Recovery Efforts for Piping Plover in Prince Edward Island National Park of Canada

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Abstract: The piping plover (*Charadrius melodus melodus*) is a small shorebird that is indigenous to North America. The species was listed as Endangered in Canada in 1985. An international census conducted in 2001 recorded less than 6000 piping plovers. Approximately 40 of those birds return each year to nest on the beaches of Prince Edward Island National Park of Canada.

Piping plover nests and young are vulnerable to floods, predators, blowing sand, and human disturbance. In an effort to enhance productivity and achieve the objective set in the Recovery Plan for Piping Plover of fledging 1.5 chicks per pair in Atlantic Canada, management tools have been implemented in Prince Edward Island National Park for more than 10 years. These include closing nesting beaches during the breeding season, exclosing nests from predators, rescuing eggs from floods and sand, and conducting egg fostering. A five-year banding project, led by the Canadian Wildlife Service and initiated in 1998, has provided valuable information on the movements of the Atlantic piping plover population.

The fledging rate of piping plovers in Prince Edward Island National Park has consistently been above the rate of sustainability; however, this has not been reflected in recruitment into the national park's population. The number of nesting pairs continues to fluctuate between 12 and 24 pairs. Recruitment of piping plovers depends on a healthy population outside the park; therefore, cooperative efforts are required from all jurisdictions in which piping plovers nest. Natural forces cannot be controlled; consequently, they often limit the success of piping plover recovery efforts. The management tools used in the park to increase plover productivity help balance the increase in stressors created by humans and predators.

Interpretation and public education programs are an integral part of the piping plover recovery effort, and the message of conservation is delivered to both residents of, and visitors to, Prince Edward Island. Conservation of the piping plover, and particularly conservation of its breeding habitat, is an important component of the recovery effort.

Key Words: piping plover, *Charadrius melodus melodus*, recovery, endangered species, breeding success, Prince Edward Island

Introduction

Prince Edward Island National Park of Canada was established in 1937 as a representative of the Maritime Plain Natural Region. Originally, the park included 20 km^2 of land and 40 km of beach and headland. In 1998, 6 km^2 of the Greenwich Peninsula were added to the park, which increased its coastline to 48 km.

The park is one of the most visited national parks in Canada. Each year, thousands of visitors are enticed by its secluded sandy beaches. The park is also visited by many species of migratory birds. One of these, the endangered piping plover (*Charadrius melodus melodus*), is afforded special protection in the park.

The decline of the piping plover population in Canada's Atlantic Region was recognized as early as 1977. By 1980, a management strategy was developed for the piping plover population in Prince Edward Island National Park (Corbett 1980). In 1982, the Piping Plover Project was initiated, and focus was placed on population monitoring and closing beaches where plovers were breeding. In 1985, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed the piping plover as Endangered in Canada (COSEWIC, in press). A few years later, a management strategy was developed for the population of plovers nesting on Parks Canada land (Corbett 1988). This involved implementing techniques to improve productivity. Methodologies were established for all measures that involved intervention with nesting plovers, and salvage permits were obtained from the Canadian Wildlife Service (CWS) for the movement of eggs.

Data have been collected since 1977 as a means of measuring the piping plover population and its productivity. The methodology and level of effort was inconsistent in the early years; however, this problem has been addressed, and the data presented here are based on the last 14 years of data collection. Data collected include numbers of individuals, pairs, nest attempts, young hatched, and young fledged (Fig. 1). The data set from 1980–1992 was reviewed and standardized by Flemming (1992), and his recommendations were followed in later data collection efforts.

