34.5%, even though equal management and monitoring efforts were devoted to both geographically distinct breeding areas. Given the lack of desired NMI fledging results, a new management strategy to address predation needed to be implemented.

Identification of predator tracks in breeding areas, direct observations of potential predators, and anecdotal data on predation have been used to identify

potential predators of Piping Plover chicks throughout Michigan, including the park. These types of information were used to develop the park's 3-year predator program, which was implemented in 2003 at Dimmick's Point, NMI.

Predator Control Strategy

An interagency team, with representatives from the United States Fish and Wildlife Service (USFWS), Michigan Department of Natural Resources (MDNR), United States Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services (USDA), Grand Traverse Band of Ottawa and Chippewa Indians, and NPS, met to review the park's plover nesting history and NMI's chick predation issue. The team reviewed several predator control methods, including behavioral and habitat modification techniques, as well as lethal removal methods, outlined in Liebezeit and George (2001). The team identified baiting, shooting, trapping, and noise deterrents as being the most efficient and effective predator control methods and the potentially least disturbing to the nesting plovers. Prior to implementing the predator control work, all necessary permits were obtained from the USFWS, MDNR, and NPS.

Since only circumstantial evidence existed as to the actual predators, such as tracks and direct observations of potential predators in the plover breeding areas, an adaptive management strategy was developed. This strategy provided maximum flexibility by having the required permits and compliance completed for all of NMI species that were considered to be potential plover chick predators. This allowed project managers to quickly adapt and respond to changing predators by expanding the scope of targeted species.

Initially, control efforts were focused only on the American Crow and Common Raven (corvids), but then expanded to

include the Herring Gull and Ring-billed Gull. The decision to expand the scope of species resulted from a chick disappearance in 2003 after most of the corvids were removed from the predator control zone. However, a large number of gulls were present within the plover breeding territory, and one monitor observed plover adults alarm calling while gulls flew into an area where chicks were located.

Throughout the predator control program, intensive monitoring occurred each time a new method was employed. This was to ensure that egg and/or chick abandonment did not occur during any control attempts. Also a sequential order of control methods was implemented, taking into account the relative noise disturbance associated with each method.

Program Objectives

The following objectives were identified for the 2003-2005 NMI predator control program.

1. Reduce corvid and gull numbers from within the predator control zone
2. Avoid any plover disturbance(s), such as nest and/or chick abandonment
3. Continuously assess and monitor the effectiveness of predator management on plover survival and revise predator management strategies and targets if additional predator species were identified
4. Synchronize predator control activities with plover hatch dates

to maximize the efficiency of control efforts

Program Location

The park is comprised of two islands, North and South Manitou, and 54.7 km of Lake Michigan shoreline along the mainland. The majority of the park's plovers nests have been established at Dimmick's Point, which is located on the southeastern end of NMI containing 3.3 km of the designated Piping Plover critical habitat shoreline, and at Platte Point on the mainland.

In the recent past, plovers have nested at two locations on NMI, including Dimmick's Point and Donner's Point. However, plovers have only nested at Donner's Point for 5 years since 1995 but have continuously nested at Dimmick's Point since at least 1993.

An identified predator control zone was delineated at Dimmick's Point based upon previously observed crow activity, the existing closed boundary, and to create a buffer to minimize any disturbances to plovers during control efforts (Figure 1). This area was comprised of 44.1 hectares (109 acres) and included 1.46 km of the 3.3 km critical habitat shoreline.

The predator control zone included Lake Michigan critical habitat shoreline, several dune ridges, and extensive gravel pans, adjacent to a northern hardwood habitat, comprised of sugar maples (*Acer saccharum*), American beech (*Fagus grandifolia*), red oak (*Quercus rubra*), and white birch (*Betula papyrifera*).

