

PRELIMINARY RESULTS OF A FIVE YEAR BANDING STUDY IN EASTERN CANADA: SUPPORT FOR EXPANDING CONSERVATION EFFORTS TO NON-BREEDING SITES?

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Abstract – An Eastern Canada Piping Plover research program was conducted from 1998-2003, with additional effort expended on recapture in 2004. During this time, 888 Piping Plovers were banded, including 561 young and 327 adults. Individuals were banded with province-specific color bands, many bearing alpha codes to permit visual identification. Of the total banded, 175 were recaptured in subsequent years, including 73 young and 102 adults. Preliminary analysis has been initiated exploring survival, dispersal, metapopulation dynamics, wintering ground and migratory tendencies. There appears to be two discrete groups of Piping Plovers in Eastern Canada – one located in southern Nova Scotia, another located in the southern Gulf of St. Lawrence. There is an indication of limited exchange with the US Atlantic population and the Gulf of St. Lawrence group however the Nova Scotia group appears to be isolated from other populations. Survival rates were calculated for both groups independently. Adult survival rates were approximately 73% for both the southern Gulf of St Lawrence and southern Nova Scotia and are comparable to rates calculated for the US Atlantic population. However, juvenile survival rates were substantially lower with estimates of 24% for the southern Gulf of St. Lawrence and 33% for southern Nova Scotia. The population model also identifies adult survival as the most important factor influencing population trends. Several Eastern Canadian individuals have been positively identified during migration and on the wintering grounds. Migration south from the nesting grounds can occur very early. Several individuals have been observed in migration from early to mid July. High fidelity to wintering areas was reported in several individuals, with plovers remaining in an area during an entire winter and returning to the same site in one or more consecutive years. The preliminary results of our study suggest that there are likely factors acting outside of the nesting grounds that must be considered in order to move towards recovery of the Eastern Canadian population.

INTRODUCTION

There has been a tremendous amount of interest in Piping Plover research, monitoring and conservation effort in Eastern Canada since the species was listed in Canada as

Endangered in 1985. Sufficient information exists to produce rough estimates of historical abundance (Cairns and McLaren 1980). These historical estimates form the basis of the population recovery goal of 650 adults or 325 pairs.

The first comprehensive survey of all known and potential Eastern Canada Piping Plover habitats occurred in 1991, during the first International Census (Figure 1). At that time, the Eastern Canada population was estimated at 509 adults. The second International Census was conducted in 1996, when it became apparent that the regional population had declined by approximately 17%. Most worrisome was the fact that this was the only portion of the Atlantic population which had declined during this period (Table 1). These results were unexpected since the region has consistently achieved the fledging target rate of 1.5 chicks fledged per pair (Table 2) and some of the highest productivity rates of any Piping Plover population. A tremendous amount of time, effort and funding are expended annually in recovery efforts for the Piping Plover, therefore it became important to determine why the status of the Eastern Canada population was not improving.

A decision was made to embark on a five-year banding project aimed at answering the most pressing questions that needed to be addressed to establish and justify a recovery program based on sound biological information on the species and its population parameters. Particularly, the following questions were identified:

- Are juvenile Piping Plovers being recruited into the Eastern Canada breeding population or short-stopping in some other location?
- What are the survival rates of Eastern Canada adults and juveniles?
- How do Piping Plovers disperse from natal beaches?
- What are their migratory behaviors (timing, location)?
- Where do Piping Plovers spend the winter and what are their wintering habits?
- What other general biology and behavioral questions remain unanswered, such as metapopulation dynamics/links to other populations; time lag to first nesting; and other unknown concerns.

Some of the key information required for conducting a PVA or setting recovery goals is missing!

METHODS

A long-term research program was endorsed by the Eastern Canada Piping Plover recovery team. A protocol for the study was developed in consultation with the team, with the main objectives of minimizing disturbance and other negative impacts of banding including the potential of band injuries while at the same time maximizing the amount of information obtained. The protocol describes in detail the methodology developed to capture and band adult Piping Plovers in Eastern Canada (Amirault 2001).