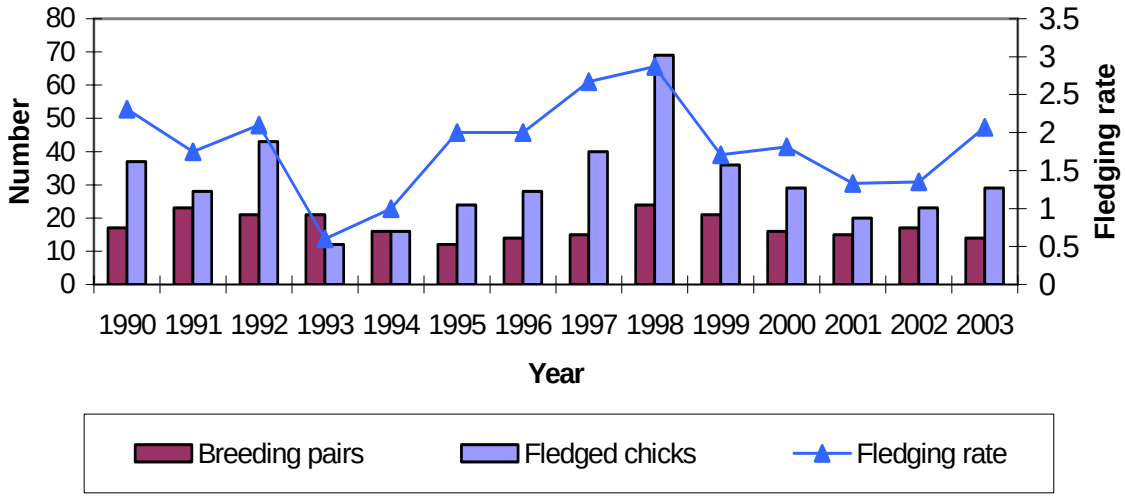

Figure 1. Number of piping plover breeding pairs and productivity (fledging) rates in Prince Edward Island National Park, 1990–2003.

By 1994, population models estimated that a productivity rate of 1.25 chicks fledged per breeding pair would maintain a stable population of piping plovers on the North American Atlantic coast (Melvin and Gibbs 1994). In Atlantic Canada, the recovery team increased the rate to 1.5 chicks fledged per breeding pair per year because of lower recruitment rates in that breeding population (Goosen et al. 2002). Management techniques were implemented to sustain and increase piping plover productivity in Prince Edward Island National Park. This included using various tools such as predator exclosures and the fostering of eggs. This paper examines the management tools implemented to increase piping plover productivity in Prince Edward Island National Park, and the role of monitoring and education in the overall recovery effort.

The Piping Plover

The piping plover is a small shorebird that is approximately 18 cm in length. It is easily distinguished by its striking plumage—pale sand-colored back, white underparts, and single black neckband and forehead band. Its bill is orange with a black tip, and its legs are orange.

The piping plover is indigenous to North America. It breeds in every province of Canada except British Columbia. Three of the seven national parks in the Atlantic region have breeding piping plover populations. The total population in North America is less than 6000 individuals, of which slightly less than 2% breed on Prince Edward Island (Table 1).

Table 1. Results of the North American piping plover census, 1991, 1996, and 2001.

	1991		*1996*		*2001*	
	no. of plovers recorded	*% of total population*	*no. of plovers recorded*	*% of total population*	*no. of plovers recorded*	*% of total population*
Eastern Canada	509	9%	422	7%	481	8%
Prince Edward Island	110	2%	65	1%	112	1%
Prince Edward Island National Park of Canada	46	0.8%	29	0.4%	32	0.5%
Total population	5484		5931		5945	

Piping plovers arrive on the breeding grounds in eastern Canada in mid-April, and the rituals of courtship and territory selection begin soon thereafter. Courtship consists of aerial displays, repeated calls, nest scraping, and stone tossing (Goosen et al. 2002). A complete clutch consists of four eggs, and incubation is shared by both sexes. The mean incubation period is 26–28 days (Haig 1992). The chicks are precocial and leave the nest shortly after hatching (Cairns 1982). Both the male and female brood and defend chicks from predators (Haig 1992). Adults and young feed on invertebrates including marine worms, fly larvae, beetles, spiders, crustaceans, and molluscs.

In eastern Canada, chicks are considered fledged at 20 days of age (Flemming 1992). After leaving the nesting grounds, piping plovers migrate in small groups to the southern United States, the Caribbean, and Mexico (Haig and Oring 1985).

Management Tools

The mandate of Canadian parks and the accompanying *Canada National Parks Act* afford protection to the piping plover, particularly by allowing the closure of beaches to the public. With this level of protection, Parks Canada (1988) set a goal of fledging 2.0 chicks per breeding pair per year for the three parks in Atlantic Canada that support breeding piping plovers. In consultation with CWS, the Atlantic Veterinary College and others working on the species' recovery used the results of many hours of field monitoring and data collection to develop management tools that could enhance piping plover productivity. Because an intensive monitoring program was already in place in Prince Edward Island National Park, it was a logical place to implement the management tools; however, a precautionary approach was applied to all decisions made and interventions used.