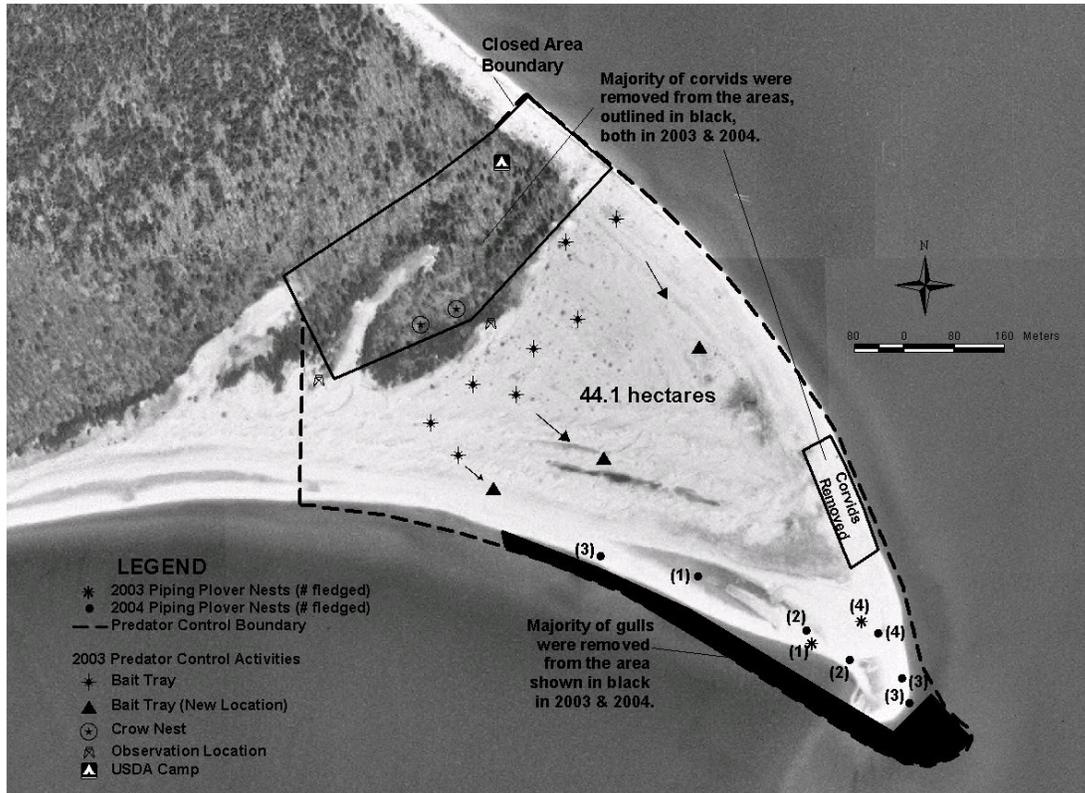


Figure 1. Dimmick's Point, North Manitou Island

METHODS

Six predator control methods were implemented to meet the program's objectives, targeting American Crow, Common Raven, Ring-billed Gull, and Herring Gull. Radio contact was constantly maintained between shooters for safety, and shooters always wore camouflaged clothing.

1. DRC-1339 (3-chlor-p-toluidine; poison) (Corvids Only)

This was the first method selected. Seven wooden platform bait stations, 2' x 2' x 5', were placed in locations of high crow activity. Untreated hard boiled chicken eggs were wired to the bait station to attract crows. If bait recognition would have occurred, the eggs would have been injected with DRC-1339 and continuously monitored while bait was present to discourage non-target species.

2. Shooting With Suppressed Rifles: (Corvids Only)

A 6 mm Remington 700 and a suppressed 22 rifle were used. A person sat on a high bluff (spotter) with binoculars and another person was located between the dunes (shooter). The spotter guided the shooter via radio into shooting range.

3. Shotgun Shooting On Flight Routes: (Corvids Only)

Shooters used 12 gauge Benelli shotguns with non-toxic #6 Hevi shot. Shooters often used the aid of a portable blind with this method.

4. Shotgun Shooting With the Aid of an Electronic Calling Device: (Corvids Only)

Shooters used 12 gauge Benelli shotguns with non-toxic #6 Hevi shot. A Fox Pro Model 700 electronic wildlife call, with remote call changing features of 12 different calls, were randomly used. Owl and crow

decoys were used when calling from open habitats but were not used in the woodlands.

5. Spot and Stalk/Crow Drive: (Corvids Only)

Once corvid locations were identified, shooters stalked corvids undetected to within shotgun range. If the first attempt failed, the first shooter directed the second shooter via radio to the corvids' flight path for a second attempt. Shooters used 12 gauge Benelli shotguns with non-toxic #6 Hevi shot. Shooters used binoculars with this method.

