Crow (*Corvus brachyrhynchos*)
Management Plan for Bermuda

Government of Bermuda
Ministry of the Environment
Department of Environment and Natural Resources

Crow (*Corvus brachyrhynchos*) **Management Plan for Bermuda**

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An electronic version of this management plan will also be made available at www.environment.bm

Director
Department of Environment and Natural Resources
Government of Bermuda

8th APRIL 2016

Date

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EXECUTIVE SUMMARY

Current species status:

The American crow is invasive on Bermuda and has been identified as a pest species under the Protection of Birds Act (1975). The Minister responsible for the Act can authorize the destruction of any bird species that is having a demonstrable detrimental impact on the environment, agriculture, or human health. This is done through a license which is issued on an annual basis to individuals through which conditions are set on control activities.

Management objective:

The main objective of this plan is to reduce the number of American crows on Bermuda by trapping and shooting, in order to minimize their negative effects on fragile island ecosystems, public health and agriculture. Research, education and public cooperation are all key elements to the success of this culling programme.

The plan is an evolving document and will be revised periodically. Culling data will be continually recorded and new culling methods evaluated for effectiveness.

Actions needed:

1. Determine all communal roosting locations across Bermuda,
2. Establish an updated estimate of crow abundance on Bermuda,
3. Reduce the number of American crows on Bermuda by using a variety of culling methods,
4. Assist the public with providing solutions to manage nuisance crows on private lands.

Management costs:

The total cost of management and/or recovery actions cannot be defined at this point. Developing budgets for each action are the responsibility of the leading party as outlined in the work plan.

PART I: INTRODUCTION

A. Historical overview

Bermuda historically had a species of crow that was considered endemic to the islands; however it was exterminated during the early years of human colonization (Wingate, 1975a; Dobson, 2002). The species that is presently living on Bermuda is the American crow *Corvus brachyrhynchos* (Bangs, 1915). The modern day population is believed to have derived from a pair of birds imported from Halifax, Nova Scotia in 1838. Those birds escaped from captivity (in the area now known as Admiralty Park) and by the 1870s had reproduced sufficiently to be considered a pest towards nesting seabirds and agriculture (see Wingate 1975a). A number of efforts to eradicate this species from Bermuda were attempted in the latter decades of the nineteenth century as well as throughout the twentieth century, with various bounties being placed upon them, to little avail except for temporary decreases in abundance. By 1975 the island-wide population was estimated to be 450 individuals (Wingate, 1975a). During the fall of that same year a collaborative effort between the Bermuda Department of Agriculture and Fisheries and the Virginia Polytechnic Institute used artificial crow calling, decoys and ambush from strategic positions along known flight paths to shoot over 200 crows, the majority (63%) of which were classified as being fully mature (Wingate, 1975b).

B. Conservation status

Not protected; deemed a pest on Bermuda.

C. Taxonomy and description of species

Kingdom: Animalia
Phylum: Chordata
Class: Aves
Order: Passeriformes
Family: Corvidae
Genus: *Corvus*
Species: *brachyrhynchos*

Crows belong to the family Corvidae, which includes ravens, rooks, magpies, jays and jackdaws. Over 120 species of corvids have been described; however the genus *Corvus* makes up over a third of the entire family.

The American crow, whose scientific name means ‘short-billed’, is covered with black feathers. The legs, feet and bill are also black in color. Overall body length typically measures 40–53 cm and wing cord 24.5–33 cm. Wingspan ranges from 85–100 cm and

bill length from 3–5.5 cm. Body mass can vary between 316 g and 620 g (Madge et al., 1994). It is a sexually dimorophic species with males being larger than females.

D. Ecology

Habitat requirements

A highly adaptable species, the American crow is found in many different habitats in North America ranging from wilderness areas, farmlands, parks and open woodlands to major urban areas. It is absent only from Pacific temperate rain forests and tundra habitat where it is replaced by the raven *Corvus corax*.

General biology

Predation throughout their North American range primarily occurs at the nest site where eggs and nestlings are eaten by snakes, raccoons, ravens and domestic cats. Adults are less frequently killed, but their predators include great horned owls, red-tailed hawks, peregrine falcons and eagles. The American crow has few natural predators on Bermuda.