Closed Areas

Habitat loss is considered to be a primary reason for the piping plover's decline (Goosen et al. 2002). In national parks, balancing increasing visitor presence with the need to provide a safe and productive breeding environment for piping plovers is a continuous challenge. As a passive management tool, nesting areas were closed in Prince Edward Island National Park as early as 1982 to provide adequate undisturbed nesting habitat for the plovers. Areas are closed from the onset of nesting until the youngest chick can fly or has reached 28 days of age.

There are seven traditional breeding areas in Prince Edward Island National Park. These beaches are closed when the first plover eggs are produced. If a nest is found outside the traditional breeding areas, the beach is closed around the nest, giving the breeding pair a minimum, if possible, of 100 m of undisturbed beach. To delineate a closed area, signs on t-bars are placed on the beach from the dune to the mean high water mark. Cavendish sand spit, the most successful plover nesting area in the park, is a 6-km sand spit with 13 washovers. It is closed at the base of the spit, and additional signs are placed in the washovers so that the signs are visible to boaters. Approximately 10 pairs of piping plovers use this habitat each breeding season. In 1980, it was estimated that recreational use of the Cavendish sand spit involved, on average, 200 people per day (Corbett and Ball 1980). Over the entire 2003 breeding season, 76 people were asked to leave the Cavendish sand spit while it was closed to the public (Parks Canada 2003). This is a significant decrease in human disturbance considering that less than 500 m away are the Cavendish main beach and campground beach. Hundreds of people use these beaches each day of the visitor season.

Beaches are an important part of the lucrative tourism industry in Prince Edward Island, and areas adjacent to piping plover habitat have a high and growing rate of recreational use and development. Area closures have greatly decreased human disturbance in plover breeding areas, and public compliance is excellent for the early part of the season; however, there is less respect for the closed areas when the restriction extends into August.

Exclosures

The use of exclosures as a means of increasing hatching success was introduced in the United States in 1987 and has proven to be highly successful. Exclosures were first used in Prince Edward Island National Park in 1988 and followed the U.S. Fish and Wildlife Service methodology (USFWS 1988). An exclosure consist of a 3-m circle of 10 x 20-cm wire mesh that is centered over the nest and is buried up to 10 cm from the base of the mesh. This keeps the eggs safe from mammalian predators, and a net covering protects the eggs from avian predation. The plovers can easily access the nest by walking through the wire mesh.

Installation of the exclosures is labor intensive as it requires a minimum of three people. The disturbance to the nesting pair has to be minimal and preferably lasts less than 20 minutes. The risk of abandonment is greater for exclosed nests, so the use of an exclosure must be assessed in

light of this risk. Habitat type must also be considered. Park monitors have found the remains of six birds, all predated from exclosed nests in dune habitat; raptors were the suspected predators. It is, therefore, highly recommended to evaluate the risks to the plovers before using the exclosures. In the park, only nests that are located away from dune habitat and that are determined to be at risk of predation are exclosed. Exclosures have been successful in improving hatching success and should continue to have a positive effect (Fig. 2).

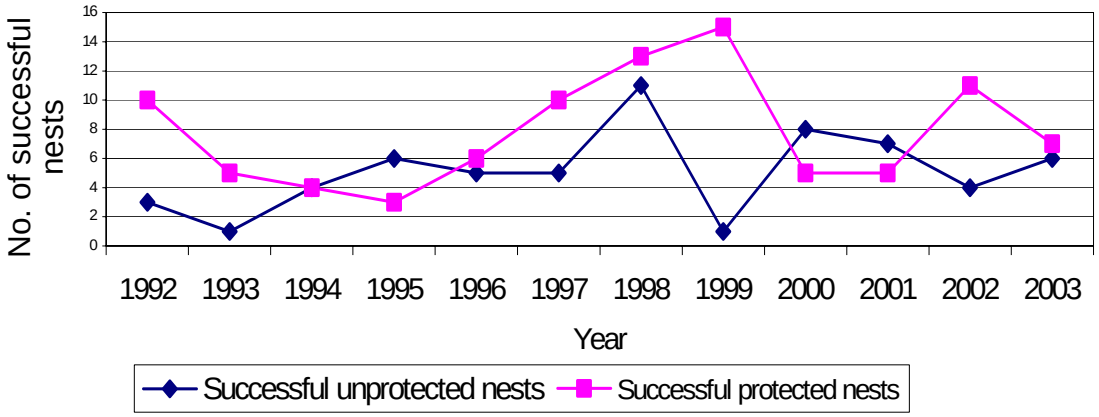

Figure 2. Number of successful protected and unprotected piping plover nests in Prince Edward Island National Park (PEINP), 1992–2003.