Adults were captured on the nest using a modified Weller Trap, and juveniles were captured by hand. A maximum trap time of 15 minutes for adults and 10 minutes for

chicks was established. Trapping was aborted if capture attempts were unsuccessful during this time. Chicks from the same brood were released together to maintain the family unit. Whenever possible, adults were confirmed to have returned to their nest and chicks were confirmed to have been reunited with the adults. This permitted an evaluation of the impact of banding.

To minimize the risk of injury, only two bands were placed on the lower legs with one band placed per leg. A color band unique to each province was used, however the color assignment was modified over the course of the study (Table 3). Adults and juveniles were marked slightly different to allow as much information to be obtained as possible from individuals without requiring recapture. The USGS band was placed on the right leg of adults and left leg of juveniles, with the color band placed on the opposite leg. Color bands used in the later years of the study included unique alpha codes which facilitated visual identification from a distance.

RESULTS

The research program was conducted from 1998-2003, with additional effort expended on recapture in 2004. During this time, 888 Piping Plovers were banded, including 561 young and 327 adults. Of the total banded, 176 were recaptured in subsequent years, including 75 young and 101 adults.

Recruitment

The number of juvenile birds subsequently recaptured as adults was considerably lower than anticipated (i.e. 75 of a total of 561 individuals or 13% of those banded). There does not appear to be a time lag between the time a bird is produced to the time when they first nest, since most nested the year after production. A delayed return time for first time nesters was therefore not a plausible explanation for lower than anticipated population levels despite good fledging rates.

There is no evidence for short-stopping as an explanation for the low juvenile return rate documented through this study. All except one juvenile returned to Eastern Canada to nest. A juvenile Piping Plover from Prince Edward Island nested in New York in 2003 and was confirmed nesting in Massachusetts in 2004. Due to the high reporting rate of migrating birds, it is felt that any other short-stopping birds would have been detected.

Metapopulation parameters, dispersal and movements

During the study, 18 banded birds were recaptured or confirmed to have moved to a different province than the original province of banding. Of these 18 birds, 14 of these were juveniles. All interprovincial movements occurred between provinces in the southern Gulf of St. Lawrence and no movements to or from southern Nova Scotia were recorded. Some movement did occur to northern Nova Scotia. This suggests that there are two discrete groups of Piping Plovers in Eastern Canada – one located in southern Nova Scotia, another located in the southern Gulf of St. Lawrence. There is an

indication of limited exchange with the US Atlantic population and the Gulf of St. Lawrence group however at this time the southern Nova Scotia group appears to be isolated from other populations. Genetic analysis of tissue samples has not yet been completed to support or disprove this isolation.

Despite the observation of inter-provincial movements, the majority (87%) of juvenile birds returned to their province of origin. However, only a small proportion of young birds returned to their natal beach (7%). A lower proportion of juveniles returned to Prince Edward Island (55%) as compared to New Brunswick (93%), Newfoundland (100%) and Nova Scotia (100%). Prince Edward Island appears to be a source province, with birds moving through and from the area. No birds moved from Newfoundland to other areas despite the fact that movements to the province did occur. This may indicate that the Newfoundland population is a sink. It is impossible to confirm that this is an accurate picture of metapopulation dynamics since links between groups may exist, but were simply not detected through such a short-lived study. Analysis of the genetic samples collected over the last few years may be able to better establish the link between groups.

Most adults exhibit high nest site fidelity (71%). Some adults have however moved considerable distances from their original location and four (4% of recaptured adults) relocated to a different province.

Survival rates and population trends

Based on the evidence suggesting isolation of the southern Nova Scotia and southern Gulf population, survival rates were calculated for both groups independently. Adult survival rates were approximately 73% for both the southern Gulf of St. Lawrence and southern Nova Scotia and are comparable to rates calculated for the US Atlantic population (74%). However, juvenile survival rates were substantially lower than those for the US Atlantic (48%), with estimates of 24% for the southern Gulf of St. Lawrence and 33% for southern Nova Scotia. The population model also identified adult survival as the most important factor influencing population trends.