In the U.S.A. American crows are monitored as a bioindicator for some zoonotic diseases (e.g. the West Nile virus, a pathogen transmitted by mosquitoes – most notably *Culex pipiens*) which are a potential human health risk. (Spielman & D'Antonio, 2001).

Anecdotal evidence suggests that crow abundance on Bermuda has increased over time. The total population was estimated to be 50 individuals in 1931; this estimate had increased to 150 by the 1950s and by 1975 it was considered to be ca. 450 individuals (see summaries in Wingate, 1975a; 1975b). Present day estimates are not available but crow abundance is considered to be in the thousands (J. Madeiros; P. Watson, pers. comm.). Data from the Bermuda Audubon Society's annual Christmas Bird Count shows a general increase in the number of crows recorded by observers between 1976 and 2015 (Fig. 1).

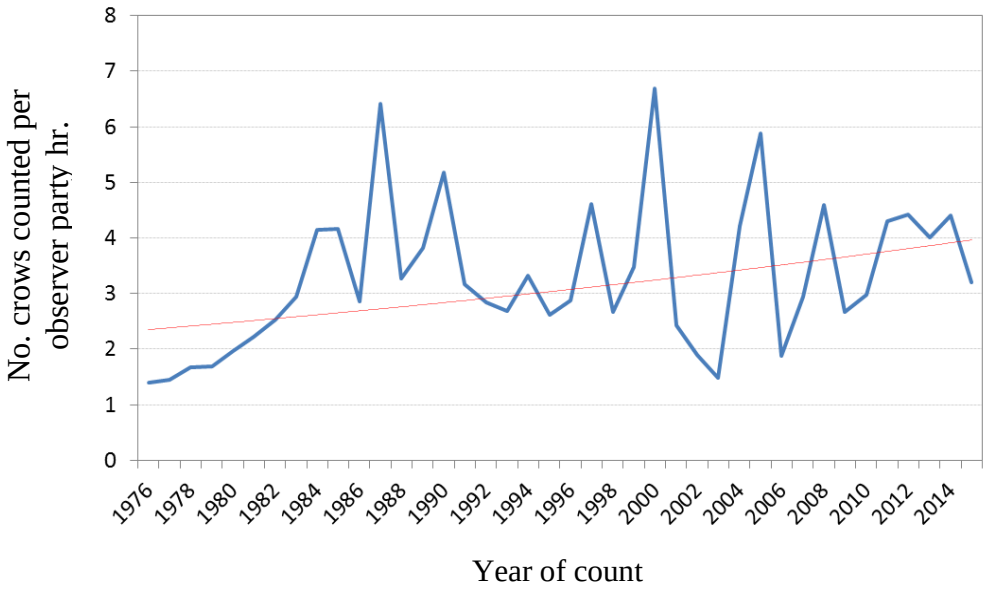

Figure 1. Graph showing the number of American crows counted per observer party hour during the 1976-2015 Bermuda Audubon Society Christmas Bird Counts.

Feeding

The American crow is omnivorous, feeding upon a variety of invertebrates, carrion, seeds, fruit, and scraps of human food. American crows are also active hunters that prey on small animals and the eggs and nestlings of other bird species. The American crow has been observed in other parts of the world carrying hard-shelled mollusks high into the air to drop them on rocks in order to break them open, and is one of only a few species of bird that has been observed modifying and using tools to obtain food (Caffrey, 2000). Crows also hide/bury food in various locations (a behaviour known as caching) so that they can return and consume it at a later date.

Stomach content analyses of 117 individuals shot on Bermuda in 1975 revealed that American crows were eating:

- ripe berries of fiddlewood, allspice, cedar, and bay grape;
- waste grains from dairy farms (also possibly obtained from feeding upon cow manure);
- garbage and other waste items generated by humans;
- land snails, large beetles and caterpillars;
- crabs and other inter-tidal organisms from the coastline;
- house mice, small birds and carrion;
- fruits and vegetable crops obtained from gardens and farm lands (Wingate, 1975b).