Flood and Sand Rescue

Weather, in combination with fluctuating ocean tides, has a great impact on piping plover productivity. When winds exceed 30 km/h and tides are higher than 1.0 m, beaches often flood. Under these conditions, even when a nest is above the flood zone, the eggs are in danger of being buried under wet sand.

When weather and tide conditions indicate that flooding could occur, monitors prepare to implement flood rescue. This can be as simple as moving eggs to dry sand, or if the conditions are expected to prevail over a longer time period, the eggs are removed and replaced by clay eggs. The removed eggs are first checked for viability, and viable eggs are kept in an incubator until all danger has passed. The clay eggs serve to hold the birds to the nest during this time. The degree of intervention used during flood rescue depends on the stage of incubation. For a clutch of eggs approaching the hatch date, monitors watch to see if the breeding pair is able to keep the eggs above the rising water. If they cannot, the monitors assist them. Clay eggs may also be utilized, depending on the intensity of the storm tide, to prevent damage that may occur from wash over or egg movement across the cobble. When flooding occurs in the early stages of incubation, clay eggs are substituted for the natural eggs, which are removed and taken to the incubator. In all

cases where eggs have survived a flooding event, use of an exclosure is recommended to prevent predation. After storms, both mammalian and avian predators hunt extensively in the wrack line.

Flood rescue is weather dependant. Some years there is no need for rescue; in other years, flooding is so severe that no beach is left to hold the breeding pair, or there is insufficient manpower to target all threatened nests. However, when it is possible to intervene, the chance for success is worth the effort (Table 2). Eggs that are lost to flooding but are later recovered are submitted to the Atlantic Veterinary College for post mortem examination. These examinations have shown that eggs washed over by water may still be viable, and eggs buried in sand may continue to develop.

Table 2. Success of flood and sand rescue attempts in Prince Edward Island National Park, 1993–2003.

Year	*Total no. of nests*	*No. of nests rescued from floods*	*No. of nests where adults resumed incubation*	*No. of nests rescued from sand*	*No. of nests where adults resumed incubation*
1993	56	16	11	2	1
1994	26	5	5	0	0
1995	24	3	3	0	0
1996	26	3	3	1	1
1997	24	2	1	0	0
1998	29	0	0	0	0
1999	52	3	3	2	1
2000	28	1	1	0	0
2001	29	0	0	0	0
2002	27	0	0	0	0
2003	27	0	0	0	0
Total	348	33	27	5	3

Egg Fostering

Egg fostering, as a management tool, was first introduced in Prince Edward Island National Park in 1994. Originally, eggs were collected when they are abandoned or recovered from flood and sand events as a means of preventing predators from associating this food source with the habitat. These eggs were candled to check for viability. The opportunity to use this management tool is rare but valuable in ensuring nesting success. Egg fostering requires a number of factors to be compatible; therefore, a specific procedure to use these eggs to replace lost ones has been developed. Viable eggs are held in the incubator until they reach a maximum of 20 days of age. Staff must be constantly aware of the age of eggs both in the incubator and on the beach. If a situation arises where fostered eggs may be utilized, immediate on-site action is required. When a nest is lost, the plover searches for its eggs for a short period of time up to a few hours. Monitors

may place clay eggs in the nest to hold the pair if they know there are eggs of the same age in the incubator.

This management tool is considered to be successful if the breeding pair continues to incubate the fostered eggs. In all, there have been 20 eggs fostered in the 10 years this tool has been in use, and only one egg was not accepted (Table 3). It is difficult, however, to measure the success of fostering since there is no way to recognize fostered chicks from the others in a clutch. When eggs are added to complete a clutch, one cannot assess if the fostered eggs produced fledged chicks unless all four chicks fledge. Some fostered nests can also be lost to either natural events (bad storms or floods) or predation even if they are exclosed.