The population modeling exercise provided interesting indications of trends and predictions for Eastern Canada Piping Plovers (Calvert 2004). Although the Gulf of St. Lawrence sub-population includes a larger number of birds, the model suggests that the population is currently in decline (-3.5% per year). The prediction for the future of this population is to decrease from its current level “to only about 100 adults within 40 years”. Conversely, the southern Nova Scotia group is currently stable or increasing slowly (+.5% per year). This sub-population is therefore projected to increase slowly over time. These results should be viewed with caution. Since the banding study was of relatively short duration, it may not be representative of the population’s function over a longer time frame.

Wintering and Migration Information

A small number of Eastern Canadian Piping Plovers have been positively identified during migration and on the wintering grounds. Of the 888 birds banded, only 33 individuals or 3.7% of the banded birds were positively identified either by the color band/alpha code match or by using the USGS band number. Many more individuals were identified according to their province of origin, which was the original intent of the study.

The Eastern Canada population was confirmed to be present during migration in Massachusetts, New Jersey, New York, North Carolina and Florida. Areas that were confirmed as wintering sites are South Carolina, North Carolina, Georgia, Florida, Bahamas and Cuba. The extent of wintering and migration locations may be biased by observer effort. Information on the 33 Piping Plovers whose identity was confirmed was obtained from 19 observers. Over half of the confirmed Piping Plover sightings were received from two observers. Relatively few observations were received from the Caribbean, despite a specific request (a trilingual poster) to return banded Piping Plover observations. Resighting effort was therefore patchy, and we do not know where the majority of individuals from Eastern Canada overwinter.

Migration observations rarely included large groups (i.e., more than 70) of Piping Plovers. This supports other efforts which indicate that plovers do not flock during migration (Haig 1992). There is also no indication that migration areas may be used consistently by the same individuals, except where the birds are seen during migration at a site which is also used for wintering. The most interesting observation with respect to migratory behavior is in terms of the timing of movements. Post-breeding migration has been confirmed as early as the beginning of July, which is much earlier than suspected. This indicates that some Piping Plovers may be present on the Eastern Canada breeding grounds for only a brief time frame (i.e. as little as three months).

Identification of individuals on the wintering grounds allowed a better appreciation of habitat use. The data collected strongly suggests that Piping Plovers exhibit high site fidelity to wintering areas both within and between years. Of the 33 individual Piping Plovers identified, 22 were seen on more than one occasion. Of these birds, nine (41%) were seen repeatedly at the same site, some over a period of three years. An additional 9 were seen within the immediate vicinity of a site (less than 1° difference in latitude and longitude between observation sites). Therefore the majority (82%) of Piping Plovers seen on more than one occasion were observed at the same site or in the vicinity of other sightings. The sightings which showed a greater distance between observation areas may have been related to migration dispersals. Since resighting effort was not consistent, it may be that site fidelity may have actually been higher than these numbers represent.

CONCLUSION

The results of the banding study enable us to understand more clearly the dynamics of the Eastern Canada population and suggest where future effort is required. We are now aware that Eastern Canada juveniles generally return to their area of origin, but they are

returning at a much lower rate than was previously anticipated. It is therefore essential to continue protection efforts on the breeding grounds and strive to consistently achieve a high productivity objective to fledge as many chicks as possible. A new target rate of 1.65 chicks fledged per pair has been suggested to maintain the population at its current level. Fledging success has been and continues to be high, however factors affecting survival during migration and on the wintering grounds may be decreasing survival and lowering juvenile return rates. Eastern Canada Piping Plovers must travel a greater distance between the wintering and breeding grounds than birds that occur in the US portion of the population range. Greater mortality may be associated with this increased distance.

Despite the obvious significance of continuing efforts on the breeding grounds, there are many valid points to justify why it is important to expand conservation to include protection during the non-breeding season. The analysis and modeling exercise have identified adult survival as the single most important factor influencing population trends. Therefore it appears that even achieving maximum productivity may not have as great an impact as increasing efforts to protect the adults. Enhancing adult survival can only be achieved by expanding protection efforts to reflect annual conservation needs, including habitat protection and other management needs during the non-breeding season.