Reproduction and life cycle

American crows are monogamous cooperative breeding birds. Mated pairs form large families from several breeding seasons that remain together for many years. Offspring from a previous nesting season will usually remain with the family to assist in rearing new nestlings. American crows do not reach breeding age until at least the age of two years, although many do not leave the nest to breed until the age of five years (Segelken, 2006). American crows build bulky stick nests in tall trees, usually in a vertical fork or where a branch meets the trunk. Three to six eggs are normally laid and incubated for two to three weeks. The young typically fledge about one month after hatching. In Bermuda the nesting season begins in April (Dobson, 2002). The average life span in the wild is 7–8 years; however captive birds are known to have lived for nearly 60 years (Cornell Lab of Ornithology, 2002).

E. Current status

Global distribution

True crows (e.g. crows, ravens, rooks and jackdaws) are found throughout Australasia, Melanesia, the Pacific Islands, Tropical Asia, Eurasia, North Africa, Tropical Africa, North and Central America and the Holarctic. The American crow is common only to North America (Fig. 2). This species is a permanent resident in most of the U.S.A.; however crows in Canada migrate south in winter.

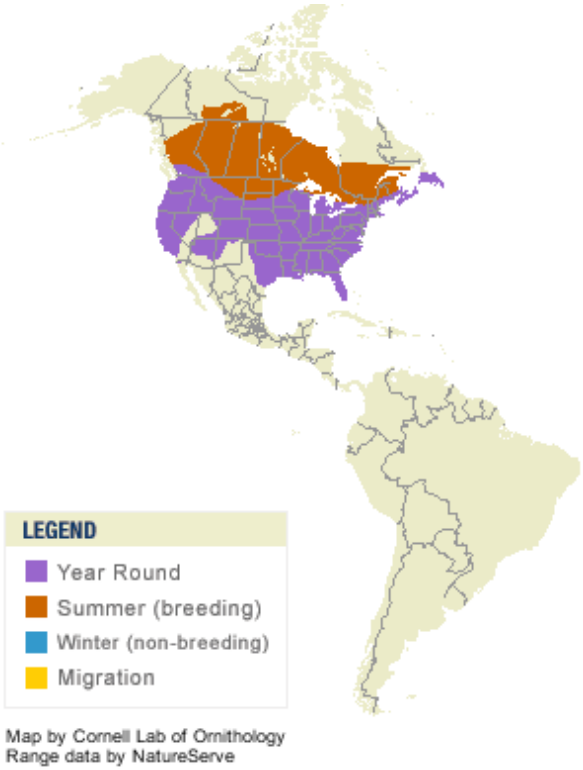

Figure 2. Global range map of the American crow *Corvus brachyrhychos*.

Local distribution

Crows have an island-wide distribution across Bermuda. Outside of the breeding season, they congregate in large numbers each evening to sleep in communal roosts. The largest is considered to be on Town Hill in Smith's Parish, however there are others on Hawkins Island in Hamilton Harbour (D. Wingate, pers. comm.) and on Hog Bay Park in Sandy's Parish (MO, pers. obs.)

Local impacts

American crows raid the nests of native breeding birds for eggs and chicks. In Bermuda they are known to target white-tailed tropic birds *Phaethon lepturus catesbyi* during the spring and early summer (http://bernews.com/2013/09/crows-threatening-bermudas-longtail-population) (Fig. 3). In 2009 four crows collected and destroyed over 50 tropic bird eggs in the Castle Harbour Islands and in 2013 six crows robbed the nests of up to 100 tropic bird nests (J. Madeiros, pers. comm.). Crows have also been observed raiding bluebird boxes for the eggs and chicks they contain (A. Card, pers. comm.). Crows contribute to the islands trash problem by ripping open garbage bags left on the road side for collection and crows are responsible for crop losses on agricultural land thereby representing loss of quality and quantity of non-imported food, in addition to being a financial loss to the agricultural sector.

Gerardo Garcia

Figure 3. Cache of broken white-tailed tropic bird eggs found on Castle Island.