Table 3. Egg fostering success in Prince Edward Island National Park, 1994–2003.

Year	*No. of eggs fostered*	*Success of fostering*	*No. of chicks known to have fledged*	*Comments*
1994	4	4	0	
1995	6	6	1	Fate of 2 chicks unknown (possible but not confirmed fledged)
1996	0	0		
1997	0	0		
1998	1	0	0	
1999	3	3	0	Nest predated 3 days prior to hatch date
2000	2	2	0	Fate of 1 chick unknown (possible but not confirmed fledged); 1 lost to predation
2001	0	0		
2002	0	0		
2003	4	4	2	
Total	20	19	3	

Although difficult to assess, there have been successful fostering events. In 2003, when a nest was flooded, the birds recovered the eggs and continued to incubate even when the eggs were damaged. At the same time, there were eggs in the incubator from an abandoned nest that had a compatible hatch date. The eggs were exchanged, and the nest was successful. Two of the four eggs hatched, and the two chicks fledged. This management tool is opportunistic and limited as a consistent method for enhancing productivity, yet it does produce results with little additional effort to the existing program, and it utilizes eggs that would otherwise be lost to the population.

Banding

Piping plover productivity in eastern Canada was consistently greater than 1.25 chicks per pair, the rate of sustainability, yet the population continued to decline (Goosen et al. 2002). To

better understand the eastern population of plovers, CWS initiated a five-year banding study in 1998. The purpose of this initiative was to determine (1) survival rates of adult and juvenile plovers, (2) rates of juvenile recruitment into the eastern Canada population, (3) dispersal movements of eastern Canada plovers, (4) possible incidences of short stopping[1] in the northeastern United States by young Atlantic Canada birds, (5) possible cases of young of the year returning to breed in their first year, and (6) locations of critical winter habitats for eastern Canada plovers (CWS 2003). Prince Edward Island National Park has participated in this study since its inception and has ensured that all nesting beaches in the park are covered by the banding team each season.

Adult plovers are banded using a box trap on the nest; thus, banding is limited to the incubation period. Chicks are hand captured and banded as soon as possible after hatching. The entire brood is captured and released together. Bands are secured on the lower legs of all birds. Adults are banded with a colour band on the left leg and a USFWS band on the right leg; the opposite is used for chicks.

In all, 888 plovers have been banded in Atlantic Canada since 1998, and 180 of those were banded in Prince Edward Island (CWS 2003). The results of the banding study have answered some questions and generated others. For instance, recruitment of juveniles occurs as early as the first year after production. There is also some evidence of site fidelity among adults. One male has nested at the same site for three consecutive years. Additionally, one bird was observed nesting in the northern United States. This was the only record of short stopping during the banding study. Perhaps the most interesting result of the banding study, however, was the documentation of considerable interprovincial movement of Gulf of St. Lawrence birds and lack of movements to or from the Nova Scotia populations (Fig. 3).

[1] 'Short stopping' refers to birds that do not return the full distance to their natal region.