6. Shotgun Shooting Interspersed With Pyrotechnics (Gulls Only)

This method was primarily a dispersal tactic, which included the use of non-lethal pyrotechnics and intermittent lethal removal, using shotguns to reinforce the pyrotechnic dispersal tactic. Shooters used 12 gauge Benelli shotguns with non-toxic #6 Hevi shot. The pyrotechnic supplies were 6 mm

percussion caps and pyrotechnic launcher with Reed Joseph screamers and bangers. Screamers and bangers were alternated and shot near the gull colony.

RESULTS

The number and type of species removed from the predator control zone in 2003 and 2004 were very similar, with the exception of the removal of seven Common Ravens in 2004.

Corvids

The two most successful crow management methods were shotgun shooting on the flight routes and shotgun shooting with the aid of a calling device, removing 28 and 14 crows, respectively (Table 1). Additionally, one crow was collected with a suppressed rifle and 3 crows were collected with the spot and stalk method.

Table 1. Piping Plover Predator Control Methods for 2003-2004 Field Seasons.

Year	Control Methods	Species	Number Removed per Method	Total Number of Individuals Lethally Removed
2003	B,SR, SF, SC	American Crow	0, 1, 17, 5	23
	SP	Ring-Billed Gull	50, dispersed 600+	50
	SP	Herring Gull	6, dispersed 150+	6
2004	SF, SC, SS	American Crow	11, 9, 3	23
	SS	Common Raven	7	7
	SP	Ring-Billed Gull	60, dispersed 1000+	60
	SP	Herring Gull	15, dispersed 200+	15
2005	n/a	n/a	n/a	n/a
Control Methods: B=baiting with DRC-1339; SR=shooting with rifles; SF=shotgun shooting on flight routes; SC=shotgun shooting with calling device; SS=shotgun spot and stalk; SP=shotgun and pyrotechnics				

During the first five days of the 2003 field season the baiting method was the only control implemented. Following five days of

zero bait recognition, the DRC-1339 effort was abandoned. However, the bait stations remained in place throughout the field

season without a single avian visit. This method was not used in 2004, but may have future application.

Gulls

In 2003 only one day was dedicated to the harassment effort on the gull colony, removing 56 gulls and dispersing over 600. Park plover monitors assisted with the non-lethal dispersal effort (shot pyrotechnics) for two days after the initial management activity. The 2004 season required several pyrotechnic events due to the increased number of plover nesting pairs and the lack of synchronized plover hatching dates, thereby increasing the number of days of chick vulnerability. Again park plover monitors assisted with the non-lethal dispersal effort after the initial control work. Nearly an equivalent number of gulls were removed each year (Table 1).

Additional Species

During both field seasons, a pair of coyotes (*Canis latrans*) and Merlin (*Falco*

columbarius) frequented the Dimmick's Point area.

Piping Plovers

Fledging and Disappearance. A total of 5 and 18 chicks fledged from Dimmick's Point in 2003 and 2004, respectively. The number of chicks fledged from Dimmick's Point in 2004 (18) was the highest from any single 2004 nesting location within the Great Lakes. A total of three locations fledged 50% of the 2004 juveniles: North Manitou Island (20%), Platte River area (17%) and Cross Village Township (13%) (Stucker and Cuthbert 2005). Moreover, the 2004 Dimmick's Point fledging rate of 69.2%, breaking an eleven year trend, where fledging rates were below 50% during even years and above 50% during odd years (Figure 2). It is difficult to predict why this fledging pattern has occurred since there are many factors affecting NMI's chick survivorship, such as inclement weather and disease, but undoubtedly predators have been a factor affecting the fledging rates.