F. Current management actions

Shooting is presently the most common method of culling crows on Bermuda. Between 2004 and 2015 a total of 717 crows were shot island-wide, of which 31% were from the Peak on Town Hill (see Table 1 in the Appendix for annual summaries). The average number of crows culled during that period was 60 per annum.

PART II: MANAGEMENT

A. Management goal

The primary aim of this management plan is to reduce the number of American crows on Bermuda by trapping and shooting in order to minimize their negative effects on fragile native species, public health and the agriculture sector.

B. Management objectives and criteria

These overall objectives translate into specific targets outlined below:

- Determine all communal roosting locations across Bermuda,
- Establish an updated estimate of crow abundance on Bermuda,
- Reduce the number of American crows on Bermuda by using a variety of culling methods,
- Assist the public with providing solutions to manage nuisance crows on private lands.

C. Management strategy

The local birdwatching community (e.g. members of the Bermuda Audubon Society) can be involved with providing estimates of crow abundance and the identification of communal roosting locations and popular flight pathways. Roosting sites with the greatest number of crows should be targeted using culling methods which yield the greatest numbers of birds (e.g. deploying letter box trap or using shot guns). Shooting birds as they commute along known flight paths and birds that have been lured by artificial means of crow-calling are additional methods of targeted control; however the former would only be effective using shot guns which limits where this technique can be safely employed. A simple public education campaign on how to protect household garbage from scavenging crows (e.g. placing garbage bags inside plastic or metal cans) would minimize incidences of refuse being scattered along Bermuda's roadways.

D. Tools available for strategy

REPORTING

The Department of Environment and Natural Resources (DENR) offers an online form for the public to report all instances of pest bird problems (http://environment.bm/feral-bird-control). DENR uses an integrated management strategy, during which technical officers assess the nature of each infestation and determine the most efficient method(s) to address the problem.

TRAPPING

The American crow is widely recognized as being an intelligent species (Marzluff et al., 2010; Cornell et al., 2011) which makes it challenging to shoot and trap, therefore it is necessary to have both an understanding of crow behavior and versatility in culling practices in order to maximize results. All traps regardless of design should catch birds in a humane manner; this also allows for the safe release of non-target species that have been captured. Crows that have been trapped need to be killed humanly (e.g. swift blow to the head or gassed with carbon dioxide). They can also be kept alive and used as decoys to aid with the catching of more birds. Decoy birds must be treated humanely, have access to fresh water and suitable food every day and be provided shelter from the elements.

Some methods of trapping are more effective at certain times of year (i.e. breeding season), while others will have greater success if used with a live decoy bird, in tandem with mock nests, or with carrion as bait.

Larsen trap

The Larsen trap is a cage trap with at least two spring loaded doors and catchment areas (Fig. 4). This type of trap works by using a split perch that breaks when the crow lands on it, releasing the trap door and trapping the crow. The most common design for these traps is the twin or double catch but multi-catch traps are also available.

The traps are split into at least three compartments; the middle compartment is for housing the decoy bird and the other compartments for catching. The primary wing feathers on one wing of the decoy bird should be clipped to prevent it from flying away if released unintentionally. Decoy birds should have access to fresh water, food and shelter. When deployed, Larson traps should be checked at least once a day.

Internet image from TrapMan.co.uk

Figure 4. Larson trap with a live crow decoy.

Larson traps are most effective when used during the crow breeding season and this presents the best opportunity to reduce breeding pairs from a population. Mature breeding crows become territorial and defend their nesting sites against other crows. By using a decoy bird with a trap set in the territory of a breeding pair, it should be possible to catch both male and female crow. Trapping during this time of year will also aid in reducing the impact on other breeding avian species, as it is when crows target the eggs and young of other birds in order to get a high protein diet for themselves and their offspring. Additionally, Larsen traps can be baited with carrion or a mock nest with eggs (see Fig. 5) and used throughout the year.

Useful for:

- Catching mature breeding pairs,
- Quick deployment,
- Not having to manually release the trap doors,
- Safe release of non-target species,

Limitations:

- A live decoy bird is required for the trap to work efficiently,
- A daily check of the trap is required to ensure decoy birds are fed and watered and captive birds are removed,
- Traps can be vandalized by the public,
- Trapped birds can be released by the public,
- The traps are bulky and require a truck or van to distribute them,
- Efficiency is seasonal,
- Complaints of cruelty by the public when caged birds are encountered,
- Handling and euthanasia of captured crows.