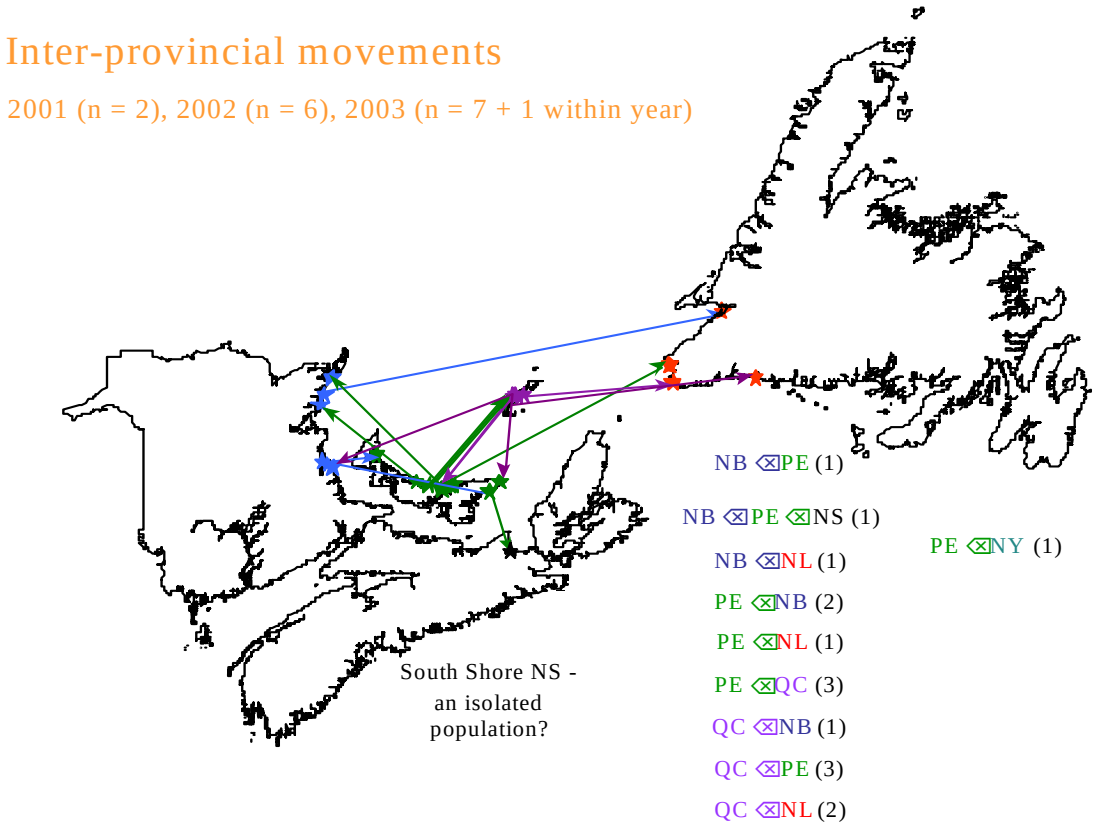

Figure 3. Interprovincial movements of banded piping plovers, 2001–2003 (NB = New Brunswick; PE = Prince Edward Island; NS = Nova Scotia; NL = Newfoundland; QC = Québec; NY = New York) (from CWS 2003).

Education and Research

An educated public is an important component of the Piping Plover Program. The knowledge of all visitors to Prince Edward Island National Park and their cooperation with recovery efforts has an effect on the future of the piping plover. Park interpretive programs concentrate on educating the public about piping plovers. Twenty percent of the park's interpretive programs focus on the piping plover, and plovers are discussed in 21–80% of the rest of the park's programs. Visitors are reached via personal and nonpersonal methods. Program staff use every opportunity to reach people with the message of the plight of the piping plover, most often via encounters on the beach. Personal contact is also made around campfires and through guided walks and school outreach programs. Nonpersonal contact involves the use of panel boards, audiovisual displays, and literature distribution. The media, newspapers, radio, and television continue to report and discuss the seasonal status of the piping plover. Because of the high visitation rate to the park, a large audience for the piping plover message is reached.

Parks Canada also encourages research projects in the park and offers technical and scientific support, equipment, and housing. The research project of Winifred Cairns in 1977 provided a great deal of insight into the piping plover. Many other research projects have contributed to our knowledge of plover habitat, energy budgets, and voiceprints, and therefore, have helped us in better managing the species. Results of these research projects are shared with our partners and are often applied in the practical implementation of piping plover recovery efforts. Research remains an important component of the program, and results of the studies continue to give us valuable information both within and outside the boundaries of Prince Edward Island National Park.

Conclusions

Twenty years of park data have shown an increase in piping plover fledging numbers; however, this has not been reflected in the number of breeding pairs that return to Prince Edward Island National Park. Natural forces often limit the breeding success of the piping plover and yet cannot be controlled. Management tools used in the national park have proven to be labour intensive and may require daily monitoring by the staff; therefore, these tools may not be feasible in all situations. However, in the context of a national park, which has high visitation rates during the critical breeding season, these management tools have proven to be effective in increasing piping plover productivity. Competition for beach habitat between humans and plovers will always remain a challenge.

It appears that chicks do not return to natal sites; therefore, recruitment of breeding plovers into the Prince Edward Island National Park breeding population depends on a healthy population outside the park boundaries. This means that cooperative efforts are required from all jurisdictions in which piping plovers nest. Education and research also have a significant role to play in securing the future of this endangered species.

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