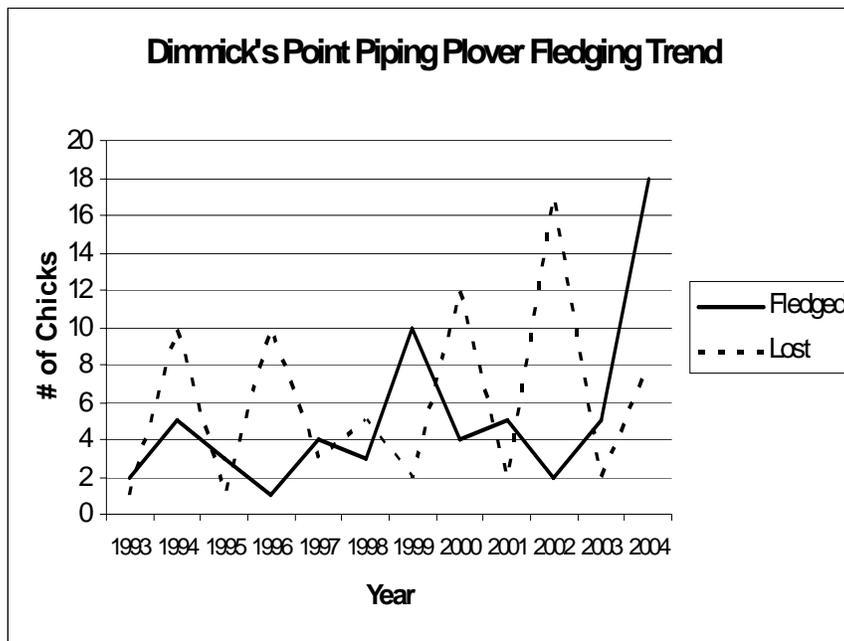


Figure 2. Chick Fledging Trend for Dimmick's Point, North Manitou Island.

Two chicks in 2003 and 8 chicks in 2004 disappeared, without any direct

evidence as to the cause(s) of disappearance with the exception of one chick from 2003.

NPS biological technician, Amanda Brushaber, was monitoring the hatching of the east nest where two chicks eventually disappeared, fledging only one. Hatching began on June 13 and lasted through June 14, 2003. Amanda observed the adults not regularly attending the nest (but no more than two hours at any given time) but brooding the two recently hatched chicks. She checked the nest cup from outside the enclosure to find one egg beginning to hatch and checked the nest cup again several hours later and saw a leg extended out from the same eggshell. Given the fact that the adults were not regularly attending the hatchling, (only for brief periods) we surmise that it died from exposure. The remaining egg was salvaged on June 15 and was viable, but the chick's head was underneath the wrong wing and could not use its egg-tooth to crack out of its shell (J. Dingleline, Recovery Coordinator, personal communication, 2003).

Nesting Habitat Expansion. No plover activity occurred within the gull occupied habitat at Dimmick's Point until after the control work was conducted. In 2003 a pair of plovers was observed scraping in the previously occupied gull area, within 7 days post control work, and in 2004 a pair of plovers nested in that same area after the gulls were dispersed. This nest was located 31 meters south of any previously recorded nest.

Monitoring. Throughout both field seasons, plovers were continuously monitored to detect and respond to any negative effects from the predator control efforts. None of the adults ever left their nests while incubating, during or after the control efforts. Nor did any adults and/or broods range beyond their territories during control implementation. The most animated response was from an incubating adult that

turned its head several times toward Lake Michigan as a result of the noise made from a firing rifle.

Additionally, monitoring occurred anytime a method was employed in the area(s) where plovers were foraging, brooding, or incubating.

Donner's Point. In 2003, two plover nests were found at Donner's Point, which is located approximately 4 km west of Dimmick's Point. A total of 8 chicks hatched and none fledged. Plovers were first discovered nesting at Donner's in 1995 but have only nested for five years between 1995 and 2003. This location has not been a productive breeding ground for plovers and is inundated with predators, most notably crows. While surveying this area on any given day, 16-20 crows were likely to be encountered along the shoreline. Additionally, in 2003, 60+ crows were observed flying above the gravel pans and bluff, where one of the 2003 nests was located. Since the predator control program was a pilot project, park biologists decided not to include Donner's Point for predator control work. But decided to wait for the results from the Dimmick's Point predator control work.

DISCUSSION

The first objective of the program was to reduce corvid and gull numbers from within the predator control zone. The number of crows observed in 2003 after control efforts was minimal, with two being the highest number observed at any given time. The number of crows and ravens observed after predator control was implemented in 2004 was much higher throughout the season. On multiple occasions 6-8 foraging corvids were observed, mainly along Dimmick's Point shoreline. However, the 2004 corvids were more likely to fly off at first sight of

human presence following control implementation.