<u>Larsen mate or clam trap</u>

The Larsen mate is a single-catch cage trap that was designed to work in conjunction with the Larsen trap to increase catch yield. These traps are small (typically 16 in. x 16 in. x 18 in.) and light weight. This trap is spring loaded and also employs the split perch design (Fig. 5). Larsen mates can also be baited with carrion or a mock nest with eggs.

Internet image from bushwear.co.uk

Figure 5. Clam trap with nest and eggs used as bait.

Given the small and light nature of the Larson mate, it can be deployed easily and more discreetly than any of the other traps designed for catching crows. Non-target birds can be easily released from these traps unharmed.

Useful for:

- Quick deployment,
- Catching birds attracted to a Larsen trap that is already at full capacity,
- Not having to manually release the trap doors,
- Safe release of non-target species,
- Year-round use,
- Discreet deployment.

Limitations:

- A daily check of the trap is required to ensure captive birds are removed,
- Traps can be vandalized by the public,
- Trapped birds can be released by the public,
- Complaints of cruelty by the public when caged birds are encountered,
- Handling and euthanasia of captured crows.

Letter box trap (aka ladder trap)

Letter box traps are large (approximately 160 in. x 130 in. x 70 in.) and can be built as permanent traps or made into sections so they can be dismantled and relocated. They are designed to allow birds to drop into the trap (with wings folded) through a gap in the roof that is not large enough to allow them to fly back out (Fig. 6). The letter box trap is a multi-catch trap that can be baited with carrion or a decoy bird and is capable of catching large numbers birds at a time. These traps have a door on one section to allow human access in order to remove captured crows and supply food and water for decoy birds. Shelter and perches should also be provided. Bait should be replaced as soon as it loses its fresh appearance and captured crows should ideally be removed after sunset when they are in a calmer state to facilitate handling. Consider leaving one or two in the trap to serve as decoys for the following day.

Internet image

Figure 6. Wood framed letter box trap (note the ends of the ladder are covered to prevent captured crows from climbing up the wire and escaping out of the cage).

Letter box traps can be deployed permanently in one discreet location or relocated to manage multiple problem areas. They are effective year-round and can be a good way of catching juvenile birds. When not in use the door can be padlocked in the open position so that birds can freely exit.

Useful for:

- Catching large numbers of crows,
- Catching crows year-round,
- Establishing a permanent catch zone when correctly positioned,
- Preventing public from freeing trapped crows by securing the door closed with a padlock.

Limitations:

- A daily check of the trap is required to ensure that captive birds are removed,
- Traps can be vandalized by the public,
- The traps are bulky and require a truck or van to distribute them,
- Complaints of cruelty by the public when caged birds are encountered,
- Handling and euthanasia of captured crows.

SHOOTING

Crows are challenging to shoot because they have very good eye sight and recognition skills (Marzluff et al., 2010; Cornell et al., 2011). Furthermore, shooting crows on Bermuda is logistically challenging given that (1) the use of firearms has been strictly controlled since 1973; (2) the total land area is small (54 km^2) and over 70% of this area is developed – making Bermuda essentially a suburban environment; (3) it has a population of ca. 65,000 inhabitants which makes it one of the most densely populated countries in the world.

The Bermuda Police Service is the only entity that grants permission to use firearms on Bermuda, and licensing is presently limited to police and military personnel, members of gun clubs and pest control officers from the Department of Environment and Natural Resources.

Shooting was perhaps the most common method of historically controlling crows on Bermuda. Prior to present day gun legislation, farmers (and other residents) would have owned guns and carried out their own control measures; however the Firearms Act of 1973 prohibited gun ownership which is thought to have been partially responsible for the recent large-scale increase in abundance (Wingate, 1975a). Shooting was considered instrumental in removing the last 10 crows (*Corvus splendens*) from Socotra Island in the Arabian Sea (Suliman et al., 2010).