Piping Plovers not only exhibit high site fidelity on the breeding grounds, but also on the wintering grounds as this study clearly demonstrates. The impact of disturbing the birds or forcing them from a preferred site is unknown. However, the long-term site use pattern demonstrated by many birds suggests that there is a survival advantage for returning to known sites. A consistent protection program that considers not only nesting site requirements but also non-breeding site requirements must be implemented to address the need for enhanced protection of adults. In the absence of evidence to the contrary, it is prudent to consider the protection of non-breeding areas, where the bulk of the year is spent, as equally or perhaps more important as breeding areas when considering the importance of protecting the adult birds.

In Eastern Canada, we are now aware that Piping Plovers are only on the breeding grounds during a small proportion of their annual cycle. Attention to breeding grounds alone will only result in protection of birds during a brief period since the bulk of the year is spent outside our region. Protection efforts during the non-breeding season should complement the substantial conservation measures implemented during nesting.

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Table 1 – North American International Census Results 1991-2001.

Region	1991 adults	1996 adults	2001 adults	% change 1991-1996	% change 1996-2001	% change 1991-2001
<i>Eastern Canada</i>	509	422	481	-17.1	14.0	-5.5
<i>Saint Pierre et Miquelon (France)</i>	4	6	9	50.0	50.0	125.0
<i>U.S. Atlantic</i>	1462	2169	2430	48.4	12.0	66.2
Total <i>C. melodus melodus</i>	1975	2597	2920	31.5	12.4	77.5
<i>Great Lakes</i>	40	48	72	20.0	50.0	80.0
<i>Canada (ON)</i>	0	1	1	100.0	0.0	100.0
<i>U.S.</i>	40	47	71	17.5	51.1	77.5
<i>Prairie Canada</i>	1437	1687	972	17.4	-42.4	-32.4
<i>U.S. Northern Great Plains</i>	2032	1599	1981	-21.3	23.9	-2.5
Total <i>C. melodus circumcinctus</i>	3469	3286	2953	-5.3	-10.1	-14.9
Grand Total	5484	5931	5945	8.2	0.2	8.4

Table 2. Productivity of Eastern Canada Piping Plover 1991-2004.

Year	Number of pairs monitored	Number of chicks fledged per monitored pair
1991	75	1.17
1992	59	1.36
1993	61	0.74
1994	64	1.28
1995	97	1.68
1996	44	1.89
1997	122	2.06
1998	140	1.83
1999	145	1.83
2000	171	1.56
2001	184	1.61
2002	177	1.17
2003	219	1.62
2004	223	1.93

Table 3. Color band schemes used in Eastern Canada (1998-2003).

Year	New Brunswick	Newfoundland	Nova Scotia	Prince Edward Island	Québec
1998	Dark green (UV stable plastic)	Light green (UV stable plastic)	-	Red (UV stable plastic)	Grey (UV stable plastic)
1999	White/light blue (Non-UV stable plastic)	-	Yellow/light green (Non-UV stable plastic)	Red/dark green (Non-UV stable plastic)	Grey (UV stable plastic)
2000	White/light blue (Non-UV stable plastic)	Pink/dark blue (Non-UV stable plastic)	Yellow/light green (Non-UV stable plastic)	Red/dark green (Non-UV stable plastic)	Grey (UV stable plastic)
2001	Blue/green (Anodized aluminum - short) with letters side by side	Red/blue (Anodized aluminum - short) with letters side by side	Red/black (Anodized aluminum - short) with letters side by side	Red/green (Anodized aluminum - short) with letters side by side	Blue/purple (Anodized aluminum - short) with letters side by side
2002	Blue/green (Anodized aluminum - tall) with letters one on top of the other	Red/blue (Anodized aluminum - tall) with letters one on top of the other	Red/black (Anodized aluminum - tall) with letters one on top of the other	Red/green (Anodized aluminum - tall) with letters one on top of the other	Blue/purple (Anodized aluminum - tall) with letters one on top of the other
2003	Blue/green (Anodized aluminum - tall) with letters one on top of the other	Red/blue (Anodized aluminum - tall) with letters one on top of the other	Red/black (Anodized aluminum - tall) with letters one on top of the other	Red/green (Anodized aluminum - tall) with letters one on top of the other	Blue/purple (Anodized aluminum - tall) with letters one on top of the other

Figure 1. Distribution of nesting Piping Plovers in Eastern Canada.