In 2003, 2 crow nests and families had been established for several years, within the predator control zone. The crows' flight routes were well defined, and juveniles were easily located in the nests prior to fledging due to their vocalizations. The fact that crows are cooperative breeders and were established within the predator control zone aided the removal process in 2003. The increased frequency of the 2004 corvids foraging within the closed boundary may have been attributable to the lack of an established crow territory at Dimmick's Point.

In 2004, no crows nested within the defined predator control zone, and the crow flight and foraging patterns within the zone seemed more random, making removal more difficult. In 2004, attempts were made to remove crows from the 2003 established flight routes, but the inconsistent activity made this strategy less effective. As a result, the electronic caller was employed almost immediately. Conversely, in 2003, the electronic caller was reserved until the end of the field season to collect the educated crows. After the 2003 crow families were removed, no additional crows nested within the closed boundary during the 2003 and 2004 management seasons.

A difficulty that arose during 2004 pertained to the limited control area within which USDA employees could pursue the corvids. This was due to the fact that the NPS' National Environmental Policy Act compliance was based upon a specific location, Dimmick's Point only. Foraging crows and ravens were observed within the control zone but would quickly fly out of the area upon human presence and could not be pursued beyond the predator control boundary. The size and area of the predator control zone was not an issue in 2003 due to the established crow families.

In 2003, gull control activity did not begin until one Piping Plover chick was discovered missing. A more proactive approach was taken in 2004 by implementing the gull dispersal/removal method immediately to minimize any gull predation events. Within one week of the initial 2003 gull control, a pair of plovers was scraping in the area formerly occupied by gulls. Furthermore, in 2004 a pair of plovers successfully nested in an area that was occupied by gulls prior to control. The nest was located 31 meters south of the southernmost recorded NMI plover nest. The lack of loafing gulls, during both seasons, appeared to create more habitat for plover activity.

The second objective of the program was to avoid any plover disturbance(s), such as nest and/or chick abandonment. NPS employees continuously monitored plover adults and chicks during control efforts and discovered that none of the adults ever left their nests while incubating, during or after the control efforts; nor did any adults and/or broods range beyond their territories during control implementation.

The third objective of the program was to continuously assess and monitor the effectiveness of predator management on plover survival and revise predator management strategies and targets if additional predator species were identified. Initially, control efforts were focused only on corvids, but then expanded to include the Herring Gull and Ring-billed Gull. The decision to expand the scope of species resulted from a chick disappearance in 2003 after most of the corvids were removed from the predator control zone. However, a large number of gulls were still present within the plover breeding territory, and one monitor observed plover adults alarm calling while gulls flew into an area where chicks were located. Coyote tracks and Merlins were observed within the predator control

boundary but removal was not attempted as NPS wanted to determine the success of corvid and gull removal only.

The fourth objective was to synchronize the predator control activities with plover hatch dates to maximize the efficiency of control efforts by minimizing predator opportunity while the plovers were most vulnerable (0-10 days post-hatch). In 2003, the number of days between the last day of predator control and first day of hatch was zero. In 2004 the number of days was twelve. It is difficult to compare the results of this effort since the 2004 hatching dates were a month apart between the first and last hatch dates. Also, in 2003 only two pairs nested and in 2004 seven pairs nested at Dimmick's Point, making it difficult to implement the control efforts prior to each hatch date.

CONCLUSIONS

In conclusion, predation is a serious issue plaguing the Great Lakes Piping Plover population and a difficult issue to address because identifying specific predators is a very difficult and time prohibitive occurrence. In addition, several agencies are involved with the recovery of the Great Lakes Piping Plover, making it imperative to discuss predator removal scope and strategy and to reach consensus among the various groups in order to maximize the control effort(s).

It is unclear as to how effective the predator management was since it was only one component of a more intensive recovery program, however, in no instance did the predator control program negatively impact the Piping Plovers. Moreover, the fledging rates at Dimmick's Point in 2003 and 2004 were 71.4% and 69.2%, respectively, which is greater than the *Great Lakes Piping Plover Recovery Plan's* recovery goal of 50% per pair per year. Also, an eleven year fledging trend was broken and a new plover

nest was found in previously occupied gull territory. These results seem to suggest the effectiveness of using predator control as a management tool to increase plover fledging rates at locations where predation continues to be a limiting factor.

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