Crows are shot on Bermuda by a limited number of licensed individuals using 12 gauge shot guns and single shot .22 caliber air rifles. Crow calling devices and artificial decoys are also employed with great effect to attract crows within shooting range.

Useful for:

- Dispatching crows where traps have proven to be ineffective or where traps are continually being vandalized by the public,
- Dealing with trap shy crows.

Limitations:

- Can lead to increased wariness among surviving crows,
- Gun licensing is strictly controlled on Bermuda,
- Negative public perception towards guns,
- Using firearms within the confines of urban and suburban environments.

SONIC BIRD REPELLENTS

These repellents use audio sounds that are either threatening or irritating to crows. Products typically play various sounds (e.g. real bird distress calls, predator sounds or high-pitch frequency sounds) over loud speakers.

PYROTECHNICS

Frightening devices such as shell crackers, automatic LP gas exploders and rope firecrackers have been used with great effect in other regions to disperse flocks of crows. Some of these products are discharged from a firearm, but all are considered controlled materials on Bermuda - making frequent use of them impractical.

VISUAL SCARE DEVICES

These devices include fake crow decoys (Fig. 7), dead crow silhouettes and artificial prowler owls. All are designed to frighten crows away from small plots of land (e.g. gardens and fields).

Useful for:

- Repelling birds from specific localities.

Limitations:

- Birds get accustomed to scaring and repelling efforts if used continually or in a single location,
- These forms of management only repel birds and do not contribute to the reduction in crow abundance.

Internet images

Figure 7. Examples of visual scare decoys for use on crows

SEDATIVES

The Department of Environment and Natural Resources does not endorse the usage of edible poisons or sedatives because of ethical considerations with poison and the problem associated with the time delay between when a bird that is capable of flight ingests a sedative and when the sedative begins to take effect.

SAFE HANDLING AND HUMANE DISPATCHING OF CROWS

It is essential that all birds, regardless of whether they are decoy animals or animals targeted for culling, are treated with care, respect and as humanely as possible. When removing captured crows from any cage trap it is recommended to wear heavy duty gloves for protection against biting and pecking and take care not to hold a live crow close to your face or anybody else's face.

Dispatch captured crows by holding their wings and body tightly together with one hand and delivering a sharp blow to the back of the head using a cudgel. If the birds are going to be taken away for euthanasia, place individuals in a suitably sized cloth sack (one per bird) and tie the top closed.

Note: Decoy birds, whether living in an aviary or working in a trap, should be kept as healthy as possible. Aviaries will be required to house live decoy crows until they are required to be used in a trap.

E. Step-down narrative of work plan

The following abbreviations are used throughout the next two sections:

DENR – Department of Environment and Natural Resources
BAS – Bermuda Audubon Society
Public – members of the general public

The required management actions are as follows:

1. Determine all communal roosting locations across Bermuda.

Actions Proposed:

- Confirm that the known roosting locations historically used by crows are still active,
- Observe, record and follow the direction that crow flocks travel as they commute in the evening to their roosting locations to determine if new sites exist.

Work Team: BAS, Bird watching community of Bermuda
Team Leader: DENR
Outputs: A list of known communal roosting locations, list of known flight paths, the identification of safe shooting positions
List of Equipment: Vehicles for transporting surveyors, binoculars

2. Establish an updated estimate of crow abundance on Bermuda.

Actions Proposed:

- Perform a crow counting survey at the communal roosting locations during the winter months.

Work Team: Bird watching community of Bermuda
Team Leader: BAS
Outputs: Crow counts used to determine a population estimate
List of Equipment: Vehicles for transporting surveyors, binoculars

3. Reduce the number of American crows on Bermuda by using a variety of culling methods.

Actions Proposed:

- Trial various traps to determine effectiveness,
- Continue with targeted shooting,
- Modify culling programme to achieve maximum results.

Work Team: DENR
Team Leader: DENR
Outputs: Report on the trapping and culling results
List of Equipment: Larson traps, Larson mate traps, letter box traps, air rifles and shotguns, firearms ammunition, decoys, crow calling devices, vehicles to transport traps.

4. Assist the public with providing solutions to manage nuisance crows on private lands.

Actions Proposed:

- Promote the use of repellents and visual scare devices to deter nuisance crows,
- Promote the use of garbage cans to prevent crows from tearing into refuse-filled plastic bags awaiting garbage collection.

Team Leader: DENR
Assistance: Public
Outputs: Testimonials about the effectiveness of the devices
List of Equipment: Refer to crow control product websites in Appendix

PART III: IMPLEMENTATION

Task #	Task Description	Task Duration	Responsible Party
1.0	**Determine communal roosting locations**		
1.1	Confirm if historical locations are active	1 week	DENR
1.2	Identify new locations	1 month	BAS
2.0	**Estimate crow abundance**		
2.1	Perform crow survey	1 week	BAS
3.0	**Reduce crow abundance through culling**		
3.1	Trial different traps	ongoing	DENR
3.2	Continue with targeted shooting	ongoing	DENR
3.3	Modify culling programme	ongoing	DENR
4.0	**Manage nuisance crows**		
4.1	Promote use of repellents and scare devices	ongoing	DENR
4.2	Promote the use of garbage cans	ongoing	DENR

APPENDIX

A quick review in April 2016 of online resources available for crow control products included the following websites:

http://icwdm.org/handbook/birds/AmericanCrows.asp

http://www.birdcontrolpro.com/control_crow.htm

http://www.pestproducts.com/crows.htm

http://pestkill.org/birds/crows/

http://www.crowaway.com

Table 1. Summary of annual crow culling efforts on Bermuda between 2004 and 2015.

Year	No. crows
2004	55
2005	95
2006	11
2007	10
2008	6
2009	7
2010	129
2011	54
2012	97
2013	81
2014	69
2015	103

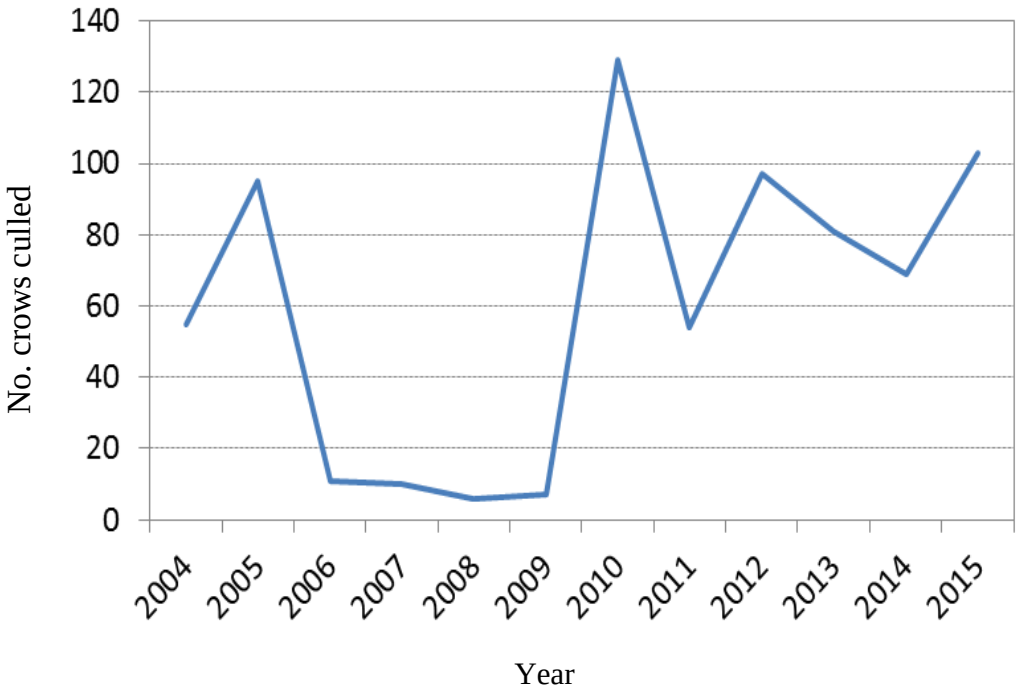

Figure 8. Graph showing number of crows culled annually on Bermuda between 2004 and 2015.

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